

Virtual Embodiment: verso un corpo digitale per l'immersione in ambienti virtuali



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worldusabilityday | MAKING
LIFE EASY!
wudUNITO

Designing for the future we want

- Human Computer Interaction
- It is not just a computer anymore, but not even a smartphone
- Natural and intuitive interaction
- Physical, bodily, gestures
- Virtual Reality



Virtual Reality: what's?

The fantastic concept:

- Creating imaginary worlds
- Audio and visual stimuli
- Possible and impossible worlds



<https://it.wikipedia.org/wiki/Stereoscopia>



Photograph by J. R. Eyerman/LIFE Magazine

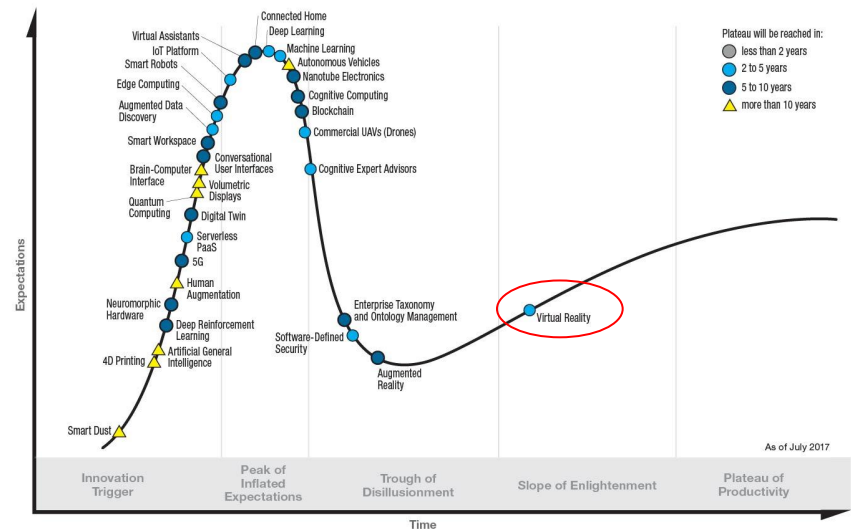
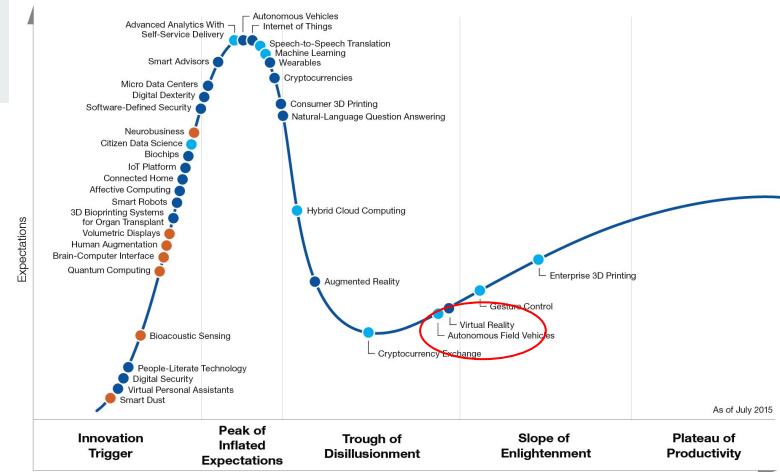
Virtual Reality Today

- 1980s
 - Birth of Contemporary VR
 - Jaron Lanier coined the name
 - First commercial Company

- 2010s
 - VR second golden age
 - Mature technology, ready for commerce
 - Affordable hardware, easy content creation

- Gartner Hype Cycle 2015 vs 2017

- 2018-2019
 - CHI and UX approach
 - Social VR
 - Embodiment



“One morning, as Gregor Samsa was waking up from anxious dreams, he discovered that in bed he had been changed into a monstrous verminous bug.

He lay on his armour-hard back and saw, as he lifted his head up a little, his brown, arched abdomen divided up into rigid bow-like sections. From this height the blanket, just about ready to slide off completely, could hardly stay in place. His numerous legs, pitifully thin in comparison to the rest of his circumference, flickered helplessly before his eyes. ‘What’s happened to me,’ he thought.

It was no dream.”



Franz Kafka, The Methamorphosis, 1915

Sense of Embodiment



What is it?

- The belief of a person that an external body is their physical one and is processed as such
- In the physical world we take for granted that we possess and control a body.
- In virtual worlds the SoE is mainly given by the representation of a digital body, together with a compound of sensorial stimuli

Two of its main components are:

- Sense of Ownership (SoO)
- Sense of Agency (SoA)

Body Ownership

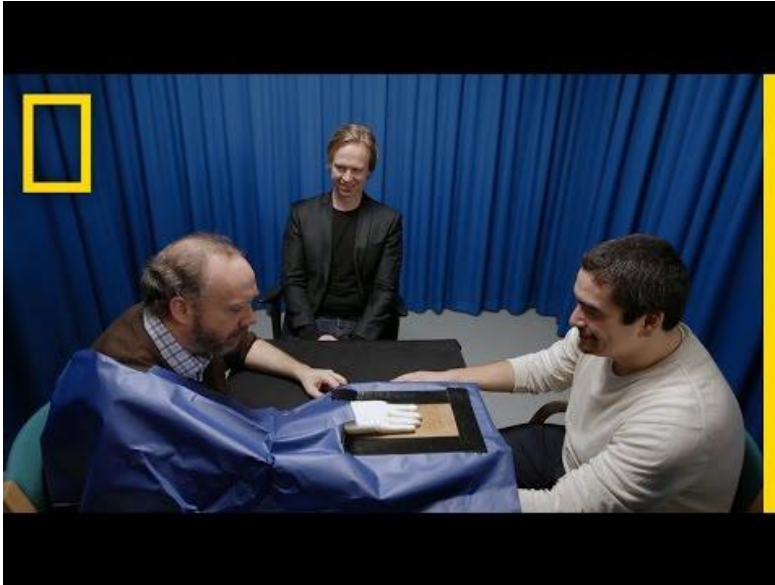


The rubber hand illusion

- Previous studies showed how it is possible to cheat human brain to make people believe that a fake part of their body is their own.
- How do we represent a human body, or part of it, to make the person feel like it is their own?
- Movie 1:10

"The Rubber Hand Illusion - Horizon: Is Seeing Believing?" by BBC
<https://youtu.be/sxwn1w7MJvk>

Body Agency



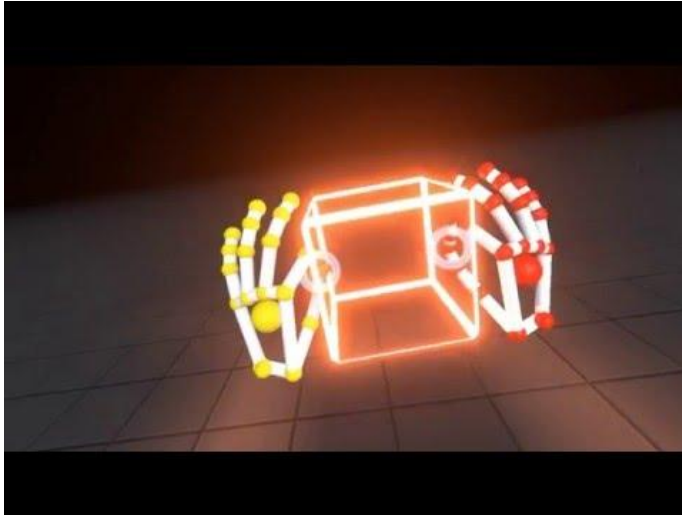
The active rubber hand illusion

- The feeling that I am making that hand move
- Movie 2:05
(The participant is the actor Paul Giamatti)

“Is That My Real Hand? | Breakthrough” by National Geographic
<https://youtu.be/DphlhmtGRqI>

What's Alien Motion?

VR is an ideal environment to study human behavior on bodily modifications.



“Leap Motion: Orion” by Leap Motion
<https://youtu.be/rnICGw-0R8g>

Someone or something is moving my body despite -or against- my will.

Previous studies focused on:

- The embodiment of steady alien limbs
- The embodiment of alien limbs in case of some cases of active or passive motion

We study the effects of alien motion on the correspondent physical body part

What we found:

Embodiment Simulation Theory

In the relationship between
the physical body and its digital avatar

- Not only:
PB can influence -through sensors-
the behavior of the VB
- But also:
VB can influence -through
sensorimotor stimuli-
the behavior of the PB itself

Theories



- Preteus Effect
 - Digital representation on the self influences the online behavior
- Embodied Simulation Theory
 - The same brain activity happens when the person experiences something or when the person empathises with someone experiencing the same (i.e. yawning)
- Homunculus
 - The brain map of the motor control of the body has big hands with bigger fingers
- Embodied Alien Motion Theory
 - Induced Movements Effect
- Choice to work on Alien Finger Motions
 - Induced Finger Movements

bothelb JAPS DEEEEEEP VRWiki - home CS Virtual Reality / Grap Google VR SDK for U VianaMayaImportScr One

Home

科研費 Grant - in - Aid for Scientific Research on Innovative Areas (Research in a proposed research area) Interdisciplinary Area, FY2014-2018

Understanding brain plasticity on body representations to promote their adaptive functions

Organization Events Publications

Embodied-Brain Systems Science
身体性システム

Advanced Robotics, Special Issue on Embodied-Brain Systems Science is out now

Call for papers (EmboSS 2016)

Call for papers (Neural Plasticity)

Call for Papers (Advanced Robotics)

IROS2015 Workshop report

Interdisciplinary Area, KAKENHI, FY2014-18
Embodied-Brain Systems Science
FY 2017-18 **Call for Prop**

Embodied-Brain Systems Science
Related Events Symp Semi
Call for Participa

Recruiting Researcher

Through the Digital Body

- Università degli Studi di Torino
- Embodied-Brain Systems Project
- NII - National Institute of Informatics in Tokyo

<http://embodied-brain.org/eng/>

Virtual Reality System As a Probing Machine



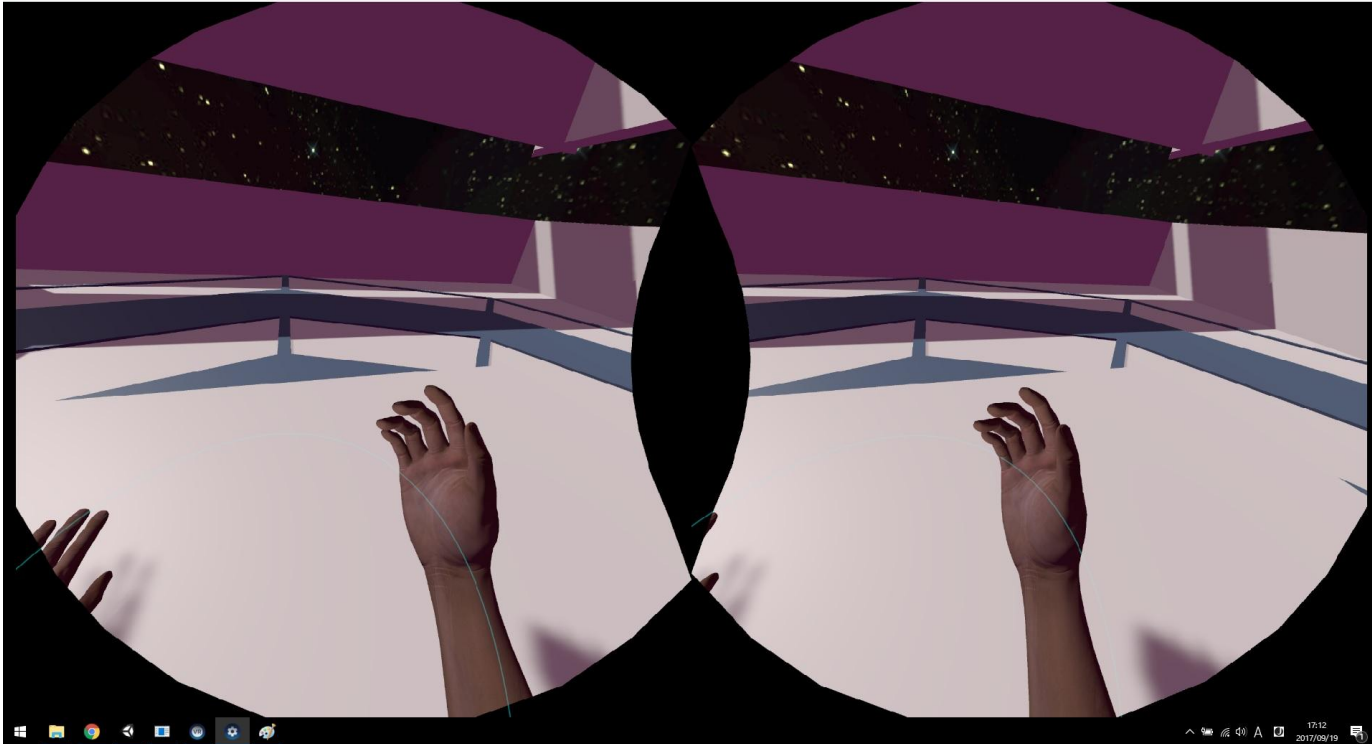
System

The Victim



The Virtual Hand in the HMD

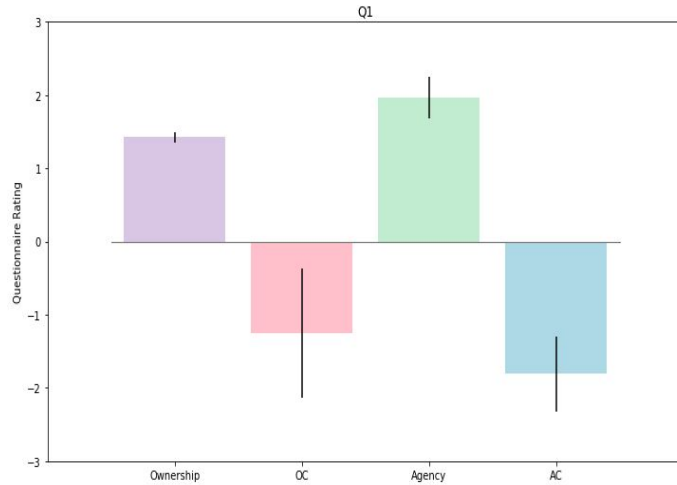
Headset Mirror
Main



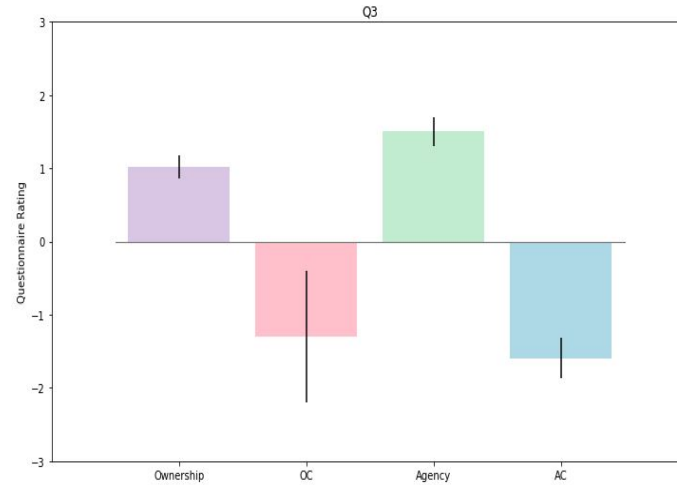
Evaluation of the UX



Real Motion



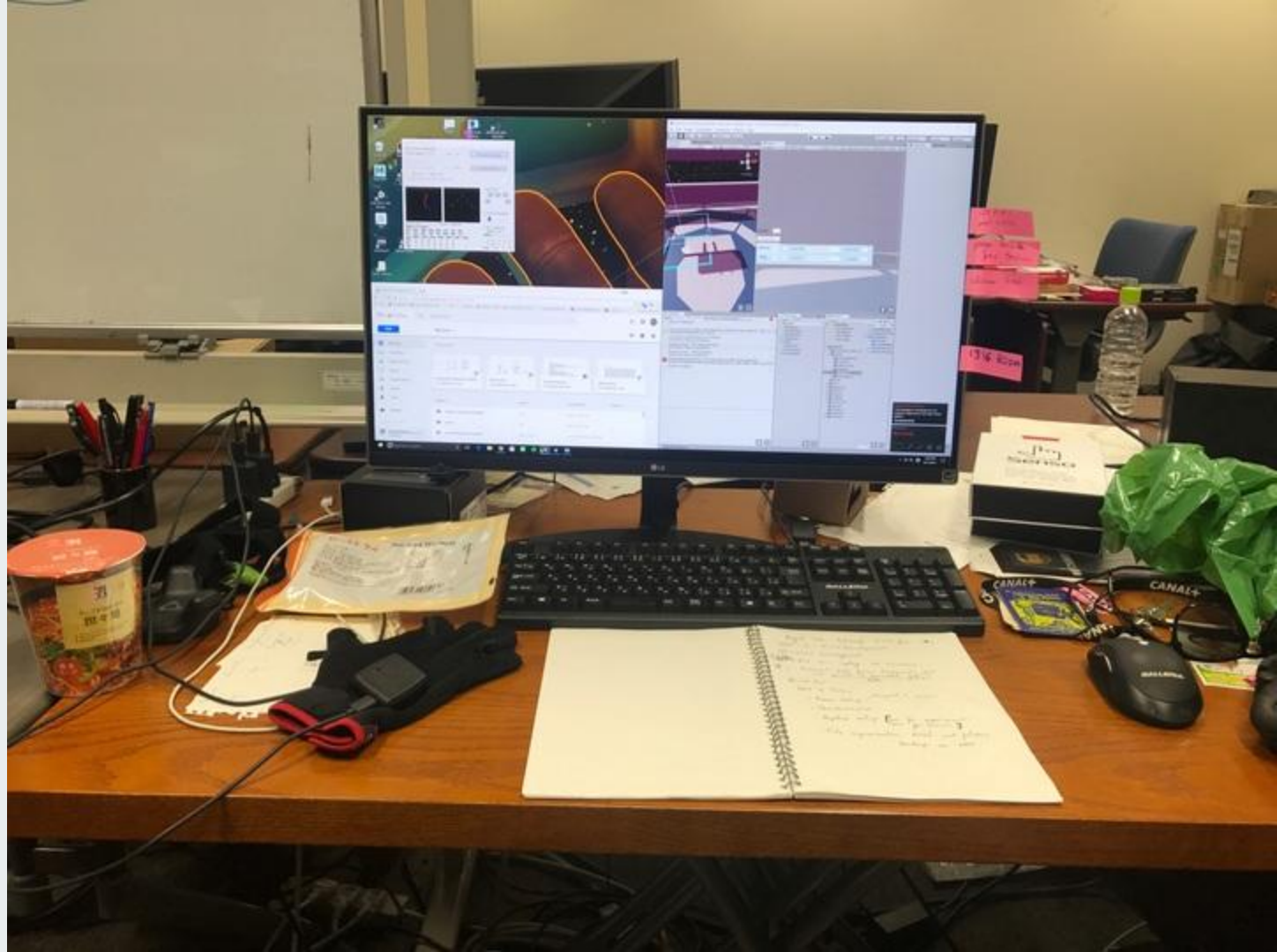
Alien Motion



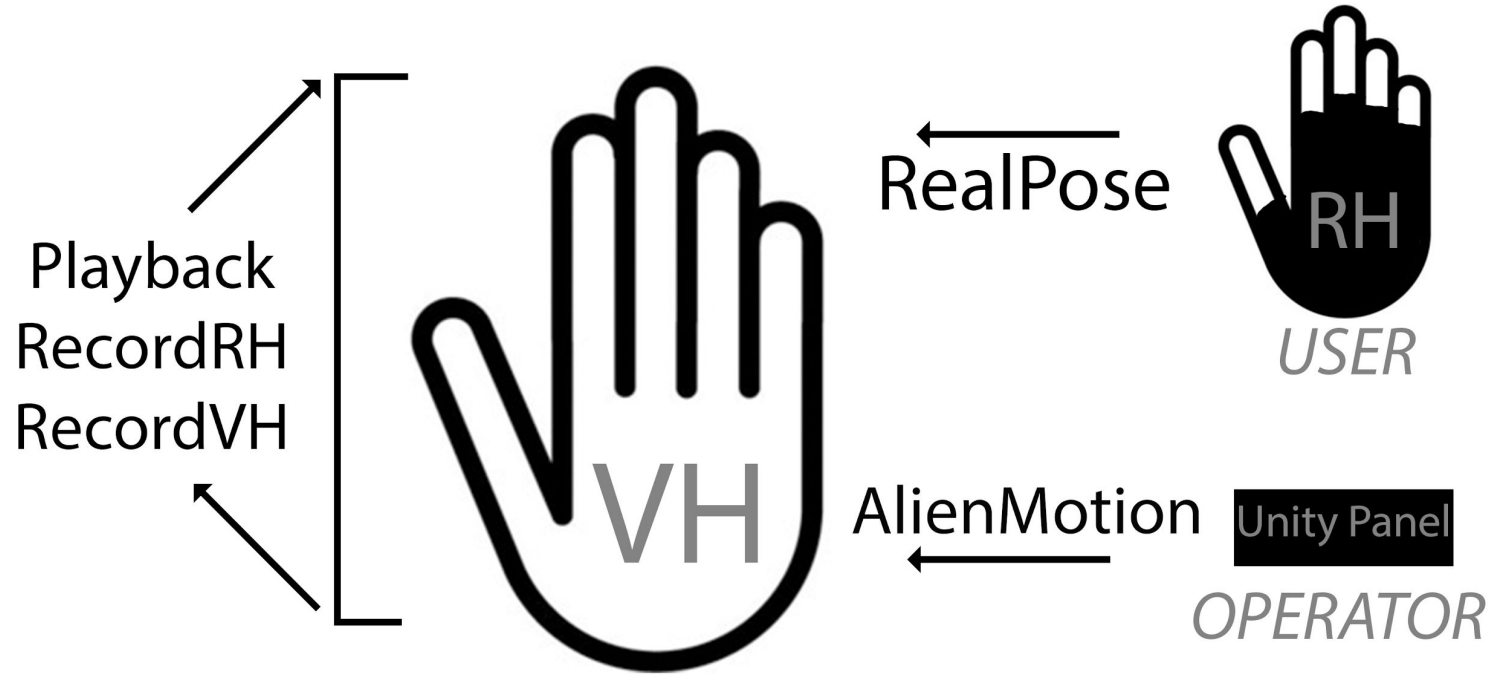


System

The Operator



Schema of the implementation

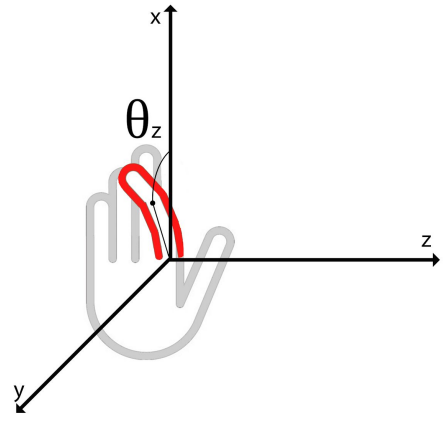
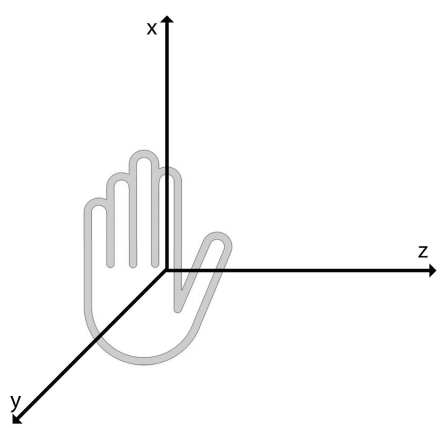
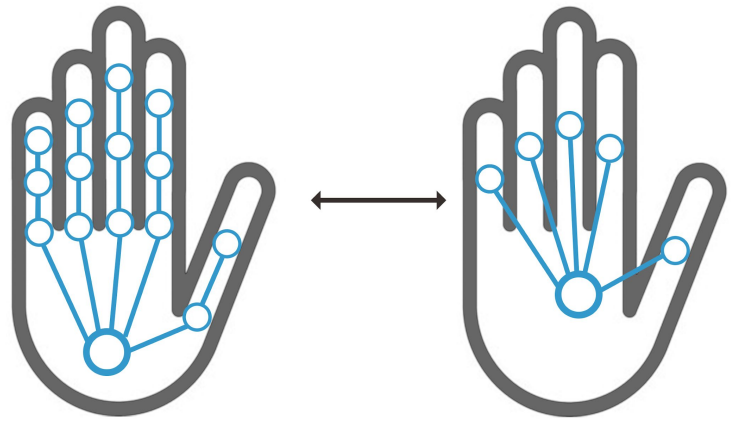




Development

The Hand Model

Real Hand \longrightarrow Glove
Virtual Hand \longleftarrow



The Alien Motion Movements Sequence



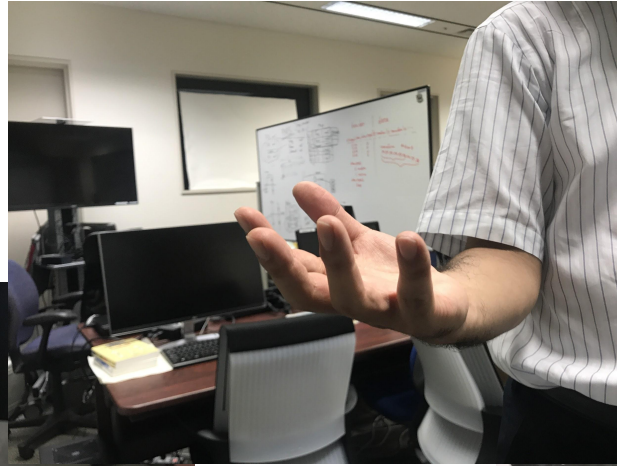


MEASURING the induced movements effect

- Distinguish the induced movements from the natural expected movements
- Finding formulas

The poses and the movements

1.



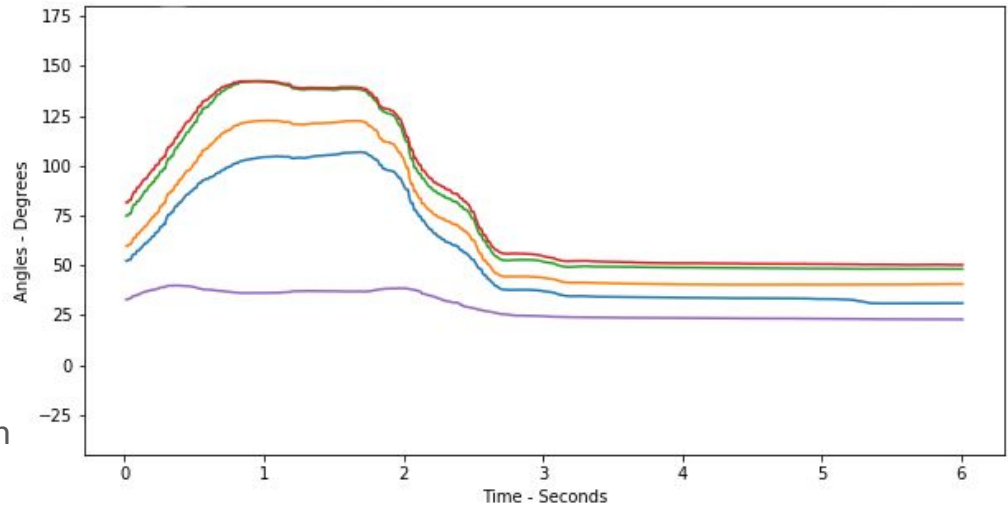
The population



- 16 participants
- 14 males, 2 females
- 10 tried a HMD before (in Tokyo)
- Age:
average 28.8
standard deviation 7.0
- All volunteers
- No rewards, beside refreshments

Objective quantitative measurements

- One line per finger
- Signal comparison between Unity3D and SensoGlove
- The playback produces the expected movement
- The data analysis library plots both the data types



Main Finding



The Induced Movements effect
only happens when embodiment happens

Applications -to the Medical Field-

Human Robot Interaction

Video 0:22
Video 0:45



"Telexistence Model H unveil" by Telexistence inc.
<https://youtu.be/K00T67zqjpl>

Traumatic Brain Injuries

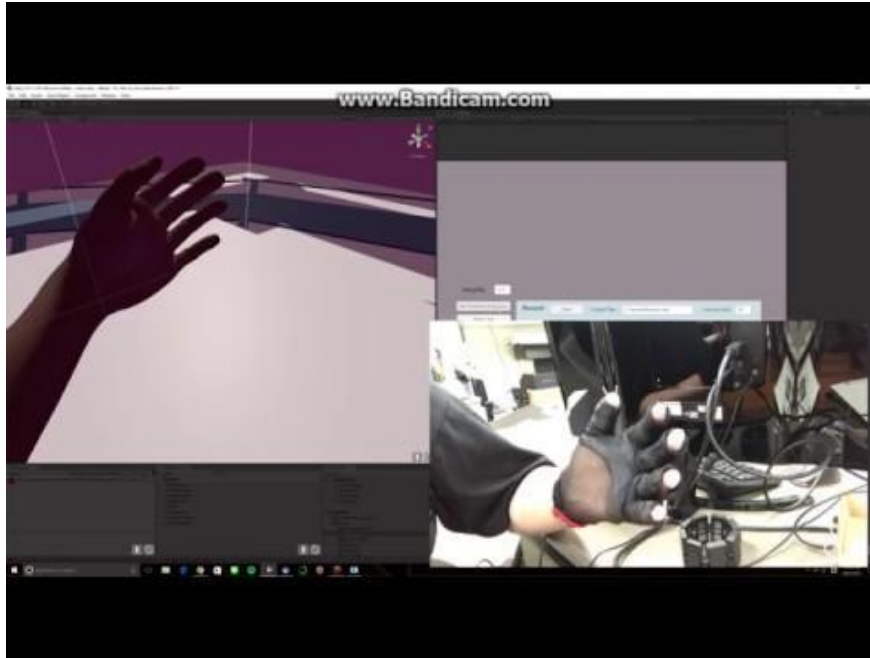


- Biggest cause of neurodisabilities, according to the World Health Organization
- The advancement of surgery techniques created a new population of survivors with disabilities.
- The topic is often included in research investigations on healthy aging.
- There is no pharmacological remedy

Our contribution:

- Apply the Embodied Alien Motion Theory to induce movements in the patients.

Embodied Alien Motion Therapy



Based on the augmentation of the movements (i.e. of the finger angles)

Video 0:24

Video 0:53



Thanks for your attention

ありがとうございます

Special Thanks to the Program Committee and the Organizing Committee

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