

REALITAT VIRTUAL I REABILITACIÓ MOTORA

SPECS – Sistemes Sintètics,
Perceptius Emotius i Cognitius

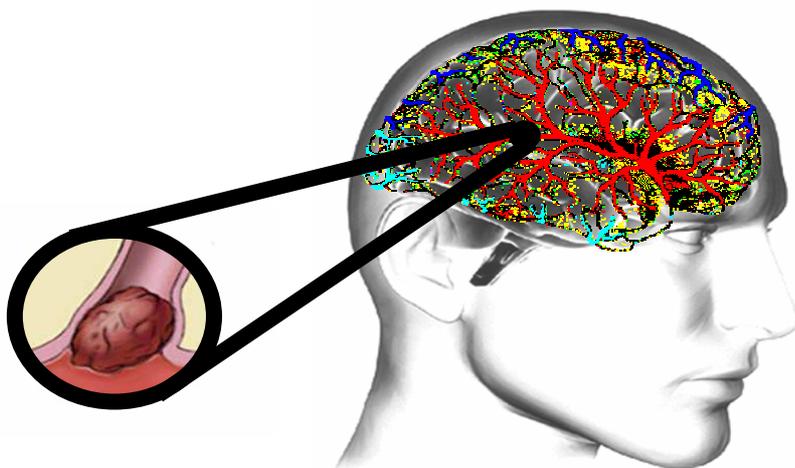
Rehabilitation Gaming System



The Rehabilitation Gaming System (RGS) is a Virtual Reality (VR) based system for the rehabilitation of the motor deficits of the upper extremities. During the training, the movements of the user are mimicked by two virtual arms embedded within a virtual world. This results in simultaneous action execution and observation. We hypothesize that such a scenario may enhance and/or speed-up recovery after a brain lesion.

Ictus

Stroke is one of the main causes of adult disability worldwide. A vein blockage (ischemic stroke) or burst (hemorrhagic stroke) leads to the death of brain cells in the affected area. This compromises the functions related to that brain area, resulting most of the times in motor impairments.



CORTICAL PLASTICITY

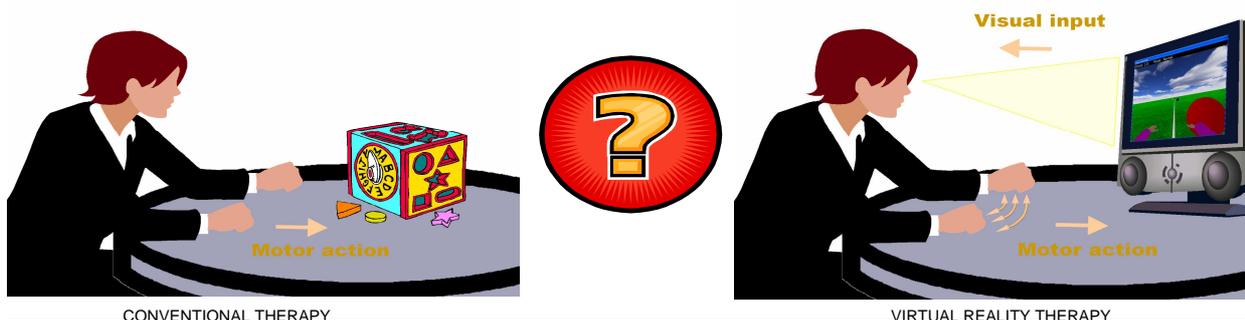
After a stroke, motor functionality can be recovered by cortical plasticity mechanisms. This means that the brain reorganizes itself in such a way that, for instance, the brain areas in the surroundings of the lesion become in charge of the lost functions. The best way to stimulate this reorganization is still under discussion, and several approaches are showing promising results. Within these we find Virtual Reality.

Advantages of Virtual Reality

A Virtual Reality based system provides:

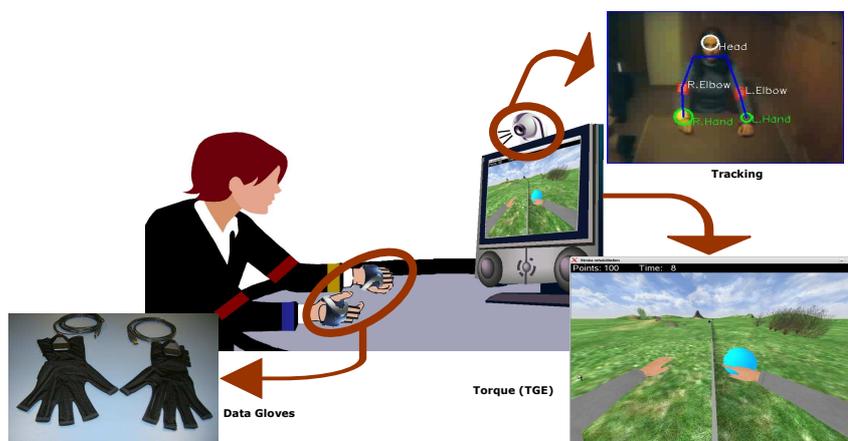
- Intensive training directed towards specific deficits
- Task oriented movement practice
- Feedback for reward and motivation
- Individualized training

VIRTUAL REALITY IN REHABILITATION ENABLES NEW TYPES OF THERAPIES THAT ENCLOSE SEVERAL BENEFICIAL PROPERTIES



The setup

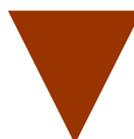
The arm movements of the patient are tracked by a camera mounted on top of the display. The tracking system determines in real-time the position of color patches located in the wrists and elbows and two data gloves are used to measure finger flexure. The measured movements are subsequently mapped onto the movements of an avatar on a VR scenario.



Diagnostics & Transfer

With the RGS, we can reproduce tasks in the real and virtual world. This allows the capture of information about the movements of the patient (e.g., speed, range of movement). This is used to see how real actions are transferred to a virtual world, and to diagnose and monitor the evolution of the patient over time.

Real Task



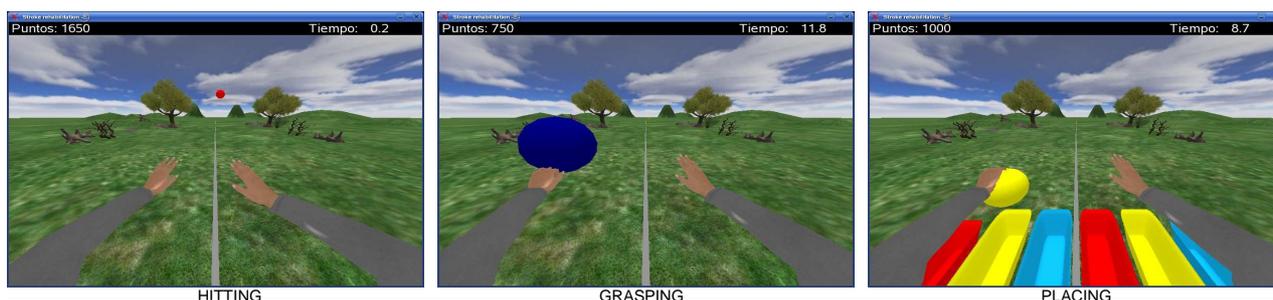
Virtual Task



The training

Three tasks define the complexity of the training. Hitting: The patient hits approaching balls with his virtual hands. Grasping: In this case the balls have to be grasped by means of finger flexion. Placing: The grasped balls now have to be placed in the basket of the corresponding color.

THE TRAINING CONSISTS OF THREE TASKS OF GRADED COMPLEXITY WITH AN ADAPTIVE LEVEL OF DIFFICULTY

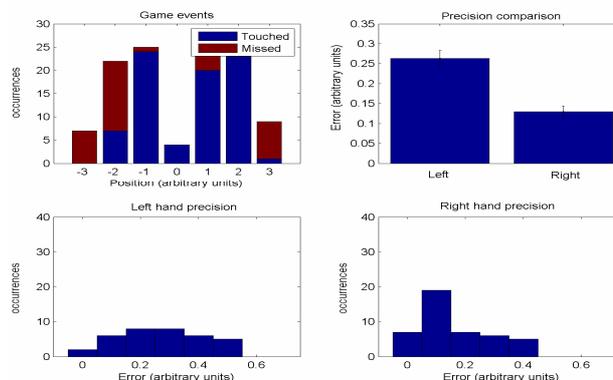


System capabilities and results

The RGS allows us to measure the performance of the patients in the game over sessions. This can be assessed by the number of points and the difficulty level achieved. Moreover, the system allows us to also measure relevant features such as

movement precision, speed and range. The monitoring of all of these parameters can be used to assess improvement and also to further adapt the task characteristics to the needs of each particular individual.

Patient 2



Steps towards future rehabilitation techniques

We presented the RGS, a novel VR system for the rehabilitation of motor deficits that is based on neuroscientific principles of the brain functioning and recovery. It is a system that allows continuous monitoring and quantitative evaluation of the performance of patients.

This system belongs to a new generation of VR therapeutic tools that in this particular case deploys tasks of different complexity and is adapted to the patient's capabilities.

The advantages of the use of virtual reality technologies are vast and we believe that important developments will take place in the next few years that will establish this as a major breakthrough in the treatment of pathologies of the nervous system.