Title: Game-based collaborative training for arm rehabilitation of MS patients: a proof-of-concept game

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Abstract: In order to optimise functional performance and quality of life of multiple sclerosis (MS) patients, it is important to provide them with an appropriate rehabilitation program. Especially, during the later stages of the disease, exercising the upper limb is needed to maximise functionality in daily life. In order to provide patients with an individual training program, adapted to their possibilities and to assess their progress, we have been investigating the feasibility of using force feedback in combination with a virtual environment. However, the training tasks given to patients must be motivating for them to continue the rehabilitation program for a longer period. To increase this motivation, we have developed a collaborative rehabilitation game. In this game, the patient has to make training-specific movements in order to successfully complete the game. This game can, however, not be played alone. In fact, only through collaboration of the patient, using the HapticMaster, and the co-player, using a WiiMote or a force-feedback device, they can successfully play the game.

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A proof of concept study was performed on four subjects with upper extremity hemiparesis secondary to chronic stroke to establish: a) the safety and feasibility of this system and b) the concurrent validity of robotically measured kinematic and performance measures to behavioral measures of upper extremity function. The game architecture was designed so that various tracking mechanisms can be used to retrieve arm, hand, and finger movement data simultaneously. The system supports the use of a pair of CyberGloves (Immersion, USA), instrumented gloves for hand tracking. Proof of concept testing methods. We conducted a series of trials to establish the safety and viability of this system for the rehabilitation of hand and arm dysfunction due to stroke.