

Early Stage (lo-fi & med-fi) Prototyping

Prof. James A. Landay
Computer Science Department
Stanford University

Autumn 2026

October 14, 2026

Music: <https://soundcloud.com/dansuneroquette>

Interface Hall of Fame or Shame?



Dyson AirBlade hand dryer
example courtesy of Maya I.

Interface Hall of Fame or Shame?

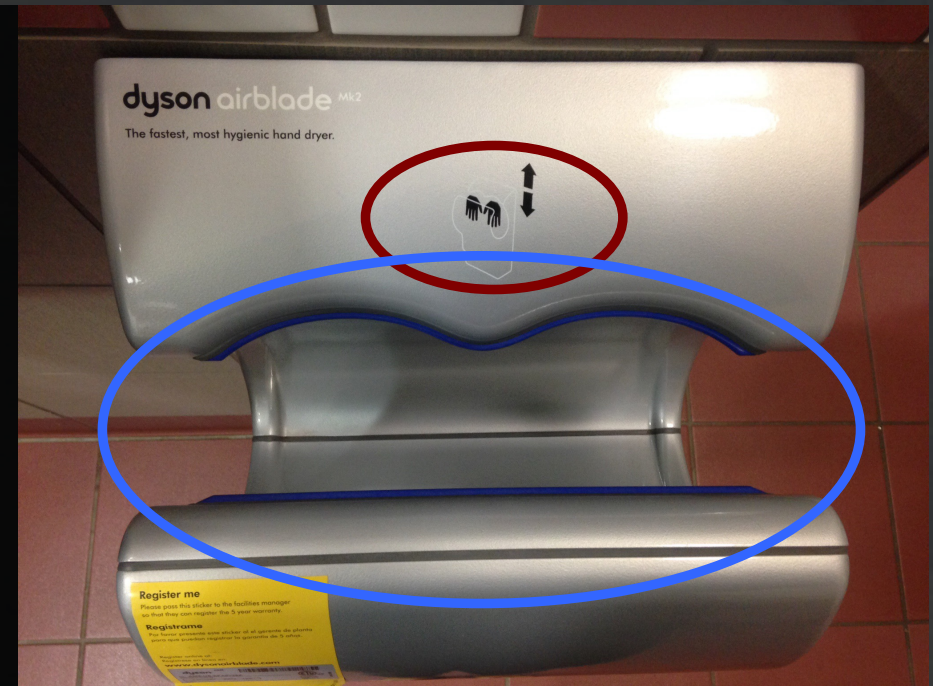


Good

- shape indicates function
- so simple that instructions fit in 1 image
- fun!

Bad

- dripping water?
- too much noise
- still takes too long



Dyson AirBlade hand dryer
example courtesy of Maya I.

Interface Hall of Fame!



Good

- shape indicates function
- so simple that instructions fit in 1 image
- fun!

Bad

- dripping water?
- too much noise
- still takes too long



Dyson AirBlade hand dryer
example courtesy of Maya I.

Can We Do Better?



Good?

- Drip on the floor...



Can We Do Better?



Good

- Integrate hand dryer into sinks...



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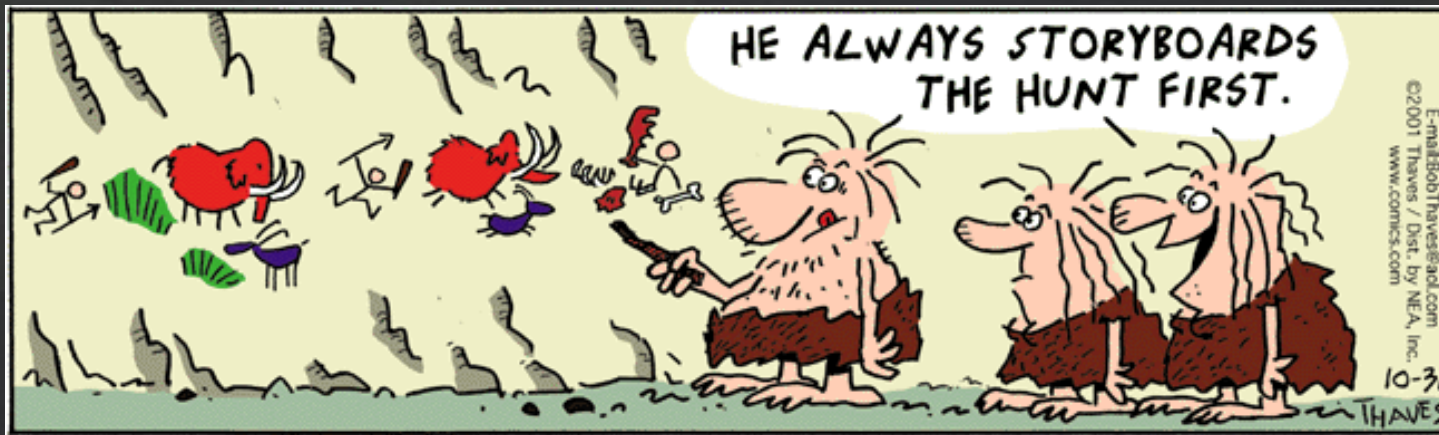
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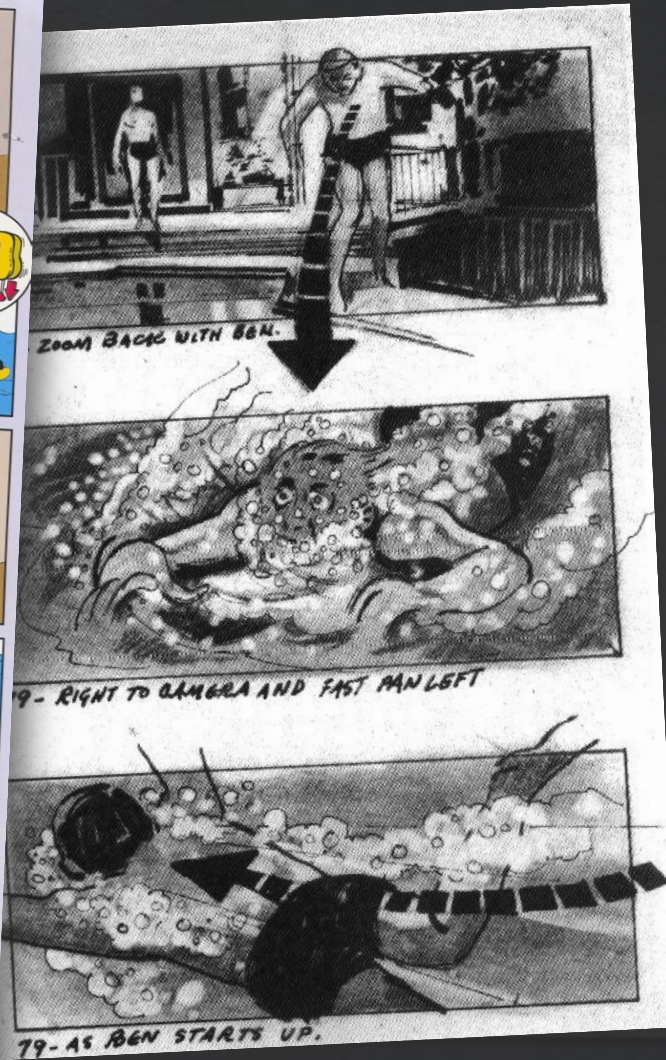
Outline

- Sketching vs. Storyboarding
- Prototyping
- Low-fi prototyping
- Conducting a low-fi test
- Medium-fi prototyping

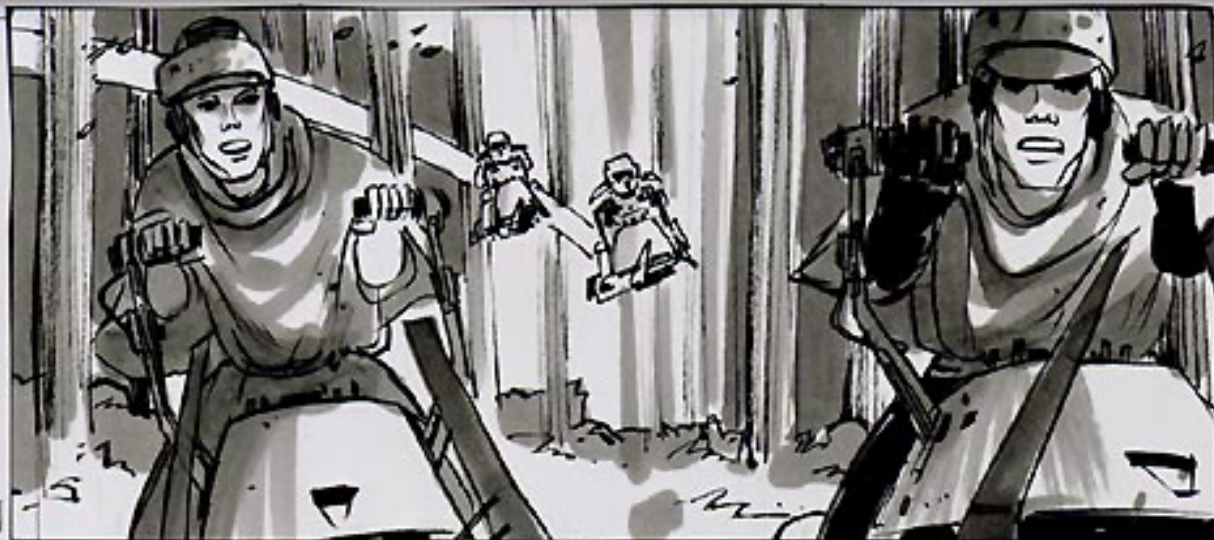
Sketches & Storyboards



- Where do storyboards come from?
 - film & animation
- Give you a “script” of important events
 - leave out the details
 - concentrate on the important interactions



REVISED SEP 8 1982 ©LFL 1982



DESCRIPTION: EXT. FOREST - MS LUKE & LEIA - TRUCKING
 Luke & Leia coming toward camera. Behind them,
 Biker #3 & Biker #4 bank in, chasing.

NOTES:

ELEMENTS:	STAGE	ANIM	PLATE	MATTE	NON-FLM
Forest			X		
Luke			X		
Leia			X		
Biker #3	X				
Biker #4	X				

ELEMENTS:	STAGE	ANIM	PLATE	MATTE	NON-FLM

SHOT # / SEQUENCE

27-28

BC 28

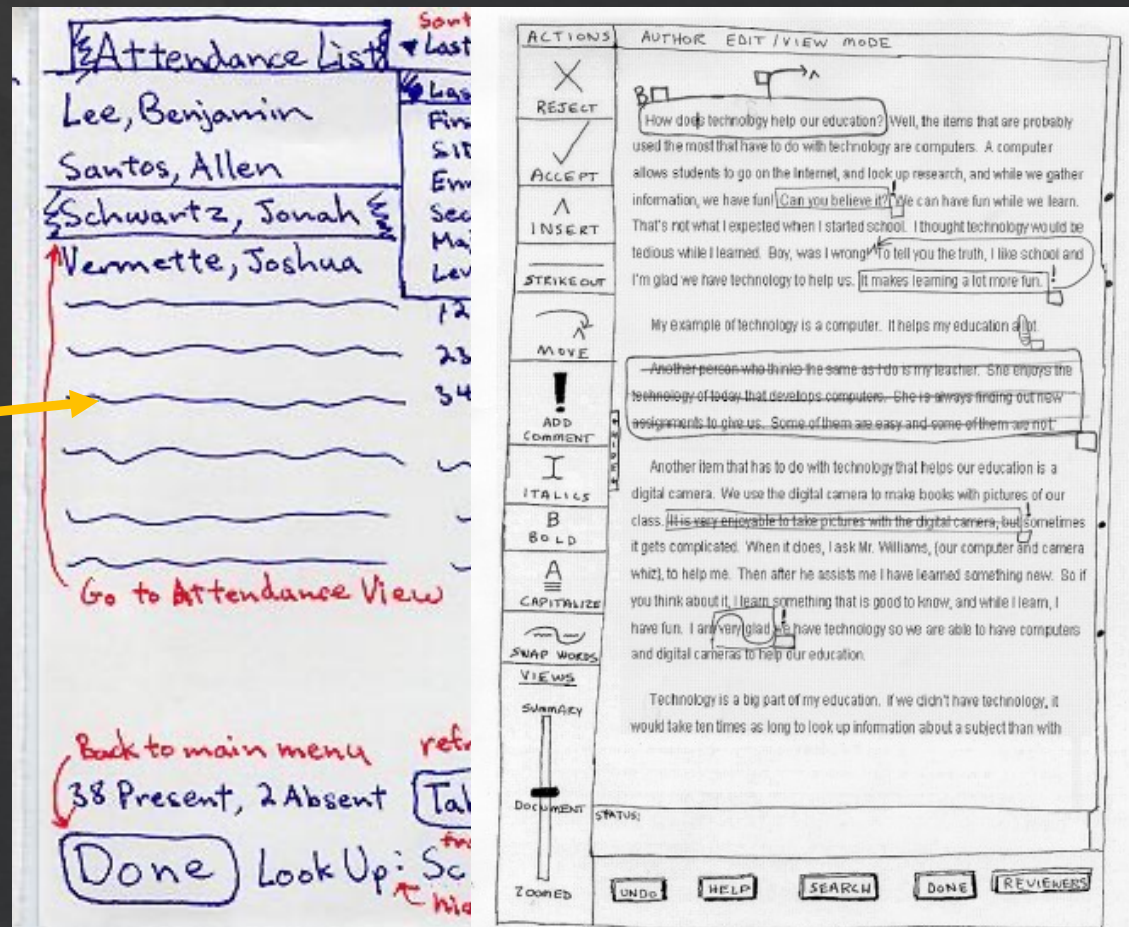
FRM COUNT
50

PAGE #

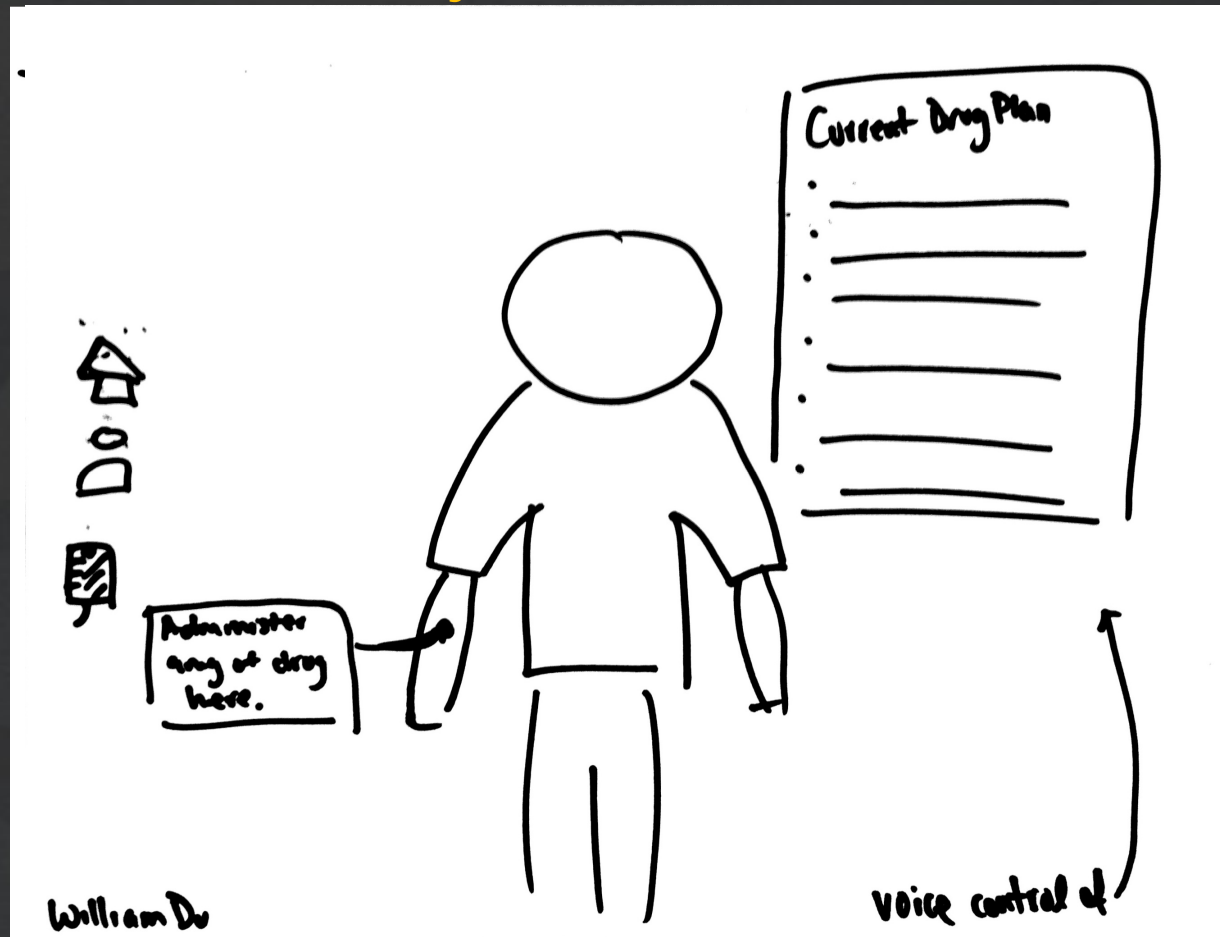


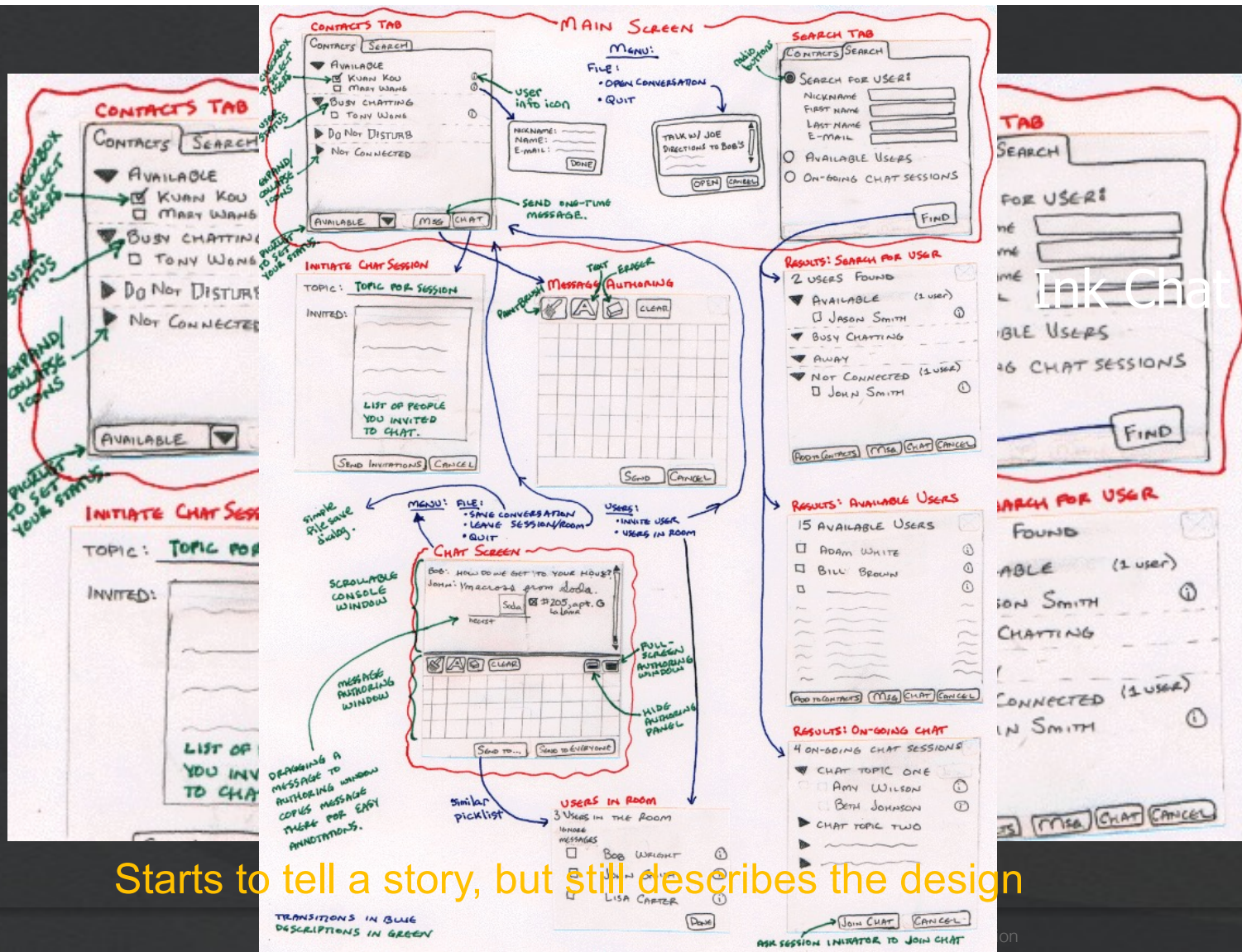
Sketches & Storyboards in UX Design

Greeking



Sketches & Storyboards in UX Design

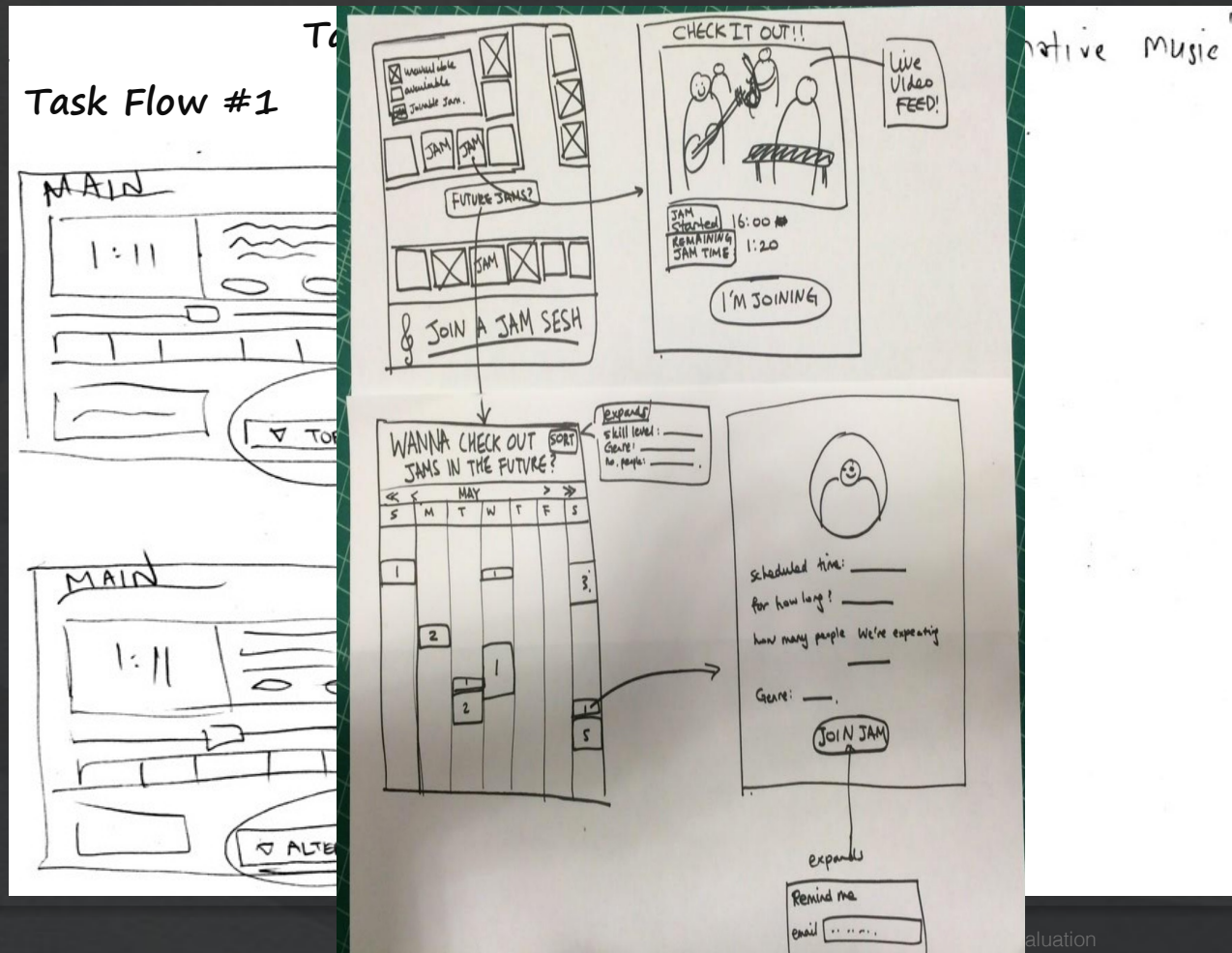




Starts to tell a story, but still describes the design

Sketches & Storyboards in UX Design

Task Flow (Wireframe)



What is a Prototype?

“A prototype is an early sample or model built to test a concept or process or to act as a thing to be replicated or learned from.”
– Wikipedia

CS147 definition: a working representation of a final artifact

<http://www.computerhistory.org/collections/accession/102716262>



Types of Prototypes

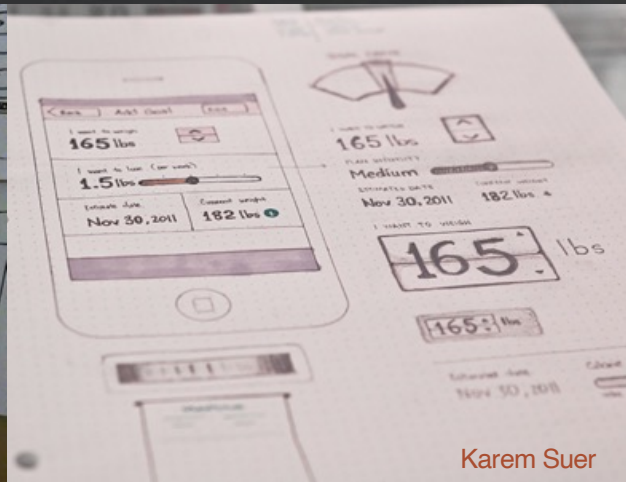
Prototypes are concrete **representations** of a design

Prototype dimensions

- representation: form of the prototype
 - off-line (paper) or on-line (software)
- precision: level of detail (e.g., informal or polished)



PJ McCormick



Karem Suer

Types of Prototypes

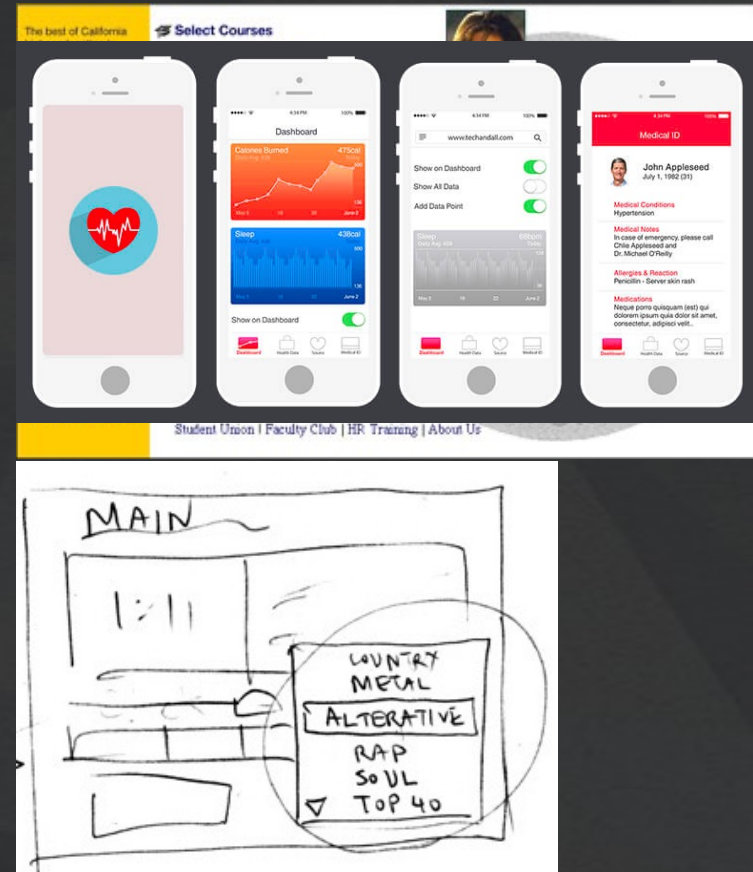
Prototypes are concrete **representations** of a design

Prototype dimensions

- representation: form of the prototype
 - off-line (paper) or on-line (software)
- precision: level of detail (e.g., informal or polished)
- interactivity: watch-only to fully interactive
 - fixed prototype (video clips)
 - fixed-path prototype (each step triggered by specified actions)
 - at extreme could be 1 path
 - open prototype (real, but limited error handling or performance)
- evolution: expected life cycle of prototype
 - e.g., throw away or iterative

Fidelity in Prototyping

- Fidelity refers to the level of detail
- High fidelity?
 - prototypes look like the final product
- Low fidelity?
 - (often) sketched renditions with many details missing

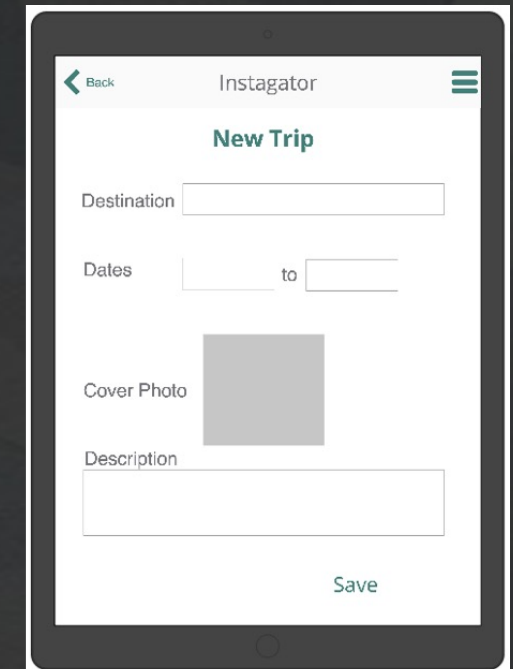
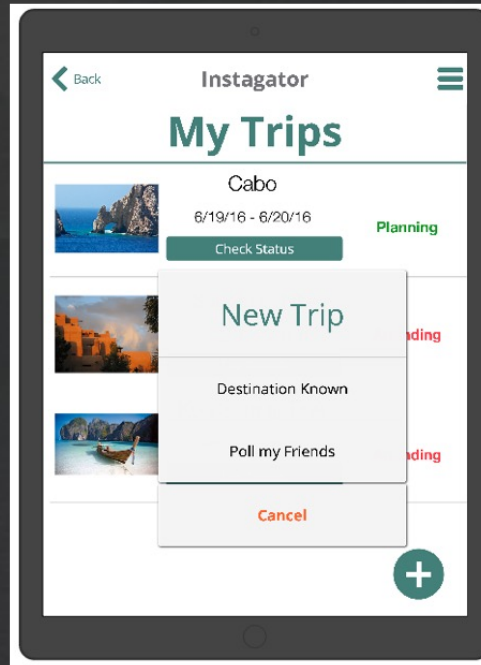
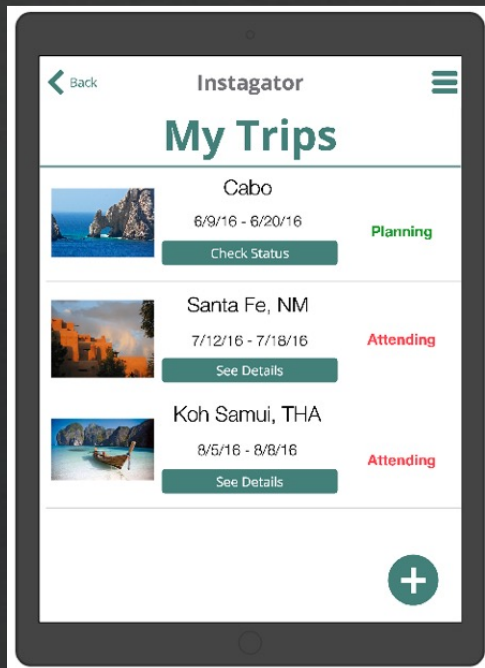


What do we like about this low-fi prototype?



What do we wish could be improved?

What do we like about this medium-fi prototype?

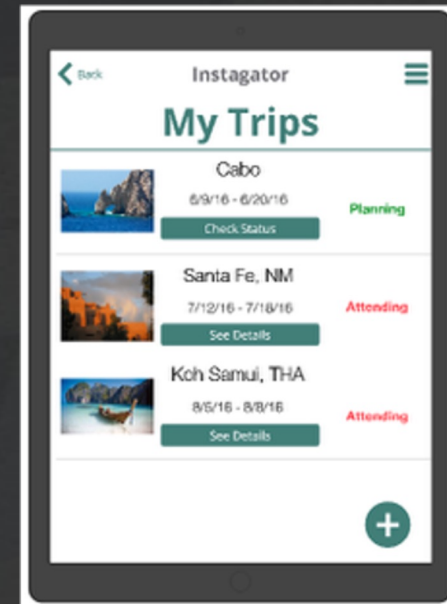


What do we wish could be improved?

The feedback you get is different



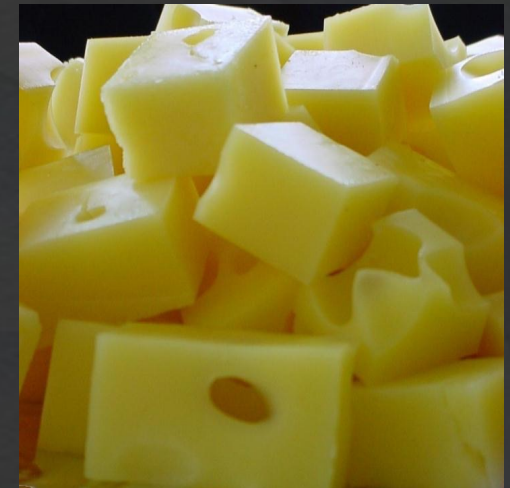
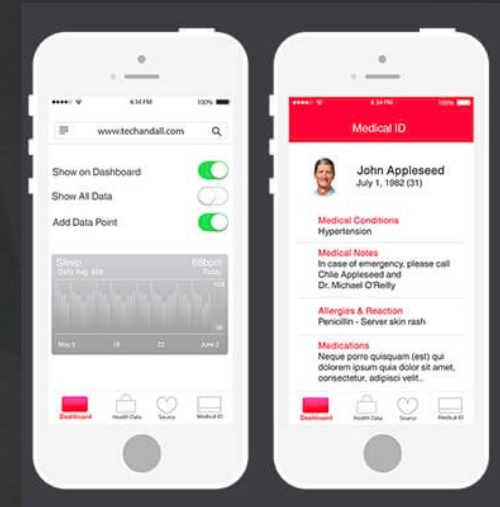
Low-fi



Medium-fi

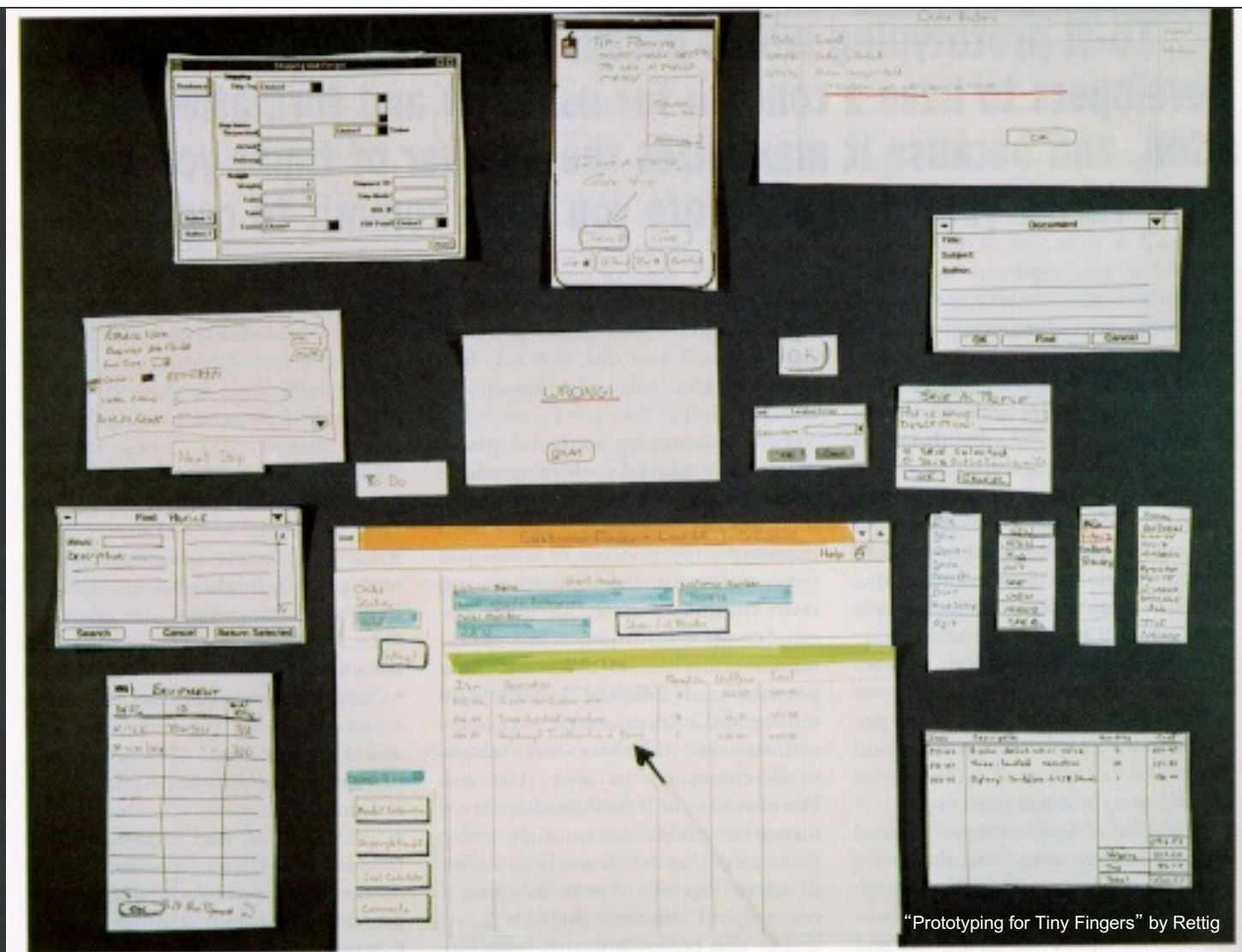
Hi-fi Prototypes Warp

- Perceptions of the tester/reviewer
 - representation communicates “finished”
 - comments focus on color, fonts & alignment
- Time of the designer
 - encourage precision
 - specifying details takes more time
- Creativity of the designer
 - lose track of the big picture



Why Use Low-fi Prototypes?

- Traditional methods take too long
 - sketches → **prototype** → evaluate → iterate
- Can instead simulate the prototype
 - sketches → evaluate → iterate
 - sketches act as prototypes
 - designer “plays computer”; others observe & record
- Kindergarten building skills
 - allows non-programmers to participate



"Prototyping for Tiny Fingers" by Rettig

[Back](#) [Forward](#) [Stop](#) [Home](#) [Search](#) [Print](#)

Kool Klotthes
Logo

[Guys](#) [Gals](#) [Kids](#) [Customer Service](#)

Shopping Cart

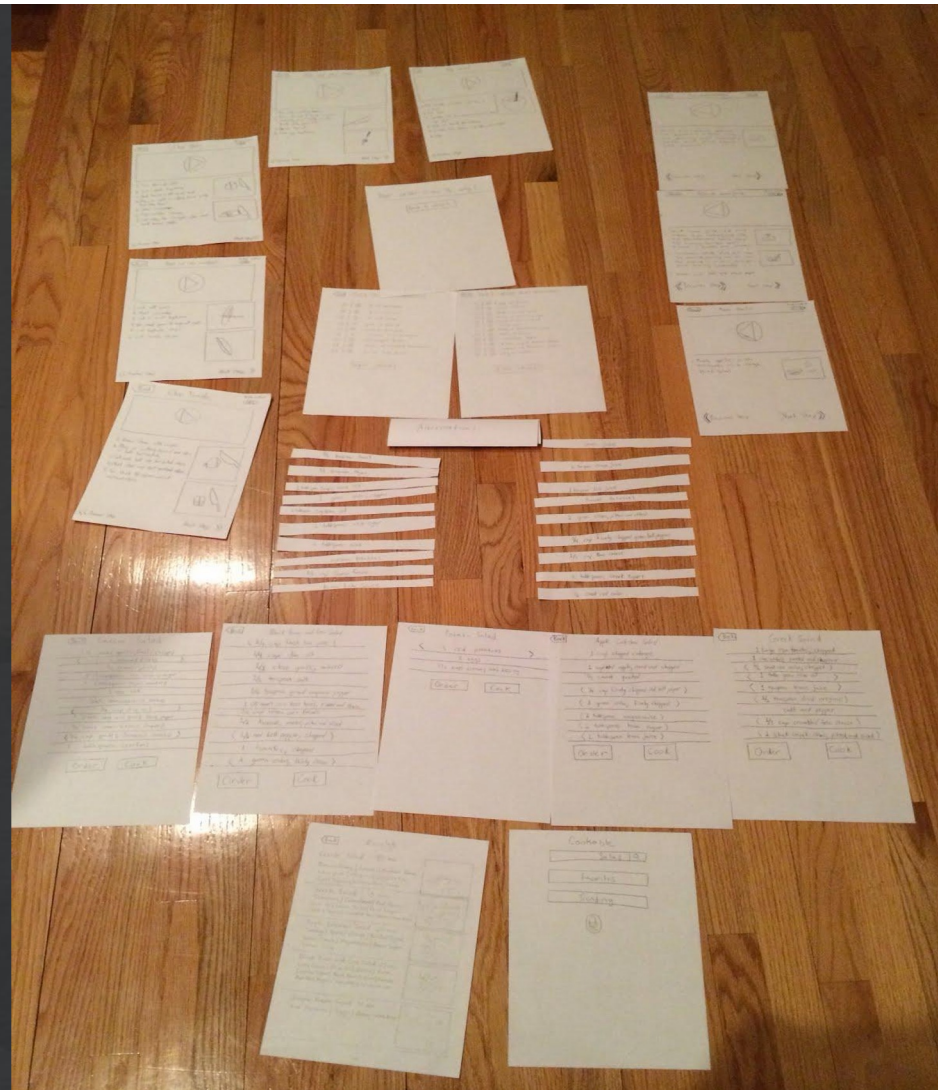
Item	Description	Color	Size	Status	Qty	Price	Total
42773	Cashmere sweater	Green	M	In Stock	1	79.99	79.99
23076	Brickcountry boot	BR	8 1/4	In Stock	1	128.00	128.00

Check out our
no-hassle
Return Policy

Subtotal 267.99
S&H 12.95
Tax 0.00
Total 220.84

[Continue Shopping](#) [Checkout](#)

Cookable



Cookable

Salad	Q
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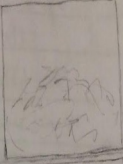
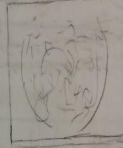
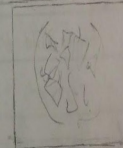
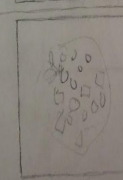
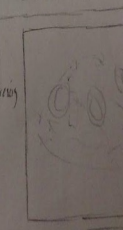
Favorites

Trending



Cookable

Cookable

Results	
Back Caesar Salad 30 min Romane lettuce Croutons Parmesan Cheese Lemon juice Olive oil Egg Garlic Salt Pepper Worcestershire Sauce	
Greek Salad 15 min Tomatoes Cucumbers Red Onion Olive Oil Lemon Juice Dried Oregano Salt & Pepper Crumbled Feta cheese Olive olives	
Apple Coleslaw Salad 25 min Cabbage Apple Carrot Red Bell Pepper Green Onion Mayonnaise Brown Sugar Lemon Juice	
Black Bean and Corn Salad 25 min Lime Juice Olive Oil Garlic Salt Cayenne Pepper Black Beans Corn Avocado Red Bell Pepper Tomatoes Green Onions	
Simple Potato Salad 40 min Red Potatoes Eggs Creamy Salad Dressing	

Cookable

Caesar Salad

2 cloves garlic, finely chopped

$\frac{1}{2}$ lemon juiced

2 tablespoons red wine vinegar

1 tablespoon Dijon mustard

1 egg yolk

1 dash Worcestershire sauce

1 pinch salt and ground black pepper

$\frac{1}{2}$ head romain lettuce, chopped

2 tablespoons croutons

Cookable

[Back](#) Caesar Salad

2 cloves garlic, finely chopped

< 3 anchovy fillets >

1/2 lemon juiced

2 tablespoons red wine vinegar

1 tablespoon Dijon mustard

1 egg yolk

1 dash Worcestershire sauce

< 1 tablespoon Grape Seed Oil >

1 pinch salt and ground black pepper

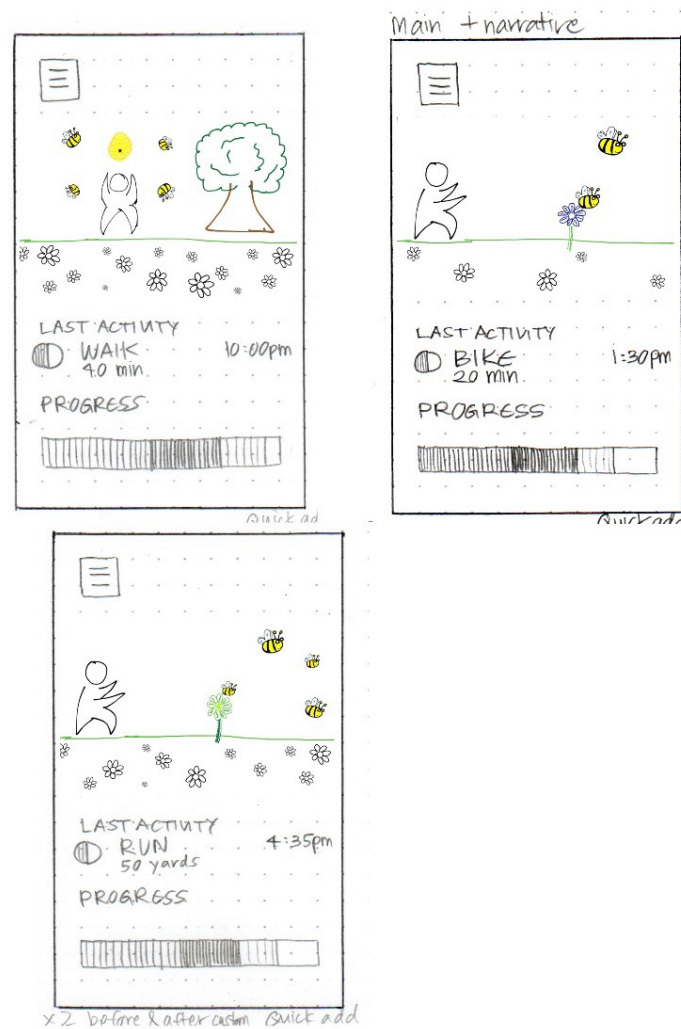
1/2 head romain lettuce, chopped

< 1/4 cup grated parmesan cheese >

2 tablespoons croutons

[Order](#) [Cook](#)

Who is Zuki?



Administrivia: Assignment 2 Grades/Feedback

A2 Group Presentations:	-: 0%	✓ -: 0%	✓ -: 6%	✓ :72%	✓ +: 22%	✓ ++: 0%
A2 Individual Presentation:	-: 0%	✓ -: 0%	✓ -: 6%	✓ : 44%	✓ +: 44%	✓ ++: 6%

We liked

- “prototype findings were grounded in observations and quotes”
- “thorough documentation of experience prototype methods”
- “creativity and diversity of HMWs”
- “intentionality behind the diversity of prototype testers”
- “use of empathy maps to unpack interview insights”
- “creative design of prototypes to test assumptions, where the prototype looks outside of the box compared to the solution”

We wished

- “we wonder statements for POVs were more *user-specific* & took *bigger leaps*”
- “HMWs were more generative to capture user pain”
- “*stronger rationale* for chosen assumptions”
- “*stronger connection* between prototype learnings & final solution choice”
- “exploration of *design opportunities* in relation to *excluded communities*”
- “more novel, robust solutions that **don't feel like ‘Tinder for X’ or single features**”

Administrivia

- Video slide deck to turn in but not present
- Check slack channels #lecture, #q-and-a, #announce
 - If you help your peers in a significant way, we can raise your class participation grade
- Check web site for Figma workshop recording end of week
- Web site directories will be created for each team by end of week
 - each team should have filled out this form by Monday, Oct 12th
 - <https://forms.gle/eNNGyoXWdamLdStQ9>
 - start to get sites (even basic) up there this weekend
 - should have all your work – not graded until mid-point check-in & near end of quarter
 - CAs will send you your directory path/name on web.stanford.edu

Good Examples from A2

NOAH POV

We met Noah, a professional glass artist who balances reliable catalogue sales with creating unique pieces.

We were surprised to notice that he pulled back from successful catalogue work to make pieces he wasn't sure anyone would buy, because he found the unique work more fulfilling.

We wonder if this means that reproducing what already sells makes him feel confined by past successes, while uncertainty gives him room to discover what he wants to express as an artist.

It would be game-changing to help Noah feel free to let his artistic voice evolve beyond what buyers already expect from him, while sustaining his livelihood.

Team 1 – Renn's studio

LOLA POV

We met Lola, a newly hired clinical dietitian who once sold watercolor commissions but lost touch with her creative hobbies—and her sense of self—during intensive schooling

We were surprised to notice that she returned to creativity through unfamiliar crafts with friends, while seeing her old paintings reminded her of a creative side she had left behind

We wonder if this means that reconnecting with creativity involves both remembering who she was and discovering who she can become through new ways of making.

It would be game-changing to help Lola carry what she loved about past crafts into new creative experiences, without feeling she has to pick up exactly where she left off

Good Examples from A2

Takeaways:

insight

Problem with “unrestful” break is not about the phone, but the purpose

Rest is lost during transitions of tasks

need

Rest that he picks on purpose rather than drifts into

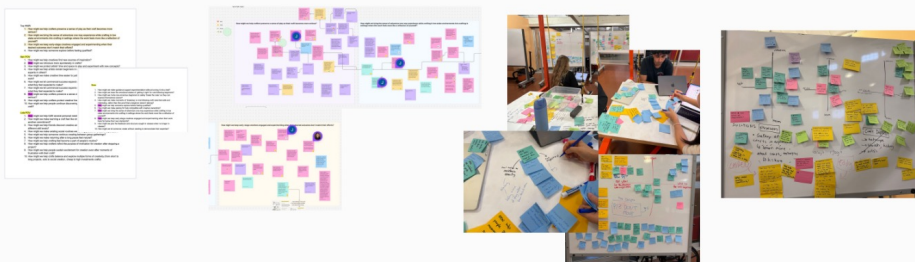
Easy options within reach that requires no planning

Team 5 –
Lindsay’s studio

Good Examples from A2

ITERATION CYCLE

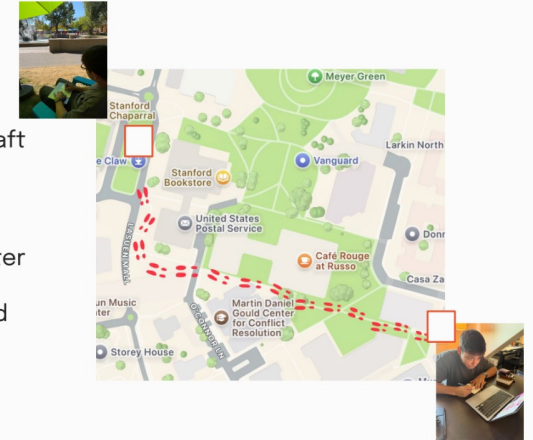
Initial HMW → Solutions V1 → Revised HMW → Solutions V2



Team 1 – Renn's studio

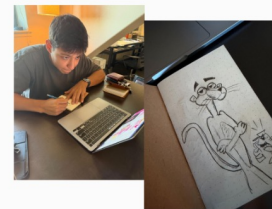
EXPERIENCE PROTOTYPE 1

1. Request a crafter to craft in their regular crafting space
2. Request the same crafter to follow us to an ~unknown~ location and craft there



WHAT WE FOUND 1

Home



"this is your job, draw this to the best of your ability."

- crafting was about proving his skill as an artist
- experience was rigid

Unknown Location



"even though I think it 'looks bad,' I liked doing it. I took in the **vibe**, and it was memorable."

- crafting became about expressing himself
- experience was meaningful

Good Examples from A2

Experience Prototype 2

How we tested

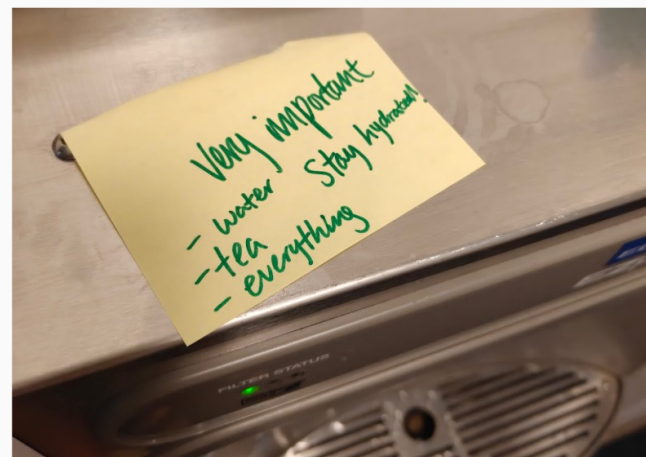
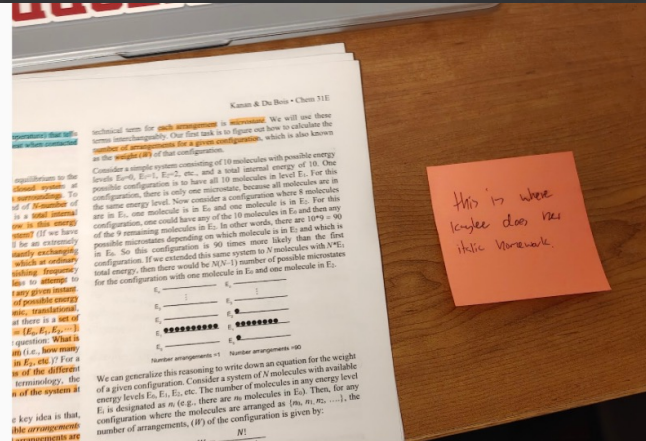
We had people go to a location they routinely visit and placed sticky note messages on different areas of that location addressed to a friend

New learnings

Different demographics of people have **different types of routines** they're obligated to do, leading them to feel differently about their environment and day-to-day life

We tested on undergrad students who were more connected to their everyday environment then talking about their routines throughout the activity

We found that they identified **strongly specific memories or commentary** with their environment (specifically their college dorm)



Team 12 –
Lindsay's studio

Good Examples from A2

Assumption Reflections

Worked

- User felt more focused with music and noted feeling more immersed because the music brought her into her memories
- Moodboard had an overall clearer theme (classical music)

Didn't Work

- Immersion $\neq$ inspiration; immersion == focus
- Overall, both moodboards were very similar and drew from a specific memory in the participant's head

Insights

Did assumption hold?

Adding senses to a moodboard will make it more immersive

= Partially held

Insights:

1. **Held: sound deepened inspiration.** Literal $\rightarrow$ emotional, and she preferred it.
2. **Didn't hold: not a new experience.** It replayed her own band memories.
3. **Sound also steers:** the song chose the content (sheet music, a conductor).

Going forward: retest with an experience they've never had; choose the sound for them.

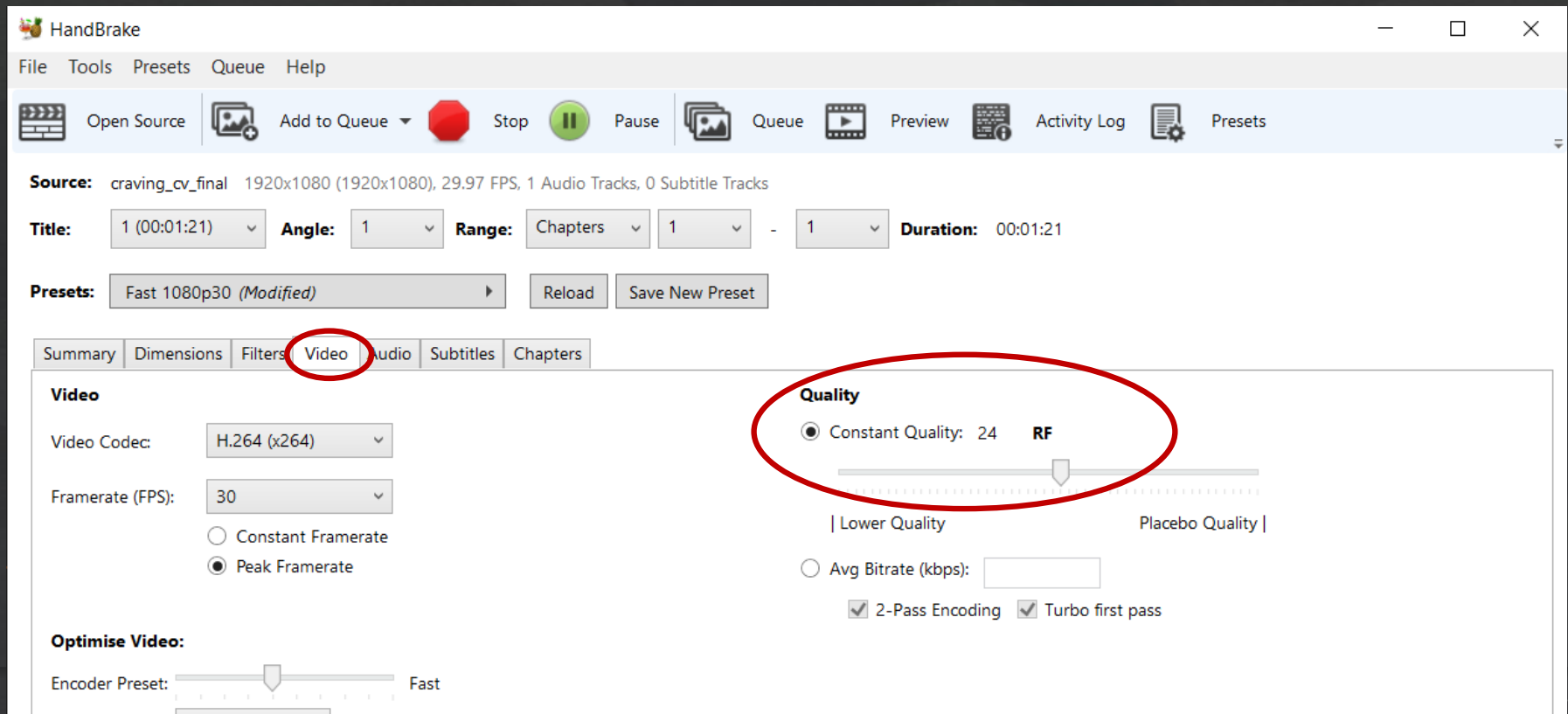
Team 4 – Renn's studio

Administrivia: Video Hints

- Under 2 minutes (90 seconds or less even better)
- Add credits at end
 - Team/project name
 - Your names (first name & last initial)
 - “CS 147 – Autumn 2026”
 - Credits will **not** count in your time limit

Administrivia

- Use *must* use handbrake to compress your video
 - It will take your video from 250MB-1GB down to ~50MB



Team Break

- Reflect on last week's assignment (~5-8 min)
 - what did you **like** about your teamwork?
 - what do you **wish** could be improved?
 - **share out** with each other
- This week's assignment (~15 min)
 - Get **greenlight from CA on solution + tasks**
 - work on your video storyboards/editing

Constructing the Model

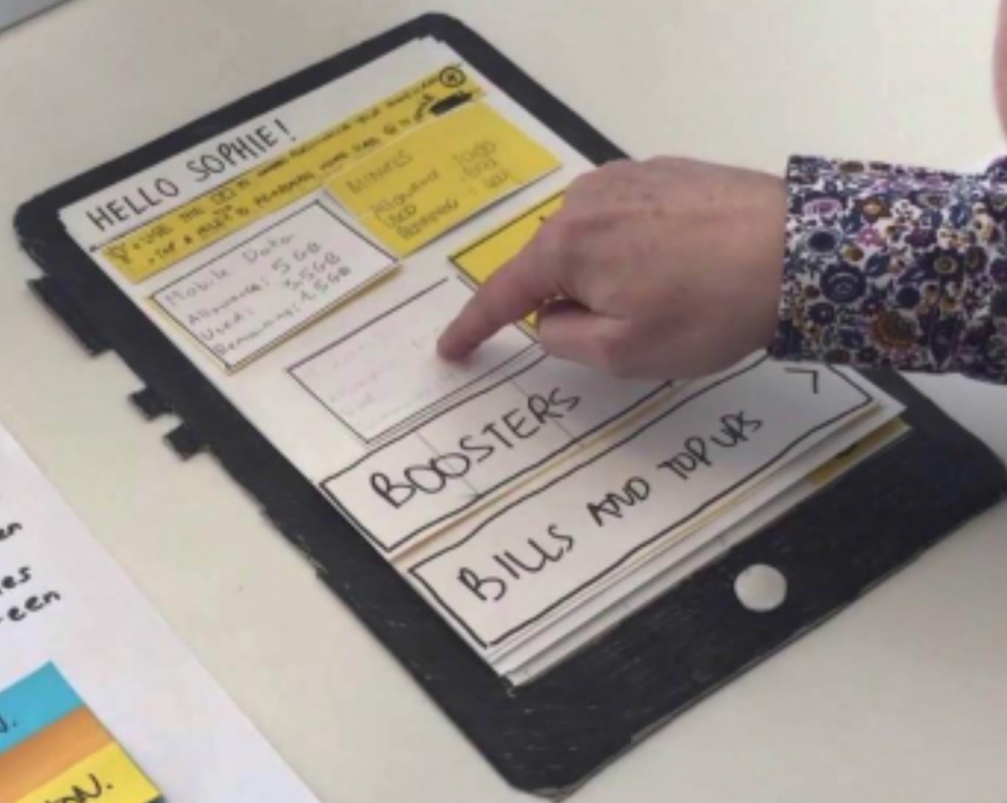
- Set a deadline
 - don't think too long - *build it!*
- Draw a window/phone frame on large paper
- Put different screen regions on cards
 - anything that moves, changes, appears/disappears
- Ready response for any user action
 - e.g., have those pop-up dialogs, etc. already made
- Use printer/scanner to make many versions

- Tasks:
1. Open the EE app
 2. Register and Log-in
 3. Remove the minutes tile from your home screen
 4. Place the "add \$10 Topup" tile to your home screen
 5. Re-arrange the tiles on your home screen

USER NOTIFICATION.

INPUT FIELD.

PRESSABLE BUTTON.



Preparing for a Test

- Select your “customers”
 - understand background of intended users
 - use a screening questionnaire to get the people you need
 - don’t use friends or family (at most 1 Stanford student)
 - **start recruiting today**
- Prepare scenarios that are
 - typical of the product during actual use
 - make prototype support these (small, yet broad)
- Practice to avoid “bugs”

Conducting a Test

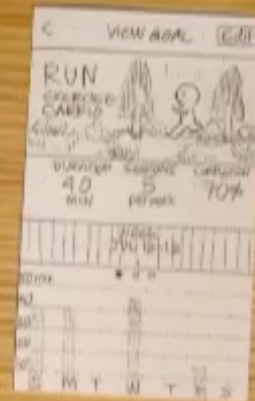
Four Roles

- Greeter – puts users at ease & gets data
 - Facilitator – only team member who speaks
 - gives instructions & encourages thoughts, opinions
 - Computer – knows application logic & controls it
 - always simulates the response, w/o explanation
 - Observers – take notes & recommendations
- } Can combine





Who is Zuki?



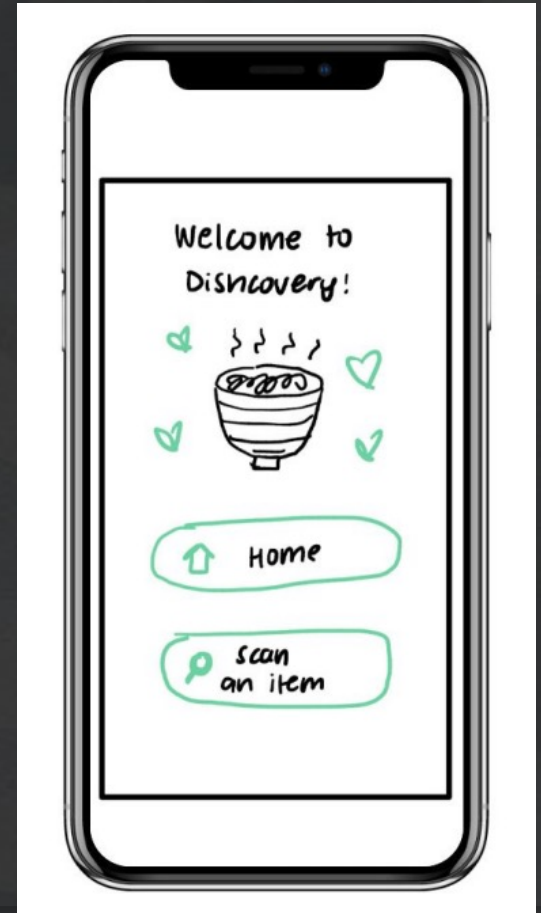
Practice: Low-fi Prototype Testing

In a group of 3-4 people around you, you will test the low-fi prototype of Dishcovery app!

One will play user, one will play facilitator, and 1- 2 will play observers taking notes.

Share the *critical incidents* (both positive and negative events) from your test in Slack.

Note: If you are the user, remember to talk-aloud about what you are thinking as you navigate the prototype

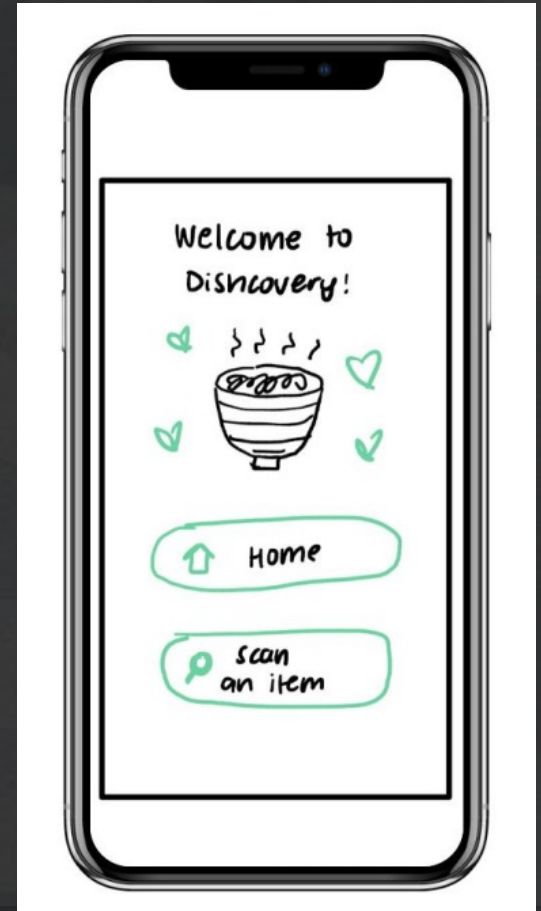


Practice: Low-fi Prototype Testing

Dishcovery allows users to cook with foreign ingredients by learning more about their history & how they are consumed.

- Simple task: Scan an ingredient
- Moderate task: Learn about the ingredient
- Complex task: Cook with the ingredient

<https://tinyurl.com/dishcovery-lofi>



Evaluating Results From a Low-fi Test

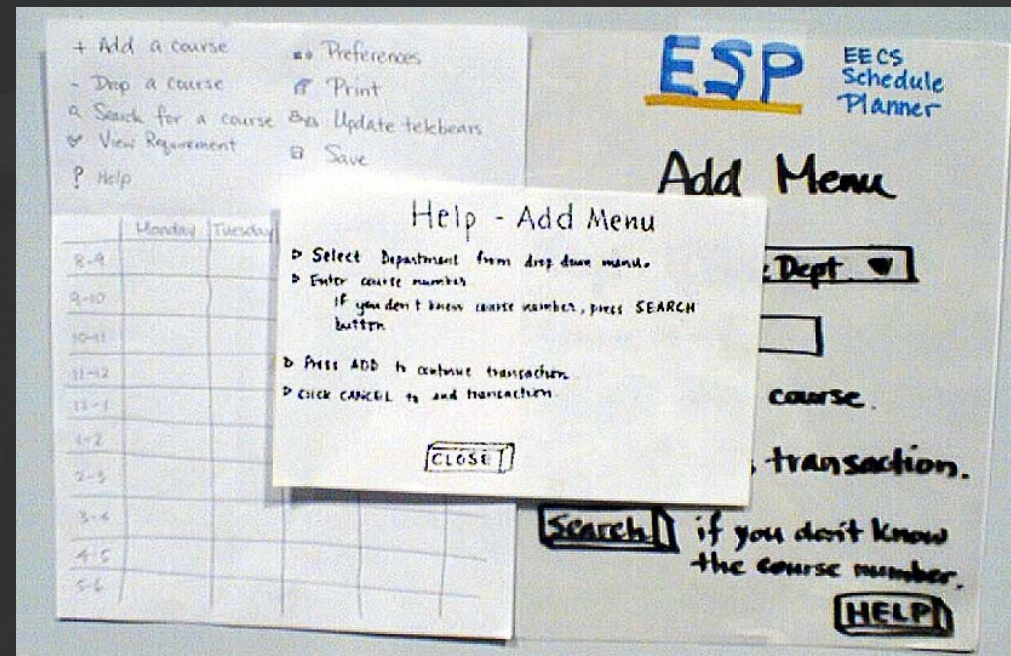
- High level questions about your design
 - does it **address the problem** you want to solve?
 - is this the **right realization** of your solution?
- Sort & prioritize observations
 - what was **important**?
 - lots of **problems in the same area**?
- Make changes & iterate
 - even ***iterate between tests***

Advantages of Low-fi Prototyping

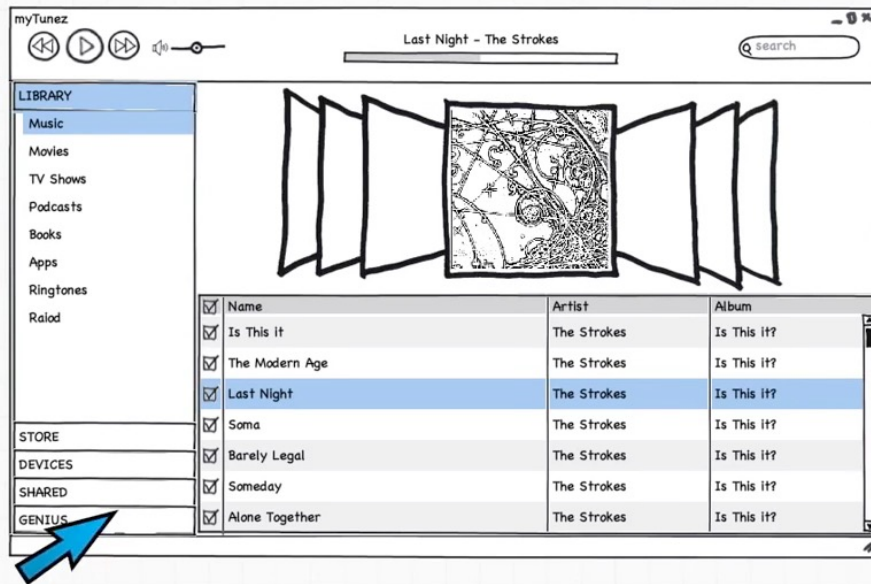
- Takes only a few hours
 - no expensive equipment needed
- Can test multiple alternatives
 - fast iterations
 - number of iterations is tied to final quality
- Participants do not focus on visual details
- Almost all interaction can be faked (Wizard of Oz)

Problems with Low-fi Prototypes

- “Computer” inherently buggy
- Slow compared to real app
 - timings not accurate
- Hard to implement some functionality
 - pulldowns, feedback, drag, viz
 - ...
- Won't look like final product
 - some widgets/controls hard to recognize
- End-users can't use by themselves
 - not in context of user's work environment



Interactive Lo-fi Tools



Balsamiq Mockups
<http://balsamiq.com>

POP
<https://marvelapp.com/pop>

Remote Testing of Low-fi Prototypes

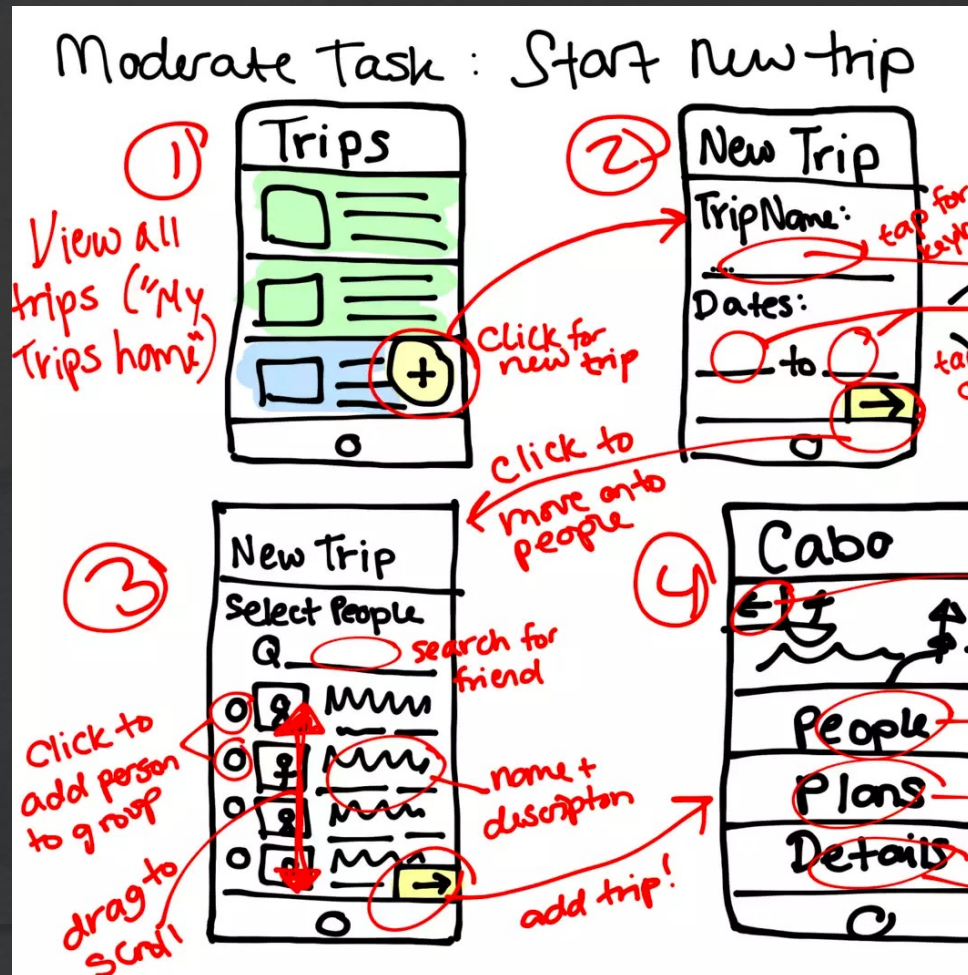
only used by permission & as last resort

1. Participant runs & records prototype (e.g., Balsamiq/POP) on their phone [hardest]
 - user records interaction by recording screen on iOS/Android
 - you record zoom meeting while participant speaks aloud
 - <https://uxdesign.cc/moderating-ux-research-with-zoom-1d4e89614277>
2. Participant runs zoom on their phone while you screen share prototype [moderate]
 - user taps on items & verbalizes aloud
 - *you control prototype & record meeting*
 - <https://uxdesign.cc/moderating-ux-research-with-zoom-1d4e89614277>
3. Participant hugs their laptop [easiest]
 - user runs your prototype (e.g., Balsamiq/POP) on their phone
 - you record zoom of their screen as *captured by their laptop camera*
 - <https://medium.com/@beparticular/were-still-hugging-our-laptops-8c7f22ed800e>



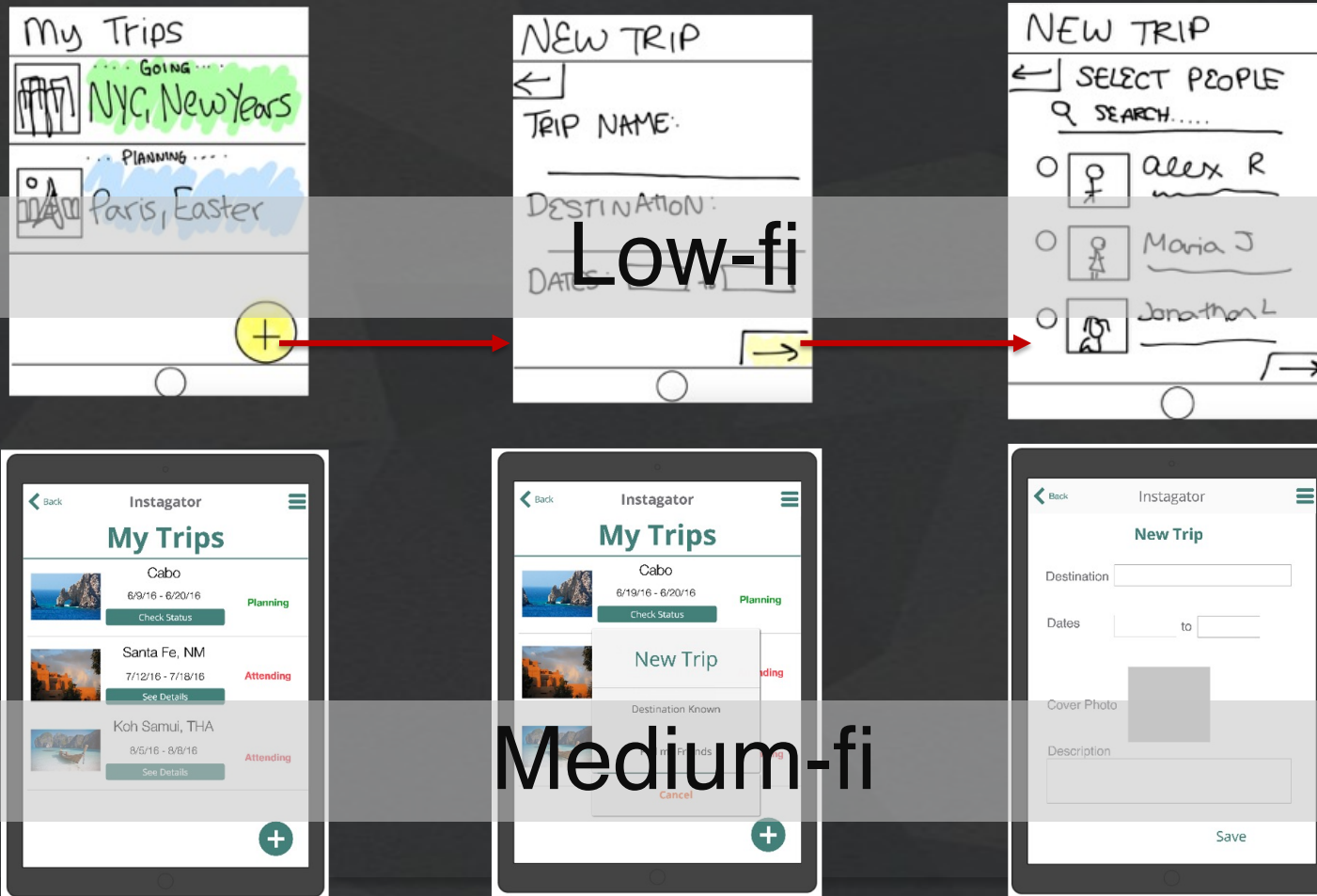
Fidelity in Prototyping:

Instagator



Fidelity in Prototyping

Task 1: Take a Destination Poll



Summary

- Prototypes are a concrete representation of a design or final product
- Low-fi testing allows us to quickly iterate
 - get feedback from users & change right away

Further Reading

Prototyping

- Books

- Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces, by Carolyn Snyder, Morgan Kaufmann, 2003

- Articles

- “Prototyping for Tiny Fingers” by Marc Rettig, in Communications of the ACM, 1994
- “Using Paper Prototypes to Manage Risk” by Carolyn Snyder, <http://world.std.com/~uieweb/paper.htm>
- “The Perils of Prototyping” by Alan Cooper, <http://www.chi-sa.org.za/Documents/articles/perils.htm>

Next Time

- Lecture on Monday: Visual Information Design
- Watch Scott Klemmer's HCIOnline lectures
 - [6.1 Visual Design](#) (7:37)
 - [6.2 Typography](#) (10:47)
 - [6.3 Grids & Alignment](#) (17:33)
- Project next week
 - 15-20 sketches of 3-5 design realizations (start in studio...)
 - pick the top two & storyboard/task flow those
 - pick the top 1 & build/test low-fi prototypes using 3 key tasks for next week's studio presentation
 - recruit representative participants **now!**

Exit Ticket

<http://hci.st/cs147-26au-exit-4-239>

