

KXH112: Virtual Reality and Advanced Media Technology (An Introduction)

UNIT DESCRIPTION

This unit will explore the exciting field of mixed reality and the advanced concepts and technologies for interfacing humans to complex machines. The course will focus on virtual interfaces and their potential impact on the way we think about computers and the way we think with them. Interface design principles will be reviewed from human factors and technological perspectives. Hardware, software and mindware aspects of virtual interfaces and virtual environments will be investigated and applications postulated and designed in the fields of medicine, education, design and entertainment.

This unit is a companion unit to the Fundamentals of Interactive Entertainment (Digital Games and Animated Film). Both units are precursors to a new cross-disciplinary program in **Human Interface Technology and Experience Engineering** that is being started at the (proposed) HIT Lab Australia. The new major is an instructional companion to the organization of the Tasmania Research Centre of Human Interface Technology Laboratory in Australia. This Laboratory is linked to the HIT Lab at the University of Washington in Seattle, Washington, USA and the HIT Lab NZ, located at the University of Canterbury, Christchurch, NZ and will promote the development of advanced human interfaces and media technologies.

This unit is offered by the HIT Lab Australia. The unit will be taught by staff members from the HIT Lab Australia as well as selected international experts from the Human Interface Technology Laboratories in New Zealand and the USA. Notable international authorities and staff from various UTAS schools, especially from the School of Computing, will also be invited for lectures.

PREREQUISITES

This is open to all students regardless of background. Taking the previous unit (KXH111) is not necessary.

The thrust of the unit is to expose students of all disciplines and interests to modern technology and cutting edge tools that can influence and contribute to all walks of life. This course is especially suited for beginning students who are interested in diversity and the spectrum of opportunities across disciplines at the University of Tasmania. Students should have a deep interest in human-computer interaction, virtual reality and the future of advance media technologies. Students should also have a willingness to work in a group project setting.

APPROACH

The unit will consist of academics for the HIT Labs and guest lectures, video presentations and demonstrations with open discussions in a seminar setting.

TEACHING STAFF

Professor Young Ju Choi, Coordinator

Professor Thomas A. Furness III
Director Emeritus, HIT Lab, University of Washington, Seattle, USA
Adjunct Professor and International Director, HIT Lab NZ, University of Canterbury, Christchurch, NZ

Professor Mark Billingham
Director, HIT Lab NZ, University of Canterbury, Christchurch, NZ

Other teaching staff: to be announced.

COURSE MATERIALS

A CD containing course materials (presentations and readings) will be distributed the first day of class. Students will also have access to a course website that will provide up-to-date information.

DRAFT COURSE SCHEDULE

PART ONE

OVERVIEW OF COURSE

- Introduction to course
- Course structure
- Outline of content
- Assignments
- Project
- Expectations/grading
- class attendance
- participation in discussions
- organization of groups
- group meeting dynamics

INTRODUCTION TO VISION

- Importance/history of vision
- Need for advanced interfaces

TAXONOMY FOR MEDIATED EXPERIENCE DEFINITIONS OF VIRTUAL REALITY

DISCUSSION: What is the take home message?

BRIEF HISTORY OF VIRTUAL INTERFACES

- early concepts
- military developments
- commercial developments

FURNESS JOURNEY IN VIRTUAL SPACE

- US WEST Tape

VIEW: *Colonizing Cyberspace*

TOPICS FOR STUDENT PROJECTS

DISCUSSION: Interesting Web Sites

HUMAN SIDE OF VIRTUAL INTERFACE DESIGN

- Human Factors of Virtual Environments
- --an interface model
- sensory/perceptual/cognitive considerations
- --interface design considerations
- --bandwidth demands

DISCUSSION: How compare and contrast development of VR as a medium to another medium

MACHINE SIDE OF VIRTUAL INTERFACE DESIGN-INPUT
MACHINE SIDE OF VIRTUAL INTERFACE DESIGN-OUTPUT
HAPTIC INTERFACES
RENDERING THE VIRTUAL WORLD

DISCUSSION: What would be the attributes of an ideal VR medium?

BUILDING THE VIRTUAL WORLD
USER INTERACTION IN THE VIRTUAL WORLD
VIRTUAL INTERFACE METAPHORS

MEASURING THE GOODNESS OF VIRTUAL WORLDS

Presence

- Creating the Virtual Message
- The concept of Place
- Measuring
- other metrics

Simulator Sickness

- Some artifacts of virtual interfaces
- Visual/Vestibular interaction
- Cybersickness (Don Parker)

DISCUSSION: VR Solutions to Like Hacker problems

PART TWO

AUGMENTED REALITY

- What is Augmented Reality
- AR vs. VR

- Human Factors of AR Environments
- Technical Requirements
 - registration
 - calibration
- Technology
 - displays
 - tracking
- Wearable Computing

DISCUSSION: Contrasting the differences in VR & AR

APPLICATIONS OF AR & VR

Collaborative VR

- Collaboration in Virtual Space (Mark Billinghurst)
- GreenSpace (Tom Furness)
- Discussion: the future of virtual collaboration

DISCUSSION: Brainstorming AR & Wearable computing applications

MEDICAL APPLICATIONS OF VR

- Virtual Simulation for Medicine
- Pain & Phobia

EDUCATIONAL APPLICATIONS OF VR

- Education in Virtual Space

DISCUSSION: Educational Applications of VR

CREATIVE & DESIGN APPLICATIONS OF VR/AR

Design

- Advanced CAD concepts in virtual space

VR as a medium for artistic expression (Peter Oppenheimer)

Architecture

- Designing in Virtual Space

FUTURE DEVELOPMENTS OF VR TECHNOLOGY & APPLICATIONS

FUTURE OF VIRTUAL REALITY

- Matrix for interface design
- Some new affordances

DISCUSSION: Social & Ethical Implications of Virtual Interface Technology

Where do we go from here?

PRESENTATION TEASER

CLASS PRESENTATIONS

Groups to handout project sheet to class and copy of briefing materials to the lecturer.
Students will grade each groups presentations

INTRODUCTION TO MAJOR IN HUMAN INTERFACE TECHNOLOGY & EXPERIENCE ENGINEERING

DISCUSSION: Where do we go from here

OTHER RESOURCES

Understanding Virtual Reality: Interfaces, Applications, and Design, William R. Sherman,
Alan B. Craig
Morgan Kauffman 2003.

Virtual Environments and Advanced Interface Design, Woodrow Barfield & Thomas A.
Furness III, editors. Oxford University Press

Virtual Reality...Scientific and Technological Challenges, Nathaniel Durlach & Anne S.
Mavor, editors. National Academy Press

Virtual Reality Technology, Grigore Burdea & Phillippe Coiffet

Virtual Reality, Howard Rheingold (optional)

HIT Lab websites: (www.hitl.washington.edu) (www.hitlabnz.org)

Representative Papers

Ellis, S. R (1991). Nature and Origins of Virtual Environments: A Bibliographical Essay
Computing Systems in Engineering, 2(4), 321-347.

Bolt, R.A. Put-that-there: voice and gesture at the graphics interface. *Computer Graphics*,
14(3), 1980, 262-270.

Hauptmann, A.G. & McAvinney, P. (1993). Gestures with Speech for Graphics
Manipulation. *Intl. J. Man-Machine Studies*, 38, 231-249.

Azuma, R.T. (1997). A Survey of Augmented Reality Presence: *Teleoperators and Virtual
Environments*, 6(4), 355-386.