Finding the Message:

Exploring the New Conventions of VR Experience

Thesis Presented

By

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To

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ABSTRACT OF THESIS

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Abstract

Since 2014, a new wave of Virtual Reality (VR) development has been on the rise, calling for more artists to utilize this new technology in creating art works. However, there is still room for improvement in both the technology itself and its application in art creations. Firstly, the lack of clear definitions in VR results in many problems. Usually, the term ‘VR creators’ is used to address all of VR game producers, 360 filmmakers, and VR experience designers. This prevents the ‘creators’ from clearly defining the realm of their roles, thus the communication between them becomes less efficient. This inefficiency in turn prohibits the establishment of design patterns, forcing artists to acquire technical skills. This, in most cases, intensifies the difficulty of transdisciplinary collaborations, which are usually seen in big-budget projects promoted by big companies or famous studios. Due to the hybrid nature of this new medium, the outcome of the artwork is hard to predict. Participants’ experiences can vary widely based on their decoding performance. What is more, there is a big chance that the work will not receive credit as artworks but will be criticized as frivolous toys.

This paper builds on my experience of creating a thesis project, Captive Memoirs, in which I explore the multiple dimensions of designing an VR experience. Starting from the theoretical study and analysis of various artworks, I attempt to define, for further reference, the design elements that a VR experience is composed of. Through the presentation of this thesis, an operational system is established that investigates the design conventions of VR experience. This work also examines the relationship between the audience and the interactive art installation to investigate why the audiences’ interaction is the key to VR experience. Above all, rethinking the creative practice of VR based artworks reveals the inspiration for new art forms and creates the opportunity to question the new standards of art.
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Introduction

Have you ever felt trapped? How do our choices come to define us, even when they result in conditions that are far beyond our control? How can listening to other people’s stories create shared memories that enable mutual support?

*Captive Memoirs* is a Virtual Reality (VR) experience that explores moments in the lives of six people who have felt trapped by social expectations, circumstances, or their own choices. This project creates an intimate virtual space that can be confronted, shared, and felt by focusing on the dilemmas of daily life.

Figure 1. Project Overview. May 28, 2019.
Visualizations for the state of being trapped are created through the VR portraits of six individuals captured inside glass vessels. Using the Oculus Rift headset, the audience is invited into a virtual environment that allows them to interact with the characters within a selectable narrative structure.

Once a viewer is invited into the virtual environment, they are trapped inside a glass vessel as well. This glass vessel symbolizes the cold, hard façade everyone is wearing.
in order to protect themselves. This façade turns out to make the viewer trapped in their own world. If the viewer is willing to look closely and break through their own protective exterior, they will step into this virtual intersection between lives and be immersed in the carefully crafted soundtracks that leak out of other peoples’ unique realities. By aligning form and content, empathy can be aroused between the viewer and each character.

As the work’s creator, I view every person as a vessel. Over time, our choices can seem to harden around us, creating an invisible structure that defines our lives. We bear witness to ourselves. The life experience collected inside the vessels enriches our emotions. Through interactions with six different characters from four different countries in a VR environment, viewers might be able to examine their self-awareness and feel more empathy for others.
State of the Field

1. A Brief History of Virtual Reality

Virtual Reality (VR), as a term that has been associated with recent technology advancement, can actually be dated back to 1792. An English painter Robert Barker coined the word “Panorama” to describe his landscape painting that was shown on a cylindrical surface.¹ This was a technique that offered the audience a wide-angle view that encompassed their surroundings. Around the 1850s, Brewster Stereoscope, a hand-held stereoscopic viewer that utilized two lenses and juxtaposed images was invented to entertain people with a magical effect of three-dimensional (3D) space.² Even though this lenticular stereoscope was not the earliest type of stereoscope, this old wooden equipment could be considered as the prototype of the contemporary VR headset.

In 1965, Ivan Sutherland published his most famous essay “The Ultimate Display,” which made precise predictions about this emergent technology. In 1968, with his students, Sutherland made the first head-mounted display known as “the Sword of Damocles,” the first virtual reality system.³ Jaron Lanier, the co-founder of VPL Research, Inc., coined the term “Virtual Reality” around the 1980s. His company was the first company that sold VR goggles and gloves.⁴ Since the 1980s, the government of the United States invested a considerable amount of money in building the research and training projects that investigate the application of this technology, for example, the SIMNET program, a DARPA (Defense Advanced Research Projects Agency) sponsored project that was used to train and rehearse tanks battles.⁵ Another big event in the timeline of VR development happened in 2014, when Facebook acquired the VR company, Oculus. This has brought the related products into the public’s imagination and motivated the wheels of VR content production ever since.
It is fair to say that VR technology was created for entertainment using 3D illusion. It is also a technology which is relevant to the art realm because it starts as a technique that can be used in painting. Its unique properties satisfy makers’ desire for simulating or depicting another world in its most full-body engagement sense and thus create illusionary experiences. As Char Davies stated in relation to her work *OSMOSE*⁶: “[T]he desire to dissolve boundaries between interior and exterior within the context of enveloping luminous space, have been the focus of my artistic practice.”⁷

2. Scope of Discussion

The definition of VR has become more precise over the past five years, but it is still a rapidly transforming technological medium. The arguments addressed here are meant to explore the general meaning behind the term “VR” by looking into the current classifications for VR projects. A new interpretation of VR is given by defining each of the individual building blocks.

In general, people may refer to VR as an immersive, or sometimes interactive, experience when using headsets. However, the general usage of this term could cause trouble in creating new **language systems** of specific forms and also presents the problem of ambiguity. For example, one cannot distinguish between 360 Video and VR Film in the given definition, but the truth is that most 360 videos are not interactive at all, and they are usually shot from the third person’s perspective. From my experience as a VR project creator, the current VR projects can be divided into four big categories: VR Game, VR Experience, 360 Video, and VR Application.⁸ Each genre provides a unique set of conventions and vocabulary. For example, the new language of 360 Video must cover topics like new shooting skills and new performance requirements while there are no similar procedures in designing VR experience. This paper builds its foundation on my
experience of creating a VR based artwork, Captive Memoirs. Therefore, in this paper, only VR Experience is discussed.

3. Five Dimensions of New Conventions

Taking inspiration from the insights of other artists’ creative implementations, a multi-dimensional framework can be used to describe the design process of VR experience. I discuss five dimensions in detail, this is not an exhaustive list, it is only the first attempt in constructing a framework for VR experience.

(1) Visual Representations

If one thinks of a human being as a machine and takes the human perception system as an input system, then most of information might be obtained through human eyes. Human beings are creatures that perceive the world through the visual system. Visual information can provide substantial evidence to help identify reality from illusion. With this said, fooling our eyes to believe that computer rendered images that are one point five inches in front of us are real is the first step to create a convincing virtual reality.

Before analyzing the requirements of visual representations for a good VR experience, it is vital to look back to the root of ‘traditional’ visual artworks, particularly in painting, to illustrate the development trends of visual practice. From the beginning, painting was used to express artists’ feelings and transmit messages to the next generation as a way of documentation. With the development of society and painting skills, painting not only adopts more functions but also becomes increasingly realistic. The most popular theme of ancient art in the western world—religious painting—was used to recreate the stories from Bible. In order to attract people and achieve a better effect of preaching, this kind of painting usually depicted a famous scene and built a solemn atmosphere through appearance. During the Renaissance period, artists began to experiment with naturalistic
expression and became obsessed with tangibility. At that time, creating presence through vivid details and richer colors met the need of people’s imaginations towards humanistic but also ideal figures. After that, “Baroque artists developed techniques to manipulate time space outside of the picture plane by controlling the viewer’s physical location”⁹. This technique mimics the experience of reality. Hence, it enhances the illusion.

After the 19th century, a number of new styles emerged, including Impressionism, Surrealism, Fauvism, Expressionism, Dada, Post-Impressionism and Symbolism, amongst which there was a constant theme of abstraction. Apart from the artists’ purpose in seeking provocative styles and free expression of their visions, all the movements reflected on a significant shift of cultural conventions, from traditional documentation technology to a more diverse range of mediums, as painting was not the only way for visual representation anymore. “[T]he advances in the scope and sensitivity of lenses and emulsions have made the camera capable of infinite receptivity and indiscriminate fidelity.”¹⁰ Photography, as a new medium for visual representation, can produce maximum results for visual representations but only requires a modicum of skills and efforts from the author when compared with painting. The crisis of representation can only be resolved by new ways of creation. Abstraction distorts the certainty between reality and representations, thus adding more information into the existing knowledge system and eventually activating boundless imagination. When a medium becomes mature, it is unavoidable that creators have to redefine its creativity and change its format. In short, the foundational orientation of visual art has been through a process from abstract to realistic and back to abstract. This tendency also applies to other forms of art.

In taking consideration for the importance of visual art, Mind at War offers a wonderful VR experience with a homage to the artistry in the characterized visual
representations. The artist, Sutu, created a series of paintings in VR using Tilt Brush. He leads the audience through tangible memories of an Iraq War veteran, Scott England.

Figure 5. Screenshot from Mind at War, 2018, Directed by Digital Artist Sutu

The paintings with vivid strokes are set in a dark background, creating a solitary tone for the experience. Compared to real-time shooting or animation, the hand-draw style makes the story more of an authentic confession. Some specific bloody scenes are intentionally hidden from the audience, making the experience less overwhelming. When Scott describes traumatic events, for example, he was given the order to shoot innocent children; Sutu uses a warm tone to help the audience experience the scariest moments in a peaceful way as well as to arouse empathy. The limited interactions seem to situate the audience inside the flashing memories of the character. Mind at War demonstrates the enormous potential of virtual reality painting for telling real stories.

There are several lessons we can learn from the history of painting as well as Mind at War. First, providing reference points (the realistic style) at the beginning stages of development of the VR medium will help to build a connection between people’s cognition and imagination. Second, the idea of expressing a story in VR requires innovative visual
effects that satisfy the audience’s expectations. For VR in general, there is an expectation towards spatial illusions. Third, the success of a VR-based artwork depends on the following considerations: how to see and make works from another reality; how to break the threshold between the physical reality and the virtual experience; how to create a unique style; how to evoke resonance from the audience.

(2)  Sound

If VR engages the audience through spatial illusions, then sound enhances the belief of the audience’s existence within a simulated reality. In the virtual space, not only can sound help the audience deduce the objects’ locations and their positions, but it can also make them feel the quality and quantity of space. Successful sound design is fully integrated with the visuals and matches the audience’s anticipation of the real-world. More importantly, voices and music are often used to create a certain mood, to provide additional messages for a scene, and to supply the VR experience with a rhythmic structure. **Immersion** can be achieved if viewers experience an imaginary world as their primary reality and have some sort of response. As such, sound design is indispensable to VR experience.

One of the most popular VR games, *Beat Saber*, is a rhythm-action game. It is an example of the synergistic effect of synchronizing sound and images. Players listen to the music, wave their arms and controllers according to the beats and the visual instructions. To succeed, players need to slash certain amounts of boxes in specific directions as well as to avoid bumping into walls. The idea is to involve players’ whole bodies into the gameplay. The game was rated the most immersive VR game in 2018 and received nine awards. Players quickly adapt to the dual command system of sound and sight without noticing the heterogeneity of these two factors.
For the design of VR experience, sound can be broken down into four components: voice, music, ambient sound, and sound effects. Each can be recorded separately and combined together later. Some research papers suggest only using “binaural microphone and ear-shaped receivers to record the live sound of the scene”\textsuperscript{13} for creating a sense of space. In the practice of VR experience design (not 360 video), it is sometimes pointless to use the mentioned equipment since it is hard to measure a game-engine generated virtual space and find a space to match its layout, size, and even reverberation. However, this is not suggesting that binaural sound is useless in the final product. On the contrary, there is evidence showing that if conditions allow, binaural audio can substantially improve the experience.

![Figure 6. Screenshot from Notes on Blindness, 2016, Directed by Amaury La Burthe, Béatrice Lartigue, Arnaud Desjardins and Fabien Togman](image)

*Notes on Blindness* is a unique VR project based on the audio diary produced by theologian, John Hull, documenting the experience of losing his sight in middle age. Each chapter addresses a memory, a moment, and a specific location from his diary, using binaural audio and real-time 3D animations to create an immersive experience in a “world
beyond sight.” Participants can hear footsteps, children’s voices, and other sounds from different directions that are paired with visual figures that fade out from, and back into, the dark surroundings, in synchronization with the sounds, conveying a depth of space as you gain insights into Hull’s inner-subjective experience through his diary entries. *Notes on Blindness* makes effective use of the aural, spatial, and visual components of VR to answer the question poetically: what do you see when you no longer can see?

(3) Space

Space is a concept that needs to be perceived from both physical and abstract perspectives since physicists describe it using dimensions while artists depict it in symbolic ways. As for interaction designers, they define space through management. Janet Murray explains the spatial **affordance** of digital artifacts by introducing the organizational interface. Surrounded by all sorts of digital media, people are used to the hierarchy of spatial arrangement and all the methods used for **encapsulation**. The standard computer desktop consists of subjects that were created through abstractions. They are not the literal recreations of the actual objects but icons that obtain those spatial properties to elaborate on their utilities. For instance, in the desktop interface, users typically have folders (abstractions from actual file folders) that contain text or media files. The interface design of VR systems inherits this method. It is intuitive for the audience to look for applications or materials by selecting a book icon that is labeled as the Library.

For VR experience design, interface design determines the first impression of the entire experience. Because it is possible that the VR experience you designed will be the first virtual space that the audience ever enters into, the menu should be clear, the graphic design should be memorable, and space should feel like a whole. Otherwise, the audience might be stuck inside or quit the experience because of the inconsistent model of space.
Artists view the space as more than a conceptual framework, but as an individual temporal area that can be shared, extended, embraced, and explored. Among them, immersive virtual space provides an uncharted territory for artists to build up new kinds of space that are entirely different from the present one – the space on the surface of the Earth. The everyday experience of terrestrial space makes people experts on telling the simulated from the natural physical reality. People can be surprised if they cannot look around, objects can float, or the ground slowly sinks. On the one hand, it may be painful for designers to recreate a fully realistic world that perfectly matches with the norm. On the other hand, it is also a precious opportunity for the artists to challenge the conventions of the world through a lens of imagination. In the process of changing the principles of human behavior and the nature of space, metaphors are created to define a symbolic space. The inventive use of metaphors can be seen in Laurie Anderson’s *Chalkroom*, which presents a world full of fractured languages. In one of the famous scenes, the audience can fly down a tree and see countless letters move towards them with the artist’s voice-over, “you realize the things are made of words.” In one of her interviews, Anderson mentioned her goal as to engage the audience with a dream-like experience, including the supernatural ability to fly and the associated feeling of freeness.16

Figure 7. Screenshot from *Chalkroom*, 2017, Created by Laurie Anderson and Hsin-Chien Huang
For VR projects, it seems unnecessary to design the “outside space” – that is, the physical space where the VR headset will be encountered by the public – since once the audience dives themselves into the experience, they should genuinely believe their presence in the virtual world. The question arises: what is the point to build installations while they are blocked out from viewers’ visions?

The first attempt to answer this question would be that installations can enhance the experience. There is a famous experiment, the rubber hand illusion,\textsuperscript{17} which found that the illusion of self-embodiment can be reinforced through physical touching. There is a piece from 2018 Sheffield International Documentary Festival (SIDF) called *Porton Down\textsuperscript{18}* that invites the participants to take part in a series of tests for research purposes. During the tests, participants are asked to hit a red button for measuring their reaction time. Because participants can feel the touch that their eyes see and hear the sound when the button is pressed, the experience provokes strong feelings of engagement.

![Figure 8. The Participant Engages with Porton Down, 2018, Don Webb, Callum Cooper, Sam Von Ehren, Anna Meller. Photograph by Yangli, June 9th, 2018.](image)
Secondly, most first-time VR users hold concerns about safety when they wear the headset. They are either unaware of the possibility of body movement or unwilling to walk around. If there is no instruction from the volunteers or a straightforward message about the physical setup of safe zones, even experienced participants will act carefully to avoid bumping into objects.

Third, as most VR experience are presented in a public space, mostly in galleries, without an outside installation that blocks out the gaze from other visitors, viewers might feel uncomfortable to participate since their “strange” behaviors might be observed by passing strangers.

Fourth, just like most of us would try a product simply because of its attractive appearance, only a VR headset placed upon a table is hard to entice the viewers into the experience. I almost missed the chance to view one of my favorite VR experiences in the Sheffield Doc/Fest, *Life in VR*, because it was almost invisible among all the other installations that were meticulously set up. On the contrary, the installation of *Vestige* was substantially big, which caught my eyes immediately. The composition of the installation corresponds to the visual elements used inside the VR experience. Thus, it becomes a metaphor that adds another layer of meaning into the work.

![Figure 9. Vestige, 2018, Aaron Bradbury and Paul Mowbray, Photograph from Internet.](image)
(4) Narrative

We have come to the time when people want to not only interpret narrative content in their own ways but also choose their own paths inside a given world. In the past, the dominating linear art did not allow us to make any changes but to let the art forms shape us. We looked at paintings. We listened to music. We read books. There might be a thousand Hamlets in a thousand people’s eyes, but Hamlet cannot escape his fate towards death. Until recently, “interactive narratives offer the viewer varying degrees of navigational control of the story.” Like what we see in last year’s TV drama, *Black Mirror: Bandersnatch,* the main character Stefan Butler can end up being in jail, committing suicide or living a happy life based on the audience’s choice. Following this trend, new narrative structures will be created, and new habits of “reading” will be formed. At the same time, this exciting potential about the future might cost producers more money and time to build the narrative branches for satisfying the new generation’s tastes.

If the audience has the freedom to decide which route to follow within a simulated world based on their free will, they may not be able to understand the work. For story-oriented VR experiences, comprehending the meanings of stories is the first procedure of decoding performance. Story is a unique pattern of multiple related events that requires at least one main plotline to create a basic framework. Events can refer to scenes in a film or chapters in a novel. The audience need to walk through all the events to form a basic understanding of the story by putting the jigsaw pieces together. For example, in the final scene of the famous movie, *Inception,* the protagonist plays the spinning top one last time when he finally gets back home. The camera is cut to black just before the spinning top appears to wobble. One will not be able to make sense out of this shot without the former scene when Cobb explained the function of the spinning top. This means that if the
audience is allowed to make decisions freely, they might miss the crucial moments in the storyline.

More than that, the complexity of narrative development has been proven by the highly competitive image-making industry. Scholars have already brought forward many different narrative structures such as “branching structures, the passenger train model, the aquarium model, indexical storytelling, the complete graph and so on.” For example, in branching structures, the audience will reach some decision points in their paths which may provide several different choices. By making the choice, the audience can travel further until they reach another decision point. For a storyteller, the challenge is how to use these models to deliver an innovative and impressive story.

For most ongoing VR project teams, the core members are usually the people who know the technology well. This group of people can make substantial progress on techniques and genuinely innovate in making new effects. However, it is a big challenge for them to do content writing, let alone create fascinating stories. For VR experiences, the nature of yielding more power to the readers represents its favor towards the first-person perspective. Jumping out of the regular usage of third-person perspective, to see the world through a first-person’s vision raises the questions about audience presence and identification.

*Life in VR* is an excellent example to discuss the narrative structure in VR experience, even though there is still room to improve its story. The story allows the audience to travel through different levels under the sea: from the shallow sea, through the abysmal sea, and finally back to sea level.
The main narration is formed with the ends joined, like a ring, but it also includes a branching hyperlinked structure. The designer made sure every viewer would be able to choose their paths in their adventure. Following the animals could only provide you with the main story but clicking on different white icons (shown in Figure 11) could offer you various possibilities to unlock different ocean attractions.

At the same time, even if you decided to leave the main track to explore the ocean by yourself, the storyteller still has the power to drag you back to the main story. At some specific points, swimming animals catch your eyes and lure you to follow them. The
journey through the story is entirely controlled because that is the only way that leads you to Rome where your experience ends.

(5) Interaction

Last but not least, an immersive virtual space is maintained through interaction. In other art forms that are not interactive, artists have the authority to act like a god, “creating a deterministic world in which the receiver’s route is ordained.” The viewers themselves do not normally expect interactions with any work of fine art, since it is usually not allowed to even touch any item displayed in a museum or a gallery. Though it is dangerous to consider a VR experience as inherently equivalent to a first-person adventure game, there is a certain structural resemblance between the two – they both require audience choices and call for interaction. The outcomes of experience are deeply affected by those choices, which means that a collaboration between the author and the audience is inevitable. In the case of interactive art, artists have to sacrifice their authorial rights and relinquish a degree of control over the experience to strengthen the partnership.

There is a vast amount of artistic interaction projects in the early 2000s that demanded body participation from the audience. “Practical interfaces are about maintaining the user’s sense of control” in spatial experience. In 1999, Romy Achituv and Camille Utterback created a work called Text Rain that enables the audience’s full-body engagement in a cross-dimensional space between the screen world and the physical space. The visitors’ images were projected onto a screen to interact with the virtual letters falling on the screen. If the visitors reach out their arms, they will be able to hold enough letters and read. Earlier than this, the pioneer of interaction art, Jeffrey Shaw, made an installation named The Legible City that puts the audience on a bike and the physical exercise was transformed into three-dimensional marching texts about the city’s history. A metaphor was created that the participants’ effort in pedaling the bikes helped to build
up the city virtually as texts. With each action the viewers take, new meanings are generated, “as the participation of the viewer is intuitive, nontechnical, and performed with the entire body.”

Physical interaction becomes a statement of full-body immersion.

![Photography from Text Rain, 1999, work of Romy Achituv and Camille Utterback.](image)

Besides the practical interface and easily accessible rules, designers should take light, material, texture, position, and scale into consideration for a good interaction design. These elements determine the usability of a project. Considering the sophisticated nature of VR technology, which demands a steep learning curve for first-time users, it is an important concept to emphasize human beings’ physical and mental capacities and limitations through human-centered design. Selecting the appropriate interaction device will create a comfortable experience for the audience. Through the critical evaluation of the projects, the designers might be able to offer “a more efficient, satisfying, and user-friendly experience for the users.”

The primacy of interaction and the interpretation of VR experience, as part of the social changes, will exert an influence on our behaviors through establishing “shared attention”. In terms of interaction design, there are expected modes of behavior called cultural constraints. If creating a VR experience in the context of non-native countries, the
existence of cultural constraints urges the designer to think through their design in the audience’s shoes. This could avoid negative results coming from inexplicable information such as an idiom that cannot be understood across languages, biases due to conventional assumptions in different cultures, or judgments that vary with cultural values.

Janet H. Murray, an internationally recognized interaction designer, mentions in her book:

> Design is always the conscious creation of a particular artifact within a longer cultural tradition of practice. It always involves a choice of conventions in a context in which there is not just one correct way of doing something.\(^{27}\)

Developing a new way of interaction in VR projects can be done through improving the existing elements, changing the traditional features, or challenging the social conventions. For example, in a recent solo exhibition at the Boston Cyberarts Gallery, Nancy Baker Cahill presented a VR piece that allows the audience to move through and observe her three-dimensional paintings.\(^{28}\) The VR piece has the same strong style as her other paintings in the gallery - black strokes on a white background. Once you squeeze yourself into the spinning, transforming, tremendous 3D drawings, you get hit by the stunning beauty of chaos and feel small. The only way to enter those drawings is to teleport through the virtual space, which is very difficult. Another drawback is the unreliable HTC Vive Controller in the gallery, which only works when points downwards towards the floor. During my experience, I found myself exhausted by the fact that teleporting myself into the spots I wanted could only be done through luck. I gave up after a few trials. This could have been a successful piece if the artist made the interaction fully functional. It might be better to only offer certain spots for the audience to explore, like what we see in Life in VR. During design iteration, the artist might find it more convenient for the audience to walk through the drawing without the help of the controller. To conclude, the design of
interaction in VR experience requires collaboration, intuition, iteration, cultural awareness, and innovation.

_Captive Memoirs: Exploring the New Conventions_

1. As an Artwork

The vessel, a common craft in our daily life, is a metaphor and symbolic item used to represent humans in _Captive Memoirs_. Millions of years ago, humans were a tasty snack in the eyes of the most ferocious predators. We were fragile, but we had tenacious vitality to fight. It was essential for us to learn how to use tools and to gain the wisdom to survive. Fire lit up the hope of survival and made cooked food available that cultivated humans’ evolving brains. Food pots, as a type of vessel, played an important role in this evolution towards a better life. Over the centuries, other types of vessels were invented to satisfy the growing needs in our daily life. The vessels mentioned here are liquid containers, such as a vase. This type of vessel could be considered one of the earliest representations of beauty, and its application provided an exceptional aesthetic experience. Because of the invention of clear glass by Angelo Barovier (1405-1460), for the first time in history, the glass vessel was transparent, completely pure and like rock crystal. Since then, the glass vessel has obtained a reputation as an art form through its sophisticated and elegant appearance.

In _Captive Memoirs_, the glass vessel is a poetically resonant metaphor for inner life. Any individual can be portrayed as a vessel because humans also absorb information, accept influence, and form identities from our experiences. All these elements define everyone’s unique identity. In our journeys, we are inevitably filled with emotions – we are constructed by life and trapped by life. We eventually build a protective shell for ourselves, that allows us to participate in the world without leaking out our inner emotions,
just like a glass vessel. In my opinion, using a glass vessel to embody everyone’s public façade is already a step towards uncovering the nature of life.

Using the latest VR technology, I want to create an artwork that the audience can enter into and interact with; I want to share some personal stories with my audience through the user-defined process of cracking a bottle; I want to start a lively conversation with the audience that may encourage mutual understanding and support. I hope this will be an interesting experience to trigger important questions: if you can choose the shape of your life (your vessel), what will you choose? If you can feel other people’s struggles through body movements, will you be more aware of others’ existence?

2. As a VR Experience

In the Gallery 360, when the participants stand in front of Captive Memoirs, a volunteer helps them wear the headset and passes a controller to the right hands. The participants are immediately transported into an illusionary, yet sensate, world. There are muffled voices coming from the deep dark space. Six giant glass vessels containing human-size figures are displayed side by side around them. They are placed in a virtual space that
resembles a cylinder, with a purple, textured wall. If they look up, they can see a shining and reflective “ring”. It is the bottleneck that the participants are looking at, although it is hard for them to realize the fact that they are also trapped inside a bottle. If they look down, they may notice that they are bodiless. However, the participants do hold a simulated hammer which they can use to interact with the virtual world. When they turn around to observe the surroundings, a cracking sound will be played as a hint that demonstrates the interaction mechanism. Another visual hint will be shown when the participants walks closer enough to any of the characters – a rectangle marking the place where the vessel can be broken. Once the participants’ attempt to break the vessel is successful, a story will be told by the character in front of them.

Figure 14. The Participant Engages with Project, June 17, 2019.

There are six stories that are told by Gloria, Daniel, Yilin, Zhenhe, David and me (Amy). Gloria’s story is about her idea of having no patterns. Daniel’s story is about his understanding of being a trans-gendered person. Yilin’s story is about making important life decisions with her newly married husband and dealing with her new families. Zhenhe’s story is about working as a receptionist in a department store. David’s story is about his
services in the military. My (Amy) story is about being trapped with cockroaches in small spaces.

Participants can pause and/or restore the story by hitting the same rectangular spot again. They can also choose to trigger another story by cracking another spot. At last, the participants can choose to leave the virtual space at any time by taking off the headset.

3. As the Exploration of New Conventions
   (1) Visual Representations

   In order to render the atmosphere of being trapped, I made a gloomy virtual space that is lit by four directional lights. Against the dark background, six transparent glass vessels stand in silence. The vessel models were created through a professional 3D model generating software, Maya. Besides making up the shapes of vessels, it took me a considerable amount of time to test out the actual appearance of vessels in a dark environment. I increased the reflection rate on the vessel objects' surfaces to gain a visual effect that mimics the material of glass. Inside those transparent shells, there are six realistic human figures.

   Virtual technologies provide a range of applications which allow the artists to create 3D imagery from a 2D plane by using controllers. In my thesis project, I used Tilt Brush to create characters’ 3D portrait paintings. I tested out several VR painting tools (VR creative tools) before choosing Tilt Brush. The first VR modeling application I learned about was Google’s Blocks. The menu is made up of six tools: Shape, Stroke, Paint, Modify, Grab, and Erase. It is an application that has features like Lego, so it has the advantage of creating geometric 3D models. Its features determine the naïve and hard-edged appearance of models. It is not an ideal application for creating realistic models.
Then I used Oculus Medium for my previous VR project, *White Lady*. The application mocks up the workspace and the layer function of Adobe Illustrator. On its tool tray, it has eight tools, such as Clay and Move. It is the top-rated VR sculpture tool in the current market. If you are a professional sculptor, it is easy for you to adapt to it through a few times of practice. For modeling, it is easy to create asymmetric models but less efficient than Maya or Blender for building symmetrical figures. This application will not satisfy your needs if you want to apply realistic textures to models for the purpose of making your models look natural.
At the beginning of this project, I tried Quill, an expressive VR painting/animation tool that has similar functions to Tilt Brush. Users only have one menu pad in Quill but three in Tilt Brush which is slightly confusing. Quill’s menu pad is cleaner than Tilt Brush, as the arrangement of hierarchy looks familiar and logically consistent. On the contrary, in Tilt Brush, it is hard for the first-time users to find some basic functions, such as storage or export. However, one of the tool pads in Tilt Brush is full of many different kinds of practical and creative brushes. You can select colors inside the color wheel, which is substantially different from Blocks, Medium, and Quill since these three applications only offer a limited choice of color. Thus, Tilt Brush is an application designed for painters and perfect for creating stylistic, colorful 3D paintings that can also be exported and used in building up VR experiences.

Tilt Brush and Quill, as 3D painting tools, I would say they can be time-consuming and exhausting if your expectation is to create solid 3D forms that can be observed from any angle through a small number of brushstrokes. It takes time and practice to avoid painting 2D sketches by using flat or thin strokes. I learned that the trick of making hollow models is to slightly change the angles of painting and create a complete flat mask that can
wrap the surface of objects. By doing so, it saves me a considerable amount of time from filling up the figures with countless strokes.

Both Quill and Tilt Brush provide a function for a user to import images from the computer into the virtual space. The artist can take reference from flat 2D images to create immersive 3D materials inside a spatial canvas. Between the physical-virtual threshold and the act of visual/spatial creation, there lies a moment that the artist can see the perceptual distance towards beauty and objects. During the process of making the sketches, I felt closer to my interviewees. I created the visual representations of their stories and the appearance of their lives, and this gesture established a spiritual connection between their characters and my characters. Through my actions that existed in two realities, I grasped the decisive moments in which my creations became an extension of myself as if I could freely stand outside the world.

(2) Sound

The overall experience is triggered by a muffled sound. Participants can hear the voices of six characters, but it is hard to tell the content of what the voices are saying. This sound is meant to create a lonely position in the virtual space where the participants can only stand outside of the “conversation” that is happening around them. With this idea of being outsiders, they may be aware of the possibility of listening to the stories from the characters. By choosing one key sentence from each story, I combined multiple voices into one channel and applied background music to the sound, which builds up a unique atmosphere. When they hear a loud, and almost frightening, cracking sound, the participants might find themselves enveloped in a shroud of mystery that can only be solved through the action of breaking out.

Once the participant figures out the interaction mechanism, they hear an audio hint, a short sound of breaking glass, every time they successfully hit the spots. One second
later, they hear the stories. Because these six storytellers are current residents of four countries: England, the United States, China, and Korea, it is impossible for me to record their stories with them face to face. I had to ask them to do the recording by themselves in quiet places.

The sound files they sent to me were stereo files that cannot define the location and reveal the sense of space. So, I applied certain audio effects to the soundtracks, such as “Studio Reverb,” to make the reverberations noticeable. I also brought up the level of frequency to enhance their voices and improve the files’ overall qualities. My greatest challenge came from the noisy background of the sound files. Even though some of the storytellers had already redone the recording several times, the outcomes were still not ideal. Along with using audio effects to decrease the noise, I added some shifting, tonal background music to give participants a sense of forward movement, and characters.

I brought in various ambient sounds to indicate the specific environments or time-space where some familiar or unexpected events might happen. In Zhenhe’s story, I used the ambient sound of a department store to suggest a crowded working space where she found her job depressing and boring.

In order to describe the crucial moments in these intimate stories and create a sense of tableau, I mixed the storytellers’ voices with some specific sound effects. In my story, I used several sound effects which are different versions of bugs crawling upon objects, to reinforce the theme of getting trapped in a small space with cockroaches. The audio outcome can express my internal fear, depict a squeezing space, and establish my story in an unusual rhythm. I received advice from a participant that she wished there were texts in front of every story so that she can tell which story is “safe” to listen to as this piece provokes strong physiological arousal from her.
By using sound effects that are nonliteral and abstract, I was able to set an appropriate tone for the whole story. In Daniel’s story, he felt lost and hopeless when he confronted the fact that he is trapped inside the gender, female, that he was assigned to at birth. I used a sound effect of slowly dripping water to depict a scene of him looking in the mirror. Finally, with the help of game engine software Unity, I placed the stories in specific positions inside the VR space to create a sense of depth. As a result, the audience can feel more immersed inside the virtual space.

(3) Space

To create a memorable and consistent model in the virtual space, instead of using existent typography, I decided to hand write my work. The audience will see a 3D title, Captive Memoirs, that can be viewed from different angles in front of them. Against the black background, this white title can be easily recognized. It was made by Tilt Brush, and I used the same type of paintbrush as I used for the characters. I also wrote the names of the six characters on their clothing in a way that only the most patient observers could discover.

Figure 19. Character's Hand-written Names
Made with Tilt Brush, 2019.

In the Gallery 360, the outside space of Captive Memoirs is defined by six white tape dots that are pasted on the floor. The participants’ movable radius is restricted by the
length of the cable connected to their headsets. There are not many visual clues for the participants to identify the author’s effort in making a safe zone for them to walk around. In my studio, I built an installation that forms the shape of space that corresponds to the cylinder shape the participants will confront inside the virtual space.

I used tubes and a specific type of fabric to build the structure. The two sides of the fabric are different: the front side of the surface is smoother than the backside. The fabric is made by light filtering material and with solid textures. The front side of it is perfect for projecting vivid and stable images. I captured some images of my human figures in fractions and utilized the round-shape installation as a screen to display them. Thus, from both inside and outside of the installation, participants can see the abstract impression of my VR piece. To mimic the surrounding of the virtual space to maximize the illusion, I turned off the room’s lights to create a dark outside space in which the audience can only see the outline of the installation and the projected images when they enter my studio.
Once the audience approaches the installation, two motion-sensitive LED light bars that are pasted into the fabric, will light up the inner space of the installation. It is straightforward for the audience to understand the boundary of my work and take in the idea of a defined space that they can interact with, without being conscious of it.

![Figure 22. The Projected Image on the Surface of the Installation, May 28, 2019.](image)

There are three breaking spots inside the virtual space aligning with the fabric so that the participants can get physical feedback from their actions when they try to break the simulated vessels. Although this implementation may not be able to enhance the full-body illusion, since the softness of fabric seems opposite to the solidity of glass, I still believe this is a successful experiment. I observed distinctive facial expressions and body reactions when the participants recognized the possibility of actual collisions and thought they were getting too close to the edge of the space. However, none of them would stop cracking the spots, because of the previous unexpected collision or their potential fear of causing damage to the controller. I found this to be the most interesting part of the participants’ performance to examine.

When the cracking action happens, the participants genuinely believe that the virtual space is their primary reality; otherwise, they would not take actions towards a
simulated spot that is not actually there. Under these circumstances, they still were shocked because they sensed a collision that is typical in their daily lives. Based in everyday experience, there is a universal understanding that when applying force on a physical object, there will be a counter force. I shall propose three hypotheses as to why people were still shocked, given this universal understanding.

First, the participants are aware that it is a simulated object that they are looking at. The cracking spot is not fully integrated into the vessel, and the shape of it is not realistic. When the participants hit the spot, there is no visual effect that indicates an actual breakdown of glass. If what they are interacting with is an illusion, then there should be no existing reaction force. In other words, the participants do not expect physical contact with a real object when they hit the spot. This hypothesis suggests that based on to what level the metaphorical representation of an object in virtual space matches the feel of the VR Experience, participants will have different preconceptions about what kind of feedback they will receive when they interact with this given object.

Second, influenced by their previous experience with VR or technical conventions of other media, the participants may think that it is normal to not experience tactile sensation when they interact with digital artifacts. For example, in an e-book, it is the visual effect that convinces people that they are flipping the pages. The readers do not seek out or anticipate the physical feeling of paper while using an electronic book. This hypothesis provides an opportunity to reflect on the degree that people are exposed to established conventions and how closely people follow norms.

Third, according to their life experiences, the participants mentally measure the range of moveable space before they wear the headsets. From this, the participants anticipate how many steps they can walk in one direction before bumping into the
installation. The participants might get surprised when they find out their anticipated step counts are wrong and recognize they cannot trust their senses and estimations.

No matter which hypothesis is correct, it is clear to me that the participants are constantly aware of the existence of their physical bodies when they wear the headsets. Even when the participants become fully immersed inside the virtual space, there is still a part of consciousness that is left to coordinate with various physical perceptions with the body. This small amount of consciousness might not be enough to remind the participants of their dual existence in two realities when they are lost in the virtual world, but, if needed, the body can “think” and react spontaneously.

The project takes around eighteen minutes for participants to finish listening to all the stories in my work. The participants spend less than six minutes with my work on average in the Gallery 360 while the participants are willing to spend more than ten minutes on average with my work in the studio. When I asked about how they like the installation, one participant said: “I feel comfortable and safe in there.” Independent from the virtual space and the public exhibition space, I think installations can create a third-party zone to encompass the participants with a safe, private, and visually appealing environment.

(4) Narrative

Every story in Captive Memoirs has its own narrative structure as it is told by different storytellers. For example, in David’s story, the main storyline is achieved through time. The story starts from the year when he entered the army at the age of 17 and ends with the moment that he felt desperate and fearful as he was informed that he was not able to get back home on a warm May morning in 2005. In Gloria’s story, she first points out the conflict in her mind and the rest of her story then states the effort towards solving the problem. The story begins with her unique vision that she wants to jump out of a life
pattern that ordinary people live in and stops with the conclusion that this vision is a paradox that cannot be realized. As we can see the apparent differences of narrative structures in each story, *Captive Memoirs* is a collection that offers the possibility for collaborative creations.

What cannot be seen behind these stories is my effort as the “primary” author who made decisions about the hierarchy of the overall VR experience. Just like an album producer, I selected these six stories from the ones I collected from my interviewees based on my goal of creating a bigger picture of being trapped. When selecting stories, I was looking for dramatic experiences. In the meantime, I made sure that every story covers a distinctive, but common, topic that can be expanded to the audiences’ everyday life. It is my role to create a peephole through which the participants can see not only other people’s struggles, but also, essentially, their own struggles as well.

The participants are engaged with the central theme through their choices. Seeing the world through the first-person perspective, it is the participants’ decisions to begin their journeys with one character inside a virtual space according to the visual appearances of the 3D figures. For example, starting a book from a random chapter would usually lead to a failure of comprehending the meaning of a story since the author intended it to be understood in a certain order. However, this concern does not exist in my work since each character tells a complete and independent story from the series. Although it might be hard to grasp the essence of the work through one story – social expectations, circumstances, or people’s own choices trap themselves – I think the participants might find it intuitive to perceive and resonate with this idea through hearing a small number of stories.

Finally, there is one trap embedded inside the overall narrative. Some participants expect that they can rescue the characters or themselves from the vessel prison in the end
as we usually see in survival games, so they try their best to finish the “task” by hitting hard on every triggering spots and listening to all the stories patiently. The disappointing result is that nothing will happens, which indicates a cruel fact that their efforts of breaking out are in vain. By positioning the audience in a reality where they cannot get away from, but only allow confrontation, a bigger narrative of being trapped has been established. The participants’ performance might help them generate more sympathy towards others. As an artist, this is my statement towards our inescapable life.

(5) Interaction

In the interaction with interactive art installations, the participants tend to observe and analyze before doing actions. Among all the other modalities of interaction, “Reading” is the primary one. My first endeavor to create the interaction was designing six symbolic shapes of vessels to represent the characteristics of the storytellers.

What is surprising to me is that most storytellers have ideas about what kind of shape their vessels should look like. I believe it is their intuition to help the storytellers realize what kind of shape is appropriate for defining their lives. For example, one of my friends, Yilin, who told her story in Chinese, informed me that she wanted her vessel to have a shape of “梅瓶.” “梅瓶,” the bottle for plum blossoms, is a specific vessel in Chinese culture. As people usually see this kind of bottle inside the upper-class people’s study rooms in ancient society, the bottle represents a good wish to become more tactful and wealthier. It also supplies a metaphor for the unpredictable fate of prosperity. Naturally, people, who do not know about Chinese culture, would not be able to decode the shape due to cultural constraints. For those who are Chinese, however, this shape is not only a clear statement about Yilin’s cultural identity, but also perfectly matches with her story. As in her story, Yilin talked about the struggles of dealing with relatives, which is a common issue in Chinese society, and pressure from her father-in-law as he asked her to
give up her dreams in exchange for the success and wealth in business. During the process of designing this vessel, I realized that configuration reading is a kind of shared attention as it could lead to the understanding of meaning.

Figure 23. “梅瓶”, Yilin’s Vessel, 2019.

As human beings, we interact with the world in many ways, such as gaze, touch, smell, speech, and so on. As VR technology provides participants with a unique vision to engage with virtual space, vision liberates the participants to use movement for interaction. In *Captive Memoirs*, the glass vessel with six cracking spots is the **interface** for the participants to operate. What the participants hold in their hands is a controller that provides them their **agency** in the virtual space. In the first version of this work, the controller was visualized as a brick, which, according to most participants, was difficult to understand how it should be used, so the design for the controller changed into a hammer.
The interactive function that allows the audience to trigger the stories is achieved through Unity’s built-in function called “collision”. When the participants wave the hammer to break the bottle, it creates a collision inside the virtual space. Once the collision has been detected, the sound (stories) will play. If another collision has been detected after the first three seconds into the stories, the sound will pause.

During interaction design, several user tests were conducted with feedback reported mostly on the instability of collision detection. Some participants would hit the same spot repeatedly (e.g. five times in a few seconds) before the stories came out, which caused difficulties for them to comprehend the mechanics of triggering stories. To avoid this confusion, the code was modified by adding a timer to create a two-second window for detecting a stable collision. As Murray states: “[T]he appropriate design goal for interactive environments is not the degree of interactivity, but whether or not the system creates the satisfying experience of agency for the interactor.”

Some participants would hit multiple spots within a relatively short time, which directly resulted in listening to multiple characters at the same time, in prior versions. For the sake of viability, a procedural listener was set up to receive the messages from different
spots and create a management system that only allowed one story to play at a time. Thus, the audience would be able to hear the stories clearly. After updating this design detail, it was valid in preventing the false affordance of multiple soundtracks playing at the same time and made the whole experience feasible.

To create a user-friendly environment in the virtual space, “the properties of architectural elements — color, light, material, texture, size, and shape — as well as their interrelationship”\textsuperscript{32} were taken into consideration. During the design process, a visible color difference between different rendering engine systems was noticed. For the Oculus Rift headset (a device that needs to connect to a high-end computer), the overall tone was close to purple and, thus, made it feel warm. For the mobile device (Oculus Go), the overall tone of the same project was close to blue and felt cold. From the perspective of psychology, the computer-generated experience is more exciting and intimate.\textsuperscript{33} The central bottle that captures the audience was less visible in the previous version, so a purple texture was applied to enhance its visibility. The sizes of the vessels, the hammer, and the participants (it is a camera in Unity) were also adjusted a few times to emphasize my vision of being trapped inside giant vessels.

Figure 25. The Timetable of Designing Captive Memoirs, 2019.
When it comes to selecting the appropriate interactive device, a false affordance was spotted in the Oculus Go headset. The application and performance of the product made people believe that 3D motion tracking was available inside this stand-alone mobile headset. This was proven to be only the techniques that allow the controller to point in different directions. Based on personal experience, the controller can only be moved horizontally within an arm’s range and is extremely hard to move vertically for more than fifteen inches. Comparing to Oculus Go’s controller, the Oculus Rift provides controllers that are weighted; this matches up with people’s experience with hammers. In addition, the Rift’s controller has a feature of haptic feedback that can be used to enhance the feeling of embodiment. These are the reasons why the Oculus Rift headset was chosen for this project.

![Oculus Go Headset](image)

Figure 26. Oculus Go Headset, Photograph from Internet.

4. As a Medium

Virtual Reality, as a medium, had its rise and fall in the past. Before 2014, the public had lost interest in VR for a long time. As always, nobody can say for sure if this VR bubble that we see in today’s market is going to burst or not, but we may be able to at least get a better understanding of the medium environment we are living in this time. Just like
what we see in the latest sci-fi film, *Ready Player One*, VR can be the most promising medium to bring social and cultural change.

Marshall McLuhan, one of the most famous medium scholars, states:

All media work us over completely. They are so pervasive in their personal, political, economic, aesthetic, psychological, moral, ethical, and social consequences that they leave no part of us untouched, unaffected, unaltered. The medium is the message. Any understanding of social and cultural change is impossible without a knowledge of the way media work as environments. All media are extensions of some human faculty – psychic or physical.34

As an artist, I found myself unavoidably attracted to this emergent medium as it involves me with new ways of seeing, thinking, and acting. There is a chance for me to develop a wholly new aesthetic experience that adds its uniqueness to the wider cultural discourses. Virtual Reality helps me to step outside of my daily life as I can see my struggle in the distance. For the last two years, I have been feeling lost and trapped because of my social status as an international student. By using the medium, I am able to portray my world in a more poetic way. It is in the virtual space that I begin to wonder the shape of other people’s life since we can exist as more than just solid flesh.

When I called for stories amongst my friends with the theme – feeling trapped – I was very much surprised by the positive responses. This is not a common question you would ask even your friends. The irony is that, even though all of us are trying our best to be supportive for the people we love, we sometimes do not have the chance to listen to their pain at such a close distance. It is this medium that bridges the gap of communication between me and the people I am close to, so I hope this project can further arouse empathy even among strangers. Moreover, as my friends are living thousands of miles away from me, geographical distance between countries and cultures can be shortened through this medium.
For the viewers, the virtual reality becomes an extension of themselves as they can observe their surroundings from angles that only exist in their illusions. More than that, the viewers’ reactions become part of this medium. Their performance generates meaningful gestures that can activate the space. In *Captive Memoirs*, the viewers would wave their arms with various facial expressions. It is a clear evidence that the audience believe their presence in another reality through live performance.

![Figure 27. The Participant Engages with the medium, 2019.](image)

**Conclusion**

Just like what we experience with the photographic medium, VR, as an emergent medium, raises additional questions about how to raise the VR Experience to the level of
fine art. If VR Experience is to take its place as a full-fledged art form, “it must determine the disciplines inherent in the medium, discover its own structural modes, explore the new realms and dimensions accessible to it and so enrich our culture artistically as science has done in its own province.” 35 This underdeveloped new form calls for the artist, who can make the most prophetic and visionary statements, to exploit the creative potential of this medium.

_Captive Memoirs_, as a highly hybrid artwork, provides a practical framework for the new medium through which I interrogate how visual representations, sound, space, narrative, and interaction are arranged to constitute a new way of expression. Through the combination of different media, a magical experience has come along the way, just like setting off a chemical reaction. Although the audience tend to not clearly identify the cause of an immersive experience, it is clear that the other media, such as painting, can be used as part of VR content to make the artwork more intense for reading.

If those who enter _Captive Memoirs_ can experience a sense of aesthetics, immersion, presence, interactions, and free will, then _Captive Memoirs_ would achieve its most fundamental goal.

For the further development of _Captive Memoirs_, I shall dive deeper into each story to make more visual contents for the participants to read. I will make a corresponding animation of the glass breaking when a collision happens. I would like to offer more choices inside each story so that the participants can enjoy the pleasure of making something happen in a dynamically responsive world. I believe it can be a fascinating experience if I create a multidimensional illusionary space that the audience can jump into and navigate through. Above all, this is not the end of my practice, nor the end of my exploration of VR Experience.
Glossary

Affordance: A concept used to describe the properties of digital medium that allows participants to use in particular ways. Murray has established a theory about four representational affordances that can be found in digital artifacts.

Agency: The capacity to interact with the digital environments and make something happen in a responsive virtual space.

A sense of tableau: An internal neurological representation of a vivid scene or a picture.

Decoding Performance: An act, in which participants understand the interactive properties provided by VR Experience and actually use those properties to interact with the work. This term adapts the concept of media studies in relation to Stuart Hall’s ‘Encoding/Decoding’ model to draw more attention to participants’ emergent uses of interactive art installations.

Encapsulation: A strategy of creating abstract blocks to build up a complicated system. This is a crucial method for computer programming.

Immersion: The state of experiencing an imaginary world as someone’s primary world and having some sort of mental or physical response within the illusion.

Interface: A window that enable the participants to enter the virtual world. More specifically, it can be a perceptible part of VR that allow participants to operate and communicate with the virtual space.

Language system: A particular sets of vocabularies that workers use to communicate with each other in the field and a unique pattern of organization, a conventional way of doing things, that operate most frequently in the medium.

Presence: The feeling that someone is in a place even though they are not there.
Self-Embodiment: A feeling of tangible body in a virtual space. It is a perception of sensory feedback related to participants’ non-physical body and a special effect on their cognitions.

Notes

6 Osmose is an immersive virtual environment, produced by Char Davies in 1994/95. One of Davies’ intentions for Osmose was to create a space that is "psychically innovating."
8 There are other categories that are left out intentionally, such as VR film since there are few successful works that can be cited.
11 Cumhur Erkut, “Rhythmic interaction in VR: interplay between sound design and editing.” In 2017 IEEE 3rd VR Workshop on Sonic Interactions for Virtual Environments (SIVE), (2017), 1.

12 The nine awards include: D.I.C.E. AWARDS (Immersive Reality Game of The Year 2018), UNITY AWARDS (Best VR Game 2018), SXSW GAMING 2018 (VR Game of The Year), CEEGA 2018 (Best Technology), GAME DEVELOPERS CHOICE AWARDS (Best VR/AR Game 2018), SXSW GAMING 2018 (Most Promising New Intellectual Property), GAMERS’ CHOICE AWARDS (Fan Favorite VR Game 2018), GAME DEVELOPERS CHOICE AWARDS (Audience Award 2018), HALO AWARDS (Gold Game 2018).


14 Amaury La Burthe, Béatrice Lartigue, Arnaud Desjardins, Fabien Togman, Note on Blindness, 2016, http://www.notesonblindness.co.uk/vr/


30 Steve Swink, Game feel: a game designer’s guide to virtual sensation. (Boca Raton, FL: CRC Press, 2008), 171-172.

31 Janet H Murray, Inventing the Medium: Principles of Interaction Design as a Cultural Practice, 12.


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