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Cultural Heritage Institutions: Implications for Virtual Experiences

The implementation of 3D technologies such as virtual reality (VR) and augmented reality (AR) in cultural heritage institutions is a fairly new practice, receiving an increase in attention and interest within the last several decades (Gomes et. al, 2014). Like any newer development in technology, it poses unique challenges, benefits, and drawbacks when dealing with documenting, preserving and disseminating data through it. There is clear potential, as Rahaman elaborates—examining how the implementation of VR and AR technology in cultural heritage institutions creates opportunities for public engagement with history, as well as provides scholarly resources for researchers to use in more hands-on methods (2019). Additionally, he suggests that development and application of these technologies could increase interest from the public but also “institutional, and philanthropic interest, engagement, and investment” (Rahaman, 2019).

As outlined by Gomes et. al (2014), the practice of digital curation of cultural heritage objects and sites aims to accomplish several tasks, including protecting the visual information of an object in case of damage, enabling the ability to share collections through virtual environments, “create replicas”, identify incidents of art forgery, “and to allow the collection of specific geometric or texture information when difficult to obtain from the real object” (Gomes et. al, 2014). In terms of user experience, the potential for cultural heritage institutions is great, especially in taking less of a ‘white cube’ approach to displaying objects and allows for environments where they can be contained in a setting that more closely fits their original context. Bekele & Champion (2019) note especially the ability of AR/VR and also MxR (Mixed Reality) to provide users with cultural context.

Documenting/Collecting 3D Data:

The process of collecting 3D data is nuanced and complex. Since there are many components that influence the perception of an object or place, 3D data that is collected must reflect the experience of actually seeing and interacting with an object. As Rourk expresses, many people may underestimate the process, assuming that only models or images are created, when in reality “3D documentation technologies provide the actual, measured conditions of a place or thing, not just an appearance of or similarity to the subject” (Rourk, 2019, p. 27).

To obtain 3D data, the following process occurs. In the beginning, information pertaining to the color and depth of an object are determined. After this has been determined, the data undergoes a process of registration and then a “mesh integration stage where data from all acquired 3D views are combined” (Gomes et. al, 2014, p. 40). Finally, after compiling these elements, a 3D model is created (Gomes et. al, 2014, p. 40). Pavlidis et. al identify three phases in the process of digitizing in 3D: Preparation, digital recording and data processing (2007). At the time of collection, Rourk notes the importance of recording the ways in which the data was collected as it aids in preserving the 3D data as well as provides a way for those viewing data in the future to repeat and reproduce processes (Rourk, 2019, p. 28). The size of the object that is being digitized dictates much of the data creation process, as smaller objects may be able to undergo processes that utilize laser scanning or rendering processes that are developed based on photos, videos, shadow and light; for larger objects, many processes rely more on topographic techniques (Pavlidis et. al, 2007). Not only does the size of the object impact the way in which this data is generated or stored, but the intended use and dissemination of it as well.

Challenges with AR/VR Integration:

As Lischer-Katz (2020) expresses, there are particular challenges associated with preserving virtual reality. They pose the question of what it means to actually preserve virtual reality, noting that VR makes use of “immersive and interactive interfaces” (p. 255), which include elements such as motion tracking and stereoscopic sound (Lischer-Katz, 2020, p. 255). This born-digital data is subject to the same issues that any other digital content would including decay especially related to file formats and technologies becoming obsolete. It is also subject to change with the hardware associated with it.

Remondino and Rizzi identify some of the reasons why, despite some clear benefits, 3D documentation is not the “default approach” in conserving cultural heritage assets (2010). These include issues related to cost, difficulty to implement and the fact that 2D documentation is frequently viewed as being adequate while 3D is just an optional feature (Remondino & Rizzi, 2010). Gomes et. al also discuss these difficulties in their 2014 publication, identifying elements including cost, quality, portability, acquisition time and flexibility as being major hindrances (Gomes et. al, 2014). As recently as 2019, Rahaman discusses the lack of implementation of 3D technologies within cultural heritage settings, suggesting that even years later, there is little active use of this technology outside of “conference presentations, one-off museum exhibitions, or digital reconstructions used in films and television programs” (Rahaman, 2019). He attributes this issue to a lack of sufficient infrastructure, which is logical considering the cost and maintenance of materials involved in the process as well as the fact that many of the institutions who are likely to seek implementing these technologies are already operating with strict budgets (Rahaman, 2019). Hannah et. al also address the issue of lack of infrastructure, especially for libraries (2019). They also report that much of the existing VR and AR data is privately owned by a range of companies including Google and Amazon (Hanna et. al, 2019). Not only is this an issue of obtaining and maintaining physical hardware including computers and peripheral technology such as VR headsets, but of data for objects and locations as well.

3D scanning can also be undesirable due to its lack of exact precision. Laser scanning is only able to record within “0.25 mm of the surface of the original” object (Rourk, 2019, p. 32). Any finer details are not able to be preserved. In addition to 3D data, other data of varying formats must be stored concurrently, including “high-resolution photographs, scholarly accounts” and other basic metadata. (Rourk, 2019, p. 32). This can pose clear challenges in curating these materials, especially as formats for each become obsolete over time, and considering that much of this data will take up large amounts of what is likely very limited storage space.

In addition to more technical complications, there are challenges when developing or making meaning out of data. Digital humanities as an area of research and practice is already a very inter-disciplinary concept by nature, and when working in the context of cultural heritage objects or sites, there are many layers of complexity that go into interpretation. As Biedermann (2021) observes, in attempts to standardize data according to approved documentation practices, authorities from different disciplines may have differing ideas on how data such as relevant dates are reflected—a piece of data that is potentially deceptive in its apparent simplicity.

AR/VR Technologies in Context:

As examined by Rourk (2019), 3D technology can be valuable in helping connect the public to cultural objects through the use of 3D printed copies; it can also aid interaction and learning possibilities for people with disabilities (Rourk, 2019). Rourk describes the work of Michelle Crow-Dolby at the Gari Melchers Home and Studio Museum in Washington, where she teaches children about art historical topics who have disabilities related to vision, effectively providing an alternative learning environment that is tailored to their unique experience and needs (Rourk, 2019, p. 32). 3D printed copies of existing artefacts are not totally uncommon finds, especially at art or history museums and allow visitors to interact with objects through feel, adding another layer of experience beyond that of viewing the object on display.

Murillo et. al express some of the complexities in dealing with digital preservation with the example of the Virtual Bethel. The project uses the UNREAL game engine with a wide variety of different associated technology including both web and mobile VR, HMD and more (Murillo et. al, 2018, p. 4). At the time of their article, plans were beginning to be formulated with regards to preservation of data, but nothing had been implemented yet; despite this, the total amount of data was at 60GB (Murillo et. al, 2018, p. 5). The project appears to still be ongoing.

The Geevor Tin Mine Museum in Cornwall is a UNESCO world heritage site that has benefited from incorporating VR and AR. As the site encompasses the original 18th century mines, physically accessing some of the underground sites can be difficult (Jung & Dieck, 2017, p. 144). They have implemented this technology in a number of ways, most notably however through providing visitors a chance to view digital models of mines and experience entering through a mine shaft (Jung & Dieck, 2017, p. 144). As their visitors include those from a wide variety of demographics, this benefits elderly or physically disabled patrons especially. These technologies were only recently implemented and with the inevitable decay of digital materials and obsolete formats and technology, it is possible that these features may no longer be offered, even within the near future.

There are a lot of challenges that must be overcome, but AR and VR technology clearly has a lot of potential for cultural heritage institutions. Technology moves quickly and VR still seems to be considered a fad, however as technology cycles, it will likely become more approachable and affordable for institutions to implement. The potential benefits are numerous, but with lack of funding and critical infrastructure, it may be a long time before these technologies are integrated into the preservation of cultural heritage in many more large-scale instances.

References

Bekele, M. K., & Champion, E. (2019). A comparison of virtual realities and interaction methods: Cultural learning in virtual heritage. *Frontiers in robotics and AI, 6*. https://doi.org/10.3389/frobt.2019.00091

Biedermann, B. (2021). Virtual museums as an extended museum experience: Challenges and impacts for museology, digital humanities, museums and visitors – in times of (coronavirus) crisis. *Digital Humanities Quarterly, 15*(3).

Gomes, L., Bellon, O.R.P, & Silva, L. (2014). 3D reconstruction methods for digital preservation of cultural heritage: A survey. *Pattern Recognition Letters 50*, pp. 3-14. https://doi.org/10.1016/j.patrec.2014.03.023

Hannah, M., Huber, S., & Matei, S. A. (2019). Collecting virtual and augmented reality in the twenty-first century library. *Collection Management, 44*(2-4), pp. 277-295. https://doi.org/10.1080/01462679.2019.1587673

Jung, T.H. & Dieck, M.C. (2017). Augmented reality, virtual reality and 3D printing for the co-creation of value for the visitor experience at cultural heritage places. *Journal of place management and development, 10(*2), pp. 140-151. https://doi.org/10.1108/JPMD-07-2016-0045

Lischer-Katz, Z. (2020). Archiving experience: An exploration of the challenges of preserving virtual reality. *Records Management Journal, 30*(2), 253-274. https://doi.org/10.1108/RMJ-09-2019-0054

Murillo, A., Spotts, L., Copeland, A., Yoon, A., & Wood, Z. (2018). Complexities of digital preservation in a virtual reality environment, the case of virtual Bethel. *International Journal of Digital Curation, 13*(1). https://doi.org/10.2218/ijdc.v13i1.631

Pavlidis, G., Koutsoudis, A., Arnaoutoglou, F. Tsioukas, V., & Chamzas, C. (2007). Methods for 3D digitization of Cultural Heritage. *Journal of Cultural Heritage, 8*(1), pp. 93-98. https://doi.org/10.1016/j.culher.2006.10.007

Rahaman, H. (2019). 3D digital heritage models as sustainable scholarly resources. *Sustainability, 11*(8), 2425. https://doi.org/10.3390/su11082425

Remondino, F., & Rizzi, A. (2010). Reality-based 3D documentation of natural and cultural heritage sites—techniques, problems and examples. *Applied Geomatics 2*, pp. 85-100. https://doi.org/10.1007/s12518-010-0025-x

Rourk, W. (2019). 3D cultural heritage informatics: Applications to 3D data curation. In J. Grayburn, Z. Lischer-Katz, K. Golubiewski-Davis, & V. Ikeshoji-Orlati (Eds.) *3D/VR in the academic library: Emerging practices and trends* (pp. 24-38). Council on Library and Information Resources.