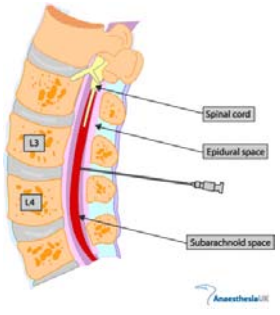
The design and development of a simulation-supported medical training system

Erik Lovquist,
Interaction Design Centre, Ireland

Spinal anesthesia – Can we improve how it is taught?



Collaboration with Cork University Hospital (CUH)

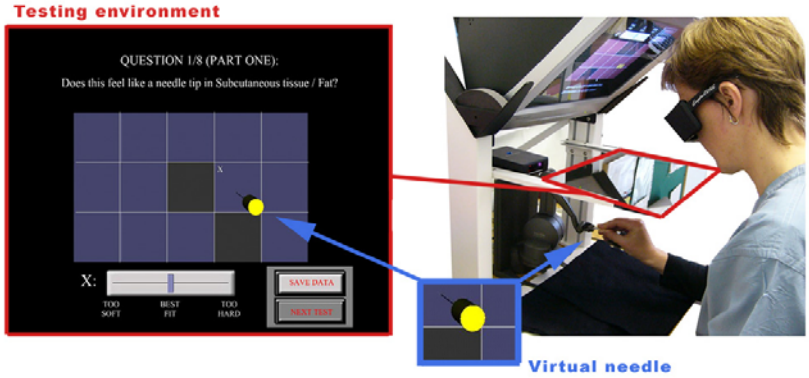
Determinant study – to understand the problem and the domain

- Learning related:
  - Recognition of certain characteristic *sensations* as spinal anesthesia is performed
  - Ability to *visualise* the relevant anatomy
- Teaching related:
  - An explicit knowledge program for the procedure
  - A case-based learning program
  - A valid, reliable competence assessment procedure

Identification of technology for simulating the procedure

- Initial focus on the learning aspects
  - Haptic technology
  - 3D Visualisations

Modeling of sensations

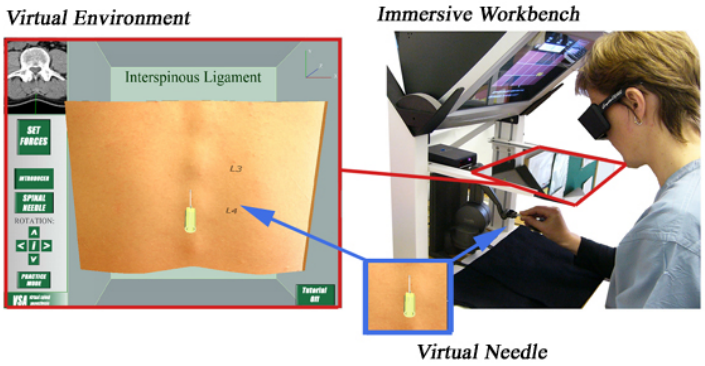


- Medical experts were recruited to rate sensations associated with spinal anaesthesia

Results from study

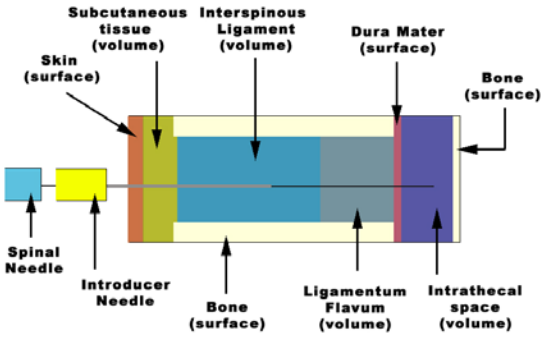
- Confirmed that the system was able to reproduce the relevant sensations
- A better of understanding of the perception of the medical experts
- A set of values was acquired to be used in a human tissue model (representation) => a simulation of the procedure

Using the initial model



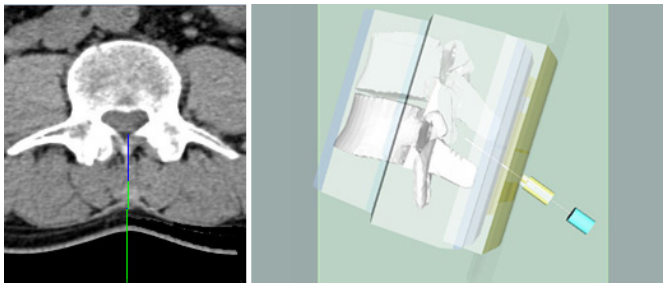
- The haptic arm controls the needles
- Each layer of tissue have different resistance
- The anatomy can be rotated for enhanced learning

Human tissue modeling



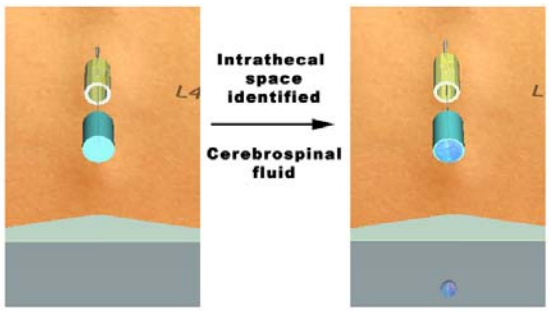
- A human tisssue model was developed to reproduce the actual sensations of performing spinal anaesthesia
- The model has been verified with medical experts and is believed to be very accurate

Visualisations



- Real-time 2D and 3D visualisations are used
- The learner can place the needles and then view how the needle was placed and from that create a mental model of the procedure

Visualisations



- The simulator incorporates displaying cerebrospinal fluid appearing at the end of the spinal needle (which is key to the success of the procedure).

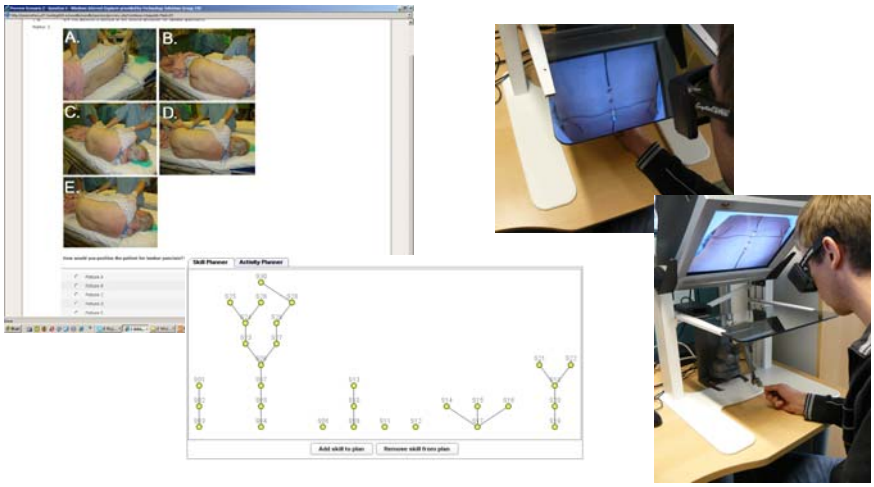
Initial face validity testing with medical experts:

- A few quotes:
  - “The different layers of feel I think is very accurate”
  - “I think it's a great tool”
  - “That you can get a 3 dimensional view (with the stereoscopic display) of the back is very good”
- However, studies have to be performed to show how performance transfers to the clinical setting

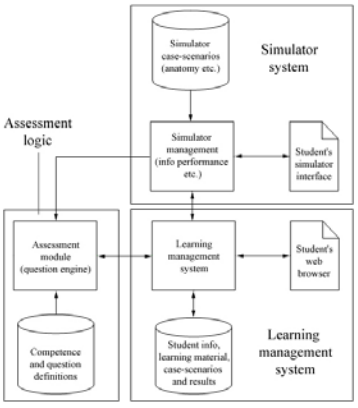
Expanding the representation

- Learning aspects have been covered, but remember the teaching related criteria!
  - An explicit knowledge program for the procedure
  - A case-based learning program
  - Competence assessment procedure

A competence assessment procedure for spinal anesthesia



Simulator-supported assessment procedure



Other uses of haptic technology

- Teaching:

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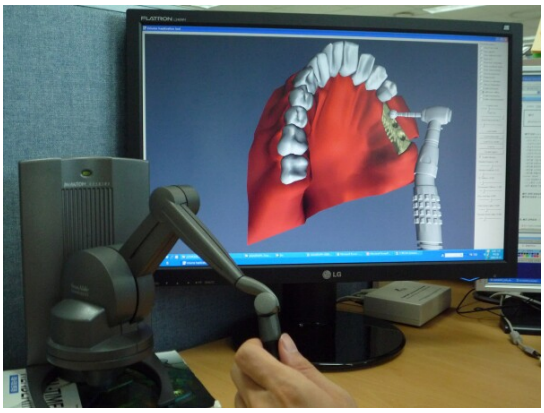
Other uses of haptic technology

- Dental:



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Other uses of haptic technology

- Surgery:
  - Arthroscopic Shoulder/Knee Surgery

Other uses of haptic technology

- Rehabilitation:

Other uses of haptic technology

- Entertainment: www.novint.com