This peer-reviewed journal paper explores, theorises, and empirically assesses the visitor's experience of 3D reconstructions of the past. In the last 10 years Virtual Reality (VR) and Augmented Reality (AR) have been used to create visions of the past to be consumed as an immersive experience (e.g. moving within a building in VR) or as an overlapping of the past on today's world (e.g. graphics onto real views from the camera phone in AR). However, neither of the two approaches have been studied from the visitors' point of view.

With this work, Petrelli contextualises and shares insight on how recreated visions from the past can be part of the visit, what is the role of the surrounding heritage, and how different technologies affect the visitors' experience in place.

The experimental design crosses different technologies with different heritage types and different reconstructions to achieve the broadest possible understanding of how each component (the visual reconstruction, the audio narrative, the heritage surroundings) influences the visitors' perception and experience.

Although the sample of participants is limited, the findings shed some light on what the most important factors are in making 3D reconstructions effective in themselves and as foundation for interactive storytelling; the findings highlight the experiential response to VR (visceral, embodied, subjective) vs the rational response to AR (cognitive, comparative, objective).

Petrelli presented this work as keynote at the "3DVis: Symposium on 3D Visualization Technologies in Cultural Heritage" held online by the Museum of Natural History at the University of Oxford 1-2 December 2020 due to Covid-19 restrictions.

Above: The 'stereoscope' used to look at the 3D reconstruction of the Forum of Augustus in Rome.

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Making virtual reconstructions part of the visit: An exploratory study

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A B S T R A C T

The paper reports a qualitative study with the objective of obtaining a better understanding of the use of 3D reconstructions as part of a visit to a heritage site. The same content was displayed on two different devices: a tablet that provides an augmented reality (AR) overlapping the reconstructions in the real world and a headset that immerses the visitor in the past via a virtual reality (VR) experience. These two settings were evaluated in two different heritage contexts: a house museum, and a display-case museum. Visitors and museum professionals participated and used both devices. The results show that an AR setting is preferred when it is possible to compare the present day with the past while VR is preferred to contextualise exhibits, particularly when the original environment was monumental. Guidelines to reuse 3D reconstructions as part of the visit are provided on the bases of the questionnaires, observations, and discussions collected during the study.

1. Introduction

The production of high-quality, multimedia content for the purpose of communicating complex, historical information in the context of a museum visit is an expensive process. To begin with, it requires curatorial expertise (to find original sources of reliable, up-to-date information to be composed into a consistent narrative); then the information collected must be effectively communicated to an audience (from dry-facts to storytelling); and finally the rendering must be compelling enough to engage and sustain the interest of visitors that may not have any knowledge on the topic. Interactive architectural 3D virtual reconstructions are an example of such multimedia content that is expensive to produce, but that holds much potential for visitors' engagement particularly in light of emerging affordable virtual reality (VR) devices such as Sony PlayStation VR, or Oculus Rift. Once the curatorial work of selecting the sources and the content is done, the cost of producing the 3D virtual reconstruction is down to both the expertise needed to master the technology, and to the lengthy process of creating a virtual world that represents in detail the evidence in the original sources. Cost-cutting strategies such as the reuse of existing 3D models are unlikely to occur within the heritage context where rigorous and faithful reconstruction of each element in the scene is expected. It goes without saying, that if 3D virtual reconstructions could be used in multiple different settings such as online or on the exhibition floor, then the cost of production would be more justified, as there would be multiple uses for the same content.

VR is appealing to both the public and heritage organisations, but there is a limited understanding of how it can be effectively integrated as part of the visit. Indeed VR has been presented and managed as a special experience offered alongside traditional exhibitions, as stand-alone supervised installations (from the early experiments surveyed in (Pujol, 2004) to the most recent installations (Tate Modern, 2017) (Museo della Scienza, 2018) (Schofield et al., 2018)) rather than as a tool used by the visitors in autonomy while they experience the museum or the heritage site at their own pace.

This paper is a step in this direction and aims to shed some light on how the device, the interactive content, and the surroundings affect the visiting experience. In other words, the focus of this work is on how 3D virtual reconstructions (content) taken around the heritage site (via a mobile device) change the experience of visiting the heritage site itself (surroundings). In the case study discussed, the high-quality content created for two commercial VR interactive games for two very different heritage sites is reused in an app that provides visitors with views of the heritage from the past while being in the actual relevant place. However, as discussed in the next section, when VR is viewed on a tablet instead of a headset, the experience is not that of immersion, but of seeing the VR content overlapping the reality surrounding the viewer and therefore making VR, from the viewer's point of view, closer to Augmented Reality (AR) than to VR as commonly understood.

As part of this inquiry, visitors and professionals used a tablet (for AR) and a headset (for VR) in a study aiming at understanding:

- if and how 3D content could improve the visiting experience;
- if and how a different device (a tablet vs. a headset) changes the experience, and
- what is the impact of the heritage setting;
- what visitors prefer and how professionals imagine this technology to be effectively implemented.

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Above: Making virtual reconstructions part of the visit: An explorary study
Official link to article: http://shura.shu.ac.uk/25143/

The study evaluates and compares two different types of technology (a tablet and a stereoscope) in two different heritage settings (a traditional museum and a house musuem and garden) to deliver the same content (3D reconstructions scenes and fragments of narratives). The images below illustrate such experimental setting.

Above: The stereoscope to see the 3D reconstructions in virtual reality mode.

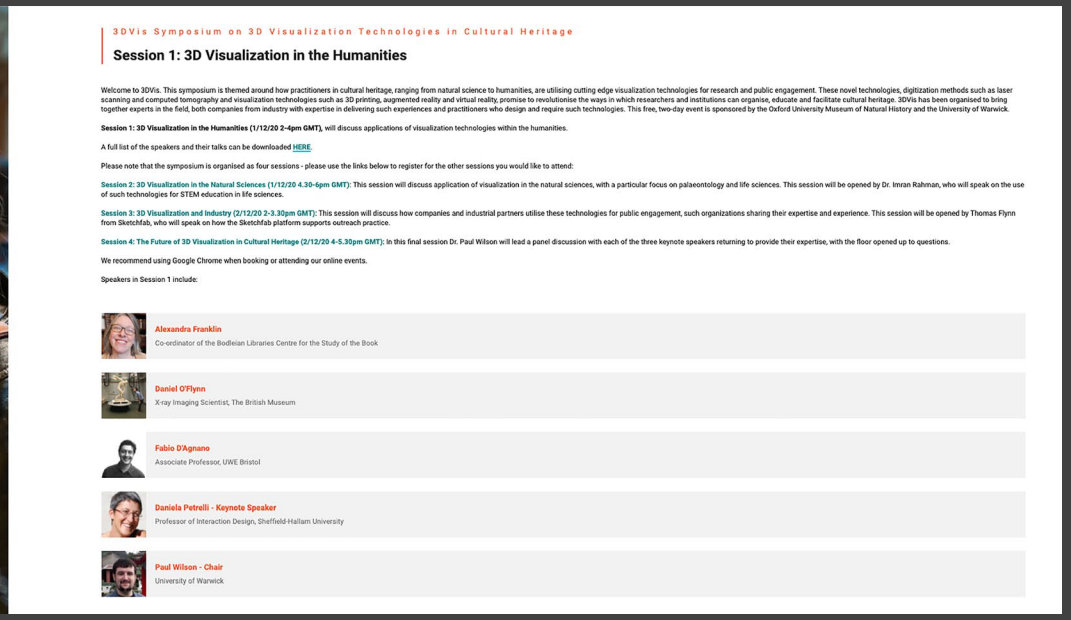
Above: The stereoscope used in the museum in front of the model of the Forum of Augustus.

Above: The stereoscope used in the garden of Dr Jenner's House Museum.

Above: The 3D reconstructions of Dr Jenner's house (right) and as it is today (left)

Above: The 3D reconstruction of the Colossus of Augustus in the Forum seen on the tablet

Above: The tablet in use at the Dr Jenner's house museum.



3DVis Symposium on 3D Visualization Technologies in Cultural Heritage

Session 1: 3D Visualization in the Humanities

Welcome to 3DVis. This symposium is themed around how practitioners in cultural heritage, ranging from natural science to humanities, are utilising cutting edge visualization technologies for research and public engagement. These novel technologies, digitization methods such as laser scanning and computed tomography and visualization technologies such as 3D printing, augmented reality and virtual reality, promise to revolutionise the ways in which researchers and institutions can organise, educate and facilitate cultural heritage. 3DVis has been organised to bring together experts in the field, both companies from industry with expertise in delivering such experiences and practitioners who design and require such technologies. This free, two-day event is sponsored by the Oxford University Museum of Natural History and the University of Warwick.

Session 1: 3D Visualization in the Humanities (1/12/20 2-4pm GMT), will discuss applications of visualization technologies within the humanities.

A full list of the speakers and their talks can be downloaded HERE.

Please note that the symposium is organised as four sessions - please use the links below to register for the other sessions you would like to attend:

Session 2: 3D Visualization in the Natural Sciences (1/12/20 4.30-6pm GMT): This session will discuss application of visualization in the natural sciences, with a particular focus on palaeontology and life sciences. This session will be opened by Dr. Imran Rahman, who will speak on the use of such technologies for STEM education in life sciences.

Session 3: 3D Visualization and Industry (2/12/20 2-3.30pm GMT): This session will discuss how companies and industrial partners utilise these technologies for public engagement, such organizations sharing their expertise and experience. This session will be opened by Thomas Flynn from Sketchfab, who will speak on how the Sketchfab platform supports outreach practice.

Session 4: The Future of 3D Visualization in Cultural Heritage (2/12/20 4-5.30pm GMT): In this final session Dr. Paul Wilson will lead a panel discussion with each of the three keynote speakers returning to provide their expertise, with the floor opened up to questions.

We recommend using Google Chrome when booking or attending our online events.

Speakers in Session 1 include:

Alexandra Franklin
Co-ordinator of the Bodleian Libraries Centre for the Study of the Book

Daniel O'Flynn
X-ray Imaging Scientist, The British Museum

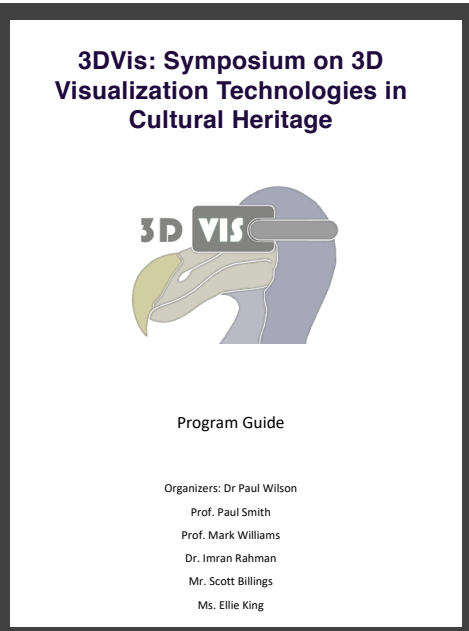
Fabio D'Agnano
Associate Professor, UWE Bristol

Daniela Petrelli - Keynote Speaker
Professor of Interaction Design, Sheffield-Hallam University

Paul Wilson - Chair
University of Warwick

Above: Online announcement of 3DVis symposium.

This journal paper has been also delivered as keynote speech on the 1.12.2020 at the 3DVis Symposium.



3DVis: Symposium on 3D Visualization Technologies in Cultural Heritage

Program Guide

Organizers: Dr Paul Wilson
Prof. Paul Smith
Prof. Mark Williams
Dr. Imran Rahman
Mr. Scott Billings
Ms. Ellie King

Click here to view the full program of the 3Dvis event