CS 889
Advanced Topics in Human-Computer Interaction

RepliCHI

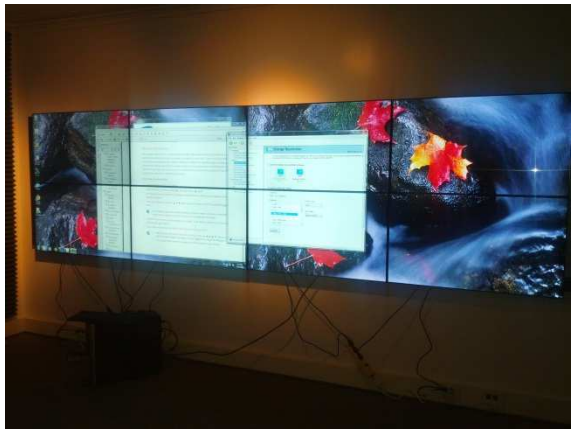
Scheduling

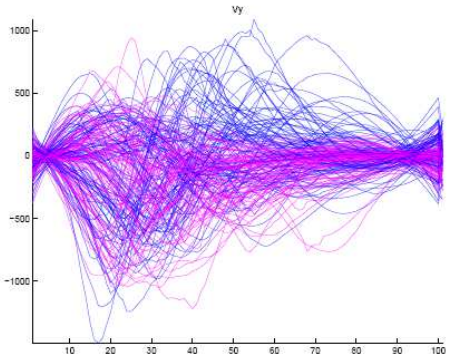
- Friday classes
  - Travel planned for May 14 – 16, May 24 to June 5, June 13 – 16, July 19 – 23rd.
- Two options:
  - Regular Friday classes early in term, followed by project breaks in June/July.
  - Make-up classes on Friday.

Overview

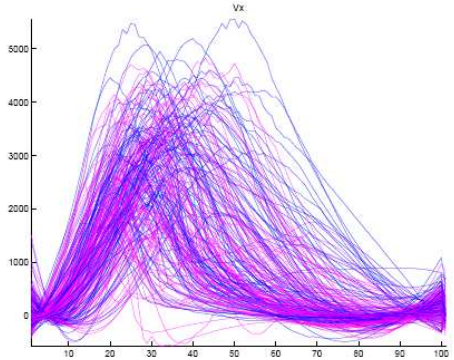
- A brief overview of HCI
- Experimental Methods overview
- Goals of this course
- Syllabus and course details

HCI at Waterloo

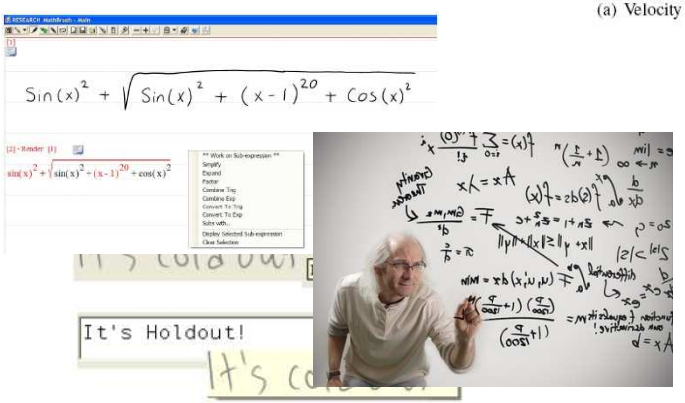




(a) Velocity in the Y direction



(b) Velocity in the X direction



Human Computer Interaction

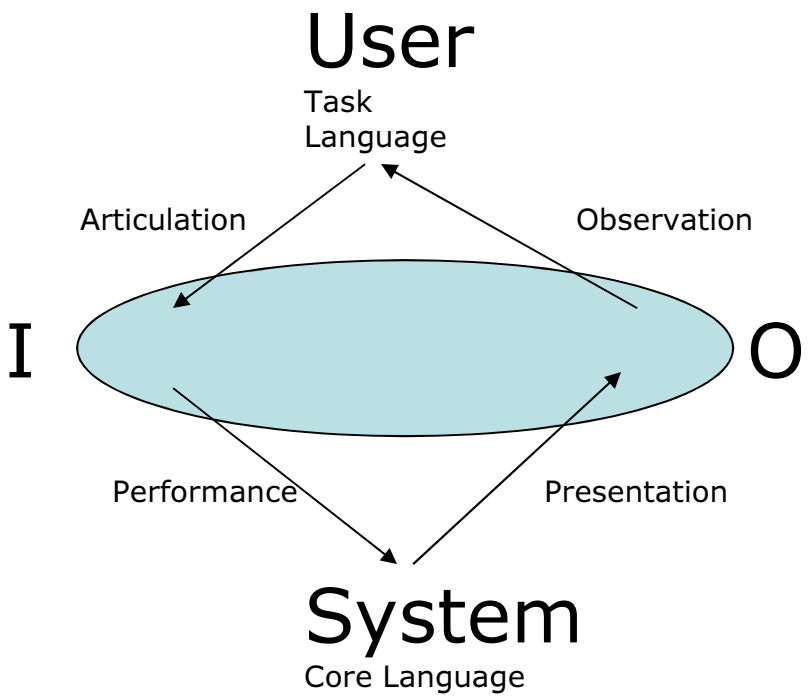
- Human
  - The user of a computer program, computerized device, or other information technology artifact
- Computer
  - The physical device, artifact, or hardware that runs the program
- Interaction
  - The communication between the human and the computer

Execution-Evaluation Cycle

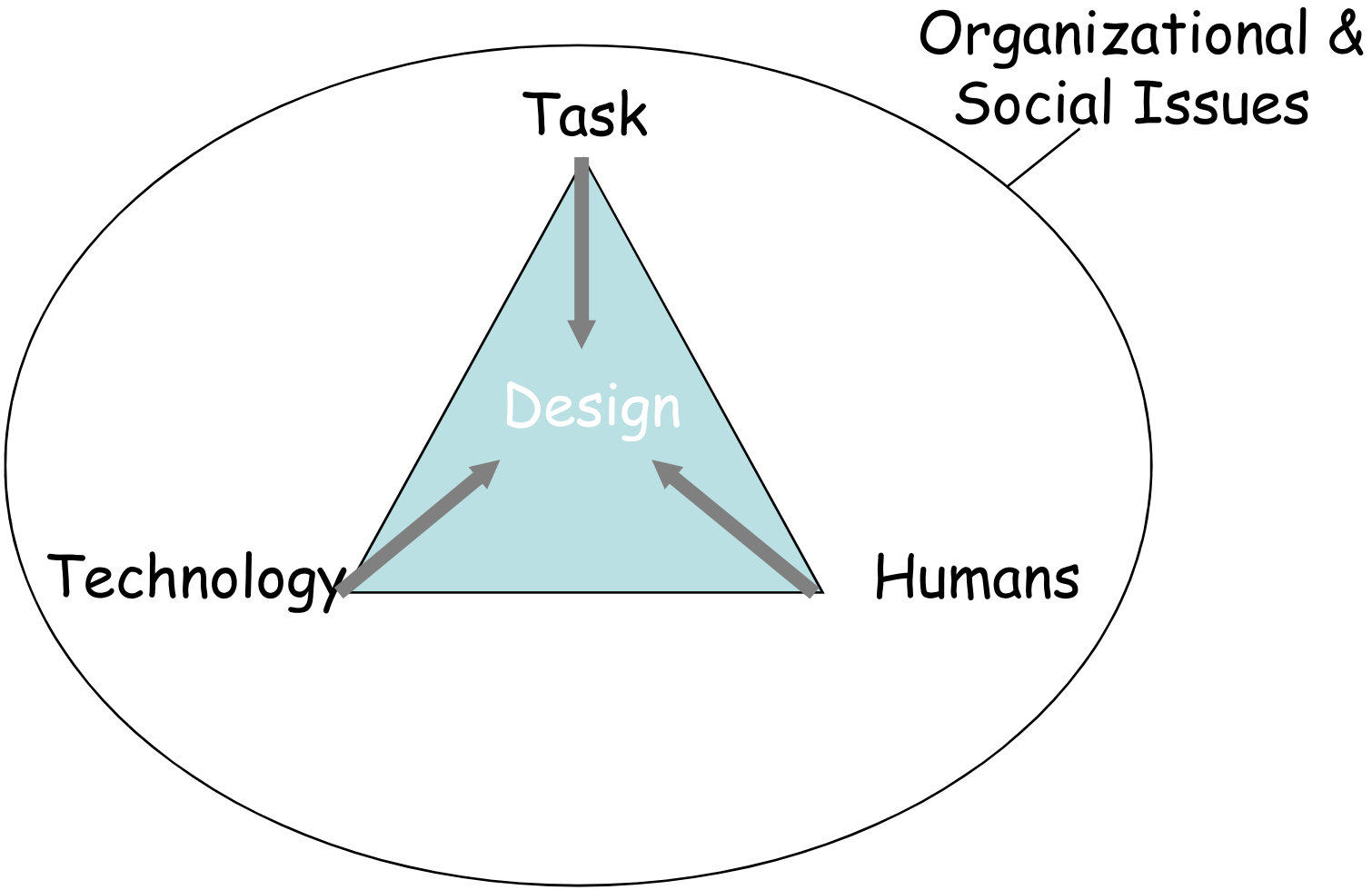
- 2 stages with 7 steps
- Developed by Norman (1980)
- Execution involves:
  - Establishing a goal
  - Forming the intention
  - Creating the plan (i.e. a sequence of actions)
  - Executing the plan
- Evaluation involves:
  - Perceiving system state
  - Interpreting state
  - Evaluating state wrt goal/intention

Interaction Framework

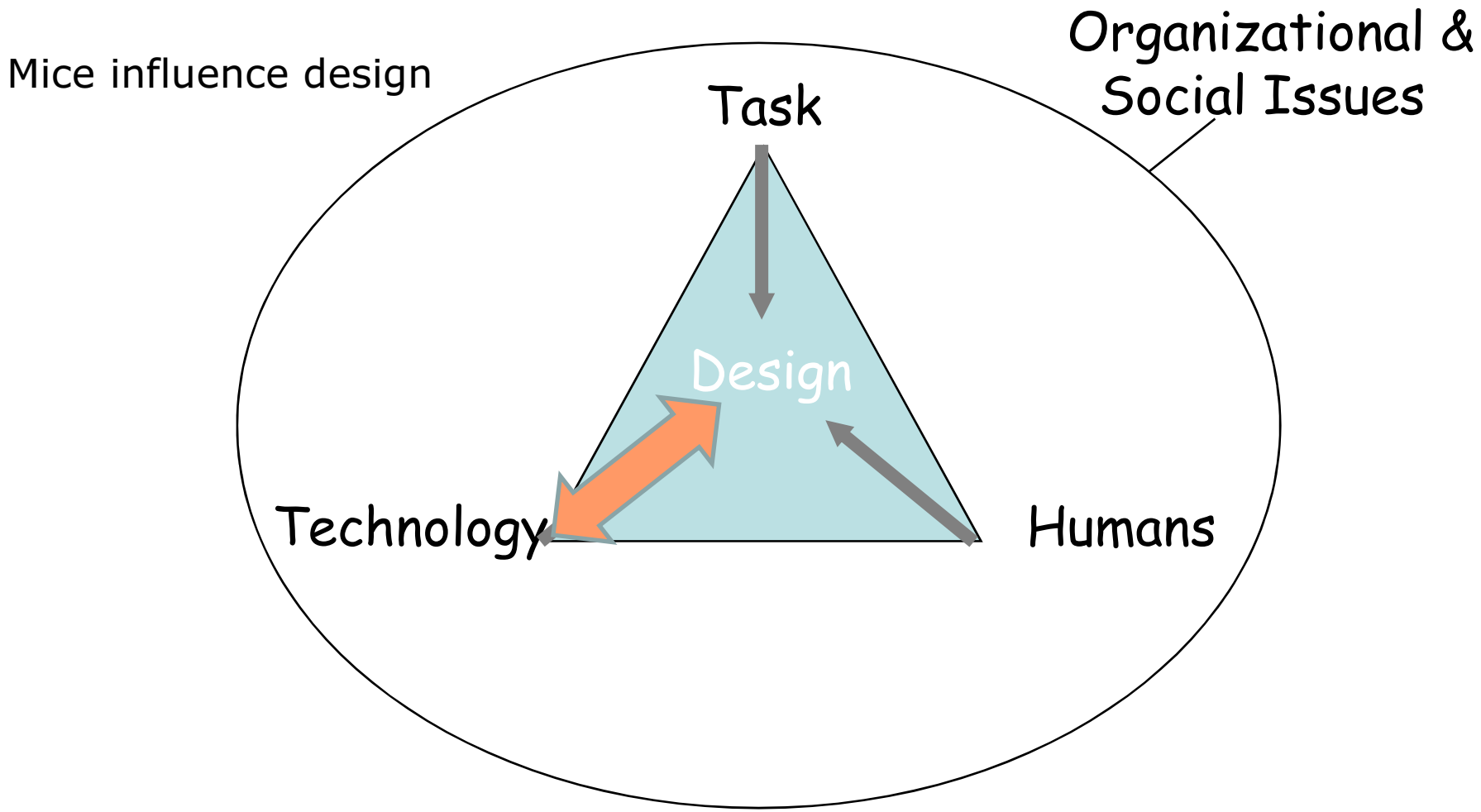
- Extends Norman's model:
  - Includes system state explicitly
- Four nodes:
  - System, User, Input and Output
  - Each node has own language:
    - System language = core language
    - User language = task language
    - Input and Output languages form the interface
      - Translates between core and task language



What is HCI?


Organizational &
Social Issues
Task
Design
Technology
Humans

What is HCI?


Mice influence design
Organizational &
Social Issues
Task
Design
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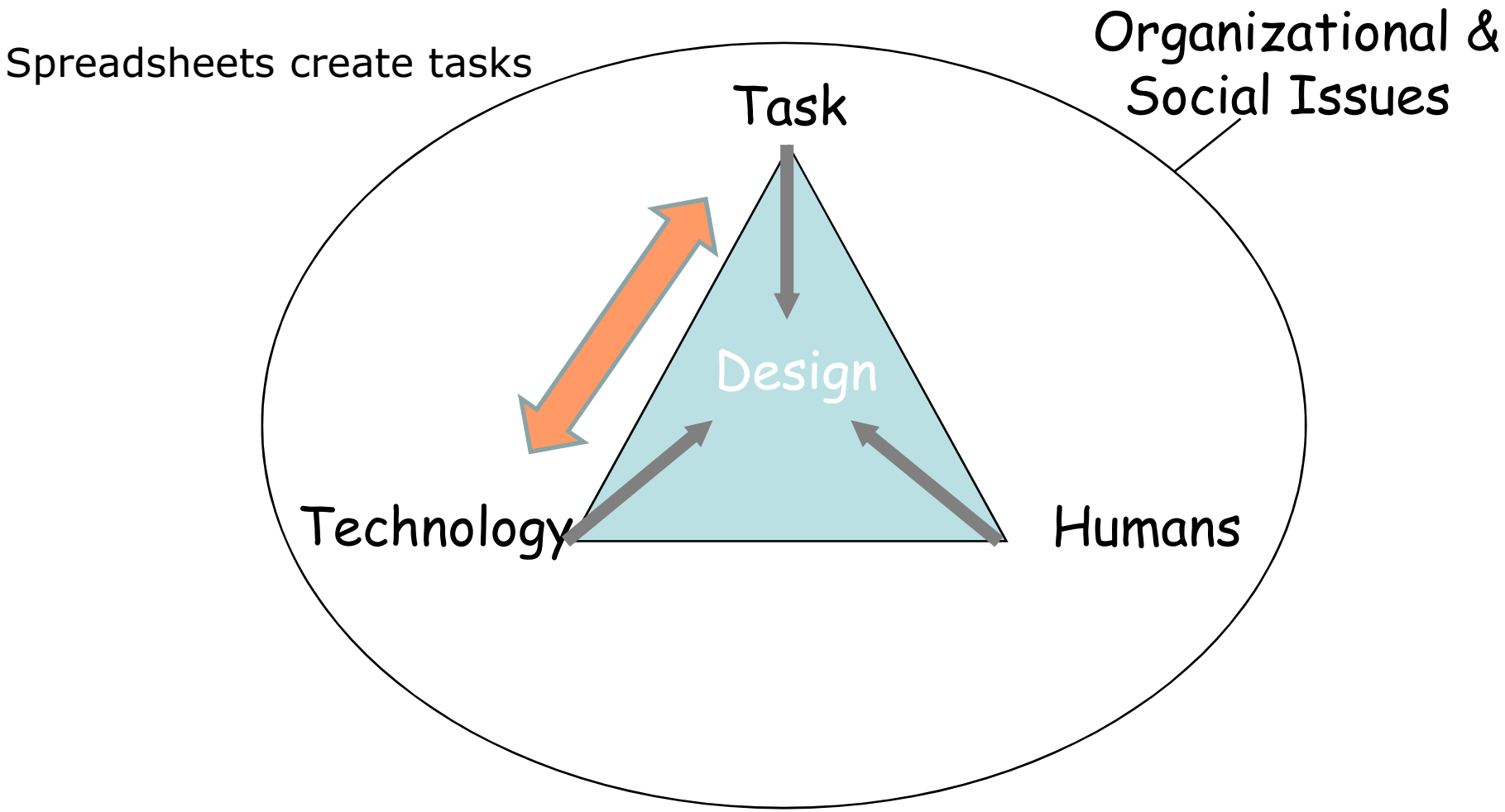
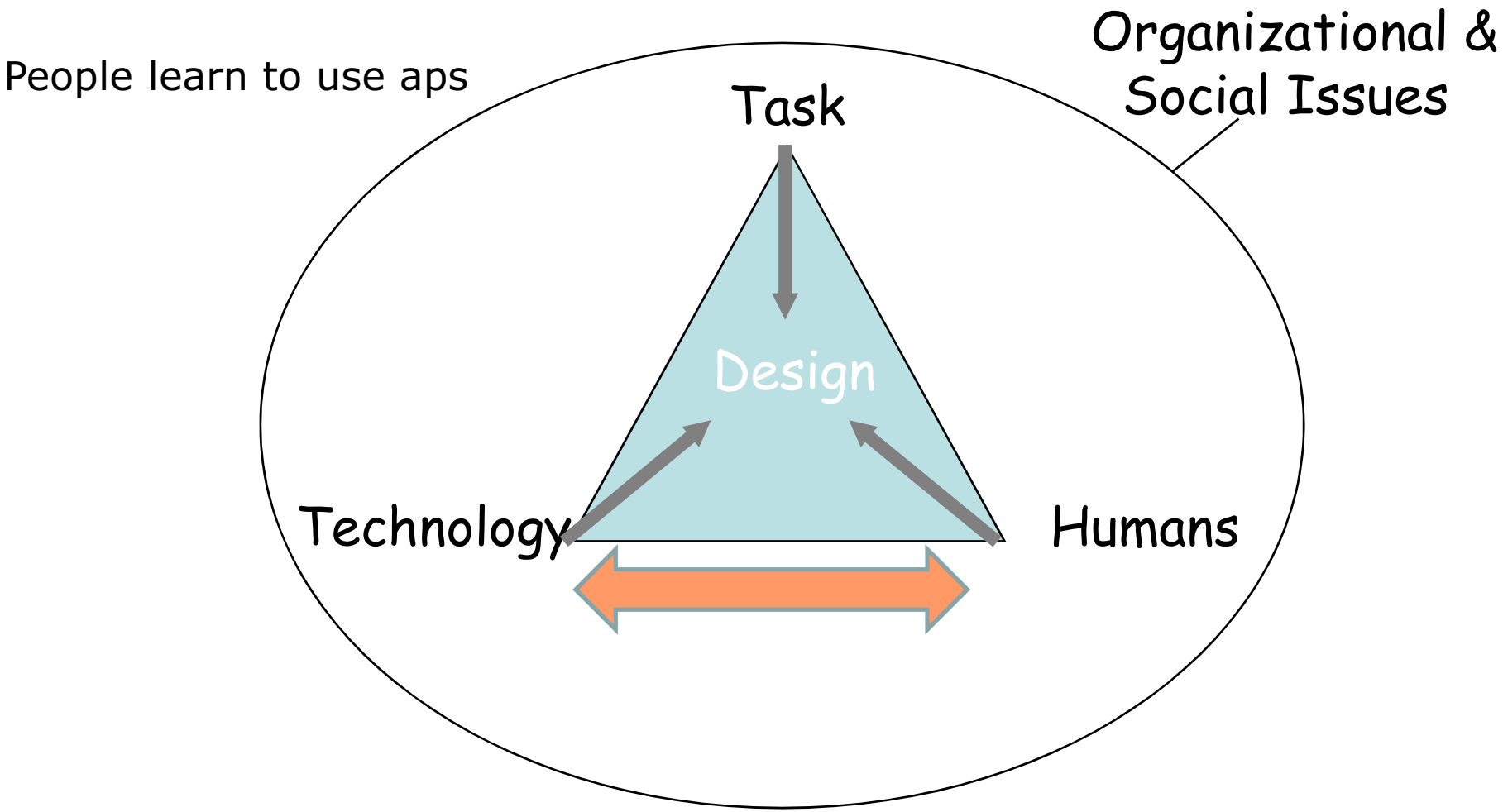
What is HCI?


Spreadsheets create tasks
Organizational & Social Issues
Task
Design
Technology
Humans

What is HCI?


People learn to use aps
Organizational &
Social Issues
Task
Design
Technology
Humans

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
    - 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
  - $P <= 0.05$
  - $R^2 \sim 1.0$

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 Nintendo DS systems for multiplayer 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 <= 0.05
    - R^2 ~ 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
    - Research papers
  - Groups of one or two
    - Exercises
    - Course project

Research papers – 35%

- Starting next week, assigned readings
  - Evening before class by 9pm, each student posts a summary of paper (typically ½ page) on course wiki
  - Typically drawn from CHI 2013
  - Some from older venues
- Early in the course (one or 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 two papers covered per class

Exercises – 20%

- Two posted
- Early exercises give some experience with data collection and analysis
  - Data collection and slide deck posted on wiki
  - Students selected at random to present their findings
  - Note that there will be distribution amongst all of you
- Later will be design crits on project research
  - Will be pre-planned and structured
  - Important learning experience

Project – 45%

- 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)
  - Qualitative Research: Choosing among five approaches
- Free eBooks
  - Basics of qualitative research : techniques and procedures for developing grounded theory, Corbin and Strauss
  - Practical Statistics 4 HCI (Wobbrock)

Questions?