

CPT208 Human-centric Computing

User-Centered Design

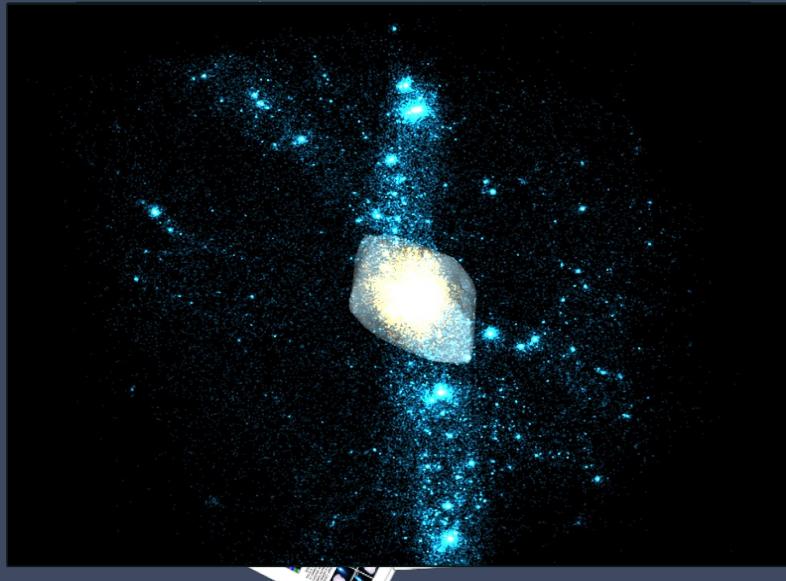
Participatory Design

Prototyping and Evaluation Cycles

Lingyun Yu

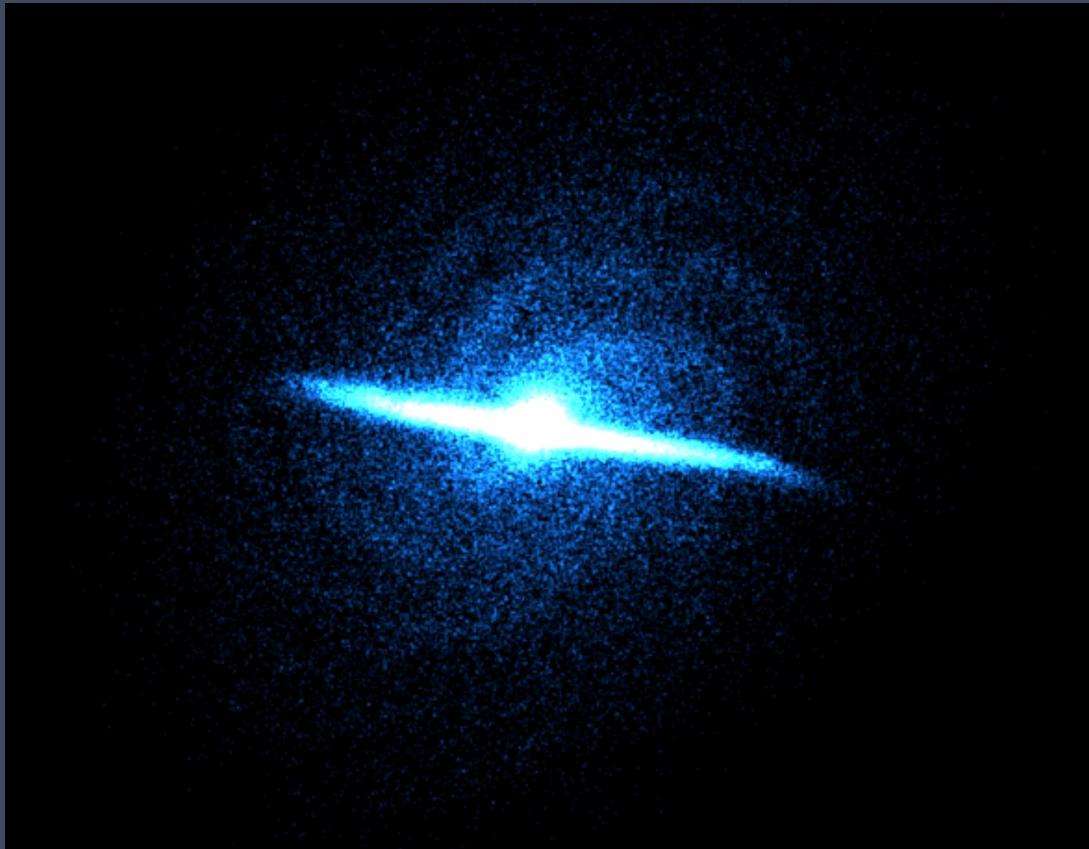
User-Centered System Design – Example (1)

- Particle selection



[Wingrove & Sellen, 2005]

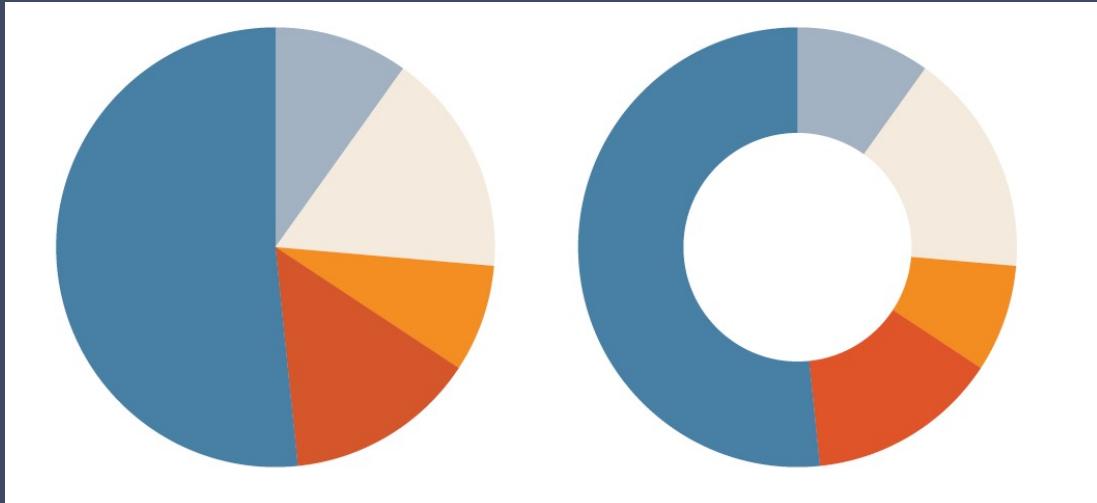
User-Centered System Design – Example (1)



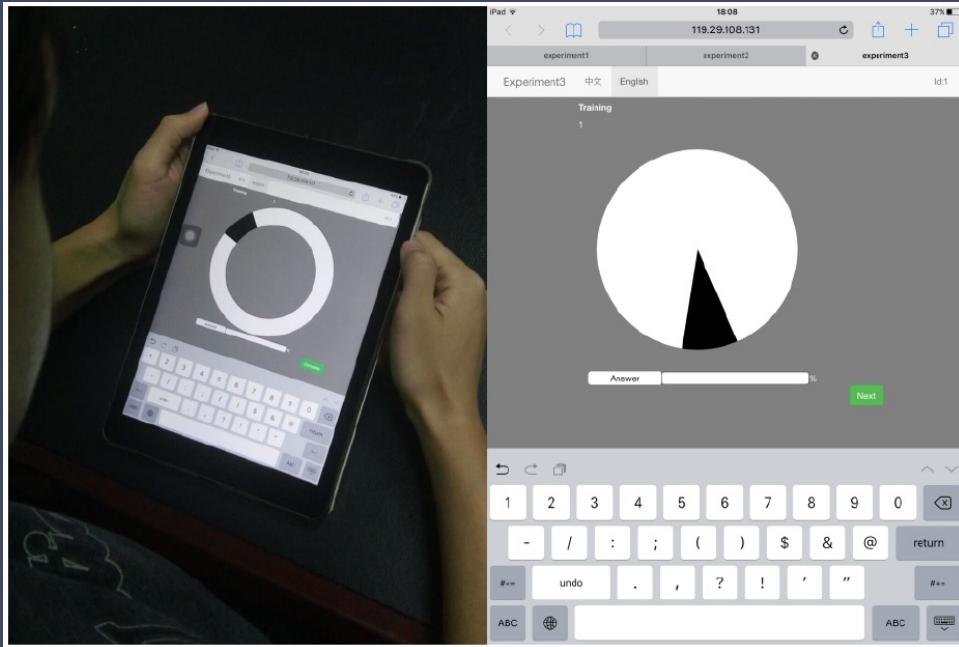
User-Centered System Design – Example (1)



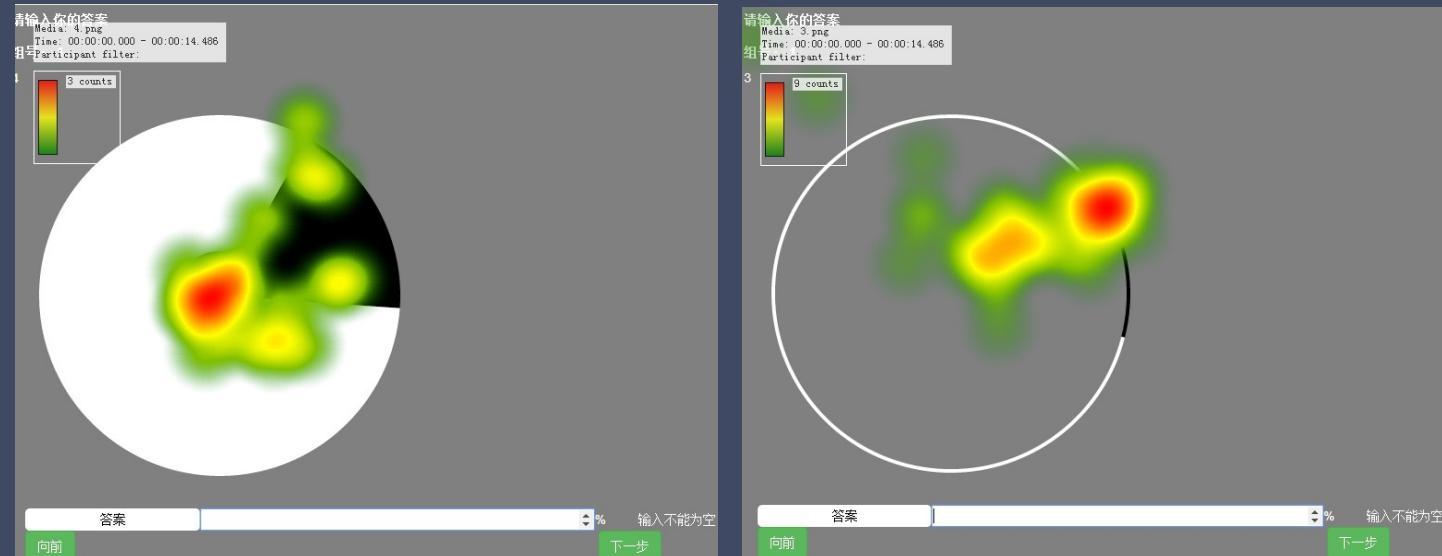
User-Centered System Design – Example (2)



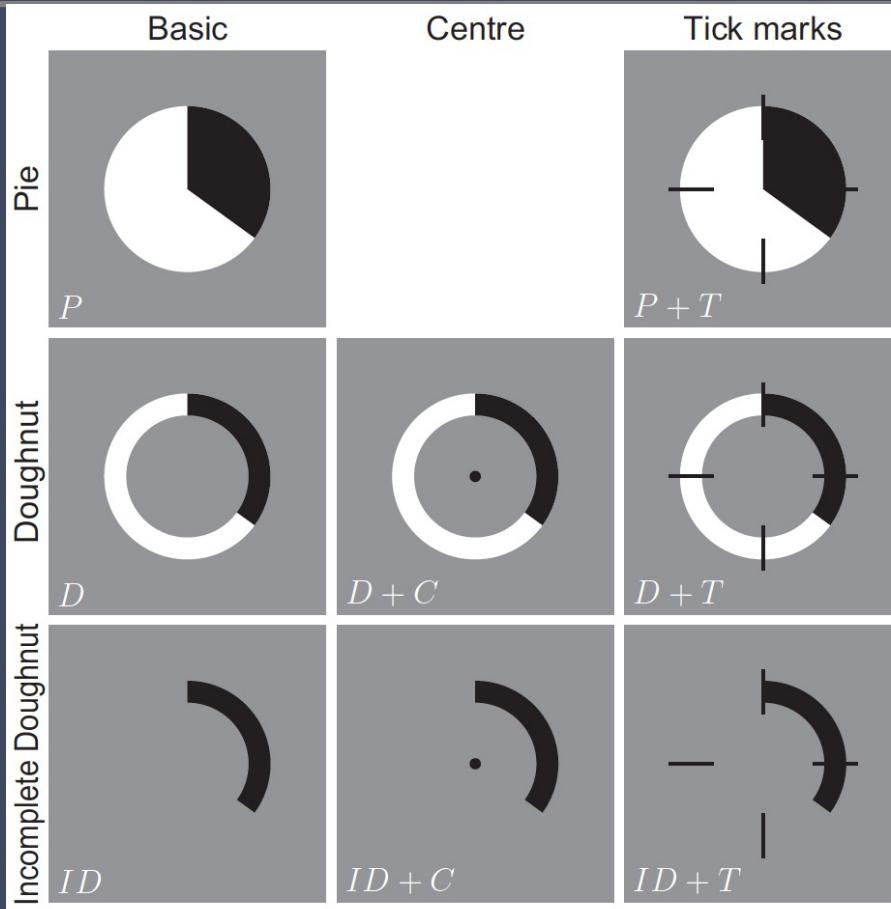
User-Centered System Design – Example (2)



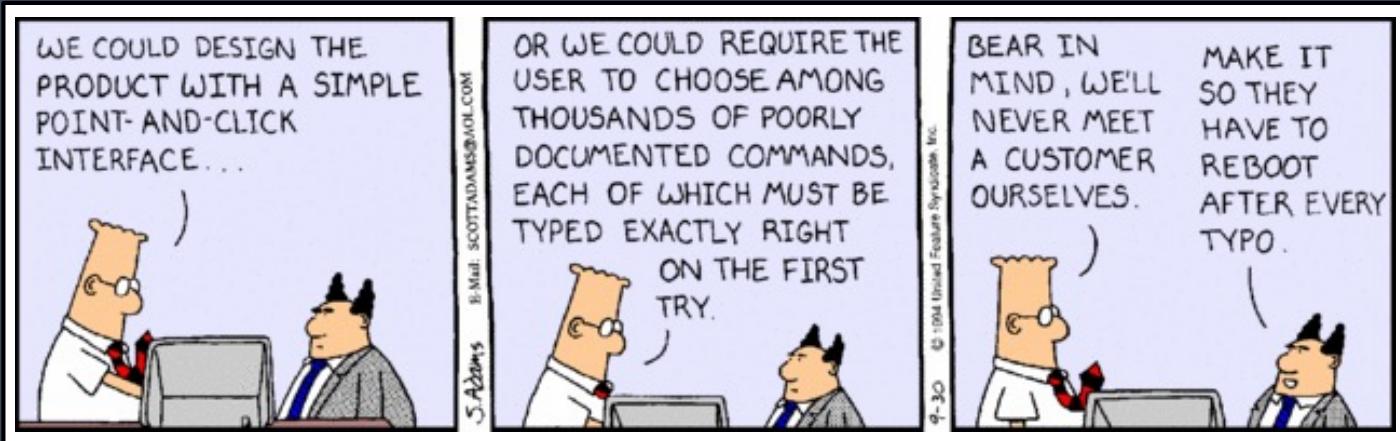
User-Centered System Design – Example (2)



User-Centered System Design – Example (2)



System-Centered Design



System-Centered Design

- what can I easily build on this platform?
- what can I create from the available tools?
- what do I as a programmer find interesting?



User-Centered System Design

- design is based upon a user's
 - abilities and real needs
 - context
 - work
 - tasks
 - need for a usable and useful product



- golden rule of interface design:

Know The User

User-Centered System Design

- ... is an iterative process that focuses on an understanding of the users and their context in all stages of design and development.
- ... is based on understanding the domain of work or play in which people are engaged and in which they interact with computers.

User-Centered System Design

- assumptions:
 - the result of a good design is a *satisfied customer*
 - the process of design is a *collaboration between designers and customers*
 - the *design evolves and adapts* to the user's changing concerns, and the process produces a specification as an important byproduct
 - the customer and designer are in *constant communication* during the entire process

Participatory Design

- problems:
 - intuitions (about the users, their tasks, ...) may be wrong
 - interviews etc. may not be precise
 - designer cannot know the user sufficiently well to answer all issues that come up during the design
- solution:
 - designers should have access to representative users
 - these should be ***END users***, not their managers etc.



Participatory Design

- users are 1st class members in the design process
→ active collaborators vs. passive participants
- users are considered subject matter experts
→ know all about the work context
→ but: users should not be required to design
- iterative process
→ all design stages are subject to revision

Participatory Design

- up side
 - users excellent at reacting to suggested system designs
 - designs must be concrete and visible
 - users bring in important “folk” knowledge of work context
 - knowledge may otherwise be inaccessible to design team
 - greater buy-in for the system often results
- down side
 - hard to get a good pool of end users
 - expensive, reluctance, etc.
 - users are not expert designers
 - don’t expect them to come up with design ideas from scratch
 - the user is not always right
 - don’t expect them to know what they want

Methods for Involving the User

- at the very least, talk to users
it is surprising how many designers don't ...
- contextual interviews & on-site visits
 - interview users in their workplace,
as they are doing their job
 - discover the user's culture,
requirements, expectations, ...



Methods for Involving the User

- explain your designs
 - describe what you are going to do
 - get input at all design stages
 - all designs are subject to revision by users

- have visuals and/or demos
 - people react far differently compared to verbal explanations
 - thus, prototypes are critical
 - type of prototype matters:
sketchy for early design phases
later more pronounced/developed/precise



Sketching and Prototyping

1. sketches

- initial ideas, very fast, very low cost, no interactivity, many different variants can be explored

2. low fidelity prototypes

- fewer variants explored further, still fast and low cost, some interactivity can be simulated

3. medium fidelity prototypes

- more functionality is simulated to test refined concepts

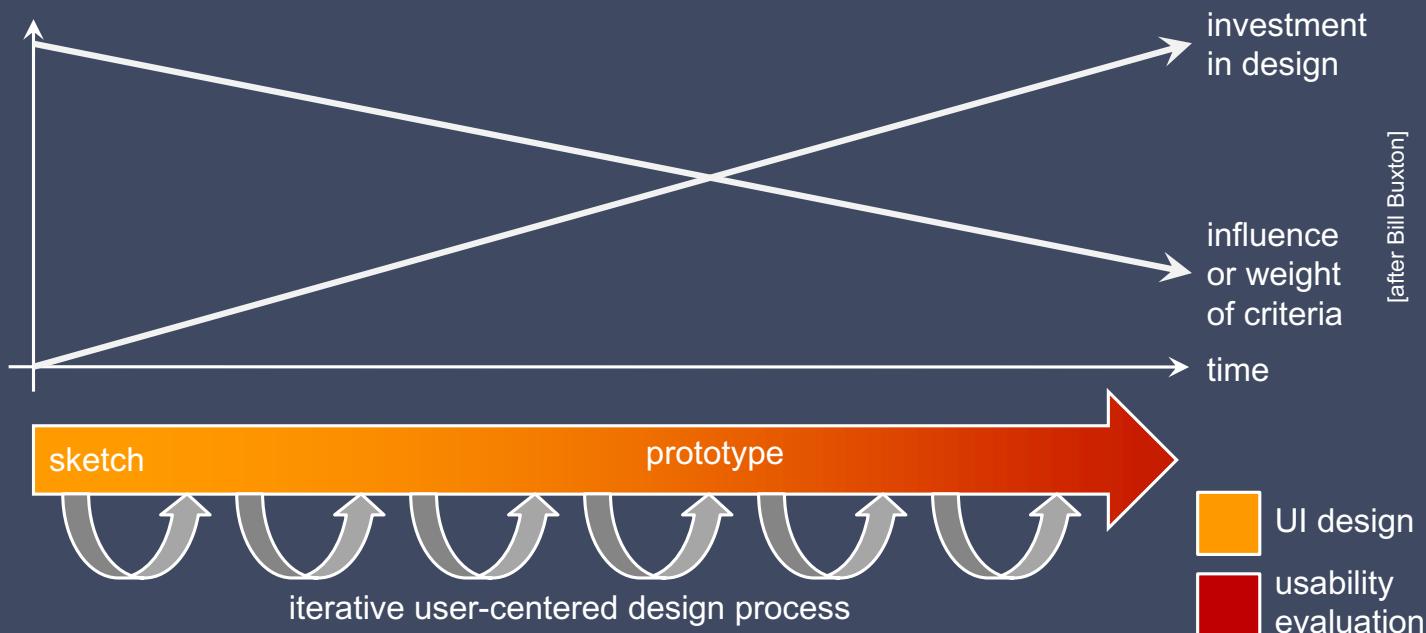
4. high fidelity prototypes

- field testing of the refined designs, more expensive

5. final design

Sketching and Prototyping

- from design to evaluation
 - interface design (idea generation) progresses to usability testing (idea debugging and refinement)



Sketching and Prototyping

early design

brainstorm different representations
choose a representation
rough out interface style

task-centered walkthrough and redesign

fine-tune interface, screen design
heuristic evaluation and redesign
usability testing and redesign

limited field testing

alpha/beta test

multitude of sketches

sketch variations and details

sketch *or* low fidelity prototypes
medium-fidelity prototypes

high-fidelity prototypes

alpha-beta tests
↓ working systems
late design

Sketches & Low-Fidelity Prototypes

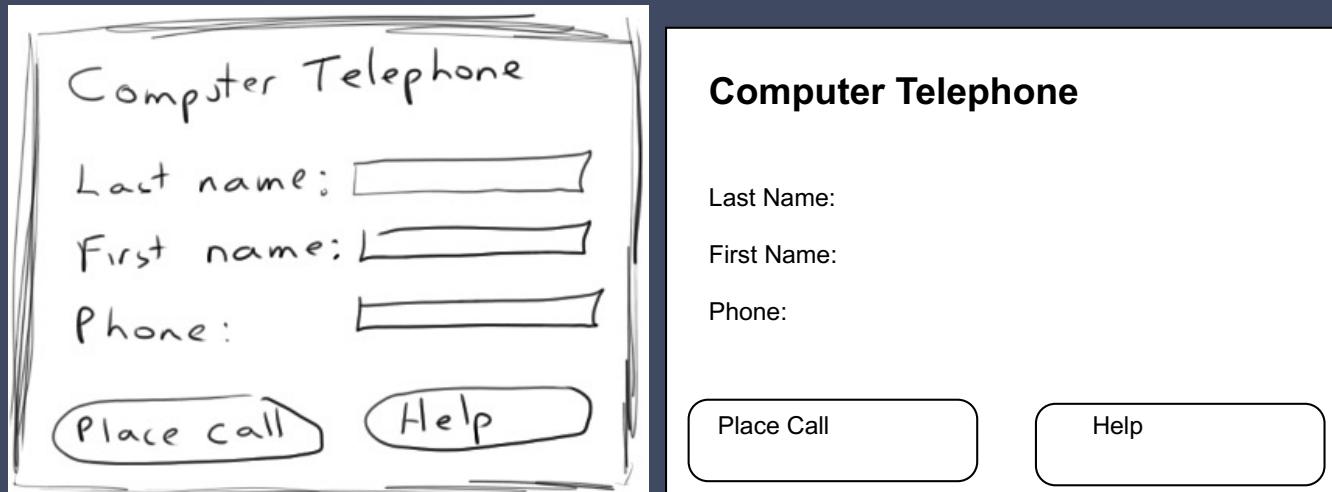
- paper mock-up of the interface's functionality, look, and feel → quick & cheap to prepare and modify
 - drawing of the outward appearance of intended system
 - crudity means people concentrate on high-level concepts
 - harder to envision a dialog's progression
- purpose
 - brainstorm competing representations
 - elicit user reactions
 - elicit user modifications/suggestions

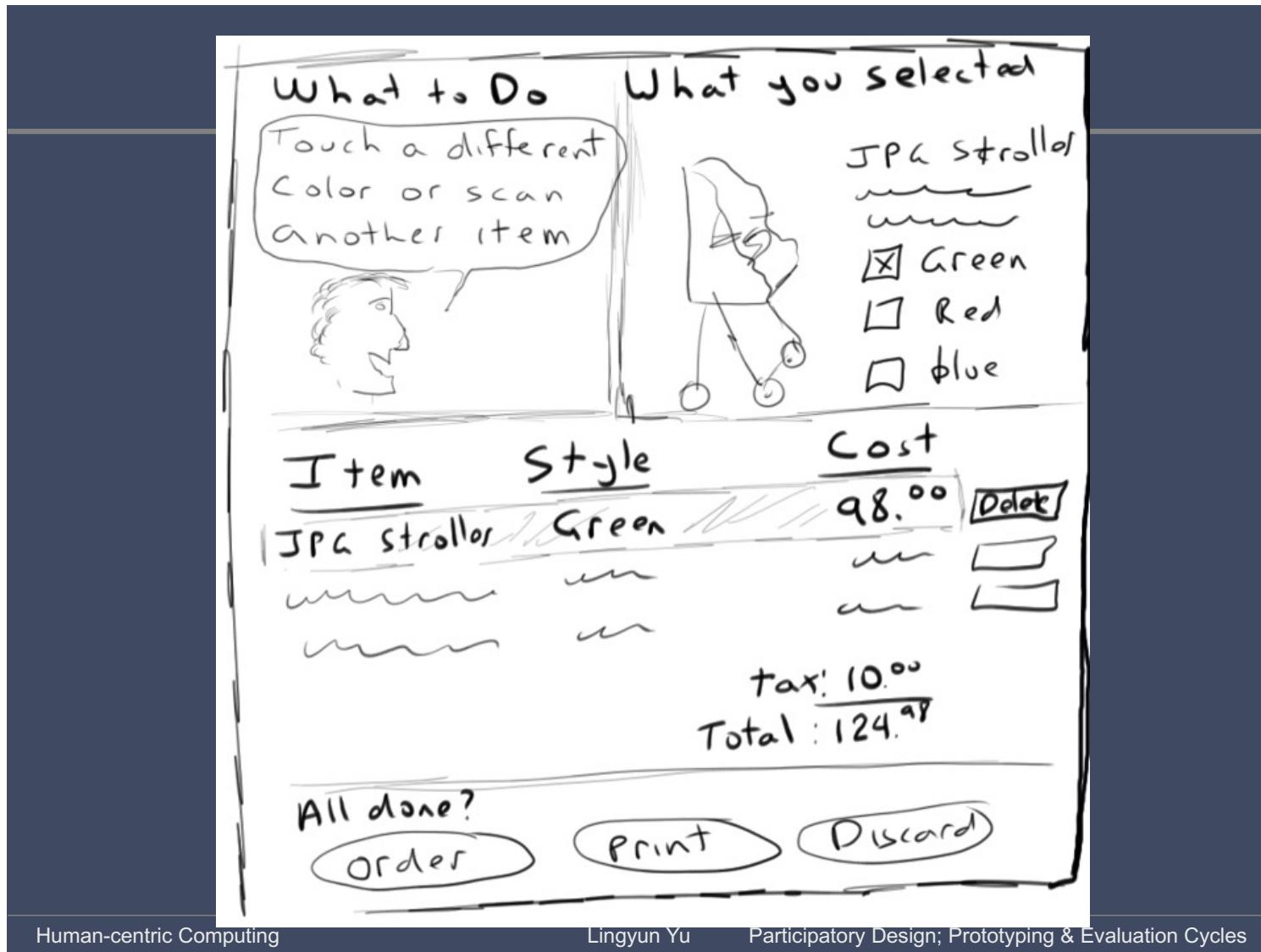


SKETCHING IS ABOUT DESIGN

Sketches

- drawing of the outward appearance of the intended system
- crudity means people concentrate on high level concepts
- Deliberately **ambiguous** & abstract, leaving “holes” for imagination
- but hard to envision a dialog’s progression





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)

<u>Item</u>	<u>Style</u>	<u>Cost</u>
JPG Stroller	Green	98.00

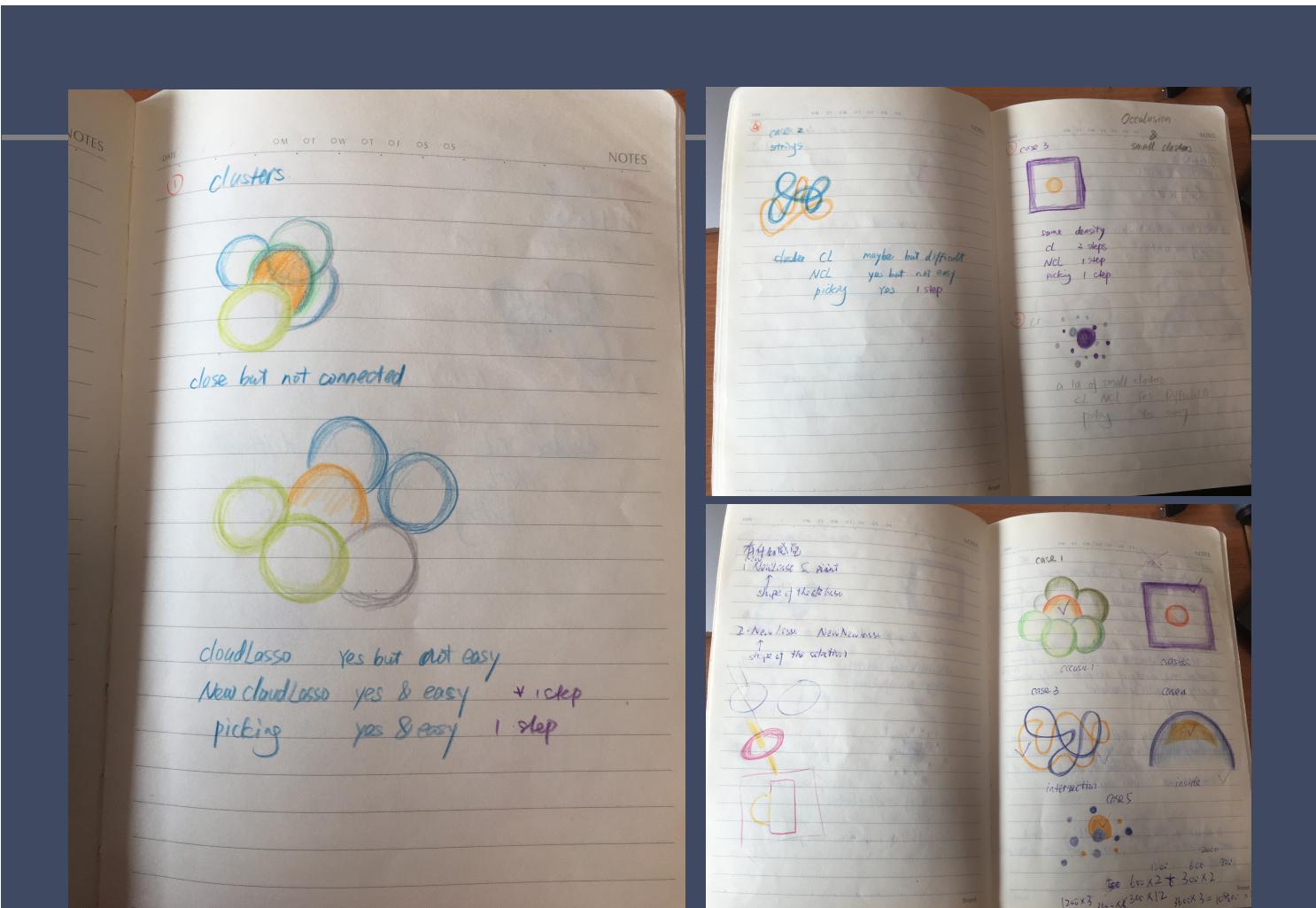
tax: 6.98

Total: \$104.98

All done?

[Place your order](#) [Print this list](#) [Throw this list away](#)

Human-centric Computing Lingyun Yu Participatory Design; Prototyping & Evaluation Cycles



Sketching is about design

- Sketching is not about drawing; it is about design.
- Sketching is a tool to help you:
 - express
 - develop, and
 - communicate design ideas
- Sketching is part of a process:
 - idea generation
 - design elaboration
 - design choices
 - engineering

Why Sketch?

- **Create**

- early ideation
- think openly about ideas
- think through ideas
- force you to visualize how things come together
- brainstorming: generate abundant ideas without worrying about quality
- invent and explore concepts

- **Record**

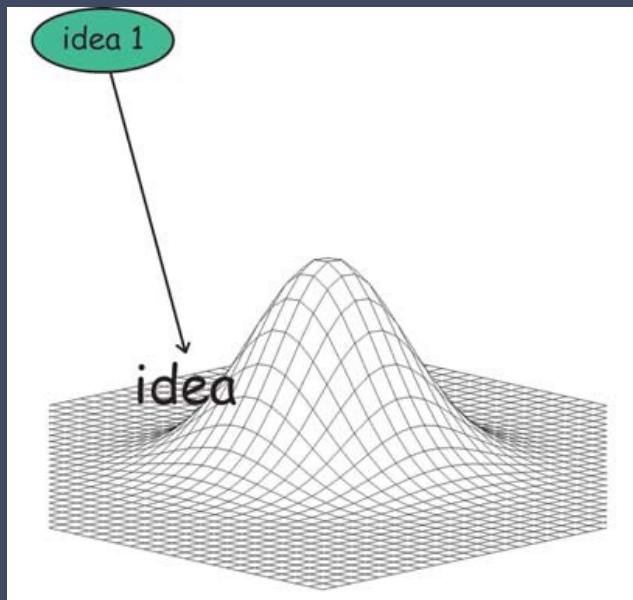
- ideas you develop
- ideas that you come across
- archive ideas for later reflection

- **Reflect, share, critique, decide**

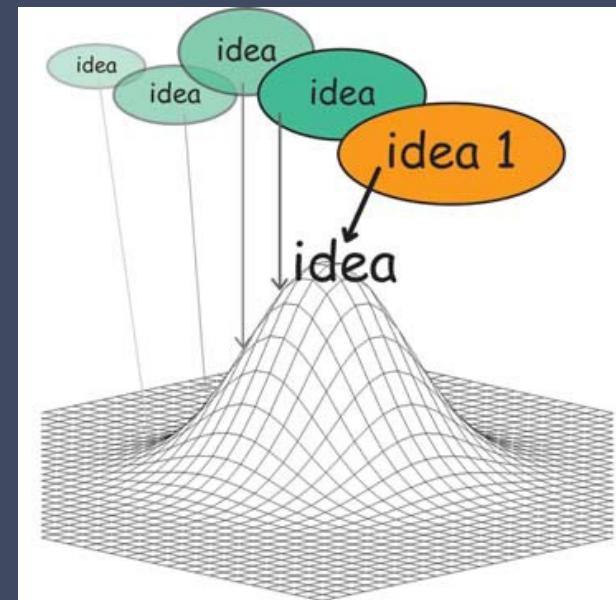
- communicate ideas to others
- invite responses, criticisms, and alternatives;
- choose ideas worth pursuing

Getting the Design Right

- Generate an idea



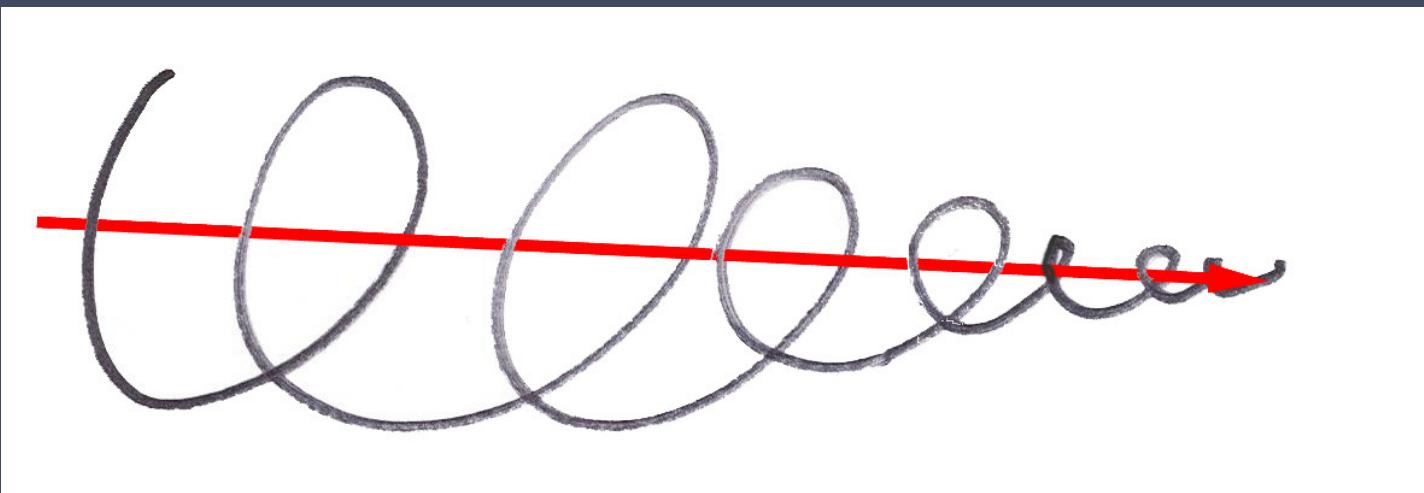
- Iterate and develop it



But is it the best idea?

Exploring an idea

Getting the Design Right

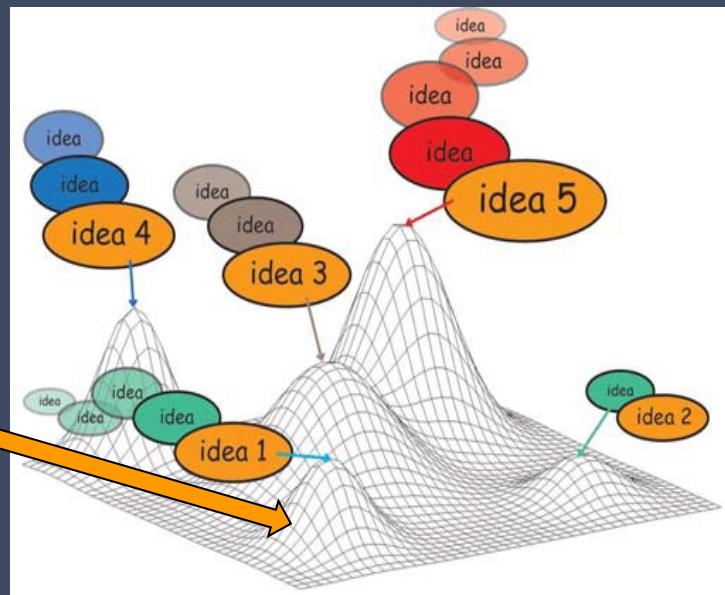
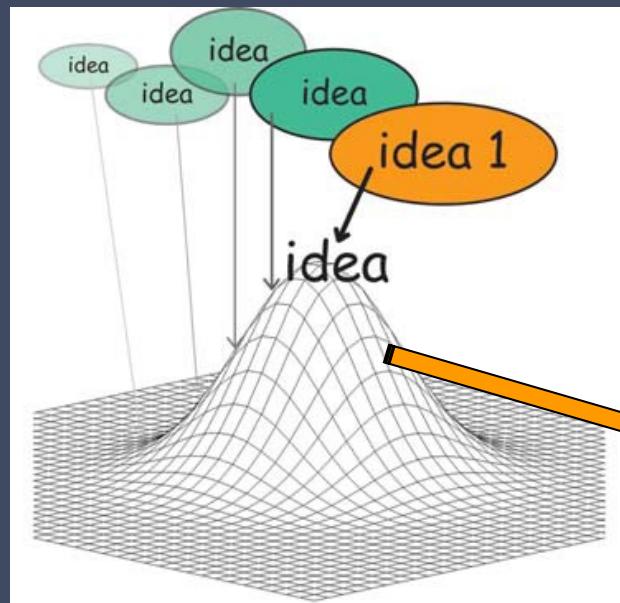


Getting the Design Right

The Problem

fixates on first idea
local hill climbing issue

- did you reach local vs. global maxima?

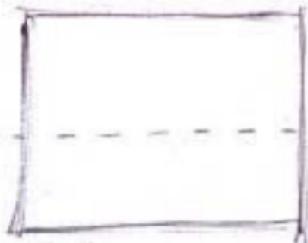
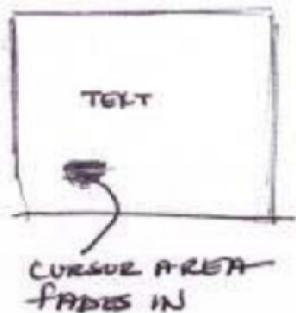


Sketch Attributes

- quick
 - to make
- timely
 - provided when needed
- disposable
 - investment in concept, not in execution
- plentiful
 - allow to create a series or collection of ideas
- clear vocabulary
 - rendering and style indicate that it's a sketch, and not an implementation
- constrained resolution
 - doesn't inhibit concept exploration
- consistency with state
 - refinement of rendering matches the actual state of development of the concept
- suggest & explore rather than confirm
 - value lies in suggesting & provoking what could be; i.e., they are the catalyst to conversation and interaction

Sketches include annotations

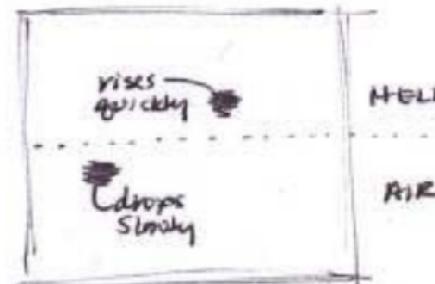
Revisiting the helium project



CAN THE
SPLIT BE
TOP AND
BOTTOM?

OK

If the cursor moves
above the line or
"up" it (the cursor)
changes to helium.
If it moves down
it changes to air.
Speed is matched.



Single image used.
Black rectangle appears
when entering the
opposite area? Or
blurred cursor circle
just behaves differently
in one versus the other.

Myers et al. (2008). How Designers Design and Program Interactive Behaviors. VL/HCC 2008.

- Annotations explain what is going on in each part of sketch & how



- Sketches suggest
 - If you want to get the most out of a sketch...
 - ...you need to leave big enough holes for the imagination to fit in

Storyboarding

- series of key frames as sketches
 - originally from film; used to get the idea of a scene
 - would be talked through
- in interaction (HCI) design:
 - a series of (usually) hand-drawn sketches of the interface
 - snapshots of the interface at particular points in the interaction
 - (can/should) contain annotations of what happens

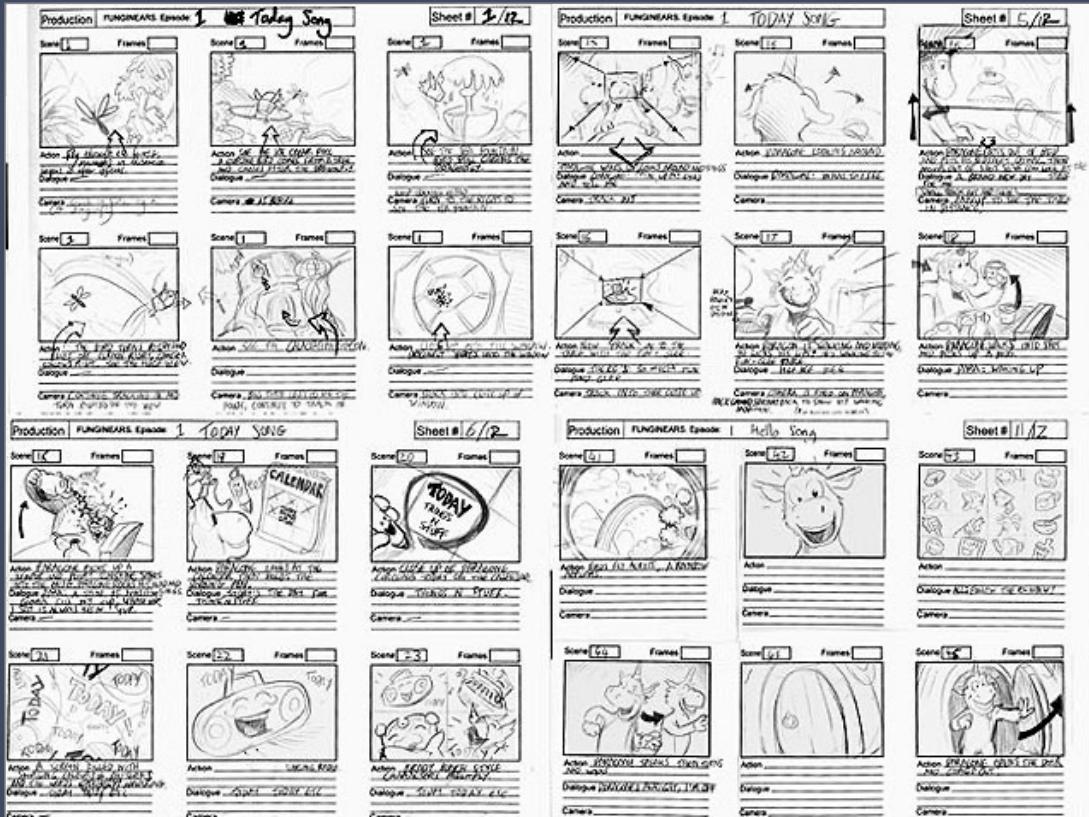


© Warner Brothers Television

Storyboarding

- Purpose of storyboards in HCI
 - to pitch ideas for a user interface to developers or possible users
 - users can evaluate quickly the direction in which the interface is heading
 - they can serve as a reference for the development

Storyboarding



© Sun and Moon Studios 2008

note how each scene in this storyboard is heavily annotated

Interface Storyboards: Stroller Example

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?
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	Blue	98.00

tax: 6.98
Total: \$104.98

All done?
Place your order Print this list Throw this list away

change
the color

scan the
barcode
of 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?
Place your order Print this list Throw this list away

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?
Place your order Print this list Throw this list away

place the
order

Interface Storyboards: Stroller Example

alternate path

What to do		
Touch a different color, or scan another item.		
		JPG Stroller For children between 1-3 years old ...\$98. <input type="checkbox"/> Green <input checked="" type="checkbox"/> Blue <input type="checkbox"/> Red (out of stock)
Item	Style	Cost
JPG Stroller	Blue	98.00 <input type="button" value="Delete"/>
 tax: 6.98		
Total: \$104.98		
 All done?		
<input type="button" value="Place your order"/>	<input type="button" value="Print this list"/>	<input type="button" value="Throw this list away"/>

What to do		
Touch a different size, or scan another item.		
		JPG Stroller For children between 1-3 years old ...\$98 <input type="checkbox"/> Green <input checked="" type="checkbox"/> Blue <input type="checkbox"/> Red (out of stock)
Item	Style	Cost
JPG Stroller	Blue	98.00 <input type="button" value="Delete"/>
 tax: 6.98		
Total: \$104.98		
 All done?		
<input type="button" value="Place your order"/>	<input type="button" value="Print this list"/>	<input type="button" value="Throw this list away"/>

touch previous item

scan the shirt

What to do		
Touch a different size, or scan another item.		
		JPG Stroller For children between 1-3 years old ...\$98 <input type="checkbox"/> Green <input checked="" type="checkbox"/> Blue <input type="checkbox"/> Red (out of stock)
Item	Style	Cost
JPG Stroller	Blue	98.00 <input type="button" value="Delete"/>
 tax: 10.08		
Total: \$154.07		
 All done?		
<input type="button" value="Place your order"/>	<input type="button" value="Print this list"/>	<input type="button" value="Throw this list away"/>

What to do		
Touch a different size, or scan another item.		
		JPG Stroller For children between 1-3 years old ...\$98 <input type="checkbox"/> Green <input checked="" type="checkbox"/> Blue <input type="checkbox"/> Red (out of stock)
Item	Style	Cost
JPG Stroller	Blue	98.00 <input type="button" value="Delete"/>
 tax: 10.08		
Total: \$154.07		
 All done?		
<input type="button" value="Place your order"/>	<input type="button" value="Print this list"/>	<input type="button" value="Throw this list away"/>

delete that item

Interface Sketch-Storyboard Videos



Bill Buxton, 2006

LOW / MEDIUM / HIGH FIDELITY PROTOTYPES

Low fidelity prototype

- **Low fidelity** prototype w/ paper mockups
- Goal: **get feedback** from users early w/ very low cost interactive prototype of envisioned interaction design

Low fidelity prototype: Paper Prototypes

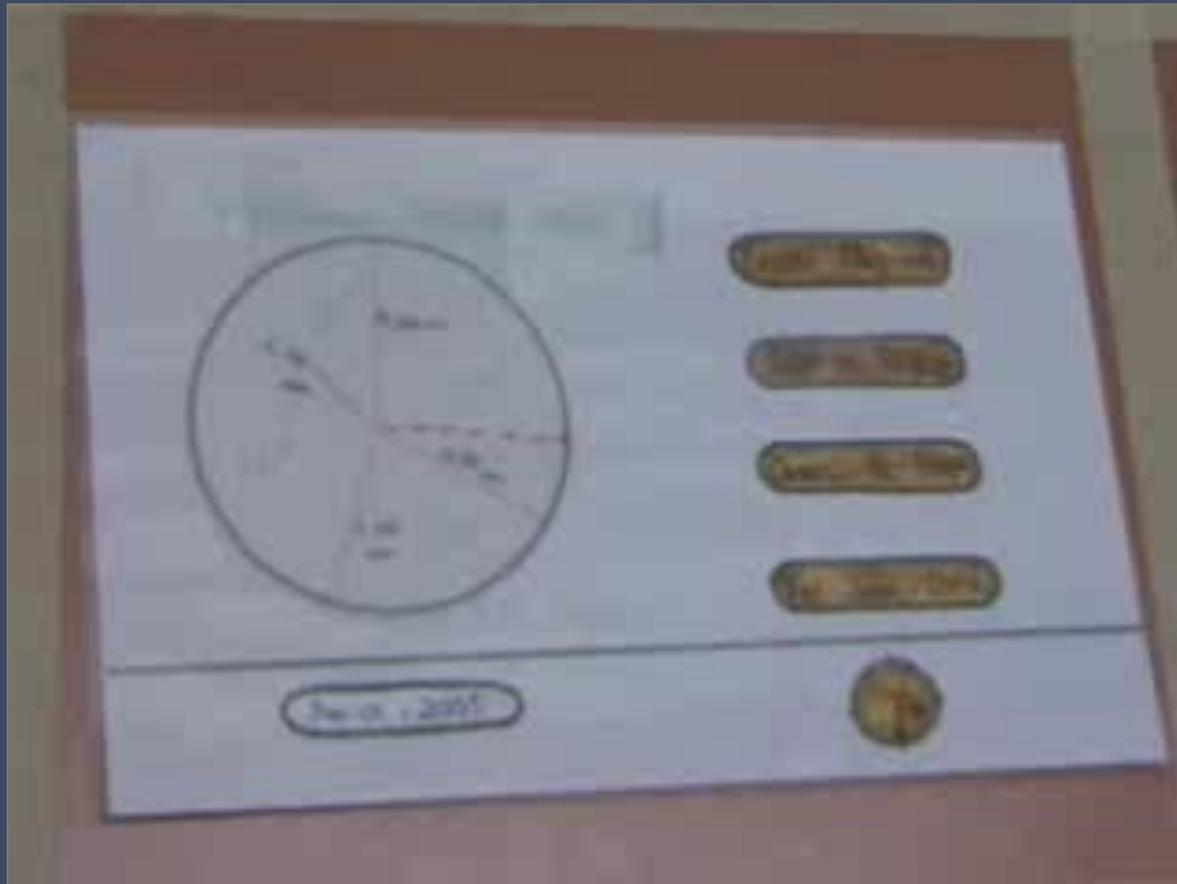
- make storyboard sketches interactive
- use office supplies
 - layers of background sketch, sticky notes, plastic overlays
 - make elements to represent icons, menus, windows, etc.
- interaction demonstrated by manipulating notes: new interfaces built on-the-fly
- sessions videotaped for later analysis:
usually end up with mess of paper and plastic



Paper prototyping

- Set a realistic deadline
- Gather set of paper prototyping materials
- Work **fast**
- Reuse existing sketches & mockups
- Make underlying paper mockups of key screens

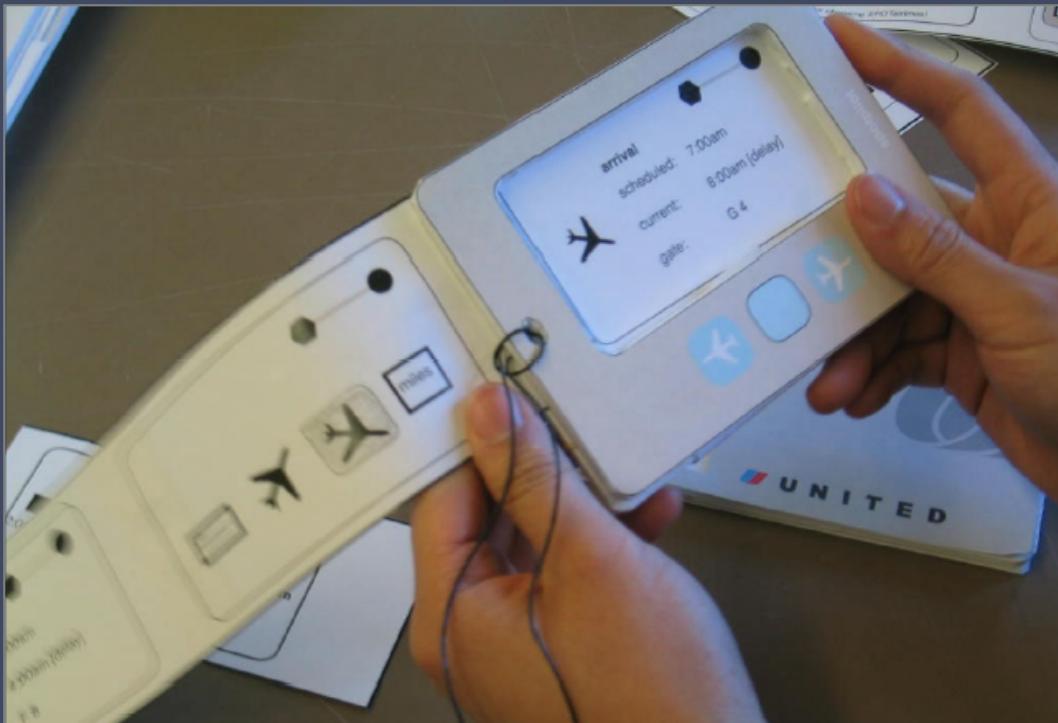
Paper Prototype Example: Climate Control



Bill Buxton, 2006

Paper Prototypes

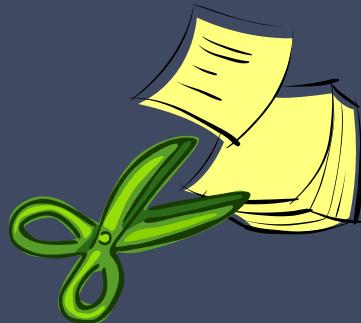
- other example: spotlight – an interactive foam core and paper sketch/storyboard



Sue-Tze Tan,
Dept. Industrial Design,
University of Washington

Low-Fidelity Prototypes: Advantages

- takes between only minutes to just a few hours
- does not require “real implementation”
- no expensive equipment needed
- can test multiple alternatives, fast iterations
- almost all interaction can be faked

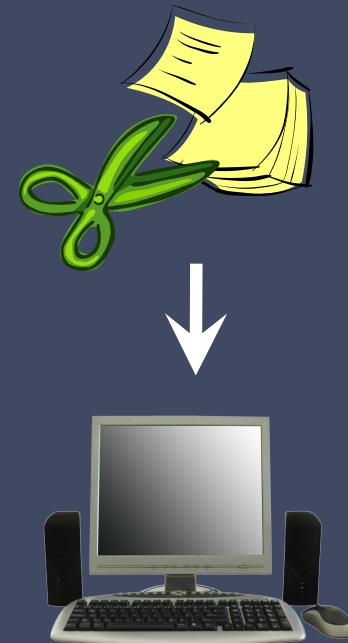


Low-Fidelity Prototypes: Problems

- human-simulated “computer” inherently buggy
- slow interaction compared to real application; timings not accurate
- difficult to implement some interaction (e.g., pull-downs, feedback, dragging, visualization, etc.)
- looks different from final product; elements sometimes difficult to recognize
- end-users cannot use it by themselves: not in the context of the user’s work environment

Medium-Fidelity Prototypes

- prototyping with a computer
 - simulate some but not all features of the interface
 - engaging for end users
- purpose
 - provides sophisticated but limited scenario for the end user to try
 - can test more subtle design issues
- dangers
 - users' reactions often “in the small”
 - users reluctant to challenge designers
 - users reluctant to touch the design
 - management may think it is real!

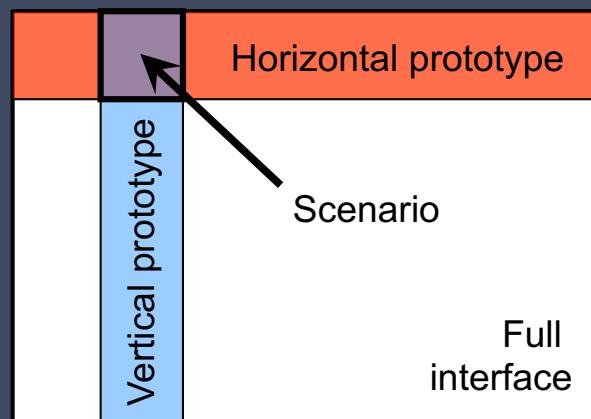


High-Fidelity Prototypes

- prototyping with (still simple) computer programs, (complex) scripted simulations, interface builders, physical interface builders
- Advantages:
 - more the final look-and-feel
 - more functionality
 - can test things in detail, engaging for end users
- Disadvantages
 - more effort
 - less likely to get major changes
 - constrained to selected (programming) tools

Limiting Prototype Functionality

- vertical prototypes
 - include in-depth functionality for a few selected features
 - common design ideas can be tested in-depth
- horizontal prototypes
 - the entire surface interface w/o underlying functionality
 - a simulation; no real work can be performed
- scenario
 - scripts of particular fixed uses of the system



Integrating Prototypes and Final Products

- throw-away
 - prototype only serves to elicit user reaction
 - prototype creation must be rapid, otherwise will be too expensive
- incremental
 - product built as separate components (modules)
 - each component prototyped and tested, then added to the final system
- evolutionary
 - prototype altered to incorporate design changes
 - prototype eventually becomes the final product

Approaches: Scripted Simulations



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

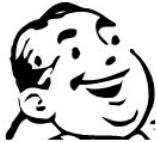
All done?

Place your order Print this list Throw this list away

Approaches: Scripted Simulations



What to do
Touch a different color, or scan another item.



What you selected

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For children between 1-3 years old ...\$98.

Green
 Blue
 Red (out of stock)

<u>Item</u>	<u>Style</u>	<u>Cost</u>
JPG Stroller	Green	98.00 Delete

tax: 6.98

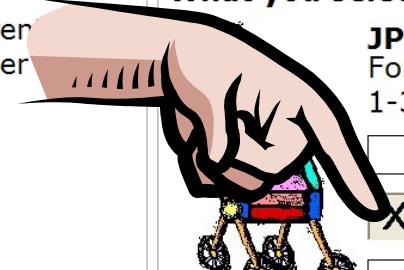
Total: \$104.98

All done?

Place your order Print this list Throw this list away

Approaches: Scripted Simulations

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JPG Stroller
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 Blue
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<u>Item</u>	<u>Style</u>	<u>Cost</u>
JPG Stroller	Blue	98.00

tax: 6.98

Total: \$104.98

All done?

[Place your order](#) [Print this list](#) [Throw this list away](#)

Approaches: Scripted Simulations

What to do

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



<u>Item</u>	<u>Style</u>	<u>Cost</u>
JPG Stroller	Green	98.00

tax: 6.98

Total: \$104.98

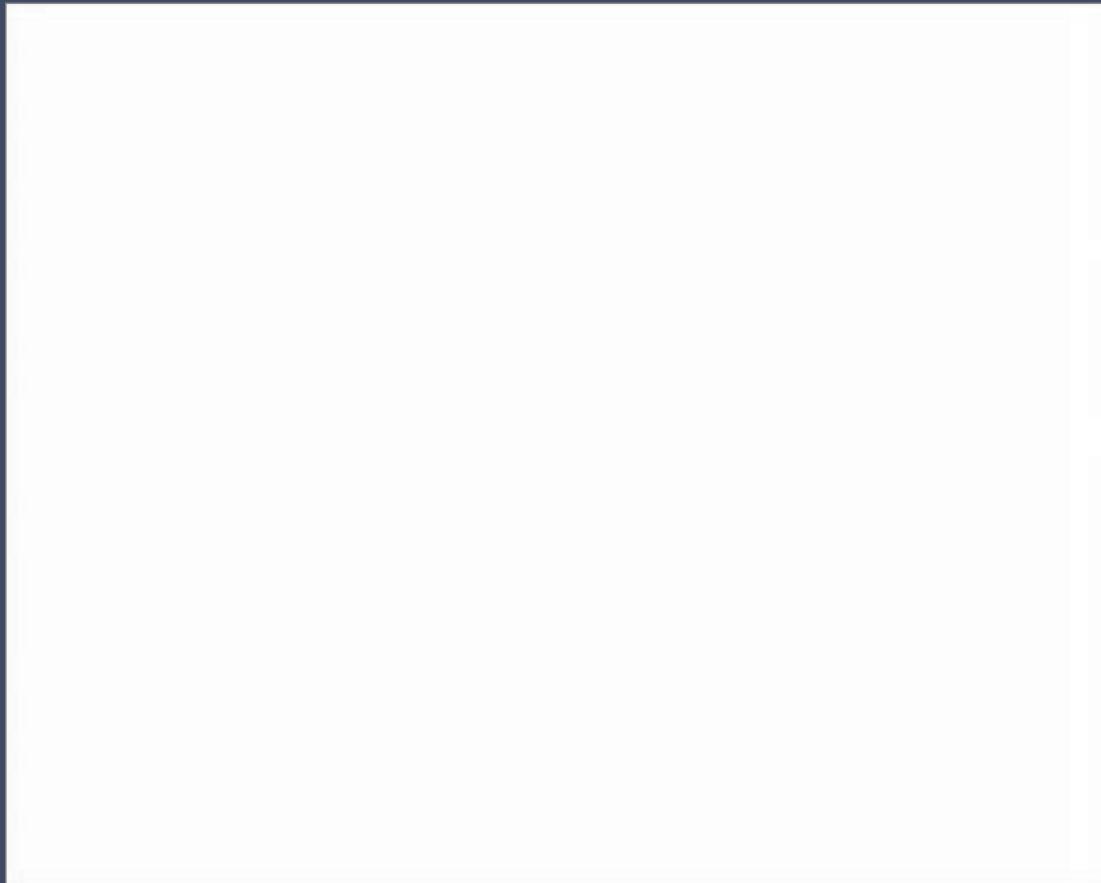
Please sign in
Name? _____

Human-centric Computing

Lingyun Yu

Participatory Design; Prototyping & Evaluation Cycles

Physical Interface Builders: VoodooIO



Villar et al., 2006

Physical Interface Builders: VoodooSketch



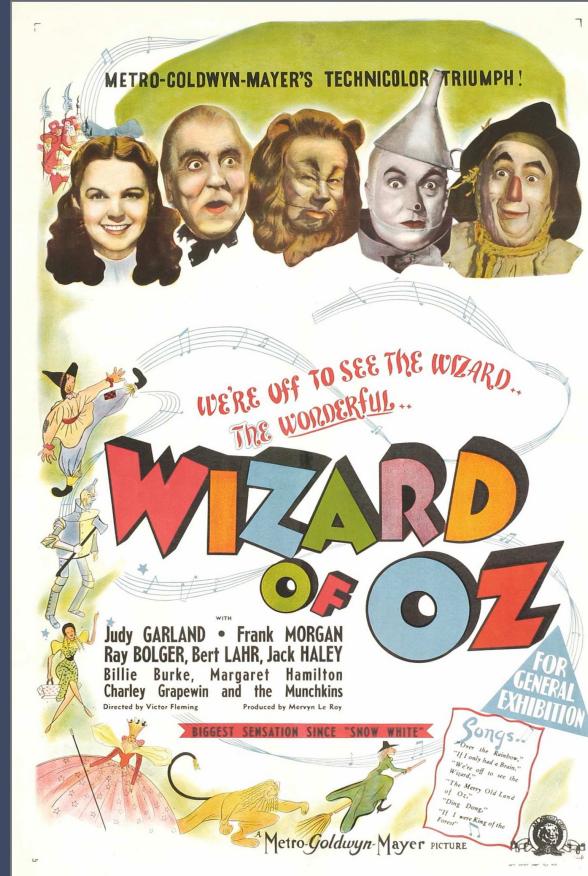
Block et al., 2008

Medium- vs. High-Fidelity Prototypes



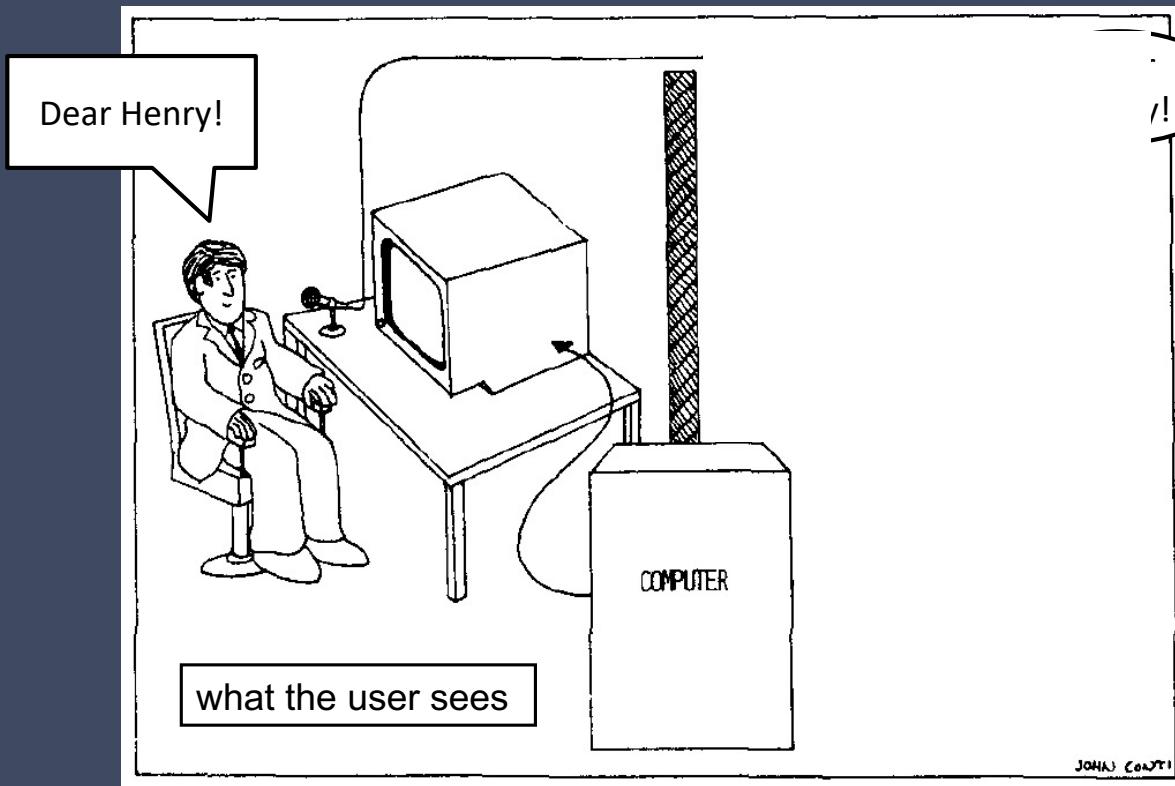
Wizard of Oz Technique

- reference to the story/movie about a fake wizard who pretends to be able to do magic



Wizard of Oz Technique

- method of testing a system that does not exist



Gould, Conti, and Hovanecz.
Composing letters with a simulated listening typewriter.
Communications of the ACM, 26(4). April 1983.

Wizard of Oz Technique

- human “wizard” simulates the system’s 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



IN CLASS ACTIVITY

Human-centric Computing

Lingyun Yu

Participatory Design; Prototyping & Evaluation Cycles

Group activity

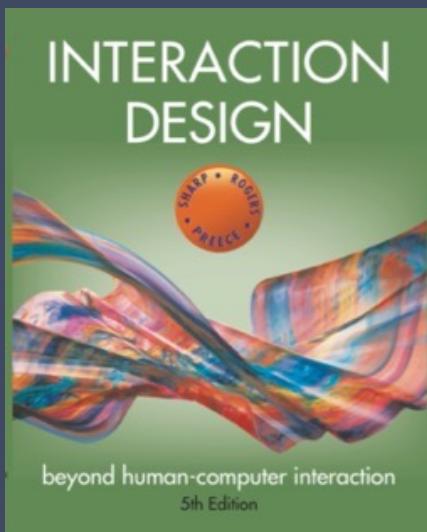
- work with your group
- continue the work from last time
- develop low fidelity prototypes
- do a walk-through evaluation and discuss the prototypes with end users (students from other groups)
- The end users and class identify problems, and we redesign the system on the fly

Summary

- user-centered and participatory design
 - based upon a user's real needs, tasks, and work context
 - bring end-user as a first-class citizen into the design process
- prototyping
 - allows users to react to the design and suggest changes
 - sketching/low-fidelity vs. medium-fidelity prototypes
- prototyping methods
 - vertical, horizontal, and scenario prototyping
 - sketches, storyboarding, paper prototypes
 - scripted simulations, Wizard of Oz

References

- Chapter 11, 12



An Interface Design Process

