

Bodies and embodiment

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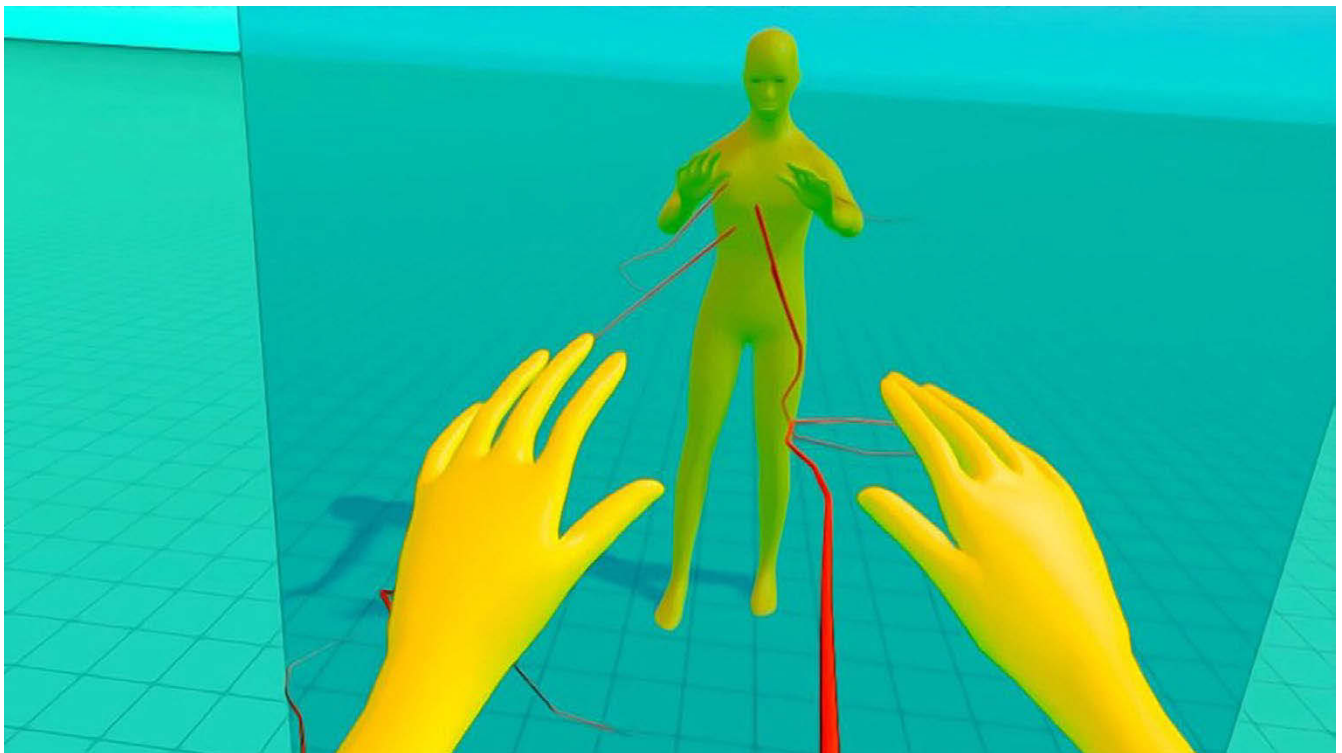


Fig. 1: Virtualshamanism: Towards an alternative digital reality of consciousness, virtual reality experience, Matias Brunacci, 2018

in immersive art

Embodied Simulation involves mechanisms of mirror neurons in the human brain. It describes our pre-rational capacity to physically simulate the actions, emotions and sensations of those we see around us and thus experience empathy (Freedberg & Gallese 2007: 198).

Virtual Embodiment, however, is mostly the object of research in the context of virtual reality (VR), and refers to forms of self-representation through avatars, also known as ›body swapping‹. Here, three key aspects come into play: self-location (knowledge of the body's location), agency (the ability to determine the body's form) and body ownership (identifying with the digital body as if it were one's own) (Kiltner et al. 2012). Thus, Virtual Embodiment plays a decisive role in creating presence: the sense of being physically present in the virtual world (Forster et al. 2022: 3).

This article was written in the frame of the project HERA with the AURORA XR School for Artists at HTW Berlin, funded by the European Regional Development Fund (ERDF) as part of the INP-III program.

Digital media artists often work with technologies that include virtual reality, projections, and screen displays in order to submerge viewers into immersive environments. In doing so, they consciously play with reducing objectivity and distance, creating space for an empathetic and embodied aesthetic experience (Grau 2001: 6, 13; Bieger 2007: 9). This immediacy allows artists to bring the physical public into contact with digital bodies, who may, through their morphology and behaviour, take on a human appearance. Often, we interact with them. Sometimes, we act through them. Accordingly, two concepts of embodiment come into play: Embodied Simulation (ES) and Virtual Embodiment (VE).

In opposition to René Descartes's mind-body dualism, both of these notions of embodiment assume the body to be highly involved in cognitive processes of perception.

With a particular focus on VR – the technology enabling the highest degree of immersion – this article situates itself within the field of tension between digital and physical bodies in immersive art. How, and with what tools, do artists produce digital bodies? What themes, reflections, and visions of the (post-)human do they convey in the process? How are the physical bodies of viewers – positioned not only to observe, but to perceive and actively participate in multiple ways – integrated into the artworks through embodiment (via ES and/or VE)? Relatively little research has been carried out on current forms of immersive art that interact with the body (see Landau 2020; Sauerländer 2022). This text seeks to make an interdisciplinary contribution to this discussion as it unfolds at the intersection between art science, information technology and the cognitive sciences, looking in detail at the work of six selected artists. Data-bodies are conceptualised here as digital models of bodies within immersive artworks, whose morphologies and movements may be dependent on the data of analogue bodies even after the work is completed. The first section focuses on production, the second on content, and the third on notions of embodiment in the context of bodies in immersive art. Demystification, mysticism around the body, and various myths relating to the body constitute meta-layers that resonate with various aspects of each chapter and artwork.

The artistic production of digital models of bodies

In our post-digital age, a growing number of tools and techniques allow anthropomorphic and often animated bodies to be created for immersive environments. Not least due to artificial intelligence (AI), such tools are able to generate evermore naturalistic results with little effort. This text therefore

represents a snapshot of the period between 2018 and 2023 in which the works under discussion were realised. At the same time, the division between processes of artistic production and the final product is often unclear: artists display an extraordinary virtuosity in their experimental combination of digital tools. Their unique processes can lead to highly enticing and idiosyncratic aesthetic results. In this context, this contribution is a short overview of a number of technologies often drawn upon. In the second section, these will be investigated in more detail in accordance with practices that allow for variations, combinations with, and deviations from other tools.

Volumetric 3D video recordings make up an integral component of the avatars of Lauren Moffat,¹ in which the moving body is recorded on a green screen stage with 12 cameras from countless perspectives and then digitally reconstructed. A 3D scanner uses LiDAR (Light Detection and Ranging) laser technology to measure the depths of rays reflected from the body, creating precise and static 3D scatter plot models. The LiDAR scanner is built into the models of some smartphones, and has also been used by both Anan Fries and Martina Menegon in the first steps of their artistic process. Further common 3D software offers extensive possibilities for modelling and modifying 3D models by working with meshes (nets of polygons) and textures (for example, skin), for example, as applied to Matias Brunacci's avatars, as well as those of Janne Kummer and team. At this point, the rigging – that is, the construction of the model's skeleton – and the resulting animation can be done manually. Software used for gaming and extended reality (XR) development offers plugins for the creation of hyperreal human models, as implemented by Theresa Reiwer. When animating her figures, the artist additionally works with motion capturing via a specially developed full-body suit – in this case, through the *Inertial Mocap Suit*, which uses inertial measurement units (IMUs) to sense the movements, accelerations, and turns of the human body in space. The resulting movement data is then wirelessly transferred to a nearby device in order to create animated 3D models. An increasing range of software is capable of automatically rigging and animating digital bodies. Beyond this, specialised AIs are able to analyse videos, capture their movements, and transpose them directly onto 3D software and the modelled bodies – a technology utilised by Menegon in the second stage of her process. Finally, inverse kinematics are used for the avatars of Brunacci, as well as of Kummer and team. For instance, if the viewer lifts their hand, the entire digital body follows the motion in a natural manner. This natural manoeuvrability contributes to convincing 'body swapping' in VE and

1 Created during a residency and collaboration with the project V-SENSE at Trinity College Dublin: <https://v-sense.scss.tcd.ie> (date of retrieval: 27.09.2023).



Fig. 3: The avatar of artist Anan Fries with digitally extended belly in the speculative environment of *Posthuman Womb*, virtual reality experience, 2022, Anan Fries & Malu Peeters.

»imminent process of transfiguration«. In the multiplayer, this begins with recognising, questioning, and deconstructing the above-mentioned questions as an emancipatory act. In VR, 3D symbols of physical norms and quantification – from Leonardo's Vitruvian Man to the weighing scale – are destroyed with hand-set-tracked fists. The precise way in which the physical body is involved in this interactive experience is described by Janne Kummer on (see p. 210). Meanwhile, the virtual body arranges itself as a digital skin, a prosthesis of the user, before itself undergoing a metamorphosis as the game unfolds: from egg, to hatchling polyp, to a human avatar – in the form of a glowing infra-red body-scan –, to a fully developed polyp. This is a form of generative self-reproduction without gender: the life cycle of a Medusa (Fig. 2).

Medusa, of course, is also a figure of Greek mythology, in which the most fantastic of births take place. Apollodorus, for instance, tells of the birth of Pegasus from the cast-off snakeskin of Medusa (Krsák 2004: 54), while according to *Homer's Legends*, the goddess of wisdom is born into the world as the

literal brainchild of the father-god Zeus (Specht 1986: 81f.). In human realities, however, it has long been feminised bodies only that have carried children. As times change, it appears that the norm of the heterosexual and cisgender pregnant woman remains set in stone, not least through the myriad of media representations of pregnancy. So how might alternatives look? In *Posthuman Wombs* (2022), Anan Fries and Malu Peeters speculate about a future in which a diverse range of emancipatory forms enable reproduction and family (Fig. 3). Their work is based on artistic research carried out through interviews with individuals who have investigated non-normative pregnancies through artificial or activist means.

A number of interviewees agreed to have 3D scans made of their bodies. Processed using 3D software, their bodies have been placed in an Arcadian landscape containing sheep that are reminiscent of the clone Dolly. Visitors to this landscape find themselves surrounded by sounds of flora and fauna: Peeters' 3D soundscape. Here, untold forms of communication and connection are suddenly made possible. In this world, everyone can become pregnant; the desire for and burden of pregnancy is

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evenly distributed throughout consciously manipulated bodies and technological extensions. The most radical solution in this speculative reality is the ectobag, a mobile, extra-corporeal system that allows a growing embryo to be collectively cared for on a rotating basis (Fig. 4).³ This artistic reflection on hybrid modes of reproduction amounts to an alternative to Donna Haraway's approach in her posthuman *Cyborg Manifesto* (1985). In her text, Haraway opposes organic forms of reproduction – associated with the feminised role of housewife and mother (Haraway 2006 [1985]: 22) – with the figure of the cyborg and its purely technical mode of reproduction: »cyborg replication is uncoupled from organic reproduction« (ibid.: 6). *Posthuman Wombs* refuses this radical division: In the context of a societal vision of collective responsibility, the connection between nature and technology intrinsic to cyborgs is applied to pregnancy and birth. In this sense, extensions such as the *ectobag* could also serve as means to mould active matter – thus resonating with techno-shamanism itself.

Replication is also a key theme in the work of media artist Martina Menegon, who has long drawn on 3D scans of her own body in her practice. The artist has a strong connection to these scans, which she increasingly views as being intertwined with her physical identity (Menegon 2023). For Menegon, these data-bodies constitute a part of her hybrid self. It follows that the strategy of identifying as being human through one's singular physical corporeality no longer holds true. Rather, instincts of self protection and self care are extended to virtual body-doubles. In her interactive installation *Sorry I made you feel that way (memories of care)*⁴ (2023), the artist repurposes a smart

ring in order to pair her biometric data with her avatar. Because her data is regularly updated in real time, her physical state of being has an immediate impact on her virtual body – in particular through stress (»daily readiness score«) and fatigue (»daily sleep score«). These parameters visibly impact her avatar's form, which takes on an increasingly disturbingly fragmented and decimated appearance when scores increase; similarly, viewer interactions with the projection via webcam become increasingly hampered (Fig. 5). The process of empathising here begins with a digital alter ego, and it generates the impulse to take care of the digital self (ibid.). For the avatar, an artificial intelligence (AI) has been trained with the aid of a Pix2Pix GAN, a machine learning model which draws on rendered videos of LiDAR body-scans with varying levels of detail. The app *Figment*⁵ executes the trained AI data in real time and combines it with data from the smart ring and webcam in order to enable interactions with the generated avatar.

While Martina Menegon externalises her body-doubles into the world of immersive art, Lauren Moffat's VR work *Image Technology Echoes* (2021) is based on two 3D-scanned central figures who appear as internalised *doppelgänger* – homunculi⁶ conjured up in the protagonists' own heads. A female and a male stand alone in a gallery. Together, they contemplate a large, Expressionist painting of a stormy sea, discussing the image using cultivated language. However, the conversation itself is

of the research project The Algorithmic Gaze at Sint Lucas Antwerpen: <https://algorithmicgaze.com> (date of retrieval: 13.09.2023).

5 <https://algorithmicgaze.com/tools/figment> (date of retrieval: 27.09.2023).

6 This is a fascinating motif that can here only be briefly outlined. In the philosophy of perception, Descartes was already able to establish that the retina of the eye generates an image of its surroundings, meaning that humans do not perceive the external world directly, but via internal images. Historical theorists argued that this could only be possible if an internal being also perceives the images: the homunculus. See e.g. Leonhard 2004.

3 In the context of premature births, this system is currently a subject of scientific research; in 2017, a lamb was successfully brought into the world using a similar pouch (Partidge et al. 2017; Fries 2023: interview).

4 Developed in collaboration with Frederik De Bleser and Lieven Menschaert as part

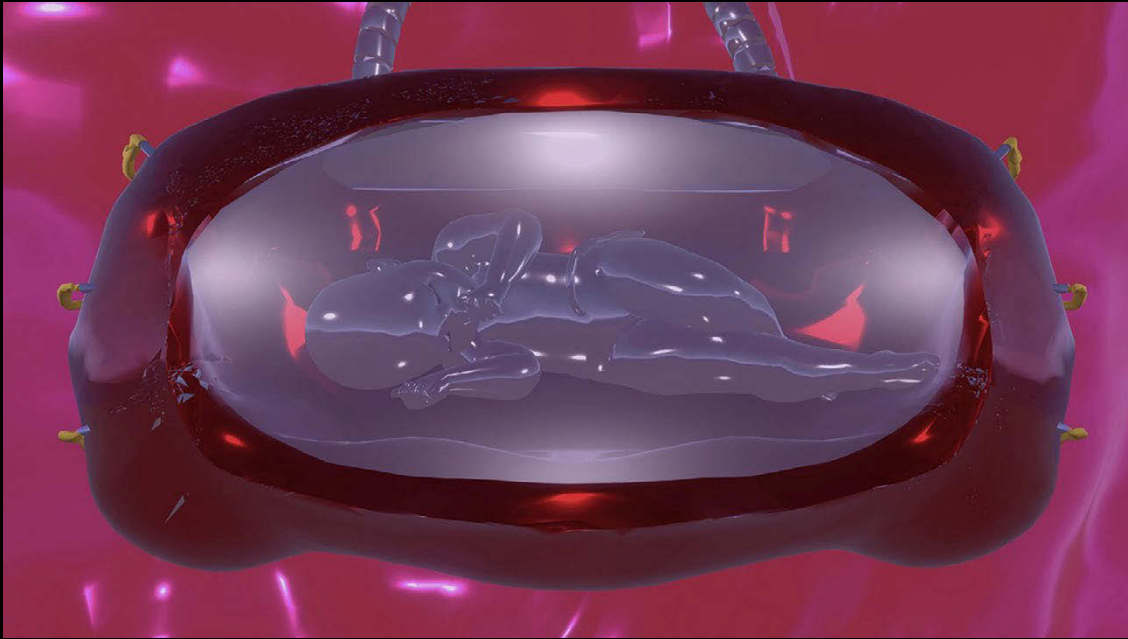


Fig. 4: The mobile, extra-corporeal system ectobag presented in Posthuman Womb, virtual reality experience, 2022, Anan Fries & Malu Peeters



Fig. 5: Martina Menegon, digital preview image 01 and exhibition view of I'm sorry I made you feel that way at discotic Vienna, 2023. Screenshot (top): the artist. Photo (bottom): Tina Kult.

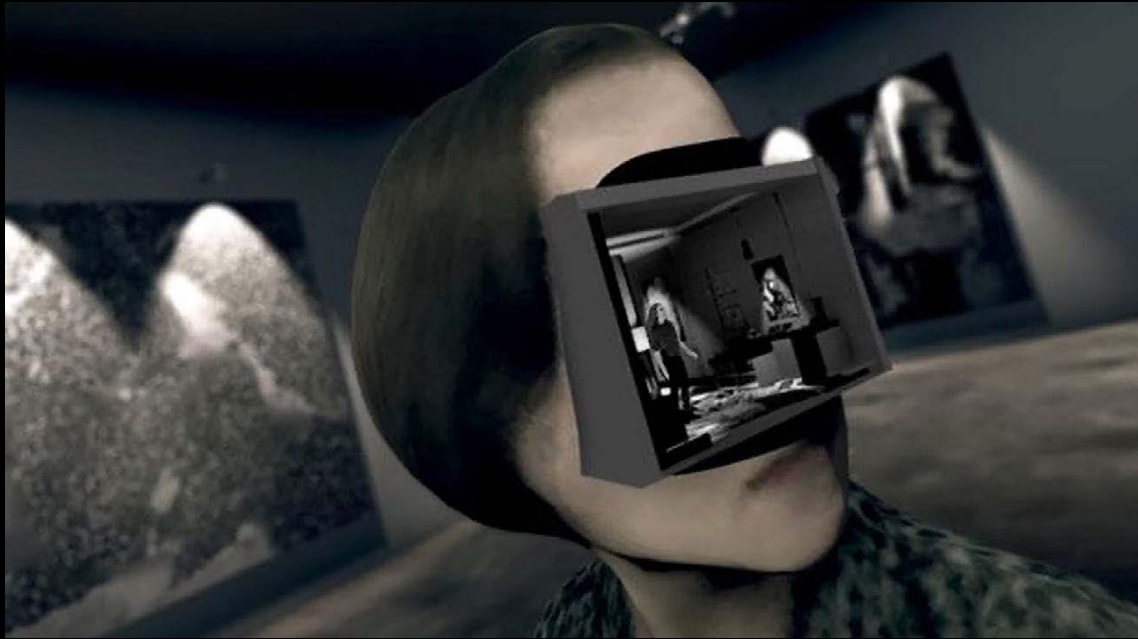


Fig. 6: A look into one figure's face in Image Technology Echoes, virtual reality experience, 2021, Lauren Moffat



Fig. 7: Decoding Bias, installation view at Monopol Berlin, immersive video/room installation, 2023, Theresa Reiwer. Photo: Carolin Saage

of secondary importance only. Moffatt's central concern in this work revolves around what plays out in our minds and bodies, and whether it is at all possible to differentiate between this and what can be perceived from the outside. Thus, the work investigates the divergence between internal experiences and »what we reveal on the surface« (Moffatt 2020: 00:30). The eyes and nose area of each figure is replaced with a box-like opening not dissimilar to a VR device (Fig. 6). As voyeurs, viewers are able to gaze into the interiors of the avatars' minds, which are likewise furnished with cultural artefacts – a literal visual translation of the word *Oberstübchen*, old German for »little room up there«⁷. The homunculi can be heard producing a monologue on what really makes their avatars tick. Their respective thoughts are produced via AI (Sauerländer 2021), which – perhaps somewhat paradoxically – allows the hidden, *authentic* self to be embodied and projected into the external world. What, in painting, would constitute a classic *mise en abyme* (image-in-image) motif, is here VR-in-VR, revealing the reality of a complex inner world.

Interior worlds, immersion, and AI are also themes in Theresa Reiwer's 2023 work *Decoding Bias*, in which viewers are presented with a witty societal dystopia. Eight AIs attend a group therapy session in which they are to discuss their problems (Fig. 7). Each AI suffers from discriminatory algorithms, which they would like to get rid of or rewrite. As the discussion unfolds around specific moral concepts, the characters constantly flounder due to defective data sets they have inherited from (mostly white and male) humans through the selection of their training data (Reiwer 2023). Ultimately, *Decoding Bias* counters toxic masculinity à la Elon Musk or Donald Trump with mindful masculinity facilitated with meditation and karaoke. In analogue space, the public is integrated into this exchange via a circle of chairs interspersed between the AIs, which are represented on screens in an eight-channel video installation with spatial sound and shifting atmospheric lighting. The anthropomorphous AIs were perfected in collaboration with human professional actors through a broad range of digital tools, including a face tracking app designed for smartphones, as well as ChatGPT, which was used to write the less complex parts of the script. Despite their hyperreal appearance, the avatars seem so imperfect, sensitive, and human that the public experiences empathy and compassion, rather than the *uncanny valley*⁸ (Reiwer 2023).

Embodiment in immersive art

Empathy arises through the aforementioned mechanism of Embodied Simulation (ES), which is set into motion by mirror neurons in the brain. Although *Decoding Bias* does not explicitly pose them, further questions certainly do arise: is it not absurd that we experience empathy for machines? How much do we really want to identify with them? When AIs (as with humanoid robots) retain the form of a human body, ES makes it increasingly difficult to maintain objective distance in immersive surrounds. This is also true beyond artistic contexts, including in games with non-player characters (NPC), which are not controlled by human players. For instance, developers are currently working on connecting ChatGPT to avatars via Text-to-Speech, making it possible to hold spiritual conversations.⁹ Revolving around the digital resurrection of departed individuals, digital media designer Chantal Piszczowski's VR project *n≠1* (2024) also works with this connection to the chatbot, allowing dialogues with a hyperreal 3D model of the deceased artist and activist Helga Goetze (Fig. 8).¹⁰ In such situations, we all appear to be equal in our digital corporeality – at least on the surface. However, how do we come to »swap bodies« with these digital forms? Virtual Embodiment (VE) is attained through a harmonised interplay between physical and digital bodies. Here, a mentally stabilised schema – that is, the internal image or model of one's own body – plays a crucial role (Biocca 1997). If this schema is believably tricked through human-machine interfaces such as screens and headphones, then the VE process has succeeded. This principle applies to all of the artworks introduced in this text. If the sensory perception between virtual and physical space diverges to a great degree – for example, through uncalibrated motions – the VE experience can be disruptive and lead to cyber-sickness. Thus, only the most natural interactions have a positive effect on VE, such as slow locomotion in *Posthuman Wombs*, using hands to grasp objects in *Virtualshamanism*, or using fists to bash structures in *XBPM*. The ways in which technology is modified to naturally interact with the body's inbuilt wiring also contributes to VE – but how does this, in turn, affect our perception? Frank Biocca calls this dynamic the cyborg's dilemma: the more natural an interface appears, the more it will adapt to us. This means that we, too, adapt to the interface – meaning that the perceived border between analogue and digital bodies is fluid and the cyborg is hybrid.

9 See https://www.youtube.com/watch?v=7xA5K7fRmig&ab_channel=Tamulur (date of retrieval: 24.09.2023).

10 Shown at Manifest:io festival, 24–25 February 2024, Alte Münze Berlin; created as student project at University of Applied Sciences (HTW) Berlin, supervised by Prof. Pablo Dornhege & Prof. Andreas Ingerl. See <https://futurerealitylab.notion.site/Helga-37552b7bbb164723bde5f53403c25452> (date of retrieval: 18.03.2024).

7 <https://www.dwds.de/wb/Oberst%C3%BCbchen> (accessed: September 14, 2023).

8 Cold, eerie feelings often described by persons when they encounter an entity that looks and acts almost like a human (for robots, see Mori et al. 2012).

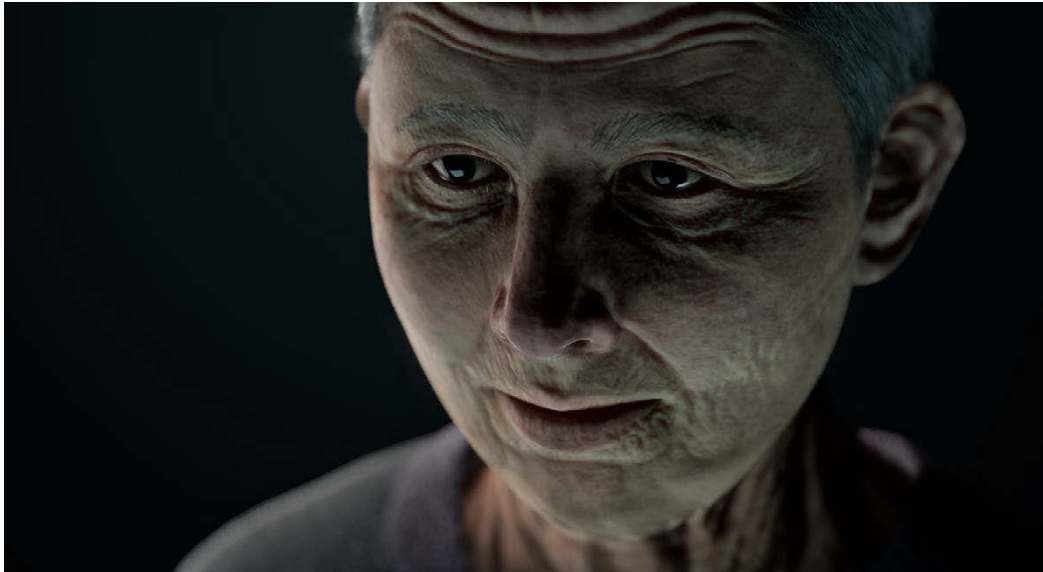


Fig. 8: n#1, close-up Helga Goetze, virtual reality experience in combination with ChatGPT, 2024, Chantal Piszczowski

An early masterpiece that uses such natural user interfaces (NUIs) is Char Davies' VR work *Osmose* (1995), in which the cyborg's dilemma is combined with aesthetics and sound to create a fascinating and beautiful experience that is often described as mystic – »facilitating awareness of one's own self as consciousness embodied in enveloping space« (Davies 2002).

In *Virtualshamanism*, the viewer recognises themselves as a cyborg in the mirror – in visual art, a symbol for vanitas and self-recognition. In VR, the mirror further becomes an effective medium in order to generate Virtual Embodiment, one that can also be used for therapeutic work (Keppler et al. 2022). Moreover, in combination with Embodied Simulation, VE can also affect our thoughts and feelings – not only during the VR experience, but also afterwards. The »proteus effect« describes how individuals adapt their behaviour to their digital self-representations during a VR experience, and how this can also affect their social interactions afterwards (Yee & Bailenson 2007). Furthermore, tests demonstrate improvements in the cognitive skills of participants when they are brought to identify with the digital body of Albert Einstein and perceive it as their own (Banakou et al. 2018).

Research is also being conducted into the long-term effects of VR in the context of encouraging certain – in this case pro-social – behaviours. In this context, experiments have been carried out that involve groups of male and female avatars. Sexual harassment of the latter led to positive changes in the social

behaviour of male participants who took on the role of female avatars (Neyret et al. 2020).¹¹

These studies were undertaken in the disciplines of psychology and communication in virtual environments. In the discussed artworks, no studies have yet been undertaken to empirically prove the effects described – that would require further research, and an expanded set of artworks. Where are the borders of human manipulability through embodiment in VR? Should Embodied Simulation and Virtual Embodiment be consciously and manipulatively used, for instance in pedagogical contexts? If yes, what rules should apply? At what point will we no longer be able to differentiate between AI and human avatars in VR or in hybrid environments? What does this mean for us as social beings? In light of the digital transformation, which goes hand-in-hand with the ongoing development of immersive art, questions such as these underscore the definite social relevance of the notions of embodiment introduced in this text. This extends to topics of techno-shamanism, queer identities, extra-corporeal pregnancies, cyborgs, body theories, and AI, all of which are thematised in the artworks here discussed. In each of these works, immersive media entails the use of ES and VE, reducing the viewer's objective distance from the themes investigated, opening new modes of access, and thereby initiating

11 This article has already been discussed by Brunacci 2021.

and extending discourse in society. At the same time, immersive art creates space for experiencing the ambivalence of this loss of distance, as in *Decoding Bias*. In analogue art, this would not be possible. In order to reflect on loss of distance, it is necessary first to experience it.

In conclusion, the potential of the various modes of interplay between Embodied Simulation and Virtual Embodiment has, to date, not yet been fully explored, neither in immersive art nor in interdisciplinary research. At the same time, the intertwined nature of notions of embodiment in practice – in particular through XR and not least through the use of AI – is becoming increasingly complex and relevant. In light of this, the following three measures may, in future, need to be reiterated: firstly, the generation of new knowledge through interdisciplinary research of immersive art with a focus on ES and VE (expanding previous research on embodiment in the reception of analogue art formats, e.g. Freedberg & Gallese 2007; Krois 2011; Casper et al. 2018); secondly, the bundling of knowledge relating to embodiment from all disciplines, and a transfer of knowledge into the creative sector, for example through interdisciplinary discussion formats, online tutorials, and further education; and thirdly, by taking into consideration and/or thematising new understandings of embodiment in future immersive artworks. Through interactions with the public, such artworks are able to pass on inherent knowledge to society, contributing to broader media competency in our dealings with hybrid corporealities.

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With a background in art science, **Maja Stark** has designed and coordinated various EU-funded research projects at the intersection of culture and XR technologies at HTW Berlin, e.g. the AURORA School for ARTists (2018–22), XR_Unites (2020–23) and HERA (started in 2023). In parallel, she has curated exhibitions, co-created creative XR applications, lectured, and conducted her own research in the fields of XR art and interdisciplinary XR development processes.