Haptics in Medical Training

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Location
All those activities need to take place in both places, Monash (Melbourne) and AEHRC (Brisbane). According to the type of project and level of students, working periods in Brisbane are financially supported.

Background: Importance of Haptics in Medical Skills
Existing surgery relies largely on laparoscopic, endoscopic or robotic-assisted surgery, where surgeons perform operations through a remote vision system (optical endoscopes or CCD cameras) using hand-held tools. In minimally invasive surgery (MIS), the manipulation of surgical tools relies, in large part, on image guidance. However, in highly delicate situations where precision and accuracy is critical for the success of procedures, the physician requires high haptic sensitivity. But kinesthetic perception is a difficult to verbalize and share, and despite its importance, trainees rely on themselves from learning, making their own acquisition of the motor skills, mainly through the visual channel and practice, with no clear assessment.

1. Reconfigurable haptic device DOF for (human) motor skills learning

The research subject is about exploring reconfigurable haptic device, for fine motor skills training in medical applications. A haptic device may provide different way to simulate hand or tools movements, in various DOF configurations, for training purpose.

Objective: design a reconfigurable haptic device

Methodology: The study should start by a survey of medical techniques to understand the range of the design in term of precision, amplitude, velocity, and focus on a central set of medical motor skills where haptics make sense.

Requirements: multi-disciplinary approach in human machine interaction and robotics.
2. Measuring and performing haptic measurements with the same device

Following some research on human haptic sensitivity, the goal is to design an haptic device for measuring haptic sensitivity (based on force measurements in different exercises) and performing haptic feedback for training exercise. The challenge is in been able to measure or perform accurately force feedback (in term of human perception).

**Objective:** building a haptic training device.

**Methodology:** The work can be based on existing advanced multi-DOF haptic device, or can be done on a new simple 1 DOF student design. A preliminary study has to be done to understand the human haptic perception.

**Requirements:** Robotics with experimental/lab ability, interest in multi-disciplinary work.

3. Activity centred haptic device design

Most available haptic devices try to be generic. Most of them are the direct outcome of the industrial robotic arms knowledge, or their evolution, to give an haptic arm as an input computer interface for hand based interactions. Most of this work are technology driven, and not user needs driven. We propose to create a new design methodology, with an experimental example of a new haptic device, centred first on a targeted activity - this activity will be related to medical training of motor skills.

**Objective:** design a haptic device based on a medical activity.

**Methodology:** A first step is get a good understanding of a specific medical task (provided), especially the haptic/motor skills dimension. A second step is to understand (why? who? what for?) the design methods in robotics, and the design methods in human machine design, and correlate them in an experimental work about a new design method, apply to through the design a new haptic interface for the medical task. The originality of this work will be to design a system, while keeping a clear vision of the design steps and methodology itself.

**Requirements:** design and simulation of robots, abstraction capability, multi-disciplinary work.