

Virtual Reality and Augmented Reality in Medical Education

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VR/AR in Medical Education - Objectives

- Review the emerging field of Virtual Reality and Augmented Reality in Medical Education
- Discuss the opportunities and challenges involved in realizing the potential of these technologies.
 - Define/Describe Virtual Reality, Augmented Reality, Mixed Reality
 - History of VR/AR/MR in Medical Education
 - Current Technologies
 - Opportunities/Examples
 - Challenges
 - Future Directions



Define/Describe Virtual Reality, Augmented Reality, Mixed Reality

Virtual Reality (VR)

- Definition:
 - the computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors.

Description:

- "Completely" immersive
- Isolated from physical world
- Can create experiences not possible in physical world
- Created vs 360 video





Define/Describe Virtual Reality, Augmented Reality, Mixed Reality

Augmented Reality (AR)

- Definition:
 - a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.

Description:

- Not completely immersive
- Interact with physical world
- Can augment experiences possible in physical world





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Define/Describe Virtual Reality, Augmented Reality, Mixed Reality

Mixed Reality (MR)

- Definition:
 - sometimes referred to as hybrid reality, is the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time.

Description:

 Useful for displaying Reality and Virtual Reality simultaneously





History of VR/AR



ViewMaster 1939





Sensorama 1950s

????



History of VR/AR in Medical Education

Cave Automatic Virtual Environment CAVE







History of VR/AR in Medical Education

Second Life









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Google Cardboard

Advantages

- Inexpensive \$5.00 \$15.00
- Uses display of your smartphone
- Entry level device

- Low resolution
- Stationary VR
- Limited interaction



Current Technologies – VR YouTube Virtual Reality





LE00 @

SD-VR-360 VIDEOS Ø

Refinery29 Ø



360 Camera



4.5K views + 2 months ago

Of: Quite Interesting @

Refinery29 @







Samsung Gear VR

Google Daydream

Advantages

- Relatively Inexpensive \$50 \$100
- Uses display of your smartphone
- Mid level device
- Allows some interaction

- Low resolution
- Stationary VR





Oculus Go

Advantages

- Relatively Inexpensive \$200
- Built in display
- Built in sound
- Allows interaction via controller

- Somewhat low resolution
- Stationary VR



HTC PlayStation Vive VR Oculus Rift Samsung Odyssey

Advantages

- High resolution
- Smooth Video
- Allows interaction
- Mobile VR

- Expensive \$400 \$800
- Requires powerful computer
- Can be challenging to set up









Google Glass

Pokemon Go

Microsoft HoloLens

Advantages

- Not isolated from surroundings
- Good for training not requiring immersion
- Access to real time schematics/information

- Can be expensive \$3,000
- Requires powerful computer
- Challenging to set up
- Limited content



Opportunities/Examples VR Anatomy Education





Opportunities/Examples VR Anatomy Education





Opportunities/Examples AR Anatomy Education - HoloAnatomy



https://www.youtube.com/embed/SKpKlh1-en0



Opportunities/Examples Voxel Bay – Nationwide Children's Hospital



https://www.youtube.com/embed/uVRilk_6UWI



Opportunities/Examples Mass Casualty Training



https://www.youtube.com/embed/JNdKo1uSRto



Opportunities/Examples Mass Casualty Training



https://www.youtube.com/embed/wGLg1XiWgo0



Opportunities/Examples Mixed Reality Video Example



https://www.youtube.com/embed/QqugCQzWOYA



Opportunities/Examples Virtual Standardized Patients





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Opportunities/Examples Virtual Standardized Patients



https://www.youtube.com/embed/mvXIruMt9Ek



Opportunities/Examples

Use VR to create illusion of loss of balance

Heather E. Stokes, Jessica D. Thompson, Jason R. Franz. The Neuromuscular Origins of Kinematic Variability during Perturbed Walking. *Scientific Reports*, 2017; 7 (1) DOI: <u>10.1038/s41598-017-00942-x</u>

Virtual Reality Exposure Therapy for Combat-Related PTSD

Judith Cukor, Maryrose Gerardi, Stephanie Alley, Christopher Reist, Michael Roy, Barbara O. Rothbaum, JoAnn Difede, Albert Rizzo, In: Posttraumatic Stress Disorder and Related Diseases in Combat Veterans, Springer International Publishing, 2016.

The feasibility and acceptability of virtual environments in the treatment of childhood social anxiety disorder. Sarver, N., Beidel, D., & Spitalnick, J. (2014). Journal of Clinical Child & Adolescent Psychology, 43 (1), 63-73.



VR/AR - Challenges



And what the heck is THAT?



VR/AR - Challenges

- Emerging technology
- Fatigue, disorientation and vertigo
- Difficult to scale
- Movement in virtual space
- Lack of haptic tools
- Limited interoperability
- Limited evidence of efficacy



VR/AR – Future Directions

Technology

- Portability
 - Untethered systems
 - Smaller more comfortable headsets
- Fidelity
 - Higher resolution displays/increased framerates
 - Haptic feedback
- Multiplayer
 - Team based simulations
- Interoperability
 - Build once deploy everywhere



VR/AR – Future Directions

Content/Applications

- Surgical simulation
 - Patient specific simulations
 - Remote surgery
- Virtual Patients
 - Practice history taking, physical exam skills, differential diagnoses
 - Automated assessment
- Team training
 - Emergency medicine, surgical siumulation



Questions?









