Investigation of brain changes due to motor rehabilitation based on virtual reality games in stroke patients

J. A. Feitosa[1,4], A. Camargo[2,4], R. F. Casseb[3,4], B. R. Ballester[5], P. Omedas[5], P. Verschure[5], L. L. Min[2,4], G. Castellano[1,4]

[1]Neurophysics Group, IFGW, UNICAMP, Campinas, Brazil, [2]Neurology Dept., FCM, UNICAMP, Campinas, Brazil, [3]Calgary University, Calgary, Canada, [4]BRAINN, FAPESP, [5]SPECS, Universitat Pompeu Fabra, Barcelona, Spain

Introduction and Hypothesis: The most commonly affected motor function in stroke sufferers is the upper limbs' motion. Functional deficit of the upper limbs has received special attention by rehabilitation teams because these members are related to the quality of life of the survivors. Several techniques have been used in the motor recovery process of the upper and lower limbs of stroke patients, where intensive and repeated task-specific training gives satisfactory results [1]. But it is still a challenge to implement such techniques in a real environment, such as in the rehabilitation clinics and health clinics of the Brazilian health system (SUS), and to overcome patients' loss of interest in repeated tasks. For this reason, rehabilitation programs based on Virtual Reality (VR) have been highlighted as alternative therapy for motor recovery [1]. In this line, [2] implemented a computer-based rehabilitation system to treat a group of stroke patients. Patients showed significant improvements in the speed of movement of the affected arm and in other clinical scales when compared to stroke patients who used other complementary therapies. However, there have been no studies yet showing the effect in patients' brains of the use of this rehabilitation therapy.

Objective: The main goal of this project is to evaluate possible brain changes, both structural and functional, of patients undergoing VR therapy using the system developed in [2]. Specifically, we aim to: 1) Evaluate the neuroplasticity of stroke patients due to the traditional therapy allied to VR therapy; 2) To create, for the purposes of this research, a rehabilitation environment using VR in the UNICAMP's hospital (HC-UNICAMP); 3) Verify if the fMRI technique is able to identify and validate changes in plasticity; 4) Characterize brain changes resulting from the complementary treatment (VR).

Methods: Thirty chronic stroke patients with upper limb motor deficit will be recruited. Subjects will be randomly divided into two groups: the experimental group, that will receive the traditional physiotherapy treatment plus VR, and the control group, that will receive the traditional treatment only. All patients will perform 24 sessions, 1h each – for the experimental group the sessions will be divided in: 20 min of VR therapy, 20 min of traditional physiotherapy and, again, 20 min of VR. The participants will be scanned on a 3.0 T magnetic resonance imaging device (Philips Achieva) in three distinct moments: before the therapy, after 12 sessions and after 24 sessions. In addition, functional and neuropsychological evaluations will also be performed in the same three moments. The project was approved by the Ethics Committee of Unicamp, and all subjects will be asked to sign an informed consent form prior to data acquisition.

Relevance: The participants of this research may benefit from the rehabilitation sessions that they will receive, which even in the control group, should potentiate their recovery and return to activities of daily living. Once the rehabilitation environment has been implemented, other patients in HC – UNICAMP will benefit from this treatment. The results of this research will be published in highly regarded journals and presented in national and international congresses, symposia and workshops, contributing to the dissemination of science, particularly in the areas of cerebral connectivity, human-computer interaction and stroke rehabilitation.

References: [1] doi: 10.1186/1743-0003-11-32; [2] doi: 10.1186/1743-0003-7-48.