SKILLS Integrated Project: Surgery and Rehabilitation Demonstrators

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SKILLS

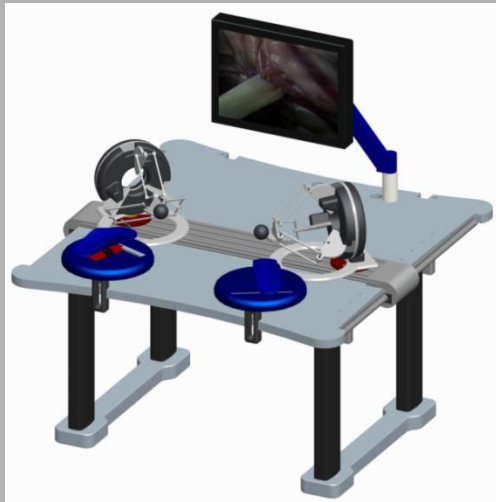Multimodal Interfaces for Capturing and Transfer of Skill

Who am I?

- Education:

  – B.A. Behavioral Sciences, Ben-Gurion University of the Negev (1999)

  – M.A. Cognitive Psychology, Ben-Gurion University of the Negev (2001)

  – Ph.D. Cognitive Psychology, Ben-Gurion University of the Negev (2006)

- Currently – Post-doc research fellow in the Skills project. Focus of interest:

  – Haptic psychophysics in Virtual Reality (VR).

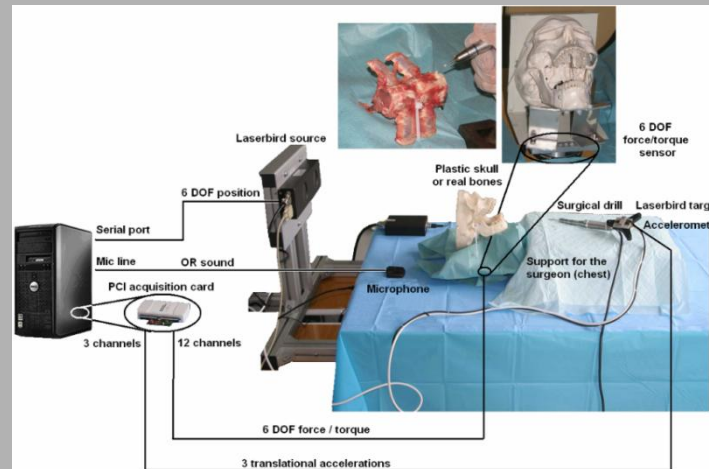 – Design of VR training systems for Surgery and Rehabilitation.

Surgery and Rehabilitation Demonstrators

Minimal Invasive Robotic Surgery (MIRS)	Maxillo-Facial Surgery (MFS)	Upper Limb Rehabilitation (ULR)

 DLR: German Aerospace Center

 Laboratoire d'intégration des systèmes et des technologies

 PERCRO: Perceptual Robotics Laboratory, Scuala di Santa Anna

Haptic is everywhere

- All demonstrators involve haptic sensing – the feeling of touch.
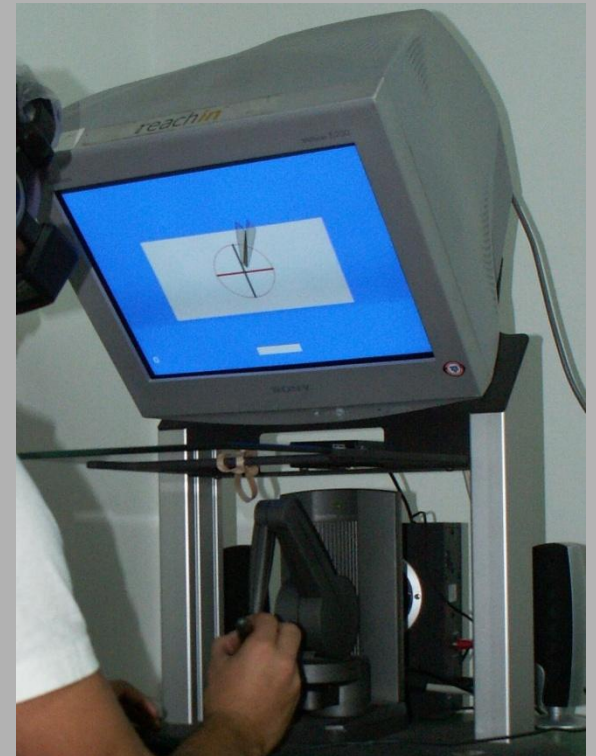
    - MFS: to locate the "spine of spix"

- Research topic:

    Training and enhancing the haptic sensation using Virtual Reality devices

Multimodal Interfaces for Capturing and Transfer of Skill

Training and enhancing haptic sensations using Virtual Reality devices

Dror Lev, Danny Gopher, Ariel Talpaz, Michal Shelef and Adi Cohen

The Haptic modality (Lederman & Klatzky, 1999)

- Kinesthetic component (muscles, joints).

- Cutaneous (skin) component.

  – Mechanoreceptors: Merkel receptor, Meissner corpuscle, Ruffini cylinder and Pacinian corpuscle

  – Vibration, Roughness, Compliance, Pain and Temperature

  – Extensively investigated by Verrillo, Gescheider and Bolanowski (mid 20th century); and by Lederman and Klatzky (end of the 20th century).

- Psychophysics of Haptic VR

    – Wang, Turner, Perrin and Hewitt (2006).

    – Hilsenrat and Reiner (In Preparation).

Haptic VR device – the PHANTOM

The research vision

- Vibration, roughness, and compliance.

- The aim: To identify effective training methods in terms of sensitivity, response bias and magnitude estimation.

- To evaluate their generalization from the virtual to the real world.

- For the beginning – characterize the psychophysics of the haptic VR

Initial Experiments

- Psychophysics of Vibration detection

- SDT parameters (d', β)

- Vibration parameters:

  – Frequencies: 40, 120 Hz

  – Amplitudes: 0.001-0.045 Newton

- Practice ranged from 400 trials (2 days) to 600 trials (5 days)

Findings

- Effective amplitude range (for 40Hz): 0.01-0.03 N.

- There is a small improvement in d′ after practice.

- In mixed sessions there is a change in β as well.

Summary

- Haptic VR is an important part of the demonstrators, especially in the Surgery and Rehabilitation domain.

- Our study should provide guidelines for the specific demonstrator development, but also more general results on what haptic properties can be trained in VR and applied to real-world situations.

Thank you!

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