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360° vision, from panoramas to VR

Laurent Lescop

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Envisioning Architecture

SPACE / TIME / MEANING

ENVISIONING ARCHITECTURE: SPACE / TIME / MEANING

The Proceedings of the 13th Biennial International Conference
of the European Architectural Envisioning Association
at the Glasgow School of Art, 2017

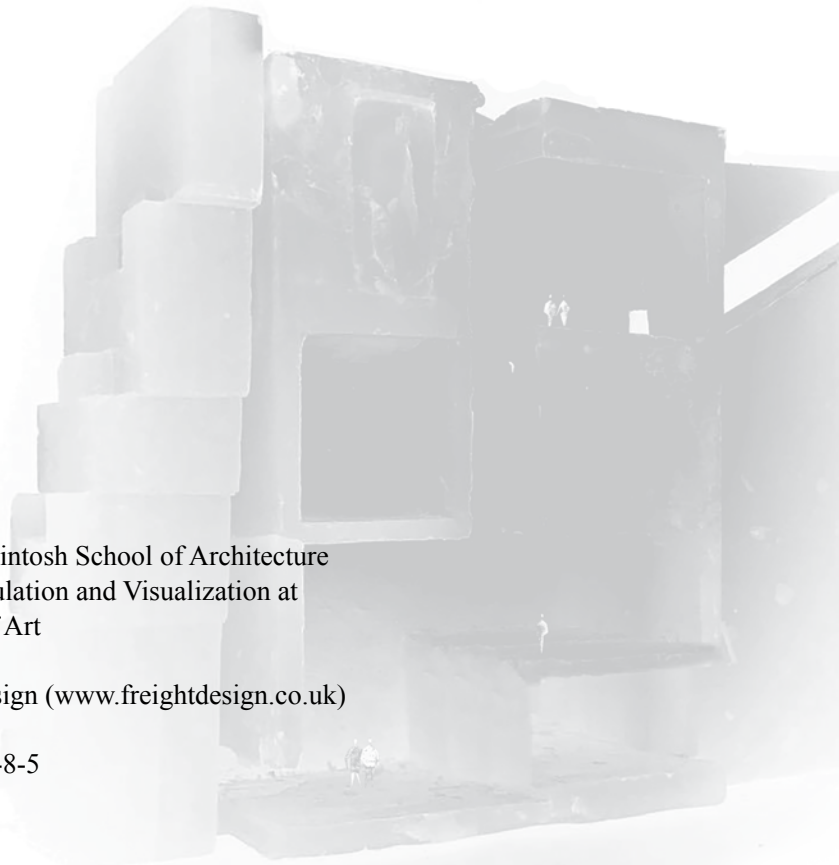
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360° vision, from panoramas to VR

Introduction

With a £5 Google Cardboard and a cell phone, everyone can live a 360° immersive experience. Youtube provides a huge amount of content, professional or private. Blockbusters like Starwars, groups like Gorillaz post their latest film in 360 Vr format to literally plunge the audience into their worlds of images and sounds. 360° photos are now accessible with a single click at a reasonable price. In museums like Stonehenge or Museums Victoria in Melbourne, cylinder screens offer a collective experience, with a one to one scaled image.

What seems to be a state of the art technology is in fact 230 years old. Everything started in 1787 in Edinburgh when Robert Barker (1739/1806) painted the first panorama. Barker did not just invent the 360° image, but also the scenography that makes the illusion perfect. The first patent was granted by American engineer Robert Fulton (1765/1815) in 1799¹. It refers to “a circular picture without boundaries” but also describes the architecture, the position of the viewers, the way to get in and out. Between the end of the 18th century and the beginning of the 20th, panoramas were very successful and huge buildings were made such as the London Colosseum built in 1827 or the Hittorff’s “*Rotonde des panoramas pour les Champs-Élysées*” in 1842. The London Colosseum was also stated as a landmark and a belvedere.

It is a common thought that cinema killed panoramas. It is partially true. At the dawn of the 20th century, most panoramas closed, were destroyed or transformed. The memory of their greatness faded away. A very few remained until a late rebirth with digital techniques. But in fact, the idea of an immersive panoramic view has still being developed and improve over time. The Oculus Rift or HTC Vive can be considered of the heirs of panoramas. In the article, we will follow those evolutions and transformations from panoramas to VR.

Two legacies: landscape painting and theatre.

Barker’s panorama is a milestone in the history of representation and is the synthesis of two important evolutions: landscape painting and renaissance theatre. In painting, the landscape went from background to the main subject mainly with

¹ Philip, Cynthia, *Robert Fulton: A Biography*, iUniverse, 2003

what is now called the Dutch Golden Age (17th century). Painters like Jan van Goyen introduced the “*tonal*” style picturing wide cloudy skies, windy atmosphere, and contrasted lights. The first Dutch paintings were quite small, but canvas became wider and wider when entering the 18th then the 19th century. Besides the artistic exploration of the landscape, started in France a topographic investigation with the Cassini family. Panoramic views were then tested with topography to give a synoptic representation of a map and the landscape around. Horace Benedict de Saussure drew a circular view from the summit of the Glacier de Buet in 1776 with a map in the middle. This image foreshadows the so-called “*little planet*” that we do now with a 360 camera. Panoramic views were also used for military purposes, very much like a 3D map. In 1915, Henry Valensy drew the panorama of the Dardanelles in two versions, a water coloured and inked version with comments. The two maps, used together, strongly recall digital maps services that we are using nowadays with a coloured satellite view and a raster view with texts.



Fig. 01. Panorama section

Source: Laurent Lescop

The second evolution came with theatre. The renaissance theatre is designed for a focused view toward the stage. The illusion of a vaster space is created by the perspective and the combination of layers with real objects in the foreground and painted scenery in the background. In the 19th century, many novelties will push creators to break this system: the photography, the lighting devices (using gas then electricity), the belvedere as a 360° point of view and new tricks to mimic reality. Swiss architect Adolphe Appia (1862/1928) revolutionised scenography by bringing new concepts to scene design and stage lighting. For him, space is not necessarily defined by an orthonormal basis for a homogeneous space but can also be thought as a lightscape. This breakthrough opened new concepts such as the “Total Theatre” (1925) led by Walter Gropius (1883/1969).

As well as for painting or theatre, the question moved from the illusion of a three-D image to the illusion to be *in* the image. Hans Belting (1935-) explains that the way we understand the three-dimensional space is purely occidental and when the first explorers arrived in Japan and showed Japanese our perspective images, those images were recognised as flat sculptures. It is because Japanese were looking their images

lying on a table as we look ours hung on walls. For Japanese, those hung pictures are *kubomi-e*: hollow concave picture. Both perspective images and renaissance theatre use the same principles to describe a narrative space: first, a perspective which constraints the position of the viewer and the direction of the look. Second, is what Josef Svoboda (1920/2002) called the watershed, meaning an invisible frontier between fiction and reality. For paintings, this watershed is bordered by the frame, the image is being considered as a window. In theatre, the watershed is the limit of the stage.

To bring the best illusion of immersion, panoramas will try to break those two principles. By offering a 360 circular picture, it will not possible to focus on one direction, the look will fly from one point to another, the body will be forced to move, to turn round. By adding a “*faux terrain*” between the circular image and the viewer, the watershed will be blurred. It will be difficult to know precisely if the spectator is already in the narrative space or very close to it, but outside.

An architecture of illusion

Most comments on panoramas focus on the image. But the illusion of being immersed is based on the design of the building, the way to get in, to discover the circular image and to get back to reality. We’ve got a very nice description of the program in Bapst’s “*Essai sur l’Histoire des panoramas et de dioramas*” (1891). Germain Bapst (1853/1921) is a member of many committees in the fields of art applied to industry. His essay is a very detailed description of a regular panorama where he emphasise the issues of the structure, the light and the how the public will experiment the illusion. He indicates that the spectator, placed in the centre of the structure, should be able to see the painting wherever he could look. It is also important that no real objects should be seen in order to make comparisons in terms of nature or scale of the painted image. Bapst also specifies that with a 15m high image, the natural light hits the upper part of the painting giving a more natural effect.

We also have a very detailed description by Hittorff, the master of panoramas in the 19th century. Jacques Ignace Hittorff (1792/1867) is a French architect renown for the construction of the Gare du Nord and the Cirque d’Hiver (“Winter Circus”) in Paris. Hittorff gave a very detailed depiction of a panorama in his essay called: “*Description de la Rotonde des panoramas élevée dans les Champs-Élysées*” (1842). The architect gives 5 imperative rules to obtain good results: the access has to be a dark corridor, mysteriously leading to the central part of the rotunda. The platform should reveal the entire circular image. The cone of vision should be 43°, for the reason that, according to Hittorff, it corresponds to the natural vision. A drop ceiling system channels the look. Last rule, a *faux-terrain* creates a connection and a visual continuity from the platform to the image.

As the circular painting is naturally lit, the size, position, and structure of the opening are very important. Hittorff indicates that in London, as glasses are not frosted, the structure of the roof shadows the painting, the illusion is not perfect. Another problem with natural light is the colorimetry. Blue skies provide powerful cold tints but reduce the impact of warm tonalities, colour intensity ratios cannot be preserved.

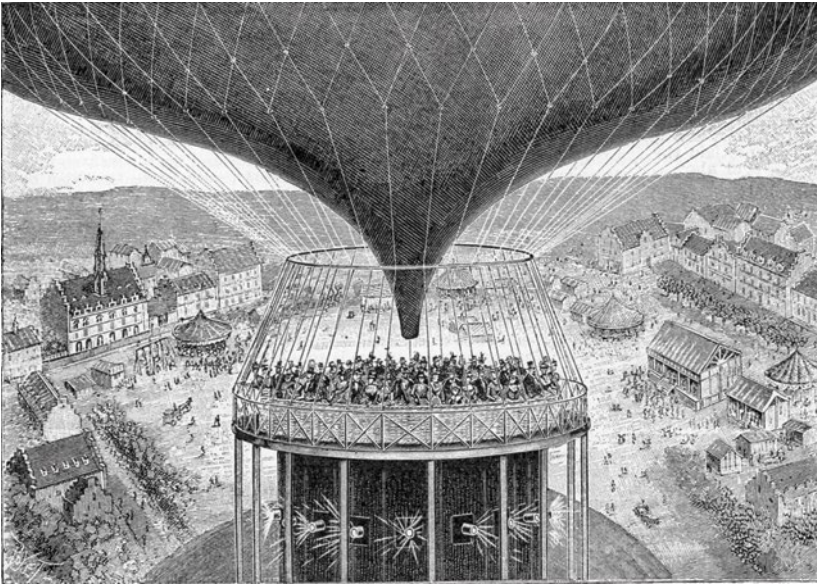


Fig. 02. The Cinéorama at the Exposition Universelle de Paris in 1900.

Source: *Scientific American* September 1st 1900

Technics of illusion

Many improvements were added to panoramas. The platform previously designed as a balcony then became a real ship's deck for the "Vengeur" panorama in 1892. As soon as photography was invented, it was seized by the panorama. The Lumiere brothers (Auguste 1862/1954, Louis 1864/1948) granted a patent for 360° photo on a single plate in 1900. The panoramic camera is called Periphote and the projector Photorama. The device allows projecting a 6m high image! The same year, Raoul Grimoin—Sanson (1860/1941) imagined a virtual balloon ride the Cineorama. Ten simultaneous projectors created a 360 moving image of an ascension while the public stood in a basket. Despite a very promising and spectacular invention, the attraction had to close because of fire issues. The 1900 International Exhibition in Paris saw many panoramas and two other impressive immersive attractions: the Hugo d'Alesi's Mareorama simulated a cruise on a huge ship. Two paintings of 750m long and 13m high each depicted the landscape and the story line. The trans-Siberian panorama suggested sitting in a real waggon mimicking the movement of a real moving train. Pictures painted by P. Piassetkiy gave the illusion of travelling through the beautiful Siberian landscape.

The next attempt to creating an immersive cinema screen came Abel Gance's *Napoleon*, created in 1927. This film actually contains only a single sequence projected onto three screens. It has been abandoned due to the difficulty to synchronise the three screens. Then Disney in its amusement parks recreated a kind of rotunda for a 360 vision experience: the Circarama. The Polyvision system, developed by Emile Vuillermoz relying on the 4:1 "format", then again, proved too complicated to put

into place and maintain. Once more it was finally abandoned. Several multi—screen projects were developed like the Vitarama (1939, eleven cameras), the Cinerama (1952, three cameras), the Circlorama (1958, eleven cameras), the Hexiplex (1992, six cameras). Much more can be listed, none of them really did a breakthrough.

An important point is the addition of the sound, of movements, light effects, sometimes even wind and smells as is the case for the Mareorama. Why? In cinema, everything outside the frame is imagined by the audience. The narration is a game where the author gives partial elements and let the spectator imagining the missing parts. The sound helps to complete the world that is depicted. In a panoramic image, there is no off-screen, everything is visible from a certain position. Some say sometimes that there is no point of view. But this is not correct. It is obviously a dominating spot for a synoptic view, a god's view. As long as the image remains flat, the watershed is not visually crossed. Sounds smells, the wind brings the illusion that part of the body is already in the narrative world.

The three movements of immersion.

We saw with those seminal examples that immersion the result of an arrangement and a device. The arrangement refers to the architecture and the scenography and the device is the technology used to create the illusion. The immersion is the feeling of being in the narrative space. Panoramas and then Gropius' *Total Theater*, followed 50 years later by Poliéri with a project like the "*Théâtre du Mouvement Total*" in Osaka, Japan in 1970, try to rip the spectator out of his world to dive him into a fictional world. Today, with digital technics, it seems easier to fool the spectator with a realistic 3D image, a 3D sound, and haptic devices. If it's true it's not that only.

We can describe immersion with three interrelating modalities: envelopment, saturation, and participation.

Envelopment

We saw that Barker invented the first panorama with this idea of literally wrapping the spectator into a unique image conferring the illusion of being on a belvedere. Louis-Jacques Mandé Daguerre (1787/1851) adds light and sound effects and earn enough money to develop his personal project: the photography. But it won't be Daguerre who will replace the panoramic painting with photographs. This step is made by Joseph-Philibert Girault de Prangey (1804/1892) with a view of Rome in 1842. One the first digital device is the *Hemispherium* (1999) but we can suspect the army or Nasa to have their own. The envelopment is improved by replacing a cylinder by a hemisphere. The *Satosphère* or *Sensorium* is one of the state of the art system to provide a fully immersive experience.

Saturation

Envelopment with image and sound may not be enough as it may be needed to focalise all spectator's attention. In fact, the best would to be stunned, when all senses are overwhelmed by the perceptual influx. In that case, the immersion a total because no exterior sensorial information can reach the spectator. It's what is expected in funfair

parks or even in cinema with a wide picture and a very loud sound. In 1961, Morton Heilig (1926/1997) granted a patent for a *Sensorama*, an immersive device with 3D wide vision, motion, colour, stereo sound, aromas, wind, and vibrations. Enclosed in the cabin, the user is totally isolated from the exterior world and his sensory system fully solicited by the device. Heilig has been rediscovered as a precursor of many actual devices. For instance, the “Stereoscopic-Television Apparatus For Individual Use” (1960) seems to be a mock-up of the Oculus Rift. Less technological, but no less impressive, we could consider that James Turrell’s perceptual cells also saturate our perception with a full coloured universe.

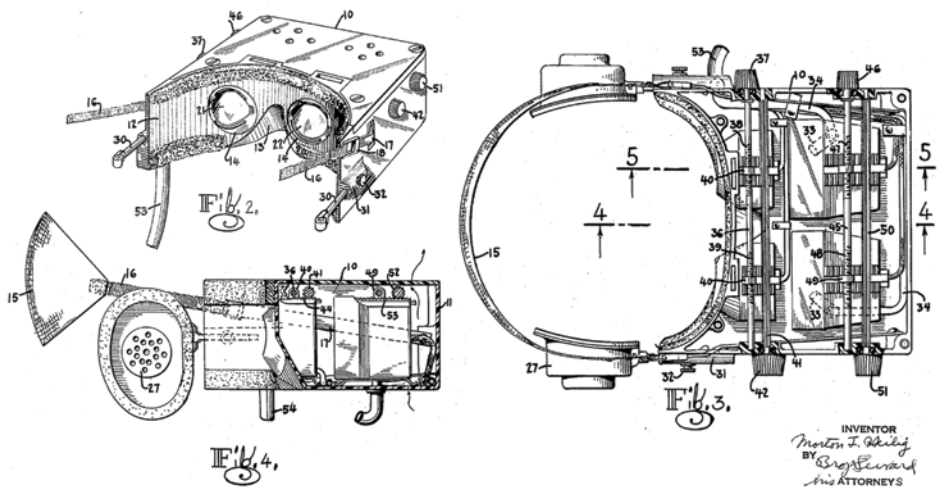


Fig. 03. Morton Heilig, Telesphere Mask, 1960,

Source: Wikimedia Commons

Participation

Interacting is the best way to believe that the watershed has been traversed. Interacting with a narrative world give the feeling that we are part of it. That is what happens in video games for instance. A gaming peripheral as body prosthesis to listen and talk, fill vibrations, activate or move; until now, a very few peripheral exist to smell or to touch. In professional simulators, to train pilots or surgeons, the entire environment is recreated in order to facilitate the immersion.

More interesting are the alternate reality game where the narrative world is the real world. In early 2000, a 3D virtual universe like “Second Life” (Linden Lab 1999-2003) appeared to be the paragon of immersion. In 2007, despite a huge buzz, Second Life, version one or two, lost any interest on earth, virtual spaces are so empty that, there are some virtual explorations of that deserted world. Now the real immersion is in our reality. With a smartphone and a specific app, it’s very easy to track a hidden world only visible through the screen. In “*Occupation Forces*”, it has been possible to see clandestine aliens in Boston. In 2013 a game goes further. All cities are a battleground opposing the Enlightened or the Resistance in Ingress (*Niantic Labs, 2013*) which is a

“location-based, augmented reality mobile game”. With the same technology, Niantic published a bit later “*Endgame: Proving Ground*” and then achieve the big hit with Pokémon GO in 2015.

In Pokémon GO the players must catch virtual creatures revealed in augmented reality through a smartphone. This innocent quest transformed the reality. Many places are now forbidden to the gamers, inattentive driving is now detected by the game warning the players. Massive gathering in some location transform neighbourhoods’ life and rhythm. Forbidden or secret places become suddenly famous and populated.



Fig. 04. virtual panoramas

Source: Laurent Lescop

AR, VR, virtual panoramas

Two competing technologies are now on the market. AR, Augmented Reality and VR, Virtual Reality. AR appears to be more promising. Even with a massive advertising, VR projects hardly find users and clients: basic equipment remains expensive, as it’s not a mask, but a powerful computer, joypads and a large spare place for the HTC Vive. Virtual reality sickness is also one big issue. In the end, major success comes with the Samsung Gear VR or the Google cardboard. In those systems, a regular telephone powers the applications, it is light, costless and easy to use, but, it has no tracking system. It means that the virtual image won’t follow the user’s moves. In the end, explorations are made from rotating chairs, discovering virtual panoramas.

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The papers – in approximate equal numbers from Europe, North America and Japan, offer an eclectic representation of the variety of ways in which we envision architecture and its related disciplines, from analogue to digital. No attempt has been made to classify them – rather they are presented as they were received, to stimulate diversity, cross-reference, comparison and inspiration.

Enjoy the publication and look out for the 2019 Conference at eae.net.wixsite.com/eaea.

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