Design Thinking & Prototyping

SWE 432, Fall 2016

Design and Implementation of Software for the Web

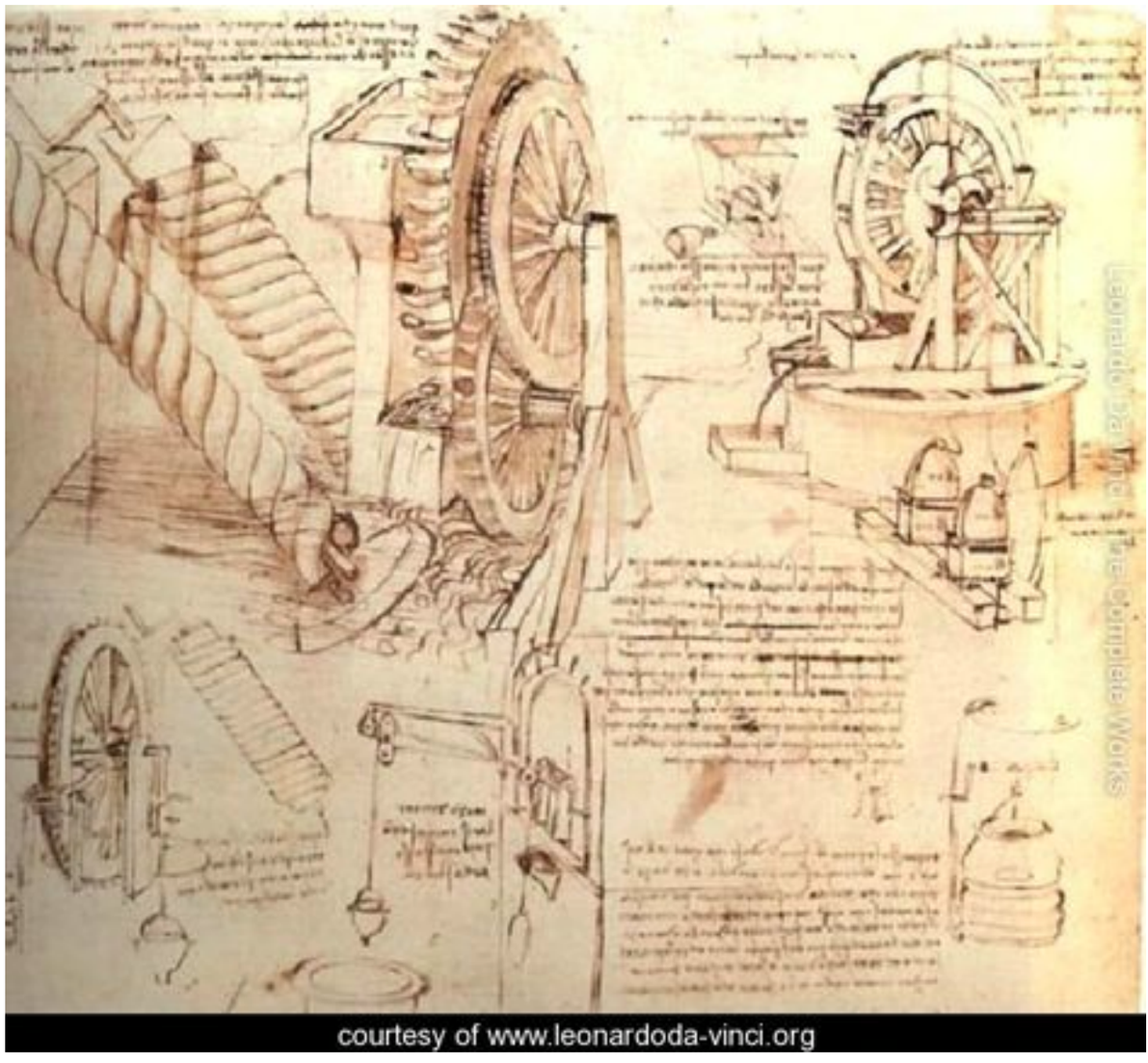
Today

- How do we set ourselves up to build good interfaces from the start?
- What is the iterative process by which we start out with a lot of ideas, and end up with some good, end result interface?

For further reading:
http://interchangeproject.org/2013/11/02/paper-prototyping/

Why sketch?

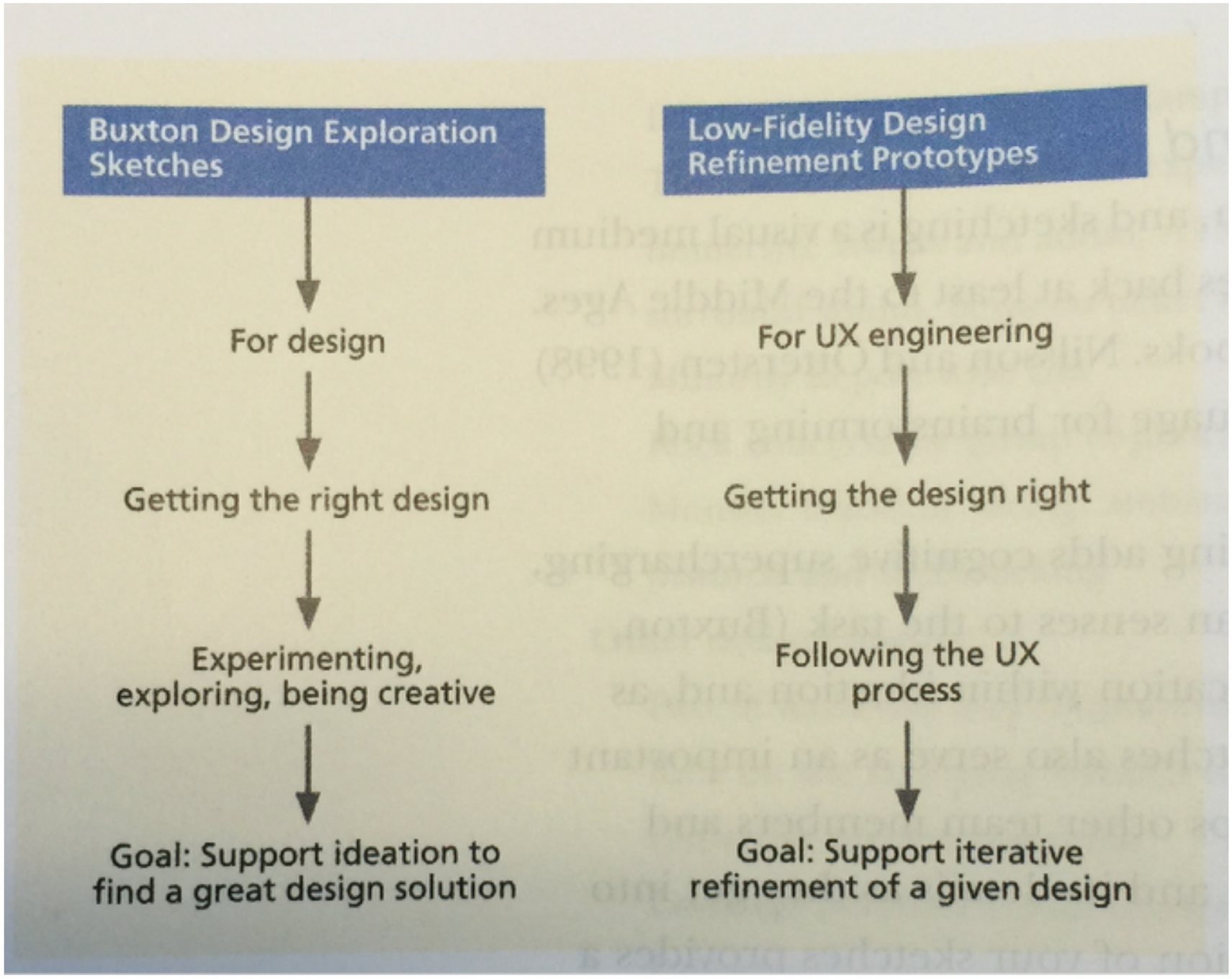
- Design is process of creation & **exploration**
- Sketching offers **visual** medium for exploration, offering cognitive scaffolding to externalize cognition
- Sketches let us explore many alternative designs



Why alternatives?

- Important to think broadly about a wide range of possible designs
  - What are the different ways in which user might do *x?*
- Rather than reimplement the status quo, alternatives offer options for doing things differently, enabling analysis of which is best
  - Important to challenge preconceptions and think deeper
- Rather than develop a single idea, sketching enables exploration and consideration of multiple designs, allowing examination of pros and cons
- Expert designers often create **many** alternatives
  - 10, 50, 100 alternative designs

Sketching vs. Prototyping

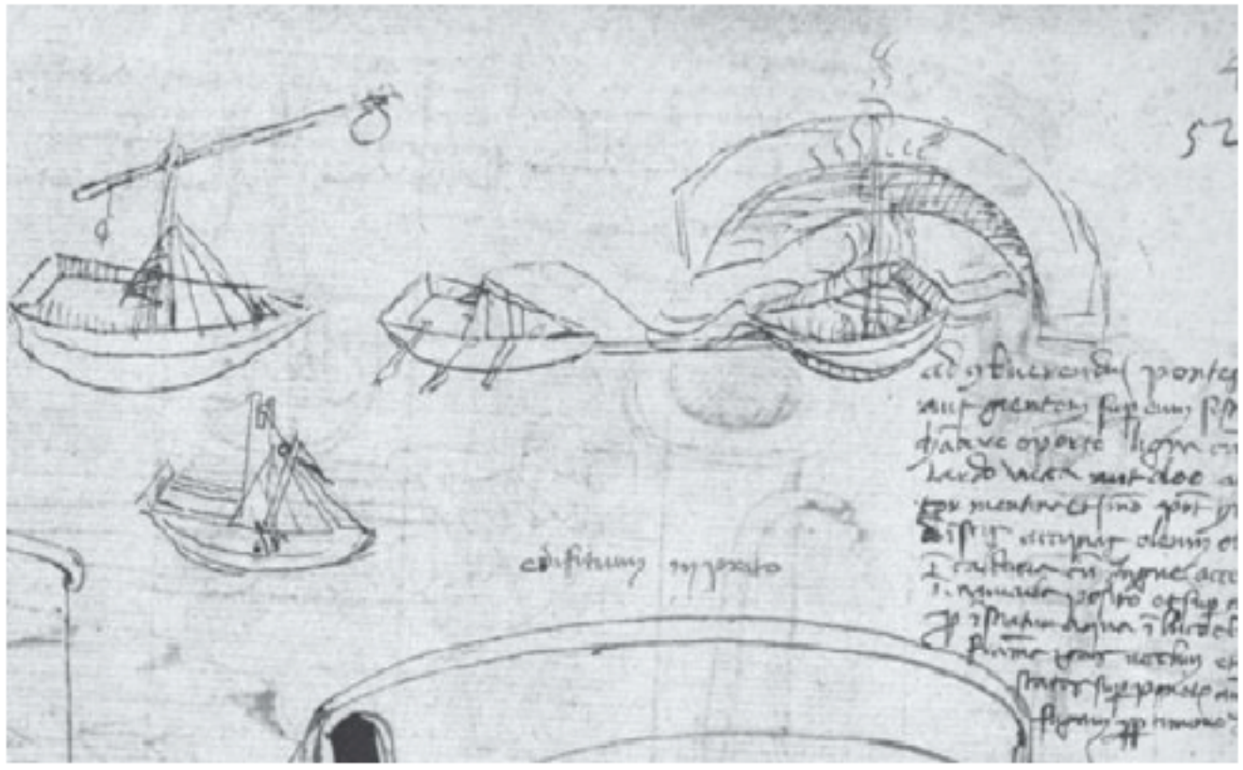


Physical sketches

- Production tools for sketching:
  - whiteboards, blackboards, cork boards, flip chart easels
  - post it notes
  - duct tape, scotch tape, push pins, staples
  - marking pens, crayons, spray paint
  - scissors, hobby knives, foam core board
  - duct tape
  - bits of cloth, rubber

Sketches are Sketchy

- Not mechanically correct and perfectly straight lines
- **Freehand**, open gestures
- Strokes may miss connections
- Resolution & detail **low** enough to suggest is concept
- Deliberately **ambiguous** & abstract, leaving “holes” for imagination



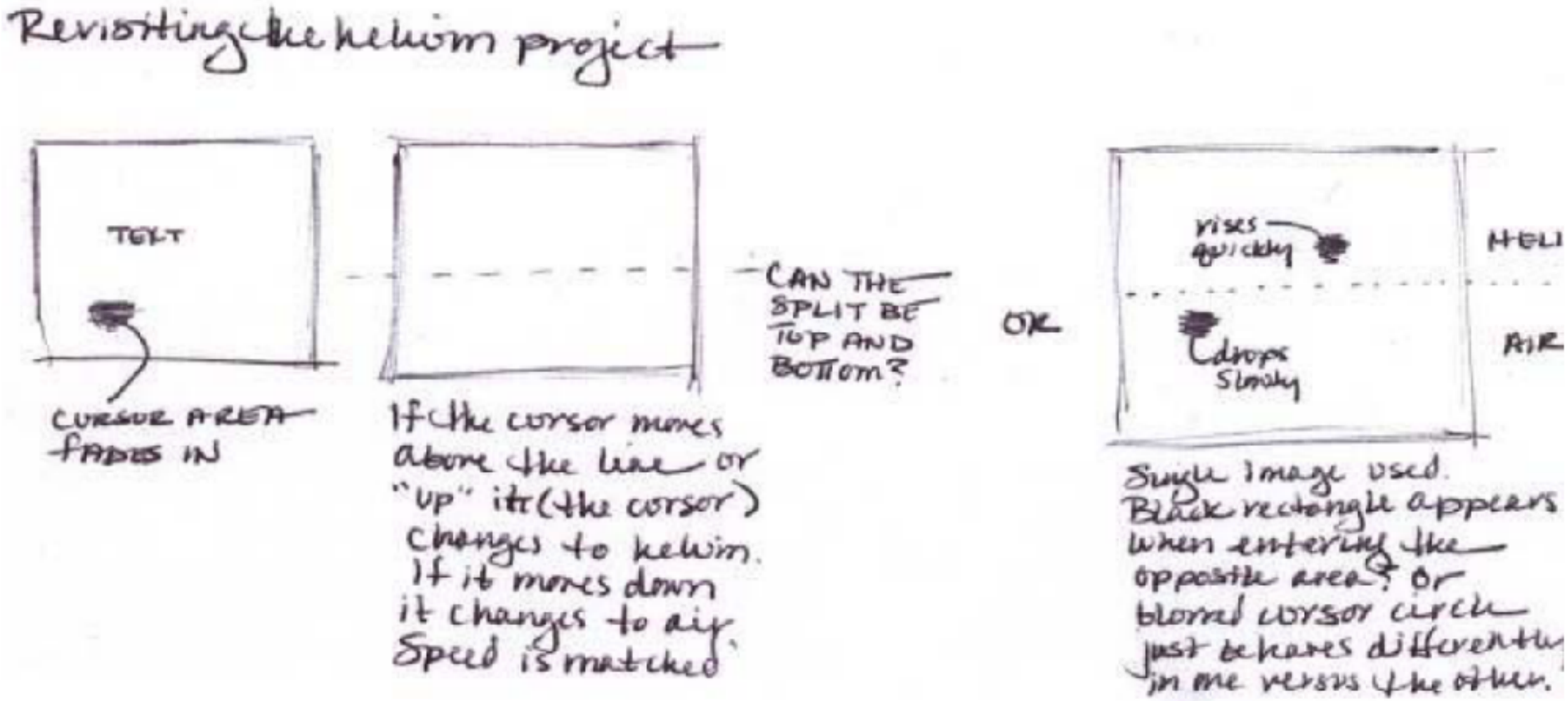
Benefits of Sketching

- No “programming” needed! Fast turnaround
  - Costs less
  - Allows more iterations
- Human computer
  - Can be (re)programmed quickly
  - Cannot crash
  - Changes can be made on the fly
- Developers feel less affection for status quo because changes are easy
- Rough “sketchy” appearance
  - Emphasizes content instead of appearance
  - Avoids low-level critiques of visual detail
  - Users are more willing to criticize high-level problems and less willing to blame themselves if something doesn’t work

Rules for sketching

- Everyone can sketch; you do not have to be artistic
- Most ideas conveyed more effectively with sketch than words.
- Sketches are quick and inexpensive to create; do not inhibit early exploration
- Sketches are disposable; no investment in sketch itself
- Sketches are timely; made in-the-moment, just-in-time
- Sketches are plentiful; entertain large # of ideas w/ multiple sketches of each

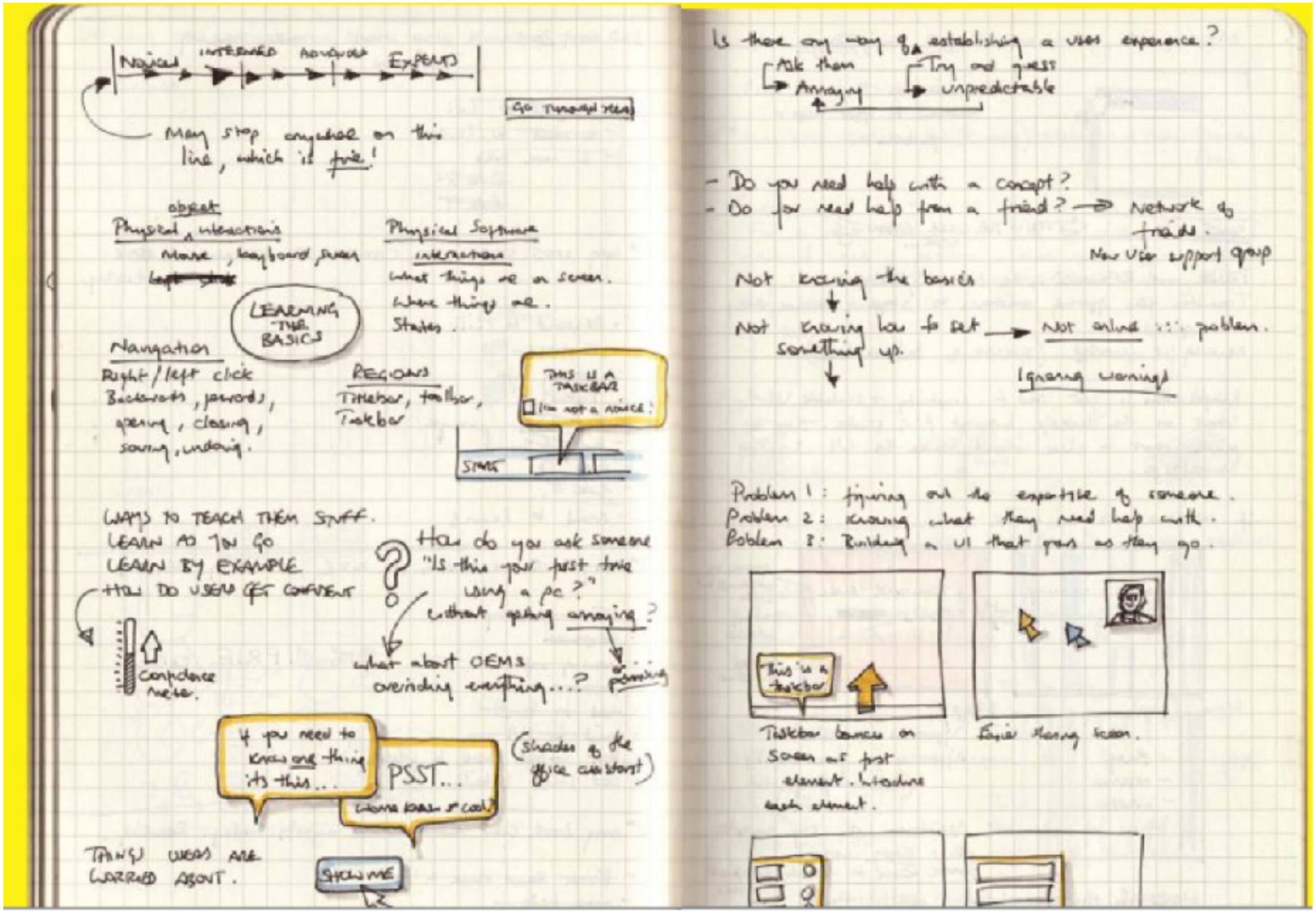
Sketches include annotations



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

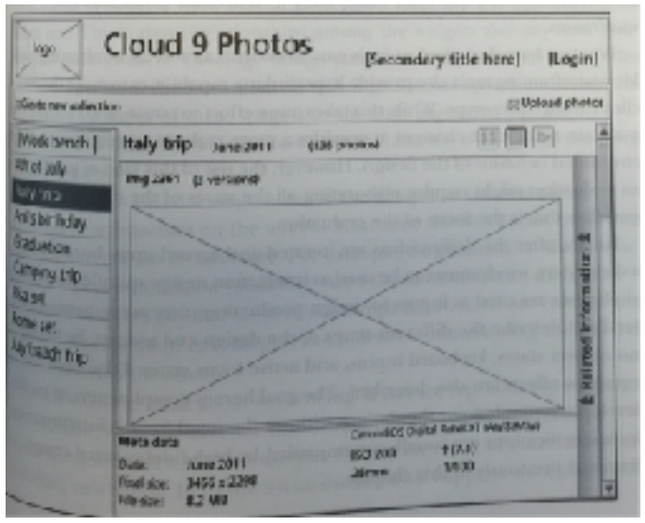
- Annotations explain what is going on in each part of sketch & how

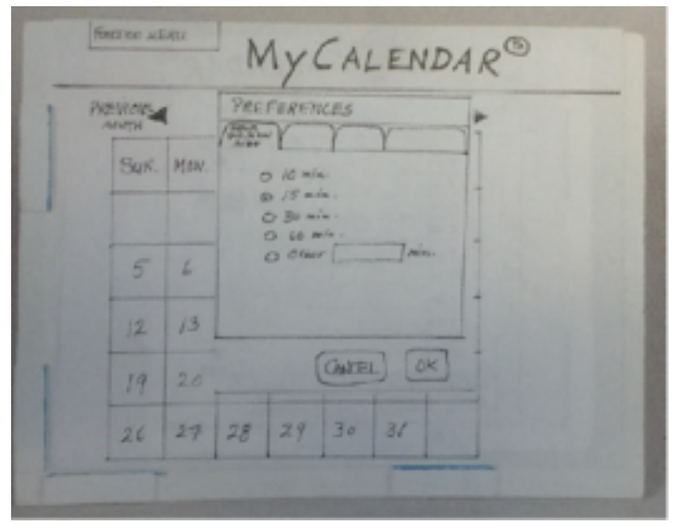
Sketches support design exploration



B. Buxton. Sketching User Experiences.

Fidelity of sketches & mockups





storyboard wireframe prototype

low ⟷ high

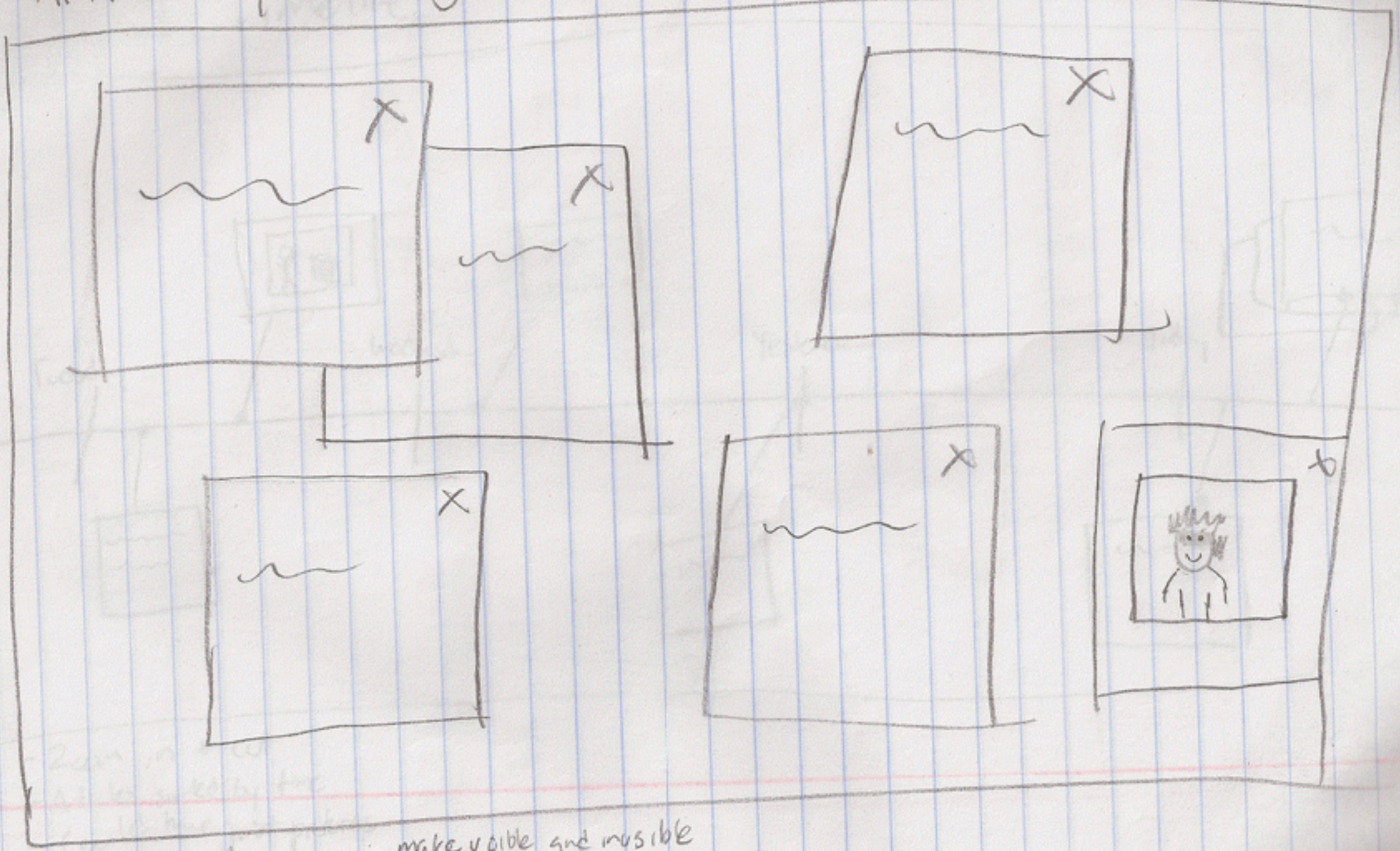
fidelity

(many details left unspecified)

(more polished & detailed)

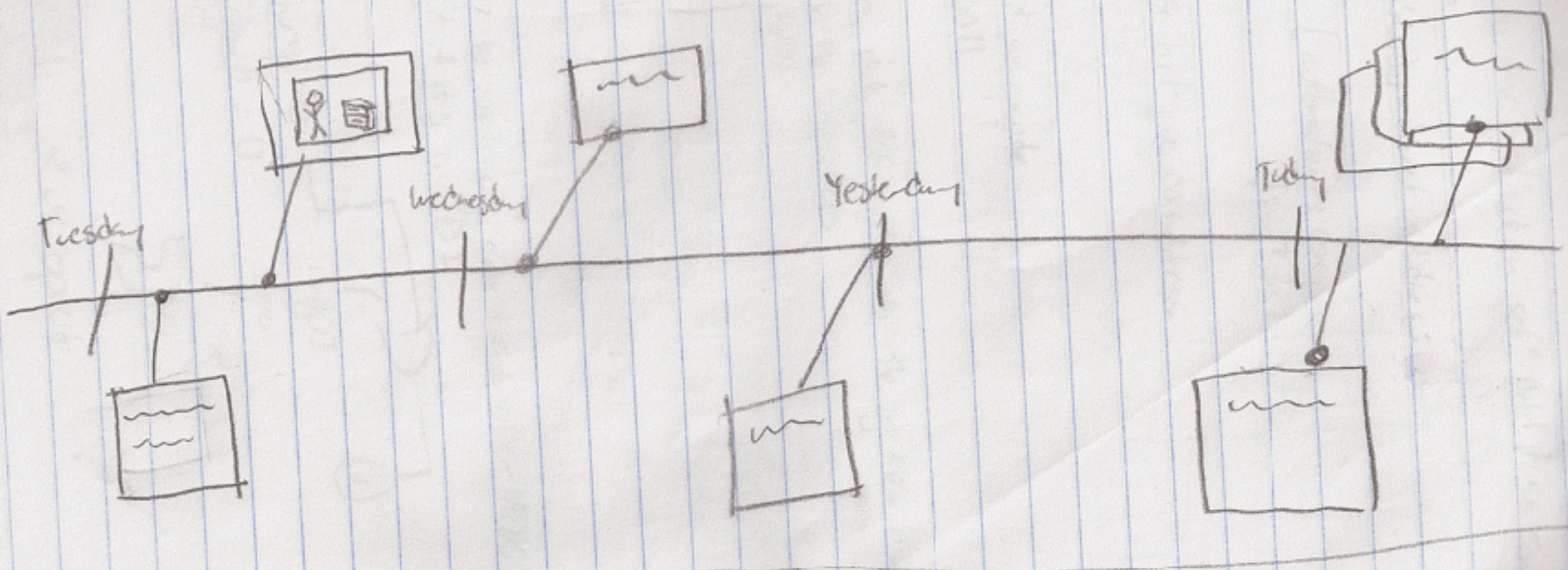
Sketching Example: News Viewer

Article Layout through moveable windows (DADA) - drag and drop articles



- Moveable windows
- closeable
- Layered by importance
- make visible and invisible

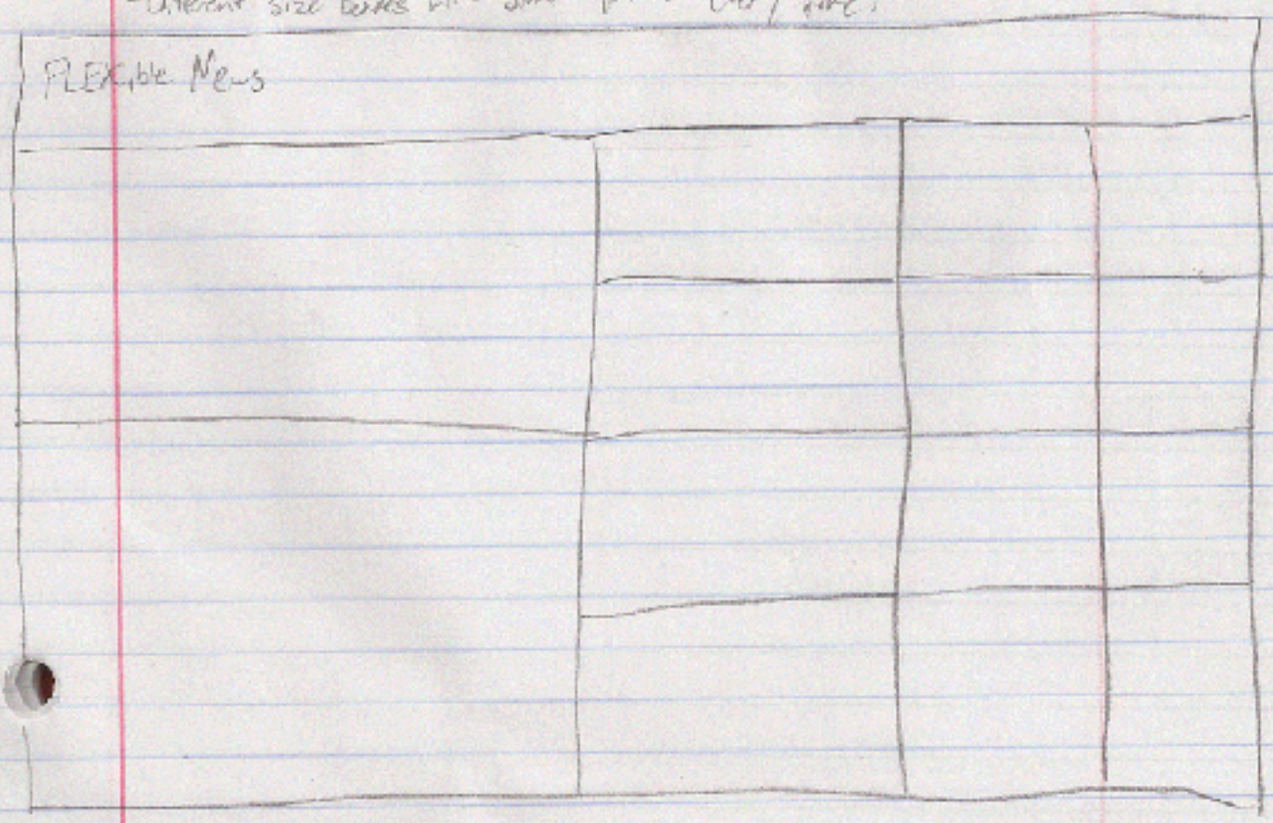
News Timeline



- Zoom in & out
- Articles sorted by time
- Could have just pictures

UID Wireframe

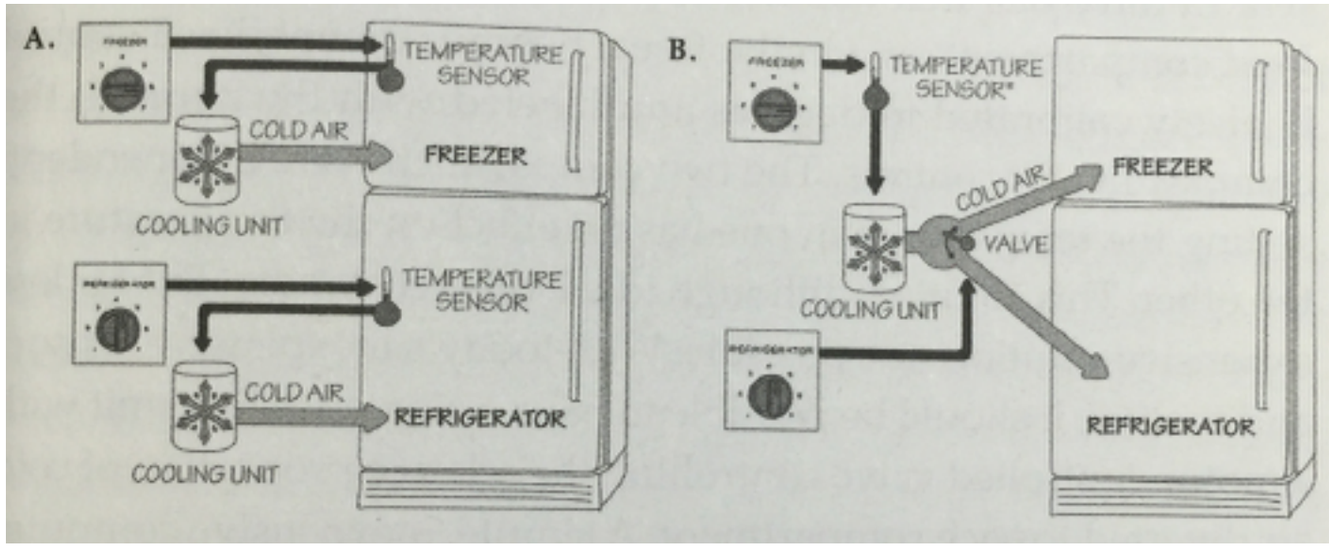
- Even boxes?
- Different size boxes with similar format every time?



Conceptual design

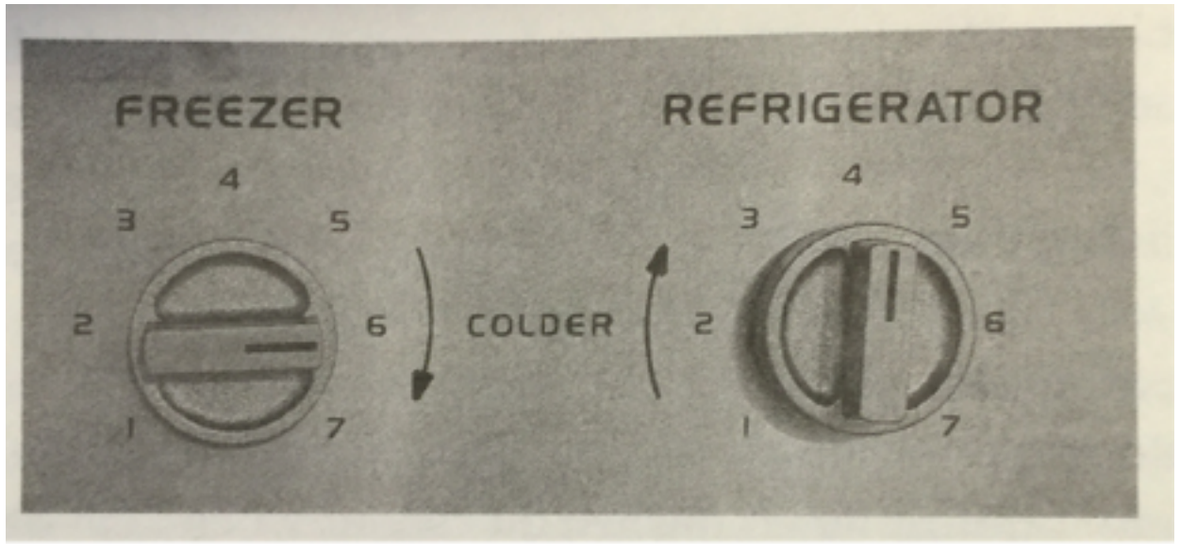
Designer's mental model

- Conceptualization of the envisioned system
  - what it is
  - how it is organized
  - what it does
  - how it works



User's mental model

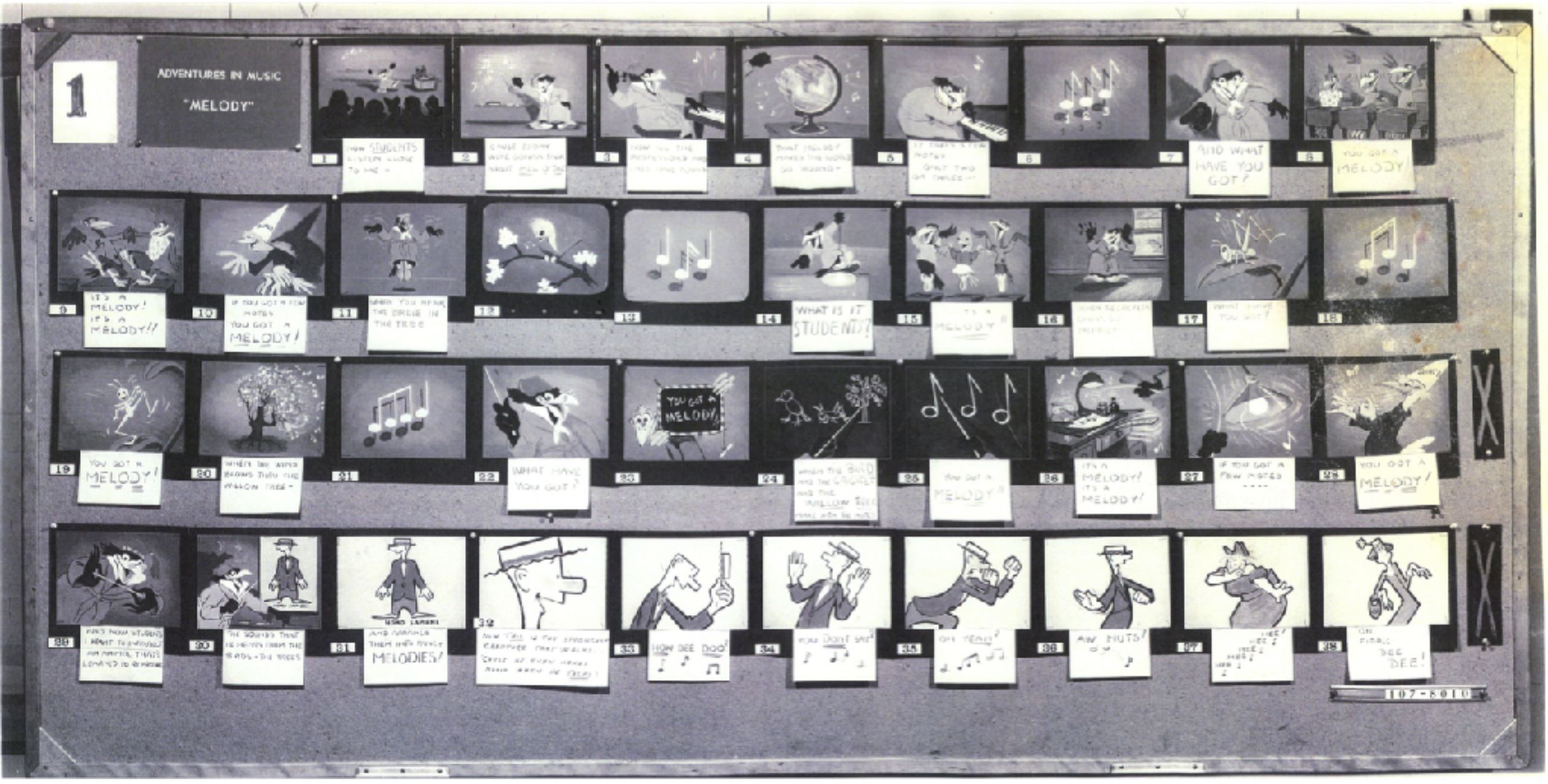
- Comes up from existing interactions with systems
- Users form cause & effect relationships to form theories that guide actions



Conceptual design

- Goal: match users' **mental model**
- Tool: Metaphor - analogies from existing system
  - Offers expectations about what system does & what can be done
- Examples
  - Email <—-> physical mail
  - Backup software <—>time machine
  - OS desktop <—> top of a desk

Storyboards



Storyboard for Disney's Melody: Adventures in Music (1953)

Source: Michael Sporn Animation


NOW STUDENTS LISTEN CLOSE TO ME -
1
CAUSE TODAY WERE GONNA TALK ABOUT MEL O DEE
2
NOW ALL THE PROFESSORS AND CATS HAVE FOUND
3

Storyboards for UI design

- Sequence of visual “frames” illustrating **interplay** between user & envisioned system
- Explains how app fits into a larger **context** through a single scenario / story
- Bring design to **life** in graphical clips - freeze frame sketches of user interactions
- “Comic-book” style **illustration** of a scenario, with actors, screens, interaction, & dialog

Crafting a storyboard

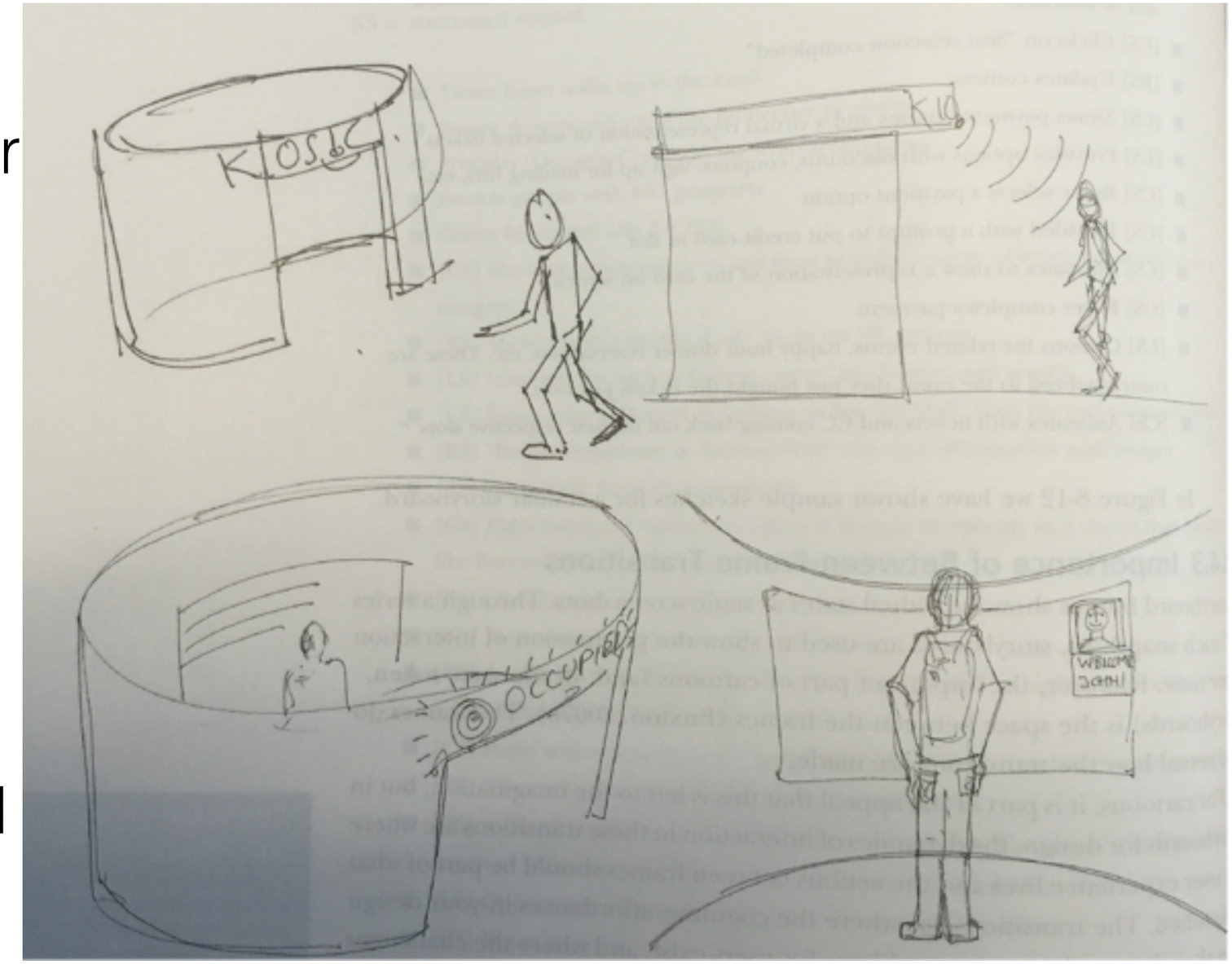
- Set the stage:
  - Who? What Where? Why? When?
- Show key interactions with application
- Show consequences of taking actions
- May also think about errors

Example elements of a UI storyboard

- Hand-sketched pictures annotated with a few words
- Sketch of user activity before or after interacting w/ system
- Sketches of devices & screens
- Connections with system (e.g., database connection)
- Physical user actions
- Cognitive user action in “thought balloons”

Example: ticket kiosk

Ticket buyer walks up to the kiosk



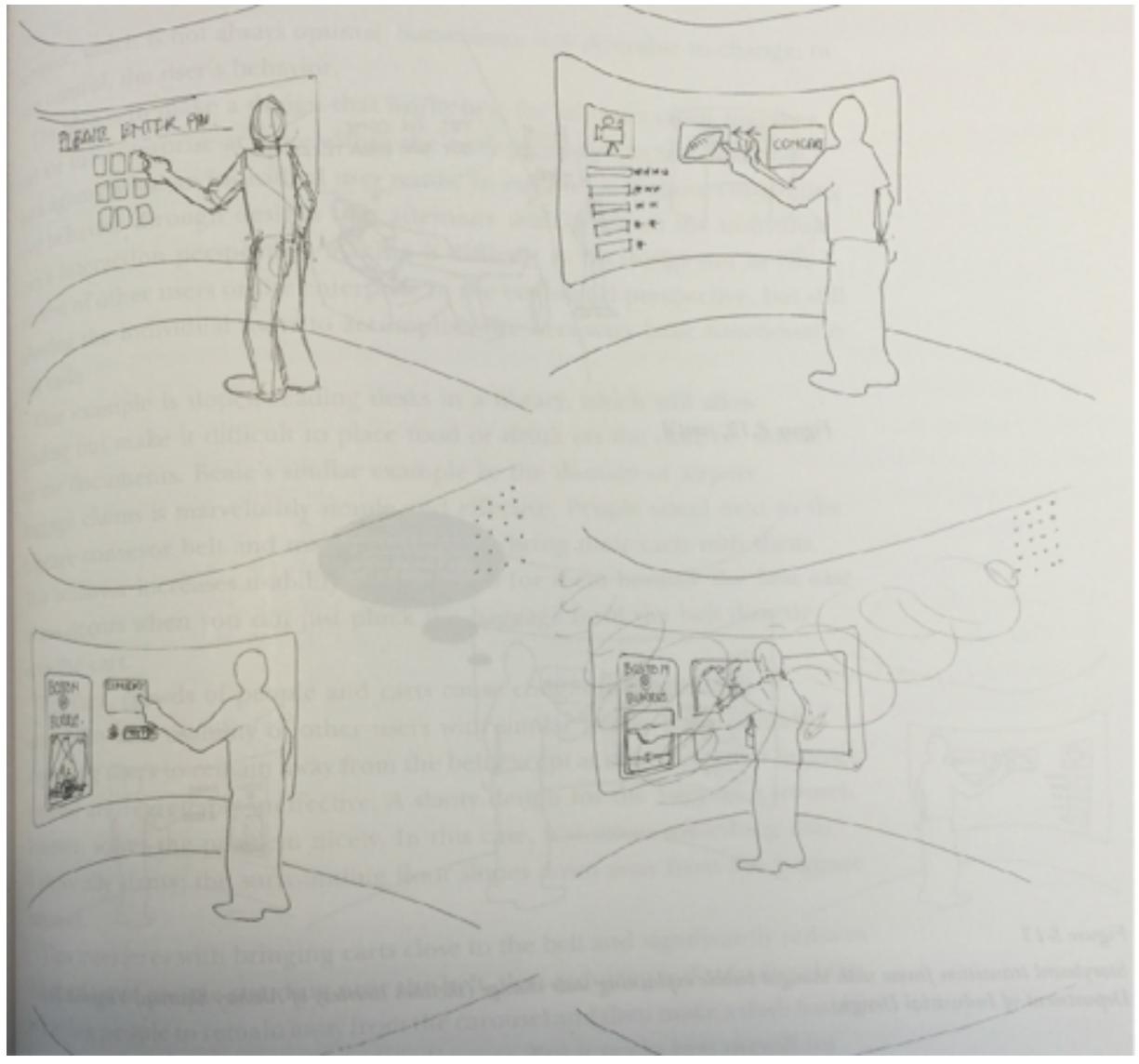
Sensor detects user & starts immersive process

Displays “Occupied” sign on wraparound case

Detects people with ID card

Example: ticket kiosk

Greets buyer and asks for PIN



Shows recommendations & most popular categories

Buyer selects “Boston symphony at Burruss Hall”

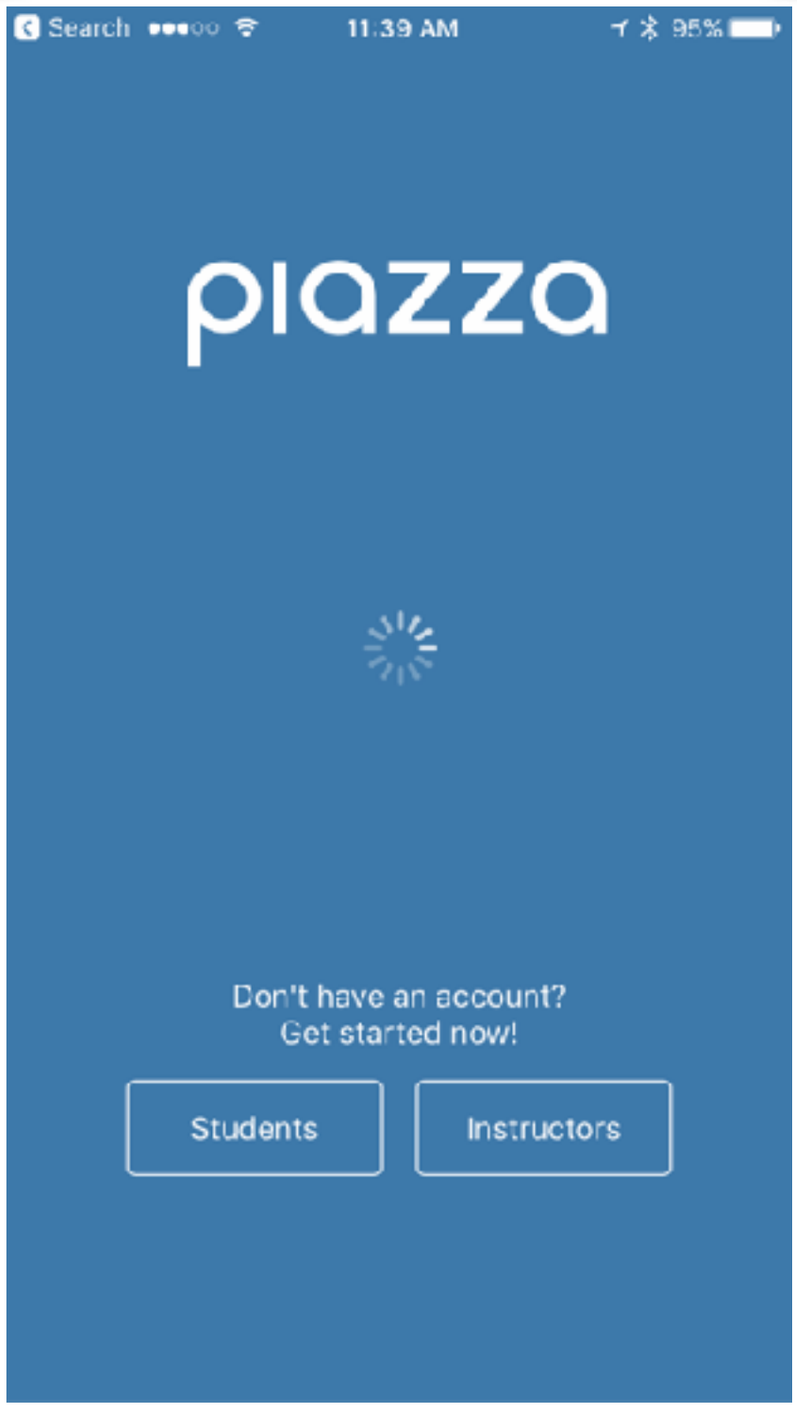
Plays music from symphony, shows date & time picker

Frame transitions

- Transitions between frames particularly important
- What users think, how users choose actions
- Many problems can occur here (e.g., gulfs of execution & evaluation)
- Useful to think about how these work, can add thought bubbles to describe

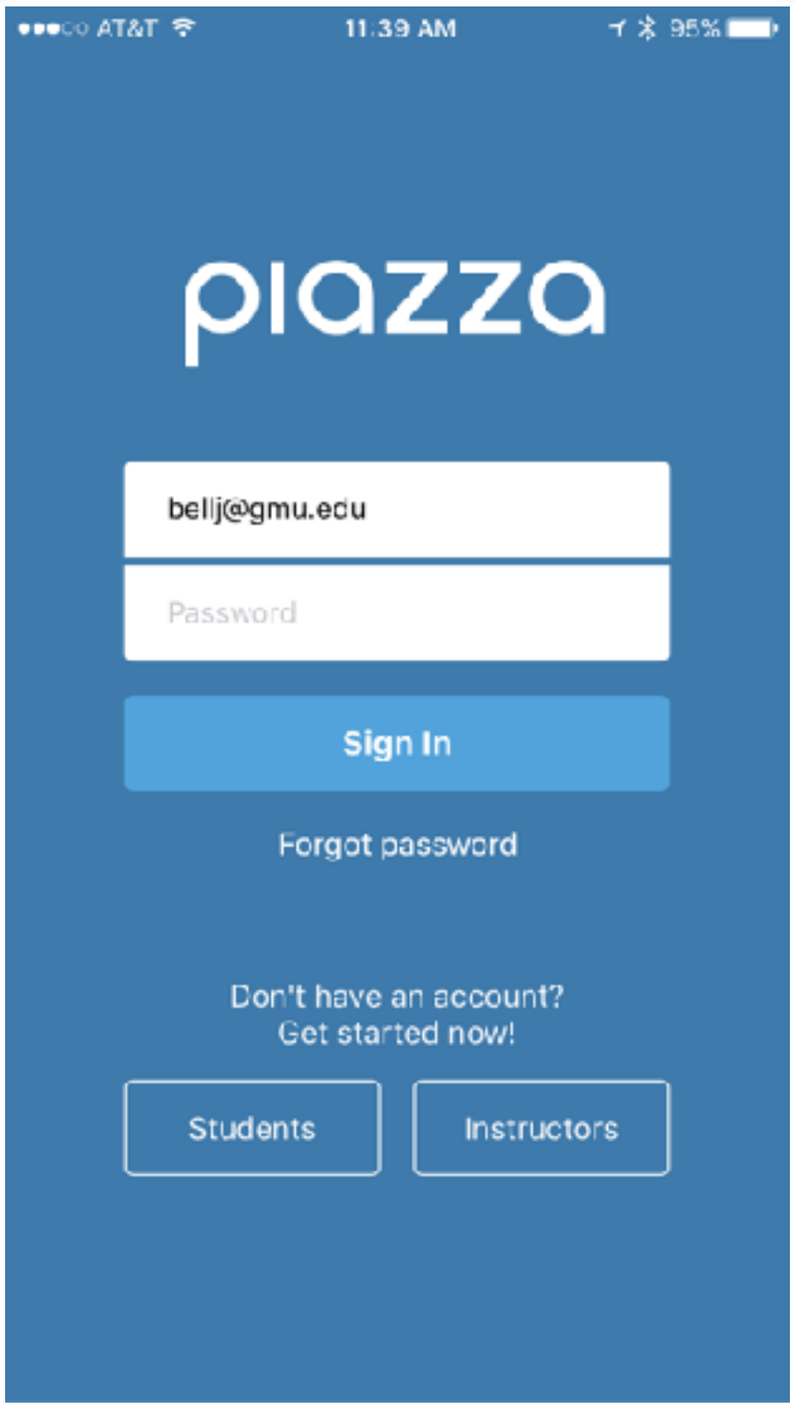
Storyboarding Fail

1: Auto-login to Piazza app



2: Network error

3: Asked for password

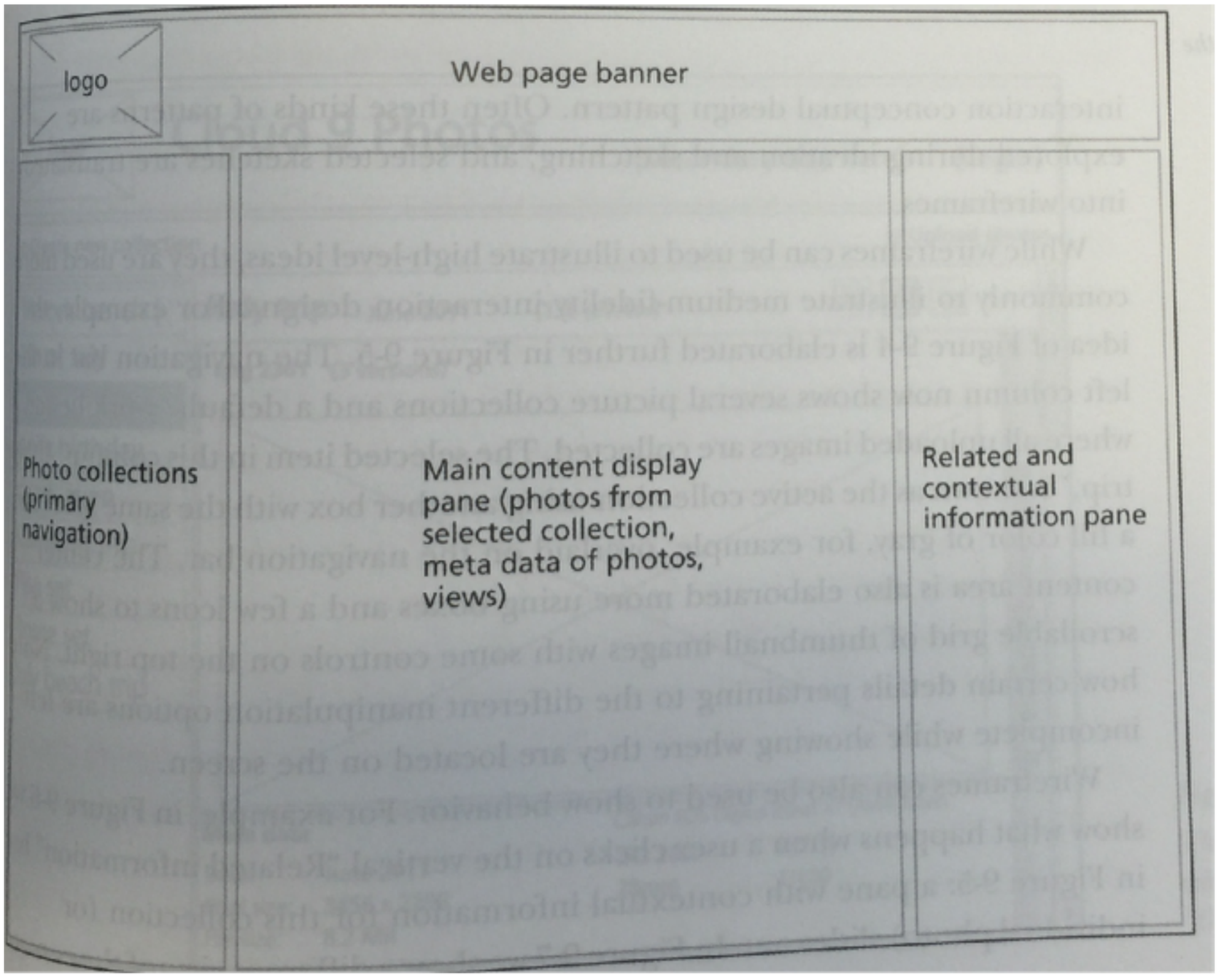


Wireframes

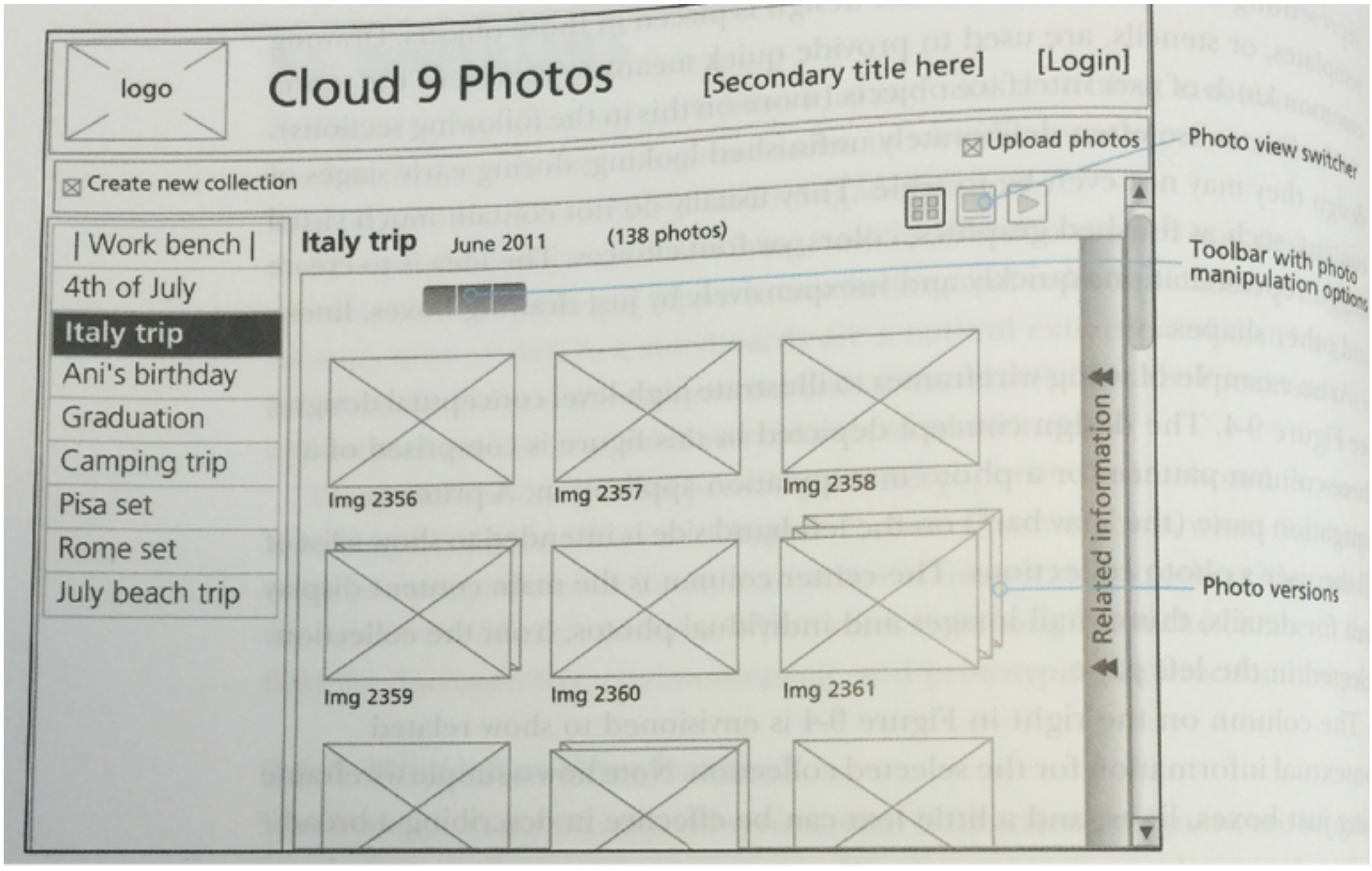
Wireframes

- Lines & outlines (“wireframes”) of boxes & other shapes
- Capturing emerging interaction designs
- Schematic designs to define screen content & visual flow
- Illustrate approximate visual layout, behavior, transitions emerging from task flows
- Deliberate unfinished: do not contain finished graphics, colors, or fonts

Example


logo
Web page banner
Photo collections (primary navigation)
Main content display pane (photos from selected collection, meta data of photos, views)
Related and contextual information pane

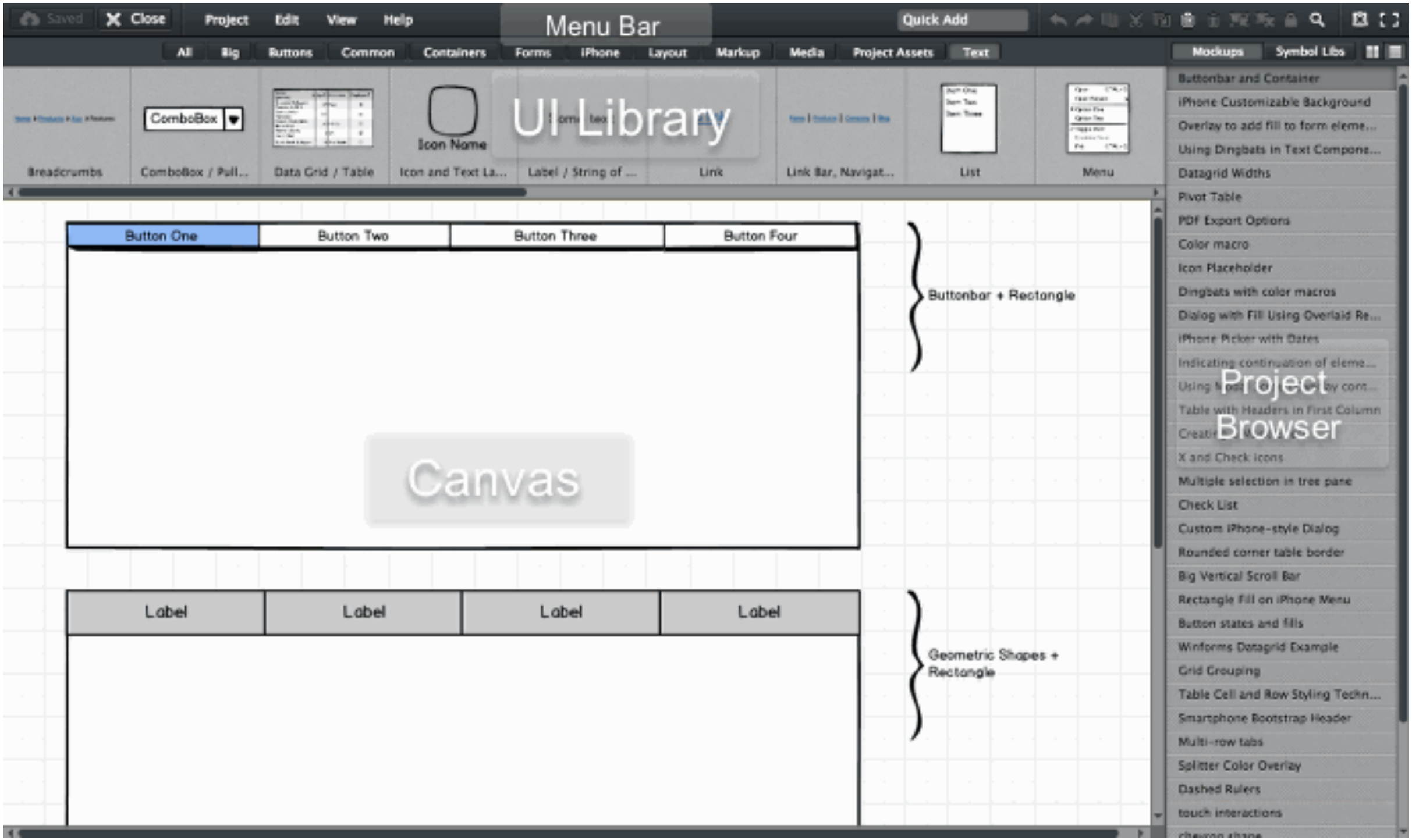
Example


logo
Cloud 9 Photos
[Secondary title here]
[Login]
Upload photos
Create new collection
Photo view switcher
Toolbar with photo manipulation options
| Work bench |
4th of July
Italy trip
Ani's birthday
Graduation
Camping trip
Pisa set
Rome set
July beach trip
Italy trip
June 2011
(138 photos)
Related information
Photo versions
Img 2356
Img 2357
Img 2358
Img 2359
Img 2360
Img 2361

Wireframes

- Can be used to step through a particular scenario
- Focus on key screens rather than every screen
- Tools can help
  - Can be made clickable
  - Can use stencils & templates; copy & edit similar screens

Example tool - Balsamiq



Prototyping

Prototyping

- How do you know your system design is right before you invest the time to build it?
- Answer: prototyping!
  - Evaluation performed **before** investing resources in building finished product
  - Early version of system constructed much **faster** & with less expense used to evaluate & **refine** design ideas

Fidelity of prototypes

Kind of Iteration	Purpose	Types of Prototypes
Ideation and sketching	To support exploring ideas, brainstorming, and discussion (so design details are inappropriate)	Sketches, fast and disposable mockups, ultralow fidelity
Conceptual design	To support exploration and creation of conceptual design, the high-level system structure, and the overall interaction metaphor	Evolution from hand-drawn paper, computer-printed paper, low-fidelity wireframes, high-fidelity wireframes, to pixel-perfect interactive mockups (to communicate with customer)
Intermediate design	To support interaction design for tasks and task threads	Evolution from paper to wireframes
Detailed design	Support for deciding navigation details, screen design and layout, including pixel-perfect visual comps complete specification for look and feel of the "skin"	Detailed wireframes and/or pixel-perfect interactive mockups
Design refinement	To support evaluation to refine a chosen design by finding and removing as many UX problems as possible	Medium to high fidelity, lots of design detail, possibly a programmed prototype

Interactivity of prototypes

- Scripted, click through prototypes
  - Prototype w/ **clickable** links to move between screens
  - Live action storyboard of screens
  - Simulates real **task flow**, but w/ static content
- Fully-implemented prototypes
  - Usually **expensive** to implement actual system
  - But can build key piece of system first to evaluate

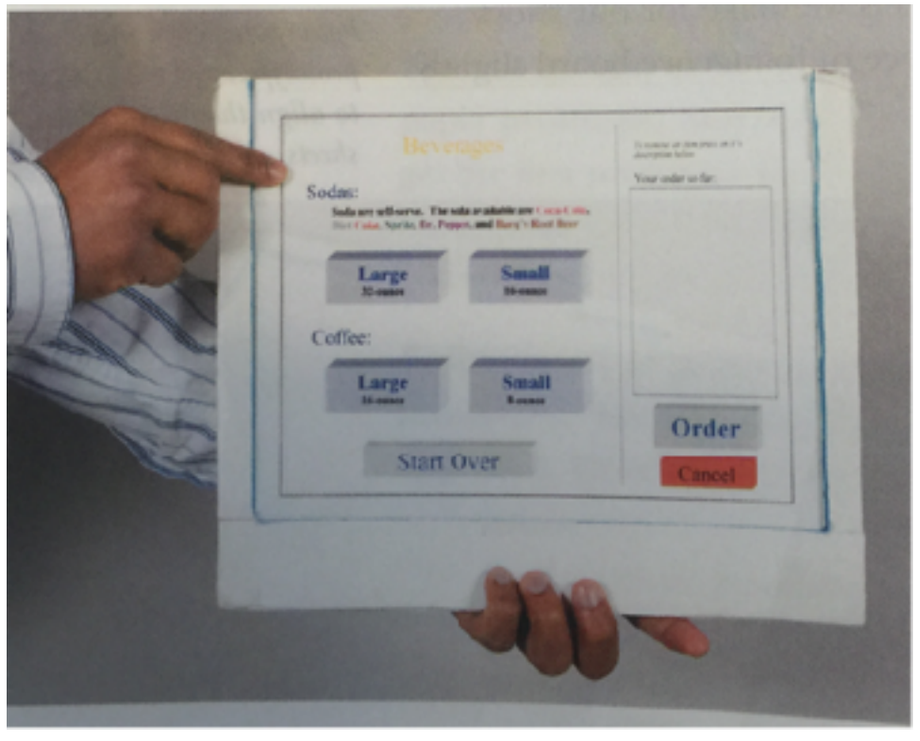
Wizard of Oz

- Goal: **simulate** actual system w/ out building it
  - Want user to interact **as if** they were interacting w/ real system
  - Helps explore how users would interact w/ novel interaction if it were to exist
- Example: natural command line (Good et al 1984)
  - Users typed in commands to interact w/ computer
  - Commands intercepted by hidden human who interpreted commands & executed them

Paper prototypes

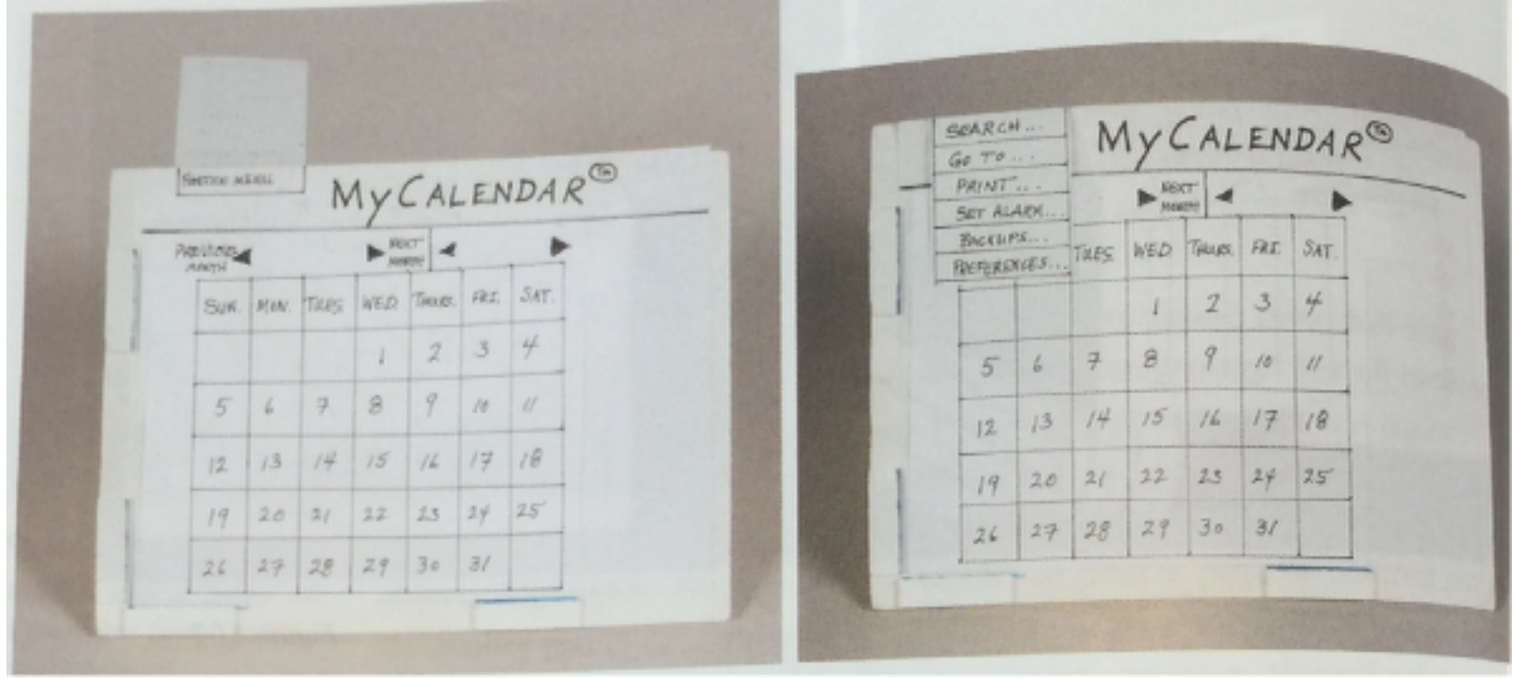
- **Low fidelity** prototype w/ paper mockups
- Goal: get feedback from users early w/ very low cost interactive prototype of envisioned interaction design

Paper prototyping (1)



- Set a realistic deadline
- Gather set of paper prototyping materials
- Work **fast** & do not color within the lines
- Reuse existing sketches & mockups
- Make underlying paper mockups of key screens

Paper prototyping (2)



- Use paper cutouts & tape onto full-size transparencies as “interaction sheets” for moving parts, making modular by including only a small amount
- Do not write or mark on interaction sheets
- Be creative
- Reuse at every level
- Cut corners wherever possible (trade accuracy against efficiency)
- Make a “this feature not implemented” message

Paper prototyping (3)

- Include "**decoy**" user interface objects not needed for expected tasks
- Accommodate data value entry by users w/ blank transparencies
- **Organize** materials to manage complex task threads
- **Pilot** test thoroughly

Video Stage

Currently listening to

Help

MASTER CONTROL

Enter a Search...

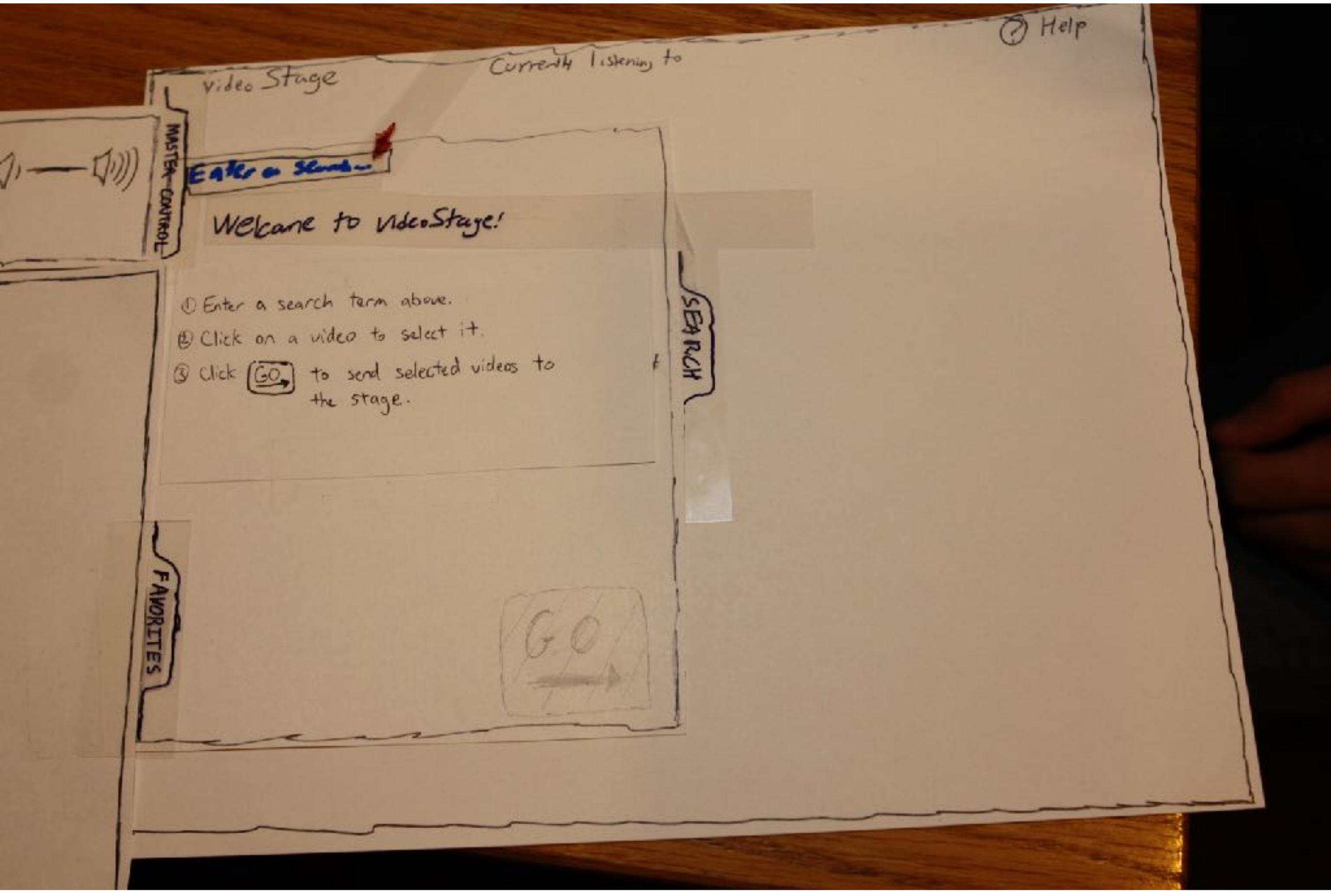
Welcome to VideoStage!

① Enter a search term above.
② Click on a video to select it.
③ Click [GO] to send selected videos to the stage.

SEARCH

FAVORITES

GO


Video Stage
Currently listening to
Help
MASTER CONTROL
Enter a search...
Welcome to VideoStage!
① Enter a search term above.
② Click on a video to select it.
③ Click GO to send selected videos to the stage.
SEARCH
FAVORITES
GO

Video Stage

Currently listening to

Help

MASTER CONTROL

Sports

SEARCH

① Enter a search term above.
② Click on a video to select it.
③ Click [GO] to send selected videos to the stage.

FAVORITES

GO


Help
Video Stage
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Football Left?
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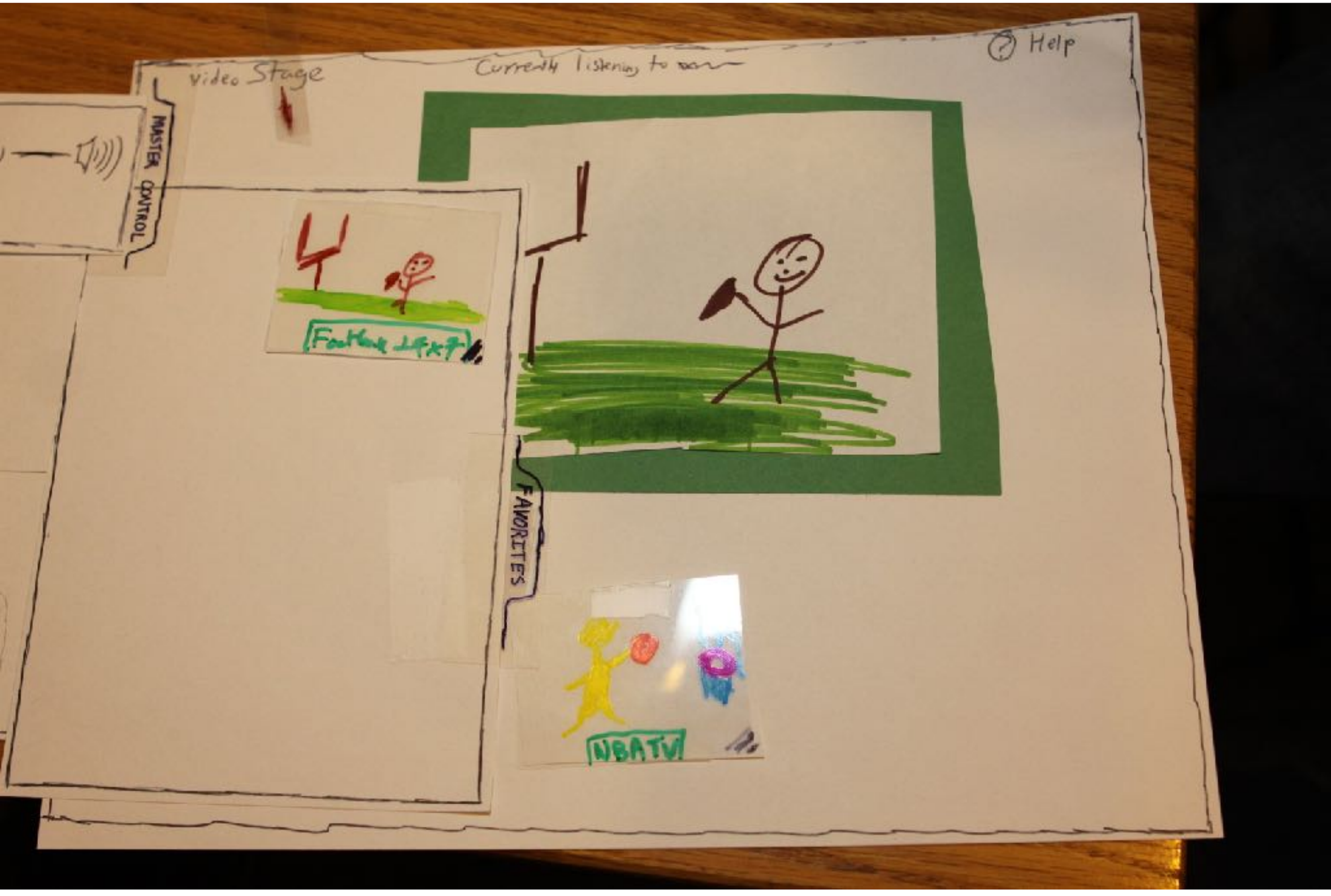
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Advantages of prototyping

- Offers concrete baseline for communication between users & designers
- Provides conversation “prop” to communicate concepts
- Allows user to “take design for a spin”
- Give project visibility & buy-in with customers
- Encourage early user participation and involvement
- Give impression that design is easy to change
- Afford designers immediate observation of user performance & consequences of design decisions

Conceptual Design of Transit Card Vending

- Design an interface for a machine that vends transit cards
- The machine accepts cash, coins, and credit cards
- The machine sells and reloads transit cards
- Transit cards can be loaded with:
  - Passes - valid for unlimited travel in the given period (1,7,30 days)
  - Value - Direct proxy for cash, used to pay fares
- Things to think about:
  - How does user decide to reload vs buy new card?
  - Can a card have both value and a pass on it? How does that work?