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MASTER'S DEGREE
INTERACTIVE MEDIA AND SYSTEMS

Transcendent Realms: Immersive environment for live performance

Anastasiia Karasynska

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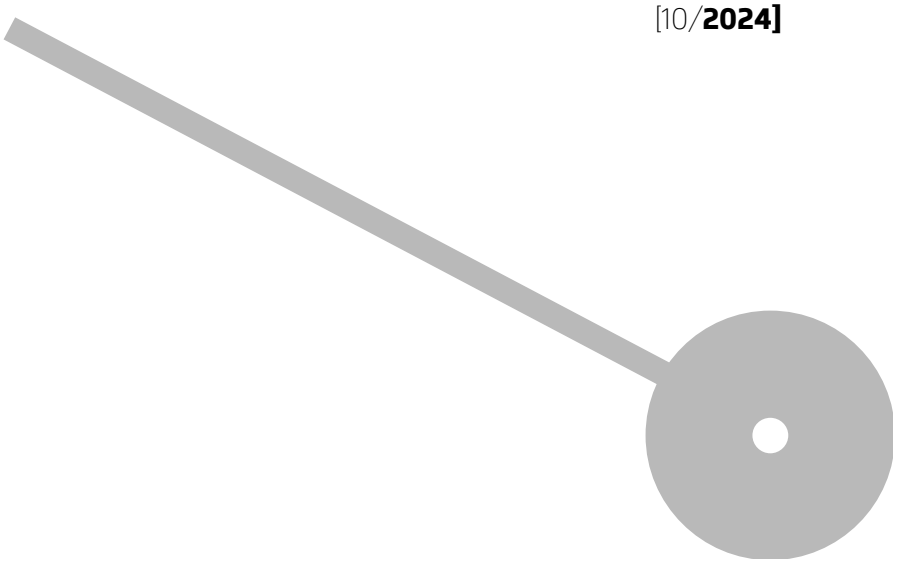

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Transcendent Realms: Immersive Environment for Live Performance

Master's Project Work
Master´s Degree in Interactive Media and Systems
Supervision: Prof. Luis Miguel Barbosa Costa Leite
Co-supervision: Prof. Filipe Cunha Monteiro Lopes

Vila do Conde, October of 2024

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Jury Member – Supervisor
Prof. Luis Miguel Barbosa Costa Leite
Escola Superior de Media Artes e Design – Instituto Politécnico do Porto

Jury Member – Examiner
Prof. Rodrigo Guerreiro Vaz Guedes De Carvalho
Faculdade de Belas Artes da Universidade do Porto

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RESUMO ANALÍTICO

O projeto de tese de mestrado "Ambiente Imersivo para Live Performance" explora a combinação da prática artística de performance audiovisual ao vivo e design em espaços imersivos. No contexto do rápido desenvolvimento tecnológico, o projeto foca na criação de novas formas de expressão e na exploração de experiências sinestésicas através de mundos virtuais. A pesquisa orientada para a prática (PBR) é aplicada ao desenvolvimento de conteúdo, implementação técnica e performance no ambiente imersivo CAVE usando TouchDesigner. Conceptualmente, o projeto é inspirado na ideia de transcendência e visa contribuir para uma nova linguagem artística espacial. O projeto oferece conhecimento teórico e prático no campo das tecnologias imersivas e da arte generativa, propondo abordagens para a implementação de performances audiovisuais e enriquecendo a compreensão da transcendência na arte contemporânea. Como resultado, o projeto contribui para a sistematização de métodos de design imersivo, avançando o discurso sobre as artes imersivas e ilustrando o potencial transformador do design imersivo na expressão artística audiovisual contemporânea.

Palavras-chave: Live Audiovisual Performance; Ambientes Imersivos; Transcendência; Design Imersivo; Arte Imersiva

ABSTRACT

The master's thesis project "Immersive Environment for Live Performance" explores the combination of artistic practice of live audiovisual performance and design in immersive spaces. In the context of rapid technological development, the project focuses on the creation of new forms of expression and the exploration of synesthetic experiences through virtual worlds. Practice-based research (PBR) is applied to content development, technical implementation and performance in the immersive environment CAVE using TouchDesigner. Conceptually, the project is inspired by the idea of transcendence and aims to contribute to a new spatial artistic language. The project provides theoretical and practical knowledge in the field of immersive technologies and generative art, offering approaches to the implementation of audiovisual performance and enriching the understanding of transcendence in contemporary art. As a result, the project contributes to the systematization of immersive design methods, advancing the discourse on immersive arts, illustrating the transformative potential of immersive design in contemporary artistic audiovisual expression.

Keywords: Live Audiovisual Performance; Immersive Environments; Transcendence, Immersive Design; Immersive Art

SUMMARY

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INTRODUCTION

The master's project "Immersive Environment for Live Performance" explores the combination of artistic practice of live audiovisual performance and visual design for immersive spaces. With the rapid development of technology, the study of immersive spaces is becoming increasingly important. The project is relevant in the context of the current interest in interdisciplinary approaches in art and reflects the desire to introduce technology into artistic practice and explore new forms of expression. It also contributes to the development of virtual worlds that are entirely separate from everyday reality, allowing users to explore new synesthetic experiences in the era of non-linear narratives intertwined with sensory environments and escapism. The project identifies gaps in the theoretical base of research on immersive design and emphasizes the need to create a new spatial artistic language for immersive art.

The project consists of several stages, including research, content development, technical implementation and performance using practice-based research (PBR). The main goal of PBR is to create new knowledge through practical activities. Practice serves as both the subject and the method of research (Candy, 2006). This method has been described as a good choice for implementing multimedia projects, as it combines documentation and practical experimentation, making it suitable for parallel writing of a thesis.

The practical tasks of the project include creating an immersive experience based on research into immersive design and the specifics of immersive media, developing content mindful of Cave Automatic Virtual Environment (CAVE), collaborating with a sound designer, composing live performance, synchronizing audio and visual components, studying the technical aspects of the implementation of immersive audiovisual performance in CAVE using TouchDesigner (TD) software as the main tool.

The project is conceptually inspired by transcendence and explores it through audiovisual metaphors. The concept of transcendence has taken a leading position in Western philosophical thought in the 20th century and covers a wide range of meanings. It is used in various contexts such as philosophy, religion, science, and art. Researchers,

scientists, and artists recognize the impossibility of absolute access to reality, as human modes of access are always indeterminate, limited by conditions and the space-time continuum (Paar & Golub, 2003). In a general sense, transcendence is associated with the idea of going beyond the familiar or known; the Latin word “transcendo” translates as something that surpasses or exceeds, goes beyond the limits.

Immanuel Kant played a key role in the development of the concept of transcendence, making important distinctions and developments that have had a significant impact on contemporary philosophy, culture, and art. His magnum opus is called the "Critique of Pure Reason." Kant divides objects of knowledge into two categories: "things-in-themselves" and "things-for-us." Things-in-themselves exist independently of human perception and are inaccessible for complete knowledge. These objects are not perceived by the senses and therefore cannot be directly known (Kant, 1781/1998). Kant also introduced the concept of the sublime, which refers to the experience of something so great and powerful that it transcends everyday reality and immediate experience, evoking feelings of wonder and awe (Kant, 1790/2007). In both philosophy and contemporary art, the concept of transcendence can be explored and expressed in a variety of ways, reflecting the diverse perspectives and questions of artists working nowadays. Drawing parallels between metaphysical ideas and artistic creation, artists can use symbolism, abstraction, or experimental art forms, including new media art and performance, to evoke a sense of the indescribable, inviting viewers to reflect on existential questions and the nature of reality.

Given the innovative nature and the wide range of industries and technologies in which immersive design is being developed, systematizing and standardizing its core principles and methods is a complex task. Today, immersive design is a universal approach used in a variety of fields, but even these types of immersive design are in the early stages of development. Can Buyukberber [1], an immersive artist at Adobe, believes that the spatial and interactive nature of immersive technologies, along with the lack of gravity and weight in digital space, radically changes the grammar of previous art forms. In his opinion, a new grammar needs to be developed that will open up new possibilities for experimentation and innovation.

[1] https://canbuyukberber.com/

Based on this, I believe that although contemporary artistic practice has a high degree of freedom of expression, a theoretical basis and systematization of experience in contemporary art, including immersive design and art, can be useful.

Main objective 1: To investigate the artistic and technical possibilities of immersive environments for live performance.

Main objective 2: To design an immersive live AV performance that explores the concept of transcendence by applying the knowledge gained during the research.

Through the development of the project, it is expected to obtain new theoretical and practical knowledge in the field of immersive technologies, design and audiovisual generative art. The project aims to generate new insights into these areas, facilitated by the application of the Practice-based research (PBR) method. Additionally, the project will offer valuable experience in developing creative practice and allow an exploration of the concept of transcendence through personal and reflective artistic processes.

1 LIVE AUDIOVISUAL PERFORMANCE

1.1 Introduction to the concept of live audiovisual performance

According to Ana Carvalho and Cornelia Lund's study "Audiovisual Breakthrough" (2015), live audiovisual performance is a term applied to contemporary artistic expression based on the live manipulation of sound and image, defined as temporal, media-oriented and performative. Live audiovisual performances are a complex phenomenon due to their diversity. They are not limited to one style or method but are a mixture of various elements and techniques; they are also often characterized by intermediality, that is, the interconnection of various artificial forms of expression. To better understand this term, Ana Carvalho and Cornelia Lund suggest breaking it down into its essential components and defining them.

The word "audiovisual" refers to audio and visual content which are combined into a single expression or work of art. Thus, in audiovisual performance, there is always a connection between sound and image. The roots of audiovisual art can be traced back to the artistic exploration of synesthesia, which is nowadays considered an uncommon

neurological phenomenon. Further in this chapter, I will touch on this topic in different ways, and now let´s move to the next essential component.

The concept of happening art, such as events, situations and performances, proposed by the 20th-century American art theorist and artist Allan Kaprow, can be regarded as a foundational element for contemporary research and practice in performance, including live audiovisual performance. This concept traces the basis of all complex relationships between the presence of artists and their significance for performing in front of an audience, that is, the dynamics of presence (Kaprow, 1993).

The presence of the artist in the space of performance is one of the key elements defining a live audiovisual performance. This gives the viewer the feeling that a work of art is unfolding before their eyes. In technological media there is no internal unity between a gesture and its result, so based on their own experience of interacting with computer interfaces, viewers interpret the body language and gestures of the performer. However, several technologies and interfaces are already beginning to overcome this problem, by creating touch screens or gesture controls that allow directly interact with media content.

There are fundamentally different approaches to performance and performers' experiences may come from other professional fields, and ignoring this component may rob an audiovisual performance of one of its most powerful and expressive elements. Designers tend to pay less attention to their bodies and try to focus on getting their work done without considering the visual expression they convey through their physical presence. Musicians tend to be more attentive to the stage and may even introduce overly emphasized instrumental gestures into their performance. Both influence the perception of the work. As a dancer and student of interactive media, this makes me think of multi-sensory and multi-performative experiences that may include not only visual and audio aspects, but also movement or even physiological responses such as heart rate, breathing, or even psychophysiological indicators of emotional states. This approach can create multidimensional communication between the artist and the viewer, as well as between the artist and the artwork itself. The combination of multiple types of activities in hybrid works of art reflects contemporary approaches to artistic expression, where the boundaries between the arts are blurred, the sensory experience is expanded, and the work becomes alive, dynamic and interacting with the environment

and the audience. The physical location of the performer in the performance space is another element that must be considered. Some performers prefer to remain in the background to let the work speak for itself, while others find it important to be in the spotlight. The decision about the placement of the performer usually depends on the goals of the artwork and the desire to create a certain effect on the audience. It is also worth considering the need to combine cognitive control over the technical aspects of the performance with the intuitive understanding of the viewer. This approach allows the performer to effectively realize his vision of the work and ensure its impact on the audience, allowing viewers to immerse themselves in the artistic experience deeply (Schacher, 2008).

"Live" addresses the relationship between performance (presence) and the technology necessary to create, manipulate, and project sound and image in real-time. (Carvalho & Lund, 2015). Given that sound and image consistently pass through media, technology assumes a central role in shaping the results. The authors also refer to the historical events of E.A.T. [2] as a major reference point that combined performance with technology. E.A.T did not adhere to any specific technology or type of equipment, such as computers or holography. The organization sought to provide opportunities for artists to interact directly with engineers in the industrial environment where technology was being developed, involving thousands of participants from various fields of science and art, producing works that reach and inspire an ever-growing audience.

In the context of audiovisual performance, the terms live and real-time can sometimes be used interchangeably, but some accentuations highlight their differences. For example, "live" often describes the performance process, while "real-time" is a technological capability that allows data to be manipulated and displayed without delays, making improvisation possible. Improvisation is a prominent feature of live audiovisual performance, and J. Schacher compares the relationship between performer and software to the relationship between performer and musical instrument (Schacher, 2008).

[2] Experiments in Art and Technology (E.A.T.), a non-profit and tax-exempt organization, that was established in 1967 to develop collaborations between artists and engineers.

Creating live audiovisual performances in real time involves the use of various technologies and tools. These technologies allow the creation of visualizations and sound that react to environmental input or the performer's actions. Some artists prefer to use custom software or develop their tools, which allows them to achieve complete freedom in realizing their ideas. Today, audiovisual performers often use tools for real-time audio processing, such as Ableton Live, Max/MSP, and Pure Data. Tools such as TouchDesigner, Resolume, MapMapper, and Millumin are used to process visualizations in real-time. Real-time communication protocols such as Open Sound Control (OSC) and Musical Instrument Digital Interface (MIDI) are used to provide the necessary communication between the various components of the system.

The concept of live audiovisual performance was examined from the perspective of three essential components. This approach is a flexible structure that allows the connection of different artworks, rather than using a rigid set of definitions. According to Tanya Leighton, this strategy is the most appropriate, as it considers the technological nature and intermediality of audiovisual performance.

It's also crucial to acknowledge related genres of live audiovisual performance, as they may share similar elements while possessing their own distinct characteristics. Visual music serves as an umbrella term for a wide range of audiovisual works and has its roots in the artistic study of synesthesia. A genre like Vjing tends to be secondary to the music. VJing has an entertainment function and usually occurs at parties, and the activity of a VJ is comparable to that of a DJ. However, some VJs believe that their practice is based on the philosophy of improvisation, which adds additional layers of meaning to the genre. The main emphasis of live cinema is usually on creating a dramatic audiovisual concept and usually seeks to convey a message, that is, it is semiotically charged (Carvalho & Lund, 2015).

In his article "Live Audio-Visual Performance as a Cinematic Practice" (2008) Jan Schacher, equates audiovisual performance with live cinema and describes a practice that I identify as live audiovisual performance. Therefore, I often refer to his ideas and quote information from his article in my thesis (2008).

1.2 Aesthetics in contemporary audiovisual art

A major influence on contemporary audiovisual art is generative visualization and algorithmic composition. Its visual expression typically includes geometric shapes and patterns that explore space and sound, as well as elements that imitate natural behavior or are reminiscent of fine art painting.

Margaret Boden and Ernest Edmonds describe generative art as work created through a set of activation rules, where the artist allows the system to take over at least some of the "decision-making". Generative art tends to take on images and forms that the human mind, without the help of a computer, could not imagine. A striking example of such art is Michael Hansmeyer with his generative architecture (Figure 1). His work explores the possibilities offered by human-machine interaction in the creative process, which fits my desire to create new audiovisual experiences through generative art (M. Boden, E. Edmonds, 2009). Michael Hansmeyer is an artist, architect and programmer who explores rule-based architectural design to reimagine traditional building paradigms and create entirely new spatial experiences. He views the computer not only as a parametric system of control and execution but rather as a tool for exploration and discovery. The computer serves as a design partner, offering an infinite array of possibilities, many of which are unexpected.

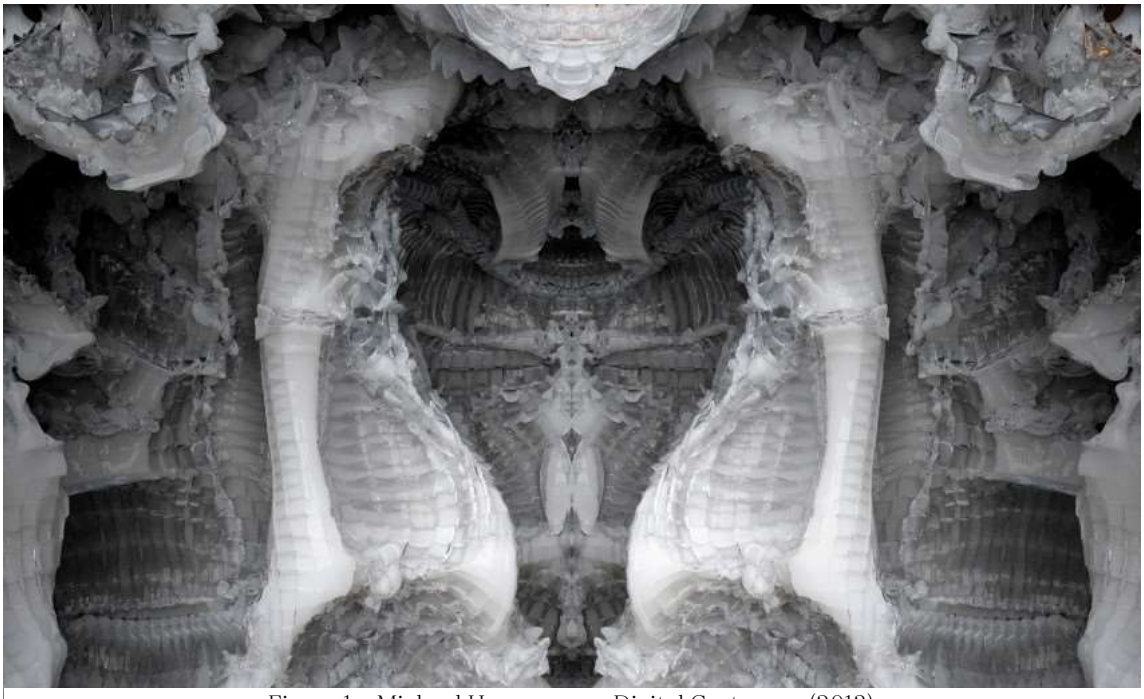

Figure 1 – Michael Hansmeyer - Digital Grotesque (2013)

My practical approach to this project is to create a generative visualization, which is audio reactive, while simultaneously being dynamically controlled in real-time within the performance space. Audio reactive visualization, based on algorithms and controlled in real-time, can be considered a form of generative art since its output in compression ratio depends on the audio input and the rules specified by the artist or developer. Audio reactive visualization is closely related to the so-called digital synesthesia, which, in my opinion, is an often-explored aesthetic component in audiovisual performance. An approach to creating a performance based on digital synesthesia helps to create a convincing connection between image and sound, and a separate section in my thesis is devoted to it.

However, there is no single style in audiovisual art. It includes a variety of different mediums and artistic approaches. Visual expression can be oriented both to photographic and narrative gesture through the depiction of the real world, and to synthetic compositional practices that refer to modernist abstract art. These include typography, photography, live action, graphic design elements, scientific visualization, as well as 2D and 3D animation, etc., bringing together all our cultural heritage. Thus, audiovisual art can be inspired by and incorporate a wide range of cultural and intellectual influences, moreover, in the context of new media art, technological innovation and complexity of process can become independent aspects influencing the value and reception of a work. Nowadays audiovisual artists tend to explore the relationship between modern technology and man, man and nature, as well as other relevant topics.

The sound includes a variety of contemporary electronic music, which can be rhythm-oriented or sound design, incorporating any experimental techniques available. This may include the use of synthesizers, audio sampling, digital processing, and other auditory techniques such as sound collages and the use of analog instruments. However, sound can be represented by any genre or sound form, including various styles of instrumental music or vocalization.

Abstraction prevails in contemporary audiovisual art, due to its widespread use of generative art as a means of expression. Abstraction often means highlighting the basic or essential characteristics of an object or phenomenon, neglecting the details. In the context of fine art, this may mean moving away from representation and recognition.

Abstraction can also be more associated with feelings and sensations, increasing attention to the perceptual experience of life. It seems to me that both approaches coexist in parallel, without excluding each other. That is, by highlighting the main qualities of phenomena or objects and depicting them abstractly through art, we draw attention to their essence and impact, ignoring details. This allows you to experience visual impressions on a more sensory level, bypassing excessive analysis.

Digital media can effectively support a wide continuum of abstractions due to their ability to recombine or reproduce simulations of time, space, and invisible or theoretical dimensions and interactions. The reduction and abstraction of the constituent elements reveals the attributes of form, color, timbre and space and allows them to be combined through the senses in such a way as to generate an idea-free mental space. This space is less crowded and can intentionally leave empty areas that can be filled by the perceiver's imagination. The visual abstract elements of audiovisual generative art often exhibit behaviors that may appear utopian or hallucinatory, such as metamorphosis, fusion, and creation. They also tend to give rise to the idea of a separate space inhabited by entities that do not obey the laws of physics. This behavior is reminiscent of biological processes on a microscopic scale or in the oceanic sphere, as well as physics observed on a cosmic scale. Recognition occurs not so much at the level of the object, but at the level of resonance and self-reference. Resonance occurs when an abstract entity relates to a personal experience unique to each viewer or listener, while self-reference occurs when a concept, intuition, emotion, or imagination evoked by an abstract expression is recognized (Schacher, 2008).

Contemporary abstract audiovisual art draws heavily from both generative art and algorithmic composition, alongside traditional musical structures. Moreover, they can be freely intertwined within one work. With the advent of the computer in everyday life, a new creative language has emerged that is experimental, design-oriented and diverse in the construction of narratives and the way artists share their creative expressions. The construction of narratives is no longer necessarily sequential or even linear, but rather more perceptual and intuitive. This is closely related to the fact that abstract content does not necessarily follow narrative logic and can therefore be more freely subject to its own internal possibilities. Here it is also worth considering the context, that the narrative also develops in real time.

Most of the time, the temporal structure of an audiovisual performance develops following the musical rhythm and form, its arc of tension more reminiscent of a piece of music than a film, however, artists can program algorithms so that changes in the visual part of the work are accompanied by corresponding changes in the audio component and vice versa. This creates additional layers of composition and integration between visual and auditory experiences, where some elements of the temporal structure are planned, while others are free-flowing improvisation.

1.3 Digital synesthesia

Digital Synesthesia is an artistic research project carried out at the Department of Digital Art at the University of Applied Arts in Vienna. The purpose of this project was to explore the potential of digital art to create translational and cross-modal sensory experiences and provide synesthetic experiences for non-synesthetes, providing further exploration of synesthesia in digital audiovisual art (Gsoellpointner, 2015).

In a general sense, synesthesia refers to the phenomenon where one type of perception activates another. For example, some people may experience the phenomenon of synesthesia, in which letters or numbers are associated with certain colors or smells, or which can trigger the perception of musical sounds or melodies. Even certain swimming styles can evoke synesthetic associations. According to Richard Cytowic, synesthesia can be considered the neural basis of metaphor. Metaphor, in turn, is a concept closely related to artistic interpretation (Malteza).

Multimedia provides the opportunity to combine two or more sensory experiences, and for media studies, especially for media aesthetics, the role of synesthesia in media studies is of central interest, since there is a surprising correlation between these phenomena. However, to date, multisensory media can only create a rough approximation of the state of true synesthetic perception. Synesthesia has inspired many artists over time and has become a major feature of new media arts, especially audiovisual and interactive arts. Among the most famous figures who explored synesthesia through their art or were real synesthetes are Wassily Kandinsky, Stephen Malinowski, Jimi Hendrix, and, according to some art historians, even Vincent van Gogh.

Further in the text, when I talk about synesthesia as an effect of multisensory environments, I will call it digital synesthesia, referring to K. Gsoellpointner. The aesthetic value of digital synesthesia is that it allows artists and users to expand their sensory experience and perceive the world in unusual ways. I believe that new media effectively achieves digital synesthesia because it can provide multisensory experience. This is because code can describe and control various aspects of visual, auditory, tactile perception, etc. Thus, at the perceptual level, new media art can produce synesthetic, cross- and multimodal translations from one sensory modality to another in the form of linguistic, musical, visual and other metaphors.

In his article, Jan Schacher emphasizes the importance of establishing a meaningful connection between senses in synesthetic designs. He argues that for live cinema expressions involving abstraction, it is crucial to find ways to integrate visual and auditory elements effectively. This integration can significantly enhance the impact of the combined audiovisual experience. Schacher, however, notes that many attempts at synesthetic fusion in audiovisual art fall short, as music is often merely added to the visuals, resulting in a superficial connection between the two. He explains this failure by the fundamental difference between the senses, namely vision and hearing referring to principal differences in the mechanisms of vision and hearing. Thus, when working with audiovisual art, one should consider working with two fundamentally different channels of perception of the environment. In the context of audiovisual art that experiments with abstraction, the key is to achieve a balance between the two senses, especially between the different concepts of temporality and density. J. Schacher recommends that artists develop sensitivity to these aspects to create a holistic and unified experience of the work of art (Schacher, 2008).

2 IMMERSIVE MEDIA ART

Immersive media generates an illusory environment that envelops one providing the sensation of being inside and part of it (Bolter & Grusin, 2000). Today, there are several ways to achieve immersive experiences. One can enter a physically enclosed architectural space, such as a virtual cave or multi-screen projection room, or use technological equipment like stereoscopic glasses, head-mounted displays (HMDs), data

suits, and communication devices. The quality and fullness of an immersive media experience depends not only on the amount and volume of information the device conveys to the human senses but also on how much this information is intellectually and emotionally captivating.

The central characteristics of immersive environments are presence and immersion. Jonathan Steuer defines presence as the feeling of being present in the environment, while telepresence is the feeling of being somewhere other than here, being present somewhere else through technological means (Steuer, 1995, as cited in Bartlem, 2005). In other words, telepresence implies that a person can sense his or her presence in a remote location or virtual environment through human-technology interfaces. Today, telepresence is mainly associated with virtual reality. Immersion means that a person is surrounded by an audiovisual (technological) environment and transported to another state of perception. Erkki Huhtamo views immersion as related to the desire to transcend the physical body and immerse oneself in a telematic environment, describing the subjective experience of immersion (Bartlem, 2005). Mel Slater, on the other hand, focuses on the objective features that contribute to this feeling, such as image resolution, frame rate, and sound quality, and their comparability to real-world sensory experiences (Bluff, 2017). Considering these complementary approaches to the concept of immersion, it can be assumed that to achieve a high level of immersion in immersive media, it is important to combine quality technologies and a skillful approach to their use with artistic solutions that can maximize creativity and move closer to the dream of creating an artificial environment that is absolutely immersive and captivating viewer on sensory, emotional and psychological levels. In everyday language, "transcendence" means "exceeding," and "self-transcendence" means going beyond a previous state or form of oneself. Thus, transcendental experience in the context of totally immersive environment can involve overcoming immediate physical existence and moving into the virtual realm.

Immersive art is an art form that first appeared in the art world, expressing artistic concepts through the artist's mind and creating a connection between art and the world. It can be seen as a continuation of movements such as Dada, Fluxus and Conceptual art, due to its emphasis on formal elements, the concept of the work, art as an event and emphasis on audience participation (Bartlem, 2015). In immersive media

art, the artist uses emerging technologies and media to create new forms of thought and expression, stimulating the active participation of viewers. The goal of many immersive media works of art is to make the viewer aware of their presence in the artwork and how they perceive the environment both physically and intellectually by interacting with it. In this process, the viewer and the artist play different but interrelated roles. The aesthetic orientation of the audience includes psychological preparation and expectations that influence the perception of the work. The aesthetic orientation of the artist is manifested in the artistic form of the work and determines what impressions and emotions the work will evoke in the viewer. Artists are interested in viewers actively interacting with works of art, creating new forms and meanings (Liu et al., 2022).

Immersive media artworks are often body-centered works that draw attention to the participant's body during direct participation and observation, emphasizing the complex role of the body in aesthetic experience and its use as a site of sensory-aesthetic perception. "The human body changes from an objective body to a "phenomenal body". The "body" and the opposing state of the environment also become a "space" where people and the environment are integrated into a phenomenon rather than being opposite each other in a certain environment" (Liu et al., 2022, Section 2.1, p. 2). Some immersive virtual reality, web and screen installations invite viewers to contemplate the structure of the work and become aware of how they move through different states of perception while immersing themselves in the work (Bartlem, 2015). The ideal artistic effect achieved in this way is to allow people to communicate and interact with the art environment, focusing on the experience of presence to create the most direct perceptual connection, allowing people to quickly establish contact with the art (Liu et al., 2022).

Immersive media art upends traditional ideas and communication in art. It is an inclusive expression that makes it accessible to a wider population that too often feels alienated from the art world (Kadlubek & Blaise, 2021, as cited in Murao, 2022). Immersive media art museums allow visitors to touch or interact with art. Art is not static; sensors and various technologies make art evolve responding to the audience. For example, the augmented reality layer can be activated by modern-day necessities such as smartphones, pushing the audience closer to the art and creating an immersive

experience. Therefore, despite being expensive and complex, immersive media art can be attractive to a wide audience.

Mikeo Murao suggests the characteristics of conventional and immersive museums. In conventional museums, art placement is static, whereas in immersive museums, it is flexible and can be interactive (Murao, 2022, p. 15). Typically, conventional museums do not incorporate sound components, whereas immersive museums often utilize sound to make the experience more dynamic and engaging. In a conventional museum, the visitor remains an observer, but in an immersive museum, the visitor becomes a participant, what makes him a part of the artistic exhibition. Conventional museums usually need to be supported by instructions, arrows, or guidelines. In contrast, immersive museums are intuitive, presenting another challenge in designing an immersive art experience. Demographically, immersive museums have lower barriers to entry and are welcoming to all ages because there is no need to be aware of specific guidelines. The experience is designed to be perceptive and abstract. However, some immersive art is more experimental, underground, or even avant-garde, requiring some background to understand. In conventional museums, it is usually not allowed to touch the art objects or interact with the art, whereas in immersive museums, interactivity is usually high, and touching objects on display is often encouraged. During a pandemic, immersive museums could retain their interactive nature through contactless methods, using sensors and augmented reality (AR). The most popular mediums in conventional museums are framed paintings, sculptures, and objects in glass cases. In contrast, immersive museums use different technologies such as projections, laser lights, haptic sensors, cameras, and controllers. Generally, conventional museums feel formal unless there is a specific event, like the opening of an exhibition, and can sometimes seem aloof to those not versed in art. On the other hand, immersive art feels casual and closer to the experience of visiting an amusement park.

The essence of immersive media art is the co-creation of an aesthetic experience, where the artist and viewer both play active roles in determining the final outcome of the work. However, even without direct interaction through sensors, the multisensory influence on the viewer can be so intense that the viewer begins to feel part of the work. It might evoke sensations of being in another reality or experiencing a journey of consciousness.

The pursuit of multi-sensory experiences, real-time technologies and immersion are key intersections between live audiovisual performance and immersive media art. Since at the level of perception, both can produce synesthetic, cross- and multimodal translation from one sensory modality to another in the form of linguistic, musical, visual, and other metaphors, which, in my opinion, opens up an interesting perspective for artistic research (Gsoellpointner, 2015).

2.1 Immersive design

The concept of "immersive design" appeared in 2007. It was formulated by British designer Alex McDowell. Alex McDowell is a professor at the School of Cinematic Arts at the University of Southern California, and Director of the World Building Media Lab (WbML) and 5D Global Studio. Designers are increasingly using 3D visual design tools, creating commonality between different forms of media. Thus, 5D (immersive design) defines a new approach to design called immersive design, which uses digital tools to immerse oneself in virtual space (McDowell, 2008). The immersive design describes the work of a new generation of designers who work inclusively across a variety of media, from film and interactive media to live audience environments. Alex McDowell has developed a worldbuilding model for film and virtual reality, known as the Worldbuilding Mandala (Figure 2). Mandala was developed after consulting on the popular science fiction film, Minority Report, directed by Steven Spielberg.

"The 21st century digital and non-linear design process replaces the anachronism of the linear, industrial 20th-century model and allows for a fluid cross-disciplinary collaboration from the start of development of the story space... The overview indicated in the Mandala represents a Horizontal slice through the world – all the major elements of society, culture, politics, science, technology, history, infrastructure and four ecosystems that interconnect the narrative elements of the world. To develop the fine detail of the world, the world builders then engage in a series of Vertical 'core samples that interrogate the world system in relation to specific

elements that have a direct impact on the narrative." (Stackelberg & McDowell, 2015, as cited in Zaidi, 2017).

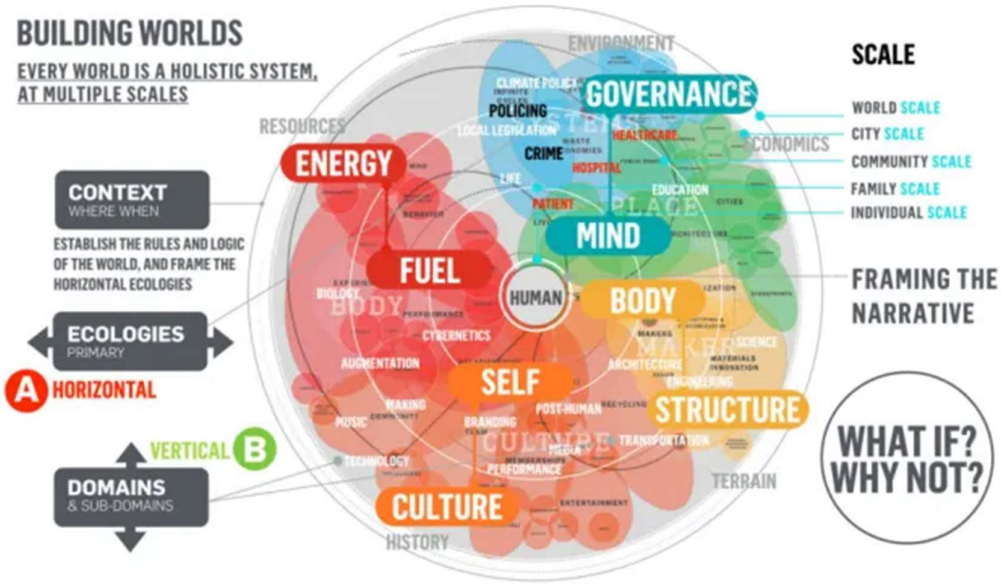

Figure 2 – A. McDowell – Worldbuilding Mandala

Today, immersive design is a universal approach used in various fields, but even these types of immersive design are in the early stages of development. For example, architects are using immersive design to create virtual prototypes of buildings, allowing stakeholders to evaluate spaces before they are built. Immersive design technologies are also used in game design, in medicine, in psychology, virtual social spaces, etc. A notable advancement in immersive design is the introduction of Apple Vision Pro[3]. This device is a significant leap in spatial computing, blending augmented reality (AR) and virtual reality (VR) to create a more immersive experience. The Vision Pro's capabilities promise to enhance the development of immersive media by offering more intuitive and interactive ways to engage with digital content.

To present developments in immersive design, there is a conference "Immersive Design Summit", which covers applications of immersive design in various industries. Immersive environments have the potential to become mainstream tools for designers, stimulating creativity by providing new ways to visualize and interact with design concepts, allowing ideas and concepts to be tested in virtual space without the

[3] https://www.apple.com/apple-vision-pro/

limitations of physical materials or locations. As well as collaborating with colleagues in a common virtual space, regardless of geographic location. Today, there are three main components of immersive design: visuals, sound and interactivity. Considering the innovative nature and the large number of industries and technologies in which immersive design is developing, systematization and standardization of its basic principles and methods are challenging. This project is focused on artistic and abstract audiovisual design within immersive environments and media, the design of sensations. Can Buyukberber[4], an artist working in immersive technologies at Adobe, believes that the spatial and interactive nature of immersive technologies, along with the absence of gravity and weight in digital space, radically changes the grammar of previous art forms. In his view, it is necessary to develop a new grammar, which will open new opportunities for experimentation and innovation. As an illustration of the potential of immersive design in media art, one can cite teamLab's[5] approach to perspective, which they refer to as "Ultrasubjective Space." (Figure 3). teamLab is renowned as a leading developer in the digital and immersive art fields, and their works are regularly exhibited at international exhibitions and prominent museums worldwide. teamLab's motivation comes from the desire to create spaces where people can experience the world without boundaries. Their approach is creating such space focuses on Japanese tradition and culture and its perspective on space (Figure 4). The artists explore ultrasubjective space using new digital methods. Specifically, they create the artwork space in three dimensions on a computer, then look for logical structures that convert it into two dimensions, making it resemble the picture space of a premodern East Asian painting. Premodern East Asian paintings are said to be conceptual or planar. Inoko's intentional use and approach to two-dimensional logical structure does not create a border between "the space where

Figure 3 – Perspective-drawing - teamLab

[4] https://canbuyukberber.com/
[5] https://www.teamlab.art/

the viewer's body is situated and the world of the painting (the artwork space)." (Murao, 2022).

"When three-dimensional space is made two-dimensional by lenses or Western perspective, such as in paintings, photographs, and videos, the picture plane becomes a boundary, and the artwork space appears to exist on the other side of the picture plane. A boundary is created that divides the space where the viewer is physically located and the space of the artwork that is cut out and framed by the lens or perspective" (teamLab, 2001).

Figure 4 – Perspective - drawing to Layer - drawing comparison by teamLab

2.2 Immersive environments (VR, IDE, CAVE)

My project explores such immersive environments as VR (virtual reality), IDE (Immersive Dome Environment) and CAVE (Cave Automatic Virtual Environment), their accessibility, current state, main characteristics and degrees of immersion. Later in the text, I provide a theoretical overview of these environments in the context of immersive art based on the material studied.

CAVE is an immersive media environment with a multi-projection system that creates a three-dimensional virtual space within a physical room. While CAVE is often used for scientific visualization, it is also suitable for artistic and entertainment content. A typical CAVE configuration is cubic and consists of three walls, each equipped with flat screens for video projection. However, some configurations can involve additional surfaces. For example, in installation version of Subassemblies by Ryoichi Kurokawa, the image is projected onto the external sides of the CAVE as well. To view stereoscopic content in a CAVE, the user can wear LCD shutter glasses, known as "active shutter glasses."

Unlike a VR headset, a CAVE does not completely cut off the participant of the immersive experience from the physical space, leaving the possibility of movement within this

environment. This allows maintaining contact with the real world - the user can track his physical body. Among other features of CAVE environments is the ability to introduce a personalized interactive component based on sensors. These sensors can track the entire body, its individual parts and hands. Hand tracking is of particular interest in CAVE immersive environments, as well as in HMD displays. Installing and maintaining a CAVE requires significant financial investment and technical expertise, which may limit its availability to a wide range of artists. Each screen must be synchronized to ensure image continuity at the junctions of surfaces, which is critical to maintaining the immersion effect. VR projects almost always focus on the user "entering" the presented work of art (Pick et al., 2015).

It is considered that CAVEs are extremely effective for visualizing 3D spatial datasets but are much less suitable for 2D information.

Artists actively use interactive components such as body tracking in their works. Among well-known CAVE artistic projects are the interactive installation with the virtual creature Uzume by Gemeinböck[6] and Virtual Anima by Heller, which presents an artistic visualization of a planned real-world project. CAVE painting presents an interesting approach to artistic usage of the CAVE environment. CAVE Painting is an artistic medium that uses the 3D analogue of 2D brush strokes to create three-dimensional works of art in a fully immersive CAVE environment. Physical objects and gestures are used to create an intuitive interface that is comfortable for artists who may not be familiar with virtual reality, ensuring full body involvement in the process (Keefe et al., 2001).

In the entertainment industry, recent developments in large format cinema technologies such as IMAX cinema have led to the development of cylindrical wraparound displays such as the OMNIMAX cinema format, designed to fully immerse audiences in the presentation. As computer technology has become more widespread, digital technologies have been used in planetariums, and the use of these media has diversified to include non-astronomical entertainment and educational applications (Lantz, 2007). The spherical surface of a digital full-dome display can be used as a canvas for any visual projection accompanied by surround sound, including real-time.

[6] https://impossiblegeographies.net/uzume/

Fulldome systems typically use one or more projection systems to display an image on the inside surface of the dome to completely fill the viewer's field of view (FOV). Fulldome projection provides a seamless, wraparound display. It typically fills viewers' horizontal field of view as well as most of their vertical field of view, with precise coverage depending on users' installation and position. Additionally, it is important to note that peripheral information is an important factor in creating the sense of vector, the perception of one's own motion while stationary (Brandt et al., 1973).

A particular advantage of a full dome is its ability to accommodate large groups of spectators, leaving the opportunity to create a collective immersive experience that can lead to natural social interaction. However, with immersive dome environments (IDEs) or planetariums, the emphasis is more on creating a sense of immersion in a virtual space (immersion) rather than on interaction between participants. According to data from the planetarium database website, as of 2023, there were 4,155 planetariums and digital dome theaters in the world, where digital dome theaters can be considered as a modern evolution of the classic planetarium. With the advancement of technology, digital dome theaters have emerged, which typically use digital projectors or LED screens instead of traditional dome lights. This architecture provides an excellent environment for organizing immersive exhibitions. There are also temporary structures that serve as planetariums, for example, geodesic dome tents. Such temporary structures can be used at music festivals, art exhibitions, educational events and other events that require the creation of immersive spaces for visitors.

However, there are several factors that can make accessing an IDE difficult for artists. Sometimes planetariums operate on strict schedules and do not have free time available for rental or use by outside artists. Planetariums may have specialized hardware and software that may be difficult to set up or use for artistic purposes. Other possible obstacles include budget restrictions, content restrictions, and difficulties in coordination with the administration of planetariums.

Immersive media has its own unique set of design challenges, and because the technology is new and evolving, there is an opportunity for innovation in solving these design challenges. The first and most obvious challenge for designers is the geometry and size of the dome's projection surface and how to warp the images to match the dome's geometry. In addition, immersive designers need to consider the sweet spot of the dome,

the place where viewers' eyes naturally rest. The designer can control the full dome environment using a variety of media, including linear panoramas, 3D objects, virtual camera rendering and recording, animation scripts, and a variety of other multimedia tools. Nowadays, many architects and artists use spherical perspectives to overcome the limited field of view of classical perspectives.

Virtual Reality can be defined as a technology, which induces a targeted behavior in an organism by an artificial sensory simulation, while leaving an organism with little or no awareness of the interface (LaValle, 2023). The experience may include visual, auditory and sometimes haptic feedback. Visual content is streamed via a Head-Mounted Display (HMD), which has individual screens for each eye to enable stereoscopic 3D view. The headset often uses sensors to track users' movements, which are essential for virtual world simulation. In addition, various controllers, such as hand-held devices, can be used to allow users to interact with the virtual world. Virtual reality has a wide range of applications, including entertainment, education, medicine, virtual tours, and social interaction.

VR has advanced significantly in recent years, driven by improvements in hardware, software, and content creation, as well as integration with other technologies. Today, a wide range of VR headsets is available, and the selection of a suitable headset primarily depends on factors such as price, portability, and performance. There are different types of headsets, including standalone, PC-tethered (where the headset is connected to a PC for rendering high-quality graphics), console, and enterprise VR headsets. A lot of interest is focused on real-time, AI-based VR generation, which enables highly personalized VR experiences (NVIDIA 2024).

Many new media theorists, artists, and designers view VR systems as the ideal medium for creating a deep sense of immersion for viewers. While cinema and VR are not the only forms that offer immersive experiences, they are the most frequently discussed in relation to immersive technologies. Over the past forty years, discussions about immersion have largely focused on VR systems and concepts of cyberspace. This emphasis on VR in conversations about immersive technologies and aesthetics stems from the belief that VR is the ultimate technology for fully immersing viewers in a virtual environment (Bartlem, 2005).

3 CASE STUDIES

3.1 Monocolor - Latent Space (2019)

To achieve a greater understanding of immersive design I studied live audiovisual performance of Monocolor Latent space for visual composition, as well as such elements as the dynamics of the development of performance and the relationship between the performer and the audience (Figure 5).

Figure 5 – Monocolor – Latent Space (2019)

Monocolor alias Marian Essl is an audiovisual artist from Vienna.[7] He explores the relationship between sound and image in both performance and installation works. His work focuses on the relationship between sound, image, light and space, aiming to create unique immersive experiences. Latent Space is a 360-degree audiovisual 8 performance that explores the spatial effects of a dome and serves as a metaphor for the virtual network that always surrounds us. In a fully immersive environment, like a full dome, the viewer's point of view can be wherever the viewer is because they are surrounded by projections on all sides and can feel like they are inside that space,

[7] https://mnclr.com/

regardless of their position. There is no center of interest, the main emphasis is not on a specific object, but on the overall visual impact. The most obvious geometric shape is parallel lines that change their curvature from sharp to more blurred and create repeating patterns. However, there is also a visualization in the form of a hemisphere and a circle, which creates a contrast of geometric shapes. It uses a spherical perspective and a combination of spherical and linear perspectives, with visual weight at the top or in the direction of perspective. All work is done using particles and lines. The color scheme used is black and white. The absence of light inside the dome creates a black "canvas" on which the visualization of white light unfolds. This approach allows to focus on the shapes, textures and movement of images without distracting the viewer's attention to color tones. The performer is positioned to the side at the base of the dome without attracting much attention, allowing viewers greater degrees of immersion, as if it were their own personal experience. Latent space presents multiple changes in dynamics creating contrasts between moments of calm and tension.

3.2 Ryoichi Kurokawa – s.asmbli / subassemblies (2019)

Japanese-born artist Ryoichi Kurokawa[8] works with 3D data of architecture, ruins and nature to create immersive installations and audiovisual art in many formats typical of new media art.

s.asmbli/subassemblies is a project that explores the relationship between natural and man-made structures through the perspective of an architectural scale. It consists of several different presentation formats such as concerts, installations, prints and shows.

First of all, I consider subassemblies/reassemblies through the lens of multi-format art, analyzing visual effects and dynamics, an approach to synesthetic design, connections to transcendence through the concept of time-space sculptures, and the combination of abstract and representational elements.

Kurokawa is supposed to go beyond the traditional understanding of synesthesia by creating an abstract semiotic structure that integrates both extra-musical meaning and the physical sound materials themselves. It is argued that this structure results in a work

[8] https://www.ryoichikurokawa.com/

in which the visual becomes audible and the audio becomes visual. Importantly, this is not achieved through a simple mapping of domains. Instead, a network of meaning is created that helps viewers and listeners perceive precise connections between natural and synthetic forms (Field, 2012).

The primary sources of subassemblies/re-assembli are 3D data obtained through laser scanning of architecture, ruins and nature. These are then distorted and reconstructed into each module as subassembli, creating a renewed timeline with layers of order and disorder, simultaneously revealing the power of nature and art (Figure 6).

Figure 6 - Ryoichi Kurokawa – s.asmbli / subassemblies (2019)

In the concert version of subassemblies/re-assembli, Ryoichi Kurokawa uses a single flat surface onto which video is projected, skillfully balancing abstraction and representational elements to create works that reflect his unique style. Considering that a concert is a live event in which the narrative unfolds in an improvisational manner, it should be noted that the dynamics and some elements may differ from one event to another. I analyzed a fragment of only one video recording of the concert, which will be indicated in the links. The use of 3D scans of architecture and simple geometry creates

depth in the scene, which serves as a visual basis for the sub-nodes and creates the impression of another world existing beyond the physical space. In the first part of the fragment, some elements of geometry remain static, acting as background anchors, while others replace each other at a very high speed, forcing the perceiver to experience a journey from real time to micro-level hyper-detailed time. Although Kurokawa works with 3D scans of destroyed buildings and his works have an immersive quality, the immersion is achieved not so much by the feeling of an illusory space, but by the sensation of an unknown dimension of time. A connection with transcendence is revealed here, as the artist invites us to immerse ourselves in a dimension of time that is inaccessible in everyday life. At one point he leaves only simple geometric elements, but the sound creates suspense, increasing tension, and then a pause - darkness. After a long pause, there is a bright splash, reflected in both sound and visuals, and the technique of working with 3D scans develops and changes. The artist experiments with various distortions of 3D scans of abandoned buildings (point clouds), creating a sense of buildings emerging from the void, and deconstructs their forms, fragmenting them with distortions, including both natural and unnatural behavior of point clouds and placing them in closed digital 3D forms, where he plays with colors, angles, energy and dynamics. On Kurokawa's website, the VR version of the project is presented as a video from the IDE, which suggests that the VR version also used spherical projection. One of the striking techniques in this installation is a distortion that imitates the inner surface of a dome collapsing on the viewers on the floor. In Kurokawa's characteristic style, architecture is cyclically reborn and destroyed in different interpretations, accompanied by abrupt changes in dynamics. "S. asmbli [wall] 2020" is a version of the same project realized in a cubic space, which includes video projections on all surfaces, both external and internal. The artist continues to fascinate with dynamic patterns and distortions of perspective, skillfully manipulating the installation space and turning it into a kind of teleporter, transporting viewers to different virtual locations within a transcendental slice of reality.

4 PRACTICAL ESSAY

4.1 Conceptualization and creative process

In the process of this project, I aimed to combine theoretical knowledge with personal creative research to make an artwork that will express the concept of transcendence through immersive art. The research conducted in the previous stages of the work allowed me to gain a deeper understanding of the philosophical and aesthetic aspects related to the concept of transcendence and immersion, as well as to identify the elements that would form the basis of my creative expression. This section describes how personal inspiration and the process of working on the project influenced the choice of visual metaphors and methods, as well as the evolution of my concept from initial ideas to the final implementation.

Transcendence, derived from the Latin transcendens (from transcendo – "to step beyond"), refers to going beyond or surpassing ordinary limits. It is a key concept in my project, as I explore the potential to go beyond typical modes of perception.

On a personal level, dance is an important source of inspiration for me. In the process of improvisation, I experience moments of going beyond the usual bodily and mental settings. The spontaneity of movement and the lack of control over how my body will behave allow me to approach a state where spiritual revelations, a sense of freedom and spontaneity are possible.

During the research, I realized that immersive spaces also have the potential to create experiences that go beyond everyday perception. Live performance, like improvisation, is close to me due to the ability to instantly respond to changes in the environment and music, which enhances the sharp perception of reality. This aspect of creativity attracts me because it allows me to experience intense emotions and immerse myself in deeper states of perception of current moment. The combination of immersive experience and improvisation creates unique conditions for creating a multi-sensory experience, where the viewer and the artist can fully immerse themselves in the atmosphere and experience something that is unusual to feel in everyday life. This exploration also became an inward journey, helping me to understand my motives more deeply and find answers to important questions. I realized why I am so attracted to

immersive art and how it relates to my personal experience. As a result, all my interests harmoniously merged into a single structure.

From the very beginning of the project, I have been interested in visual communication, meaning the desire to learn how to express ideas through visual means. Therefore, exploring levels of abstraction through audiovisual art has been important to me, as I aimed to choose a form that would allow me to convey ideas related to elements of physical reality through abstract and symbolic means of interactive generative graphics.

Additionally, during my research, I became acquainted with the concept of world-building proposed by Alex McDowell, which I already mentioned in the section about immersive design. This led me to adopt an approach that was not solely based on algorithmic experiments but aimed to convey sensations and emotions.

Film historian and synesthete William Moritz identified degrees of abstraction, ranging from "pure," connected to something familiar, to "wild," completely unrelated to anything specific. His synesthesia significantly influenced his interest in experimental cinema and animation. He deeply explored how sound and image could interact and create synesthetic effects on screen (Fletcher, 2008). Moritz also distinguished mixed forms of abstraction, which represent intermediate levels where artistic elements can maintain a connection to reality. In my opinion, this approach to abstraction is more flexible and not confined by rigid boundaries, thereby opening up new opportunities for experimentation and self-expression in art. It represents a vector for creative exploration, where abstract forms can include elements reminiscent of specific objects and allows for representations that may contain both abstract and concrete elements.

The first stage of the project involved creating a mind map, which served as a tool for organizing concepts in a convenient and structured format. The mind map helped visualize all ideas related to the project and organize them into a logical structure. This facilitated navigation among numerous concepts and understanding their interconnections. Additionally, creating the mind map became a process of generating new ideas through visual connections. Some mood boards allow for placing images on the page in any order, experimenting with different combinations and sequences.

Thus, I divided the concept of transcendence into six components, which helped me visualize it by revealing narrower ideas that reflected the core concept, as well as

several metaphors. The main areas of interest that emerged after creating the mind map were: the time sculpture (I encountered such interpretations of works while exploring audiovisual artists), the time-space synesthesia, the Japanese concept of MA, liminal space, and the idea of inanimate objects "coming to life" during a performance. I planned to implement some of these ideas using 3D scanning. The tools I had for 3D scanning limited me, preventing the capture of large objects, like architecture, which restricted the scale of the experience I wanted to create.

As I delved deeper into reflections on transcendence, I envisioned transcendence as an abstract array that is always beyond the possible realm of human perception and knowledge, representing an incomprehensible aspect of reality. Thus, transcendence is conceived as an ideal of the unknown. Transcendence can be thought of as an abstract array that includes not only elements that are inaccessible to our perception but also the dynamic structures and relationships between these elements. This array represents a multidimensional reality in which each point or element may be inaccessible or unknowable in the traditional sense. For example, we cannot fully understand the experience of an animal, a rock, or even another person. We are limited by our own sensory and cognitive abilities and the time frames of our lives, making absolute cognition impossible even on a collective level. Additionally, transcendence encompasses aspects of reality that are beyond our current level of knowledge and technology. This may include unexplored corners of space, mysteries of the microscopic world, or fundamental questions about the nature of time and space. Each of these aspects can be thought of as part of a larger abstract array, where the interactions between the elements create a complex and often incomprehensible picture of reality.

I realized that infinite objects can create a high level of immersion and also reflect the concept of transcendence, so I chose a different visual metaphor. However, I do not consider my previous developments and reflections to be a waste of time - it is part of the creative process of my project. Analyzing my first visual references, I see many parallels with the current version. I perceive it as moving up the ladder of abstraction: at first my visualizations were vague and unclear, and in the process of work they gradually crystallized, synthesized with the main concept and united into something more representative, although created from abstract elements. To better formulate and visualize the idea, I developed the first synopsis and a new mood board. The main visual

metaphor I chose is based on the image of architecture and is expressed through stylized forms, which are on an intermediate level of abstraction. In addition, I used abstract elements reminiscent of black holes, symbolizing the unknown.

I used two opposing approaches during the development of the project. The first approach was aimed at conveying a specific image that inspired me. The second approach was based on the experimental process inherent in generative art, which implies the unpredictability of the results.

The first scene begins with a minimalist grid floating in space. Initially, it is simple, but then begins to transform dynamically, taking on increasingly voluminous and dynamic forms. At a certain point, the grid begins to resemble architectural images - a spiral staircase or an endless tunnel leading into the unknown. These images create a preparatory atmosphere for the participants, immersing them in the mood of the upcoming scenes and reflects the concept of the transition from simple to complex.

In the second scene, the grid is replaced by a geometric structure consisting of pipes, which is endlessly generated forward, creating the illusion of a growing architectural structure. These forms seem alive and develop, stretching their segments into the depth of space. The viewer is immersed in this labyrinth, in which geometric elements are constantly transformed, taking smooth or sharp outlines depending on the bending angles of the pipes.

The third scene contrasts with the previous bright and complex geometry. The space abruptly switches, and a black hole appears, symbolizing the unknown and the boundless. The darkness itself becomes an active space - not just emptiness, but a hypnotic force that evokes a sense of mystery.

The fourth and final scene resembles an architectural abyss - a deep well or a cyclically collapsing building that forms a funnel of geometric elements. The viewer finds himself on the verge of falling into an infinite depth, where the space seems to disappear into nothingness. This scene completes the immersive experience, creating a powerful sense of irreversible immersion into the unknown and the infinite.

4.2 Immersive design and its implementation in TouchDesigner

During the project development, a lack of immersive design guidelines which are based on the geometry of the space and degrees of immersion was identified. To explore this topic, the work of other artists was analyzed, and compositional principles were adapted through active reflection and practical experimentation. In the context of the project, there is an interest in abstraction, and it was found that 3D graphics have the potential for higher degrees of immersion, as they allow placing the visitor “inside” the 3D scene. In traditional visual arts depicted on flat surfaces or screens, also known as 2D planes, artists may use various techniques such as color palette, composition, and contrast to direct the viewer's attention to key elements of the image. Immersive spaces where the user can move freely, and the illusory space is in motion, creating focal points and managing attention requires different approaches. Another important component is creating an atmosphere, which can be influenced by sound, light, and color, among other factors. In perspective drawing on 2D planes, the artist can control the viewer's point and angle of view creating the impression of depth and three-dimensional space. In immersive spaces, the user is surrounded by dynamic images and can freely move and change the point of view, which presents challenges in creating a stable and uniform perception of space. The competent use of different perspectives and angles determines the sense of depth and scale in immersive environments and can also play an important role in controlling the participant’s attention. Furthermore, experiments with perspective distortion can create surreal sensations, which can be used for artistic purposes. In the real world, we are accustomed to perceiving objects of various sizes, and our perception of space and depth partly depends on their size. When designing immersive environments, it is important to consider cultural associations, and which objects evoke the greatest sense of scale and space in the user and vice versa. Additionally, large-scale relationships between objects in an immersive environment can be used to achieve the desired psychological effect. Proportion can also refer to the relationship between the sizes of different elements within a particular object or scene. For example, in architectural design, it is important to maintain the correct proportions between the height, width and length of a building to achieve a harmonious look. Visual elements such as lines and shapes play an important role in creating structure and

composition in an image. In immersive environments, geometry may appear distorted or irregular due to differences in viewing angle or spherical perspective. Composition and balance play a crucial role in distributing visual elements within a frame and shaping the viewer's perception. In immersive environments, it's important to experiment with composition, such as adapting traditional visual practices or drawing inspiration from real-world environments. Techniques like scientific visualization, including 3D scanning, can also be valuable. Naturally, there are numerous other compositional elements to consider when developing visual content. Color and lighting play a key role in creating atmosphere in immersive environments. Choosing the right color palette and adjusting the light helps enhance the emotional impact on the visitor and highlight key elements. The play of light and shadow adds volume and realism to 3D objects. In immersive environments, adapting light and shadow can involve the use of dynamic lighting sources and many other approaches to create interesting effects.

I chose the TouchDesigner (TD) software as the main tool. TD is a platform for visual nodal programming and real-time interactive multimedia content, optimized for giving versatile support to live performances. It has six family operators: Component (COMP), Texture (TOP), Channel (CHOP), Surface (SOP), Material (MAT) and Data (DAT), through which I have composed the artifact’s network (at the time of the study, a new family of POP operators was announced). Software also allows extensive interactivity with media inputs and data devices as well as the integration of other software and VR components. It has a fairly developed community and a large amount of information to study on the Internet and does not require knowledge of programming languages. This combined with the above makes it a good choice for this project.

From an implementation perspective, the program has three main levels. Using TD (TouchDesigner) software, an infrastructure was developed for switching between scenes, connecting a MIDI controller for scene and parameter management, outputting to streaming, connecting to projectors via NDI, and transmitting audio signals for audio analysis via the OSC protocol. The chosen program architecture is modular, allowing for the integration of additional scenes. This setup can be further refined and used for future audiovisual performances.

At the second level, individual scenes are placed. To optimize resources, only one scene is active at a time during switching, while the others remain disabled. The third

level involves the individual scenes – visualizations – as well as a unified part responsible for directly connecting each of these scenes to the infrastructure, which includes scene activation and routing signals from MIDI to the appropriate variations. For ease of performance execution, a UI component has been developed that allows users to view the mapping of MIDI controller elements to variations and see the list of scenes in a playlist format. The camera setup consists of three cameras positioned at the same point in a virtual 3D space. They are orthogonally oriented relative to each other in the horizontal plane from the viewer's perspective, each with a Field of View (FOV) angle of 90 degrees, to ensure seamless stitching of the view fields.

A 90-degree FOV is commonly used in games and virtual realities to provide a comfortable and natural spatial perception. This means you see 90 degrees of horizontal space in front of you (Figure 7). A wider FOV can offer more context and reduce the feeling of "tunnel vision," but it may also lead to image distortions at the edges of the screen. While the optimal FOV can vary depending on the context, 90 degrees is a popular choice for many users. This setup allows for streaming that is projected onto the corresponding walls in a CAVE environment and supports camera movement with six degrees of freedom (6 DOF). This configuration provides maximum immersion, akin to the way human eyes function without limitations on the field of view, allowing for

Figure 7 – Camera set-up and streaming

unrestricted viewing in any direction. Additionally, this setup enables future adaptation of the visualization to various immersive environments.

The first scene is a SOP Grid that is distorted by twist operators and rotates around its axis, changing the angle and size. The scene also has a displacement (glitch) post-effect, controlled by sound and a MIDI controller (Figure 8). Immersion is achieved through the hypnotic movement of the grid, its displacements and constant dynamic transformations with an increase in size, creating the illusion of a ghostly tunnel.

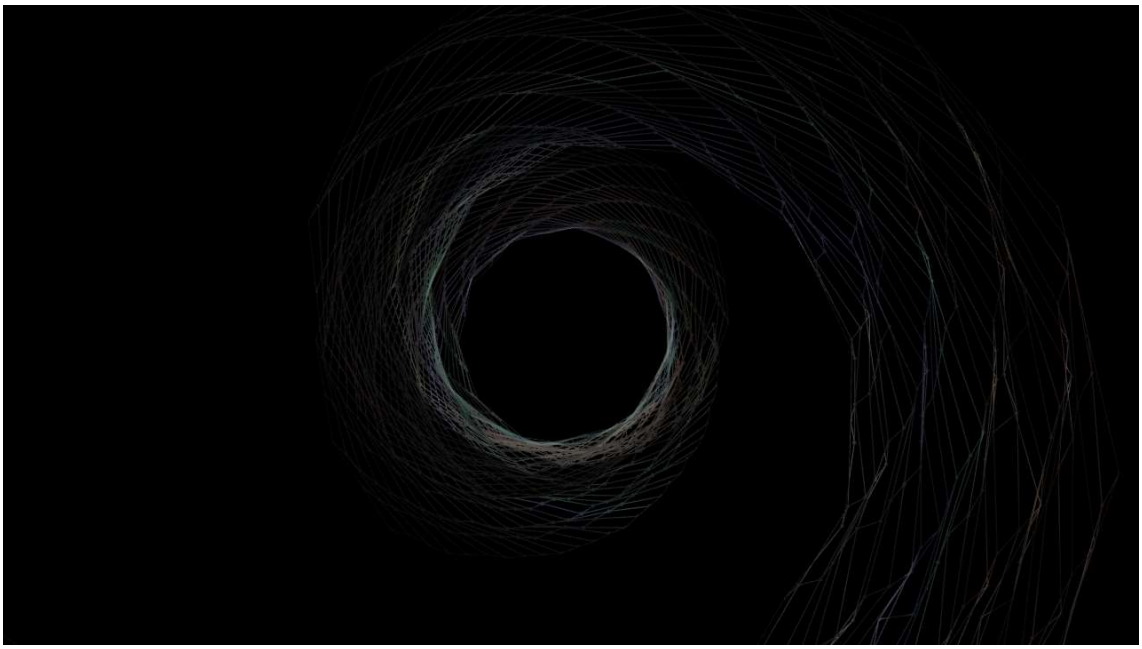

Figure 8 – Scene 1

In second scene as the basic geometry and functionality of the TouchDesigner, instancing was used to create a whole system of pipes (Figure 9). The decision to use instancing was made in order to achieve optimization, due to which the calculation of the positions of each element of the 3D structure occurs on the graphics card. The scene consists of a parameterized number of strings (lines), dynamically increasing in the direction of one vector. Each string consists of a series of cylindrical sections adjacent to each other with the positioning of a sphere at each junction between the sections. Over time, the string remains static except for the last section, which has a dynamic orientation and length. The static offset is stored in the 3D texture operator (cache mechanism). As the camera moves, the oldest sections are replaced by new ones, creating the illusion of a constant location deep within the 3D structure. Parameterization allows for real-time visual changes, resulting in a scene with a variable

growth rate of sections and a dynamic orientation pattern. This is displayed as sharper and smoother angles, along with an overall vector of structural development. The

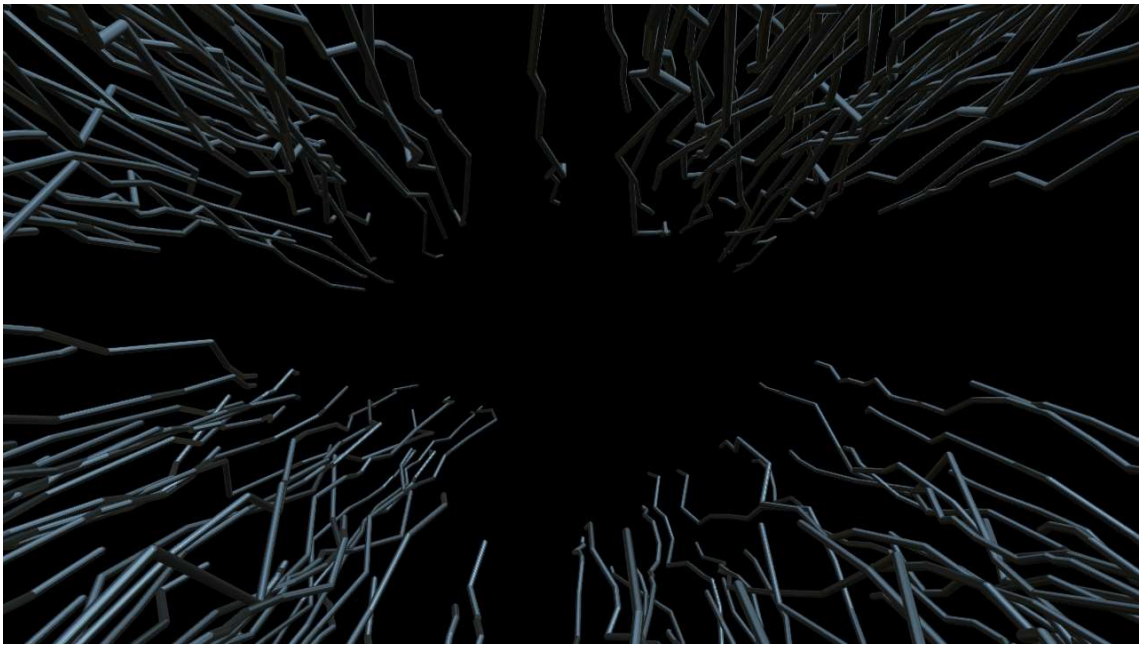

Figure 9 – Scene 2

camera is positioned between the back and front edges of the strings. The camera can be moved between these edges in a controlled manner, creating the illusion of acceleration in the same space. But rotating around its longitudinal axes creates the illusion of being inside a flying object.

In my opinion, this solution was effective from a design point of view in the CAVE space, due to the fact that the focus of attention, created by parallel lines converging at one point, was concentrated on the central wall of the CAVE, so the illusion surrounded from left and right sides, engaging peripheral vision. The forward movement played a key role in achieving realism and high degrees of immersion.

The third scene consists of two types of geometry—boxes and triangles—that are replicated using instancing (see Figure 10). Boxes are gathered in a 2D array with noise defined scale in particular height of the boxes. Using same technology of instancing a cloud of triangles is positioned on a spherical pattern and positioned in the centre of the scene. Additionally signal from an audioanalysis is used to manipulate the amplitude of noise which variates radius of triangles displacement. Another sound is used to shape the pattern of boxes height in the 2D array. This scene was meant to create a sense of pause and immersion into another dimension of reality with a different flow of time,

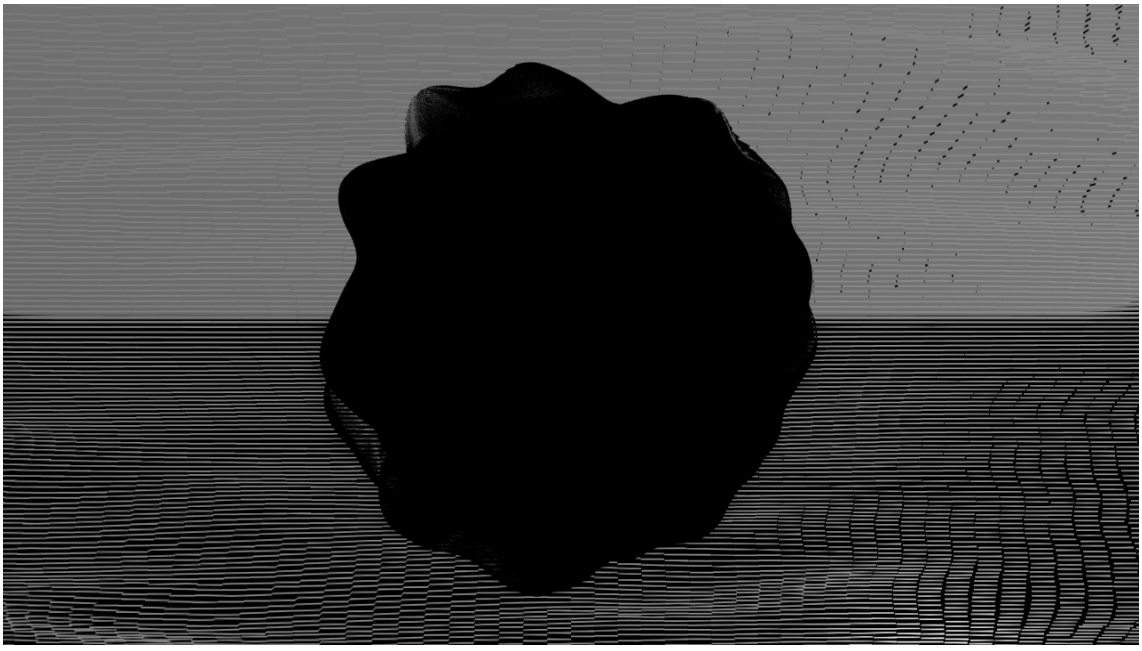

Figure 10 – Scene 3

contrasting with the dynamic second scene. Immersion here is achieved not through geometry, but by shifting attention and atmosphere.

The fourth scene is built using instancing of twisted box geometry, with scale and position values calculated by Texture Operators (TOPs) (see Figure 11). Boxes are positioned adjacent to each other in a circular grid. Additionally, the positions of the boxes are animated in a cyclic manner: as the boxes move inward and reach the center, they decrease in size to zero and then reappear at the outermost ring. The height position of the boxes is determined by an inverse cubic function. The speed of the animation is configurable and can be controlled via a MIDI controller. The common camera setup consists of three cameras positioned orthogonally, with their positions variable and linked to MIDI controls. Each camera can rotate in a circular manner with adjustable radius and height. Additionally, the camera orientation can be controlled by changing its 'look at' position, which is by default located on the central axis but can be displaced from the center. The visual structure, featuring a funnel with spiral geometric elements, creates a powerful focal point, drawing attention to the center of the geometry. The camera setup, offering six degrees of freedom, allows for controlled movement around the geometry, enabling dynamic manipulation of angles and perspectives. Together with the engaging funnel-shaped space, these features contribute to achieving impressive results and a high degree of immersion.

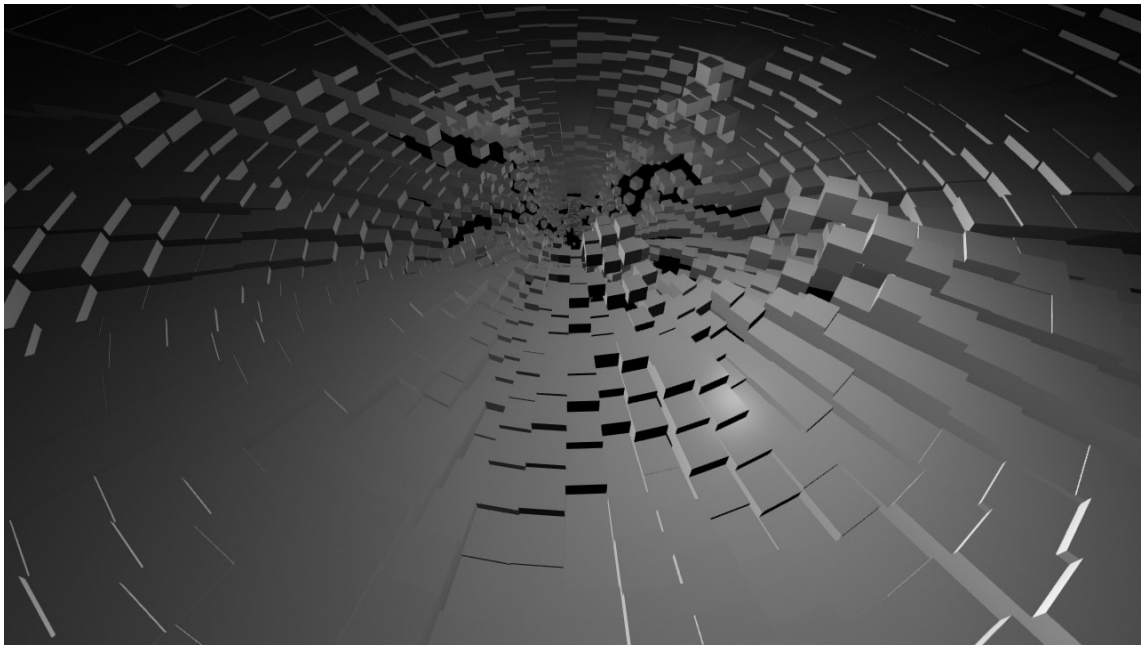

Figure 11 – Scene 4

4.3 Compositing live audiovisual performance

This section elaborates on the evolution of performance as a time-based audiovisual narrative and live event, viewed through the lens of synesthetic design, visual and sound associations, and briefly considers the technical approach employed. In Design for the Synesthesia: Audio, Visual, and Haptic Correspondences Experimentation, the author refers to the synesthetic designer as a manipulator of sensations, capable of working with texts, figures, sounds, tactile stimuli, and more to achieve congruence between these elements (Ricco, 2001).

The authors also describe a fascinating experiment. The primary goal of the experiment was to explore which combinations of visual and sound elements are perceived as harmonious or, conversely, cause interference in perception. The intent was to test whether there are universal associations between specific shapes and sounds that can be utilized in design or art. The experiment was conducted with two groups of participants: one group consisted of individuals more attuned to sounds (musicians, composers), while the other group was composed of those more sensitive to visual images (artists, designers).

Participants were tasked with perceiving and evaluating pre-prepared combinations of visual elements (shapes with different colors and textures) and sound elements (sounds of varying intensity and duration). Each participant was shown images and played sounds, after which they shared their impressions, focusing particularly on the associations or sensations these combinations evoked. Interestingly, certain compositional factors and visual or auditory elements exhibited surprising agreements. High-intensity sounds were often associated with angular, sharp shapes, while low sounds were linked to rounded, soft forms.

Color preferences turned out to be subjective; however, dark colors were more frequently associated with "rough" or "fragmented" sounds, while light colors were linked to "smooth" and "flowing" ones. The same associative principle applies to musical sounds and language sounds when correlating sound with its visual correspondence, which lies beyond the specific aspects of various cultures. The results of the synesthetic design experiment provided insights into how visual and auditory elements can harmonize or, conversely, interfere with perception. Combined with the associative approach, this became the basis for developing the sound component.

In the process of creating the performance, I was responsible for the results, and I explored several ways of collaborating with the sound designer to find an effective model of interaction. To create the first musical sketches, after familiarizing myself with the previously mentioned concept of Worldbuilding by A. McDowell, I created a description of the world and highlighted keywords as an associative guide. The goal of this stage was to convey the mood and atmosphere to the musician.

Description of the world:

Mood 1:

An event or place simultaneously grand and intriguing, as if it unveils a majestic scene of plummeting into the abyss. It leaves the impression of an abandoned place from the future where one could lose oneself and disappear, evoking associations with forsaken, forgotten worlds, futuristic landscapes, as if it were a fragment from a metaphysical dream of a future that never came to pass.

Keywords 1: Something big, majestic, the feeling of falling into the abyss, connection with the endless void, metaphysical, abandoned, forgotten future, strange, endless potential

Mood 2:

Cold shades of metal merge with bright flashes of electricity and lightning, creating an atmosphere of a force field in which elements of nature and technology play. This sensation of coolness and freshness permeates the place as if you are at the center of a storm front where electricity and the power of nature play, immersing us in the world of technological unconsciousness.

Keywords 2: No emotion, techy, liquid metal, plasma, electricity, lightning and thunderclaps, coolness, speed, technological unconsciousness.

The name of the performance was also chosen: EXOS, where "EXO-" is a prefix from the Greek word "ἔξω" (éxō), which means "outside," "beyond," or "external," and it also associates with Exit, Existence, Exceedance, while the letter S stands for space, state, source.

It was important to me that the sound in this project not only accompanied the visualizations but enhanced them through synesthetic and cultural associations. The sound also had to reflect the dynamics of the visual sequence, emphasizing key moments and creating a unified atmosphere of the described world. To advance in the audio-reactive component, I examined the created visualizations, or in the context of the performance—scenes, for variability. Understanding the variations and limitations within the scene creates space for improvisation within the established parameters. Such research allows one to understand where flexibility is acceptable, and where strict adherence to the plan is needed, which maintains a balance between creativity and technical feasibility. In addition, this approach helps identify the types of visual effects, dynamics, lighting solutions, and other nuances that can be implemented within the framework of a given visualization. In this regard, the next step was to outline the approximate structure of the dynamics, which allowed us to set the basic guidelines for the further development of the soundtrack. This included ups and downs, changes in tempo, intensity, and mood. The overall duration of the performance was determined.

For the first scene, I employed a technical approach due to its technical simplicity and high variability. I proposed a structure consisting of three parts. The visual effects, which correspond to the sound, are introduced gradually, starting from complete darkness with only sound and culminating in the gradual emergence of visuals. In the next phase, the dynamics increase gradually, accompanied by various rustling sounds

and pauses that highlight changes in the visual elements. In the third part, the visuals reach their maximum size, and sound is introduced to create a spatial effect.

The second scene is the most technically complex, featuring a concept where the participant travels through an infinite space made of broken pipes at varying speeds, reminiscent of a roller coaster effect. To enhance the dynamics, elements gradually emerge and fill the space, leading to a journey in a zero-gravity environment. The space occasionally rushes or rotates, creating phantom sensations of movement. From a sound perspective, it was crucial to establish an associative connection with the endless space and highlight the geometric elements. To achieve this, we composed a deep, atmospheric low-frequency sound. As the dynamics and excitement increased, the sound transitioned into a rhythmic musical phase. This transition proved effective in inducing a trance-like state, which is often triggered by repetitive musical elements. The second scene was developed on the spot, closely resembling an improvisational process with immediate results. The scene featuring the black hole was created using sound to complement the suggested atmosphere. The final scene was designed to be the most dynamic, aiming to deliver an intense conclusion to the performance. It was created in Blackbox through experimentation with visuals.

Thus, I explored various approaches to collaborating with a musician within the context of a single piece.

The performers were positioned at the edge of the CAVE so that the participants of the immersive experience could move freely around the space of the room.

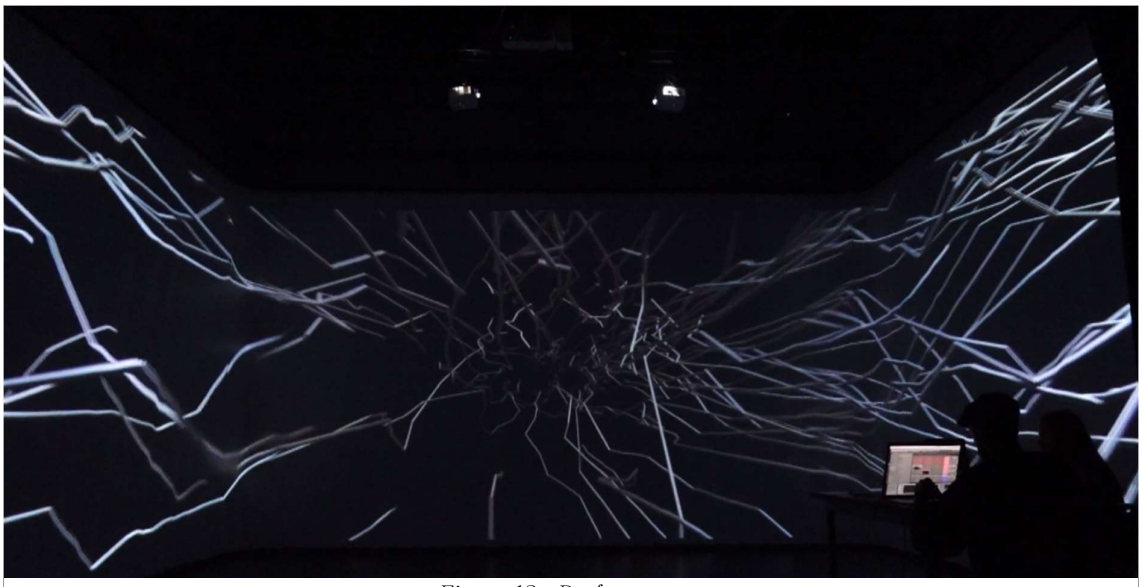

Figure 12 - Performance

A simple audio frequency analysis was also performed for low, mid, and high frequencies with the built-in audio analysis component in TouchDesigner. These frequencies affected the brightness of the visualizations, causing a strobe-like effect, as well as controlling the light. In addition to the audio-reactive component that was performed in real-time, improvisation was also carried out using a MIDI controller. Manipulating the visualizations in real-time is an immersive experience that requires a certain sensitivity and quick reaction to changes in the music. This element is planned to be developed in future live performances to create an even more dynamic and integrated interaction between the audio and visual components. Additionally, participants were invited to use MIDI controller to explore interactivity (Figure 13).

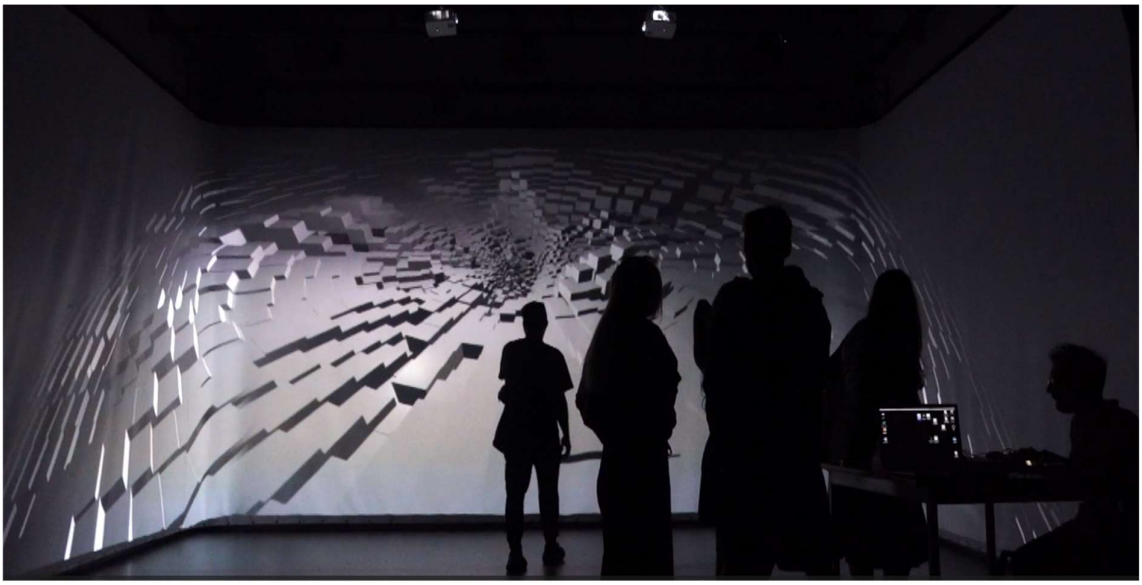

Figure 13 – Participant´s interaction

5 CONSIDERATIONS AND FUTURE WORK

In the process of creating this project I was able to imagine the place that I am creating. It is an abandoned world of the future, where one of the virtual worlds is destroyed. It combines elements of non-functionality and futurism, creating a conflicting dystopian aesthetic, where elements of the future and destruction collide with each other. While this vision is compelling, I feel it is not yet complete. I would like to delve deeper into this aesthetic, further developing the world to enhance the interaction between these contrasting elements and explore the nuances of this unique dystopian environment.

Moving forward, I would like to take the project to other immersive environments, explore synesthetic design, audio-reactive and emotional components more deeply, as well as look for ways to more accurately express the atmosphere of the immersive world. This may include the creation of visual, sound or interactive elements that create mental events to convey the feeling of a certain emotional or conceptual atmosphere.

During this research, I have gained a lot of inspiration to continue working in immersive and synesthetic design, and to become a designer of experiences. Mixing different sensors can provide experiences that go beyond the everyday life, reminiscent of abstract landscapes where the laws of physics are absent or surreal worlds of escapism. To continue my exploration into the world of experience design, I am going to answer the question of what an experience is, especially one that encompasses emotional and sensory aspects. Also, as someone who loves to experiment, I want to develop an approach in which I will document my sensory experiences, creating palettes of experiences for their subsequent interpretation into immersive art. By systematically documenting and interpreting these sensory experiences, I aim to push the boundaries of traditional experience design and craft unique, multi-dimensional immersive environments.

6 CONCLUSION

During the project, the main objective was achieved - the design of an immersive live audiovisual performance expressing the concept of transcendence in the immersive CAVE environment. Studying immersive environments in the context of immersive design for audiovisual performance allowed a deeper understanding of the philosophical, artistic and aesthetic aspects of immersive environments, especially the levels of immersion and artistic solutions for achieving different levels of immersion. It is already clear that such synesthetic immersive experiences have significant artistic potential, offering virtual worlds that allow participants to explore entirely new sensory experiences. The creation of an abstract audiovisual narrative based on a certain concept through visual metaphors was also explored. A basic audio analysis was performed and a scene switching component was developed that can be improved and integrated into future audiovisual performances. During the project, skills in node programming in TouchDesigner software were improved, specifically, for the development of 3D graphics. The project also explored collaborative interactions in audiovisual performance aimed at achieving digital synesthesia, which means an intuitive correspondence between image and sound, as well as the creation of a certain atmosphere of the chosen immersive world. As a result, dynamic visual scenes were created and combined with audiovisual components to achieve a holistic artistic expression and high levels of immersion and participants enjoyed the event.

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ATTACHMENTS

Full video of the performance - https://www.youtube.com/watch?v=9hy5FvlLqFs