Computer Games and Virtual Environments for Medical Education and Research

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Overview

- Background motivation
- Innovations in Medical Education: *Some ideas*
  - Clinical practice
  - Basic science and translation into clinical practice
  - Collaborative experience technologies
- Medical Education Platforms
- Funding partnership opportunities: *some ideas*

Motivation

What are we interested in doing?

- *Empirical research* and *technology prototyping* of computer games/virtual worlds (CGVWs) that support challenge problems in science, health care, medical education, and more
- Collaborate with academic partners and external R&D sponsors
- Engage in high risk, adventuresome research projects
  - *Game-Based Telerehabilitation for Stroke Patients*

Advanced training center concept using low-cost Virtual World technology

Game-based VW simulator interfaces for immersive *medical education*: a spectrum of *cost* vs *realism*

- Virtual humans (game-based)
- Animal surrogates (surgical pigs)
- Cadavers
- Manikins
- Human subjects

$500 vs. $5000 vs. $50,000 vs. $500,000 vs. $5,000,000

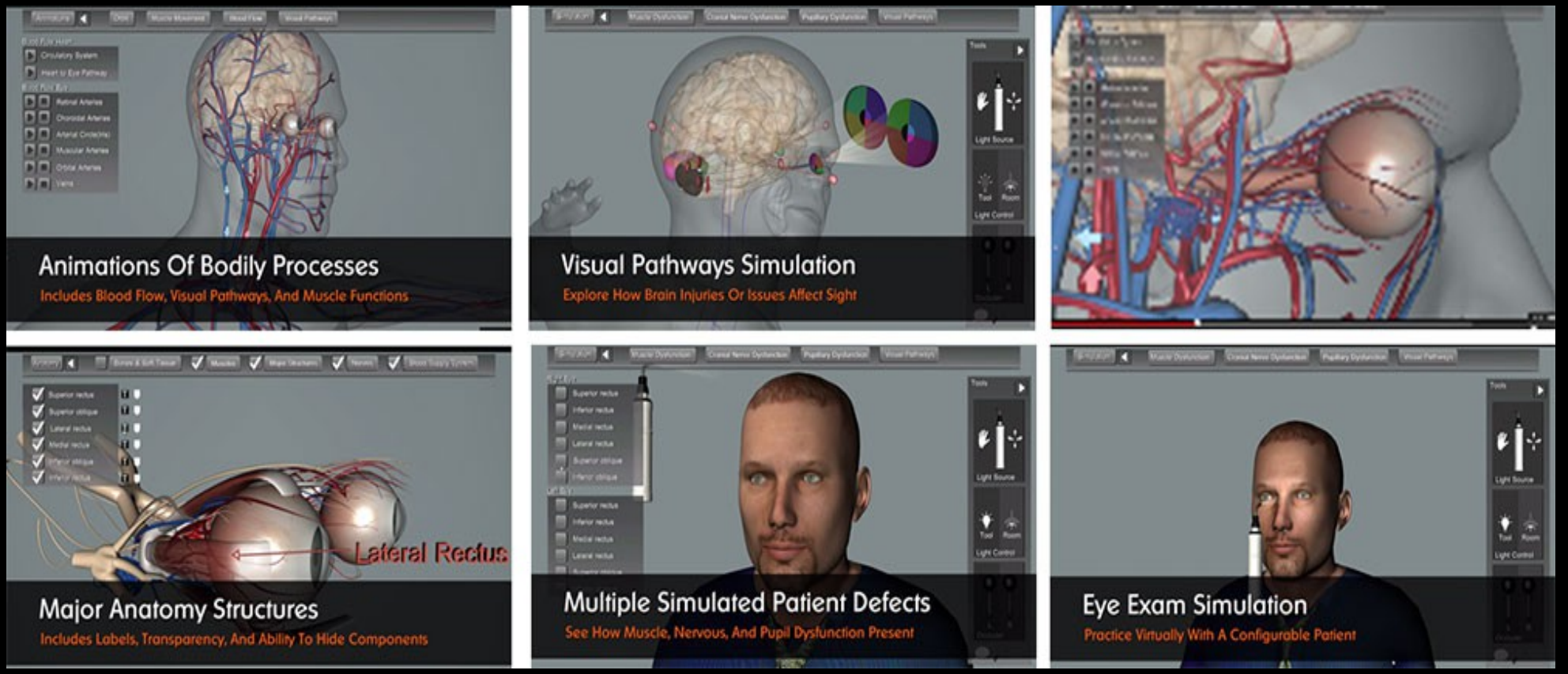
Game-based VW simulator interfaces for immersive *motorsports racing experiences*: a spectrum of *cost* vs *realism*

$500 vs. $5000 vs. $50,000 vs. $500,000 vs. $5,000,000

Game-based VW simulator interfaces for immersive *medical education*: *low-cost* vs *realism?*

Virtual human in *Surgeon Simulator 2014* (iPad/PC *game*)

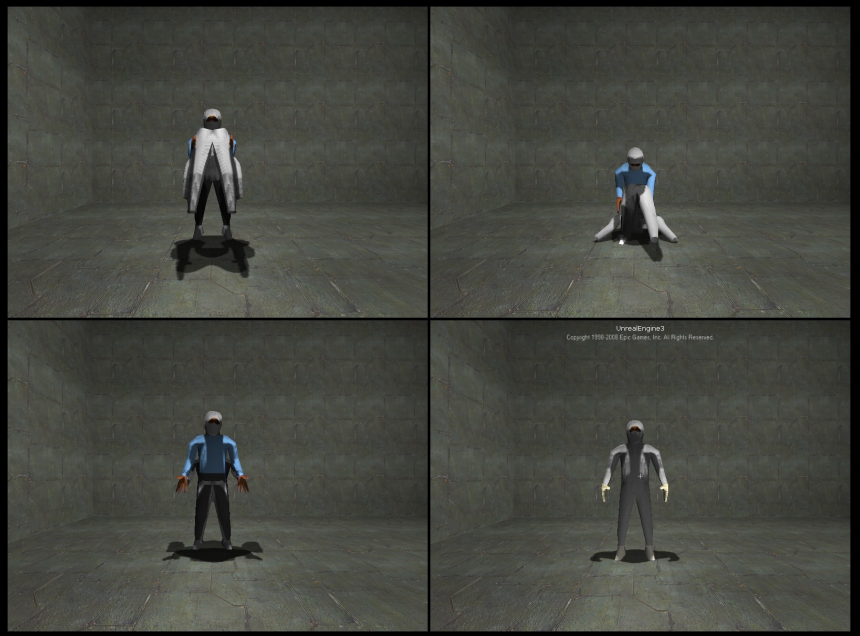
Commercial, high fidelity virtual anatomical training systems



Commercial, high fidelity virtual clinical laboratory training systems

Commercial, virtual medical clinic simulator

Avatar-based training of “gowning processes” for clean rooms, biohazards, or surgical preparation



Human-avatar verisimilitude

- Virtual human avatars can enable low-cost, high fidelity medical education experiences
  - Assumes avatars can enact "intelligent behaviors" (pre-programmed or scripted)
- Student can interact with avatars in different roles, both individually and in groups/teams.
  - Student::patient
  - Patient::family-member::physician
  - Surgical team
- Group/team interactions can be heterogeneous
  - *collaborative* or *in conflict*
  - *multi-site play* (home, school, distant locale, etc.)

Clinical education *platforms*

- Classrooms
- Teaching laboratories/facilities
- Clinics and hospital
- Mobile devices (tablet, PC, smartphone)
- Web (including medical social media)
- Cross-cultural centers
- VW medical clinics/hospitals

CGVW for Medical/Clinical Devices

- Diagnostics and (big) data analytics
- Patient sensing or monitoring
  - Mobile/remote patient (tele)monitoring
- Interventions
- Therapeutics
- Recovery and Rehabilitation
- Patient Care Device Education

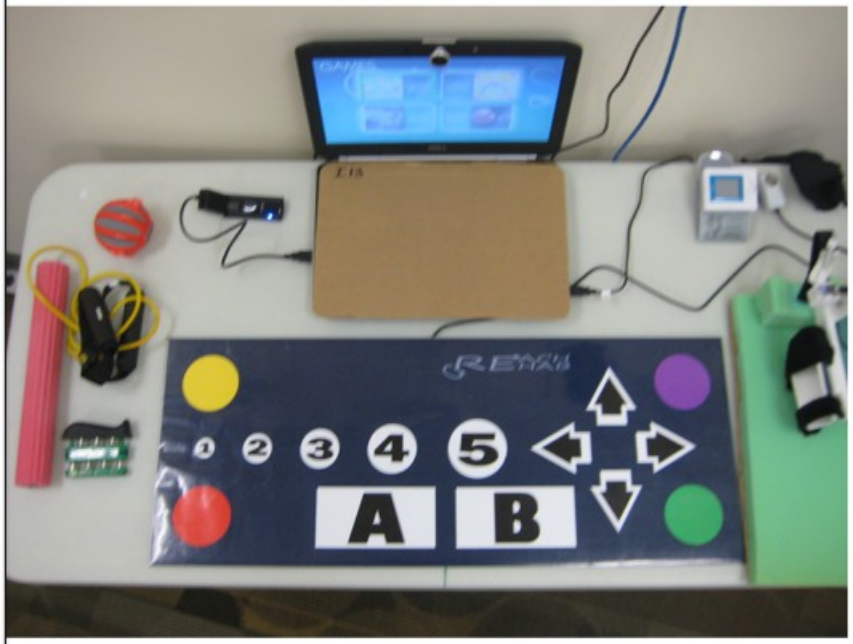
How best to provide education with complex intervention technology?

How best to provide care device education to patients?

Basic science and translation into clinical practice

- *Neurosciences*
  - Neurobiology and Behavior
  - Anatomy and Neurobiology
  - Neuro-rehabilitation
    - Game-based stroke telerehabilitation

Game-Based Telerehabilitation for Stroke Patients

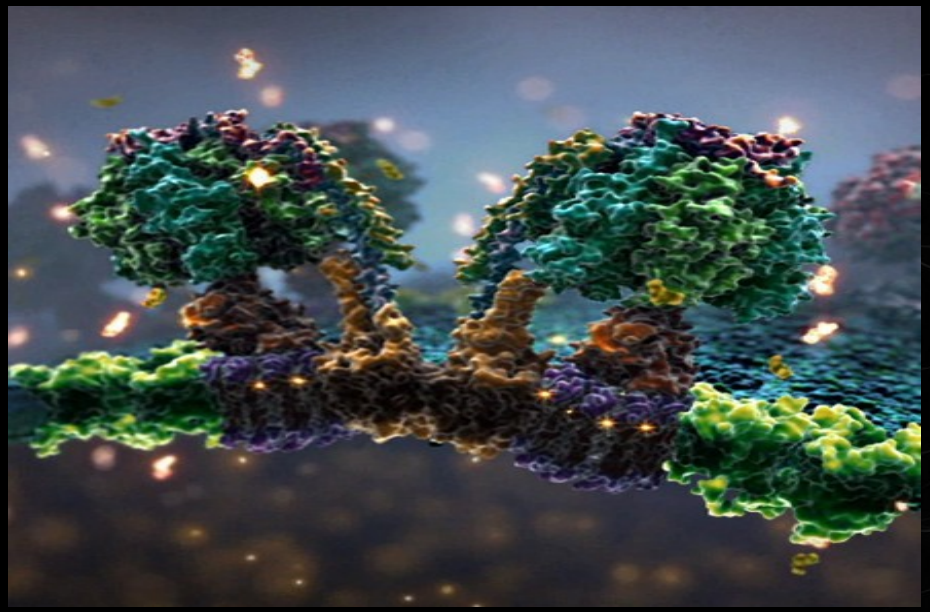


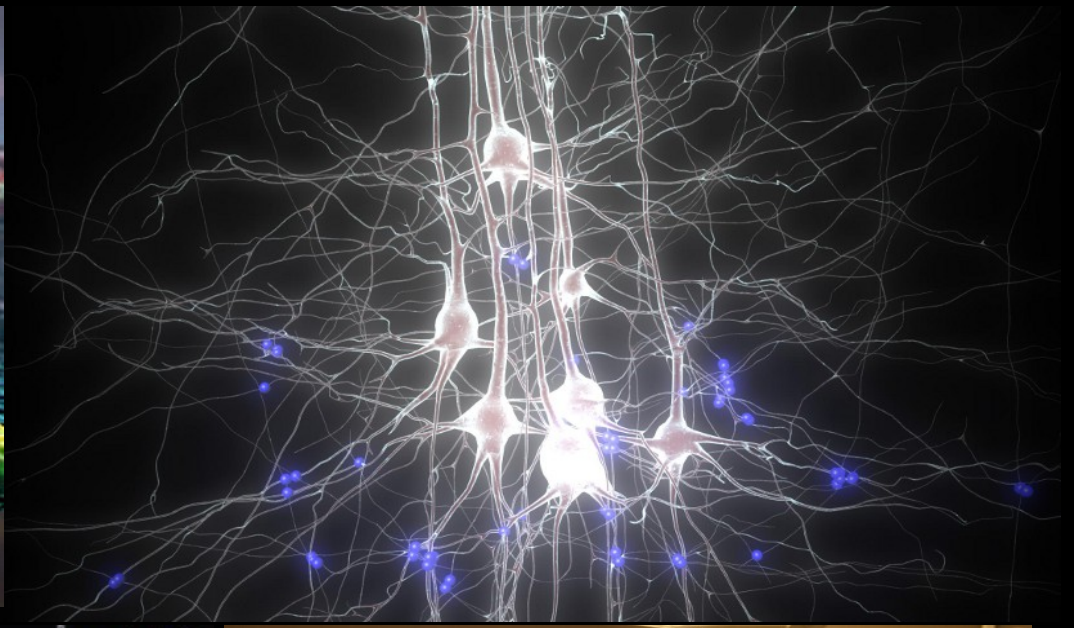
Telehealth system components

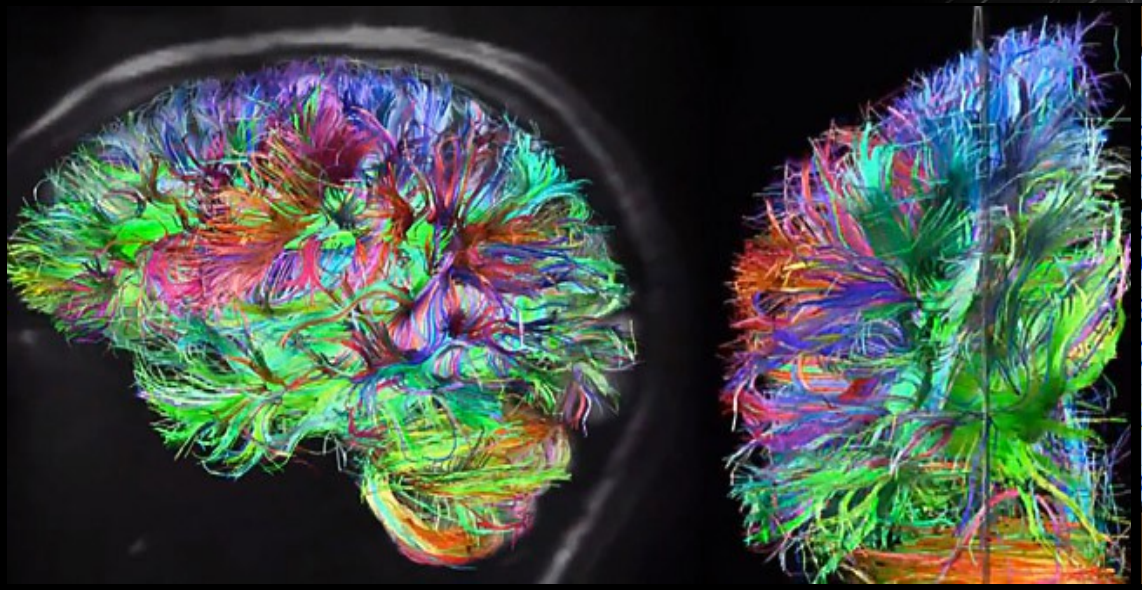
- Standard table and chair
- Dell laptop
- Verizon wireless card
- Blood pressure cuff (USB)
- USB-input devices to operate the system and to play rehab-related games

S. Cramer, *et al*. 2013

How best to design games for NeuroSciences?







Funding partnership opportunities: *some ideas*

- Government (NIH, DoD/Army)
- Foundations/Benefactors (TBD)
- Partnerships
  - Corporate
  - Startup venture
  - "Advanced licensing via joint partnership"
    - Global/cross-cultural joint MedEdu R&D
      - VW vendor + UCI + International partner(s)
        - Internationals: Korea, China, Middle East, etc.
        - 10+10+10 approach:
          - 5/10 yr investment; primary joint partners cross license results to secondary partners
        - UCI "10" from govt, benefactors, in-kind, SoM.