# *Introduction to Human-Computer Interaction*

## Designing Interactive Systems

## Lecture 4 –Prototyping

Nadia Boukhelifa
nadia.boukhelifa@inria.fr


with acknowledgements to:
Petra Isenberg, Anthony Tang, Tobias Isenberg, Nic Marquardt,Raimund Dachselt, Saul Greenberg

# *last time you learned*

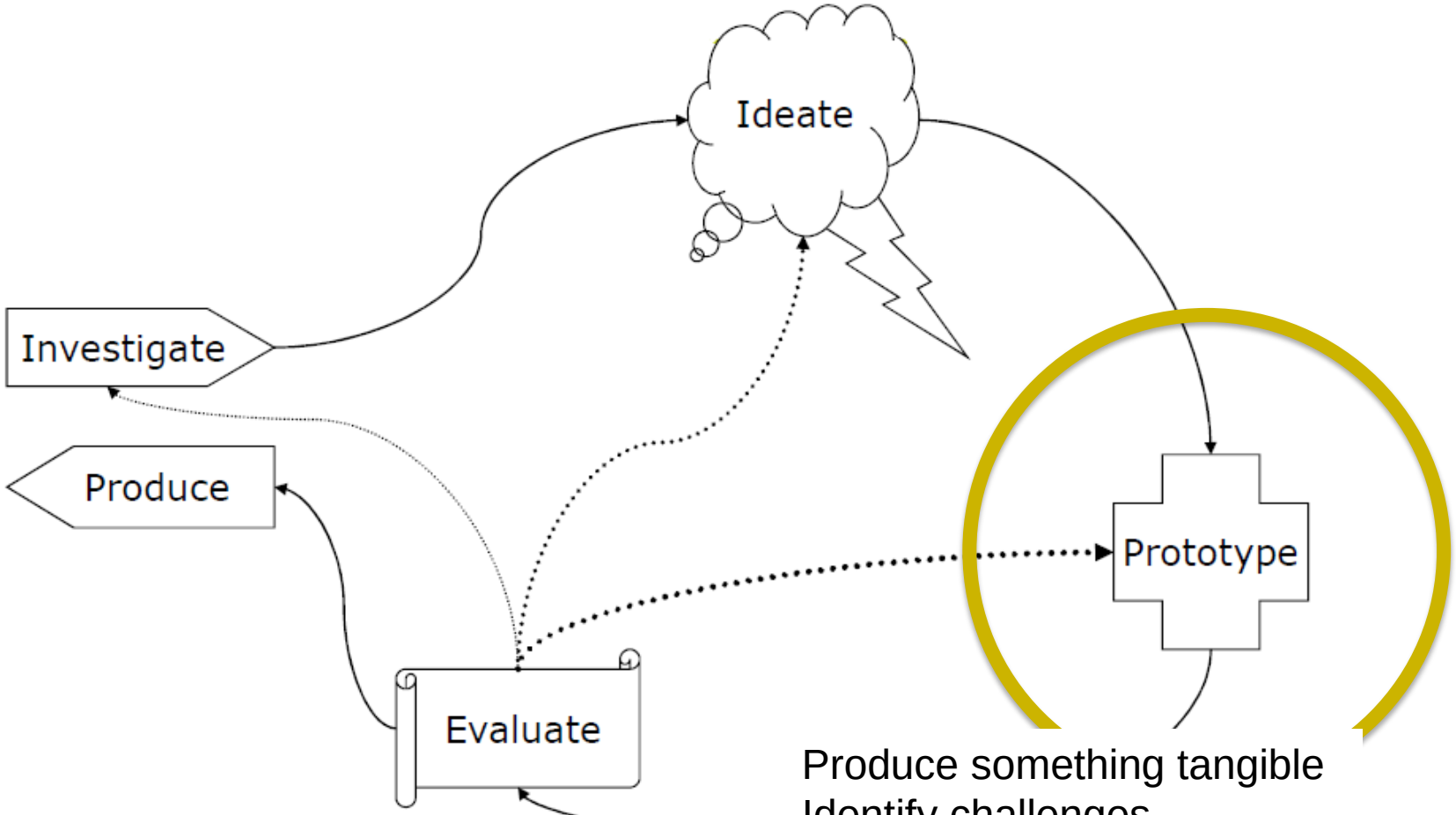
ideation:

- sketching
- storyboards as one type of prototype

# *after today*

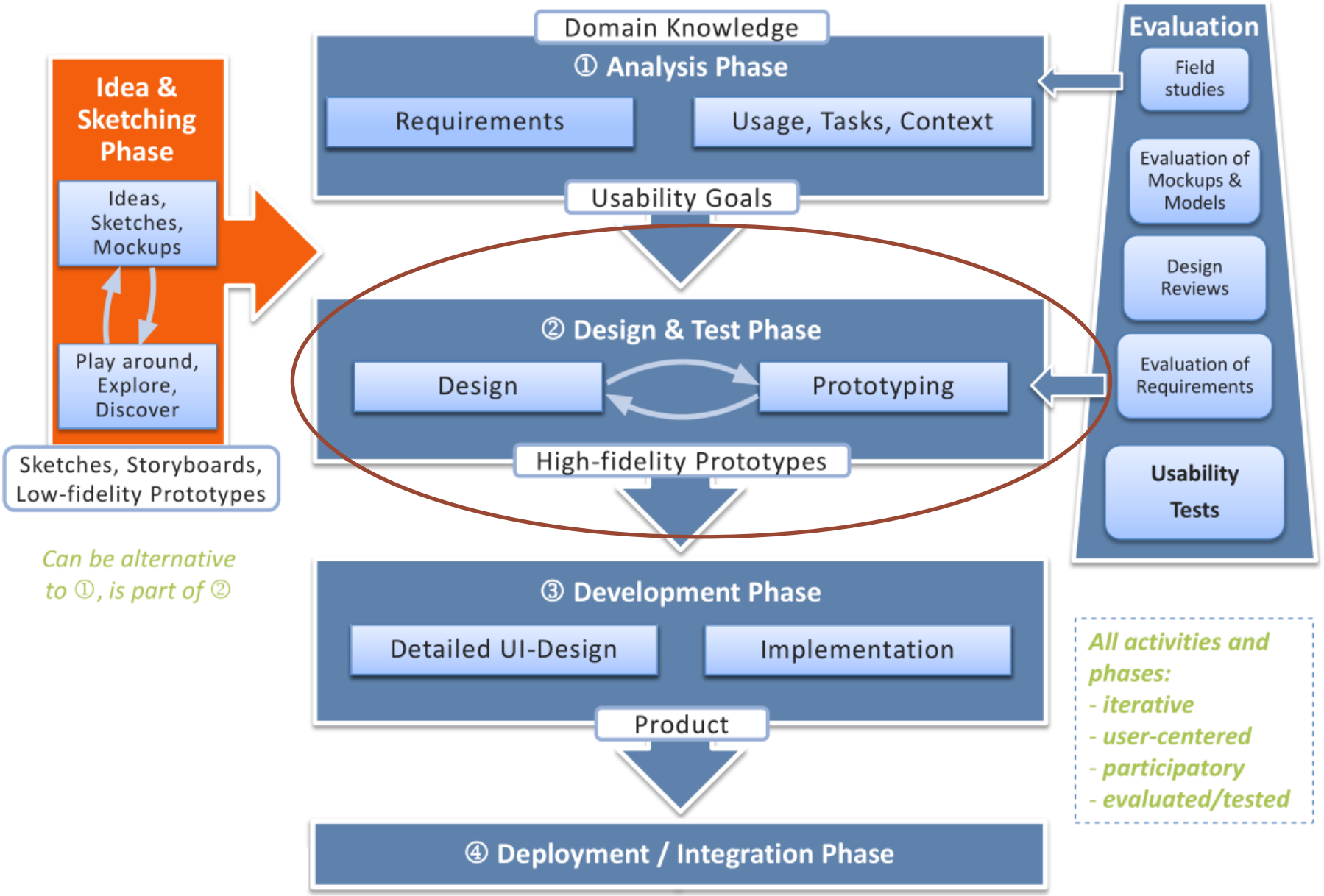
- you will have learned
  - which prototypes are good to design when
  - how to design different types of prototypes
  - what prototype you need to build for your next project component

# *user centered design process*




Produce something tangible
Identify challenges
Uncover subtleties

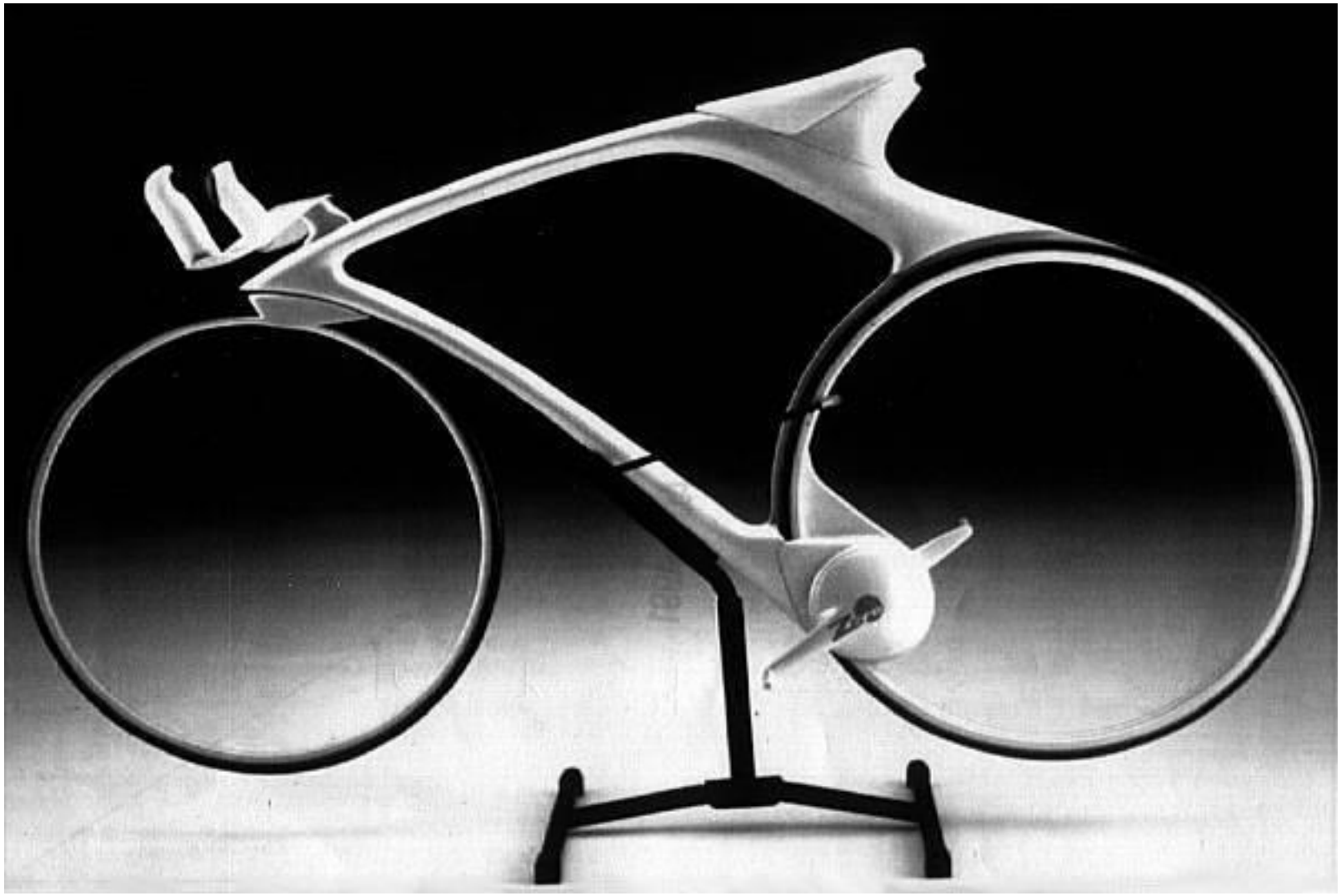
# *a more detailed view*



# *prototyping phase*

- starts once you have an idea about what your interface will accomplish
- will help you to figure out what to implement more specifically
- find out what it will look and feel like to the user

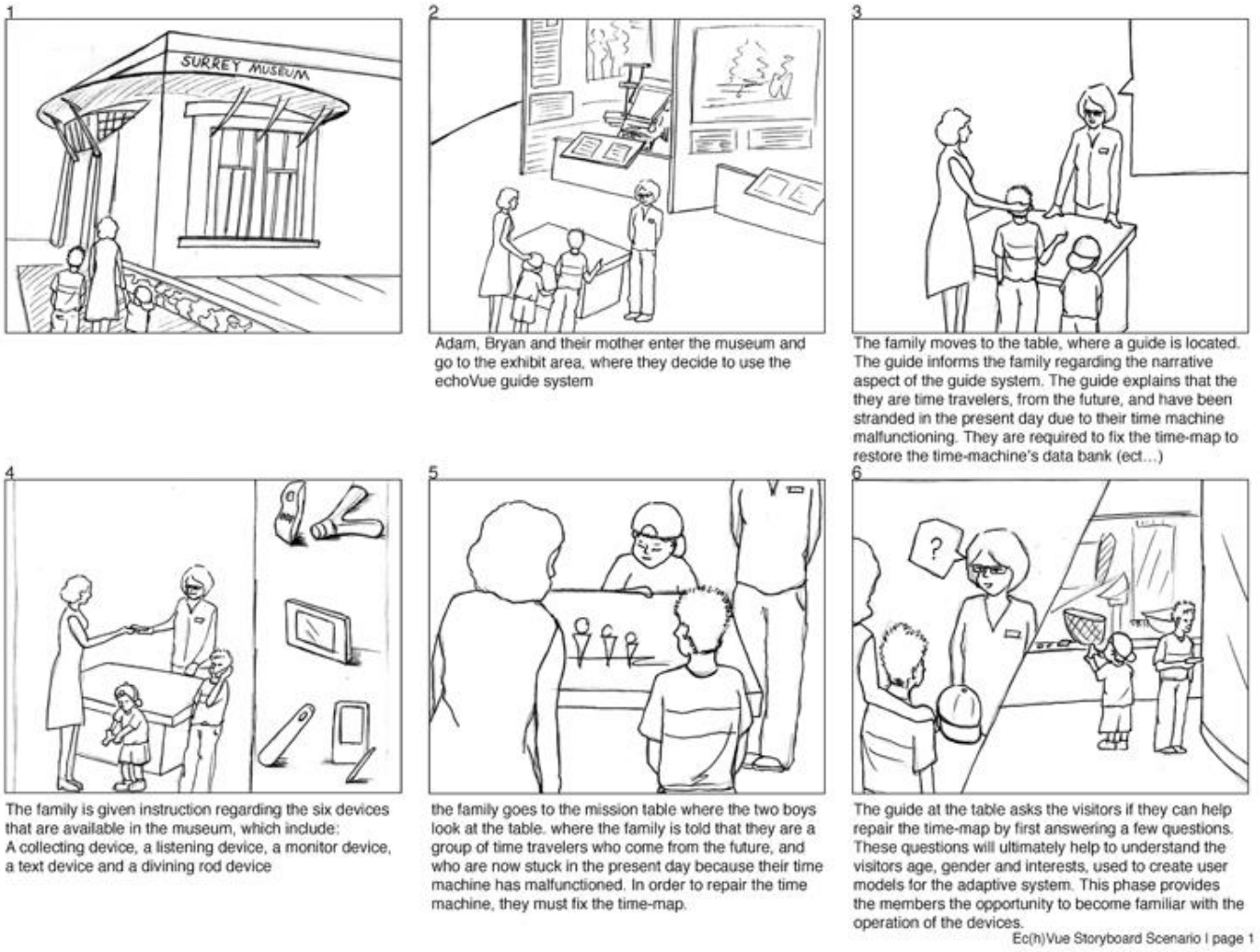
# *what is a prototype?*



# *what is a prototype?*

# *prototype of a prototyping environment*

# *what is a prototype?*



# *what is a prototype?*

- a prototype is defined less by form, and more by its function:
  - a prototype expresses and realizes a design concept for the purpose communication.

# *many different kinds of prototypes*

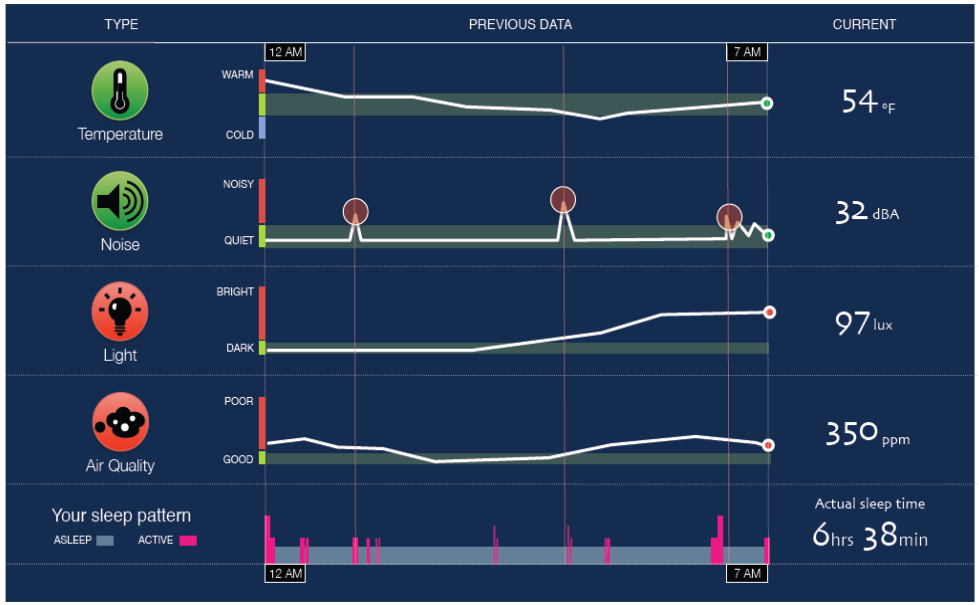
- storyboards » last time
- PowerPoint slideshow
- video prototype
- paper prototype
- physical model
- software with limited functionality » your next project
- …

# *prototype "types": two dimension classification scheme*

- high vs. medium vs. low fidelity
- horizontal vs. vertical
  (generally for software prototypes)

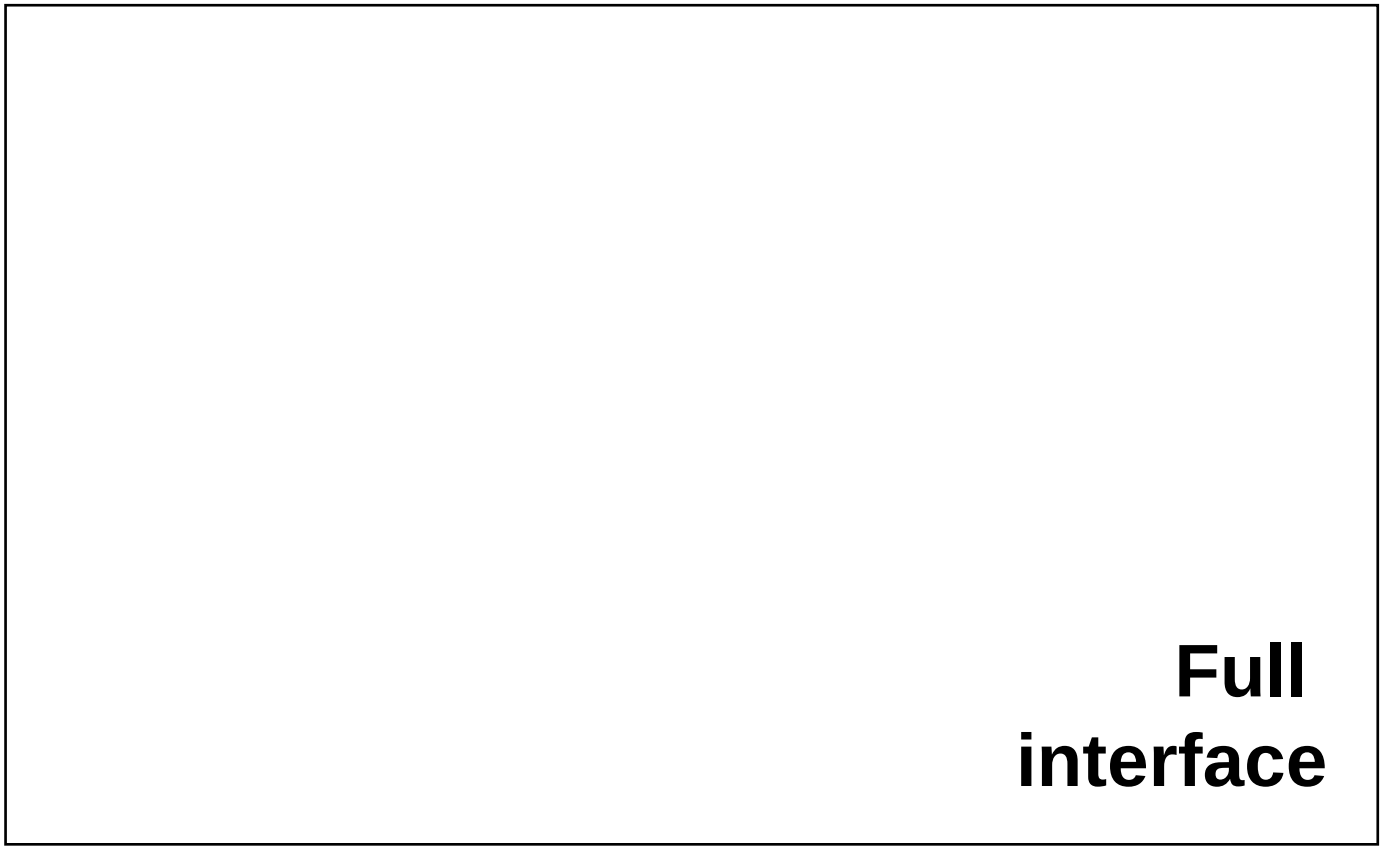
# *high vs. low fidelity*

- distinction: is the choice of medium close or far from that of final design?
  (high = software; low = paper prototype)

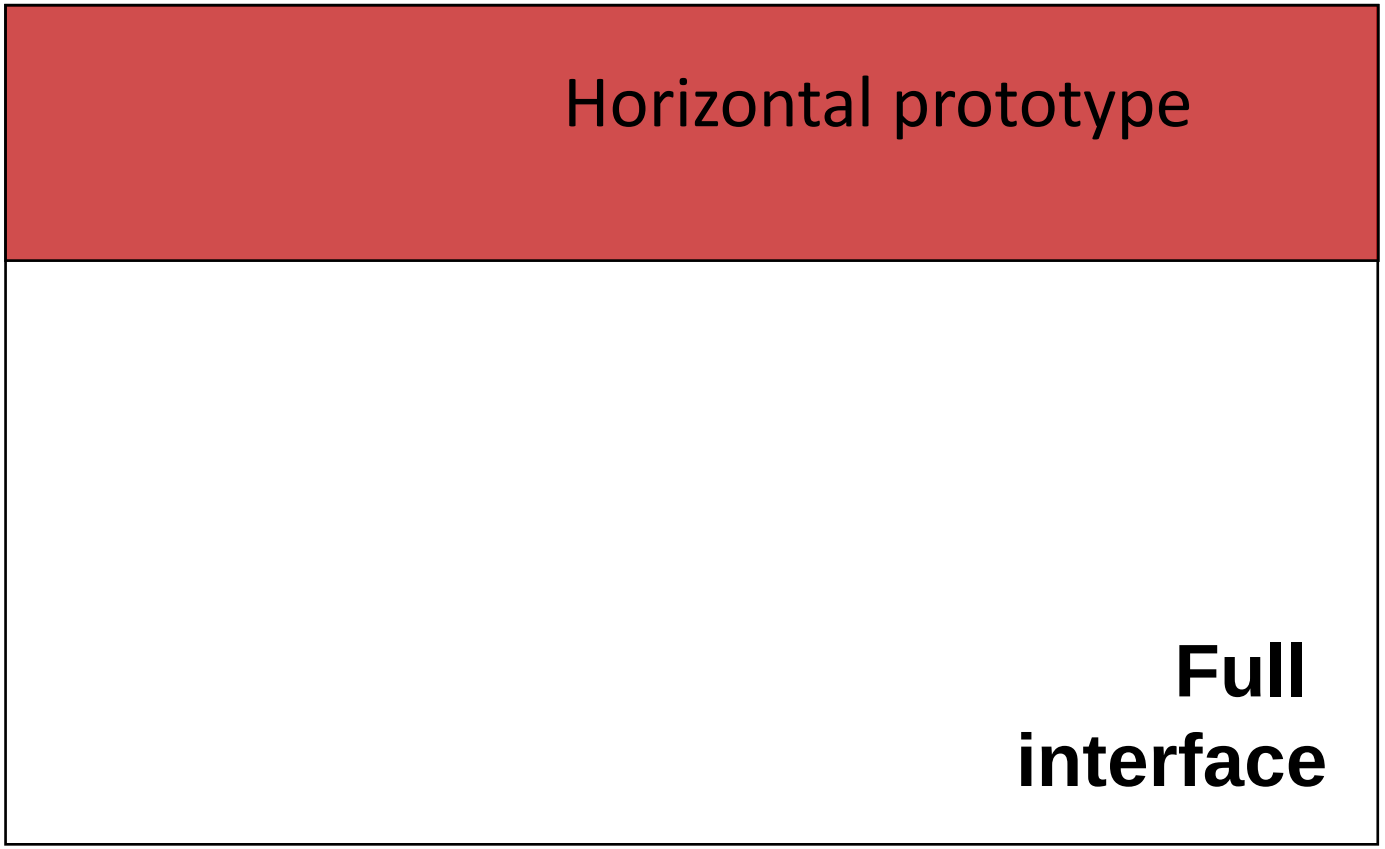



# *horizontal vs. vertical*

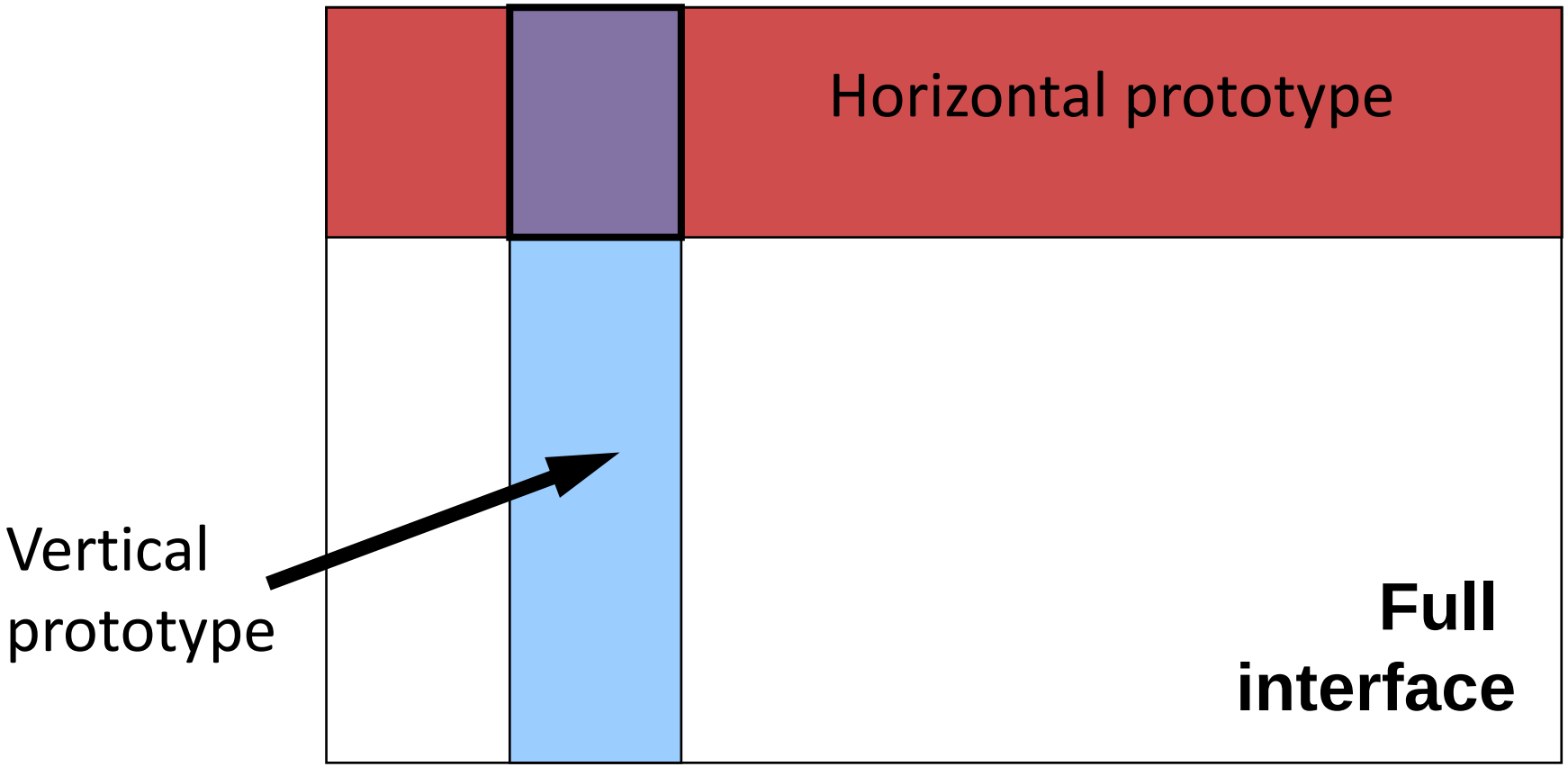
- limiting prototype functionality



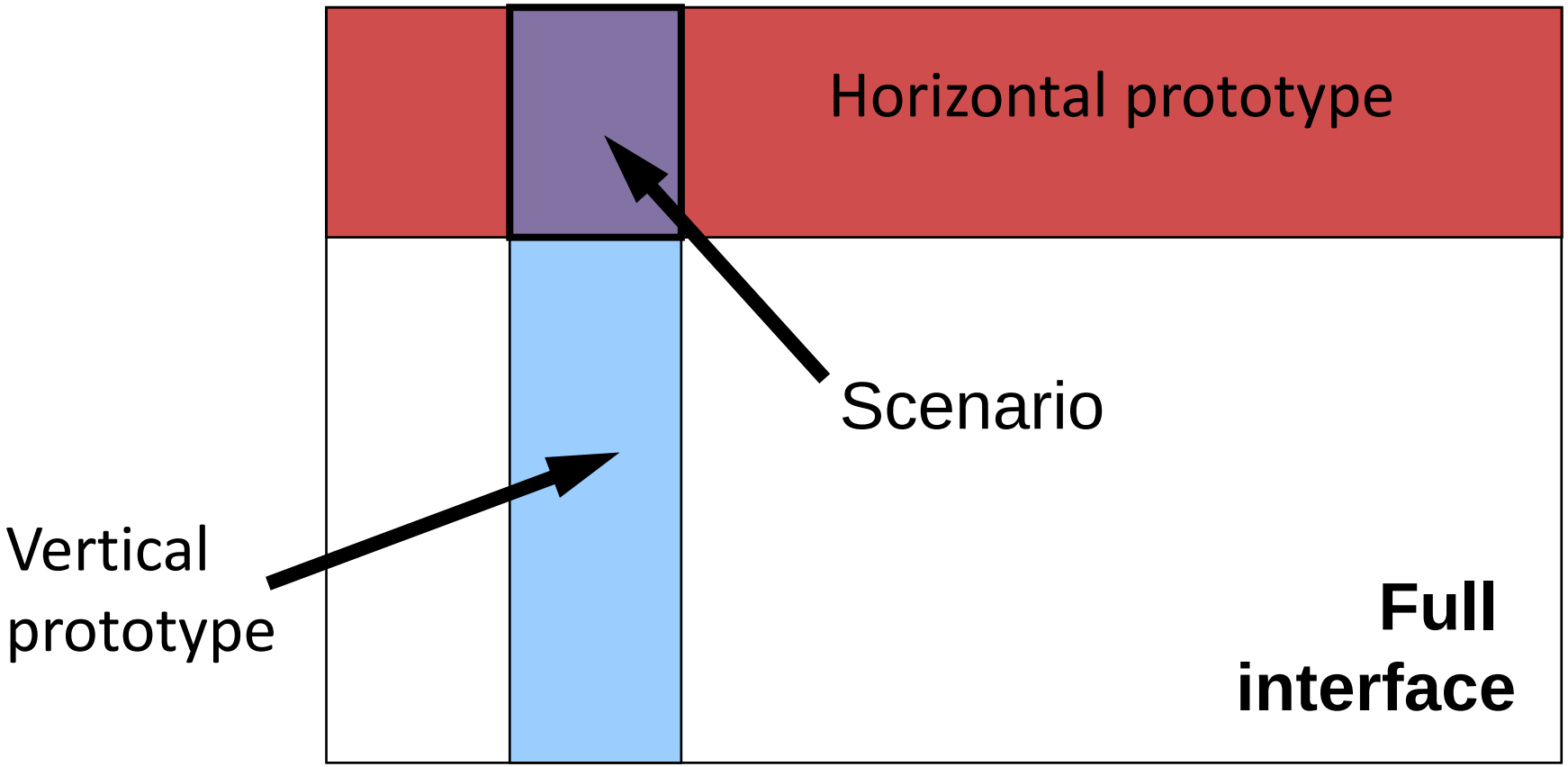
# *horizontal vs. vertical*



# *horizontal vs. vertical*

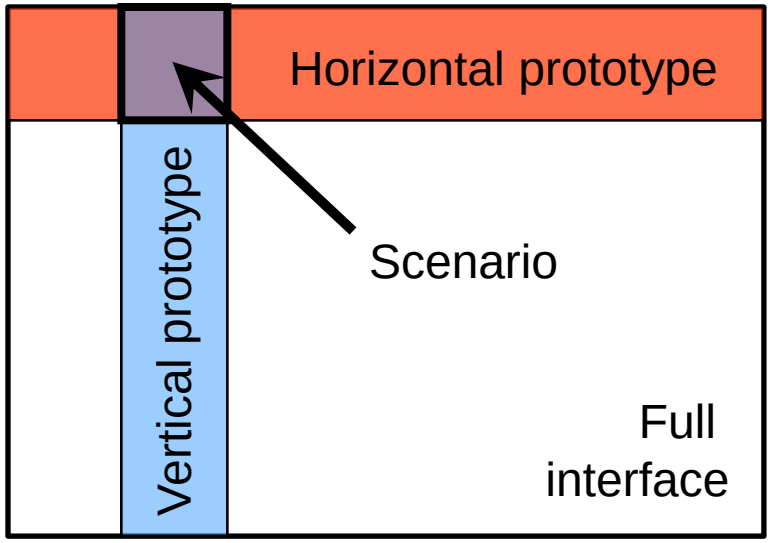


# *horizontal vs. vertical*



# *horizontal vs. vertical*

- 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
  - no deviation allowed



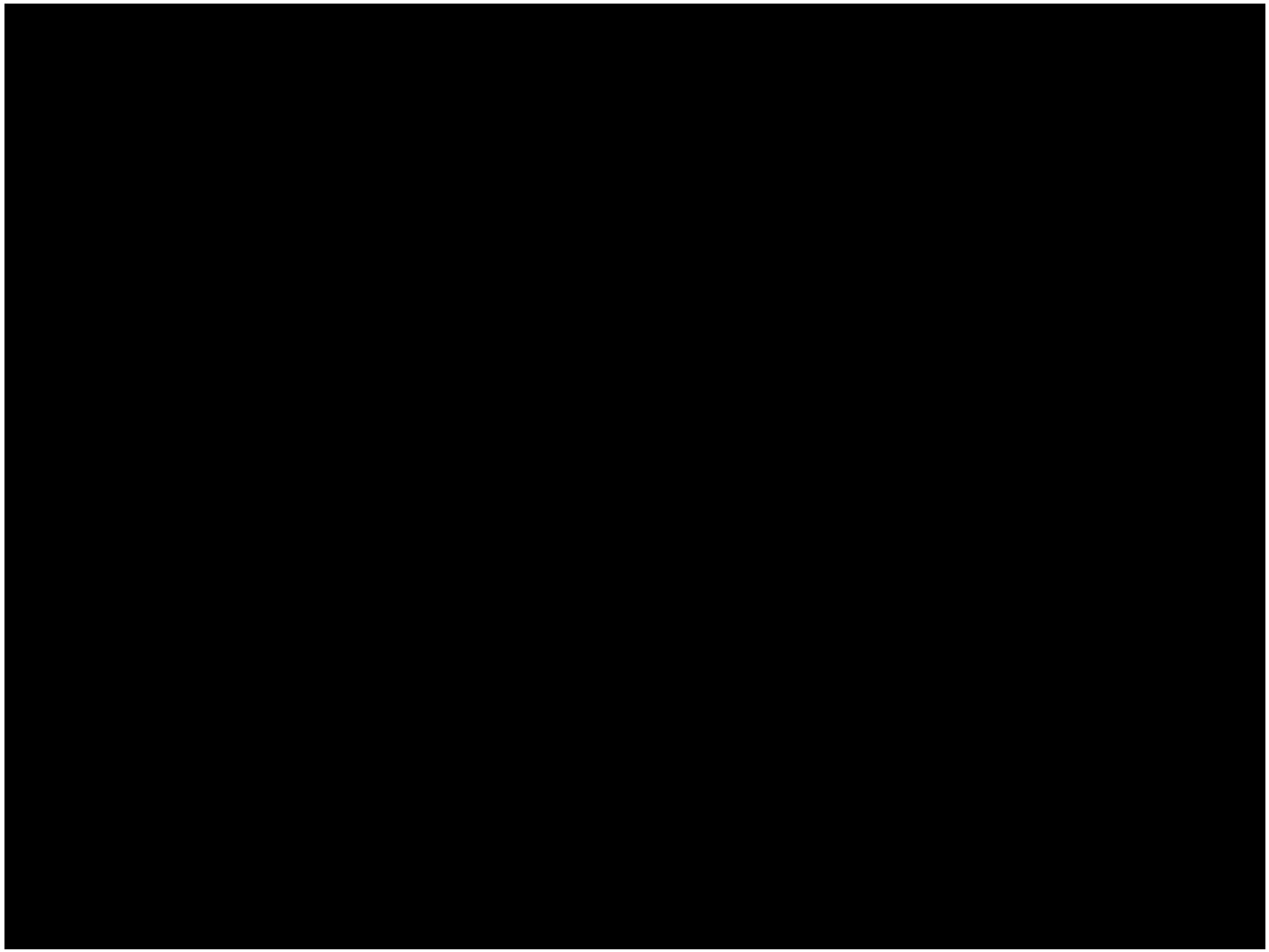
# *some example classifications*

- storyboard
  - low fidelity, vertical
- site/navigation/screen map
  - low fidelity, horizontal
- paper prototype
  - low fidelity
- software where everything reports: "not implemented yet"
  - high fidelity, horizontal
- software where only one feature is implemented
  - high fidelity, vertical

# *PAPER PROTOTYPES*

# *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



http://www.youtube.com/watch?v=zJqiZrnJSuw

# *paper prototypes*

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

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

# *Case study 1: Satoru Iwata (Nintendo)*

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# *case study 2: IDEO's Redesign of the ATM*

# *case study 3: Jeff Hawkins: Palm Pilot*

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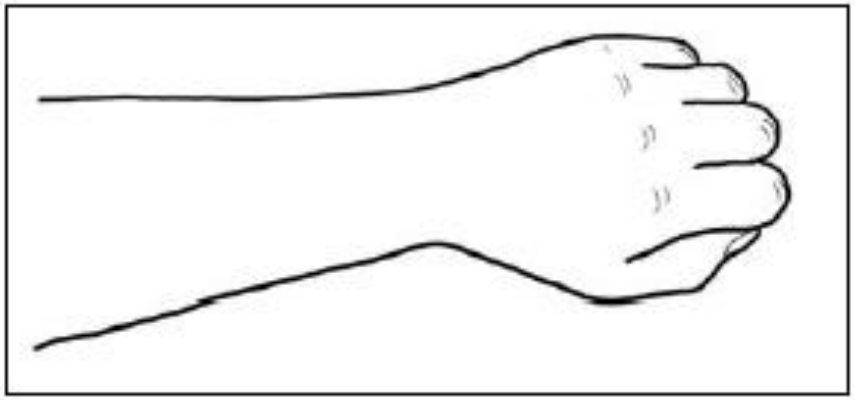
step-by-step

# *CREATE PHYSICAL PROTOTYPES*

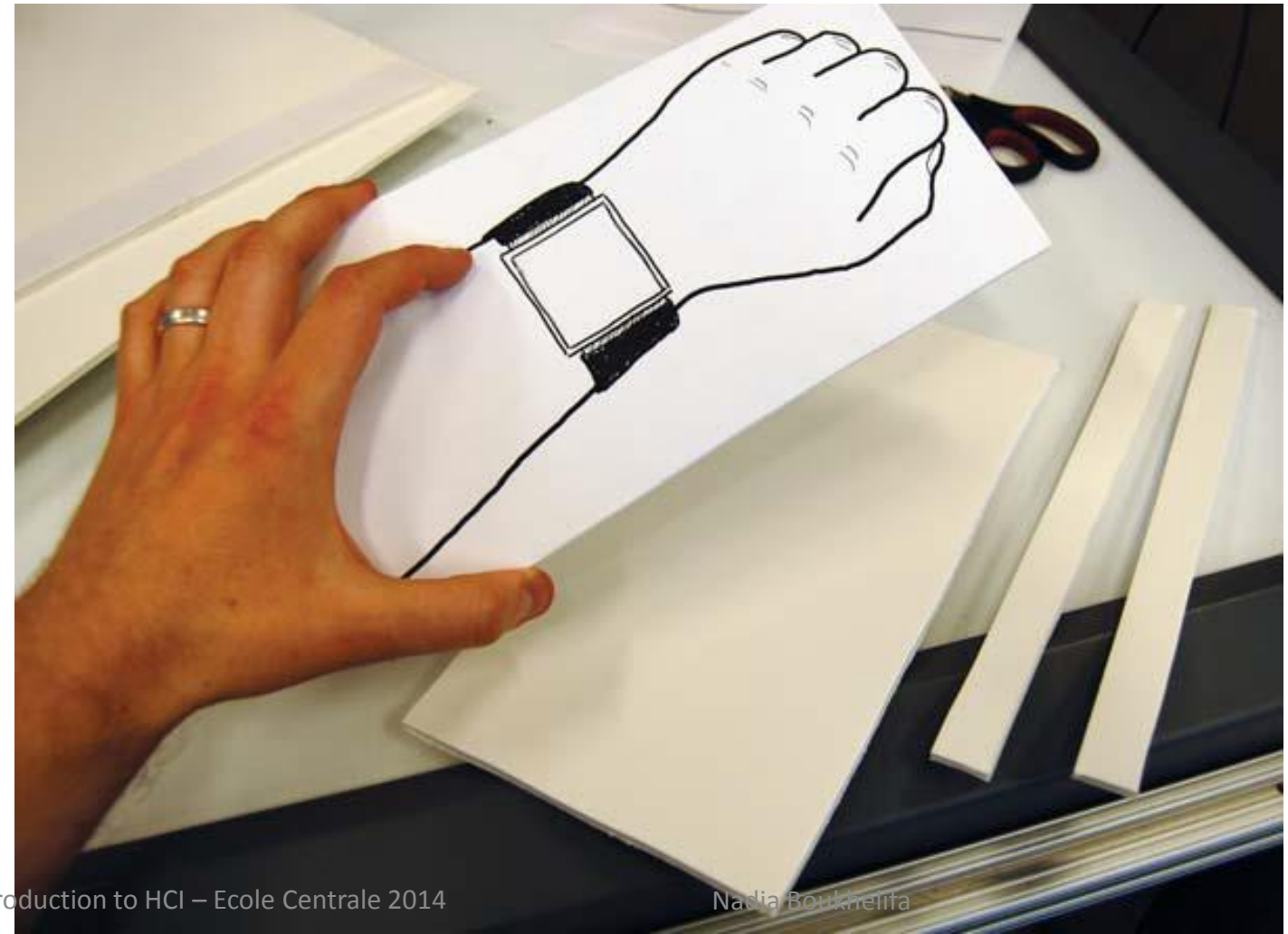

Contact List
Adam
Allan
403-283-1234
Betty
Create Contact
Name
Options
Cancel
Back
Speed Dial List
1 2 3
4 5 6
7 8 9
Back
Management
1. Default saving
2. Copy All to
3. Sort by Contacts
4. Delete All
5. Memory Status
Select
Back
Own Number
1 TELEPHONE
403-265-
2 Empty
3 Empty
4 Empty
Back

# *photo trace of arm as starting point*

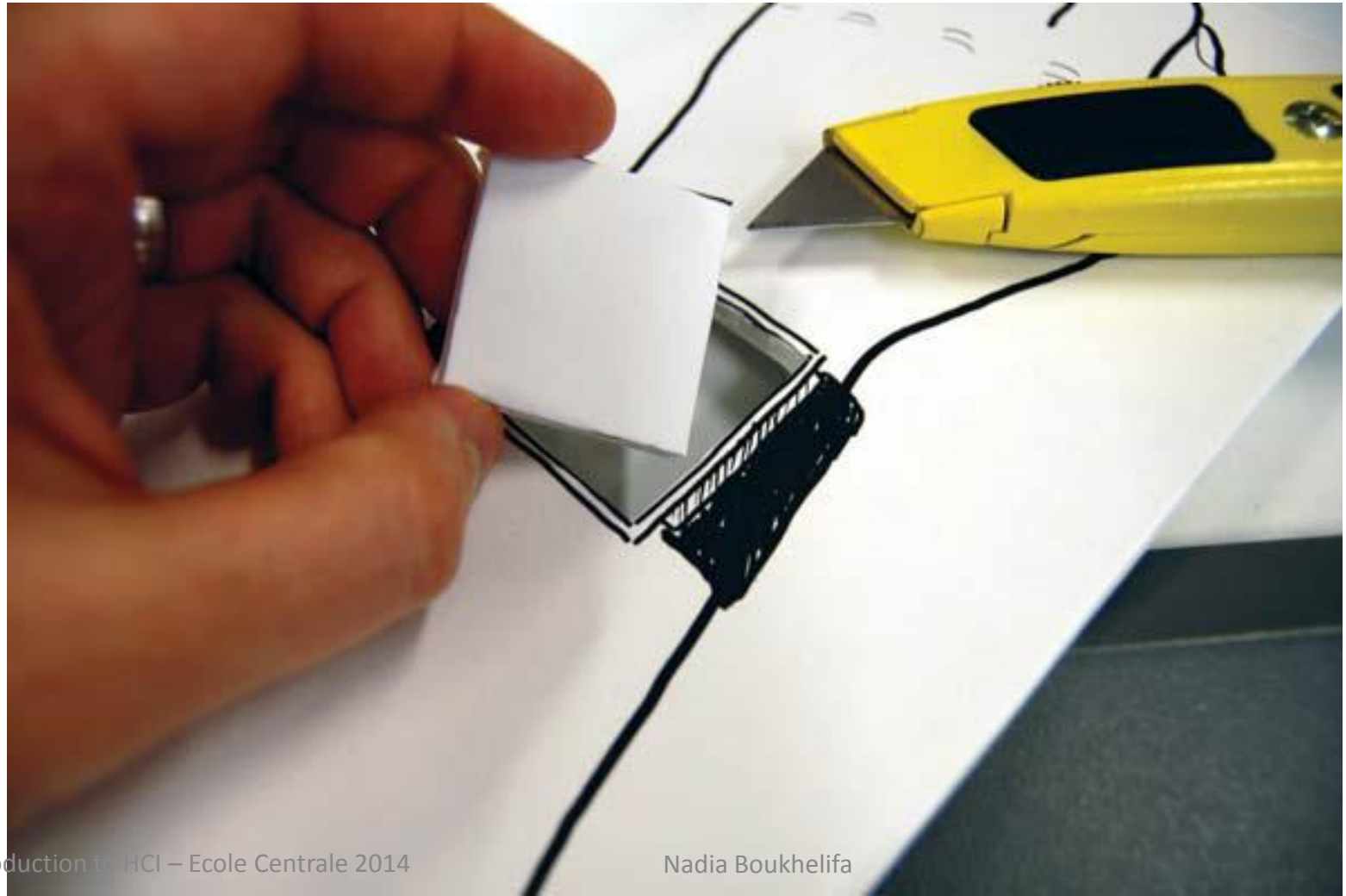


# *glue on foam-core board and cut out*

# *cut the back in same size, and sides*

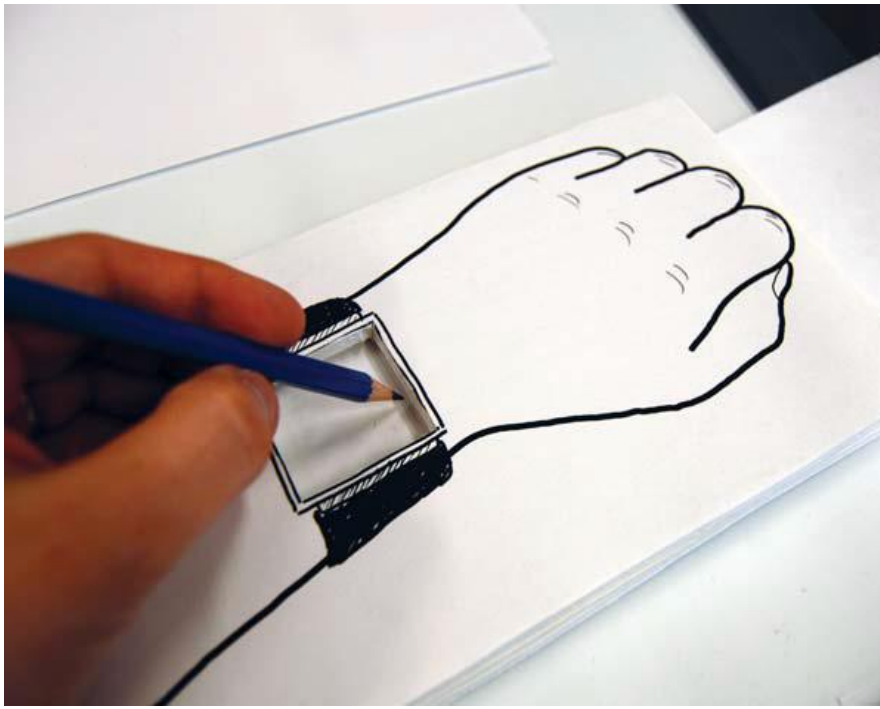


# *Cut out area for display from watch*

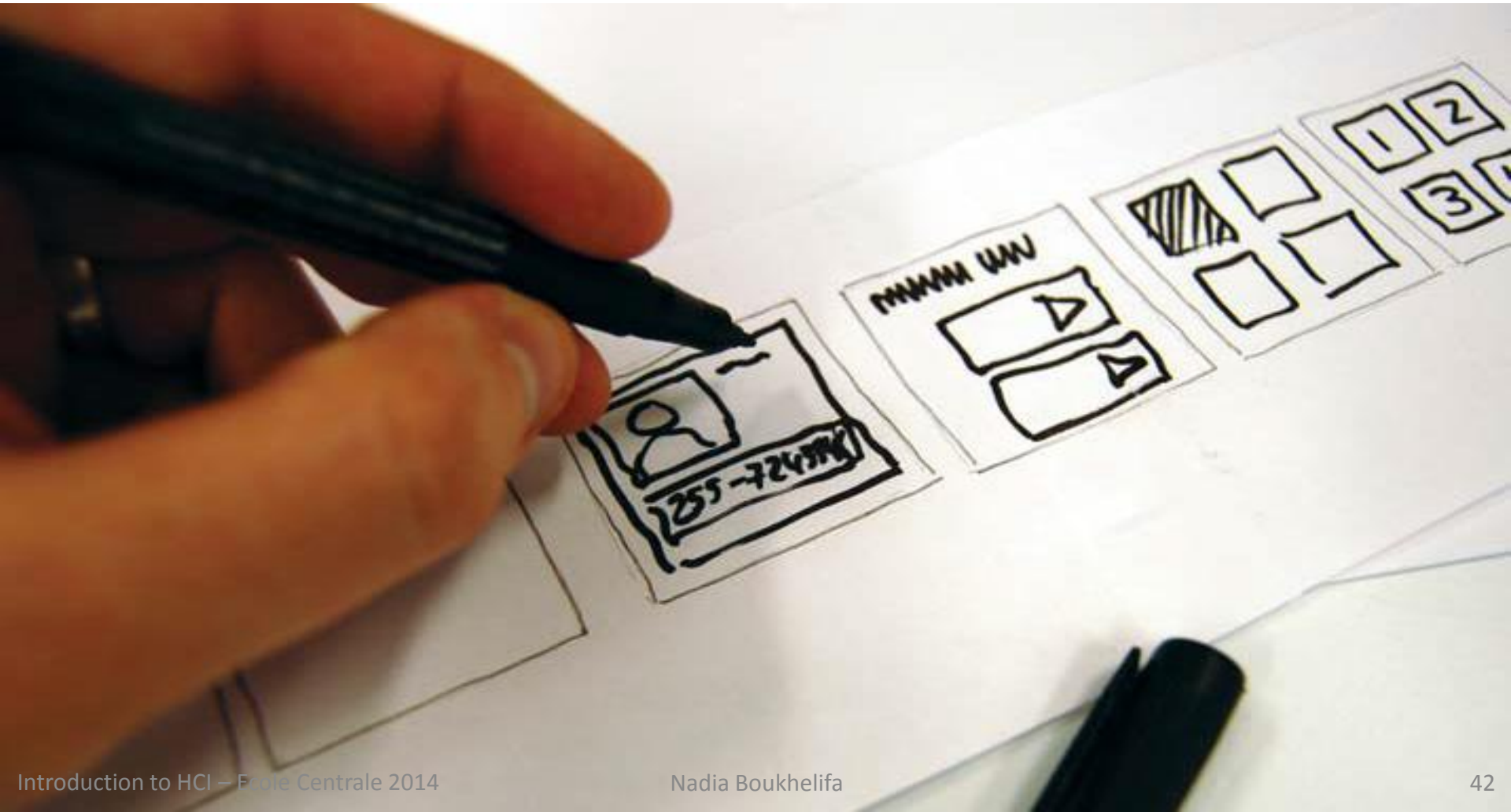


# *glue pieces together*

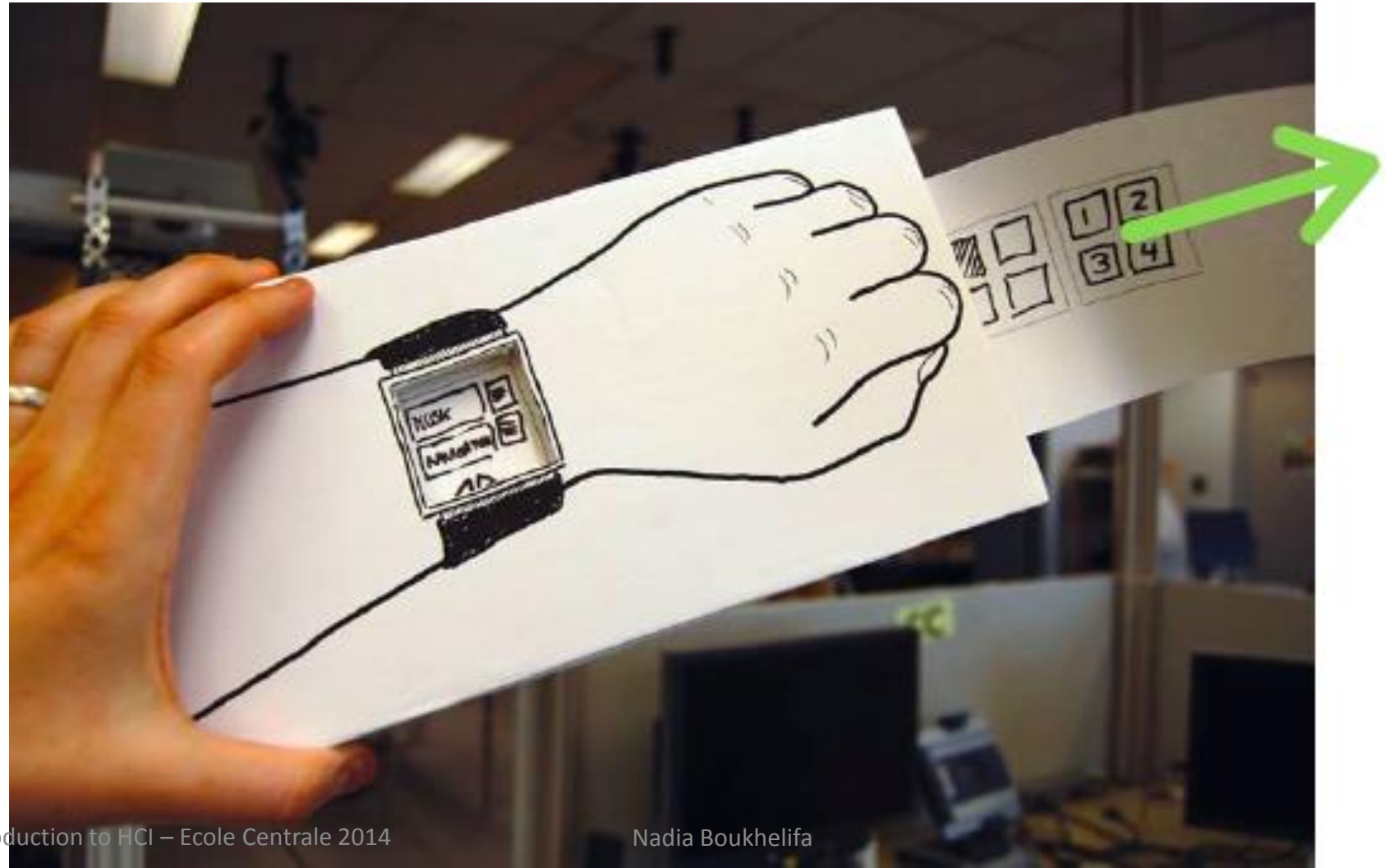
# *cut paper strips and mark size*



# *draw interface elements (→ storyboard)*

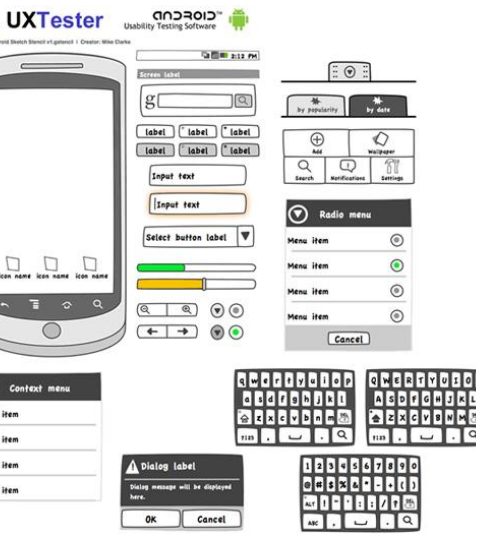


# *final prototype*

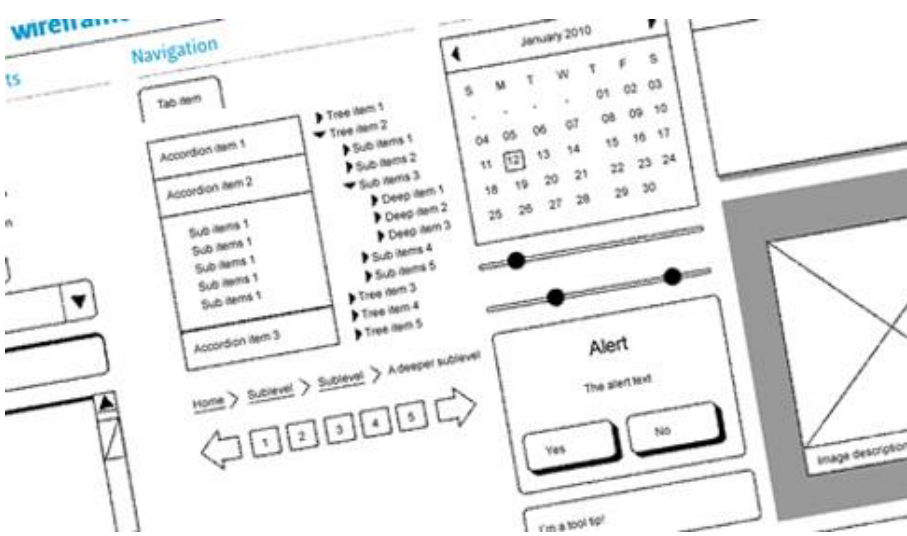


# *paper prototyping: tools and resources*

**http://www.smashingmagazine.com/2010/08/27/free-wireframing-kits-ui-design-kits-pdfs-and-resources/**





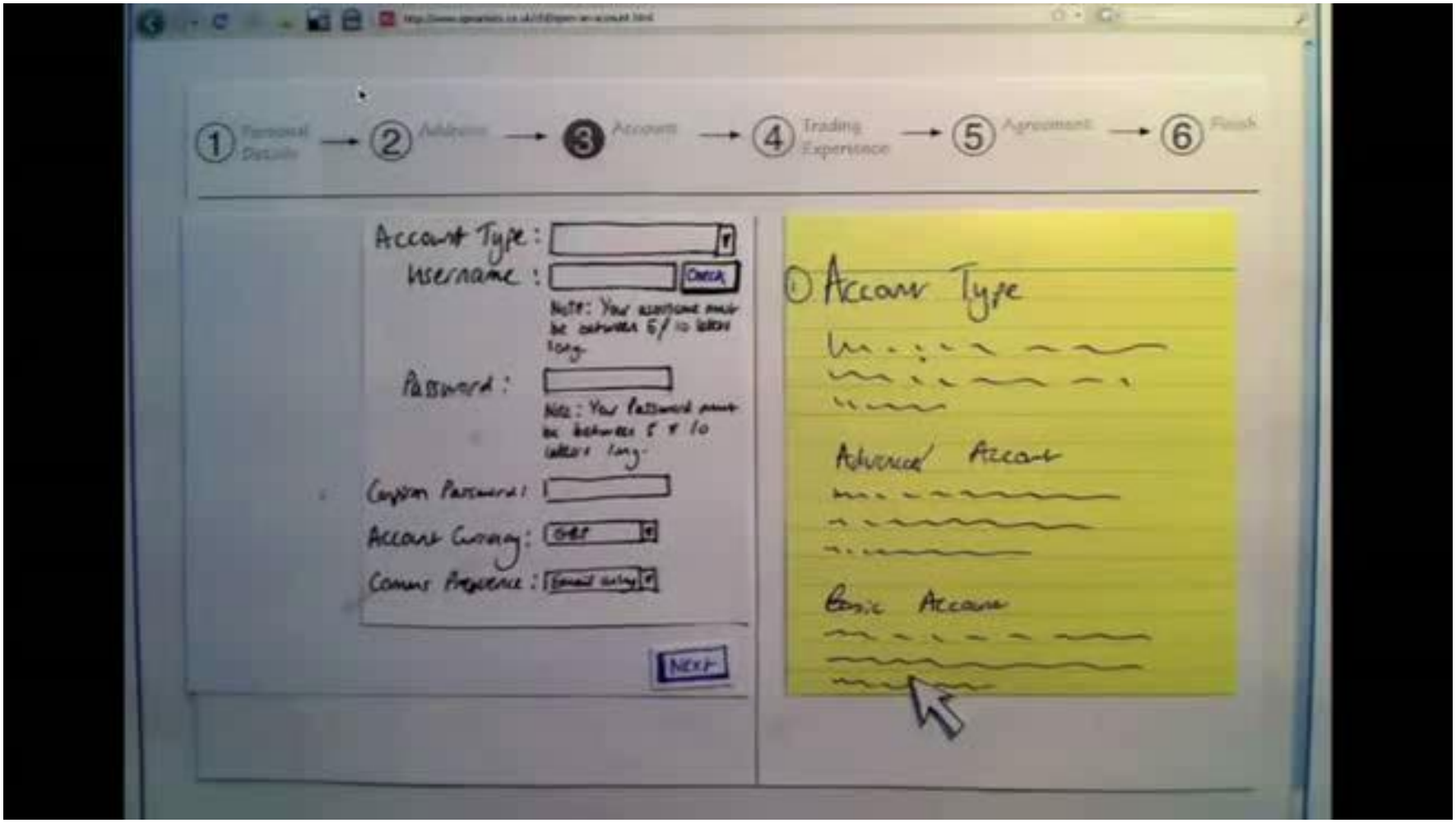


combine paper with

# *VIDEO PROTOTYPES*

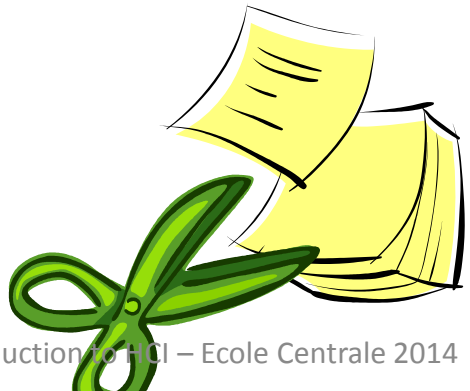
# *video prototype*

- how to with sticky notes


1 Personal Details
2 Address
3 Account
4 Trading Experience
5 Agreement
6 Finish
Account Type :
Username :
Check
Password :
Confirm Password :
Account Currency :
Comms Preference :
NEXT
1. Account Type
Advanced Account
Basic Account

# *low-fidelity prototypes: advantages*

- takes between only minutes to just a few hours
- interface can be refined before "real implementation"
- no expensive equipment needed
- can test multiple alternatives, fast iterations
- a multidisciplinary team can participate
- encourages creativity



# *low-fidelity prototypes: problems*

- slow interaction compared to real application; timings not accurate
- difficult to implements 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
- does not produce any code
- makes some development teams nervous because they fear users will think it unprofessional

prototypes

# *MEDIUM-HIGH FIDELITY*

# *medium-fidelity prototypes*

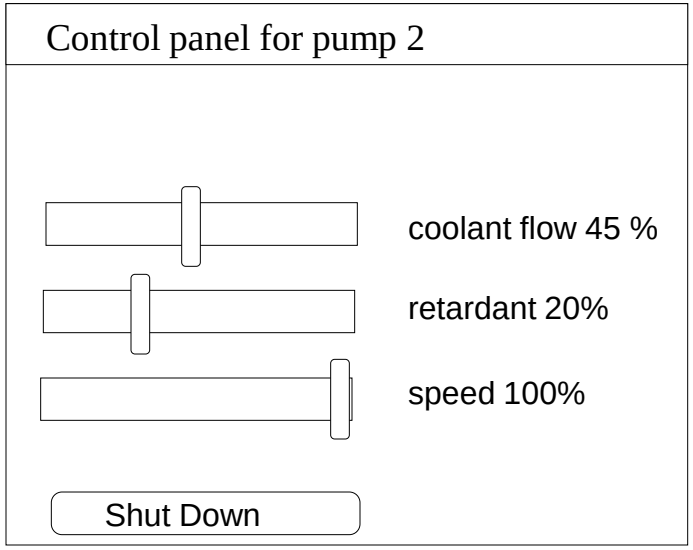
- prototyping with a computer
  - simulate some but not all features of the interface
  - engaging for end users
- purpose
  - provides sophisticated but limited scenario for the end user to try
  - can test more subtle design issues
- dangers
  - users' reactions often "in the small"
  - users reluctant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

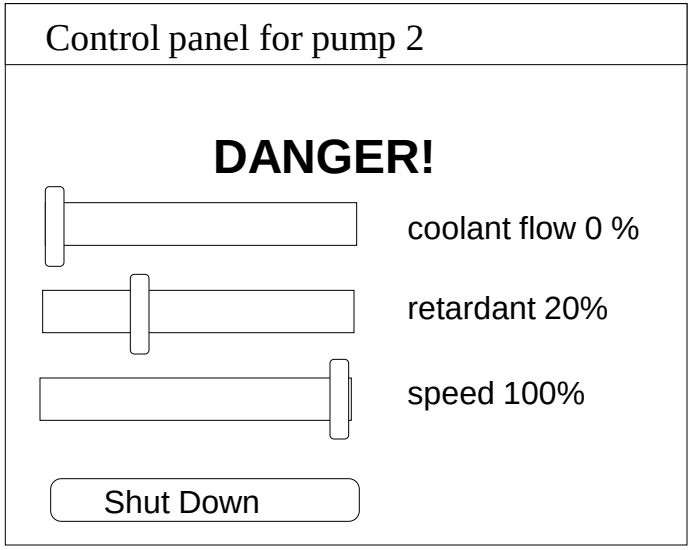
# *high fidelity prototypes:*

- big part: prototyping the visual design
- with the right tools, hi-fi prototypes can be done very quickly
- requires very little client imagination
- communicates the form very well
- very effective in persuasion
- danger that users think they have a full system

# *approaches: painting/drawing packages*

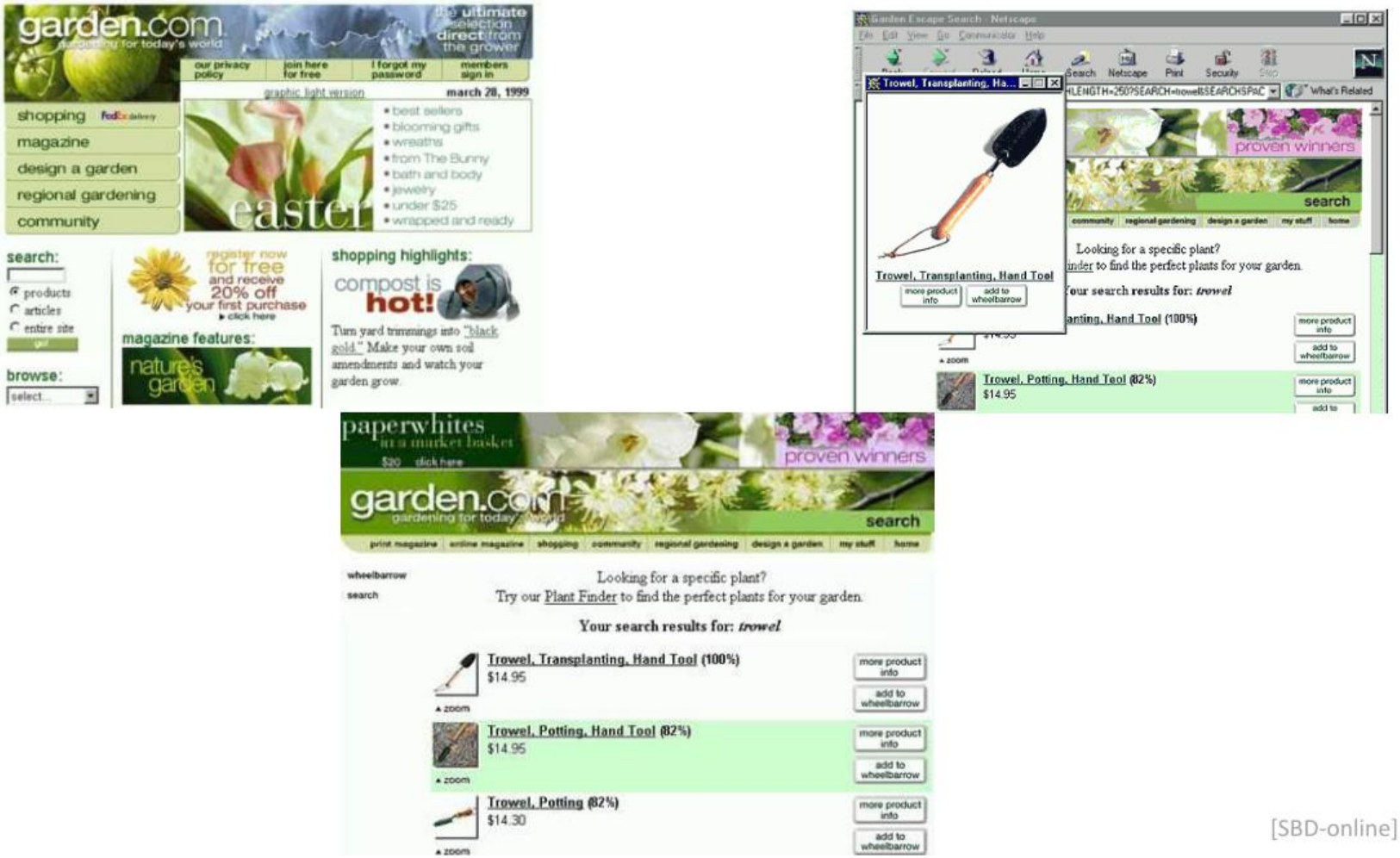
- draw each storyboard on the computer
  - very thin horizontal prototype
  - does not capture the interaction "feel"



# *screen mockups*

home page, search results, detailed product Info

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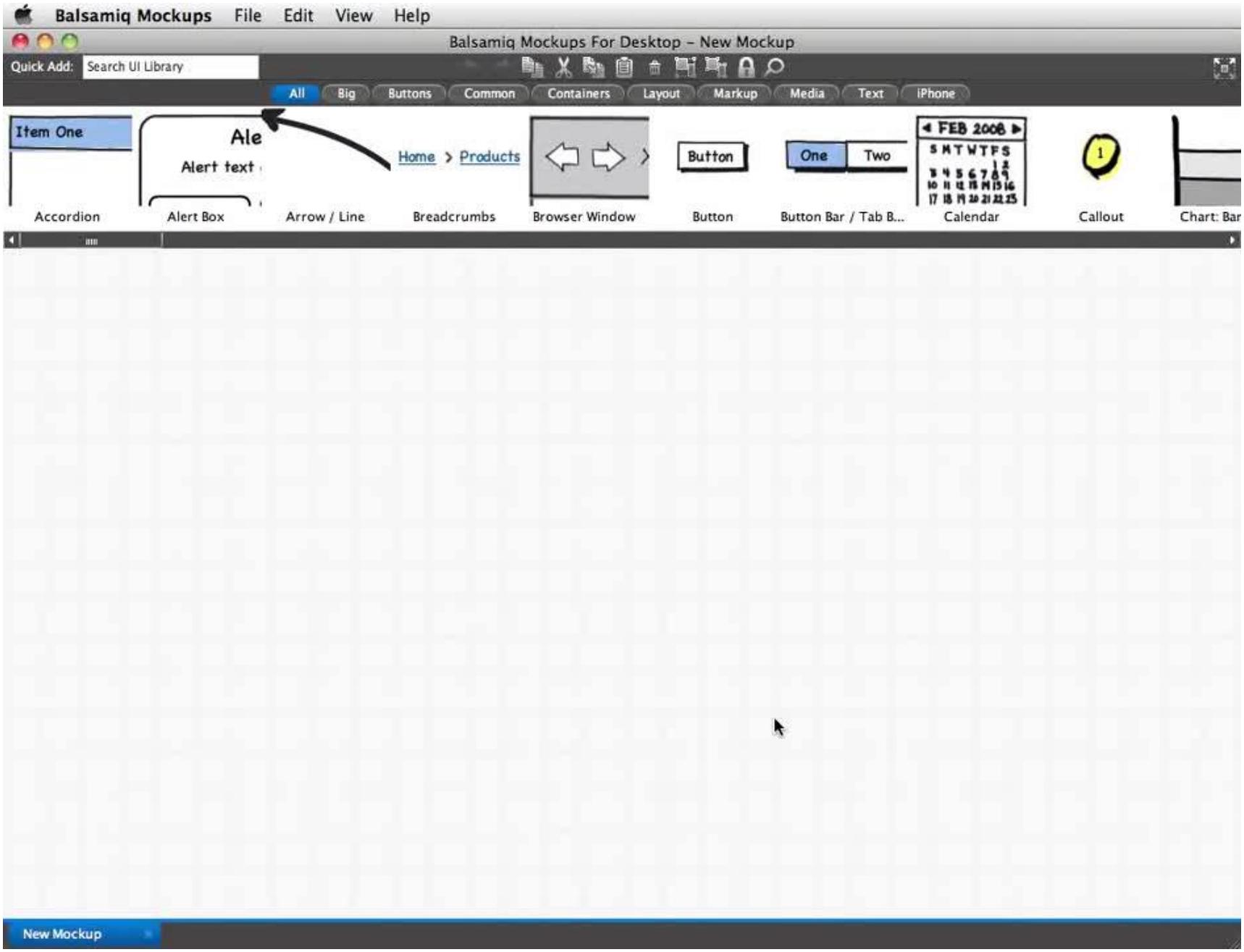
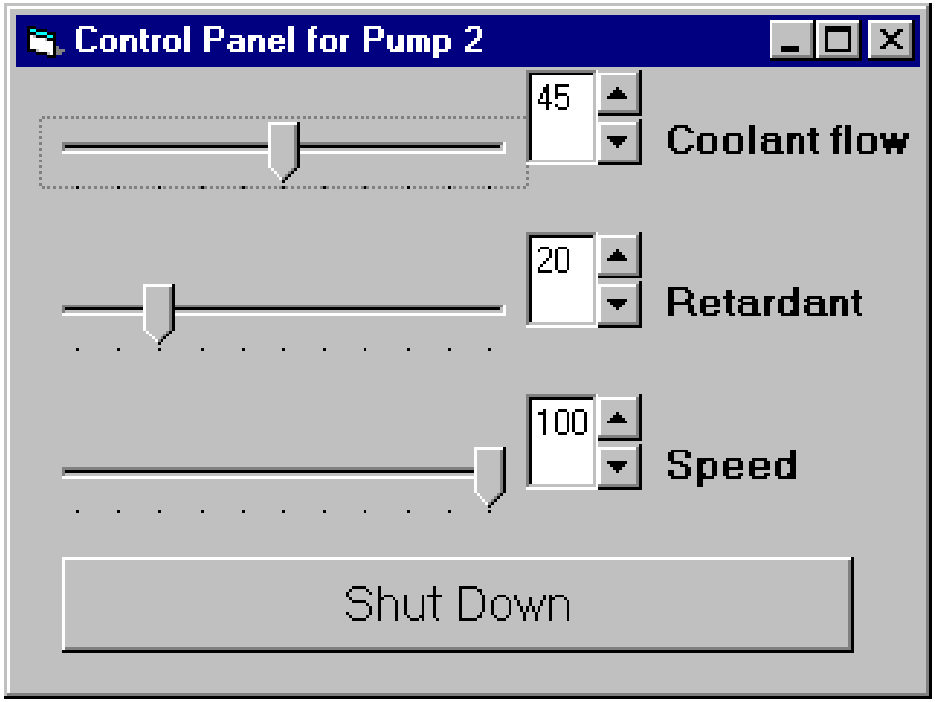

Balsamiq Mockups File Edit View Help
Balsamiq Mockups For Desktop - New Mockup
Quick Add: Search UI Library
All Big Buttons Common Containers Layout Markup Media Text iPhone
Item One
Accordion
Alert text
Alert Box
Arrow / Line
Home > Products
Breadcrumbs
Browser Window
Button
Button
One Two
Button Bar / Tab B...
FEB 2008
Calendar
Callout
Chart: Bar
New Mockup

# *interface builders*

- design tools for laying out common widgets
- excellent for showing look-and-feel
  - a broader horizontal prototype
  - but constrained to widget library
- vertical functionality added selectively through programming



# *approaches: scripted simulations*

- create storyboard with media tools
  - scene transition activated by simple user inputs
  - can create a simple vertical prototype

- user is given a very tight script/task to follow
  - appears to behave as a real system
  - script deviations blow the simulation

# *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?**

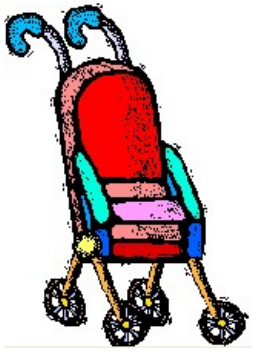
Place your order | Print this list | Throw this list away

# *approaches: scripted simulations*

**What to do**

Touch a different color, or scan another item.

**What you selected**



**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 |

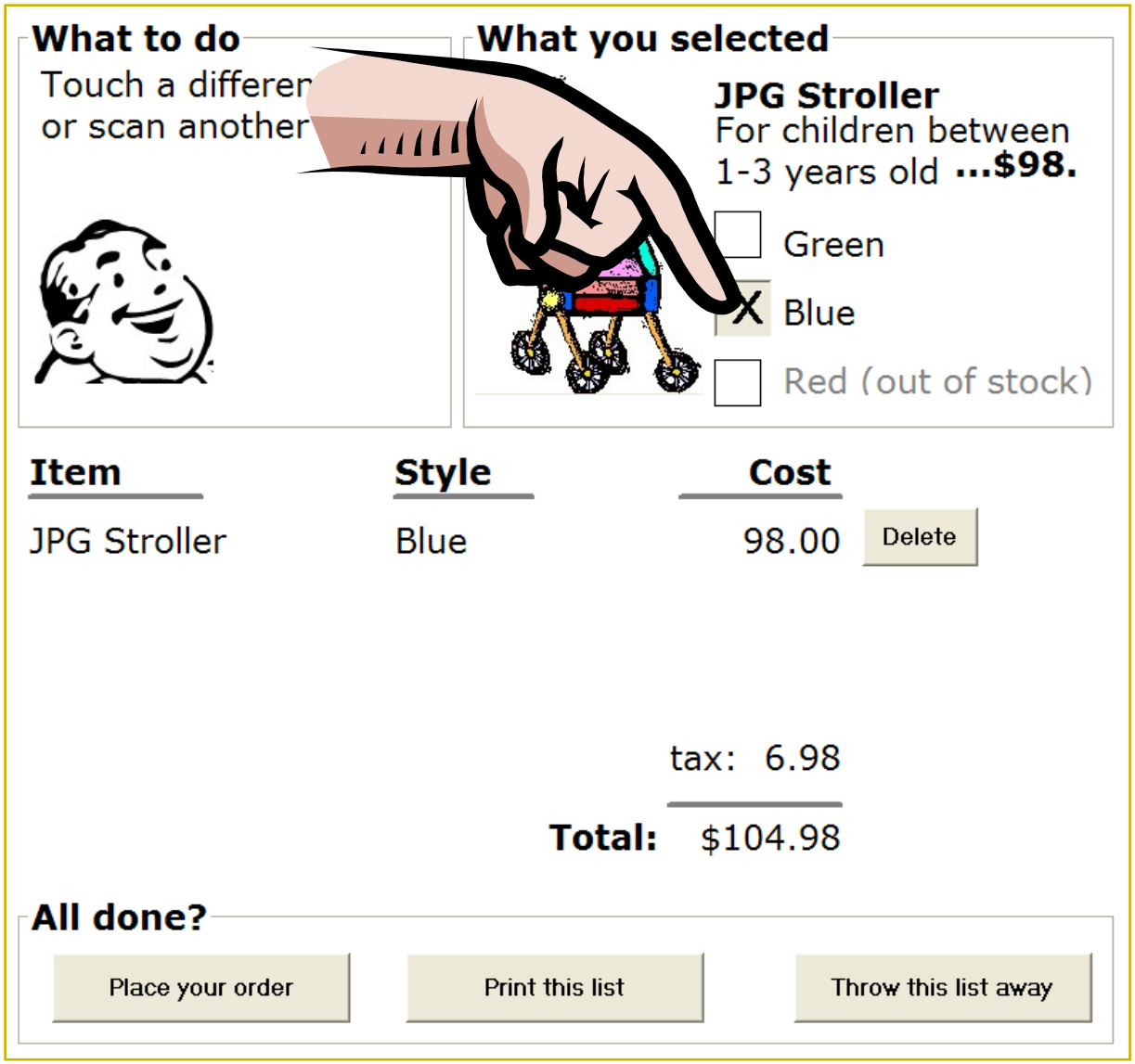
tax: 6.98

**Total:** $104.98

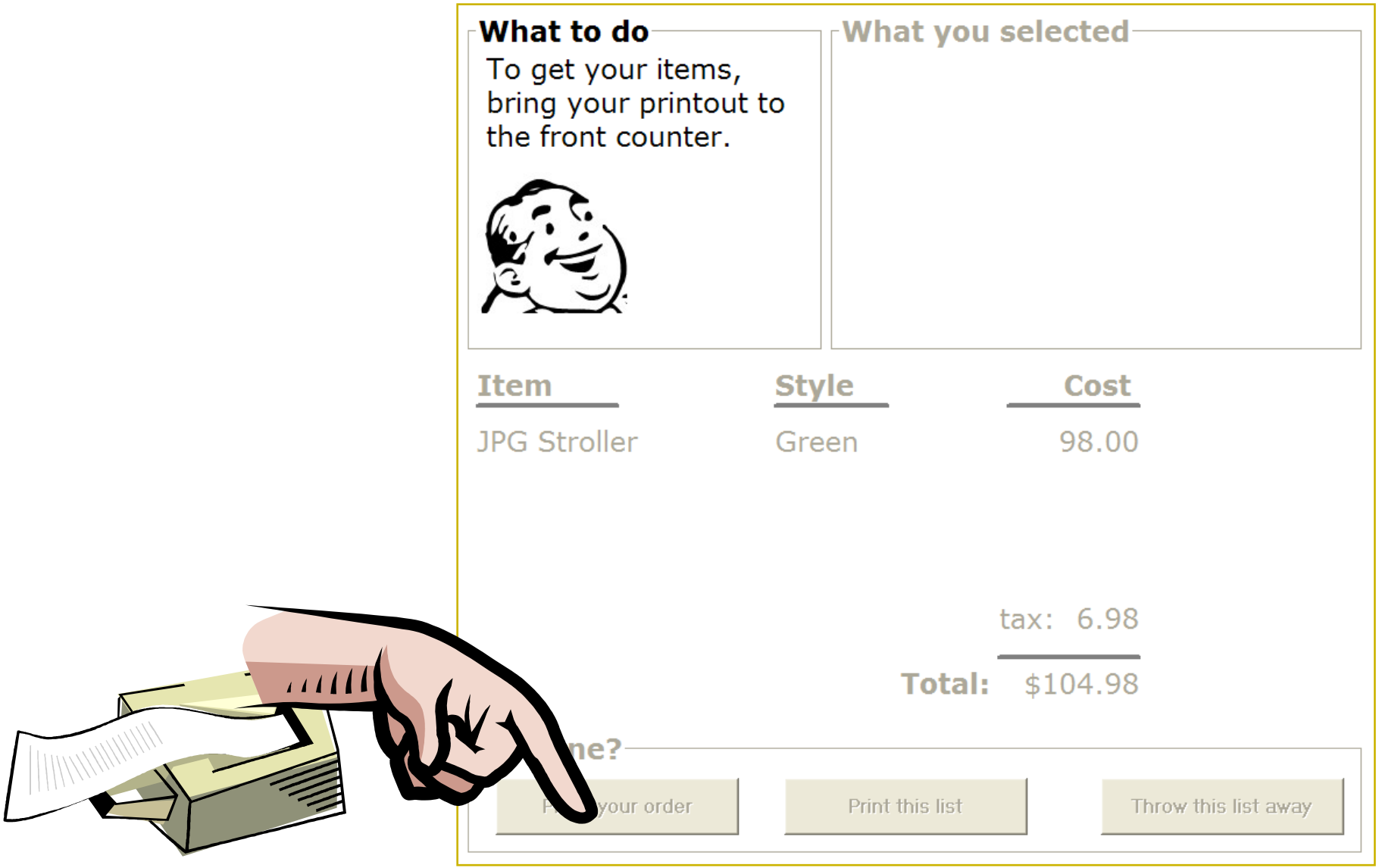
**All done?**

Place your order | Print this list | Throw this list away

# *approaches: scripted simulations*



# *approaches: scripted simulations*



# *physical interface builders: VoodooIO*

# *physical interface builders: VoodooSketch*

# *advantages & disadvantages*

- better sense of finished  product
- more realistic experience
- can evaluate experience

- time-consuming to create
- users may focus on unnecessary details
- takes a lot of time to make
- blind users to major representational flaws

Interlude

# *PROTOTYPES SUMMARY*

# *why prototype?*

- evaluation and user feedback is central in good design
  - stakeholders can see, hold and interact with a prototype
  - aids communication of an idea, and provides focus for a team
  - you can test out your ideas
  - encourages reflection
  - answers questions, and helps you make choices between different alternatives

# *what should be prototyped?*

- task design & user flow
  - Based on expected tasks, what will the users see, what will they do?
- screen layouts and information display
  - How should information be laid out to provide information as users need it? How can this be optimized?
- graphic design and look & feel
  - What should it look like?
- technical aspects
  - Can we actually make this go?!

- * Start with controversial and critical areas (e.g. security)

# *which prototyping method to choose?*

- choose the method that works best for what you are trying to achieve (pragmatics).
- for example:
  - User flow » storyboard
  - Screen layouts/page flow » paper prototypes
  - Overall experience » video prototype
  - Look and feel » PowerPoint or PSD
  - Functionality » software
  - … etc.
- alternately, maybe you are at different stages in the design. Early on, use techniques that are cheap and quick; later on, use techniques that give a stronger sense of finished idea.

# *prototypes in an organization*

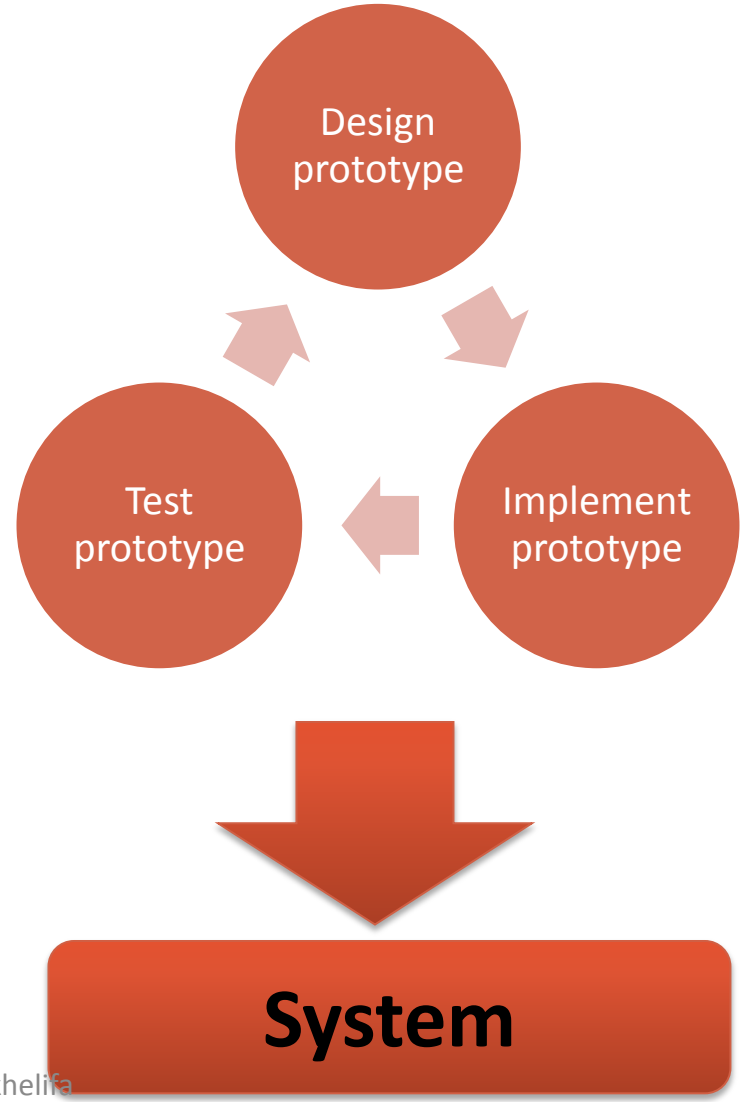
- **question**: How do we integrate the philosophy of prototyping into an organization?

- three methods for managing this integration:
  1. Evolutionary
  2. Modular (incremental)
  3. Throw-away

# *evolutionary approach to prototype integration*

iteratively change the prototype to incorporate changes

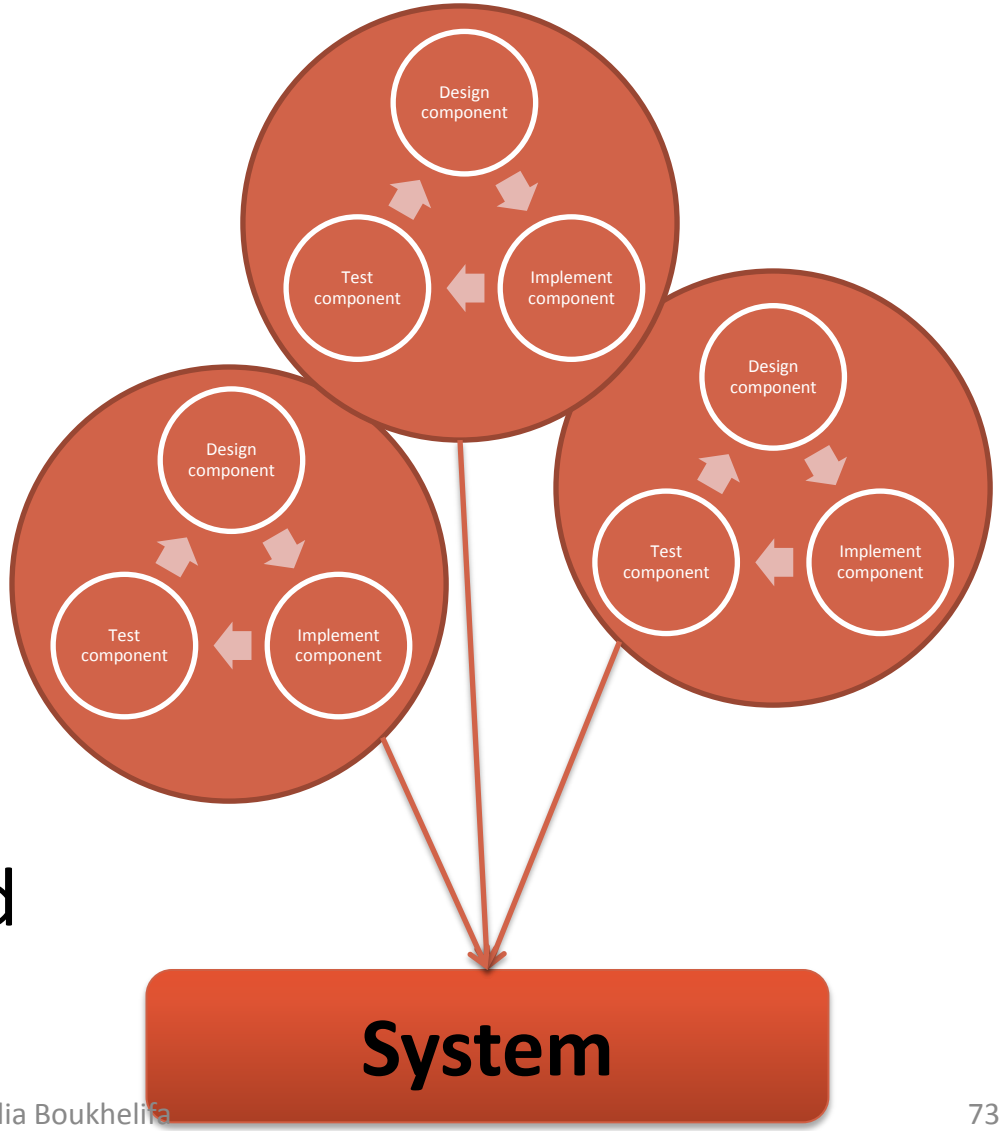
eventually, the reworked prototype becomes the final system



# *modular (incremental) approach to prototype integration*

build the system as separate modules/components

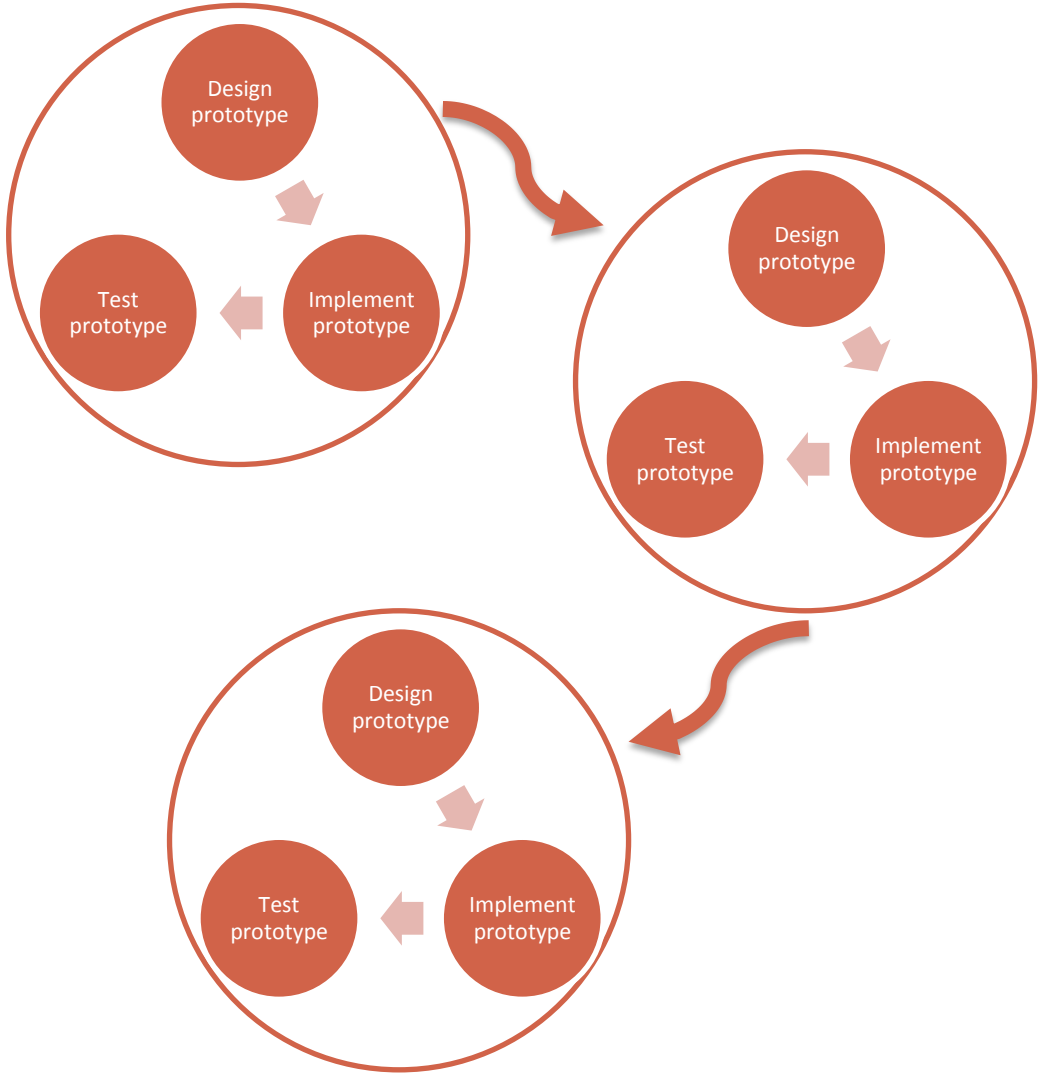
each module is designed, prototyped and build separately before being combined into a final system



# *throw-away Approach to Prototype Integration*

prototype is used to get rapid feedback (i.e. to learn lessons)

prototype is built, tested, and deployed (or discarded)



# *integrating prototypes in organizations*

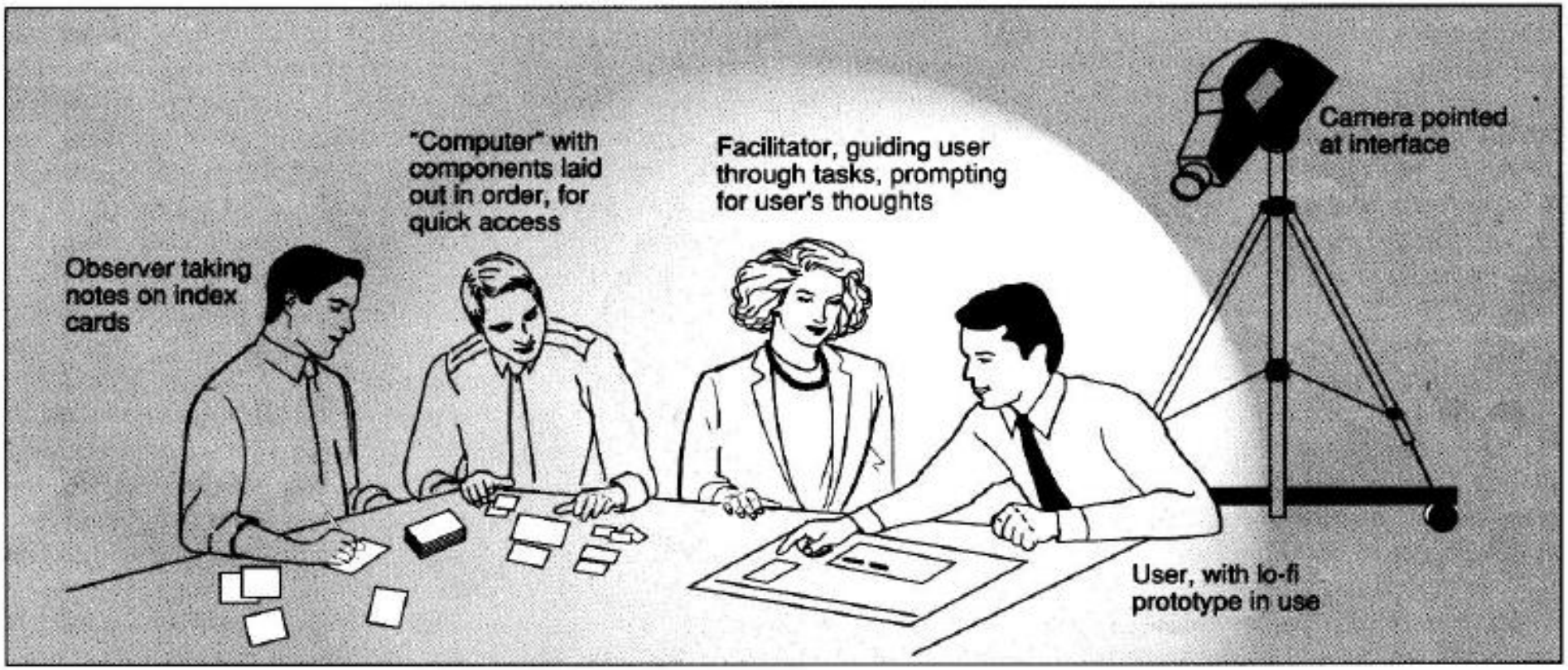
1. evolutionary
   - » prototype is altered to incorporate design changes
   - » eventually becomes the final product
- 2. modular (incremental)
   - » product is built as separate components (modules)
   - » each component is prototyped and tested, then added to final system
- 3. throwaway
   - » prototype serves to reveal user reach, then discarded
   - » creating prototype should be rapid, otherwise can be expensive

# *PROTOTYPING & EVALUATION*

# *paper prototyping and evaluation*

- paper prototyping can be used in early usability testing
  - representative users perform realistic tasks
    - by interacting with a paper version of the interface
    - that is manipulated by a person 'playing the computer' (hidden operator)
    - who doesn't explain how the interface is intended to work
  - Users are instructed to "click" (touch) buttons or links, and "type" (handwrite) data directly onto the prototype
    - The Human Computer responds to those actions as the system would
- when?
  - early usability testing
  - get quick feedback from users while the design is still (literally) "on the drawing board"
  - helpful in generating design ideas and conducting internal interface reviews

# *low-fi testing session (Marc Rettig)*



# *low vs. high fidelity prototypes*

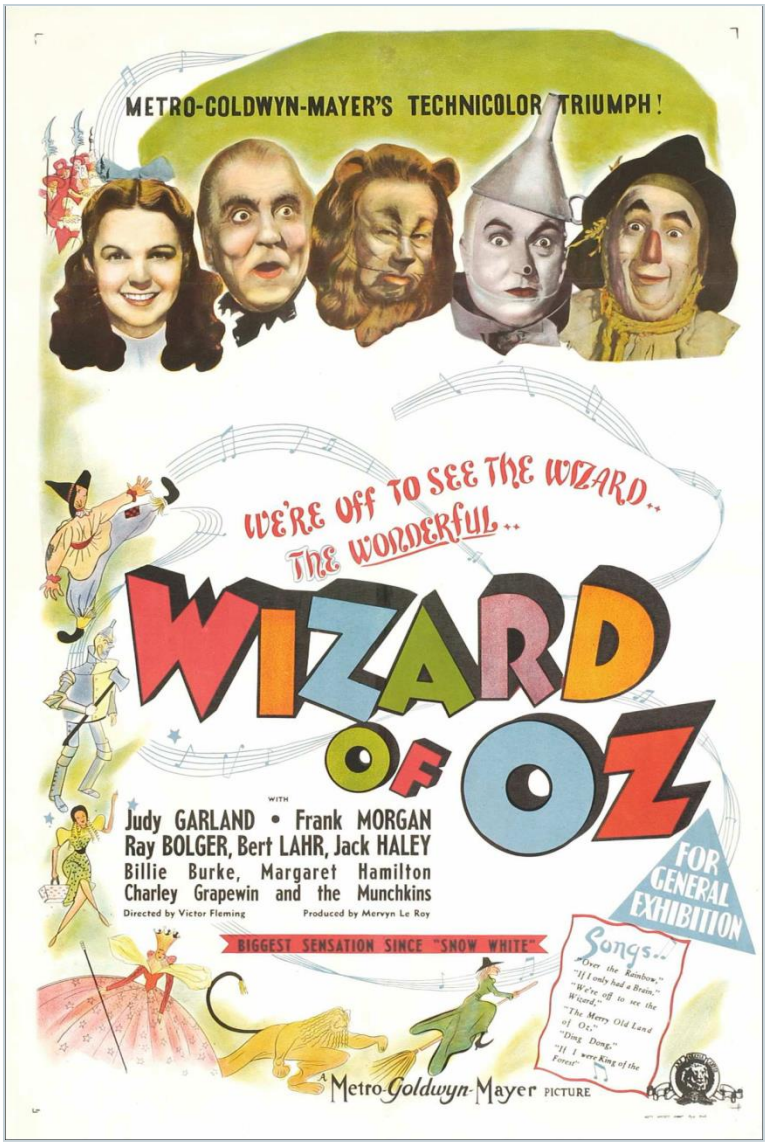
User test of a low-fidelity paper prototype of a website

vs.

User test of a high-fidelity paper prototype of a homepage.

# *Wizard of Oz technique*

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



# *nordstrom video*

- prototyping and user feedback in a tight loop

# *Wizard of Oz: The Point*

- up until the point the wizard is discovered, the thoughts, feelings, and actions of Dorothy and the others were all genuine
- they were genuinely experiencing what it would be like to talk to a powerful and terrible wizard

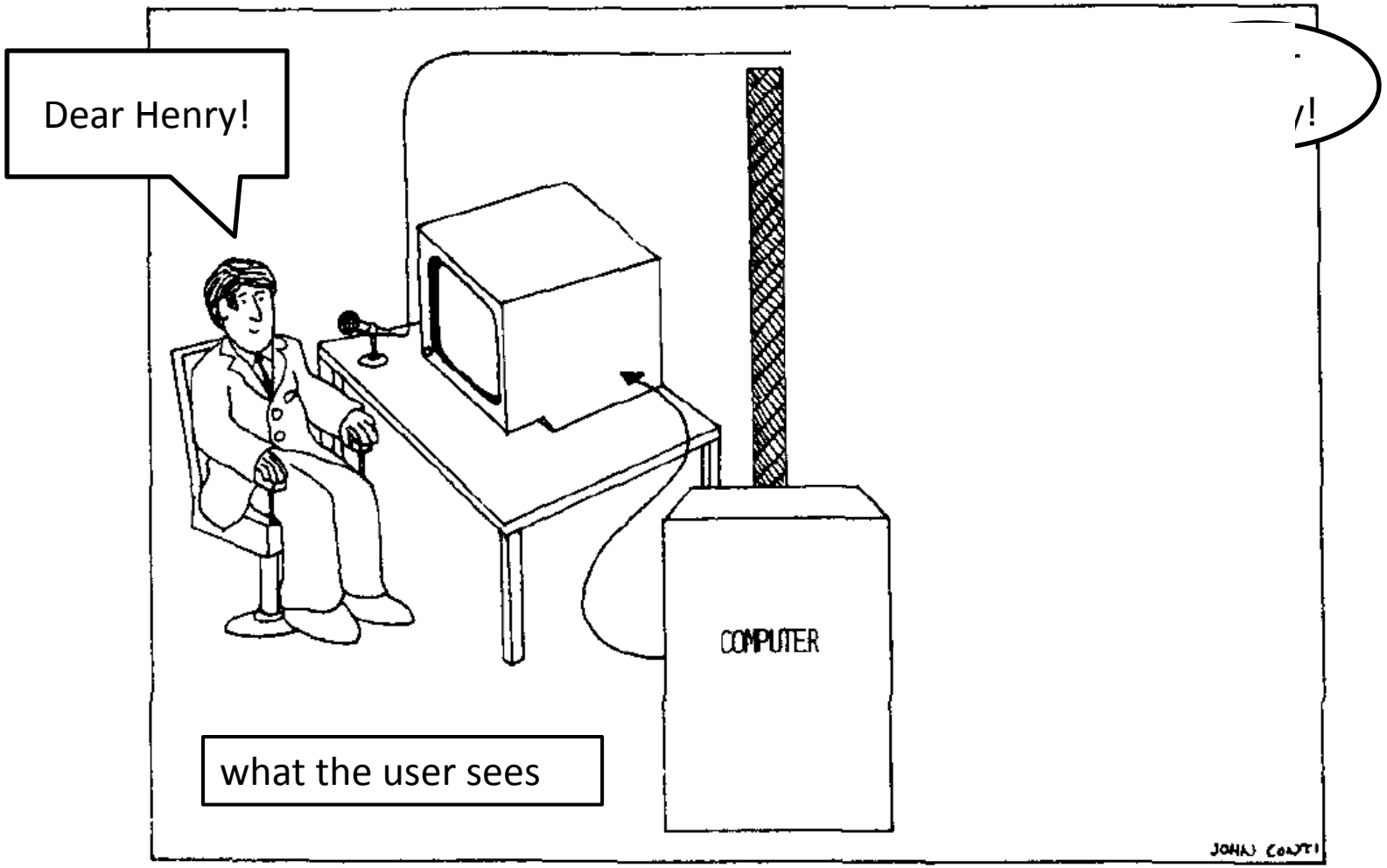
# *Wizard of Oz: The Point*

- we have a dilemma:
  - we want to get feedback from users as early as possible
  - high-fidelity prototypes do not yet exist

- what if we could…
  - make an interactive app without (much) code
  - get feedback from people

# *Wizard of Oz technique*

- method of testing a system that does not exist



# *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")

# *making a wizard-powered prototype*

- map scenario and application flow
  - what should happen in response to user behavior?
- put together interface skeletons
- develop "hooks" for wizard input
- define what is the wizard allowed to offer and how
- rehearse the wizard role with a colleague

via Scott Klemmer

# *running wizard-powered prototypes*

- practice it
- once you're comfortable – recruit "users"
- two roles: facilitator and wizard
- facilitator: provides tasks and takes notes
- wizard: operates interface
  - more authentic if hidden or remote
- user feedback can be…
  - think aloud
  - retrospective
  - heuristic evaluation (will discuss later)
- debrief users

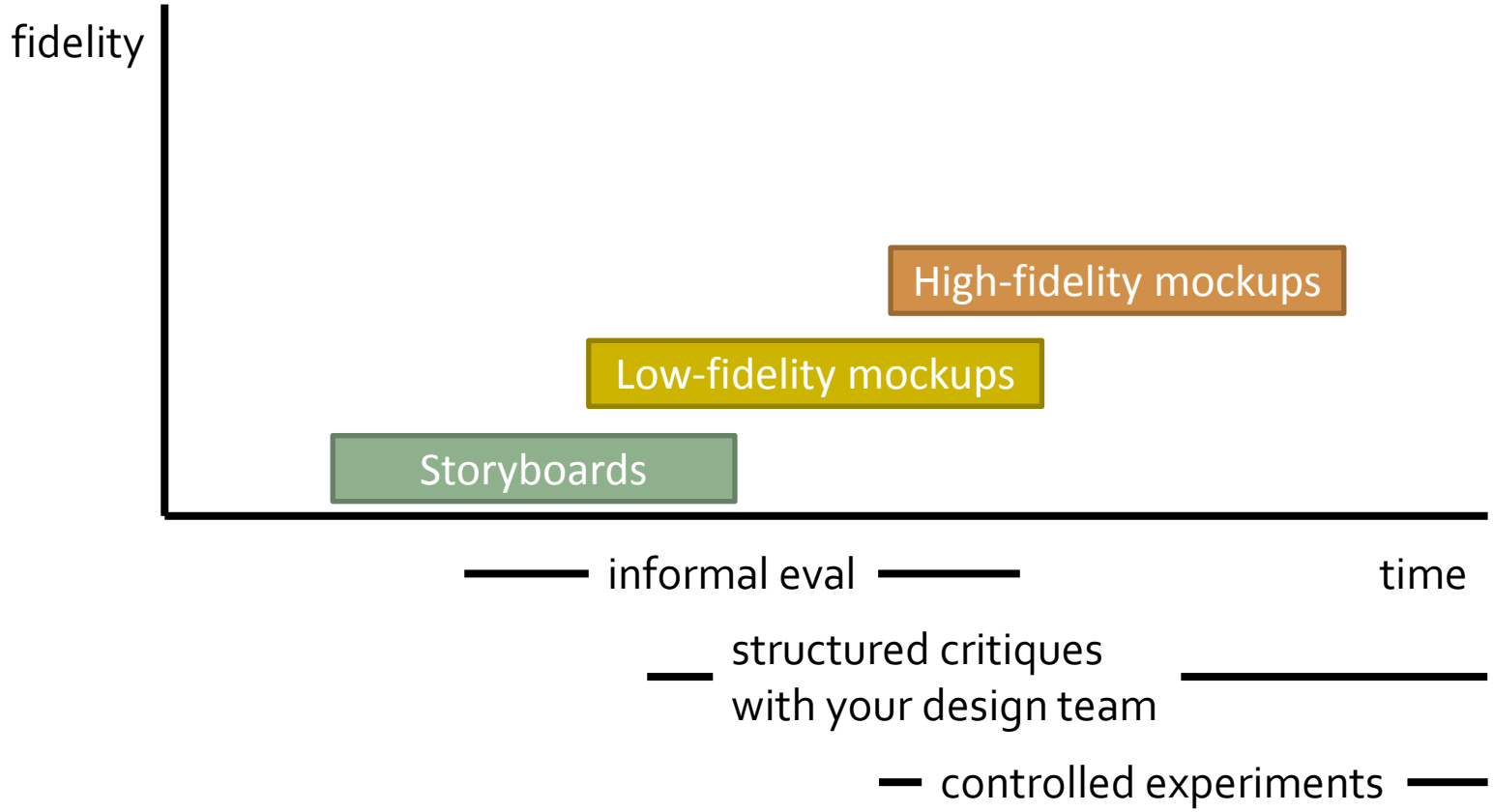
via Scott Klemmer

# *disadvantages*

- simulations may misrepresent otherwise imperfect tech
- may simulate technologies that do not exist (and may never)
- wizards need training and can be inconsistent
- playing the wizard is exhausting
- some features (and limitations) are difficult/impossible to simulate effectively
- may be inappropriate in some venues (e.g. home)

via Scott Klemmer

# *evaluation with prototypes*

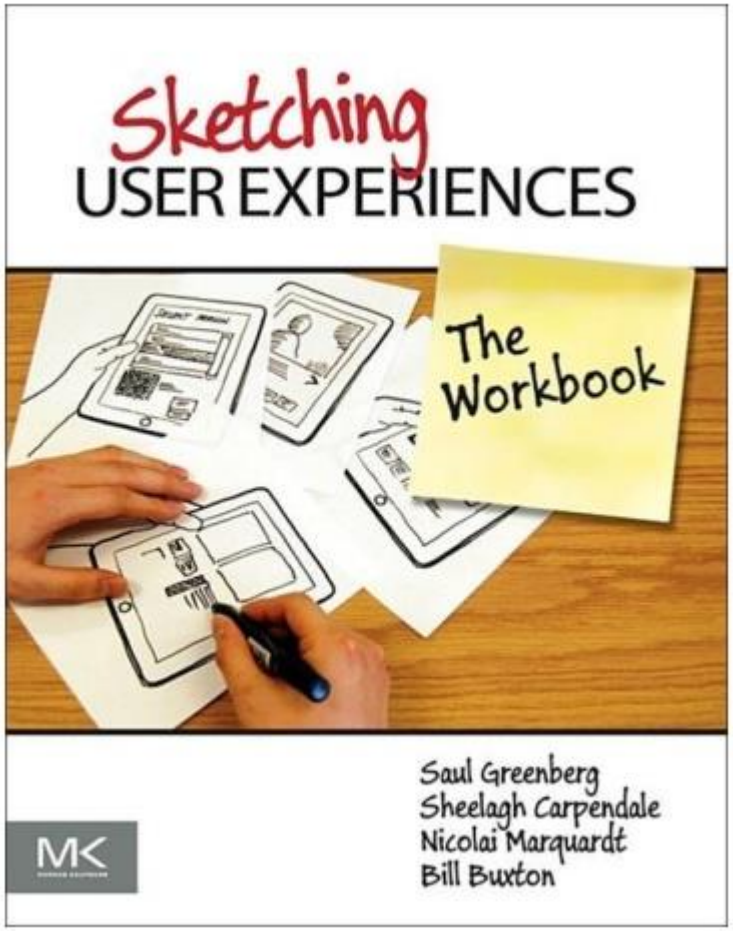


# *book recommendation*

- Bill Buxton: Sketching User Experiences – Getting the Design Right and the Right Design. Morgan Kaufmann, 2007, ISBN 0-12-374037-1
- Tons of supplementary information at: www.billbuxton.com

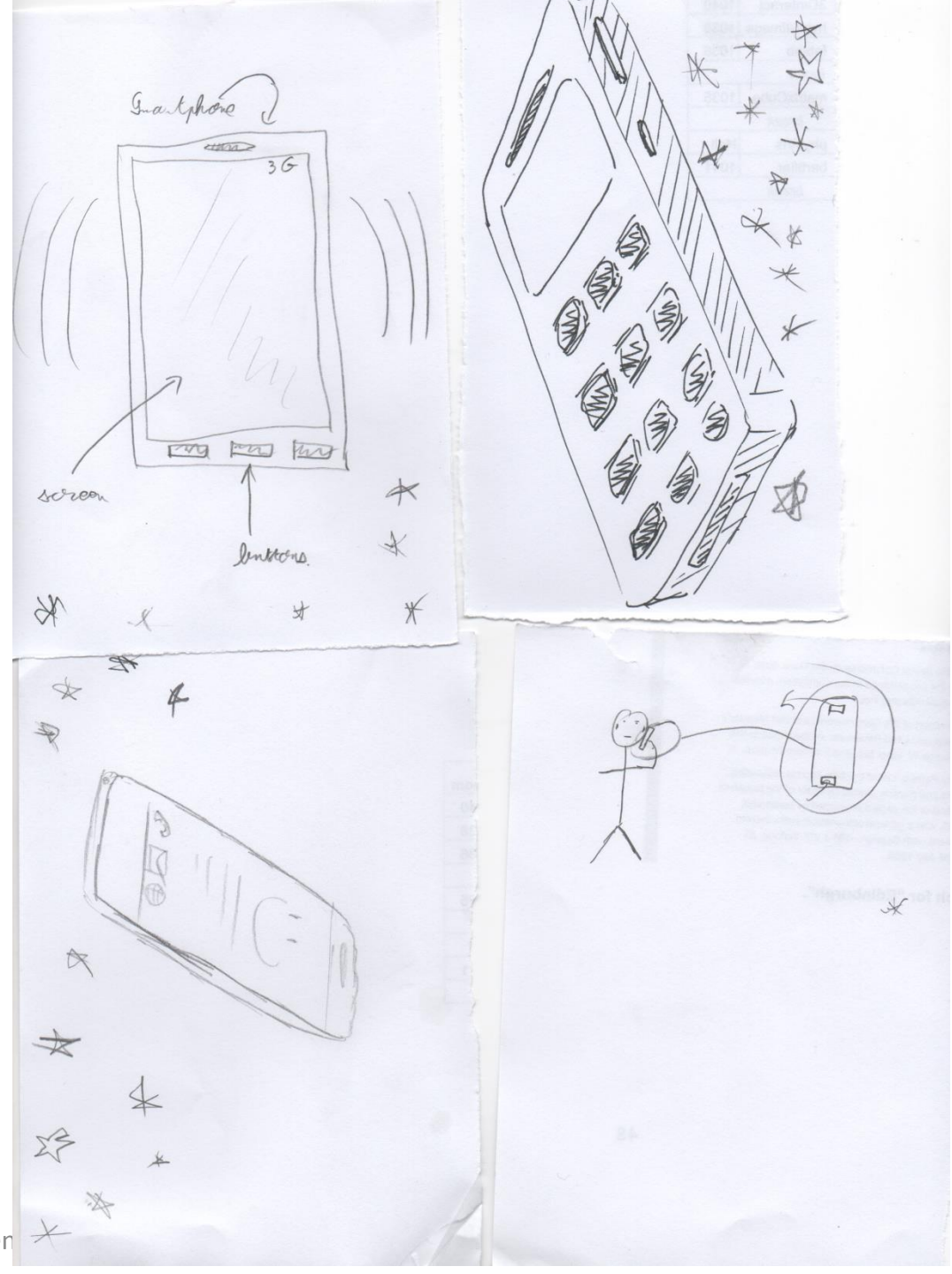
# *book recommendation*

S. Greenberg, S. Carpendale, N. Marquardt and B. Buxton Sketching User Experiences: The Workbook Morgan Kaufmann, 2011, ISBN 0-12-381959-8




More information at:
http://saul.cpsc.ucalgary.ca/sketchbook/

# *LAB*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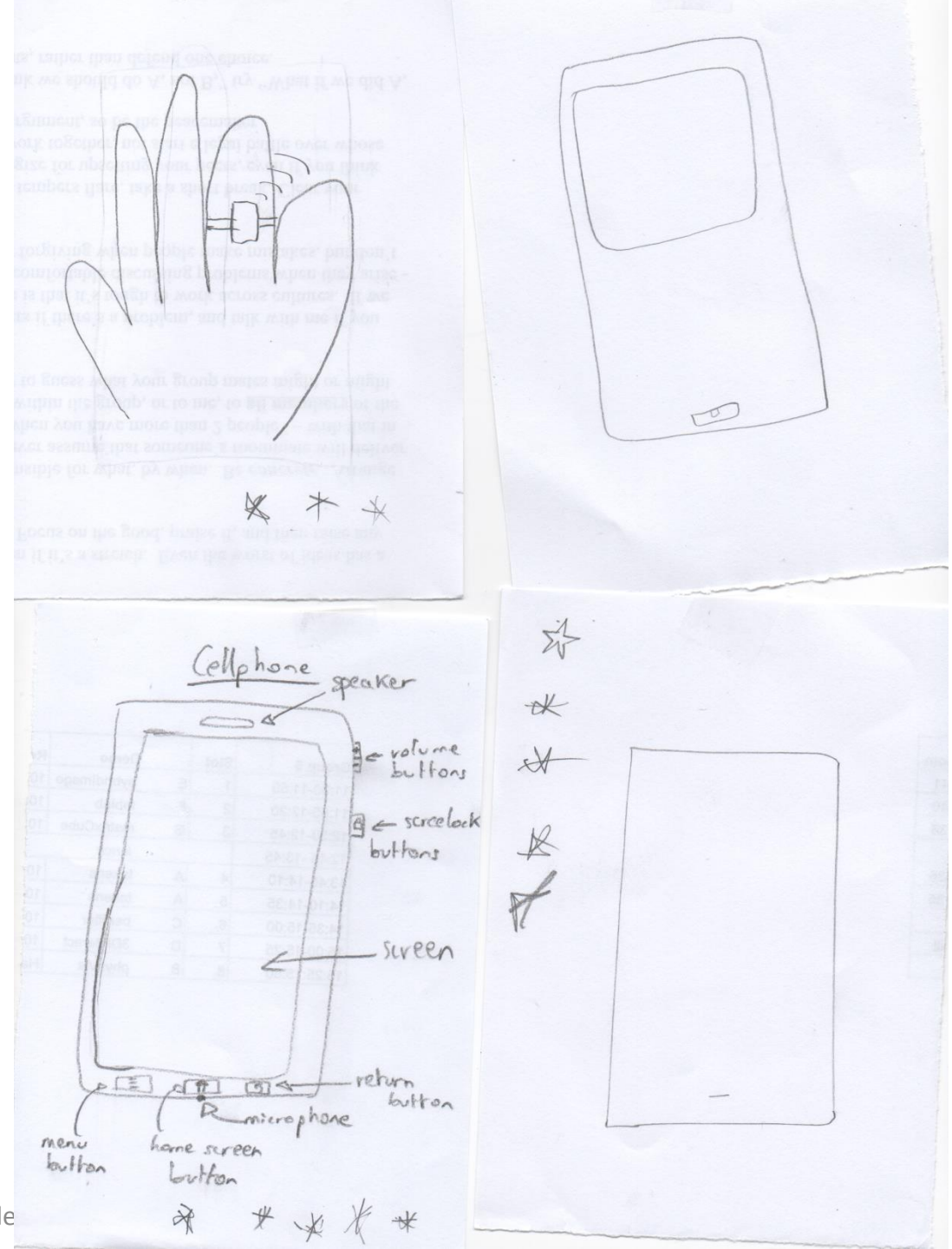
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volume buttons
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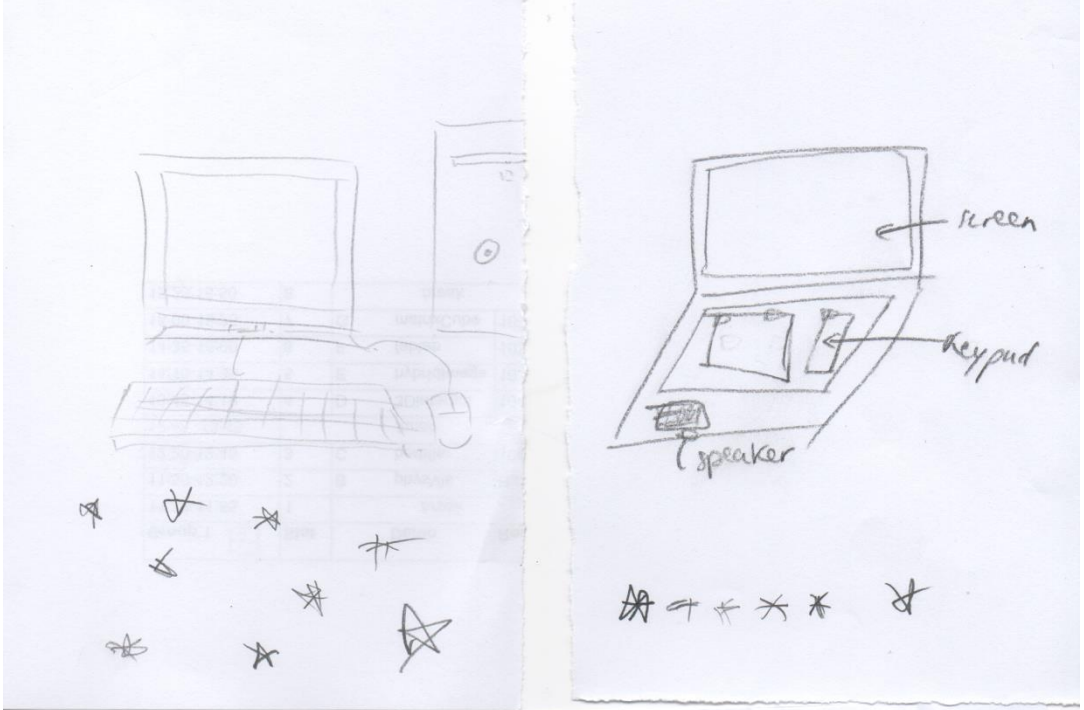
screen
return button
microphone
menu button
home screen button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keypad
speaker
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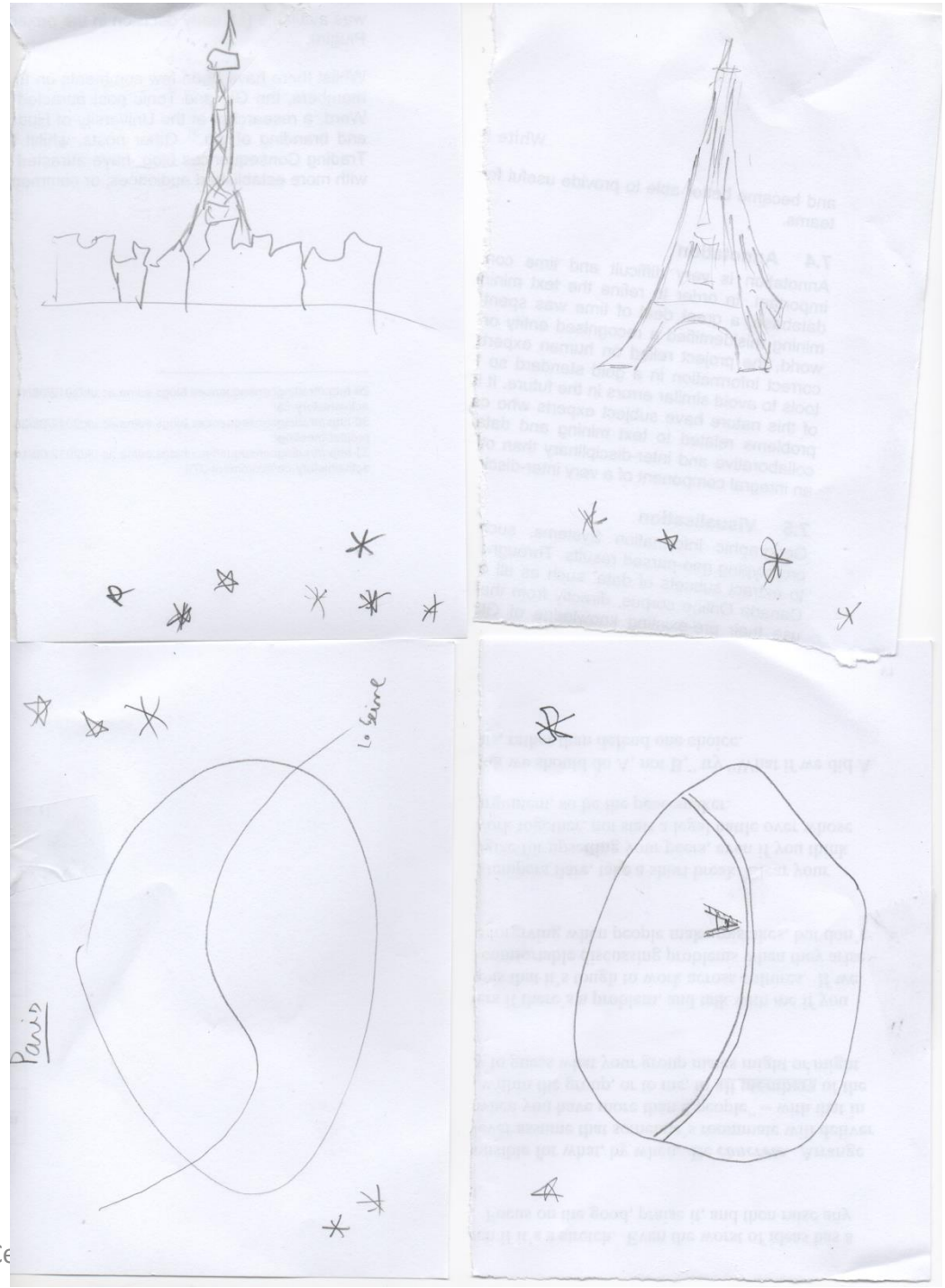
Computer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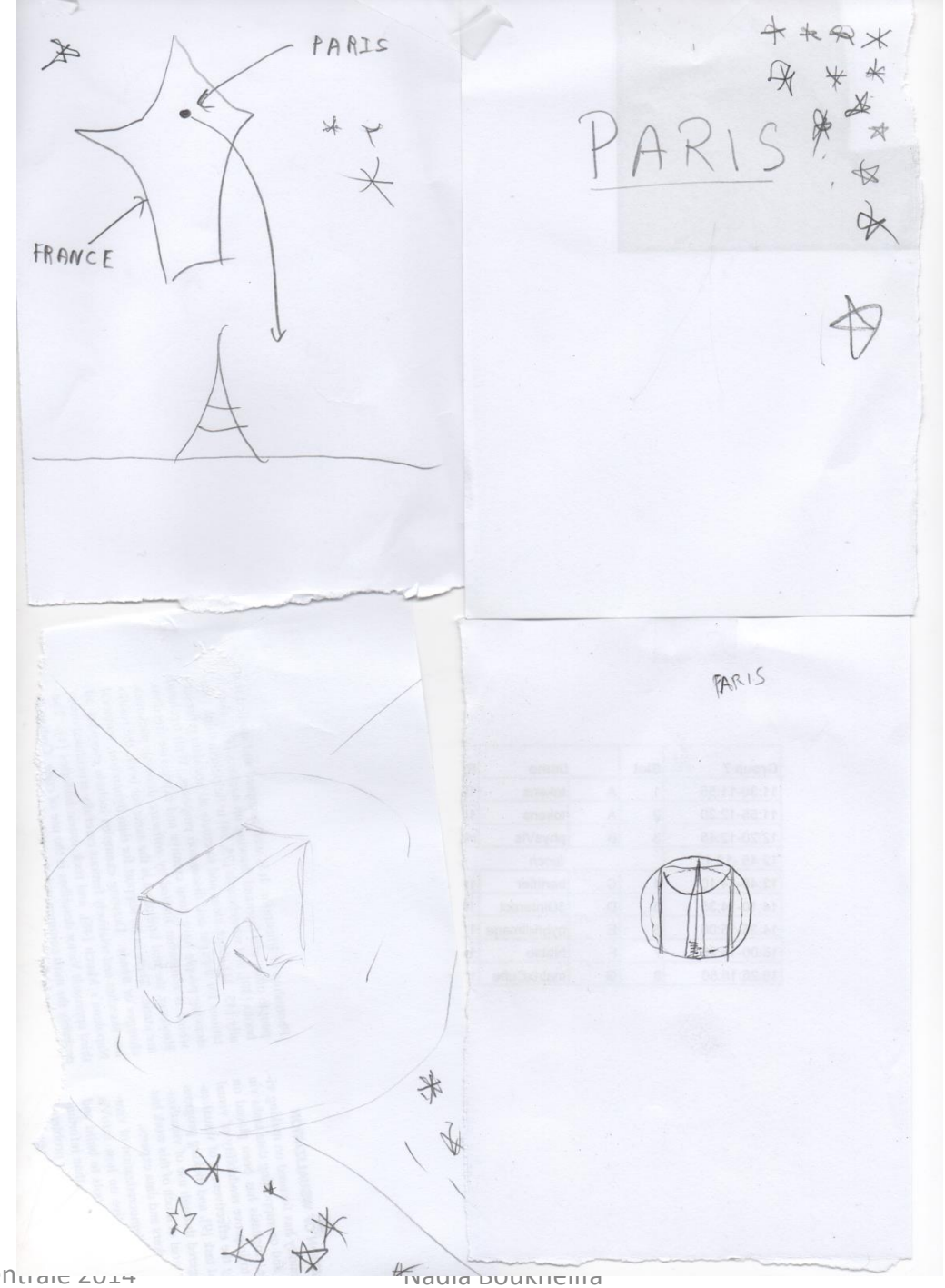
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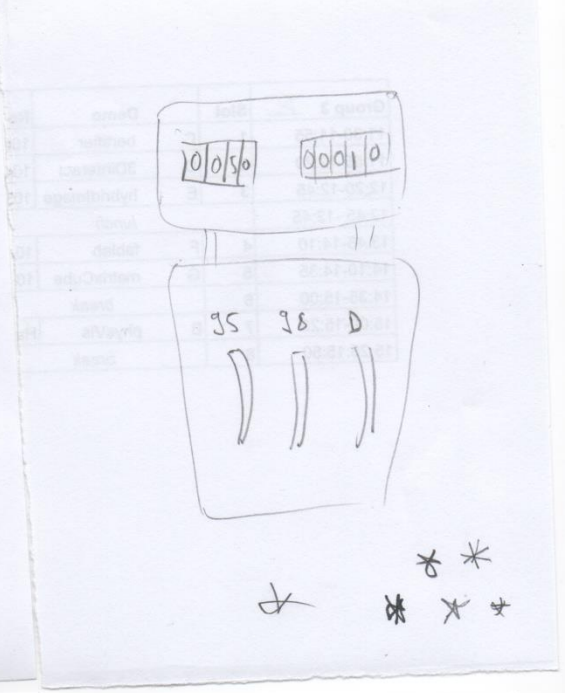
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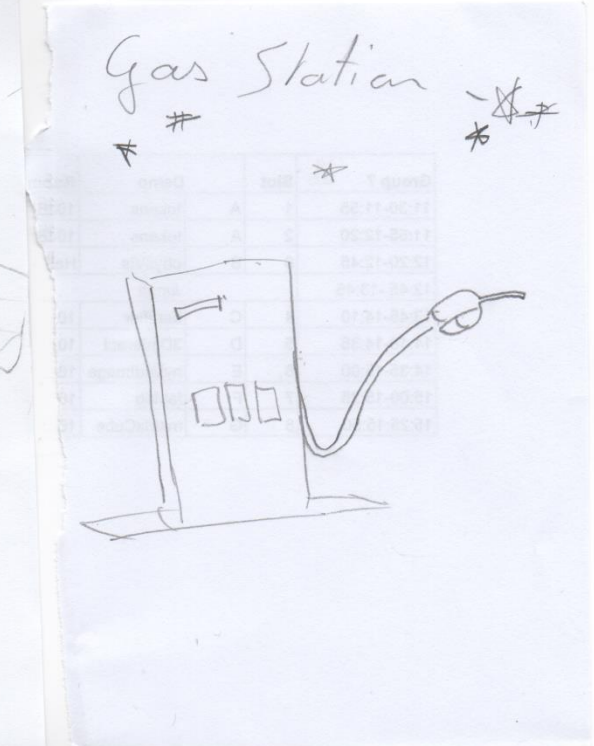
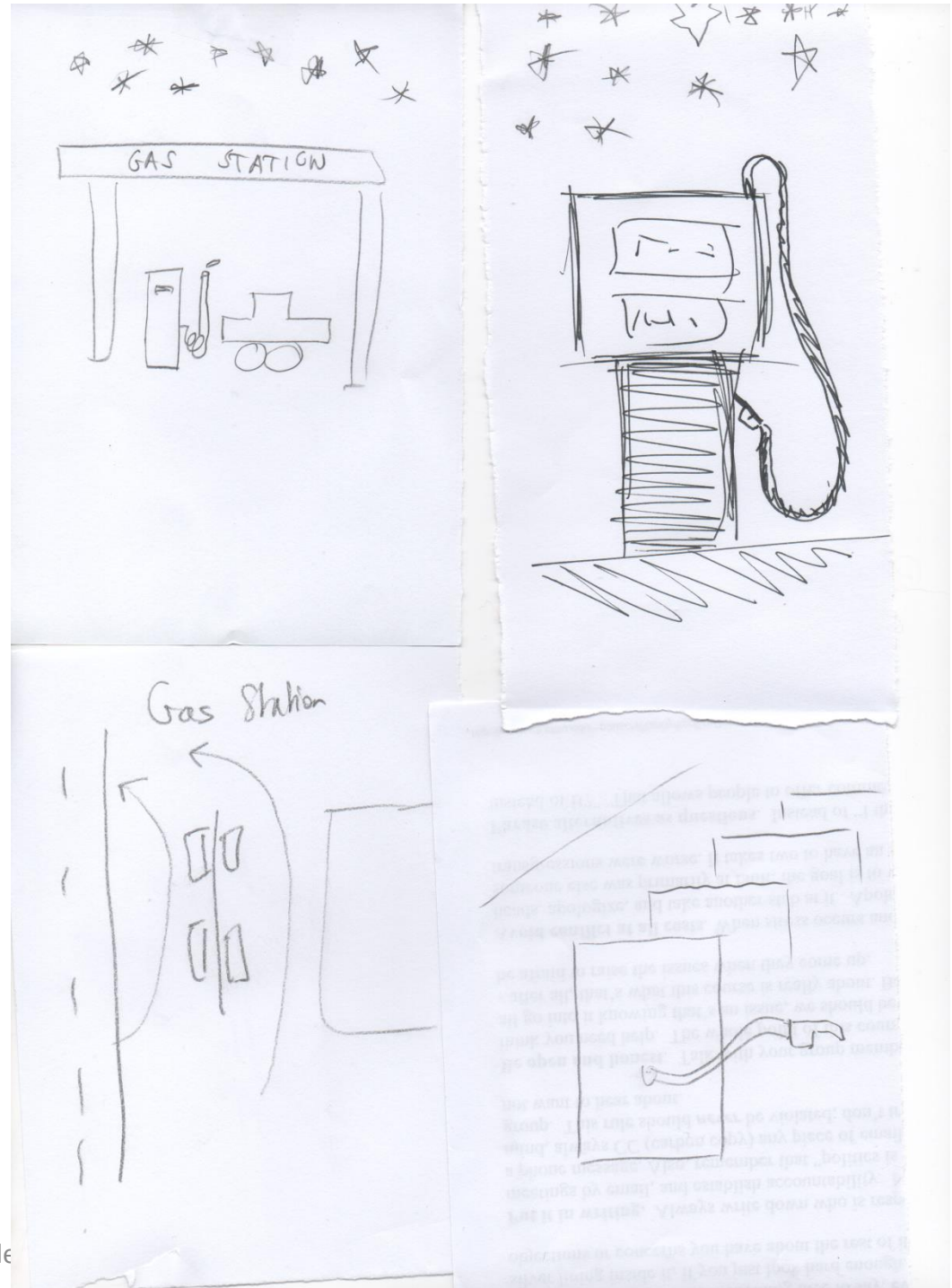

Gas Station


GAS STATION
Gas Station

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Visual Analytics Project

MAIN | SCHEDULE | PROJECT

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  - Lecture: Introduction to HCI
  - Tutorial: Group formation, picking projects
- January 19
  - Lecture: User requirements analysis
  - Tutorial: Conducting a requirements analysis
  - **Hand in Project Component I**
- February 2
  - Lecture: Sketching and Storyboards
  - Tutorial: Sketching and Brainstorming
  - **Hand in Project Component II**
- February 3
  - Lecture: Prototyping
  - Tutorial: Development of a low-fidelity prototype

February 23
  - Lecture: Interaction Design
  - Tutorial: Development of high-fidelity prototype
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March 2
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  - Tutorial: **Demo project component IV**
- March 9
  - Lecture: Information Visualization
  - Tutorial: Heuristic Evaluation
- March 16
  - Exam

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Visual Analytics Project

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# Finish Design stage this week and start prototyping coding next week

# *your next assignment (due Feb 23)*

- brainstorming session (spend 1h together)
  - sketch ideas, each on single sheet of paper
  - we will do this in the lab today with the 10+10 technique
- create an affinity diagram with the sketches
  - organize them into groups (see lecture 2 slides)
- Deliverable 1:
  - report on your brainstorming session
    - describe the range of ideas explored
    - briefly describe the major conceptual groupings you came up with (likely 3-5 )
    - report how the groupings relate to the user requirements from last assignment

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# *your next assignment (due Feb 9)*

- select and polish ideas
  - from the affinity diagram
  - select the three or four most promising sketches
    - three if you are in a group of three, four for groups of four
    - they do not have to be from different students
    - discuss these sketches
    - re-sketch them on a piece of paper neatly, one per student (even if it was not your original sketch)
      - add annotations, provide descriptions where necessary, add date and name of re-sketching student
- Deliverable 2:
  - the 3 or 4 re-sketched ideas.
  - add the whole set of sketches as an appendix.

# *your next assignment (due Feb 9)*

- create storyboards
  - take the three sketches and turn them into a storyboard
  - each student should do one
  - put your name on it
- Deliverable 3: one storyboard per idea / student

# *your next assignment (due Feb 9)*

- Due on Monday Feb 9th at noon

- Exceptionally this time, hand-in electronically.
  - You will receive a confirmation e-mail from me (2 hours later or so)
  - If not, email me

- Attachement (do not forget to attach as .pdf), see website for more detail:
  - D1: Brainstorming report
  - D2: 3 or 4 sketches, and all sketches in appendix,
  - D3: one storyboard per idea / student
  - **Appendix**

# *evaluation criteria storyboard*

| | Guiding questions | Bare minimum | Satisfactory effort & performance | Above & Beyond |
|---|---|---|---|---|
| ***Task choice*** | Do your storyboards clearly communicate a user's real problem or need? Convince us that this problem needs to be solved! | Task is vague, or ill-specified. Storyboards do not demonstrate the need for such a task | Storyboards communicate an authentic need and the task effectively | Task is unique and addresses a real need. Storyboards clearly convince reader of the task's authenticity. |
| ***Design alternatives*** | Do your storyboards communicate significantly different alternatives? Do you demonstrate how your idea solves the user's problem or desire? Don't be married to an idea. Generate as many as you can and show us! | Little variation among each storyboard of either interface or scenario. Designs do not convincingly accomplish the task at hand. | Storyboards show significant variation in interface or scenario. Designs solve problem to a degree. | Storyboards demonstrate deep thought about multiple design alternatives, Utility of designs is shown clearly & elegantly. |
| ***Clarity*** | Are your design ideas communicated clearly? Are the important aspects of your interface illustrated? Do your storyboards give a decent understanding of how your interface works? We are not looking for artistry, just good communication! | Storyboards poorly communicate design ideas. Lacks key elements necessary to establish scenario and design solution. | Storyboards communicate design ideas effectively, using a solid mix of illustrations and words to focus on key elements of story. | Illustrates ideas intelligently, focusing on important scenarios and interface elements. Relies less on labels for explanation. |
| ***Research*** | Did you use insights from the user requirements assignment? | Design ideas are based more on author's ungrounded ideas than on research | Design ideas are taken directly from user research | Design ideas are based on user research and go further to addressing *root* of breakdowns or opportunities |

# *Next: your project component IV*

- build a vertical prototype
  - follow storyboard from component III
  - if your requirements or storyboards are not usable, send me a new one and get it approved
  - pick a programming language you like
- prototype should
  - be functional, core functionality has to work
- prototype does **not**
  - have to run on final platform (e.g. mobile device, web browser ,…)

# *your next project component*

- deliverable
  - on March 2nd
  - print out and bring grading sheet to class
  - 10 minute demo of your system
  - every student has to do part of the presentation
- next time
  - I want to talk to every team and see progress made in the lab
  - take the time to check with me if you are on the right track

Lab today

# *WORK ON YOUR DELIVERABLE III*

# *sketching for your Projects*

# *10 Plus 10 Technique - reminder*

- the 10 plus 10 technique is a great way to generate ideas, PLUS refine those ideas
- we will actually use the 10 plus 10 technique today to generate ideas/refining them for the purpose of your project

# *10 Plus 10 Technique - reminder*

- Generate 10 sketches individually that relate to your project design problem (individually) (10 mins)
  - These sketches must be meaningfully different (i.e. avoid variations on the same idea)
  - Take risks: do not limit yourself to the realities of "today"
  - Avoid judging the quality of these ideas now; the point is to get diversity
- Discuss within your group each of the design ideas represented in the sketches, then select the most promising 3 design ideas (10 mins)
- Using these promising design ideas, generate an additional 10 sketches that are variations of these 3 design ideas (10 mins)
- Discuss within your group each of these variations, and select the 2 best variations for each design idea (5 mins)
- Present these best ideas to the class and discuss (5 mins for each presentation, plus 5 mins of discussion)

# *Your Design Challenges*

- Your project idea!
- Give it a name

# *Phase 1: Make 10 sketches (10 mins)*

- Generate 10 sketches **individually** that relate to the design problem (individually)
  - These sketches must be meaningfully different (i.e. avoid variations on the same idea)
  - ***Take risks: do not limit yourself to the realities of "today"***
  - Avoid judging the quality of these ideas now; the point is to get diversity

# *Phase 2: Internal Discussion*

- Discuss within your group each of the design ideas represented in the sketches

- Select the most promising 3 design ideas

# *Phase 3: "Plus 10" (10 mins)*

- Using the 3 promising design ideas, generate an additional 10 sketches that are variations of these 3 design ideas

- On a per-person basis, it might be best to stick to one of the design ideas

# *Phase 4: Internal Dicussion 2*

- Discuss within your group each of these variations
- Select the 2 best variations for each design idea

# *Phase 5: Present (5 mins/group)*

- Present these best ideas to the class and discuss (5 mins for each presentation, plus 5 mins of discussion)

Lab today (if time remaining)

# *CONTINUE WORK ON DELIVERABLE I OF YOUR PROJECT COMPONENT III*