RESEARCH-ARTICLE

Spheritivity, a Hybrid Immersive VR Art collection

LUCAS FABIAN OLIVERO, University of Algarve, Faro, Faro, Portugal

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Spheritivity, a Hybrid Immersive VR Art collection

Lucas Fabian Olivero
Algarve University and Aberta University
Lisbon, Portugal
lucas.olivero@uab.pt

Abstract

Spheritivity is a collection of handmade immersive art exploring the influence of hybrid (physical/digital) perspective artworks for boosting artists' creativity. Spheritivity exposes applications of Hybrid Immersive Art and the wide range of possibilities that perspective (as knowledge) can offer to artists, from the mastering of geometries in space up to the creation of digital environments using the latest advancements in the field of graphic representation: spherical perspectives. Furthermore, Spheritivity is enhanced with visual paradoxes (intellectual component) and Spheri (interactive component). The visual paradoxes are Escher-like visual games, such as never-ending stairs, non-orientable surfaces, etc., which Spheritivity upgrade to a never-ending canvas (via digital technology) and considering all vanishing points around the observer (via spherical perspectives). In turn, the installation Spheri uses body tracking via the machine learning library MediaPipe, and it provides Spheritivity with an interactive framework for visitors and artists to discover the potential and applications of VR environments created from spherical perspectives.

CCS Concepts

• **Human-centered computing** → Visualization; • **Applied computing** → Arts and humanities; Fine arts; Arts and humanities; Media arts; • **Keywords**;

Keywords

Hybrid immersive art, spherical perspectives, handmade drawings, digital art, VR art, Spheri

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1 Introduction

The research behind Spheritivity focuses on the influence and applications of hybrid (physical/digital) perspective artworks for boosting artists' creativity. Spheritivity is a collection of handmade (physical) drawings showing the wide range of possibilities that the knowledge in perspective might offer to an artist: from helping them to understand the abstraction of a geometry in space, passing through the creation and visualisation of non-existing and/or impossible places, and up to the creation of digital virtual environments using spherical perspectives. The interest in using spherical perspectives is driven by the fact that such drawings can be "folded back" both digitally (to create a VR environment), and physically (to craft art objects, such as a sphere or a cube), shaping what it has been defined as a Hybrid Immersive Model [24] (Figure 1). Within a Hybrid Immersive Model, all three media (drawing, VR environment and physical objects) share the same visual data, although each of them shows it in a different way. Therefore, a Hybrid Immersive Artwork merges the physical and the digital experience by giving a wide range of possibilities to explore, read, and compare one same artwork from inside/outside, above/below and/or materially/immaterially.

Spheritivity is a collection framed on the research "Hybrid Immersive Art" (HIA) that puts together methodological definitions for importing the Hybrid Immersive Models to the field of digital media art [25], the state of the art on perspectives (parallel, conical, linear, curvilinear, etc.), the latest developments for cubical perspective [32], applications on workshops and teaching [3, 4, 30, 31], and applications of spherical perspectives within the field of art [26–28]. Spheritivity is the largest collection produced within HIA and aims to show the path of knowledge from the conventional and already known systems of representation (such as the classical conical perspective, double parallel orthogonal projections, isometric perspectives, etc.) to the new and emerging world of spherical perspectives. Furthermore, the collection adds two enhancements to the hybrid immersive art experience: **visual paradoxes** (intellectual component) and the use of the installation **Spheri** [29] (interactive component).

For the **visual paradoxes**, Spheritivity takes inspiration in works of M.C. Escher [12], such as Relativity (1953), House of Stairs (1951), Concave and Convex (1955), Waterfall (1961) and plays with them using different linear and curvilinear perspective systems, with the aim of criticizing the way we perceive reality, a hybridisation between the space as we know it is (mental model) and how we see it (graphical model):

> "The challenge in mastering linear [or any other] perspective is resolving the conflict between our knowledge of the thing itself - how we conceive its objective reality - and the appearance of something - how we perceive its optical reality" [11].

On the other hand, **Spheri** is an installation through which visitors can interact with the VR environment using hand gestures via body-tracking: it is enough to wave and move the hands in front of the camera (no special gloves required) to move, orient and zoom in/out the virtual reality (Figure 2). Spheri operates as a web application and it has been coded using JavaScript, CSS and

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Figure 1: A Hybrid Immersive Artwork is produced by one spherical perspective and their associated products: a VR environment, and 3D crafted objects.

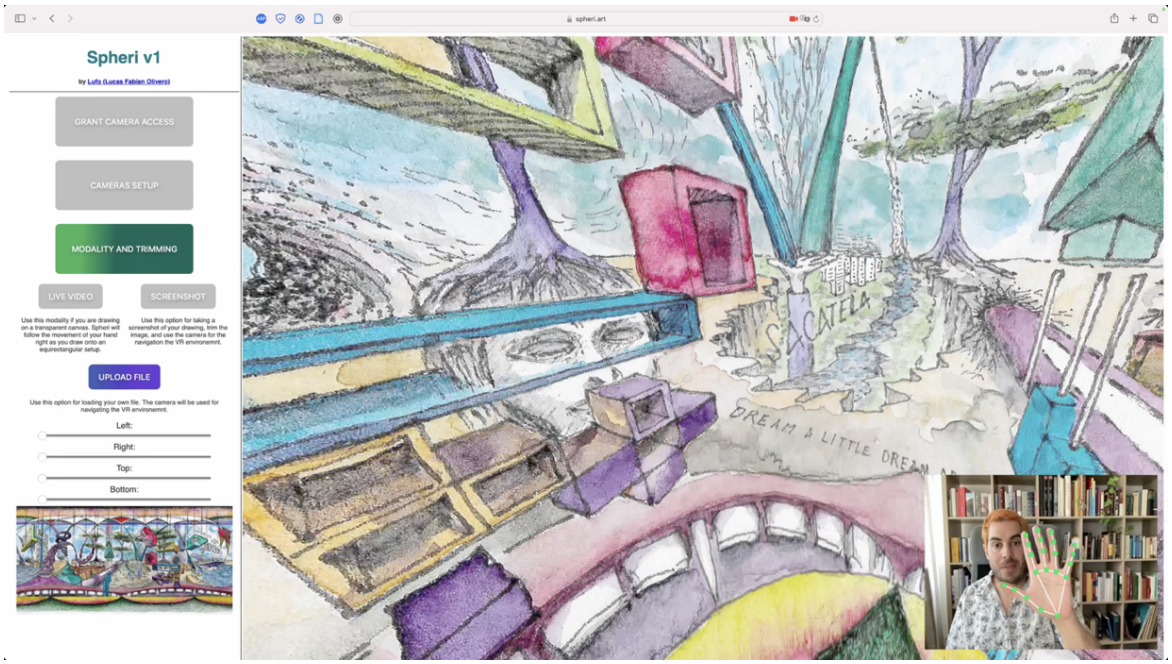

Figure 2: Using the interactive installation Spheri. The hand landmarks detected by MediaPipe are highlighted ingreen (bottom, right).

HTML5. When executed, it runs the library tree.js to create a very simple 3D scene composed by a spherical geometry and a virtual camera; then, it maps the spherical artwork as the sphere's texture; third, the MediaPipe's machine learning algorithm [16] determines hand landmarks' coordinates; and finally, the camera's orientation and field of view are operated through functions defined with the index and thumb's landmarks. Spheri only requires any regular web browser, a camera and good lighting on the subject.

1.1 Goals

In a general view, Spheritivity seeks to stimulate and promote the most recent developments on spherical perspectives and anamorphoses. It is expected that the engagement of artists and visitors with Spheritivity might show, materialise, and present them with part of the potential that both classical and spherical perspective systems can offer.

In the specific, some goals are:

- For the introduction of **visual paradoxes**: to experiment with optical illusions (e.g., never-ending stairs, paradoxes of continuity, non-orientable surfaces) and bring them to an upper level, exploring how these optical games are built using all the vanishing points around the observer, considering an unlimited canvas and not only a framed window, how they are perceived in a virtual space, how digital technologies affect their creation and interaction, what are the implications of mixing systems (e.g., how to represent a paradox developed in parallel perspective using an equirectangular canvas where we normally draw using a conical projection), etc.
- For the use of **Spheri**: to understand how visitors react to the interaction, giving insights on, for example, what is the most natural (i.e., chosen) hand gesture for moving the sphere when they are not given any instructions? The answers to these questions are to be gathered right in a survey after

the interaction, using a QR-code in which participants can express their anonymous opinion.
- For the exhibition of **Spheritivity**, to present publicly the results of the Hybrid Immersive Art research, for the academic and artistic community to debate, analyse, criticise and, hopefully, explore, improve and extend in the future.

2 Theoretical framework

2.1 Brief overview of spherical perspectives

Spherical perspectives are an emergent topic in the field of handmade and methodical graphic representation and projective geometry: they replace the conventional plane canvas of the classical linear perspective from the Renaissance with a sphere that is then flattened. Hence, a spherical perspective is a map of the sphere, done methodically, line by line, and following a systematic method for rendering lines according to the way the map is created. Maps and cartography are present in our history at least since the classic antiquity and, although they represented big challenges for many centuries, is not the case anymore:

> "today, the planimetric construction of world maps using projections is neither a mathematical nor a technical challenge. Standard cartographic works describe projections, their derivation, their intended use and their characteristic properties. Cylindrical, spherical or azimuthal projections and their mathematical rules as well as the corresponding distortion properties such as length, area or angular distortions are described and, as the basic material of projection theory, are decisive for the definition of conventions" [37].

In other words, if we want to draw a spherical perspective, we have to learn about the way maps treat information: what and how do they distort, what is preserved and what is not, etc. Because of this, a spherical perspective results a human construction where the person behind it needs to necessarily understand the logical implications of the method to get accurate results. Furthermore, and because of this "humanity", it is also a slow process, limited in time, which forces an on-the-fly analysis and a critical selection of the elements to be represented. The map contains all the visual information that an observer can see around one unique point: if you consider an observer O, place a virtual sphere S centred on O, radially project the surrounding environment, and flatten the sphere, then you get a spherical perspective. A more elegant definition of this can be found in [2], where the author sets up a general scheme from which every spherical perspective is the result of a two-step process: first, an anamorphosis onto the sphere (unique and mimetic), followed by the flattening of the sphere (neither unique nor mimetic). Indeed, there are many ways of flattening a sphere and hence of spherical perspectives:

> "(spherical) perspective is to anamorphosis what a world map is to the globe, its purpose is to store visual information conveniently on the flat surface and, like in cartography, no flattening is perfect – each being merely convenient for some purposes" [32:4].

Nevertheless, each of these possible flattened maps are equivalent among them since they all come from the same anamorphic projection on the sphere. This equivalence is well-known in photography, where each projection can be easily converted into another (Figure 3).

However, when it comes to drawing, the task is not so well-known, although there is a raising interest developed in the last years, with the development of new systems, analytical developments and applications [2, 9, 18, 21–23, 31, 34, 35]. Currently, some full methods for drawing immersive perspectives are the cubical perspective (Figure 3) [5] (linear method), the equirectangular perspective (Figure 2, Figure 4) [2] and the azimuthal equidistant perspective (Figure 5) [1] (curvilinear methods). Several other works develop further methods and although many times they are framed within different optics of work, they evidence the developments on the field [7, 10, 18, 20, 35].

2.2 Drawing, as a way of thinking art

Drawing serves as both a method and a medium for thinking through art, grounding the creative process through a simple (if not the simplests) tool and interface: pencil and paper/tablet. While drawing line by line, the artist engages in a brain-hand flow that externalizes thoughts and feelings, in the case of physical drawing on paper this connection is more private, without major distractions such as software, notifications, complexer interfaces, etc. [6, 14:29]. Nevertheless, the simplicity of the tool and the interface does not limit the complexity of the result: whether a quick sketch, expressive marks or meticulous scientific illustrations, handmade drawing remains always as a versatile tool for thinking through experimentation, an organic way of organising ideas, shaping projects and guidelines, materialising proportions, ratios, and non-material mental models that cameras cannot capture, and a way of providing artists with more tools for manipulating geometries in the abstract space [15, 17, 33:36, 38, 39]. Regardless if physical or digital, the well-known dynamic pencil/drawing has been a protagonist in the history of art, not because their technology, but because of what is implied behind the act of drawing itself, i.e., the process of thinking the artwork and the externalisation of a self-communication process which is "an essential practice in all creative and artistic processes" [8].

2.3 Perspective, as a way of expanding skills

The simplicity behind a pencil leaves us more space for thinking the artwork but sadly no pencil includes the knowledge of how to represent a geometry in space (for now). Then, perspective knowledge is a must if an artist wants to compose and distribute geometries in space, place and depict body expressions, create optical paradoxes and play with perception, etc. Knowing about perspective is far from being a restriction to creativity, on the contrary, it gives artists the freedom to manipulate and create environments and situations, architectonic atmospheres and proportionated spaces, materialise geometries and situations that never existed before, etc. A perspective drawing can be the equivalent of an environment before its construction, so we could draw a new environment, magnify it - using digital technology, and have a first person experience [19:2]. If we analyse how do we express graphically, we can say

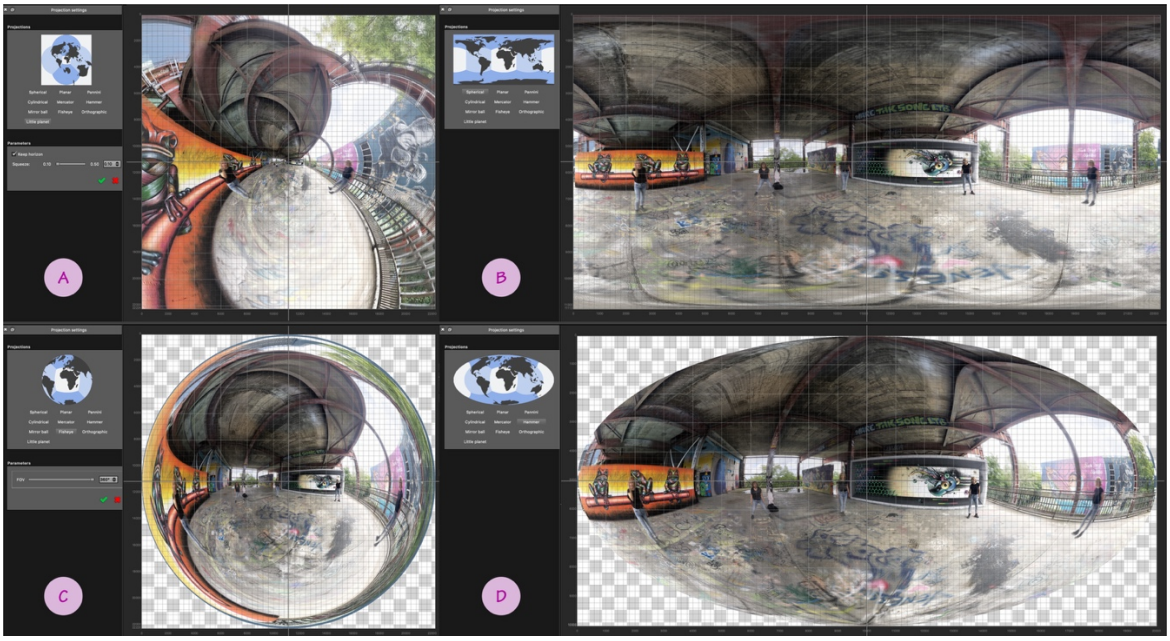

Figure 3: Conversion among spherical projections: little planet (A), equirectangular (B), azimuthal-equidistant (C), hammer (D). Equirectangular panorama shot at Teufelsberg, Berlin, Germany. Collaborator: Ana Aparicio. Panorama ©Lucas Fabian Olivero, 2023.

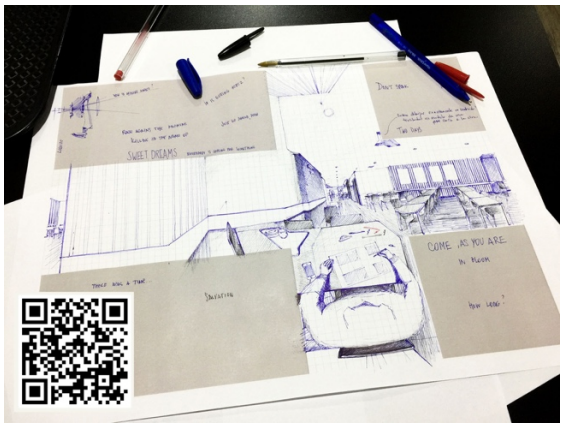

Figure 4: "Tall as you are". Urban sketch in cubical perspective. Scan the QR code to view the VR environment. Lisbon, Portugal ©Lufo Art (Lucas Fabian Olivero), 2018.

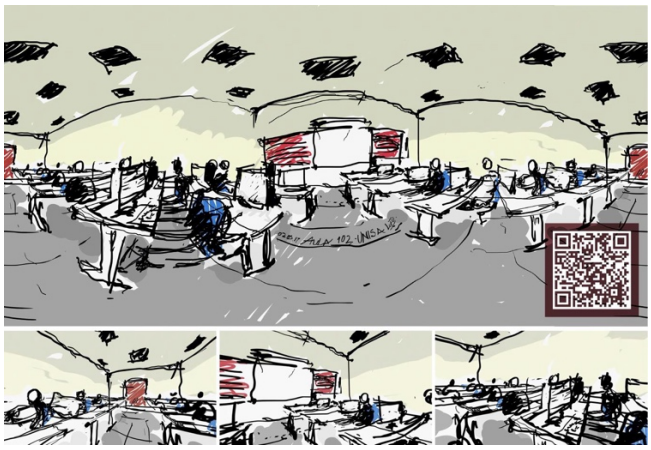

Figure 5: "Aula 102, UNISA". Digital artwork in equirectangular perspective made on-the-fly during a drawing course. University of Salerno, Italy ©Lufo Art (Lucas Fabian Olivero), 2017.

that mathematicians do not need any canvas at all (as they think in terms of logic and their constructions are purely mental); architects, designers and engineers need a canvas, but they have to think in construction protocols for the further materialisation of those geometries, and hence they are limited by statics; artists do not have to leave the canvas but they do need to materialise their projects, hence they are freer than architects but more limited than mathematicians [13]. If we consider mathematicians as the "freer builders", then artists could get one more degree of freedom and enhance their constructions using the tools of logic and abstract thinking, as mathematicians do (e.g., M. C. Escher). This provides the artist with a further, embracing structure of the mere visual expression, and leaves space to visitors for building the logic in their mind (if they understand the structure behind). Philosophy and social sciences provide more structures through humanistic tools such as deep emotional messages or experiences, social behaviour, etc. The management of these embracing structures allow artists to manipulate the composition of an artwork to a deeper level and the

flexibility of creating less complex compositions if wanted, which leaves the aesthetic experience accordingly to the complexity of the observer's mind [39].

2.4 Handmade Immersive Art (HIA)

Creating handmade Immersive Art is, therefore, the intellectual exercise of understanding spherical perspectives in the abstract space and within the canvas, a reciprocal process of thinking and materialising with and from each new stroke. Understanding such principles give the artists also the freedom of composing their own system by breaking, distorting and mixing rules, with linear and curvilinear systems, with Euclidian and non-Euclidian geometries [20]. In other words, rather than limiting, structures like perspective enhance the artists' skills and the complexity of the artwork, without taking away from them the possibility of escaping towards pseudo random expressions.

3 The Spheritivity collection

3.1 Concept (artistic statement without a scientific proof)

In the world of art, creativity gets often related to ideas like "opening the mind", "stretching boundaries", "leaving structures behind", "searching for the unknown", etc. Many times, all these actions get associated to the consume of psychotropic compounds or alcohol, as they help to put the guards of our consciousness down to open the doors of freedom and creativity. Nevertheless, the human mind can also be highly creative and flight free of structures without consuming anything, right as many children can easily demonstrate. In fact, adult minds might get more limited not by the absence of substances but by the idea of how the final artwork must be, by the expectations on how the artwork should have been, by the frustration of all the things they did not do instead of the joy of all the things they did do. In this case, the creative process is focused on the result, rather than in the construction behind it, the slow process of building an image. This has been increasingly going on and on, up to the current ectasis in which we live nowadays, where an impressive artwork needs nothing but seconds to be generated by an artificial intelligence. But, as António Bandeira Araújo put in better words: "Suppose we invent a machine that make love better than you, would you stop making love? The machine can do it instead of you, but it cannot do it for you". And indeed, are we not built and shaped by our experiences? We must pass through life to know what life is, we must love to discover what it feels like, no matter how many books you read about it, how many and how good people explains it to you, or how much of it you watch on a screen. Spheritivity strongly adheres to this. Indeed, we can enjoy the slow process of building an image, making it appear as if a meditation would be. The more tools and knowledge you have about graphic representation, the more you will enjoy playing in the abstract space, and the more creative and wilder your mind will go on the canvas... And everything for free and without brain damage!

3.2 The collection

Spheritivity brings together several artworks, made using watercolours, ink, acrylic, oil on papers and canvases. They gather the graphic experimentation hold since 2022 where the first ideas of playing with visual paradoxes started. Among them there are:

Parallel isometric perspectives, both at 60°/30°and 45°(Figure 6). Artworks included in this category: Deconstructing Berlin (2023), Labyrinth 01 (2023), Labyrinth 02 (2023), Who Wants to Kiss (2023), All You Need is Art (2024), Io Vivo Quasi in Ciel (2024).

Conical linear perspectives, from one vanishing point projecting on one single plane up to infinite vanishing sets projected on a cubical surface (Figure 7), it includes: Los Chicos Solo Quieren Rock (2022), Impossible Things (2023), Whatever it Might Be (2023), Mitte (2023), Running All Day (2023), The Eye in the Sky (Forthcoming).

Conical curvilinear perspectives, using the equirectangular and fisheye projections (Figure 8). Artworks included in this category: Un Faro en la Noche (2022), La Petit Tempete (2023), A Miracle (2023), Armonía (2024), Du Bist Liebe (2024), Enjoy the Silence (2024), Portal (2024), Moebiuslin (2025), Paradoxes 1 (Forthcoming), Paradoxes 2 (Forthcoming).

Free mixed-up perspective systems (Figure 9). Artworks included in this category: A Wizard Without a Shadow (2023), A Shadow Without a Wizard (2024), Was ist jetzt an der Zeit (2024), Set Me Free (2024), Sulle Corde di Aria (2024), Rudolph Deconstructed (2024), Upon What (2024), Der Wind (2025), The Eight Step (2025), Noch Einmal (2025).

3.3 Setup and interaction

A desirable setup would be a space of between 12-16 m^2, following the scheme detailed in Figure 10. This requires an art easel, a table, a computer, a beamer or an external monitor, and 4 to 6 wall hangers for paintings.

The easel with either a spherical or a cubical perspective is placed next to the table. The virtual environment generated with such drawing is the one loaded on the computer. Visitors interact with the computer by waving their hands in front of the camera, while the projector shows the result of such interaction in the wall in front of the visitor. Visitors can compare the flattened drawing with the VR environment and either seek for conclusions on the artwork/VR environment correlation (if they are new to immersive and handmade perspectives), and/or analyse and discuss how the most complex parts were solved (e.g., the poles within an equirectangular perspective, the faces' discontinuity within a cubical perspective). On the side wall, a collection of artworks shows the path of perspective knowledge with at least one artwork per category (one parallel perspective, one conical linear, one conical curvilinear, one mixed). Visitors can follow this path and indagate the many possibilities that perspective can offer for boosting creativity and the versatility of the technique to be explored either through more precise methods (like tracing with ink on paper) up to freer methods such as oil and acrylics on canvas.

3.4 After interaction survey

Visitors can take a gift postcard, containing a print of the spherical or cubical drawing in exhibition and a QR-code where they can access and run the VR environment directly within their mobile phone, access a digital anonymous survey, or see further details of the artworks.

Figure 6: "Deconstructing Berlin". 30º/60ºparallel linear perspective. Ink and watercolours. DIN A3 (42x29.7 cm.) ©Lufo Art, 2023

Figure 7: "Running All Day". Conical linear perspective with three vanishing points. Ink and watercolours. DIN A3 (42x29.7 cm.) ©Lufo Art, 2023

The survey aims to rate the experience so that visitors can express their opinion and give feedback on the operation of the installation. It is expected that this information, which include scales, guided choices, media sharing, will give quantitative data on usability and perceptual impact; and qualitative insights to be processed and elaborated for improving both the user interface and experience in further editions of Spheritivity.

Background

- Are you an artist? (Yes/No).
- How high would you rate your **theoretical** knowledge on perspective? (Scale 1-10).
- What would you say is your **practical** knowledge on perspective? (Scale 1-10).

Gesture Intuitiveness

- Did the hand gestures feel natural? (Scale 1-10 for "orienting the camera" gesture / Scale 1-10 for "zooming in/out" gesture).
- Which other/s gesture/s would you suggest? (Text field and/or upload picture/video).

Ease of Interaction

- How easy was it to learn the hand-gesture controls without instructions? (5-point Likert scale: 1=Very easy; 5=Very difficult).

Spatial Understanding

- Did you notice differentes between the VR environment and the flattened drawing? (5-point semantic differential: 1=Not at all; 5= A lot).
- Which ones? (Text field).

Perceived Creative Insight

- Did exploring a Hybrid Immersive Artwork give you ideas you never had from a flat drawing alone? (Yes/No + text field: "If yes, please describe briefly").

Visual Paradoxes

Figure 8: "Moebiuslin". Conical spherical perspective. Equirectangular projection. Acrylic on canvas. 40x60 cm. The artwork contains all vanishing points around the observer and explores several visual paradoxes including infinite stairs and a non-orientable surface (a Möbius strip, visible only on the VR view) ©Lufo Art, 2025

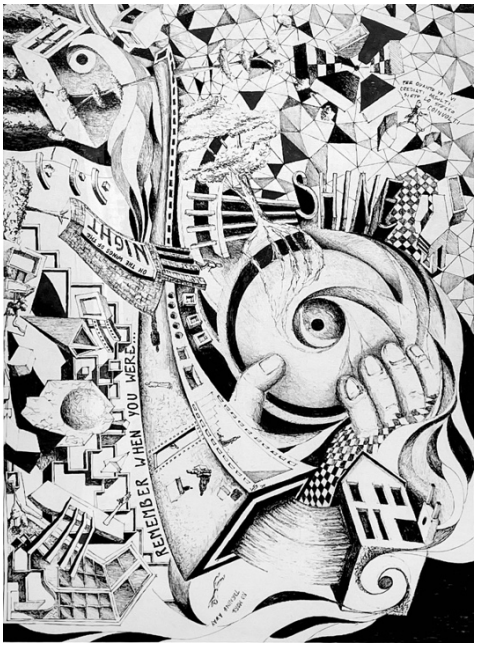

Figure 9: "A Shadow Without a Wizard". Mixed perspective. Ink on canvas. 50x70 cm. ©Lufo Art, 2024

- Did you notice any Escher-like visual paradoxes or impossible geometries? (Yes/No; if Yes → open text: Which illusion stood out most?).
- You noticed them better on the flattened drawing or during the VR navigation? (Flat drawing/VR).

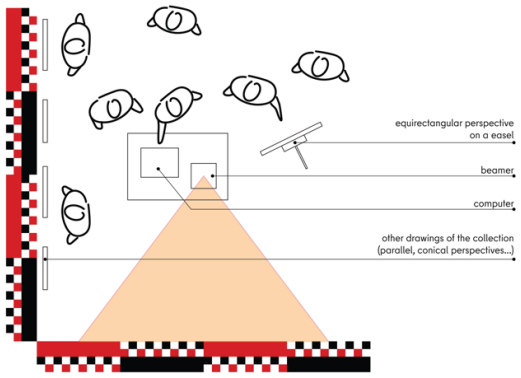

Figure 10: Desirable setup

Learning Transfer and utility

- Did you know you can create a virtual environment using a physical handmade drawing? (Yes/No).
- Do you feel confident you could sketch a simple spherical-perspective scene on paper after seen all the artworks of Spheritivity? (5-point Likert scale: 1=Not confident; 5=Very confident).

Open Reflection

- Any other thoughts or suggestions about Sphertitiviy, Hybrid Immersive Art, Spheri? (Text field).

4 CONCLUSION

The article developed the content of Spheritivity, a collection of non-automatised perspective drawings exposing the potential that

perspective can give to artists for boosting their creativity. The collection includes compositions using parallel and conical projections (both linear and curvilinear) onto a plane, a sphere or a cube. As a way of enriching the applications in digital arts, Spheritivity highlights applications following the latest methods for spherical perspectives: the equirectangular, the azimuthal-equidistant and the cubical-spherical methods. Furthermore, Spheritivity is enhanced with two components: an intellectual one, optical paradoxes, and an interactive one, through the installation Spheri. The setup of the exhibition shows a path of knowledge from the most well-known systems up to the newest developments, leaving also place for free and mixed systems. Within the presentation of Spheritivity, it is expected to be carried out a voluntary and anonymous survey with the goal of collecting both qualitative and quantitative data for enhancing future editions. By boosting the association between perspective and creativity, Spheritivity contributes to a broader dialogue about innovation and the knowledge of projective geometry, encouraging a deeper understanding of perspective as a theoretical and practical whole, what is its role within artistic processes and the relationship between perception, imagination, and art.

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