CSE 593

Interactive Systems Design and Prototyping

Farnaz Jahanbakhsh

Lecture content adapted with modifications from:

- MIT 6.813 materials authored with contributions from: Elena Glassman, Philip Guo, Daniel Jackson, David Karger, Juho Kim, Rob Miller, Stefanie Mueller, Clayton Sims, and Haoqi Zhang
- MIT 6.S063 by David Karger & Lea Verou
- UMich EECS 593 by Nikola Banovic

EECS ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
UNIVERSITY OF MICHIGAN

Logistics

- Assignment 1 (individual) grades published.
- Assignment 1 (Group) being graded.
- Assignment 2 (Individual) due next week (Oct 9 at 5PM).
- Assignment 2 (Group) due in two weeks (Oct 16 at 5PM).
- Quiz 4 assigned today at 4:30PM and due tomorrow, Friday, at 5PM.

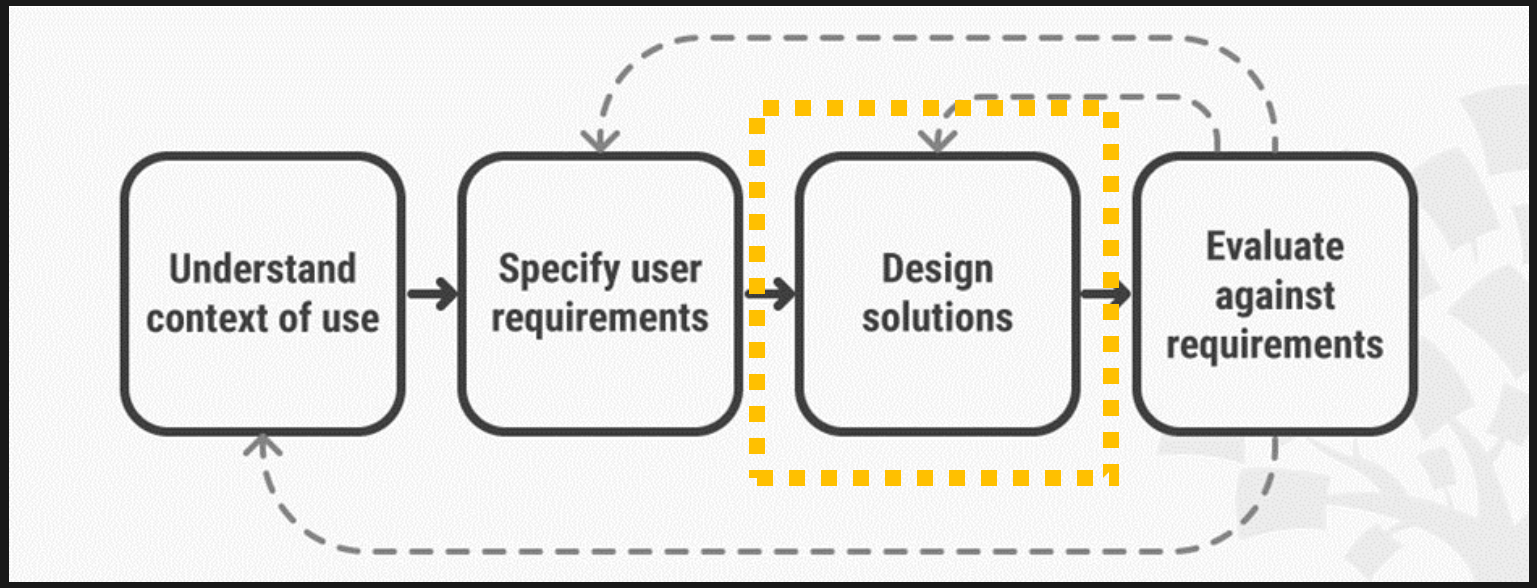
Learning goals

Define design vocabulary.

Learn methods to design systems that match user requirements and functional constraints.

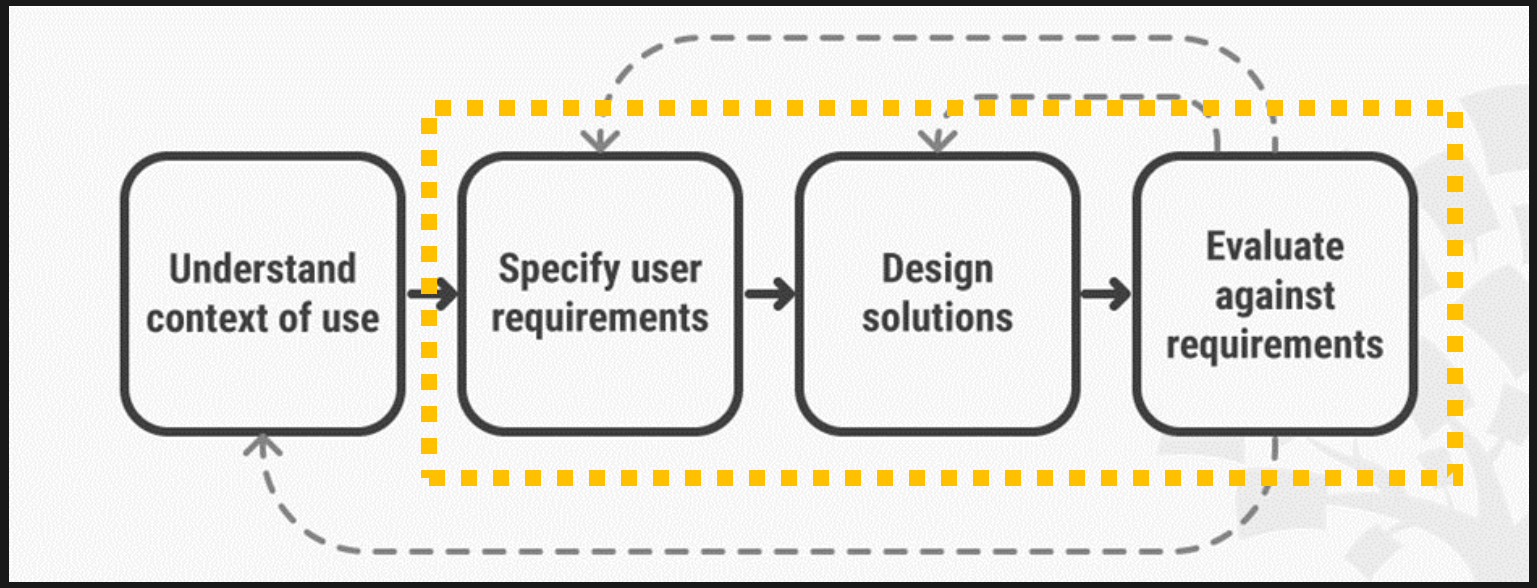
Learn methods to prototype interactive systems.

User-centered design process



Interaction Design Foundation (https://www.interaction-design.org/literature/topics/user-centered-design)

User-centered design process



Interaction Design Foundation (https://www.interaction-design.org/literature/topics/user-centered-design)

What is design?

Please answer this question in Canvas

What best describes Design? Select all that apply.

- ❑ Design is creating an artifact, system, or process according to a plan.
- ❑ Design seeks knowledge about what already exists.
- ❑ Design seeks optimal solutions to problems.
- ❑ Design seeks to create new materials.

You have 120 seconds…

DONE!

What is design?

“Construction of an artifact, system, or a process based on a specification and according to a plan.”

What is design?

Different from sciences in that it does not only seek knowledge about what already exists, but produces new artifacts that change the status quo.

What is design?

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Different from engineering in that it does not seek optimal solutions and new materials; rather it uses existing materials to create new realities.

What is design?

Different from sciences in that it does not only seek knowledge about what already exists, but produces new artifacts that change the status quo.

Different from engineering in that it does not seek optimal solutions and new materials; rather it uses existing materials to create new realities.

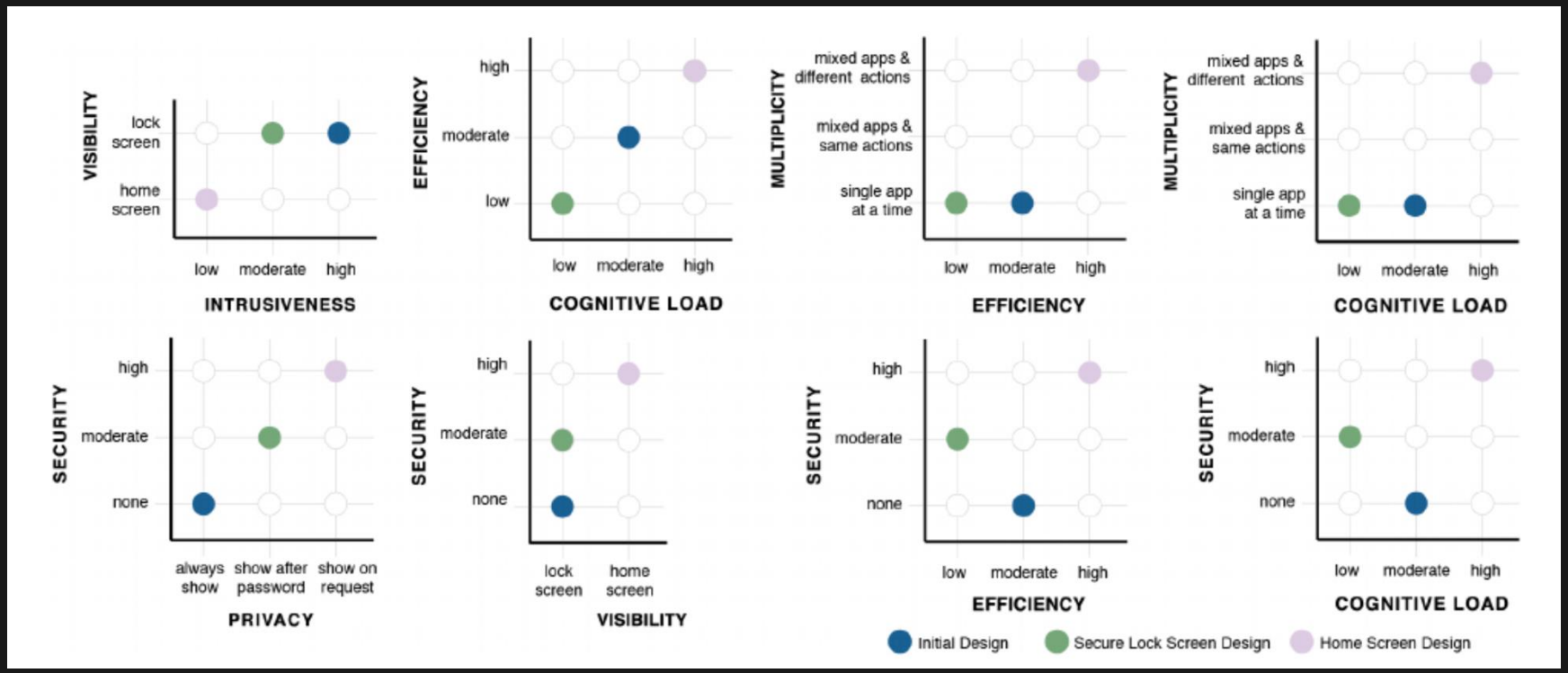
Different from art in that it is not just about expressing ideas, but produces solutions with testable outcomes.

What is design space?

What is design space?

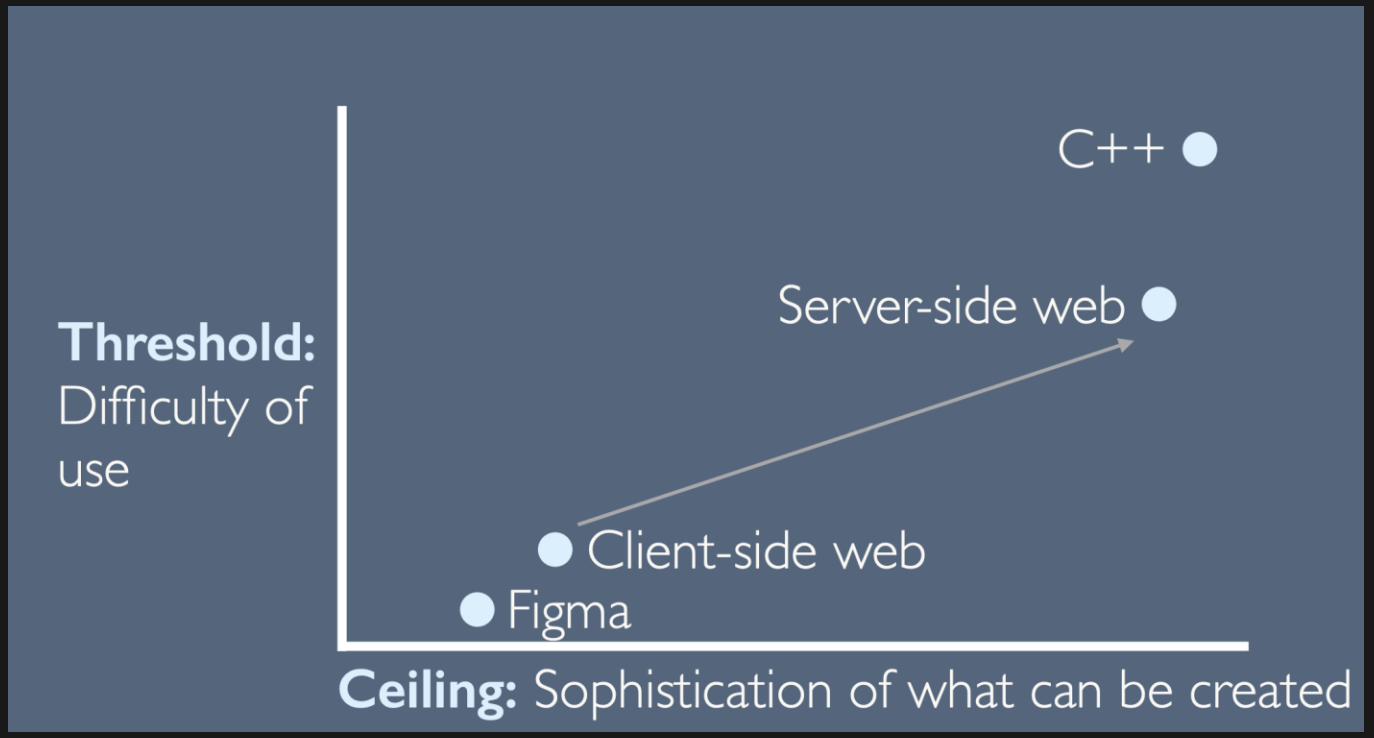
“Multidimensional combination of “variables” from user requirements and constraints.”

Design space



Banovic et al., 2014. ProactiveTasks: the short of mobile device use sessions.

Design space



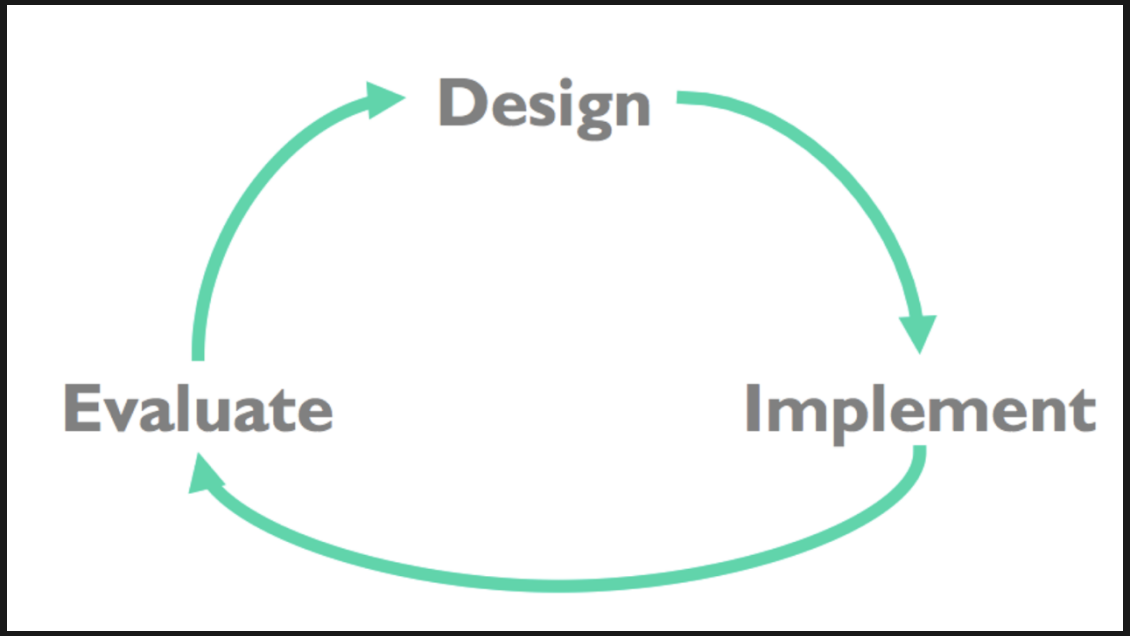
Michael Bernstein's rendering of Myers, Hudson, and Paush TOCHI 2000
from CS347 at Stanford

How to specify designs?

How to specify designs?

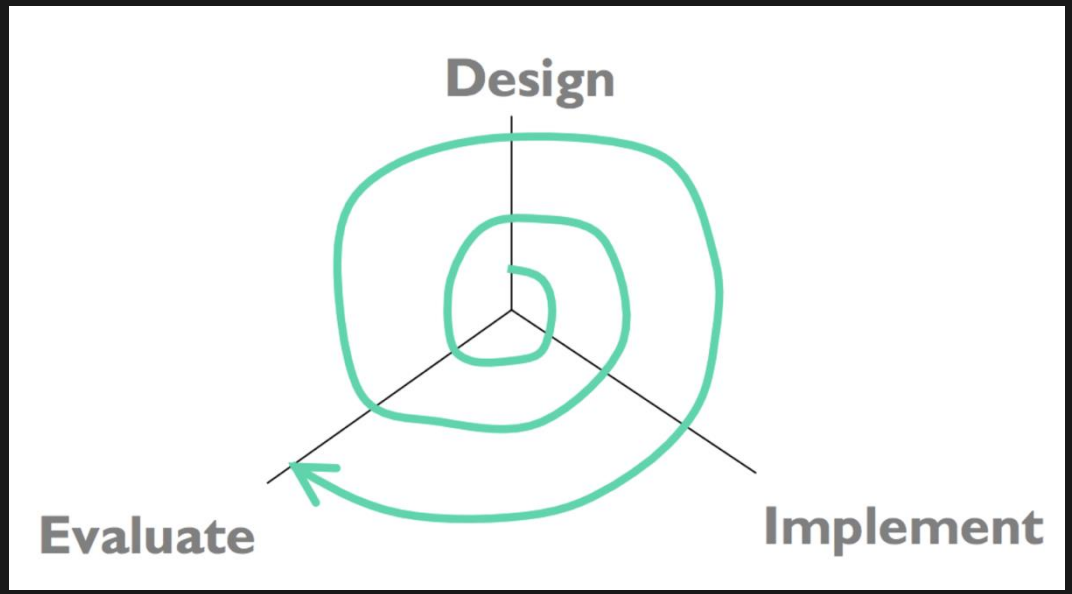
Prototyping!

Iterative design



Spiral Model:

- Know early iterations will be discarded
- So make them cheap
- Storyboards, sketches, mock-ups
- Low-fidelity prototypes
- Just detailed enough for evaluation

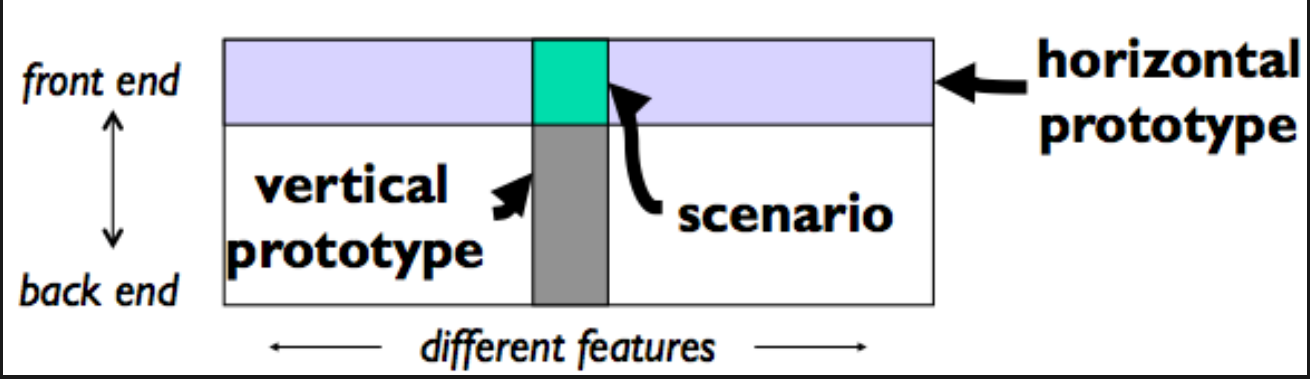


Why spiral model?

- Risk is greatest in the early iterations
- So we put our least commitment into early implementations
- Allows for parallel design
- Keep parts of the design that work, redesign others

Fidelity is multidimensional

- Breadth: % of features covered
  - Only enough features for certain tasks
- Depth: degree of functionality
  - Limited choices
  - canned responses
  - no error handling



Personas

Emma: The Emerging Professional Adult

Emma sees herself as "cool, connected, creative, hip, up on fashion, health conscious, having depth and opinions." Emma knows who she is and is trying to stay authentic to herself as she moves into the professional world. Emma also realizes that part of becoming an adult is moving toward buying things of quality, rather just what's cheapest.

"The coolest people I know don't need to flaunt anything."

Emma is actively engaged in deliberately creating a public image of herself, so she carefully considers the devices she uses. She says, "It's not just if you have an iPod or any one thing. It's the whole package." Emma is struggling with how to maintain her unique identity while adjusting to the new corporate world she's part of now.

The phone Emma uses perfectly embodies this struggle. She carries a Blackberry, which they gave her at work. But the two-tone color is too industrial and the overall image is too corporate. Emma covered the phone with a black neoprene case to try to reconcile its appearance with her image. But a case only goes so far. Emma would strongly prefer using an iPhone, its appearance and streamlined interface better reflects her image. The functionality of the iPhone feels immediate – "boop, I've done it" – whereas with the Blackberry she feels like she's tediously "loading and pressing," even when using the same "cool" app, like Facebook. The Blackberry's clunky interaction doesn't represent Emma.

Nonetheless, there are certain gadgets that Emma loves, though they don't fit her public image, so she uses them in private. For example, her Bluetooth headset gives her freedom to move around her apartment, where the cell phone reception is spotty. To Emma, the headset is "super cool and cute." But Emma would never be caught using the headset out of her home. She says, "People who use a Bluetooth are trying to project an image of importance that ends up working against them."

Part of being an adult to Emma is making careful, higher quality purchases. Her proudest "adult" purchase was a 42" flat-screen TV. She did research beforehand to make sure she was getting a good deal and a good product. This careful consideration before purchasing has changed the way Emma now purchases almost everything. For example, rather than buying "cheap, junky" clothes, she researches and gets a good price on good clothes. Emma says, "My new TV is the electronic version of a cute new outfit."

Cool Characterization
- Sleek design
- Immediate interaction
- Things that portray self image

Life Tasks
- Work, commute to work
- Keep up with current events
- Stay in touch/socialize

Devices/Technology
- Blackberry
- Flat-screen TV
- Digital camera
- iPod
- Bluetooth headset
- Windows laptop (not MacBook)
- Nice car when commuting

Demographics
- Female or male
- Mid-20's
- Single
- Rents in city or suburbs
- Middle class

When Emma was younger...

"I'm proud of the responsible and capable adult I am becoming."

Cool Characterization
- Good value for cost
- Helps provide feeling of safety and

Contextual Design *Evolved* (https://doi.org/10.2200/S00597ED1V01Y201409HCI024)

Why personas?

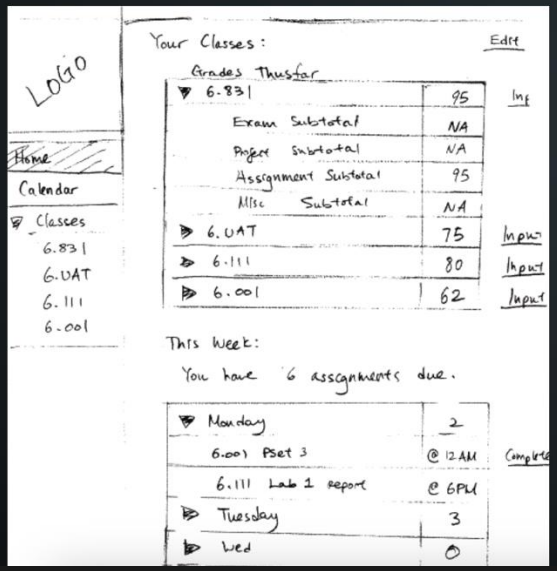
- Helps prioritize features
- Think about trade-offs across user types

Anti-personas

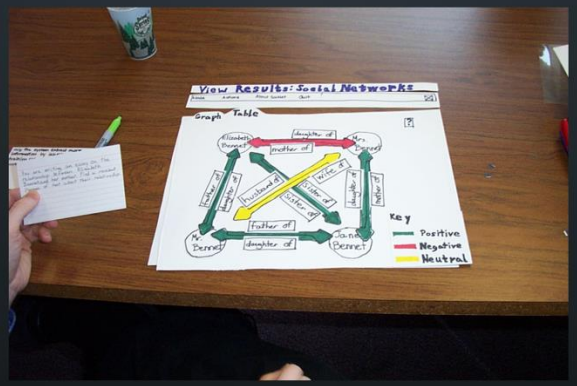
- Disengaged users: not interested in the design
- Extreme users: atypical or outlier behaviors
- Misaligned value users: their values conflict with the design’s purpose
- Power users: with advanced needs
- Casual users: only occasionally use the design
- Negative behavior users

Low-fidelity prototypes

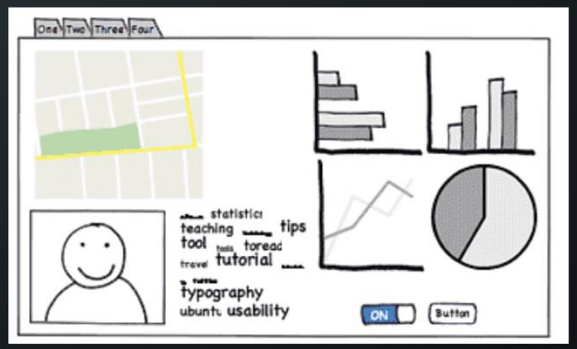
Sketches



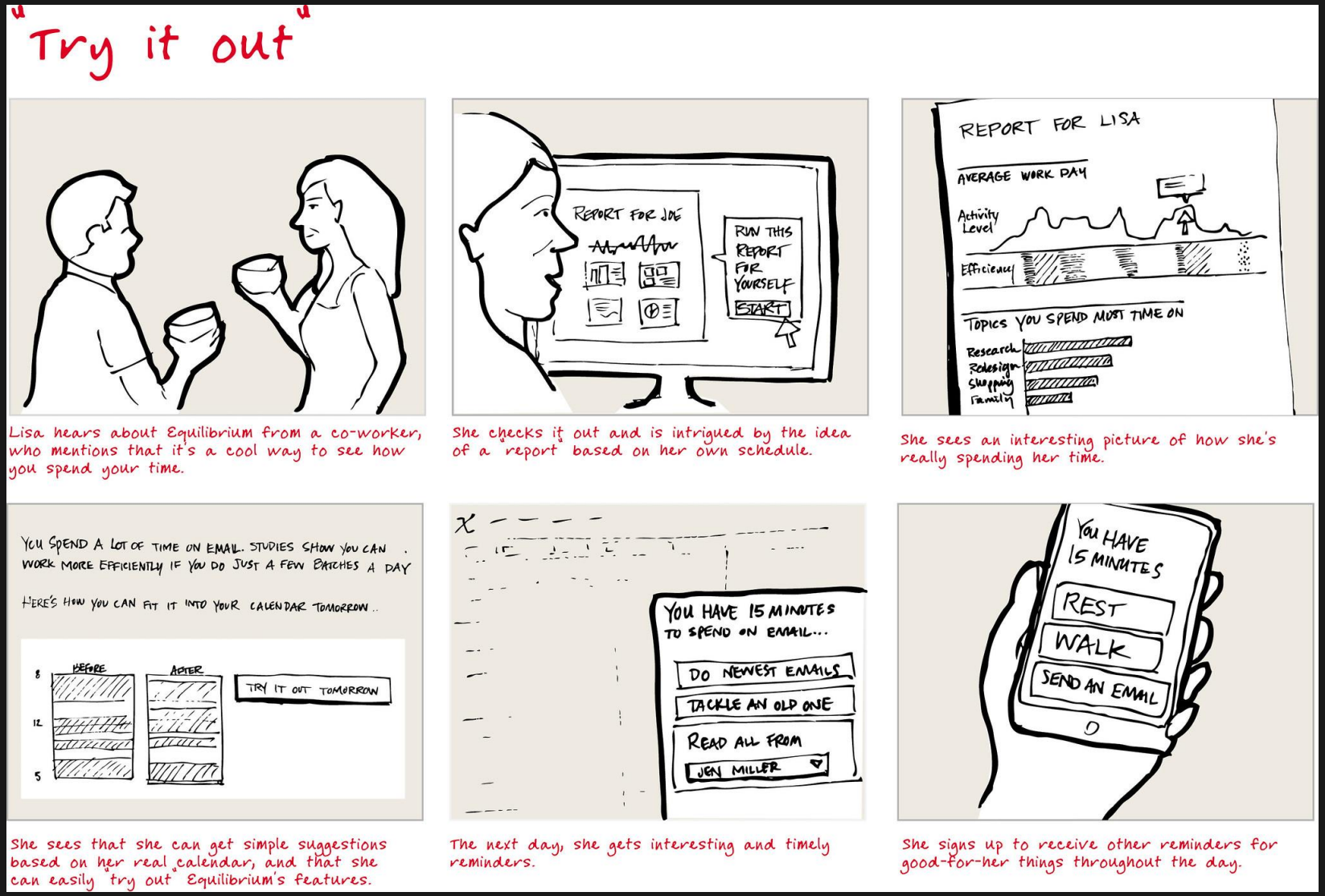
Paper Prototypes



Computer Mockups



Low-fidelity prototypes: story boards



Buley. 2013. The User Experience Team of One. rosenfeldmedia.com/books/ux-team-of-one/

Please answer this question in Canvas

What are storyboards good for? Select **all** that apply.

- ❑ Help with ideation; i.e., a way to document design ideas.
- ❑ Can be evaluated to determine how well the design supports the user goals.
- ❑ Help collect early feedback on how useful the design could be.
- ❑ Help collect early feedback on how usable the design could be.

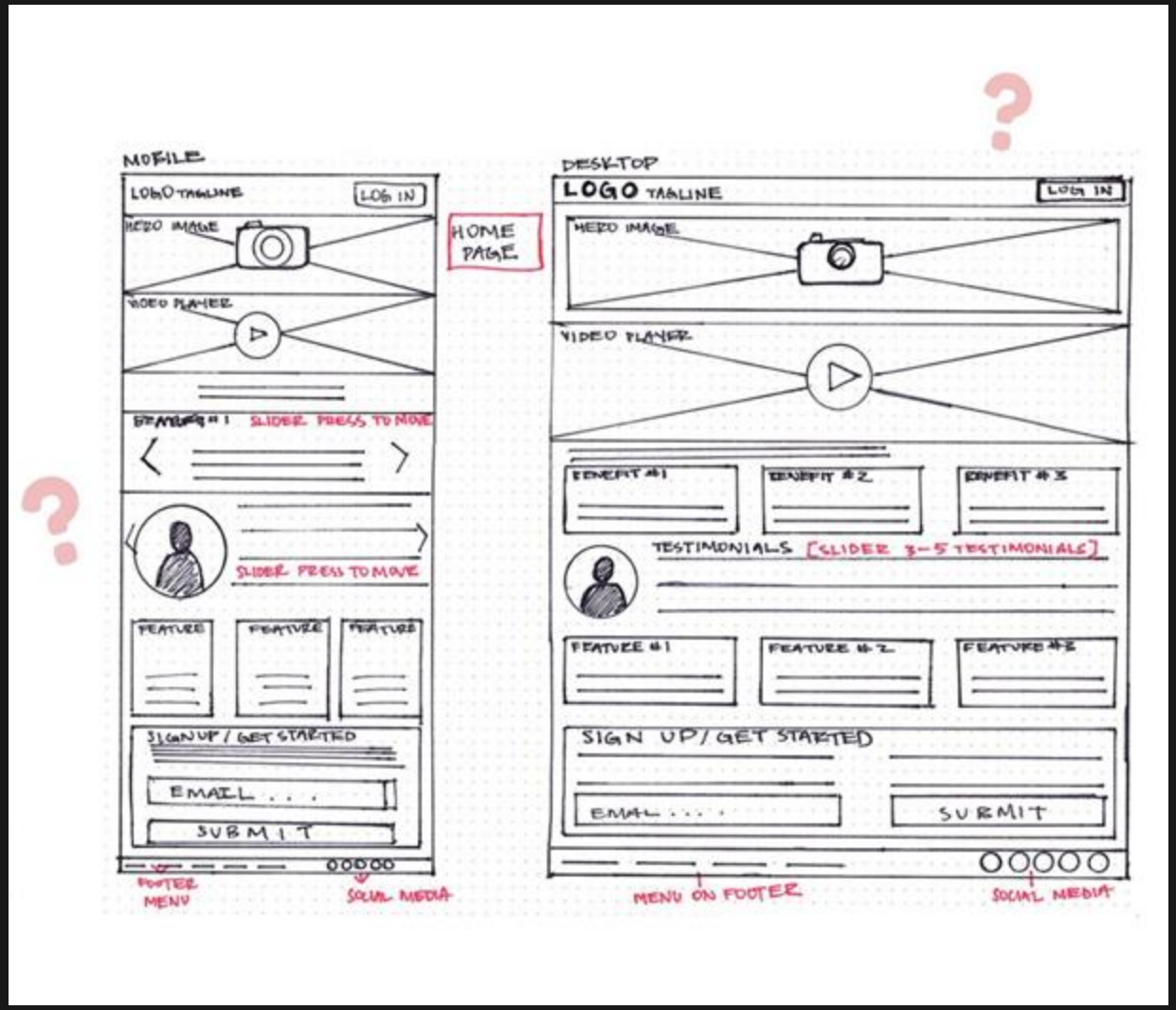
You have 120 seconds…

DONE!

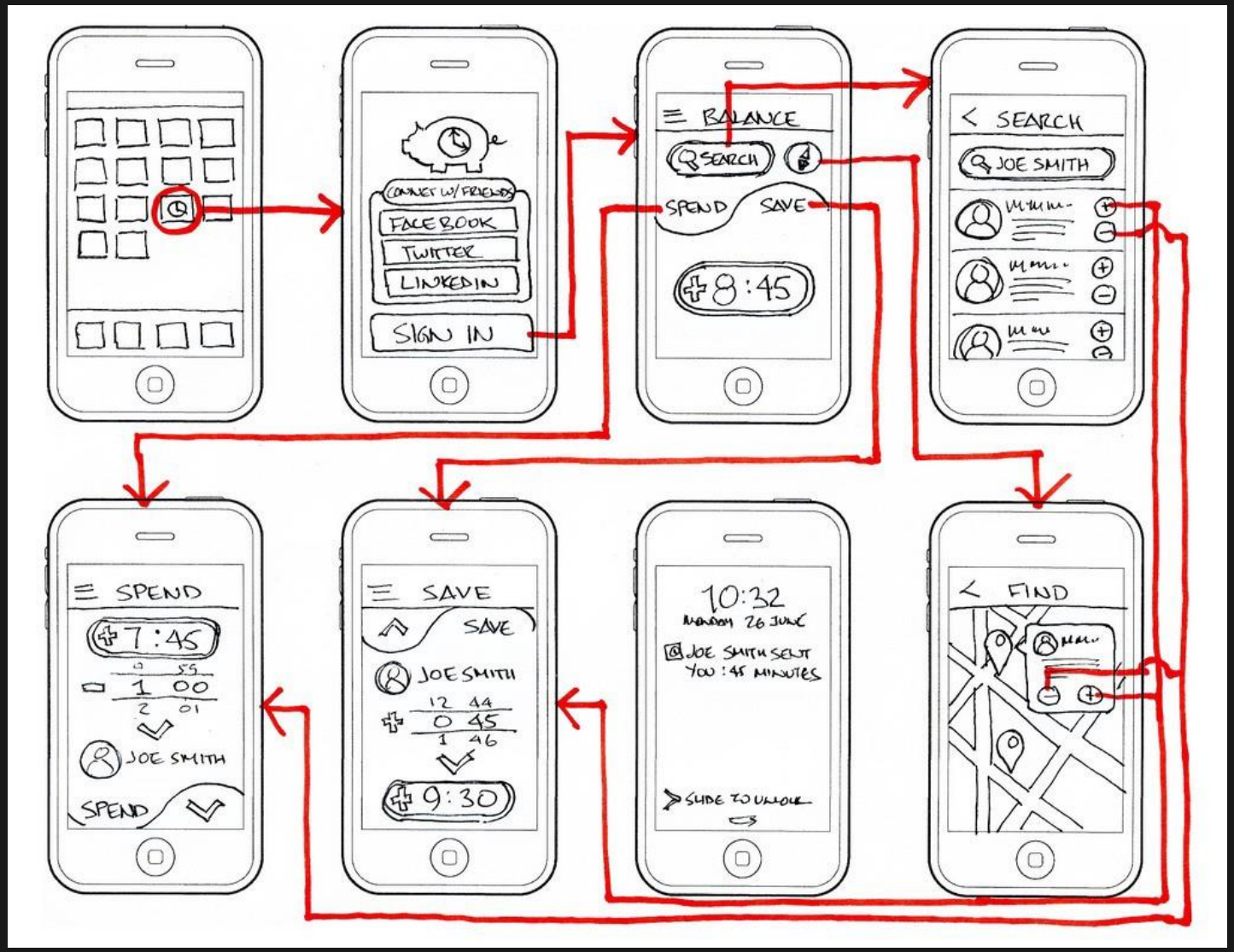
Low-fidelity prototypes: wireframes

- Visual representation of user interface without any branding / aesthetics
- A “floor plan” for building a UI
- Useful:
  - Communicating functionality to different stakeholders
  - Giving designers starting point
  - Reference points for functional specifications

Low-fidelity prototypes: wireframes



Low-fidelity prototypes: paper prototyping



Ergomania UX. 2019

Low-fidelity prototypes: paper prototyping

- A person simulates the computer's operation
  - Putting down & picking up pieces
  - Writing responses on the "screen"
  - Describing effects that are hard to show on paper
- Low fidelity in look & feel
- High fidelity in depth (person simulates the backend)

Low-fidelity prototypes: paper prototyping

Example: https://www.youtube.com/watch?v=y20E3qBmHpg

Why paper prototype?

- Faster to build
  - Sketching is faster than programming
- Easier to change
  - Easy to make changes between user tests, or even *during* a user test
  - No code investment - everything will be thrown away (except the design)
- Focuses attention on big picture
  - Designer doesn't waste time on details
  - Customer makes more creative suggestions, not nitpicking
  - Customer more willing to propose radical changes

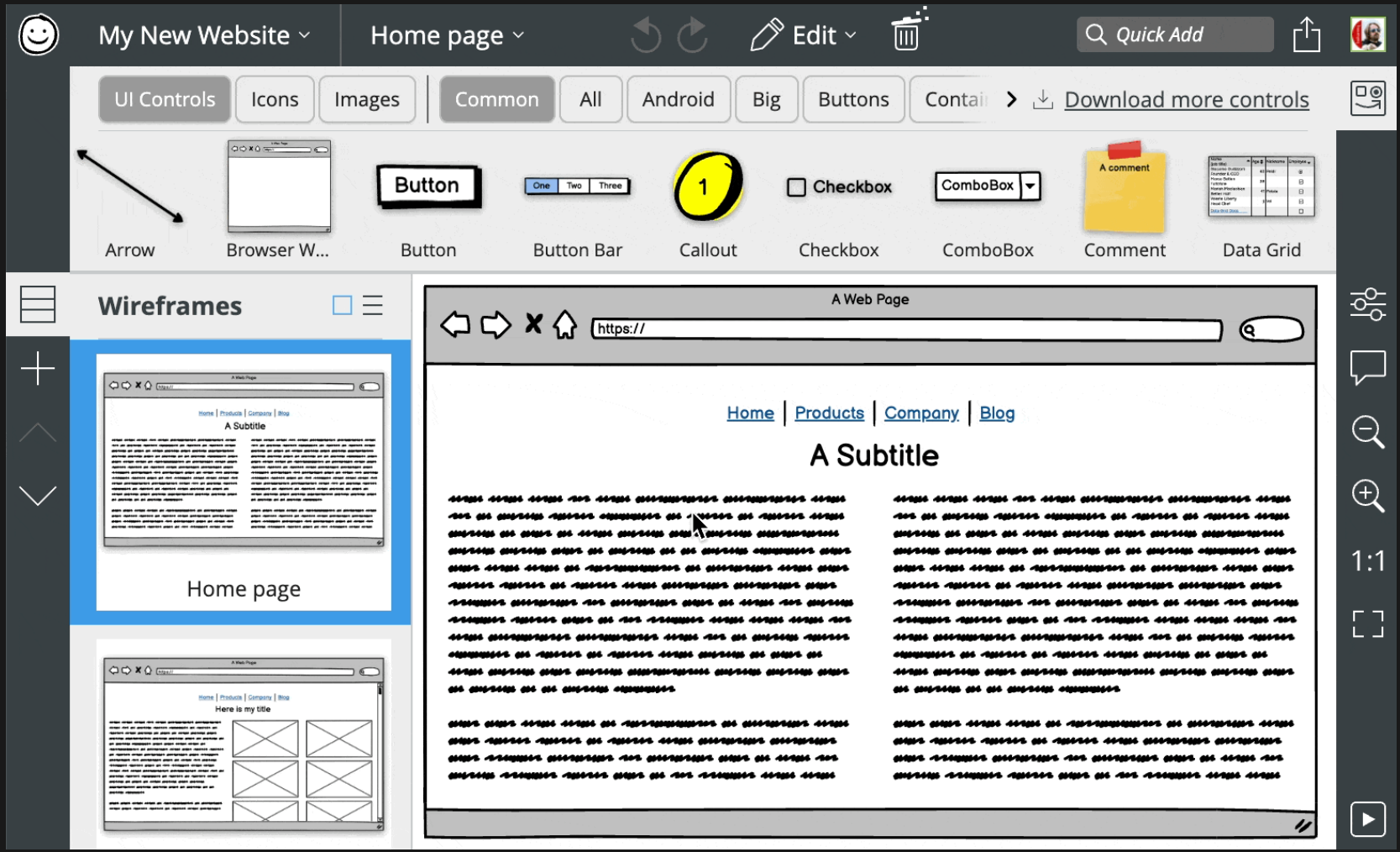
Low-fidelity prototypes: paper prototyping

Image source: http://www.davidfenigstein.com/

Tips for good paper prototypes

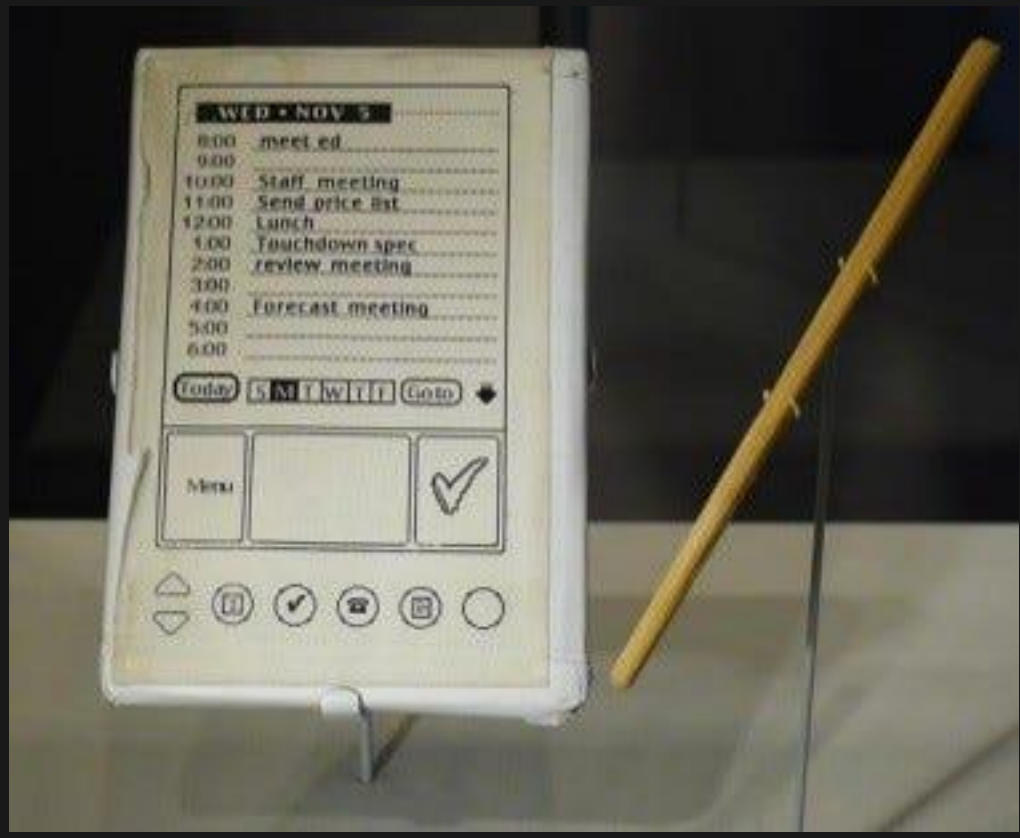
- Make it larger than life
- Make it monochrome
- Replace tricky visual feedback with audible descriptions
  - Tooltips, drag & drop, animation, progress bar

Digital wireframes

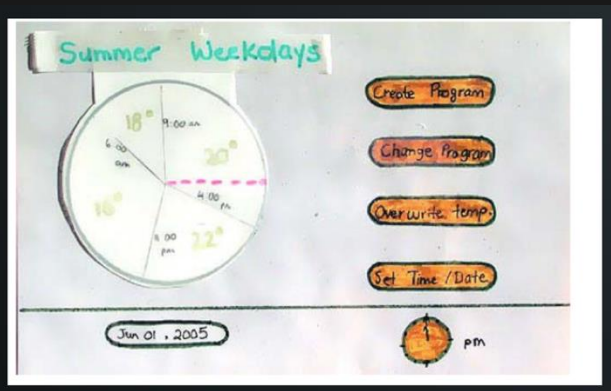


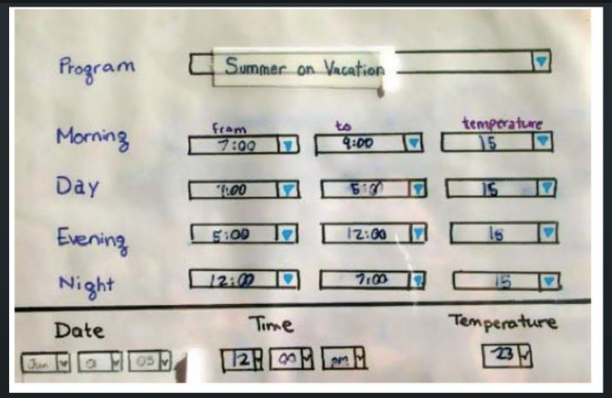
Low-fidelity prototyping

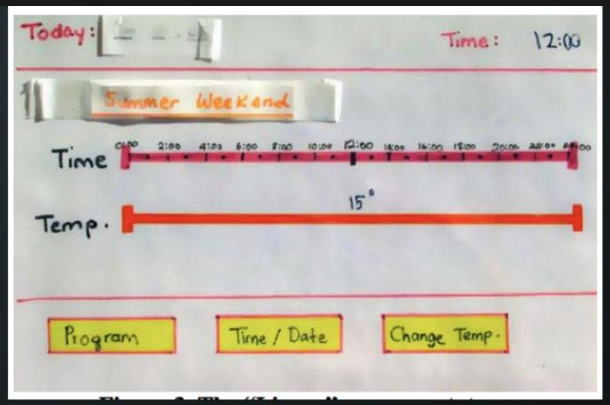
- Use cheap physical objects
- Desktop and web UIs are flat, hence use paper
- Jeff Hawkins used a block of wood for PalmPilot



Parallel design







Pictures from Tohidi, Buxton, Baecker, Sellen. "Getting the Right Design and the Design Right: Testing Many Is Better Than One." *CHI 2006*

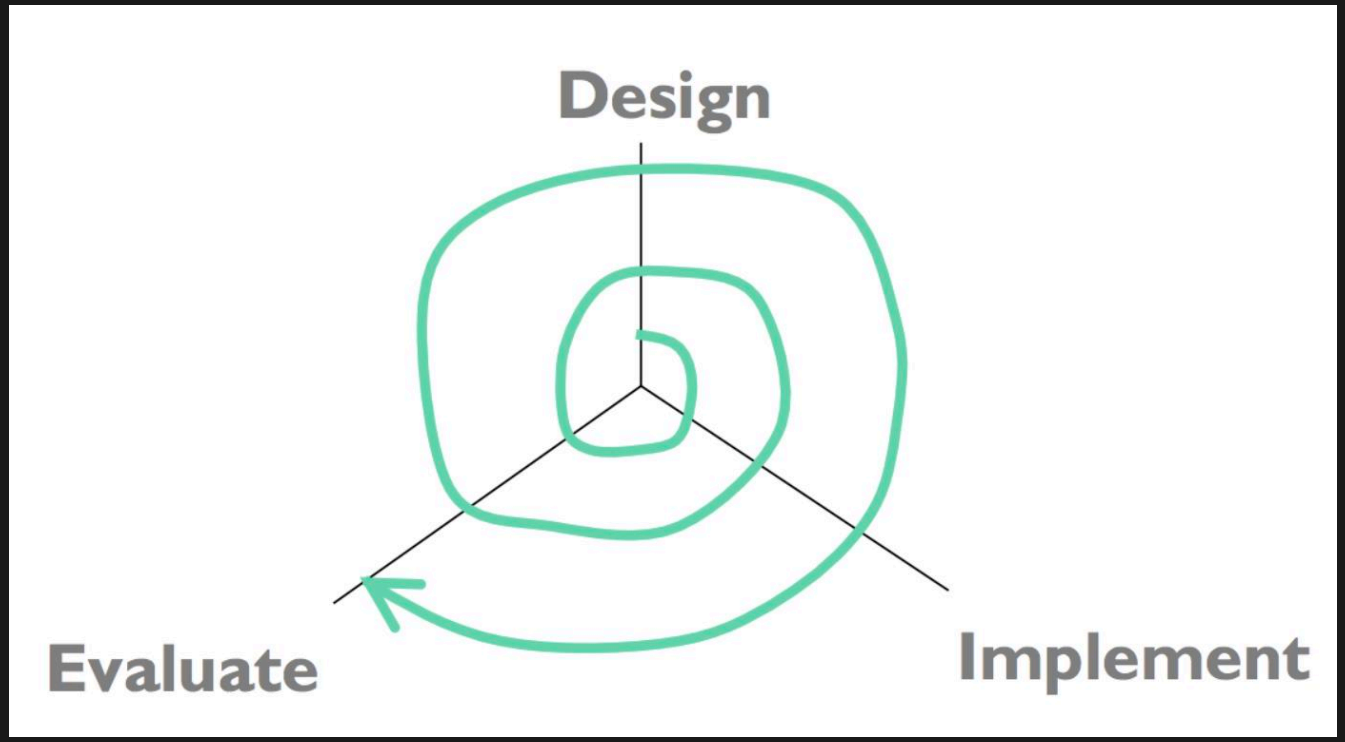
Wizard of Oz prototype

- Software simulation with a human in the loop to help
- "Wizard of Oz" = "man behind the curtain"
  - Wizard is usually but not always hidden
- Often used to simulate future technology
  - Speech recognition
  - Machine learning
- Challenge
  - Wizard has to be mechanical

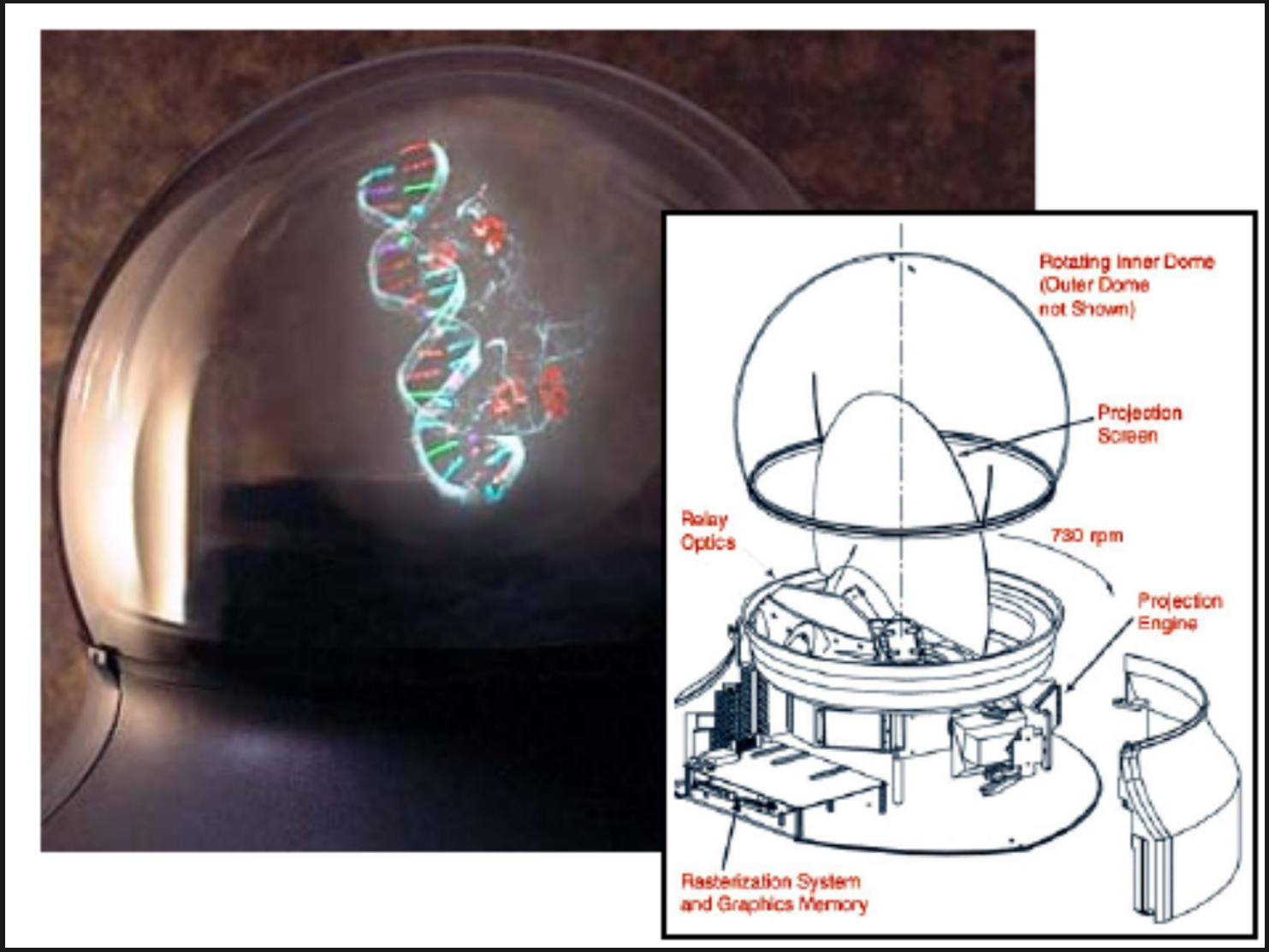
Low-fidelity prototypes: wizard of Oz

Fitzmaurice. Exploring Volumetric User Interfaces using Wizard-of-Oz Prototyping. (https://youtu.be/jxsDBFgXZoE?t=194)

High-fidelity prototypes



High-fidelity: functional prototypes



Grossman & Balakrishnan. 2008. Collaborative interaction with volumetric displays. In CHI '08.

High-fidelity: functional prototypes

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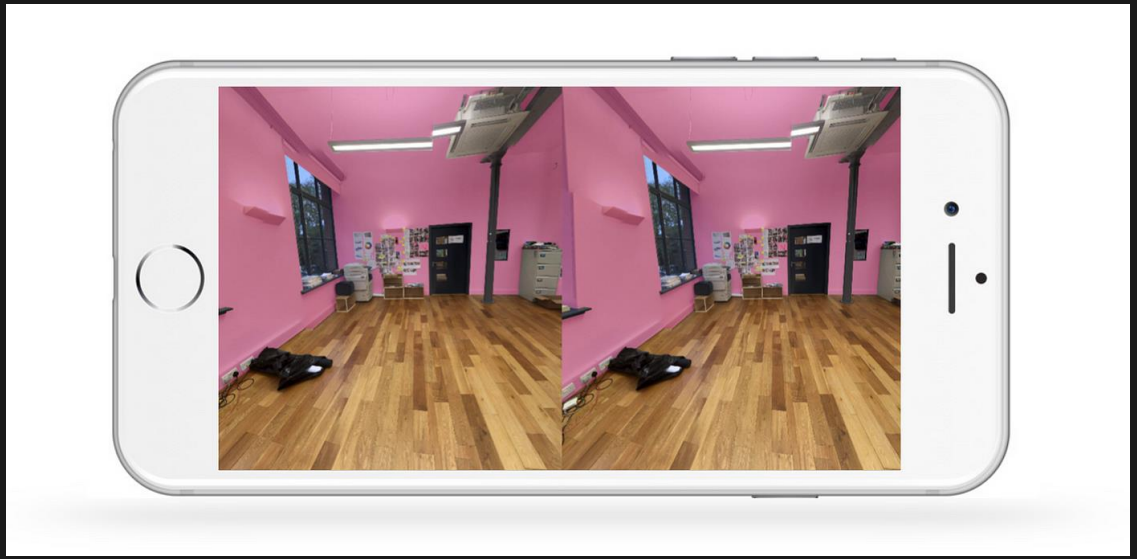
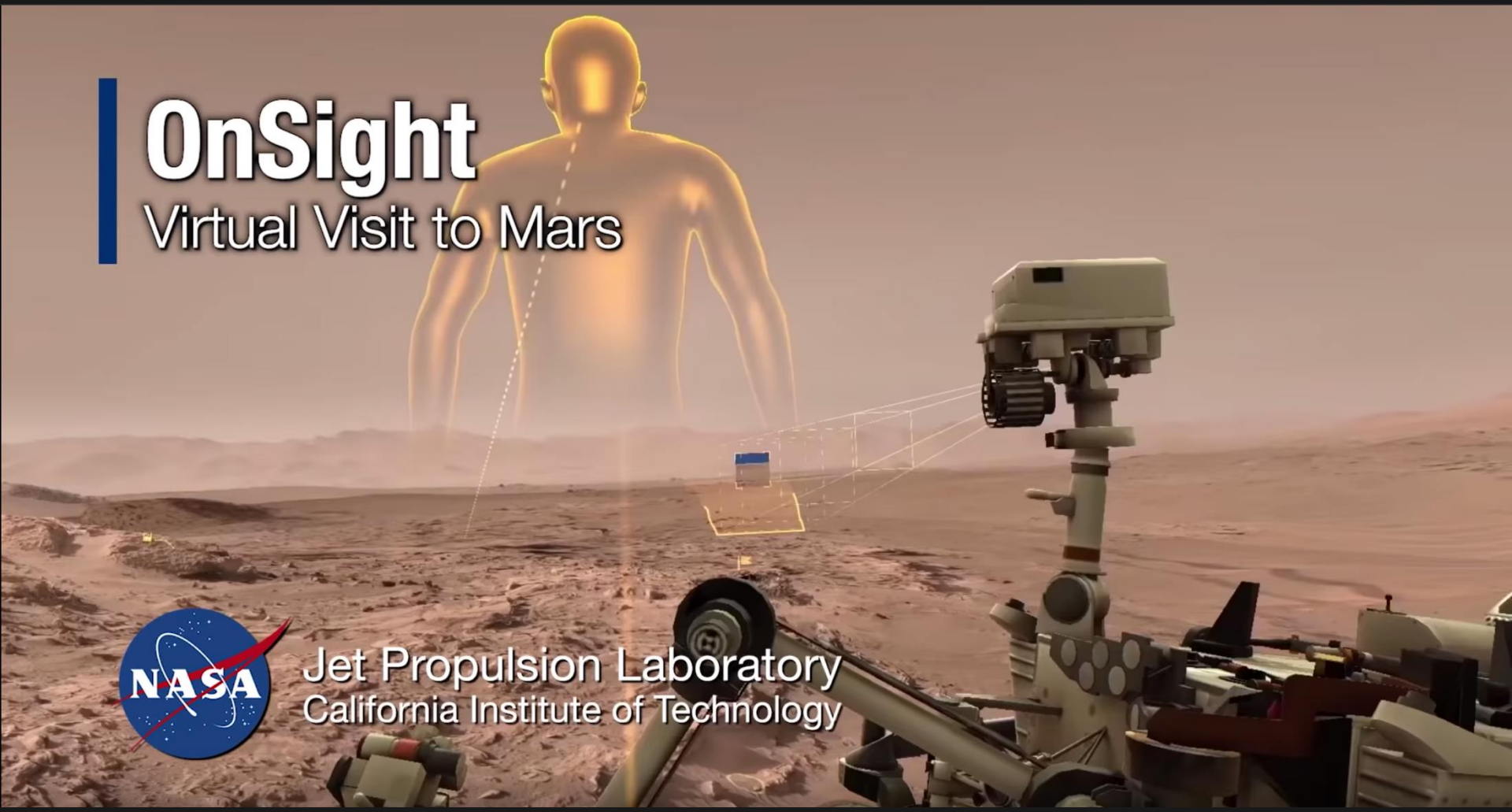
High-fidelity: functional prototypes



https://medium.com/common-good/quick-dirty-prototyping-with-google-cardboard-f00991c495e3
https://www.youtube.com/watch?v=y1YHKSjp5bk

High-fidelity: functional prototypes



OnSight: Virtual Visit to Mars. (https://youtu.be/XtUyUJAVQ6w)

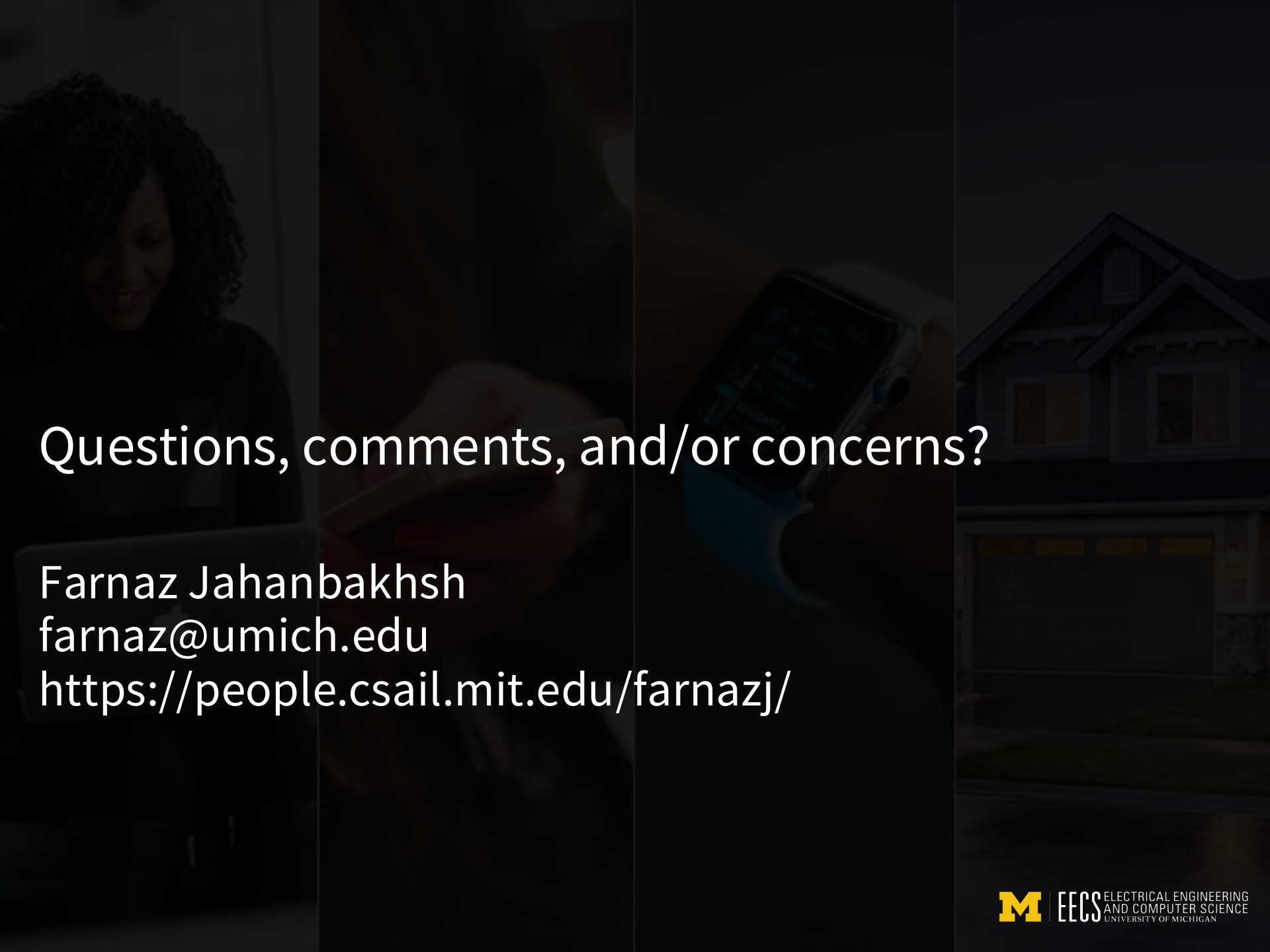
Please answer this question in Canvas

What is true about design prototypes? Select all that apply.

- ❑ Once prototype evaluation is done and satisfactory, the prototype can be deployed into production.
- ❑ Low-fidelity prototypes enable designers to explore and discard unpromising design ideas early in the process.
- ❑ High-fidelity functional prototypes enable designers to explore and discard unpromising design ideas early in the process.
- ❑ Only functional prototypes can be properly evaluated.

You have 120 seconds…

DONE!



Questions, comments, and/or concerns?

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