Chapter 79
Pure Land UNWIRED:
New Approaches to Virtual Reality for Heritage at Risk

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ABSTRACT

The Mogao Grottoes located in Gansu Province of north-western China consist of 492 cells and cave sanctuaries carved into the cliffs above the Dachuan River in Mogao. A UNESCO World Heritage Site, they comprise the largest, most richly endowed, and oldest treasure house of Buddhist art in the world. However, for preservation and conservation reasons most of the caves are now closed to the public. This chapter discusses the range of technologies currently available for the virtual representation of Cave 220, just one of the many caves located at this site. In particular, the chapter focuses on the latest prototype, developed by the authors called Pure Land UNWIRED which uses a virtual reality platform specifically designed for a unique single user full-body immersive virtual reality experience. The discussion includes technical and evaluative analysis of this prototype.

INTRODUCTION

The field of creative technologies encompasses multi-sensory experiences that are the result of a combination of fields including Computer Technology, Design, Art, and the Humanities. Virtual heritage is an example that combines the fields of Virtual Reality and cultural heritage and involves functions that facilitate the synthesis, conservation, reproduction, representation, digital reprocessing, and display of cultural evidence with the use of virtual reality imaging technologies (Roussou, 2002). The field of digital heritage is rapidly evolving through the utilization of digital technology and the maturation of

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processes in research and practical methodologies (Thwaites, 2013) and provides a means to explore and examine past and present heritage resources.

Virtual heritage projects provide an audience with an opportunity to inhabit the cultural imaginary. The audience becomes an integral part of, and is immersed into, the digital heritage experience (Kenderdine & Shaw, 2009). Virtual heritage presents potential to provide access to heritage sites that are remote, closed, or no longer existing. However, virtual heritage representations have often been criticised for issues relating to authenticity, expensive development costs, usability problems, high maintenance, and their confinement to a particular environment located at specific venues that limits widespread dissemination, distribution, and use (Roussou, 2007).

This chapter provides a case study that is focused on a new full-body immersive virtual reality application that allows unparalleled access to a world heritage site that is so vulnerable it can no longer sustain physical visitors. The application, *Pure Land UNWIRED* is the third in a series of virtual and augmented reality installations that utilize sensorial and experiential exhibition technologies to recreate precious heritage locations. The *Pure Land* projects digitally replicate parts of the UNESCO World Heritage Site located at the Mogao Grottoes in Gansu Province, north-western China. Current *Pure Land* applications focused on Cave 220; known for its important early Tang Dynasty murals. The peerless treasures of the paintings and sculptures at Dunhuang are extremely vulnerable and, as such, many caves are closed to the public - including Cave 220.

Comprehensive digitization, including laser scanning and ultra-high resolution camera array photography, are now undertaken by the Dunhuang Research Academy as the primary method of preservation and interpretation for the site. The digital facsimiles of this paragon of Chinese Buddhist art are transformed allowing virtual visitation to the site for museum visitors.

The *Pure Land* projects contribute to new strategies for rendering cultural heritage landscapes, and redefine the possibilities for digital preservation and embodied museography. *Pure Land UNWIRED,* currently in prototype stage, is the third *Pure Land* project in the series and was developed by the authors of this chapter in collaboration with the Dunhuang Research Academy. *Pure Land UNWIRED* allows full-body immersion in a virtual reality (VR) environment: visitors walk around inside Cave 220 at 1:1 scale. The VR platform combines a head-mounted display with a camera-based motion tracking system to capture movements of a single user's body and limbs within a small space similar to the size of the Cave 220 itself. A tablet computer carried in a backpack runs the game engine, which integrates the tracking with real-time visualisation.

Pure Land UNWIRED addresses several of the often-criticised shortcomings of virtual heritage projects related to authenticity, usability, cost, maintenance, and the potential for dissemination. This chapter contextualises *Pure Land UNWIRED* within the field of virtual heritage experiences, describes the *Pure Land UNWIRED* prototype and discusses the results of a user experiences study gathered from an evaluative survey of users who have experienced the Cave 220 using *Pure Land UNWIRED* at the Real 2015 conference held February 25-27, 2015 in San Francisco, California, USA.

Heritage at Risk

The Mogao Grottoes consist of 750 caves that have been hewn on five levels into an escarpment in the Gobi Desert. Mural paintings are found in 492 caves; in total there are 45,000 square meters of murals and more than 2,000 painted clay figures. Buddha statues and paintings of paradise and angels adorn the walls of the caves, as do images of the patrons or donors who commissioned the paintings. The largest