Programming of Interactive Systems

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Week 1 :
b. Design Cycle of Interactive System developing & prototyping

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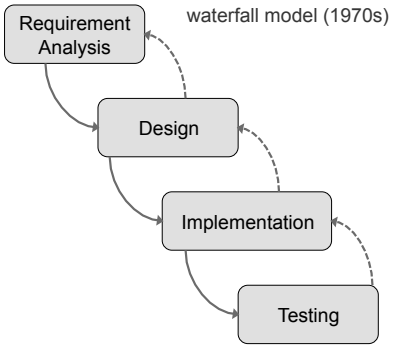
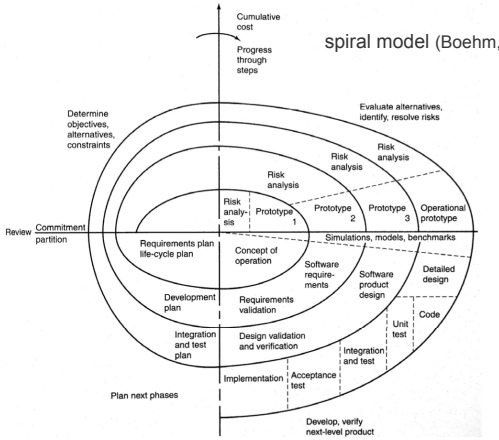
(part of this class is based on previous classes from Anastasia,
and of T. Tsandilas, S. Huot, M. Beaudouin-Lafon, N.Roussel, O.Chapuis)

software engineering



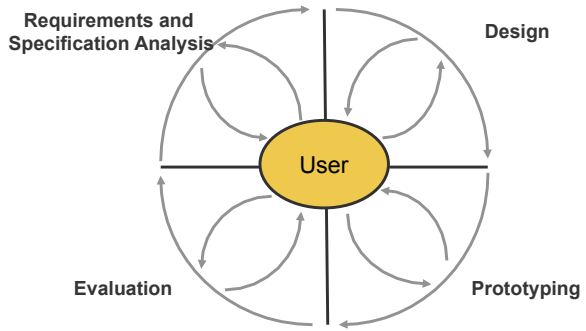
waterfall model (1970s)

software engineering



spiral model (Boehm, 1998)

user-centered design



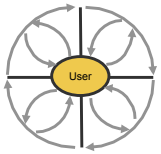
user-centered design

Requirements and Specification Analysis

personas
scenarios
field studies
task analysis
requirement specification

Evaluation

usability tests
heuristic evaluation
focus groups
lab experiments
observational studies



Design

brainstorming
participatory design
conceptual models
metaphors
interaction styles
scenarios
storyboards
interaction models

Prototyping

paper prototypes
low/high fidelity prototyping
physical models
alpha/beta releases

methods: multidisciplinary origin

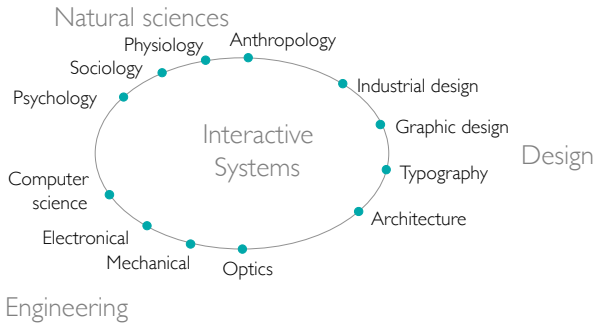


Image by W. Mackay & M. Beaudouin-Lafon

importance of user-centered design

Development Cost
Cost of user interfaces : ~50% of total cost

Maintenance Cost
20% : « bugs »
80% : unexpected user needs

Problem correction Cost
= $1 during design
= $10 during development
= $100 after delivery

importance of user-centered design

In this class we focus on IS programming,

… but we still need other parts of the cycle to help us in the development, such as …

Design + Prototyping

system design + prototyping

how to start?

Get the results of your observations/user understanding (prev. step in cycle)
- Personas, scenarios, etc.

Invent ideas
- Generate as many solutions as possible

Create a design space
- Not the same as a list of functionalities

Chose a concept
- Focus on the consistent interaction between user and system

brainstorming

Goal: Generate as many creative ideas as possible

brainstorming : procedure

Form a small group with different roles and expertise (if possible with real users)

Limit time (1 hour maximum)

Describe a specific design problem to solve

Generate as many ideas as possible
Do **NOT** evaluate/critique ideas!
If you do not like an idea propose your own version

Write ideas on a board or paper

analyze ideas

Vote
Each one chooses the 3 best ideas
See if ideas can be grouped together
Result: Identify key ideas

Categorize the ideas
Organize the ideas that go well together
e.g. touch/mouse, whiteboard/tablet, menu/gesture, plot function/sketch
Search for gaps and add ideas
e.g. voice, laptop/phone, gestures to invoke menus, plot and correct
Result: technology and design axes or dimensions
e.g. input, device method, command activation, plotting creation

Choose your design space and your concept
e.g. a system for plotting and editing math functions on touch devices, using sketching and touch gestures

prototyping

user-centered design

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scenarios
field studies
task analysis
requirement specification

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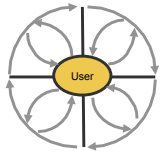
lab experiments
observational studies



Design
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conceptual models
metaphors
interaction styles
scenarios
storyboards
interaction models

Prototyping
paper prototypes
low/high fidelity prototyping
physical models
alpha/beta releases

design activities

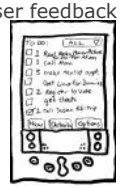
We start with (previous step):
- an understanding of the users' needs
- a design space and a set of possibilities
- a problem to solve and decide what we will develop (concept)

We explore possibilities:
Functionality: functional tables (in Fond HCI)
Interaction in context: design scenario (in Fond HCI)
Storyboards

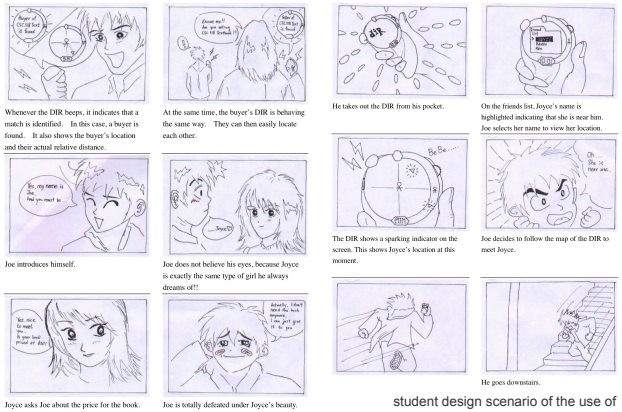
interaction in context

Design scenarios and storyboards
capture and communicate an interaction story with the new system

Rapid Prototyping
physical models, sketches, paper prototypes, …
receive user feedback early in the design cycle



a storyboard

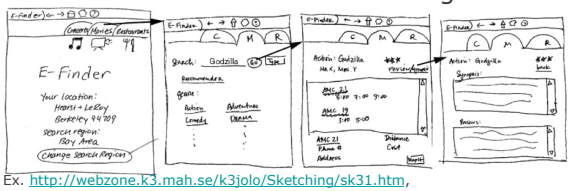


student design scenario of the use of communcation device

storyboards

a series of key frames as sketches
originally from film
used to get the idea of a scene sequence
snapshots of the interface at particular points in the interaction

portrays key scenes in the interface and the transitions that caused the changes



Ex. http://webzone.k3.mah.se/k3jolo/Sketching/sk31.htm, http://stavchansky.net/work.php?wID=42&cat=3

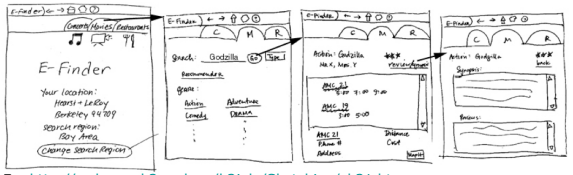
storyboards

Illustrate a design scenario (in Fond HCI)

Describe the interaction in easy to read segments

Define the key elements and a coherent order

Decide what details to show



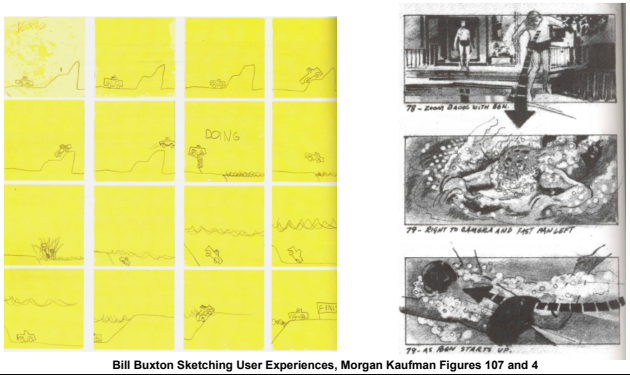
Ex. http://webzone.k3.mah.se/k3jolo/Sketching/sk31.htm, http://stavchansky.net/work.php?wID=42&cat=3

storyboards: possible shots

Bill Buxton Sketching User Experiences, Morgan Kaufman Figure 4

storyboards: transitions between frames

implicit (empty space) explicit (arrows)



Bill Buxton Sketching User Experiences, Morgan Kaufman Figures 107 and 4

storyboard techniques

State Transition Diagrams

Scenario Sequences

Make storyboards come alive

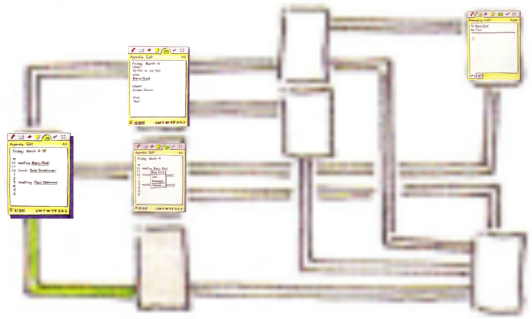
storyboard techniques

State Transition Diagrams

Scenario Sequences

Make storyboards come alive

storyboard: State Transition Diagrams



storyboard: State Transition Diagrams

Create transition diagram
- key interaction steps
- branch points when multiple interactions exist

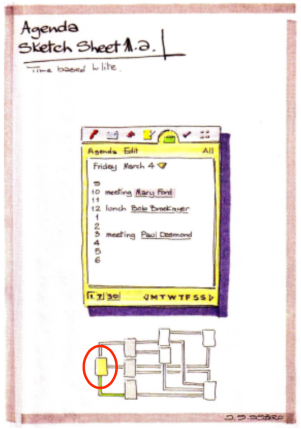
For each transition
- sketch the screen
- include the transition diagram
- (a navigational map)

Label the transition with what triggered it
- typically user input or set of system responses

storyboard: State Transition Diagrams

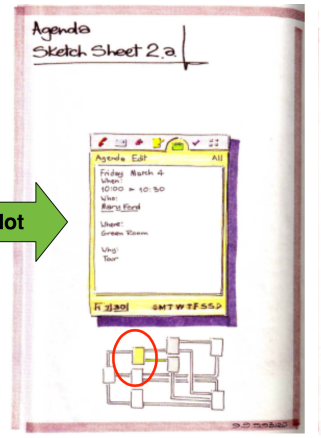
Interacting with a PDA-based agenda:

Looking at the agenda and seeing that there is a 10am meeting with someone named Mary Ford.



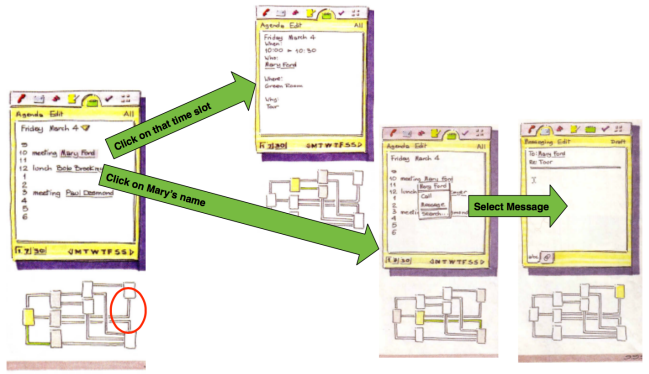
storyboard: State Transition Diagrams

Check to see what the meeting is about.

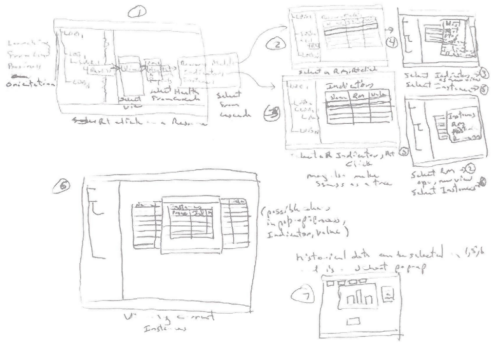


etc …

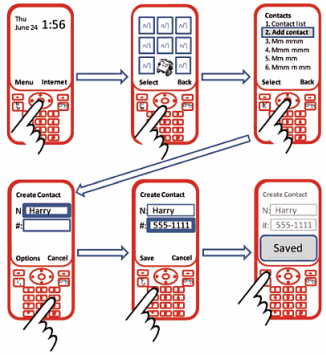
storyboard: State Transition Diagrams



storyboard: State Transition Diagrams



storyboard: State Transition Diagrams

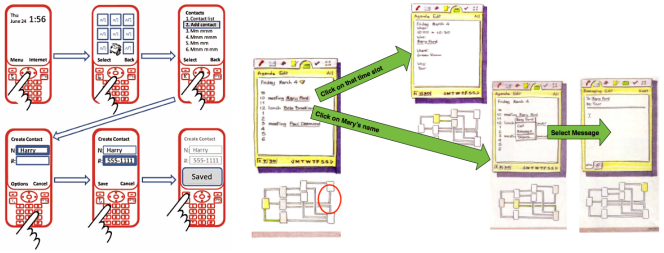


this shows a linear interaction (no branches)

from the book "Sketching User Experiences: The Workbook"

storyboard: State Transition Diagrams

This is the detail we need before programming



storyboard techniques

State Transition Diagrams

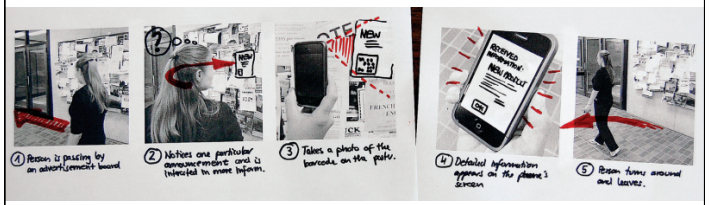
Scenario Sequences

Make storyboards come alive

storyboard: Scenario Sequence

Describes a **person** doing a particular task

e.g. checking announcement with mobile



http://grouplab.cpsc.ucalgary.ca/grouplab/uploads/Publications/Publications/2012-NarrativeStoryboard.Interactions.pdf

storyboard: Scenario Sequence

Storyboard techniques

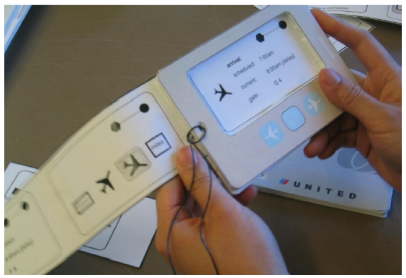
State Transition Diagrams

Scenario Sequences

Make storyboards come alive

making storyboards come to life : prototypes

An interactive storyboard
Concrete representation of an IS (that does not exist)



Spotlight system, From Design for the Wild, Bill Buxton

e.g. paper prototypes

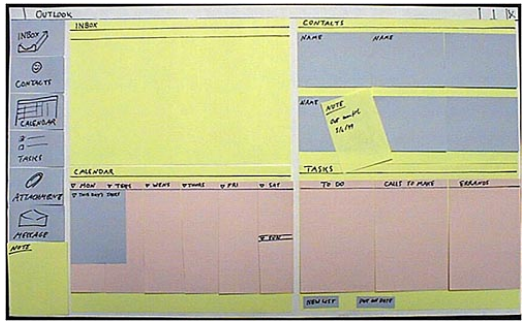
Designing with office supplies
- multiple layers of sticky notes and plastic overlays
- different sized post-it's represent icons, menus, windows etc.

interaction demonstrated by manipulating notes
- new interfaces built on the fly

sessions videotaped for later analysis
- usually end up with mess of paper and plastic!

prototypes

concrete representation of an IS (that does not exist)



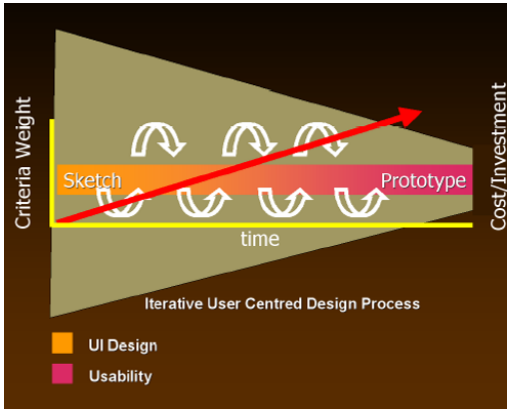
prototypes

Prototype is used to …
- Explore different design alternatives
- Ensure its usability under different conditions
- Aid users to imagine the interface
- Focus on problematic aspects of the interface

Why prototype?
- If you start implementing code too early, you risk spending too much time to create a system that does not work for your users

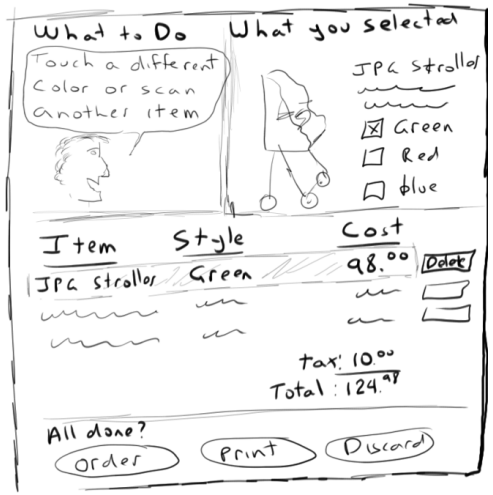
Prototyping is a fast way to …
- Explore details of your concept before implementation
- Communicate the concept to users, your managers, etc
- Justify your design choices

prototype evolution

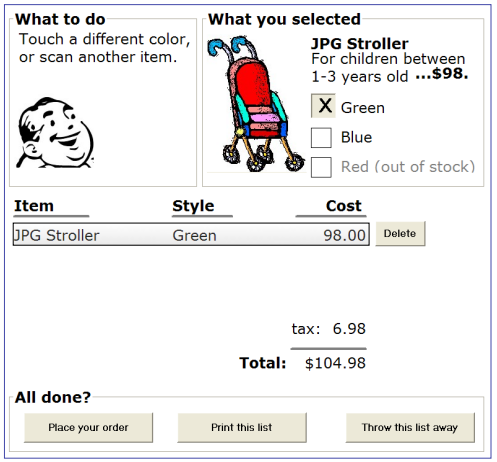


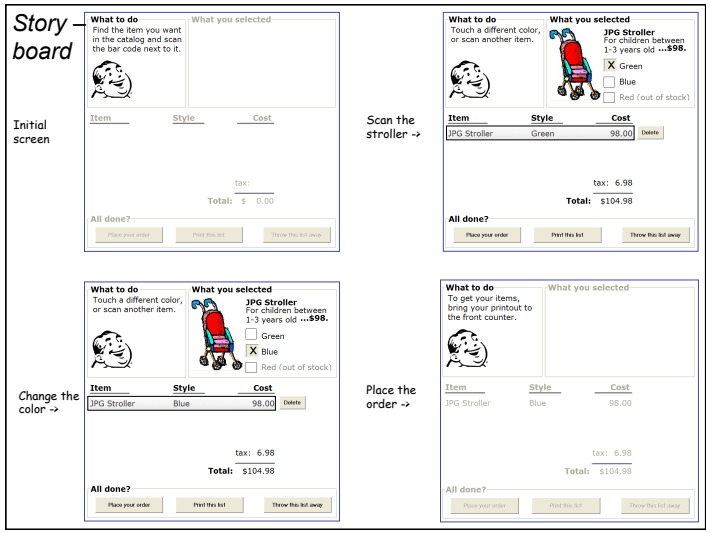
From Sketching the User Experience, Bill Buxton

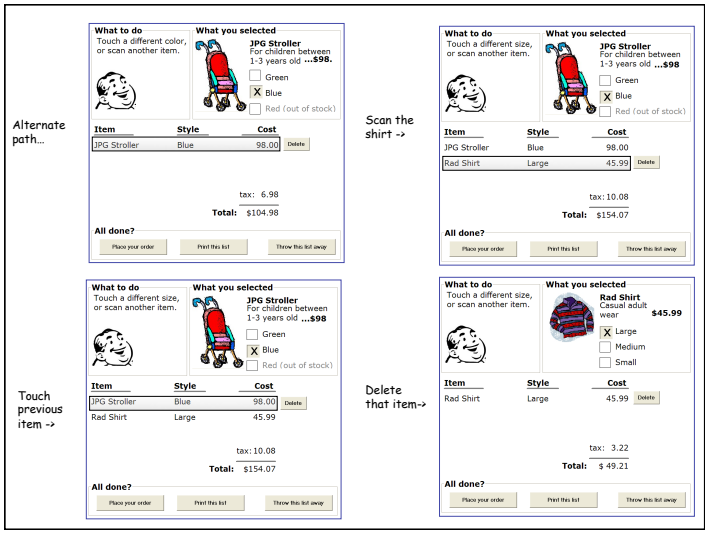
sketches

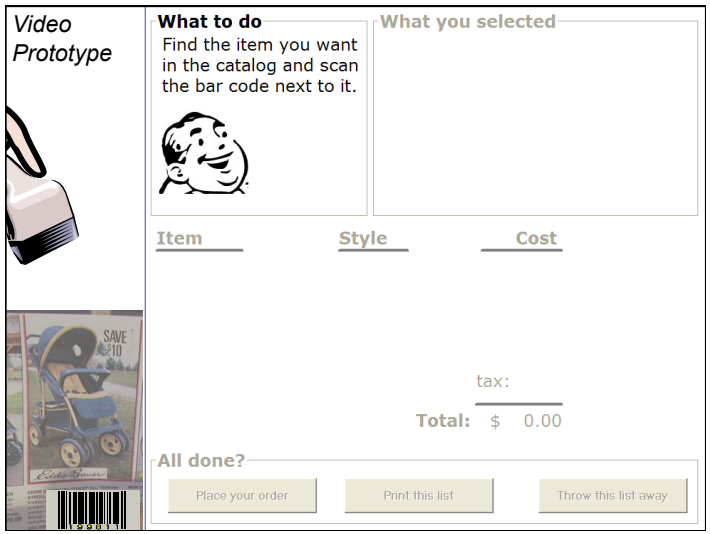


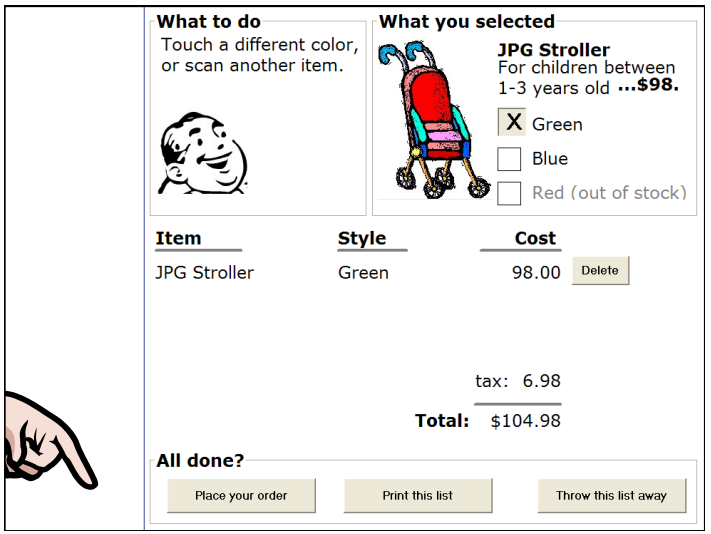
mid-fidelity prototype

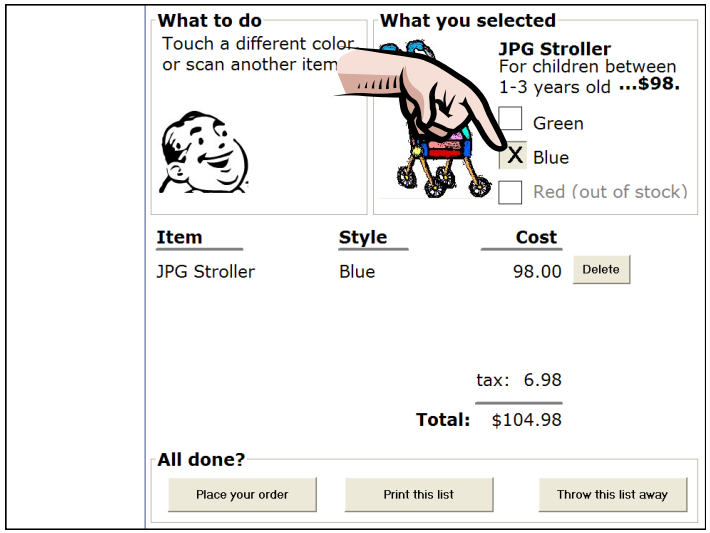


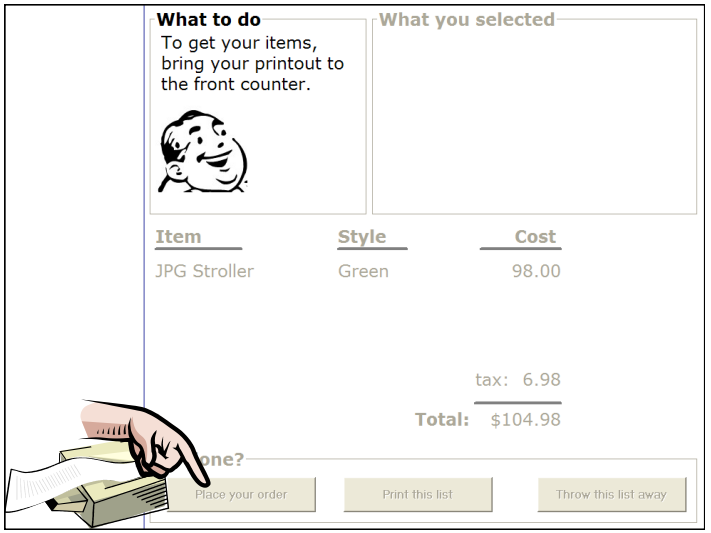

Story – board
Initial screen
Scan the stroller ->
Change the color ->
Place the order ->
What to do
What you selected
Item
Style
Cost
JPG Stroller
Green
Blue
Red (out of stock)
tax: 6.98
Total: $104.98
All done?
Place your order
Print this list
Throw this list away


Alternate path…
Scan the shirt ->
Touch previous item ->
Delete that item->
What to do
What you selected
Item
Style
Cost
JPG Stroller
Rad Shirt
Large
Medium
Small
tax: 10.08
Total: $154.07
tax: 3.22
Total: $ 49.21
All done?
Place your order
Print this list
Throw this list away


Video Prototype
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.
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

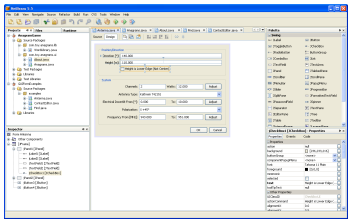




high fidelity prototype

High-fidelity (very detailed) prototypes
Can be build by interface builders or your Toolkit
… but (some) functionality is missing

Good for communicating a specific aspect
e.g.: detailed dialog box with the size and text of buttons



Sketching and Prototyping

Early design

Brainstorm different representations Choose a representation Rough out interface style	Sketches & low fidelity paper prototypes
Task centered walkthrough and redesign	Medium fidelity prototypes in computer (wireframes, animations)
Fine tune interface, screen design Heuristic evaluation and redesign Usability testing and redesign	High fidelity prototypes (interface builders)
Limited field testing Alpha/Beta tests	Working systems

Late design