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MILANO 1863

Breaking down barriers through new technologies: where is research going?

Topics:

What do clinicians want?

What do the technicians offer?

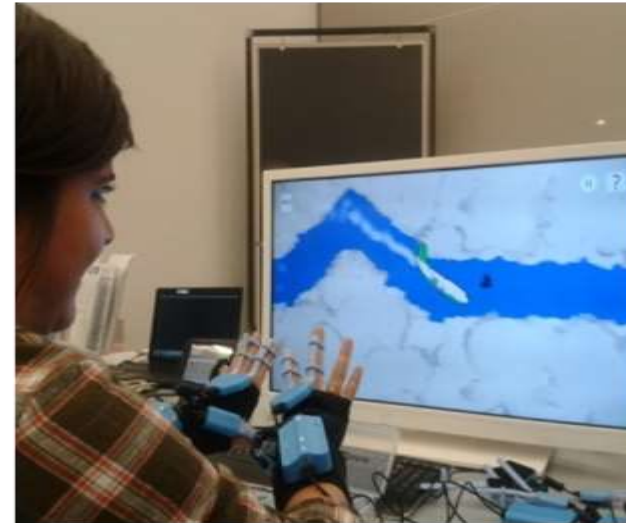


In our experience



ARMEO Spring for robotic rehabilitation of the upper limb

YOU GRABBER a virtual reality system for the rehabilitation of fine hand movements



InMOTION WRIST for the recovery of motor skills of the wrist

In our experience

Lokomat :How to work for a better involvement of the child?



Difficulties and ideas for improvement

**Is VR interface really effective ?
How can we improve it?**

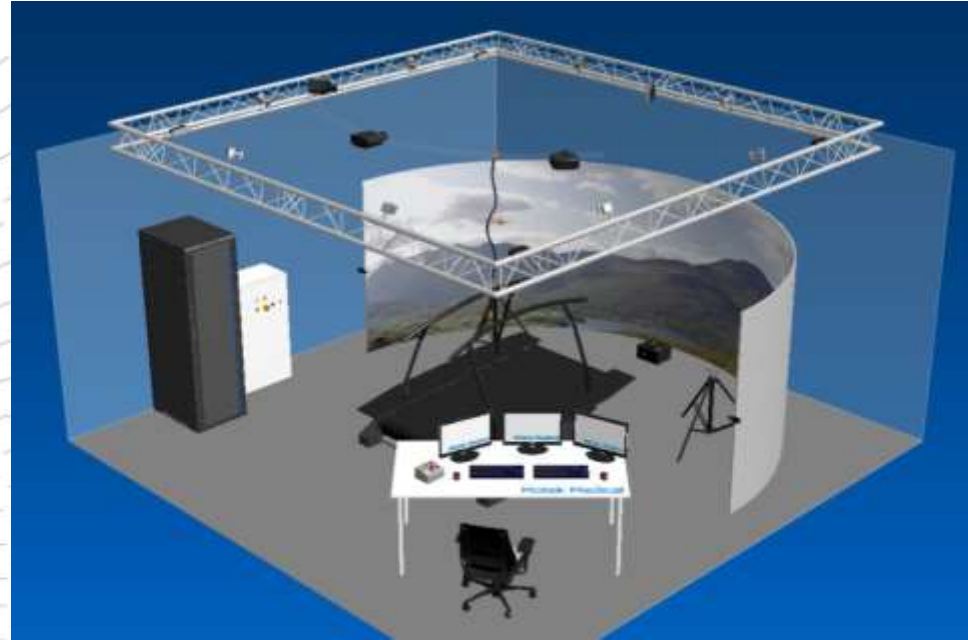


- **Child's video?**
- **Child's avatar?**

In our experience

GRAIL

Gait
Real-time
Analysis
Interactive
Lab



Gait analysis and training

And.....

Whole-body treatment
and evaluation
Cognitive Dual tasks



Immersive Experience

THE PATIENT

Perceives the treadmill movements

Sees the 3D scenario on the screen

Hears the sound linked to the images

Interacts with the system through the body movement



From our experience

How can we improve the involvement in VR activities?

- Visual feedback
- Auditory feedback
- Proprioceptive feedback
- Tactile feedback
- Olfactory feedback
-

Could Metaverse be integrated in rehab programs?

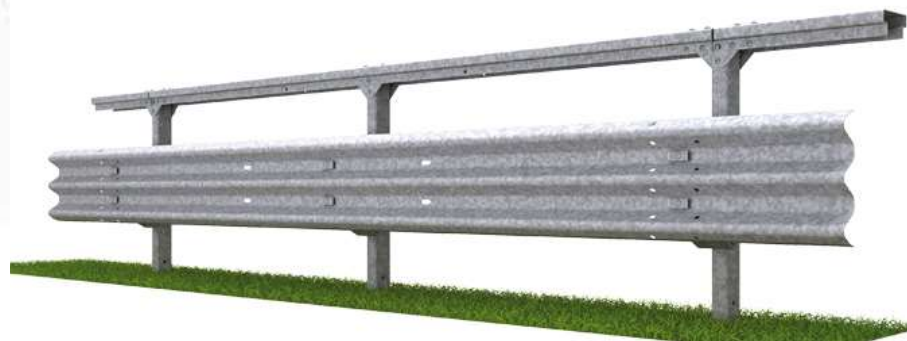
- We can assume that metaverse could make the treatment more attractive and stimulating for children and kids
- We also can assume tha metaverse could involve the mirror neurons system to enhance the learning of a more correct motor engram



Could Metaverse be integrated in rehab programs?

- **Creation of child's avatar**
- **Developing of sotware aiming to enhance a particular functional activity**

Are we able to make an effort to break barriers?



BARRIERS

FRAGILITY

Functional and/or cognitive limitations lead to a child's self-exclusion and to isolation by the peers



CULTURAL:

Parents prefer to exempt children from sport activity because of possible accidents



PEDAGOGICAL

poor preparation and consequent fear of teachers in managing children with different fragilities



NORMATIVE

school system unable to develop an inclusive model to be applied to all schools



TECHNOLOGICAL

- lack of adequate gyms
- absence of equipment suitable for the motor practice of a child with disabilities



Breaking down barriers

The Orthosis Issue: an example

Often children affected by cerebral palsy are excluded from sport activities because they use orthosis



To break barriers



IRCCS
EUGENIO
MEDEA



**LA NOSTRA
FAMIGLIA**
CURA RIABILITAZIONE E RICERCA
DALLA PARTE DEI BAMBINI



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POLISOCIAL



ENGINEERING
FOR SPORT FOR ALL

Polisocial Award - 2019

30 March 2022



en**G**ineering **F**or sport**T** for all

For Sport NOT to create more social exclusion

Project aim



Activities

March
2020

KICK-OFF
meeting

March-June 2020

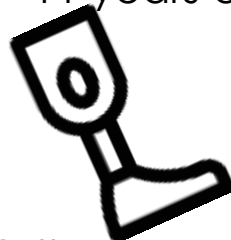
Literature Analysis and
ORTHOSES STUDY

September 2020
(onwards)

RECRUITMENT of
project participants



6 – 11 years old



Orthosis users

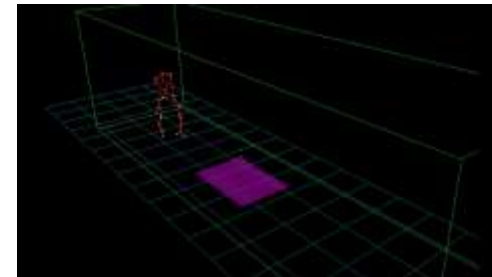
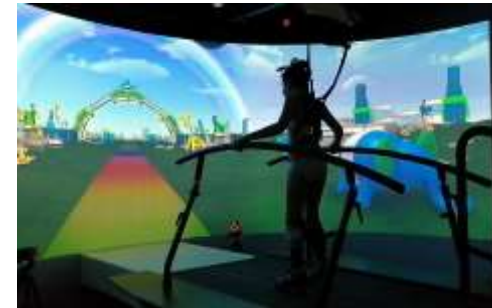
October
2020 (onwards)

NEW GENERATION
ORTHOSES design



September 2020
September 2021

GAIT Analysis
flat, uphill and downhill



March-May
2021

GYM sessions



Results



EU Award

- #BeInclusive Sport Awards
- Call: ERASMUS-SPORT-2021-BE-INCLUSIVE-SPORT-AWARDS
- Project: 101070249 - GIFT
- First position -Primo classificato





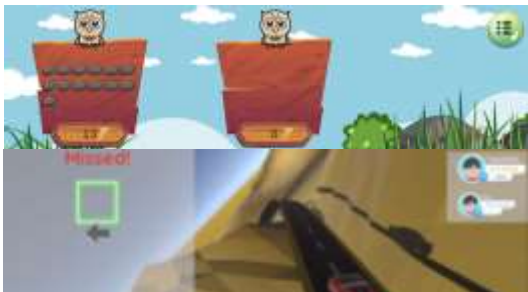
ActiveE³. Everyone, Everywhere, Everyday



Active3 project contex



Experimental Lab



interactive multi-sensory smart space for customizable “full-body” activities

AR/VR stations to carry out simulated activities: swimming, walking, dribbling

adapted, sensorised, reconfigurable and interactive climbing wall

Immersive exergames to train behavioral and learning disorders



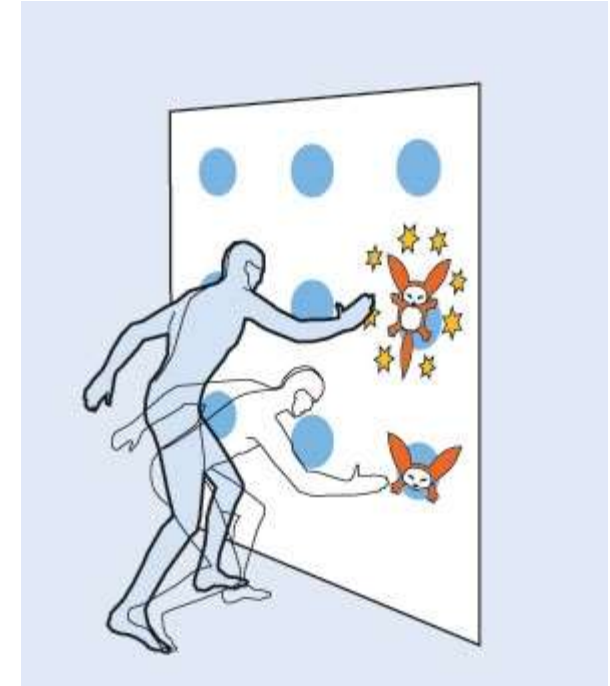
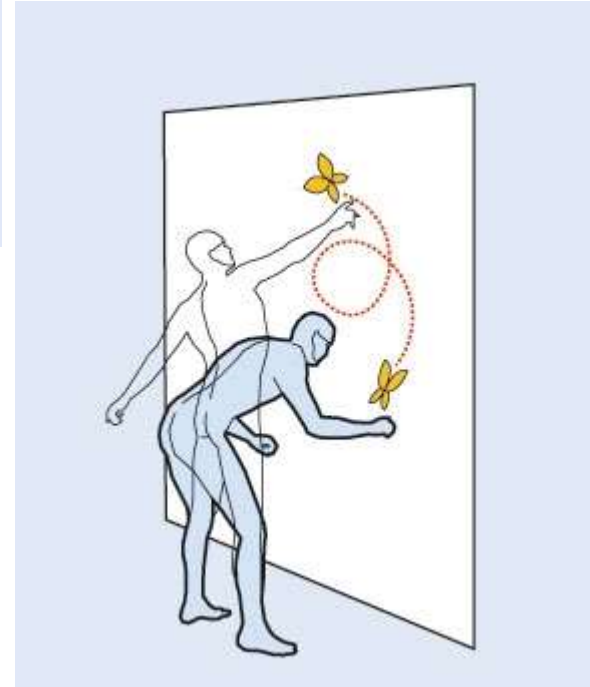
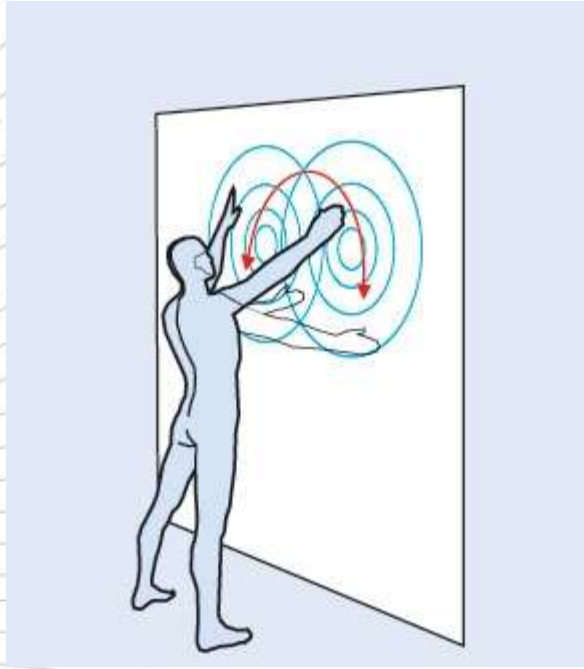
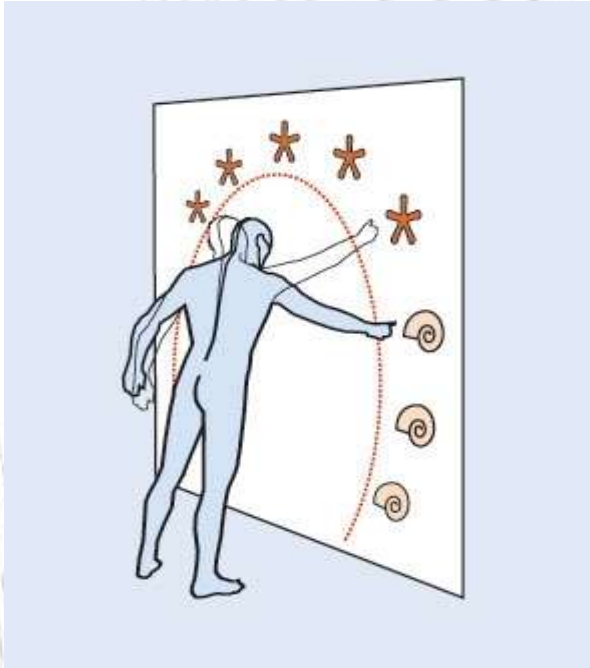
200 children Elementary School



Experimental Lab



Experimental Lab



1° phase



2° phase

POLITECNICO @LECCO



Kit low cost



SCHOOLS @LECCO @BOSISIO



MOOCs educational programs for teachers and families

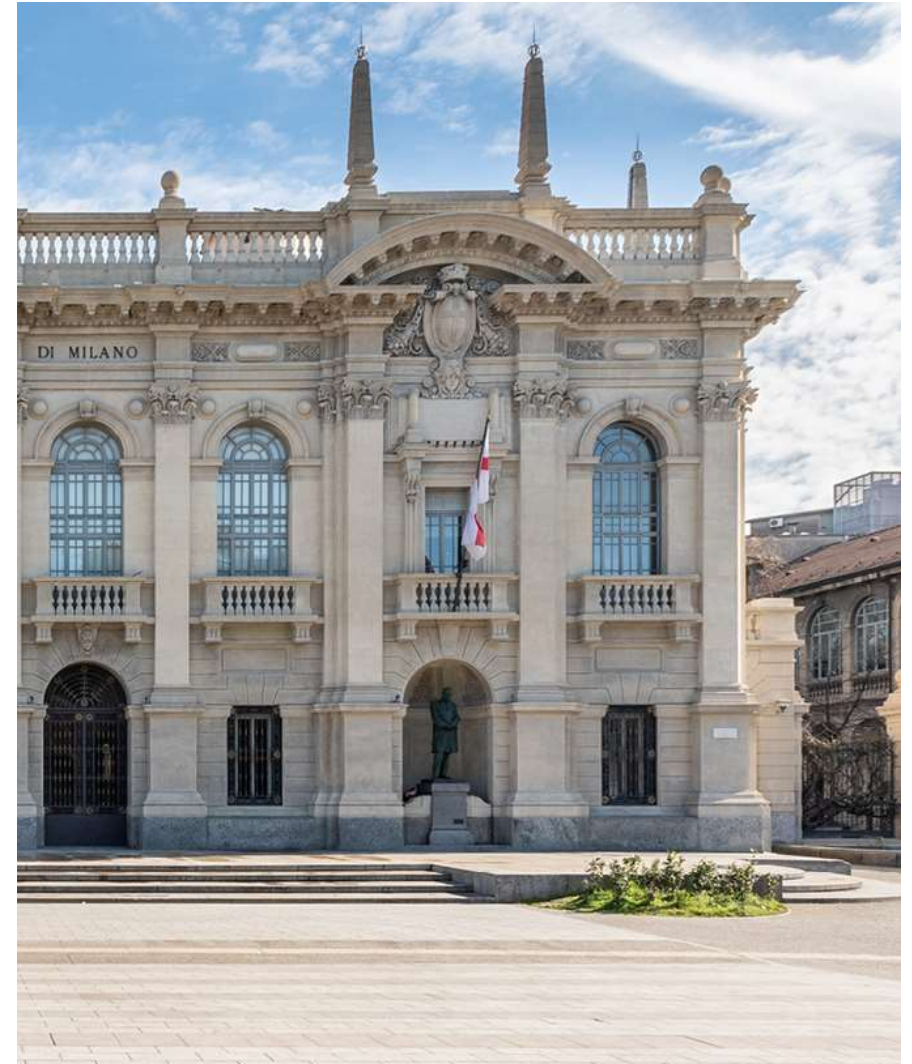


An innovative program for the **inclusion of all children in physical activity.**

It provides **guidelines** for the **adaptation of the activity** and the **use of technologies and tools to encourage inclusive physical practice.**

For each class the innovative program intends to produce:

- new learning objectives
- activities, technologies and tools for the participation of all children
- low-cost set-up to be distributed and installed in primary schools participating in the project, including technological solutions and equipment



Where are we going?




Human Avatar

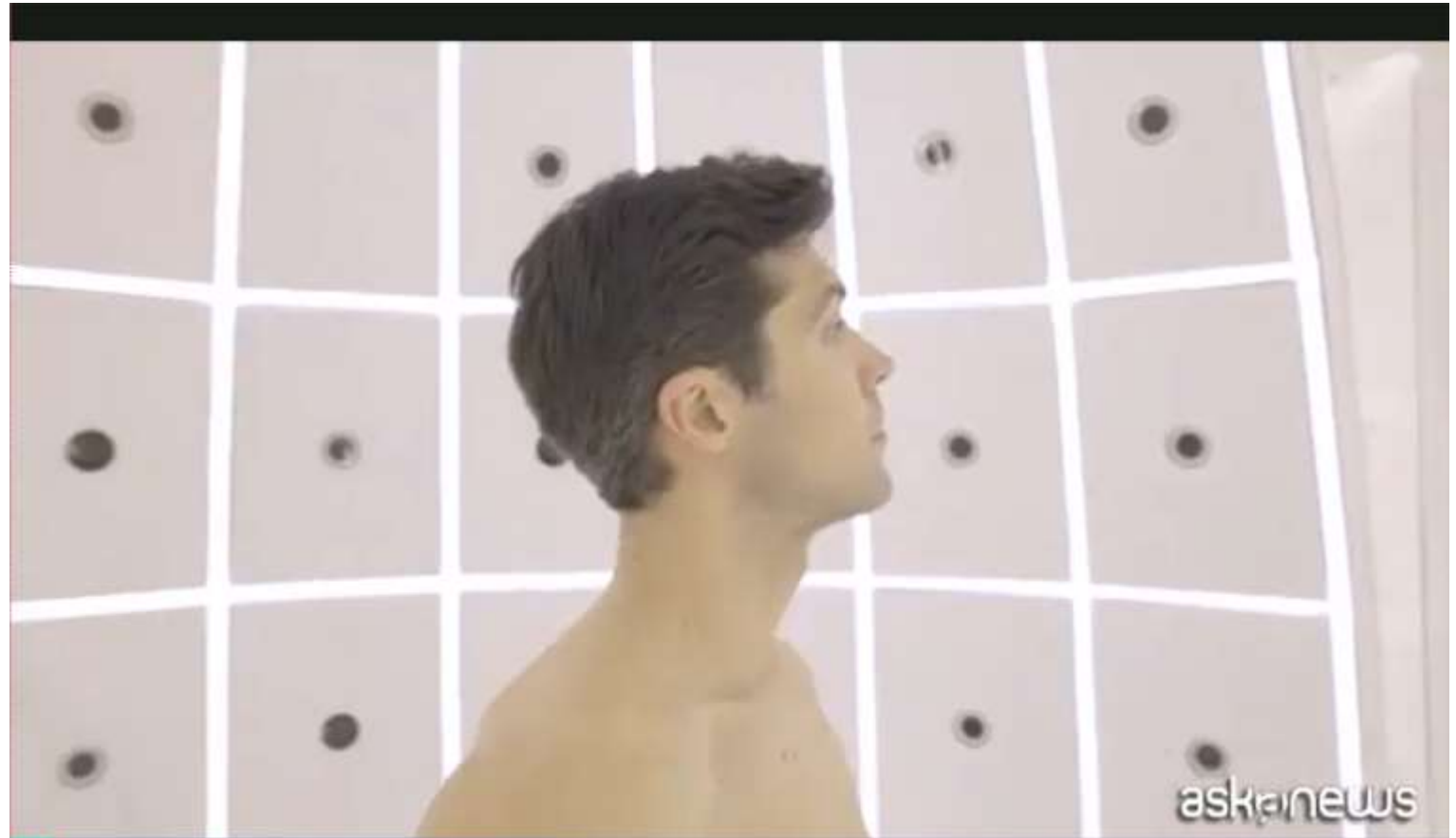
Multimedia Tools and Applications
<https://doi.org/10.1007/s11042-022-13661-x>

TRACK 4: DIGITAL GAMES, VIRTUAL REALITY, AND AUGMENTED REALITY

The smart body concept as a demonstration of the overarching utility and benefits of 3D avatars in retail, health and wellbeing: an accuracy study of body measures from 3D reconstruction

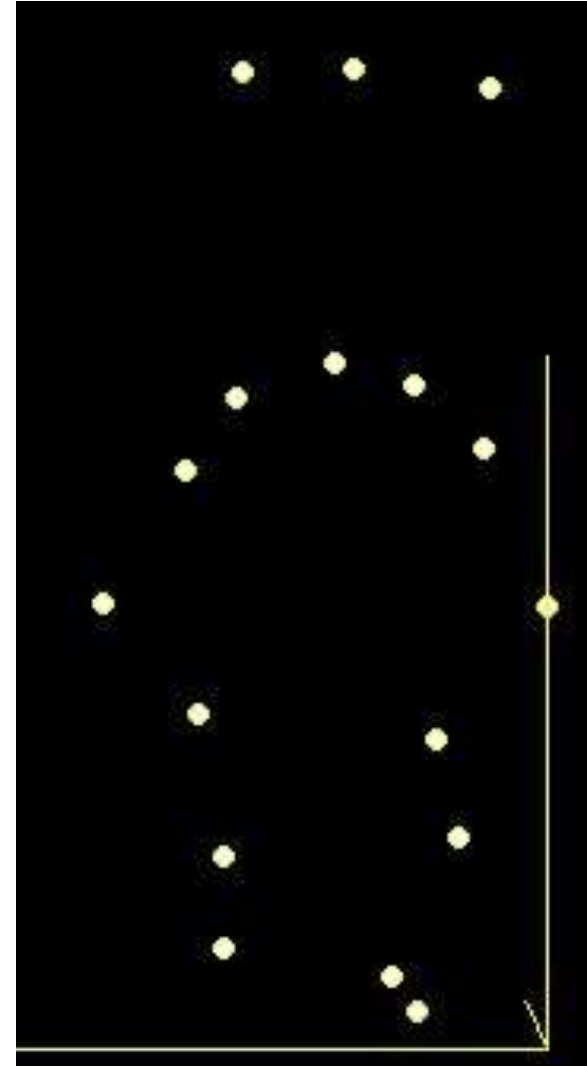
Veronica Cimolin^{1,2}  • Ioannis Th. Paraskevopoulos³ • Maurizio Sala³ • Marco Tarabini⁴ • Manuela Galli¹

Received: 29 October 2021 / Revised: 21 June 2022 / Accepted: 2 August 2022
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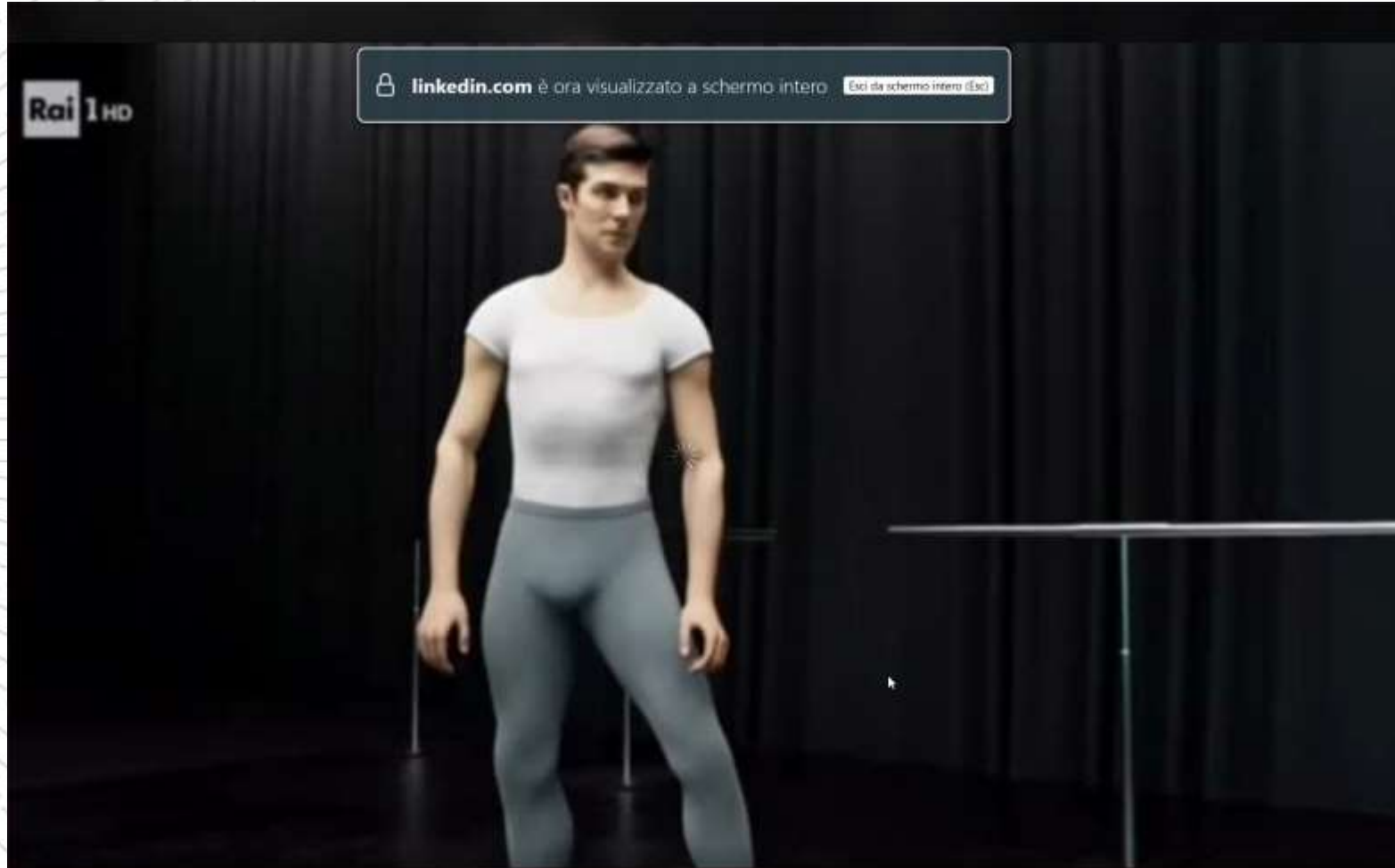


<https://stream24.ilsole24ore.com/video/cultura/roberto-bolle-si-fa-rubare-danza-avatar/AEiAc5SC>

Human Avatar and MoCap



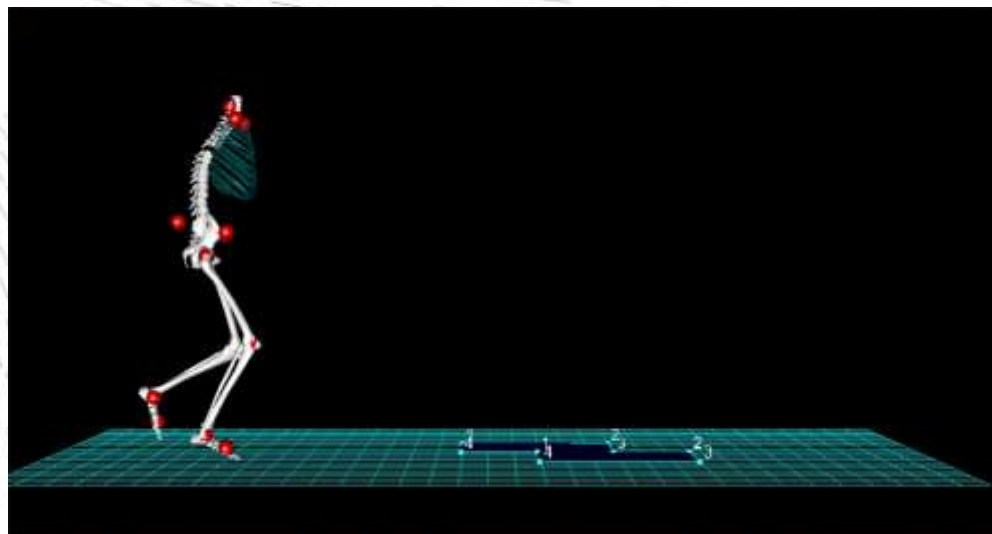
What can we do with Human Avatar and MoCap??



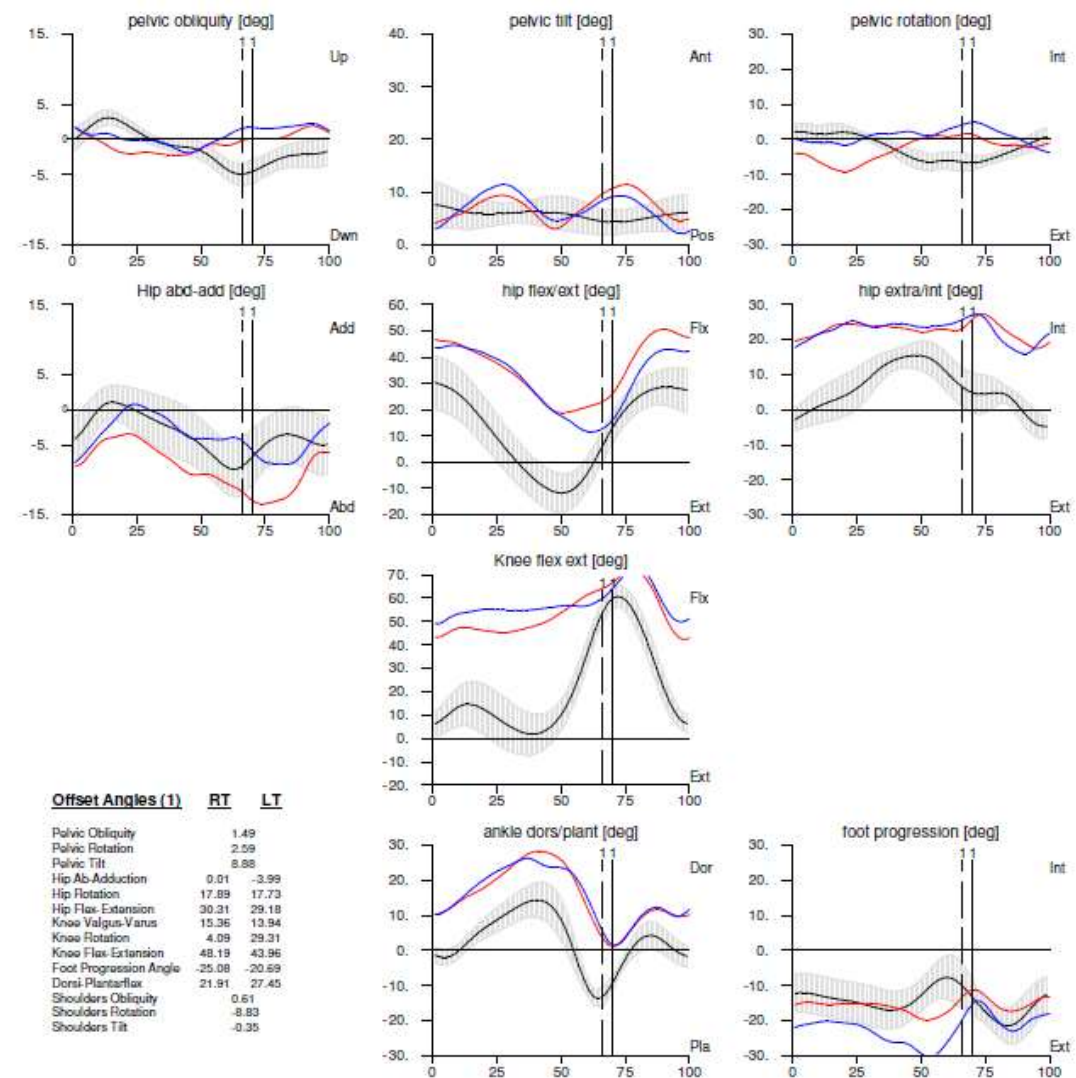
https://www.linkedin.com/feed/update/urn:li:activity:7015681442202431488?utm_source=share&utm_medium=member_desktop

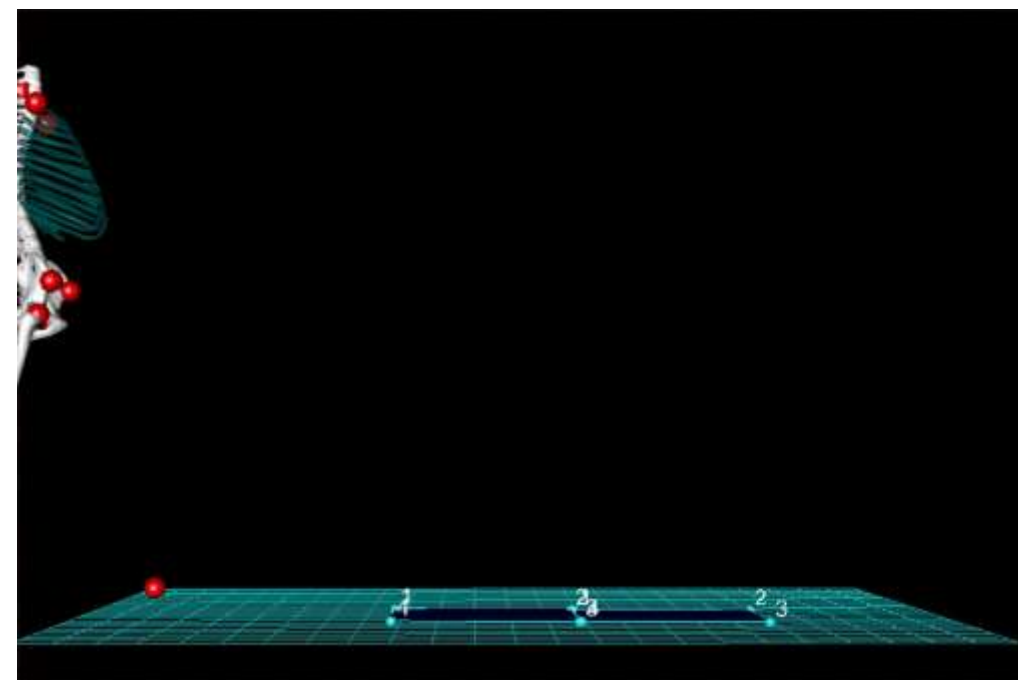
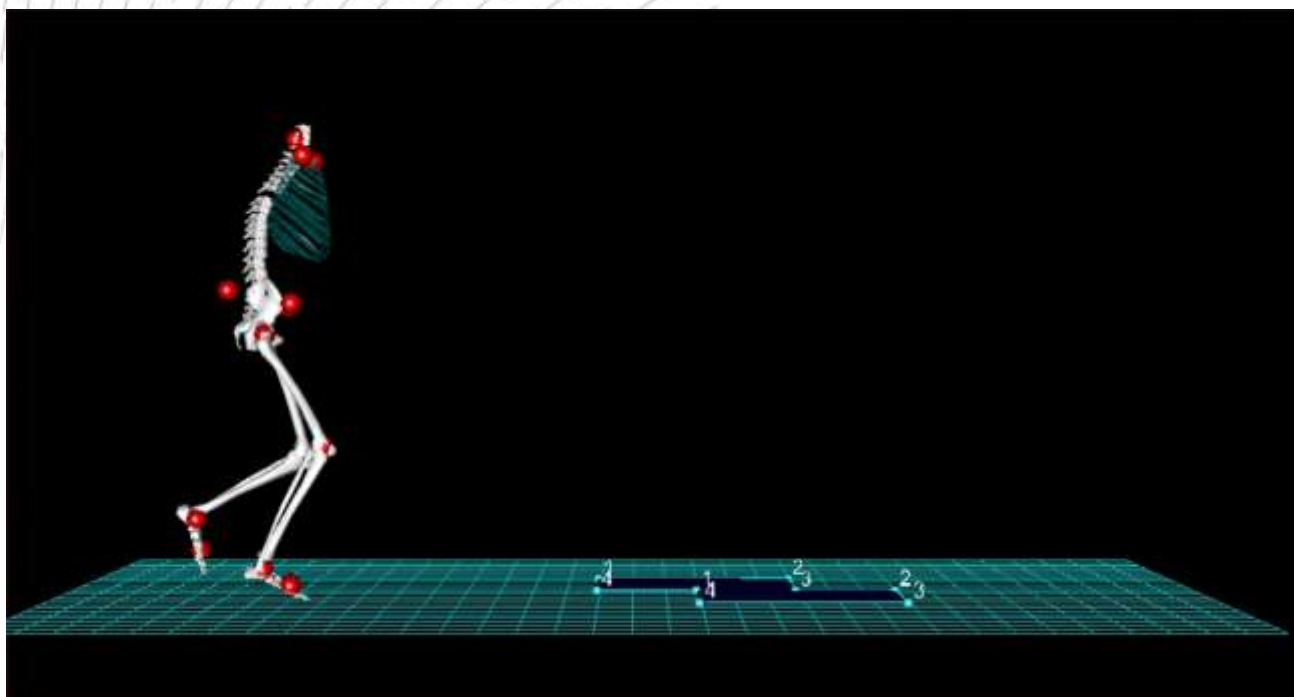
From entertainment to clinic.....





Stance line R ———
Stance line L - - -



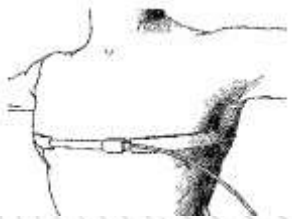


How can we evaluate and quantify the sensation experienced by our patients during the metaverse activities?



Emotions

- Emotions are perceived as a **limited set of discrete states**. Commonly: anger, fear, disgust, surprise, happiness, and sadness
- Each state is thought to have independent **behavioral, psychological, and physiological manifestations**, and to activate **distinct neural pathways** of the autonomous (ANS) and central nervous system (CNS)

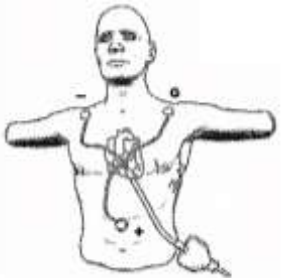


Respiratory
signal



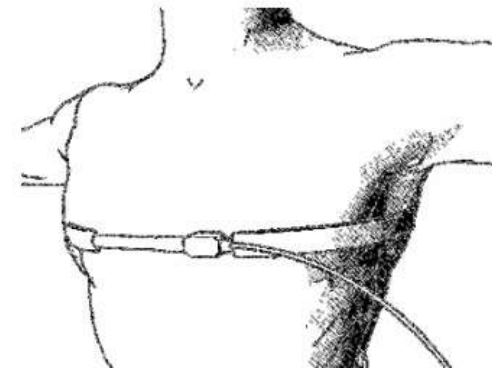
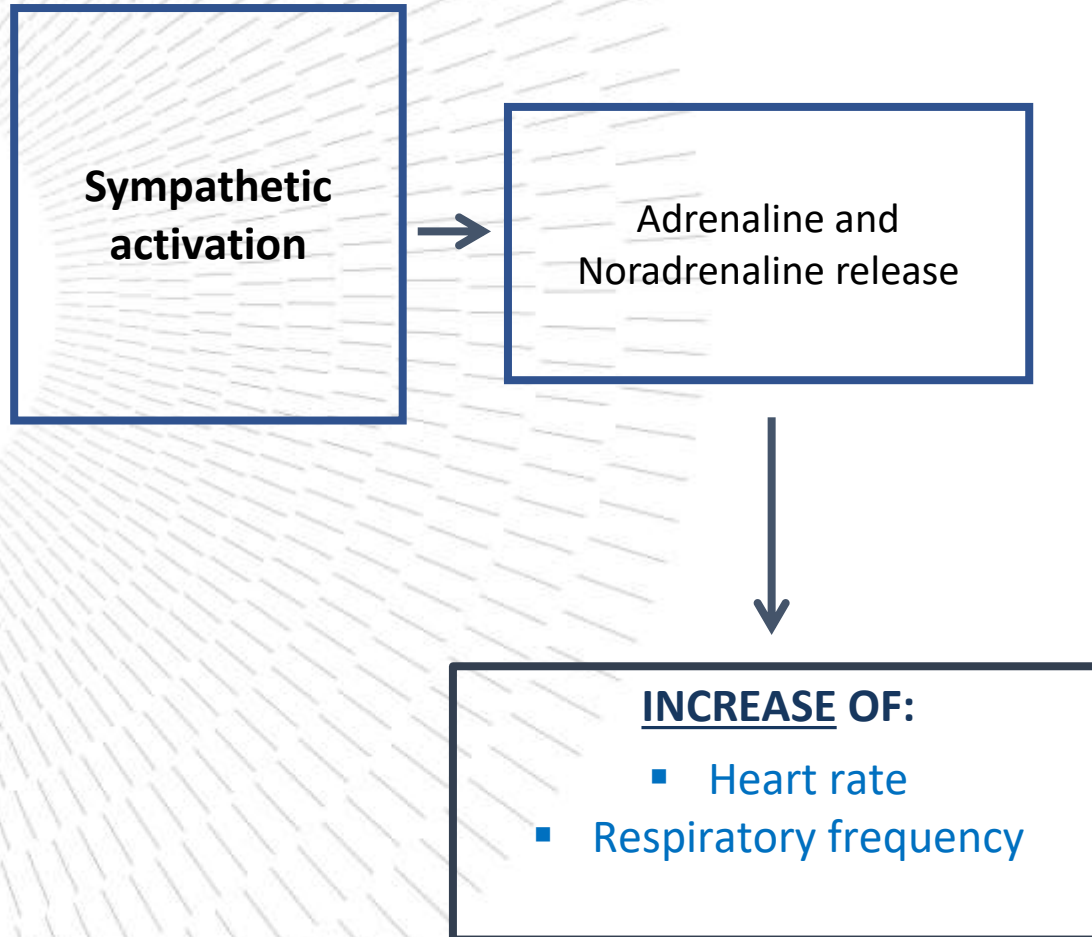
EEG

ECG



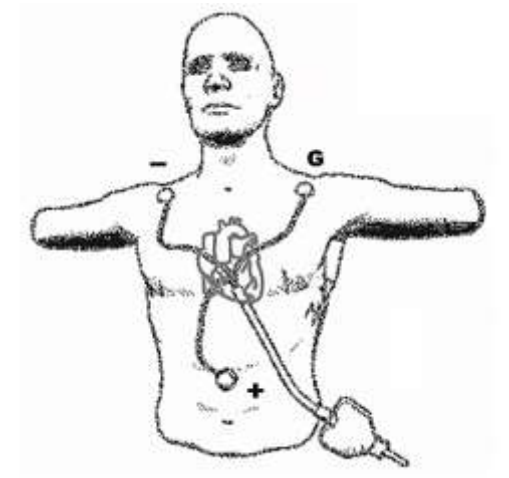
ANS and emotions

Effects of emotions and stress on the ANS



Respiratory
signal

ECG

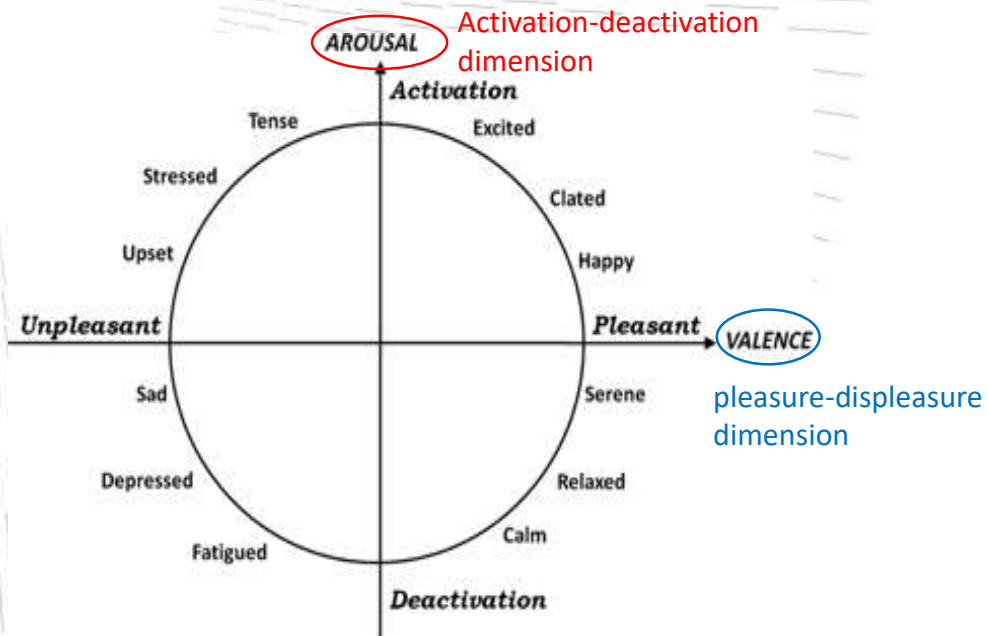


EEG and emotions

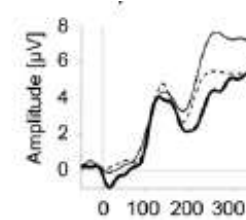
Emotions stimulation: **modulation of brain electrical activity in time**

IAPS dataset of Images for emotional stimulation

Circumplex model of affect (Russell, 1980):



Early posterior negativity
(200-300 ms)

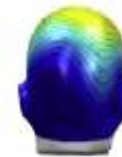


200-300 ms

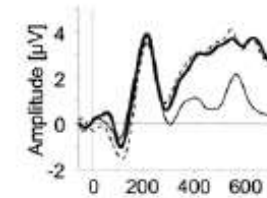
Pleasant - Neutral



Unpleasant - Neutral



Late posterior potential
(>400 ms)



400-700 ms

Pleasant - Neutral



Unpleasant - Neutral



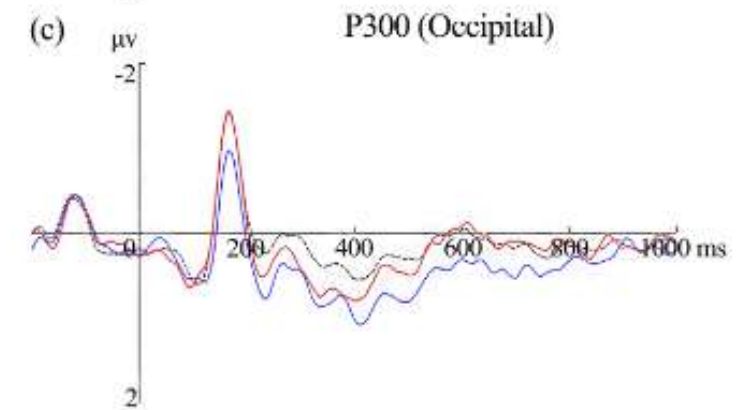
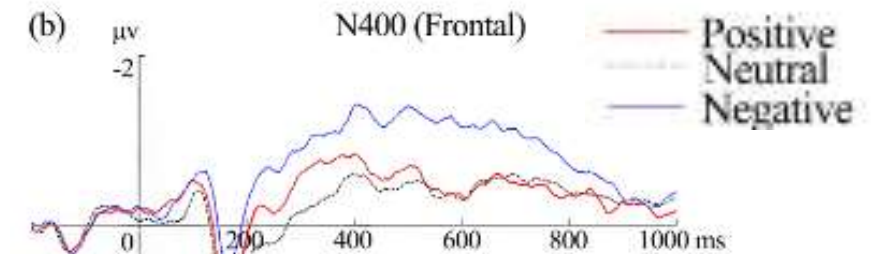
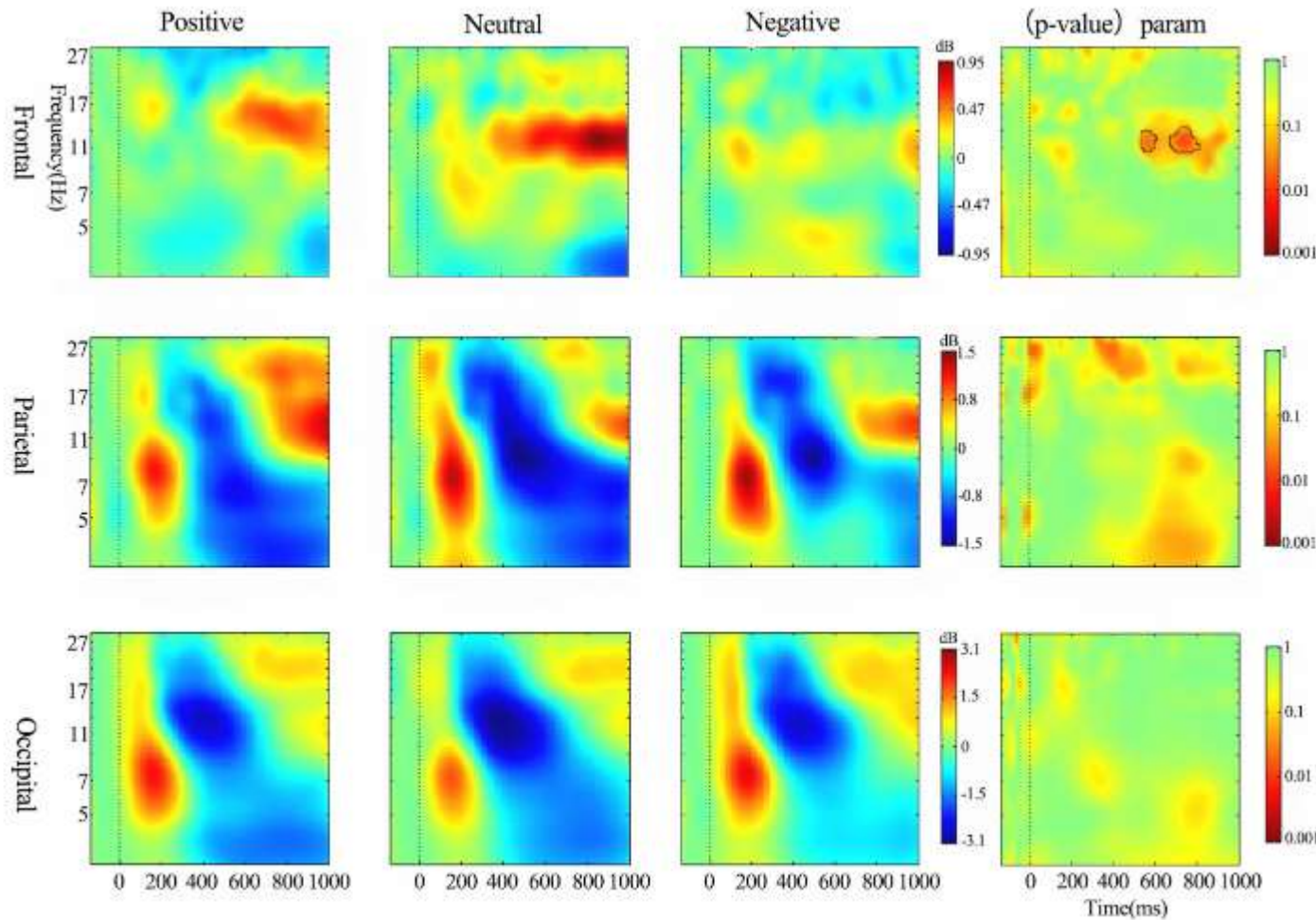
Target

— pleasant
--- neutral
--- unpleasant

H.T. Schupp et al. / Biological Psychology 91 (2012) 81–87

EEG and emotions

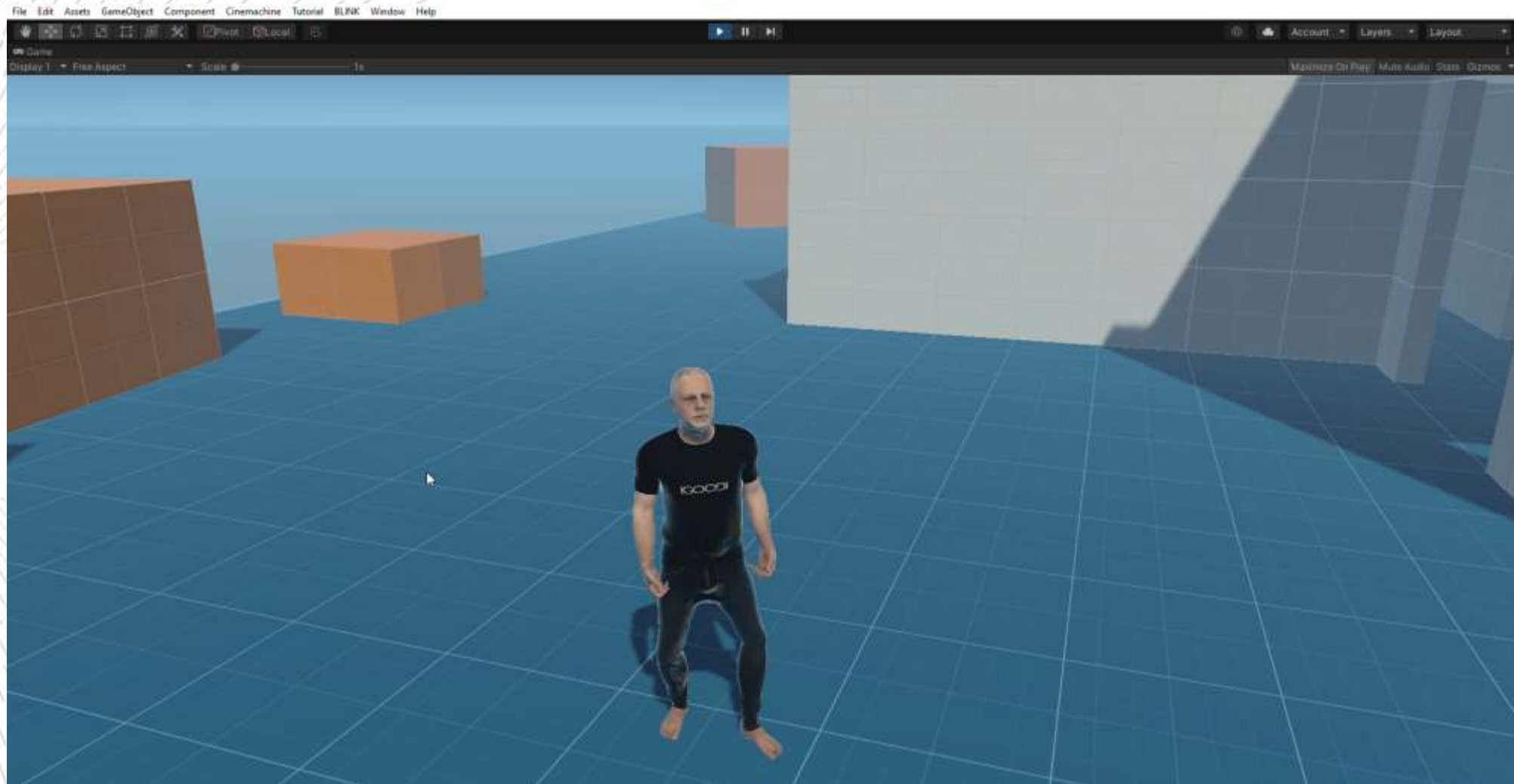
Emotions stimulation: **modulation of brain electrical activity in time and frequency**

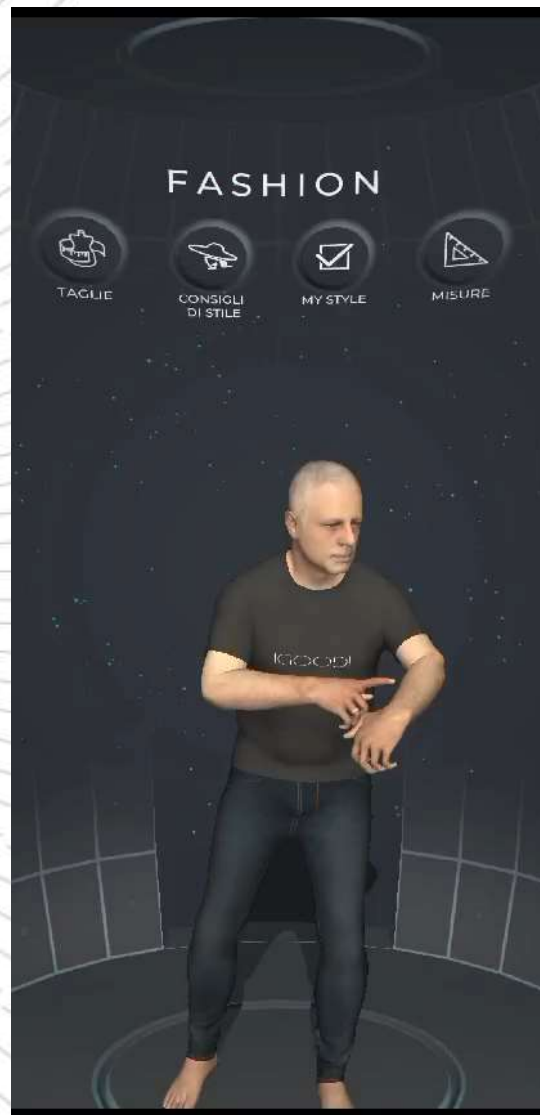
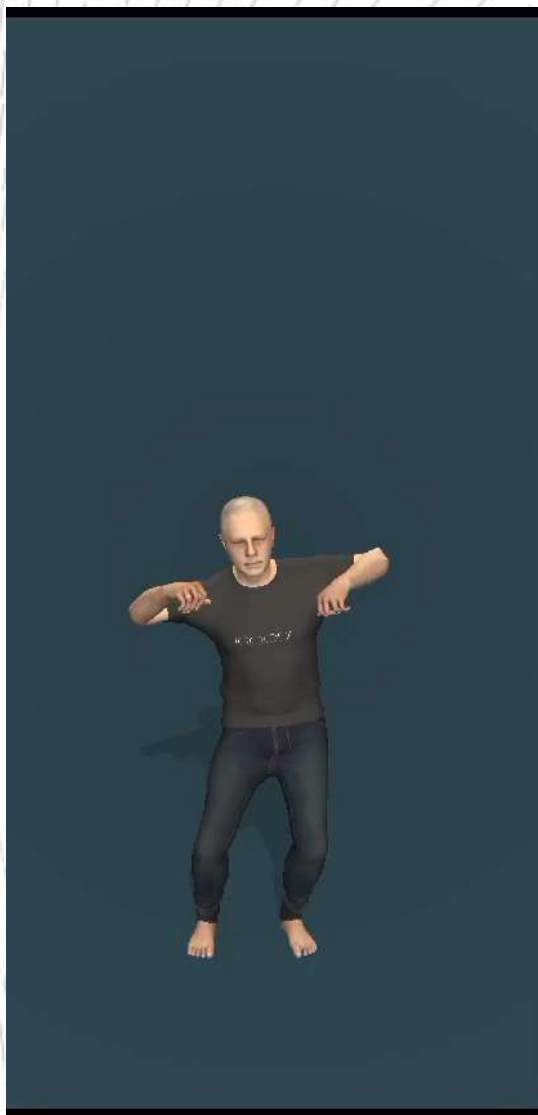


Our next research

To study with a multidisciplinary and multifactorial approach (Avatar, motion capture, bio-signals) the effect of metaverse on children with disabilities

Luigi's experience







Congresso internazionale


**SPORT,
DISABILITY
& METAVERSE**

6-7 ottobre
2023

Auditorium IRCCS E. Medea - Associazione La Nostra Famiglia
Via don Luigi Monza, 20 - Bosisio Parini (LC)

Thank you!!!!!!!!!!!!!!