Technology Development Implications

Alan Liu

Director – Virtual Medical Environments
National Capital Area Medical Simulation Center
www.simcen.usuhs.mil

Overview

- A summary of initiatives
- Categories of simulation
- Simulation objectives
  - Current state
  - What's missing
  - Trends
- Summary and Conclusion

ACS Surgical Skills Curriculum/Plastic Surgery Training

- Dexterous skills
- Didactic material
- Community/group learning
- Standardized curriculum
- Metrics
- Procedural skills
- Team training

Military Medical Simulation

- Training requirements range across entire continuum of care
- Sustainment training
  - Redeployment
  - Transition into military (e.g. Army Reserve and National Guard)
  - Transition out of military

Simulation Technology

- Broadly categorized into
  - Patient Actors
  - Low Fidelity Trainers
  - Human Patient Simulators
  - Computer-Based Trainers
  - Immersive Training Environments

Patient Actors

- Individuals with training suitable for specific medical scenario

Low Fidelity Trainers

- Training devices that use substitute tasks to develop relevant motor skills
  - E.g., Dexterity Peg Board in FLS trainer
- Training devices that develop motor skills using materials that crudely approximate anatomy
  - E.g., part task trainers

Human Patient Simulators

- Whole body mannequins with integrated mechanical and electronic components to simulate physiological signs
- Often incorporates human physiological models of varying sophistication

Computer-based Trainers

- "Virtual" patient generated by 3D computer modeling
  - Accurate and varied anatomy
- Physiological modeling
- Incorporates potential for performance measurement

Immersive Training Environments

- Replicate operational environment of medical team
  - Operating Room
  - First responder
  - Mass casualty
  - Triage

Simulation Goals

- Task Training
- Procedure Training
- Team Training

Task Training

- Supported by
  - Patient Actors
  - Low fidelity trainers
  - Human Patient Simulators
  - Computer-based Trainers

Current status

Significant Advances

- Acceptance of simulation
- Integration into curriculum
- Standardization

Procedure Training

- Supported by
  - Patient actors
  - Human patient simulators
  - Computer-based trainers
- Move toward development of cognitive skills

Current Status

Cognitive Skills Development

What's missing?

- Separation of dexterous skills from cognitive skills development
  - Can this be done?
- Case bank creation

Orthogonal Training

- Motor skills trained independently of cognitive skills
- Breakdown procedures into sequence of tasks trainers
- Train decision making skills separately
- Testing vs. assessment simulators

DPL trainer

- Simple motor skills component
  - Seldinger technique
- Complex cognitive skills

Case Bank

- Variability is crucial to learning new procedures
- Ease of content creation
- Research on rule-base case creation

Team Training

- Emphasis on team dynamics
- Supported by
  - Patient Actors
  - Low Fidelity Trainers
  - Human Patient Simulators
  - Immersive Training Environments

Current Status

Problems That Need to be Addressed

- Physical presence is required
- Elaborate/extensive logistics support
- Repeatability

Physical Presence

- Flatland (U. of New Mexico)
  - Distributed team training (headmount based)
- Virtual Emergency Department (Forterra, SUMMIT)
  - Distributed team training (screen based)
- WAVE (SimCen)
  - Fully immersive environment

Support Infrastructure

- Virtual worlds
  - Flatland (U of New Mexico)
  - Flatworld (Inst. for Creative Technologies)
  - WAVE (SimCen)
- Virtual OR (Old Dominion U)
- Avatars
- Natural Language processing

Repeatability

Summary

- Initiatives
  - Civilian
  - Military
- Simulation technology categories
- Simulation objectives
  - State of the art
  - What's missing?
  - Areas of focus