

Use of Oculus Rift for an immersive “time shift” experience in the Medieval Ages

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Abstract: The paper will describe an Oculus Rift application in a cultural heritage immersive exhibit, developed by the ICT company ETT S.p.A., for the Medieval Castle in Monteverde, located in the province of Avellino (Southern Italy) and dating from the ninth century. The exhibit opened in August 2014.

The project is a development of the approach using advanced technologies to enhance visitor engagement and ‘absorb’ them into the storyline. This concept is applied in the castle Throne Room, where the visitor sits on a rotating chair and – wearing an Oculus Rift device – has a 360° view of a 3D reconstruction of the hall, complete with detailed and life-like furniture and fittings. In this way, visitors experience a real ‘time-shift’ into the atmosphere of the medieval period, aiding storytelling and transforming them into active participants in the ‘story’ narrated by the historical site. The project will exploit Oculus Rift’s features in order to obtain – as a final result – a deep-level immersive virtual reality environment. It creates the sensation of being entirely transported into a virtual three-dimensional world and can provide a far more intuitive experience than screen-based media. By removing an interface layer between the user and the experience, Oculus Rift has huge potential and will be able to have deep emotional impact on users. It has the enormous ability to deceive the brain into feeling that a particular situation or setting is ‘really there!’

Keywords: Oculus Rift, ICT, advanced technologies, Virtual Reality, Cultural Heritage

Premise

This presentation focuses on a project developed by ETT, an ICT company, in the field of museum exhibits. We shall illustrate and describe a case history, based on a Virtual Reality application and using Immersive Visitor Engagement Technology

The museum context

Today, as never before, virtual reality is part of our daily lives. There is a growing interest in the world of culture and research to demonstrate the application of this technology in different areas (art, history and the preservation of ancient works), and the need to discover new ways of sharing and spreading our heritage is emerging as a compelling task. It is a new way of thinking about cultural enjoyment as an experience, not only participatory but also completely immersive.

Italy is a country of unparalleled cultural richness that, unfortunately, is not fostered enough. Today, many institutions such as museums and libraries feel the need to innovate, making works of art usually reserved for a niche audience more interesting and eye-catching. Despite the fact that these places are particularly suitable for processes of learning and acquiring new knowledge, the concept of “museum” is even today

often associated with something boring and old. New Technologies, however, can help change this way of thinking and, as we have seen, can be used to build new kinds of educational activities with the aim of regaining a wider audience; no longer passive but active and participatory. As a private company specialised in multimedia exhibits, we have the opportunity and the good fortune to manage projects involving the use of advanced virtual technologies.

The Approach to Museum Exhibition Design

Within this evolutionary process, as we have seen, museums have become increasingly digital; not only for cataloguing and conservation but also for enjoyment and communication. The central point on which ETT has focused its development activities is *the enhancement of the visitor experience*.

In recent years, the trend towards improving the visitor experience has taken a great leap forward. We are entering a new era in museum design as the technologies for immersive, interactive experiences become more sophisticated and widespread. This new approach to museum exhibitions is based on the use of the most recent technologies and devices in order to:

- enhance visitor engagement and interaction
- give visitors an active role to play, part visitor – part actor: a “*visit-actor*”
- define the goal of an “immersive museum”, in which the visit-actor is absorbed into the storyline

Museums are, in fact, becoming more aware that boredom is the most fearsome enemy and that in order to attract, a museum must surprise every visitor. Starting from the message that the organisers want to get across, together with the exhibition theme, the best use of the most effective Immersive Visitor Engagement Technology must be correctly planned. A successful way in which advanced technologies can be used to enhance visitor engagement and “absorb” them into the storyline is outlined here.

Virtual Reality: the technological instrument

The use of immersive virtual reality (VR) systems in museums is a recent trend, and the development of new interactive technologies has inevitably had an impact on more traditional sciences and arts. This is more evident in the case of novel interactive technologies that fascinate the broad public, as has always been the case with virtual reality.

While the word “virtual” is typically overused in the computer world, it is aptly placed in the expression “virtual reality”. According to the American Heritage Dictionary, virtual means “existing or resulting in essence or effect though not in actual fact, form, or name.” It can also mean “created, simulated, or carried on by means of a computer or computer network.” Therefore, virtual reality is best described as an illusion of reality created by a computer system. Virtual Reality stands for the field of computing which has the objective of creating a virtual world, having one immerse into it and giving one the capability of interacting with this world, while using specific devices to simulate an environment and stimulate one by feedback in order to make the experience as real as possible (GONÇALVES 2013) .

A person may enter a world of virtual reality by putting on special glasses and headphones attached to a computer system running the virtual reality program. These devices immerse the user with the sights and

sounds of the virtual world. Some virtual reality systems allow the user to wear gloves too, with electronic sensors to touch or move virtual objects. As the user moves his head or hands, the computer moves the virtual world accordingly in real-time.

Virtual reality has been widely used for entertainment purposes, but the technology has found its way into the military and medical fields as well. While virtual reality systems have advanced significantly over the past decade, for the most part they are still more “virtual” than real (TUCK, KUKSA 2009).

The increasing development of VR technologies has matured enough to expand research from the scientific visualization into more multidisciplinary areas, such as cultural heritage, education, art and edutainment.

The exhibit location: Monteverde Castle

Our proposal describes an Oculus Rift application in a cultural heritage immersive exhibit, developed by the ICT company ETT S.p.A., for the Medieval Castle in Monteverde, located in the province of Avellino (Southern Italy) and dating from the ninth century. The exhibit opened in August 2014.



Fig. 1 – The Monteverde Castle

Monteverde Castle was built on the top of a hill overlooking a valley with two rivers, the Ofanto and the Osento. According to some historians, the Castle dates back to the ninth century. It had a trapezoidal layout, cylindrical Towers on four corners and a drawbridge that was still there until the end of the last century. After the Norman conquest, Monteverde passed under the control of the Swabians who were replaced by the Angevins until the fief went under the control of the Aragonese in the 16th century. The Castle underwent

several changes in order to adapt its defensive structure to changing needs. The current look of the Castle is mainly due to rebuilding carried out in the 19th century, after the Castle was almost destroyed during the earthquake of 1851. The village of Monteverde became a fief held by the Orsini in 1444: it then passed to the prince of Monaco Onorato Grimaldi in 1532 and Michele Sangermanno held it in 1642. The Caracciolo family became Princes in 1689 and ruled over Monteverde until the abolition of feudalism (1806). The building was both a fortress and a private home for nearly eight hundred years as several aristocratic families lived in the Castle from 1059 to 1932, when the last Lord died.

The project: an immersive “time shift” experience

The project undertaken by ETT regarded the recreation of a real Castle Throne Room located in Monteverde. The ultimate goal of the project was to create a virtual tour of the Throne while enabling the viewer to experience the décor, as it may have looked in the thirteenth century, while at the same time giving the virtual tourist optional interpretations for various features.

Of particular interest in the use of virtual reality devices such as Oculus RIFT is the fact that they allow visitors to travel through space and time without stepping out of the museum building (ROUSSOU, EFRAIMOGLOU 1999). The potential to transcend the physical location of a built-up environment and the growing sense of the educative function of the museum – juxtaposed with commercial pressure – has lead museums to consider virtual reality as a necessary component in the arsenal of tools to educate, entertain and dazzle (ROUSSOU 2000). The creation of Cultural Heritage applications for VR systems is an experience-learned process with its share of challenges.

The project is a development of the approach that advanced technologies can be used to enhance visitor engagement and ‘absorb’ them into the storyline. Of all forms of media, VR probably comes the closest to real world experience. Just like the physical world, it surrounds visitors in a completely immersive environment (KALAWSKY 1996). We used this to create experiences that would be impossible in any other medium.

In fact, Oculus is an immersive medium. It creates the sensation of being fully transported into a virtual three-dimensional world, and it can provide a more instinctive experience than screen-based media. Maintaining the mind's continual suspension of disbelief requires particular attention to detail. As a piece of technology delivering a user experience, the Oculus Rift has a huge amount of potential to affect users at a deep emotional level; with much greater ability to trick the brain into feeling that something is real. Here is a technology that can really trigger emotional responses. Much of the ability of Oculus Rift to deliver on this promise comes from removing an interface layer between the user and the experience.

This concept is applied in the castle Throne Room, where the visitor sits on a rotating chair and – wearing an Oculus Rift device – has a 360° view of a 3D reconstruction of the hall, complete with detailed and life-like furniture and fittings. In this way, visitors experience a real ‘time-shift’ into the atmosphere of the medieval period, aiding storytelling and being transformed into an active participant in the ‘story’ narrated by the historical site.

The project exploits Oculus Rift's features in order to obtain – as the final result – a deep-level immersive virtual reality environment.

The Oculus Rift has a huge amount of potential to affect users at a deep emotional level. Focusing on a particular element of the virtual world is a simple matter of turning the user’s head. While this is just a small thing in itself, the AR approach also removes the need to have separate controls for looking at things, and it filters out the distractions of the real world. About the user experience, it is important to underline that the user is able to look around completely naturally, without using any controls. It is an intuitive approach to discover the hidden story of a fragment of cultural heritage.

Oculus Rift looks much like a pair of ski goggles. There are two lenses inside, one for each eye, pointing at a single LCD display. The screen delivers two separate images, one for each eye, giving stereoscopic 3D. There are sensors in the goggles – accelerometer, gyroscope – that are keyed into the applications. Visitors can turn their head and their vision moves almost perfectly with it, 360 degrees around the room of the Castle. In this way it is possible to create a very immersive interactive experience.

The VR Application

We developed an application in which visitors can see a kind of medieval castle scene. The VR application was built on Unity 3D. This is a commonly used development environment for the Oculus Rift, as well as for 3D games and visualizations in general. In Unity, a digital “scene” is created with the digital material that is to be presented, and a virtual stereo camera within the digital scene captures an image, which is then seen in the Oculus Rift headset. This virtual camera follows the orientation of the Oculus precisely, giving the illusion that the user is inside the virtual scene and can look around freely, in essence creating a virtual reality experience. Visitors put on these goggles and slip into a completely new, albeit ancient, world. To balance the poor resolution provided by the first version of Oculus RIFT DK1 with the mini PC on which the application had to run, we decided to map, inside a sphere, a high polygon animated rendering of the reconstructed castle room. Adding slight atmospheric effects (like dust and light changes) we were able to give depth to what is actually a flat vision. This technique is commonly used in VR when the content to be shown consists of 360° imagery, mainly video or simply photos.



Fig. 2 – Oculus Rift Application

By removing an interface layer between the user and the experience, Oculus Rift has huge potential and is able to have deep emotional impact on users. It has the enormous ability to deceive the brain into feeling that a particular situation or setting is 'really there!'

The use of three-dimensional representations presents itself as an excellent visual translation of bi-dimensional images, such as architectural drawings. These 3D representations are much more enlightening to the public. Their reading and understanding are immediate, serving as a framework for other iconographic sources. The introduction of a new technology such as OCULUS RIFT provides the necessary link for achieving the main goal of this type of creation, which is promoting maximum immersion for users.

This headset displays a stereoscopic image from a computer with a wide field of view. However, the headset itself does not contain any software and needs to be connected to a computer. In future scenarios, by mounting two webcams to the Oculus at roughly the position of the viewer's eyes and providing live video as a backdrop to the digital scene, the real world can be viewed through the Oculus. The design is in principle similar to the previous PRISMA and AR-View systems, especially the stereo vision camera aspect of the latter. Unity supports a wide range of different media, including images, video, animated 3D models, particle effects and sounds. These can be presented as small objects in front of a live view, or be large enough to be layered over the whole view.

The Thrones

The application is comfortable to wear and to make it more immersive we reproduced a throne, which turns around during interaction. In fact, this application creates the sensation of being entirely transported into a virtual three-dimensional castle and provides a far more intuitive experience than screen-based media. As the VR application had to be presented to the public inside the actual Throne Room, we designed and built two rotating real size thrones

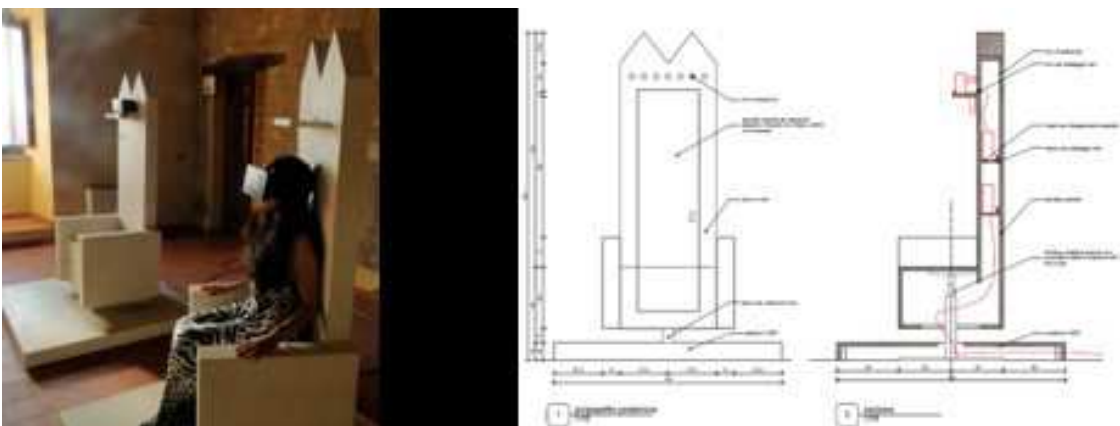


Fig.3 – Thrones and technical details

The throne design was inspired by authentic Italian medieval thrones and had many useful functions: it contained all the necessary hardware (only a power cable emerges from the prop); it limited users' movements, keeping them in the optimal position from which the 3D reconstruction was rendered; it gave a

physical and tangible complement and introduction to what was presented in the VR application. It also gave the whole exhibit a more coherent look by identifying with the venues spaces, suggesting its past function (otherwise difficult to imagine as the throne room was empty)



Fig.4 – Monteverde Castle – Thrones

New Horizons for the Museums: Mixed Reality

In the field of immersion and interaction, OCULUS RIFT has been taking an active role in the dissemination of cultural heritage. It is an excellent way of transmitting knowledge while playing at acting (users play the role of a king on the throne). This mechanism operates in information transferring, taking on a specific didactic form that presents very positive results. In addition, motivated by the installation, the user makes a significant commitment that is unparalleled in a multimedia application existing only for informative purposes. Developing this application, we found a way to make a headset that does more than just hang a big screen in front of the visitor's face.

By combining stereoscopic 3D, 360° visuals, and a wide field of view – along with our software – we created a new way to experience the castle. During the interaction, there is no difference between experiencing something on the Rift and experiencing it in the real world.

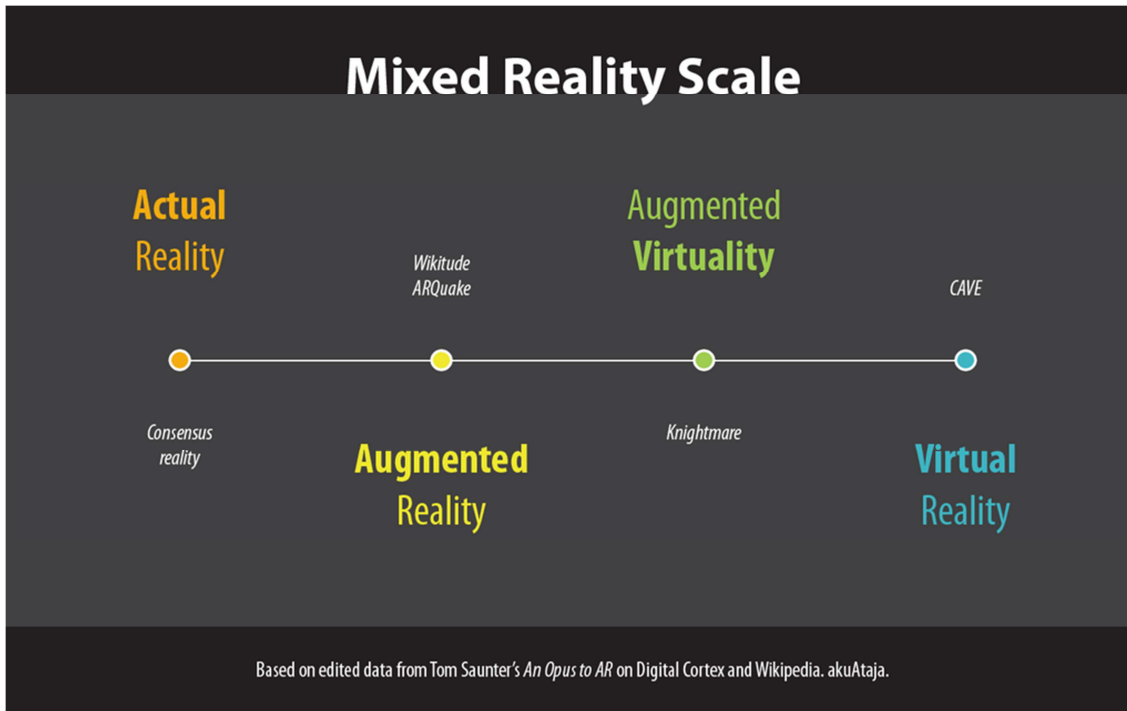


Fig. 5 – Milgram continuum

We are moving towards experiences that are aimed at being even more immersive through better integration between AR and VR → *mixed reality* (the centre of the *Milgram continuum*).

Mixed Reality environments are characterised by the combination of the real with the virtual. If the real world occupies the left of the continuum, the virtual world stands at the other end. It is, however, possible to combine elements of the surrounding real world into a virtual environment (Augmented Virtuality) as well as to overlay virtual objects onto a view of the real world, if observed or seen using a video or see-through display (Augmented Reality). It is therefore pertinent to define Mixed Reality (MR) environments as environments in which “real world and virtual world objects are presented together within a single display, that is, anywhere between the extreme of the Reality - Virtuality continuum.

Results and conclusions

During the opening period of the exhibit (3 days), almost 1000 people visited the Castle, of which 80% asked to try the Oculus based exhibit. The average reaction was initial surprise at the technology, and then a deeper comprehension of the space represented in the VR scene.



Fig. 6 – Multimedia exhibition experience on the Throne in Monteverde

We are still at the early stages of using immersive virtual reality systems for public access. Virtual environments, such as the ones we are developing, can provide rewarding aesthetic and learning experiences that would otherwise be difficult to obtain



Fig. 7 – Mercati di Traiano Museum (Rome) – Multimedia exhibit of the Digital Museum EXPO

We believe that it is well worth investigating the added value and potential that virtual reality can bring to the public domain. In order to keep VR technology as accessible as possible to the broad public, it has to become transparent and provide natural, consistent and seamless modes of interaction and interfaces (WALKER, SONG, KOBAYASHII, HODGES 1999).

Both the hardware and the software employed are becoming as human-friendly as possible. In this sense, an important aspect will be the ease of use of devices: new tools are emerging, wireless, not connected to the computer, which are based on smartphones integrated into them (e.g. Samsung Gear VR). Another aspect in development is multisensory, the integration of the visual interface with sound effects and with sensors such as a depth cam (e.g. Leap Motion). That fact will help bring the experience of the visitor to the "Mixed Reality". Encouraged by our visitor numbers and positive comments, we are working towards further development of cultural and educational experiences.

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Imprint:

Proceedings of the 19th International Conference on Cultural Heritage and New Technologies 2014 (CHNT 19, 2014)

Vienna 2015

<http://www.chnt.at/proceedings-chnt-19/>

ISBN 978-3-200-04167-7

Editor/Publisher: Museen der Stadt Wien – Stadtarchäologie

Editorial Team: Wolfgang Börner, Susanne Uhlirz

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