

Course Outline

INFO410 Multimedia User Experience - Theory and Practice Semester 1, 2018

Version 1.0; 22/02/2018

Introduction

What is an interactive system? What is Mixed Reality? What theoretical frameworks do we need to understand in order to design an effective system? Which degree of “information richness” is suitable for a given problem? What methodologies and technologies are out there to design usable, enjoyable and desirable systems? These are some of the issues and questions that this one semester paper will seek to find answers to. INFO410 introduces students to the main areas of human-computer interaction (HCI) development leading to an understanding of the underlying principles of visual computing using theoretical frameworks. The focus areas of the course are Mixed Reality Systems and Computer Aided Design. We are following a research-informed, problem-based learning approach with a flipped classroom model.

Students are greatly encouraged to take ownership of a problem. In the process, develop lifelong learning skills such as critical, analytical and creative thinking, and communication. Different, sometimes contradicting interaction design methodologies will be introduced and reflected by the students.

Students are required to read technical and academic literature, critically reflect on it and discuss this literature in class.

Staff

- Holger Regenbrecht (co-ordinator), Room 9.07, Commerce Building;
email:holger@infoscience.otago.ac.nz (Tel. 479 8322)

General Information:

- Tuesdays, 11am - 1pm, Lectures and Presentations followed by Consultations and Discussions (compulsory attendance at core time 11am-12noon)
- Thursdays, 11am - 1pm, Show & Tell with milestone/assignment checks followed by Consultations and Discussions (compulsory attendance at core time 11am-12noon)
- All seminars are held in the HCI Lab (Commerce, room 3.26)
- Flipped classroom and student lecture model: closer to Humboldt and Oxbridge models
- Holger is your course co-ordinator, supported by Jack as tutor
- Workload expectations per week:
 - 1-2 hours Seminar attendance
 - 1-2 hour Consultation attendance
 - 8 hours of self-dependent work (includes ½-1 hour of blog writing)
- all INFO410 students are invited to join the HCI group meetings on Wednesdays, 2pm-3.30pm, Co3.26
- all INFO410 students are encouraged to go to the CS/IS seminars on Fridays 1-2pm, Owheo Bldg.

Intended Learning Outcomes

- You are able to conceptually design and develop an MR application.
- You know the basic principles of Computer Aided Design and are able to practically apply CAD in a Mixed Reality context.
- You know the main technical components and concepts comprising a Visual Computing system.
- You are able to present VC/MR research & development to a technical audience.

4th-year study in general and INFO410 study in particular is about:

- Methodologies & Self-Regulated Learning
 - Research and Exploration
 - Building Self-Confidence
 - Independency in Gathering Knowledge
 - Knowledge Construction (not Consumption)
- Communication and Presentation

Presentations:

- Each student will give three Student Lectures (45 minutes each). These Student Lectures (SL) are presented during seminar time on Tuesdays, 11.00 – 13.00.
- The PowerPoint slides for each SL have to be provided, also to be handed in electronically on USB thumb drive with all files required e.g. embedded videos etc.,)
- What you present you have to understand!
- You have to acknowledge all sources in your slides.
- Initial pointers to resources will be given by Holger, but you have to find more and have to provide the content
- For each presentation, you have to provide five potential exam questions with model answers; Holger will pick from those for the end of year (oral/written) exams.

INFO410 presentation topics (Student Lectures)

The topics will be discussed in the first seminar and the Course Outline will be updated in due course.

1. Introduction to Course, HCI, CAD/CAAD (Holger)
2. Introduction to Computer Graphics
3. Theory and Practice of Textures, Lights, and Materials
4. Introduction to AR and VR (MR)
5. 3D CAD Basics: coordinate systems, operations, data storage, layers, ... (example Autodesk AutoCAD)
6. 3D CAD file formats (and how to convert them)
7. 3D CAD modelling programs for architectural and industrial design (SketchUp, Revit, SolidWorks, contrast Blender)
8. Scenegrph APIs—OpenSceneGraph vs. Unity3D
9. Tracking technologies
10. VR/AR/MR Head-mounted displays: technology and applications

11. Integrated Optical See-Through HMDs—Microsoft HoloLens: technology, applications, limitations
12. Lightfield displays—The mysterious MagicLeap
13. The Office of the Future (Fuchs' UNC group)

Each student writes a **lab book as a blog** (accessible to other INFO 410 students, as well as to Holger and Jack) with reports on progress (positive and negative), screenshots, photos, references to work and web sites visited, video clips; spend ½ - 1 hour per week on this!

INFO410 Student Project

The details will be discussed in the first seminar.

From CAD to Mixed Reality

Computer Aided Design (CAD) in architecture and industrial design significantly differs from e.g. game asset and environment design—its purpose is not entertainment and excitement, rather CAD is used to relate to reality in civil engineering, architecture, product design, mechanical engineering, etc. With this year's INFO410 project we are focusing on computer aided *architectural* design as an example for “serious” applications of Mixed Reality technology. The main purpose of the project is to demonstrate the process of CAD modelling through to an interactive Mixed Reality experience as a form of problem-based learning. I.e. challenges with the project have to be overcome by learning new techniques, skills, and methods.

There will be two demonstrable “end-products”: (1) a prototype Microsoft HoloLens application for the exploration of (parts of) the university campus and (2) a video documentation on the process for future students (at Otago and elsewhere) on how to build such a prototype application.

Weekly tasks and **assignments** (to be adjusted along the way)

1. Assign roles and responsibilities within group. Division of labour for upcoming tasks based on skills, expertise, and interests.
2. Modelling of the cubature (no furniture, no textures, but with windows, doors, openings) of the HCI lab rooms (3.22 – 3.26) with SketchUp. Production of an architectural walk-through movie (<1 minute).
3. Texturing and Lighting of HCI lab model. Production of an architectural walk-through movie (<1 minute).
4. Furnishing of HCI lab model (tables, chairs, bookshelves; all textured). Production of an architectural walk-through movie (<1 minute).
5. Interactive Walk-through through HCI lab model using Unity3D and Oculus Rift HMD; Ability to interactively switch on/off individual furniture. Production of walk-through movie (<2 minutes).
6. Interactive Walk-through with Microsoft HoloLens 1:1 scale in situ. In addition, Microsoft HoloLens 3D model review application with a 1:20 scale model on meeting table in 3.26. Production of 1:1 scale walk-through movie plus review scenario (total <2 minutes).
7. Interactive loading (at run-time) of different 3D models and display on meeting table with HoloLens. Production of < 1 min. movie.

8. Interactive HoloLens visualisation of University of Otago campus buildings (cubatures, model will be provided) on table in 1:200 scale. Bird's eye viewing from different angles and 1:1 scale interactive walkthrough (navigation interface). Production of < 2 min. movie.
9. Re-modelling and texturing of G502 (Clocktower Building), G503 – G507 buildings, and F613 (Commerce) building. Simple planar facades. Correct placement within campus model. Bird's eye viewing from different angles and 1:1 scale interactive walkthrough (navigation interface). Production of < 2 min. movie.
10. Refinement of geometries and textures. Skybox/-dome. Lighting. Production of < 2 min. movie.
11. Production of a <5 minutes movie on the process on how to build and interactively visualise architectural CAD models. (remember to collect enough material during semester, e.g. video footage with outside recordings of people wearing HMDs, outside views of clocktower, etc.,)
12. Presentation of movie and other material.

Timetable

wk		topics	date	comment
1	1	Introduction	27/02	
	2	<i>Project: Assign Roles</i>	01/03	
2	3	Computer Graphics	06/03	
	4	<i>Project: SketchUp HCI Lab</i>	08/03	
3	5	Textures etc.,	13/03	
	6	<i>Project: Texturing/Lighting</i>	15/03	
4	7	AR/VR/MR	20/03	
	8	<i>Project: Furnishing</i>	22/03	
5	9	CAD Basics	27/03	
	10	<i>Project: Oculus Rift</i>	29/03	
6	11	CAD file formats	03/04	
	12	<i>Project: MS HoloLens</i>	05/04	
7	13	CAD modelling programs	17/04	
	14	<i>Project: Loading models</i>	19/04	
8	15	Scenegraph APIs	24/04	
	16	<i>Project: Campus Cubatures</i>	26/04	
9	17	Tracking	01/05	
	18	<i>Project: Re-Modelling and -Texturing</i>	03/05	
10	19	HMDs	08/05	
	20	<i>Project: Refining</i>	10/05	
11	21	HoloLens	15/05	
	22	<i>Project: Movie Production</i>	17/05	
12	23	MagicLeap	22/05	
	24	<i>Project: Presentation</i>	24/05	
13	25	Office of the Future	29/05	
	26	Wrap-Up and Exam Prep	31/05	

Marking:

- 30% Student Lectures (three per student), Quality of delivery to class, Powerpoint material quality, Examination questions
- 20% Project Work and Milestone Achievements (indiv. & group)
It is expected that all members of a group should contribute equal effort. However, roles may differ, based on agreement within the group. The course coordinator reserves the right to award lower marks to a group member who does not contribute sufficiently to the group work.
- 20% Blog Reporting (indiv.)
- 10% Class Participation and Engagement (indiv.)
- 20% End of Year Oral Examination (indiv.)
In order to pass this paper, you must obtain 40% or greater in the final exam.

Recommended Readings:

(to be updated, dynamic)

- Cooper, A., Reimann, R., & Cronin, D. (2007). About Face 3: The Essentials of Interaction Design. John Wiley.
- Kelly, T. (2002). The Art of Innovation: Success Through Innovation the IDEO Way. Profile Books Ltd.
- Shneiderman, B. & Plaisant, C. (2005). Designing the User Interface (4th edition). Addison Wesley.
- Preece, J., Rogers, Y., & Sharp, H. (2002): Interaction Design: Beyond Human-Computer Interaction. John Wiley.
- Bowman, D., Kruijff, E., LaViola, J., & Poupyrev, I. (2005). 3D User Interfaces – Theory and Practice. Addison Wesley.
- Norman, D. (2002). The Design of Everyday Things. Basic Books.
- Norman, D. (2005). Emotional Design: Why We Love (or Hate) Everyday Things. Basic Books.
- Saffer, D. (2007). Designing for Interaction. Berkeley/CA: New Riders.
- Haller, M., Thomas, B. & Billinghamurst, M. (2006). Emerging Technologies of Augmented Reality: Interfaces & Design. Hershey/PA: Idea Group Publishers

- OpenGL Programming for the X Window System by Mark J. Kilgard (Aug 15, 1996)
- Steuer, Barfield Presence papers on VR
- Azuma Presence papers on AR
- Holger's INFO340 slides on VR and AR
- Computer Graphics: Principles and Practice (3rd Edition) by John F. Hughes, Andries van Dam, Morgan McGuire and David F. Sklar (Jul 20, 2013)
- Design Patterns: Elements of Reusable Object-Oriented Software by Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides (Nov 10, 1994)
- Extreme Programming Pocket Guide by chromatic (Jul 31, 2003)
- Unity3D online tutorials
- ...