Human-Centered Design for Immersive Interactions

A Half Day Tutorial

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ABSTRACT

VR has the potential to provide experiences and deliver results that cannot be otherwise achieved. However, interacting with immersive applications is not always straightforward and it is not just about an interface for the user to reach their goals. It is also about users working in an intuitive manner that is a pleasurable experience and devoid of frustration. Although VR systems and applications are incredibly complex, it is up to designers to take on the challenge of having the VR application intuitively communicate to users how the virtual world and its tools work so that those users can achieve their goals in an elegant and comfortable manner.

Keywords: Virtual reality, immersion, interaction, human-centered design.

1 INTRODUCTION

The most important part of VR interaction is the person doing the interacting. Human-centered interaction design focuses on the human side of communication between user and machine—the interface from the user's perspective. Focusing on users is more important for VR than for any other medium. When VR is done well, interactions can be brilliant and pleasurable, but when done badly, they can result in frustration, fatigue, and sickness. Whereas there are many causes of bad VR, much is centered on a lack of understanding human perception, intuitive interaction, design principles, and real users. Quality interactions enhance user understanding of what has just occurred, what is happening, what can be done, and how to do it. For the best VR applications, not only must goals and needs be efficiently achieved, but the experiences must be engaging and enjoyable.

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This course will start with the most fundamental aspects of VR interaction design that are essential for VR creators, yet that many are not aware of. Topics include human perception, human-machine communication, adverse health effects, input device classes and their characteristics, reference frames, interaction patterns & techniques, multimodal input, and bimanual interaction. Emphasis will be on designing and iterating around content and goals (hint there is no best interface for everything!), selecting input devices (and conversely designing around specific input devices), and many example interfaces such as realistic and non-realistic hands, hand-held panels, color cubes, jigs, 3D multitouch, and the viewbox. The course will also include a broad overview of how attendees can apply the define-make-learn iterative design cycle to their own VR interfaces and projects.

This tutorial will cover many of the topics discussed in Part V Interaction (Chapters 25-29) and Part VI Iterative Design (Chapters 30-34) of the instructor's book "The VR Book: Human-Centered Design for Virtual Reality" recently published by Morgan & Claypool Publishers [1].

2 SCHEDULE

Introduction to Human-Centered Design Applied to VR (45 minutes)

- The Human Brain
- Norman's Principles of Interaction
- Direct vs indirect interaction
- The Cycle of Interaction
- The human hands
- Reference Frames
- Interaction fidelity
- Proprioceptive & egocentric interactions
- Speech & gestures
- Multimodal input
- Sensory substitution

VR Sickness (20 minutes)
- Adverse Health Effects
- Reference Frames
- Examples to Increase comfort

Input devices (20 minutes)
- Hand input device classes
- Non-hand input device classes
- Device Characteristics

Interaction Patterns & Techniques (30 minutes)
- Overview of Patterns and Techniques
- Selection Patterns
- Manipulation Patterns
- Viewpoint Control Patterns
- Indirect Control Patterns
- Compound Patterns

Development (15 minutes)
- Universal requirements
- Iteration (the define-make-learn cycle)

Conclusion, Questions, and Answers (20 minutes)
- Where to Get More Info
- Questions and Discussion

3 TECHNICAL LEVEL AND INTENDED AUDIENCE

This tutorial focuses on the design aspects of VR interactions and is intended for a diverse audience including developers, researchers, psychologists, and user experience professionals. No technical background is required; there will be no math or code. Attendees are expected to have a basic understanding of and experience with virtual reality.

4 EXPECTED VALUE

Attendees will gain insight for designing immersive interactions that go beyond the basics. Attendees will gain new ideas for creating novel bimanual interfaces that take advantage of hand-tracked controllers that are now becoming popular (e.g., Oculus Touch, Playstation Move, and Valve/HTC Vive) as well as for more unique devices. Most importantly, attendees will conclude there are no absolute truths when it comes to immersive interaction design—understanding core concepts and iterating towards specific project goals are essential for creating quality interactions.

5 SPEAKER

Jason is Co-Founder and Principal Consultant at NextGen Interactions, is Adjunct Faculty at Duke University, serves on multiple advisory boards of companies focusing on VR technologies, and speaks about VR at various events throughout the world.

Jason has been creating VR systems and applications for approximately 20 years. He has been involved in over 60 VR-related projects across more than 30 organizations including Valve, Oculus, Virtuix, Sixense, NASA, General Motors, Raytheon, Lockheed Martin, three U.S. national laboratories, and five universities. Jason's work has been featured on ABC's Shark Tank, on the Discovery Channel, in the New York Times, and on the cover of the MIT Press journal Presence. He has held various technical and leadership positions, and has served on the ACM SIGGRAPH, IEEE Virtual Reality, and IEEE 3D User Interface Committees.

Jason earned a Bachelor of Computer Science degree with an emphasis in Computer Graphics and Minors in Mathematics and Electrical Engineering from Washington State University. He earned a Masters and a Doctorate in Computer Science from the University of North Carolina at Chapel Hill with a focus on perception of motion and latency in VR. Jason has authored over 20 publications and patents directly related to VR, most notably "The VR Book: Human-Centered Design for Virtual Reality."

REFERENCES

[1] J. Jerald,. *The VR Book: Human-Centered Design for Virtual Reality*, Morgan & Claypool Publishers and ACM Books, 599 pages, 2015. http://dx.doi.org/10.1145/2792790