Title (tentative): Augmenting kinesthetic feedback to improve hemiparetic arm control after stroke

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Motivation and application domain

Research and clinical efforts related to post-stroke arm rehabilitation focus primarily on motor retraining, with limited focus on the impact of somatosensory deficits on motor function. However, sensory deficits are common in the contralesional arm and may contribute importantly to deficits in the control of functional movement. This project promotes motor recovery after stroke by creating sensory substitution technologies that re-establish kinesthetic feedback control of the contralesional arm.

General objectives and main activities

The objective of this application is to determine how best to synthesize and deliver supplemental kinesthetic feedback, and to test its ability to enhance sensorimotor control over the contralesional arm post-stroke. This study has two Aims. The first seeks to optimize delivery of supplemental kinesthetic feedback to enhance reach, stabilization and manipulation actions of the contralesional arm post-stroke. The second seeks to characterize learning that accrues due to extended training with supplemental kinesthetic feedback. Successful completion of this project will ultimately lead to novel, continuously wearable technologies that will enable many stroke survivors to recover impaired or lost capabilities in the contralesional arm.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn

1. designing, building and controlling a wearable stimulation system, (CAD, embedded microcontroller circuitry)
2. Testing and calibration procedures
3. Programming a robotic manipulandum
4. Mixed software skills (C/C++, Matlab, microcontroller programming)
5. Human subjects testing; sensorimotor psychophysics

Place(s) where the thesis work will be carried out: Neuromotor Control Laboratory, Marquette University, Milwaukee WI USA Medical College of Wisconsin, Milwaukee WI USA

Pre-requisite abilities/skills: programming skills in Matlab; Interest in developing microcontroller-based technology. Some basic circuit building skills.

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