CS4249 Phenomena and Theories of HCI

Shengdong Zhao

Fall, 2014
Instructor: Shengdong Zhao

Asst. Professor in SOC
Joined NUS Dec. 2008

Work in HCI
- Systems/tools for Creativity
- Interaction techniques/studies
- Human Robot Interaction
- Information Visualization

Office Hours
- Tuesday 1 hr after class (or by appt)

Email Contact
- cs4249-fall-2014@googlegroups.com

http://www.shengdongzhao.com
Topics

- Self-introduction
- A brief review and preview of HCI
- Course review and overview
We live in an exciting time!
Traditionally ...
In the future ...

Augmented Human

Augmented Environment
In the future ...
Sight ...

http://www.youtube.com/watch?v=lKdkpazjl
In the future ...

Augmented Human

Augmented Environment
A day of life with Corning ...

http://www.youtube.com/watch?v=6Cf7IeZ38
But not long ago ... 1946

ENIAC
1946
Mauchly and Eckert

stats:
3,000 cubic feet
30 tons
18,000 vacuum tubes
70,000 resistors
170 kilowatt power req.
~1 kilobit memory

approximate processing power of today’s
singing birthday card

but not a stored-program device

Great description here: www.computinghistorymuseum.org/teaching/lectures/pptlectures/7b-eniac.ppt
Configure switches, run batch, output to tape
Batch process: feed it cards, wait for it runs
Prepare punch cards:
1975 PC (Switch Interfaces)
Command Line Interfaces
(1960s – 1980s)
Ivan Sutherland: Sketchpad (1962)

Turing award winner 1988

http://www.youtube.com/watch?v=USyoHbA
Douglas Engelbart (1925 – 2013)

A conceptual framework (SRI Report 1962)
"By augmenting man's intellect we mean increasing the capability of a man to approach a complex problem situation, gain comprehension to suit his particular needs, and to derive solutions to problems.

One objective is to develop new techniques, procedures, and systems that will better adapt people's basic information-handling capabilities to the needs, problems, and progress of society."

...Doug Engelbart
The First Mouse (1964)
The Mother of All Demos (1968)

http://dougengelbart.org/events/1968-demo-highlights.html
What has been shown?

- **Document Processing**
  - Modern word processing
  - Outline processing
  - Hypermedia

- **Input / Output**
  - Mouse + one-handed corded keyboard
  - High resolution displays
  - Multiple windows
What has been shown?

- Shared work
  - Shared files and personal annotations
  - Electronic messaging
  - Shared display with multiple pointers
  - Audio/video conferencing
  - Internet
- User testing, training
Turing Award Winner 1997
XEROX PARC Star (1973)

XEROX 6085 Workstation

User-Interface Design

To make it easy to compose text and graphics, to do electronic filing, printing, and mailing all at the same workstation, requires a revolutionary user interface design.

Bit-map display: Each of the pixels on the 19" screen is mapped to a bit in memory; thus, infinitely complex images can be displayed. The 6085 displays all fonts and graphics as they will be printed. In addition, familiar office objects such as documents, folders, file drawers and in-baskets are portrayed as recognizable images.

The mouse: A unique pointing device that allows the user to quickly select any text, graphic or office object on the display.

See and Point

All functions are visible to the user on the keyboard or on the screen. The user can filing and retrieval by selecting them with the mouse and recalling the COPY, COPY, DELETE, PROPERTIES command keys. Text and graphics are edited with the same keys.

Shorter Production Times

Experience at Xerox with prototype work stations has shown shorter production times and that lower costs, as a function of the percentage of use of the workstation. The following equation can be used to express this:

- 18-point text
- 24-point text
- 36-point text.
WIMP (1980s – 2000s)
Post-WIMP (Today)
Future …

• Augmented Human
  – Computers feel like part of us

• Augmented Environment
  – Smart, ubiquitous computing

• Foreground to background
  – Goal oriented operation

• In this process, many interaction will be redesigned …
Menus
Multi-stroke Marking Menus
Multi-stroke Marking Menus
Multi-stroke Marking Menus
Multi-stroke Marking Menus
Multi-stroke Marking Menus
Multi-stroke Marking Menus
Multi-stroke Marking Menus

- Clothing
- House
- Auto
- Groceries
- Bread
- Misc
- Junk
- Fruit
- Pears
- Oranges
- Bananas

1. 1
2. 2
3. 3
### Advantage of Marking Menus

<table>
<thead>
<tr>
<th>Marking Menus</th>
<th>Linear Menus</th>
</tr>
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<tbody>
<tr>
<td>time: 0.00 secs.</td>
<td>time: 1.48 secs. Hammer</td>
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</table>
Challenge to HCI

• How to innovate?
• How do we know something is better?
• What can we learn from it?
• How to create additional inventions based on the principles we learned?
Course Review
CS3240 Interaction Design
Design Thinking Workshop

- Empathize
- Define
- Ideate
- Prototype
- Test
Design

Prototype

Evaluate
What have You Learned?

- Contextual inquiry
- Interpreting data via affinity diagram
- Brainstorming, storyboard, and rapid prototyping
- Qualitative and Quantitative evaluation methods
CS4249 will take you from design to theory
Challenge to HCI

• How to innovate?
• How do we know something is better?
• What can we learn from it?
• How to create additional inventions based on the principles we learned?
Scientific Method

- Characterizations
- Hypotheses
- Predictions
- Experiments
Scientific Method

Observation
Scientific Method

create or modify the theory

Observation → Theory
Scientific Method

- **Observation**: create or modify the theory
- **Theory**: use the theory to make a prediction
- **Prediction**: use the theory to make a prediction
Scientific Method

- **Observation**: create or modify the theory
- **Theory**: use the theory to make a prediction
- **Prediction**: design an experiment to test the prediction
- **Experiment**:
Scientific Method

Observation: perform the experiment

Prediction: design an experiment to test the prediction

Experiment: use the prediction to make a prediction

Theory: create or modify the theory

Scientific Method:

Observation → Prediction → Experiment → Theory → Observation
Scientific Method

Iterative Process

- Theory
  - create or modify the theory
  - use the theory to make a prediction
  - design an experiment to test the prediction

- Experiment
  - perform the experiment

Observation
Scientific Method

Theory
- create or modify the theory
- use the theory to make a prediction

Observation
- perform the experiment

Prediction
- design an experiment to test the prediction

Experiment
- perform the experiment
- create or modify the theory
- use the theory to make a prediction

Observation
Scientific Method

- **Theory**
  - create or modify the theory
  - use the theory to make a prediction

- **Observation**
  - perform the experiment

- **Prediction**
  - design an experiment to test the prediction

- **Experiment**
Focus of the class

- **Empirical**: Experimental design
- **Theoretical**: MHP, GOMS, KLM, Fitts Law, Hick’s Law, Power Law of Practice
- **Tools**: CogTools and R
# PHENOMENA AND THEORIES OF HUMAN-COMPUTER INTERACTION (2014/2015, Semester 1)

<table>
<thead>
<tr>
<th>Module Code</th>
<th>CS4249</th>
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<tbody>
<tr>
<td>Module Title</td>
<td>PHENOMENA AND THEORIES OF HUMAN-COMPUTER INTERACTION</td>
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<tr>
<td>Semester</td>
<td>Semester 1, 2014/2015</td>
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<td>Modular Credits</td>
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<td>Faculty</td>
<td>School of Computing (Computer Science)</td>
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<tr>
<td>Module Facilitators</td>
<td>Click to view who is teaching the module.</td>
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<td>Weblinks</td>
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<td>Tags</td>
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Facebook Group (Discussion)

https://www.facebook.com/groups/1522594494643050/
TAs

- **Ho Ren Sen**
  - 2nd year undergraduate student
  - cs4249-fall-2014@googlegroups.com

- **Li Yawen**
  - 2nd year PhD student
  - cs4249-fall-2014@googlegroups.com

- **Communication tips**
  - If benefit other people, consider posting on discussion forum
  - If private, send email to cs4249-fall-2014@googlegroups.com!
  - However, we will not answer questions regarding assignments less than 24 hours before due-date/time
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic(s)</th>
<th>Instructor(s)</th>
<th>Time</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Course introduction and structure</td>
<td>Dr Shengdong Zhao</td>
<td>~2 hrs</td>
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<td>(Aug 12)</td>
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<td>Week 2</td>
<td>Experimental design and analysis 1</td>
<td>Dr Shengdong Zhao</td>
<td>3 hrs</td>
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<td>(Aug 19)</td>
<td><strong>Experiment assignment out by the end of the week</strong></td>
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<td>Week 3</td>
<td>Experimental design and analysis 2</td>
<td>Dr Shengdong Zhao</td>
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<td>Week 4</td>
<td>Experimental design and analysis 3</td>
<td>Dr Shengdong Zhao</td>
<td>3 hrs</td>
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<td>(Sep 2)</td>
<td><strong>Experiment assignment part 1 due by the end of the week</strong></td>
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<td>Week 5</td>
<td>Experimental design and analysis 4</td>
<td>Dr Shengdong Zhao</td>
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<td>(Sep 9)</td>
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<td>Week 6</td>
<td>Experimental design and analysis 5</td>
<td>Dr Shengdong Zhao</td>
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<td>(Sep 16)</td>
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<td><strong>MIDTERM BREAK – NO CLASS</strong></td>
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<td>Week 7</td>
<td>Human cognition</td>
<td>Dr Shengdong Zhao</td>
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<td>(Sep 30)</td>
<td><strong>Experiment assignment part 2 due</strong></td>
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<td><strong>CogTool assignment out by the end of the week</strong></td>
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<td>Week 8</td>
<td>GOMS, KLM, CogTools, and applications</td>
<td>Dr Shengdong Zhao</td>
<td>3 hrs</td>
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<td>(Oct 7)</td>
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<td>Week 9</td>
<td>Motor behavior models</td>
<td>Dr Shengdong Zhao</td>
<td>3 hrs</td>
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<td>(Oct 14)</td>
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<td>Week 10</td>
<td>Current trends in HCI research 1</td>
<td>Dr Shengdong Zhao</td>
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<td>(Oct 21)</td>
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<td>Week 11</td>
<td>Current trends in HCI research 2</td>
<td>Dr Shengdong Zhao</td>
<td>2 hrs</td>
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<td>(Oct 28)</td>
<td><strong>CogTool assignment due</strong></td>
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<td>Week 12</td>
<td>Irrationality: introduction to human biases</td>
<td>Dr Shengdong Zhao</td>
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<td>(Nov 4)</td>
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<td>Week 13</td>
<td>Course review</td>
<td>Dr Shengdong Zhao</td>
<td>2 hrs</td>
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<td>(Nov 11)</td>
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<td>DEC 2, 2014</td>
<td>Final Exam</td>
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Course Evaluation

**Assignment 1:** Experimental design & analysis . 25%

**Assignment 2:** Fitts Law, KLM, and Cogtools .....25%

**Subtotal:** 50%

**Class and workshop participation** ......................... 10%

**In-class quiz** ............................................................. 10%

**Subtotal:** 20%

**Final Exam** ..................................................................30%
Course Evaluation

• Extra credits
  – Participating in up to three HCl experiments (0.5 % per experiment)
Notes

• LATE ASSIGNMENTS: 5% of deducted everyday, up to 8 days.

• RE-MARKING: submit detailed reasons in writing within 1 week.

• Cheating (official)
  – Will get you an F in the course
Next Time: Experimental Design