

CINEMATIC VIRTUAL REALITY AS A NEW NARRATIVE FORM

Ali MATAY¹, Hazal BAYAR²

Abstract: Over the past three decades, digital information technologies have rapidly transformed our means of communication and introduced new media forms. Some of the most recent developments in this respect are the emergence of 360-degree video cameras (both at the consumer level and for industrial production), the introduction of computer applications to process 360-degree video images, and wide-scale adoption of head-mounted displays (HMD). These technologies, all working together, seem to provide us with a new form of filmmaking, new potentials for cinematic storytelling, and in fact, a new form of cinematic experience. Although 360-degree films that are produced to be watched on HMDs have immensely evolved in the past decade, the creative projects produced in this field remains relatively experimental. Cultivating the widespread adoption of VR headsets towards developing new narrative forms and exploiting the potentials of this new medium towards storytelling remains as challenging yet promising task. This paper will examine the narrative potentials of a new media form, which is called Cinematic Virtual Reality (CVR).

Keywords: cinematic virtual reality, 360-degree film, immersive narrative, viewer engagement

1. INTRODUCTION

It is preferred to use the term "Cinematic Virtual Reality" rather than 360-degree filmmaking, by reason of the essential usage of HMDs and the position of the viewer, through which, the audience settles at the heart of the scene and recomposes the framing. Viewers are allowed to move the head up and down, left and right by wearing an HMD. The audience must wear HMDs to engage in the immersive experience of Cinematic Virtual Reality, in the same manner, how they interact with computer generated virtual environments. Therefore, the common ground of two VR forms is creating an immersive experience through the support of HMDs. The difference between two forms is the computer-generated quality of the latter, and the recorded nature of the former that also sustains its adherence to corporeality, and the actual world that surrounds us. Although both forms can be experienced on desktop computer screens by moving and rotating the mouse, this is not the main aim of virtual reality filmmaking but a rendering of the 360 degrees image on a two-dimensional flat plane for practical purposes. 360-degree film offers an immersive experience, envelopes its audience by the representation of the world constructs. This mode of representation is "cinematic" since it is based on the recorded images of corporeal world and offers a representation of reality.

Although definitions of Cinematic Virtual Reality are still being developed, there seems to be a general agreement, that, it is some degree of immersive VR experience where the viewer can freely choose the direction of view (this freedom provides subjective point of view) and hear spatialized audio that is intended to increase the immersion level (Figure 1). Immersive VR is characterized as the sense of being enveloped by computer-generated graphics and naturally interact within the environment. As opposed to real-time flow in VR, CVR offers non-interactive, pre-rendered pictures as well as sound. Briefly stated by Mateer (2017, p.15), "CVR qualifications are likely to be found in television and feature film." While the traditional filmmaking techniques overlap in part with filmmaking techniques of CVR, researchers and filmmakers envision it to become an entirely new type of filmmaking. Cinematic storytelling, particularly in mainstream narrative films, relied on the illusion of reality; yet CVR seems to impose an entirely different set of representational techniques/ modalities. Although CVR is a new type of filmmaking, its tools for film creation are heavily dependent on traditional filmmaking tools constructed in decades. Traditional 2-D cinema is designed to be experienced in a linear construction by the juxtaposition of images to create an illusion of reality,

RESEARCH ARTICLE (ARAŞTIRMA MAKALESİ)

¹ Department of Art and Design, American University of Sharjah, matayaliphd@gmail.com

² Department of Cinema and Digital Media, İzmir University of Economics, hazal.bayar1@gmail.com

and events in cinema occur from the eye of the camera. The audience is exposed to a specific frame to understand the story. Events in Cinematic Virtual Reality might be coherent with traditional cinema; however, there is no frame in CVR, but on the contrary, the audience is the camera. Dependent on users' choices of framing, the meaning of the story varies, and this distinction leads to new questions concerning CVR filmmaking: How is it possible to apply traditional filmmaking tools to CVR, and to what extent can film making techniques be used in CVR production? In order to search answers for these questions, this study aims to underline significant notions regarding CVR filmmaking and look into certain possibilities and tools within the context of immersive experience.

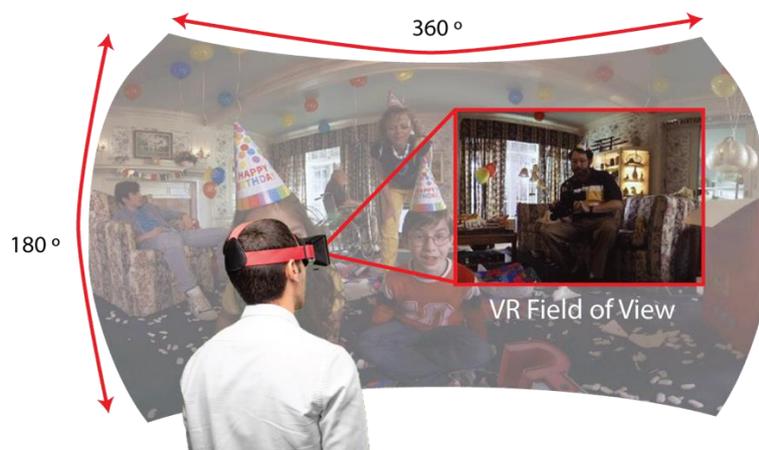


Figure 1. Illustration of the video viewing sphere and the field of view observed by the viewer using the VR device.

2. ILLUSION OF REALITY: IDEOLOGY OF TOOLS OF TRADITIONAL FILMMAKING

In his article, *Immersed in Difficulty: The Problem of Suspension of Disbelief in Transmedia and VR Experiences*, Dalby (2016, p.21) refers to Holland, defining “illusions of reality” through four stages:

1. we no longer perceive our bodies
2. we no longer perceive our environment
3. we no longer judge probability or reality-test
4. we respond emotionally to the fiction as though it were real

In traditional cinematic experience, filmmakers depend on to build the illusion of reality by using tools such as cinematography, editing, sound and mise-en-scene, to engage the audience as a voyeur and establish an identification. Narrative techniques in illusion of reality are submitted through spatial and temporal construction of cinematic reality. The illusion of reality and the feeling of the world built in films is shaped by light, camera angles, focus, editing, and many other factors, for example, music conveys the feeling of this visuality. According to Bates (1991), the style of presentation plays a primary role in traditional media. Storytelling logic refers to the structure of shots, sequences, and scenes. The continuity style is main provider of illusion of reality in cinema. The continuity style consists of spatial and temporal connections. Spatial connections are the units of the composition, and most common shot sizes are a long shot, medium shot, and close-up. Shot sizes can be used to describe spaces, and in order to create a consistent spatial/temporal order, different shot sizes are used together. It is not the only visual connection of shots create the continuity style, but also narrative logic cooperates to create a sense of continuous space. There are certain rules for filmmakers to take into consideration to provide seamless continuity in the spatial connection. The most essential one is line of action: organization of camera angles and position in order to provide consistent screen direction (180° rule) (Katz, 1991). The composition tells the audience where to look, the frame is two-dimensional on the basis, and this two-dimensional design points out the direction that the viewer should pay attention to. The mode of establishment of the perspective determines the perspective of the audience. Objects, visual identity of which is determined in a frame take place in the unconscious of the audience. The four corners of the frame are a natural (constraint) visual force; objects close to the frame are more implied at the center of attention than objects at a distance. Objects in any spatial direction of the frame (including off-frame) constitute the visual area of the entire composition that is desired to be emphasized. As a rule, dialogues are matched, at the eye level of the characters, and eye-level is used to emphasize the psychological state in different storytelling techniques. When the camera is above and below the eye level (high angle, low angle), it is possible to have an idea about the status of the subjects in psychological sense and composition. In addition to this cinematographic variations, depth-of-field is an important part of the spatial composition, upon determining the area where the camera is in focus, the high and low depth of field creates a cinematic

language in the establishment of the objects that need to show interest and relationship with the character (Brown, 2016)

Editing plays one of the significant roles in submitting the continuity of the film. According to Bordwell et al. (2016, p. 230), “the historically dominant language to film editing is continuity editing.” The primary purpose of the idea of continuity is that successive images can flow in terms of space, time, and action. André Bazin (1967) mentions that there are two separate ways to cut films: “invisible montage” and “montage by attraction.” Bazin (ibid., pp. 91-92) mentions about three possible methods of analysis for (invisible) classical editing: “a purely logical or descriptive analysis, a psychological analysis from within the film, and a psychological interest from the point of view of the spectator.” As Brown states (ibid., p. 74);

Filming is ultimately shooting for editorial. The primary purpose of shooting is not merely to get some “great shots”—in the end it must serve the purpose of the film by giving the editor and the director what they need to actually piece together completed scenes and sequences that add up to a finished product that makes sense, has emotional impact, and accomplishes its purpose.

In addition to “invisible montage”, in cinema, “montage by attraction” is also another narrator tool for filmmakers. Bazin defines “montage by attraction” as a supporter of the meaning of one image by relation to another, which does not necessarily need to be part of the same episode. According to Røssaak (2006, p.330), “Eisenstein's cinematic idea is similar to painting: embroidering the art of painting on film strips.” To Eisenstein, recording the bodies in motion does not mean that it will create a sense of motion, montage is necessary to create movement. Moving the camera can be an alternative to a series of edited shots and can provide another solution to make connections between space and the subject (Katz, 1991).

The narrative techniques adopted by mainstream cinema to sustain the realism of the film brings forward the condition and ideological effect that is referred to as “illusion of reality” in film studies. In his book *Cinema Against Spectacle*, Jean-Louis Comolli (2015) claims that the two contradictory principles, illusion and reality, give momentum to each other. Perfect realism contradicts the nature of the film, but as a goal, he thinks that it tends to reproduce the status quo. His approach aims to overthrow the illusion of reality. According to Comolli, the main factor of the ideological role of the cinema is to create its own “reality”, not just a pure “illusion of reality”; since it is dangerous to reproduce the status quo in a non-critical way. Comolli argues that there is a reciprocal relationship between film and reality. In these cases, instead of strengthening the status quo for its own sake, cinema should question what it records, arouse a new reality in the audience. Comolli’s criticism of the power of cinema is that cinema relies on allurement. As Brown (2016, p.271) says:

As machines have colonized our time (we are always checking email), our gestures (the ways in and the speeds at which our bodies move), and our identities (I am my job), so, too, have they colonized our dreams: rather than create, I watch, and my ambition is somehow to achieve fame by being a movie star.

Comolli’s argument on “reality” underlays this argument; to put it more explicitly in other words, we do not think about what we see; instead, we are told what to think. He argues that the cinematic impression of reality should evoke the viewer's activation rather than simply exposing the spectator to an illusion. So, the impression of reality can only be achieved with the audiences' engagement. In her book, *French Cinema in the 1970s*, Smith (2019, p. 145) addresses to Comolli's understanding of "illusion of reality”:

The definition which Comolli arrives at reiterates the idea of a two way relationship between film and reality: “a system not of reproduction but of reciprocal production”. Comolli adds that the mystification constituted but the illusion of reality implies an actual effort on the part of the audience, an effort which is willingly furnished. However, it is implied in “Machines of the Visible”, the desire to concur with illusion is itself the result of preconditioning, the audience having already become accustomed to a prevailing world-view which the realist presentation reinforces. That reinforcement gives the audience the security which it unconsciously desires.

Although Comolli brings a critical perspective to the illusion of reality, it is also questionable that the idea to maintain illusion of reality in cinema works effectively.

3. DEFINITIONS OF VIRTUAL REALITY AND CINEMATIC VIRTUAL REALITY

Virtual Reality (VR) is a communication medium that enables users to experience a computer-generated environment through desktop and immersive systems. The way immersiveness is applied to the virtual reality depends upon which aspect of the medium is being illuminated. There is a fundamental distinction to be drawn within the virtual reality system that cuts across the distinction between desktop usage and immersive systems. Desktop usage of VR construes non-immersive experience where

users can use simpler tools such as keyboard and mouse to navigate in a virtual environment, on the other hand immersive VR construes surrounding experience for the user by including hardware such as a HMD and sensory feedback. Immersive VR conceived as an apparatus that appears unmediated, whereas desktop VR users are aware of the mediated experience. In this case, the immersion level is the fundamental distinction between these two systems (Markowitz & Bailenson, 2019). Immersion and presence are the key elements to determine the level of the immersive experience of VR. This distinction turns upon how the usage of non-immersive and immersive VR is to be evaluated. In 1968, Evan Sutherland implemented the first virtual reality system, using wireframe graphics and HMD, users could occupy the same space as virtual objects (Pausch et al., 1997). Visual dominance of VR has to give the user an illusion of looking in on an approximate reality. Sutherland (1965) calls VR the ultimate display, where the bullet shown in such an area will be fatal. To expand the idea behind VR, Sutherland (1968, p. 757) borrows the concept of "kinetic depth effect" to explain how we perceive two-dimensional images as three dimensional. The fundamental concept of a three-dimensional display is presenting the user with a picture of a viewpoint that changes within the movement. In retina, objects are two dimensional, yet two-dimensional objects on the observer's retina can produce the impression as it is like a three-dimensional object. It is possible to say that Sutherland is the inventor of HMD systems.

However, Jaron Lanier is the innovator that coined the phrase "virtual reality" during early 80s, along with creating the first immersive simulation in which numerous avatars might interact (Bailenson et al., 2007). According to Lanier (2017), VR is a very difficult topic to explain because it's hard to contain. It directly connects to every other discipline. In his book, *Dawn of the New Everything: Encounters with Reality and Virtual Reality*, he has fifty different definitions for VR, and the most remarkable one is that VR is the ultimate media technology (ibid., p. 488), "meaning that it is perpetually premature.", *par excellence*. Lanier (ibid., p. 564) admits that radical dramatist Antonin Artaud used the French phrase, *réalité virtuelle*, in his discussions of "theater of cruelty", by saying, "Artaud meant a nonverbal form of theater that was intense enough to rouse depths of human experience and understanding beyond conventional language." Even though the term virtual reality was used long before Lanier brought it, these two concepts suggest different results.

There is a distinction between VR and CVR; in CVR, the viewer watches 360-degree movies using a HMD. The perspective in the virtual world is the perspective of the viewer, and the viewer watches the film within that environment. CVR experiences rely on a 360-degree view, and there is no interaction between the subject and the viewer, as opposed to interactive VR games or stories. Viewers can't touch or manipulate the events in the story but free to look at any part of the film. There are suggestions including interactive elements in CVR, as an example, Reyes & Detorri (2019) coins the term IFcVR which is a hybrid narrative form born from the convergence between Interactive Fiction and Cinematic Virtual Reality in order to create interactive, immersive film experiences. The critical element here is to shift from the authoritative perspective of traditional media, literature, cinema, and theater. The end product comes out with an interactive narrative experience that proceeds with the user's individual preferences; the user can choose what to watch and when to watch. It determines the development of the story by drawing its path, and each attempt results in a different story world. *Kinoautomat*, created by Raduz Cincera in 1967, would be an example of this suggestion. *Kinoautomat* was shown in a film theater that offered different narrative options, and the narration of the film changed with viewers' votes. The problem is that viewers who did not participate in this majority had to watch the story they did not vote for. In VR, there is no such situation since the viewer is isolated. Due to the fact that, interactive stories are another subject of research, it would be more accurate to focus on 360-degree movies for the nonce. Being in another world or environment is the primary goal of the CVR experiences. Thus, the creator tries to imitate the physical world or design a sub-world where the sense of "being" is active for virtual reality environments.

4. LIMITATIONS OF CVR

Spielberg (cited Child, 2016) believes that virtual reality is a dangerous medium. The reason is that in VR viewers may look anywhere in the scene without any constraints, which may cause a misleading in the story. If the viewer doesn't get any intended direction from the filmmaker, they can forget the story while focusing on the 360-degree environment. Pixar co founder Catmull (Dredge, 2015) claims that VR does not offer any type of storytelling. Filmmakers, engineers, and game designers have been trying to build a storytelling in VR for almost 40 years, and there is no successful result so far. Otherwise, big production companies would already jump on it. He thinks that this technology should suggest something different than film. Lanier (2017) does not consider 360-degree film as a virtual medium because there is no interaction between the characters and the environment. These arguments might be accurate from the perspective of mainstream linear storytelling, but the aim of CVR is not to establish another Hollywood style filmmaking platform instead find its skin by using the components of filmmaking techniques and other art fields. Lanier's claim is much more understandable since the main aim of VR is to interact with the environment. However, the "immersiveness" of VR should also be considered as a distinctive character of the device, and this feature is available for CVR as well. Although there are continuing discussions, it has been several years since famous film festivals (Sundance, Venice, Tribeca, SXSW) have started showing VR films in their selections and exhibitions. Another problem

in VR is the users' inability to adapt to a virtual environment that usually arouses possible responses such as rejection and dizziness. Early films were like the traditional recordings of theater. Over time, cinematic language has been developed, new ways of showing have been invented. The viewers of the early films were also exposed and believed in the cinematic reality of this period. In this case, it would be quite difficult for the audience to understand modern film techniques (Bates, 1991). A similar development can be experienced in the art of virtual reality. Although virtual reality is already seen as a realistic narrative from the first-person view, the way the language is presented will improve over time.

5. IMMERSION, EMBODIMENT AND PRESENCE

Philosopher Don Ihde, whose seminal works in phenomenology and philosophy of technology are particularly famous; inquires (1990) about the transparency of technology and forms of embodiment in his book *Technology and the Lifeworld*. His project is to formulate a phenomenological reflection of technological embodiment (p. 22):

Phenomenologists contend that all experience is experience of something. That is, experience is referential, and that which is referred to or experienced is anything which fills in the blank. The phrase "I see" implies something like "I see ____" where the blank must be filled in to make a meaningful statement. In its history, phenomenology took an increasingly existential development, and the term 'existential' in context refers to perceptual and bodily experience, to a kind of "phenomenological materiality."

Ihde's phenomenology is rooted in a relationship between body, perception, and objects of perception. Ihde expresses this relation in his writings as, "I—relation—World", where "relation" stands for any perceptual/bodily connection to the world. In its context, these relations are mediated by artifacts, by technological means, the form of relation becomes "I—technology—World". Ihde discusses three types of relations that humans can have in their mediation of the world through technology. According to him, *embodiment* relationships are those in which technological artifacts extend human abilities in such a way that they become transparent. That is to say, the technological artifact is not noticed, *per se*. It is, as if in our mediated experience with the world outside the mediating technological artifact disappears. He exemplifies this type of relation with case of eyeglasses. They improve the wearers vision, but they are hardly noticed once the wearer has adjusted to them. Ihde points out in a number of places that the relationships he discusses are not total relationships, since eyeglasses do not become completely transparent, hence, they are simply not an entity we focus our attention on, or, to use his phrase, they are not "focal entities" (ibid., p. 107).

The second relationship is the *hermeneutic* relationship. In this type of relationship, a technological artifact presents a text through which we deal the world with. Instruments that yield measurements are the examples of this type of relationship. Physicians once would use their senses directly, or indirectly through devices such as stethoscopes, to examine patients. Now a few pages of data from a blood test gives measurements of things like cholesterol, glucose, oxygen, carbon dioxide, etc., and interpreting this text gives a physician a new way of experiencing a patient. The technology that enables these measurements sits in a lab where the blood sample was processed. The physician sees the results without having to see either the equipment or the measurement process. Presence of the technological artifact is not required for its use.

The third type of relationship is *alterity*. In the case of embodiment and hermeneutic relationships, the human ability is extended through technology. Whereas in the case of alterity, the technological artifact operates somewhat independently from the human user. Such artifacts appear to have, to some degree, a life of their own. The artifact appears to have its own agency, and such artifacts can range from simplistic things, such as a spinning top, to the most advanced AI program. These types of entities are experienced as part of the outside world. They are *other than us* rather than being *extensions of us*.

Based on Ihde's argument, in an immersive environment the presence of technological artifact should not be noticed. It must seamlessly operate behind human awareness. An immersive environment gives the user a sense of "presence" by creating a perceptual experience of the environment from an internal perspective and expressing the feeling of being truly present from this perspective. In general, this includes inputs that probably use auditory or other sensory elements to create a visual experience from a three-dimensional environment. Being in another world brings the concept of presence. Presence, how immersed one is in virtual reality, is independent of technology. Bailenson et al. (2007) claim that one may feel more engaged (higher presence) in a well-done film or novel than a low-quality VR environment. Being in a virtual environment is not just a question of perception; it is also related to mental states or psychology. Presence is available in movies regardless of sensory technology.

In contrast to this statement, Lombard & Dittoechn (1997) argue that maintaining a presence to the feeling of "being there" is the most critical part of immersive VR because the user's actions have to mimic the actions in an unmediated space. In order for this proposal to occur, devices that will provide sensory interaction are needed. Although, the terms immersion and presence are

mostly used as synonyms, there are different suggestions on the concept. Vosmeer & Schouten (2017, p.87) differentiates immersion from presence by defining immersion as an objective criterion which depends on hardware and software:

Presence is subsequently defined as the psychological, more subjective sense of being in the environment and mainly influenced by the content of the mediated world. Immersion could be seen as a quality of the medium, in this case, a VR movie, while presence is a characteristic of the user experience. Hence, higher immersion may lead to or result in a deeper presence.

Apart from presence and immersion, the concept of the embodiment and its varied definitions should also be considered. According to Kiltani et al. (2012), the embodiment is the state of responding to our demands and interacting with the virtual environment, whereas Bermúdez (1998) coins the term as "bodily self-consciousness.", and Arzy et al. (2006) claims the sense of having one's own body variously termed "embodiment." Such separate definitions of embodiment mean that by combining the various sensory impulses that appear in our body, we can feel the sense of having a body that our brain interprets to create a cohesive image (Matamala et al., 2019).

6. ILLUSION OF REALITY AND SENSE OF PRESENCE IN CVR

In virtual reality or CVR, viewers are already immersed, as a head-mounted display completely covers the audience's environment. It is possible to say that in order to create a sense of presence, VR uses the advantage of sensory impulses, haptic devices, and wearable technology. These hardware inputs increase the immersive level of VR. However, CVR is limited in terms of hardware support. As mentioned earlier, CVR experience is limited with a 360-degree view. Thus, in CVR, the concept of "presence" exists with narration techniques and filmmaking tools. For the feeling of "presence" in VR movies, an immersive environment is helpful to some degree, but without "illusion of reality", it might be insufficient.

In *The Matrix* (1999), cyberpunk rebel Trinity turns around when the cops handcuff her hands, and then she breaks the police's arm with a quick move, rushing to the cops. As soon as she leaps into the air, the frozen image of hers turns 360 degrees around Trinity. Røssaak (2006, p. 325) defines this scene as "The feeling here is now not only cinematic but also sculptural." Time is frozen in this impossible virtual camera movement and Trinity enters a new time-space dimension. In this scene, the effect enters a passage between the dull and the mobile, by turning cinematography itself into another cinema. Røssaak (ibid., p.326) summarizes the idea: "All of these techniques and alterations in time created new physiological and psychological moments for the audience." The same suggestion is available for CVR; it is an ideal tool to inject new physiological and psychological moments for the viewer, CVR can turn itself into another cinema. Filmmaking techniques for VR is not a new concept, in fact one of the essential elements of an active virtual environment setup is the "illusion of reality". The user must perceive this world as real, without departing from the depicted world. In the long term, VR experience cannot be an extension of traditional films even though they can merge with film and TV. VR offers something new that stands for its own narration space. In this sense, CVR can discover new techniques to maintain the illusion of reality.

Bates (1991) emphasizes the need to integrate research on "deep structure" and increase the role of the experience of presence in the virtual world by using filmmaking techniques developed to build "illusion of reality." Almost all of the novels, television, and films include some key elements; first, for the most part, they contain people and feelings. This allows the viewer to see the world as a form of life. Moreover, there are goals in human-hosted stories, such as, a traditional linear storytelling, and its intention to add meaning and explanation. Cinematic narratives have developed artistic techniques almost around these items. Traditional media allows the author to influence and direct the viewer in this way. A sensual and intellectual context is created with the audience. In the absence of this context, it is difficult for the author to establish a significant world. Setting up a similar physical world structure is an area where VR is also involved. Upon its immersive dimension, VR is building a fresh relationship between humans and art. The aim is not whether the created world is as real as the physical world, but whether it is real enough to suspend the disbelief for a while. This is the same mental change that happens when the user hugs a good novel or get absorbed while playing a computer game (Pinemtel and Texeira, 1993). Suspension of disbelief is to obtain metaphors within the virtual environment rather than perceiving the reality as it is (Roth, 2015).

7. NARRATIVE POTENTIALS AND STRATEGIES OF CVR

The storytelling techniques of cinema have developed and matured throughout history. In the production of 360 degrees, most techniques try to find forms around cinematic narrative techniques, but due to the format and nature of the 360 films, cinematic narrative techniques cannot be transferred and applied as they are. Mateer (2017), highlights different instances in which film production can be experienced in virtual reality. According to him, CVR can provide distinct, valuable, and new forms of filmmaking. One of these tools is the concept of “presence.” Heeter (1992) mentions three types of presences, which are environmental, social, and personal. The first two require interaction with other human beings or the environment, hence, it is not possible to apply it to CVR. However, personal space is relevant to CVR since it is based on simulation real-world perceptions with sound and images. Matter (2017) suggests that there are two user perspectives and means of user engagement in cinematic VR filmmaking; “first person (i.e., the user is directly addressed by a story character and thus present within the narrative) and third person (i.e., the user purely observes the action) perspectives.” According to Nicolae (2018, p.168), there are three possible experiences or three spectatorship modes in VR film:

The hero – where the spectator is the one that is at the center of everything and retains his/her identity, the witness – where the presence of the spectator is ignored by the characters and the impersonator – where the spectator point of view is assimilated with a character in the film and the character’s identity is forced upon the spectator.

The hero and impersonator perspectives are the character’s point of view, and the witness perspective is the immersive passive view. In *Great Performers: LA Noir* (2016), which was made to increase the popularity of the medium, the main idea of the series is to experience a scene with well-known actors. There was no intended story or connection between scenes but rather experiencing a movie star feeling. In this film, the perspective is the hero's perspective (Figure 2). Actors talk to the viewer and allow them to be a part of the scene. However, the feeling of presence is limited due to a lack of storytelling. *HELP* (2015), which is one of the first live-action CVR films, uses a witness perspective (Figure 3). The viewer watches the whole short film as if they’re sitting on a crane, and the movie drop the audience into the middle of downtown Los Angeles whit an unexpected meteor shower. Among the falling meteorites, an E.T. arises, and the story continues with a young woman fluttering to escape from an E.T. In another film, *I, Philip* (2016), director decides to put the viewer to an impersonator perspective (Figure 4) where the audience takes on the role of the reconstructed consciousness of Philip K.Dick.



Figure 2. In *Great Performers: LA Noir*, the perspective is the hero's perspective. The viewer directly engages with the characters (Natalie Portman) and the viewer is the main character in the film.



Figure 3. In *HELP*, the perspective is the witness perspective. The viewer is not a character in the film rather views the film as a witness.



Figure 4. In *I, Philip*, the perspective is the impersonator perspective. The viewer is a part of the film but this time not as him/herself but as a constructed character.

All these films offer different approaches to handle both the physiological and psychological perspective of the viewer. Due to the different perspective modes, each of them offers a different feeling of “presence.” To empower the feeling of presence, measuring the Attentional Synchrony of the viewer is critical. Attentional Synchrony refers to the degree of spatiotemporal agreement in the scene (Smith, 2008). In Bender's (2018) study, the participants watched two versions of the same 360 film (*Gone in 360 seconds*, 2016). The most striking factor among the findings is, among Character Point of View (CPV) (Figure 5), and Immersive Passive View (IPV) (Figure 6), CPV has a greater potential for "Attentional Synchrony." It should not be understood that IPV does not engage the viewer; it is only valid that CPV increases the engagement slightly more. Thus, positioning the camera at the character point of view might improve a better feeling of presence. However, the story, mise-en-scène, and production values of the film are critical to providing this claim. Low-quality CPV movies could be less striking than high-quality IPV movies. According to Gødde et al. (2018), when the viewer plays a part in the scene, the viewer becomes active, and the viewer tends to lean forward. However, the viewers' expectation of being in interaction with the content gets higher. There is high involvement, high potential for a feeling of presence, but the story fades into the background. On the other hand, when the viewer is the observer, the experience becomes passive, and the viewer tends to lean back. They don't expect any interaction, and the involvement of the virtual environment reduces. The feeling of presence is also weaker than active experience, but since the viewer is not distracted by the interaction, more engagement with the narrative occurs.



Figure 5. Images adapted from Bender (2018), the full 360-degree view in the Character Point of View version. Note the viewer is addressed by the Boss (at frame right) as a character within the diegesis.



Figure 6. Images adapted from Bender (2018), Immersive Passive View: In this version the viewer is not addressed as part of the diegesis, and the film edits to different camera angles during the narrative.

In his book *The VR Book*, Jerald (2015) claims that the illusion of presence divides into four components. The illusion of being in a stable spatial place is a feeling of being in a physical environment, second one, the illusion of self-embodiment is the perception that the user has a body within the virtual world, third one, "is the illusion of physical interaction." Adding some form of feedback such as audio, visual highlights, or a rumble of a controller can give the user a sense that he has, in some way, touched the world, and the last one is "the illusion of social communication," where the user communicates with other characters (real or AI) in the same virtual environment. Among all four of these illusions, only the illusion of being can be considered in CVR filmmaking. The illusion of physical interaction can also be applicable; however, this will probably distract the viewer's attention to the story, as mentioned above.

Sound is also another crucial element in order to enhance the sense of presence. According to Rothe's (2017) experiments, she found that the participants responded positively to being directly addressed or acknowledged by characters within the scene. The usage of sound, whether diegetic or nondiegetic, can manipulate the viewing direction of the viewer. In his book *Storytelling for Virtual Reality* (2017, p.91), Bucher emphasizes the importance of "sound as the main driver of the viewer's attention." Sound can be one of the vital elements to direct the audience's Point of Interest (POI).

There are critical moments in the narrative of a film where the user must see the specific moment to understand the whole story. If the user is looking into another direction at that critical moment, they miss a significant part of the narrative. In these cases, director must draw the user's attention to the POI. According to studies (Nielsen et al., 2016), researchers compared two approaches to guide the user's point of interest in VR. The first one lets the user inspect the environment freely, but the orientation of the user's view would always face in the direction of the intended part of the picture. This force perspective rule is found to be nondiegetic and reduces the sensation of presence. The second approach lets the user look around freely, but a small flying firefly offers clues about where to look. They found out that this kind of manipulations are more helpful for the viewer and maintain a better sense of presence since they are not forced to look at a specific part of the scene.

Pan and tilt methods can also be considered for the user to focus on one point. However, in such a situation, this could lead to motion sickness (Jerald, 2015) as the immersive system covers the entire field of view. The user's attention can also be drawn by color or moving objects. Bolte & Lappe (2015) suggested that POI can be achieved by translating and rotating the camera between the eye's fixing points during its rapid movement. However, an eye tracking system is required for such a system. Another technique could be to make use of the *mise-en-scène*; Danicau et al. (2017), tests the objects that as they move away from the POI, they fall into darkness and only the objects that remain in the POI area remain illuminated. However, none of these tests suggest any idea for the filmmakers. The blurriness and deformation of the objects were also tested, but it was found that they are uncomfortable for the users. Directing POI is helpful in linear storytelling and may help directors to establish a better narration in the VR story. Nevertheless, one may not forget that the main aim of CVR is to wrap a 360-degree world where the viewer is free to view any part of the environment and catch meaning in it.

In her interview Jessica Brillhart (cited Haridy, 2016) suggests that instead of directing the audience to follow a linear narrative and telling them what to look at, directors should invent a new way of telling stories. CVR creators should let viewers the way they wish to look and discover the details in the story. This problem has not been solved yet and awaiting filmmakers to come up with suggestions. If the viewer has to look at a specific part of the scene (in order to understand the story), what would be the difference between 2-D cinema and CVR?

Ross (2018) says that; while the cinema viewer witnesses the events from a certain distance, the VR user is positioned as a character. This diegesis is allowed to feel events as they occur and creates an emotional experience for the viewer. It has been reported that subjective emotional experience and the physiological reaction showed a significantly stronger emotional effect in CVR than in the 2D film (Ding et al., 2018). Four emotions (excitement, nervousness, hostility, and jitteriness) appear to be more closely relative with the CVR than traditional 2D film.

Thus, it is not surprising to see that the horror genre is widespread in VR. *IT: FLOAT (2017)*, as an example, in which the whole film is about creating a sense of scare, and most of the horror genre for VR aims to create attractions rather than a story. In some other works, such as Inaritu's *Carne y Arena (2017)*, 360 film experience creates a space for visitors to take a stroll through a virtual environment, providing a headset, controllers, and a PC-backpack. Visitors experience the struggles of the immigrants crossing the US border and the abuses they encounter along the way as if they are in the same condition. This approach could be a new way of telling stories in VR, but on the other hand, they require specific exhibition hall and hardware. What is CVR for then? To experience the characters' struggles and create some impact on the viewer or to narrate stories where the viewer is free to explore and observe?

Creating a story where the audience is free to look while maintaining the illusion of reality is a challenge. This debate is a challenge between the VR creator and the viewer. Bates's (1991) chess analogy is a clear guideline to look at the relationship between the director and the viewer. They both play their game when their turn comes in, and the user moves as he desires. Meanwhile, the director tries all motivations to increase the experience of the game, no matter how the user moves. The director achieves his goal if the user is satisfied with the created world's aesthetic values. Besides presence, editing, and sound, other tools can also be used to achieve aesthetic values. CVR or immersive content may benefit from spatial interaction practices for theatre. Such as, virtual reality, the theater is a high field of view experience where the user costs nothing to look at any place, so the theater's spatial organization can improve cinematography in a virtual environment. Traditional filmmaking processes change the feeling of space by altering the viewer's gaze. The management of the complicated spatial relationship between audience members lies not just in the narrative through spatial cues but also in the actual physical activity of the narrative. Searching for remedies to VR's narrative difficulties, VR content makers think the theater provides potential responses.

Pope et al. (2017) experimented to explore how the creative team uses spatial composition to establish relationships between character and audience members, and then compare them with a 360-degree camera and direct audience members during the show. The aim is to investigate how the environmental composition changes. The participants have asked questions that can be regarded as crucial to the topic of VR: Who is the viewer? Exactly why are they there? Need to target them immediately? The inclusion of theater techniques, combined with an examination of the benefits of the active geometry between the figures, this research could further enrich the job of VR filmmaker. CVR creators can borrow spatial tactics used by theater professionals in this study. Architectural features and how physical objects are used between characters and how they relate to the audience can impact CVR filmmaking—spreading the stage to multiple spaces and that the auditorium produces a collaborative suspense. To experience a VR film in exhibition space (*Carne Y Arena, 2017*) (Figure 7) or in a theatre (*enter wonder.land, 2015*), they all present their experience in a specific location.

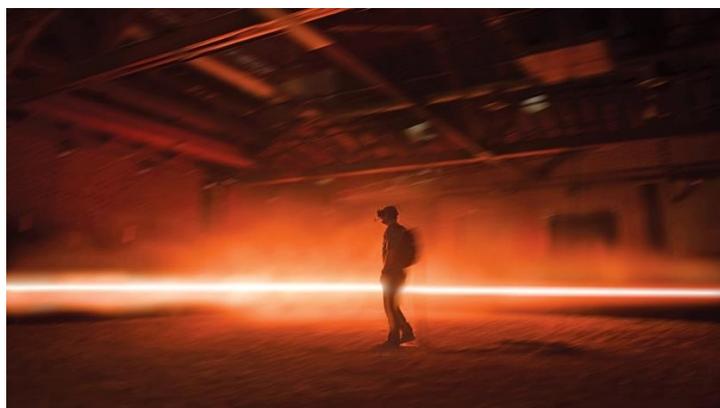


Figure 7. Inárritu's conceptual virtual reality installation *CARNE y ARENA* (Virtually present, physically invisible) explores the human condition of immigrants and refugees.

Another aspect of CVR filmmaking is editing. Jaunt (2018) suggests that the main action should pass at an angle of 150 degrees at most. On the other hand, Jessica Brillhart (2016) claims that the action should happen all around the audience. For this, she introduced the concept of probabilistic experiential editing. In her website *In the Blink of a Mind* (2016), Brillhart explains her theory as:

If I could identify the potential experiences in each world, evaluate the probability that they will occur, and then take into account how a visitor might engage with them, I could then identify possible paths. I could rotate these worlds around each other like some kind of intricate cipher, using the most probable potential experiences to guide someone through.

This technique can be called as, match on attention, aligning the point of interest (Figure 8) in one shot with the point of interest in the next shot (Kjær et al., 2017). Although matching the cuts on the attention area ensures the continuity of the film, the traditional 2-D cinema continuity editing approach also succeeds in maintaining the continuity in VR. Research (Serrano et al., 2017) suggests that despite the visual discontinuity across edit boundaries, viewers manage to build a mental model of the shown event structure.

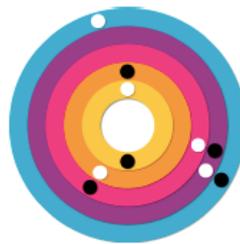


Figure 8. Visualization of matches on attention adapted from Brillhart (2016). The viewer is at the center and each circle represents a new shot. Black dots represent the POI at the beginning of a shot and white dots the POI at the end of the shot. Aligning white and black dots result in matches.

The Jaunt guidelines (2018) advise to give around at least 20 seconds per shot for the viewer to orientate the new scene, but on the other hand, researchers (Kjær et al., 2017) test the effects of cutting frequency on the audience. The aim was to analyze the effect of frequency on the audience's experience. According to their findings, when the region of interest (ROI) remained consistent across cuts, the viewers managed to follow the story (without any disorientation) regardless of the duration of the cuts. Usually, CVR filmmakers prefer to avoid cuts, crossfade and fades to a black is a safer method for changing the scene. However, Gødde et al. (2018) claim that the transitions (crossfade) between two scenes slow the pace of the movie and may distort the rhythm. In addition to that, some movies manage to create cuts unblinkingly. Emmy award-winning, Google Spotlight Stories produced immersive animation stories for six years, until it sealed its doors. *Pearl* (2016), produced at Google Spotlight, is a short 360 non-linear animated film with a story that compresses decades into minutes by using montage. The film includes hard cuts, which was used to be thought that impossible for Virtual Reality experience (Curtis et al., 2016). It received numerous praises with its bravely approach to VR filmmaking. The only exception here is that the film uses computer generated graphics instead of recorded media.

There is also another component: cinematography. In CVR, the cinematography is evaluated through camera height. Depth of field and framing is one of the main concerns on traditional filmmaking, but there is no frame in CVR, therefore the ultimate solution would be the organization of the space and position of the camera. In CVR, users usually spend 75% of their time within the frontal 90 degrees of a spherical video (Bender, 2018). The reason might be that over 100 years of collective viewing experience (in cinema theatre) of looking straight ahead. Another reason might be the orientation of the scene, content, blocking, and the direction of the POI. The human eye's visual field is around 150 degrees (Jerald, 2016), thus, even though the viewer does not exceed 90 degrees most of the time, they are aware of VR's field of view. 360-degree has the potential to create sensational cinematography. The field of view changes according to VR's capability. The spherical video containing a 360-degree view of the scene shot from a single point is displayed through Virtual reality HMDs. The video mapped to the inner surface of a sphere shows a limited portion from the center of the sphere by HMD. This image is called the viewport, and a limited portion refers to the field of view. According to the field of view that HMD can show technically, the field of view of the user will be that much. Depending on the direction the user is facing, this limited area is displayed over HMD. The resolution quality of 360° videos should be higher than 8K and it corresponds to today's UHD television picture quality (Nasrabadi et al., 2017).

Thus, new ways of compressing and streaming cinematic VR content are required to get quality content to the end-user (Knorr et al., 2018). All these aspects of the medium deeply affect the cinematographic qualities of the VR film. The height of the camera is a tool to develop a cinematic language rather than a problem. However, problems in HMD are progressing differently. If the camera height does not coherent with the physical height of an object (in the real world), it may disturb the viewer. According to the study, it has been found that the difference between the camera and eye heights can only be tolerated when the camera is slightly lower than the average human height (Rothe et al., 2019). Based on this study using traditional cinema camera angles such as low and high camera angles might seem uncomfortable for the viewer; hence, more experiments are needed. The camera angle may create great sense if the story is coherent with the intended feeling. The height of the camera is only one instrument that has to be considered with all the other instruments. Shot sizes are also very limited in CVR due to its mere goal is to show the entire scene without distorting the viewer's eyes. However, according to the study (Passmore et al., 2017), the audience shows great interest in close-up shots. Viewers experienced the bee's life through the hive (bees were in close-up), and they found it surprisingly entertaining. Nonetheless, more research needed in order to understand the shot sizes in CVR.

Witness 360: 7/7 (2015), a documentary about experiences of survivors of London bombings in 2005, aims to tell real-life stories and expect viewers to create empathy. There is a narrator in the documentary, which makes things easier while viewing the film, and it doesn't demand the viewer to catch up with the events constantly. In that sense, the narrator's techniques in VR documentaries might be beneficial for VR fiction films. Witness or impersonator perspectives are also available in many VR fiction films, but the viewer needs to follow the events to create a meaningful story. If the viewer misses some portion of the action, this may lead to confusion. However, the same result might not happen in documentaries.

Besides linear stories, CVR can be a suitable medium where experimental and non-linear works can arise. For example, *Ex Anima (2019)* suggests unique visual poetry where the viewer is at the center of the stage and experience the dreamlike, hypnotic choreography of humans and animals. The film pushes the viewer to look around 360-degree to get the sense of the moment and let the viewer experience the film the way they would like to see. Although the film does not offer a 3-act story, it is remarkable due to its aesthetic concerns.

8. CONCLUSION

This study aims to find out unique properties that distinguish CVR from other media. There is a need to define the concept of CVR and its filmmaking techniques on a theoretical level. By looking at past film studies and traditional and VR filmmaking techniques, the goal of this study is to provide a comprehensive analysis of CVR works and compare different ideas and opinions on its form and methods. Intention of this study is to provide extensive research on CVR filmmaking tools and bring empirical findings of current discussions on instruments of virtual reality experience.

ACKNOWLEDGEMENTS

We'd like to thank Prof. Dr. Özgen Osman Demirbaş for his invaluable contributions on the relationship between the concepts of "embodiment" and "aesthetics of virtual environments", and Asst. Prof. Aras Özgün for his invaluable contributions on the topic "embodiment" and "illusion of reality."

REFERENCES

- Arzy S, Thut G, Mohr C, Michel CM, Blanke O. (2006). Neural basis of embodiment: distinct contributions of temporoparietal junction and extrastriate body area. *J Neurosci*, 6(31).
- Bailenson, J., Yee, N., Kim, A., & Tecarro, J. (2007). Sciencepunk: The influence of informed science fiction on virtual reality research. In: M. Grebowicz, ed., *SciFi in the Mind's Eye: Reading Science Through Science Fiction*. Open Court Publishing., pp. 147-164.
- Bates, J. (1991). Virtual Reality, Art, and Entertainment. *Presence: Teleoperators and Virtual Environments*, 1(1), pp. 133-138.
- Bazin, A., (2004) *What Is Cinema?: Volume I*. 2nd ed., University of California Press, pp. 24-30.
- Bender, S. (2018). Headset Attentional Synchrony: Tracking the Gaze of Viewers Watching Narrative Virtual Reality. *Media Practices and Education*, 20(3), pp. 277-296.

- Bermúdez, J. L. (1998). *The Paradox of Self-Consciousness*. Bradford: MIT.
- Brillhart, J. (2016). *In the Blink of a Mind — Attention*. [online] Medium. Available at: <https://medium.com/the-language-of-vr/in-the-blink-of-a-mind-attention-1fdff60fa045>. [Accessed 04 May. 2020].
- Bolte, B. and Lappe, M. (2015). Subliminal Reorientation and Repositioning in Immersive Virtual Environments using Saccadic Suppression. In: *IEEE Transactions on Visualization and Computer Graphics*, 21(4), pp. 545-552.
- Bordwell, D., Thompson, K., Smith, J. (2016). *Film art: an introduction*. 11th ed. New York: McGraw-Hill Education.
- Botvinick, M., and Cohen, J. (1998). Rubber Hands “Feel” Touch that Eyes See. *Nature*, 391(6669), p. 756.
- Brown, B. (2016). *Cinematography: Theory & Practice*. New York: Routledge.
- Brown, W. (2016). Cinema against spectacle: technique and ideology revisited. *New Review of Film and Television Studies*, 14(2), pp. 268-273.
- Bucher, J. (2017). *Storytelling for Virtual Reality: Methods and Principles for Crafting Immersive Narratives*. Taylor & Francis.
- Child, B. (2016). *Steven Spielberg warns VR technology could be 'dangerous' for film making*. [online] the Guardian. Available at: <https://www.theguardian.com/film/2016/may/19/steven-spielberg-warns-vr-technology-dangerous-for-film-making>. [Accessed 10 Jun. 2020].
- Comolli, J. L. (2015). *Cinema against Spectacle*. Amsterdam: Amsterdam University Press.
- Curtis, C., Eisenmann, D., El Guerrab, R., & Stafford, S. (2016). The making of pearl, a 360° google spotlight story. In: *ACM SIGGRAPH 2016 VR Village*
- Dalby, J. (2016). Immersed In Difficulty: The Problem of Suspension of Disbelief in Transmedia and Vr Experiences. *Online Journal of Communication and Media Technologies*, Volume 6 (September 2016 - Special Issue), pp. 67-85. Available at: <https://www.ojcm.net/article/immersed-in-difficulty-the-problem-of-suspension-of-disbelief-in-transmedia-and-vr-experiences-5662> [Accessed 15 May 2020].
- Danieau, F., Guillo, A., & Doré, R. (2017). Attention guidance for immersive video content in head-mounted displays. In: *IEEE Virtual Reality (VR)*.
- Ding, N., Zhou, W. & Fung, A. (2018). Emotional effect of cinematic VR compared with traditional 2D film. *Telematics Informatics*, 35, pp. 1572-1579.
- Dredge, S. (2015). *Pixar co-founder warns virtual-reality moviemakers: 'It's not storytelling'*. [online] the Guardian. Available at: <https://www.theguardian.com/technology/2015/dec/03/pixar-virtual-reality-storytelling-ed-catmull>. [Accessed 10 Jun. 2020].
- Gödde, M., Gabler, F., Siegmund, D., & Braun, A. (2018). Cinematic Narration in VR – Rethinking Film Conventions for 360 Degrees. In: *Virtual, Augmented and Mixed Reality: Applications in Health, Cultural Heritage, and Industry*, pp.184-201.
- Haridy, R. (2016). *How VR is rewriting the rules of storytelling*. [online] New Atlas. Available at: <https://newatlas.com/vr-storytelling-darnell-brillhart/45010>. [Accessed 02 Jun. 2020].
- Heeter, C. (1992). Being There: The Subjective Experience of Presence. *Presence: Teleoperators & Virtual Environments*, 1(2), pp. 262–271.
- Holland, N. (2003). The Willing Suspension of Disbelief: A Neuro-Psychoanalytic View. *PsyArt*, [online] Volume 7, at: https://psyartjournal.com/article/show/n_holland_the_willing_suspension_of_disbelief_a_ne [Accessed 20 May 2020].
- Ihde, D. (1990). *Technology and the Lifeworld*. Indiana University Press.
- Jaunt. (2018). *The Cinematic VR Field Guide*. [online] Oculus. Available at: [https:// creator.oculus.com/learn/cinematic-vr-field-guide/](https://creator.oculus.com/learn/cinematic-vr-field-guide/). [Accessed 04 Jun. 2020].
- Jerald, J. (2015). *The VR Book: Human-Centered Design for Virtual Reality*. Morgan & Claypool Publishers.
- Katz, S. D. (1991). *Film Directing Shot by Shot: Visualizing from concept to screen*. Michigan: Sheridan Books.
- Kilteni, K., Normand, J.-M., Sanchez-Vives, M. V., & Slater, M. (2012). Extending Body Space in Immersive Virtual Reality: A Very Long Arm Illusion. *PLOS ONE*, 7(7).
- Kjær, T., Lillelund, C.B., Moth-Poulsen, M., Nilsson, N.C., Nordahl, R., & Serafin, S. (2017). Can you cut it?: an exploration

of the effects of editing in cinematic virtual reality. In: *Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology*.

Knorr, S., Ozcinar, C., Fearghail, C. O., & Smolic, A. (2018). Director's cut: a combined dataset for visual attention analysis in cinematic VR content. In: *Proceedings of the 15th ACM SIGGRAPH European Conference on Visual Media Production*. New York: Association for Computing Machinery, pp. 1-10.

Lanier, J. (2017). *Dawn of the New Everything: Encounters with Reality and Virtual Reality*. 1st ed. [ebook] New York: Henry Holt and Co., Inc. Available at: <https://www.kobo.com/us/en/ebook/dawn-of-the-new-everything-1> [Accessed 12 May 2020].

Lombard, M., & Ditton, T. (1997). At the Heart of It All: The Concept of Presence. *Journal of Computer-Mediated Communication*, 3(2).

Markowitz, D., & Bailenson, J. (2019). *Virtual reality and communication*. In: P. Moy ed., In Oxford bibliographies in communication: Oxford University Press.

Matamala-Gomez M., Donegan T., Bottiroli S., Sandrini G., Sanchez V., Tassorelli C. (2019). Immersive Virtual Reality and Virtual Embodiment for Pain Relief. *Frontiers in Human Neuroscience*, 13(279).

Mateer, J. (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), pp. 14-25.

Nasrabadi, A. T., Mahzari, A., Beshay, J. D., & Prakash, R. (2017). Adaptive 360-Degree Video Streaming using Scalable Video Coding. In: *Proceedings of the 25th ACM international conference on Multimedia*. New York: Association for Computing Machinery, pp. 1689-1697.

Nicolae, D. (2018). Spectator Perspectives in Virtual Reality Cinematography. The Witness, the Hero and the Impersonator. *Ekphrasis. Images, Cinema, Theory, Media*, 20, pp. 168-178.

Nielsen, L., Brandt Møller, M., Hartmeyer, S., Ljung, T., Nilsson, N., Nordahl, R., & Serafin, S. (2016). Missing the point: an exploration of how to guide users' attention during cinematic virtual reality. In: *Proceedings of the 22st ACM Symposium on Virtual Reality Software and Technology*. Munich: Association for Computing Machinery.

Passmore, P. & Glancy, M., Philpot, A. & Fields, Bob. (2017). 360 cinematic literacy: A case study. In: *International Broadcasting Convention Conference*. [online] Amsterdam. Available at: <https://www.ibt.org/production/360-cinematic-literacy-a-case-study/2479.article> [Accessed 04 Jun. 2020].

Pausch, R., Proffitt, D., & Williams, G. (1997). Quantifying immersion in virtual reality. In: *SIGGRAPH '97: Proceedings of the 24th annual conference on Computer graphics and interactive techniques*, 13-18. Available at: <https://dl.acm.org/doi/pdf/10.1145/258734.258744> [Accessed 10 May 2020].

Pimentel, Ken, and Kevin Texeira. (1993). *Virtual Reality: Through the New Looking Glass*. Intel / Windcrest McGraw Hill.

Pope, V., Dawes, R., Schweiger, F., Sheikh, A. (2017). The Geometry of Storytelling: Theatrical Use of Space for 360-degree Videos and Virtual Reality. In: *Proceedings of the 2017 CHI Conference on Human Factors in Computing System*. Association for Computing Machinery, New York, pp. 4468-4478.

Reyes, M. C., & Dettori, G. (2019). Developing a Media Hybridization based on Interactive Narrative and Cinematic Virtual Reality. *Ekphrasis. Images, Cinema, Theory, Media*, 22, pp 131-151.

Ross, M. (2018). Virtual Reality's New Synesthetic Possibilities. *Television & New Media*, 21(3), pp. 297-314.

Roth, C. (2016). *Experiencing Interactive Storytelling*. (PhD). Vrije Universiteit Amsterdam.

Rothe, S., Hussmann, H., & Allary, M. (2017). Diegetic cues for guiding the viewer in cinematic virtual reality. In: *VRST '17: Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology*. New York: Association for Computing Machinery, 54, pp. 1-2.

Rothe, S., Kegeles, B., & Hussmann, H. (2019). Camera Heights in Cinematic Virtual Reality: How Viewers Perceive Mismatches Between Camera and Eye Height. In: *Proceedings of the 2019 ACM International Conference on Interactive Experiences for TV and Online Video*. Manchester: Association for Computing Machinery, pp.25-34.

Røssaak, E. (2006), Figures of Sensation: Between Still and Moving Images. In: W. Strauven, ed., *The Cinema of Attractions Reloaded*, 1st ed. Amsterdam: Amsterdam University Press., pp. 321-334.

Ryan, M. L. (1999). Immersion vs. Interactivity: Virtual Reality and Literary Theory. *Substance*, 28(2), pp. 110-137.

Serrano, A., Sitzmann, V., Ruiz-Borau, J., Wetzstein, G., Gutierrez, D., & Masia, B. (2017). Movie editing and cognitive event

segmentation in virtual reality video. *ACM Transactions on Graphics*, 36(4), pp. 1-12.

Smith, A. (2019). French cinema in the 1970s. Macnhester: Manchester University Press.

Smith, T. Henderson, J. (2008). Attentional synchrony in static and dynamic scenes. *Journal of Vision*, 8(6).

Sutherland, I. (1965). The Ultimate Display. In: *Proceedings of the IFIPS Congress*. New York: IFIP, pp. 506-508.

Sutherland, I. (1968). A head-mounted three dimensional display. In: *AFIPS Proceedings of the joint computer conference*, pp. 757-764.

Tekgün, E. & Erdeniz, B. (2020). Bedensel Öz-Bilincin Nörolojik Temelleri ve İlişkili Psikopatolojiler. *Current Approaches in Psychiatry*, 12, pp. 32-53.

Vosmeer, M., & Schouten, B. (2017). Project Orpheus A Research Study into 360° Cinematic VR. In: *TVX '17: Proceedings of the 2017 ACM International Conference on Interactive Experiences for TV and Online Video*, New York: Association for Computing Machinery, pp. 85-90.

MEDIA WORKS

Great Performers: LA Noir (2016) Directed by Ami Canaan Mann, Gina Prince-Bythewood, Armando Kirwin. USA: Milk VR.

HELP (2015) Directed by Justin Lin. USA: Bullitt, Google Spotlight Stories, YOMYOMF Network.

I, Philip (2016) Directed by Pierre Zandrowicz. Paris: Okio-Studio

Gone in 360 seconds (2016) Directed by Stuart Bender, Brandon D'Silva. USA: Virtual Guest.

IT: FLOAT - A Cinematic VR Experience (2017) USA: SunnyBoy Entertainment.

Carne y Arena (2017) Directed by Alejandro G. Iñárritu. California: Legendary Entertainment.

Pearl (2016) Directed by Patrick Osborne. USA: Google Spotlight Stories.

Witness 360: 7/7 (2015) Directed by Darren Emerson. UK: Darren Emerson for East City Films Ltd.

Ex Anima Experience (2019) Directed by Bartabas, Pierre Zandrowicz. France: ARTE.

Kinoautomat (1967) Directed by Radúz Cincera and Ján Rohác. Czechoslovakia.