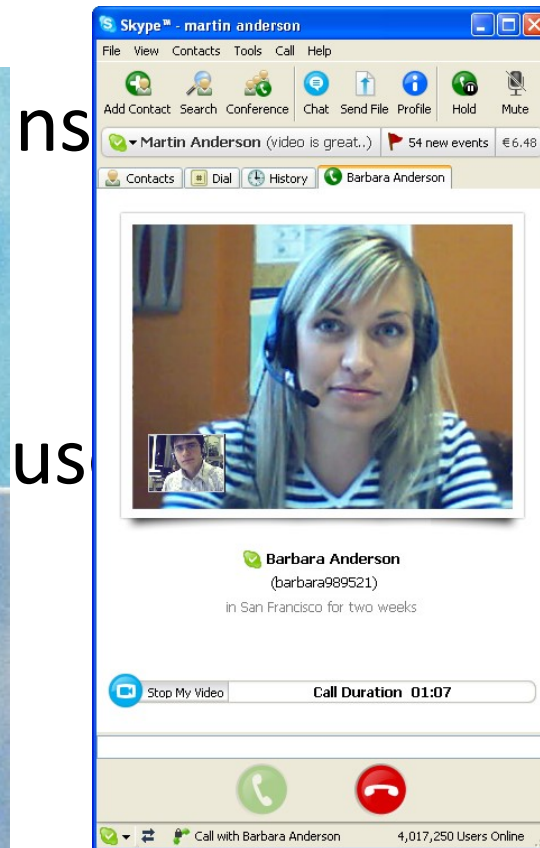# Prototyping

Video Calling

-
-

1969

2006

2010

Contextual Design: Stages

- Interviews and observations
- Work modeling
  - Five Models
- Consolidation
  - Affinity diagrams + consolidated models
- Work redesign
  - Task Analysis, Visioning, New task description (HTA)
- User environment design
- Prototypes
  - Today
- Evaluation
- Implementation

Contextual Design: Stages

- Interviews and observations
- Work modeling
- Consolidation
- Work redesign
- User environment design
- Prototypes
- Evaluation
- Implementation

Brainstorming

Can Objects Have Politics?

- Does a pen have politics? Why or why not?
- Can a CD?
- Can a DVD player?
- Does the Google search engine?
- Can a bridge?

Politics of Design

- Check out Chris Csikszentmihalyi's work
  - http://edgyproduct.org/pm/pmwiki.php?n=Main.Index
- Premise
  - All technology is political. It is created by the most powerful organizations on Earth – businesses and governments.
- Design work on
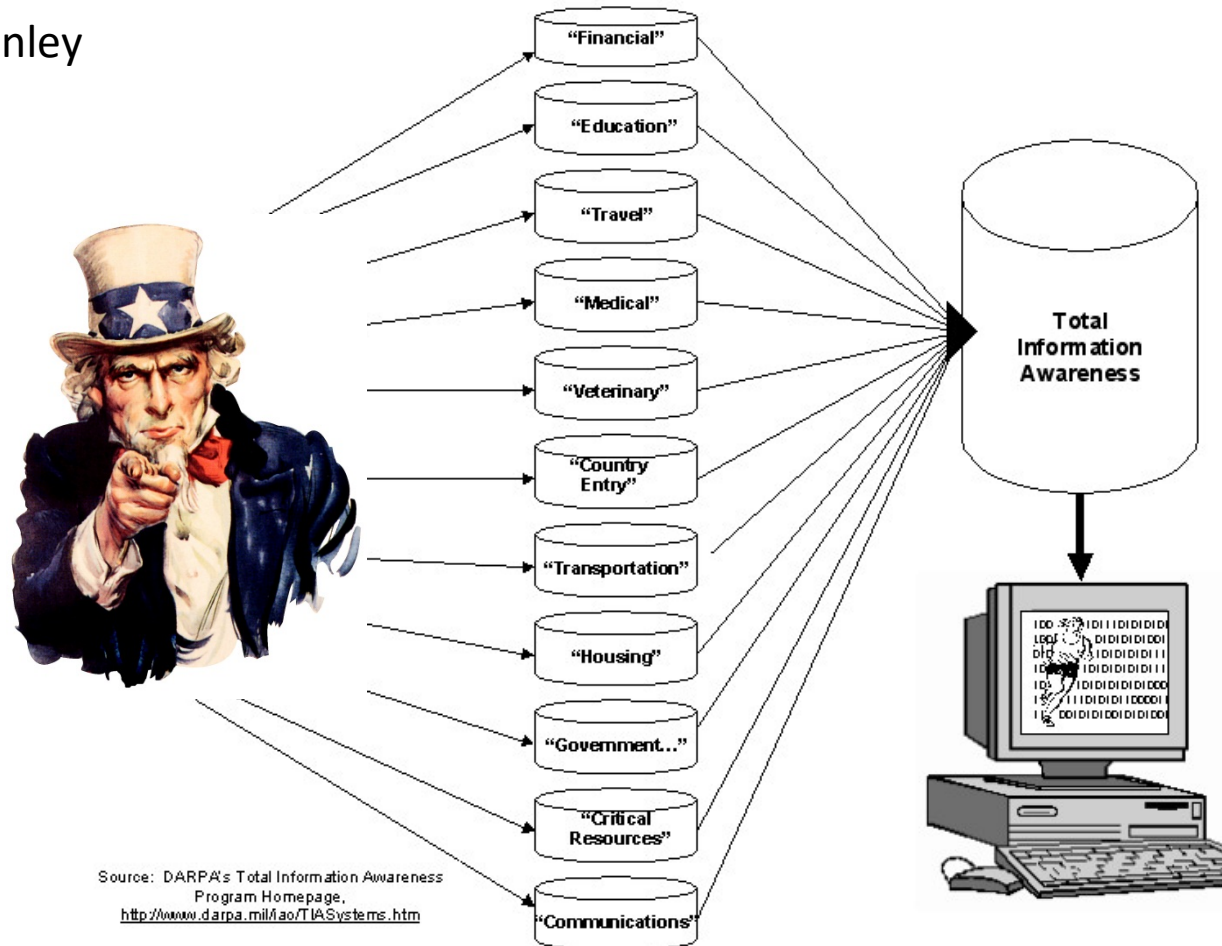 - Countersurveillance
  - Civic engagement

Countersurveillance

- "random screening" by Ayah Bdeir
- Airport screeners seemed to be taken a frequent interest in her
- Designed a plastic suit to evaluate screeners
  - Video

Total Information Awareness

Ryan McKinley

Source: DARPA's Total Information Awareness Program Homepage, http://www.darpa.mil/iao/TIASystems.htm

Baghdad in Boston

Politics and Objects

- *The Whale and the Reactor*, Langdon Winner
- Primary thesis: Objects always have politics embedded within them
- Example: Argues that Robert Moses' bridges from NYC to Long Island were racist because they had low clearance
- Why?

Understanding to Design

- Your designs will change the way people work
- You need to understand *how* this change will manifest itself
- What politics will you design into the new tools?
- Will it mesh with their politics?
- First you need to understand *how* they do work and *what* matters to them…

On to Design

Designing the Interaction

- Any design needs to address identified requirements

- To be successful, must integrate with constraints of culture of practice

- Must also properly delegate work between user, computer, and existing tools/artifacts

Assign the Right Job

- People and computers are good at doing different things

- Consider the user and the computer *partners* in the context of solving a problem

- Don't assign a task to the user or computer when the other party is better suited to it

- Always ask, "What parts of this task are appropriate for the computer? For the person?"

Delegating Work

- What are computers good at?
- What are people good at?

What Computers Are Good At

- Perfect memory
- Long-term memory
- Fast calculations
- Processing large amounts of data
- Repeatedly performing a task the same way, every time
- Mundane, routine, unvarying, *well-defined* tasks
- Non-destructive editing and experimentation
  - "Undo"
  - Layers
  - Version control…
- …

What People Are Good At

- Creative tasks
- Open-ended tasks
- Working with their hands, eyes, ears
  - Responding to touch, smells, sights, sounds…
- Using physical and digital media
- Finding patterns
- Interpreting "fuzzy" data
- Working with ambiguity and incomplete data
- Understanding context
- Understanding emotion

Computers versus People

- Computers are good at computation
  - Accurate calculation
  - Storage and retrieval
  - Defined tasks
  - Repetitive processes
  - Non-destructive editing and experimentation

- People are good at "soft tasks"
  - Creative/open-ended tasks
    - Design, writing a paper
  - Empathy
    - Recognizing emotions
  - Interpreting fuzzy data
  - Finding patterns
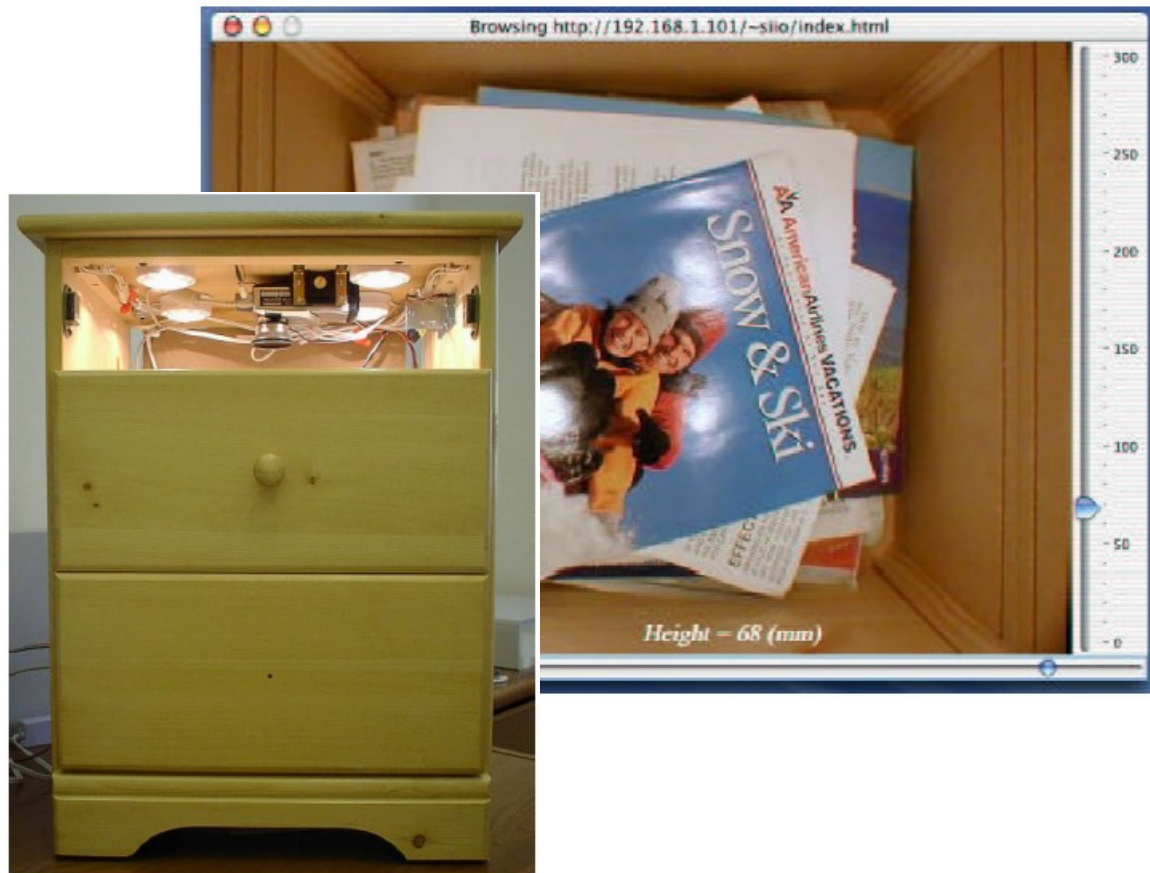
Properly Partition Work

- Computer doesn't have to do everything
  - Just needs to help person be faster, more efficient, more accurate, more satisfied…
- Don't try to solve everything
- "Partial" computational solutions still valid
  - Add-ons that augment existing methods

Blending Physical and Digital


Anoto Pen

Strata Drawers

Itiro Siio (2003)

Designing Prototypes

- Goal is to build and prototype a system
  - Must satisfy vision
    - Recognize what is good about existing systems
    - Consider how you can naturally augment them
  - Must take into account cultural constraints
    - Use consolidated models
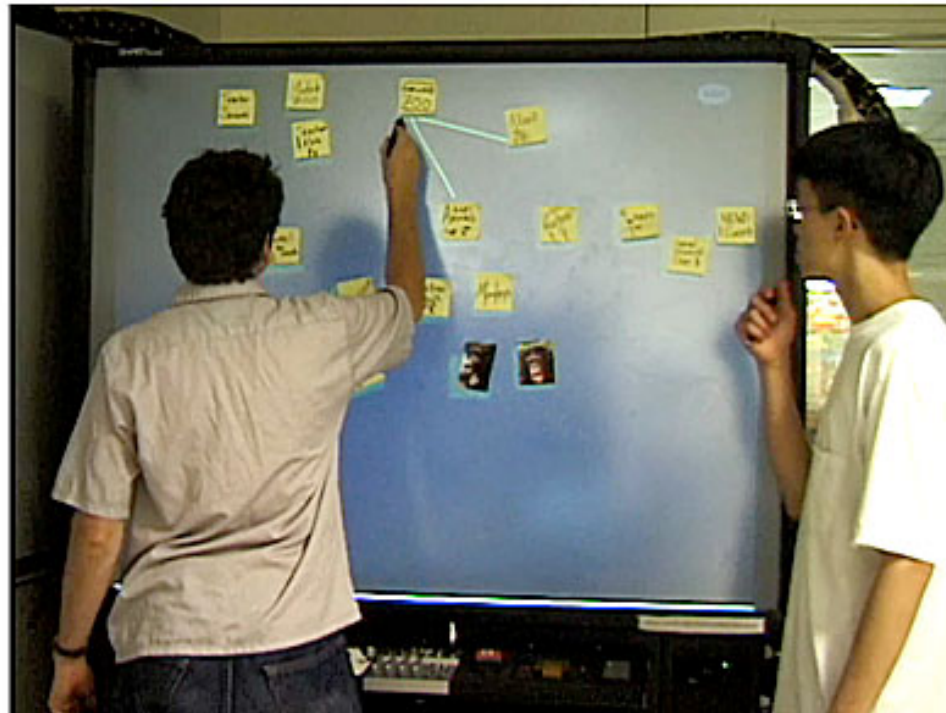 - Must properly partition the work

Preserving What Works

- Paper-augmented digital documents
  - Papiercraft
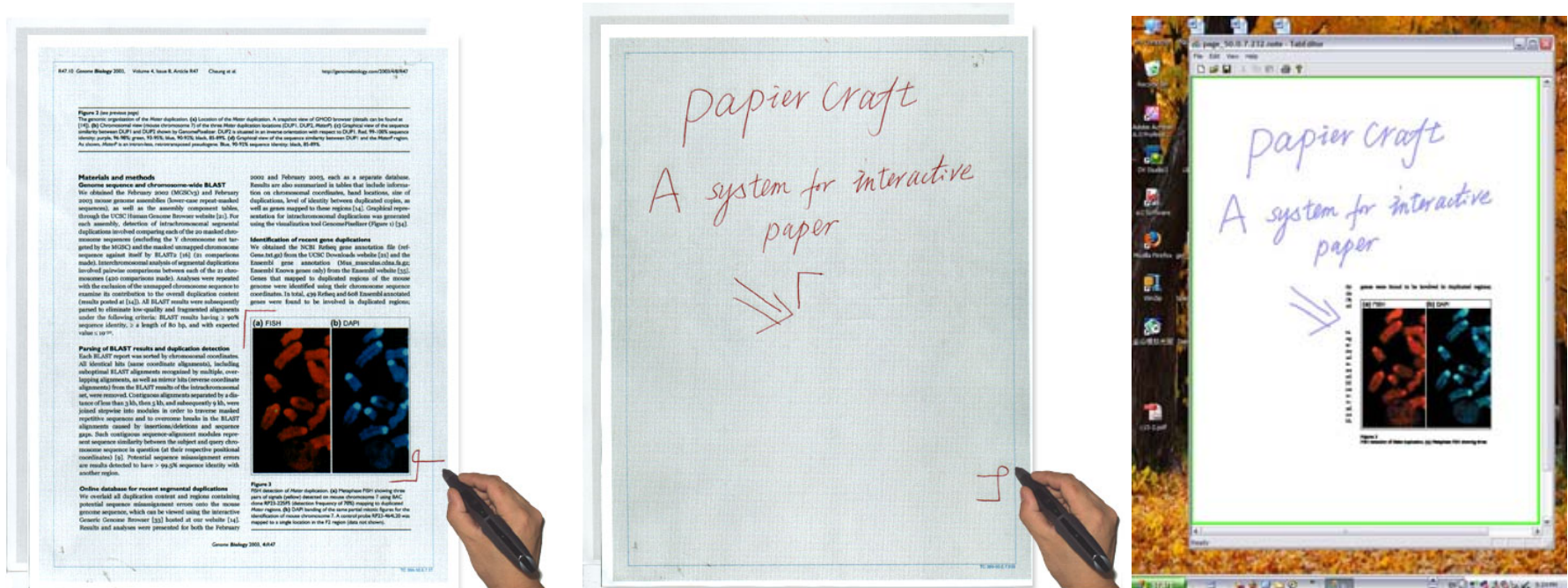
Preserving What Works

- Designer's Outpost

Preserving What Works

- ButterFlyNet

http://hci.stanford.edu/research/biology/butterflynet/
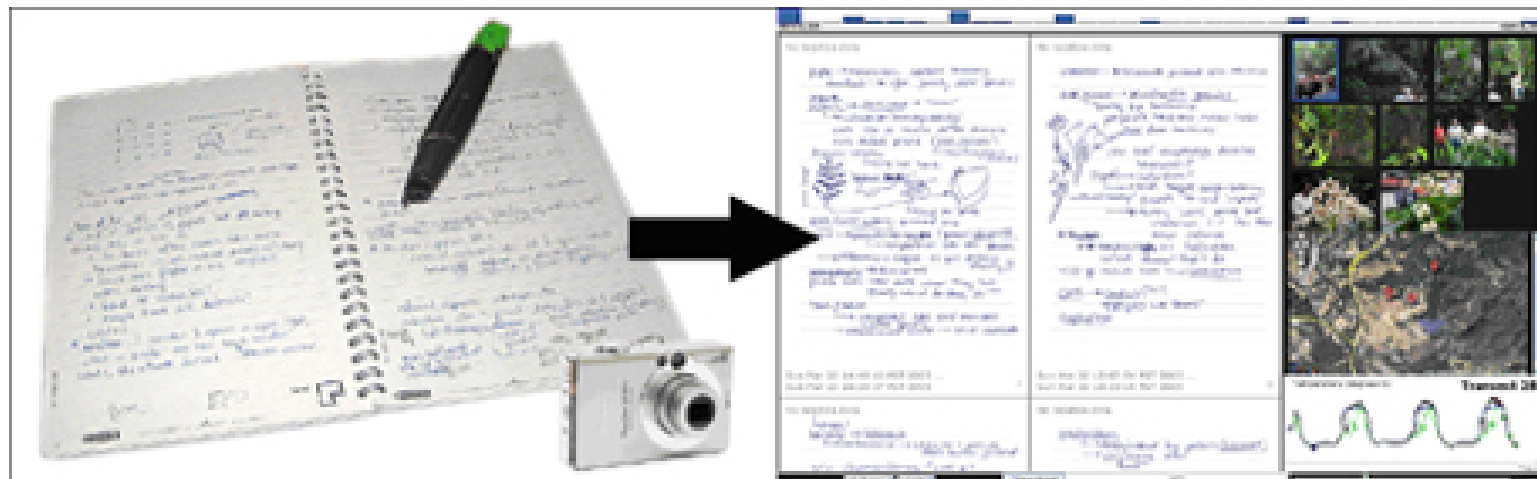
Preserving What Works

- Jump
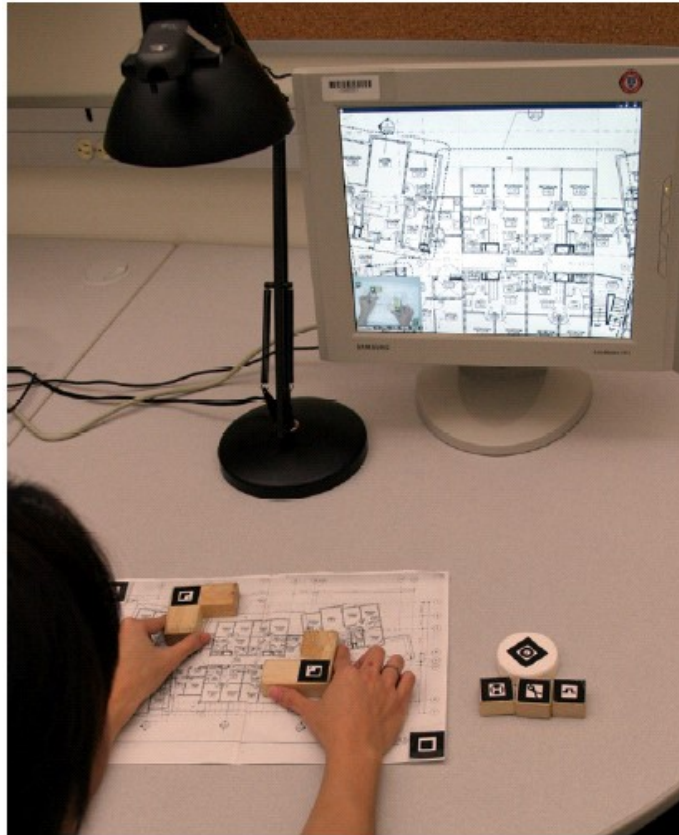
Design

- Design is the process of planning *deliberate* change for the better
- There is no one right "design" for any ill-defined, open-ended problem
- *Any* design can be improved. <u>Always</u>
- Any design is thus the result of choices made to satisfy negotiable and non-negotiable constraints

Design Process

- No one "right" design process
  - Can't follow a series of "textbook" steps to be guaranteed a good design
- But there are common practices

Design Process

- Ideate
- Select / evaluate
- Repeat ideation at finer level of granularity
- One useful tool is a "design space"

Design Space

- Design space is both conceptual and a real tool
- Conceptually, refers to the full range of possibilities for addressing identified problem
  - Infinite in scope
- Realistically, refers to a mapping of one or two dimensions of the design
- Helps to organize and suggest possibilities
- Example: Digital vs. physical, manual vs. automatic, input modalities, output modalities
  - More on this next week

Design Process

- Start with concrete goal: a vision
- Ideate
  - Generate alternatives
  - For example, everyone come up with 10 design ideas for new implementation
    - Sketch these ideas on paper
  - Explore sets of alternatives for as long as possible
- Analyze design space for system
  - Use affinity diagrams to cluster ideas
  - Look at dimensions of design
  - Explode and explore design alternatives at each level

Ideation

- Recall Ideo video
  - Generate many ideas – e.g. come up with 25 design ideas
  - Pick 5 best and develop 5 alternatives for each
  - Continue refining best ideas.
- Don't develop blinders
  - Cherry pick ideas from other ideas
  - Goal is to come up with best overall design
- Use affinity diagram to find common threads in your solution
  - Leverage this into a design space

Design Space

- Typically done by mapping one or two dimensions of the design
- Serves to:
  - Represent all possible solutions
  - Provide a conceptual tool to ideate
  - Represents an externalization of the possible space of solutions
  - Helps organize and suggest solutions

Design Space Concept

Tastescreen   Beancounter

http://www.monzy.org/eui/

Output Modalities

- Taste
- Movement of objects
- Sound
- Printer
- Display

Input

Tangible   Mixed   Electronic

Design Space Concept

Work
Change

Large

Small

Tangible   Mixed   Electronic

Medium

Design Space Concept

Automatic

Automation

Manual

Desktop   Tablet   Handheld   Tangible

Platform
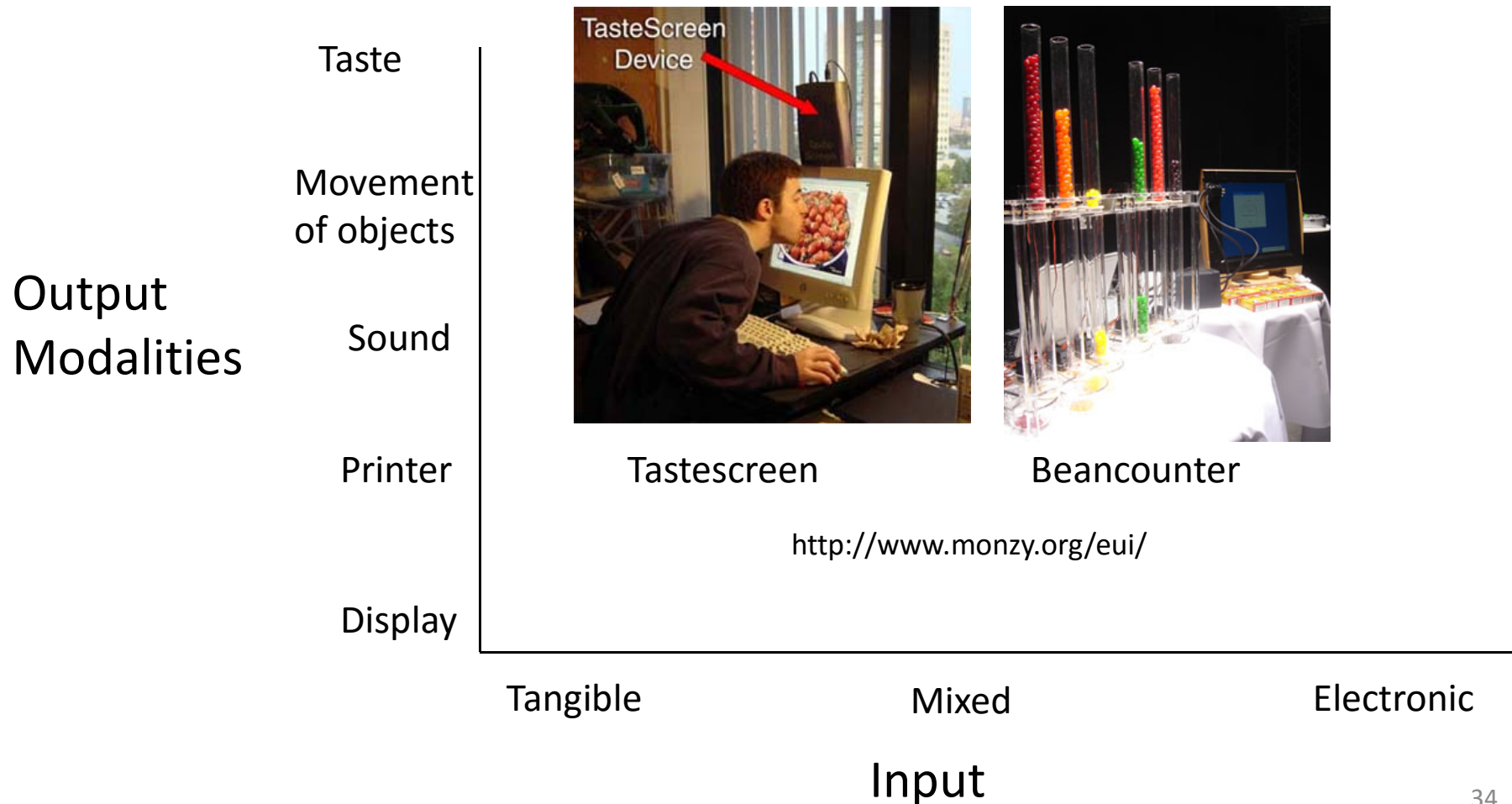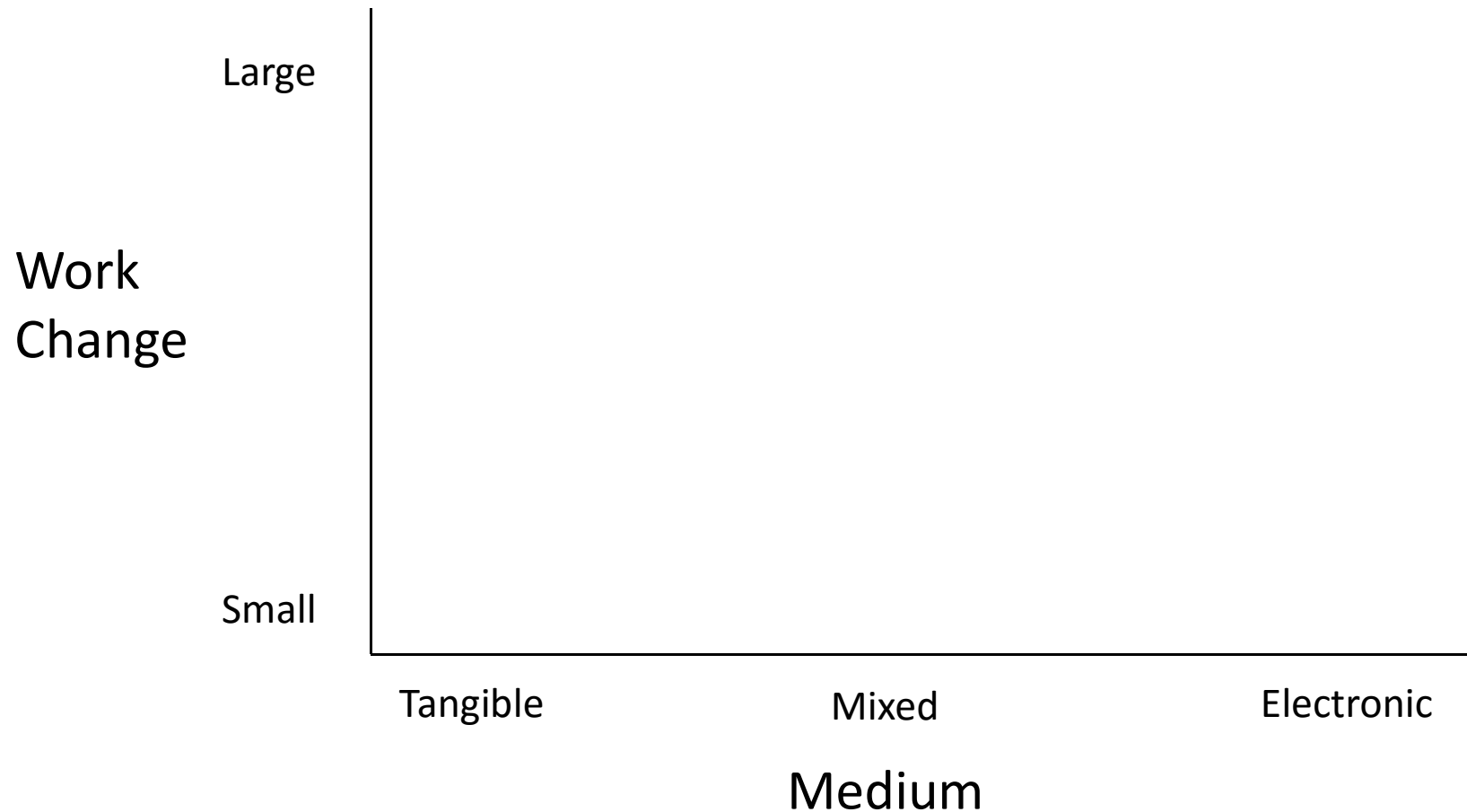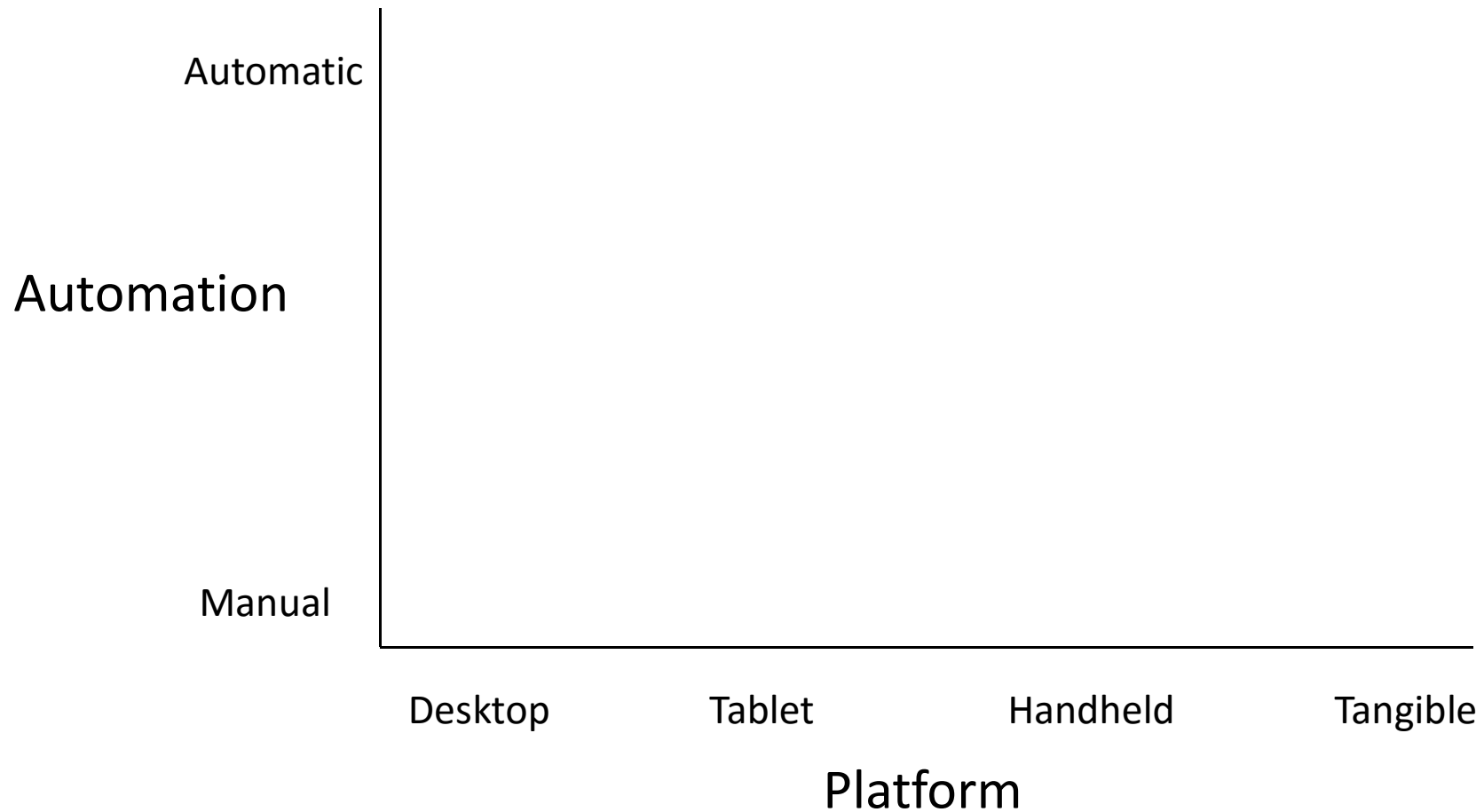
Design Representations

- Need tangible design representations
  - Off-loads cognition
  - Communicate design to others
  - Immerses you in design (for study)
  - Allows iteration, comparison of alternatives
  - Allows exploration of holes in design ideas, unexplored alternatives
- Think about Ideo's process
  - Iterative refinement
  - Looking at each others designs and voting
  - Good ideas come from bad ideas
  - Allows others to use your bad ideas
  - Not about feasibility

On to Prototyping ...

- Goal: To engineer the interaction with the system from the user's perspective
  - Input/Output
  - Guiding use
- UED provides an initial high-level design granularity
- Tools
  - Scenarios and storyboards
  - Mental models of interaction

Scenarios

- Also called User Stories
- Plain language description of interaction with software
- Includes
  - Goals
  - Expectations
  - Actions
  - Reactions
- Allows user to understand how software will be used
- Early stage evaluation
  - Are goals and actions/reactions reasonable (grounded in reality)
- Late stage evaluation
  - A set of tasks that users can perform with software

Scenarios (1)

- Can be conveyed in many ways
  - Text only
  - Test with example screenshots
  - Storyboards
  - "acted out"
  - Movie
  - Etc.

Scenarios (2)

- Tom presses the on button on his smartphone and is presented with a screen where he can select his username and input his password. After logging in, he is presented with an alphabetically sorted list of application icons. He clicks on "Inventory Management." Pointing the smartphone camera at the box on the shelf, he presses the "scan" button on the screen to scan the QR-code on the side of the box into the system.

Scenarios (3)

- As the smartphone screen illuminates, Tom is presented with a login screen with a list of users on the left, 7 thumbnail-sized blank rectangles in the top right , and five rows of images below the bland spaces. After selecting his username with his finger, he click on 7 images in turn – his password for the system. As he clicks on each image it appears in the left-most empty rectangle at the top of the screen.

Scenarios (4)

- After selecting his name with his finger, Tom taps on one of the images to start entering his password. As each image is selected, it is dropped into the left-most blank rectangle at the top, but does not disappear from the list of images. In attempting to select a second image, Tom accidently presses the wrong image. When the images is placed in the blank rectangle, each is augmented with a red "x" in the top right corner. Tom presses on the "x" of the wrongly chosen image, and it disappears from the rectangle.

Scenarios (5)

- Need appropriate level of detail for stage in design
- Create alternatives
  - Explore the design space
- Consider a handheld inventory management system
  - Can elaborate to any degree to handle interactions, exceptions, etc.
  - Consider errors, worst-case scenarios, etc.
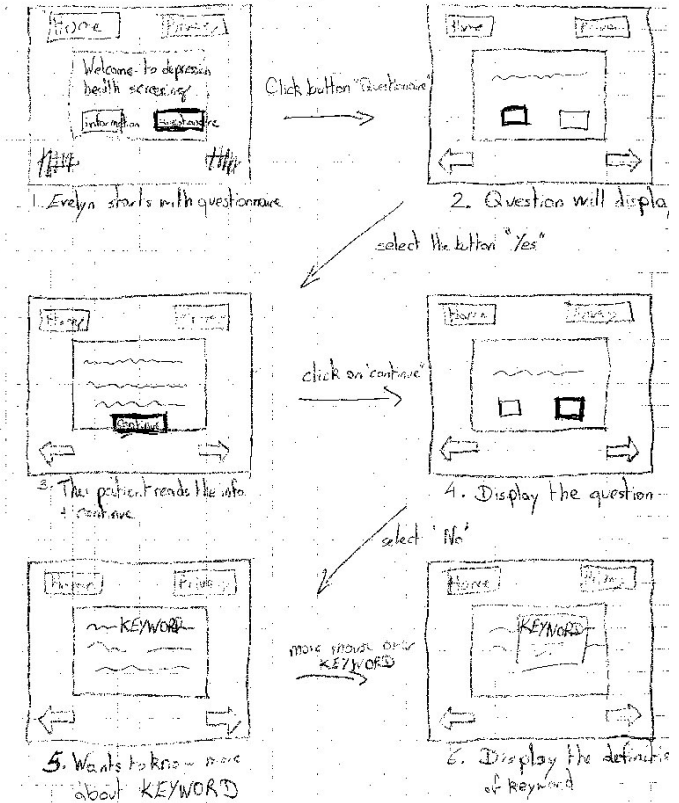
Storyboards

- Makes scenario real
- Shows people, words, screenshots, whatever is appropriate


```
┌──────────────────┐      ┌──────────────────┐      ┌──────────────────┐
│  Field engineer  │      │  Field engineer  │      │  Field engineer  │
│ goes out to work │─────▶│ calls up correct │─────▶│   enters data    │
│ site with wireless│     │      form        │      │ directly into form│
│ connected mobile │      │                  │      │  on mobile device │
│     device       │      │                  │      │                  │
└──────────────────┘      └──────────────────┘      └──────────────────┘
         ◀───────────────────────────────────────────────────┘
         │
         ▼
┌──────────────────┐      ┌──────────────────┐      ┌──────────────────┐
│  Field engineer  │      │  Field engineer  │      │  Field engineer  │
│ sends the form to│─────▶│ stores the form in│────▶│  prints form at  │
│    supervisor    │      │     the form     │      │   work trailer   │
│                  │      │    database      │      │                  │
└──────────────────┘      └──────────────────┘      └──────────────────┘
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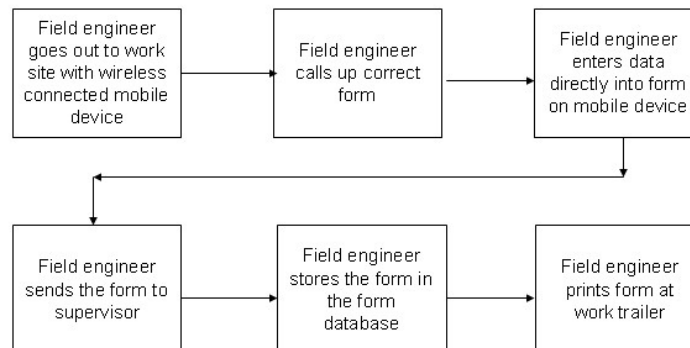
Storyboards

- Borrowed from movie industry
- Depict how work will play-out
- Uses simple, comic-strip narratives illustrating the most important aspects of a portion of interaction
- Particularly useful for scenarios that are difficult to describe in words

Creating a storyboard

- Develop a narrative
- A specific interaction, e.g. the password entry above (though this doesn't really need storyboard)
- Draw 3-5 panes
  - Each pane advances narrative
  - Can use photos in lieu of drawings
- Keep it simple
  - People can fill in details
- Add explanatory text to enhance understanding
- Use "droopy leaf" characters rather than stick figures

Prototyping: Dimensions

- Horizontal versus Vertical
  - Broad perspective on system functionality
  - Deeply exploring one aspect of system behaviour
- High fidelity versus Low fidelity
  - Lowest fidelity is paper/cardboard/crafts supplies
  - Higher fidelity includes Wizard of Oz prototypes
    - Wozzing

Wozzing

- Can fake interaction using pre-canned input and output
    - Real estate agents from last term
- Can also build elaborate applications
    - Sketchwizard is for pen-based UIs
    - Source downloadable and I have binary

Sketchwizard

SketchWizard: Wizard of Oz Prototyping of Pen-based User Interfaces
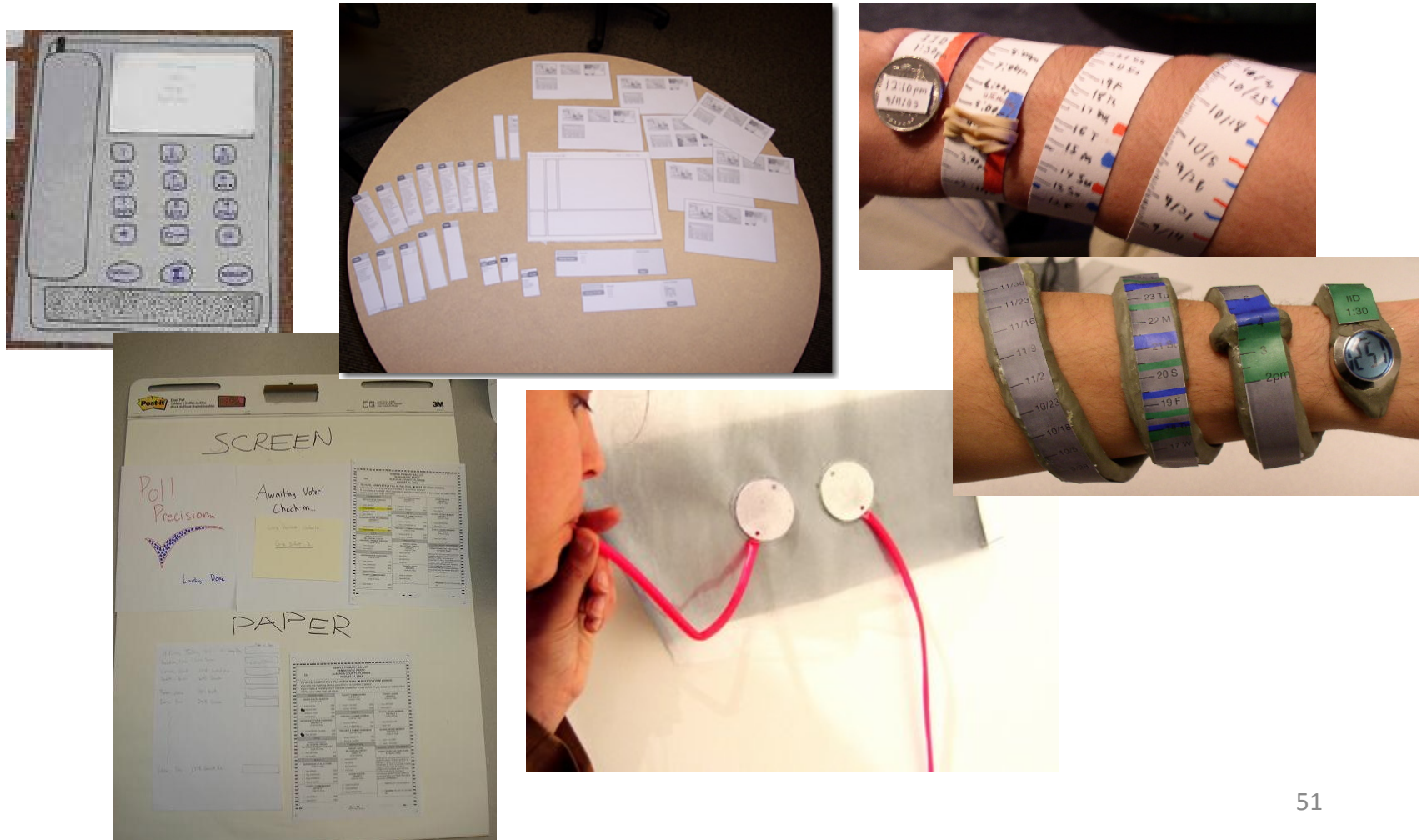
Richard C. Davis
U.C. Berkeley

T. Scott Saponas
U. of Washington

Michael Shilman
ChatterPop, Inc.

James A Landay
U. of Washington
Intel Research Seattle

Low-fidelity prototypes (Goal of Phase 2)

Do Low Fidelity Prototypes Make Sense?

- See Erick Schonfeld's article "Will you try my iphone app?"
  - Approached at CVS in Palo Alto
  - Asked by a Stanford student in Human-Computer Interaction course to try iPhone app
  - The app was a paper prototype

What Erick Schonfeld said:

- "... you might want to wait until you have an actual working app on an iPhone before testing it out in the wild and asking for feedback ..."

- "... I blame his professor for sending him on this hapless mission."

- "There is really no way to test an iPhone app on paper, <sic> the buttons don't do anything."

- "The best part: the course is called 'Introduction to Human-Computer Interaction Design'."

Just a Note

- It's all garbage (everything Schonfeld said)
- A blogger is a blogger because he writes well
  - Not because he knows anything
- Further
  - Low-fidelity prototyping is not unique to HCI
  - Wireframes in software engineering, web design
    - Wireframes Magazine
  - Sketches in architecture

Why use low-fidelity prototyping?

1. Easier implementation
2. Faster iteration
3. More variety
4. Quality of feedback

Creating low-fidelity prototypes

- Materials
    - Paper (various sizes)
    - Scissors, glue, tape, X-acto knives
    - Markers (various colors)
    - Overhead transparencies
- Build fast
    - Draw ideas quickly (don't worry about neatness)
    - Start with window
    - Use smaller papers for things that change
    - Have menus ready
    - Think about interaction – anything customer might want to see
- Remember to think about device differences!

Faster iteration

- High fidelity prototypes require careful implementation
  - Get caught up in details
  - Lose sight of big picture
  - Design – prototype – evaluate – iterate
- Require only kindergarten level skills
  - User can participate in design process as well
  - … Or can alter design
  - … Or can design on their own as well
    - Implies buy-in
- User feedback starts earlier

Variety

- Build lots of prototypes
  - Use photocopier and go to town
- Think creatively
  - Try different things
  - Get a feel for what client likes
- Overcome *Representational Determinism*
- Tools don't bias form

Representational Determinism

- The medium constrains your approach to solving a problem.
- Initial work done by Jiajie Zhang
  - Tic-Tac-Toe
  - Did four other equivalent representations
  - Showed that people did worse with other representations
- Why is representational determinism a problem? Who suffers from it?

Quality of user feedback

- High-fidelity prototype implies finished product
  - Users reluctant to make large-scale modifications
    - They are paying …
  - Architecture story
    - Users view hi-fi differently???
- High-fidelity prototype implies less variety
  - Limited time to build
    - Even prototyping takes time …

Does Feedback Differ?

- CHI study in 2003
- Found no difference between feedback from a computer prototype vs feedback from a paper prototype for two projects
  - Ticket machine
  - Calendar system
- Notes still lots of reasons to use paper prototypes, including
  - Prototyping tools don't support components and ideas
  - Want to incorporate non-technical in design process
  - When evaluation may lead to lots of drawings

Does Feedback Differ?

- Maybe
  - You can't really prove that it doesn't in every case with only two projects
  - Issue with independent variable
- So what?
  - Cost is a huge factor
  - Designers are cheaper than developers
  - See comments in Erick Schonfeld's post.

Design Progression

- Refinement of designs is iterative
  - More and more detail
  - Move from designing interaction to designing interface
  - Interaction is discourse between user and computer
  - Interface is the vehicle for interaction, the display components
  - Good design leads the user

Contextual Design: Stages

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- Work redesign
- User environment design
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- Implementation

Brainstorming