

Changing
The Technology needed
to build a Virtual
Environment for training
Medical Procedures

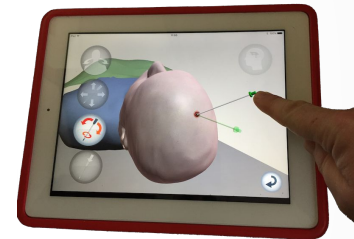
Professor Nigel W. John

@ SCHOMS 2016
University of Bath



Talk Outline

- Case Study 1 (2002)
 - Manchester Visualization Centre
 - Remote rendering and the VIP Lab
- Case Study 2 (2014)
 - Downsizing and haptics
 - Bangor University Powerwall
 - Neurosurgery training on an iPad
- Case Study 3 (2015/16)
 - My new Laboratory at Chester
 - 3D Displays and HMDs
- Future Predictions



Visualization Immersive Projection Lab ~2002



- HEFCE JREI Grant £715K
- Panoram GVR 120e
 - Cylindrical Screen
 - 8x4 Matrix Switcher
 - 3 Electrohome Projectors (Marquee 9501)
 - Active Stereo
 - 6 Channel Surround Sound Audio System
 - 3D Hand Controller and tracking stand
- One use of the cylindrical screen was for anatomy education

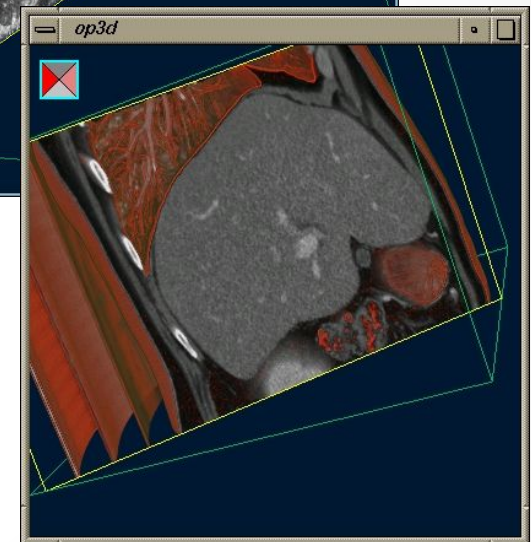
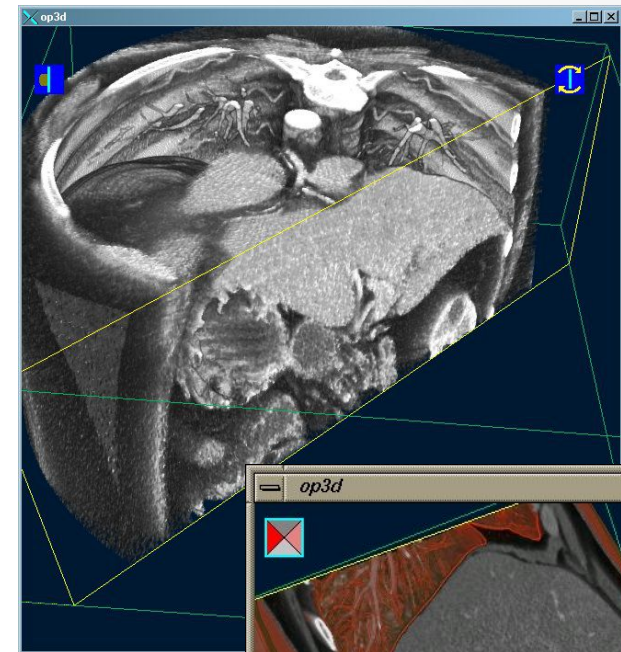


MVC Visualisation Server

- Kilburn (SGI Onyx 2)
 - 40 x MIPS R10000 CPU
 - 6 x InfiniteReality 3 Graphics Pipelines
 - 2 Raster Managers per pipe
 - 256 MB TRAM per pipe
 - DPLEX
 - 10 Gbytes Memory
 - 250 Gbytes Disk Space

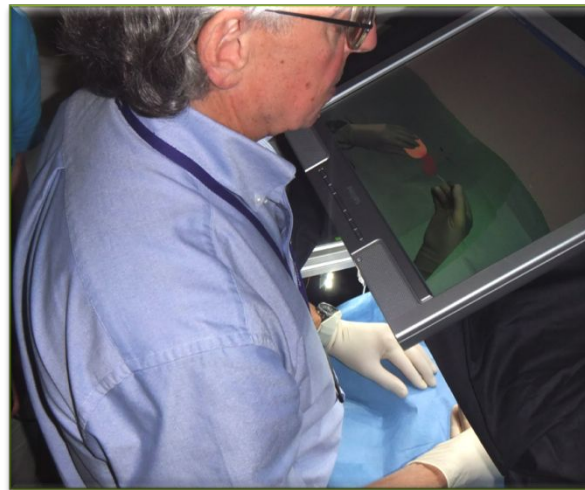


Remote Visualization in the OR

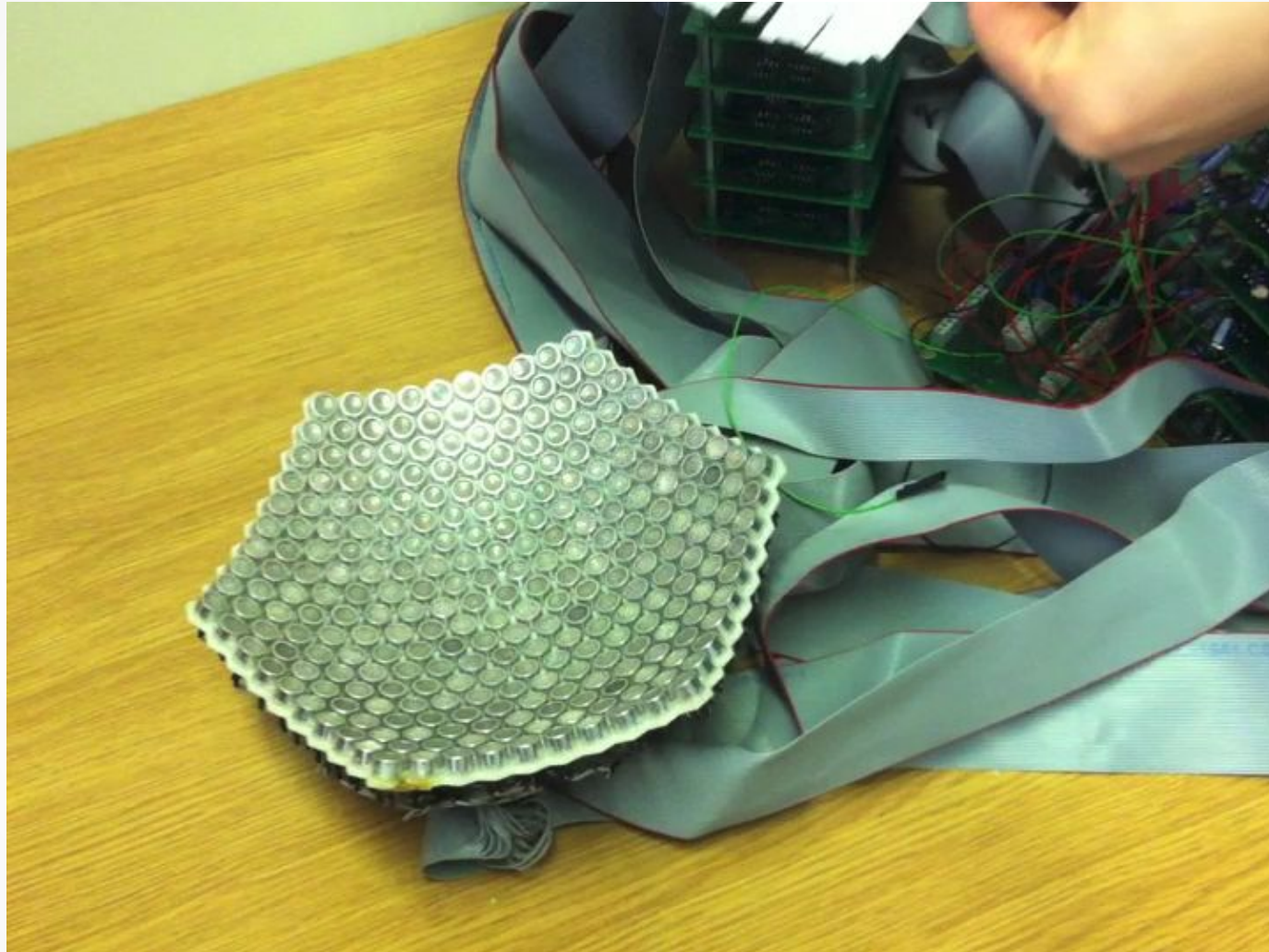


Training Simulators at Bangor

- More focus on a single PC solution
- Use the sense of touch (haptics) as well as vision



UltraPulse



PowerWall at Bangor (2014)

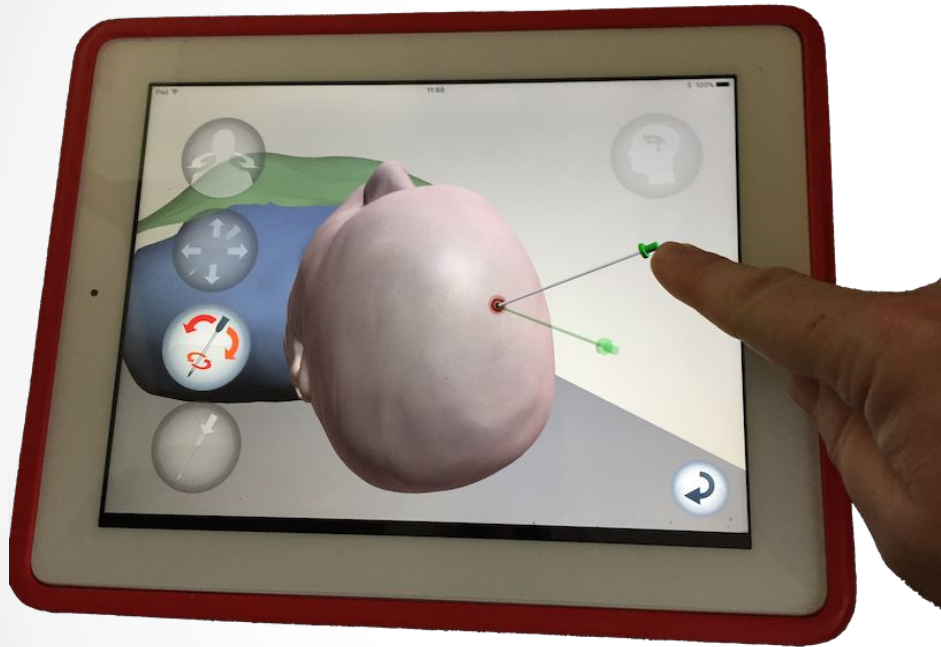


PowerWall Build Cost

- Single Panasonic DLP projector with short throw lens for rear projection
 - stereo mode (1024 x 768, 120Hz refresh rate)
 - 8500 ANSI lumens (halved in stereo mode)
- Multiprotocol infrared emitter (DI619)
 - angle of radiation 60° and range 8m
 - supports the NVIDIA 3D Vision active shutter glasses
- Gaming spec. PC
 - Quadro K5000 GPU
- Screen recycled from Dept. of Chemistry
- Total cost: ~£20K

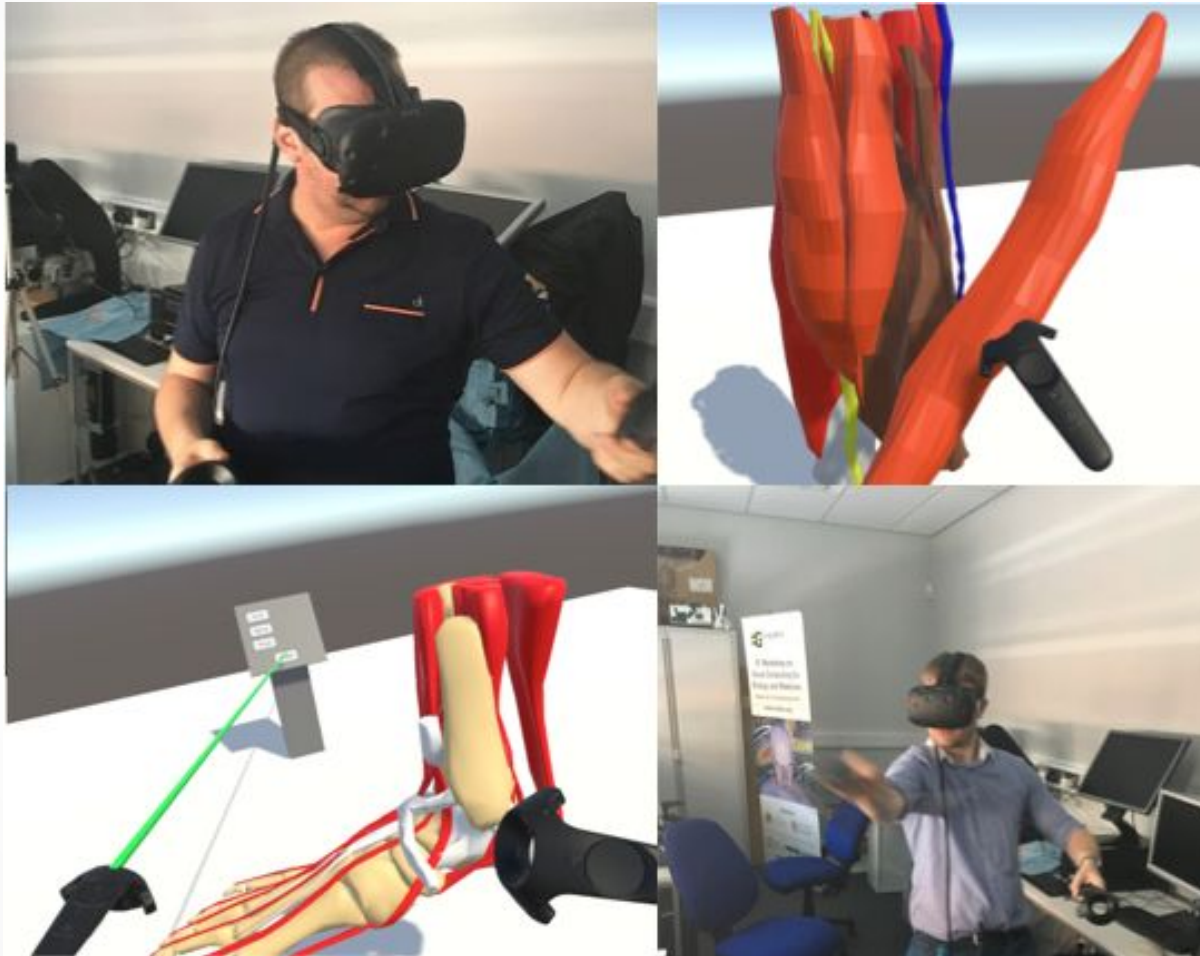


but will an iPad do the job?

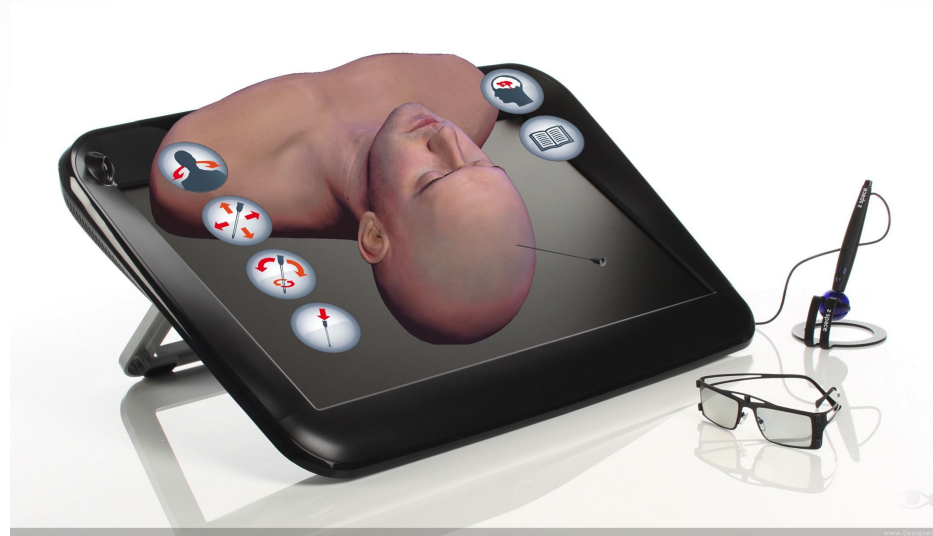


- VCath App Simulates a Neurosurgery procedure
 - Ventricular Catheterisation
 - Insert a cannula through brain to puncture ventricles
- Over 5000 downloads
- Tested at annual Nuerosurgery bootcamp held in Manchester (2014)
 - Proven to help learn the tack

Medical Graphics Lab at Chester (2016)

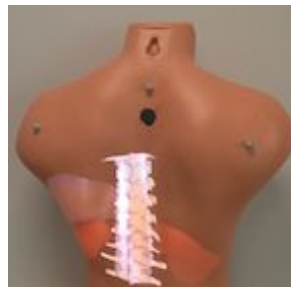
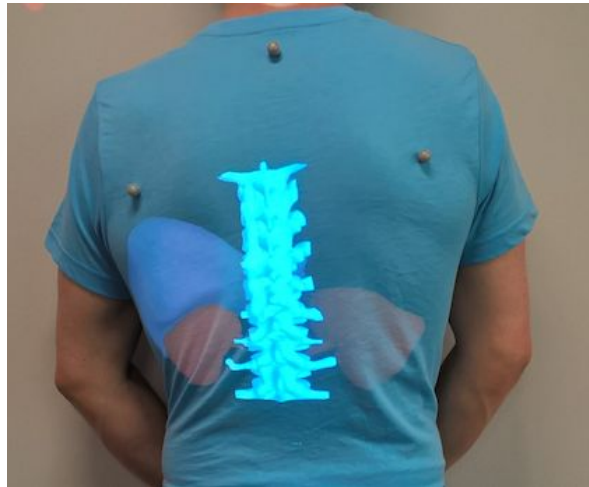


VCath Revisited



- VCath ported to the zSpace stereoscopic display
 - Display costs £4K + VAT
- Hypothesis was that stereoscopy will improve the training
 - Tested at the 2015 annual Neurosurgery bootcamp held in Manchester
 - No improvement found through the use of the stereo display!

Image Projection onto Patients



- Using off the shelf data projector
- Kinect used for tracking the patient
- Can be used for procedure guidance, patient education, or anatomy education
 - Real time tracking of patient position and update of models

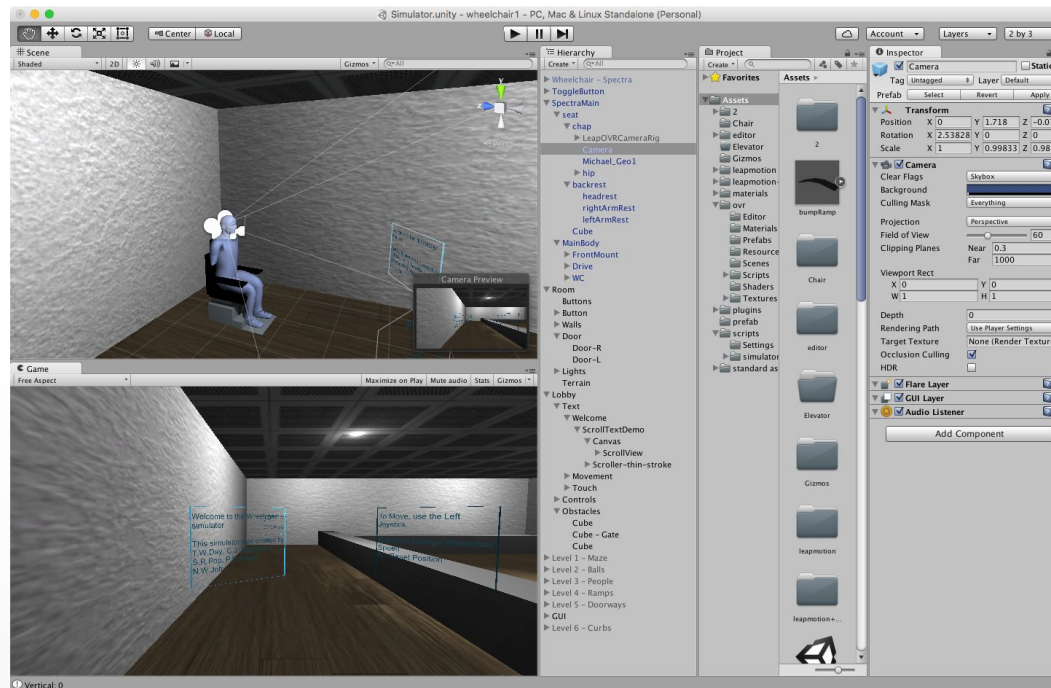
Wheelchair-rift

- Oculus Rift DK2 application for training how to drive a powered wheelchair
- Microsoft Xbox 360 Controller for a convenient joystick
 - With 3D printed attachment
- Standard “gamers” Desktop PC or Laptop



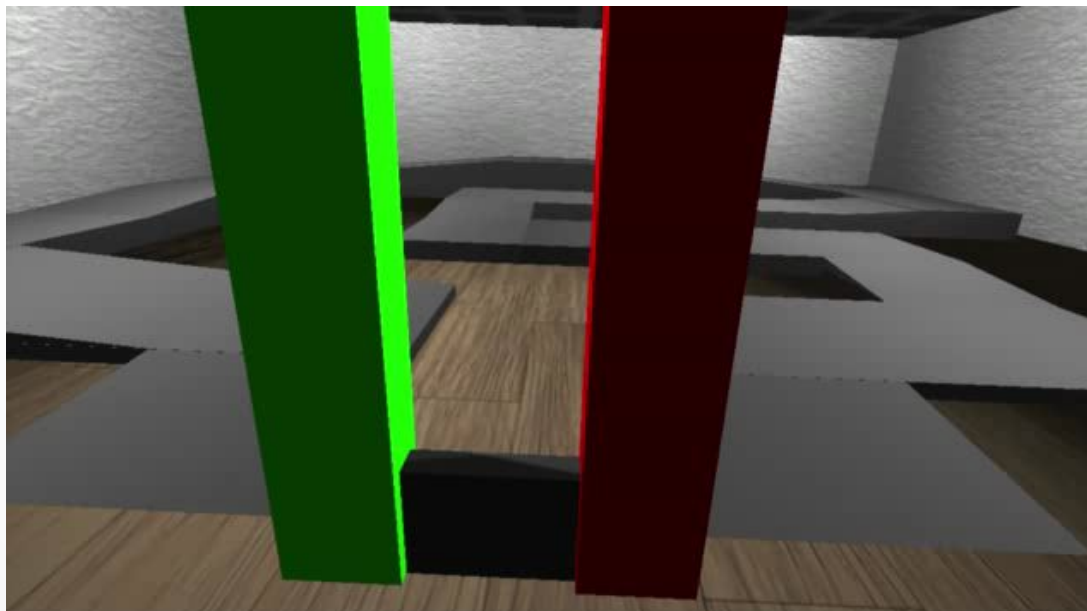
Wheelchair-rift Software

- Unity 3D
 - Cross platform games engine with advanced physics and rendering
 - Offers built-in VR support for the Oculus Rift



Training Environment

- Any desired training environment can be modelled
- For our prototype, we designed a virtual building with a different challenge on each floor level:
 - Collecting objects by driving to them and “touching” them with your hand
 - An obstacle course of different sized ramps
 - Avoiding moving obstacles
 - A maze of doorways
- Metrics such as time taken and obstacles hit can be recorded by the software.



Validation Study

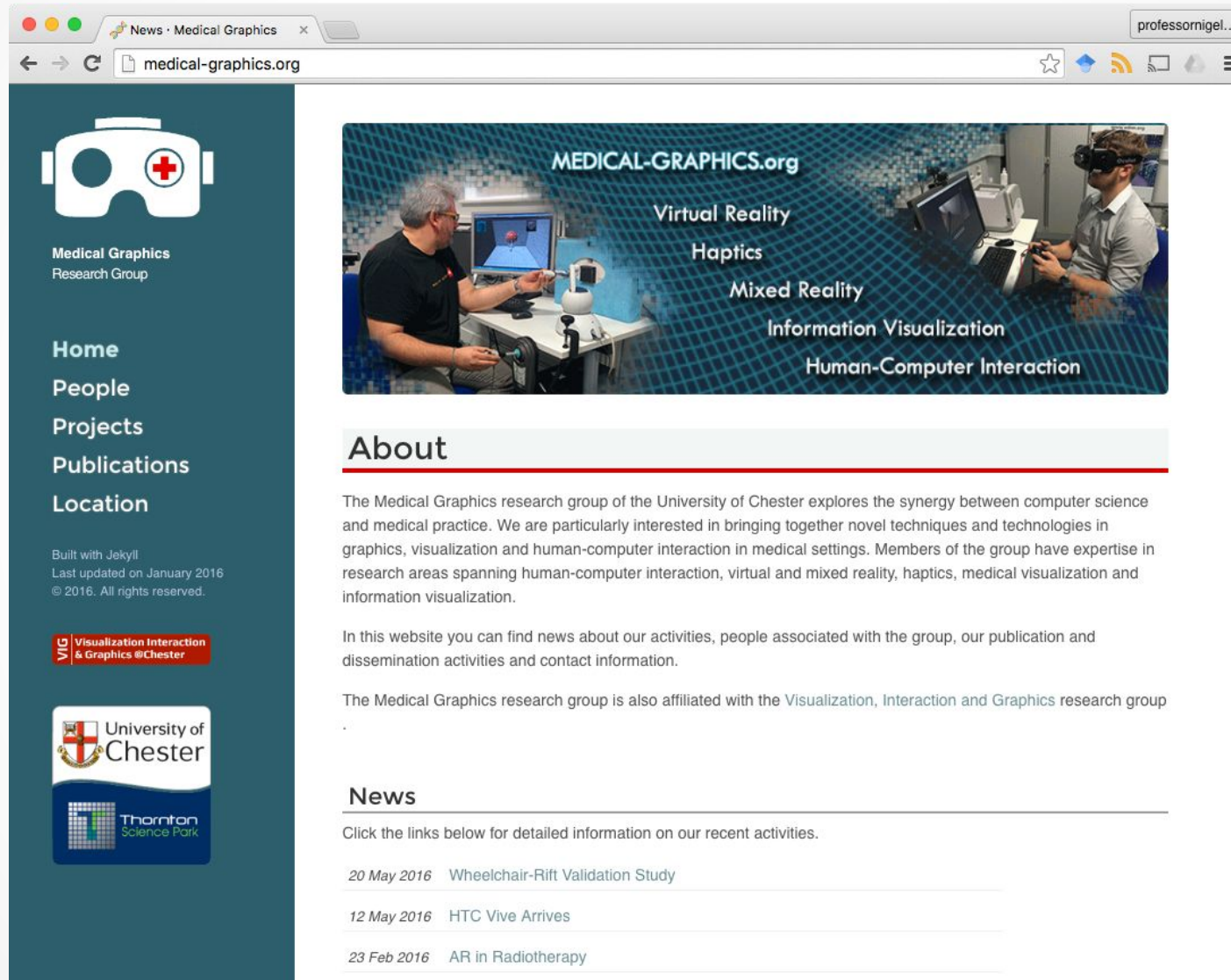
- Obstacle course to measure competency in real chair at start and end
- 33 participants randomly divided into 3 groups:
 - Control
 - Oculus
 - Desktop
- Those trained using the Oculus showed statistically significant improvement



Future Predictions

- VR resurgence will continue
 - Driven by the games market
 - The Sony HMD will be launched later this year. The first to use OLED display technology
 - Cybersickness still a problem, however
 - Microsoft's Hololens will open up the Augmented Reality market
- Large scale visualization facilities will persist in Universities, but become rarer
- Cost/performance continues to improve
 - Affordable solutions will benefit medical professionals and patients
- Developing 3D content is becoming easier
 - Tools like Unity offer huge functionality support a variety of hardware peripherals natively
- There are still plenty of research challenges

Medical Graphics Research Group



The screenshot shows a web browser window displaying the Medical Graphics Research Group website. The browser's address bar shows 'medical-graphics.org'. The website has a dark teal sidebar on the left with a logo of a VR headset with a red cross. The main content area features a large banner image of two people using VR equipment, with text overlays listing research areas: 'MEDICAL-GRAPHICS.org', 'Virtual Reality', 'Haptics', 'Mixed Reality', 'Information Visualization', and 'Human-Computer Interaction'. Below the banner is an 'About' section with a red underline, followed by a 'News' section with a red underline. The sidebar also contains a navigation menu, contact information, and logos for the University of Chester and Thornton Science Park.

Medical Graphics Research Group

Home
People
Projects
Publications
Location

Built with Jekyll
Last updated on January 2016
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VIG Visualization Interaction & Graphics @Chester

University of Chester
Thornton Science Park

About

The Medical Graphics research group of the University of Chester explores the synergy between computer science and medical practice. We are particularly interested in bringing together novel techniques and technologies in graphics, visualization and human-computer interaction in medical settings. Members of the group have expertise in research areas spanning human-computer interaction, virtual and mixed reality, haptics, medical visualization and information visualization.

In this website you can find news about our activities, people associated with the group, our publication and dissemination activities and contact information.

The Medical Graphics research group is also affiliated with the Visualization, Interaction and Graphics research group.

News

Click the links below for detailed information on our recent activities.

- 20 May 2016 [Wheelchair-Rift Validation Study](#)
- 12 May 2016 [HTC Vive Arrives](#)
- 23 Feb 2016 [AR in Radiotherapy](#)

Thank you

Any questions?

