



Figure 1. Model of a decorated cup found as part of the Dive on to Victory project in Portsmouth Harbour, United Kingdom. The image was made using a technique called photogrammetry, which is done by taking hundreds or thousands of photos of the object, making sure that the photos overlap in their coverage. Then, using specialist software, the images are stitched together based on the points of overlap. The 3D model is made by connecting these points of overlap. Image courtesy Maritime Archaeology Trust

Digital Archaeology and Digital Representations in Maritime Museums

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One of the challenges maritime archaeologists face is in sharing their work with a wider audience.¹ Few people worldwide can dive and access sites, and very few museums are able to display objects as large as a shipwreck. Even if a museum has the space to do so, the costs of raising, conserving, and displaying a shipwreck are extremely high. Therefore, much maritime archaeology work falls into the “out of sight, out of mind” area of public engagement. Maritime museums have an opportunity to help raise the visibility of maritime archaeology if they consider ways to embrace digital representations within traditional museum exhibitions. This is not always considered an option by museum professionals, however.

People love museums because they provide the opportunity to see objects from the past. They get to see “the real thing” and connect with history. A museum is seen as a physical representation of the past and objects are seen as “aesthetic witnesses to their period, to historical events or people” with historical actuality.² By nature, a digital representation of an object is at odds with this. Looking at a three-dimensional (3D) model of a vase on a screen is not the same as viewing the vase itself. Authenticity is a core value for a museum³ and “a fundamental measure of museum distinctiveness.”⁴ This might be why curators are reluctant to incorporate digital objects into an exhibition, particularly since those objects are “judged from the standpoint of the ‘superior’ physical counterpart.”⁵ But there are some scenarios in which digital archaeology and digital representations may help enhance an exhibition and leave a visitor with a deeper consideration of the objects and stories of the past.



Figure 2. A model of the *Yellowfin* created by the Maritime Archaeology Trust. The wreck lies in the River Medina, Isle of Wight, UK. The model was created using drone-captured images in 2017 and was used to create a virtual tour as part of the National Lottery Heritage Fund Fathoming the Future project. Image courtesy Maritime Archaeology Trust (<https://skfb.ly/oTQly>)

Digital Archaeology

At its essence, digital archaeology involves employing tools and techniques for virtual data and representations. Digital archaeology includes many things, from 3D modeling artifacts or entire sites (figs. 1 and 2) to digital mapping with tools like Geographic Information Systems (GIS) (fig. 3).

Digital techniques are used by archaeologists in the field as they excavate and in the data processing stage that comes after. Archaeologists make 3D models underwater using divers, remotely operated vehicles (ROVs), and autonomous underwater vehicles (AUVs). Divers, or vehicles, slowly circle a site holding underwater cameras inside specialty housing, with added protection and even lighting apparatuses. The more photos taken, the stronger the 3D model that can be developed with software. These 3D models can be made for entire shipwreck sites.

Digital representations can help archaeologists revisit a site for further study.⁶ Especially in deep-water sites, where time underwater is limited, or in locations with poor visibility, digital models allow researchers to go back, time and time again, to make observations and measurements, or to assess a site from an overall, big-picture view. Fieldwork in maritime archaeology can be extremely expensive, and professionals are therefore relying more on quick, digital methods of recording sites.⁷ Because many underwater cultural heritage (UCH) sites are under threat from multiple factors, including bottom trawl fishing, illegal treasure hunters, and climate change, digital models can also help researchers measure continuity or change over time.

Once a 3D model exists, it can also be made available to the public. Tools like virtual reality (VR) can be efficiently used “to allow universal

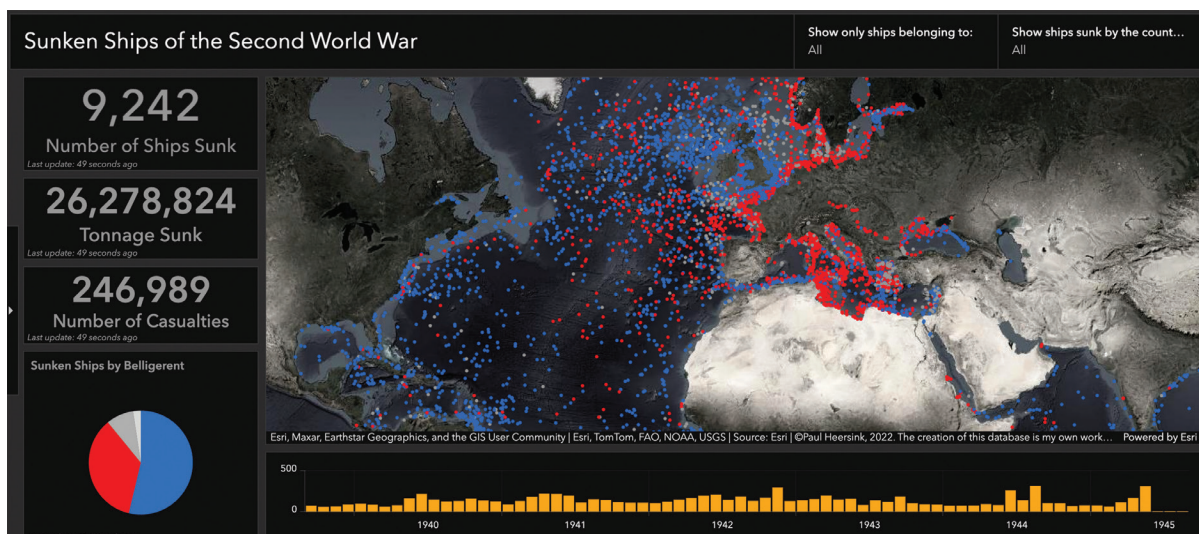


Figure 3. GIS is a database of georeferenced information (e.g., the latitude and longitude of a specific point) and the characteristics of objects. It can be used in various ways, depending on what the researcher is focused on, and in all stages of maritime archaeology, from planning to documentation and the later analysis of results. This image shows an ArcGIS database made by Paul Heersink, mapping the wrecks of the World Wars. It shows examples of what sort of data can be linked to wreck locations (<https://www.arcgis.com/apps/dashboards/fe88b5e18c6443c7afaf6e32f8432687>)

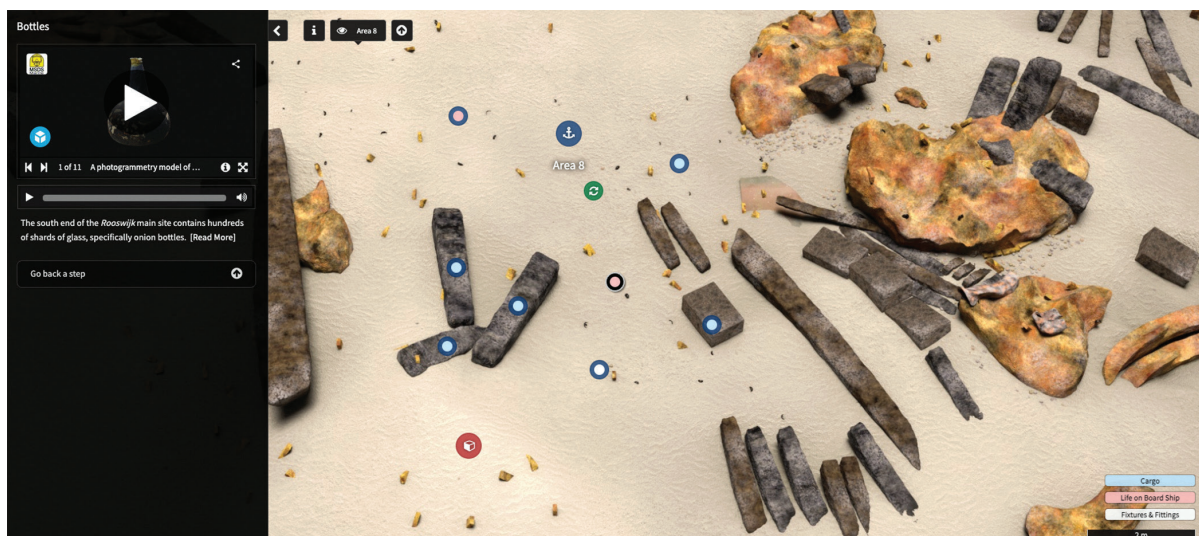


Figure 4. A screengrab from the educational virtual dive of the shipwreck site of the Rooswijk. MSDS Marine created the tour (in cooperation with ArtasMedia and CyanSub) after excavations. The #Rooswijk1740 project is funded and led by the Cultural Heritage Agency of the Netherlands (Ministry of Education, Science and Culture), in collaboration with project partner Historic England and UK contractor MSDS Marine. It involved creating 3D models of artifacts using photogrammetry and laser scanning. The models are available on Sketchfab (https://www.cloudtour.tv/rooswijk/information_introduction/0_0). Image © 1740 Project, used by permission

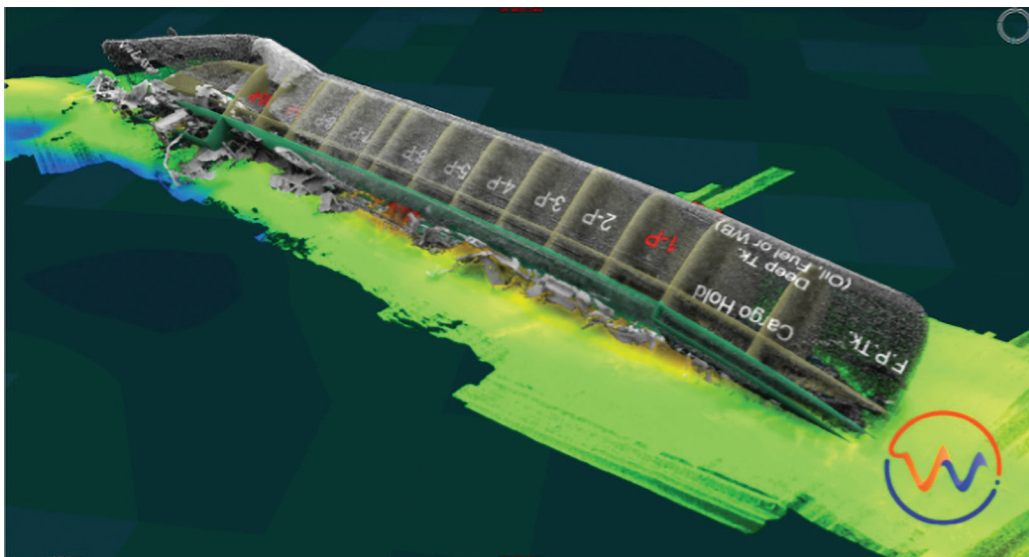
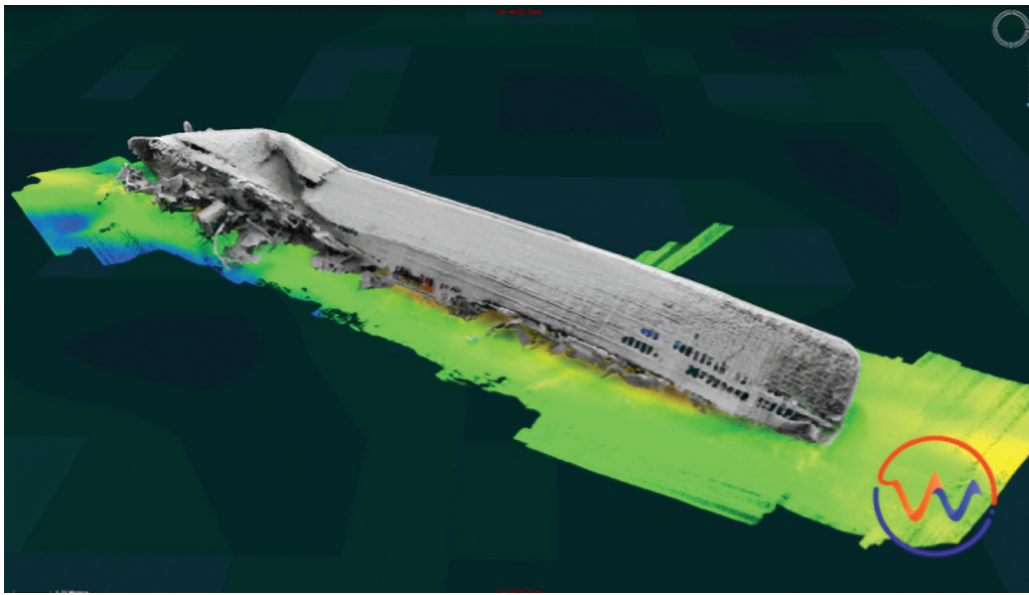


Figure 5. These two images show an example of how digital archaeological data can be integrated with archival records to deepen understanding. The high-resolution multibeam bathymetry data of the wreck of the Derbent is shown at the top, and the bottom image shows a digital model integrated with the multibeam sonar data. The digital model highlights the internal structure of the wreck—data usually gathered from ships' plans and archival documents. For this vessel, establishing the location of potential pollutants was the goal, but these sorts of methods can be used for any shipwreck with archival plans available. Image courtesy the Waves group, with data from UK Salmo. © Crown-owned copyright 2022

accessibility of the Underwater Cultural Heritage.”⁸ The average person may not have scuba certifications, and even if they do, maritime archaeologists often work in remote sites or with rough conditions. With digital representations of a site, anyone can be brought underwater (fig. 4). Using headsets, VR can take a visitor under the waves and into the world of a shipwreck. Using VR to create virtual dives can help “bridge the gap between recreation and science.”⁹ Virtual shipwrecks can be combined with archival data not only as a research tool for scientists, but also as a way to display a vessel to the public on a touch screen, for example. Where archival data exists, such as a historic ship plan, this can be superimposed on top of a 3D model of a shipwreck (fig. 5). This helps the visitor understand the history of the wreck and its time as a vessel traveling the ocean.

Digital archaeology is, of course, not a perfect solution, and there are many considerations. The technology can become outdated very quickly, and

it can (and will) break. Some institutions might not have the staff to tackle the challenges presented by using technology such as VR headsets. Additionally, not every visitor is eager to use digital presentation tools such as screens or a virtual reality headset. Digital resources also have a carbon footprint and an environmental cost.

But if digital representations of shipwreck sites or other archaeological features already exist from the excavations and research, then they can make great features in a museum. Digital representations offer an innovative way to link different maritime museums together and integrate fieldwork and archaeological investigation into museum spaces. Maritime museums are often repositories of data, and this includes information generated by archaeological projects. Increasingly, this excavation data is in a digital format, and so museums should think not only of archiving this data but also displaying it.

Endnotes

1 This article is adapted, in part, from a presentation given by the author at the International Congress of Maritime Museums, Het Scheepvaartmuseum, Amsterdam, September 19, 2024.

2 Fiona Cameron, “Beyond the Cult of the Replicant: Museums and Historical Digital Objects—Traditional Concerns, New Discourses,” in *Theorizing Digital Cultural Heritage*, eds. Fiona Cameron and Sarah Kenderdine (MIT Press, 2007), 54.

3 Ole Marius Hylland, “Even Better than the Real Thing? Digital Copies and Digital Museums in a Digital Cultural Policy,” *Culture Unbound* 9, no. 1 (2017): 62–84, 80.

4 Deepak Chhabra, “Positioning Museums on an Authenticity Continuum,” *Annals of Tourism Research* 35, no. 2 (2008): 427–47, 430, <https://doi.org/10.1016/j.annals.2007.12.001>.

5 Cameron, “Beyond the Cult,” 49.

6 Carlo Beltrame and Elisa Costa, “3D Survey and Modelling of Shipwrecks in Different Underwater Environments,” *Journal of Cultural Heritage* 29 (January–February 2018): 82–88, <https://doi.org/10.1016/j.culher.2017.08.005>.

7 John McCarthy et al., “The Rise of 3D in Maritime Archeology,” in *3D Recording and Interpretation for Maritime Archeology*, ed. John K. McCarthy et al. (Springer, 2019), 3.

8 Massimiliano Secci et al., “Virtual Reality in Maritime Archaeology Legacy Data for a Virtual Diving on the Shipwreck of the *Mercurio* (1812),” *Journal of Cultural Heritage* 40 (November–December 2019): 169–76, 169, <https://doi.org/10.1016/j.culher.2019.05.002>.

9 Secci et al., “Virtual Reality,” 175.