HAW HAMBURG

Fakultät Design, Medien und Information Department Medientechnik

Fantasizer: an interactive and immersive music club experience

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Leila Alavitabar

Matr.-Nr. [redacted]

Erstprüfer: Pro. Thomas Görne

Zweitprüferin: Sandra Trostel

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List of Abbreviations

2D	-	2 Dimensional
3D	-	3 Dimensional
4E	-	embodied, embedded, enacted, extended
ACM	-	Association for Computing Machinery
AI	-	Artificial Intelligence
DIY	-	Do It Yourself
DJ	-	Disc Jockey
E.A.T	-	Experiments in Art and Technology
EJ	-	Experience Jockey
EMT	-	Extended Mind Theory
HCI	-	Human Computer Interaction
IEEE	-	Institute of Electrical and Electronics Engineers
LED	-	light-emitting diode
MDMA	-	Methylenedioxymethamphetamine
PARC	-	Palo Alto Research Center
VJ	-	Visual Jockey or Video Jockey

Abstract

This research explores the conception and development of a novel interactive club experience, integrating immersive technologies such as ambisonics audio, surround visuals, lights, and tangible elements to create a dynamic, multisensory environment. Drawing on embodied interaction and extended approaches to musical experiences, the study examines how the combination of these sensory modalities fosters a unique collective atmosphere, blurring the boundaries between individual and collective experiences. It contributes to the field of immersive entertainment and interactive experience spaces, offering practical insights into designing musical environments that extend beyond traditional auditory stimulation. By crafting a multisensory environment where auditory, visual, and tactile stimuli intertwine, the project seeks to facilitate a state of primary consciousness marked by heightened emotional responses, a sense of timelessness, and a deep connection with the music and surroundings.

Keywords: interactive club experience, immersive technologies, spatial audio, surround visuals, multisensory environments, tangible interface, haptic elements, primary consciousness, embodied interaction

Zusammenfassung

Diese Forschungsarbeit befasst sich mit der Konzeption und Entwicklung eines neuartigen interaktiven Club-Erlebnisses, bei dem immersive Technologien wie Ambisonics-Audio, umgebende visuelle Darstellung, Licht und greifbare Elemente eingesetzt werden, um eine dynamische, multisensorische Umgebung zu schaffen. Die Studie stützt sich auf verkörperte Interaktion und erweiterte Ansätze für musikalische Erfahrungen und untersucht, wie die Kombination dieser sensorischen Modalitäten eine einzigartige kollektive Atmosphäre schafft und die Grenzen zwischen individuellen und kollektiven Erfahrungen verwischt. Sie trägt zum Bereich der immersiven Unterhaltung und interaktiven Erlebnisräume bei, indem sie praktische Einblicke in die Gestaltung von musikalischen Umgebungen bietet, die über die traditionelle auditive Stimulation hinausgehen.Durch die Schaffung einer multisensorischen Umgebung, in der auditive, visuelle und taktile Reize ineinandergreifen, soll das Projekt einen Zustand des primären Bewusstseins fördern, der durch erhöhte emotionale Reaktionen, ein Gefühl der Zeitlosigkeit und eine tiefe Verbindung mit der Musik und der Umgebung gekennzeichnet ist.

Schlagwörter: interaktives Cluberlebnis, immersive Technologien, Räumlicher Klang, umgebende visuelle Darstellung, multisensorische Umgebungen, greifbare Benutzeroberfläche, haptische Elemente, primäres Bewusstsein, verkörperte Interaktion

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Introduction

Is it a temporary escape from reality or a profound experience of meaning? Does it symbolise a relentless pursuit of pleasure or serve as a channel for spiritual healing? Academic research and non-academic discussions into music clubs and rave culture present a spectrum of interpretations on this theme. *Fantasizer*, an interactive and immersive club experience, seeks to provoke further inquiry rather than provide definitive answers. It draws attention to some of the broadly discussed ideas and concepts around the creation of immersive and interactive environments, situated approaches to clubbing, raving and musical experiences, as well as experimenting with the possibilities that new technologies offer for artistic expression and design of multimedia spaces.

Fantasizer investigates the transformative potential of immersive technologies in redefining the club experience by creating an environment where the traditional roles of performer and audience blur, giving rise to a dynamic, participatory experience.

At the heart of this practice-based study is the conception and development of an installation that intertwines higher order ambisonics audio, interactive visual projections, and tactile elements within a uniquely designed space. This project positions itself not merely as an entertainment venue but as a laboratory for examining the depth and breadth of sensory engagement in social and recreational settings.

The core objective of *Fantasizer* is to challenge and expand the conventional boundaries of clubbing experiences. Central to this exploration is the notion of embodied interaction, wherein the participants' physical presence and movements become integral to the modulation and evolution of the audio-visual landscape.

In addition, this study explores the theories of collective atmosphere and shared experience as commonly discussed themes in club and rave culture. By employing motion sensing and depth cameras, *Fantasizer* aims to not only respond to individual interactions but also to capture and amplify the collective dynamics of its audience.

In this thesis, the conception and realization of *Fantasizer* is discussed, along with the exploration and elaboration of the theoretical ideas and concepts underpinning this project. Central to this exploration is the interplay of immersive technologies and multisensory engagement within the context of a music club environment. The thesis critically examines frameworks such as embodied interaction, the psychology of collective atmospheres, and the dynamics of sensory stimulation. These theoretical pillars serve not only to contextualize *Fantasizer* within the broader discourse of interactive art and entertainment technology but also to dissect the nuances of how such an

environment influences and is influenced by its participants. The aim is to explore beyond the surface-level implementation of technology and design, seeking to uncover the deeper cognitive, emotional, and phenomenological aspects that define the essence of this multisensory experience.

Discussions about music clubs encompass a variety of definitions and viewpoints. Therefore, it may be helpful to establish a clear foundational understanding of the key elements. In this project, a music club is defined as a specifically designed architectural space enhanced with a variety of multimedia technologies aimed at creating an enveloping musical environment. This setting may feature live performances or curated playlists. Additionally, the assembly of individuals with shared interests, such as a specific genre of music or dancing to electronic music, creates an environment conducive to social and cultural encounters.

It is worth mentioning that the project's development has repeatedly raised questions regarding its definition and designation as a music club. One possible reason is the project's interdisciplinary nature, which complicates its categorisation into a pre-existing, well-defined concept.

A closely related term, contributing to a clearer understanding of the project's concept, is "hybrid place" (Dixon and Smith, 2007) also referred to as "hybrid space" in some literature. [1] (Baradaran Rahimi, Levy and Boyd, 2021) Hybrid places represent a spectrum of environments that bridge the virtual and physical. It is an umbrella term to describe spaces where both ubiquitous digital technologies and the tangible aspects of physical rooms and objects coexist and can be find in various domains, including museums, urban spaces, and even personal spaces like homes equipped with smart technology. Unlike purely virtual spaces, which seek to immerse users in computer-generated environments, hybrid spaces integrate these virtual elements into the users' physical surroundings.

Another related terminology that merits attention, is immersive environment. While immersion aptly describes projects like *Fantasizer*, its utility as a term is diminishing due to widespread, over-hyped, often unrelated, or incorrect applications. A diverse array of multimedia events, including virtual and mixed reality environments, projection mapping, and the use of large LED walls, are often labeled as immersive. Whether all these environments possess immersive qualities remains debatable. While the concepts of "immersive environments" and "hybrid places" both contribute to the definition of the project, *music club experience* – or in shorter form *club experience* – has been chosen as a more specific and accurate descriptor.

[1] While the term space emphasize on the actual physical and geometrical environment, place describes the experience of the space; in other words space is elevated to place when meaning and experience is added to it. (Tuan, 1979)

Building upon a shared understanding of what constitutes a music club, *Fantasizer* can be specifically defined as an interactive and multi-sensory club experience. While music clubs have always offered interactive and multi-sensory experiences since their inception, the term *interactive* in this context emphasises the real-time participation of the audience in influencing the content. Similarly, *multi-sensory* aims to highlight the enhanced sensory engagement that distinguishes it from traditional club environments. These terms will be elaborated upon in more detail in subsequent chapters. This concept, which includes participant's interaction in a multimedia augmented physical space, has its roots in a variety of disciplines and approaches.

Considering the genealogy of an interactive multisensory music club, *Fantasizer* can be positioned as a hybrid within various disciplines that integrates and mixes elements from different conceptual fields. To better understand this complex, more precisely transdisciplinary field, the following diagram is presented.

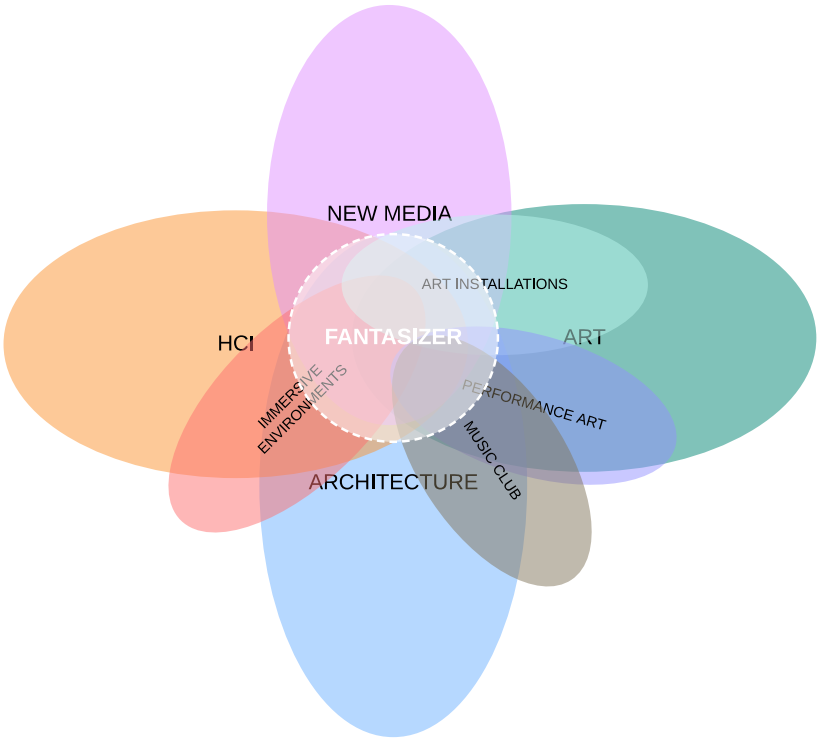

Figure 1: Fantasizer as intersection of different disciplines

In the subsequent chapters, the thesis embarks on an exploration of the genealogy of interactive music clubs. This historical analysis investigates into the evolution of interactive environments, tracing their roots and examining key developments that have shaped the contemporary landscape. Following this historical perspective, the discussion will be followed by a phenomenological study of interactive musical environments, diving deeper into the notions of embodied cognition and

embodied interactions. This theoretical inquiry serves as a foundational framework for the practical project, clarifying the underlying principles that inform the design and implementation of the project. Moving forward, the final chapters of the thesis present a detailed account of the project's development and outcomes, followed by the conclusion and outlook.

Genealogy of interactive music club

The components of interactive music clubs are shaped by the fusion of diverse media, including music, dance, lights, and images, which have their origins in the performance arts and theatre. (Dekker, 2003) John Reaves (1995, as cited in Dixon & smith, 2007) states: “In the digital world you cannot distinguish different disciplines by the physical nature of the media or by which work is created....Theatre has always been an integrative, collaborative art which potentially (and sometimes actually) includes all art: music, dance, painting, sculpture, etc. Why not be aggressive in the tumultuous context of the Digital Revolution? Why not claim all interactive art in the name of theatre?” (Dixon and Smith, 2007)

An interactive multimedia club experience can be traced back not only to Richard Wagner's concept of Gesamtkunstwerk (Total Artwork) in 1849, but also the efforts of later composers, artists and scientists who ventured into composing music with other media. (Jordan and Packer, 2002)

Wagner's concept of Gesamtkunstwerk represents one of the earliest efforts to formulate a comprehensive and practical theoretical framework for integrating various art forms. Wagner’s vision was to achieve a synthesized and harmonious blend of music, song, dance, poetry, visual arts, and set design through the unifying power of music drama. Wagner's ambition was to encompass the entire spectrum of human experience in his operas, giving equal importance to each component of the production. Wagner’s effort to emphasise the experience of multimedia art as a single work continued and has been mirrored in “The Futurist Cinema” manifesto by Marinetti and others in 1916, claiming film –as the new media technology of the time– to be the superior art, which had the *totalizing* effect on human consciousness. Similarly in 1924 Moholy-Nagy in an essay on Bauhaus theatre asserted that the true expression of the complete spectrum of human experience could only be achieved through an organic fusion of the fundamental elements of theatre – space, composition, motion, sound, movement, and light, believing that it was this synthesis that would bring these components into a cohesive and expressive whole. (Jordan and Packer, 2002)

Breakdown of traditional boundaries has continued and embraced by theatrical experiments of John Cage in collaboration with choreographer Merce Cunningham and artists Robert Rauschenberg and Jasper Johns in late 1940s blurred the lines between different art forms. Cage was especially drawn to artistic approaches that increased audience engagement and fostered a deeper consciousness of personal experience. Cage adoption of indeterminacy and chance in his methods redistributed the responsibility for a work's final result, moving it away from the artist. This approach further weakened a conventional barrier, diminishing the distinction between the artwork and its audience. Inspired by Cage, in the late 1950s, artists such as Allan Kaprow, Dick Higgins and Nam June Paik

questioned traditional concepts of form, categorisation, and composition, contributed to the birth of new genres like happenings, electronic theatre, performance art, and interactive installations. (Jordan and Packer, 2002)

The interest in fusing art and technology as “an equal collaboration between artist and engineer” along with a focus on audience engagement, was also a central theme in the 1960s initiative Experiments in Art and Technology (E.A.T) led by Billy Klüver. As he explained about the collaborative and multimedia Project Pepsi-Pavilion: "The initial concern of the artists who designed the Pavilion was that the quality of the experience of the visitor should involve choice, responsibility, freedom, and participation. The Pavilion would not tell a story or guide the visitor through a didactic, authoritarian experience. The visitor would be encouraged as an individual to explore the environment and compose his own experience." (Jordan and Packer, 2002)

Similar to performance arts, interactive arts can be studied as precursors of interactive environments. While early instances of interactive art can be traced back as far as the 1920s, exemplified by Marcel Duchamp's "Rotary Glass Plates," the contemporary concept of interactive art gained prominence in the 1960s. Notable works showcased at the 1968 exhibition “Cybernetic Serendipity” in London, featuring plotter graphics, light and sound environments, and sensing robots, are recognized as precursors to today's interactive installations. (Paul, 2023)

Concurrently, developments in cybernetics, particularly the work of Gordon Pask and other cyberneticists in the early 1960s, laid the groundwork for the realization and determination of interactive architecture. (Yiannoudes, 2016)

In the 1960s, Cedric Price, a pivotal figure in the early exploration of artificially intelligent architecture, played a crucial role in developing theoretical foundations in cybernetics. Price introduced the concept of “anticipatory architecture,” showcasing his influence on the conceptualization of intelligent structures. In this context, intelligence refers to the capacity to comprehend the surrounding environment and engage with it proactively. Building on these ideas, Charles Eastman further advanced the field in 1972 with the formulation of the “Adaptive-Conditional Architecture” model. In Eastman's model, the interaction between space and users is conceived as a feedback system, wherein the environment dynamically adjusts itself to accommodate the evolving needs of its users. (Yiannoudes, 2016)

In the 1980s and 1990s, innovations and advancements in computer science led to the technological and economic feasibility of embedded computation, sensor effectors, and wireless networks. Consequently, interactive architecture gained a more robust foundation during this period, marking

the inception of the history of kinetics in architecture. The evolution of technology significantly shapes the perception and experience of computation in each era. During the Mainframe Era, large and expensive computer systems primarily facilitated calculations and were shared among numerous users. The advent of the Personal Computer Era brought computers to individual desktops. Subsequently, the concept of ubiquitous computing extended computers into the physical environment, providing individuals with tens or hundreds of computational devices dispersed not only on desktops but throughout entire environments. The way humans interact with computers, irrespective of time or location, is seen as a consequence of ubiquitous computation. In the late 1980s, ubiquitous computing emerged as a research program at Xerox's Palo Alto Research Center (PARC) under the direction of Mark Weiser. Weiser characterized ubiquitous computation as initiating the “third age of computing,” envisioning a computer seamlessly embedded, fitting, and natural to the extent that its use becomes instinctive. (Weiser, 1991; West, 2011)

Ishii and Ullmer from MIT Media Lab coined the term “Tangible Bits,” which enables users to comprehend and manipulate bits at the forefront of their attention by linking these bits with commonplace physical objects and architectural surfaces. The primary objective of tangible bits is to establish a connection between cyberspaces and physical spaces, rendering digital information tangible and easily graspable. This concept encompasses three key approaches: firstly, “interactive surfaces,” such as walls, ceilings, doors, and windows, are transformed into active interfaces bridging the virtual and physical realms. Secondly, “coupling of bits and atoms” involves blending everyday objects like books and cards with digital information. Lastly, “ambient media” involves the use of sound, light, and other elements as background interfaces that present virtual spaces to human perception. (Ishii and Ullmer, 1997)

Later, Sauter (2004) differentiated between “interactive spaces” and “interactive architecture,” categorizing them alongside “screen applications” and “interactive objects/installations” as the four physical formats of New Media, which are characterized by four key qualities: interactivity, multimedia, connectivity, and generativity. These qualities enable the representation, expression, and communication of content, narrative, and form.

Interactivity allows for a two-way dialogue between the user and an artwork, facilitating a creative application. In classical art forms, such as painting, there is a dialogue between the picture and the viewer, but it is not reciprocal since the picture does not respond to the viewer. However, in interactive works, arts, or applications, the piece reacts to the visitor. It transforms through interaction or offers various modes of access, inviting the viewer to actively participate in the reception.

Multimedia offers the possibility to utilize traditional media—such as real film, animation, sound, music, language, illustration, and photography—independently or in combination within a single application. While traditional media like film integrate multiple elements like moving pictures and sound, they cannot be separately accessed. In contrast, new media allows for such independent utilization.

Connectivity, or networkability, is the capability to link and network information within an application, either locally or distributed. It enables parts of a work to be interconnected and refer to each other. This process can occur locally within a work or extend to distributed locations via networks.

Generativity refers to the creation of information, narrative, or form, initiated by external input based on an algorithm developed by the artist or designer. The outcome is not pre-produced but is shaped through the use of the artwork or application. (Sauter, 2004)

In summary, the roots of interactive music clubs can be traced back to performance arts, interactive arts, and architecture, which have undergone various changes and modifications over the decades. Understanding interactive music clubs and interactive experience spaces as total artworks can aid in comprehending each component's interplay with others. Drawing on and building upon the characteristics of New Media—such as interactivity, generativity, multimedia, and networkability—can help in understanding some key features of these environments. The next chapter will delve deeper into the phenomenology of these environments.

Embodied cognition - Embodied Interaction

Drawing from and inspired by cognitive science which is distancing itself from Cartesian dualism, computationalism and skull-bounded views that traditionally consider mind as a processor and ignore its connection to the surrounding world, there is a broad tendency in art, design, psychology, philosophy and other fields toward the importance of physical body and the environment in mental processes, perception, action, experience and emotions.[2] Variations of this idea are discussed: embodied cognition, enactivism (embodied, embedded, enacted, extended; collectively known as 4Es cognition) situated cognition, distributed cognition or extended mind thesis to name a few. Each of these theories inquire into the relationship between cognition and the environment, but they emphasise various aspects. While they all converge on the idea that cognitive processes are interlinked with environmental factors, they offer distinct perspectives on how this interaction is manifested and understood.

Prior to investigate how these concepts relate to interactive music clubs, it would be beneficial to first offer a brief overview of the most common terms.

According to Mark Rowlands, mental processes are embodied, meaning they involve more than just the brain and include other bodily structures and functions. They are also embedded, functioning effectively only within a specific external environment. Additionally, these processes are enacted, encompassing not only neural activities but also various actions by the organism. Finally, they are extended, meaning they extend beyond the organism, interacting with and incorporating aspects of the environment. (Rowlands, 2010)

Distributed cognition is a theory that posits cognitive processes are not solely confined within an individual but are distributed across individuals, artifacts, and environmental elements. This approach to understanding cognition extends beyond the individual's mind to include interactions with the external world. The term "distributed cognition" was coined by cognitive scientist Edwin Hutchins. His work emphasized that cognitive tasks are often accomplished through the coordination of human minds with each other and with external resources.(Hutchins, 1995)

The Extended Mind Thesis, coined by philosophers Andy Clark and David Chalmers, proposes that cognitive processes can extend beyond the human brain to include the body and external environment. It suggests that tools and technologies used by people, such as notebooks or computers, can become integral parts of their minds. (Clark and Chalmers, 1998)

[2] It is also necessary to mention that the mind-body connection is gaining great attention in physiological health and medical treatment as well. (Littrell, 2008; Frith, Miller and Loprinzi, 2020; Levine *et al.*, 2021; Prescott and Liberles, 2022)

Embodied cognition, probably the most debated notion among the others, which also enjoys a fair degree of acceptance and popularity in the academic world, stands for the idea that "the mind must be understood in the context of its relationship to a physical body that interacts with the world". and that “human cognition rather than being centralized, abstract and sharply distinct from peripheral input and output modules, may instead have deep roots in sensorimotor processing.” (Wilson, 2002) Almost every domain within cognitive science, including areas like perception, language, learning, memory, categorization, problem-solving, emotion, and social cognition, has undergone a transformation influenced by the principles of embodied cognition. (Shapiro, 2019)

In human-computer-interaction, Paul Dourish coined the term Embodied Interaction and emphasized that embodiment is not limited to mere physical existence; it is more about a participatory state of being. It signifies that things exist as part of the world and their essence is tied to this integration. The concept of embodiment emphasizes how the existence and significance of things are anchored in their embeddedness within the world, rather than just their physical form. (Dourish, 2001) Now a well-established research and design area, also known as Tangible and Embodied Interaction, focusing on integrating computational elements into the physical world. It adopts a comprehensive perspective, encompassing diverse systems that employ physical interaction, body movements, tangible manipulation, and digital augmentation of physical spaces. (Hornecker, 2011)

While the older views of aesthetic experience, such as the stimulation theory of the aesthetic, which involves empathy and mirroring, are found to be critical (Brinck, 2018); aesthetic experience and perception of art is also understood as embodied, embedded and enacted in engagement with the work of art. (Noë, 2004; Brinck, 2018) Although the brain still plays its role, it originates and unfolds in the real world through the involvement of an embodied individual. This experience is born from actively engaging with and examining art in a physical space, signifying the role of physical interaction in the appreciation of art. Perception is considered both adaptive (Gibson, 1986) and explorative (McGann, De Jaegher and Di Paolo, 2013). Adaptiveness means that perception has evolved to ensure an organism's survival and harmony within its environment. The explorative aspect of perception involves actively seeking new ways to interact with and benefit from changes in the environment. The interaction between these adaptive and explorative behaviours is significant in the context of art. When nature is transformed into art, the resulting transparency and clarity enhance the experience for both the artist and the viewer. Essentially, exploration through art can lead to a deeper understanding and appreciation of reality. (Brinck, 2018)

Phenomenologists such as Maurice Merleau-Ponty offer a perspective on perception and art that complements enactivism. Merleau-Ponty’s work, particularly from 1964, focuses on the performative

aspects of art perception. Merleau-Ponty describes how we perceive art from a first-person viewpoint. This approach underscores the idea that our experience of art is subjective and deeply rooted in our personal, bodily engagement with it. It suggests that understanding art goes beyond intellectual interpretation, involving a more direct, embodied, and personal experience of the artwork. (Merleau-Ponty, 1964; Brinck, 2018)

Over time, viewers develop an expertise in perceiving art, enhancing their depth and complexity in experiencing aesthetics. This skill involves learning not only the act of observing but also understanding what aspects to focus on and how to interpret them. This process of cultivating an artistic eye and comprehension is a gradual development, enriching the viewer's engagement with art (Gibson, 1986). Traditionally, aesthetic experience was seen as an intellectual pursuit, valuing the pure form according to Immanuel Kant's theories. This view, differentiating between abstract tastes and sensory experiences, overlooked art's pre-reflective, emotional, and bodily responses. Mainstream aesthetics of the 19th and 20th centuries focused heavily on rational and discursive aspects, neglecting other dimensions. However, recent interests have shifted towards understanding the roles of emotion, perception, physical sensation, and empathy in aesthetic appreciation. Today, it's acknowledged that while reflection and verbal analysis can be significant, they aren't always essential for an aesthetic experience. (Brinck, 2018)

Not only aesthetic experience but also music (Leman, 2007), dancing (Kirsh, 2010) clubbing and raving (Witek, 2019) have been studied as a form of embodied consciousness and in relation to extended mind thesis.

A key principle of Extended Mind Theory (EMT) is the diminishing distinction between the subject and object in cognitive processes. EMT, often seen as the most radical among the 4E approaches, suggests that cognition is not just linked to the external world through interaction and bodily sensations. It proposes that there are no definite boundaries between the brain, the body, and the environment. Instead, the relationship between the mind and its surroundings is seen as flexible and dynamic. In this view, cognition is reimagined as a system where the brain, body, and environment all contribute equally. (Clark and Chalmers, 1998)

Shaun Gallagher expands the Extended Mind Theory (EMT) beyond objects to encompass other individuals and groups. Gallagher exemplifies this with socially distributed cognition in systems like legal, scientific, and family structures. For instance, in a court case, cognitive processes like judgment are distributed across the entire legal system, including participants and societal norms, not just confined to individual brains. Gallagher emphasizes an enactive approach, arguing that what extends in cognition are not the brain's materials but its cognitive and social processes. (Gallagher, 2013)

Jan Slaby (2014) contends that our physical interactions with the world are deeply intertwined with our emotional experiences, aligning emotions within the Extended Mind Theory framework. Slaby views emotions as inherently relational, directed towards something like a person, scene, or music, thus forming a part of a distributed affective system. Slaby's perspective shifts EMT towards enactivist theories by emphasizing relational rather than locational embodiment. (Slaby, 2014)

Slaby introduces “Phenomenal Coupling” to describe how an individual's emotions directly interact with emotionally expressive elements in their environment, like music or art. This concept extends to social interactions, where the expressiveness of others can elicit emotional experiences unattainable alone. In art, responses to dynamic forms such as music or dance are deeply linked to the artwork's expressiveness, highlighting a close attunement to environmental emotional cues. This illustrates how both interpersonal dynamics and art can activate and shape our emotional responses. Slaby adds that “The feeling body is a transparent, though evaluatively *tinted*, medium of emotional experience, and it is constitutively open to be affectively engaged in interaction.” An extreme case of extended emotion occurs when one person significantly influences another's emotional state. For example, a demagogue's intense anger might infect others, intensifying their emotions and leading to regrettable actions. Alternatively, a cheerful person might uplift someone with a mild depression, invigorating their emotions and actions beyond their usual scope. This embodiment of emotional interaction can act like a dynamic interplay, where the strong expressivity of one person initiates and guides an emotional *dance*, effectively scaffolding the other's emotional state. (Slaby, 2014)

Slaby explains the concept of “affective atmosphere” as extended emotional situations and how feelings connect the body to an emotionally charged environment. For instance, a person exhibiting intense anger not only feels this emotion but also exudes an atmosphere of aggressive energy, creating a palpable emotional field that impacts those nearby. This is a form of “phenomenal coupling”, where one's emotional state resonates with and influences the surrounding environment. (Slaby, 2014)

Joel Krueger (2013) suggests the term “musical affordances” and how they foster various types of entrainment. (Krueger, 2014) Affordance is a term in cognitive psychology and ecological psychology, originally coined by psychologist James J. Gibson. It refers to the perceived and actual properties of an object or environment that suggest how it could be used. For example, a chair affords sitting, a button affords pushing. Affordances are about the relationship between an object and an organism, indicating what actions the object makes possible for the organism. This concept is widely used in fields like design and human-computer interaction to understand and optimize how users interact with products and interfaces. (Gibson, 1986) Entrainment is a widespread phenomenon where

physical and biological systems naturally align with external rhythms or patterns, either in space or time. This process involves recognizing rhythm, responding to it, and synchronising these systems to harmonize with these external events or movements. (Brinck, 2018)

Krueger claims that music is a particularly potent tool for extending our emotions. It is often used for emotional regulation and identity formation. Krueger views music as “affective scaffolding,” allowing us to transfer emotional regulation processes onto its dynamics, rhythms, harmonies, and lyrics. This concept implies that music helps manage and mould our emotional states. Krueger describes our interaction with music as a synchronisation of our reactions and feelings, leading to emotions that are intensified and more complex than those experienced internally. Similarly, other people can also serve as emotional scaffolds. In interactions involving coordinated actions and shared intentions, emotional experiences become distributed among individuals. This interpersonal convergence of emotions is based on entrainment between people. Krueger suggests that shared emotions are unique because they offer phenomenological experiences distinct from those we have alone, much like the shared experience of music. (Krueger, 2014)

"Collective effervescence" is a term coined by sociologist Emile Durkheim (1912) to describe the sense of energy and harmony people feel when they come together in a group, particularly during rituals or collective events such as a concert or sport stadium. This phenomenon leads to individuals feeling a greater sense of community and unity, often accompanied by heightened emotions and a sense of belonging. It's a key concept in understanding how collective experiences can transcend individual experiences, creating a shared emotional state among the group. (Durkheim, 2016) Collins (2004) expanded on Durkheim’s idea through his theory of interaction ritual chains, highlighting how physical co-presence and synchronised emotional and attentional responses create a unified emotional and cognitive experience. (Collins, 2014)

Building upon these ideas, Von Scheve and Ismer (2013) explain collective emotions as “synchronous convergence in affective responding across individuals towards a specific event or object.” They suggest that face-to-face interactions lead to shared emotions through mechanisms like mimicry and emotional contagion. Synchronised actions and attention cause emotions to be mirrored physically and subjectively among individuals. However, shared emotions are not solely due to physical closeness. Cultural norms and values also play a role, allowing people to have similar emotional responses to events. Additionally, belonging to specific social groups can influence emotions independently of direct interaction. Physical co-presence can further intensify these shared emotional experiences. (Von Scheve and Ismer, 2013)

In context of raves and clubs the *affective atmosphere* is referred to as “vibe”. (Fikentscher, 2001) The vibe at raves and clubs is created by various factors including the DJ's music choice, dance styles, the venue or outdoor setting, sound levels, bass vibrations, tempo, lighting, temperature, scents, and fashion. Some elements like the venue and sound levels are relatively constant, while others like the DJ lineup, crowd dynamics, and temperature change over the course of the event, contributing to the dynamic and evolving nature of the vibe. (Witek, 2019) The vibe is “an active communal force, a feeling, a rhythm that is created by the mix of dancers, the balance of loud music, the effects of darkness and light, the energy. Everything interlocks to produce a powerful sense of liberation. The vibe [is] an active, exhilarating feeling of *now-ness* that everything is coming together—that a good party is in the making” (Sommer, 2001) Fikentscher describes rhythm as a key to vibe: “synchronising force, facilitating the process in which a vibe is created, shaped, and maintained” (Fikentscher, 2001)

Witek (2017) suggests that the distinct rhythm in electronic dance music like house and techno uniquely intertwines music with dance movements. These genres often feature syncopation and polyrhythms, creating rhythmic gaps that prompt bodily responses to “fill in” these spaces through synchronised movement. This active participation in the music exemplifies the concept of the musically extended mind and body, blurring the lines between the dancers' minds, bodies, and the music itself. Even in stillness, listeners engage with the music through their embodied attention. (Witek, 2017)

Luis-Manuel Garcia (2015) discusses the unique tactile and haptic qualities of electronic dance music, attributing these to the texture and granularity of its production. This quality creates a sensory-affective connection, blending touch and sound on the dance floor. The music's physical impact, especially through high-amplitude bass, is tangible in the body. The use of bodily sounds, like hand claps, in house and techno music enhances its “fleshy” quality. The granularity in electronic dance music's sound production is key to its sensory experience. This aspect, particularly through the manipulation of microtemporal structures like sound decay, creates a sonic texture that evokes tactile sensations. This quality of the music enhances the multisensory experience, contributing to a collective sociability among dancers and listeners. It blurs the boundaries between them and the music, “touch is an inherently interactive mode of perception”. (Garcia, 2015)

While the source of the club's vibe might be non-human, it is subjectively felt by everyone there, though not constantly or uniformly. This personal experience is shaped by the social, emotional, and cognitive spread of the vibe within the club environment. The club's vibe extends beyond a simple transfer of emotion from individuals to the music. It is a collective phenomenon, shaped by various external factors and the interactions of different people. The vibe originates not from a single dancer

but from the collective energy of the crowd and environment. It can change dramatically with shifts in any contributing elements, like a DJ's music selection or the mood of new arrivals on the dance floor. (Witek, 2019)

Clarke (2011) proposes that musical engagement can lead to a distinct form of consciousness, different from our regular waking state. This idea is based on Antonio Damasio's concepts of primary and higher-order consciousness. Primary consciousness is immediate and sensorimotor-based, mostly non-verbal and focused on the present. Higher-order consciousness, conversely, is verbal and reflective, concerned with personal narrative and time. (Damasio, 1999) Clarke suggests that intense musical experiences, like dancing to music, might allow us to temporarily bypass higher-order consciousness, reconnecting us with a more corporeal and emotional state of primary consciousness. (Clarke, 2014)

Engaging intensely with music, like dancing or listening deeply, may lead to a primary consciousness state where the mind and body are widely distributed in cognitive, social, and affective ways. However, this concept of an extended self isn't limited to experiences like clubbing. Extended Mind tTheory applies universally, suggesting the mind is always extended, particularly evident during intense musical experiences. These experiences underscore the idea that our “selves” are integrally connected with the world, a contrast to the more detached state of higher-order consciousness. Moments like clubbing highlight this connection, revealing the inherent extension of our “self”. (Witek, 2019)

The study of clubbing and raving without studying the associations with drug use in these environments is not comprehensive. Observing brain activity during the affective atmosphere of dancing is challenging due to movement restrictions in brain scanners and the complexity of recreating a club's vibe in a lab. However, the psychedelic state, an “oceanic” experience similar to clubbing and raving, offers a more accessible subject for neuroscientific study.[3] Research using psychedelics to understand primary consciousness suggests that the complexity of neural network dynamics is key to explaining these experiences. (Witek, 2019)

Psychedelics, derived from natural sources like psilocybin mushrooms or synthetic ones like LSD cause perceptual (such as visual pseudo-hallucinations and synaesthesia), cognitive (Heightened perception of significance or purpose), affective (Experiences of transcendence, sorrow, happiness, and anxiousness), and subjective (Sensations of losing one's self-identity) changes. (Griffiths *et al.*,

[3] In a 1927 letter to Sigmund Freud, Romain Rolland coined the phrase "oceanic feeling" to refer to "a sensation of 'eternity'", a feeling of "being one with the external world as a whole". https://en.wikipedia.org/wiki/Oceanic_feeling

2006) Other *psychedelic-like* substances such as MDMA (Ecstasy) induces profound feelings of intense joy, emotional closeness, openness, and a heightened sense of connection and empathy with others. (Palamar *et al.*, 2017)

The connection between psychedelics and the rave and club scene is largely due to their usage by attendees to intensify and enhance their experiences (Palamar *et al.*, 2017) The heightened, ecstatic states often sought in these environments is reported to be generally brief and short-time and more pronounced when drugs are involved. (Malbon, 1999) The prevalence of psychedelic and similar drugs at dance clubs and raves is attributed to their ability to induce affective states that align. (Witek, 2019) The phenomenon of “ego-dissolution”, where individuals feel their sense of self or the boundaries between themselves and the external world diminishing, is reported in both psychedelic research (Lebedev *et al.*, 2015) and ethnographic studies of dance-music cultures. Hutson (2000) references ravers’ observation that techno music alone can evoke an ecstatic experience, even without the act of dancing and use of drugs: "It's the only music that lifts you out of your body without putting something down your throat first." Or "the human ability to dream while awake." highlights the profound impact of the music itself on the listener's emotional state. (Hutson, 2000)

Embodied cognition theories such as EMT or 4E draw attention to the interconnectedness of mind, body, and environment, offering a blurred distinction between human being and their surroundings. This idea encouraged the experimentation with deliberately created environments that might offer an optimal condition for creating emotions in individuals and groups.

These concepts provoke questions such as: How probable is the *entrainment* between human bodies and computer-generated artifacts? What happens when visuals mirror and react dynamically to one's movement while both are synchronised to the music? How are sensory feedback and real-time interaction perceived by individuals and groups of people? Benefiting from the potentials that music, particularly electronic music and techno, offer, is it possible to generate and maintain emotional experiences? Can immersive audio create an optimal condition for *affective scaffolding*, allowing one to emotionally regulate onto the music? Can the coordinated actions of humans toward each other (and machines), as well as their shared interest in a particular genre of music and dance, facilitate this? What circumstances can influence the vibe of an event? Can multisensory engagement, in addition to physical co-presence and synchronised bodies, create a unified emotional and cognitive experience? Can being enveloped in the artificially created reality create a dream-like-while-awake effect without assistance of substances? Can adding haptic stimuli as *an inherently interactive mode of perception* facilitate this goal? *Fantasizer*, aimed to explore these ideas deeper and further in practice.

Methodological Approach

The groundwork for *Fantasizer* initiated with theoretical research, primarily focusing on the music clubs and how they may look like in the future from a speculative perspective. A variety of topics briefly explored, serving as a brainstorming session for factors that could potentially influence the clubbing experience. From this extensive exploration, selected topics were chosen for further in-depth analysis. These include the multisensory engagement of the audience, with a critical lens towards addressing overlooked accessibility concerns within club settings. Additionally, the roles of cross-modal correspondences in creating a coherent and enjoyable experience were examined, alongside an investigation into generative content and the significance of interactivity and extended reality within this context.

This phase involved an extensive search for relevant literature, books, and publications. This has been done within the confines of the university library, where a comprehensive collection of academic resources was accessed. Additionally, exploration extended to esteemed publication libraries such as ACM, IEEE, Springer, among others, to ensure a thorough examination of scholarly works in the field, aimed to gather insights from a diverse range of sources.

Some key topics have consistently emerged in the literature. One such topic underscores the significance of the physical presence of the audience and the act of dancing within carefully designed architectural spaces, influencing both individual and collective experiences of music. Another highlighted theme revolves around the importance of sensory engagement and interactive content, accentuating the potential afforded by advancements in technology and the accessibility of sensors, offering innovative opportunities to reimagine the longstanding concept of raving and music clubs.

In this phase, a range of case studies from 1998 to the present time were selected for more detailed investigation. A closer examination of this collection of non-traditional club designs revealed some common features.

One was the attempt to create a novel club experience, distinct in some respects from other contemporary practices. Another characteristic was the concept of an interactive music club with active audience participation, often in the form of collaborative music and/or visual creation. (Ulyate and Bianciardi, 2002; Hromin *et al.*, 2004; Kaiser and Ekblad, 2007; El-Nasr and Vasilakos, 2009; van Hout *et al.*, 2014; Röggla *et al.*, 2017; Ulyate *et al.*, 2018) In most cases, dancing and movements are detected, classified, and mapped to more advanced algorithms that can alter multimedia content in a variety of complicated ways.

Another shared trait is the transformation of the role of the DJ (Disc Jockey) in this context. Either the audience collectively assumes the role of the DJ, or the DJ evolves into an “Experience Jockey” (EJ), who adjusts the effects produced by each type of sensor. (Ulyate and Bianciardi, 2002) They can respond to the crowd and alter the overall structure in real time, adding a meta layer of direction to the entire environment.

In terms of interaction, these works can be primarily classified into three categories: fixed interactive zones, such as light beams that can be interrupted with hands and body (van Hout *et al.*, 2014), steppable platforms for single or multiple users, or rotatable wheels and objects (Ulyate and Bianciardi, 2002); camera-based interaction, such as infrared cameras registering participants' body heat (Ulyate and Bianciardi, 2002); and movable systems, including Bluetooth-enabled wearables and wristbands or wireless motion capture sensors that track dancers' movements, locations, body temperature, heart rate, and similar. (Hromin *et al.*, 2004; Majoe, Kulka and Schacher, 2009; Röggla *et al.*, 2017)

Another aspect studied in relation to the future of clubbing is the various methods of creating a more engaging and accessible music experience. While lighting and visuals have long been a focus in this context, attention has shifted to less explored senses such as scent, haptic feedback, and taste.

To highlight some of these findings, studies within club settings have demonstrated that a pleasant ambient scent can enhance visitors' enjoyment of the music, mood, and overall perception of the event. (Schifferstein *et al.*, 2011) While there have been investigations into cross-modal correspondences between sounds and tastes -such as how music can alter the perception of wine's taste (Spence and Wang, 2015)- specific studies in the context of clubs are scarce, suggesting that taste has rarely been the focus of such research.

In contrast, the interplay of haptic stimulation and music has garnered considerable attention in recent years. Despite being a relatively new field, its application has been explored in various contexts, indicating a promising potential for further exploration in club environments. Research has shown that haptic feedback can significantly enhance immersion (Danieau *et al.*, 2013) as well as the musical experience for both performers and audiences. (Hashizume *et al.*, 2018; Kim and Schneider, 2020; Turchet, West and Wanderley, 2021) Common installations include haptic chairs, which utilize their large surface area to spatialize stimuli effectively. Other forms of haptic feedback involve wearable devices like bracelets, gloves, belts, jackets, full-body suits, and handheld movable devices. (Nanayakkara *et al.*, 2009; West *et al.*, 2019; Remache-Vinueza *et al.*, 2021; Turchet, West and Wanderley, 2021)

Findings indicate that haptically enhanced audio-visual content is perceived as more pleasant, unpredictable, and creative, leading to an increased overall user satisfaction and a positive shift in expectations, regardless of the form of haptic stimulation. Research suggests that haptic feedback plays a crucial role in user immersion, making it highly suitable for entertainment applications. While haptic stimulation has been shown to enrich the musical experience in terms of arousal, valence, enjoyment, and engagement, it's important to note that these audio-haptic experiences vary among individuals. (Turchet, West and Wanderley, 2021) Furthermore, the enhanced perception of music in individuals with hearing and visual impairments is another significant aspect to consider. (Turchet, Baker and Stockman, 2021; Turchet, West and Wanderley, 2021)

These findings raised questions in different areas such as:

- What kinds of sensory engagements might enhance the audience experience in a music club? What forms of interaction are meaningful in this context? What levels of interaction are considered appropriate?
- How can the interplay of different stimuli result in a harmonious experience of the event?
- How does the design of the space itself influence audience immersion and facilitate shared emotional experiences?

In addition, lessons learned from previous case studies inspired more in-depth research and practical investigation as well as a number of takeaways, which can be summarised as the following:

- Space and content including interactive and non-interactive elements should encourage and facilitate free movement. Restrictive and isolating technologies are to be avoided.
- Haptic and tangible elements offer new opportunities in designing and rethinking music clubs. Physical engagement that goes beyond sound and vision can create a new dimension that might enhance the experience of space and entire event.
- Interplay of all the elements should encourage exploration without getting overwhelming or needing any instruction of use or expertise.
- In the context of music club, a degree of passivity to the music and environment is appreciated that might be considered while designing interactions. Considering audience as a component of the entire happening rather than the operator of a system might be beneficial.
- Due to the experimental nature of the project, an end point is vague and unrealistic. By setting a deadline and sticking to it, the goal of realisation becomes more achievable. The final project will be the presentation of the status within a certain period.

These questions and takeaways provided a starting point for the practical project. Initiation phase has started with the goal of a more in-depth research based on the findings, defining project scope and requirements, brainstorming, conceptualising, and team building. A four-month time limit has been set for implementation, with fixed event times at the end of this period.

In the following sections, the conception and design of the project are explored in greater detail, along with the various phases of project development, challenges encountered, and decisions made that led to the final creation.

Project Development

Ideation and inspirations

As discussed in the previous chapter, the importance of unrestricted movement and maintaining the natural physical state of the audience as they enter the space emerged as a priority. The decision to forgo special devices such as head-mounted displays and headphones was driven by the concern that such gadgets could disrupt the seamless experience and hinder the audience's ability to freely move and interact with others. Additionally, the reliance on such devices would limit the number of attendees due to the availability of these devices. The use of gadgets also viewed as a potential barrier, considering both the audience's willingness to use them and the accessibility of the event.

Another crucial decision involved the use of audio and visual technologies known for their immersive capabilities, like spatial audio systems and surround visuals. Spatial or 3D audio systems create a three-dimensional sound environment, allowing sounds to come from various directions, enhancing the auditory experience and providing a sense of being within the soundscape. Surround visuals, on the other hand, use multiple screens or projections to create a panoramic visual experience, enveloping viewers in images that surround them. These technologies offered a foundation with the potential to deeply involve the audience in content, regardless of whether they actively engage with it or passively observe.

“Come now, with all your powers discern how each thing manifests itself, trusting no more to sight than to hearing, and no more to the echoing ear than to the tongue’s taste; rejecting none of the body’s parts that might be a means to knowledge, but attending to each particular manifestation.”[4]

One additional aspect highlighted during the pre-ideation research was the significance of sensory engagement with space and its impact on the experience and emotions. While lighting and visual elements have long been critical components of musical environments for many decades, other sensory stimuli such as haptic or olfactory cues have remained relatively unexplored and underrepresented. Inspired by the potentials that haptic stimulation offers to enhance the experience of the music and increase the accessibility, tangible elements considered as non-auditory and non-visual stimuli that can be integrated in the environment and set design.

For ease of operation and technical efficiency, the University's existing immersive audio lab was chosen as the installation site for the project. The 5th order ambisonics dome is built on a truss system, which could also simplify the set-up for projection and lighting. This early decision has

[4] Empedocles advocates for a sensory democracy. (Wheelwright, 1966)

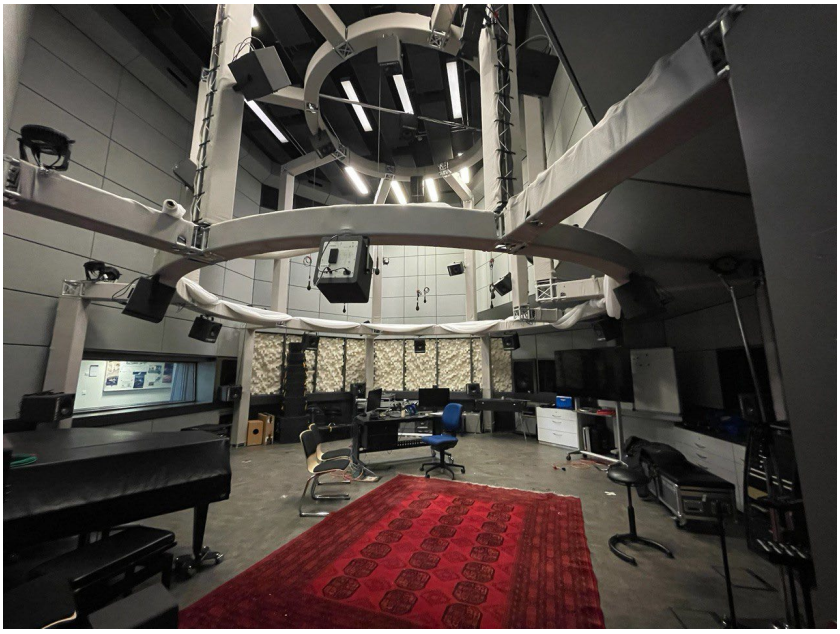

Figure 2: immersive audio lab at HAW Hamburg

accelerated the project's set-up, but has also introduced new challenges to the project, such as the placement of projectors.

The primary objective of the project was to establish an immersive space where the audience could enter and experience profound engagement through all their senses, both individually and collectively, fostering a sense of active participation in the overall experience. Viewing the project holistically, the environment and all its components, including human bodies, intertwine to form a playful and harmonious interplay.

Instead of the typical frontal arrangement found in other music clubs, where the DJ is faced by the audience, the audience should be afforded the freedom to move freely, explore the space, and interact in a non-directional manner. To avoid the directional layout of the room, consideration was given to a circular stage design. A circular dance floor, with no obvious ends or beginnings, offered several advantages that were integral to the atmosphere of the event. As well as being an appropriate choice for the use of omnidirectional content, dancing and moving in circles, as an ancient practice in different cultures, rituals and religions, suggested the potential to foster a sense of “collective empathy” - a sense of connectedness and a change of emphasis from the individual to the group, a sense of unity with others and the environment; of integration into a whole. (Borges da Costa and Cox, 2016)

In many previous case studies, the concept of an interactive music club has often been intertwined with audiovisual instruments, where auditory and visual components are integrated into the space. This has inspired more hands-on experimentation with a system that is not entirely dependent on, or

completely closed off from the users' input. This emerged the idea of a pre-programmed system that could not be controlled in real time - as DJs, VJs and lighting technicians typically do - but relied on algorithms and generative content that was supplemented by audience interaction.

In the next section the development of the project based on the initial ideation will be discussed.

Introduction to the project concept

As previously discussed, haptic stimuli were integrated into the final concept of the installation. During the brainstorming sessions, a wide range of forms and types of tangible elements in art installations and musical environments has been reviewed and studied. While some have focused on texture and material, such as feather or plush fabric, others have been highly dependent on the architecture of space, creating a new structure inside the available environment and transforming the entire interior of the room. An important criterion for the installation was that the tangible elements should not restrict the movement and dancing in the space and should ideally be available throughout the entire room so that majority of the audience can access them easily.

This inspired the idea of creating a structure within the room that serves various functions including acting as a touchable, interactive element in both analogue and digital sense, serving as a projection surface for visuals, concealing technical equipment, and creating a space within the space. Figure 3 illustrates early visualisations of the circular dance floor as a tangible structure, created with AI text to image generator tool, DALL-E.

Figure 3: early visualisations of circular dance floor and tangible elements

A semi-transparent textile or projection fabric such as gauze emerged as a suitable material for this purpose. In addition to its traditional use in set design owing to its lightweight nature and ease of manipulation, its ability to serve as an effective projection surface was noted. Moreover, its ability to change from translucent to solid, depending to the direction of illumination, combined with its ethereal characteristic, made it perfect for the intended use. It is worth noting that the use of curved LED panels or LED-strip-curtains with video pixel mapping techniques was initially considered as

alternative options. However, these were soon ruled out due to their unavailability at the university and their cost exceeding the project budget.

Visual projection has been envisioned as 360° surround surface to capitalise on its immersive potential. While this could be facilitated by existing trusses in the room and their circular shape, it also presented new challenges due to the limited space available between walls and trusses. This necessitated the use of ultra-short-throw projectors and posed the additional challenge of projection mapping on a curved surface that could be moved easily due to its lightweight.

The integration of light alongside textile and projection was explored through various scenarios and lighting techniques. LED Fixture lights as commonly used elements in club environments, were included in the final sketches as they provided a valuable means of comparison between established methods and experimentation with newer tools. These lights were primarily placed to accentuate the circular form of the room and planned as audio-reactive elements.

In addition to fixture lights, DIY LED strips have been considered as another element that could enhance the set design and serve as interactive elements influenced by participants. The placements of these lights higher from head-level up to the ceiling has been seen as vertical extension of the room, literally bringing light to the more overlooked aspects of the installation site and altering the viewer's perspective upwards.

A tangible sculpture in the middle of the room offered multiple functionalities. One function was as a hanging-from-ceiling decorative element of set design, easily reachable from various positions in the room. Another function was to serve as a "tangible bit," a physical object, capturing audience touch and sending it to the system for further manipulation of content. This concept evolved from the early idea of having a touchable element that captures the hand contact and functions as a trigger in the system, altering the lights -such as LED strips and audio- thereby creating a whole-room effect such as expanding the visual and auditory effects along the vertical axis of the room. To ensure aesthetic harmony with the entire set design, the same fabric as the projection fabric was considered suitable. The form was also thought as soft, curved shapes to correspond to the circular, non-angular structure of the room.

It's worth noting that the concept of incorporating tangible elements initially stemmed from ideas about creating haptic feedback, such as vibrations corresponding to specific elements of the music to make the music tactile. However, this concept was later simplified due to the prioritization of other aspects of the concept and the challenges associated with implementing it on a non-fixed surface.

The transformation of the fabric into a tangible interface has been prototyped utilizing Arduino microcontrollers with various methods and sensors, including ultrasonic sensors, infrared sensors, and conductive threads. While each method had its own advantages and disadvantages, ultrasonic sensing was selected as the most suitable method, as ultrasonic sensors were less influenced by factors such as temperature and light emission from other devices, providing a less noisy signal to start with.

The concept of capturing audience presence and involvement necessitated techniques for detecting motion in the space without relying on wearable gadgets. Another essential requirement was the ability to track multiple users simultaneously in low-light conditions. Ideally, these techniques needed to be discreet and hidden from the audience, preserving the magical effect of unexpected occurrences and enhancing the novelty of interaction. To achieve this goal, various motion-capturing techniques were tested, including depth-sensing cameras like Microsoft Kinect and Intel RealSense, distance sensors such as ultrasonics and infrared sensors, and video cameras in conjunction with motion-tracking machine learning solutions like Google MediaPipe.

Because of the size and shape of the installation, multiple sensors were required to cover a larger area. Consequently, Kinect version 2 was selected due to its availability at the university and its excellent performance in low light conditions, as well as its capability for full-body tracking of up to six individuals simultaneously.

During multiple listening sessions, a broad genre of electronic music has been discussed and categorised in different internally defined groups. The selection of the music pieces that made their way into the listening sessions was based on the personal preferences and suggestions of team members. In the categorisation process, it was not only the tempo or genre of the music that was considered, but also the influence of the music on the body and whether there is a tendency for individuals to move to the music. Moreover, the relevance of the song to the entire event and environment was taken into account, along with imagery, colours, seasons, emotions and moods evoked by the music. Furthermore, consideration was given to how the music corresponds to other senses.

Another topic discussed in these sessions was how the presence of participants in the room can influence the music. One primary idea was to have isolated elements of the music react dynamically to audience movements and interactions, with a main focus on the 3D mix of the music in the room. The aim was to avoid creating major changes that could strongly impact the musicality of the pieces.

With the aim of creating an emotional journey for the participants, an idea emerged to incorporate a kind of narration or storyline—a sequence of emotional events—built on the moods and feelings evoked by the songs and explored and extended by visual and haptic elements. This was conceived as an internal guideline for the team members during content creation, with room left for free interpretation by the audience.

After conceptualizing the main goals and ideas and outlining the project, the execution phase began, which involved testing various tools and deciding on the equipment available at the university. The next section will delve into further design considerations and decisions during the development process. Figure 4 illustrates 3D visualisations of the projection fabric and lights in the room.

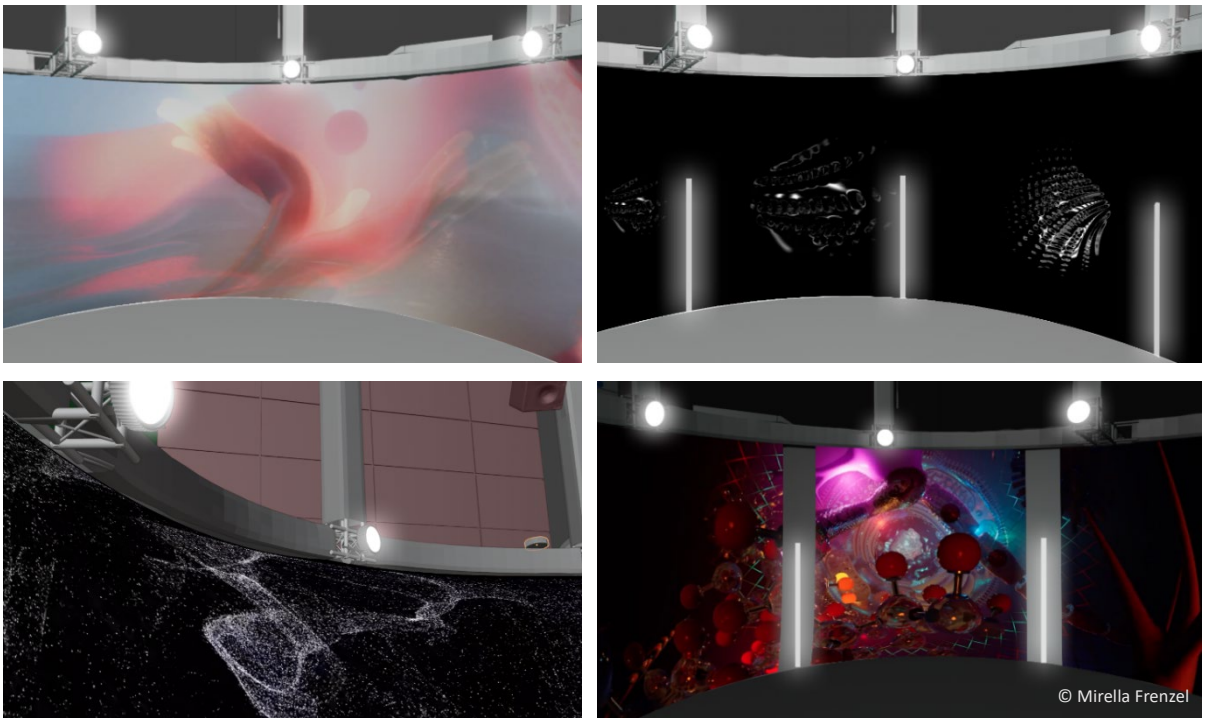

Figure 4: 3D visualisations of the projection fabric and lights in the room

Project Implementation

During the implementation phase, the extent of interactivity in the club context was a key consideration that influenced the iterative process. While participant interaction with the room was deemed crucial, questions arose regarding the appropriate level of interaction. To address this, a combination of interactive and non-interactive content was considered, providing a basis for practical comparison.

Drawing from previous case studies, it became clear that simplicity and intuitiveness are paramount in interaction design. Complex systems requiring new skills or instructions were to be avoided, ensuring participants could engage effortlessly and achieve pleasant results irrespective of their approach.

Presence and movement of participants has been decided as the input for changes in the generative imagery content. This implied that the audience was already exerting influence on the imagery projected on the 360° projection gauze merely by being present in the room. Various methods had been explored, including using audience coordinates to adjust subtle elements like colors and forms, as well as more immediate effects such as creating or erasing elements through different hand gestures. These methods had been tested using different 2D or 3D image generation techniques, which could significantly affect performance of the system.

For the final installation, a series of interactive content was chosen after evaluating its aesthetic harmony with other components of the room and its computational compatibility with the available software and hardware setup. This resulted in visuals that were altered and modified by the movement and dancing of participants, without constraining their communication with their companions or other visitors. Visuals that mirrored the audience's dance and movement in an abstract way, alongside their playful quality, were considered a suitable choice to encourage synchronised movement between the audience and the content.

Audience presence had been underscored as a fundamental aspect of the entire event, signifying that in the absence of individuals in the room, visual content would be entirely absent as well. This content had also been crafted in such a manner that only through movement could a dynamic dialogue between the room and the participants be fostered.

Throughout the iterations of the project, a dynamic shift between responsive and non-responsive content was considered as an effective method of allowing participants to engage with the content in various ways. This spectrum ranged from low-tempo, non-danceable, soundscape-like music

accompanied by completely interactive content, to higher-tempo dance music and non-interactive visuals.

Shortly after entering the room the audience was encountered with a rather low tempo not necessarily dance music, to get to know the environment for the first time. This has been also accompanied with responsive content functioning as a warmup and also offering the audience the opportunity to be involved in a shared activity. This transitioned to more subtle interactions, ending with non-interactive content giving the audience the chance to enjoy the environment in a rather passive way as there is normally the case in the typical club experience.

There were also occasions when visual stimuli were absent, enhancing the impact of the music and drawing attention solely to the auditory experience. This provided the audience with an opportunity to fully immerse themselves in the music, allowing them to become completely absorbed in the auditory sensations and become lost in the musical experience.

However, due to unforeseen technical issues that consumed more time than initially anticipated, the music remained a non-interactive element throughout the event. Due to the novelty of experiencing spatial music and the environment for many attendees, this aspect went largely unnoticed.

For the tangible sculpture in the room, an ultrasonic sensors ring had been created, suspended above the head with the gauze fabric hanging from it. This configuration formed a cylindrical room within the larger cylinder of the projection, providing a safe space at the center that could also modify the content. However, because of technical issues that remained unresolved, the planned use of LED strips that were intended to be triggered by touching or entering the structure had to be omitted shortly before the installation.

As an alternative solution, the impact of touching the tangible sculpture was implemented on the visual projection. Although the influence on the content went largely unnoticed by many participants, the mere physical effect of the soft textile was celebrated. This structure enveloped a dancer while remaining invisible to others, offering a moment of solitude amidst the crowd, as well as enjoying a light show through the fabric.

This has emphasized the significance of physical interaction and haptic elements in multimedia and virtually enhanced environments. Analogue interaction, sometimes overlooked in these types of spaces, has proven to be a crucial component of the space and the entire event.

Figure 5 to 7 present impressions of the installation and the event. A simplified overview of technical setup is illustrated in appendix.

Figure 5: making of tangible sculpture (left) – early variations of tangible sculpture (right)

Figure 6: dancers moving to interactive visuals

Figure 7: participants interacting with tangible elements

Conclusion and Outlook

During the 3-day event, approximately 140 visitors attended the *Fantasizer* prototype. An intriguing observation during this time was the inclination to interact with tangible elements of the room regardless of their impact on the real-time content. This highlighted the potential of physical interaction and haptic stimuli in musical environments, irrespective of the music genre. Worth mentioning that some visitors found the tangible structure “surprisingly and unexpectedly” interesting in combination with electronic dance music.

The possibilities that sensory engagement offers in musical environments, particularly non-visual and non-auditory interactions, present new potentials for novel experience design in entertainment environments, which require further exploration. Based on observations and casual conversations after the event, the depth of emotional experience varied largely depending on the music taste of the visitors and their willingness to interact with the content. Those with an interest in techno music and raving found the installation pleasant and satisfactory.

The non-directional layout of the installation was another characteristic pointed out by the participants. The circular dance floor and the presence of an object in the middle of the room offered a quality that might be comparable to a ceremony or a “ritual,” -as some described it- in appreciation of the music and engaging with other people present in the room, moving and dancing in circles.

During the event, there were also some accidental happenings that worked surprisingly well. One of them was an improvised act of sitting on the dance floor by the author as the outro song began. This resulted in a synchronised act of sitting or lying down on the dance floor during the last minutes of the show by all other visitors. This remained a fixed part of the show and was mentioned multiple times by other users as an impressive way of finishing the event, accompanied by a proper choice of music for this part.

Another observation during the event was how some carefully crafted interactive elements remained hidden and unnoticed due to the newness of the content for participants. This raised the question of whether, despite being subtle, this sort of interaction could still influence the atmosphere and mood of the event, which calls for more experimentation on the topic.

In general, it can be summarised that physical interactive elements introduce novel perspectives for developing innovative musical and entertainment environments, while immersive technologies enhance participant engagement with the content, resulting to a richer experience of the whole event.

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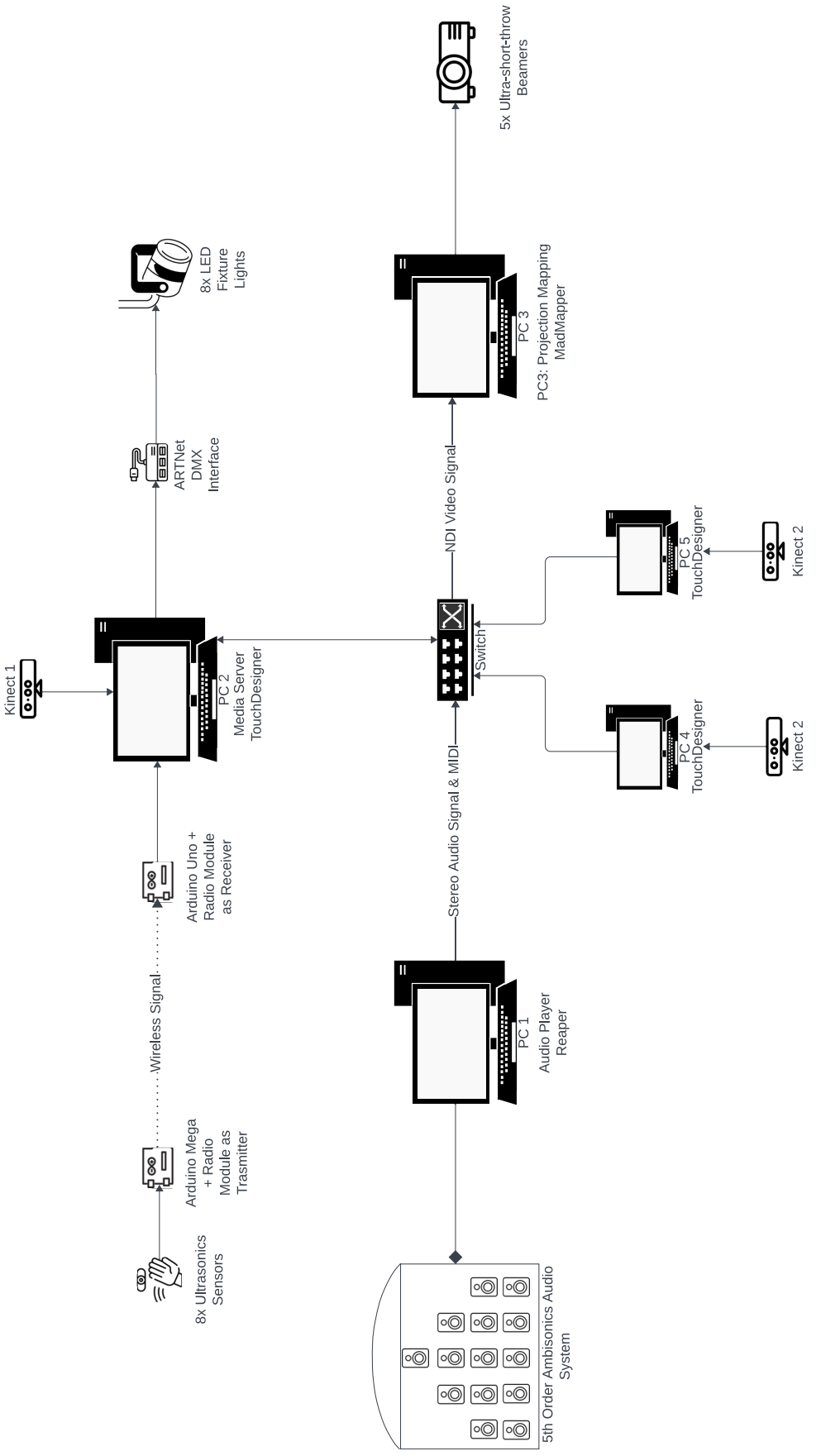
Appendix



Simplified Illustration of Technical Setup

Eigenständigkeitserklärung

Ich versichere, die vorliegende Arbeit selbstständig ohne fremde Hilfe verfasst und keine anderen Quellen und Hilfsmittel als die angegebenen benutzt zu haben. Die aus anderen Werken wörtlich entnommenen Stellen oder dem Sinn nach entlehnten Passagen sind durch Quellenangaben eindeutig kenntlich gemacht.

Ort, Datum

Hamburg, 15.05.2024

Unterschrift