


# PROSPECTIVE WORKFLOWS FOR GENERATIVE AI-ASSISTED IMMERSIVE ILLUSTRATION. THE CASE OF *MULTIPLICITY*

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## ABSTRACT

The introduction of generative AI into the field of immersive illustration threatens to displace both the knowledge of perspective and the practice of drawing as the main tools of this very technical branch of illustration. Yet for many illustrators this type of technical drawing is not just a tool but an end in itself. We consider what future workflows may accommodate both AI and handmade drawing in a way compatible with the market realities of illustration, and we illustrate our reflections with the case study of *MultipliCity*, an immersive installation exploring and representing the interplay between myth and reality in the Venetian urban environment..

Keywords: Spherical perspective; Immersive illustration; Generative AI; Technical drawing; Equirectangular.

## 1. INTRODUCTION

It is likely that the introduction of high-performance Generative AI at scale will revolutionize the field of illustration. It remains to be seen what the impact will be upon the public, the publishers, and the illustrators themselves. It is the latter group we focus on in this paper. The reception of AI by illustrators has been overwhelmingly negative, as evidenced from the furious online vitriol, interviews with insiders, lawsuits (Cavna, 2023) and organized movements for AI regulation (*Creative Rights in AI Coalition*, 2025). There are several reasons for this negative reception. The one that concerns us in this paper is the problem of the likely minimization or near elimination of the role of drawing in the making of illustration work. We will discuss these concerns with a look towards the prospective workflows that may be created to keep drawing at the center stage of the illustration activity. We will focus on the special — and very technical case — of our own artistic specialty, which is immersive illustration.

## 2. THE PURPOSE OF ILLUSTRATION

Illustration walks a thin line between art and business — it is a commercial artform, bound by tight deadlines and external requirements; whether helping to sell soap or war bonds, magazines or ideologies, its purpose is mostly clear cut and shaped to a client's requirements. Such commercial artist is the historical norm, much more than the contemporary gallery artists that creates on his own whim and then attempts to sell his work; most artists, most of the time, have created to spec in a form or another. The typical Renaissance artist was a commercial artist, and much of their work was even akin to illustration. There is no Michelangelo without a Medici or a Della Rovere to engage him, and even if a Michelangelo had sometimes great leeway, there was still a general purpose, a direction to follow, even when not as constrained as to paint one more *Madonna con Bambino*. But even if market realities have a strong say in illustration, it has always remained a work of passion and creativity and one of the great expressive avenues for the human skills of drawing and painting. The fact that the Sistine chapel is a work for hire with a purpose supplied by a patron does not nullify the artistry and the passion and the personal meaning that the artist manages to squeeze through the more or less tight constraints. One can look at illustration as a job whose purpose is to create images for consumption. This is strictly correct. But we might as well say that illustration's main point of interest is that it is a commercial vehicle that finances one of the worthwhile endeavors of the human spirit — in this view, the main thing that is produces is not illustrations, but illustrators. Drawing can be seen as a mode of thinking, and one that is supported on a skillset developed and transmitted across a chain of multiple generations.

In this view illustrators are not just commercial makers of pictures, but the bearers of one of the torches of the human spirit, and the

existence of this knowledge and this mode of thought is something that enriches us all, even those who do not partake in it directly but only infer its existence from the enjoyment of its products. We take pleasure in illustrations not just because they look pretty, but because it pleases us to know that other humans — like us — exert their abilities to the utmost, in a way that makes us proud of being human, just as we ourselves may dignify our humanity by expressing it in some other creative way, being engineering, science, chess playing or sports. Let us put it this way: the value of the Renaissance is not that it produced Michelangelo's Sistine chapel ceiling, but that it produced Michelangelo. And our pleasure in gazing at the chapel's ceiling is not that it offers such a splendid view but that it reassures us of our value as humans, even if we ourselves are no Michelangelo.

So, in the case of illustration — as in many similar activities — there is a delicate balance between the legitimate needs of the business that finance the artist and the preservation of the deeper aspects of the artform. The insertion of AI generated imagery — like many technologies before, such as photography — risks breaking this delicate balance. Drawing may be replaced by textual prompting as a main creative tool of illustration — and this may happen whether or not the AI imagery is better than the human generated one; it just needs to be judged good enough by the clients so that whatever originality and creativity is lost is compensated well enough by speed and convenience. This may happen by sheer market force even if not desired explicitly by any specific client or publisher. One can imagine a scenario where drawing can no longer compete in speed and convenience with text prompting and gets replaced by it, even if the generated imagery lags behind the best of human illustration. This parallels what happened when the convenience and speed of photography ended the golden age of illustration:

The very thing that had helped create Vogue would now be sidelined to the more popular medium. Illustrators would still find work outside of fashion and with the magazines as art directors, but the influence and prominence of the hand-rendered image had waned (Ward, 2022).

The volume of image creation would certainly not decrease, quite the opposite; one expects imagery to multiply to a glut (“To those decision-makers who value high speed over creative originality, ‘AI is their wet dream.’” (Cavna, 2023)); but how much poorer the experience of creating them! Prompting is mainly a verbal, not visual activity, and a poor one at that! It is disjointed prose, a guessing game of reverse engineering. The promise of AI, that it would allow for natural conversation instead of programming may be true in LLMs but is not the usual experience of AI image generation. Textual prompts are like blind probing for the hidden knobs inside a black box, filled with ugly pseudo-technical terms of doubtful effect, like so many dark incantations. Take this sample of anti-poetry by an AI prompter using Midjourney (Shadow, 2024):

maze, Narrow steep staircase, Old Building, Floating buildings, Urban, City rain, art by miyazaki and Ian McQue and Akihiko Yoshida and Katsuya Terada, colorful, trending on artstation, gorgeous, ultra-detailed, realistic, 8k, octane render, hyper detailed, cinematic

It is hard to see an improvement in the human condition when instead of taking classes in drawing — or 3D modelling, or even programming — the budding artist takes instead classes on “prompt engineering”, which is to say, on begging the machine for favors. We say begging for favors because the techniques involved — though elaborate — are not at all like programming, which is rooted in a deep knowledge of mathematics and logic, and not stable nor translatable nor deep nor developed enough to be called either an art or a science (it is unclear whether some common tokens such as “50mm lens, 8k, hyper detailed” are effective or just cargo cult superstitions), but more analogous to the soft skills that an art director needs for verbally finessing an erratic artist into doing what he wants.

## 2.1 THE ROLE OF DRAWING

But why care so much about drawing after all? Why worry to preserve it above other of the many skills of the illustrator such as painting and the more current ones such as 3D modelling or compositing? “Drawing” does not just denote the thing that stays in the paper. It denotes a process and not just a process of art creation, but a thinking process. It can be seen as a mode of visual thinking essentially different from verbal thought (“When we do not have the words to say something, drawing can define both the real and unreal in visual terms” (Kovats, 2007)) and it has long been seen as the fundamental skill underneath illustration and in fact all visual art, being fundamental for the ideation of painting or sculpture or architecture. This has been argued quite explicitly at least since the Renaissance by such authors as Leonardo and Michelangelo as reported by Vasari and others, and was always taken for granted in the trade books used for the instruction of budding illustrators (Heller & Arisman, 2004).

## 3. IMMERSIVE ILLUSTRATION

Immersive art has a long history that we will not recap here, from the 19th century panoramas to VR (see Grau, 1999; 2003). We will only refer to the special case of the recent type of immersive illustration done with spherical perspective drawing. This is a drawing discipline that has hijacked the tools of spherical photography, that works by stitching several photos so as to cover a full “360” view from a fixed spatial point. They usually store the stitching as an equirectangular projection that carries all the visual information. This image can then cover a virtual sphere to allow for immersive visualization of the photographic content in VR. Immersive illustrations work by drawing directly onto the equirectangular projection. Then the drawing, just like a spherical photograph, can be visualized in VR. Of course this requires the artist to master the peculiar

perspective deformations that the equirectangular projection causes. This has been formalized into a specific type of perspectives, called spherical perspectives (Araújo, 2021) which include equirectangular (Araújo, 2018a), azimuthal equidistant (Araújo, 2018b), and cubical spherical perspective (Araújo et al., 2020; Olivero et al., 2025), which have been formalized and can now be learned as technical drawing methods, although most artists just draw using fixed grids and other ad-hoc methods, or just by their intuitive knowledge of the perspective's geometry (Masiero Sgrinzatto, 2021; 2023).

### 3.1 THE EFFECTS OF AI ON IMMERSIVE ILLUSTRATION

The pressure to integrate AI is being felt in the field of immersive illustration and we have experienced it personally. Both believe that the ability of spherical drawing to bridge the analog and digital realms is very unique and is not only a way to represent environments, but also a way to think, understand and design through one's hands (Pallasmaa, 2009). It is urgent to work out how to integrate the abilities of generative AI into a creative workflow that could expand the scope of handmade drawing rather than eliminate it.

Chiara Sgrinzatto is an experienced professional illustrator working in this field for many years and António Araújo has been deeply involved in the formalization of spherical perspective drawing as well as in the development of immersive drawing software. Both authors are enthusiastic about the potential of AI but are concerned that their field — currently based on a foundation of handmade technical drawing — will be rendered not obsolete but less interesting by relegating the artist to the position of prompter and art director, thereby not robbing him of the job exactly but making that job less satisfying by pushing it far from its visual foundations.

There are two main ways that AI can render immersive illustration less interesting:

1. By negating the use of drawing, relegating the artist to a cycle of textual prompting and evaluating of AI proposals, more an art director than an artist.
2. By negating the need for perspective knowledge, through interfaces that do not require or profit from it.

Point 1 does not mean to diminish or denigrate the role of art director, it just means that the two different roles are valuable, and it is the artist's role that is at risk. Analogously, some people like to be working as engineers/programmers rather than project managers and would think it a loss to lose that role to the machine. Is there an objective reason why you should care, if the job is still done and you still have a role? Maybe not. Preferences are subjective. This does not make them any less real or important. Some people think that drawing — as a process — is not just a valuable tool but a way of life, and they want to preserve it.

Point 2 probably sounds strange to outsiders. In fact, there have been considerable efforts in software interfaces precisely to eliminate the need for perspective knowledge (Kihlström, 2018; Tran Luciani & Lundberg, 2016). But the fact is that for many immersive illustrators understanding the perspective is both interesting and leads to its own form of visual expression (Araújo et al., 2019; Michel, 2013).

The installation described in the present work is a first exploratory step in a program — to be implemented as a Ph.D. dissertation by Chiara Sgrinzatto under António Araújo's supervision — on how to go a different way: how to develop artistic workflows that integrate AI techniques to enhance rather than replace the art of handmade drawing in the specific context of immersive illustration.

The way to address the question is to investigate how to bridge the gap between traditional drawing techniques and AI-generated imagery, while exploring new artistic processes for 360° immersive environments. Focusing on the production of immersive artworks, the research does not have a text-based workflow, but aims to maintain a visual approach.

Drawing good 360° illustrated imagery requires great effort and advanced skills, AI generation could help democratize this medium and improve the work of designers and artists. AI could assist in generating ideas or styling existing sketches, as well as automating repetitive and time-consuming tasks (e.g., background creation, texture generation), especially in the highly distorted areas of the spherical image. This hybrid workflow not only enhances the efficiency and creativity of the artistic process but also has potential applications in fields such as architecture, game design, and virtual reality experiences, where fast and precise visualization of complex environments is required.

A better understanding and use of 360° generative AI technologies could enable a more effective real-time generation of virtual or mixed environments, which is currently possible in a very rudimentary way with a very poor spherical geometry. This could lead to an effective and varied immersive experience for the public.

Thus, the possible results of this study could be useful for immersive artists and, as a side effect, for art related fields. It could stimulate reflection on current possibilities, necessary requirements, improvements of existing services, possible software integrations and future developments.

### 3.2 CURRENT PLATFORMS FOR IMMERSIVE ILLUSTRATION

The installation described ahead makes use of *Skybox AI*, a generative AI from Blockade Labs (*Skybox AI*, n.d.) that specializes in the generation of equirectangular panoramas. Let us briefly survey the current tools in the field of generative AI available to the artist at the moment of the creation of the installation, so as to explain our choice of platform.

A 360° picture has a higher complexity than a normal image: rules of composition have to be concerned with object disposition around the viewer, details are usually numerous and the resolution must be larger

than a normal image because in the process of re-projecting a spherical image onto a screen, the viewer watches only a small part of the image at a time, and each such part must have enough resolution to fill the screen with adequate detail. Thus, combined with a specific spherical projection format in which those illustrations must be done to work properly (usually the equirectangular projection), this sets a limit on the number of Generative AIs that are up to the task.

*Dall-E* can be used to create an immersive image by generating 6 views (one for each cube face of a cube map) with 6 text prompts; assembling and patching using a combination of inpainting techniques and exporting the portion of the image through a panoramic patching software (e.g. Pano2VR). Kevin Holer explains the process in detail (Holer, 2024).

*nVidia GauGAN 360* (*GauGAN Turns Doodles into Stunning, Realistic Landscapes* / *NVIDIA Blog*, n.d.) (Park et al., 2019) is a highly intuitive tool made to help artists create virtual worlds from scratch. It converts scribbles in realistic spherical panoramas, allowing users to draw their own segmentation maps and manipulate the scene on an equirectangular or cube map image, updated in real-time. Each drawn area is labeled with material labels like sand, sky, sea or snow, that are rendered in the generated output. However, there was no way to integrate this interface with detailed handmade drawing as a prompt and the results were too painterly for our purposes; we wished for a more drawing-like look for both input and output.

*Midjourney* can generate panoramic seamless images, by using a text prompt and setting the parameters “2:1 aspect ratio” for the same ratio as an equirectangular image and “tile”, to get seamless images for tiling pattern. The generation of an equirectangular image in *Stable Diffusion* was done with *Deforum* on *Google Colab*. The only parameter that can be set for panoramas is the aspect ratio 2:1.

Both models fail to properly solve the spherical geometry: sometimes the horizon is misplaced, or the distorted areas at zenith and nadir are not rendered at all, or are rendered in another projection, or the tiling fails. The generated image is 1024px wide for *Stable Diffusion* and 1500px wide for *Midjourney*, requiring upscaling to be viewed as a VR panorama. There is almost no control over composition, although in *Midjourney* one can highlight and change some areas of the image during the generation process.

By contrast, *Skybox* by Blockade Labs is a model based on *Stable Diffusion* but especially trained for generating spherical images (Stan et al., 2023), capable of generating 8k equirectangular scenes from text prompts with a great variety of styles. It also creates depth maps of the generated panorama. It is possible to enhance the generation by drawing directly on the tridimensional space in the web app, or by adding a control image when using the API service. This last aspect made it possible to integrate visual prompting in a suitable way to our purposes. The API version of *Skybox* Blockade Labs was used for the installation for the spherical geometry reliability, the high resolution of the generated

image and the possibility to use handmade drawings to preserve the composition. It was possible to exploit the spherical drawings done during the sketching campaign through the control image feature. The drawings were stylized, obtaining a white sketch on a black background which was fed to the model as a visual prompt along with the textual one. The access through the API, mediated by Node.js was another strong point, as it allows for programmatic variations and systematic tests in prompt and control image variations.

### 3.3 360° DEGREE IMAGERY, AI AND DIGITAL MEDIA ART

The literature on digital media art projects that combine AI and immersive environments is still limited. (Anantrasirichai & Bull, 2022) review current AI technologies in the creative industries, highlighting advances in content creation, analysis, enhancement, extraction, and compression. They argue that AI developments will continue to augment human creativity rather than replace it. (Y. Wu, 2022) focuses on VR and AI in art, proposing an AI-based method for recognizing art objects in VR creations. (Gong, 2021) discusses Artistic Stylization, which uses mathematics and computer simulation for digital media applications such as film, animation, and game development. (Takacs & Vincze, 2021) and (S. Wu et al., 2022) present an object recognition toolset for multimedia experiences. (Bussell et al., 2023) propose text-to-image AI models for design inspiration, while (Grech et al., 2023) present an AI-powered VR environment for collaborative brainstorming.

Documented digital media art projects combining AI and 360-degree environments are rare. "Terra Mars" (Shi, 2019) at Siggraph 2019 features artistic renderings of Mars using AI trained on Earth's topographical data and satellite imagery. "Desiring Machines" (Forero et al., 2023) is an interactive media art project that uses speech emotion recognition to create affective virtual environments with real-time speech recognition and panoramic image generation. "Tulpamancer" by Matthew Niederhauser & Marc Da Costa, premiering at Venice Immersive 2023, uses machine learning to generate personalized, dreamlike VR experiences in real time (*Biennale Cinema 2023 | Tulpamancer*, 2023).

Although their work is not specifically 360-degree based, the practices of the following artists are noteworthy. Refik Anadol (Anadol, 2025) and Davide Quayola (*Selected Series*, 2025) both use AI to create immersive installations that transform data into dynamic visual experiences, often incorporating interactive elements that respond to viewer movement. Mario Klingemann (*Quasimondo | Mario Klingemann, Artist*, 2025), widely known for his work with neural networks, creates AI-generated art encapsulated in beautifully crafted objects, exploring the boundaries between human and machine creativity.

## 4. MULTIPLICITY

*MultipliCity* is the first phygital immersive installation designed and exhibited by Chiara Sgrinzatto in the process of exploring the potential of AI to augment human creativity and develop hybrid artistic workflows. Hand-drawn 360-degree panoramas and generative immersive AI are key elements in exploring and representing the enigmatic interplay between reality and myth in urban environments, with a specific focus on the city of Venice. Four pairs of hand-drawn spherical panoramas, drawn on site by Sgrinzatto, establish an identification and correspondence between specific locations in Venice and their analogues in a series of parallel cities. The combination of places, content and narrative creates a circular relationship. The generation of 360-degree images based on the drawings creates the "invisible" third layer, where the machine's interpretation of the environment is given and then combined with that of the artist.

This approach pushes the boundaries of digital art and provides valuable insights into the collaborative potential of human and machine creativity.

In *MultipliCity*, the hand-drawn and AI-generated panoramas are displayed on a series of paper-printed mini-domes equipped with a QR code that leads to the corresponding immersive content in the virtual world. Visitors are invited to walk through the mini-domes, stop and observe each one, and find their cross-correlations. They can then enter the virtual layer through their smart devices to enhance and complete the experience.

### 4.1 CONCEPT OF THE INSTALLATION: MYTHICAL CITIES

Throughout history, certain cities have acquired a powerful mythological appeal, transforming them into iconic places that transcend time, which we can call "eternal cities." They have become icons of the past, a source of pride in the present, and simulacra of themselves in the future. Mythical cities captivate visitors and leave a lasting impression on their hearts and minds.

One of the most famous among them is the city of Venice. Observing Venice reveals several mythological layers: its dual nature as a city in the air and its floating reflection in the lagoon, where water and land are constantly in motion; its physical dimension, made up of its narrow *calli*, dozens of islands connected by bridges, and magnificent *palazzi*; its vast history and the resilience of its inhabitants and visitors, for the will of the Doges that made it flourish and resist over time as a water city; its majestic identity, tales of ports, travels, distant markets, decay, and modern gentrification (Davis & Marvin, 2022). Venice is also a myth because of the storytelling it has created for itself over the centuries, because of the thousands of artists who have visited it, and the resulting narratives it has inspired in literature, music, painting, theater, cinema, video games, and even science. Venice has inspired the founding of other cities in the New World, and pieces of its iconic

architecture have been replicated in multiple locations (Molledo, 2009). These copysites, designed to generate profit and convey the idea of the perfect city, (Bernhard & Canestrini, 2019) encompasses a multitude of manifestations, from entire Venetian-themed cities or neighborhoods, such as the *Floating Lido* in Dubai or *The Venetian* in Las Vegas, Macau, and Tokyo, to Venetian-inspired areas or buildings, such as the *MetLife Tower* in New York and the copy of the *Café Florian* inside the cruise ship *Costa Atlantica*, among others.

The eternal allure of Venice is so strong that visitors unconsciously begin to see through new lenses and perceive echoes of a particular place in other contexts. Thus, they could see Venice when they are in Amsterdam or Stockholm (both called *Venice of the North*), Aveiro (called *Venice of Portugal*), and hundreds of other cities around the world. *MultipliCity* aims to explore how places influence their inhabitants and visitors, how this extraordinary inspiration occurs, and how these individuals in turn develop new perceptions and interactions in other places.

In the process of studying and understanding places through drawing, Sgrinzatto adds another layer to the game of perspectives, entering into a dialog with the machine. In a contemporary provocation, the artist asks the AI to open a third eye, providing an additional perspective and vision of Venice-the-Myth. Through generative AI, new interpretations of iconic places are created, enriching the narrative and offering new insights into their timeless appeal.

## 4.2 TECHNOLOGIES, TECHNIQUES, AND WORKFLOW

*MultipliCity* leverages a hybrid workflow that combines traditional hand-drawn illustration techniques with generative AI technologies, applied to spherical environments.

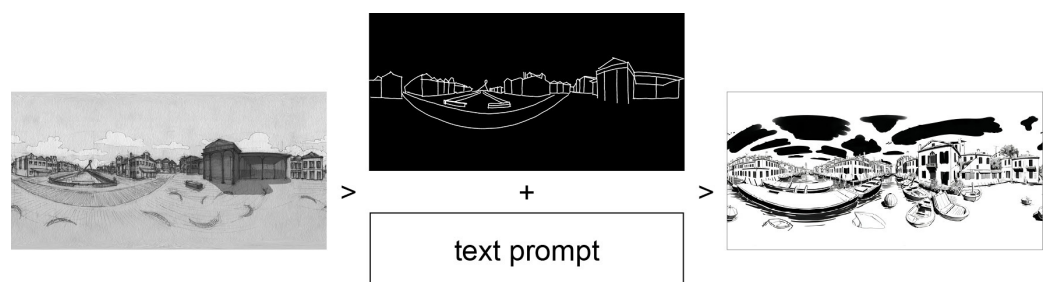


Figure 1. Left: Equirectangular drawing of Praça do Peixe in Aveiro. Center: Control image traced from the original drawing. Right: Image generated from the control image and a text prompt by Skybox AI from Blockade Labs. © Chiara Masiero Sgrinzatto

The process begins with (1) the artist creating detailed hand-drawn, which serve as the foundational layer of the artwork, (2) then the sketches are transformed into schematic “control images” for (3) feeding the AI along with the text prompt to get a new panoramic image, related to the drawing (Figure 1).

The 360-degrees sketches are done on location in equirectangular perspective, with pencil on A4 paper (Figure 1 - left). During the sketching

campaign (Figure 2), visual snapshots such as photos and 360-degree photos are captured from the same viewpoint for future reference. When relevant to the artwork, Sgrinzatto gathers additional material from local libraries, archives and City museums.



Figure 2. Documentation of the panoramic sketching campaign (Aveiro, Venice, Amsterdam, Stockholm). © Chiara Masiero Sgrinzatto

Sometimes the spherical perspective is the fruit of merging of two different viewports: the composition is adjusted accordingly when daily life urban elements obstruct or disturb the view. After the refinement of the sketch, the paper is scanned and edited in Adobe Photoshop, to refine and color the 360-degree illustration and fix issues on the discontinuities of the projection (0-360 seamline and poles). At the end of the editing process, 360 metadata are injected to the image file.

The hand-drawn 360-degree sketches serve as a base layer for the new visions generated by the AI, they are employed to creating the triptychs (which as mentioned above are in fact sets of 4 paired pictures). The elementary operation that is at the basis of the triptych creation is an interaction between the human artist and the generative AI. Skybox AI Model 2 via its API allows the upload of a schematic equirectangular image, along with a text prompt, to influence the composition of the 360-degree generated image. The “control image” (Figure 1 - center) is a kind of visual prompt, it is a white-on-black linear interpretation of the panoramic drawing, sized at 2048x1024 pixels, that keeps only the main structural lines, as judged by the intentions and purposes of the artist. Finally, the AI model is fed with visual and text prompt, along with styling parameters, in order to generate a new spherical panorama.

This process results in a pair of related images — a handmade drawing and an AI-generated image — in a way that is deeply mediated by drawing (Figure 1 - right). The original drawing, of course, retains the main features of traditional illustration — it is fully under the control of the artist, who not only draws but also *chooses*, for choice is the main activity of traditional illustration, the expression of artistic intention. The illustrator doesn't draw what is merely seen, but must choose what to emphasize or delete, in a plethora of major and minor adjustments in composition, elimination of extraneous elements, and so on, for compositional and general artistic effect.

This process of selection is again present in the second step, when the control image is "traced". Again, there is a wide range of choices in the hands of the artist. One does not simply trace the main lines of

a drawing; one decides which lines are the main lines. There are many choices of "main lines" one can make, as well as the level of detail with which they are drawn, from the simple lines of Figure 3 (top row) to the sketchy lines of the alternative control images of Figure 3 (bottom row). You can change details at will, remove or emphasize elements; you could even simply invert the brightness of the original sketch and provide the entire original image as a control. The possibilities are endless. The different approaches in manipulating the original 360-degree drawings show the attempts to find a way to stylize the panoramas keeping a meaningful structure, both for the artist and the AI. The different ways lines are drawn lead to differences in representation and interpretation of positive and negative spaces by the diffusion model, especially next to the distorted areas.

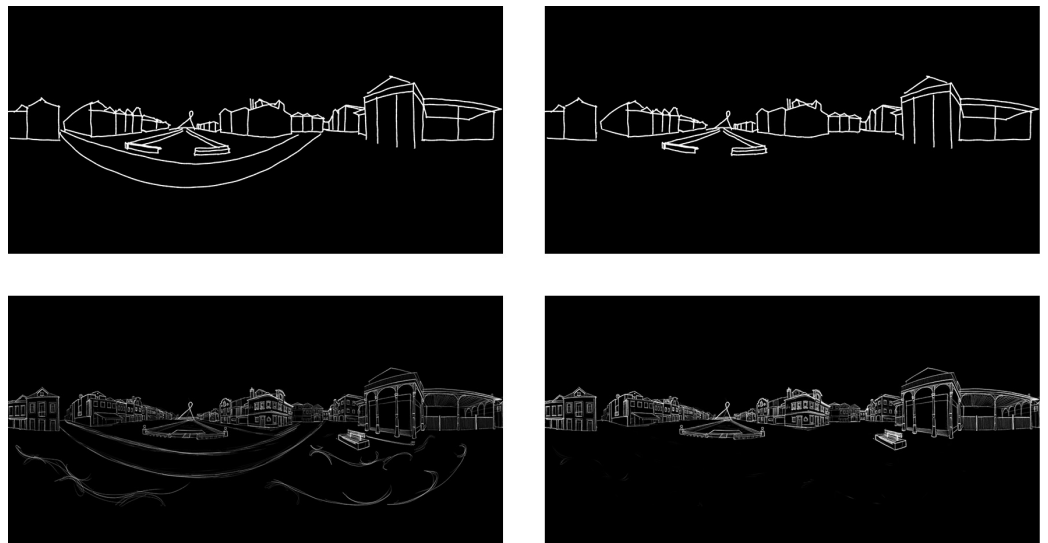


Figure 3. Three variations in the control image for the drawing of Praça do Peixe in Aveiro. Top row: digital traced version and variation in the elements; Bottom row: variation obtained by editing the sketch in Photoshop. © Chiara Masiero Sgrinzatto

Having established this main process, the workflow for creating the images in each triptych is a variation of the following:

1. The artist explores one of the parallel Venices (PV), selects a location, and makes a handmade drawing of an equirectangular image from observation in the field. Then Sgrinzatto & Araújo traces the stylized control image of the panoramic drawing and writes a textual prompt describing the location of the first drawing.
2. The artist finds a corresponding location in the (original) city of Venice (OV), draws another panorama on site, draws its sketch map, and describes the location as a text prompt.
- 3A. The control image of the OV location and the text prompt of the PV location are fed into the AI to generate a new panorama that is a mix of the two.
- 3B. The control image of the parallel Venice location and the text prompt of the Venice location are fed into the AI to generate a new panorama that is a mix of the two.

In this way, a triptych of interactions is established: between the images of the two locations cross-matched with their prompts; between the cities themselves; between the artist and the AI. And in this interaction, the practice of drawing is the fundamental mode of communication, as it is one of the primary ways that artists perceive and express the world through their sensibility (Bergen, 2005). Attention was primarily focused on preserving the act of drawing with the spherical sketches and by redrawing the sketches to be used as visual prompts. For example, in the drawing of Praça do Peixe in Aveiro (Figure 1), the corresponding prompt is simply "a view of Venice", which was cross-matched with an image of Venice whose prompt was simply "a view of Aveiro".

The interaction was dominated by the drawing process and driven by a curiosity to explore, through basic instructions, how machines interpret and visualize abstract concepts rooted in cultural and sociological frameworks. Using a series of 8 panoramas of 4 parallel locations, with variations, similarities and differences in the composition of the drawings (fig. 8-11, upper rows), the artist was able to analyze the performance of the AI in generating spherical images and evaluate how the sketches are geometrically interpreted, especially in the critical areas (zenith and nadir) where the projection is distorted; and at the seamline where the panorama ends. A detailed inspection, both in the equirectangular projection and in the VR view, was performed to highlight the problems in the generated images. For example, in Fig. 10, bottom right, the seamline is not handled well, while in Fig. 11, bottom left, the model failed to solve the 360° space in equirectangular projection, producing an image similar to the raw files of the one-shot 360-degree cameras, made up of two fisheye images. Sgrinzatto & Araújo also encountered some hallucinations and objects that did not adhere to the geometry (Fig. 8 and 10 bottom right).

#### 4.3 INSTALLATION CRAFTING

Once the images of the triptych are created, they are prepared for display in the installation. They are not presented directly as simple drawings in equirectangular projection, nor as strictly digital VR panoramas. Instead, they are presented as a physical/digital hybrid arrangement of anamorphic mini-domes equipped with QR codes linking to the interactive views (Figure 4).

Each image is turned into a hemispherical anamorphosis, that is, it is made to cover the inside of a physical hemisphere in the same way that the VR images cover the inside of virtual spheres. An ideal observer in the center of such a sphere would have the illusion of seeing the real environment. Because the hemispheres are small and the user is not in the center, there will be some perception of visual deformation, but the observer still has the sensation of seeing a very natural wide-angle view of the location.

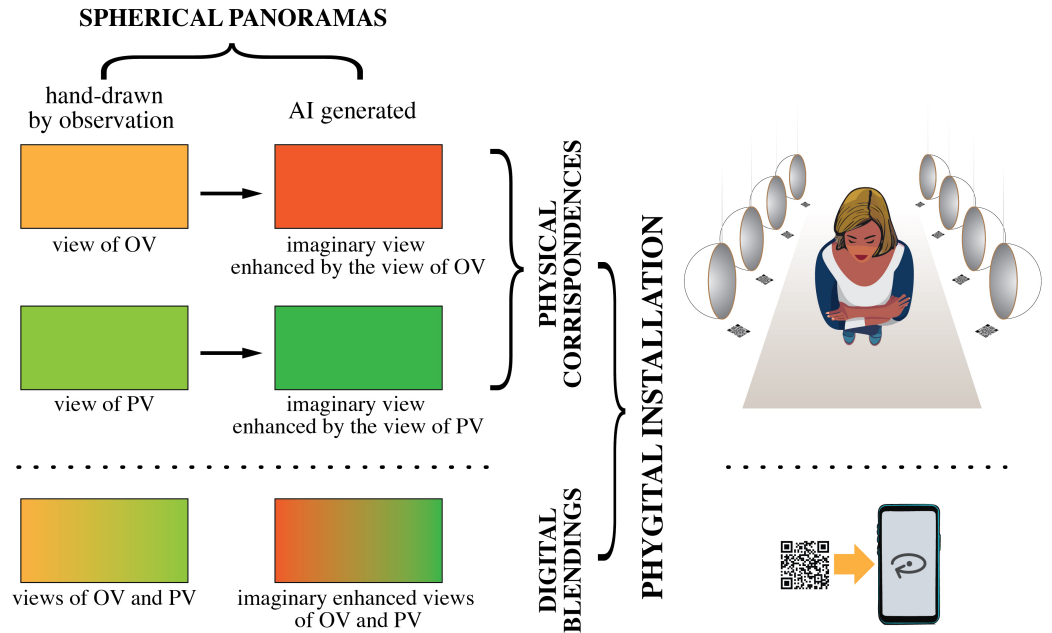


Figure 4. Diagram showing of the concept and the functioning of MultipliCity. On the left it shows how the tryptics of panoramas are created through iterations between the drawings and the related generated images. On the right side it shows how the visitor can experience the physical correspondences of the locations on the mini domes, and the blending between the images on smart devices. © Chiara Masiero Sgrinzatto

The hemispheres are constructed by the artist using embroidery tambourine instruments and the paper origami technique. Several prototypes were developed, testing paper, frame, size and weight. The equirectangular images are converted into an interrupted sinusoidal projection (Bugayevskiy & Snyder, 1995), printed, laser-cut to ensure perfect shape, and assembled into mini-domes to create an anamorphic illusion of a wide semi-panoramic view (Figure 5).



Figure 5. Working prototypes of the mini domes (left, center) and the solution adopted (right). © Chiara Masiero Sgrinzatto

The 360-degree images are presented as digital interactive worlds to allow viewers to experience the blending of the corresponding pairs of immersive views, adding further meanings not possible in the physical experience (Fig. 4). The blending between the images is specifically coded by the artist in KR pano, a html5 360° viewer and programming language.

By scanning the QR code on the bottom of the dome (Fig. 6), the Venice panorama is displayed. As you turn it to the left or right, it blends in with the parallel Venice panorama to reveal it completely when you turn

the view more than 180°. The blending effect is particularly effective when using smartphones with a gyroscope.



Figure 6. Visitors interacting with the installation. © Chiara Masiero Sgrinzatto

#### 4.4 EXHIBITION VENUE AND CONTENTS

*MultipliCity* was publicly displayed in the collective exhibition *Circuitos*, in the context of the XI Doctoral Retreat in Digital Media Art of the Doctorate in Digital Media Art, a joint degree of Aberta University and Algarve University, in Portugal. The exhibition took place from July 16 to 19, 2024 in a temporary gallery space at Aberta University in Lisbon (Figure 7).



Figure 7. The installation *MultipliCity* at the *Circuitos* exhibition, held at Aberta University, Lisbon, 16 to 19 July 2024. © Chiara Masiero Sgrinzatto

The installation was placed at the intersection of two spaces - the foyer of the auditorium and the bar, where the space narrows slightly to form a kind of hallway that facilitates the experience.

Four pairs of spherical drawings, corresponding to the following pairs of locations were exhibited, as well as the four pairs of AI generated panoramas (Fig. 10-13):



Figure 8. Top row: 360-degree illustration sketched in Venice and Aveiro. Bottom row: AI generated 360-degree images crossmatching the views of Aveiro and Venice © Chiara Masiero Sgrinzatto



Figure 9. Top row: 360-degree illustration sketched in Venice and New York City. Bottom row: AI generated 360-degree images crossmatching the views of New York City and Venice © Chiara Masiero Sgrinzatto

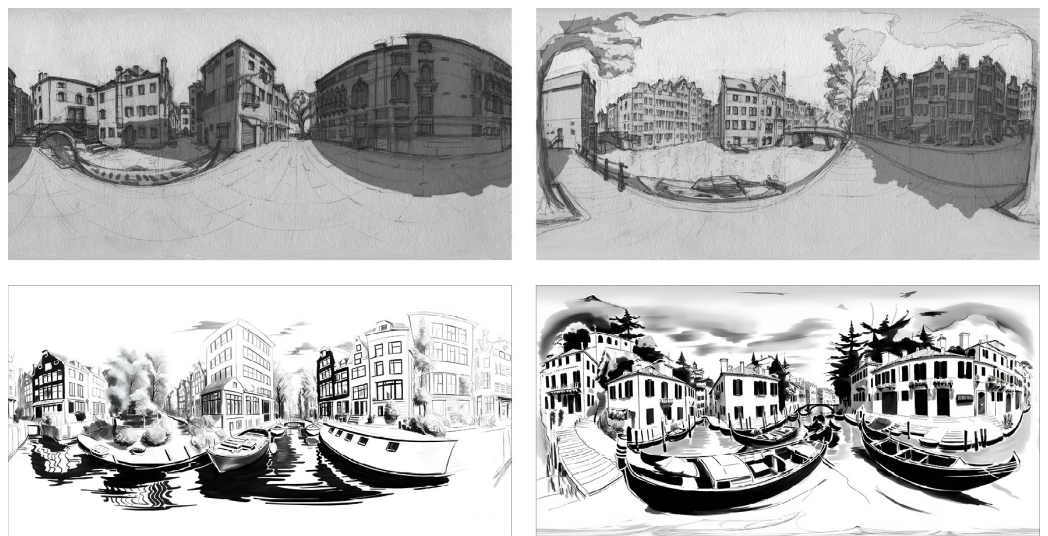


Figure 10. Top row: 360-degree illustration sketched in Venice and Amsterdam. Bottom row: AI generated 360-degree images crossmatching the views of Amsterdam and Venice © Chiara Masiero Sgrinzatto

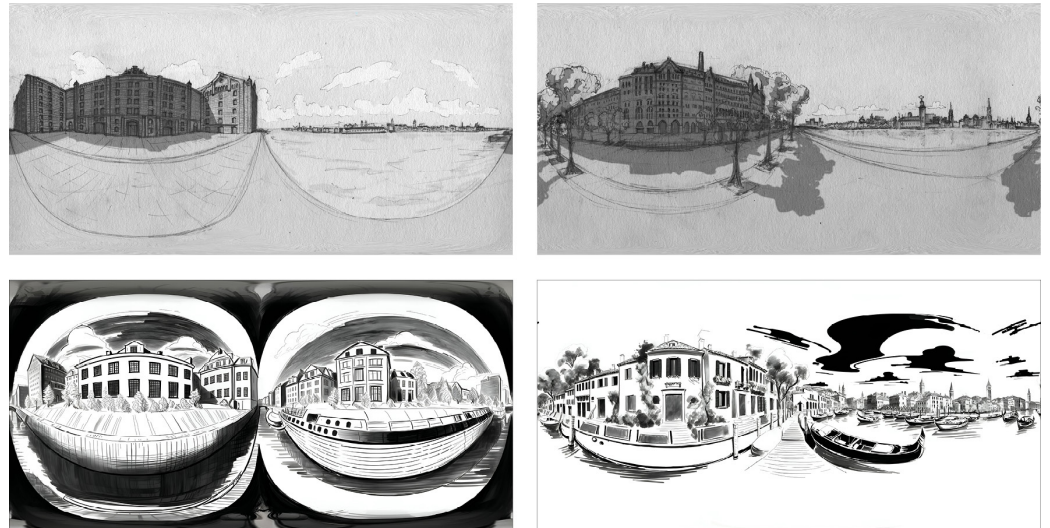


Figure 11. Top row: 360-degree illustration sketched in Venice and Stockholm. Bottom row: AI generated 360-degree images crossmatching the views of Amsterdam and Venice © Chiara Masiero Sgrinzatto

The generated 360-degree panoramas were displayed along the drawings. Each mini dome had a printed label with the QR code, and the name of the place depicted. The archive of material produced by the exhibition is collected in a virtual tour accessible online, via computer, tablet, smartphone and HMDs (Masiero Sgrinzatto, 2024).

The concept of the exhibition can of course be implemented in many ways and with varying numbers and locations. The choice above was influenced by the spatial characteristic of the exhibition venue and the portability constraints of aircraft transportation, that gave the opportunity to build a lightweight setup that could be completely assembled on site. Improvements such as larger printed domes, a professional development of the digital panorama code combined with a better knowledge of the exhibition site would be beneficial for a further version of *MultipliCity*.

## 5. TOWARDS A HYBRID WORKFLOW FOR IMMERSIVE ILLUSTRATION

*MultipliCity* represents a first step towards an investigation of hybrid human-AI workflows in the field of immersive illustration, through the means of artistic practice. It was created in the context of a Ph.D. thesis plan in Digital Media Arts to be developed by Chiara Sgrinzatto under the supervision of António Araújo. In future work we intend to investigate the possibilities of a fruitful interaction with AI. What would that entail?

In terms of technology, we would desire to use open-source tools. Not only for reasons of cost — after all digital illustrators have in the past used commercial tools at great cost even if for marginal performance benefits — but because of a special need to control both configurations and the user's own data. This poses problems as the current best model, although it can be accessed through a convenient API is not open source and cannot be subject to the desired changes or customizations. Also, the requirements for training such a model from scratch are beyond the abilities of the individual artist, at least as done in this case. However it would be interesting to see how far one can go with relatively low budget

options such as DreamBooth (Ruiz et al., 2023) Low-Rank Adaptation (LoRA) or the more recent Weight-Decomposed Low-Rank Adaptation (DoRA)(Liu et al., 2024) which brings promise of bridging the gap to full fine-tuning at greater efficiency. As we write this paper a new open source generative AI is available — 360PanolImage (Feng, 2024b, 2024a) based on Stable Diffusion, and might be a worthy alternative or a starting point to be refined further.

More than technology, we are concerned with objectives. It is easy to be led by the nose and forget what one's purpose is, instead adapting to whatever is available. We must remember that our purpose is to preserve perspective drawing, rather than textual prompting, as the main activity of the illustrator. This, paradoxically, may seem to require *more* (but different) text prompting. A big limitation of Skybox and all the other panorama generators is that the “discussion” with the AI does not resemble at all the conversation with an assistant artist. One simply feeds prompts and gets results. It does not have the nuance found with LLMs such as ChatGPT, the sense of easy back and forth. In fact, what one might look forward to, is a general purpose LLM *that can draw* — interacting though elaborate conversation rather than the stunted prompting of with diffusion models.

The desired future hybrid might be well anticipated from the following interaction: one of the authors' fed ChatGPT the Figure 12, by António Bandeira Araújo, which is a demo of perspective multiplication in equirectangular drawing. The interaction below followed:

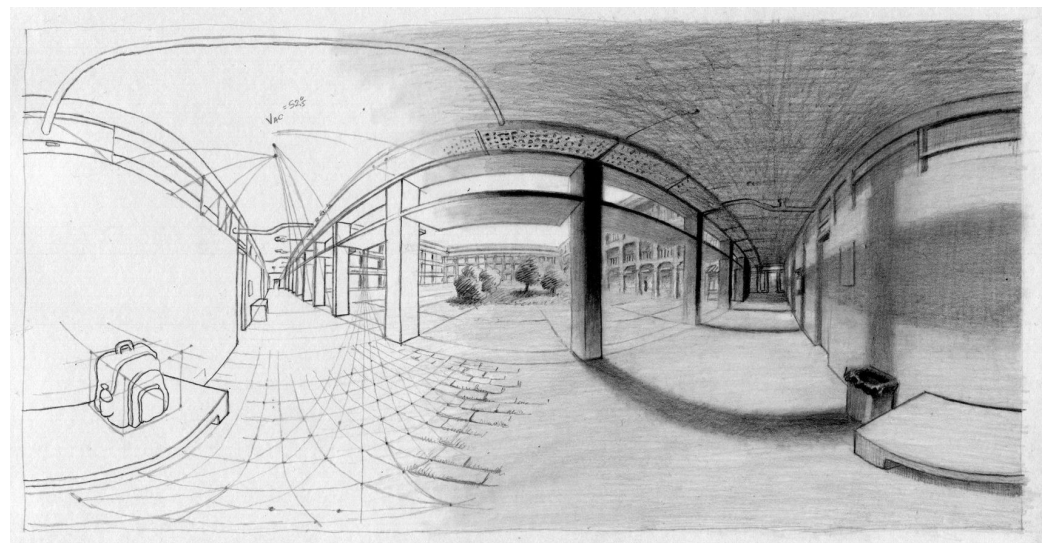


Figure 12. Perspective multiplication – Graphite drawing. © António Bandeira Araújo

"User: can you describe to me the picture i just gave you?"

ChatGPT: The image appears to be a hand-drawn sketch of an architectural space, rendered in an equirectangular perspective, often used for 360-degree panoramic views. The drawing captures a spacious hallway or corridor area with structural elements like pillars, walls, and ceiling arches curving in the distorted perspective typical of equirectangular projections. The viewer's perspective is from the center of this space, allowing a wide view of the entire scene.

To the left, there is a backpack sitting on a bench, and further in, a courtyard-like open area can be seen, with trees and windows along the back wall. The corridor stretches into the distance on both sides, with the lines of the walls and ceiling curving towards the vanishing points. The grid pattern on the floor aids in emphasizing the perspective and depth of the space. The use of shading suggests depth and form, particularly on the ceiling and pillars.

This style of drawing seems to capture both interior and exterior views within the same scene, possibly representing a detailed study of a public or institutional building. The annotated angle at the top suggests some technical or architectural intent behind the sketch, potentially for design visualization.”

What is striking in this interaction is the fact that ChatGPT already recognizes equirectangular perspective, identifies objects and locates them in space correctly in spite of the perspective, comments on more general terms such as the purpose of the building, and, more impressively, notices quite correctly the didactical purpose of the work from the identification of construction lines and of the pencil annotation that it impressively identifies as an angle measurement. Unfortunately, as of this writing, its synthetic abilities do not match its analytic ones. If asked to create an equirectangular panorama it will just delegate to Dall-E, which at the moment is very lacking in equirectangular imagery.

In general terms, what one would wish is that AI would take up the drudgery and leave us more time for the creative work. The direction has been the exact opposite lately. It will do us no good to have a surplus production of images if our new job is in the lithium mines, or less dramatically, a drudgery of bad prose. The biggest negatives of AI for our field are on the one hand the removal of drawing from center stage, on the other the removal of the discipline of perspective itself.

What is desirable is that the interface is both heavily drawing-based and that it understand the language of spherical perspective with its characteristic constructions, its special notions such as antipodal vanishing points and its groups of symmetry. Then communication could both motivate and make use of the illustrator’s knowledge of perspective and his ability to communicate visually. AI could help with the undesirable aspects of panorama drawing, such as the handling of extreme deformations near zenith and nadir, or the covering of surfaces with textures, which suffer deformations very difficult to render by hand. Here the use of annotations such as in GauGAN 360 might be the direction to follow. AI could also help outside of image generation. A big hindrance to equirectangular drawing is the hassle of scanning and preparing the drawing for VR — a trivial but time-consuming task. Image recognition and computer vision are already in use to simplify that process (see Olivero, 2024; Olivero & Araújo, 2022) but AI might make it more seamless.

LLMs could help in the creation of custom software tools to enhance the creative process of spherical perspective drawing. For example, Araújo recently required a very specific piece of software —

an equirectangular shader (Figure 13). A shader is a graphical program made to run on the GPU, and it requires special programming techniques. Araújo had failed several times to create this program for reasons familiar to the non-specialist in programming: modern programming requires not only an understanding of algorithms but a daily familiarity with byzantine implementation details. Thus, if programming is not your daily task, you will often have projects stall due to quite tiresome implementation details, such as some detail about a library, rather than a problem with the desired algorithm itself. Going back to your main job and returning days or weeks later much has been forgotten or, worse, something has been changed in a library update. But this time, using an LLM, Araújo managed to program the shader in a useful timeframe. The most interesting aspect is that this was not done by delegating the task: the LLM utterly failed to produce the functioning program, nor would it have been interesting if it had succeeded. Araújo did not want to avoid programming, but to learn programming more efficiently. This was done by using the LLM in dialog, not to program, but to elucidate the structure and the details of the task. For instance, an error in hidden face removal was solved by inquiring about the details of the WebGL pipeline. To do this in directed dialogue proved much quicker than plodding through documentation. This kind of process may extend the abilities of the artist, making programming a more accessible skill rather than another skill to delegate and lose. AI properly used can and should be a way to make us know more rather than an excuse to know less, and, in general, to break the shackles of overspecialization to which we have become accustomed. There is no reason why an artist, for being an artist, cannot be also a programmer, up to some measure. In this AI might bring us back to the attitude of the Renaissance artist, who might as easily dabble in architecture as in painting and who took nothing as being beyond his reach.

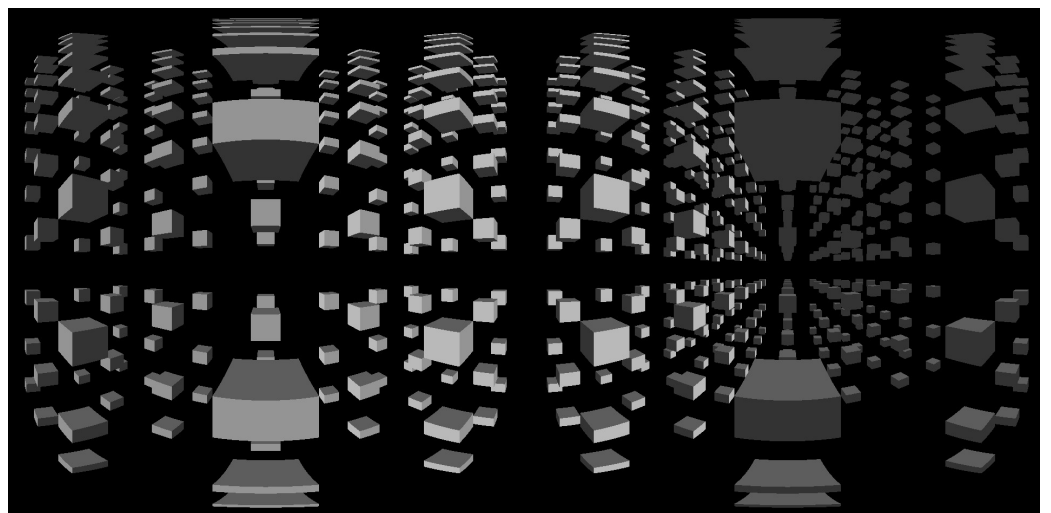


Fig 13. Equirectangular Shader programmed in WebGL and three.js. © António Bandeira Araújo

It is inevitable that AI will have a strong impact on the lives of illustrators, and panoramic illustrators in particular. Blind market forces alone will not be concerned with whether the coming changes are beneficial or not to illustration as a human activity, but only with efficiencies of production.

It is up to illustrators themselves — and aligned technologists — to ensure that whatever workflows arise treat them like more than machine operators. We hope that the work we are now starting will contribute in some small measure to a desirable outcome in this regard.

## 6. FURTHER DEVELOPMENTS

Future developments, materials and media will be deposited at the personal websites of the authors (Masiero Sgrinzatto, 2025; Araújo, 2025).

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