iPhone Specialist Lab
L02: User-Centered Design

Prof. Dr. Jan Borchers, Florian Heller, Jonathan Diehl
Media Computing Group, RWTH Aachen University

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http://hci.rwth-aachen.de/iphone

User-Centered Design

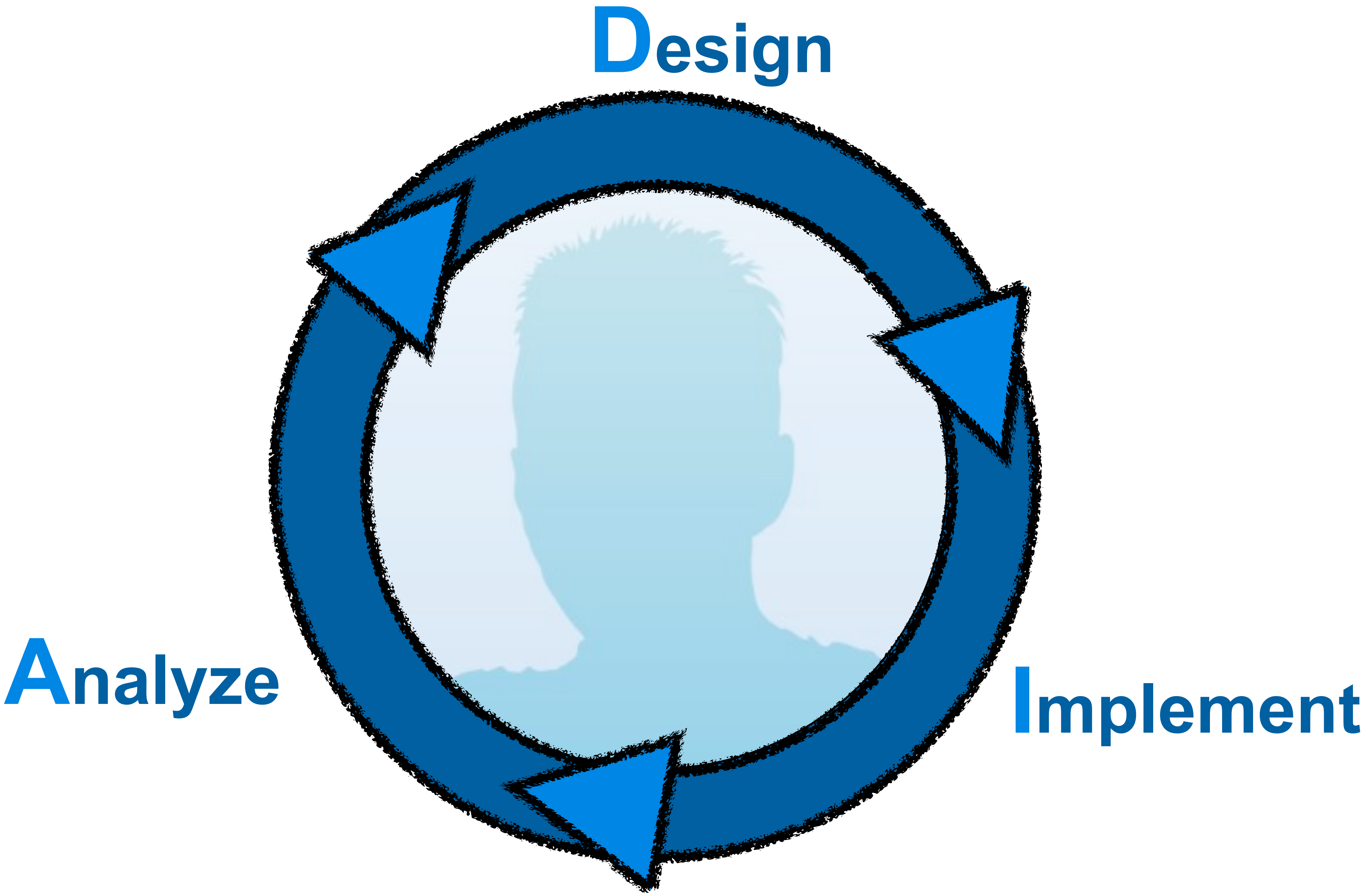
- Standard software process easily misses users' needs

⇒ Involve users during entire process

  - Questionnaires and interviews
  - Usability tests and observation

- Goal: more usable, more successful systems

The Right Way: DIA Cycle



DIA Cycle

- Usually many iterations necessary
- With each iteration:
  - Design becomes more concrete & precise
  - Implementation (prototype) gets more detailed and technically complex
  - Analysis and user feedback focuses on smaller and smaller problems
- Fix big design bugs first, small ones later

The First 2 Questions

- Whenever designing an interactive system, ask the following two questions first:
    1. **Who are the users?**
    2. **What do they want to do with the system?**
- Many projects fail because these questions have not been answered!
- Q1 requires thinking, but Q2 asking!

Styles Of Thinking

- When thinking about a problem, we try to do too much at once
  - Emotion, information, logic, hope, creativity,...

⇒ Instead: Think in *one* style at a time!

- Maximizes sensitivity of the brain in that direction

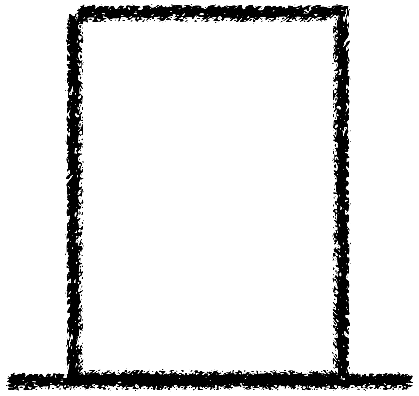
- Everybody has their own preferred styles of thinking
  - Correlated with personality, training, professional background, role, situation,...
- When people think in different styles, they argue

⇒ *Parallel thinking*:

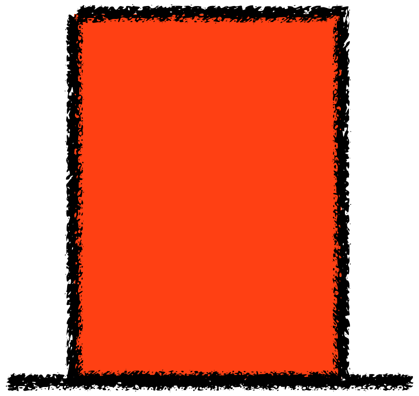
- Let everybody think in the same style for a while
- Then move to the next style of thinking, to cover all styles

Six Thinking "Hats" (Styles)

[de Bono, 2001]

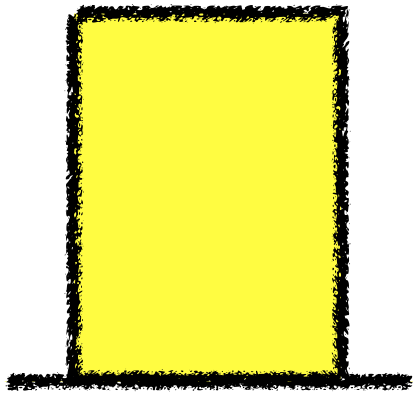


Paper
Objective, facts and figure

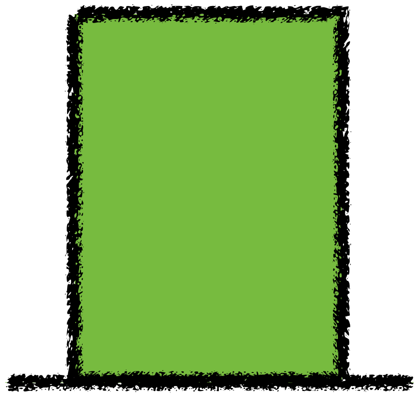


Blood
Intuition, gut feeling, emotion

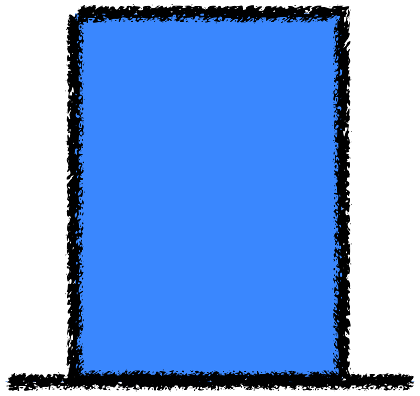
Serious
Cautious, critical



Sun
Hope, benefits, positive thinking



Growing Grass
Creativity, new ideas



The Sky Above
Organize other hats

Six Thinking Hats

- Use hats to refer to thinking styles instead of people
  - ✔ “That was good black hat thinking; now let’s put the yellow hat on.”
  - ✗ “You are too critical. You should see the benefits of this.”
  - ✗ “You are a black hat!”
- When to use which hat?
  - Preset: Determine hat sequence before meeting
  - Evolving: Determine next hat on-the-fly (not for beginners)

Six Thinking Hats Guideline

- Only moderator can trigger hat changes
- Short time per hat (1 min per participant)
    - Extend when new things come up — do not limit creativity
    - Red hat: Keep time short. Make statements as definite as possible.
- Example sequence
    - Blue: organize the meeting and hats
    - Red (if there is a strong preexisting feeling): let people lay down emotional burden
    - White: bring everyone up-to-date with information
    - First Yellow, then Green, and then Black (benefits motivate people to overcome difficulties, get the ideas, criticize the ideas)
    - White: assess the idea against existing information
    - Blue: conclude and summarize
    - Red: reflect on thinking performance

Brainstorming: An Initial Design Technique

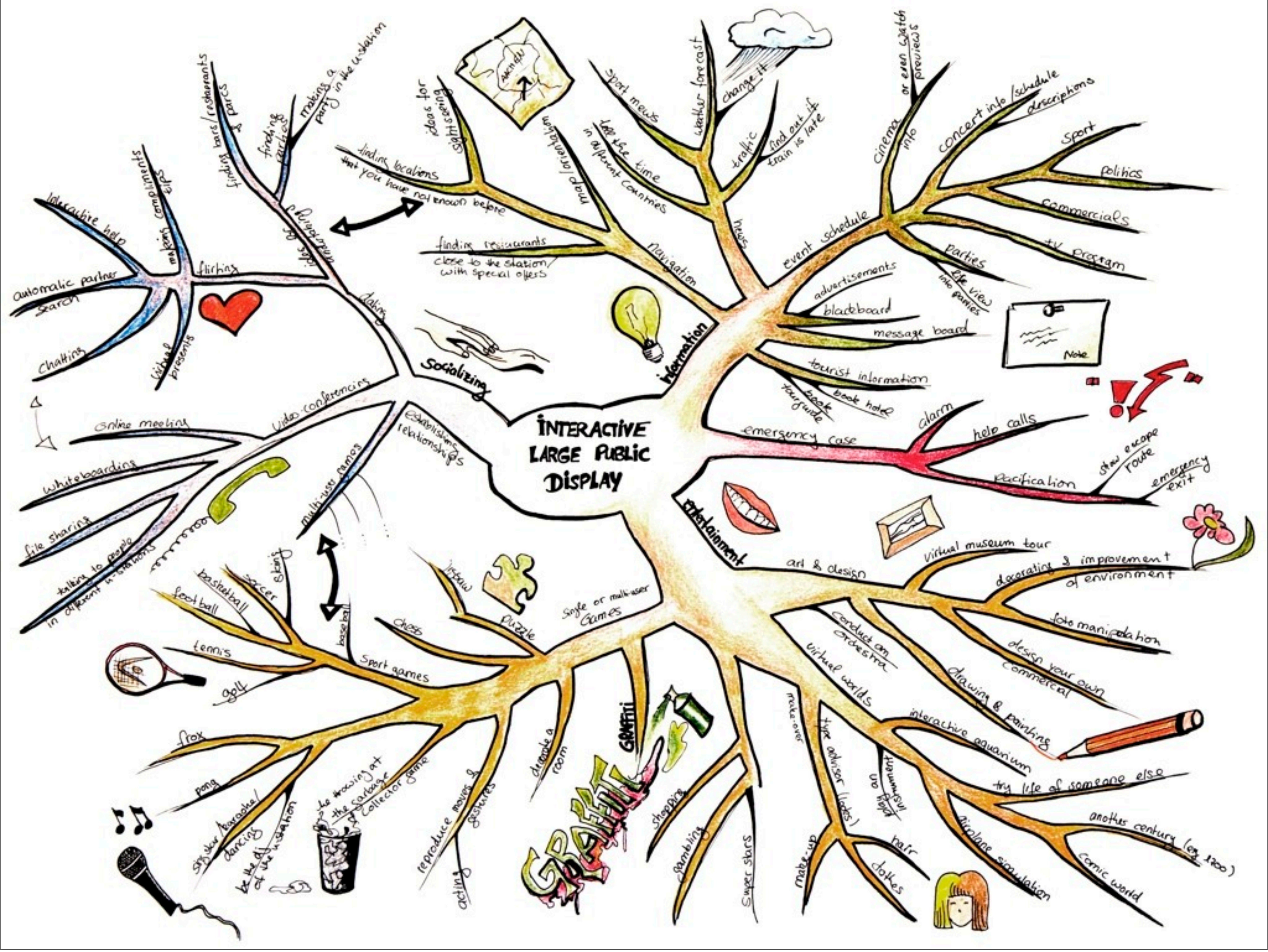
- A green hat technique
- Goal: Collect as many ideas on a given topic as possible
- Relax, have fun, invite good brainstormers
- Defer judgment, don’t criticize or argue (no black hat)
- Instead, leapfrog on each other’s ideas (green hat)
- Quantity, not quality; include crazy ideas
- Go for a certain number of ideas, say, 100
- Scribe collects ideas visible for all
- Limit to 5–10 minutes
- Trick: Cross-pollination who–what–where

In-Class Exercise: Six Hats

- Brainstorm a new interface of a universal remote
  - CD Player
  - DVD Player
  - TV
  - Radio
- Groups of 2-3
- Follow the Six Hats

Structuring Brainstorms: Concept Mapping

- Used since 1500s by Spanish monks
- “Mind Mapping” trademarked by Tony Buzan in 70’s
- Uses both brain sides, structures note-taking for overview, planning, learning… with a visual “gestalt”
- Use A3 landscape, subject in middle, aspects on branches, subtopics on subbranches (software?)
- Connect additional relationships with arrows
- Use images/icons for keywords where they work
- Use color for branches & connections (after pencil version becomes stable)
- Grows over time, combine individual maps



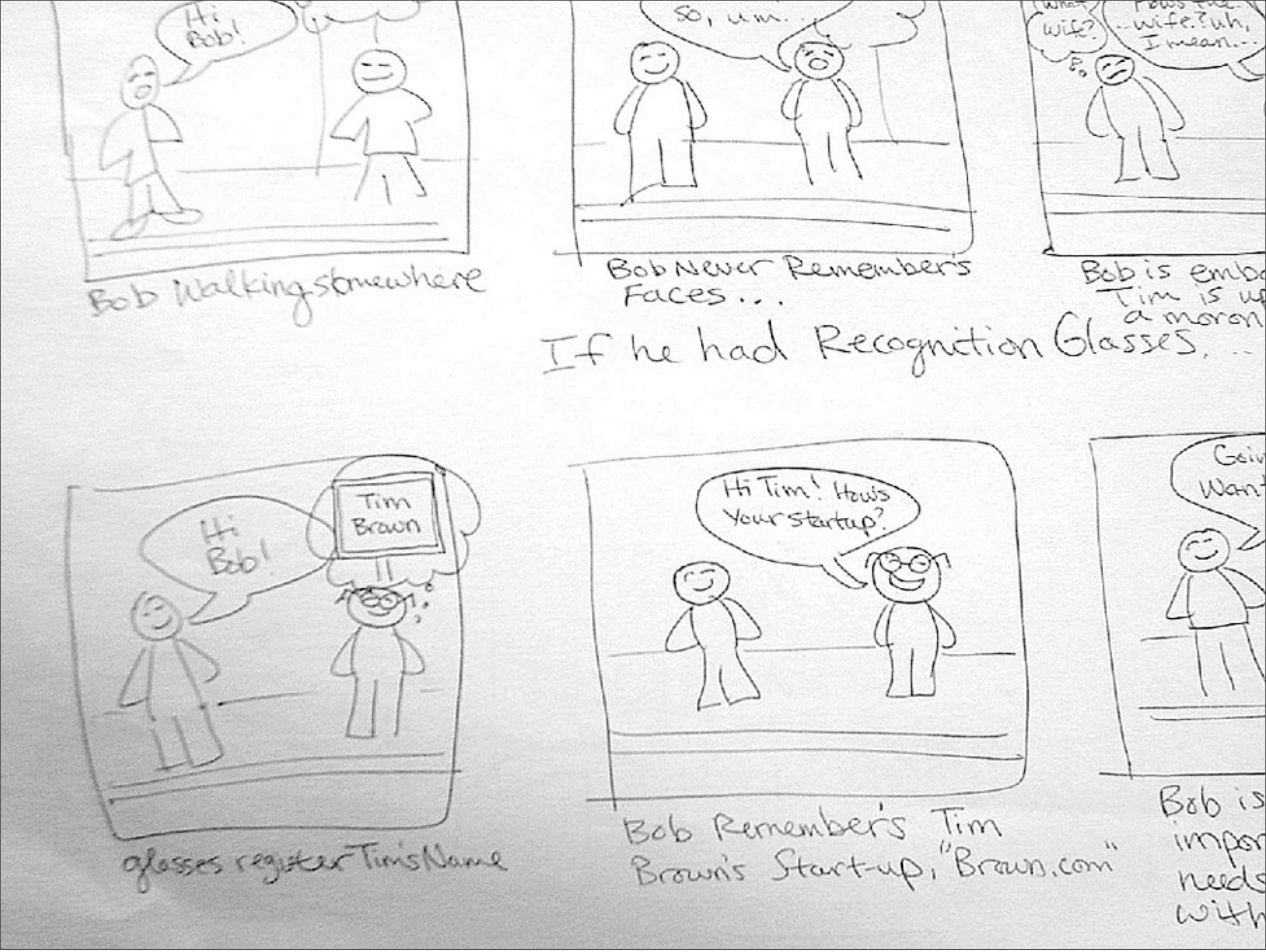
Tuesday, March 1, 2011

In-Class Exercise: Concept Map

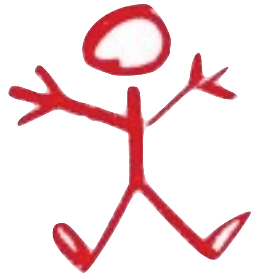
- Create a pencil + paper concept map of your brainstorming results
- Use first-level branches for different aspects of your idea
- Note how the graphical layout helps you to organize your thoughts
- Use color + graphics to increase visual impact and uniqueness

Storyboarding: An Initial Design Technique

- What?
  - Sequence of single images
  - Visual representation of a script
  - Illustrates interaction
  - Like visual outline of a film
- Why?
  - Describes task showing environment, user, and computer
  - Or describes UI as series of screen images (but include user representation)
  - Helps working out interaction details
  - Great at-a-glance overview of interaction
  - Helps developing usage scenarios, tasks, and tools
- When?
  - After describing a task, storyboard it, then take back to user. Did you get the story right?


Hi Bob!
Bob Walkingsomewhere
So, um...
Bob Never Remember's Faces...
What wife?
How's the wife? uh, I mean...
Bob is emb
Tim is u
a moron
If he had Recognition Glasses...
Hi Bob!
Tim Brown
glasses register Tim's Name
Hi Tim! Hows Your startup?
Bob Remember's Tim Brown's Start-up, "Brown.com"
Goin
Want
Bob is
impor
needs
with

How To Draw Users



- Star Man and friends (interactive blackboard interlude)
  - Stick Man (bad)
  - Star Man
  - Sad, happy Star Man
  - Star Man pressing a button
  - A hand
  - Star Trek Man, Simple Star Trek Man
  - Family, users around an exhibit
  - Architect Man, Suits
  - Faces

In-Class Exercise: Storyboard

- Draw a simple storyboard for your preferred brainstormed idea
- Show how it helps users with a task in three pictures
- Make it readable from 2 m distance
- Walk-around idea fair

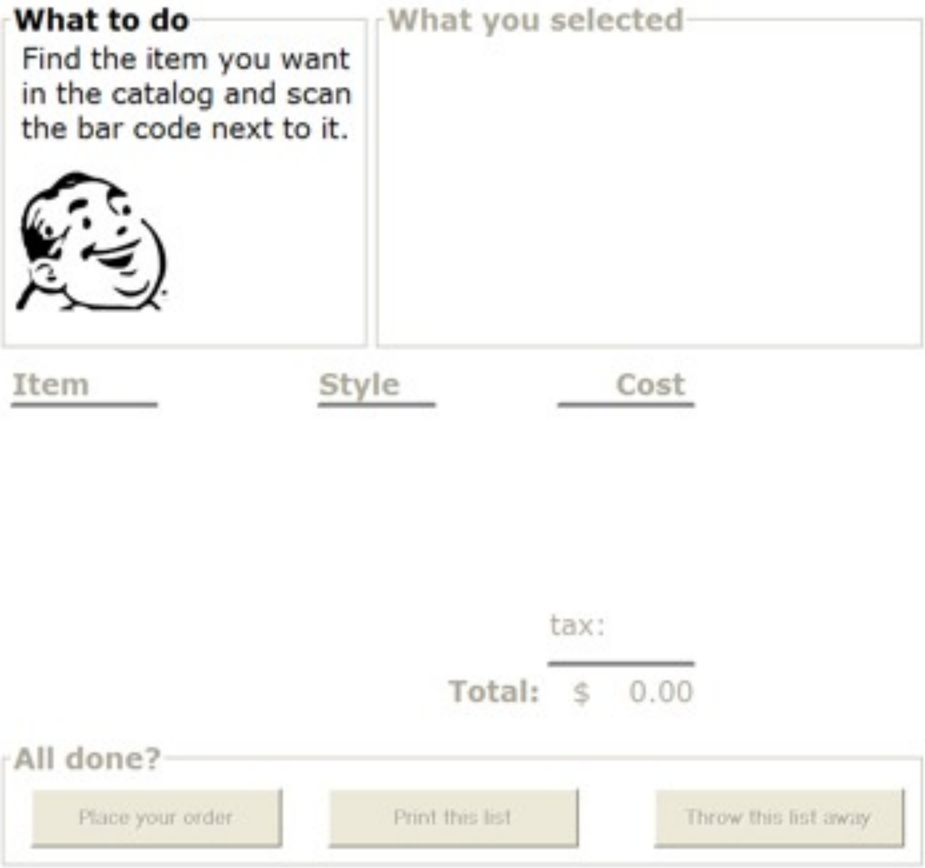
Paper Prototypes

- First prototype, quick and cheap
- Rough paper & pencil sketches of interface or central UI dialogs
- Hand-drawn, no ruler, no computer!

Paper Prototype Example: Shopping Application

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

Initial screen



What to do

Find the item you want in the catalog and scan the bar code next to it.

What you selected

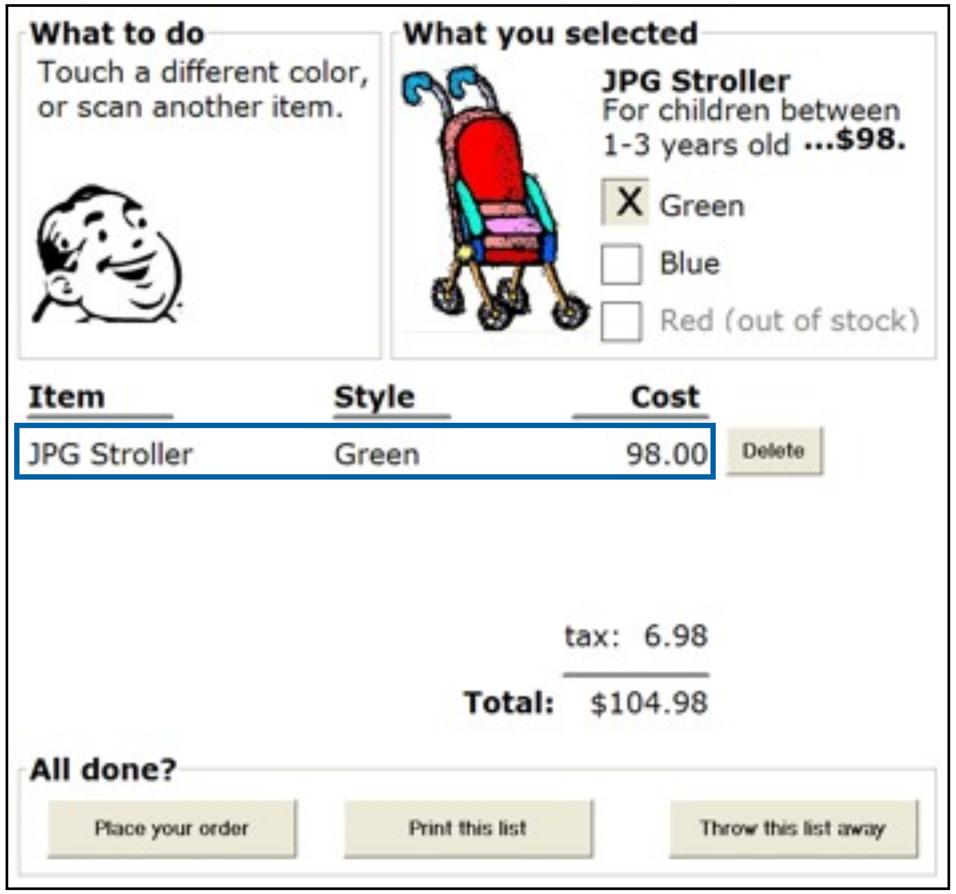
Item	Style	Cost

tax:

Total: $ 0.00

All done?

Scan the stroller →



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)

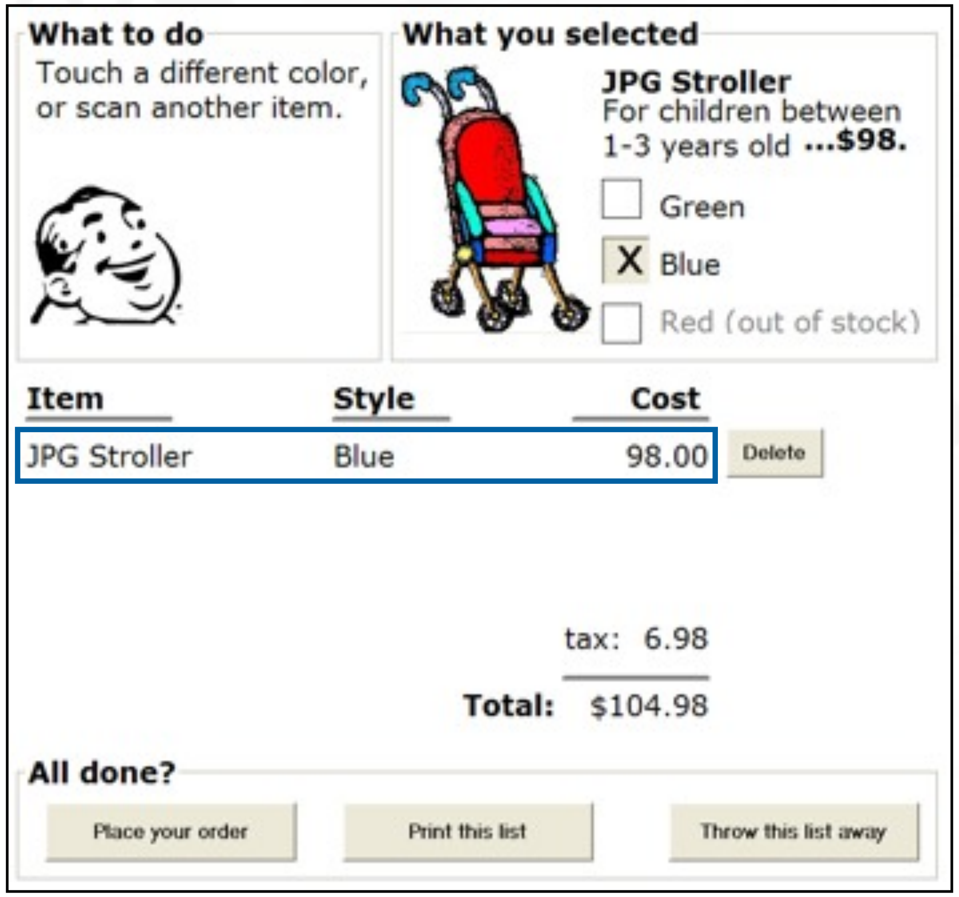
Item	Style	Cost
JPG Stroller	Green	98.00

tax: 6.98

Total: $104.98

All done?

Change the color →



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)

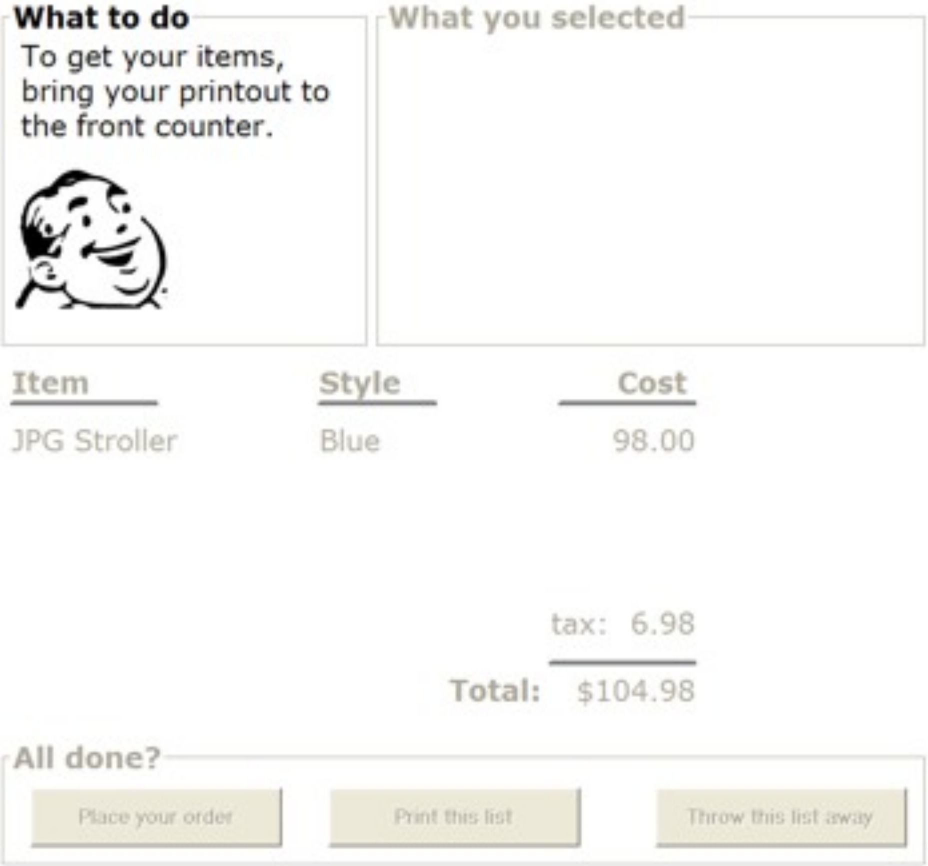
Item	Style	Cost
JPG Stroller	Blue	98.00

tax: 6.98

Total: $104.98

All done?

Place the order →



What to do

To get your items, bring your printout to the front counter.

What you selected

Item	Style	Cost
JPG Stroller	Blue	98.00

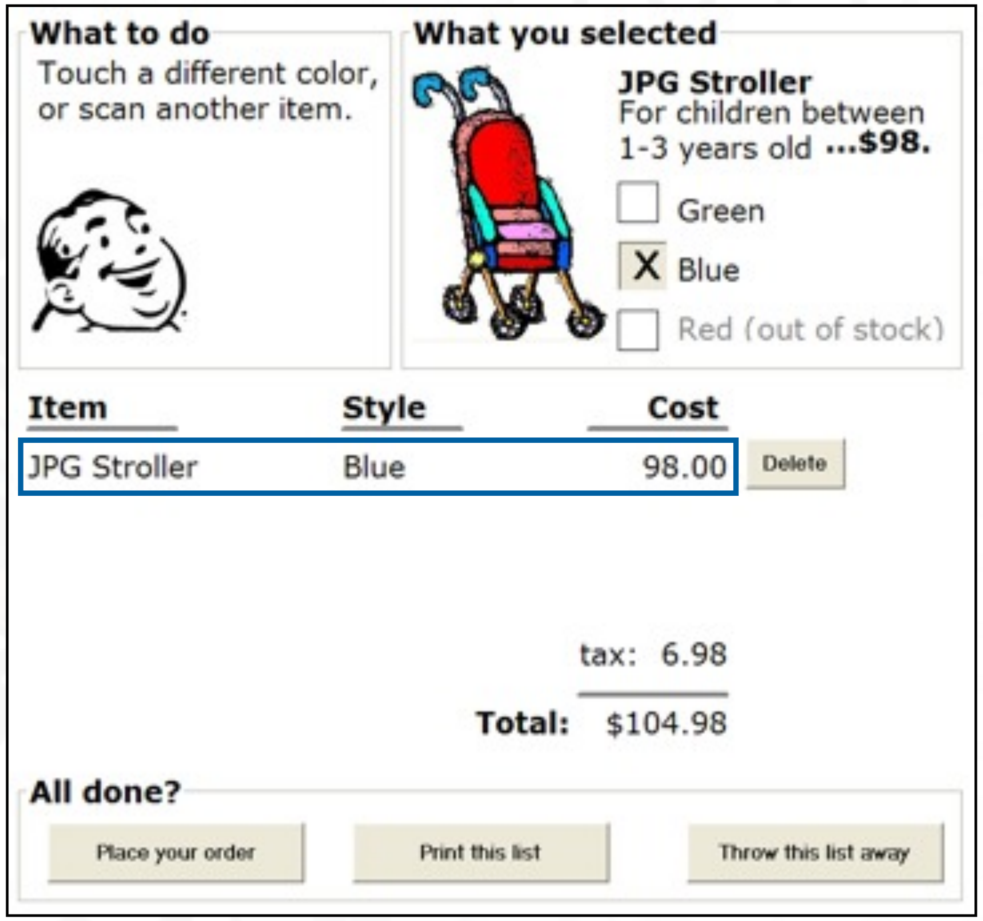
tax: 6.98

Total: $104.98

All done?

Courtesy S. Greenberg

Alternate path…



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)

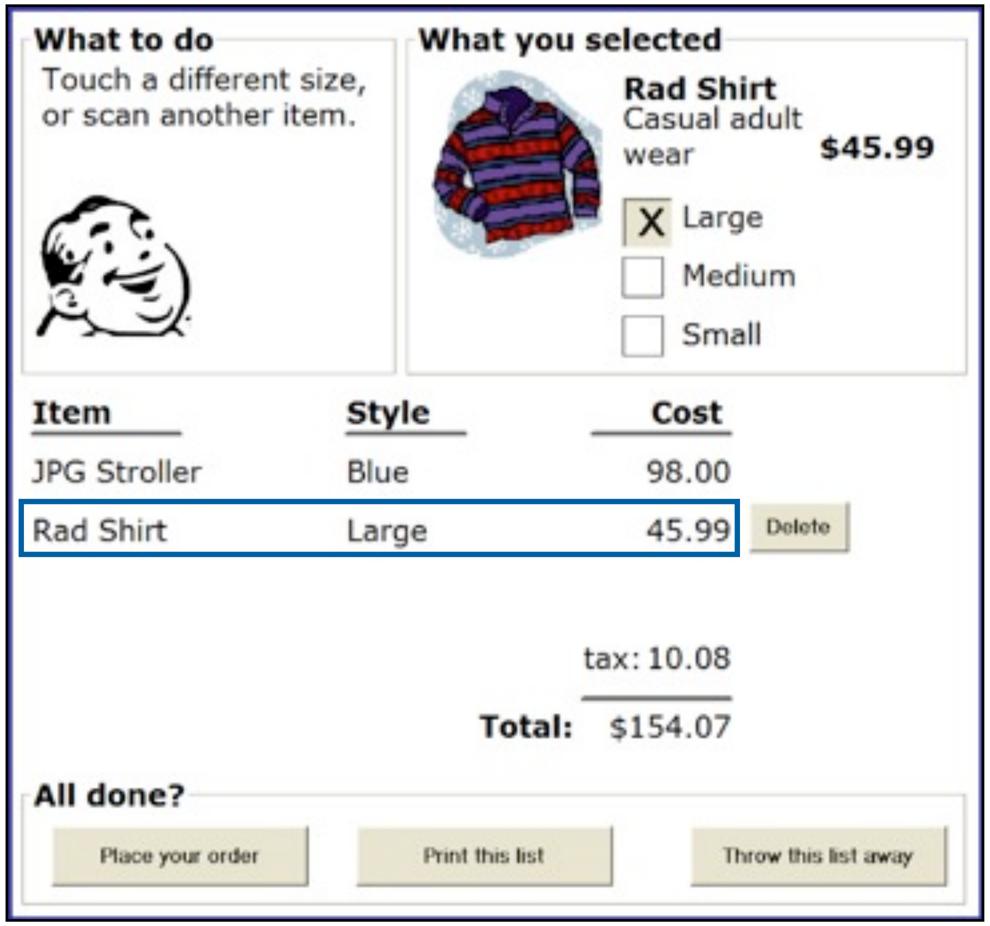
Item	Style	Cost
JPG Stroller	Blue	98.00

tax: 6.98

Total: $104.98

All done?

Scan the shirt →



What to do

Touch a different size, or scan another item.

What you selected

Rad Shirt
Casual adult wear **$45.99**

☒ Large
☐ Medium
☐ Small

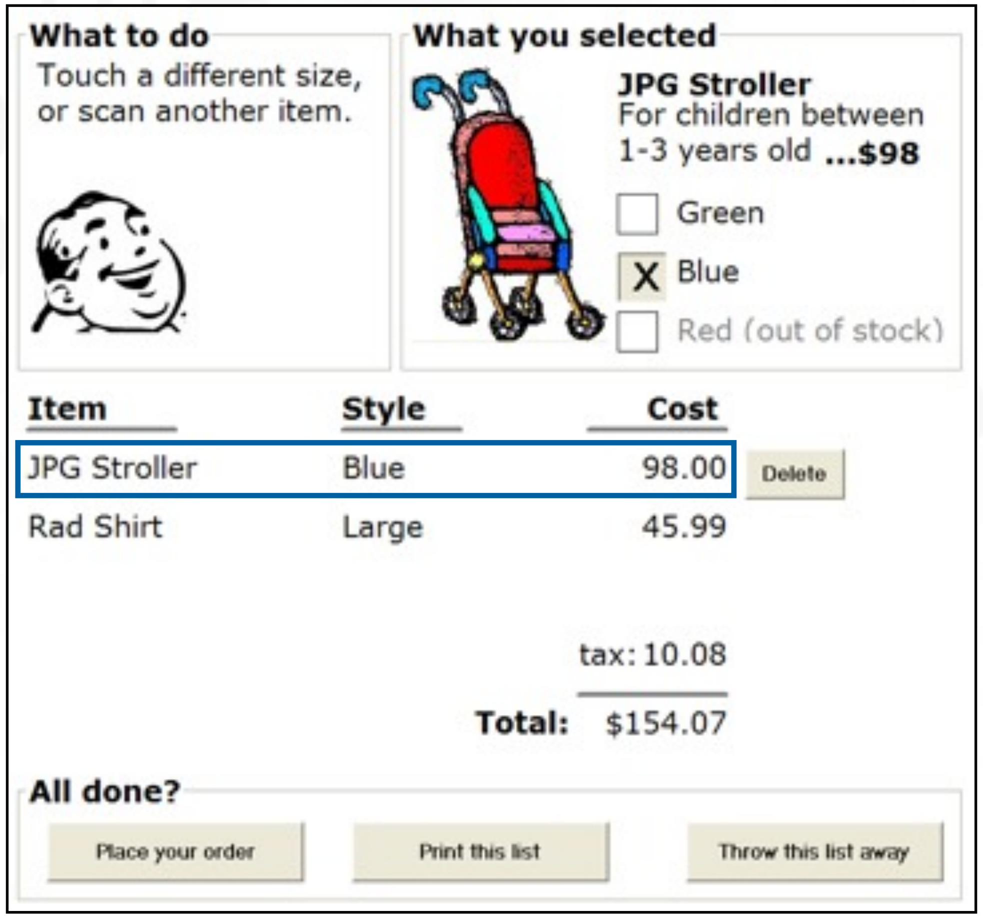
Item	Style	Cost
JPG Stroller	Blue	98.00
Rad Shirt	Large	45.99

tax: 10.08

Total: $154.07

All done?

Touch previous item →



What to do

Touch a different size, or scan another item.

What you selected

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

☐ Green
☒ Blue
☐ Red (out of stock)

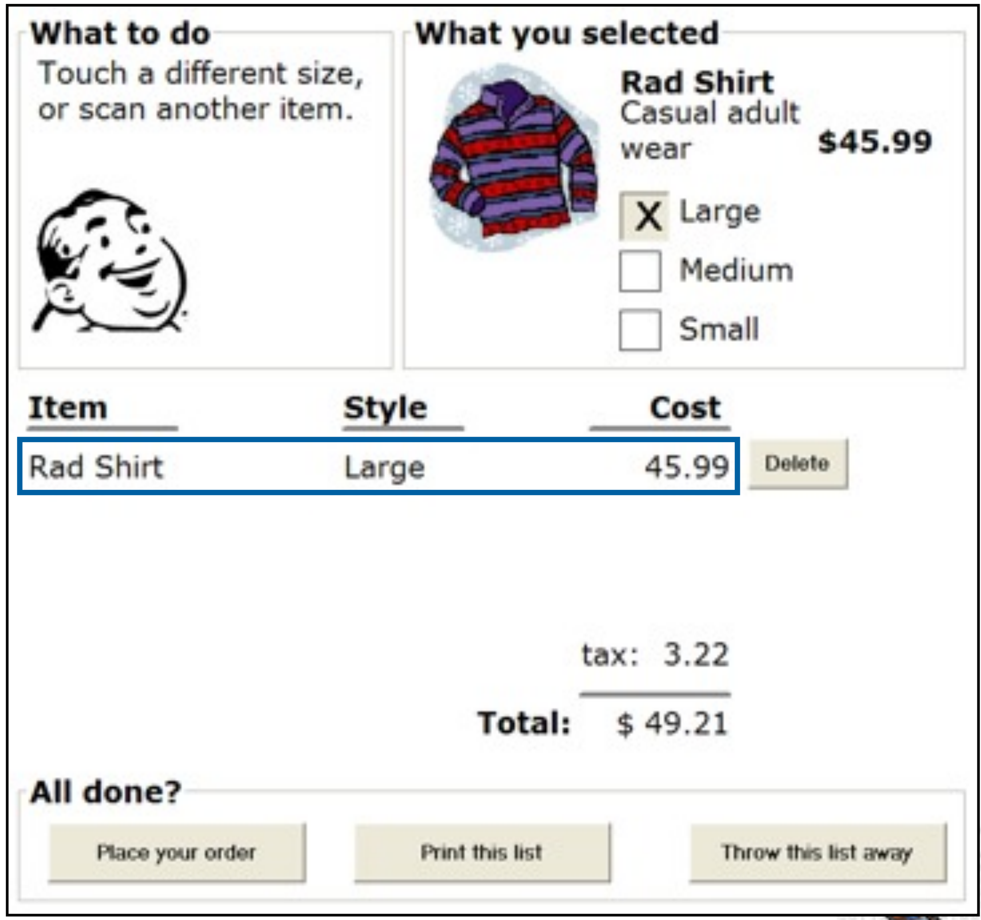
Item	Style	Cost
JPG Stroller	Blue	98.00
Rad Shirt	Large	45.99

tax: 10.08

Total: $154.07

All done?

Delete that item →



What to do

Touch a different size, or scan another item.

What you selected

Rad Shirt
Casual adult wear **$45.99**

☒ Large
☐ Medium
☐ Small

Item	Style	Cost
Rad Shirt	Large	45.99

tax: 3.22

Total: $ 49.21

All done?

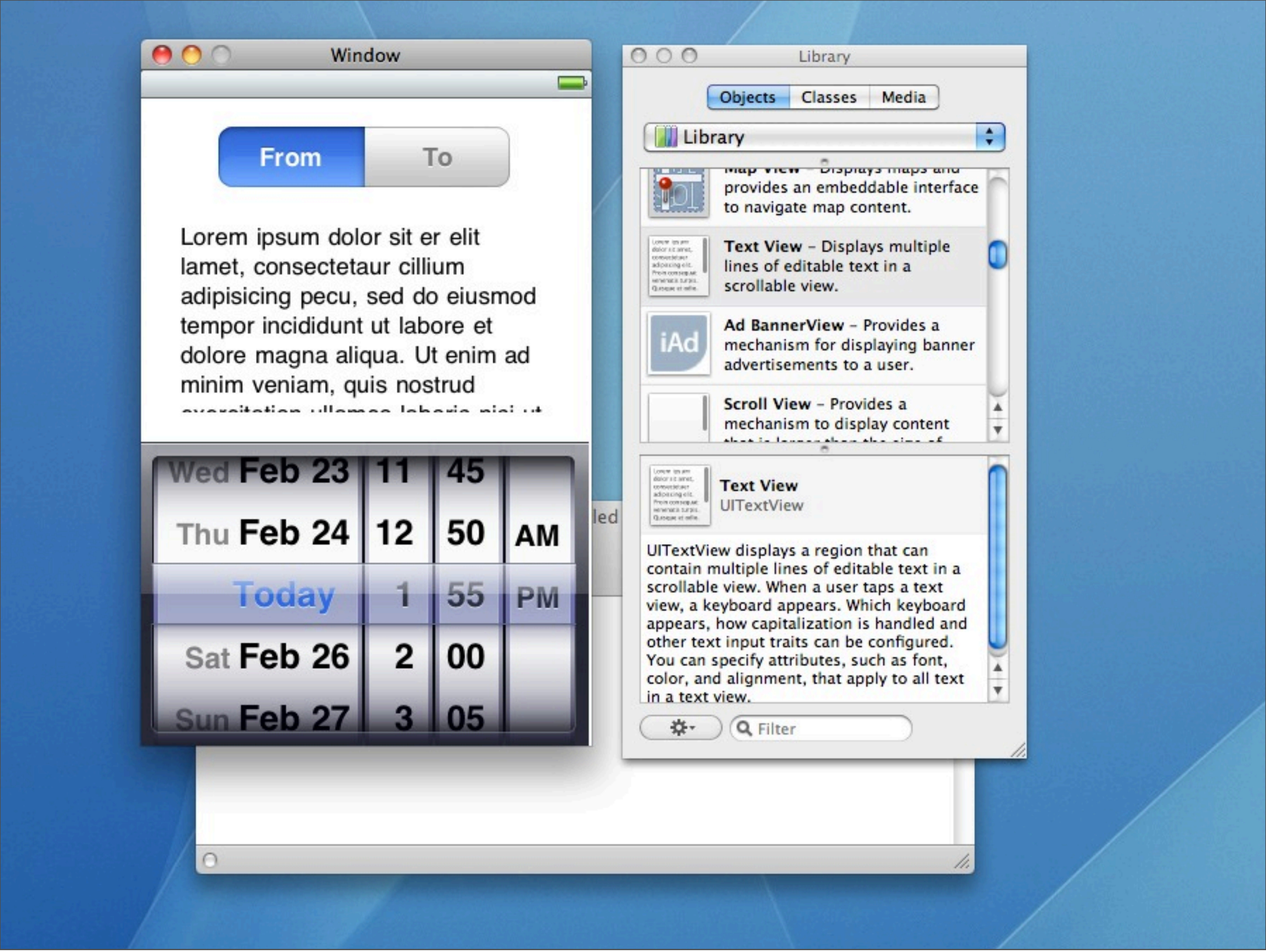
Courtesy
S. Greenberg

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
  - PICTIVE: Plastic Interface for Collaborative Technology Initiatives through Video Exploration

Software Prototype

- Medium fidelity prototype
  - More detail, 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: Screenshots, Flash animation
- Important: UI, not functionality is key!
- Pro: More engaging for user to try, user can play with it without designer around



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Map View – Displays maps and provides an embeddable interface to navigate map content.

Text View – Displays multiple lines of editable text in a scrollable view.

Ad BannerView – Provides a mechanism for displaying banner advertisements to a user.

Scroll View – Provides a mechanism to display content

Text View
UITextView

UITextView displays a region that can contain multiple lines of editable text in a scrollable view. When a user taps a text view, a keyboard appears. Which keyboard appears, how capitalization is handled and other text input traits can be configured. You can specify attributes, such as font, color, and alignment, that apply to all text in a text view.

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

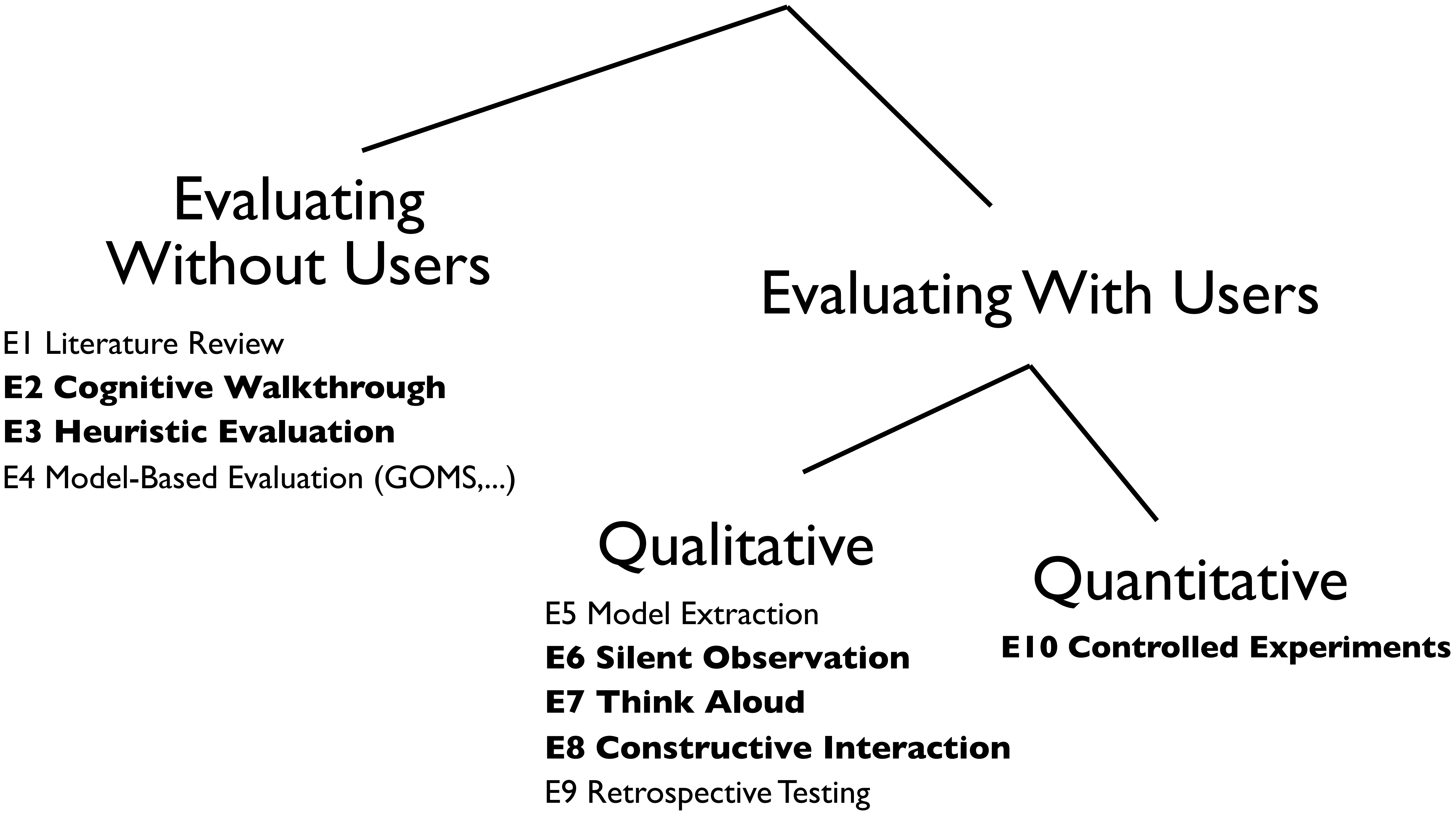
Why Evaluate?

- To ensure that system matches user needs
- Necessary even if design was already user-centered (interviews, …)!
- Evaluation should happen throughout the entire software development process
  - Early designs are more often evaluated by design team, analytically and informally
  - Later implementations are more often evaluated by users, experimentally and formally

Why Evaluate?

- To judge system features
  - Does it facilitate users' tasks?
  - Does it offer the right features, easy to reach, and presented as expected?
- To judge effects on users
  - How easy to learn and use is the system?
  - How do users feel about the system?
  - Are there areas that overload users?
- To discover specific problems
  - Do unexpected/confusing situations come up?

Evaluation Techniques



Evaluating Without Users

- E1 Literature Review
- **E2 Cognitive Walkthrough**
- **E3 Heuristic Evaluation**
- E4 Model-Based Evaluation (GOMS,...)

Evaluating With Users

Qualitative

- E5 Model Extraction
- **E6 Silent Observation**
- **E7 Think Aloud**
- **E8 Constructive Interaction**
- E9 Retrospective Testing

Quantitative

- **E10 Controlled Experiments**

+ Interviews, questionnaires,...

E2: Cognitive Walkthrough

- Without users
- Expert = designer or cognitive psychologist
- Goal: Judge learnability and ease of use
- Step through each task and ask
  - How does interaction influence user?
  - What cognitive processes will she need?
  - What problems could learning/doing this step have?
- Does system help user to get from goals to intentions and actions?
- Requires interface description, task description, and user profile

E2: Cognitive Walkthrough

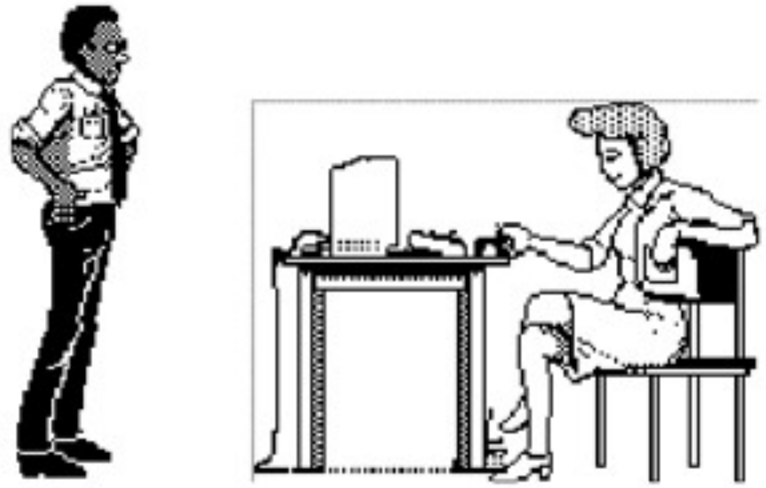
- What to do:
  - Choose task—describe goals—determine actions
  - Analyze this decision process using above questions
- Question forms capture psychological knowledge and guide the tester
- Analytical method for early design or existing systems
- Takes time

E3: Heuristic Evaluation

✓...
✓...
✓...

- Variant of Cognitive Walkthrough
- Choose usability heuristics
  (general guidelines, e.g., Nine Golden Rules)
- Step through tasks and check whether guidelines are followed
  + Quick and cheap
  – Subjective
    - Better done by several independent designers

E6: Silent Observation



- Designer watches user in lab or in natural environment while working on one of the tasks
- No communication during observation

+ Helps discover big problems

– No understanding of decision process (that lead to problems) or user's mental model, opinions, or feelings

E7: Think Aloud

Hmm, what does this do? I'll try it... Ooops, now what happened?
Saul Greenberg

- As E6, but user is asked to say aloud
  - What she thinks is happening (state)
  - What she is trying to achieve (goals)
  - Why she is doing something specific (actions)
- Most common method in industry

+ Good to get some insight into user's thinking, but:

  – Talking is hard while focusing on a task

  – Feels weird for most users to talk aloud

  – Conscious talking can change behavior

E8: Constructive Interaction

Now, why did it do that?
Oh, I think you clicked on the wrong icon

- Two people work on a task together
  - Normal conversation is observed (and recorded)
  - More comfortable than Think Aloud
- Variant of this: Different partners
  - Semi-expert as "trainer", newbie as "student"
  - Student uses UI and asks, trainer answers
  - Good: Gives insight into mental models of beginner and advanced users at the same time!

E10: Controlled Experiments

- Quantitative, empirical method
- Steps:
    - Formulate hypothesis
    - Design experiment, pick variable and fixed parameters
    - Choose subjects
    - Run experiment
    - Interpret results to accept or reject hypothesis

Controlled Experiments

- Subjects
  - Similar to real users in profile (age, education, computer and domain expertise, system knowledge, …)
  - Use at least 10 subjects
    - Use more if you need finer details
    - Statistical power analysis can tell you exact number
- Variables
  - Independent: are varied under your control
    - E.g., number of menu entries
  - Dependent: are measured
    - E.g., execution time, error rates, subjective preferences

Hypothesis

- Predicts outcome of experiment
- Claims that changing independent variables influences dependent variables
- Experiment goal: Confirm hypothesis
- Approach: Reject null hypothesis (inverse, i.e., “no influence”)

Choosing A Method

- Between-groups:
  - Each subject only does one variant of the experiment
  - There are at least 2 variants (manipulated form + control, to isolate effect of manipulation)
  - + No learning effect across variants
  - – But requires more users
- Within-groups:
  - Each subject does all variants of the experiment
  - + Less users required, individual differences canceled out
  - – But often learning effect problem

Analyzing Results

- Do statistical analysis using well-defined test methods
  - E.g., Student's *t*-test, ANOVA (analysis of variance), regression analysis, Wilcoxon- or Mann/Whitney test, χ^2test
- Choice depends on number, continuity, and assumed distribution of variables, and the desired form of the result (yes/no, size of difference, confidence of estimate)

Other Evaluation Methods

- Before and during the design, with users:
  - Questionnaires
  - Personal interviews
- After completing a project:
  - Email bug report forms
  - Hotlines
  - Retrospective interviews and questionnaires
  - Field observations (observe running system in real use)

Recording Observations

- Paper + pencil
  - Evaluator notes events, interpretations, other observations
  - Cheap but hard with many details (writing is slow). Forms can help.
- Audio recording
  - Good for speech with Think Aloud and Constructive Interaction
  - But hard to connect to interface state
- Video
  - Ideal: two cameras (user + screen) in one picture
  - Best capture, but may be too intrusive initially

Dealing With Testers

- Tests are uncomfortable for the tester
  - Pressure to perform, mistakes, competitive thinking
- So treat testers with respect at all times!
  - Before, during, and after the test

Before The Test

- Do not waste the tester’s time
  - Run pilot tests before
  - Have everything ready when testers arrive
- Make sure testers feel comfortable
  - Stress that the system is being tested, not them
  - Confirm that the system may still have bugs
  - Let testers know they can stop at any time
- Guarantee privacy
  - Individual test results will be handled as private
- Inform tester
  - Explain what is being recorded
  - Answer any other questions (but do not bias)
- Only use volunteers (consent form)

During The Test

- Do not waste the testers' time
  - Do not let them complete unnecessary tasks
- Make sure testers are comfortable
  - Early success in the task possible
  - Relaxed atmosphere
  - Breaks, coffee, …
  - Hand out test tasks one by one
  - Never show you are unsatisfied with what the tester does
  - Avoid interruptions (cell phones, …)
  - Abort the test if it becomes too uncomfortable
- Guarantee privacy
  - Never let testers' boss (or others) watch

After The Test

- Make sure testers are comfortable
  - Stress that tester has helped finding ways to improve the system
- Inform
  - Answer any questions that could have changed the experiment if answered before the test
- Guarantee privacy
  - Never publish results that can be associated with specific individuals
  - Show recordings outside your own group only with written consent from testers

Summary

- DIA Cycle = Design, Implement, Analyze
- Design Techniques
  - Six Thinking Hats, Brainstorming, Concept Maps, Storyboards
- Implementation Techniques
  - Paper Prototypes, Post-It Prototype, iPhone...
- Analysis
  - Evaluation without / with users