Rethinking Presence in the Age of Mixed Reality

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Introduction

Let me describe an artistic situation which evokes the uncanny. I enter into a gallery and stand before a flat panel screen positioned in portrait format and with a small camera attached on the side. The image on the screen is that of a body standing in A-Pose, a term originating from computer animation that describes a natural stance with arms angled downward at about 45 degrees, forming an A shape with the body. As I position myself into this pose, which is reflected in the whited-out figure standing before me on the screen, a sudden flash takes place and the figure vanishes. I am then greeted with the phrase ›the system is processing you. Please take a headset‹. The attendant to this strange ritual provides me with a bulky and almost wrap around headset – a pair of virtual reality glasses that are then strapped uncomfortably to my face. I am greeted by what sounds like elevator music: annoying Muzak that is occasionally interrupted with a disembodied voice stating ›please hold the line‹. I am told that the experience will begin. There is a sharp blast of white noise and suddenly I am confronted with my self-image standing before a mirror in the real space. Of course, I recognize that this apparition, a kind of double or *doppelgänger* which seems to have been generated from the capture of my body with the camera, is *fake*. It is derived from a contemporary technology – the video passthrough mode of the headset which allows a real time video feed of the physical place I am standing in to be augmented with this computationally produced double. The image both appears to be a realistic rendering of me but, at the very same moment, is riddled with errors and mistakes. There is a strange hole in the side of my arm. The grinning face which stares into the mirror, is frozen, as if in suspended animation. The feet seem to be a reflection of my feet but are distorted and twisted. Suddenly, the mirror begins to crack,

accompanied by breaking noises. The white noise blast comes again, and the screen goes black.

It is admittedly a strange experience to be confronted with oneself, not only in the mirror as we would expect but also by way of a worn technological device. In Austrian psychologist Otto Rank's 1925 work on the double, the mirror itself served as the primary site for the projection of self-preservation and immortality.[1] Later, Freud would revise Rank's notion to describe what he famously termed »the uncanny« – when that which should be familiar becomes strange, unsettling and threatening. The double of oneself is not only unsettling because it is a copy. It also disturbs the psyche because it causes one to doubt the solidity of one's self.

The project I have described here, coincidentally named *doppelgänger:apparatus*, which was developed at the Immersive Arts Space, a research-creation lab based at the Zurich University of the Arts (ZHdK) which I direct, is not meant to discuss psychoanalytic understandings of the self. Instead, the description aims to provoke a different question: namely, what would *presence* signify in this context? That is, the context of wearing a virtual reality headset (in this case, Meta's Quest 3.0 VR headset) that attempts to create not a virtual experience but rather a *combination* of real and constructed. Such a *mixed reality* (MR), a term coined by computer scientists Paul Milgram and Fumio Kishino in 1994, describes ›having both‹ virtual space, on the one hand and ›reality‹ on the other, available within the same visual display environment.[2]

But the word *presence* itself is also a confusing concept with multiple meanings and contexts. Long defined as a cornerstone of *virtual reality* (VR), the technological paradigm of surrounding the user's eyes and ears with a completely computationally generated space, the concept of presence carries a specific meaning: that is, the sense of action at a distance or as Marvin Minsky termed it in the mid 1980s, ›telepresence‹.[3] In other words, as VR researcher Mel Slater has argued in his concept of the *place illusion* (informed by Minsky) one is ›present‹ in a virtual space which is not really there while ignoring the *co-extensive* real space.

Yet, since Milgram and Kishino proposed the concept of MR together with the technological development of *head mounted displays* (HMDs) through Mi-

1 Otto Rank (2012): The Double: A Psychoanalytic Study, Chapel Hill: UNC Press Books.

2 Paul Milgram/Fumio Kishino (1994): »A taxonomy of mixed reality visual displays«, in: IEICE TRANSACTIONS on Information and Systems 77/12, pp. 1321–1329.

3 Marvin Minsky (1980): »Telepresence«, in: Omni June 1980.

crosoft's Hololens in the late 1990s and then the Magic Leap in the late 2000s, such a concept of presence has been challenged by way of the emergence of a new technological paradigm: that of so-called *video passthrough*. Passthrough is a process which involves capturing video from external cameras (usually mounted on/in a device) and displaying this video image directly on a screen or the HMD in *real time*. In other words, the idea is to ›pass through‹ the outside world into the display, allowing the user to see both their physical environment as well as a computationally generated one that appears to be embedded in the real environment while wearing the device.

The argument that will unfold in this article is that such passthrough technology could suggest an expanded understanding of presence – one that departs from the idea that one is present in a virtual space where one *believes* one is located. Instead, presence and its associated term – *immersion* – now shifts from the notion of *suspension of disbelief* to that of *artifice*; that is, believing that what one experiences from the perspective of the HMD mixing up the real and the computational is not real at all but a *construction*. Because of the potential of the camera as a mediating device and the ability to embed the camera's feed with computationally generated objects through passthrough technology, there is thus a break from the idea that the mediating technology of these devices disappears and becomes transparent to the wearer. In other words, *what would it signify to think of presence and immersion within such a technological instrumentarium as the passthrough-based HMD not as engulfing the wearer's attention in a constructed world which pretends to be believable* but instead as what Walter Benjamin termed ›shock‹ – the manner in which modern technologies serve to rupture, dislocate, defamiliarize and alienate our received perception of the world?[4]

To argue this point, this article is divided into four sections and a conclusion. Section I briefly describes the context of where this argument emerges, namely, a research project appropriately called »Probing XR's Futures: Design Fiction, Bodily Experience and Critical Inquiry« which is taking place at the Immersive Arts Space, a research-creation lab based at the Zurich University of the Arts (ZHdK). This project explores the larger question of what imaginaries Extended Realities (XR) has of diverse human bodies and vice versa. Section II focuses on the core mediating material-technical *instrumentarium* of XR – the

4 Walter Benjamin (2003): »On Some Motifs in Baudelaire«, in: Howard Eiland/Michael W. Jennings (eds.), Selected Writings, 4: 1938–1940, Cambridge, MA: Belknap Press of Harvard University Press, pp. 313–355.

HMD – a device which is continually reinvented but that somehow never can escape its mediating form, despite the fact that one of the core definitions is that this device disappears; what is referred to as the illusion of non-mediation.

In Section III, I discuss the question of presence, still the holy grail of virtual reality. I explore what the basic definitions are according to the key literature and then contest them based on the emergence of so-called worn mixed reality HMDs. What comes to pass in Section IV is thus a proposition: that is, a revision of thinking around the concept of presence that has endured in VR research over the last decades. Instead, I suggest a turn to understanding the conundrum of presence in XR from another disciplinary perspective: that of theater studies and, in particular, how theater theorists have challenged the concept of presence as something akin to »being there«. The article concludes briefly then with a return to the question that was first brought up in the *doppelgänger:apparatus* project: what role can strategies play that are not based on constructing a verisimilitude of reality but instead, an experience of shock and estrangement? In other words, what kinds of aesthetic and perceptual possibilities are offered when our belief in the virtual and simulated is shattered by the effect of being caught in two spaces at once?

1. Probing XR's Futures

The aforementioned questions around presence and immersion stem from ongoing research in »Probing XR's Futures« (PXRF) a four-year research program funded by the Swiss National Science Foundation and taking place at the Immersive Arts Space at the Zurich University of the Arts (ZHdK). Within its inquiry to grasp the manner in which contemporary bodily experience transforms and is transformed through XR technologies, the project asks three core research questions: (1) How is everyday interaction in XR routinely achieved? (2) How exactly will XR change interaction and what social reciprocity and mutual access will be enabled? (3) What concrete effects and forms of discipline will be enacted on disabled bodies interacting in XR?

In addressing these questions, PXRF has three specific trajectories that form part of an experimental program of inquiry. The first, which we call the *Metabox* (in reference to behavioral psychologist B.F. Skinner's concept of the Skinner Box) involves exploring XR and its coincident space – the so-called *metaverse* – in order to ask what kind of social order is imagined by way of XR

technologies and how is such a social order worked out in experimental procedures?

The second phase of the project is an artistic one, asking what kinds of future scenarios of interaction might take place in the metaverse as a social milieu? Here, we examine work in the sociology of science which is focused on ›technological promises‹ and ›social-technical imaginaries‹ where we will develop scenarios using the approach of *design fiction*. Design fiction is a critical design-oriented practice which involves creating evocative prototypes or artifacts from possible near futures to help discover new kinds of futures.[5] The kind of artifact we focus on is that of the HMD itself and what potential future scenarios can emerge through this device. For example, what happens when the HMD, which receives from its manufacturers like Meta, HTC and Samsung a yearly resolution update, doesn't actually deliver a high-resolution image of the real world but instead what Hito Steyerl has called the ›poor image‹?[6]

The third phase focuses on larger questions about the role publics play in interacting with and shaping XR technologies as well as the role of publics in transforming these technologies' already pre-packaged expectations. More specifically in the project, we plan to create different kinds of public demos: interactions with scenarios and discussions around these technologies which are normally closed off from public view within their academic research-industrial development stages. What kind of social milieu, for example, emerges when individuals start wearing these devices within public spaces: walking on the street, in the park, sitting in restaurants and bars. Indeed, as Silicon Valley imaginaries, embodied by the like of Apple's Vision Pro HMD, describe future scenarios of 24/7 embedding within these devices, the question of what kind of experiences such technologies actually propose needs to come to the fore of attention.

One of the central issues that arises within such a program of exploration around the human body as a tool for critical inquiry is what kind of bodies are imagined by the HMD. In other words, an underlying question for the research is interrogating the manner in which XR technologies like the HMD severely institute certain body norms, aiming for what Campbell has called a *corporeal*

5 Julian Bleeker (2009): »Design fiction. A short essay on design, science, fact and fiction«, in: Near Future laboratory, March online: https://systemsorienteddesign.net/wp-content/uploads/2011/01/DesignFiction_WebEdition.pdf (last access: 15.11.2025).

6 Hito Steyerl (2009): »In Defense of the Poor Image«, in: *e-flux journal* 10/11, pp. 1–9.

standard, an »ideal (i.e., nondisabled) body«.[7] The minor adjustments to the technologies incorporated for inclusion of people with disabilities therefore reify what disability scholar Ellcessor calls the »common sense idea of accessibility« – the perception of disability as a problem that is easily solvable by bare minimum engineering functionalities.[8] In collaboration with German disabled researcher/technologist Christian Bayerlein and PhD researcher Puneet Jain we are utilizing the mouth as an interface as well as an access point to navigation in XR. Thereby we explore how different bodily imaginaries could shape XR technology in a profoundly different way than the predominant ableist imaginary these technologies now harbour.

2. XR Instrumentarium: The HMD

The research program that has been described above would not be possible without XR's essential technological development: the head-mounted display or HMD. Despite historical arguments about the HMD either being inspired by science fiction stories or emerging from 1990s attempts to bring VR technologies to video gaming, like many Cold War technologies, the core origin stories trace back to US military contexts. Inspired by applied military research taking place at the Texas-based Bell Helicopter corporation during the 1960s, engineer and one of the founders of the field of computer graphics Ivan Sutherland developed one of the first working HMDs in 1965. At the time at Bell, the defense contractor utilized an experimental prototype display that was strapped around pilots' heads and equipped with a head tracking sensor and small CRT displays in front of the eyes and connected to remote control infrared cameras.[9]

This curious device was rumored to have been developed in order to facilitate the landing of helicopters in darkness. As the pilot turned their head, the camera turned with it. In this sense, XR, like most modern electronic and computing technology, was rooted in the midst of war, in this case, the Vietnam

7 Fiona A. K. Campbell (2001): »Inciting legal fictions. Disability's date with ontology and the ableist body of the law«, in: Griffith Law Review 10/1, pp. 42–62.

8 Elizabeth Ellcessor (2016): Restricted Access. Media, Disability, and the Politics of Participation. New York: NYU Press.

9 SIGGRAPH Conferences (2017): »VR @ 50: Ivan Sutherland's 1968 Head-Mounted 3D Display System«, in: suggraoh.org (14.08.2018). Online: https://blog.siggraph.org/2018/08/vr-at-50-celebrating-ivan-sutherland.html/ (last access: 31.08.2025).

conflict where landing helicopters in dense jungles would have clearly benefitted from the technological advance of seeing at a distance. Inspired by Bell's research, Sutherland himself set out to improve on their device, envisaging a ›kinesthetic display‹ that could »serve as many senses as possible« by inserting a computer in place of the camera to »enable the engineer to view a mathematical wonderland of their own choosing«.[10]

In its context as a kinesthetic interface to an abstract computational world, it is important to position the HMD as a *worn* form of augmentation; one »which involves the coupling of humans with computational devices, taken to extend the body's native capacities through information processing«.[11] In this sense, the HMD is not simply an extension but a creator of a »symbiotic relationship between person and device«.[12] This emphasis on the primacy of what Mark Hansen has called the *sensorimotor body* for embodied action, in which »material structures are interpenetrated with informational patterns and lay bare the enabling constraints of the body«[13] characterizes XR as a ›perceptual technology‹.[14] Such a technology serves to model human perceptual mechanisms and traits.

As such a perceptual technology, the HMD would thus evolve, oscillating between the military, the research sector and the gaming industries and finding its way into the arts by the late 1980s. For example, before the general public had ever heard of the HMD, the French visual artist Nicole Stenger, ensconced as an artist in residence at MIT's Center for Advanced Visual Studies (CAVS), developed one of the first VR-based artistic experiences. In Stenger's »virtual reality film« *Angels*, wearers of Jaron Lanier's ultra expensive VPL Eye Phone HMD and accompanying data glove interface would navigate a ›travelling in paradise‹ experience. By moving through an emotional world of sight, sound and (ultimately, non-interactive) touch, the users were to experience

10 Ibid.

11 Ana Viseu/Lucy Suchman (2010): »Wearable Augmentations«, in: J. Edwards/P. Harvey/P. Wade (eds.), Technologized Images, Technologized Bodies: anthropological approaches to a new politics of vision, Oxford/New York: Berghahn Books.

12 J. C. R. Licklider (1960): »Man-Computer Symbiosis«, in: IRE Transactions on Human Factors in Electronics HFE-1/1 (March), pp. 4–11.

13 Mark B. Hansen (2006): Bodies in Code: Interfaces with Digital Media, New York: Routledge, p. 22.

14 Alexander Waibel et al. (2009): »Computers in the Human Interaction Loop«, in: Id./Rainer Stiefelhagen (eds.), Computers in the Human Interaction Loop. Human–Computer Interaction Series, London: Springer, pp. 3–6.

what Stenger in her essay »Mind as a Leaking Rainbow« later described as a »new nature of reality in our everyday life […] opening up an infinity of space in an eternity of light«.[15]

Not ironically, Stenger's multi-modal methodology of creating an experience combining sound, image and touch was also inspired by a military project: an HMD that was part of an US Air Force research program called *Super Cockpit* led by the engineer and HMD pioneer Tom Furness. For Stenger, Super Cockpit's bulky and oversized HMD represented nothing other than the dissolution of the self's solidity in the framework of a cybernetic device enrolling pilot and machine in an embodied and multi-sensory feedback loop. Such a device would »redistribute information according to the parallel tracks of vision, hearing, and touch, when the pilot faces a paralysis of decision in front of the maze of graphics and commands. At the speed of war, Descartes' world becomes brittle. Cyberspace will shatter it like a mirror«.[16]

Today, more than half a decade later, a similar mix of visionary promises, and technical specifications animates the XR industry. Augmented reality-(AR) or VR-labeled technology has been brought to broader public attention through recent IT industry innovations, rhetorical and infrastructural. These advances not only include Meta's (ex-Facebook's) now forgotten media ›Metaverse‹ and its associated technologies (e.g., Oculus Quest headsets), as well as competitor products (e.g., Apple Vision Pro). For Meta, the dream of accessing user's bodies and dreams continues the long developing cybernetic project of the HMD. For example, as of 2023, Meta had spent some 50 billion USD on research towards these displays – as the company staked their future on the Metaverse and the technologies that would enable access to it.

In following the tradition of the HMD not only as a tool for manufacturing Stenger's ›paradisical cyberspace‹ but also for pursuing the fusion of human and machine necessary for future war, Meta signed a contract in 2025 with defense contractor Anduril to develop MR headsets stocked up with AI for the US Military in order to provide soldiers with ›enhanced perception‹ and to transform them into ›technomancers.‹[17] Anduril is special in Meta's history.

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15 Nicole Stenger (1991): »Mind is a Leaking Rainbow«, in: Miachel Benedik (ed.), Cyberspace: First Steps, Cambridge, MA: MIT Press, p. 51.

16 Ibid.

17 Steffan Katte (2023): »Meta to make AI-powered mixed-reality headsets for US military«, in: https://cointelegraph.com (02.06.2025). Online: https://cointelegraph.com/news/meta-ai-powered-headsets-us-military (last access: 31.08.2025).

The company was launched by Palmer Lucky, the right-wing founder of Oculus and inventor of the Oculus Rift HMD which Meta acquired for some 2 billion USD.

As HMDs have advanced from bulky, expensive and low-resolution headsets to inspirations for new forms of military machine awareness, one of the more interesting technologies that has emerged, particularly in respect to the Meta Quest is that of video passthrough. According to a recent article by a number of well-respected XR experts, including Stanford VR researcher Jeremy Balienson, while using passthrough, which is based on the cameras in the HMD, a person »does not see light from the real world but instead relies on stereoscopic, color, high resolution, low latency, real-time video of the world, which is displayed on small screens inside a headset«.[18] This observation is in contrast to light-based arrays, the main technology behind AR glasses like the *Hololens* or *Magic Leap*. Originally, developed as a safety feature to prevent users from going beyond the ›guardian‹, the sensed boundary inside an HMD display which is enclosed by a virtual fence, passthrough in such HMDs as the Meta Quest 3 or the Apple Vision Pro, has slowly moved from a safety feature to a new kind of perceptual system: a core portal into the world of MR.

As the authors of this aforementioned survey on passthrough systems make clear, there is a dearth of literature and studies around the technology. Indeed, even if Milgram and Kishino's 1994 article introducing mixed reality claimed that the paradigm did not describe a specific kind of technology but rather a taxonomic paradigm depicting a continuum between the purely virtual (i.e., computationally simulated) and the real, physical world, at the time, there were few material examples of such technologies. As Viseu and Suchman make clear, the HMD as a portal into a mixed space constructed through a computational, physical, and perceptual imaginary, is nothing less than a new form of bodily extension.[19]

18 Jeremy N. Bailenson/Brian Beams/James Brown/Cyan DeVeaux/Eugy Han/Anna CM Queiroz/Rabindra Ratan et al. (2024): »Seeing the world through digital prisms. Psychological implications of passthrough video usage in mixed reality«, in: Technology, Mind and Behavior 5/2, pp. 1–16, https://doi.org/10.1037/tmb0000129.

19 A. Viseu/L. Suchman: Wearable Augmentations, p. 62.

3. Co-Extensive Space and its Presence Effects

Passthrough-based technology might not only enable a different kind of technical imaginary. It might also shift another long-standing concept that has dominated XR-based research for decades: that is, the notion of presence. To understand what is at stake here, let's return to the artistic project that led off this article: *doppelgänger:apparatus*. According to the co-creator, Immersive Arts Space research associate Chris Elvis Leisi, the participative installation focuses on the appearance of virtual doppelgängers in MR, which act autonomously beyond the users' control. As the installation is described as one in which the virtual doppelgängers influence participants' experience of presence, social engagement and embodiment inside MR, the interesting questions that the project catalyzes is what constitutes physically embodied space that is computationally entangled and, importantly, what or who inhabits such a space. As Saker and Frith articulate, in the predominant tradition of VR, which is principally based on the HMD technology discussed in Section II, there has traditionally been little interest in what they call ›co-extensive‹ space – the developing »symbiotic relationship between physical and digital that is increasingly proximate, extensive and transformative«.[20] Yet, with the introduction of passthrough technology, »users can seamlessly shift their display between the digitality of VR and the concrete reality of their surroundings«.

Saker and Thrift argue that the vast majority of VR literature is not focused on participants' embedding in concrete space. Thus, passthrough technology offers a new possibility to go beyond VR systems ›simulation‹ of physicality that »feigns the materiality of actual space, even though the spaces mediated through VR are not concrete per se«.[21] What VR systems that cut off the real physical world from the participant do is to create »a form of presence that is outwardly dislocated from its physical setting.« In other words, what *presence* here indicates is that the user feels they are physically there – that is, present – even though their bodies are usually immobilized and effectively »transported to a dislocated space that is visually and audibly distinct from the space outside of their headset«.[22]

20 Michael Saker/Jordan Frith (2020): »Coextensive space. virtual reality and the developing relationship between the body, the digital and physical space«, in: Media, Culture & Society 42/7-8, p. 1429.

21 Ibid.

22 Ibid., p. 1430.

The mediating ability and power of passthrough technology on the HMD strongly suggests that the sense of *presence* of oneself and others (human or more than human) may actually be reconfigured through technologies of simulation that engage with the placeness of the real world. This transformation of presence thus could shift from the classic understanding of presence as ›being there‹ – what Mel Slater famously termed ›the place illusion‹. The place illusion is exactly that; a paradox that constitutes a kind of double bind which is the experience of being in a place (even though the real place one is in is usually irrelevant to the virtual experience) »in spite of the sure knowledge that you are not there«.[23] What passthrough technology adds to this picture is to complexify presence even further: that is, to see oneself and one's own body along with others in a real physical surrounding through the live camera feed of passthrough. In this sense, one is indeed in a real place, even though the perception of that place is brought to the perceiver through a mediating technology.

It seems, however, that one cannot escape the term *presence* and that its definitions, particularly in the context of psychology which has held a strong grip on VR research for some 40 years, still holds. For example, in work from Murphy and Skarbez from 2023 exploring the continued debate around presence, the researchers summarized some 30 years of VR research and deduced three core characteristics.[24] Presence is defined first and foremost by: (1) the sense of being there in the non-co-extensive space that constitutes VR-based environments; (2) the illusion of non-mediation, which suggests that users forget about the mediating power of the HMD technology; and (3), the willing suspension of disbelief – the »commitment of the person's entire neurology to the ›suspension of disbelief‹ that they are somewhere else [,] rather than where their [. . .] body really is«.[25]

Yet, these concepts of presence, particular the place illusion, which still holds as the gold standard in VR research, are based on a *historically contingent concept* – that space cannot be co-extensive because one in VR always in-

23 Mel Slater (2009): »Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments«, in: Philosophical Transactions of the Royal Society B: Biological Sciences 364/1535, pp. 3549–3557.

24 Dooley Murphy/Richard Skarbez (2020): »What do we mean when we say ›presence‹?«, in: PRESENCE: Virtual and Augmented Reality 29, pp. 171–190.

25 Mel Slater/Martin Usoh (1993): »Representations systems, perceptual position, and presence in immersive virtual environments«, in: Presence: Teleoperators & Virtual Environments 2/3, pp. 221–233.

habits a computational (in the HMD) and a real space (outside of it). This concept of presence harkens back to American AI pioneer Marvin Minsky's notion of *telepresence* – which Minsky in the original context specifically describes as action at a distance and more importantly, the control of a robot in one location from another location (this was part of Minsky's vision for a telepresence-based economy). Minsky's description emerges from a specific historical period in the United States in the mid 1980s around the Three Mile Island nuclear disaster and so the idea that someone could control a machine to inspect damage and repair a reactor was appealing. Minsky states that »the biggest challenge to developing telepresence is achieving that sense of ›being there‹. Can telepresence be a true substitute for the real thing? Will we be able to couple our artificial devices naturally and comfortably to work together with the sensory mechanisms of human organisms?«[26] Thus, a historically contingent idea – the concept of ›being there‹ – in the case of VR situated in a computationally generated space, was transformed into scientific criteria and the basis of a definition (that of presence) that seems to hold, regardless of the technological development of the HMD.

We can explore how this concept of presence as ›being there‹ starts to be challenged by passthrough by briefly examining another artistic project, one that the author of this chapter developed between 2021–2023. *Animate* is a theater work that utilizes the techniques of XR to tell the story of a doomed relationship in a near future Canada radically transformed by climate change. Premiered in August 2022 at the Kunstfest Weimar performing arts festival in Germany and divided into three acts, *Animate* resonates specifically with researcher Ronald Azuma's argument of focusing on »virtual content that is integrated with the surrounding real world, while users remain engaged with and aware of that ›real world‹«.[27] In the three act story, the audience moves between three genres: (1) live theater that is unmediated by digital technologies; (2) VR, in which the audience wears VR headsets and is collectively led by the actors through a physical space; and (3) an MR finale in which the audience encounters the earth coming alive in an apocalyptic scene of animated 3-D flying rocks that are mapped into the real space and which visually and acoustically attack both characters and audience.

26 M. Minsky: Telepresence.

27 Ronald T. Azuma (2006): »The most important challenge facing augmented reality«, in: Presence 25/3, pp. 234–238.

What is salient about the MR setting in *Animate*'s third act is the production of a *believable* experience – animated rocks of varying shapes and sizes and with specific physics that explode over, chase and in general, produce the feeling of a climate change-oriented apocalyptic end game in the audience. Interestingly enough, even though the audience wearing the HMDs knows that there are no real (i.e., physically present) flying rocks in the physical space, they act as if the rocks were actually there. This believability aligns with a renewed notion of presence proposed by Skarbez in which presence is defined as »the perceived realness of a mediated or virtual experience«.[28] According to the authors, realness is perceived in contrast to actual realness as a »function of a system's ability to provide stimuli that match reality«.[29]

But this so-called Skarbez model also incorporates another key trope which is the complement to presence in VR research: the so-called *plausibility illusion*. According to Slater, the plausibility illusion (or Psi) »is the illusion that what is apparently happening is really happening (even though you know for sure that it is not)«.[30] Psi involves what Slater defines as »correlations between external events not directly caused by the participant and his/her own sensations (both exteroceptive and interoceptive)«.[31] Psi is based on the virtual environment reacting to the actions of the user, events that coherently incorporate the user into the action and finally, a kind of verisimilitude that the simulation could happen in reality.

More recently and in light of increased research in MR, researchers are attempting to revisit these conceptions of presence. For example, Skarbez introduces an additional argument, namely, that plausibility should be augmented by the notion of *coherence*: »the extent to which a virtual environment behaves in a reasonable or predictable way«.[32] In another article, a group of researchers led by Slater argue that while the place illusion is ›inverted‹ in AR (incorporating virtual objects into the real world) the plausibility illusion stays the same:

28 Richard Skarbez/Frederick P. Brooks Jr./Mary C. Whitton (2017): »A survey of presence and related concepts«, in: ACM computing surveys (CSUR) 50/6, pp.1–39.

29 Ibid.

30 M. Slater: Place illusion, p. 3550.

31 Ibid., p. 3551.

32 Richard Skarbez/Frederick P. Brooks/Mary C. Whitton (2020): »Immersion and coherence: Research agenda and early results«, in: IEEE transactions on visualization and computer graphics 27/10, p. 3840.

the virtual objects that are embedded into this real world must be seen as real.[33] The researchers point to how this might be done, for example, through the casting of virtual shadows on real objects or the occlusion of real objects with virtual ones.

At first, one could attribute *Animate*'s audience running from virtual rocks as exemplary of Psi. But the aesthetic experience of rocks exploding in one's midst and then forming a chain that rushes through a space certainly is not a simulation of what happens in lived reality. The fact that *Animate* utilized an early version of Meta's passthrough control (not an API) meant that the system would occasionally result in glitches, for example, where the virtual rocks would not occlude real objects in the space or when suddenly, the same virtual rocks would ›bleed‹ through the real visitors in the video feed. Indeed, one would think from the scientific definitions of Psi that belief in the virtual/real world overlay would shatter through such glitches and that the audience would stand in place while 3-D photorealistic rocks would move towards them at accelerated speeds. But this was not the case. So where does this leave Psi and place illusion in trying to understand the role that immersion plays in MR experiences?

4. Revising Belief

So far, we have explored how the emergence of a new technological instrumentarium, the video passthrough augmented HMD, begins to question long established definitions of immersion and presence that describe HMD based AR. The question that remains, however, is not whether the sense of presence is better or worse, or higher over lower fidelity in MR or VR. Indeed, in our *doppelgänger:apparatus* example, the captured and reconstructed image of the visitor, is certainly not a perfect replica or copy. It is marked with digitally generated glitches due to technical issues around the quality and control of ambient light, the background setting in which the visitor stands and even the color of their clothing. Rather, the question is how presence might be reformulated not only due to a new kind of mediating technology (passthrough based HMD) but also a new phenomenology of this technology *in use.* This notion thus takes into

33 Mel Slater/Donma Banakou/Alejandro Beacco/Jaime Gallego/Francisco Macia-Varela/Ramon Oliva (2022): »A separate reality. An update on place illusion and plausibility in virtual reality«, in: Frontiers in virtual reality 3/914392.

account the tension between the perceptual experience of being in one's body inside the physical co-extensive space while having that space mediated by a visual sensing technology – that is, the camera.

Of course, even though there is a form of technical mediation taking place, one would find it challenging to argue that the space one is seeing with the camera – even though its live feed might be subjected to visual distortions, frame drop outs, lower pixel resolution, and the like – is *not the same* co-extensive space that one moves within. This is because of a host of *sensorimotor contingencies*, the idea that the different senses give us multiple channels of feedback about where our bodies are in space and in time.[34] In other words, what I have argued is that what passthrough might do is create a tension between the co-extensive and non co-extensive space – as potentially seen in the *doppelgänger:apparatus* and *Animate* examples. But how then does the concept of presence get rethought through this tension?

One of the key ways that immersion and presence have been defined in the VR literature derives from the idea of the suspension of disbelief (sod). Although the notion originally can be traced to the poet Samuel Taylor Coleridge, sod is also used frequently in another disciplinary context: that of theatre and performance theory. Here, sod describes where we »will ourselves to ›see as,‹ without the necessity of belief«.[35] In other words, we suspend the belief that what we are watching in front of us (usually, in the theater's case, on the stage) is *not* real and take on the stance that we will *believe* that the artificial is real. Clearly, presence theories in VR are built on this cornerstone: that the interactor wearing the HMD believes that their body spatially inhabits a ›real‹ space (it is self-located there because the wearer of the HMD always has the 1st Person Point of View) even though they know that what they are seeing (and sometimes hearing) is artificially constructed.

But isn't this the same as with a theatrical performance? Isn't it also true that the actors (in the context of dramatic theatre) are playing characters that are also not present and that the audience's bodies are simultaneously in both a fictional space and also a real one? If one doubts this, just imagine a typical theatre experience when the real intrudes on the fictional as your limbs fall asleep during a poor performance. In this sense, you inhabit the place illusion,

34 J. Kevin O'Regan/Alva Noë (2001): »A sensorimotor account of vision and visual consciousness«, in: Behavioral and brain sciences 24/5, pp. 939–973.

35 Marvin Carlson (1989): »The iconic stage«, in: Journal of Dramatic Theory and Criticism 3/2, pp. 3–18, here: p. 4.

oscillating between the real space and, at the same time, a virtual one – that of the stage event. In other words, as the theatre studies scholar Cormac Power states, theatre is an overlapping of illusion and reality. Similarly, applied to the passthrough experience, the participant overlaps both spaces. In this way, we can say that the passthrough based MR experience »can be seen not so much as ›having‹ or containing (or being defined as) presence but rather *functioning to play with its possibilities*«. In other words, the passthrough technology creates a strange perceptual disjunction between our awareness of artifice (we know the digitally produced objects or, in the case of the *doppelgänger:apparatus* project, the participant's virtual double) and the felt and seen reality of our very present bodies in the actual space, by way of the camera feed.[36]

This process of suspension of disbelief, of believing you are in one space while your body is in another, is not unique to VR. It is also highly emblematic of dramatic theatre where characters are represented on the stage but at the same time are absent. In drawing on the vast literature from Derrida to the theatre phenomenologist Bert O' States that problematizes theatrical theories of presence, such a theory assumes that the theatre is somehow from the start an *experience that one believes is real and that presence is based on such a belief*.

Yet, we need to remind ourselves that the theatre, like other art forms is, in essence, an artifice and construction. This is where we thus come full circle to our question of how the HMD as a technological device mediates these conceptions of presence and immersion. Indeed, if the suspension of belief model partially connects theatre to older ideas of being there in a virtual world, what it leaves out is another key element of the stage: namely its *technicity* that is made possible from viewing the stage itself as a technical system. As theatre theorists argue, one key notion of presence in performance is that of the literal fact of ›being-there‹ in-the-same-room-at-the-same-time as the artist/character. This kind of being there at once implies both a rejection of a transcendent stage ›aura‹ (that the stage is somehow more present) and an eschewal of attempts to create theatrical illusion.

Thus, we could argue that the concept of immersion might not then be defined by the belief of being there but by a *break*, a rupture and shock that the world that comes to the wearer of the HMD is *anything but real*. Such a concept is certainly not new. In fact, it broadly defines the 20th century theatre avant-garde where artists from Meyerhold to Brecht attempted to tear down

36 Cormac Power (2008): Presence in play. A critique of theories of presence in the theatre, Amsterdam: Rodopi.

the conception of the theatre as a realistic experience, instead creating works that aimed to deconstruct the expectation of real life portrayed on the stage. In fact, Power argues that a key feature of theatrical experience involves the simultaneity of imaginatively ›seeing‹ a fictional world that has been conjured up, while also seeing the theatrical means/machinery of creating that fictional world. Likewise, theater's technicity »both stages and represents the technologies it dramatizes, including those apparently immediate to theater«.[37] Such a conception of performance as expressive of technicity could also be said to apply to the fundamental technical mediation of perception that takes place within the realm of XR. This conception also radically departs from the concept that VR's understanding of presence is also determined by the illusion of non-mediation (forgetting that one is wearing a technical device) functioning for users.

Conclusion

The break from immersion as suspension of disbelief also harkens back to notions emerging from Russian formalism in the early 1920s about thinking poetry (or art in general) as a device to understand the ›literariness‹ of literature or ›the stoniness of a stone‹. Power argues something similar in his position that theater's basis in the world is that which allows us to perceive its *materiality* in a different way – perhaps even a strange manner. Thus, in the context of aesthetic experience, it becomes necessary to reposition the manner in which XR is thought. That is, to move away from the idea that transparency and non-mediation is the guarantee of immersion. Instead, immersion is really about fracturing belief – shocking the perceiver through technical mediation to begin to see the world not as it is given but in its artifice as a social-technical construction. Perhaps herein thus lies the political potential of immersion as shock – to unmask the ideologies that drive technologies like mixed reality by defamiliarizing our use and experience of these systems.

Here, the technologies harnessed to construct immersion function as in what the Russian literary critic Viktor Shlovsky described as a *device*. In a now influential 1924 essay entitled »Art as Device«, Shlovsky argued that the aim of poetry is to make the reader aware of the devices that make people aware.

37 William B. Worthen (2020): Shakespeare, Technicity, Theatre, Cambridge UK: Cambridge University Press.

This conception of estrangement (*ostranie*) is traditionally not discussed in the context of immersion. Yet, estrangement in Shlovksy's and later Brecht's context of *verfremdung* (defamiliarization) suggests that performative immersion through distance and shock is actually not in opposition but goes hand in hand. In other words, immersion is not belief in a world which is ultimately not there. Rather, through the very shock of technical mediation, immersion brings us into direct confrontation with what Shlovsky said defined art: the very fact that »the process of perception is, in art, an end in itself and must be prolonged. Art is a way of experiencing the artfulness of an object.«[38]

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38 Victor Shklovsky (1965): »Art as Technique«, in: L. Lemon/M. Reis (eds.), Russian Formalist Criticism, Nebraska: University of Nebraska Press, pp. 3–24, here: p. 12.

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