Using mixed and virtual Reality systems for Gait-Rehabilitation

L. Zimmerli and P.F.M.J. Verschure

SPECS – Laboratory for Synthetic, Perceptive, Emotive and Cognitive Systems

Institute of Audiovisual Studies (IUA), University Pompeu Fabra, Ocata 1, 08003 Barcelona, Spain

http://www.specs.upf.edu

Abstract

Neurological deficits resulting from spinal cord lesions, stroke and traumatic brain injuries frequently affect walking functions. Since the ability to walk influences the participation in social and economic life, its restoration through rehabilitation plays an important role in improving a patients quality of life [1]. Nowadays gate therapy is mostly achieved through electrically driven gait orthosis combined with partial body weight support, where rehabilitation sessions involve the constant repetition of physiologically correct gait patterns. We have earlier proposed that neuronal reorganization and functional recovery can be optimized by embedding rehabilitation in a task oriented paradigm [2] here we present the application of this concept to gate rehabilitation. we have developed a virtual reality application that is capable of autonomously producing different procedural, virtual environments and rehabilitation tasks. The initial environmental variability is obtained by varying topography, weather condition, time, flora and fauna. These factors are constantly altered over time in a task dependent way. The application furthermore modifies rehabilitation tasks online through the assessment of a patients motor capability [3, 4]. Hence, using this technology we can enhance the ecological validity of the gate rehabilitation by defining terrain properties and tasks that implicitly define the gate patterns that the patient is supposed to exercise. We will present preliminary results of our system.

References

[1]   Holden, M.K., Virtual environments for motor rehabilitation: review, Cyberpsychol Behav. 2005 Jun; 8(3): 187-211;

[2]   Cameirao, M.S., Bermudez i Badia, S., Duarte Oller, E., Zimmerli, L., and Verschure, P.F.M.J. The Rehabilitation Gaming System: A virtual reality based system for the diagnostics and rehabilitation of sensory-motor deficits. Proceedings of Virtual Rehabilitation 2007, 27-29 September, Venice, Italy.

[3]   Lünenburger, L., Colombo, G., Riener, R., Dietz, V., Biofeedback in gait training with the robotic orthosis Lokomat, Conf Proc IEEE Eng Med Biol Soc. 2004; 7: 4888-91.

[4]   Lünenburger, L., Colombo, G., Riener, R., Dietz, V., Clinical assessments performed during robotic rehabilitation by the gait training robot Lokomat, IEEE. 2005; 345-348.