Mental Practice with Augmented Reality for Post-Stroke Rehabilitation: The I learning Project

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The aim of the project is to apply augmented-reality technology to teach motor skills to patients suffering from stroke. To achieve this goal the project adopts an innovative approach based on the use of so-called "motor imagery." Recent studies in neuroscience have provided converging evidence that imagining a motor action involves the same brain areas involved in performing the action [1]. This supports the idea – already exploited by sports trainers – that training with motor imagery (mental practice) could be effective in learning new motor skills or in promoting motor recovery after damage to the central nervous system [2]. Previous clinical studies have shown that the rehabilitation of post-stroke hemiplegic patients can be made more effective by combining physical practice with mental practice [3, 4]. However, for many patients who suffer from damage to the central nervous system, mental simulation of movements can be difficult, even when the relevant neural circuitry has not been injured. Starting from these premises, a team of researchers coordinated by Italian psychologists Andrea Gaggioli and Giuseppe Riva, from Istituto Auxologico Italiano, in collaboration with Spanish engineers of MedICLab (Medical Image Computing Laboratory), a scientific and technological public laboratory from Polytechnic University of Valencia (Spain) that it is headed by Dr Mariano Alcañiz, have designed and developed an augmented-reality workbench (called "VR Mirror") to help post-stroke hemiplegic patients evoking motor images. The research is supported by the EU project, called I-learning (Immersion/Imagery Enhanced Learning [5]), which is funded under the FET Program (Future and Emerging Technologies [6]). First, the movement is acquired by the system from the healthy arm. Second, the movement is being mirrored and displayed so that the patient can observe and see as if the impaired arm is performing the movement. Third, the patient is instructed to rehearse in his/her imagination the movement he/she has just observed. Last, the patient has to perform the movement with the affected arm. The system is currently being tested to see if it really does help patients to recover more quickly and regain control of arms that have been paralysed following a stroke. If clinical

trials show the I-learning hypotheses to be correct the method developed could make a useful contribution to improving the effectiveness and reducing the duration and cost of post-stroke rehabilitation.

Pictures of the I-learning prototype

References

1. Jeannerod, M., *Neural simulation of action: a unifying mechanism for motor cognition.* Neuroimage, 2001. **14**(1 Pt 2): p. S103-9.
2. Jackson, P.L., et al., *Potential role of mental practice using motor imagery in neurologic rehabilitation.* Arch Phys Med Rehabil, 2001. **82**(8): p. 1133-41.
3. Stevens, J.A. and M.E. Stoykov, *Using motor imagery in the rehabilitation of hemiparesis.* Arch Phys Med Rehabil, 2003. **84**(7): p. 1090-2.
4. Page, S.J., et al., *A randomized efficacy and feasibility study of imagery in acute stroke.* Clin Rehabil, 2001. **15**(3): p. 233-40.
5. http://www.tils.com/i-learning/html/objectives.htm.
6. http://www.cordis.lu/ist/fet/pr2-da.htm.

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