Designing Interactive Systems I

Prototyping

Prof. Dr. Jan Borchers
Media Computing Group
RWTH Aachen University

Winter Semester ’23/’24

https://hci.rwth-aachen.de/dis
Paper Prototypes
Paper Prototypes

- First prototypes, quick and cheap

- Rough paper & pencil sketches of interface or central UI dialogs

- Hand-drawn, no ruler, no computer!

- Pro: Not detailed, so designer and user focus on important **high-level** UI design

- Con:
  - Dialog sequence hard to convey unless you drive it yourself
  - Drawing many screens is a lot of work

- A storyboard can be your first paper prototype
Paper Prototypes

- Type A: Storyboard-like
  - Put several frames with sketched snapshots of the UI on one page
  - Label each frame and each connection
  - Only allows you to show one fixed interaction sequence (scenario)
  - Like a storyboard, but only shows the UI (and maybe the user’s hand), not the entire environment of the task

- Type B: Flipbook
  - Sketch each UI snapshot frame on separate page
  - Collect in a loosely bound flipbook that flips over easily
  - Usage: Show start screen page to user—he selects an action—turn to the resulting page from your flipbook, etc.
  - Allows you to simulate the UI for a user
Storyboard-like Prototypes
Flipbook Prototypes
Franzen, Ahmad, Rusmita, Iglesias, Avellino, Krishnasamy, Shekow, Busto, Todi, and Djordjevic.
DIS1 students in 2010
Patient overview

Max Mustermann

Gender: Male
ID: 13527938X
Age: 35
Problems: Diarrhea

CT  MRT  X-RAY  History  Tests
Timeline showing the test results
Post-It Prototypes

• More interactive paper prototype

• Dialogs, menus, windows on post-it notes in multiple layers

• Allows simulating opening dialogs, etc., by manipulating notes

• Quick to change by making new notes

• Tip: Create empty templates for dialog objects, then fill in

• Tip: Videotape user session for later analysis
Radio Buttons/Checkboxes

<table>
<thead>
<tr>
<th>Range Name</th>
<th>PrototypeRange</th>
</tr>
</thead>
</table>

**Row:***
- [ ] Height: 5
- [ ] Fit largest font
- [ ] Default width: 9

**Column:***
- [ ] Hide row
- [ ] Break page at row
- [ ] Hide column
- [ ] Break page at column
<table>
<thead>
<tr>
<th>Range Name</th>
<th>Prototype Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Row:</strong></td>
<td></td>
</tr>
<tr>
<td>0 Height:</td>
<td>5</td>
</tr>
<tr>
<td>0 Fit largest font</td>
<td></td>
</tr>
<tr>
<td><strong>Column:</strong></td>
<td></td>
</tr>
<tr>
<td>0 width:</td>
<td>9</td>
</tr>
<tr>
<td>0 Default width:</td>
<td></td>
</tr>
</tbody>
</table>

- □ Hide row
- □ Break page at row
- ✔ Hide column
- □ Break page at column
Expandable Dialog Boxes

Error Dialog

This is an Error

Details:

This is a detailed Error description
Expandable Lists
Disabled ("grayed-out") Controls

Images: Paper Prototyping by Carolyn Snyder, 2003
Simulating Touchscreen UI with Paper Prototype

Kaiser, Dieckert. DIS1 students in 2010
Digital Prototypes
Digital Prototypes

- Medium fidelity prototype
  - More detailed, more precise, interactive
  - Create only after initial, simpler (paper) prototypes!

- Mock-up (model, illusion) of some (but not all) aspects of the final UI

- Example: Powerpoint prototype

- Important: UI, not functionality, is key!

- Pro: More engaging for user to try, user can play with it without designer around
How to Limit Prototypes

• Horizontal prototype
  • Entire UI visible, but no functionality
  • Simulate each interaction step (nothing “works”)

• Vertical prototype
  • Few functions, but those implemented in detail
  • Allows testing general design ideas by example

• Scenario
  • Combination of horizontal and vertical prototype
  • Script simulates only fixed interaction paths
Digital Prototyping: Screenshots

• Photoshop, PowerPoint, etc.
• Draw screens / UI storyboards
• Thin horizontal prototype
• Easier to change than hand drawings
• Allows for visual detail and quality
• Designs can become part of actual UI
  • Useful for non-standard GUIs
• Easy to distribute electronically
What to do
Find the item you want in the catalog and scan the bar code next to it.

What you selected

Item  Style  Cost

---

tax:
Total: $ 0.00

All done?
Place your order  Print this list  Throw this list away
### What to do

Touch a different color, or scan another item.

### What you selected

**JPG Stroller**  
For children between 1-3 years old ... $98.

- **Green**
- **Blue**
- **Red** *(out of stock)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Style</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPG Stroller</td>
<td>Green</td>
<td>98.00</td>
</tr>
</tbody>
</table>

**tax:** 6.98  
**Total:** $104.98

### All done?

- Place your order
- Print this list
- Throw this list away
What to do
Touch a different color,
or scan another item.

What you selected
JPG Stroller
For children between
1-3 years old ...$98.

- Green
- Blue
- Red (out of stock)

Item | Style | Cost
--- | --- | ---
JPG Stroller | Green | 98.00

tax: 6.98
Total: $104.98

All done?
Place your order | Print this list | Throw this list away
### What to do
Touch a different color, or scan another item.

### What you selected

- **JPG Stroller**
  - For children between 1-3 years old ...**$98.**
  - Green
  - **Blue**
  - Red (out of stock)

<table>
<thead>
<tr>
<th>Item</th>
<th>Style</th>
<th>Cost</th>
<th>Tax</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPG Stroller</td>
<td>Green</td>
<td>98.00</td>
<td>6.98</td>
<td>104.98</td>
</tr>
</tbody>
</table>

- tax: 6.98
- Total: $104.98
What to do
To get your items, bring your printout to the front counter.

What you selected

<table>
<thead>
<tr>
<th>Item</th>
<th>Style</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPG Stroller</td>
<td>Green</td>
<td>98.00</td>
</tr>
</tbody>
</table>

tax: 6.98
Total: $104.98

All done?
Place your order  Print this list  Throw this list away
Screenshot Prototypes: Problems

• No interaction, does not capture any dynamic behavior or “feel” of the UI

• Danger of looking too polished, limits feedback, suggests the interface is “done”

• Missing physical aspects of devices
Screenshot Prototypes: Adding Effects

• Scripted simulations

• Using media tools such as PowerPoint or Photoshop layers

• More potential for interactivity:
  • Scene transition by simple input, timing, animation

• Prototype with slightly more vertical depth

• Use as click-through prototype for pitching

• Pro: looks real, good for non-standard UIs, no programming

• Con: still linear—simulation fails when script is not followed
Demonstration: Personal Orchestra Prototype

- Alternative to sequential interaction scripts
- Using Photoshop layers to simulate
  - Highlighting menu options
  - Moving to different screens
- Photoshop layers can do some magic
- Normally your Screenshot Prototype will look less polished
  - This example turned out to also become our final graphical layout
Using Layer Comps for Prototyping
Non-Linear Digital Prototypes

- Connect UI elements to a specific screenshot
- Prototypes with more horizontal and vertical depth
- No predefined sequence of actions
  - Users can decide what to do next and do it themselves
Warum Informatik an der RWTH?
Girls' Day 2011
Schülerinformationstag 2011
Helle Köpfe 2011 für Grundschüler
8 vor 12: Die Wissenschaftsnacht 2011
Fit für Informatik? Mach' den Test!
Vorkurs Informatik
Bachelor Informatik
Master Informatik
Master of Science in Software Systems Engineering
Master of Science in Media Informatics
Promotionsstudium Informatik
Diplomstudiengang Informatik
Lehramtsstudiengang Informatik - Gymnasium und Gesamtschule
Schwerpunkt Informatik im Studiengang Technik-Kommunikation
Studium | Forschung | Wirtschaft | Die Fachgruppe

Aktuelles | Studieren bei uns? | Studiengänge | Ansprechpartner | Service | Absolventen

Informatik-Bibliothek
Rechnerbetrieb Informatik (RBI)
RWTH-Rechenzentrum

Alle Lehrveranstaltungen in CAMPUS
Das RWTH-Lernportal L2P
Vorlesungen auf iTunes U

Prüfungsordnungen
Formulare
Semesteretermine
<table>
<thead>
<tr>
<th>Studium</th>
<th>Forschung</th>
<th>Wirtschaft</th>
<th>Die Fachgruppe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aktuelles</td>
<td>Die Informatik als Partner</td>
<td>Angebote</td>
<td>Recruiting</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Weiterbildung...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Digital Prototyping Software

Apple Keynote
Microsoft PowerPoint
Figma
Adobe Xd
miro
Meta Origami

More examples:
• DIS 2
• https://www.interaction-design.org
Prototyping Tools: Animation Apps

• Timeline metaphor
• Good for intricate animations
• Powerful when extended with scripts
  • But: Scripting languages are clumsy by CS standards
• May allow for integration of non-standard hardware and other OS features
• E.g., Adobe Animate
• Can even become final product
• But: Large designs become hard to manage


More in DIS2!
Prototyping Tools: Web

- HTML + JavaScript, etc.
- Natural choice for web interface design
  - Can become final product
- Ubiquitous
  - Many tools (Electron, Cappuccino, ...)
  - Cleartext format
  - Viewable in any browser (in theory…), over the net
  - But: No precise look & feel (nature of the web)
Prototyping Tools: Rapid Development Environments

- Visual Basic .NET, Tcl/Tk, etc.
- Good for standard GUIs (create standard look & feel)
- Often become final product
- Partly interpreted
  - Quick development cycle, but potential performance issues
- Distribution: OK
  - Not always cross-platform
  - May require specific runtime environment
Prototyping Tools: Special-Purpose

- Example: MAX/MSP
  - Multimedia development environment
  - Originally for MIDI applications
  - Extended to handle graphics, audio, and video
  - Build applications by connecting “patches” that process incoming data
  - Very helpful for specific type of applications
    - MIDI/audio/video processing, interactive music systems
  - Can be used for end products (WorldBeat)
  - Distribution: Mac and Windows, free player
    - pd for Linux
User Interface Builders

• Graphical/textual tools to define UI of real software application

• Usually part of integrated development environment (IDE)

• Pro:
  • Finished design can be used for final implementation
  • Real look & feel
  • Vertical functionality can be added easily

• Con:
  • Limited to 1 window system and its toolkit (windows, buttons, …)
Digital Prototypes: Dangers

• Users focus on design details and overlook larger problems

• Users afraid to criticize or suggest changes to “nice” UI design
  • Looks like it was so much work…

• Management may think it’s real 😊
  • Looks like the software is almost done
  • Reason: Users think the interface is the system! (“Conceptual models”)
Hardware Prototypes
Hardware Prototypes

• For systems that are hard to imagine by software alone
  • Example: Palm’s wooden blocks

• Physical interaction is important
  • E.g., new 3-D mouse

• Design in wood, foam core, plastics, styrofoam, cardboard, …

• Problem: high effort to build and change
Prototypes of Microsoft Touch Mouse, Cut From Foam
3D Printed Prototype of Pebble Watch

Image (C) Sarah Kessler (mashable.com)
HELLO! Please Select Device :D
For more freedom of play use the Virtual Airguitar Simulator™.
Wizard of Oz

• Human ‘wizard’ simulates system response
  • Interprets user input according to an algorithm
  • Controls computer to simulate appropriate output
  • Uses real or mock interface
  • Wizard sometimes visible, sometimes hidden
  • “Pay no attention to the man behind the curtain!”

• Good for:
  • Adding simulated and complex vertical functionality
  • Testing futuristic ideas
  • Example: 1984 IBM voice recognition editor
What to Do with a Prototype?

• Throw away
  • If creation was quick and cheap

• Continue to develop
  • Prototype improved incrementally
  • Becomes final product
  • Problem: Has to use production-strength technology
Summary

• Many iterations of prototypes necessary
  • Paper prototypes for high-level, rough UI design
    • Types: Storyboard-like & Flipbook
  • Post-it prototypes to create first interactive versions
  • Digital prototypes for more detailed, interactive walkthrough
    • Can be vertical and/or horizontal
    • Types: Screenshot, Non-Linear
    • Tools: Wireframing Apps, Animation Apps, Web, Interface Builders
  • Hardware prototypes if physical interaction is important

• Wizard of Oz technique to add simulated and complex vertical functionality

• Throw it away or keep it?