CS 889
Advanced Topics in Human-Computer Interaction
RepliCHI
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.
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

• Interactive System Design (CS 449)
  – 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 research
    • 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
  – \( P \leq 0.05 \)
  – \( R^2 \sim 1.0 \)
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
RepliCHI

- This course is about replication studies in HCI
  - Given some experiment and data collection that’s been published
  - Replicate the study to verify results
- Why replicate?
  - Quantitative
    - $P \leq 0.05$
    - $R^2 \sim 1.0$
  - Qualitative
    - Imagine a study of Nintendo DS multi-player gaming from 2007
    - Imagine a study of digital video consumption from 2006
Extended Goals of this course

• Doing replication is essentially doing experimental HCI
  – 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 paper 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 2015
  – Some from older venues or other venues depending on your interest
• 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%

• Two posted
• Early exercises give some experience with data collection and analysis
  – 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 replication study
- Must identify a published research result that you wish to replicate
  - Can also "extend" the result
  - Some flexibility for thesis work
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

• Reserve in library
  – Research Design: Qualitative, Quantitative and Mixed Methods Approaches (Creswell)

• Free eBooks
  – Basics of qualitative research: techniques and procedures for developing grounded theory, Corbin and Strauss
  – Practical Statistics 4 HCI (Wobbrock)
Questions?
Replication Case Study
Acquisition of Expanding Targets

• Idea is to enlarge targets to speed clicking
Components of this paper

• Fitts’s Law
  – Log term is called the Index of Difficulty, ID
  – 1/b is the Index of Performance, IP
  – a is the start-stop time, i.e. “additive factors”

• Optimized Initial Impulse Model
  – Ballistic impulse followed by iterative corrections

\[ MT = a + b \log_2 \left( \frac{A}{W} + 1 \right) \]
Design Implications – Fitts’ Law

Pop-up Linear Menu

<table>
<thead>
<tr>
<th>Today</th>
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<tbody>
<tr>
<td>Sunday</td>
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<td>Friday</td>
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<td>Saturday</td>
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</tbody>
</table>

From Landay’s HCI slides
I’m still not sold on Pie menus
Design Implications – Fitts’ Law
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• Optimized Initial Impulse Model
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Findings

- Even if target expansion occurs as late as 90% of movement distance, still get full benefits
  - To understand why...
Findings

• Movement time from Fitts’s Law is based on final target size, not initial size
Design Implications
Problems?
Zhai et al. Replication

- Did participants start to assume target would expand?
- Looked at randomly expanding, shrinking of leaving target unchanged
Other findings

• Reaction time varied with ID
  – Explanation?

• Why Mac Dock expansion sucks
  – And what we can do about it …
Replications from class

- Ruoti et al. → Atwater and Bocovich (SOUPS 2015)
- Mandryk and Lough → Ruiz (AVI 2014)