Introduction to Virtual Reality and Its Application in Rehabilitation

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Disclosures

- No personal disclosures

- The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of Brooke Army Medical Center, Navy Health Research Center, Walter Reed National Military Medical Center, Uniformed Services University of the Health Sciences, the U.S. Army Medical Department, the U.S. Army Office of the Surgeon General, the Department of the Army, the Department of the Navy, the Department of Defense, the Department of Veteran’s Affairs, or the U.S. Government.

- All person’s presented within have given their expressed written consent to be filmed and/or photographed.
“A **simulation** of a real world environment that is generated through computer software and is experienced by the user through a human-machine interface.”

- (Holden, 2005)

**VR**: Virtual Reality

**VRE**: Virtual Reality Environment

**VE**: Virtual Environment

Photo courtesy of the CFI MPL
**Live simulations**

- People interact with equipment and/or other people while performing activities in settings that simulate where they would operate for real.

[https://www.heart.org/](https://www.heart.org/)

Virtual simulations

- People interact with equipment and/or other people in a computer-controlled environment.

Photo courtesy of the CFI

**Type of Simulation**

**Serious Games**

- Commonly associated with electronic devices and software that people interact with for the purpose of training rather than just entertainment
- Category examples:
  - Games for Health – meant to promote health/wellness (Cognitive rehab)
  - Exergaming – a form of exercise which can track body motion

Zoezi Park- (Alpha)

www.bluemarblegameco.com

http://www.cyberbiking.com/
VR Componentry

Used to engage the **senses** and immerse the individual in a simulated environment

- **Visual**: TVs, computer monitors, head-mounted displays, mixed reality displays, projectors and movie screens

[Images and links provided for visual content.]
Used to engage the **senses** and immerse the individual in a simulated environment

- **Auditory & Communication:** Real and virtual 3D sound, speakers, headsets, microphones


Photo courtesy of WRNMMC
VR Componentry

Used to engage the **senses** and immerse the individual in a simulated environment

- **Smell:** Scent simulation to match objects in the VRE

http://static.ddmcdn.com/gif/exhaust-heat-recovery3.jpg

http://www.firearmsid.com/a_distancegrs.htm

http://www.livekorman.com

www.scentair.com

www.playacofresi.com
VR Componentry

Used to engage the senses and immerse the individual in a simulated environment

- **Touch**: Haptics for force, vibration (rumble packs), movements, and pain

www.engadget.com/2013/06/03/araig/
www.exergameland.org
VR Componentry

Used to engage the *senses* and immerse the individual in a simulated environment

- **Taste**: Digital taste interface, chemical arrays

[Image of VR componentry setup and a person using a taste simulation device.]

[Website link: www.nimesha.info]
VR Componentry

Used to interact with and manipulate the environment
- Controllers: keyboards, joystick, mice, weapons
- Kinematic: Motion capture, Kinect, data gloves, treadmills
- Kinetic: Force platforms
- Physiologic: EMG, EKG, vitals

www.vicon.com
www.costar.hw.ac.uk/costar2.html
www.deltasix.com
www.ljmu.ac.uk
VR Componentry

Can be used to record data for clinical research and outcomes

– Stimulus response
  • Task performance, physiologic, metabolic

– Biomechanics
  • Temporospatial, kinematic, and kinetic variables
  • Balance, stability
Use of VR in Rehab

• Ongoing efforts to utilize VR assessment and treatment paradigms across multiple patient populations

• VR facilitate motor learning
  – Tasks are systematically manipulated and reproducible
  – Provides feedback
  – Engaging/encourages motivation

• Training within VR environments translatable to performance in real-world situations
Take Home Messages

• VR systems combine hardware, software, and human-computer interface technologies to promote interaction with simulated “virtual” environments.

• Range of VR systems available for use/implementation.

• VR interventions are based on well-established therapeutic techniques use to identify and/or treatment physical and psychosocial deficits/symptoms

• VR-based rehabilitation tools are accessible to clinicians and can be customize to promote interactions with realistic, challenging environments while maintaining full safeties and controls.
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