Interactive Fiction in Cinematic Virtual Reality: Epistemology, Creation and Evaluation

María Cecilia Reyes Redondo

Advisors:

Giovanni Adorni

Elisa Bricco

Toby Miller

Dottorato di Ricerca in Digital Humanities

Università degli Studi di Genova

Doctorado en Comunicación

Universidad del Norte

2019

A tres mujeres, Miosotis, Griselda y Giuliana.

Abstract

This dissertation presents the Interactive Fiction in Cinematic Virtual Reality (IFcVR), an interactive digital narrative (IDN) that brings together the cinematic virtual reality (cVR) and the creation of virtual environments through 360° video within an interactive fiction (IF) structure. This work is structured in three components: an epistemological approach to this kind of narrative and media hybrid; the creation process of IFcVR, from development to postproduction; and user evaluation of IFcVR. In order to set the foundations for the creation of interactive VR fiction films, I dissect the IFcVR by investigating the aesthetics, narratological and interactive notions that converge and diverge in it, proposing a medium-conscious narratology for this kind of artefact. This analysis led to the production of an IFcVR functional prototype: "ZENA", the first interactive VR film shot in Genoa. ZENA's creation process is reported proposing some guidelines for interactive and immersive film-makers. In order to evaluate the effectiveness of the IFcVR as an entertaining narrative form and a vehicle for diverse types of messages, this study also proposes a methodology to measure User Experience (UX) on IFcVR. The full evaluation protocol gathers both qualitative and quantitative data through *ad hoc* instruments. The proposed protocol is illustrated through its pilot application on ZENA. Findings show interactors' positive acceptance of IFcVR as an entertaining experience.

Keywords: *Cinematic Virtual Reality, Hyperfiction, Interactive Digital Narrative, Interactive Fiction, Interactive Fiction in Cinematic Virtual Reality, Virtual Reality.*

Riassunto

Questa dissertazione presenta la Fiction Interattiva nella Realtà Virtuale Cinematografica (IFcVR), una narrativa digitale interattiva, che unisce la realtà cinematografica virtuale (cVR) e la creazione di ambienti virtuali attraverso il video a 360°, all'interno di una struttura di fiction interattiva (IF). Questo lavoro è strutturato in tre componenti: un approccio epistemologico a questo tipo di ibrido mediatico-narrativo; il processo di creazione della IFcVR, dalla fase di sviluppo alla postproduzione; e la valutazione degli utenti sulla IFcVR. Con lo scopo di gettare le basi per la creazione di film immersivi e interattivi, l'IFcVR viene analizzato studiando le nozioni estetiche, narratologiche e interattive che convergono e divergono in esso, proponendo una narratologia medium-cosciente per questo tipo di artefatto. Questa analisi ha guidato la produzione di un prototipo funzionale di IFcVR: "ZENA", il primo film interattivo in VR ambientato a Genova. Il processo di creazione di ZENA viene riportato proponendo alcune linee guida per i cineasti interattivi e immersivi. Al fine di valutare l'efficacia dell'IFcVR come una forma narrativa adatta all'intrattenimento e alla comunicazione di diversi tipi di messaggi, questo studio propone anche una metodologia per misurare l'esperienza dell'utente (UX) su IFcVR. Il protocollo di valutazione presentato raccoglie dati sia qualitativi che quantitativi attraverso strumenti creati *ad hoc*. Questo protocollo è illustrato attraverso la sua applicazione pilota su ZENA. I risultati mostrano un'accettazione positiva verso l'IFcVR come un'esperienza gratificante per l'utente.

Keywords: *Cinematic Virtual Reality, Hyperfiction, Interactive Digital Narrative, Interactive Fiction, Interactive Fiction in Cinematic Virtual Reality, Virtual Reality.*

Resumen

Esta disertación presenta la Ficción Interactiva en la Realidad Virtual Cinematográfica (IFcVR, por sus siglas en inglés), una narrativa digital interactiva, que crea experiencias fílmicas inmersivas e interactivas, uniendo la realidad virtual cinematográfica (cVR) con la ficción interactiva (IF). Este trabajo está estructurado en tres componentes: una epistemología de este híbrido mediático-narrativo; el proceso de creación de la IFcVR, desde la fase de desarrollo hasta la postproducción; y la evaluación de la experiencia del usuario en la IFcVR. A fin de sentar las bases para la creación de películas interactivas de ficción en VR, este trabajo investiga las nociones estéticas, narratológicas e interactivas que convergen y divergen en la IFcVR, proponiendo una narratología consciente del medio para este tipo de artefacto. Este análisis condujo a la producción de un prototipo funcional de IFcVR: "ZENA", la primera película interactiva de realidad virtual ambientada en Génova. En el trabajo se relata el proceso de creación de ZENA, proponiendo algunas pautas para realizadores interactivos-inmersivos. Finalmente, este estudio propone una metodología para medir la experiencia del usuario (UX) en IFcVR, y evaluar la efectividad del artefacto como una forma narrativa para el entretenimiento y la comunicación de diversos tipos de mensajes. El protocolo de evaluación reúne datos tanto cualitativos como cuantitativos a través de instrumentos creados *ad hoc*. El protocolo propuesto es ilustrado a través de su aplicación piloto en ZENA. Los resultados muestran una respuesta positiva hacia la IFcVR como una experiencia narrativa gratificante para el usuario.

Keywords: *Cinematic Virtual Reality, Hyperfiction, Interactive Digital Narrative, Interactive Fiction, Interactive Fiction in Cinematic Virtual Reality, Virtual Reality.*

List of Publications

Reyes, M. C. (2018, December). Measuring User Experience on Interactive Fiction in Cinematic Virtual Reality. In *International Conference on Interactive Digital Storytelling* (pp. 295-307). Springer, Cham.

Reyes, M.C., Zampolli, S. (2018) Shooting an Interactive VR Film: ZENA's Production Case Study. In: Rouse, R., Dionisio, M. (eds) *Looking Forward, Looking Back: Interactive Digital Storytelling and Hybrid Art-Scholarship Approaches,* Carnegie Mellon ETC Press

Reyes, M.C. (2018) Le Marittime Irraggiungibili: Scenari Alpini a 360°. In: Maiullo, R. (ed) *Contemporaneamente 2016 Abstract Book.* https://www.piccolopificiosociologico.it/download/9022/

Reyes, M.C. (2017) An Epistemological Approach to the Creation of Interactive VR Fiction Films. In: Nunes N., Oakley I., Nisi V. (eds) *Interactive Digital Storytelling. ICIDS 2017. Lecture Notes in Computer Science, vol 10690.* Springer, Cham

Reyes, M.C (2017, June) Screenwriting Framework for an Interactive Virtual Reality Film. *Paper presented at the 3rd Immersive Research Network Conference iLRN.* http://castor.tugraz.at/doku/iLRN2017/iLRN2017OnlineProceedings.pdf

Acknowledgements

When walking in the mountains, paths are often marked by colorful signs, or cairns. When you find one, you know you're on the right track, no matter how tough is the path you find yourself on. Several people accompanied this research path, orienting my research activity and encouraging me to always remain on track. I thank my advisors Prof. Elisa Bricco e Prof. Giovanni Adorni from the University of Genoa, whose tenacity pushed me to expand my borders to places I did not imagine before, and Prof. Toby Miller from Universidad del Norte, who always reminded me to look at the world with wide, open eyes. I deeply thank my mentor, Giuliana Dettori, senior researcher at the Institute for Educational Technologies of the National Research Council of Italy (CNR-ITD), for teaching me the craft of research and showing me the way in the exciting world of interactive narratives.

Thanks to the University of Genoa for giving me the opportunity to undertake this journey: especially Prof. Sergio Poli for believing in me, as well as Prof. Maurizia Migliorini, Prof. Fabrizio Bracco, Prof. Simone Torsani. Thanks to Universidad del Norte for welcoming me again in its classrooms: Prof. Jesús Arroyave, Prof. Marieta Quintero, Prof. Enrique Uribe-Jongbloed. Thanks to both universities, to make this double degree program possible. During this journey, I could also share experience and knowledge with colleagues and students from the CrossmediaLab of the University of Bogota Jorge Tadeo Lozano. Thanks for receiving me, Prof. Alejandro Ángel and Prof. José Augusto Ventín.

There is always a moment in the path, where you understand when you are walking in the right way. That moment for me was ICIDS 2015, the International Conference on Interactive Digital Storytelling. There, I not only brought into sharper focus my field of study, but also found a generous community full of brilliant minds from all over the world. Thanks to that experience, today, I am a member of ARDIN, the Association for Research in Digital Interactive Narratives. Thanks, ICIDS. Thanks, ARDIN. Sometimes, there are parallel roads, and they touch, pushing each other forward. Thanks to my colleagues from the E-Learning, Multimedia and Web Tools of the University of Genoa for their unconditional support:

Marina Rui, Marco Ferrante, Alberto D'Agnano and Davide Colombino; and to my colleagues and senior researchers from CNR-ITD, Guglielmo Trentin, Enza Benigno, and Marcello Passarelli.

There are no meaningful journeys without friendship. Thank you Serena Zampolli, Ph.D., for inspiring me, bringing me joy, walking with me along this path that we have shared. Thank you Sandro Bozzolo, Ph.D., for taking me to the top of the maritime alps. Thanks to my friend and professor Prof. Alejandro Navia, and to my VR colleague Simon Duflò. Thanks for teaching me the art of montage, Raul Blanco Rois. Thanks for your loving backing, my dears Alexandra Alonso, Anna Fochesato, Ph.D., Albert Tichy, Eduardo Losada Cabruja, Ph.D., Luigi Ricciari, Alessandro Rudi, Ph.D., Bruno Volpez, and Marco Lo Baido. Thanks to all the friends who have been there, waiting, asking, encouraging, supporting.

Great things can only be made by dreamers. A big *thank you* to the wonderful cast and crew of ZENA, for dreaming with me of the first Interactive VR film of Genoa: my storyteller alchemist, Lorenzo Caviglia; The Master, Pier Renzo Ponzo, for honoring ZENA with his presence and music; the fiercest pirate in Genoa, Eduardo Losada Caruja; the most magical storyteller, Serena Zampolli; our poet of light and mother of Lorenzo, Beatrice Tassara; the oracle with the joyful eyes, Margherita Friburgo; the sinner, Leonardo Clemente Briata; and the bitter Genovese, Luciano. Thank you Massimo Frattarolo for dreaming of ZENA with me. An especial thank you to all those who have enjoyed walking through ZENA.

There is no road without horizon, where is home, awaiting. Thanks to my uncle and mentor, Alejandro Reyes, to my uncle Francisco Reyes for supporting each step; to my cousins Juan Carlos Reyes, Rodrigo Reyes, Canela Reyes and Camilo Molina. I deeply thank my grandmother, my rock, Griselda Torres; my father, Dr. Alfredo Reyes and my brother, Dr. Manuel Ignacio Reyes, for supporting me through the distance, for their patience and their love. To my beloved mother, Miosotis María Redondo Torres, who would have loved to walk with me.

List of Abbreviations

AI	Artificial Intelligence
ANS	Autonomic Nervous System
AR	Augmented Reality
BCI	Brain Computer Interface
cVR	Cinematic Virtual Reality
CG	Computer Graphics
DOF	Degrees of Freedom
DOP	Director of Photography
ECG	Electrocardiography
EEG	Electroencephalography
EDA	Electrodermal Activity
EMG	Electromyography
HCI	Human-Computer Interface
HF	Hypertext Fiction
HCD	Human-centered design
HMD	Head Mounted Display
HRV	Heart Rate Variability
KAS	Capacitive Sensors
IDN	Interactive Digital Narrative
IDS	Interactive Digital Storytelling
ID	Interactive Drama

IF	Interactive Fiction
IFcVR	Interactive Fiction in Cinematic Virtual Reality
IMU	Inertial Measurement Unit
IR	Infrared
IV	Interactive Video
LED	Light Emitting Diode
MR	Mixed Reality
NG	Narrative Games
NLP	Natural Language Processing
NU	Narrative Unit
NT	Narrator Type
PPG	Photoplethysmography
SKT	Skin Temperature
UCD	User-centered Design
UX	User Experience
VE	Virtual Environment
VR	Virtual Reality
Webdoc	Web Documentary

Preface

I like to consider myself a media creator. My professional and artistic carrier has alternated between journalism, radio, writing, video making, and web-based projects. However, filmmaking has been the hardest and the most satisfying one. What I like most about this media and art form is how it visually unravels a story in such an organic way for human cognition. We "read" films instantly, we rarely notice the cuts between shots, or even the types of shots. Structure, form and content are all contained in a single linear flow that, in most cases, is natural for us to understand. Undertaking a PhD study means to me to dedicate a period of my life to analyze in deep a certain phenomenon, to theorize about what I love most. I decided then to study the phenomena of filmic experience, extrapolated and mixed with a new game-changer media: VR. To create a mediatic graft, putting together hypertextuality, virtual reality, and fiction stories.

Like Jenkins (1999, p. 234), I agree with Lev Manovich when he wishes that, at the beginning of the cinema, researchers and practitioners had systematically described and registered the small advances that supported the development of the medium in its early stages. This is a difficult task when we have to produce media contents and do research in media knowing that "like volatile stormy weather, at some level changes in mass communication theory and research occur almost too rapidly and unpredictably for even the best-intentioned reporters to chronicle and explain accurately" (Bryant & Miron, 2004). This thesis, therefore, is aligned with Jenkins and Manovich's desire. My objective is to register the process of creating a filmic experience that no longer uses the computer as a tool but as the medium itself, and eliminates the film as a unique invariable piece to turn it into a process that no longer belongs only to the author but also to the user.

When I decided to study the intersection between Interactive Fiction and Cinematic Virtual Reality, my first intention was to elaborate an immersive experience in which users were not simply watching around, but interacting with the storyworld. Initially, what I imagined was an extension, or even an evolution, of cinema as we know it today. After completing this

research work, I have come to the conclusion that it is not an evolution of cinema itself, but an independent artistic and narrative form with its own characteristics, that uses film theory and workflow as a model for its development and production. Despite the uniqueness of IFcVR, however, the filmic experience prevails, just taking a different form. With the aim of verifying how much a filmic experience could be enhanced by the possibilities offered by hypertextuality, multimedia, and VR, I used as the basis for the construction of the script the two most replicated models in the history of mainstream cinema: Syd Field's Paradigm as classical narrative structure and Joseph Campbell Hero's Journey, being complementary and not exclusive models.

Since the Frankfurt School coined the term *Culture Industries*, we are no longer unconscious about the industrialization and commercialization of culture under capitalist relations of production (Kellner, 1999, p. 205). In this sense, we must acknowledge that, through the entertainment experience that cinema offers, there is a load of meanings that has direct effects on how we build our vision of the world. In fact, economic potentialities of VR are already being studied by the corporations who own the main computational platforms that we use today. Paradoxically, a good example of this phenomenon can be found on the blockbuster film directed by Steven Spielberg *Ready Player One* (2018), based on the homonymous novel written by Ernest Cline (2011). The story takes place in the near future, 2044. In this dystopia, people live in Oasis, a VR universe, in which its creator has hidden an *Easter egg*. Whoever finds the Easter egg becomes the new official owner of Oasis. The fight for Oasis is disputed between a mega corporation, Innovative Online Industries (IOI), and Wade, a young dreamer and player. The film itself is an oxymoron as a Hollywood's product: the film follows strictly both the paradigm of Syd Field and the Hero's Journey, but its content makes a critic of a possible future where people live more time inside the virtual world than in the real world, without traces of nature and with people living in devastated cities where primary resources are scarce. Besides the sales at the box office, this film had another role in the current evolution of the VR medium: it presented a possible future scenario for virtual reality, and it made VR known to millions of viewers who may not yet be in contact with it. Could it be another small step towards the massification of VR?

Considering IFcVR as a possible mainstream format for VR, this thesis undertakes a comparative study between artistic and technological means, which, from a sociological point of view, can be perceived with a naive tone since I am applying Field's and Campbell's models, two paradigms that have been used to transmit hegemonic cultural traditions, in content and form. As an independent filmmaker, I live this paradox on my own when in a film festival, in a pitching forum or in a simple meeting with a producer, the same questions always arise, regardless of the country where I am presenting my projects (usually documentaries): *Who is the protagonist? What is s/he looking for? What obstacles does the main characters find? What happens in the climax? and what happens at the end?* These questions generally do not obey to the producer's aim of transmitting hegemonic cultural models, but to their need to guarantee that the public will identify with the characters and their struggles.

My decision of using the two most popular narrative strategies for the creation and assessment of an IFcVR experience, has the objective of testing this narrative hybrid with the main public, the same public that worries the producers. By using the two models that people can easily recognize as a film, it is possible to establish similarities and differences between traditional cinema and IFcVR, from different angles: the writing process, the production workflow and the enjoyment of the final experience. The cornerstone of this debate is the pursuit of a climax and the need to guarantee a progressive tension that permeates the narrative in all its stages. The search for the climax and the preservation of tension in interactive narrative has been one of the biggest issues that *hyperwriters* face. I felt it necessary to create an experience that would emotionally lead interactors throughout the story, regardless of their choices, offering through the whole storyworld, plot points, moments of uncertainty, various climaxes and different outcomes. I believe that a point of strength of Interactive Fiction is the possibility to offer multiple climaxes. How these climaxes are reached is an open task for authors' creativity. They can choose if using or not conventions and popular formulas while shaping their way to achieve interactors' narrative immersion.

This PhD thesis is the final point of my course of study to earn a double PhD degree, thanks to an agreement between the doctoral program in Digital Humanities of the Università degli Studi di Genova (Genoa, Italy) and the doctoral program in Communication Sciences of the Universidad del Norte (Barranquilla, Colombia). This is the first thesis presented since the signing of the agreement. The convergence between Digital Humanities and Communication Sciences has allowed me to develop my research work on *Interactive Fiction in Cinematic Virtual Reality* from a kaleidoscopic point of view (as Janet Murray pointed out in her opening presentation at ICIDS 2018) which alternates between interactive digital narratives and media studies.

Chapter 1. Introduction

1.1 Initial Statement, Research Questions and Hypothesis

1.1.1 Initial Statement

Since its inception, the emergence of the digital environment has seduced artists and writers to tell stories and transmit their perceptions of the world through a medium whose coding allows the convergence of different types of languages and artistic forms under a single content that needs the interaction of the receiver to be decoded. This interaction of the receiver upon the artwork changes the logic of the fixed output (Koenitz, 2017), putting such process at the core of the aesthetic experience. Hypertext, hypermedia, multimedia, or cyber art are some of the terms that refer to a digital artistic content that exposes its components for the interactor to organize into a linear experience, forced by the linearity of time itself.

This authorial desire to expose ideas, narratives and perceptions of the world in small pieces, explicitly and without apparent organization, is not new. Although digital coding opened the doors to both author and receiver to access the artistic work through the same interface, already in literature, theater and film there were some authors who created interactive narratives in an analogical way. In each medium, these interactive narratives have their own structures, different ways of interacting and arranging the components of the artistic text, and

different levels of interaction for the user. All, however, share the same spirit: to free the narrative from the single read.

Extracting from our mind and soul what we want to express is not an easy task. Inside us, the message is present as a chaos of words, images, colors, shapes and signs that need a syntax and a code to be transmitted, and only when we are seating in front of paper, canvas or a blank screen we begin the hard process of expressing the content conjoining substance and form. The advent of the computer allows authors to centralize in a single device, yet separately, their digitally-encoded ideas in different formats. Rapidly, the computer acquired two facets in the artistic act: to create and to manifest. The creation process or the assembly of the components is done through the computer, then the computer itself performs the art work, and finally the narrative is re-created by the interactors when tracing their own path in the textual forest that reflects the mind of the author.

The author creates an apparently chaotic and unordered universe, whose components are connected to each other, and it is in these connections, especially in their multiplicity, that meaning resides: the experience lies in the navigation alternatives, while the generation of meaning rises from the connections that we find between apparently disconnected contents. “Great narrative is an invitation to problem finding, not a lesson in problem solving. It is deeply about plight, about the road rather than about the inn to which it leads.” (Bruner, 2003, p. 20). Ted Nelson, in his book *Literary Machines*, warns us that the hypertext is not "another type" of dark structure, but the reunification and reorganization of various types of electronic texts. Nowadays internet has allowed this reunification to be decoded by a user sitting in front of a terminal in any part of the world, then re-coded by himself, this time as an author, and uploaded to the cloud so that the cycle reoccurs countless times.

The hypertext, which can be easily implemented by means of electronic tools, allows a non-sequential organizational structure of the content (Nelson, 1987, p. 15). This content can be narrative or non-narrative, fictional or not. This is how Hyperfiction or Interactive Fiction (IF) was born. In the same way, the digital medium allows the development and proliferation

of interactive audiovisual narratives, such as the Interactive Video (IV), the Web Documentary (Webdoc), or Narrative Games (NG). More complex narrative systems have also emerged, such as the Interactive Drama (ID) (Szilas, 1999). These interactive digital narratives are run by Artificial Intelligence (AI) based systems, and transmitted by a wide variety of interfaces. This type of narrative is known as Intelligent Narrative Technologies (INT) (Riedl & Bulitko, 2012). For many years, computer-mediated narratives have been known as Interactive Digital Storytelling (IDS) or simply Interactive Storytelling (IS). However, as Nick Montfort notes in his introduction of the volume *Interactive Digital Narrative: History, Theory and Practice* (Koenitz et al, 2017), the most important theorists in the field have opted, in recent years, to coin the term Interactive Digital Narratives (IDN) to embrace a vast spectrum of art forms and technologies.

One of the technologies that, during the last century, has tried to achieve the human dream of creating and living new realities is Virtual Reality (VR). VR takes human cognition away from the materiality of the physical reality to transfer it to a computer-mediated time-space that does not replace physical reality but is a reality of its own, by connecting user's senses to a digital environment. VR, as medium, offers new possibilities to all types of human activities (social, educational, artistic, communicative) within a *neoreality* (Diodato, 2005) that concerns the experiential dimension of the human being. In March 2015, Chris Milk defined VR as "the ultimate medium, since, while in other media the consciousness interprets the medium, in VR the consciousness is the medium"[1]. As a primarily audiovisual medium, VR takes a step further in the rupture of the fourth wall, already done by music video-clips and contemporary theater spectacles, by totally encapsulating the cognitive capacity of the interactor through sound and image, while technological development works in connecting user's emotions and movements to the *neoreality*. In this way VR, unlike other media, creates a type of communication that goes from conscience to conscience, in Jaron Lanier's words "a post-symbolic communication" (2010). We are no longer talking about telling stories or transmitting speeches, but about creating multisensory experiences. We are getting closer,

[1] https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine

from the creation point of view, to the construction of artificial experiences which are real in appearance. Until now, only through altered states of consciousness and sleep (not a coincidence that Google named its VR company "Daydream") we have been able to attenuate, almost until it's fading, the line between physical reality and cognitive reality. However, through VR this fading between both realities is a fact: the more time we spend in a virtual environment (VE) proposed by a creator, the more organic and natural it gets to our brain; the more realistic its interface, the greater the immersion and smaller the disbelief; the more advanced the technology, the better the graphic and auditory representation, the faster and smarter will be the interaction with the VE and its agents, as possible the *full-body* immersion (Sra & Schmandt, 2015).

From its very beginning, VR has aroused a strong interdisciplinary interest that looks for the understanding of the medium, its language, its forms of production and reproduction, and its applications in various fields. However, unlike radio, film, television or internet, the great public has not been able to adopt and manipulate the medium, even though VR has been around the corner for more than 60 years, thus what we know about user's uses and gratifications of VR is very little. While I write this document, in 2018, we are already living a strong drop from the hype that VR caused in the last five years. Since 2013, with the decrease of the cost of VR tools of production and reproduction, the mass market has been able to access a technology that has been exclusively available to few laboratories in the world. The programming of VEs and the design of various types of Human-Computer Interfaces (HCI) require a large group of engineers and important sums of money. Instead, today it is possible to afford 360º video cameras and well-documented software for the creation of Computer Graphics (CG) VEs at a low cost, as devices for reproduction only need a smartphone and a cardboard box such as Google Cardboard. In the same way, Oculus Rift, HTC Vive, or PlayStation headsets, or the new standalone headsets as Oculus Go can be afforded by a fairly large market segment. On the other hand, the most important online video platforms in the world, YouTube and Vimeo, are distributing 360º video, while the big technology companies of the world compete for the front in the VR development: Facebook purchased Oculus, integrated 360º photography and video to the news feed, and is developing

applications for Social VR. In this area Microsoft has joined the race buying AltSpace. Oculus, in partnership with Samsung, developed the head mounted display (HMD) for mobile devices with the highest graphic and performative quality. Google, along the same vein, has developed a large variety of services and devices such as the Cardboard, the Daydream platform, the HMD Daydream View, or JUMP, the GoPro camera rig for the recording of high quality 360º images, among others. This panorama in constant mutation allows us to see how close is VR to the mass public.

The hype is largely due to all these facilities that we have today to create and enjoy VR experiences, but it is noteworthy that already in the 80's a good segment of researchers and computer scientists predicted the scope of VR as the next Information Technology (IT) platform that would replace sitting in front of a screen and a keyboard, in other words, *a reality shift* (Heim, 1993). It is undeniable that VR proposes an important paradigm shift, as within it the interface completely encloses our vision and hearing to the point that "we do not realize when we are trapped in our minds and cyber systems" (Heim, 1993, p. 80). For the authors of VR artefacts, this means transmitting not only their discourses, but also their physical perception of reality. This transmission of reality needs a comprehension of the VR semiotic sign, that transcends the complexity of the audiovisual sign, is constituted by the combination of two types of discourse, visual and auditory (Hall, 1980), and opens up to spatial perception, haptic stimulation and interaction with the storyworld through different types of, conscious and unconscious, user's inputs in real time. For the interactors, this door to that other dimension means to trust the author and to abandon themselves, losing the connection with what it is happening on the outside.

Accessing a medium with these characteristics brings us closer to the creation of artificial experiences that are woven by the oldest immersion form we know: storytelling. Artists, architects, writers, musicians, caricaturists, programmers, filmmakers, etc. have turned to experiment with the plasticity of VR. In his book *Metaphysics of Virtual Reality* (1993), Michael Heim quotes Jim Morrison to describe the scope to which a computer interface can reach on its way to truthfulness: "There may be a time when we will attend the Weather

Theater to recall the sensation of rain" (p. 82). Currently, VR still retains a certain sensation of prototype: when using a smartphone, it is possible to see the pixels on the screen and also in more advanced systems the visual quality of the VEs or the speed of human-machine interaction still need improvement. However, knowing that the technology is in development and these limits will likely be soon overcome, the exploration of the medium capabilities should not be stopped, in order to further expand the frontiers of art and storytelling.

At the current state of VR technology, the number of visual artists who experiment with the medium is steadily increasing. From the artistic creation point of view, a first crossroads arises: the creation of VEs through 3D or 2D CG, or using "real images" through the acquisition of 2D or 3D 360º videos, also called Live Action. Naturally, the acquisition of 360º video has attracted the special attention from those who come from the field of filmmaking. Switching from traditional video capture to 360º video involves a series of changes in all the stages of the production of a video/film project. From development to post-production, through pre-production and production, the filmmaker faces different challenges that arise mainly from the elimination of the frame. The *frameless* image seems to remove a relevant part of author's control over the audiovisual work, because the *what-to-see* and *when-to-see* is conceded to the interactor, threatening the traditional conception of Director's role.

In the presence of a new medium, relying on known methodologies seems fair, borrowing concepts, dynamics and structures that have been used in other artistic forms or consolidated media. Sergei Eisenstein (1977) points out that "cinema is not altogether without parents and without pedigree, without a past, without the traditions and rich cultural heritage of past epochs" (p. 232). In the same way, we cannot look at a new media or artistic form as an unrelated artifact. Cinema has its foundations in literature, photography and theater, television in film, radio in theater; during the twentieth century, the innovative structures proposed by cinema and new media managed to be *re-mediated* (Bolter & Grusin, 2000) by means of artistic forms with secular existences. However, the challenges and novelties that a new artistic text proposes need to be understood by defragmenting its nature, identifying the

intermediations that are generated between the different ways of transmitting a story and the different ways of representing it (Chatman, 1980).

Currently, on the different online video distribution platforms, or on VR platforms such as Oculus Video, Samsung Video, Within or Daydream video, it is possible to find a high number of narrative projects made with 360º video, documentarist or fictional. While VR develops also as a field for research, various terms have been used to refer to the recorded 360º video: Live Action VR, Surround Video, Immersive Video, Spatial Video or 360º Video, among others. Even so, the appearance of the 360º video as a tool to create VR experiences has generated controversy within the VR field. On one hand, VR purists maintain that 360º video is not properly VR, since the VE does not react to the user's interaction and it does not change while running the experience, emphasizing the limits of video as an already recorded element. On the other hand, there are those who claim that the capture of reality in 360º allows interactors to stand in existing places, increasing their level of immersion due to the naturalistic realism of the image. Recently, the term Cinematic Virtual Reality (cVR) has appeared in the academic literature. By using this term, the 360º video is validated as a tool for the creation of VR experiences, and VR in turn upholds a connection with its cinematic roots, as contemporary VR can be seen as "still an experiment in cinematic point of view" (Bolter & Grusin, 2000, p. 4).

cVR projects are mainly audiovisual contents whose duration does not generally exceed eight minutes. Although interactors have a certain level of autonomy within the cinematic VE (cVE) by choosing what they want to observe within the visual sphere, there are no other mechanisms that allow them a greater level of interaction with the cVE and therefore with the narrative text. The experience is limited to the sensation of immersion and to the possibility of visually exploring the cVE, yet interactors do not have interactive elements that enhance the experience or decisional power over the development of the story. The feeling of being immersed in the cVE contrasts then with the inability of the user to interact with the storyworld.

The addition of interactive elements within a 360º video allows users to have a greater degree of interaction with the virtual experience and move the narrative forward (Vosmeer et al, 2015), regardless of the fact that the virtual environment is still not modifiable. The creation, however, of an interactive structure, with links that connect different thematic units or story beats, and the incorporation of diverse multimedia materials inside the storyworld, can generate experiences with multiple navigation alternatives besides a high degree of realism, as a result of recording the reality. The final output of an Interactive cVR (IcVR) experience relies on the user's individual process while living the immersive experience, choosing *what-to-see* and *when-to-see* and having decisional power upon the development of the story within a storyworld rich in content or expression stimuli.

The fields of application of VR experiences can be very varied, from journalism (Hopkins, 2017) up to military applications (Lele, 2013; Rizzo, 2005). However, an important niche for Interactive cVR can also be found in documentary or nonfiction (museum installations, interactive documentaries, guided visits in places of interest, immersive learning, among others.) Even though most of this research can be applied to non-fictional experiences, this thesis focuses on the creation of fictional audiovisual narratives that is both immersive and interactive: Interactive Fiction in Cinematic Virtual Reality (IFcVR). This kind of experiences can be noticed as interactive VR fiction films.

This work analyzes the theory and practice necessary to create an immersive and interactive film experience, comprising the aesthetics of cVR as the study of the narrative and interactive elements of IFcVR, approaching the IFcVR as an IDN. As far as practice is concerned, the development, production and postproduction of IFcVR has been studied in this thesis through the realization of an immersive interactive film prototype "ZENA". Finally, a user evaluation protocol is proposed, worked out through its pilot application on the user evaluation of the prototype.

1.1.2 Research Questions

The research questions that guided this work, analyze the IFcVR as an audiovisual narrative genre as a whole, and address the challenges posed in relation to the author and the user experience.

Regarding the IFcVR as a whole:

1. Which theoretical concepts from Cinema, Interactive Digital Narrative and Virtual Reality merge into the Interactive Fiction in Cinematic Virtual Reality?
2. Is IFcVR a narrative text able to provide engaging narrative experiences delivering coherent messages and stories?
3. Can IFcVR be considered an Interactive Digital Narrative?

From the author point of view:

1. Which frameworks for development, production and postproduction can be used in order to create an IFcVR experience?
2. How can the creator narrate a solid and coherent story inside an immersive environment, giving the interactor agency and power upon the flow of the story?

From the user experience point of view:

1. Is IFcVR perceived as a filmic experience or as a gaming one?
2. Does the interactor enjoy having decisional power upon the story?
3. How the IFcVR user experience can be evaluated?

1.1.3 Research Hypothesis

1. The analysis of the narrative components of an Interactive Fiction in Cinematic VR leads to a *re-mediation* dynamic in which Cinema, IDN and Virtual Reality, as other artistic forms in the background, find a point of convergence in a hybrid art form that can be considered itself an Interactive Digital Narrative.

2. The capture of reality, through 360º video, as a method to create a VEs reproduced in an HDM for VR, brings VR closer to the cinema. Even though cinema can be a theoretical and methodological basis for the creation of Interactive cVR, new methods and tools for screenwriting, pre-production, production, post production and evaluation, have to be designed in order to respond to the specific needs of an IDN where the sensation of *living* the film prevails over *watching* it.

1.2 Research Objectives

1.2.1 Main Objective

To Analyze the theoretical convergence between Cinema, Interactive Digital Narrative (IDN) and Virtual Reality (VR), in order to propose methods and tools for the creation and assessment of Interactive VR Fiction Films.

1.2.2 Specific Objectives

1. To describe the aesthetic change entailed by putting the receptor at the center of the audiovisual work through the study of the characteristics of VR as a medium.
2. To recognize the IFcVR narrative elements by identifying analogies and differences between concepts from classic narratology in literature and cinema, and interactive digital narrative.
3. To define the IFcVR as a narrative text by identifying its components.
4. To identify the IFcVR as an Interactive Digital Narrative (IDN) by applying the theoretical creation and evaluation frameworks proposed in the field of IDN in the last decade.

5. To create an IFcVR prototype as similar as possible to a classic film in its narrative structure, and with a duration superior to most cVR experiences. This similarity will allow us to analyze how much it can be considered a film.
6. To propose guidelines for the screenwriting, pre-production, production, post-production and testing, by producing an IFcVR prototype.
7. To evaluate user experience of the IFcVR prototype by developing a specific assessment tool based on IDN and VR evaluation tools.

1.3 Methodology and Structure of the Thesis

As it is described in the paper *Steps Towards a Unified Theory for Interactive Digital Narrative* (Koenitz et Al, 2014), many IDN researchers not only work on the analysis of interactive artifacts created by independent artists or large industries, but they are also creators: "the result is a field not only rich in expressive forms, but also in theoretical perspectives" (p. 2). Therefore, this study follows, during all its stages, the latest frameworks that look for a theoretical and methodological unification in the IDN field. Although this research is based on the latest theories and frameworks coming from the IDN field, it considers IFcVR as an artistic form in itself, to give way to the creation of methodologies, instruments and techniques specific for its nature and expressive needs.

The thesis is developed in three parts: firstly, an epistemological approach to the study of the IFcVR, that takes into consideration the shift of the aesthetic paradigm by putting the user at the center of the moving image; the identification of IFcVR as a narrative text and as an Interactive Digital Narrative. The second part of the thesis regards the IFcVR creation and comprises the experimental approach of this work, that is, the workflow and frameworks for development, production and postproduction, through the development of a functional prototype. The third part concerns the user evaluation of IFcVR. The final user evaluation provides theoretical and methodological basis for the creation of IFcVR experiences. Figure

1 shows an overview of the structure of this doctoral thesis. All macro areas and subdivisions are explained below.

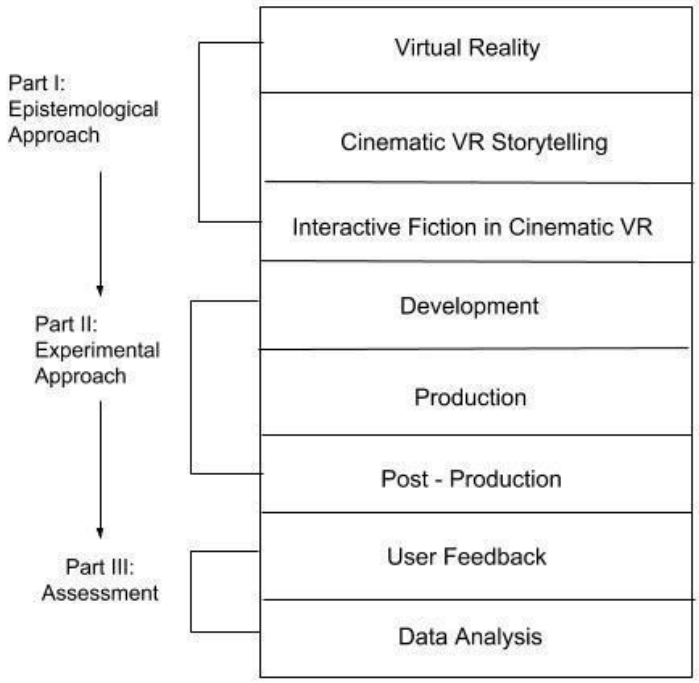


Figure 1. Overview of the structure of the doctoral thesis.

1.3.1 Part I: The Epistemological Approach

The epistemological approach analyzes the nature of IFcVR as a hybrid art form in which several components are merged: the aesthetics of the VR medium, the re-mediation of narratology into the cinematic VR environment and interactivity as an agent for immersion, on both the narrative and perceptive levels. The object of study then focalizes on the fictional narrative. The analysis is based on two conceptual assumptions: (1) Interactive Cinematic Virtual Reality is an Interactive Digital Narrative (IDN) art form, and therefore can find a theoretical ground for its creation, practice and assessment in IDN ontology, taxonomy and frameworks; (2) IFcVR as a specific IDN art form must develop a medium-conscious

narratology with its own methods, techniques and instruments. The epistemological approach is based on three theoretical axes: aesthetics, narratology and interactivity.

Chapter 2 “Human at the Center of the *Story* World: IFcVR Aesthetic Notions” regards to the first theoretical axis: the change of aesthetic paradigm that VR proposes. The *ultimate* medium is the first macro area to be deconstructed, identifying its evolution and its current state, its characteristics as a medium and the changes that it generates in the communication process, wondering for the role of the author and the role of the user.

Chapter 3 “The (Film) Form of Cinematic Virtual Reality”, comprises the narratological elements that characterize Cinematic VR. Through this macro area, the connection that exists between VR and its cinematographic aspect is developed, analyzing the processes of re-mediation that take place between VR and cinema, and in which underlie, simultaneously, concepts of classical narratology as Focalization, Point of View and Narrative Density. In this chapter, the study focuses especially on the study of fiction narration, taking into account aspects such as Drama and the creation of a Storyworld. This axis provides the theoretical basis for a screenwriting that is aware of the nature of the VR, taking in consideration the change of paradigms for the director, crew, actors and scene management.

Chapter 4 “Interactive Fiction in Cinematic Virtual Reality” regards Interactivity. It seeks for the convergence between Cinematic VR, deconstructed and defined in the two preceding chapters, with Interactive Fiction. In order to achieve this theoretical convergence between narrative and media forms, the study starts from the evolution of the IF and its current state, differentiating it from other forms of IDN. Different narrative structures are studied and some problems related to interactive storytelling are addressed, in particular the consistency of the dramatic tension independently of user’s choices, joining the discussion of the narrative structures on IDN and the need for a climax or several climaxes.

As a hybrid genre, IFcVR generates a juxtaposition of various media and narrative forms: Interactive Fiction, as a narrative structure is contained in another narrative form, that is

Cinematic Virtual Reality, and cinema is contained in VR. This juxtaposition generates various intersections that can be found in the convergence between the components *Interactivity, Cinema, Fiction, and VR*, as shown in Figure 2. By analyzing this intersections, it is possible to set methodological basis for the creation and assessment of Interactive VR Fiction Films.

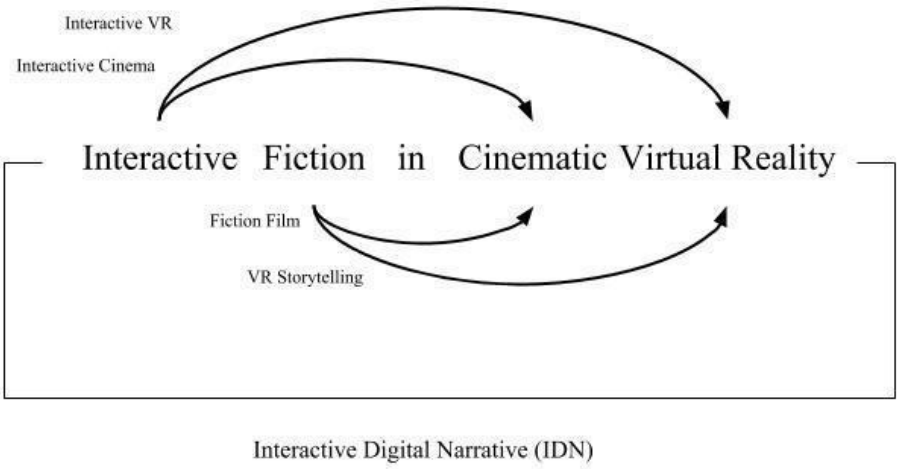


Figure 2. Intersections between Interactive Fiction and Cinematic Virtual Reality

- ➔ Interactivity + Fiction = Interactive Fiction
- ➔ Interactivity + Cinema = Interactive Cinema
- ➔ Interactivity + VR = Interactive VR Experiences
- ➔ Cinema + VR = Cinematic VR
- ➔ Fiction + Cinema = Fiction Film
- ➔ Fiction + VR = Fiction VR Storytelling

1.3.2 Part II: IFcVR Creation

As a filmmaker, it was impossible for me to carry out a theoretical investigation without practical application and without the involvement of potential interactors. My goal is to close

the circle in which theory gives the bases for creation, the artwork is submitted to the use and criticism of a heterogeneous audience and this feedback strengthens the theory. This thesis deals with the narrative text from the author's point of view, therefore the second part of the doctoral thesis comprises the development, pre-production, production and post-production of an IFcVR project.

Chapter 5 “Development and Pre-Production” investigates the computer-mediated nature of the IFcVR prototype, and uses as a basis the *Protostory* model for the design of an IDN. Regarding the IFcVR narrative design, I propose a specific framework for the screenwriting of the interactive script, based on Syd Field's (Field, 2005) cinematographic paradigm and the *interactivization* of a traditional narrative structure, such as the Hero’s Journey (Campbell, 2009), as a model to diversify scenes and navigation paths, while creating role identification with the hero.

Telling an interactive story through 360º images is, above all, a creative process. During the elaboration of the script, the theoretical narratological bases described in Chapter 3 are tested, constructing each scene as a narrative experiment: either from the point of view of how the interactive story is told in the 360º environment (changes of point of view, movement and positioning of the characters in the scene, how the hotspots are related to the storyworld, use of dialogue, ellipsis, etc.), as well as from the technical point of view (height and positioning of the camera and microphones in the scene, positioning of the hotspots, use of black and white, moving camera, etc.).

In Chapter 6 “Production”, the script and the shooting script are tested during the shooting of the prototype, which leaves important lessons on the management of the scene/stage, the role of the director, actors and crew. In this chapter, the different types of 360º shots are identified, and some guidelines are proposed for the creation of IFcVR experiences.

In Chapter 7 “Post Production”, the material is taken to the editing room, and the 360º video post-production process begins, followed by the assembly of the interactive structure. The

post-production process, as it happens in the cinema, brings to light the mistakes made in the previous stages, both at script and filming levels, and at the same time poses challenges related to the construction of the interactive experience: the visual design or auditory of the hotspots, the time of choice given to the interactor in a product that has been previously recorded, the fluidity between the video cuts within the scene and between scenes.

1.3.2.1 ZENA, An Interactive VR Film Prototype

ZENA is an Interactive VR film set in Genoa, Italy. The story unfolds in a 360º environment created through 360° high-definition video capture. The main objective of ZENA is to bring an interactive narrative in a 360º environment to be enjoyed with a HMD, in order to create an Interactive VR experience similar to hyperfiction, in which the users rearrange story fragments into different configurations (Ryan, 2009), placing themselves between a passive reception, as it is the case with cinema, and a highly active role, as in videogames. In ZENA, interactors play an active role inside the narrative by taking part directly in the story: they decide which way to go in a Maze-like structure (Ryan, 2015), if they want to follow or ignore the advice of some character, or access extra information that contributes to story understanding.

The narrative structure has been inspired by the labyrinth of alleys in the historical center of Genoa, where passersby are constantly finding their ways across the maze of small streets. ZENA, which means Genoa in Genovese dialect, was shot inside the historical center of Genoa (Old Town), which is a World Heritage Site, the perfect place for shooting a 360º project: the high buildings invite the visitors to always look up to discover an ancient fresco, or to say hello to someone who hangs laundry out of a window. The scenes, that develop in the alleys and in some important buildings in the Old Town, show these environments for the first time in VR.

The project is the experimental part of this research and is the result of the work of one person behind the development, production and editing of the final product. For the production work,

the project counted on the participation of an eight-people team, both actors and crew, some of whom with experience in the fields of audiovisual making, theater or storytelling, and others with zero experience in these areas, but motivated by the scope of the project. In the same way, ZENA did not have the economic resources to develop a higher quality video or to involve a professional team for the technical realization. In particular, there would have been a strong need of a sound expert, for the capture and post-production of spherical audio. Although, on one hand, the lack of economic, material or human, resources to carry out a project of higher quality, can be considered a weakness of the project, on the other hand the conclusions presented in this thesis show the feasibility of such projects, hence offering any filmmaker practical suggestions to develop a IFcVR experience with a low budget.

1.3.3 Part III: IFcVR User Experience

In this last section the main questions of this research are approached: Can IFcVR be considered an entertaining experience able to deliver coherent stories and discourses? Is IFcVR experience more similar to watching a film or to playing a videogame? In order to answer these questions, the third part of the thesis develops a methodology to evaluate the IFcVR user experience (UX). Although this thesis focuses on the theoretical and methodological basis for the realization of an experience that moves between film and interactive narrative, as an audiovisual product, it is designed to be submitted to the reception of the public. For this reason, I decided to create a story that could be engaging for an audience within an age range from 13 to 100 years, because, beyond the content of the story itself, we cared that both the narration and the technical interaction were fluid, leading to a climax that would invite to *re-do* the experience.

In Chapter 8 “Interactor Experience in IFcVR”, a full evaluation protocol is proposed and applied to evaluate ZENA’s user experience. As a hybrid product, the assessment methodology merges two theoretical aspects in order to evaluate the Interactive Fiction and the Cinematic Virtual Reality axes:

➔ Virtual Reality Assessment

➔ Interactive Digital Narrative Assessment

This investigation goes into a virgin territory seeking to establish a dialogue between artistic forms and mediums, and tries to offer a conceptual and methodological basis for the creation of IFcVR. Therefore, the theoretical proposals, the methodologies, including the production and post production workflow and instruments for measurement, are part of an approach that contemplates the analysis of the data to elaborate new hypotheses or conclusions that initially could not be cataloged. This represents another reason for this thesis to collect feedback from the user, hence allowing us to draw conclusions based on the experience and enjoyment of the IFcVR.

1.4 Original Contributions of this Doctoral Thesis

In this thesis, I am presenting the Interactive Fiction in Cinematic Virtual Reality (IFcVR): a hybrid narrative text that stands at the intersection between Interactive Fiction and Cinematic VR (cVR). In IFcVR, the user is immersed in the film through the use of a HMD, and has the ability of changing the course of the story by making conscious or unconscious decisions. IFcVR can represent one of the embryonic approaches in the creation of artificial experiences that can, in a not distant future, concretize the complete division between physical reality and cognitive reality. The original contributions of this doctoral thesis are summarized as follows:

1. The IFcVR is presented as a narrative text:
    a. Narrative Elements of IFcVR
    b. Towards a IFcVR Reception Theory
2. A medium-conscious narratology for IFcVR is presented, identifying:
    a. Point of View
    b. Focalization
    c. Narrator

    d. Narrative Density
3. IFcVR characterized as an Interactive Digital Narrative.
4. Screenwriting Framework for IFcVR Fiction and Script Model for IFcVR.
5. Shooting an IFcVR experience:
    a. Back to theater: The Scene - The Stage
    b. The director's role within the frameless image
    c. Guide to the use of the interactive elements, access points or hotspots (diegetic and extradiegetic hotspots, multimedia elements)
    d. Interaction possibilities through different kinds of Human Computer Interfaces.
6. Full Evaluation Protocol for IFcVR

Part I. AN EPISTEMOLOGICAL APPROACH

Chapter 2. The Human at the Center of the *Story* World: IFcVR Aesthetic Notions

2.1 Frameless View: Change of an Aesthetic Paradigm

Like filmmakers and creators of audiovisual experiences, I consider that the beginning of our journey towards the creation of immersive interactive films involves understanding the change of aesthetic paradigm that is presupposed by a frameless vision. This understanding leads us to discover the plasticity of the VR medium through which we seek to create this type of artifact, forcing us finally to change our point of view on the communicative act and the relationship between author and user in this new medium. This first chapter opens the epistemological study of the Interactive Fiction in Cinematic Virtual Reality (IFcVR), taking us to a reflection that starts from the current state of VR, to look towards the past, carrying out an archeology of the medium. This archeology of the VR will look not only at the medium in its material state, but at the evolution of the human agent, as both sender and receiver, in relation to this new extension of his.

On the reality-continuum (Milgram, 1994), Virtual Reality represents the opposite end to the Real World. Reality is principally represented by what is visible and audible, while what turns the Virtual in Reality is technology, intended not only as a set of hardware and software tools but in a broader sense as the *dispositio* (Agamben, 2006) that Cyberspace (Heim, 2012)

represents in the current socio-cultural landscape. Technology mediates the human relationship with the world, while art appears as the visual metaphors that allow humans to interact and live in the Cyberspace. Virtual Reality opens a new chapter in the relationship between art and technology (Ryan, 2015, p. 50), locating itself at the core of the relationship of the human being with images (Grau, 2003), while the human vision is located at the center of the (digital) image. The challenge that VR is putting in front of us goes beyond the only reception of the digital 360° image: it needs us to coordinate different sensory languages within a virtual environment that completely encloses our sight and hearing. In other words, we need to learn how to *live* in other realities.

An archeology of Virtual Reality as a visual medium, with anthropology as a constant, takes us to the first wall paintings in the caves of Altamira or Lascaux, passing through the Egyptian and Etruscan tombs, up to the medieval cathedrals and Renaissance villas. In all these cases, man recreated non-digital virtual environments that enclose our sight and body in a spherical artistic representation that usually tells some kind of story: from biblical stories to representations of the daily life. In such environments, people can move around and make a stop wherever a little area of the wall catches their attention. People can read the images in any order, and they can analyze a single detail as long as they want. There is a special feeling when crossing the gate to Santa Maria del Fiore's cathedral in Florence or the tomb of Tutankhamun in Egypt, because we are aware that we are entering *somewhere* else. This human desire to create new environments for the human body and cognition was concretized very slowly until reaching the creation of special devices designed for this purpose.

In his book *Panorama: History of a mass medium*, Stephan Oettermann (1997) makes an archeology of the visual media with a cylindrical or spherical form. In particular, he refers to the Panorama, an innovation patented in 1787 by Robert Barker, initially called *La nature a coup d'œil*. The panorama was a spherical landscape painting in which the viewer was placed at the center of space and could walk observing the paintings around him. During the same period, the Panopticon was born, a prison where, using light effects, the prisoners could be constantly observed from a control tower located in the center of the construction. These two

inventions were born in the midst of the industrial revolution, at a time when there was also a kind of "revolution of the eye": the first binoculars and microscopes appeared, and with the creation of hot air balloons, the concept of horizon, much appreciated by Goethe, begun to be elaborated by the common man (Oettermann, 1997). At the time, Goethe was very interested in studying the vision and especially the "subjective observation". According to his studies, the subjective observation was not an "interior space or a theater of representations" but an increasingly exteriorized process; the body of the observer and his objects began to constitute a single field in which the interior and exterior were merged (Crary, 1990, p. 77). The way in which humanity observed the world around changed radically, especially during the period between the 18th and 19th centuries when the conception of the *viewer* changed (Manovich, 2001; Crary, 1990). The observer was no longer a physiological observer, but an active and autonomous producer of her/his own experience.

At the beginning of the 19th century, the panorama became an indispensable instrument for geography, becoming even more popular than maps themselves: "while reading a map was a technique that had to be learned, anyone with some years of instruction could understand a panorama" (Oettermann, 1997, p. 57). What finally gave a kind of victory to the panorama upon the map was the possibility that it offered to *live* the experience of being at the top of a mountain. Today, two centuries later, VR still backs up in this concept, considering that Virtual Reality itself is above all, an *image-object* (Diodato, 2005), and what is striking in this concept is precisely the possibility of seeing a representation of reality in the same way we see reality. Soon, several photographers began to make panoramic photographs, and even geographical maps tried to recreate this all-encompassing view.

During the first decade of film history, the Lumière brothers also flirted with panoramic projection screens, that they called the *Photorama* (Schreer, 2005). In the late 30's, the *Vitarama* appeared, another system of hemispheric projection that was adapted into a gunnery simulation machine during the Second World War. These first panoramic projection experiments evolved into the *Cinerama* in the 50's, what we know today as IMAX and

Omnimax, in their 2D or 3D formats, systems that offer the larger and sharper resolution frame ever seen (Schreer, 2005, p. 11-13).

During the 20th century, along with the evolution of audiovisual media, other inventions were born with the intention of trapping user's cognition by creating hardware and software that not only enhance vision but also allow the connection of different human senses to one experience, going beyond the audiovisual narrative to perform simulations. Such experiments can be considered the first forms of VR. An early one is Morton Heilig's *Experience Theater* (1959). Its aim was to "say goodbye to the rectangular picture frame, the two-dimensional images, the horizontal audiences, and the limited senses of sight and hearing, and reach out for everything and anything that would enhance the illusion of reality" (as cited in Schreer, 2005, p. 13). It was Heilig who, after the Experience Theater, created the *Sensorama*[2] (1962) and then the *Telesphere Mask*, one of the first Head Mounted Displays (HMD), a game-changer in the evolution of vision, by recreating the stereoscopic vision and the natural Field of View (FOV) of the human eye. With this attempt, Heilig went further and tried to connect other senses to the experience by giving inputs like movement, aromas, wind, etc. Afterwards, with the massification of computers, some software tools were created such as the Encarta Encyclopedia or web applications like Google Street View (Nite, 2015), systems that allow the navigation in a 360º environment. This type of exploration takes place on the two-dimensional screen of the computer, and rapidly became well known by the massive public.

It is important to note that all these technological processes have always been accompanied, and in most cases led, by artistic creation. The engineering of media apparatus guided by the creative impulse takes us into a field in which it is difficult to determine if the Lumière brothers, George Méliès, Morton Heilig, Jaron Lanier, or Robert Barker, as many others, were artists or engineers. "Media artists represent a new type of artist, who not only highlights and extracts the aesthetic potential of these advanced methods of image creation, posing new

[2] http://www.mortonheilig.com/SensoramaPatent.pdf

options for perception and artistic position in this media revolution, but also researches innovative forms of interaction and interface design, thus contributing to the development of the environment in key areas, both as an artist and as a scientist "(Grau, 2003, p. 3). All the experiments mentioned above have in common a particular characteristic: the release of image, as artistic representation, from the frame.

A frameless image leads to a frameless view. The frameless view has one relevant characteristic; the human perception is located at the center of the world. Wladyslaw Tatarkiewicz begins his book *A History of Six [aesthetic] Ideas* (1980), phrasing Giovanni Pico della Mirandola's *Discourse on the Dignity of Man* (1486):

> *"Ti ho posto al centro del mondo,*
> *affinché con maggiore facilità tu possa guardarti intorno e vedere ciò che è"*
>
> *"I have placed you in the center of the world, so that you can more easily look around and see what exists."* (p. 11)

Pico della Mirandola is one of the first thinkers placing human cognition at the center of a 360º metaphorical vision of world knowledge, followed by Giulio Camillo Delminio, who, in his *Teatro della Memoria* (1550), organizes and categorizes human knowledge through mnemonic images from mythology, so as from the center of a theater's stage the viewer had visual access to the information (Bolzoni, 1984). This system of organization of world knowledge is frequently compared to the web 3.0 or semantic web (Feliciati, 2010), which connects web digital material through metadata that relate its meaning(s). Following the path of his predecessors, Giordano Bruno in 1582 presents the *Ars Memoriae*, "a mnemonic structure that bridges human awareness with raw data" (Heim, 2012, p. 1). The conceptual switch consists in placing the human not before the "iconic interface" through which we access knowledge of the world, but at the center of it. This switch is subtly evidenced by the use of the term "panorama", which initially designated a pictorial-circular expression, as a metaphor that denotes a holistic vision of a phenomenon or situation. Both the artistic object

and the metaphor, however, enclose the same idea: the human being is placed at the center of the vision so as to be in the position to receive and process the information from the outside without any type of disturbance or margin.

The panoramic or panoptic vision, with all its applications and derivations in different media, laid the foundations of the optical simulation by "forcing the viewer to observe the external world through its replica" (Oetterman, 1997). Paradoxically, over the course of time, the frameless view not only released image and vision, but also became a prison for the eye, as the HMDs evidence. The frameless view sets a clear separation between the reality that is contained inside the *experience theater* or HMD and the *real* reality; there is no escape, the viewer must choose between one or the other. This is one of the main obstacles that VR has been facing from its beginnings, people are not sure about whether or not to enter the *new reality*. A problem already faced by the Panorama, initially introduced as a new art form, but "conceived to create a market for mediated realities and (seemingly) emancipated gazes" (Huhtamo, 2013, p. 5).

If the content of a new medium is an old medium (McLuhan, 1964), the content of VR is the frameless/omnidirectional image. As an evolutionary process and not as a finished product, the panorama is the code that sets the foundations for the evolution of VR as a visual medium, whose hardware differs from other visual media where the viewer is placed in front of an apparatus (cinema, television, computer, radio, smartphone, tablet, newspaper, etc.) that has a defined range of visual and/or auditory transmission. When a medium becomes the content of another medium, it sets up the symbolic form and the aesthetic style used to create messages (Strate, 2008). This new aesthetic paradigm has consequences on the transmission of messages on both sides of the communication process, posing a challenge for both sender and receiver, both of which must place themselves at the center of the world in order to *see* what the other *sees*.

2.1.1 Towards the Artificial Experience: The Post-Symbolic Communication

It was the French poet and playwright Antonin Artaud who first used the expression *Realité Virtuelle* in his book *Le Théâtre et son double* (1938), referring to that other storyworld brought on stage by theatre. The fact that the same term is used today for a computational system that generates a realistic VE highlights the link between the artistic creation and the technology that allows us today to access other universes that are real in effect. This link transcends VR visual nature to dive into a metaphysical nature. For example, when we remember a past event, we abstract ourselves from physical reality so as to "visit" a reality that no longer exists as an external event. We see and live our memories as a narrative (Bruner, 2005, p. 65). We narrate our life experience, our dreams, we become the stories we create. However, narrative needs symbols to be transmitted.

Analogously, since the beginning of artistic expression, humanity has sought to isolate cognition from the real world to create alternative spaces that mimic the sensation of reality, trying to live "artificial experiences". Some situations in which we experience different realities can be achieved by altered states of consciousness, as sleep, hallucinations, hypnosis or meditation. All these examples share two conditions with VR: (1) the individual sensory perception is positioned at the center of the experience, and (2) there is an implicit decision to separate ourselves from our physical reality to enter a different cognitive dimension. Although artistic discourse constitutes an access point towards a peculiar dimension created by some author, in Virtual Reality this pact goes even further, compromising our physicality and our senses into the digital materiality of that other reality.

It seems that there is an intrinsic human desire to live alternative realities in which it is possible to experience the life of others or unknown spaces. In 1954, Aldous Huxley wrote in his book *The Doors of Perception, Hell and Heaven:*

> "Thus, it seems virtually unquestionable that I will never know how it feels to be Sir John Falstaff or Joe Louis [...] sensations, feelings, intuitions, insights or fantasies are

> private and, except of symbols and at second-hand, incommunicable [...] Words are pronounced, but they do not illustrate. The things and events to which the symbols refer belong to fields of experience that are mutually exclusive"
> (Huxley, 1954, p. 3).

The core of this plight seems to be our inability to transmit our experience of the world, not what we think about it. VR could be the answer to this desire. In April of 2018, during his TED talk "How we need to remake Internet", Jaron Lanier, pioneer[3] of what we know today as VR, compares the existential moment of VR in the context of the evolution of humanity, with the first stages of the appearance of language. In this sense, Lanier points out the birth of a new era in the history of human communication, giving an answer to Huxley's plight:

> "With language came new adventures, new depth, new meaning, new ways to connect, new ways to coordinate, new ways to imagine, new ways to raise children, and I imagined, with VR, we'd have this new thing that would be like a conversation but also like waking-state intentional dreaming. We called it post-symbolic communication, because it would be like just directly making the thing you experienced instead of indirectly making symbols to refer to things."

The post-symbolic communication, as Lanier explains in his book *You're not a gadget* (2010), can be described as "a shared, waking state, intentional dream... Instead of the word 'house', you will express a particular house and be able to walk into it... It will be a fluid form of experiential concreteness providing similar but divergent expressive power to that of abstraction." A similar definition is given by William Gibson (1986) when he called the Cyberspace "a consensual hallucination". VR as a *Sprachmaschine*[4], does not refer anymore

[3] https://www.wired.com/1993/02/jaron/

[4] The literary translation for Heidegger's terminology would be "Language Machine". Michael Heim in his essay "Heidegger and Computers" (1990) relates the difficulty that he found translating this concept: "As scholarly translators often do, we ended up taking the cautious route of literal translation, putting *Sprachmachine* into the vague English "language machine." But a subsequent experience made me realize that Heidegger's reference to the language machine was in fact a prescient insight into what was to become computerized word-processing technology."

just to the word-processing application of computers, but rethinks the communication act, since it is no longer "the simple transmission of a message from A to B, but a blip of telepresence inside the digital void where virtual entities and realities can exist" (Heim, 2012). This new form of communication moves away from symbols and gets closer to pure perception, but as a computer mediated process, it must accommodate inputs and outputs to what Kant called the human *sensory-schemata* (Heim, 2012).

What we call VR refers specifically to a computational system that generates events and entities that are real in *effect* but not in *fact*. Through this computational system, artistic creation can play a decisive role in the creation of meaningful experiences in a medium "that awakens fundamental questions of philosophy such as: *What is real?* and *What is existence?*" (Heim, 1993, p. 3). Artists have now the material possibility of creating artificial experiences that explore, to a certain degree, those metaphysical questions that Huxley or Lanier expressed. Doing this research, something that always captured my attention was the acceptance, *a priori* and without questions, of the fact that other realities exist. This thought arises multiple questions that are beyond the scope of this investigation: *is it possible to talk about a physical reality that is the real reality and separate it from the cognitive reality that is the virtual reality? Is the real reality an objective or subjective reality? Is virtual reality a subjective reality? Can virtual reality also be an objective reality?*

It is coherent that most of the names of VR companies are related to that other reality: "Within", "Daydream", "Spaces", or "Alt" are some examples. It is also very common that when talking about VR, terms like metaverse, cyberspace, matrix, among others, are suggested to refer to that other space. As Michael Heim notes, the Cyberspace is a spatial metaphor where human perception meets digital data (Heim, 2012), but in VR, when the human senses interact with a VE, the metaphor is no longer needed, the human-computer interface refines the sensation of truthfulness of the VE and reaffirms it in its *real* condition. With the improvement of technology some issues about the distinction between real reality and virtual reality arise. Baudrillard (2014), with his thoughts about reality, simulation and simulacrum, raises different questions for VR in its path of self-definition, especially when

he wonders about recognizing "the real". How to recognize "the real", when there is nothing but the surface? How to recognize "the real" in a virtual reality when the surface is a data representation? In an interview published by *The Atlantic*[5] on April 25th of 2016, Donald Hoffman, professor of cognitive science at the University of California, discusses human perception and translates this philosophical issue into the technological field:

> "There's a metaphor that's only been available to us in the past 30 or 40 years, and that's the desktop interface. Suppose there's a blue rectangular icon on the lower right corner of your computer's desktop — does that mean that the file itself is blue and rectangular and lives in the lower right corner of your computer? Of course not. But those are the only things that can be asserted about anything on the desktop — it has color, position, and shape." (Gefter and Quanta, 2016)

In 1980, during an interview, Stuart Hall - discussing Baudrillard conceptions about meaning - says that there can be two assertions when trying to recognize the real. The assertion that "there is no absolute meaning or ultimate signified, just a chain of significations" and the assertion that meaning does not exist at all (Hall, 1996). Prescinding from vision, post-symbolic communication, as an immediate and transparent exchange of perceptions, looks for the transmission of that ultimate signified, and technological development on brain interfaces (Lécuyer et al, 2008; Aranyi et al, 2016) that meet in a VE, concretizes this search. Referring to Chardin's *Basket with strawberries*, Jonathan Crary locates the immediacy of the experience of sense into a scenic space in which the relation between one object and the other does not concern only optical appearances but rather the knowledge of isomorphisms and positions in a unified terrain (Crary, 1990, p. 66). Since space is a form of our faculty of intuition, a cerebral function[6], brain interfaces will communicate diverse types of messages, through visual-spatial perceptions that can only take place in a VE where human sensory imagination can project and be experienced.

---

[5] https://www.theatlantic.com/science/archive/2016/04/the-illusion-of-reality/479559/

[6] A. Schopenhauer *Il mondo come voltontá e rappresentazione (p.763)* cited by Jonathan Crary in *Techniques of the Observer* (1990)

When speaking about VR content, we are no longer talking about films, shows, games, or simulations, VR content is called Experience, and inside this umbrella term one can find different types of experiences, as those mentioned before. We start to talk about creating and living "artificial experiences", but what is artificial is the *human-made* space, not the *human-lived* narrative. The creation of meaning in VR experiences passes through what Eugene Gendlin called the *felt-meaning* "a concept that describes how our bodies process information with as much, if not more speed and accuracy than our minds" (cited in Kerckhove, 1995), a conception that Horst Ruthrof called "The Corporeal Turn" (Ruthrof, 1997):

> "Rather, verbal meaning occurs when linguistic expressions are activated by non-verbal signs, such as tactile, olfactory, gustatory, thermal, haptic, aural, and other perceptual readings. As such, meaning is an intersemiotic and heterosemiotic event, a linkage among distinct sign systems [...] I have termed the semiotic corroboration thesis, according to which the reality force of meaning increases in proportion to the number of sign systems activated in any meaning event." (p. 254)

The previous stage to symbolic communication on the development of language by the child is strictly related to our perceptive nature. Jean Piaget called this stage the *pre-symbolic communication,* in which symbolic language conventions have not been adopted yet (Piaget, 1997). Post-symbolic communication looks for the transmission of elaborated thoughts as primary perceptions without the support of symbolic representations. Following Ruthrof's thought, it seems that post-symbolic communication looks for the transmission of *Vorstellung* or "mental representations"[7] aided by computer interfaces: a simple but abstract desire that VR can carry on, but that requires a rather complex technological apparatus. Next

[7] "The standard English translation of *Vorstellung* as 'idea' is as convenient for formal semantics as it is misleading. A more accurate translation would be 'mental representation.' In this sense Vorstellung is at the heart of corporeal semantics. Without the fantasizing acts of quasi-tactile, quasi-visual, and other representations the schema of linguistic expressions could not be made to mean. More radically one could say that without Vorstellung we could not even walk." (Ruthrof, 1997, p. 257)

I face this phenomenon from the point of view of its material support, the medium, and its adoption in mass society.

2.1.2 Virtual Reality: The Medium

In 2015, Chris Milk, founder of the company Within, coined one of the most used definitions of VR in his TED talk *How Virtual Reality can create the ultimate empathy machine*. Milk states that "VR is the ultimate medium, because, while in other media consciousness interprets the medium, in VR the consciousness is the medium". This phrase recalls Marshall McLuhan's famous statement "The medium is the message" (McLuhan, 1964). However, Milk thought is already contained in McLuhan conception of technology, what he saw as a human extension. According to McLuhan, technology creates new environments and becomes itself the artifact of which the user is the content (Heim, 1993). "This applies to electric lights, any language whatever, and, of course, housing, engine cars, and even tools of any sort. It is obvious that the user or content of any medium is completely conformed to the character of this man-made environment" (McLuhan, 2008, p.27). Users interpret the messages they receive, process sensory data, generate meaning from their environments, from the artifacts within them, and from the events that take place there (Strate, 2008, p.132). McLuhan saw the medium as the environment that surrounds the individual: "the environment we inhabit, where we move, where we produce meaning, where our myths acquire significance: the medium is the message" (Roncallo, 2014). In this sense, VR represents the apex of the medium/space pair, and it does not need to have a direct relationship of dependence with *real* reality (Riegler, Peschl and Stein, 2000). As a three-dimensional digital environment with a vast spectrum of possibilities, VR becomes the metaphysical laboratory of reality (Heim, 1993), a function that until now belonged to the sphere of the human mind.

The concept of medium is polysemous and covers a wide spectrum of significance and signifiers. Each area of study, according to its context and applications, relies on a particular meaning of medium, which in some cases can hinder interdisciplinary dialogue, but

converging into a single meaning of medium could improve exchanges between the arts, the humanities, philosophy, technology, cognitive sciences, etc., yet opening the doors to the risk of losing different meanings of the concept (Ryan, 2014). The continuous evolution of technology offers more and better supports for the articulation of different media; nowadays we speak of multimedia, intermediation, transmedia and crossmedia. Ryan (2014) suggests a definition of medium based on a narrative approach, because the choice of the medium determines which "stories can be told, how they are told, and why they are told […] Through the form that is given to the narrative, the medium is also shaped and therefore the human experience" (p.25). On the other hand, Rebecca Rouse (2016) notices that an overly literary approach of medium can skew our idea of what constitutes a progress for the field, for example to keep waiting for the *Citizen Kane* of VR (Rouse, 2016).

The current media landscape lets us think that we will continue to articulate, mix and adapt the traditional limits of each medium, pushing also the limits between creator and user. For both researchers and artists, I feel that the invitation is to look beyond the formats inherited from old media to identify and assimilate the native properties of the new medium itself (Murray, 1998), since "there are varied indeterminations that emerge from the peculiarities of the nature of each medium; each one creates specific and unique narrative effects that distinguish it from other media" (Chatman, 1989). The narrative vision of the medium applied to VR allows us to approach this new environment, in a first instance, through what it looks for: the creation of worlds that allow the viewer to experience possible realities, a notion already accepted in narratology (Wolf, 2011). In VR, the artificial experience is the narrative created by the user, while the VE is the storyworld created by the author, in which communication between author(s) and interactor(s) take place.

Each text finds its own mechanism to be transmitted, and the creation process becomes a kind of struggle between what the author wants to express and the materiality that will support and transmit it. The creation of interactive experiences challenges both authors and receivers, and this challenge passes at first, through the knowledge of the materiality and the different functionalities of the object-medium that will instantiate the experience during the

fruition process. It is emblematic that the distorting power of a medium (a lens, the air, or a liquid) is considered neutralizable, and that this can be done by intellectually mastering the properties of the medium so as it becomes effectively transparent through an exercise of reason (Crary, 1990, p. 66-67). Every form of communication or language operates through codes within the syntagmatic chain of a discourse. If the audiovisual sign is complex, constituted by the combination of two types of speech, visual and auditory (Hall, 1980), how can we define the sign of VR, which is constituted by a combination going far beyond the visual and auditory stimulation?

As Rebecca Rouse writes in her paper *Media of Attraction: A Media Approach to Panoramas, Kinetography, Mixed Reality and beyond* (2016, p. 97), the evolution of a medium should not be interpreted under a *media-centered* approach in which a medium is a sort of "final result" or is accepted as "serious art". Instead, she proposes to considerate every medium experiment as autonomous art form that contributed to its evolution. This suggestion is also effective to understand the historical moment of VR. For more than 60 years, VR has been around the corner, waiting for its great moment. Several devices have had brief but exciting moments of hype in the 70's, 80's and 90's, moments in which the arrival of VR to the mainstream seemed imminent. Nonetheless, among the common consumers, VR never had a massive reception. Something similar happened in 2016, year in which VR leaved a beta state of more than sixty years to seek to reach the mass market. This leap to everyday life is still waiting and we still do not know if it will ever happen. This may be due to the fact that, from a macro-social point of view, media are the spaces in which we build our social realities (Strate, 2008, p. 133) and VR is still far from that stage.

However, the image of Mark Zuckerberg, CEO of Facebook, walking in the middle of a crowd wearing HMDs during the Mobile World Congress in Barcelona (2016), kicked off a year of competition between the big technological companies that are betting on this new medium: from the manufacturers of devices for reproduction, to the manufacturers of devices and software for the creation, through the offer of various platforms for distribution. Indeed, 2018 is not 1996, processors and screens of today are much more powerful than those of

twenty years ago, and the current technological environment with all its possibilities is undoubtedly more conducive to the creation of mixed reality experiences. But still in 2018, VR is almost in its "natal condition", and in spite of its "abject crudeness" it "conveys an amazing new kind of experience in a way that no other media ever had" (Lanier, 2010).

Something curious is happening with VR that has not occurred with other audiovisual media: it exists, it fascinates everyone, it fills conferences, it is in constant development for different applications, but, without the common user's feedback, nobody really knows what to do with it. We still do not know why someone would use VR. On the other hand, VR has managed to gain a space in the global collective imagination, since its inception as pure science-fiction, and later as technology, has always aroused interest, but even now it remains something for the few. Palmer Luckey, founder of Oculus Rift, expressed it this way in an interview with the BBC (Betters, 2013 August 30): "VR got featured in movies, TV shows, games, and books as a kind of holy grail technology about to change the world". It is common to find in Information Technologies (IT) researchers and developers born in the 50's and 60's, total and sad skepticism about VR, precisely because they lived the ups and downs of the VR hypes.

In recent years, there has been a strong economic investment for VR technological and artistic development, and everything indicated that finally in 2016, VR would have reached social systems and not just some individuals, but despite all efforts, VR did not have the reception that had been expected. Probably, due to the novelty of VR and the change of paradigm that it supposes, people do not feel ready to completely evade reality. "A technological innovation creates some uncertainty in the individual, who is forced to look for information that allows him to evaluate said technology, to try to reduce the uncertainty related to the possible consequences of innovation. The way in which a social system perceives the characteristics of an innovation determines its rate of adoption" (Rogers, 1983, p. 35).

The difficulty of predicting the adoption of VR in the past five years, confirms that it is not possible to guarantee that a technology will be adopted. It is not reliable to predict technology

diffusion since the methods of social sciences for behavior-related data analysis are based on the "here and now" and not on the "there and then" (Rogers, 1983). The adoption of innovation also conditions the evolution of technology itself, knowing what interactors do with technology, leading to a better understanding of the use and scope that it can have. This could be the blind spot where VR is today: until such technology is not adopted within a social system, we cannot decipher the way forward in its evolution, at hardware and software level (Rogers, 1983).

VR has generated a dreaded uncertainty as it has an evident potential to isolate us from physical reality (It is enough to observe a person using a HMD). However, technology has always generated this type of fear in society; this was the case of computers, for example, even today some people see the computer as an opponent of human intelligence, although in practice is a component (Heim, 1993). McLuhan, from a sociological context, warns us that it is the medium that has an impact on the human being and its social systems, and not the messages we send or receive, “what counts is the nature of the medium and its structure, not its intentions” (Strate, 2008, p. 132). Our romance with computers as indicated by Michael Heim in his book *Metaphysics of Virtuality* (1993), goes far beyond the mere aesthetic fascination “we are searching for a home for the mind and heart” (p. 85). While the computational logic is inspired by human reasoning but it does not reproduce it, in the same way VR as an electronic space should not try to lucidly reproduce reality, but rather be inspired by the perceptual processes through which we perceive reality.

There is still rejection and disbelief towards VR. One of the main obstacles that it has faced in reaching the mass market is the quality of the visual experience: we still see the pixels in HDM binoculars. However, despite the uncertain path that VR will take in the near future, computer science is living a quite prolific moment for academic and artistic research, as well as for the industry, in terms of innovation and profitability. This technological context opens the doors to a large number of experiences (simulations, videogames, social networks, narrations, etc.) in different areas of application: education, entertainment, telecommunications, training, psychological and medical help, among others.

We produce media contents and do research in media knowing that "like volatile stormy weather, at some level changes in mass communication theory and research occur almost too rapidly and unpredictably for even the best-intentioned reporters to chronicle and explain accurately" (Bryant & Miron, 2004). However, if we look back to mass media history, we can find common patterns. For example, we could use the same words written by Oettermann (1997) referring to the evolution of panorama, to describe the current moment of the historical evolution of VR, the medium that has promised to put the human vision at the center of the world:

> "Neither the panorama nor the Panopticon, were ever at the forefront of their times: both phenomena, each in its own way, were the reflection of the most progressive and liberal thought of its time. From these circumstances, the paradox emerges that the panorama has become obsolete on the day of its presentation. At the same time, he sought to hide his anachronism by reproducing in himself new apparently different variations with the themes of fashion. In this way, it continued for a century trying to understand the needs of a large public that had not even had a small role in its creation". (p. 47)

2.2 The Human at the Center of the World

Recognizing the human being at the center of the perceptual experience was a true revolution. It started with the new conception of the observer as an active subject and then quickly extended to the overall view of the human being in relation to the environment. Maine de Biran proposes the term *Coénesthèse* to describe that immediate perception of the body presence, the contemporary feeling of the whole and the composite awareness of all vital impressions inherent in the organism (Crary, 1990, p. 76). VR, that is at the same time image-object and image-event (Diodato, 2005), can be conceived as an experiential topography of electronic data (Heim, 2012). Within its scenic space, the embodied subjectivity of the

observer becomes the place where the observer status itself is made possible (Crary, 1990, p. 72), as it happens in reality itself.

VR looks not only for a verisimilar representation of an environment that augments the feeling of immersion, but for the possibility to physically interact with such VE. The possibility for the user to interact with the environment is equally important as the images in building the effect of realism (Manovich, 2005, p. 225). As a location-based medium, there are some necessary requirements for the creation and enjoyment of a meaningful VR experience. Even though these requirements can be fully accomplished through a high technical quality, there are three terms related to the user experience that constantly appear when speaking about VR and IDN: (1) Realism, (2) Immersion, (3) Presence and (4) Agency.

2.2.1 Realism

The discussion about realism applied to any type of artistic and/or narrative text, has ancient roots that start with the classic theater and sculpture. Since the appearance of photography and later cinema, the relationship between the artistic text and reality revived a heated debate. Given its hybrid nature, cinema highlights the dichotomy between the "naturalistic" condition of its photographic dimension, and its ability to create its own reality or to alter reality through narrative and/or montage. The multifaceted relationship between realism and cinema is related by Christopher Williams in *Realism and the Cinema: A Reader*. The book was published by the British Film Institute in 1980, after the heated debates between Colin MacCabe (1974) and Colon McArthur (1975), among other theoreticians, about the realist text. Often these debates took as starting point adaptations from literature to the British television of the time (Kerr, 1982). This fact focused the debate on the “social realism”, the study of realism as a social construction and. as such, a conveyer of ideology. Making a step back, there is an intimate opposition between the reality of things as we perceive them empirically, and the reality that we cannot perceive through the senses, “but which, in Hegel 's words, is 'born of the mind'. In religious systems, the true reality is thought to derive from

God; in liberalism, from the ethical or moral workings of the individual consciousness; in Marxism, from the workings of class consciousness" (Williams, 1980, p. 11).

Based on a Marxist vision of reality, Georg Lukacs distinguishes between naturalism and realism: "naturalism shows only the appearances of situations, and realism, using devices like the historically typical character and action, functions in the same sort of way as the 'inner core' [...] Naturalism describes events but without providing the reader with a key to understanding them; and thereby denies him/ her access to the truth" (Williams, 1980, p. 11). Such dichotomy, that emerges in all artistic texts, must be taken into account in the field of VR, AR, and MR, as these new media open the possibility to completely new realities, they do not necessarily try to create constructions of the reality that we accept as real one (at least for practical purposes). But even when speaking about different realities, "the credibility of an artificial world, the reliability of an artificial eye, depend on the consistency of their relationship with our reality and on a system of deviation from the norms of our experience" (Williams, 1980, p. 71). From this standpoint, virtual realities need to communicate with empirical reality, and this one does not only obey physical laws of nature but also our collective construction of the world we live in.

Considering the characteristics of cinematic VR, the questions about realism in cinema re-emerge, as all representations or manipulations of reality on a filmic experience can be interpreted from different points of view: "movement, narrative and its organization, the authorship of films, the relationships of film with more traditionally established forms of art, entertainment, manipulation and the role it plays in the construction of film works, technology and techniques, and ideology and its relations with film forms" (Williams, 1984, p.81). At first glance, in cinematic VR we can find the opposition between, on one hand, the naturalistic view of the world through the 360° live action recording, and, on the other hand, the narrative universe in which characters that generate events exist. According to MacCabe (1974), these two opposite sides meet in the way how the subject matter is ordered and articulated: "To deal with the facts of the world is, in itself, not only a realist but also a materialist viewpoint. The materialist, however, must regard these materials as ordered

within a certain mode of production, within which they find their definition" (p. 19). In this sense, a naturalistic view on reality is essential in VR in order to create the sensation of the real, according to the way in which our bodies experience life; on the contrary, a materialistic interpretation of reality regards the content of the virtual world: how objects, characters and situations are organized and categorized in it. *Naturalism* puts the interactors there, it makes the virtual world plausible; *materialism* explains in what type of world interactors are into, and this categorization in cinematic VR does not escape from the fact that, even if it is fictional, the recording of our real world is linked to all the cultural and social meanings that a single object on scene can carry. *Realism,* for the purposes of this research, will be addressed as the ability of a VR experience –in form and content– to make the interactors feel that the world they are experiencing truly exists.

2.2.2 Immersion

Probably this is the most problematic term since the appearance of VR HMD, as VR doubles the meaning of the term. A first definition of immersion is given by narratology, relating it to the aesthetic illusion that "consists primarily of a feeling, with variable intensity, of being imaginatively and emotionally immersed in a represented world and of experiencing this world in a way similar (but not identical) to real life" (Wolf, 2009). As noted in the *Encyclopedia of Narrative Theory* (Herman et al, 2008), immersion is related to the ability of humans to enter in a state of absorption. Its nature is a simulative process, a specific form of the pervasive phenomenon of mental simulation. It is transferred by props (Walton, 1990) or mimetic primers, which may be verbal, visual, visual-acoustic, or even visual-acoustic-tactile; being its target domain a mentally projected world, i.e., a holistic set of mental representations foregrounding phenomenological and spatial properties prospectively organized (Dokic and Proust, 2002). Monika Fludernik in *Towards a Natural Narratology* (1996), introduces a term especially pertinent when applied to VR: *Experientiality*. She defines it as "the quasi-mimetic evocation of real-life experience" (p. 12). She introduces the notion of experiencing, just like telling, viewing or thinking, as a holistic schema acquired from real life that can be used as building stones for the mimetic evocation of a fictional

world; as it happens on film and drama, also in VR the visual experience works on a reflector mode in which we appear to experience reality from within another's psyche (p. 20).

Janet Murray in *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (1997) starts her definition of immersion remembering the origins of the word, that is, the psychological feeling of being submerged in water, a different element from air in our normal environment. Immersion in computer-generated environments, requires, as Murray says, that we learn how to digitally swim, just as it happens when we are submerged in water, and live immersion as a participatory activity (p. 211). In its beginnings, the term VR was used also to refer to CG environments even though they were reproduced on a 2D computer window. When these VEs started to be reproduced on HDMs or CAVEs, then it began to be called "Immersive VR". Today, however, we refer as VR to the omnidirectional VE. The term immersion, afterwards, took a new role on the development of VR as a medium. Immersion became the lighthouse of the technical development of VR: the finer and more diverse is the connection of the human perceptive nature within the virtual environment, the higher the level of immersion. This translates into more senses connected to the VE and more interactor's feedback (movements, emotions, speech, etc.) interacting in real time with the VE and its agents. In this sense, VR development understands Immersion in its perceptive nature.

Both definitions of immersion, however, are collected by Konitz and Roth in the paper "Evaluating User Experience in Interactive Digital Narrative" (2016). In order to evaluate user experience in IDNs they propose to take in consideration both Perceptive Immersion and Narrative Immersion. Each definition in turn comprises a series of factors that generate both types of immersion. This research is based on this theoretical proposal that consolidates the User Experience Dimensions on IDN, to evaluate the user experience in the IFcVR in its IDN condition.

2.2.3 (Tele) Presence

Following the definition of Immersion given by Roth and Koenitz (2016) when describing the user experience dimensions on IDN, *Presence* is a component located inside the Perceptive Immersion together with *Flow*. Even though presence is considered a sub factor of the perceptive immersion, it represents an important characteristic when referring specifically to VR. Presence is defined as "the subjective experience of being in one place or environment, even when one is physically situated in another [...] It is a normal awareness phenomenon based in the interaction between sensory stimulation, environmental factors that encourage involvement and enable immersion" (Witmer and Singer, 1998). The sensation of presence is reached through the degree of realism of the proposed world, where the interactor accepts the nature of that other reality that do not necessarily coincide with the real nature.

The concepts of Presence[8] and Telepresence have been one of the main objects of research in the past decades, since the appearance of the Cyberspace. Telepresence was defined my M.L. Ryan as follows: "the conjunction of immersion and interactivity leads to an effect known as telepresence […] Telepresence relates to presence as virtual reality relates to reality" (Ryan, 1999). This approach considers Telepresence as the overall feeling that VR looks for, a feeling in which interactors are immersed -perceptively and narratively- but without leaving behind the fact that at the same time they have agency on interacting and modifying the VE or a physical space from remote. This second conception is often neglected, as Lev Manovich points out in *Language of New Media* (2005). He starts from Brenda Laurel's definition of telepresence as a remote presence, to then draw a definition in which Telepresence means "to be present in a virtual environment or to be present in a real environment from another location through the transmission of images in real time. Thus, telepresence allows the subject to control not only the VEs but also the reality" (p. 210-211).

[8]In this thesis the term "presence" will be used as a component of perceptive immersion.

In the book *Immersed in Media: Telepresence theory, Measurement and Technology* (Lombardi et al, 2015), it is pointed out that Presence Theory is highly interdisciplinary and includes different points of view for the understanding of this phenomenon: non-mediated presence, social presence, self-presence, co-presence, etc. However, the prevalent discussion in the technological context focuses on *spatial presence*, the presence feeling within a human-made or mediated space. This concept implies "that an individual perceives and experiences media stimuli almost in such a way as if they were real, even though they are not" (p. 117), "a subjective experience, conviction or state of consciousness, when perceivers feel bodily or physically situated in a mediated environment" (p. 118). The level of presence has an impact on different fields of application: medical training, videogames, VR-Learning (Bottino et al, 2016), including cinematic and interactive cinematic experiences as proposed in this work.

VR authors are especially committed to the feeling of presence; this, being a perceptual condition, requires the digital creation of a predominantly visual and auditory scenic-space that, although fantastic, should be perceived as real. This challenge goes through the understanding of the nature of human perception. In this sense, there are two components for the generation of presence in VR: on one hand, the manufacture of the devices for generating and reproducing virtual realities, and on the other hand the creation of a storyworld that needs to make the interactor feel physically comfortable inside the audiovisual experience. This search for the natural feeling of presence reminds the famous phrase of the architect and futurist Buckminster Fuller: "I'm not trying to copy Nature. I'm trying to find the principles she's using" (cited in Vogler, 2008).

2.2.4 Agency, Interactivity and the Illusion of Freedom

"The essence of telepresence is in its anti-presence" (Manovich, 2005, p. 213). Telepresence allows a subject to experience a certain reality (virtual or remote) without being physically present in that place. *Agency* in the context of VR materializes this essence. One of the great challenges for a creator is creating the feeling and pleasure of Agency for the user. This

capacity is often called "freedom", although in digital environments in general there is no such thing as freedom. In its broader conception, freedom is the capacity of an individual to think and act according to her own will, and, in metaphysical terms, "to look for the unconditioned in the conditioned" (Hoyos, 1997). Janet Murray (1997) defines agency as "the satisfying power to take meaningful action and see the results of our decisions and choices" (p. 125). In VEs, agency is based, on one hand, on the technical capacity of the VR generator system to be modified based on the decisions of the interactors in real time, and, on the other hand, to the creativity of the creator to foresee all possible actions and reactions of the interactors within the VE. These agency factors are summarized as: system usability, autonomy and affectance (Koenitz & Roth, 2016).

Agency is related to the concept of *Interactivity,* and interactivity is a very controversial topic (Mason, 2013) particularly in the context of IDN. A true interactivity requires that both agents of the communicative act elaborate coherent answers based on the input of their interlocutor. What we know today as interactivity with computer systems continue to be more reactive than active responses (Crawford, 2005) preconfigured in a database of possibilities. A film, for example, is just one possible path of a database of recorded moving images (Manovich, 2005, p. 283), and a linear VR experience is the alignment of all the visual areas of the sphere that interactors put together one after the other. According to Crawford (2005), this is not real interactivity but an illusion of interactivity. Following this claim, other IDN theorists, like Koenitz (2016), prefer to use the term *interactivization* of traditional media (film, literature, etc.) rather than interactive storytelling. From a narrative point of view, the convergence between story and interactivity leads to the "narrative paradox"[9] (Aylett & Louchart, 2004): the higher is the level of interactivity the less control has the author upon the story unfolding. "The contradiction between authorship and participation is an important element of the mentioned narrative paradox. On one side an author seeks control over the direction of a narrative in order to give it a satisfying structure. On the other side, a

[9] The Narrative Paradox is a concept developed by Ruth Aylett and Sandy Louchart in "The Emergent Narrative Theoretical Investigation" (2004) In *Proceedings of the Narrative and Learning Environments Conferences, 25-33.*

participating interactor demands autonomy to act and react without explicit authorial constraints" (Aylett & Louchart, 2004). Marie-Laure Ryan in her chapter *The Interactive Onion: Layer of User Participation in Digital Narrative Texts* (2011) points out that "the major obstacle to the development of truly interactive narratives is not technological but logical and artistic. How can user's freedom be reconciled with the need to produce a well-formed, aesthetically satisfactory story?" (p. 48)

A real interactive storytelling, intended in Chris Crawford's terms, will possibly be reached with future developments in Artificial Intelligence (AI) and Machine Learning, fields of study intrinsically related to narratology and neuroscience (Morson in Schank, 2000, p. xiii). With the aid of AI, it is believed that an IDN system will be capable of running real-time story generation, achieving a true interactive narrative, in which interactivity penetrates the core of the story (Ryan, 2011). At present, we only have increasing levels of interactivity that slightly *touch* the surface of a storyworld. Ryan (2011, p. 37-52) has identified 4 levels of interactivity: (1) Peripheral Interactivity, (2) Interactivity Affecting Narrative Discourse and the Presentation of the Story, (3) Interactivity Creating Variations in a Predefined Story and (4) Real-Time Story Generation. The IFcVR can be located on Level 3: Interactivity Creating Variations in a Predefined Story, as it will be developed in Chapter 4. The achievement of a real interactive narrative, as Crawford intends it, however, does not eliminates the relationship between the creator of the storyworld and the interactor that triggers the generation of the narrative events. Next, I outline a first approach to an application of reception theory for IFcVR.

2.3 Applying Reception Theory to IFcVR

In the same way as VR opens up to the world proposing a change of aesthetic paradigm so as to place the interactor at the center of the frameless image and move the human consciousness towards a reality different from its physical reality, likewise it changes the act of coding and decoding the artistic text. The communication act in VR arises some concerns: *What kind of text is the virtual experience? Which codes does the virtual experience use to transmit perceptions of the world? Which is role of the sender? Which is the role of the receiver?* An answer to these questions requires an interdisciplinary effort from the humanities towards a realization mediated by digital systems that still requires development and user feedback. Hence, aesthetic and literary reception theories offer a starting point for the analysis of the dynamics of artistic creation and aesthetic reception that are found in the VR medium.

Art is a creative-productive, receptive and communicative activity (Jauss, 1982), in which an artistic/narrative text acquires life and meaning during the process of reception or "reading". Hans Jauss (1982) suggests that the text itself does not have inherent meaning or value but it is constructed by readers and their “horizon of expectations”. This is determined by their socio-cultural background and the context in which that particular text is received. Umberto Eco (1992), on the other hand, conceives the text as a *macchina presupposizionale* that is open to multiple interpretations coming from multiple readers and multiple contexts. The fragmentation process of the artistic text happens to be the mechanism to find meaning as an intersemiotic and heterosemiotic event (Ruthrof, 1997). Stuart Hall (1997) argues that “things don’t mean: we construct meaning, using representational systems – concepts and signs” (p. 11). Hall (1986) also observes our historical period full of a multiplicity of codes, readings and discourses that produce new forms of self-consciousness and reflexivity.

The act of reading, defined by Iser (1980) as a function of text construction, is posited as an efficient and necessary condition, having the same importance that the creation of the text

itself has. Iser distinguishes two poles on the literary work: "the artistic pole is the author's text and the aesthetic pole is the realization accomplished by the reader" (p. 21). In general, the various trends of the Reception Theory of the second half of the 20th century (Pugliatti, 1985; Eco, 1992) balance the weight of the textual operation, conferring to the receiver an active role in understanding, updating and interpreting the text. Nowadays, we acknowledge that the text, even from the moment of its creation, foresees this kind of participation on the other side of the communication act (Eco, 1992, p. 22). In the communicative act posed by new media, reading is a digital travel around multimedia fragments floating in the cyberspace. Reader function becomes *Hyperreading* (Hayles, 2012) the reading act of hypertexts. Hyperreading poses a form of communication in which readers build relational logics. In the introduction of Derrick de Kerckhove conference presentation *La rete ci renderà stupidi?*[10] (2016), Massimo Arcangeli uses the word pun *"*nodi da scegliere, nodi da sciogliere*"*[11] to define hyperreading. In Hyperreading, meaning is not contained only in each single text node, but in the semantic connections that may exist between nodes, multimedia materials, URLs, etc., and at the same time, on an upper level, between the relationships that exist between the final output of the navigation process and interactors' background and motivations.

VR as omnidirectional *image-event* can also be considered a hypertext: audio and visual information is spread around the sphere and the way in which interactors elaborate their own narrative path is through the same mechanism that hyperreading applies. Moreover, in VR, the metaphor of McLuhan (1964) that conceives the medium as an environment, acquires a visual representation. VR is itself a visual-spatial environment, in which interactors find themselves spatially immersed in the message, and the way to decode the message-medium is through the multiplicity of sensory stimuli that they experience. If the VR text is consistent with human experience, reception passes through the coordination of the senses involved in the experience together with what occurs within the scenic-space. Though Cinematic VR is not interactive as computer-generated VEs, it still can be considered an IDN, as the very act

[10] In italian: "Will the web make us stupid?" presented at the Futura Festival (July 30, 2014)
[11] In italian: "Knots to choose, Knots to loosen"

of looking around and choosing what to see within the visual sphere is a type of interaction. However, the increasing integration of cinematic VR artifacts with contextual performances such as *Carne y Arena*[12] (González-Iñárritu, 2017), or the enrichment of the cVR space-scene with layers of multimedia elements, enhance the VR experience. IFcVR uses an underlying Interactive Fiction (IF) structure in order to deliver an enactive immersive cinema.

In Figure 3, a visual representation of the VR communication act is proposed. The representation is based on the polarization between creator and interactor. On the Aesthetic Pole, the *Actual Reader* is situated together with her horizon of expectations. The meaning construction process is located between *Text* and *Actual Reader*, and is related with the feeling of Telepresence (comprising perceptive immersion, narrative immersion and agency) during the acts of hyper-reading and living the *Experience*, which represents the VR text.

On the Artistic Pole, we find the *Creator* who, through the mastery of the platform, translates the *Imagined Storyworld* into sensory codes. Through a user-centered design, the creator needs to put herself, simultaneously as author and reader, at the center of the perceptive storyworld. This act corresponds to the conceptualization of the Implied Reader. The imagined storyworld is the starting point of the creation process, it is a mental space with narrative content, where by narrative content we intend humans able to generate multiple events that unfold in time and changes the state of things (Fludernik, 2010, p. 6). The theory of the *Possible Worlds*[13] expands this idea by defining reality "as the sum of the imaginable rather than as the sum of what exists physically, a universe composed of a plurality of distinct worlds" (Ryan, 2013). "If a storyworld is anybody's world, it is the world of the characters" (Ryan, 2014, p. 32).

[12] "CARNE y ARENA" defined by its creator as a VR installation, was premiered at the 70th Cannes Film Festival as the first virtual reality project to be featured in the festival's history. https://carneyarenadc.com/

[13] Possible Worlds | the living handbook of narratology. (2018). Lhn.uni-hamburg.de. Retrieved 31 July 2018, from http://www.lhn.uni-hamburg.de/article/possible-worlds

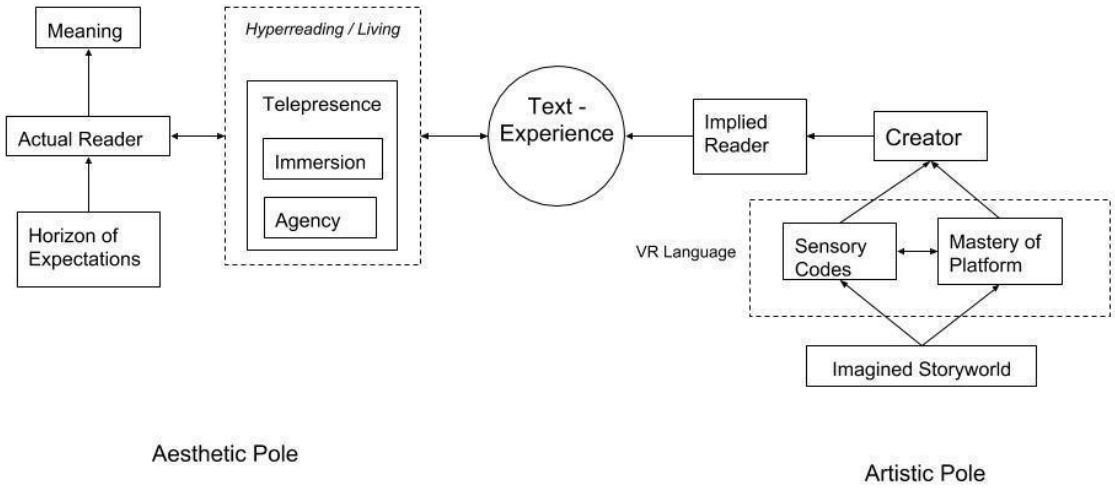


Figure 3. Communication Act in Virtual Reality.

2.3.1 Who is the IFcVR receptor?

In IFcVR, the cVR (see Chapter 3) is formed by the recorded scenes or sequences that constitute the narrative units of a hyperfiction or interactive fiction structure (see Chapter 4). In order to enjoy the IFcVR experience, the interactor of the system will experiment two levels of reading, already described by IDN theory (Roth & Koenitz, 2016): Local and Global. The local reading regards the current narrative unit or story beat, that in this case corresponds to each cVR NU, while global reading corresponds to the final output or journey created by interactors' choices. Figure 2.2 describes the levels of reading starting from cVR and gradually reaching the interactive use of the IFcVR.

As shown in Fig 4, the pragmatics of hyperreading in IFcVR occurs in a multilayer activity, in which the first level of interpretation of each narrative unit comprises:

1. The recognition and exploration of space.
2. The coordination of the multiple sensory stimuli disposed into the scenic space that is related to the intuitive use of the HCIs.
3. The recognition and identification of the story that is being told in a 360º VE.

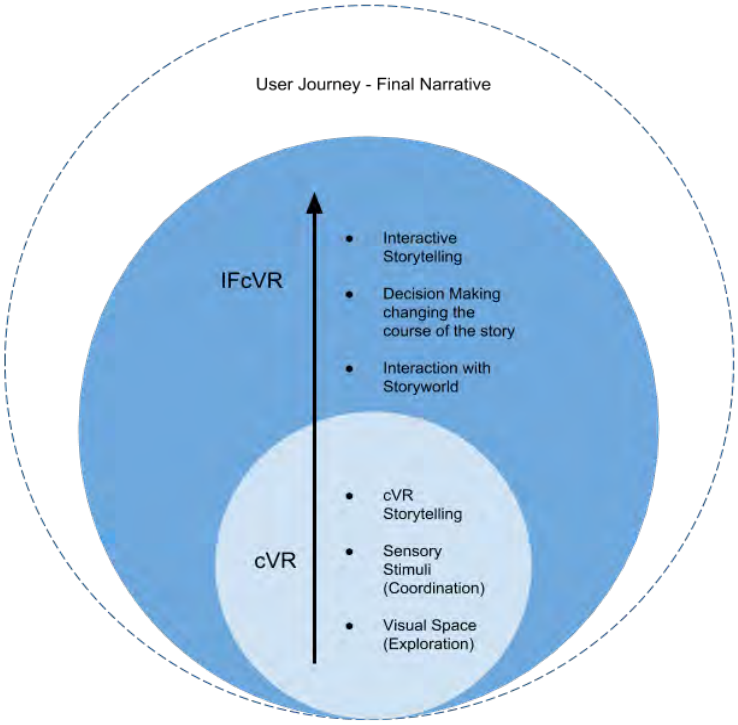


Figure 4. Levels of "Hyperreading" on IcVR.

Afterwards, there is a second level that travels along the interactive elements in each cVR unit and through the links between narrative units:

1. Interaction with the storyworld through hotspots.
2. Decision-making processes that are based on her own interpretation of the information that is receiving by the fictional scene.
3. User's construction of the story throughout Interactive Storytelling.

The third reading layer regards the final interpretation of the ultimate journey, the single output formed by interactors' choices. This linear output is intimately related to the interactor's socio-cultural context and to her own horizon of expectations.

It is difficult to identify a type of reader/user of an experience like the one proposed in this thesis, not only because of the lack of other similar experiences, but also because in general the VR audiences have not yet been defined and speculations about potential publics and markets can emerge[14]. In spite of this fact, through the articulation of the history of new media (Wardrip-Fruin & Montfort, 2003) the point of view of who receives and interprets information, and manipulates media artifacts, has been a constant. This person is often called *User*: the one who uses something. In Human-Computer Interaction (HCI) theory, the third wave of HCI, where "technology spreads from the workplace to our homes and everyday lives and culture" (Bødker, 2006), extends the User Centered Design (UCD) (Vredenburg et at, 2002) to a broader conception that is the Human Centered Design (HCD), a framework based on the recognition of human needs and desires during the ideation, development and prototyping of a service or product[15]. The essence of UCD - and HCD - lies in the awareness and anticipation of the user's interaction with the system: it is not possible to design a system outside user's point of view. There is a significant contribution from new media in the conceptualization of today humans, we are all users of a technology that is struggling to become invisible[16]. The UCD has spread in all areas of application turning the term "user" into "human", reaffirming our position at the center of any technology.[17]

User in their role of pure interactor does not care much about technology itself, about its components or code, the user only interacts with the perceptive surface. "User has no direct

[14] https://www.theguardian.com/culture-professionals-network/2015/jan/30/virtual-reality-cinema-experience-vr

[15] http://www.designkit.org/methods

[16] "The best interface is no interface" (Krishna, 2015)

[17] This egocentrism implies a double way attitude towards technology: "In the present state of the world, the control we have of physical energies, heat, light, electricity, etc., without control over the use of ourselves is a perilous affair. Without control of ourselves, our use of other things is blind." John Dewey, Preface to F.M. Alexander, The Resurrection of the Body (1974)

contact with technicalities. The technicalities underneath are simply the means whereby certain exact and simple services are rapidly performed" (Nelson, 2003, p. 444). Something similar happens with traditional audiovisual content. Even though the fruition of audiovisual content has become a natural activity, when audiovisual content is consumed little attention is given to its construction, so that what is absorbed is only what is immediately happening on the screen. In the same way, it happens when an HMD is used: our audiovisual education leads to read the content as we read cinema or television, and the coordination of vision and hearing with other senses such as spatial perception or the use of joysticks is at the moment still to be developed. About hypertext reading, Kerckhove (2016) considers that "today's readers are able to read like a cinematographic montage, to acquire images with a hypertextual approach and to put them together using phenomenal intellectual abilities. "Hypertextual intelligence" is the ability to know things quickly, when needed: it is a thought that shares the global knowledge of the Internet through a screen" (p. 33).

A definition of the IFcVR reader takes into consideration both components of the artifact: its cinematographic component and its interactive nature. The IFcVR readers, in their cinematic connotation, are spectators, viewers and listeners. All these definitions imply a passive attitude, as they seem to be only receiving information. In IFcVR however, at the same time they are using, manipulating, operating and modifying the VE, within the new media connotation. The VR component deepens this interpretation of user while they explore, interact, interpret and experience. These considerations relate to the conceptual shift from User-centered design to Human-centered design. When I started to write this dissertation, I opted to use the term *user* due to the computer-mediated foundations of the proposed art form, but after a short talk about this project with Janet Murray at ICIDS 2018, I switched to the word *interactor*. This term fits perfectly, as interactors are not only using the system, but because they become actually *actors* of the story, and simultaneously they are interacting with the virtual environment.

2.3.2 Who is the IFcVR Sender?

A medium that contains another medium requires a complex analog and/or electronic support that presupposes a further challenge for creators. On one hand, creators must know the technology they are using and the techniques to compose an artistic text on that specific platform. On the other hand, media involving different perceptive stimuli usually require an artistic dialogue between different arts and diverse media. A scriptwriter may not be the director of a film, as an actor may not be the writer of his monologue. This issue has been one of the most relevant debates raised in film theory: In cinema, who is the author? (Meskin, 2008, p. 17; Caughie, 1981, p. 408). The one who imagines and writes the storyworld and plot or those who translate them into audiovisual signs? This dichotomy takes place also in literature but in a more abstract way. In literature's narrative universes, the author of the book is often also the creator of the storyworld. This dichotomy was well expressed by Jorge Luis Borges in *Borges y Yo* (1960):

> "To the other one, to Borges, is to whom things happen. [...] I live, let myself go on living, so that Borges may contrive his literature, and this literature justifies me [...] Thus my life is a flight and I lose everything and everything belong to oblivion, or to the other [...] I do not know which of us has written this page."

When talking about the VR creation process, the creation of alternative realities is implicit. Each storyworld/VE is closed in its oneness as a complete and autonomous universe but open at the same time, as interactors can navigate, explore and create their own experiences. The debate about authoring emerges like in cinema, and is even expanded because the cybernetic and interactive aspects add a new layer or dimension to the act of artistic creation and communication. The technical aspects involved in the construction of virtual digital worlds usually unite the artist and the engineer in a single figure. In computer-based media, a new kind of artist has emerged, who "masters the technical details to control the actual platform on which the space-making happens" (Heim, 2012). The construction of virtual worlds, whether hyperstructures or artificial audiovisual worlds enclosed, is in the first place what

Kerckhove calls *multimedia writing* that "tends to the iconicity rather than to the sequentially" (Kerckhove, 2016, p. 29).

In this study, I am using the conception of author proposed by Pia Tikka in *Enactive Cinema: Simulatorium Eisensteinense* (2008). Tikka explores "the very grounds from which the phenomenon of cinema emerges [...] the intrinsic dynamics of a cinema author's mind in the process of creating a moving image" (p. 23). She distances herself from the debate of authorship in cinema (individual author, (co-) authorship, or multiple authors), focusing her study

> "on the hypothetical imagery aspects of the author's mental working process. This set-up implicitly excludes the other potential agencies of authorship, and the collaborative teamwork of cinematographers, sound designers, scriptwriters, set designers, actors, and other film professionals is understood to converge into a single holistic embodiment of expertise, as exemplified by Sergei Eisenstein's own use of the word 'author' or 'creator'" (p. 28).

It is difficult to find a specific term to refer to the person who creates complex digital environments; in the literature, we can find a vast variety of terms depending on the discipline or area of study that is analyzing the creation of VEs. From a spatial point of view, we talk about *space maker, space shaper, void developer, architect, designer;* from a (hyper) narrative point of view we refer to: *author, hyperwriter*; from a technological point of view, we can speak of a *developer, programmer*. However, there is one holistic term that transcends the craft work and embraces an ulterior meaning: *Creator*. The connotation of creator has an intrinsic religious implication; thus the creator must conceive all the single aspects of both virtual environment and storyworld. This dissertation has been built from the point of view of those who feel and translate their feelings into IFcVR, independently of the interdisciplinary nature of the production of this type of artifacts. Therefore, the term adopted in this thesis is "creator".

In IFcVR, the creation process occurs in the opposite way to the reading process (Fig. 5). In Figure 2.3 the creation process of a IFcVR is presented. The process, from the point of view of the creator, follows a two-moment sequence.

The first moment relates to the creation of the Interactive Fiction:

1. Definition of a storyworld (characters, atmosphere, context, etc.).
1. Definition of an Interactive Fiction (hyperfiction) structure from which it is possible to trace divergent storylines.
2. Definition of the HCI system and design of the interaction moments in relation with the storyworld.

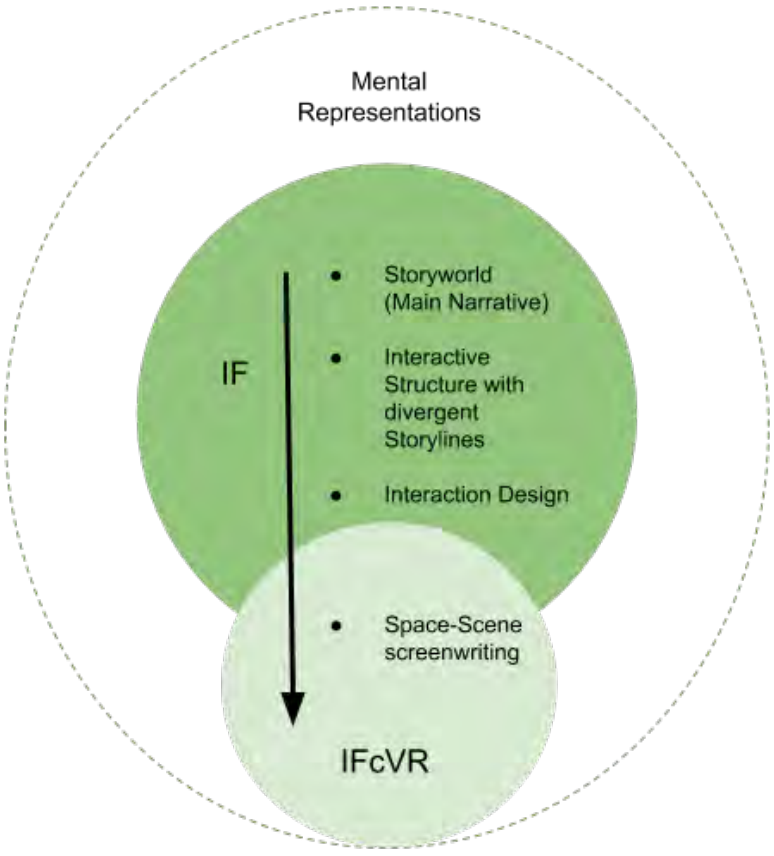


Figure 5. Writing process of IFcVR.

The second moment relates to the creation of each cVR Narrative Unit, in which the creator does the screenwriting of what happens within each scene-space. This writing takes into consideration not only what happens on the scene but contemporarily in the whole space. The whole process of creation is traversed by a continuous dialogue of the creator with her mental representations, understood as perceptive stimuli and not only visual mental images of the storyworld.

Chapter 3. The (Film) Form of Cinematic Virtual Reality

3.1 Cinematic Virtual Reality

The latest developments in Virtual Reality, and the recent access that storytellers with different backgrounds have to VR production means, result in an increasing development of VR experiences and in the interest of researchers[18] to document the technology adoption and evolution process of VR as medium and art form. For creators, VR poses interesting challenges from the narrative point of view. A first approach to the environment, even with the simple act of using a HMD, opens a wide spectrum of issues regarding technique, narrative and creativity, in the same way as it opens enormous possibilities related to the creation of storyworlds and interaction modalities. At this point, a conceptual base is offered by earlier media and artistic forms, comprising literature, theater, cinema, architecture and videogames. Cinema and videogames -as interdisciplinary audiovisual art forms- offer a more complex understanding of audiovisual and interactivity techniques; however, the spatial nature of VR requires insights from theater as regards managing how performer, spectator and space come together (McAuley, 2007), while architecture offers some useful concepts both for the design of the scenic space (Carlson, 1993) and the application of a way-finding theory (Blades, 1991).

[18] https://www.huffingtonpost.com/turnstyle/vr-finding-the-storytelli_b_7985682.html?guccounter=1

Cinematic Virtual Reality (cVR) is a branch of VR, in which the VE is created by capturing real environments with a 360° video camera (also called *Live Action*), differing from Computer Graphics (CG) generated environments. The cVR category also includes 360º 2D[19] and 3D animations, as well as 360º 3D video and volumetric video. Some of these categories, as 2D and 3D animations, in their "flat"[20] version have also been recognized by cinema industry. This is even including VR experiences into film festivals: Cannes[21], Venice[22], Sundance[23], Tribeca[24], are just some of the most important worldwide film festivals that have opened a special space for VR. This door has been opened in a very organic way, despite the low reception of VR in the mass market.

It is natural to wonder about the immediate relationship between VR and cinema. The question is not new. Cinema itself faced this issue at its beginnings, when it was constantly compared to established arts. Rudolf Arnheim in "Film as Art" (1957) points out that, during its birth period, cinema was considered nothing but the mechanical reproduction of nature and therefore not art (p.127). Somehow the same position is implied when speaking of VR as art. It would seem that, given its digital nature and its (almost) sci-fi appearance, VR is far away from art. In her chapter about film editing in "A Companion to Film Theory" (Miller & Stam, 2007, p. 64-83), Lucy Fischer identifies the issue from two points of view:

> "On one level, this impulse speaks an aesthetic curiosity: How does a new medium extend or revamp our understanding of earlier artistic forms? On another plane, however, such diatribes are meant to "legitimize" the cinema by heralding its ancestry and origins in more respectable forms." (Fischer, 2007, p. 69)

[19] https://www.theverge.com/2015/12/22/10636638/google-atap-aardman-animations-spotlight-stories-special-delivery

[20] In Cinematic VR jargon, traditional videos are called "Flatties". This term was coined by Google VR artist and theorist Jessica Brillhart https://vimeo.com/jessicabrillhart

[21] https://www.festival-cannes.com/en/69-editions/retrospective/2017/actualites/videos/next-virtual-reality-fine-tunes-its-festival-presence

[22] http://www.labiennale.org/en/cinema/2017/venice-vr

[23] http://www.sundance.org/blogs/news/2017-sundance-new-frontier-story-lab-projects

[24] https://www.tribecafilm.com/immersive

This is the same logic of McLuhan (1964) that invites us to think of the media as extensions of our senses. As in every branch, each medium carries a genetic load from its predecessors. In each new branch that grows on the big tree of media, we look for the similarities with well-known media, as well as for those differentiating elements that move a little further from the center. In this mental image, cinematic VR is the section of the VR branch closest to the cinema log. The way in which cinema articulates all the elements that reproduce a story is called the *Film Form*. In the broadest sense, the film form is the total system that the viewer perceives in a movie. The form is the global system of relationships that interactors can perceive among the elements of the whole film (Bordwell & Thompson, 2010). It is possible to start the analysis of the form of cVR by applying the same words that Eisenstein (1977) used to describe the two main features of cinema:

> *"Primo:* photo-fragments of nature are recorded;
> *Secondo:* these fragments are combined in various ways." (p. 3)

Both features are perfectly applicable to cVR, however for each of them there are differences given by the spatial nature of cVR. The fragments (*primo*) and its relationships (*secondo*), represent a two-fold process which in cinema is enhanced in a deepest and strongest ways in comparison with other arts (Eisenstein, 1977, p. 4). In linear cVR, this process keeps its character even though acquires a new dimension: the omnidirectional image and sound. The photo-fragments compose a visual sphere in which the vision will be enclosed, while spatial audio creates an auditory landscape (Vosmeer and Schouten, 2017); placed one behind the other, these elements create a living space. The shot or frame, which is the minimal narrative unit of cinema, in cVR disappears, while the scenic-space as a whole becomes the minimal narrative unit. Thus, the scenic-space can be designed by the creator, who choreographs various spatial *audio-visual counterpoints* (Eisenstein, 1997). Although the scenic-space is frameless, human vision naturally frames space: the linear montage of each fragment of the sphere is a task for the interactor to do.

The audiovisual counterpoints designed by the creator go beyond the "storytelling process involving agents and actions, establishing a dialogue with iconographic traditions, ancient and modern" (Xavier, 2007, p. 337). Ismail Xavier in "Historical Allegories" (Xavier, 2007, p. 337) recognizes two creation-reading axes for the *Primo* status of cinema that can be perfectly applied to the omnidirectional scenic-space, as the minimal narrative unit of cVR: (1) The horizontal narratological succession of shots to create specific space-time structures of action and (2) The vertical relationships created by the interaction of image and sound, or by the intertextual connections between the film's pictorial composition and cultural codes deriving from painting and photography.

The concept of montage in cVR shall not be intended just as a post-production event but as an activity that unfolds during screenwriting, production and post. In this sense, we can understand montage in cVR on three levels:

1. Creator's montage of what happens within the scenic space, that is, the choreography of all the sensory stimuli;
2. Creator's montage of the *space-after-space.*
3. Interactor's montage of the *frame-after-frame* within the frameless image; and interactor's montage of *space-after-space* within the interactive structure.

By making the typical comparisons between cVR and its predecessors, we can wonder if a new interpretation of montage could be the basis for the understanding of the cVR language, as it happened with cinema. In cinema, montage was not only the meeting point of the inheritance and tradition of other arts, but the element that later would have created its language. In VR, the cinematographic montage, carrier of the genes of the theatrical montage and of certain literary structures, is undoubtedly an important gene of VR genealogical tree. Eisenstein locates the issue of the meaning-creation in cinema in his "conflictive" interpretation of montage:

> "By what, then, is montage characterized and, consequently, its cell ~ the shot?
> By collision. By the conflict of two pieces in opposition to each other.

By conflict. By collision."
(cited in Fischer, 2007, p. 75)

It is worth wondering how these collisions occur within the cVR scenic space, and in which way. Fischer quotes Eisenstein *Film Form: Essays in Film Theory* (1977) when he spots the legacy of theater -especially Japanese- and literature in cinema. Both ancestors of cinema are reflected in the differentiator feature of the emerging art: *montage*. Eisenstein describes in *Dickens, Griffith and the Film Today* (1977, p. 195-255) the legacy of Dickens "parallel action" writing method in Griffith's montage practice, which would then lay one of the main foundations of nowadays film montage. The artisanal craft of cutting and pasting images one after the other was the cinema's *plastic sharpness* that "very soon became sensed as some sort of a "language" [...] Attention was gradually shifted from curiosity concerning excesses towards an interest in the nature of this language itself [...] Thus the secret of the structure of montage was gradually revealed as a secret of the structure of emotional speech." (Eisenstein, 1997, p. 248-249).

Today, VR lives the same period that Eisenstein described for cinema. The attitude of the world towards VR is closer to what Eisenstein called a "curiosity concerning excesses". The efforts of most VR researchers some way ignore the generalized skepticism and continue to deepen in the gear of this new language. "If the art of cinema consists in everything that plastics and montage can add to a given reality" (Bazin, 2004, p. 26), the art of VR consists in the reality that human perception and computers can build together. This time, the montage of the perceptual stimuli keeps the structure of the emotional speech unrevealed, perhaps not in the form of discourse, but of mere, immediate emotion. In this abrupt change of paradigm that asks us to disconnect from the known reality, some skepticism is understandable. Nevertheless, Manovich (2005) points out that there is nothing to be afraid of because "the relationship that exists between the structure of the digital image and the language of the contemporary visual culture is characterized by the same dynamics" (p.285) and that even in the new media narrations persist. This thesis approaches Cinematic Virtual Reality in its

epistemology, as a conceptual and aesthetic bridge towards this (probably imminent) post-symbolic future.

3.2 Space Vs Time: Vertical and Horizontal Montage

There are two abstract components that represent the space-time dichotomy posed by VR nature: the spherical digital *image-object* (Diodato, 2005) in its quality of frameless visual medium and the indisputable linearity of time. Within the sphere, a multiplicity of events coexists simultaneously, while each event unfolds a change of state in its own independent temporal sequence. This is the same paradox of Borges' *Aleph*[25]:

> "What my eyes beheld was simultaneous,
> but what I shall now write down will be successive,
> because language is successive.
> Nonetheless, I'll try to recollect what I can."
> (Borges, 1945)

From the point of view of the human that observes the sphere, the idea of missing something is already a preconceived agreement. In our experience of agency, we choose what to pay attention to, within the sphere we choose what to see, even though we choose based on mechanisms we ignore. "Choices are actions, and they are often determined by processes of which we are unaware" (Holton, 2006). In the meanwhile, other multiple events are happening; to this quality of the visual sphere, the term *Image-event* was coined (Diodato, 2005).

This multiplicity of visual events has created some controversy among filmmakers and video makers entering VR. They feel that they are losing control of their story by losing the frame.

[25] El Aleph, 1945. Translation by Norman Thomas Di Giovanni in collaboration with the author. http://web.mit.edu/allanmc/www/borgesaleph.pdf

This generalized feeling agrees with André Bazin's thoughts when referring to the power of cinema upon the spectator: "through the contents of the image and the resources of montage, cinema has at its disposal a whole arsenal of means whereby to impose its interpretation of an event on the spectator" (Bazin, 2004, p. 24). However, this control freak attitude should be abandoned by creators. In VR, the concept of authorial narrative control acquires a whole new interpretation. Through its spatial audiovisual sign, VR arsenal of means does not try to impose a visual interpretation, but on the contrary, it releases multiple possibilities. This authorial narrative control travels along different dimensions. A first step in enlightening this new interpretation passes through the unravel of the aleph paradox. To do this, it is possible to apply Eisenstein's theorization of Vertical and Horizontal montage, as shown in Figure 6.

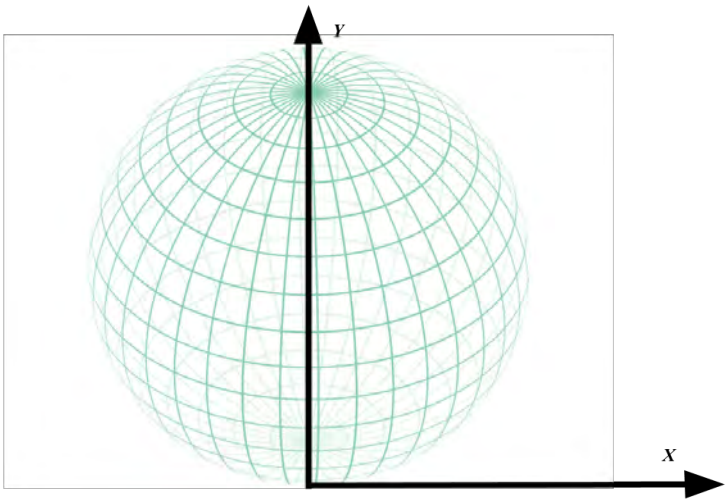


Figure 6. Vertical Vs Horizontal montage in cVR.

According to Eisenstein the *Vertical* montage corresponds to the "inner synchronicity between picture and music" (cited in Afra, 2015), while the *Horizontal* montage is the temporal juxtaposition of images, and the relationships produced by them. In Figure 3.1, the Vertical Axis (Y) crosses the sphere, while the Horizontal Axes (X) represents the linearity of time. Christian Metz, in his aim to develop a *Semiotics of Cinema* (2007), referred to the Syntagmatic and Paradigmatic categories to specify the relationships that emerge between

signs. A *syntagma* is a unit of actual relationship, while a *paradigm* is a unit of potential relationship. *La Grande Syntagmatique,* or The Large Syntagmatique Category, "is the organization of the major actual relationships among units of relation in a given semiological system (these relations may be potential ones, but they are not paradigmatic, because they are actualized in analysis)" (Metz, 2007, p. xiv). These concepts can be applied to linear cinematic VR, because in a single shot, multiple visual and auditory signs can be arranged in vertical montage that constitutes a syntagma, while the large *Syntagmatique* category takes into account what unfolds shot after shot, and space after space, on the horizontal axis. Paradigm, on the other hand, finds an actual representation in IFcVR, as a single scene-space can be replaced with another.

3.2.1 Space (*Y*)

The vertical axis montage corresponds to the composition of the scenic space. In cinema, this is a first form of cinematic articulation, which forms the very basis of cinematic process and permits the presentation, in continuity on the screen, of successive photographic frames (Gaudreault & Jost, 2007, p. 58). This montage comprises the cinematic audio-visual counterpoint enhanced by the spatiality of omnidirectional image and spatial audio. The VE can be accessed from a HMD (Head Mounted Display) in sight-only mode, or full body through a CAVE (Automatic Virtual Environment) (Cruz-Neira et al, 1993). In *Aesthetics of Virtuality* (2005), Roberto Diodato explains the virtual image by sorting out its materiality until it can be defined as an environment. In cVR, space is a visual sphere constituted by an *image-object*, the equirectangular frame. As a moving image, when wrapped up as a sphere, the equirectangular video becomes an *image-event.* However, when the video becomes a narrative space, an a theatrical stage, due to the sense of spatiality for both creator and interactor, it becomes a *corpo-ambiente* [environment-body], with an "irreducible alterity", that is, it is an external body that exists beyond use and the sensation of *being-there* (Diodato, 110). The *corpo-ambiente* is the scenario in which interactors and creator's perceptive stimuli come into dialogue. Entering the VE for the first time raises some questions: *Who am I? Where am I? and why am I here?* Regardless of the purpose of the experience, such

philosophical questions will find an answer within the storyworld itself, confirming narrative as an intrinsic characteristic of human experience.

The main feature of a storyworld is its *evenementielle* capacity (Genette, 1972), that is, the capacity of convening a multiplicity of situations, whether as developing actions and events or as potential storylines that can emerge from the combination of these actions and events. Inside the spherical space, although all the *evenementielle* information is happening simultaneously, what interactors see are fragments of the sphere, which is the natural frame that human vision has. This natural frame is the human Field of View (FOV). It is measured from a fixed point and slightly varies by facial anatomy. Typically, binocular visual field is 135° vertical and 190° horizontal (Howard & Rogers, 1996). When humans visually explore a space, they build a string of pearls with each frame they choose to watch, in other words, a narrative. Within the FOV, human vision chooses what to focus on, closing again the range of space to put the attention on.

This fragmentation that humans do during the visual exploration of a space will determine the design of the scenic space and the placement of events and elements within it. This events and elements to which people pay attention to are called Points of Interest (POI). This is a concept proposed by Jessica Brillhart, first cVR creator of Google JUMP. She suggests to identify the areas of the video in which the author wants to call interactors' attention. POIs are closely related with interactors' motivation to find human (or human-like) figures. During a scene, the points of interest can move through space forcing interactors to move around to follow characters' actions. With spatial audio, a POI can also be auditory and located in space in correspondence with the sound source. Multiple POIs can be arranged within a same scenic space and they can also change location or alternate. In this way, the narrative becomes a choreography of sensory inputs where time and rhythm define the flow of the story.

Looking for POIs and following character actions within the scene space requires the interactors to move their head around. The interactive feature of HMDs consists in allowing interactors to visually explore the 360º space. This mechanism is realized by tracking head

movements. HMDs can vary depending on how much they allow interactors to explore the space by moving their heads. There are three basic types of visual movements that allow 6 DOF (degrees of freedom): pitch, yaw and roll, which plots your head in terms of your X, Y and Z axis to measure movements forward and backwards (pitch), side to side (yaw) and shoulder to shoulder (roll).

However, in VR and cVR, a very old concept comes alive again and stronger: the horizon. Human experience needs to recognize the physics we live in, in order to feel a new VE as real. At a visual level, the first element that we perceive in order to recognize space is the horizon line. From a physical point of view, the awareness of the horizon gives us stability and the reference to recognize distances, giving a sense of perspective. The construction of any VE starts from the setting of the horizon, and according to it the location of POIs and their movements. If it is not a desire effect within the narrative, the lack of the horizon causes motion sickness and spatial disorientation.

Once the horizon is set, POIs and actions can be composed within the scene space in relation to the eye of the interactor. Distances from the eye of the interactor can give a different meaning or importance to the POI. For instance, a POI located 5m -or less- from interactor's eye will be easy for the interactor to observe in detail, while a POI located 20m from interactor's eye will be seen less clearly. The distance from the camera to the POIs' locations can therefore correspond to what in cinema are the different types of shots.

When fictional events are (re)produced in the cinematic *corpo-ambiente*, the *image-object* is the interactor's access to the storyworld. In the same way, the pages of a book are the interface between the reader and the virtual (story)world contained in the narrative, the set of the elements is a cinematic interface of the creator's virtual world. The cinematic interface is what differentiates cVR from VR.

3.2.2. Time (*X*)

The organization of time is an inescapable part of the construction of any film (Williams, 1980, p.12). In this proposal, time is represented with the horizontal axis (*x*), as each version of the sphere, and what happens within it, is placed in a sequential timeline. "We know less about time than anything else" wrote Tarkovsky (cited in Skakov, 2013, p. 1) engaged into complex philosophical and physical thoughts about the fourth dimension. Time in cVR exercises the same function that it has in cinema, as cinema is positioned between still image and a theater with no stage. According to Metz (2007) "Film is given a middle position between photography and theater [...] film gives us images only, whereas a play unfolds in real time and real space" (p.12). As in cinema, the differentiating element between cVR and a 3D model is temporality.

Time in narrative has always been a complex issue; it is not different when creating VR worlds. Time is the factor that distinguishes a description (that creates space in time) from narrative (which creates one space in another space) (Metz, 2007, p. 18). The sphere and its omnidirectional and contemporaneous visual nature is opposed to the linear and directional nature of time executed by human experience and the cognitive logic of the human organizer of that experience in a sequence of events. In narrative, time is understood in its duality: the time of the signified or story-time and the time of the signifier or discourse-time (Metz, 1974, p. 18). While story-time travels independently, the X axis relates to the discourse-time. In cinema, it arises from the activity of sequencing called montage, a procedure that filmmakers have been using to tell their stories (Gaudreault & Jost, 2007, p. 58).

Discourse-time operates a central role in determining the rhythm, narrative tension and the *evenementielle* density of the discourse, elements that influence the aesthetic perception of the story. Discourse-time in cVR is related to cinematic time and its duality. Keeping Eisenstein terminology, we can use again the vertical/horizontal duality. Vertical Time relates to the time in which actions occur simultaneously within the scene-space, while

horizontal time regards the sequentiality of shots, scenes, sequences, and, in Interactive Fiction, to the sequentiality of the Narrative Units chosen by the interactor.

The narrative instance is organized as a sequence of signifiers that has a certain duration (for the literary narrative, the time it takes to read it; for the cinematographic narrative, the time it takes to see it, etc.) (Metz, 2007, p. 19). In computer-based narrative experiences, discourse-time acquires an ulterior layer: the HCI-time, which is the time in which the human-computer interaction happens. HCI time presents a duality: (1) interactors' time to coordinate perceptive stimuli with the story development and (2) system's time to process interactors' input and give feedback. In optimal conditions, this exchange should not present obstacles by systems' delays. If the interactors have to make conscious decisions, they must have enough time to process information and to think about the decision to make. In the case of unconscious decisions, the system should be able to read interactors' physiological data and change the course of the story in a short time, so as it does not affect the flow of the experience. For both cVR and IFcVR, Figure 7 presents the time duality mentioned above: Cinematic Time Duality and HCI Time Duality. Cinematic Time and HCI time work in a codependent relationship due to the interactor's ability of building her own discourse by choosing what to see within the sphere, and which hotspots to activate in the case of IFcVR.

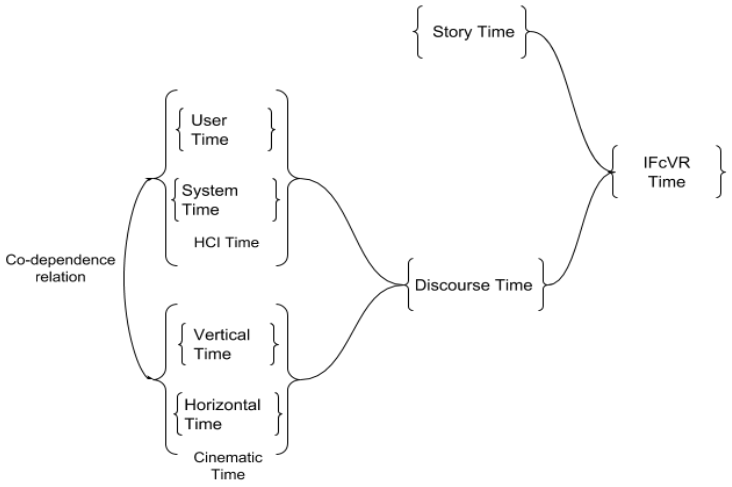


Figure 7. Time in IFcVR.

3.2.3 From the *KinoGlaz* to The *All Feeling Eye*

Vertov's masterpiece *Man with a Movie Camera* (1929) marks the beginning of a new relationship between man and the moving image, where the role of the camera is no longer recognized as an external and mechanical element, but as an organic element that does not need further action mediations to transmit the phenomenology of the act of seeing and constructing meaning through the sequentialization of images. The identification and recognition of the chamber as an autonomous entity, the Kino-glaz or Kino-eye, "is directed towards the creation of an authentically international absolute language of cinema on the basis of its complete separation from the language of theater and literature" (Vertov, 2004, p. 318). In VR the concept of Kino-eye acquires a new level of meaning. The user experience is lived through a dual device (hardware-software) that tries to simulate the natural mechanics of the human eye. However, at the level of reproduction of the experience, the mechanism of visualizing the sequence of images is similar to filmic phenomenology, to a "cinematographic process directed by oneself […] giving rise to a disembodied mind-eye capable of experiencing mental products that appear as sensitive only by means of technological prostheses" (Diodato, 2005, p. 8). In fact, there is no big difference, in perceptual terms, between seeing *reality* or a *virtual reality*: "for H. Sapiens, space-time is the desktop of the interface and physical objects are icons on the desktop. The shapes and colors of physical objects resemble objective reality no more than the shapes and colors of desktop icons resemble files in a computer" (Hoffman et al, 2015).

The Interface Theory of Perception claims that our perceptions are not veridical reports of reality, the relationship between our perceptions and reality is analogous to the relationship between a desktop interface and a computer (Hoffman et al, 2015). In this sense, it is possible to understand the experience of the virtual world in the same way we perceive the real world. From a Narrative point of view, in which we organize experience as a sequence of events, it is possible to conceive the experience as an extension of the experience of the film viewer" (Diodato, 2005, p. 110). In both cases, on VR, the Kino-eye as a technological prosthesis is not limited by the visual aspect. Keeping the image as central core, the Kino-eye expands

itself and includes in its perceptive nature the other senses. Depending on the technical complexity of the interaction design, the Kino-eye becomes a sort of Eye of Horus, that not only *sees* but *feels* everything. This symbolic eye represents the unification of all senses in our construction of the world. Some storytellers[26], use the Eye of Horus as the icon that represents the interactor on the storyboard of VR experiences. The *all-feeling-eye* presents itself in contraposition to the *all-seeing-eye* (Koenderink, 2014) while at the same time enhance the conception of the KinoGlaz in its search for the *KinoPravda*, which is the truth that cannot be reached by the naked eye.

Even though for Vertov the concept of KinoPravda wanted to bring up the social realities, the conceptual weight that Vertov gave to technology as a mediator between the eye and reality unleashed another series of questions that delve into the concepts of reality, credibility and perception in the film image.

The impression of reality has been one of the main issues of VR as it is for cinema (Bazin, 2004; Metz, 2007). The core activity of the technological development of VR has been to recreate with the highest possible level of fidelity the nature of human sensory perception. A large number of studies in VR focuses on testing the level of presence, immersion and agency within VE. The outcome of these studies has shown that the more natural is the quality of the visual experience (in the organicity of the human eye physics together with the visual refinement of the virtual environment, its objects and agents), and the more numerous the sensory stimuli (haptic, auditory, olfactory), along with a fast interaction with the VE, the greater the level of presence, immersion and agency of the interactors' experience.

Metz finds in motion the distinction between object and copy "because movement is never material but is always visual, to reproduce its appearance is to duplicate its reality [...] In the cinema the impression of reality is also the reality of the impression, the real presence of

[26] https://external-mxp1-1.xx.fbcdn.net/safe_image.php?url=https%3A%2F%2Fs3.amazonaws.com%2Fstatic.oculus.com%2Fwebsite%2F2016%2F06%2FFigure0.png&_nc_hash=AQBUURZGMww2hhM6

motion." (Metz, 2007, p. 9). Metz goes further by noticing that movement is insubstantial, and that we relate our feeling of real with its quality of being tangible. This is what the *all-feeling-eye* looks for: the materiality of the virtual reality. A dream pursued by cinema, towards which, however, it recognizes its impossibility. "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 kinesthetic experiences" (Arnheim, 1957, p. 102). Even in 3D films, spectators when watching a film do not confuse the space of the film accessed by a display with their own space (the movie theater)[27], in the same way they do not confuse a film with a real theater spectacle. In *event-based* arts or narrative arts -to use Bazin terminology- the perception of reality requires interactors' affective, perceptive and intellective activity; furthermore, the KinoGlaz through its plasticity finds the *truth*. It is worth asking to what extent will interactors be able to distinguish reality from spectacle in VR or cVR? The answer of Bazin (2004) referring to cinema highlights again its link with cVR:

> "It is montage, that abstract creator of meaning, which preserves the state of unreality demanded by the spectacle" (p.45).

The concept of the *all-feeling-eye,* as the KinoGlaz did, poses interesting questions that go beyond its technological nature and enter into the field of narration in its objective to seek the sensation of the real. We can consider the *all-feeling-eye* as the mediator between the virtual (story)world and reality, the receiver of the articulation of all the systems that interactors perceive, the cinematic form of VR.

[27] Albert Michotte van den Berck called it "segregation of spaces": The space of the diegesis and that of the movie theater (surrounding the spectator) are incommensurable (Cited in Metz, 2007, p. 10)

3.3 The Issue of the Point of View in cVR

For the ordinary person in everyday life, sight is simply a means of finding his bearings in the natural world (Arnheim, 2009, p. 42). The same happens in novels: "when a novel begins with "I am alone here, now, sheltered", the reader immediately asks: who is this "I?", when is "now" in the story? and what defines "here" and being "sheltered"?" (Gaudreault & Jost, 2007:47). In narrative arts, no matter its sign system (verbal or audiovisual), there is a process in which the story becomes discourse. During this process, the creator chooses someone to delegate the mediation of the discourse, especially in fictional narrations (Hühn et al., 2009). This mediation on the transmission of the story has been recognized for a long time by narratology as Point of View.

The conceptualization of the Point of View in narrative arts has been a crucial conflict on narratology. The mere term "Point of View", as Genette noted, is not enough to designate so many and so different aspects of the discourse: which is the story, who tells the story, who perceives the story, with whom the viewer feels the story, how much story information characters and readers have at disposal, if they are close or distant from the main actions. These aspects, among others, make a difference between speaking and perceiving. This theoretical issue depends on which type of narrative art is being analyzed, literature, film or theater, and currently also new media. Depending on each narrative art it is possible to identify perspective, focalization, ocularization and auricularization. Studies in comparative narratology aim to develop a system of categories under the umbrella term Mediation: "Such a system would make it possible to identify features common to all forms of mediation as well as the features characteristic of, and peculiar to, each specific medium and mode of narration" (Hühn, 2009, p. 8).

As we have seen, vision as a human act, by recognizing space and what happens within it, is the core of VR. Vision allows us to understand where we are and at the same time, on a cognitive level, it allows us to understand *who we are* in a certain context. Since this study is

based on a medium whose interface to the VR storyworld is cinematic, studies on cinematic point of view are the closest insights that lead the understanding of this topic to the effects of this dissertation on cinematic VR. Following this idea, cVR presents itself again as the middle point between cinema and VR, thus these considerations support the definition of a medium-conscious narratology for VR. In this sense, we can find that all VE-builder software in its documentation and guidelines[28] suggest in the very first lines to locate the camera-user at the 0°0°0° position, which means locate the *all feeling eye* at the center of VE. The visual position of the interactors in a distance relation with objects and agents within the VE determines the quantity of visual-auditory information that interactors perceive from the scene-space, and this fact does not deal with the camera position as a *viewpoint* but is a result of authorial decisions in terms of narrative mediation. Hence, interactors can be invited to enter and explore a space, but that does not mean that they are actually agents of the storyworld.

3.3.1 *Discoursivization* in cVR and IFcVR

Narrative is the outcome of a completed process: it is a product (Meister & Schonert, 2009, p. 12). In cinema, this process has been called by Gaudreault (1988, p. 199) "filmic discoursivization". In the dichotomy story/discourse, discourse is the representation of something that is not materially present (Meister & Shonert, 2009), but is virtually present. The filmic discoursivization is developed as a layered activity, as a big orchestration of different expression modes (Gaudreault & Jost, 2007). In cinematographic terms, Gaudreault & Jost (2007) proposed a categorization of who narrates according to the division Vertical/Horizontal montage that has been proposed in this thesis. To what is shown in the Vertical axis, resulting from the combined work of *mise-en-scène* and framing, can be related to what has been called *monstration*. Corresponding to the Horizontal axis, there is a second layer of cinematic narrativity, that is superior to the monstration level, with a function of temporal modulation: the *narrator*. At a higher level, these two instances would be modulated

[28] Platforms as Daydream, Unity, Unreal, Oculus.

and regulated by the filmic *Meganarrator* responsible for the meganarrative: the film itself (Gaudreault & Jost, 2007, p. 58).

At this point, to the role of the *Meganarrator*, it is pertinent to include an extra level, due to the interactive nature of cVR and IFcVR: The *HyperMostrator.* The *HyperMostrator* acts on both vertical and horizontal montage, and it includes the interactive hotspots in the cinematic interface, as well as the decision-making moments within the narrative. The *HyperMegaNarrator* comprises the hyper montage of both vertical and horizontal axes. This last figure, is not included within the Filmic Narrator category, comprised as a function of *Meganarrator*, as it function takes place when the creator delivers part of his authorial power to the interactors. Figure 8 shows the distinctions between the different functions, and the independence between *Meganarrator* and *HyperMegaNarrator*.

In cVR, interactors choose the fragments of the sphere that they want to see and this means to create a sub-sequence within the same shot; this level of interactivity corresponds to the vertical montage. In IFcVR, instead, interactors will choose the path to follow by taking conscious or unconscious decisions, creating the ultimate sequence and therefore their own experience; this higher level of interactivity correspond to the horizontal montage. Hence, in cVR and IFcVR, as in cinema, the *Meganarrator* is the responsible of the grand-image making, while the *HyperMegaNarrator* is the constructor of the final narrative-experience.

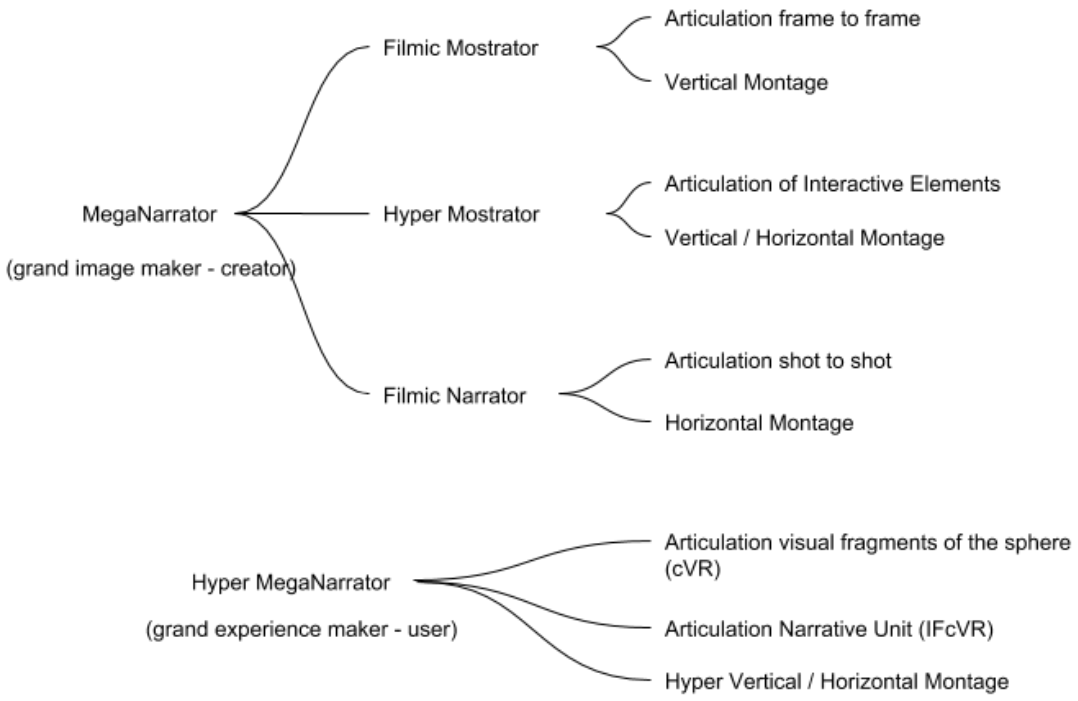


Figure 8. Hyper Filmic Narration in cVR and IFcVR.

3.3.2 The Narrator Type in cVR: A Proposal

"Whether it is a question of cinema or any other form of narrative, it is impossible, without taking useless risks, to do away with the notion of the *narrator*" (Gaudreault & Jost, 2007, p. 62). To understand the concept of Point of View in cinema, Francois Jost and André Gaudreault, in their book *Le Récit Cinématographique,* find a theoretical basis on the concept of *Focalization* proposed for the study of literature by Gerard Genette. Focalization designates the cognitive relationship between narrator and character, it answers the question "who sees?" (1980, p. 186), "who is the character whose point of view orients the narrative perspective," (1980, p. 186) and the "regulation of narrative information" (1980, p. 162). In cinematic analysis, the term point of view is often understood as the *viewpoint,* that is an optical paradigm, while Francois Jost (2004) designates as *Ocularization* the phenomenon that determines both the position of the camera and the vision of a homodiegetic or

heterodiegetic character. “Ocularization has to do with the relation between what the camera shows and what the characters are presumed to be seeing” (p. 74). External ocularization puts the characters before the camera, while Internal ocularization recreates the visual field of the character.

In omnidirectional video, the role of the camera acquires new functionalities regarding Focalization and Ocularization, as the interactor vision *viewpoint* is the same of the camera. Depending on the narrative instance, the production process will vary. In order to locate the camera within the scene-space, the cinematographer needs to know which is the interactor role in the experience. To solve this issue, in this thesis the *Narrator Type* (NT) is proposed. I opted for the term *Narrator* on its distinction from *Focalizator*. The focalizator is the character who leads the narration, who will restrict the narrative to his/her perspective, while the Narrator is the voice that carries through the narrative. As shown in figure 8, the Interactor as HyperMegaNarrator is the final agent on the discoursivization process of cVR and IFcVR. This role is not related to the focalizator but to the narrator.

The NT item indicates who is the viewer inside the scene. The framework proposed by Cleanth Brooks and Robert Penn Warren (1943), used also by Gerard Genette for drawing the concept of Focalization (1976), describes the different types of narrator in literature. Brooks and Warren’s framework offers a simple division of narrator roles, that can vary on the levels of information restriction of the focalizer. However, such restrictions deal with the literary screenplay rather than having an effective role on technical filmic issues. Table 1 presents an adaptation from Brooks and Warren (1943) in which the narrator is replaced by the Interactor of the cVR experience, allowing us to identify four types of Interactor roles inside the discourse. Such role defines how the camera will be placed into the stage, in accordance with the director’s intentions.

	Internal Analysis of the Events	**External Observation of the Events**
Interactor is a character of the story (Intra-diegetic)	1 - Interactor lives her own story	2 - Interactor and main character interact
Interactor is not a character of the story (Extra-diegetic)	3 - Interactor is analytical regarding the story, having access to characters' feelings and thoughts, or having information that is unknown to the characters.	4 - Interactor observes the events without participating

Table 1. Narrator Types in VR storytelling. Adaptation from Brooks & Warren (1943)

The narrator-interactor role in relationship with characters, as noticed in the *Routledge Encyclopedia of Narrative Theory* (2010), seems to present the same difference between narrators and characters, as a matter of hierarchy, function, and representational authority, not of different mental processes. In Table 1, Narrator Types are individuated according if they are *intradiegetic* (they are characters of the storyworld) or *extradiegetic* (they do not belong to the storyworld) in Genette terms, and according to the degree of information that they can get from the storyworld. From the Genettian division between *homodiegetic* and *heterodiegetic* narrator, the distinction of first-person narrator or third person narrator, and the different levels of focalization can be extracted different combinations that regard script and *mise-en-scene* rather than the camera position, or the use of a voice over. However, in VR, interactor as narrator is always homodiegetic, as s/he is constantly building the story around her own experience, no matter who is the focalizer of the narrative.

3.4 Narrative Distance in cVR

If we look around at 360°, we find hundreds of elements that offer information about the world, about reality; these elements can be concrete parts of the ambient, like objects, or perceptive ocular phenomena, like vanishing points and diminishing lines, color, lights and shadows. The arrangement of all these elements make up the situation to which we belong. This wealth of information and the lack of intermediation between us, as interactors of this

“real interface” and the situation that we build by arranging all the elements, is related to the concept of *Narrative Distance* (Genette, 1980). As we have seen before, borrowing concepts from verbal-mediated narratives is not always the best way to go if these concepts are forced into the new medium, however, narratological concepts, as narrative art forms themselves, are in a continuous evolution and adaptation.

In HMD-driven VR, immersion, both perceptive and narrative, is often taken for granted. Reaching a perceptive immersion passes through the system’s ability to link multiple senses to the VE, while a narrative immersion passes not only through the content of the story but through a form that is so natural that is almost invisible. No matter how fantastic it is, there should be no space for disbelief. Classical narratology suggests that the less is the mediation between story and interactor and the less is the feeling of *reading* an artifact, the higher the level of narrative immersion, as “it assumes natural human skepticism when dealing with mediated content” (Lyons, 2016, p. 130), as “with the mediation comes also an unavoidable emotional distance from the events that are taking place” (Harviainen, 2016, p. 112). Narrative immersion in cVR finds interesting insights in classical narratology: the absence of a mediator, the low speed and a large volume of "free" information (Tornitore, 2005). In fact, it is already possible to find these insights in blogs and tutorials about VR and cVR. For example, the Oculus Story Studio (storystudio.oculus.com, 2015) has offered some suggestions based on their experience in creating some of the first high-quality VR short films, related to the concept of narrative distance.

In cVR, depending on the level of authorial control that the creator desires to have upon the narrative, the *filmic monstrator* must know how to guide the experience of the interactors and their montage of the story. Until now, the Holy grail of cVR storytelling has been the dichotomy between interactors’ gaze freedom and authorial control. In other words, how to be sure that interactors are looking in the right direction at the right time, retaining respect for the interactors’ visual freedom?

3.4.1 The Mediator Presence

All discourse presupposes a mediation, but a strong notability of the mediator increases the distance between storyworld and interactor as it can be whether a facilitator of the discourse, or an obstacle in experiencing the story. It is not possible to think that the only act of wearing a HMD eliminates the figure of the mediator, both for fictional and non-fictional VR experiences.

The term *Mediator* indicates all the narrative strategies that the *Meganarrator* uses to guide the cinematic discourse. Again, Genette understands mediation as a two-fold element: mediation on the discourse and the narrator's act of telling. As in cinema, in cVR discourse cinematic elements are included related with the *mise-en-scene,* such as characters and props disposed to guide interactors' gaze; the position and movements of the camera; the insertion of graphics that enrich the scene-space; visual and auditory interactive elements. On the narrator's act of telling we can account the use of a voice over, or audiovisual insertions (texts, animated figures, etc.) that verbally narrates past, present or future events, thoughts or feelings, or instructions.

In cVR, as spatial medium, the mediation in both dimensions (filmic discourse and verbal narration) is also used for instructive purposes, besides the diegetic narration. Some of these functions are:

1. To contextualize interactors in the storyworld.
2. To guide interactors in space.
3. To give instructions on how to live or navigate the interactive experience.

An interesting example can be found in the study of Mirjam Vosmeer and her team, about the use of the voice over in cVR experiences. In the paper *Who Are You? Voice-Over*

Perspective in Surround Video (Vosmeer et al., 2017) they present the results on using first person, second person and third person voice over:

> "Our experiment showed that of the respondents that were given a choice between second and first-person perspective, and second and third person perspective, a large majority (75%) preferred the second person perspective. After the test, [...] many respondents stated that the third person narrative felt more like listening to an audio book, and that this perspective gave them the sense of just having to sit back and listen. Apparently the third person perspective did not stimulate them to engage or to look around, and they did not feel actively involved in the movie. With the first-person perspective, on the other hand, many respondents indicated that they had a hard time identifying with the voice that was telling the story.
>
> With the second person perspective, a majority of the respondents experienced a strong sense of presence. They indicated that, in this version, the visual perspective that was provided by the surround video content seemed to relate closely to the perspective that was given by the voice-over narration. This version also triggered them to look around and actively engage with the surround video content." (p. 229)

Another insight that tries to answer to the main question how to visually guide interactors' gaze into the right event (author[itarian] point of view) is given by the Story Study of Oculus[29]:

> "We tried guiding the audience's view through audio cues. We had a bird fly by the viewer to capture their attention and guide their gaze towards a point in the scene. We also tried to design the set in a way that guides the viewer's gaze to the

[29] https://www.oculus.com/story-studio/blog/5-lessons-learned-while-making-lost/

right areas. However, each time we implemented one of these dictatorial tools too heavy handedly, the storytelling started to feel forced, staged, and artificial.

To embrace VR as its own unique medium, we have to let go of our almighty control of what the audience sees. Instead of instantly pushing the story onto the viewer, we take a step back for a while and let the viewer take part in discovering the story themselves. We call this "The Letting-Go".

By not forcing the viewer to look somewhere and making the surroundings interesting in all directions, we incite the viewer's curiosity in the world. And through this curiosity, have them take a more active role in experiencing the story. We give the audience time to look wherever they want and get used to where they are. Then, after 40 seconds or so, a time we felt was enough for most people to feel settled and relaxed, we start utilizing things like the bird to get the audience's attention back. But by now, because we gave them time to settle in, they are willing to listen to us."

The more information without a mediator, the greater the narrative immersion (Tornitore, 2005). This statement by Tornitore referring to literary narratology also applies to cVR, with a twist: the presence of the mediator will be more notorious, especially in spatial and interactive environments where the interactors need clues and guides that allow him to build the experience. However, the less invasive and authoritarian is this mediation, the greater the sense of agency, and therefore, the immersion.

3.4.2 *Evenementielle* Density and Discourse Speed in cVR

This last advice from the Oculus team offer two special insights related to the two last components of Narrative Distance:

***Evenementielle* Density (ED):** "To make interesting surroundings in all directions"
Discourse Speed (DS): "To give the audience time to look and get settled in"

These two components have been placed together since they are closely related. The greater the amount of visual and auditory information in all 360º, the longer the interactors will need to be able to perceive and understand the information within the storyworld; therefore, the speed of the filmic discourse will be slower.

In cVR, a VE with few information around can be perceived as empty. Emptiness without a narrative purpose can generate boredom, a feeling of being lost, and even anxiety. The Evenementielle Density refers to the number of audiovisual stimuli within the VE, including diegetic and extradiegetic elements, and it is also related to the Points of Interest (POI). However, not all the audiovisual stimuli that enhance the ED are necessarily Points of Interest. POIs instead, are those special elements move the story, being on top of the *evenementielle* hierarchy of ED. From a cognitive point of view, interactors, as *HyperMegaNarrators*, unite and give meaning to the elements they find, whether they are related to the story or to the discourse. In this sense, all these elements play an evenementielle role, since the cVR is in itself a *corpo-evento* and interactors are narrating their own experience. The ED needs are regulated, as the POIs are choreographed in order to give space and time to the actions (carried out by characters), that push the story forward.

A great density of audiovisual information means a slowdown both in the Narrative Time and in the HCI Time. The decrease in discourse speed induces the interactors to a greater participation, either because the increase in the flow of information requires an active participation in recognizing and semantically connecting the audiovisual signs within the experience, or because the decrease in discourse speed is understood by the interactors as the request for greater attention in the presence of an important moment of the story, without forgetting the reactions of intolerance produced by long descriptions.

The regulation of both ED and DS are subject to the creator's narrative intentions, and there is no mechanism or rule to follow. As it is highlighted in the article "The Storyteller's Guide

to the Virtual Reality Audience"[30] (2016), Kate Newton developed some experiments on the design of the scene-space and noticed that few visual information can generate three cases:

- When the audience has limited visual information, they will work twice as hard to make meaning out of every detail they see.
- If something doesn't correspond to their expectations, it takes them out of the experience.
- It sends them into detective mode, investigating the scene from a distance.

An interesting debate raises concerning what is called an event in a spatial medium: a moment in a given scenic space in which "nothing happens" can be an event? or in narratological terms is it just a description?

3.5 The Scene-Space: Back to Theater

Cinematic VR finds itself opening on a new space between cinema and theater. The history of these two narrative arts have always been interlaced, not only by the connection that cinema has with theater as its predecessor, but also by the intermediality that have emerged from the contaminants that cinema have had in theater. A first approach can see the relationship between cVR and theater as a legacy brought from the cinema. However, this relationship moves in a very new spectrum that cinema, due to its nature, could not explore. Cinematic VR, as the recorded image/sound of the real, steps back and, in that audiovisual medium, gets in touch with space in a way that cinema cannot do. During its history, cinema developed a new conception of stage, choreography and performance, being forced to cut the space into frames. Cinema composes space by delivering fragments that interactors must arrange in their heads.

[30] https://medium.com/stanford-d-school/the-storyteller-s-guide-to-the-virtual-reality-audience-19e92da57497

Some of the main distinctions between cinema and theater are pointed out by Pudovkin. For him, “the theater director works with reality,” while the film artist’s “active raw material is no other than those pieces of celluloid”; hence, film craft is more plastic and material than theatrical art. Pudovkin also recognizes that, due to editing, screen acting requires a different skill from that of the stage (Fischer, 2007, p. 69). These two first distinctions take us directly to what Cinematic VR does differently from cinema, even though both are based on space. cVR delivers the recorded moving-image of what happens inside this scene-space, hence going back directly to theater itself. As in theater it is the duty of the director to interpret the content of the dialogue, for the eyes of the audience through color, shape, and motion, through the appearance and gestures of the actors, through the spatial organization of the setting and the way the bodies move within this space (Arnheim, 2009).

We can divide the setting of the cVR’s scene-space into two components: (1) the one related to the location and (2) the one related with the performance within the location.

3.5.1 The Scene-Space Design

The Scene-Space Design is the composition of the scene-space as location, and this composition is developed as a two-fold structure: The Scenic Space and the Spatial Space. The Scenic space is related to the *Evenementielle* Density, it includes all the elements that creates the diegetic space and the organization of these elements in relation with the camera, so its positioning respects the comfortableness of vision. The scenic space takes into account the order of the POIs and the evenementielle hierarchy of all the visual and auditory stimuli.

The Spatial Space, instead, is related to the laws of physics and the positioning of the all-feeling-eye (the camera) within the scenic-space, creating a comfortable environment for the interactor, so as to avoid vertigo or nausea. It takes into account the horizon and the interactor role (NT) within the experience, in order to locate camera, lights and microphones, not only in relation with the narration but in relation to the feeling of presence.

3.5.2 Direction on Set

The direction role in cVR is a mixture between the director in cinema and theater; it manages the direction of the events that are taking place on the stage. Tarkovsky regretted that "a vast number of clichés and commonplaces, nurtured by centuries of theatre, found a resting-place in the cinema" (Tarkovsky, 1987, p. 24). He referred specifically to the concept of *mise-en-scène*, and argued how this concept was a simplistic way to express the idea of a scene by giving it the depths that the meaning requires, a "violence to the living texture of the artistic image". His plight was to conceive the *mise-en-scène* not only as the design made up of the disposition of the actors in relation to each other on set, but as the scene construction that is built with the life, beauty and the emotional and psychological states of the characters.

The *mise-en-scène*, in Tarkovsky terms, does not make a distinction between theater, cinema or cVR; it is about transmitting emotions and beauty, as he said. This entails a synergy between directors and actors. As regards cVR, acting and direction are rather related to theatrical acting methods, that needs a different approach to corporality and expression of feelings. Even though it is possible to locate the actor very near to the camera in order to create a close up shot, in most cases the actor will move around the stage in a way that interactors can perceive almost the actor's entire body; there will also be cuts that switch from American shot, to close up shots of facial expressions, as it happens in cinema.

The fact of being able to perceive the body of the actors in relation with one's own body changes the approach of director and actors regarding the camera and the performance, establishing a distance, for director, crew and actors, between cVR and cinema. In cVR, everything happens around the *all-feeling-eye*, the camera; according to the "Narrator Type", the performance will involve the interactor as part of the diegetic space or not. Thus, there is effectively a disposition of the bodies and actions on the stage which follows a theatrical corporality, that keeps a cinematic role for the camera.

However, just as Cinema, cVR is also plastic and material. As a recorded image, cVR keeps a fourth wall or a FUI, even though it is shot in a theatrical way, that can even generate some level of alienation between the new generation of filmmakers without knowledge of theater's stage management.

3.6 The Actor Presence

Christian Metz pointed out a main difference between the theater actor and the film actor: "The bodily presence" (Metz, 2007, p. 10). This turns to be also the difference between the film actor and the cVR actor. In general, in films, television and videos we cannot fully realize how tall or thin the actors are. In VR and cVR in general, some of these features are not yet very noticeable due to the state of technology, but we can measure and feel the corporeality of the actors in relation to our own.

The materiality of the human body, especially in cVR films made with 3D stereoscopic video or volumetric video, and even animated characters in 3D, enhance the willingness of belief, the feeling of realism and presence. These sensations are related with the self-consciousness of being bodily in the world (Legrand, 2007). This self-consciousness applies not only on experiences in which interactors are "embodied", which means that they actually can see a body that belongs to them in the VE, diegetic or extradiegetic. In some cases, when interactors do not have a physical body within the VE, the sensation of being a human being passes through the corporeality of the characters and the dimensions of the objects and elements that form the VE. Legrand (2007) argues that "the fundamental form of self-consciousness cannot rely on self-specific information. It rather relies on self-relative information, information about the world that is relative to the self/body" (p.514).

It is possible to account two dimensions on the role of the actor in cVR:

1. The performative act during the production.
2. The relationship between character(s) and interactor during the experience.

The first dimension is related to the disappearance of the frame, the performance for the cVR moves away again from the cinematographic logic and turns towards the logic of the theater. This theater method is reflected in the management of the stage and the ability to deliver long and coordinated performances. In some cases, the different types of cinematography shots (i.e.: close-ups, American shots, etc., unlike high angle or low angle shots that depend on the height of the camera) are reached by the distance of the actor from the camera, thus it is the actors' jobs to move across the space in order to express the semantic meaning related to the cinematic different types of shots, within the scene-space. During the production, the cuts in a scene are very rare, so actors have to perform in what cinema calls "Sequence Shots" in which actors are asked to deliver for long times and in perfect choreography. Actors must also be aware that there is someone else in the scene, the interactor. Especially in cases where interactors play a role in the story, actors must involve them in the scene, and sometimes address them directly.

The second dimension is related with the cinematic interface of cVR. Unlike computer-generated VEs and computational agents, in cVR interactors cannot interact in real-time with the characters. In this sense the cinematic nature of cVR predominates and works in the same way cinema does. "Metz argues that the cinema installs the spectator in a situation in which his gaze is inoculated from reciprocal awareness. Spectatorial voyeurism is further promoted by the keyhole effect of the screen which suggests we are looking through an aperture/apparatus upon the actors" (Allen, 2007, p. 130). This sense of spectatorial voyeurism, even though this may seem a conflictive term, could be the hidden weapon that can develop the potential of cVR.

When producing an Interactive Fiction in Cinematic Virtual Reality (IFcVR), the actor role acquires a new nuance. The actor performance influences the decisions that interactors will make in her task to assemble the filmic discourse. Within the IFcVR, we can identify two main types of actors:

The Avatar Actor: Interactor's decisions will have direct consequences on the future of this character (or characters in the case of a narrative with multiple focalizators). This type of character drives the narrative. The avatar actor takes the feeling of empathy and identification of the interactor to a higher level. The fact of being a character subject to the decisions of the interactor requires the actor to perform with certain characteristics of a videogame character, giving gestural signals to the interactors about his state of mind. He also accepts his destiny, and this "docility" must be reflected in his performance.

In the pilot implementation Zena (that will be described in detail in the second part of this thesis), from an artistic point of view, Lorenzo, the actor playing the main character, suffered the fact of not having a strong character. According to him, he had to interpret an empty character to be filled in by the interactor. Actually, "an avatar character", he said (Fig 9).

The Non-Playable Actor: Non-playable characters are characters that belong to the storyworld on a secondary level, but fundamental for the development of the story, with the difference that their story does not change based on interactors' decisions. The non-playable actor in any case will have to interact with the avatar actor(s), and likewise will have to respect the interactors decision-making time, and in some cases it may be the trigger for a certain decision or present alternatives that will have consequences on the development of the story of the avatar actor (e.g.: they can give advice, need help, etc.).

Figure 9. Lorenzo, ZENA's protagonist and avatar character, during a decision-making moment.

Chapter 4. Interactive Fiction in Cinematic Virtual Reality

4.1 Bringing Interactivity into Cinematic Virtual Reality

While current research is focused on unveiling the film language and production methods of the linear Cinematic Virtual Reality (Tricart & Mendiburu, 2017), cVR still offers a limited level of interactivity if compared to what VR can actually reach. It is fascinating to be "present" inside the scene, and excellent results can be achieved if cinema's *spectatorial voyeurism* is enhanced in cVR as well as the contextualization of the immersive filmic work with performances in real spaces. However, an extra level of interactivity to the filmic immersive experience can overcome the incongruence generated by being immersed and having little agency within the scene-space. Through the implementation of an interactive fictional narrative structure, interactors can manipulate directly both the course of the story and the discoursivization of the filmic experience, besides looking at the omnidirectional image.

Interactive Fiction in Cinematic Virtual Reality (IFcVR) can be defined as an Interactive Digital Narrative (IDN), placed at the intersection of Interactive Fiction (IF), the computer-mediated interactive fictional narratives and Cinematic VR (cVR), the creation of virtual experiences that have a cinematic interface: 360º video (stereo and monoscopic), 2D 360º

animations, 3D 360º animations and video, volumetric video in 360º VEs. cVR is distinguished from VR by not allowing the interactors to modify the VE or to interact with its agents in real time. In cVR, interactors can only observe the VE and activate interactive objects overlaid upon the interface. Even in 6DOF[31] cVR experiences, the cinematic interface does not allow user manipulations. It is a fixed and finite object. It is after all an enhanced film (or video) experience. Although the reception of the IFcVR passes through the cVR aesthetics, a non-linear narrative structure offers the possibility of counteracting the limited interactivity of the cinematic interface. In IFcVR. interactors can manipulate the transmission of the discourse by making decisions that modify the course of the story, stimulating their interest in repeating the experience to look for missed details or discover different endings.

In this Chapter, I will approach the narrative definition of the IFcVR, through the analysis of the convergence between interactive cinema, interactive fiction and cVR. Starting from the hypothesis that IFcVR should be the type of filmic experience of the VR, the creation of IFcVR goes through the integration of the latest developments in Human Computer Interaction. The innovation in connecting the story with the different ways of interacting with it would be the key to success of an IFcVR experience. Possible interactive structures and today's HCI possibilities are presented in order to display the spectrum of possibilities of interaction between human and narrative in cVE. Regardless of the types of interaction, I reaffirm the IFcVR as a narrative form, following the thought of Seymour Chatman, and consequently as an IDN, through the adoption of the latest advances in the field of IDN.

4.1.1 The Interactive Film

The idea of creating an interactive film experience hybridizing it with other analog media and art forms is old as cinema itself. It is not a fashion that came along the digital age. Yet, when researching about interactive cinema in books, journals and conferences, or just by googling it, one word jumps above all the others: *Kinoautomat*. This is an interactive cinema

[31] http://www.onsetfacilities.com/virtual-production/360-6dof-volumetric-vr-video-technologies-reviews/

created by Raduz Cincera in Czechoslovakia in 1967 and presented at the Expo 67 in Montreal. Kinoautomat was designed to screen a 35mm film with numerous narrative pathways in which the audience voted the alternative paths for the film. This voting system "brought a novel democratic aspect to the cinematic experience" (Hales, 2014, p. 143). As Hales notes, Cincera's Kinoautomat was not intended to be a one-screening interactive film but a movie theater for interactive films, a "system designed to function with any non-linear film that had been created correctly for it" (Hales, 2014, p. 153). Years after, at the Osaka "Flower Expo" from April to September of 1990, Cincera presented another filmic interactive experience: *Cinelabyrinth*, a theater with eleven rooms called "show spaces" and a total of 22 (video) projection screens. Inside the Cinelabyrinth, the audience could move from a show space to another watching the sequences that they choose. (Hales, 2014, p. 160-163). In 1992, the LA Times[32] presented an invention as "the world's first truly interactive motion picture, a film in which audience members use their Nintendo-like pistol grips to collectively determine the shape and direction of the action". The interactive film was *I'm your man* (Bejan, 1992) and it worked with Nintendo-like pistol grips to collectively determine the shape and direction of the action, as Kinoautomat proposed. The interactive film, or Interfilm as they called it, promised to be "the most revolutionary technological development in film since Al Jolson ushered in the talkie era with *The Jazz Singe*r in 1927." Just six years later, The New York Times published the article Interactive *Filmmakers Hope to Make a Comeback*[33], noticing the failure of "I'm your man", as Lisa Napoli wrote:

> Ideas that are ahead of their time don't necessarily die. If they're lucky, they get reincarnated as new technologies are invented. Take for example Interfilm, an attempt to create "interactive" films that failed, for a variety of reasons, earlier in the '90s. Its creators hope the concept will make a comeback thanks to the increasing popularity of digital video disk (DVD) technology (Napoli, 1998).

[32] http://articles.latimes.com/1992-12-23/news/mn-2336_1_pistol-grip
[33] https://archive.nytimes.com/www.nytimes.com/library/tech/98/08/cyber/articles/17dvd.html

Two decades later, we know that interactive films in movie theaters, DVDs or browser-based, never got the attention that they dreamed to receive. Nonetheless, the importance of these attempts does not rely only on the fact to change the course of the filmic narrative, but in how it established a new relationship between public and medium, at a time when audiences timidly began to exercise their power over devices and media more frequently and with greater control. In interactive narrative texts, both content and support are constantly shouting to the public: *go ahead, manipulate me!*

We can say that Kinoautomat, as well as Interactive Cinema, are the direct grandfathers of the IFcVR, since they share two fundamental characteristics: the filmic content and the *push-button* logic (Huhtamo, 2014, p. 181). In IFcVR, the filmic content has a new aesthetic form but it still keeps its cinematic interface, and yes, we are simply pushing buttons and clicking options on all interfaces from all devices on the reality spectrum. The name Kinoautomat is in fact inspired by the push-button logic of the "coin-operated drinks vending machine with multiple choices (of drink configurations) by pressing a combination of buttons" (Hales, 2014, p. 145). Nonetheless, the name also reveals a hidden potential of the cinema, something that sounds almost an oxymoron, when the adjective "automatic" is added to the word "cinema". Even though it connotes indirect or limited human control, it refers to a machine or system able to act on itself autonomously.

There is one main difference that marks out IFcVR from Kinoautomat: the individual experience. In Kinoautomat, as in cinema, spectators were "together alone" (Huhtamo, 2014, p. 175) in a physic space where spectators voted the alternatives and afterwards they watched a sequence that they perhaps did not vote. This kind of democracy does not work in new media. In the *one-to-one* relationship user-device, user's decision-making capability, or even just the "clicking activity", is an individual process. This fact has strong repercussions on the concept of spectacle, as a social and collective event, where social and collective translates into "many people in a single space". In this sense, we are living a *metamorphosis of the virtual crowds*, where the connecting point to virtual networks is supplanting corporeal participation in public spaces (Huhtamo, 2014, p. 187).

But the individual logic did not stop the evolution of the hybrid *see/hear* and *choose*, on the contrary it traced its course by finding good ground in computers. The fact that "the mouse was designed for an individual user sitting in front of a computer terminal" (Huhtamo, 2014, p. 183) freed the interactive audiovisual from the chain that had it tied to democracy, and at the same time it accomplished the democratic utopia in which each one can have what they choose. In this way, the idea of Kinoautomat as a theater for interactive films was abandoned, and new proposals that combine cinema and interactivity consist in temporary artistic installations, with no intention of evolving as a unified artistic form. With the massification of the personal computer and afterwards, with internet access, along with the constant evolution of the digital audiovisual supports, a new format emerges: the interactive video.

Interactive video was born as the counterpart of linear playback videos, in which interaction consists in the manual video search, play, stop and pause. In *Interactive Video: Algorithms and Technologies*, Riad Hammoud (2006) presents interactive video as the promise of video formats by offering interactors "nonconventional interactive features, powerful knowledge-acquisition and teaching tools, efficient storage, as well as non-linear ways of navigation and searching" (p. 3). In 2005 YouTube appears, a game-changer in video consumption. Since then, VOD (Video on Demand) web platforms for computers and smart TVs entered the mass market, modifying forever the way in which people consume audiovisual content. Although VOD systems and strategies were already proposed in the 90's, the shift accomplished through internet had a bigger impact. While VOD is a consumption mode (it gives interactors what they want, whenever they want, how many times they want), interactive video is an audiovisual format, it is enriched video content.

Hammoud indicates three definitions of interactive video depending on the complexity of its interactive structure and elements:

> "1. Interactive video is a digitally enriched form of the original raw video sequence allowing viewers attractive and powerful interactivity forms and navigational possibilities.
> 2. Interactive video presentation is a form of interactive video document that is centered on enriched video but is not exclusively video.
> 3. Interactive video database is a collection of interactive video documents and interactive video presentations." (Hammoud, 2005, p. 6)

In recent years, the possibilities of interactive video have aroused the interest of videomakers and web developers, proposing browser-based experiences whose backbone is video, or audiovisual content. Interactive video has also become a tool for storytelling, from which two genres have had a humble success among web surfers: (1) the Interactive Music Video, in which interactivity pushes the boundaries of a groundbreaking audiovisual genre. Some examples are Bob Dylan's "Like a Rolling Stone" or Jack White's "Black Liquorice"; and (2) the Webdoc, proposed as an audiovisual genre by Arnau Gifreu Castells (2013) in his PhD thesis *The Interactive documentary as a new audiovisual genre*[34]. The webdoc moves along the thin line between documentary and journalism, and mixes multimedia content in a browser-based product. It is possible to find great webdocs from independent filmmakers as well as others produced by well-known media conglomerates.

Something interesting about these formats is the change entailed in their aesthetic reception as audiovisual content. In many webdocs, for example, the quantity of multimedia materials, such as text or still images, moves the documentary reception away from the film experience. In these cases, the hyperreading dynamic prevails over the "watching a film" feeling, decreasing the relevance to audiovisual content and giving it to navigation. However, other webdocs and interactive videos propose interactive experiences in which the video content is the core of the experience. This is the case, for instance, of the webdoc *I love your work*; the

[34] Original title in spanish: "*El documental interactivo como nuevo género audiovisual: Estudio de la aparición del nuevo género, aproximación a su definición y propuesta de taxonomía y de modelo de análisis a efectos de evaluación, diseño y producción"*

360º video for browser and HMD *A Way to Go (2014)*[35]; *Turbulence: a Hypernarrative Interactive Movie* (Knoller & Arie, 2009)*;* or the recent *Black Mirror Bandersnatch* (2018)[36].

New frontiers of Interactive Cinema are moving towards the non-conscious interactivity, in which interactors' biofeedback and brain activity change the course of the story. In this way, the final output of the non-linear film is perceived by the interactors as linear, granting the filmic experience, but removing the decision-making process from the experience. Pia Tikka (2008) has called this type of new cinema *Enactive Cinema.* This already differs from interactive cinema by its very name. Enactive cinema is rooted in cognitive-constructivism film theory. According to cognitive-constructivism, "viewers are cognitively active and aware when watching films [...] narrative cinema complex engagement is not due to its simple linearity but to the films' rewarding play with the spectators strive for coherence" (Ben-Shaul, 2008, p. 10). In her web page[37], Tikka explains that while viewers are immersed in the film's narrative, a system called 'Eisensteinian montage machine' tracks their unconscious emotional and bodily responses and modifies the film based on these changes. Following this idea, in recent times research and creation is moving in the direction of enactive cinema rather than of interactive cinema (Ramchurn, Wilson, Martindale & Benford, 2018).

It should be noted that, despite the obstacles, failures and its little recognition, the idea of Interactive Film has been around since the very conception of cinema. The Interactive Film is a content, an autonomous interactive narrative text, independent of its reproduction support, whether it is an interactive cinema with a democratic voting system, a video installation connected to brain sensors, a DVD or a webpage, and it can present a fiction story, a documentary, a mockumentary, or an experimental art film. The divergences among interactive film media (interactive cinema, interactive video, enactive cinema, etc) seem to be rooted in the kind of interactivity that is required from the interactors: whether it should

[35] http://a-way-to-go.com/
[36] https://www.youtube.com/watch?v=XM0xWpBYlNM
[37] http://www.enactivecinema.net/

be a collective experience in a physical space or an individual experience through a desktop computer or a HMD; whether interactors' input should be conscious, stimulating participation and active role during the filmic experience, or if the storyline should vary based on physiological data, without involving interactors' decisions. The common points, on the other hand, are (1) to separate the film, as narrative entity, from the single outputs and from one-time *readings*, and (2) to involve interactors' thoughts and/or emotions in the filmic discourse.

4.2 Fiction meets Interactivity

IFcVR looks for an interactive fiction film experience. The Interactive Fiction (IF) is the underlying narrative structure of IFcVR, in which its interactive feature is the multiplicity of pathways, while fiction is the core of the narrative. Fiction is the essence of a storyworld, whether it is narrated in linear cVR or IFcVR. It is a tough task to recognize fiction from non-fiction, because fiction "represents events, or imitates discourses, that we assimilate through nonfictional modes of narrative understanding, via the mimetic logic of fictional representation" (Walsh, 2008, p. 150). Furthermore, narrative is an artifice, and this fact presupposes that all narratives contain some fiction, because through narrative *Possible Worlds* (Ryan, 1991) can exist. Marie-Laure Ryan calls this theoretical stand the "Doctrine of Panfictionality" (Ryan, 1997). To explain the difference between fiction and non-fictional narratives, Ryan separates the actual world we live in from possible realistic or fantastic worlds created by imagination. In this sense, non-fictional texts refer to the actual world, while fictional texts create non-actual possible worlds (Ryan, 2013)[38].

As Ryan (2011) notes, fiction is based on the pretense to represent reality, not on being a representation of reality. Nonetheless, fiction's reality takes a new form in photography, cinema or video, in opposition to literary fiction. These media capture realities visibly and audibly, defying in a further degree interactors' cognition in separating fiction from

[38] http://www.marilaur.info/illusion.pdf

nonfiction, because fiction films present simulated events relying on the pretense that the actors are the characters. According to Ryan (2011), fiction literature differentiates from fiction cinema, in how we access the storyworld. In fictional verbal language, we hear a report of the events through a narrator, while in film we are looking at the events that someone, the *Grand Mega Narrator* or *Grand Image Maker*, is showing to us. Ryan also notes that this fashion has an alternative: the idea that film is unmediated, and that we feel as a spectatorial voyeur, not as an embodied witness within the scene, but as a "disembodied consciousness that moves around the fictional world as freely as the camera" (Ryan, 2011).

Ergodic Literature (Aarseth, 1997), Interactive Fiction (IF)[39] (Blank & Lebling, 1980; Buckles, 1987; Reed, 2012), Hyperfiction (Douglas, 1999; Bell, 2010), or Text Adventures, are some of the names that have been used to describe the fiction narrative with alternative storylines, in contradistinction to Interactive Narratives or Hypernarratives, that designate nonfiction interactive narratives. Since the advent of digital supports, these terms reflect the intersection between hypertext (Nelson, 1987; Landow, 1994) and narrative: hypertext and fiction. Yet, IF was born before the digital era. Most research on Interactive Digital Narratives (IDN) points at Jorge Luis Borges' *The Garden of Forking Paths* (1941) as the seed of interactive narratives. Even though the tale itself was not an interactive text, it presents the idea of a book that is, at the same time, a labyrinth:

> Ts'ui Pên would say once: I retire to write a book.
> And another: I retire to build a labyrinth.
> Everyone imagined two works;
> nobody thought that book and labyrinth were a single object. (Borges, 1941)

And the idea of multiple futures, forking paths in time, possibilities that give rise to other possibilities, and possibilities that converge in one time:

[39] Mary Ann Buckles 1987 UC San Diego Ph.D. dissertation *Interactive Fiction: The Computer Storygame "Adventure"* was the first book-length academic work on the form. (Rettberg, 2017, p. 34)

> ...the garden of the forking paths was the chaotic novel;
> the phrase *several futures* suggested to me the image of the bifurcation in time, not in space.
> [...] It creates, in this way, different paths, different times, which, too, proliferate and bifurcate. (Borges, 1941)

Afterwards, books themselves became labyrinths, as the narrative artifacts became interactive: the reader had to physically manipulate the book to assemble chapters, segments and pieces of the story. Some examples are: Composition No.1 (Saporta, 1963), Rayuela (Cortázar, 1966), House of Leaves (Danielewski, 2000) or 4321 (Auster, 2017). With the digital support, the *Hypertext Fiction*[40] appears, a genre of Electronic Literature or e-literature. This era is opened by Judy Malloy's *Uncle Roy* (UNIX version: 1986, BASIC version: 1988) and Eastgate[41] writers as Michael Joyce's *with afternoon, a story*[42] (1987) and Stuart Moulthrop's *Victory Garden* (1992). But, as it was the case with interactive cinema, hypertext fictions never had either "an operable business model, nor a significant cultural apparatus" (Rettberg, 2017, p. 174). This fact did not mean the end of interactive fiction narratives. Even though no genre or product really landed on the mass public, something probably better happened: IF established itself as a narrative method and continued to migrate to new digital platforms with new human computer interfaces.

There is a prejudice that eclipses the potential of the IF, that of the gamebook or Choose Your Own Adventure. This idea should be abandoned, as IF "is not a simple "Choose Your Own Adventure" scenario [...] since hypertexts can include hundreds or even thousands of narrative episodes or segments, connected with an even vaster number of links [...] a single work can have thousands of permutations" (Douglas, 2003, p. 24). On the contrary, IF is a theoretical and technical basis for the creation of intricate and complex narratives, which means a great authorial work for the creation of meaningful interactive digital experiences.

---

[40] Also called Hyperfiction
[41] http://www.eastgate.com/catalog/Books.html
[42] It is written with no uppercase letters

With the arrival of faster telecommunication standards, and the development of new and better platforms for VR, MR and AR, narratives will continue in this reformulation path, and IF is one of the main links between narrative and hypertextuality. This is how IF also broke through a format that seemed to be far from novels and books: videogames. This perceived distance, however, could not be more wrong, since all video games unfold in a storyworld, even though they do not obey classic narrative mechanisms. This 'narratology vs. ludology' debate (Koenitz, 2015, p. 3), opened a branch of study within the field of IDN: Narrative in Video Games, also called Ludonarrative (Aarseth, 2012; Koenitz, 2018). Aarseth (2012) in *A Narrative Theory of Games* points out the two main issues at the core of the debate: "*Games*, as a metonymic label, is the wrong term for ludo-narrative software, and that narrative theory, while necessary, is not sufficient to understand these new forms".

In fact, one of the first questions that emerged was if IFcVR would be enjoyed by interactors as a videogame or as an interactive film, as its interactive nature has a ludology component. This question led to the production of a prototype in order to measure if user experience of IFcVR is closer to a videogame or to a filmic experience. During the development of this thesis, some projects that can be considered IFcVR have been published. Even though, a detailed study of each project is not part of the purposes of this thesis, it is pertinent to make a first recognition of what has been done and is being done in this format, or similar. The projects are listed in chronological order, along with the descriptions made by their own creators, in order to spot some common characteristics on their concept. I decided to also include some VR experiences that are described by their creators as VR games, but with a strong narrative component that makes the experience move forward.

> *Way to Go (2014)*[43]*:* "Way to Go is an interactive experience for human beings between 5 and 105 years old. Maybe it lasts six minutes; maybe it lasts forever. Way to Go is ready for your web browser and willing to go VR, if you're Rift-y. It is like a grey squirrel balanced on a branch, fearless.".

[43] http://a-way-to-go.com/

Bear 71 (Browser Hypervideo: 2012; VR: 2016)[44]*:* "The intersection between humans, animals and technology. 20 minutes' length, Bear 71 is the true story of a female grizzly bear monitored by the wildlife conservation offices from 2001 - 2009. Turning the lens of technology on itself, Bear 71 examines the story of the bear through the digital interactive medium, creating a vivid technological interpretation of nature for us to explore, and for the bear to inhabit as she tells her story".

A Perfect Party (Vosmeer & Schouten, 2015): "The movie narrative itself takes place at a party, which has just started when the user enters the experience. In the role of the main character, the user is made clear that he/she is hosting a get-together for the best friend who plans to propose to his girlfriend that night. The success of the party and therefore the proposal depends on user behaviour."

Kept (2016)[45], an interactive VR experience: "*Kept* is an interactive virtual reality journey to free a forsaken soul that explores the path we take when die. It is an experience that was built in 3D animations exclusively for virtual reality using the HTC Vive".

Broken Night (2017) [46] [47], a VR interactive short film: "A woman and her husband return home one evening to discover an intruder. As she recounts the events of that evening to a police detective, the viewer chooses which of her memories to follow. Exploring the nature of memory itself, Broken Night takes the viewer on a psychological journey to uncover the truth of what transpired [...] It was developed through live action 360º video and Eko interactive editing software: viewers use their gaze to direct their choices within the performance-led narrative, effectively shaping the story as it unfolds. Stereoscopic 360 video seamlessly and immediately adapts to

[44] https://bear71vr.nfb.ca/
[45] https://www.s1t2.com.au/blog/virtual-reality/kept-virtual-reality
[46] https://www.youtube.com/watch?v=-1d0sEhxfFM
[47] http://www.brokennightvr.com/

these individualized choices, presenting the viewer with a unique experience that puts them in control of the story as well as amid the intensity of the on-screen action.".

Dark Sides (France, 2017)[48], an interactive VR movie: "this project has been titled 'The Movie You Are The Hero'. It uses the possibilities presented by the interactivity of VR to not only put the player in the driving seat as the hero, but also to let them change the outcome".

Found (2017)[49], an Interactive Virtual Reality Film: "Found is an interactive short film experience. Its story speaks to the connection and lack of, between nature, technology and fellow travelers as you make your way through a fantastical yet familiar world".

Twilight Path (2018)[50]: "A virtual reality fantasy adventure set in surreal realm between the real world and the afterlife. Meet mischievous spirits and gods. Solve puzzles. Restore ancient stone structures. Explore a gorgeous and vibrant world".

State of Darkness (2018)[51]: "In the Enactive VR installation State of Darkness you will find yourself in the prison cell of some unrecognized country, locked up with a distressed person. Your feelings provoked during this encounter are tracked by biosensors, connecting your fate to that of your fellow prisoner."

Tales of the Aswang (2019)[52]: "Tales of the Aswang is a VR game that explores the myths and the epic creatures of Filipino oral tradition compiled from books written by Maximo Ramos and stories passed on through generations of storytelling and remembrance. Experience Filipino mythology from the eyes of Juno, a young boy

[48] https://www.vrfocus.com/2017/10/mindtree-pictures-developing-interactive-vr-movies/
[49] https://www.youtube.com/watch?v=ofQpXZisaRk
[50] https://uploadvr.com/twilight-path-new-vr-adventure-makers-form/
[51] http://enactivevirtuality.tlu.ee/enactive-artsci-vr-project-the-state-of-darkness/
[52] http://aswangvr.com/

who stumbles upon the world of the Kapre, a Cigar Smoking Tree Giant, and is dragged into a quest that calls for bravery and a sense of wonder".

At this point, it is relevant to underline what I consider the main difference between narrative VR videogames and IFcVR, that is, how the experience moves forwards: in videogames, narrative experience is pushed by interactors' accomplished missions or goals; on the contrary, in IFcVR, narrative leads interactors' experience and their interactions are based on the displayed events. In games, the communication between creator and player is different than the one that gets established in films. A game writer is always communicating with the player, by offering narrative context, passing on game information regarding goals and missions, or tutoring the player on the game mechanics (Bateman, 2008, p. 85). Instead, communication between filmmaker and spectator moves in other terms, narration does not pass information but generates experience and only when it is experienced by the spectator narration is complete, as Carlos Ruiz Carmona argues in *The Role and Purpose of Film Narration* (2017):

> "It is the experience of the narrative that provokes the emotion during the act of communication […] film narrative evokes abstract dimensions of human experience which don't necessarily translate into data or need to be understood or explained [...] Experience cannot be or does not need to be understood or processed rationally or emotionally to communicate. Thus, film narration only needs to provoke experience to communicate. This is why I argue that film narratives only complete themselves after the audience experience them. Before the viewer's experience, the narrative remains an intention to become something." (Carmona, 2017)

Following this idea, the IFcVR examples share the cinematic interface and the interactive fiction structure, and, excluding the last example, they have not been catalogued by their creators as video games or narrative video games, but under the tag "interactive VR film / movie", reaffirming a distinction that lies in the experience of film narration. In a videogame, interactors have the responsibility to detonate the flow of the events, to discover, to win, or

simply to try not to die, in the same way the interactors are expecting not to get bored. In IFcVR, interactors have a privileged position in being present in the space where the events take place and in manipulating them according to her interpretation, but with the awareness that she is attending a film that is an autonomous narrative. The fact that interactors are living an external independent narrative should not give them a passive role, as there is always the risk of them getting bored and taking off the HMD. On the contrary, an IFcVR experience must maintain curiosity and suspense, and make interactors feel that the events are evolving, that something will happen when that door is opened, that in the end her participation in the story will bring cognitive and emotional satisfactions. This sensation is called "dramatic tension" and is one of the great issues that IDNs face.

4.2.1 The Issue of Dramatic Tension

The process of construction of a unified theory of IDN is still ongoing (Koenitz, 2015) and with it, a theoretical basis for all the artistic forms and platforms included under the IDN concept. As Koenitz (2015) summarized in *Towards a Specific Theory of Interactive Digital Narratives*, since the beginnings of the intersection between narrative and computer-based media, several researchers have developed frameworks and methodologies that allow the understanding and production of this type of narrative texts. First approaches for IDN are based on the first dramatic theory: Aristotle's *Poetics* (Laurel, 1986; Mateas, 2001), while a Narrative Theory for VR (Aylett & Louchart, 2003) find a primary basis on Plato's distinction between *mimesis* and *diegesis.* Subsequently, the narrative basis for computer-based media were heavily influenced by the narratology studies of the second half of the twentieth century conducted by Gerard Genette (1980, 1983), Seymour Chatman (1980), Gerald Prince (1982, 1987, 2003), and Mieke Bal (1997) as proposed by Espen Aarseth (1997, 2012), Nick Montfort (2003a, 2003b), Henry Jenkins (2004), and Marie-Laure Ryan (2005, 2006). During IDN history, the issue of *narrative vs interactivity* keeps re-emerging, from mainly two points of view: (1) level of authorial control vs level of user agency and (2) narrative coherence and engagement vs level of interactivity.

As authors are shifting from an over authoritarian attitude to embrace the death of the author (Barthes, 1977), the second issue seems to be the most controverted of the two: "for hyper-narratives to be comprehensible, coherence within narrative threads and between them must be maintained" (Ben-Shaul, 2008, p. 31). Hence, the returning question is: how to create an engaging and coherent interactive story? How to achieve that feeling that keeps up our attention and emotion towards the story? In this respect, the keyword is *engagement*. Novels, films, theater spectacles, videogames, TV series and oral storytelling have achieved this challenge as they stimulate receiver's need to know what is happening next. Propp (2003), followed by Campbell (2008) and Vogler (2008) have recognized some patterns in folk storytelling that raise empathy with the protagonist and her endeavor. These patterns were combined together in the popular *Hero's Journey*, a series of stages that the hero has to overcome in order to master his challenge. Hollywood blockbusters scripts, on the other hand, have been using a three-acts structure in order to guarantee a climax; this structure is known as *Syd Field's Paradigm* (2003). Both Hero's Journey and Field's Paradigm share a structure often labeled as *dramatic arc* or *story arc*.

In the article *The 'Story Arc', a Ghost of Narrative Game Design*, Koenitz (2017) demystifies the dramatic arch as a narrative standard, "the notion of the 'Aristotelian story arc' is at best loosely connected to the original texts. This status provides an explanation for contradictory positions on the suitability of the Aristotelian model for analysis and for the design of narrative-focused video games" (Koenitz, 2017)[53]. This rejection of using the "dramatic arc" in the design of IDNs was presented by Pamela Jennings (1996), who instead proposes the study of multi-climax narrative structures, as in African storytelling, for interactive digital narratives. The "story arc" responds to Brooks and Warren proposal of breaking down fictional narratives into plot-stages: exposition, complication, climax, and denouement, tracing the experiences of storyworld participants who are faced with some sort of conflict, whether external or internal (Herman et al, 2008).

[53] http://digra2017.com/static/Extended%20Abstracts/142_DIGRA2017_EA_Koenitz_Story_Arc.pdf

The implementation of a narrative structure such as the Field's paradigm or the Hero's Journey responds to the authorial need of "narrating" or "showing" the storyworld. During the discoursivization process undertaken by interactors, they will expect something to happen: conflict. For Brooks and Warren, conflict is what links plot with character (1959, p. 172), but as Iser (1997) remarks, the immersion is not accomplished by the mere presentation of the conflicts but includes the multiple solutions that the text can imply, thus "the more explicit the text, the less involved the interactors will be, leading them to the feeling of anticlimax" (p. 46). This concatenation of conflicts creates a dramatic progression in time. During the time in which interactors *live* the storyworld, there is the hope or the desire to reach a peak moment in which they find the message, live a strong emotion, or discover the truth. The arrival into a narrative (experiential) discovery - a climax - represents a reward for the interactors after taking the decision to access the proposed storyworld. The debate, beyond the underlying temporary structure, falls back on having a narrative climax or not. This opens up different concerns: Why not to talk about multiple climaxes? or even, is it necessary to reach a climax?

> "If narrative, as Bruner has suggested, is about "the vicissitudes of intention," it is also, as historian Hayden White argues, about seeing events "display the coherence, integrity, fullness, and closure... that [in life] can only be imaginary." The ways in which interactive narratives map and yet do not map onto this concept speak eloquently to potential for future development in hypertext fiction and digital narratives alike. And to the reasons why we listen, read, or watch fictions in any medium unfold, climax, and resolve for no purpose aside from the unalloyed pleasures they give us". (Douglas, 2003, p. 151)

The issue is about creating and releasing tension. Vogler, for example, suggests the insertion of several climaxes, one for each act, and even one for each stage of the Hero's Journey. The objective of the climax is to change the hero's direction, assigning a new goal. He also suggests a differentiation between "crisis" and "climax", the first one related as a "point in a story or drama at which hostile forces are in the tensest state of opposition", and the latter as

"the crowning event of the whole story" (Vogler, 2008, p. 156), and expands the conception of climax describing the "quiet climax". In opposition of "an explosive, dramatic, loud, or dangerous moment of the story, a quiet climax can give a sense that all the conflicts have been harmoniously resolved, and all the tensions converted into feelings of pleasure and peace" (Vogler, 2008, p. 202).

The challenge is to create interesting interactive stories that take interactors into a narrative experience leading to enjoyment, transformation and satisfaction, without discarding the conception of the climax, but embracing and multiplying it according to the number of possible paths, scenes or narrative nodes that the predefined structure engages. Today, most IDNs prototypes and experiences are based on a fixed structure of predetermined hyperlinks, a structure that can be limited in terms of user agency while we move towards a "constructive hypertext" that "aspires to its own reshaping" (Joyce cited in Koenitz, 2017, p. 93). In Interactive Films, the predetermined hyperlinked mind map is the most common structure, if not the only one, since the costs of production of each audiovisual node are higher than those of others media. The same happens in IFcVR.

What may seem a disadvantage may actually result to be a potential. Since IFcVR is based on an interactive fiction structure with prerecorded narrative units, the creator effectively has a bigger control over the narrative text. The variety of navigation outputs relies on two features: (1) the richness of auditory and visual inputs within each scene-space and (2) the multiplicity of links between nodes. In IFcVR, the fictional pact implies the fruition of a cinematic experience rather than a game. This characteristic changes the position of the creator towards an experience that finally seeks a linear and fluid output, and frees her from proposing an experience in which interactors assume a player role. The success of the final linear output, like in a film, depends on the coherence between all details and events, so as, at the end of the experience, interactors can draw conclusions from a unified whole. Interactivity cannot be created in the same way in games as in hypernarrative films, because the first ones bring simultaneity to the fore while the latter ones rely on the evolution of a storyline. Divergences from coherent storylines result in less satisfying stories. Likewise,

restrictions for players result in less satisfying games (Ben-Shaul, 2008, p. 55). In fact, assembling a coherent story that can take different paths is a hard creative work. Here are, however, interactive structures that facilitate this task and better adapt to narrative's need for coherence.

4.2.2 Non-Linear Narrative Structures

The interactive fiction film is built upon a predetermined structure composed by single narrative nodes with multiple in and out links connected to each other. This interconnected structure acquires the shape of a network, and according to this shape, the navigation can take different shapes. Despite its underlying interactive structure, IFcVR, as an Interactive film, searches for a consistent linear narrative, in which the *jumps* (Ryan, 1999) between audiovisual nodes are imperceptible and the navigation becomes a cognitive activity rather than a player attitude. The final output is a linear film. In this sense, this final output is not different from any film, the only difference is that interactive films sequences and scenes are organized by the interactors during each interaction. In film history, non-linear films have become a genre on itself. In non-linear films, the storyline has been broken down and gets re-organized with a different diegetic temporality, thus it is the spectator's task to rearrange the sequences in a cause-effect order. The article *How the Brain Reacts to Scrambled Stories* (Green, 2016) published by the newspaper The Atlantic, relates to some experiments that show how people enjoy to pay attention to disruptive narratives in which they have to assemble the pieces.

Either to create a traditional non-linear film or an interactive one, the screenwriting must follow the chosen interactive structure. The screenwriting, therefore, occurs in a second moment guided by the mental map of the sequences that make up the story from beginning to end. The interactive structure can be found in literature as in blogs or software, with different names: mind map, mind tree, hyperlinked structure, networked structure, etc. Marie-Laure Ryan (2015, p. 165-175) has summarized the interactive architectures as follows:

1. **The Vector (with optional side branches):** This structure keeps the linearity and works as a "pearl of strings", a succession of narrative sequences with a cause-effect relationship. The interactivity is added through extra multimedia material that does not change the course of the story. A great example showing that a simple interaction should not mean an insignificant experience is Vincent Morrissey's "A Way to Go" (2014)[54].

2. **The Complete Graph.** In this structure all nodes are linked to all the other ones. This is the most interconnected structure and contemplates all possible navigation paths, and therefore, higher level of interactor's autonomy. However, as Ryan notices, this structure cannot guarantee a perfect narrative coherence.

3. **The Network.** According to Ryan, this is the most used structure for interactive narratives as it allows more authorial control over the course of the story. Nodes can be accessed through different routes allowing interactors different navigation alternatives. Although the network structure is intended for the creator to restrict the navigation pathways, the structure does not guarantee narrative coherence as interactors risk to return into previous nodes, creating loops and circuits that can break the temporal unfolding of the narrative.

4. **The Tree.** This architecture is based on branching plots, in which there is no risk to create loops or circuits, since once a pathway is taken it will develop independently of the others. The big problem of this kind of architecture is its exponential growth. A higher level of interactivity requires a vast number of nodes that results in a great amount of creative and production work, on one side, by designing all the narrative possibilities, and, on the other side, on producing such a high number of audiovisual nodes.

[54] http://a-way-to-go.com/

5. **The Database.** Ryan refers to the database as the typical structure of informational websites, in which a homepage offers a menu with different options. In a database structure it is possible to choose "randomly" a narrative node, turn back and explore another one. This structure activates interactors' cognition while connecting at a semantic level the selected nodes. The database organization has become a cultural interface. "After the novel, and subsequently cinema, privileged narrative as the key form of cultural expression of the modern age, the computer age introduces its correlate: database. Many new media objects do not tell stories, they do not have this purpose; they don't have beginning or end; in fact, they don't have any development, thematically, formally or otherwise which would organize their elements into a sequence. Instead, they are collections of individual items, where every item has the same significance as any other" (Manovich, 1999). However, database randomness is not incompatible with narrative, as interactors organize nodes sequentially and semantically.

6. **The Maze.** This structure is common on quest adventures as it is goal-driven. Interactors can choose different navigation paths that take them into different endings, so there can be "one or more ways to reach the goal". This structure has two positive features: it allows a great level of authorial control and narrative coherence as the creator foresees all the possible pathways, and it also stimulates repetition as interactors may want to repeat the experience to live a different ending.

7. **The Flowchart.** According to Ryan, this structure is the best way "to reconcile a reasonably dramatic narrative with some degree of interactivity, as the system prescribes an itinerary through the storyworld, but interactors are granted some autonomy in connecting the various stages of his journey". It eliminates the risk of running in circles or hit a dead end. As Ryan suggests, if this structure is run by a system capable of keeping a memory of interactors' past choices the events of a specific node can be influenced by this memory allowing or denying some possibility.

8. **The Hidden Story.** This architecture is a two-level structure: an a-temporal interactive network of choices and a fixed chronologic linear narrative. Interactors move in the first interactive network. In this network some nodes are connected to the first linear structure, thus interactors have access to hidden information that they have to assemble. This structure is commonly found on mystery stories.

9. **The Braided Plot.** This structure is often called "parallel structure" as, over time, interactors can jump between different parallel plots. In literature and cinema, it is possible to find several examples of parallel plots, commonly used for change between characters' points of view, spaces or temporalities.

10. **Action - Space.** "In this model interactivity takes place on the macro-level and narrative plotting on the micro-level" as interactors move freely within the geography of the virtual world finding self-contained adventures, events, pieces of information or episodes. Usually this model offers a backstory that is completed as interactors take action within the experience, and is often used by MMORPGs (massively multiplayer online role-playing games)

For IFcVR, the architectures that contain links to past nodes can be problematic as interactors can be bothered about watching repeated scenes, this is the case of *The Complete Graph*, *The Network* and *Action-Space* models. *The Maze*, *The Hidden Story* and *The Flowchart,* can present the same problem if returning points are contemplated. In this case, an alternative version of the node should be shot or created, thus interactors will not see the same video again. The audiovisual medium, comprising animation, live action or CG, entails high costs in terms of time, money and production complexity, therefore the greater the number of scenes, the greater the costs; this is why the *Tree* structure is not recommended. However, this can also be considered a "weak point" for IFcVR when shot in live-action 360º video: few scenes mean little interactivity, and few alternatives for the interactor

The interactive structure underlies, waiting for the path that the interactor traces through it. To work out its way, the interactor must jump from one node to another and activate key elements to make meaning of the story. In each node, the system presents *decision-making* moments or time lapses in which the interactor's feedback is expected to push the story forward, creating a rebound dynamic between system and user: interactivity. The rebound is mediated by the Human-Computer Interface (HCI).

4.3 Forging the Path: HCI and IFcVR

Interactivity is a conversation between two agents. One of them says something while the other one is expected to answer based on the interlocutor input, and so on. As IFcVR spectators are humans, and IFcVR travels through a computing system, there are interfaces that allow the conversation between both agents: human and computer. VR HCI developments can allow unsuspected ways to interact with a film (imagine that you have to literally run to escape from danger, or that the film becomes more or less frightening depending on your heart beats) maybe we can speak directly to the characters to make them take one or another direction, we even could move objects with our thoughts to help the protagonist. Movement, biometrics, voice recognition and brain interfaces are some of the interactor's inputs that can be given to the VEs through current HCI. This section presents current developments in HCI that can be used to compose the IFcVR experience, cataloged into conscious and non-conscious user inputs.

VR HCI can be divided into two technological settings: inputs and outputs. Inputs in VR are in the first place related to user's position in space; this means that *Tracking* positions and orientations of user's head, user's limbs, and interaction devices (such as gloves, mice or joysticks) provide input to the VR system. Besides spatial user inputs, user can also send *Action* or *Event* inputs to the system (Raycast, 2018), by activating an Interactive Item or Object. "Interpreting the participant's facial expressions, voice, gestures, and pose as inputs could provide a new level of natural interaction. Also, participants will interact with more

complex objects, such as deformable objects and virtual characters" (Benjamin & Hodges, 2004).

Given the system inputs, the resulting VE (visuals, audio, tactile information) is output to the participant through visual and audio hardware, a HMD or a CAVE. The HMD can be connected to a computer or can be a *stand-alone* device. The HMD works by tracking user's head movements allowing 3DOF or 6DOF depending on the device. VR tracking systems need to accurately determine the participant's pose and to display the appropriate images in under 90 milliseconds, and preferably under 50 milliseconds. Otherwise, the VR system induces a "swimming" feeling, and might make the participant disoriented and hamper the quality of interactivity (Benjamin & Hodges, 2004).

Action inputs have two main functions within the IFcVR:

1. Jump between alternative narrative units (NUs).
2. Access or Activate extra-information: multimedia material that contains diegetic information enriching interactors' knowledge about the storyworld and its characters, or extradiegetic information with instructions on how to navigate the experience or paratext (Genette, 2001). The multimedia material can be of different nature: text, images, audio, flat videos, 3D objects or even minigames.

Action or Event inputs can be catalogued as conscious or unconscious, according to the type of HCI that activates the interactive object. This distinction obeys to the type of input given to the system: in the first case, interactors' input involves the reflection and conscious coordination of their cognitive abilities (e.g.: moving head or body, talking, applauding, thinking, using a joystick); in the second case, data on the physiological functions of the interactor are collected by the system without requiring a conscious action of the interactor to modify the course of the story; only their emotions expressed by physiological changes will control the experience. Such creator's choice is at the root of the design that runs the IFcVR experience and is related to the artistic and narrative purposes of the creator.

IFcVR systems can be multi-sensory and multimodal, since the design of the system can foresee the integration of one or more HCIs to receive interactors inputs and to send them back the system's outputs (e.g.: a sound, a vibration, or a change of temperature to confirm an action or to contextualize interactors in the storyworld). However, it is important to think the interfaces not as mere technological instruments, but as integral part of the storyworld; they must have a role and a meaning within the narrative experience. The selection of the interface(s) changes the relationship between interactor and system, and between interactor and storyworld. In the next sections, current HCIs will be presented. They are divided into HCIs that require the conscious coordination of the interactor and those based on the physiological data of the user. Some of the presented HCIs not only allow the reception of user's input but also can send output to the user. Some interfaces such as the brain-computer interface (BCI) or the respiratory feedback, although based on physiological data, can also allow the conscious interaction.

4.3.1 Cognitive Interaction

In this type of interaction, interactors can decide whether or not to activate an interactive object. The decision-making process hence requires a conscious activity on the part of the interactor, either reflecting or reacting to a specific event presented in the story. The depth of the interactors' thinking activity at the decision-making moments will depend on the creator's artistic intentions, as interactors' decisions may require an exhaustive reasoning, or they can be taken as a fast reaction to the environment, as Stephen Cowley and Frederic Vallée-Tourangeau argument in *Cognition Beyond the Brain: Computation, Interactivity and Human Artifice* (2013). They challenge the conception of *thinking*, separating it from an isolated brain activity and describing it as a response to environmental inputs. In this order of ideas, interactors' horizon of the expectations, together with their socio-cultural background, will react to the events presented in the scene, pushing them to take one path or another. As in life, some decisions will be harder than others, needing more time to analyze the possibilities, while others will be based on simple intuitive reactions to the sensory or narrative stimuli of the VE.

Decisions, especially difficult ones, take time. In IFcVR, as in IDNs in general, the decision-making time becomes part of the time of the discourse. It is not a time detached from the narrative experience, but a time that connects discourse and experience. When creating a IDN, narrative time can be a tricky issue to solve due to quantity of interactive elements, agents and decision-making moments that run through the narrative experience. Hence, the writing and development of the narrative system need to design the time of the story and of the filmic discourse (construction of the scenes), as well as to plan the time of the user interaction, which will become part of the time of the interactive discourse. Several research studies have explored the issue of time in IDN (Veloso, 2010; Porteous et al, 2011; Schønau-Fog, 2015), proposing time planning frameworks to organize narrative actions and events in an IDN system, especially for advanced types of IDN systems based on artificial intelligence (AI) software. Hence, during the development of the interactive fiction, and afterwards during system setup, the creator must allow decision-making time in order to ensure that, from a UX standpoint, interactors know what they are doing and feel in control, so as no one would select something by mistake[55], even by compromising immediacy if creator chooses to ask a user confirmation through some type of visual or auditory feedback to user interaction.

Current HCIs for VR allow different types of conscious interaction by the user. IFcVR can make use of any of these interfaces to make interactors act, and by acting have agency within the experience. The way in which the HCI, or the use of multiple HCIs, is connected to the story lies on the creative capacity of the creator and her artistic intentions. As technology is in constant development, the following HCIs for VR are in different stages of development and adoption.

Head Tracking. This is the most common type of HCI for interactive applications in VR as every HMD in the market has a built-in head tracker, including headsets for smartphones as

[55] https://unity3d.com/learn/tutorials/topics/virtual-reality/interaction-vr

new generation smartphones contains a inertial measurement unit (IMU), a combined device that merges accelerometers and gyroscopes, sometimes also magnetometers. Interactors can activate hotspots by gazing at an interactive object with a cursor on the screen that they can move with their heads (Lavalle et al, 2014).

Controllers. They are joysticks with an integrated 3 or 6 degrees-of-freedom (DOF) tracking sensor that reports the device's position and/or orientation, with numerous buttons for the participant to provide input, and they are cheap, easily adaptable for different tasks, and familiar to many users. However, they might not provide the required naturalness, feel and functionality for a given task (e.g.: object manipulation in simulations or trainings) (Benjamin & Hodges, 2004). To face this lack of "naturalness", VR companies are working on special design and tracking systems to enhance the VR controller. The objective is to give interactors a fuller hand motion range through a special design that adapts to the hand and avoids dropping the controller. New generation controllers are equipped with capacitive sensors (KAS) that detect when individual fingers are touching the controller, so interactors can do things like picking up objects by naturally closing the fist, instead of hitting a trigger or grip button[56].

(Full) Body Immersion. Full body immersion is the saint grail of VR. The purpose is to make interactors feel and be bodily present in the VE, being also able to move and interact with their body within the storyworld. This is a bi-directional communication between interactors and VE. The body immersion has been a never-ending process since the beginnings of VR, in which it is possible to find two branches: (1) Those that are focused on hands presence and ability, a hard task if we consider the versatility of human hands and (2) Those that are working on the Full body immersion, which creates a virtual body that performs as accurate as possible as the real body, including hand work.

[56] https://www.theverge.com/2018/6/22/17494332/valve-knuckles-ev2-steamvr-controller-development-kit-shipments-portal-moondust-demo

In order to achieve full body immersion, it is necessary to combine different technologies, either to give user's input to the system by translating body movements in VR, or to give feedback to the interactors of their actions within the VE. Within this set of technologies, it is possible to account: motion sensors powered by Infrared Light Emitting Diode (IR LEDs) or radar chips, position tracking sensors (IMU), gloves and suits with tactile sensors and haptic, force and temperature feedback, and even EMG (Electromyography) sensors to enable real-time selection of operational commands together with recognition of interactors' motions and gestures (Lee et al, 2015; Kallmann, 1999). These technologies are being used and merged by VR companies in a series of diverse wearables and accessories, as shown in Table 2.

Full Body Immersion Wearables and Accessories in 2018 Market		
Wearables	Bodysuit	https://teslasuit.io/
		https://www.holosuit.com/
	Vest	http://www.korfx.com/
		http://www.hardlightvr.com/
	Gloves	https://manus-vr.odoo.com/
		https://vrgluv.com/
		https://hi5vrglove.com/
		https://haptx.com/
		https://www.senseglove.com/
	Shoes	https://taclim.cerevo.com/en/
		https://www.cybershoes.io/
Accessories	Motion Sensors (Infrared)	https://developer.microsoft.com/en-us/windows/kinect
		https://vicovr.com/
	Motion Sensors (Radar)	https://atap.google.com/soli/
	Platforms	http://www.virtuix.com https://www.omniversevr.com/
		http://www.infinadeck.com/
		http://katvr.com/

Table 2. Full Body Immersion Wearables and Accessories in 2018 Market

Eye Tracking and Facial Expressions. Another way of interacting with the VE is making use of eye movement. The mechanism, even at a lower stage of development with respect to the HCI seen above, works through an eye-tracking camera located inside the HMD that recognizes the movement of the pupil (Geiselhart et al, 2016). These same cameras can be used to detect and categorize the facial expressions of the interactor's eye contour, that is, the face part enclosed within the HMD (Chen et al, 2018; Hickson et al, 2017).

Natural Language Processing (NLP). Through voice commands, it is possible to interact with the VE, either for selecting interactive objects (e.g.: Dorozhkin, 2002), to interact with storyworld agents and objects (Bellassai et al, 2017), to manipulate objects within the VE (Zhao et al, 2005) or even to create intelligent VEs (Kamath et al, 2013). Current research in this area is merging NLP together with other types of HCI in order to create a multimodal interaction with virtual worlds (Olmedo et al, 2015). This convergence is being already applied in conversational gameplay[57] and interactive narratives[58].

In *A Speech Interface for Virtual Environments,* Scott McGlashan and Thomas Axling (1996) propose a spoken language interface "as speaking is a 'natural' way of communicating our goals to others, and effecting changes in the world" (McGlashan & Axling, 1996). In order to enable this type of interaction, they put forward three technical aspects that also belong to the creator's sphere and can be extrapolated to other types of human-computer interfaces:

> *"Speech Recognition:* The larger the user vocabulary and grammar, the greater the potential for recognition errors. How do we restrict the user's language yet providing a comfortable interaction?
>
> *Language Understanding:* The interpretation of spoken commands is dependent upon context: while some utterances are sufficiently specific to identify which object they

[57] https://www.roadtovr.com/conversational-gameplay-interactive-narrative-starship-commander/
[58] https://www.tomshardware.com/news/starship-command-leverages-cognitive-services,33606.html

refer to, others require knowledge of the situation for their interpretation. What (limited) situational knowledge maximizes spoken language understanding?

Interaction Metaphor: With direct manipulation, the system is relatively transparent: the user is directly embodied as an actor in the virtual world. Speech, however, requires a dialogue partner: who does the user talk to?"
(McGlashan & Axling, 1996)

4.3.2 Biofeedback Interaction

This type of interaction relies on interactors' biofeedback, the measurement of physiological functions as brainwaves, heart function, breathing, muscle activity, or skin temperature. Physiological signals are sent into the system as a response of a specific activity or situation in which interactors are immersed. In IFcVR, the system will receive interactors' biofeedback as an emotive response for what they are experiencing in each NU. This type of interaction relies on several research studies that identify a "biological basis of cinema as embedded in the emotional simulation dynamics of the mind" (Tikka, 2008, p. 235). Pia Tikka summarizes these researches looking for an "embodied cognitive modeling" approach (Tikka, 2008) that functions as the foundation for an enactive cinema:

> "The recognition of otherness in cinema based on mirror neuronal imitation, which links to dynamical views on action and perception in an embodied goal-driven survival system. The integration of the senses, neurophenomenological views of perception, the dynamics of 'as if' body loops, the 'narrator in the brain', image-schemas, and the neural basis of conceptualization enable a description of the continuous unfolding of enactive cinema in terms of embodied simulation." (Tikka, 2008, p. 235)

If we consider the human being as an emotion-driven organism and this characteristic as the core of the filmic experience, an interactive system or emotion-driven cinematic montage

system, in which interactors do not take conscious decisions but let their pure emotions "choose" the way to go along the film, Pia Tikka's *Enactive Cinema* proposal would be the theoretical basis for an IFcVR system that works through unconscious interactions.

Bio signals measure the behavior of the autonomic nervous system (ANS) in situations that move along a spectrum that goes from relax to stress, and VR is the perfect medium to expose the interactors to simulated situations, thus making it possible to carry out studies on stress treatment (e.g: Ridout et al, 2017; Crifaci et al, 2012; Bullinger et al, 2005), and leading to the development of therapies in different areas, including social psychology (Blascovich et al, 2002). The following types of interfaces can be used, with two purposes:

1. To induce sensations that enhance the experience and contextualize the interactors within the VE (i.e.: thermal, olfactive).
2. To modify the story course during *run-time*.

Often, different types of biofeedback are combined in order to obtain accurate data on the user's emotive response to the VE (Cho et al, 2017). Self-efficacy feedback is another tool often used in physiological HCIs, so as interactors can track their own performance within the VE (Weerdmeester et al, 2017).

Brain-Computer Interface (BCI). In the human computer interaction field, the ability to control machines only by mental activity, or to be able to transmit thoughts and sensations to another human brain (Jiang et al, 2018), used to be a sci-fi dream[59]. Brain-Computer Interfaces (BCI) development is now making great steps in brain-to-computer and brain-to-brain communication. Neural Interfaces allow interactors to send commands to computer-based systems through brain waves (electroencephalographic (EEG) signals), and VR (Fig 10) is a fertile field for the design of interactive applications in which the BCI system is used

[59] https://www.technologyreview.com/s/612212/the-first-social-network-of-brains-lets-three-people-transmit-thoughts-to-each-others-heads/

to control, navigate or perform within the VE just by thoughts[60] (Amores et al, 2016; Renard et al, 2010; Ron-Angevin & Díaz-Estrella, 2009; Guger et al, 2009). Researchers in the BCI field "imagine a future in which users have total intuitive control of remote virtual environments within some kind of think-and-play user interface" (Lecuyer et al, 2008). BCI developments expand from rehabilitation applications to artistic purposes (Nijholt, 2015). Even though controlling one's own EEG signals is very difficult and requires training, it needs a conscious activity in order to successfully control or modify the VE.

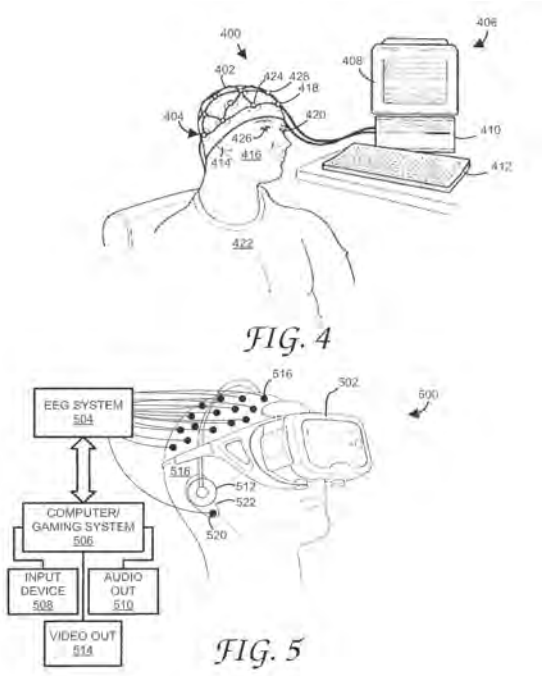


Figure 10. Electroencephalograph-based interface for VR-AR systems (Hurst, 2018).

Thermal or temperature biofeedback. Temperature has proven to be a reliable factor in measuring the sensation of embodiment in the VE (Tieri et al, 2017). Skin temperature (SKT) changing over time can be used in both ways during an interactive experience: (1) On one side, body temperature data can be the input that modifies the course of the story or that activates interactive elements, (2) but it can also be the system's output or response to a user

[60] https://www.youtube.com/watch?v=ZxSUnehE24o

interaction, or can help to contextualize interactors inside the virtual environment; for example: interactors are able to "feel" the weather of the VE (Chen et al, 2017a), or through specific devices as the “thermal taste machine” (Karunanayaka et al, 2018) or a thermally enriched HMDs (Chen et al, 2017b) interactors can be able to experience pleasant or unpleasant sensations related to the thermal stimulation.

Sweat - Electrodermal biofeedback. Skin conductance or Electrodermal Activity (EDA) measures the amount of sweat on the skin, and it is often used to measure the level of users’ stress. The stress level of the interactors can be used as an input to create interactive VR applications, for example by generating a run-time adaptive dialog (Blankendaal & Bosse, 2018). This type of interface has been widely used in VR therapy for stress management especially post-traumatic stress (Rothbaum, 2001; van’t Wout et al, 2017); for the management of different types of phobias or anxiety disorders (Ayala et al, 2018; Rooji et al, 2016; Gorini et al, 2010), or to measure emotions during decision-making moments (Beck & Egger, 2017).

Heart variability biofeedback. Heart rate variability (HRV) can be measured through different systems as photoplethysmograms (PPG) or electrocardiographs (ECG). HRV data represent another way to both measure interactors’ reaction to the virtual scenario and to send the input to the system in order to activate some command during the virtual experience. Current studies analyze multiple stress levels in virtual reality environments using heart rate variability (Ham et al, 2017) while developing different applications supported by the use of a HRV fitness shirt (Gradl et al, 2018) or fit trackers. Heart rate can also be delivered to the interactors as an output during the virtual experience, so as they can be aware of their own heart rate in different types of heart-rate representations. A recent study shows that “audio-haptic feedback was the most preferred while visual feedback was reported as being distracting” (Chen et al, 2017c).

During the preliminary testing of ZENA[61], before the application of the full evaluation protocol proposed in Chapter 8, one of the subjects was a 75 years-old man with a pacemaker (Figure 11). In spite of his age, the subject naturally managed to immerse himself in the story and enjoy the experience without any help: it was intuitive for him to activate the hotspots with the movement of his head, and had no adverse reactions such as nausea or headache. In one of the scenes of ZENA, Lorenzo, the protagonist, is threatened by a thief in a *vicolo* (the characteristics narrow streets of Genoa's historical center). From a window on top of the vicolo, a man throws a bucket of water to help Lorenzo escape. A moment that takes by surprise who watches this scene. At that moment, a light went on in the subject's pacemaker. His heart had reacted to the surprise effect of the scene, and immediately with his gaze, he tried to locate the place from which the bucket of water had been thrown. Hence, in an empirical way and without being part of the testing, it was possible to notice the level of immersion of this interactor, either by his conscious reaction (try to identify who had thrown the water) as by his unconscious reaction (his heart being startled by the surprise).

Figure 11. A 75 years-old man with a pacemaker enjoying ZENA.

[61] The IFcVR prototype developed and tested during the realization of this thesis.

Respiratory Biofeedback. Heart rate variability is closely related to breathing, and breathing pace is also related to anxiety or relaxing states. It is possible to intercept respiratory biofeedback through a pneumograph or respiratory strain gauge with a flexible sensor band that is placed around the chest, abdomen, or both, providing feedback about the relative expansion/contraction of the chest and abdomen, and measuring respiration rate (number of breaths per minute). A 2018 experiment, BreathVR (Sra, Xu & Maes, 2018), uses respiratory feedback as physiological input to enhance single and multiplayer VR games. In the experiment, they apply different types of intuitive active breath control actions as additional input channels in a VR game, offering insights for the design of Interactive VR applications controlled by breathing inputs. Below, some insights are summarized, whose validity can be applied to the use of any biofeedback HCI in the design of interactive VR narrative and gaming experiences:

> *Providing Narrative for Gestures.* Creators must strive for the interactor's narrative immersion, hence the actions interactors perform within the experience are related to their role within the narrative (e.g. relatively explain the reasons for using breathing actions and for wearing a sensor).
>
> *Relevance of Effects to Actions*. Give some type of feedback to the interactors once they have performed an action. "Pertinent audio feedback is as important as the visual effect to connect the physical world action with the virtual world effect" (e.g. some breathing actions trigger fire-breathing or a wind force in the game).
>
> *Managing Suitable Physiological Load.* When using a biofeedback interface, especially one of those controlled by the interactor (by means of, e.g., brain waves and respiratory feedback), creators have to moderate the use of the actions performed by the interactors in order to avoid fatigue from overuse.

4.4 Interactive Fiction in Cinematic Virtual Reality: An Interactive Digital Narrative (Text)

One of the first questions that emerged during the conception of this study is if Interactive Fiction in Cinematic Virtual Reality can be considered an Interactive Digital Narrative (IDN), or even if, in its essence, it can be considered a narrative text. Whether an IDN work can be considered a text or not, is not a superficial question in the field of interactive digital narratives. As Barthes (1975) points out, there are countless forms of narrative in the world, genres, media, vehicles, and the expansion of this variety is closely related to technological development. It is fair to claim that the new fields in narratology and new media that emerge within the sociocultural mini revolutions caused by technological novelties are guided by this simple question: *Can we consider this artefact a narrative text? What makes this artefact a narrative text? Which tools do we have to analyze the artefact in its narrative quality?* This section aims to contribute to this discussion.

IDN as a study field has not developed yet a series of conventions for the study of its own narrative artefacts, in part due to the novelty of the field, in part due to the wide spectrum of narrative forms, genres, media and vehicles that it covers, and in part also because narratology itself is a young[62], extremely alive, field. After all, when we talk about narratives, we are talking about an essential human activity. The "absence of a canonical set of narrative structures specific to IDN" (Koenitz et al., 2015) raises a variety of issues when trying to identify a narrative text within the field. The core of the discussion "Can IDN experiences be considered *narrative texts* or not?" resides mainly in two aspects of the technological hypertextual nature of any IDN experience: the abolition of the *fixed output* (the possibility that each time an IDN experience is enjoyed by an interactor in different ways), and the fact that "the text is the only aspect directly accessible to the reader, and the text of any work of IDN incorporates the interface" (Knoller, 2015). Both characteristics have an impact on the

[62] If we take into consideration that the study of narrative structures had an important flourishing in the 20th century, and the term "Narratology" just appeared in 1969, coined by Tzvetan Todorov.

levels[63] of creation, enjoyment and meaning of the narrative quality of any IDN text. From now on, considerations on the narrative structure of IDNs will be done through its application to IFcVR and its feature, in order to identify its narrative features.

In *Language of New Media,* Manovich translates Roland Barthes concept of "text" into the logic of computer-based products. He indicates that no matter how interactive, hypertextual, distributed or dynamic a product, the "text" is in any case a finite object (Manovich, 2009, p. 209). An IFcVR experience is a fiction film whose sequences or scenes have been detached from a single timeline organizing them one after the other. Instead, these unique sequences or scenes constitute a Narrative Unit (NU): pieces of narrative sequentially disseminated in a *cyberspace.* The links between Narrative Units and extra material creates a form in the cyberspace: a *mindmap*. The mindmap is a structure whose conformation gives it a specific way of behaving, modeling the way to navigate through it. Interactors assemble the NUs and inscribe them in a finite temporal experience, other possible outputs remaining potential. In IFcVR, possible outputs are not infinite as there is a *x* number of NUs and a *x* number of pathways. In this sense, IFcVR finitude makes it a text. This consideration applies also for any type of IDN, since so far there is not a system powerful enough to generate all the possibilities.

A narrative text, however, contains other characteristics besides finitude. As Genette (1980) points out, by *narrative* we can understand: the *narrative statement*, the discourse that relates a sequence of events and actions; the *subject* of the discourse, the sequence of events and actions themselves, be they fictitious or real; and the act of narrating itself. Christian Metz (2007) elaborates a definition of narrative:

> "It is a closed sequence, a temporal sequence. Every narrative is, therefore, a discourse [...] What distinguishes a discourse from the rest of the world, and by the same token contrasts it with the "real" world, is the fact that a discourse must

[63] The term *Level* is intended in Roland Barthes' conception: "Levels are operations: a system of symbols, rules, etc., which must be used to represent expressions" (Barthes, 1975, p. 242)

necessarily be made by someone (for discourse is not language), whereas one of the characteristics of the world is that it is uttered by no one." (Metz, 2007, p. 20)

In *Story and Discourse: Narrative Structure in Fiction and Film*, Seymour Chatman (1989) proposes a structuralist model (Fig 12) for the study of the structure of narrative texts. The model is based on the distinction between *Story* (a sequence of events plus its setting) and *Discourse* (the expression of the story, how it is narrated). Such a structuralist approach for the study of an interactive narrative is needed, because, as it happens in narratology, the only object of study that we have is the text itself, the signifier of the story, what Gerard Genette (1990, p. 27) simply refers to as *narrative*.

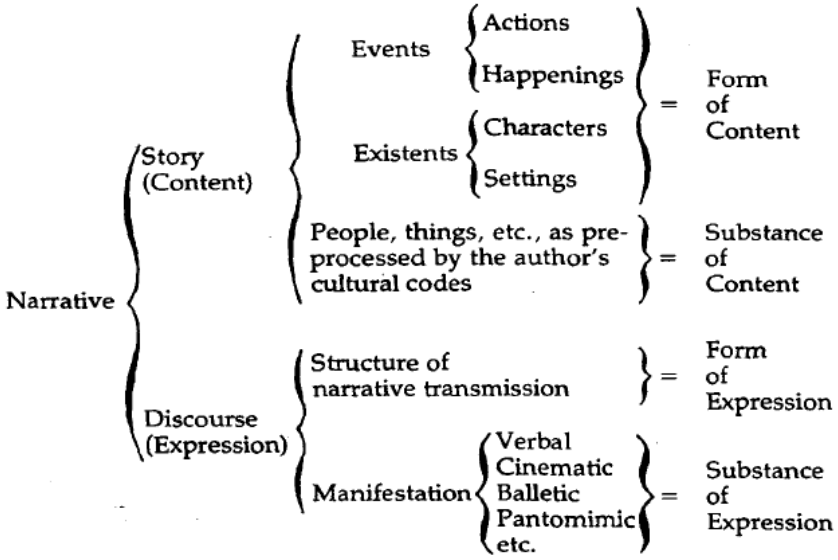


Figure 12. Chatman's Elements of Narrative Theory (Chatman, 1978, p. 26)

How to study, then, a signifier that mutates from person to person, from iteration to iteration? In IFcVR, for instance, different media are contained within one another, in a matrioska-like style: a literary script inside film, film inside VR, VR inside a multisensory and multimodal interactive VR work. This matrioska-like combination of different media poses the challenge in distinguishing which media "transmits" the story, and which one "manifests" it. In this

sense, the distinction that Chatman makes between *Content* and *Expression*, and its crossing with *Substance* and *Form* is of great help (1989, p. 24):

- ➔ *Substance of Expression* refers to the type of media that conveys the discourse.
- ➔ *Form of Expression* stands for the organization of the narrative elements, that is, the narrative discourse.
- ➔ *Substance of Content* refers to the representations of objects and actions in real or imaginary worlds, under creator's view of the world.
- ➔ *Form of Content* describes the elements of the story: the relationship between events (characters that perform actions and make things happen) and existents (characters profiles and settings of the storyworld).

Unlike narratives with a fixed output, like films or books, IDNs are based on the technological system that allows both creation and usage of the experience. Koenitz' theoretical framework on IDN uses the distinction established by Nick Montfort, between the computer program as the material artefact and the narrative as its output (Koenitz, 2015, p. 96). Studies focused on creating a theory for IDNs cover a wide range of approaches. It is possible to account approaches that:

- apply narratology theories related to the *Form of Content*[64] to IDNs;
- identify intrinsic characteristics of IDN works (Koenitz et al, 2013a);
- categorize the existent IDN artefacts (Koenitz et al, 2013b), mapping and organizing what has been done;
- propose new models that step away from legacy media models and take into consideration both system (the digital artifact) and process (the user interaction with the system) (Koenitz, 2010);

[64] These theories are based on the ideas of narratologists likes Propp, Greimas, Campbell or Jennings, who propose conceptual tools to understand archetypal characters and their relationships, dramatic progression, hero's stages, all elements that belong to the content.

- discuss the extent to which narratology theories can actually inspire interactive narrative technologies (Cavazza & Pizzi, 2006).

As shown in Fig 13, legacy media produce an enclosed fixed output, while IDN texts exist by running a code and each version of this output can be fixed only by recording it. Figure 14 shows the instantiation process in IFcVR.

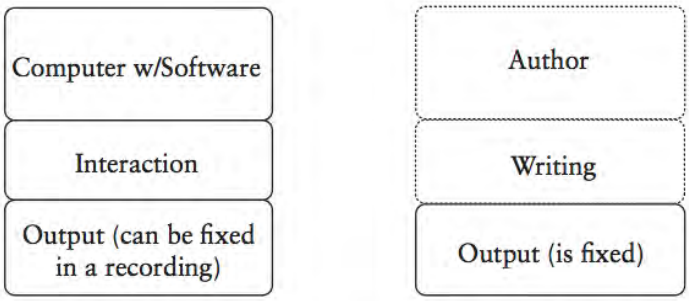


Figure 13. Comparison IDN and (literary) narrative in traditional media. (Koenitz, 2015, p. 97)

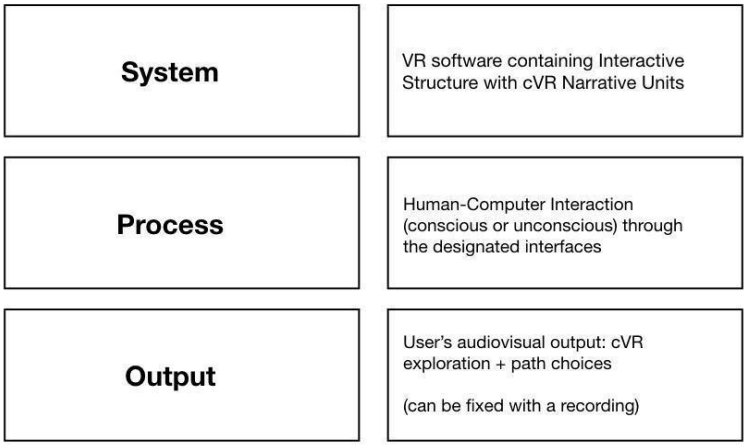


Figure 14. High-level view of IDN (Koenitz, 2015, p. 97) applied to Interactive cVR

However, theoretical research has not observed with a structural approach, the *run-time* narrative text: the narrative that interactors actually receives. Such endeavor starts from the understanding of interactive narrative as narrative. This means decomposing it into: *story* and

discourse. The story is the content of the narrative, while the discourse is the way this content is transmitted. “Interactive storytelling relies on a predefined story, a specific plot concerning facts and occurrences. Only the telling of the story is done interactively.” (Spierling et al, 2012). In Fig 15, I am proposing a structural approach to understand the composition of the IFcVR text. Based on Chatman proposal, I divided the IFcVR into Story and Discourse, and, at a second level, both content and expression are divided into form and substance. Next, a differentiation is presented between what is part of the storyworld and what is part of the system, understood as Ted Nelson’s literary machine.

The Storyworld is an abstract space where characters and time coexist. Characters with goals and dreams, which are related to each other, creating conflicts and pleasant situations or stress. The creator takes specific moments from the storyworld and transforms them into reality by recreating them through cinematic VR. At this point, we find a degree of complexity superior to that of linear cVR: we find ourselves at two levels of transmission narrative structure that belongs to the *Substance of Expression*, that is, to Manifestation instead of to Transmission. The authorial control of the creator arrives to this point.

1. ***Narrative structure of transmission of the cVR unit:*** The filmic moment (scene, sequence) that will constitute a single narrative unit.

2. ***Interactive narrative structure of transmission:*** The connections that the creator makes between cVR units, giving a form and a specific behavior to the network or mind map.

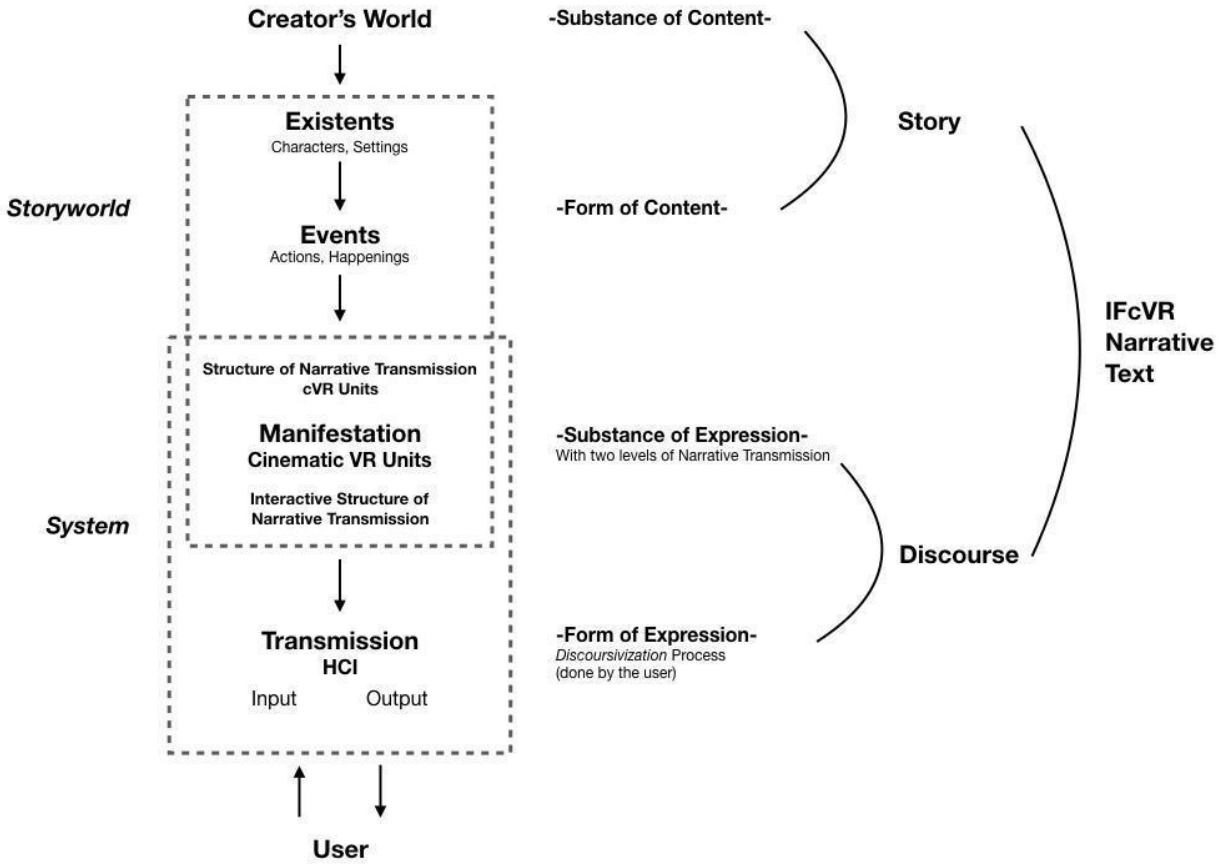


Figure 15. Elements of the IFcVR Narrative Text

Finally, the *Form of Expression* is partially an interactor's task. This is related to the Storyworld through the System, and simultaneously can manipulate the system through a human-computer interface. While sending inputs to select the cVR units and receive the cVR unit together with other outputs of the system, a discoursivization process is generated, in which floating elements of a mind map are aligned sequentially by the interactor's action. As we can see, Storyworld and System merge on the Manifestation or *Substance of Expression* of the Discourse.

To conclude, I would like to note that this conceptual map can also be applied to other types of digital interactive narratives, including linear cinematic VR, by subtracting a level of

transmission. However, to close the theoretical journey that has brought us to this point, I consider that the path that VR films will now take on should abandon linearity to delve into the creation of interactive structures for the transmission of the immersive filmic narrative. Not only because the immersion is increased by interactivity, but mostly because of the contrast that is generated when we are completely abstracted and surrounded by an alien reality, without being able to have any effect on it. We can be voyeurists in the movie theater or in our homes, where to observe someone else's life we must not abandon our own reality. But when we are asked to make a fictional pact in which we give full control of our cognition to a system, and therefore to someone who is behind the creation, a legitimate demand is to have the possibility to interact with that world, or better, to be able of fully *being*.

Part II. IFcVR CREATION

Chapter 5. Development and Pre-Production

5.1 ZENA: An Interactive VR Fiction Film

The Interactive VR fiction film ZENA, was designed and implemented as an IFcVR prototype to guide the development of this research and test its feasibility. In order to suitably explain its content, let me first write a few lines about Genoa, that provided the main inspiration for the story plot. Genoa is an old city with more than 1000 years of history. For centuries, it was an independent republic (*Repubblica Marinara*), whose importance was recognized and respected throughout Europe. Genoa's historical center, the larger of Europe and a UNESCO world heritage, is a labyrinth of narrow streets (called *vicoli*). Nowadays, Genoa is a very lively city, with a unique urban design, which has managed to maintain its authenticity over the years.

As an outsider, my first days living in Genoa were rather difficult, I had to learn how to move inside the labyrinth; once I did it, I started to discover the city and its secrets. There was always a new *vicolo* to be discovered. I learnt which paths were shorter to get to my destinations, which were the commercial, which were only residential and which were populated mostly by people from Africa, Asia or Latin America. As a port city, Genoa is full of the most diverse people, and of all the stories these people have brought across centuries.

As a filmmaker, I immediately realized that Genoa itself is a unique location for a film; some of the most remarkable films shot in Genoa are: *Le Mura di Malapaga* (France-Italy, 1949)

directed by René Clément, won the Oscar in 1951 as best foreigner movie, and Michael Winterbottom's *Genoa* (UK, 2008). In both movies, the conformation of the city plays a role within the story, as characters get lost in Genoa's labyrinth. The twining streets move among very tall buildings, forcing visitors and walkers to look up to discover a narrow line of sky, or the ancient frescoes that decorate the buildings. This peculiarity is very appropriate for 360º video or photo, because it invites the viewer to look up and around. It is very common for people who live in the historical center to wake up in the morning, poke their head out of the window and look up to see how is the weather. At the same time, filming in Genoa is very difficult because the camera exposure has to be adjusted for the darkness of the ground level and the sunlight that enters through the narrow space between the buildings.

Genoa is very different from other Italian cities with historical centers perfectly preserved and cleaned for tourism. In Genoa, the historical center is inhabited by a large variety of people; all social classes and nationalities can live in the various flats of a single building. The streets are dark, and this favors dirt accumulation and a weird sense of security and insecurity at the same time. The industrial port makes Genoa a very live city, full of commerce, tourism, students, and particular situations, like sex workers offering their services during the day even near to the most frequented streets of the center. These factors make it a city with a strong sense of sharing space with the most diverse others.

Since my arrival, Genoa gave me the inspiration and suggested the path to follow to develop this film. ZENA, which means Genoa in Genovese dialect, is the put-into-practice of my research. It is a prototype of immersive interactive fiction film set in Genoa. It does not pretend to look like a commercial production but to show the feasibility and effectiveness of the proposed theoretical approaches to create interactive immersive experiences, even for independent video makers with a low budget. ZENA has been produced with a filmic rather than a videogame approach, hence the production stages have been ruled by the workflow of film production. In order to document the experience, a record of the whole creation process was kept.

The story unfolds in a 360º environment created through Live Action 360° high definition video capture, one of the technologies developed to create VR experiences. Within the story, interactors will have to take an active role in the narrative course by interacting directly with the story: they can decide where to go, listen to or ignore the advice of a character, or access extra information that contributes to story understanding. The scenes, which develop in the alleys and in some of the most important palaces in the Old Town, carry these environments for the first time in the world of Virtual Reality.

In the next sessions, the creation process of ZENA will be described and the most relevant outcomes of this process will be shared. Lessons are drawn from the achievements, the mistakes and the shortcomings that I found during the realization of this prototype. Therefore, the stages and practices described here do not try to become a canonical procedure, but rather guidelines, which can also serve as inspiration for the future creation of other IFcVR experiences.

ZENA is available in browser version and HMD version at https://www.xehreyes.net/zena, while ZENA's screenplay can be found in Appendix 1.

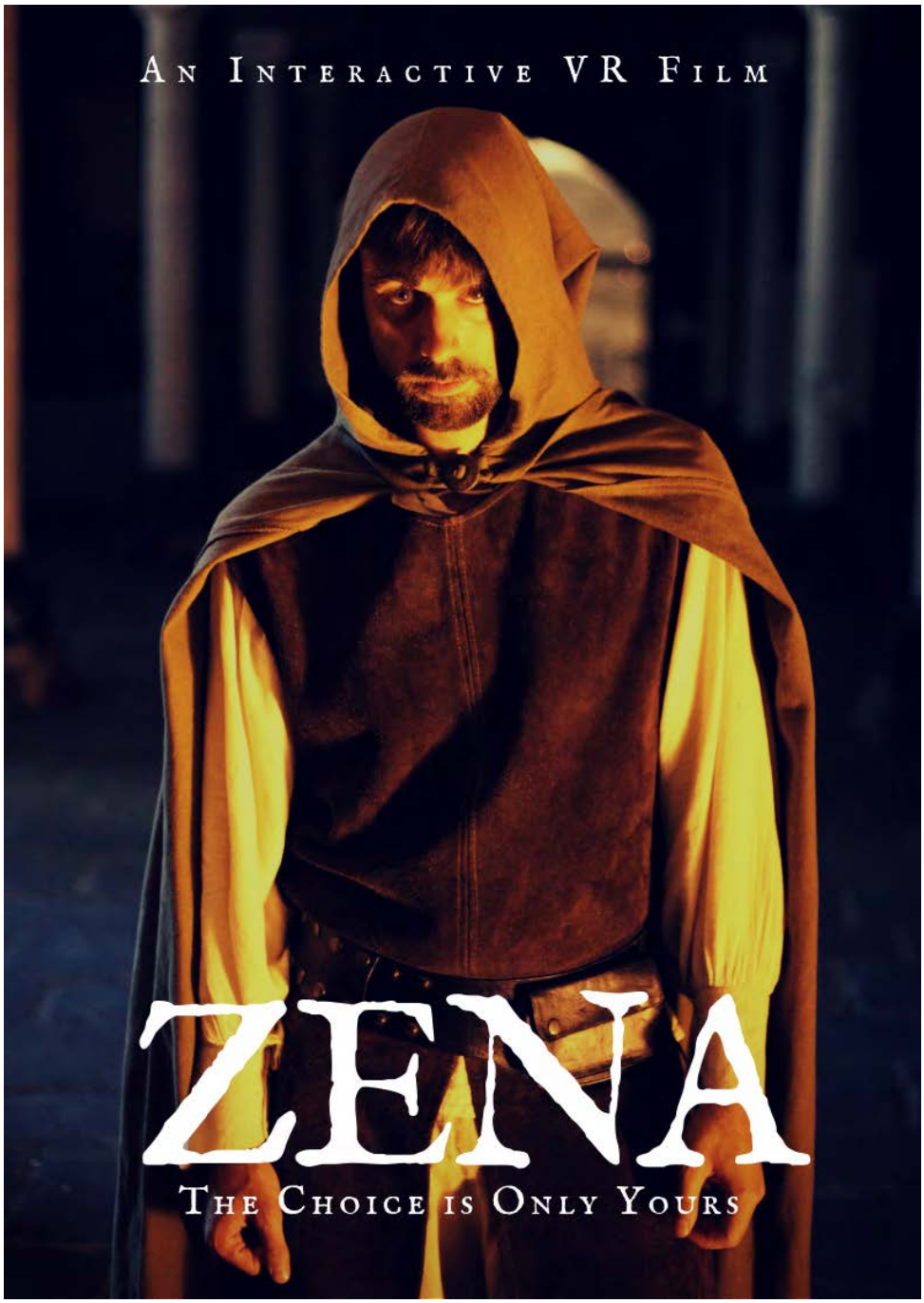


Figure 16. ZENA Poster

5.1.1 ZENA: The Story

It is the year 1517, Genoa is one of the most important Maritime Republics of the Mediterranean Sea. Its domains reach the coasts of the Middle East and the Black Sea. The name of the republic is respected by the other republics and empires of Europe, and feared by the bravest pirates of the Mediterranean.

Lorenzo is a young apprentice of alchemy and member of an ancient congregation scattered all over the world, *The Knights of Saturn*. In Genoa, his Master is the custodian of the magic clepsydra, an artifact capable of manipulating time, unique in its kind. In a quiet day, Lorenzo dreams something disturbing, someone in a very strange world is about to shoot him. He feels the dreams has been a premonition that regards the magic clepsydra, it is about to be destroyed. Sercan, an old pirate of the Black Sea, has undertaken his way to Genoa to assault the city and steal the clepsydra.

Frightened, Lorenzo runs to his teacher sure that the dream has been a premonition. The Master has already received a scroll warning of Sercan's attack. The Master has decided that Lorenzo must travel to the future to save the clepsydra, giving it to his correct custodian. Just taking out the clepsydra from the 1517, this one could be safe from Sercan. This is the first decision Lorenzo must take. If he says *No*, the adventure will not start and he will disappoint his Master. “Without courage, there is no adventure”.

After accepting the challenge, the Master gives Lorenzo the *Eye of Saturn*, the magic cane from whose sphere all the Saturn knights can see Lorenzo's journey and can help him on his journey. Lorenzo opens his eyes in the port of Genova, on a hot summer day. Incredulous of what his eyes see begins to walk towards the entrance of the city. It can still recognize its facades but around it everything is strange. The people around him look at him like he's crazy. Lorenzo arrives at *Piazza Caricamento*, the entrance square to the city; at this point he must decide where to go.

If Lorenzo is feeling confident in his city, because he knows it, he will look for *Piazza Grillo Cattaneo*, where his friend Simonetta used to live. Once he arrives, a girl with headphones will approach him as she knows him. He looks lost so she offers some help, indicating two ways, to walk towards the roads that go to the sea, or to walk towards the roads that lead to the mountain.

If Lorenzo is feeling lost, he will look for the Church of the *Scuole Pie.* Inside, he will sit down and think about his journey. But the old lady that takes care of the church approaches him, telling him to look for the light and believe in his journey. Meanwhile a drunken and sinful man enters the church and sits behind Lorenzo. He tells him that what he lacks is love, and that if he goes to the *Holy Sepulcher* street, he will find someone who can help him. He will have to choose between following the advice of the old lady or of the sinner.

Maybe Lorenzo feels that someone is waiting for him, so he will enter into one of the narrowest streets of Genoa's labyrinth. There, he will find Sercan for the first time, he has been waiting 500 years for him. In a tense situation, Sercan explains to Lorenzo that, when traveling to the future, he and the Master were trapped in time, unable to die. Sercan threatens Lorenzo to remove the clepsydra, but Lorenzo manages to escape. But by which of the streets?

At this point, Lorenzo could have ended in different situations. He could...

- Live a situation of danger when a man in the street tries to stab him in the street. He manages to escape because someone throws a bucket of water on the attacker. Lorenzo will have to choose between two streets.

- Find the oracle at the Holy Sepulcher street, a young lady whose grandfather was a Saturn Knight. She reads the tarot to Lorenzo and gives him some advice to continue with the journey. At the end she gives him two cards to choose from… *The Tower* and *The Fool.*

- End up at the old port looking for the old lighthouse, the symbol of the city. In this search, he finds a desolate and angry inhabitant of the city, who complains about how cement has devoured the city. After that, he finally arrives at the port, to the sea, where he asks for help from the Saturn knights looking directly at the sphere of the magic stick. Lorenzo does not know if he should continue on his way or if he should return to his time without having fulfilled the mission.

If he returns to the past, the Master will receive him with delusion, and the journey ends with disappointment.

But if Lorenzo goes to *Piazza Embriaci,* things may improve. At the square, he finds Sercan, who arrives in peace, and gives him useful information. He tells Lorenzo to go to *Porta Sottana*, someone is waiting for him there. But in *Piazza Embriaci*, the beautiful young woman with the headphones is observing him without being noticed. Thus, Lorenzo can choose to follow Sercan's advice, or to go up where the girl with the headphones magically suggests, or to go to the lighthouse.

If Lorenzo chooses to feel the call of the girl with the headphones, he will find himself at *Porta Soprana,* the upper gate to the old city. Once there, he hears the voice of the girl calling him, telling him to go up through the stairs. He reaches the top of the tower; from which he can see the city. Suddenly, the voice of the girl with the headphones reveals to him. It is Chronos, the final custodian of the magical clepsydra. Chronos explains Lorenzo the reason of his journey and what happened to humanity in the last 500 years. Chronos sends Lorenzo to *Porta Sottana*, the other gate to the old city, the same one that Sercan suggested.

When Lorenzo arrives at *Porta Sottana*, he discovers that the old palace of the gate is today a university. His intuition guides him through the corridors and teachers' offices, until he reaches the door where someone waits for him. Lorenzo opens the door, and finds his Master, dressed in a contemporary manner. Hard to believe it but it's him. The Master tells Lorenzo

that he is the final custodian of the clepsydra, and that his mission is over. But should Lorenzo trust him?

If Lorenzo trusts the Master, what Lorenzo saw in his dream becomes true. The Master will shoot him, to take the clepsydra and control the time for ever.

But if Lorenzo does not trust his Master, he will escape. The Master takes his gun and goes after Lorenzo. While running away from the Master, Lorenzo arrives into *Piazza dei Fregoso.* Once there, he does not know where to go. While he decides where to go, Sercan appears and from Lorenzo's back the Master arrives. Sercan confronts the teacher, finally he is who caused their being trapped in time for 500 years, and the only thing he wants is to die. To do so he needs the power of the clepsydra. In the presence of the clepsydra, Sercan cuts his neck, and by its magical power, the Master also dies. Lorenzo cannot believe what his eyes see, the Master is dead and so is Sercan. Lorenzo rescues the clepsydra from the Sercan's hands, and runs away.

Lorenzo arrives in *Castelletto*, one of the highest points of the old city with a beautiful view of the sea. Chronos, in the body of the girl with the headphones, is waiting for him. He arrives exhausted with a lot of questions, he now does not know what to do. Chronos gives him two alternatives: either he gives the clepsydra to her and goes back to his time where he will meet the Master he knows with the mission accomplished, or he can be now the new guardian of the clepsydra, the new master of the congregation and remain in the future.

5.2 The System Design: Applying the Protostory Model to IFcVR

As seen in Chapter 4, in IDNs it is not possible to separate the system from the storyworld. Therefore, when creating an IFcVR, the first step is to design the system that will contain the possible stories to be delivered during the *discoursivization* process. The protostory model is a conceptual framework proposed by Hartmut Koenitz (2005) that gathers all the aspects to take into account during the ideation phase of any IDN project. By using the protostory model, the IDN not only focuses on the narrative design but makes a step back in order to have an overview of the aspects that will be managed by the IDN system. As the etymology of the word suggests, the protostory is a root, the original element from which the other elements develop, the starting point that allows us to pursue a medium-conscious narratology taking into consideration the technological nature of IFcVR, even if it is not an emergent narrative (Jenkins, 2004), but a pre-scripted one.

In cinema, the screenplay starts with an idea that is embodied by a character (whom is the story about?) and an action (what is the story about?) (Field, 2003, p. 32). In literature, cinema and theater, an assumed premise is leading to a conclusion (Lajos, 1972, p. 4). In the same way, all IDNs start with an idea, a message that will remain on the interactor's mind; the difference is that, in IDN, the idea does not have the form of a typical drama or film subject, it goes further. If the premise in cinema is the initial state of affairs that drives the plot, the protostory is the "Encoded Storyworld" (Knoller, 2012), that gathers all the possibilities, technical and narrative, of an interactive digital narrative. Koenitz (2015) proposes as a starting point the Protostory model (Fig 17): "A procedural blueprint that defines the space of potential narrative experiences contained in one IDN system".

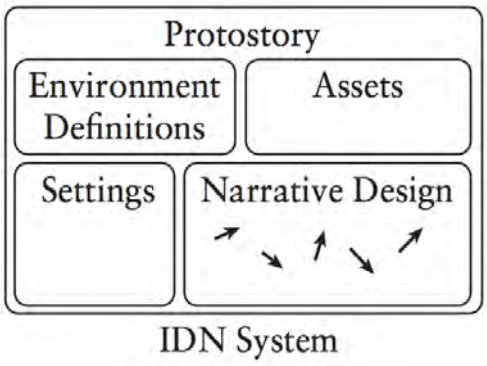


Figure 17. Protostory model (Koenitz, 2015)

Protostory. The dynamic narrative prototype.

Environment Definitions. Where the story takes place.

Assets. Through which kind of elements the story is delivered (text, animated characters, still images, videos).

Settings. Through which kind of interfaces interactors interact with the story.

Narrative Design. The concrete structure of the Interactive Narrative, often represented with a graph. In Koenitz' proposal, the narrative design includes *Narrative Vectors*, moments that direct the flow of the story, allowing the author to keep some level of control. Koenitz compares Narrative Vectors with Syd Field's (2008) definition of plot points in cinema screenplays.

The use of this proposal in the ideation phase of an interactive narrative can be useful because it allows us to integrate storyworld and system in a single conceptual framework. Once these concepts are defined, one can move on to think about Narrative Design, the creative moment in which the interactive screenplay is written. In AI-based IDN systems, programming can take place almost simultaneously to the creation of the final product. In IFcVR, as a prescripted filmic experience, the protostory is placed before the phases of film production: protostory, development, pre-production, production, post production. Using the Protostory model, Figure 18 illustrates the primary components of a IFcVR project.

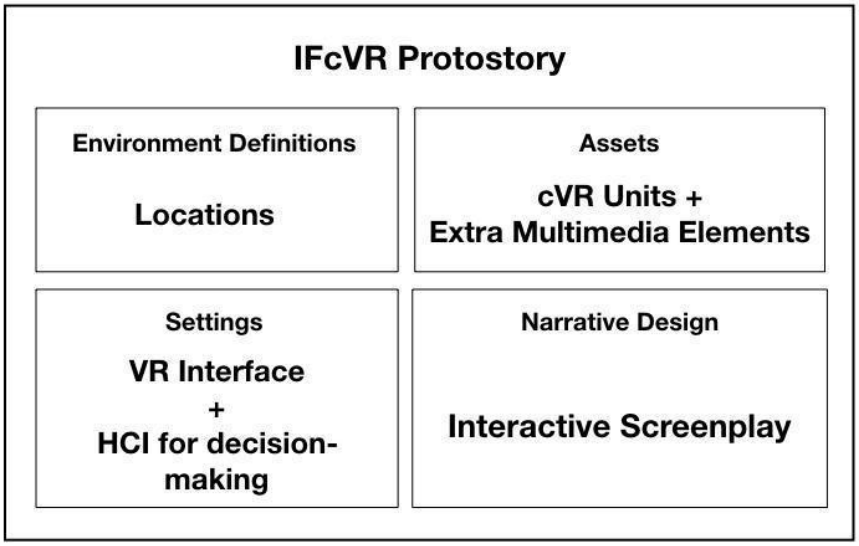


Figure 18. IFcVR Protostory Model

Environment Definitions. In IFcVR, the environment corresponds to the locations in which the scenes of the story are going to be shot or animated. Again, a cinema term is used to designate a component of the IFcVR system design. I propose to consider, already in the Protostory phase, the direction of art for the environment. Considerations like photography key, design of the spaces, etc., should be described in this phase.

Assets. The assets of an IFcVR experience are, in first place, the cVR units, the independent scenes that deliver parts of the story. In second order, it is possible to deliver extra information through multimedia elements (text, animated characters, still images, videos) layered upon a 360° moving image.

Settings. As the main interface of the IFcVR project is VR, the settings correspond to the integration of the VR system with the interface designated for interactors' decision-making moments.

Narrative Design. The narrative design is the interactive structure of the interactive VR film. This structure is created by the screenwriting of each narrative unit and followed by the connections between them. The resulting graph of the interactive structure will determine the number of the possible output stories or paths that interactors can take within the storyworld.

In the next section, a framework proposal for the screenwriting of interactive VR fiction films is presented.

5.3 The Narrative Design: Screenwriting Framework for IFcVR

The narrative design of an IFcVR project can be related to screenplay for cinema, both are conceptual tools for the shooting of the scenes. At the same time, the IFcVR narrative design is indeed the IF of IFcVR: Interactive Fiction. However, the screenplay of an IFcVR experience needs to preserve narratological consistency on one side, and granting real interactive experiences on the other side. In this section, a screenwriting framework is proposed, that aims to become a conceptual tool for the authorship of a pre-scripted interactive narrative with multiple navigation alternatives. The main contribution of the framework is to support the design of an interactive narrative that is independent of interactor's decisions within the storyworld: the plot is always conducted into a dramatic climax, so as the filmic experience can be received by the viewer as a fluent and coherent story. The question that served as a guideline for the development of this proposal is the flagship question of interactive digital narratives, already discussed in Chapter 4: *How to tell an engaging interactive story without compromising its dramatic progression?*

This study relies on three elements in order to achieve a fluent interactive VR film:

(1) A well-structured pre-scripted interactive story with special attention to its dramatic arc based on the classical cinematographic structure (Field, 2003).
(2) The *interactivization* of the narrative structure (e.g.: The Hero's Journey (Campbell, 2008; Vogler, 2008; McKee, 2010), other narrative structures as proposed by Koenitz, 2018).
(3) The immersive nature of cVR.

Interactive Digital Narratives should also pursue the Principle of Unity, "the absolute and essential relations of all the parts of the whole" (Price, 1908, p. 56). As it happens in films,

the ultimate linear sequence formed by the narrative units that interactors have chosen needs a dramatic tension in order to conduct the story and keep the viewer's interest alive during the experience. To achieve this goal, an interactive screenwriting framework is proposed that takes as foundation the classical cinematographic narrative structure summarized by Syd Field in his book *Screenplay: The Foundations of Screenwriting* (2005); hence the final experience can have a dramatic progression similar to watching a film. In this sense, Field's paradigm becomes a canvas, upon which the narrative structure can be *interactivized*.

5.3.1 A Time Paradigm as a Canvas

> *"What is the common aim of all dramatist? Twofold: first, as promptly as possible to win the attention of the audience; secondly, to hold that interest steady or, better, to increase it till the final curtain falls"* (Baker, 1919)[65]

Also for interactive structures, as it has been used for theater, radio, cinema and television, a starting point for creation is to set periods of time that will help the creator on her way to guarantee a series of events and complications that character(s) will live during the time of the experience, driving the story and the interactors along ups and downs of emotions, independently of interactor's choices. In this way, the creator can set the rhythm of the narrative and keep a great level of control, not by telling the interactors what to see or to choose, but by controlling the temporality of the events. Interactors will live the illusion of freedom of choice, while the experience is already built: each temporal segment has an objective, complications, turning points, its own climax and a final climax that fills and rewards the interactor's struggle.

Of course, this idea is nothing new: already in 335 BC, Aristotle recognized three acts in a narrative structure by identifying the anatomy of a *whole* action, which is composed by "a

[65] Originally, this segment was titled "Syd Field's Time Paradigm as a Canvas", however theater texts of the beginning of the XX century (Baker, 1919; Freytag, 1900; Lewis, 1918; Price, 1908) clearly expose Aristotle's ideas of segmentation of the narrative piece, and even the famous manuals of the cinematographic screenwriting (Field, 2003; McKee, 2010) follow exactly the same guidelines and writing of these dramaturgical volumes.

beginning, a middle and an end". Afterwards, he split the play into two parts: "complication and unravelling". Returning to the thought of Aristotle, Gustav Freytag (1900) represented the action in the form of a pyramid (Fig. 19), and identified five moments for its completion. Even though the image represents the climax at the middle point in which the action splits, this is not a perfect mathematical timing, but each action can have different timings, moving the climax to the exposition or to the denouement. Since the time of Aristotle, there have been theatrical and literary works that develop their stories in one (Lewis, 1918), two, three, four or many acts. Analogously, a lot has been theorized about the number of acts that a story should have. However, beyond the number of acts, the important concept is the division of the plot and plot actions into Periods of Progression (Price, 1908, p. 78). Each period of progression or act, should have an object and a proposition, and "carry it out" (Price, 1908, p. 79). Following this idea, we can think at each act as an independent action, giving it the composition of a *whole,* including a climax. By doing this creative exercise, the interactive story will not only ensure a final climax, but multiple climaxes that interactors can live during the filmic immersive experience, besides the interactive structure of the story and the number of narrative units that integrates it.

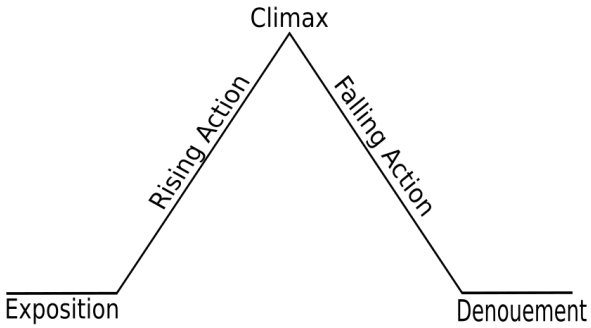


Figure 19. Freytag's Action Pyramid

In the same flow of ideas, I propose to base the writing of the interactive screenplay on time and its subdivision into acts, which in the case of ZENA was done by using Syd Field's Paradigm (Fig 20). The notion of time and its subdivision in periods of progression will work as a canvas, in which the interactive narrative structure will be designed. This structure can

be recognized also in the traditional Hollywood film structure, where stories develop in a paradigm of three acts: setup, confrontation and resolution. Generally, the time of the whole film is divided as follows:

- ➔ Setup (1/4)
- ➔ Conflict (1/2)
- ➔ Resolution (1/4)

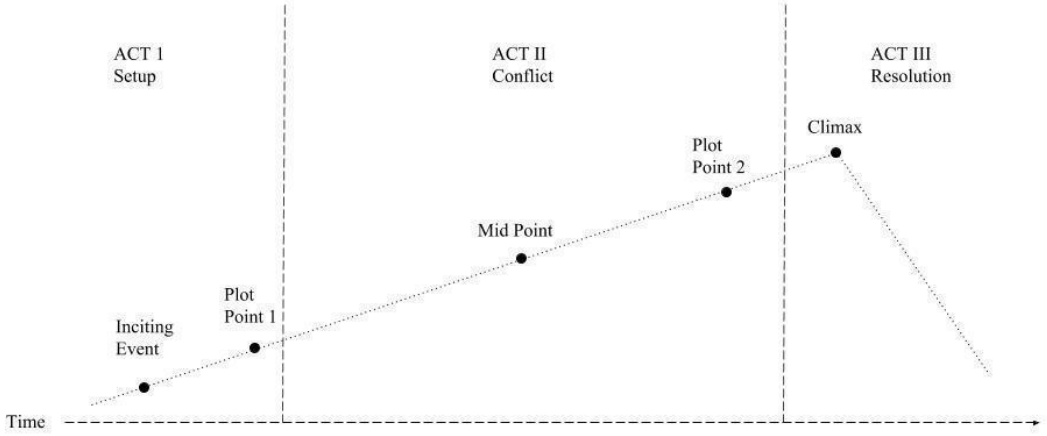


Figure 20. Syd Field's Film Narrative Paradigm

Each act contains specific turning points and stages that continuously add tension and contribute to interactors' engagement: "at the end of each act you have reached a predetermined stage of your journey" (Price, 1908, p. 79). The turning points, or narrative vectors in IDN terms, will be distributed on the single narrative units that will make up the interactive structure's graph. The creation of the Time Paradigm canvas is summarized in the following steps:

1. In a blank space (paper, computer screen, board, etc.), temporal divisions are drawn that separate the acts or periods of progression of the whole experience. Each act has its own duration according to its importance or complexity.

2. Once the canvas is divided into acts, to each of them an objective which can be given in a word or a short sentence is assigned: “What will be accomplished in this act?”
3. The creator can already decide when the plot points or narrative vectors will take place on each act. To this end, the creator can get help by using Hollywood established plot points, or other narrative structures, turning points and stages, or simply by creating them on her own. At this point, the creator can foresee the climaxes and maxi climax of the whole experience.

The next step is the creation of the interactive fiction graph or structure, by writing the narrative units with a brand-new logic, different from theater or cinema.

5.3.2 Writing the Screenplay as Mind Map

This conceptual framework provides a way to *interactivize* a narrative structure in order to create a prescripted interactive digital narrative. At the time, most cinematic VR experiences are linear with little interactive opportunities or agency, besides the look around of selecting elements that do not change the course of the story. Changing the course of the story means creating multiple stories, multiple parallel universes, multiple "What if". This is one of the critical parts of the conception and subsequent writing of an interactive story. While there are online tools for writing interactive fictions, such as *Twine* or *Inform7*, which allow us to create hyperlinked words or phrases that branch off the story -which can be also done with any text editor- the concept behind creative work is the same, i.e., to shape a story with different possibilities. In this sense, the story is itself a mental map that covers points where the development of story can diverge.

IFcVR is based on single prerecorded audiovisual narrative units or nodes, especially 360° videos. Therefore, in order to create a nonlinear story with multiple navigation alternatives, the proposed framework creates a graph-based preconceived structure formed by unique video clips that correspond to a scene or sequence. Each video clip represents a narrative

unit. Regardless if it is a scene or a sequence[66], it has been already edited in post-production. Each narrative unit (NU) can be origin or destination of another one or of multiple units; this is a crucial aspect to keep in mind when developing the narrative events that occur on each NU. Whether it is a scene or a sequence of scenes, each NU must be an independent and coherent narrative element; this is necessary in order to make it possible to easily connect each NU with other NUs.

At this moment, the creator may or may not have decided if their NUs are individual scenes or sequences; this division will take place in the next phase of the screenwriting. Here, the creator finds herself at a middle point between the division into acts and the division into scenes-sequences: The Division into Narrative Units. The step-by-step process for creating and locating each NU is described below, and it will be exemplified through the *interactivization* of a well-known Hollywood structure: The Hero's Journey. This model was chosen to led the creation of ZENA, in the attempt to create a fiction film with an easily recognizable structure. The same creative method, however, can be applied to the interactivization of non-western-like narrative structures[67].

"Narrative events have not only a logic connection, but a logic of hierarchy. Some are more important than others" (Chatman, 1980, p. 53). This phrase of Chatman illustrates very well the task of mentally placing on an empty canvas the events that will push our interactive story forward in time. These narrative events take place inside the NUs. In the previous step, the whole experience time was segmented into acts and in the timeline of each act the turning points were pointed out. In this step, questions such as *What are those important narrative events? What occurs in them? At what turning point do they correspond to?* trigger the creative process.

In the case of the Hero's Journey, there is a characteristic that facilitates the creation of the

[66] The terms Scene and Sequence is used in its cinematographic sense (Field, 2003).

[67] It is important to note the difference between *narrative structure* and *interactive structure.* The narrative structure concerns the content of the story, while the interactive structure (See Chapter 4) refers to the disposition of the UN and the form and behavior of the graph.

NUs: the time division of the hero's journey is the same of Field's Paradigm. The hero's journey is represented as a circle with three acts: the departure from the ordinary world (setup), the entering into the extraordinary world (confrontation) and the return to the ordinary world with the achievement of the main purpose, that brings peace, mastering the two worlds (resolution). Each act – *Separation from the ordinary world*, *Extraordinary world* and *Return* – is subdivided on stages of conflict, illumination, fear and overcome, victory and wisdom. Using the linear structure divided into three acts as a canvas, each stage can be located as an independent NU inside its correspondent act. The division of each stage and its location on the timeline allows the creation of a non-linear structure where the order and connections can be made by following the specificities of the plot. In this study, a nonrestrictive way to locate each NU within the correspondent act is suggested, presenting different alternatives to diversify and combine stages. Below, I am describing how the process of interactivization was undertaken during the narrative design of ZENA (Fig 21).

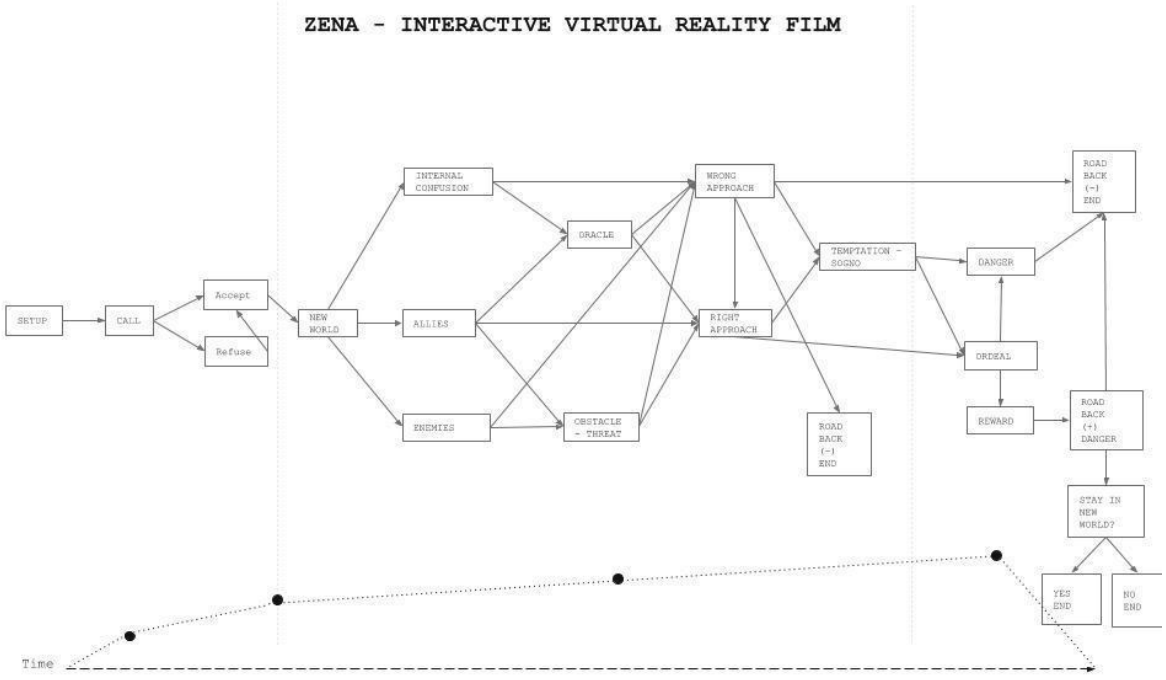


Figure 21. ZENA's Interactive Narrative Design

Act I: The Departure – Setup. On Act I, the first possibility of interaction is related to the acceptance or refusal of the call that represents the inciting incident. These two possibilities (accept or refuse) have been regrouped into one single dramatic stage: the help of a supernatural agent. The simplicity of the interaction in this first act obeys not only the narrative beginning of the story but also the progressive multiplicity of choices that the interactor will make along the development of the story. In this particular case, no matter what his/her choice, the hero has to be conducted to begin the adventure. The call to adventure corresponds to the inciting incident, while the first plot point coincides with the first threshold, the entering into the extraordinary world.

Act II: The extraordinary world – Confrontation. The second act starts after the arrival of the hero into the extraordinary (new) world and the entering into the *"belly of the whale",* the stage in which the hero descends into darkness and discovers new truths about himself, emerging as a reborn hero. These two stages, as *setup* and *call,* are in this scheme represented as separated but consequential scenes. Scenes-stages can also be edited as one on postproduction in accordance to the plot or the production requirements of the project. From *The belly of the whale* stage, a number of trials are proposed; all these scenes are part of the *Road of Trials* stage. The Road of Trials is a series of obstacles and tests but also the moment in which the hero meets allies and friends. In this scheme, three situations are represented: an *inner confusion* of the hero, the encounter with some *ally(s)* as well as the encounter with some *enemy(s)* and threats. Specifically, the encounter with a *deity/oracle* or an *obstacle/threat* are situated on the *Middle Point* of the experience, because, according to Campbell, this is the moment in which the hero finds key information that will be helpful on the way to the climax. The *Middle Point* closes the first part of the story and opens the second.

At this moment, an example of double stage is introduced: the approach to the *Ordeal*, which in the scheme is represented with a *Right Approach* and a *Wrong Approach,* each stage adds dramatic tension before getting into the climax. This duplicity can be adapted to any stage of the journey.

Act III: Return – Resolution. The last act begins with the climax of the story, the moment

when the hero is near to reach the key element that will bring peace and happiness. But as it happens in videogames, reaching the reward can be related to the behavior of the interactor, its attention to details and commitment with the hero's goal. In ZENA's interactive structure four possible endings are presented: two negative endings where the hero does not achieve his mission and two positive endings where the hero gets the reward and can choose between two options for a happy life, *mastering the two worlds*: ordinary and extraordinary world. An interactive story with only one possible end would spoil the curiosity of the interactor to try other alternatives in subsequent usages of the interactive story.

The process of creating the mind map or interactive structure of the interactive screenplay can be summarized in the following steps:

1. Identify the NUs that correspond to the turning points or narrative vectors, giving to each NU a proposition or sentence that describes the event that take place in it.
2. Identify the NUs that build the rest of the story, giving to each NU a proposition or sentence that describes the event that take place in it.
3. Identify in which NUs, interactors will face a decision to move forward in the story.
4. Identify which NUs can have multiple outcomes. i.e.: The call in Act I can be accepted or rejected; the approach in Act II can be right or wrong; the road back in Act III can be positive or negative.
5. Identify which NUs can be a hub so the interactor can go back and forth. E.g.: The New World, at the beginning of Act II, offers three different possibilities. At this point, as ZENA's creator, I gave my interactors the possibility to come back to the New World NU, so as they can choose a different path. This is the only time in which interactors can go back in time. A different video version of the NU was shot so as interactors will not see the exact same video of this place.

By following this method, the final result will be a mind map canvas that works as a visual tool for the creator, offering an overlook of the whole interactive structure. The mind map can be used as starting point, so as it is possible to take into consideration the navigation options when writing the actual scenes, as well as to use it to *interactivize* a story that is

already written. The next step is to connect the Narrative Units.

5.3.3 Connecting the nodes

At this point, the creator has before her eyes a map of events that are made hierarchical and distributed over time. Now the task is to connect the narrative units between them and decide which of those events can offer more information to the interactors about the storyworld, so as they can build an entertaining interactive narrative experience. This is the part in which the film component of IFcVR meets the play component, and this phrase from Sid Meier confirms it: "A good game is a series of interesting decisions (Hiwiller, 2016, p. 84). It is also not about increasing the number of decision-making times, but about making those decisions meaningful in the context of the story, together with interactor's background and horizon of expectations.

Although IFcVR is a pre-scripted narrative, the success of the experience lies in the cleverness of these decisions. In IFcVR, the interactive options are mainly two: the power of the interactor to select the next scene or to accede to additional information that enrich the experience. Therefore, interactions can occur between NUs (external link) or inside the narrative node (internal link). Interactions can be activated through elements that belong to the storyworld (diegetic) or elements that are external to the storyworld (extradiegetic).

5.3.3.1 External and Internal Links

External Links. External links connect a NU with others. They represent a change of scene or sequence, a dramatic situation that is different from the previous one, a new event. The external links are those that make interactors move forward in time, towards the end of the experience. In order to jump from a NU to another NU, interactors will need to make a decision at the end of the event, because we are necessarily working with prerecorded units. It is also possible to insert the decision-making moment at the beginning of the NU, but interactors should be informed that the NU continues, so they can choose if skip it or not.

An external link that returns to a previous narrative node can present two possibilities:

1. **What in movies is called a flashback.** The narrative need for a flashback responds to the search for key information to fulfill the story. This information could have been already given but requires a second look or can be added by doubling the narrative node creating two versions of the same scene: the first narrative node and the flashback narrative node that contains the new information.

2. **A return that enables the possibility to make a different choice.** The return to the previous narrative node that enables the possibility to take another path, requires a number of versions of the same narrative node in correspondence with the number of links that this specific narrative node offers. In this way, it is possible to add free information and new details to each version of the narrative node (e.g. a non-fundamental character that says hello or some casual situation).

Internal Links. Internal links connect diegetic or extradiegetic elements inside a single NU. Technically, a diegetic or extradiegetic hotspot is linked to a multimedia element (video, image, sound, text) that can be overlapped above the current 360° video or can transfer to another 360° video that returns to the same NU. The purpose of the internal link is to offer useful information to the interactor. This information can be:

1. **Diegetic.** Multimedia elements that belong to the storyworld and enrich the understanding of the story.
2. **Extradiegetic.** Multimedia elements that do not belong to the storyworld but give useful information to the interactor, i.e.: instructions, credits, further information material.

5.3.3.2. Hotspots

The IFcVR hotspots are areas of the video with a linking function. When clicking, tapping or hovering a hotspot, the player will jump to the video segment linked to by the hotspot or will display multimedia material. When interactors face decision-making moments, they will have to choose between hotspots, or select one to access some information. Hotspots are generally visual, images overlay above a segment of the video that contains a link, hence creating a hypervideo. Depending on whether or not the hotspot belongs to the storyworld (characters, objects, places, sounds), it will be considered diegetic or extradiegetic. Hotspots can also be used to start over a 360 video or to transition to a specific time in a different video.

Dynamic Hotspots. An issue posed by hypervideo, especially for narratives based on interactive video, is the lack of software with dynamic hotspots, that is, hotspots that move frame by frame. Thus, in a shot with camera movement, a hotspot located on a door, for example, can always remain on the door tracing the movement of the camera frame-by frame, without remaining fixed on a single area of the video. During the realization of this thesis, Gabriele Fusi (2017), a bachelor student of software engineering of the University of Genova, developed Prometeo 360[68] an editor for interactive 360° video that not only allows the creation of interactive immersive experiences, but also allows the creation of dynamic hotspots. With Prometeo 360 (Fig 22), creators and editors can "redefine the interactive areas using key frames, hence the areas will follow the objects in the videos while they move" (Fusi, 2017).

[68] http://prometeo360.gabrielefusi.com/

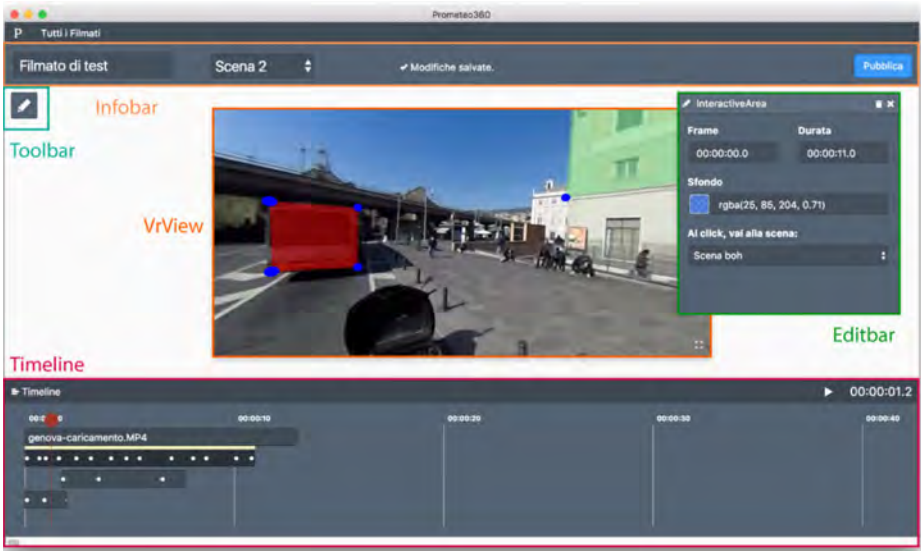


Figure 22. Screenshot of Prometeo 360 User Interface (Fusi, 2017)

Auditory Hotspots. In cVR, hotspots can also be auditory through the use of Spatial Audio. They work in the same way of visual hotspots with the difference that there is a sound source associated with the active area that is visually transparent. In this way, the interactors will make their choice by recognizing the audio source and then hovering or selecting that invisible area. Auditory hotspots can be combined with a visual element within the environment. Auditory hotspots can also have interactive functions: "reduce audio volume when an interactor looks away from the hotspot, while keeping the audio track playing; stop and restart the audio track when a viewer looks away from and then back at the hotspot again or gradually fade the volume in and out as the interactor looks toward and away from the hotspot" (eevo, 2018).

5.4 The IFcVR Screenplay

Once the narrative design is created, that is the interactive architecture of the IFcVR project, the next step is to write what is going to be seen: the cinematic screenplay of the immersive interactive film. At this point, all Narrative Units have been created and to each of them a narrative event has been associated (a scene or a sequence of scenes). NUs have also been connected with other NUs, creating the whole interactive structure. Now, with the overview of each step, the creator can actually write how the events unfold in a cinematic form, visually describing the actions that characters play. The writing of the screenplay for an immersive film needs to consider in the first place the aspects related with the 360º environment.

This conceptual exercise creates narratological issues, in particular related to the cinematic VR narrator: *Who tells the story? Who is the interactor within the storyworld? Is the interactor part of the story at all?* There are also some challenges in relation with the Interactive Fiction (IF) structure: *What kind of interactions are going to be used? In which way will they affect the story? How to write a fluent and coherent story where a single narrative node is both source and destination of one or multiple other nodes?*

This section will describe how these issues were tackled during the development of ZENA, proposing a format for the script master head.

5.4.1 IFcVR Screenwriting

Each NU has been identified with a logline that describes its narrative event. Now, it is time to write the screenplay, which includes the detailed visual description of what happens in the scene: the characters, their actions, their movements in space and their dialogs (Field, 2005). The IFcVR Narrative Unit needs to take into consideration two aspects: the cVR aspect and the IF aspect.

cVR. The cVR aspect is related to the 360º space. At this point the first step is to define who is the interactor within the NU (See Table 1). It is possible that the role of the interactor will be always the same during the whole experience, or change depending on the dramatic needs of the experience. For example: in one scene the interactor lives in first person the story while in the next scene she can see herself as an external third person character. Once the interactor role (or what I've called *Narrator Type* (NT), see Chapter 3.3.2), has been selected for the NU, it is possible to locate the camera within the stage.

	Internal Analysis of the Events	**External Observation of the Events**
Interactor is a character of the story (Intra-diegetic)	1 - Interactor lives her own story	2 - Interactor and main character interact
Interactor is not a character of the story (Extra-diegetic)	3 - Interactor is analytical regarding the story, having access to characters' feelings and thoughts, or having information that is unknown to the characters.	4 - Interactor observes the events without participating

Table 1. Narrator Type in VR storytelling. Adaptation from Brooks & Warren (1943)

As in cVR the scene is the stage, the creator will have to figure out from which physical point of view the interactor is going to experiment the scene. If the NT relates him with a character of the story, the creator will have to think, for example, how tall is that character or from which distance the character interacts with the other characters. If the NT does not belong to the storyworld, the creator will choose from which area of the stage the interactor will have the best visual field of view (FOV) to live the events, and, narratively, how to offer the information from which the interactor will build up the understanding of the events. The selection of the NT will have not only a narrative impact but also a technical impact during the shooting. The logline of the NU, together with creator's dramatic intention, will determine the location of the camera and how close this will be to the objects and characters.

Since the scene is the stage, during the screenwriting it is also important that creators describe the stage in 360°. The description of the stage will allow us to integrate visual and auditory elements (characters, extras, props, or interactive elements) that enhance the experience in the whole visual space, and consequently the movements of the characters within the scene/stage, e.g. from which area the characters enter the scene and from where they will go out, in which area of the stage the main action will take place, where the hotspots will appear, and to which objects/characters they are related in relationship with space.

IF. From the Interactive Fiction point of view, the screenplay needs to clearly describe how the interaction is going to be activated by the interactor. In this sense, the screenwriting logic turns away from cinema and develops itself in a different way. A good IFcVR, as all interactive narrative experiences, requires an intense creative work to bring together the dramatic weight of the scene into a meaningful decision for the interactor and the development of the story. And that driving towards the decision-making moment must be achieved organically and according to what happened in the narrative unit.

Another aspect to take into consideration is that one NU can be both destination and source of multiple nodes, and this ambiguity must be handled not only from a strictly narrative point of view but also visual one. The story logic must be maintained despite the multiple possibilities, as well as the cinematic continuity and the visual flow between NUs. This narrative and visual harmony should be maintained so that the interactive film will have unity and flow.

5.4.2 The IFcVR Script Model

In traditional linear cinematic screenplays, a heading is assigned to each master scene to show: the scene number, if it is shot in *interiors* (INT) or *exteriors* (EXT), the main location in which the scene develops and if it occurs at day or night. Underneath, the body of the scene is included, together with the detailed visual description of the stage, the emotional state of the characters, their movements, and their words. At the end of each scene, the type of cut that connects the master scene with the next one is written on the right margin, if any. In the same way, IFcVR screenplays keep the same logic in which the script translates the narrative events into visible and audible actions. Figure 23 contains a page from the screenplay of the film TRON (1982), that shows the structure of a traditional film screenplay, the starting point for the development of IFcVR screenplay.

However, since the IFcVR screenplay has two different characteristics from cinema screenplay (cVR and IF), it is important that the script shows clearly this differences in order to guide the actors and the crew during the shooting. Some useful information to be displayed on the IFcVR is listed below:

From the cVR point of view:

1. The NT will indicate the position of the camera within the stage.

2. The 360° environment, especially if there are objects or elements within the cVE that will be useful for the scene.

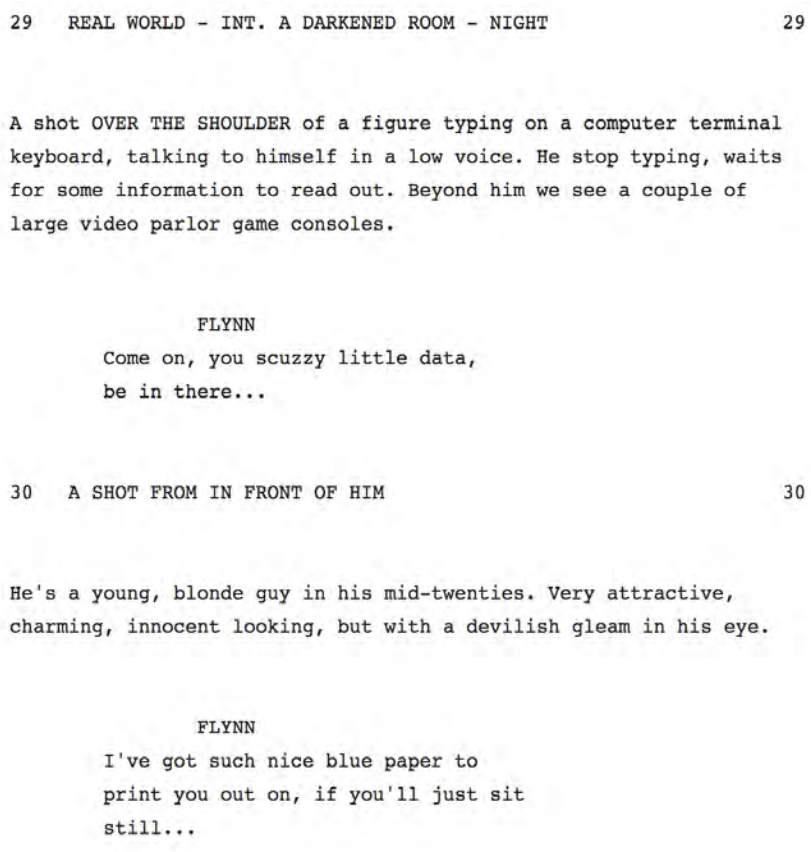
3. The number of shots/scenes contained in one single NU.

4. Spatial audio specifications, so as it is possible to determine in which area of the sphere the audio sources will be located.

From the IF point of view:

1. The screenplay needs to indicate the path that the story is following: current NU, previous and next NUs.

2. The type of interaction: number of hotspots, visual or auditory hotspots, internal or external links, diegetic or extradiegetic hotspots and the location of the hotspot.



29 REAL WORLD - INT. A DARKENED ROOM - NIGHT 29

A shot OVER THE SHOULDER of a figure typing on a computer terminal keyboard, talking to himself in a low voice. He stop typing, waits for some information to read out. Beyond him we see a couple of large video parlor game consoles.

FLYNN
Come on, you scuzzy little data, be in there...

30 A SHOT FROM IN FRONT OF HIM 30

He's a young, blonde guy in his mid-twenties. Very attractive, charming, innocent looking, but with a devilish gleam in his eye.

FLYNN
I've got such nice blue paper to print you out on, if you'll just sit still...

Figure 23. Screenplay of TRON 2.0 by Charles S. Haas

In Table 3, I propose a Master Scene Heading format. It is composed by the number of the NU, the logline of the NU, the location, the number of scenes and shots of the NU, which characters are participating, the precedent NUs (Inputs), the sequent NUs (Outputs), a space

for the description of the audio setting, and the types of interaction (number and types of hotspots). The Master Scene Heading shown in Table 3 was used to shoot ZENA.

NU	6	**Description**	Enemy
Location	Vico della Torre di San Luca	**Narrator Type**	2
Nº Scenes / Shots	3 (6, 6a, 6b)	**Characters**	Lorenzo - Sercan
Inputs	3. New World	**Outputs**	7. Oracle 8. Wrong Approach
Audio	Dialogue - Binaural Mic	**Interaction Type**	n.2 Visual Hotspots n.1 Return Visual Hotspot

Table 3. Example of the Interactive Screenplay Heading used in ZENA

The screenplay is completed by the body of the scene, which describes the actions of the characters, their dialogs, their physical and emotional states, as well as the physical space. It reports what can be seen or heard and also the movements of the characters inside the stage. At this point, the screenwriter must take into consideration the whole space in 360º when locating characters and props, so as to create a rich scene for the viewer to explore. At the end of each scene, the body of the interactive screenplay also reports the interactive choices and how they are presented to the interactor, e.g. if they include text or only visual symbols. To write the body of the scene, I suggest to use the typing guidelines of traditional movie screenplays. In Figure 24 the whole script page is exemplified using ZENA's screenplay.

N.N	4	**Description**	Internal Confusion
Location	Church	**Narrator Type**	2
Nº Shots	1 Square 2 Inside Church	**Characters**	Lorenzo - Old Lady - Drunk Man
Inputs	3. New World	**Outputs**	7. Oracle 9. Wrong Approach
Audio	Dialogue	**Interaction Type**	Hotspot on characters

EXT/DAY - PIAZZA SCUOLE PIE

Lorenzo arrives in Scuole Pie Square. He looks around with hard breathing. In front of him there is the church.

CUT TO:

INT/DAY - CHURCH

Lorenzo is seated in one of the pews of the church meditating in silence. An old lady is cleaning around. She notices him and talk to him with curiosity.

OLD LADY
(talking to Lorenzo)
Did you lose your way, young man?

While the woman talks to Lorenzo, a drunkard walks into the church and seat just behind Lorenzo.

OLD LADY
Those like him have no salvation.
But I can say from your eyes, that you have so many things to do, important things.
Always seek the light. Always remember to walk towards the light.

The old lady walks away, continuing with her work.

DRUNKARD
I know what your problem is. You just need some love.
Go to the Holy Sepulcher street. Trust me.
Do not listen to that woman.

The drunkard stands behind Lorenzo, looking at him while he makes a decision. The hotspots are located on the characters. Lorenzo has to choose one of them.

Outputs:
Drunkard: 7. Oracle
Old Lady: 9. Wrong Approach

Figure 24. Interactive Screenplay with heading and body

5.5 Pre-Production

During IFcVR pre-production phase all the necessary elements are settled for shooting, this includes: crew, locations, props, actors, technical equipment, as well as financial arrangements, and a detailed schedule for production and postproduction. However, in addition to the tasks of preparation of the necessary elements, as well as the financial tasks, during the pre-production a breakdown of the script is made. This breakdown produces two important tools for production: the storyboard and the shooting script. In this section, some insights will be given in order to elaborate both storyboard and shooting script, as we prepare to go to production.

5.5.1 cVR Storyboard

In cinema, the storyboard is the visual storytelling of the film. For each shot, the storyboard draws what is going to be shot and seen in the final film. It is a visual tool especially useful for director and photography director during the shooting process. It not only shows the type of shot, but also communicates its intention. Storyboards are the blueprint of films, animation films, videogames, commercials and TV shows (Paez & Jew, 2013). "The director can come late to a project; a cinematographer can start on a film the week before it shoots. But the art department must be there from the outset, deciding what the film will look like" (Halligan, 2015). The question that arises is: how to storyboard for an omnidirectional, frameless image, even with multiple events happening at the same time?

At this moment, most VR and cVR producers and directors are self-taught; surfing the web, it is possible to find the knowledge that the new communities of VR creators are sharing and constantly updating[69]. In the same way, both academia and industry are sharing insights and tools for sketching and storyboarding for VR (Henrikson et al, 2016). As far as storyboarding is concerned, we can summarize some principles:

[69] https://medium.com/cinematicvr

1. Areas of Interest (Fig 25). The sphere can be divided into 4 main areas according to the FOV: the front area is what the user clearly see without moving the head; the right (90°) and left (270°) areas can be clearly seen by moving just the head to one side or the other, and the curiosity zone (180°), the user needs to turn the whole body to see what is happening behind her. The sphere can be also divided according to the distance camera-object. The minimum comfortable viewing distance in an HMD is 0.5-meters while beyond 10-meters the sense of depth perception diminishes rapidly until it is almost unnoticeable beyond 20-meters. This gives us "a sweet spot between 0.5-meters to 10.0-meters where we can place important content" (McCurley, 2016).

When it comes to direct the interactor's gaze, theatre has tackled many of these challenges using light, motion and sound. All these cues should be located on the spherical storyboard, as well as hotspots or other types of interactive areas with thermal, haptic or auditory cues.

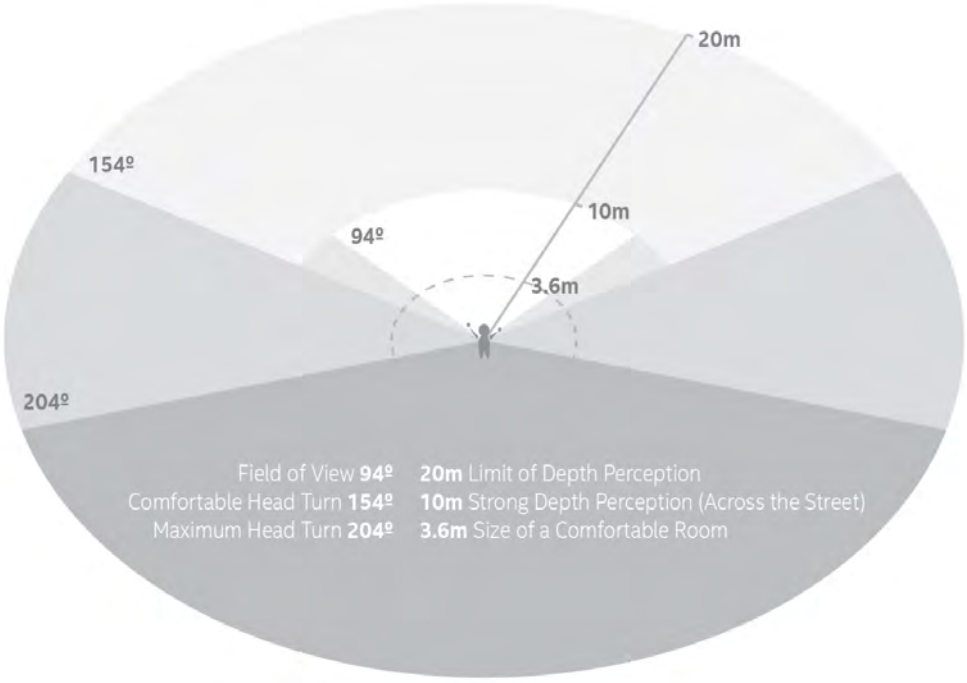


Figure 25. Areas of Interest – VR Prototyping Kamppari-Miller (2017)

2. Framing Points of Interest (Fig 26). When points of interest (PoIs), (important objects and characters) have been located within the sphere, it is possible to draw how these PoIs are going to be seen by interactor's FOV. By storyboarding such PoIs, the art department and cinematographer will be able to set the elements according to the creative intention of the scene. These drawings can be compared with the storyboard of traditional cinema, that takes into account the different types of shots that can be produced depending on the location of the camera, the distance between it and the objects, and the height of the camera in relation to the ground and the objects.

Figure 26. Framing Points of Interest on ZENA's NU 14 "Danger" Scene

5.5.2 The Shooting Script

The shooting script is the schedule of the shooting, the timing to shoot each scene, the order in which they are going to be shot and production breaks. It takes into consideration aspects related to cinematic continuity, hence the order of the scenes during shooting does not necessarily follow the order of the story, but a new order established by production needs: distance from one location to the other, time of the day (morning, afternoon or night) or special needs related to effects, costumes, actors.

The shooting script gives also information about the technical requirements of each scene: number of shots, camera movements, audio information. For IFcVR, it is suggested to include the number of the NU, the number of takes, if lighting key corresponds to day or night, the location, if it is exterior or interior, the characters called for that NU, the Narrator Type in order to know where the camera is going to be located, and if there are special requirements for that NU from the art department or from the team.

ZENA was shot in June 2017, in three full days from 8 am to 8 pm in order to take advantage of sunlight. Some scenes were shot during Mallick's magic hour[70]. Figure 27 shows the heading of the shooting script used during the production of ZENA.

DAY 1 - SATURDAY (June 10th)								
Time	N.U	Take	Light	Int/Ext	Location	Characters	Narrator Type	Special Requirements (Art, Team)

Figure 27. Shooting Script Heading

[70] The "Golden hour" also known as Mallick's magic hour (in honor to film director Terrence Mallick) "refers to a brief window of time each morning and night when the quality of sunlight changes, casting a soft and gentle glow instead of harsh, direct sunlight" (Gilderdale, 2016).

When screenplay, storyboard and shooting script are ready, it is advisable to do a read-through of the screenplay with cast and crew before shooting, and to share storyboard and shooting script with all members of the crew.

Chapter 6. Production

6.1 Producing an Interactive VR Film: ZENA's Case Study

"The *first* movie is its own justification, because it's the first movie" (Lumet, 1996, p. 8). Lumet's enthusiasm is the best way to open the chapter dedicated to the production of an interactive and immersive fiction film, precisely because he encourages the very first attempt. In this chapter, I am relating how the production workflow was undertaken during the realization of ZENA. From this experience, similarities and differences in the production of a traditional film with an IFcVR project are extrapolated. For this production, all resources I had at disposal was a group of talented friends who were excited about making this IFcVR experience, and the limited equipment described below. Even though most of those friends had experience in theater and traditional video production, this was their first time with cinematic VR; hence, I felt that some initial preparation was necessary for the team to get a first contact with the equipment and the workflow. This preparation took place the week before the shooting, and consisted in a read-through of the screenplay and storyboard, sharing some basic notions about shooting with 360° video, and watching some available experiences on a HMD.

ZENA was shot in 4K 360º video with two Kodak Pix Pro cameras with a field of view of 180º each, binaural microphones and a bidirectional microphone situated under the camera for ambient audio and wild tracks. ZENA was built with a longer duration than most VR experiences already realized, in order to check the possibility to raise the feeling of actually watching a film, and to test if experiences with a length that exceeds the average 7 minutes of current realizations can entertain without generating discomfort. Thereby, ZENA's longest path is 18 minutes and the shortest 8. Some NUs include more than one scene, hence a single

scene in ZENA has a length of one minute or less, and each NU has an average length of 1’30’’.

One of the main characteristics of this prototype is that each scene experiences a technical, narrative or cinematographic aspect to be tested by the users. In this way, I was able to test how effective were these aspects in relation to the narrative and visual flow of the whole experience. The experiments were both narrative or technical:

- The use of voice over
- The switch between narrator types (in most of the scenes, interactors were part of the story but not the main character, in other scenes interactors watched the scene from an omniscient type narrator not belonging to the storyworld)
- Camera movements
- Different camera positions with different semantic meanings
- Hotspots with text or not
- Black and White Scene
- Transitions (Dip to white, Dip to black, Direct Cut)

In this section, I will describe how the shooting of ZENA was conducted, giving general information about each stage of the production: the setting of the scene, the action moment, the role of the director, and the reformulation of the frameless image.

6.2 IFcVR Shooting Workflow

The IFcVR shooting workflow takes into consideration characteristics from both IF and cVR; however, the spatial condition of cVR will be the aspect that settles the shooting. The cVR condition sets the mental framework for director and crew: we are actually shooting all the space contemporarily. Everything is being recorded and therefore, every single angle will be seen by the interactor. There are no hidden spaces. This frame elimination brings some issues to the shooting process: the scene must be developed in its entirety in the same shot, reminding cinema's *sequence shot* which requires that actors and crew choreograph the performance together with the technicalities of the scene; this includes cinematography, lightening, audio recording and art direction, and, when referring to an immersive digital narrative, also the spatial audio, as well as the graphic and interactive assets that will be added in post-production. The spatiality of the scene and the performance of the narrative event in one single shot move the cVR shooting towards the lands already dominated by theater (See Chap. 3.5).

Although the cVR component predominates during the shooting, on the behalf of the Interactive Fiction component, two aspects are fundamental:

(1) The Cinematic Continuity: The record of the cinematic continuity is crucial to maintain the visual and performative coherence between NUs that could have been recorded in different moments or days, and not in sequential order. This continuity includes especially the performative intention and emotional charge of the actor at the end of one node, therefore, no matter which is the interactor's choice, the character's emotional state must always be consistent.

(2) The Decision-making Timing: When at the end of a scene or NU the interactor will have to make a decision, this needs to be made within a video in a limited time, thus it is important to allow a prudent time for the decision-making in the recording, and, if this moment involves

the presence of one or more characters, all those characters will need to stay in position until the cut.

The shooting itself can be divided into two moments: the preparation of the scene and the actual shooting, when the *action!* is given. The preparation of the scene comprises three moments:

- ➔ The Setting of the Scene
- ➔ The Measurement of Distances
- ➔ The Rehearsal on Set

6.2.1 Setting the Scene

The configuration of the stage (Fig 28) comprises the location of the camera according to the description of the scene and the location of the key elements and characters in relation with the area where the narrative event will take place. When deciding where to put the camera, it may be useful to remember the words of Sidney Lumet (1996) "If my movie has two stars in it, I always know it really has three. The third star is the camera" (p.75). This claim takes on a new life in VR, where we know that the vision of the camera is in fact the vision of our interactor, thus she is the "third" star of the movie. The location of the camera raises technical issues regarding lighting and sound. For instance, light sources need to be visual elements that are part of the diegesis while working with recorded 360° image. As far as audio is concerned, the on-site audio sources also need to be part of the diegesis, while the spatial audio capture must be close to the camera, so as the interactor's vision and hearing are faithful to natural embodiment.

For the shooting of ZENA, the two cameras used, each with a field of view of 180º each, gave rise to two stitch zones merged in one *stitch zone* all around the sphere, the area in which the images of both cameras merge. Depending on the characteristics of each camera, it is possible to have from none to multiple stitching zones, therefore, during the setting of the

scene, it is important to take into consideration the stitch zones so as no key element will be located on it.

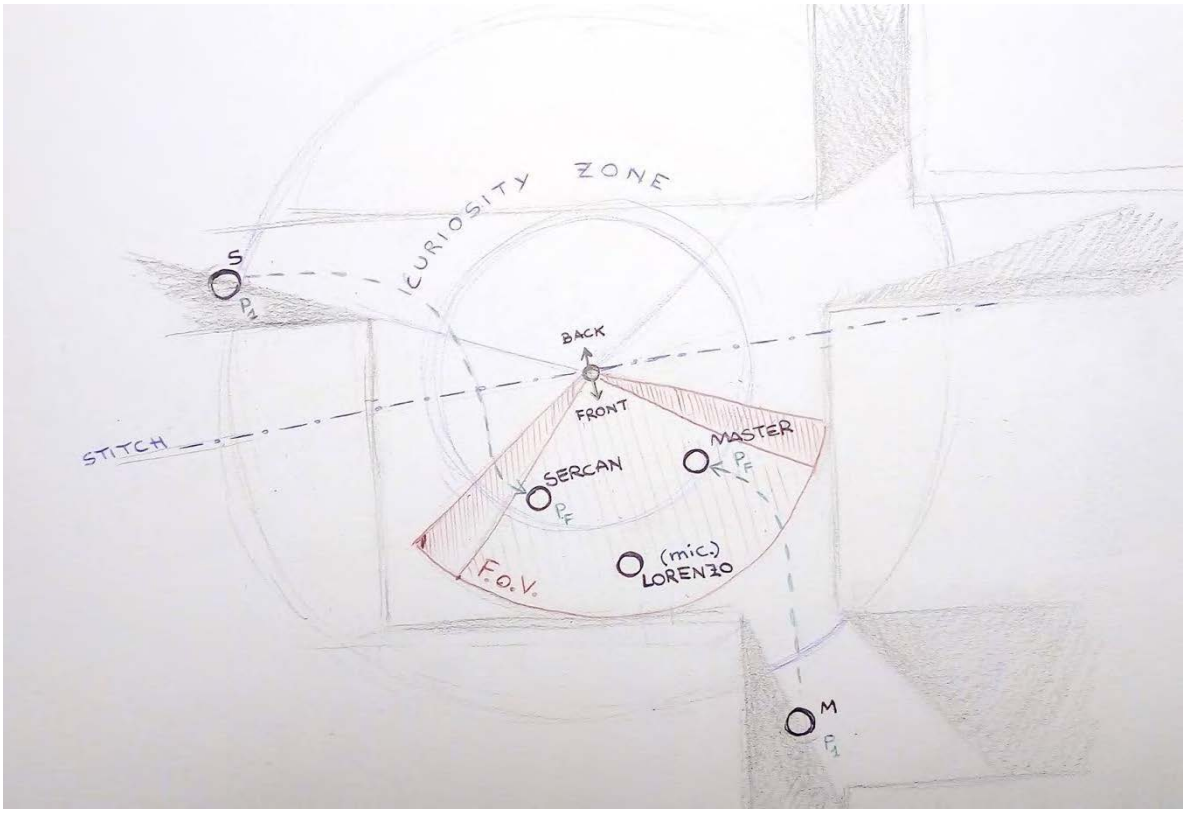


Figure 28. Setting ZENA's NU 14 "Danger" Scene

Figure 29 shows the position and height of the camera in the stage, and the position of the character. The front camera is directed towards the place where the central event of the scene will take place. The back camera is directed towards the area where Lorenzo will enter into the scene/stage. Lorenzo's final position will be next to the Master, who is already in place. In this case, while the master remains fixed in a single area of the sphere, Lorenzo enters the scene from the area of curiosity shouting *"Maestro, Maestro"*. Lorenzo's voice forces the interactor to turn around to understand what happens, and then the interactor will follow Lorenzo until he joins the master in the area where the narrative event will take place. In this scene, the camera is slightly shorter than the Master's and Lorenzo's eye lines with the

intention to make the interactor feel in front of two important characters. This is the third scene of Narrative Unit 1. In this NU, Lorenzo is introduced in Scene 1, in Scene 2 he receives the call through a dream, and in Scene 3 he runs to his Masters to ask for some suggestions. Scene 3 was shot in St John's church, located in the complex of *La Commenda di Pré,* a location dating from the year 1180. Within this Scene, Lorenzo needs to make the first choice: whether to accept or to reject the challenge. When he accepts, the Master gives him some indications along with the magic cane, through which the knights of Saturn (the interactor) accompany him and guide him, and with which he can make his trip to the future.

Figure 29. Setting the scene. Backstage of NU 1 Scene 3. The front camera is directed towards the area in which the main action of the scene unfolds.

Some scenes of ZENA were recorded in the streets of Genoa during day time. Depending on the scene, it was allowed to people non-involved in the film to pass through, as it happens in the daily life of a city, some other times, especially during the scenes with dialogue, we closed the entrances to the zone in which we were shooting. Due to the small size of the camera, most of passers-by did not noticed that we were actually shooting. Therefore, when the actors were performing, passers-by would cross the scene without reacting. This preserved the life-like sense of a scene set in the busy old alleys of Zena. In other cases, when a scene was

being performed, most of the time passers-by would react to the character's actions. The setting of the scene on location depends on the relevance of the location; it can help to ask *Why is it important to shot in that specific place?* By answering this question, director, cinematographer and art director should be able to determine the areas in which the narrative events will take place within the space, where the camera will be located and how actors will move within the space.

6.2.2 Measuring Distances

Meaning in cVR is a distance-perspective matter. The spatiality of VR and the close relationship between scene and stage that exists when recording at 360º puts a semantic value on the distances between the camera and the objects or characters present in the scene. Unlike cinema, in VR the camera does not get close to the elements and the particulars, but is "naturally" located in a strategic position from where interactors observe and participate in the scene. The position of the camera will determine interactor's embodiment; this awareness also differs from the cinematographic practice where the montage of the different types of shots builds meaning and narrative flow. Given the bodily presence of the interactor in the scene, and the *sequence shot* that is the long take of the entire scene, the positioning of the camera along with how objects are distributed in space will dictate the semantic value of each character/object in space.

Once located the camera, we used a meter to suitably position characters and objects in relation with the camera; distances should be consistent with the director's intentions and the storyboard of the scene. In the scenes where there is a camera movement, and especially where there is some movement of the actors in space, we found it necessary to mark the starting and ending points of the movement (Fig 30). The distance between the starting and destination points were slightly marked on the ground with tape. These marks had two functions: (1) To give the actors a guide to move in the space, and (2) To keep a record in order to assure cinematic continuity among scenes.

Figure 30. Measuring distance from the camera to the actor's position. Backstage of NU 10 Scene 1.

6.2.3 Rehearsal on Set

Akira Kurosawa maintained that the thoroughness of the rehearsals makes the actual shooting every time very short, and that the rehearsal not only included actors, but every part of every scene – the camera movements, the lightning, everything (Kurosawa, 1983). As Kurosawa points out, the rehearsal makes the recording more fluid when everyone involved knows the role they should play during the scene. In cVR, the rehearsal has many functions: to choreograph actors and/or camera movements; to characterize the emotional intention of the scene with the actors; to make technical adjustments, and in general, to control how the scene and stage work together. In cVR there is also another motivation for rehearsal: anyone who does not belong to the diegesis cannot remain visible on set.

During the shooting of ZENA (Fig 31), we did not have a real-time monitor to check how the performance was developing during the shooting, or a place to hide inside the scene to watch what was happening during the recording, hence all the team had to leave the stage except actors. In some cases, we did have a place to hide from the camera (for example, in

the old church I could hide in the confessional) so we could look if the scene was fine or not, but most of the times this was not the case. The actors rehearsed not only for performance purposes but also to show to the director and the crew how the scene was going to develop, especially in those scenes that were designed for the actors to move across the stage so as the viewer is forced to move around following the characters.

Figure 31. Rehearsal on set. Backstage of NU 13 Scene 1. Actors are rehearsing on their final positions while director gives some instructions, art director and best boy control that everything is in position.

6.3 Action!

At this point, we are ready to shoot. Once microphones, audio and camera recorders, as well as actors and crew, are in position, the *Action!* is given. "Action! says it all. Internal Action. External Action. Perform. Do, acting is active, is doing. Acting is a verb" (Lumet, 1996, p. 116). If we have had a place to hide on the location, everyone should be already in their places, otherwise, and for the most of the cases, before the *Action!* we left the stage for the actors. I had to trust my actors in those scenes in which the crew did not have a chance to directly check the development of the performance. The actors helped the director to know if the scene was shot as rehearsed. When one of the actors pointed out something that could have been better, I always repeated the scene. We kept the record of every single take we

shot, specifying why we made another take. However, as we rehearsed before the shooting, we decided to always shoot two takes, most of the times the first take was a print, while the second one was more like a safety take. Further repetitions were sometimes requested by the actors, or because there was some intromission.

The actors played an essential role during this shooting: they performed, remembering all dialogs and movements on scene, and they told us when they felt OK or not with the take. Beside this, they had some other instructions related to the IFcVR type of film we were shooting. One of the instructions was related to the *decision-making* moments, the moment in which the interactors have to decide which way to follow. In general, the actors were requested to always wait at least 30 seconds after the *Action!* and to remain in position until the camera operator would stop the camera. The *decision-making* moments represented a critical aspect. Actors were asked to keep the emotion of the final moment, especially the *avatar character,* Lorenzo, the one who performs interactor's choices. Lorenzo had to express the moment of choice with his face and body movements, e.g. by pointing where the hotspots were located or showing indecision between two characters, while the other characters were holding the last emotion or situation.

One of the main mistakes that were made in this movie has to do with this precise moment. The fact that the video is limited in time, many times interactors felt that they did not have enough time to reflect on their decision. Certainly, deciding which way to proceed is an individual matter and varies from person to person, which makes it difficult to determine how much time is enough; however, this moment will receive particularly important attention in future projects, allowing more time for decision making. Lorenzo, protagonist and avatar character, also had to remember where the hotspots would be located in space, and act having these invisible objects in mind.

Something important to mention is that Lorenzo was also often the camera operator, not by starting or stopping the recording, but actually operating the camera movements. Narrator Type 2 corresponds to an interactor that is part of the diegesis without being the protagonist

of the story. In ZENA, this role was interpreted by the magic stick that guides Lorenzo in his journey. In some scenes Lorenzo had to walk with the cane/camera in his hand (Fig 32) with stable and slow movements to avoid interactors to suffer from motion sickness, and at the same time, he had to remain in his character, being also aware of the presence of the interactor who was, literally, in his hand. In some scenes, he had to hold the camera and to interact with other characters and people passing by. In ZENA's case, even though we protected our locations from external interferences (e.g. street loud sounds or people passing through), one of the intentions was to give a sense of the real city during the experience, so we kept some scenes with passers-by talking on the phone or looking at Lorenzo with perplexity.

Figure 32. NU 3 - Scene 1. Arrival to the New World. Director giving the last instructions to Lorenzo before the Action! Lorenzo is holding the camera/magic cane as NT 2 indicates for this scene.

6.3.1 The Experience Director

> *"The intentions that motivate an act are contained within the action itself. You will never escape this. Even though the "why" of any work can be disguised or hidden, it is always present in its essential DNA."* (Bogart, 2008, p. 30).

Although the type of artifact that is being proposed and analyzed in this thesis is an interactive experience that differs from both the film and the videogame, when trying to work out its own identity we are definitely moving in a land that has already been well explored by theater and film. This affirmation arises from the fact that, although the interactor has a higher level of agency within the cVE than in 360° linear videos and linear VR experiences, in IFcVR the narrative weight falls on the scene, and from this the interactor makes the decision that will model his unique narrative outcome. Likewise, during the development of this thesis, we have seen how the creation process distances itself from the cinematic workflow at first, but at this moment of the creation, the cinematic and cVR methods are very similar again. For this reason, I return to the figure of the director to refer specifically to the moment in which creators leave their studios, and find themselves on the set to direct the production.

However, when I say *director* I am not only referring to the film director but also to the theater director, as characteristics from both figures merge in this new kind of director: the term *Experience Director* comes to my mind to describe this figure. The Experience Director is, in first place, a director who works in a real environment with real actors; in this sense, the Experience Director moves away from a creator who works only with computer-generated agents and spaces. Secondly, the Experience Director works with a different conception of his audience: as the theater director directs the work towards an audience that is physically present in the same space as the play, and the film director directs for an audience that will receive the film through a screen in a movie theater, the experience director directs for a person who is embodied in a VE environment and actively involved in the narrative event. For every of these three types of director, the conception of the audience is completely different.

Sidney Lumet points out the limited control of the film director over certain areas, "one of these areas is the operation of the camera" (Lumet, 1996, p. 116). In cVR, this aspect is less problematic as the camera does not always need an operator during the recording and it does not have to cut the scene in multiple shots. However, the Experience Director, especially when working with VR[71], needs to physically see from the place from which the interactor will see the scene. Only by doing this, creators will understand how the audience will live the IFcVR experience. By *living*, I mean all the aspects that interactors will be in touch with during the experience, not only what happens on the scene but also the way in which they are going to interact with the storyworld. Akira Kurosawa points out that all the occupations on a film production "melt together under the heading of direction": actor's coaching, cinematography, sound recording, art direction, music, editing, dubbing and sound mixing (Kurosawa, 1983, p. 192). The experience director has to do with all of this, but also with the sensitive dimension of her audience as well as the care of the relationship between interactor and system.

Regarding the direction of the scene during the shooting, all the aspects concerning what is going to be seen and heard (the setting of the scene, the movements of the actors, the distances between characters and objects, and the performance of the narrative event playing along with the location and height of the camera), regard only the experience director and her intention, and this is something inherent to the artistic creation. But although the direction of the IFcVR content, i.e. the film matter, takes us to the cinema grounds, there is a primordial physical connection between VR and theater that transcends cinematography. This connection is pointed out by Anne Bogart (2008) as: "The theater is always about what it means to be alive now, present at this particular moment in the theater" (p. 106). Analogously VR is about what it means to be present at a particular moment in a particular virtual space, as well as the relationship between that particular virtual experience and both creator and interactor's personal and historical context.

[71] I consider that the expression Experience Director can be used to name directors who work with hybrid environments, which include VR, MX, AR.

6.4 Rethinking the Frameless Image: Shots and Intentions

As the frameless image frees viewers' eyes and gives them autonomy to explore the space, during the screenwriting but also during the shooting many film and video makers ask themselves: *How can I direct viewer's attention to what I want them to see?* During the realization of this research I have been able to follow the curve of interest on the part of the academy in specifically analyzing the cVR language for storytelling in the past three years, and this has been the most recurrent topic regarding cVR's narrative immersion (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, another topic that has stimulated cVR research, is the gaze/eye tracking of the POIs within the 360° video (Bala et al, 2018; Bender, 2018; David et al, 2018; Bala et al, 2017; Löwe et al, 2017; Bala et al, 2016).

This need for control is caused by the fears that comes together with disappearance of the frame, which is frequently related to a possible disappearance of the direction role, but from my perspective the director's intentions in a VE can have a greater reach on the viewer's experiential level. I believe that film and video makers should abandon this logic when working in VR if what we want is to give *visual freedom,* otherwise traditional film and video can fit better their creative needs. I think that this attitude underestimates interactors' willingness to immerse themselves in the story, and visually follow the narrative events and interesting elements that creators are presenting to them.

The creator's intention lives in the narrative action and then translated into the images according to the point from where she is looking at the world around her. Hence, in order to organize the technical possibilities of directors during the *mise-en-scene,* I propose a grid with the different types of shots that can be achieved by the position of the camera and its distance from the key elements and events, and the type of semiotic intention that they can convey. Such different types of shots will be exemplified by means of screenshots from

ZENA. The grid (Table 4) contemplates four different conditions, that can be combined with each other, determining the position of the camera. In relation to the given condition, these are the possible types of shots that can be achieved:

Narrator Type or Interactor Role: This condition is based on the Narrator Type (NT), that is, the role of an interactor who belongs to the storyworld. This type of narrator can be: (1) Protagonist of her own story or (2) a character that interacts with the protagonist. In both cases, however, the camera is positioned as a subjective one in first person shot. 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, in the same way the camera position will need to adapt to the physical characteristics of this non-human character. Locating the camera as a "live" character has technical consequences: it requires a special rig to be placed on a person or object in a way to recreate the embodiment of the first person's point of view.

Height of the Camera when Perpendicular to the Ground: If the camera is located perpendicular to the ground, it offers the natural vision of a human being standing. Depending on the height of the camera in relation to the ground and the characters and elements that surround it, the shot can have different semantic meanings. We find three cases: A natural height to the surrounding world, a low angle shot that means little distance from the ground, and a high angle shot, when the camera is located at a great distance from the ground.

Distance between Camera and Key Elements/Events: Since the camera is at the center of 360 degrees, the objects around it are more or less visible depending on how distant they are from the camera. In Table 6, types of shots that can be achieved within a comfortable view distance, objects located beyond 20 meters are hard to focus.

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 natural vision but not very common to humans: observe

the world at ground level (nadir), observe the world from above (zenith), observe the world on a horizontal axis (i.e. lying down, with the turned head). 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 is very delicate, as losing the horizon and the sense of standing on the ground can lead some people to suffer from motion sickness.

Conditions	**Types of Shot**	**Intention**	**In ZENA**
Narrator Type - Interactor Role	NT1 - Interactor Protagonist (Fig 33)	First Person Shot, also called Point of View (POV) Shot.	In Figure 33, the back camera is located directly over Lorenzo's right eye, so the front camera gets the feeling of being Lorenzo's eyes.
	NT3 - Interactor not protagonist but part the storyworld (Fig 34)		In Figure 34, the interactor was a magical object: Lorenzo's cane. The cane guides and accompanies Lorenzo in his journey. Lorenzo is constantly creating visual contact with the magic cane. Lorenzo is holding the camera/magic sphere with the front camera directed to the front, and the back camera to Lorenzo's face.
Height of the Camera perpendicular to the ground	Natural Eye line (Fig 35)	Natural Vision. The intention can change according to the distance between camera and elements.	For the natural eye line, we chose a camera height of 1,70 MT, in order to give a realistic feeling of someone standing along the characters. This height worked very well in relationship with ZENA's actor's stature.
	Below the Eye line (Fig 34)	Low Angle Shot	During Scene 2 of NU 9 Lorenzo speaks directly to the camera, asking for help to the magic cane (interactor). The intention of this shot is to create an emotional bond between Lorenzo and the interactor, through eye contact. The height chosen is the natural height of the cane that is shorter than Lorenzo. The position of the camera gives us what in cinema is called a Low Angle Shot as the main element on the scene is the character, and interactors are seeing him from below.
	Above the Eye line (Fig 36)	High Angle Shot	In Scene 1 of NU 10 Lorenzo lives a magical revelation that can help him, depending on interactor's choices, to succeed in his mission. The scene was

			shot inside a medieval tower. Lorenzo hears a voice that says to him to go to the top of the tower to have the revelation. He goes up but he is afraid. During this scene, we are using NT 3. Figure 36 shows the camera/magical cane located above the level of Lorenzo's head, creating a cinematic High Angle Shot in relation to his face and body. This shot makes Lorenzo look smaller, and therefore, in relation to the narrative, fragile and scared.
Distance between Camera and Key Elements	From 3 to 10 meters (Fig 37)	Extreme Wide Shot or Long Shot	When actors move within the space, they can reach different types of shot according to their distance in relation with the camera. In ZENA, we did not shoot an entire scene with an Extreme Wide Shot, but in many scenes Lorenzo enters the space from afar, and at that moment we can see it in a long shot.
	From 1.5 to 3 meters (Fig 38)	Wide Shot or Full Shot	In this wide shot we can see the figure of Lorenzo, from head to toe entirely into our FOV without moving the head to see his feet.
	From 1 to 1.5 meters (Fig 35)	Medium Wide Shot	In this scene, we can see Lorenzo and the Master almost entirely; to see their feet the interactor needs to move the head. This shot is what in cinema is called “American Shot”. It was shot with a “natural eye-line”.
	From 0.5 and 1 meters (Fig 39)	Medium Shot	In this scene, Lorenzo is asking for help to the oracle. They sit around the table and the camera even though is not part of the storyworld this time, is located as the interactor was also seated at the table with them. The camera is located above the eye-line of the characters, allowing the interactor to have a better vision of the cards on the table, and both characters can be seen from their waist up.
	Within 0.5 meters (Fig 34)	Close Up - Detail	In this scene, we have a close up of Lorenzo’s face from below his eye-line.
Position of the Camera in	Camera on the ground (Fig 40)	Nadir Shot	Nadir shot is taken from the ground level. This type of shot was not used

relation to the ground - Parallel to the ground			during the realization of ZENA, but I had the opportunity of use it during the realization of *Le Marittime Irraggiungibili: Scenari Alpini a 360°*
	Camera detached from the ground (Fig 41).	Aerial Shot or Zenith Shot	Zenith shot is made from "above" an object, location or subject. This type of shot can also be an aerial shot if the camera is located in a drone or other flying object. During ZENA, we shot a scene "Death of Lorenzo", that was not included into the final project due to an error in continuity. The scene, however, allowed us to experiment with non-natural positions of the camera. The scene was shot from a 4th floor window, locating the front camera towards the ground, where the scene was developing, and the back camera towards the sky. The camera was hold by a man who was observing the scene from his window, making him a subject that belongs to the storyworld. From the frontal camera, we achieved a Zenith in Extreme Wide Shot in relation with Lorenzo and Cronos, while from the back camera we have a close up of the man and his daughter looking through the window.
	Horizontal Axis (Fig 42; Fig 43)	Lying down or flying	During the mentioned scene "Death of Lorenzo", the monopod of the camera was hold by the man on a horizontal axis, when interactors look to their side they can see the street as they were floating horizontally. I had the opportunity to experiment with this type of shot during the realization of another short film, "Aura"[72], where, in the final scene, the protagonist lies down on the grass, locating the camera in a parallel position to the ground. The front camera is looking at the sky as the first person shot indicated.

Table 4. Types of shot and Intentions in Cinematic Virtual Reality

[72] The linear VR short-film was developed during my studies as visiting professor at the CrossmediaLab of the University of Bogota Jorge Tadeo Lozano.

Figure 33. Frame of NU 1 Scene 2 "Premonitory Dream". First Person Shot.

Figure 34. Frame of NU 9 Scene 2 "Wrong Approach". NT 3. Low Angle Shot Close Up.

Figure 35. Frame of NU 12- Scene 2 "Ordeal". Natural Eye Line Wide Medium Shot.

Figure 36. Frame of NU 10 Scene 1 "Revelation". High Angle Shot.

Figure 37. Frame of NU 6 Scene 1 "Enemy". Extreme Wide Shot

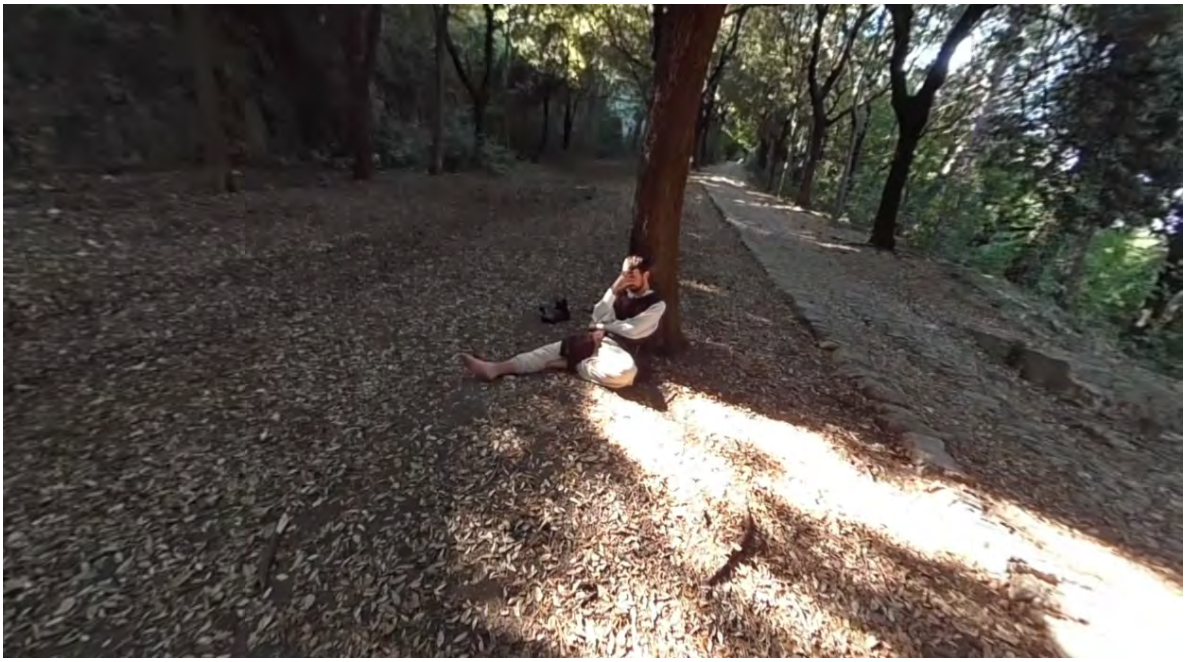


Figure 38. Frame of NU 1 Scene 3 "Call". Wide Shot.

Figure 39. Frame of NU 7 Scene 1 "Oracle". Medium Shot.

Figure 40. Laying down shot from "Aura" (2017)

Figure 41. Death of Lorenzo. Unshown Scene. Zenith shot from the frontal camera. Back camera is a Low Angle Shot.

Figure 42. Death of Lorenzo. Unshown Scene. View of the street from the horizontal axis.

Figure 43. Nadir Shot from Le Marittime Irraggiungibili (2016)

6.5 Sound Recording

The missing element during the creation of ZENA was the spatial sound. At that time, I did not have the material possibility to involve a space sound specialist in the production and post-production of the prototype. Without 360° audios, I could not experiment with the inclusion of auditory hotspots, with the creation of narrative environments based on the placement of sound sources in space, or being able to guide the interactor with their audition more than with their vision. Spatial audio would be very important to create realistic atmospheres and to enhance both perceptive and narrative immersion. Spatial audio can play a fundamental role in the creation of IFcVR, and in general of VR experiences.

Even if we could not work with spatial audio, I was very careful to take into account from where the interactor would listen to the dialogues and the other sounds inherent to the cVE,

or diegetic sounds. The sound treatment of ZENA includes both diegetic and non-diegetic sounds. Within the diegetic sounds we find: the ambient sound of each location, natural sounds generated by the characters (breathing, steps and movement-generated sounds), dialogues, music played by one of the characters on stage. The non-diegetic sounds comprise: background music for Lorenzo's presentation scene and all four endings, music for the decision-making moments, few sound effects in some cases at the beginning of a new narrative unit.

Another sound that had a particular role in the experience is the voice over. This was used twice: the first one is the non-diegetic voice-over of an omniscient narrator that introduces the story, telling where is the interactor, in what time and who is Lorenzo. The second moment of the voice over is diegetic; this is the voice of Chronos, the magical helper, who reveals Lorenzo the reason of the mission and how he must act to achieve his assignment. As a filmmaker, I have noticed that voice-over is frequently overused in cinema, as it is very effective in facilitating the narration; I took it as a personal challenge, and I try to avoid the use of voice-over during the development of any type of audiovisual work. But during the realization of this study, I had already had the opportunity of enjoying many VR and cVR experiences that are built upon a voice-over. In this sense, VR is very effective in visualizing a soundscape around us, but also a story that is being told. In fact, regarding the voice over, VR poses again the question for the interactor *Who am I listening to?* (Vosmeer et al, 2018).

ZENA then had two moments of recording: the recording on location, and the recording of the voice over. The voiceover, was recorded after the three days of shooting, in studio with a bidirectional microphone, and later it was "spatialized" with an effect in post-production. During the recording on location, we placed three microphones: a pair of binaural microphones, one in each ear of Lorenzo, and a bidirectional sound recorder located just below the camera, on its same axis. The choice of the microphones and their location during the recording have an important role for the narrative immersion. The binaural microphones, for example, played an important part in creating *role identification*, one of the components that enhance narrative immersion. Having microphones on the ears of Lorenzo allowed me

to create a closer relationship between the interactor and Lorenzo, especially during the scenes in which the interactor was identified with Lorenzo (NT1) or in which the interactor was positioned at the magic cane that accompanied and guided Lorenzo (NT3). The binaural microphones allowed the interactor to listen more clearly to Lorenzo's breathing, the sound produced by his body gestures, his voice, the thoughts that he sometimes expressed aloud to himself, and gave a better clarity of the dialogues between Lorenzo and the others characters. The binaural also allowed me to carry out a more accurate stereo post-production, emphasizing the sounds coming from Lorenzo's left or right side.

The sound recorder, located on the same axis of the camera, had three functions: (1) to simulate the natural hearing of the interactor, as it is attached to the camera/eye of the interactor, picking up ambient sounds and dialogs from the location of the camera, (2) to create a safe additional track to binaural microphones and (3) the recording of a wild-track for ambience audio. The sound recorder that we used has an integrated bidirectional microphone. It was placed in the same way our ears are located in relation to our eyes, therefore depending on the front lens of the camera we located them at the right and left side. Afterwards, all sounds were worked out in post-production: the environmental ones were spatialized, while sounds with a specific source in space were worked in stereo.

Chapter 7. Post Production

7.1 Editing on IFcVR

As a spatial medium, navigation in VR results from the combination of two user activities: wayfinding and travelling. Wayfinding refers to the interactor's "cognitive process of determining a path based on visual cues, knowledge of the environment and aids such as maps or compasses" (Bowman et al., 1998), while traveling is simply the ability to move from one space to another within the VE, which is, after the head movement, "the most common type of interaction in VR" (Bowman et al., 1998). In IFcVR, the traveling can take place as an automatic feature of the experience, or can be triggered by the interactors when they choose the path to follow. The traveling, on the one hand, affects the spatial orientation of the interactor, and, on the other hand, follows the flow of the experience, at both story and discourse levels. For these reasons, the "travel technique should be easy to use, cognitively simple, and unobtrusive" (Bowman et al., 1998). However, as we are working with video files, moving from one space to another is what we technically call transition in film/video making.

The cinematic transition is the juncture that connects one shot after the other. It is already established during the screenwriting: as there are different types of shots, there are also different types of transitions, and each of them has a semantic value within the audiovisual discourse. Transitions play an important role in organizing time: the time of the story, the time of the discourse and even the psychological time of the film, by establishing dynamic

relationships between shots, scenes and sequences (Mitry, 2000). Although the post-production work comprises aspects related to audio, color, graphic and subtitles, in this chapter it seems essential to draw from the filmic editing of the IFcVR experience as the temporary organization of shots, scenes and sequences, and how the transitions or travelings can be done between them.

Film directors often have to fight with the impulse to edit or not to edit, as Lucy Fischer states citing Siegfried Kracauer in her chapter *Film Editing* (Fischer, 2007, p. 64-83) about these opposing tendencies when creating an audiovisual work. The debate resides in how much is taken from reality and its interpretation through the shot, and how much is created by the juxtaposition of shots. This internal debate is another issue[73] that traditional film/video makers face when they start working with cinematic VR (Zhang et al, 2018; Kjær et al, 2017; Moghadam & Ragan, 2017), but neither the cVR discourse nor the IFcVR discourse are created by what Eisenstein (1949) called the *collision* of different shots. On the contrary, these collisions or conflicts are created within the single shot (through the performance, the location of key elements and characters, the design of the stage, etc.) and when the shot arrives to the computer it already has an irreducible life.

Shot and montage are the basic elements of cinema; montage, in particular, has always played an important role in defining what is cinema itself. Soviets called it "the nerve of the cinematographic art" (Eisenstein, 1949, p. 48); I must warn, however, that the montage of the object of study of this thesis has very little to do with the montage of traditional video or traditional cinema, both technically and syntactically. This deflection from the cinematographic concept of montage is rooted in the conception of *shot*, the cell or molecule of the cinematic discourse. While cinema "combines shots that are *depictive*, single in meaning, neutral in content, into intellectual contexts and series" (Eisenstein, 1949, p. 30), in IFcVR, and in cVR in general, each "shot" is an *image-space* with narrative actions happening within it. The shot becomes a window to a specific time-space, that can be cut,

[73] The first one is "How do I make the interactors see what I want them to look at", tackled in Chapter 6 - Production.

linked or juxtaposed according to the events unfolding within. The montage, at this point, deals with little worlds that contain semantic framings already designed by the creator during the development and/or the shooting phases. Thereby, in cVR, the cinematographic montage, as film theory have defined it, is done by the interactor as the ultimate *MegaGrandNarrator*. Going up a level, in IFcVR, the interactor links these small worlds, one after the other, becoming what I have called in Chapter 3 the *HyperMegaGrandNarrator.*

To approach the process of montage of an IFcVR experience, we must divide the process in two moments in which there will be two types of different montages: (1) the montage of each narrative unit, and successively, (2) the montage of the interactive experience. Each of these types of montage has a unique mechanism, and both move away from the cinematographic montage in its intellectual sense. This chapter faces technical aspects approached by the mechanism through which an IFcVR experience can be built as a fictional filmic experience, where the narration of events prevails, and where interactivity joins the flow of events as a narrative element, and not as a disruptive one.

7.2 Editing the Narrative Unit: The cVR Montage

Being a pre-scripted interactive narrative, IFcVR has an underlying structure that is immutable. The interactor delineates its passage through this structure, which is formed by single Narrative Units (NUs) each of which is, in a strictly technical sense, an already stitched[74] 360º video file, be it monoscopic, stereoscopic, or 3D[75]. The possibilities of interaction are basically two: (1) accessing extra information within the same NU and (2) being able to choose the next NU. At this moment of the creation of the IFcVR experience, the creator finds herself in the editing room with the raw material, both audio and video, that

[74] If the scenes were shot with multiple cameras.
[75] In principle, animated videos should also be included in such list, but as I have been working with live-action video only I am not considering them right now.

was recorded during the filming, and it is time to put it together in order to create each single NU.

As a filmic experience, the IFcVR story is divided into scenes and sequences. A scene unfolds an action or event in the same time-space, while a sequence contains a series of scenes. A NU can contain a single scene, with one shot or multiple shots, or can contain a sequence. If the NU contains a scene with multiple shots or a sequence of scenes, there will be cuts within the same video. In an audiovisual narrative sense, I do not find problematic the cut between a scene and the next one, because it simply implies a transition between one time-space and another, led by the events that take place in each of them. On the other hand, cuts within a single scene can be tricky. To cut is to change camera position in a single scene/space, and that means to change the interactor's position in space. This can be done to offer the interactor different perspectives over the same event or space. However, even though strengthening the narrative by giving more information about the place or event can be a valid mechanism, it will slow down the discourse time, because in cVR, interactors need time to understand where they are standing, who they are in the experience, and what they are looking at. Analogously, the creator will need to give time to the events or actions to fully evolve from that camera position.

These notions about the cut gives us also valuable information about the cVR shot. When referring to the cinematographic shot as material for composition, Eisenstein (1949) describes it as more resistant than granite, with a resistance that is specific to it, and with a tendency toward complete factual immutability that is rooted in its nature (p. 5). If already in cinema the shot has this indivisible and strong quality, in cVR it acquires an even greater robustness because it must allow interactor's sense of location and flow of events, and it must contain all the elements, conflicts and collisions that the creator needs to locate and coordinate in the time-space to set up the scene. Taking a look to cVR projects and videos, through a HMD and even through YouTube or Vimeo, we can see that most of them treat the scene with a single long-shot, thus the whole narrative event unfolds in that single shot. This means that the creator just chose a single camera position and let the action happen in space.

This one-shot reminds cinema's long-takes or sequence shots. Referring to Orson Welles' sequence shot in *The Magnificent Ambersons* (1942), Bazin notices "his refusal to break up the action, to analyze the dramatic field in time is a positive action the results of which are far superior to anything that could be achieved by the classical cut" (Bazin, 1967, p. 34). This same spirit should guide the creator during the screenwriting and later during the shooting.

The montage at this point is a careful sharpening of each shot. While cinema's montage "creative remodels nature" (Eisenstein 1949, p. 5), cVR montage somehow "facilitates" nature approaching the essential cinema's montage which keeps a "straightforward photographic respect for the unity of space" (Bazin, 1967, p. 46). In Eisenstein's words, in cVR the creator can approach montage as a *Tonal Montage* (Eisenstein, 1949, p. 75), a montage that takes into consideration the tone of the whole narrative event, the set of dynamics that come together in the *emotional sound* of the scene.

Before working on the actual montage, the two 180° video files of each shot were stitched with the Kodak PixPro 360° Stitch software[76] to create an equirectangular monoscopic video file. These shots were later edited with the video editing software Final Cut Pro X[77], in which I made color correction and audio editing, with the *Surround Sound* preset, that allows one to "dynamically re-create surround sound fields from stereo source content" (Apple, 2018). During the postproduction of ZENA, I had to edit NUs formed by single scenes, one-shot and multi-shot, as well as NUs formed by a series of scenes. Below, each type of NU is described and exemplified with the realization of ZENA.

[76] The stitch software specific for the Kodak PixPro 360°camera.

[77] I did not choose FCPX for any specific reason, but simply because it is the video editing software that I have been using on my pc. When I started this research, neither FCPX nor Adobe Premiere CC had the immersive video setting, only the last updates of both tools allow immersive video and immersive audio.

7.2.1 One-shot Scene Narrative Unit

In total, there are seven One-shot Scenes NUs in ZENA. I am taking as example NU 7, that corresponds to the first encounter with the contagonist of the film, Sercan. This character livens up the plot by threatening to steal the magic clepsydra, but later in the story will try to help Lorenzo save the precious object. This NU is reached as one of Lorenzo's three possible choices when he arrives into the new world, the present ZENA: (a) I feel lost (b) I know my city, and (c) Somebody is waiting for me (this NU comes after option c).

I chose this NU to exemplify the process because it has a camera movement at the beginning of the scene, and afterwards there is an internal movement of the characters that forces the interactor to look around, following Sercan. The camera is in Narrator Type 3, that is, the interactor is the eye of the magic cane that Lorenzo holds in his hand. As a one-shot scene NU, at the end of the scene interactors will face again a decision-making moment. Technically, the editing of this scene was very simple, it consisted in setting the start and the end of the scene, synchronizing the audio tracks (binaural microphones, ambient audio from recorder and the audio of the camera) and spatializing the final audio track in the editing software.

This NU has two outputs or choices; in it, I did not use any text to help the interactor. This decision is due to the fact that the scene is of fear, Lorenzo must escape from the hands of Sercan who threatens him with a knife pointed at his throat. Lorenzo, and therefore the interactor, must only choose which of the two narrow streets he wants to escape, without knowing where each of them would lead him; labels on the links would just take extra-time to read, breaking the suspense created by the scene, without highlighting any meaningful information. At the end of this NU, only 30 seconds were allowed, to give the interactor the time to make a decision. Additionally, two "annexes" of the scene were recorded, with Lorenzo escaping through the *vicolo* that has been chosen by the interactor. These scenes, that were used after several NUs, were added with an automatic transition after the decision making and an automatic transition to connect the completion with the following NU.

7.2.2 Multi-shot Scene Narrative Unit

In ZENA, the interactor will find four NUs of this type, which is formed by several shots that are part of the same narrative moment. The different shots help to give the interactors a better understanding of the space in which they are, different points of view of the same element, and contextualizes the completion of the event, either in exactly the same space, or a space related to the same location.

To exemplify this type of NU, I will use ZENA's NU 9, which corresponds to the moment of the *Revelation,* in which Lorenzo and the interactor meet the magic helper "Chronos" who gives him more information about his mission together with some mystical messages; for this reason, this scene was written in a "magical way": Chronos talks to him as a voice over and, in general, the scene has a very unhurried rhythm that slows down the experience. The scene was shot in a very suggestive location of Genoa's old city, the old gate Porta Soprana. Upon entering one of the towers of the gate, Chronos calls Lorenzo inviting him to climb to the top of the tower. The interactor is in NT3, meaning that Lorenzo is carrying the magic stick.

This multi-shot scene, and therefore this NU, is formed by five shots that add suspense to the scene before he meets Chronos:

- *Shot 1. Natural Eye Line - Wide Shot of Porta Soprana:* Lorenzo is in front of the gate. People walk around, some of them look incredulous at Lorenzo.

- *Shot 2. Natural Eye Line - Close up of Lorenzo's face:* Lorenzo is inside one of the towers with the spiral staircase around him. A voice calls him: "Lorenzo".

- *Shot 3. Natural Eye Line - Close up of Lorenzo's face:* Lorenzo is climbing the stairs; he is at the middle of his way up. He is so close to the railing that if the interactors look down they can see the bottom of the stairs, if looking up they can see the ceiling of the tower. The voice keeps calling him.

- *Shot 4. Above Lorenzo's Eye Line - Close up of Lorenzo's face:* Lorenzo is about to get to the top, but he is scared. The interactor can see him with a high angle shot. The voice tells him not to be scared.

- *Shot 5. Natural Eye Line - Close up of Lorenzo's face:* Lorenzo is at the top of the tower; around him he can see the new ZENA. Chronos reveals herself to him and gives him some hints to accomplish his mission.

The transitions between these shots were simple *cuts*, passing from one shot to the other. However, while shooting I was very careful on always keeping the front camera towards the front of Lorenzo, and the back camera towards his body. By doing this, the interactor could always find Lorenzo in the same position, maintaining the spatial orientation. Regarding the sound design, the audio was also cut with each image cut, so as passing from one place to the other also meant to change sound landscape. On top of the tower, the voice of Chronos speaking to Lorenzo was spatialized, while Lorenzo's breathing (recorded with the binaural microphones) was intensified.

7.2.3 Sequence Narrative Unit

In cinema, a sequence edits together a group of related scenes that share the same event, time, space or thematic. In IFcVR, the sequence NU puts together different scenes until a decision-making moment is reached. The need to unite several scenes arises from two possible cases: a decision is not presented to the interactor until that moment, or the output of a previous sequence is connected to the successive sequence before the interactor returns to make a decision. However, it is important to keep in mind that the IFcVR sequence NU puts together different time-spaces with different events. Unlike the transition occurring between different shots that belong to the same scene, the type of cut between scenes obeys the tone of each of those small worlds and the narrative or artistic need of the creator.

This kind of narrative unit can be found three times in ZENA. To exemplify this type of NU, Table 5 presents the audiovisual composition of ZENA's three NUs of this kind, divided into scene number, Narrator Type (NT) used in each shot, type of shot, description of the narrative event, and type of transition used at the end of each shot. Some of the scenes contain more than one shot.

NU	Scene	NT	Shot	Description	Transition
1	1	4	Above Lorenzo's eye line - Medium Shot of Lorenzo	Lorenzo picks some herbs on his daily work as an alchemist apprentice. The voice over contextualizes the interactor in the place and time where the story unfolds.	Cut
		4	Natural eye-line - Wide Shot of Lorenzo	Lorenzo walks near the walls of the old city. The voice over presents him.	Cut
		4	Above Lorenzo's eye line - Wide Shot of Lorenzo	Lorenzo is taking a nap under a tree.	Dip to black (Slow)
	2	1	Natural eye line - Lorenzo POV - Wide Medium Shot of the Master:	(Flashback - Black and White color) The interactor is Lorenzo. Lorenzo is in a office with a man that is pointing a gun to him.	Dip to black (abrupt, in concomitance with the gun's shot)
	3	4	Above Lorenzo's eye line - Wide Shot of Lorenzo	Lorenzo wakes up from his dream and goes to find his master.	Cut
	4	3	Natural eye line - Wide Medium Shot of the Master	Lorenzo arrives running from the curiosity zone, until he reaches the master on the front camera, where the main action evolves. The dream was a call to adventure. At the end of this scene, the interactor will have to choose between "Accept" or "Refuse" the mission that will take him to the future ZENA.	Cut
3	1	3	Natural eye line - Wide Medium Shot of the Master	The interactor has accepted the mission. The master gives Lorenzo various indications about his mission. He also gives him the magic cane that will transport him 500 years in the future and will	Dip to white (Slow)

				guide him in his mission. The characters will start the conversation in the same place where NU 1 ends, and then they will move, each on one side, towards the back camera, where the journey to the future will take place. At the end of the scene, Lorenzo is transported to the future. This effect is given by a very slow dip to white transition with a sound effect that takes the interactor from a dark medieval church, to the port of the future ZENA in a very bright sunny day.	
	2	2	Natural eye line - Close Up of Lorenzo's face	Lorenzo arrives into the new world. The orientation of the interactor looks towards the face of Lorenzo that is at the back camera. Through the front camera the interactor, that finds himself as the eye of the magic cane, can explore the new space together with Lorenzo.	Cut
			Natural eye line - Close Up of Lorenzo's face	Lorenzo walks among the people, perplexed and a little afraid. He is surprised at the place where he is and approaches the old city. Plane in motion, Lorenzo holds the camera in his hand and walks slowly. Ambient audio from the binaural mics.	Cut
			Natural eye line - Close Up of Lorenzo's face	Lorenzo arrives at the *Caricamento* square; from which he has a view of the facade of the old city before entering the labyrinth of narrow streets. At this moment, the interactor must decide where to enter to explore the city and move forward the story. The possibilities are three: (a) I feel lost (b) I know my city, and (c) Somebody is waiting for me.	Fade out
13	3	1	Natural Eye Line - Wide Medium Shot of Lorenzo and the Master	The interactor chooses not to trust the Master. Lorenzo escapes with the clepsydra leaving the room. The interactor sees the Master preparing himself to go after Lorenzo with a gun.	Cut

	3	2	Natural Eye Line - Full Shot of Lorenzo, Sercan and the Master encounter	Escaping from the Master, Lorenzo arrives into a little square in which he finds Sercan. When the Master arrives, Sercan and the Master get into a fight, from which none of them survives. Lorenzo can now finish the mission.	Cut
	3	3	Natural Eye Line - Wide Medium Shot of Lorenzo and Chronos	Lorenzo meets Chronos, the final destination of the Clepsydra. She asks him to decide if remaining in the future or going back to his time.	Fade out

Table 5. ZENA's NU1 and NU3 Sequence NUs description

Although most of the time I simply used a cut to make the transition between one shot and another, especially within the same scene, sometimes I used other types of transition to give an aesthetic and narrative value to the experience. For instance, a slow dip into black when Lorenzo is falling asleep in NU1/Sce1; a fast dip to black when the Master shots Lorenzo with a gun; a slow dip to white accompanied by a sound effect to simulate the time travel that takes Lorenzo into the nowadays ZENA, or a fade out between a NU and the other to create an ellipsis.

7.3 The Interactive Montage

Once all NUs are crafted for both video and sound, it is time to create the interactive structure, the labyrinth that will allow the interactor to trace her own experience. This phase is not only about connecting the pieces but about making them work in interaction, running the experience along with the HCI through which the interactor will have agency within the storyworld. In the case of ZENA, I used the software WondaVR[78] to perform the interactive montage. WondaVR allows the creation of experiences that can be downloaded on a device or played in streaming. Beyond the technicalities, I will expose some insights from my experience with ZENA about the creation of a filmic interactive experience that is fluid and

[78] https://www.wondavr.com/

pleasing for eyes and ears. At this point, the work is quite simple if an accurate screenwriting has been done, if the shooting took into account the positioning of the camera as well as the moments of interaction, and if the editing of the NUs was done in a meticulous way, either in the treatment of the image and in the treatment of sound.

In this phase of the IFcVR production, most of the work must be done by trial and error. The trials test whether the hotspots and the multimedia materials visually adapt to the space; whether the interactions work and tackle what could happen if the interactor fails to make a decision on time. In this section, I am describing two processes within the interactive montage: the construction of the mind map and the location of the hotspots in space.

7.3.1 Setting the Mind Map

The construction of the mind map is a process that was already done during the development of the narrative design (see Chapter 5.3.2). From the development to the final structure, this blueprint should change very little during the creation of the experience (Fig 7.3). Significant changes put forward new NUs that have been added, as well as connections or alternative paths that were not initially contemplated, that were created in successive phases or that were even eliminated. Changing the interactive structure implies that the narrative itself have been changed.

The process of the interactive montage software consists in:

1. Uploading all the necessary assets: 360° video files, audio files (music, sound effects or the spatial audio file), graphic elements (hotspots, multimedia materials) that can be texts, images, sounds, 3D objects and flat videos to overlay upon the spherical video.

2. Locating in the storyboard space each NU in the order that has been given by the narrative design, and configure the settings of each.

3. Working individually on each NU. At this point, each NU can be edited in the timeline, very similar to the video editing timeline, in which we can locate when the multimedia assets should appear or disappear. This includes the insertion of Internal Links (See Chapter 5.3.3.1), or objects that appear within that specific NU.

7.3.2 Connecting the Narrative Units

In Chapter 5, I referred as External Links (See Chapter 5.3.3.1) the links that connect a single NU with one or multiple NUs. This process follows the narrative design and at this point the work is mostly technical. However, there is an important difference if the IFcVR is based on cognitive interaction (see Chapter 4.3.1) or biofeedback interaction (see Chapter 4.3.2). If it is an IFcVR experience where the interactor consciously chooses its way forward, the project presents a UI through which the filmic experience offers the interactor the ludic component. If, on the other hand, the IFcVR experience is based on the interactor's biofeedback and therefore interactors do not have a conscious control of their choices, the interface disappears and the cVR experience flows as a symbiosis between the narrative and the interactor's emotions. In this work, I am referring to a IFcVR experience with cognitive interactions, as it is the case of ZENA.

In cognitive interaction, the connections between NUs are made through a hotspot, a target in space that displays different alternatives to the interactor at the decision-making moment. The hotspots can be part of the story (i.e. two characters that present two different alternatives) or can be some graphic elements not belonging to the storyworld. These targets, that can be visual or also be auditory if working with spatial audio, appear in sync with the narrative event, so as the interactor is ready to make a decision. The hotspots work as channels through which the narrative event is decompressed. However, when we give the interactors the power to choose between several options, they must know what those options are. This knowledge of the different possibilities should be the result of what the interactor has seen during the scene, therefore they are an output of the preceding narrative event. It is,

however, possible to offer some hints about what can happen if one option or the other is taken, or about the feelings and thoughts of the avatar character. Hotspots, therefore, may contain a bit of text that explains the option; can trigger off the interactor's *wayfinding* sense if they have to choose which way to go; can be explained verbally by the characters, or they can simply activate objects and characters from the storyworld.

7.3.3 Locating the Hotspots

The narrative design together with the interactive screenplay indicates how the narrative units are connected with each other: what type of hotspot will be used, if it is diegetic or extradiegetic, if it is visual or auditory. Thus, at this part of the interactive montage, the hotspots as a visual or audio file will be added within each NU's at the *decision-making* moment, locating it within the scene/space and setting its behavior. Below I propose some suggestions for interactive editing, arising from my experience with creating ZENA.

Location in Space. I recommend to set the hotspots at this time of assembly, and not on the assembly of the cVR, so that the visual target is not a flat object of the equirectangular video, but an object with a body inside the VR environment. Interactive montage software, as WondaVR allows to give depth and body to the placement of objects in 360º space (Fig 44).

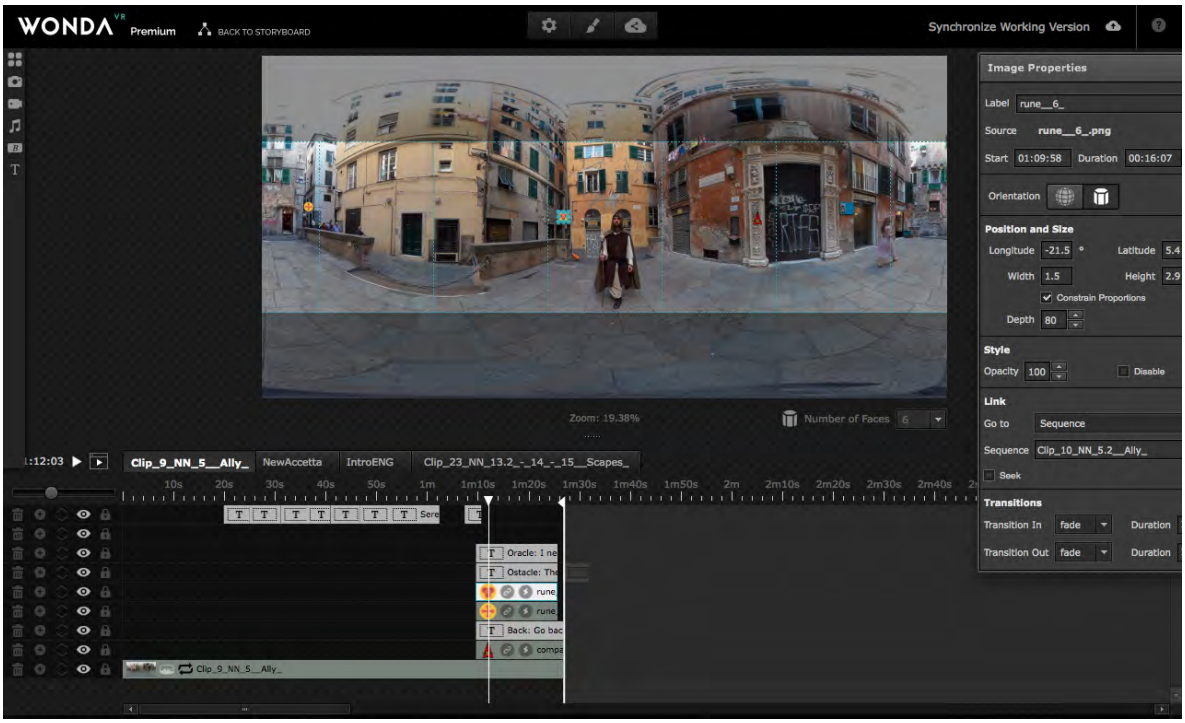


Figure 44. WondaVR Interface Locating Hotspots

Type of Interaction. This setting establishes how the hotspot is activated and what type of behavior it has, if it is an internal link that displays extra multimedia material, or if it is an external link that changes to the next NU. This setting is related to the type of HCI through which interactors activate the hotspot, be it a joystick, a vocal command, or the head movement.

Look at. The hotspot then is linked to the correspondent NU, and a time for the transition can be given. When passing from one NU to the next, we can also decide were the POV of the interactor will be located at the beginning of the NU; by doing this, we can direct the vision of the interactor to the area in which there is something important for the narrative. Otherwise, the POV of the interactor will be the same when jumping from one NU to the other. Therefore, another task of the screenwriting and/or storyboarding work consists in locating objects and actions at the end of a scene/space or the other, in order to create a visual continuity of the narrative actions, and maintain a certain authorial control by locating in the space the important elements for the story.

Setting the look of the interactor at this point of the interactive montage can be useful if we need to force the interactor to look at that particular detail. However, if in the previous scene the interactor was looking at his shoes, and in the next one his vision is immediately changed, the interactor will need a time to look up and understand the new scene/space.

Automatic Transitions. In this type of experience, the interactor is choosing the path. However, automatic transitions can be added in order to: (1) create a sequence narrative unit (See Chapter 7.2.3) or (2) decide what can happen if the interactor did not make a decision on time (whether to go to a NU chosen by the creator or to repeat the current NU).

Once the task of connecting all the NUs is completed, the interactive narrative structure will be completed (Fig 45) and the debugging phase will start, to verify that all the hotspots work and that the decision-making moments are narratively effective in terms of timing, sound and graphic design.

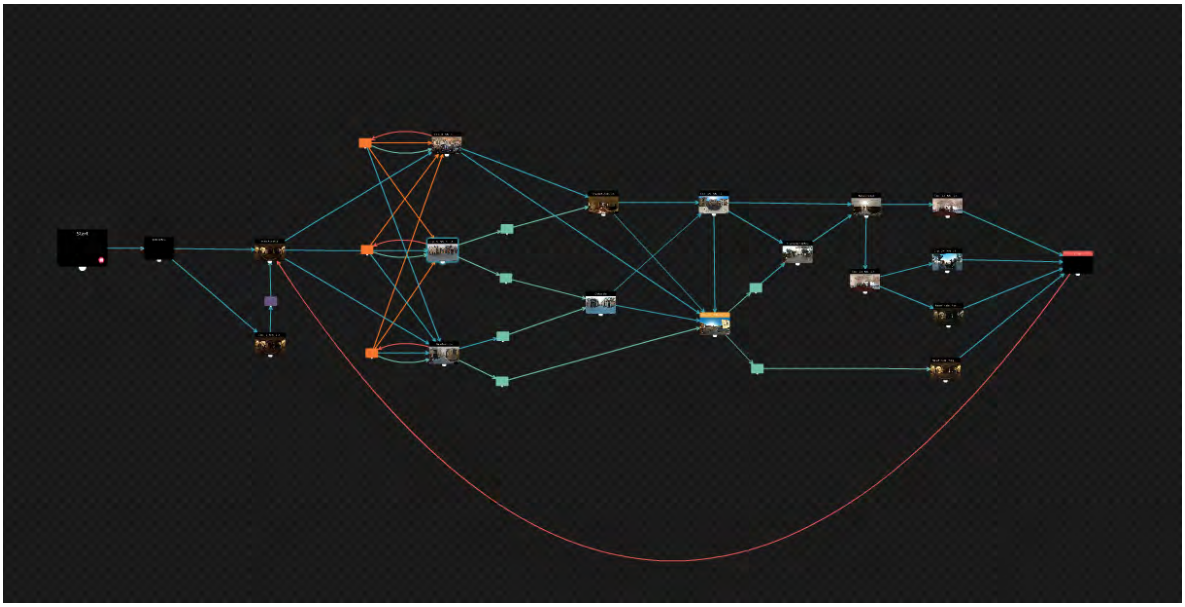


Figure 45. ZENA's Final Interactive Structure

7.4 Subtitles

The dialogues of ZENA were written and recorded in Italian; subsequently, when the project was chosen to participate in the Art Exhibition at ICIDS (International Conference on Interactive Digital Storytelling) in 2017, I had to add English subtitles in Zena for an international audience. Initially, I thought it was impossible and that I should have doubled the whole film, but, due to time issues, I decided to take the risk of subtitling. Until that moment I had never seen a subtitled cVR project, and even today there are very few projects of this kind with subtitles. Unfortunately, I did not manage to measure this aspect of production in the UX evaluation. However, during the art exhibition more than 15 non-Italian speakers were able to enjoy ZENA from start to finish, without problems to follow the course of the events. A sign that the subtitles worked correctly.

Subtitles are a useful tool to reach a wider audience, not only for translations but also for people with hearing problems. In this section, I will share some lessons that I learned subtitling ZENA.

The issue to tackle when subtitling in VR is *How to insert the captions in a spherical space while interactors are possibly looking in different directions and can easily miss the subtitles?* To accomplish this mission, once again I fully relied on the interactor's interest in the narrative events. My intuition was that the interactor would have closely followed the movements and actions of the characters in space. Trusting the interactor is fundamental in VR and cVR in general, as we are using this specific medium to give visual freedom.

I recommend to undertake the subtitle work during the interactive montage, and not during the editing of each linear NU. If the caption is treated as a separate asset from the 360º video file, it can be overlaid upon the video and set with characteristics such as location in space, depth and volume, so that it can be read with a better clarity. What made ZENA's subtitles clear and efficient, regardless of the movements of the actors in the space were three key aspects: Simple text, Speech Balloons and Timing.

Simple Text. A good subtitle is, above all, a good translation, and second, a good fit into the screen. In immersive environments, it is important that the caption does not occupy too much space with too many words to read. We must remember that interactors are constantly exploring space and we do not want to spend a lot of time reading a text.

Speech Balloons. The most natural thing for me to do, was to write the subtitles in speech balloons that can be located near to the character that is speaking, just as comics do. By doing this, each single speech balloon would always follow the position of the character within the space, and therefore be always related to the character that is actually speaking. The styling of the speech balloons can differ to identify different speakers or sound sources.

Timing. Unlike the cinema technique where the new caption replaces the other, in VR we can give to each speech balloon a longer time. This extra time allows the interactors to catch up if they were looking somewhere else.

Figure 46 shows how the subtitles were placed in NU 6, when Lorenzo meets his enemy for the first time. In this scene the two characters have a conversation while they revolve around the camera (which in this scene is NT2 - Lorenzo's magic cane), so interactors have to move their bodies around to read the subtitles.

Figure 46. ZENA's subtitles NU 6

Part III. IFcVR EVALUATION

Chapter 8. Interactor Experience on IFcVR

8.1 Is IFcVR an Entertainment Artefact?

Contemporary debates on cyberculture and the impacts of technology on society have shifted from the 90's widespread skepticism about scientific and technological development (Schroeder, 1994), to a more open and aware mindset that recognizes how a certain technology can appear and alter our lifestyle in the blink of an eye. But even with this new worldview, VR still encounters great difficulties in being understood and adopted, as evidenced by the Gartner's *Hype Cycle of Emerging Technologies of 2018*[79] report (Panetta, 2018). Making a step back, we are still wondering who are the VR audience(s) and how the concept of spectatorship is being addressed by the companies that produce VR hardware and content. Until now, the strategy that companies such as Facebook Oculus and Google Daydream have taken, to just mention the most famous ones, can be compared to the strategies that movie makers and movie merchants of the Nickelodeon era used, as Burst writes in *The Imagined Audience in the Nickelodeon Era:*

> "What was important to shaping the decisions of moviemakers, in the short run, as they shaped the movies, was not who the audiences were and what they wanted, but instead how the makers imagined their audience and its desires [...] In the immediate

[79] https://www.gartner.com/smarterwithgartner/5-trends-emerge-in-gartner-hype-cycle-for-emerging-technologies-2018/

process of moviemaking, it was most likely the short-run speculation that directly shaped any given film and its style." (Burst, 2011)

This short-run speculation can also be perceived from VR independent creators that are producing experiences without knowing precisely how and by whom their products will be experienced. VR as a media will be able to define its audiences in order to create for them, as well as it will understand its utilities for society itself and its place in the world market. Take the feature film for example, it took several years before it became the main product of the film industry, and when that happened it started to be "promoted as narrative art on celluloid" (Burst, 2011). This legitimization, as Burst notices, had as a consequence a profound impact on its diffusions, "ending its definition as lower-class amusement, and establishing its legitimacy among middle and upper classes" (Burst, 2011). Along this line, we should wonder who is consuming VR nowadays, as it was the case with cinema in its beginnings. Is it the working class? the tired businessman? the *Matinee Ladies*? (Butsch, 1994)

Since the genesis of this research work, I focused on the study of a media and narrative hybrid, especially from the creator point of view; therefore, I approached the IFcVR essentially as an entertainment product, which could also be a media for narrative learning (Dettori, 2016) or for promotional, touristic or informative purposes, but with the main goal of offering a pleasant and entertaining experience. Research on entertainment psychology has shown how effective is entertainment to encode and store media messages as it is, in the first place, an intrinsic human activity (Bryant & Vorderer, 2013). Thanks to the developments on the psychology of entertainment, we now know that "entertainment can provide individuals with both pleasure and meaning" (Oliver et al., 2014); that entertainment is not just a purely joyful and fun activity, but as Mary Beth Oliver writes "an entertainment that is poignant, meaningful, or even tragic may be gratifying for some people [...] because it allows individuals the opportunity to contemplate and experience questions such as purpose-in-life or the human condition or to fulfill higher order needs such as the need for relatedness" (Oliver et al., 2014). In the same way, we now acknowledge that meaningful

entertainment experiences "can remind viewers of elements of a shared humanity" (Rieger, Frischlich & Oliver 2018, 10).

I am highlighting the importance of entertainment in this section because one of the questions I have often asked myself, and that people have asked me during this research, is *why would someone want to have an IFcVR experience*, a question that has not been fully answered yet. Referring specifically to IFcVR and the possible elements that can motivate an individual to consume this kind of content, I find that the convergence of perceptive immersion, narrative and interactivity results in a powerful mix to generate emotions in the audience, and emotions "are at the heart of entertainment media" (Bartsch, 2012). Game studies has shown that, beyond mere interaction, videogames with a compelling and engaging story "may be particularly able to be meaningful", while "autonomy and competence are associated with enjoyment, and feelings of relatedness and particularly insight are strongly associated with appreciation" (Oliver et al, 2016). And the way in which interactors react to a narrative or artistic artifact, also changes in history, as Mirjam Vosmeer and Ben Schouten (2014), point out: "new kinds of interactive experiences lead to new kinds of user engagement, and new ways in which the user may be immersed in these experiences". In this vain, it is vital for any new type of medium to keep a constant conversation with its users about their uses, motivations and gratifications.

My approach to undertake the study of the user experience (UX) of IFcVR is very much in line with the thought of Zillmann and Bryant (2011) presented in their book *Selective Exposure to Communication*. They claim that mass media research has mostly focused on the societal impact of the media, in how media influence people and affect their behavior, documenting broadly undesirable effects whereas only a few desirable effects have received similar attention (Zillmann & Bryant, 2011). Although Zillmann and Bryant understand mass media as entertainment media, such conception allows us to create a bridge towards the study of new media audiences. The study of the VR impact on society is crucial as we are dealing with a technology that has emerged from deep human desires to fulfill (Schroeder, 1994). Nonetheless, at this moment of its history, it may be advantageous to pay attention to

“questions such as why people enjoy whatever they elect to watch or hear, and why they elect to watch or hear, in the first place, whatever it is that they elect to watch or hear” (Zillmann & Bryant, 2011).

Audience research have shifted from the idea of an uncritical and submissive mass, to fully recognize the active role of the audiences and the role of their contexts and backgrounds when consuming a certain media or interpreting a certain text. This acknowledgment of the audience (as a collective and individuals) translates into several fields of media and cultural studies, including audience studies within their scope, as well as research on media or text production incorporating an audience study (Livingstone, 1998). It is worthwhile to question how to use the term “audience(s)”, especially within VR studies, because VR has the capability to be a *one-to-one, one-to-many,* and *many-to-many* medium. Even less is our knowledge about IDN’s audiences, as well as their uses and gratifications, which has failed to address the production of content towards their needs and purposes. Since the bases for the formation of a new discipline for the study of interactive digital narratives are now being set (Koenitz, 2018), we can start to build a legacy of media audiences historiography for the field.

For the scope of this research, beyond of the potential applications or developments of VR and IFcVR, I am handling the IFcVR text in the same way as a novel or a film can be treated, with that intimate one-to-one relationship that arises between creator and interactor. After having presented the theoretical bases to approach the IFcVR hybrid, and then having detailed the production of an IFcVR prototype, it was important for the completion of this work to understand if IFcVR could be, in the first instance, an entertaining experience. With this goal in mind, entertainment is understood as a twofold element: the enjoyment provided by the interactor’s agency, together with immersion on both narrative and perceptive levels.

8.2 Protocol Proposal for IFcVR UX Evaluation

The current scarcity of IFcVR experiences has a direct consequence in the lack of research on the production workflow (from development to post-production), potential applications, and assessment tools for measuring user experience (UX) in terms of enjoyment and engagement. This lack of user feedback hinders the creation of a medium-conscious narratology (Wolf, 2011) for IFcVR as a hybrid genre, as well as the detection of IFcVR audience. The study of the UX is the basis of the design and improvement of successful system and interfaces, as UX measures user's satisfaction, from a pragmatic and a hedonic points of view (Bevan, 2008). Human-Computer Interfaces (HCI) evaluation standards, protocols and techniques (Bevan, 2016; Issa & Isaias, 2015) can partially help to evaluate the usability aspects (effectiveness, efficiency, satisfaction, learnability, accessibility and safety) (Bevan, 2008) of the IFcVR system, but they leave out aspects related to the degree of entertainment of a given IFcVR experience, as they do not take into consideration narrative aspects that are peculiar to cVR and IDN. The protocol proposal presented in this section aims to contribute to fill this gap.

An evaluation protocol for IFcVR needs to tackle aspects related to the VR system by including its usability, the sense of presence and the degree of sickness that certain cVR experiences may cause, as well as to evaluate aspects related to the IDN, the degree of user agency, the narrative immersion as the perceptive immersion, and the degree of enjoyment, affect, transformation and continuation desire (Schoenau-Fog, 2014). To achieve such a comprehensive view, the protocol should gather both qualitative and quantitative data, so as we can analyze non-filtered and spontaneous data as well as structured and cognitively processed information about the UX. To this end, the proposed evaluation protocol joins three *ad hoc* instruments: an observation grid, a questionnaire and a semi-structured interview. The protocol will be illustrated through a pilot application on the IFcVR fully functional prototype ZENA.

8.2.1 IFcVR Analytical Tool Box

The IDN User Experience Dimensions toolbox proposed by Cristian Roth and Hartmut Koenitz (Roth & Koenitz, 2016) offers an interdisciplinary approach that can be applied to the evaluation of a wide range of technologies and narratives. This is a flexible analytical framework that "connects research in psychology, based on Entertainment Theory, with a humanities-based perspective" and allows us to get an overview of what should be evaluated in an IDN. However, for the purposes of this research, we needed some other categories to focus on very specific technical aspects related to the possibilities offered by IFcVR, and in some cases these categories do not belong directly to the micro categories presented in the initial framework. Table 6 presents a breakdown of the categories proposed by Roth and Koenitz with the adaptation and/or the addition of some specific categories[80] related to both IF and cVR.

Agency	System's Usability	
	Autonomy	Intuitive use of HCI to Activate the Hotspots
		Use of Text as a Guide for the Decision-making
		Length of the Decision-making moments
		Type of Hotspot if Visual or Auditory
		Use of Diegetic and Extradiegetic Hotspots
	Affectance	
Perceptual Immersion	Realism of the cVE*	
	Presence	
	Flow (Audiovisual and Interactive)	Awareness of the Camera Position
		Awareness of Editing Cuts between shots and NUs
		Use of Interaction Feedback

[80] The categories added are marked with an asterisk, while the adapted categories are listed in the right column.

	Use of Spatial Audio	
Narrative Immersion	Cinematic Continuity*	
	Understanding and remembering the story*	
	Believability	
	Role Identification	
	Curiosity	
	Visual exploration of the Space Vs Interest on the Scene Events*	
	Diegetic and Extradiegetic Sound	Use of the Voice Over
		Use of Music
Transformation	Sense of "Living" the Film Vs Video Game Feeling*	
	Aesthetic Pleasantness / Eudemonic Appreciation	
	Positive or Negative Affect	
	Continuation Desire*	
	Enjoyment	

Table 6. IFcVR User Experience Measurement Categories of Analysis.

*: Specific IFcVR categories

Even though linear cVR is considered as an IDN in itself, IFcVR adds an upper level of interactive creation and reception (See Chapter 2). While a first level refers to what happens inside each immersive narrative unit, the second level is related to the navigation path that the user creates through the whole experience. These levels will determine the methods to be used to measure the enjoyment of the experience. Following the definition of *local and global affectance* proposed by Roth and Koenitz (201), I identified the levels of IFcVR as follows:

1. Local - cVR assessment: aspects related to what happens inside each NU.
2. Global - IDN assessment: aspects related to how users navigate between nodes that lead to the final IDN outcome.

Local Assessment - Aspects related to Cinematic Virtual Reality. As a place-based experience, the effects on emotion, enjoyment and narrative flow regarding IFcVR rely on

what happens within each NU. On a first level, UX is based on what occurs within the *scene-space*; the interaction consists in what the user chooses to see. Data collection instruments such as head tracking (Rothe et al., 2018; Bala et al., 2016), body movements and biometrics (Bian et al., 2016; Cipresso et al., 2014) software have been used to measure the behavior and emotional involvement of the user during the immersive experience in correlation to what she is seeing-living within the *scene-space.*

Since IFcVR is mostly based on 360° video, aspects related to the level of realism offered by the video, image and cinematic techniques, such as the position of the camera or the internal and external cuts, the use of the spatial audio (Aspöck, 2018) and the diegetic or extradiegetic sound (voice over, music, effects) can be used to evaluate the quality of the cinematic VR experience and of its audiovisual language.

Global Assessment - Aspects related to Interactive Digital Narrative. In IFcVR, during each *scene-space,* users face decision-making moments that represent the agency level offered by IFcVR. Users make their choices based on the information given by the NU and the level of engagement they are experiencing. Agency in IFcVR, where the VE cannot be modified by the users, can be measured by the intuitive use that the users can do of the proposed HCI to make choices that will change the course of the story, or to activate the hotspots that offer extra-information. Hence, HCI measurements that regard usability parameters (such as time on task, time to learn, number of errors, etc.), help to reflect the level of effectance and autonomy that influence the enjoyment of the overall interactive experience.

8.2.2 Procedure Design

The design of the evaluation procedure follows the division between the Local and the Global level. Being that the local enjoyment of the experience happens while each NU is being lived, this aspect needs to be measured during the experience, with specific instruments to analyze what the interactors are seeing in space, what they are thinking or feeling during that narrative unit and how their bodies respond by being present in that particular scene/space. The global enjoyment of the experience, on the other hand, can be measured once the interactors have traveled all the way to the end, and can retrospectively analyze what decisions they made and what their consequences were. Summarizing, the procedure design was divided in two moments, in each of which different methods and instruments were used. Table 7 illustrates the procedure design:

	Analysis	***Methods***
User Characteristics (collected during the "After the experience" phase)	Participant Tendencies	Consensus Demographic Data Expertise level in Film, Videogames and VR
During the Experience	Local Assessment (cVR): Scene-Space	User's Journey System Recording Observation of Body Movements Think-aloud Protocol
After the Experience	Global Assessment (IDN): Final Journey	Questionnaire Semi-structured Short Interview

Table 7. Procedure Design IFcVR User Evaluation Protocol

8.2.2.1 During the Experience

The *During-the-Experience* phase corresponds to the local assessment and analyzes aspects related to the cVR quality of each NU, and consequently to the *decision-making* moments. This moment of the evaluation is very important because we will be analyzing how the interactors relate physically and emotionally with the IFcVR experience. It is a crucial moment because while they are immersed, we can observe them without any kind of filter. This behavioral evaluation will allow us to know, in real time, to which elements of the scene or space the interactors devote more visual attention, how active they are in the cVE, what are their thoughts or natural reactions during the reception of the story. The aim of this choice is to correlate body movements, feelings and thoughts, together with what interactors were observing at a specific time inside the *scene-space* or NU. This correlation allows us to analyze the construction of the scene from the cVR point of view, analyze how much a user follows a scene or prefers to observe the space, and to understand the mental and emotional process of each interactor when choosing one way or the other.

Lacking technological tools as motion sensors, biometric sensors or VR analytics software, for the evaluation of the prototype three types of qualitative data were collected simultaneously and correlated through an Observation Grid (see Table 8) while the users were experiencing the film: User's Journey System Recording, Observation of Body Movements and the Think-aloud Protocol (Janni et al., 2002). *During-the-Experience,* interactors and system's mirror view can be recorded in video. This option allows us to review and correlate, in a second moment, aspects of the evaluation.

N.U	Time	System Recording	User Observation	Think-aloud
		● Scene ● Space	● Move in place ● Walk around ● Touch attempts ● Head movement ● Others	● Attitude ● About the Story ● About the Space ● About the Prototype ● Discomfort ● System Usability

Table 8. During-the-Experience Observation Grid

8.2.2.2 After the Experience

The *After-the-Experience* phase corresponds to the global assessment, evaluating user's final journey, that is, the output resulting from the instantiation process. This part of the evaluation will allow us to know in depth the reflections of the users on various aspects of the IFcVR experience. Two instruments are proposed for this phase: a questionnaire and a short semi-structured interview. User's characteristics and tendencies questions were included in the initial part of the *After-the-Experience* questionnaire.

The aim of this part of the evaluation is to gather user's retrospective quantitative and qualitative data regarding the overall journey in relation to agency, perceptive and narrative immersion, and transformation aspects (enjoyment, aesthetic pleasantness, affect) and the level of physical discomfort. This mixed method allows a better comprehension of UX aspects related to their cognitive remembrance and understanding of the story, their feeling of presence within the cVE, their level of enjoyment, and their feelings in determining if the IFcVR experience was perceived as watching a film or playing a videogame.

Questionnaire. The questionnaire takes into account aspects related to the immersive experience and to the interactive narrative. Table 9 presents the structure of our questionnaire. It is based on the ITC-SOPI questionnaire: Sense of Presence in Cross-media Experiences (Kennedy et al., 1993), using as main structure the toolbox for the evaluation of User Experience of Interactive Digital Narrative. Finally, some questions were added from the Simulator Sickness Questionnaire (SSQ) (Lessiter et al., 2001) in order to spot the physical discomfort caused by an IFcVR artefact.

The final questionnaire contains 73 questions: 6 questions on demographic data, 6 questions on User's knowledge and consume of films, videogames and VR. 57 questions have a response option on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree), one is a multiple-choice question with constructed answer and three open questions explore users'

appreciation of story features (scenes, places and characters); finally, an open comment about the experience is requested.

User Dimensions	**Categories**	**N° Q**
User Information	Demographic data	4
	Knowledge (Expertise) and Use of: Films, Videogames and VR	6
	Nausea tendency and use of glasses	2
Agency	System Usability	3
	Autonomy	4
	Affectance	3
Perceptive Immersion	Realism of the cVE	6
	Presence	5
	Flow	2
Narrative Immersion	Curiosity and Suspense	4
	Believability	5
	Role Identification	5
	Sound (Voice Over, Music)	2
	Scene Vs Space	4
Transformation	Enjoyment	4
	Film Vs Videogame Feeling	3
	Affect	4
Physical Discomfort	General Discomfort	2
	Visual Discomfort	2
	Nausea	3

Table 9. Structure of the IFcVR Questionnaire

Semi-structured Short Interview. The interview consisted in a short dialogue in which users were invited to share their thoughts and feelings about the experience in a retrospective way. The questions covered several topics that allowed us to understand the Transformation aspect from different points of view: Understanding the story and the journey, Enjoyment and Affective aspects of the IFcVR experience. Table 10 presents the main questions that were asked to the participants.

	Questions
IQ1	Can you tell us what the story was about?
IQ2	Can you relate your journey? (Remembrance of the navigation path and the choices lead them to the specific ending)
IQ3	What aspects of the story caught your attention? (characters, places, sounds, etc.)
IQ4	What feelings did you have about the Virtual Experience? (Impressions about the experience)
IQ5	Do you have any suggestion for future improvements or projects?

Table 10. Structure of the IFcVR Semi-Structured Short Interview

8.3 Measuring ZENA's User Experience

ZENA was created with the aim to investigate the realization of an IFcVR artifact, but above all, to test if this hybrid could be capable of transmitting different types of message and give rise to entertaining and meaningful experiences. A positive evaluation would stimulate and guide the creation of interesting IFcVR products. As a consequence, an *ad hoc* evaluation methodology was created to test if the IFcVR can be received as an engaging immersive film experience. I recognize the limitation of testing a prototype with a protocol created for it.

With a length of 18 minutes for the longest path and 8 minutes for the shortest, ZENA has a longer length than traditional VR short films, in an attempt to create an experience that could be perceived as a film despite the interaction moments. The prototype was shot in Genoa's

labyrinth of “vicoli”, in 4K 360° video, with stereo audio (questions regarding spatial audio were not included in the evaluation) and hotspots are activated by head-tracking gaze. During the evaluation, the experience was played through a Samsung Gear HMD, in field sessions: a school classroom, the living room of a countryside house, and an office, as I did not want to make people feel that VR is something that only belongs to the laboratories, but to make them feel that it is a device that can be used anywhere, as long as it is a controlled environment and/or there is someone taking care of the person using the HMD.

8.3.1 Research Questions

As many narrative concepts and audiovisual techniques were experimented in ZENA, there are many questions from different points of view: narrative, interactive and audiovisual. The user evaluation was driven by the following research questions (Table 11):

	RQ
IFcVR	Does IFcVR provide engaging narrative experiences able to deliver coherent messages and stories?
	Is IFcVR perceived as a filmic experience or as a gaming one?
	Are interactors able to remember their path?
cVR	Is cVR realistic enough to convey a fully immersive experience?
	Do users pay more attention to the narrative event or to the surroundings?
	Is the audiovisual experience developed in a fluid way, despite changes in the camera's position, color changes and cuts between shots?
IF	Do interactors enjoy being able to choose their path in the story?
	Is the user interface intelligible at the time of decision making?
	Does the interactor make decisions based on the events?

Table 11. ZENA User Experience Evaluation Research Questions

8.3.2 Participants

The prototype was tested by a total of 62 participants, within the age range 12 - 64 years (*M* = 30.46, *SD* = 15.02), 64.5% female. The test was developed in three different sessions, one user at a time. Each session corresponded to a different group:

G1 = Genoa's middle and high school students (24 participants)
G2 = Non-resident adults in Genoa (19 participants)
G3 = Genoa residents video makers and/or researchers (19 participants)

Participants were asked if they are residents of Genoa or if they have visited the city in the past in order to differentiate the sensation of residents and non-residents of *being* in the city. 56% of the participants were residents. 95% of them had been in Genoa at least once. G3 group was differentiated in order to highlight expert view on cinematic language, VR development and new media applications.

Among the participants, 33.3% were enrolled in high school, 10% in middle school, 6.7% already had a Bachelor's degree, 25% had a Master's degree, a 15% were enrolled or already finished their PhD program and 10% had a technical diploma. As concerns the physical discomfort of participants, such as nausea or use of glasses, 51.7% of the participants wore glasses while a 36.7% often suffered from motion sickness.

Participants were asked about their knowledge, expertise and use frequency of videogames, cinema and VR. 3.3% play videogames every day, 5% play weekly, 36.7% play occasionally and 55% never play. This 55% corresponds to the participants older than 40 years. Regarding film consumption: 51.7% two or more films a week, 26.7% at least one film a week, 18.3% few times a month and only 3.3% few times a year. As concerns knowledge about film production, 41.7% reported intermediate, 38.3% basic, 11.7% none and 8.3% expert. 63.3% have never used before a VR HMD. 43.3% did not have any knowledge about VR production,

a 46.7% had a basic knowledge, a 8.3% a intermediate knowledge, while a 1.7% were VR experts.

Therefore, the test included a group of people used to watch films very often but not to play videogames, and neither knowing or using VR HMDs. Hence, for them the cinematographic language was natural, allowing us to evaluate if the cinematic narrative in the 360° environment was perceived as fluid, in spite of the alternative possibilities of navigation paths. On the other hand, their little use of video games and VR systems allowed us to have a clearer idea of how intuitive and easy to use is the interactive system for the non-expert user.

In 68.3% of the cases, the experience ran in a fluid way and without technical errors. 25.8% experimented an error due to the expiration of the decision-making time, while 5.9% experimented some kind of system errors or freezing that were corrected immediately.

8.3.3 Procedure

The evaluation protocol in total took between 20 and 30 minutes for each participant, depending on the navigation path they took in ZENA. Below, I will briefly explain how the protocol was applied.

8.3.3.1 During the Experience

The first phase of the evaluation process starts from the moment in which the opportunity to live the experience is offered to the user. This is the first decision that the user must make, if s/he accepts or not to be isolated in a neo-reality that will disconnect them, for some minutes, from their own reality. Some indications were given to the participants before putting on the HMD:

- Participants were not asked to express their thoughts, but only encouraged to speak up their feelings and impressions when they wanted, so as the think-aloud process would not interfere with the enjoyment of the experience.
- Very few explanations about the use of the artifact were given, since at the beginning of ZENA the mechanism of interaction is illustrated. This also provides information on how much intuitive is the interaction.
- All the participants were told that the experience could be suspended at any time if they felt some kind of discomfort or boredom.

The video recording was carried out with G3 participants: user's navigation path was recorded by mirroring the HDM vision on a computer, while user's body movements and think-aloud were recorded with a video camera. The video recording allowed me to complete the observation grid at a later time.

8.3.3.2 After the Experience

Once the experience was over, after allowing a prudent time to rest their eyes and return to reality, the participants were asked to answer a Google Forms questionnaire on a laptop. Once the questionnaire was completed, the short semi-structured interview was carried out.

8.3.4 Findings

The results of the study will be presented according to the evaluation moment to which they correspond, and later some correlations between both kinds data will be analyzed.

8.3.4.1 During the Experience Results

The observation grid provided data that allowed me to evaluate the overall appreciation of the story in relations with space. In this part of the evaluation, three components were taken into consideration: (1) The system mirroring, (2) Participant's body movements, and (3) The thinking-aloud. I will present the insights gained from these data that can be useful for the creators when designing their IFcVR experiences.

The System Mirroring: First the Story, then the Space.

Mirroring the system allowed me to see what the participants were looking at on the HMD. Confronting the system mirroring with participants' body movements, I could notice some behaviors related with their way to approach the immersive storytelling. In the first place, the majority of the participants looked for the protagonist every time they found themselves in a new space, and only after this character was spotted they felt free to visually explore the space and the elements around. I could notice in all the participant's body movements that they followed the movements and actions of the characters in the scene, especially in those scenes that were designed to make them turn around while following the characters, or to look for the hotspots. This corresponds to a high level of narrative immersion, in particular to role identification, curiosity and suspense. Interactors wanted to know what was going to happen to the characters, how the story was going to unfold; based on this insight, I strongly believe that creators need to rely their story and adequate the space around it, instead of adapting the story to the space, forcing the eye and the attention of the interactor.

Body Movements: They are Present.

To observe how interactors move in space, while their minds are actually in another space, gives us precious information about their level of immersion. They actually disconnect their cognition from the real space and the more time they spend in the cVE, the more comfortable they feel exploring that other space. Unlike a computer-generated VE, a quality of cVE is that it actually looks like reality, but we easily realize that we cannot interact with it, just like we do in real life. While we recognize CGVE as unreal, its truth is reaffirmed in this unreality.

From the participant's body movements, I could notice their need of interacting with the cVE. Some participants moved around in the room, others simulated walking during moving-camera scenes (avoiding nausea), others tried to touch characters and objects during the experience, other participants also tried to approach objects that they wanted to see better. Participants who tried to touch the VE or changed position in space felt a higher level of VE realism, some even reported feeling the smell of the sea or of the streets; their favorite locations were those that they felt most real. All these body movements were attempts to interact with the cVE, and at the same time they indicated the level of presence and realism that they felt in the cVE. This active body attitude mostly characterized people without previous experience with VR, that were more than half of the participants.

With the type of interaction that was used in ZENA, the bodily attitude of the participants was determining at the *decision-making* moments. Participants that were bodily passive mostly focused on the narrative event rather than exploring the spaces; they also delayed in making decisions while those who were bodily active were able to spot the hotspots and make their decision in a shorter time.

When designing VR experiences in general, we must remember that interactors are aware of being entering a different reality. During the User Evaluation of ZENA, two participants took off the HMD: one of them, from G1, was afraid and refused to continue the experience, while the other one, from G3, needed some time to accept to be isolated with the HMD and then he restarted the experience. As creators, we need to be sensitive and respectful of the presence

of the interactor, but also ingenious and playful to help interactors to coordinate their body movements with what is happening within the immersive interactive film.

Thinking-aloud: Living the Film.

To take a record of the thoughts that the participants expressed out loud provided some insights about their narrative immersion. Most of the participants, when they needed to express some feeling or thought about the experience, used the verb *To Be* in the present tense to indicate where they were, who they were with or to refer their choices (e.g. “I am at the tower”, “I am Lorenzo!”, “I am going this way”), in the same way, they always used the first person to describe situations (e.g. “I don’t trust the Master”). However, each group had different thoughts when talking during the experience, and those thoughts were in line with their ages and expertise with videogames, VR or films.

Participants from G1 (middle and high school students) expressed feelings regarding the story. They talked to characters to give them instructions, or they spoke to themselves about the choices to make. As non-residents adults, G2 participants shared comments about the novelty of the VR experience and the places that they remembered. They were trying to recognize the streets and squares of the city. G3, formed by video makers and researchers, shared thoughts about the quality of the audiovisual experience (e.g.: “I can feel the different heights of the camera”, “the cuts between scenes are practically imperceptible”) and about the system usability by asking questions about the technical development of the experience (e.g. “How did you do this?”, “This camera position/movement works”).

8.3.4.2 After the Experience Results

After the Experience, a questionnaire and a semi-structured interview were submitted to the participants.

Questionnaire. The average outcomes divided into macro categories (and corresponding standard deviations) are presented below.

Agency (Fig 47). Participants felt that the interactive system was intuitive and easy to use. Regarding effectance, participants felt that their choices were actually modifying the story, even though they did not feel fully autonomous during the experience.

Figure 47. Agency Category Results

Perceptual Immersion (Fig 48). This category takes into consideration the factors supporting a sense of presence within the cVE. The data show a similar level of Presence and Realism of the cVE; the high values obtained for both aspects confirm that cinematic VR can indeed generate a good level of presence. Flow shows a slightly higher level and this is interesting

as ZENA experiments with a large variety of types of camera positions, transitions, points of view, and spaces. The fact that participants felt that the audiovisual content flowed naturally motivates further audiovisual experimentation with 360º video and spatial audio.

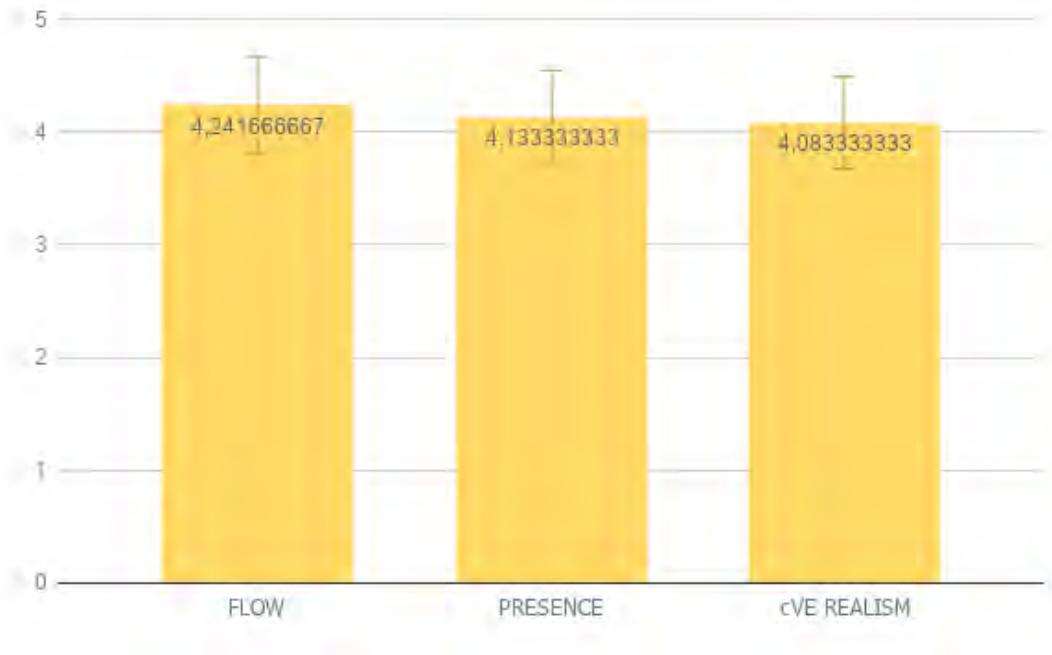


Figure 48. Perceptive Immersion Category Results

It is interesting to see how each group was immersed in the IFcVR experience, be at the perceptive level as well as at the narrative level. In many categories, especially those related to the Perceptive Immersion (Fig. 49), there are not many contrasts between groups, however, some readings can be made from these slight differences. Regarding Flow, G2, non-residents adults felt a higher level of fluency and logic continuity between scenes, while the feeling of Presence was perceived by all the groups in almost the same level, except for the G3 that shows a lower level of sensation of presence. The realism of the cVE, in the same way, shows greater skepticism on the part of the G3, video makers and researchers, who with more experience in VR and video making, are less prone to the suspension of disbelief.

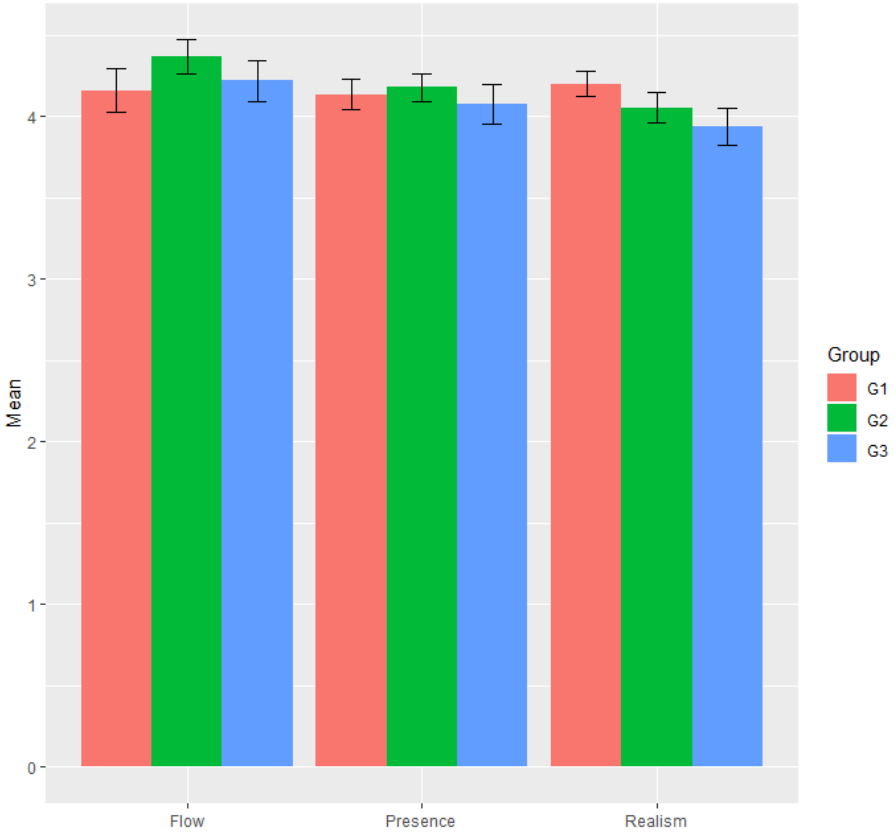


Figure 49. Perceptive Immersion Categories divided in Groups

Narrative Immersion (Fig 50). This category shows data regarding narrative elements and the role they played during the experience. The lower level was Story Participation, which regards how much the participants felt they were participating into the story. I consider that the low score obtained does not represent a negative aspect, but is consistent with the type of interactivity and medium that we are using. The cVE is not modifiable as a CGVE and, at the same time, interacting only with the head to choose between a range of options does not represent a real participation in the event that is unfolding in each scene. Curiosity and Role Identification reach a fair score, while items as Voice Over and Music had a determining role in enhancing the narrative immersion; this suggests that VR is an effective medium for visualizing oral stories and sound landscapes, and that voice-over and music are powerful instruments for audiovisual storytelling. The highest score was obtained by the Visual Exploration of the Spaces; within this category, I was interested in knowing the level of

curiosity of the participants in exploring the spaces, if the film allowed them enough time to do so, and if the choice of the locations contributed to the narrative immersion. An interesting result emerges from comparing the answers to the open questions *"What was your favorite scene?"* and *"What was your favorite place and Why?"*; usually the favorite scene matched with the favorite place, and the preferences were due to the level of presence that the users felt in those places, the particularities of the spaces, and also to the narrative event that took place in them.

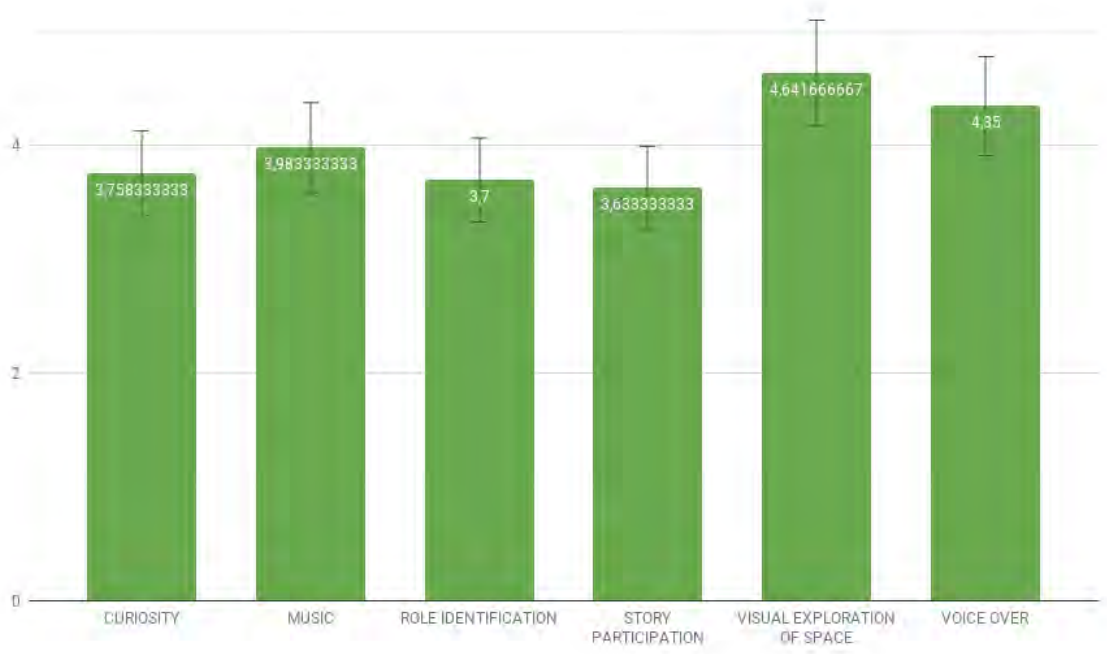


Figure 50. Narrative Immersion Category Results

The Narrative Immersion category (Fig. 51), shows major variances between groups. Regarding the curiosity micro category, it is possible to notice a lower level of curiosity from G1, high school students, while G3, was more involved in discovering what will happen next. The music and the voice over aspects do not present major differences, even though there a greater appreciation on the part of video makers on each category. Role Identification, instead, shows the biggest difference between two groups: G1 and G3. The youngest ones highly identified with Lorenzo: most students chose him as their favorite character, while the

videomakers and researchers, with an average age of 45, did not feel so involved with the adventures of our hero. The curiosity of this group, was more focused on discovering the other characters and spaces, than feeling empathic with the avatar character. The same reading can be made about the level of participation in the story: youngest people were more connected with the adventure. This aspect can be related to the genre of ZENA.

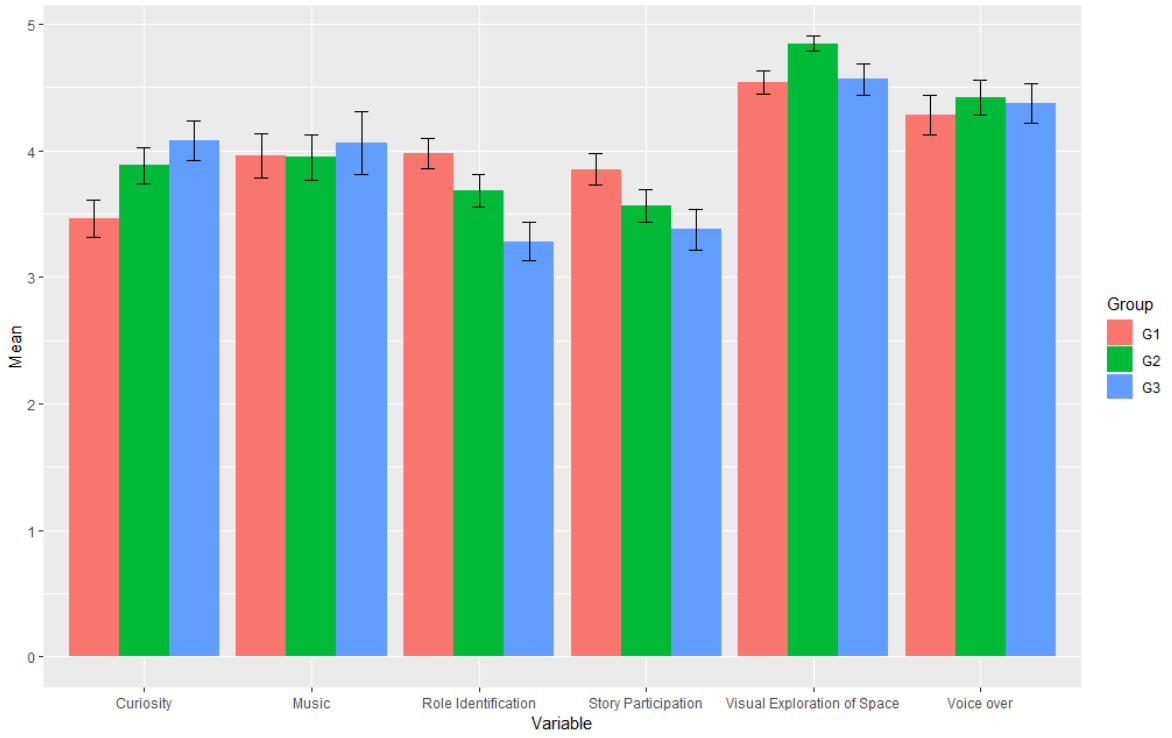


Figure 51. Narrative Perception Categories divided in Groups

The Visual Exploration of the Space was one of the most important aspects during the development of this thesis, as I am interested in investigating the close relationship between space and narration in cVR. This column highlights how important is to connect the narrative event with its location. All groups have shown high levels of interest in visually exploring the space, but in this case, G2, the non-resident adults, were the most impressed by the spaces. Indeed, if we think that these people do not live in Genoa, and that many of them have visited the city very few times, it is natural to understand why they were so fascinated with discovering the city. This group also shows high and constant levels of flow, presence,

realism of the cVR, curiosity, role identification and story participation. These values allow us to perceive that the visual exploration of spaces does not interfere with following the development of the narrative.

Transformation. This category contains four micro categories; Enjoyment and Affect are presented in Figure 52, while the Continuation Desire in Figure 53 and the Videogame vs. Film feeling in Figure 54 and 55. While Enjoyment reveals high scores, the feeling of have been affected by the experience is lower. I think this last sensation is closely related to the type of content that is transmitted, a more delicate or intimate theme can cause a deeper feeling of affect. Even though in ZENA, participants did feel affected by the experience (perhaps because of the novelty of the medium), this sensation goes beyond the pleasure of experiencing the story.

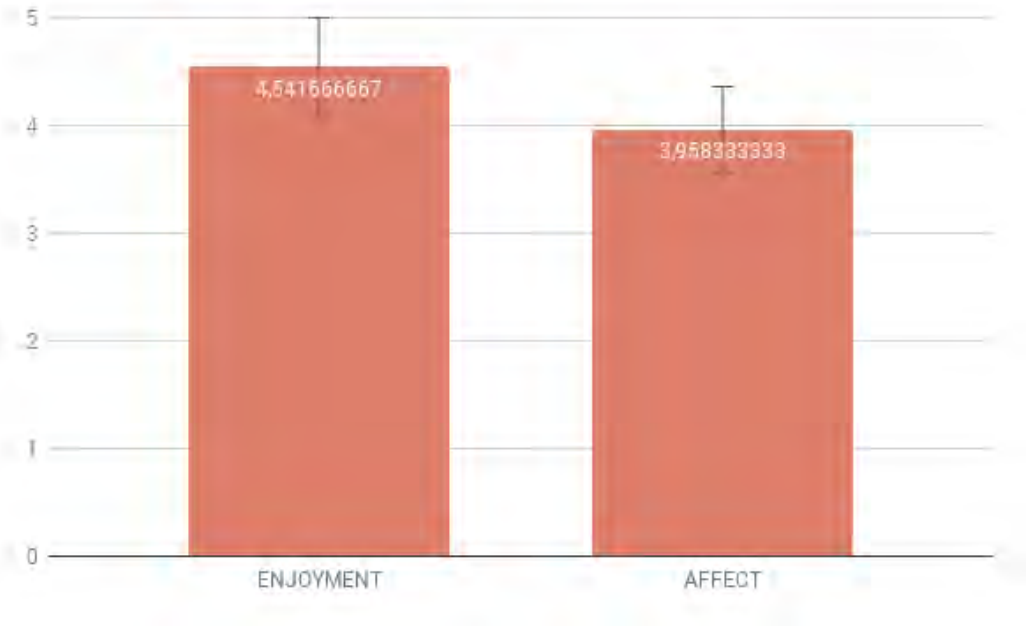


Figure 52. Transformation Category: Enjoyment and Affect Results

Regarding the desire to continue using the film (Fig 53), 58% of the participants wished the experience to continue; this is a high result if we consider that ZENA is very long in

comparison with usual VR and cVR experiences. A 15% of the participants restarted the experience immediately after it was over, so as to explore other possible narrative paths.

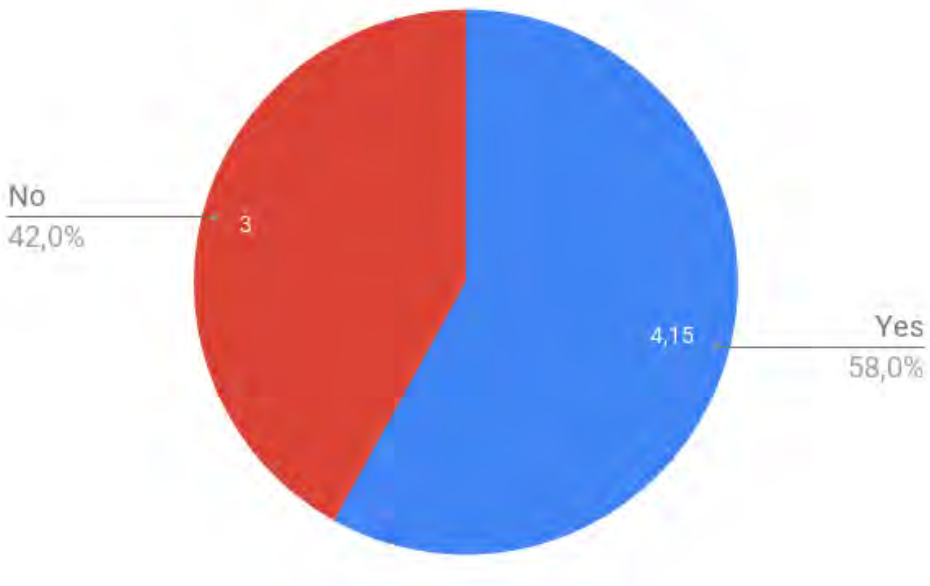


Figure 53. Transformation Category: Continuation Desire.

In this category, three questions were included to check if using the artefact raised a feeling similar to watching a film or to playing a videogame. The results show a very close balance between both feelings: 56,3% for film, while the feeling of being playing a videogame resulted 43,7% (Fig. 54). A detailed view on how each group perceived the experience (Fig. 55) shows interesting results. The younger group, G1, did not find a big difference between both appreciations. For them, IFcVR is almost film as it is videogame, this feeling corresponds also with their active attitude in making the decisions and exploring the spaces. G2 shows a slightly bigger difference between both feelings, while the filmic experience prevails. However, the most interesting result is shown by G3, the group formed by expert filmmakers or researchers. They found without a doubt that IFcVR was, above all, a filmic experience, even though recognizing its gaming component.

Figure 54. Transformation Category: Film Vs Videogame Feeling.

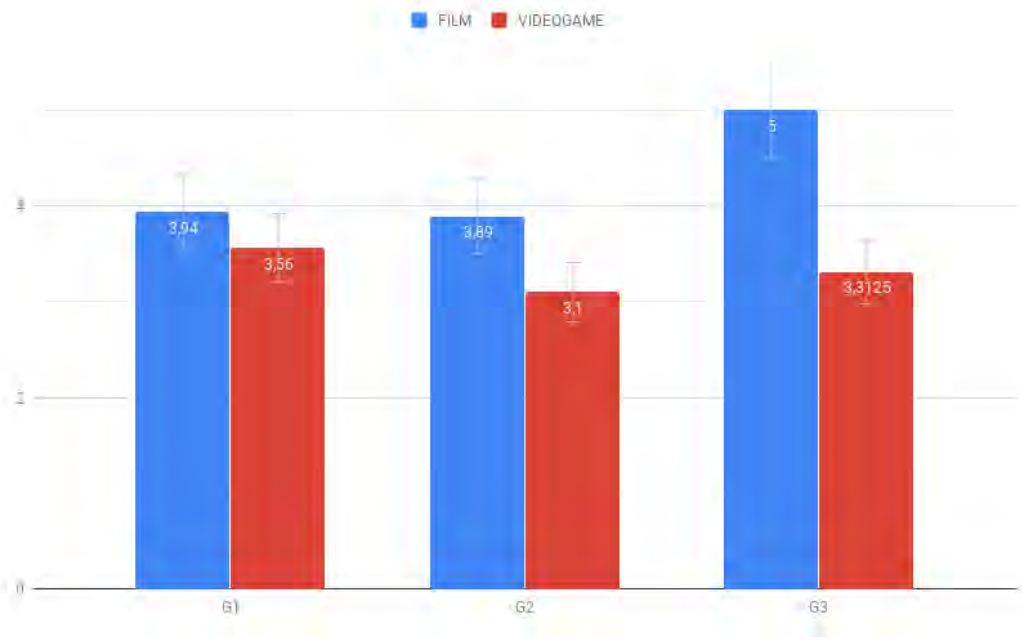


Figure 55. Transformation Category, Film Vs Videogame Feeling Groups Division.

This information contributes to answer one of the main questions of this research; what it shows is in line with some of the claims of members of the IDN community, about the continuous dispute and perplexity regarding if an interactive experience should be considered a movie or a videogame. What this suggests to me is, indeed, that in the particular case of IFcVR, it is neither a videogame nor a film, it is a new kind of experience of its own. The filmic feeling prevails upon the videogame, even if not in large measure; the perception of watching a film is consistent with the fact that IFcVR is actually a video-based narrative, while the perception of playing a game is likely supported by the agency implied by this kind of artefact to perform some action (even though a simple choice) in order to make the story carry on.

Even though the data provided by the questionnaire presents low scores in some aspects related to Narrative Immersion, the open questions complemented the information related to the narrative immersion showing very positive results that also allowed interesting correlations. For example: the favorite place corresponds also to the favorite scene; during the scenes shot in the labyrinth of narrow streets of the historical center, participants felt high levels of suspense and curiosity, and some of them felt them so real to remember the characteristic smells of the historical center. Among the eight characters, the favorite one was Lorenzo, protagonist and avatar-character, with a 35% of the appreciation. This is probably dependent on the fact that people tend to identify with the main character while reading or watching a story.

Physical Discomfort (Fig. 56). This category reported low scores; Visual Discomfort resulted the most problematic aspect with $M = 2.65$. These results are likely influenced by the fact that several scenes contain camera movements which can cause discomfort to people who suffer from motion-sickness. Another possible cause is the use of cellphone VR headsets whose visual quality is usually not excellent.

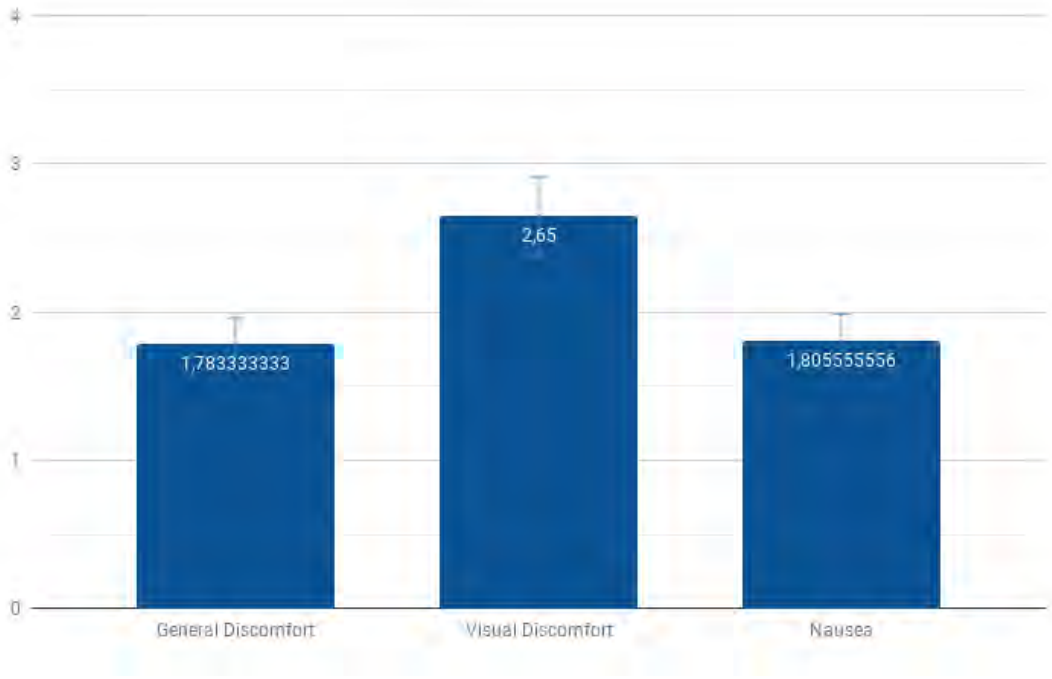


Figure 56. Physical Discomfort Category Results

Semi-structured Short Interview. The short interview, 5 minutes' average, helped to evaluate the level of understanding of the story and how participants remembered it. All participants could elaborate a recap of the main plot of the story (IQ1), and also relate the decisions they made during the experience, reconstructing clearly their navigation path (IQ2). Some of the participants reported their feelings when choosing a path:

- *"I started again after completing the route. I wanted to continue, as if it was not enough. Probably in large part I was guided by my intuition. I had little way of "consciously choosing". I felt guided, rather than capable of deciding my destiny"* (G2 Participant)
- *"I felt that the final goal was not very clear, I asked myself "what should I look for physically?", So I made my choices based on my knowledge and my relationship with the city (example: I went to the sea because I like the sea more than the mountain and not because I understood that my goal was to look for a certain thing that was more*

likely to be on the sea than towards the mountain). However, it was very enjoyable and there is a lot of potential in this field." (G3 Participant)

- *"The story is fun for different reasons. 1) The possibility of deciding the course of events kept me focused. 2) The plot is compelling. 3) The possibility to explore the spaces of all the scenes generates a lot of fun in the "spectator". 4) The "redefinition" of the places that I explored also in reality impressed me a lot!"* (G3 Participant)

They could also elaborate on the aspects that caught their attention (IQ3). Some frequent comments were about the ability to see the city:

- "*I think I saw more of the city in this experience than in my 15 years of life"* (G1 Participant)
- *"The places that I liked the most were the alleys. I frequent them often and had the impression to really find myself there."* (G1 Participant)
- *"The Ancient Port of Genoa because I was in my city virtually"* (G1 Participant).

The story and the characters were considered interesting, with comments on the personality of the characters, the acting quality, and how the turn of the events surprised them. Another aspect highlighted was the sound:

- *"I liked sound effects (the ambient, the sea, when I went back to the past the music was from the middle ages, the sound of people talking)"* (G2 Participant)
- *"The joint death of Sercan and the Master. Very well structured, but above all interesting from the point of view of the turns of the story."* (G2 Participant)

A representative comment regards the coherence of the story:

- *"Being able to choose the paths of the character is fun as it has a logical consequence. (e.g.: the choice I'm lost leads Lorenzo to the church which in my eyes makes a lot of sense)"* (G2 Participant).
- *"My favorite scene was the one in which Lorenzo had to choose whether to give the hourglass or not to the Master. Because it was the only time I chose based on the*

scene (the tone of voice with which the Master spoke) and not based on my emotions towards the city." (G1 Participant)

About the feeling of the Virtual Experience (IQ4), impressions are quite positive if we take into consideration that 63.3% of the participants had never worn a HMD before. Comments about the feeling in the majority of the cases were adjectives to describe the experience, while others extended the answer:

- *"Good experience to escape from the stress of daily life"* (G3 Participant)
- *"Nice but tiring"* (G2 Participant)
- *"At first, I was a bit fearful, then I had fun".* (G1 Participant)

Some answers correspond to some technical aspects of the cVR experience:

- *"It is very strange not to see my own body"* (G2 Participant)
- *"The graphic quality is still low and can be improved"* (G3 Participant)
- *"It is possible to optimize the times in which we have to make choices".* (G2 Participant)
- *"Wonderful experience, very beautiful and exciting. The only thing that bothered me was not clearly seeing things in the background (they were a bit blurry)* (G1 Participant)

Finally, suggestions for future improvements or projects (IQ5) were asked: some highlighted the value of the experience regardless of the fact that maybe they would like to see another film genre. Others imagined applications for tourism or education, or enhancements for the experience.

- *"Interesting and engaging, it would be interesting to also interest the other senses (touch, smell)"* (G2 Participant)

- *"Fun, addictive. Personally, I am not fascinated by fantasy and the historical context. But the prospects seem to me very interesting."* (G2 Participant)

8.4 Final Remarks on the IFcVR Assessment

When you create a product, especially an artistic one, you expect and know that someone other than yourself will consume that product. Although the creative and production part of this thesis was born with the aim of documenting the process of creation, it was clear to me that the resulting product would be used and judged by an audience. This was the main reason why this evaluation was carried out. However, with the decision to evaluate the user experience, especially with an innovative device, different questions are posed that will possibly feed the theory. The first was what to check through this test and the second how to check it.

As a narrative hybrid, it was necessary to evaluate the artefact as a whole as well as its main components. Many details and features could be assessed separately and carried out more accurately with single experiments; however, I decided to test as many aspects as I could analyze during the evaluation. This led to a complex protocol that includes different types of information, as well as a long questionnaire that should be validated as consistent evaluation tool. Likewise, the dataset obtained from this protocol can be interpreted in very different ways as it gives very specific information about ZENA, which can be helpful for future improvements of the artefact itself. Nonetheless, evaluating ZENA only as an IFcVR product, and understanding from this example whether this hybrid genre can be successful or not, is double-edged. On the one hand, if an artefact such as ZENA, with a simple story and limited means of production, can result in an entertaining experience, it surely opens up a promising path for future IFcVR experiences. On the other hand, we could focus too much in analyzing ZENA's particular features, leaving aside the analysis of IFcVR in general. For this reason, the results of this evaluation have been interpreted as much as possible in a broad and flexible manner.

One of the answers to the question *What was your favorite scene?* was "when Sercan pointed

the knife at me in the alleys of Genoa[81]" (G1 participant) while another answer was "When I had to decide whether to trust the Master or not[82]" (G3 participant). These two answers explain the discrete success of ZENA, but also of the potential of IFcVR. The first one shows the level of immersion, perceptive and narrative, of the cinematic VR: the participant uses the pronoun *me* to describe the situation, although the one who is pointed with the knife is Lorenzo. It also refers to a scene of suspense, where there are particular movements of the camera requiring the interactor to have an active corporal state. Next, the participant names the location in which the scene takes place, Genoa's old alleys, demonstrating interest both in the narrative event and in the place where it took place.

The second answer shows an interactor who enjoyed to have decision-making power over the development of events, as well as s/he is pointing out the danger scene (NU 14) or the maxi-climax of ZENA. In this scene, the decision of the interactor is crucial for the positive or negative end of the experience, therefore it carries with it an important dramatic load that generates suspense and emotion in the interactor. This scene appears after three quarters of the total duration of the experience, and after that the interactor has had to make several decisions. What makes this scene special is precisely the narrative path that led to that decision. It confirms not only a solid narrative design of the interactive story, but also a conception of *climax* that can be useful and perhaps necessary for all interactive narratives: a narrative moment that led to *that* important decision.

Regarding the cinematic VR aspect, the results confirm that a VE created through 360º video can convey a fully immersive experience that is perceived as real and generates high levels of presence in the interactor. Interactors also reacted very well with several audiovisual experiments, such as changes of camera position, color changes, cuts and transitions, showing that 360º video can deliver an audiovisual experience in a fluid way, and it does not necessarily need to be a static experience. Nonetheless, the most important aspect regarding the cVR component is the demystification of the dilemma "how do I make interactors look

[81] "Quando Sercan mi ha puntato il coltello addosso nei vicoli di Genova".
[82] "Quando ho dovuto decidere se fidarmi del maestro oppure no".

where I want them to look". This is an issue I have been addressing throughout this work, and one of the main results of this evaluation is the fact that users first get in touch with the narrative and afterwards they feel free to explore and identify the space. When they are already following the discourse, they are constantly putting the story bits together. Therefore, one of the main lessons for the creators that this project work has achieved can be summarized in “Trust your story and trust the interactor”.

The Interactive Fiction (IF) aspect was pretty much appreciated. The interface showed to be intuitive and easy to use at the decision-making moments, however a serious error was presented to a quarter of the sample. The error, rather than the interface, is related to the time of decision making. Although most interactors managed to make their decisions in a short time, several others needed a few more seconds to decide, or even to identify in which area of the sphere are the hotspots. The video, meanwhile, continued to reproduce until its duration allowed it. Once the video was finished, the interactor found himself in a black space. This is a subject that must be taken into account during preproduction and postproduction, because if the decision-making has to be made in the current video, enough time must be granted to allow the user to interact. Otherwise, some kind of mechanism must be generated (e.g. loop of video) to give the user a prudent time to choose. In ZENA, many decisions were of rapid action and were based on spatial decisions: which street to take, or to go to the sea or to the mountain. Others were more intuitive, in which the interactors had to trust one or the other character. Therefore, not all decisions were based entirely on events. When I asked the participants what their favorite scene was, many answered the scene in which they had to decide whether to trust the Master or not, and the justification was precisely that in this particular scene they should choose based on the events. Therefore, another important output of this evaluation is that, in ZENA’s case, interactors preferred decisions based on narrative events.

Regarding the whole IFcVR experience, the results of this first evaluation and the reproductions of ZENA in other environments outside of the evaluation, I could see interactors having fun living this interactive immersive film. They moved, screamed,

laughed, talked. These results suggest that interactors enjoy being able to change the course of the narrative events and that they remember their experience as one who remembers a trip, also remembering their favorite places and people, as well as their decisions. The idea of thinking the IFcVR as a trip also responds to the mixed sensation of perceiving this experience as an intersection between the videogame and the film. These two components intermingle particularly well in VR. Finally, we can refer to the IFcVR as an entertaining interactive experience. Thanks to its ability to entertain, the IFcVR can transmit different types of stories and messages, being able to create a meaningful experience for the interactor.

Chapter 9. Conclusions

This dissertation has proposed a holistic view on *Interactive Fiction in Cinematic Virtual Reality*, a narrative and mediatic hybridization which could be consolidated, in a not distant future, as one of the main audiovisual genres of VR narratives. In this moment in which the technological panorama changes in a vertiginous way, researchers struggle to theorize any mediatic fashion, as not only the technological landscape is changing, but also the audiences change, along with their motivations, uses and gratifications, as well as contents, formats and narratives. Reflecting on a *possible* audiovisual genre in a particular medium that has not yet been fully adopted is in part a speculative task. This speculation on *what people may like* pushes forward innovation, as it was the case with the cinematographic industries at the beginning of the 20th century. At the time, the pioneer studios were continuously proposing different types of contents as modalities of projection, until they reached a wide knowledge about the interests of the public and the motivations that took them to the cinemas. This knowledge converged into cinema's main content: the feature film. An industry was created, and artists, theoreticians and engineers worked in parallel towards the construction of a new medium and a new artistic form.

A hundred years ago, cinema as a medium arose from a high number of inventions and media forms, some of which subsequently disappeared, but nevertheless contributed to give birth to a new, relevant medium. Cinema, as an industry, has been continuously evolving by proposing new formats, new narratives and new spaces, until it achieved its place in society. Cinema, as an art form, was designed by experimenting with techniques, stories and *mise-*

en-scène from earlier media, and could be formally defined through comparative studies with its predecessors. This was carried out not with the intention of readapting old media in a new, emerging medium, but with the legitimate intention to learn from and exploit what had already been written, elaborated and told in other ways and with other supports. Cinema was also involved into experiments with spherical screens, multiple screens and even with the audience pushing buttons to change the end of the movie. Any medium and art form is not a static entity, but is always evolving and adapting to its environment changes.

At present, we can see a similar path in the development of Virtual Reality. But, unlike cinema, VR has a history of encounters and disagreements with the public, and is still far from becoming what its pioneers dreamed: a medium able to transmit perceptions of the world, through a post-symbolic communication. Instead, what we have today is an audiovisual medium whose screen frees the image from the frame, but constrains human vision and hearing and, by doing this, it encapsulates human cognition. The VR screen reproduces audiovisual contents that constitute our main interface with a virtual environment (VE). The VE is an *image-event* that looks to create in its users the feeling of presence, realism and immersion, while several types of human-computer interfaces allow us to explore and interact with the VE in different ways: through vocal, gestural, haptic and biofeedback interfaces, among others. It is not surprising that storytellers, especially from film and video making, are attracted to VR to tell their stories, especially when they have the power to lock the interactor in it.

Capturing reality at 360° is one of the possibilities to create VR narratives. The recording of real scenarios has been directly related to cinematography, under the term Cinematic VR (cVR). cVR has a unique characteristic that differentiates it from cinema and brings it closer to theater. Interactors are immersed in space, they understand the storyworld as a real space and can actually see people in real dimensions as if they were in the middle of a theater stage, surrounded by the actors. But they are not actually there, they are invisible for the actors, so cinema's *spectatorial voyeurism* (that intriguing feeling of being watching someone else's life) is intensified by the feeling of being present. In my opinion, this is the point of strength

of cVR fictional narratives. However, the mere fact of being surrounded by a moving image is presented as a somehow cruel confinement, because who is in *there* has no way to interact with the environment, being just able to observe and listen to it. This contrast between the perceptive immersion and the scarce or missing level of agency of the interactor pushed the development of the proposed IFcVR: not only to offer interactors some possibilities of interaction with the VE, but to intensify the immersion - this time leveraging on narrative- by empowering the interactors to influence the narrative development and by giving them the possibility to create their own unique final journey. If interactors can live the *spectatorial voyeurism* and at the same time intervene about what happens to the characters in the storyworld, they (partially) become the directors of those characters' storylines. VR gives interactors a kind of *safe place* from which to control others' life. This is the core of the IFcVR experience.

This research does not present the IFcVR as an existing product, but it investigates towards the definition of this hybrid as an interactive digital form of narrative, by dissecting and analyzing each of its roots. This research, both in theory and practice, was carried out from the point of view of the creators, in order to give them some conceptual tools and methodologies to create IFcVR products, or similar formats, as *experiences* rather than simply as *artefacts*. From their artistic pole, creators must master the materiality of the medium that will convey their messages. In order to deeply master the roots of what can be achieved by merging cinematic virtual reality and interactive fiction, I propose an epistemological approach that interweaves aesthetics, narratology and interactivity. Throughout this theoretical path, a brief archeology of the panoramic vision was made, pointing out how it evolved into VR, a medium that locates the human perception at the center of the (story)world. This aesthetic shift invites us to re-think the communicative act and the reception of the VR text, that is, experience itself.

As the IFcVR content is transmitted through its cVR component, from it we can analyze issues regarding the discourse time and story time, as the problem of the point of view in VR, the narrative density, and the discourse speed, from narratology and cinematic point of view,

achieving an understanding of the filmic form of the IFcVR. Going up one reading level, the IFcVR text opens up a kind of matrioska-like narrative artefact in which each of its different components has a specific role within the story and in the discourse, its form, substance, expression and manifestation. Being able to separate IFcVR content from its expression, creators can choose through which kinds of human-computer interfaces will deliver and shape the IFcVR discourse. With this theoretical background, the creation labor starts: the development of the interactive digital narrative experience, the production on set or location of the cinematic VR narrative units and the post production, that comprises both cVR montage as the interactive montage. The IFcVR creation was put into practice through the realization of ZENA, which was finally submitted to user evaluation. IFcVR assessment constitutes the last part of this research work. I propose a full evaluation protocol; from whose application, some useful insights were extracted to strengthen the knowledge about this narrative hybrid.

During the development of this study, some issues of the IDN and VR fields were tackled in relation to IFcVR. The most recurrent issues are (1) the concern of directors to control the attention of the user without the support of the cinematic shot, which implies a side issue regarding the disappearance of the director's role, and (2) the use of the *dramatic arc* for the narrative design of the interactive experience. The first aspect arises especially from creators that come from a cinematic or video background. For them, not having the framing in shots reduces their power to indicate the viewer what they have to see. This is a problem depending on the choice of the medium and therefore on the knowledge we have of it. When a creator chooses VR, as a spatial medium, to tell an audiovisual story, it is because space has a predominant value in experience, it is intrinsically related to the narrative immersion of the interactor. Otherwise, if the intention is to give the interactor audiovisual frames, it may be useful to reconsider the choice of the medium, and opt for a framed moving-image. However, it is possible to accentuate objects and characters within the *scene-space*, giving different semantic meanings to the interactor’s view. This multiplicity of semantic shots in cVR can be achieved according to: the positioning of the camera in space; the Narrator type (or role of the interactor in the story); and the height of the camera with respect to the points of

interest. It is also possible to play with the movement either of the camera or, even better, of the characters and objects within the *scene-space*. In the same way, spatial audio plays an important role not only for the perceptive immersion, but also as an agent for narrative immersion, as it can guide the interactor in space, as well as stress or relax certain situations. Through these methods, creators are impressing their artistic intentions, without mentioning other types of interfaces different from the audiovisual.

Results from the evaluation of ZENA show that interactors are interested in following the story; they look for the characters and, even when they are exploring the space, they are constantly building relationships between the space and the scene. This worry of video makers can be summarized in: "trust the interactor and trust your story". This takes us to the implicit concern of this issue: what is the role of the director if interactors are free to look what they want? "Trust your story" does not mean not to prepare the space/scene, on the contrary, it means re-inventing the role of the director. In IFcVR, and cVR, directors are *experience directors*, they must manage the stage and the actors as a theater director would, but at the same time they have to locate themselves in the place of the *all-feeling-eye*, to transmit the interactors their own perceptions of the world. The potentiality of VR relies on the illusion of being free in another reality. This means having autonomy, agency and power to act, to be. A controlling attitude over the interactor's experience goes against the essence of VR. As creators, our role is to design a rich and wide storyworld, conveyed by a solid system. But at the end we have to keep in mind that the experience belongs only to the interactor.

The second issue regards the use of a *dramatic arc* or *story arc,* or a known narrative structure as the Hero's Journey to support the interactive structure. To address this issue, we can take into consideration the distinction between IFcVR content (story) and discourse. The IFcVR content can relate a hero's journey, while the discourse can use a dramatic arc to support the interactive structure. The use of these paradigms or structures is related, on the one hand, to the authors' need of creating identification with the characters through already known archetypes and patterns, and, on the other hand, in order to assure a constant dramatic

progression that is independent of interactor's decisions. Both needs are subject to the storytelling dynamics of creating tension up to reaching a final resolution that satisfies and rewards the receiver. In IFcVR, and in general, in IDN, each story beat or narrative unit is a step of progression. Each of them adds information to the story and pushes the storyline forward. The dramatic arc therefore is not an interactive structure by itself; it can be considered as an imaginary line that must go through each of the possible paths taken by the interactors, so that at one point of their journeys they can reach an epiphany, a climax or several climaxes (for example, several mini climaxes with one main maxi climax). In other words, a narrative reward to the users for their time and emotional involvement.

In Interactive Fiction, interactivity represents a creative challenge for storytellers. It does not create emergent narratives, but rather performs within a pre-scripted structure. This means that each narrative unit has an independent and irreducible identity, and what interactors do is only to jump between one and the other, making conscious or unconscious decisions. A second level of interactivity regards extra information, perceptive or narrative, that interactors can access or feel. IFcVR's kind of interactivity makes the Fiction (in IF) have a greater weight than interactivity itself, in the whole construction of the experience. The cVR narrative units carry all the narrative weight of the experience, placing the main role of interactivity on the decision-making time. Serious and complex decisions that require introspection and attention, as well as decisions that seem banal but that can change forever the story development. This is the reason why IFcVR is not a videogame. Although the ludic spirit is in its DNA, interactivity does not trigger the narrative, it is the narrative that leads to interactivity. IFcVR is not a film in the traditional sense, either, but its cinematographic soul is undeniable, as reality is *mise-en-scene*, and the scene guides the whole journey. With these premises, we have a greater power, to be present within the film and affect its core.

The development of this study, both in theory and in practice, demonstrates the potential of the Interactive Fiction in Cinematic Virtual Reality as a narrative artefact. The understanding of the aesthetic, narrative and interactive notions of a possible genre has the same importance as the impulse of creating it. The production of ZENA, therefore, remains one of the biggest

accomplishments of this work, as it is the first VR fiction film shot in Genoa, and probably one of the first ones of Italy. Perhaps, in a future historiography of VR films, ZENA will be named, and creators may take a look to the insights learnt from its production process. I can conclude that all the bases for the emergence of IFcVR already exist; the results of the evaluation have shown that cinematic virtual environments are perceived with high degrees of realism, generating the feeling of presence in the interactors, as it also confirmed the pleasure of the interactors in having decisional power over the story in an immersive environment, and their desire of repeating the experience to take another path. These elements allow us to think that the IFcVR has all the chances to become VR's feature film. In this line, I would propose that all VR films should be IFcVR.

Bibliography

5 Lessons Learned While Making Lost. (2017). Oculus.com. https://www.oculus.com/story-studio/blog/5-lessons-learned-while-making-lost/

Aarseth, E. (2012). A narrative theory of games. *Proceedings of the International Conference on the Foundations of Digital Games - FDG '12*. doi:10.1145/2282338.2282365

Aarseth, E. J. (1997). *Cybertext perspectives on ergodic literature.* Johns Hopkins University Press.

Afra, K. (2015, 07). 'Vertical Montage' and Synaesthesia. *Music, Sound, and the Moving Image, 9*(1), 33-61. doi:10.3828/msmi.2015.2

Agamben, G. (2016). Che cos'è un dispositivo? Nottetempo.

Alexander, F. M. (1974). Resurrection of the body. Delacorte.

Allen, R. (2007) Psychoanalytic Film Theory. In Miller, T. *A companion to film theory*. Blackwell. p. 64 - 83

Amores, J., Benavides, X., & Maes, P. (2016). PsychicVR. *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '16.* doi:10.1145/2851581.2889442

Apple. *Final Cut Pro X: Pan audio* (2018). Retrieved from https://support.apple.com/kb/PH12578?locale=en_US&viewlocale=en_US

Aranyi, G., Pecune, F., Charles, F., Pelachaud, C., & Cavazza, M. (2016, 07). Affective Interaction with a Virtual Character Through an fNIRS Brain-Computer Interface. Frontiers in Computational Neuroscience, 10. doi:10.3389/fncom.2016.00070

Aristotle. The Poetics. (n.d.). Retrieved from https://www.gutenberg.org/files/1974/1974-h/1974-h.htm

Arnheim, R. (1957). *Film as art*. University of California Press.

Aspöck, L., Kohnen, M., & Vorlaender, M. (2018, 03). Evaluating immersion of spatial audio systems for virtual reality. The Journal of the Acoustical Society of America, 143(3), 1829-1829. doi:10.1121/1.5036003

Ayala, A., Martinez, P., Loredo, A., Rosas, R., & Reyes, P. (2018, March). Virtual Reality for Social Phobia Treatment. In S*mart Technology: First International Conference, MTYMEX 2017, Monterrey, Mexico, May 24-26, 2017, Proceedings (Vol. 213, p. 165)*. Springer.

Aylett, R., & Louchart, S. (2003, 12). Towards a narrative theory of virtual reality. *Virtual Reality, 7*(1), 2-9. doi:10.1007/s10055-003-0114-9

Baker, G. P. (2006). *Dramatic technique.* Elibron.

Bala, P., Dionisio, M., Nisi, V., & Nunes, N. (2016). IVRUX: A Tool for Analyzing Immersive Narratives in Virtual Reality. Interactive Storytelling Lecture Notes in Computer Science, 3-11. doi:10.1007/978-3-319-48279-8_1

Bala, P., Nisi, V., & Nunes, N. (2017). Evaluating User Experience in 360º Storytelling Through Analytics. *Interactive Storytelling Lecture Notes in Computer Science,* 270-273. doi:10.1007/978-3-319-71027-3_23

Barfield, W., & Furness, T. A. (1995). *Virtual environments and advanced interface design.* Oxford University Press.

Barthes, R., & Duisit, L. (1975). An Introduction to the Structural Analysis of Narrative. N*ew Literary History, 6*(2), 237. doi:10.2307/468419

Bartsch, A. (2012, 07). Emotional Gratification in Entertainment Experience. Why Viewers of Movies and Television Series Find it Rewarding to Experience Emotions. Media Psychology, 15(3), 267-302. doi:10.1080/15213269.2012.693811

Bateman, C. M. (2008). Game writing: Narrative skills for videogames. Course Technology

Baudrillard, J., & Glaser, S. F. (2014). Simulacra and simulation. The University of Michigan Press.

Bazin, A. (2004). *What Is Cinema? Vol. I.* University of California Press.

Beck, J., & Egger, R. (2017, 12). Emotionalise Me: Self-reporting and Arousal Measurements in Virtual Tourism Environments. I*nformation and Communication Technologies in Tourism 2018,* 3-15. doi:10.1007/978-3-319-72923-7_1

Bell, A. (2010). *The possible worlds of hypertext fiction.* Palgrave Macmillan.

Bellassai, J., Gordon, A. S., Roemmele, M., Cychosz, M., Odimegwu, O., & Connolly, O. (2017, October). Unsupervised text classification for natural language interactive narratives. In *Proceedings of the 10th International Workshop on Intelligent Narrative Technologies,* Snowbird, Utah, October.

Ben-Shaul, N. S. (2008). *Hyper-narrative interactive cinema: Problems and solutions*. Rodopi.

Bender, S. (2018, 05). Headset attentional synchrony: Tracking the gaze of viewers watching narrative virtual reality. *Media Practice and Education,* 1-20. doi:10.1080/25741136.2018.1464743

Betters, E. (2013, August 30). Virtual reality: Lessons from the past for Oculus Rift. Retrieved from https://www.bbc.com/news/technology-23877695

Bevan, N. (2008). Classifying and selecting UX and usability measures.

Bevan, N., Carter, J., Earthy, J., Geis, T., & Harker, S. (2016). New ISO Standards for Usability, Usability Reports and Usability Measures. *Lecture Notes in Computer Science Human-Computer Interaction. Theory, Design, Development and Practice,* 268-278. doi:10.1007/978-3-319-39510-4_25

Bian, Y., Yang, C., Gao, F., Li, H., Zhou, S., Li, H., Meng, X. (2016, 09). A framework for physiological indicators of flow in VR games: Construction and preliminary evaluation. Personal and Ubiquitous Computing, 20(5), 821-832. doi:10.1007/s00779-016-0953-5

Blades M. (1991) Wayfinding Theory and Research: The Need for a New Approach. In: Mark D.M., Frank A.U. (eds) *Cognitive and Linguistic Aspects of Geographic Space. NATO ASI Series (Series D: Behavioural and Social Sciences), vol 63.* Springer, Dordrecht

Blank, M. & Lebling, D. (1980) *Zork I. [Interactive fiction].* Cambridge, MA: Infocom.

Blankendaal, R. A., & Bosse, T. (2018). Using Run-Time Biofeedback During Virtual Agent-Based Aggression De-escalation Training. *Advances in Practical Applications of Agents, Multi-Agent Systems, and Complexity: The PAAMS Collection Lecture Notes in Computer Science,* 97-109. doi:10.1007/978-3-319-94580-4_8

Blascovich, J., Loomis, J., Beall, A. C., Swinth, K. R., Hoyt, C. L., & Bailenson, J. N. (2002, 04) Immersive Virtual Environment Technology as a Methodological Tool for Social Psychology. *Psychological Inquiry, 13*(2), 103-124. doi:10.1207/s15327965pli1302_01

Bødker, S. (2006). When second wave HCI meets third wave challenges. Proceedings of the 4th Nordic Conference on Human-computer Interaction Changing Roles - NordiCHI '06. doi:10.1145/1182475.1182476

Bogart, A. (2008). *And then, you act: Making art in an unpredictable world.* Routledge.

Bolter, J. D., & Grusin, R. (2000). *Remediation: Understanding New Media*. MIT Press.

Bolzoni, L. (1984), *Il teatro della memoria: studi su Giulio Camillo.* Liviana.

Borah, P. (2016, 01). Media Effects Theory. *The International Encyclopedia of Political Communication, 1-12*. doi:10.1002/9781118541555.wbiepc156

Bordwell, D., & Thompson, K. (2010). *El arte cinematográfico: Una introducción.* Paidós.
Borges, J. L. (2009). *El Hacedor.* Alianza Editorial.

Bottino, R., Freina, L., & Tavella, M. (2016). From e-learning to VR-learning: An example of learning in an immersive virtual world. *Journal of E-Learning and Knowledge Society. 12*. 101-113.

Bowman, D. A., Koller, D., & Hodges, L. F. (1998). A methodology for the evaluation of travel techniques for immersive virtual environments. Virtual reality, 3(2), 120-131.

Brooks, C. & Warren, R.P. (1943) Focus della Storia, Focus della Narrazione, Distanza. In

Meneghelli, D., *Teorie del punto di vista*. Scandicci: La nuova Italia editrice.

Bruner, J. S. (2003). Making stories: Law, literature, life. Harvard University Press.

Bryant, J., & Vorderer, P. (Eds.). (2013). Psychology of entertainment. Routledge.

Bullinger, A. H., Hemmeter, U. M., Stefani, O., Angehrn, I., Mueller-Spahn, F., Bekiaris, E., ... & Mager, R. (2005). Stimulation of cortisol during mental task performance in a provocative virtual environment. *Applied psychophysiology and biofeedback, 30*(3), 205-216.

Butsch, R. (1994, 09). Bowery B'hoys and Matinee Ladies: The Re-Gendering of Nineteenth-Century American Theater Audiences. American Quarterly, 46(3), 374. doi:10.2307/2713270

Butsch, R. (2011, 11). *The Imagined Audience in the Nickelodeon Era.* The Wiley-Blackwell History of American Film. doi:10.1002/9780470671153.wbhaf004

Campbell, J. (2008). *The hero with a thousand faces*. Novato, CA: New World Library.

Carlson, M. A. (1993). *Places of performance - the semiotics of theatre architecture*. Cornell University Press.

Carmona, C. R. (2017). The Role and Purpose of Film Narration. *Journal of Science and Technology of the Arts, 9(2)*, 7-16.

Carolina Cruz-Neira, Daniel J. Sandin, and Thomas A. DeFanti. 1993. Surround-screen projection-based virtual reality: the design and implementation of the CAVE. In Proceedings of the 20th annual conference on Computer graphics and interactive techniques (SIGGRAPH '93). ACM, New York, NY, USA, 135-142. DOI: https://doi.org/10.1145/166117.166134
Caughie, J. (1981). Theories of authorship: British film institute readers in film studies.

Cavazza, M., & Pizzi, D. (2006). Narratology for Interactive Storytelling: A Critical Introduction. *Technologies for Interactive Digital Storytelling and Entertainment Lecture Notes in Computer Science,* 72-83. doi:10.1007/11944577_7

Cipresso, P., Serino, S., Giglioli, I. A., Giuliano, I., Borra, D., Farina, A., & Riva, G. (2014). Low-Cost Motion-Tracking for Computational Psychometrics Based on Virtual Reality. *Lecture Notes in Computer Science Augmented and Virtual Reality*, 137-148. doi:10.1007/978-3-319-13969-2_11

Cowley, S. & Vallée-Tourangeau, F. (Eds). (2013) *Cognition Beyond the Brain.* Springer: London

Crary, J., & Acquarelli, L. (2013). *Le tecniche dell'osservatore: Visione e modernità nel XIX secolo*. Einaudi.

Crawford, C. (2005). *Chris Crawford on interactive storytelling*. Berkeley: New Riders Games.

Crifaci, G., Tartarisco, G., Billeci, L., Pioggia, G., & Gaggioli, A. (2012, 09). Innovative technologies and methodologies based on integration of virtual reality and wearable systems for psychological stress treatment. *International Journal of Psychophysiology, 85*(3), 402. doi: 10.1016/j.ijpsycho.2012.07.105

Chatman, S. (1989). *Story and discourse: Narrative structure in fiction and film*. Ithaca, NY: Cornell University Press.

Chen, H., Dey, A., Billinghurst, M., & Lindeman, R. W. (2017). Exploring the design space for multi-sensory heart rate feedback in immersive virtual reality. P*roceedings of the 29th Australian Conference on Computer-Human Interaction - OZCHI '17*. doi:10.1145/3152771.3152783

Chen, K.H. (Ed.) & Morley, D. (Ed.). (1996). Stuart Hall. London: Routledge.

Chen, S. Y., Gao, L., Lai, Y. K., Rosin, P. L., & Xia, S. (2018, March). Real-time 3D Face Reconstruction and Gaze Tracking for Virtual Reality. *In 2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)* (pp. 525-526). IEEE.

Chen, Z., Peiris, R. L., & Minamizawa, K. (2017). A Thermally Enhanced Weather Checking System in VR. *Adjunct Publication of the 30th Annual ACM Symposium on User Interface Software and Technology - UIST '17.* doi:10.1145/3131785.3131825

Chen, Z., Peng, W., Peiris, R., & Minamizawa, K. (2017, July). ThermoReality: thermally enriched head mounted displays for virtual reality. *In ACM SIGGRAPH 2017 Posters (p. 32)*. ACM.

Cho, D., Ham, J., Oh, J., Park, J., Kim, S., Lee, N., & Lee, B. (2017, 10). Detection of Stress Levels from Biosignals Measured in Virtual Reality Environments Using a Kernel-Based Extreme Learning Machine. *Sensors, 17*(10), 2435. doi:10.3390/s17102435

David, E. J., Gutiérrez, J., Coutrot, A., Silva, M. P., & Callet, P. L. (2018). A dataset of head and eye movements for 360° videos. *Proceedings of the 9th ACM Multimedia Systems Conference on - MMSys '18*. doi:10.1145/3204949.3208139

Dettori, G. (2016). *Learning through the design of interactive stories: Exploring the concept of storyworld.* In Proceedings of the 6th International Workshop on Adaptive Learning via Interactive, Collaborative and Emotional approaches (ALICE 2016), Ostrava (CZ), 7-9 Sept. 2016, pp. 370-374

Diodato, R. (2005). *Estetica del virtuale.* B. Mondadori.

Diodato, R. (2012). *Aesthetics of the Virtual* (SUNY Series in Contemporary Italian Philosophy). State University of New York Press.

Dooley, K. (2017, 09). Storytelling with virtual reality in 360-degrees: A new screen grammar. *Studies in Australasian Cinema, 11*(3), 161-171. doi:10.1080/17503175.2017.1387357

Dorozhkin, D. V., & Vance, J. M. (2002). Implementing Speech Recognition in Virtual Reality. *Volume 1: 22nd Computers and Information in Engineering Conference.* doi:10.1115/detc2002/cie-34390

Douglas, J. Y. (2003). *The end of books-or books without end? Reading interactive narratives.* The Univ. of Michigan Press.

eevo Features (2018). Retrieved from https://eevo.com/features

Eisenstein, S., & Leyda, J. (1949). *Film form; essays in film theory. edited and translated by Jay Leyda*. New York, Harcourt, Brace & World.

Ellenshaw, H., Kushner, D., Miller, R. (producers) and Steven Lisberger (director). (1982). TRON [Motion Picture]. EU.: Disney

Fearghail, C. O., Ozcinar, C., Knorr, S., & Smolic, A. (2018). Director's Cut - Analysis of Aspects of Interactive Storytelling for VR Films. *Interactive Storytelling Lecture Notes in Computer Science,* 308-322. doi:10.1007/978-3-030-04028-4_34

Feliciati, P. (2010). Il nuovo teatro della memoria. Informatica e beni culturali in Italia, tra strumentalità e sinergie. Retrieved from https://www.academia.edu/771134/Il_nuovo_teatro_della_memoria._Informatica_e_beni_culturali_in_Italia_tra_strumentalit%C3%A0_e_sinergie

Field, S. (2005). *Screenplay the foundations of screenwriting*. New York, NY: Delta Trade Paperbacks.

Fischer, L. (2007) Film Editing. In Miller, T. *A companion to film theory*. Blackwell. p. 64 - 83

Fludernik, M. (1996). *Towards a natural Narratology. Routledge.*

Frasca, G. (1999) Ludologia kohtaa narratologian. *Parnasso, 3.* English translation Ludology meets narratology: Similitudes and differences between (video) games and narrative. Available at: http://www.ludology.org

Freytag, G. (1895). *Technique of the drama: an exposition of dramatic composition and art.* S. Griggs.

Fusi, G. (2017). *Video interattivi: studio di un caso con video a 360°* (Unpublished bachelor dissertation). Università degli Studi di Genova, Genoa, Italy.

Gaudreault, A. & Jost, F. (2007). Enunciation and Narration. In Miller, T. *A companion to film theory*. Blackwell. p. 45 - 63

Geiselhart, F., Rietzler, M., & Rukzio, E. (2016). EyeVR. *Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing Adjunct - UbiComp '16.* doi:10.1145/2968219.2971384

Genette, G. (1972). *Figures III*, Paris, Seuil.

Genette, G. (1976) Focalizzazioni. In Meneghelli, D., Teorie del punto di vista. Scandicci: La nuova Italia editrice.

Genette, G. (1980). *Narrative discourse: An Essay in Method*. Ithaca, N.Y.: Cornell University Press.

Genette, G. (2001). *Paratexts: Thresholds of interpretation.* Cambridge Univ. Press.

Gibson, W. (1986). Neuromancer. Ace Books.

Gilderdale, M. (2016, September 10) No One Lights A Scene Like Mother Nature. Retrieved from https://www.tiff.net/the-review/no-one-lights-a-scene-like-mother-nature/

Gödde, M., Gabler, F., Siegmund, D., & Braun, A. (2018). Cinematic Narration in VR – Rethinking Film Conventions for 360 Degrees. Virtual, Augmented and Mixed Reality: Applications in Health, Cultural Heritage, and Industry Lecture Notes in Computer Science, 184-201. doi:10.1007/978-3-319-91584-5_15

Google Spotlight Stories. (2017). Atap.google.com. https://atap.google.com/spotlight-stories/

Gorini, A., Pallavicini, F., Algeri, D., Repetto, C., Gaggioli, A., & Riva, G. (2010). Virtual reality in the treatment of generalized anxiety disorders. *Stud Health Technol Inform,* 154, 39-43.

Gradl, S., Wirth, M., Zillig, T., & Eskofier, B. M. (2018, 03). Visualization of heart activity in virtual reality: A biofeedback application using wearable sensors. *2018 IEEE 15th International Conference on Wearable and Implantable Body Sensor Networks (BSN).* doi:10.1109/bsn.2018.8329681

Grau, O. (2003) Virtual Art: From Illusion to Immersion. MIT Press: Cambridge

Green, M. (2016). *How the Brain Reacts to Scrambled Stories.* The Atlantic. Retrieved from https://www.theatlantic.com/health/archive/2016/01/linear-storytelling-psychology/431529/

Gruenefeld, U., Löcken, A., Brueck, Y., Boll, S., & Heuten, W. (2018). Where to Look. *Proceedings of the 10th International Conference on Automotive User Interfaces and Interactive Vehicular Applications - AutomotiveUI '18*. doi:10.1145/3239060.3239080

Guger, C., Groenegress, C., Holzner, C., Edlinger, G., Slater, M., & Sánchez-Vives, M. V. (2009). Brain computer interface for virtual reality control. *Cyberpsychology & Behavior, 2009, vol. 12, num. 1*, p. 84-84.

Hales, C. (2014) Spatial and Narrative Constructions for Interactive Cinema, with particular reference to the work of Raduz Cincera. In Kelomees, R., & Hales, C. (eds) *Expanding practices in audiovisual narrative.* Cambridge Scholars Publishing.

Hall, S (1986) On Postmodernism and Articulation. An Interview with Stuart Hall. Edited by Lawrence Grossberg - Journal of Communication Inquiry Vol 10, Issue 2, pp. 45 - 60 First Published June 1, 1986

Hall, S. (1980). Codificar y Decodificar. In *Culture, Media & Lenguaje* (pp. 129–139). London: Hutchinson.

Hall, S. (Ed.). (1997). *Representation: Cultural representations and signifying practices (Vol. 2). Sage.*

Halligan, F. (2015). *The art of movie storyboards: Visualising the action of the world's greatest films*. Ilex.

Ham, J., Cho, D., Oh, J., & Lee, B. (2017, 07). Discrimination of multiple stress levels in virtual reality environments using heart rate variability. *2017 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).* doi:10.1109/embc.2017.8037730

Hammoud, R. (2006). *Interactive Video*. New York: Springer-Verlag Berlin Heidelberg.

Hatavara, M., Hyvärinen, M., Mäkelä, M., & Mäyrä, F. (Eds.). (2015). *Narrative theory, literature, and New media: narrative minds and virtual worlds.* Routledge.

Hayles, N. K. (2012). How we think: Digital media and contemporary technogenesis. Ill.

Heim, M. (1990). Heidegger and Computers. Retrieved 29 June 2018, from http://www.mheim.com/wp-content/uploads/2014/05/Heidegger-and-Computers-1990.txt

Heim, M. (1993). The metaphysics of virtual reality. New York: Oxford University Press.

Heim, M. (2012) Cyberspace. Retrieved from http://www.mheim.com/wp-content/uploads/2014/05/Cyberspace.e0147-revised-2012-copy.pdf

Henrikson, R., Araujo, B., Chevalier, F., Singh, K., & Balakrishnan, R. (2016). Multi-Device Storyboards for Cinematic Narratives in VR. Proceedings of the 29th Annual Symposium on User Interface Software and Technology - UIST '16. doi:10.1145/2984511.2984539

Herman, D., Jahn, M., & Ryan, M. (2008). *Routledge encyclopedia of narrative theory.* Routledge.

Hickson, S., Dufour, N., Sud, A., Kwatra, V., & Essa, I. (2017). Eyemotion: Classifying facial expressions in VR using eye-tracking cameras. arXiv preprint arXiv:1707.07204. https://arxiv.org/abs/1707.07204

Hiwiller, Z. (2016). *Players making decisions: Game design essentials and the art of understanding your players.* New Riders.

Hoffman, D. D., Singh, M., & Prakash, C. (2015, 09). The Interface Theory of Perception. *Psychonomic Bulletin & Review, 22*(6), 1480-1506. doi:10.3758/s13423-015-0890-8

Holton, R. (2006). The act of choice. In *Philosophers' Imprint 6*. p.1-15.

Hopkins, M. (2017). Pioneering Virtual Reality and New Video Technologies in Journalism. Retrieved from https://www.nytimes.com/2017/10/18/technology/personaltech/virtual-reality-video.html

Hou, G., Dong, H., & Yang, Y. (2017, 09). Developing a Virtual Reality Game User Experience Test Method Based on EEG Signals. 2017 5th International Conference on Enterprise Systems (ES). doi:10.1109/es.2017.45

Howard, I. P., & Rogers, B. J. (1996). *Binocular Vision and Stereopsis*. Oxford University Press.

Hoyos, V. G., & Vargas, G. G. (1996). La Teoría de la Acción Comunicativa. p. 47-64

Hühn, P., Schmid, W., & Schönert, J. (2009). *Point of view, perspective, and focalization: Modeling mediation in narrative.* Walter de Gruyter.

Huhtamo, E. (2013). Illusions in motion: Media archaeology of the moving panorama and related spectacles. The MIT Press.

Huhtamo, E. (2014) Push the Button, Kinoautomat will do the rest! Media Archaeological Reflections on Audience Interactivity. In Kelomees, R., & Hales, C. (eds) *Expanding practices in audiovisual narrative.* Cambridge Scholars Publishing.

Huxley, A. (1954). The doors of perception and Heaven and hell. Harper & Row Publishers.

Iser, W. (1997). *The act of reading: A theory of aesthetic response.* Johns Hopkins Univ. Press.

Issa, T., & Isaias, P. (2015). Usability and Human Computer Interaction (HCI). *Sustainable Design,* 19-36. doi:10.1007/978-1-4471-6753-2_2

Jiang, L., Stocco, A., Losey, D. M., Abernethy, J. A., Prat, C. S., & Rao, R. P. (2018). BrainNet: A Multi-Person Brain-to-Brain Interface for Direct Collaboration Between Brains. arXiv preprint arXiv:1809.08632.

Joyce, M. (2001). *Afternoon, a story.* Eastgate Systems.

Kallmann, M., & Thalmann, D. (1999, December). Direct 3d interaction with smart objects. In Proceedings of the ACM symposium on Virtual reality software and technology (pp. 124-130). ACM.

Kamath, R. S., & Kamat, R. K. (2013). Development of an Intelligent Virtual Environment for Augmenting Natural Language Processing in Virtual Reality Systems. *International Journal of Emerging Trends & Technology in Computer Science (IJETTCS) Volume, 2*, 198-203.

Kamppari-Miller, S. (2017, April 13). *VR Paper Prototyping* – Prototypr. Retrieved from https://blog.prototypr.io/vr-paper-prototyping-9e1cab6a75f3

Kelomees, R., & Hales, C. (2014). *Expanding practices in audiovisual narrative*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Kennedy, R. S., Lane, N. E., Berbaum, K. S., & Lilienthal, M. G. (1993, 07). Simulator Sickness Questionnaire: An Enhanced Method for Quantifying Simulator Sickness. *The International Journal of Aviation Psychology, 3(3)*, 203-220. doi:10.1207/s15327108ijap0303_3

Kerckhove, D. D. (2016). *La rete ci renderà stupidi?* Castelvecchi.

Kerckhove, D. D., & Dewdney, C. (1995). *The skin of culture: Investigating the new electronic reality.* Somerville House Publishing.

Kerr, P. (1982). Classic serials—to be continued. *Screen*, *23*(1), 6-19.

Kjær, T., Lillelund, C. B., Moth-Poulsen, M., Nilsson, N. C., Nordahl, R., & Serafin, S. (2017). Can you cut it? *Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology - VRST '17*. doi:10.1145/3139131.3139166

Knoller, N. (2012). The Expressive Space of IDS-as-Art. *Lecture Notes in Computer Science, 30–41.* https://doi.org/10.1007/978-3-642-34851-8_3

Knoller N., Ben Arie U. (2009) Turbulence – A User Study of a Hypernarrative Interactive Movie. In: Iurgel I.A., Zagalo N., Petta P. (eds) Interactive Storytelling. ICIDS 2009. Lecture Notes in Computer Science, vol 5915. Springer, Berlin, Heidelberg

Koenderink, J. (2014, 01). The All-Seeing Eye? *Perception, 43*(1), 1-6. doi:10.1068/p4301ed

Koenitz, H. (2018). Narrative in Video Games. *Encyclopedia of Computer Graphics and Games, 1-9.* doi:10.1007/978-3-319-08234-9_154-1

Koenitz, H. (2018). Thoughts on a Discipline for the Study of Interactive Digital Narratives. Interactive Storytelling Lecture Notes in Computer Science, 36-49. doi:10.1007/978-3-030-04028-4_3

Koenitz, H. (2016). Design Strategies for Interactive Digital Narratives. Proceedings of the *ACM International Conference on Interactive Experiences for TV and Online Video - TVX '16.* doi:10.1145/2932206.2932428

Koenitz, H., Ferri, G., Haahr, M., Sezen, D., & Sezen, T. İ. (2015). *Interactive digital narrative history, theory and practice.* Routledge, Taylor & Francis Group.

Koenitz, H. (2016*) Interactive Storytelling Paradigms and Representations: A Humanities-Based Perspective*. In Nakatsu, R et al. (eds.) Handbook of Digital Games and Entertainment. Singapore: Springer

Koenitz, H. (2014). An Iterative Approach towards Interactive Digital Narrative – Early Results with the Advanced Stories Authoring and Presentation System. *Lecture Notes in Computer Science New Horizons in Web Based Learning,* 59-68. doi:10.1007/978-3-662-43454-3_7

Koenitz, H., Haahr, M., Ferri, G., & Sezen, T. I. (2013). First Steps towards a Unified Theory for Interactive Digital Narrative. *Transactions on Edutainment X Lecture Notes in Computer Science,* 20-35. doi:10.1007/978-3-642-37919-2_2

Koenitz, H. (2010). Towards a Theoretical Framework for Interactive Digital Narrative. *Interactive Storytelling Lecture Notes in Computer Science,* 176-185. doi:10.1007/978-3-642-16638-9_22

Krishna, G. (2015). The best interface is no interface: The simple path to brilliant technology. New Riders.

Kurosawa, A. (1983). *Something like an autobiography*. Vintage Books.

Laarni, J., Ravaja, N., Saari, T., Böcking, S., Hartmann, T., & Schramm, H. (2015). Ways to Measure Spatial Presence: Review and Future Directions. Immersed in Media, 139-185. doi:10.1007/978-3-319-10190-3_8

Landow, G. P. (1994). *Hyper - Text - Theory.* Johns Hopkins UP.

Lanier, J. (2018) We need to internet. Ted Talk 2018. Retrieved April 14, 2018 from

Lavalle, S. M., Yershova, A., Katsev, M., & Antonov, M. (2014, 05). Head tracking for the Oculus Rift. 2014 IEEE International Conference on Robotics and Automation (ICRA). doi:10.1109/icra.2014.6906608

Lecuyer, A., Lotte, F., Reilly, R., Leeb, R., Hirose, M., & Slater, M. (2008, 10). Brain-Computer Interfaces, Virtual Reality, and Videogames. *Computer, 41(10)*, 66-72. doi:10.1109/mc.2008.410

Lee, S., Ha, G., Cha, J., Kim, J., Lee, H., & Kim, S. (2015). CyberTouch - Touch and Cursor Interface for VR HMD. Communications in Computer and Information Science HCI International 2015 - Posters' Extended Abstracts, 503-507. doi:10.1007/978-3-319-21380-4_85

Legrand, D. (2007). Pre-reflective self-consciousness: On being bodily in the world. *Janus Head. 9*. 493-519.

Lele, A. (2013). Virtual reality and its military utility. Journal of Ambient Intelligence and Humanized Computing, 4(1), 17-26.

Lessiter, J., Freeman, J., Keogh, E., & Davidoff, J. (2001, 06). A Cross-Media Presence Questionnaire: The ITC-Sense of Presence Inventory. Presence: Teleoperators and Virtual Environments, 10(3), 282-297. doi:10.1162/105474601300343612

Lewis, B. R. (1918). *The Technique of the One-act Play: A Study in Dramatic Construction*. JW Luce.

Lin, J., Duh, H., Parker, D., Abi-Rached, H., & Furness, T. (2002). *Effects of field of view on presence, enjoyment, memory, and simulator sickness in a virtual environment.* Proceedings IEEE Virtual Reality 2002. doi:10.1109/vr.2002.996519

Lin, Y., Chang, Y., Hu, H., Cheng, H., Huang, C., & Sun, M. (2017). Tell Me Where to Look. Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems - CHI '17. doi:10.1145/3025453.3025757

Livingstone, S. (1998) Relationships between media and audiences: Prospects for future audience reception studies. In Liebes, T., and Curran, J. (Eds.), Media*, Ritual and Identity: Essays in Honor of Elihu Katz.* London: Routledge

Livingstone, S. (2013, 01). The Participation Paradigm in Audience Research. The Communication Review, 16(1-2), 21-30. doi:10.1080/10714421.2013.757174

Lok, B. & Hodges, L. (2004). Human Computer Interaction in Virtual Reality. In Ross, M. (Ed) *Encyclopedia of Human Computer Interaction*. Barrington, MA: Berkshire

Lombardi, M., Biocca, F., Freeman, J., IJsselsteijn, W. A., & Schaevitz, R. J. (2015). Immersed in media: Telepresence theory, measurement & technology. Springer.

Louchart, S., & Aylett, R. (2004). The emergent narrative theoretical investigation. In *the 2004 Conference on Narrative and Interactive Learning Environments* (pp. 21-28).

Löwe, T., Stengel, M., Förster, E., Grogorick, S., & Magnor, M. (2017). Gaze Visualization for Immersive Video. *Eye Tracking and Visualization Mathematics and Visualization,* 57-71. doi:10.1007/978-3-319-47024-5_4

Lumet, S. (1996). *Making Movies.* Vintage.

MacCabe, C. (1974). Realism and the cinema: notes on some Brechtian theses. *Screen*, *15*(2), 7-27.

Mackey-Kallis, S. (2001). *The hero and the perennial journey home in American film.* University of Pennsylvania Press.

Magliano, J. P., & Zacks, J. M. (2011, 10). The Impact of Continuity Editing in Narrative Film on Event Segmentation. Cognitive Science, 35(8), 1489-1517. doi:10.1111/j.1551-6709.2011. 01202.x

Manovich, L. (1999) *Database as a Symbolic Form.* Retrieved from http://manovich.net/index.php/projects/database-as-a-symbolic-form

Manovich, L. (2009). *Il linguaggio dei nuovi media.* Olivares.

Martin, J., & Ostwalt, C. E. (2018). *Screening the Sacred Religion, Myth, and Ideology in Popular American Film*. Routledge.

Mason S. (2013) On Games and Links: Extending the Vocabulary of Agency and Immersion in Interactive Narratives. In: Koenitz H., Sezen T.I., Ferri G., Haahr M., Sezen D., Çatak G. (eds*) Interactive Storytelling. ICIDS 2013. Lecture Notes in Computer Science, vol 8230.* Springer, Cham doi:10.1007/978-3-319-02756-2_3

Mateer, J. (2017, 01). 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. doi:10.1080/14682753.2017.130583

Mcarthur, C. (1975, 12). Days of Hope. Screen, 16(4), 139-144. doi:10.1093/screen/16.4.139

McCurley, V. (2016, May 22). Storyboarding in Virtual Reality – Virtual Reality Pop. Retrieved from https://virtualrealitypop.com/storyboarding-in-virtual-reality-67d3438a2fb1

McGlashan, S., & Axling, T. (1996). A speech interface to virtual environments. *In Proc., International Workshop on Speech and Computers.*

McKee, R. (2010). *Story: Contenuti, struttura, stile, principi della sceneggiatura e per l'arte di scrivere storie.* Omero.

McLuhan, E. (2008). *Marshall McLuhan's Theory of Communication: The Yegg*. Global Media Journal -- Canadian Edition, 1(1), 25–43.

McLuhan, M. (1964). *Understanding media: The extensions of man*. London: Routledge & Kegan Paul.

Metz, C., & Taylor, M. (2007). *Film language: A semiotics of the cinema.* Univ. of Chicago Press.

Milgram, Paul & Kishino, Fumio. (1994). A Taxonomy of Mixed Reality Visual Displays. *IEICE Trans. Information Systems.* vol. E77-D, no. 12. 1321-1329.

Miller, T., & Stam, R. (1999*). The Blackwell companion to film theory.* Blackwell.

Mirandola, G. P., & Bausi, F. (2003). *Discorso sulla dignità dell'uomo.* Parma: Fondazione P. Bembo.

Mitry, J. (2000). *The aesthetics and psychology of the cinema*. Indiana Univ. Press.

Moghadam, K. R., & Ragan, E. D. (2017). Towards understanding scene transition techniques in immersive 360 movies and cinematic experiences. *2017 IEEE Virtual Reality (VR)*. doi:10.1109/vr.2017.7892333

Montfort, N. (2005). *Twisty little passages: An approach to interactive fiction*. MIT.

Moulthrop, S. (1992). *Victory garden.* Eastgate Systems.

Murray, J. H. (1997). *Hamlet on the holodeck: The future of narrative in cyberspace.* Cambridge, MA: MIT Press.

Nelson, T. H. (1987). *Literary machines: The report on, and of, Project Xanadu concerning word processing, electronic publishing, hypertext, thinkertoys, tomorrow's intellectual revolution, and certain other topics including knowledge, education and freedom.* Theodor H. Nelson.

Nielsen, J., Clemmensen, T., & Yssing, C. (2002). Getting access to what goes on in people's heads? Proceedings of the Second Nordic Conference on Human-computer Interaction - NordiCHI '02. doi:10.1145/572020.572033

Nielsen, L. T., Møller, M. B., Hartmeyer, S. D., Ljung, T. C., Nilsson, N. C., Nordahl, R., & Serafin, S. (2016). Missing the point. *Proceedings of the 22nd ACM Conference on Virtual Reality Software and Technology - VRST '16*. doi:10.1145/2993369.2993405

Nijholt, A., & Nam, C. S. (2015, 04). Arts and Brain-Computer Interfaces (BCIs). *Brain-Computer Interfaces, 2(2-3)*, 57-59. doi:10.1080/2326263x.2015.1100514

Nite, S. (2015.). Virtual reality insider: Guidebook for the VR industry [Kindle Version]

Oculus Connect 3 Opening Keynote. (2017). *YouTube*. Retrieved 18 April 2017, from https://www.youtube.com/watch?v=hgz0hFokkVw

Oettermann, S. (1997). The panorama: History of a mass medium. New York: Zone Books.

Oliver, M. B., & Raney, A. A. (2011, 10). Entertainment as Pleasurable and Meaningful: Identifying Hedonic and Eudaimonic Motivations for Entertainment Consumption. *Journal of Communication, 61*(5), 984-1004. doi:10.1111/j.1460-2466.2011. 01585.x

Oliver, M. B., Ash, E., Woolley, J. K., Shade, D. D., & Kim, K. (2014, 10). Entertainment We Watch and Entertainment We Appreciate: Patterns of Motion Picture Consumption and Acclaim Over Three Decades. *Mass Communication and Society, 17(6)*, 853-873. doi:10.1080/15205436.2013.872277

Oliver, M. B., Bowman, N. D., Woolley, J. K., Rogers, R., Sherrick, B. I., & Chung, M. (2016). Video games as meaningful entertainment experiences. *Psychology of Popular Media Culture, 5*(4), 390-405. doi:10.1037/ppm0000066

Olmedo, H., Escudero, D., & Cardeñoso, V. (2015). Multimodal interaction with virtual worlds XMMVR: eXtensible language for MultiModal interaction with virtual reality worlds. *Journal on Multimodal User Interfaces, 9(3)*, 153-172.

Paez, S., & Jew, A. (2013). *Professional storyboarding: Rules of thumb*. Focal Press.

Panetta, K. (2018). 5 Trends Emerge in the Gartner Hype Cycle for Emerging Technologies, 2018. Gartner.com. Retrieved 29 December 2018, from https://www.gartner.com/smarterwithgartner/5-trends-emerge-in-gartner-hype-cycle-for-emerging-technologies-2018/

Phelan, J., & Rabinowitz, P. J. (2008). *A companion to narrative theory.* Blackwell Pub.

Piaget, J. (1997). *The language and thought of the child.* Routledge.

Porteous, J., Teutenberg, J., Charles, F. & Cavazza, M. (2011) Controlling Narrative Time in Interactive Storytelling. *Proceedings of the 10th International Conference on Autonomous Agents and Multiagent Systems (AAMAS),* Taipei, Taiwan, May 2011, pp. 449-456.

Price, W. T. (1908). *The analysis of play construction and dramatic principle.* WT Price.

Propp, V. J. (2003). *Morfologia della fiaba; Le radici storiche dei racconti di magia.* Grandi tascabili economici Newton.

Ramchurn, R., Wilson, M., Martindale, S., & Benford, S. (2018). #Scanners 2 - The MOMENT. *Extended Abstracts Of The 2018 CHI Conference On Human Factors In Computing Systems - CHI '18.* doi: 10.1145/3170427.3186481

Reed, A. (2012). *Creating interactive fiction with Inform 7*. Course Technology.

Renard, Y., Lotte, F., Gibert, G., Congedo, M., Maby, E., Delannoy, V., Lécuyer, A. (2010, 02). OpenViBE: An Open-Source Software Platform to Design, Test, and Use Brain–Computer Interfaces in Real and Virtual Environments. *Presence: Teleoperators and Virtual Environments, 19(1)*, 35-53. doi:10.1162/pres.19.1.35

Rettberg, S. (2017) The American Hypertext Novel, and Whatever Became of It?. In Koenitz, H.(ed) *Interactive digital narrative: History, theory and practice.* Routledge.

Reyes, M.C. (2017, June) Screenwriting Framework for an Interactive Virtual Reality Film. Paper presented at the 3rd Immersive Research Network Conference iLRN. http://castor.tugraz.at/doku/iLRN2017/iLRN2017OnlineProceedings.pdf

Ridout, S. J., Spofford, C. M., Wout-Frank, M. V., Philip, N. S., Unger, W. S., Carpenter, L. L., & Shea, M. T. (2017, 08). Heart Rate Variability Responses to a Standardized Virtual Reality Exposure in Veterans with PTSD. *Current Treatment Options in Psychiatry, 4*(3), 271-280. doi:10.1007/s40501-017-0118-9

Riedl, M. O., & Bulitko, V. (2012, 12). Interactive Narrative: An Intelligent Systems Approach. AI Magazine, 34(1), 67. doi:10.1609/aimag.v34i1.2449

Riegler, A., Peschl, M., & Stein, A. (2000). Understanding Representation in the Cognitive Sciences: Does Representation Need Reality? Boston, MA: Springer US.

Rizzo, A., Morie, J. F., Williams, J., Pair, J., & Buckwalter, J. G. (2005). Human emotional state and its relevance for military VR training. UNIVERSITY OF SOUTHERN CALIFORNIA MARINA DEL REY CA INST FOR CREATIVE TECHNOLOGIES.

Ron-Angevin, R., & Díaz-Estrella, A. (2009, 01). Brain–computer interface: Changes in performance using virtual reality techniques. *Neuroscience Letters, 449(2)*, 123-127. doi:10.1016/j.neulet.2008.10.099

Roncallo-Dow, S. (2014). Marshall McLuhan. El medio (aún) es el mensaje 50 años después de comprender los medios. *Palabra Clave - Revista de Comunicación, 17(3),* 582–588. https://doi.org/10.5294/pacla.2014.17.3.1

Rooij, M. V., Lobel, A., Harris, O., Smit, N., & Granic, I. (2016). Deep. *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '16.* doi:10.1145/2851581.2892452

Roth, C., & Koenitz, H. (2016). Evaluating the User Experience of Interactive Digital Narrative. *Proceedings of the 1st International Workshop on Multimedia Alternate Realities - AltMM '16*. doi:10.1145/2983298.2983302

Rothbaum, B. O., Hodges, L. F., Ready, D., Graap, K., & Alarcon, R. D. (2001). Virtual reality exposure therapy for Vietnam veterans with posttraumatic stress disorder. The Journal of clinical psychiatry.

Rothe, S., & Hußmann, H. (2018). Guiding the Viewer in Cinematic Virtual Reality by Diegetic Cues. *Lecture Notes in Computer Science Augmented Reality, Virtual Reality, and Computer Graphics,* 101-117. doi:10.1007/978-3-319-95270-3_7

Rothe, S., Hußmann, H., & Allary, M. (2017). Diegetic cues for guiding the viewer in cinematic virtual reality. *Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology - VRST '17.* doi:10.1145/3139131.3143421

Rouse, R. (2016). Media of Attraction: A Media Archeology Approach to Panoramas, Kinematography, Mixed Reality and Beyond. In: *9th International Conference on Interactive Digital Storytelling, ICIDS 2016. Los Angeles, CA, USA*: Springer, pp.97-107

Ryan, M. (2015). *Narrative as virtual reality 2: Revisiting immersion and interactivity in literature and electronic media.* Johns Hopkins University Press.

Ryan, M., (2014). *Story/Worlds/Media: Tuning the Instruments of a Media- Conscious Narratology*. In Ryan, M., & Thon, J. Storyworlds across media: Toward a media-conscious narratology. Lincoln: University of Nebraska Press.

Ryan, M., & Thon, J. (2014). *Storyworlds across media: Toward a media-conscious narratology.* Univ. of Nebraska Press.

Ryan, M. (2013) Possible Worlds | the living handbook of narratology. Lhn.uni-hamburg.de. Retrieved 31 July 2018, from http://www.lhn.uni-hamburg.de/article/possible-worlds

Ryan, M. L. (2013). Impossible Worlds and Aesthetic Illusion. In Bernhard, W. & Wofl, W. (eds) *Aesthetic Illusion in Literature and Other Media.* Amsterdam/New York: Rodopi. 131-48.

Ryan, M. L. (2011) Fiction, Cognition, and Non-Verbal Media. In Grishakova, M. & Ryan, M (eds) *Intermediality and Storytelling.* Berlin: De Gruyter, series Narratologia.

Ryan, M. (2009). From Narrative Games to Playable Stories: Toward a Poetics of Interactive Narrative. Storyworlds: A Journal of Narrative Studies 1(1), 43-59. University of Nebraska Press. Retrieved April 17, 2017, from Project MUSE database.

Ryan, M. (1999). Immersion vs. Interactivity: Virtual Reality and Literary Theory. SubStance 28(2), 110-137. Johns Hopkins University Press. Retrieved April 16, 2018, from Project MUSE database

Sassatelli, L., Pinna-Déry, A., Winckler, M., Dambra, S., Samela, G., Pighetti, R., & Aparicio-Pardo, R. (2018). Snap-changes. *Proceedings of the 2018 International Conference on Advanced Visual Interfaces - AVI '18*. doi:10.1145/3206505.3206553

Schank, R. C. (2000). *Tell me a story: Narrative and intelligence*. Northwestern Univ. Press.

Schlickers in Hühn, P., Schmid, W., & Schönert, J. (2009). Point of view, perspective, and focalization: Modeling mediation in narrative. Walter de Gruyter.

Schoenau-Fog, H. (2014, 03). At the Core of Player Experience: Continuation Desire in Digital Games. Handbook of Digital Games, 388-410. doi:10.1002/9781118796443.ch14

Schoenau-Fog, H. (2015). Adaptive Storyworlds. In *Interactive Storytelling Lecture Notes in Computer Science, 58-65*. doi:10.1007/978-3-319-27036-4_6

Schreer, O. (n.d.). *3D Video Communication: Algorithms, concepts and real-time systems in human centred communication.* Wiley.

Schroeder, R. (1994, 06). Cyberculture, cyborg post-modernism and the sociology of virtual reality technologies. Futures, 26(5), 519-528. doi:10.1016/0016-3287(94)90133-3

Sheikh, A., Brown, A., Evans, M., & Watson, Z. (2016). Directing attention in 360-degree video. *IBC 2016 Conference*. doi:10.1049/ibc.2016.0029

Singer, M.J. & Witmer, B.G. (1998) Measuring Presence in Virtual Environments: A Presence Questionnaire. In Presence: Teleoperators and Virtual Environments 7:3, 225-240

Skakov, N. (2013). *The cinema of Tarkovsky: Labyrinths of space and time*. I. B. Tauris.

Spierling, U., Grasbon, D., Braun, N., & Iurgel, I. (2002, 02). Setting the scene: Playing digital director in interactive storytelling and creation. *Computers & Graphics, 26*(1), 31-44. doi:10.1016/s0097-8493(01)00176-5

Sra, M., & Schmandt, C. (2015). MetaSpace. *Proceedings of the 28th Annual ACM Symposium on User Interface Software & Technology - UIST '15 Adjunct*. doi:10.1145/2815585.2817802

Strate, L. (2008). Studying Media as Media: McLuhan and the media ecology approach. Media Tropes, 1(1), 127–142.

Sutcliffe, A. G., Poullis, C., Gregoriades, A., Katsouri, I., Tzanavari, A., & Herakleous, K. (2018, 03). Reflecting on the Design Process for Virtual Reality Applications. *International Journal of Human–Computer Interaction, 35*(2), 168-179. doi:10.1080/10447318.2018.1443898

Syrett, H., Calvi, L., & Gisbergen, M. V. (2016, 11). The Oculus Rift Film Experience: A Case Study on Understanding Films in a Head Mounted Display. *Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering Intelligent Technologies for Interactive Entertainment,* 197-208. doi:10.1007/978-3-319-49616-0_19

Szilas, N. (1999, November). Interactive drama on computer: beyond linear narrative. *In AAAI Fall symposium on narrative intelligence* (Vol. 144, pp. 150-156).

Szilas, N. (2002). Structural models for interactive drama. In *2nd Conference on Computational Semiotics for Games and New Media 02–04 September 2002 Universität Augsburg* (p. 22).

Tarkovski, A., & Hunter-Blair, K. (1986). *Sculpting In Time Reflections on the Cinema*. University of Texas Press.

Tatarkiewicz, W., & Jaworska, K. (1993). *Storia di sei idee: L'arte il bello la forma la creatività l'imitazione l'esperienza estetica.* Palermo: Aesthetica edizioni.

The Raycast. (2018) *Interaction in VR - Unity*. Retrieved September 17, 2018, from https://unity3d.com/learn/tutorials/topics/virtual-reality/interaction-vr

Tieri, G., Gioia, A., Scandola, M., Pavone, E. F., & Aglioti, S. M. (2017, 03). Visual appearance of a virtual upper limb modulates the temperature of the real hand: A thermal imaging study in Immersive Virtual Reality. *European Journal of Neuroscience, 45*(9), 1141-1151. doi:10.1111/ejn.13545

Tikka, P. (2008). *Enactive cinema: Simulatorium Eisensteinense.* University of Art and Design Helsinki.

Tornitore, T. (2013). *Della Narratologia* [Versione per Kindle] Genova: Genova University Press

Tricart, C., & Mendiburu, B. (2017). *Virtual Reality Filmmaking Techniques & Best Practices for VR Filmmakers.* Taylor and Francis.

van't Wout, M., Spofford, C. M., Unger, W. S., Sevin, E. B., & Shea, M. T. (2017). Skin conductance reactivity to standardized virtual reality combat scenes in veterans with PTSD. *Applied psychophysiology and biofeedback, 42*(3), 209-221.

Vertov, D. (2004) *Lines of Resistance: Dziga Vertov and the Twenties.* Edited by Yuri Tsivian, translated by Julian Graffy. Pordenone: La Giornate del Cinema Muto. p. 318-9

Vidali, P. (1998) Esperienze e comunicazione nei nuovi media, in G. Bettetini, F. Colombo, *Le nuove tecnologie della comunicazione.* p 306

Virtual reality: Lessons from the past for Oculus Rift - BBC News. (2013). BBC News. Retrieved from http://www.bbc.com/news/technology-2387769

Vogler, C. (2008). *The writer's journey: Mythic structure for storytellers and screenwriter's.* Wiese.

Vosmeer, M. & Schouten, B. (2017) Project Orpheus: A Research Study into 360° Cinematic VR. In P*roceedings of the 2017 ACM International Conference on Interactive Experiences for TV and Online Video (TVX '17).* ACM, New York, NY, USA, 85-90. doi:10.1145/3077548.3077559

Vosmeer, M., Roth, C., & Koenitz, H. (2017). Who Are You? Voice-Over Perspective in Surround Video. *Interactive Storytelling Lecture Notes in Computer Science*, 221-232. doi:10.1007/978-3-319-71027-3_18

Vosmeer, M., Roth, C., & Schouten, B. (2015). Interaction in Surround Video: The Effect of Auditory Feedback on Enjoyment. *Interactive Storytelling Lecture Notes in Computer Science,* 202-210. doi:10.1007/978-3-319-27036-4_19

Vosmeer, M., & Schouten, B. (2014). Interactive Cinema: Engagement and Interaction. *Interactive Storytelling Lecture Notes in Computer Science,* 140-147. doi:10.1007/978-3-319-12337-0_14

Vredenburg, K., Isensee, S., & Righi, C. (2002). *User-centered design: An integrated approach.* Prentice Hall PTR.

Wardrip-Fruin, N., & Montfort, N. (2003). *The new media reader.* MIT.

Weerdmeester, J., Rooij, M. V., Harris, O., Smit, N., Engels, R. C., & Granic, I. (2017). Exploring the Role of Self-efficacy in Biofeedback Video Games. *Extended Abstracts Publication of the Annual Symposium on Computer-Human Interaction in Play - CHI PLAY '17 Extended Abstracts.* doi:10.1145/3130859.3131299

Williams, C. (1980). *Realism and the cinema: A reader*. Routledge & Kegan Paul in association with the British Film Institute.

Wolf, W. (2011, 01). Narratology and Media(lity): The Transmedial Expansion of a Literary Discipline and Possible Consequences. *Current Trends in Narratology*. doi:10.1515/9783110255003.145

Wolf, W. (2009). Illusion (aesthetic). *Handbook of narratology*, 144-160.

Wyrwoll C. (2014) User-Generated Content. In: Social Media. Springer Vieweg, Wiesbaden

Xavier, I. (2007) Historical Allegories. In Miller, T. *A companion to film theory*. Blackwell. p. 45 – 63

Zhang, T., Tian, F., Hou, X., Xie, Q., & Yi, F. (2018, July). Evaluating the Effect of Transitions on the Viewing Experience for VR Video. In *2018 International Conference on Audio, Language and Image Processing (ICALIP)* (pp. 273-277). IEEE.

Zhao, W., & Madhavan, V. (2005). Integration of voice commands into a virtual reality environment for assembly design. I*n Proceedings of the 10th Annual International Conference on Industrial Engineering Theory, Applications & Practice*, Clearwater Beach, Florida, USA.

List of Figures

List of Tables

Appendices

Appendix 1. Interactive Screenplay of ZENA

ZENA
Dir: María Cecilia Reyes
_____

N.U	1	**Description**	SETUP - MONDO ORDINARIO
Location	Righi	**Narrator Type**	4
Nº Shots	3	**Characters**	Lorenzo
Inputs	0. Intro	**Outputs**	Sogno
Sound	Voice Over, Music, Ambience	**Interaction Type**	--

FADE IN

EXT/DAY - WOODS

LORENZO raccoglie erbe nel bosco.

CHRONOS
(Voice Over)

Benvenuto a ZENA. Sei nell'anno 1517.
Zena è una grande e potente repubblica marinara, nota in tutto il Mediterrano. Nella vecchia Europa, tutti sanno di Zena e dei Zenesi.
Welcome to Zena. It's 1517.
Zena is a great and powerful maritime republic known all over the Mediterranean.
In old Europe, everyone knows Zena and its citizens, the Zenesi.

DIRECT CUT

EXT/DAY - WOODS. OUTSIDE THE CITY WALLS

LORENZO raccoglie erbe nel bosco.

CHRONOS
(Voice Over)

Lui è Lorenzo, un giovane apprendista di alchimia. Quando è nato è stato adottato dall'antico Ordine dei Cavalieri di Saturno. Un ordine presente in tutto il mondo. Loro sono i saggi del tempo, e custodiscono la Clessidra di Chronos. L'único oggetto capace di manipolare il tempo.
He is Lorenzo, a young apprentice of alchemy. When he was born he was adopted by the ancient Order of the Knights of Saturn, an order whose members are all over the world. They are the wise men of time, and they guard Chronos' Hourglass. This object can manipulate time.

DIRECT CUT

EXT/DAY - WOODS. OUTSIDE THE CITY WALLS

Stanco, Lorenzo Fa un pisolino sotto un grande albero.

CHRONOS
(Voice Over)

Quella di oggi è iniziata come una tranquilla giornata nei campi. Ma presto si creerà una rottura nel tempo.
Today has begun as a quiet day in the fields. But soon there will be a rift in time.

La clessidra è in pericolo, e
Lorenzo avrà bisogno del tuo aiuto per scegliere la strada giusta.
The hourglass is in danger, and
Lorenzo will need your help to choose the right path.

FADE TO BLACK

12. Flashback Scena Morte

N.U	1	**Description**	SOGNO - Flashback Scena Morte
Location	Porta Sottana	**Narrator Type**	1
Nº Shots	1	**Characters**	Lorenzo - Maestro
Inputs	1. Setup	**Outputs**	2. Call
Sound	Ambience	**Interaction Type**	--

FADE IN

INT/DAY - UNIVERSITY PORTA SOTTANA

In una stanza, un uomo con cappello apre un coffanetto e tira fuori un arma. Punta verso Lorenzo.

FADE TO BLACK

Output:
2. Call

N.U	2	**Description**	CALL
Location	Commenda di Pre	**Narrator Type**	4
Nº Shots	2	**Characters**	Lorenzo - Maestro
Inputs	12. Sogno / Morte	**Outputs**	2.1 Si 2.2 No
Sound	Dialogue, Ambience	**Interaction Type**	Hotspots with text
		Internal Link	Manuscript with Text

Inputs:
12. Sogno / Morte

EXT/DAY - COMMENDA DI PRE

Lorenzo corre agitato verso il suo maestro, che sta leggendo un manuscritto.

LORENZO
Maestro, ho appena sognato mondi agitati.
Non v`è dubbio: è stata una chiamata.
Eppur non so come debbo comportarmi. Maestro, ve ne prego: aiutatemi.

Master, I had a strange dream.
I feel something is calling me.
But I don't know what. Master, please, help me.

MAESTRO
(chiudendo il manoscritto)
Figliolo, la Clessidra è in pericolo.
Dovrai raggiungere la Zena dei tempi futuri e consegnarla in potere di chi saprà custodirla e difenderla. Diciassette soli e venti secoli: l'anno 2017.
Nessuno, nella nostra Famiglia, si è mai spinto così lontano.

Son, the Hourglass is in danger.
You have to travel to the future, to Zena in 2017,
and you have to give it to someone who can keep it safe.
No other Saturn Knight has ever undertaken such an endeavour.

LORENZO
Duemila e diciassette?
Cinque secoli oltre l'orizzonte?
Maestro, non mi sento adatto.
Strane figure si agitano nei miei pensieri…

2017?
Five centuries?
Master, I am not ready.
My mind is not ready.

MAESTRO
Non avere paura, il tuo spirito ti saprà sorreggere ben più in alto di quanto tu non creda.
Ma si tratta di una scelta importante, che appartiene solo a te.

You don't have to be afraid. You are ready.
But it is up to you.

Outputs:
2.1 YES
2.2 NO

N.U	2.1	**Description**	Si - Consegna del Bastone
Location	Commenda di Pre	**Narrator Type**	4
Nº Shots	1	**Characters**	Lorenzo - Maestro
Inputs	2. Call 2.2.1 Nero	**Outputs**	3. New World
Sound	Dialogue, Ambience, Sound effect	**Interaction type**	Direct - Visual Effect time travel

EXT/DAY - COMMENDA DI PRE

Il maestro si mostra felice. Prende il bastone e lo offre a Lorenzo.

MAESTRO
Questo bastone ti aiuterà a scegliere la strada giusta.
Nella lingua degli antichi druidi si chiamava “ween”.
Non esiste tale parola, nel nostro parlare.
Ma orsù, bada ben a quel che ti dico: la sfera è attiva. Nulla più le sfugge.
È giunto il tempo della tua partenza. E ricorda: non voltarti mai..

This cane will help you choose the right path.
The ancient druids called it “ween”, a word long forgotten.
Now, listen: the sphere is active. It sees everything.
It’s time for you to go. Remember: Never look back.

Lorenzo prende il bastone, guarda direttamente la sfera e viaggia nel tempo.

DIP TO WHITE

Output:
3. New World

N.U	2.2	**Description**	No - Delusione del maestro
Location	Luogo Medievale	**Narrator Type**	4
Nº Shots	1	**Characters**	Lorenzo - Maestro
Inputs	2. Call	**Outputs**	2.2.1 Nero
Music	--	**Interaction Type**	Direct

EXT/DAY - COMMENDA DI PRE

Lorenzo rifiuta la chiamata. Il Maestro deluso si gira dandogli la schiena e inizia a camminare verso il monastero. Lorenzo rimane da solo, in preda della sua vergogna.

FADE TO BLACK

SPAZIO NERO

“Senza coraggio non c’è avventura”

New adventures take courage

Countdown per tornare alla storia

DIRECT

Output:
2.1 SI

N.U	3	**Description**	NEW WORLD
Location	Porto di Genova, Piazza Caricamento	**Narrator Type**	2
Nº Shots	(6) 3, 3a, 3b, 3c	**Characters**	Lorenzo
Inputs	3.1 Yes	**Outputs**	4. Internal Confusion 5. Ally 6. Enemy
Sound	Ambience	**Interaction Type**	Geographic Hotspots Return from next N.U to 3a/3b/3c

EXT/DAY - PORTO DI GENOVA (3 shots)

Lorenzo arriva nel 2017. È stupito. Cammina verso piazza Caricamento. Tutto gli sembra incredibile. Deve scegliere dove andare.

EXT/DAY - PIAZZA CARICAMENTO

3a. Simonetta passa ascoltando musica con le cuffie.

3b. Sercan è seduto sulla statua.

3c. La gente cammina intorno e lo guarda strano.

Output:
4. Internal confusion
5. Ally - Simonetta
6. Enemy - Sercan

N.U	4	**Description**	INTERNAL CONFUSION
Location	Chiesa Scuole Pie	**Narrator Type**	2
Nº Shots	2	**Characters**	Lorenzo, Old Lady, Sinner
Inputs	3. New World	**Outputs**	7. Oracle 9. Wrong Approach
Sound	Dialogue, Ambience	**Interaction Type**	Dialoghe characters

EXT/DAY - PIAZZA SCUOLE PIE

Lorenzo arriva in Piazza Banchi. Ha paura della gente che lo guarda strano. La respirazione è agitata. Vede la chiesa e decide di entrare.

DIRECT CUT

INT/DAY - CHIESA SCUOLE PIE

Si inginocchia e inizia a pregare, quando un tipo strano gli si siede dietro. Intanto la signorina che contribuisce alle pulizie della chiesa lo guarda con aria un po' stranita.

SIGNORA
(rivolgendosi a Lorenzo)
Hai perso la strada, ragazzo? **Did you lose your way? / Are you lost?**
(guardando verso l'ubriacone)
Quelli come lui non hanno salvezza. **People like that cannot be saved.**
Invece si può capire dai tuoi occhi che hai tante cose da fare, cose importanti.
But I can tell from your eyes you are destined to do great things.
Cerca sempre la luce. Ricordati sempre di camminare verso la luce.
Look for the light, always. Walk towards the light.

La signora va via e continua con i suoi lavori.

UBRIACONE
Lo so io qual'è il tuo problema. A te quello che manca è l'amore.
I know what's your problem. You need some sweet love.

Output:
7. Oracle
9. Wrong Approach

N.U	5	**Description**	ALLY
Location	Piazza Grillo Cattaneo	**Narrator Type**	3
Nº Shots	5, 5a, 5b	**Characters**	Lorenzo - Simonetta
Inputs	3. New World	**Outputs**	7. Oracle 8. Obstacle
Sound	Dialogue, Ambience, Music	**Interaction Type**	Hotspots Return

EXT/DAY - PIAZZA GRILLO CATTANEO

Lorenzo arriva in una piazza, si sente perduto, si guarda intorno e cerca di leggere le targhe. C'è una ragazza silenziosa che lo osserva mentre ascolta la musica in cuffia. Le toglie e si avvicina a lui.

SIMONETTA
Ciao! Hai bisogno? Ti sei perso?
Hi! Do you need help? Are you lost?

Lorenzo all'inizio non la sente. Poi quando la guarda in faccia rimane stupito dalla sua bellezza. In qualche modo la trova familiare.

LORENZO (ancora stupito)
Eh.. no no.. conosco questa piazza. Qua abitava una donna che conoscevo. Ma tutto mi sembra strano.
No no … I know this square. A woman used to live here … It's all so strange.

SIMONETTA
Dove devi andare? Hai qualche indirizzo?
Where are you going? Do you know the address?

LORENZO
(continua a guardarsi intorno e rimane pensieroso)
Non so bene dove devo andare…
I am not sure of where I am going ...

SIMONETTA
(guarda la clessidra che ha Lorenzo al collo)
Dipende da cosa vuoi fare. Lo so che i vicoli possono sembrare spaventosi, ma sono affascinanti. Se cerchi qualcuno dentro le mura, sei proprio dentro in un labirinto. Ricordati sempre che verso est ci sono i monti, e che verso ovest c'è il mare. Così non ti perdi.
It depends on what you want to do.
I know, these alleys can be scary, but also fascinating.
If you look for someone inside the city walls, it feels like being in a labyrinth.
Here's a trick to not get lost: the mountains are East, and the sea is West.

Lorenzo guarda entrambi i lati che Simonetta gli indica. (Appaiono gli hotspot)

SIMONETTA
Adesso devo andare. Buona fortuna viaggiatore.

Gotta go. Good luck traveller.

Simonetta va via. Lorenzo la guarda allontanarsi. Deve decidere in quale direzione andare.

Choice:

5a. Lorenzo scrolla per terra e scappa verso il vicolo a sinistra (7)

5b. Col bastone gli da un colpo sulla pancia che lo abbatte. Lorenzo scappa verso vicolo a destra (9)

Output:
7. Oracle
8. Obstacle

N.U	6	**Description**	ENEMY
Location	Vico della Torre di San Luca	**Narrator Type**	2
Nº Shots	6 / 6a / 6b	**Characters**	Lorenzo - Sercan
Inputs	3. New World	**Outputs**	7. Oracle 8. Wrong Approach
Sound	Dialogue, Ambience, Music	**Interaction Type**	Hotspots Return

EXT/DAY - VICO DELLA TORRE DI SAN LUCA

Lorenzo passa da un Vicolo, quando si accorge che un uomo strano lo guarda in modo fisso. L'uomo sbuccia una mela.

SERCAN
Sono io quel che tu cerchi. Ti stavo aspettando. 500 anni per essere precisi.
Ah! Questa mela non sa di niente!!!
I am the one you're looking for. I have been waiting for 500 years.
This apple tastes like shit!

Butta via la mela con rabbia. Si alza. Inizia a camminare in cerchio intorno a Lorenzo. Guarda i suoi orologi costantemente.

LORENZO
Chi è lei? **Who are you?**

SERCAN
Non te l'ha detto il tuo maestro, chi sono io? Non mi sorprende.
Una volta fu il terrore di tutto il Mediterraneo.
Non c'era repubblica che non temesse il mio nome,
e adesso eccomi costretto ad attenderti.
Didn't your Master tell you? I am not surprised.
I once was the most feared man in the whole Mediterranean,
and look at me now, here, waiting for you.

LORENZO
Voi siete… Sercan? **You are … Sercan?**
Come è possibile? **It's impossible!**

SERCAN
Quando sei partito, qualche stregoneria vostra ha confinato me e il tuo caro Maestro ad aspettarti.
When you left, your damn sorcery somehow forced me and your Master to live and wait for you.

LORENZO
Quindi… il Maestro è qui? **That means my Master is here?**

Sercan si ferma e si avvicina a Lorenzo da dietro.

SERCAN
Certo che è qui. **Of course.**
Ma non è più l'uomo che tu conosci. **But he is no longer the man you knew.**

Sercan lo spinge verso il muro.

Lorenzo lo guarda agli occhi mentre Sercan si avvicina col coltello in mano. Lorenzo si guarda intorno, vede il suo bastone e un vicolo dal quale può scappare. (Hotspots)

SERCAN
Vorrei tanto finire con questa storia. **I want all this to end.**

LORENZO
(voice over)
Coraggio! Coraggio! **I have to be brave!**
Devo trovare il Maestro! **I have to find the Master!**

Choice:

6a. Lorenzo scrolla per terra e scappa verso il vicolo a sinistra (7)

6b. Col bastone gli da un colpo sulla pancia che lo abbatte. Lorenzo scappa verso vicolo a destra (8)

Output:
7. Ostacolo
8. Wrong Approach

N.U	7	**Description**	ORACOLO
Location	Casa Santo Sepolcro	**Narrator Type**	2 - 3
Nº Shots	1	**Characters**	Lorenzo - Oracolo
Inputs	4. Internal Confusion 5. Ally	**Outputs**	9. Wrong Approach 10. Right Approach
Sound	Dialogue, Ambience	**Interaction Type**	Hotspots on Tarot cards

INT/DAY - CASA SANTO SEPOLCRO

Entra in un appartamento normale ma buio. Sul tavolo c'è un po' di cibo servito.

ORACOLO
Mangia. Hai fame. **Eat. You're hungry.**

Lorenzo inizia a mangiare con molta fame.

ORACOLO
È cambiata la nostra amata Repubblica vero? **How has the Republic changed, isn't it?**
Adesso non è più che una città. **Now it is nothing but a city.**
Alcune cose dovrai riconoscere, altre invece non potevi neanche immaginarle.
There are things you can recognize, other which exist only in the imagination.

LORENZO
Perchè voi conoscete il mio nome? **How do you know my name?**

ORACOLO
Mio nonno era un Cavaliere di Saturno. **My grandfather was a Saturn Knight.**
Non qui, in un altro territorio, dall'altro lato dell'oceano. **Not here, in a land across the ocean.**
Mi ha insegnato molte cose. **He taught me many things.**

LORENZO
(dice per sè)
Grazie Chronos. **Thank you Chronos.**
(guarda la donna)
Non capisco come agire. **I don't know what to do.**

L'oracolo prende un mazzo di carte, chiede a Lorenzo di tagliarlo. Gli chiede di scegliere due carte.

ORACOLO
Segnalando una carta: La luce si può spegnere, ma se hai speranza hai buone possibilità.
Light can shine even in the darkness, if you have hope.
Segnalando l'altra: (ride) devi fare attenzione al tuo istinto, ma ricordati che a volte le cose, le persone non sono quello che sembrano.
Trust your instinct, and remember: sometimes people are not what they seem.

Lorenzo deve scegliere fra una carta e l'altra.

Output:
10. Wrong Approach
11. Right Approach

N.U	8	**Description**	OSTACOLO / THREAT
Location	Via dei Giustiniani	**Narrator Type**	3
Nº Shots	1	**Characters**	Lorenzo - Thief
Inputs	5. Ally 6. Enemy	**Outputs**	9. Wrong Approach 10. Right Approach
Sound	Ambience, music	**Interaction Type**	Geographic Hotspots

EXT/DAY - VIA DEI GIUSTINIANI

Lorenzo corre in mezzo ai vicoli. Da un vicolo sbuca un uomo con il cappuccio. Tenta di rubbarlo. Lorenzo cerca di difendersi col bastone. Dall'alto una donna getta sui due un secchio d'acqua. Lorenzo scappa. Si trova di fronte a un bivio.

LORENZO
(voice over narra la sua scena)
Mi chì. A Zena. Genova, ora. **I am here, Zena, Genova.**
Questo pensavo, dopo poche ore nel 2017. **In 2017.**
Arrivai in un vico stretto che somigliava a un serpente. **The alley had the shape of a serpent.**
Di nuovo Zena mi aveva ingannato. **Zena was fooling me again.**
Il labirinto sa compiere la sua funzione. **The labyrinth was working.**

Un uomo mi incrociò. Uscì da vico _____. **A man came out of vico … and passed by me.**
Non riuscii a vedere il suo volto. **I couldn't see his face.**
Nell'imputo dell'attacco, il sangue si scalda e cerca solo di proteggersi.
In the fight, the blood gets warm, all you can think of is survival.
Non avrei mai pensato che esistesse ancora la vecchia usanza di buttare qualcosa dalla finestra,
per difendere la città e i cittadini.
I didn't expect to be helped by someone throwing something out of the window, like in the old times

Un altro bivio, un altra decisione.
Another fork, another choice.

Output:
9. Wrong Approach
10. Right Approach

N.U	9	**Description**	WRONG APPROACH
Location	GENOA'S PORT	**Narrator Type**	2
Nº Shots	1	**Characters**	Lorenzo
Inputs	4. Internal Confusion 6. Enemy 7. Oracolo 8. Ostacolo	**Outputs**	11. Revelation 17. Negative End I (torna senza consegnare la clessidra)
Sound	Ambience, Dialogue	**Interaction Type**	Hostpots with text

EXT/DAY - CITY WALLS NEAR THE PORT

Lorenzo arriva in un luogo molto industriale, non può credere quello che vedono i suoi occhi: di tutti i futuri possibili mai avrebbe immaginato una cosa del genere. È perso e affascinato, l'único elemento che gli sembra di riconoscere è la lanterna, e pure quella era cambiata. Adesso è molto più potente.

Imbebuto nei suoi pensieri, guarda fissamente la lanterna, guarda la sfera. Un uomo da dietro si avvicina.

BARBONE
Ou… Ou Belin **Hey! Damn!**
We are disgusting,
the only thing that exists is cement
Cement everywhere
You can not see the lighthouse anymore

Il barbone si allontana. E Lorenzo lo vede allontanarsi.

EXT/DAY - PORT

Lorenzo arriva al mare. Perso, decide di chiedere aiuto ai cavalieri di Saturno attraverso la sfera.

LORENZO
Maestro, sono un incapace. **Master, I'm useless.**
Mi sento perduto, irrimediabilmente perduto. **I feel lost.**
Non so come agire. **I don't know what to do.**
Ve ne prego: datemi un segno. **Please: give me a hint.**

Hostpots on Lorenzo's shoulders.

Output:
11. Revelation
17. Negative END I

N.U	10	**Description**	RIGHT APPROACH
Location	Piazzetta	**Narrator Type**	2 o 4
Nº Shots	1	**Characters**	Lorenzo - Simonetta - Sercan
Inputs	7. Oracle 8. Ostacolo	**Outputs**	9. Wrong Approach 11. Tentazione 13. Ordeal
Sound	Ambience, Dialogue	**Interaction Type**	Characters Hotspots on Simonetta, Sercan and Street.

EXT/DIA - Piazzetta

Lorenzo è in una piccola piazza seduto per terra, molto pensieroso. Ha la clessidra in mano e la osserva concentrato. Si guarda intorno prevenuto. Tira fuori dalla tasca una carta, la guarda e la ripone nuovamente in tasca.

Simonetta arriva da un vico, ascolta la musica, e lo vede seduto. Si avvicina. Gli sorride e lo accarezza in faccia. Continua il suo cammino. Quando Simonetta si sta allontanando, Sercan appare dal vico contrariio zoppicando e guardando costantemente gli orologi. Simonetta rimane immovile, osservando la scena, cercando di essere invisibile per Sercan e non intervenire. Lorenzo si alza in modo di difesa.

SERCAN
Non sono venuto a farti del male. **I don't want to hurt you.**
C'è qualcuno che ti aspetta a Santa Fede. **Someone is waiting for you at Santa Fede.**
Te la ricordi la Porta Sottana? **Do you remember Porta Sottana?**

Lorenzo si guarda intorno avendo 4 direzioni dove andare: Verso Simonetta o Sercan, oppure verso i vicoli liberi.

Outputs:
9. Wrong Approach
11. Simonetta (Revelation)
13. Sercan (Ordeal)

N.U	11	**Description**	REVELATION
Location	Porta Soprana	**Narrator Type**	2
Nº Shots	5	**Characters**	Lorenzo - Simonetta (Voice Over)
Inputs	9. Wrong Approach 10. Right Approach	**Outputs**	13. Ordeal
Sound	Ambience, Sound Effect, Dialogue	**Interaction Type**	

EXT/DAY - OUTSIDE PORTA SOPRANA

Lorenzo è arrivato a Porta Soprana. Vede la Porta da fuori stupito, mentre le persone passano a fianco a lui.

DIRECT CUT

INT/DAY - OUTSIDE PORTA SOPRANA

He enters the tower, and in its way up to the top, a voice speaks to him

SIMONETTA/CHRONOS
(Voice Over)

Lorenzo
Lorenzo
Vieni qui **Come here**
Ancora più su **Upstairs**
Non aver paura **Do not be afraid**

Io sono Chronos! Io sono il Tempo! **I am Chronos! I'm the Time!**
Muovo il mondo e la vita. **I move the world and life.**
Sono fuori da tutte le dimensioni. **I am out of all dimensions.**
Sono l'inizio e l'infinito. **I am the beginning I am infinite.**
Vedo dentro di me tutte le possibilità. **I see all possibilities within me.**

Stamattina eri nel 1517. Ora sei qui. Nell'anno 2017.
This morning you were in 1517. And now you are here. In 2017.

Il mondo è cambiato, la società, il paesaggio, il pensiero, e anche l'aria che respiri.
Tutto gira più velocemente.
Ho visto i tuoi occhi riempirsi di paura al vedere così tante persone.
Il pianeta ha oggi più di 7 trillioni di persone.
The world has changed, society, landscape, human thought, and even the air you are breathing.
Everything runs faster.
I saw your eyes filled with fear when you saw all those people around you.
La Zena dove ti sei svegliato ora si chiama Genova.

The Zena where you woke up is now called Genoa.

So che ti senti spaesato, e hai ragione.
Ma è tuo dovere come cavaliere di Saturno custodire la clessidra e usarla con saggezza nei momenti di difficoltà, come avete fatto finora.
I know you feel disoriented, and you have all rights to feel this way. But it is your duty as a Saturn Knight to save the hourglass and use it wisely in times of difficulty, as you have always done.

Ora, dalla Porta Soprana dovrai scendere a Porta Sottana, nel quartiere di Santa Fede.
C'è qualcuno che ti aspetta, segui il tuo istinto e lo troverai.
Now from Porta Soprana you will have to go down to Porta Sottana, in the Santa Fede district. There is someone waiting for you, follow your instinct and you will find him.

DIRECT CUT

Outputs:
13. Ordeal

N.U	12	**Description**	DANGER - NEGATIVE END II
Location	Piazza Don Gallo	**Narrator Type**	1 - 4
Nº Shots	1	**Characters**	Lorenzo - Maestro - Simonetta
Inputs	11. Tentazione 10. Right Approach	**Outputs**	Negative END II
Sound	Ambience, Voice Over	**Interaction Type**	

EXT/DAY - Piazza Don Gallo

Lorenzo cammina in una piazza molto vecchia. Si guarda intorno un po' spensierato.

LORENZO
(Voice Over)

Arrivai in una piazza che un tempo avevo percorso da bambino **The square where I arrived was familiar**
Nel mio ricordo, tutto era diverso. **But everything was different**
Adesso è una piazza familiare e grigia. **Now the square is grey, meaningless**
Conserva ricordi strani. **Still revives strange memories ...**

Da dietro arriva un uomo di cui non riesce a vedere il volto. Lo butta per terra. Lorenzo alza lo sguardo. L'uomo appunta una pistola verso di lui. Suona lo sparo. Tutto diventa buio.

EXT/DAY - Piazza Don Gallo

Dall'alto si vede il corpo di Lorenzo sul pavimento. Simonetta arriva lentamente e si mette davanti a lui. Lo chiama per nome. (Si fa capire che Simonetta è la morte e porta via la sua anima). Simonetta va via con l'anima di Lorenzo.

DIRECTOR'S NOTE:
THIS SCENE WAS SHOOTED WITHOUT ATTENTION TO CONTINUITY.
WE SHOOTED LORENZO'S DEATH AT THE UNIVERSITY AFTER THE ORDEAL.

N.U	13	**Description**	ORDEAL
Location	Università	**Narrator Type**	3
Nº Shots	13, 13a	**Characters**	Lorenzo - Maestro
Inputs	10. Right Approach 11. Tentazione	**Outputs**	12. Negative END II 14. Reward
Sound	Ambience, Dialogue, Music	**Interaction Type**	Hotspots on MAster's hand and door

INT/DAY - UNIVERSITY PORTA SOTTANA

Lorenzo arriva in università e cerca il Maestro.

Lo trova infine in un grosso ufficio, lavorando al computer. Maestro si alza dalla sua postazione.

MAESTRO
(Abbracciandolo, con gli occhi sulla clessidra, con ipocresia)
Lorenzo! Caro! Finalmente! Tanti anni di pazienza, di tenacia, di disperazione.
My dear Lorenzo! Centuries of patience, perseverance, desperation.

LORENZO
(stupito e neutro)
Quindi lei è qui. **You're here then.**

MAESTRO
Sono io, Lorenzo! Sono io! Ero io che ti aspettavo! Hai completato la tua missione! Sei stato bravissimo!
It's me, Lorenzo! I have been waiting for you. Your mission is completed.Well done!
Quando sei nato ho saputo subito che eri il predestinato. **I knew you where destined to great things.**
Adesso l'ultima cosa che devi fare è consegnarmi la clessidra.
Now all is left to do is giving me the hourglass.

LORENZO
E che succederà con l'ordine? **What will happen to the Knights?**

MAESTRO
Sono io a dover conservare la nostra conoscenza e per questo c'era bisogno della clessidra che hai portato tu dal passato con tanto coraggio. Solo tu lo potevi fare.
I am the designed keeper of knowledge and I needed the hourglass you so bravely took here.

LORENZO
E che succederà con me? **What will be of me?**

MAESTRO
(coinvolgendolo ma invidioso)
Continuiamo il nostro lavoro. Insieme. **We will go on, work .. together.**
Sei l'único che ha mai fatto un viaggio così importante nel tempo.
You are the only one who survived such an extraordinary journey.
Hai salvato l'intera Ordine dei Cavalieri di Saturno. **You saved the entire Order of Saturn.**

LORENZO

E rimanere nel futuro? Qui? **So I have to stay in the future? Here?**

MAESTRO
Vedrai che non è così male come sembra. **It's not that bad.**
Non c'è niente di più bello che vivere l'eternità. **Nothing is better than immortality.**
Non vorresti essere eterno? Rimani vicino a me. **You can stay with me.**

Lorenzo si avvicina alla finestra. Rimane pensieroso. Non sa se consegnare la clessidra al maestro. Il suo atteggiamento gli sembra strano.

LORENZO
(voice over 1: ha visto Sercan)
Sercan aveva ragione. **Sercan was right.**
Il Maestro non è più lui. **The Master has changed.**
È diventato un uomo spregievole. **He has become a despicable man.**

LORENZO
(voice over 2: non ha visto Sercan)
Il 2017 non è il mio tempo. **The year 2017 is not where I want to stay.**

MAESTRO
(disperato)
Dammi la clessidra! **Give me the hourglass!**

Lorenzo deve decidere se consegnare la clessidra al maestro o no.

1. La consegna - NU 12
2. La tiene e scappa - NU 14

13a. Lorenzo scappa, il maestro si prepara per andare dietro di lui.

Outputs:
12. Negative End II
14. Reward

N.U	14	**Description**	DANGER
Location	Piazza dei Fregoso	**Narrator Type**	4
Nº Shots	1	**Characters**	Lorenzo - Maestro - Sercan
Inputs	13. Ordeal	**Outputs**	15. Stay in this world?
Sound	Dialogue, Ambience	**Interaction Type**	

EXT/DAY - PIAZZA DEI FREGOSO

Lorenzo sta cercando di fuggire dal Maestro.Il Maestro lo segue. Sercan appare. Lorenzo rimane in mezzo ai due.

MAESTRO
Sercan! Allontanati. **Sercan! Back off!**
Questa vicenda non ti appartiene! **This is none of your business!**

SERCAN
Certo che mi appartiene! **Of course it is!**
500 anni intrapolato! **Five-hundred years trapped!**

MAESTRO
Lorenzo!
È ora che mi dai la clessidra! **The time has come: give me the hourglass!**

Il Maestro si avvicina a Lorenzo in modo intimidante. SERCAN corre verso il maestro e lo acoltella.

MAESTRO
Stupido adesso morirai anche te **Fool, you will die too**

SERCAN
Non desidero altro **I can't wait!**

Lorenzo takes the clepsydra from the hands of Sercan and runs.

Output:
15. Stay in this world?

N.U	15	**Description**	STAY IN THIS WORLD?
Location	Spianata Castelletto	**Narrator Type**	3
Nº Shots	1	**Characters**	Lorenzo - Simonetta
Inputs	14. Reward	**Outputs**	15.1 Si 16. No
Sound	Dialogue, Ambience	**Interaction Type**	

EXT/DAY - CASTELLETTO

Lorenzo arriva da Simonetta che si trova nella torre. Appena si vedono tutti e due sorridono. Appoggiano la clessidra e il libro su un tavolo. Lorenzo è stanco e ha un po' di sangue addosso.

LORENZO
Ci sono ancora tante cose che non capisco. **I still don't understand …**

SIMONETTA
Ad esempio? **What?**

LORENZO
Il mio Maestro ci ha tradito. **My master betrayed us.**

SIMONETTA
Il tempo non passa mai in vano. **Things change with time.**

LORENZO
E ora? Che devo fare? **What should I do now?**

SIMONETTA
È l'ultima scelta che devi fare: **That is your last choice:**
Vuoi tornare? o Vuoi rimanere? **Do you want to go back? Or do you want to stay here?**

Output:
15.1. YES
16. NO

N.U	15.1	**Description**	STAY IN THE NEW WORLD?
Location	Spianata Castelletto	**Narrator Type**	3
Nº Shots	1	**Characters**	Lorenzo - Simonetta
Inputs	14. Reward	**Outputs**	15.1 Si 16. No
Sound	Dialogue, Ambience	**Interaction Type**	

EXT/DAY - CASTELLETTO - SUNSET

CHRONOS/SIMONETTA ha la clessidra al collo. La toglie lentamente mentre sorride a Lorenzo.

SIMONETTA
Hai deciso di rimanere. **You decided to stay.**
Puoi portare avanti l'ordine, insegnare quello che sai.
From now on, you are the leader of the Order.
Presto troverai gli altri membri che sono rimasti. **Soon you'll meet the other members.**
Oppure loro ti troveranno. **They will find you.**
Hai dimostrato avere coraggio e nobiltà. **You proved to be brave.**
La clessidra sarà salva nelle tue mani, e tu potrai continuare con l'ordine.
The hourglass is safe in your hands, and so is the Order.
E ora che io vada. **Now it is the time for me to go.**

IL TEMPO si allontana, mentre Lorenzo rimane guardando il mare e la nuova Genova.

POSITIVE END I

N.U	16	**Description**	POSITIVE END II
Location	Medievale	**Narrator Type**	4
Nº Shots	1	**Characters**	Lorenzo - Maestro
Inputs	1	**Outputs**	POSITIVE END II
Sound	Dialogue, Ambience, Sound Effect	**Interaction Type**	

16. POSITIVE ROAD BACK

Lorenzo torna dal Maestro. Lo trova molto preoccupato, aspettando notizie sue. Appena lo vede si alza nervoso.

MAESTRO
Lorenzo!
Sei tornato. Che è successo? **You're back! What happened?**
Sercan è uscito dalle mura quando si è reso conto che non era più nelle mie mani.
Sercan stopped the siege when he realised the hourglass was no longer here.
Hai consegnato la clessidra? **Is it safe in the future?**
È salva?

LORENZO
Si Maestro, la clessidra è salva. **Yes, Master, it is safe.**

MAESTRO
Il mio cuore è di nuovo in pace. **My heart can rest now.**
Avevo fiducia in te. **I trusted you.**
Adesso.. raccontami cosa hai visto… **Now … Tell me,**
Com'è il futuro **how is the future? ...**

Lorenzo e il Maestro si allontanano felici.

POSITIVE END II

N.U	17	**Description**	NEGATIVE END I
Location	Commenda di Pre	**Narrator Type**	4
Nº Shots	1	**Characters**	Lorenzo - Maestro
Inputs	1	**Outputs**	NEGATIVE END !
Sound	YES - Finale	**Interaction Type**	

INT/DAY - COMMENDA DI PRE

Lorenzo torna dal Maestro. Lo trova molto preoccupato, aspettando notizie sue. Appena lo vede si alza nervoso.

MAESTRO
Lorenzo! Lorenzo!
Sei tornato. Che è successo? **You're back. What happened?**
Sercan è uscito dalle mura quando si è reso conto che non era più nelle mie mani.
Sercan got out of the walls when he realized he was no longer in my hands.
Hai consegnato la clessidra? **Did you deliver the hourglass?**
È salva? **Is it safe?**

LORENZO
No Maestro, ho fallito. **No, Master. I failed.**
Mi sono perso. **I got lost.**
Ho avuto paura. **I was scared.**

MAESTRO
Quel che hai fatto non era facile **You had a difficult task**
Non ti abbattere **Do not worry**
Ma adesso dobbiamo prepararci **Let's get ready**
Sercan tornerà **Sercan will be back**

Lorenzo e Maestro si allontanano.

NEGATIVE END I

Appendix 2. Riassunto in Italiano

Fiction Interattiva nella Realtà Virtuale Cinematografica: Epistemologia, Creazione e Valutazione

Premessa

Fin dal suo inizio, lo sviluppo del mondo digitale ha indotto artisti e scrittori a narrare storie e trasmettere le loro percezioni del mondo attraverso un qualche mezzo che permetta la convergenza di vari tipi di linguaggio e forme artistiche, e che stimoli l'interazione dell'utente per essere decodificato. Questa interazione utente-opera d'arte modifica la logica dell'*output* fisso (Koenitz, 2017), ponendo il processo di interazione al centro dell'esperienza estetica. Ipertesto, ipermedia, multimedia o cyberart sono alcuni dei termini che fanno riferimento ad un contenuto artistico digitale che mette in luce le proprie componenti in modo che l'utente le possa organizzare in un'esperienza di tipo lineare.

Questo desiderio degli autori di esporre idee, storie ed impressioni del mondo in piccole unità, in modo esplicito e senza un'organizzazione apparente, non è una novità. Sebbene il codice digitale abbia spalancato le porte d'accesso all'opera artistica tanto per l'autore quanto per l'utente, mediante un medesimo tipo di interfaccia, c'era già stato in precedenza, sia nella letteratura, sia nel teatro o nel cinema, chi aveva saputo creare opere narrative interattive in modo analogico. In ognuno dei diversi media, queste storie interattive hanno le proprie strutture, modalità differenti di interazione e di architettura per le componenti del testo, e gradi diversi di interazione per l'utente. Tutte hanno però in comune una stessa idea di base: quella di liberare la forma narrativa da un tipo di un'unica lettura.

Estrarre dalla mente e dall'anima ciò desideriamo esprimere non è un compito semplice. Dentro di noi il messaggio si presenta come un coacervo di parole, immagini, colori, forme e segni che necessitano di una sintassi e di un codice per poter essere trasmessi, ed è solo

quando siamo di fronte al foglio bianco, alla tela o allo schermo vuoto che iniziamo il difficile processo di esprimere un contenuto articolando materia e forma. L'avvento del computer ha permesso agli autori di accentrare in un solo dispositivo, ma separatamente, le loro idee digitalizzate in vari formati. In breve tempo il computer ha acquisito due aspetti nella creazione artistica: può creare e mostrare. Il processo creativo o l'assemblaggio delle sue componenti avviene grazie al computer, che poi mette in esecuzione l'opera artistica; infine, la storia narrativa viene ricreata dall'interazione dell'utente, che traccia il proprio percorso all'interno della foresta testuale, riflesso della mente dell'autore.

L'autore crea un universo apparentemente disordinato le cui componenti sono interrelate, ed è in queste connessioni e specialmente nella loro molteplicità che risiede il significato: l'esperienza è da ritrovarsi nelle alternative della navigazione, la creazione di senso nelle correlazioni che ritroviamo tra contenuti apparentemente scollegati fra loro. "La grande narrativa è un invito a trovare problemi, non una lezione su come risolverli. Si tratta soprattutto di una situazione e di un percorso, piuttosto che della locanda a cui questo percorso conduce." (Bruner, 2003, p. 20). Ted Nelson, nella sua opera intitolata *Literary Machines*, ci avverte del fatto che l'ipertesto non è "un'altra variante" di struttura oscura ma la riunificazione e riorganizzazione di differenti tipi di testi elettronici. Oggi internet consente all'utente di decodificare questa riunificazione davanti ad uno schermo in qualunque parte del mondo, nonché di ricodificarla nuovamente in veste di autore ricaricandola sul *cloud* in un ciclo che può ripetersi all'infinito.

L'ipertesto come criterio organizzativo del testo elettronico sta alla base di una struttura costruttiva non sequenziale del contenuto (Nelson, 1987, p. 15). Questo contenuto può essere di tipo non narrativo oppure di tipo narrativo, di fantasia oppure no: in questo modo nasce la Hyperfiction o Interactive Fiction (IF). Analogamente, il mezzo digitale permette lo sviluppo ed il proliferare di opere audiovisive narrative di tipo interattivo, come i Video Interattivi (IV), il Documentario Web (Webdoc), i Giochi Narrativi (NG). Sono inoltre apparsi sistemi narrativi più elaborati, come gli Interactive Drama (ID) (Szilas, 1999). Queste storie interattive digitali sono operate da sistemi di Intelligenza Artificiale (AI) e trasmessi ad una

vasta gamma di interfacce. Questi tipi di opere narrative sono note come Intelligent Narrative Technologies (INT) (Riedl & Bulitko, 2012). Per molti anni le opere narrative basate sull'uso del computer sono state chiamate Interactive Digital Storytelling (IDS) o semplicemente Interactive Storytelling (IS). Come nota Nick Montfort nell'introduzione al suo volume *Interactive Digital Narrative: History, Theory and Practice* (Koenitz et al, 2017), i più importanti teorizzatori in questo campo hanno optato ultimamente per il termine Interactive Digital Narratives (IDN), che abbraccia un ampio spettro di forme artistiche e tecnologie.

Una delle tecnologie che nel secolo scorso hanno cercato di realizzare il sogno dell'uomo di creare e sperimentare nuove realtà è la Realtà Virtuale (VR). La VR allontana la cognizione umana dalla materialità della realtà fisica per trasferirla ad uno spazio-tempo mediato dal computer che non sostituisce la realtà fisica, ma che costituisce di per sé una realtà indipendente, mettendo in relazione le percezioni dell'utente con un ambiente digitale. La VR è un medium che allarga le potenzialità di qualunque attività umana (sociale, educativa, artistica, comunicativa) nell'ambito di una *neorealtà* (Diodato, 2005) incentrata sulla dimensione sperimentale dell'essere umano. Nel marzo 2015, Chris Milk ha definito la VR come il "medium definitivo", dal momento che mentre per gli altri media questi vengono interpretati dalla coscienza, nella VR la coscienza è il medium stesso. In quanto medium prettamente audiovisivo, la VR compie un passo avanti nella demolizione della "quarta parete" racchiudendo completamente la capacità cognitiva dell'utente mediante suono ed immagine, mentre lo sviluppo tecnologico è in processo di sviluppo per connettere le sue emozioni e i suoi movimenti alla *neorealtà*. In questo modo la VR, diversamente dagli altri media, crea un tipo di comunicazione da coscienza a coscienza, nelle parole di Jaron Lanier, una "comunicazione post-simbolica" (2010). Non si tratta più cioè di raccontare storie o trasmettere discorsi, ma della creazione di esperienze multisensoriali. Ci avviciniamo, da un punto di vista progettuale, alla costruzione di esperienze artificiali, che hanno però un'apparenza reale. Finora era stato possibile solo tramite stati alterati di coscienza oppure durante il sonno (non a caso Google ha battezzato la propria compagnia VR "Daydream") il poter attenuare, fino a quasi farla scomparire, la linea di divisione tra realtà fisica e mentale. Tuttavia, grazie alla VR, questa scomparsa della separazione tra le due realtà diviene un dato

di fatto: più tempo passiamo in un ambiente virtuale (virtual environment, VE), più coerente e naturale esso appare alla nostra mente; più diviene realistica l'interfaccia maggiore è l'immersione al suo interno, e minore l'incredulità dell'utente; quanto più è avanzata la tecnologia e raffinato l'aspetto grafico e sonoro, tanto più rapida e riuscita sarà l'interazione con il VE e le sue componenti, rendendo possibile un'immersione *full-body*.

Fin dal primo momento, la VR ha provocato un forte interesse interdisciplinare che indaga sulla comprensione del medium, sul suo linguaggio, sulle sue forme di produzione e riproduzione e sulle sue applicazioni in vari campi. Tuttavia, al contrario di quanto avvenuto per la radio, la televisione o internet, il grande pubblico non ha potuto usufruire e maneggiare subito questo medium, e sebbene da oltre 60 anni la VR imminente appaia sempre sul punto di acquisire visibilità e diffusione, ciò che di fatto conosciamo degli utilizzi della VR e del suo apprezzamento sa parte degli utenti è assai poco. Mentre scrivo questo documento, nel 2018, stiamo già assistendo ad un notevole balzo in avanti rispetto al battage pubblicitario che la VR ha causato negli ultimi cinque anni. Dal 2013, con l'abbassarsi dei prezzi dei mezzi di produzione e riproduzione di VR, il mercato di massa ha reso accessibile una tecnologia precedentemente disponibile soltanto a pochi laboratori al mondo. La programmazione di VE e la progettazione di vari tipi di Human-Computer Interfaces (HCI) richiede un notevole sforzo economico e programmativo. Al contrario, oggi è possibile permettersi videocamere a 360º e dettagliati software per la creazione di VE a Grafica Computerizzata (CG) a basso costo, così come dispositivi di riproduzione che utilizzano uno smartphone e una cardboard box, come ad esempio Google Cardboard. Analogamente, Oculus Rift, HTC Vive o le cuffie Playstation, o quelle più recenti wireless tipo Oculus Go sono accessibili per una fetta piuttosto ampia di mercato. D'altra parte, le più importanti piattaforme mondiali di video online, da Youtube a Vimeo, stanno mettendo in circolazione video a 360º, mentre le principali compagnie tecnologiche a livello globale competono per accaparrarsi il primato sul fronte dello sviluppo di VR: Facebook ha acquisito Oculus, immagini e video a 360º nelle proprie rubriche di news, e sta mettendo a punto applicazioni per VR sui Social. In questo contesto, Microsoft si è unita alla gara comprando Altspace. Oculus, in collaborazione con la Samsung, ha sviluppato un display da indossare in testa per dispositivi cellulari (HMD) ad

altissima risoluzione grafica e prestazione di riproduzione. Sulla stessa linea, Google ha prodotto una vasta gamma di servizi e dispositivi quali Cardboard, la piattaforma Daydream, HMD Daydream View, Jump, l'attrezzatura per videocamera Gopro in grado di registrare immagini a 360º ad alta definizione, per citarne solo alcuni. Questo contesto in rapida evoluzione ci permette di comprendere come la VR si sia avvicinata al pubblico di massa.

La battage è in buona parte dovuto a questa varietà di dispositivi che ci permettono oggi di creare e godere di esperienze di VR, ma vale la pena di notare come già negli anni Ottanta molti ricercatori e scienziati informatici avessero predetto che la VR, si sarebbe sostituita all'uso dello schermo ed della tastiera - in altre parole, avrebbe prodotto uno *slittamento di realtà* (Heim, 1993). È innegabile il fatto che la VR proponga un importante cambiamento paradigmatico, visto che ora l'interfaccia ingloba completamente i nostri sensi visivi e uditivi al punto che "non capiamo più quando siamo intrappolati nelle nostre menti e nei sistemi cibernetici" (Heim, 1993, p.80). Per gli autori, questo significa trasmettere non solo i propri discorsi, ma anche la propria percezione fisica della realtà. Una trasmissione di questo tipo implica una comprensione del simbolo semiotico della VR che trascende la complessità del simbolo audiovisivo costituito dall'unione di due modalità comunicative, visuale e uditiva (Hall, 1980) e si apre alla percezione spaziale, tattile, nonché all'interazione col mondo virtuale attraverso vari generi di input dell'utente, in tempo reale. Per l'utente, varcare la soglia di questa dimensione significa affidarsi all'autore ed abbandonar visi alla sua creazione, perdendo il contatto con ciò che avviene nel mondo esterno.

L'accesso ad un medium con queste caratteristiche ci avvicina alla creazione di esperienze artificiali ordite dalla più antica forma conosciuta di astrazione: la narrazione di storie. Artisti, architetti, scrittori, musicisti, caricaturisti, programmatori, registi e così via hanno fatto esperimenti sulla duttilità della VR. Nel suo volume *Metaphysics of Virtual Reality* (1993), Michael Heim cita Jim Morrison per descriverne la portata nella resa di un'interfaccia informatica in relazione alla propria veridicità: "Ci sarà forse un giorno in cui andremo al Teatro del Clima per ricordarci la sensazione della pioggia" (p. 82). Al momento la VR mantiene ancora un certo che di prototipo; si possono vedere i pixel sullo schermo di uno

smartphone, e la definizione visiva di VE in sistemi più avanzati o la velocità interattiva uomo-macchina necessita di maggior raffinatezza. In ogni caso, il sapere che la tecnologia è in fase di sviluppo non dovrebbe inibire l'esplorazione delle potenzialità del medium al fine di espandere frontiere artistiche e narrative per quanto ci riguarda.

Allo stato attuale di tecnologia VR, il numero di artisti audiovisuali che sperimentano con questo medium è in costante aumento. Dal punto di vista della creazione artistica si pone un primo bivio: la creazione di VE in 3D o 2D CG, oppure lo sfruttamento di "immagini reali" tramite acquisizione di video 2D o 3D a 360º, detto anche *Live Action*. La seconda opzione ha naturalmente attratto in modo particolare l'attenzione di chi lavora nel campo della regia cinematografica. Il passaggio da un video tradizionale ad una regia video a 360º implica una serie di modifiche in ogni fase della produzione di un progetto video o filmico. Dalla lavorazione alla post-produzione, ma anche fin dalle fasi preliminari di produzione, il regista deve affrontare sfide di vario tipo che nascono soprattutto dalla soppressione dell'elemento "cornice". L'immagine *frameless* sembra privare gli autori di una parte rilevante del loro controllo sull'opera audiovisiva, dato che la scelta di *che cosa guardare* e *quando guardare* ricade sull'utente, mettendo alla prova la concezione tradizionale del ruolo del Regista.

Interagendo con un nuovo medium, appare ragionevole confrontarsi con metodologie già conosciute, prendendo a prestito concetti, dinamiche e strutture già utilizzate in altre forme artistiche e media consolidati. In questo modo, il cinema si avvale dei fondamenti della letteratura, della fotografia e del teatro, la televisione di quelli del cinema, la radio di quelli del teatro, così che nel corso del Ventesimo Secolo le strutture innovative proposte dal cinema e dai nuovi media hanno potuto essere *ri-mediate* (Bolter & Grusin, 2000) attraverso forme di espressione artistica ormai secolari. D'altronde, le sfide ed innovazioni introdotte da un nuovo testo artistico devono poter essere comprese tramite la sua deframmentazione e identificazione delle mediazioni che si vengono a generare a causa dei vari modi di trasmettere e di rappresentare una storia (Chatman, 1980).

Attualmente è possibile reperire su varie piattaforme di distribuzione video online, o su piattaforme VR quali Oculus Video, Samsung Video, Within or Daydream video, un grande numero di progetti narrativi realizzati con la tecnologia video a 360º, di genere documentaristico oppure narrativo. Mentre la VR si sviluppa parallelamente come campo di ricerca, sono stati coniati vari vocaboli per riferirsi ai video registrati a 360º: tra gli altri, Live Action VR, Surround Video, Immersive Video, Spatial Video e 360º Video. Nondimeno, la comparsa dei video a 360º come strumento creativo per esperienze VR ha generato dibattiti nel campo della VR. Da un lato, i puristi della VR ritengono che un video a 360º non si possa definire propriamente VR, in quanto i VE non rispondono in modo interattivo all'utente e non cambiano nel corso dell'esperienza, sottolineando i limiti del video come elemento pre-registrato. D'altra parte vi è chi sostiene che l'immortalare una realtà a 360º permette all'utente di esser posto all'interno di un luogo esistente, aumentandone il grado della sua immersione grazie al "realismo" delle immagini. Il termine Cinematic Virtual Reality (cVR) è apparso recentemente nella letteratura accademica. Con esso il video a 360º viene convalidato quale strumento per la creazione di esperienze VR, mentre la VR stessa afferma il suo collegamento con le sue radici cinematografiche, dato che la VR contemporanea "rimane pur sempre un esperimento da un punto di vista filmico" (Bolter & Grusin, 2000, p. 4).

I progetti cVR sono costituiti perlopiù da contenuti audiovisivi la cui durata non supera di norma gli otto minuti. Nonostante agli utenti sia consentito un certo grado di arbitrio all'interno del VE (cVE) cinematografico nella scelta di ciò che desiderano osservare nella sfera del campo visivo, non vi sono altri meccanismi a permettere una maggior interazione con il cVE, e di conseguenza col contesto narrativo. L'esperienza si limita alla sensazione di immersione e alla possibilità di esplorazione virtuale del cVE, ma gli utenti non dispongono di elementi interattivi che esaltino la loro esperienza, o di potere decisionale sullo sviluppo della storia. La sensazione di essere immersi nel cVE contrasta dunque con l'impossibilità per l'utente di interagire col plot narrativo.

L’aggiunta di elementi interattivi all’interno di un video a 360º consente agli utenti un maggior grado di interattività con l’esperienza virtuale, a prescindere dal fatto che l’ambiente virtuale resta ancora non modificabile. Tuttavia la creazione di una struttura interattiva con links che colleghino unità tematiche differenti o frammenti di storie, e l’incorporare svariati materiali multimediali all’interno del plot narrativo, possono generare esperienze con scelte molteplici di navigazione oltre che un elevato grado di realismo, derivante dall’estrapolazione filmata del mondo reale. Il risultato finale di un’esperienza interattiva cVR (IcVR) è rapportato al processo individuale dell’utente nel corso dell’esperienza di immersione, in relazione alle scelte compiute su *che cosa guardare* e *quando guardare*, e sul potere decisionale riguardo allo sviluppo della storia all’interno di un contesto narrativo ricco di stimoli sia di contenuto che di espressione.

I campi di applicazione dell’esperienza IcVR possono essere svariati. Una nicchia di rilievo è da vedersi nel genere documentario (installazioni museali, documentari interattivi, visite guidate in luoghi d’interesse, apprendimento in un ambiente immersivo, per citarne alcuni). Sebbene gran parte di questa ricerca si possa applicare anche a esperienze non-fiction, questa tesi però si concentra sulla creazione di una narrativa audiovisiva di fiction di tipo sia immersivo sia interattivo: la cosiddetta Interactive Fiction in Cinematic Virtual Reality (IFcVR). Questo genere di esperienza può essere definita come film di fiction interattivo di VR. Questo lavoro analizza gli aspetti teorici e pratici collegati alla creazione di un’esperienza filmica immersiva ed interattiva, includendo l’estetica dei cVR così come lo studio degli elementi narrativi ed interattivi della IFcVR, indicando la IFcVR come IDN. Per il lato pratico in particolare, lo sviluppo, la produzione e post-produzione di IFcVR è analizzata mediante la realizzazione di un prototipo di film immersivo-interattivo: “ZENA”. In conclusione viene proposto un protocollo di valutazione per l’utente, basato sull’applicazione sperimentale della valutazione del prototipo da parte dell’utente.

Quesiti di ricerca

I quesiti di ricerca alla base di questo lavoro analizzano la IFcVR come genere narrativo audiovisivo nel suo insieme, le le esperienze degli utenti e le difficoltà che gli autori devono affrontare.

In particolare, riguardo alla IFcVR nel suo insieme:

- Quali concetti teorici derivanti dal Cinema, dalla Interactive Digital Narrative e dalla Virtual Reality si mescolano nella Interactive Fiction in Cinematic Virtual Reality?
- La IFcVR costituisce un testo narrativo in grado di fornire esperienze narrative interessanti che trasmettano messaggi e storie in modo coerente?
- Si può considerare la IFcVR come Interactive Digital Narrative?

Per quanto riguarda la prospettiva dell'autore:

- Quale struttura organizzativa si presta alla creazione di un'esperienza IFcVR relativamente al suo sviluppo, produzione e post-produzione?
- In che modo l'autore può raccontare una storia ben fondata e coerente all'interno di un ambiente immersivo, mantenendo per l'utente capacità di intervento e decisionalità riguardo al corso della narrazione?

Per quanto riguarda la prospettiva dell'esperienza dell'utente:

- La IFcVR viene percepita come esperienza cinematografica o come un videogioco?
- L'utente apprezza il fatto di avere controllo decisionale sulla storia?
- Come valutare l'esperienza IFcVR sperimentata dall'utente?

Ipotesi di Ricerca

- L'analisi delle componenti narrative di una Interactive Fiction in Cinematic VR comporta un processo dinamico di *ri-mediazione* in cui Cinema, IDN e Virtual Reality, oltre ad altre forme di espressione artistica in secondo piano, trovano un punto di convergenza in una forma artistica ibrida che può essere vista in sé come Interactive Digital Narrative.

- La cattura cinematografica della realtà grazie a video a 360º come strumento di creazione di VE riprodotti da dispositivi HDM pensati per la VR, avvicina la VR al cinema. Ma, sebbene il cinema possa fornire basi teoriche e metodologiche per la produzione di Interactive cVR, occorre progettare nuove tattiche e strumenti per la sceneggiatura, pre-produzione, produzione, post-produzione e fase di valutazione, che possano rispondere alle esigenze di una IDN in cui prevale la sensazione di star *vivendo* il film anziché semplicemente *guardarlo*.

Obiettivi di Ricerca

Obiettivo Principale

Analizzare le convergenze teoriche fra Cinema, Interactive Digital Narrative (IDN) e Virtual Reality (VR), al fine di proporre metodologie e strumenti operativi per la creazione e valutazione di Film di Fiction Interattiva VR.

Obiettivi specifici

- Descrivere i cambiamenti di tipo estetico derivanti dal mettere l'utente al centro dell'opera audiovisiva attraverso lo studio delle caratteristiche della VR come medium.

- Riconoscere gli elementi narrativi portanti della IFcVR identificando analogie e differenze tra i concetti base della narrazione classica in letteratura e nel cinema da una parte, e della narrativa interattiva digitale dall'altra.

- Definire la IFcVR come testo narrativo attraverso l'identificazione delle sue componenti.

- Identificare la IFcVR come tipo di Interactive Digital Narrative (IDN), applicando le strutture di riferimento teoriche riguardo a creazione e valutazione proposte negli ultimi anni nel campo della IDN.

- Creare un prototipo di IFcVR quanto più possibile simile ad un film tradizionale nella sua struttura narrativa e di durata superiore alla maggior parte delle esperienze cVR in circolazione. Questa somiglianza permetterà di analizzare quanto esso si possa considerare un vero e proprio film.

- Proporre linee guida di sceneggiatura, pre-produzione, produzione, post-produzione e controllo mediante la realizzazione del prototipo di IFcVR.

- Valutare la User Experience della IFcVR sviluppando una metodologia specifica di valutazione basata su strumenti dalla IDN e VR.

Metodologia e Struttura della Tesi

Come descritto nella pubblicazione *Steps Towards a Unified Theory for Interactive Digital Narrative* (Koenitz et Al, 2014), molti ricercatori nel campo delle narrative interattive non solo prendono in esame i manufatti interattivi creati da artisti indipendenti o dalla grande industria, ma sono essi stessi creatori: "ne risulta un campo ricco non solo quanto a forme espressive, ma anche nelle sue prospettive teoriche" (p. 2). Pertanto questo studio si propone di seguire in ogni fase le più aggiornate strutture di riferimento che cercano un'unificazione teorica e metodologica nell'area dell'IDN. Tuttavia, in questa ricerca basata sui più recenti contesti teorici e operativi riguardo all'IDN, la IFcVR viene considerata come forma artistica a sé stante, dando la precedenza alla realizzazione di metodologie, strumenti e tecniche specifiche per sua tipicità e le sue esigenze espressive.

La tesi viene sviluppata in tre parti: un approccio epistemologico allo studio della IFcVR che prende in considerazione il cambiamento nel paradigma estetico legato al porre l'utente al centro dell'immagine in movimento, nonché l'identificazione della IFcVR quale testo

narrativo ed esempio di Interactive Digital Narrative; la seconda parte concerne il lavoro sulla IFcVR e comprende l'approccio sperimentale di questa tesi, ovvero il workflow e le strutture operative per lo sviluppo, produzione e post-produzione mediante l'elaborazione di un prototipo funzionale. La terza parte, infine, riguarda la valutazione dell'IFcVR da parte dell'utente, valutazione che fornisce basi teoriche e metodologiche per la creazione di esperienze di IFcVR. La Figura 1.1 mostra una visione d'assieme della struttura di questa tesi di dottorato. Ogni macroarea e suddivisione è illustrata qui di seguito:

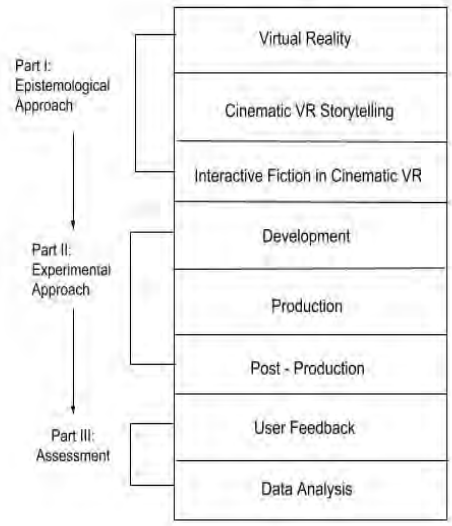


Figura 1. Visione d'insieme della metodologia e struttura della tesi di dottorato

Parte I: L'approccio epistemologico

L'approccio epistemologico analizza la natura della IFcVR in quanto forma artistica ibrida nella quale convergono l'estetica del medium VR, la ri-mediazione narratologica in ambiente cinematografico VR e l'interattività come agente di immersione narrativa e percettiva. L'oggetto di studio si focalizza dunque sulla narrativa di fiction. L'analisi si fonda su due assunti concettuali: (1) la Realtà Virtuale Interattiva Cinematografica è una forma artistica di Interactive Digital Narrative, e può quindi trovare una base teorica di creazione, esecuzione e valutazione nell'ambito di una struttura contestuale, ontologica e tassonomica di IDN; (2) la IFcVR come specifica forma artistica IDN deve elaborare una narratologia conscia del

medium con le sue proprie metodologie, tecniche e strumenti. L'approccio epistemologico è basato su tre assi teorici: estetica, narratologia e interattività.

Il Capitolo 2 intitolato "L'essere umano al centro del mondo" concerne il primo dei tre assi teorici: il cambiamento di paradigma estetico proposto dalla VR. Il medium *definitivo* è la prima macroarea a venir destrutturata, identificandone l'evoluzione e lo stato attuale, le caratteristiche come medium ed i cambiamenti che apporta al processo comunicativo, mettendo in discussione i ruoli di autore ed utente.

Il Capitolo 3, "Narrazione all'interno della Sfera", passa in rassegna gli elementi narratologici che caratterizzano la VR cinematografica. In questa macroarea si indaga la connessione esistente fra VR ed i suoi aspetti filmici, esaminando i processi di ri-mediazione che avvengono tra VR e cinema e nei quali si fondano al tempo stesso concetti di narratologia tradizionale come la Focalizzazione, il Punto di Vista e la Densità Narrativa. In questo capitolo l'indagine si incentra in modo particolare sullo studio della creazione di storie rappresentate in forma di film, prendendo in esame aspetti quali l'Aspetto Drammaturgico e la creazione del Plot Narrativo. Questo (secondo) asse fornisce le basi teoriche per una sceneggiatura consapevole della natura della VR, tenendo in considerazione i cambiamenti paradigmatici per il regista, la troupe, gli attori e la gestione della scena.

Il Capitolo 4, "Fiction Interattiva nella Realtà Virtuale Cinematografica", si occupa di Interattività e cerca una convergenza tra VR filmica, definita e destrutturata nei due capitoli precedenti, e Fiction Interattiva. Al fine di ottenere questo incontro teorico tra narrativa e medialità, l'analisi prende le mosse dall'evoluzione della IF fino al suo stato presente, differenziandola dalle altre forme di IDN. Vengono analizzate varie strutture narrative e messi in luce alcuni problemi relativi alla narrazione interattiva - in particolare, la tenuta nella tensione drammatica indipendentemente dalle scelte dell'utente, unendosi così al dibattito sulle strutture narrative di IDN e sulla necessità o meno di uno o più climax narrativi.

In quanto genere ibrido, la IFcVR genera una giustapposizione di vari media e forme narrative: la Fiction Interattiva come struttura narrativa si ritrova all'interno di un'altra forma narrativa, ossia la Realtà Virtuale Cinematografica, ed il cinema all'interno della Realtà Virtuale. Questa sovrapposizione crea varie intersezioni riscontrabili nella convergenza tra le componenti *Interattività*, *Cinema*, *Fiction* e *VR*, come illustrato dalla Figura 1.2. Analizzandone le intersezioni è possibile porre le basi metodologiche per la creazione e valutazione di Film di Fiction Interattiva VR.

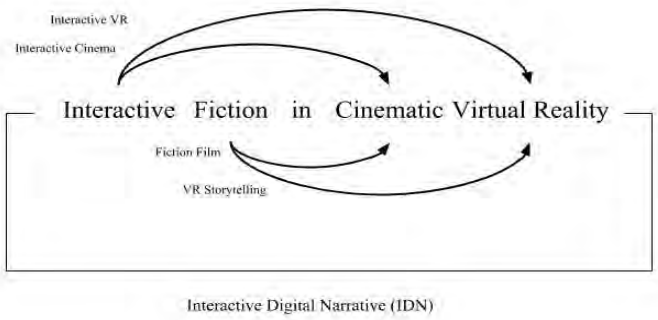


Figura 2. Intersezioni tra Fiction Interattiva e Realtà Virtuale Cinematografica

- Interattività + Fiction = Fiction Interattiva
- Interattività + Cinema = Cinema Interattivo
- Interattività + VR = Esperienze di VR Interattiva
- Cinema + VR = VR Cinematografica
- Fiction + Cinema = Film di Fiction
- Fiction + VR = Narrazione VR di Fiction

Parte II: Creazione della IFcVR

Come regista, era per me impossibile portare avanti un'analisi teorica senza applicazioni pratiche e senza il coinvolgimento di utenti potenziali. Il mio obiettivo è di chiudere il cerchio per cui la teoria mette le basi per la realizzazione pratica, l'opera d'arte viene utilizzata e valutata da un pubblico eterogeneo e la sua risposta va a rafforzare la teoria di partenza. Questa tesi si occupa del testo narrativo dal punto di vista dell'autore, pertanto la seconda parte concerne sviluppo, pre-produzione, produzione e post-produzione di un progetto di IFcVR.

Il Capitolo 5, “Sviluppo e Pre-Produzione”, inizia dall’analisi del carattere tecnologico del prototipo di IFcVR, e sfrutta come base un modello di *Protostoria* per la progettazione di una IDN. Per quanto riguarda il progetto narrativo della IFcVR, ho proposto un framework specifico per la sceneggiatura dello script interattivo, tratto dal paradigma filmico di Syd Field (Field, 2005) e da classiche strutture narrative di interattività tipo il Viaggio dell’Eroe (Campbell, 2009) come modello per diversificare scene e percorsi di navigazione, creando al tempo stesso autoimmedesimazione con il personaggio dell’eroe.

Raccontare una storia interattiva mediante immagini a 360º è, innanzitutto, un processo creativo. Durante l’elaborazione del copione vengono esaminate le basi teoriche narratologiche descritte nel Capitolo 3, costruendo ogni scena come un esperimento narrativo: sia dal punto di vista della modalità narrativa di una storia interattiva in un ambiente a 360º (cambiamenti di prospettiva, movimento e posizione dei personaggi sulla scena, collegamento tra luoghi-chiave rispetto al plot narrativo, uso di dialogo, ellissi, etc.) sia dal punto di vista tecnico (altezza e posizionamento della telecamera e dei microfoni sulla scena, posizione dei luoghi-chiave, impiego del bianco e nero, telecamera in movimento, etc.)

Nel Capitolo 6, “Produzione”, vengono testati il copione e lo script di ripresa nel corso della realizzazione filmica del prototipo, fornendo importanti lezioni sulla gestione della scena e sul ruolo del regista, degli attori e della troupe. In questo capitolo sono analizzati diversi tipi di inquadratura a 360º e vengono proposte alcune linee guida per la creazione di esperienze IFcVR.

Infine nel Capitolo 7, “Post-Produzione”, il materiale girato viene portato in sala montaggio e ha inizio la fase di post-produzione del video a 360º e quindi l’assemblaggio della struttura interattiva. Esattamente come avviene nel cinema, è il processo di post-produzione che mette in luce eventuali errori compiuti nelle fasi precedenti, a livello sia di sceneggiatura sia di ripresa, e al tempo stesso pone problemi legati alla realizzazione dell’esperienza interattiva:

la progettazione audiovisiva dei luoghi-chiave, il tempo di scelta lasciato all'utente nei confronti di un prodotto filmato in precedenza, la fluidità nei tagli all'interno di una stessa scena o fra scene diverse.

ZENA: Un Film Interattivo Immersivo ambientato a Genova

ZENA è un Film Interattivo VR ambientato in Italia, a Genova. La vicenda si svolge in un ambiente a 360º creato grazie a riprese ad alta definizione con questa tecnologia. L'obiettivo principale di ZENA è quello di collocare una narrazione interattiva in un ambiente a 360º fruibile mediante un dispositivo HMD, al fine di creare un'esperienza interattiva VR analoga all'hyperfiction nella quale l'utente possa riconfigurare frammenti narrativi in combinazioni diverse (Ryan, 2009), ponendosi tra un ruolo di ricezione passiva (come avviene al cinema) ed un ruolo decisamente più partecipativo (come nei videogame). In ZENA gli utenti prendono attivamente parte alla narrazione intervenendo in modo attivo sulla storia: possono decidere che direzione prendere all'interno di una struttura tipo Labirinto (Ryan, 2015), se accettare oppure ignorare i consigli di alcuni personaggi, o accedere ad informazioni addizionali che contribuiscono alla comprensione della storia.

La struttura narrativa si ispira al dedalo di vicoli nel centro storico di Genova. ZENA ("Genova" nel dialetto locale) è stato girato nel centro storico (Città Vecchia) del capoluogo ligure, sito architettonico protetto e luogo ideale per riprese a 360º: gli alti palazzi invitano costantemente i visitatori ad alzare lo sguardo per osservare un antico affresco, o magari per salutare qualcuno che stende la biancheria fuori dalla finestra. Le scene del film, che si snodano tra i vicoli ed alcuni importanti palazzi della Città Vecchia, mostrano per la prima volta questi luoghi in VR.

ZENA costituisce la parte sperimentale di questa ricerca ed è il risultato del lavoro di una persona alle prese con le fasi di elaborazione, produzione e montaggio del prodotto finale. Nel processo di produzione il progetto ha visto la partecipazione di una squadra di otto persone tra attori e troupe, alcune con precedenti esperienze di realizzazioni filmiche, teatrali

o narrative, altre digiune in questi campi ma motivate dall'obiettivo del progetto. Analogamente, per ZENA non erano disponibili i fondi necessari per creare un video di qualità commerciale, o per coinvolgere un team di professionisti per la realizzazione tecnica. In particolare, si è sentita fortemente la mancanza di un fonico esperto nelle fasi di ripresa e post-produzione dell'audio a 360º. Ma se da un lato la mancanza di risorse economiche, materiali ed umane al fine di realizzare un livello qualitativo più alto può vedersi come un punto debole del progetto, da un altro le conclusioni presentate in questa tesi offrono a qualunque regista la possibilità di creare un'esperienza di questo tipo a basso costo.

Parte III: L'Esperienza dell'Utente nella IFcVR

In quest'ultima sezione vengono affrontati i quesiti principali di questa ricerca: la IFcVR può essere considerata come un'esperienza divertente in grado di trasmettere storie in modo coerente? Assomiglia di più ad un'esperienza cinematografica o a un videogame? Per rispondere a queste domande, la terza parte della tesi elabora una metodologia di valutazione dell'esperienza IFcVR da parte dell'utente (UX). Infatti, sebbene questa tesi si focalizzi sulle basi teoriche e metodologiche per la realizzazione di un'esperienza a metà strada fra film e racconto interattivo, come prodotto audiovisivo è pensato per essere usato dal pubblico; per questo motivo, ho deciso di creare una storia che possa risultare accattivante per un'audience di età dagli otto ai 100 anni, dal momento che, al di là del contenuto della storia in sé, si è cercato di far sì che tanto la narrazione quanto la tecnologia interattiva scorressero in modo fluido, arrivando ad un climax che invita l'utente a compiere *nuovamente* l'esperienza.

Nel Capitolo 8 intitolato "L'Esperienza di IFcVR dell'Utente" viene proposto un protocollo completo di valutazione al fine di stimare l'esperienza di ZENA da parte dell'utente. In quanto prodotto ibrido, la metodologia di valutazione fonde due aspetti teorici per analizzare criticamente i due assi della Interactive Fiction e della Cinematic Virtual Reality:

- Valutazione sulla Virtual Reality
- Valutazione sulla Interactive Digital Narrative

Questa indagine si muove su un territorio ancora vergine alla ricerca di un dialogo tra forme artistiche e media, cercando di fornire basi concettuali e metodologiche per la creazione di IFcVR. Pertanto, le proposte teoriche e le metodologie (inclusi il workflow di produzione e post-produzione, e gli strumenti di valutazione) sono parte di un approccio che contempla l'analisi dei dati per elaborare nuove ipotesi e conclusioni non preventivabili in fase iniziale. Questa è un'ulteriore motivazione per cercare un feedback da parte dell'utente, che permetta di trarre conclusioni basate sull'esperienza e sul gradimento dell'IFcVR.

Conclusioni

In questa tesi presento la Interactive Fiction in Cinematic Virtual Reality (IFcVR): un testo narrativo ibrido che si pone alla convergenza tra Interactive Digital Narrative (IDN), narrativa interattiva mediata dal computer, e Cinematic VR (cVR), la creazione di esperienze virtuali grazie a riprese video effettuate con la tecnologia a 360º. Nella IFcVR l'utente si trova immerso all'interno del film grazie all'uso di un dispositivo HMD ed è in grado di cambiare il corso della storia con le proprie decisioni, consce o inconsce. La risposta positive degli utenti alla loro esperienza con ZENA, permette di concepire la IFcVR come un'esperienza narrativa che non solo intrattiene le persone, ma che è anche capace di trasmettere diversi tipi di messaggi in diversi tipi di applicazioni. Così come il cinema sviluppò un percorso che lo portò successivamente alla produzione del suo prodotto principale, il lungometraggio, allo stesso modo l'ibrido proposto in questa tesi potrebbe diventare uno dei principali formati della narrativa immersiva fatta attraverso la cattura della realtà, e interattivizzata con diversi tipi di *human computer interfaces*. La IFcVR potrebbe quindi rappresentare uno degli approcci embrionali alla creazione di esperienze artificiali che, in un futuro non tanto remoto, renderanno tangibile la divisione completa tra realtà fisica e mentale.

Appendix 3. Resumen en Español

Ficción Interactiva en la Realidad Virtual Cinematográfica: Epistemología, Creación y Evaluación

Premisa

Desde sus inicios, el desarrollo del mundo digital ha seducido artistas y escritores a narrar historias y transmitir sus percepciones del mundo a través de un medio que permite la convergencia de varios tipos de lenguajes y formas artísticas, y que necesita de la interacción del usuario para ser decodificado. Esta interacción entre usuario y obra de arte modifica la lógica de la obra artística como un *output* fijo (Koenitz, 2017), situando el proceso de interacción en el centro de la experiencia estética. Hypertexto, hypermedia, multimedia o cyber art son sólo algunos términos que hacen referencia a un contenido artístico digital que desfragmenta sus componentes, para que sea el usuario quien les organice en una experiencia linear.

El deseo del autor de exponer sus ideas, historias e impresiones del mundo en pequeñas unidades, de manera explícita y sin una organización aparente, no es una novedad. Si bien el soporte digital permite tanto al autor como al usuario manipular la obra de arte a través de la misma interfaz, ya en el pasado, diversos autores crearon narrativas interactivas, en la literatura, el teatro o el cine de manera analógica. En cada medio, las narraciones interactivas presentan estructuras distintas, distintas modalidades de interactuar y organizar los componentes del texto artístico, y distintos niveles de interacción para el usuario. Todas, sin embargo, comparten el mismo espíritu: liberar la narración de una única modalidad de recepción.

Extraer de nuestras mentes y corazones lo que queremos expresar no es una tarea sencilla. En nosotros, el mensaje se presenta como un caos de palabras, imágenes, colores, formas y signos que necesitan una sintaxis y un código para ser transmitidos, y sólo cuando nos sentamos frente al papel en blanco, el lienzo limpio, o la pantalla vacía, empezamos ese arduo proceso de expresar el contenido conjugando sustancia y forma. El computador permite al autor concentrar en un mismo dispositivo, pero de manera separada, sus ideas digitalmente codificadas en diferentes formatos. Rápidamente, el computador adquirió dos facetas dentro del acto artístico: crear y manifestar. El proceso de creación, o el ensamblaje de distintos componentes del texto artístico es realizado a través del computador, sucesivamente el computador reproduce el texto artístico, y finalmente la narrativa es re-creada por los interactores cuando inician a trazar su propio camino en ese bosque textual que es el reflejo de la mente del autor.

El autor crea un universo aparentemente caótico y desordenado, cuyos componentes están conectados entre sí, y es en esas conexiones, especialmente en su multiplicidad, que el significado reside: la experiencia yace en las alternativas de navegación, mientras que la generación de significado surge de las conexiones que encontramos entre contenidos que a primera vista parecen desconectados. “Una buena narración es una invitación a encontrar problemas, no una lección en resolución de problemas. En su esencia, se trata del apuro, de las situaciones problemáticas, del camino, y no sobre la posada o destinación a la que conduce” (Bruner, 2003, p.20). Ted Nelson, en su libro *Literary Machines,* se refiere al hipertexto no como “otro tipo de estructura escondida”, sino de la reunificación y reorganización de varios tipos de textos electrónicos. Hoy en día, internet ha permitido que esta reunificación de los más diversos textos electrónicos pueda ser decodificada por un usuario sentado frente a un terminal en cualquier parte del mundo, re-codificada por él mismo, esta vez como autor, y subida a la nube para recomenzar de nuevo este ciclo infinito.

El hipertexto puede ser fácilmente implementado a través de medios electrónicos, y permite crear una estructura no-secuencial en la cual está organizado el contenido (Nelson, 1987, p.15). Este contenido puede ser narrativo o no narrativo, ficcional o documental. Es así como

nace la Hyperficción o Ficción Interactiva (IF por sus siglas en inglés). El medio digital permite también el desarrollo y la proliferación de narrativas audiovisuales interactivas, como el video interactivo (IV), el documentario web (Webdoc), o los Videojuegos narrativos (NG), e incluso sistemas más complejos, como el Drama Interactivo (ID) (Szilas, 1999), narrativas ejecutadas por sistemas basados en la Inteligencia Artificial (AI) y transmitidas a través de una diversa variedad de interfaces. Esta última categoría de narrativas interactivas es conocida también como Tecnologías de Narrativas Inteligentes (INT) (Riedl & Bulitko, 2012). Por muchos años, las narrativas mediadas por el computador se han conocido como Interactive Digital Storytelling (IDS) o más sencillamente como Interactive Storytelling (IS). Sin embargo, como nota Nick Montfort en la introducción que hace al volumen *Interactive Digital Narrative: History, Theory and Practice* (Koenitz et al, 2017), los teóricos más importantes en la materia, han optado en los últimos años por utilizar el término Interactive Digital Narratives (IDN), para denominar un vasto espectro de formas artísticas y tecnologías.

Una de las tecnologías que durante el siglo XX ha tratado de materializar el sueño humano de crear y vivir en nuevas realidades, es la Realidad Virtual (VR). VR lleva la cognición humana fuera de la materialidad de la realidad física para transportarla a un tiempo-espacio mediado por el computador que no remplaza la realidad física, sino que ofrece una realidad nueva y única en sí misma, conectando los sentidos del usuario al ambiente digital. La VR como medio, permite que distintos tipos de actividades humanas (comunicativas, sociales, educativas, artísticas, entre otras) se desarrollen al interno de una *neo-realidad* (Diodato, 2005) que concierne la dimensión experiencial del ser humano. En marzo de 2015, Chris Milk, se refirió hacia la realidad virtual como "el medio último, pues mientras en otros medios la conciencia interpreta el medio, en la VR la conciencia es el medio". Como un medio primariamente audiovisual, la VR da un paso más hacia la ruptura, esta vez total, de la cuarta pared. Este proceso de romper con la cuarta pared se logra con éxito durante la segunda mitad del siglo pasado en el cine, el teatro contemporáneo y el video musical, sin embargo, la VR lo logra por completo al encapsular la capacidad cognitiva del interactor a través de imagen y sonido, mientras que la investigación en tecnología avanza en el desarrollo

de interafaces que conecten las emociones humanas y los movimientos corporales del usuario con esta neo-realidad. De este modo la realidad virtual, a diferencia de otros medios, crea un tipo de comunicación que va de conciencia a conciencia, lo que Jaron Lanier llama "la comunicación post-simbólica" (2010). Ya no hablamos de contar historias o discursos, sino de crear experiencias multisensoriales. Nos acercamos desde el punto de vista de la creación, a la construcción de experiencias artificiales que son reales en apariencia. Hasta ahora, sólo a través de estados alterados de conciencia y el sueño (no es una coincidencia que Google haya nombrado su dependencia para la VR "Daydream") hemos logrado atenuar casi hasta su desaparición, la línea entre la realidad física y la realidad cognitiva. A través de la VR, esta atenuación entre ambas realidades se concretiza: entre más tiempo pasamos en el ambiente virtual (VE) que nos propone un autor, más orgánico y natural este se vuelve para nuestros cerebros: entre más realística la interfaz, mayor es la inmersión y menor la incredulidad; entre más avanzada la tecnología, mejores serán las representaciones gráficas y auditivas, más rápidas e inteligentes las interacciones con el VE y sus agentes, y posible la inmersión a cuerpo entero (Sra & Schmandt, 2015).

Desde sus inicios, la VR ha generado un fuerte interés interdisciplinario que busca comprender el medio, su lenguaje, sus formas de producción y reproducción, y sus posibles aplicaciones en diversos ámbitos. Sin embargo, a diferencia de la radio, el cine, la televisión o internet, el gran público no ha logrado adoptar, manipular y apropiarse de este medio, aunque desde hace 60 años la realidad virtual se encuentre a la vuelta de la esquina. En este sentido, es muy poco lo que conocemos sobre las motivaciones, los usos y las gratificaciones que los pocos usuarios de la VR encuentran en este medio. Mientras escribo este documento, en 2018, estamos ya viviendo un fuerte descenso del entusiasmo que ha causado la realidad virtual en los últimos cinco años. Desde 2013, con los bajos precios de los equipos de producción y reproducción de la VR, el mercado masivo ha tenido acceso a una tecnología que por décadas se encontraba sólo al alcance de pocos laboratorios en el mundo. En efecto, la programación de un ambiente virtual, así como el diseño y producción de cualquier tipo de Human-Computer Interface (HCI) requiere un numeroso grupo de ingenieros e investigadores, así como altas sumas de dinero. Hoy en cambio, es posible adquirir cámaras

de video a 360º, softwares con exhaustiva documentación para la creación de ambientes virtuales con gráfica computarizada, así como dispositivos para la reproducción que sólo necesitan un Smartphone y un visor de cartón como el Google Cardboard. Del mismo modo, los heatsets de Oculus Rift, HTC Vive, o PlayStation, así como el heatset standalone de Oculus Go, pueden ser adquiridos por un segmento de mercado bastante amplio. Por otra parte, las más importantes plataformas de distribución de video online, Youtube y Vimeo, empezaron a distribuir también videos a 360º, mientras que grandes compañías tecnológicas compiten por el primer lugar en el desarrollo de la VR: Facebook compró Oculus, integró el visionado de fotografías y video a 360º en el muro del usuario, y se está desarrollando aplicaciones para la VR social. En esta área, Microsoft se ha unido a la carrera comprando AltSpace. Oculus, en partnership con Samsung, desarrolló un head mounted display (HMD) para dispositivos móviles con la mejor calidad gráfica y de ejecución. Google por su parte ha desarrollado una vasta variedad de servicios y dispositivos como la Cardboard, la plataforma Daydream, el HMD Daydream View, o JUMP, el soporte para videocámaras GoPro para la grabación de imágenes y videos a 360º de altísima calidad, entre otros. Este panorama en constante evolución nos permite ver lo cercana que la realidad virtual se encuentra del público masivo.

El entusiasmo se debe en gran medida a todas estas facilidades que hoy tenemos para crear y reproducir experiencias en VR, sin embargo, vale la pena recordar que ya en la década de los 80's un gran segmento de investigadores e ingenieros informáticos predijeron el alcance de la VR como la plataforma dentro de las tecnologías de la información (IT) que habría remplazado el sentarse frente a una pantalla y un teclado, en otras palabras, habría traído consigo un cambio de realidad *reality shift* (Heim, 1993). En efecto, la VR propone un importante cambio de paradigma, ya que su interfaz encierra por completo la visión y el oído, hasta el punto en el que "no logramos reconocer cuando estamos atrapados en nuestras mentes, y cuando estamos atrapados en un cyber sistema" (Heim, 1993, p.80). Para los autores de experiencias en VR, esto significa transmitir no sólo sus discursos, sino sus percepciones físicas de la realidad. Transmitir la realidad necesita entonces una comprensión de signo semiótico de la VR, que trasciende la complejidad del signo audiovisual compuesto

por la combinación de dos tipos de discurso, visual y auditivo (Hall, 1980), y se abre paso hacia la percepción espacial, la estimulación háptica, y la interacción con el universo narrativo a través de distintos tipos de inputs en tiempo real, conscientes o inconscientes de parte del interactor. Para los interactores, esta puerta hacia otra dimensión significa confiar en el autor y abandonarse a sí mismos a la experiencia, perdiendo la conexión con lo que sucede fuera del ambiente virtual.

Tener acceso a un medio con estas características nos acerca a la creación de experiencias artificiales tejidas por la forma más antigua de inmersión: contar historias. Artistas, arquitectos, escritores, músicos, caricaturistas, programadores, realizadores audiovisuales, etc, han inciado a experimentar con la plasticidad de la VR. En su libro *Metaphysics of Virtual Reality* (1993), Michael Heim cita a Jim Morrison para describir el alcance que puede llegar a tener una interfaz tecnológica en la búsqueda de su propia verdad: “Puede que en algún momento asistamos al Teatro del Clima para recordar la sensación de lluvia” (p.82). En la actualidad, la realidad virtual aún conserva una cierta sensación de prototipo: cuando se usa un teléfono inteligente, es posible ver los píxeles en la pantalla, en sistemas más avanzados la calidad visual de las VEs o la velocidad de la interacción persona-máquina aún deben mejorar. Sin embargo, sabiendo que la tecnología está en desarrollo y que estos límites probablemente se superarán pronto, la exploración de las capacidades del medio no se debe detener para expandir las fronteras del arte y la narración.

En el estado actual de la tecnología VR, el número de artistas visuales que experimentan con el medio aumenta constantemente. Desde el punto de vista de la creación artística, surge una primera encrucijada: entre la creación de VEs a través de 3D o 2D CG, y el uso de "imágenes reales" a través de la adquisición de videos 2D o 3D 360º, también llamados Acción en vivo (Live action). Naturalmente, la adquisición de video a 360º ha llamado la atención de aquellos que provienen del campo de la cinematografía. El cambio de la captura de video tradicional, al video 360º implica una serie de cambios en todas las etapas de la producción de un proyecto de video o una película. Desde el desarrollo hasta la postproducción, pasando por la preproducción y producción, el cineasta se enfrenta a diferentes desafíos que surgen

principalmente de la eliminación del plano. La imagen sin plano pareciera eliminar una gran parte del control del autor sobre el trabajo audiovisual, porque se concede al interactor el *qué ver* y *cuándo verlo*, lo que amenaza la concepción tradicional del rol del Director.

En presencia de un nuevo medio, resulta natural emplear metodologías conocidas, tomar conceptos prestados, dinámicas y estructuras que se han utilizado en otras formas artísticas o medios ya consolidados. Sergei Eisenstein (1977) señala que "el cine no es huérfano de padres y sin pedigrí, sin un pasado, sin las tradiciones y el rico patrimonio cultural de épocas pasadas" (p. 232). De la misma manera, no podemos ver un nuevo medio o forma artística como un artefacto aislado. El cine encuentra fundamentos en la literatura, la fotografía y el teatro, la televisión en el cine, la radio en el teatro; durante el siglo XX, las estructuras innovadoras propuestas por el cine y los nuevos medios lograron también ser re-mediadas (Bolter & Grusin, 2000) en formas artísticas con existencias seculares. Sin embargo, los desafíos y las novedades que propone un nuevo texto artístico deben entenderse mediante la desfragmentación de su naturaleza, identificando las intermediaciones que se generan entre las diferentes formas de transmitir una historia y las diferentes formas de representarla (Chatman, 1980).

Actualmente, en las diferentes plataformas de distribución de video en línea, o en plataformas de realidad virtual como Oculus Video, Samsung Video, Within o Daydream video, es posible encontrar un gran número de proyectos narrativos realizados con video a 360º, documentalista o de ficción. Desde la academia y la investigación, se han utilizado diversos términos para referirse al video grabado a 360º: live action VR, video surround, video inmersivo, video espacial o video 360º, entre otros. Sin embargo, la aparición del video a 360º como herramienta para crear experiencias virtuales ha generado controversia dentro del campo de la realidad virtual. Por un lado, los puristas de la VR sostienen que el video 360º no es exactamente VR, ya que el VE no reacciona a la interacción del usuario y no cambia durante la ejecución de la experiencia, enfatizando los límites del video como un elemento ya grabado. Por otro lado, hay quienes afirman que la captura de la realidad a 360º permite a los interactores ubicarse en lugares existentes, aumentando su nivel de inmersión debido al

realismo naturalista de la imagen. Recientemente, el término Cinematic Virtual Reality (cVR) ha aparecido en la literatura académica. Al usar este término, el video de 360º se legitima como una herramienta para la creación de experiencias de realidad virtual, y la realidad virtual a su vez mantiene una conexión con sus raíces cinematográficas, ya que la realidad virtual puede entender como "un experimento desde el punto de vista cinematográfico" (Bolter & Grusin, 2000, p. 4).

Los proyectos de cVR son principalmente contenidos audiovisuales cuya duración generalmente no excede los ocho minutos. Aunque los interactores tienen un cierto nivel de autonomía dentro del VE cinematográfico (cVE) pues deciden qué desean observar dentro de la esfera visual, no hay otros mecanismos que les permitan un mayor nivel de interacción con el cVE y, por lo tanto, con el texto narrativo. La experiencia se limita a la sensación de inmersión y a la posibilidad de explorar visualmente el cVE. En este tipo de experiencias, los interactores no tienen elementos interactivos que enriquezcan la experiencia o que les otorgue poder de decisión sobre el desarrollo de la historia. La sensación de estar inmerso en el cVE contrasta entonces con la incapacidad del usuario para interactuar con el universo narrativo.

A pesar de que el entorno virtual no es modificable, añadir elementos interactivos a un video a 360º permite a los interactores tener un mayor grado de interacción con la experiencia virtual y ayuda la narrativa a avanzar en el tiempo (Vosmeer et al, 2015). La creación de una estructura interactiva, con enlaces que conectan diferentes unidades temáticas o *story beats*, y la incorporación de diversos materiales multimedia dentro del ambiente virtual, pueden generar experiencias con múltiples alternativas de navegación además de un alto grado de realismo, como resultado de la captura de la realidad. El resultado final de una experiencia cVR interactiva (IcVR) se basa en el proceso individual del interactor durante la experiencia inmersiva: el interactor que elige qué ver y cuándo ver y que tiene poder de decisión sobre el desarrollo de la historia dentro de un universo narrativo rico en contenido y estímulos.

Los campos de aplicación de las experiencias de VR pueden ser muy variados: desde el periodismo (Hopkins, 2017), hasta las aplicaciones militares (Lele, 2013; Rizzo, 2005). En

este espectro, existe un nicho importante para la cVR interactiva, sean documentales o no-ficcionales (eventos live, instalaciones de museos, documentales interactivos, visitas guiadas en lugares de interés, aprendizaje inmersivo, entre otros). Aunque la mayor parte de esta investigación puede aplicarse a experiencias cVR no-ficcionales, esta tesis se centra en la creación de narrativas audiovisuales de ficción que son a la vez inmersivas e interactivas, es decir la ficción interactiva en la realidad virtual cinematográfica (IFcVR). Este tipo de experiencias pueden entenderse también como películas de ficción interactivas e inmersivas.

Este trabajo analiza la teoría y la práctica necesarias para crear una experiencia cinematográfica inmersiva e interactiva, que comprende la estética de la cVR como el estudio de los elementos narrativos e interactivos de la IFcVR, comprendiendo la IFcVR como una Narrativa Interactiva Digital (IDN). En lo que respecta a la experimentación, el desarrollo, la producción y la postproducción de la IFcVR se han estudiado en esta tesis a través de la realización de un prototipo de película interactiva inmersiva titulada "ZENA". Finalmente, se propone un protocolo de evaluación de la experiencia del usuario, desarrollado a través de su aplicación piloto en la evaluación del prototipo.

Preguntas de investigación

Las preguntas de investigación que guían este trabajo consideran la IFcVR como un género narrativo audiovisual en su conjunto y abordan los desafíos que plantea al autor y a la experiencia del usuario.

Respecto a la IFcVR en su conjunto:

1. ¿Qué conceptos teóricos del cine, la narrativa digital interactiva y la realidad virtual se fusionan en la ficción interactiva en la realidad virtual cinematográfica?
2. ¿Es la IFcVR un texto narrativo capaz de proporcionar experiencias narrativas entretenidas, capaces de transmitir mensajes e historias coherentes?
3. ¿Se puede considerar la IFcVR una narrativa digital interactiva?

Desde el punto de vista del autor:

1. ¿Qué métodos para el desarrollo, la producción y la postproducción se pueden utilizar para crear una experiencia IFcVR?
2. ¿Cómo puede el creador narrar una historia sólida y coherente dentro de un entorno inmersivo, dejando al interactor el poder decisional sobre el flujo de la historia?

Desde el punto de vista de la experiencia del usuario:

1. ¿La IFcVR es percibida por le interactor como una experiencia fílmica o como un videojuego?
2. ¿Disfruta el interactor del tener poder de decisión sobre la historia?
3. ¿Cómo se puede evaluar la experiencia del usuario de la IFcVR?

Hipótesis de la investigación

1. El análisis de los componentes narrativos de la ficción interactiva en la realidad virtual cinematográfica lleva a una dinámica de re-mediación en la que el cine, las IDNs y la realidad virtual, como otras formas artísticas de fondo, encuentran un punto de convergencia en una forma de arte híbrida que se puede considerar una narrativa digital interactiva.

2. La captura de la realidad, a través del video a 360º, como método para crear VEs que son reproducidos en un HDM para VR, acerca la realidad virtual al cine. Sin embargo, a pesar de que el cine ofrece una base teórica y metodológica para la creación de cVR interactivo, nuevos métodos y herramientas para la escritura de guiones, la preproducción, la producción, la postproducción y la evaluación deben diseñarse para responder a las necesidades específicas de una narrativa digital interactiva. Donde la sensación de *vivir* la película prevalece sobre el ser espectadores.

Objetivos de la investigación

Objetivo principal

Analizar la convergencia teórica entre cine, narrativa digital interactiva (IDN) y realidad virtual (VR), para proponer métodos y herramientas para la creación y evaluación de películas de ficción interactivas e inmersivas.

Objetivos específicos

1. Describir el cambio estético que presupone situar el receptor al centro de la obra audiovisual, a través del estudio de las características de la realidad virtual como medio.
2. Reconocer los elementos narrativos de la IFcVR mediante el reconocimiento de similitudes y diferencias entre conceptos narratológicos en la literatura, el cine, y la narrativa digital interactiva.
3. Definir la IFcVR como texto narrativo identificando sus componentes.
4. Identificar la IFcVR como una narrativa digital interactiva (IDN) mediante la aplicación de los marcos teóricos de creación y evaluación propuestos en el campo de las IDNs en la última década.
5. Crear un prototipo de IFcVR, que logre asemejarse a una película con una estructura narrativa clásica, y con una duración superior a la mayoría de las experiencias de VR. Esta similitud nos permitirá analizar cuánto la IFcVR puede considerarse una película.
6. Proponer pautas para la escritura de guiones, la preproducción, la producción, y la postproducción, mediante la producción de un prototipo de IFcVR.
7. Evaluar la experiencia del usuario del prototipo IFcVR mediante el desarrollo de una herramienta de evaluación específica basada en las herramientas de evaluación de IDN y VR.

Metodología y estructura de la tesis.

Como se describe en el artículo *Steps Towards a Unified Theory for Interactive Digital Narrative* (Koenitz et Al, 2014), existen investigadores de las IDNs que no solo trabajan en el análisis de artefactos interactivos creados por artistas independientes o grandes industrias, sino que también son creadores: "el resultado es un campo no solo rico en formas expresivas, sino también en perspectivas teóricas" (p. 2). Por ende, este estudio sigue, durante todas sus etapas, los últimos referentes que buscan una unificación teórica y metodológica en el campo de las IDNs. Si bien esta investigación se basa en teorías y metodologías propuestas por el ámbito de las narrativas interactivas, la IFcVR es propuesta como una forma artística en sí misma, dando paso a la creación de metodologías, instrumentos y técnicas específicas dadas su naturaleza y necesidades expresivas.

La tesis se desarrolla en tres partes: en primer lugar, un enfoque epistemológico para el estudio de la IFcVR, que toma en consideración el cambio del paradigma estético al poner al usuario en el centro de la imagen en movimiento; la identificación de la IFcVR como texto narrativo y sucesivamente como narrativa digital interactiva. La segunda parte de la tesis se refiere a la creación de la IFcVR, y comprende el enfoque experimental de este trabajo, es decir, el flujo de trabajo y los métodos para el desarrollo, la producción y la postproducción, a través de la creación de un prototipo funcional. La tercera parte se refiere a la evaluación del usuario. Esta evaluación final del usuario aporta al robustecimiento de una base teórica y metodológica para la creación de experiencias de IFcVR. La figura 1 muestra una visión general de la estructura de la tesis doctoral. Todas las áreas macro y subdivisiones se explican a continuación.

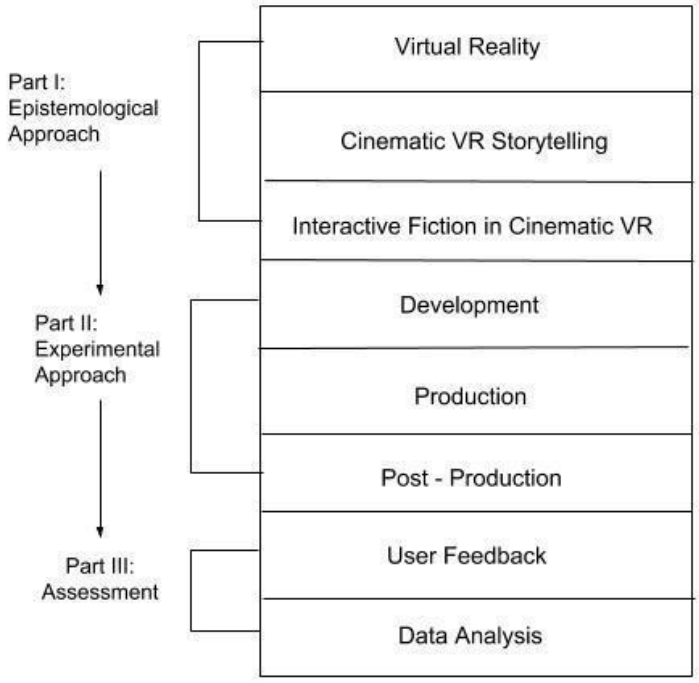


Figure 1. Estructura de la tesis doctoral.

Parte I: El enfoque epistemológico

El enfoque epistemológico analiza la naturaleza de la IFcVR como una forma de arte híbrida en la que se combinan varios componentes: la estética del medio VR, la re-mediación de la narratología en el ámbito de la VR cinematográfica y la interactividad como promotor de la inmersión, tanto narrativa y como perceptiva, concentrando el objeto de estudio en la narrativa de ficción. El análisis epistemológico se basa en tres ejes teóricos: estética, narratología e interactividad, y se desarrolla a partir de dos supuestos conceptuales: (1) La realidad virtual cinematográfica interactiva es una forma de arte dentro de las narrativa digitales interactivas y, por lo tanto, puede encontrar un fundamento teórico para su creación, práctica y evaluación, en la ontología, taxonomía y marcos teóricos de las IDN; (2) La IFcVR como una forma de arte específica, debe desarrollar una narratología consciente de su medio, con sus métodos, técnicas e instrumentos propios.

El Capítulo 2 “Human at the Center of the *Story* World: IFcVR Aesthetic Notions”, se refiere al primer eje teórico: el cambio de paradigma estético que propone la realidad virtual. El “último medio” es la primera área macro que se deconstruye, identificando su evolución y su estado actual, sus características como medio y los cambios que genera en el proceso de comunicación, indagando en el rol del autor y el rol del usuario.

El capítulo 3 “The (Film) Form of Cinematic Virtual Reality”, comprende los elementos narratológicos que caracterizan a la VR cinematográfica. En el capítulo se desarrolla la conexión que existe entre la realidad virtual y su aspecto cinematográfico, analizando los procesos de re-mediación que tienen lugar entre la realidad virtual y el cine, y en los que se basan, simultáneamente, conceptos de la narratología clásica como Focalización, Punto de vista, y Densidad Narrativa. El estudio se enfoca especialmente en el estudio de la narración de ficción, teniendo en cuenta aspectos como el drama y la creación del universo narrativo. Este eje proporciona la base teórica para la escritura de un guion que es consciente de la naturaleza de la realidad virtual, y que tiene en cuenta el cambio de paradigma para el director, el equipo, los actores y el manejo del escenario.

El capítulo 4, “Interactive Fiction in Cinematic Virtual Reality”, tiene su foco en la interactividad. Este capítulo desarrolla la convergencia entre la VR cinematográfica, deconstruida y definida en los dos capítulos precedentes, con la Ficción Interactiva (IF). Para lograr una convergencia teórica entre estas formas narrativas y mediáticas, el estudio comienza a partir de la evolución de la IF y su estado actual, diferenciándolo de otras formas de IDN. Se estudian diferentes estructuras narrativas y se abordan algunos problemas relacionados con la narración interactiva, en particular la consistencia de una tensión dramática que es independiente de las elecciones del usuario, este último aspecto busca aportar a la discusión sobre las estructuras narrativas en IDN, y a la necesidad de crear un clímax o varios clímax.

Como género híbrido, la IFcVR genera una yuxtaposición de varios medios y formas narrativas: la ficción interactiva, como estructura narrativa, está contenida en otra forma narrativa, que es la realidad virtual cinematográfica, y el cine está contenido en la realidad virtual. Esta yuxtaposición genera varias intersecciones que se pueden encontrar en la convergencia entre los componentes Interactividad, Cine, Ficción y VR, como se muestra en la Figura 2. Al analizar estas intersecciones, es posible establecer bases metodológicas para la creación y evaluación de películas de ficción interactivas e inmersivas.

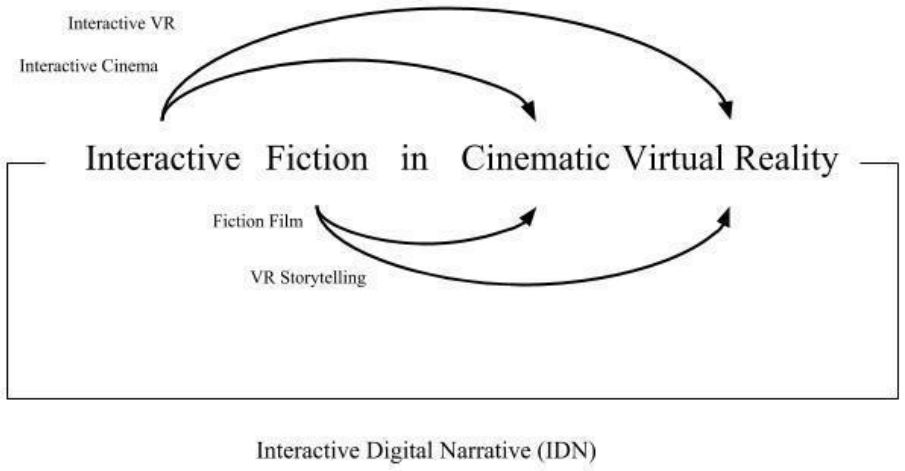


Figure 2. Intersecciones entre Ficción Interactiva y Realidad Virtual Cinematográfica.

- ➔ Interactividad + Ficción = Ficción Interactiva
- ➔ Interactividad + Cine = Cine Interactivo
- ➔ Interactividad + VR = Interactive VR Experiences
- ➔ Cine + VR = VR Cinematográfica
- ➔ Ficción + Cine = Películas de Ficción
- ➔ Ficción + VR = Narración de historias de ficción en VR

Parte II: Creación de IFcVR

Como cineasta, me resultaba imposible desarrollar una investigación teórica sin una aplicación práctica y sin la participación de potenciales interactores. Mi objetivo es cerrar el ciclo en el que la teoría da las bases para la creación, la obra de arte se somete al uso y la crítica de un público heterogéneo, y esta retroalimentación finalmente fortalece la teoría. Esta tesis trata el texto narrativo desde el punto de vista del autor, por lo que la segunda parte de la tesis doctoral comprende el desarrollo, la preproducción, la producción y la postproducción de un proyecto IFcVR.

El Capítulo 5 "Development and Pre-Production" investiga la naturaleza tecnológica del prototipo IFcVR, y utiliza como base el modelo *Protostory* para el diseño de una narrativa interactiva. Con respecto al diseño narrativo de la IFcVR, propongo un marco de referencia específico para la escritura de guiones interactivos, basado en el paradigma cinematográfico de Syd Field (Field, 2005) y la interactivización de una estructura narrativa tradicional, como *El viaje del héroe* (Campbell, 2009), como un modelo para diversificar escenas y rutas de navegación, mientras se promueve la identificación del interactor de rol con el héroe.

Contar una historia interactiva a través de imágenes a 360º es, ante todo, un proceso creativo. Durante la elaboración del guion, se ponen a prueba las bases narrativas teóricas descritas en el Capítulo 3, construyendo cada escena como un experimento narrativo: ya sea desde el punto de vista del cómo se cuenta la historia interactiva en el entorno inmersivo (cambios de punto de vista, movimientos y posicionamiento de los personajes en la escena, cómo se relacionan los hotspots con el universo narrativo, uso de diálogos, puntos suspensivos, etc.), así como desde el punto de vista técnico (altura y posicionamiento de la cámara y los micrófonos en la escena) , posicionamiento de los hotspots, uso dle blanco y negro, cámara en movimiento, etc.).

En el Capítulo 6, "Production", el guion y el guion de rodaje se ponen a prueba durante el rodaje del prototipo, lo que deja importantes lecciones sobre la gestión de la escena/escenario, el papel del director, los actores y el equipo. En este capítulo, se identifican los diferentes

tipos de planos en 360º, y se proponen algunas pautas para la creación de experiencias de IFcVR.

En el Capítulo 7, "Post-production", el material se lleva a la sala de edición y se da inicio el proceso de postproducción del video a 360º, seguido del ensamblaje de la estructura interactiva. El proceso de postproducción, como sucede en el cine, pone de manifiesto los errores cometidos en las etapas anteriores, tanto a nivel de guion como de rodaje, y al mismo tiempo plantea desafíos relacionados con la construcción de la experiencia interactiva: el diseño visual o auditivo de los hotspots, el tiempo de elección dado al interactor en un material grabado previamente con una duración determinada, la fluidez entre los cortes de video dentro de cada escena y entre las distintas escenas.

ZENA, un prototipo de película VR interactiva

ZENA es una película de realidad virtual interactiva ambientada en Génova, Italia. La historia se desarrolla en un entorno a 360º creado a través de la captura de video de alta definición. El objetivo principal de ZENA es crear una narrativa interactiva en un entorno a 360º para reproducir en un HMD, con el fin de crear una experiencia de realidad virtual interactiva similar a la hiperficción, en la que los usuarios reorganizan los fragmentos de la historia en diferentes configuraciones (Ryan, 2009), alejándose de una recepción pasiva, como en el caso del cine, y acercándose a un papel más activo, como el de los videojuegos. En ZENA, los interactores desempeñan un papel activo dentro de la narrativa al participar directamente en la historia: deciden qué camino tomar en una estructura similar a un laberinto (Ryan, 2015), si quieren seguir o ignorar los consejos de algún personaje, o acceder a información adicional que contribuye a la comprensión de la historia.

La estructura narrativa se ha inspirado en el laberinto de callejones del centro histórico de Génova. ZENA, que significa Génova en dialecto genovés, fue rodada en el centro histórico de Génova (Ciudad Vieja), Patrimonio de la Humanidad y el lugar perfecto para rodar un proyecto a 360º: los altos edificios invitan a los visitantes a mirar siempre hacia arriba para descubrir un fresco antiguo, o para saludar a alguien que cuelga la ropa de la ventana. Las

escenas, que se desarrollan en los callejones y en algunos edificios importantes del casco antiguo, muestran estos entornos por primera vez en la realidad virtual.

ZENA es la parte experimental de esta investigación y es el resultado del trabajo de una persona detrás del desarrollo, producción y edición del producto final. Para la producción, el proyecto contó con la participación de un equipo de ocho personas, entre actores y equipo, la mayor parte de ellos cuenta con experiencia en la producción audiovisual, el teatro o la narración, y otros con poca experiencia en estas áreas, pero motivados por el alcance del proyecto. Vale la pena aclara que ZENA no contaba con los recursos económicos para crear un producto con mayor calidad audiovisual o para involucrar a un equipo profesional para la realización técnica. Nos hizo gran falta, por ejemplo, contar con un experto en sonido para la captura y postproducción de audio espacial. Si bien la falta de recursos económicos, materiales o humanos para llevar a cabo un proyecto de mayor calidad, puede considerarse una debilidad del proyecto, las conclusiones presentadas en esta tesis muestran la viabilidad de tales productos, ofreciendo sugerencias prácticas a cualquier realizador audiovisual para desarrollar una experiencia de IFcVR con un presupuesto reducido.

Parte III: Experiencia de usuario de IFcVR

En esta última sección, se abordan las principales preguntas de esta investigación: ¿Se puede considerar la IFcVR como una experiencia entretenida capaz de ofrecer historias y discursos coherentes? ¿Es la experiencia de IFcVR similar a ver una película o a jugar un videojuego? Para responder estas preguntas, la tercera parte de la tesis desarrolla una metodología para evaluar la experiencia del usuario (UX) de la IFcVR. Aunque esta tesis se enfoca en las bases teóricas y metodológicas para la realización de una experiencia que se mueve entre la narrativa interactiva y el cine, como producto audiovisual, la IFcVR está diseñada para ser presentada a la recepción del público. Por esta razón, decidí crear una historia que podría ser atractiva para una audiencia dentro de un rango de edad de 13 a 100 años, porque, más allá del contenido de la historia en sí, lo importante es que tanto la narración como la interactividad técnica fueran fluidas, llevando a un clímax que invitaría a rehacer la experiencia para descubrir caminos alternativos y otros finales.

En el Capítulo 8, “Interactor Experience in IFcVR”, se propone un protocolo de evaluación completo y se aplica para evaluar la experiencia del usuario de ZENA. Como producto híbrido, la metodología de evaluación combina dos aspectos teóricos para evaluar los ejes de Ficción interactiva y Realidad virtual cinematográfica:

➔ Evaluación de la realidad virtual

➔ Evaluación de la narrativa digital interactiva

Esta investigación se adentra en un territorio virgen que busca establecer un diálogo entre las formas artísticas y los medios, y trata de ofrecer una base conceptual y metodológica para la creación de la IFcVR. Por lo tanto, las propuestas teóricas, las metodologías, incluido el flujo de trabajo de producción y postproducción y los instrumentos para la evaluación, son parte de un enfoque que contempla el análisis de los datos para elaborar nuevas hipótesis o conclusiones que inicialmente no pudieron catalogarse. Esta es otra razón por las cuales esta tesis documenta la retroalimentación de los usuarios, precisamente para extraer conclusiones basadas en el experimentar y disfrutar la IFcVR.

Conclusiones

En esta tesis presento la Ficción interactiva en realidad virtual cinematográfica (IFcVR): un texto narrativo híbrido que apunta a la convergencia entre narrativa digital interactiva (IDN), es decir la narrativa interactiva mediada por el computador, y la VR cinematográfica (cVR), la creación de experiencias virtuales a través de la captura de video con tecnología 360º. En la IFcVR, el usuario observa la película desde dentro gracias al uso de un dispositivo HMD y puede cambiar el curso de la historia con sus propias decisiones, conscientes o inconscientes. La respuesta positiva de los usuarios a su experiencia con ZENA nos permite concebir la IFcVR como una experiencia narrativa que no solo entretiene a las personas, sino que también es capaz de transmitir diferentes tipos de mensajes en diferentes tipos de aplicaciones. Así como el cine desarrolló un camino que lo llevó a la producción de su producto principal, el largometraje, de la misma manera, el híbrido propuesto en esta tesis podría convertirse en uno de los principales formatos de narrativa inmersiva realizados a

través de la captura de la realidad y el interactuar con diferentes tipos de interfaces entre humano y computador. En este sentido, la IFcVR podría representar uno de los enfoques embrionarios para la creación de experiencias artificiales que, en un futuro no muy lejano, harán tangible la división completa entre la realidad física y la mental.

Genoa, May 2019