Virtual Reality Interface and Applications

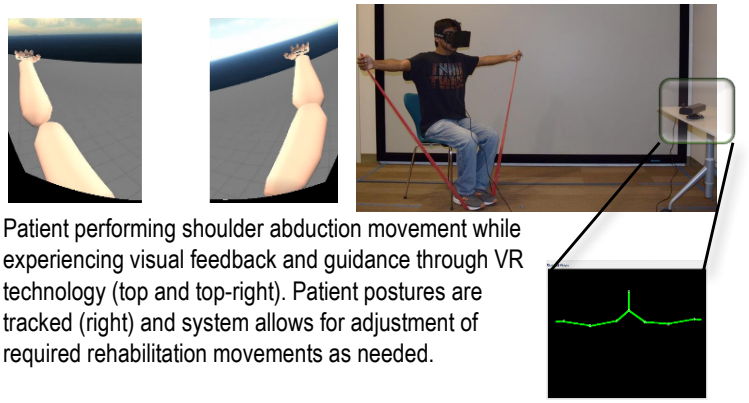
NC STATE UNIVERSITY

(Karen Chen; kbchen@ncsu.edu)

What is Virtual reality (VR)? – Computer-generated 3D graphical environment with programmability and high flexibility for applications and research.

Research Thrust 101 – VR Applications in Healthcare

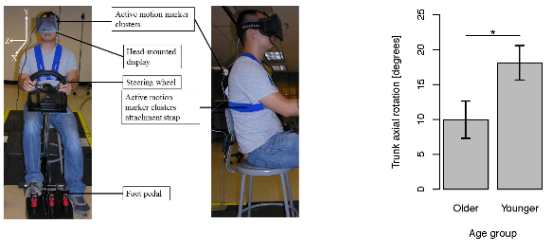
- Neck pain is common musculoskeletal problem; 16% of U.S. adults report neck pain in past 3 months
- Empirically assessed utility of VR for incentivizing chronic neck-pain patients to perform rehab exercises
- VR provides major opportunity for alternative healthcare delivery methods!



Patient performing shoulder abduction movement while experiencing visual feedback and guidance through VR technology (top and top-right). Patient postures are tracked (right) and system allows for adjustment of required rehabilitation movements as needed.

Research thrust 102 – VR Applications for Aging Population

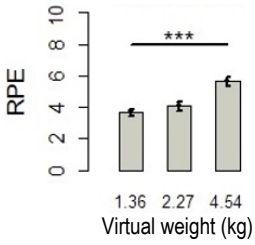
- Older adults "have places to be and people to see"; need access to individual transportation but data shows greater crash rates than young and middle-aged. How do older adults perform driving tasks? What is functional range of motion in driving?
- Used low-cost VR system to empirically study older and younger driver performance in simulated tasks



Participant experiencing driving scenario (top left). Results indicated overall (functional) range of motion of older adults is statistically significantly less than younger adults during driving task performance (top right). Need to address in vehicle design.

Research Thrust 201 – Augmenting the Human-VR Interface

- Primary mode of feedback in VR is visual and objects are "weightless"!
- Need to evoke sense of exertion (force) on VR objects
- Need to support user-object interaction without "artificial" controller
- Empirical study of participant muscle use in "lifting" virtual objects
- Realistic simulation led to participant feelings of exertion and signs of muscle fatigue!



Participants exerting forces to move virtual weights (far left and top). Bar graph shows participants subjectively experienced more exertion with "heavier virtual weight."

Industry Collaborators

Target: RTP companies with VR work (e.g., Lenovo; IBM - "Second Life"); VR manufacturers – Oculus Rift

Target Funding

- NSF CHS – Applied for grant to study human-computer interaction (Fall 2016)
- RISF - Applied for grant (Fall 2016)
- Private sector - John Deere (PI; $30k)
- NSF CAREER – Expected (Sum. 2017)

Outcomes

- 1 MS student (in progress)
- 1 undergrad student working on VR research
- VR review paper (to be submitted to journal by 2/28/17)