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A Sensory Experience Through the Entanglement of Dynamic Virtual Memories

Marta Shilova

Digital Image & Virtual Reality Lab. (INREV),
Paris 8 University,
Paris, France
marta.shilova@etud.univ-paris8.fr

Chu-Yin Chen

Digital Image & Virtual Reality Lab. (INREV),
Paris 8 University,
Paris, France
chu-yin.chen@univ-paris8.fr

Hui-Ting Hong

Digital Image & Virtual Reality Lab. (INREV),
Paris 8 University,
Paris, France
w102060018w@gmail.com

Ray-Kuang Lee

Institute of Photonics Technologies (IPT),
National Tsing Hua University,
Hsinchu, Taiwan
rklee@ee.nthu.edu.tw

Abstract

Intricate Memories is an immersive and interactive virtual reality installation that explores how bodily sensations, gaze, and multi-modal feedback affect the participant's sense of presence through a responsive avatar. The system integrates real-time body tracking, eye tracking, and generative AI to enable a dynamic entanglement between the participant and their avatar, whose appearance evolves based on emotional and sensory stimuli.

By combining multiple input modalities and sensory outputs, this VR space supports non-linear interactions guided by gaze, allowing the avatar's body to act as a medium of somatic memory. The project examines how three types of memory: somatic, mental, and collective artificial, reshape presence and body representation in immersive environments. It also critically examines how media representations, especially those shaped by disinformation, can alter our affects.

Keywords

Virtual Reality, multisensory interaction, eye tracking, entanglement, virtual body, generative AI, somatic memory

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1 Intercession and entanglement between real world and virtual world

1.1 The avatar: an interface of perceptual transformation of presence

Presence in VR, particularly the participant's bodily sensations, is at the core of our exploration. Through the staging and the interactions it enables, Philippe Fuchs emphasizes the direct link between presence, bodily perception, and self-awareness. He underlines the importance of embodied sensoriality within immersive experience [8]. From an artistic perspective, Judith Guez examines presence as a dynamic relationship between the avatar and the real body, shaped by the visual and interactive alterations of the device [9]. Simon Richir extends this notion with a technocognitive lens, emphasizing the need for a continuous sensory loop to stabilize lived experience [16]. Furthermore, Lombard and Ditton define presence as the illusion of non-mediation, a key condition for perceptual engagement in simulated environments [11]. Biocca expands this notion to social presence, incorporating affective and narrative dimensions [3]. However, existing installations often lack dynamic responsiveness and multimodal entanglement between body and media. Our VR art installation, *Intricate Memories*, conceptualizes the avatar as a sensitive interface, shaped by somatic, mental, and artificial memories. It functions as an expressive surface where self-perception is transformed through visually encoded memory feedback. The system links real-time gesture and gaze input to visual transformations in the avatar, shaping memory-driven embodiment, as shown in Figure 1. The installation bridges physical and virtual realms. The real world captures gestures and gaze; the virtual world displays an evolving avatar, a skybox projection, and a memory carpet interface. By triggering AI-generated sequences via gaze, the participant navigates layers of simulated reality—what Mann et al. [13], describe as a continuum from virtual to mediated and augmented reality. These layers articulate three memory forms: somatic (visible in the avatar's transformation), mental (symbolized by the projected silhouette), and collective/artificial (encoded in the memory carpet), echoing Pierre Lévy's notion of shared intelligence [12]. Unlike traditional immersive experiences, these memory types are algorithmically entangled and embodied through visual morphing.

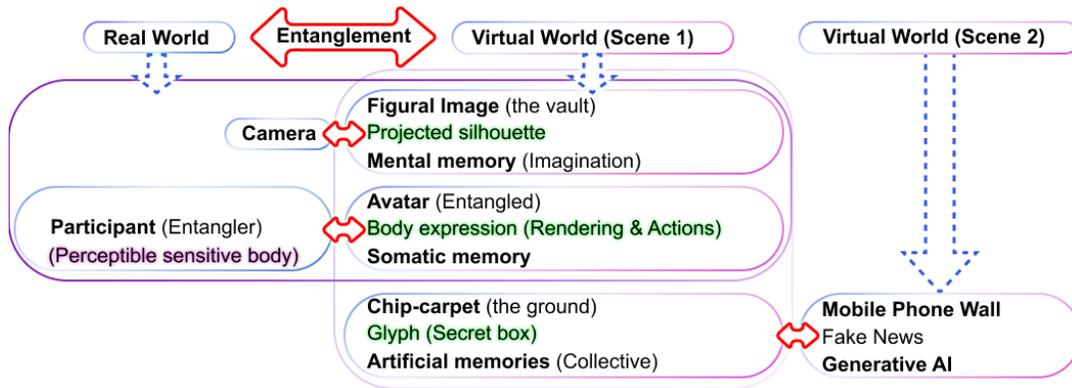


Figure 1: Entanglement scheme between real and virtual world

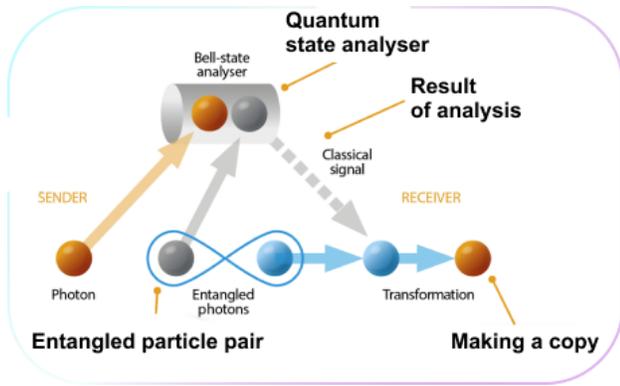


Figure 2: Quantum entanglement (image credit of Pr. Lee Ray-Kuang, Future PLC)

1.2 Interaction and alteration between virtual memory fields

The VR experience is based on a feedback loop shown in Figure 1 between the participant’s actions, digital stimuli, and sensitive alterations to their avatar. In this context, the following questions arise: how can interactions between the three fields of memory (mental, somatic and artificial) and the avatar, as a double of the participant, affect the participant’s sense of presence? How can the participant feel the impact of AI-generated visual and textual fake news content on their self-perception? [2]

In the *Intricate Memories*, we assume that the participant experiences an entanglement between the real world (the physical environment of the participant, including their body, gestures and gaze, captured in real time by the device’s sensors) and the virtual world (the immersive universe perceived in the VR headset). In this hybrid space, the participant is confronted with automatically generated images and texts, such as fake news, which affect their sensation and body memory, visible through the transformation of their avatar. Through this alteration, the installation attempts to highlight a form of entanglement [2] between technology, presence, self-perception, one’s own body and its representation (first-person avatar), shown in Figure 2 and Figure 3a.

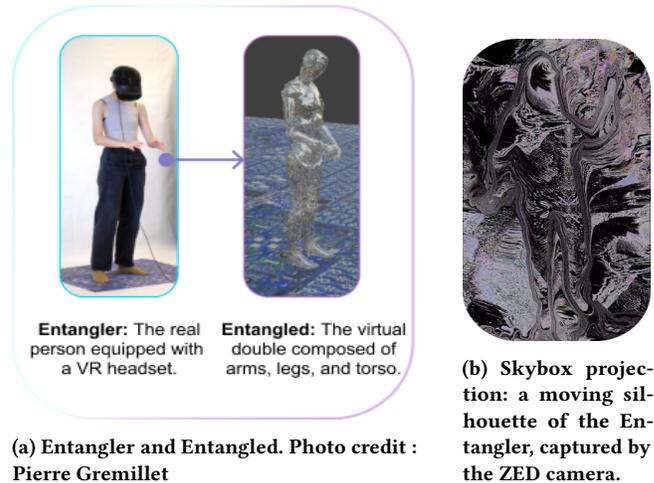


Figure 3: The Entangler and the Entangled

1.3 Methodology: a research-creation approach

This project is part of a research-creation approach, where artistic practice constitutes a field of experimentation in its own right. It is not just a matter of producing an artwork, but of thinking through creation, in order to question the relationships between bodies, immersive technologies and sensitive narratives. The main objective is to explore how a mixed reality (XR) device can make a living, moving and emotional experience by visually transforming the participant’s virtual body, that is their avatar. As emphasized by Amato and Weissberg, the body in interaction functions both as an interface and a narrative agent, shaping the perceptual dynamics of the dispositif [1]. This approach combines artistic creation, interactive devices and reflections in a logic of going back and forth between practice and theory.

The installation aligns with Jean-Louis Boissier’s notion of interactivity as a compositional form, where memory and perception emerge from the situated relationship between user and system [4]. The system functions as a reflexive loop: false information alters the avatar, which becomes a sensory mirror of internal states, altered memories and identity questions. The dispositif aligns with

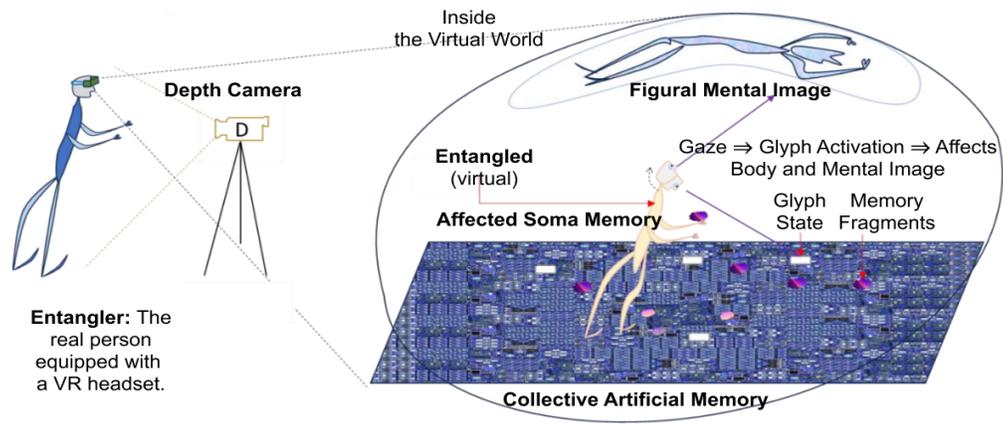


Figure 4: Technical design

an enactive approach to experience, in which the body is understood as a dynamic trace of sensory engagement in interaction with the system [17, 18]. This perspective aligns with Thouvenin’s work on co-constructed, embodied experience [21] aiming to render memory-in-action as a visible and felt process through the digital body.

1.4 Intricate Memories Synopsis

Intricate Memories is set in a VR environment inspired by the concept of digital twins, where multiple presences coexist: real and virtual, Entangler and Entangled. Through the avatar, the project explores three forms of memory: figural mental image, somatic affect, and collective artificial memory, resonating with Michel Serres’ [19] reflections on the externalization of memory by technology.

This installation immerses the participant, hereinafter referred to as the Entangler, in a symbolic space. Equipped with a VR headset, they also perceive in the virtual world a representation of their body, hereinafter called the Entangled, which is covered with a layer of interlocking scales that represent fragments of their entangled somatic memory.

At their feet stretches an infinite tapestry of RAM cards and semiconductors, evoking a collective artificial memory. Fragments of evanescent forms dot the ground or float softly in the air, like memories still free of attachments. Entangled can bounce these fragments on the huge circuit board on the ground. They can grab them or simply sweep them away with their hands or feet. This allows them to discover silver magic glyphs upon this tapestry of glittering, whose signs recall the layout of integrated circuits. When the Entangled lock eyes with a glyph, they are teleported into a world of Fake news, surrounded by floating smartphones broadcasting real-time AI-generated content. Back to the real world: A depth camera (a ZED stereo camera) captures the figure and gestures of the Entangler and transmits in real time a representation of the figural mental image to the virtual reality application, shown in Figure 3b. Projected onto the celestial vault (skybox) of this virtual world, this image haunts the imagination of the Entangler and the Entangled, shown in Figure 4.

2 Implementation and Developments

Our virtual reality installation is built on a modular architecture supporting real-time interaction, procedural generation, and synchronization of experiences. It integrates three subsystems: 3D scene orchestration and avatar transformation, real-time body and eye tracking, and AI-driven image texture generation. These modules communicate via Unity’s coroutines and C# concurrency structures, the Network Device Interface (NDI) protocol for low-latency video streaming with TouchDesigner; and HTTP requests to OpenAI’s DALL-E 2 [15] text-to-image service integration. By adhering to event-driven design and asynchronous I/O, this installation experience provides an extensible platform for integrating sensors data sources and delivering immersive narratives while ensuring reliable, real-time synchronization between visual rendering, user interactions, and AI-generated content.

2.1 A 3D Scene & Avatar Bodily Transformation

The VR installation alternates between two gaze-triggered scenes, shown in Figure 5. Shared global variables ensure the persistence of states, including the prompt category, avatar state, and audio playback indicators, while the ZED stereo camera feeds real-time spatial data to TouchDesigner, projecting a mental image onto the virtual sky, shown in Figure 3b.

Scene 1 – Collective Memory: the participant walks over a RAM circuit tapestry. Interacting with fragments alters the Entangled’s skin, imprinting traces of media exposure. Returning from Scene 2, the avatar bears visual signs of that experience, shown in Figure 6. This transformation is directly linked to the type of prompt used to generate the fake news. Thus, the body bears the traces of its media exposure: it becomes the visible archive of a process of perceptual manipulation.

Scene 2 – Chaos of Fake News: the participant is surrounded by floating phones broadcasting real-time AI-generated content from emotional prompts. Their body disappears, inducing disorientation and highlighting the effects of disinformation on identity and grounding, induced by exposure to disinformation media. Each emotional prompt triggers a specific morphing of the Entangled’s body, shown in Figure 6 encoding the affective impact of algorithmic

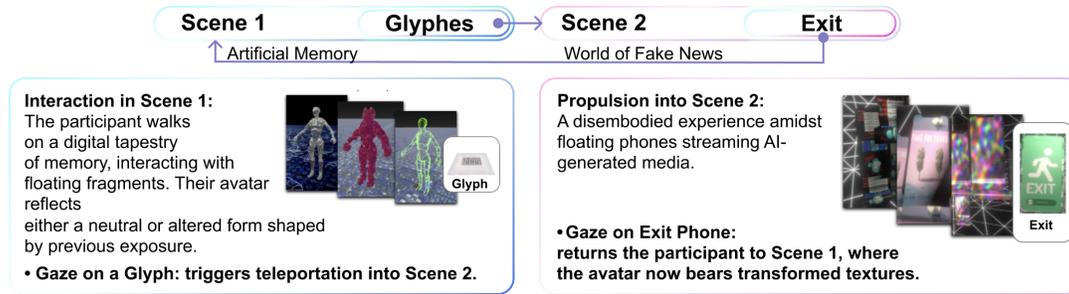


Figure 5: Transition system between scenes

imagery. These visual states act as coded stimuli, recalling Edmond Couchot’s reflections on digital images as modulating expressive interfaces between body and representation [5]. The details of the avatar designs are listed below:

- Acid: The body takes on a fluorescent green hue and appears distorted from within.
- Oceanic: The body becomes translucent, appearing aqueous and relaxed.
- Bristled: The body intensifies into bright red, with visually exploding structures and angular contours.
- Base Body: It represents the Entangled’s original state, neutral but sensitive to modifications.

After returning to the initial scene, the visual alterations persist: the body retains traces of the experience. This visible somatic memory acts as a witness to the passage and emotional impact, generating a form of computational subjectivity.

2.2 A Real-Time Eye Tracking and full-body Body Tracking

This installation utilizes a Meta Quest Pro headset to enable gaze-based interaction, leveraging its integrated infrared cameras and IR emitters to track eye movements at 120 Hz. Eye tracking data is accessible in Unity through the Meta XR plugin. When a participant gazes at a visual glyph for more than 500 milliseconds, a raycast is triggered from the camera to the glyph’s mesh. Upon intersection, the corresponding script is executed, either transforming the avatar, transitioning the scene, or activating an audio sequence based on the visual glyph chosen by the participant at the moment of interaction.

We support an intuitive interaction paradigm where visual attention directly drives narrative progression. Gaze and gesture, as intentional actions, activate system elements. As demonstrated by [6], these interaction modalities are central in interactive exhibitions, where they redefine body perception through the interface. Simultaneously, full-body presence is achieved through the body tracking capabilities of the VR headset, which estimates shoulder and torso positions by combining data from cameras and inertial sensors. Unity utilizes this data via the Movement SDK and inverse kinematics (IK) algorithms to animate a responsive body avatar. The OVRCameraRig configuration and the body tracking parameters of the Meta XR plugin enable real-time rendering of upper body movements.

2.3 A Procedural AI Image Texture Generator

To sustain an ever-changing media landscape, Unity executes a coroutine (*GenerateTextureLoop*) at 3.5s intervals. Each iteration selects one prompt category, constructs a JSON payload, and issues an HTTP POST to the OpenAI DALL-E 2 images endpoint. Upon receiving the generated image URL, the system asynchronously downloads the asset and updates target *MeshRenderer* materials, specifically the *_MainTex* and *_EmissionMap* channels. This pipeline ensures that the visual environment remains constantly evolving, reflecting the disorienting pace of algorithmically generated news feeds.

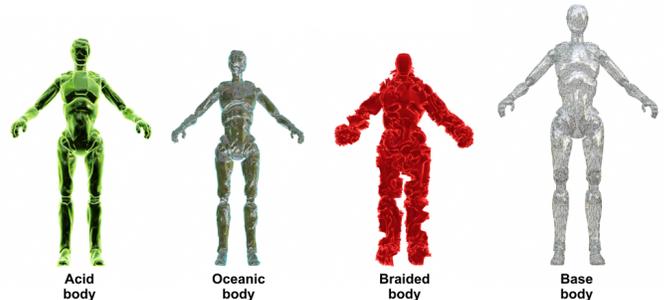


Figure 6: Visualization of affected morphologies.

3 Results, observations and feedback

3.1 Feedback from participants and analysis

The public feedback highlighted three main types of reactions: emotional, playful and therapeutic.

Emotional: Many visitors reported a sense of strangeness when witnessing their avatar’s disappearance or unexpected transformation. Some described a disturbing mirror effect; others noted a strong emotional resonance triggered by the system’s responsiveness. These bodily shifts disrupted their perception of self.

Playful: Participants expressed fascination with the virtual materiality, especially the iridescent textures and animated glyphs, often described as poetic and organic. Children responded with spontaneity, engaging playfully with the fragments and mimicking gestures.

Therapeutic: Some adults experienced catharsis or self-projection, linked to the avatar's morphing body. A therapist suggested potential clinical applications, including exploration of body dissociation, trauma, or somatic disorientation.

A recorded aftermovie of the installation is available at <https://vimeo.com/1106398424?share=copy#t=0>, showcasing participant interactions and the visual environment.

3.2 Limitations and Prospects

While the current installation establishes a strong foundation for immersive interaction, it also opens up several promising avenues for enhancement. One key area for development is the integration of haptic feedback, which could further enrich the sensory palette. By introducing tactile or vibration-based responses, future versions may deepen the sense of embodiment, reinforcing the connection between gesture and sensation in a more visceral way.

Lower body tracking, though currently limited in precision, presents an exciting challenge. Improvements in this domain could significantly increase the coherence of full-body motion, resulting in a more seamless and expressive avatar embodiment.

Emotional responsiveness is currently driven primarily by gaze behavior, offering a valuable first layer of affect detection. Future iterations will aim to expand this capacity through biometric integration, such as heart rate variability, skin conductance, and vocal tone analysis, to heighten the system's sensitivity to users' affective states. These signals could be used to dynamically inform the generative AI, enabling it to either amplify emotional resonance (mirror effect) or provide a calming, regulatory presence (regulation effect).

A future multiplayer mode, in which emotional and bodily states interweave among participants, holds potential for creating a deeply resonant collective experience. Qualitative and quantitative data collection is also planned to assess affective engagement and embodiment across a range of users.

4 Conclusion

Intricate Memories proposes an experience at the crossroads of immersive storytelling, virtual body metamorphosis, and computational memory. By merging sensory aesthetics, algorithmic devices, and visual transformation, the project interrogates our relationship to the body, memory, and the reliability of perception.

It opens a path to an immersive writing of uncertainty and memorial flux, where identity instability is staged as a symptom of contemporary information regimes. The device is also part of an enactive approach to cognition [22], where the subject co-constructs their perception in constant interaction with the environment. Through this dynamic, *Intricate Memories* fully engages with the issues raised by Frank Popper [14] around interactive art and active participant participation. Here, the body is no longer a simple receiver, but an actor of an embodied memory process.

In an era described by Jean-Paul Fourmentraux as post-media, *Intricate Memories* follows a logic of hybridized media and sensitive experience, situated at the crossroads of immersive technologies and computational narratives [7]. This computational poetics echoes Sha Xin Wei's reflections on topological enchantment and lived experience as a malleable material [20], as well as Mark Hansen's view of digital dispositifs as agents of affective reconfiguration [10].

Through this sensory computation, the work gives form to an affected presence—shaped, destabilized, and inscribed by algorithmic flows. It reflects critically and poetically on memory as both data trace and experiential interface, revealing the digital body's affective plasticity in the face of opaque media systems.

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