Virtual Body Swap: A New Feasible Tool to be Explored in Health and Education

Presented By:

Team 9

Team 15

Virtual Reality:

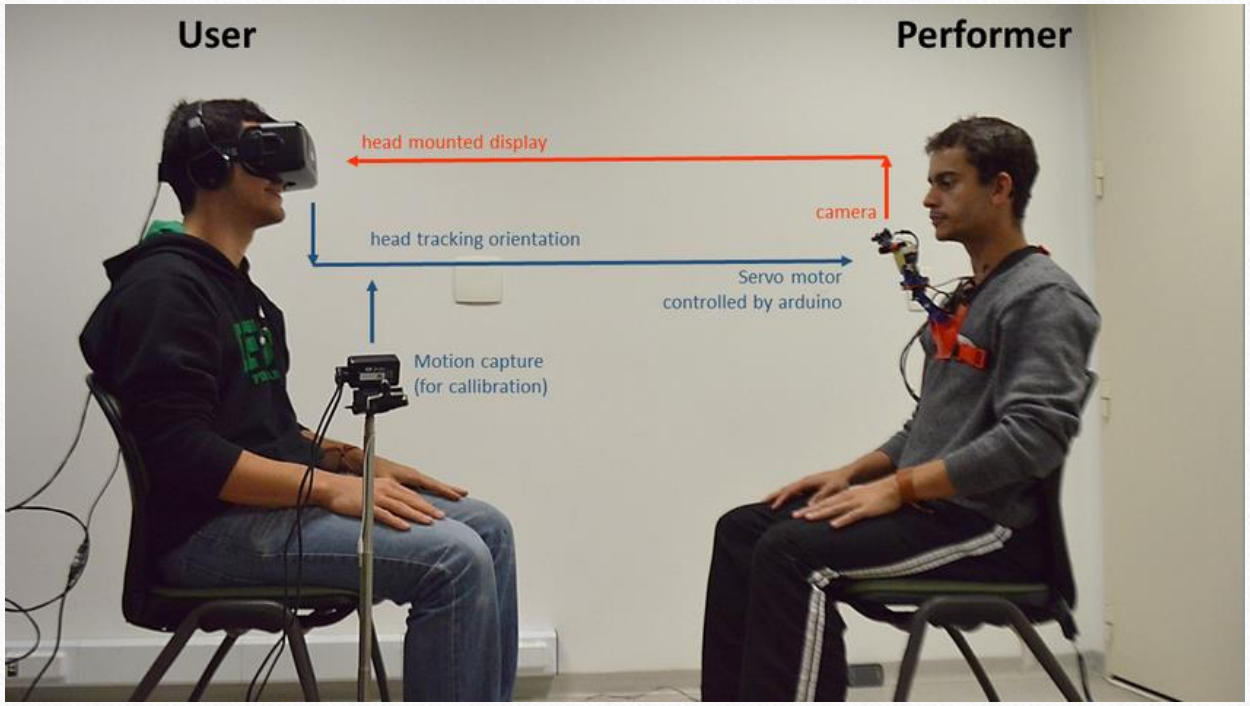
Virtual reality (VR) typically refers to computer technologies that use virtual reality headsets to generate the realistic images, sounds and other sensations that replicate a real environment or create an imaginary setting.

Virtual Body Swap:

- They observed that the system does promote higher levels of realism and involvement (“presence”) compared with an immersion experience without body agency.

- To carry out this research they used the system The Machine to Be Another (TMBA)

The-Machine-to-Be-Another-TMBA



PRESENCE

- Feeling you think living in the world outside your physical bodies generated by technology
- Subject of many research fields including medicine, psychology,military, philosophy,…
- approaches can be clustered into two main categories for evaluating presence: objective and subjective approaches.

EVALUATION OF PRESENCE

- Objective approach use physiological measure to quantify presence such as changes in skin conductance, blood pressure, heart rate, muscle tension
- Subjective approaches use survey methods such as Presence questionnaires
- In subjective approach participants are asked to carry out a task in a virtual environment and then answer a questionnaire. . For example, 1 means "no presence" and 7 means "complete presence"
- a combination of objective and subjective approaches

THE MACHINE TO BE ANOTHER: THE SYSTEM

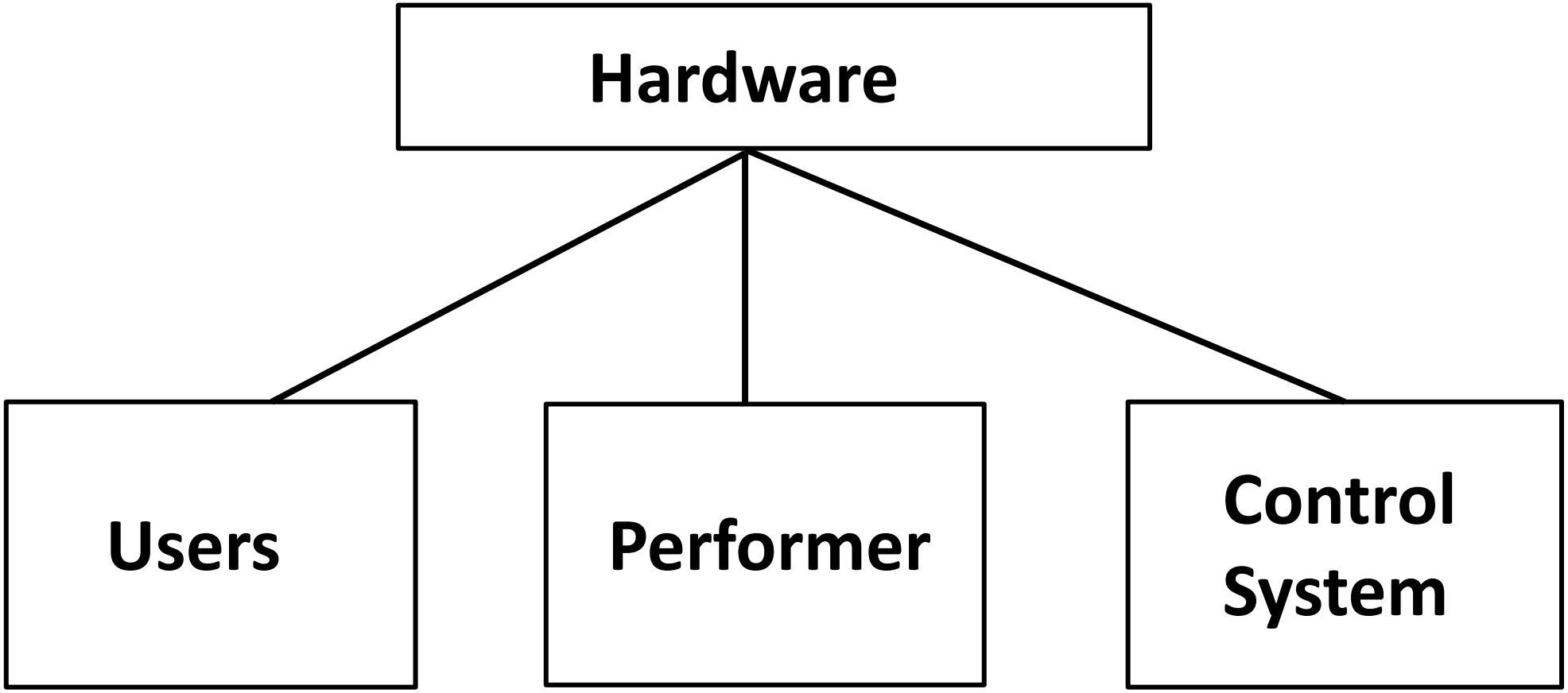
- Objective of BeAnotherLab group is to create a low budget body swapping system
- The Machine to Be Another (TMBA) uses multi-sensory stimuli to induce body swap illusion

Important components

- Head-mounted –displays perspective of another person mimicking movements
- Audio system-- plays a personal narrative recorded by the performer.

Figure 2. TMBA System - low budget approach to induce body swap illusion.

Hardware



User’s Set:

- Head Mounted Display (HMD)-- OCULUS RIFT DK2

---An infrared limited motion capture camera available with the HMD

- Set of stereo headphones

Performer’s Set:

- camera orientation controller -- webcam mount attached to 2 mini servo engines for controlling the pitch and yaw of the webcam
- an Arduino which controls the movement of the servo engines

Software

- TMBA built on OpenFrameworks (OFx) version 0.7.4.
- The OFx software is also able to trigger audio files containing instructions and personal narratives of the performers by pressing the computer number keys.

System Architecture

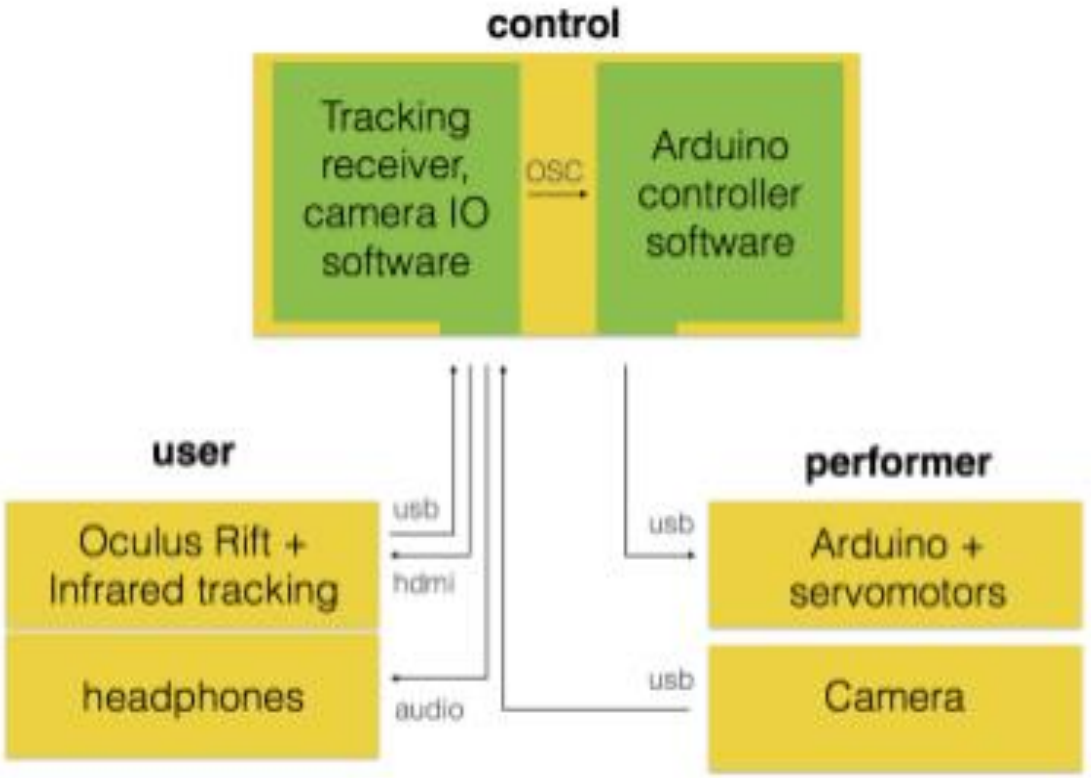


Figure 3. Diagram representing the system consisting of three sets, the user's, the performer's and that of the control. The direction of the arrows shows the direction of the signals.

Protocols of Interaction

- Participants having HMD and headphones.
- Audio instructions to participants so they know,
- -environment
- -movement
- -interaction
- A performer to carefully follow participants movements.
- An assistant to keep track of time and provide the synchronous tactile stimulation.

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Part IV - Methods

Speaker: Dayu Wang (45) (From Team 9)

- **Part IV - Methods**
- **Design of the Present Study - 2 Different Procedures**

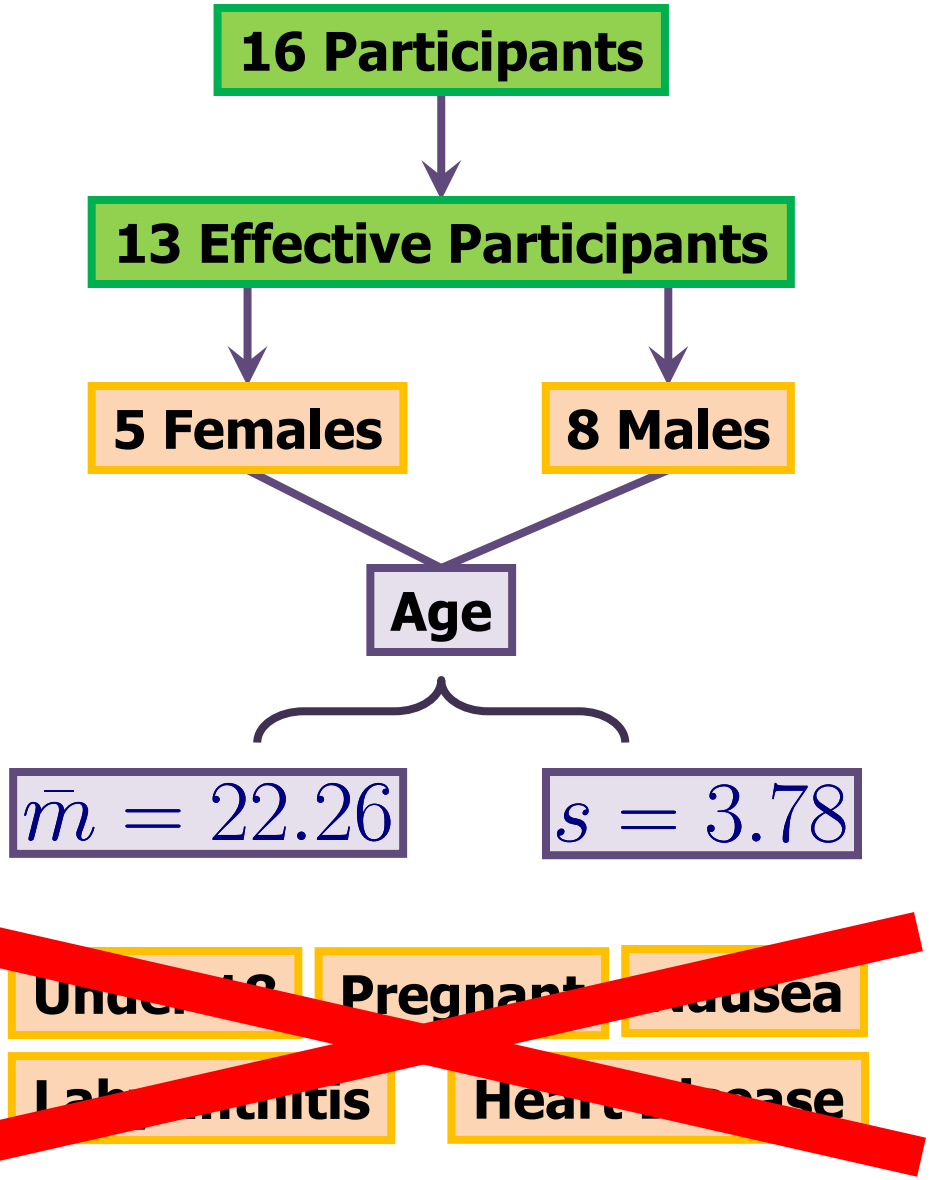
A person is immersed in another virtual environment, captured from the real world through a video camera.

Head-Controlled Illusion	Full Body Swap Illusion
Provides immersion (P in VE).	Experiences full body control.
Head-mounted display (HMD).	Contains the same HMD.
Performer's body available.	Performer's body not available.
Real person *vs.* virtual avatar.	Freely moving the head.

- **Experiment Set-up**

	Experiment 1	Experiment 2
Aim	1. Show that it is possible that immersion in another person's body. 2. Evaluate subject impact.	1. Examine the effects of body image. 2. Examine the effects of body agency.
Consideration	With head and body agencies, see other person's body from my perspective.	In a 3D virtual world environment, performers can freely move head, but no body agency, no seeing of virtual body.
Participants	Same group of people.	Same group of people.
Order	First	Second
Questionnaire	Subtle adaption to the context.	Same questionnaire.

• Experiment Procedure - Participants and Illusions



Body Swap Illusion

Exploration
→ 2 min
→ Slow move
→ See their own body

Explore Touch
→ 2 min
→ 2 assistants
→ Touch hand palm

Narrative with Object
→ 3 min
→ Held an orange
→ Move the object freely

Face-to-Face Handshake
→ 3 min
→ Performer *vs.* user
→ Immediate interview

• Experiment Procedure - Question are and Statistics

Questionnaire Items

Questions	Body Agency	No Body Agency
1	I had a sense of acting in the other person's body, rather than operate something from outside.	I had a sense of acting in the other body, rather than operate something from outside.
2	I was not aware of my own body.	I was not aware of my own body.
3	I was completely captivated by the body swapping.	I was completely captivated by the virtual tour.
4	How real did the body swap seem to you?	How real did the virtual tour seem to you?

Qualitative Method | **Taken immediately after the experiment**

Statistical Data Analysis

SPSS 22.0

Presence Induction Efficacy
Repeated measures ANOVA

TMBA Procedure (Body Agency)

SL Procedure (No Body Agency)

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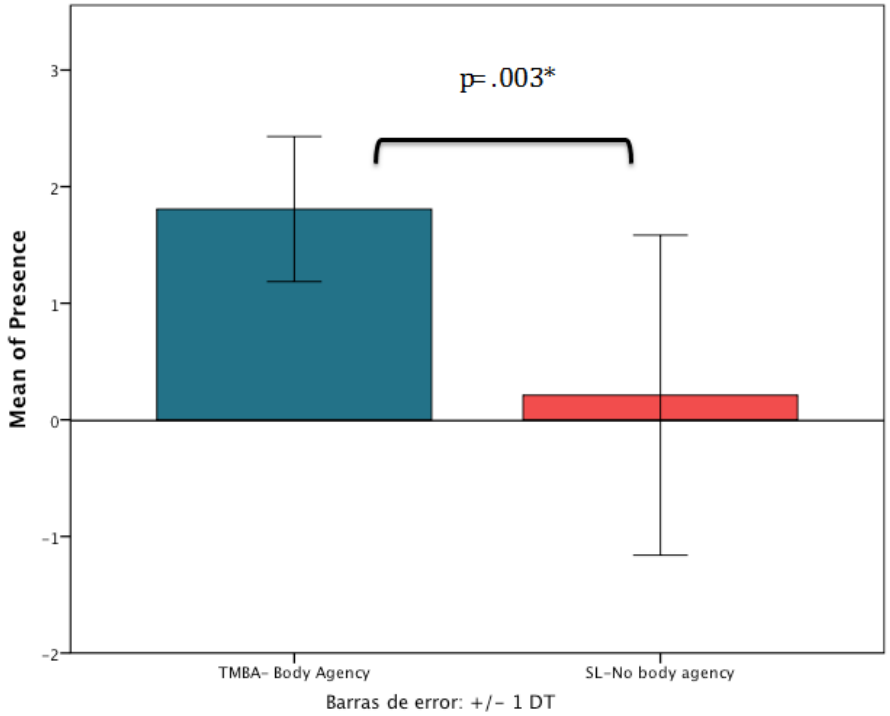
Part V - Results

Speaker: Chen Wang (44) (From Team 9)

Result - Mean of Presence (M)

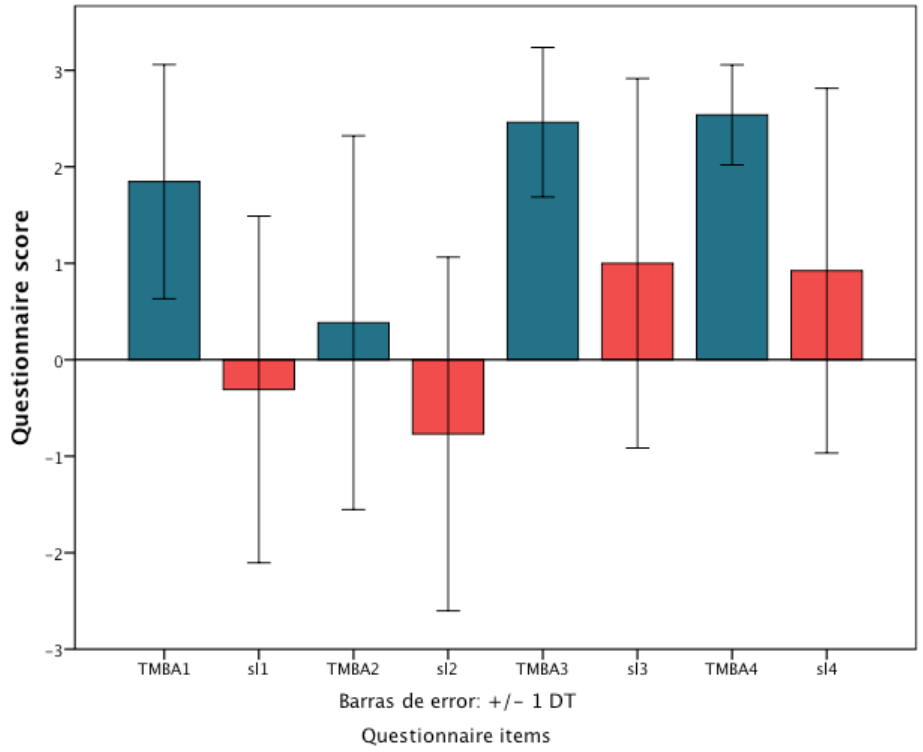


Procedure	M
TMBA	1.80
SL	0.62

TMBA procedure has higher performance than SL procedure

Interview about the TMBA:	Answer
Whole experience	"It was very interesting to experience a body different from my own body!"
Feeling about the performer	"I would like to be her friend!"
Experience about the last step	"I'm shaking hands with myself!".

Result - Standard Deviation (SD)



Procedure	SD
TMBA	0.21
SL	1.37

Deviation of SL is larger than TMBA.

Influenced factor

Fatigue of the participants.

Misinterpretation of the questions.

Diversity in the expectations of the participants that arouse after they experienced the body swap illusion.

Result - Existing Ethic Problem

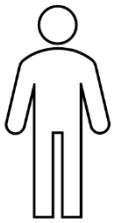
Participants never see their own real body or their entire avatar's body

But they can feel both of them

Their own real body

VS

Their virtual body



There is no conceptual difference if a virtual body was replaced by a real-person's body except for emotional and affective aspects.

It was not known whether this could be generalized to another real entire body with body agency.

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Part VI - Conclusion

Speaker: Yunlong Liu (22) (From Team 9)

Conclusion

Significance: 1. Show an effective and low cost way to induce body swap illusion with body agency.

2. The participant can face his or her own real body without noticing of the technological mediation.

3. Experience of controlling another body, having a real person as our avatar.

Comparison

	This Experiment	Other Studies
Hardware	1. Head mounted display 2. Camera 3. Motion capture	1. Rraditional rubber hand illusion 2. Invisible body 3. Full mannequin's body and an entire real body illusion
Body Agency	With	Without
Cost	Low cost	Might be high

Table: Comparison with other studies related to body ownership illusion present

Future work

Future work: 1. Develop better localization of standard questionnaires

2. Increasing the number of participants and reducing the time spent by each during the experiment.

3. Improve the hardware part of the system: replacing the moving mechanical part of the system with two 180 degrees cameras graphics processing software.

Possibilities area:

- neuroscience
- psychology
- education
- social science.

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This is the END of the presentation.

Thank you!