Human Safety
Virtual Surgery
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No disclosures
Collaborating Hospitals:
Beth Israel Deaconess Medical Center (MA)
Massachusetts General Hospital (MA)
Cambridge Health Alliance (MA)
Mount Auburn Hospital (MA)
Tufts University (MA)
Yale University Medical School (CT)
University at Buffalo (NY)
Baylor University Medical Center (TX)
University of Texas Southwestern Medical Center (TX)
University of Texas San Antonio (TX)

Academic Collaborators:
Harvard Medical School
University at Buffalo
Wright State University
University of Central Arkansas

Industrial Partners:
Kitware
Simquest
CFDRC
Infocitex
Charles River Analytics
Surgery is a complex task performed in a complex environment
To Err is Human

98,000 Americans die per year of medical errors [Institute of Medicine, 1999]

Causes of death in the US, 2013

source: http://www.cdc.gov
Knowledge-based (KB) errors:
- Decision making
- Problem solving

Rule based (RB) errors:
- Wrong rule
- Misapplication of correct rule
- Non-compliance with rule

Rasmussen’s Skill-Rule-Knowledge (SRK) Framework
“See one, do one, teach one”

Challenges of the residency model:
- Patient safety
- Complex cases
- High cost ~ $50K/year/trainee
- Subjective assessment
- Reduced patient contact
  - 80 hour work week
  - Increased malpractice liability
  - Reduced hospital stays

"The Agnew Clinic" Thomas Eakins, 1889
The Human Safety Framework

1) Individual patient/operator/user
2) Provider
3) Tools, Smart instrumentation
4) Team
5) System
6) Population
7) Disease level/injury level
8) Data and information sharing
Virtual Surgery

Immersion

Interaction

Imagination

Rensselaer

why not change the world?
Towards immersive virtual reality (iVR): a route to surgical expertise

Saurabh Dargar, Rebecca Kennedy, WeiXuan Lai, Venkata Arikatla and Suvranu De*
Grand Challenges of Engineering

Enhance Virtual Reality

“True virtual reality creates the illusion of actually being in a difference space. It can be used for training, treatment, and communication”
Technical Challenges

Interactivity
Real time graphics (min 30 frames/sec)
Real-time haptics (min 1000 frames/sec)

High fidelity
Multi-physics
Multi-phase
Multi-scale
Thank you!