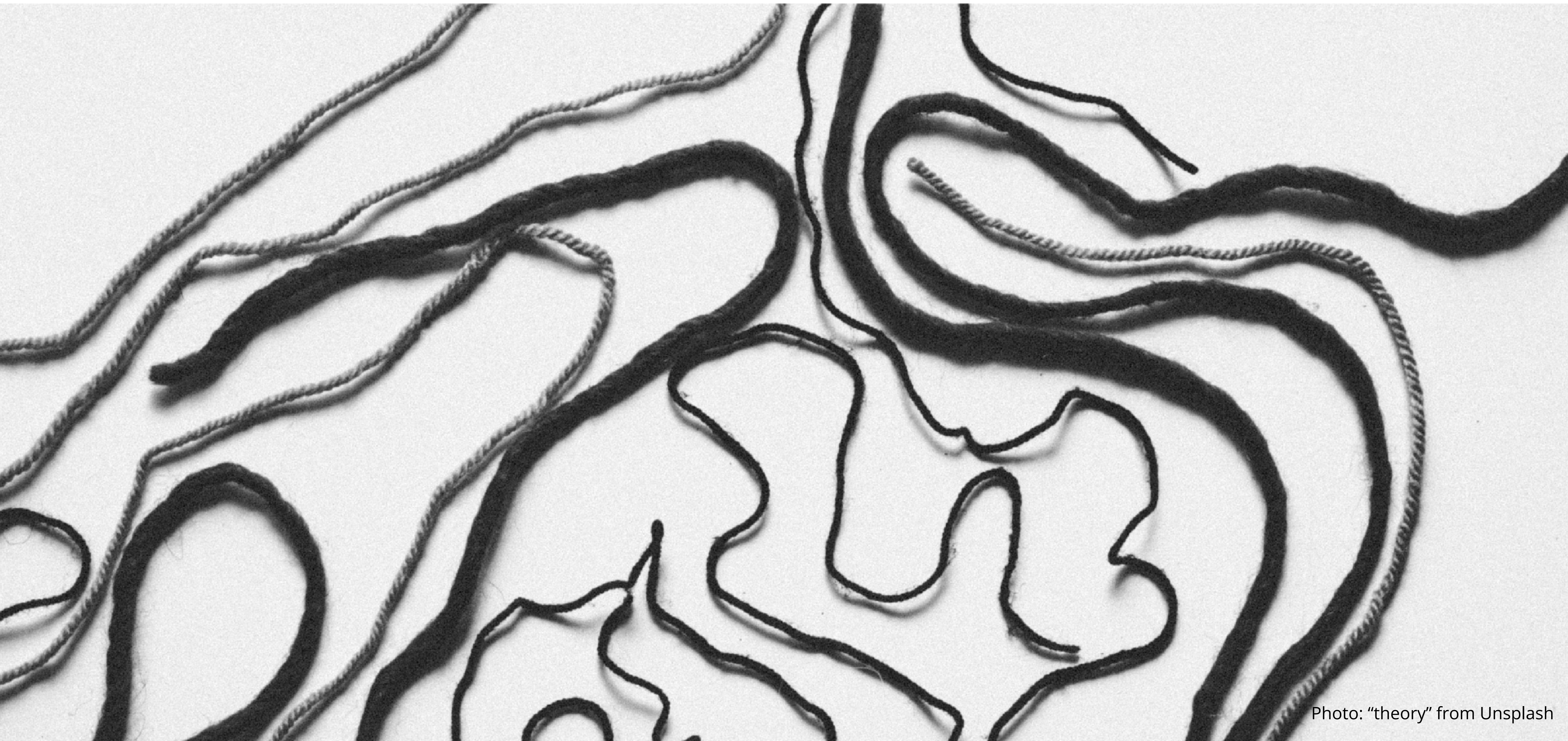# CS181DT Class 14: Theories of Creativity

Class 14 agenda

- Sorry we're on Zoom!!

- ZC

- Milestone 3: Task analysis & video prototyping (10)

- Lecture: Some theories of creativity (30)

- Break

- Seminar: DOET & Abstracting Craft (25)

Milestone 3: Task Analysis & Video Prototype

Some common methods for design work

- User interviews
- Personas
- Task analysis
- Competitive analysis
- Prototyping

→ Milestone 2

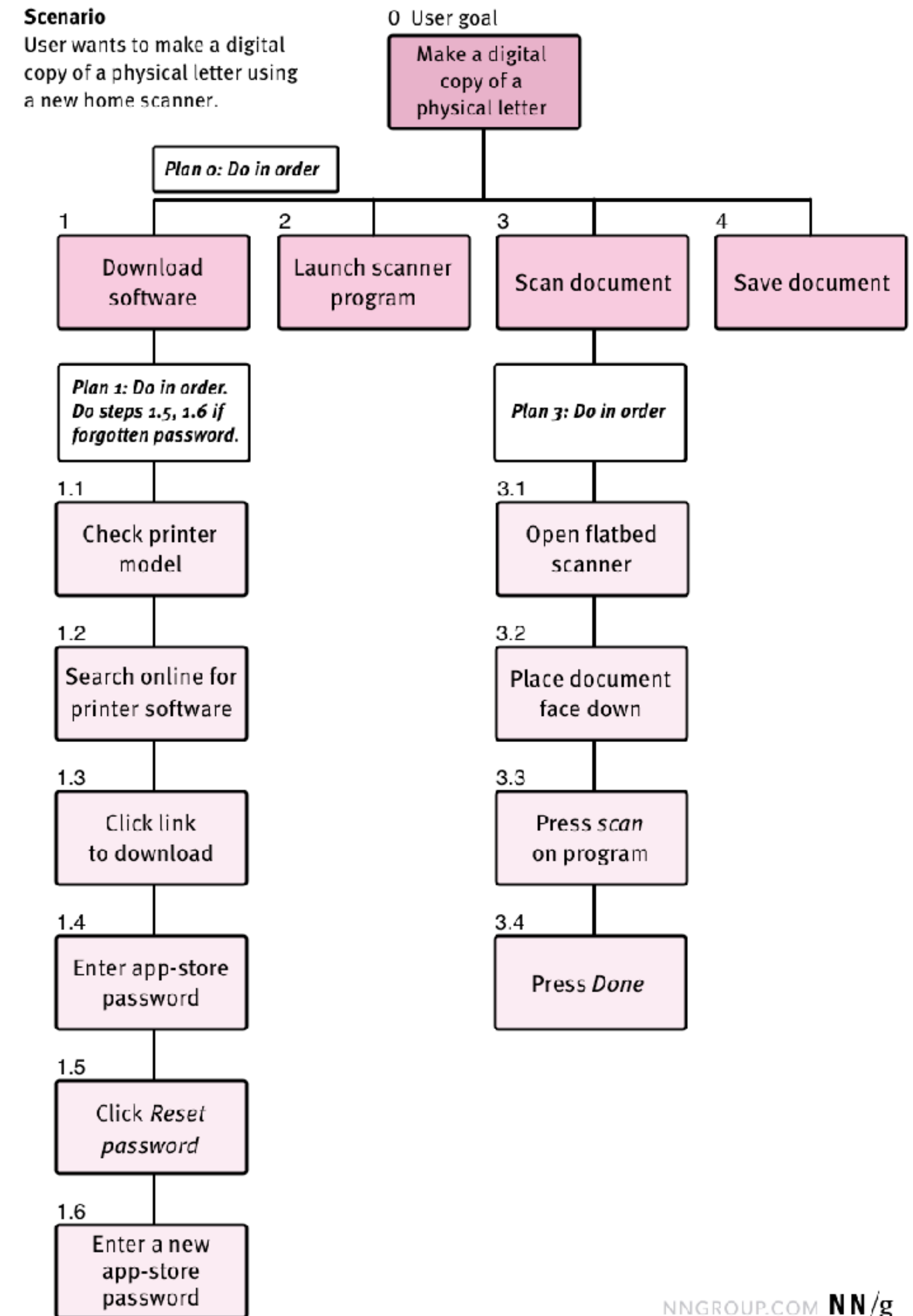→ Milestone 3

→ Milestone 3

→ Milestone 3

Personas

- Realistic fictional characters you create (based off of user research) to represent different users of your tool

- Have backgrounds, goals, motivations

- For your next project milestone, create 2 personas that span the wide design space of your tool

- Limitations?

Task Analysis

- A task analysis answers: 1) What are the user goals when using this tool? 2) What are the tasks users need to do to complete their goals within the tool?

- Root node: A goal that the user **goals**

- Then: branches to ordered **tasks** that users need to do to accomplish their goals

- Some tasks have subtasks

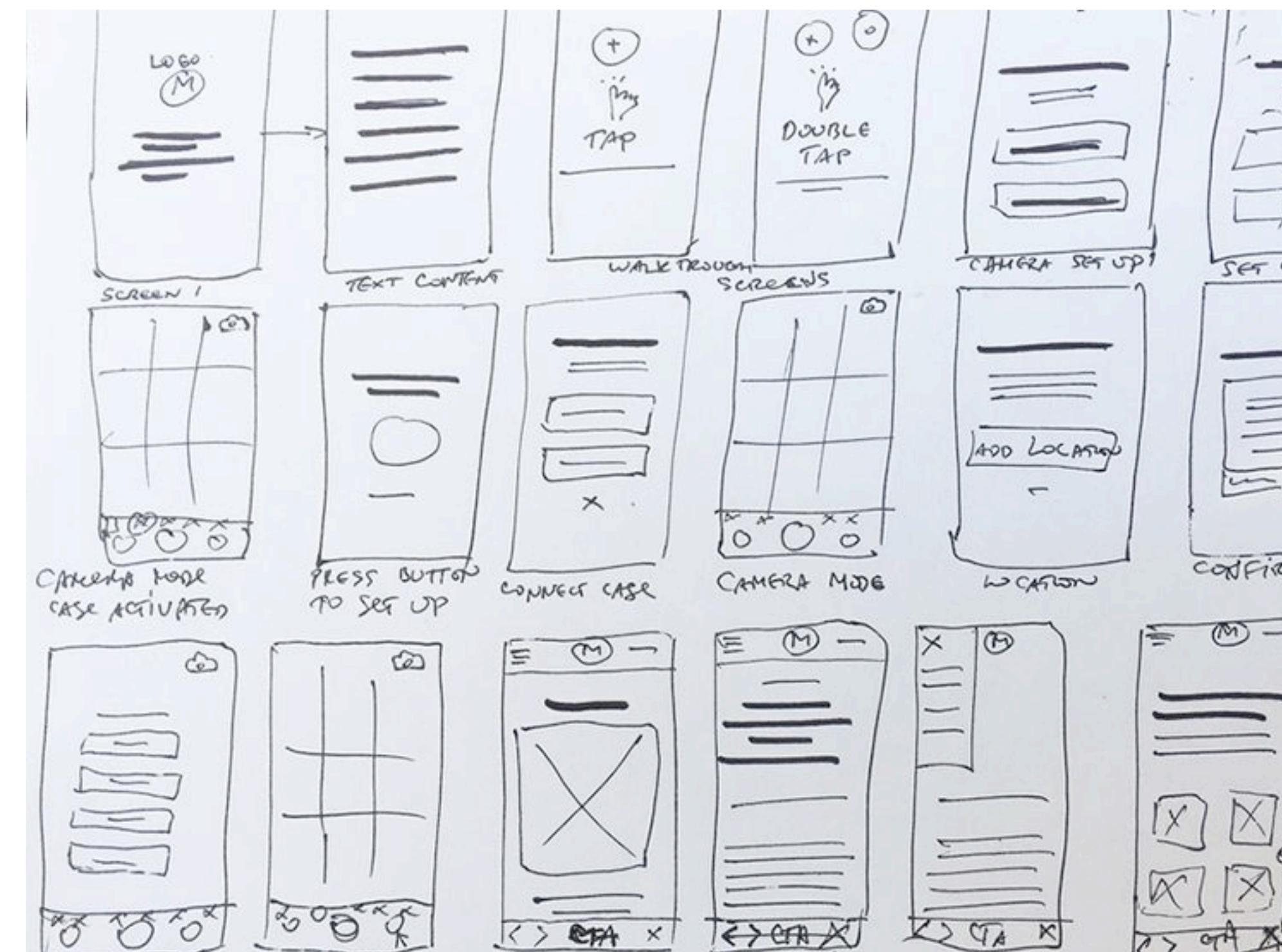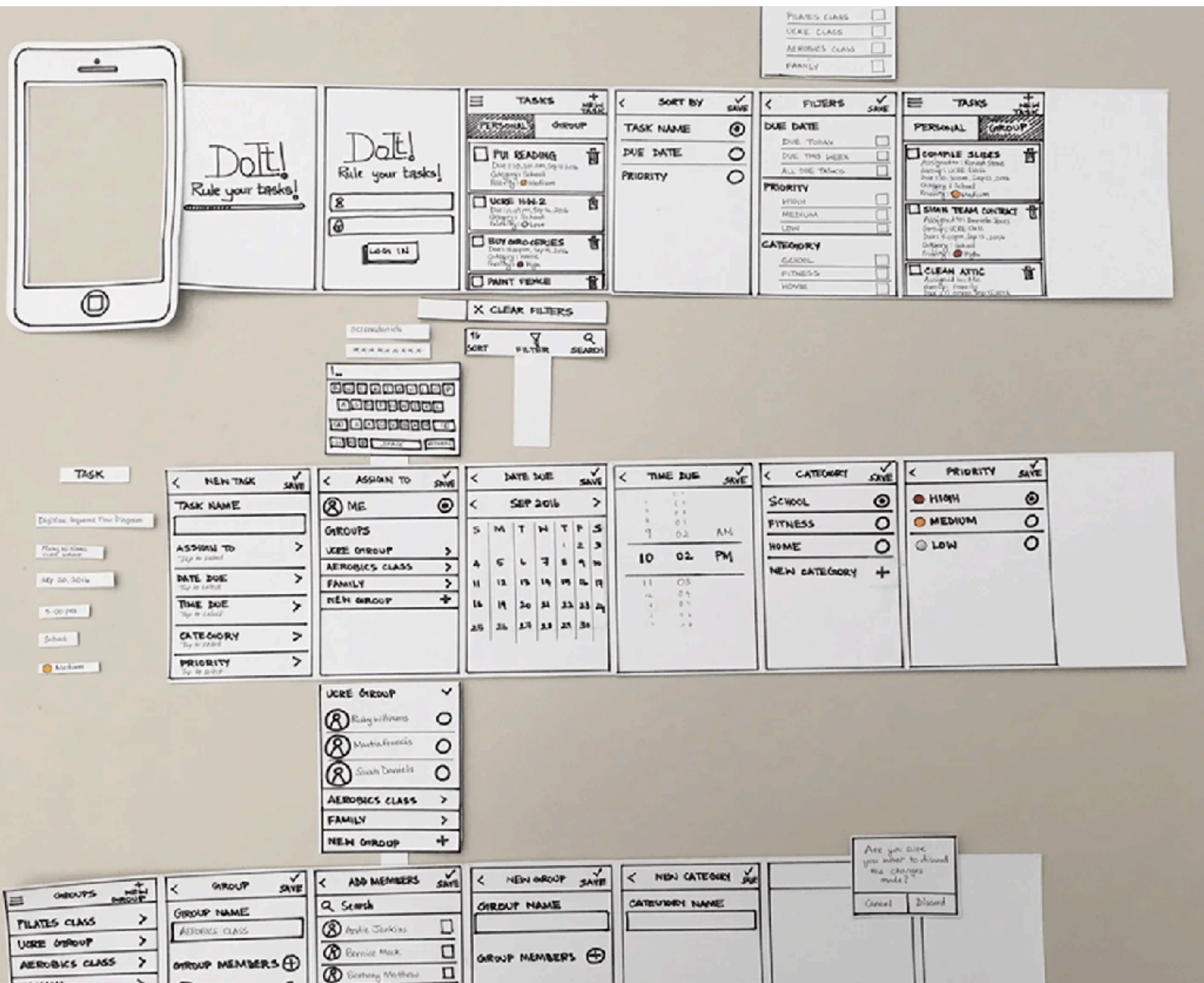 - What determines a subtask? More complicated "turn taking" with the tool

Scenario
User wants to make a digital copy of a physical letter using a new home scanner.

0 User goal — Make a digital copy of a physical letter

Plan 0: Do in order

1 Download software
2 Launch scanner program
3 Scan document
4 Save document

Plan 1: Do in order. Do steps 1.5, 1.6 if forgotten password.

1.1 Check printer model
1.2 Search online for printer software
1.3 Click link to download
1.4 Enter app-store password
1.5 Click *Reset* password
1.6 Enter a new app-store password

Plan 3: Do in order

3.1 Open flatbed scanner
3.2 Place document face down
3.3 Press *scan* on program
3.4 Press *Done*

NNGROUP.COM **NN**/g

Competitive Analysis

- Look at products that are similar to yours

  - What do they do well? (Pros)

  - What don't they do well? (Cons)

  - What can you steal from them?

- Basically just make a spreadsheet where each row is a competitor and each column is some feature or metric you care about

- Good to know alternatives out there and how you can be different (similar to creating a "related works" section in academic writing)

- We won't do this in this class, but if you want to be a PM, you can read up more on it

https://www.nngroup.com/articles/competitive-usability-evaluations/

https://www.kamranhughes.com/the-ultimate-guide-to-ux-competitive-analysis/

Wireframes, not sketches

Good: content is there, UI fleshed out

Bad: Too abstract, no real content

Video prototypes

- Videos capture **interactions** better than to static images

- Create a video of a user achieving your main goal + its associated tasks

  - One person as the camera person recording the video

  - One person as the user, who points and interacts

  - One person as the Wizard-of-Oz "computer", who switches out sheets of paper depending on user actions

- Narrate the video and what's going on

- This will prepare you for in class feedback on your wireframe prototype next Monday

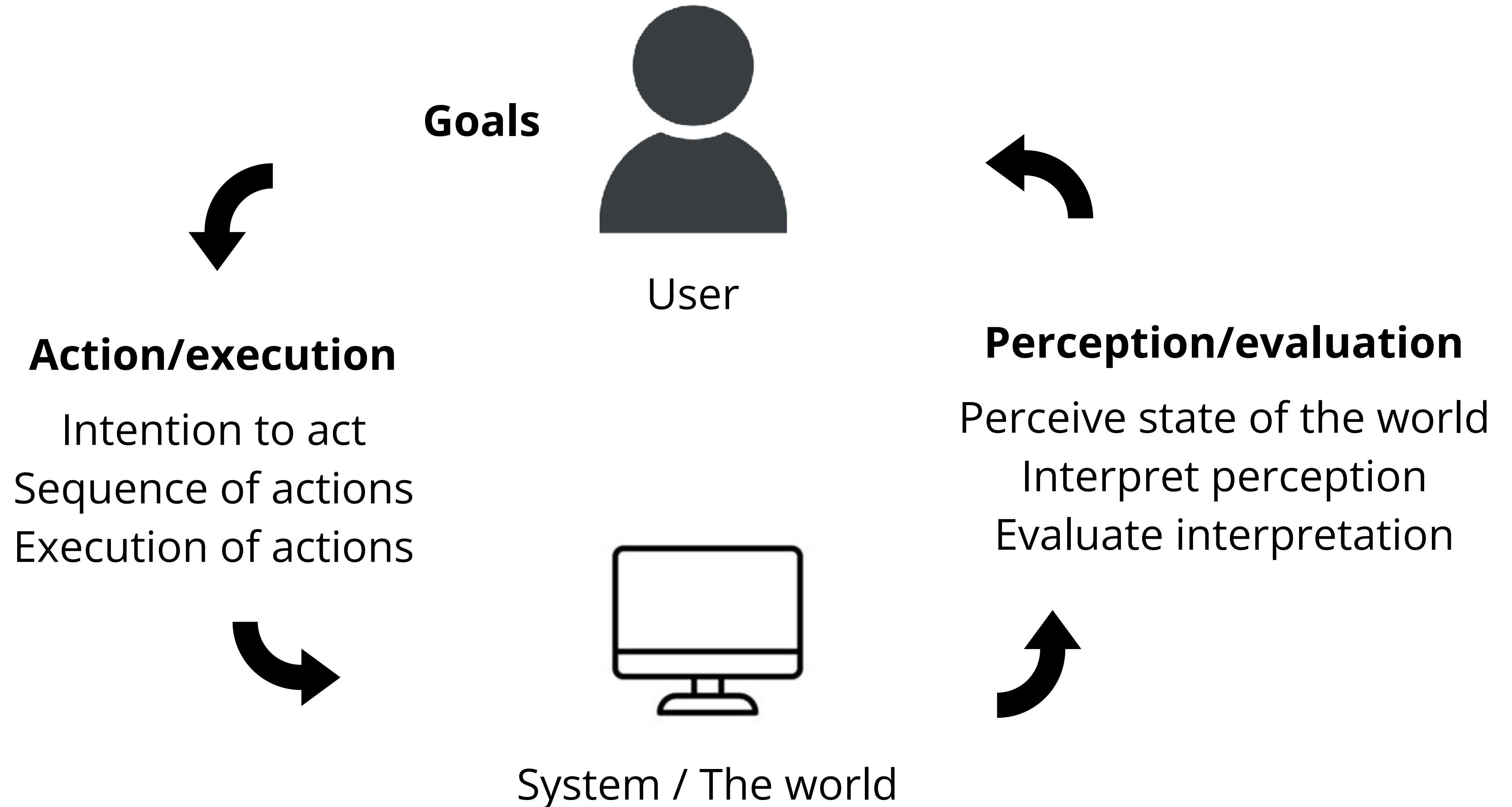This interaction technique was really pioneered by Wendy Mackay: https://www.lri.fr/~mackay/VideoForDesign/print/print.pdf

https://cs.pomona.edu/classes/cs181dt/project/#milestone-3-task-analysis--video-prototype
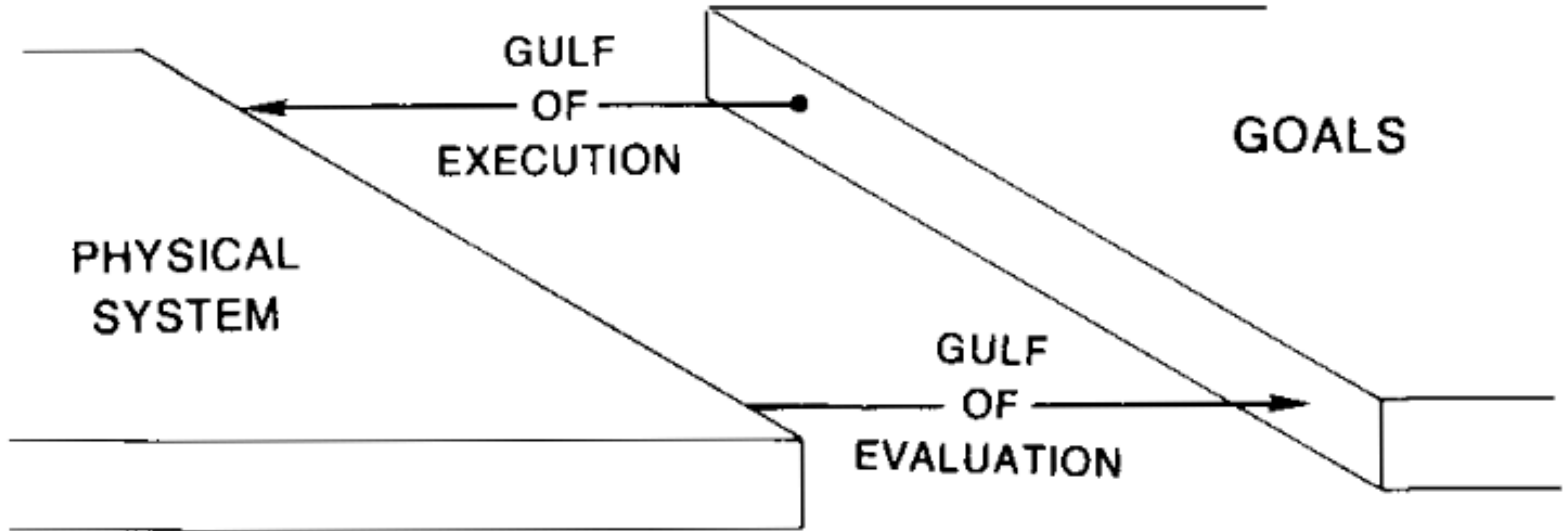
Theories of creativity

Theories of creativity: mostly from cogsci

- As we've seen, *cognitive science* has a big influence on how we design interactive software systems: software is a *tool for thought.* **Software tools let us manipulate symbols and representations to help us think and take creative action.**

- We can inform design through needfinding; we can also inform through applying theory

- If any of these theories apply to your tool, it might be good to mention it in your paper introduction (more Wednesday) as motivation for your design decisions :)

Action-perception cycle

Goals

User

Action/execution

Intention to act
Sequence of actions
Execution of actions

Perception/evaluation

Perceive state of the world
Interpret perception
Evaluate interpretation

System / The world

In other words: gulfs of execution and evaluation

GULF
OF
EXECUTION

GOALS

PHYSICAL
SYSTEM

GULF
OF
EVALUATION

(you read this)

Your goal as designers: minimize the gulfs

Gulf of evaluation

Goal: is my data correlated?

Higher gulf

X	Y
0.67	0.79
0.32	0.63
0.39	0.72
0.27	0.85
0.71	0.43
0.63	0.09
0.03	0.03
0.20	0.54
0.51	0.38
0.11	0.33
0.46	0.46

Look at raw values
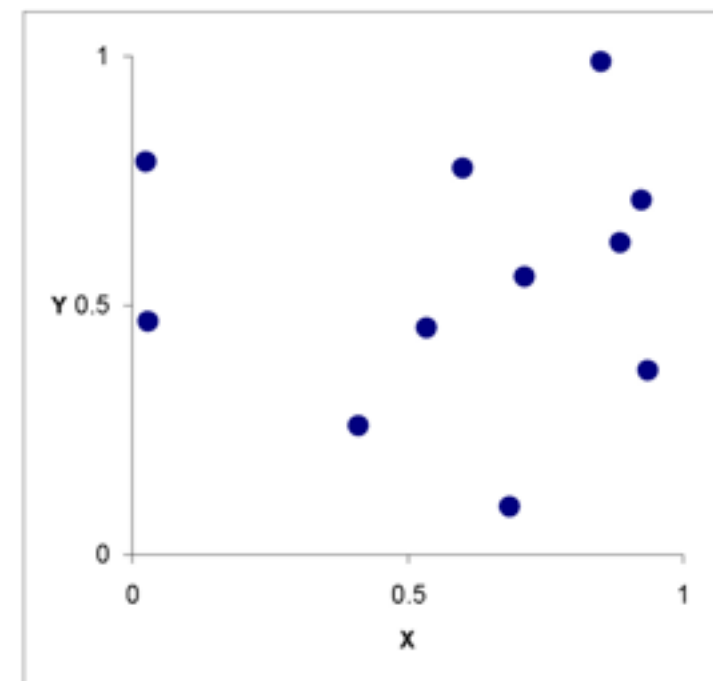
Look at plot

Lower gulf

$\rho = -.29$ Look at correlation coefficient
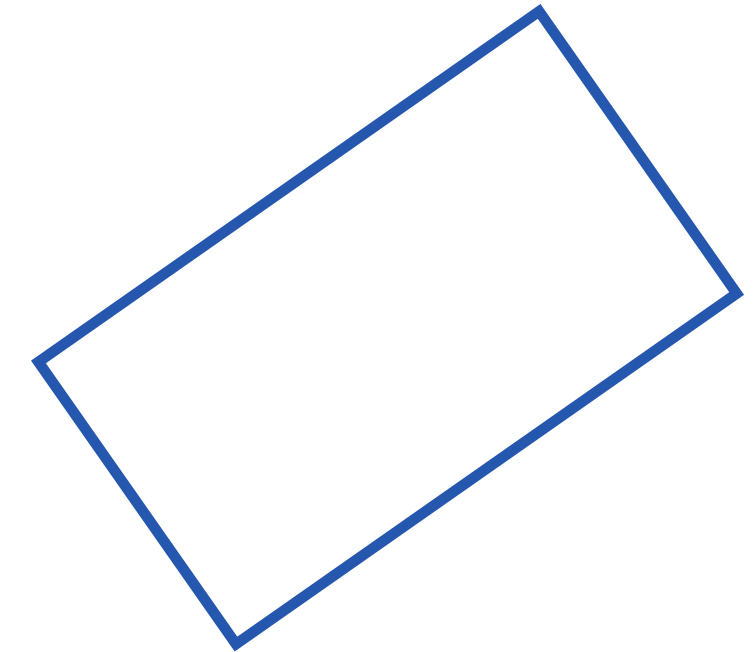
Your goal as designers: minimize the gulfs

Gulf of execution

Goal: draw this rectangle

Higher gulf

Pen down
Move 90 left
Move 30 down
Move 90 right
Move 30 up
Pen up
Rotate 35
…

Turtle graphics

rotate(35)
rectangle(0,0,100,200)

p5.js

In computational tools especially, there's a tension between using computation to harness abstractions (like p5.js) versus doing everything by hand (direct manipulation interfaces). Sometimes something that is less direct control may actually be easier to do with abstractions (like creating many rectangles)

Lower gulf

direct manipulation interface

Tacit knowledge

- The knowledge, skills, and abilities someone has that is hard to put into words and communicate (Michael Polanyi, *Personal Knowledge* (1958))

- Example: recognizing faces, motor skills like throwing a baseball correctly, creative skills like mixing paints correctly

- Ask an artist details of how they make their work and they will struggle to verbalize it since so much of manual work is *tacit knowledge*

- A lot of design tools want to support tacit knowledge, but it's hard to formally operationalize/evaluate. How does one develop metrics for something that can't be put into words?

Reflection in action

- Donald Schön, *The Reflective Practitioner* (1983)

- **knowing-in-action:** "When we go about the spontaneous, intuitive performance of the actions of everyday life, we show ourselves to be knowledgable in a special way. Often we cannot say what it is that we know…Our knowing is *in* our action."

- **reflection-in-action**: Reflecting on your knowledge through the process of doing (like baseball pitchers "finding their groove" — they can't verbalize what that means, but they can reflect on their actions through *more* action until it "feels right")

- Poses this in contrast to "technical rationality" (that there is a theory and plan that can guide us through everything) — no, sometimes in-the-moment reflection is the source of decision making

Epistemic action

- Kirsh & Maglio, *On Distinguishing Epistemic from Pragmatic Action* (1994)

- Observed participants spinning blocks while playing Tetris, even though they didn't need to do that

- Existing models of cognition couldn't explain this

- Propose **epistemic action**: "actions performed to uncover information that is hidden or hard to compute mentally" - actions that aren't goal oriented, but that help how you think about a problem. Reduces space/time complexity

- I.e., spinning or moving Tetris blocks helped participants visualize all possibilities in space
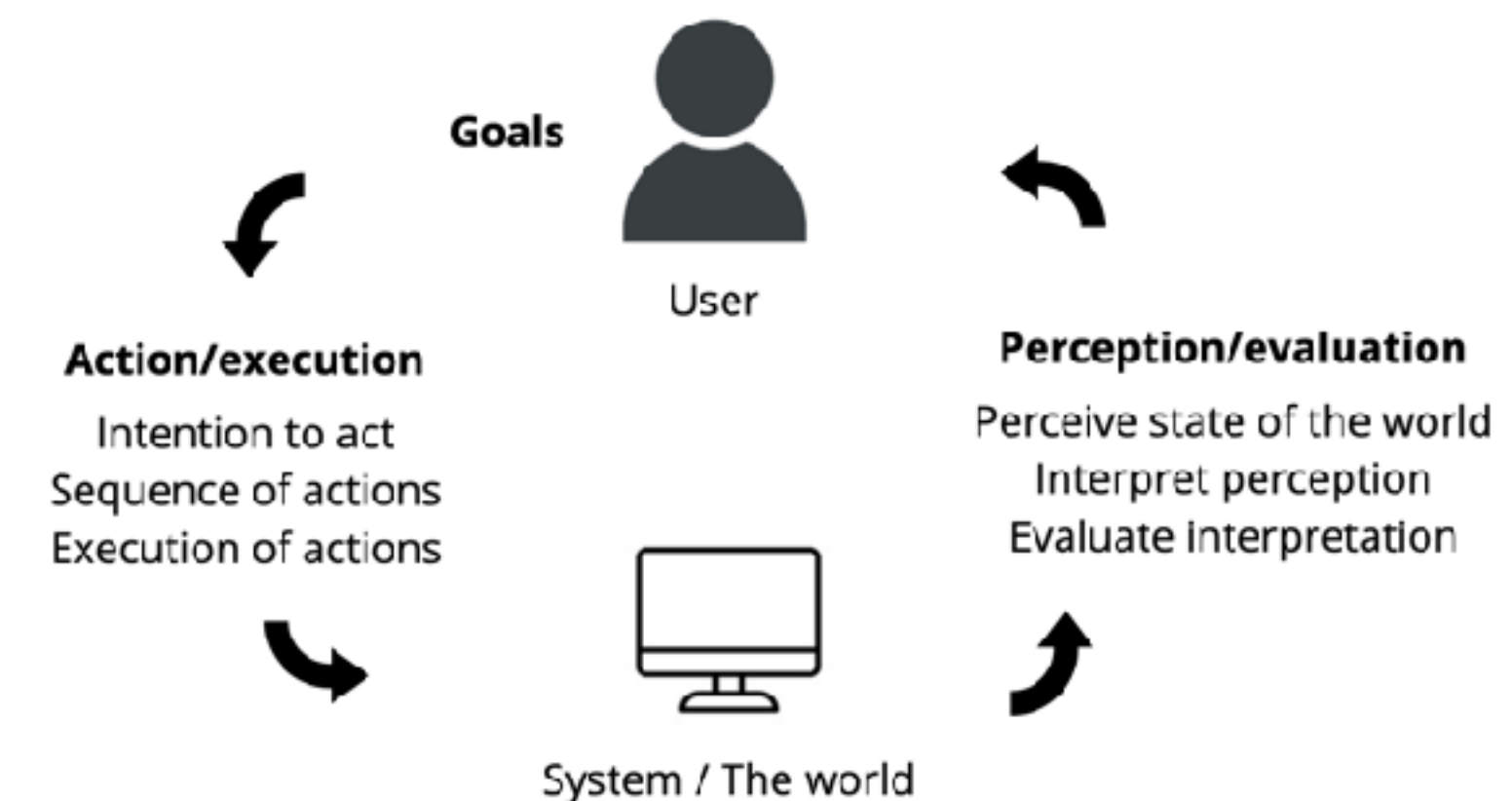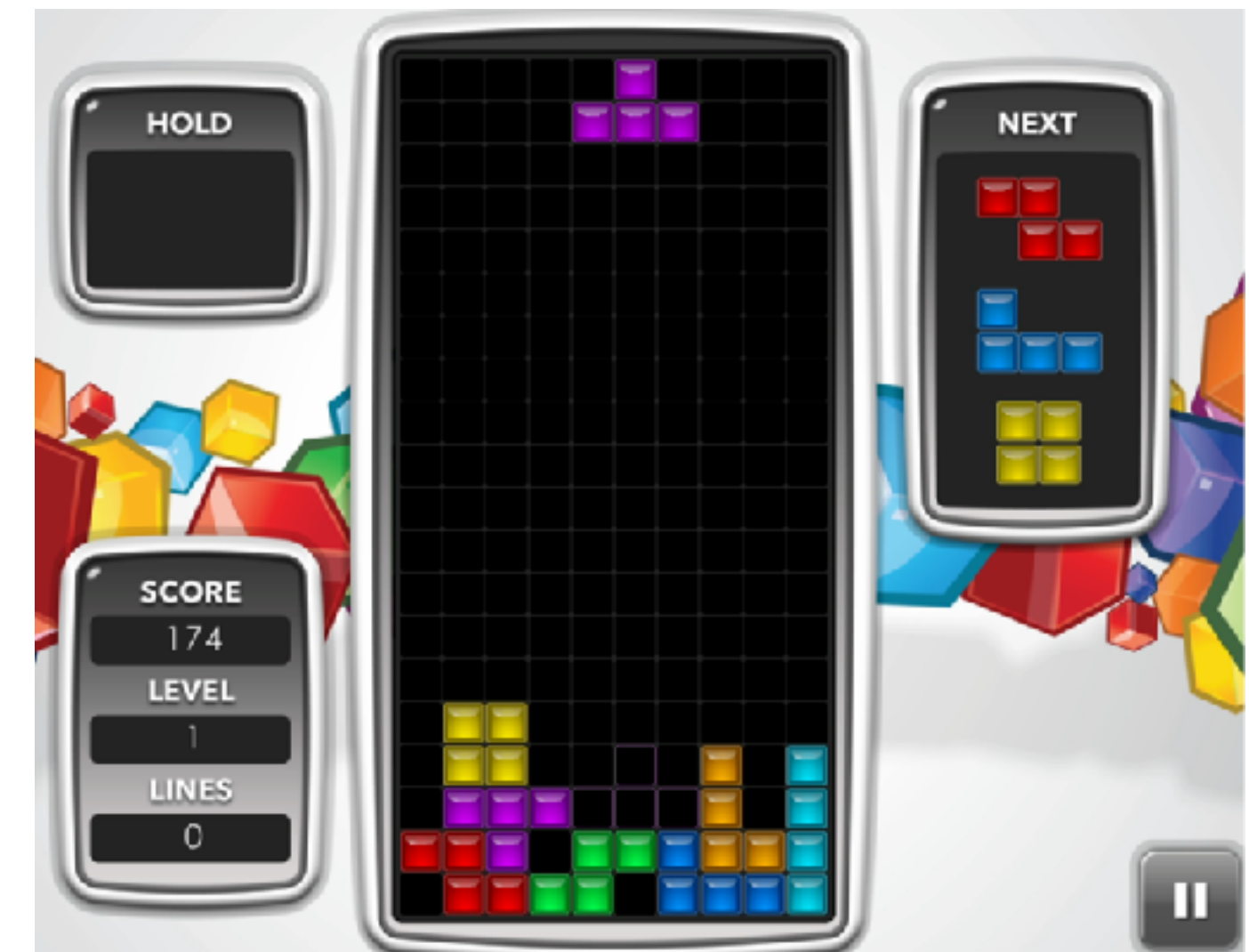
Sometimes the goals aren't to implement a plan (**pragmatic action**), but to change the world in order to simplify a problem solving task (**epistemic action**)

Cognitive load

- **Cognitive load** is how much information a user has to hold in working memory

- How can we reduce cognitive load? Provide feedback, visualizations, write things down — these are also forms of *epistemic action*!

- Reducing cognitive load is also often an implicit goal when reducing the gulfs of execution/evaluation, matching mental models in your tool

Breakdowns (from philosophy)

- Heidegger's concepts of **present-at-hand** and **ready-to-hand**

  - When you have a hammer, you're using the tool to accomplish a goal, and not thinking about its intrinsic properties or affordances—that's **ready-to-hand**

  - But when your tool isn't working the way you want it to (the hammer's head flies off—a **breakdown**), then the tool is suddenly **present-at-hand.** By losing its "usefulness," and your relationship with the tool changes and you notice its properties

- Breakdowns don't always have to be frustrating: they can also be opportunities for new creative insights since the user is forced to interact with the tool on a different level

Summary

- We interact with the world in an action-perception cycle

- Tools should try to reduce the gulfs of execution (action) and perception (evaluation) to feel "seamless", to support interactivity and human agency. Tools can also help us reduce our cognitive load in accomplishing our goals

- A lot of our creative knowledge is tacit, which we figure out through a process of reflection-in-action and epistemic action

- When interactions are not "seamless", breakdowns occur

Discuss: What was the last breakdown you had while using a tool? How did you recover from it?
What parts were a valuable learning experience?
What parts just felt bad and frustrating?

Seminar

Class 14 recap

- Weds

  - No synchronous lecture, but please use class time to work on your projects!

  - ~30 min video on writing research paper introductions and introducing Milestone 4 (Paper introduction draft), due 11:59pm Fri 11/1

- TODO next week:

  - Milestones 3 (Mon 11am) & 4 (Fri 11:59pm)

  - Ariel will also lead a Figma workshop sometime in the evening

- No OH this week, but you can always request a Zoom meeting!