• **Homework due:**
  – Today:
    • Design 1
    • Stove
  – Next week:
    • Implementation 2
    • Shower

• **Project:**
  – Today: Proposal
  – Next week: User and task analysis
Lecture 7: Prototyping

February 22
Why prototyping?

• So we can test it with real users earlier

• Early usability testing catches 80% of usability problems [Heaton]

• Catch22. can’t evaluate until it’s built, can’t build because don’t know what to build without evaluation
• We want it **early**.
• We want it **quick**.
• We want it **inexpensive**.

• Reduce fidelity
Five fidelity dimensions

1. Level of visual refinement
2. Breadth of functionality
3. Depth of functionality
4. Richness of interactivity
5. Richness of data model
1. Level of visual refinement

**Low**
- The prototype does not look like the final product.
- Hand-drawn sketches
- Box-and-line wireframes
- Brick

**High**
- The prototype looks very similar to the final product.
- Pixel-accurate mockups
2. Breadth of functionality

**Low**
- The prototype only supports a small subset of tasks.

**High**
- The prototype supports all the tasks.
- Horizontal prototype
3. Depth of functionality

**Low**
- The prototype allows users to perform only parts of a task.

**High**
- The prototype allows users to complete a task.
- Vertical prototype
4. Richness of interactivity

**Low**
- The prototype gives users limited ways to interact.

**High**
- The prototype provides a fully interactive experience.
5. Richness of data model

**Low**
- The prototype includes a small amount of fake data.

**High**
- The prototype includes a large amount of real data.
Prototyping techniques

- Imagination “what if?”
- Scenario
- Storyboard
- Design sketches
- Paper mockups
- Computer simulation
Examples
Prototyping in other areas

• Houses
Prototyping in other areas

• Car
Example: ATM

- **Users:**
  - Bank customers

- **Task:**
  - Do bank transactions

- **Technology:**
  - kiosk

**Fidelity dimensions:**

1. Visual
2. Breadth
3. Depth
4. Interactivity
5. Data
Children collaboration

• Users:
  – Children

• Task:
  – Making seating arrangement collaboratively

• Technology:
  – Tabletop
Hybrid museum experience

• Users:
  – Museum visitors

• Task:
  – Obtain more information about an artifact

• Technology:
  – Some kind of digital display
Wireless P2P

• Users:
  – Teenagers

• Tasks:
  – Share data with others

• Technology:
  – Mobile devices
Cell-phone robot

- **User:**
  - Cell phone users

- **Task:**
  - Interacting with a cell phone

- **Technology:**
  - Robot
Wearable computing for firefighters

• Users:
  – Firefighters

• Tasks:
  – Emergency response to chemical spills

• Technology:
  – Head-mounted display
  – Sensors
Lo-fi vs Hi-fi
Low-fidelity prototype: Pros

- Low development cost
- No coding if possible
- Non-programmers can help
- Evaluate multiple design concepts
- Communicate with designers and users
- Address screen layout issues
- Identify market requirements
- Proof-of-concept
Low-fidelity Prototype: Cons

- Limited error checking
- Poor specification to code to
- Facilitator driven
- Navigational and flow limitations
High-fidelity prototype: Pros

• Complete functionality
• Fully interactive
• User-driven
• Clearly defines navigational scheme
• User for exploration and test
• Look and feel of the final product
• Serves as a living specification
• Marketing and sales tool
High-fidelity prototype: Cons

- More expensive to build
- Time consuming to create
  - Prototype efforts = development efforts
- Inefficient for proof-of-concept
- Not effective for requirements gathering
- May give customers unrealistic expectation
  - Prototype is too much better than the final product
  - Not all functions may go into final products
Paper prototypes
What is a paper prototype?

• Paper with moving parts
When to paper prototype?

• After we have evaluated several design sketches (using CW and HE)
• After we have identified the best design
Why paper prototypes?

• Can simulate some user interactions
• Get users feedback
• Faster to build
• Easier to change
• Focuses on big pictures
• Focuses on design
• Non-programmers can help
Fidelity

- Fidelity dimensions:
  - Visual (low)
  - Breadth (low to high)
  - Depth (low to high)
  - Interactivity (medium)
  - Data (low)
Steps

1. Design some tests
2. Build a paper prototype
3. Run the tests
4. Analyze results
1. Design some tests

- What aspects should we test?
- How should we test them?
What aspects to test?

- Risky parts (where usability problems are likely to arise)
  - Novel design
  - Frequent use
  - Error prone
  - Complexity
  - Satisfaction → later
How to test?

• Design scenario-based tasks that involve the risky parts.
2. Build a paper prototype

- Windows, background
  - Poster board, large table top
- Menus, window content, dialog boxes
  - Index cards
- Text fields, checkboxes, short messages
  - Write on tapes, masking tapes
- High lighting, user typing
  - Transparencies
• **Animation**
  – Move with hands

• **Sound**
  – Make noises
Tools

• White poster board
• Big index cards
• Restickable glue
• White correction tape
• Overhead transparencies
• Photocopiers
• Pens, markers, scissors, tape
Make it large
pointing = clicking
Keep it (mostly) black and white
Keep UI components organized
Make photocopies of components for multiple runs
User transparency for text input
Sticky notes
Use index cards for different data items
Dialog boxes and popup messages
Highlighting
Tips

• Create static components beforehand
• Create templates with fill-in fields for dynamic content
• Describe complex effects (sound, animation) verbally
3. Run the tests

Roles:

- User
- Design Team
  - Computer
  - Facilitator
  - Observer
• Facilitator
  – Brief the users
  – Encourage users to think-out-loud

• Observer
  – Take notes

• Computer
  – Simulate system output and feedback
4. Analyze results

- Identify usability problems
- Propose solutions
What paper prototypes can’t test?

• Look and Feel
• Efficiency
• Response time
• Subtle feedback noticeable
• Exploration vs. deliberation
Activity: Graphics Editor