Virtual Reality Gets Real in Healthcare
Session 47, March 6, 2018
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COMMITMENT

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Conflict of Interest

Richard Krohn, MA., MBA
David Metcalf, Ph.D.

Rick Krohn has no real or apparent conflicts of interest to report.

David Metcalf has reported a recent J&J Wearables trial and ownership in an outside investment company- DM2 Research
Agenda

• Context
• Industry Adoption
• Industry Applications
• Obstacles
• Cases
• Outlook
Learning Objectives

• Analyze the disruptive application of VR technology throughout the healthcare landscape
• Describe how VR is being architected to create immersive, personal health prevention and treatment experiences
• Discuss actual cases of VR applications that address personal and population health
• Recognize VR healthcare solutions that are in development, pilot and launch pad
VR vs. AR

**Virtual reality** (“VR”) is an artificial environment created with software and presented to the user in such a way that the user suspends belief and accepts it as a real environment.

**Augmented reality** (“AR”) is the integration of digital information with the live video of the user's environment in real time. AR takes an existing visual digital feed and blends new information to create an augmented environment.

**So what’s the difference?**

While VR aims at *immersing the user into a computer generated virtual world*, AR describes *virtual computer generated objects that are added to a real physical space*. 
VR isn’t a new concept

Flight simulator
1929

Sensorama
1962

SEGA VR
Gaming Headset
1993
The Technology has Advanced....

and Price Points have Dropped

<table>
<thead>
<tr>
<th>Product</th>
<th>2015 Price</th>
<th>2017 Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samsung Gear VR</td>
<td>$99</td>
<td>$39</td>
</tr>
<tr>
<td>Oculus Rift</td>
<td>$800</td>
<td>$400</td>
</tr>
<tr>
<td>Dream Vision</td>
<td>$10</td>
<td></td>
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Global Market for Healthcare VR

ABI Research forecasts that VR services in the medical and healthcare segment is about to explode in value from $8.9 million in 2017 to around $285 million in 2022. Although still niche, the growing interest and investment in VR applications from professionals, hospitals and medical institutions is going to lead to a significant new wave of applications being used to treat patients around the world.

Over 40 years of academic research and over 3000 studies demonstrate that VR can improve behaviors and health.
Medical Applications of VR

Behavioral Health
Clinical Interventions
Professional Training
Health and Wellness
Today, there are VR Solutions for Phobias and Mental Health

- Phobias and Anxiety
- Drug/Alcohol Abuse
- Schizophrenia
- PTSD
- Depression
- Autism
- ADHD

Flying

Heights

Spiders

Anxiety

Dementia

PTSD
...for Clinical Interventions

- Physical Therapy and Rehab
- Stroke/Brain Injury
- Speech Therapy
- Pain Management
- Telemedicine
….for Professional Training

- Clinical and Surgical Skills Training
- Use of Equipment and Tools
- Team Training - eg: Emergency Department, Surgical Team
- Emergency Response Training and Rehearsal
- Interpersonal Skills, Protocols and Empathy
...for Health and Wellness

- Weight Management
- Exercise
- Stress Management
- Behavior Modification
- Addressing Isolation
- Grief Counseling

Meditation
Stress
Exercise
Gaming
But it’s still early days in healthcare.....

Healthcare is dwarfed by gaming as VR investments, but Industry-wide, it’s a green field for innovation.

**VR in the Office/Enterprise**
- Behavior change
- Virtual diagnosis
- Education and Prevention

**VR in Pharma**
- PTSD
- Rehabilitation
- Pain management
- Behavioral health (ex. pain management, Drug efficacy

**VR applications for patients and consumers**
- Immersive health/wellness
- Gamification
- Brain injuries
- Behavioral health (ex. anxiety, body image, phobia)
- Chronic disease management
VR Effectiveness Proof Points

- **Phobias:** Researchers at Yonsei University’s Gangnam Severance Hospital in South Korea used VR training programs with a group of 82 South Korea-based participants. The training sessions brought about a reduction of nearly 90 percent in fear of heights and public speaking in the group.

- **Pain Reduction:** Dr. Brennan Spiegel of the UCLA School of Medicine found patients experienced a 24% reduction in pain after only ten minutes of using a special visualization and administered via Samsung Gear goggles. And in a 2011 study conducted by the military for soldiers with burn injuries from IED blasts, etc. VR worked better than morphine. Patients reported 60 to 75-percent less pain than before their VR sessions. For comparison, morphine averages around 30-percent pain reduction.
VR Effectiveness Proof Points

- **Professional Education:** Brian Sweeney, M.D of the Department of Surgery, University of Massachusetts Medical School, has reported that "simulation can increase the learner’s knowledge base, improve decision making, teach teamwork, develop psychomotor skills ... and ensure some degree of competency in the learner."

- **Rehabilitation:** The University of Aarhus and Hammel Neurocenter (Denmark) conducted a study of stroke patients using a VR game in which the patients wore gloves with sensors, their movements tracked by an infrared camera and transferred to a virtual arm on screen. The researchers found the virtual reality solution to be as effective, less expensive, and more motivating than physical therapy.
There are, of course, hurdles to VR Adoption in Healthcare

- **Funding** – the real development action is still in gaming
- The **headsets** currently used in VR are still bulky and not the most comfortable, and the visual presentation and interactivity continue to improve.
- Infrastructure, Integration and Gadget **cost**
- New **technology aversion** – VR is a young technology not easily deployed in enterprise environments (but has shown effectiveness in ER, OR and with field staff to drive better outcomes).
- Creating a truly engaging **VR experience** in a practical, consumer-ready device.
- **User** discomfort (disorientation, motion sickness)
- **Privacy, compliance**
- **Pushback** from doctors unaccustomed to retail solutions
3D/AR/VR Examples

David Metcalf
Institute for Simulation and Training
WHAT IS THE INTERNET OF THINGS?

The Internet of Things connects devices such as everyday consumer objects and industrial equipment onto the network, enabling information gathering and management of these devices via software to increase efficiency, enable new services, or achieve other health, safety, or environmental benefits.
Picture-based playing cards

- Practice careful hygiene. Avoid contact with blood and body fluids.
- Wear appropriate clothing, including gloves, gowns, and eye protection.
- Do not handle items that may have come in contact with an infected person’s blood or body fluids.

Flash card mobile app

MMS Messaging

Interactive Poster

Pull video from posters using your iPhone or iPad.
Advanced Simulation and Mobile Learning

Dignity in work. Dignity in care.

Juan Cendan, MD, UCF

Cognition, CNA eLearning/Sim
Volumetric Rendering

Using DICOM imagery, 3D volumetric models are generated in near real-time. This data is usable in multiple formats including those optimized for mobile platforms.
Betty Social Companion Robot/Hologram

Drs. Julio Hajdenberg, Tomas Dvorak, Diane Robinson

Orlando Health UF Cancer Center
Virtual Co-Pilot

WITH THE VIRTUAL CO-PILOT, STUDENTS WEAR VIRTUAL REALITY GOGGLES.

Voice of: VIRTUAL CO-PILOT

Look at the lower right-hand corner. That is our taxi route.

AND SEE THE AVATAR OF A MALE OR FEMALE CO-PILOT OF ANY CULTURE RIGHT NEXT TO THEM.

ENGINEERS BELIEVE THIS COULD BE FLIGHT TRAINING OF THE FUTURE.
is a desktop 3D bioprinter that builds 3D living tissues out of human cells. It is a beautifully designed, precision manufactured robot that prints cells and bioinks, bringing a new dimension to biology.

WHAT WILL YOU BUILD?

Tiny kidneys are world’s first 3D printed living organs
Colin Druce-McFadden  Monday, September 9, 2013 - 4:26pm

Two years ago, Anthony Atala took to the stage at TED and showed the world that human organs could be 3D printed. Now, a team from eastern China has successfully printed a series of living kidneys. This is a huge step forward in the quest for 3D printed replacement organs.

While Atala’s original 3D printed kidneys were made with a bioink that perfectly replicated kidney tissue. The problem was that these tissues were not vital (living). Without the ability to create living organs, 3D printed transplants would remain impossible. That’s why this new breakthrough is so important.
Partnership approach at Univ of Central Florida Institute for Simulation and Training

• Partners with similar vision
  – Public, nonprofit university
  – Compelling projects with the potential for global impact
  – International partnerships that meet the broad goals of UCF, and the Institute
  – We can be an academic partner that understands how to interact with NGOs, Government and Industry partners
  – Joint pursuit of grants

• Resource strategies for people, funding, and tools that create sustainable innovation
  – Spin-off multiple commercial entities and help launch/fund startup activities for students, faculty and our staff
  – Develop next generation leaders and technologists
VR Innovation – Trends

• Smart, adaptive virtual simulations that learn as a patient interacts with it
• Commoditization and retail availability of VR devices and solutions
• Increasingly immersive – from passive viewing to active engagement
• Granular range of apps, better resolution, heightened expectations for creative content
• Form factor – lighter, more comfortable, less scary
• Presentation will grow closer to the Star Trek holodeck.

“After years of validation and use by early adopters - VR technology is poised to move to the mainstream” – Dr. Walter Greenleaf, Stanford University
Questions?

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