Immersive visualization architectures and situated embodiments of culture and heritage

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Abstract—**This paper describes a series of transdisciplinary research projects in five large-scale, interactive visualization architectures. These immersive architectures and their associated visual, sonic and algorithmic techniques offer compelling means for mapping and remediating the tangible, intangible and abstract aspects of culture and heritage landscapes. This paper brings these unique systems and the installations developed for them together for the first time. The task here is to highlight the strategies for embodied, kinaesthetic, multisensory and collaborative engagement as powerful ways to reformulate narrative made possible through these stereographic, panoramic, situated interfaces.**

Keywords-augmented reality, immersive architecture, interaction, kinaesthetic, post-processural archaeology, museums, situated media, narrative, cultural heritage, visual analytics.

I. INTRODUCTION

The body of work described in this essay contributes to the reframing of cultural heritage interpretation and the reformulation of somatic, kinaesthetic and embodied experiences in immersive digital environments. The research has been articulated through a series of transdisciplinary experiments in large-scale, interactive visualization architectures (hereafter 'immersive architectures'). These immersive architectures and their associated visual, sonic and algorithmic techniques offer compelling means for mapping and remediating the tangible, intangible and abstract aspects of culture and heritage landscapes. The immersive architectures included in this paper are:

- *The Virtual Room* (Figure 1) [27]
- *PLACE* (Figure 2) [21]
- *The EYE* (Figure 3) [26]
- *iDome* (Figure 4) [8] [33]
- *Advanced Visualization & Interaction Environment* (*AVIE*, Figure 6) [2] [19]

These unique display systems form the core infrastructure of a new research centre, the Applied Laboratory for Interactive Visualization and Embodiment (ALiVE) established at the Hong Kong Science Park, by the School of Creative Media in conjunction with Computer Science, City University, Hong Kong (Figure 12). [1]

The specific installations made for these display systems are part of a research inquiry in multisensory journeying that addresses perceived challenges in visualizing 'things' in archaeology, people in landscapes and the imaginary of texts. The works act as propositions for the reformulation of digital narrative and aesthetics through virtual embodiment and *enaction*. [5]
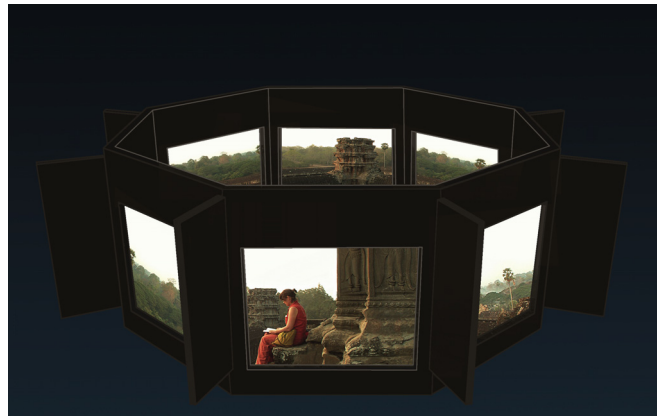

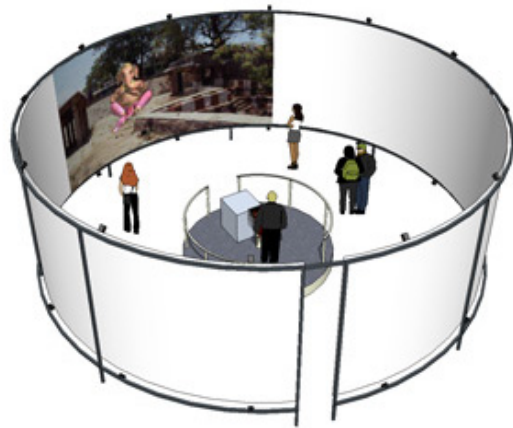Figure 1. *Sacred Angkor* for The Virtual Room, © Kenderdine 2003.

Figure 2. *PLACE-Hampi*, PLACE © Kenderdine & Shaw, 2006.

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This paper is collated together here for the first time unique research demonstrating new modalities for meaningful cultural experiences and narrative re-formulation, utilizing the results of archaeological, historical and anthropological field data-capture and analyses. The installations themselves are intended for multicultural audiences in situated public spaces (as opposed to internet-based, virtual and distributed spaces). Each explores significant cultural precincts, including: the UNESCO World Heritage sites of Angkor, the Monuments at Hampi, and The Fort of the Hooded Cobra in Nagaur, Rajasthan. The installations are:

- *Sacred Angkor,* 2004 (Figure 1)
- *PLACE-Hampi,* 2006 (Figure 2 & Figure 8)
- *Eye of Nagaur* 2008 (Figure 3)
- *iNagaur* 2008 (Figure 5)
- *Hampi-LIVE* 2009 (Figure 9 & Figure 10)

The work described also includes the exhibition *Ancient Hampi: the Hindu Kingdom Brought to Life* (Immigration Museum, Melbourne 2008-2010) that investigates the archaeological imaginary of this historic precinct (Figure 7).

The research that has contributed to these installations has been described in various scientific papers over the past five years (for example [11] [12] [13] [14] [15] [16] [17] [18] [19]). The purpose of this essay is to juxtapose the unique and specific properties of these works with broader philosophical framing to make explicit their contribution to the meta-endeavor of cultural heritage interpretation. The reader is pointed to the aforementioned publications to substantiate the philosophical positions taken in this essay and the technical discussions relevant to each work.

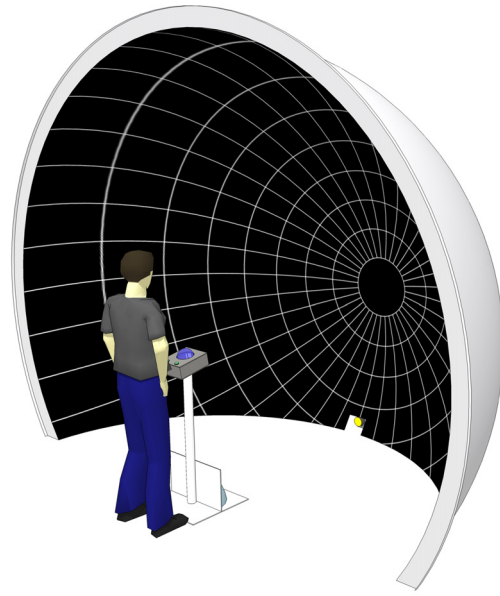Figure 3. *Eye of Nagaur* for The EYE © Kenderdine & Shaw 2008

Figure 4. *Eye of Nagaur* for The EYE © iCinema Centre, UNSW.

II. POST-PROCESSURAL ARCHAEOLOGY AND KINAESTHETICS

The theoretical frameworks that underpin the installations described here are in part drawn from the discourses of post-processual archaeology, including the domains of interpretive and symmetrical archaeology. [28] [34] From fissures within the long-established practices of processual archaeology, there has been a growing call to 'contest traditional predominantly textual modes of thought and action' and to 'illuminate and expose the interpretive and *artistic* qualities of presentation and narration' using visual media. [6] Similarly, advocates of media [in] archaeology (e.g. [35], [24]) suggest broader approaches to interpretation 'that move toward an archaeological expression of recombinatory poetics'. [24]

In the post-processual frameworks for interpretive archaeology, practitioner Christopher Tilley advances a phenomenological understanding of the experience of landscape. [28] [29] [30] His arguments emphasize approaches to archaeological assemblages that go beyond their material manifestation. In his book, *Body and Image: Explorations in Landscape Phenomenology,* Tilley usefully contrasts iconographic approaches to the study of representation with those of kinaesthetic enquiry. Tilley's line of reasoning provides grounding for the research into large-scale, immersive and kinaesthetically provocative environments, designed for the experience and embodiment of cultural and heritage. In this context, it is useful to quote his discussion of the interpretation of rock art:

"The potential of kinaesthetic approaches tell us something different… Iconographic approaches are usually primarily cognitive in nature. They grant the primacy to the human mind as a producer of the meaning of the images through sensory perception. The mind

responds in a disembodied way… Kinaesthetic approaches, by contrast, stress the role of the carnal human body. The general claim is that the manner in which we perceive, and therefore relate to visual imagery, is fundamentally related to the kinds of bodies we have. The body both limits and constrains. It enables us to perceive and react to imagery in specifically embodied ways". [32]

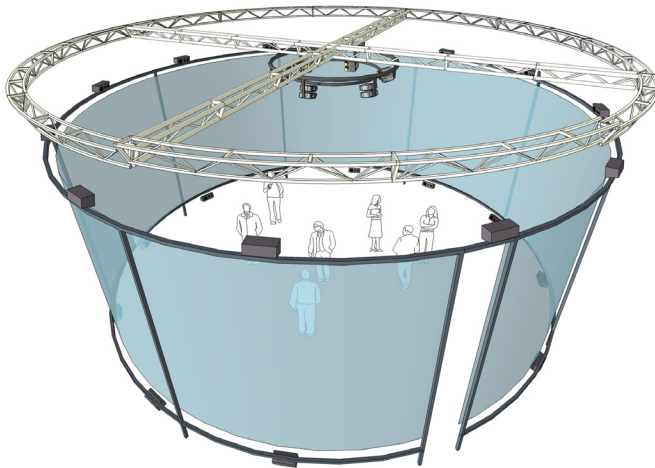Figure 5.   *iNagaur* for iDome © Kenderdine & Shaw 2008.

Figure 6.   Advanced Visualization & Interaction Environment © iCinema Centre, UNSW.

Such arguments, emerging out of post-processual archaeology, form crucial foundations for the works included in this essay. The challenge for digital cultural heritage disciplines is to design environments where, for example, 'archaeologists take up what is left of the past and translate and (re)mediate'. [25] These new strategies avoid the predefinition of data itself, evidenced in the current 'archaeological meta-endeavor', and moves towards an approach that destabilizes the notion of 'finding what we are looking for'. [25]

Figure 7.   *Ancient Hampi*, 360-degree videoconversation @ Kenderdine 2008.

Figure 8.   *PLACE-Hampi*, PLACE © Kenderdine & Shaw, 2006.

The immersive works highlighted in this essay follow a methodological framework that incorporates an understanding of the body in motion, in both real and digital spaces. By suggesting that landscape studies are transformed by re-focusing on the kinaesthetic, Tilley stresses the autonomy of images to convey meaning. Imagery has a 'direct agency' [31] that acts as one inhabits and *moves* through the landscape. In the majority of the installations described here, the design of the immersive systems demands that people ambulate and circumambulate, continuously re-orienting themselves in relation to real-world scale imagery of augmented virtual landscapes. The acoustic spaces in these systems are dynamic in relation to the positioning of visitors and their movements. Participants interact and perform with *both* the imagery of the virtual world and with the other people who co-inhabit the space. The issues of inhabiting the immersive space and its relationship to real environments and the performative qualities of people within these hybrid and multimodal spaces are of central concern (Figure 8).

III.   INSITU

All the installations included in this paper have been deployed as temporary or permanent installations at major cultural organizations, museums, galleries, on-tour as part of

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arts festivals or in heritage sites throughout the world. A primary motivation has been to animate a *resocialization* of public spaces, reinforced by the understanding of museums as places of 'civic seeing' and 'zones of contact' for people. [3] Situated, immersive experiences bring people together in real spaces to interact not only with the virtual 'other' and the virtual objects of encounter but also amongst themselves. Emerging research into the rapid growth of 'casual gamers' who come together socially to use commercial interfaces such as Nintendo's Wii to interact with video-style games, also support the thesis for collective interaction with new interfaces by non-traditional audiences in real space where bodies are active. [10]

The situated spaces of museums and galleries provide a counterpoint to the small-scale desktop delivery and distributed consumption of internet-deployed cultural content. Content that is 'real-world scale', stereographic, panoramic and ambisonic such as in large immersive architectures described, is an important aspect of the research presented here. These immersive architectures encourage physical proximity, allowing new narrative paradigms to emerge through interactivity and corporeal relationships. Situated installations allow for human-to-human collaborative engagements in the interrogation of cultural material and mediations of virtual worlds. The proximity of the participants has a significant influence on the experiences of these installations.

IV. DRAMATURGIES OF DIFFERENCE

New forms of archaeological investigation draw upon, and advance, performance theory and practice. [20] [25] Archaeology is increasingly understood less as the '*discovery* of the past, and more in terms of *different relationships* with what is left of the past.' This foregrounds 'the anthropological questions of performance and construction of the past, in memory and of narrative meaning'. [25] These processes involve a re-visioning of collections (texts and material objects) and the redesign of archives and systems of documentation. The installations in this essay thus can be interpreted partly as theatres for new modalities of performance in archaeology and heritage.

The work described here, inside new forms of immersive architectures, is motivated by media archaeologist Siegfried Zielinski's call for 'dramaturgies of difference' [37] and the potential for the remediation of archaeological and historical landscapes and culture knowledge. In 2001, archaeologist Michael Shanks and performance studies theorist Mike Pearson collaborated to write *Theatre/Archaeology*, an examination of the points of convergence between contemporary performance theory and practice and interpretive approaches in archaeology. [20] Invoking the notion of performance in archaeology helped to make sense of the spiral of association between archaeological materials—empirical, spatial, conceptual and metaphorical. For Shanks, archaeological interpretation should also emphasise *manifestation* of archaeological materials, which is 'letting the material display itself'. [23] He also notes the emphasis of performance, ceremony and ritual in relation to

post-processual archaeology. This ties together 'issues of signification, of the embodiment and corporeality of social actors, agency and the constitution of social structure and social norms'. Shanks concludes, 'performance is the root metaphor for social and cultural processes' and further, archaeology itself can be conceived of as a performance 'where the remains of the past are mobilized in practise, often conceived as mimetic, of representing or restoring behaviour'. [23]

These ideas can be extrapolated to new media theories of performance and spectatorship, drawing upon the extensive evaluation studies of *PLACE-Hampi* (see *PLACE-Hampi* evaluation for aggregated results [21] for example as an embodied theatre of participation. From the perspective of the social interaction and individual/group interaction within *PLACE-Hampi*, it is worthwhile to explore the dynamic series of relationships as *performance* in the cybernetic theatre. [17]

V. HERMENEUTICS AND EMERGENT NARRATIVES

Museum specialist Linda Young, in her review of *Handbook of Material Culture* [36] provides comment on a section of the book that deals with the body, materiality and the senses. Young says:

"…[the somatic] confronts textuality and visuality as our culture's dominant modes of understanding material culture, and suggests that the embodied subject and its multiple, concomitant ways of sensing, feeling, knowing, performing and experiencing, offer dynamic routes to different perceptions of the human relation to the material… Corporeality and sensuality open up to the concept of sense-scapes—an enticing notion". [36]

The research covered in this paper has created a manifold terrain of both philosophical framing and tangible demonstrators focused at the bodily and cognitive faculties of the participants. The investigative framework also addresses a complex mix of human-computer interface issues that arise during the hermeneutic, phenomenological and epistemological encounters with archaeological and cultural heritage landscapes. The methodology recognizes that the past is constantly re-created in learning experiences, a never-ending process of 'making sense'. This supports the notion that interpretation is always in flux, and never final, because more can always be said or learned in recurrent acts of making meaning. Interpretation is always historically situated therefore it changes through time.

This concept is fundamental to the work described here for two reasons: firstly, it reinforces the experiential real-time encounter with interactive systems, wherein no participant will experience the same thing twice, even after recurring visits to the system. Secondly, it strengthens the personalized cognitive and kinaesthetic encounter as a valid form of interpretation—particularly important in the research described here work, which is supported by narrative agency. (for example see discussion on co-evolutionary narrative, for Hampi-LIVE, Figure 9, Figure 10 [13]). In the research, narrative content and immersive architectures combine to

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provide a context for multisensory mediation between humans, machine agents and virtual environments

The prosthetic devices within the interactive display amplify the sensorial and allow the senses to go where they have not gone before. Modalities of interaction can be described as forms of prosthetic vision, acoustic immersion, kinaesthetic activation, telepresence, inhabitation and dwelling, travelling, driving and walking, and dynamic contemplation. In the cultural imaginary activated by immersive architectures, the sensory world of participants is tuned for encounter and thus emergent narratives become possible.
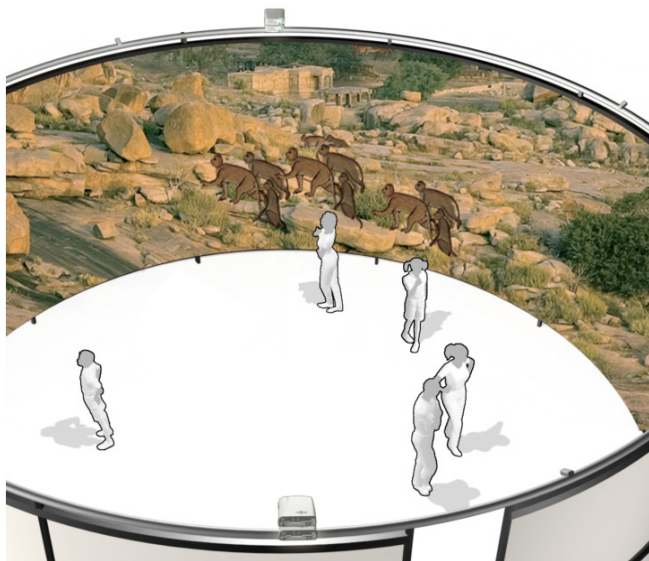

Figure 9. *Hampi-LIVE* graphic © Kenderdine & Shaw 2010.

Figure 10. *Hampi-LIVE*, autonomous monkey kingdom © Kenderdine & Shaw 2010.

The research also investigates relationships between embodiment and representations of the material. Don Ihde, post-phenomenologist and philosopher of science and technology, promotes a *material* hermeneutics that 'gives things voices where there had been silence, and brings to sight that which was invisible'. [38] The 'things' of Idhe's visual hermeneutics are viewed through instrumental magnification of prosthetics, such as telescopes and microscopes, thus allowing perception to go where it has not gone before. Likewise, the immersive architectures described in this essay promote the visualization of the material—of 'things' *and* aspects of embedded meanings found within those things.

VI.   THE FUTURE OF CULTURAL DATA SCULPTING

Visual analytics for large-scale datasets has seen unprecedented growth in its first 5 years. ALiVE in conjunction with several of its research partners (Museum Victoria; iCinema Centre, University of New South Wales; University of Southern California, San Diego; and ZKM Karlsruhe) is currently beginning a three-year Australian Research Council funded project (2010-2013) for visualization and analytics of museological data. Primary datasets include the world's largest media art database (ZKM) and over 30,000 multimedia rich object data from Museum Victoria history and natural sciences collection containing audio, video, object movies, still photographic (panoramic, stereographic etc) and the PADiL dataset for pest identification in Australia. [40] [41] [42]

Entitled 'Narrative reformulation of museological data' for coherent representation of information by users in interactive systems' this research builds upon foundation work done at iCinema Centre on a homogenous dataset (24 hours of broadcast TV footage, *T'Visonarium*, Figure 9 [39]). In the upcoming applications using heterogeneous data, users will be able to stand inside the 360-degree interactive and immersive stereographic interface of AVIE (complete with infra-red camera tracking of visitors) and manipulate text, sound, photos, 3D or panoramic imagery from existing digital archives, creating a whole new visual interface for accessing data. Through real-time semantic remapping of this data users construction narrative effects, and are able to literally 'walk inside' the heterogeneous data. The project will foster innovations in research practices for digital humanities scholars and new cultural experiences for museum audiences. The project will include symposium and workshops on visual analytics and culminate in 2013 with a public exhibition of the results.

These research trajectories seek to solve key problems identified in visual analytics through the integration and development of tools dealing with large-scale heterogenous cultural datasets, in AVIE. The project uses exceptionally rich data and will address not only the paradigms of interrogation but also issues such as data occlusion, cognition, contextualization, humans-in-the-loop and distributed and localized collaboration thus contributing to the rapidly changing face of disciplinary inquiry using digital tools. Through the AVIE interface this project will also provide fundamental solutions to some of the top ten problems identified for the next 5 years of visual analytics [9] and human-centered immersive environments design, with application across the sciences, business and government and entertainment industries.

Research at ALiVE concurrently underway includes immersive environment visual analytics for textual materials

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and cultural atlases (including archaeological data such as high-resolution laser-scan and GIS materials).

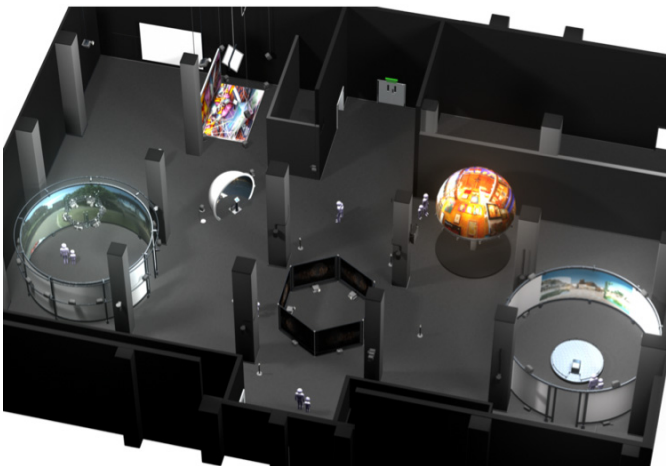Figure 11. Figure 11: T'Visionarium, © iCinema Centre, UNSW 2008.

Figure 12. ALiVE, graphic axonometric of the research facility at the Hong Kong Since Park © School of Creative Media, City University.

CONCLUSION

The installations and immersive architectures in this essay contribute to the development of new strategies for the rendering of cultural content and heritage landscapes, demonstrating the potential for 'presence' and 'co-presence' with the past, as theatres of embodied experience from a cultural imaginary located in the *here and now*. 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 the spirit of these endeavors:

"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". [4]

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