Embodied Experiences in Virtual Reality Artworks

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Declaration

I, Yiwen Li, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Yiwen Li

Abstract

This thesis explores participant experiences of virtual reality (VR) artworks from an embodied perspective, aiming to provide an in-depth understanding of how individuals engage with immersive art. It investigates three central areas: how participants interact with VR art in embodied ways; how individual positionalities shape these engagements; and how immersion can be unpacked from a participant-centred approach. Framed through posthumanist theory, the research examines the co-constructive relationships between physical and virtual bodies and environments, highlighting the fluid, hybrid nature of embodiment within VR artworks.

The study employs qualitative methods, including autoethnography and three case studies involving non-narrative, interactive VR artworks. Data were collected through observation and semi-structured interviews and analysed thematically. To trace how movements, thoughts, feelings, and meanings unfold, I use storyboarding as a visual analytical tool. This approach maps participants' experiential flow across time and space, offering a layered view of their embodied interactions.

Key findings identify cooperative dynamics and autonomous exploration as central to understanding VR art experiences. Cooperative dynamics unfold through: (1) shared authorship between artists and participants; (2) the interplay between human and nonhuman agencies; and (3) the co-constitution of immersive technologies and embodied connections. Simultaneously, autonomous exploration—facilitated by non-linear paths, unscripted movements, and contextual guidance—supports personalised and thematically coherent interactions.

This thesis contributes to growing conversations around embodiment, immersion, and viewer agency in VR art. It emphasises the importance of designing VR experiences that support reflective, exploratory, and participant-led interactions. By prioritising the relational and situated nature of embodiment, this research offers both theoretical insights and methodological tools for understanding how immersive media can foster nuanced and meaningful engagements.

Impact statement

The findings of this thesis offer benefits to academia and the field of VR and VR art. This thesis offers a useful academic contribution by advancing an embodied perspective in understanding VR art experiences. It bridges theoretical insights with empirical investigation, demonstrating how the concept of embodiment can be applied to the study of participant interactions within virtual environments. By foregrounding the interconnectivity between physical and virtual realms, this research challenges dualistic frameworks and emphasises the co-constructive nature of bodily and affective engagements in VR art.

Methodologically, the thesis introduces an innovative approach to studying embodiment in VR experiences. By integrating qualitative methods such as observation, semi-structured interviews, and autoethnography with thematic analysis, it provides a framework for capturing the nuanced dynamics of participant movements, thoughts, and feelings. This methodological contribution equips researchers with tools to investigate the embodied aspects of VR, facilitating a deeper exploration of how participants engage with and interpret virtual artworks.

For the research community, this thesis offers a useful lens to analyse VR art, encouraging further exploration of embodiment in media studies. It not only expands theoretical discourse on the role of the body in shaping VR experiences but also provides practical strategies for empirical research, contributing to future studies that recognise the importance of bodily engagements and embodied knowledge in participant interactions with virtual environments.

Beyond academic discourse, this thesis has practical implications for VR artists and designers. By highlighting the potential of VR in fostering complex, personalised participant experiences, it encourages creators to design VR artworks that support individualised exploration and meaning-making. It challenges conventional approaches to VR design and instead advocates for the creation of virtual environments that prioritise participant autonomy, encourage individualised and exploratory interactions. Through its embodied-centred perspective, the research underscores the importance of designing

VR artworks that embrace fluidity and adaptability, accommodating diverse participant positionalities and preferences. By integrating the insights from this thesis, VR artists and designers can explore innovative ways to deepen engagement, foster embodied and affective connections, and enrich the immersive dimensions of their creations.

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Table of Contents

List of Figures

Glossary

Posthumanism

Posthumanism is a philosophy that critically rethinks the definition of the "human" and its place in the world. It emphasises the interconnectedness and co-constitution of human and nonhuman entities, including technologies, animals, and environments. In this thesis, posthumanism supports an exploration of VR interactions as relational and co-creative processes, highlighting how physical and virtual realms are entangled rather than separate.

Mind-body dualism

Mind–body dualism refers to the philosophical distinction between the mind (as immaterial) and the body (as material), historically rooted in Cartesian thought. This dualism has influenced early approaches to VR, which often conceptualised virtual embodiment as a disembodied mental experience. In this thesis, the concept is critically examined to challenge such separations and to understand their influence on the design and understanding of VR interactions.

New materialism

New materialism, situated within posthumanist thought, reconceptualises materiality as dynamic, processual, and relational rather than fixed or merely concrete. It emphasises the agency of both human and nonhuman matter and the entanglements between them. In this thesis, new materialism informs how bodies are seen as hybrid and fluid entities shaped through interactions with VR artworks.

Intra-action

Intra-action is a concept discussed by Karen Barad (2007) in describing the dependent and mutual constitutive relationships between entities—meaning entities do not pre-exist their interactions but emerge through them. In this thesis, the concept of intra-action helps frame the cooperative relationship between the physical bodies and virtual environments in shaping participant VR art experiences.

Co-creation

Co-creation refers to the collaborative process in which participants and virtual elements—such as bodies, objects, and environments—mutually influence and shape each other. During this process, participants learn, adjust, and compromise their embodied habits to adapt to different ways of movements in the artworks. This process involves a mutual impact between human and nonhuman agencies in both the physical and virtual worlds.

Hybridity

Hybridity refers to the composition of the body as a mix of different components—such as biological, technological, and socio-cultural. It challenges ideas of a fixed, original, and authentic body by acknowledging how embodiment is always mediated and in flux. In this thesis, hybridity is central to analysing the flexibility of bodily boundaries in VR.

Fluidity

Fluidity describes the body's continuous adaptability and transformation in response to different environments. In this thesis, fluidity is combined with hybridity to describe how the body is not merely flesh but also a becoming entity, positioned in and entangled with multiple influences.

Embodiment

Embodiment in this thesis refers to how the body moves, thinks, feels, and collaborates with virtual environments. It is treated as an ongoing and multidimensional process of physical and affective engagement between the participants and the VR artworks.

Immersion

In this thesis, immersion is understood as a process of participant building embodied and affective connections with the artworks. It is a complex, multidimensional, and reflective process facilitated not only by technological envelopment and mental absorption, but also by participants' individual meaning-making engagements with VR artworks.

Transparency

In media theory, transparency refers to the minimisation of the viewer’s awareness of the medium, facilitating the illusion of seamless and direct engagement with a virtual environment. The idea of transparency is often associated with realism and technological

invisibility, and connects to concepts such as totalisation, replacement, and presence in VR design.

Totalisation

Totalisation describes the attempt to create an all-encompassing VR experience that feels fully absorbing and "natural". This is typically achieved through realistic audiovisual design that mirrors physical-world experience and diminishes viewers' awareness of mediation.

Replacement

Replacement refers to the idea that virtual experiences can substitute or simulate real-world environments, interactions, or sensations. It is often tied to the goal of creating ultimate immersive realism in VR.

Sense of Presence

Sense of presence refers to the subjective feeling of "being there" within a virtual environment. Often cited as a key marker of VR immersion, it is closely related to ideas of totalisation and replacement in providing seamless illusion and technological realism.

Hypermediacy

Hypermediacy, as defined by Jay David Bolter and Richard Grusin (1999), describes media experiences that foreground their own mediation rather than concealing it. In VR, hypermediacy can involve layered content and non-linear navigation, encouraging viewers to reflect on their engagement in an individually meaningful way.

Chapter 1. Introduction

My thesis explores participant experiences in virtual reality artworks (VR art) through an embodied approach, underpinned by posthumanism as its theoretical framework. Posthumanism offers a non-dualistic perspective that views the physical and virtual realms as interconnected, recognising the agency of both participants and virtual environments in co-creating experiences. It also emphasises that participant VR art experiences are deeply influenced by their individual positionalities (i.e., socio-cultural and professional backgrounds). Through this framework, my thesis aims to provide an in-depth analysis of how participants interact with VR artworks, highlighting the specificity, complexity, interconnectivity, and co-constructive nature of their engagements.

To examine how participants engage with VR artworks in embodied ways, this thesis sets out three key objectives:

1. Design data collection and analysis methods to study participant embodiment in VR art through a posthumanist lens.
2. Describe the interconnections between participants' individual positionalities and how these co-construct their specific VR art experiences.
3. Contribute theoretical and empirical insights to inform alternative designs for participant interactions in future VR/ VR art projects.

To achieve these objectives, three research questions guide the exploration:

1. How do participants interact with VR artworks in embodied ways?
2. How do participant prior knowledge and personal experiences contribute to their interactions with VR artworks?
3. How is immersion experienced by participants in VR art?

To address these questions, three interactive VR artworks were selected as case studies: *False Mirror: Skyville* (Eslami, 2017), *False Mirror: Lena* (Eslami, 2017), and *In Between Nodes* (Kooshki & Qaderi, 2021). These artworks were chosen for their design features that facilitate embodied exploration, such as non-narrative structures, non-linear exploration, and the absence of pre-designed camera movements. By allowing less

restricted movement, sequencing, and timing, these artworks enable participants to pursue individual paths of exploration and interpretation, making them ideal for investigating the personal and contextual meanings participants derive from their engagements.

The methods employed in this thesis were developed to capture participant movements, thoughts, and feelings. Three qualitative methods were used: observation, semi-structured interviews, and autoethnography. These methods enable exploration of participants embodied knowledge and experiences and how these shape their interactions within virtual art worlds. Data analysis was conducted using thematic analysis, incorporating storyboarding to map how participant diverse reflections intertwine and mutually influence one another throughout their engagement with the VR artworks.

By integrating these qualitative methods with a posthumanist framework, my thesis contributes to a deeper understanding of embodied engagement in VR art. It also offers potential pathways for the future design and research of VR to enhance participant interaction and meaning-making.

1.1 Research positionality

To briefly outline the research path that led me to this topic, during my postgraduate studies, I developed a strong interest in exploring the notions of reality and virtual reality. My fascination began with Plato's "Allegory of the Cave" [1], which challenged my fundamental understanding of “reality” and prompted me to question the nature of knowledge and “perception”. This initial curiosity, coupled with a longstanding enthusiasm for science fiction, soon evolved into an exploration of traditional dualisms and futuristic imaginings. I became captivated by the disembodied fantasies and the envisioning of immortal life within VR.

This fascination marked the beginning of my research journey. However, as I explored the field of VR, I started to critique the binary frameworks—physical/virtual, material/immaterial—commonly employed to characterise VR experiences in many

[1] Plato's “Allegory of the Cave” is a philosophical metaphor that tells the story of prisoners who have been chained inside a dark cave their entire lives, facing the cave wall. The only way for them to know the world is through the shadows projected onto the wall. These shadows represent the prisoners' perceived reality.

(scientific) studies, including my own previous understanding. This critical engagement led me to the concept of embodiment, which has since become central to my vision of VR experiences. This evolving perspective shapes my theoretical approach to this research, emphasising a critique of dualistic frameworks commonly used to conceptualise and study VR experiences. Within the scope of my thesis, I aim to investigate participant experiences in VR art through a lens that acknowledges their situated, embodied, and relational nature, thereby bridging the perceived divide between the physical and the virtual.

1.2 Research gap and contribution

In media studies, VR art research spans diverse contexts, including VR museums (Tsita et al., 2023), VR in dance and performance art (Ojha, 2024; Moura et al., 2019a), intersection of VR with science and art (Moura & Kolen'ko, 2019b), and viewer engagements in cinematic VR (Tong et al., 2021). Topics in this domain include viewer motivation for engaging with VR art (Kim & Lee, 2021), attention and behaviour in VR art creation (Mu et al., 2024), spatial and social behaviours in VR experiences in museums and galleries (Parker & Saker, 2020), gamified VR art experiences (Chrysanthakopoulou et al., 2022), and appreciation of art in VR (Lin et al., 2020). This emergent body of literature has explored the impact of VR technology on viewer experiences, with particular attention on VR interaction techniques (Helgert et al., 2022; Ojha, 2024), sense of presence and immersive technology (Cummings & Bailenson, 2015), virtual body ownership and stereoscopic video (Landau et al., 2020), body movements and spatial capturing technologies (Cisneros et al., 2019), and locomotion methods (Langbehn et al., 2018).

While these studies provide valuable insights into the technological dimensions of VR experiences, they tend to overlook the complexity of viewer embodied interactions. Popat (2016), for example, highlights that, despite the attention given to the scientific approach to people's "perceptions of location and presence in virtual worlds…there has been surprisingly little investigation of the embodied experience of the participant" (p. 358). Similarly, Sora-Domenjó (2022) points to a limited understanding of how virtual bodies contribute to emotional and empathetic responses in VR experiences. While many VR simulations aim to generate empathy by placing viewers from a first-person perspective,

viewers are often positioned as "mere spectators of the scene without participating, having any agency, or being able to mitigate the pain of others" (Sora-Domenjó, 2022, p. 9). This observation highlights how limited interactivity and constrained agency within VR environments can affect the ways in which viewers engage emotionally with the content. According to Sora-Domenjó, such conditions reduce the availability of contextual cues that might support deeper emotional connection with the virtual scene (2022). He calls for further empirical research into how empathy is constituted in virtual interactions, emphasising the need to account for the complexity of emotional engagement, rather than focusing solely on presence within virtual environments or shifts in perspective through different virtual bodies (Sora-Domenjó, 2022).

With the emergence of new media landscapes and advancements in technology, the interplay between viewer embodiment in physical and virtual environments has become increasing complex (Jamaludin, 2015). Existing research, as argued by Popat and Sora-Domenjó, has yet to fully address how viewer physical bodies, emotions, and embodied knowledge integrate in shaping their engagements within VR spaces. These critiques echo concerns raised by pioneering VR artist Char Davies (in Bailey, 2012; Rafferty, 2017) and media scholars such as Moura (2021), both of whom highlight the issue of limited attention to participant bodily engagements in VR art creations. According to Davies and Moura, this lack of focus on the body's role in VR has limited the exploration of VR's full experiential potential.

This thesis responds to this gap by providing an in-depth study of viewer experiences in VR artworks. This thesis critically examines the historical tendency to overlook the body in VR. This oversight, I argue, stems from a dualist separation of mind and body and the pursuit of transcendence through VR technology—a perspective that has led to an underdeveloped understanding of embodied engagement in VR experiences.

In response, this thesis highlights the importance of embodied knowledge and positionality in shaping viewer interactions within virtual worlds. By adopting a participant-oriented, embodiment-centred approach, this thesis contributes to the broader research community in media studies by emphasising the relational, processual, and mutually constructive nature of bodily and affective engagements in VR art.

Furthermore, this research informs future VR art design, assisting creators in exploring VR's potential to foster personalised, meaningful, and immersive experiences. By recognising viewer agency, emotional engagement, and individual positionalities, this study encourages the development of VR artworks that promote deeper and more individualised explorations within virtual spaces.

1.3 Thesis overview

This thesis is organised into nine chapters. Following this introductory chapter (Chapter 1), Chapter 2 introduces the theoretical framework of posthumanism, which underpins the thesis's philosophical, epistemological, and methodological approaches. It explores the concept of posthumanism and its reconsideration of the body, laying the foundation for how embodiment is conceptualised throughout this thesis.

Chapter 3 reviews relevant literature on participant embodied experiences in VR. It consists of three sections. The first section discusses embodiment and how it is applied in this thesis to study participant interactions with virtual worlds. The second section examines early interpretations of VR from the 1990s, shaped by Cartesian dualism, and analyses how some early VR artworks either reflected or challenged this paradigm. The third section unpacks immersion from two perspectives: the transparent approach, which seeks realistic and interfaceless interactions, and the hypermediated approach, which emphasises participant agency. This chapter argues for unpacking VR immersion through hypermediacy, emphasising embodied engagement as central to meaningful interactions with VR art.

Chapter 4 outlines the thesis's methodological approach, detailing the research design, data collection, and analysis methods. It provides an overview of the three VR artworks selected for the study, the criteria for their selection, and the rationale behind their inclusion. The chapter explains how observations and semi-structured interviews were used to examine participant movements, gestures, associations, emotions, and interpretations within VR art experiences. It also sets out the rationale for using autoethnography to document the researcher's evolving VR art experiences. Finally, the chapter explains the thematic analysis process using storyboarding to create a visual, holistic representation of the participants' movements, thoughts, and feelings.

The empirical examination of participant embodied experiences unfolds across Chapters 5 to 7. Chapter 5 investigates the interconnections and mutual influences between participant movements, emotions, imagination, and interpretation, exploring how their experiences evolve dynamically. Using a non-binary framework, it examines co-creation as a collaboration between participants' physical bodies and the virtual environment, emphasising the role of human and nonhuman agency in shaping experiences.

Chapter 6 focuses on the role of participant personal positionalities and prior knowledge in shaping their artwork experiences. Through participant data analysis, this chapter investigates how embodied habits and perspectives influence the formation of their interpretations and interactions with VR artworks.

Chapter 7 demonstrates the complex, multidimensional nature of immersion as experienced by participants. It illustrates how immersion emerges through building embodied and affective connections with the artwork, facilitated by individualised meaning-making. This chapter also underscores the importance of reengagement and its relationship with autonomous exploration in enhancing immersive experiences.

Chapter 8 provides a discussion of the thesis key findings. It emphasises the cooperative dynamics and autonomous exploration revealed in the empirical data. The discussion elaborates on three levels of relationships that co-construct cooperative dynamics in participant VR art experiences, shedding light on their exploratory and reflective nature. It identifies three interrelated aspects of autonomous exploration, demonstrating how they foster contextually relevant and meaningful engagement. The chapter also discusses how the exploration of cooperative dynamics and autonomous exploration contributes to forming a non-reductive approach to studying VR experiences, advocating for considerations of the complexity of VR art experience. Finally, the chapter addresses the limitations of the thesis and discusses its implications for future VR art design.

Chapter 9 concludes the thesis by summarising its key contributions to media studies and offering insights for future research, particularly in studying participant interactions and embodied engagement in interactive virtual environments.

Chapter 2. Theoretical framework

Overview

In this chapter, I discuss the theoretical framework of posthumanism, which forms the foundation for exploring participant experiences in VR art as examined in my thesis. Posthumanism is a philosophy that redefines what it means to be human, providing an onto-epistemology and methodological approach that offers an alternative understanding of the relationship between humans and the more-than-human world (Ferrando, 2013). By rejecting dualistic understandings such as mind/body, subject/object, and human/nonhuman, posthumanism emphasises the interconnectedness, mutual dependence, and variety of influences within these relationships. In a posthumanist framework, bodies, whether human or nonhuman, are considered co-constituted through their interactions with the surrounding entities. This chapter outlines the concepts of posthumanism within the context of media studies, laying the theoretical groundwork necessary to understand its relevance to the study of participant experiences with VR art.

2.1 What is posthumanism?

According to Ferrando (2013), posthumanism can be interpreted as both "post-humanism" and "posthuman-ism". In the first interpretation, Ferrando refers to "post-humanism" as an alternative approach to the traditional humanist and anthropocentric understanding and positioning of the human body. In the traditional humanist view, the concept of the human is often framed in terms of singularity, exclusiveness, and independence (Braidotti, 2013), thereby elevating human beings above all other entities. To elaborate briefly: *Singularity* in humanism is the notion that a specific type of human (typically a white, male, able-bodied European) is taken as the standard representing all others, thus reducing the diversity of human identities to a singular model. *Exclusiveness* implies the existence of a boundary between certain humans and the rest of the world (e.g., other cultures, genders or objects), which correlates to a hierarchical view that positions a narrow category of humans over other beings and entities, reinforcing ideas of superiority and separation. *Independence* from nature and animal origins fortifies this separation further by portraying the human body as isolated from the more-than-human

worlds (Wolfe, 2010). By centring on particular groups of people, the humanist stance constructs a problematic notion of humans and their relationship with the world. This set the stage for later critiques of postmodernist thought, such as Foucault's radical deconstruction of the human subject through his concept of the "Death of Man".[2]

Emerging as "a second generation of postmodernism" (Ferrando, 2013, p. 14), posthumanism revisits and rethinks the postmodernist critique of traditional humanism. Unlike Foucault's radical deconstruction, posthumanism does not necessarily dismiss the uniqueness of human beings. Instead, it reinterprets this uniqueness as *particularity* rather than exclusiveness. While the notion of exclusiveness is used to describe the superior, exceptional position of human beings in a humanist context, particularity is more commonly accepted in posthumanist discussions, which refer to humans as unique entities without implying that they are above all other forms of life.

This leads to the second interpretation Ferrando provides, in which the term "posthuman-ism" represents an alternative conceptualisation of "human" that has traditionally been the focus of humanist thought. In this sense, posthumanism does not deny the existence, agency, or value of the human; rather, it proposes a "qualitative shift in our thinking about what exactly is the basic unit of common reference for our species, our polity, and our relationship to the other inhabitants of this planet" (Braidotti, 2013, p. 2). Taken together, the two explanations of posthumanism provided by Ferrando reveal the fundamental objective of posthumanism: rethinking the concept of the human and the relationships between humans and the more-than-human world. The focus on more-than-human in this context suggests an inclusive perspective, highlighting the interconnectedness and interdependence of all forms of existence. This perspective encourages reimagining humans within a complex network encompassing multiple human/nonhuman influences, including animals, plants, ecosystems, technologies, etc.

The posthumanist perspective on the relationship and interactions between humans and nonhumans provides a framework for embracing the complexity, specificity, interconnectivity, and co-constructive nature of participant experiences with VR art. This

[2] The "Death of Man" is an anti-humanism statement proposed by Michel Foucault, which critiques and ultimately denies the notion of the "human" in the context of humanism, as well as the value of humans, such as freedom and agency (Han-Pile, 2010).

approach has guided my analysis of how individuals cooperate and co-produce experiences with virtual bodies, environments, and VR technologies.

In the following section, I unpack the concept of "human" as conceived within humanism and posthumanism. This examination is crucial because it underpins how the body and its interactions with the world are understood within these different theoretical frameworks. By exploring these differing notions of the human, I discuss key ideas surrounding the concept of the body and its relationship to other human and nonhuman entities. These considerations provide the foundation for understanding embodiment within virtual environments as explored in my thesis.

2.2 The notion of human and body

To discuss the notions of the human and the body in posthumanism, it is essential to first understand the foundational ideologies of humanism, as they provide the backdrop against which posthumanist ideas emerged. Humanism originated during the 13th century Italian Renaissance, a period characterised by a renewed emphasis on human experience that represented a marked shift away from the earlier dominance of religious authority. Drawing inspiration from classical Greek and Roman traditions, humanism centred on human-centric ideas, emphasising the freedom, value, and agency of (certain) humans (Braidotti, 2013). While humanism sought to foreground human life and experience, its ideology introduced a problematic and exclusionary notion of what it means to be human.

The notion of the human in the humanist context is associated with a particular human population with distinct characteristics—those who are "implicitly assumed to be masculine, white, urbanised, speaking a standard language, heterosexually inscribed in a reproductive unit, and a full citizen of a recognised polity" (Braidotti, 2013, p. 65). This narrow definition normalises diverse human experiences into a singular image, positioning certain types of men as representatives of all human civilisation. As Braidotti asserts, "Humanity is very much a male of the species: it is a he" (2013, p. 24). This standardised view creates a dichotomy that places the European male at the centre of the universe while marginalising those who diverge from this standard model, including women, members of the LGBTQIA+ community, non-Western cultures, indigenous peoples, and nonhuman entities. Within this division between "humans" and "others", the distinctions carry connotations of superiority and inferiority. Those who conform to

the normative standards set out by humanism are regarded as superior, while individuals and entities that deviate from these standards are considered “less than human” (Braidotti, 2013, p. 24).

The division between humans and others influences how the body is conceptualised within humanist thought. By recognising humans as separate from nature and nonhuman entities, this perspective implies a sense of disconnection between human/nonhuman and nature/culture. These disconnections create a binary divide between humans and the more-than-human world by positioning the human as a self-contained entity, unaffected by its surrounding influences. This perspective frames the body as closed and independent, isolated from the impact of the larger ecological or socio-cultural systems in which it is situated. Thus, the primary goal of posthumanism is to introduce alternative perspectives that challenge this problematic definition of human (Wolfe, 2010). By questioning the human-centric perspective, posthumanism provides a framework for rethinking our relationship with the nonhuman and with technology, which, in my thesis, is particularly relevant to understanding the relationships between participants and nonhuman entities in virtual environments.

Posthumanism offers an alternative perspective on both what it means to be human and how we exist in relation to the more-than-human world (Wolfe, 2010). It challenges the traditional notion of the human in humanism, which is rooted in Eurocentric and male-dominant ideologies. Posthumanism seeks to dismantle this hierarchical view of humanity, advocating for equality and inclusivity among all beings (Braidotti, 2013). In supporting equality, posthumanism does not aim to erase the biological distinctions between different humans or between humans and nonhumans. For instance, it does not claim that all beings are equally intelligent or physically strong, nor does it seek to replace the humanist conception with another universal definition (a misinterpretation of the theory would be to neutralise cultural and species differences). Instead, posthumanism’s emphasis on plurality serves as a reminder that there are many types of humans who exist in this world, each unique and valuable in their own way. In this sense, posthumanism rejects hierarchical value judgments based on these differences, refusing notions of superiority or inferiority among species. This perspective urges us to consider

the notion of “human” as an inclusive, non-Eurocentric, and non-male-centric term that embraces and celebrates differences.

Extending the posthumanist theoretical approach to the relationship between humans and the more-than-human world, the body is understood as being entangled with the material world and dependent on nonhuman entities (Wolfe, 2010). This perspective recognises the body as interconnected and co-constituted by the broader ecosystem and technologies with which it interacts. Within this framework, the interactions between humans, nature, and technology are viewed as dynamic processes where meanings, identities, and existences emerge and evolve through relational engagement. By emphasising the co-constitutive nature of the body, the posthumanist perspective underscores its openness to change. This openness signifies that the body is not a fixed entity but rather an adaptive being, constantly shaped and reshaped by its interactions with the broader environment.

In the context of this thesis, this perspective highlights the mutual influence and co-constructive relationship between participant bodies and virtual environments. When participants interact with the virtual worlds, their physical and virtual bodies, alongside human and nonhuman elements, collectively shape how the VR artwork is experienced. In other words, a posthumanist approach allows me to recognise participants’ physical bodies and virtual elements as interconnected, dependent, and cooperative. The posthumanist notion of the body is essential for exploring how participants co-create their experiences with VR artworks. In Section 2.4, I further elaborate on the key ideas regarding the concept of the body in posthumanism. However, to address how and why the body is open to changes, it is first necessary to shift our understanding of matter and materiality, moving away from traditional perspectives to embrace alternative views offered by new materialism.

2.3 Posthumanism and new materialism

New materialism is a movement within the broader theoretical framework of posthumanism, offering an alternative perspective on the concept of matter (Ferrando, 2013). To understand new materialism, it is essential to first acknowledge how matter, as tangible objects, has traditionally been conceptualised, particularly within a dualistic

framework. This context is crucial for situating my later discussions on the materialities of mind/body and physical/virtual in early studies of VR experiences, which I explore in the literature review.

Before and during the 16th century, matter was typically associated with the physical, the corporeal, the flesh, and the concrete, as opposed to the spiritual, the transcendent, and the incorporeal (Gamble et al., 2019). A classic representation of this dichotomy is the mind/body dualism, also known as the Cartesian split, proposed by French philosopher René Descartes (1641). Mind/body dualism is a philosophical perspective that sees the mind and body as fundamentally separate substances. In Descartes' view, the mind is an immaterial entity that exists independently of the material body and holds greater significance. Moreover, he regarded the mind as proof of one's existence, arguing that while we could doubt the existence of everything else, we cannot doubt the fact that we are thinking beings (Descartes, 1641). For Descartes, the act of thinking serves as evidence of human existence, encapsulated in his renowned statement, "I think, therefore I am" (Descartes, 1641).

Descartes' conception of the mind exists in a realm akin to Platonic forms[3]—divorced from the material world—and imparts ultimate purpose and significance to human existence. This notion of a powerful mind, capable of executing tasks and experiencing the world independently of the body, has persisted and can be seen in later thought experiments like "The Experience Machine" (Nozick, 1974) and "Brain in a Vat" (Putnam, 1981). Both scenarios operate on the premise that the brain can be plugged into a virtual world and gain sensory experiences just as "authentic" as those in the physical world.

This understanding establishes, among other things, an active/passive dichotomy, where matter is seen as something to be passively manipulated or produced (Gamble et al., 2019), a mere shell for the mind. I argue that this creates a problematic interpretation of the relationship between mind and body and between the physical and virtual, especially in the context of VR experiences. Since the early developments in VR technology, it has often been envisioned as potentially providing a disembodied experience (Penny, 1992),

[3] The Platonic form is a concept from the Greek philosopher Plato that refers to the abstract, ideal, and immortal entities that exist independently of the physical world. They represent the essence or true reality of things, serving as perfect models for the objects we encounter in our physical experience.

where the mind “travels” from the physical to the virtual world. Consequently, VR experiences have often been portrayed as “out-of-body experiences” (Rheingold, 1991). This binary division between physical and virtual body experiences is problematic because it marginalises the physical body's role in shaping VR interactions. By prioritising the disembodied mind, this perspective neglects the involvement of the physical body in VR interactions, which hinders our understanding of the embodied connections between the viewer's physical body and the VR environment. Furthermore, this dualistic view limits the potential for designing VR experiences that fully engage the body as a crucial component in creating immersive and meaningful interactions. (A detailed discussion on how mind/body dualism has influenced early developments in VR technology and interpretations of VR experiences is provided in Chapter 3, Section 3.2.)

New materialism challenges the dichotomous view of material/immaterial, mind/body, and physical/virtual, initiating a "materialist turn" that critiques the neglect and devaluation of matter in traditional Western philosophy (Gamble et al., 2019). A key figure in this movement is Karen Barad (2007), who has advocated for a performative approach to understanding matter. Drawing on insights from theorists such as Judith Butler and Donna Haraway, Barad (2003) defines performativity as an ongoing process through which matter and meaning are co-constituted. By viewing matter as performed, Barad (2003) emphasises that material entities are not fixed or possess inherent, pre-existing properties. Instead, they take shape through a continuous process of materialisation—relational and inseparable from their interactions.

For Barad, matter is processual and unquantifiable, constantly emerging through its relationships. This idea is articulated through her concept of intra-action. According to Barad (2007), intra-action differs from a traditional understanding of interaction, which assumes that entities in interactions pre-exist their encounter. In a traditional interaction framework, the viewer and the VR system might be seen as separate and distinct, with the viewer’s agency dominating the interaction. However, using Barad's concept of intra-action, the boundaries between the physical body and technological interface become blurred. Intra-action suggests that entities emerge and take shape through their mutual relationships (Barad, 2007). This approach recognises the agential power of both humans and nonhumans in intra-actions. The viewers are not the sole “actors” in the process, nor

the virtual bodies and objects passively controlled by human agency. In this sense, Barad's approach dismantles the active versus passive dichotomy commonly found in traditional views of the relationship between physical and virtual.

Stacy Alaimo (2010) takes the new materialist perspective further through her concept of "trans-corporeality", which explores the process of material connections between humans and the more-than-human worlds. Trans-corporeality refers to the material movements across human and nonhuman bodies, emphasising the "interchanges and interconnections between various bodily natures" (Alaimo, 2010, p. 2). Through this lens, Alaimo highlights how the body is not a closed entity but one that is constantly engaged in material transformations within its environment. To explain this point, Alaimo uses the example of the exchange of toxins between human and nonhuman bodies. By tracing the journey of toxic chemicals from manufactured products to human bodies, then through human waste into the environment, and back into human bodies via natural substances, Alaimo vividly demonstrates how materials travel between human and nonhuman entities. This movement of toxins underscores the material connections between the human and the more-than-human world, demonstrating how both entities are never isolated nor closed. Alaimo's example reinforces the new materialist and posthumanist perspective of viewing bodies as part of a collective network of interactions and influences in a material sense, in which our bodies are constantly shaped and transformed by countless interactions with the surrounding world.

Alaimo's concept of trans-corporeality contributes to my later discussion of the hybridity and fluidity of the body. By framing the body as mutually constructed and continuously transformed through its interactions with surrounding environments—including virtual environments—trans-corporeality challenges the notion of the body as a static, flesh-bound entity. This new materialist reconceptualisation of matter challenges conventional dichotomies such as physical/virtual and material/immaterial, proposing a more fluid and interconnected framework. This perspective underpins the cooperative dynamics explored in this thesis, where participants and VR artworks co-shape participant experiences. In analysing participants' interactions with virtual artworks, binary distinctions like mind/body, physical/virtual, or material/immaterial are insufficient. Rather, the body is approached as a complex, dynamic process, involving

the ways we move, think, and feel during immersive engagements. In the following section, I further examine how the body is theorised within posthumanist discussions, emphasising the flexibility of the body's boundaries and the mutual influences between physical bodies and their surrounding environments.

2.4 The hybridity and fluidity of the body

The posthumanist approach conceptualises the body as both fluid and hybrid. To briefly define these terms, the fluidity of the body refers to its flexible and changing boundaries, which shift and reshape depending on the context. Hybridity, on the other hand, highlights how the body is composed of a mix of components, blending human and nonhuman aspects, such as cultures, technologies, environments, and other influences. Together, these concepts are used to conceive of the body not merely as a physical entity but as one entwined with a range of influences.

To illustrate this, I draw on Haraway's (1985) figuration of the cyborg. For Haraway, the cyborg is an entity that exists beyond the boundaries of humans, animals, and machines. As she writes, "The cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction" (Haraway, 1985, p. 65). Haraway's notion of hybridity extends beyond a simple technical combination of human and machine, like the cyborg assassins in the film *The Terminator* (1984). Rather, it points to the co-constitutive nature of different bodies. This sense of co-constitution operates through the interplay of traditionally separate categories, such as human and machine or nature and culture (Haraway, 1985). For Haraway, the cyborg is a reflection of the socio-cultural, technological, and political forces that define what we are and shape how we become (1985). According to Haraway, there is no such thing as an "original" or "authentic" body, as the body is not something we naturally or inherently possess from birth; rather, it is something that changes, evolves, and becomes through its interactions with surrounding people, objects, and environments. In this sense, Haraway argues that we already inhabit a state of being cyborgs since we are already hybrid creatures (Haraway & Wolfe, 2016). This hybridity stems from the continuous interactions between humans and a variety of different entities. The integration of technological and socio-

cultural influences into daily life, such as wearing glasses and using smartphones, demonstrate how the boundary between the body and its surroundings becomes blurry.

Challenging the notion of a fixed body with stabilised boundaries, Haraway asks, “Why should our bodies end at the skin, or include, at best, other beings encapsulated by skin?” (Haraway & Wolfe, 2016, p. 61). Within the context of my thesis, this question invites a rethinking of participants’ bodies as entities in constant flux, influenced by multiple dimensions. For example, socio-cultural knowledge may shape participants’ understanding of certain virtual elements, while the biological characteristics of their physical bodies may affect how they move and interact with their virtual counterparts.

In the context of participant experiences with VR art that forms the focal point of this thesis, posthumanism provides a valuable framework for three key reasons. First, by erasing dualisms such as those between mind and body or physical and virtual worlds, this framework allows me to examine participants’ movements, thoughts, and feelings in relation to VR art in a holistic and interconnected manner. This theoretical approach fosters an in-depth interpretation of participant data, capturing the complexity of how individuals engage with artworks. Second, posthumanism foregrounds the agency of nonhuman entities such as virtual bodies, objects, and spaces by highlighting their role in influencing participants and co-constructing experiences. This perspective brings nonhuman agents to the forefront, underscoring the collaborative nature of VR art experiences. Third, posthumanism's recognition of knowledge and experiences as situated within individual positionalities draws attention to the importance of participants’ prior knowledge, personal experiences, backgrounds, preferences, and contexts in shaping their interactions with VR art. This ensures that my analysis of participant experiences remains grounded in the specificities of their personal and contextual engagements.

Summary

In this chapter, I have introduced posthumanism as a theoretical framework to explore the body and its relationship with virtual worlds. By tracing the historical relationship between humanism and posthumanism, I have examined their differing philosophical perspectives on understanding the body. This discussion has highlighted several key

posthumanist ideas, including fluidity and hybridity, which offer a non-binary framework for interpreting participants' bodily experiences in VR art. The posthumanist conception of the body challenges traditional notions of authenticity and originality, instead presenting the body as a hybrid entity shaped by a continuous flux of influences. This perspective emphasises the body's uniqueness in its specificity rather than its exclusivity. Furthermore, posthumanism underscores the mutual constructive relationship between the physical body and the objects or people it interacts with. This theoretical grounding establishes the basis for understanding participants' VR art experiences as dynamic and evolving processes. It frames these experiences as emergent from embodied interactions within virtual environments, offering a foundation for later discussions of embodiment and interaction in my thesis.

Chapter 3. Literature review

Overview

In this chapter, I provide an overview of the concepts and studies that contribute to the context of this thesis. The chapter is divided into three main sections. The first section explores the concept of embodiment and its relevance in understanding participant experiences with VR art. Embodiment offers a framework for analysing how participants' interactions with virtual environments shape their artistic experiences. The discussion draws on N. Katherine Hayles' (1999) and Nathaniel Stern's (2013) theories of embodiment, emphasising how bodies move, think, feel, and cooperate with their surrounding environments. In the second section, I elaborate on the role of bodies in VR and VR art, examining how prior discourses have framed the interaction between physical and virtual bodies in early and contemporary VR artworks. Using examples from the existing literature in this vein, this section demonstrates how various VR art creations either address or neglect the embodied connections between physical and virtual experiences. The third section reviews past concepts of immersion, focusing on how these notions have influenced the understanding and creation of VR art experiences. Key concepts such as a sense of presence are discussed alongside the traditional goal of achieving a seamless and realistic immersion. This section also proposes a rethinking of immersion, arguing for a shift away from viewing immersion as a property of VR technology and instead emphasising an understanding of immersion as a process of embodied and affective engagement with VR artworks.

3.1 The concept of embodiment

While cybernetic posthumanists[4] may focus on the body's role as a transmitter of information, Hayles' concept of embodiment places importance on how the bodies are situated in their specific physical, cultural, and historical contexts. For Hayles (1999),

[4] The first and second waves of cybernetics challenged prior dualistic distinctions between humans and machines by highlighting their similarities in information processing and feedback mechanisms. However, such similarities, as articulated by Hayles (1999), were established on a dualistic and transcendental understanding of the body as material, whereas information is immaterial.

embodiment is fundamentally about bodies in interaction—influencing and being influenced by their surroundings. She conceptualises embodiment as a body in action, a network of diverse influences that collectively compose, define, and alter the body (Hayles, 1999). Understanding embodiment as a network requires acknowledging the contextual connections that ground it. As Hayles states, “Embodiment is contextual, enmeshed within particular place, time, physiology, and culture, which together compose enactment” (Hayles, 1999, p. 196). This perspective underscores the nature of specificity and instability of embodiment in Hayles’ conceptualisation, suggesting that individual experiences unfold as unique trajectories in ongoing engagements.

Hayles’ notion of embodiment, particularly its emphasis on specificity and instability, aligns closely with Haraway’s (1988) concept of situated knowledge, which offers a critical perspective on how meanings and perspectives are produced. Haraway (1988) challenges the scientific assertion of objectivity, which often presents partial perspectives as complete and unbiased representations of reality. She asserts that no one can see the world from an all-encompassing, universal vantage point that accounts for all positionalities (Haraway, 1988). Instead, Haraway (1988) contends that knowledge production and meaning-making are local and partial, shaped by the interplay of personal, gendered, political, and socio-cultural influences. This means that our ways of seeing, understanding, and producing meanings are always mediated by specific contexts and individual positionalities.

For Haraway, knowledge and experience are deeply rooted in the embodied realities of individuals. Her critique of "universal experience" resonates with Hayles’ (1999) perspective on embodiment. Hayles argues that embodiment is not a fixed or replicable state, but a dynamic process situated in the ongoing, context-specific interactions between individuals and their environments. It cannot be divorced from the particularities of time, place, and circumstance. As she writes:

> Embodiment never coincides exactly with “the body”, however that normalised concept is understood. Whereas the body is an idealised form that gestures toward a Platonic reality, embodiment is the specific instantiation generated from the noise of difference. Relative to the body, embodiment is other and elsewhere, at once

> excessive and deficient in its infinite variations, particularities, and abnormalities. (1999, pp. 196–197)

By intertwining the ideas of body specificity and diversity, Hayles' notion of embodiment rejects a singular, universal framework for understanding the body's interaction, and calls for an approach to acknowledge the situated and relational nature of bodily experiences.

Applied to the context of VR, these insights suggest the necessity of considering each participant's positionality—their unique histories, perspectives, and interactions—in understanding their VR experiences. Recognising embodiment as a relational and situated process, in my thesis particular attention to participants' individual backgrounds, prior knowledge, and personal experiences is essential for understanding the emergence of their specific movements, thoughts, and feelings in relation to VR artworks in a broader and more complex context. For instance, the data shows that while some participants may have exhibited similar movements when interacting with virtual environments, the underlying motivations driving these actions could vary significantly from one person to another. Furthermore, even when participants engaged with the same work of art, their understandings of it diverged markedly due to their unique perspectives, interpretations, and associations with the elements they encountered. These associations were closely tied to individual participants' cultural backgrounds, professional histories, gender identities, and other personal factors. These observations reflect Hayles and Haraway's elaboration of embodied and situated experiences, revealing the significant role that unique characteristics of individual bodies play in shaping their experiences with VR artworks.

3.1.1 Studying embodiment: the moving-thinking-feeling bodies

While Hayles's argument significantly contributes to this thesis by emphasising the contextually grounded and embodied nature of experiences, it has also faced critique for its treatment of the relationship between the body and embodiment. Specifically, Stern (2013) critiques Hayles's conceptualisation of creating a "dual" division between the body and embodiment, potentially undermining the integrated relationship these terms

should represent (p. 38). In the context of my thesis, this binary framing of the body and embodiment could present a methodological challenge in studying participant bodily experiences in VR artworks, particularly given my adoption of a non-binary framework for investigating VR experiences. The rigid distinction between the body as culturally constructed abstraction and embodiment as individual lived experiences (Hayles, 1999), can potentially steer this research into a binary approach, deviating from its purpose of exploring the interdependent and relational aspects of embodiment in VR experiences.

To address this challenge, I incorporate Stern's refinement of the concept of embodiment to develop a more holistic and interdependent perspective. This integrated approach aligns more closely with the non-binary framework adopted in this thesis, which seeks to capture the complexity of participant experiences in VR artworks. To unpack Stern's critique and conceptual framework of embodiment further, we should first return to Hayles.

Hayles (1999) uses the term "body" to describe both the physical human form and the humanist ideological construct of the singular body. Hayles (1999) argues that the body, as constructed within humanist ideology, represents an abstraction tied to a specific group: white, able-bodied, European men. In contrast, embodiment is rooted in specific, individual experiences and resists being reduced to such abstractions. To clarify the relationship between the body and embodiment, Hayles introduces the concepts of "inscription" and "incorporation" as metaphors. For Hayles, inscription refers to information conveyed independently of its specific medium, such as converting text from a paper document into a digital format. Incorporation, on the other hand, describes a process where information becomes inseparable from its medium, like the meaning conveyed by a goodbye wave. Hayles characterises inscription as a "conceptual abstraction", as it can be detached from its material medium (1999, p. 198). Conversely, incorporation is described as "instantiated materiality", as it cannot be detached from its medium (Hayles, 1999, p. 198).

Hayles draws a parallel between these contrasting positions of inscription and incorporation and the concepts of the body and embodiment. She likens the body to an inscription, which represents an abstraction, while embodiment corresponds to

incorporation, where the body and its interactions with the world become intertwined, much like how information becomes inseparable from its medium. As Hayles writes:

> When the focus is on the body, the particularities of embodiment tend to fade from view… Conversely, when the focus shifts to embodiment, a specific material experience emerges out of the abstraction of the body, just as the particularities of an incorporating practice emerge out of the abstraction of inscription. (1999, p. 199)

In response to Hayles' distinction between the body and embodiment, Stern (2013) proposes an alternative perspective that emphasises their inseparability. Stern argues that the body and embodiment are inseparable and should not be treated as distinct entities. In his view, the body is continuously shaped through its ongoing embodied interactions with the worlds, and thus should not be positioned as separated or opposite to embodiment (Stern, 2013). Stern's argument corresponds to Braidotti (2013)'s view, stating that the universal body depicted in humanist thought, frequently exemplified by the figure of the European male, also emerged from the specific embodied experiences of a group of people within particular historical and cultural contexts. This view underscores the interconnectedness of the body's abstraction and its lived experiences, further challenging dichotomous framings.

It is worth noting that Hayles (2002) revisits the distinction she originally made between the body and embodiment in a later paper. Despite her initial efforts to view the two concepts as dynamically interacting entities, Hayles (2002) acknowledges that her earlier framing inadvertently perpetuated a Cartesian split by defining the body and embodiment in binary terms. In revising her approach, Hayles (2002) proposes that both the body and embodiment emerge from the dynamic interactive processes between one's mind, body, and environment.

Stern's argument disrupts the dichotomy in Hayles's discussions that positions the body as an abstraction and embodiment as a grounded material experience. Instead, he suggests that the existences of body and embodiment are intertwined. Building on the work of Hayles and other posthumanist scholars, Stern (2013) presents embodiment as a unified process of physical and affective engagement. He defines embodiment as the

body “moving-thinking-feeling” in response to its surroundings (Stern, 2013). By using this tripartite term, Stern refers to a multisensory process in which movements, thoughts, and feelings emerge and evolve together during bodily engagements. Central to Stern's conception of embodiment is an emphasis on relationality and continuity. For Stern, the relationship between the body’s movements, thoughts, and feelings is not linear or causal—where one leads to another—but rather intertwined, forming a network of mutual influence. As Stern explains, “Each of the activities of moving and thinking and feeling is moved and felt and thought, before and after and during the others” (2013, p. 42).

Stern’s perspective offers a useful framework for structuring the methodological approach outlined in my thesis, particularly in the data collection and analysis process. By combining observations of participant interactions with the artwork and conducting semi-structured interviews about their experiences, special attention was given to understanding how participants’ movements correlate with their emotions and personal associations in specific contexts. This approach enabled an investigation into the interconnectedness of various elements within participant experiences, such as how their bodily movements are influenced by associations, how their emotions shape interactions with virtual spaces, and how personal perspectives affect interpretations of VR art. During the analysis process, I used storyboarding as a tool to combine these fragmented experiences visually, making it easier to trace the connections and mutual influences within each participant’s journey. I unpack this methodology in greater detail in Chapter 4.

In these sections, I have explored the concept of embodiment through the works of Hayles and Stern, integrating their perspectives to develop a framework for understanding participant embodied experiences in VR art. Hayles’s discussion of embodiment as situated, specific, and relational informs my analysis of how participant engagements in VR art are deeply personal and contextual. Meanwhile, Stern’s notion of embodiment is useful in framing participant embodied experiences as a continuous and mutually influential process of moving, thinking, and feeling. By integrating Hayles’s and Stern’s perspectives, a bridge is built between the theoretical and empirical investigations of embodiment, offering tools to examine how participant experiences in

VR artworks should be studied in this thesis. Together, their insights enable a methodological and analytical framework that is sensitive to the complexity, diversity, and processuality in unpacking embodied experiences.

In the following section, I turn to the early conceptualisations of VR, providing a historical context that illuminates some foundational ideas underpinning VR. This exploration investigates how early visions of VR anticipated participants' experiences with virtual environments. This historical context is important to understanding the ongoing dialogue between the technological affordances of VR and the embodied potentials that my thesis seeks to explore.

3.2 An overview of early VR studies

This section provides an overview of the early literature on virtual reality to demonstrate how VR has been viewed as a technological manifestation of mind/body dualism. While this thesis refrains from endorsing dualistic interpretations of VR, it is necessary to introduce these discussions due to their profound influence on the general understanding of VR, particularly among participants and VR developers.

Between the 1920s and 1960s, computer scientists and engineers developed various electronic devices to create immersive simulations. Notable examples include Morton Heilig's *Sensorama* (1950) and Ivan Sutherland and Bob Sproull's *The Sword of Damocles* (1968). While most early prototypes of VR headsets were connected to remote cameras, *The Sword of Damocles* is widely considered the first Head-Mounted Display (HMD) capable of presenting computer-generated 3D environments, combining elements of both VR and AR (Egliston, 2023). In his papers, Sutherland (1965, 1968) articulates his vision of an HMD VR system as the ultimate immersive environment created through all-encompassing display equipment. As he states, "It is a looking glass into a mathematical wonderland. A display connected to a digital computer gives us a chance to gain familiarity with concepts not realisable in the physical world" (Sutherland, 1965, p. 1). The creation of *The Sword of Damocles* marked a significant milestone in the development of VR, paving the way for subsequent HMD VR products. In 1987, Jaron

Lanier coined the term “virtual reality” to characterise this field, and VR headsets transitioned into commercial products (Berkman, 2024).

While the technological innovation of Sutherland’s headset was certainly ahead of its time, Biocca & Levy (2013) argue that the underlying concept of an ultimate virtual reality reflects a longstanding desire to free the mind from the constraints of the physical body. This perspective, described by Harley (2024) as emblematic of a “Western gaze”, conveys a sense of detachment from embodied experience. Simon Penny supports this perspective, stating that VR technology “is a clear continuation of the rationalist dream of a disembodied mind, part of the long Western tradition of denial of the body” (1992, part one). He further notes that “one does not take one’s body into VR, one leaves it at the door. VR reinforces Cartesian duality, replacing the body with a body image, a creation of the mind, as all objects in VR are a product of the mind” (1992, part two).

Penny’s critique underscores how early studies of VR perpetuated the dualistic divisions between the mind and body and the physical and virtual. For example, Howard Rheingold (1991) depicted VR as an "out-of-body experience”, one that fundamentally alters the human experience (p. 256). Similarly, Hans Moravec (1997) envisioned a speculative VR future, inviting us to imagine a VR version of the “brain in a vat”, “sustained by life-support machinery, connected by wonderful electronic links to a series of artificial rent-a-bodies in remote locations, and to simulated bodies in virtual realities” (p. 5). Moravec’s vision, like Rheingold’s, reinforces VR as a space where the mind escapes the constraints of physical limitations. Anna Munster (2006) expands on this critique, noting that during the late 1980s and 1990s, “the virtual, more than any other quality or dimension associated with digital technologies, has promised to leave the body and its ‘meat’ behind, as minds, data, and wires join together in an ecstatic fusion across the infinite matrix of cyberspace” (p. 86).

These works reveal how early interpretations of VR experiences, shaped by the mind/body and physical/virtual dichotomies, have profoundly influenced both the design of VR and VR art, as well as the expectations of users. As discussed later in Sections 6.5 and 6.6, some participants referenced popular media, such as *The Matrix* (1999) and *Sword Art Online* (2012), when envisioning their ideal VR experiences. These narratives

often depict VR as a space where the mind transitions seamlessly into virtual bodies without boundaries or constraints. Such participant reflections highlight how cultural representations of VR in media continue to perpetuate the trope of disembodiment, which, in turn, influences how participants understand and expect their VR experiences to unfold. In the context of my thesis, this posed challenges in the analysis of participant data, particularly when participants expressed contradictory reflections that oscillated between embodied experiences and disembodied views or language.

3.2.1 Artists' explorations of VR

Described as "an entirely new and unexplored universe for creation" (Pimental & Teixeira, 1993, p. 230), the emergence of virtual reality in the 1990s provided artists with a novel medium for exploration and expression. However, despite its innovative potential, VR remained relatively niche and inaccessible for decades, primarily due to its high costs and reliance on advanced computing technologies. These barriers limited VR to artists and institutions with access to significant financial or institutional support, such as the Banff Centre, the Institute for New Media (INM), and the Centre for Art and Media Technology (ZKM) (Shanken, 2009). Collaborations with VR companies like VPL Research also provided opportunities for some artists to experiment with this emerging medium (Shanken, 2009).

Char Davies, a prominent figure in early VR art development, exemplifies the limited opportunities for artists to explore VR in the early 1990s. As an artist and head of Visual Research for Canadian software firm Softimage between 1987 and 1997, Davies created two landmark VR artworks, *Osmose* (1994–95) and *Ephémère* (1998), using state-of-the-art VR technology (Shanken, 2009). These two works were powered by a computer that Davies noted cost over half a million dollars (Davies, 2012). Similarly, artist Brenda Laurel, sponsored by the Banff Centre, created *Placeholder* (1993) with the VR setup that cost around one million dollars (Laurel, 2016). Other pioneer VR artworks include Diane Gromala and Yacov Sharir's *Dancing with the Virtual Dervish: Virtual Bodies* (1994), L. P. Yuxweluptun's *Inherent Rights, Vision Rights* (1992), Micael Naimark's *See Banff!* (1993), and Catherine Richard's *Spectral Bodies* (1991). These projects, utilising cutting-edge VR technology of the time, such as head-mounted displays, data gloves, and 3D interactive

graphics, often required collaborations with technical expertise from programmers and engineers (Seo, 2011).

In the exploration of VR experiences, the medium centres participants within a 360-degree immersive environment and allows them to experience an artwork from "inside" the virtual space. This shift in perspective fundamentally alters how participants are positioned within artworks, inevitably bringing the topic of bodies into focus and making the relationship between participants' physical and virtual bodies a critical point of artistic exploration. Through studying these early VR artworks, it becomes evident that artists approached virtual bodies from differing philosophical perspectives. Some adopted a disembodied stance, presenting the virtual body in a "transcendental" state (e.g., portraying the mind leaving the physical body and entering the virtual body). This approach often emphasises the separation between the physical and virtual, suggesting that virtual bodies are freer. Others embraced an embodied perspective, exploring the integration of bodily movements within the virtual space. In some cases, these opposing stances coexisted in the same work, leading to confusion in interpretations. These three different scenarios are discussed below through examples of artwork.

Throughout the 1990s, artistic explorations of VR often leaned toward a disembodied approach, marked by a distinction between the materiality of physical and virtual spaces and bodies. A clear example of this can be found in Ulrike Gabriel and Bob O'Kane's *Perceptual Arena* (1993–1995). Gabriel describes the work as "an open audiovisual generative space, free from the physical meaning of things" (n.d.). In this context, materiality is associated with the tangible, concrete, and physically present, while the virtual is an immaterial space—an abstract realm of sound, vision, and digital constructs. The virtual was imagined as a space where traditional notions of materiality could be transcended, leading to an experience of "immateriality". Gabriel's interpretation aligns with the early studies of VR mentioned above, which characterised VR through a mind/body and physical/virtual dualism.

This disembodied approach has persisted in contemporary artworks, as exemplified in Rebecca Allen's *The Tangle of Mind and Matter* (2017). The work begins with a human brain positioned at the centre of a virtual space, which participants can deconstruct into

smaller parts using a controller. As the fragments separate, a human figure emerges from within, swimming through the air. The virtual space is occupied by brain fragments and tree stems, while the human figure remains the only element in motion.

Through Allen's artistic statement (2017), the symbolism becomes apparent: the brain fragments represent the tangible aspects of the physical body, while the liberated figure embodies the intangible essence of the mind. In the work, the brain components remain static; meanwhile, the mind is depicted as moving freely within space, unbound by physical limitations. As Allen (2017) explains, “While the brain is part of the body, with physical, tangible properties, the mind is ephemeral”. As the water level gradually rises in the VR experience, engulfing the brain fragments and trees, the human figure ascends higher into the sky. Allen (2017) elaborates, “While our body stays grounded to the earth, reacting to the rising level of virtual water, the mind continues to explore beyond our horizon”. Similar to Gabriel and O’Kane’s work, Allen portrays the mind as immaterial, liberated from the restrictions of the physical body in the virtual world.

This theme of disembodiment continues in Allen's later work, *Life Without Matter* (Allen, 2018), where the immateriality of bodies and realities is further explored. In a similar vein, Clemens Schöll’s *Questions to Self-Perception* (2017) questions whether VR can ultimately lead us to a separation of mind and body. As part of the *Overkill Festival 2018* in Enschede, an exhibition titled *THIS COULD BE YOU: Disembodiment in Virtual Reality* gathered works that centred on the topic of disembodiment. The exhibition featured pieces such as Martina Menegon’s *All Around Me Are Familiar Faces* (2018), Zeesy Powers’ *This Could Be You* (2017), and Jessy Jetpacks’ *Can Our Bodies Still Remember?* (2017). Through these artworks, the exhibition explored Moravec’s (1991) idea of VR as a potential means of achieving immortality, reflecting on the separation of mind and body and questioning the implications of disembodiment in virtual space (Schoenegge, 2018).

These examples of VR artworks illustrate a persistent disembodied view found in descriptions of the relationship between the mind and body, physical and virtual, with the virtual often characterised as transcending material bodies. As noted by Davies (2017), despite the rapid advancements in VR technologies, artistic approaches to participant interactions and underlying cultural values embedded in the medium have remained relatively unchanged. This enduring view of VR as a means of surpassing physical

limitations raises significant concerns for Davies. She argues that the limited understanding of both the materiality of the virtual spaces and participants' embodied interactions hinders our ability to realise VR's full potential in artistic exploration (Davies, 2012).

Davies' critique of conventional VR experiences corresponds with this thesis's argument: the potential of VR to provide immersive and in-depth embodied experiences cannot be achieved by de-centring the bodies and embodied practices of the participants. However, it is important to clarify that the purpose of this discussion is not to criticise artists or their conceptualisations of VR artworks. Instead, my aim is to shed light on the potential connections between their philosophical approaches to VR in relation to the designs of user interactions in these artworks. In the following section, I turn to an early example of VR art, *Dancing with the Virtual Dervish* (1994), to examine how the viewer's body is engaged in this piece.

3.2.2 Engaging with the virtual body

In exploring the engagement of bodies within VR artworks, some artists attempt to harness the embodied and interactive potential of VR, yet their works may still implicitly suggest a disembodied perspective. An example of this is *Dancing with the Virtual Dervish* (1994), created by artist Diane Gromala and choreographer Yacov Sharir, which combines live performance with an interactive VR experience. The virtual environment features body parts recreated from MRI scans of Gromala's body, such as the ribs, kidney, and heart (Gromala, n.d.). In the video archives (Sharir et al., 1994) of *Dancing with the Virtual Dervish*, Sharir is observed wearing a VR headset and data gloves while performing choreographic movements in coordination with the virtual body parts. He moves slowly—spinning, bending, stretching his body, and rotating his arms—while navigating through the virtual body parts. At certain points, some parts decay and reform in response to his movements. His perspective within the virtual space is projected onto a screen for the viewers to witness.

While researchers like Steve Dixon (2006) have interpreted *Dancing with the Virtual Dervish* as an exploration of anti-Cartesian and embodied experiences, I argue that the work reflects a tension between embodied and disembodied perspectives in its

depiction of the relationship between physical and virtual bodies and spaces. The interactions between Sharir's physical body and Gromala's virtual body parts can be seen as an attempt to blur the boundaries between physical and virtual realms. However, the narratives of disembodiment embedded in the artists' perspectives should not be overlooked. This is particularly evident in the metaphor of "Dervishes" referenced in the artwork's title, which alludes to Muslim mystics known for their ascetic rituals designed to achieve transcendental states and spiritual enlightenment (Gromala & Sharir, 1996).[5] This metaphor serves as an illustration of Gromala's tactics for coping with her chronic pain; like the Dervishes, who aim to transcend the material world, Gromala seeks a state of detachment from her body to manage her pain. This implies a disembodied potential, where certain sensations can be disassociated from the body.

Additionally, the visual representation of the artwork conveys a reduction of the body. In the artwork, Gromala's body—along with her embodied sensations and emotions—is reduced to images and figures derived from MRI scans. This reduction aligns with Lisa Blackman's (2008) notion of medical objectification of the body, which mirrors how the medical field fragments the body into isolated parts, devoid of its holistic experience. At a conceptual level, *Dancing with the Virtual Dervish* reflects a disembodied perspective through this separation and reduction of the physical body. This theme is also present in Sharir's reflections on his experience within virtual space. He notes that his virtual experience felt freer and less constrained than the physical (Sharir, 1996). For Sharir, the manipulation, extension, and distortion of both the "outer and inner body/world" in VR highlights this separation. He conceptualises the digitalisation of the body as a way of transcending the limitations of the physical body, engaging with what he describes as a more liberated "other" body (Sharir, 2013).

The disembodied perspective is further reinforced by how viewers' interactions with the artwork are designed. Although interactive—featuring digital gloves and interactive graphics—*Dancing with the Virtual Dervish* may place less emphasis on fostering

[5] Best known for their whirling dances, which have been practiced since the 13th century, Dervishes engage in a form of meditation where they whirl faster and faster to the rhythm, attempting to achieve transcendental ecstasy.

experiential connections between the physical and virtual bodies. While virtual body parts decay and reform in response to the viewer's dance movements, these interactions may offer limited opportunities for participants to engage with the themes of pain, illness, or the "transcendental" state. This is because the viewers' movements may not be contextually grounded in their individual ways of exploring and empathising with the virtual body parts in the artwork. While some viewers may still empathise with the artwork, potentially drawing on their personal associations with pain, the decontextualised interactions with the virtual body, I argue, may restrict the depth of their affective engagement. For instance, those without experiences of bodily vulnerability may find it challenging to engage with the emotional weight of the work, thereby hindering their ability to form affective connections with the artwork. In this way, the piece further reinforces a sense of disconnection between the physical and virtual bodies on an experiential level.

The articulation of the physical and virtual bodies by Gromala and Shari provides a lens through which we can understand the complex relationship between the two in early VR art explorations. While *Dancing with the Virtual Dervish* explores the boundaries and interactions between physical and virtual bodies through interactive technologies, its discourse remains rooted in the dualistic separation of the mind and body, as well as physical and virtual realms. In the following section, I examine another example of engaging the body in VR artworks through a more embodied approach.

3.2.3 Embodied potentials in VR artworks

Char Davies provides an alternative understanding and design of the viewer's interactions in VR through her pieces *Osmose* (1994–95) and *Ephémère* (1998). For Davies (2012), VR is not merely another stage to experience objective realism; it has the potential to inhabit the individual participant's body within a virtual space. This sense of inhabitation, as Davies describes it, refers to the forces that act upon participants' bodies in the virtual environment. Unlike Sharir's view of physical and virtual bodies as separate entities, the collapse of boundaries in Davies' perspective does not imply a transcendental journey in which the mind moves from the physical to the virtual domain. Instead, she envisions VR as a shared experiential space where the mind and body, as

well as the physical and virtual, are united and interdependent. As she writes, “My goal is to use immersive virtual space to collapse the boundaries between subject and object, interior and exterior, and self and other” (Davies, as cited in Wands, 2006, p. 104). This vision is exemplified in her work *Osmose* (1994–95).

Osmose (1994–95) is an interactive VR artwork featuring elements like trees, leaves, layers of earth, glowing particles, and various natural components. These elements are presented as translucent shapes within a dark space, accompanied by sounds from nature, such as birdsong and the buzz of insects. In *Osmose*, traditional navigation methods like joysticks and other hand-held devices are abandoned, which the artist describes as “driving or pointing one’s way through the virtual space” and can evoke feelings of both control and disembodiment (Davies & Harrison, 1996, p. 26). Instead, viewers interact with this world using a real-time motion-tracking vest, allowing them to navigate the space through their breathing and body balance. This approach to movement was inspired by Davies’ experience of scuba diving, where she floats in the water by breathing and balancing the body (Immersence Inc, n.d.). Viewers can rise in the virtual space by inhaling and descend by exhaling. To change direction, they must subtly shift their body’s centre of balance.

I interpret the viewers’ interactions with *Osmos* as embodied because, rather than aiming to move beyond the physical limits of the body, the work prioritises the body itself, placing it at the centre of the viewer’s experience. In *Osmos*, how viewers breathe, balance, and move is not solely about physical capabilities; they are also integral aspects of their evolving experiences within the virtual environment. The variability in how viewers navigate the virtual space—some gliding smoothly while others may encounter moments of imbalance—creates unpredictable interactions that highlight the significance of embodied practices in shaping individual experiences. This dynamic of viewer engagement suggests that the interaction between viewers and the artwork goes beyond a negotiation of physical-virtual boundaries by involving a co-creation of the viewer’s experience through their embodied engagement with the artwork. Co-creation in this context entails a more evolving and mutually constructive relationship between the viewers’ bodily movement, the responses of the virtual elements in the artwork, and the viewers’ personal and affective reflections of the artwork. In this process, the viewers not

only move with the virtual content, but also participate in meaning-making through their embodied practices. In the next section, I will elaborate how the embodied potential of VR art experiences is facilitated through this co-creative process and why it matters in shaping participant experiences.

As I discuss in Chapter 5, this co-creative process, driven by participants' embodied interactions, leads to complex, multi-layered experiences. When participants engage with VR art in an embodied manner, a wide range of associations, interpretations, and imaginings can emerge. These interactions invite personal reflections and evoke questions based on individual bodily movements and sensations within the virtual world, fostering diverse and comprehensive understandings of the artworks.

3.2.4 Interaction as co-creation

Building on Barad's (2007) concept of intra-action and Shanbaum's (2019) exploration of co-constitutive processes in interactive new media art, co-creation in my thesis is conceptualised as a multidimensional and relational process in which both the viewer and the artwork contribute to the formation of experiences. Rather than viewing the relationship between the viewer and the VR artwork as unidirectional—where one exerts control over the other—co-creation suggests a non-binary understanding of their engagement processes, emphasising the agency of both viewers and VR artworks in producing viewer experiences.

As discussed in Section 2.3, Barad (2007) introduces the term intra-action to challenge the idea that entities interact as separate, independent units, instead arguing that entities emerge through their relationships with one another. The term "intra" is used to emphasise a state of co-existence and mutual-acting process when interactions happen. Barad asserts that individuals do not pre-exist their interactions but rather emerge through ongoing intra-active reconfigurations (2007, p. 33).

In the context of VR art, the concept of intra-action highlights the intertwined relationship between viewers and the artworks they engage with. This means that the viewer's physical movements, emotions, and associations shape how the artwork is experienced. Simultaneously, the design and responses of the artwork influence how viewers navigate and interpret the virtual space. This challenges the division between creator and

interpreter and instead acknowledges that both viewer and artwork are simultaneously influencing and being influenced, making both parties co-dependent in driving the narrative or experience forward. In my thesis, the concept of intra-action is crucial for understanding the evolving relationship between participants and VR artworks, as it frames interaction as an emergent process, where participant movements, sensations, and affections are not predetermined but arise through the specificities of each engagement. Participant experiences are thus co-constituted, unfolding in a way that is unique to each intra-active encounter.

A contemporary VR artwork that reflects such a cooperative relationship between viewers' physical and virtual bodies is Ali Eslami's VR project *False Mirror* (2017–2022). *False Mirror* is a vast virtual world made up of numerous individual virtual spaces, each featuring a distinct environment. One such space belongs to a nonhuman creature named Lena, who resides on an alien planet with a primitive, desert-like climate, surreal floating objects, and enigmatic sounds.[6] Lena's body has four long, twisting, twig-like limbs with a metallic surface. From the viewer's perspective, the two upper limbs, positioned near Lena's head, move in synchrony with their head movements, while the two lower limbs follow their arm and hand motions. To move with Lena's body, viewers must adjust their habitual movements to align with Lena's unique ways of moving—such as learning to float through the air and interact with objects using her twig-like limbs.

The process of viewers adapting to Lena's movement patterns exemplifies the "co-constitutive" relationship between the viewer and the artwork, as described by Shanbaum (2019). Shanbaum defines co-constitution as the collaborative production of the participant's experience through their interactions with the artwork. This process involves negotiation, conflict, and struggle on behalf of the participant, which further influences how they interact within the piece. For Shanbaum, co-constitution extends beyond the mere synchronisation of physical and virtual movements on an instrumental level. Instead, it represents a way of meaning-making where viewers interpret and connect with the artwork through embodied interaction.

[6] Lena's world is used in one of the case studies in this thesis; see detailed descriptions in Section 4.2.2.

In my thesis, Shanbaum's insights help connect participant interactions with artworks to their evolving interpretations of them. As discussed in Chapter 5, participants engaging in C2-Lena's virtual environment developed various interpretations based on their explorations, including ideas about the history, climate, and geography of virtual space, Lena's biological characteristics, and aspects of Lena's life and hobbies. These varied interpretations, shaped by each participant's personal explorations and experiences, highlight how VR art experiences are co-created, emerging from the complex relationship between the participant and the virtual environment.

3.3 The concept of immersion

This section focuses on the concept of immersion, a foundational idea in the discourse surrounding VR experiences. In Sections 3.3.1 and 3.3.2, I examine two dominant conceptualisations of immersion in existing scholarship. First, immersion as a psychological state, defined as a subjective experience of deep mental and sensory engagement with a virtual environment (Murray, 1997). This understanding has often been applied in the contexts of literature, painting, theatre, and film, where immersion is associated with the viewer's absorption into an alternate reality. Second, immersion as an objective property of the technology or system that facilitates such experiences (Slater, 2009). These two perspectives have largely shaped the discourse on immersion across media studies (Agrawal & Bech, 2023), influencing how immersive experiences are designed, analysed, and evaluated.

Despite the apparent differences between these two approaches—one prioritising subjective experience and the other focusing on technological capabilities—I argue that both perspectives converge in their underlying pursuit of realism, sharing a focus on creating realistic and "interfaceless" experiences. This pursuit resonates with a longstanding interest in Western visual representation to diminish and ultimately erase the presence of the medium from participants' awareness (Bolter & Grusin, 1999). Such interest has significantly shaped key concepts in VR studies, such as the sense of presence, totalisation, and replacement (Ng, 2021), seeking to envelop participants in virtual environments, and enhance the immersive feeling by erasing distinctions between physical and virtual realities.

While this pursuit of realism has contributed to the development of high-quality, sensory-rich VR experiences, it might have overlooked the embodied dimensions that interactive VR art uniquely affords. Thus, in Section 3.3.3, I emphasise the critical role of participation in unpacking the concept of immersion and designing immersive experiences. This perspective aligns with a hypermediated approach, which foregrounds the importance of participation and interaction in generating meaning (Bolter et al., 2021). This unpacking of immersion acknowledges the participant's agency and autonomy in the formation of immersive experiences and stresses the importance of enabling participants' unique and embodied engagements with the artworks to foster more personal and individually meaningful interactions.

3.3.1 Immersion as transparency

The concept of immersion has been extensively explored in studies across various disciplines in the humanities, including media, music, games, film, literature, and virtual environments (Nilsson et al., 2016). This interdisciplinary interest has resulted in a multitude of categories and subcategories of immersion, contributing to a complex discourse around the concept but also presenting significant challenges in defining it (Agrawal & Bech, 2023). Given that the focus of this thesis is on VR art, I primarily draw on conceptualisations of immersion from the field of media studies and discuss its historical influences on contemporary interpretations as well as its applications in VR experiences.

In this section, I expand on the first dominant notion of immersion introduced earlier—immersion as a state of complete mental involvement in an alternate reality. A key proponent of this perspective is media scholar Janet Murray (1997), who characterises immersion as an experience of deep cognitive and sensory absorption, enabling viewers to transition between physical and mediated realities. As she writes:

> Immersion is a metaphorical term derived from the physical experience of being submerged in water. We seek the same feeling from a psychologically immersive experience that we do from a plunge in the ocean or swimming pool: the sensation of being surrounded by a completely other reality, as different as water is from air, that takes over all of our attention, our whole perceptual apparatus. We enjoy the movement out of our familiar world, the feeling of alertness that comes from being

> in this new place, and the delight that comes from learning to move within it. (1997, pp. 98–99)

Murray uses the word "submerge" here to describe the experience of immersion, which emphasises a feeling of being surrounded by a different reality. While she acknowledges the potential for "learning to move", her definition of immersion predominantly centres on the idea of losing oneself in an unfamiliar world. This portrayal can be seen in how Murray characterises experiences of immersion as similar to those in "illusions" and "enchantments" (1997, pp. 99–102). For Murray, immersion entails an experience that keeps viewers closely connected to media-based content while concealing the medium responsible for its creation. Murray frames any realisation of the medium or the mediation process as a disruption to the immersive experience.

To illustrate this, Murray references Suzanne Langer's (1953) account of watching a *Peter Pan* theatre performance. According to Langer, in one scene, the actress begins engaging with the audience by speaking to them during the performance. This action is considered a "terrible shock" (Langer, 1953, as cited in Murray, 1997, p. 101) and "awkward" (Murray, 1997, p. 101) by the authors because it disrupts the audience's sense of immersion in the story and the characters. In other words, such interactions remind the audience of the existence of the medium—in this case, the play and the actress delivering the story—revealing the boundaries of the illusion that should ideally remain unnoticed by the audience.

Murray's conceptualisation emphasises the psychological effects of immersion, wherein viewers become so engrossed in the mediated experience that they suspend awareness of their physical surroundings and mediation process. This notion aligns with the concept of transparent immediacy widely adopted in the field of media studies. Bolter and Grusin (1999) define transparent immediacy as a "style of visual representation whose goal is to make the viewer forget the presence of the medium (canvas, photographic film, cinema, and so on) and believe that he is in the presence of the objects of representation" (pp. 272–273). The idea of transparency, as explained by Friedberg (2009) using the metaphor of the window, is to allow viewers effortlessly seeing through to the other side of the medium. According to Friedberg, the intention of providing transparent visual

experiences is to “dematerialise” the medium, meaning to minimise its presence in individuals’ awareness (2009, p. 117).

In media theory, transparency is commonly used to conceptualise a seemingly unmediated visual representation. This suggests that while the medium is physically present to facilitate the viewer’s experience, it should feel “natural” and “interfaceless” as if there is no medium standing between the viewer and the content (Bolter & Grusin, 1999, p. 23). The goal of making the medium invisible aligns with Murray's objective of maintaining an illusion that keeps viewers unaware of the mediation process. However, while Murray’s conception effectively characterises immersion in traditional narrative media, it does not fully account for the unique characteristics of viewer experiences in interactive VR art. This is because its emphasis on preserving an uninterrupted illusion risks creating a dichotomy between immersion and interaction when interpreting VR experiences. In the following section, I elaborate on this limitation by examining Murray’s perspective on VR.

Murray’s notion of immersion in theatre provides a conceptual bridge to her interpretation of VR, where she describes VR experiences as hybrids of various earlier mediums. As she notes:

> VR experiences are like movies but with interactivity; they are like paintings but with navigable spaces; they are like plays but with computer-controlled characters; they are like theme park rides but with simulated motion; they are like games but with VR headsets and controllers. (2020, p. 23)

While this comparison highlights VR’s connections to earlier media forms, I argue that it also presents challenges in fully capturing its unique interactive potential. This is particularly evident in Murray’s treatment of immersion and interactivity, which she frames as existing in a state of tension rather than complementarity. For instance, as previously discussed, Murray emphasises the importance of maintaining illusion in theatre, a perspective she extends to VR: “How will we know what to do when we jump into the screen? How will we avoid ripping apart the fabric of the illusion?” (Murray, 1997, p. 106) Murray’s concern for preserving the “fabric of illusion” reveals a tension in her framework: While Murray acknowledges interactivity as a defining characteristic of VR,

she simultaneously frames it as a potential threat to illusion. This emphasis on seamlessness and unbroken immersion implies that interactivity, especially if it disrupts or challenges the illusion, is at odds with the immersive goals of VR.

To address the tension between illusion and interactivity, Murray proposes that participants should engage with virtual spaces as "visitors" and engage with the environment through "role-play" (Murray, 1997). By adopting dual roles within the virtual environment, she argues, participants can maintain the illusion while still engaging interactively. However, I argue that this approach does not fully resolve the tension between immersion and interactivity in her framework. Instead, it introduces a constrained mode of engagement—one that prioritises maintaining the illusion over enabling viewers to fully explore the interactive possibilities in VR.

While the submerging quality of immersion has become one of the dominant ways to describe immersive experiences—aligning with the broader pursuit of hiding and minimising the presence of the medium from viewer awareness—this approach presents several challenges when applied to interactive VR art. First, prioritising the seamless maintenance of illusion can result in relatively guided experiences that constrain the diversity of participant engagements. Second, the restriction of movement limits opportunities for participants to explore the virtual space through more open-ended and autonomous interactions. Third, the emphasis on guided narratives reduces the potential for participants to engage with VR experiences in a reflective and critical manner, as they are encouraged to remain within the boundaries of an uninterrupted, pre-designed illusion. Addressing these limitations, in my thesis, I propose an alternative understanding for unpacking immersion in interactive VR art. In this perspective, immersion is not about "losing" oneself in the virtual world but rather about engaging deeply with it on one's own terms, fostering critical, exploratory, and reflective interactions. I expand on this argument further in Section 3.3.3.

3.3.2 Totalisation, replacement, and sense of presence

In this section, I examine how the goal of creating a convincingly real environment has become central to VR immersion and how designs and interpretations of VR experiences continue to uphold this approach.

Characterised as a form of “postcinematic media” (Kirschner, 2023), VR exhibits a tendency toward a greater technological emphasis on envelopment and the absorption of viewer sensory experiences within the framework of immersion. Scholars such as Slater (2009) advocate the idea that the quantity and authenticity of sensory inputs primarily determine the quality of immersion. For instance, the more lifelike and comprehensive the sensory simulation, the more immersive the experience is considered to be. This perspective represents the second predominant conception of immersion, which frames it as an objective property of technology (Agrawal & Bech, 2023). Within this framework, immersion is achieved through the technological erasure of boundaries between the physical and virtual realms.

Reflecting on this, Jenna Ng defines VR as a “post-screen” technology. The aim here, she states, is for viewers “to ‘forget’ the frame and boundaries of the screen” (2021, p. 115). This perspective reinforces the longstanding pursuit of realism in immersive media, aiming to achieve a sense of seamlessness by minimising the awareness of mediation. In the following discussion, I analyse how this dominant conceptualisation of immersion manifests in VR through its associations with “totalisation,” “replacement,” and the “sense of presence”.

Totalisation is an idea associated with the concept of immersion when deployed in a VR setting, which means to immerse viewers in a complete sense. It suggests an all-encompassing audiovisual engagement being imposed on participants in a virtual environment (Jarvis, 2019) and is characterised by a pursuit of heightened realism (Ng, 2021). A totalised VR experience refers to scenarios where viewers encounter virtual environments that replicate—or even surpass—physical-world experiences without any barriers. This illusion is achieved by substituting physical sensory inputs, such as audio and visual stimuli, with virtual ones in a “natural” way.

In this manner, totalisation in VR is characterised by the goal of replacement. Ng (2021) outlines three stages through which replacement is anticipated to occur in VR. The initial stage involves the elimination of visual boundaries between the physical world and the virtual environment. According to Ng, this is achieved by creating a virtual space that seems boundless while simultaneously confining participants' visual fields within the limited view provided by a VR headset. In such headsets, the edges of the visual field

must be imperceptible to participants. Consequently, their view of the physical environment is replaced by a virtual one, thereby erasing the visual boundary between the two realms.

In the second stage, the objective shifts from eliminating the visual boundary to erasing the differences between the physical and virtual worlds (Ng, 2021). As VR technologies progress, this may be achieved through the two distinctive features of VR immersion identified by Ng: creating increasingly realistic, high-definition virtual environments and the enhancement of participants' sensory experiences to closely resemble their real-life interactions. By facilitating more realistic visual and sensorial experiences, the disparities between physical and virtual are diminished.

Though criticised by Murray (2020) and Ng (2021) as a fantasy that is unlikely to happen (Murray, 2020; Ng, 2021), the final stage of replacement entails the complete transition from physical reality to virtual existence (Ng, 2021). A vivid depiction of total replacement can be observed in sci-fi films like *The Matrix* (1999) and *Ready Player One* (2018). *The Matrix,* for instance, portrays a complete replacement of reality, where individuals inhabit a computer-generated worldwide simulation while unconsciously lying in tanks in the physical world. *Ready Player One*, on the other hand, presents a sensory-based form of replacement, where individuals move with advanced VR suits and headsets to experience sensations like those in reality.

The concepts of totalisation and replacement reflect a longstanding pursuit in relation to VR technologies, dating back to the 1960s, aimed at creating the ultimate immersive experience (Bolter et al., 2021). The underlying assumption here is that VR's effectiveness as an immersive medium is determined by its ability to replace the physical world with a fully realised digital one. As noted by Bolter et al., totalisation is a myth of "a single, transparent experience — a perfect, coherent, alternated world" (2021, p. 138). At the heart of this ambition, both historically and in contemporary practice, lies the promise of offering a more realistic and convincing sense of "being there" (Bolter & Gromala, 2003, p. 36).

The emphasis on "being there" as central to creating immersion has significantly shaped the concept of presence, making it a defining characteristic of VR immersion. Bob G.

Witmer and Michael J. Singer (1998) define presence as “the subjective experience of being in one place or environment, even when one is physically situated in another” (p. 225). The notion of presence, as considered by many studies, captures the most distinctive characteristic of immersion, and is often used interchangeably with immersion (Nilsson et al., 2016). Encapsulating the core ideas of totalisation and replacement, the sense of presence remains largely dependent on providing viewers with a virtual experience that feels indistinguishable from the physical world.

In pursuit of presence, VR creators often aim to design what Bolter and Gromala (2003) describe as an interfaceless experience, seeking to erase perceptible boundaries between physical and virtual realms. However, the pursuit of ever-greater realism, I argue, is an endless path, as embodied experience is not a matter of replicating sensory stimuli but emerges from a complex network of entangled interactions. While a “transparent” spatial, audiovisual, and bodily experience may contribute to a convincing illusion, experiential differences between physical and virtual embodiment can still persist. This is evident in my data where participants remain aware of the differences between the physical and virtual worlds due to the distinctive embodied experiences that emerged.

Regardless of this, even if we were to achieve a perfectly “authentic” and “realistic” simulation, is that where the unique potential of VR immersion lies? Should VR strive to become a mere replication machine?

The findings in my thesis suggest an alternative approach. Participant data indicate that immersion in VR artworks can still occur even when individuals are consciously aware of boundaries, differences, or even the “fakeness” of the experiences. In this context, immersion is not about achieving perfect illusion but about fostering affective connections between participants and the artwork. Rather than being a fixed quality dictated solely by technology, immersion emerges as a dynamic and relational process. As Agrawal et al. (2020) observe, “immersive tendency” is shaped by multiple interacting influences, involving the interplay between content and individuals in a complex, evolving manner rather than being reducible to a set of predefined factors (p. 408).

In the following sections, I expand on my exploration of immersion by providing a useful perspective that complements the two previous notions. My approach moves beyond the

emphasis on seamless illusion and technological realism, shifting focus toward the dynamic, processual, and relational nature of immersion.

3.3.3 Unpacking immersion through the concept of hypermediacy

In this section, I draw on the concept of hypermediacy to frame my understanding of immersive experiences. In media theory, hypermediacy refers to media representations that feature multiple forms and layers for viewers to navigate, emphasising the process of mediation rather than concealing it. For example, viewers may be encouraged to experiment with the media content in individual random ways and compose their own narratives along the journeys of exploration. As Bolter and Grusin (1999) explain, while immediacy seeks to erase the medium by making its boundaries invisible, hypermediacy acknowledges the existence of the medium through multiple possibilities of interactions and representations. In a hypermedia environment, content is presented in a manner that encourages viewers to navigate in a diverse and nonlinear fashion, leading to personalised interpretations (Szüts, 2019). This allows viewers to engage with the content in ways that are not confined to a single, predetermined narrative, instead drawing from their own individual contexts and perspectives.

Unlike transparent immediacy, which aims to conceal the medium and create an illusion of unmediated access, hypermediacy prioritises viewers' experiences of the media content through their engagements with the medium itself (Bolter & Grusin, 1999). Underlying the concept of hypermediacy is an emphasis on participant autonomy and interactivity. In the process of exploration, viewers shift their roles between creators and audiences (Szüts, 2019). Rather than encouraging viewers to "lose" themselves in the illusion, hypermediacy invites them to navigate through diverse layers of content and interact with the medium in a more participatory manner.

I use the concept of hypermediacy in my thesis to shape my understanding of participant immersion in VR artworks. In this context, immersion involves building multiple connections between viewers and the content through their engagements (Poffenroth, 2021). Adopting a hypermediated perspective does not mean rejecting ideas of presence or multisensory experience in VR immersion; rather, it expands on these by addressing a broader spectrum of participant experiences. While absorption, presence, or being surrounded by a 360-degree virtual environment are integral to immersion and were

frequently experienced by participants in my study, they do not fully capture the complexity and diversity of participants' immersive experiences. Instead, they experienced immersion as a diverse, multi-layered, and reflective process of engagement. Therefore, in unpacking the notion of immersion, I shift focus from the pursuit of creating a convincing illusion to highlight the role the viewer plays in the co-creation process.

Kirschner's concept of "anamersion" (2023) offers a similar hypermediated approach to immersion. For Kirschner, "ana-" (mersion) conveys meanings such as "upward, towards; again, anew; backwards, against", which diverge from "im-" (mersion), which mainly focuses on "in; into; within" (2023, p. 15). This linguistic shift differentiates anamersion from the all-encompassing, absorbing quality commonly associated with immersion. Instead, anamersion is conceived as a processual, hybrid construction involving the mutual influences of human bodies in physical and virtual realms, as well as between machine and biological elements, individuals, and their environments (Kirschner, 2023). Rather than aiming for seamless illusion, anamersion is framed as an emerging experience co-created by multiple agents, a view that emphasises entanglement over the control of the creators typically implied in immersive environments.

Kirschner 's proposed conceptualisation aligns with the argument of my thesis in viewing immersion as more than a technological property of VR technologies or a representation of realism; rather, it is a complex, processual, and multi-layered phenomenon entangled with participants' embodied interactions and interpretations. It is a continuous and evolving process that involves "uncertainty and instability… complexity and change" (Dogramaci & Liptay, 2015, p. 1). In the context of my thesis, fostering a hypermediated VR experience is crucial for examining participant embodiment in VR art. Both hypermediacy and embodiment stress the importance of participant agency and exploratory autonomy, enabling participants to navigate VR artworks through personalised pathways. This approach allows for multidimensional exploration where participants can engage with artworks through their individual contexts, preferences, and embodied knowledge, encouraging more meaningful connections in between.

In Chapter 7, I explore how hypermediated VR art and embodied interactions together shape participants' in-depth experiences. My analysis highlights how the nonlinear,

autonomous modes of interaction within VR artworks allow participants to explore the pieces in a less directed and predetermined way. The autonomous exploration observed in my thesis contributed to creating complex, multi-layered narratives that may even contain self-contrasting or self-questioning reflections. Through these discussions, I hope to illuminate an alternative potential in the future design of immersive VR/VR art experiences, where emphasis is placed on fostering participant embodied and affective engagements. As Bolter and Gromala remind us, immersion is not a technological determination but a cultural choice (Bolter & Gromala, 2003). By focusing on the possibilities enabled through viewer-centred, embodied interactions, this shift encourages opportunities for exploration in VR design that prioritises participant autonomy and depth of engagement. I expand upon this potential in greater detail in Chapter 8.

Summary

This chapter explored the concept of embodiment as a foundational framework for understanding participant bodily experiences in VR art. It has emphasised the situated, contextual, and interrelated nature of these experiences, which are shaped by participants' movements and affective responses within virtual environments. This chapter also examined early conceptions of VR, which have often centred on its potential to provide out-of-body experiences. These early perspectives influenced the design of virtual bodies in VR artworks, frequently downplaying the significance of bodily engagement in shaping meaningful interactions.

Additionally, the chapter reviewed traditional understandings of immersion, which highlight the goal of transporting viewers into an alternate reality. This approach has influenced the prioritisation of totalisation, replacement, and a sense of presence in VR, limiting the scope of immersion to a technological emphasis. In my thesis, I adopt a hypermediated perspective on immersion, underlining the importance of participant agency and autonomy in creating meaningful and immersive experiences. As touched on in this chapter, I argue that immersion is a dynamic interaction where participants shape their experiences through nonlinear, agential engagement. By addressing these concepts, this literature review has laid the groundwork for analysing participant experiences in VR art as deeply embodied, contextual, and affective.

Chapter 4. Methodology

Overview

This chapter outlines the methodological approach used in my thesis to investigate participant experiences in VR artworks. Focusing on embodiment as a central framework, the design of data collection and analysis methods revolve around the connections between participant movements, thoughts, and feelings emerging in the artwork. The methods employed include observation, semi-structured interviews, and autoethnography. Observations were conducted to track the process of participants navigating the artwork, including their movements, gestures, and time length of interactions. In semi-structured interviews, participants were asked to describe and explain their bodily engagements, associations, reflections, and interpretations of the artwork. These two methods were combined to generate rich qualitative data about the connections between participant movements and their affective responses. The use of autoethnography allowed for the documentation of a longer process of my own evolving embodied experiences in the artwork. While providing another level of detailed reflections on my own experiences, this method was also useful to explore how emotions and thoughts changed or intensified across multiple experiences. Detailed descriptions of the methods are provided from Section 4.3 to 4.6.

In this thesis, three existing VR artworks have been selected for study, provided by artists Ali Eslami, Razieh Kooshki and Vahid Qaderi. All selected artworks enable undirected exploration without imposed time limits, narratives, or pre-designed camera movements. This design choice aligns with the thesis's focus on allowing participants to interact in a highly personalised manner, facilitating the study of how their embodied connections are built throughout their interactions with the artworks. The following Section 4.2 will provide a detailed description of the selected VR artworks and their relevance to the research.

In Section 4.7, I outline the analysis process used in my thesis, where I conducted thematic analysis with a combination of inductive and deductive approaches. In the data analysis process, participant observational and interview data were combined using

storyboarding, in which their individual paths of exploration were mapped out. Through the visual representations of each participant's experiences, themes were generated surrounding three key focuses: interactions, embodied knowledge, and immersion.

4.1 Case studies

Case study is a qualitative method that focuses on exploring specific cases within their complex contexts, providing an in-depth understanding of the phenomena being studied (Stake, 1995). This approach allows researchers to investigate particular examples in great detail, using a range of methods to gather diverse perspectives on a complex phenomenon (Bhatta, 2018). Although case studies are critiqued for their lack of generalisability due to the limited number of cases (Lucas et al., 2018), the strength of this method lies in their ability to offer an in-depth understanding of the particularities and complexities of a case, which might be overlooked in broader studies (Ridder, 2016). In my thesis, three case studies were conducted to explore the intricacies of participant engagement in VR art. The selection of these cases was functioning-specific (Stake, 2005) within the context of this research study, aligning closely with my research focus and rationale. The research enquiry includes understanding how participant movements, thoughts, and feelings within the artwork are mutually shaped, how participant embodied knowledge impact the generation of their VR art experiences, and how immersion is experienced in various ways by the participants.

To address this research enquiry, three VR artworks were selected for the three case studies: Case Study 1 (C1) — *Sky Ville* (Eslami, 2017), Case Study 2 (C2) — *Lena* (Eslami, 2017), and Case Study 3 (C3) — *In Between Nodes* (Kooshki & Qaderi, 2021). The selection of these three VR artworks is significant because they embody key characteristics that allow for open-ended, personalised engagement, diverging from the traditional emphasis on narration guided or task-based experiences in VR. By incorporating room-scale movements, interactive objects, and a non-narrative structure, these artworks remove constraints that typically direct participant attentions and movements, instead fostering an environment where participants can navigate and interact based on their own embodied awareness. This approach aligns with my argument in Section 3.3.3, where I emphasise the importance of autonomous participant exploration in shaping immersive experiences. In the following sections, I provide

detailed descriptions of each of these artworks, highlighting how their design choices contribute to my research enquiry.

4.2 VR artwork Descriptions

4.2.1 Sky Ville

Sky Ville is a VR artwork created by Eslami as part of his larger VR project *False Mirror* (2017–2022). In the conceptual background of the artwork, *Sky Ville*, along with other spaces, is designed to be accessed by a virtual character named Alless. Thus, when participants enter the virtual world as Alless, they can see a VPN device on their virtual hand, which helps them to feign Alless' identity. The device displays a countdown starting from 100, marking the duration of the participant's journey as Alless (The countdown is slow, and no participants have experienced being forced out). Alless' body is composed of a head and two hands, equipped with interactive devices on the wrists, including a VPN, a small screen, a small vacuum, and a torch.

Sky Ville is comprised of three interconnected spaces: the Main Hall, the Big Chair, and the Time Tunnel. The Main Hall (Figure 1) is a large rectangular space with a partially open ceiling. The walls, floor, and ceiling display patterns of a blue sky and white clouds overlaid with a grid. This space contains four large floating geometric shapes—a ball, a square, a triangular cylinder, and a cuboid—along with smaller floating fragments. Participants can touch and move these objects, which behave as if they are in zero-gravity; if pushed harder, they move in the direction of pushing and eventually float upwards into the sky.

Near the entrance, two panels on the wall allow participants to change the background music and wall patterns. The music options are all classical, and the wall patterns can be switched between the default sky and cloud grid, sky and cloud without a grid, an Islamic geometric pattern, and a pure grey wall. Another section of the wall displays the artist's statement, with a refresh button to toggle between three versions of the statement, each maintaining the same sentence structure, such as "my work explores the relationship between new class identities and UFO sightings… / My work explores the relationship between new class identities and unwanted gifts… / My work explores the relationship between postmodern discourse and unwanted gifts" (see Appendix 3 for full

statements). A small window with closed roller blinds contains four interactive objects: three lighters (Slow-Mo lighter, Time Boost lighter, Aqua lighter) and a gun-dictionary with three cartridge clips. Lighting the lighters produces special effects, such as changing the speed of the music or creating a water pattern. The gun-dictionary, when used to shoot at objects, displays definitions of those objects on its small attached screen.

A short corridor leads participants to the second room, the Big Chair (Figure 2). This space is circular with a skylight, featuring a large chair hanging at the centre. Sunlight filters through the skylight, casting shadows of the chair on the walls. The rope suspending the chair is tied in a hangman's knot, with the other end extending upward into the sky. Approaching the big chair, participants can hear sounds of fire, cracking wood, and distant women's cries. Surrounding the big chair are fifteen smaller chairs arranged in a circle, which can be lifted and moved around the space.

A wooden door leads to the Time Tunnel (Figure 3), a long, irregularly shaped passage. The tunnel is dimly lit with small, bright yellow images on the walls accompanied by a deep humming sound. At the end of the tunnel is a sphere and a dark area beyond it. If participants proceed through the darkness, they find themselves in the external space of *Sky Ville*, where they can see the entire external structure of the interconnected spaces.

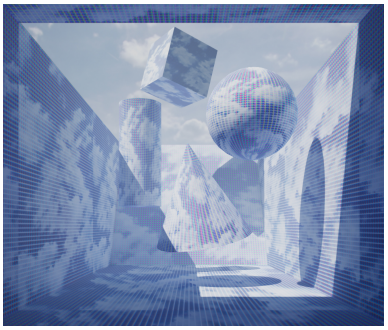

Figure 1The Main Hall

Figure 2 The Big Chair

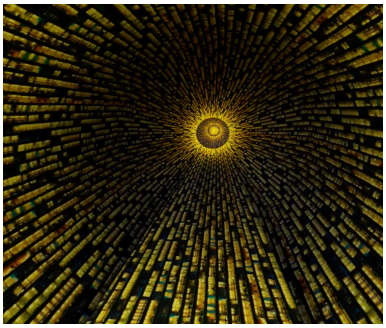

Figure 3 The Time Tunnel

By placing the three rooms on the same level within a single building and connecting them with wooden doors, the environment eliminates linear progression, allowing participants to move between spaces without imposed constraints. This spatial openness encourages individualised paths of exploration. The absence of guiding signs or directional arrows further emphasises this participant-driven experience. Without explicit instructions, participants must rely on their own embodied knowledge and

interpretations to navigate the space and interpret their surroundings. This lack of prescribed direction enhances the personal and exploratory nature of the interaction, allowing each participant to develop a unique understanding of the VR environment.

The design choices in this VR artwork supports my research enquiry by fostering an open-ended VR experience where participants explore at their own pace, navigate according to their own perspectives, and engage in a meaning-making process that is deeply personal and shaped by their unique embodied interactions. These support my research focus on how participants can construct affective and in-depth experiences through embodied and autonomous exploration, rather than through rigidly structured narratives.

4.2.2 Lena

Lena's World is a unique space within Eslami's larger VR project *False Mirror* (2017–2022), featuring a nonhuman creature named Lena. Lena's physicality and movements are distinctly different from those of a human body. She possesses four soft, floating and twisting twig-like limbs—two positioned at the participant's head and two at the position of their arms. These nonhuman limbs do not necessarily correspond with the participant's finger movements on the VR controller, and therefore cannot be used as human hands. To grab something with Lena's limbs, participants must move their head or entire arms rather than merely their fingers. Additionally, participants can grow alien plants from Lena's body by pressing a button on the controller, producing illuminating eggs that slowly transform into large alien flowers or mushrooms. Lena primarily moves by floating in the air, and participants use their controllers to control the direction and height. As she moves, small fragments fall behind her, leaving a trace. Sounds of wind and a gentle mysterious sound can be heard while moving.

Lena's world is a vast desert with an oasis, inhabited by Lena. The oasis does not feature traditional greenery but is instead filled with uniquely shaped alien objects, some taking forms similar to metal, rock, mushrooms, and flowers. Participants begin their experience from a seed at the centre of the oasis, where Lena was born. The environment contains various portals and islands scattered across the air and ground. Some islands feature interactive objects, such as a floating greenhouse where psychedelic mushrooms are bred. When participants move near the greenhouse, their vision becomes colourful

and disoriented, with a hallucinatory effect accompanied by fast-beat music. One island hosts three time-changing objects shaped like a combination of mushrooms and flowers, each corresponding to a different time of the day: noon, dusk, and night. Touching these objects changes the daylight accordingly. Multiple portals are spread throughout Lena's world, leading participants to other spaces within *False Mirror*. These portals are mostly one-way, meaning participants cannot return to Lena's world once they enter another space. When participants take Lena's body into other spaces within False Mirror, which are primarily designed for the human character Alless, they are unable to interact with most elements, such as buttons and screens.

The artwork *Lena*, with its distinct nonhuman bodies and unconventional modes of movement, offers a valuable focal point for this research by making the process of participant adaptation and cooperation with a virtual body highly visible. The alienated nature of the virtual body, which differs significantly from participants' daily embodied habits, brings to the forefront the adjustments they must make to navigate the virtual environment. Unlike more human-like avatars that might align with a participant's expectations and habits, *Lena* disrupts their familiar movements, requiring them to constantly adapt and cooperate with the nonhuman body and different ways of movement.

The heightened visibility of these adjustments not only facilitates observation during the study but also allows for more focused discussion in participant interviews. The challenges participants encounter while inhabiting Lena's nonhuman body become key moments of reflection, providing rich insights into understanding the adaptability of embodied knowledge in virtual environments, highlighting how participants make meaning through the cooperation of unfamiliar bodies and movements.

4.2.3 In Between Nodes

In Between Nodes (2021) is a VR artwork created by experimental visual artists Razieh Kooshki and Vahid Qaderi. The piece is composed of different virtual spaces, each contains a virtual VR headset that participants can use to transition from one environment to the next.

Participants begin their journey in a white cube room where a virtual VR headset is placed on one side. Upon grabbing and putting on the headset, the space folds into small squares and disappears, revealing a new environment: a night park. This night park features grass, flowers, trees, and a large skeleton-like sculpture illuminated by three standing spotlights. Through the headset in the park, the participants travel to the next setting—a small living room furnished with chairs, plants, a lamp, bin bags etc. There are interactive objects, such as tea sets, and bananas on a tea table. A curtain with a sign reading "draw it down" reveals a cave when pulled open. As participants enter the dark, stalactite-filled cave, rocks block the entrance from behind, preventing them from returning to the previous room. Leaving the cave, participants find themselves walking down a small hill and onto snow-covered ground, dotted with sculptures made from human limbs. In the distance, two larger sculptures with human bodies and nonhuman heads stand behind the snowy mountains, and a large screen displays a cyborg baby. Among the sculptures, participants must find the headset in this space to move to the next one.

In the subsequent space, participants encounter a white area covered in black lines forming squares, abstract shapes, and a baby. A liquid black object hovers above their heads. At the centre of this space lies the VR headset and a small model of the next environment. The following space is a floating white villa structure set on the sea. A human avatar greets participants with a "hello" from the upper floor. Participants can explore corridors, pools, and stairs. On the upper floor, they find the male human avatar in a booth, wearing a pink cloak. The avatar’s head follows participants' hand movements.

The next environment is a colourful, dome-shaped structure with a large central object resembling a breathing organ. Finally, participants enter a small pink box with an open ceiling, made of translucent crystal bricks. A large head at the edge of the wall moves to look in different directions, either upwards at the sky or inside the box at the participants. If participants move through the wall, they can see the body of the large figure. In this last space, there is another VR headset, but putting it on returns participants to the same space. It may take several attempts for participants to realise that this is the final space, and the headset will not transport them further.

Although the spaces in *In Between Nodes* (2021) are structured in a linear sequence preventing participants from re-engaging with previous spaces, and the virtual robot hand offers limited opportunities for exploring virtual embodiment, the artwork's diverse virtual environments present a rich ground for investigating how participant develop affective connections with certain spaces. By examining why participants feel more connected to certain spaces over others, this artwork enables explorations of the potential aspects that foster deeper immersive experiences. Additionally, the varying sizes and boundary conditions of the virtual spaces enable an analysis of how spatial design influences participant movement and engagement.

4.2.4 Movement methods in the VR art works

Three movement methods are involved in the selected VR artworks: walking, smooth navigation, and teleporting. The three artworks share qualities of room-scale movements, which allow participants to walk in the physical space while walking in the virtual space. Walking in VR is particularly effective in shaping and enhancing spatial awareness and memories (Janeh & Steinicke, 2021). However, this moving method also presents notable limitations. In a room-scale VR art experience, participants move within a preset virtual safety boundary drawn in advance by the researcher, depending on the walkable size in the physical room. This boundary only appears in the virtual environment. When participants approach the boundary, a blue grid appears, and if they touch it, the area turns red. Moving beyond the boundary causes the virtual environment to disappear, replaced by a black-and-white real-time image of the physical space captured by the camera on the VR headset. This design ensures participant safety but also introduces moments of disruption.

Smooth navigation, also known as steering locomotion, is one of the primary movement methods present in the selected VR artworks (in C1 and C2). This technique allows participants to move within the virtual space using VR controllers while remaining stationary in the physical world. Participants can push the joystick in any direction—forward, backward, left, or right—to move steadily in the desired direction. By simulating walking through joystick movements or head directions, it allows participants to move smoothly from one location to another (Christou & Aristidou, 2017). Compared to instant

locomotion in VR, smooth navigation provides a stronger sense of presence by enabling a continuous and fluid spatial experience (Clifton & Palmisano, 2019).

However, smooth navigation comes with limitations, particularly the risk of motion sickness. Also known as VR sickness, this phenomenon manifests through symptoms such as dizziness, nausea, and headaches (Geršak & Guna, 2020). It arises from a sensory mismatch between the visual and vestibular senses, where participants feel their bodies moving at a different speed than their vision in VR (Chang et al., 2020). This disconnect can lead to discomfort, limiting the accessibility of smooth navigation for some participants.

In addition to smooth navigation, teleportation serves as an alternative locomotion technique within the selected VR artworks (featured in C1 and C3). Teleportation enables participants to move instantly to a specific location by pointing the controller and pushing the joystick. In the selected artworks, participants see a blue dotted curve (in C1) or a blue square with a dotted curve (in C3), indicating their intended destination before teleporting. Teleportation is widely regarded as a low-risk locomotion method for motion sickness (Bozgeyikli et al., 2016; Prithul et al., 2021; Clifton & Palmisano, 2019). In teleportation, instant travel decreases the chance for participants to experience a continuous visual motion, thus preventing motion sickness (Prithul et al., 2021). Despite its advantages in reducing discomfort, teleportation has drawbacks regarding sense of presence and spatial continuity. The instant shift from one location to another can create an abrupt, less coherent experience (Clifton & Palmisano, 2019). Some participants may experience spatial disorientation due to the lack of continuous movement, which can disrupt their sense of navigation within the virtual world (Prithul et al., 2021).

The case studies allow participants to choose their preferred movement method—walking, smooth navigation, or teleportation—based on their individual needs and comfort levels. This flexibility not only enhances accessibility but also minimises the risk of discomfort, particularly for those susceptible to motion sickness.

While this thesis does not aim to offer a direct comparison of these three movement methods, they remain highly relevant to the investigation of participant engagement. Rather than isolating participant responses to each movement method, this thesis

considers how participants combine and adapt these movement options during their interactions with the VR artworks. The focus lies in how participants explore virtual environments through embodied positioning, and how their gestures, movements, and spatial strategies contribute to their physical and affective engagement. By attending to these embodied practices, the research demonstrates how movement functions not merely as a mode of navigation, but as a constitutive element in the co-creation of meaning and experience within VR.

4.3 The case study set-up

4.3.1 HMD VR headsets

In these case studies, the selected VR artworks were presented using Head-Mounted Displays (HMD) with the Oculus Quest 2 VR headset. HMD is a display technology that uses a head device with built-in systems and wide-angle screens, commonly used for virtual reality experiences (Shibata, 2002). The Oculus Quest 2, also known as Meta Quest 2, is an HMD headset that supports room-scale movement, built-in tracking sensors, and wireless connectivity (Meta, 2024). These features make the headset easy to set up and use in research, offering increased flexibility for movement in physical spaces without the constraint of cables. A gaming laptop was used to play the VR artwork files. In C1 and C2, the VR artworks were shared by the artist through the Oculus application library and played via the application. In C3, the artwork was provided as a Unity file, originally designed for the HTC Vive VR headset. As the file could not be played directly on the Oculus Quest 2, Steam VR was used to open the Unity file on the Oculus headset. The decision to use the Oculus Quest 2 instead of the HTC Vive was driven by practical constraints. Specifically, the research setting in a seminar room did not allow for the installation of external sensors required by the HTC Vive. Despite this limitation, the quality of the VR experience was not compromised when playing the artwork through Steam VR on the Oculus headset.

4.3.2 Space

In the selected artworks, the virtual environments extend beyond the physical space available, requiring participants to use multiple movement methods—walking, teleportation, and smooth navigation—to explore both physical and virtual spaces

effectively. The case studies took place in two seminar rooms at UCL Knowledge Lab, where the gaming laptop was set up. Room availability dictated the allocation of spaces for each case study.

C1 was primarily conducted in a larger seminar room measuring approximately 40 square metres. The spacious environment allowed participants to physically walk as they navigated the virtual rooms, closely aligning their physical and virtual movements. However, due to room availability, some participants in C1, as well as all participants in C2 and C3, experienced the VR artworks in a smaller seminar room of approximately 20 square metres.

In C2, the smaller space was not a major limitation, as participants primarily used controllers to levitate and navigate in the air. However, in C3, participants movements were notably affected by the reduced physical space. The limited room size required them to adjust their navigation, often repeating motions such as stepping back from the edge of the space before continuing forward. One participant in C3 experienced the artwork in an office space measuring 5 square metres. While this setting allowed for slight movements using locomotion, the VR safety boundaries further restricted the usable space. As participants approached physical objects, the headset automatically outlined their shapes as a proximity warning, interrupting their visions in the virtual space. This setup proved unsuitable, as the constrained space disrupted movement and visual continuity within the VR experience. Consequently, data collected from this session was excluded from the analysis due to its compromised conditions.

Overall, the size and configuration of the physical spaces significantly influenced participant movement and the quality of the data. The larger seminar room provided the most conducive environment, encouraging more physical movements. The smaller seminar room, while more constrained, remained viable for experiences that relied more on controller-based movement.

4.4 Study recruitment and overview of participants

Recruitment for the three case studies was conducted through snowball sampling and advertisement. Snowball sampling involves the researcher initially inviting a small number of participants from their personal network, who then recommend additional

participants for the study (Parker et al., 2019). This method was chosen to ensure a diverse participant pool, drawing individuals from various professional fields and levels of familiarity with VR. However, recognising that snowball sampling may limit cultural diversity due to its reliance on personal networks, an additional recruitment strategy was employed through advertisement. Advertisement is a widely used method to broaden participant pools and enhance diversity in research studies (Campbell et al., 2023). For C3, a recruitment advertisement was posted on the forum of the UCL-IOE doctoral community, outlining the study and participation requirements.

Of the 26 participants, 18 were recruited through snowball sampling and 8 through the UCL-IOE doctoral community advertisement. All participants were adults aged 22 and over, representing a range of backgrounds, including social sciences, art, film, education, medicine, and gaming. Their familiarity with VR varied; some had no prior experience, while others had limited or extensive exposure. Despite these differences, all participants shared an interest in the arts, regularly visiting galleries and museums. As a result, they were representative of a typical museum and gallery audience—individuals interested in engaging with art, regardless of professional expertise.

The gender distribution of the participants was 7 male and 19 female. This imbalance was not intentional but rather a result of practical availability. While gender was not a criterion for recruiting participants in this study, participant gender was inferred from their names. Although initial recruitment responses indicated a more balanced gender pool, some male participants were unable to take part due to geographical constraints or other reasons. Despite this imbalance, the research primarily examined participants' embodied experiences in VR art, where gender was not considered a critical factor. However, future research could explore potential gender differences in embodied interactions and engagement with VR art.

Once recruited, communication with participants was conducted via social media and email. While social media provided an efficient and flexible means of coordination, they also led to frequent schedule changes and last-minute cancellations. To streamline the scheduling process, each participant was assigned a number and given access to a Google Doc containing available time slots. The document was accessible without requiring a login, allowing participants to select their slots while maintaining anonymity.

This approach facilitated smooth coordination and ensured participant confidentiality throughout the recruitment process.

4.5 Ethics

This research was registered with the UCL Data Protection Registration office (NO Z6364106/2020/11/80) and was approved by the UCL IOE research ethics committee in 2020.

Given that the case studies were conducted in the post-COVID period (October 2021 – May 2022), additional precautions were taken to ensure the hygiene of the VR equipment and prioritise participant safety. The VR headset and controllers were disinfected with alcohol wipes after each use, and disposable eye masks were provided and required for all participants. Prior to participation, individuals were also given relevant health information, including body temperature guidelines and recent travel record considerations.

The ethical risks associated with this study were minimal. The selected VR artworks did not contain violent or sensitive imagery, and the study did not involve vulnerable groups. All participants were adults over the age of 18. Potential risks related to discomfort—such as navigating virtual environments that involve movement in the air, dark spaces, or fast-moving images—were clearly outlined in both the recruitment advertisement and the participant information sheet. The recruitment materials explicitly advised individuals with motion sickness or a fear of heights or darkness (which could trigger panic attacks) against participating. This information was reiterated to interested participants and verified again during the briefing session. Additionally, the participant information sheet included contact details for emotional support services, such as the Samaritans helpline, Anxiety UK, and No Panic, in case participants experienced distress after the study. Although a few participants reported mild discomfort related to heights and darkness during interviews, their emotions remained manageable, and no panic attacks occurred.

To ensure informed consent, participants received three documents before the study: a participant information sheet (Appendix 1), an artwork description and artist statement (Appendix 2 & 3), and a consent form (Appendix 4). The participant information sheet

provided an overview of the study, its purpose, the research process, confidentiality and anonymity measures, researcher contact details, and directions to the research location.

The consent form allowed participants to specify their preferred level of consent regarding data usage, including whether they agreed to be filmed, whether they preferred to be blurred in images and videos, and whether they consented to the use of images in publications or conferences. Before any observation or interviews, consent was reconfirmed, particularly for video recordings. For those who opted out of filming, only audio recordings were taken. The artwork description detailed the VR experience, provided navigation instructions for the virtual space (with illustrated guidance on VR controllers), and included an artist's statement. Any elements that could pose emotional risks (e.g., darkness) were clearly highlighted.

Participants' personal information (names and emails) were accessible only to the researcher. Throughout the data analysis and writing process, participant data was anonymised using pseudonyms and shared with my supervisors, Professor Carey Jewitt and Dr. Phaedra Shanbaum.

4.6 Data collection methods

The three qualitative research methods—autoethnography, observations, and semi-structured interviews—were used in this research to capture the diversity and depth of participant data necessary for understanding embodied experiences in VR art. Autoethnography allowed for a deep, reflective account of personal engagement, providing detailed insights into the researcher's evolving thoughts and feelings. It was particularly useful for exploring key research concepts like the fluidity of the body and cooperation with virtual bodies in VR.

Observations and semi-structured interviews complemented this approach by gathering data from participants with varied backgrounds, aligning with the study's theoretical focus on embodiment. Drawing on Stern's (2013) framework of embodiment as a relational process, these methods were designed to capture participants' movements, thoughts, and feelings and their mutual influences. Together, these methods provide an empirical investigation into the embodied and affective dimensions of how participants interact with and make meaning of VR art.

4.6.1 Autoethnography

In each case study within this research, autoethnography is employed to explore embodied experiences on a personal level. Autoethnography is a qualitative research approach that utilises the researcher's own experiences as the primary source of data (Cooper & Lilyea, 2022). This method is particularly well-suited for studies that require personal engagement and self-reflection with the subject matter. It entails self-observation and reflexive investigation, conducted within the context of ethnographic fieldnotes and writing (Silverman, 2017). One of the primary advantages of autoethnography is the "easy access" to data, as the researcher is the source of the data themselves (Chang, 2016). Such access allows for a more holistic and intimate exploration of the research subject that is often difficult to achieve through other research methods (Chang, 2016).

In this thesis, autoethnography is conducted through multiple visits to the three selected VR artworks. These visits enable me, as the researcher, to document the evolution of my feelings and interpretations over time. My experiences are recorded in two primary formats: detailed written fieldnotes, and video recordings. The fieldnotes provide thick descriptions, capturing changes in engagement while continuously reflecting on the research focus. The video recordings, on the other hand, document my movements in both physical and virtual spaces. Videos of physical space are recorded using a smartphone, while in-VR recordings are captured via the Oculus headset's built-in recording function. These two recordings are then edited into a side-by-side format, allowing for simultaneous viewing of both perspectives. More details of recording as a data collection method are elaborated in Section 4.6.3.

Autoethnography offers a unique advantage in studying participant experiences of VR art through processual engagement. While other participants typically experienced each artwork for approximately 30 minutes, I engaged with the three artworks for a total of nine hours across multiple visits. These repeated encounters facilitated ongoing reflection, enabling revisits of previous interpretations and exploring the artworks from multiple perspectives, shaping a more holistic understanding of the experience.

However, a common critique of autoethnography is its potential lack of diversity in data, as it relies on a single individual's perspective. To address this limitation, this thesis

integrates autoethnography with additional research methods, ensuring a more comprehensive and diverse understanding of participant experiences.

4.6.2 Observation

In this thesis, the processes of participant interactions are studied through observations and interviews. Observations were conducted during participants' interactions with the VR artworks, capturing their movements in both the physical and virtual spaces simultaneously. Observation in qualitative research is “one of the oldest and most fundamental research methods. This approach involves collecting data using one’s senses, especially looking and listening in a systematic and meaningful way” (McKechnie, 2008, p. 573). This method allows for the exploration of data by examining participant behaviour with a specific research focus (Lofland et al., 2022).

The observation process consists of two key components: first, observing participants’ bodily movements and behaviours in the physical space, and second, monitoring their interactions within the virtual environment on a computer screen, which displays their real-time engagement. Conducting simultaneous observations of both physical and virtual spaces provided a more comprehensive understanding of how participants navigated and engaged with the VR environments.

Several key aspects were examined during observations, including the types of movements participants made and the overall tone of their movement (e.g., walking cautiously), the sequence and duration of interactions with specific objects, and the nature of these interactions. Particular attention was paid to instances of creative movement or improvisation within the virtual environment, as well as repetitive patterns in movement, such as consistently looking up upon entering a new space. These patterns could indicate certain embodied habits or tendencies in how participants experienced the virtual setting.

Since participants’ faces were mostly covered by the VR headset, non-visual cues such as verbal and audible reactions—laughter, gasps, or sounds of surprise—were also noted. These observations were recorded in field notes and later used to develop more specific interview questions. By analysing participants’ physical and virtual interactions in parallel,

the study aimed to explore the mutual influences between their movements, thoughts, and emotions in shaping their embodied experiences.

Throughout the observation process, some guidance was provided to ensure participant safety and address any immediate concerns. This included reminding participants of time constraints and ensuring they remained aware of their physical surroundings. However, unnecessary intervention was deliberately avoided to allow participants to explore the VR artworks according to their own focus and logic. Providing too much direction could have structured the experience in a way that disrupted the development of their thoughts and emotions. By maintaining a non-intrusive approach, participants were encouraged to engage with the VR environments in a more personal and exploratory manner, deepening their embodied experience within the virtual space.

4.6.3 Video Recording

In the case studies, video recording was employed to document participant observations and interviews. Video is a valuable tool for capturing detailed data during participant interactions within a particular context, including their facial expressions, body posture and gestures, and ways of looking (Jewitt, 2012). It is particularly useful to study participant movements and interactions with certain objects (Jewitt, 2012). In the data analysis process, the recorded videos served as a crucial resource, allowing to revisit participant interactions in greater depth and examine specific exploration paths.

Participant interactions with the artworks were recorded using two devices. Physical body movements in the seminar room were captured using an iPhone Pro 12 fixed on a tripod, while virtual body movements and visual perspectives were recorded using the VR headset's built-in recording function. The iPhone, an existing technology available to the researcher, provided a 1080p HD camera with sufficient image and sound quality for the study. Its portability and ease of setup made it a practical choice. To ensure uninterrupted recording, the iPhone was set to aeroplane mode with Wi-Fi turned off, eliminating potential disruptions from notifications or incoming calls.

The use of an iPhone also offered the advantage of extended recording time. Many digital cameras manufactured before 2019 are subject to a 30-minute recording restriction due to regulations under the World Trade Organization's Information Technology Agreement

(ITA), which classifies cameras with longer recording capabilities as professional film/video equipment subject to higher tariffs (Information Technology Agreement, 2017). As a result, most digital cameras automatically stop recording at 29 minutes and 59 seconds, potentially leading to data loss during observations and interviews. In contrast, phone cameras are not bound by this limitation, making the iPhone a more reliable and uninterrupted recording tool for this research.

A total of 58 hours of video data and 1.5 hours of separate audio data were collected during this research. This data was distributed across the case studies as follows: 7 hours in autoethnography, 19.5 hours in C1, 17.5 hours in C2, and 14 hours in C3. The differences in the total time length across the three case studies were primarily due to the interview durations and a simplification of the recording process. Each interview in C1 lasted approximately 1.5 hours. However, as the research progressed, the interview questions became more refined and focused, leading to shorter interview durations of 45 minutes to 1 hour for each participant in subsequent case studies.

In C1, the recording process during observation was initially divided into two components: first, recording participants' physical movements in the seminar room, and second, capturing their first-person views of the virtual environment using the VR headset's built-in recording function. These video recordings were later transferred to an encrypted hard drive and edited together using Adobe Premiere Pro. However, this approach proved inconvenient for participants. For instance, if they needed to adjust the headset or replay their experience, the recording would automatically stop when the headset was removed. Restarting the recording required navigating back to the menu bar, disrupting the flow of the session. Additionally, the appearance of a red dot on the screen during recording acted as a potential distraction, affecting participants' immersion in the experience.

To address these issues and streamline the recording process, an alternative method was implemented. The researcher used an iPhone to record both the seminar room and the computer screen that displayed the participant's real-time perspective in VR. This approach allowed for simultaneous documentation of the physical and virtual spaces within a single frame, enabling a more cohesive observation of participant movements across both dimensions. It also eliminated the need to switch focus between different

screens and the physical environment, facilitating a smoother process for generating interview questions based on real-time observations.

While this alternative method improved workflow efficiency and reduced interruptions for participants, it introduced a limitation: the quality of the recorded virtual space was compromised. The resolution of the virtual environment, as captured on the iPhone, was lower than that of direct screen recordings from the VR headset. To overcome this limitation, future studies should consider integrating supplementary screen recordings that provide higher-quality visuals of the virtual space. Combining these recordings with the iPhone footage would ensure the collected data is both holistic and visually detailed, enhancing the accuracy and richness of observations related to participant interactions in both physical and virtual contexts.

Video recordings are particularly useful as they can be "'re-opened' for later analysis and capture things not noticed at the time of being present" (Jewitt, 2012). In this thesis, participant videos were especially valuable during the data analysis process, allowing the researcher to integrate observations of participants' movements, thoughts, and feelings. Additionally, video analysis provided opportunities to reinterpret specific movements and gestures after reviewing participants' interview data, offering a more comprehensive perspective on their embodied interactions.

However, the use of video as a data collection method can influence some participants' behaviour. Being recorded can sometimes lead to self-consciousness, making some participants more aware of their actions in front of the camera. One participant in the case studies refused to be filmed during the interview process. To accommodate their preference, an audio recording was used instead.

Despite these challenges, video recordings played a crucial role in constructing a holistic and detailed account of participant interactions with VR artworks. By allowing the researcher to revisit participants' real-time experiences, video recordings enhanced the depth of the analysis, ensuring a richer understanding of how participant experiences were shaped within the VR environment.

4.6.4 Semi-Structured Interview

Semi-structured interviews were conducted following participant observations to gain deeper insights into their interactions with the VR artworks. This method is particularly effective for understanding participants' experiences related to specific research focuses (Naz et al., 2022). Semi-structured interviews enable researchers to examine participants "opinions, behaviour, and experiences to narrow down the area of research that researcher is interested to discover while listening to them being involved through dialogue" (Naz et al., 2022, p. 42).

In semi-structured interviews, pre-planned questions are aligned with the main research focus, providing structure and ensuring that data collected from each participant is comparable (Naz et al., 2022). In this study, interview questions were designed around three core themes: experiences of virtual bodies, interactions with virtual objects and spaces, and the influence of prior knowledge and personal experiences. Questions about virtual bodies examined how participants adapted to and moved with these bodies, as well as their feelings toward these movements. Questions about interactions with virtual objects and spaces focused on how participants engaged with specific elements of the VR environment and the thoughts or emotions evoked during these interactions. Lastly, questions about prior knowledge and personal experiences explored how participants' previous encounters with VR, art, or related media influenced their engagement with the artworks and their post-interaction reflections.

During the interviews, pre-planned questions were asked in a flexible order based on the conversations. Additional questions were used as probes for more detailed information or clarifications. This approach provided both structure and flexibility and helped uncover meaningful connections to participant various responses.

Each interview averaged 1.5 hours in length, ranging from 45 minutes to 2 hours, totalling 30 hours of interview time. To create a comfortable and open atmosphere, the researcher employed active listening techniques, such as summarising and paraphrasing participants' thoughts, reflecting on their responses, maintaining encouraging facial expressions, and allowing silence for thoughtful pauses. These strategies fostered rapport and ensured that participants felt heard and respected while also helping the researcher accurately interpret their responses.

Data from the interviews were collected through video recordings and written notes. Interview videos are useful for understanding participants' verbal expressions combined with nonverbal expressions, retaining accuracy and completeness of the data (Wang & Lien, 2012). To enhance transcription accuracy, the recordings were edited in Adobe Premiere Pro to reduce noise and improve audio clarity. Initial transcription was conducted using iFlytek, a paid online auto-transcription and translation software, followed by manual corrections made by the researcher. During this process, additional notes on participants' facial expressions, tone of voice, and emotional cues were incorporated into the transcripts, contributing to a richer and more nuanced interpretation of their experiences.

4.7 Data Analysis process and themes

The empirical study included a set of autoethnographic data alongside 26 sets of participant data. The participant data comprised 26 interview transcripts, observation field notes, and video recordings. The autoethnographic data included a series of reflective vignettes written during the research process, accompanied by video recordings.

To analyse the data, thematic analysis was employed, combining both inductive and deductive approaches. Thematic analysis is a flexible method that enables researchers to identify, interpret, and uncover patterns within data (Braun & Clarke, 2022). Individual codes, sub-themes, and overarching themes were developed through careful categorisation of the data (Braun & Clarke, 2022). The deductive approach involved drawing on established theoretical concepts—such as embodiment, the fluid body, and intra-action—to create an initial framework for analysis. These concepts provided a structured lens through which participants' process of engagement with VR art could be interpreted. At the same time, an inductive approach was used to allow themes to emerge organically from the data. This meant closely analysing participants' own descriptions, movements, and emotional responses within the VR environment, identifying recurring patterns or unique experiences that might not have been anticipated by the initial framework.

Initially, NVivo software was used to code the interview transcripts. However, it soon became evident that the coding process risked fragmenting participant experiences,

making it difficult to grasp the interconnectedness of their movements, emotions, and reflections.

To address this challenge, storyboarding was adopted as an alternative analytical tool. A storyboard is "a frame-by-frame, shot-by-shot series of sequential drawings adapted from the shooting script" (Naicker et al., 2020). Originally developed in the early stages of film creation to visualise narrative sequences (Greenberg et al., 2012), storyboarding has been adapted in qualitative research as a visual method for making meaning of data through selected participant experiences (Naicker et al., 2020). It is seen as a creative qualitative method that can effectively draw meaning from participant experiences (Ayob & Omidire, 2021) and understand the complexity of data from the "restorying process" (Naicker et al., 2020).

Storyboarding allows researchers to visualise participants' experiential trajectories, combining observational data and post-experience interviews to track the emergence and evolution of their interpretations, actions, and emotions. In this thesis, storyboards were created using Scapple to visually map participants' movements and reflective accounts while navigating VR artworks. Observed physical interactions within the VR environment (e.g., pushing a ball into the sky, moving a chair into darkness) were documented and aligned with participants' self-reported motivations and interpretations (e.g., "I was trying to explore the boundary of the space"). These actions were further linked with interview data, capturing the reasons behind participants' actions, their emotional responses, imaginative associations, and reflections during or after the experience. Importantly, this method also enabled the analysis of how one movement shaped other interactions, showing how experiential meaning emerged and developed over time.

As shown in Figure 4, each storyboard was structured using color-coded boxes to represent different types of data and analytical layers. The green boxes indicate a series of physical movements during key turning points in the participant's journey—such as their initial entry into a room, their navigational choices, or their process of interacting with specific virtual objects. These segments of movement provide a structural backbone for the storyboard, offering a temporal anchor around which other elements unfold. White boxes capture participants' descriptions of movements, their thoughts, feelings,

personal knowledge, or associations triggered during these movements, while blue boxes present participants' interpretations and meaning-making related to the artwork or specific moments within it. These boxes were connected with lines to form a visual sequence, offering a clearer sense of the affective flow of each participant's experience as it developed.

Themes for the later stages of thematic analysis were partially developed through insights gathered from the storyboarding process. The orange boxes—used to document initial analytical reflections—played a crucial role in identifying recurring experiential patterns across participants. For instance, reflections such as "participant experienced fear when seeing their interactions with virtual objects as 'unreal'" contributed to the development of a theme around "reflective immersion", highlighting how participants engage affectively with virtual experiences beyond merely sense of presence or realistic sensory input. Similarly, reflection note like "retreat from the room due to physical and emotional discomfort" informed the theme of "contextual and flexible boundaries", discussing how both physical and emotional discomforts subtly shape and regulate participants' path of exploration in the virtual space.

Storyboarding offered several advantages for analysing the intricate data generated from participant interactions with VR artworks. This visual arrangement was particularly valuable in identifying key turning points, emotional shifts, or moments of heightened engagement. By layering these diverse data types and connecting them across time, storyboarding made it possible to reconstruct multi-layered narratives and support a deeper understanding of embodied, affective engagement in VR. This approach enabled the researcher to move beyond fragmented accounts and view each participant's journey as a continuous, evolving whole (see Appendix 7 for the full storyboarding).

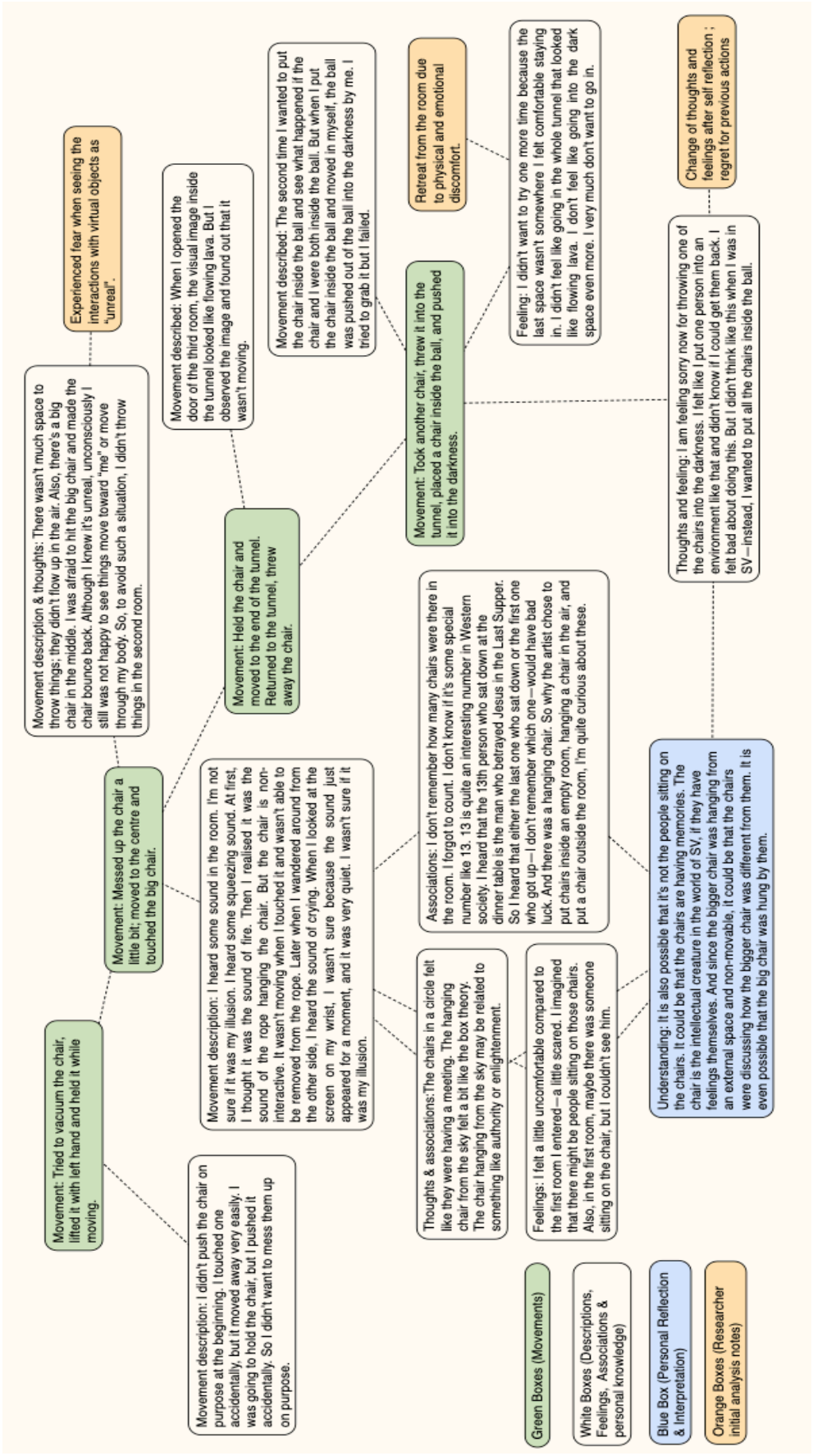

Figure 4 Participant Storyboarding

4.7.1 Overview of Themes Generated

Themes	Descriptions
Extent of agency and autonomy in exploration	
Taking initiative in interactions	Participants took initiative in their interactions with the virtual environment, creating their own paths of exploration, rather than following predefined narratives or guided interactions.
Flexible time spent in different interactions	The open-ended nature of the VR art experiences enabled the participants flexibility in interacting with the virtual objects and spaces, with the duration and frequency of their interactions dependent on individual explorations.
Creative interactions	Autonomy in the virtual space encouraged curiosity, experimentation, and playfulness, leading participants to explore individual interpretations, feelings, or questions about the artwork.
Interactions with interactive objects	Interactive objects provided responses to participants movements, which contributed to their continuous shaping of interpretations of the artwork.
Contextual and flexible boundaries	Emotional resistance can become a mean to impact or regulate participant path of explorations
Engagement of body movements	
Increased physical body engagements	When given autonomy and flexibility, participants displayed a higher degree of physical engagement, incorporating movements such as touching, sitting, crouching, and bending in their explorations.
Cooperation with the virtual body	Participants had to learn and adapt to different virtual body structures and movement mechanics, leading to a

Themes	Descriptions
	collaborative process between their physical and virtual bodies.
Interactions with virtual objects	The intangibility of virtual objects created a lower sense of risk, making participants feel less threatened when engaging with objects they might typically avoid in daily life, which can sometimes broaden their willingness to engage.
Embodied knowledge and experiences	
Influence of prior knowledge and personal experiences	Participants' prior knowledge, preferences, and personal histories played a significant role in shaping their interpretations and interactions within the VR environment.
Individual meaning-making	In the absence of verbal guidance or fixed narratives, participants generated personalised understandings of their movements and the artwork itself, constructing meaning of their movements and created individualised interpretations of the artworks.
Embodied and affective immersion	
Personal attachment affects immersion	Emotional connections to specific elements in the virtual environment influenced participants' level of immersion, shaping their affective responses and willingness to engage with the artwork.
Reflective immersion	Participants engage affectively with the artwork beyond merely realistic sensory input

These themes are discussed in the three empirical chapters (Chapters 5–7), centring around the key areas of embodiment, interaction, and immersion.

In Chapter 5, I provide an analysis of how participants physical and affective engagements mutually shape their experiences in a processual and dynamic way. Themes related to the connections and interplay between movements, thoughts, and feelings are explored. This chapter also investigates the co-creation process of participant physical bodies, virtual bodies, and environments. Themes such as "increased physical body engagement" and "creative interactions" are demonstrated, emphasising the adaptability of the participant's body and its collaboration with the VR environments.

Chapter 6 shifts focus to the individual positionalities of participants and their influence on VR art experiences. This chapter explores how participants' unique backgrounds, prior knowledge, and personal histories shape their paths of exploration within virtual environments. Themes such as "prior knowledge and personal experiences" highlight the role of individual context in determining how participants interpret and interact with VR art.

Chapter 7 addresses how participants experience immersion in a complex and multidimensional way. Themes like "personal attachment affecting immersion" and "reflective immersion" are reflected through participants' diverse emotional and personal connections to the artwork.

Together, these discussions offer insights into how bodily engagement, personal histories, and emotional connections shape participant interactions in VR art, highlighting the complex and context-dependent nature of immersion.

4.8 Limitation and reflection

The limitations of the methods designed in this thesis primarily relate to space constraints and equipment limitations, both of which affected participants' engagement with the VR artworks.

As discussed in Section 4.3.2, the research was conducted in two seminar rooms on campus, both of which had limited physical space. Since the VR artworks studied were room-scale experiences—allowing participants to physically walk around—the restricted environment sometimes disrupted the flow of their interactions. When participants reached the safety boundary of the room, they were required to walk back

and use the controller to teleport to their previous location before continuing their exploration. This repetitive need to reset movement may have discouraged physical engagement, creating an inconvenience that detracted from their engagements in the VR artwork.

For future studies, the availability of a sufficiently large physical space should be considered a critical aspect in facilitating participants' movement within interactive VR artworks. A more expansive and unrestricted environment would likely enhance physical engagement, reduce interruptions, and allow participants to interact with the virtual space with fewer distractions.

Another technical limitation in this study was the use of a wired VR headset. While wireless headsets were initially tested, they were replaced due to performance issues, such as decreased image quality and connection freezes. As a result, later phases of the study—particularly in case studies 2 and 3—relied on a wired setup. However, the presence of the wire introduced another form of disruption. Many participants were observed touching or adjusting the wire, expressing concern about its length, or momentarily breaking their experience process to manage it.

For future research, prioritising wireless VR headsets with improved connection stability and high-resolution displays could help minimise physical distractions, thereby allowing participants to remain focused on the VR art experiences.

Chapter 5. Embodied engagements: Participant experiences in VR art

Overview

This chapter discusses participants' experiences in VR art through the concept of embodiment (Hayles, 1999; Stern, 2013). As outlined in the literature review (Sections 3.1 and 3.1.1), embodiment informs my understanding of participants' experiences with VR art as a process involving a moving, thinking, and feeling body collaborating with virtual worlds. In my thesis, this conceptualisation underscores that participant experiences are contextually grounded in the artwork and shaped by their embodied connections with virtual bodies, objects, and spaces.

Drawing on empirical research data, the chapter begins by elaborating on participants' embodied engagement with VR artworks, emphasising the interconnected and mutually influential relationships between their movements, thoughts, and feelings (Section 5.1). Subsequently, Section 5.2 presents findings that demonstrate how participants co-created interpretations of the artworks through these engagements. This discussion then transitions to Section 5.3, which examines the cooperative relationships between participants and the artworks.

In Section 5.4, I elaborate on the role of nonhuman agency in co-constituting participant engagements. By illustrating how participants acclimatise to virtual bodies throughout sustained interactions, I argue that they occupy a position that is more dependent and cooperative rather than dominant or controlling. Finally, Section 5.5 addresses the significance of contextual coherence between virtual bodies and their environments in enriching participants' experiences. Drawing on a comparative analysis of participant data across three case studies, this section reinforces my argument that the participant experiences are collaboratively shaped by multiple influences embedded within the artworks.

5.1 The body as a process of moving, thinking, feeling, and collaborating with the virtual world

As discussed in Section 3.2, in the early 1990s, VR experiences have been characterised as a technological manifestation of the mind/body, physical/virtual separation. The physical body has often been viewed as detached from the VR experiences while the mind is free from its constraints (Munster, 2006). In the early 21st century, media scholars such as Bolter and Gromala (2003), Dixon (2007), Stern (2013), Popat (2016), Shanbaum (2019), and Doyle (2024), among others, have advocated for an embodied approach to comprehending new media, particularly VR. For example, Popat's work (2016) explores embodiment in VR by analysing the blurring of physical/virtual, visible/invisible, and present/absent bodies. Similarly, Doyle (2024) discusses the complexity of virtual bodies in hybrid physical-virtual experiences, highlighting how these hybrid experiences construct virtual bodies that are not merely digital representations but are deeply intertwined with participants' embodied experiences. Both scholars, along with others, stress the significance of the body, agency, and physical movement in shaping immersive experiences, moving beyond a dualistic framework that separates the mind from the body and the physical from the virtual, and instead acknowledge the interconnectedness and mutual influences of these domains.

This thesis builds on this embodied approach to understanding VR experiences, emphasising the importance of participants' physical and affective engagement in shaping their immersive interactions with virtual artworks. In this section, I showcase the process of participants' embodied engagements through the rich array of associations, questions, feelings, reflections, and interpretations they generated from interactions with the artworks. I also present how their thoughts and feelings are explored and experimented with through their individual movements within the artworks, which continuously enrich their interpretations and emotional responses during their experiences. This exploration is crucial for understanding the embodied connections between individual participants and their VR art experiences. As discussed in Chapter 1, much of the existing literature has focused on technological interactions in VR, leaving participant-oriented and embodiment-centred studies of VR art relatively underexplored (Popat, 2016; Moura, 2021a). Addressing this gap, I analyse how participant experiences

of VR art emerged and evolved through their embodied, specific, and contextual engagements.

In the following paragraphs, I present a vignette of participant Yuan's interactions within the first room in C1. The room featured five floating geometric shapes (see Section 4.2 for a full description). Throughout her engagement with the shapes, Yuan experienced a range of emotions, shifting from feelings of power, privilege, and relaxation to feelings of powerlessness and inferiority.

Vignette: From powerful to powerless

During Yuan's exploration of the first room (the Main Hall) in *Skyville*, she found a button on the wall labelled "get big for 20 seconds", accompanied by two arrows pointing upward. When she pressed the button, her perspective shifted dramatically as her gaze rose from the floor to the air. With this newfound height, Yuan could easily reach the floating geometric shapes that had previously been out of her reach. She moved towards the shapes and gently pushed them, watching as they floated away effortlessly. She described the experience as empowering, interpreting it as the ability to manipulate objects: "I can turn big and feel like floating in the air. There is a very powerful feeling because my little push can have a big impact on the object".

As Yuan continued to manipulate the objects, her sense of power grew. She felt that no one else in space held an equal position of power. She explained:

> I can control everything in this room, even though they are much larger than me. I don't feel the existence of other individual humans… I was in a more advantageous position, and my power also changed these things, so I felt more powerful and more comfortable.

Feeling satisfied and privileged, Yuan pushed the shapes around without hesitation. She watched as they moved from the air to the floor, collided with one another, and floated back into the sky. This sense of control and ability to affect her surroundings appeared to enhance her feelings of power and ease in the room.

Yuan's pleasant feelings changed during her later exploration of the room. When she returned to the first room and randomly pressed buttons on the control panel, she accidentally triggered the reset button. As a result, all the shapes in the sky returned to their original positions. At that moment, Yuan felt the presence of another power, one that could easily undo the changes she had made. She likened this power to nature and its ability to restore itself from human alterations through phenomena such as natural disasters. Reflecting on this, she said, “There is a reset button that makes everything go back into place. So, no matter what humans do to nature, nature will come back to you. There are some opposite effects”.

Acknowledging this other power—not as another human but as a much more potent force like nature—Yuan began to perceive the shapes differently. She remarked, “There are some geometric shapes that can be seen but not touched, and some uncontrollable factors, such as those placed by the outside creator”. This realisation led her to think of the myth of Prometheus’ punishment by Zeus, explaining, “I think of Zeus and Prometheus. Prometheus was punished by eternally pushing a huge rock to the top of the mountain, where it would always fall back to the bottom”. Yuan resonated with this feeling of an unreachable end, adding, “When I pushed the geometries, I felt like Prometheus. The end I thought was actually not the end; it might be the starting point for others. No matter how hard I try, there are some things I cannot change”.

At this point in her experience, Yuan’s feelings of power, relaxation, and pleasure began to fade. Rather than feeling disappointed, she accepted this reality, explaining that as an adult, she was less eager to face challenges compared to when she was younger:

> If I were still 21 or 22 years old, I might have a stronger sense of powerlessness because I had a strong desire to change things. But I am more mature now. I think this sense of powerlessness is a normal state. In society, we often experience it. We can't change most things quickly, or we can't change them at all.

Following this shift from power to powerlessness, Yuan touched the shapes again with more thoughtful and controlled movements. She pushed them gently, careful not to let them float back into the sky. During one interaction with a ball, she was observed creating a deliberate sequence of movements. She approached a ball near the edge of the first

room and pushed it into the sky (Fig. 5). She then immediately moved to the second room, where she looked up at the skylight and found the ball (Fig. 6). As she explained, “I pushed the ball over the second room, and I wanted to see where its boundary was. Even if I can't change it, I can widen its boundaries”. For Yuan, pushing the ball served as a symbolic act of testing and exploring boundaries. She acknowledged that her power was limited by other forces—she couldn't touch the unreachable objects high in the sky or make permanent changes to the room. Despite these limitations, she accepted this reality and created an alternative interaction by pushing the ball as a way to explore and expand the boundaries.

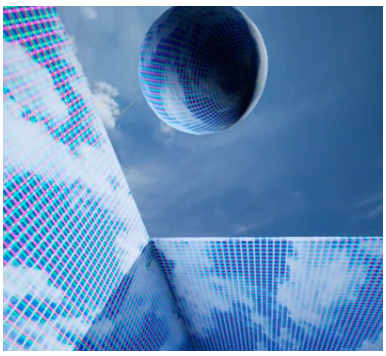

Figure 5 Participant pushed and observed the ball

Figure 6 Participant observed the ball in another room

This vignette illustrates how Yuan’s interpretations and emotions in response to her experience of the VR artworks evolved over time through her multiple interactions with the shapes. Initially, Yuan’s movements were infused with a sense of power, stemming from her belief that small efforts could have significant impacts. This feeling of power is evident in her reflections (“...my little push can have a big impact...”, “...a powerful feeling...”) and her perception of being in a more privileged position than other objects (“I can control everything...”, “...more advantageous position...”).

In the second stage of her experience, the reset button triggered a series of new thoughts and feelings. For Yuan, the act of resetting signified the existence of a higher power capable of undoing her manipulations. She associated this powerful entity with nature, which she perceived as having the ability to restore changes made by humans to the environment. This realisation brought about a change in the tone of her interactions. Her

earlier interactions, which symbolised power, control, and satisfaction, shifted to feelings of futility and endless effort, similar to “Prometheus’ punishment”, where no desired outcomes could be achieved. In response to this shift, Yuan began interacting with the shapes less frequently, instead spending more time observing them as she walked around the room. When she did engage with the shapes, her movements were more thoughtful and controlled, reflecting her new understanding and feelings about interacting with the shapes.

In the third stage of her experience, Yuan's changed interpretations of the room inspired her to find new meaning in her actions. She began pushing a ball with the intention of exploring and expanding boundaries. For her, pushing the ball into the upper space of another room symbolised an exploration of limits. This movement represented her desire to experiment with possibilities, reinterpret the artwork, and find new meaning in her actions, even though she understood she could not make permanent changes to the room. This analysis of Yuan’s three stages of experience reveals the continuous interplay between her feelings, associations, and interpretations of the VR artwork, dynamically evolving through her interactions with the virtual environment.

The process of Yuan’s interactions offers a compelling illustration of what it means for participant engagements to be embodied. Stern (2013) emphasises that embodied action involves the interconnectedness of movements, thoughts, and feelings, creating a cohesive and meaningful process. In Yuan’s example, participant movements are not merely isolated or functional actions but are intricately woven into their broader interaction with the artwork. For instance, the physical gestures participants make while navigating the virtual environment may simultaneously evoke emotional responses or trigger reflective thoughts, creating a layered interaction. This interconnectedness highlights how physical and affective engagements are deeply intertwined in shaping participant experiences. Rather than viewing movements in VR artworks as discrete, utilitarian acts, Yuan’s example underscores their role as integral components of a holistic, embodied engagement.

For researchers and VR developers, this example underscores the significance of considering participant responses as part of an integrated process. By acknowledging the mutual effects of physical and affective responses, creators can design experiences that

resonate more profoundly with users—a topic explored further in Chapter 8. In the following section, I specifically examine the co-creation process between participants and the artwork, focusing on how participants generate meaning through their interactions with the virtual world.

5.2 A process of co-creation and meaning-making

As outlined in Section 1.2, previous studies—particularly in fields such as human-computer interaction, game studies, neuroscience, and psychology—have contributed valuable insights into participant embodiment in virtual environments. For instance, Spanlang et al. (2014) explored participant movements within virtual spaces, Ichino (2022) investigated participant thoughts and feelings related to virtual bodies, and Mu et al. (2024) examined participant attention and behaviour in VR art creations. While these studies offer valuable perspectives on the effects of technological features on participant engagement, they tend to overlook the embodied and contextual meanings behind viewer movements. As previously discussed (Section 1.2), this lack of focus on embodied meanings may limit our understanding of the complexity of how affective engagements unfold during viewer interactions.

In an effort to address this gap, in this section, I present and discuss my findings related to participant VR art experiences, focusing specifically on the complexity and multidimensionality of these experiences. This discussion highlights how participants co-create meanings through their interactions with the artworks. As Shanbaum (2019) notes, “The ability to participate in the meaning-making process provides the viewer/participant with an opportunity to engage with, subvert, and restructure (within certain parameters) the underlying narratives that help shape her experience in interactive new media installations” (p. 38). In this vein, the findings of this thesis reveal that, during the meaning-making process, participants engage in a complex series of engagements, such as self-reflecting, questioning, experimenting, and even contradicting or denying their initial interpretations. This process goes beyond simply decoding the artist's intended message and includes participants’ personal, reflective contributions as they co-create the context and meaning of the artwork. In the following paragraphs, I analyse data from participants Yuan and Lora to show how their interactions

with the artworks generated their own narratives, leading to a richer, more multilayered understanding of the artworks.

In C1, participants visited three rooms connected by two wooden doors (see Section 4.2.1 for a full description). In the first room, an artist statement was displayed on the wall near the entrance. This statement was also included in the participant information sheet (see Appendix 3 for the full statement). The artist's statement included descriptions and metaphors such as “UFO”, “new class identities”, and “post-humans”. While some participants were partly influenced by the statement in their interpretations of the artwork, Yuan and Lora chose to disregard these terms. Yuan explicitly mentioned that she purposefully avoided reading the statement:

> Before I entered the room, I saw an artist statement on the wall, but I didn't read it because I didn't like to experience art with a pre-existing understanding. Because other people's explanations will affect me subconsciously, after reading it, I may experience the work according to his ideas.

Rather than adopting the artist’s framing, Yuan and Lora created their own interpretations of the artwork through individual exploration. Yuan described the artwork as encompassing three interconnected themes: the relationships between humans and nature, humans and society, and humans and the universe (further discussed in her commentary below). In contrast to Yuan’s interpretations, Lora interpreted the artwork as portraying two distinct paths of escape from judgement—one leading to freedom and the other to an abyss. Their exploratory processes are presented in the following paragraphs, demonstrating how they arrived at these differing interpretations.

During Yuan's 30-minute experience, she visited each room two to three times, taking care to thoroughly observe and interact with the objects in one room before moving to the next. Lora, on the other hand, adopted a different approach, spending the first 15 minutes exploring the three rooms individually and the remaining 15 minutes moving fluidly between them.

In the first room, Main Hall, Yuan spent ten minutes on her first visit and an additional six minutes on her second visit interacting with the geometric shapes. As described in the above vignette “From Powerful to Powerless”, Yuan experienced a shift in the power

dynamics between herself and an unknown entity in space. This led her to interpret the room as reflecting the relationship between humans and nature. Lora, however, described feeling “fun, free, and curious” as she played with the geometric shapes, putting the fragments together like a puzzle. Thus, for Lora, the first room symbolised “freedom”.

In the second room, Big Chair, Yuan spent two minutes on her first visit observing the space without touching any objects. She explained, “I first noticed the hanging rope and the crying rather than the chairs, which made me think of the cruel murder of pagans in medieval times… This room made me feel negative, so I left quickly”. Yuan's initial reflections centred on themes of death and “the existence of other humans, peers, companions”.

On her second visit, Yuan decided to explore “what I could feel or learn from this room”. She stayed for five minutes and interacted with the chairs based on her evolving interpretations and feelings. She saw the relationship between the small chairs and the big chair as “people sitting around to judge the person in the centre”. The arrangement of chairs reminded her of a biblical story from *The Book of Revelation*: “A prostitute was surrounded by people, and the priest said to people, ‘Throw a stone at her if you never tell a lie’. No one did because everybody tells lies. So, no one is more noble”. This association with unjust judgement made her feel a “desire to destroy and rebuild”. Yuan expressed this desire by taking a small chair and throwing it at the big chair, though it had no effect. She then pushed a small chair to the ground and began pushing other chairs around the room. “I wanted to release the big chair, but I could not, so I messed up the chairs in a circle because I think no one should have the right to judge anyone”, she said. She continued moving the chairs until half of the circle was destroyed. Explaining her decision to leave some chairs untouched, Yuan remarked, “When interacting, I quickly think of society because society is partly ordered and destructive, so there are some chairs that I don’t touch to maintain the order”. She also perceived the light and shadow in the room as conveying the same meaning: “The sunlight only shines on a part of the room, and the other part is in the shadows, which reminds me of social hierarchy and injustice”. Reflecting on her experience, Yuan concluded that the second room explored themes of

“the relationship between humans and society, peer pressure, and the influence of people around”.

Lora shared a similar perspective on the second room, associating it with “judgements” and “rules”. She noted, “A chair allows different groups of people to sit on it. This conveys a meaning that everyone can be the judge of others”. During her exploration of the rooms, Lora was observed moving a chair from the first room into the second. She explained that she initially felt the chair was “left out” and “excluded from where it was supposed to belong”. After placing it alongside the other chairs in the second room and closing the door, she later reconsidered her actions. Upon gaining a more comprehensive understanding of the three rooms, Lora expressed regret for moving the chair, realising that “it may be a person who is excluded from social norms…the only chair that could be seen from a larger perspective”. She described her conflicting feelings about this action, stating, “To be an outsider, one would not know anything. To be an insider, one would be very depressing”. This shift in perspective illustrates how Lora continually reflected on her experiences as new contexts emerged. She was also observed stacking small chairs into a ladder in an attempt to “save” the big chair. However, this action failed because the big chair could not be moved: “I want to save the big chair, but it cannot interact. This is a rule that it cannot be moved”. Through Lora’s interactions with the chairs, it becomes clear that she experienced them as entities evoking varied emotions. For her, the chairs not only served utilitarian purposes; they also represented life forms and community. Emerging from her interpretation of the artwork, the chairs also symbolised concepts like judgment, social rules, and constraints.

Despite spending less time interacting with the chairs than Yuan, Lora considered the second room crucial to her experience of the artwork. She emphasised, “It is the most important room in the artwork, a room that produces rules, which connects the two paths”. These paths referred to the first and third rooms. Lora perceived the first room as representing freedom, but her experience in the third room was markedly negative, describing it as uncomfortable and depressing:

> The roaring noise and moving narrower tunnel led to a black hole and an unknown world, which made me feel depressed and dizzy. The space was getting smaller inside; the more I went in, the stronger I felt this way. When I moved out to the

> completely different external space, I felt like an outsider; I felt lost, left outside, empty, dizzy.

This contrasting experience of freedom in the first room and depression in the third room shaped Lora's interpretation of the artwork. She concluded that the three connected rooms depicted "an action of escape from judgement, with two paths". She elaborated, "One direction is a wider and freer space, and the other direction is a more depressing and unknown space… one led to a broader space, the other led to an abyss".

While Lora interpreted the third room as an abyss, Yuan understood it as symbolising the relationship between humans and the universe. In the third room, Yuan spent five minutes closely observing the pictures on the wall and another nine minutes re-examining the pictures and exploring the inside and outside structure of the tunnel. She associated the images on the tunnel as "fragments of life, human memories" and the dark part outside the tunnel as "a black hole, which cannot be explored". From these associations, Yuan concluded, "The third room is talking about the relationship between men and the universe". Her interpretations of the first room also shaped her understanding of the third room, which she saw as thematically related. She noted, "The first room is about the influences between humans and nature, and the third room is about the relationship between humans and the universe, which are related to each other".

Yuan and Lora's experiences illustrate the complex and multidimensional nature of how participants generate their unique VR art experiences. While both expressed similar emotions— such as feeling that the room filled with chairs was heavy and depressing— their emotions were rooted in distinct associations and personal narratives. This highlights the interplay between participants' physical and affective engagements, which not only influence one another but are also central to the meaning-making process.

Yuan and Lora's differing interpretations align with Shanbaum's (2019) argument that participants do not engage with artworks in a purely instrumental manner; rather, they contribute to the (re)construction of their narratives. In this distributed creative process, the artist, participants, and the artwork itself collaboratively shape the narrative. Yuan and Lora's examples demonstrate how participants integrate fragments of stories—

whether derived from personal experiences or imaginative fictions—into coherent, personalised narratives. As they explored the virtual worlds, they engaged in a continuous cycle of (re)making and (re)interpreting meanings, which deepened and complicated their associations and feelings. This process enabled multilayered interpretations and invited reflective and emotional depth as their journey through the artwork unfolded.

5.3 Cooperation with the virtual body

In this section, I elaborate on how participant experiences in VR art are collectively produced through their interactions with virtual bodies, drawing on Barad's (2007) concept of “intra-action”. As discussed in Section 3.2.4, Barad’s notion of intra-action emphasises how entities are not pre-existing but emerge through their relationships with one another. Within this framework, cooperation with the virtual body, in an intra-active sense, moves beyond the idea that participants merely use virtual bodies to navigate digital spaces. Instead, this form of cooperation is open-ended and co-creative (Shanbaum, 2019), reflecting a continuous process of engagements between physical and virtual bodies and environments, stressing their collective role in co-producing immersive experiences. In the following paragraphs, I present vignettes from my autoethnography in C2 to illustrate how my physical-virtual bodily experience of VR art was a process of learning, compromising, and adapting.

In the methodology chapter (Section 4.2.2), I described Lena’s body in C2 as twisted branches flowing gently in the wind. The surrounding environment was vast and alien, evoking a sense of ancient and primitive history with no traces of human civilisation. The spaces within Lena’s world featured islands floating in the air, which were inaccessible through conventional movement methods like walking or climbing. Instead, exploration required levitation and aerial movement with Lena’s body. With my autoethnography data from C2, I present three stages of partnership between me and my virtual body, Lena, illustrating how my previous knowledge and habitual movements were compromised to adapt to a new way of movement.

Vignette: What is Lena's way?

I placed my hands relaxed at my sides, ensuring I could still use the controllers, and I began moving toward the psychedelic mushrooms. Although I couldn't see my entire body from a third-person perspective, I imagined myself moving like a piece of coral or seaweed. My (virtual) body floated in the air, swaying with the flow, my limbs extending and waving gently in the wind. It was a pleasant sensation—a feeling I would describe as free.

When I was in Alless' world (the virtual space of Skyville in C1), I often held my hands in front of my body because I needed to use the controllers. It felt natural and comfortable to see two human hands in front of me, as they were essential for the teleport movement, allowing me to see the direction I was moving in. However, in Lena's world, holding my hands in front of my body felt strange and unnatural, as though this movement was against Lena's life, habits, and her living environment (Fig. 7). I had never seen a bird flying in the sky with two feet sticking out, or a jellyfish swimming with its tenacles outstretched as if it were holding a cup of coffee. I realised that to truly experience Lena's body, I had to let go of some of my habits.

In the first stage of cooperation between Lena and me, my habitual body gestures (in daily life and in most VR experiences) became destabilised due to my interpretations of Lena's body and the alien planet. As I began to understand the characteristics of Lena's floating body and the landscape, I felt a dissonance between my usual ways of moving in VR and the context of this particular virtual body and environment. I felt compelled to adapt my movements to fit my interpreted context of Lena's body and the environment. This destabilisation marked the beginning of my adjustment to the virtual body.

Vignette: One controller

I found a new way to experience Lena's body as if I were encountering it anew. While checking if the application was running normally after an update, I entered Lena's world, holding the headset in one hand and a controller in the other. It ran smoothly. I pushed the joystick, and I began to rise. I realised that the controller in my right hand was only for up-and-down movement. Since my left hand was occupied, I decided to move vertically to check the image quality during motion. I continued ascending, observing the environment and thinking about how to improve the connection stability. After some time, I started descending, preparing to return to the ground and conclude the test. Just before reaching the ground, I noticed something surprising—I hadn't landed at my starting point but at some distance from it. Based on my prior experiences, I knew the left controller was for directional movement, while the right controller was for altitude. Using only the right controller, I had expected to move in a straight vertical line. However, the fragments left behind the body were fading away, so I could not precisely trace my movements. Curious, I ascended again and descended one more. To my astonishment, I found myself even further from my original point. I was not moving in a straight line! How would my directions have changed without the left controller that supposed to navigate my directions? I was thrilled by this discovery, as if I had accessed Lena's secret.

As described above, relinquishing control opened a space for me to perceive and engage with a different mode of movement. In this stage of the cooperation, letting go of my habitual way of moving decentred me from an experience dominated by my assumptions, prompting me to look for Lena's way. The limitation of using just one controller also challenged my previously assumed approach to movement, where I anticipated being able to move up and down in a straight line without needing the direction controller. This assumption was based on my understanding of the functionality of the controller rather than any exploration of Lena's body. In the following vignette, I present "Learning Lena's way" to show how I explored, experimented with, and adapted to a different way of moving and how this process affected my experience with the artwork.

Vignette: Learning Lena's way

I began to ascend again using only one controller, turning my head to observe the fragments left behind me. The trace was messy, undeniably not a straight line. I could not discern any regularity in the movement, which made navigating to specific locations with just one controller seem impossible. But I started to suspect that the two controllers were designed to mimic a more human-like movement, enabling the body to stand straight and face forward. But to move in Lena's way, one controller was sufficient. I looked down as I moved, and this time, I noticed a clear pattern. When I faced downward, my body moved in the direction that the top of my head was pointing (Fig. 8). I started to figure out this way of moving. I bent my upper body, pointing the top of my head toward a specific direction, and pushed the joystick. Sure enough, I moved toward the direction the top of my head was pointing. Maintaining this bent posture, I then pushed the joystick backwards, and I moved backwards instead of downward.

Figure 7 Controlling direction with the controllers

Figure 8 Controlling directing through head movements

I was very excited to discover this and decided to move toward the time-changing mushroom, aiming to land on it. My body felt strange as I was forced to keep my eyes on the ground instead of the object ahead. This made it difficult to gauge the exact distance and direction between myself and the mushroom. "If Lena had eyes", I thought, "they must be very different from mine". The journey was anything but smooth. I struggled to adapt to this unfamiliar movement style, which required me to alternate between raising my head to look at the mushroom and lowering it to move toward it. As I got closer, my clumsy movements became increasingly more obvious. I was able to move above the mushroom, but I wasn't sure how to land on it, so I slowly descended based on what I had

learned from my previous attempts. I was able to touch the time-changing mushroom, but I had forgotten that I could just reach out my hand and touch it. I awkwardly turned my back to the mushroom and hit it. Despite this inelegant manoeuvre, I succeeded, and the sky shifted to a soft orange hue.

It felt like I just went to a shop in a foreign country, where I tried all the languages I knew to describe an unknown product to the store owner, and finally, we had a successful communication... I learnt and explored this body, trying to understand and adapt its movements. And more than ever, I experienced that Lena was an alien creature who not only looked different but also lived differently.

In the third stage of cooperation with Lena's virtual body, I experimented with movements I interpreted as aligning closer to Lena's characteristics. This cooperative process was fraught with challenges arising from the differences between my physical body and Lena's virtual body. My physical body, constrained by its structure and embodied habits, felt inflexible and clumsy in the unfamiliar movement style, requiring extra time and effort to reach destinations.

This struggle diverges from the idea of the virtual body as a mere tool for accessing virtual worlds. As noted by Munster (2006), interactions with virtual worlds involve a negotiation of embodied knowledge as participants adjust to their virtual environments. This process of adjustment is exemplified in my interactions with Lena's body. Rather than effortlessly controlling the virtual body, I had to adjust my gestures and movements, adapting to Lena's unique structure, characteristics, and ways of movement. This challenging process highlights the intricate negotiation required when participants engage with virtual bodies. It highlights the complex interplay between the physical and virtual, rejecting a hierarchical model in which one dominates the other. Instead, their relationship can be understood as a co-constitutive and cooperative, shaped by a network of agential influences. These influences include the participant's physical body, embodied knowledge, and the design and affordances of the virtual body and environment.

Adopting this perspective on the cooperative relationship between physical and virtual bodies reveals significant creative potential in participant experiences. For instance, in my experience with Lena's body, adapting to her distinct mode of movement unlocked opportunities for my exploratory and creative interactions with the virtual environment (see Fig. 9–12), allowing me to engage with the virtual world in novel ways. The findings discussed in this section suggest that fostering cooperative interactions between participants and virtual bodies in VR art may encourage individuals to step outside their usual bodily habits. By doing so, they may uncover avenues for creative movement and engagement, offering participants a richer and more dynamic VR art experience.

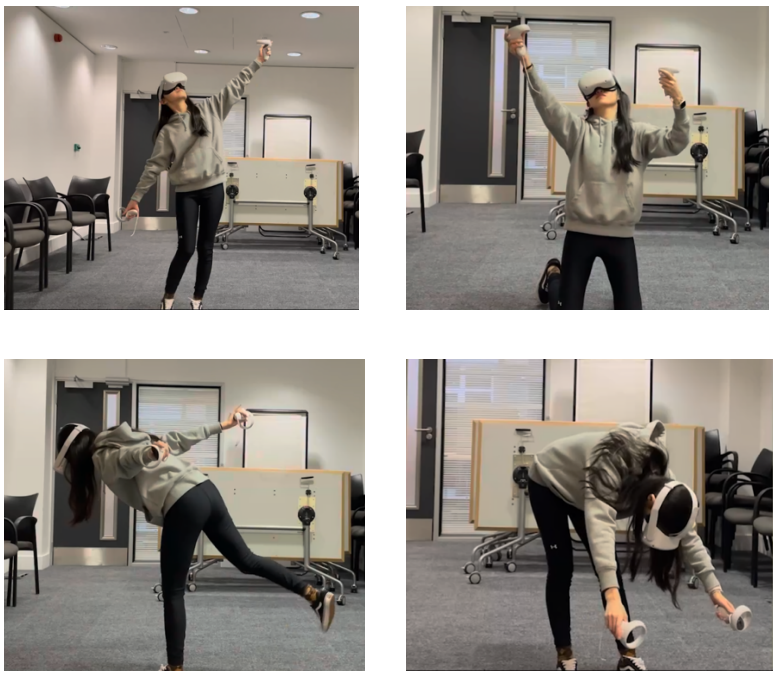

Figure 9-12 Exploratory movements with Lena's body

5.4 Resistance and acclimatization

In this section, I explore a case in which a participant resisted cooperating with a virtual body due to discomfort with inhabiting an unfamiliar identity or heightened awareness of the differences between their physical and virtual bodies. The findings suggest that while participants may resist engaging with virtual bodies, the process of acclimatisation to the virtual world can still occur through interactions with the environment. This discussion draws on the agential power of the nonhuman (Barad, 2007) in shaping participant

interactions with VR artworks. These findings further underscore the non-dominant position of participants in these interactions, highlighting how their engagement emerges as a mutually constructive process. To illustrate this argument, I turn to Fiona's experience.

In C1, Fiona embodied "Alless", a male virtual body (with a head and two hands). Having initially assumed she was embodying a female character named "Alice", Fiona was surprised to see the shadow of a male head on the wall. "I always thought he was a girl before. I found it strange to see him as a man. And my gender identity is relatively strong… I prefer my gender, and I cherish my femininity", she said. Fiona expressed her unwillingness to embody a different gendered body than her own, revealing a resistance to exploring another body and identity.

This example contrasts with the vignette I presented in Section 5.3, where I embraced a cooperative relationship with my virtual body. Fiona's resistance is evident in her observational and interview data, which show that she paid little attention to exploring the virtual body during her interactions. Additionally, her engagement with the identity, culture, history, and characteristics of Alless remained limited. However, even though Fiona's engagement with the virtual body was minimal, a degree of adaption unfolded through her interactions with the environment. In the following paragraphs, I present a vignette from Fiona's experience that shows how she gradually developed a sense of familiarity with the virtual body.

Vignette: Adapting to a virtual body

Fiona returned to Alless' home (a room in *False Mirror* where participants can travel to *Skyville*) after spending 30 minutes thoroughly exploring *Skyville*. With great curiosity, she explored nearly every corner of Alless' home, touching everything that caught her interest. At one point, she pressed a button on her wrist, and a torch lit up. As she moved through the room, the shadow of her hands fell on the wall. Noticing this, she approached a bare wall and began playing with her shadow, flipping, overlapping, and crossing her hands. This was the first and only time Fiona was observed exploring her body in the artwork.

Although Fiona had previously noticed the shadow of a male's head on the wall, she did not spend time interacting with it. After her exploration of the hands, she found a control panel in the room with an adjustable bar labelled "HAND". Pulling the bar, she observed the thickness of her virtual hands change. She didn't seem too concerned about adjusting the hands true to her size, instead pulling the bar back and forth quickly and casually. At the bottom of the panel, there were four patterns representing different materials for the hands, such as wood and metal. She chose the transparent hands with a pink grid (Fig. 12), which looked the most digital and least like human flesh.

On the left side of the room, Fiona found a screen where she could see me (Fig. 13). This screen showed an image of the physical space through the camera on the computer, allowing us to interact with each other in real time. Fiona was one of the few participants who discovered this and the only one who tried to interact with me. Excitedly, she poked at me on the screen. From my computer monitor, I could see myself from her perspective and watched as she tried to greet me by poking my face. We both laughed. I reached out one finger, and she reached out hers. Our fingers touched on the screens (Fig. 14). After leaving the screen, Fiona turned left and glanced at the wall, where she found an image of two fingers about to touch one another (Fig. 15). Intrigued, she moved closer to examine it. The image became clearly visible in the centre of my computer screen. Although there were no words communicated between us, I felt that she wanted to tell me through the screen that we surprisingly did something like this.

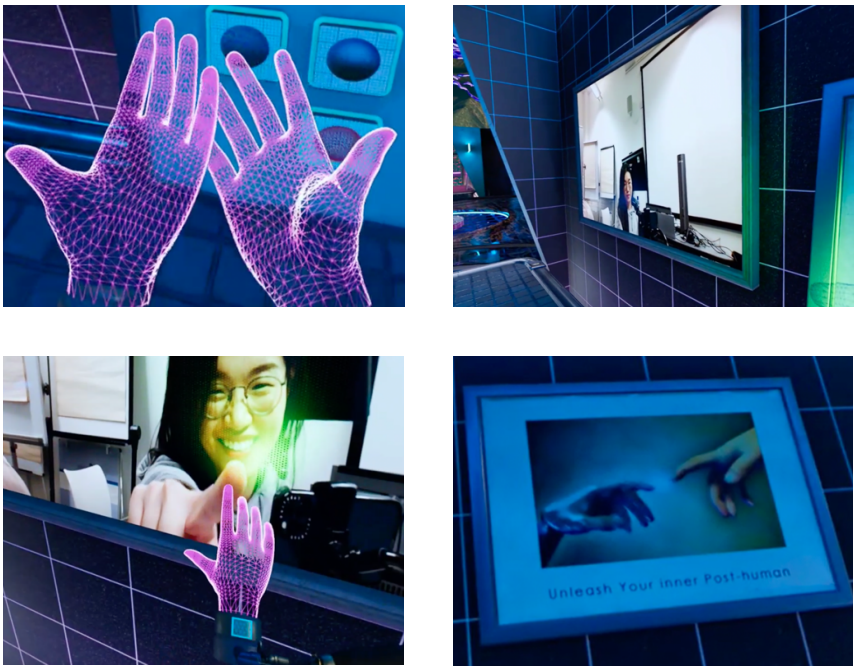

Fig. 13-16 Process of interactions between Fiona and me

When asked about this interaction in the interview, Fiona used the words “intimate” and “familiar”, which had different definitions in her view. She explained that she felt “intimate” when seeing my image appear in the virtual world, likening the experience to encountering a real-world image poster while at Disneyland. She said:

> I just feel very intimate that I saw things in the original world. I think this feeling was like waiting in a long queue in Disneyland because there would be some decoration and lighting as if I were really in another space, and then suddenly, there’s an advertisement for a product in the real world.

Seeing me on the screen reminded her of the physical world she would soon return to, which made her feel safe and relaxed. “When I saw you”, she elaborated, “I would think that in a while I would return to the space I am familiar with, and then this period of time in the virtual space became more relaxing”. The image of the physical space offered her a sense of security and relaxation. Paradoxically, though, she added, “When I see you in the real world, I feel that I am more familiar with the virtual world, but I don't know why”.

Compared to participants who exhibited curiosity and enthusiasm for exploring virtual bodies, Fiona demonstrated less attention and engagement with her virtual form. As previously mentioned, this lack of engagement diminished the depth of her understanding of the virtual body and its relation to the environment. However, despite her resistance, Fiona still developed a sense of familiarity and acclimatisation with the virtual body and world.

Fiona's experience demonstrates the relational nature of agency, as proposed by Barad (2007). In this framework, agency is more than a singular attribute possessed by humans; it encompasses a process of mutual influence that emerges through the dynamic interactions between participants, virtual bodies, and the surrounding virtual environment. Fiona's initial resistance to engaging with the virtual body frames her approaches and understandings of it in a certain way, reflecting the agential influence of her own embodied positions. At the same time, her eventual acclimatization reveals the presence of other agential forces—such as the virtual environments—that impact the formation of her experiences.

This interplay of resistance and adaptation highlights the reciprocal and non-dominant nature of agency within VR interactions. As Shanbaum (2019) describes, interactions between participants and artworks undergo a process of co-constitution. Rather than a human-centred or mastery-driven engagement, these interactions are relational, emergent, and shaped by the participant and the virtual environment. Fiona's contradictory experiences of resistance and acclimatization exemplify this co-constitutive process, illustrating how agency is distributed across humans and non-humans.

Fiona's case reinforces my argument that participant movements, thoughts, and feelings are in constant collaboration with the virtual environment during VR interactions. For VR creators, this insight carries significant implications for understanding the agential power of virtual bodies and environments. It suggests that virtual bodies and objects are not merely tools for human engagement. Instead, they are capable of shaping participant behaviours, emotional states, and interpretations of their own existence in the artwork.

5.5 Contextual coherence between virtual bodies and environments

In this section, I examine contextual coherence as a crucial aspect in enhancing participant engagement and meaning-making within VR art experiences. The term contextual coherence, developed from my study findings, refers to the alignment and correspondence between elements within the virtual environment, which together enrich participants' understanding of the artwork. This coherence fosters an integrated experience, allowing participants to connect more deeply with the virtual world and its underlying themes. Contextual coherence can manifest in various forms, such as content or aesthetic elements that reinforce each other to create a unified environment. For instance, in C2, Lena's virtual world is set in a desert climate. Here, the textures of Lena's skin, the shapes of the surrounding plants, and the ambient sounds of the wind all align cohesively to build a comprehensive sensory experience. These interconnected elements function as both experiential and narrative frameworks, guiding participants to explore and understand the life and living conditions within Lena's environment.

Lyu et al. (2023) highlight the relevance of semantic congruency between contextual and atmospheric conditions in virtual environments, pointing out that when sensory elements like space, objects, weather, and light visually and contextually correspond, participants can form meaningful connections with these features, enhancing their sense of presence and immersion in the virtual world. Similarly, Anastasocitis et al. (2024) emphasise the role of multisensory approaches—including audio-visual, haptic, and kinaesthetic elements—in strengthening participant immersion and their sense of inclusion in the experience. Jewitt et al. (2021) add that multisensory engagement with VR is not only physical but also socio-cultural, contextual, and affective. Participants engage with virtual objects on multiple levels—seeing, hearing, feeling, and imagining—which creates layered interactions that contribute to a deeper understanding of the virtual space.

Building on these studies, my findings suggest that contextual coherence between virtual bodies and environments fosters a deeper connection with the virtual world. When virtual bodies and environments share a coherent thematic and sensory framework, participants can establish more meaningful connections with the VR experience. For

example, participants reported feeling more engaged and connected to their virtual body when its appearance and movements aligns with the understood themes they have drawn from the virtual environment. Even when the virtual body was vastly different from the participant's physical identity, coherent relationships between the body and the surrounding space helped participants bridge such gaps and form more immersive, meaningful experiences. Together, this alignment of bodies, spaces, and objects enriches the contextual backgrounds of the artwork, providing participants with more opportunities to experience it from multiple dimensions. In the following, I compare participant experiences of virtual bodies across three case studies to elaborate on this dynamic.

In C2, participants experience an alien world through the body of Lena (Fig. 16). The findings suggest that participants generated rich interpretations of the virtual space and body through contextually related elements in the environment—such as climate, geography, objects, shapes, sounds, and ways of movements. For instance, Shira interpreted Lena's skin as thick and capable of retaining moisture, which was influenced by her understanding of the alien space as having a desert climate. She explained:

> The place where Lena lives feels like a desert climate; my first reaction was the equator. And her skin is like a lizard; it can lock in moisture, so it is not easy to lose water, so she may not drink water for a long time.

As Shira floated between giant rocks in the space, she made connections between the texture of Lena's skin and her movements among objects. She noted, "The colour of Lena's body is also very dark, dark silver; it feels very thick, can block ultraviolet rays and harmful rays, and also is not easily scratched". In Shira's experience, the design elements of the alien world—including the desert climate, the textures and shapes of the plants, and the appearance of Lena's skin—all contributed to a holistic understanding of the setting. These elements resonated with one another, allowing the participant to piece together Lena's biological nature and living habits.

Zoey's experience offers a contrasting interpretation while still demonstrating the role of contextual coherence in understanding Lena. Unlike Shira, who saw Lena's skin as thick

and resilient, Zoey perceived Lena's body as fragile: "I feel that Lena's body is a very fragile body, a body that is made up of hard, sharp but fragile tentacles". She explained:

> When I get close to some plants, I don't know if it's because the plant may be poisonous, like the bright-coloured fungus; I feel that Lena's body is a little stiff, resists approaching it, and its body movements become less free and soothing. It seemed forced, stuttered, and slow.

Zoey's observations of the environment and the body's movement evoked feelings of anxiety and nervousness during her interactions. She added, "When I get close to some surface, like a hard, sharp, or hot surface, I panic a little, afraid that the body will break".

The examples of Shira and Zoey's experiences illustrate how participants formed individualised understandings of the virtual body and space by connecting various elements in the environment. The rich context of the artwork functioned as a collection of diverse fragments accessed by participants in unique and personal ways. Shira and Zoey's non-linear, open-ended, and diverse explorations also show the value of granting participants undirected choices to compose individual interpretations in enhancing their embodied and affective connections with the artwork, which I discuss further in Chapter 7.

In comparison to C2, participants in C1 and C3 reported less feedback regarding the contextual relevance between the virtual bodies and spaces. In C1, participants could see two human hands attached to interactive devices and the shadow of a male's head and hands in light (Fig. 17). As they progressed toward *Skyville*, they first encountered Alless' home—a futuristic space filled with screens, panels, a car mounted on the wall, and models of Alless' head and hands. Despite being introduced to Alless' identity, most participants did not feel a strong connection to the virtual body during their experiences. For instance, Aiden remarked:

> I remember you told me: I would start my role as a person called Alless. Actually, I didn't take on this role a lot, maybe because I don't know much about this identity. Many times, I think of myself as myself, and then I try to explore.

Quinn echoed this sentiment, saying, "I didn't really feel the existence of Alless. I felt that it wouldn't make much difference without the avatar. I didn't get the meaning of Alless".

Rachel further highlighted this disconnect by pointing out the lack of contextual information about the virtual body: “I didn't know who Alless was, how he grew up, how he was created. I didn't have enough background about Alless that could help myself immerse or get to know what kind of world I was in”. These participant reflections suggest that the lack of contextual coherence surrounding the virtual body negatively impacted their ability to construct a meaningful understanding of Alless’ identity and its relationship with the virtual environment.

A similar issue arose in C3, where a robotic hand served as the virtual body. Neutral in terms of gender, species, and age (see Fig. 18), the absence of contextual information left participants struggling to identify or interpret its characteristics. During interviews, participant reflections on the virtual body were notably infrequent compared to the other two cases. Most feedback suggested that the virtual body was not considered an integral part of the artwork’s context. Ruth, for example, commented, “The hand was instrumental. It was not something that I was really interested in seeing. I knew that it was there because I needed to use it. But it was not something that I was very, very conscious of”. Similarly, Kiana reflected, “In terms of my virtual body, I think I rarely noticed anything different.”

The participants’ responses to the virtual bodies in C1 and C3 stand in contrast to their responses in C2, where participants constructed various interpretations of Lena’s background—such as her biological traits, habits, and lifestyle—based on the surrounding environmental cues. In those instances, participants were able to make sense of the virtual character by drawing inferences from spatial design, ambient sound, and symbolic elements, which contributed to a more engaged and affective sense of embodiment. The differing responses underscore the importance of contextual framing in shaping participants’ interpretive and emotional connections with virtual bodies. When such contextual scaffolding is lacking, as in the case of Alless and the robotic hand, participants may struggle to locate themselves within the narrative of the artwork, resulting in detachment with the virtual bodies.

Notably, both Alless’ and Lena’s bodies incorporated interactive elements—Alless’ hands were equipped with various interactive tools like a torch, vacuum device, VPN device, and a screen, while Lena’s limbs could grow alien plants. Despite both bodies being

interactive, Lena elicited more complex affective responses from participants. This difference can be attributed to the comprehensive understanding and emotional resonance participants developed through their interactions with Lena's body. For instance, in Zoey's case, Lena's body was perceived as fragile and highly sensitive to danger, leading participants to engage with it more thoughtfully and empathetically. This outcome aligns with the findings of Tong et al. (2021), who argue that the depth of participant engagement in VR is not solely determined by the quantity of interactive features but is also significantly influenced by the degree of participant autonomy and the meaningful integration of interactions into the broader narrative and experiential context. Lena's design encouraged participants to interact in ways that felt connected to the virtual environment, enhancing both emotional involvement and the richness of their experiences.

The comparison of participant experiences with the virtual bodies across the three case studies demonstrates varying levels of attention, engagement, and interpretation. Compared to Alless and the robotic hand, participants formed more complex understandings of Lena, particularly regarding her biological characteristics, life, history, and emotions. These findings suggest that the depth and complexity of participants' interpretations and emotional connections with virtual bodies are closely tied to the contextual coherence between the virtual bodies and their surrounding environments. Coherent contexts appear to provide participants with fertile ground to autonomously and creatively construct meanings, fostering richer engagement with the artworks.

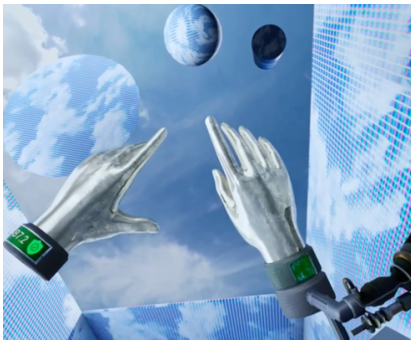

Figure 17 virtual hands in C1

Figure 18 virtual hands in C2

Figure 19 virtual hands in C3

Through the lens of contextual coherence, the findings in this section further highlight the virtual body as more than just a functional tool within the virtual environment—it is an

integral part of the participant's immersive experience. The examples presented show how participants' experiences of the virtual bodies evolve into a multidimensional and mutually shaped process. This analysis aligns with the broader discussion in my thesis on the cooperative relationship between participants' physical and virtual bodies, where the body becomes a site of interaction, negotiation, and meaning-making. This discussion provides a crucial foundation for exploring how embodiment in VR art can be further enriched through intentional design strategies, which I elaborate on in Chapter 8.

5.6 Summary

Findings in this chapter ground the concept of embodiment within the context of VR art experiences, showcasing how this notion can be studied and analysed through real-world applications. This chapter analysed participant experiences across several case studies to illustrate the processes of their dynamic, mutually influential engagements. These analyses supported my overarching argument in this thesis, emphasising that participant interactions with VR art unfold as embodied processes of moving, thinking, feeling, and collaborating with the virtual environment.

Embodiment, in this context, emerges through participant's rich physical, sensory, and emotional engagements, which are continuously shaped and reshaped by their interactions with virtual content. Extending Stern's (2013) conception of the continuum and relational nature of physical and affective engagements, the findings further underscore the cooperative dynamics between participants and artworks in the emergence of embodiment within VR art.

The analysis revealed that meaning in VR art does not necessarily arise from mastery or control by either the artists or participants. Instead, it seems to emerge through the reciprocal influences between human and nonhuman agencies. These findings reinforce Barad (2007) and Shanbaum (2019)'s arguments of the co-constitutive nature of interaction. By integrating their perspectives into the VR context, the findings illustrate how meaning arises through dynamic interactions where participants learn, compromise, and acclimatize to virtual bodies and environments.

The findings in this chapter demonstrate the non-dominant role of human agency within these relationships, positioning VR art experiences as collaborative processes that

exceed hierarchies of control. By emphasising the cooperative relationships, this thesis advocates for a non-binary perspective that integrates participant movements with emotions and contextual meanings, affording greater opportunities for complex and multilayered interpretations.

Chapter 6. The body in virtual space

Overview

In this chapter, I focus on the connection between participants' positionalities, prior knowledge, and personal experiences to demonstrate how this significantly influenced their interactions with VR artworks. While previous qualitative studies have explored participant interactions with virtual spaces, as discussed in Chapter 1, this thesis focuses on VR art experiences and the connections between physical and virtual realms in shaping participant experiences. This approach highlights the possibilities for participants to bring their embodied experiences into virtual art spaces. I argue that such embodied and situated contexts play a crucial role in shaping participants' individualised choices, movements, feelings, and interpretations of such artworks.

This chapter begins by examining the fluid boundary of the body (6.1). I discuss how participants bring their habitual movements and prior knowledge into their interactions with virtual bodies, exploring what it means for the body to be conceptualised as fluid and open to changes within VR art experiences. In Section 6.2, I touch upon the posthumanist notion of the body's hybridity. Through participants' encounters with virtual bodies of various forms, material properties, genders, and characteristics, I demonstrate how the body exists as a flux of human and nonhuman components. Section 6.3 compares participant data to further elaborate on how their interpretations and interactions with Lena's body were shaped by their personal backgrounds, preferences, habits, and perspectives. Drawing from several examples, I illustrate how participants' potential experiences with virtual bodies were influenced and, to some extent, limited by their embodied knowledge and personal experiences. In Section 6.4, I focus on how participants' embodied knowledge impacted the ways they interacted with virtual objects. By comparing participant movements, I highlight the importance of enabling personalised engagements and how such interactions foster affective connections with the artwork.

In Section 6.5, I address the presence of mind/body dualistic perspectives observed in participant data. I demonstrate the coexistence of participants' embodied connections

with the artwork alongside their dualistic understandings of the body and VR. Through this discussion, I explore how such dualistic perspectives may influence participants' expectations of VR experiences. Finally, I show how certain design elements of the VR art experience can evoke feelings of separation from participants' physical bodies. These include limited contextual coherence between the virtual body and space, difficulty in performing certain movements, or unnatural sensations when using the controllers. These experiences, as the data suggest, can contribute to a sense of separation between participants' physical and virtual bodies and further reinforce dualistic understandings of VR experiences.

6.1 The body beyond the skin

In Section 2.4, I outlined how posthumanist scholars have challenged traditional humanist views of the body as a closed and independent entity. Notions of fluidity and hybridity in such contexts, as previously discussed, underscore the idea that the body is not a static or isolated entity but rather one that is constantly evolving and being reshaped through its interactions with the broader environment (Haraway, 1985; Hayles, 1999). In my thesis, the fluidity of the body is explored through how participants bring their embodied knowledge into their engagements with VR artworks. In this section, I focus on Shira's experiences in interacting with Lena's nonhuman body in C2 to illustrate the fluidity of the body within the context of VR art. By analysing Shira's experiences, we gain insight into how her interactions with Lena's body were deeply shaped by her personal preferences and habits.

In C2, Shira began her experience in Lena's world with a mixture of excitement, confusion, and fear. She remarked:

> This environment was completely unfamiliar to me, and I had never been there. I would be cautious. I didn't dare to explore things because I was afraid that they might have some interactions with me. And I didn't go to high places because I was worried that I would be afraid of heights.

Lena's ability to float in the air encouraged most participants to start their experiences by levitating. However, Shira, expressing insecurity in the strange world and a fear of heights, initially stayed close to the ground during the first ten minutes of her experience. Despite

her apprehensions, Shira noted that staying on the ground would prevent her from fully engaging with the alien world, as most objects floated in the air. Therefore, she decided to ascend, but instead of rising directly into the air, Shira chose a gradual and smooth ascent. She was observed spiralling upward from the basin, slowly moving up the shallow hill, and then finally into the air. Shira's careful approach allowed her to overcome her fear while maintaining a sense of control throughout her exploration. Even as she grew curious about the higher spaces, she consciously managed her altitude. Reflecting on her experience, Shira noted, "I didn't dare to go up because I was afraid of going too high... But I kind of regret not going up there and exploring to see how high I can go".

As this example suggests, Shira's embodied knowledge and experiences were deeply integrated into how she moved, thought, and felt in relation to her virtual body. Her movements—including staying close to the ground, ascending in a spiral shape, and limiting the height of her explorations—reflected how her fear of heights was transformed into strategies for interacting with the virtual body.

This entangled relationship between the participant and VR art experience is further demonstrated by Shira's transformed habitual movements, carried from her physical body into her virtual interactions. As previously mentioned, participants moving with Lena's body could see two limbs emerging from the position of their head and two additional limbs in the positions of arms. During Shira's experience, she repeatedly moved Lena's upper limbs, which she called "hair", to the sides of her head. She explained, "I had a feeling that I wanted to cut my hair [referring to Lena's upper limbs]. I think the tentacles could be cut a little shorter because it is really blocking the way, it blocks the view". Shira's descriptions of her movements suggest that she brought the knowledge of her own body structure into recognising and interpreting the virtual body. Having short hair with a split fringe herself, Shira brought her personal preference for hairstyle and habitual movements into her interactions with the virtual body. She remarked, "There is a familiar feeling when I push aside my hair [referring to Lena's upper limbs] because I have short hair most of the time, so I have a habit of moving my hair to the sides".

This example demonstrates the intertwined relationship between Shira's unique embodied history and her engagement with the artwork. Through her knowledge and

interactions with Lena's limbs, it becomes evident that Shira's body characteristics, habitual movements, interpretation of Lena's body, and repeated physical gestures were intricately interconnected. The analysis of her experience illustrates what it means for the body to exist beyond the skin in the context of VR art. These findings highlight the importance of viewing participant bodies as a dynamic interplay of embodied knowledge, where movements are not merely mechanical but imbued with personal significance and meaning.

In the following section, I explore the sense of hybridity experienced by participants in relation to virtual bodies. By examining the hybrid nature of their physical and virtual bodies, I further analyse how embodied knowledge influences participant interactions with virtual bodies.

6.2 The hybrid body and situated knowledge

Haraway (1985) describes hybridity as a fluid, evolving entity continuously shaped by environmental, socio-cultural, political, and technological forces. As discussed in the literature review, the body in hybridity challenges traditional binaries—such as male/female, human/animal, and living organism/machine—by presenting the body as an amalgamation of intersecting elements. This concept informs my thesis in two key ways. First, it conceptualises participants' embodied knowledge as emerging from a body that exists in a perpetual state of flux between human and nonhuman components. Second, it situates embodied knowledge within the specific contexts of each participant's unique VR art experiences, emphasising its dynamic and contextual nature. Applying the concept of hybridity facilitates a non-dualistic discourse in understanding participant experiences of virtual bodies, disrupting conventional dichotomies such as physical/virtual and human/nonhuman by foregrounding the entanglement of these categories within VR contexts.

In the following paragraphs, an analysis of William's data illustrates the multiplicity of his experience with Lena's body—encompassing different genders, materials, and forms. The entanglement of human, nonhuman, and fictional elements in William's interactions underscores the posthumanist perspective that participant experiences of virtual bodies do not originate from an "original" or "authentic" self but from a continuously evolving

hybrid self, one shaped by personal experiences, interests, expertise, and cultural background.

Unlike Shira, who saw Lena's limbs as hair, William experienced them as being more distant from the human body. During his initial experience, as he familiarised himself with Lena's body, he found the limbs so unlike his own that he did not understand them as hands. He explained, "I found out that my [Lena's] hands can only be used to generate some plants, and there is no very practical use... I didn't know they were hands until you said they were hands". For William, the seemingly impractical "hands" led him to perceive them as tails instead. He later described, "I think they are like an animal's tail, swinging with people's movements. I experienced it as the tail, not as the main limb".

During the initial phase of his interaction with Lena, William felt a sense of detachment from his familiar human body. Although Lena's limbs appeared where his hands would be and mirrored his movements, he did not perceive them as human-like or as extensions of his own body. This marked the first instance in which a nonhuman body experience emerged in William's descriptions.

Despite initially perceiving the limbs as two swinging animal tails, once William grew accustomed to the virtual body, he embarked on a journey driven by curiosity and a passion for game design. Unlike some participants, who generated alien plants to understand their biological characteristics (like Yoko) or to seek companionship within the virtual space (like Hannah), William engaged with the plants to study their designs and technical properties. He began by generating numerous alien plants in the air to analyse their patterns and then interacted with them individually to explore their properties and the functions of the limbs. He described his process as follows:

> I started by exploring the relationship between the colours of seeds and the objects they correspond to, so I planted a lot of mushrooms in the air to observe their relationship... Then I started to explore the physical properties of mushrooms, whether they could react to my interaction, and then I found some patterns... I also observed that the two hands on my head and those on the hands react differently when hitting objects, with the head [virtual hands in the head] bouncing off the object and the [virtual] hands passing through the object.

From animal tails to digital artefacts, William's interpretation of Lena's body continued to evolve over the course of his explorations. At one point, William entered a portal in Lena's world, which led him to the upper space of the rooms in *Skyville*. He descended from the air and entered the second room through the skylight, approaching the large chair suspended at the centre. "I heard the sound of fire", William said. He waved his arms in the air, trying to touch the big chair, and explained his reasoning, "The shape of Lena's body looks a bit like a branch. I walked over to let it burn, but there was no response". William's attempt to set Lena's body on fire further illustrates how he imbued the virtual body with material properties, interpreting it as wood. From William's interpretation and interaction with Lena's body, it can be observed that he experienced the body in a hybrid form—part animal, part plant, and part digital artefact.

In our interview, William also revealed the fictional dimension of his experience with the virtual body. He described how his expectations of interactions within the virtual world were influenced by media references, particularly the film *Avatar*. William drew parallels between his virtual experience and the film's depiction of Neytiri, the female protagonist, noting:

> I would naturally imitate the behaviour of the girl in the movie and expect similar settings in the movie. For example, the plants in *Avatar* can be connected with the girl's hair to communicate. So, I'm also expecting some changes in how mushrooms interact with me.

Additionally, William associated Lena's body with Nüwa, a goddess in Chinese mythology. Specifically, he connected his actions of generating alien plants in Lena's world with Nüwa's mythological role in creating humans from mud. He remarked, "I can generate a lot of mushrooms, which reminds me of Nüwa creating humans".

William's example illustrates the posthumanist assertion that there is no such thing as an original or authentic self, but rather hybrid entities where the boundaries between human and nonhuman bodies blur (Haraway, 1985; Nash, 2006; Braidotti, 2013). His experience of Lena's body exemplifies this hybridity by viewing it as a fusion of multiple elements: a tail-like appendage on the head, the physical attributes of wooden branches, the communicative abilities of Neytiri, the creative power of Nüwa, and his own

professional identity as a game designer. In his experiences, it becomes difficult to distinguish which aspects of the experience belong solely to “William” as they are enmeshed in his ongoing and evolving bodily experiences.

This example highlights how the fluidity and hybridity of the body manifest through participant interactions with virtual bodies and environments. Embodied knowledge, in this context, is embedded within this sense of fluidity, brought into the interaction by the participants themselves. William’s hybrid experience reflects how embodied knowledge informs and shapes participants' interpretations and emotional responses to VR artworks. This knowledge enriches their engagement while simultaneously defining and constraining it, as it is deeply rooted in their personal, cultural, and historical contexts. I expand on these ideas further in the following section, unpacking how embodied knowledge operates within VR interactions and exploring its implications for understanding participant experiences.

6.3 Individual positionalities and participant experiences

Building on my previous discussion of the close relationship between participants’ embodied knowledge and the formation of their VR art experience, this section examines in greater depth how individual positionalities impact their experiences with VR artworks. Positionality refers to “the individual social and political context that creates a person’s identity… and how such markers influence the stance people take, or what they can access, in society” (Hayes, 2023, p.1). In the context of my thesis, participant positionality encompasses the specific backgrounds, personal characteristics, and experiences that contribute to the unique ways in which individuals move, think, and feel when interacting with VR artworks.

This perspective does not aim to establish a generalised link between specific participant traits and responses in VR. Instead, it emphasises the localised and experiential nature of these engagements. The experiences of virtual bodies and the meanings participants construct within VR art are deeply rooted in the interplay between their embodied knowledge and positionalities. These positionalities reflect the diverse ways in which individuals navigate and interpret virtual environments, influenced by their distinct historical and social contexts. To illustrate this, I present an analysis of Colton and Hannah’s experiences in C2.

Colton and Hannah developed distinctive interpretations of Lena's body, shaped by their unique positionalities and embodied knowledge. Hannah, who has a background as an artist, expressed her interest in imagination:

> I'm a painter, and when I paint, I think of it as an escape from reality. So, when I am in the virtual world, I am also willing to believe what I see and feel. I will not keep myself but will immerse my emotions and thoughts in this world and let myself enter this illusory world.

Hannah further explained her current life circumstances, which contributed to her desire for escape: "I am now going through a period of confusion about my life choices. So, I really enjoyed going through a whole different world and escaping the troubles of reality". With her artistic background and expressed interest in imagination, Hannah perceived Lena's body as an alien organism possessing its own biological structure. Demonstrating keen attention to detail and imaginative interpretation, she described Lena's limbs and skin as having distinctive biological characteristics:

> It looks like antennae, very thick antennae. Sometimes, I see light inside, a bit like flowing lava, lighting up for a while and then returning to its original appearance as if there is dust covering the light. I imagine that this body has its own energy.

Hannah also engaged critically with the two limbs positioned where human hands would typically be, drawing on her knowledge of human anatomy:

> I naturally substitute my limbs into its four limbs, and I think the bottom two are hands, so I will substitute my usual hand habit and try to treat it as my hand. But maybe it's not a limb at all; maybe it doesn't fit our concept of a body.

Her descriptions reflect a blended experience of Lena's body that involved her existing knowledge of human anatomy alongside her imaginative observations of an alien form. This interpretive approach extended to her observations of the illuminated bubbles produced from the body and the fragments it left behind: "The body will produce something, just like a living being, which can reproduce or excrete. I imagine this body has its own way of metabolism". Hannah's use of terms like "produce", "excrete", and "metabolism" reveals her interpretation of Lena as possessing a biological nature akin to

animal life. These insights illustrate how her knowledge, artistic perspective, and attentiveness informed her unique understanding of the virtual body.

Colton's interpretation of Lena's body differed significantly from Hannah's, influenced by his positionality as a first-time VR user and his unfamiliarity with the medium. Lacking experience with the controllers used for movement and interaction, Colton described feeling "disabled in some way", reflecting his difficulties adapting to Lena's body. He elaborated on this sense of disability: "We can function in life within a body, we can exchange ideas, get things done, solve problems, go from A to B. I couldn't really do that [with Lena's body]". Colton's struggles with controlling the virtual body were evident during his interactions. He frequently misjudged distances, moving past or through objects he intended to engage with. This difficulty influenced his interpretation of the fragments left by Lena's body. When asked about these fragments during the interview, he reacted with surprise: "Oh, so I did damage the body". He explained, "When I walked into something, I thought, 'Oh, I probably damaged it, the bits are sort of falling off'". The concern of harming Lena's body limited the degree of Colton's explorations with the body. "You don't want to make mistakes", he said, "so whatever the body I've been given, I don't want it to die. I want to continue and enjoy its world and experience and interact with things".

Colton also expressed dissatisfaction with Lena's slow movement speed, which he attributed to his own impatience:

> The only thing I didn't like was slow. I would like it to be a bit quicker; perhaps I'm just an impatient person. So, you know, I like to kind of go and have a go at things really quickly. Whereas we have to take a little bit of time for Lena to move.

This frustration culminated in Colton choosing to sit during part of the experience, feeling physically tired from standing and waiting for the virtual body to travel. This led him to characterise Lena's body as "heavy" and "overweight". Colton's sense of immobility also shaped his interpretation of Lena's flying ability. Unlike Hannah, who envisioned Lena as a self-contained alien creature capable of flight, Colton imagined Lena's body as "attached to a flying thing... something to make it move, to carry it around". This

interpretation was also informed by his personal experiences with paragliding: “I'd have a go at it; I've used it, so like a glide paragliding. It’s something like that”.

Hannah’s and Colton’s experiences highlight how their interactions with Lena’s world were deeply situated in their individual positionalities and shaped by their specific engagements with the artwork. Colton’s unfamiliarity with VR and his struggle to align his physical and virtual movements led to more restricted interactions, characterised by concerns about damaging Lena’s body, a sense of impatience, and difficulties adapting to the virtual environment. His personal experiences with paragliding and physical tiredness were also reflected in his understanding of the virtual body. In contrast, Hannah’s artistic inclinations, attention to detail, and desire to escape from real-life stress enabled her to approach the virtual world with curiosity and imagination. Her interpretations of Lena’s body as an alien organism, coupled with her ability to creatively explore its biological and fantastical traits, allowed her to engage with the experience from a different perspective.

Their distinct positionalities acted as boundaries that shaped and differentiated each participant's VR art experience. These findings illustrate how embodied experiences are rooted in each participant’s unique perspectives, which simultaneously enable and constrain their engagements. It is through these individual lenses that immersive VR experiences take shape, offering participants highly personalised and varied encounters with the artwork.

In the following section, I explore how participants’ situated experiences impact their ways of moving and experiencing the artwork, further emphasising the role of embodied knowledge and personal experiences in shaping VR art interactions.

6.4 Embodied knowledge and movements

Recognising that participant experiences in VR artworks are deeply rooted in their personal backgrounds, I now provide another example to illustrate the connections between participants’ embodied knowledge and their movements within the virtual environment. The findings suggest that embodied knowledge strongly influences participants’ choices and processes of interaction within the virtual space.

Lena's world in C2 was filled with strangely shaped alien objects. Among these, Shira and Colton had contrasting understandings and feelings about certain objects in the space, such as a spiky green object on the ground and three giant time-changing mushrooms on a floating island. Colton developed a strategy for distinguishing harmful objects based on their appearance. He stated, "In theory, if something looks ugly, then it's dangerous, I suppose. And if it's pretty, like a flower or something, then it's safe". Colton provided examples to illustrate his point:

> The mushrooms look fine. So, it's quite curious. It's okay to go and touch them or walk into them. But maybe the green thing with tentacles, I was not sure about that. I thought maybe some harm could come to me, I suppose.

Colton saw the mushrooms as attractive and safe, while the spiky green object seemed unappealing and potentially harmful. These interpretations were reflected in his movement patterns within the VR environment. When encountering the green spiky object, Colton moved quickly past it, showing no interest in exploring it further. In contrast, his movements were noticeably deliberate and exploratory when interacting with the mushrooms.

Due to his inexperience with VR environments, Colton had difficulty navigating with the alien body, where his movements were predominantly linear—forward or across objects—while avoiding more complex motions, such as moving backwards or in circular patterns, which likely felt more challenging or effortful. However, when Colton approached the mushrooms from a distance, he carefully adjusted his position, realising he had moved past them, and deliberately descended from the top of the mushrooms to their base. He repeatedly turned his body to ensure he could maintain focus on the mushrooms if he accidentally moved away. This sequence of precise and considered movements reflected his strong interest in the mushrooms, which he described as "fine, safe, and curious". Colton's selective movement patterns highlight how participants' processes of interaction with virtual elements are deeply tied to their embodied experiences, preferences, and interpretations.

Unlike Colton, who was wary of the spiky green object but intrigued by the mushrooms, Shira had the opposite reaction. Upon seeing the large, spiky, bright green object on the

ground, Shira moved toward it without hesitation. She explained, “I like to grow succulent plants, and many of the succulents I raise are almost like this. The familiarity made me feel safe… So I didn't fear it”. Shira’s personal affinity for succulent plants, which closely resembled the spiky green object, elicited a sense of familiarity and safety that directly contradicted Colton's wariness. Her personal background and embodied knowledge shaped a positive and exploratory interaction with an object that another participant avoided.

Different from Colton, Shira found the mushrooms unappealing and dangerous. She refused to move near them, explaining:

> The mushroom looked disgusting… There were a lot of balls at the bottom of the mushroom, like eyeballs; I felt like having trypophobia[7]. I was worried that there would be “popping beads” that would attack me—I didn't dare to approach.

Shira's vivid description highlights how her sensitivity to certain patterns triggered discomfort, influencing her interpretation of the mushrooms as dangerous. Despite being informed during the briefing that the floating mushrooms were interactive, Shira maintained a safe distance and observed them only from afar, refusing to engage with them throughout her entire experience.

These contrasting interactions with the same objects illustrate how participants’ embodied knowledge significantly shapes their choices and movement patterns within the VR art environment. For Colton, unfamiliarity with the green object and his preference for other more aesthetically pleasing elements led to avoidance, while Shira’s familiarity with similar forms in her real-life hobby encouraged curiosity and comfort. Likewise, Shira’s fear of certain patterns caused her to distance herself from the mushrooms, which Colton found intriguing.

These findings reinforce my argument that embodied knowledge and contextual background play pivotal roles in shaping participants’ interactions and interpretations within VR art environments. Participants’ engagements emerge from their positionalities, which encompass various embodied characteristics. By situating their understandings

[7] Trypophobia is a fear of clusters of bumps or holes.

of virtual content within their personal contexts, participants co-construct the meanings of the virtual world in ways that resonate with their lived realities.

This analysis underscores the importance of designing VR art experiences with an awareness of how individual embodiment and context influence meaningful and affective engagement. For VR creators, this entails enhancing the accessibility of artworks by offering environments that accommodate diverse ways of seeing, feeling, and moving, a matter that I discuss in greater detail in Chapter 8.

6.5 The mind/body dualism in participants' perspectives

As discussed in Section 3.2, early interpretations of VR often carried transcendental ideas in their philosophical definitions, describing it as a kind of "electrical-spiritual" reality (Botz-Bornstein, 2015). For instance, Moravec (1997) envisioned that virtual reality could become a computer utopia that enables human consciousness to escape the restrictions of the physical body. In this framework, the mind is imagined as connecting to the virtual world while leaving the physical body behind (Munster, 2006), positioning VR as a tool for realising the humanist tendency to devalue the body (Penny, 1992). While later scholarship, such as the works of Stern (2013) and Shanbaum (2019), has reframed VR experiences as fundamentally embodied, a continuum of dualistic perspectives remains ingrained in many people's conceptualisations of VR. This dualism was evident in participants' understandings and descriptions of their VR experiences in the case studies for this thesis, influencing how they understood, discussed, and anticipated their VR engagements and revealing a coexistence between embodied and disembodied interpretations.

This interplay of perspectives manifested in a tension between embodied interactions with VR and adherence to a mind/body split. For example, Hannah's account of her movements with Lena illustrates both embodied and dualistic perspectives. She said, "I slowly found a pattern and knew how to coordinate my body with my virtual body... a feeling of working with it". This description highlights a collaborative, affective relationship between her physical and virtual bodies, suggesting that Hannah's experience was not limited to using her body as a tool to navigate the virtual space but involved recognising the agential power of the virtual body as a co-constitutive element

in her interaction with the artwork. This recognition reflects an embodied understanding of VR as a medium where the physical and virtual are deeply intertwined.

However, Hannah's language also reveals an underlying dualism. She stated, "I feel that my brain is in Lena's body. I don't feel that Lena is a thinking creature. I feel that my brain is inside its body". This language echoes a Cartesian framing of the body as a vessel for the mind, with her brain positioned as a controlling entity inhabiting and directing the virtual body. Such dualistic language creates a conceptual distance between her physical and virtual bodies, even as her embodied experience suggests a more integrated and collaborative interaction.

Similar dualistic perspectives appeared in other participants' descriptions of the body, where the mind was often associated with the ability to think and control while the body was seen as a vehicle for executing orders. For instance, Tomas explained, "The body is something that can be controlled by my willpower, on a physical level". Here, Tomas explicitly identifies the body as a controllable object, subordinate to the will or mind, which he sees as the source of agency and control. Likewise, Isabella described a division between the mortal body and the immortal mind, implying the transcendence of the mind/spirit beyond the physical body: "My body is something that will go away when I die, but then I will still be there. My spirit will still be there". Ruth's metaphor of the body as a "heavy container" further reflects Cartesian thought, reminiscent of Descartes' (1641) analogy of the body as a "pilot in a vessel", where the mind is the pilot directing the body.

These statements underscore the enduring influence of Cartesian dualism, even though this perspective has been critiqued by modern philosophies like posthumanism, which advocate for viewing the body and mind as interconnected and inseparable. In my thesis, this dualistic perspective among participants created a paradoxical tension: while participants engaged with VR artworks in an embodied manner, their conceptualisations and critiques of their experiences seemed to stem from an idealised, disembodied framework. As a result, their interactions with the artwork were influenced not only by their physical engagement but also by their preconceived notions about what VR should achieve.

This paradox presents a critical challenge for posthumanism. While posthumanist researchers critique dualistic frameworks, participants' conceptualisations of VR are often shaped by cultural expectations or technological myths, framing their engagements within dualistic structures. This tension reveals a significant discrepancy between the participant-centred and researcher-centred perspectives on VR experiences—a dynamic that warrants further exploration. The findings in my thesis call for a deeper examination of how culturally shaped dualistic narratives influence VR interactions, even in contexts aiming to challenge such traditional boundaries.

In our interview, Quinn expressed frustration with the lack of seamless control over the virtual body, stating, "I think it's a bit hard to control. It [the virtual body] doesn't follow the direct order from my brain… it wasn't controlled by my brain but by my hand. I controlled it indirectly". Her critique reflects an expectation that the virtual body should integrate seamlessly with her mind, bypassing the physical intermediary of her hands. Quinn's dissatisfaction extended beyond her specific VR art experience, reflecting a broader critique of the current state of VR technology, which she described as "technologically incomplete" compared to fictional portrayals. She referenced *The Matrix* (1999) and *Sword Art Online* (2012) as examples of technologically complete VR, both of which depict scenarios where users enter virtual worlds through direct neural interfaces. In *Sword Art Online* (2012), for instance, players lie in beds and use VR headsets to enter a game world where their avatars are controlled purely by brain activity, effectively surpassing the need for physical body engagements. For Quinn, this ideal represented the "ultimate realisation of VR's potential", highlighting a desire for a disembodied, mind-centred experience where physical limitations are transcended. This desire for a seamless mind-to-virtual-body transfer not only mirrors longstanding cultural fantasies about escaping the confines of the body but also illustrates how dualistic expectations shape participants' evaluations of VR technologies.

These findings highlight the complexity of studying participant experiences in VR art, where embodied interactions frequently coexist with dualistic expectations. The persistent influence of mind/body dualism demonstrates the need for VR creators and researchers to address these layered perspectives. Participants' dualistic expectations of VR can also limit their experiences of VR art. The anticipation of a frictionless mind-to-

virtual-body connection often shifts participants' attention away from the content and artistic dimensions of VR art to the technological constraints of the medium. For instance, participants may focus on bugs, glitches, delays, or the learning curve associated with adapting to the VR system's mechanics. This preoccupation with technical imperfections can detract from their embodied and affective engagement with the artwork, limiting their opportunities to fully appreciate the artistic experience.

Consistent with previous studies, my findings suggest that specific design limitations in VR experiences significantly impact the establishment of embodiment. These include issues such as incoherence in the movement mechanisms and interaction affordances (Omar, 2022), visuo-tactile feedback (Sun et al., 2024; Jewitt et al., 2021), and spatial presence (Mal et al., 2023). While addressing VR design limitations is not the primary focus of this thesis, participant feedback provides valuable insights into how these aspects contribute to feelings of disconnection between physical and virtual bodies.

Several participants reported discomfort and an increased awareness of the physical-virtual divide due to the unusual movement mechanics imposed by the VR system. For instance, Aiden described the act of continuously pointing VR controllers to navigate as akin to "holding two cups of coffee for a long time". This unusual posture made him acutely aware of the misalignment between his physical and virtual bodies.

Sensory discrepancies also played a significant role in participants' experiences of disconnection. Fiona, for example, struggled to reconcile the tactile sensation of holding a VR controller with the virtual action of holding and firing a gun. She remarked, "I don't know how to hold a [virtual] gun with a controller already in my hand or to pull the trigger because my hands don't move like they do in reality". This mismatch forced her to consciously adapt to the virtual movement logic, intensifying her awareness of the separation between her physical and virtual bodies. Similarly, Ruth found it challenging to match her tactile experience of the VR controller with the visual representation of her virtual hands. She noted:

> I wanted to see the controller because you explained how it worked. But when I looked down, I saw the virtual hand; I couldn't see the buttons. So, I had to remind

myself where the buttons were. It took me some time to realise that it was not a hand; it was the controller.

This experience accentuated the difficulty of learning and adapting to the VR interface, further reinforcing the sense of disconnection.

As the findings in Section 5.3 suggest, participants engage with virtual bodies by learning, adapting, and compromising their habitual movements. However, it is important to distinguish these findings from the argument I make in this section. While cooperative interactions allow participants to perform intuitive movements that align with the nature of their engagements (e.g., waving or crawling), incoherent physical-virtual interactions often lead to frustration and distraction. This occurs when participants struggle to perform actions that do not align with their embodied expectations, such as firing a gun while holding a VR controller. For some participants, overcoming such challenges required intentionally diminishing their awareness of their physical bodies to focus on mastering virtual movements. As Fiona reflected, "I think I just need to forget about my body, just focus on the virtual hand in my vision, and then study how it moves". Jiashu echoed this perspective, saying, "In VR, you will really forget or ignore the existence of your physical entity, and then after you accept the movement logic in it [the virtual body], the [physical] body is not so important". Participants' intentional diminishment of their physical bodies, I argue, may contribute to their sense of separation between their physical and virtual bodies. This act of suppressing awareness of their physical bodies highlights a potential reinforcement of the mind/body divide and a dualistic mindset in how participants understand VR experiences.

Rather than critiquing participant dualistic perspectives outright, these findings highlight a complex dilemma at the intersection of posthumanist critiques of dualism and the persistent influence of culturally ingrained ideologies, particularly in the context of VR interactions. Posthumanist theory, particularly in the work of thinkers such as Hayles and Stern, challenges Cartesian separations by emphasising the entangled, co-constitutive relationships between bodies, technologies, and environments. Yet, despite these critical reconfigurations, many participants in this study framed their VR experiences through a dualistic lens—describing a clear split between their "real" and "virtual" bodies, or experiencing immersion as a disembodied cognitive absorption.

This discrepancy illustrates how deeply embedded dualistic ideologies continue to shape how people interpret and make sense of VR technologies. It also suggests a critical tension in VR research and experience: while many creators and scholars aim to advance embodied ways of experience, participants may continue to draw on familiar binaries to articulate and process their interactions with virtual environments. This tension invites critical reflection on how VR experiences can be designed to navigate, disrupt, or transform dualistic frameworks without alienating participants—one that acknowledges participant dualist experiences not as a failure, but as a situated response shaped by historical and cultural contexts. It raises important questions about how to bridge the gap between posthumanist goals and participant experiences, fostering more integrated and embodied engagements while addressing participant dualistic tendencies.

Acknowledging this tension opens creative possibilities. Rather than expecting participants to adopt posthumanist perspectives from the outset, VR artists and designers might consider how experiences can intervene in these dualistic frameworks—offering moments of disruption, estrangement, or ambiguity that invite reconsideration of the relationships between physical and virtual, human and nonhuman, and create conditions for critical negotiations between them.

6.6 Summary

This chapter examined the interplay between participants' embodied knowledge, individual positionalities, and localised perspectives in shaping their VR art experiences. These findings support the argument in the thesis that participant VR art experiences are grounded in their embodied knowledge and contribute to highly personalised engagements. By studying participants' movements, associations, and emotions beyond the confines of the virtual environment, this chapter highlights how personal habits, preferences, and backgrounds influenced their interactions with VR artworks.

These findings contextualise a posthumanist perspective on the fluidity and hybridity of the body (e.g., Haraway, 1985; Braidotti, 2013) by examining how participant recognition and experience of the virtual body emerges from the interaction of multiple components, including physical and virtual, human and nonhuman elements. Within the scope of this thesis, these insights emphasise the individuality and localization of participant

experiences, reinforcing the importance of embodied and situated perspectives in understanding VR art interactions.

Additionally, the chapter addressed the persistence of dualistic perspectives in participant descriptions of the body and VR. This finding highlights the complexity and challenges in navigating the tension between posthumanist critiques of dualistic frameworks and the culturally constructed ways in which participants describe their experiences. It invites further continuation of the posthumanist discourse on these dualistic tendencies in participant VR art experiences.

Chapter 7. Immersion as embodied and affective engagement in VR art

Overview

This chapter centres on participant immersion as a process of embodied and affective engagement with VR artworks. As discussed in Sections 3.3.1 and 3.3.2, drawing on the work of Murray (1997, 2020), Bolter (1999, 2021) and Ng (2021), immersion in VR aims to create an illusion that suspends participant disbelief in a different reality, often placing emphasis on achieving a sense of "realism". This objective impacts the concept of "a sense of presence" (Witmer & Singer, 1998) commonly associated with immersion in VR, which emphasises the total and realistic feeling of being in a virtual environment. The data analysis suggests that a sense of presence was indeed an important feature for participants to feel immersed in the virtual environment. However, in my thesis, a greater range of complexity and depth of immersion is revealed through the analysis of participant data. In this chapter, I explore how immersion is experienced as a process in which participants construct multilayered connections with VR artworks through individual meaning-making interactions.

In Section 7.1, I present participant data to illustrate how immersion goes beyond a sense of presence, representing a complex process of embodied and affective engagements. Section 7.2 provides examples to show the complexity and multi-dimensionality of participant immersion. Section 7.3 focuses on the reflective dimension of participant immersive experiences. The findings suggest that participants' awareness of the physical-virtual boundaries do not hinder the formation of immersive experiences. Instead, such awareness can shape self-reflective engagements, adding depth to their VR art experiences.

In Section 7.4, I discuss the significance of re-engagement with VR artworks in fostering a continuous process of development, accumulation, and evolution of participants' feelings and understandings of the artworks. The findings demonstrate that through revisiting and re-feeling the artwork, participants attained a more comprehensive experience, heightening their emotional investment, inspiring creative and experimental

movements, and contributing to their richer and more in-depth interpretations of the artworks.

The final section, 7.5, analyses the relationships between autonomous exploration and re-engagement. The discussion begins with how emotional resistance can serve as a flexible and contextual boundary, prompting participants to re-engage with the artworks by guiding them back to previous spaces. The focus then shifts to the observed risks associated with extensive free-form exploration, which may prompt interactions that are less pertinent to the content of the artwork, diverting participants' attention from re-engaging with the artwork.

7.1 Immersion as more than a sense of presence

In Section 3.3.2, I discussed the enveloping quality of VR technology as a central focus in the discourse on immersion. Building on this foundation, I proposed an alternative perspective that expands immersion beyond a sense of presence (Section 3.3.3). This shift helps us better understand the complexity and particularity of how participants experience immersion.

Aligning with other works in the field of media studies, my thesis examines a sense of presence as a contributing aspect to participants' immersive experiences in VR. For example, participants often described their immersive feelings with phrases like a "feeling of being there" or "feeling like a real place". As Keira said, "I can see the snow mountains [in VR] in the right proportion, and then I felt very real as if I was looking at the mountains surrounding me… it's quite immersive". However, while a sense of presence is significant, the findings also highlight an emotional and embodied dimension of participant immersive experiences. For instance, Kiana described her experience as feeling "close to my heart", while Tyler characterised his immersion as "being somebody else". These accounts suggest that participants' embodied engagements and emotional connections with the VR artworks are also crucial to their immersive experiences. Immersion, in these cases, involves multiple affective layers, not just being surrounded by a 360-degree virtual environment or interacting with virtual objects. In the following paragraphs, I illustrate the variability of participants' immersive experiences within the VR artworks.

My findings demonstrate a connection between participants' immersive feelings and their ability to make changes and progress in the virtual environment. As Lynn said, "The sense of immersion it brought was more like a freedom, a space to interpret rather than telling me what it is… I am not an audience but a participant; I need to do something to make progress". Lynn's reflection highlights the different levels of engagement she experienced between two roles: an audience member, who is typically guided by instructions, and a participant, who can make changes and co-create meanings. This finding indicates that participants' ability to alter their virtual environment contributes to a sense of immersion. The need to participate in the experience and form their interpretations signals a sense of agency and autonomy in collaboratively shaping VR art experiences. In my thesis, I argue that these agential and autonomous engagements form the foundation for participants to cultivate a sense of immersion, positioning them as co-creators in VR art experiences.

Yoko shared a similar view, explaining how the ability to affect changes in the virtual space changed her relationship with the artwork and the virtual body. Using Lena's ability to produce alien plants, Yoko created various plants from Lena's body as she navigated through the virtual world. She said, "I am more immersed in the character of Lena because I can have some interactions through my actions and get reactions in the virtual world… I can leave some things in this space, not just a passer-by". By emphasising that she is not a passer-by who merely observes and interacts with the virtual objects on a physical level, Yoko's descriptions of her immersion in the virtual body suggest a fulfilling affective experience. Through interactions and responses from the virtual world, she was able to gain a deeper sense of connection, closeness, and inclusion within the virtual environment.

Lynn and Yoko's immersive experiences illuminate the critical role of autonomous and affective engagement in shaping their sense of immersion. Their reflections demonstrate how immersion emerges as a dynamic process of forming connections with the artwork in a participatory manner. By being empowered to explore, influence, and co-create within the virtual environment, participants were able to engage with the artwork in ways that are personally meaningful and accessible.

Immersion was also observed through participants' sensorial transformation during their interactions with the artworks. For instance, through her journey within Lena's world, Amelia witnessed a notable transformation in her sensations and emotions:

> When I interacted with the mushroom for the first time, I went through the surface of the mushroom and into it. I was a little scared at first, feeling a bit like under the water, suffocated. I had a physical discomfort; it felt like I was going to kill myself, I was going to sink in. But then I felt as if I had superpowers. I could move between objects, and I was not afraid.

Amelia's sensory feelings in Lena's world evolved from fear and discomfort to having superpowers. She explained that these changes stemmed from her shifting awareness of the physical and virtual bodies. Reflecting specifically on her experience moving towards the mushroom, Amelia said:

> As a human, I definitely wanted to land on its surface, not enter it... But I found that after I landed on the surface of the mushroom, I could continue to fall. The feeling of being submerged into a solid; I have not experienced this, but I had a feeling of being swallowed up. I had a physical discomfort—that there was a feeling of a solid object moving through my body.

In this initial stage, Amelia's experience reflects the submerging quality attributed to VR technologies, where she described a realistic sensation of "being swallowed". This sensation evoked a sense of being completely enveloped by the virtual environment, contributing to her feelings of unease and constraint. However, as her experience progressed, Amelia described a noticeable shift in her sensations and feelings evoked by a changed understanding of her body and identity:

> And then I found out that I was in control. I had this ability to go in and out of the solid object. Feeling like practising wall penetration; a very magical feeling. I have never experienced it before. I was scared at first, but then I felt excited and wanted to experience it again.

Although Amelia did not explicitly use the term immersion, her descriptions reveal a deeply affective and processual engagement with the virtual environment. For Amelia, immersion unfolded as a multilayered experience involving an interplay of emotions,

interpretations, and physical sensations that evolved over time. Initially, she felt suffocated, seeing her body as a human entity. However, as she adapted to the virtual space, she began to recognise her body as an alien or virtual form, capable of moving freely through solid objects. This transformation reframed her initial discomfort into a sense of excitement as she embraced the superhuman abilities afforded by the virtual environment. This finding underscores how immersion can emerge dynamically, shaped by evolving emotional and sensory experiences rather than being solely a technological feature.

The findings in this section emphasise the multiplicity and richness of understanding immersion in VR art experiences. While previous studies have characterised immersion as a primarily enveloping quality (Witmer & Singer 1998), my findings illustrate the value of understanding immersion as an embodied and affective process. Rather than being a technological feature, immersion in this sense is a processual, transversal, and hybrid construction that arises from the dynamic interplay between the physical and virtual realms (Kirschener, 2022), emerging and developing as participants' interpretations and emotions evolve through their interactions with the artwork.

These findings offer an alternative perspective on immersion in VR and VR art, potentially inspiring innovative approaches to designing participant interactions in future works. As participants navigate virtual worlds, their interpretations, emotions, and modes of engagement continuously shift, adding depth and complexity to their experiences. This dynamic nature of immersion suggests that fostering adaptable and multifaceted interactions could enhance the richness and accessibility of VR art creations, which I discuss further in Chapter 8.

7.2 Building emotional bonds with the virtual world

In this section, I explore how participants experienced immersion through building emotional connections with the artworks. While existing studies, particularly in cognitive science, have highlighted the connection between participants' emotional feedback and immersion, many of these investigations were conducted in controlled laboratory settings (Bujić et al., 2023). Bujić et al. (2023) note that such studies often focus on the relationship between specific stimuli and emotional reactions, potentially simplifying the complexity of emotional dimensions involved in immersive experiences. They argue that

these findings, while valuable, are limited in their applicability to more complex VR experiences (Bujić et al., 2023). In contrast, my thesis explores the dynamic interplay between participants' emotions, interactions, and interpretations within virtual environments. Through this analysis, I underline the diversity and complexity of how participants' emotional responses emerge and evolve, moving beyond a cause-and-effect model to better understand the relationship between emotions and virtual stimuli.

In C3, Kiana described the virtual night park as "particularly immersive" due to the "intimate feeling" it evoked. The park featured a statue illuminated by spotlights at its centre, surrounded by grass, flowers, and trees under a night sky. The objects in the space were not portable, meaning that participants could not move them around. In the night park, Kiana was observed sitting quietly on the floor for five minutes, slowly looking around at the grass and sky. She said:

> While I was a child, there were many summers staring up at the sky in the middle of the woods by the lake. So, all of these things were very close to my heart... It was extremely relaxing, extremely pleasant. I really enjoyed them.

Kiana's profound emotional response to the virtual environment stemmed from a deeply personal connection to her childhood memories. Her memories of summer nights, woods, lakes, and stargazing enriched her experience with feelings of intimacy, relaxation, and pleasure. This example demonstrates how an emotional bond between participants and the artwork serves as a means of establishing a deeper connection with the virtual environment. This finding also highlights the individuality of such emotional connections, as not all participants experienced the night park in the same way. While Kiana's personal attachment added a unique dimension to her interaction with the virtual environment, some participants found the space calming, boring, or even unsettling.

Similarly, emotional connections rooted in embodiment were evident in the experiences of Hannah and Tyler in C2. Hannah's sense of loneliness in the alien world stemmed from feelings of alienation and exclusion in an unfamiliar environment. She explained:

> I feel that I am very lonely in this world. The world is relatively alien. It was very interesting at first, but after a long time, I felt lonely. I'm the only person in it, and there is no living creature in it to interact with.

To cope with this loneliness, Hannah began producing "bubbles"— yellow luminous eggs that grew into alien plants. She described this process as fostering a close, almost relational connection: "When I feel lonely, I create some bubbles. I feel like we have a very close relationship, and they will stay with me... I'm feeling attached and intimate". Through these actions, Hannah's sense of isolation was transformed into connection and intimacy, cultivating a feeling of ownership and emotional attachment to the virtual environment. These emotions enriched the depth of her interactions with the virtual objects, enhancing the emotional landscapes of her VR art experience.

Tyler's connection to the alien world unfolded in a different manner. Rather than playing with Lena's body, Tyler found his immersive moment while floating peacefully in the air and listening to the wind. He described how the auditory sensations contributed to his sense of connection:

> The wind made me feel very connected to this space. Specifically, it is the sound of air going past your ears ... You can hear the wind blowing against you and your tentacles moving as if they are in wind or water... And there are some other sounds as well, a kind of non-melodic music, like a droning sound, which generates some emotions.

This peaceful state led him to reflect on the fragments left behind by his virtual body:

> The fragments that are left behind by the alien body, my body. It's very poetic and very beautiful, and it's sad... It's just purely this kind of seeing the fragments leaving your body as you move brings up a lot of emotions, I think. But very abstract. Just feels like this creature is quite fragile and very mysterious.

Tyler's immersion was deeply connected to a sensory and emotional resonance with the virtual space. The soundscapes and visual elements evoked a complex mixture of feelings, including peacefulness, sadness, curiosity, and a sense of the poetic. These overlapping emotions enriched Tyler's experience, adding depth and complexity to his engagement with the virtual environment.

When comparing Hannah and Tyler's experiences, it becomes evident that emotional connections within VR experiences are highly personal, shaped by participants' unique backgrounds, feelings, and modes of interaction. This specificity underscores the

challenge of directly linking certain stimuli to predictable emotional responses, as mentioned earlier by Bujić et al. (2023).

These examples demonstrate that participants' emotions evoked by VR artworks cannot be reduced to singular or isolated emotional types. Instead, they represent an emotional bond with specific elements in the artwork, which is shaped by the participants' individual histories, sensory experiences, and evolving interpretations of their interactions within the virtual environment. These findings suggest the necessity of moving beyond an analysis of specific emotional triggers to recognise the intricate interplay between participants' embodied knowledge and their affective responses, which I discuss further in Chapter 8.

7.3 Reflective engagements: Immersion as removing the physical and virtual boundaries

As discussed in the literature review (Sections 3.2 and 3.3), the pursuit of the ultimate immersive experience has long dominated the field of VR, from its early explorations in the 1960s to present-day advancements (Bolter et al., 2021). This pursuit has often centred on the concept of immersion as the erasure of boundaries and distinctions between the physical and virtual domains (Ng, 2021). According to Ng (2021), this erasure is often characterised by the replacement of physical reality with virtual reality through increasingly realistic visual representations that eliminate the differences between the two realms. However, the findings in my thesis offer an alternative perspective, suggesting that the visual erasure of these boundaries does not necessarily eliminate participants' experiential awareness of the differences between physical and virtual realities. In fact, these differences, particularly in the unique and often unfamiliar movements required in virtual environments, persist through participants' experiences. Yet, this awareness does not inhibit the emergence or development of immersive experiences; instead, it fosters a reflective process that connects participants' experiences to their embodied knowledge, as I elaborate on in the following paragraphs.

Hannah's experience in C2 provides an insightful example of this dynamic:

> I think the experience was a very wonderful deception; it tricked my mind through vision. Although rationally, I could tell the difference between reality and virtuality,

> my emotions and my body still changed in VR. I was really scared when it was dark. I knew it was fake, but I couldn't control the fear.

Hannah's description of the VR art experience as a "wonderful deception" highlights the powerful visual substitution that VR creates. This deception achieved through VR as a "post-screen technology" (Ng, 2021) envelops participants by limiting their visual field to the virtual environment presented by the headset, creating the illusion of an expansive virtual space. Despite this visual deception, Hannah remained aware of the differences between physical and virtual realities. As she later described, her feelings of "insecurity", "clumsiness", and "fakeness" while navigating the movements of an unfamiliar virtual body further heightened those differences. Hannah's awareness of the differences became particularly evident when she began to feel tired: "When I was moving, I could clearly feel my body when I turned or walked. And when I stand for a long time and squat down, when my body feels tired, I also feel my own body". The different moving methods, physical sensations, and degree of "authenticity" served as constant reminders of her presence in the physical world, highlighting a clear divergence between her physical and virtual experiences. Although the visual "deception" may blur the boundaries between the physical and virtual realms, Hannah's example illustrates the challenges of eliminating the experiential differences between the two.

However, Hannah's ability to distinguish between physical and virtual realms did not diminish her emotional or physical engagement with the virtual environment. For example, her fear of the darkness within the virtual space elicited a visceral response. As she reflected, "I am afraid of the dark... Although I know that my body is not really here". This fear prompted her to descend to the virtual ground in search of a safer space. She explained, "I was very scared. I didn't want to float in the air; I wanted to run to the ground and find a bright place to stay and wait for the dawn".

Hannah's emotions and her awareness of the distinction between physical and virtual realms demonstrate how immersion can coexist with a critical awareness of the VR medium. Her engagement with the virtual space was deeply reflective, as she fully recognised the differences between her physical and virtual bodies, spaces, and movements. Yet, this awareness did not detract from her immersive experience; rather, it

enriched it by prompting emotional and physical responses that were deeply personal and contextually significant.

Through this example, I wish to emphasise the reflective dimension of immersion, proposing a shift away from the traditional focus on achieving an illusion of realism. Instead of framing immersion as a state where participants are expected to forget or "lose" themselves in a seamless virtual environment, this perspective recognises immersion as a dynamic and participatory process. In this context, immersion emerges not from erasing the awareness of mediation but from participants engaging with and reflecting on the mediated nature of the experience. This reflective engagement allows participants to build affective connections with the artwork while remaining aware of its constructed and mediated dimensions.

7.4 Immersion and re-engagement: Rethinking and re-feeling through non-linear explorations

In Section 3.3.3 of the literature review, I discussed how the concept of hypermediacy (Bolter et al., 2021) conveys a form of autonomous exploration in VR art, allowing participants to navigate spaces in a non-linear manner without pre-determined narratives. This non-linear mode of engagement enables multiple layers of connection during the process of participant experiences (Poffenroth, 2021). This approach not only empowers participants to interact with VR artworks in unique ways and contributes to the formation of individualised experiences and interpretations but also encourages participants to rethink and re-feel the artworks they have previously experienced. These re-engagements promote a continual process of development, accumulation, and evolution of participant feelings and understandings towards the artworks, in which new details, perspectives, or emotions can emerge. In this section, I discuss how re-engagement with the virtual spaces and objects can impact participant experiences, including eliciting a more holistic experience, enhancing emotional investment, inspiring creative and experimental movements, and contributing to more complex and multidimensional interpretations of the artworks.

Aiden's experience in C1 exemplifies how participant re-engagement in VR art can serve as an iterative process, allowing participants to add new dimensions to their prior encounters. By focusing on different features and reflecting from varied perspectives,

participants can deepen their understanding and emotional engagement over time. Aiden's three visits (two to three minutes each time) to the chair room reveal this process, as his initial feelings of unease gradually evolved into a nuanced mixture of sorrow and hope.

On his first visit, Aiden approached the large, hanging chair cautiously and observed it from beneath. He reflected:

> I walked under the big chair and heard the sound of children crying… I think it represented something uneasy, and the small chairs around were watching… It reminded me of an installation I saw in Switzerland, where there was a chair without one leg. The installation was a memorial of the soldiers sacrificed in World War II.

The combination of audiovisual elements and his association with a similar installation in Switzerland evoked feelings of unease, causing Aiden to interpret the space as representing death and sacrifice. This heavy and solemn interpretation restrained him from physically engaging with the chairs during his first and later encounters. In his later visits, Aiden refrained from approaching the large chair, opting instead to observe the room from a distance. He remarked, "I passed through the room several times. I mostly stood and observed the whole room because I felt that I should not approach too close". During his several visits, Aiden paid attention to different things and asked himself a series of questions: Why would the chair in the centre be bigger and the chairs in the circle smaller? Does it represent a relationship between adults and children? What does it mean when the sun shines into the space? What does the shadow mean?

These questions illustrate Aiden's process of re-engaging with the space and interpreting its elements from different perspectives. He began to focus on the interplay of light and shadow, as well as the symbolism in the arrangement and sizes of the chairs. These constant reflections added new dimensions to his previous feelings and interpretations. He said:

> I feel that although the entire space symbolises death or sacrifice, I think that kind of sacrifice also means hope… The sun is a representation of hope for me… The chairs on the side seem to be our next generation, like the feeling of predecessors planting trees and descendants enjoying the shade.

Through his reflections, Aiden's interpretation of the chair room evolved. He came to view the space not only as a commemoration of sacrifice but also as a symbol of hope and continuity. The sunlight became a metaphor for hope, while the smaller chairs surrounding the large one symbolised future generations. His initial feelings of "heaviness" and "unease" transformed into a complex mixture of sorrow and hope. He remarked, "I don't feel so heavy. I don't think there is such a strong negative emotion anymore... After I understood this, I went back and forth between different rooms, and I was more comfortable".

Aiden's example demonstrates how re-engagements allow participants to develop richer and more layered interpretations of artworks. Through his repeated visits, Aiden engaged in a reflective process, continuously building on the multiple dimensions of his interpretations and emotions. Compared to his initial associations with fallen soldiers in WWII, Aiden's later interpretations integrated more intricate details and meanings, creating a deeply personal understanding of the artwork.

Through this analysis, I highlight the critical role of autonomous re-engagement in enriching participant immersion. By allowing them to revisit, rethink, and re-feel the artwork from different perspectives, an iterative process is formed, allowing participants to peel back layers of an artwork, uncovering deeper symbolic and emotional connections. This example reinforces my argument regarding the dynamic, participatory, and evolving nature of immersion in VR. By facilitating enriched reflections and emotions, the process of affective engagement is not only initiated but also deepened over time.

Re-engagement, as observed in my analysis, also intensifies emotions and provokes creative or experimental interactions. To illustrate this, I present a vignette from my autoethnographic data, documenting my multiple visits to the second room in C1. This process highlights how repeated encounters with the same virtual environment can lead to deeper emotional investments and more complex actions.

Vignette: A massacre

I created a massacre in VR. A strange thrill runs through me just by saying this sentence. The second room in *Skyville*, where the large chair hung, was the room that made many

people feel heavy and negative, including me. The atmosphere here made me think of destruction, death, and killing. It felt suffocating—filled with cold sunlight, dust, and floating ash. There were sounds of fire, cracking wood, and crying. Yet, beneath the noise, the room felt extremely silent, in the sense that the smaller chairs remained silent amidst the suffocating presence of the bigger chair. The more I ventured into this room, strangely, the less empathy I felt for the big, hanging chair, replaced by unspeakable emotions, like the desire to destroy.

The first time I entered the chair room was after I had spent 40 minutes in the first room playing with the geometric shapes and fragments. The moment I opened the door, I was stunned by the atmosphere inside. I stood at the door, and the giant hanging chair collided with my sight. I felt guilty to have spent so much time playing without knowing what happened in this room. I felt guilty about being happy and innocent. I carefully walked to the centre of the room and looked at the big hanging chair. It looked like a body, or a spirit of a nation, burdened by history and lifeless. The small chairs, sitting in a circle, gazed upon it coldly and silently.

After my first visit, I revisited the rooms several times. Sometimes, it was to explore the artwork from different perspectives. Other times, it was to ensure that everything was functioning smoothly after an update. As time passed, my empathy gradually gave way to anger when I visited this room. I grew frustrated with the smaller chairs—how easily they could be moved, manipulated, like they were numbed, careless, and weak. I held the smaller chairs and threw them at the bigger chair one by one. They struck the hanging chair and fell on the floor. I tossed one of the smaller chairs into the others, and they all fell. I looked at the chaos I created in the room—the big chair was hanging there motionless, no one could save it. The smaller chairs lay scattered on the floor, without dignity. I felt frustrated and disappointed.

An even more dramatic scene unfolded during my last proper visit to the chair room, not for a technical check but to immerse myself fully in the experience. I went into the room and walked around quietly without touching anything. Creating chaos could not satisfy my eagerness to destroy or seek justice for the big chair anymore. I felt frustrated to interact with these bodies that were playing deaf. I sat on the floor with my legs crossed and played around with a chair in my hand. I felt bored. It was the calm before the storm.

While playing with the chair, I soon discovered that I could drag it beneath the floor. The floor in the virtual space was slightly higher than the physical floor I sat on so that I could put my hands beneath the virtual floor. Suddenly, when I pulled the chair halfway into the floor, it began to tremble as if in extreme pain. I knew, of course, that this was due to some kind of technical glitch caused by the chair's strange position. But the way it moved made me feel that it was being tortured. I was both empathetic and thrilled, simultaneously scared and exhilarated because I thought the chairs had finally responded to me. To me, this reaction meant that they finally stopped being silent and disinterested. After a while, the chair bounced, hit the wall, and fell on the floor, motionless. "It died", I thought to myself. I repeated this movement with the other chairs, dragging them into the floor and watching them struggle. In this same way, I killed all the chairs.

I looked around the sunny room with the scene I had just created—a massacre without blood. I didn't imagine myself killing people, just chairs—chairs that represented certain kinds of characteristics. I felt a conflicting sense of peace and thrill because it seemed that I had avenged the big chair, yet I also felt curious about my own actions. I am not a violent person at all. I speak softly, and I have a slim body that I believe is not physically strong enough to fight. I feel scared and disgusted when squishing a bug. So, I was a little surprised and confused when this room evoked violent behaviours within me. I did not enter the room again. I saw this "massacre" as the culmination of my engagement with the artwork—a place where all my emotions and desires had been fulfilled.

This vignette reveals the powerful role of re-engagement in shaping participants' affective responses within VR art environments, illustrating how immersion evolves through complex layers of interpretation, emotional engagement, and movements. During my initial visit, I interpreted the big chair as symbolising "a body" or "the spirit of a nation", prompting careful and respectful movements within the space, accompanied by feelings of empathy and guilt for my previously playful engagement in the first room. The small chairs were initially perceived as silent bystanders observing the scene. However, in my subsequent visits, a gradual shift in emotions occurred, with feelings of empathy transforming into disappointment, frustration, and even anger. These emotions stemmed from emerging interpretations of the small chairs, which were seen not only as numb and

careless observers but also as weak, undignified, and manipulable. As engagement with the room increased, feelings of disdain quickly turned into indignation, prompting actions such as creating chaos by throwing the small chairs at each other. Yet, this anger turned into disappointment again upon realising the small chairs' indifference to being mistreated. An accidental discovery—the ability to "torture" the chairs by dragging them partially into the floor—provoked a reaction in the form of "trembles", offering a way to satisfy the urge to destroy and seek symbolic revenge. Eventually, this culminated in the dramatic scene of the "massacre".

This vignette illustrates how re-engagement in VR art acts as a catalyst for evolving interpretations and intensifying emotions, transforming participants' relationships with the virtual space over time. As a form of non-linear interaction, re-engagement serves as a powerful means for participants to reconnect with different layers of emotions and associations within the artwork to build new narratives. These evolving emotions and interpretations, in turn, can inspire creative and experimental movements, leading to increasingly complex and personal narratives.

Furthermore, this vignette highlights the value of non-linear and autonomous engagements in VR art, which provide flexibility and depth to participant experiences. As noted by Schoonmaker (2007), creators may not anticipate the exact paths participants experience due to the fragmented nature of hypermediated media. However, this "letting go" of control can yield positive results by accommodating diverse perspectives. In this way, the limitation of unpredictable participant experiences can also become opportunities for the emergence of innovative interactions.

7.5 Autonomous exploration and contextual boundaries

Whereas the previous section illustrated how re-engagement contributes to creating complex and diverse VR art experiences, this section shifts focus to the use of barriers in virtual spaces, examining how they influence participant exploration. Boundaries, such as walls, are often used in VR art to regulate movement and orientation, but they can inadvertently restrict participant autonomy by creating an implicit sense of finality. Observations from the case studies reveal that participants frequently interpreted walls as establishing definitive limits to their movements, even when these walls were traversable and contained unexplored spaces beyond them. For instance, in C3,

participants encountering the final pink room with translucent walls generally refrained from attempting to move through them, despite the presence of a compelling giant figure visible just outside. This strong sense of restriction is reflected in Jiashu's reflection: "I looked at it [the outside space], but I did not have a way to go out". Thus, while walls can effectively regulate participants' paths of experience, they also tend to decrease their autonomous exploration.

Building on this observation, I analyse a different type of barrier employed in VR art—contextual barriers—which subtly discourage participants from venturing further into certain areas without explicitly restricting their movements. Unlike walls, which function as direct limitations, contextual barriers rely on thematic, atmospheric, or symbolic elements of the virtual environment to guide participants' movements. These barriers prioritise participant autonomy, encouraging reflective decision-making and interpretative engagement while still shaping their paths in meaningful ways. In this section, I demonstrate how participants' emotions of resistance and fear can act as flexible and contextual barriers, prompting them to revert to previous spaces and re-engage with the main installation of the artwork. Because these barriers appear not as tangible objects but as spaces that can be explored, I also address the limitations of such boundaries, which may potentially risk participants spending a substantial amount of time exploring areas less pertinent to the art content.

In C1, participants explored three connected rooms that foster a multi-directional exploration, offering them various opportunities to navigate and interpret the space. One of the rooms features an irregular tunnel shape, at the end of which lies a dark area. If participants chose to move through the darkness, they could access an outside space beyond the rooms. As mentioned previously, the use of walls in virtual spaces can often prevent participants from moving forward. For example, when Jiashu attempted to see the ocean beyond a wall in C3, she leaned forward, standing on her tiptoes to peer outside the window, making an effort to see the ocean beyond the wall. She said, "I want to go to the sea, but I found out that I couldn't, the controller wouldn't let me. I could only look around and see it from different angles". Despite being able to walk through the wall in this virtual environment, Jiashu did not explore this possibility, later reflecting, "I forgot that I could walk into the sea; I didn't consider this".

In contrast, the dark area in C1 served a similar purpose of discouraging some participants from moving forward but did so in a contextually relevant way. Observing participant interactions revealed that the dark area at the end of the tunnel often deterred many participants from proceeding further, largely due to the negative associations they made with it. One participant, Quinn, said, "I knew if I wished to continue exploring, I needed to go further into the darkness. This feeling was like I was about to step off a cliff. I knew I could explore further, but I just really didn't want to go". Other participants shared Quinn's apprehension. For instance, Lora expressed her resistance to continuing, stating, "After going out of that narrow tunnel, I saw a black hole. It was such a chaotic space; I could only choose to go back again". Participant reflections suggest that the dark area was not understood as a spatial boundary where the VR art experience ended but as a "cliff" or "chaotic space". These findings show that participants' emotional resistance can serve as a means of prompting them to return to the space and re-engage with previous content. However, unlike a wall, the sense of discouragement to proceed appears as a personal, emotional, and contextual choice rather than a fixed boundary.

The interactions between participants and the dark area reflect how contextual boundaries in VR art can influence participants' interpretations and decisions to engage with or retreat from certain spaces. These decisions are also closely related to how they interpret the artwork. For some participants, initial hesitation gave way to eventual exploration. Fiona, for instance, resisted entering the dark area during her initial visit but decided to move through it on her subsequent visit. Reflecting on her decision, she shared:

> The outside dark space of the time tunnel was a bit scary... I am afraid of the dark. But I felt that it was the only way to the unknown outside, so I walked through twice... I closed my eyes in the headset.

Fiona's experience illustrates how participants may grapple with their emotional resistance while simultaneously recognising the significance of certain elements within the artwork. This finding further exemplifies the relevance of contextual boundaries in enriching participants' affective engagements, as such boundaries may act as subtle navigational aids that maintain participant autonomy while anchoring their exploration of the artwork's thematic core.

While contextual boundaries were observed encouraging participants to re-engage with the artwork, as seen in Quinn's case, and contributing to participants' overall engagements, as seen with Fiona, they can also lead to divergent experiences that may detract from the core content of the artwork.

In C1, for instance, the open, undirected exploration of the space motivated participants like Zoran to focus on peripheral aspects of the environment rather than the intended central narrative. After exploring the three primary rooms, Zoran ventured into the upper open space, where he became intrigued by the distant fence and decided to investigate its boundaries. His motivation stemmed from a scientific curiosity to map the perimeter rather than engage with the artwork's overarching themes. Using the changing numbers displayed on Alless' VPN device as a guide, Zoran calculated the rate of progression through the space and observed how the distant trees reacted to his movements. He explained, "The trees didn't change when I moved. When I moved back, it was faster than the speed I moved toward the tree… I think I spent five to six minutes moving towards the trees, but I only spent two minutes moving back". Through these observations, Zoran deduced that the distant fence was programmed to be unreachable, interpreting it as a "vague boundary". His detailed analysis of the mathematical principles behind the boundary highlighted his methodical engagement with the space. Zoran reflected:

> If we take half of our last step, we can continue walking endlessly because the division of one by two can be repeated infinitely. The objects in the distance will gradually appear smaller as we move further away, but their rate of shrinking will slow down. For instance, they may become smaller by one-fifth when I take one step initially, but later, it may take ten steps for them to reduce by the same one-fifth.

While Zoran's exploration demonstrated the openness of the VR art environment to diverse participant investigations, it did not significantly contribute to his affective engagement with the artwork. Thinking back on his experience, he noted, "I don't feel much. The upper space feels emptier, and the surroundings seem boundless". Zoran dedicated 12 minutes to this experiment—roughly a third of his total time in the artwork—yet his findings served more as a personal curiosity, which did not enhance his connection to the piece's thematic or emotional layers.

Zoran's experience highlights the double-edged nature of undirected exploration in VR art. On the one hand, the "freedom" to navigate certain spaces can empower participants as co-creators of their experiences, enabling them to construct personalised narratives that align with their interests and curiosity. On the other hand, excessive autonomy can risk diverting participants' attention away from the central content as they become absorbed in tangential explorations that might lack relevance to the artwork's themes. This tension raises questions about whether these contextually irrelevant engagements can contribute meaningfully to participants' overall experiences. While Zoran's case suggests that such detours may detract participants from the intended depth of the artwork, it remains possible that the "freedom" to explore peripheral elements could still enhance participants' sense of connection to the artwork in unforeseen ways. This ambiguity marks the complex relationship between autonomy and regulation in VR art environments, emphasising their interplay as critical to shaping enriching and multilayered experiences.

7.6 Summary

This chapter explored the complexity of immersion in VR art, highlighting the central role of affective and reflective engagements alongside autonomous exploration in shaping multilayered and in-depth immersive experiences. By prioritising participant agency, this chapter advocates for a more participant-centred approach to immersion, encouraging VR designers to view participants as co-creators of their experiences. This perspective resonates with the hypermediated approach proposed by Bolter et al. (2021), which encourages non-linear, less constrained, and participant-driven interactions with media.

Within the context of this thesis, adopting a hypermediated framework shifts the focus from the technological exploration of immersive quality in VR to the participant's agency and autonomy in shaping immersive experiences. This shift underscores the relationship between embodied situated engagement and the depth of immersion, revealing the critical role of embodied experiences in fostering emotional connections with the virtual world through multidimensional interpretations. In such a process, re-engagement emerges as a key aspect that enables participants to deepen their connection with the artwork and explore its layered meanings over time. This embodied and reflective engagement, intertwined with autonomous exploration, is a cornerstone of personalised

and contextual interaction, encouraging randomness, diversity, and participant-driven co-creation.

This chapter also addressed the challenges posed by unrestricted autonomy, cautioning that it may divert participants' attention away from the core content of the artwork. The implications of these findings are expanded upon in the following chapter, where the role of design in fostering immersive and meaningful VR art experiences is further examined.

Chapter 8. Discussion

Overview

This thesis posits cooperative dynamics and autonomous exploration as key aspects for capturing the co-constructive nature of VR art experiences, illuminating the fluidity and hybridity of embodied engagements within virtual environments. This chapter discusses these two aspects, drawing on key findings in the empirical chapters and literature. This exploration offers valuable insights into the complexity of viewer participant experience, contributing to understandings of the potential of VR art in forming in-depth, reflective, and multidimensional artistic experiences.

Through the lens of cooperative dynamics (8.1), I elaborate on three interwoven levels of relationships: (1) the shared authorship between artists and participants, where the creative process is distributed; (2) the interplay between human and nonhuman agency, where both participants and virtual elements mutually influence one another; and (3) the co-constitutive process involving immersive technology and embodied connections. Together, these relationships reveal the intricate and dynamic nature of co-creation between participant and VR art, emphasising its potential to foster exploratory and reflective participant experiences.

The discussion of autonomous exploration (8.2) highlights three essential aspects—non-predetermined paths, unscripted movements, and contextual guidance. These elements, as discussed in this research, collectively foster highly personalised and thematically coherent engagements. By encouraging participant agency without abandoning narrative cohesion, autonomous exploration advances a non-reductive approach to interaction design.

Finally, this chapter offers practical implications for future VR art design and research (8.3), advocating for participant-centred frameworks that embrace dynamic co-creation. It also acknowledges the limitations of this research (8.4) while opening avenues for further exploration into the embodied dimensions of VR art.

8.1 Embodiment and cooperative dynamics

In my thesis, I recognise VR art interactions as processes rooted in the moving, thinking, and feeling body in collaboration with virtual worlds, stressing that participant experiences are produced collectively rather than in isolation. Drawing on posthumanist literature, this thesis engages with foundational ideas regarding the affective dimensions of physical movement (Stern, 2013), the situated and specific nature of individual experience (Haraway, 1985), the co-constitutive relationships between viewers and artworks (Shanbaum, 2019), and the intra-active formation of experiences through various agencies (Barad, 2007). These theoretical insights underpin the empirical chapters, which examine how participants co-produce their evolving movements, associations, and emotional responses to the artworks.

Building on the concept of embodiment, which highlights the continuum and relational processes between individual interactions with the surrounding environments (Hayles, 1999; Stern, 2013), the findings of this thesis expand this conception further into the context of VR by stressing the cooperative dynamics within participant VR art experiences. The concept of embodiment, as developed here, foregrounds the co-creation of experiences as a dynamic process involving multiple agents—both human and nonhuman—operating across physical and virtual realms. This perspective emphases the complexity of VR art experiences as situated within networks of embodied interactions, where meaning emerges through reciprocal influences between participants and the artwork.

This co-creation process unfolds across three interconnected levels: the relationships between artists and participants, the relationships between participants and artworks, and the relationships between immersive technologies and embodied connections. These levels are not intended to suggest binary or hierarchical separations but rather to address specific analytical dimensions of co-creation. Each level uncovers unique dynamics that contribute to the formation of VR art experiences as collaborative and evolving processes.

8.1.1 Co-creation and shared authorship

The relationships between artists and participants in VR art centres on the questions of authorship and interpretive agency. Authorship is generally considered as the prominence of the authors and their visions in the creation process (Šimbelis, 2018). This is particularly evident in narrative-driven VR experiences, where guided paths and predetermined narrations position the artist as the primary author, leaving limited room for participant agency in co-creation. Such experiences often tend to direct viewers' attention and engagement through camera movements and pre-determined paths (Tong et al., 2021), with less bodily engagements involved in shaping viewer experiences (Moura, 2021). While these linear, structured narratives can create coherent immersive environments, I argue that they also risk constraining participant exploration, reducing the potential for embodied engagement and reflective meaning-making.

In interactive media, a negotiable process is often demonstrated through the shared authorship between artists and participants (Šimbelis, 2018). This shared authorship introduces a sense of openness and flexibility, enabling multiplicity in interpretation rather than enforcing a singular artistic vision. The findings of this thesis underscore the value of encouraging shared authorship as a means to enable the emergence of affective experiences shaped by participant individual positionalities.

My findings show that distributed authorship between artists and participants fosters diversity, specificity, and unpredictability in the co-creation of conceptual meanings within VR art. While artists establish the frameworks and initial narratives of their works, participants engage with, contextualise, specify, and individualise these frameworks, bringing their own interpretations, movements, and emotions into the interpretative space. For example, Shira extended her understanding of Lena's biological characteristics and living habits (6.1), while William drew upon his personal experiences to interpret the functions of Lena's body (6.2). In some cases, participants generated narratives that diverged significantly from the artist's original vision. For instance, Yuan connected her interactions with the geometric shapes in C1 to the myth of Prometheus' punishment (5.1). These examples highlight how participant engagement moves beyond an active-passive division where creation and consumption are clearly defined. Instead, a shared authorship shifts from an artist-led process to a distributed, collaborative model

(Takala, 2023), where meaning is constructed through the dynamic interactions between artists, participants, and the artwork itself.

While the findings of this thesis present the importance of inviting participants into the evolving, co-constructed process of shaping meaning in VR art, they also highlight the potential limitations of shared authorship. Many participants expressed appreciation for the "freedom" to create their own meanings, yet some reported feelings of disorientation or detachment due to a lack of clear intent or guidance in their contributions to the narrative. For these participants, the absence of direction led to limited interpretations and emotional engagement with the artwork and a sense of disconnection from the thematic depth of the piece.

These findings bring to light a challenge in interactive VR art design: finding the balance between enabling autonomous exploration and providing sufficient guidance. While autonomous exploration can facilitate rich, multidimensional experiences for some participants, the lack of structure or direction may result in disengagement, or even a focus on personal interests that stray too far from the core themes of the artwork. Concerning this challenge, the distinction between interest-driven, contextual-relevant exploration, and a distracted, overly personalised focus is particularly nuanced. This is because many contextually relevant interactions initially stem from individual interests, making it difficult to predict when personalised exploration enhances or detracts from the intended narrative. This ambiguity raises several questions for VR artists: How much autonomy should participants be granted? How can guidance be integrated without undermining participant agency? And how can artists balance highly personalised exploration with the risk of irrelevance?

These questions echo Takala's (2023) discussion of the role of the artist in interactive media, where the artist assumes roles as both creator and curator. This double responsibility involves expressing an individual artistic narrative while simultaneously enabling participants to embark on open-ended journeys of discovery and meaning making. The balance between the two roles ensure that participants can engage in autonomous exploration while still staying within the intended conceptual framework. To respect participant agency while providing contextual guidance, one potential strategy is to adopt a hypermediated approach to the design of VR artworks. As discussed in this

thesis, a hypermediated approach emphasises the integration of rich, contextually relevant “nodes” within the virtual environment—anchor points that provide guidance while still allowing space for participant agency. By embedding these nodes within the artwork, participants can weave their personal interests into the broader narrative, enabling them to maintain a sense of autonomy while still remaining connected to the artwork’s thematic framework.

In this way, the artist assumes the role of both creator and curator, offering a curated environment that allows participants to contribute to the narrative without veering too far from its original intent. This balanced approach to authorship can enhance both the personalisation and emotional resonance of VR art experiences, providing rich opportunities for individual exploration while ensuring that the core themes and artistic vision remain engaged.

8.1.2 Human and nonhuman agency in co-creation

The second level of relationships in the co-creation process lies between participants and the various elements present in the artworks, shaped by both human and nonhuman agency. Drawing from the concepts of intra-action (Barad, 2007) and hybridity (Haraway, 1985), this relationship highlights how nonhumans—such as virtual bodies, spaces, and objects—contribute to the co-constitution of participant experiences. This hybridity is manifested in the merging of participant physical bodies with the virtual world, blurring the boundaries between the two. Such a perspective disrupts traditional notions of bodily originality and authenticity, emphasising the interconnectedness between human and more-than-human worlds (Alaimo, 2010; Haraway, 1985). This co-constitutive nature points to the existence of a collective, dynamic network of influence (Barad, 2007; Shanbaum, 2019) embedded in both the physical and virtual contexts in which participants operate. Participants are positioned as co-producers of their experiences within VR artworks, engaging as contributors in a mutually constitutive process (Stern, 2013).

The co-constitutive nature of human and nonhuman interaction challenges the conventional dominance of human agency in VR environments, shifting from a model of control and mastery to one of collaboration. As detailed in Sections 5.3 and 5.4, nonhuman agents—such as virtual bodies, spaces, and objects—play a significant role

in influencing participant behaviours. For example, my cooperation with Lena's body (5.3) and Fiona's acclimatisation to the virtual world and body (5.4) demonstrates how participants must learn to adjust their habitual physical actions to align with the movements and capabilities of their virtual bodies. This process often requires adaptation, compromise, and even moments of resistance as participants recalibrate their movements to interact with the virtual environment. These adaptations do not occur in a one-directional manner where participants impose their will on the virtual world. Instead, the interactions are reciprocal, with participants and nonhuman agents co-constructing the virtual experience. Within this process, the participants adapt to the unique characteristics of a virtual body, shaping their interactions with the virtual environment while simultaneously being shaped by it.

These findings highlight a non-dominant positioning of human agency in VR, emphasising the mutual and evolving influences that drive the participant's experience. Within this network, participants' agency interweaves with the agential power of nonhuman elements, leading to experiences that are shaped collectively. This collaborative process reflects a shift from traditional hierarchies of human control to a networked, relational framework of co-creation in VR art, where human and nonhuman agents both influence the emergence of meaning and experience.

The contribution of the nonhuman agencies to shaping participant experiences draws our attention to their potential to enrich the variety and randomness of participant movements. While many existing VR art experiences often feature virtual elements that respond in predictable or repetitive ways to participant interactions, this approach, I argue, can constrain the diversity of participant experiences and interpretations. To address this limitation, virtual objects could be designed to exhibit more improvised and autonomous movements, fostering a dynamic interplay that creatively connects to participants' actions. Such autonomy could disrupt predictable patterns and extend the possibilities for interaction, encouraging participants to explore novel movements, assumptions, and emotions. By introducing complexity and unpredictability into the actions of virtual objects, designers could foster a more dynamic interplay between participants and virtual environments. This approach not only broadens the scope of embodied engagement but also creates opportunities for richer interpretations. In doing

so, VR art interactions can move beyond a relatively reactive system to create more complex, multilayered experiences.

8.1.3 Immersive technology and embodied connections

The third level of co-creation in participant VR art experiences concerns the relationships between immersive technology and embodied connections. In Section 3.3, I examined the two dominant notions of immersion, which emphasise the preservation of illusion (Murray, 1997) and sensory fidelity (Slater, 2009) as essential components in creating immersive experiences. While both perspectives offer valuable insights in shaping our understanding of VR engagement, they are limited in addressing the role of autonomous, embodied engagement in cultivating individualised, multi-layered VR experiences.

As discussed in Section 3.3.1, Murray (1997; 2020)'s emphasis on preserving illusion during VR experiences implies a binary position between immersion and interaction. Interaction, in this framework, enriches viewer engagement on the one hand but risks disrupting absorption on the other. Thus, there is a tension in Murray's conception of the relationship between immersion and interaction. In the context of VR art creation, applying these ideas can lead to restricting participant interaction, with the primary goal being the preservation of immersion through a transparent mediation process. Although Murray's concept of immersion has been influential in narrative-based media, its applicability to interactive VR art experiences warrants reconsideration. Specifically, questions arise: Should immersion be viewed as a "fabric of illusion" (Murray, 1997, p. 106) to be preserved in interactive VR art? And whether interactions beyond the restrictions of "role-play" (Murray, 1997) will decrease viewer affective engagements with the media?

These questions lead to my critical reflections on the second dominant notion of immersion—the prevailing emphasis on technological development as the primary driver of immersive experiences. As outlined in Section 3.3.2, a key goal of VR development has been to "erase" the boundaries between physical and virtual environments, an aspiration that remains central to many contemporary VR designs. However, the findings in this thesis offer an alternative perspective on the relevance of these physical/virtual boundaries in relation to participant immersion.

Participants in my study did not experience a suspension of awareness between physical and virtual realities, even while engaging with virtual environments that invoked a strong sense of presence. Instead, they maintained a clear sense of the distinctions between these realms (7.3). This was facilitated by contrasting visual representations (e.g., alien landscapes versus seminar rooms), divergent bodily forms (e.g., human and nonhuman), and differing modes of movement (e.g., walking and floating). These distinctions continuously reminded participants of the differences between the physical and virtual worlds, even when such boundaries were subtle or unnoticeable. Nevertheless, despite the ongoing awareness of the physical-virtual divide, participants reported a strong sense of immersion. For example, Hannah described her experience of the virtual space and body as "fake" and "unreal," yet also expressed a sense of belonging and intimacy with the virtual environment (7.3).

Returning to the two questions I proposed earlier, these findings suggest that immersion, in participant experiences, does not necessarily manifest as the fabric of illusion. Instead, it emerges as a reflective process driven by interactions between the participant and the artwork. Participants do not fully lose themselves in an alternative reality, nor do they forget the mediation process. Rather than taking "dual roles" (of themselves and as a visitor), they bring their individual positionalities into their movements, thoughts, and emotions, leading to immersive experiences that are personally shaped by diverse affective connections.

My argument, however, does not negate the importance of technological advancements that provide the foundational infrastructure for immersive VR experiences, nor the role of narrative-based experiences in eliciting rich affective responses. Rather, I aim to shift the focus toward understanding how experiences within VR are complexly formed. These experiences are not merely the result of isolated visual or emotional stimuli but are instead shaped through a web of entangled, embodied events that unfold within the virtual environment.

Hence, my findings advocate for a holistic perspective in understanding immersion in VR art—one that integrates embodied connections alongside technological features. This alternative perspective moves beyond technologically deterministic models of immersion, underscoring the interplay between embodied interactions, reflective

engagement, and contextual influences. By focusing on how participants' embodied experiences shape their engagement with VR artworks, this approach provides a critical lens for rethinking how immersive VR experiences are designed, understood, and studied.

8.2 The multi dimensions of autonomous exploration

While in Section 8.1.1, I introduced both the positive aspects and potential challenges of enabling autonomous exploration in co-creating participant experiences, this section specifically focuses on what autonomous exploration entails and why it matters to embodied and affective connections.

Building on the empirical observations of this thesis, I suggest that the potential of interactive VR art experiences lies in their ability to cultivate deeply personal, embodied, and affective connections between participants and the artwork. Rather than prescribing a singular narrative, VR artworks can offer a landscape of potential meanings and interactions, allowing participants to construct their own narratives by interpreting and engaging with the cues and elements embedded in the virtual world.

In this section, I unpack three key aspects that collectively shape effective autonomous explorations: non-predetermined paths, unscripted movements, and contextual guidance within virtual environments. Drawn from the empirical data, I suggest that these elements matter to the formation of experience in empowering the participant to shape their experiences in ways that are both individually meaningful and contextually rich.

8.2.1 Non-predetermined paths as a non-linear mode of exploration

The findings of this thesis underscore non-linearity as a crucial feature in fostering autonomous engagement within VR environments. Drawn from the empirical studies in this thesis, I argue that non-predetermined paths serve as the foundation for enabling such non-linear exploration, allowing participants to make decisions regarding the sequence of their exploration, the duration spent in each space, and their focus on specific objects. These empirical findings demonstrate that participant choices were shaped by how they assigned significance to certain elements, and the relevance of those elements in relation to their evolving personal narratives.

The application of non-predetermined paths closely align with the earlier discussion on shared authorships between artists and participants (8.1.1). By prioritising participant agency, VR artworks shift from predefined storytelling structures to open-ended, co-creative engagements. Within these engagements, participants craft personalised experiences that resonate with their unique perspectives, emotions, and interpretations. This shift enhances the co-constructive relationship between the participant and the artwork, turning VR exploration into a dynamic, evolving dialogue rather than a fixed, linear journey.

The findings in this thesis illustrate how non-predetermined paths facilitate non-linear exploration, contributing to the depth and complexity of participant VR art engagement. As discussed in Section 5.2, Yuan and Lora's distinct exploratory choices led to vastly different associations and interpretations of the same artwork. Similarly, Section 7.4 examines Aiden's experience alongside my own autoethnographic reflections, revealing how re-engagement—a form of non-predetermined exploration—deepens emotional connection and fosters a more holistic experience. By revisiting and reflecting on the artwork, participants are encouraged to uncover new layers of meaning, thereby enriching their engagement. These examples suggest that allowing participants to reengage, reinterpret, and re-feel the VR environments in non-linear ways creates richer, multi-layered interactions.

By embracing non-predetermined paths, VR can potentially provide more diverse, interconnected, and deeply personal experiences compared to conventional linear narratives. This approach allows participants to weave together contextually relevant nodes, co-constructing individually meaningful narratives rather than following a singular, imposed storyline. This collaborative process is enriched by the interpretive possibilities that emerge through participant engagements, where the choices participants make regarding paths, sequences, timing, and focus become integral to their meaning-making process.

8.2.2 Unscripted movements and unpredictability

A crucial aspect of fostering autonomous exploration in VR art is the presence of unscripted movements—actions that emerge organically from participants' interpretations, emotions, and questions rather than being pre-defined responses to

scripted stimuli. As demonstrated in the findings, unscripted movements play a pivotal role in shaping participant meaning-making process. For example, in C2, Lora attempted to stack small chairs together to "save" the big chair (Section 5.2). This action was not pre-determined by the artwork but instead stemmed from her interpretation of the narrative, illustrating how embodied responses and improvised interactions can generate new layers of meaning within VR environments.

Prior research has stressed the physical and logical coherence and consistency of participant movements in VR as crucial elements that contribute to immersive experiences (Hameed & Perkis, 2024). Such congruent and autonomous movements, as noted by scholars like Omar (2022), not only enhance a sense of “freedom” in interactions, but also contribute to participant agency, body ownership, and a heightened sense of presence in virtual environments. My findings extend this discourse by elaborating the relationships between unscripted movements and participant emergent narratives and emotional depth in VR art. Across the case studies, these spontaneous interactions unlocked novel interpretative possibilities, fostering affective engagement and a multiplicity of meanings in ways that scripted experiences often constrain.

The findings suggest that unscripted movements introduce an element of unpredictability to VR art experiences, encompassing both participant actions and the behaviour of interactive objects. This unpredictability is shaped by how participants engage with virtual objects and the meanings they derive from these interactions. For instance, in C2, participants could generate illuminated eggs from their virtual bodies, which would then grow into random alien plants. The ambiguity of this transformation invited participants to explore the plants’ functions, patterns, and symbolic meanings, leading to diverse emotional and interpretative responses. In contrast, the VR headset in C3 had a straightforward, predetermined function—transporting participants between virtual spaces. While functional, this design limited participant engagement to a single interpretive layer, reducing emotional resonance and preventing deeper narrative co-construction.

The key difference between these two interactive elements, the illuminated eggs in C2 and VR headsets in C3, lies in their capacity to extend participant interpretation and emotional responses. The VR headset, while informative, functioned primarily as a tool—

a device for navigation rather than a co-creative element of the experience. The illuminated eggs, however, fostered a space for imagination and improvisation, inviting participants to become co-creators by allowing more possibilities for engagement and interpretation. In C2, participants reported associating their interactions with the alien plants with emotions such as intimacy, ownership, parenthood, and partnership, reflecting an individualised and deeply affective engagement process.

Echoing my earlier discussions of co-creative dynamics (8.1), unscripted movements facilitate the balanced agency between human and nonhuman agents (participants, artists, artwork, and VR system) in co-constituting experience, contributing to a model of shared authorship between artists, participants, and the artwork. By embracing unpredictability and improvisation of participant interaction with the artworks, VR can cultivate more diverse, affective, and personally meaningful experiences.

8.2.3 Contextual guidance in facilitating autonomous exploration

Building on the earlier discussion regarding the potential risk for distraction posed by less relevant interactive elements (8.1.1), the findings suggest that unscripted movements and non-predetermined paths should be thoughtfully designed within a framework of contextual coherence—ensuring alignment between the appearance, mechanics, and interaction modes of virtual elements (5.5). Contextual guidance, as the third interrelated aspect of autonomous exploration, emerges as a critical strategy to focus participant attention on relevant content while preserving their autonomy and capacity to craft individual narratives.

The findings reveal that contextual guidance functions as a subtle regulatory mechanism, encouraging participants to (re)engage with significant elements without disrupting their affective connections to the artwork. For instance, in C1 (7.5), participants responded differently to the dark area at the end of the tunnel, with some experiencing emotional resistance while others developed metaphorical interpretations. This led some participants to retreat from the dark area, revisiting previous spaces. As discussed in Section 7.5, while this form of guidance influences participant movements and spatial navigations, it does not impose rigid constraints on their explorations. Instead, it operates as a flexible, thematically embedded boundary, subtly steering participants toward

certain directions without dictating a singular narrative. During this process, participant's interpretations of the artwork's thematic and symbolic implications continue.

Additionally, the findings indicate that contextual guidance enhances the depth of participant engagement by offering interpretive cues that support layered understandings of the artwork. This is particularly crucial in helping participants navigate abstract or unfamiliar elements (e.g. strange or unknown objects) in the artworks. In C2, for example, participants constructed multidimensional understandings of Lena's biological and geographical attributes, interpreting her resilience to desert climates or sensitivity to poisonous plants (5.5). This was made possible, I argue, through thoughtfully integrated contextual elements within the artwork that resonated with participant explorations and affective responses.

In contrast, in C3, participants struggled to interpret abstract forms, such as the virtual robotic hand. While some participants made instant personal associations, they did not develop cohesive narratives about these elements. As discussed in Section 5.5, this disparity can be attributed to the differing levels of contextual guidance in the respective VR environments. The weaker contextual alignment between the appearance, mechanics, and interaction modes of the virtual body and environment in C3 limited participants' ability to establish physical and emotional connections with the artwork. This misalignment constrained engagement and made it more challenging for participants to enhance depth of interpretations.

The variations in participants' interpretive depth also reveal a non-linear relationship between art appreciation and participants' professional art expertise or knowledge. While Leder et al. (2012) suggest that understanding art, particularly abstract and ambiguous content embedded with implicit meanings or emotions, is closely tied to participant expertise in art, the findings of this thesis suggest otherwise. My findings indicate that participants' ability to engage with abstract or unfamiliar elements was not necessarily determined by their art background, but rather by their capacity to establish personal connections with these elements. This highlights the significance of contextual guidance in VR art—it provides participants with the necessary cues to collect, connect, and construct meaning across multiple elements within the artwork. Rather than requiring formal expertise, effective contextual scaffolding enables participants to

anchor their interpretations in personally meaningful ways, fostering affective engagements with the virtual experience.

The interplay between non-predetermined paths, unscripted movements, and contextual guidance is pivotal in eliciting effective autonomous explorations. This interconnection allows participants to construct narratives that are both personally significant and thematically coherent within the artwork. By maintaining this balance, VR artworks can support exploratory engagement while offering a scaffold for multidimensional experiences. This approach contributes to the development of a hypermediated approach for understanding VR art experiences in a non-reductive framework. By embracing multiplicity, complexity, and fluidity in participant engagement, this framework challenges the dominance of structured narratives, predetermined interactions, and technologically deterministic models. Instead, it underscores the co-constructive nature of VR experiences—where meaning emerges through complex, embodied interactions between participants and VR art.

8.3 Implications for VR art creation and research

In this thesis, I explored the concepts of embodiment, interaction, and immersion within the context of VR art to examine the processes underpinning participant experiences. These concepts formed the foundation for several key arguments developed throughout the thesis. First, participant engagements are situated within their individual positionalities, shaping their unique ways of moving, thinking, and feeling within the artworks. These positionalities influence the interpretations and connections participants develop with the virtual environment. Second, the interactions between participants and artworks are co-constitutive, involving human and nonhuman, physical and virtual elements. Participants learn and adapt to alternative ways of movement, fostering new methods of engagement. Third, immersion in interactive VR art is understood not as a fixed technological outcome or merely a product of human agency but as a processual, reflective, and complex experience characterised by participants building embodied and affective connections with the artworks.

While participant interactivity in VR has been largely conceptualised as the ability to move and manipulate virtual objects and environments (Lee & Cho, 2019), the findings in my thesis show that participant movements in VR art experiences are not purely

functional; instead, they are imbued with affective meanings that contribute to deeper levels of engagement. Immersive experience, in this context, emerges as a dynamic and cooperative process where participants simultaneously influence and are influenced by the virtual environment. This cycle of co-creation demonstrates the unique potential of VR art to cultivate diverse and profound participant experiences.

For VR artists and designers, the findings of this thesis advocate for a more open and participant-centred approach to designing VR art experiences—one that acknowledges embodiment as central to how meaning is created and experienced. This approach involves granting participants greater autonomy to explore the artwork based on their own interests, memories, sensorial awareness, and emotional responses. Rather than confining viewers to pre-determined paths, functional tasks, or linear narratives, artists are encouraged to treat them as co-creators of experience within the virtual environment. Importantly, allowing interpretive flexibility does not mean abandoning artistic intention or leaving participants disoriented. Instead, it invites a rethinking of how meaning is embedded and conveyed. By designing layered structures and non-linear narratives, artists can offer multiple entry points for engagement without dictating a single pathway. This fosters a more embodied, reflective, and personally meaningful form of immersion, where each experience is uniquely shaped by the participant's engagements and positionality.

From a creative standpoint, this thesis invites artists to consider VR as a space that can support relational, fluid, and co-constitutive experiences—foregrounding the potential entanglements between human and nonhuman agencies. Practically, this perspective encourages more inclusive design, viewing unpredictability as a generative part of the creative process. The findings suggest that approaching VR with an awareness of participant embodiment—while recognising that individuals bring diverse physical, cultural, and emotional backgrounds into virtual environments—may offer valuable opportunities for artistic experimentation. This thesis proposes that a participant-centred, embodiment-aware approach can support VR artists in exploring new dimensions of meaning-making, while remaining attentive to the complexity of participant experience.

For researchers, these findings highlight the importance of considering participants' individual contexts as significant aspects influencing their VR art experiences. Recognising participant interactions as deeply embodied and situated allows for a richer understanding of how meaning is co-produced through the continuous interplay of physical and virtual engagements. Such an orientation has the potential to enrich theoretical exploration of the concepts of embodiment, immersion, and interactivity by grounding them in experiential complexity. In doing so, it encourages methodological sensitivity to the lived and affective dimensions of VR interaction and supports the analytical methods that capture the relational and complex nature of virtual experiences.

While this thesis has primarily focused on embodiment as it relates to interaction and immersion in VR art, the findings also suggest broader applications. Embodiment appears to play a critical role in shaping experiences of body ownership, agency, emotions, sense of belonging, intimacy, and presence. Future research could usefully investigate how these dimensions emerge and intersect through embodied VR engagement, offering insights not only for art-focused experiences but also for broader fields of digital media.

8.4 Limitations of this research

In examining participants' experiences with VR art, several limitations have influenced the depth and scope of this research. These include (1) the degree of participant agency permitted by the design of the artwork, (2) constraints on movement imposed by the VR headset and the physical research space, and (3) technical challenges associated with setting up and connecting personal VR headsets within the university network.

First, as discussed throughout this thesis, the degree of agency and autonomy granted to participants in co-creating their experiences significantly affected the depth and complexity of their engagements. The varying levels of autonomous exploration enabled by the three selected artworks resulted in differences in the richness and variety of data across the case studies. When artworks restricted participant exploration—for example, by enforcing linear narratives, prioritising visual observation over bodily engagement, or focusing on functionality over meaning-making—participants produced fewer reflective and meaningful responses. For instance, although all three selected artworks provided exploratory paths undirected by camera movements, C3 presented the virtual spaces in

a linear format that hindered opportunities for re-engagement. Furthermore, many spaces in C3 offered limited areas for movement and fewer interactive possibilities. These constraints reduced the diversity of participant interpretations and interactions, thereby impacting the depth of the collected data. Future research may consider the levels of autonomous exploration and interactive possibilities as important features in encouraging embodied explorations.

Second, participant movement, a critical element in producing affective and embodied experiences, was constrained by technological and spatial limitations. Issues with the VR headset, such as connectivity problems in wireless settings, the encumbrance of cables in wired settings, the physical discomfort caused by the heaviness of the headset over time, and the challenges of using controllers to perform certain movements, all impacted the quality of participants' physical experiences. Moreover, the use of a seminar room as the research space posed additional constraints. As discussed in Section 4.8, the limited size of the room restricted participants' physical exploration, with many participants frequently reaching the boundaries of the space and needing to step back to continue moving forward, thereby interrupting the continuity of their experiences and introducing distractions. Participants also expressed concerns about bumping into walls or damaging the equipment, which led to a reduced willingness to engage in experimental or exploratory movements.

Finally, the setup and connection of personal VR headsets within the university network presented additional challenges. These technical difficulties required effort to resolve and carried risks of failed connections, which could lead to lost research time and disrupted participant visits. The need to troubleshoot network compatibility issues often added delays and interruptions to the research process, creating logistical barriers that occasionally impacted the scheduling and smooth execution of participant sessions.

These limitations highlight the practical challenges of conducting research on VR art and underscore the importance of addressing technological, spatial, and logistical constraints in future studies. To mitigate these challenges with current technologies, future research could explore the use of larger, purpose-designed research spaces, advancements in VR hardware, and improvements in network infrastructure to enhance both the quality of participant experiences and the reliability of data collection. Another

potential future solution may also involve VR walking devices, which are currently in development. These technologies could help address spatial limitations by enabling more walking movement within virtual environments, further expanding the possibilities for autonomous exploration and embodied interaction in VR art research. Additionally, designing VR artworks that prioritise participant agency and foster open-ended, embodied engagement could further deepen the understanding of VR art experiences.

8.5 Summary

This chapter synthesised the key findings from the empirical chapters, integrating theoretical frameworks with empirical evidence to examine how cooperative dynamics and autonomous exploration shape participants' engagements within virtual environments. It encapsulates the main arguments of this thesis by demonstrating the interconnected processes of creation and interaction in VR experiences.

Through the analysis of three interrelated levels of cooperative dynamics, the chapter explores the distributed process of creation among artists, participants, and the artwork. This process is characterised by the interplay between human and nonhuman agencies, supported by the mutual contribution of VR technologies and embodied connections. These discussions elucidate the meanings of cooperative physical-virtual bodies in the context of this thesis, elaborating on the complex layers of connection within these dynamics. By unpacking these co-constitutive relationships, the chapter furthers posthumanist discourse of VR interaction and virtual embodiment.

This chapter also examines the significance of autonomous exploration in VR experiences, highlighting three key aspects fostering it: non-predetermined paths, unscripted movements, and contextual guidance within virtual environments. These elements, drawn from the findings of this thesis, collectively contribute to meaningful and effective autonomous explorations. The insights gained provide implications for the future design of VR experiences, advocating for a more open and participant-centred approach to the creation and design of VR art experiences. This perspective calls for rethinking how the meanings of artworks are conveyed and negotiated among artists, the artwork itself, and participants. Additionally, the chapter suggests embedding layered contexts within VR environments to offer multiple points of entry for interpretation, striking a balance between highly personalised exploration and the risk of irrelevance.

Chapter 9. Conclusion

This chapter concludes the thesis by summarising its key contributions and reflecting on its implications for academic scholarship and professional practice. As highlighted in Section 1.2, significant research has focused on exploring the technological properties of VR and their relationship to participant experiences, often centring on viewer cognitive responses to VR stimuli. While these studies have established a strong foundation for understanding VR interaction, this thesis seeks to contribute another useful perspective that expands and complements this body of work.

By adopting an embodied and participant-centred approach, this research highlights the relational and processual nature of VR immersive experiences, focusing on how participant movements, emotions, and reflections intertwine with the virtual environments. This perspective acknowledges the co-creative dynamic between participants and VR artworks, proposing that VR interaction is not solely a product of technological design but also shaped by the embodied and contextual engagements of the viewers. The empirical findings address the three research questions posed in this thesis: 1) How do participants interact with VR artworks in embodied ways? 2) How do participant prior knowledge and personal experiences contribute to their interactions with VR artworks? 3) How is immersion experienced by participants in VR art?

The findings reveal that participant embodied experiences in VR art emerge from dynamic and interdependent processes of moving, thinking, feeling, and cooperating with virtual bodies and environments. These findings support arguments for approaching interaction in interactive media art as embodied and affective (Stern, 2013; Shanbaum, 2019). The physical movements participants perform within the artworks are often imbued with contextual meanings, created through embodied engagements that intertwine with associations, questions, reflections, and emotions arising during the experience. These processes are neither wholly dictated by the participants' interpretations nor entirely governed by the artist's intended vision. Instead, participants navigate a middle ground constructed through “intra-action” (Barad, 2013), learning, compromising, and adjusting to alternative modes of engagement with the virtual bodies and environments. In this dynamic interaction, participants become co-creators of their experiences, shaping their experiences through the interplay of human and nonhuman influences. This co-creative

dynamic emphasises the relational nature of VR art experiences, where meaning and interaction are continuously negotiated and constructed through embodied and affective interplay.

In the process of experiencing VR art, participants' prior knowledge and personal experiences play a critical role in shaping and constraining how they interpret and engage with virtual content. Their choices and modes of engagement are largely informed by personal habits, preferences, and knowledge, while their interpretations and emotional responses are often deeply rooted in their personal histories and backgrounds. Supporting the arguments that knowledge and experiences are grounded in individual positionalities (Haraway, 1985; Halyes, 1999; Braidotti, 2013; 2019), the findings in my thesis underscore the individuality and contextual specificity of participant experiences, highlighting the localized and personal nature of their interactions. Such highly personalised engagements are vital for fostering emotional connections to the artworks, enabling participants to derive individually meaningful and impactful experiences. This emphasis on the participant's unique perspective enriches the understanding of VR art's potential to create profound, reflective, and deeply personal interaction and immersive experiences.

In the context of my thesis, immersion in interactive VR artworks is understood as a complex and multidimensional process of building embodied and affective connections with the artworks. Participants experience a reflective engagement process in which they remain aware of the distinction between their physical and virtual bodies and environments while critically engaging with these layers of experience. Affective connections are established through embodied and contextually relevant engagements, where participants continually enhance their emotional investment and gain a more holistic understanding of the artworks. These findings underscore the significance of participant agency and autonomy in shaping immersion, as participants co-construct connections with the artwork through their unique perspectives and interactions. This perspective aligns with arguments for approaching immersion through a hypermediated framework (Bolter & Grusin, 1999; Bolter et al., 2021), which highlights the role of participant agency in creating meaningful and personalised experiences, rather than viewing immersion as total absorption.

Through these findings, this thesis argues that VR and VR art hold the potential to create embodied, exploratory, and reflective experiences that are deeply personal and meaningful. By enabling participants to engage with virtual environments in ways that are rooted in their embodied knowledge, prior experiences, and individual positionalities, VR and VR art can cultivate multidimensional exploration and interpretation. These characteristics underscore the potential of VR as a medium for creating in-depth and emotionally resonant experiences.

9.1 Contribution and future research

The findings of this thesis address critical gaps in scholarly discourse, particularly the underexplored investigation of viewer embodied experiences (Popat, 2016), the processes underlying viewer emotional responses (Sora-Domenjó, 2022), and the potential of VR to foster more meaningful bodily engagements (Davies, 2017; Moura, 2021). This thesis contributes to the academic community by broadening the scope of VR research to include and emphasise the embodied, affective, and relational dimensions of viewer interactions. By situating participant experiences within their unique personal and cultural contexts, this research underscores VR's potential to facilitate embodied experiences that extend beyond the conventional focus on replicating realism or achieving technical precision. By doing so, it provides deeper insights into the complexity and diversity of participant engagements with VR.

The study extends posthumanist discourse on the body to the empirical investigation of VR art, introducing innovative methodologies to explore the concept of embodiment within virtual worlds. Through its in-depth qualitative exploration of participant experiences in VR art, this thesis builds steps for future studies that recognise the critical role of bodily engagement and embodied knowledge in shaping interactions with virtual environments. The methodologies and findings presented here invite further research to build on these ideas, enriching the field by addressing the diverse and situated nature of VR experiences.

Beyond its academic contributions, this thesis offers valuable insights for VR artists and designers by presenting an alternative perspective on interaction design and participant experiences. By emphasising VR's prospective to foster complex and personalised engagements, the research advocates for the creation of VR artworks that support

individualised exploration and meaning-making while embracing the diversity of participant positionalities. This work encourages creators to reconsider the balance between maintaining their artistic vision and allowing for participant agency. It highlights the importance of designing experiences that empower participants to navigate and interpret virtual environments autonomously, while ensuring contextual coherence to support deep and meaningful engagement. By adopting innovative engagement strategies, VR artists and designers can create works that are both impactful and inclusive, fostering profound connections between participants and the virtual worlds they explore.

While this thesis focuses primarily on participant embodiment in VR art interactions, the findings open several potential avenues for future research. Expanding the theoretical and methodological approach of this thesis, future inquiries could explore the relationships between embodiment and concepts such as body ownership, sense of belonging, intimacy, and privacy in VR or other forms of interactive media experiences. While these areas were touched upon in the data, they were not deeply examined in this thesis. For instance, this study noted that participants reflected their experiences in VR as private, which gave them a greater sense of security and confidence, and enabling actions they might avoid in public contexts. These areas present rich opportunities to further comprehend understandings of participant embodied experiences in interactive VR experiences.

Another important direction for future research involves addressing the paradox between posthumanist perspectives on embodiment and the culturally shaped dualistic perspectives held by participants in recognising VR. As highlighted in Section 6.5, this thesis identified a significant tension: while posthumanist critiques reject binary and disembodied frameworks, participants often conceptualised their VR experiences within such frameworks. This discrepancy reflects a broader gap between researcher-centred and participant-centred perspectives on the nature of VR experiences. Further research could explore how these contrasting viewpoints shape the design, experiences, and expectation of VR artworks. By investigating this tension, scholars and creators might identify ways to bridge the gap, fostering mutual understanding and creating VR experiences that both challenge traditional dualistic paradigms and resonate with

participant expectations. This line of enquiry could contribute significantly to advancing both posthumanist theory and the practical development of VR as a medium for complex, embodied interactions.

As highlighted in Section 8.4 of this thesis, future research should consider addressing several limitations that emerged during this study, including spatial constraints, participant agency in artwork design, and technological challenges. Addressing these limitations in future studies could benefit the process of the research and lead to richer data.

Fostering collaboration between academics and VR creators presents another promising research avenue. As discussed in Section 8.3, findings of thesis provide several potential implications of future designs of VR. The theoretical and empirical insights from this thesis could inform the development of new interactive VR experiences, enabling creators to experiment with and refine these findings in practice. Such partnerships could lead to innovative designs that integrate theoretical frameworks with artistic and technological creativity.

By addressing these research directions, scholars and creators can deepen their understanding of embodied engagement in VR and interactive media, enriching both theoretical discourse and practical applications. This continued exploration has the potential to advance the fields of media studies and VR creation, expanding the boundaries of how we conceptualise and design embodied interactions in virtual environments.

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Appendices

Appendix 1: Participant information sheet

The Embodied Experience in Virtual Reality Art

Participants information

My name is Yiwen Li, I am a PhD student at UCL Institute of Education (IOE). I am inviting you to take in part in my research project "The embodied experience in virtual reality art". The embodied experience refers to how you move, think and feel in the VR art experiences. In this study, I am hoping to explore how you will act in embodied ways in an interactive VR art experience, how prior knowledge and personal experiences are brought into your interactions, and in what ways a sense of immersion will be realised in your experience.

In the research, you will experience a virtual reality artwork *False Mirror* (2017) created by artist Ali Eslami. In the VR art work, you will embody Lena, a nonhuman avatar, and experience an alien world with her body. You are welcome to explore the artwork in any creative ways / movements.

The study will be conducted in a seminar room at UCL Knowledge Lab (23-29 Emerald St, London WC1N 3QS). The study will take about 2 hours, which includes 30 minutes of experience time and an hour interview.

I very much hope that you would like to take part. This information sheet will try to answer any questions you might have about the project, please don't hesitate to ask me if there is anything else you would like to know.

Who is carrying out the research?

The research will be carried out by myself (Yiwen Li) and supervised by Professor Carey Jewitt and Dr. Phaedra Shanbaum.

Why are we doing this research?

The aim of this research is to contribute understanding of participant embodied experiences of interactive VR art, which provides insights on the designs and uses of interactive VR art works. The research will not only explore participant interactions in VR art, but also draw attention to their thoughts, feelings, and self-reflections that each participant brings to their experiences.

Why am I being invited to take part?

The study of embodied experiences requires sharing from different backgrounds and perspectives, your contribution will be important to the research. Please feel free to share any thoughts about your experiences.

What will happen if I choose to take part?

In taking part, you will be involved in an observation research and an hour interview. You will need to wear a mask and keep social distancing with the researcher (Yiwen Li) while doing research. Before the research day, the researcher will communicate with you about your recent schedule and body conditions to make sure both of you are safe to meet. Please contact the researcher and rescheduled the research if: 1) you recently travelled to other countries in the past 14 days, 2) you had face to face contact with someone is Covid-19 positive, 3) you appear to have Covid/flu symptoms.

The VR equipment will be provided by the researcher. The equipment will be cleaned by sanitizing wipes before and after use. A disposal eye mask will be provided. Before the experience, you will have 10 minutes familiarization with the headset. Please feel free to adjust screen brightness and sound volume with your needs. During the experience, the researcher will observe your experience and make records by notes and videos.

After the experience, the researcher will have a debrief session with you to ascertain if you feel stressed or anxious about the experience. If you are happy to continue, you will be invited to attend an hour interview. You can refuse to answer any questions you do not feel like to. Interviews will be recorded by a camera and notes.

Will anyone know I have been involved?

Your personal information will not be shared with anyone outside of the project. Your names will be pseudonymized in reports, publications and final PhD thesis. No identifiable data will be used in the research.

Could there be problems for me if I take part?

The artwork involves experience of floating/moving in the air. If you have motion sickness, or a strong fear of height that may result in a strong response (e.g. a panic attack) we advise you do not participate in the research. If you do not feel comfortable with any scene, you are free to stop the experience or withdraw at any point of the study. The researcher will debrief you after the experience and provide support. If later, you feel emotionally unwell, we suggest that you seek support from "Samaritans" on telephone: 116 123 or email: jo@samaritans.org ("Samaritans" is a UK organization which provides listening and support for people who are emotionally venerable). You can also call these charities and organisations for support.
No Panic: 0844 967 4848 (Daily, 10am to 10pm)

Anxiety UK: 03444 775 774 (Monday to Friday, 9.30am to 5.30pm)

What will happen to the results of the research?

Results of the research will be used in a PhD upgrade document, the final PhD report and relevant journal articles and conference presentations. If you would like to receive a copy of the report, please tick the option in the consent form. Data will be stored in an encrypted computer with copies in external hard drive. All identifying data will be erased when the PhD has been completed (Maximum 10 years).

Data Protection Privacy Notice

The data controller for this project will be University College London (UCL). The UCL Data Protection Office provides oversight of UCL activities involving the processing of personal data, and can be contacted at data-protection@ucl.ac.uk. UCL's Data Protection Officer can also be contacted at data-protection@ucl.ac.uk. Further information on how UCL uses participant information can be found here: https://www.ucl.ac.uk/legal-services/privacy/ucl-general-research-participant-privacy-notice.

Contact for further information

If you have any further questions about the research or your personal data, please feel free to reach me through email [redacted]. If you would like to be involved, please complete the attached consent form and return to the researcher.

This project has been reviewed and approved by the UCL IOE Research Ethics Committee. If you wish to exercise your rights as a research participant, or wish to make a complaint, please send an email with details to the UCL Institute of Education Research Ethics Committee on ioe.researchethics@ucl.ac.uk so that we can look into the issue and respond to you. You can also contact the UCL Institute of Education Research Ethics Committee by telephoning +44 (0)20 79115449.

Thank you very much for taking the time to read this information sheet.

Meeting place

UCL Knowledge Lab
23-29 Emerald St, London
WC1N 3QS

Google map link: https://goo.gl/maps/iPAwxKxPUEpeuF6n8

(10 minutes walk from Russell Square/Holborn underground station)

The researcher will meet you at the entrance (as shown in the picture) of the building.

Please contact when you arrive.
Yiwen Li
Telephone: [redacted]
Email:[redacted]

Appendix 2: Artwork descriptions

Case study 1: Descriptions of artwork

Methods of moving

In the experience, you will have two ways of moving: walking and smooth navigation. You can walk in the virtual space within the preset safety boundary in the physical space. When you reach the edge of the safety boundary, blue lines will appear in the virtual space to remind you stop walking forward. To use smooth navigation, use the joystick on your left controller (Fig. 1) to smoothly move toward certain locations. (*Smooth navigation may cause motion sickness/dizziness*). With the joystick on your right controller (Fig. 2), you can smoothly move up or down in the virtual space. You can use the two joysticks together or separately based on your needs.

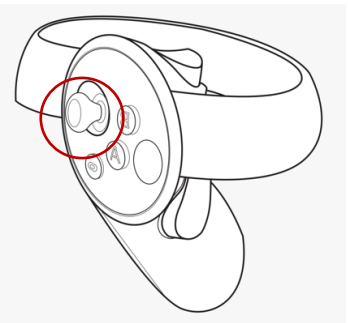


Figure. 1 Smooth navigation

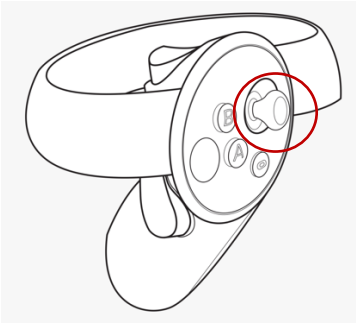


Figure. 2 Up & down

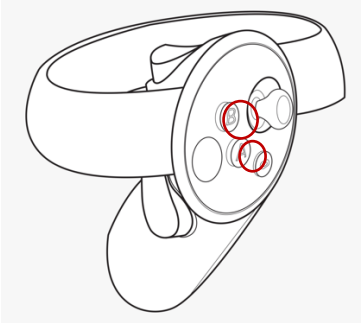


Figure.3 Interact with body

Avatar

In the experience, you will use an avatar body called Alless. The world of False Mirror can only be accessed by Alless, therefore, you can see a VPN device on your left wrist that help you to fake Alless' identity. When the number goes from 100 to 0, you will be forced out of the virtual world. On your right hand is a vacuum and torch device which can be activated by pressing the buttons.

Entering the experience

Your experience will start at a lobby. After pressing the [START] button in front of you, you can move to the elevator in front. Press the button with an icon of a house, you will be transported to Alless' home. There are some adjustment panels on your right-hand side room, where you can adjust your avatar body if needed. To enter Sky Ville, go to the round platform with a big screen in the middle of the room, click button [A] on your right controller (Fig. 3) to select [ACID PARK—— Skyville ——GO].

Interactive objects

At the entrance of *Sky Ville,* you will see two panels on your left-hand side, where you can adjust the pattern and music playing in the first room. On your right-hand side is the artist statement and a small window, where you can open and find some interactive objects. You are free to take them with you or come back later during the experience. The objects include: Slow-Mo lighter (Fig. 4), which slows down the speed of time in *Sky Ville*; Time Boost lighter (Fig. 5) which speeds up time; Aqua lighter (Fig. 6) that creates water effect and sound around you; and Gun dictionary (Fig. 7) that defines objects that it shoots at.

Figure. 4-7 Slow-Mo lighter, Time Boost lighter, Aqua lighter, Gun-dictionary

Case study 2: Descriptions of artwork

Methods of moving

In the experience, you will have two ways of moving: walking and smooth navigation. You can walk in the virtual space within the preset safety boundary in the physical space. When you reach the edge of the safety boundary, blue lines will appear in the virtual space to remind you stop walking forward. To use smooth navigation, use the joystick on your left controller (Fig. 1) to smoothly move toward certain locations. (*Smooth navigation may cause motion sickness/dizziness*). With the joystick on your right controller (Fig. 2), you can smoothly move up or down in the virtual space. You can use the two joysticks together or separately based on your needs.

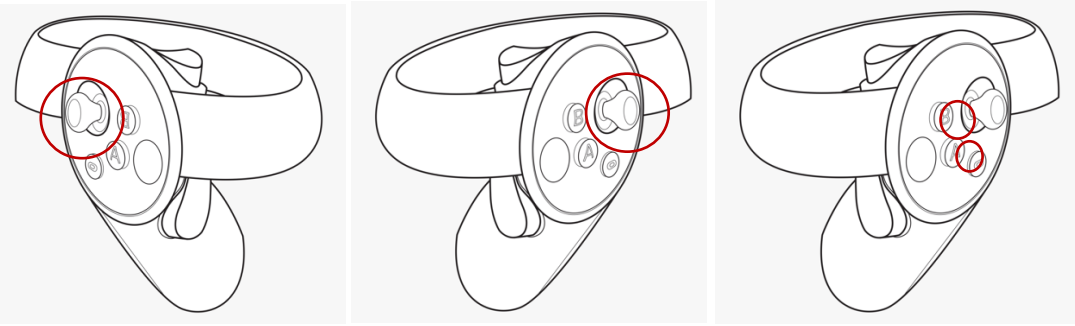


Figure. 1 Smooth navigation Figure. 2 Up & down Figure.3 Interact with body

Avatar

In the experience, you embody an avatar called Lena (Fig. 4). Lena is a nonhuman form who lives in an alien world. She has completely different physicality, movements, and

perceptions of time and space compared to human beings. While moving, she unconsciously leaves fragments of her body. Lena has a strong connection with alien plants that she grows on her body. To interact with Lena's body, press "B" and "A" button on the right controller (Fig. 3).

Figure.4 Lena's body

Virtual space

Lena lives in an alien world which has a completely different geography and landscape than the Earth. In this world, a different sense of gravity, physicality, and space-time applies. Lena was born from a seed (Fig. 5) in a pond, you will start the experience from here. Traveling in this world, you will encounter some interactive objects, such as: a floating greenhouse (Fig. 6) where psychedelic mushrooms are bred, plants (Fig. 7) that correspond to specific time of the day, and also portals (Fig. 8-10) where Lena can travel to other spaces in *False Mirror* (These portals are one way travel, which means you will not be able to come back to Lena's world after you travel to other spaces).

Figure. 5 Seed

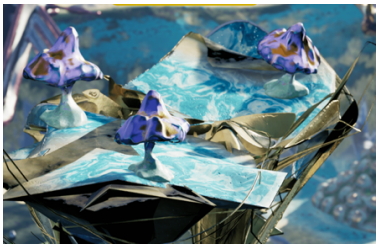


Figure.6 Greenhouse

Figure.7 Plants

Figure.8-10 Portals

Case study 3: Descriptions of artwork

In Between Nodes (2021) is a VR artwork created by experimental visual artists Razieh Kooshki and Vahid Qaderi. In this artwork, participants can travel to parallel virtual spaces and interact with some virtual objects. Through travelling to difference scenes, participant can explore their relationships with the spaces, objects, and avatar.

Methods of moving

In the experience, you will have two ways of moving: walking and teleport. You can walk in the virtual space within the preset safety boundary in the physical space. When you reach the edge of the safety boundary, blue lines will appear in the virtual space to remind you stop going forward.

To use teleport, raise your hand and point the right controller at certain direction, and gently press the joystick or "A" button (Fig. 1). You will see a blue arrow showing the area that you will move to. To interact with virtual objects, press and hold the button on either side of the right/left controllers (Fig. 2 & 3).

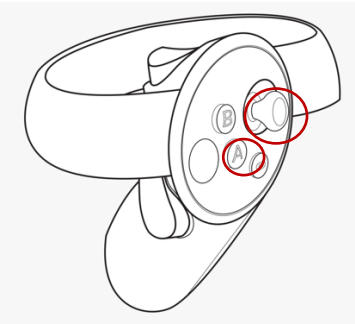


Figure. 1 teleport

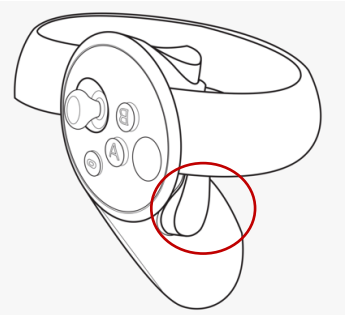


Figure. 2 hold objects

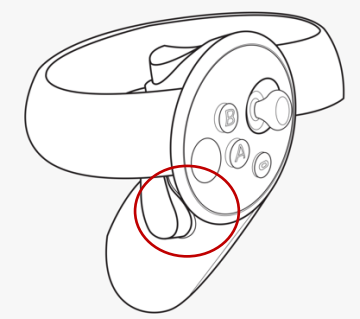


Figure.3 hold objects

Virtual space

Participant will experience eight different virtual spaces in the artwork. Some spaces can be dark. *If you have strong fear of darkness that would evoke panic attack, we suggest you not to take part in the research*. To enter the next virtual space, you need to find the VR headsets (Fig. 4 & 5) in each virtual space and put it on your head. You will not enter the next space if you lose or cannot find the VR headset.

Figure. 4 & 5 VR headsets in virtual space

Appendix 3: Artist statement

Case study 1 & 2: Artist statement by Ali Eslami

If future humans (or post-humans) ever live in completely virtual worlds, what would their lives look like? False Mirror is an open-ended, interactive, virtual reality project, which aims to explore speculative futurism and emerging forms of inhabiting virtual space-times, as post-humans.

My work explores the relationship between new class identities and UFO sightings. With influences as diverse as Machiavelli and Roy Lichtenstein, new tensions are manufactured from both simple and complex meanings. Ever since I was a child I have been fascinated by the ephemeral nature of the moment. What starts out as hope soon becomes finessed into a manifesto of greed, leaving only a sense of failing and the inevitability of a new reality. As momentary replicas become clarified through frantic and repetitive practice, the viewer is left with a testament to the edges of our condition.

My work explores the relationship between new class identities and unwanted gifts. With influences as diverse as Camus and Frida Kahlo, new tensions are created from both mundane and transcendent narratives. Ever since I was a student I have been fascinated by the ephemeral nature of the zeitgeist. What starts out as contemplation soon becomes corrupted into a hegemony of power, leaving only a sense of failing and the prospect of a new reality. As subtle phenomena become frozen through boundaries and academic practice, the viewer is left with a testament to the outposts of our culture.

My work explores the relationship between postmodern discourse and unwanted gifts. With influenced as diverse as Wittgenstein and Francis Bacon, new tensions are manufactured from both opaque and transparent layers. Ever since I was a pre-adolescent I have been fascinated by the ephemeral nature of the zeitgeist. What starts out as hope soon becomes corroded into a tragedy of defeat, leaving only a sense of chaos and the possibility of a new beginning. As shimmering phenomena become clarified through studious and academic practice, the viewer is left with a testament to the limits of our culture. (Eslami, 2017)

Case study 3: Artist statement by Razieh Kooshki and Vahid Qaderi

The only reality is existence." There have always been and there will always be doubts about the reality of the world we live in. Is it real or is it just a dream, or a designed virtual space? Even if someone comes and leads us to the real world by offering the famous red pill, we can still question that world too. Is that one finally real? Or is it another designed space? And what if we design reality? What if we design a reality within a virtual reality that lies inside another virtual reality…? How many designed worlds do we need to cross to finally reach reality? (Kooshki & Qaderi, 2021)

Appendix 4: Consent form

CONSENT FORM

OBSERVATION / INTERVIEW

If you are happy to participate in this study, please complete this consent form and return to Yiwen Li.

I understand that by not giving consent for any one element that I may be deemed ineligible for the study. If you have any question about the consent form, please feel free to ask the researcher.

	Yes	No
I have read and understood the information leaflet about the research.		
I consent to the observation research in the experience.		
I understand that I can withdraw from the project at any time, and that if I choose to do this, any data I have contributed will not be used.		
I give consent for (please tick any that apply): Images ☐ Video recording ☐ Notes ☐ to be used in (please tick any that apply): Written publications Images ☐ Video recording ☐ Notes ☐ All three options ☐ Conference presentations Images ☐ Video recording ☐ Notes ☐ All three options ☐ Social media (for research purposes only, no images reproduced anywhere) Images ☐ Video recording ☐ Notes ☐ All three options ☐		
I agree to participate in the interview ☐		
I understand that any personally identifying data other than my likeness captured in the recordings will be erased immediately. All data will be destroyed after a period of 10 years from the completion of the PhD.		
I consent to the processing of my personal information *(name, email or telephone contact details)* for the purposes explained to me. I understand that such information will be stored anonymously and securely and handled in accordance with all applicable data protection legislation.		
I understand that the data will not be made available to any commercial organisations but is solely the responsibility of the researcher undertaking this study.		
I understand that I will not benefit financially from this study or from any possible outcome it may result in in the future.		
I understand that the information I have submitted will be published as a part of a PhD and/or journal articles and I wish to receive a copy of them. ☐		

Email_____

_____ _____ _____

Name Date Signature

Yiwen Li
UCL Institute of Education
20 Bedford Way London WC1H 0AL
[redacted]

Appendix 5: Approved ethics application

Departmental use
If a project raises particularly challenging ethics issues, or a more detailed review would be appropriate, the supervisor must refer the application to the Research Development Administrator via email so that it can be submitted to the IOE Research Ethics Committee for consideration. A departmental research ethics coordinator or representative can advise you, either to support your review process, or help decide whether an application should be referred to the REC. If unsure please refer to the guidelines explaining when to refer the ethics application to the IOE Research Ethics Committee, posted on the committee's website.

Student name	Yiwen Li
Student department	CCM
Course	PHD
Project title	The Embodied Experience in Virtual Reality Art
Reviewer 1	
Supervisor/first reviewer name	Carey Jewitt
Do you foresee any ethical difficulties with this research?	No
Supervisor/first reviewer signature	Carey Jewitt (digital)
Date	11.12.2020
Reviewer 2	
Second reviewer name	Sara Price
Do you foresee any ethical difficulties with this research?	No
Supervisor/second reviewer signature	[redacted]
Date	14/1220
Decision on behalf of reviews	

Decision	Approved	☒
	Approved subject to the following additional measures	☐
	Not approved for the reasons given below	☐
	Referred to REC for review	☐
Points to be noted by other reviewers and in report to REC		
Comments from reviewers for the applicant		
Once it is approved by both reviewers, students should submit their ethics application form to the Centre for Doctoral Education team: IOE.CDE@ucl.ac.uk.		

Appendix 6: Semi-structured interview questions

Open question:

Can you tell me about your experience?

Interactions with Body:

Can you tell me something about your experiences of the virtual body?

Can you tell me in more details about how you moved and interacted with this virtual body?

How was it different from your previous experience or habit? (If and how these affect your understanding of yourself in the experience?)

Have you imagined the virtual body you have? (Was it different from your own body? / Did this affect some of your behaviours or ways of movements?)

Can you tell me your process of familiarization with the virtual body?

How did you aware of your own body in any way during the experience?

Understanding of the body:

How do you understand the concept of body (e.g. boundaries, definition, meaning to you)?

If and how did this understanding affect the ways you experience the virtual body and explore the virtual world through this body?

Interaction with space & objects:

Can you tell me your experience of the virtual space? / How did you understand the space?

You spent a lot of time interacting with..., why did that draw your attention? (What did you do there?)

What do you find particularly interesting in the artwork that gives you a strong impression? (Did you do anything to explore your interests or questions?)

Can you tell me your experience in the...? Why did you do...?

Were there any moments when you felt more strongly immersed? (What triggered that?)

Did you do anything to explore your sensations/emotions about this (what did you do? How did this help you to explore your experience)?

Did you experience any moments where you felt less immersive/disconnected from the VR environment?

Prior knowledge and personal experience:

What previous experiences, if any, did this experience remind you of? (different mediums, imaginations, dreams...).

Have you experienced VR or some immersive installation or art exhibition before? (Can you tell me how you experience the differences between them this VR artwork?)

Interpretation of the artwork:

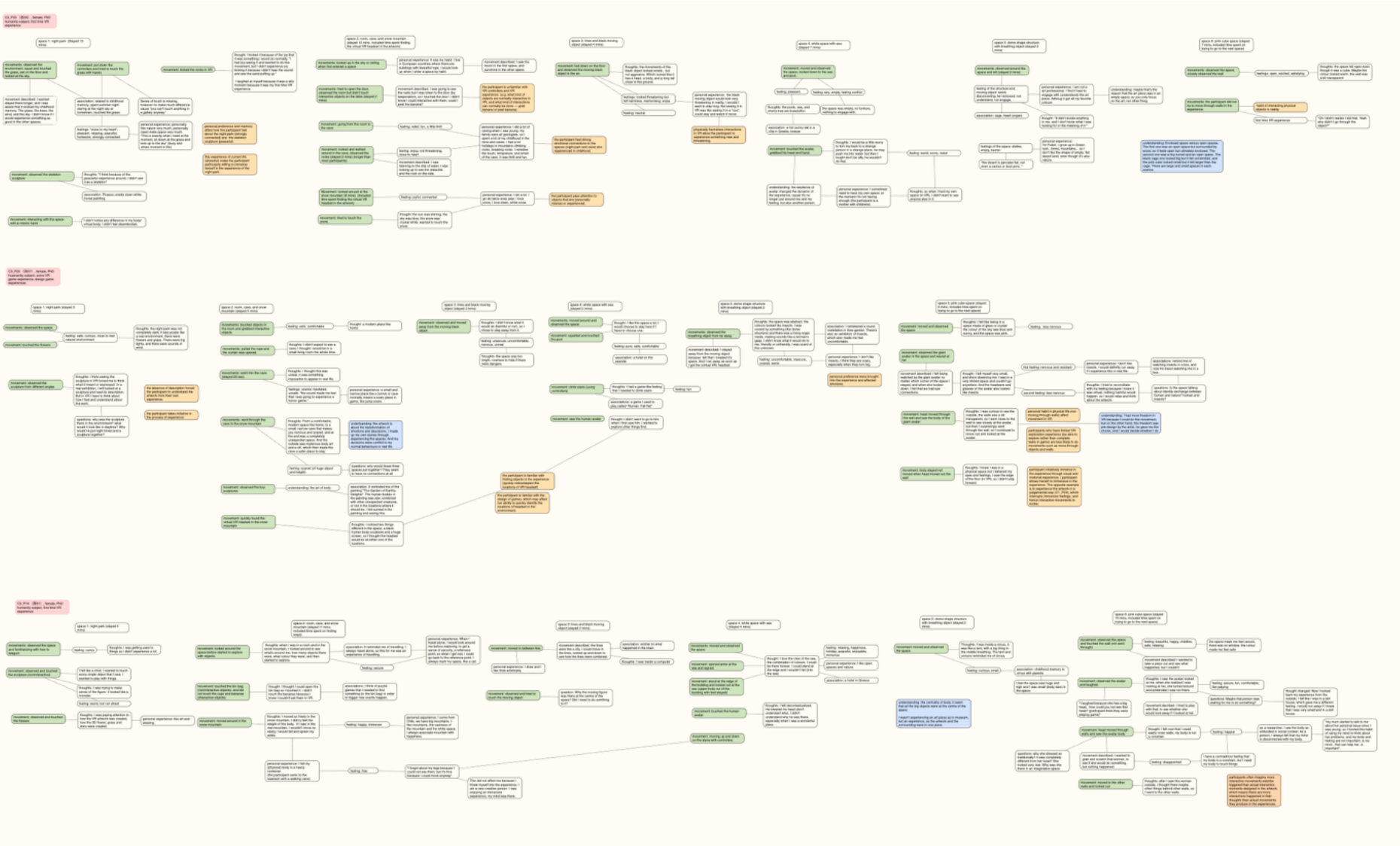
How do you understand the artwork? Can you describe the artwork in three words?

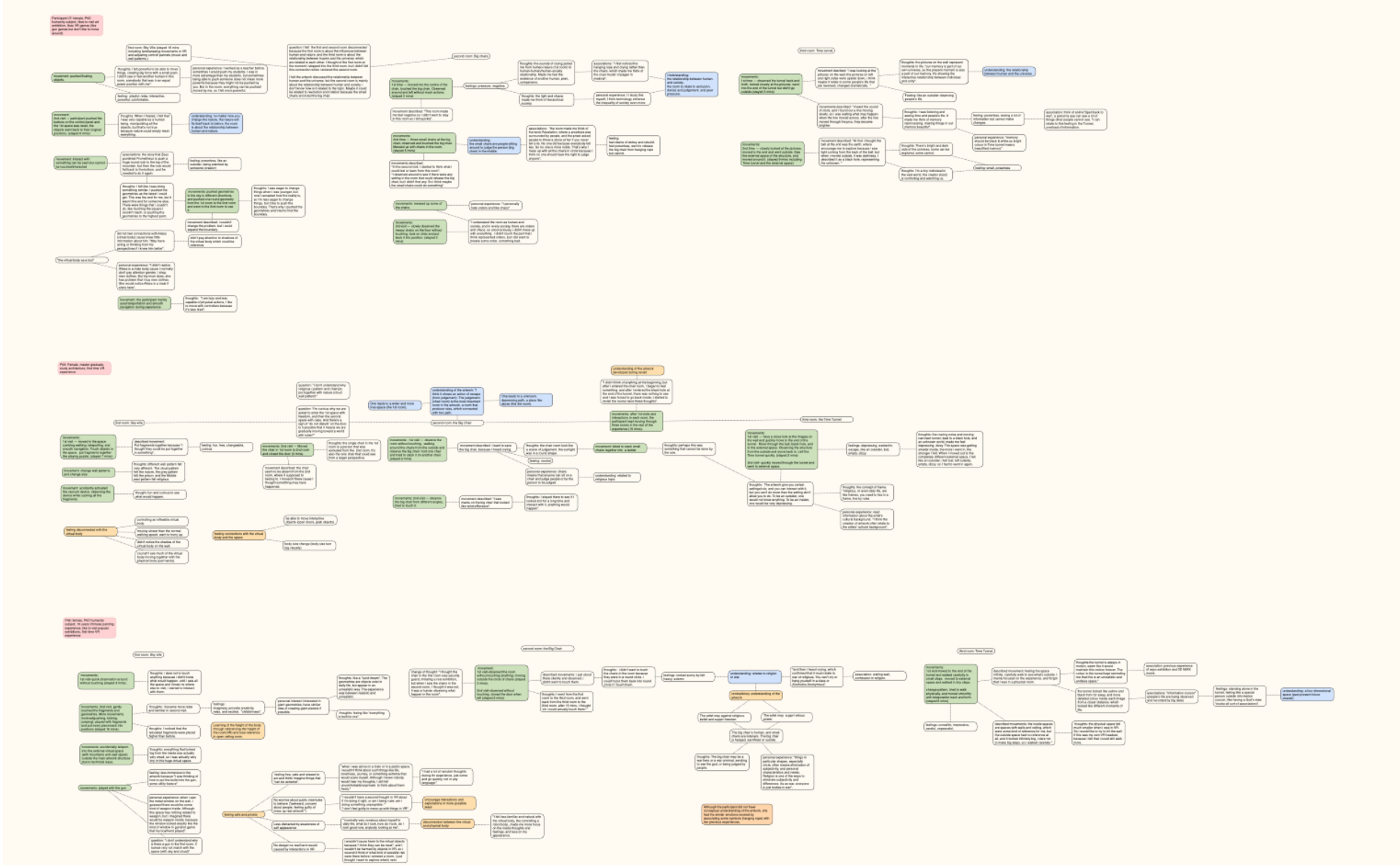
Why would you understand the artwork as...What triggered this understanding?

Has this understanding change or develop during your experience?

If and how did that affect the way you interact with other objects?

Appendix 7: Visual examples of story boarding





Appendix 8: Autoethnographic excerpts

The body of Lena

In Lena's world, I let go of thoughts about where I was or whether this world was real. The notions of time, space, and reality faded. I focused only on the experience before me. The sound of the wind howled, interspersed with the crisp chimes of bells, and music that felt both ancient and futuristic surrounded me. I was immersed in an alien world—not a planet in the solar system but a realm far removed from my understanding.

I looked down at my body. What I saw wasn't human but a body with four limbs, resembling twisted metal branches. Their texture was complex—soft inside, hard outside. Light reflected on the surface like polished metal, but they swayed gently in the wind, reminiscent of coral. I experimented with moving these limbs. Twisting my wrists, pressing the controllers, and waving slowly, I sought connections between my physical hands and Lena's virtual limbs. There was a connection, but it felt unfamiliar and elusive. The movements didn't correspond in ways I understood, and I couldn't discern a clear pattern. For instance, the right and left limbs moved differently in response to my wrist motions. I couldn't even identify which part of Lena's body functioned as a "wrist" or how to control specific actions. I realised that Lena was a fundamentally different being—her body couldn't be understood with human knowledge. To engage with Lena's world, I needed to distance myself from my human-centred perspective.

I relaxed my physical hands by my sides, holding the controllers lightly. I let myself move through the world with curiosity, free from assumptions or expectations. As I floated toward psychedelic mushrooms, I imagined myself as a coral or seaweed—drifting, flowing, and embracing the wind. My virtual limbs extended and waved gently, moving with the air. It was a liberating sensation, a feeling I would describe as freedom.

When interacting with Alless's world earlier, I had kept my hands in front of me, as if naturally holding the controllers. It felt intuitive to see two human hands in my field of view, essential for guiding teleportation movements. But in Lena's world, keeping my hands extended in front of me felt unnatural. It clashed with Lena's existence and her environment. I reflected: birds don't fly with their legs extended, and jellyfish don't swim with tentacles positioned as if clutching a coffee cup. To truly experience Lena's body, I needed to let go of such human habits.

As I approached the mushrooms, I raised my chin and spread my arms wide, seeking to fully embrace the moment. What followed was overwhelming—a kaleidoscope of sensations. I had never taken psychedelic substances in real life, but this moment felt like stepping into a vivid, chaotic dream. I felt lost yet exhilarated, insecure yet alive. Overwhelmed by fear and joy, I hugged myself for comfort, pulling my limbs inward to shield my chest and belly. This inward movement provided a sense of safety, my virtual limbs acting as protectors. Moments later, I opened myself up again, eager to embrace

the chaos. I repeated this oscillation between closing inward and expanding outward several times, exploring the interplay between danger and delight. I swung my head, twisted my torso, and reached out with my limbs, trying to experience Lena's body as fully as possible. Her upper limbs, positioned near my head, were longer than those near my hands. Though visually similar, they seemed more functional due to their reach.

An impression that does not go away

I find myself reflecting on the lingering influence of art, how a work of art can interact with us over time, shaping our thoughts and feelings long after the initial encounter. This reflection emerged as I looked at two small paintings I recently created. One of them, completed earlier, depicts a giant white sphere teetering on the edge of a surface, moments away from falling.

When I painted it, I wasn't consciously trying to capture anything specific. But now, I realise that this image was born from my experience in *Sky Ville* (SV). It wasn't an intentional act of recall but an unconscious impression that surfaced naturally as I searched for inspiration. At the time of my visit to SV, I couldn't pinpoint what I felt beneath the massive geometric forms. The experience was neither distinctly comfortable nor uncomfortable, leaving me without clear or immediate feedback.

This makes me think of my participants and their descriptions of VR art experiences. Many found the works interesting and fun, but they often struggled to articulate exactly why or how. It's been several months since I first experienced SV, and the sensations from that day have gradually crystallized.

The feeling of standing beneath those giant geometries left a profound imprint on me. While I wasn't scared or uneasy, the sheer size of the objects above me resonated deeply. I thought of the term *megalophobia*—the fear of large objects. It wasn't quite fear, though. Instead, the sensation reminded me of a strange balance between two opposite feelings. I associated the experience with meditation, recalling the tranquillity I felt at Genius Loki, a vast underground building on Jeju Island. That space exuded a unique calmness, enveloping me with a sense of security despite its immense scale. It struck me how the feelings in both places were complex and contradictory, a blend of anxiety, fear, calm, and safety, all at once.

This contradiction mirrors the intricacies of embodiment in virtual reality artworks. It's not a straightforward experience but a dynamic, reflexive process. The impressions don't end with the 30-minute interaction. They continue to resonate, intertwining with my thoughts and memories, evolving and growing over time. Looking at the painting of the precarious white sphere, I see this reflexive process embodied in my art. The sphere captures something about that delicate balance between unease and tranquillity, a reminder of

how my experience extends the moment of encounter. It lingers, intertwines, and transforms, shaping how I see and feel in ways I'm only beginning to understand.

The tree

During the Covid-19 quarantine, I halted my pilot study at the Serpentine Gallery. The uncertainty surrounding the pandemic, along with closed galleries and health risks, compelled me to shift my research from physical public spaces to private settings. Following the advice of my supervisors, I purchased a VR headset to explore virtual reality artworks myself. This decision provided an opportunity to connect theory with practice in a novel way.

One notable app I explored was *Unframed* on the Oculus Store, which offered VR experiences based on the paintings of three Swiss artists: Arnold Böcklin's *Isle of the Dead* (1883), Ferdinand Hodler's *The Woodcutter* (1910) and *Night*(1890), and Félix Valloton's *Intimacies* (1898). Upon selecting *The Woodcutter* in the app's interface, I was first transported to a serene virtual landscape rather than directly entering the artwork. This prelude featured a vast grassland, a large tree, a shimmering lake, distant mountains, and a cloudy sky. This virtual space was a composite of several of Hodler's landscape paintings, including *View of the Horn of Fromberg from Reichenbach* (1903) and *Lake Geneva on the Evening in Chexbres* (1895).

After completing the VR experiences for *The Woodcutter* and *Night*, I felt slightly dizzy due to the simulated walking motions. Seeking relief, I returned to the Lake Geneva landscape. Reclining on my bed in reality, I mirrored the VR experience of lying on the grass by the lake. Above me, a tree swayed gently in the wind, its leaves a mosaic of dark green, jade, peacock blue, yellow-green, and light green. Through the gaps in the foliage, patches of sky peeked through. Despite noticing pixelation in the digital leaves, the overall experience felt serene, the environment evoked a genuine sense of relaxation.

The next evening, I revisited the tree. Interestingly, some details appeared different. The grass, which I had initially remembered as golden-yellow adorned with red and blue flowers, was now a simple green. I wondered whether my initial memory had been influenced by my emotional impression of warmth. Lying under the tree again, I experimented with stillness, thinking about what Stern (2013) meant by "stillness is also moving". I stayed still and began to feel my own body, shifting my head or moving my eyes. I noticed how these subtle actions altered my impression of the tree and its surroundings. This realisation prompted deeper questions about how movements are connected to my visual experiences.

The following morning, I reflected further on these interactions while observing real trees from my balcony. I sat at the balcony and ate my breakfast. The sky had not gotten completely bright at 8 in the morning. I looked at the trees, just outside of the balcony

about 20 metres away. They stood tall, their branches intertwined, creating a gentle greyish-green canopy. Sometimes, when there was a gentle breeze, the leaves on top would shake lively. I looked into the gaps of those leaves, and they looked so different from the flickering pixels in VR. I stared at them for a while and thought of a way to see them as "pixels," so I could compare them with digital pixels in VR, I took off my glasses.

Without my glasses, the trees, usually detailed and vivid, became abstract blocks of green. Light filtered through the foliage, creating a blur that resembled the pixelated VR imagery. When the trees danced in the wind, they looked as if they were trying to pounce upon me. With and without my glasses, my attention and feelings toward the trees shifted. With my glasses on, I focused on the subtle movements and colours of the leaves. Without them, I concentrated on the volume and blocks of colours. I could not tell which was more real because neither reflected an objective reality. I did not see reality; I saw my own ways of interacting with the trees. Dourish says that embodiment does not represent the physical reality but reflects one's participatory methods with the world (Dourish, 1999). The world can appear vastly different to various creatures, as each interacts with it uniquely. These interactions are embodied not only through physical contact but also through their specific movements and context. Every movement I make holds meaning specific to my subjectivity, which is shaped by my background and experiences. My movements are tied to a unique set of histories, relationships, understandings, and emotions that I have accumulated over time. Therefore, to explore why I have certain feelings during VR experiences and how those interactions occur, I must consider my subjective experiences in relation to the technical and aesthetic characteristics of VR art.

Understanding how my movements were situated in the environment, I experimented with different positions—sitting, lying, standing, and walking. The lying position was the most comfortable, which partly explains why I felt so relaxed during my initial experience. My earlier experiences occurred on the bed or sofa, which supported my body and allowed me to relax most of it. My lying posture in the physical environment aligned with the visual experience of lying under a tree in VR. Although I had not experienced lying under a tree in daily life, I had learned from documentaries, films, and animations that it could be relaxing and comfortable. The space in VR also reminded me of Miyazaki Hayao's cartoons, known for depicting pure, nature-embraced childhoods. The brushstroke aesthetics resembled Impressionist paintings. Additionally, I did not need to worry about insects, dirt, strangers, or weather. My sense of relaxation did not stem from the material sensations of touching grass or feeling wind but from the interactions between my body and the physical-virtual environment. My body connected to VR even before I noticed, as my interactions are always grounded in the relationality between me and the world, physical and virtual. My body was inevitably intertwined with the virtual environments, immersed in the relationships between myself and the virtual objects. My body moved in its static position, influenced by the forces surrounding me.

The movements

I once attended an acting workshop out of interest. The workshop was organised by Yellow Earth Academy, a UK-based theatre company dedicated to training British East Asians as theatre actors and actresses. Over two weeks, there were several sessions focused on movements. In one session, we were asked to pair up with a partner and create movements together to music. Thanks to the unique techniques used in actor training—frequent physical contact, sharing childhood stories, trust-building exercises, and extensive body movement—everyone quickly became comfortable with one another. Even as someone who is typically shy, I felt at ease dancing and acting in front of the class. My partner, Alice (pseudonym), was particularly kind and supportive. To collaborate on movements, I closed my eyes and followed Alice's touches, responding to her cues with my body. The instructor monitored the room and would pause any pair who seemed uncomfortable. It was an extraordinary experience that remains etched in my memory.

The session took place on a sunny afternoon in a bright classroom. When I closed my eyes, my world transformed into a blank, white space. I felt peaceful and secure, largely because I trusted Alice and the rest of the group, knowing everyone was serious about the training and free from judgment. In this mental space, there were no people or objects, only the music and the subtle sounds of movement—sliding across the floor, the friction of skin. The only tangible sensation was Alice's touch. She guided me by pointing with her finger, pushing with her palm, holding my hand, grabbing and pulling my back, pushing my legs, and twisting my waist. Following the direction and intensity of her movements, I responded with gestures of my own. I extended my arms and fingers into the air, raised my chin, rolled my head, moved across the floor, and lifted my chest.

With my eyes closed, I became acutely aware of the forces Alice initiated. A composed, steady touch led to smooth movements; a long, strong push resulted in expansive gestures; a short, intense push created quick actions; and a gentle touch inspired soft, tender motions. As Alice's energy transferred through her hands to my body, it seemed to dissolve into the ground and air through my movements. When the forces subsided, my body returned to stillness. It felt as though the energy flowed through me, completing its journey.

I didn't know if what I was doing could be called dancing, nor was I concerned about whether my movements were graceful or awkward. It didn't matter. When the music stopped, Alice and I were one of the last three pairs still moving. Opening my eyes felt like waking from a meditation or emerging from another dimension. My body felt simultaneously open and closed—open in its heightened sensitivity to movement and its connection to the surrounding environment, and closed in its exclusion of shapes, figures, and images from my awareness.

Reflecting on this experience later, I began to consider the role of my body, my relationship with Alice, how movements occurred, and their meanings. What created this experience? How were my sensations tied to the environment around me? These questions led me to

Stern's concept of "flesh-space," which describes the body as a space grounded in its relationship with the surrounding environment. This relationship frames the body's potential for movement. In the workshop, my body was a space within the classroom space, which in turn was part of a larger space—like a drop of water within a lake, and a lake within an ocean. The forces guiding my movements flowed through these interconnected spaces.

My movements were shaped by my interactions with Alice. She provided the forces, I interpreted them through my own understanding, and she continues along with my bodily expressions. Similarly, the environment also influenced my movements. The bright room and the meditative atmosphere created by trusted peers made me feel safe and at ease. My comfortable clothing and bare feet allowed me to move freely. The interplay of these elements—the classroom space, the people within it, the music, and my attire—framed my movements.

This experience often comes to mind when I think about my movements in virtual reality. It prompts me to experiment with different positions in VR—sitting, lying, standing, and walking. In both contexts, the relationships between my body, the environment, and the forces surrounding me define the nature and meaning of my movements.