Communicating with Data– Prototyping

Dr. Ab Mosca (they/them)

Slides based off slides courtesy of Jordan Crouser (https://jcrouser.github.io/)

Coming Up

- Final Project!
- Yes, you do need to work with a group. If that is impossible, please speak with me
- Pick a topic you are interested in – you'll work on this for the rest of the semester

Plan for Today

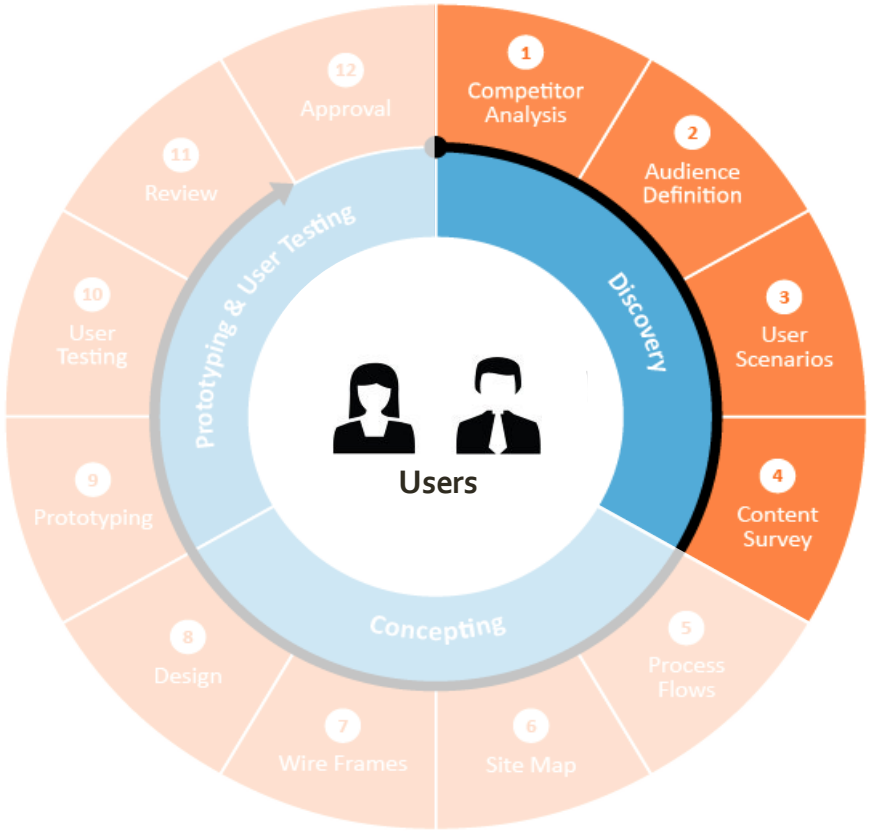
- User-centered design
  - What it is
  - Why do it
  - Ways to do it
- Paper prototypes

Hypothetical Example

Admissions asks you, a visualization expert, to **make a visualization summarizing Smith College for prospective students**.

How do you start?

User-centered design framework



1) Discovery

- Learning about your users
- Modeling your users
- Analyzing your users' tasks
- Eliciting and defining clear product requirements

2) Concepting Phase

- Developing conceptual models
- Solving design problems through ideation
- Detailed design activities

3) Prototyping + User Testing

- Delivery of a high-quality product that meets users' needs and is easy to learn and use

http://www.uxmatters.com/mt/archives/2010/07/design-is-a-process-not-a-methodology.php

Discovery: Competitor Analysis

- **Why?**
  - If you look at what already exists, you might be able to identify potential issues in advance
  - Also helps establish your unique contribution
- **How?**
  - Literature or product review
  - Analysis
    - What are the existing tools?
    - What is their purpose?
    - What audience are they aiming for?
    - What kinds of strategies are they using?
    - What functionality do they contain?
    - What are their strengths and shortcomings?
  - Identify opportunities and design constraints

Discovery: Competitor Analysis

https://www.smith.edu/discover-smith/smith-glance

Smith at a Glance

Founded in 1871, Smith College opened in 1875 with 14 students. Today, Smith is among the largest women's colleges in the United States, with students from 46 states and 78 countries. An independent, nondenominational college, Smith remains strongly committed to the education of women at the undergraduate level, but admits both men and women as graduate students.

Enrollment & Geography

At Smith, we have more than **2,500 undergraduates** who come from all over the country and all over the world. For students entering in fall 2023, we received **9,869 applications** and **admitted 20%**. Check out more admissions statistics.

Here's the geographic breakdown of enrolling students (based on data for the class of 2027):

24% Mid-Atlantic

23% New England

20% West

11% Foreign & U.S. Territories

10% Midwest

7% South

4% Southwest

Financial Aid to the Class of 2025

At Smith we are committed to making a high-quality education possible for women from all economic backgrounds by meeting 100% of the documented need of all admitted students who meet our deadlines. In the fall of 2022, Smith College eliminated loans from its undergraduate financial aid packages for students receiving need-based institutional grants and replaced the loan amount with grants from the college.

- Recipients of need-based gift aid from Smith: 63%
- Smith grant range: $1,120-$81,000
- Average need-based grant: $55,000

Undergraduate Tuition and Fees, 2025–26

$67,140 Tuition

$23,360 Housing and Meals

$308 Student Activities Fee

$800 Books, Course Materials, Supplies, and Equipment

$640 Transportation (domestic average)

$1,850 Personal Expenses

Discovery: Audience Definition

- Learning about their problem
  - Semi-structured interview
- Analyzing their tasks
  - Hierarchical task analysis
- Modeling users
  - Personas

Semi-structured interviews

- **Why?**
  - gather qualitative data about users to understand the problem
  - can help identify key differences between designer and target user
- **How?**
  - ask open-ended questions
  - bring along a "cheat sheet" to ensure that you gather all the information you need

- **Some tips**:
  - establish trust at the beginning
  - participant engagement will vary
  - be flexible, but make sure you get what you came for
  - consider recording or note-taking to help with recall

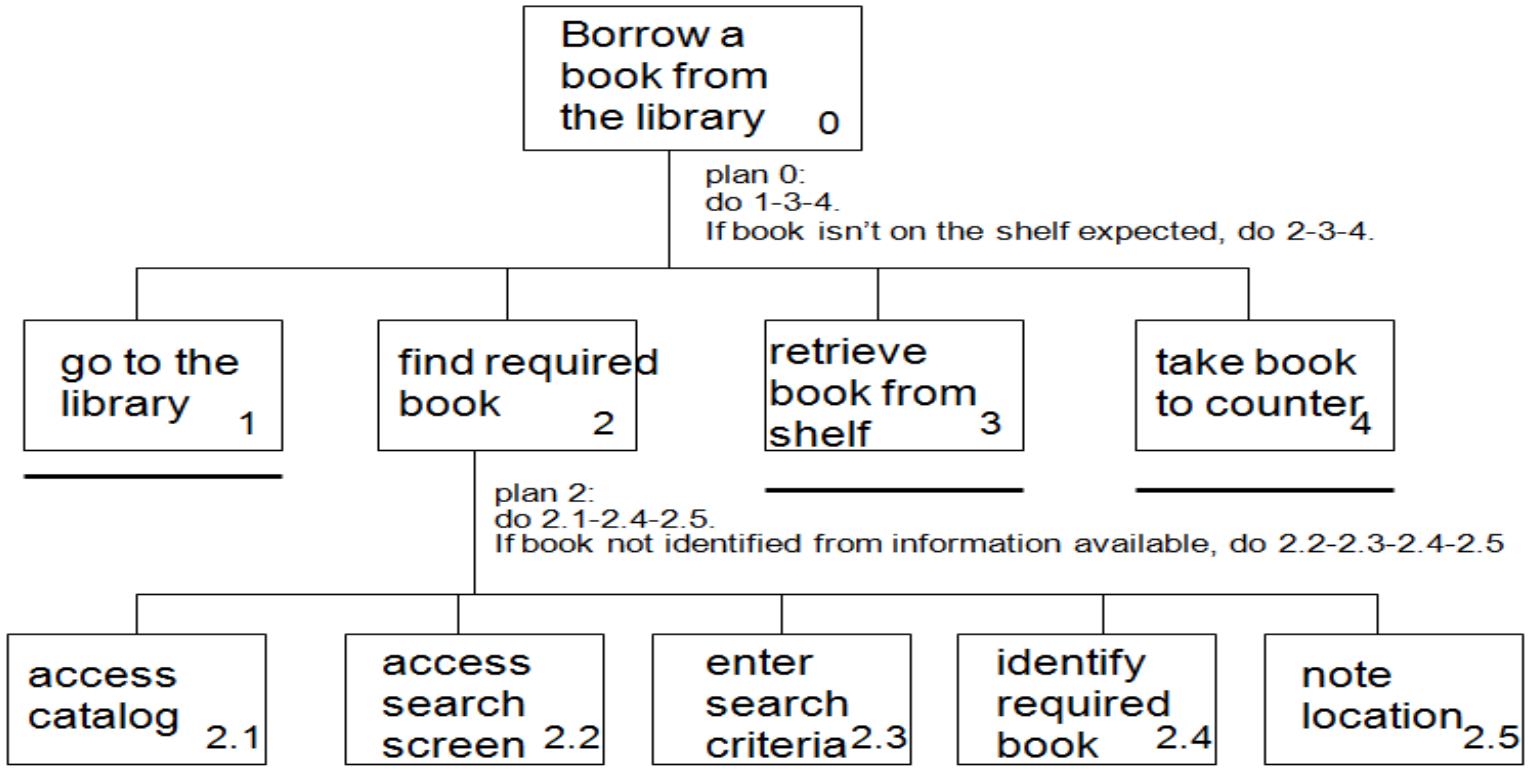
Wood, L. E. (1997). Semi-structured interviewing for user-centered design. *interactions*, 4(2), 48-61.

Hierarchical task analysis

- **Why?**
  - Understand user workflow
  - Identify pain points and areas for optimization
- **How?**
  - Decompose tasks into 4-8 sequential steps
  - Identify patterns, sequences and skips in the tasks
  - An example:

Hackos, J. & Redish, J. (1998). User and Task Analysis for *Interface* Design. Chichester: Wiley.

Task analysis example



http://i1206241.blogspot.com/2013/01/task-descriptions-hierarchical-task.html

Personas

- **Why**?
  - mechanism for reasoning about user needs
  - model behavioral characteristics of target users
  - doesn't require access to ACTUAL users
- **How?**
  - fictionalization
  - narrative, goals, needs, "pain points"
  - attributes specific to the problem space
  - data-driven method* using info from interviews
  - mapping persona to software features

Personas

Example for a Smith College dining a

- Ellis is a first year Smithie who lives in Wilson. They [illegible] cross country and have 6am practice before their 9:25a[illegible] art history class in the art museum on MWF. On TR, they ha[illegible]e engineering 101 in Ford Hall until 12:05, and their work stud[illegible] job at the campus school that starts at 12:45pm sharp. Ellis is a "live to eat" kind of person, and likes to optimize the "yum" factor in their meals. In addition, they are vegan. They are comfortable using apps on their phone like GoogleMaps, but are struggling to find the time to survey dining hall menus and get to the appropriate dining hall for the [illegible]eal they want bet[illegible]ween their various other activities.

Pain Point: Limited time

Goal/Need: Eating what they like

Pain Point: Limited time

Pain Point: Distilling current menu list

Technical skills: Comfortable with basic apps

Pain Point: Walking far & fast

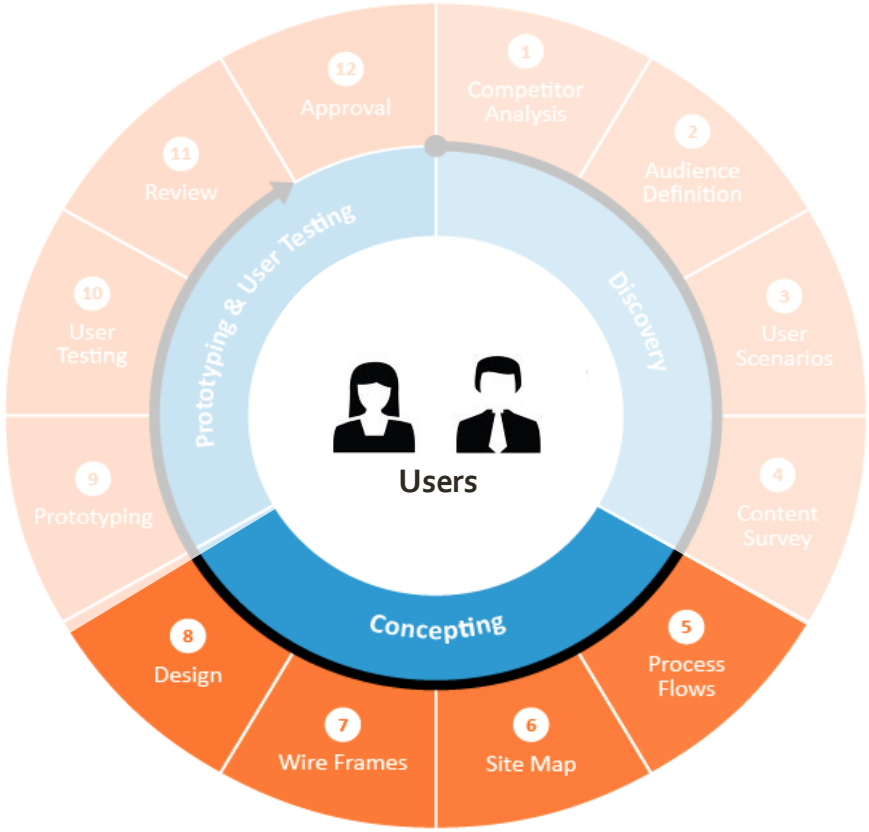
Goal/Need: Minimize walk distance

Activity: personas

Goal: come up with **a persona** that characterizes a user of the visualization admissions asked you to create.

Now that we've got some end users in mind, what would the system look like?

User-centered design framework



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Conceptual Models: Why?

- What *concepts* do your users need to be aware of to use your visualization?
- Consider:
  - What data will they interact with?
  - How will they interact with it?

Conceptual Models: Why?

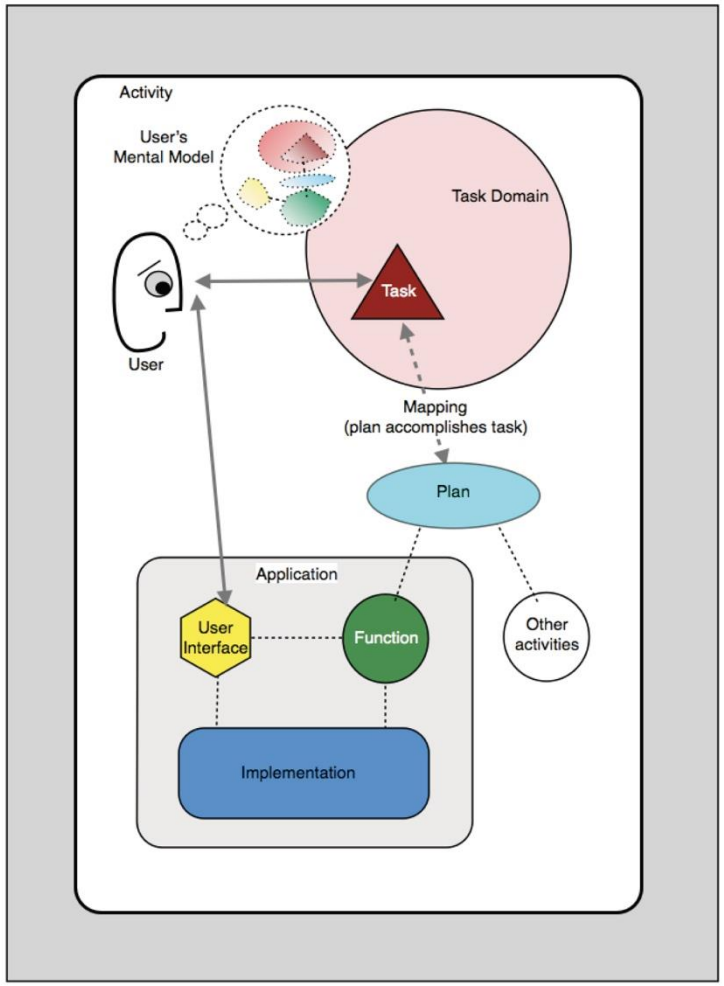


Figure 1.1: Using a tool (an application).

Johnson, J. and Henderson, A. (2011) *Conceptual Models: Core to Good Design*, Morgan & Claypool Publishers, DOI: 10.2200/S00391ED1V01Y2011HCI012

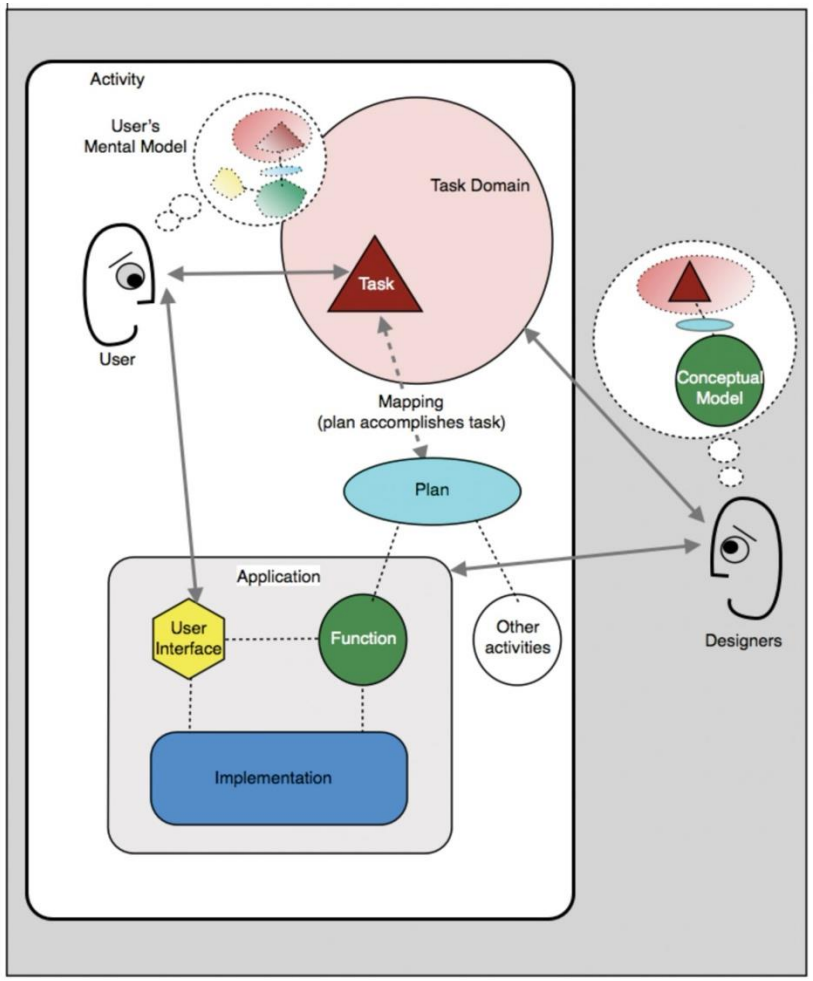
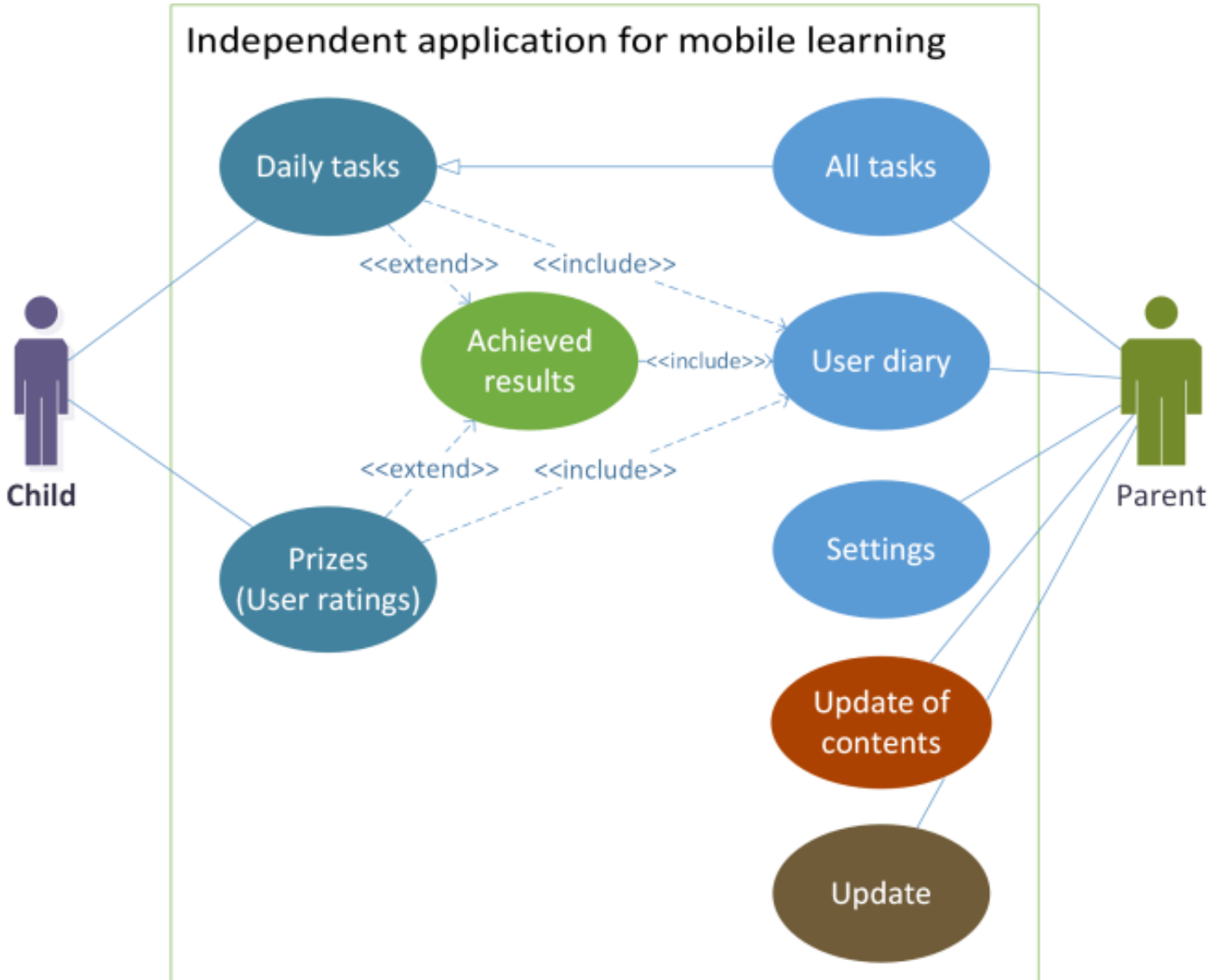


Figure 1.2: Designers' model of a user using an application.

Johnson, J. and Henderson, A. (2011) *Conceptual Models: Core to Good Design*, Morgan & Claypool Publishers, DOI: 10.2200/S00391ED1V01Y2011HCI012

Conceptual Models: How?

- Focus on key components and content areas
- Describe all essential tasks for your visualization



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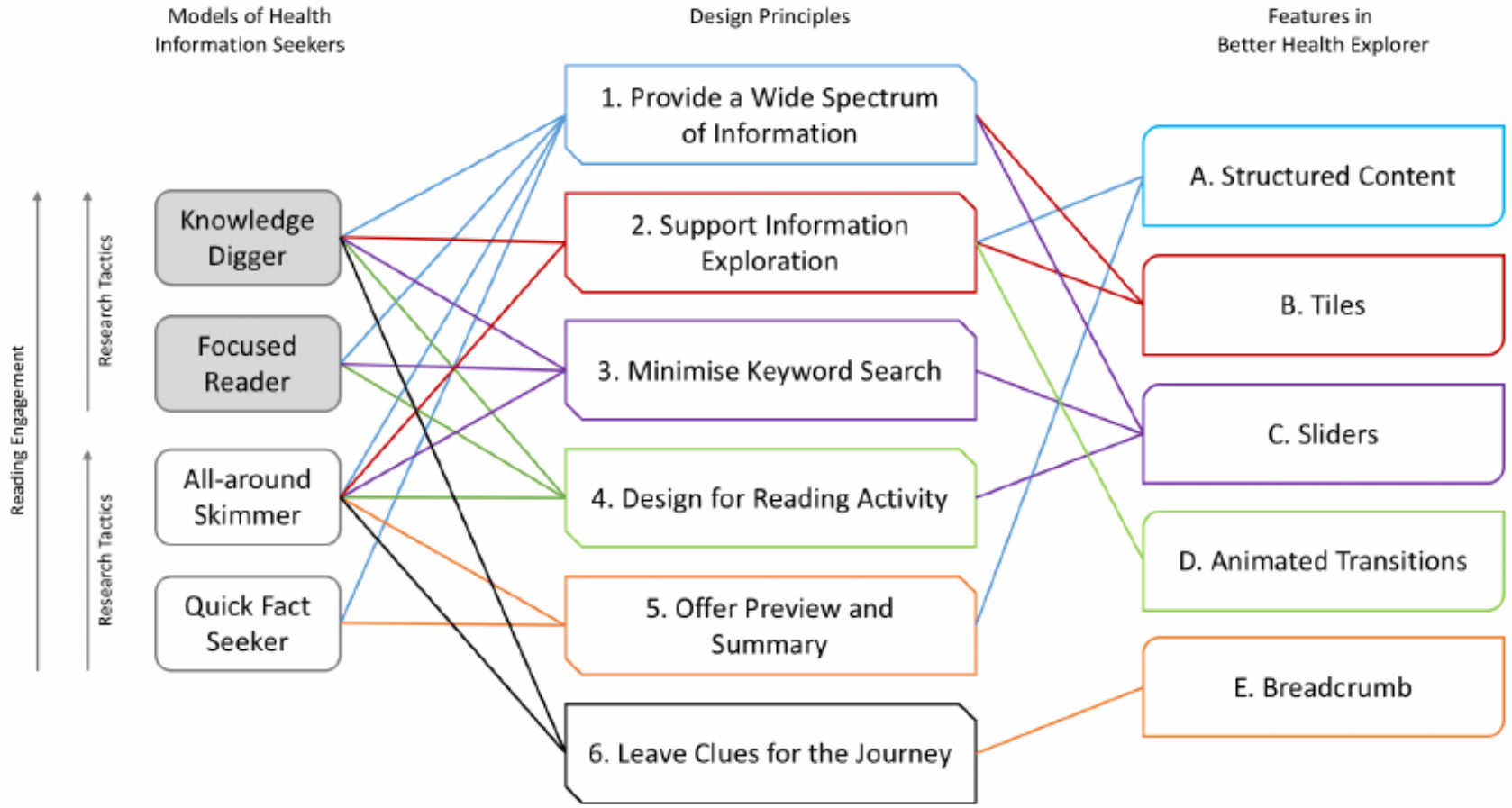
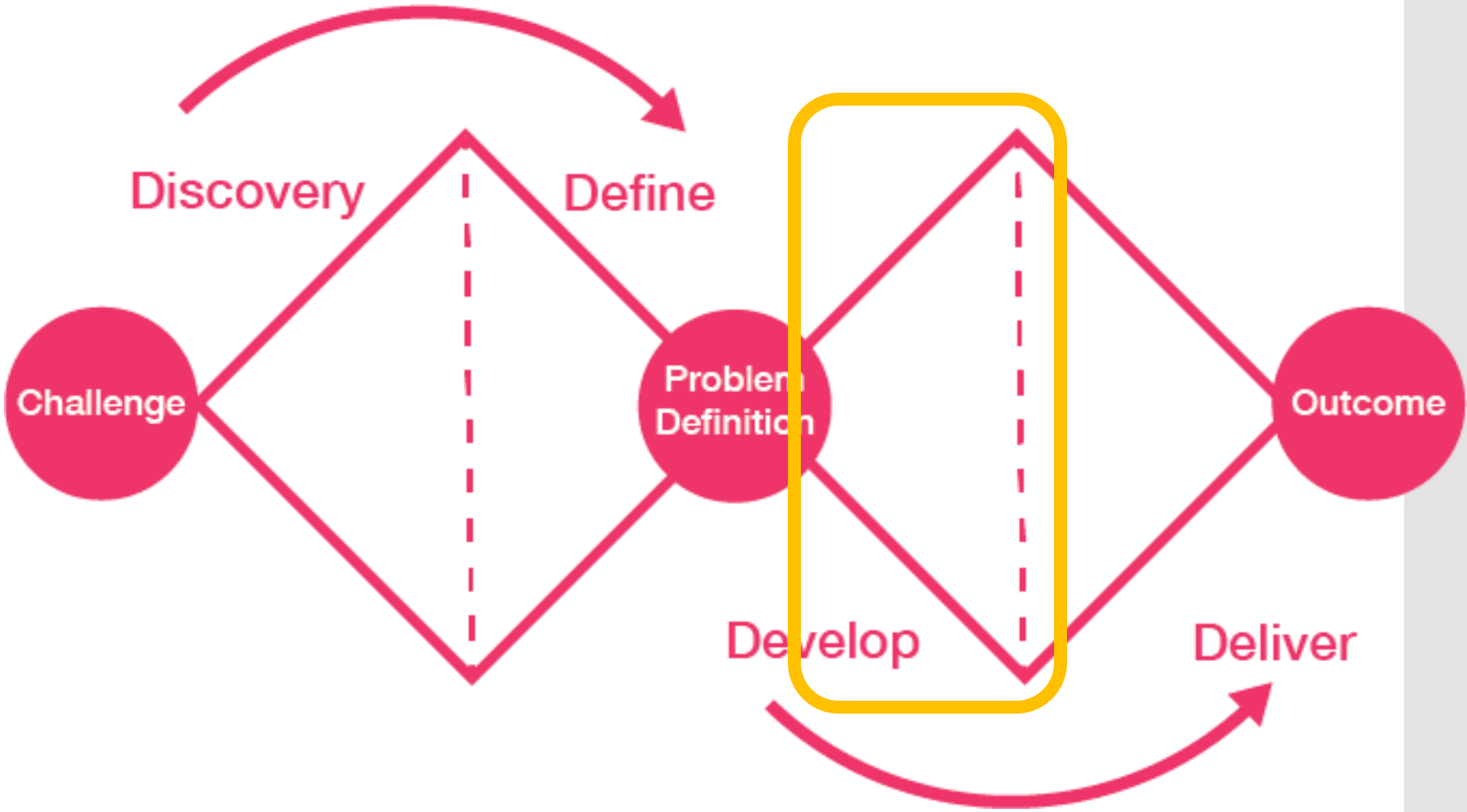


Activity: Conceptual Models:

- Draw a conceptual model for the visualization admissions asked you to make

Ideation and Detailed Design



Sketching

- What will it look like?

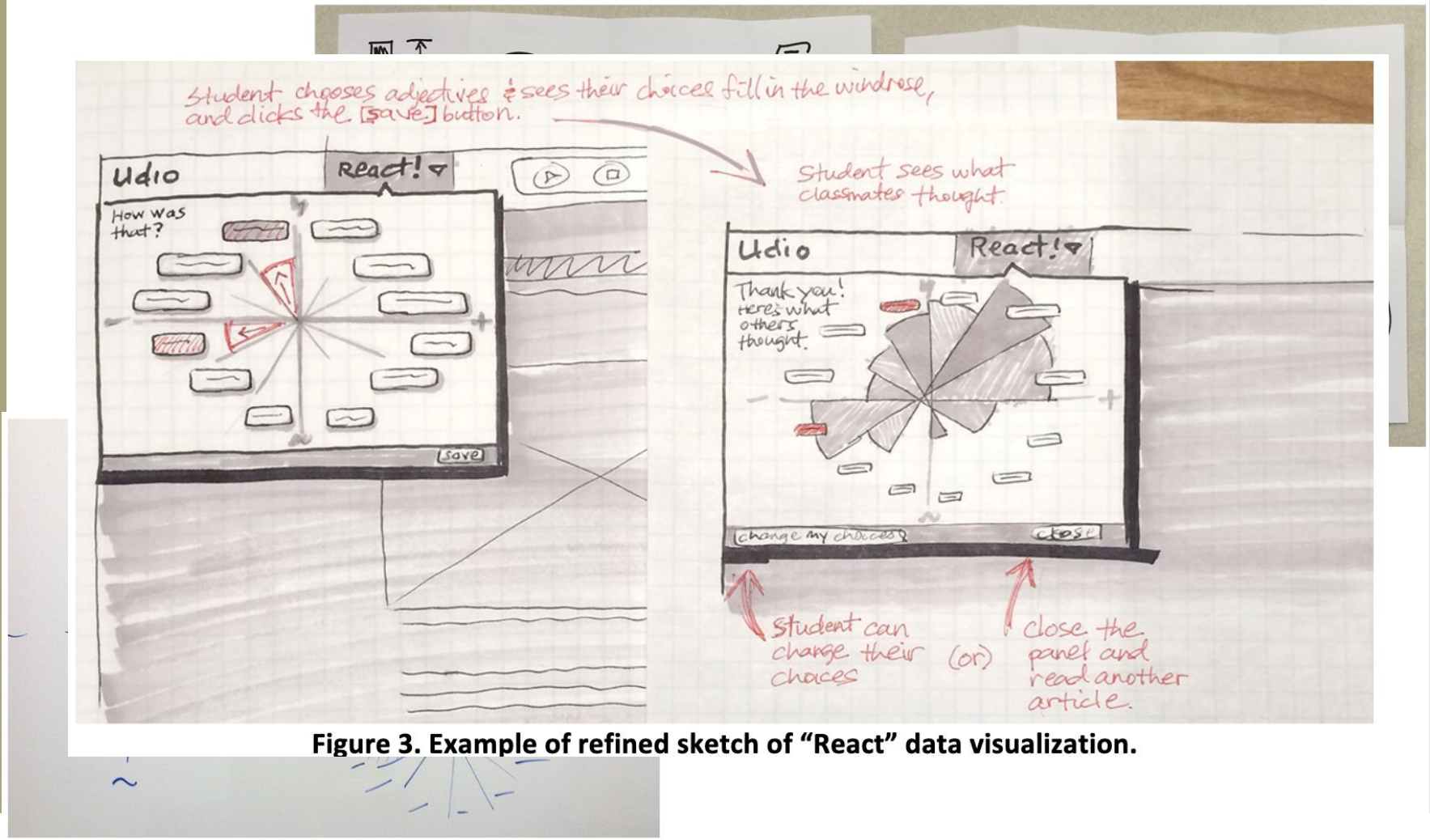


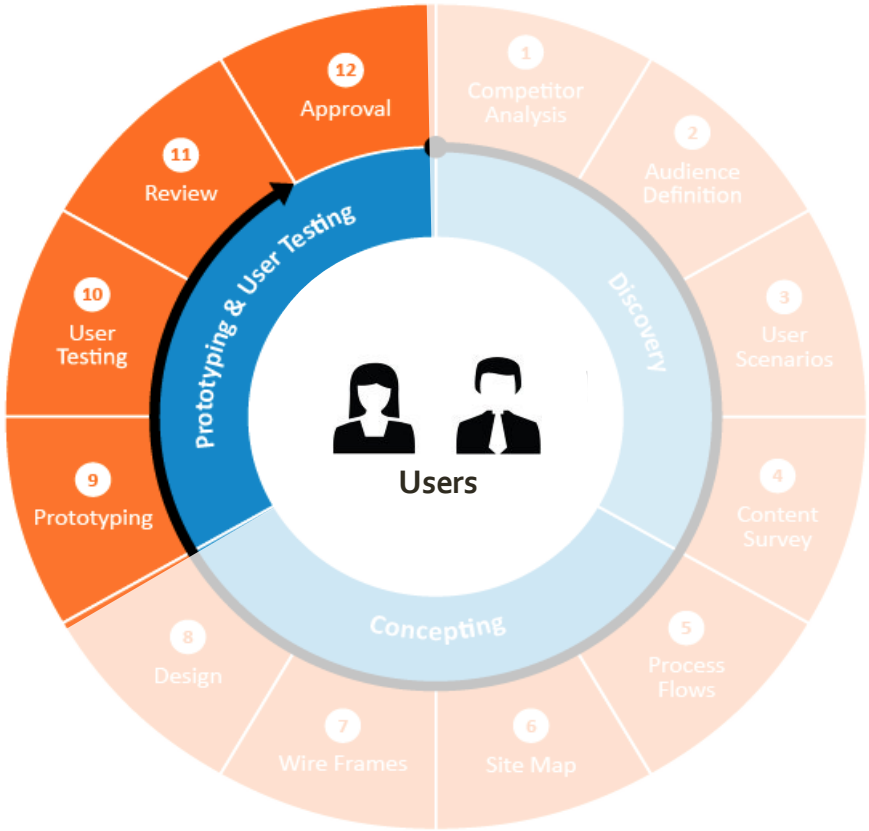
Figure 3. Example of refined sketch of "React" data visualization.

(2016).Prototyping visual learning analytics guided by an educational theory informed goal. Journal of Learning Analytics, 3(3), 115–142.http://dx.doi.org/10.18608/jla.2016.33.7

Sketching

- Roughly sketch the visualization you would make for admissions
- Pair up with 2 other teams and compare rough sketches
- Based on feedback / input draw a more polished sketch

User-centered design framework



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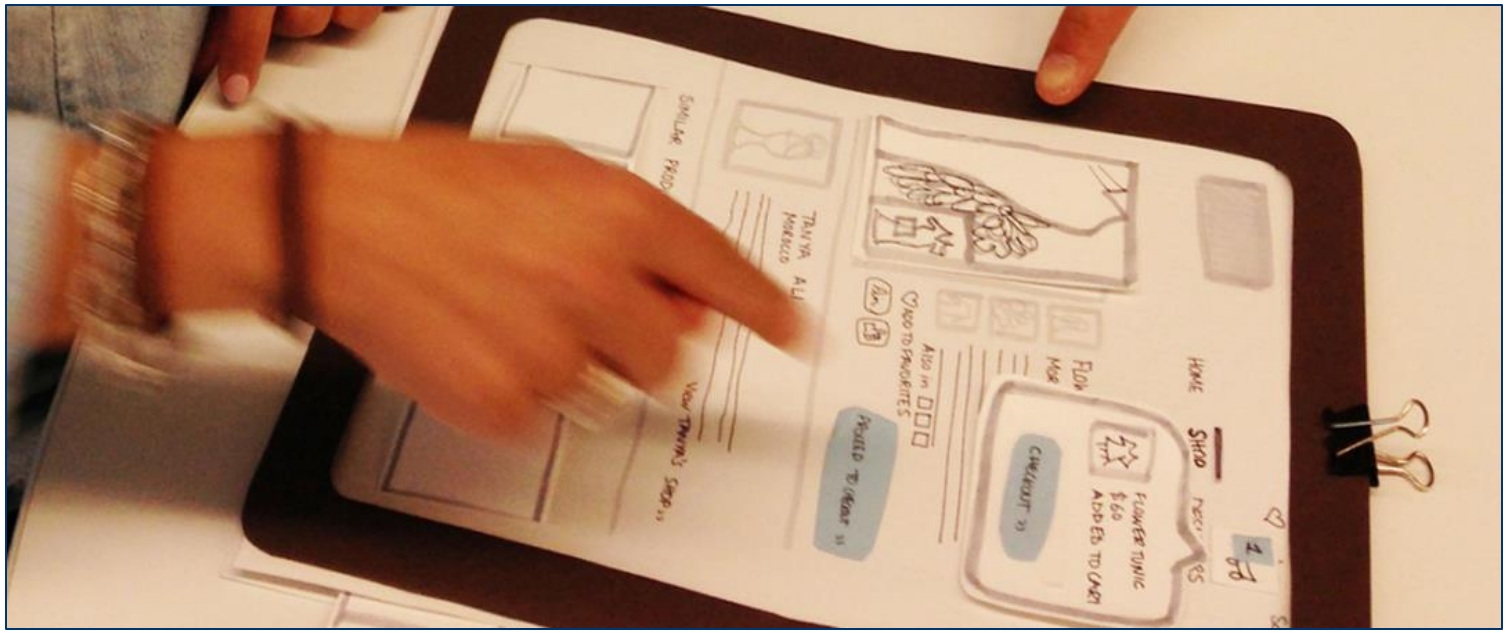
Prototyping and Testing: Low-fidelity paper prototyping

- **Big idea:**
  - Not sure yet whether or not an **idea** will work?
  - Making a **paper version** of an interface is a lot faster and easier than coding a working prototype – start there!



Prototyping and Testing: Low-fidelity paper prototyping

- Generate **lots of ideas**
- Engage **other people** in the design process
- Identify **potential problems** before you waste time coding
- Get **feedback** quickly, from lots of different people
- Some tips:
  - Focus on the **big picture**, don't worry about the details
  - **Think about what you want it to do,** rather than what you know how to implement (we'll worry about that later)
  - Not so into arts and crafts? It doesn't have to be **actual paper**… Whiteboard / PowerPoint / Keynote will also do the trick!

Prototyping and Testing: Low-fidelity paper prototyping

Examples:

- https://www.youtube.com/watch?v=nA9QP9lkl20
- https://www.youtube.com/watch?v=y20E3qBmHpg
- https://www.youtube.com/watch?v=yafaGNFu8Eg

Prototyping and Testing: Soliciting feedback

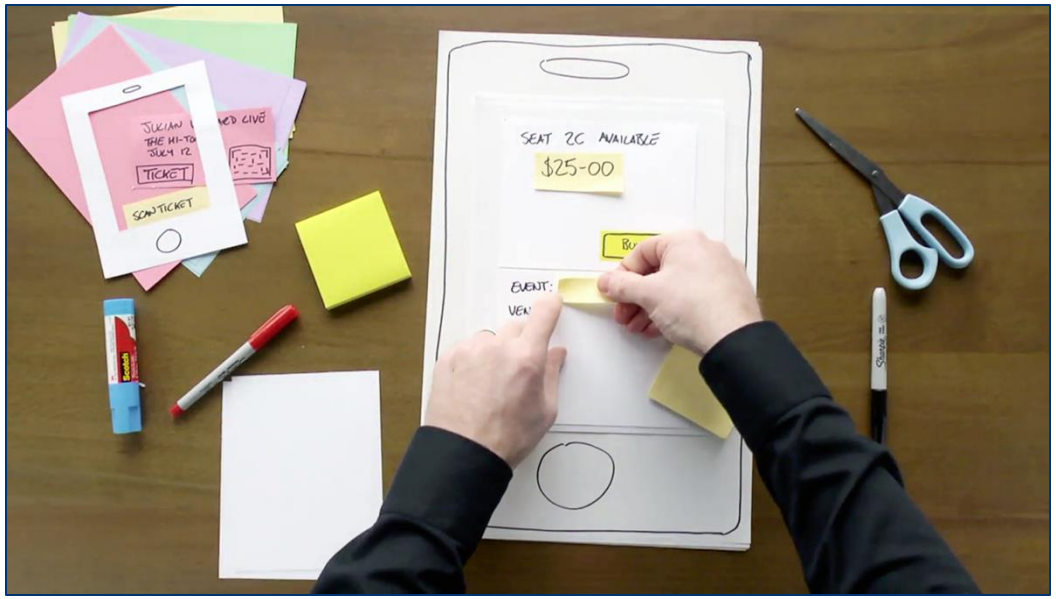
- One purpose of a prototype is to get feedback on your design idea. We do this through **user testing**:
  - Choose specific tasks your end user should be able to do with your app
  - Ask someone to perform those tasks with your prototype
    - Do not give clues or help while they perform each task
    - Ask the tester to "think out loud" i.e. narrate what they are doing / why
    - Observe where they get stuck and what they like
  - Modify your design based on testing

- What tasks could we ask a user to perform to test the admissions visualization?

Prototyping and Testing: Medium & High Fidelity

- **Medium-fidelity prototype**
  - Typically made once design is more solidified
  - Usually does not involve coding
  - Could be made with:
    - Powerpoint
    - Canva
    - Figma
    - Etc..
  - Same idea -- build, test, adapt
- **High-fidelity prototype**
  - Once you have a solid idea of the design, code your app
  - Test and adapt
    - You might implement one feature at a time

Your turn!



- Build a paper prototype for your admissions visualization
- Choose 3 tasks to have another group perform with your prototype
  - Pay attention to where they run into trouble

Takeaways

- Thinking about your end user early → you're more likely to **build something that actually solves the problem**
- **"Low-fidelity" prototyping** saves time and energy by helping identify problems before you commit to code
- **Architecture diagrams** help you plan out your implementation so you don't run out of time
- Also, the process is **kinda fun**…