On virtual auras

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Introduction

Making 3D models for public facing cultural heritage applications currently concentrates on creating digitised models that are as photo realistic as possible. The virtual model should have, if possible, the same informational content as its subject, in order to act as a 'digital surrogate'. This is a reasonable approach, but due to the nature of the digitisation process and limitations of the technology, it is often very difficult, if not impossible.

However, museum objects themselves are not merely valued for their informational content; they serve purposes other than simply imparting information. In modern museums exhibits often appear as parts of a narrative, embedded within a wider context, and in addition, have physical properties that also retain information about their creation, ownership, use, and provenance. This ability for an object to tell a story is due to more than just the information it presents. Many cultural heritage objects have, to borrow an old term, *aura*: an affectual power to engender an emotional response

in the viewer. Is it possible that a 3D digitised model can inherit some of this aura from the original object? Can a virtual object also have affectual power, and if so, fulfil the role of a museum object without necessarily being a 'realistic' representation?

In this chapter we will first examine the role of museums and museum exhibits, particularly as regards to their public-facing remits, and what part aura plays. We will then ask if digitised objects can also have aura, and how they might help to fulfil the museums' roles. We will see in the case of the Science Museum's Shipping Gallery scan, that a digitised resource can, potentially, exhibit affectual power, and that this ability depends as much on the presentation and context of the resource as the information contained within it.

3D models as digital surrogates

'Digital surrogate' is a common term used when talking about 3D models in cultural heritage applications (Mudge, Ashley & Schroer, 2007, p. 1; Cameron, 2007, p. 56; Hess, Were, Brown, MacDonald, Robson & Millar, 2009, p. 44; Arnold & Geser, 2008, p. 67). It is worth spending some time picking this meaning apart. The standard dictionary definition of 'surrogate' is "a thing that acts for or takes the place of another; a substitute"[1], and a 'substitute' is "an object … which takes the place of another; a replacement"[2], it follows that a 3D model is a digital surrogate if it can replace the real object: interacting (for example performing a measurement) with the model will provide the same results as interacting with the object. But when a 3D model is described as being a digital surrogate, there is clearly a missing clause; a digital model cannot serve as a substitute for a physical object for *all* purposes. Obviously, with current technology, you cannot pick up a digital surrogate, weigh it in your hands or ascertain its material properties through the sense of touch. There is clearly more to the concept of digital surrogate and different authors have attempted to define the term more rigorously. Mudge (2007, p. 1) refers to the "essential scientific nature" of the digital surrogate; these are digitised models created via some repeatable methodology with a traceable connection between each point of data in the model and a corresponding point on the subject. Mudge's description is a functional one, it makes no claims as to the model's quality or properties, but talks about 'goals' and 'purposes'. Arnold (2008, p. 67)

[1] OED http://www.oed.com/view/Entry/195052?rskey=I1ZpJY&result=1#eid
[2] OED http://www.oed.com/view/Entry/193078?rskey=W4uhUq&result=1#eid

makes the functional definition makes even more explicit, distinguishing between digital surrogates and "representations captured for illustration or entertainment". The digital surrogate is "the closest fidelity to the actual object that can be achieved digitally" (ibid).

This definition begs several questions though. As technology changes, so does the 'closest fidelity' that can be achieved. Does this entail that today's digital surrogate is tomorrow's 'representation'? Different technologies may be chosen for different purposes as well. A model used for monitoring changes in an object over time may need to measure accurate geometry but no surface texture, while other professional purposes may require accurate colour recording but be more ambivalent towards geometric accuracy. One must choose what technology to use at the capture stage; the one that records geometry to the highest level of accuracy or the one that captures the best colour? It follows that in creating a single model with the 'highest fidelity' to reality, we must choose which particular aspect of reality we are most interested in. Thus a clearer definition for digital surrogate might be: the model is a digital surrogate if it can substitute for the object *for the purpose of x*.

In the case where 'x' is professional curatorial purposes' or 'academic research', even limiting the interaction to non-contact inspection of an object's surface properties, it is still difficult to see how any 3D model feasible with today's technology could be considered a true digital surrogate.
Apart from state of the art methods of measuring complex surface reflectance properties at research centres such as CultLab3D (Singh 2014) in Darmstadt and the Dome II project at the University of Bonn (Schwarz et al 2013) (see also Murat 2018), digitisation technologies which rely on measuring reflected light at a single angle (whether by triangulating a laser spot or taking a photograph) will fail to accurately capture texture (and potentially geometry) for a wide variety of cultural heritage objects, including, but not limited to:

> [objects] that exhibit complex reflectance properties such as anisotropy or iridescence, ones that exhibit significant self-shadowing or mutual illumination, ones that exhibit significant subsurface reflection, objects that are highly specular or translucent, and objects with intricate surface geometry. (Hawkins, Cohen & Debevec, 2001, p. 1)

All materials[3] exhibit some amount of shine or specularity, and will therefore cause problems in

[3] With the possible exception of specialist materials used in calibration devices, such as Spectrolon -

capturing accurate colour. Even the best available scanning resolutions will fail to capture details that might be revealed by a camera with a telephoto lens or a curator with a powerful magnifying glass, and surface geometry does not have to be particularly intricate to cause holes in the data.

Three projects conducted with the Courtauld Institute illustrate these problems. The objects digitised were a ceramic lustreware bowl, a miniature bible and the 14th century silver and brass 'Courtauld Bag' (Hindmarch 2015, p. 172 & 238). The bible (laser scanned) and bag (captured with structure from motion) both featured polished metal with excessive specularity[4], while the bible also had areas of dark leather which did not reflect sufficient light – a case of a single object being simultaneously too bright and too dark to capture perfectly! The lustreware bowl, as can perhaps be inferred from the name, was highly varnished, generating large specular highlights in the photos used to create the SFM model. Whilst it was possible to create usable (and, in terms of the required use cases, successful) 3D models, there were inevitable gaps in the data and lack of accuracy in the models' geometry and texture due to the objects' material properties. Whilst these were particularly difficult objects to digitise, they illustrate just some of the problems cultural heritage objects can present (figure 1).

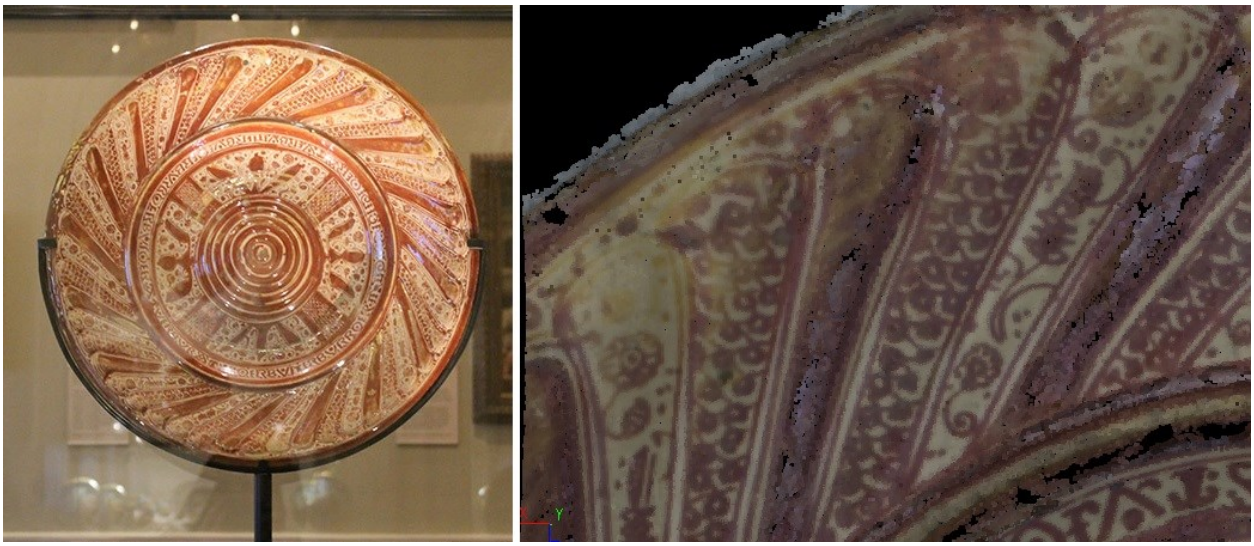

Fig. 1: L-R Photo of Lustreware bowl showing its extreme specularity; detail of the unprocessed 3D model of the bowl showing noise and artefacts caused by the specular highlights (Photo: Lustred ceramic dish. Probably Valencia,

https://www.labsphere.com/labsphere-products-solutions/materials-coatings-2/targets-standards/diffuse-reflectance-standards/diffuse-reflectance-standards/ (accessed 14/3/18)

[4] specular (as opposed to diffuse) reflections are mirror-like reflections of light from an object's surface, where the amount of reflected light seen by the viewer is highly dependent on the position of both viewer and light source; objects which exhibit strong specularity tend to show sharp, bright highlights

Spain, about 1500-25, 47.cm diam, The Courtauld Gallery, London, Gambier-Parry Bequest, 1966.

That isn't to say that digital models don't have utility. The E-Curator project (Hess, Millar, Ong, MacDonald, Robson, Brown & Were, 2008; 2009a) and subsequent work by Mona Hess (2015) has shown the potential for 3D scanning technology for professional CH purposes, and there are clear advantages to working in the digital realm. Interrogating a virtual model does not require handling of friable objects or accessing objects in storage or on public display. The model can be examined remotely from (potentially) anywhere with an internet connection, and allow for digital repatriation – see, for example the Western Solomon Islands War Canoe (Hess, Were, Brown, MacDonald, Robson, & Millar, 2009b). It can be simultaneously accessed by an unlimited number of people, and objects situated in different collections on different continents can be compared side by side.

So at least in terms of professional applications, we can abandon ambiguous criteria such as 'closest fidelity', or 'essential scientific nature', and define digital surrogacy by a digital model's ability to substitute for the object *for a specific, well defined purpose*. If this purpose consists of extracting some piece of information from the model we can say that the model is indeed a digital surrogate if the information gleaned from interrogating the model is the same, within specified parameters determined by the particular purpose of the measurement, as would have been gleaned from conducting the same investigation on the real, physical object.

The digital surrogate in public facing applications

Visitors to Cultural Heritage (CH) institutions – members of the public with no privileged access to the exhibits – will have a very different experience to that of a CH professional. Often the object will be behind glass, at some minimum distance from the visitor, only viewable from certain angles. Since the information the member of the public can extract from the real object will be of a presumably lower quality than that available to the professional with unrestricted access, it would follow that the virtual model would have a lot less work to do to be considered a digital surrogate. In fact there may be circumstances where a visitor can extract more (or at least different) information from the digital surrogate (see, for example, visitors responses to the 3D model displayed alongside the Courtauld Bag in the Court and Craft exhibition (Hindmarch, 2015, p.

290). On top of this, the digital model provides the same (if not greater) accessibility benefits as in the professional case.

Of course, here we are falling into the same trap as earlier: we are talking about a digital surrogate for public facing applications without talking about its specific purpose, as if all museum visitors seek out all cultural heritage objects for the same reasons. The class of cultural heritage objects is exceptionally heterogeneous, defined by a series of polythetic properties or family resemblances. It is impossible to find a single (non-trivial) property shared by all, and similarly, to define a single purpose for which people interact with them is equally difficult. To achieve a functional definition of a public facing digital surrogate we must approach it from another direction. What are the *roles* or *remits* of CH institutions – and how may digital surrogates fulfil these specific purposes?

The museum's dual remit

Organisations such as the International Council of Museums (ICOM 2007), UNESCO (UNESCO 1978) and the Museums Association (Museum's Association *Code of Ethics for Museums*) all stress the two stranded nature of a museum's function, its *professional* and *public-facing* remits. Whilst the former would include all activities related to the acquisition, conservation and preservation of cultural heritage and academic research conducted on it; the latter would include activities concerned with providing access and disseminating knowledge to the general public.

Whilst the public facing role would seem subservient to the professional – without preservation there will be nothing to display; without research there will be no knowledge to disseminate – the primacy of the museum's professional role in no way diminishes the importance of the public. All three organisations mentioned above stress this: Collections of cultural objects are "part of the common heritage of mankind" (UNSECO, 1978) and are "held in trust for the benefit of society and its development" (ICOM Code of Ethics), while the Museum Association states that museums should focus on public service and encourage people to explore collections for inspiration, learning and enjoyment. One could argue that the museum's professional remit is, in fact, there to support the public one; that the preservation and understanding of cultural heritage is devalued if what is preserved and what is understood is inaccessible to the people for whom it is held in trust.

The public facing role of a museum is clearly vital, and if a 3D digitised model can help support that role, then this would provide an argument for investing the necessary resources in their creation. There are intuitive reasons to believe that 3D models may indeed help museums fulfill their public facing remit: as Metallo and Rossi say: “our experience with museum websites so far has shown that putting high resolution images of collections online just increases audience engagement and familiarity with collections ... We expect 3D to do the same.”(Metallo & Rossi 2011). However, institutions adopting 3D technologies risk what Pallud (2009) calls technological determinism, where the “implementation of [digital technologies] in museums is assumed will positively impact visitor satisfaction even while there is little verification of whether these technologies really achieve their goal.”

As the barriers to 3D digitisation have fallen in the last decade, primarily due to advances in digital cameras and structure from motion software, there has been a concurrent rise in 3D models of cultural heritage being made available through platforms such as Sketchfab. At the same time, we have not seen a similar increase in research into the utility or otherwise of 3D content. To avoid falling into the technological determinism trap, and be sure that 3D technologies really are achieving their goal, we need to be clear what this goal is. If it is to educate, engage and entertain, what are the properties a digital model needs? Whereas in the professional sphere we can evaluate the success or otherwise of a model by its ability to fulfill a specific purpose, the purposes in the public arena are perhaps harder to define and thus contrary to what we found earlier, the public facing model may actually, counter-intuitively, have more work to do to prove its utility than its professional equivalent. Whereas a professional might accept gaps in the data so long as they do not interfere with their specific purpose, this might be more problematic for someone used to consuming high quality video game graphics and expensive CGI on film and TV, and is expecting a realistic virtual rendering of the entire object. In many cases what makes an object beautiful and unique – the complex way that it interacts with light – is the very information the museum visitor may be looking for, and the one thing we cannot easily recreate in a digital model. But is there more to cultural heritage objects and museum exhibits than simply imparting informational content? To determine in more detail the purpose of 3D models of cultural heritage objects, and thus the criteria by which their digital surrogacy may be judged, we must first look at the role of the objects themselves.

The purpose of museum objects

Following Casey (2003), it is helpful to divide museum practise into three typologies: The *legislative*, *interpretive* and *performing* museum. Casey describes the oldest type of museum, the *legislative*, as a pre-19th century conception. Legislative museums aim to be "paragons of the aesthetic and intellectual pursuit … a venue for display not debate", while the museum itself becomes merely "a container for collections of objects." In this incarnation the museum gained its authority through its collections; unique and special objects intended to be viewed with a passive, awe-struck demeanour.

The *interpreting* museum is, perhaps unsurprisingly, closer to our modern conception of 'museum', and arose from the realisation that whilst we should, as Gurian & Heumann (1999, p. 19) say, "acknowledge the power of some objects to speak directly to the visitor, for example, in the sensual pleasure brought about by viewing unique original objects of spectacular beauty, the notion that objects, per se, can communicate directly and meaningfully is under much scrutiny." As well as preserving cultural heritage, museums also act as transmitters of the current prevailing culture by interpreting the past through its prism:

> Rather than having objects speak for themselves, museum professionals interpret cultural significance for visitors by structuring art and artefacts around easily identifiable chronologies, geographies, formal themes, and narratives. (Casey, 2003, p. 6)

The third type, the *performing* museum, is in part a reaction to changes in society and the commercial pressures faced by museums. The museum has assimilated "commercial strategies to entertain audiences … the contemporary museum privileges the processes of display over the particularity of objects to convey information." (Casey, 2003, p. 9) The performing museum sees as much emphasis placed on how an object is displayed as on the object itself; the museum object is further removed from its legislative pedestal and becomes just another (albeit important) feature of the exhibit as a whole. Chakrabarty (2003) sees the shift in museum philosophy in the 20th century as a reflection of the evolution of western democracies away from a pedagogical model to a performative one, the change in museums reflecting the idea that we are no longer so receptive to information (or interpretations) handed-down to us from an unimpeachable source, instead we

place more emphasis on constructivist learning. Messham-Muir (2006) describes it as a move away from cognitive forms of interpretation to affective forms.

We could see this trend as a move away from object-centric approaches. Objects are no longer to be appreciated just for their own sake, as in the legislative museum. Stories, events and experiences become the primary components of exhibitions; the objects have become subservient to the narrative. As Gurian (1999, p. 5) says, "in the late 1960s and early 1970s, the definition of museums always contained reference to the object as the pivot around which we justified our other activities", whereas today, MacDonald (2001) points out, museums' primary role has become the dissemination of information. It could be argued that a museum's activities (storytelling, education, entertainment) justify the objects: If exhibiting an otherwise unremarkable object is the best way of telling a story or imparting information, then that justifies its presence rather than any particular characteristics of the object itself. Instead of the museum gaining its authority from its objects, the objects gain authority from the museum.

This evolution would, on the surface, make the argument for the use of digital models more compelling. The object has changed from an end-in-itself to a means-to-an-end, and if the value of a museum object is its ability to impart information or sustain a narrative, and less do with any intrinsic worth, then a digital model which could impart the information or support the narrative equally well could easily be substituted for the object.

Would it follow, then, that we could replace all the objects in our museum with digital copies (or indeed any other information containing object, such as a textbook) so long as support the story as effectively[5]? The medium is irrelevant, only the message is important.

And yet museums *do* contain objects. The reason for a museum visit may vary – for recreation, entertainment, a social experience or learning – but museums' enduring popularity is also something to do with their collections. As Falk and Dierking (2016, p. 46) put it, museums' continuing popularity is down to the public's need for "reverential experiences". Perhaps we

[5] See, for example, 'Caravaggio: An Impossible Exhibition', a multimedia exhibition including 65 high resolution images of Caravaggio's works: http://www.beniculturali.it/mibac/export/MiBAC/sito-MiBAC/Contenuti/MibacUnif/Eventi/visualizza_asset.html_88273758.html (accessed 14/3/18)

haven't moved far from the legislative museum after all.

Aura and affectual power

This idea of 'reverential experiences' is an important one. Not only is it somehow integral to what we might think of as the archetypal museum experience, it also marks a clear distinction between cultural heritage's professional and public worlds. Whilst a museum curator may feel reverence for the objects they handle, it is irrelevant to their interactions with them or their digital surrogates. But if an element of reverence is part of a museum visitor's interaction with an object, and what allows/encourages people to engage with cultural heritage, then what import does that have for a public facing digital surrogate?

While the requirements for digital surrogacy for both professional and public facing models are the same – that the model can substitute for the object for a particular purpose – it is the purposes which differ between the two applications. In both cases the model can be considered successful if the viewer's purpose is fulfilled; the professional acquires a measurement or some information, the member of the public engages with the model and perhaps learns something or is entertained. However, if the ability for members of the public to engage with a museum object is related to the 'reverential experience', we must examine how, or if, a digitised model can evoke this type of experience.

This question is related to Benjamin's concept of "aura"[6] (Benjamin, 1939, p. 61). His aura represents an ineffable quality inherent in the object, and which is not captured by any form of mechanical reproduction[7]. Whatever you think of his arguments, Benjamin's concept as applicable to cultural heritage objects is useful and would seem to have an intuitive validity; these objects do seem to have a particular power to evoke emotional responses in viewers.

This ability to elicit an emotional response can be described as the *affectual power* of an object. Witcomb describes an object's power to affect alteration, this being an emotional response to an

[6] Benjamin, Walter. 1939. The Work of Art in the Age of Mechanical Reproduction.

[7] For Benjamin, mechanical reproduction has a history as long as art itself; from copies of ancient Greek statuary through woodcuts and engravings and up to the new technology of the day, photography and film. One can only imagine what he would have thought of 3D digitisation.

object that through imagination and empathy allows us to "experience what it is to be 'other'" (Witcomb, 2008, p. 41) and thereby come to a greater understanding. Many other authors (Messham-Muir, 2006; Hooper-Greenhill, 2000; Muller, 2002) refer to a similar power in museum objects, often framed in terms of the potential of an object to engender feelings of empathy in the viewer.

Some objects may have affectual power due to their materials, craftsmanship or aesthetic qualities[8]. But for many objects the aura is derived not from the object's material and physical properties but its history, its unique biography, to borrow another of Benjamin's terms. An otherwise mundane object becomes part of our heritage due to its connection with a historical figure or event.

For an example of this affectual power in a real museum object, Messham-Muir recollects viewing an exhibit of shoes, part of a larger holocaust exhibition at the Imperial War Museum. Focussing on one single shoe, the experience profoundly affected him, the "raw stark materiality" of the object providing a link between the observer and the shoe's owner, 60 years in the past. He talks of our relationships with objects and how they allow us to "enter into powerful empathic relationships that seem to transcend place and time" (Messham-Muir, 2006, p. 6). But the author's reverential experience is clearly due to more than just the stark physical facts of the exhibit. It is a result of three things: the context of the exhibit itself, including the extra information imparted by the shoe being presented within the larger context of both the holocaust exhibition and the Imperial War Museum itself; the context provided by the author's knowledge and experience of the holocaust; and ultimately the shoe itself, the material object with a biography that intersects historical events. It is these three things working together that induces the empathic response and leads the viewer to a greater understanding.

Another, perhaps less emotive example comes from the lead author's experience and involves the Petrie museum's ancient (c.2800 BC) Tarkhan dress[9]. Whilst damaged and decayed it is still instantly recognisable and despite its condition, could easily pass for a modern article of clothing.

[8] Though these may still require some pre-existing knowledge in the viewer: the value of gold and other precious materials, the skills required to create something of beauty as well, perhaps, as aesthetic values inherited from their culture
[9] https://www.ucl.ac.uk/culture/petrie-museum/tarkhan-dress

On its own, the item invoked no particular emotional response. However the context of the exhibit, in this case the label text, explains how the object was found inside-out on the floor of a dwelling, as if it had been taken off and thrown down[10], and it was only after reading the label that an involuntary and powerful emotional response was experienced, as if the millennia had been compressed: the simple action of taking off a piece of clothing and throwing it, inside out, on the floor is such a basic human experience that an immediate sense of empathy with the past was felt. Neither the label nor object alone were sufficient to elicit this response: Again, we see the affectual power of an exhibit as a product of multiple sources, in this case context provided by the label information, personal experiences, and the object itself.

The cultural heritage object in the age of digital reproduction

So how does this concept of aura or an object's affectual power relate to digital, virtual copies? On the surface, it would seem to argue against the utility of public facing 3D models: if what makes a museum object special is its affectual power, a product of an aura which is in turn a product of the object, there doesn't seem much hope. As Messham-Muir said it was the object's "raw materiality" which induced the response. How could even a perfect digital model of the shoe evoke the same emotional response? Unless we are dealing with a purely aesthetic object, the aura seems to have little to do with its surface properties, and it is the surface, after all, that is the sole domain of current models of digitisation.

Taking our digital model in isolation, the prognosis would be poor: it is hard to see where its aura, and subsequently its affectual power, will come from. However, as we have seen, modern museum objects are rarely viewed in isolation. Instead they are presented in context, as parts of a narrative.

There are good examples of this type of presentation in the 3D digitised arena – for example, the Smithsonian X3D project includes multimedia tours that combine interactive 3D models with other content, to create immersive narratives – a good example being the Repatriation and Replication of the Kéet S'aaxw (Killer Whale Hat) [11]. Even on platforms such as Sketchfab, the ability to

[10] The 'as if' is important here, demonstrating that this is, of course, an interpretation of the facts – or simply speculation on behalf of the curatorial staff; an example of the importance of context and the malleability of an object's 'true' biography.

[11] Viewable at http://legacy.3d.si.edu/tour/repatriation-and-replication-k%C3%A9et-s%E2%80%99aaxw (accessed 12/3/18)

annotate models and add audio content[12] allows for 3D models to be presented with a certain amount of context. Nevertheless, the majority of public-facing models presented online are still viewed in isolation, divorced from a larger exhibition context or any over-arching narrative. The purpose of these models is unclear; there is a hint of technological determinism about their provision.

The shoe or shirt on their own, are mundane and unremarkable. In the contexts of their respective exhibits, collections and provenance they have aura. So the question is not does our virtual object have an aura, but can an entire exhibit have affectual power when one part of it, the object itself, is replaced with a digital copy?

Case Study: The Science Museum's Shipping Gallery Scan

Before its closure in 2012, the Shipping Gallery was London's Science Museum's largest single space and its oldest surviving exhibition. Opened in 1963 and containing over 1800 individual exhibits, the gallery showcased maritime technology, the evolution of shipping and an array of model ships. Largely untouched since the 1960s, the gallery's floorplan felt very dense compared to the rest of the museum (for comparison, the gallery which now fills the space contains just 800 exhibits[13]), and whilst the objects were arranged with a rough chronological flow, there was no clear path or obvious signposting. Labels on individual exhibits often featured long, manually typed chunks of text and there was little interactivity or attempt to place exhibits in a wider context. The 'old fashioned' nature of the exhibition and its incongruity within the museum as a whole was reflected in attendance. Even during the museum's busiest times the gallery was often deserted.[14]

When the Science Museum decided to replace the Shipping Gallery with a new exhibition, the Making of Modern Communication, they approached UCL to discuss the possibility of using laser scanning to create a permanent record. ScanLAB[15], a company formed by two former UCL

[12] See for example items from the British Museum's Sketchfab collecton, such as their Rosetta Stone model with audio commentary: https://sketchfab.com/models/1e03509704a3490e99a173e53b93e282?ref=related (accessed 12/3/18)
[13] https://eandt.theiet.org/content/articles/2014/10/analysis-the-science-museum-information-age-gallery/
[14] For example, one of the comments below the video on metafilter (http://www.metafilter.com/130281/Scrapped-but-not-forgotten): "This is sad also because the Shipping Gallery had a few benches where you could eat your lunch in complete peace, even during the school holidays …. Always deserted."
[15] ScanLAB is a terrestrial laser scanning company set up by two former students of UCL's Bartlett School of Architecture. They create point cloud models for a diverse set of clients including architecture firms, television productions, artists,

students specialising in large scale terrestrial scanning were engaged to complete the scan and produce a video from the data.

The gallery was scanned over five nights using two Faro Photon 120 terrestrial laser scanners, capable of capturing up to one million points per second, with a maximum range of 120m and an accuracy of +-2mm at 10m. Colour was obtained from panoramic images taken by a DSLR camera attached to the scanner and projected on to the point cloud. Over four months the 275 individual scans, comprising approximately ten billion points, were colourised, registered and cleaned of noise. Due to software limitations, only 17% of the total data was used in rendering a seven minute fly-through video. The finished clip was sent to the gallery's curator, David Rooney, to record a narration, and Box Of Toys Audio[16] composed incidental music and added sound effects. The finished video was published on July 22, 2013 and can be viewed on the Science Museum's website[17] and YouTube channel[18].

Research was conducted on the video via a survey linked on the Science Museum website, and analysis of comments left on social media and the various sites which embedded the video.[19] The survey, comment analysis, and quantitative analysis of likes on the Museum's YouTube channel showed a strong positive reaction to the video (Hindmarch, 2015, p. 150).

However, despite its overall popularity there were some common complaints (made in some cases by users who otherwise enjoyed the video and rated it highly), namely the lack of detail and poor informational content. Even with two billion points, the model's resolution of a point every few millimetres meant that much of the detailing on the intricately featured model ships was lost. (figure 2, 3) With each point rendered as an individual pixel, the model appears translucent rather than solid; the exhibits are often *suggested* rather than shown explicitly. The scan neither approaches, nor attempts 'photo-realism' and taken simply as a source of informational content is unsatisfactory. If the purpose of the Shipping Gallery scan was to allow users to extract detailed

Greenpeace and cultural heritage organisations. See scanlabprojects.co.uk for examples of their work.
[16] http://www.boxoftoysaudio.com/
[17] http://www.sciencemuseum.org.uk/about_us/history/shipping.aspx
[18] https://www.YouTube.com/watch?v=gDTbFhFZl9I
[19] Hindmarch (2016), Chapter 4.9, pp150. A total of 35 survey respondents and approximately 120 comments and tweets were analysed

information about the exhibits in the gallery, it would have to be considered a failure, and yet by most metrics the project was a success.

Fig. 2: Render from the Shipping Gallery model. View from the southern end of the gallery showing the model's point cloud rendering. Note the ghostly, translucent nature of the walls. From Hindmarch (2015, pp 145) with acknowledgement to ScanLab.

Fig. 3: Still from the Shipping Gallery video, showing the figurehead from HMS North Star. Again, note the

translucent nature of the objects. From Hindmarch (ibid) with acknowledgement to ScanLab.

At this point we return to the concept of a digitised model not simply as a carrier of information, but as something seen in a wider context as part of a narrative with the potential for affectual power. In this case, the context is provided by the narration and audio components and the wider narrative is the story of the gallery itself. Its affectual power can be seen in the emotional language used in the comments submitted to the survey and left on websites, often referring to feelings of nostalgia and sadness at the gallery's demise, and indeed the emotive responses engendered by the video (for example: "I actually applauded at the end of that"!)[20].

The divisive presentation of the point cloud model also has relevance. One of the survey questions did specifically refer to the 'ghostly' style, and therefore could be construed as a leading question, but commenters on other websites also used this and synonymous terms unprompted ("That is at the same time beautiful and very very ghostly.", "ghost-like images", "The 3D model is very spooky"). Perhaps serendipitously, the rendering style, as much an aesthetic choice as a constraint of the available data, fits the narrative and mood of the video. It is, after all, a memorial to something that is no longer with us, and the elegiac tones of both the incidental music and narration complement the 'ghostly' nature of the translucent point cloud aesthetic. The power of the three aspects – visuals, narration and music – to come together and evoke emotion in the viewer is summed up by one comment: "Great. Now I'm feeling wistfulness over the non-existence of a place I never knew existed."

We can also examine the context beyond the video itself. From the survey we see that the video was most popular amongst those who already had familiarity with, and positive feeling towards, the Shipping Gallery itself. The digital resource itself is not the only factor to be considered when evaluating its success; the wider context includes people's memories, the exhibition's longevity had allowed it to become a focus for emotional recollections of family and childhood, with commenters reminiscing about visits many decades ago ("You have made a 3D rendering of our 4D world. I wish that you could go the last step and bring my Grandad back so we could walk

[20] All comments, from both the survey and the web can be read in Hindmarch (2016), Appendix A, pp342-363

around together.”). Other comments refer to the gallery’s context in terms of the history of shipping and its particular connection with British history, Empire and the recollection of a (real or imagined) golden age entangled with notions of sea power. These, for some viewers of the video, are in themselves emotive subjects and thus the Shipping Gallery itself, and to a certain extent, the scan and then the video, become carriers of a much larger significance, in much the same way that Messham-Muir’s shoe carries the context of the holocaust.

Conclusions and recommendations

It certainly seems possible that the digitised version of the Shipping Gallery has inherited some of the Gallery’s aura. Whether that aura is present in the data – the point cloud – itself, or is a product of the visualisation, music and narration – or indeed of an even wider context that includes viewers’ own experiences and cultural baggage is an open question. But as we saw in the examples of museum exhibits discussed earlier, it is neither uncommon nor problematic for an object’s aura to be a product of the object-plus-context.

We have seen that while many 3D models currently being created of museum and other GLAM institution objects do so without clear purpose, it is important not to treat the output of the digitisation process in isolation, stripped of the context provided by the surrounding material. In a museum, an exhibit acquires context almost by default. There is its physical location amongst other, perhaps similar objects which together tell a larger story. A digital model displayed in isolation is stripped of this additional context: a digital model of a shoe displayed in isolation will be a digital model of a shoe; a digital model of the entire exhibit, with the shoe presented in context, perhaps embedded in a larger virtual museum, with additional sources of information that describe the provenance of the show and why it has been digitised, may look like something else entirely.

Another reason for cautious optimism is that while we don't have a physical connection – there is none of Messham-Muir's 'stark materiality' – with the virtual object, neither do we have a physical relationship with the vast majority of museum objects anyway; we are usually separated by glass and/or distance. Pallud (2009) advances an argument based in phenomenology that simply seeing an object is a flawed experience, and that the ability to touch *or manipulate* object contributes to a better experience. Obviously without the use of haptic technology we cannot 'touch' virtual

objects, and in the case of the Shipping Gallery's non-interactive video we have no control, but we can often spin virtual objects, zoom in and out and examine particular areas at will. It is possible that this interaction may lead to a richer engagement with the digital model than we might perhaps have with an object in a display, and that this engagement might in turn increase the virtual object's affectual power.

The limits of currently available scanning technology mean that no 3D model can be an exact replica of a museum object and whilst this raises issues around the copying of cultural heritage objects and the information-carrying purposes to which these models can be put, we believe digitised objects can still fulfil other purposes but that these purposes require considerations beyond the digitisation process itself. We propose that the *purpose* of creating a 3D model of a cultural heritage object is clearly stated before acquisition work even begins: only by clearly defining purpose and scope, is a model useful, useable, and understandable for advancing a museum's remit.

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