Design, prototyping and construction

Lecture 12
Kristina Lapin
Overview

- Prototyping and construction
- Conceptual design
- Physical design
- Generating prototypes
- Support for design
Prototyping and construction

- What is a prototype?
- Why prototype?
- Different kinds of prototyping
  - low fidelity
  - high fidelity
- Compromises in prototyping
  - vertical
  - horizontal
- Construction
What is a prototype?

In other design fields a prototype is a small-scale model:

• a miniature car
• a miniature building or town

• the example here comes from a 3D printer
What is a prototype?

In interaction design it can be (among other things):

- a series of screen sketches
- a storyboard, i.e. a cartoon-like series of scenes
- a PowerPoint slide show
- a video simulating the use of a system
- a lump of wood (e.g. PalmPilot)
- a cardboard mock-up
- a piece of software with limited functionality written in the target language or in another language
Why prototype?

- Evaluation and feedback are central to interaction design
- Stakeholders can see, hold, interact with a prototype more easily than a document or a drawing
- Team members can communicate effectively
- You can test out ideas for yourself
- It encourages reflection: very important aspect of design
- Prototypes answer questions, and support designers in choosing between alternatives
What to prototype?

- Technical issues
- Work flow, task design
- Screen layouts and information display
- Difficult, controversial, critical areas
Low-fidelity Prototyping

- Uses a medium which is unlike the final medium, e.g. paper, cardboard
- Is quick, cheap and easily changed
- Examples:
  - sketches of screens, task sequences, etc
  - ‘Post-it’ notes
  - storyboards
  - ‘Wizard-of-Oz’
Storyboards

• Often used with scenarios, bringing more detail, and a chance to role play

• It is a series of sketches showing how a user might progress through a task using the device

• Used early in design
Sketching

- Sketching is important to low-fidelity prototyping
- Don’t be inhibited about drawing ability. Practice simple symbols

Hartfield, Winograd, 1996
Card-based prototypes

- Index cards (3 X 5 inches)
- Each card represents one screen or part of screen
- Often used in website development
‘Wizard-of-Oz’ prototyping

- The user thinks they are interacting with a computer, but a developer is responding to output rather than the system.
- Usually done early in design to understand users’ expectations
- What is ‘wrong’ with this approach?
PinTrace robot surgery system with a touch-screen interface. To the left of the screen there is a robot arm which oves to an exact position to guide the surgeon in the insertion of hip fixation devices.

Molin, 2004
Low-fidelity prototyping

**Advantages**
- Lower development cost
- Evaluate multiple design concepts
- Useful-communication device
- Address screen layout issues
- Proof-of-concept

**Disadvantages**
- Limited error checking
- Poor detailed specification to code to
- Facilitator driven

2014.03.31
High-fidelity prototyping

• Uses materials that you would expect to be in the final product.

• Prototype looks more like the final system than a low-fidelity version.

• For a high-fidelity software prototype common environments include Macromedia Director, Visual Basic, and Smalltalk.

• Danger that users think they have a full system.......see compromises
High-fidelity prototyping

Advantages
- Complex functionality.
- Fully interactive.
- User-driven.
- Clearly defines navigational scheme
- Use for exploration and test
- Look and fell of final product
- Serves as living specification
- Marrketing and sales tool

Disadvantages
- More expensive to develop
- Time-consuming to create
- Inefficient for proof-of-concept designs
- Not effective for requirements gathering
Compromises in prototyping

• All prototypes involve compromises
• For software-based prototyping maybe there is a slow response? sketchy icons? limited functionality?
• Two common types of compromise
  • ‘horizontal’: provide a wide range of functions, but with little detail
  • ‘vertical’: provide a lot of detail for only a few functions
• Compromises in prototypes mustn’t be ignored. Product needs engineering
## Filtering dimensions of prototyping

<table>
<thead>
<tr>
<th>Filtering dimension</th>
<th>Example variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>size; color; shape; margin; form; weight; texture; proportion; hardness; transparency; gradation; haptic; sound</td>
</tr>
<tr>
<td>Data</td>
<td>data size; data type (e.g., number; string; media); data use; privacy type; hierarchy; organization</td>
</tr>
<tr>
<td>Functionality</td>
<td>system function; users’ functionality need</td>
</tr>
<tr>
<td>Interactivity</td>
<td>input behavior; output behavior; feedback behavior; information behavior</td>
</tr>
<tr>
<td>Spatial structure</td>
<td>arrangement of interface or information elements; relationship among interface or information elements – which can be either two-or three-dimensional, intangible or tangible, or mixed</td>
</tr>
</tbody>
</table>
Filtering out different aspects of design

- Fully working product
- 3D form with a hand strap
- Screen-based viewfinder and interface panel
- 3D form with partially working breadboard

- Examining the ergonomic quality
- Examining the input-feedback relationship quality
- Examining the input layout quality

Lim et al. 2008
## Manifestation dimensions of prototyping

<table>
<thead>
<tr>
<th>Manifestation dimension</th>
<th>Definition</th>
<th>Example variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Medium (either visible or invisible) used to form a prototype</td>
<td>Physical media, e.g., paper, wood, and plastic; tools for manipulating physical matters, e.g., knife, scissors, pen, and sandpaper; computational prototyping tools, e.g., Macromedia Flash and Visual Basic; physical computing tools, e.g., Phidgets and Basic Stamps; available existing artifacts, e.g., a beeper to simulate a heart attack</td>
</tr>
<tr>
<td>Resolution</td>
<td>Level of detail or sophistication of what is manifested (corresponding to fidelity)</td>
<td>Accuracy of performance, e.g., feedback time responding to an input by a user (giving user feedback in a paper prototype is slower than in a computer-based one); appearance details; interactivity details; realistic versus faked data</td>
</tr>
<tr>
<td>Scope</td>
<td>Range of what is covered to be manifested</td>
<td>Level of contextualization, e.g., website color scheme testing with only color scheme charts or color schemes placed in a website layout structure; book search navigation usability testing with only the book search related interface or the whole navigation interface</td>
</tr>
</tbody>
</table>
Example: Samsung VI660 prototypes

The paper prototyping setup and its use situation.

Lim et al. 2008
Example: telefono Samsung VI660 prototypes

The computer-based prototype and its test setup

Lim et al. 2008
The fully functional prototype (Samsung VI660)
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Paper Prototype</th>
<th>Computer Screen-Based Prototype</th>
<th>Final Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manifestation dimensions</td>
<td><em>Materials</em>—paper; foam core board; knife; pen; wooden sticks; glue; yellow cellophane paper; two-dimensional phone appearance color-printout&lt;br&gt;<em>Resolution</em>—rough and simplified sketches of screens;</td>
<td><em>Materials</em>—mobile phone simulation toolkit; laptop computer; mouse&lt;br&gt;<em>Resolution</em>—simplified screens using given interface formats from the simulation toolkit;</td>
<td><em>Materials</em>—same as the final product&lt;br&gt;<em>Resolution</em>—the same as the final product&lt;br&gt;(picture from [Lim et al. 2006])&lt;br&gt;<em>Scope</em>—exactly same as the final product (picture from [Lim et al. 2006])&lt;br&gt;partially working in a simulated way;&lt;br&gt;keying with a mouse (not a touch screen)&lt;br&gt;<em>Scope</em>—Limited to the text-messaging feature and making other parts as “not available” screens</td>
</tr>
</tbody>
</table>
Construction

- Taking the prototypes (or learning from them) and creating a whole
- Quality must be attended to: usability (of course), reliability, robustness, maintainability, integrity, portability, efficiency, etc
- Product must be engineered
  - Evolutionary prototyping
  - ‘Throw-away’ prototyping
How to understand users’ experience?

- Experience prototyping
  - Simulating user’s experience
- Designing a chest-implanted automatic defibrillator for victims of cardiac arrest
  - The patient kit: pager, camera, notebook
  - The random pager message simulated the occurrence of a defibrillating shock.
  - Team member reccors what they thought and felt knowing that this represent a shock
- Anxiety around everyday happenings such as holding a child or operating power tools

Buchenau, Suri (2000)
How to understand users’ experience?

- Experiences of third age people

[Image: Third Age Suit ICE, Loughborough University]

http://www.lboro.ac.uk/research/thview/archive/ss10/articles/restricted-mobility/page2.html
Conceptual design: from requirements to design

• Transform user requirements/needs into a conceptual model

• “a description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended”

• Don’t move to a solution too quickly. Iterate, iterate, iterate

• Consider alternatives: prototyping helps
Conceptual design: from requirements to design

- Developing the aesthetics in design
  - Mood boards
    - a collage of the ideas and inspiration
Designing universally accessible games

Overview

• Prototyping and construction
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• Physical design
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Is there a suitable metaphor?

• Interface metaphors combine familiar knowledge with new knowledge in a way that will help the user understand the product.

• Three steps: understand functionality, identify potential problem areas, generate metaphors

• Evaluate metaphors:
  How much structure does it provide?
  How much is relevant to the problem?
  Is it easy to represent?
  Will the audience understand it?
  How extensible is it?
Considering interaction types

• Instructing
  • issuing commands and selecting options
• Conversing
  • interacting with a system as if having a conversation
• Manipulating
  • interacting with objects in a virtual or physical space by manipulating them
• Exploring
  • moving through a virtual environment or a physical space
Considering interface types

<table>
<thead>
<tr>
<th>Interface type</th>
<th>See also</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Command-based</td>
<td>WIMP and web</td>
</tr>
<tr>
<td>2. WIMP and GUI</td>
<td>Augmented and mixed reality</td>
</tr>
<tr>
<td>3. Multimedia</td>
<td>Multimedia</td>
</tr>
<tr>
<td>4. Virtual reality</td>
<td>Mobile and multimedia</td>
</tr>
<tr>
<td>5. Information visualization</td>
<td>Mobile</td>
</tr>
<tr>
<td>6. Web</td>
<td>Augmented and mixed reality</td>
</tr>
<tr>
<td>7. Consumer electronics and appliances</td>
<td>Shareable, touch</td>
</tr>
<tr>
<td>8. Mobile</td>
<td>Shareable, air-based gesture</td>
</tr>
<tr>
<td>9. Speech</td>
<td>Tangible</td>
</tr>
<tr>
<td>10. Pen</td>
<td>Multimodal</td>
</tr>
<tr>
<td>11. Touch</td>
<td>Speech, pen, touch, gesture, and haptic</td>
</tr>
<tr>
<td>12. Air-based gesture</td>
<td>Touch</td>
</tr>
<tr>
<td>13. Haptic</td>
<td>Virtual reality</td>
</tr>
<tr>
<td>14. Multimodal</td>
<td></td>
</tr>
<tr>
<td>15. Shareable</td>
<td></td>
</tr>
<tr>
<td>16. Tangible</td>
<td></td>
</tr>
<tr>
<td>17. Augmented and mixed reality</td>
<td></td>
</tr>
<tr>
<td>18. Wearable</td>
<td></td>
</tr>
<tr>
<td>19. Robotic</td>
<td></td>
</tr>
<tr>
<td>20. Brain–computer</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6.1 The types of interfaces covered in this chapter*
Expanding the conceptual model

• What functions will the product perform? What will the product do and what will the human do (task allocation)?
• How are the functions related to each other? Sequential or parallel?
  Categorisations, e.g. all actions related to telephone memory storage
• What information needs to be available? What data is required to perform the task? How is this data to be transformed by the system?
Overview

- Prototyping and construction
- Conceptual design
- Using scenarios in design
- Generating prototypes
- Support for design
Using scenarios in conceptual design

• Express proposed or imagined situations
• Used throughout design in various ways
  • scripts for user evaluation of prototypes
  • concrete examples of tasks
  • as a means of co-operation across professional boundaries
• Plus and minus scenarios to explore extreme cases
Example plus scenario

Scenario 3: Hyper-wonderland
This scenario addresses the positive aspects of how a hypermedia solution will work.
The setting is the Lindholm construction site sometime in the future.
Kurt has access to a portable PC. The portables are hooked up to the computer at the site office via a wireless modem connection, through which the supervisors run the hypermedia application.
Action: During inspection of one of the caissons Kurt takes his portable PC, switches it on and places the cursor on the required information. He clicks the mouse button and gets the master file index together with an overview of links. He chooses the links of relevance for the caisson he is inspecting.
Kurt is pleased that he no longer needs to plan his inspections in advance. This is a great help because due to the 'event-driven' nature of inspection, constructors never know where and when an inspection is taking place. Moreover, it has become much easier to keep track of personal notes, reports etc. because they can be entered directly on the spot.
The access via the construction site interface does not force him to deal with complicated keywords either. Instead, he can access the relevant information right away, literally from where he is standing.
A positive side effect concerns his reachability. As long as he has logged in on the computer, he is within reach of the secretaries and can be contacted when guests arrive or when he is needed somewhere else on the site. Moreover, he can see at a glance where his colleagues are working and get in touch with them when he needs their help or advice.
All in all, Kurt feels that the new computer application has put him more in control of things.

S. Bødker (1999)
Example plus scenario

Scenario 4: Panopticon
This scenario addresses the negative aspects of how a hypermedia solution will work.
The setting is the Lindholm construction site sometime in the future.
Kurt has access to a portable PC. The portables are hooked up to the computer at the site office via a wireless modem connection, through which the supervisors run the hypermedia application.
Action: During inspecting one of the caissons Kurt starts talking to one of the builders about some reinforcement problem. They argue about the recent lab tests, and he takes out his portable PC in order to provide some data which justify his arguments. It takes quite a while before he finds a spot where he can place the PC: either there is too much light, or there is no level surface at a suitable height. Finally, he puts the laptop on a big box and switches it on. He positions the cursor on the caisson he is currently inspecting and clicks the mouse to get into the master file. The table of contents pops up and from the overview of links he chooses those of relevance - but no lab test appears on the screen. Obviously, the file has not been updated as planned.
Kurt is rather upset. This loss of prestige in front of a contractor engineer would not have happened if he had planned his inspection as he had in the old days.
Sometimes, he feels like a hunted fox especially in situations where he is drifting around thinking about what kind of action to take in a particular case. If he has forgotten to log out, he suddenly has a secretary on the phone: "I see you are right at caisson 39, so could you not just drop by and take a message?"
All in all Kurt feels that the new computer application has put him under control.
Generate storyboard from scenario

1. Thomson family gather around

2. System suggests flotilla

3. System shows descriptions

4. Further details?

5. System asks for details

Summary printed
Generate card-based prototype from use case

<table>
<thead>
<tr>
<th>TRAVEL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visa Requirements</td>
</tr>
<tr>
<td>Vaccination Recommendations</td>
</tr>
<tr>
<td>What to pack before you go</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VISA REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination Country ▼</td>
</tr>
<tr>
<td>Traveller's Nationality ▼</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VISA REQUIREMENTS FOR (COUNTRY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print</td>
</tr>
</tbody>
</table>
Overview

• Prototyping and construction
• Conceptual design
• Physical design
• Generating prototypes
• Support for design
Physical design: getting concrete

- Producing prototype means making detailed decisions
- Design platform and application domain standards have to be met – ISO 9241, ISO 13407, ISO 14915
- Interaction patterns, design rules
- Special attention to accessibility and national culture differences should be paid
Pattern library

All patterns are listed here. It's quite a bunch of them, but I have tried to group them meaningfully.

User needs

Patterns that meet a direct need of the user.

Navigating around
- Accordion
- Headerless Menu
- Breadcrumbs
- Directory Navigation
- Doornail Navigation
- Double Tab Navigation
- Faceted Navigation
- Fly-out Menu
- Home Link
- Icon Menu
- Main Navigation
- Map Navigator
- Meta Navigation
- Minesweeping
- Panning Navigator
- Overlay Menu
- Repeated Menu
- Scrollable Menu

Searching
- Advanced Search
- Autocomplete
- Frequently Asked Questions (FAQ)
- Help Wizard
- Search Box
- Search Area
- Search Results
- Search Tips
- Site Index
- Site Map
- Footer Sitemap
- Tag Cloud
- Topic Pages

Shopping
- Booking
- Product Comparison
- Product Advisor
- Product Configurator
- Purchase Process
- Shopping Cart
- Store Locator
- Testimonials
- Virtual Product Display

Making choices
- Country Selector
- Date Selector
- Language Selector
- Poll
- Rating

Dealing with data
- Carousel
- Table Filter
Web site patterns

Duyne, Landay, Hong.
The design of sites

**DESIGN PATTERNS at a glance**

The patterns featured here, are excerpts to all of the issues, click on a pattern title to see our general solution, and post your own.

**SITE GENRES: Pattern Group A**

- Site Genres
  - in brief | more details

Web sites have evolved into genres, each with customizable content and audiences. This pattern group explains how to deliver the best experience to your customers, depending on the type of site you're building.

> Discover solutions of this pattern group

**SOLUTION**

Present content in a simple, scanable format that leads browsing readers from one page to the next, while giving them clear navigation markers to make their way back.

Organize your content in several ways, in categories that make sense to your customers and in the intuitive ways that they think about doing their tasks. Build navigation tools and cues that let customers know where they are, where they can go, and how to get back. Build each page with its own reading hierarchy so that customers can scan it quickly.
Interface patterns

- Jennifer Tidwell
  – UI patterns and techniques

UI Patterns and Techniques

Introduction
About Patterns

Organizing the Content
Overview plus Detail
Hub and Spoke
Extras on Demand
Step-by-Step Instructions
One-Window Drilldown
Intriguing Branches
Multi-Level Help

Getting Around
Clear Entry Points
Toplevel Navigation
Color-Coded Divisions
Animated Transition
Detail View Navigation
Organizing the Page

Overview Plus Detail

![Graph Image]
Designing universally accessible games

Visual hints for players of UA-Chess with mild memory or cognitive impairments (Grammenos ir kt., 2009)
Implementation of power distance

High power distance: Malaysian University website.

Low power distance: Dutch Educational website.
Individualism vs. Collectivism

High individualist value: US National Park website, an emphasis on the visitor, his/her goals, and possible actions in coming to the park.

Low individualist value: Costa Rican National Park website, an emphasis on nature, downplays the individual tourist, and uses a slogan to emphasize a national agenda.
Masculinity vs. Femininity (MAS)

High masculinity website: Excite.com for women in Japan

Low masculinity website: Swedish Excite.com.
Masculinity vs. Femininity (MAS)

Medium masculinity website: ChickClick.com in the USA.
Uncertainty Avoidance

High uncertainty avoidance: Sabena Airlines website from Belgium.

Low uncertainty avoidance: British Airways website from United Kingdom.
Long- vs. Short-Term Time Orientation

Low Long-term orientation: website from Siemens Germany

High Long-Term Orientation: website from Siemens in China.
Overview

- Prototyping and construction
- Conceptual design
- Scenarios in design
- Physical design
- Support for design
Support for design

- Patterns for interaction design
  - individual patterns
  - pattern languages
  - pattern libraries
- Open source systems and components

- Tools and environments
Mockup tools

• Mockups

http://www.balsamiq.com/products/mockups
Mockup tools
Mockup tools

- [http://iplotz.com/](http://iplotz.com/)
- Not up to date but still useful list
Summary

• Different kinds of prototyping are used for different purposes and at different stages

• Prototypes answer questions, so prototype appropriately

• Construction: the final product must be engineered appropriately

• Conceptual design (the first step of design)

• Consider interaction types and interface types to prompt creativity

• Storyboards can be generated from scenarios

• Card-based prototypes can be generated from use cases
References

- Bergmann, Haitani (2000). Designing the PalmPilot: A Conversation with Rob Haitani. Chapter 4 in Information Appliances and Beyond, Eric Bergman
- Bødker, S. Scenarios in user-centered design – setting the stage for reflection and action. *Interacting with Computers, 2000,13 (1)*, 61–76.
References


