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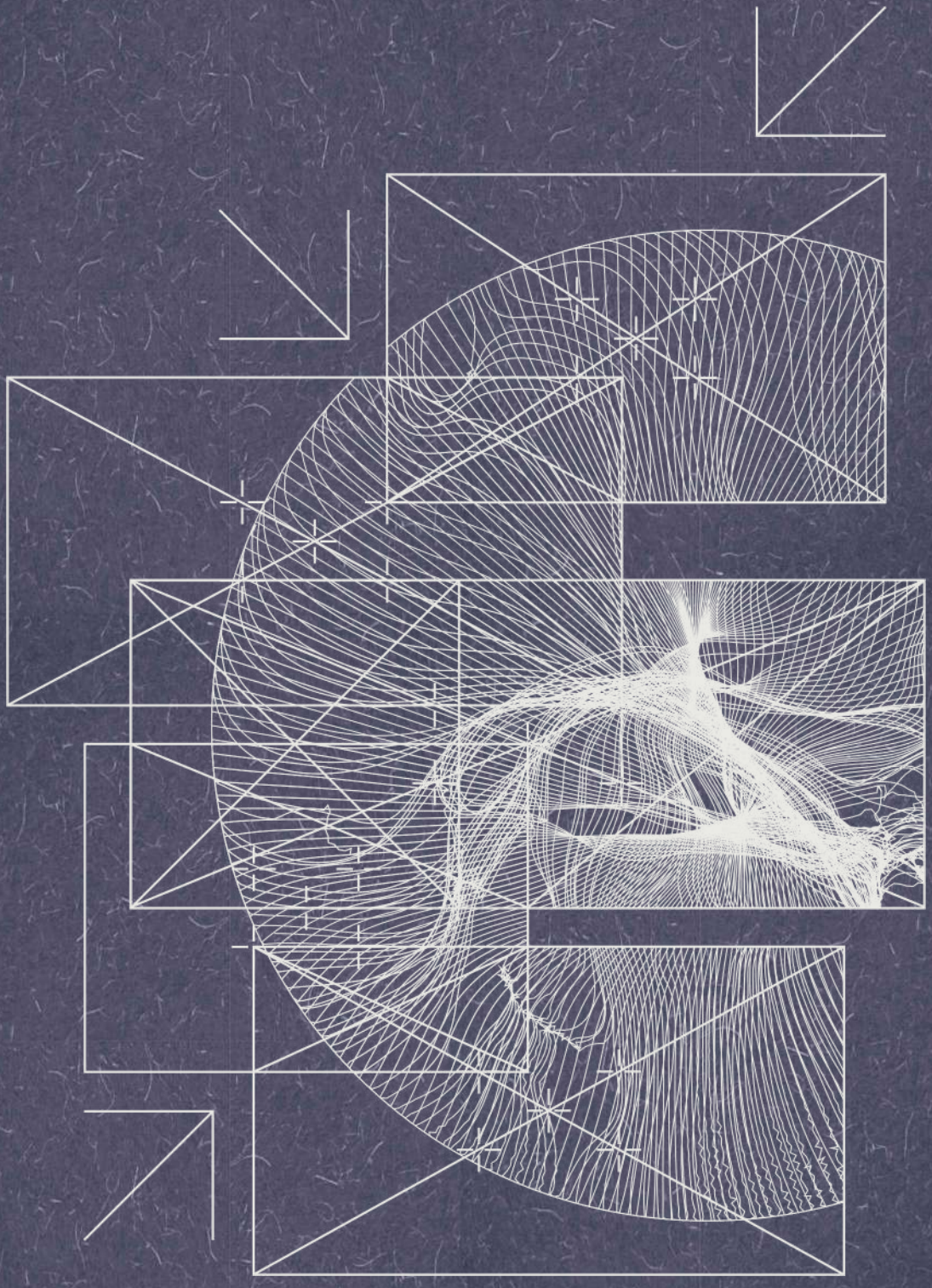

Disegno

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Disegno publishes original research papers, essays, and reviews on all aspects of design cultures. We understand the notion of design culture as resolutely broad: our aim is to freely discuss the designed environment as mutually intertwined strands of sociocultural products, practices, and discourses. This attitude traverses the disciplinary boundaries between art, design, and visual culture and is therefore open to all themes related to sociocultural creativity and innovation. Our post-disciplinary endeavour welcomes intellectual contributions from all members of different design cultures. Besides providing a lively platform for debating issues of design culture, our specific aim is to consolidate and enhance the emerging field of design culture studies in the Central European academia by providing criticism of fundamental biases and misleading cultural imprinting with respect to the field of design.

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Contents

FROM SCREENWRITING TO SPACE-WRITING

María Cecilia Reyes

ABSTRACT

In the past ten years, audiovisual creators have been working on the development of narrative experiences for extended reality (XR) technologies, especially virtual reality (VR). The evolution of this practice has led to the creation of a technical language and processes. The transfer of knowledge from cinematography and videography has been the basis for the creative practice of "immersive narratives," very often carrying with it jargon and practices that do not fit entirely with XR's spatial nature. In this essay, I reflect on whether we are still writing for a screen or writing for space from a practitioner's perspective. Such a change of perspective starts with the recognition of the perceptual sphere and how to compose scenes in it. In this regard, a review of storyboarding for VR, followed by my own experience in creating an interactive VR movie, allowed me to reflect on the concept of framing, camera positions, and authorial intentions. Finally, I argue that we can move from screenwriting to space-writing in relation to the technologies and immersive power of XR.

#immersive narratives, #screenwriting, #space-writing, #storyboarding, #XR, VR

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INTRODUCTION

Theory is often ahead of practice, but in virtual reality (VR) storytelling the opposite seems to be the case. Since the beginning of the third wave of VR, practitioners have taken control of the medium by experimenting and translating previous knowledge from legacy media, especially filmmaking, into the new medium. We have seen how VR storytelling techniques have evolved considerably in the past ten years. We have also witnessed how the term *immersion* has taken over the extended reality (XR) technologies, often called "immersive technologies." XR narrative experiences are called "immersive stories" or "immersive narratives." This moment in the evolution of computer-mediated immersive narratives requires us to reflect on our current storytelling practice.

We understand XR screenwriting as the practice of writing stories for screens of immersive technologies. However, these screens are in effect imperceptible to the user. In other words, they are a kind of invisible mediation, offering the users the illusion that their bodily awareness in space is "unaided." In this sense, I wonder how our practice as storytellers can evolve from screenwriting to space-writing?

In this article, I examine several design concepts and frameworks for VR screenwriting: the comprehension of the human perceptual point of view; the segmentation of the perceptual sphere; and how meaning is created through camera positions. Finally, I propose to expand these spatial notions to other types of immersive storytelling, tech-based or analogue, interactive or not, linear or non-linear.

2. WRITING IMMERSIVE STORIES

My path as a creator has taken me from filmmaking, performance, and oral storytelling to interactive fiction in cinematic VR, and more recently to work on multi-reality narratives that move from physical space to virtual space and vice versa. During my career as a creator and researcher, I have seen that experimentation has been the only constant in the artistic practice of creating narrative for VR, and more broadly, for "immersive" storytelling. It was natural for me to approach the VR medium from cinematic VR, in the form of 360º live-action video, and to test classic narratological concepts, such as narrator type, time, velocity,

and narrative distance (Reyes 2019), as well as testing filmic screenwriting, shooting and editing techniques (Reyes and Zampolli 2018).

Even though tech manufacturers have been reclaiming the term immersion for XR technologies, writing for immersive narratives expands beyond the computer-mediated all-surrounding experiences, to comprise non digital immersive experiences as well. In this regard, Christian Stiegler (2021) already called for a broader understanding of immersion: "immersion should be understood as a socio-cultural concept, which defines the sensation of all-encompassing engagement and involvement in all-surrounding mediated experiences" (65). He goes further, stating that "immersion generates psychological sensations that make it difficult to distinguish between the physical and the mediated" (53).

Storytellers creating spatial narratives come from very different backgrounds, for example, filmmaking, programming, design, literature, visual arts, sound design, video gaming, and anthropology. Every storyteller brings to the field the practice and knowledge from their background. Such a variety of perspectives is shaping the present and future of immersive storytelling. Nonetheless, they all depart from the same starting point: the location of human perception at the centre of immersive experience, with immersion understood in both physical and narrative senses.

We can say that this practice of immersive storytelling produces a spatial and embodied experience that happens in an all-surrounding mediated storyworld, a fictional space with narrative content. Screenwriting becomes space-writing: narrative and interactive elements (characters, events, objects, setting, hotspots, etc.), and perceptive counterpoints (audio-visual, skin perception, body awareness, etc.) are carefully located and choreographed in space and time.

Immersive stories can be developed through both linear and non-linear interactive narrative structures and can offer several degrees of agency depending on the chosen interfaces. However, regardless of how interactive an immersive story can be, it has the unique quality of surrounding the spectator. It is the authors' decision to make it a safe and entertaining space rather than a prison for human experience, since they are the rulers of our perception in this sphere.

3. THE PERCEPTUAL SPHERE

One notion that has emerged in the past ten years during the development of the VR storytelling field is the idea that the frame disappears. This statement feels imprecise. Indeed, the director's power to choose which visual section of the scenic space is shown and which one is hidden disappears. However, in VR, where all the space is available to the eye, an organic framing also occurs, due to the nature of human sight. And even in a traditional "flat" image, the viewer can also choose which

areas of the screen to focus their attention on. Framing sections of the space is therefore key to space-writing.

Although writing for VR consists in writing a story that is accessed via a screen, using the term screenwriting, which the cinema industry uses, is not entirely appropriate as human perception is no longer located outside the scenic space but is right at the centre of it. The creative activity of VR storytelling begins when creators locate themselves at the centre of the space, understand their own relation with the space, and then build a storyworld around themselves by assembling interactive and narrative elements within the perceptual sphere of someone at the centre of the space.

I understand perceptual sphere as an individual's spatial interface with the world. From the centre of the perceptual sphere, we perceive the world through our senses. Around the individual, the world takes place. Through vision, hearing, and smell we can perceive depth and objects in space; through our skin we can perceive temperature, objects, and the wind messing with our hair; and we are aware of our own bodies in relation to objects and other humans in space. From physical reality all the way to virtual reality, we use the horizontal coordinate system (fig. 1) to locate ourselves in relation to the visual space, even when we are using "computerized clothing" (Lanier 1988) to interact with digital realities:

It recreates our relationship with the physical world in a new plane, no more, no less. The glasses allow you to perceive the visual world of virtual reality. Instead of having transparent lenses, they have visual displays that are rather like small three-dimensional televisions. When you put them on you see a world that surrounds you—you see the virtual world. It's fully 3D and it surrounds you. (Lanier 1988)

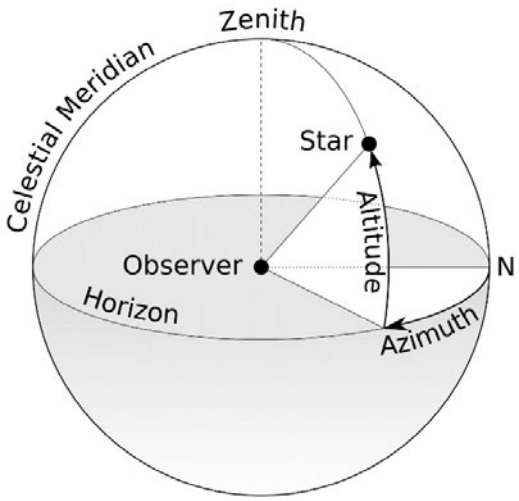

FIGURE 1. *The horizontal coordinate system. Source:* Wikipedia. *Illustration by TWCarlson, licensed under CC-BY-SA-3.0, https://commons.wikimedia.org/wiki/File:Azimuth-Altitude_schematic.svg.*

Even though VR has its own "absolute physics" (Lanier 1988), elements of the horizontal coordinate system for our perception of the real world are the same as the ones that we use to perceive virtual reality. These elements are:

- Horizon: the horizon gives us perspective and stability. Nothing is more discomforting than a distorted horizon.
- Upper hemisphere: objects are perceptible above the horizon.
- Lower hemisphere: objects are not perceptible below the horizon, obstructed by earth.
- Zenith: the highest point of the upper hemisphere.
- Nadir: the lowest point of the lower hemisphere.

At the centre of the horizontal coordinate system, we find the observer who is the interactor within the perceptual sphere. The interactor's point of view matches the point of view of the camera, both for traditional cameras and for virtual cameras in computer generated environments, or 360° video cameras for cinematic VR. The interactor is not only looking around, but is also the central recipient of all sensory stimuli provided by the mediated experience within the perceptual sphere.

To understand the point of view of the interactor within the perceptual sphere, early film studies reflected on our relationship with the mechanical "eye" and our appreciation of reality, while leaving open several questions that were fertile ground for the development of VR.

With Vertov's *Man with a Movie Camera* (1929) the relationship between man and the moving image changed radically. The role of the camera was no longer recognised as an external and mechanical element, but as an organic element that does not need further mediation to transmit the phenomenology of the act of seeing and constructing meaning through the sequentialisation of images. The recognition of the camera as an autonomous entity allowed "the creation of an authentically international absolute language of cinema on the basis of its complete separation from the language of theatre and literature" (Vertov 2004, 318). This acknowledgement is very similar to the one that recognises the change of paradigm that supposes locating the viewer at the centre of the mediated space in XR technologies, which, in this case, separates XR language from legacy narrative forms.

Considering the audiovisual nature of VR, comparative studies with legacy media—in particular cinema—allow us to better understand immersive storytelling.. In fact, the mechanism of visualising a sequence of images is very similar to filmic phenomenology: "a cinematographic process directed by oneself […] giving rise to a disem-

bodied mind-eye capable of experiencing mental products that appear as sensitive only by means of technological prostheses" (Diodato 2005, 8). There is no big difference, in perceptual terms, between seeing reality or virtual reality, as the interface theory of perception suggests. Hoffman et al. argue, for humans, space-time is the desktop of the interface and physical objects are icons on the desktop. The shapes and colours of physical objects resemble objective reality no more than the shapes and colours of desktop icons resemble files in a computer (2015).

If our perception of real and digital realities blends, as it does in the XR spectrum, what do we consider real? Cognitive immersion, "the phenomenon of getting lost, involved, or drawn into storyworlds" (Troscianko 2012), has already demonstrated its power across millennia. All storyworlds are real no matter the media in which they are conveyed.

VR technological development has recreated the nature of human audiovisual perception with the highest possible level of fidelity, Greater levels of presence, immersion, and agency of the interactors' experience in virtual environments (VE), have a direct impact on the impression of reality. To achieve this, there are several elements that need to be articulated together: the quality of the visual experience (the physics of the human eye together with the visual refinement of the virtual environment, its objects, and agents); the quality and quantity of sensory stimuli (haptic, auditory, olfactory); and the usability of the system.

The impression of reality and the materiality of virtual reality are not only determined by the audio-visual sphere but includes everything that can be perceived by the spectator, including themselves. The eye becomes a sort of all-feeling eye that serves as a mediator between the virtual (story)world and reality, the receiver of the articulation of all the systems that interactors perceive. In fact, "one of the factors that determine the difference between looking at a motion picture and looking at reality is the absence of the sense of balance and other kinaesthetic experiences" (Arnheim 1957, 102).

When watching a film, spectators do not confuse the space of the film accessed by a screen with their own space (i.e., the movie theatre or their living rooms), in the same way they do not confuse a film with a real theatre spectacle. In XR technologies in general, this border can reach a point where it disappears completely. Furthermore, in event-based arts or narrative arts—to use Bazin's terminology (Bazin 2004)—the perception of reality also requires interactors' affective, perceptual, and intellectual activity. From a narrative perspective, developing a story for XR is not very different from film, theatre, and even literature, however the craft of translating that story for physical immersion is a completely dfferent task.

4. VR STORYBOARDING

In immersive storytelling viewers have autonomy to explore the space and to naturally frame the areas of the sphere they want to focus on. The creators' concern with how to direct viewer's attention has been a central issue in academic research (Rothe et al. 2018; Gödde et al. 2018; Fearghail et al. 2018; Gruenefeld et al. 2018; Dooley 2017; Mateer 2017; Lin et al. 2017; Sheikh et al. 2016; Syrett et al. 2016; Nielsen et al. 2016). Following this fashion, researchers have also used gaze/eye tracking to identify how users explore the visual story world (Bala et al. 2018; Bender 2018; David et al. 2018; Bala et al. 2017; Löwe et al. 2017; Bala et al. 2016). Useful insights have also been offered by practitioners in non-academic platforms, such as blogs and social media.

The first VR storyboards that I found during my research date back to 2016 (fig. 2). Jessica Brillhart (2016) proposed the first approach to the language of VR, in particular for cinematic VR. "In the Blink of a Mind" (which recalls Walter Munch's *In the Blink of an Eye*) is a series of three chapters in which she explains linear storytelling in cinematic VR. It is interesting that her starting point is the editing workflow in traditional filmmaking, the way in which we articulate the filmic discourse, frame after frame. She moves towards the internal "editing" of the narrative elements in space in each scene, their location and movement in the scene-space, to then elaborate on the transition from scene to scene, or "world to world" as she calls it. Brillhart's contributions paved the way for practitioners to understand VR language.

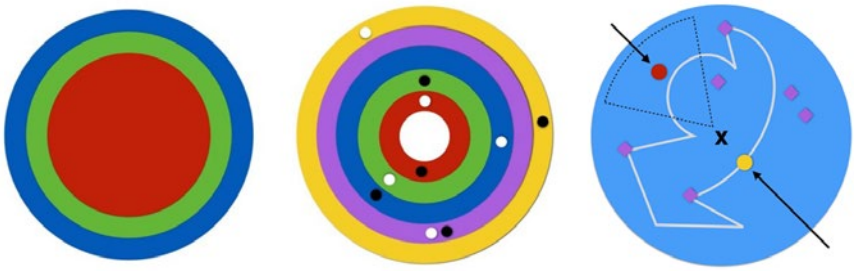

FIGURE 2. *Brillhart (2016) illustrations (from left to right) world-to-world, the hero's journey, and layers of experience. Source: Medium.com.*

Soon after, Vincent McCurley (2016) proposed a more detailed representation of the perceptual sphere on his blog. Both Brillhart and McCurley reflected on the transition from the framed moving image to the frameless view. It was clear for them that the way to understand VR storytelling starts with a sphere. Nonetheless, based on VR interface design, McCurley points out that the circle is divided into areas of interest, and these areas are defined by the comfortable field of view and the viewing distance that VR head-mounted displays offer. Typically, we have a field of view of around 154° with rotating our heads

from side to side, while regarding viewing distance, we have a "sweet-spot between 0.5 meters to 10 meters where we can place important content" (McCurley 2016). McCurley proposes a simplified storyboarding layout (fig. 3) that highlights the best area to place content when the user is straight ahead. Behind the user, there is a dark area that I call the "curiosity zone."

A year later, Katy Newton and Karin Soukup published *The Storyteller's Guide to the Virtual Reality Audience* (2017). In one of their experiments, they offer three different fields of vision to measure how much attention spectators give to each specific visual area (fig. 4). The results show that "audiences with a 90° range of vision could recall nearly every event in the story, whether the information was physically in the room or relayed through the audio. However, audiences in the 360° view recalled fewer details of the story and the environment." On the other hand, they found that "audiences in the 360° scene were more aware of the tone of the piece, which they attributed to the pacing and shifts in the lighting" (Newton and Soukup 2017). These results show that space-writing needs a deep understanding of the perceptual sphere for creators to carefully design the scenic space, locate objects and events, and set the tone and rhythm of the narrative.

FIGURE 3. *Vincent McCurley (2016) storyboarding layout. Source: Medium.com.*

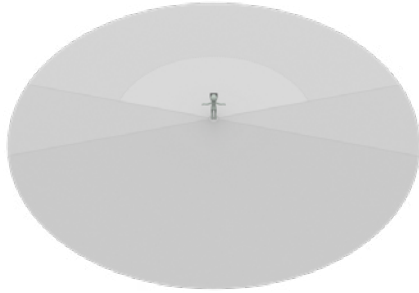

FIGURE 4. *Newton and Soukup's experiment with different degrees of viewing restriction (2017). Source: Medium.com.*

Saara Kamppari-Miller (2017) has shown how to create VR low-fidelity prototypes. Using the McCurley storyboard as a base, she went further and reminded us of organic human visual framing and used it to guide creators in "sketching ideas in 2D for something that is 3D" (Kamppari-Miller 2017). Learning how to use perspective and unfolding the perceptual sphere into an equirectangular projection, we can sketch the space and the key narrative elements of our story. Figure 5 shows us what happens when we translate the field of view and view-

ing distance from the circular blueprint into an equirectangular projection: the grey areas represent the areas of the sphere (fig. 5) that are outside a comfortable field of view, the dark lines show the area of clear vision for a human without turning the head or body.

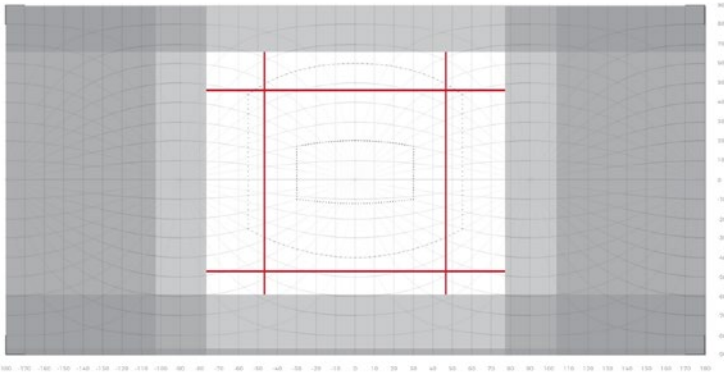

FIGURE 5. *Kamppari-Miller's equirectangular version of the visual sphere (2017). Source: Medium.com.*

In fig. 6, Kamppari-Miller proposes a VR storyboard comprised of both the visual sphere and the organic frame containing key narrative elements or events.

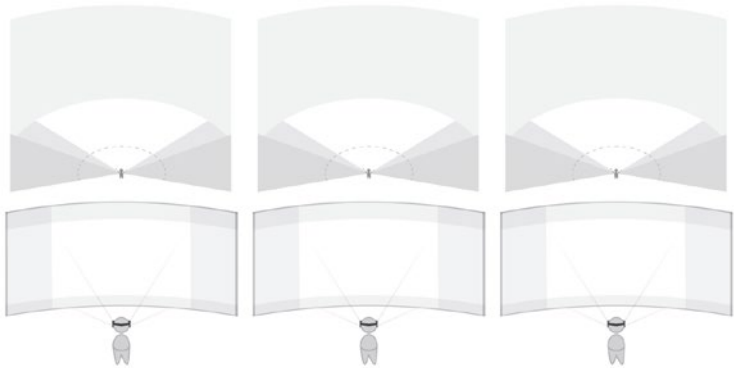

FIGURE 6. *Kamppari-Miller's VR Storyboard template (2017). Source: Medium.com.*

4.1. Storyboarding *ZENA*, an Interactive VR Film

ZENA (Reyes 2017), my first interactive VR fiction film (fig. 7) was part of my experimentation in creating a cinematic VR experience with an interactive fictional structure.[1] In other words, an interactive and immersive fiction film. Each scene of *ZENA* is a narrative and technical experiment exploring to the possibility for the viewer to change the point of view from protagonist to supporting character, or to external observer. Voice-over, flashbacks, black-and-white scenes are included and different camera positions are used to explore authorial intention

[1] *For a trailer see https://www.xehreyes.net/zena.*

(the cinematographic device of generating meaning through framing). Even the duration of the experience (eighteen minutes for the longest path) was an attempt to push the limit of the recommended eight minutes for VR experiences in 2017.

ZENA is a fantasy genre story. Lorenzo, a young alchemist apprentice living in medieval Genoa (Zena, in Genovese dialect), must travel to modern Genoa to save the magic clepsydra, an object that has the power to time travel. In modern Genoa, he needs to find his way through the labyrinth of streets in the historical centre, to follow the advice of diverse characters, and to make difficult decisions when characters reveal their true intentions. The film has twenty-five narrative units, four endings (two negative and two positive), and around forty possible single journeys.

FIGURE 7. *Poster for* ZENA.

When I was developing the script and the production plan for *ZENA*, the materials and insights provided by Brillhart, McCurley, Newton and Soukup, and Kamppari were extremely helpful. Blog posts with simple language, examples, anecdotes and sometimes even templates, are the place to look for step-by-step instructions. I had been experimenting with the 360º video camera Ricoh Theta before acquiring a Kodak Pix Pro, which was needed to seamlessly stitch together the different video files into the full sphere.

From my experiments, I noted that the director's role is not only arranging what happens within the perceptual sphere, but also deciding the camera position, and small differences in placement make a big difference. Locating it lower than the rest of characters in space makes the interactor shorter, locate it above the heads of the rest of the characters and you make the interactor a giant. Locate it between a wall and a threatening character at less than half a metre from the interactor's face and you might provoke a panic attack. This brings us to the next topic: how we locate the camera creates meaningfor the interactor, and it is equivalent to the semantics of the shot in cinematography.

Before moving on, in figure 8 we can see how I made storyboards for *ZENA*. I started by mapping real space, then I located the camera, indicating its front and back, the stitch zone, and the curiosity zone. Finally, I located the starting point of each character in the scene, their movement in space and the area where the main event takes place. The following image (fig. 9) shows the shot scene in its equirectangular version, and the natural frame of the main event when viewed in the headset.

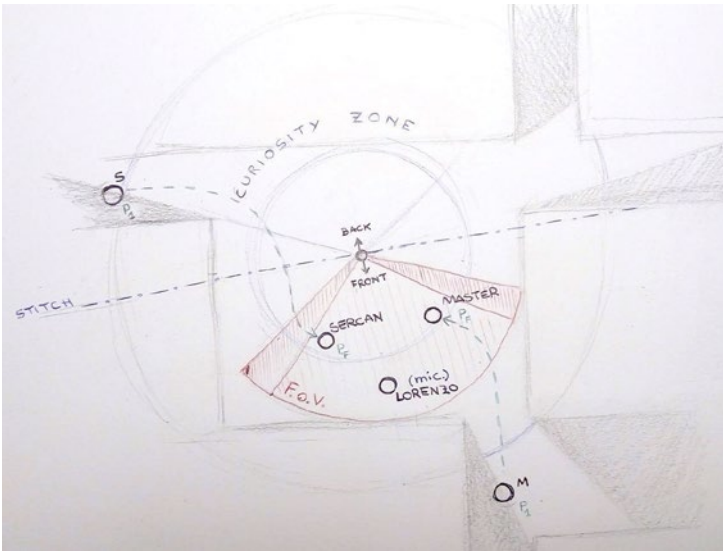

FIGURE 8. *Encounter between Sercan and The Master. Scene storyboard.*

FIGURE 9. *Encounter between Sercan and The Master. Final scene in equirectangular version. The organic visual frame of the narrative event is highlighted.*

5. CAMERA AND INTENTIONS

Creators' intentions are integral to the story itself. This includes their motivations, the concept, and the sensations that are transmitted during the immersive experience. However, the storyworld and the narrative events need to be translated into space. This translation begins from the point in space where the interactor is looking at the world around her, that is, the position of the camera.

Self-awareness of our body and narrative role in a given reality—or the answer to the question "Who am I?"—is generated through our relationship with objects and other people's bodies in space. In my practice, I have had the opportunity to test different camera positions concerning the height of the camera from the ground, the distance between the camera and the key points of interest in space, relative to characters, objects, sound sources, and the architectonic features of the space, but also in response to the question of whether the camera has a body.

When storyboarding, we assume that the camera position is at the average human height. But what does this mean more precisely? Is the interactor standing or sitting? Do we want to make them feel small and afraid, or huge and invincible? Maybe we want the interactor to be lying down on the bed. It is also common to locate the camera at the centre of the dedicated space in which we are shooting, in the middle of the living room, or in the middle of the park. But perhaps we want the interactors to observe the room from the corner, from behind a plant.

These notions together with the director's decisions regarding camera position will have an impact on the production workflow. For example, if the director has decided that the interactor requires a body (human or not), in cinematic VR we will need to build a body for the camera and mount the camera in it or create a virtual body in postproduction.

I have identified four main conditions that affect the position of the camera and have an impact in the meaning-making process. Each camera position has an authorial intention and creates a specific sensation for the interactor. Each position defines a standpoint from which the interactor will make sense of their experience. The four conditions can be combined with each other, generating several types of intentions. A more detailed description of the types of shots and intentions are presented in the chapter "Shooting an Interactive VR Film: *ZENA*'s Production Case" (Reyes and Zampolli 2018).

The interactor has a body. In this case the interactor can look down and discover a body. They are the mind within that body, regardless of being part of the storyworld or not. Normally, when interactors have a body, they are part of the story. They can be the main character or a

supporting character. The interactor can be a human, and in this case the first person shot needs to recreate the human characteristics of the character, or can also be a non-human character, and accordingly the camera position will need to adapt to the physical characteristics of this non-human character. In cinematic VR, this condition requires a special rig to be placed on a person or object to recreate the embodiment of the first person's point of view. While in computer-generated environments, the character needs to be designed.

Height of the camera. Depending on the height of the camera relative to the ground and in relation to the characters and elements that surround it, the shot can have different semantic meanings (fig. 10). We find three cases: (1) A natural view of the surrounding world, (2) a low angle shot when the camera is close to the ground and below the eye level of the other characters in space; and (3) a high angle shot, when the camera is located above the eyeline of the other characters in space and/or a great distance from the ground.

FIGURE 10. *Scene from ZENA. Camera above the eyeline of the character combined with half-metre viewing distance from camera. In cinematic language it is equivalent to a high angle shot combined with a medium shot. The intention is to make the interactor feel pity for the main character by allowing the viewer to see him from above.*

Distance between camera and key elements/events. Since the camera is at the centre of 360º, the visibility of the objects around it depends on how far they are from the camera. Within the natural framing of the interactors' sight, different types of shots can be achieved from a comfortable viewing distance. From the closest to the furthest point the narrative element is from the camera, we will find a range of shots from close-ups all the way to extreme wide shots (fig. 11).

Position of the camera in relation to the ground. The viewing axis of the camera may not be perpendicular to the ground, as it can also be located parallel to the ground. This positioning gives us three types of

vision not very common to humans: (1) to observe the world at ground level (nadir), (2) to observe the world from above (zenith), and (3) to observe the world on a horizontal axis (i.e., lying down, flying). The location of the camera in horizontal position in relation to the ground can give a feeling of flying, lying on the ground or falling. This choice can cause discomfort, especially if the position of the physical body does not match the position of the camera.

***FIGURE 11**. Scene from ZENA. A viewing distance of more than half a metre allows the interactor to see the full bodies of the characters in the scene. The camera height is around the eye lines of the characters. In cinematography the equivalent is a wide shot.*

TOWARDS SPACE-WRITING

When I started exploring the VR medium around 2014, I remember having interesting and heated discussions with filmmaker colleagues who argued that the director's role disappears in cinematic VR and VR in general because the imposed framing is no longer part of the creative workflow. Several years have passed and I think that this belief has been overcome. From my perspective, film and video makers should abandon this logic when working in VR and immersive narratives in general, as one of the features of immersive technologies is in fact visual freedom itself. As creators, we also have several narrative, visual, and auditory tools, and strategies to guide the interactor's attention. Nonetheless, the will to control a user's attention underestimates interactors' willingness to immerse themselves in the story, to follow the narrative events and to explore the story world that we are presenting to them.

During my experience as a creator and researcher of interactive cinematic VR, I have not only seen the evolution of VR narrative experiences but also the expansion of the term "immersion." Sometimes, it seems that "immersion" is the cultural threshold that we are crossing right now. Despite the fact that we already live in a hybrid environment in which the digital and physical worlds coexist, the immersive endeavour aims to perceptually merge the two.

Such merging can happen by embedding digital assets in the physical world that are always accessible through different kinds of interfaces, or by accommodating the physical world around the virtual one, as seen in VR experiences that add extra sensory stimuli in the physical setting where the VR narrative is experienced.[2]

We must remember that immersive stories do not need the mediation of computers, as shown by theme parks, interactive theatre, and other types of fictional spaces that surround the interactors. Considering both immersive technologies but also immersive experiences that do not need the computer mediation, we can think about the expansion of screenwriting to a space-writing practice. As industry and academia reflect on how to find common practices for the creation of immersive experiences that move away from legacy media—especially cinematography—we are slowly moving towards some sort of "immersography," or a unified framework for writing immersive experiences.

The intersection of different media and their processes does not only occur with the shift from older to newer media, but it can also happen the other way around. In this sense, I strongly believe that the language that computer-mediated immersive storytelling is consolidating today can also influence and promote the development of non-digital immersive stories. Syd Field ([1979] 2005) once defined screenwriting as "telling a story with pictures." It remains a question whether we should use the same term when telling a story in space, providing interactors with the unique ability of omnidirectional awareness.

[2] *Alejandro G. Iñarritu's* Carne y Arena *(2017) is a good example of this, see https://phi.ca/en/carne-y-arena/.*

REFERENCES

Arnheim, Rudolf. 1957. *Film as Art*. Berkeley: University of California Press.

Bala, Paulo, Mara Dionisio, Valentina Nisi, and Nuno Nunes. 2016. "IVRUX: A Tool for Analyzing Immersive Narratives in Virtual Reality." In *Interactive Storytelling Lecture Notes in Computer Science*, 3–11. https://doi.org/10.1007/978-3-319-48279-8_1

Bala, Paulo, Valentina Nisi, and Nuno Nunes. 2017. "Evaluating User Experience in 360° Storytelling Through Analytics."In *Interactive Storytelling Lecture Notes in Computer Science*, 270–73. https://doi.org/10.1007/978-3-319-71027-3_23

Bazin, André. 2004. *What Is Cinema?* Vol. 1. Berkeley: University of California Press.

Bender, Stuart. 2018. "Headset Attentional Synchrony: Tracking the Gaze of Viewers Watching Narrative Virtual Reality." *Media Practice and Education*, 20 (3): 277–96. https://doi.org/10.1080/25741136.2018.1464743

Brillhart, Jessica. 2016. "In the Blink of a Mind—Prologue." *Medium* (blog). https://medium.com/the-language-of-vr/in-the-blink-of-a-mind-prologue-7864c0474a29#.d3x4ljppm

David, Erwan J., Jesús Gutiérrez, Antoine Coutrot, Matthieu P. Da Silva, and Patrick Le Callet. 2018. "A Dataset of Head and Eye Movements for 360° Videos." In *Proceedings of the 9th ACM Multimedia Systems Conference on MMSys '18*. https://doi.org/10.1145/3204949.3208139

Diodato, Roberto. 2005. *Estetica del virtuale*. Milano: Bruno Mondadori.

Dooley, Kath. 2017. "Storytelling with virtual reality in 360-degrees: A new screen grammar." *Studies in Australasian Cinema* 11 (3): 161–71. https://doi.org/10.1080/17503175.2017.1387357

Fearghail, Colm O., Cagri Ozcinar, Sebastian Knorr, and Aljosa Smolic. 2018. "Director's Cut—Analysis of Aspects of Interactive Storytelling for VR Films." In *Interactive Storytelling Lecture Notes in Computer Science*, 308–22. https://doi.org/10.1007/978-3-030-04028-4_34

Field, Syd. (1979) 2005. *Screenplay: the Foundations of Screenwriting*. New York: Delta Trade Paperbacks.

Gödde, Michael, Frank Gabler, Dirk Siegmund, and Andreas Braun. 2018. "Cinematic Narration in VR—Rethinking Film Conventions for 360 Degrees." In *Virtual, Augmented and Mixed Reality: Applications in Health, Cultural Heritage, and Industry Lecture Notes in Computer Science*, 184–201. https://doi.org/10.1007/978-3-319-91584-5_15

Gruenefeld, Uwe, Andreas Löcken, Yvonne Brueck, Susanne Boll, and Wilko Heuten. 2018. "Where to Look." In *Proceedings of the 10th International Conference on Automotive User Interfaces and Interactive Vehicular Applications - AutomotiveUI '18*, 221-28. https://doi.org/10.1145/3239060.3239080

Hoffman, Donald D., Manish Singh, and Cheta Prakash. 2015. "The Interface Theory of Perception." *Psychonomic Bulletin & Review*, 22 (6): 1480–1506. https://doi.org/10.3758/s13423-015-0890-8

Iñarritu, Alejandro Gonzalez, dir. 2017. *Carne y Arena*. VR film.

Kamppari-Miller, Saara. 2017. "VR Paper Prototyping" *Medium* (blog). https://blog.prototypr.io/vr-paper-prototyping-9e1cab6a75f3

Lanier, Jaron. 1988. "A Portrait of the Young Visionary." http://www.jaronlanier.com/vrint.html

Lin, James Jeng-Weei, Henry Been-Lirn Duh, Don E. Parker, Habib Abi-Rached, and Thomas A. Furness. 2002. "Effects of Field of View on Presence, Enjoyment, Memory, and Simulator Sickness in a Virtual Environment." In *Proceedings IEEE Virtual Reality 2002*. https://doi.org/10.1109/vr.2002.996519

Löwe, Thomas, Michael Stengel, Emily-Charlotte Förster, Steve Grogorick, and Marcus Magnor. 2017. "Gaze Visualization for Immersive Video." In *Eye Tracking and Visualization Mathematics and Visualization*, edited by Michael Burch et al., 57–71. https://doi.org/10.1007/978-3-319-47024-5_4

John Mateer. 2017. "Directing for Cinematic Virtual Reality: How the Traditional Film Director's Craft Applies to Immersive Environments and Notions of Presence." Journal of Media Practice, 18(1), 14–25. https://doi.org/10.1080/14682753.2017.1305838

McCurley, Vincent. 2016. "Storyboarding in Virtual Reality." Medium (blog). https://virtualrealitypop.com/storyboarding-in-virtual-reality-67d3438a2fb1

Newton, Katy, and Karin Soukup. 2017. "The Storyteller's Guide to the Virtual Reality Audience." *Medium* (blog). https://medium.com/stanford-d-school/the-storyteller-s-guide-to-the-virtual-reality-audience-19e92da57497#.5patmkf6o

Nielsen, Lasse T., Matias B. Møller, Sune D. Hartmeyer, Troels C. M. Ljung, Nils C. Nilsson, Rolf Nordahl, and StefaniaSerafin. 2016. "Missing the point." In P*roceedings of the 22nd ACM Conference on Virtual Reality Software and Technology* - VRST '16. https://doi.org/10.1145/2993369.2993405

Reyes, María C., dir. 2017. *ZENA*. Interactive VR Film.

Reyes, María C. 2019. "Interactive Fiction in Cinematic Virtual Reality: Epistemology, Creation and Evaluation." PhD diss., Università degli Studi di Genova.

Reyes, María C., and Serena Zampolli. 2018. "Shooting an Interactive VR Film: ZENA's Production Case Study." In *Looking Forward, Looking Back: Interactive Digital Storytelling and Hybrid Art-Scholarship Approaches*, edited by Rebecca Rouse and Mara Dionisio, 93–108. Pittsburgh, PA: Carnegie Mellon ETC Press

Rothe, Sylvia, and Heinrich Hußmann. 2018. "Guiding the Viewer in Cinematic Virtual Reality by Diegetic Cues." In *Lecture Notes in Computer Science Augmented Reality, Virtual Reality, and Computer Graphics*, 101–17. https://doi.org/10.1007/978-3-319-95270-3_7

Sheikh, Alia, Andy J. Brown, Michael Evans, and Z. Watson. 2016. "Directing Attention in 360-Degree Video." IBC 2016 Conference. https://doi.org/10.1049/ibc.2016.0029

Stiegler, Christian. 2021. *The 360° Gaze: Immersions in Media, Society, and Culture*. Cambridge, MA: MIT Press.

Syrett, Hannah Syrett, Licia Calvi, and Marnix van Gisbergen. 2016. "The Oculus Rift Film Experience: A Case Study on Understanding Films in a Head Mounted Display." In *Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering Intelligent Technologies for Interactive Entertainment*, 197–208. https://doi.org/10.1007/978-3-319-49616-0_19

Troscianko, Emily T. 2012. "Cognitive Perspectives on Immersion. In *Immersion and the Storyworld, St John's College, Oxford, June 25–26, 2012. JLTonline Conference Proceedings*. http://www.jltonline.de/index.php/conferences/article/view/517/1350

Vertov, Dziga. 2004. *Lines of Resistance: Dziga Vertov and the Twenties*. Edited by Yuri Tsivian and translated by Julian Graffy. Pordenone: La Giornate del Cinema Muto.