Preserving Virtual Reality Artworks

A Museum Perspective

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ABSTRACT

As artists increasingly engage with virtual reality (VR) technologies, the artworks they produce are beginning to enter the collections of cultural heritage institutions. Museums, libraries and archives are therefore assessing how these complex works might be brought into collections and how they might be stabilised to ensure they can be exhibited in the long-term. Reporting on ongoing research at Tate in London, in this talk we will introduce our perspective as conservators of time-based media (broadly understood as art with a technological component that unfolds over time) on the challenges we face in preserving virtual reality artworks. We expect this to be of interest to SIGGRAPH attendees who are considering the legacy of their creations and the ways in which virtual reality artworks (and related technologies) might be stabilised in order to secure their future.

CCS CONCEPTS

• **Human-centered computing~Virtual reality** • Human-centered computing~Mixed / augmented reality • **Applied computing~Fine arts** • **Applied computing~Media arts** • Applied computing~Digital libraries and archives • Software and its engineering~Virtual worlds software

KEYWORDS

Digital Preservation, Time-based Media, Art Conservation, Virtual Reality, Cultural Heritage

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1 Background

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Tate is a major arts institution that houses the United Kingdom's national collection of British, international and contemporary art. It's conservation department works to ensure that this collection is appropriately cared for and remains displayable within the galleries. As part of its conservation research programme, Tate keeps abreast of new technologies and their use in contemporary art, to ensure preparedness as the collection continues to grow. A recent research focus has been the conservation of software-based art [Falcão et al. 2014; Laurenson 2016; Rechert et al. 2016, Ensom 2018], including works using real-time 3D technologies. Research has also been carried out on the suitability of VR technologies to document complex installations of physical artworks [McConchie 2018]. This has fed into a new strand of research on the preservation of VR materials.

When an artwork is acquired by a museum or archive, it can be thought of as not only a work in its own right, but also a reflection of the time in which it was made. Therefore, the hardware and software acquired can be thought of as a historical document that may require preserving in its original form. Works may show characteristics which are closely linked to the specific technologies employed. In an industry that develops new technology at a rapid pace, the interests of a collecting institution can be seen to quickly diverge from technological progress. Building on earlier exploratory research around preserving VR artworks [Campbell 2017; Cranmer 2017], this research has sought to identify key risk factors in their long-term preservation and develop high-level guidelines for those creating and collecting them. We have also taken Tate's existing strategies for documenting and stabilising complex artworks as a starting point for our research.

2 Identifying Preservation Risks

We have broken the challenge down into several parts, and will briefly reflect on each of these. At the core of this challenge are the VR systems themselves—HMDs, sensors, controllers, drivers and runtime software. These technologies define what we think of as a VR experience, and are evolving rapidly. Our concern here has been understanding the defining characteristics of hardware components and the qualities they bring to an experience (such as

the impact of lens distortion and resolution in HMDs), alongside understanding connections with the supporting software environment. In exploring this we have aimed to understand the impact of migrating to new hardware in the future. We are also interested in how open platform runtimes such as OpenXR [Khronos Group 2019a] might create a flexible solution to engine, runtime and hardware integration, and so accommodate future changes.

We have examined VR application software in relation to three closely related technologies—360 video, native real-time 3D and web real-time 3D—all of which pose slightly different challenges. The digital video component of 360 video might be treated using established methods of preserving digital file formats, but diverges in other respects. Due to the various emerging projection types used in 360 video playback, our research highlights the need to understand 3D objects and the corresponding UV maps used to render the experience, alongside preserving the 2D video file.

Native real-time 3D applications, residing largely in native code in their built form, are a major source of concern in ensuring long-term access to VR artworks. Web real-time 3D applications on the other hand, pose less of a risk through their dependence on open technologies, although these technologies but remain in their relative infancy. Industry movement towards open APIs such as Vulkan [Khronos Group 2019b] and OpenXR [Khronos Group 2019a] show promise in alleviating concerns over long-term access, but their value in a preservation use-case is dependent on adoption and continued legacy support.

3 Exploring Preservation Strategies

Emulation (and related techniques like virtualization) shows potential as a means of enabling access to binaries compiled to run on older platforms. However, the limited support for 3D graphics in emulated environments and unavoidable reliance on physical hardware present barriers to running VR applications. Further concerns are raised when we consider consistent rendering, and the potential for driver-level and device specific processes to be lost without the hardware for which they were implemented.

Another possibility for maintaining long-term access to VR applications is to incrementally update them in the short-term and migrate to new engines in the longer-term. However, these strategies are resource intensive for museums and risk the loss of important characteristics of the original version (for example, rendering techniques specific to a particular engine). Preserving production environments is essential if such strategies are to be explored in the future, and also benefits our understanding of historical artistic processes. We have identified a number of useful strategies for enabling this, including collecting period hardware and preserving software environments as disk images. We have also explored the potential suitability of file formats such as X3D [Web 3D Consortium 2019] and glTF [Khronos Group 2019c] for preserving 3D assets independently of the tools they were produced with.

VR artworks present a host of new preservation challenges and we are still only in the early stages of understanding how they might be addressed. Recent research at Tate has worked towards the development of a high-level preservation strategy which addresses the imminent prospect of collecting works of this type, identifying particular points of concern and offering some tentative recommendations. We are keen to invite responses from the SIGGRAPH community on the challenges discussed, and ways in which artists and industry are dealing with problems of technological obsolescence in relation to the products and artistic creations they generate. We propose that through a shared understanding between creators, technologists and conservators, we can make progress in addressing this significant challenge.

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