Investigating Neurological Diseases by Robotic Agent

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**PROJECT DESCRIPTION:**

Preliminary analysis of non-dominant proprioceptive acuity and inter-limb asymmetry in the human wrist is being conducted. It is known that impaired proprioception severely affects the control of gross and fine motor function. However, clinical assessment of proprioceptive deficits and its impact on motor function has been difficult to elucidate. Recent advances in haptic robotic interfaces designed for sensorimotor rehabilitation has enabled the use of such devices for the assessment of proprioceptive function. The aim of this project was to evaluate the proprioceptive acuity of the non-dominant wrist joint in flexion/extension and adduction/abduction and to compare these results to the acuity of the dominant wrist. To assess proprioceptive function, researchers obtained psychophysical thresholds for joint position sense (JPS) of participants. Two different stimuli were presented in each trial by the robotic device.

The smallest perceivable difference was found for movements performed in adduction followed by abduction. A higher threshold was found for extension, while the highest threshold was found for flexion. Apart from one case, subjects always showed higher acuity for movements performed with the non-dominant wrist.

The hypothesis that “proprioception recalibrates after experiencing a mismatch between visual and proprioceptive feedback” is being currently tested.

Under robotic mapping of wrist position sense, researchers evaluate inter limb differences in proprioceptive acuity during unimanual and bimanual task. They analyzed inter limb differences (i.e. right versus left) and differences related to the task (i.e. unimanual versus bimanual).
With regards to the influence of visual information on bimanual haptic manipulation, the coordination of the upper limbs has been shown to be beneficial for post-stroke treatment. The present study sought to examine whether additional visual information regarding the penetration of the wrists into the virtual object (i.e., the colour and shape of the spheres changed according to the level of force exerted by the subject) leads to improved bimanual task performance in a virtual environment. Result shows that inter limb coordination was enhanced during the haptic+visual condition. It is speculated that the presence of visual information provides a more natural way for individuals to exploit inter-limb coordination synergies, and may have useful implications for VR game development and post stroke rehabilitation protocols.

GRANT:
$200,000.00, NTU Start-up Grant, 1 Sep 2013 – 11 Aug 2016

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PUBLICATIONS:

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