Advanced Design of Interactive Systems

Course Objectives

- Participatory Design of Interactive Systems
  1. Detailed observations of interaction
     - User-oriented thinking
     - Critical observation
  2. Principled design of interactive systems
     - Instrumental interaction
     - Co-adaptation

Course project

- Work in groups of 4-5
- some activities are individual, others are in groups
- Create a video prototype of an original design that meets the needs of real users in a real setting
- Use techniques you learned in HCI Bootcamp plus participatory design and other techniques
- Projects involve in-class exercises and homework attendance is critical!
Generative Deconstruction

Emphasis on Participatory Design
You will be the designer … and the user

Deconstruct an existing, system
1. Uncover critical problems
2. Create a new, principled design
   based on co-adaptive instruments and other principles

Design Brief

• Identify key problems with an existing system, using:
  introspection, observation, interviews, questionnaires
• Design and run a participatory design workshop
  with users to explore new ideas
• Create a novel, principled design that takes advantage
  of generative design principles, including (at least)
  instrumental interaction and co-adaptation
• Create a video prototype video to illustrate the design

Topic:

Help users find, use, create, ... local sports facilities
housing options
local eating & shopping
-cultural activities
Paris-Saclay admin

Look for real problems ... how can you make it better?

Advice

First, find a specific, grounded design problem

Design it to be personalizable, shareable, reusable in different contexts, by multiple people, for different reasons

Ensure that you use instruments, substrates and co-adaptation
### Final presentation

<table>
<thead>
<tr>
<th>15-minute oral presentation includes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• design problem and user profile</td>
</tr>
<tr>
<td>justify based on user studies</td>
</tr>
<tr>
<td>• design concept</td>
</tr>
<tr>
<td>explain in terms of design principles</td>
</tr>
<tr>
<td>• video prototype (maximum 5 minutes)</td>
</tr>
<tr>
<td>story of use, include breakdowns</td>
</tr>
<tr>
<td>• future work</td>
</tr>
<tr>
<td>how would you extend this to a complete system?</td>
</tr>
</tbody>
</table>

5-minute class discussion

• every group asks at least one question

Also due: video prototype, slides, final storyboard

### Grades

<table>
<thead>
<tr>
<th>HCI Bootcamp valued:</th>
<th>Process, speed, collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced course values:</td>
<td>Creativity, principled design</td>
</tr>
<tr>
<td>Participation</td>
<td>20 %</td>
</tr>
<tr>
<td>Class exercises</td>
<td>30 %</td>
</tr>
<tr>
<td>Final Video Presentation</td>
<td>50 %</td>
</tr>
<tr>
<td>Extra exercises</td>
<td>10 %</td>
</tr>
<tr>
<td>(bonus – you choose)</td>
<td>Focus on participatory design techniques</td>
</tr>
</tbody>
</table>

### Quiz

**Remembering HCI Bootcamp**

1. Understanding users
   a. Is the following a good way to start an interview? Explain
      [ ] Yes    [ ] No
      What do you think about Excel?
### How to ask questions

The form of the question provides the form of the response (habitable sub-languages).

- If you want specific, real answers, you must ask the questions correctly.
- If not, you will get vague general answers that provide little help with design.

Careful! We are not conducting marketing surveys. Our goal is to better understand users to design a better system.

### Choose questions that support design

**Question order matters!!!**

- **Start specific, then general.**
- **Start with directed, then open.**
- **Start with facts, then opinions.**

### Quiz

1. Understanding users
   - b. Ask a question (related to Excel) using the "critical incident technique":

### Critical incident technique

Focus on a recent, memorable event:
- Describe the initial situation
- Tell what happened, step-by-step, in as much detail as possible:
  - What did you do?
  - How did the system respond?
  - What did you do next?

Was the situation resolved successfully?
- If not, what did you do?

Later:
- Was this typical?
- If typical, find a different example
- If unusual, find a typical example
### Critical object technique

Identify an object that you recently created
What led you to create this object?
Tell what happened, step-by-step, in as much detail as possible:
- What did you do?
- How did the system respond?
- What did you do next?

Were you happy with the result?
If not, what did you do?

Later: Was this typical?
If typical, find a different example
If unusual, find a typical example

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### Quiz

1. Understanding users
   - What are interaction points? Where do they come from? Where can you use them?

---

### Interaction Point

#### Interaction points: Titlecard

- ![](image)
- ![](image)
- ![](image)

---

### Interaction Points

Title: Summarize what happened

Identify the sequence of events:
- User acts – System reacts – User reacts
- System acts – User reacts – System reacts

For each segment:
- Sketch what happened (use Verplank's starmen)
- Describe what happened
Quiz
1. Understanding users
   d. What is a persona? What is an extreme character? Why do we use the latter?

Persona
- Personal details: Name, age, gender
- Physical description
- Occupation, relevant activities
- Representative or Extreme user?

- Personality: Describe the person & design-relevant details
- Likes, dislikes?
- Capabilities, weaknesses?
- Unusual characteristics?

- Activities: Typical, breakdowns, user innovations

Identify the relationship with real users interviewed or observed.

Extreme character
Identify people who are extreme along one or more dimensions:
- Normal hands → Arthritic hands
- Takes vitamins → Cancer patient
- Exercises regularly → Athlete
- Adult → Child

It is useful to brainstorm ideas about what it means to be extreme in the context for which you are designing, even if you do not end up using such extreme characters.

Quiz
2. Design process
   a. What is the difference between video brainstorming and video prototyping?
### Video brainstorming

**Goal:** Video individual ideas about how the user could interact with the system

**Design resources:**
- Written brainstormed ideas

**Each idea has one director who controls:**
- description of the idea
- how to video the idea
- who will do what

However, different directors can video different variations of the same idea

### Video prototyping

**Goal:** Tell a story that illustrates how the user(s) interact(s) with the system through a series of interaction points

**Design resources:**
- Design concept
- User profile, personas
- Use scenario with interaction points
- Video brainstormed ideas

Create a storyboard to illustrate how the interaction

Follow the storyboard to create the video

### Quiz

2. Design process
   b. What is the difference between a video prototype and a marketing/concept video?

### Quiz

**Video prototypes:** designers sketch & explore design options with users and design team

**Marketing videos:** designers envision ideas to attract investors & other stakeholders
Quiz

2. Design process
c. What is the difference between a use scenario and a design scenario?

Use Scenario vs. Design Scenario

Use scenario describes current activities
tells a story with a series of action points

Design scenario builds on the use scenario
envistsions a future version with a new technology

Both include realistic personas, realistic context,
and explore breakdowns, workarounds and surprises

Quiz

2. Design process
d. What is the difference between an instrument and an object-of-interest? Give an example of each.
Quiz

2. Design process
e. What is the difference between a video prototype and a tutorial?

Video prototype:
tells a story of how users in the future will interact with a proposed system, including breakdowns and context

Tutorial:
explains how the specific features work, without context

Quiz

f. What are the four main phases of the design process? (hint: key types of design activities)
Discovery
Invention
Design
Evaluation

Each phase involves which three key activities?
Collect or generate material
Interpret or analyze material
Produce a design resource

Four phases

Each phase contributes to the other phases:

- Evaluate the system
- Understand the user
- Design the system
- Generate new ideas

The process is iterative
Generative Design

Each phase includes:
- Collecting or sampling information
- Analyzing information
- Generating design resources

user profile

design space

design analysis

interpret

design brief

design alternatives

user insights

design studies

analyze

design

technical possibilities

design space

axes

impl ications for design

Who is the user?

Does it work?

user information

user needs

user insights

use data

results

variations

categories

possibilities

design space

constraints

design

users

understand users

evaluate system

generate ideas

design system

user insights

design space

variations

results

user needs

user information

implications

Who is the user?

refine

expand

Select & refine possibilities

Generate new possibilities

refine

expand
Generative Design

Discovery
- Collect User Information
- Explore User Needs
- Produce User Insights

Invention
- Collect Possibilities
- Explore Categories
- Produce Design Space

Design
- Collect Constraints
- Explore Variations
- Produce Prototype

Evaluation
- Collect Use Data
- Explore Results
- Produce Implications

Reification

Turns concepts into (interface) objects

Interaction instrument
- Reification of a command into an interface widget

Example:
scrolling a document -> scrollbar

Examples
- Guidelines: reification of alignment
- Layers: reification of mode

Polymorphism

Extends commands to multiple object types

Common examples:
- Cut, paste, delete, move

Context-dependent commands
- Homogenous groups
  - If applicable to one object, then applicable to a group of same-type objects
- Heterogeneous groups
  - Applicable to a heterogeneous group if it has meaning for individual object types

Quiz

3. Design principles

a. Instrumental Interaction involves three key properties. What are they? Describe them.

1. Reification
2. Polymorphism
3. Reuse
### Reuse

Captures interaction patterns for later reuse

**Output reuse**
- Reuse previously created objects
  - Example: duplicate, copy/paste

**Input reuse**
- Reuse previous commands
  - Example: redo, history, macros

### Generative power: Three design principles

**Reification**
- Extends the notion of what constitutes an object

**Polymorphism**
- Extends the power of commands with respect to these objects

**Reuse**
- Provides a way of capturing and reusing interaction patterns

### Quiz

3. Design principles
   - b. What is a co-adaptive system? Give an example.

### Key phenomenon: Co-adaptation

Users adopt to a new system, they **learn** to use it.

Users adopt the new system to their own needs, they **appropriate** and change it.

Creative activities require both especially when integrating physical and digital information.

Create digital tools that are as intuitive, and learnable, as physical tools.
We learn (adapt to) a hammer’s properties

But we also adapt (or appropriate) other tools

Many physical tools are easy to appropriate

… why not software?

Reciprocal Co-adaptation

People adapt their behavior to technology

… they learn it

People adapt the technology for their own purposes

… they appropriate it

Computers adapt their behavior to people

… machine learning

Computers adapt human behavior

… training
Key phenomenon: Co-adaptation

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Users adapt the new system to their own needs
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Creative activities require both especially when integrating physical and digital information

Create digital tools that are as intuitive, and learnable, as physical tools

Quiz

3. Design principles

   c. What is a substrate? Give an example. (extra credit)
**Quiz**

3. Design principles
   
   c. What is a substrate?
      Music system

Layered substrates:
- Treat notes as pixels (bitmap editor),
- as notes in a score (Finale),
- or as musical notes (Open Music)

**Multi-Disciplinary Design Methods**

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<th>Analyse the user</th>
<th>Invent new ideas</th>
<th>Prototype the system</th>
<th>Evaluate the system</th>
<th>Redesign the system</th>
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<td>Interactive Thread</td>
<td>Oral brainstorming</td>
<td>Paper prototyping</td>
<td>Focus group</td>
<td>Generative walkthrough</td>
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<td>Critical incident interview</td>
<td>Conceptual Inquiry</td>
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<td>Video prototyping</td>
<td>Usability study</td>
<td>Technology probe</td>
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<td>Design critique</td>
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Multi-disciplinary Design Methods

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<tbody>
<tr>
<td>HCI design techniques</td>
<td>derived from diverse disciplines</td>
</tr>
<tr>
<td>No individual technique is best nor can it stand alone</td>
<td></td>
</tr>
<tr>
<td>All have advantages and disadvantages, each is influenced by the norms of the parent discipline</td>
<td></td>
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<tr>
<td>We can choose from among these techniques and modify them as needed or create our own</td>
<td></td>
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Gathering information about users

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<td>Cultural probe</td>
<td>Users try objects that prompt reflection</td>
</tr>
<tr>
<td>Technology probe</td>
<td>Users use technology to reflect</td>
</tr>
<tr>
<td>User workshops</td>
<td>Hands-on participatory design with users</td>
</tr>
<tr>
<td>Prototypes</td>
<td>Users test technology</td>
</tr>
<tr>
<td>Log study</td>
<td>Record users actions over time</td>
</tr>
<tr>
<td>Diary study</td>
<td>Users record their own actions</td>
</tr>
<tr>
<td>Interactive thread</td>
<td>Interact with users at an event</td>
</tr>
<tr>
<td>Focus group</td>
<td>Ask customers about a product</td>
</tr>
<tr>
<td>Lab study</td>
<td>Determine cause/effect relationships</td>
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Design Brief

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