HIMmaterial

Exploring new hybrid media for immersive drawing and collage

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ABSTRACT

We propose an installation that explores Hybrid Immersive Models (HIM), the conjunction of digital VR panoramas with physical, handmade spherical perspectives and anamorphoses, as a new hybrid art medium that connects traditional drawing with digital, immersive art, creating a dialogue between material and immaterial forms of visual expression.

CCS CONCEPTS

• Human-centered computing~Visualization • Applied computing~Fine arts • Applied computing~Media arts

KEYWORDS

Spherical perspective, equirectangular perspective, cubical perspective, virtual reality, immersive drawing, anamorphosis

1 Purpose of the installation

We propose HIMmaterial, an installation that explores Hybrid Immersive Models (HIMs) as a new medium of visual expression. HIMs are sets of three elements: handmade spherical perspective drawings, 3D physical anamorphoses, and digital VR panoramas. All three modes present the same visual data of an environment that can thus be experienced both from within and from without, both materially and immaterially, through a new hybrid medium that connects digital, immersive art with traditional, physical drawing.

Drawing is the most immediate expression of visual thought, a way the mind and hand give quick visual form to a concept; but drawing also has the dual purpose of providing immersion into the imagined object, through the visual illusion of anamorphosis. This

dual purpose used to require elaborate and expensive means such as the vaulted ceilings of 18th century churches, or the rotundas of 19th century panoramas [1: 153-161, 2]. VR panoramas are digital implementations of the same geometric principle, but portable, inexpensive, and interactive – such is the nature of technological progress, a provider not necessarily of better means, but of more accessible and plentiful ones. It is hard to say that there is a progress in artistic quality from the anamorphoses of Andrea Pozzo to those of the latest VR panorama demo, but there is certainly an increase in frame count and a decrease in budget. On us then, lies the burden of making the most of it, and so have done a growing group of artists, intent on putting VR panoramas into the utility belt of the draughtsman.

Although originally made for 360º photos or CGI, VR panoramas have been subverted by artists to display handmade drawings, thus reshaping an old drawing tradition in digital form. This connection was for a long time no more than a hack, limited to ad-hoc methods. A recent work on the geometry of spherical anamorphoses and perspectives has firmly established the connection of spherical perspectives with formal, technical drawing [3], bringing VR panoramas into the fold of geometry and formal perspective. This theoretical systematization opens up spherical perspectives as a new digital-analog hybrid medium of immersive drawing that can be used by anyone, not just a secret trick of a virtuoso artist. Like Alberti's work did for classical perspective, systematization makes spherical perspective an Open Source tool. Like any art medium, this will have its own scope, possibilities and limitations, it will stress some subjects (how many tiled floors were painted in the renaissance just because perspective begged for them!) and inhibit others. This scope is what we intend to investigate, in a preliminary way, with the current exhibition/artefact. In it we wish not merely to show one artist's work but to present the medium itself, still incipient, as open to all: so the focus is on the paint box rather than the artists. Hence the shape of a collective exhibition, that shows the way in which several hands and eyes approached not the same subject but the same tools of visual thought. So the works of L. F. Olivero focus more strongly in the whimsical, seeking the possibilities of the new tools to express imaginative spaces, while those of A. B. Araújo focus on structure and geometry of the perspective itself, revealing vanishing points and lines on top of observational sketches, and the work of S. Antinozzi explores the connection with collage, by inserting classical paintings onto immersive photographs.
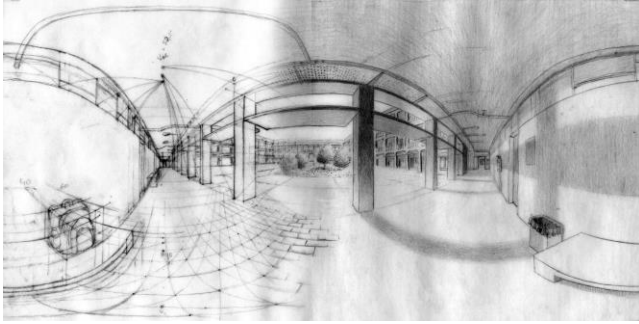
Figure 1 - Observational drawing of ISEL's engineering school in Lisbon, Portugal. The closest arch is multiplied by sending successive parallel diagonals to their common vanishing point. © A. B. Araújo
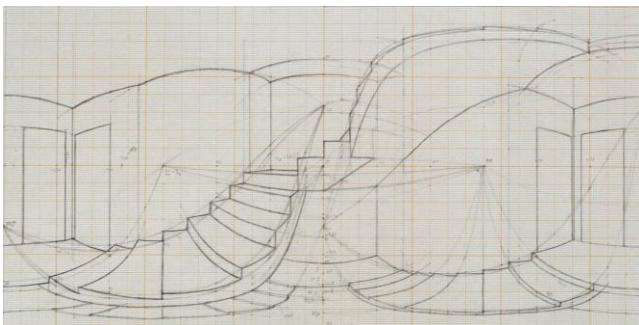

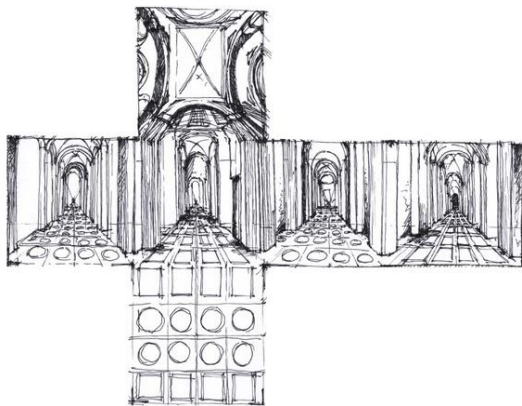**Figure 2 - Stairway with vanishing points. © A. B. Araújo**

Figure 3 - Imaginary architecture using cubical projection. © L. F. Olivero

The form of the exhibit itself revisits and extends previous shows by two of the authors. Both A. B. Araújo and L. F. Olivero had presented spherical perspectives and VR panoramas in 2018:

A. B. Araújo presented azimuthal equidistant and equirectangular perspectives in Óbidos, Portugal, and L. F. Olivero presented equirectangular perspectives in Salerno, Italy, together with their concrete realizations as physical spherical anamorphoses, reminiscent of the spherical paintings of

American artist Dick Termes [4] but with the innovative possibility of their virtual visualization with VR glasses.

The present exhibit follows mainly the format of L. F. Olivero's Salerno 2018 show, with the following important updates: both A. B. Araújo and L. F. Olivero present equirectangular but also cubical perspectives drawings, together with their materializations as anamorphic projections onto physical cubes, and S. Antinozzi presents work that, from an artistic point of view, may be classified as collage, joining three paintings of Naples from the 1800s to present day photographs of the same locations in an immersive whole that contextualizes both the artworks and the represented heritage within the living present.

The works presented reflect the theoretical and technical advances made by the authors, all of whom are researchers of advanced methods in some way related to immersive tools of visual expression:

Araújo proposed a redefinition of anamorphosis as a framework for solving any general spherical perspective [3], aiming to replace the ad-hoc, incomplete, or grid-based methods then in existence [5, 6, 7] for drawing in such perspectives, to give spherical perspective a basis as rigorous as that of classical perspective. In [3], this framework was developed and applied to the azimuthal equidistant case (generalizing to 360º the fisheye perspective of Barre and Flocon [8]) and in a later work to the equirectangular case [9]; Araújo's main works presented here illustrate these systematic techniques – they are *urban sketches* made from observation, where observed features and angular measurements result in geometric constructions typical of a perspective, vanishing points are explicitly seen and precise constructions of regular features – e.g. tiled floors or repeating arches - are obtained by perspective constructions such as segment multiplication [10]. For instance, in Figure 1, a single arch was measured and then multiplied by the use of parallel diagonals going to common vanishing points. Methods for regular divisions of space are patent in both the tiled floor of Figure 1 and the stairway of Figure 2.

L. F. Olivero worked at first with ad-hoc techniques on equirectangular perspectives, and then became interested in cubical perspective. This perspective, although well-known in digital panoramas [12, 13], never received more than a fragmentary treatment as a perspective proper [14: 2, 15: 11]. In [16], L. F. Olivero, A. Rossi and S. Barba made a preliminary investigation of this perspective and called for a systematic solution. A partial solution for the case of verticals and horizontals parallel to the cube's faces was obtained by the same authors in [11], as an organization of six classical perspectives. Finally, in [17], A. B. Araújo, L. F. Olivero and A. Rossi solved the perspective completely as a special case of the method in [3], by considering cubical perspective as a type of spherical perspective. L. F. Olivero's works in this exhibit reflect these developments; they are whimsical explorations of imagined spaces and fantastic architectures with a surrealist inclination, drawn in both equirectangular and cubical perspectives.

In a parallel route, S. Antinozzi investigated techniques for the creation of immersive scenes from 19th Century paintings, with the aim of documenting and preserving cultural heritage, as well as enhancing its fruition.

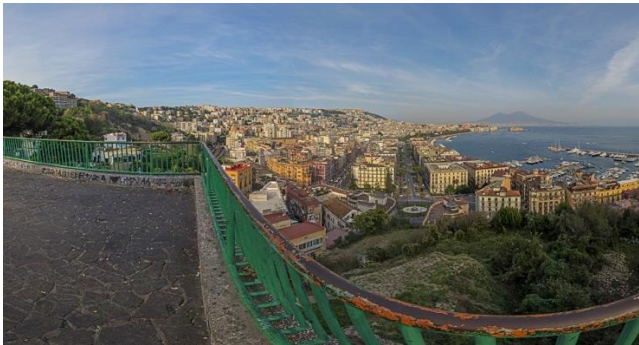**Figure 4 - Surrealist artwork using equirectangular projection. © L. F. Olivero**

Figure 5 - View of Naples from Chiaia. Detail of 360° photograph. © S. Antinozzi
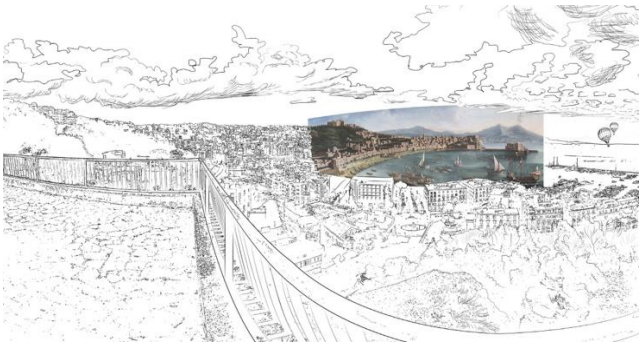

Figure 6 - The same view of Figure 5, turned into a line drawing, with the painting '*Veduta di Chiaia*' inserted into the scene. © S. Antinozzi

Her work stems from a collaboration between the University of Salerno, NAOS Consulting Ltd., the Filangieri's and the Circolo Artistico Politecnico Museums of Naples, and is based on advanced immersive photography and photogrammetry techniques studied under the orientation of S. Barba and following specialized workflows for heritage survey applications [18: 871-886]. Her work also involved elements of spherical perspective drawing techniques learned during a brief collaboration with the other two authors at Aberta University, in Lisbon. Her work here presented creates immersive scenes by inserting 19th Century

paintings of views of Naples into contemporary 360° photographs of the same locations. The source paintings are '*Veduta di Chiaia*' and '*Veduta di Napoli dal mare*', made around the 1830s, attributed to one of the two Ruiz brothers, Tommaso or Juan, both part of the Filangieri's collection, and '*Via Anticaglia*' by Gustavo Pisani, in the collection of the *Circolo Artistico*. The works were surveyed with photogrammetry techniques, the place from which they were painted precisely identified, and 360° photography was shot from the same place, to achieve seamless insertion of the paintings into the present-day VR environment, that was in turn simplified into an immersive line drawing. This work means to enhance the understanding of the paintings and the relation of the viewer with the cultural heritage, by mixing the properties unique to drawing with the techniques of immersive photography that are already an essential part of heritage studies [19: 6]. For the present purposes, from a purely artistic point of view, we can also look at the resulting work as an investigation into a spherical perspective form of collage.

All of these theoretical advances are exemplified in the works presented, as proof-of-concept and invitation for the artist to participate in the use of this new expressive drawing method that lives in the space between the virtual and the physical.

There is a strong academic flavor to this exhibit, in the sense that the author's do not intend (as is common and understandable among professional artists who have dealt with related techniques in the past) to keep techniques half veiled or secret – rather the point is to fully expose the technique, trivializing it from the realm of the personal sleight of hand to that of the reproducible. As technique grows trivial through clear system, virtuosity moves up the ladder to the next stage where the light of understanding still does not reach. That is always the transitory realm of the artist *as artist*, and it is never taken away by reason but only displaced further up, as it should.

2 The artefact

The central purpose of this exhibit is to show the possibilities of spherical perspective drawing. To that end, the same visual data is presented in several representations: a flat 2D representation (A), a 3D physical representation (B) and an immersive VR panorama (C).

The flat representation (A) is a physical print of a handmade drawing made in either cubic or equirectangular spherical perspective. The cubical drawings are cross-shaped cubemaps within a 4:3 rectangle. The equirectangular drawings are rectangular map with proportion 2:1. We see the flat drawing, whose perspective is explicitly known, as both artistic object and generating set for the other two representations.

The 3D representation (B), a physical realization of the visual data in (A) shows the anamorphic projection on top of a physical sphere – reminiscent of Dick Termes's work – but also of a cube, pointing at the potentially infinite set of possible realizations. This projection would be a *trompe l'oeil* if seen from the center of the cube/sphere, but here we see it from without, as a variation of the time-honoured game of anamorphosis, an appreciation of the "deformed" image as an object of interest in itself.
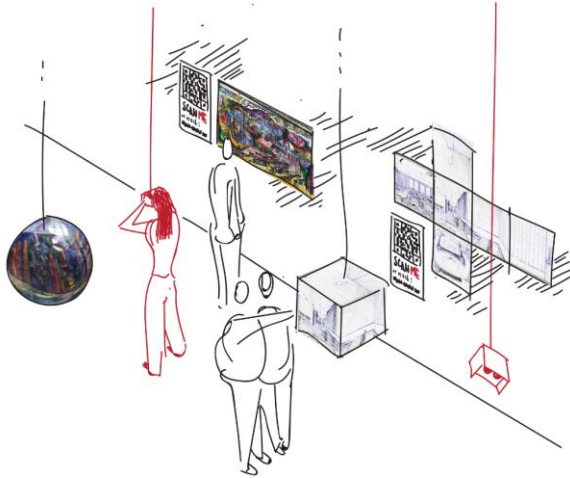
Figure 7 - Preview of the exhibition space

Figure 8 - Shots from a previous exhibition by L. F. Olivero (Salerno, 2018). Left: physical realization of the spherical anamorphosis from the equirectangular drawing of Figure 4

Finally, the VR object (C) is a virtual reality panorama, often associated with so-called 360° photography but here subverted for the display of handmade drawings. It shows the anamorphic *trompe l'oeil* from the inside of the surface with digital technology and is triggered by the reading of a QR code or URL from the physical representations.

The physical and the digital objects thus form a connected ensemble, the former serving as trigger and physical interpretation of the latter, the latter as proper visualization of the former, the whole constituting a hybrid work between digital and physical.

3 Installation and Interaction

The space is a 3x3m square where the printed versions of the original drawings (A) and the glasses for VR navigation (C) are hanging from the ceiling, attached to walls, or on a table, according to the venue's convenience. For each artwork, there are a QR code and a short URL to access the respective virtual tour. The visitor uses a smartphone to enter a website which contains the virtual tour of each immersive drawing. Then, putting the phone inside a VR Cardboard set, the user goes inside the artwork. With the use of the gyroscope to rotate all around the visual field, the experience is a first-person full immersion.

During the experience, the user is invited to take off the glasses and compare the VR view (C) with the flat representation (A) and the physical anamorphosis (B). With this interaction, the user can perceive the difference between the perspective (A) (which often defies visual intuition); the correct perception (C), and its view from without (B). This way, it is possible to understand the complexity of the spherical perspective rules and the polyvalence of these new methods. The ensemble (A, B, C) forms a new language for digital art based on analogical drawings, that can be apprehended once the bidirectional paths between shape, anamorphosis, and perspective are understood.

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