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# Body RemiXer: Extending Bodies to Stimulate Social Connection in an Immersive Installation

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## ABSTRACT

*Body RemiXer* is a mixed reality installation that connects immersants across the virtual/actual divide through emergent tactility and abstract embodiment. Using a virtual reality headset, Kinect and projections, the installation explores the potential of immersive technology to create copresent experiences that foster intercorporeal relationships between immersants wearing a headset and those using the projections. Immersants' bodies are at the center of the installation, activated as a site for social exchange. *Body RemiXer* has been exhibited at an art festival and at several smaller events. The authors' observations during these exhibits reveal *Body RemiXer*'s capacity to disrupt social norms and stimulate new connections.

*Body RemiXer* (2019) is an immersive mixed reality installation (Fig. 1) that connects immersants by transforming and expanding upon their bodies and movements. This mixed reality (MR) experience uses body tracking, projections and a virtual reality (VR) headset (Fig. 2) to create a multilayered experience that transcends the virtual/actual divide. The projections act as mirrors, providing access to the virtual space, while the experience is grounded in the actual copresence of immersants' bodies. We have exhibited the installation at the *Carnival of Mixed Realities* and at several smaller events in Vancouver, Canada. Our observations of participants interacting with the installation reveal the capacity of colocated experiences to stimulate intercorporeality by mediating social spaces through embodied interactions.

As immersants enter the installation, they are tracked by a Kinect, which transforms their bodies into clouds of particles on the projection screens forming three-dimensional silhouettes that follow their movements. *Body RemiXer* invites immersants to engage in expressive movements and tactile interactions with one another that are made socially acceptable through the context of the installation. By touching hands with other participants, immersants connect their virtual auras through a steady exchange of particles, blurring the boundaries between them. This newly established connection manifests as a drumbeat that gets louder when they move together.



Fig. 1. Composite image of several people interacting with *Body RemiXer*. (Composite by John Desnoyers-Stewart. Original photos © Andreas Psaltis, 2019.)

One immersant can put on the VR headset, finding themselves among ethereal auras that take on the physicality of the other immersants' bodies through touch. The headset-wearer is, in effect, seeing the bodies of the people around them—and the exchanges of particles resulting from their tactile interactions—as they appear on the projection screens.

### The Case for Intercorporeal VR

VR is typically seen as a product for private consumption. Consequently, many public exhibitions neglect the site-specific requirements of the exhibition space. Often, a VR headset is placed in a gallery with limited consideration of the social context and no connection to the outside world. Such experiences rarely bring those outside the headset into the experience.

*Body RemiXer* is designed to activate bodies as a site for social exchange, acting as what Nicolas Bourriaud calls a “social interstice” [1]. This focuses immersants toward their intercorporeal relationship with one another and mediates the social norms of the space. Intercorporeality is the relational connection between bodies, as described by embodied mind philosopher Maurice Merleau-Ponty. Merleau-Ponty argues that our social interactions are fundamentally embodied and that we understand others through the possibility of mirroring their actions through our own bodies [2].

*Body RemiXer* is a response to the emerging social future that promises to make reality ever more virtual. The installation attempts to counter telepresent mediation that promises to facilitate social connections while simultaneously dividing us into isolated physical spaces. In 2002, Bourriaud observed that “communications are plunging human contacts into monitored areas that divide the social bond up into (quite) different products . . . before long, it will not be possible to maintain relationships between people outside these trading areas” [3]. This claim has become especially true with the emerging popularity of VR.

Instead, *Body RemiXer* is a social experiment that explores how VR could help connect people through their copresent bodies. We wanted to demonstrate the importance of this embodied aspect of the social experience and the capacity of VR to activate bodies and alter social norms to facilitate connection.

### Inspiration

There are some examples of VR being used for colocated social interaction. *CAVE* brings all immersants into the same co-located virtual space using avatars [4]. Despite being a passive experience, the presence of audience members acknowledges the social context and allows participants to share in the experience. *Invisible Walls* investigates copresence between an immersant wearing a headset and spectators represented by abstract forms [5]. This interaction enables the immersant to feel copresent with the spectators and encourages interaction between them, allowing for connection at a distance. *Body RemiXer* takes this colocated interaction further, bringing the headset-wearer into the same space as the spectators, enabling them to interact on the same level. Their bodies become activated as the central element of the installation, drawing immersants' attention toward one another.

*Body RemiXer* was inspired by *The Machine to Be Another* [6], which allows immersants to see another's perspective through synchronized movement. While this experience can give immersants the sense of being in another body, it simultaneously draws attention to the similarities and differences between those bodies, dividing them through the same process it uses to connect them. *Body RemiXer* was designed to retain the focus on the physical body without reinforcing superficial appearances. We also wanted to use the abstract appearance to allow immersants to freely move from the boundary of their body to connecting with another, and back again.

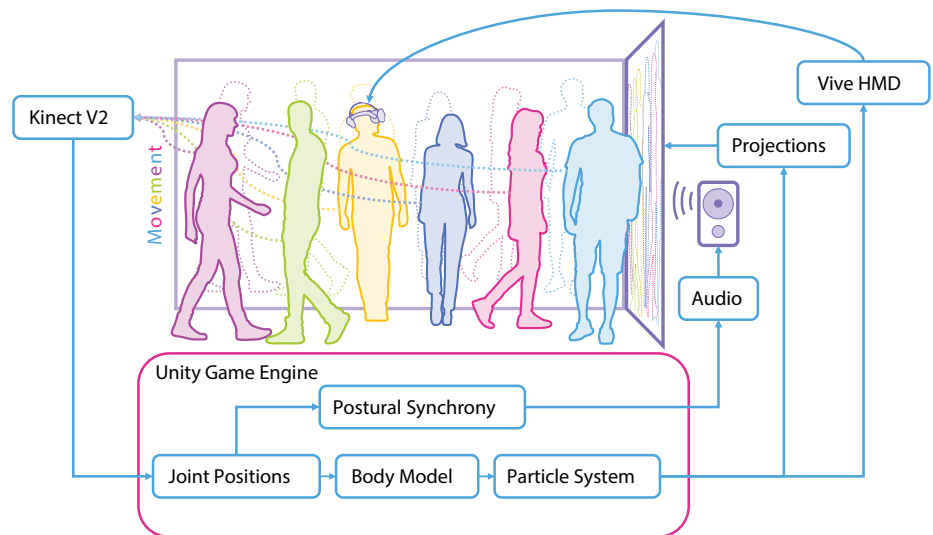


Fig. 2. *Body RemiXer* system diagram showing integration of each component. (© John Desnoyers-Stewart, 2020)

In *We Are All Made of Light* [7], Maja Petric captures bodies as simple “shadows” made of light that form evolving constellations to create a sense of unity and interconnectedness through abstraction. We were inspired by this concept and the aesthetic of *Notes on Blindness* [8], which demonstrated the capacity of abstract representations to represent the essence of human presence in VR. Similarly, we created an abstract neutral body that revealed only a silhouette or “aura” of the immersants and removed most visually identifying features. We hoped that this abstraction and neutral figure would focus immersants on the body and movement, encouraging new forms of connection that go beyond the surface.

## The Experience

A critical aspect of *Body RemiXer* is creating an experience that suits a variety of levels of curiosity and openness to public expression. We want to encourage individual exploration that progresses toward tactile connections with other immersants. Immersants can interact with the system via either mirror-like projections or the VR headset. Immersants can play with their particles’ movement individually; however, to fully realize the potential of the system, they must interact with other immersants. Immersants can selectively move between three modes (Fig. 3); the particles respond differently in each mode, guiding immersants’ attention to their engagement, connection and synchronization with others. In solo mode, immersants’ individual aura bodies are distinct and well defined, giving them an opportunity to embody the aura. In exchange mode—which immersants enter by exchanging a high five with a partner of their choosing—the particles flow between immersants, representing their connection. Finally, in swap mode—which immersants enter by touching both hands to their partner’s hands—each immersant’s particle body is overlaid onto the other’s, focusing immersants’ attention on the relationality between their body and their partner’s.

The experience begins from the moment onlookers notice the installation from afar. They can watch others play and interact with the piece, becoming spectators of an impromptu performance, and can enter whenever they desire.

**Discovering the aura in the mirror.** Upon entering the active space, immersants see their ethereal reflection fade into existence in the projection as their bodies are detected by the Kinect. Particles swarm around their body, appearing as a kind of virtual aura. Each immersant’s aura takes on a different color, allowing them to retain a sense of identity that can later be mediated in the other modes. The immersant can play with their reflected aura, responding to the particles’ motion and experimenting with different movements. This allows the immersant to transition into the active space of the installation, establishing a connection with their own virtual body. The aura was designed to allow immersants to embody their virtual bodies by removing biasing features, such as sex or race, that might alienate other immersants, and to encourage playful interaction through visuals that respond to their movement energy.

**Becoming more immersed.** We designed *Body RemiXer* to allow immersants to interact with or without the headset to make the installation more accessible to all participants. Those who put on the headset find themselves surrounded by the virtual space seen in the mirror projections. Their body and the bodies of those around them are transformed into auras of energetic particles, each with their own color. The identities of friends, strangers and oneself become blurred together as they are abstracted.



Fig. 3. Progression of interaction through *Body RemiXer*. (© John Desnoyers-Stewart, 2020)



Connecting through touch. As an immersant seeks to understand this new reality, they reach out toward these strange bodies. Another immersant reaches toward them in response and, as their hands make contact (Fig. 4), they find their aura bodies suddenly connected as they progress to exchange mode. Particles fly between their bodies, breaking the previously clear boundary and creating a sense of connection.

**Moving together.** Once connected, the immersants hear a faint drumbeat. The drumbeats are heard equally by all and shared between pairs. Each pair has a unique track, so they contribute to the overall drums in layers. Through their shared movement, they discover that they can control the loudness of the drums. Moving synchronously makes the drums grow louder, while moving asynchronously from one another makes the drums grow softer. This audio feedback is intended to encourage immersants to move in response to one another, further strengthening their connection.

Swapping bodies. By touching both hands together, immersants can move from exchanging particles between their bodies to an abstract form of body swapping. Each sees their partner's aura superimposed onto their own. This allows immersants to see their body and their partner's simultaneously, reinforcing the similarities and discrepancies between them and encouraging attention to their partner and movement synchronization.

### A Carnival of Mixed Realities

In its first public exhibition, *Body RemiXer* was experienced by 400 attendees at *A Carnival of Mixed Realities: Fun Palace Edition* (Fig. 5). This one-night mixed reality event sought to reimagine Littlewood, Price and Pask's concept of the *Fun Palace*, a reconfigurable and active space of inquiry designed to stimulate social change by prompting new possibilities [9]. The event was designed to facilitate unconventional social interventions like *Body RemiXer*. Attendees were primed to expect the unexpected and to engage with the installations, as everything in the space was interactive. We observed attendees approach *Body RemiXer* with active curiosity, exploring the possibilities offered by the installation. Attendees could freely enter and leave the space, without waiting in line, and could interact through the projections until the headset became available.

### Activating Bodies as a Site for Social Exchange

*Body RemiXer* is what Bourriaud refers to as a relational artwork: a work that takes human relations as its subject and forms a "social interstice"—a state of encounter that runs counter to the norms of everyday life. It mediates immersants' bodies virtually with material effects on their social relations. It is "an art form where the substrate is formed by intersubjectivity . . ." [10]. Somaesthetic designer and interaction researcher Kristina Höök claims that this intersubjectivity is driven through an intercorporeal process that can be mediated through technology [11]. The subjective and affective experience of social interaction is thus experienced through the relationality between bodies as attuned by the medium of interaction.



Fig. 4. Physically touching their hands together allows participants to connect their virtual auras and move between the installation's three modes. (© John Desnoyers-Stewart, 2020. Photo by Stephen Crocker.)



Fig. 5. *Body RemiXer* as shown at *A Carnival of Mixed Realities*. (Photo © Andreas Psaltis, 2019)

*Body RemiXer* capitalizes on this intercorporeality to gain an alignment of immersants' inner states by aligning their physical states and giving rise to an intersubjective experience. As Höök claims, "In social relations, the other's body influences us in an immediate sense; we mirror and might feel what they feel" [12]. In *Body RemiXer*, immersants observe and respond to one another's movements, establishing the body as a site of social exchange, through an intercorporeal relationship that extends into future connections.

As installation artist Nathaniel Stern claims, interactive artwork reframes the body's movement, thoughts and sensations: "Interaction is a limitation—but it is also an amplification. At its limits, interactive art disrupts our relational embodiment and thus attunes us to its potentials" [13]. In *Body RemiXer*, certain social elements are hidden or subdued, amplifying others. The body's appearance is altered and the others' gaze is hidden, removing visual indicators typically

used to discriminate and replacing them with a unifying aesthetic intended to transcend physical boundaries. Through its imagery, *Body RemiXer* restricts the forms of social interaction available to immersants to attune them to aspects that ordinarily go unnoticed and momentarily freeing them of their conventional social boundaries.

This momentary alteration has the potential to persist beyond the installation, both in those relations established through the experience and in the newly realized social potentials of the immersant. As an MR installation, *Body RemiXer* is designed to allow for connection to evolve across the virtual/actual divide, connecting the experiences within these realms together. Immersants are encouraged to adopt their virtual auras through MR mirrors (Fig. 6). From here, interpersonal connection starts as physical touch between immersants and extends into the virtual merger of their auras. This could then extend back to the connection between the actual participants leaving the exhibit and beyond into their subsequent relations.



Fig. 6. Immersant reaching toward their reflection in VR. (Photo © Melissa Dex Guzman, 2019)

### Observations on How Virtual Reality Can Mediate Social Interaction

*Body RemiXer* is a prototypical social structure that forms a template for what VR-supported intercorporeality could look like. By inverting many of the assumptions about what VR *is*, we explore what *it could be*. To understand the social effects of *Body RemiXer* and the ways it mediates intercorporeal relations, we discuss our observations of immersants' interactions with the system and with one another below. We observed immersants' behavior directly while facilitating the installation and later through video footage of the *Fun Palace* event. Exemplary images from our video footage can be seen in Fig. 7.

#### *Impromptu Performers on the Mediated Stage*

The open, progressive nature of *Body RemiXer* allowed people to interact in a variety of ways. Some observed from afar, carefully staying outside the tracked space, while others ran toward the projections with excitement. An audience/performer relationship emerged, with the headset-wearer at the center of the performance. Those who engaged responded to the projections, dancing and playing around with one another. The installation became a stage for these impromptu performers surrounded by spectators taking pictures and watching the unfolding performance. Most spectators eventually did take part in the installation, having had the opportunity to safely observe the altered rules of the space.

#### *Divergent Social Norms*

The altered relations between immersants showed that the context of the installation disrupted social conventions, establishing new ones in their place. Immersants' performances may have been normalized by the setting and established a space of heightened intersubjectivity that drew their attention toward one another. From the perspective of the headset-wearer, those norms were further altered, creating a space with two disparate social norms overlaid onto one another. Headset-wearers were seen reaching out to touch the mirrors and the virtual bodies surrounding them, perhaps to reconnect with the physicality of the space and to test whether it was "real."



**Fig. 7. Examples of interactions seen in our observations. Clockwise from top left: several participants interact together; two immersants dance together, one in VR; immersants hold each other as they interact; a headset-wearer high-fives another immersant.**  
(© John Desnoyers-Stewart, 2020)

Connecting by touching hands seemed to prompt immersants to playfully explore larger possibilities of tactile interaction: We observed people hugging, trying to touch their legs together, reaching out to touch a stranger's head or inviting someone to waltz. For headset-wearers, the neutral appearance of the virtual bodies around them appeared to reduce their social inhibition. Subsequently, the interaction between a headset-wearer and others around them seemed to occur across the social norms of two distinct spaces, as indicated by observations of touch that would not have ordinarily occurred between strangers. In most cases, the headset-wearer initiated contact and the other reciprocated, becoming more active as they become more familiar with VR and their ability to navigate the space around them. These unusual forms of social contact may have enabled interpersonal embodied interactions and formed what Bourriaud calls a social interstice, where connections emerge in ways not otherwise possible outside of the installation.

#### *Transcending Social Boundaries through a Unifying Aesthetic*

The abstract auras were designed to provide immersants with a unifying aesthetic to encourage a sense of collective identity. While wearing the headset, the only way to identify others was through the sound of their voice, a strategy that some immersants subverted by playing a game of virtual hide-and-seek. On several occasions, we observed immersants using the fluidity of others' identities to hide, tricking the headset-wearer into confusing them for another person. Through this mechanism, immersants may have become more open to interacting with every participant in the space, establishing a connection that transcended social boundaries, including age and visible disability, as described below in the section "A Lingering Experience."



### *Intercorporeal Mimicry*

We observed indications of intercorporeality as immersants moved in response to one another. We saw them mimicking one another: Some instantaneously synchronized their movement, while others watched and then repeated or responded to others' movement. This mimicry was seen in the apparition and repetition of certain movements. During the event, when a new movement was introduced, we observed that it was frequently mimicked by other immersants until another movement appeared, became more popular and took its place. This allowed the installation to be somewhat self-sustaining, reducing the need for an attendant. Interaction mechanisms were passed along from one immersant to the next without the need for our intervention. Immersants demonstrated their discoveries to one another and helped each other to put the VR headset on, creating subtle opportunities for connections to emerge. Even when immersants appeared to act alone, they were continuing the train of the intercorporeal interactions distributed over time.

### *A Lingering Experience*

Even after the experience ended, the effects of immersants' altered relationality appeared to linger. While many connected with people they knew, the tactile interaction encouraged interaction between individuals who appeared to be strangers prior to the interaction. In several cases, this newly formed relationship continued through conversation. Immersants often socialized after their interaction with *Body RemiXer*. Many remained within the tracked area, continuing to interact with the installation more casually while focusing on their conversation. In one instance, a headset-wearing immersant sought to find their virtual partner after taking off the headset but was unable to as they had no way to identify them. Their partner's disappearance could have led them to connect with others as they sought to reestablish their connection with an unknown other. While not directly measurable, these observations indicated that immersants' relations were indeed affected by their experience. For example, one headset-wearing immersant invited a visually impaired participant to interact together. Upon removing their headset, the participant was visibly surprised by the white cane held by the other participant, having interacted in the absence of their preconceptions of disability. Those who realized the independence of superficial appearances and their intercorporeal experience may have taken this awareness with them.

## **Conclusion**

*Body RemiXer* explores the potential of inviting intersubjective experiences in both actual and virtual realms by linking interpersonal tactile interaction with ethereal virtual representations. This presents new possibilities for MR to connect people by mediating co-present embodied intercorporeal interactions. We have proposed a way to encourage social connection by visually limiting the perception of the body's outward appearance while amplifying its movement and connection to others. We continue to build upon this knowledge, exploring the phenomenology of virtually transcending one's body to connect with others through in-lab studies and continued observations of installations in the wild.

## **References and Notes**

1. Nicolas Bourriaud, *Relational Aesthetics* (Dijon, France: Les Presses du Réel, 2002).
2. Maurice Merleau-Ponty, "The Philosopher and His Shadow," in *Signs* (Evanston, IL: Northwestern Univ. Press, 1964) pp. 159–181.
3. Bourriaud [1] pp. 8–9.
4. Kris Layng et al., "CAVE: Making Collective Virtual Narrative," *Leonardo* **52**, No. 4, 349–356 (2019).
5. Michael Lankes et al., "Invisible Walls: Co-Presence in a Co-Located Augmented Virtuality Installation," in *CHI PLAY '17* (Amsterdam: ACM, 2017) pp. 553–560.
6. Elen Collaço de Oliveira et al., "Virtual Body Swap: A New Feasible Tool to Be Explored in Health and Education," *2016 XVIII Symposium on Virtual and Augmented Reality (SVR)* (2016) pp. 81–89.
7. Maja Petric, *We Are All Made of Light*, immersive art installation, 2018. See [www.majapetric.com/we-are-all-made-of-light](http://www.majapetric.com/we-are-all-made-of-light) (accessed 9 January 2020).
8. *Notes on Blindness*, feature film/virtual reality experience, 2016. [www.notesonblindness.co.uk/vr](http://www.notesonblindness.co.uk/vr).
9. "Special Conference Event: An Evening at the Fun Palace," Acting Cybernetically: 2019 Annual Conference of the American Society for Cybernetics: [www.asc-cybernetics.org/2019/special-conference-event-an-evening-at-the-fun-palace](http://www.asc-cybernetics.org/2019/special-conference-event-an-evening-at-the-fun-palace) (accessed 8 January 2020).
10. Bourriaud [1] p. 15.
11. Kristina Höök, *Designing with the Body: Somaesthetic Interaction Design* (Cambridge, MA: MIT Press, 2018) p. 114.
12. Höök [11] p. 115.
13. Nathaniel Stern, *Interactive Art and Embodiment: The Implicit Body as Performance* (Canterbury, U.K.: Gylphi, 2013) p. 13.