

CS 889
Advanced Topics in Human-
Computer Interaction
Experimental Design

Overview

- Scheduling
- A brief overview of HCI
- Experimental Methods overview
- Goals of this course
- Syllabus and course details

A note on scheduling

- Course is scheduled in two 2.5 hour slots per week.
- Anticipate teaching between 12 – 14 classes during term, so 5 or 6 weeks equivalent with no classes
- Goal is to front load learning and presenting so that later part of course focuses on data collection and projects
- First content class May 13th due to CHI 2019.

Human-Computer Interaction

- The discipline concerned with designing products that are useful, usable, and used.
 - Problems with this definition?
- Design systems that are:
 - Learnable, flexible, robust?
 - More Efficient?
 - That people “like better”?
- Contrast “like better” with “usable”
 - Which is more quantitative a metric?

Two Sides to HCI Practice

- Interactive System Design (CS 449/649)
 - Understand current work practice of users
 - Identify breakdowns
 - Re-design work
 - Design architecture of system
 - Draw UI sketches
 - Evaluate with users
 - Redesign
 - Implement Prototypes and evaluate
- User interface implementation (CS 349)
 - Graphic output and input
 - Events
 - GUI toolkits, toolkit architectures
 - Undo and Errors
 - Screen design and layout
 - Custom controls
 - Computationally intensive tasks
 - Scripting languages

BUT ... CS 889 is a research-based course

HCI Research

- Areas
 - User interfaces systems and technology
 - Computer supported cooperative work
 - Ubiquitous computing
 - Designing interactive systems/Designing user experiences
 - Mobile interaction
 - Etc.
- Most research has some experimental or evaluation component to them

Goals of experiments/evaluation

- Understand real world
 - How users use technology
 - Can design be improved, can work be automated, can we help a potential user group?
- Compare things
 - Best/better/worse
- Engineering toward a target
 - Essential features
 - Is design good enough
- Check conformance to a standard
 - Microsoft design guidelines
 - Mac interface guidelines

Research-Based Evaluation

- Two broad approaches
 - Quantitative methods
 - Positivist/post-positivist
 - Qualitative methods
 - Constructivist
- Combined in mixed methods research
 - Two approaches to mixed methods
 - Sequential
 - Concurrent

Quantitative Approaches

- Hypothesis driven or model driven
 - Testing a theory
 - Statistics
 - Correlation
- **Post-positivist** => hard to be absolutely sure
 - Causes probably determine effects and outcomes
- Goal is to be able to say that it is unlikely to see effect by chance
 - $P \leq 0.05$
 - Correlation with model significant and $R^2 \sim 1.0$

Quantitative Metrics

- Need to be measurable
 - Time
 - Error rate
 - User satisfaction
 - Cognitive load (NASA TLX)
 - Learning curve (time/efficiency)
 - Clicks
- All indirect measures of “better” interface
 - All relative measures
- Correlation with model
 - $R^2 \sim 1.0$ (depending on number of data points)

Qualitative Approaches

- Research starts with data collection
- Collection motivated by questions that are broad and non-leading
 - How do people use smartphones for gaming?
 - Establish meaning from views of participants
- Process
 - Look for patterns
 - Build theory from ground up

Mixed Methods

- Collect diverse types of data
- Can do sequentially
 - Typically starts broad using qualitative or quantitative data
 - Then focuses using another methodology
- Can do concurrently
 - Use multiple types of data simultaneously to develop a more complete picture
- Triangulates data
 - Uses different sources to develop a full understanding

Experimental Design

- This course is about designing experiments in HCI
 - Experimentation defined broadly
 - Can include quantitative and/or qualitative approaches
 - Can be modeling or scientific approach
- More broadly, goals are:
 - To understand strengths and weaknesses of different experimental method in HCI
 - To develop an appreciation for experimental HCI research
 - To be able to apply these techniques to do HCI research

Syllabus

- Three components
 - Individual – 35%
 - Research papers
 - Groups of one or two
 - Exercises – 15%
 - Course project – 50%

Research papers – 35%

- Starting next week, assigned readings
 - Evening before class by 9pm, each student posts a summary of every paper under discussion of exactly 4 sentences on course wiki
 - Summary of research question of paper
 - Summary of results
 - Some value judgement on paper including one sentence on strengths and one on weaknesses.
 - Typically drawn from CHI Proceedings
 - Some from older venues or other venues depending on interest (SOUPS, etc.)
- Early in the course (~ two weeks), I will present material on and around papers and class will discuss papers
 - Class participation is important
 - It is a good rule of thumb to have added to discussion every class
- Later, students will present once or twice during term
 - Typically three – four papers covered per class

Exercises – 15%

- Posted by next week
- Early exercises give some experience with data collection and analysis
- Deliverables:
 - Data collection and slide deck posted on piazza
 - Students selected at random to present their findings
 - Note that there will be distribution amongst all of you

Project – 50%

- Goal is to perform a HCI study
- Suggest you leverage papers that you will present to identify either methodology or domain
 - If you don't have a topic, check out CHI 2019 proceedings for papers
 - Skim topics that interest you
 - Reading order: abstract, introduction, conclusion to identify papers
 - If you find a paper that you are suspicious of wrt results, this might be a good target for replication.

Course Resources

- Website
 - Will include links to readings
 - Readings are typically in ACM DL
 - Must be on-campus or using library's proxy connection to access
- Free eBooks
 - Basics of qualitative research : techniques and procedures for developing grounded theory, Corbin and Strauss
 - Practical Statistics 4 HCI (Wobbrock)
- Statistics help desk, any book in statistical analysis.

Course Enrollment

- Course is full!
- Please make decisions early regarding enrollment
 - I have some flexibility and will sign in starting next week with priority to CS grad students
 - However, max enrollment is ~25 students to preserve seminar format

Post Questions on Piazza!