Spatial Transfiguration: Anamorphic *Mixed-Reality* in the Virtual Reality Panorama

Abstract

Spatial illusion and immersion was achieved in Renaissance painting through the manipulation of linear perspective's pictorial conventions and painterly technique. The perceptual success of a painted trompe l'œil, its ability to fool the observer into believing they were viewing a real three-dimensional scene, was constrained by the limited immersive capacity of the two-dimensional painted canvas. During the baroque period however, artists began to experiment with the amalgamation of the 'real' space occupied by the observer together with the pictorial space enveloped by the painting's picture plane: real and pictorial space combined into one pictorial composition resulting in a hybridised 'mixed-reality'.[1] Today, the way architects, and designers generally, use the QuickTime Virtual Reality panorama to represent spaces of increasing visual density have much to learn from the way in which Renaissance and baroque artists manipulated the three-dimensional characteristics of the picture plane in order to offer more convincing spatial illusions. This paper outlines the conceptual development of the QuickTime VR panorama by Ken Turkowski and the Apple Advanced Technology Group during the late 1980s. Further, it charts the technical methods of the Virtual Reality panorama's creation in order to reflect upon the VR panorama's geometric construction and range and effectiveness of spatial illusion. Finally, through a brief analysis of Hans Holbein's Ambassadors [1533] and Andrea Pozzo's nave painting in Sant 'Ignazio [1691-94] this paper proposes an alternative conceptual model for the pictorial construction of the VR panorama that is innovatively based upon an anamorphic 'mixed-reality'.

INTRODUCTION

The historical genealogy shared between the VR panorama and the nineteenth-century 'painterly' panorama has been suggested by Art Historian Oliver Grau.[2] According to Grau, Virtual Reality is the latest manifestation in a long history of visuality whose genealogy stretches from the rock-wall painting's of prehistoric man,[3] through the immersive mural and frescoed rooms of sixteenth-century Western society,[4] the *trompe l'œil* images popularised in the seventeenth and eighteenth-centuries, and finally to the relatively recent development of the image-artefacts and technologies of the nineteenth-century, such as the Phenakistiscope, the Zoetrope, the Stereoscope, and finally the 'painterly' panorama of the nineteenth-century.[5] Each of these image artefacts and technologies are a direct result of the cultural context in which they were generated, and each 'scopic' regime as Martin Jay has observed, offering its own construction and re-construction of the viewer's relationship to, and with, the image.[6] The history of visuality is a broad multifaceted terrain that has been directly effected by the changing agency of culture upon the methods and techniques of representation. The intention of this paper however, is not to analyse in depth the complex matrix of agents and effects that have lead to each subject/object construction and re-construction: to do so would involve a far more detailed study than is afforded in the scope of this paper. Rather, this paper aims to outline one emerging dramatic transfiguration in this evolving subject/object relationship, as identified by Grau; the VR panorama.

Although there is a well established history of pictorial construction and composition in Art History, there has not to date been a comprehensive exegesis offered as to the pictorial construction of the VR panorama and its various methods of geometric construction, and ultimately its techniques of spatial immersion. That is to say, the manipulation of the spectator's perception of spatial depth in the VR panorama, their viewpoint, field of view, and most importantly the VR panorama's geometric construction have not been concisely evaluated in order to offer potential alternative conceptualisations of the VR panorama or its application. This paper will outline the conceptual and technical methods of the VR panorama's construction in order to inform a spatial transfiguration of both the geometric character of the VR panorama, moreover the viewer's relationship to the resulting pictorial illusion. Further, this paper attempts to understand how the geometry that is used to construct the VR panorama might be transformed through a reflection of several key paintings in the Renaissance and the baroque. Specifically, Hans Holbein's *Ambassadors* [1533] and Andrea Pozzo's nave painting in *Sant 'Ignazio* [1691-94] will be discussed in

order consider how the geometry of the picture plane in these paintings might offer clues as to how to transform the VR panorama today.

WHAT IS THE VR PANORAMA?

So what exactly is a Virtual Reality panorama, and who uses them? The VR panorama is a radically different kind of photographic image; affording higher levels of interactivity, immersion, spatial illusion, and visual information density then any other available image type today. “By its Greek derivation, it signifies an entire or universal view - that is, a view all around.”[7] The proliferation of digital cameras over the past decade, and the rapid development of associated panoramic software used to extract, manipulate, blend, and stitch digital images into various types of panoramic images, has resulted in the rapid increase in popularity of the VR panorama for both domestic and commercial applications. Almost every digital camera bought within the last decade incorporated rudimentary panoramic stitching software that further amplified its proliferation throughout the domestic market place. These primitive software applications were aimed primarily at the production of extra-wide, ‘landscape’ format images that expanded the image’s size, relative to the observer’s field of view. The panoramic image technology allowed the production of panoramic scenes that could not be photographed in a single shot, directly recalling the compositional effects of the painted Panorama’s popularised throughout Europe in the nineteenth-century.[8] More advanced software gradually began to emerge in the 1990s such as Apple’s QTVR [*QuickTime* Virtual Reality] panoramic stitching software.[9] In its most simplest terms, QTVR allowed the novice photographer a simple, and relatively intuitive tool to combine multiple photographs, shot systematically through 360º, into one immersive and interactive Virtual Reality panoramic image. The release of the *QuickTime* 5.x movie format in the mid-1990s,[10] paralleled with the rapid increase in the processor speed of personal computers resulted in the QTVR panoramic format quickly becoming the standard format for the delivery of web-based VR panoramic content.

The nineteenth-century ‘painterly’ Panorama is conceptually akin to the VR panorama, both in terms of its geometric form and in terms of its conceptual intent. However, both image-technologies share another important cultural characteristic; both have been proactively developed in order to serve a specific cultural activity, that of popular entertainment. Whilst they both provide this primary function, they also simultaneously produce operational by-products whose existence is denied and repressed through its

systematic and deliberate erasure. In the nineteenth-century Panorama the traditional methods of documenting a scene, literally the conventions of perspective applied to recording its pictorial representation, caused dramatic distortions when multiple pictures where brought together in order to create the resulting encircling panoramic picture.[11] The conventional application of perspective in Landscape painting of the nineteenth-century did not adequately allow for the correction of the resultant distortions that occurred when amalgamating multiple images that extended beyond the observer's field of view. Robert Barker, the English artist and entrepreneur, sought to reconcile this technical and conceptual challenge by patenting a procedural method of reconciling this conceptual and technical problem, the *La Nature á Coup d' Œil.*[12] The neologism 'Panorama' emerged through a direct journalistic redefinition of Barker's patent in an article announcement in *The Times*.[13] Barker's method reconciled the deficiencies inherent within the application of 'spherical perspective'[14] to a series of interconnected picture fragments that were brought together to unify the panoramic whole.[15] Similarly, the procedural creation of the VR panorama also yields perspectival distortions between each of the photographs that are procedurally blended to create the resulting VR panorama. In the case of the VR panorama, the potential distortions that result between photographic fragments are potentially the most interesting aspect of the image-technology, and offer the most revealing insights as to alternative conceptual applications of the image-technology. In both instances, in the construction of Barker's panorama in the nineteenth-century, and in the creation of the VR panorama, the pictorial fragments that are used to procedurally create the panorama each yield their own specific perspectival vanishing points or spatial constructions. In both cases the spatial character of each individual image fragment is systematically erased from the final panoramic image. Their own potential generative agency is wholly denied throughout the panorama's conception and construction.

PROCEDURAL BY-PRODUCTS

In order to understand the implications of this erasure, it is necessary to examine in greater detail how the VR panorama is procedurally constructed. The VR panorama is constructed from three base geometries; cylinder, cube, and sphere. Although the cylindrically based geometry was the first panoramic type to be commercialised, it was not the first to be conceptualised. At the time of Apple's development of the VR panorama image-technology in the late 1980s, a rival software developer called *iPix* had applied for the patent of the spherical VR format, which was also Apple's preferred first-phase commercial format.[16] The legal difficulties in determining the copyright and patent

authority for the software forced Apple to use another geometry for its first generation VR panorama image-technology. As a result, the cubic geometry was proposed as the first format to be commercialised, followed by the sphere, and finally the cylinder.[17] However, as the lead developer at Apple Computer Inc., Ken Turkowski has observed, "the choices [of which geometry came first was] determined by the ease with which the geometrical primitives could be texture-mapped."[18] Due to the relatively slow processor speeds of personal computers in the late 1980s, and the processor intensive demands of the spherical geometry which required a large amount of computation to effectively map any image-texture onto the complex geometric form, Apple was forced to use the simpler cylinder-based geometry for its first release of the QTVR panorama in 1995.[19] All three geometries are used today in the construction of VR panoramas by a number of different software developers, however, as will be demonstrated, each of the three geometric form used in the VR panorama offer very different conceptual and technical outcomes from one another. Further, each of the three VR panorama geometric types also each require a different photographic technique. Therefore, each geometric type provides varying levels of potential immersion and illusion, depending upon which geometry and method of photo–documentation is used in its construction.

The cylindrical VR panorama is the most common geometric type used domestically today and is generally constructed though the amalgamation of a series of photographs, representing a 360º horizontal band of space. These sequentially photographed pictures are then blended using proprietary panoramic stitching software, such as Apple's own proprietary software QTVR Authoring Suite™. The resulting panoramic image is then rendered onto the internal surface of an interactive virtual cylinder. The cubic VR panorama however, is constructed through the projection of six separate images upon the six internal faces of a virtual cube, representing a complete 360º volume. The six faces of the cube can be created by the careful photo-documentation of a space with six separate photographs, but generally is harvested from multiple photographs that are blended to create the six faces of the cube. The third VR panoramic typology appropriates the sphere as its geometric structure through the projection of one equirectangular[20] image upon the internal surface of a sphere, or similar to the cubic geometries construction, a series of photographs that are blended and mapped onto the 360º internal surface of the sphere. The three VR panorama geometries yield varying levels of interoperability and transformability. The cubic and spherical VR panoramas can be converted to a cylindrical VR panorama, but not back again as there is inadequate visual or spatial information to create a full 360º immersive environment. The cubic VR

however, can be converted to a spherical VR, and visa versa, without any loss of visual information. The importance of this interoperability I will return to later in the paper after several other important contrasting concepts are discussed.

In all three geometries used in the VR panorama's creation, a base conceptual premise remains; in each case multiple flat photographs are procedurally transformed and projected onto a virtual three-dimensional geometry that in turn provides its own unrealised pictorial 'spatialisation'. Although there is a certain level of interoperability between the different geometries, there is no recognition of the fundamental difference between the subject/object displacement in each of the three geometric types. One of the primary purposes of the panoramic stitching software is in fact to remove the perception of the VR panorama's geometry entirely. Specifically, the translation process does not incorporate the varying displacement between the viewer and the surface of the cubic VR as they pan around within the resulting virtual environment, or the constant displacement between the viewer and the surface of a spherical VR. Importantly, as the viewer pans across the cubic image's surface, there is a change in relative distance between the viewer's position and the image's surface. The software used to create each of the three panoramic typologies homogenises this experience, reducing any perception of displacement variation in the resulting panorama, regardless of its geometric specificity. The developers of the three VR panoramic typologies, were not interested and/or aware of these considerations in the VR panorama's conception and development. They were concerned with only one thing: its computational simplicity in order to afford rapid online delivery and ease of interaction and navigation.[21]

PICTORIAL FLATNESS

As a result of the proceeding analysis, it is clear that current manifestations of the *QuickTime*-based VR panorama do not consciously discriminate between any oscillation in displacement between the subject and object in either of the three geometric typologies that underpin the VR panorama's spatial construction. The primary question that subsequently emerges is, what potential revelations might this difference in geometric character afford? In order to understand the implications of the VR panorama's geometry, it is necessary to briefly examine how painting in the Renaissance and the baroque used the geometric character of the painting's surface, its very medium, in order to provide certain spatial and immersive effects. Numerous treatises on perspective have been completed throughout the history of Art, too numerous to adequately give justice to here,

however, since Leon Battista Alberti's systematisation of a theoretical conception of linear perspective in 1420[22] irreconcilably altered the path of representation. Art has struggled to relinquish the grasp of perspectival-based representation upon its generative figure. The dogmatic application of linear perspective by many artists presented idealised images of geometrically ordered, utopian cities. This spatial unity clearly exemplified in the spatial composition of Luciano Laurana's *La Città Ideale* [*Ideal City*, 1470].[23] The fastidious application of linear perspective in the *Ideal City* ordered both the pictorial composition en-framed by the painting's picture plane, but also the viewer external to the work. When viewing the *Ideal City* from an angle oblique to its picture plane, segments within the painting's composition appear to distort and loose their spatial unity. Common to Painting generated through the application of one-point linear perspective, only from a viewing position directly adjacent to the painting's picture plane, from a location mirroring the painting's vanishing point, does the painting appear spatially correct.[24] Perspective's rigid conditioning of both pictorial composition and viewing location undermined its conceptual longevity in Art, however it merits a brief discussion in this paper in order to understand how the viewers relationship to the painting, and its geometry, was controlled through compositional technique.

In the baroque, artists developed techniques to manipulate this contrivance of the subject's viewing location. The perceptual distortions that were observed when a painting was viewed from a location oblique to its picture plane presented baroque artists with an anamorphic effect capable of embedding multiple vanishing points within one scene. Hans Holbein famously applied two perspectival vanishing points within his composition of the *Ambassadors* [1533], disturbing the compositional unity of the painting through the introduction of an abstract skull across the foreground of the painting. Observing the painting from its perspectival viewpoint, directly adjacent to the work, the skull does not appear to conform to the same pictorial space as the figures standing either side of the table at the centre of the painting's composition. However, when viewed to the left of the painting's primary viewpoint, the lateral distortion that was apparent in the skull is visually reconciled: the representation of the skull from this position is ontologically emancipated from the painting's composition, 'magically' revealing itself as a skull. Holbein's execution of perspective in the *Ambassadors* reveals the "potential discontinuity between an object present to perception and its visual experience."[25]

THE 'SPATIALISED' PICTORIAL SURFACE

In the church of *Sant 'Ignazio* in Rome, painted 150 years after Holbein completed the *Ambassadors,* Andrea Pozzo rendered a perspective illusion upon the underside of the church's nave through a similar application of anamorphic projection. However, unlike the geometric flatness of the *Ambassadors,* in *Sant 'Ignazio* Pozzo applied the anamorphic projection technique upon a three-dimensional surface, the concave nave. Pozzo's nave painting in the church, painted between 1691 to 1694, involved a clever manipulation and translation of a flat picture onto a three-dimensional surface. Pozzo achieved this result through the aid of a sophisticated suspended grid representing the Cartesian grid of the painting's picture plane.[26] Pozzo observed that the painting represented the Son of God, "send[ing] forth a ray of light into the heart of Ignatius, which is then transmitted by him to the most distant regions of the four parts of the world."[27] A string line was used to mimetically trace the radiating 'ray of light' emanating from the painting's vanishing point on the floor beneath the nave, through each intersection point in the suspended grid, and onto the underside of the nave.[28] The systematic translation of the flat grid onto the underside of the nave provided a general organisational framework through which to represent the painting's flat composition onto the concave three-dimensional surface of the nave. Similar to the *Ideal City,* the painting dramatically distorts when not viewed from its predetermined viewpoint directly under the nave. The implication of Pozzo's appropriation and amalgamation of the space enveloped by the painting's surface into its spatial composition, is that both real and pictorial space are brought together in order to amplify the overall theatrical effect of the work. The projection and transferral of a flat picture plane onto the three-dimensional surface of the nave provided the resulting perspective illusion with an increased level of perceptible spatial depth that was not achievable through the conventional application of perspective alone upon a flat pictorial surface.

At virtually the same time on the far side of Europe in the Netherlands, Samuel van Hoogstraten used anamorphosis to create elaborate 'peepshow boxes' that spatially transfigured a single image upon the five internal surfaces of an empty box. Each of the pictures rendered on the interior of the box were perspectively distorted in order to provide an anamorphic unification of the five pictorial segments of the box, only when viewed through the boxes' peephole. The 'peepshow box' presented a highly convincing spatial illusion that, similar to Holbein's application of anamorphosis, offered a highly effective representational technique that subsumed the spatial reality of the box's internal geometry into the illusion's pictorial composition.[29] Similar to the *mixed-reality* within *Sant*

'Iganzio, van Hoogstraten's 'peepshow boxes' fused real and pictorial space into one composition, however here the space that is appropriated is more complex and difficult to compositionally reconcile then the relatively gently curving nature of *Sant 'Iganzio's* nave. The internal faces of the box collide at 90º yielding an abrupt dislocation in the spatial and geometric continuity of the picture's surface. The relatively even diminution across the surface of *Sant 'Iganzio's* nave amplified its view-*point* into a view-*field*, however van Hoogstraten's 'peepshow boxes' restrict the painting's internal composition to a precise singular point in space, transforming the immaterial construct of its vanishing point into a manifest, physical location in space, the boxes peephole.

CONCLUSION

Although at first it may have appeared that the VR panorama shared a typological affinity with the nineteenth-century 'painterly' Panorama, based primarily upon similarities between their cylindrical typology, however this paper has outlined other concepts that it could appropriate from within the history of art to achieve its effect. This paper has outlined the potential amplification of spatial illusion through the application of anamorphic projection upon the geometry of the VR panorama. The VR panorama currently does not consciously draw upon any of the techniques and concepts of immersion exemplified by Holbein's *Ambassadors* or Pozzo's *Sant 'Ignazio* nave painting. In all three VR panoramic typologies; the cylinder, cube, and sphere, the observed image unravels uniformly before the viewer as the distance between viewer and image remains at a relative constant, however, as has been discussed, the displacement constant does not hold true when applied to geometric forms such as the cube. Even in VR panoramas that do assume the geometric construction of a cube, they do not embrace the geometric and immersive potentials that would result if anamorphic projection techniques were applied to the image's conception and construction.

This paper therefore proposes the conception of a new form of illusion technique within the existing geometric framework of the cubic VR panoramic typology; one that is directly informed by an objective historical critique of illusion methods in Art History. It both builds upon the concepts and techniques embedded within the cubic VR panorama as it exists today, whilst amplifying its technical capacity to afford higher levels of illusion through the application of anamorphic projection. It is important to remember that the development of the VR panorama in the 1980s was dictated solely by its technological delivery across the internet, and not by concepts and techniques capable of maximising its immersive affect

such as those that have been outlined here. Further, the interoperability between each of the three VR panorama typologies further exacerbates the potential appropriation of one specific geometry over another. The algorithms used to translate between cylinder, cube, and sphere do not account for their actual spatial geometry. However, the acknowledgement and incorporation of spatial depth offered by geometric simplexes such as the cube, offer a wholly new conception of spatial illusion in the VR panoramic image technology. Van Hoogstraten's 'peepshow boxes' provide the most prevalent physical manifestation of the conceptual intent presented by this paper. However in the cubic VR panorama, the viewpoint of the image is centralised within the middle of the box, rather then in the same location as the boxes' peephole. Through the application of the anamorphic techniques mastered by Holbein and Pozzo, combined with a 'spatialised' picture plane made possible by the varying subject/object displacement characteristics offered by geometries such as the cube, we arrive at a wholly new anamorphic *mixed-reality* VR panorama that transcends the limitations of the uniform subject/object displacement. The subsequent image typology presents us with a representational framework though which to record, interrogate, and represent space in Architecture with amplified levels of spatial illusion, in a way that no other image technology affords today. The VR panorama does not represent the end of a long history of visuality, but rather the beginning of a new form of *mixed-reality* image technology that transfigures the observer's relationship to images in/within space for perhaps the first time in history.

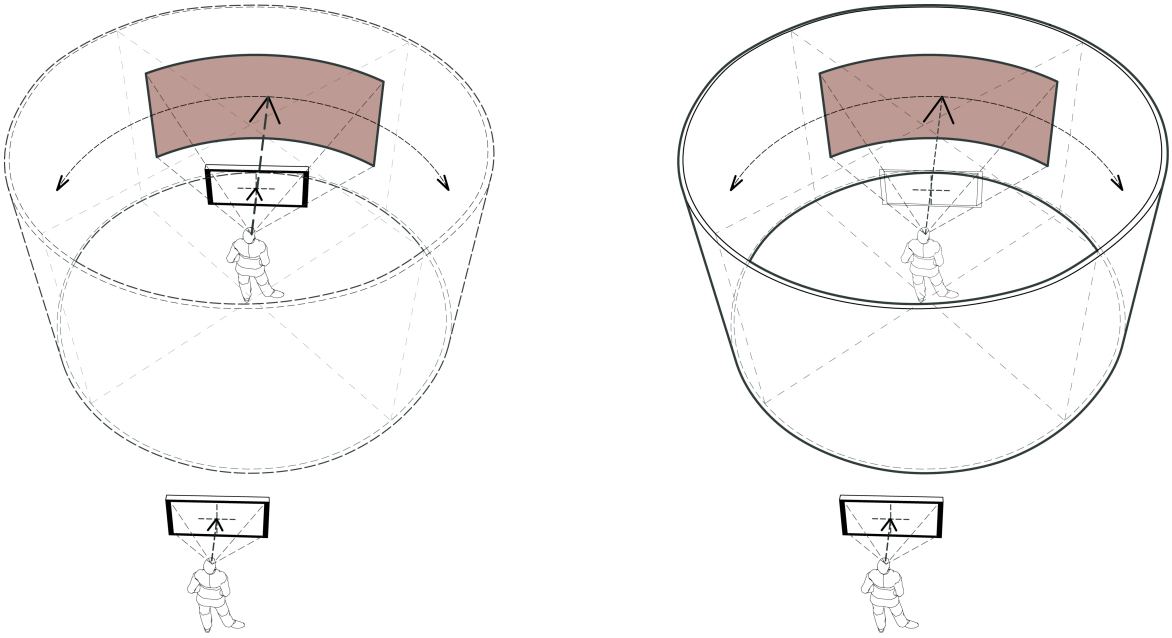

Fig.01 [above]
Cylindrical VR panorama interactivity diagram illustrating the panning of the drum around the observer, and their tele-present location at the drum's centre.

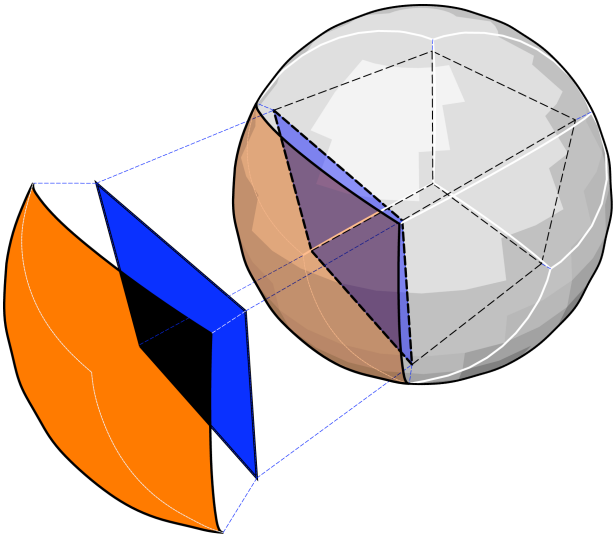

Fig.02 [right]
Diagram representing the translation of sptial information through anamorphosis, from the cube-based typological state to the sphere-based VR panorama.

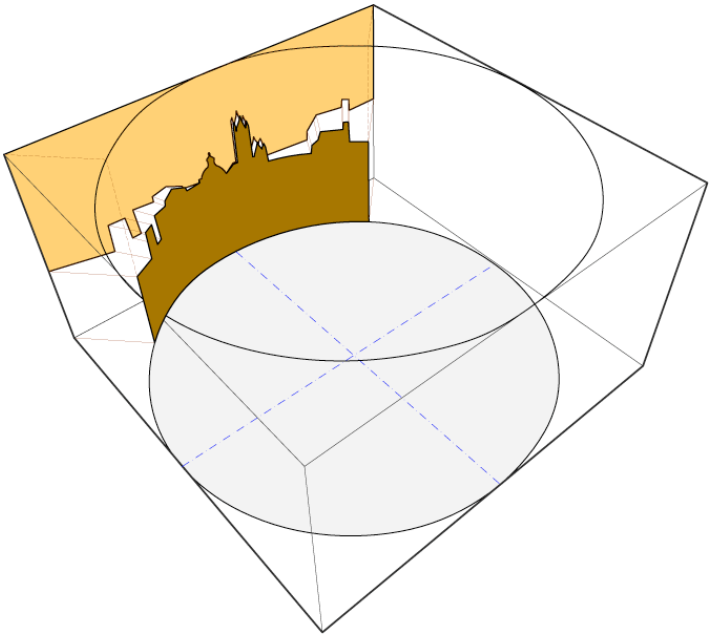

Fig.03 [right]
Diagram representing the anamorphic translation from the cyclinder-based typology to the cube-based typology. This diagram also represent the change in displacement from the central viewing position in the drum & cube's centre, to the outer surface fo the panorama's geometry.

Endnotes

[1] Yuichi Ohta and Hideyuki Tamura, *Mixed Reality : Merging Real and Virtual Worlds* (Berlin: Springer, 1999).
[2] Oliver Grau, *Virtual Art: From Illusion to Immersion* (Cambridge, Massachusetts: MIT Press, 2003). Oliver Grau, "Into the Belly of the Image: Historical Aspects of Virtual Reality," *Leonardo* 32, no. 5 (1999).
[3] Grau, "Into the Belly of the Image: Historical Aspects of Virtual Reality," 365.
[4] Edward Croft-Murray, "The Panoramic Room," in *Decorative Painting in England: 1537-1837*, ed. Edward Croft-Murray (London: Country Life, 1962).
[5] Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, Massachusetts: OCTOBER books - MIT Press, 1990). Crary's argument attends to separate these later image-artifacts of the nineteenth-century into a scopic regime of corporeal embodiment where by the act of 'seeing' is literally activated by the image-artifact. Put simply, the image thus perceived is not the result of a picture presented to an observer, but rather a direct outcome of the 'bodily' cognitive process of the observer. This paper does not draw upon, celebrate, critique, or denigrate Crary's 'embodiment' argument.
[6] Jay, Martin. "Scopic Regimes of Modernity." In *Vision and Visuality : Discussions in Contemporary Culture ; No. 2.*, edited by Hal Foster, 3-27. Seattle, Wash.: Bay Press, 1988.
[7] Here I am referring to Chamber's observations as to the epistemology of the nineteenth-century Panorama, however its conceptual intent is the same as the Virtual Reality panorama being discussed in this paper. See William & Robert Chambers, "Panoramas," *Chamber's Journal of Popular Literature* 316 (1860): 33.
[8] Comment, Bernard. *The Panorama*. Translated by Anne-Marie Glasheen. London: Reaktion Books Ltd, 1999. See also Oetterman, Stephan. *The Panorama: History of a Mass Medium*. New York: MIT Press, 1997.
[9] Although other software developers did design alternative methods through which to technically construct VR panoramas, for the purpose of this paper, I am specifically focusing upon the QuickTime VR format. I am not interested in this paper in the agency of other VR format such as Apple's Quicktime VRML. For a discussion of the VRML format, see Lev Manovich, *The Language of New Media*, *Leonardo.* (Cambridge, Mass.: MIT Press, 2001), 311-17.
[10] For a description of the development of the Apple QuickTime movie format, see Lev Manovich, *The Language of New Media*, *Leonardo.* (Cambridge, Mass.: MIT Press, 2001), 311-17.
[11] Oetterman, Stephan. *The Panorama: History of a Mass Medium*, 51-52.
[12] Barker, Robert. "La Nature Á Coup D' Oeil." 19/06/1787. England: The Repertory of Arts and Manafactures, 1787.
[13] Comment, Bernard. *The Panorama*, 7.
[14] White, John. *The Birth and Rebirth of Pictorial Space*. 3rd ed. Cambridge, Mass.: Belknap Press, 1987, 207-15.
[15] For a detailed account of Barker's technical process for the reconciliation of spherical distortion, see William and Robert Chambers, "Panoramas," *Chamber's Journal of Popular Literature* 316 (1860).
[16] Email correspondence between Chris Brisbin [author] and Ken Turkowski [2005], Ken Turkowski <turkowsk@pacbell.net>
[17] Bienias, "An Interview with a Qtvr Original - Ken Turkowski," review of Reviewed Item, no.
[18] Email correspondence between Chris Brisbin [author] and Ken Turkowski [2005], Ken Turkowski <turkowsk@pacbell.net>
[19] Ibid.
[20] The equirectangular image projects meridians to equally spaced vertical and horizontal straight lines, effectively unfolding a three-dimensional object into a flat picture.
[21] Email correspondence between Chris Brisbin [author] and Ken Turkowski [2005], Ken Turkowski <turkowsk@pacbell.net>
[22] Alberti, Leon Battista. *On Painting [De Pictura & Della Pittura]*. Translated by Cecil Grayson. London ; Ringwood, Vic.: Penguin Books, 1991.
[23] The painting's true authorship has been widely debated. Art Historian Sir Kenneth Clark proposing that Piero della Francesca rendered the image whilst the wider scholarly community favours Laurana. See Kimball, "Luciano Laurana and the "High Renaissance", 130. Kimball

discounts Piero's eligibility as the painting's author through a critique of the compositional nature of the building motifs within the painting. It is more likely that Laurana painted the *Ideal City* as he was Federico's court Architect, engaged at the time of the paintings conception as Architect on the Palazzo Ducale in Urbino. See Laurie Adams Maria Grazia Pernis, *Federico de Montefeltro and Sigismondo Malatesta: The Eagle and the Elephant* (New York: Peter Lang, 1996), 68-69. Many scholars have indicated the painting's conception as an idealisation of the urban and architectural work that Laurana was engaged in for Duke Federico da Montefeltro at the time of the paintings rendering. Further, Art Historian Walter Hanak has observed the inscriptions in the *Ideal City* panels, which are in Laurana's native Slavic script, Cyrillic. Laurana was the only Slavic Architect in Urbino in the period which the *Ideal City* panels were rendered. See http://www.marcheworldwide.org/html/ideale.asp?lingua=en The Marche World Wide, the international web site for Italy's Marche Regional Authority. See also Kimball, "Luciano Laurana and the "High Renaissance." Kimball also has interpreted the inscriptions as evidence of Laurana's authorship. It is believed to be one of three painting in series of 'ideal city' depiction. The first is in Urbino, whilst the second is displayed in the Walter Art Gallery in Baltimore, USA, and finally the third is displayed in Gemaeldegalerie, Berlin. The third panel has been unequivocally discounted as an authentic Laurana work, and therefore not part of the same painting series. See also Richard Krautheimer, "The Tragic and the Comic Scene in the Renaissance: The Baltimore and Urbino Panels," *Gazette des Beaux-Arts* xxxiii (1948).

[24] Puttfarken, Thomas. *The Discovery of Pictorial Composition : Theories of Visual Order in Painting 1400-1800*. New Haven, Conn. ; London: Yale University Press, 2000, 70.

[25] Pérez Gómez, Alberto, and Louise Pelletier. *Architectural Representation and the Perspective Hinge*. Cambridge, Mass.: MIT Press, 1997, 138-9.

[26] Eve & Kaufman Blau, Edward, ed., *Architecture and It's Image: Four Centuries of Architectural Representation Works from the Collection of the Canadian Centre for Architecture* (Montreal: MIT Press, 1989), 31.

[27] Martin Kemp, *The Science of Art : Optical Themes in Western Art from Brunelleschi to Seurat* (London: Yale University Press, 1990), 139. See also Pérez Gómez, Alberto, and Louise Pelletier. *Architectural Representation and the Perspective Hinge*, 204. Pérez Gómez goes on to identify the vanishing point on the floor of the Sant 'Iganzio as the "true point, the Glory of God." Pozzo, like many baroque artists of the period, is using the applciation of persepctive to infer some higher form of symbolic meaning within the work. See Jay, Martin. "Scopic Regimes of Modernity."

[28] Andrea Pozzo, *Perspective in Architecture and Painting*, An unabridged Reprint of the English-and-Latin edition of the 1693 "Perspectiva Pictorum et Architectorum" ed. (New York: Dover Publications, 1989), 214.

[29] Kemp, *The Science of Art : Optical Themes in Western Art from Brunelleschi to Seurat*, 204-06.