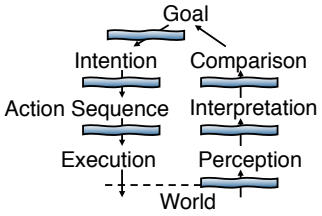
Review



- What are the Seven Stages of Action?
  - Where are gulfs between the seven stages?
  - What are design implications?
- Why is it important to recognize the differences between knowledge in the world and in the head?
- Why is the waterfall model not suitable for developing interactive systems?
  - What is the alternative?
  - Why is the DIA cycle more superior than the Waterfall Model?
- What are the first two questions to ask when designing an interactive system?
  - What tools do we have to answer those questions?

Errors

- People make errors using everyday objects all the time
- Often blame themselves (untypical!)
- Often caused by taught helplessness
  - E.g., maths classes
- May lead to learned helplessness
  - Conspiracy of silence, depression
- Not only "dumb folk" have misconceptions of everyday life, and often those "wrong" models work better for everyday life
  - E.g., thermostats

Mistakes

- Form wrong goal, then execute action sequence
- Hard to detect
- Often major events
- Result of conscious decision/thinking
- Reasons: leaping to wrong conclusions, false causalities

Slips

- Most everyday errors
- Small things going wrong
- Goal formed, but execution messed up
- Usually easy to discover
- Occur mostly in skilled behavior
- Often caused by lack of attention, busy, tired, stressed, bored, more important things to do,…
- We can only do one conscious thing at once
  - Jef Raskin, The Humane Interface: Walking and eating and solving a maths problem

Types of Slips

- Capture errors
  - Two action sequences with similar initial but different later sequence
  - The one well practiced can easily "capture" the unfamiliar one
  - E.g., driving somewhere on Sunday, then taking the wrong turn to "go to work as usual". Or, pocketing a borrowed pen.

Types of Slips

- Description errors
  - Intention not described in enough detail, allowing 2 different action sequences to fit it
  - Often occur if similar objects are physically close to each other (e.g., switches)
  - E.g., throwing t-shirt into toilet instead of laundry basket
  - Putting a lid onto the obviously wrong container
  - Pouring orange juice into your coffee pot

Types of Slips

- Data-driven errors
  - Arriving sensory data intrudes into ongoing action sequence, causing unintended behavior
  - E.g., dialing a room number instead of phone number because you look at the room number on a sign in front of you when dialing
- Associative activation errors
  - Internal association triggers wrong action
  - Also known as Freudian slips
  - E.g., answering the phone saying "Come in!"

Types of Slips

- Loss-of-activation errors
  - Forgetting goal while action sequence is running
  - Special version of forgetting to do something
  - E.g., walking into your bedroom then wondering what you wanted to do here.
  - Can be reactivated by repeating original stimulus
  - E.g., walking back to the living room where you see something that reminds you why you were going to your bedroom
- Premature conclusion errors*
  - Forgetting to complete action sequence because main part of goal is accomplished
  - E.g., ATM card in machine, originals in copier

Types of Slips

- Mode errors
  - Triggering the wrong action because the device is in a different mode than expected
  - Who has seen this in their favorite text editor: "`:wq`"?
  - Happens whenever devices resort to modes to cope with more functions than controls
  - The most prominent problem in many software user interfaces

In-Class Exercise: Slips

- In groups of two, think of three examples of slips that happened to you. What type are they?
  - Capture (driving to work)
  - Description (shirt in toilet)
  - Data-driven (dial room number)
  - Associative Activation ("Come in!")
  - Loss of Activation (walk into bedroom)
  - Premature Conclusion (copier)
  - Mode (vi)

Detecting Slips

- Easy but requires visible feedback
  - Example: "Adjust the window!"
- Problem: Finding the right level at which to correct
  - Are we doing this bottom-up?
  - The wrong car key
  - Confirmation is unlikely to catch errors

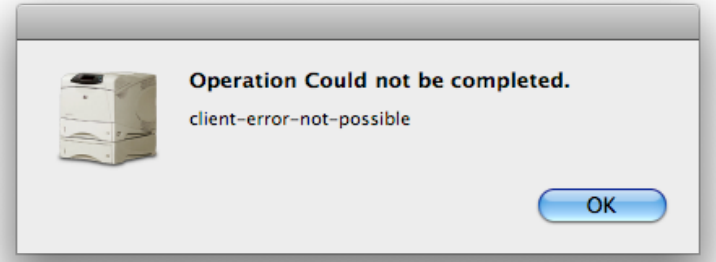
    "Remove file bla.txt?"
  - Soft, reversible actions are better (e.g., trashcan), but people begin to rely on it

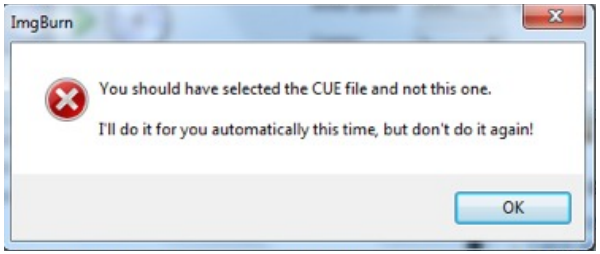
Decision Structures

- To reduce chance of error, use either shallow or narrow decision trees
  - Shallow: No planning required, e.g., ice cream parlor menu
  - Narrow: No deep thinking required, e.g., cook book instructions, start your car, motorway exits
- Wide *and* deep structures:
  - Games like chess, etc.
  - Designed to occupy the mind
- Subconscious thought is effortless, associative, pattern-matching
- Conscious thought is slow, serial, demanding

Designing for Error

- Assume all possible errors will be made
- Minimize the chance of errors occurring
- Minimize their effect if they are made
- Make them easy to detect
- Make them easy to reverse (undo)
- Watch people using your system (and their slips and mistakes)
- Don't punish, don't ignore
- Warning signals are ignored, warning features bypassed if inconvenient

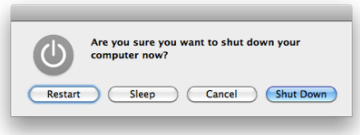




http://imgur.com/gallery/3nbIZ

Forcing Functions

- Forcing functions can help to avoid errors (= Extreme physical constraints)
- Think through the burden on normal operation!
  - E.g., seat belts
- Known from safety engineering
- Lockout prevents an action
  - E.g., stairways to basements
- Lockin prevents prematurely stopping an action
  - E.g., soft power-off switch on computers to avoid data loss
- Interlock enforces correct sequence
  - E.g., microwave turning off when opened, shelf in public restrooms



Why Is Good Design So Rare?

- Pressure of product schedules, creeping featurism
- Curse of individuality, "being different"
  - Swedish Hair Dryer
- Good design takes many iterations, but after initial failures many products are "dead"

1893

1899

How *Not* to Design a GUI

- Make things invisible, widen the gulfs
- No feedback
- Use non-obvious commands and arbitrary mappings between them and outcomes
- Use tech speak and abbrv.
- Be impolite, especially in error messages
- Make operations potentially fatal. No Undo.

Designing for Users

- Form should follow function
- Designers are virtually never users
- Clients are not always users
- There is no average user
  - Designing it "right for 99% of people in the US" leaves out 2.5 million Americans
  - Age effects set in in the mid-20s

Seven Principles of Design

- Use knowledge in the world and in the head
- Simplify task structures
- Make things visible, bridge the gulfs of execution and evaluation
- Use natural mappings
- Use natural and artificial constraints
- Design for error
- When all else fails, standardize

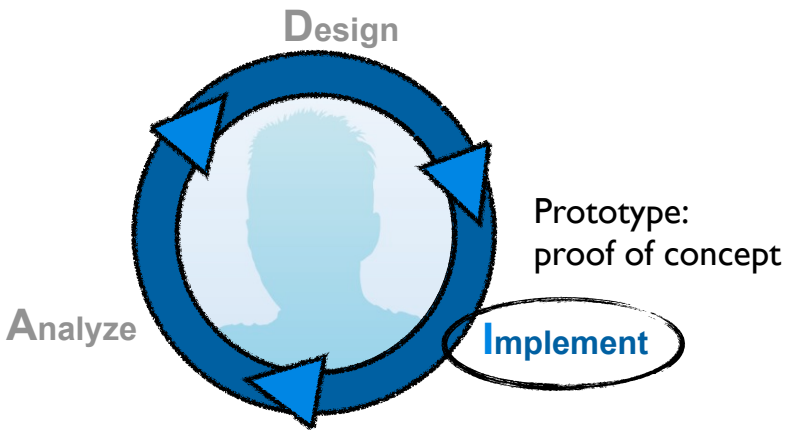
Closing the Book

- Norman's book is outdated in many technology aspects
- But it has hopefully provided you with a new power of observing people and their interaction with everyday objects and technology
- It will be a book to go back to and re-read in a few years
- *Read through the rest of the book this week!*

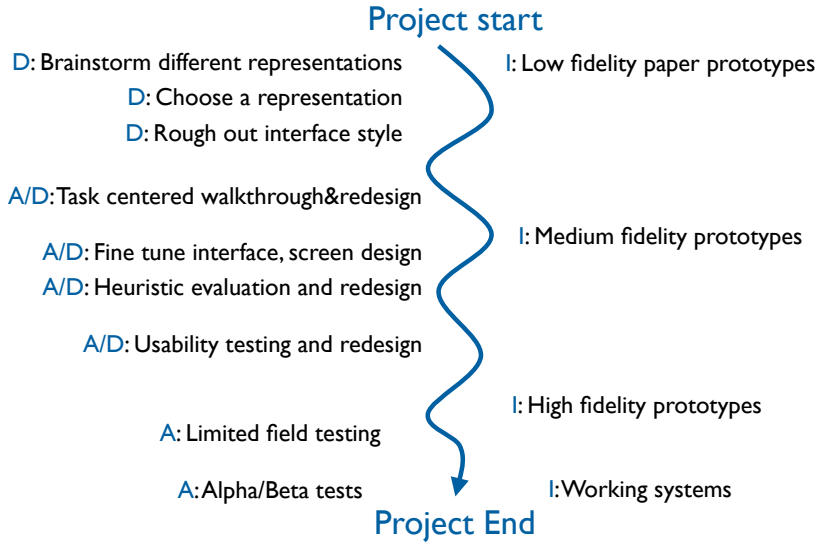
Theory	Practice
✓ Models of interaction	✓ Sketching
✓ Affordances, mappings, constraints, types of knowledge, errors	✓ User observation
• Design principles	✓ Iterative design
• Human cognition and performance	⇒ Prototyping
• History and vision of HCI	• Ideation
	• User study and evaluation

Prototyping

When to Prototype



Prototyping in DIA iterations

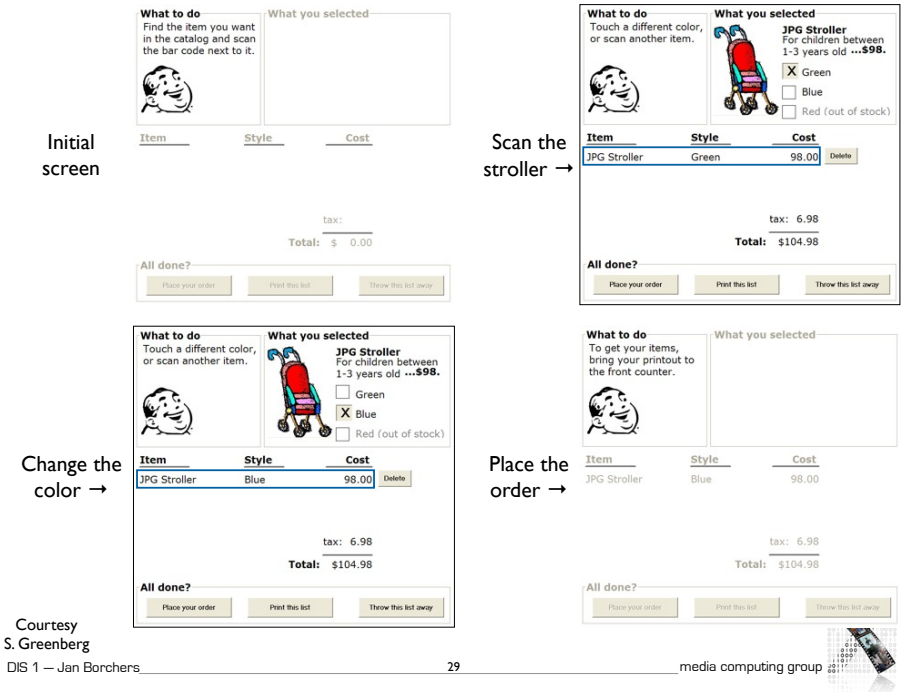


Paper Prototypes

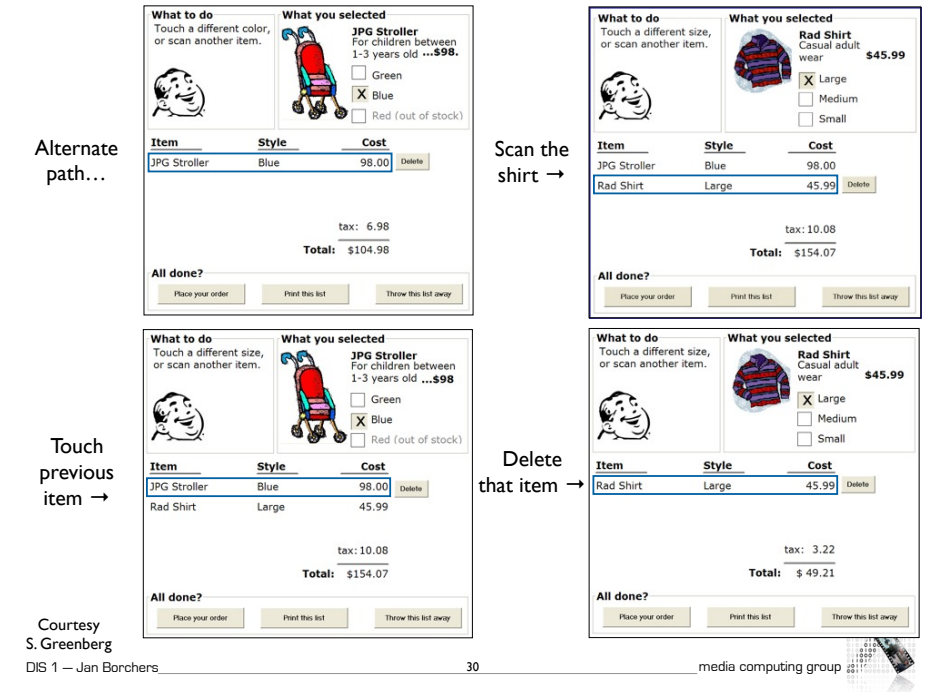
- First prototypes, quick and cheap
- You can use storyboards as your first prototype!
- Rough paper & pencil sketches of interface or central UI dialogs
- Hand-drawn, no ruler, no computer!
- Type A: Storyboard-like
  - Put several frames with sketched snapshots of the UI on one page
  - Label each 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

Paper Prototype Example: Shopping Application

- Uses a storyboard-like format
- Includes two sample interaction sequences (scenarios)
- Bad example because it is not hand-drawn



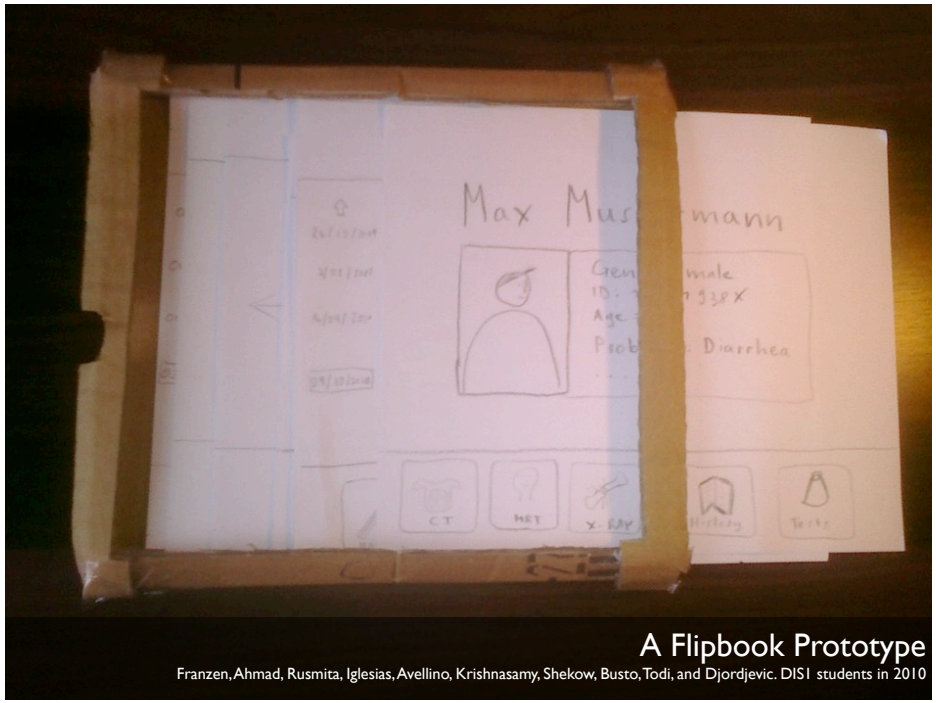
Courtesy S. Greenberg



Courtesy S. Greenberg

Paper Prototypes

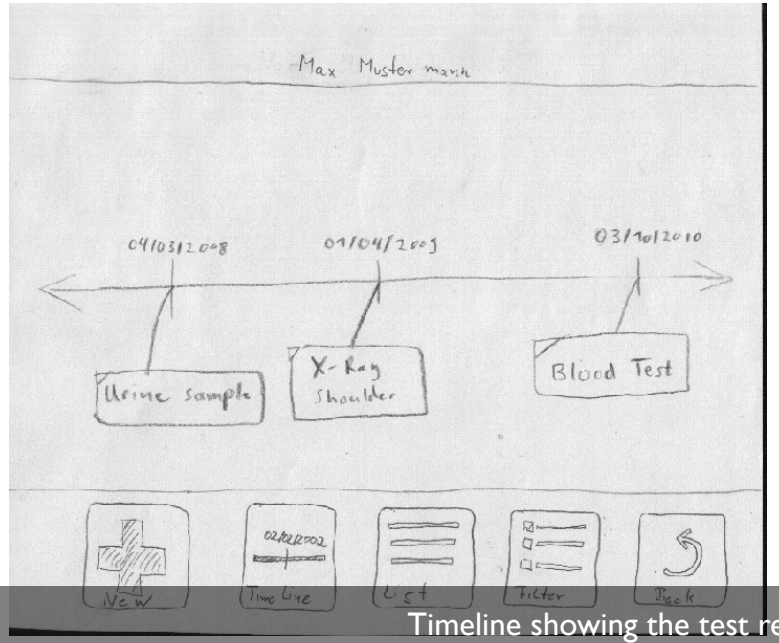
- Type B: Flipbook
  - Sketch each UI snapshot frame on separate page
  - Collect in a loosely bound flipbook that flips over easily
  - Usage: Show start screen page to user—he selects an action—turn to the resulting page from your flipbook, etc.
  - Allows you to simulate the UI for a user (Wizard Of Oz)
- 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 (as in the flipbook); drawing many screens is a lot of work



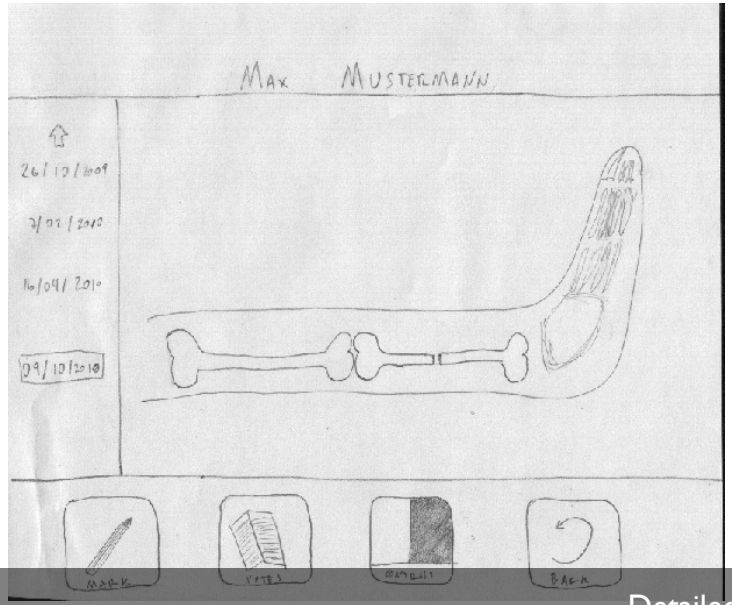
A Flipbook Prototype

Franzen, Ahmad, Rusmita, Iglesias, Avellino, Krishnasamy, Shekow, Busto, Todi, and Djordjevic. DIS1 students in 2010

Patient overview



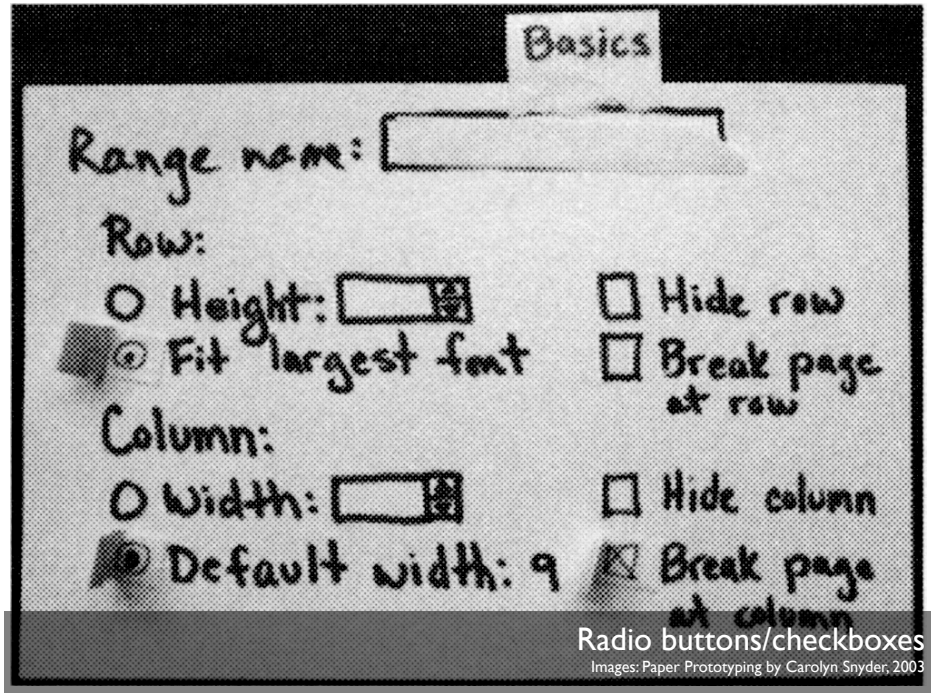
Timeline showing the test results



Detailed result

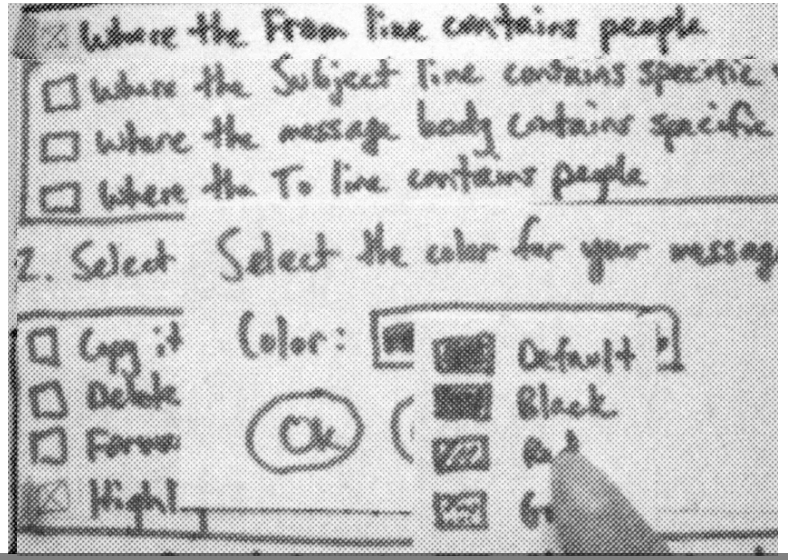
Post-It Prototype

- 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



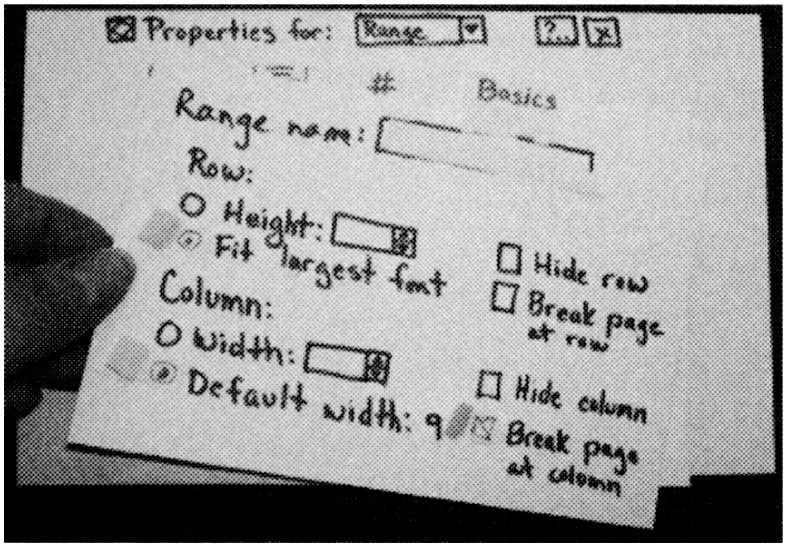
Radio buttons/checkboxes

Images: Paper Prototyping by Carolyn Snyder, 2003



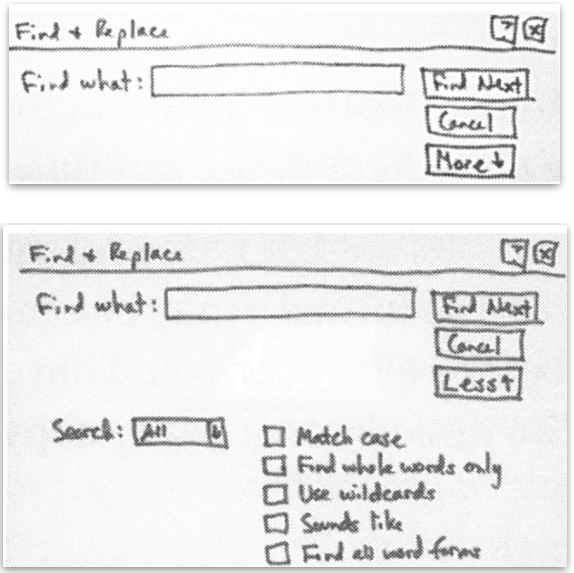
Drop-down list

Images: Paper Prototyping by Carolyn Snyder, 2003



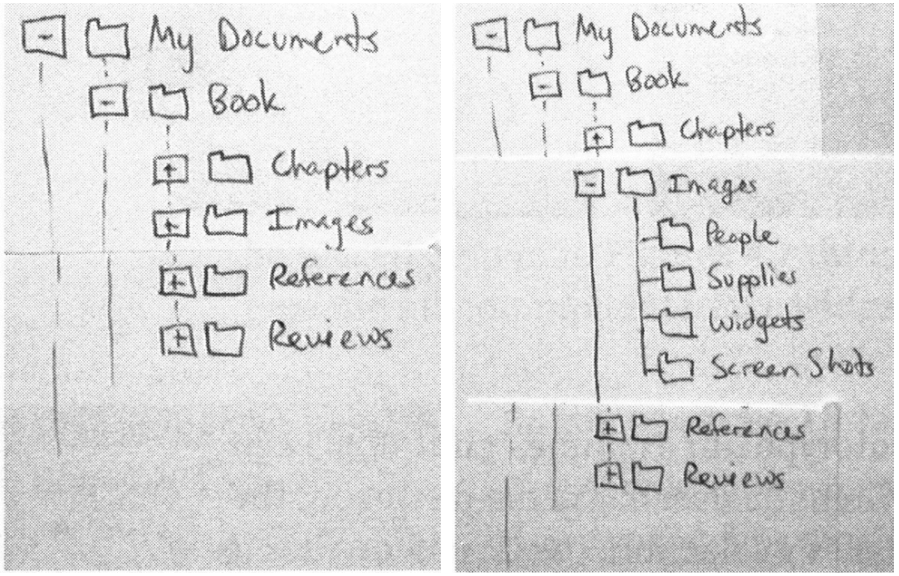
Tabbed dialog boxes

Images: Paper Prototyping by Carolyn Snyder, 2003



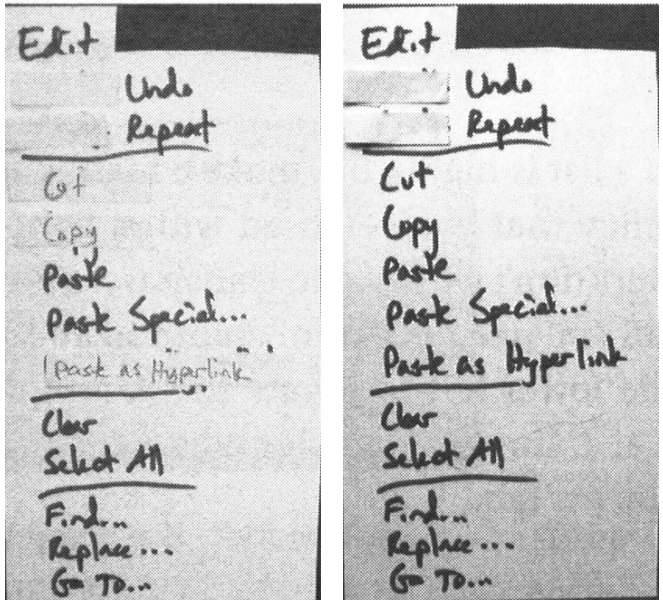
Expandable dialog boxes

Images: Paper Prototyping by Carolyn Snyder, 2003



Expandable lists

Images: Paper Prototyping by Carolyn Snyder, 2003



Disabled ("grayed-out") controls

Images: Paper Prototyping by Carolyn Snyder, 2003

Simulating touchscreen widget with paper prototype

Kaiser, Dieckert. DIS1 students in 2010

Software Prototype

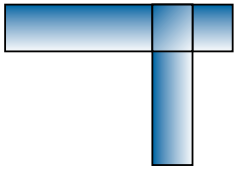
- Medium fidelity prototype
  - More detailed, more precise, interactive
  - Create only after initial, simpler (paper) prototypes!
- Mock-up (model, illusion) of some (but not all) aspects of the final UI
- Example: Flash animation
- Important: UI, not functionality, is key!
- Pro: More engaging for user to try, user can play with it without designer around

Software Prototype: 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: Conceptual models

How to Limit Prototypes

- Vertical prototype
  - Few functions, but those implemented in detail
  - Allows testing general design ideas by example
- Horizontal prototype
  - Entire UI visible, but no functionality
  - Simulate each interaction step (nothing "works")
- Scenario
  - Combination of horizontal and vertical prototype
  - Script simulates only fixed interaction paths



Software 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

Screenshots: 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

Software Prototyping: On-Screen Storyboards

- 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 or for pitching
- Pro: looks real, good for non-standard UIs, no programming
- Con: simulation fails when script is not followed

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 ite

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

Item	Style	Cost	
JPG Stroller	Green	98.00	Delete

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 ite

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

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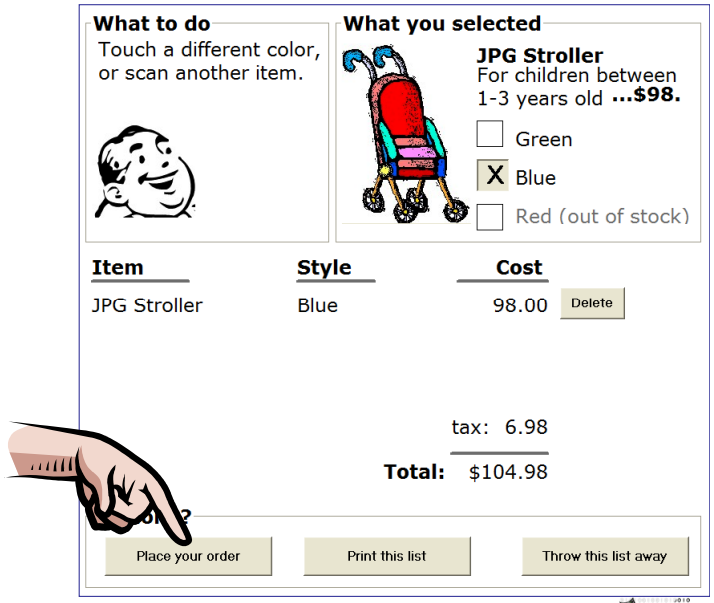

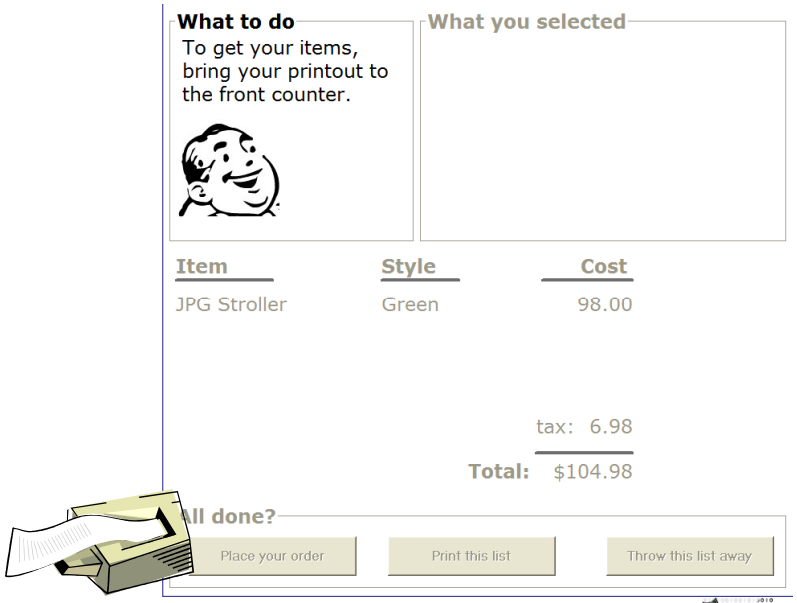

Wizard of Oz

- 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

Wizard of Oz

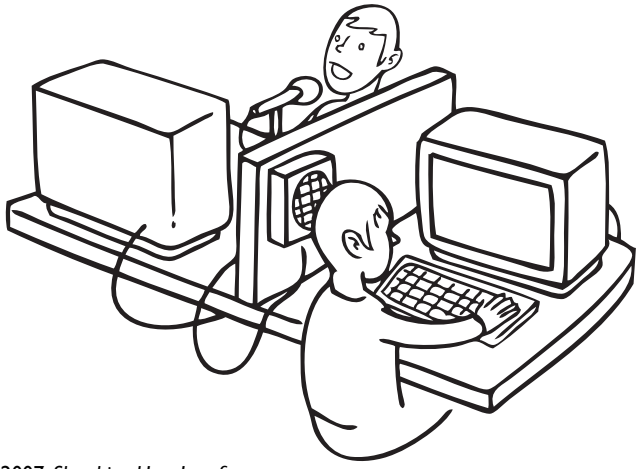

Image: Buxton 2007, *Sketching User Interfaces*

Hardware Prototype

- 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

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 (i.e., generally not Flash…)

Summary

- "To err is human"
- Slips are small errors that mess up task executions
  - Good design can prevent slips or help recover from them
- Creeping featurism causes bad designs to recur
- Prototypes let you catch big bugs early
- Choose prototyping method to match what you wanted to test