Human Patient Simulators

A Human Factors Research Tool in Patient Safety

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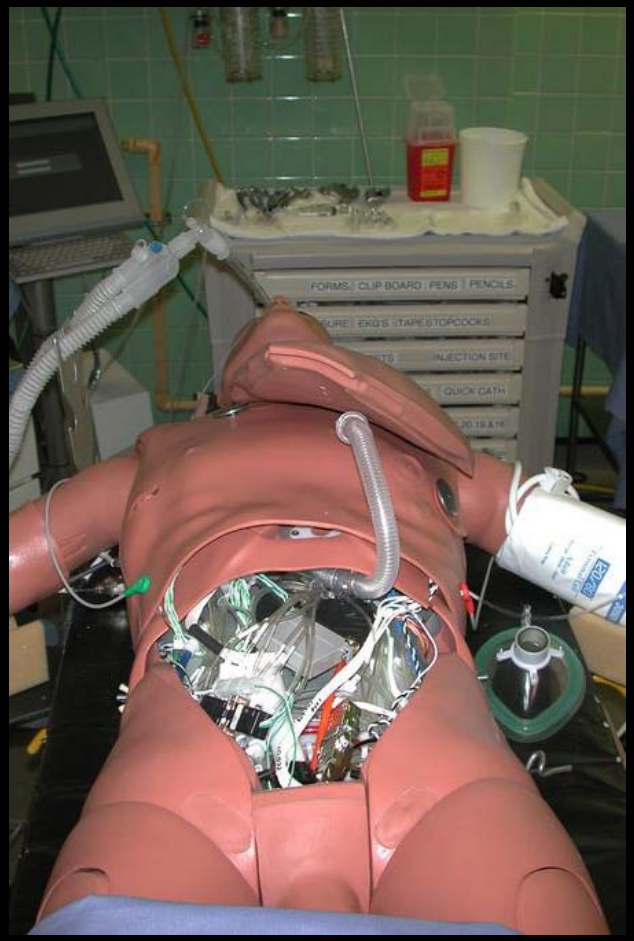
Benefits of Human Patient Simulators

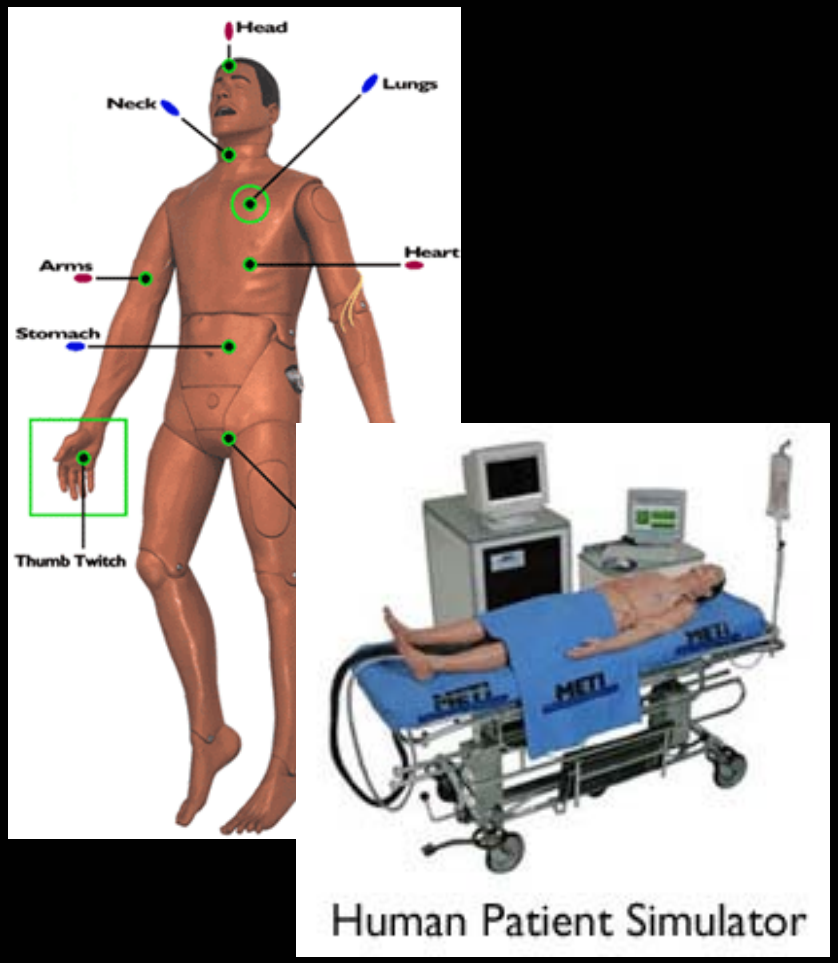
- Train and practice without risk
- Practice uncommon but critical scenarios
- Allow errors to occur and reach their conclusion
- Evaluate and train interpersonal relationships
- Test limitations of human-machine interface
- Evaluate equipment and procedures without risk

Human Simulator Development



- Began with anesthesia
- Collaborative efforts between academia and industry
- Recent advancements spurred on by IOM reports

High Fidelity Human Patient Simulators



- Mannequins
- Supporting Computers
- Basic Patients
- Basic Scenarios
- Control the Clinical Environment
- Simulate Rare Events or Combination of Events

Standard Patients / Scenarios

- Standard Man
- Orthostatic Granny
- Soldier
- Truck Driver
- Stannette
- Sam Brien

- Anesthesia Scenarios
- Medical Scenarios
- OB Scenarios
- Surgical Scenarios
- ACLS Scenarios
- Trauma Scenarios

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Simulation Room

- Operating Room
- Intensive Care Unit
- Emergency Room Bay
- Floor Bed
- Clinic Locations
- EMT (Trauma Site, etc)

AudioVisual Equipment

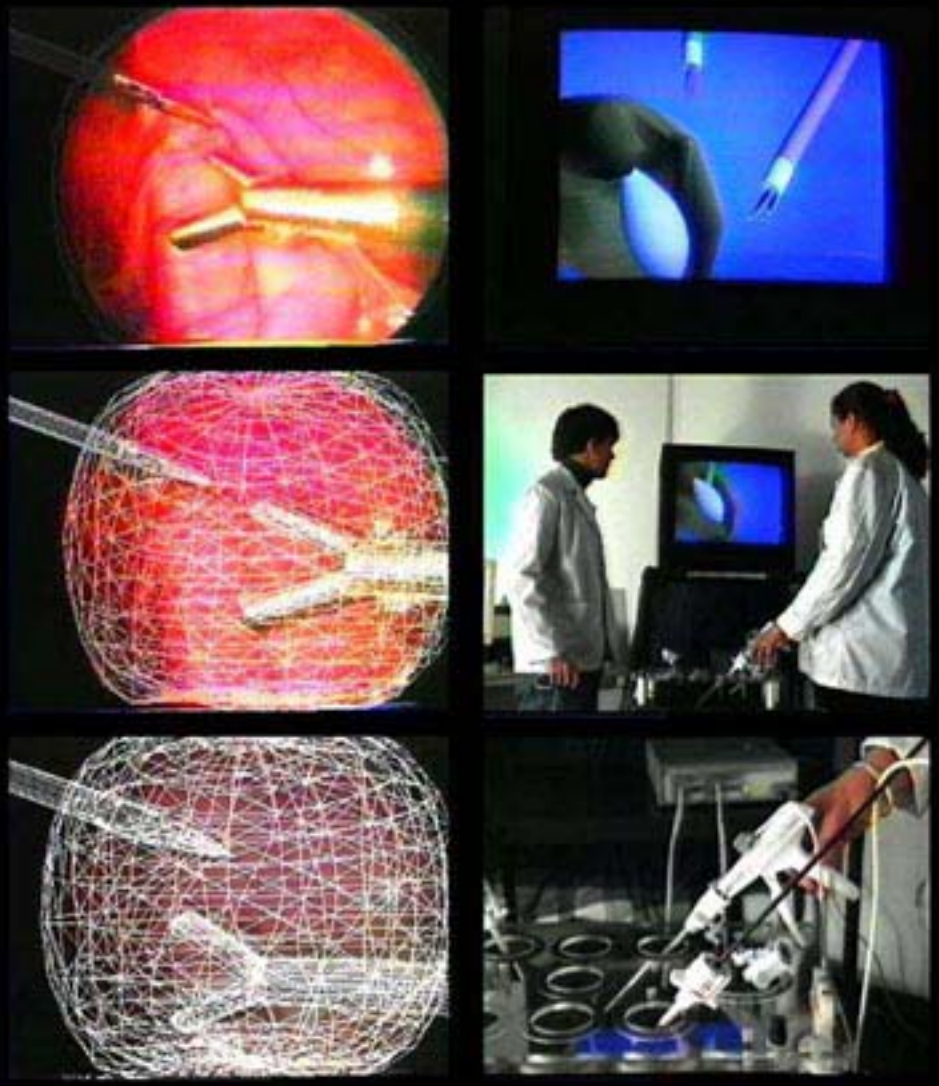
- Computer Controlled Cameras
- Complex Audio / Video Capture and Editing
- Smart Board
- State-of-the-Art multimedia classroom

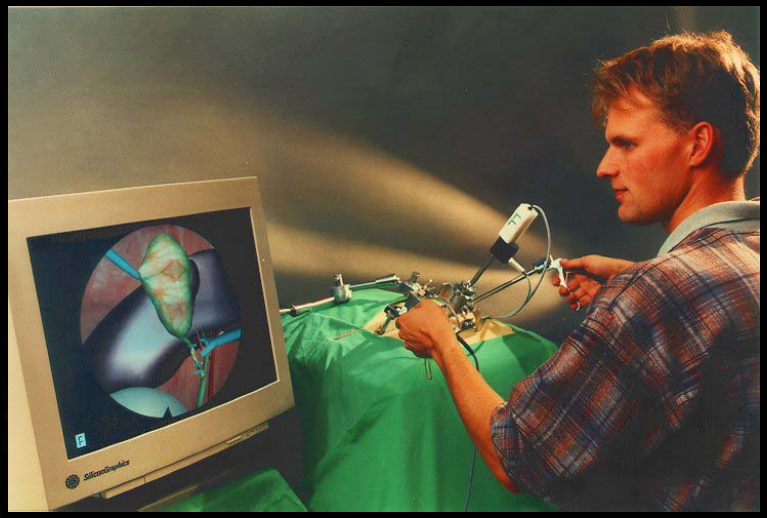
Immersion-Bronchoscopic Tutor

Immersion

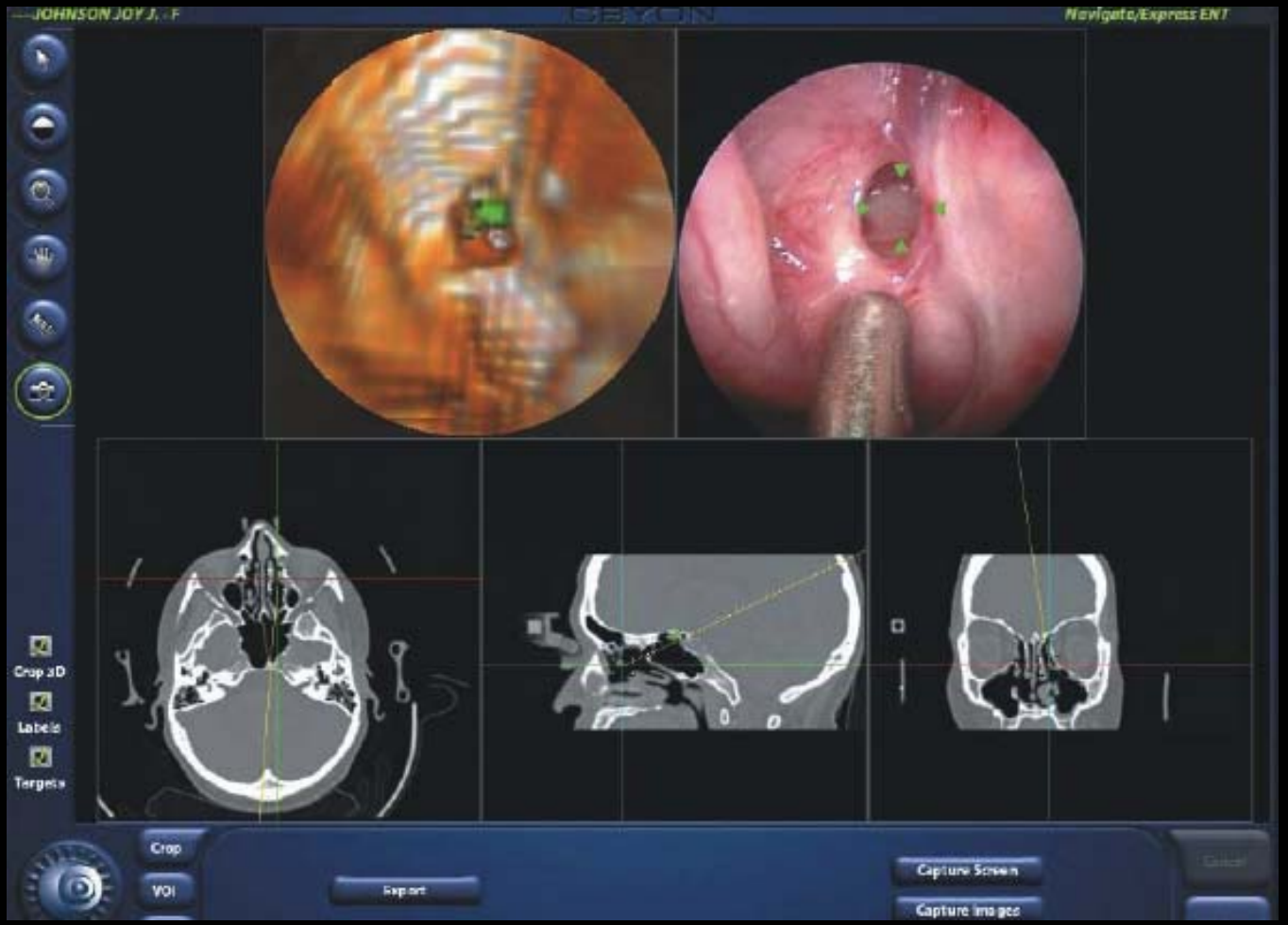
http://www.immersion.com/

Virtual Reality Surgery





Realism: CBYON



Video Clip

Simulators in Medical Training

- Used commonly for training
- Research supports training benefits, but limited
  - Difficulty defining objective measures and control conditions for fair comparisons
  - Compelling benefits limit desire for control conditions

"…no industry in which human lives depend on skilled performance has waited for unequivocal proof of the benefits of simulation before embracing it."

- David Gaba, M.D.

Simulators in Medical Performance Assessment

- Less commonly used for assessment compared to training
- Measures
  - Observer ratings
  - Written tests
  - Observed errors
  - Objective measures of simulator response
- Evidence of correlation with traditional assessment measures (Schwid et al., 2002)
- Medical certification in simulators coming soon

Human Factors Research using Human Patient Simulators

- Display evaluations (Zhang et al., 2002; Syroid et al., 2002)
- Drug delivery system (Merry et al., 2002)
- Cognitive modeling of ventilation related events (Sowb & Loeb, 2002)
- Usability testing for the development of new medical equipment design

Challenges

- Cost
- Complexity of medical environment and human patients
- Accuracy of patient models
- Completeness of patient models
- Development of objective measures
  - No one correct response
  - Numbers needed to observe errors
  - Time consuming observational methods
  - Objective measure directly from the simulator

Solutions and Future Directions

- Community efforts to improve patient models (SimDOT, Medical-SimL)
- Build on human factors research in other domains
  - Measures of situation awareness (Endsley, 1995)
  - Further development of physically observable and quantifiable errors (Seymour et al., 2002)
- Systems approach
  - To manage complexity
  - Not just an equipment evaluation tool – useful for early analysis and design phases such as cognitive task analysis

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