EMBODIED MUSEOGRAPHY

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This essay focuses on a series of large-scale immersive and interactive media museum installations for tangible and intangible heritage. In doing so, the discussion explores the role that these experiences play within the museological context, building a framework for "embodied museography". This "embodied museography" is defined by attributes of immersion, interaction, and participation and necessarily asks us to re-examine our notions of aura, authenticity, and authorship.

Museums and heritage organisations have institutionalised authority to act as custodians of the past in Western societies. As such, they hold a significant part of the "intellectual capital" of our information society. Museums and science centres are educational and historical sites where public meaning is articulated and disseminated. These exhibitionary institutions have been theorised as "a context for the permanent display of power/knowledge" (Bennett 1995, 66) and collecting organisations are also understood as vehicles for the enduring concerns of public spectacle, object preservation, and shifting paradigms of knowledge. The contemporary shift towards increasingly spectacular museums in the 20th century is aligned with shifting modes of display and roles of curatorship and museology. As museologist Nick Prior observes:

> The idea of universal survey, ideationally bound to Enlightenment narratives of progress, has appeared increasingly unrealistic and outdated, as has the top-down model of museums, whereby curators and scholars present the fruits of their connoisseurship to a passive audience. Instead, museums are embracing mixed arrangements aimed at opening up audience interpretation beyond the linear narratives of traditional art history. (Prior 2006, 516)

The use of emerging digital technologies to activate, engage, and transform "capital" is paralleled by shifts in the organisational practices of the institutions entrusted with its care.[1] In a symbiotic relationship, cultural

[1] For example: the internet, environments of virtual and augmented or mixed reality, mobile computers, wearable technologies, automatons, artificial intelligence, and intelligent agents. For a discussion of culture and digital technologies see Gere 2002.

heritage "ecologies" also appropriate, adapt, incorporate, and transform the digital technologies they adopt. Why and how this transformation occurs in our cultural organisations has been the subject of increasing investigation (e.g., Parry and Sawyer 2005; Cameron and Kenderdine 2007). Digital technologies are implicated with historical transformations in language, society and culture, and with shifting definitions of the museum. Indeed, to speak of the digital is to engage simultaneously with global interconnectivity and the impressive array of virtual simulacra, instantaneous communication, ubiquitous media, and all of their multifarious applications (Gere 2002, 11). Interactive experiences in museums and science centres now saturate the advertising language of these organisations with phrases such as "high tech fun", "hands on", and "fascinating displays" (Witcomb 2006, 353). The design paradigm is generally associated with one-way interaction where "the visitor touches and there is a reaction" (Lewis 1993, 33, quoted in Witcomb 2006, 354). As museum theorist Andrea Witcomb acknowledges, dialogical interactive exhibits (ones which are dynamic, relational, and engaged) display open-ended narratives and the more complex of these deals with the notions of immersion and experience (Witcomb 2015). Interactive exhibits are believed to increase visitor time spent on an exhibit.[2] Interactive experiences are also thought to be more effective as pedagogical tools according to constructivist and cognitive learning theories.[3] Thus, new media and technology in museums opens up many opportunities to view the creation of knowledge.

As museum researcher Mia Thornton asserts:

> Interpretations can be open ended; that the knowledge inherent in the past is constantly shifting and evolving; and that a two-way relationship is being exercised between the technology and the user. In this way, virtual heritage can be viewed as a cultural form... embedded and intervening through interpretations and cultural difference about the past. (Thornton 2007, 306)

Aligned with technological intervention, there is an increasing trend to merge architecture and media. In the book chapter "Space and the Machine: Adaptive Museums, Pervasive Technology and the New Gallery", museum theorists Ross Parry and Andrew Sawyer (2005, 39–52) suggest that museums are adapting Information and Communication Technology (ICT) to fit the exhibition and museological context, just as they have always made use of available communication technologies. This change is happening through a six-phase process that started in the 1950s (when ICT was generally still 'outside' the museum), culminating in the present "integrated" stage (where high-tech displays are physically blended with the rest of the exhibition and allow a dialogue between the on-site and on-line dimensions). Parry and Sawyer argue that an "innate" phase is emerging in which, instead of "placing digital media into a gallery environment", exhibitions are "shaped literally as a digital medium" and visitors are immersed in and interact with more transparent and intuitive mixed-reality devices. That is, within the museum context, visualisation systems and architectures come together to operate as discreet entities.

[2] There is a well-established body of research that shows that the addition of interactive elements to a museum display may increase the amount of time that visitors spend in an exhibition (Stevenson 1994). "As early as 1936, for example, Melton demonstrated that average time at an exhibition went from 13.8 to 23.8 seconds if visitors manually manipulated components" (Hein 1998, 143–4, quoted in Witcomb 2006, 354).

[3] Cognitive learning theory posits that the memory system is an active organised processor of information and that prior knowledge plays an important role in learning. Constructivist models emphasise that learning involves constructing one's own knowledge from one's own experiences.

The technologies of immersion and large-screen stereographic formats could be considered attractive simply because of the "spectacle" they offer. Museums oscillate between the tensions of delivering their intended monochromatic and didactic interpretations and using such instruments of the spectacular. The coupling of museums and immersion is the focus of Alison Griffiths book *Shivers Down Your Spine: Cinema, Museums, and the Immersive View* (2008). Griffiths' central thesis is that one cannot really talk about the "immersive view" or immersion without dealing with museums, since the two go hand-in-hand. "Presence" (essential in immersion), virtual travel, death, a "revered gaze", visual spectacle, the sublime, and a sense of awe are all mobilised in the museum. Museums have always relied upon technologies of vision and sound — such as photography, recorded sound, cinema and electronic images — to heighten the gallery experience and to enhance learning and understanding through sensory and emotional appeal (Griffiths 2008).[4]

Digital cultural heritage

Virtual cultural heritage examines the intersection of cultural heritage research, documentation, and interpretation as it is mediated through the techniques and modalities of virtual reality. It is a process of visualisation. The term "virtual heritage" within the disciplines of digital humanities is generally accepted as referring to virtual reality (specifically 3D and 4D computational and computer graphics systems that support real-time, immersive, and interactive operations) employed for the presentation, preservation, conservation, and documentation of natural and cultural heritage. "Virtual heritage" is distinguished from the broader aspects of the digital humanities by its preoccupation with replication and so-called re-construction or re-creation. "Interpretive virtual heritage" is the term often used in the public domain for the exploration of archaeological and cultural heritage through visualisation. Implicated in this terminology is "virtual reality".

While most of the preconditions for virtual reality have been available since the 1990s, the cultural, aesthetic, sociological, and scientific implications of the use of these technologies for heritage are still being formulated as demonstrated in the ongoing struggle to create compelling narratives that accompanies the explosion of head-mounted displays for consumer use. Those engaged in the practice of digital cultural heritage are particularly concerned with the (lack of) translation of the scientific principles of the discipline of archaeology to the modalities of virtual reality. For some, the failure of most virtual heritage to live up to its scientific potential invites dismissive labels such as "edutainment" and even the "Disneyfication of culture", and, as Juan Barceló states, "'in most cases the use of virtual reality in archaeology seems more an artistic task than an inferential process" (Barceló 2000, 28). In a long-term vision statement, Silberman concludes:

> The Future of Heritage requires forms and modalities of recording, analysis, interpretation, and public dissemination that go far beyond those already available. The watchwords are place, network, memory, identity, and communication. Obviously technology can and will provide the context and tools for these new approaches to heritage. From a strictly Cultural Heritage perspective, the big changes to be anticipated in the next ten years or so are unlikely to

[4] This celebration of virtual environments in public spaces is not to brush over the problems of understanding the potential use of immersive environments for pedagogical outcomes. With only a few empirical studies on virtual reality learning environments, the ways in which immersion, presence and co-presence can contribute to cognitive understanding and learning lacks adequate investigation. See Bonini (2008), Forte and Bonini (2008), Economou and Pujol (2007a; 2007b) and Forte, Pescarin and Pujol (2006).

> be about automation but rather about systemic changes in the way our heritage is categorized, protected, and interpreted. (Silberman 2008, 45)

The key term here is "interpreted" and it is the pivot for the work discussed in this essay and for building immersive cultural heritage for the public. Interpretive digital cultural heritage is being challenged to emerge from a period of increasingly sophisticated digital model-making and the creation of navigable landscapes of pictorially rendered objects to embark on a critical examination into the meaning of representations of space and place in order to facilitate dynamic, inter-actor participation, and cultural learning.

As Michael Shanks and Connie Cvabo describe, the digital archive demands "new prosthetic architectures for the production and sharing of these archival resources... an animated archive emphasising personal affective engagement with cultural memory" (2013, 98). This short essay focuses on a series of interactive installations that take up the challenges of new media storytelling for cultural heritage inside museums. It explores strategies for creating and translating the digital record into narratives of engagement by which museum visitors virtually re-embody and "perform" digital archives.

Demonstrator projects

The *Pure Land* series

Since 2012, five different *Pure Land* projects have been created ranging from a 360-degree 3D version (*Pure Land: Inside the Mogao Grottoes at Dunhuang*, 2012) and an untethered head-mounted display version (where the visitor is mobile; *Pure Land Unwired*, 2015) through to an interactive fulldome version (Cave Dome, 2015). The *Pure Land* series immerses visitors in the Dunhuang's Buddhist grotto temples, which constitute an art treasury abounding with murals, statues, and architectural monuments. This UNESCO World Heritage site, also known as the Caves of the Thousand Buddhas, is located at Dunhuang—a small town in northwestern China and an oasis in the Gobi Desert that once served as a major stop along the ancient Silk Road gateway to and from China. *Pure Land* brings to life the story painted in a single composition on the north wall of Cave 220. The cave is dated to the early Tang (618 to 907 C.E) and the detailed mural within, known as Bhaisajyaguru's Eastern Paradise, depicts the paradise of the Eastern Pure Land of the Medicine Buddha, Bhaisajyaguru. Two of these projects are described in more detail below.

Dunhuang Academy's Dunhuang Mogao Cave Paintings Digitization Project Plan focuses on the quest for a definitive model of preservation for this highly significant site, which is under extreme duress from climate change and human factors. Between 2002 and 2012, over five million people visited Dunhuang. In 2012 alone, nearly 800,000 people toured the caves; 90 per cent of these visitors were domestic tourists. Like many other cave and subterranean sites worldwide, the Mogao Grottoes are under serious threat from this rising number of visitors and the increasing humidity inside the caves. Maintaining careful monitoring, the Dunhuang Academy opens a limited number of caves — approximately thirty at a time — to ensure long-term preservation. In most caves, the murals and statues are protected (and often optically hindered) by glass panels and the only lighting is via low intensity LED torches — one of them held by the guide who is explaining the narrative iconography of the paintings and sculptures. Thus, a real-life visit suffers from restrictive, albeit necessary, limitations. Many believe that Dunhuang's future lies in its digitisation programme.

a) *Pure Land: Inside the Mogao Grottoes at Dunhuang* (2012)

Pure Land: Inside the Mogao Grottoes at Dunhuang takes place in AVIE (2006) — a large 360-degree, panoramic, stereoscopic projection theatre that offers a true-to-life experience of being inside a cave temple viewing its magnificent Buddhist wall paintings at one-to-one scale (Fig. 1). Using the high-resolution photography and laser-scanned models specially provided by the Dunhuang Academy, *Pure Land* constitutes an immersive virtual facsimile that reframes and reconstitutes the extraordinary wealth of paintings and sculptures found in the caves at Dunhuang.

The datasets of Cave 220, with its richly narrative murals, become the subject for innovation in heritage interpretation by enhancing the architectural and photographic representations of the cave with animation, 3D modelling, pictorial recolouring, digital enlargement, and a rich sound design. This augmented reality interaction design includes a virtual torch that simulates the real-world experience of visiting these caves, where the visitor handles a small LED flashlight to illuminate the painting (Fig. 2). Another powerful feature is the virtual magnifying glass that lets the viewer zoom in and view the paintings in ultra-high resolution through a 3D lens that can be enlarged to full-screen height. Specific objects in the painting, such as a row of incense burners and musical instruments being played by two groups of musicians, are reconstructed as 3D models that float out of the screen. In one instance, live performers from the Beijing Dance Academy emerge from the mural to bring to 3D life the famous painted Dunhuang dance scenes, which depict a genre of classical Chinese dance influenced by the cultures of India and the Middle East.

Pure Land's virtual, one-to-one-scale 3D visualisation of the cave, in conjunction with its multi-layered, multimedia augmented reality features, constitutes an immersive embodied visual experience that brings new life to the aesthetic, narrative, and spiritual drama of these exceptional cave paintings and sculptures. It provides conceptual, technological, and operational paradigms for the future of digital preservation, cultural heritage interpretation, and an embodied museography. *Pure Land: Inside the Mogao Grottoes at Dunhuang* has been described

Fig 1. *Pure Land: Inside the Mogao Grottoes at Dunhuang* (2012), a 360-degree 3D experience of Cave 220 at Dunhuang. RHS a 3D model of the full Cave made from laser scanning.
Image © Sarah Kenderdine & Jeffrey Shaw.

Fig 2. *Pure Land: Inside the Mogao Grottoes at Dunhuang* (2012), a browser displays significant caves distributed along the escarpment.
Image © Sarah Kenderdine & Jeffrey Shaw.

as "the exhibition experience of the future" by Julian Raby, director of the Smithsonian's Freer & Sacker galleries (quoted in Stromberg 2012). Philip Kennicott for the Washington Post (2012) wrote, "at last we have a virtual reality system that is worthy of inclusion in a museum devoted to the real stuff of art".

Digital practitioners within museums have often struggled with shifting concepts of "aura". Recently, the contemporary philosopher Bruno Latour and digital preservationist Alan Lowe have argued for the "migration of aura" by which good quality digital facsimiles both propagate and add layers of significance and meaning to the original, providing the object with a biography as opposed to being a weak surrogate for the original, or competing with, or supplanting it (2011). The focus of our age has been on the reification of the original object, but Latour and Lowe see this frenzy of interest rising exponentially along with the number of copies of the original that are circulating. In other words, the intensity of the search for an original depends on the amount of passion and the number of interests triggered by its copies, so the question that must be asked becomes: "Is it well or badly reproduced?" The authors theorise that:

> facsimiles, especially those relying on complex (digital) techniques, are the most fruitful way to explore the original and even to help re-define what originality actually is. (278)

The role that facsimiles play in the interpretation and preservation of cultural heritage has been proven to be both essential and effective. For an increasing number of sites, the facsimile provides the only means of public access, and may even give a superior viewing experience due to the constraints of the original site. True-to-scale physically built models (it seems necessary to distinguish these from models that are virtually rendered) of caves and subterranean sites, enabled by high fidelity digital registration, now exist to represent

the Lascaux Caves, Altamira Caves, and the Tomb of Thutmose III. At the Dunhuang interpretation centre, there are already eleven life-sized *built* reconstructions of important caves, with accurate replica murals covering the walls and ceilings. Such built facsimiles increase accessibility on-site and in traveling exhibitions, diverting stress away from the originals and involving visitors in a pro-active protection of the site through promoting awareness.

The digital imaging of sites also creates a set of resources for in-depth study in preservation and conservation processes (Lowe 2004). Archaeological and heritage communities are rapidly expanding advanced digital imaging techniques for conservation and preservation needs, but these techniques have also become necessary tools integrated into cultural memory and vital to living communities of practice. As we have seen, the Dunhuang Academy is at the forefront of this research, developing new strategies and technologies not only because the site demands it but also because of its importance in the Chinese cultural memory and imagination.

b) *Pure Land Augmented Reality Edition* (2012/2016)

Pure Land Augmented Reality Edition (*Pure Land AR*) uses mobile media technology to create a complementary augmented reality rendition of the data from Cave 220 at Dunhuang. The installation employs tablet screens that visitors use as mobile viewing devices or "windows" to explore the cave. The paintings and sculptures of the cave are rendered virtually within the architecture of a simply constructed rectangular room that shares the same dimensions as those of Cave 220 itself. In this installation, the walls of the exhibition room are covered with one-to-one scale prints of Cave 220's "wireframe" polygonal mesh (Fig. 3). Derived from the laser scan of the cave, this image creates a structural aesthetic alignment between the space of the cave and that of the exhibition space, providing visitors with a visual cue for navigating and exploring the cave (Kenderdine 2013a). Walking around inside the exhibition space with iPads in hand, visitors are able to view the interior of

Fig 3. *Pure Land Augmented Reality Edition* (2012/ 2016), installation at the Shanghai Biennale 2012-2013. Image © Sarah Kenderdine & Jeffrey Shaw.

Fig 4. *Pure Land Augmented Reality Edition* (2012/ 2016), installation at the Shanghai Biennale 2012-2013. Image © Sarah Kenderdine & Jeffrey Shaw.

the real cave through their mobile "windows" and experience a kinaesthetic revealing of the painted architectonic space (Fig. 4).

This new technical rendering of *Pure Land AR* is facilitated by the use of infrared cameras that accurately track the position and orientation of two iPads as they are being handled by the visitors. The cameras can detect these iPads because of small optical markers that are attached to their frames (see Fig. 4). Computers then create the appropriately rendered views of the actual cave on the screen which are transmitted to the iPads via a Wi-Fi connection.

Pure Land AR demonstrates the future of mobile media and augmented reality as a means of virtually embodying one-to-one scale cultural heritage experiences. It creates a space for the conjunction of real and virtual formations that give transacted aesthetic expression to Dunhuang's Buddhist art treasury of mural paintings and sculptures. Visitors to *Pure Land AR* immediately grasp the functionality of the iPads; their familiarity with the device draws them into the physical room and their exploration of the virtual imagery of Cave 220. Furthermore, the experience generates spontaneous discussion among these visitors, as well as "virtual tourism", as they enthusiastically photograph the imagery on the iPad with their own cameras.

Further reading

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Look Up Mumbai (2016)

Mumbai's architectural heritage is unrivalled in India. The city has numerous examples of Indo-Saracenic architecture and features one of the largest representations of grand neo-Gothic and Art Deco architecture in the world. This exceptional architectonic heterogeneity of Mumbai is the subject of *Look Up Mumbai*. The dome of the Chhatrapati Shivaji Maharaj Vastu Sangrahalaya (formerly the Prince of Wales Museum) has been adopted as the epicentre of an artistic exploration that specifically focuses on the ceiling architectures of Mumbai's heritage and contemporary buildings, transforming them into an urban celestial imaginary (Fig. 5 and 6). Visitors to *Look Up Mumbai*'s new media-art installation recline on a custom-made couch under an immersive digital projection dome and look up to view an animated sequence of over eighty fisheye photographs that constitute a unique portrait of Mumbai's extraordinary and varied architecture of churches, mosques, temples, government and industrial buildings, private homes and nightclubs — all seen from this unusual and spectacular point of view (see Fig. 7). Images of these singular ceilings — gothic and contemporary, sacred and secular, monumental, and everyday — digitally transform from one to another inside this dome, enveloping viewers in an unfolding and immersive realm of artistic revelation and gratification.

Correct geometric projection mapping of these ceilings within the dome maintains the architectonic integrity of their varying sizes and proportions, providing dramatic perceptual shifts in scale and form as the sequence of images unfold. To amplify this experience, digital image processing techniques are used to create transitions between each image and the locations they present. These deconstruct the internal pixel structure of each image, then modulate and blend them in various patterns and transformations. This cinematic

Fig 5. *Look Up Mumbai* for DomeLab (2016).
Image © Sarah Kenderdine & Jeffrey Shaw.

Fig 6. *Look Up Mumbai* for DomeLab (2016).
Image © Sarah Kenderdine & Jeffrey Shaw.

Fig 7. *Look Up Mumbai* for DomeLab (2016).
Image © Sarah Kenderdine & Jeffrey Shaw.

trompe l'oeil of structural conjunctions and iconographic interpolations creates an aesthetic re-visioning of these various sites, and they became remediated as a narrative sequence that focuses their spatial, formal and pictorially associative qualities. An underlying symbolic dimension also reveals itself, as the architecture and decoration of these ceilings often imply correspondences of cosmological significance.

The philosopher Villem Flusser wrote that "we live in two worlds: one that is given and the other that is provoked by the attention that we pay to it". In the course of our daily lives, the architectural context — and especially its ceilings that we seldom look up to contemplate — tend to belong to the insensible world "that is given". *Look Up Mumbai* sets out to relocate these ceilings in the other world, the one "that is provoked by the attention that we pay to it", and in so doing it re-focuses the multi-cultural richness and diversity of these structures as objects of aesthetic allure, technological wonder, and empyrean fascination.

Further reading

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Museum Victoria's Data Browser

This interactive work uses the AVIE 360-degree stereoscopic interactive visualisation environment and one hundred thousand heterogeneous digital records of objects from Museum Victoria's collections (out of a total collection of 16 million objects held by this encyclopaedic museum). The Data Browser creates a navigable interactive data landscape for visitors inside the Melbourne museum's permanent 360-degree, 3D display system. Given that only a fraction of Museum Victoria's physical collection can be displayed at any given time, the intention of the project is to give users an intuitive and creative platform from which to engage with the wealth of cultural materials found at the museum.

A visitor can select a single collection from the eighteen themes available and browse the tens of thousands of images associated with that theme. The themes are diverse and include "Childhood & Youth", "Indigenous', "Cultural Diversity", "Horology", and "Medicine in Society". The image "cloud" for each theme is distributed by time around the 360-degree screen (Fig. 8). Users may select any single image and retrieve it from the data cloud to view at a much larger scale. Each image is then associated with a description and title (Fig. 9). All images can be "zoomed in", effectively magnifying the content to give full range to the high resolution of the images. Through metadata (database relationships), each image is also related to many other images and across different themes. This matrix of dynamic relationships becomes visible in response to the user's actions. The application is designed as a single-user, multi-spectator interaction paradigm. Visitors use a tablet interface to elicit actions on the screen. The interactive data-scape is amplified by specific sonic reflections created from the museum's archive and in response to the users' actions.

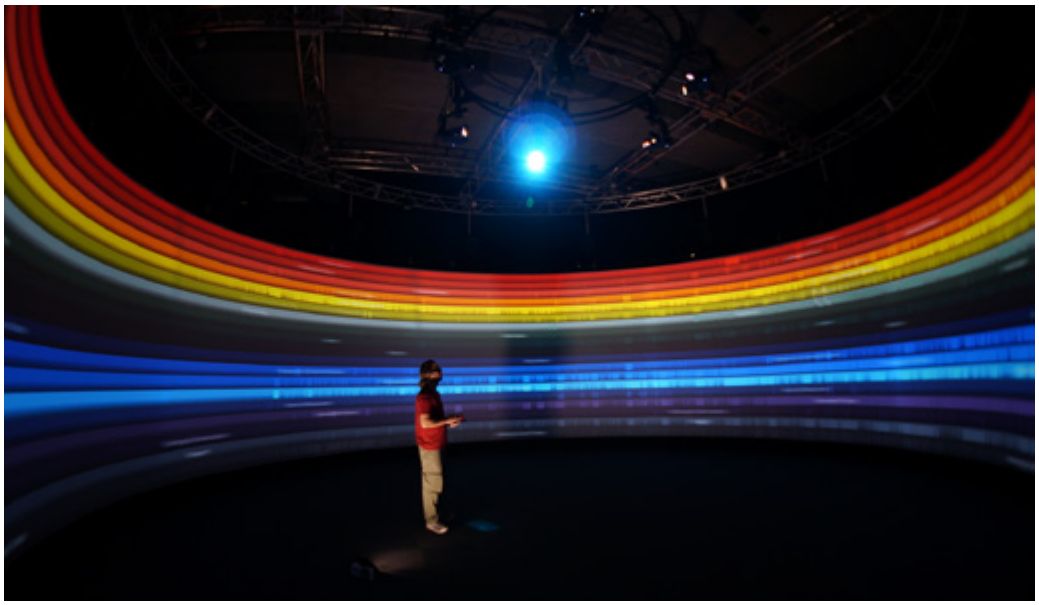

Fig 8. Museum Victoria's Data Browser showing 18 thematic collections (2015).
Image © Museum Victoria.
Photo: Volker Kuchelmeister.

Fig 9. Museum Victoria's Data Browser of 100,000 objects (2015).
Image © Museum Victoria.
Photo: Volker Kuchelmeister.

Through an infinite set of permutations, visitors can navigate unfolding narratives in the data landscape that are based on their specific, and emerging, interests. The application develops a new visual paradigm for the social and collaborative exploration of big audio-visual datasets within a museum. It is a situated, participatory, and collective framework that distinctly contrasts this data browser with interfaces for cultural datasets found on the internet.

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Pacifying the South China Sea Pirates (2013)

The source material for this interactive installation is the "Pacifying the South China Sea" handscroll, painted by an anonymous Qing painter almost two hundred years ago. The handscroll chronicles the suppression of piracy by the forces of the Jiaqing Emperor (r. 1796–1820). The scroll illustrates the events of the period in twenty different scenes, each abundant with detail depicting the "annihilation and appeasement" (*jiaofu*) of the pirates by government forces.

Commissioned for the Hong Kong Maritime Museum, *We Are Like Vapours* is a digital re-presentation of "Pacifying the South China Sea", staged in the AVIE 360-degree display system, which is ten metres in diameter and four metres high. Inside this cylindrical enclosure, the high-resolution image of the scroll slowly rotates; parts of the painting are obscured from viewers by digitally generated sea mists that drift over its surface (Fig. 10). These mists thin

Fig 10. *We Are Like Vapours*, Hong Kong Maritime Museum (2013).
Image © Sarah Kenderdine & Jeffrey Shaw.

Fig 11. *The Scroll Navigator*, Hong Kong Maritime Museum (2013).
Image © Sarah Kenderdine & Jeffrey Shaw.

and part to reveal the key situations, characters, and events in the painting, which are brought to life as animated vignettes. Fifty-five animations appear in a sequence around the screen, so the viewer experiences a 360-degree unfolding of the narrative during its fifteen-minute exposition.

The Scroll Navigator is another installation at the Hong Kong Maritime Museum that offers an interactive system for examining the scroll and revealing this narrative sequence. A reduced-scale photograph of the entire scroll is presented in a five-metre-long light box backlit with a fine raster of LEDs. Each LED is independently controlled so that any section of the photograph can be illuminated. Above this, a motorised, ultra-high-definition, forty-two-inch LCD monitor is mounted on a track that allows it to move freely above the entire length of the photograph (Fig. 11). Any given section of the scroll that appears on the monitor is simultaneously illuminated in exactly that section of the light box. The visitor uses an iPad to control the movement of the LCD screen from one narrative zone to the next. Within each section, the viewer can pan and zoom into minute details of the painting — a capability afforded by the ultra-high-resolution scan of the original scroll that was made for this project.

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300 Years of Hakka Kung Fu (2016)

Intangible cultural heritage encapsulates social practices, oral traditions, and performances as cultural expressions that are defined by their reliance on tacit and embodied knowledge practices. In contrast to the tangible heritage manifesting as objects in museums and as monuments, intangible cultural expressions are enacted, socially transmitted, and inextricably linked to people. Immaterial cultural forms by their nature pose significant challenges for documentation methodologies (and the reproduction of these materials in the public

domain is also fraught with philosophical hurdles). As holistic cultures and individual histories comprised philosophy and belief, custom, skills, and artefacts, kung fu traditions are quintessential examples of intangible cultural heritage. These traditions are subject to the effects of rapid socioeconomic and cultural change that have severely altered the processes of transmission and conditions in which students are able to undertake the physical, mental, and temporal commitment of learning kung fu. The Hong Kong Martial Arts Living Archive (HKMALA) project examines strategies for encoding, retrieving, and re-enacting intangible heritage in ways that allow cultural practice to be "alive" in present and to emerge as part of a contemporary reciprocity between expert and novice, performer, and agent.

Combining motion capture technologies with a knowledge transfer objective and a holistic view of heritage, the project demonstrates a comprehensive and ongoing approach to sustaining the life of cultural practices. The production of a detailed inventory of Hong Kong kung fu is underway using diverse digital methods for the documentation of practices, rituals, and daily lives of practitioners (in addition to historical materials). The project seeks to promote and sustain Chinese kung fu through processes of engagement via an open access archive, exhibitions, and teaching programmes based on the Archive's materials. The HKMALA is comprised of materials representative of Hakka, Fujian, and Northern Chinese styles. The motion capture data forms the basis of creative visualisations of motion over time, and learning aids that utilise innovative sensing technology (Fig. 12). The pedagogical resources of the Archive are intended to reinstate the corporeal identity of kung fu, while the multimodal nature of the Archive and its platforms for public exhibition extend this capacity to re-present and revivify kung fu by evoking a state of participatory immersion that facilitates the reconstitution of knowledge within the (individual and public) body.

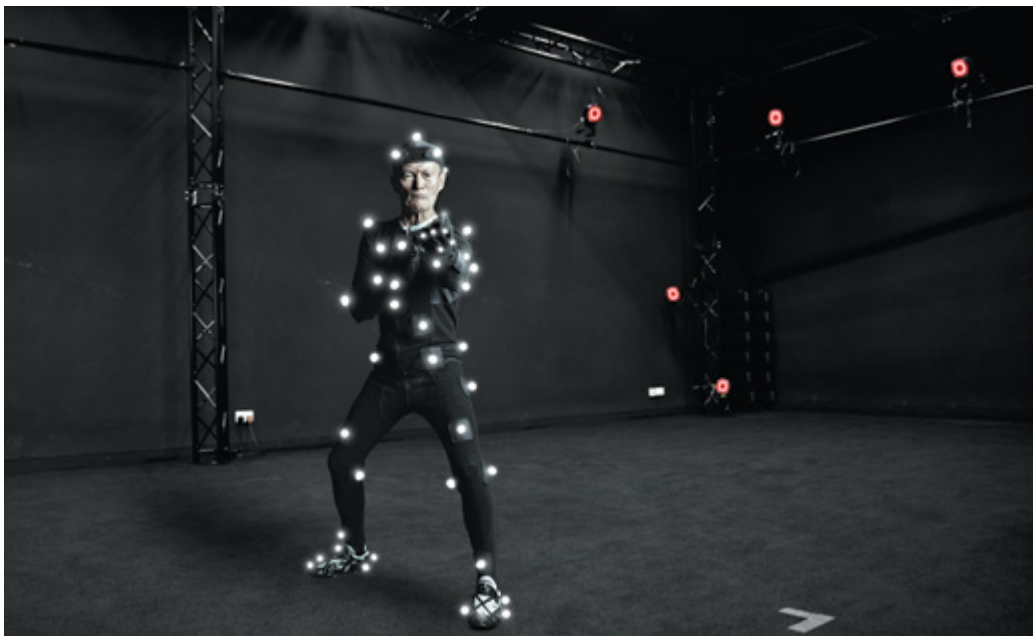

Fig 12. Motion capture of kung fu master (2015).
Image © HKMALA.

The project premiered in the form of the *300 Years of Hakka Kung Fu* exhibition at the Hong Kong Heritage Museum in 2016. The exhibition set out to create "embodied artefacts", which "novel motion-sensitive cyber-technologies are uniquely geared to both craft and leverage . . . as a means of fostering learning" (Trninic and Abrahamson 2012, 283). Interactive pedagogical platforms on display included a pose-matching installation wherein the increasingly ubiquitous technologies of "gamification" are brought to bear on the contemporary issue of knowledge transfer in the potential absence of qualified masters. Another platform, *Re-Actor*, provides a rich opportunity for a deeper and more engaged relationship with the motion capture materials of the Archive. *Re-Actor* is a hexagonal construction 5 metres in diameter and 2.5 metres high, with six rear-projected screens and stereoscopic 3D viewing. Walking around it, the visitor can look into a virtual space and view its contents from six different points of view. Each of the six viewpoints has an interactive control panel that allows visitors to select five different styles of motion-graphic visualisation (Fig. 13). Dynamic motion visualisation allows the motion capture datasets to be digitally processed and re-visioned so that the viewer can better perceive and analyse various "hidden" aspects of the movements. For example, motion visualisation can trace the temporal paths of each part of the kung fu actor's body and give formal expression to the relative movement, speed, and spatial displacement of his/her body (Fig. 14).

Fig 13. *300 Years of Hakka Kung Fu: Re-Actor* interactive installation (2016).
Image © Sarah Kenderdine & Jeffrey Shaw. Photo: Tang Ming Tung.

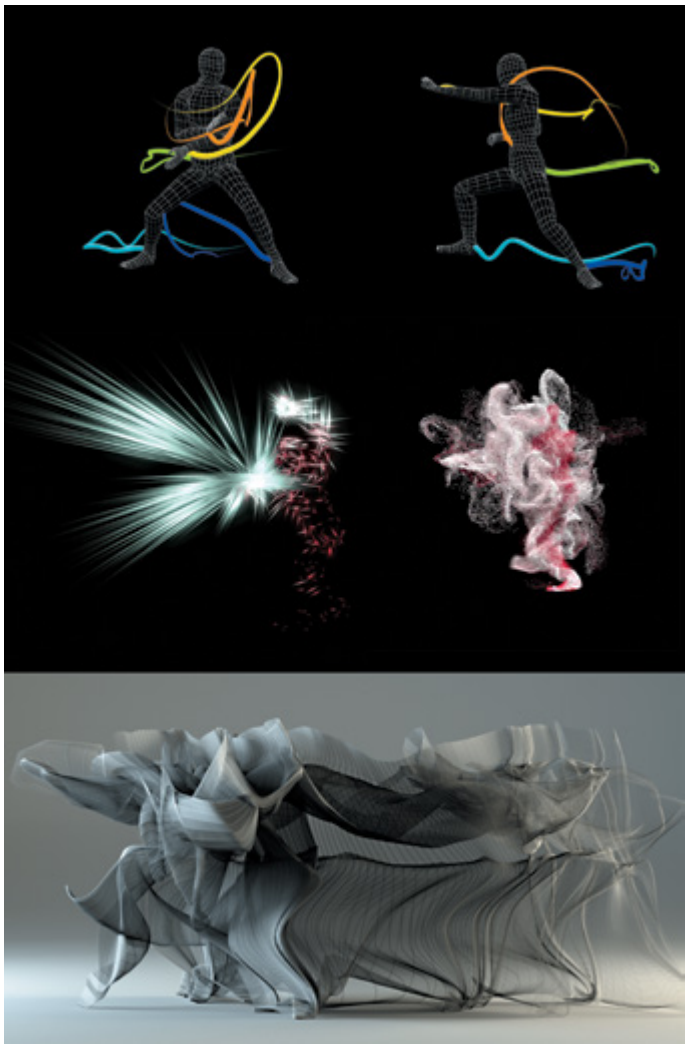

Fig 14. *300 years of Hakka Kung Fu: Re-Actor* motion of time analysis (2016).
Image © Sarah Kenderdine & Jeffrey Shaw, Tobias Gremmler.

The various installations presented in the exhibition foster multimodal engagement that goes beyond the knowledge of style sets and movement itself to refer to tangible aspects of kung fu traditions and a consideration of these practices as holistic philosophies and ways of life. The exhibition presented a combination of motion capture data, visualisations, artefacts, photographs, documentary video, and text presented in an interactive and narrative immersive setting. The multimodality of the Archive and its exhibition are key to its potential as a digital prosthesis for memory that still foregrounds the body as the principal site of the repertoire and the holder of knowledge.

In the context of cultural heritage, the benefits of interactive platforms combined with the multiple forms of the Archive allow for a mode

of engagement that situates the public in the act of re-producing heritage—or what might be interpreted as the "social production of heritage":

> Cross-media interaction can be powerful when people take active roles in the interpretation and construction of heritage and their experience is social and collaborative. Collective storytelling plays a critical role in supporting a situated and narrative mode of interpretation and construction of our sense of place and heritage... Combining technical infrastructure with diverse media and actively promoting social interaction are vital steps to support the tensional relationships between past, present and future, so that people can remember, perceive, and imagine encounters with the heritage. (Giaccardi and Palen 2008, 284)

Thus, *300 years of Hakka Kung Fu's* use of interactive and immersive media places Hakka kung fu in a state of continuity, providing a valuable resource for both research and learning purposes, and acknowledges the status of the practice as living heritage and culture.

Further reading

Kenderdine, S. and J. Shaw. 2016. "A Digital Legacy for Living Culture." In *300 Years of Hakka Kung Fu: Digital Vision of Its Legacy and Future*, edited by H. Chao, S. Kenderdine and J. Shaw. Hong Kong: International Guoshu Association.

Conclusion

The installations described in this short paper, and the frameworks considered in their analysis, offer ways of thinking about cultural heritage presentation in the digital domain and museum setting. Demonstrating the potential for "presence" and "co-presence" with the past, the exhibitions described here contribute to the development of new strategies for the rendering of cultural content and heritage landscapes as theatres of embodied experience from a cultural imaginary located in the here and now. Each example offers fresh visualisation and audification strategies directed towards artistic rendering of cultural heritage. The discussion broadly spans themes such as embodiment, immersion, performance, and narrative; describing a new wave of digital cultural heritage. It should be noted that these experiences are not concerned with the didactic learning requirements often associated with the rhetoric of heritage, nor the desire to transport the participants back through time using virtual technologies. In a celebration of the landscape as "alive", post-colonial cultural theorist Homi K. Bhabha describes well the spirit of our endeavours:

> The borderline work of culture demands an encounter with 'newness' that is not part of the continuum of the past and present. It creates a sense of the new as an insurgent act of cultural translation. Such art does not merely recall the past as social cause or aesthetic precedent; it renews the past, refiguring it as a contingent 'in-between' space, that innovates and interrupts the performance of the present. The 'past-present' becomes part of the necessity, not the nostalgia, of living. (1994, 7)

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