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# *Eve 3.0: stories of our extreme selves*

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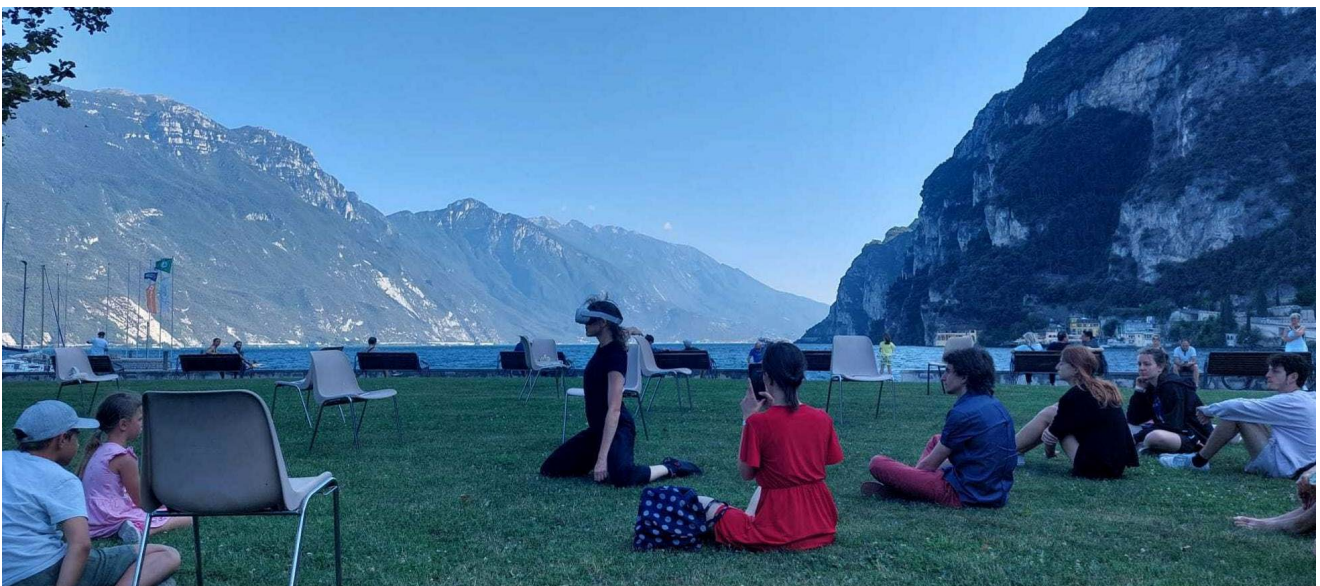
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**Eve 3.0 is a participatory contemporary dance performance that pushes the boundaries of Virtual Reality (VR). This cutting-edge layered performance unfolds through the integration of physical interaction with a live performer, stereoscopic 360 video, interactive motion-captured dance, and ends with mixed reality passthrough where the participants dance freely. A dancer brings the audience into the embodied stories of 6 characters affected by addiction, anxiety, depression, obsession, jealousy, and paranoia. Each story is told simultaneously through 6 VR headsets. The performer's dance facilitates the tactile and embodied experience, producing a multi-layered performance across virtual and physical. Audience members are encouraged to express themselves through movement becoming co-creators of a rich multisensory aesthetic and affective experience. Moments of physical interaction with characters in the stereoscopic video coincide with the dancer's tactile interactions. This immersive interactive performance invites participants to experience the unseen challenges of the embodied mind revealed through dance. *Eve 3.0* presents an innovative form of participatory artistic expression that promotes a positive vision for immersive technology to facilitate empathy and self-expression through co-present physical interaction between moving bodies.**

*Virtual Reality. Immersive Performance. Interactive Performance. Touch. Dance. 360 Video.*



**Figure 1:** Performance of *Eve 3.0* at PAN Festival 2023 in Riva del Garda, Italy. Photo ©2023 PAN Festival. Visit <https://compagnievoix.com/en/projects/creation/eve-3> for trailers and more information.

## 1. INTRODUCTION

*Eve 3.0* is an interactive immersive experience that pushes the limits of current virtual reality (VR) technology and encourages participants to reflect on the unseen challenges that shape our experience. Six stories are told synchronously through the VR headsets. The immersive experience features stereoscopic video, motion-capture, synchronized real-time visual effects, and performer-facilitated and mixed reality modulated through sound and movement. *Eve 3.0* is inspired by a long line of experimentation with interactive live performance. We build upon BeAnotherLab's multisensory installation "The machine to be another" (2012), Rhizomatiks' participatory performance "Border" (2015), and Jeffery Shaw's immersive approach to expanded sounds and visuals in pieces such as "PLACE – Turkey" (2010). Growing from these inspirations integrate choreographic language, audience participation, and immersive technology to produce an interactive performance across several layered realities.

## 2. AN INNOVATIVE IMMERSIVE PERFORMANCE

This immersive performance presents the hidden challenges that affect many far more than we might realize. The goal is that those who experience the performance come away with a renewed empathy for themselves and those around them as expressed through collective movement. The project supports nonverbal communication and expression (Martin-Juchat, 2020) invoking the mediating role of dance in somatic education (Homann, 2010). Dance is gradually brought in through the performer's physical body, then the virtual bodies, and finally manifests through the participants' bodily expressions and empathy with their character's emotions (Fuchs, 2014).

Embodied emotional expression is a fundamental element of the conscious awareness we have of our own body. It is vital to our capacity to communicate with others and understand ourselves. The body in motion materializes our psychological experience (Fuchs, 2010). The lived experience of the body, its emotions and physical movements, and the social context are all deeply intertwined, mutually influencing one another (Di Petta, 2020). The body's movement in dance can thus create metaphorical visions and open paths to understand diverse lived experiences. Immersive and interactive technology providing tools that augment, guide, and encourage participants' movements. This technology guides the experience from both proprioceptive and social points of view.

### 2.1 Eve—a gateway across layered realities

In *Eve 3.0*, the protagonist, Eve, becomes the mediator between the real and the virtual, providing

a narrative anchor. She ties the dramaturgical line as the experience moves from realistic recordings to abstract interactive images, to mixed reality that gives the participant full control as they return to the real world while still wearing the VR headset.



**Figure 2:** Six dances were motion captured representing six different characters. Photos © 2020 Audrey Planchet.

Eve meets six characters affected by different mental disorders. Fiona: anxiety, Desirée: addiction, Meredith: depression, Amir: paranoia, Lohan: obsession, Jonas: jealousy. Each character's lived experience of their condition and how it evolved from childhood through adulthood is shared through a narration of their diary. Their emotions are simultaneously expressed through dance. Participants are invited to reflect on the complex experiences behind each character's struggles.

### 2.2 6+1 synchronous narratives

The main character, Eve, is thus in seven places simultaneously: in the physical space shared with the general audience, and in the six virtual stories with the VR participants. Each participant has a different overlapping experience. These narratives are also observed externally, forming a seventh perspective for the audience: a meta-narrative of those characters whose stories overlap fused with the emergent choreography that arises between guided performance and self-expression.



**Figure 3:** The six characters' internal monologues visual representations. Teal: Desirée, Yellow: Lohan, Magenta: Fiona, Red: Amir, Blue: Meredith, Green: Jonas.

### 2.3 Layered roles and 3 modes of participation

Throughout the performance there are different roles adopted by the audience. For clarity we refer to the live performer as the dancer. Character always refers to virtual characters seen in the VR

headset. The audience can take 3 different roles: Travellers, Performers, and Observers.

**Travellers** wear a VR headset and are fully immersed in the embodied story. The virtual journey takes place through the character of Eve, a gateway body who allows you to travel through time, space, and into the soul of another person, embodying moments of their life through their diary.

**Performers** enter the experience near the end/ This role helps the Travellers on their virtual journey by providing a tactile body that aligns with the virtual avatar, making physical contact and following the movements of the Traveller.

**Observers** watch the performance, witnessing the Travellers' and Performers' interaction and the interwoven narratives guided by the dancer. This role experiences all the stories told by Eve from a different perspective. Two projections show what is seen by the Travellers along with abstract visuals.



**Figure 4:** *Eve 3.0 progresses from 360° video (left) to motion-captured dances rendered in real-time (centre) ending with responsive passthrough visuals (right).*

#### 2.4 Multi-modal mixed reality performance

Within the headset, *Eve 3.0* delivers an experience across multiple modalities. As shown in Figure 4, beginning with stereoscopic video, *Eve 3.0* progresses from realistic visuals towards the abstract while the experience moves from fiction to physical reality. *Eve 3.0* begins with stereoscopic video that requires Travellers to move along with their character, limiting their agency and requiring them to directly follow the choreography. While the visuals are highly realistic, they are the most removed from the Travellers' physical reality. This progresses to real-time stylized graphics that respond in part to the Travellers' movements. Despite being more visually abstract, this part of the experience is modelled after their actual bodily movement. Finally, in the last stage, passthrough cameras are used to produce visuals based on the real physical surroundings responding directly to the Travellers' movement and encouraging them to dance. The visuals are the most abstract, yet most directly rooted in reality. In this way, participants simultaneously move from being carefully guided through choreographed movements in virtual reality towards free and open expression in mixed reality.

#### 2.5 Performer Facilitated Embodiment

Participants' embodiment in the immersive experience is facilitated through physical interaction with the performer. This technique was first used in *Eve: dance is an unplaceable place* (Bergamo Meneghini, 2019) which *Eve 3.0* evolved from. The dancer coordinates her interactions by dancing to the music in a carefully timed choreography as seen in Figure 5. This multi-sensory alignment immerses participants in the reality of the narrative experience (Desnoyers-Stewart et al., 2024).



**Figure 5:** *The dancer kneels in sync with the virtual character. Following the music, she touches the immersant's hand in time with the visuals.*

#### 2.6 Reality Capture and Synthesis Technology

**Hybrid 360° Video.** *Eve 3.0* integrates a variety of technology to capture and create the alternate reality presented in the VR headset. We used a combination of a 180° stereoscopic camera with a 180° monoscopic rear camera to capture the depth of the characters while focusing attention and eliminating typical 360° stereoscopic artefacts.



**Figure 6:** *Left: Dancers on the set of 360 filming in Laval, France. © 2022 Pietro Lepore. Right: Motion capture of the hug interaction. Photo © 2020 Audrey Planchet.*

**One-Shot Motion Capture.** Perception Neuron 2.0 was used to motion capture six 8-minute dance sequences that correspond to each character's choreography. The performances were cleaned up in Axis Studio and Blender. They were then incorporated into the performance to produce real-time visual effects in Unity. The visual effects' aesthetics disguise imperfections in the motion capture, making these one-shot recordings with simple hardware and minimal cleanup possible.

*Immersive Environments from Traditional Media.* Watercolour artist Amira-Sade Moodie and graphic designer Kirstin Huber produced six icons representing each character. The paintings were digitally scanned and edited in Photoshop to produce the icons seen in Figure 7. These icons were used directly in each diary as shown in Figure 4. The icons were also used to create the immersive environments for the CG segment. VR participants enter the imagined space of the diary, going from seeing the icon on the page to being surrounded by it. The original painting is shown next to the resulting environment in Figure 8.

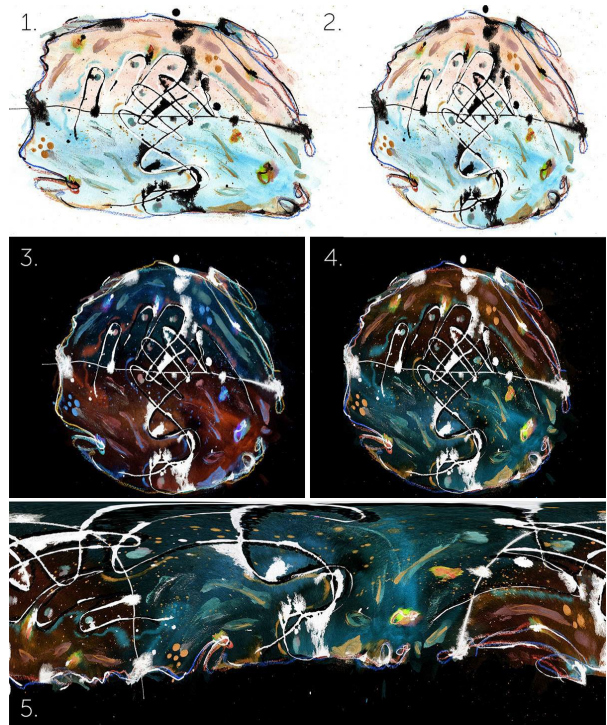


**Figure 7:** Watercolour icons. From top-left to bottom-right: Fiona, Lohan, Desiree, Amir, Meredith, Jonas.



**Figure 8:** Watercolour painting and resulting scene. Watercolour image ©2021 Amira-Sade Moodie.

To transform watercolour paintings into immersive spaces required a series of transformations applied to each icon as seen in Figure 9. The icon was rounded to create the shape of the virtual stage and inverted to better suit the dark aesthetics of the virtual experience. The original colour scheme was reproduced by rotating the inverted hues 180°. The image was then recoloured to suit the aesthetics of the virtual space. For example, colour was added to Meredith and Jonas which had substantial areas of white that would have been distracting. To create the overhead environment the image is converted from polar to equirectangular coordinates. Finally, those equirectangular images are separated into layers based on the colours. Those layers are then overlaid onto different size skyboxes, creating a sense of depth through parallax.



**Figure 9:** Converting original watercolours into VR environments. 1. Original; 2. Rounded; 3. Inverted; 4. 180° hue correction; 5. polar to equirectangular.

*Visual Effect Design.* The characters in the motion-captured segment are generated using Unity 2021's VFX Graph and Shader Graph. They use the character's colour scheme to produce a neon-digital, ethereal particles and outlines to help them stand out in front of the watercolour background. The visual effects evolve over the course of the performance. Initially, they create a dust-like trail that fades over time, accentuating the poses that the dancer moves through. Along with the narrative development, the trails begin to follow the dancer in space, reinforcing expressive movements. These are also projected onto the stage floor, referring to the characters changing over time. They paint a new image as they learn to adapt and face the challenges from their childhood integrating their past and present selves into an evolving painting.



**Figure 10:** The 6 CG characters each in an environment generated from watercolour imagery. Top-left to bottom right: Fiona, Lohan, Desiree, Amir, Meredith, Jonas.

**VR Headset.** This performance was designed specifically for Meta Quest 2. This headset incorporated hand tracking and passthrough into a low-cost portable package that facilitated free participant movement. The hand tracking provided seamless interaction while the passthrough cameras immersed participants in another view of their own reality allowing them to dance freely in front of an audience.

**Synchronization.** Open Sound Control (OSC) is used to synchronize the six headsets, soundtrack, and video projections. A PC-based controller broadcasts its timestamp and clock time on a Local Area Network (LAN). Each VR headset aligns its timeline to the PC and responds with the time received. The round-trip time is used to synchronize the clocks, synchronizing within approximately 10 milliseconds of the PC. The headsets each transmit their position relative to key moments and can be re-calibrated by pressing a button on the PC. The PC controller is used to play 1 or 2 projections and plays the music and some audio. Each character's audio is played locally on the headset allowing for six different stories to be heard simultaneously. An Android phone-based controller can also be used to synchronize and play music only when projections are not needed.



**Figure 11:** PC Interface. Left: display and webcam controls. Top: network connectivity indicators show participant alignment. Bottom: timeline controls.

### 3. PERFORMANCE STRUCTURE

Each narrative begins with finding the diary of a character facing extreme states of consciousness: addiction, anxiety, depression, obsession, jealousy, and paranoia. The performance unfolds through physical interaction with a live performer, an interactive motion captured dance, and progresses towards ending with the participants dancing freely.

#### 3.1 Scenography

*Eve 3.0* takes place in an open exhibition space or theatre with up to one hundred spectators. In the performance space, six chairs, equipped with six VR headsets, are arranged in a circle. The six chairs are the starting point for the virtual

experiences: the life stories of six characters affected by different extreme states of consciousness. Screens around the space relay some of what the participants see in VR to the general audience. The six VR experiences, which focus on the stories of six characters, together form a unified work. Participants are encouraged to stand up, move, and ultimately participate freely in this shared choreography.

#### 3.2 Prelude

In some performances, the dancer begins with a short prelude wearing headsets with the passthrough enabled. This is done to lead the audience to the performance space and attract attention either in open public spaces or in the lobby. For example, at Recto VRso 2023, the prelude began with two dancers performing in front of a large projection outside the exit of the Laval Virtual awards ceremony as seen in Figure 12.



**Figure 12:** Dancers perform wearing headsets in front of a projection of their view. Photo © 2023 Audrey Planchet.

#### 3.3 Opening

A single dancer begins the performance with a contemporary solo dance, setting the stage for the performance. The dancer rearranges the chairs into a cohesive circle, dragging, carrying, and sliding them through careful movements—laying across them, dancing around them. The projections display text and video that abstractly introduce the characters and their challenges punctuated by recordings of the watercolour painting process that created the icons for each character.



**Figure 13:** The dancer carries diaries in front of watercolour projections. Photo © 2022 Julia Gaes.

### 3.4 Entering VR

The dancer looks for six spectators in the audience to be invited to sit on the chairs and put on the headsets. These six Travellers join in a shared choreography where the dancer moves around them and interacts through touch at specific moments. Touch and performance in front of an audience requires a careful process of consent. Participants are informed of the performance structure and only invited if they express a clear and enthusiastic desire to participate.



**Figure 14:** Dancer selecting a participant from the crowd. Photo © 2022 Élise Boileau.

### 3.5 Dear Diary

The immersive portion of the experience begins with a live-action 360° video titled “Dear Diary.” The participants each find the diary of a different character, hearing an excerpt from their character’s childhood as they hold on to the diary. Children playing in front of the participant interact and dance with them. The children tease the main character as they throw around their diary and laugh.



**Figure 15:** Dancer fans participants as the 360 video appears in front of them. Photo © 2023 Audrey Planchet.

The stereoscopic video includes moments of physical interaction with characters in the film that coincide with the dancer’s real physical interactions. Moments of touch include being touched on the shoulder, having the diary ripped from their hands, being helped to stand up from a chair as seen in Figure 16 and more. See

Desnoyers-Stewart et al. (2024) for a study of the effects of these moments of touch. For each active Traveller participant, these physical interactions coincide with a moment in their VR experience. Meanwhile, for the Observers, the Travellers become part of the performance.

The dancer interacts with each participant one after another in a round. This produces a layered dance where the audience can vicariously experience the immersive performance through these reinforced moments of touch. Despite being simple actions, their rapid repetition combined with additional motifs demonstrates the incredible skill and timing of the dancer, deeply engaging the entire audience. Between these key moments, the dancer performs elements of the choreography that are seen inside the headset as shown in Figure 17. Projections show two characters’ point of view in the 360° video allowing the audience to understand its connection to the physical performance.



**Figure 16:** The participant sees a character help them out of their chair at the exact same moment in the video.

### 3.6 Untold Stories Expressed in Dance

The diaries are the guiding elements to reveal the intimate stories of each character. The main character holds their diary up to the participant in the 360° video revealing an icon. The icon comes to life as particles emerge from it and forms a silhouette in front of the participant. Participants are transported within the diary as the imagery from the icon fades into view surrounding them.



**Figure 17:** Dancer performing motifs from each character, connecting the virtual and physical performances. Photo © 2023 Damian Kirzner.

This following segment is a 6-degree of freedom real-time CG experience where Travellers see their avatar and can dance with a silhouette of light representing the aura of the character expressing their struggles. A monologue is heard as the motion-captured dance unfolds through the silhouette and particle system as seen in Figure 18. The Travellers dance in response to the silhouette, some following the motion-captured dance, while others move in their own ways. Their own bodies are represented with traces and particles emitted as they move. The Travellers take on more agency, forming part of the generative performance that evolves outside the headset for the Observers.



Figure 18: Lohan's silhouette dancing as seen in VR.

### 3.7 Dancing with a Stranger

As the individual motion-captured dances end, the silhouette walks towards a predefined point and raises their hands. The dancer goes into the crowd to gather six Performer participants bringing the total on stage to twelve. The Performers stand in line with the position of the silhouette with their hands out. As the Travellers wearing VR headsets reach out, they contact the Performers' hands, bringing the silhouette to life through touch. The Traveller wearing the headset follows the silhouette's movements, unknowingly leading the Performer in dance through their hands.



Figure 19: "Travellers" wearing a VR headset dance with "Performer" participants. Photo © 2023 Audrey Planchet.

### 3.8 Hugging to Return to Reality

As the dance ends, the silhouette guides the two participants to hug. The virtual environment fades, and the physical world is revealed through the passthrough cameras. Stepping back from the hug, the Traveller sees the Performer they danced with fade into view in place of the silhouette.

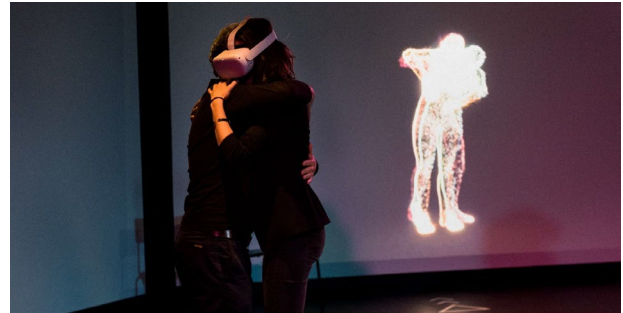


Figure 20: The hug at Tanzahoi 2022. The visuals can be seen in the background. Photo ©2022 Julia Gaes.

### 3.9 Freely Dancing Together

The last segment allows the six Travellers to see each other, and their surroundings brought to life through music where they can dance and move together. Their hands continue to produce streamers and particles, encouraging movement. The Travellers wearing the VR headset are then asked to share their headsets with the Performer in front of them. The stage is transformed into a playground for improvised dance as Observers are also invited to join. As seen in Figure 21 this creates a unique ending every time.



Figure 21: Free dance at Tanzahoi 2022 (left) and Laval Virtual 2023 (right). Photo © 2022 Julia Gaes.

### 3.10 Finale

All participants are then invited to form a circle and sit. The dancer performs a final choreographic message referring to acts of sharing and helping. Some watch in mixed reality while others watch directly. The passthrough visuals continue to respond to the music in the headsets and in the projections as the performance draws to a close.



Figure 22: Participants sit in a circle watching the finale. Several remain in VR watching through sound-modulated passthrough visuals. Photo © 2023 Audrey Planchet.



#### 4. INSTALLATION MODE

*Eve 3.0* also has an installation mode as seen in Figure 23. In this version, each participant sees the same story so that the moments of touch to be synchronized are in line with the visuals in the projection. This allows volunteers to facilitate the experience for more participants in smaller venues with little training. No dance is performed outside VR, but participants are nonetheless encouraged to perform as they become immersed in the story. Onlookers are also invited to participate by standing in as Performers when possible.



**Figure 23:** Installation at Recto VRso 2023. Participants pick up a diary seen in VR. facilitators prepare to enact moments of touch. Photo © 2023 Recto VRso

#### 5. PERFORMANCES AND OBSERVATIONS

Since 2022, *Eve 3.0* has been performed across Europe 18 times, including Laval, Hamburg, Rabat, Riva del Garda, Bologna, Leiden and Paris. We have solicited audience feedback after every performance and incorporated improvements to the choreographic language, audience participation and application of immersive technology. The observations collected continue to contribute to the evolution of the piece as the performance tours and a thorough qualitative analysis of participants' feedback is forthcoming.

Overall, we see considerable excitement and curiosity surrounding participants' experiences. Most issues faced by participants are related to the technical challenges typical of such an innovative narrative format with little prior experience to build from. We observe that participants' embodied experience of a kinaesthetic experience helps in identifying with the characters and becoming involved emotionally. While some remain aware of their surroundings, *Eve 3.0* immerses most participants in another reality, encouraging lively performances in front of an audience. As demonstrated by Desnoyers-Stewart et al. (2024) the combination of rich tactile, visual, and narrative experiences in *Eve 3.0* leads to a deeply embodied and immersive experience.

In all, *Eve 3.0* presents a new way to evoke rich embodied storytelling by layering different technologies and realities into a multimodal experience. By integrating performer-facilitated touch with high-definition stereoscopic video and real-time CG we can encourage self-expression and share embodied narratives through mixed reality. We hope this performance inspires others to push the boundaries of virtual and mixed reality, seeking new opportunities for participatory performance that reach across realities.

#### 6. ACKNOWLEDGEMENTS

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#### 7. REFERENCES

- Bergamo Meneghini, M. (2019) "Performance 'Eve, Dance Is an Unplaceable Place.'" In *IEEE GEM 2019*, 1–6. New Haven, CT.
- Desnoyers-Stewart, J., Bergamo Meneghini, M., Stepanova, E. R., and Riecke, B. E. (2024) "Real Human Touch: Performer-Facilitated Touch Enhances Presence and Embodiment in Immersive Performance." *Frontiers in Virtual Reality*, 4. 1–26.
- Di Petta, G. (2020) Interview: "Il corpo vissuto." *I concetti della fenomenologia* 12. [psicologiafenomenologica.it/corpo-vissuto](http://psicologiafenomenologica.it/corpo-vissuto).
- Fuchs, T. (2014) "The Virtual Other. Empathy in the Age of Virtuality". *Journal of Consciousness Studies*, No. 5–6: 152–73.
- Fuchs T. (2010) Phenomenology and Psychopathology. *Handbook of Phenomenology and Cognitive Science*. 547–573. Springer, Dordrecht.
- Homann, K. B. (2010) "Embodied Concepts of Neurobiology in Dance/Movement Therapy Practice". *American Journal of Dance Therapy* 32, 2. 80–99.
- Martin-Juchat, F. (2020) "L'aventure du corps. La communication corporelle, une voie vers l'émancipation." Presses universitaires de Grenoble, coll. Rien d'impossible.