

VIMM

Thematic Area 2: Directions

Working Group 2.2: Meaningful Content Connected To The Real World

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Abstract

The Working Group 2.2 Technologies and Tools of the VIMM Thematic Area 2-Directions has provided the outcome of work: a vast list of 89 best practices and state of the art examples used in CH MR/VR/AR, in order to find out what the characteristics of VR as a medium are, to discover what stories can be told using AR/VR/MR and to recognise how these stories remain connected to the real world. The expert group consisting of international experts on the field of new media, storytelling and cultural heritage created and assessed a list concerning five topics; 21 cases of media - what kinds of media support the AR/VR/MR experience, 18 cases of interactivity - how can content connect to the user, 31 cases of storytelling - how do we connect content pieces between them and to the general message, 12 cases of meaningful content vs. the real world - how does content connect to the real world and 7 cases of media characteristics - how can we define VR as a medium.

Introduction

Preserving the past within the collective memories of people is one of the ultimate goals of creative industries. Virtual cultural heritage applications recreate history by inviting users to travel back in time. One of the more popular approaches for enhancing the immersion of time-travellers within virtual environments is interactive digital story-telling, which enables users to learn while exploring.

While the process of developing interactive digital story-telling applications is still complex, involving professionals from various artistic and scientific disciplines, significant technological advances have recently been made towards improving content production.

Advanced Earth observation systems are capable of capturing hundreds of thousands of

points within a second, thus creating extremely accurate representation of artefacts such as cultural sites. Usually mounted on mobile and airborne platforms, they produce high-resolution point-clouds with densities ranging up to several hundred points per square meter.

However, the lack of topology, huge data sizes, and the contained noise, requires new data processing, storage, and management approaches before these data can be successfully utilized.

The outcome of the work is this vast list of best practices and state of the art examples of content used in CH VR/AR/MR achieved through several Skype conferences and a live meeting with experts in Maribor, where each representing stakeholder have presented approximately 3 of best practices or state of the art examples of the themes.

During the meetings, these examples were analysed and discussed by the WG members (e.g. what are pros or cons of using this, what media is available, how storytelling fits into the VR/AR/MR)

WG2.2 has the following scope and objectives:

- to find out what the characteristics of VR as a medium are,
- to discover what stories can be told using VR,
- to recognise how these stories remain connected to the real world.

To achieve this, the expert group consisting of 6 international experts on the field of new media, storytelling and cultural heritage created and assessed a list concerning five topics.

These are:

- **media** (what kinds of media support the VR experience?)
- **interactivity** (how can content connect to the user?)
- **storytelling** (how do we connect pieces content between them and to the general message?)
- **meaningful content vs. the real world** (how does content connect to the real world?)
- **media characteristics** (how can we define VR as a medium?)

AR/VR/MR need to be “embedded” into other priorities, such as virtual museums: it shows the way forward: the use of different techniques (like storytelling; user involvement, crowd-sourcing) with tools and technology (AR/VR/MR, transmedia digital and traditional).

A community of practice around the processes and tools that create immersive, inclusive, and participatory experiences of cultural and scientific heritage is quite vivid. Topics include virtual reality, transmedia, and augmenting reality; visitor-centric and participatory approaches to experience AR/VR/MR design.

WG 2.2 introduces an advanced pipeline for creating virtual worlds as environments for interactive digital storytelling applications for future museums and for cultural heritage. By considering the challenges and issues arising during this process, recent developments in content creation, editing, and post-production is demonstrated through the list of practices the implemented end-user applications.

Media – what kind of media support the VR? (21 cases)

Best examples of innovative usage of VR technologies: VR headsets, VR with usage of mobile phone, mobile phone standalone apps, 360 web video player and tablets.

VR is something that's not a trend as much as it is another channel for media. Viewing content with or without being a computer is vastly different, as are the experiences that are possible. VR is already moulding certain industries like gaming, museums and architecture, as well as immersive experiences like diving in reefs or visiting Machu Pichu that some would never have the chance to do in real life. VR is more than show and tell. It's about *presence*, a most powerful way to involve the audience.

The difference between AR and VR is subtle, but significant. VR takes users inside a completely different world, while AR integrates users' current surroundings into a virtual experience. From a technical standpoint, while both technologies can merge with social media, many brands are currently using augmented technology over virtual because it's more accessible to a larger audience, and AR doesn't require additional equipment or VR headsets.

Virtual reality in film and TV

Virtual reality has featured in film and television programmes. It is often used to illustrate the concept of being trapped within the machine (or in this case, cyberspace), or as a form of advanced technology. Examples of VR inspired films include: The Lawnmower Man, The Matrix, Tron (1982 version), The Thirteenth Floor.

And then there are television programmes such as selected episodes of Doctor Who, Red Dwarf and Star Trek: The Next Generation which utilise VR technology. One example is the holodeck as seen in Star Trek.

Virtual reality music

This technology has formed part of experimental sound displays and sound installations. Another use is virtual reality musical instruments which the person can interact with these instruments as a new type of performance or to create new compositions.

Virtual reality books

Virtual reality has been a theme of many fictional stories such as William Gibson's Neuromancer and Mona Lisa Overdrive as well as Orson Scott Card's Enders Game.

Virtual reality art

There are artists who use virtual reality to explore certain ideas or concepts. They create a three dimensional environment as a form of communication with the audience. One example is the work of Kenneth Rinaldo who uses robotics and augmented reality to explore ideas related to the human-technology boundary.

(<https://www.vrs.org.uk/virtual-reality-applications/media.html>)

First Look: Artists' VR, New Museum, New York, December 2017

(<https://www.newmuseum.org/calendar/view/1135/first-look-artists-vr>)

An exhibition in a selection of artists participating in "First Look: Artists' VR"—Jeremy Couillard, Jayson Musson, Peter Burr, Rachel Rossin, and Jacoby Satterwhite—had demonstrated their works and reflect on the distinct possibilities and challenges of working with the medium. Courtesy of a partnership with Google Arts & Culture, Cardboards had distributed to attendees as complimentary gifts. The six works range from fantastic original worlds to moving social commentary and include an astral memorial to victims of police

violence (Musson); a guided meditation through landscapes taken from the game *Call of Duty: Black Ops*, drained of violence and transformed into an ethereal dreamworld (Rossin); a journey through a fantastical industrial nightclub (Satterwhite); a portrait of a woman navigating an unfolding labyrinth (Burr with Heartscape); a simulation of the afterlife (Couillard); and an unsettling dive into an alternate world rife with avatars both banal and magical (Rafman).

How to Watch VR?

There are 4 basic options for viewing virtual reality (VR) content today:

- an immersive VR headset;
- a simple VR viewer that uses a mobile phone;
- a mobile phone on its own;
- a web video player.

<https://with.in/how-to-watch-vr/>

Cases:

1. Virtual reality The Cave (3D SBS headset needed)

<https://www.youtube.com/watch?v=hcD9uIAIxKg>

2. Virtual Reality Roller Coaster for VR Box & Google Cardboard: 3D SBS Underwater Park

<https://www.youtube.com/watch?v=HTbjDW8u5Tk>

3. Roller Coaster VR v1.1(Samsung Note 3 SM-N9005)[HD 720p]

<https://www.youtube.com/watch?v=7HFeNJEXMUI>

First 3 examples are just an illustration of capability of different VR media, showing the possibilities and graphical challenges (and solutions) for immersive VR experience (Roller Coaster and Underwater Park as classical examples of first person VR experience). Media used: VR goggles (Oculus Rift or HTC Vive) using the benefits and advantages of landscape design (Unity3D), combined with programming (C++) for interactivity.

4. MTC (Stereoscopic 3D cave) - A Virtual Reality Cave at the Manufacturing Technology Centre in the UK uses the latest F35 AS3D

<https://www.youtube.com/watch?v=U0uZLkcPuU4>

Article: <https://dpntax5jbd3l.cloudfront.net/images/content/1/5/v2/158662/2016-VR-AR-Survey.pdf>

Article: <https://dpntax5jbd3l.cloudfront.net/images/content/1/5/v2/159053/ARVR-Infographic-Final.pdf>

A Virtual Reality Cave at the Manufacturing Technology Centre in the UK uses the latest F35 AS3D projectors to test new machinery and processes before bringing them into production.

A cave display is a multi-sided immersive environment that offers great levels of immersion. Barco cave displays can have any number of sides, ranging from two to six, in any size you want. Furthermore, caves are completely customizable to your specific demands, and can be a fixed or transportable installation with rigid or flexible screens, high or lower resolutions, with active or passive 3D, or even both.

5. Kids' interaction with 3D printed objects, VR 360-degree content and 3D scanning technologies (photogrammetry), #digiRDG team at the Museum of English Rural Life and Reading Museum

Article: <https://medium.com/merl-rm-blogtest/do-kids-care-about-museums-and-3d-7336061aae96>

3D printing and scanning for children: it is a case study for itself, good example what kids think about these technologies.

This activity gave students the opportunity to handle:

a piece of a vase and a floor tile from Reading Abbey

3D printed versions of the artefacts

3D models of the artefacts on tablets using Sketchfab.

The 3D printed object was passed around first and the students were asked to guess what they think it may be. Once they had guessed, the real object was revealed and the students were given a brief explanation about the object and the history of the abbey. They were then able to handle the real object and also see a 3D model on Sketchfab using a tablet.

6. Skin & Bones app App to overlay skin and movements onto the bones, Smithsonian National Museum of Natural History, Washington, D.C., US

<http://naturalhistory.si.edu/exhibits/bone-hall/>

Skin on monuments: in one part of the exhibit, a vampire bat flies away from its mount. In another, a sea cow grows flesh before your eyes. And in yet another spot, an anhinga demonstrates how it catches fish. Thirteen total enhancements can be found throughout the exhibit.

Really good example of contextualisation of data that is not easily understandable or for non-experts: we can put together different info and combine it with AR and VR so this could be very beneficial.

The best way to fully experience the amazing augmented reality of *Skin & Bones* is by visiting the museum and using the app within the Bone Hall. However, if you've downloaded and installed the app but can't visit the museum, have no fear. You can still experience *Skin & Bones'* augmented reality by downloading these triggering images (Acrobat PDF) and viewing them on a computer screen or printing them out. Follow the included directions to experience augmented reality from home.

7. Historic persons as holograms incorporated in exhibits: Heroes and Legends, Kennedy Space Center, Florida, US

<https://www.kennedyspacecenter.com/heroesandlegends.aspx>

Accompanied by voice-overs, visitors can look through a screen to see a hologram of Cernan superimposed over the actual historical space capsule.

Holograms incorporated into exhibits, another way how VR info could be put into some physical space, interesting is also the size (scale of info) which is 1:1, so visitor is the same scale as AR content. Part of storytelling.

8. Archaeological site and artefacts interpreted in 3D using AR/VR: ancient civilization Shu, Jinsha Site Museum, Chengdu, China

<http://www.jinshasitemuseum.com/en/enabout.html>

Archaeologists in China unearthed the site, and along with it found more than 5,000 gold, jade and ivory artefacts. Visitors to Jinsha can use an app to explore these relics, see how

they look in 3D, and learn more about what they were used for.

Archaeological sites are another case study of exploration in different ways, it is a good way to see what other people are doing in other countries, for example in China.

9. Superimposing information on historic walls: England's Historic Cities AR apps, England's Historic Cities, England

<http://www.heritagecities.com/stories/explore>

At Chester's Roman Amphitheatre, centurion Marcus Aurelius Nepos tells about England's bloody combat history at the spot. And at Statford-upon-Avon, William Shakespeare leads visitors through a behind-the-scenes history of his life in his family home

Superimposing info: very well know in AR for some years, there are numerous ways for superimposed info in the future, how the 3D data can be presented or even prepared and visualized in 4D.

10. Exploring places that are hard to access (e.g. zero-gravity environment) or doesn't exist anymore: VR simulation of the International Space Station Mission: ISS, Oculus RIFT

<https://www.oculus.com/experiences/rift/1178419975552187/>

Exploring places hard to access: VR will be more and more in use, especially in heritage sector to present places that don't exist any more. Article about some evaluations on what users think how heritage should be represented, and a lot of positive answers were added for 3D models and such, so now it is about trying to develop more contents, some different situations and scenarios. How those places can be represented – to be able to work with dinosaurs, and being invited to do a 360 video of dinosaur, and a lot of users wanted to get involved into something they never experienced before. It could be archaeology or palaeontology, representing past in the present, but with something that is not accessible.

11. Superimposed photos / videos of historic events – how 3D / VR could be included?: Chicago 00: The Eastland Disaster, Chicago History Museum, Chicago, US

<http://chicago00.org/#Eastland>

Superimposed photos, case from Chicago. They have one disaster they are now trying to digitally recreate – gathering videos and photos from that event. It is about presenting cultural heritage as it was.

The Chicago 00 Project is a partnership between the Chicago History Museum and film maker Geoffrey Alan Rhodes to produce and publish a series of site-specific, multimedia experiences that showcase the Museum's film, photo, and sound archive. This episode features over 70 captioned historical photographs and newsreel films showing the disaster and ensuing relief efforts on the river where the Eastland capsized in 1915.

"Chicago 00 The Eastland Disaster" is an Augmented Reality experience that takes place along the Chicago riverwalk between Clark and LaSalle Streets: the site of one of the largest nautical disasters in U.S. history, the capsizing of the SS Eastland in 1915. The app provides an AR Tour, specifically designed to be used along Chicago's riverwalk, and a VR Gallery of images that can be viewed anywhere. Together they reveal the story of the disaster in a new and visceral way.

12. Louvre

<http://www.louvre.fr/en/visites-en-ligne>

The virtual tour offers an interactive visit of the galleries of the Louvre Museum. The navigation is performed within 360° panoramic views, of which certain areas are active.

These active areas allow the visitor to zoom in certain oeuvres or to access other panoramic views of the same gallery or of a contiguous one.

The interactive map located under the panoramic view displays the current position of the visitor and gives direct access to a chosen gallery. To navigate maintain the left button of the mouse, move it within the map. On click, you can access one panoramic view or another. Icon for accessible panoramic views. Positioning icon.

13. Hermitage

<https://www.hermitagemuseum.org/wps/portal/hermitage/panorama>

Straightforward example of classic 360 degree panoramic presentations. Museum has put a lot of effort into providing the 360 degree videos for the entire Hermitage Museum together with information on individual objects.

14. Casa Batllo – Virtual tour and video guide

<https://www.casabatllo.es/en/virtual-tour/>

<https://www.youtube.com/watch?v=bMtgDaZeN-E&feature=youtu.be>

A real adventure in which we have the privilege of discovering, for the first time, the secret spots of the modernist building. 360° of Gaudinian concepts to find out about, endless allusions to Mother Nature by the very pioneering in a unique new style and an aura of mystery floating in the spaces that will be surrounding the visitor from the beginning to the end of the virtual route.

15. BLVD

<http://blvrd.com>

Bringing the arts to life through innovative VR technology. Boulevard is reshaping the landscape of storytelling and revolutionizing the way the world looks at art and culture. Boulevard partners with the world's leading museums to share their collections through VR technology and leading-edge interpretive modes.

Boulevard is working in parallel with the growth and development of industry leaders including Oculus, Samsung, Sony, HTC, Google, Microsoft, and others. As they say: "We are hardware agnostic so that our content-rich museum experiences can be used on any HMD."

Take students on virtual trips and access the world's great art collections and cultural sites from your very own classroom through Boulevard. Their VR experiences complement education curriculum across disciplines and open up new possibilities for learning.

16. Exploring historic sites through different perspective (e.g. for Nazca lines): Birdfly VR (Reboot Reality), Tech Museum of Innovation in San Jose, California, USA

<https://www.thetech.org/rebootreality>

Exploring sites from different perspective. Now we are pretty much limited to whether stand or sit, but with this VR we can explore the heritage from the other perspective, for example as fly-by and such.

17. Going "behind the paintings": Dreams of Dali: Virtual Reality at The Dali, Salvador Dali Museum

<http://thedali.org/exhibit/dreams-vr/>

Work by Dali Museum, we already saw that example and it is about going into the famous painting and immerse into this Dali's desert. We can enjoy the remarkable marriage of art and technology in *Dreams of Dali*, a virtual reality experience, as we explore Dali's painting *Archaeological Reminiscence of Millet's "Angelus."* We immerse in the world of the

Surrealist master like never before in this encounter, venturing into the towers, peering from them to distant lands and discovering surprises around every corner. We imagine Dali himself, known in his lifetime as what we now call an “earlier adopter” of new technology, would applaud this inspiring homage to his 1935 painting.

18. Minerva App

<http://www.minervavr.com/index.php/DVS2/>

It is a classical example of 360 degrees’ virtual presentation. The VR Dudes took a tour through the salons of Minerva with ‘wick’, the curator for the exhibition, and one of the artists, ‘Allusion’. The videos are presented as episodes – this one presents Minerva as a digital visual space in virtual reality, where people are able to interact with the artwork as well as with each other, with or without a head mounted display.

19. Notes on blindness, VR App download: iOS Version + Android

Video extract: https://www.youtube.com/watch?v=W2eTgbyiY_0

Notes on Blindness is an enchanting, award-winning interactive VR experience, based on the audio diary of author and theologian John Hull, who went blind after years of declining vision. He kept an audio diary during this drastic period of his life. In the course of three years, he recorded more than 16 hours of material documenting his journey into a world beyond sight. It’s now a multimedia project consisting of a short film, a documentary and this virtual reality experience.

It is a lovely example of what sound does without any spare visuals. It is a 15-minute experience of a man losing his sight and then recording his visual memos for Oculus and Android. The documentary is great too: you get the feeling of what your ears tell you without the vision, so to experience the power of audio in storytelling.

20. Eye of the Owl - Hieronymus Bosch VR Exploration

Video extract: https://www.youtube.com/watch?v=wI_p1vveFj8

The Delights of Hieronymus Bosch is a documentary style Virtual Reality experience which provides an innovative way for people to experience the Hieronymus Bosch painting - The Garden of Earthly Delights up close and personal. Viewers can explore a single Bosch painting as a complete experience, similar to a visitor exploring a complete body of work at a museum.

It is storytelling and interactive as well, you can explore Bosch without being there, so it is about bringing museum to your house. You can really explore more than you can do in a normal museum. Interactive google glasses – you are really standing in the painting.

21. Gallery One from Cleveland

www.clevelandart.org/artlens

They give visitor interactive pen, and one can use it throughout the exhibition space to draw something or pin-point a figure and it will show all kinds of things that are exhibited in the museum. It will turn the whole room into the wallpaper. Different types of interactivity for visitors, Vincent will upload it. Again - focusing on audio for merging with interactive storytelling.

Interactivity - how can content connect to the user? (18 cases)

Interaction as the main focus: how much involvement and possibilities for interactivity users have?

Current Discourse on Digital Storytelling in Museums

<https://www.storylabinteractive.com/blog/2017/5/23/current-discourse-on-digital-storytelling-in-museums>

The original HMD John Mitchell 3D interactive underwater tour

Webpage: <http://www.maritimearchaeologytrust.org/hmd-john-mitchell-interactive-model>

Creating 3D interactive models is a great way to make our underwater heritage available to everyone, not just for divers! The original HMD John Mitchell 3D model has now been upgraded to create an immersive interactive model to explore the wreck and the surrounding seabed. The model features give the viewer a realistic experience to what it would be like to dive on this wreck with the use of VR Glasses. Well the closest experience one can have without getting wet!

Video: <https://www.youtube.com/watch?v=diocuQO2RKI>

1. Pokemon Go like interaction: Story of the Forest App, National Museum of Singapore, Singapore

<http://nationalmuseum.sg/exhibitions/exhibition-list/story-of-the-forest>

The exhibit is housed in the museum's glass rotunda, with a giant mural of 69 drawings from The William Farquhar Collection of Natural History Drawings consisting of flora and fauna. Visitors use an app, combined with the camera function on their phones, to hunt for and capture various plants and animals within the drawings.

Interaction of Pokemon Go: interesting how the contents in the space is geolocated in virtual reality. Working with partners Project Mosul and The Economist, The Baltimore Office of Promotion and Arts wanted to educate people on the issue of lost cultural heritage in an engaging new way. The result is truly one of a kind.

2. Look On Media created an interactive virtual museum allowing users to learn and interact with destroyed art pieces and lost cultural artefacts. The VR Museum featured interactive exhibits from the Middle East as well as Baltimore and still has room to grow.

Video: <https://www.youtube.com/watch?v=m3Rd0xoQ7VI&feature=youtu.be>

3. The VR Museum of Fine Art, Steam's finest art gallery

Video: <https://www.youtube.com/watch?v=ZtjisBSafRk>

If you're into art and history, then this app is for you. It's pretty cool that you can view artwork with reflections and shadows as if they were there. It's free and it's educational!

4. Weaving a Better Future Virtual Reality App: Being immersed in a foreign / past culture using 360-degree video and VR headset: - Canadian Museum for Human Rights, Canada

<https://humanrights.ca/explore/exhibit/empowering-women/>

Video from Canadian Museum of human rights: 360 video of some cultures in South America or Africa so users can see how different cultures live.

5. Multimodal interactions of the “Forbidden City is a Museum” digital exhibition, Palace Museum, China

<http://www.dpm.org.cn/Home.html>

Forbidden City: another multimodal example, different interactions, good case to compare with others for interaction possibilities.

6. Co-creative interactions using depth-tracking cameras and body motion: ArtLens Studio, Cleveland Museum of Art, USA

<https://creategallery.tumblr.com/>

Cleveland museum is very successful in using modern technologies, so this is one more good example on producing a new meaning with digital media.

7. 3D for navigating complex 3D space using POIs: Digital Wayfinding Experience, Asian Art Museum, USA

<https://mw17.mwconf.org/paper/creating-the-smart-museum-the-intersection-of-digital-kiosks-web-and-native-mobile/>

<https://youtu.be/jCAQLVso5fY>

Example of 3D navigation, very complex. The Asian Art Museum’s digital transformation relies on collaborating with strategic partners to handle design and development capabilities. Guidekick (<http://www.guidekick.co>) creates digital experiences for museums and cultural attractions. Some of their other partners include Hearst Castle, the Legion of Honor, and the de Young Museum. Their de Young app was the first to offer dynamic mapping and indoor location tracking. At the core of their technology are interactive 3D maps that allow visitors to easily explore and understand multi-floored museums or historic sites. The mapping is particularly valuable for complex and unorthodox spaces, like ours.

They imagined physical touch-screen kiosks that visitors could use to explore a map and decide where they wanted to go. This will be the entry point to the ecosystem that would provide immediate value to visitors (museum overview, points of interest, navigation) while also serving as a primary tool to help market the mobile app and on-board users. The app remembers what was accessed on the kiosk, provides directions, and ultimately a deeper level of interpretive content. The project had several key objectives:

- Allow visitors to quickly get a complete overview of museum art-focused offerings (Exhibitions, Collection Galleries, Masterpieces) and public spaces;
- Provide turn-by-turn directions to points-of-interests (POI);
- Provide content in multiple languages, initially targeting the City of San Francisco’s Language Access Ordinance (LAO);
- Offer other accessibility features (e.g., text size, contrast, etc.)

8. Exploring historic landscapes by riding a bike (by a car, etc.) – or experiencing life of famous people from the past: Virtual Reality 4-D Jump Experience - Evel Knievel Museum

<http://evelknievelmuseum.com/>

Digital bike-riding: how to use mixed reality to combine bike-ride experience and to have different body motions. Here one can ride a bike and do some jumps using VR technologies.

In Slovenia, VIAR360 company produced

9. Planica VR jumps.

<https://www.viar360.com/>

A very good example of virtual reality combined with user experience using VR goggles.

10. First-person experience of past events: Battle of Vimy Ridge - Royal Canadian Regiment Museum at Wolseley Barracks

Article: <http://www.lfpress.com/2017/03/30/new-display-at-wolseley-barracks-museum-offers-multi-sensory-look-at-first-world-war-battle>

First person experience. When thinking about battles and war museum stuff, again it is interesting for storytelling. There are some personal data, and visitor becomes a part of the whole situation.

11. Sitting in famous rooms (interiors): Pierre Chareau: Modern Architecture and Design 360 degree view, Jewish Museum

<http://thejewishmuseum.org/vr-tour/chareau-studio-stereo-mono/index.html>

Interesting for particular topics and sites - modern architecture for example or famous places that we always want to see in person, so 360 degrees can help us in the feeling of the space in VR and with visual experience.

12. Merging tactile experiences (3D printing) with immersive experiences: Little polar dinosaur in Mixed Reality, Deakin University, Swinburne's PrimeSCI, National Wool Museum

They are going to 3D print a small dinosaur from their region with intention of interaction: that we will be able to see and at the same time also touch. The story behind is how to explain to the user how palaeontology decides what size and colour dinosaurs were. It is also about using multi materials and 3d printer for printing the skin thus combining different 3d printing materials.

13. Cave experience of the ancient settlement: Ullastret3D, Ullastret Museum; Archaeological Museum of Catalonia

<http://patrimoni.gencat.cat/en/stories/ullastret-3d-walk-through-iberian-town-existed-2000-years-ago>

Ancient settlement: one very good project, complex, if you go through it has a lot of different types of examples. Ullastret 3D was already prepared as state-of-art example.

14. Experiencing environments hard to access: David Attenborough's VR Experiences: Great Barrier Reef Dive VR, David Attenborough

http://www.attenboroughsreef.com/vr_dive.php

David Attenborough: we know him, he is now exploring VR while exploring the last accessible places, endangered places. Some sites are in danger of disappearing (Coral Reefs for example). Difficult to visit anyway so it is a perfect example for presentation in 3D.

15. Experiencing the past - Domus Aurea VR, società cooperativa culture

<https://www.coopculture.it/en/heritage.cfm?id=51>

Domus Aurea: another VR experience, already presented in WG2.1. It is a great example of combining real landscapes with virtual ones and presenting history with sophisticated media – we can recreate historical sites or buildings and present them in modern and accurate landscape for research or simply visitors purposes.

16. VR of an archaeology museum: Archeologie Gemeente Den Haag, We are Museums

<http://www.wearemuseums.com/visit-the-first-virtual-reality-museum-of-archeologie/>

Another way for exploration of digital technologies, archeological. Presentation of dig-site in 3D and possibilities for interaction with artifacts of historical value.

17. Meet Vincent Van Gogh.

<http://www.meetvincent.com/about-meet-vincent-van-gogh/>

Experience Highlights: An all-encompassing multidisciplinary experience for all ages, for artists and scientists, novices and experts alike. One can wander with Vincent from the rural Netherlands to the streets of Paris, or pull up a seat at The Potato Eaters table or at Café Le Tambourin in Montmartre. Visitors can investigate the details of Van Gogh's paintings using a microscope and step into the life-sized Yellow House and engage with a dramatic shadow play. Very good example of interactive exhibition with use of modern digital media.

18. The Tower of Babel (circa 1568) by Pieter Bruegel the Elder – simple case with the starting point for storytelling from Museum Boijmans Van Beuningen.

<https://www.google.com/culturalinstitute/beta/exhibit/oALSLk-iI3ULLQ>

<https://goo.gl/hRBjff>

Zoom in on 'The Tower of Babel' by Bruegel the Elder. There are so many intricate details in Bruegel's work you have the feeling you can zoom in indefinitely.

Storytelling - how do we connect content to each other and the general message (31 cases)

a) Ensure that the virtual reality experience is not simply a gimmick. IE: when a virtual reality experience can just as easily be replaced by a “real world” approach, it can often be a hindrance. For instance, when a museum gives out multimedia guides where the visitor has to go through various clicks and steps to get simple information, which could be also read off a sign within a few seconds. *Positive example:* The Van Gogh Museum (Netherlands) allows children to blend colours digitally to get a sense of Van Gogh’s different types of yellow. In a setting where children cannot be left alone with real paint, they can still experiment creatively as well as experience the painting more profoundly. Link: https://www.youtube.com/watch?v=-j7oxO2fxRU&ab_channel=VanGoghMuseum

b) Counteract the rapid aging of cutting edge technologies by tailoring the virtual experience around universal needs of audiences. From many virtual approaches it is clear that the developers were thrilled to have new animations, internet possibilities etc. to “play” with. However, a few years down the line, many of these new inventions have lost their spark and may even appear awkwardly antiquated, especially to younger audiences. By developing an experience which identifies the needs of audiences first, and the technology to fulfil these needs second, outdatedness can be staved off for a few more years or even more.

c) Develop a format which can easily be updated. Many websites, apps, multimedia guides and large-scale narrative environments create a beautiful programme or experience, but as soon as something changes, it is almost impossible to make a quick adjustment. This may be the case, for instance, when the software is outdated or the designer or developer of the virtual experience is no longer available and nobody else knows how to implement the changes. Many museums have had to replace their entire multimedia tour or redo their entire website for these reasons. *Positive example:* The Rijksmuseum (Amsterdam, the Netherlands) has invited young vloggers to create youtube videos to draw in teenagers to look at older artworks. Teenagers can choose from a number of “personalities” to be their guide in the museum. This has proven to be very successful. A few years later, teenagers may no longer be interested in 2017 vloggers. Then, it is only a simple step to invite popular vloggers from 2020. Anyone can upload a video to youtube and thus, modifications can be made by almost anyone.

d) Connecting visuals with stories

Link: <https://vimeo.com/213715457>

1. VR spacewalk lets you fly over Earth - BBC Click

<http://rewind.co/portfolio/bbc-home/>

<https://www.youtube.com/watch?v=z9qSUXJjhJI>

A VR Spacewalk lets you look down on the Earth from space before going on an emergency mission. BBC Click's Lara Lewington put on her VR headset to see what it was like.

The immersive nature of ‘*Home: A VR Spacewalk*’ means that users will really get to feel what it’s like to be an astronaut floating 250 miles above earth with stunning and vast views of the spaceship, the space station and the universe.

Home can be experienced using a haptic feedback chair, adding to the sense of immersion as vibrations simulate impacts of the spacewalk to the body. There is also a full body biometric system which allows the user to hear and monitor their own heartbeat during the mission.

Faced with the endless blackness of space and earth a blue-green jewel below, you take on your mission, throw yourself into the challenges of this alien environment and contend with an emergency scenario as you jet pack home to the International Space Station. There is a BBC blog about the project and their involvement with VR.

2. Google Tabel

<https://tabel.withgoogle.com/making-of>

The creative canvas for storytelling has hit another evolutionary milestone with the introduction of virtual reality. Immersive 360 degree experiences have opened an opportunity to redefine how stories are told.

For Tabel, we wanted to experiment with storytelling that takes advantage of two strengths of the medium:

VR is uniquely capable of enhancing human capabilities while maintaining the semblance of true-to-life situations. VR empowers the storyteller to tell a story over the entire 360 degrees of a scene. This is a large canvas! 360 film does not have to restrict the viewer to focus only on a directed object, but rather the VR directors can create a world the viewer experiences on his own terms.

Tabel started with seed of an idea about eavesdropping on conversations in a restaurant. To create a realistic atmosphere, we needed multiple tables, various storylines, and it had to all be happening concurrently, like it would in a real restaurant. VR itself is a new experience for most users, and the story of Tabel itself is a new world for that user. The film is about the interaction and control the user has with the audio experience of the film. So, we created a familiar, comfortable restaurant setting to ease our viewer into world of Tabel.

3. CHESS Augmented Reality at the Acropolis Museum

<http://www.chessexperience.eu/>

CHESS (Cultural Heritage Experiences through Socio-personal interactions and Storytelling) is a project, co-funded by the European Commission, that aims to integrate interdisciplinary research in personalization and adaptivity, digital storytelling, interaction methodologies, and narrative-oriented mobile and mixed reality technologies, with a sound theoretical basis in museological, cognitive, and learning sciences.

The principal objective of CHESS is to research, implement and evaluate both the experiencing of personalized interactive stories for visitors of cultural sites and their authoring by the cultural content experts.

You can see how the chess is used at the Acropolis Museum:

<https://www.youtube.com/watch?v=DUPLPwOVE-M>

4. The project meSch

<http://www.mesch-project.eu/>

The project meSch (Material EncounterS with digital Cultural Heritage) explores new ways to let people hear the stories behind heritage objects directly and immediately, in this way enriching the experience of European cultural heritage.

The loupe: a tool to explore the stories behind museum pieces. This video shows a prototype developed by Waag Society for the meSch project: <https://www.youtube.com/watch?v=phhoiJ-Aikk>

<https://www.youtube.com/watch?v=q2qw6N9X7rM>

5. Smart object enhanced museum exhibition - Atlantic Wall at Museum :

<https://www.youtube.com/watch?v=sK3AdQU9kkc>

Not VR but very interesting: The Hague and the Atlantic Wall – War in the City of Peace’ is the first exhibition ever that has been realized with fully integrated meSch technology – thus with partly 3D printed replicas of museum objects that have been enhanced with sensors to create a smart interactive environment. This video gives an impression of the technology used and the reactions of visitors to this new kind of interactives.

More about the background of the exhibitions can be found in a series of blogposts on the project website: <http://mesch-project.eu/why-we-are-us...> The interactives in this exhibition were co-designed and produced by meSch partners: Museon in The Hague and Sheffield Hallam University. The video was produced by Waag Society and meSch.

6. Aviation Pavilion Virtual Tour

<http://museumofflight.org/vr>

The only thing more inspiring than being able to see these incredible aircraft in one place is to hear the amazing stories that they have to tell. However, as is true with all priceless and delicate artefacts found in cultural institutions, visitors will only be able to marvel from a safe distance. That is until now...

In close partnership with Microsoft, we are using technology to unlock unprecedented access to these aircraft. For the first time, visitors – both on site as well as remotely – will be able to ‘step inside’ the cockpits and interiors of these carefully preserved artefacts through high fidelity 360-degree virtual tours.

VR is another new communications avenue and type of media, just like social media was not too long ago. VR is "communications" blossoming, and it will be used as an effective tool for reaching customers in a more dynamic way.

7. Jewish Monument

<https://www.joodsmonument.nl/en/>

The Jewish Monument is an online site that commemorates the over 104,000 Dutch Jews who perished during the Holocaust. Every victim of the Holocaust who was murdered is memorialised on the Jewish Monument with a personal profile. Here is the informational [VIDEO](#).

The Homepage combines a listing of every Dutch Jew who perished during the Holocaust with the placing of events against a timeline. Each person is represented by a pixel. If the visitor clicks on a year, each individual who perished during that period will appear as an orange pixel. Search features allow the visitor to view an individual’s personal profile as well as to conduct more general searches.

The Jewish Monument allows you to search for specific individuals, addresses and commemorations. As a visitor, you can also actively contribute to the Monument by uploading images and documents, writing new stories or completing and restoring familial connections. The Monument also enables you to contact family members and/or other users of this site.

8. WITHIN

<https://with.in>

It is a place for innovative, entertaining, and informative story-based virtual reality. They bring together immersive experiences from the VR creators-from gripping tales set in worlds of pure imagination to documentaries taking visitors further inside the news than ever before.

WITHIN supports all major headsets, including Oculus Rift, Samsung Gear VR, HTC Vive, Sony Playstation VR, and Google Daydream. To get started experiencing their content, download the app for [iPhone](#) or [Android](#). Article about [WITHIN](#).

The video previews of 360 degrees virtual reality experiences can be found [here](#).

9. Frozen in Time - histories of life and moments of death at Sandby borg - Explaining difficult heritage (massacre) with VR storytelling - Department of Museum Archaeology at Kalmar County Museum, RISE Interactive C-studio and Linnaeus University

<http://www.sandbyborg.se/en/home/>

<https://www.tii.se/projects/sandby-borg-a-virtual-connection>

This project aims to communicate difficult heritage through visualisation and virtual reality. Through a collaborative effort between the Department of Museum Archaeology at Kalmar County Museum, RISE Interactive C-studio and Linnaeus University, a VR demo will be produced with the aim to engage the user in the story of Sandby borg through interaction, storytelling, and immersive virtual experience. Sandby borg is located on Öland and was in the 400-century the victim of a brutal massacre, where the deceased have been left where they then fell. Giving archaeologist unique insight into the time of the gruesome event, as well as how the daily life might have looked like by the end of the 5th century AD.

This project is connected to the research project *Frozen in Time - histories of life and moments of death at Sandby borg*, and will relate to these research questions connected to the difficult heritage. This VR demo will be used as material to initiate discussions about difficult topics like violence and the mentality of war in a difficult cultural heritage like Sandby borg in relation to contemporary society and conflicts of today. The project further aims to work as a springboard for potential future developments of VR to communicate through archaeology and cultural heritage.

10. Participating (recreated) historical events in VR, e.g. Abba's concert, Abba

Article: <http://www.digitalspy.com/music/news/a837870/abba-virtual-reality-tour-2019/>

The Swedish pop group are reuniting for a new entertainment experience in 2019. The project will use the very latest in digital and virtual reality technology to build an original entertainment experience, which will enable a new generation of fans to see, hear and feel ABBA in a way previously unimagined.

11. Students has recreated a war-zone using a museum collection, the Minecraft game and learnt about WW1: Gallipoli in Minecraft, Auckland War Memorial Museum

<http://www.aucklandmuseum.com/whats-on/exhibitions/2015-past-exhibitions/gallipoli-in-minecraft>

Article: <https://www.museumnext.com/2017/10/museums-stop-producing-exhibitions/>

Visitors explored the Gallipoli campaign in an exhibition which featured the interactive world of Minecraft and incredible objects from the Museum's collections.

Minecraft is a hugely popular online game that is all about breaking and placing blocks. Since its inception players have worked together to create all sorts of incredible and imaginative things.

In the year leading up to the exhibition, students from Alfriston College re-created the landscape of 1915 Gallipoli in Minecraft. Working with the Museum's staff and utilising our First World War collections, the students learned about the experiences of the New Zealand soldiers in the 1915 campaign.

12. Interaction Munduruku: The Fight to Defend the Heart of the Amazon, Greenpeace

Article: <https://futureofstorytelling.org/project/munduruku-the-fight-to-defend-the-heart-of-the-amazon>

Munduruku: The Fight to Defend the Heart of the Amazon is a multi-sensory VR experience inviting viewers to visit the Munduruku and join their struggle. Commissioned by Greenpeace with funding from the Ford Foundation, this 12-minute virtual reality film is combined with multi-sensory elements produced by The Feelies. The team spent two weeks living with the Munduruku people, capturing the very essence of tribe life to create an immersive, inspiring experience.

13. Personal experiences of conflicts in Israel/Palestine, the Congo, and El Salvador: The Enemy by Karim Ben Khelifa, MIT's Center for Art, Science & Technology

<https://mitmuseum.mit.edu/enemy>

Article: <http://opendoclab.mit.edu/enemy-odl-alumnus-karim-ben-khelifa-mit-museum>

Through 360-degree imaging and recordings, participants will encounter combatants on opposite sides of conflicts in Israel/Palestine, the Congo, and El Salvador. In their own words, each will offer personal perspectives on war, including thoughts on motivations, suffering, freedom, and the future. The exhibition incorporates concepts from artificial intelligence and cognitive science-based interaction models.

14. VR Journey to the indigenous people in Western Australian desert: Collisions (Emmy award-winning film by Lynette Wallworth), National Museum Australia

<http://www.nma.gov.au/whats-on/events/collisions-vr-experience>

<http://www.collisionsvr.com/>

<https://www.youtube.com/watch?v=e1C5lxD3P7k>

Article: <http://www.canberratimes.com.au/act-news/canberra-life/we-tried-collisions-virtual-reality-film-at-the-national-museum-of-australia-20170914-gyhk4.html>

Lynette Wallworth's 'Collisions' virtual reality film blends oral history, film, and sci-fi into a visceral immersive experience. *Collisions* tells the largely forgotten story of the Maralinga nuclear tests by the British between 1956 and 1963, largely through the words of Indigenous elder Nyarri Nyarri Morgan.

Watching a VR film, we are able to adjust the vision to be able to view the film and to marvel at the extremely wide field of vision covered by the cameras - 360 degrees, up and down. It's certainly a novelty to be able to control what you see in a movie by looking up and down and spinning around (and moving about more than expected).

The bomb blast and animated moments are effective and the sound and music contributed to the feeling of immersion without detracting from the poignant humanity of Nyarri Nyarri Morgan's story at the centre of the fascinating and poignant 18-minute film.

15. VR Story about painter Amedeo Modigliani, TATE Modern

<http://www.tate.org.uk/press/press-releases/virtual-reality-comes-tate-modern-modigliani>

Article: <https://www.standard.co.uk/goingout/arts/tate-modern-will-use-virtual-reality-to-bring-modiglianis-paris-to-life-a3572976.html>

As part of the most comprehensive exhibition of Modigliani's work ever held in the UK, the virtual reality room will bring visitors closer into the artist's world, enriching their understanding of his life and art. Headsets from the leading VR platform Vive will provide an immersive layer of interpretation as visitors are invited to step into early twentieth century Paris. Drawing on archival material and new research, the experience recreates aspects of Modigliani's adopted city, bringing his historical context to life.

16. VR story about the Berlin wall: Berlin Wall: The Virtual Reality Experience, Newseum

<http://www.newseum.org/exhibits/current/berlin-wall-gallery/>

Video: <https://www.youtube.com/watch?v=7MjY5KwxtxQ&feature=youtu.be>

Article: <http://www.newseum.org/2017/07/26/berlin-wall-vr-experience-now-open-at-the-newseum/>

At the Newseum, visitors can now step back into time for seven minutes and experience communist East Berlin at the height of the Cold War. Using a VR headset, headphones and two hand-held controllers, visitors can walk through the deserted streets of East Berlin and witness the communist propaganda posters and austere atmosphere that characterized the walled-off city. Although visitors are safely tethered within a 10-foot-by-10-foot space inside the museum, their experience is punctuated by the anxiety of dodging the guard tower searchlights that sweep “no-man’s land” looking for wall jumpers. Once back on the West Berlin side of the wall, visitors can use their controllers to help break down the decades-old barrier to freedom.

The Berlin Wall VR experience is presented in partnership with HTC and the HTC Vive. The Berlin Wall is the first of several artefacts in the museum’s collection that will be explored through VR over the coming year.

17. AR “cinematic experience” of Turku Cathedral: Wordsmith (Sanan seppä), MIRACLE project of the University of Turku

<http://trc.utu.fi/ar/research/miracle/>

VIDEO: <https://youtu.be/lsmn7OttSRY>

Article: <https://www.ctrlreality.fi/?project=wordsmith-sanan-seppa>

Wordsmith (Sanan seppä) is a cinematic augmented reality experience situated in the Turku Cathedral. It takes the visitors in the Cathedral to the year 1514, that is, to the situation before the reformation. It then represents the changes during the following decades from a viewpoint of a fictional family. The story, written by author Tytti Issakainen, is told by using objects and historical characters digitally added in the church and made visible on tablet computers. The goal for this app has been to create an experience that is both educating and entertaining. The story is told through eight short scenes in which Hemminki, a son of a blacksmith, becomes an assistant of Mikael Agricola and the progenitor of a priest family.

The application runs on a tablet computer. The user sees the scenes on the tablet screen through the device camera view where the virtual characters are added. The app can be downloaded free of charge to user’s own Android or iOS tablet, or a tablet can be borrowed from the church entrance. Besides the actual scenes, the app provides information about the characters and events in the story as well as references to background information in the internet.

18. Storytelling Ceramic Artifacts through Augmented Reality

Article: <http://kreatywna-europa.eu/fundedprojects/storytelling-ceramic-artifacts-through-augmented-reality/>

During the creation of ceramic artifacts, presentations focus on the aesthetic rather than the cultural aspects. Questions such as „what it represents”, „what is it made of?”, „how was it made?”, „what was its original use?” etc., are not usually addressed.

CERARE project will develop a Collaboration Ecosystem specifically designed to boost the production of „smart” ceramic cultural products. Interdisciplinary teams of professionals from various creative fields will be able to work together in this platform to create outstanding products enhanced with Augmented Reality (AR). Researchers, designers,

craftsmen, storytellers, authors, curators, art historians, information technology experts, advertising companies, translators and many others will cooperate and co-create, ICT powered, ceramic products that will offer a memorable experience. CERARE will be a cross region platform, presenting opportunities to ceramists to develop new products with added spiritual value, which will help them communicate the intangible cultural heritage through new interpretations, contributing to innovation and creativity in the field of culture.

19. Storytelling Hi-Story 4.0, Youbiquo s.r.l.

<http://www.youbiquo.eu/wordpress3/hi-story-4-0-presented-at-smau-milan-2016/>

Video: <https://www.youtube.com/watch?v=gHtNuzlZjZk> and

<https://www.youtube.com/watch?v=Ovn70Zana5o>

Have you ever thought you could see beyond reality? And to be able to enter history in the first person? From today we can amplify what we see and what we live in a place, at the same time you are visiting it: Hi-Story 4.0 is the Augmented Reality experience that makes us travel within the cultural heritage with a couple of smart glasses.

With Hi-Story 4.0 one chooses in which historical scenarios "navigate", just a swipe or a voice command to the device to catapult you into an incredible historical show. This idea can be applied in any tourist, outdoor and indoor environment, and innovation lies in the possibility of customizing software and hardware, of spectacularizing tailor-made contents and user-experienced interaction.

20. Difficult heritage (slavery) storytelling AR app - Bitter&Sweet & Finding Alberta, Malmö University

Article: <https://mw17.mwconf.org/paper/augmented-and-mixed-reality-design-for-contested-and-challenging-histories-postcolonial-approaches-to-site-specific-storytelling/>

It is a series of mobile Augmented Reality Experiences focusing on the postcolonial history of various sites in Copenhagen, Denmark. The applications—Bitter&Sweet & Finding Alberta—are part of a university-led research project, situated at the now closed Royal Cast Collection of the Copenhagen National Gallery and in the city, itself. Using site-specific archival material for contemporary experiences in an urban landscape, the design process deals in part with contested sites and sensitive histories, while the application tells the story of colonial pasts in a Danish context.

In the resulting AR experience, named *Finding Alberta*, the sites of memory are scattered across Copenhagen. On seven sites of importance in Alberta's life in Denmark, we present the user with audio that recounts snippets of what is known about her experiences at each site, images and documents from Copenhagen at that time, and material from the colonies.

21. Being immersed in an archaeological interpretation using real objects (using Viking masks): The Viking World VR, University of York: Digital Narratives for Archaeology Research (DiNAR) Project

<https://www.york.ac.uk/digital-heritage/research/portfolio/dinar/>

Article: <https://www.york.ac.uk/news-and-events/news/2017/research/virtual-reality-vikings/>

Viking World VR: archaeological interpretation – one uses Viking masks instead of real VR devices, very interesting for museums with objects. To be connected or to merge physical materials and artefacts in one place.

22. Experiencing hard to access environment narrated by real people: Space Descent VR narrated by an astronaut, Science Museum

http://www.sciencemuseum.org.uk/visitmuseum/plan_your_visit/simulators/space_descent_vr

If we are talking about outer space, there is another topic where we could experience benefits of using 3D and R/VR technologies. It is a virtual reality mission that puts you in the pilot's seat of a Soyuz capsule—just like the one that brought him home.

Using the latest state-of-the-art VR technology, you'll get a 360° look inside a Soyuz capsule and experience the thrill of being an astronaut as you retrace Tim's 400km journey back to Earth from the ISS.

23. AR storytelling app revealing ancient Indigenous stories: Indigital Storytelling app, Indigital

<https://www.indigital.net.au/>

Indigital Storytelling is an augmented reality Indigenous cultural app that brings the world's oldest living stories to everyone through the world's newest technology. We are working with several global communities to add content and will notify users when further content becomes available.

Indigital Storytelling is a beautiful and intuitive app that uses your device camera to precisely spot and identify Indigenous places, artworks and objects. Once your camera 'sees' a place, artwork or object in your live environment, a Traditional Owner virtually shares their story with you through their cultural expression within your live environment. In the future, you will be able to watch Dreaming's come to life through #3D animation, listen to Traditional Owners share important knowledge with you and learn more about our rich global Indigenous cultures.

24. Heritage users to co-create stories using VR Tilt Brush , Google

http://store.steampowered.com/app/327140/Tilt_Brush/

Tilt Brush by Google is a software that allows 3D painting (simulation of painting with a brush) using VR headset and motion- and location-sensing controller. In terms of interaction enable user/participant to paint in 3D space, as well as visitor/attendee to be a part of a 3D painting in its progress. Some examples:

Google Cultural Institute in Paris: <https://www.youtube.com/watch?v=91J8pLHdDB0&feature=youtu.be>

Louisiana Art & Science Museum: Art After Hours: The Art of Animation in Gaming & Film: <https://blog.turbosquid.com/2016/07/21/a-night-at-the-museum-with-virtual-reality/>

25. Interpreting content rich images using storytelling and AR: Stitching Our Struggles Augmented Reality App, Canadian Museum for Human Rights, Canada

<https://humanrights.ca/exhibit/freedom-expression-latin-america>

AR app used to explain artwork about the dictatorship time in Chile using on-screen images, text, interviews conducted. The two digital artefacts not physically exhibited in the gallery are also featured in the app.

Sound and music are the original augmented reality technology. Making music or play-back audio, e.g. in an environment is an additional audio layer in the reality. It doesn't block reality, it's transparent, but yet it ads emotion/information/story. You've got all the time and space to tell a story in audio. It's easy to play and place in the real world.

Good voice-actors in combination with a good script can transform information into an experience. With the use of music and or audio design, you can add emotion to your narrative. One could feel blocked or separated when putting up headphones. The use of VR (binaural) audio keeps the visitors/listeners in touch with the surrounding, but the content could still immerse them completely. Also open back headphones let the actual audio thru, so there's not a complete disconnect to the real world. Closed-back or noise canceling headphones will obviously block out the surrounding, some stories need that. Sound played on headphones becomes a more personal experience, but techniques are there to link with other people, a kind of listening apart together. An augmented audio layer / story for a complete audience can be achieved by play back thru multichannel speakers.

26. Cooper Hewitt Smithsonian Design Museum

<https://www.cooperhewitt.org/>

Visitors become designers for one day. Each visitor to the Cooper Hewitt receives an interactive pen, an all-access pass to the world of design. Visitors use the pen to save any object in the museum to their personal collection, or experiment with creating their own designs. The Cooper Hewitt gives visitors the opportunity to create throughout the museum. In the Process Lab, visitors can design and submit improvements to everyday objects, and browse ideas created by previous users. The Immersion Room brings the museum's vast collection of wallpaper samples to life with an array across two projection walls. As visitors create and project their own designs, the system recognises their approach and presents feedback from renowned designers. By turning visitors from observers to designers, the museum transforms how they relate to the collection. Visitors can search artworks by drawing lines and patterns, or by posing in front of a motion detector.

27. Cleveland Museum of Art - *Please Touch the Art*

<https://localprojects.net/work/cleveland-museum-of-art-gallery-one>

Make a face in front of a screen with a camera and the museum surfaces an artwork from the collection that has the same facial expression. It's a wordless, hands-free way to use visitors' expressions to create a personal connection, recasting the gallery as a place that is performative, social, and fun. Strike a pose. Visitors' modelling abilities are tested by giving them a chance to imitate poses from works of art in CMA's collection. As visitors pose, a Kinect motion sensor will measure how accurately they were able to recreate the pose from the original artwork, and rate the performance. Search by line An intuitive touch interface allows users to simply draw lines and shapes to call forth artworks from the collection with similar geometry. See the art in context. Works of art melt away from their cases and mounts and reappear in their original setting. By contextualising CMA's collection, visitors are given the opportunity to experience the magic of time travel from the comfort of a gallery, learning more about the history of a work of art.

28. The Sound Of Things

<https://vimeo.com/61766546>

The Sound of Things is an interactive sound installation. Ordinary things are lying on a table: a stack of papers, a wine glass, candles, a lamp. When the visitor puts on headphones, all items on the table start to sound to him. The observer can experience and explore this three-dimensional sound-scape by moving his head and wandering about.

29. Detour

<https://www.detour.com>

Detour brings you off the beaten path, through up-and-coming neighbourhoods and inside noteworthy buildings. Using location-aware GPS tracking, the app modifies audio scripts in order to speak to whatever site is in your line of vision, or lies just ahead. Most tours will recommend food and drink stops, and all can be synced across multiple devices to allow for makeshift group tours.

Note: Narrative, actors, use of music are good and engaging. Experience could be enlarged by positional / binaural audio so the store really integrates with reality

30. Into the Wild

<https://www.commarts.com/exhibit/into-the-wild-ar-app>

Into the Wild is a Google Tango experience that transforms the ArtScience Museum into a virtual rainforest you can physically explore by walking through the museum. The app combines computer vision and augmented reality to let visitors learn about devastating effects of deforestation first hand.

31. Alter Bahnhof Video Walk

Video extract: https://www.youtube.com/watch?v=wI_p1vveFj8

The Alter Bahnhof Video Walk was designed for the old train station in Kassel, Germany as part of Documenta 13. Participants are able to borrow an iPod and headphones from a check-out booth. They are then directed by Cardiff and Miller through the station. An alternate world opens up where reality and fiction meld in a disturbing and uncanny way that has been referred to as "physical cinema". The participants watch things unfold on the small screen but feel the presence of those events deeply because of being situated in the exact location.

Very nice augmented reality tour. This one makes good use of video, audio and information in an engaging storyline. Not that old, but it has been out there for a while. He likes it because use of audio and VR is very good in cultural heritage, since it merges you in the story, it is used with video and graphics to enrich the storytelling - how the story is told to the visitors, not only a boring background voice. Different approach of guiding people through museum or building.

We could split up the topics also as VR, AR, Mixed reality and so. It is complicated since one can do one sort of storytelling for and on VR, and for Augmented Reality you need different kind of storytelling.

Meaningful Content vs. the Real World - how does content connect to the real world? (12 cases)

From newspaper to radio to TV to computers, the evolution of communication has now brought us VR. While it can't be guaranteed as a medium forever, it is the next step in consuming media. Virtual reality allows media consumers to submerge the senses, drowning out the rest of the world, eliminating distractions and magnifying the experience.

Real-world uses beyond video games or 360 degrees panoramas

1. Virtual Paphos.

<http://www.paphostheatre.org/paphos-theatre-education-blog/virtual-paphos>

In 2017 the Paphos Theatre Archaeological Project is proud to announce its 3D virtual reality model of the Antonine (2nd century AD) phase of the theatre of Paphos made by our good friends at LithodimosVR, specialists in reconstructing the ancient world using exciting new technologies. The 3D model is viewable through VR googles.

2. Degenfeld Castle Museum: VR/AR and Kinect experience

Video and website: <http://www.arworks.com/en/portfolio-item/vrar-and-kinect-experience-in-a-historical-museum/>

ARworks developed an extraordinary digital experience layer for a Museum in Europe. In three rooms of the historical castle-museum state-of-the-art interactive programs are waiting for the visitors.

In the first room, with the help of Augmented Reality (AR), the otherwise empty room is filled up with mysterious animated ancient furniture (prints on the walls and 3D chairs, wardrobes start to appear in front of you, and just by a click of your finger, you can make them perform some unexpected animation).

In the second room they've used virtual reality (VR) so when the visitor picks up the tablet, he is taken into a fantastic Versailles like room and can listen to the virtual guide, sharing the story of the family, who lived here 200 years ago.

In the third, and most exciting room, visitors are invited to learn the basics of well known Hungarian folk dances 'Czardas' and 'Palotas'. Having their size taken for an authentic dress by camera, a virtual dancer performs the elemental steps of these dances. Then, visitors, displayed in these historical costumes, are to follow the moves to their best skills. Dancers get their grades from 1 to 5 stars at the end of the session.

3. Robben Island Museum

<http://www.robber-island.org.za/map>

Robben Island Museum (RIM) is a public entity responsible for managing, maintaining, presenting, developing and marketing Robben Island as a national estate and World Heritage Site. It was established by the Department of Arts and Culture in 1997.

Online visitors can use their [virtual tour](#) or [interactive timeline](#) to explore the history of the prison. Storytelling using [3D street-view panorama's](#).

4. Openspace 3D

<http://www.openspace3d.com>

Watch the [presentation video](#).

OpenSpace3D is "Free software" for Virtual and Augmented Reality projects development.

Their goal is to democratize real-time 3D applications and provide a tool for all creative minds, not just developers.

Users can download the software Open Space 3D for creating virtual environments, augmented reality and specific presentations of imaginative or real spaces. The platform supports and incorporates HTC Vive, Oculus and Google Cardboard applications.

OpenSpace3D supports two augmented reality techniques to make AR applications. The feature marker detection that allows to detect an image on the camera and the Aruco fiducial marker detection that allows to make fast applications with several markers and also use them as a tangible interface. More about augmented reality usage can be read [here](#).

One of the great things about OpenSpace3D is it's native support for several Virtual Reality and Input devices: the Leap Motion for hands tracking, the Myo armband for gesture recognition, the Neurosky headset for concentration and meditation or the Emotiv EPOC for EEG signals, the Nonin Oxymeter for heart pulse, HTC Vive, Oculus and Vuzix for VR, the Tobii EyeX for eye tracking, or any serial devices that support so you can play with Arduino and any device and tracking system compatible with VRPN.

Once completed, the virtual reality application can be easily exported for Windows, Mac, Android, Linux and iOS.

5. Zeekit

<http://zeekit.co/>

<https://youtu.be/CvTVIt75bRE>

Shopping online could save much hassle – driving, parking, crowds, and the like – but the chance that the purchased items won't be as seen on the screen often deters customers from hitting the "Buy" button. Fashion designer Rebecca Minkoff's new app, Zeekit, uses AR to show consumers how clothes will look and fit, without requiring shoppers to step foot in a dressing room. This is how it works: The user uploads a selfie into the app and then selects items to virtually try on. The app displays the item on the photo, so the user can see how it looks. He or she can then share this photo on social media with friends to get feedback.

This technology has spread to the world of sports as well. The Lay's "Cheer of Champions" campaign allows soccer fans visiting La Vaguada, a mall in Madrid, to use AR to cheer on their favourite teams while wearing custom-designed sportswear. It starts with fans' own Lay's potato chip bags, which are imprinted on a digital version of their team's T-shirts. After taking a photo of themselves, fans can get digitally "decked out" for the game by adding face paint and other accessories. And, to make it even more fun, fans can share their "soccer fan selfies" on social media.

6. Lowe's Virtual Room Designer

https://www.lowes.com/cd_virtual+room+designer_189310537

Effectively uses AR to let customers design a new room using the home-improvement company's products, and then experience virtually how it will look and feel in real life. Lowe's takes it a step further by letting customers adjust their perspectives, so they can experience the room from others' viewpoints, such as their children's. However, at present, the feature only allows users to email and print their designs instead of sharing them on social media. By adding social media-sharing buttons, Lowe's could help their customers elicit additional feedback from friends, as well as gain greater exposure for the company's products and the Virtual Room Designer.

7. VR representation of destroyed castle: Segeberg 1600 - Hafencity University Hamburg, Museum Alt-Segeberger Bürgerhaus

Research paper:

https://www.researchgate.net/publication/313950357_the_return_of_the_siegesburg_-_3d-reconstruction_of_a_disappeared_and_forgotten_monument

Article: <http://www.ifp.uni-stuttgart.de/phowo/2017/PDF/29-Kersten-Presentation.pdf>

Many Cultural Heritage (CH) monuments were destroyed in the past and are often lost forever. If there is no contemporary metric documentation of the historic objects available, the monument and the information about this monument could be disappeared and forgotten forever. The Siegesburg (also known as Segeberg castle) located on the "Kalkberg" (Chalk Mountain) in Bad Segeberg in Northern Germany, is a typical example for such a monument, which was destroyed by Swedish troops at the end of the Thirty Years' War in 1644. This important monument was only documented by a few historic isometric maps, but the castle and even the later castle ruin were totally destructed and demolished over the last centuries and disappeared forever. Furthermore, this significant memorial is even forgotten in many people's mind.

This contribution describes the physical and virtual return of the Siegesburg by 3D reconstruction using historic sources. The laboratory for Photogrammetry & Laser Scanning of the HafenCity University Hamburg conducted this project in co-operation with the museum Alt-Segeberger Bürgerhaus (Old-Segeberg town house). The process of the 3D reconstruction and visualisation of both the Kalkberg and the castle is presented.

Using isometric maps such the one from Braun-Hogenberg, historic sources and expert knowledge, the castle and the appertaining Kalkberg were successfully reconstructed in 3D for the generation of video sequences in Lumion 3D representing a half-timbered architecture from Central Germany, while a second video generated with 3ds Max represents the northern European Brick Gothic. These video sequences symbolise the virtual return of the Siegesburg, while the physical return was already realised using the physical castle model in the museum exhibition. Furthermore, a 3D video has been generated using Lumion 3D.

8. Intuitive and user-friendly AR app for labelling artworks, Royal Academy of Arts, London

<https://www.royalacademy.org.uk/exhibition/richard-deacon-ra-selects>

Video: <https://www.youtube.com/watch?v=v8qwQrzRpuo>

Article: <https://www.itsnicethat.com/news/smartify-digital-250917> and

<https://www.fastcodesign.com/90144263/the-shazam-for-art-museums-is-so-much-better-than-an-audio-tour>

This future actually arrived last year, via [Smartify](#), an augmented reality art-identifier for iOS and Android that's since been adopted by over 30 museums worldwide. That's right: Long before we had the current wave of AR apps powered by Apple's ARKit, Smartify found a foothold in fine art at places like the Royal Academy of Art in London and the Metropolitan Museum of Art in New York. From oil paintings to marble sculptures, just aim and identify. You don't even need to hit a button to take a photo.

While the app is free for users, Smartify stays afloat with government grants and memberships from participating museums—and it reserves the right to monetize in-app purchases, run advertisements, or sell its own data to art organizations.

Though it's been around for a bit, Smartify is proof of AR that works, rather than AR as gimmick. It's essentially quick, visual search, which focuses its lens on extremely specific environments, and an extremely specific topic: art. While nobody really wants to be on their

phone at an art museum, it serves as a handy surrogate for squinting at the tiny title cards next to most paintings, especially as those cards are often nothing more than a title, date, and artist name. Smartify just adds useful context to a piece of our confusing real world.

9. VR study tour (for students) to ancient archaeological site in northern Iraq destroyed by terrorists, Center for Teaching and Learning (CTL)

<http://ctl.yale.edu/>

Video: <https://www.youtube.com/watch?v=y0EVnOqvguQ&feature=youtu.be>

Article: <https://news.yale.edu/2017/09/25/students-visit-lost-archaeological-treasure-virtual-reality>

The students didn't actually travel to the ancient city of Nimrud, about 30 kilometres south of Mosul. Rather, in a confluence of the very old and the very new, students "travelled" to a virtual model of the Northwest Palace — often called a "jewel" of archaeological remains in Iraq — via Oculus Rift, a virtual reality (VR) system housed at the [Center for Teaching and Learning](#) (CTL).

The VR experience of the Northwest Palace at Nimrud was provided by Learning Sites, a Massachusetts-based company that specializes in models of archaeological sites for the purpose of interactive education and research. Dozens of experts in the ancient Near East contribute to the production of these models, making them as accurately and meticulously detailed as possible. In the model, students can not only see what the palace would have looked like, but also interact with objects to learn more about them; for instance, a student can click on a piece of art on the wall and hear its background.

10. 3D models of artefacts and fossils for learning purposes Idaho Museum of Natural History

<http://virtual.imnh.isu.edu/>

The Idaho Museum of Natural History has developed this website to give visitors full open-access to 3D models and images of their treasures. They have a wide range of fossils, bones and cultural artifacts from their museum and other institutions across North America.

They use a seven step-process which is relatively simple, even if the technology used to do it is not. Throughout the process, the following procedures are being followed:

- All of the available data for an object to be scanned is compiled into a database that we have constructed for the IVL Virtual Specimen Library.
- Regardless of the subject, any object must be scanned and edited in several orientations in order to sample the entire surface area and create a solid model.
- Once the appropriate number of scans has been completed by any of scanners, the resultant model consists of a rough series of merged polygon meshes.
- A final edit is conducted inside of Geomagic Studio and removes any intersecting polygons, fills any remaining holes, and clears the vertex color data that gets 'baked' into the model while it is being scanned.
- The raw full resolution models produced by the end of this final edit are often very large, averaging from several hundred thousand to several million polygons per model. This is generally too large for most computers to handle smoothly. Therefore, they should be optimized.
- Now that the model is fully edited, has a consistent topology, and contains several available levels of resolution, the next step is to create a texture map by using the photographs taken of the object before scanning it. Generally, six photographs are

sufficient to create a texture map that fills the model's surface; however, in objects with a high degree of surface morphology, more photos are taken to fill in whichever holes may exist.

- The final stage in our modeling pipeline is translating and rendering these files into a usable and distributable file format which allows them to set up material, lighting, and orientation and exports a .u3d file which is then converted into a .pdf.

11. Workshop about 3D scanning clay artworks and teleporting them into VR, Children's Museum of the Arts, New York

<http://cmany.org/classes-and-activities/activities/view/interactive-storytelling-vr/>

Join them in the Media Lab at the Children's Museum of the Art for a unique "Interactive Storytelling" workshop in Virtual Reality with Mokuni game designers! During this family workshop, young artists and their caregivers will explore the storytelling potential of the Virtual Reality game world. They will start by designing and sculpting their characters out of clay. Participants will then be introduced to the 3D scanning process by which their creations will travel into the virtual reality space. Finally, through the use of a VR headset, guests will experience this newly created game world! This workshop is for young artists and adults to work side by side!"

12. AR observation using Microsoft Hololens: First impressions of Hololens: Traditional boats of Ireland , Traditional boats of Ireland (Pat Tanner)

<http://www.tradboats.ie/index.php>

Article: <https://memetechnology.org/2017/09/29/first-impressions-of-hololens/>

Traditional Boats of Ireland Project is the result of a combined effort by Irish people who are passionate about the rich diversity of boat types throughout the country since Ireland's traditional boat types are rapidly disappearing.

Through the innovative application of laser scanning technology, a new virtual maritime museum is being created on www.tradboats.ie, showing also a template for how to record, and display any type of three dimensional objects. This project has significance far beyond its initial maritime theme and it has relevance to many fields including conservation, marine archaeology, naval architecture, even to museum policy.

Museum have scanned boat builders' half models and full size craft in a non-invasive technique, and with sub-millimetre accuracy, but this approach is applicable to any significant three-dimensional object, from Viking hair combs to High Crosses; the list is limited only by imagination. On screen one can rotate at will and literally illuminate a target object from any angle, picking out features previously hidden.

As the data is gathered and processed, it can be exhibited in a virtual museum online. Now that museums are obliged to be popular visitor attractions, with only a tiny fraction of their collections on display, the www.tradboats.ie model shows how significant items from hidden collections can be best be "displayed", making them easily available to the public and for research, and even providing a possible revenue source. In this way, the initiative has triggered an international joint re-writing of best practice for how to address such wrecks in the future.

Media Characteristics - define VR as a medium (7 cases)

The virtual reality phenomenon is more than just a trend; it's an opportunity for unique interaction and gamification on a new level of engagement.

People are trying to understand VR largely in terms of two mediums we already know: film and video games. One is interactive, one is not. One is made with code, one is made with camera. One is experienced in a communal setting, as an event (i.e in cinemas), the other is played online or in the home.

The first step is to dispel false divisions like film vs. video games, in place of better questions like passive vs. interactive, linear vs. non-linear. We shouldn't be talking about a VR film or VR video game. We should be talking about VR experiences.

After realizing a story could be told very effectively through VR, we can start with the construction of the world we want through Unity 3D. Within this world, I interspersed photographs and video from the real world, which again, was an important aspect of the story I was telling. Finally, rather than construct my experience on a strict passive vs interactive dichotomy, I instead gave a limited interactivity to my users. This interactivity could change the world they saw around them, but would not speed up, slow down, or change the story they were hearing. This is but a small example, but shows it is possible to create something which is neither a video game, nor a film, but rather a native VR experience.

<https://hackernoon.com/back-to-the-fundamentals-how-to-define-vr-2312571d7904>

Not anything viewed with a headset is VR.

A set of industry definitions to help companies better explain to consumers the spectrum of experiences their technologies deliver:

- “Virtual Reality” (VR) creates a digital environment that replaces the user’s real-world environment
- “Augmented Reality” (AR) overlays digitally-created content into the user’s real-world environment
- “Mixed Reality” (MR) is an experience that seamlessly blends the user’s real-world environment and digitally-created content, where both environments can coexist and interact with each other
- “360° Video” or “360 Video” allows the user to look in every direction around him/her
- “Immersive Experience” is a deeply-engaging, multisensory, digital experience, which can be delivered using VR, AR, 360° video, MR and/or other technologies

CTA’s pending *U.S. Consumer Technology Sales and Forecasts* industry report, to be released Jan. 3 at CES 2017, shows AR/VR technologies will be among the tech sector’s overwhelming leaders in year-to-year growth in 2016, which was driven by two important developments (1) cheap, untethered mobile headsets and (2) new high-end consumer products like the HTC Vive, Oculus Rift and PlaystationVR. VR unit sales in the U.S. will skyrocket 593 percent over 2015 to 1.4 million units, and total revenues will leap 362 percent to reach \$462 million. That’s nothing. Industry analysts are predicting VR hardware sales will climb to 20BN (yes, billion) in 2020 (that’s three years from now) as HMDs become mainstream. Many predict AR headsets, like Microsoft’s HoloLens, will eventually replace computer monitors.

<https://medium.com/@CharlieFink/vr-ar-mr-defined-finally-ef255ba10>

What exactly is meant under Media characteristics?

As far as we understand, the media supporting VR/AR is the media in which the VR/AR contents can be presented to audience. VR is usually connected with film, video, gaming, panoramic photos, 360 degrees photos, and so forth. So MEDIA that supports the VR/AR experience could be: 3D videos, panoramas, installations-on-site, projections, AR presence and so on. The task is to find as many different media as possible that could be used for presentation/experience of VR/AR.

1. Altamira VR walk

<http://virtualwaregroup.com/portfolio/altamira-vr-experience>

<https://www.youtube.com/watch?v=k75tJr5AtZc>

The film “Altamira” directed by Hugh Hudson and characterized by Antonio Banderas, Rupert Everett, Irene Escola among other, which is about the discovery of the Cantabrian cave, Morena Films and Samsung promote the film in an exceptional and unique way. From the 3D data, accurately scanned by Gim Geomatics, a company dedicated to the Management of Civil, Heritage, Historical and Environmental Information, Virtualware has created a 3D model that reproduce the cave in real scale and at a high-level precision, specially of the cave paintings also declared World Heritage in 1985.

The company Gim Geomatics has been in charge of developing a high detailed topography that contains information from both the outside and from the geological structure data. The combination of these technologies enable the user to get immersed in the cave, discovering the bison, deer and horse paintings as the main character of the film, Maria Sanz de Santuola did in 1878. The access to cave has been forbidden for 12 years to the public due to heritage preservation and conservation issues. The National Archaeological Museum of Spain in Madrid, and some other important museums along the country have Altamira VR Experience at the users’ disposal, a virtual reality experiences developed by Virtualware that introduces the viewer inside the cave, declared Cultural Heritage.

2. Magic Butterfly is an immersive virtual reality (VR) experience by REWIND and WNO.

<https://www.wno.org.uk/event/magic-butterfly-vr-experience>

The free experience will reimagine scenes from *Madam Butterfly* and *The Magic Flute*, enchanting you in through a unique form of storytelling using classical music, art and technology. Featuring an original WNO recording, this presentation will be your perfect companion if you are new to, or unfamiliar with, the world of opera.

Be among the first to participate in this pioneering event. Enter our specially designed shipping container and don a VR headset, to be taken right inside two of our classic productions as you conjure up some animals as Tamino from *The Magic Flute* and enjoy an exclusive performance of *Madam Butterfly*’s ‘One Fine Day’ aria.

3. Practices and observations about Virtual applications in Greece Examples, Archaeological museum of Thessaloniki

<https://www.amth.gr/exhibitions/permanent-exhibitions/makedonia-apo-tis-psifides-sta-pixels>

The digital exhibition of the Archaeological museum of Thessaloniki is about 7 interactive applications which are developed by Forth - ICS. Through these digital applications artefacts from archaeological sites and museums from Macedonia region are promoted and delivered to the public. Two of these applications are included to the permanent exhibitions. The other five are placed in a special hall that was designed for this purpose.

This isolation of the digital exhibition hall does not offer to the visitor the sense of unity that is needed in order the users to understand the meaning of each application. The visitor suddenly enters a dark hall with monitors and other equipment and tries to understand what he has to do, without receiving any guidance from the museum personnel. Though the applications are interesting, the isolation of the room and the lack of guidance are not helping them to fulfil their initial scope.

It is simply a dark room, where u experience something different: a painting that is being restored. You can move on the map and see info about archaeological sites in Macedonia. No connection to the museum, it is just a darkroom. Mainly educational.

4. Foundation of the Hellenic World

http://www.fhw.gr/vr/gr/docs/in_intro.html

A virtual reality globe has been created at the Foundation of the Hellenic World, located at Athens. The visitors have the opportunity to walk virtually with the use of special equipment (VR glasses, vr monitors, sensors) at the ancient cities of Olympia, Milos and other. The use of these applications is mainly educational and entertainment. Most of the many visitors are students, which are really enjoying their visit and gain useful knowledge

On the other hand the scientific aspect of the virtual reconstructions of the ancient cities is limited, taking into account that the original sites are not fully documented. So a scientific use of these reconstructions cannot be considered as reliable. Furthermore there are some problems at the graphic appearance of the reconstructions as the graphics and the lighting don't appear real and are technologically old. This is a big problem for 3d graphics reconstructions, as old graphics cannot easily be updated.

5. Cretan Aquarium

<https://cretaquarium.gr/>

The Cretan aquarium has an advanced and user friendly webpage, where with good simple graphics and with the use of YouTube videos provides to the users simple, useful information. The visitors are not getting tired by big texts and annoying slideshows.

Also through the webpage, the users can download and print smart info cards, which they can scan with a special app in their mobile phone and can see living digital holograms.

6. Ancient theatre: The circle of time

<http://ancienttheater.culture.gr/el/>

At the webpage users have access to a digital presentation of the ancient Greek theatres. The webpage contains digital material (videos, texts, photos and other) concerning ancient theatres. Also users and kids can find useful educational applications.

The digital museum of ancient theatres gives to the public a simple gateway to useful information about its subject. Users are not lost in difficult, academic, multidimensional and impressive information, which most of the times cannot fully understand. The education of the public to simple meanings and terminology is one of the most important aspects of virtual information.

On the other hand, the webpage provides to more advanced users, access to academic knowledge and special information. The webpage maybe in the future has to be enriched with a more advanced section of digital applications, such as QTVR Panoramas and tours at ancient theatres.

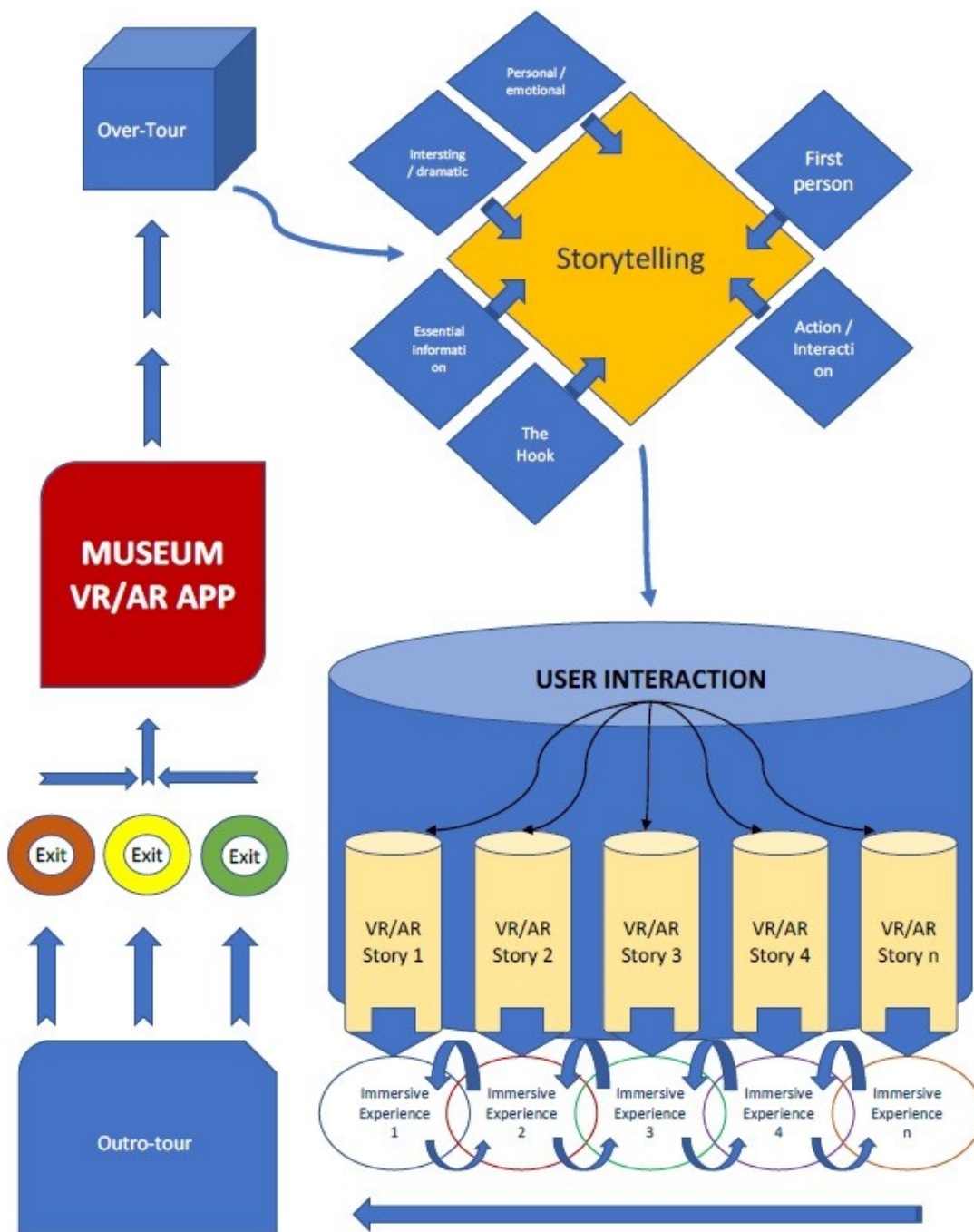
7. Kotinos VR experience

<https://www.indiegogo.com/projects/kotinos-experience-ancient-olympia-vr-education#/>

This project is a private project where with the collaboration of museums, the visitors can experience a guided educational virtual tour with the use of special gear such as VR Glasses. This project is very ambitious, but also will face many problems. For example the simultaneous use of VR Glasses by 10 people, which are walking on a real museum will change the way a museum is communicating its content and the way people is experiencing a museum. Also might be dangerous....

Basic Principles of Storytelling in VR, AR, MR

A model for storytelling starts with a clear over-tour, which could be possible to approach online or on-site. An over-tour should start with a good story hook, effective and catchy; shocking, interesting and emotional. Giving an initial information through “one door” to invite users and motivate them to go further. A museum should be able to offer a knowledge of museum contents to touch the interest of visitors. It is possible to have more than one door to enter VR. Starting with a basic story entrance, several key points should open into several parallel stories. Such flexible approaches to non-linear stories lead to hyper stories, where a visitor can be immersed. A visitor is following or better discovering different stories which could lead one into another as a kind of labyrinth and learning by going through different paths, researching different information. The VR stage is actually a theater stage where a visitor is aloud to enter and to interact with objects and characters on the stage. Different stages have different stories or one story could be told through different stages/spaces. Easily and clearly defined main characters should appear and clearly visible narrative arcs should lead a visitor through a fable, a myth, a plot, a moral, a drama or a genre. At the end are several exit locations with different messages provided by museum experts. There is no one type of visitor, that's why storytelling should be respective to different types of visitors, with different backgrounds and ages, non-motivated visitors and others.



VR Flowchart

Conclusions

1. The user must not be distracted by advanced technology (VR/AR Glasses, tablets) while visiting a museum and its exhibits, in a way that he gives more attention to the technology and not the museum.
2. Digital applications should be complementary to the museum exhibits rather than independent.
3. Immersive storytelling is the key to success.
4. There should always be some guidance from trained personnel in the museum's independent digital applications.
5. Structured information must be provided on a web digital museum, ie the inexperienced public must receive simple information in a pleasant way and the skilled public must have access to more specialized information: importance of the curator for digital museums.
6. Define the goals and audiences of each digital application.
7. Easy (and therefore constants) upgrade of applications.
8. Easy and free web access.