

Standard Mirror Therapy (MT)

- ▶ *Stroke victims* suffer from lost hand functions or long-lasting impairments
- ▶ *Hand rehabilitation* is crucial to restoring patients' quality of life
- ▶ In MT, users perform movements with their healthy hand in front of a mirror
 - ▶ The mirrored hand is perceived in place of the impaired one
 - ▶ The visual perception of the mirrored motion stimulates *neuroplasticity*
 - ▶ Higher the therapy dosage, the better its outcome
- ▶ The delivery of high-dose neurorehabilitation is costly and unpractical for both the patients and the healthcare system

The VRHEM Project

- ▶ "Virtual Reality and Hand Exoskeleton for Mirror Therapy: a Feasibility Study (*VRHEM*)" aims at improving the traditional setup
- ▶ The brain illusion of impaired hand motion is augmented using both visual (through VR) and physical (with the exoskeleton) perception
- ▶ We argue that VRHEM improves the embodiment sense and the MT efficacy and efficiency
- ▶ VRHEM objective is the design and implementation of a portable MT tool that allows easy and autonomous therapy at home
- ▶ The ambition of VRHEM is to improve the quality of the rehabilitation for both patients and therapists

Virtual Reality Component

- ▶ We use the Meta Quest2 VR headset
- ▶ The VR headset tracks both user's hands
- ▶ The healthy hand is displayed in the VR scene following the real healthy hand motion
- ▶ The impaired hand is displayed in the VR scene by mirroring the motion of the healthy hand

The VRHEM setup

- ▶ The user wears the VR headset and the exoskeleton at the impaired hand
- ▶ The user is asked to perform simple opening/closing motions with their healthy hand
- ▶ The healthy hand is mirrored in VR and its motion is induced on the real impaired hand by the exoskeleton

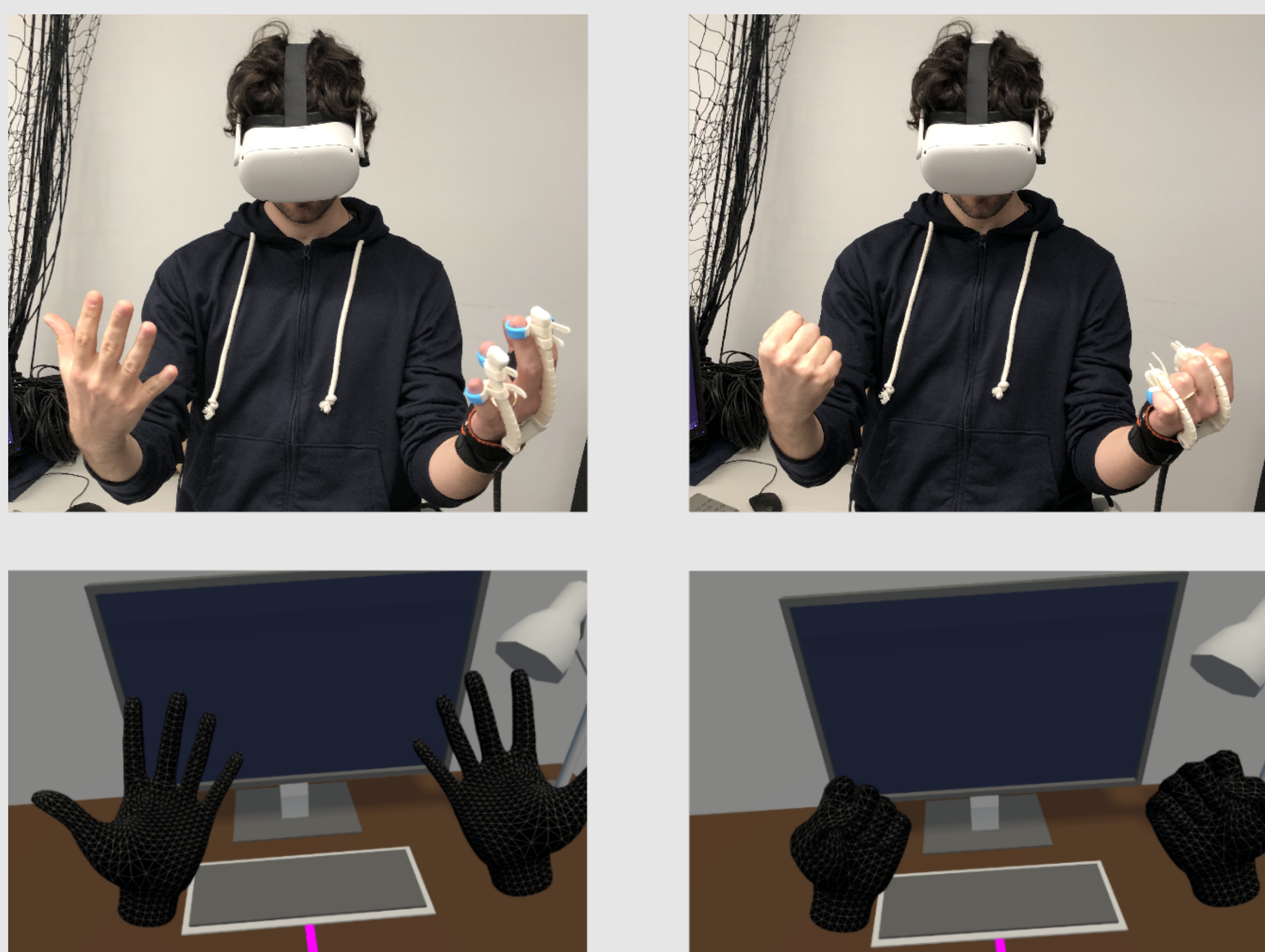
Actuation

- ▶ The difference between the virtual mirrored motion and the real impaired hand is used as feedback to actuate the exoskeleton
- ▶ The exoskeleton command aims at matching the posture of the real impaired hand with the one mirrored in the VR scene
- ▶ The command is sent to the exoskeleton controller via Wi-Fi connection

Hand Exoskeleton

- ▶ We use the device provided by Emovo Care
- ▶ It is a portable and lightweight hand orthosis composed of two exoskeletal fingers
- ▶ The fingers are actuated by one motor through two tendons
- ▶ The fingers are worn coupling the index with the middle finger, and the ring finger with the pinkie

Current Work



- ▶ Validation of the technical soundness of our assumptions with healthy users

Future Possibilities

- ▶ Clinical trials involving motor-impaired patients
- ▶ Assessment of our tool's benefit to the MT outcome
- ▶ Evaluation of the quality of life of patients and therapists
- ▶ Implementation of telemedicine scenarios



Innovation project supported by



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Swiss Confederation

Innosuisse – Swiss Innovation Agency