Special Issue on VR for Culture and Heritage: The Experience of Cultural Heritage with Virtual Reality

Guest Editors' Introduction

1. Introduction

Human culture is profound and is always changing and evolving. Heritage, on the other hand, remains perpetually frozen in time, molded or engraved in material culture as a testament to the past. Yet some intangible heritage lives on, sewn into the intermingled fabric of present cultures, evolving, being influenced by and conforming to a highly connected modern society brought about by digital technologies. Others are at risk of diminishing as newer generations, enticed by disparate modern cultures, shun the traditions that were handed down to them.

What cultural heritage contributes to our present society is that it validates our memories and provides us a physical means to connect us to past cultures. Tangible heritage may appear to be unchanging, perhaps because of the fraction of our existence within the arrow of time, yet entropy occurs and the physicality of any material will inevitably decline, eroded by the passage of time and any unfortunate disasters, including threats from deliberate destruction of monuments (CuriousTravellers, 2016). This is why digital preservation is important (Webb, 2003). Any virtual records of cultural heritage are considered good contributions, for digitized information can potentially preserve and generate more value than its physical counterpart in the longer term (Ch'ng, 2013). However, the simple record of information will not add any more value to culture and heritage than what the present existence of it already does. What are needed are accessibility and a means to contextualize and communicate digital information in a way which can bring to life past cultures, and enhance the learning of it (Ch'ng, 2012).

We believe that virtual reality exists for this reason and more. The ability to simulate complete interactive virtual environments can provide a more concrete means to the experience of past cultures. How well virtual reality and Augmented Reality are doing in terms of allowing participants to truly experience past cultures remains a question. Here, we are focused not on the museum experiments (Bowen et al., 2008) in general, but on the experience of past cultures, the phenomenology (Tilley, 1994) of it, which we believe virtual reality can provide. As such, this special issue aims to gather researchers working on all aspects of culture and heritage that use virtual environments or aspects of the mixed-reality continuum to conserve, analyze and communicate contents from the past and the present. It therefore encompasses contemporary public-facing work in GLAMs (Galleries, Libraries, Archives, and Museums) and the backdrop of in-depth investigations to bring to light the contents and contexts of culture and heritage via virtual environments.

The series of articles presented within this two-part issue is a continuation of the previous special issue on "Virtual Heritage: Cultural Agents, Environments, and Objects" (*Presence: Teleoperators and Virtual Environments 24*-3), which highlighted the need for a closer inspection of our method of work in merging often disparate focuses from multiple disciplines (Ch'ng, 2015). In the guest editor's introduction to the 2015 issue, we discussed the role of technology in support of research, conservation, and communication of cultural heritage, and how technology must not become the focus of virtual heritage within the many opportunities provided by heightened awareness of the importance of cultural heritage conservation, funding bodies, and cooperation with cultural institutions. The introduction to the previous issue also discusses the issue of sustainability and how virtual heritage can be a means to exploit the value of cultural heritage and, at the same time, conserve heritage in the process.

As with any fast-developing sector, both heritage and the use of digital technologies are important to society and even to economic growth. The *Flow and Collections*

Trust's "Mapping the Use of Digital Technologies in the Heritage Sector" review report suggests that "Policies on digital heritage need to address how to develop business models that will help generate value in both digital/creative sectors and in heritage tourism, so that digital investments build a thirst for heritage experiences—both real and virtual, that improve heritage environments and provide efficient ways to conserve and sustain heritage into the future" (McKenzie, 2010).

In continuation of the past special issue, which brought to light the state of work and present thoughts on virtual heritage research, particularly on cultural agents, cultural environments, and cultural objects and 3D printing, this issue naturally draws a collection of thematic articles focusing on the virtual-reality experience of cultural heritage.

2. Experiencing Culture and Heritage

Knowledge is well understood as the commodity that museums offer (Greenhill, 1992); however, "much more is happening within the visit than a quest for learning" (Kavanagh, 2000, p. 149). We often refer to museums when talking about cultural heritage because they carry the spirit of cultural heritage preservation. Museums not only contextualize artefacts, they provide a space where personal and social experience occurs in relation to the artefacts and the components of the often elaborate architecture of the museum itself. More importantly, museums—at the core of their responsibility as a cultural institution, and as a center for the dissemination of knowledge—can provide, through various media and narratives, an experience of the past. This is especially important when digital technology, although seemingly incompatible, is being incorporated more and more into museums (Parry, 2007).

We believe that virtual reality technology has become mature for facilitating the experience of and, as a consequence, the learning of culture and heritage. Present trends in the adoption of virtual reality in multiple investments and application areas, and the increased submission of virtual reality research papers in the recent VSMM conference proceedings (International Conference on Virtual Systems and Multimedia 2017, Dublin,

Ireland) is testament to this fact. However, it remains unclear where we are in terms of how well the research community and cultural institutions are doing with the technology. Can culture and heritage be experienced via some elaborate headsets, interaction devices, and enhanced visual reality? Although they can be mediated in particular ways, culture and heritage are as they were. How, then, do we now, as a vibrant research community, use the technology with which we are most familiar for increasing value, for both cultural heritage and our users? What can VR offer for the arts and humanities?

In the article "Welcome to the Experience Economy," Pine and Gilmore (1998) noted that "While prior economic offerings—commodities, goods, and services—are external to the buyer, experiences are inherently personal, existing only in the mind of an individual who has been engaged on an emotional, physical, intellectual, or even spiritual level. Thus, no two people can have the same experience, because each experience derives from the interaction between the staged event (like a theatrical play) and the individual's state of mind." Perhaps the virtual experience which the use of virtual reality can provide will be no different from what the experience economy is aiming for in our physical reality. The research community creates the "stage"—our virtual environment, the immersive experience, and the design of interaction provides the mind of our users with a unique experience. This experience is personal and unique to each individual user, for it involves an intrinsic connection with one's own culture and memory.

It has been almost two decades since Sheridan (2000) described the research needs for Interaction, Imagination and Immersion, originally known as I^3 (Burdea & Coiffet, 1994), and yet the points raised within that article still apply today. Suggestions for research needs in application areas and concerns have yet to be addressed to the full. This shows how long it has taken VR development to arrive at a stage where software libraries and hardware devices have become accessible to researchers, at a fraction of the cost as compared to a decade ago. One need only develop contents and design the interaction without the need to care for innovation in hardware and devices, for the corporations and their investments have largely resolved most of the technical issues.

Sheridan continues, "When interactive VR becomes less expensive and more available the possibilities will be limitless. School children can displace themselves in time and space to walk through the streets of ancient villages or other cultures, or experience being fish or dinosaurs. Films have done this to some extent, but VR allows the additional possibility for the participant to be a more active agent in the virtual environment, not just a passive observer." Virtual reality seems to be at a stage where these dreams can be accomplished, yet amongst experts, the general feeling is that the journey is still a long one for virtual reality.

3.   The Scope of the Special Issue

This two-part issue is unique mainly because of the inimitable cultural heritage contents at the core of each article's research. Except for a distinctive article verifying and validating the concept of Cultural Presence, the other articles have specific focus on attempts to use VR for the study and experience of unique cultural contents. Part II of this special issue will immediately follow with new methods and developments for substantiating concepts with further applications of virtual environments for cultural heritage.

In "Cultural Presence in Virtual Archaeology: An Exploratory Analysis of Factors," Laia Pujol-Tost attempts to verify the validity of the concept of cultural presence through an empirical examination of it, which was mostly defined theoretically.

In "Kilo Hōkū—Experiencing Hawaiian, Non-Instrument Open Ocean Navigation through Virtual Reality," Patrick Karjala, Dean Lodes, Kari Noe, Anna Sikkink, and Jason Leigh preserved the cultural practice of Hawaiian wayfinding, prototyping a system, and evaluated whether VR can be used for the learning and practice of open-ocean navigation founded by Hawaiian ancestors.

"EvoluSon: Walking through an Interactive History of Music," by Ronan Gaugne, Florian Nouviale, Octavia Rioual, Arnaud Chirat, Kevin Gohon, Vincent Goupil, Martin Toutirais, Bruno Bossis, and Valérie Gouranton contributes in the use of VR for intangible cultural heritage by valorizing different pieces of music throughout several historical periods by immersing the user at the center of the experience in a coherent interactive visual and aural environment.

Alexander Kulik, André Kunert, Stephan Beck, Carl-Feofan Matthes, Andre Schollmeyer, Adrian Kreskowski, Bernd Fröhlich, Sue Cobb, and Mirabelle D'Cruz present a multi-view, multi-user virtual environment in the article "Virtual Valcamonica: Collaborative Exploration of Prehistoric Petroglyphs and Their Surrounding Environment in Multi-User Virtual Reality," exploring the interactivity and collaborative analysis of large 3D scans in an aggregate size of over 14 billion points at interactive frame rates.

Finally in this first set of articles, "Recommending Multimedia Information in a Virtual Han Chang'an City Roaming System," by Junmei Feng, Xiaoyi Feng, Liming Deng, and Jinye Peng, proposes a system which, based on information recommendation, suggests personalized visiting paths through a virtual realization of an ancient city.

4.   Conclusion

This special issue complements the 2015 issue by focusing on the experience of cultural heritage using virtual reality technology. Virtual Heritage as a discipline has always had accessibility as one of its key aims. In a seminal paper on Virtual Heritage, Refsland and colleagues (Refsland, Ojika, Addison, & Stone, 2000) stated that ". . . technology is solving one of the largest problematic issues concerning cultural heritage assets—nondestructive public access." In the two decades that have passed, we have witnessed parallel developments in virtual reality technology and virtual heritage applications, the majority of which were preservation through digital capture or detailed reconstructions, both having digital accessibility as an outcome. While digitization is necessary as a first step towards accessibility, this urge to digitize everything does need to be questioned and probed in relation to its use (Thwaites, 2013).

We now believe that the Virtual Heritage community will need something more than accessibility, for contemporary users will look for the experiential aspect of cultural heritage as 3D models become as common as images and videos. This should become our goal in the

next decade of development in Virtual Heritage research. Strategies for facilitating the experiential aspect of Virtual Heritage have been discussed (Ch'ng, 2009), but creating authentic experiences is challenging on many fronts, for it involves the attempt to connect human psychology and physiology with the believability of virtual reality.

The collection of articles published within this two-part issue is an indicator of the present trend of the use of virtual reality for culture and heritage. The culmination of work presented here is a testament that Virtual Heritage research is progressing, and is at a transitional period leading towards the mediated experience of culture and heritage. The experience of culture and heritage via virtual reality does matter in the sustainable preservation of the intangible aspects of physical sites and monuments, including the artifacts in them. Experience can be mediated via virtual reality and has implications in the sustainable preservation of and the learning of past cultures.

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