

Should Holograms Be Displayed Next to Papier-Mâché Models?

Reflections on the Conflict of the Pre-Digital and the Post-Digital Museum

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Introduction

Digital continues to disrupt and transform the parameters of the audience experience at museums. Yet is this what museum staff and visitors to small local museums want? Can and should new technologies be situated next to traditional dioramas and papier-mâché dinosaurs?

The post-digital museum where digital is normalized and forms part of museums' missions, structures, and practices (Parry 2013; Pierroux 2018; Mason 2020) is now being used to describe a new age for museums. But how post-digital are small local museums? How can they enter this new paradigm with limited digital literacy and limited resources? It is widely recognized that the digital literacy of the museum workforce, particularly in smaller local and regional museums, remains one of the main challenges continuing to impede the adoption of technology within the sector (NMC 2015; 2016). Could low-cost holograms be the answer? This article reflects on the development of interactive experiences leveraging low-cost holographic displays portraying digital scans of taxidermy artifacts, and using animation and motion-capture technology to bring the museum collection to life.

Previous research has explored the use of interactive technology to create new hybrid experiences and augment museums' collections. Two examples are introducing hybrid critical play to engage with contested heritage collections (Løvlie et al. 2021) or combining physical and digital experiences to allow visitors to tell their own stories through gifting (Back et al. 2018). Similarly, other practitioners leveraged the use of 3D printed representations of museum artifacts as a tool for reflection and the sharing of stories that in turn could become part of the museum collection (Spence et al. 2020). Indeed, the emergence of more affordable tools to create digital

assets offers a unique opportunity to digitalize hidden museum collections perpetually in storage. For instance, portable photogrammetry scans can be used to digitize artifacts in the storeroom and bring them back to the exhibited collection in digital displays. In a time when museums strive with minimal resources to introduce new ways to engage visitors (Black 2020), for instance, holographic displays offer an accessible and attractive medium with the potential to engage broader audiences (Pietroni et al. 2019).

In this article, we describe the outcome of a sustained collaboration between the Cumberland House Natural History Museum and the School of Creative Technologies at the University of Portsmouth. This project was devised as a student design challenge exploring the suitability of creative technologies and interactive systems to augment the museum's collection with new interactive experiences.

The aim of the project was twofold. First, we explored the opportunities and limitations of photogrammetry to digitize taxidermied animals with the support of the University of Portsmouth's Centre for Creative and Immersive Extended Reality. Second, we explored the suitability of novel interactive experiences to increase audience engagement in museums with limited digital displays and resources. We draw on the lessons learned from developing two interactive experiences deployed at Portsmouth's Cumberland House Natural History Museum and discuss the opportunities and shortcomings when adopting novel displays in local public museums.

Designing Experiences for Post-Digital Natural History

Cumberland House Natural History Museum is a small local museum in the city of Portsmouth (United Kingdom) with a collection encompassing a look at the geology and habitats of the local area, including an A-Z of Natural History, an observational beehive, a butterfly house, and a sculpture trail, among other collections. Nevertheless, more than 90 percent of the museum's collection remains in storage and, as such, poses challenges for audiences to access the museum's hidden collection. This is not unusual, with research suggesting that the majority of museums have a prominent part of their collections in storage (Corona 2023). Objects in storage are an integral part of museum collections. Rather than collections which have been ignored or disregarded, they constitute a large archive from which to draw new information and for future experiences to be created (Brusius and Singh 2018).

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The museum, in collaboration with the university, is exploring how using creative technologies and low-cost digital interactive systems can unlock some of the potential of collections currently hidden and unseen in storage. This article discusses the creation of two pilot digital prototypes: *HoloRoom* and *Daddy the Porcupine Fish* to illustrate the potential of utilizing creative technologies to augment the local natural history museum's collection.

Transforming Museum Artefacts into Holograms (“HoloRoom”)

In a preliminary exploration of the potential applications of creative technologies, we used a portable photogrammetry scan to digitize four taxidermied animals (a turtle, hedgehog, peregrine, and porcupine fish) from Cumberland House Museum's stored collection at the University of Portsmouth's Centre for Creative and Immersive Extended Reality (see Figure 1). A photogrammetry scan consists of photographing an object from different angles that can be used to create a 3D reconstruction of the object by overlapping patterns in the images.

Figure 1. Pictures of photogrammetry scans of taxidermied animals



(Left to right) Turtle with a marker to aid reconstruction;
live 3D reconstruction of peregrine (center);
and porcupine fish (right).

Although photogrammetry offers a fertile environment to digitize museum artifacts, it is limited by the technology's precision in capturing the granularity of textured models such as feathers, hard shells, or spikes. For

instance, the reflection of the camera flashing light may return void areas on shiny materials (such as turtle shells) necessitating further reconstruction. Further, photogrammetry scans may not handle the interpretation of spikes successfully, because its imaging can cope only with a lower density of details (such as dispersed spikes on the porcupine fish as opposed to concentrated spikes on a hedgehog) and textures with “flattened” details (such as feathers).

To showcase the resulting 3D models of scanned artifacts at the museum, we developed a dynamic holographic display that was deployed during a pilot event. The “HoloRoom” is a low-cost artifact utilizing the reflection of a suspended monitor on an acrylic surface to create the illusion of a holographic display (see Figure 2, left). HoloRoom provided a canvas to dynamically display the 3D models which were constantly rotating for museum audiences to engage with the details of the scans.

Figure 2. Dynamic holographic display in the “HoloRoom”



(Left to right) Image of HoloRoom displaying scanned 3D models; schema of Wizard-of-Oz-based interactive experience and image of porcupine fish avatar mimicking facial features from webcam input.

Wizard-of-Oz Experience: Creating Narratives for Natural History (“Daddy the Porcupine”)

To further explore the potential of creative technologies to enhance post-digital museum experiences, an interactive experience leveraging real-time motion-capture and Wizard-of-Oz (Kelley 1983) performative methods to animate a conversational animal was designed. This animal engages with visitors through voice interaction, creating narratives around the museum’s collection (see Figure 2, center). The Wizard-of-Oz (WoZ) method allows testing of an interactive concept that is perceived as intelligent and autonomous by the audience but is controlled by “the wizard” in the background. One of the 3D scans (porcupine fish) was transformed

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into an interactive character by reconstructing and animating the model and integrating it into the streamer-focused platform Animaze.

Animaze allows the creation and control of interactive avatars through real-time capturing of facial motion. It uses webcam input to scan a person's facial expressions and map the scan to the facial anatomy of a virtual avatar, resulting in an interactive animation. We combined our animated porcupine-fish avatar with Animaze and developed the WoZ experience ("Daddy the porcupine"; see Figure 2, right), which was installed in the museum during a one-day pilot event.

Reflection

After the development and piloting of the post-digital museum experiences, we organized a workshop with the museum staff to reflect on the challenges and opportunities for designing new post-digital experiences with their collections. We draw on the critical conversation held with museum staff to reflect on the adoption, sustainability, appropriateness, and opportunities of designing post-digital experiences in pre-digital museums to engage audiences with hidden natural history collections.

One of the main challenges in the adoption of new digital experiences in the museum space is infrastructure limitations because local museums may rely on centralized management and support in the public sector. This may make the adoption of new post-digital collections difficult because, for instance, museum curators do not have admin rights to control the access to the museum's network to install digital artifacts or have limited space to work with in historic buildings. Nevertheless, when given the opportunity to play with new ideas, museum staff demonstrates an appetite for forward-thinking and imagining new digital museum experiences for their collection.

Museums with limited digital experiences within their collections may question the appropriateness of digital interactive artefacts ("Does it belong to the museum's collection?"). The use of new digital media to tell stories about natural history challenges predefined mental models of the representation of museum collections. For example, visitors may expect to find physical objects rather than a potentially biased digital model. In addition, new innovative and interactive experiences may attract new audiences and enhance visitor engagement with collections.

However, accessibility needs (for instance, different audiences) and the limitations of technology (for instance, degrees of freedom, viewing angle) may create friction with the museum's ecology ("Does it fit the space as

part of the collection?”). Although artifacts like the HoloRoom allow the display of multiple objects in a single space, this application of creative technologies may only be relevant to an academic audience rather than appeal to visitors. In a social environment where space is limited, the crowding of museum spaces with technologically driven artifacts highlights the potential of innovative post-digital experiences to distract visitors from the collection, in turn hindering the educational experience.

Moreover, although there is a fondness for adopting new digital collections, this comes with challenges regarding the sustainability of the new collection to move forward. Local museum staffing operates in small teams and is dependent on a pool of volunteers. This poses questions on the maintenance of new digital collections because museum staff may not feel confident in operating or being in charge of innovative systems. This adds uncertainty regarding the resilience of the digital artifact because it may need updating (“Who is responsible for maintaining it?”) or technical support (“What to do if it breaks?”).

This highlights a need for a co-creation strategy so museum staff feel supported in the adoption of new digital or hybrid museum experiences. In our exploration, museum staff showed a positive attitude toward the opportunities creative technologies pose for museum experience design (such as new media for storytelling and playfulness) which could align with the museum’s mission for outreach, social demand, and community engagement. Undeniably, creative interactive experiences may attract new audiences (and even new volunteers) that may create a supportive network to help the transition to a post-digital museum.

Technology can create an environment that makes people more interested in ordinary objects within the museum’s collections. Although there is an appetite to adopt new digital museum experiences, museum staff lacks confidence in their digital literacy and have to work with limited resources. There is a need to create a supportive and synergetic framework (such as museum-university-community) to support museums in the co-creation and adoption of post-digital experiences. We call for future action to help strive for the sustainable and responsible digital transformation of regional public museums.

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Works Cited

- Back, Jon, Benjamin Bedwell, Steve Benford, Lina Eklund, Anders Sundnes Løvlie, William Preston, Paulina Rajkowska et al. 2018. "GIFT: Hybrid museum experiences through gifting and play." In *Workshop on Cultural Informatics* co-located with the EUROMED International Conference on Digital Heritage 2018 (EUROMED 2018), Nicosia, Cyprus, November 3, 2018, vol. 2235, 31-40.
- Black, G. 2020. *Museums and the Challenge of Change: Old Institutions in a New World*. London: Routledge.
- Brusius, M. and Singh, K. 2018. *Museum Storage and Meaning. Tales from the Crypt*. Abingdon: Routledge.
- Corona, L. 2023. "Digitization for the visibility of collections." *Collection and Curation*, 42, no. 3: 73-80. <https://doi.org/10.1108/CC-06-2022-0024>.
- Kelley, John F. 1983. "An empirical methodology for writing user-friendly natural language computer applications." In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*, 193-196.
- Løvlie, Anders Sundnes, Karin Ryding, Jocelyn Spence, Paulina Rajkowska, Annika Waern, Tim Wray, Steve Benford, William Preston, and Emily Clare-Thorn. 2021. "Playing games with Tito: Designing hybrid museum experiences for critical play." *Journal on Computing and Cultural Heritage (JOCCH)* 14, no. 2: 1-26.
- Mason, Marco. 2020. "Visioning in the Digitally Mature Museum." *Culture 24: Digital Pathways*. <https://digipathways.co.uk/visioning-in-the-digitally-mature-museum>.
- Parry, R. 2013. "The End of the Beginning; Normativity in the Postdigital Museum." *Museum Worlds*, 1(1), 24-39. Retrieved Jan 30, 2023, from <https://www.berghahnjournals.com/view/journals/museum-worlds/1/1/air-mw010103.xml>
- Pierroux, P. 2018. Learning and engagement in museum mediascapes. In *The Routledge Handbook of Museums, Media and Communication*, 128-142. Routledge.
- Pietroni, E., Ferdani, D., Forlani, M., Pagano, A., & Rufa, C. 2019. "Bringing the illusion of reality inside museums – A methodological proposal for an advanced museology using holographic showcases." In *Informatics* 6, no. 1 (January): 2. MDPI.
- Spence, Jocelyn, Dimitrios Paris Darzentas, Yitong Huang, Harriet R. Cameron, Eleanor Beestin, and Steve Benford. 2020. "VRtefacts: Performative substitutional reality with museum objects." In *Proceedings of the 2020 ACM Designing Interactive Systems Conference*, 627-640.

