



Rensselaer

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

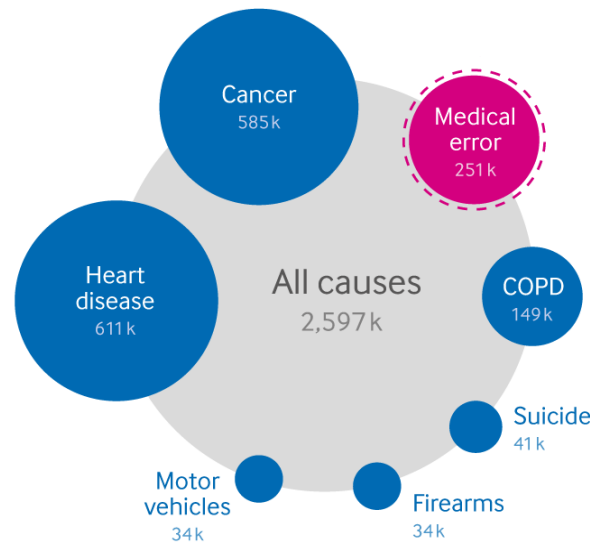




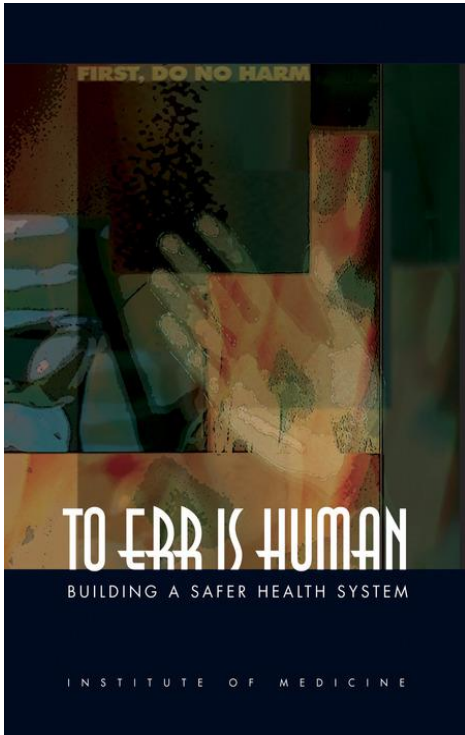
Surgery is a complex task performed in a complex environment

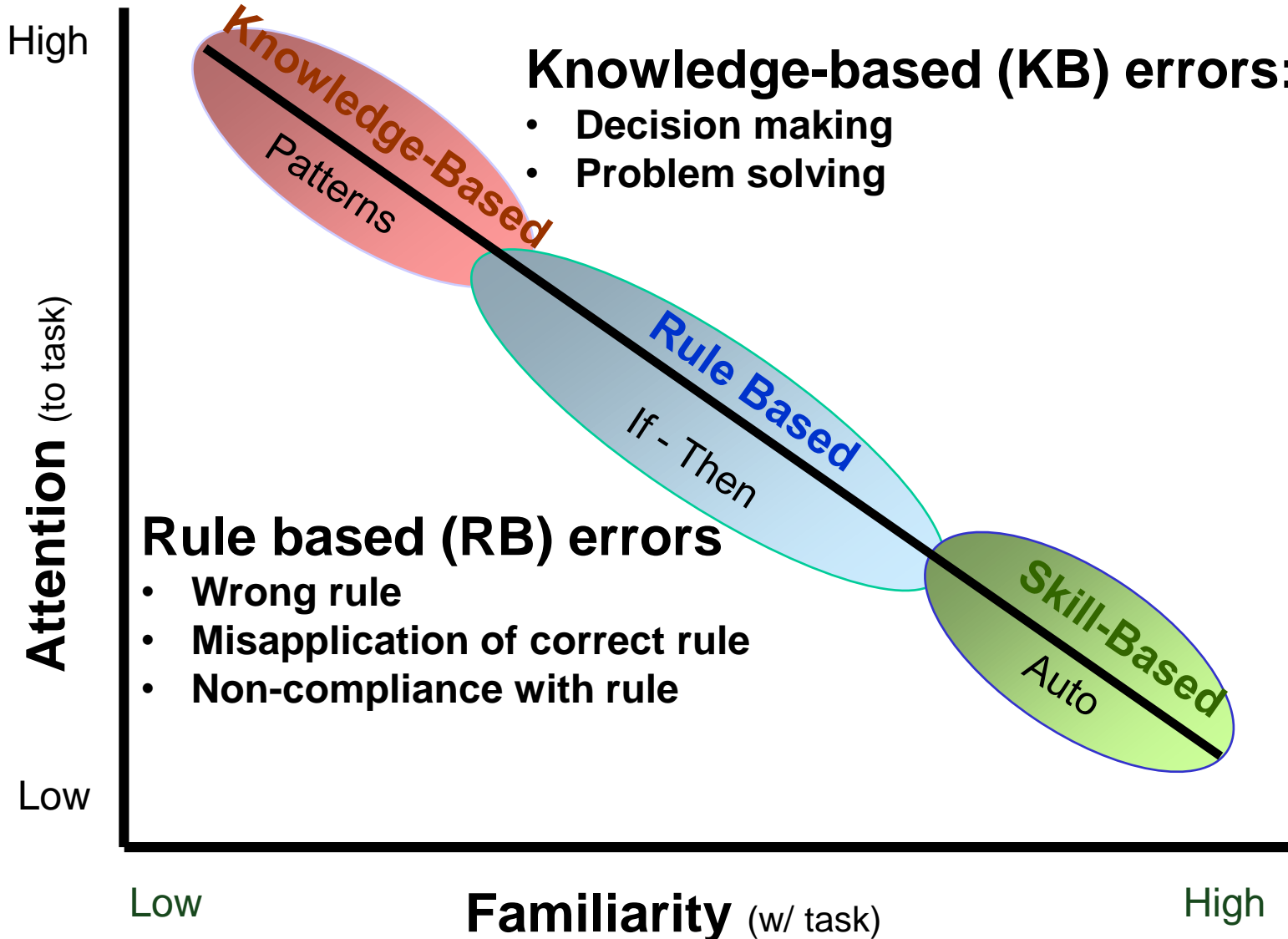
98,000 Americans die per year of medical errors [Institute of Medicine, 1999]

Causes of death in the US, 2013



source: <http://www.cdc.gov>





Rasmussen's Skill-Rule-Knowledge (SRK) Framework

“See one, do one, teach one”



"The Agnew Clinic" Thomas Eakins, 1889

Challenges of the residency model:

Patient safety

Complex cases

High cost ~ \$50K/year/trainee

Subjective assessment

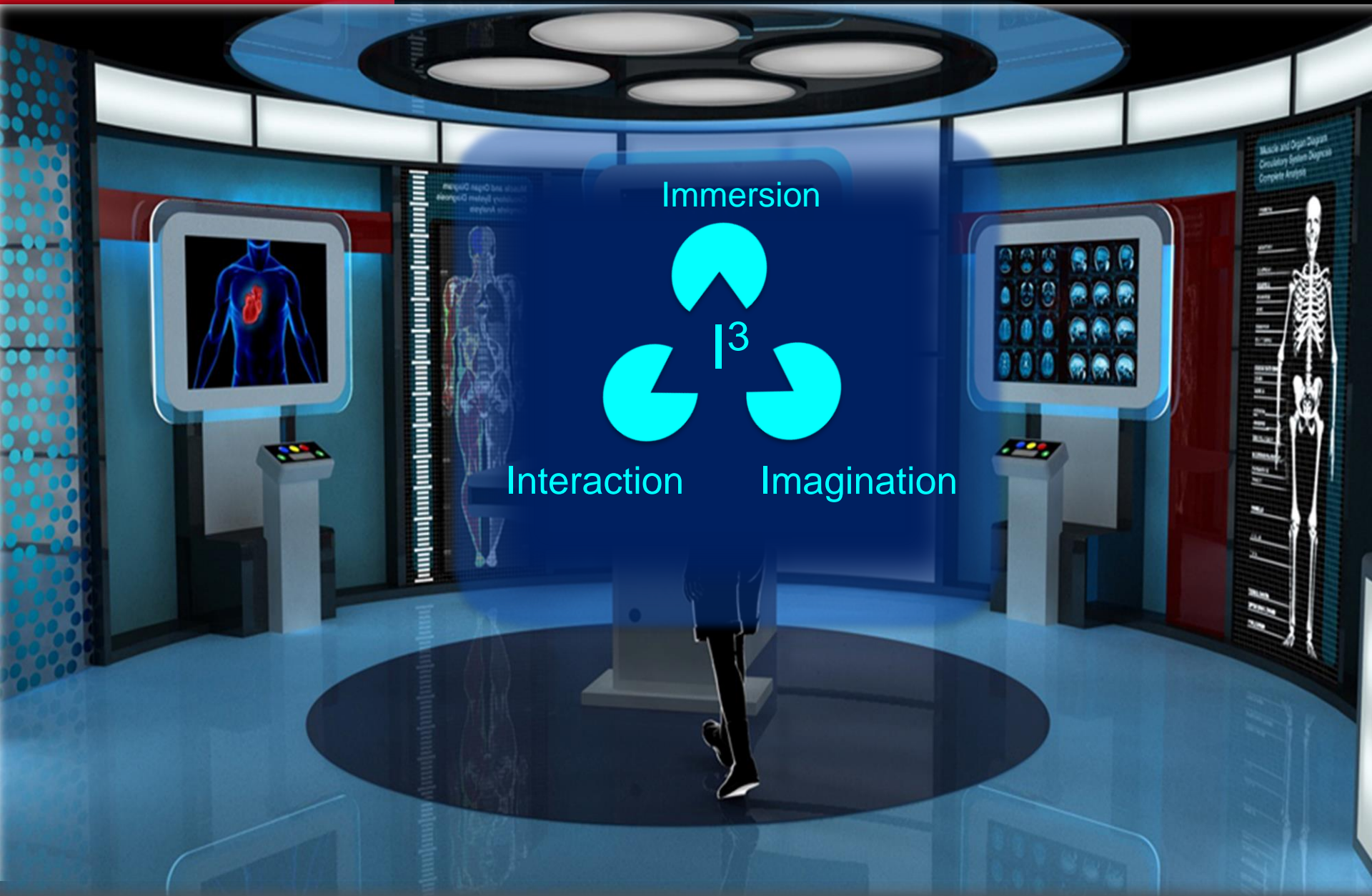
Reduced patient contact

- 80 hour work week
- Increased malpractice liability
- Reduced hospital stays

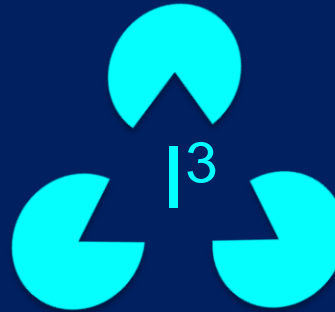


The Human Safety Framework

- 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



Immersion



Interaction

Imagination



Dargar et al. *Journal of Computational Surgery* (2015) 2:2
DOI 10.1186/s40244-015-0015-8

 **Journal of Computational Surgery**
a SpringerOpen Journal

REVIEW

Open Access

Towards immersive virtual reality (iVR): a route to surgical expertise

Saurabh Dargar, Rebecca Kennedy, WeiXuan Lai, Venkata Arikatla and Suvaranu De*



- High fidelity
- Risk-free
- Rare conditions
- Objective evaluation



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”

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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!



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