

ALBERTI'S WINDOW v2.0: A VISION MACHINE FOR EXPANDED SPACES OF REPRESENTATION.

Volker Kuchelmeister, College of Fine Arts, iCinema Centre for Interactive Cinema Research, University of New South Wales, Sydney, Australia.
Email: <kuchel@unsw.edu.au>

Abstract

Alberti's Window v2.0 is a novel interactive cinema platform for the expression of stereoscopic 3D panoramic and multi-viewpoint spaces of representation, in which participants embark on an embodied journey of discovery. In this paper, the author outlines the conceptual and technical framework, exemplified through a work specifically made for this platform, the interactive cinema project *Juxtaposition*. An introduction to the history of immersive imaging, presentation modalities and innovators contextualises this work within the wider field.

Keywords: interactive cinema, expanded cinema, panorama, immersion, narrative space.

Introduction

Since Leon Battista Alberti's first scientific study on perspective as an instrument of artistic and architectural representation [1], the term 'Alberti's Window' has become a metaphor for linear perspective. Version 2.0 is an interpretation and extension of the conceptual 'window to the outside'. It utilises modern technology and digital imaging to create a vision-machine, which allows for: the spatial correspondence between the real and the representational space, the expansion of the perspectival model, and an interactive experience where participants embark on an embodied journey of discovery.

Panoramic, Multi-viewpoint and Stereoscopic 3D Representation

Panoramic and multi-viewpoint representation have a long tradition in the arts, from Zhang Zeduan's twelfth century depiction *Along the River During Qingming Festival* to the large-scale painted panoramas in the eighteenth and nineteenth centuries.



Fig. 1. Example of multi-viewpoint representation, generated with slit-scan extraction (© Volker Kuchelmeister)

With the emergence of photography and later digital imaging, panorama photography is now widely adopted. Modern digital cameras are now capable of stitching panoramic images from multiple source images within the camera's processing unit.

Artists working in traditional media rarely use strict linear perspective. The ability to control and manipulate perspective in an image allows the artist to explore a broader range of expression. Projection models that go beyond linear perspective can be a useful tool to alter a viewer's perception of a scene, and to manipulate spatial relationships within it.

By constructing a picture in central perspective, in which the orthogonal lines converge at the vanishing point, there is theoretically only a single point of view from which the perspective is perceived as correct. Outside this 'sweet spot' the picture appears to be distorted, as the converging lines are outside the observer's line of sight.

This exclusivity to a single observer is overcome in the panoramic image. As Ottermann [2] put it, the panorama constituted a more 'democratic perspective', as it allows multiple viewers to observe the image at any given moment. This might be one of the reasons why the panorama quickly gained popularity in the nineteenth century, and is still en vogue today. Massumi [3] noted: "The painted panorama liberated the horizon line".

It is important to note the difference between cylindrical-panoramic and multi-viewpoint [Fig.1] representation. The panoramic (or cylindrical) projection can incorporate an up to 360-degree horizontal field of view, and is usually constructed by stitching multiple images captured from a panning camera. A multi-viewpoint scene, on the other hand, is generated from a collection of photographs or video of a roughly planar scene, such as a landscape or city street. After processing, the horizontal field of view is only limited by the number of images, and not by the projection geometry; it can extend into infinity.

Stereoscopic 3D imaging offers another expanded model of representation; here the image is transformed into a volume, and the screen frame into a window. Stereoscopic depth perception is based on the principle of binocular vision, and the cognitive process of stereopsis, in which the brain estimates depth within the visual field based on the disparity of two slightly dissimilar images presented to the visual cortexes by both eyes.

Working with depth in stereoscopic 3D imaging is technically challenging, but more importantly, it is a creative choice. Not unlike framing a shot, in 3D a scene can be shaped to appear shallow or deep, and an object can extend beyond the screen plane to share the space with an observer. The screen or projection plane forms the link between the virtual, stereoscopic world and the environment in which the images are viewed.

Presentation Modalities

In 1787, Robert Barker was granted a patent 'La Nature à Coup d' Oeil', in which a panoramic view could be depicted on a 360-degree circular canvas in correct perspective, and perceived as undistorted for an audience located in its centre. In 1793, he opened the London Leicester Square Panorama, a circular building designed to exhibit these large-scale panoramic paintings. This spectacular immersive visual entertainment flourished throughout the nineteenth century, making it a mass medium [Fig. 2].

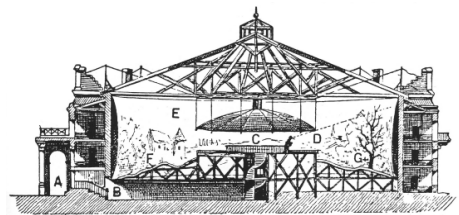


Fig. 2. Cross-section of a panorama with a faux terrain, 1790.

Digital versions of the panorama are now established as immersive 360-degree cylindrical projection environments, some able to present in stereoscopic 3D, such as the *AVIE* (Advanced Visualisation and Interaction Environment) [4] [Fig. 3].

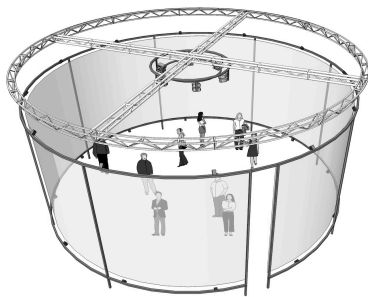


Fig. 3. Illustration of AVIE (Advanced Visualisation and Interaction Environment) at the iCinema Centre for Interactive Cinema Research, UNSW Sydney.

Another form of pre-cinema entertainment was the moving panorama for multi-viewpoint representation. In 1840, John Banvard started to work on a large-scale painting of a journey on the Mississippi river, which depicted a continuous view of the scenery. In its final stage, this painting measured 3.6m high and 800m long. In the moving panorama, the long strip of canvas was wound between two vertical rollers and unrolled before an audience, accompanied by a narrator describing the scenes [Fig. 4]. The moving panorama quickly established itself as a popular spectacle, particularly as an itinerant medium outside the cities.



Fig. 4. Illustration of a moving panorama apparatus, John Banvard, 1848. The long strip of painted canvas was mechanically unrolled with the help of a crank handle.

Huhtamo [5] notes “Circular Panoramas emphasized immersion into a place or event, while moving panoramas relied more on narration and combination of different means of expression.”

Expanded cinema applications, or the elimination of the frame

In film and television, with its constraints of standardised spatial formats, the viewer is always looking through the eye of the camera into the narrative world that unfolds within the frame. Even as the image in the window is moving, it is clear that it is the director and editor who control the movement on screen, while the audience is restricted to passive consumption of the medium. Friedberg [6] described “... the paradox of the mobility of the image versus the immobility of the spectator”.

Today, we have control over what we view on a television set and can change channels whenever we want, but this does not allow us to change the point of view or take on an alternative perspective. And by looking beyond the frame, the surrounding reality always contradicts the depiction on screen, one reason why cinema theatres are kept dark.

In experimental art practices, which work with cinema as a context and frame of reference, the notion of the passive viewer is overcome by either a non-linear narrative model, or more interestingly, an altogether different framework of representational space.

In 1977 Michael Naimark [7] noted: “I began to wonder why movie cameras move and movie projectors do not.” In his work *Displacements* (1980), Naimark placed a 16mm film camera on a motorised turntable, capturing a 360-degree panning shot of a model of an archetypal American livingroom, set up in a gallery space. After filming, the entire room was spray-painted white and the camera replaced with a film-loop projector, projecting the scene back onto the livingroom interior. As the movie frame physically moved across the walls, the images inside the frame stayed stationary, appearing locked in place.

Naimark observed “Just as when audiences of the [sic] Lumiere’s film of an oncoming train ducked in 1895, seeing these unusual forms for the first time caught viewers by surprise.” Today the same principle is applied by artworks mapping digital projection onto building facades.

Another example of practitioners working with the correlation of imagery and representation is the 2004 interactive immersive video installation, *There is still time ... Brother* by NYC experimental theatre company *The Wooster Group*, created in collaboration with Jeffrey Shaw and the author [8] [Fig. 5]. This work is rooted in the recording of a performance developed to be viewed within a 360-degree projection environment. The installation offers the viewer control of a narrative displayed within the video panorama.

Seated on a revolving stool in the center of the space, audience members take turns to control a virtual ‘window’, to highlight discrete aspects of the story. With each viewing, a new cinematic experience is spun out of the choices of the individual audience member.



Fig. 5. Installation view of *There is still time ... Brother*, The Wooster Group, 2008 (© Volker Kuchelmeister)

This model of spatial correspondence between the virtual and the representational space breaks with the paradigm in conventional film and television by substituting the frame with a virtual window, by overcoming the immobility of the spectator, and by challenging the traditional notion of linear narrative.



Fig. 6. Excerpt of image collage created for *Juxtaposition*, here shown in anaglyph 3D (© Volker Kuchelmeister)

Juxtaposition

In the work *Juxtaposition* (Volker Kuchelmeister, 2011-13) [9] and its modalities of representation, the aforementioned perspectival paradigms of stereoscopic 3D panoramic and multi-viewpoint imaging are integrated with the concept of the moving panorama, spatial correspondence between the depicted and the representational space, and Alberti's metaphorical window.

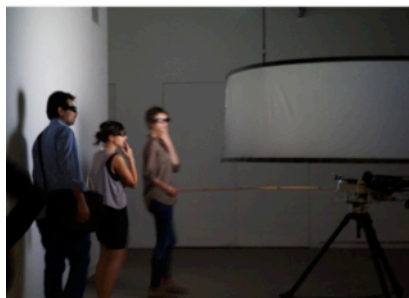
Juxtaposition is an interactive installation that invites its participants to make an embodied journey in a landscape of 3D panoramic photographic scenes. It explores place and representation by interconnecting two radically different environments: the Tasmanian wilderness vs extreme urban development in Hong Kong. The segments link together as a collage of open landscape and dense urban setting, whereas the points of contact are shaped as seamless transitions [Fig. 6].

The outcome is a seemingly endless (80 megapixel) extended image, with its beginning and end connected to form a continuous space of representation. Since the images present no recognisable landmarks, and their spatial order does not follow a rule of progression, the inherent narrative unfolding is subjective and unique to each viewer. It is an exploration and voyage of discovery.

Juxtaposition is presented within a custom-built, 360-degree revolving projection platform [10], comprised of a suspended 2m (diameter) cylindrical rear-projection screen with a rotary projection platform at its centre. The device utilises electrical slip-rings for continuous power supply, a rotary sensor for angular data, and a computer interface. A 3D projector with a wide-angle lens and a Mac Mini is fitted onto the platform [Figs. 7, 8, 9].

The operator manually rotates the platform, and therefore the projected image, following its circular path. This rotation of the virtual viewing window around the panoramic screen continuously reveals new and discrete sections of the image. The spatial correspondence between imagery and the representational space (the angular position of the window) is fixed; the image appears to be stationary. With this tactile and intuitive user interface, a viewer's proprioceptive actions in the real space have direct concurrency with their movements in the virtual space.

The viewer is involved in an immersive process of discovery in which their chosen point of view creates the dramaturgy of the piece, and literally activates the story. Or as Massumi [11] puts it "The viewer is seeing actively ..."



Figs. 7, 8, 9. Custom-built revolving projection platform, illustration (top image) and situated in a gallery (bottom two). (© Volker Kuchelmeister)

Evaluation

Observations of people interacting with *Juxtaposition*, plus a survey conducted during its exhibitions, indicate that utilising stereoscopic 3D imaging in this context challenges a viewer's perception. The virtual window into the 3D world 'behind' the screen surface, or as Friedberg [6] put it "the membrane of where surface meets depth", is no longer a fixed entity but a dynamic frame, in which uncanny interactions occur between the space depicted and the reality of the installation space.

This effect can activate a viewer's sense of balance by gently throwing it off, but at the same time, opening up another layer of interaction and resulting in an impactful embodied experience [Fig.10].

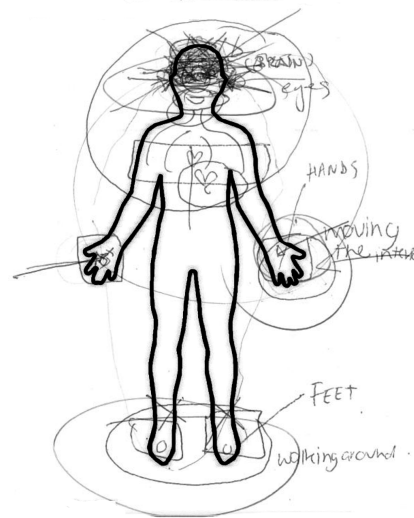


Fig. 10. Embodied experience *Juxtaposition* - result of a survey conducted during exhibition at Screenspace Melbourne, Feb 2013 – image composited from 23 responses to: "Where on your body did you experience the work? Please point/draw to body-parts in the diagram." (© Volker Kuchelmeister)

References and Notes

1. Leon Battista Alberti (1404-72), *De Pictura* (1435).
2. Stephen Oettermann, *The Panorama, History of a Mass Medium* (Zone Books New York, 1997).
3. Brian Massumi, 'PANASCOPIA The Panoramic Photography of Luc Courchesne' (2003), <www.brianmassumi.com/english/essays.html>.
4. Matthew McGinity, Jeffrey Shaw, Volker Kuchelmeister, Ardrian Hardjono and Dennis Del Favero, 'AVIE: A Versatile Multi-User Stereo 360 degree Interactive VR Theatre' (ACM Siggraph, Vol. 25, 2007).
5. Erkki Huhtamo, *Illusions in Motion, Media Archaeology of the Moving Panorama and Related Spectacles* (MIT Press, 2013).
6. Anne Friedberg, *The Virtual Window: From Alberti to Microsoft* (MIT Press, 2006).
7. Michael Naimark, 'Two Unusual Projection Spaces', in *Presence* journal (special issue on Projection), MIT Press, 14.5, October 2005.
8. Volker Kuchelmeister, 'Stereoscopic multi-perspective capture and display in the performing art', in *Stereoscopic Displays and Applications XXII*, Proc. SPIE Vol. 7863 (2011).
9. *Juxtaposition*, Volker Kuchelmeister (2011-13), <http://kuchelmeister.net/prj_juxtaposition.html>.
10. 360-degree revolving projection platform, Volker Kuchelmeister (2013), <http://kuchelmeister.net/prj_turntable.html>.
11. Massumi [3].