Case Study: Virtual and Augmented Reality for Medical Education & Training

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Traditional Medical Training (Lectures and Manikins)

- photos, atlas, movies, cadavers, animations, real patients, actors, models (manikins)
- pressure sensors, motor actuators

- A real-time adjusted projection of internal organs onto human-shaped surface.
- Both the viewer's head and the manikin object are tracked in real time, which allows students to handle the display and examine it from different angles.
Hand Calibration in 2008

Hand calibration is performed for each new user, after he or she puts on the gloves and straps the motion sensors onto them. During calibration, users are asked to put their hands in a “praying” position and keep them in this pose for 5s.

Hand Alignment in 2008

- The transmitter is placed under the examination table.
- In order to align the hands with the manikin model, the user must touch a dedicated spot on the manikin surface with one of the motion sensors, making a physical contact.
- At medical simulation workshop held in Singapore Medical Training Institute, April 16th, 2008.
- A young cadet is performing percussion of Anne Torso manikin, searching for sore spots.
Experiences Using Augmented Reality Environment for Training and Evaluating Medical Students (2013)

- **Motivation**
  - high-end manikins are too expensive
- **Their approach (ARLIST)**
  - Built on conventional manikins, used in cloth shops
  - Facial expressions are projected on a mask placed on the manikin face
  - When the student plugs the stethoscope on a connector, the system plays sound.
- **Evaluation**
  - Three editions of the Selection Exam
  - 450 users at local Brazil hospital

Visuo-Haptic Augmented Reality Runtime Environment for Medical Training (ISMAR 2013 Doctoral Symposium)

- [www.magicvisionlab.com](http://www.magicvisionlab.com)
- **Research Questions**
  - What are measurable benefits of applications with VHAR user interfaces in general, and specifically for medical training simulators?

Video See Through AR Head-Mounted Display for Medical Procedures (ISMAR 2014 DS)

- Technical
  - Increase accuracy and robustness of the tracking methods
  - Advancements in marker detection
    - Modifying the chromatic properties of the marker
    - Environment lighting
    - Adaptive color segmentation with dynamic thresholds
    - Fluorescent dyes
- Clinical Studies


Touch Sensing on Non-Parametric Rear-Projection Surfaces: A Physical-Virtual Head for Hands-On Healthcare Training (VR 15, UCF)

- Advisor: Greg Welch, UNC, then Florida
- Color checkerboard + 123D Catch for 3D model reconstruction
  - Simplification: Edge flow topology
- Touch
  - Captured by cameras,
- Evaluation by projection error by 600+ touches

Superman-Like X-Ray Vision: Towards Brain-Computer Interfaces for Medical Augmented Reality (ISMAR 12 Poster)

- Integrated a BCI device and a gaze-tracker into two medical AR systems
- The Neural Impulse Actuator (NIA, 250$ used on Amazon) is a head-band that can read bioelectric signals
  - Not to use alpha & beta waves due to long learning phase
  - Electromyographic (EMG), learnt from muscle tension, triggered by raising the eyebrows.
- Eye-tracker: Tobii X60
- User study with 9 people to prove BCI is better. Not very convincing

Relevance-based blending of Xray with video
Magic Mirror - Anatomy Learning

BodyVis: A New Approach to Body Learning Through Wearable Sensing and Visualization

Augmented Reality in the Operating Room

Telepresence for Medical Surgery, Training, and Telemedicine
VR for Therapy

https://www.youtube.com/watch?v=jNlqyyypojg