Human-Computer Interaction

# Course Introduction

Professor Bilge Mutlu

# Today's Agenda

- Topic introduction
- HCI research at Wisconsin
- Course introduction

# Instructional Team

**Instructor:** Bilge Mutlu

*Associate Professor of Computer Science, Psychology, & Industrial Engineering*

*Director of Human-Computer Interaction Laboratory*

PhD, 2009, Carnegie Mellon University

bilge@cs.wisc.edu, http://cs.wisc.edu/hci

# Instructional Team

**TA:** Hanna Strohm

First year graduate student

Department of Computer Sciences

*How about you?*
*Give us your name, program.*

# *What is this course about?*

# Human-Computer Interaction

*What does HCI mean to you?*

# Different Perspectives

**Design Implications**

*I want to design a computer system and need to know what to design.*

**Evaluation**

*I have designed a computer system and would like to understand whether it is any good (for people).*

**Understanding Impact**

*I would like to understand how a computer system that I designed affects people's lives.*

**Societal Change**

*I would like to understand how a computer technology affects society at large.*

# Definitions

"…a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them."

— ACM

*Where does HCI fit within Computer Science?*

[1]

[1] Image sources: 1, 2, 3, 4, 5, 6

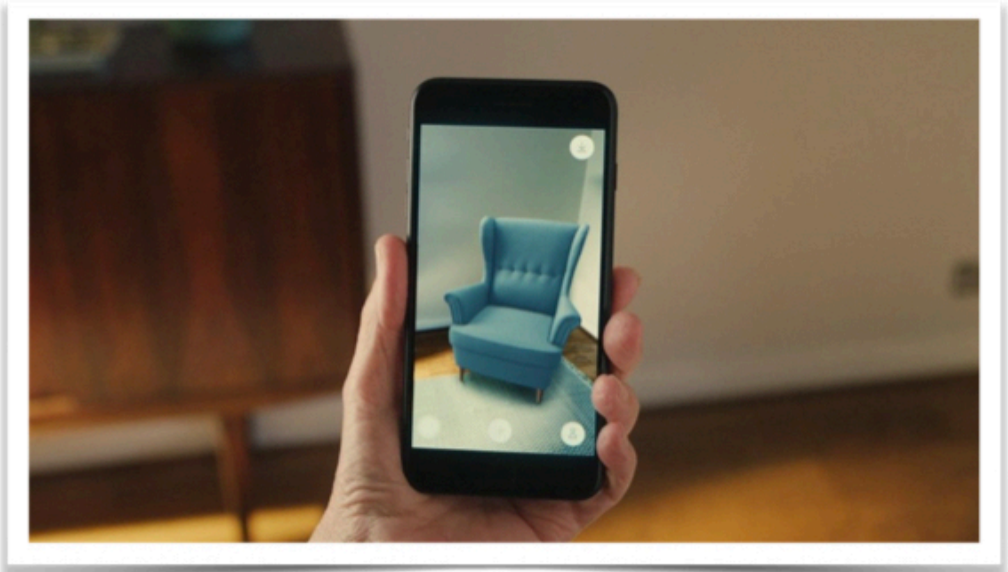
*What's missing here?*

"The old computing is about what computer can do, the new computing is about what people can do [using the computer]."[2]

— Schneiderman, 2002


[2] Image source

[3]






[3] Image sources: 1, 2, 3, 4, 5, 6

*Where does HCI fit within psychology/ education?*

4

[4] Image sources: 1, 2, 3, 4

*What's missing here?*

5

[5] Image sources: 1, 2, 3, 4

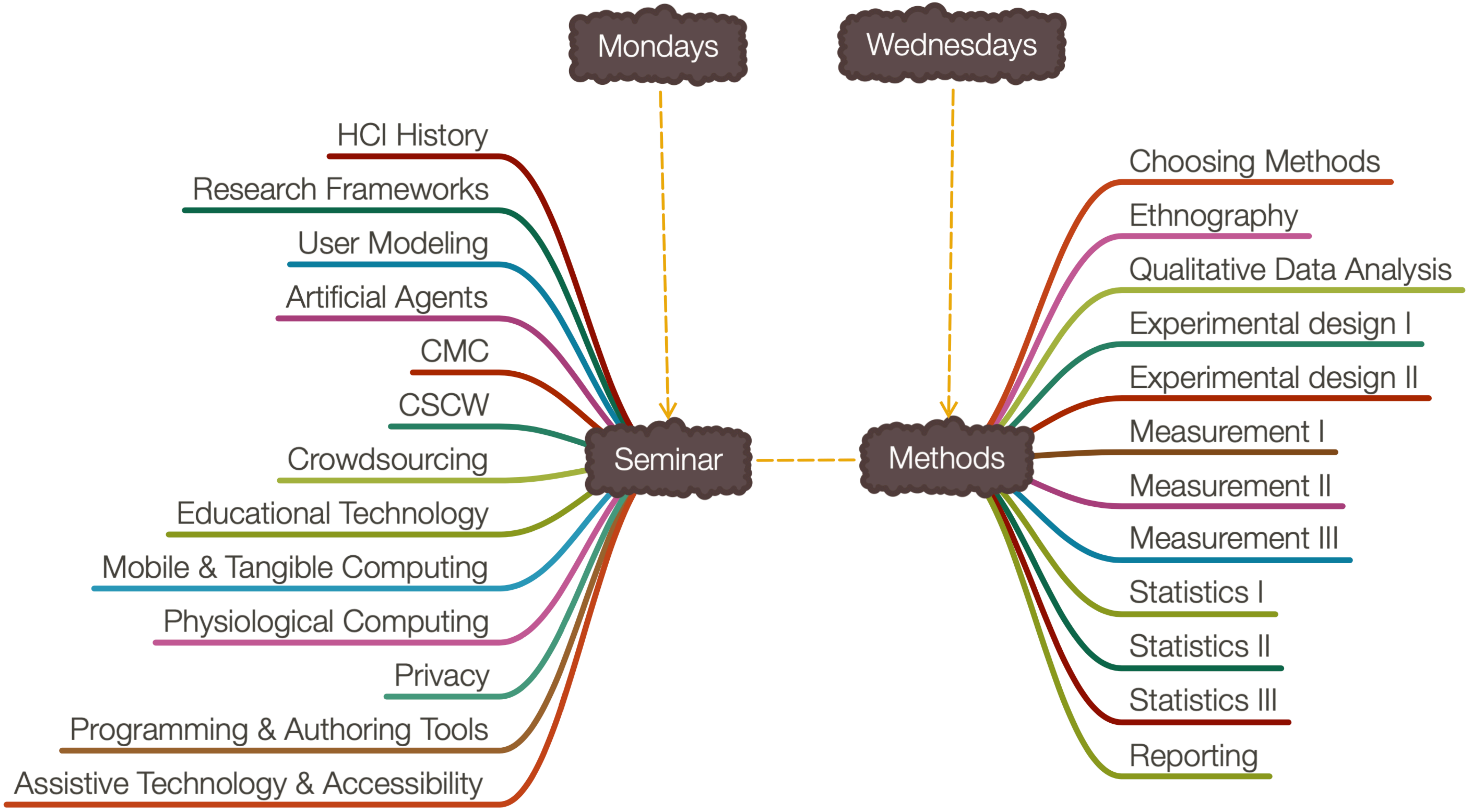
**Seminar** in HCI

+

**Research Methods** in HCI

+

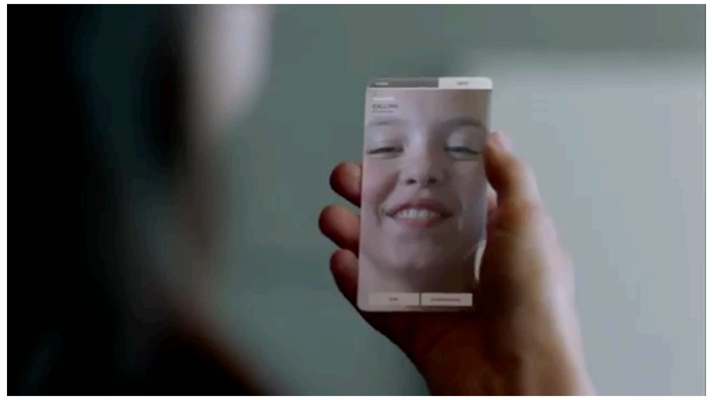
**Independent Study** in HCI


Mondays
Wednesdays
HCI History
Research Frameworks
User Modeling
Artificial Agents
CMC
CSCW
Crowdsourcing
Educational Technology
Mobile & Tangible Computing
Physiological Computing
Privacy
Programming & Authoring Tools
Assistive Technology & Accessibility
Seminar
Methods
Choosing Methods
Ethnography
Qualitative Data Analysis
Experimental design I
Experimental design II
Measurement I
Measurement II
Measurement III
Statistics I
Statistics II
Statistics III
Reporting

## Wearable computing[7]


## CSCW

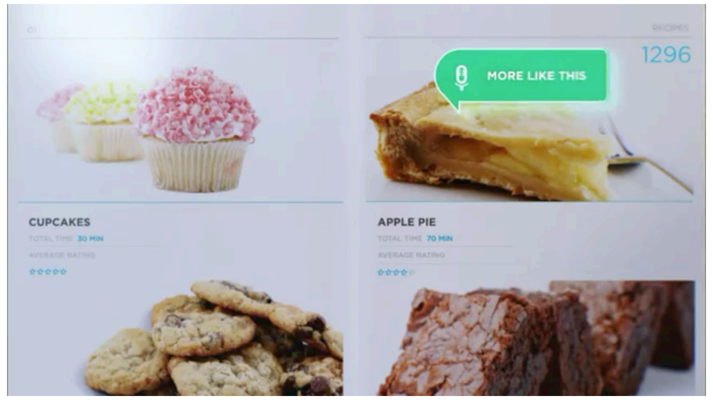
## CMC



## Mobile computing

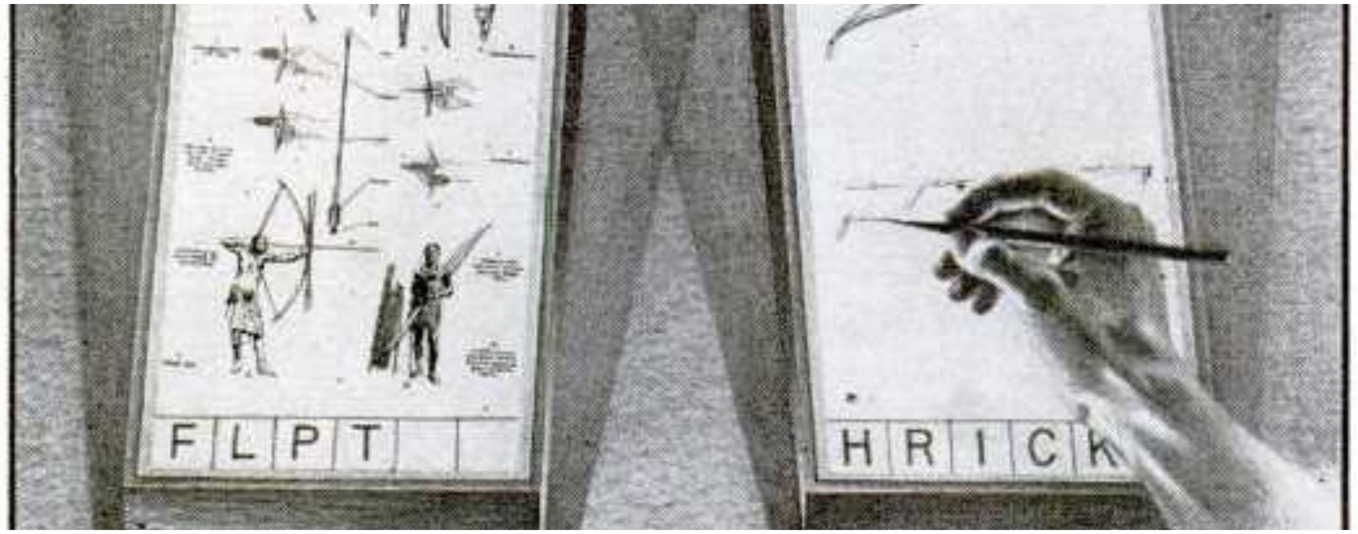

## Educational Technology

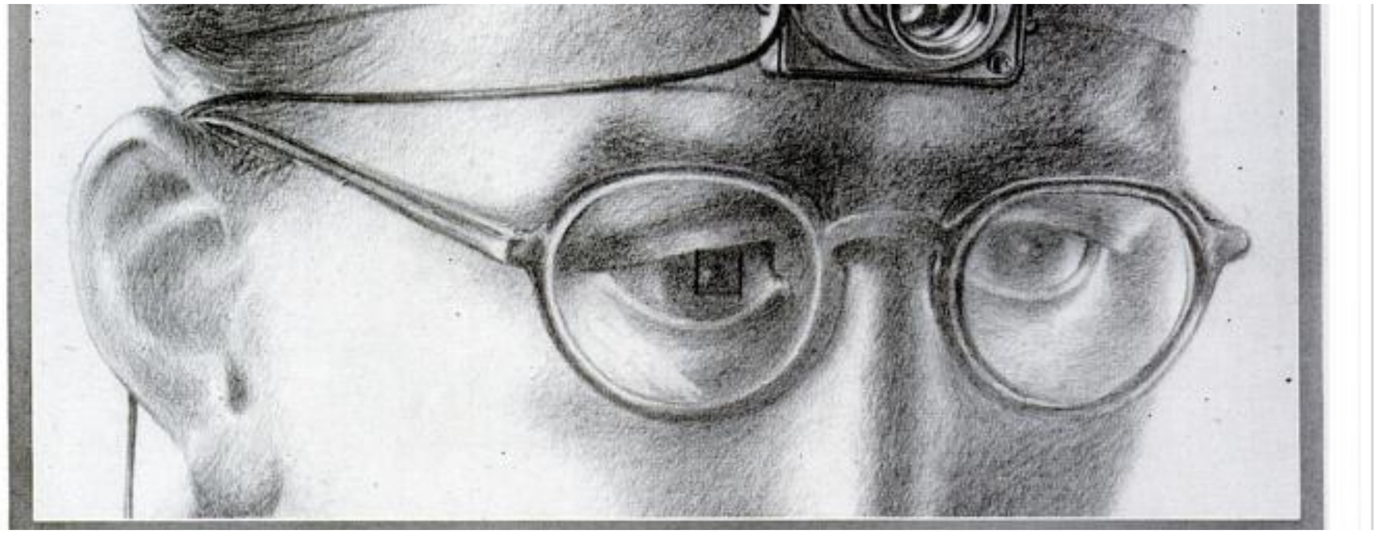

## Recommender Systems




[7] Microsoft Office

## 1945 (Vannevar Bush)[8]



## 2011 (Microsoft)


[8] Wired, Microsoft

# Questions?

# HCI Research at Wisconsin

# Questions?

# Course Outline

*What's the different between 570 and 770?*

"…a discipline concerned with (**570**) [the design, evaluation and implementation of interactive computing systems for human use] and with (**770**) [the study of major phenomena surrounding them]."

— ACM

# Learning Goals

1. Define research questions, construct hypotheses, map out and identify gaps in the research literature, and situate research questions and hypotheses in existing knowledge
2. Gain familiarity with seminal research across various topics in human-computer interaction
3. Determine the research approach that best fits a research question, identify variables of interest for empirical investigation, and design qualitative, qualitative, and hybrid studies

1. Determine appropriate objective, behavioral, physiological, subjective, and composite measures for empirical investigation
2. Design survey questions, construct scales, and assess reliability and validity
3. Analyze qualitative and quantitative data using grounded theory and statistical methods
4. Carry out a project to investigate an original research question in human-computer interaction
5. Write an academic paper to report on research design and

# Setting Expectations

1. Be prepared to read a lot ~ 2 papers + 1 book chapter each week
2. This class will take about ~15 hours/week (university guidelines require a minimum of 9 hours for 3-credit courses, and that's for undergraduates)
3. Be prepared to discuss

# Questions?

# Overview of Syllabus

# Three modules

1. Seminar
2. Methods
3. Project

# Module 1: Seminar

# General Outline[9]

We will read seminal papers, discuss them online and in class.

» You will read 1–2 papers per week and will find 1 resource (an academic paper, popular science article, a video) yourself

» First 45 minutes of Monday class

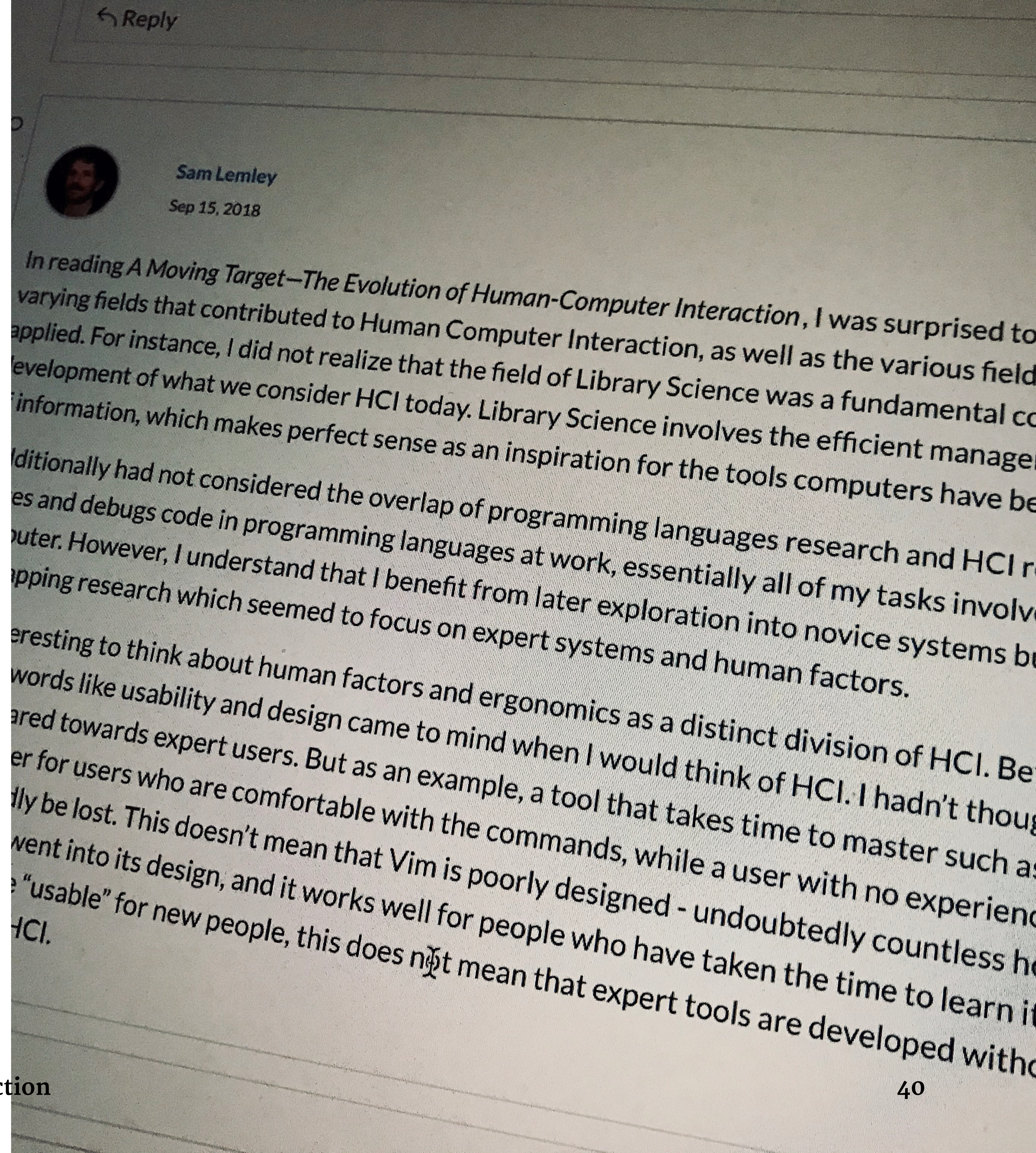
» I will give a 15-minute overview of the topic and lead a 30-

[9] Image source

# Online Discussion

Students reflect on the topic (from the readings and/or the resource they found) in online forum

- Minimum of 250 words
- Due Sunday midnights
- Post on Canvas
- Graded on timeliness, depth, and substantiveness



# Classroom Discussion

We will work together to try to come up with a list of takeaways from the topic

- Instructor will give an overview
- Students will have a brief discussion, generating questions
- Instructor will collect questions and facilitate discussion
- Class will collectively distill the discussion to a set of takeaways

We'll review the process on Tuesday.

# Why are we doing this?

» **Dialectics** — through discussion, we establish common themes/concerns/ground

» **Reflection** — you rarely get the chance to engage in open-ended discussion on research topics

» **Trivium** — you will get the grammar (language), logic (mechanics), and rhetoric (arguments) of a topic

# Module 2: Methods

# General Outline[10]

We will learn about HCI research methods through lectures, hands-on-activities, and assignments.

- Every week, a new research method is presented
- Reading a chapter from the textbook
- Lecture for ~30 minutes


[10] Image source

# Assignments

You will complete six 1-2-week-long assignments:

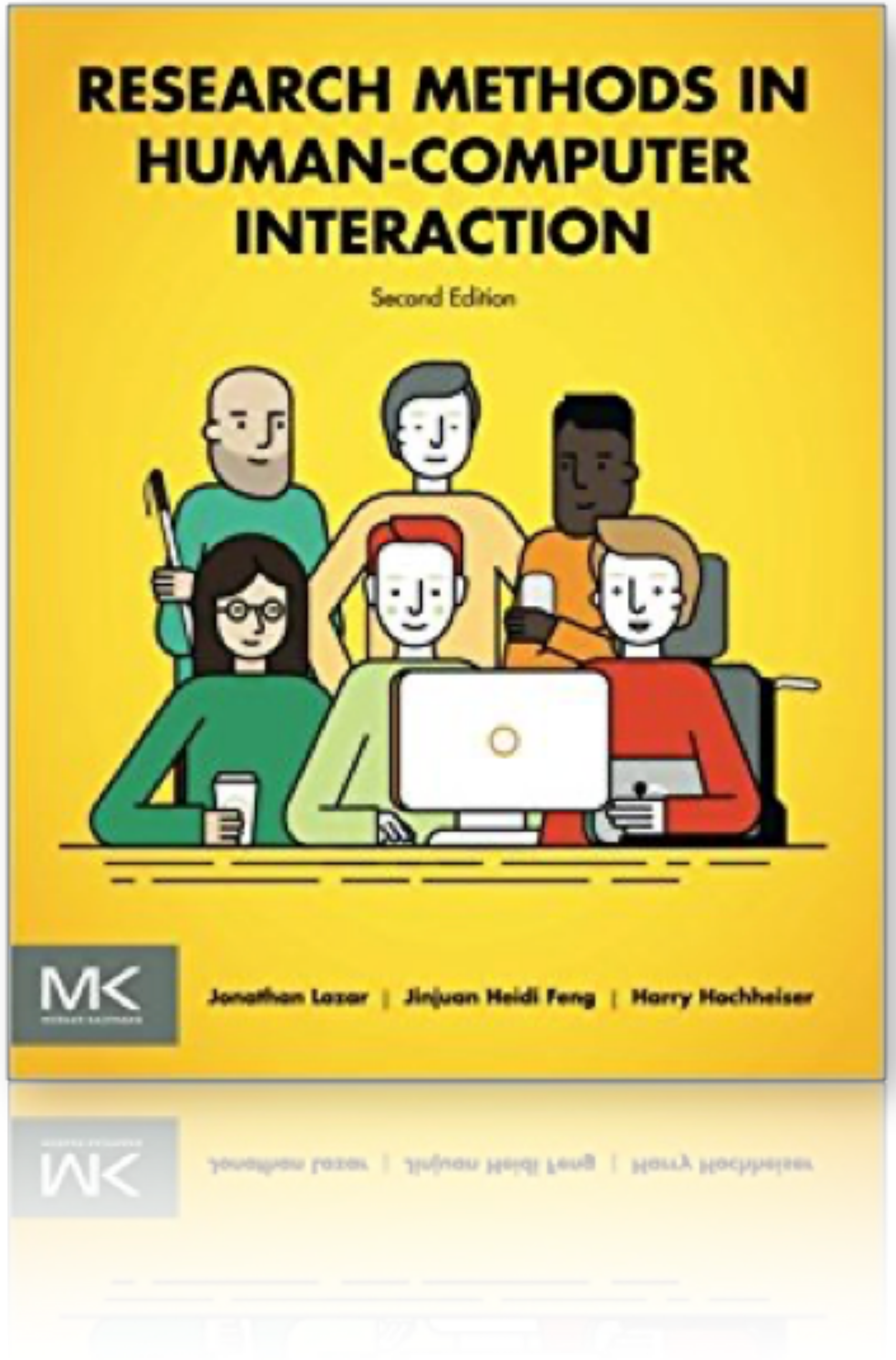
» **Assignment 0:** Human subjects protection training
» **Assignment 1.A–B:** Qualitative/ethographic research
» **Assignment 2.A–B–C:** Quantitative/experimental research

Always due Fridays at midnight

# Textbook

Research Methods in Human-Computer Interaction, *Second Edition*, Lazar et al., 2017

*Free through the University Library*



# Why are we doing this?

- **Learning** — you will learn a sample of all of the major methods and tools used in HCI research
- **Practice** — you will practice some of the critical ones in structured, guided ways

# Module 3: Project

# General Outline

We will carry out a semester-long research project where you will connect and practice the **seminar** and **methods** modules.

» We will use the last 15 minutes of class on Mondays and Wednesdays to discuss project goals, steps, deliverables

» Feedback during office hours, through deliverables

» Individual or pairs, expectations are different

# Project Deliverable

We will incrementally write a four-to-six-page paper potentially submittable to an HCI conference.

- **Individuals:** 4 pages
- **Pairs:** 6 pages

## Designing Persuasive Robots: How Robots Might Persuade People Using Vocal and Nonverbal Cues

Vijay Chidambaram, Yueh-Hsuan Chiang, Bilge Mutlu
Department of Computer Sciences, University of Wisconsin–Madison
1210 West Dayton Street, Madison, WI 53706, USA
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### ABSTRACT

Social robots have to potential to serve as personal, organizational, and public assistants as, for instance, diet coaches, teacher's aides, and emergency respondents. The success of these robots—whether in motivating users to adhere to a diet regimen or in encouraging them to follow evacuation procedures in the case of a fire—will rely largely on their ability to *persuade* people. Research in a range of areas from political communication to education suggest that the nonverbal behaviors of a human speaker play a key role in the persuasiveness of the speaker's message and the listeners' compliance with it. In this paper, we explore how a robot might effectively use these behaviors, particularly vocal and bodily cues, to persuade users. In an experiment with 32 participants, we evaluate how manipulations in a robot's use of nonverbal cues affected participants' perceptions of the robot's persuasiveness and their compliance with the robot's suggestions across four conditions: (1) no vocal or bodily cues, (2) vocal cues only, (3) bodily cues only, and (4) vocal and bodily cues. The results showed that participants complied with the robot's suggestions significantly more when it used nonverbal cues than they did when it did not use these cues and that bodily cues were more effective in persuading participants than vocal cues were. Our model of persuasive nonverbal cues and experimental results have direct implications for the design of persuasive behaviors for humanlike robots.

### Categories and Subject Descriptors

H.1.2 [**Models and Principles**]: User/Machine Systems – *human factors, software psychology*; H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *evaluation/methodology, user-centered design*

### General Terms

Design, Human Factors



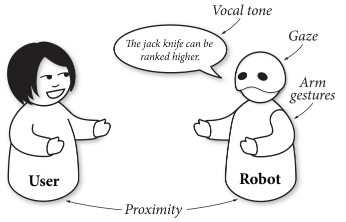



**Figure 1:** The vocal and bodily cues of persuasion in human-robot interaction.

### Keywords

Persuasion, compliance, nonverbal immediacy, nonverbal cues, gaze, gestures, proximity, vocal tone

### 1. INTRODUCTION

Robots hold great promise as social actors that may positively affect and improve people's motivation and compliance in such areas as education [13], health [31], and well-being [29]. The success of these robots in motivating people will rely largely on their ability to *persuade*. But how could robots persuade people? And how can we design persuasive robots?

Research in human communication has identified a number of behavioral attributes that shape individuals' *nonverbal immediacy*—the degree of perceived bodily and psychological closeness between people—and suggested that individuals' nonverbal immediacy plays a key role in persuading others [35]. These attributes include primarily nonverbal behaviors, particularly *bodily* cues such as proximity, gaze, gestures, posture, facial expressions, touching and *vocal* cues such as vocal tone and expressions [43]. While a considerable amount of research in robotics has explored the role of nonverbal cues in human-robot interaction (e.g., [47, 5, 25]), the way in which these cues might shape the persuasive ability of a robot has not yet been studied.

A few studies in human-robot interaction have explored how robots might be designed as persuasive agents [48, 37]. While existing work highlights the importance of persuasion in human-robot interaction and provides some guidelines for

Chidambaram et al., 2012

(137 citations)

## Is cheating a human function? The roles of presence, state hostility, and enjoyment in an unfair video game [1] [2] [3]

J.J. De Simone,[4] Tessa Verbruggen, Li-Hsiang Kuo, Bilge Mutlu

### Abstract

In sports and board games, when an opponent cheats, the other players typically greet it with disdain, anger, and disengagement. However, work has yet to fully address the role of the computer cheating in video games. In this study, participants played either a cheating or a non-cheating version of a modified open-source tower-defense game. Results indicate that when a computer competitor cheats, players perceive the opponent as being more human. Cheating also increases player aggravation and presence, but does not affect enjoyment of the experience. Additionally, players that firmly believed that their opponent was controlled by the computer exhibited significantly less state hostility compared to players that were less certain of the nature of their competitor. Game designers can integrate subtle levels of cheating into computer opponents without any real negative responses from the players. The results indicate that minor levels of cheating might also increase player engagement with video games.

### 1. Introduction

In society, the concept of cheating is largely met with disdain, anger, and revenge. For example, Bernie Madoff enacted a large-scale fraudulent investment operation, which resulted in the thievery of $64.8 billion from thousands of investors (Frank, Efrati, Lucchetti, & Bray, 2009). A judge sentenced Madoff to 150 years in prison and hundreds of billions of dollars in restitution. Thus, society viewed Madoff's cheating as highly unethical and inhuman. Similar rules about cheating are also applied to sporting events, children's games, schoolwork, and video games. For example, when humans are playing video games against other human gamers, cheating is not accepted. If one player cheats in the game world, other players either resort to cheating themselves or disengage entirely with the game (Kabus, Terpstra, Cilia, & Buchmann, 2005).

When it comes to computer-controlled agents, cheating is not only the norm; the human competitor generally accepts it (Fairclough, Fagan, Mac Namee, & Cunningham, 2001). That is, in order to construct a realistic and evenly matched competitor, designers must create algorithms that allow the agents to ''see'' through walls or use other means to locate the human player's avatar. The human player does not disengage with the game; rather, he or she is aware on some level that this subtle form of cheating is necessary in order for the game to possess an aspect of challenge (Fairclough et al., 2001). Interestingly, little empirical evidence has been collected and analyzed regarding a cheating agent controlled by the computer. This paper presents a study that begins to analyze the effects of the computer cheating in video games in order for designers to be able to create video games that are more enjoyable, immersive, and engaging. Two theoretical models will help to explain possible effects of cheating in a game.

[1] University of Wisconsin–Madison, Department of Computer Sciences provided financial support for this research.

[2] A preliminary version of this manuscript has been presented at the 2012 Association for Education in Journalism and Mass Communication Conference.

[3] Authors thank Karyn Riddle for her valuable comments.

[4] Corresponding author. Tel.: +1 816 589 1469. E-mail address: jdesimone@wisc.edu (J.J. De Simone).

De Simone et al. 2012

(11 citations)

## Handheld or Handsfree? Remote Collaboration via Lightweight Head-Mounted Displays and Handheld Devices

Steven Johnson[1], Madeleine Gibson[2], Bilge Mutlu[1]
[1] Department of Computer Sciences
[2] Department of Industrial and Systems Engineering
University of Wisconsin–Madison
sjj@cs.wisc.edu; mcgibson2@wisc.edu; bilge@cs.wisc.edu

### ABSTRACT

Emerging wearable and mobile communication technologies, such as lightweight head-mounted displays (HMDs) and handheld devices, promise support for everyday remote collaboration. Despite their potential for widespread use, their effectiveness as collaborative tools is unknown, particularly in physical tasks involving mobility. To better understand their impact on collaborative behaviors, perceptions, and performance, we conducted a two-by-two (technology type: HMD vs. tablet computer; task setting: static vs. dynamic) between-subjects study where participants ($n = 66$) remotely collaborated as "helper" and "worker" pairs in the construction of a physical object. Our results showed that, in the dynamic task, HMD use enabled helpers to offer more frequent directing commands and more proactive assistance, resulting in marginally faster task completion. In the static task, while tablet use helped convey subtle visual information, helpers and workers had conflicting perceptions of how the two technologies contributed to their success. Our findings offer strong design and research implications, underlining the importance of a consistent view of the shared workspace and the differential support collaborators with different roles receive from technologies.

### ACM Classification Keywords

H.5.3 **Information Interfaces and Presentation**: Group and Organization Interfaces–*Collaborative computing, Computer-supported cooperative work, Evaluation/methodology*

### General Terms

Human Factors; Performance; Experimentation

### Author Keywords

Computer-supported cooperative work; remote collaboration; videoconferencing; head-mounted displays (HMDs); wearable computing; handheld devices; tablet computers



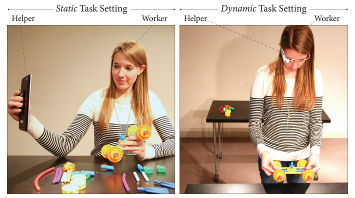



**Figure 1. Participants remotely collaborated in pairs using either a tablet or an HMD in a construction task in one of two task settings: a *static* task setting, requiring low levels of mobility, or a *dynamic* task setting, requiring high levels of mobility.**

### INTRODUCTION

Collaborative work across many domains involves physical tasks. A team of doctors performing surgery, workers repairing machinery, and young adults learning how to cook from their parents are examples of hands-on activities where the level of expertise differs across members of the collaboration. Distributed physical tasks, in which not all members of the collaboration are collocated, have important roles in medical, industrial, and educational domains. With the rapid development of communication and collaboration technologies that enable remote workspace sharing, such as smartphones, tablets, and lightweight head-mounted displays (HMDs), remote collaboration for physical tasks has become more feasible than ever. These technologies promise easy assistance to users from their co-workers, family members, or friends who have expertise in their task—not just those individuals who are most geographically accessible.

While many technologies that support assistance in physical tasks are finding widespread use, little research has been conducted to evaluate their efficiency and effectiveness in these settings. One class of collaboration technologies are handheld mobile devices, such as smartphones and tablet computers, which are equipped with videoconferencing capabilities that can enhance collaboration [8]. Tablets are also becoming increasingly popular for both work and casual use [9]. The larger screen size of a tablet computer relative to the smartphone may

Johnson et al., 2015

(36 citations)

# Project Topics

We will take inspiration from last year's best-paper-award winners at CHI and choose a topic following the algorithm:

**Skim a set of papers**

**Focus on 2-3 based on interest/research style**

**Read related work to understand gap**

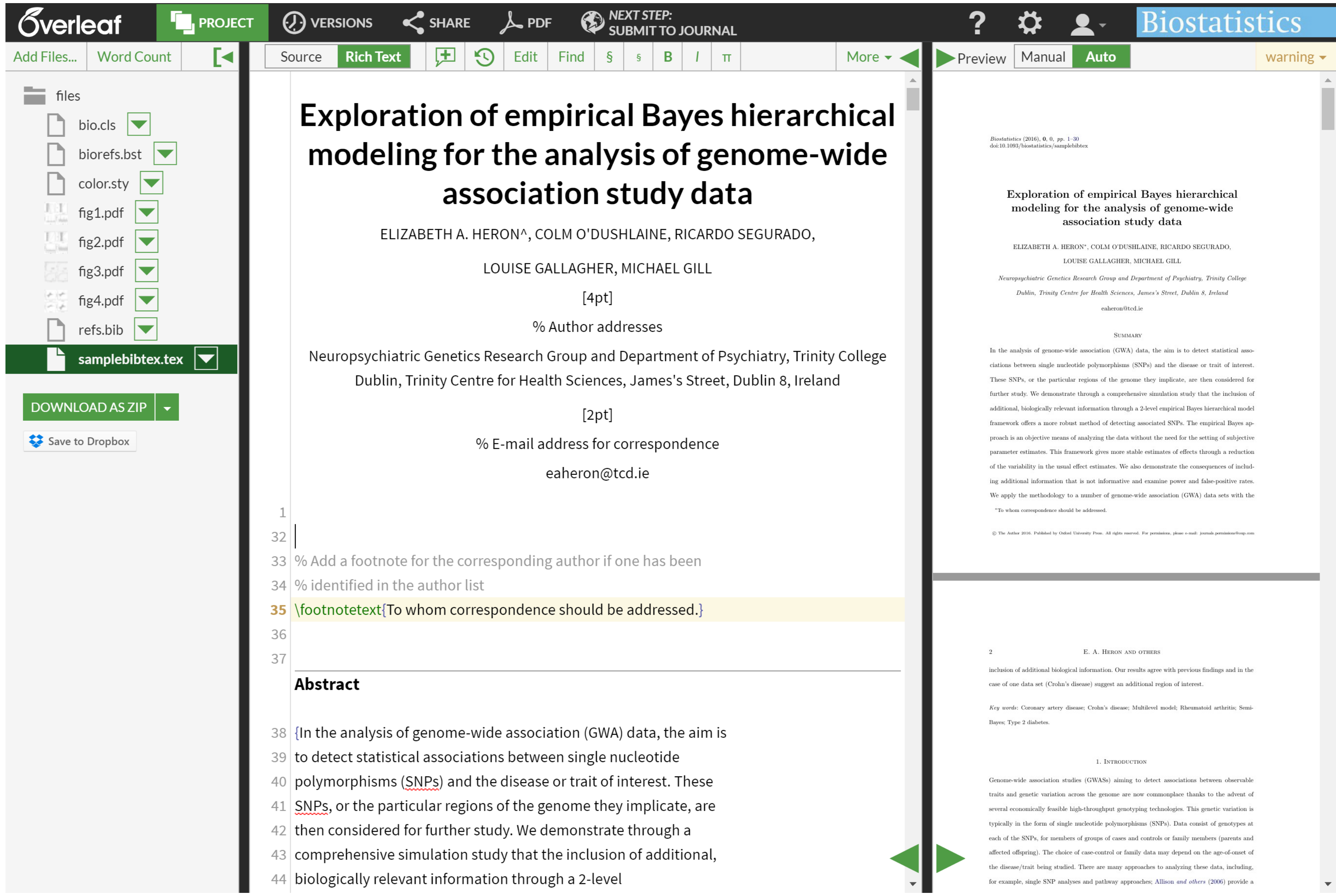
**Read what the paper did to understand where it fits**

**Determine what else remains unexplored from limitations**

**Zoom out, choose topic, find partner (optional)**

# Project Deliverables[11]

- » Project Topic
- » Literature survey, RQs
- » Method
- » Data
- » Analysis, results
- » Final paper




[11] Image source

# Why are we doing this?

- Practicing research with different levels of uncertainty
  - **Hands-on activities**: controlled, structured, short
  - **Assignments**: semi-controlled, semi-structured, medium
  - **Projects**: uncontrolled, unstructured, long
- This might feel redundant, but redundancy is often good!
- Bridging the seminar and the methods, contextualizing the methods within the seminar topics

# Questions?

# Course Policies

# Grading

| **Assessments** | **Points** |
|---|---|
| **Seminar:** Participation in online discussions | 15 |
| **Methods:** Hands-on activities | 10 |
| **Methods:** Assignments | 40 |
| **Project** | 30 |
| **General:** Attendance, classroom participation | 5 |
| *Total* | *100* |

| **Letter grade** | **Grade range** | **Description** |
|---|---|---|
| **A** | 93.5–100 | Excellent work *(Exceeds expectations)* |
| **AB** | 89.5–93.4 | Good work *(Robustly meets all stated requirements)* |
| **B** | 83.5–89.4 | Adequate work *(Meets the spirit of all stated requirements)* |
| **BC** | 79.5–83.4 | Slightly below adequate *(Missing small required elements or turned in late without approved extension)* |
| **C** | 73.5–79.4 | Below adequate *(Missing required elements or turned in late without approved extension)* |
| **D** | 73.4–63.5 | Well below adequate *(Missing many required elements or turned in late without approved extension)* |
| **F** | 63.5 | Inadequate *(Work not turned in, no extension requested)* |

*Rule of Thumb:* If you complete every assignment, you should be getting an **A** or an **AB**. So, just come to class, do the work, and don't worry about your grade.

# Communication

| Type | Examples | Channel |
|---|---|---|
| **Question about course content** | "R is giving me a singularity error;" "Should we be turning in our data file?" | Post on Piazza |
| **Personal questions** | "I am traveling to a conference on <date>;" "I have to travel to my home country because of an emergency!" | Email hci-class@cs.wisc.edu |
| **Feedback request** | "Can we get feedback on our study design;" "Can you check if I'm doing this analysis right?" | Office hours |

# During Class

**Laptops/tablets:** Laptop and tablet use is encouraged for the ongoing class and discouraged for anything else:

» Engaging in Piazza; looking through readings, slides; researching.

» We will have a Piazza thread open at every class for questions.

**Phones:** Should be put away.

In general, please strive to **be present**.

# Late, Absence Policy

**Late assignments:** Will lose 20% of the total grade for the assignment for each day it is late. Only true emergencies (e.g., hospital visits) justify extensions.

**Missing class:** $E[m] = 2, m = \{0, 1, \ldots, 29\}$, so we will discount two absences from hands-on-activities/classroom discussion.

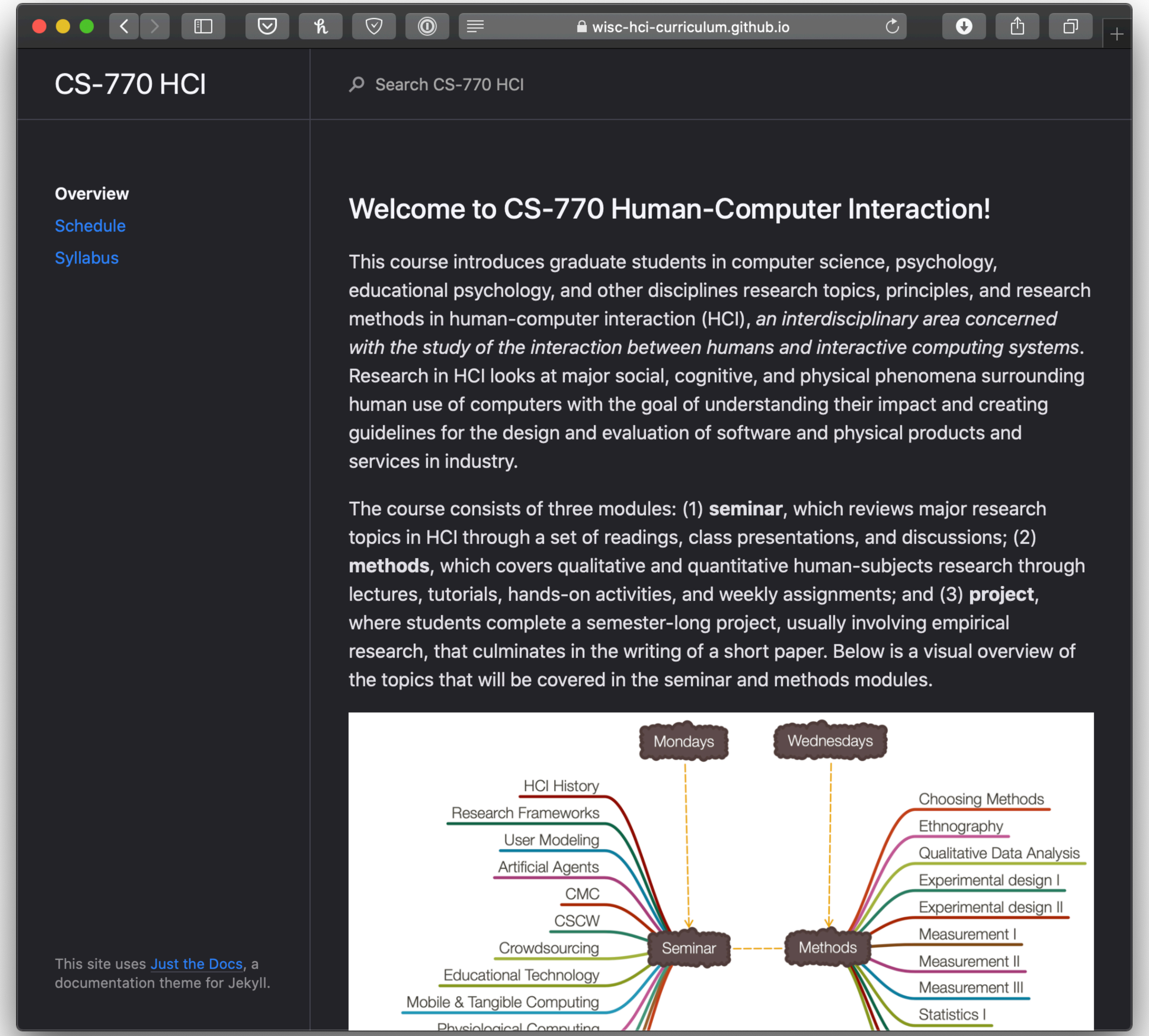
# Logistics

» [Course Website](#) | [Course Canvas](#)

## Office Hours

» **Instructor:** MW 2:15–2:45 pm, Ed Sciences 228

» **TA:** Tue 4:30–5:30 pm, Thu 1:00–2:00 pm, CS 1308



# Questions?

# What's next?

- **Seminar**
  - *Readings* due on Monday; *forum comment* due on Sunday
- **Method**
  - *Chapter reading* due on Wednesday; *Assignment 0* is due Feb 7
- **Project**
  - We'll discuss on Monday; *topic selection* due Feb 3