DiVE Virtual Reality Lab

Duke Robotics Student Symposium

4/14/2017

David J. Zielinski
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DiVE Lab Personnel

**Dr. Regis Kopper**
Assistant Research Professor of Mechanical Engineering and Materials Science
Director of the Duke immersive Virtual Environment (DiVE).

**David J. Zielinski**
Research and Development Engineer for the DiVE

**Joanne Grosshans**
Administrative assistant for the DiVE
DiVE Facilities

Duke immersive Virtual Environment
Establish 2005, Upgraded 2015
History of VR

1929 - Edward Link
mechanical flight simulator

1956 - Morton Heilig
“Sensorama”

1968 - Ivan Sutherland
tracked stereoscopic HMD

1989 - Jaron Lanier
“Virtual Reality” coined
Commercial VR

1992 - Carolina Cruz-Neira
CAVE System

1992 - 1999

Commercial VR
Second Wave of VR

- 2012 - Palmer Luckey
  Oculus Rift Kickstarter

- 2014 - Mark Zuckerberg
  Oculus acquired by Facebook for $2B

- 2016 - Microsoft
  Hololens Released
VR + Robotics?

- Telepresence / Remote Operator
- Simulating the sense of touch in VR (Haptics)
- Explore human robot collaboration/interaction from the safety of VR
Some Academic VR Research Questions

What causes / reduces simulator sickness?

What effect do system parameters (i.e. display fidelity) have on user experience / performance?

How can users interact with virtual worlds in novel ways?

How well does training in a VR simulation, transfer to real world skills?
Recent Research in the DiVE...
Marksmanship in Virtual Reality
Hrishikesh Rao, Jillian Clements, Greg Appelbaum, Marc Sommer, Regis Kopper, David Zielinski, Nick Potter

Olympic trap shooting

Virtual simulation in the DiVE

Goal: study human motor learning
Marksmanship Results

Accuracy increases across blocks. Grey lines show individual subjects.

Increase in duration of ballistic phase and decrease in duration of refinement phase.
Marksmanship + EEG

**Brain**: electroencephalography (EEG)

Sample rate: 500 Hz

Preliminary results: eye movements are larger, faster with training
Emotional Qualities of VR Spaces (IEEEVR 2017)
Asma Naz, Regis Kopper, Ryan McMahan, Minhai Nadin

- Color (Blue, Orange)
- Brightness (Light, Dark)
- Texture (Rough, Smooth)
Emotional Quality Results

Emotional responses were consistent in simulated spaces to those in the real world.

Interesting interaction effects found.
DiVE Project: Specimen Box (3DUI 2017)

David J. Zielinski, Derek Nankvil, Regis Kopper

Inspiration:
Historical “Specimen Jars”
Late 1700s.

Normally hard to do tangible interfaces in world-fixed systems, as they are visible to user.

- Clear acrylic box
- User can touch the box
- Can't reach contents
Specimen Box Faster, Less Rotation

Specimen box:

- Time significantly lower  $p<0.05$
- Accuracy of user’s movements?
- Less overshoot?
- Proprioception?
- Need additional experiments!

- Rotation significantly lower  $p<0.0001$
- Avoid spending additional energy with weighted object?
- Good for training transfer?
Classes

ISS 320S: Introduction to Programming and User Interface Design in Unity 3D (Fall)

ME 555.05: Virtual Reality Systems Research and Design (Spring)

ISS 320S Final Projects Fall 2016  https://youtu.be/S6MFgpLoT4Y

DiVE Open Houses
Thursday 5pm-6pm

Thank you for your Attention!

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Bonus Slides
Domain Specific Applications of VR

Virtual Prototyping
- Pre-vis architecture
- Products testing

Visualization
- Molecules
- Geology

Training
- Medical
- Military

Entertainment
- Horror
- Sports
Specimen Box Limitations

Box was too heavy (2.1kg)
Could make walls thinner, make box smaller.

Specimen Box Future Work

Use technique for object translation and placement