Medical Applications of VR

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HIT Lab Medical Projects

- broad spectrum of medical applications
  - tools for clinical practice
  - medical informatics
  - therapeutic VR/AR
  - surgical simulation
- www.hitl.washington.edu
- Medicine Meets VR (www.amainc.com)
Virtual Retinal Display

- high resolution
- bright enough for see-through display
- small “exit pupil” produces long depth of focus

Optical Tools for Medicine

- True 3D display (Furness/Seibel)
- scanned fiber endoscope (Seibel)
- optical tomography (Seibel)
Medical Informatics

- virtual ER
- distributed tumor board
- virtual anatomy browser (Campbell)
Therapeutic Uses of VR

- pain distraction
- phobia desensitization
- perceptual prosthesis (e.g. Parkinson’s Disease)

Meredith Bricken, 1990

Parkinson’s Disease

Kinesia Paradoxa
- objects/lines in the subject’s path
- transverse lines spaced about one stride-length apart work best
- learning/imagining cues doesn’t work

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Virtual Vision Sport

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Surgical Simulation

- suturing simulation using FFE (fast finite element) methods
- ESS (endoscopic sinus surgery) simulator
- TURP (trans-urethral resection of the prostate) simulator

Why Surgical Simulation?

- training
- credentialing
- planning and rehearsal
- telesurgery/OR of the future

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See One, Do One, Teach one

Once is Not Enough
Big Questions

• What is the objective of the simulation?
• What do you need to simulate to achieve the objective?

Core Design Issues

• anatomical detail
• graphical realism
• haptic realism
• instrumental realism
• bells and whistles
• user (proctor) interface
• validation
Anatomical Detail

Graphical Realism

- **in-vivo**
- **in-vitro**

Type 1  Type 2  Type 3
Haptic Realism

Instrumental Realism
Bells and Whistles

- OR sounds
- speech input
- intelligent agents
- training aids

System Integration
Proctor Interface

Simulator Validation

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Simulator Validation

Collaborators

HIT Lab
- Peter Oppenheimer
- Jeff Berkley
- Chris Airola
- Duff Hendrickson
- Tim Kowalewsky

UW School of Medicine
- Rob Sweet, Jim Porter (Urology)
- Dan Berg, Greg Raugi (Dermatological Surgery)
- Mika Sinanan (Surgery/CVES)

Others
- Chuck Edmond (Madigan Army Hospital - ENT)
- Marvin Fried (Montefiore Hospital - ENT)
- Rick Satava (Yale Medical School - Surgery)
- George Turkiyyah (Civil Engineering)
- Mark Ganter (Mechanical Engineering)
Thank You