



All about touring exhibitions

MEDIACOMBO

WHAT VIRTUAL REALITY CAN BRING TO TRAVELLING EXHIBITIONS

IMMERSIVE VR TECHNOLOGY FOR TOURING

Virtual Reality (VR) is a powerful tool for creating experiences and telling stories. Many museums and cultural institutions that produce travelling exhibitions have already been considering how to take advantage of its potential. The Covid crisis brings a new set of issues to consider around using virtual reality, both for and against.

The technology is new enough that the rules and best practices for how to tell stories in VR are being discovered and improved upon every day. Curators, exhibit designers and educators can collaborate with VR producers to shape the future of how they communicate information in this medium.

The simplest way to define Virtual Reality is this: “Virtual Reality” (VR) creates a digital environment that replaces the user’s real-world environment.¹ VR empowers people to become time and space travellers, to feel physically immersed in realities they could never otherwise experience. This visceral sensation of believing that you’re somewhere else is called ‘presence’. It opens up new possibilities for storytelling, deeper ways of understanding ideas and experiences.

This feeling of presence, of being completely immersed in the virtual environment, is affected by three things: how well-crafted the story is, which headset or viewing device the experience was designed for, and which type of VR production method was used.

In this article I will describe examples of different ways to tell stories in VR, how VR can be used in travelling exhibitions, and best practices for presenting VR. In a separate technical report, I will also define different production methods and viewing devices, and provide recommendations for producing VR experiences.

An article by Robin White, President of [MediaCombo](#)
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¹ Definition from the Consumer Technology Association’s AR/VR Working Group, 2018. They have also provided these definitions of related immersive experiences: “Immersive Experience” is a deeply-engaging, multisensory, digital experience, which can be delivered using VR, AR, 360° video, MR and/or other technologies “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.

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EXPERIENCING VR

You cannot really know what it is like until you've tried it yourself, but imagine...

You can put on a virtual reality head set and while you may actually be sitting on a couch in your living room, you feel like you are standing in the Sistine Chapel in Rome, gazing at the exquisite paintings by Michelangelo on the walls and ceiling surrounding you. You can move to any point on the floor, walls or ceiling of this magnificent and enormous space, and see tiny details of individual brush strokes and even cracked plaster on the walls - all without the crowds who would normally be competing with you for the best views. Produced by Epic, [IL DIVINO: Michelangelo's Sistine Chapel in VR](#) is an absolutely jaw-dropping experience, accompanied by an hour of informative audio commentary.

You open another VR application and find yourself in the Carnegie Museum of Natural History in Pittsburgh, PA, at the entrance to [We Are Nature](#), an exhibition that closed back in September 2018. You quickly get a bird's eye view of the exhibition galleries and then zoom in to move around each exhibit in 360°, accompanied by audio, video, text and interactive options. You are looking at the evidence of climate change and how scientists are calling this a new geologic age, the Anthropocene. Full disclosure, my firm [MediaCombo](#), co-produced this experience with [GuidiGO](#).

Other types of virtual reality experiences can also be incorporated into an exhibition. For example, the Tate Modern presented [Modigliani VR: The Ochre Atelier](#), in 2017 during their retrospective of the painter's work. Visitors entered a small gallery, put on VR headsets and were transported out of the museum and 100 years back in time, into the artist's studio in Paris in 1920. You really feel that you are there, in his frugal space, with candles and sunlight filtered through dirty windows illuminating his last paintings, seeing and feeling how he lived and painted in the last months of his life.

VR can also be ideal for providing experiences that are not readily available because they are too dangerous and require professional levels of expertise. Science North's travelling exhibition [Beyond Human Limits](#), for example, includes a VR experience where visitors can feel what it would be like to race down a backcountry slope in a showdown of snowboarder vs skier, twisting, sliding, and gliding down the hill from the perspective of your chosen athlete.

VR is also a powerful tool for bringing people to places that may not actually exist! [Samskara](#), produced by [FullDome.pro](#), has been called a "beautiful, energy provoking art exhibit." 360° dome projections, and its Microdose VR experience immerses visitors in a virtual field trip to an alternate reality.

Right now, most people who have experience with VR know it through playing games at home, or at VR arcades popping up in shopping malls and [store fronts](#) like this one in Dumbo in Brooklyn, NY.

Museums are one of the best environments to introduce people to VR documentary, narrative, and game experiences, because visitors feel that museums are trustworthy and safe spaces. Thus they are more likely to take a chance on trying something new.

HOW VR CAN BE USED TO ENHANCE TRAVELLING EXHIBITIONS

Travelling exhibition designers can use these diverse approaches to bring visitors much closer to the stories and objects in museum collections:

- a VR experience which is the travelling exhibition – a virtual field trip to a location or a moment in history, for example, the Sistine Chapel VR mentioned above or the [Anne Frank House in VR](#).
- Virtual field trips, to locations or back in time to historic moments, as a component to an exhibition. [Claude Monet, The Immersive Experience](#) for example, is an immersive project that combines 360° projections of Claude Monet's paintings covering multiple gallery walls, and a virtual travelogue to the places where Monet painted. The Modigliani VR: The Ochre Atelier experience mentioned above is also an example of this use.
- Playing games in VR is one of the biggest drivers of consumer adoption. For example, motion based chairs, such as Peak VR by [Seed Interactive](#), can enhance the feeling of immersion in a virtual environment. It is very effective for increasing the excitement of simulation games that may be part of a travelling exhibition.

THE VALUE OF A 3D VIRTUAL VERSION OF A TRAVELLING EXHIBITION

Travelling exhibitions are quite costly to produce and usually take years to develop. Creating a 3D virtual version of a travelling exhibition can be of great interest and notably increase the value of the work of curators, scientists, exhibition designers, educators, funders and everyone who was involved in development because:

1. It is a very efficient way to promote the exhibition to potential venues.
2. It extends the life of the exhibition beyond the physical travelling schedule for years to come.
3. It creates an archive that can be used by scholars, future exhibit designers, etc.
4. It documents the project to use as evidence for funders of future projects.
5. It's completely portable, requiring no installation or internet connectivity and adds nothing to the cost of transportation.
6. It can be used by museum educators and membership services to reach audiences who cannot visit the museum during or after the exhibition is up.
7. These experiences can also be seen on flat screens in a web browser. This minimises the immersive quality that comes from viewing in a VR headset, but still far exceeds any other method of being in the environment and understanding the story, short of physically being there. It multiplies accessibility to the curated experience.

BEST PRACTICES FOR PRESENTING VR EXPERIENCES IN A TRAVELLING EXHIBITION

Most people have not had a VR experience and are not familiar with what to expect in a headset so it is necessary for museums and cultural organisations to establish a procedure to onboard and offboard visitors.

- This means having staff members to:
 - onboard visitors by describing what they will experience and answer any questions they have before putting on the headset;
 - help them put on the headset so that it fits correctly and comfortably;
 - show visitors how to use any controls if they are needed and explain how to interact with the experience;
 - answer questions from visitors after they've had the experience;
 - keep the devices fully charged and are properly stored between use;
 - now that Covid19 is with us for the foreseeable future, it will be essential to provide disposable face masks for each visitor, to thoroughly clean headsets and hand controls after each use, and provide hand sanitizer to visitors after their experience. New decontaminating box technology such as [CleanBox](#) is an effective way to do this.
- It means putting a procedure in place to minimize the time people have to wait in line to have the experience, for example by having visitors book a specific time in advance of their arrival in the exhibition.
- It also means having enough space for swivel seating for seated experiences so that people can take advantage of the 360° imagery.
- In a room scale experience the visitor will see a “guardian” in the headset, a 360° perimeter grid that warns her when she is about to step beyond the boundaries of virtual world. However, in the real world, where visitors are on their feet, physically walking through space just as they are virtually walking through space, there has to be enough room for them to move around safely, without banging into walls, objects or other people.
- If the content is potentially disturbing or very emotional it will also be important to help visitors transition from the VR story back to the real environment.
- It's also nice to provide a safe place where visitors can drop their bags while engaged in the VR.

A GUIDE TO STORYTELLING IN VR

MediaCombo's Guide to Creating Compelling Stories in VR

By Robin White and Michael Owen

There are five main components to consider: Narrative, Environment, Cognitive impact, Social Impact and Technology.

Narrative Considerations

- Plot, narrative arc, and characters that elicit emotions from viewers, are basic elements of storytelling, and are as important in VR as any other medium.
- Virtual Reality provides the opportunity to tell a story where things are happening in 360° around the person in the headset, not just in front of them. This immersive quality is what makes the medium so powerful. But most viewers are not used to following a story in the round so the user experience design (UX) needs to provide guidance about where to look and what to pay attention to.
- UX should also draw the viewers' attention to the important objects and story points, so they spend less energy constructing the story and more energy receiving it.
- If your story can't take advantage of the 360° world then don't use VR.

Environment (created with visuals and sound)

- Whether the world is 360° video or computer generated there will be a lot to see outside a viewer's field of view. Give them time to look around at their surroundings and explore before the story really gets underway.
- Fictional worlds created with computer graphics don't have to be visually perfect to feel real. The human brain can fill in a lot of details if the story and characters are well developed.
- Audio is important, for many reasons. It can be used to cue viewers when to turn their gaze away from what's directly in front of them, so they don't miss what's going on behind or beside them. It also enhances the feeling of being in a real space, since sounds are all around us in real life.

Cognitive Concerns

- Viewers will automatically adopt a role because they are inside an experience. They may only be observers, or you may assign them a specific role. You can hint at this showing arms or legs that signal who they are, or place them in something like a cockpit or a wheelchair or whatever is appropriate to their character. There are different ways to do this but the more the viewer feels connected to the action, the stronger the impact of the story will be, regardless of whether you're producing a social impact documentary or creating a fictional world.
- Producers have a responsibility to convey that an immersive virtual experience can feel like it's really happening, and thus take care to warn users about violent or emotionally charged situations before they put a headset on.

Social Impact

- With documentary or social impact VR, it's important to remind visitors that the VR headset is serving as a proxy. The virtual experience is not the same as the real thing.
- Yet it can still inspire users to take action in the real world to address the issues.
- Pre- and post-experience guidance is advisable. Visitors often want to talk about the visceral scene they've witnessed, to share their reactions, ask questions, process their feelings.

Technology

- The ultimate VR experience occurs when the user can physically move about in a virtual environment composed of computer-generated imagery (CGI). This is known as a room scale experience and requires a VR headset that provides 6DOF (Degrees of Freedom), the ability for the user to move forward, backward, left and right, up and down in the virtual space mirroring movement in the physical space. This requires tracking devices that can tell where the headset is and what the viewer is looking at. As of June 2020, the Oculus Quest is the only headset that offers inside out tracking for a 6DOF experience without a cable or "tether" to a computer with a powerful graphics card. There also headsets such as the Oculus Rift S, the HTC Vive, and the Varjo that can deliver better quality visuals but they all must be tethered, to an external computer.
- Projects that are composed of 360° video footage, rather than CGI worlds can be viewed in 3DOF headsets. These offer the ability look up, down and around 360° but from a single point. Even though the visitor can't move through the virtual space, they can still have an extremely immersive seated or standing experience.
- You can also make your content directly available to visitors on their own devices to be viewed with Google Cardboard, either via YouTube 360° or an app downloaded from app stores.

TECHNICAL REPORT

A description of design paradigms, production methods and virtual reality headsets.

Three VR Design Paradigms

VR experiences can take one of three forms. One is where the person is physically seated and stationary and has no agency to move about in virtual space, as in the *Library of Congress* program described below.

The second type is where the person is physically seated and stationary but has the option to move around in virtual space using a controller. [We Are Nature](#), and *Michelangelo's Sistine Chapel in VR*, described in the article, are examples.

The third type is “room-scale” VR, where the person can move about in real physical space and simultaneously experience that movement mirrored in the VR environment, like in the [Anne Frank House VR](#) and [Modigliani VR: the Ochre Studio](#) experiences. Room-scale VR is only possible in programs produced using photogrammetry or 3D computer animation. It can only be fully experienced in headsets that provide 6 Degrees Of Freedom (6DOF), which permits the person to move forward, backward, left and right, up and down in virtual space as they do in real space.

Virtual Reality Production Methods

The term virtual reality can be loosely defined to cover several different production methods and experiences where visuals entirely surround the user, entirely replacing the real-world environment with the virtual one.

360° Still Images in a 2D World

The most basic type includes a 2D 360° still image or series of images that can be viewed in a head mounted display (HMD) or on Youtube. This 360° tour of the [Library of Congress](#) is an example. Here the visitor is taken on a narrated tour of the building, but has no agency to move through the space, from room to room independently.

360° Still Images in a 3D World

[We Are Nature](#), mentioned in the article, is also a sequence of 360° still images, but in this program the stills have been stitched together and uploaded into Unity, a 3D game engine software. This software allows the stitched together 2D still images to appear as a 3D world you can move through. Visitors have the ability to transport/teleport themselves around the galleries in any direction. They can also explore the many Points of Interest: text, audio narration, videos and simple interactives.

360° Video Images

Many travelogue VR experiences are simply enjoyable 3D 360° videos. Viewers can look around each scene from a stationary position but cannot move within the scene. [Lake Baikal: The Science and Spirituality of Extreme Water](#), for example, includes seven short vignettes, shot with a custom designed 13 go-pro camera rig, but today the Insta-pro 360° camera is one of the most popular systems to use, for shooting video or stills for an immersive experience. 360° video can be used to

create indoor and outdoor experiences. [The Antarctica Experience](#) is another example of this type or production.

Photogrammetry

Here is where the full potential of virtual reality comes into play. [Anne Frank House VR](#) and [Modigliani VR: The Ochre Atelier](#) are examples of this type of storytelling production. With photogrammetry a space is scanned to capture both depth and visual information. There are several ways to do this but all produce a large amount of volumetric and visual data that must be processed to create a virtual model of the real-world space. Once that is done, the resulting asset can be loaded into a 3D development platform or game engine like Unity or Unreal. Developers can then manipulate the virtual model's appearance and how users interact with it. This includes the size of the virtual space: will it appear life-sized or like a doll house? How the virtual visitor moves around the model. They can add digital signage, interpretive audio or video. The Modigliani Studio VR experience is a beautiful example of how interpretive content can be embedded in a virtual space.

Computer Generated Imagery (CGI)

Computer generated imagery can be either static or dynamic. Computer animation is the process used for digitally generating animated images. [Dear Angelica](#) is an award-winning example of this type of VR experience. Drawing programs such as Google's Tiltbrush or Oculus' [Quill](#) can be used to produce 3D animated programs, immersing the visitor in imaginary worlds of unlimited dimension.

For further reading, here is a comprehensive, somewhat technical [glossary from Unity VR](#) with definitions of commonly used terms in VR/AR/MR production.

Head Mounted Displays

There are three types of head mounted displays (HMDs) for viewing virtual reality:

- Viewers that use mobile phones: Google Cardboard, Samsung Gear VR. Google Cardboards are very popular in schools because students can use their own devices with these viewing devices to access content. These work with 360° still images only.
- Stand-alone mobile headsets: Oculus Go and Oculus Quest: These HMDs access content through a tiny computer built into the headset and they come with hand controllers to permit users to navigate through space. The Go is a 3DOF (Degrees Of Freedom) headset offering a seated experience and a limited range of motion. The Quest offers higher screen resolution and full 6DOF motion, allowing visitors to move forward & backward, left and right, and up and down for room scale experiences.
- Tethered headsets: Oculus Rift S, HTC Vive and Vive PRO, Varjo: These headsets offer the highest resolution experience because they must be connected to a powerful PC to access content. All four provide dynamic 6DOF room scale experiences. The Vive PRO also adds high quality built-in headphones to hear the 3D spatial sound design while other models require users to provide their own headphones. For more detailed information, prepared by my colleague Elena Pessina, read on.

Virtual Reality Head Sets (Head Mounted Displays – HMDs), May 26, 2020

With recent advances in Virtual Reality, several Head-Mounted Devices (HMDs) have been released on the market, featuring different characteristics.

The Oculus Go (\$149 for 32GB, 159€) is pricier than mobile headsets but unlike those, you don't need a compatible mobile as the computer is already in the device. As it is wireless, users can move freely around and use an intuitive and simple controller. However, it offers only 3DOF motion tracking, unlike the Oculus Quest (\$399 for 64GB, 449€), which offers full 6DOF motion tracking with dual motion controls and a more powerful processor and a sharper screen. This device is one of the best options of standalone headsets for price and quality of vision, that provide room-scale VR experiences. However, these two headsets are limited to the Oculus' mobile software store, so they don't have the same selection of experiences as the PC-based Oculus Rift S (\$399, 449€) and its much bigger Oculus Store. Rift S it's more limited in terms of freedom of movement than the wireless Oculus Quest, but it provides more detailed and dynamic experiences, even if it requires a gaming PC to work well. However, another pro is that it doesn't need external tracking stations, as the HTC Vive does.

Another standalone headset is Pico G2 (\$299, 300€), which allows users a 3DOF motion tracking with a crystal clear visual and user-friendly lightweight design, perfect for educational applications or panorama experiences. It also has the hands-free control option that enables easy "look and choose" selection. The advanced series, Pico Neo (\$749, is completed with two controllers and two mono fisheye cameras on the front, like HTC Vive Pro. Compared with PicoG2, the headset allows more freedom with inside-out room-scale 6DoF tracking as well as a high performance computing platform.

Vive is one of the best headsets on the market. The package (\$499 one year ago...- can't see it anymore on their US official website, 599€) includes two motion controllers, and two base stations for setting a room-scale VR area that can track your movements in a 10-foot cube (approximately 3.5m x 3.5m). The Vive PRO headsets feature also a front-facing camera that allows users to have a glimpse of the real world while playing. However, as a PC-tethered VR system, it requires a powerful computer, with HTC recommending at least an Intel Core i5-4590 CPU and a GeForce GTX 970 GPU.

The recently released Vive Cosmos at \$699 has a much higher resolution than the Vive and outward-facing cameras that can track your position without any need for base stations.

Another powerful PC-tethered headset is the Varjo VR-2 (the least expensive is \$4995 and 4995€ - same price for both currencies), mostly used in industrial businesses. Its most promising feature is the human eye-resolution which provides excellent quality of vision, and the integrated eye-tracking. Users can look around in photo-realistic environments just like they would in real life, capturing details as they come closer to 3D objects. There's also a Leap-Motion equipped VR-2 Pro (\$5,995, 5995€) model that tracks users' hands, allowing them to manipulate virtual objects in the onscreen environment.

CONCLUSION

VR is an entirely new way to deeply engage visitors in exhibition content. It augments traditional approaches to exhibition design and can provide fresh insights and new perspectives on the subject and story of an exhibition. As people become more familiar with using VR in a variety of contexts, they will be eager to know how exhibitions are enhanced by that sense of “presence” VR provides. Furthermore, since the arrival of Covid19 there is great uncertainty around how and when crowds will be gathering again in public spaces such as museums. Virtual reality exhibitions, or versions of an exhibition, or signature VR components of an exhibition will certainly be important possibilities to explore as ways to enhance travelling experiences in a Covid-conscious environment.

Robin White, President of [MediaCombo](#)

SOURCES AND USEFUL LINKS

Exhibitions and experiences mentioned

IL DIVINO: Michelangelo's Sistine Chapel in VR

https://store.steampowered.com/app/1165850/IL_DIVINO_Michelangelos_Sistine_Ceiling_in_VR

We Are Nature

<https://www.oculus.com/experiences/go/2072766929487859/>

Modigliani VR: The Ochre Atelier

<https://www.tate.org.uk/whats-on/tate-modern/exhibition/modigliani/modigliani-vr-ochre-atelier>

Beyond Human Limits

<https://www.teo-exhibitions.com/touring-exhibitions/exhibition/beyond-human-limits/>

Samskara

<https://www.teo-exhibitions.com/touring-exhibitions/exhibition/samskara/>

Anne Frank House in VR

https://www.oculus.com/experiences/go/1596151970428159/?locale=en_US

Claude Monet, The Immersive Experience

<https://www.expo-monet.be/en/about/>

Library of Congress

<https://www.youtube.com/watch?v=khRb3Y72fA8>

Lake Baikal: The Science and Spirituality of Extreme Water

<http://baikalvr.mediacombo.net/>

The Antarctica Experience

Dear Angelica

<https://www.oculus.com/story-studio/blog/beyond-animation-dear-angelica-premieres-at-sundance/>

Further reading

<https://mediakwest.com/realiser-premier-film-vr/>