CS3240: Interaction Design

Dr. Shengdong Zhao

Acknowledgement:
Some of the material in these lectures from Maneesh Agarwala, Dan Vogel, Ilona Posner, Ron Baecker, Ravin Balakrishnan, John Chattoe and materials from www.ID-book.com (used with permission).
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

cs3240-spring-2013@googlegroups.com

http://www.shengdongzhao.com
Course Website

• **Note:** we DON’T using IVLE
• The course website is located at:
### TAs

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Habib Rubaiat</td>
<td>PhD student</td>
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<tr>
<td>Khare Amulya</td>
<td>Undergraduate student</td>
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<td>Monserrat Tj</td>
<td>PhD student</td>
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<td>Ng Steve</td>
<td>Undergraduate student</td>
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<tr>
<td>Zhang Haimo</td>
<td>PhD student</td>
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</table>

- **Communication tips**
  - If benefit other people, consider posting on discussion forum
    - News forum (Announcement by teaching staffs only)
    - General forum (Ask questions or socialize with your classmates)
  - If private, send email to cs3240-spring-2013@googlegroups.com!
  - **However**, we will not answer questions regarding assignments less that 24 hours before due-date/time
Topics

• Course Overview
• Project Description
• Course Organization and Info
• Introduction to the design life cycle
Course Overview
The big question: How to achieve the ultimate balance?
Who is good at what?
How to design?
How to combine?
...

The assumption
Optimized to benefit human
• **Tasks division optimized**
  – Optimize performance with computer tasks (*CS minus HCI*)
  – Optimize performance with human tasks and interaction (*HCI in a narrow sense*)

• **Tasks division unoptimized**
  – Shifting tasks from one side to another & re-define the interaction in between (*HCI in a broader sense*)
earPod

Shengdong Zhao, Pierre Dragicevic, Mark Chignell, Ravin Balakrishnan, Patrick Baudisch

CHI 2007
Menu Selection on Mobile Devices

Often Requires Visual Feedback
Why Eyes-free?
Visual vs. auditory menu

Visual Linear Menu
Visual vs. auditory menu

Visual Linear Menu

IVR System
earPod
earPod
earPod design

Dial

Inner disc
earPod walkthrough
Browsing
Fast browsing
Fast browsing
Very fast browsing and cancel
Very fast browsing and cancel
Expert use
Expert use
earPod Video

http://www.youtube.com/watch?v=bATkA0Usoio
Experiment: earPod vs. iPod
Results: response time

![Graph showing the response time for different block numbers and depths for audio and visual inputs. The graph displays two subplots: one for Depth 1 and another for Depth 2. The x-axis represents the block number, ranging from 1 to 4. The y-axis represents the time in seconds (S). The graph shows a decrease in response time as the block number increases, with audio input generally showing a lower response time compared to visual input.]
Results: response time

- **Audio**
- **Visual**

Selection Time

<table>
<thead>
<tr>
<th>Block number</th>
<th>Depth 1</th>
<th>Depth 2</th>
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<tbody>
<tr>
<td>1</td>
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<td>2</td>
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<td>4</td>
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</table>

Time (S)
Results: response time

[Graph showing response time for Audio and Visual modes across different block numbers and depths. The graph illustrates a decrease in selection time with increasing block numbers and different depths.]
However, there is a limitation with earPod!

Can you guess what it is?
Optimize for the 20%

- Pareto principle (80-20 rule)
  - 80% of income in Italy went to 20% of the population
  - 80% of your sales comes from 20% of your clients

Frequency of use of 49 options in the pull-down menu bar of MacWrite (Norman '91)
• Tasks division optimized
  – Optimize performance with computer tasks (*CS minus HCI*)
  – Optimize performance with human tasks and its interaction (*HCI in a narrow sense*)

• Tasks division unoptimized
  – Shifting tasks from one side to another & re-define the interaction in between (*HCI in a broader sense*)
Vignette

Kazi Rubaiat, Takeo Igarashi, Shengdong Zhao, Richard Davis
CHI2012
Motivation
Pen and Ink Illustration Workflow

Step 1
Step 2
Step 3
Step 4
Step 5
Texture synthesis in Illustrator

Texture synthesis involves creating a seamless pattern that repeats consistently. In Adobe Illustrator, this can be achieved by utilizing the Pattern Brush feature. Here’s how you can create a texture using this tool:

1. **Select the Brush Tool** and click on the 'Pattern Brush' option in the Brushes panel.
2. **Create Your Design**. Draw or trace the pattern you wish to use as a texture. For example, you could draw a simple leaf shape.
3. **Define the Pattern**. Go to the 'Pattern Brush Options' window and name your pattern. Set the scale to your desired percentage and adjust the spacing as necessary. Click 'OK' to apply the pattern.

By following these steps, you can effectively use Illustrator to create custom textures for your design projects.
Vignette System

• An interactive system for pen-and-ink illustrations
  – Accelerating the creation of textures from user defined example strokes
  – Preserves traditional pen-and-ink illustration workflow
  – Preserve the original style and signature of individual artists
Vignette Video

http://www.youtube.com/watch?v=R4NnYNsOcio
Current Status

Unoptimized

Unoptimized

Imbalanced

However, making improvements is NOT EASY
**Challenge: Human & Computer are very Different**

**Human**
- End-user of program
- Others related people
  - Including human computation

**Computer**
- Machine the program runs on
- Often split between clients & servers

**Interaction**
- User tells the computer what they want
- Computer communicates results
Computer science
Design Life Cycle

Design → Prototype → Evaluate → Design
Goals of the Course

Learn to design, prototype, evaluate interfaces
- Discover tasks and needs of prospective users
- Develop the right mindset for design
- Contextual inquiry and affinity diagram
- Rapid prototyping
- Iterative evaluation methods
- How to work together on a team project
- Communicate your results to a group

Many of these will be key aspects of your future jobs
<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>Introduction to interaction design and HCI. Design problem + personal introduction due</td>
<td>Dr. Shengdong Zhao</td>
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<td>(Jan 15)</td>
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<td>Week 2</td>
<td>Design Problem Elevator Pitch</td>
<td>Dr. Shengdong Zhao</td>
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<td>(Jan 22)</td>
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<td>Week 3</td>
<td>Design-thinking workshop (Lab 1: bootstrap). G1 stage 1 (project group form) due</td>
<td>Dr. Shengdong Zhao, TJ Monserrat</td>
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<td>(Jan 29)</td>
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<tr>
<td>Week 4</td>
<td>Contextual inquiry (Lab 2: Flash). Submit paper presentation topic</td>
<td>Dr. Shengdong Zhao, Haimo Zhang</td>
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<td>(Feb 5)</td>
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<td>Week 5</td>
<td>CHINESE NEW YEAR ~ NO CLASS (Lab 3: Flash)</td>
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<td>(Feb 11)</td>
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<td>Week 6</td>
<td>Affinity diagram (Lab 4: Flash)</td>
<td>Dr. Shengdong Zhao, Rubaiat Habib</td>
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<td>(Feb 19)</td>
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<td>Week 7</td>
<td>MIDTERM BREAK ~ NO CLASS</td>
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<td>(Mar 5)</td>
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<td>Week 8</td>
<td>Low-fidelity prototyping G1 due</td>
<td>Dr. Shengdong Zhao, Rubaiat Habib</td>
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<td>Week 9</td>
<td>Physical prototyping (Lab 5: presentation) G2 stage 1 due</td>
<td>Dr. Shengdong Zhao, Maryam Aj</td>
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<td>(Mar 19)</td>
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<td>Week 10</td>
<td>Qualitative evaluation Optional lab re-presentation</td>
<td>Dr. Shengdong Zhao, Haimo Zhang</td>
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<tr>
<td>Week 11</td>
<td>Quantitative evaluation (Lab 6: evaluation) G2 due</td>
<td>Dr. Shengdong Zhao, Tj Monserrat</td>
<td>3-hr</td>
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<tr>
<td>(Apr 2)</td>
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<tr>
<td>Week 12</td>
<td>Graphical and information design</td>
<td>Dr. Shengdong Zhao</td>
<td>2-hr</td>
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<tr>
<td>(Apr 9)</td>
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<tr>
<td>Week 13</td>
<td>Course review (Lab 7: final poster session consultation)</td>
<td>Dr. Shengdong Zhao</td>
<td>3-hr</td>
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<td>(Apr 16)</td>
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<tr>
<td>Week 14</td>
<td>Final project poster session (G3 due, Final exam)</td>
<td>Rubaiat Habib, Haimo Zhang</td>
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Course Evaluation

• **FINAL EXAM (40%)**

• **OTHER ACTIVITIES (20%)**
  
  – Assignment I1 3% Design problem pitch
  – Assignment I2 5% Oral Presentation
  – Participation 12% Participation

  **Total:** 60%
Course Evaluation

PROJECT GRADES

• Group Assignment G1 (12%)
  – Problem scenario, contextual inquiry, affinity diagram

• Group Assignment G2 (12%)
  – Design and rapid prototyping, concept video

• Group Assignment G3 (16%)
  – Evaluation, poster presentation, final video

• Total: 40%
Course Evaluation

• **Extra credits**  up to 5.5%
  
  – Up to 1% for design problem pitch
  – 3% for winning the 1\textsuperscript{st} place in final poster presentation
  – 2% for 2\textsuperscript{nd} place
  – 1% for 3\textsuperscript{rd} place
  – Up to 1.5% for participating in HCl experiments (0.5 % per experiment)
Class Participation

• 12% of total course grade
  – They are located in quizzes, attendance, and participation in tutorial, lab, and lecture

• Attendance and participation in course lectures & tutorials is correlated with course grades!
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
Project Description
Project Theme

• The project theme is completely open
  – Design a problem you, your friends/relatives face
  – Come up with an interactive solution for it

• However, there are a number of constraints
  – The solution has to involve computers
  – It also needs to be interactive
  – The interactive system you aim to design need to be implementable by you and your classmates in two years
Teams

Each of you will individually propose a problem
– Fixing something you don’t like or a new idea
– Significance and creativity will be considered

Groups
– 5 students to a team
– Work with students with different skills/interests

Cumulative
– Go through the complete design life cycle
Assignment I1: Design Problem Pitch

• 3%, Due THIS WEEK Friday (Post to Course Website)

• Individual design problem pitch
CS3240 and other HCI classes

CS3240: Interaction Design
  – Overview of HCI, the design life cycle
  – Focus on hands-on skills

CS3249: User Interface Development
  – How to write programs for user interface

CS4249: Theories and phenomenon of HCI
  – In-depth explanation about HCI theories, methods and practices

CS6206: Advanced topics in HCI
  – Graduate level class for HCI research
HCI Classes and the CS Curriculum

Most courses for learning algorithms and technology
- Compilers, operating systems, databases, etc.

CS3240 concerned with design, prototyping & evaluation
- Technology as a tool to evaluate via prototyping
- Heavy investment, high rewards
- Skills will become very important upon graduation
  Complex systems, large teams
  Don’t look for large immediate impact in other CS courses
Readings

Readings are very important to the class
  – Make sure you do the reading *before class*
  – There will be surprise quizzes before certain lectures
Important TODO

• Download the course information sheet and take a look

CS3240 Interaction Design (Morning Session)

Note that the evening session may have some minor differences. If you belong to the evening session, please refer to the IVLE website for the most accurate information for the course.

General Information

This course is intended for students in computing and related disciplines whose work focuses on human-computer interaction issues in the design of computer systems. The course stresses the importance of user-centred design and usability in the development of computer applications and systems. Students will be taken through the analysis, design, development, and evaluation of human-computer interaction methods for computer systems. They will acquire hands-on design skills through laboratory exercises and assignments. The course also covers HCI-design principles and emphasizes the importance of contextual, organisational, and social factors in system design.
Lecture 1

• The Design Cycle
The Design Cycle
Design

Prototype

Evaluate
The Art of UI Design

But, there’s more to it …

A cake is eggs, butter, milk & flour, but the difference between soaring and sinking is in the execution.
The Design Process [Koberg & Bagnall]

1. Acceptance
2. Analysis
3. Definition
4. Ideation
5. Idea selection
6. Implementation
7. Evaluation
Acceptance

Getting started
– Because of a deadline
– Because of possible reward
– Because you are forced to

Commitment
– Time
– Resources
– Responsibility

Key is to set motivation
Analysis

Understand users and tasks

Who are the users? 
What are their tasks? 
Observe and test, don’t guess
Analysis

Understand users and tasks

Who are the users?
What are their tasks?
Observe and test, don’t guess

Tools
– Notebook
– Tape recorder
– Camera
– Video camera
Definition

Focus on the problem
– Choose appropriate level of detail

Not “bicycle cup-holders” but “helping cyclists to drink coffee without accidents”
Ideation

Brainstorming

– Stretch mental muscles
  • Loosen up with simple games
  • Do homework
  • Seed with related ideas/objects

– Get physical
  • Sketch
  • Make models
  • Act out

– IDEO rules
  • One conversation at a time
  • Stay focused
  • Encourage wild ideas
  • Defer judgment
  • Build upon idea from others

Aim for quantity
Idea Selection

Define importance of each idea
- Does it address problem
- Will target users like it
- Is hardware available
- Is software available
- What is the cost
- Market window
- ...

Rank ideas according the your criteria

Pick top N
- Choices depend on resources and stage of the project
Implementation

Scale up low ➔ high fidelity
Implementation

Scale up low → high fidelity
– Low-fidelity (quick, cheap, dirty)
  sketches, paper models, foam core, …
Implementation

Scale up low → high fidelity
– Low-fidelity (quick, cheap, dirty)
  sketches, paper models, foam core, …
– Medium fidelity (slower, more expensive)
  Flash, JavaScript, AJAX, …
Implementation

Scale up low $\rightarrow$ high fidelity

- Low-fidelity (quick, cheap, dirty)
  sketches, paper models, foam core, …

- Medium fidelity (slower, more expensive)
  Flash, JavaScript, AJAX, …

- High fidelity (slowest, most expensive)
  The full interface
Implementation

Web design
- Sites created at multiple levels of detail
- Sites iteratively refined at all levels of detail
- Iterate quickly to see what works

1. Acceptance
2. Analysis
3. Definition
4. Ideation
5. Idea selection
6. Implementation
7. Evaluation

Site Maps → Storyboards → Schematics → Mock-ups
Evaluation

Early tests - Wizard of Oz approach
Evaluation

Walk-through prototype design

1. Acceptance
2. Analysis
3. Definition
4. Ideation
5. Idea selection
6. Implementation
7. Evaluation

Observer (or video camera)

“Computer”

User

Interface

Interface elements

A bit slow for a computer - but it works!
Design Cycle Over Project Lifespan

1. Acceptance
2. Analysis
3. Definition
4. Ideation
5. Idea selection
6. Implementation
7. Evaluation

Number of Ideas under consideration

Project timeline
Evaluation reveals problems with design. Re-design requires cycling the process.
Prototype implementations eventually increase in fidelity to reach final product.
Waterfall Model (Soft. Eng.)

1. Initiation
2. Application Description
   - Analysis
   - Requirements Specification
     - Design
     - System Design
       - Implementation
       - Product
Comparison

Focus differs
- WF has no feedback
  - High cost of fixing errors
  - Increases by 10x at each stage
  - Iterative design finds problems earlier
Video: The Deep Dive

How well do they follow the cycle?
What do they do for each step of the cycle?
How many cycles do you think they went through?

http://www.youtube.com/watch?v=M66ZU2PClcM
Next Time

• Tasks to be done before next lecture
  – 11: design problem pitch Friday night 23:59

• Next week’s lecture will be the elevator pitch of your design problem
Thank You