

---

# The Machine to be Another - Embodied Telepresence using human performers

**Philippe Bertrand**<sup>1</sup>: BeAnotherLab, MUAD, IDEC Universitat Pompeu Fabra - beanotherlab@gmail.com

**Daniel González Franco**<sup>1</sup>: BeAnotherLab, MUAD, IDEC Universitat Pompeu Fabra – sciogenetic@gmail.com

**Arthur Pointeau**<sup>1</sup>: BeAnotherLab, CSIM, DTIC Universitat Pompeu Fabra - arthur.pointeau@gmail.com

**Christian Cherene**<sup>1</sup>: BeAnotherLab, SPECS Universitat Pompeu Fabra - christian.cherene@gmail.com

<sup>1</sup> Roc Boronat, 138- 08018 Barcelona – Spain

## Abstract

'[The Machine to Be Another](#)' is an embodiment system designed to address the relation between identity and empathy. The project merges performances with protocols of neuroscience experiments, in order to offer users an immersive experience of seeing themselves in the body of another person. The paper reports the methods and partial results of the interdisciplinary qualitative investigation that we are making on low budget approach to stimulate empathy through embodied interaction between individuals.

## Author Keywords

Telepresence, Virtual Reality, Embodiment, Presence, Empathy, Body Extension

## ACM Classification Keywords

J.5 ARTS AND HUMANITIES; *Performing arts*

K.4.2 Social Issues; *Assistive technologies for persons with disabilities.*

## Introduction

'The Machine to Be Another' is an artistic project addressing the perception and understanding of the *Self* based on the understanding of the *Other*. The project merges low-budget virtual reality technology with real human performances in order to provide

users a telepresent experience of another person's point of view.

The investigation reported in this document includes results from collaborations issued from a four month art residency at l'Estruch (March to June 2013 - Sabadell, Spain) and the participation in Madrid-MIT M+Vision Hacking Medicine event (July 2013).

Embodied simulation mechanisms, in particular of actions, emotions and corporeal sensations have been recently proposed as having deep implications in the understanding of empathy and social cognition, perception of one's body, neural plasticity but also in the formation of concepts [3]. They are also an active field of investigation in the arts [2].

In several experiments at the Karolinska Institute, Henrik Ehrsson and his colleagues have been studying how the brain constructs a representation of one's own body through the integration of different sensory modalities. Among remarkable achievements were the possibility to induce in healthy subjects the sensation of owning dummy limbs [6], the illusion of owning a third arm or even the body of a Barbie doll [14]. They have demonstrated that when individuals visually experience that they are located in a different place from their real body they disown this body and no longer perceive it as part of themselves [4]. They have observed that this effect is best induced when the brain has to perform multisensory integration of stimuli [11].

On the other hand, the discovery of mirror neurons and its relation to empathy has also shown a deep root that bonds us to others "in other words, how bizarre it would be to conceive of an I without an us". [12]. This bond goes beyond physical observation and would also be related to social skills [9].

Recent investigations in neuroscience supporting an embodied simulation account of empathy are exploring new theories of identity, reporting a blurriness of the self and other in the neural representation of threat when related to familiar individuals [1]. Other studies suggest the effectiveness of inducing body ownership for reducing implicit racial bias, both in virtual reality [10] and using the *rubber hand illusion* [8].

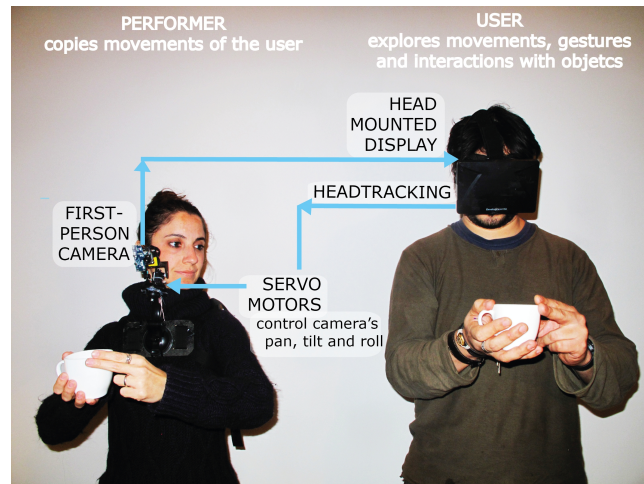
In "The Machine to Be Another" we're adding a poetic frame to the embodiment experience by creating layers of content that conducts users and performers to a reflexion about the other and themselves.

### **The System**

The system combines elements of telepresence and performance to generate the psychophysical experience of being present in the body of another. The users movements are coupled to those of the performer through head-mounted displays, head tracking, headphones, microphone and servo controlled cameras. The performer follows user's movements in an identical space. They are able to interact with objects, their own body, as well as the internal narrative of the performer's thoughts and memories. In this manner the system provides a unique way for the exploration of identity and how it relates to embodiment and narrative in a deeply immersive way.

### **Using a real human as Avatar**

In "The Machine to be Another", dummy or virtual bodies are replaced by the body of the performer, a person whose role is to reproduce as accurately as possible the movements of the user, a person exploring an environment through the body of the performer.



**Figure 1.** Basic functional diagram of the system

To maintain the embodiment sensation, the performer must try to reproduce the user's movements as accurately as possible. User and performer will usually be in different but seemingly identical places. The performer holds a camera capturing his point of view, and the camera orientation is controlled by servos, accordingly to the head orientation data sent by a sensor on the user's head.

The goal of this experiment is to stimulate empathy by provoking the sensation of embodiment through the system and add on top of it a narration of the performer, triggered by multisensory cues, involved in objects' manipulation. The performer tells personal experiences evoked by the objects, further enhancing the immersion of the user in the performer's point of view, not only physically but also emotionally.

The system provides a real tactile sensation instead of haptic devices like vibration motors sometimes used in neuroscience increasing the embodiment effect. It also allows detailed gestures (such as fingers movement) that traditional computer vision tracking systems can not achieve easily.

Although performers tend to copy movements of users with a certain delay, the head tracking controls the camera in real time. We've observed that users tend to accept the movements latency and to move slowly in order to achieve a better control of the movements. Interestingly studies relating to embodiment have demonstrated that if there is real-time head tracking in a virtual environment there may not be a requirement for concurrent physical stimuli as it involves motor acts and corresponding perceptual changes comparable to physical reality, such as with head tracking and a head-mounted display [7]. This also ties in with an observation that the strong illusion of being in the place depicted by the virtual reality [13] occurs when sensorimotor contingencies for perception are similar to those of physical reality, that is, when a participant can use their body for perception in much the same way as normally.

### **Design and Qualitative analysis Process**

The investigation and development was driven to investigate possible uses of "The Machine" as a collaborative artistic and social application. During the art residency, we invited artists and members of the public to participate as performers in order to address an issue of their interest. After sessions of interviews and informal debates, the performers suggested new uses and approaches with the Machine. After each experiment, performers and users shared their conclusions and impressions about the experience with

investigators, in order to help understanding how the Machine can contribute for the comprehension of the 'Self' and the 'Other'. The diversity of issues raised by the performers led us to develop a small variety of specific setups, addressing different interaction aspects: from more narrative to more physical.

During the Hacking Medicine event, we had also the opportunity to collaborate with neurologists to devise pre-prototypes pitches dealing with eating disorder and motor neurorehabilitation. This series of pre-prototypes were developed with low budget technology and further investigation is being led on possible uses.

### **Experiment and Performances**

#### *Mother-daughter relationship:*

In this performance called "la noia de les lagrimes vermelles" ("the girl with red tears") Sarah - a 12 year old girl - shares her creative process of drawing the illustration of her own story, while she narrates this story to her mother. The experiment was suggested by her artist mother - Anna - that wanted to get closer to her daughter. We've simplified the system so that the performer (Sarah) used a camera on her head, while the user (her mother) followed her movements. This approach reduces the level of the user's agency, but allows more freedom of expression to Sarah, relying on little visible technological means (a small camera attached to a hat, and headphones). The performance was also presented to an audience, allowing "The Machine" to work as a tool for artistic expression for Sarah. According to Sarah's mother, the experience helped Sarah to assume a more secure and happy attitude during her everyday life, what we believe is driven by the recognition of her creative talent by her mother and the audience.

#### *Empathy towards an immigrant:*

In this performance users could see themselves in the body of Youssoupha, an immigrant from Senegal living in Spain. Youssoupha shared stories about his childhood, his love for dancing and his immigrating, according to the interaction of users with objects in the room. This set up uses the embodied interaction with objects, in which users can explore the space and control the movements and stories told by the performer. The performer follows the movements of the user from a different room, using a see through head-mounted display and radio frequency video transmitters.

#### *Functional diversity exchange:*

Performance "In Merce's wheels": users with no disabilities could see themselves in the body of a woman in a wheelchair, while listening to the inspiring story of Merce's life, and how people in wheelchairs feel facing everyday challenges. This approach uses the same set up as the experiment on *Empathy towards an immigrant*, adding another level of physical interaction through the wheelchairs. The user operates a similar chair with small wheels and can command the direction by pointing to the desired destination, while the performer uses an electric wheelchair.

We have observed that both in *Empathy towards an immigrant* and *Functional diversity exchange* the interactive narrative highly increases the level of engagement in users' experience and the reported presence (some users stated that after some time they felt that the voice came out of their own heads). The interaction based on objects have offered a strong sensory experience once it is related to agency (users decide the content of the story they want to hear



**Figure 2.** Sarah and her mother Anna performing "La noia de les lagrimes vermelles"



**Figure 3.** Yousoupha letting the user see himself through his Point of View



**Figure 4.** User seeing herself in wheelchair under the perspective of Merce



**Figure 5.** Body extension

through their own movements), and the objects have worked as powerful symbols to trigger different stories from a real person. Users tend to demonstrate empathetic feelings towards the performers – claiming that the experience has raised their awareness about the performers' social condition. Besides that, in most of the cases, we've observed that users wanted to hug the performer at the end of the experiment, smiling at them. Although purely qualitative, the statements from users revealed that they got "deep into this other person's life" which contributed to their experience that the story "could be me in their place".

#### *Body extension:*

In the performance "Dancing on the Feet" a dancer in wheelchair (Victoria) was able to perform while seeing herself from the point of view of a dancer with no disabilities (Cristina). The wireless set up used radio frequency transmitters and analog video. To accomplish the performance, we've also developed a gestural vocabulary that allowed Victoria (user) to convert her improvised dance movements into choreographic instructions to Cristina (performer). This experiment was suggested by physically challenged dancers that have been in wheelchairs for many years and were interested in the possibilities of their artistic self expression. Besides reporting a very strong and unfamiliar feeling that many of them couldn't remember in their lives (being able to stand up or vertigo of being taller) we have been strongly encouraged by them to investigate the use of "The Machine" in neuro-rehabilitation systems.

## **Hacking Medicine**

During Madrid-MIT M+Vision Hacking Medicine we have collaborated with neurologists, engineers and designers to pitch two projects that used "The Machine":

- Quantitative and qualitative embodiment techniques for diagnosis and treatment of eating disorders as school activities: interactive game in which kids can act both as performers and users, switching their image perspective. Built with a camera and Wireless HMD that offers a easy-to-use hardware.
- Mirror Illusion embodiment device solution for neurorehabilitation in neurological diseases with loss of bilaterality: in this system we re-create the experiment of 'mirror illusion' using HMDs, video and performances. The system uses the Oculus Rift immersive HMDs and cameras controlled by head tracking in order to increase agency and to offer new possibilities especially in therapies for inferior members.

## **General Findings**

Based on the statements from users and performers regarding their newfound awareness and interest towards "the other" we have concluded that the system has great potential as a social tool to stimulate empathy among different groups. The hybrid approach of merging performance and technology has also revealed to be very flexible and could be used in a wide variety of embodied applications for performing arts, systemic psychotherapy, neurorehabilitation, and empathy research.

## Future Work

We will continue the investigation of 'the Machine' in order to address social issues such as conflict mediation, gender identity and mutual respect. Besides the artistic approach, we are very interested in measuring the efficacy of the system to generate empathy by qualitative questionnaires.

## References

- [1] Beckes L, Coan J.A, Hasselmo K. "Familiarity promotes the blurring of self and other in the neural representation of threat" (2012) *Social Cognitive and Affective Neuroscience*
- [2] Freedberg D, Gallese V. "Motion, emotion and empathy in esthetic experience" (2012). *TRENDS in Cognitive Sciences Vol.11 No.5*
- [3] Gallese, Vittorio, and George Lakoff. "The Brain's Concepts: The Role of the Sensory-motor System in Conceptual Knowledge." (2005) *Cognitive neuropsychology* 455-479.
- [4] Guterstam A. & Ehrsson H.H. "Disowning one's seen real body during an out-of-body illusion." (2012) *Consciousness and Cognition*
- [5] Guterstam A, Petkova VI, Ehrsson HH. "The illusion of owning a third arm." (2011) *PLoS One*
- [6] Kalckert A. & Ehrsson H.H. "Moving a rubber hand that feels like your own: a dissociation of ownership and agency." (2012) *Front. Hum. Neurosci.*
- [7] Kiltner K, Groten R. and Slater, M. "The Sense of Embodiment in Virtual Reality" (2012) *Presence: Teleoperators and Virtual Environments* 373-387

On the other hand, we are also working on the refinement of the prototype of a game for children that can work as a tool for early diagnosis and treatment of body dysmorphia and eating disorders. This development includes a refinement of the hardware and of the procedures that can be applied by educators.

- [8] Maister L, Sebanz N, Knoblich G, Tsakiris M. "Experiencing ownership over a dark-skinned body reduces implicit racial bias" (2013). *Cognition Volume 128, Issue 2., Pag. 170-178*
- [9] Oberman, Pineda, Ramachandran "The human mirror neuron system: A link between action observation and social skills" (2007) *Soc Cogn Affect Neurosci*
- [10] Peck T.C, Seinfeld C, Aglioti SM & Slater, M. "Putting yourself in the skin of a black avatar reduces implicit racial bias" (2013) *Consciousness and Cognition, 22(3), 779-787.*
- [11] Petkova VI, Khoshnevis M, Ehrsson HH. "The perspective matters! Multisensory integration in ego-centric reference frames determines full body ownership" (2011) *Front. Psychology 2:35*
- [12] Rizzolatti, Craighero *Mirrors in the Brain: How Our Minds Share Actions, Emotions, and Experience* (2008) Oxford University Press
- [13] Sanchez-Vives, M.V. and Slater, M. "From Presence to Consciousness through Virtual Reality" (2005) *Nature Reviews Neuroscience, 6.4 332-339*
- [14] Van der Hoort B, Guterstam A & Ehrsson HH. "Being Barbie: the size of one's own body determines the perceived size of the world" (2011). *PLoS One*