CS181DT Class 16: Theories of Creativity

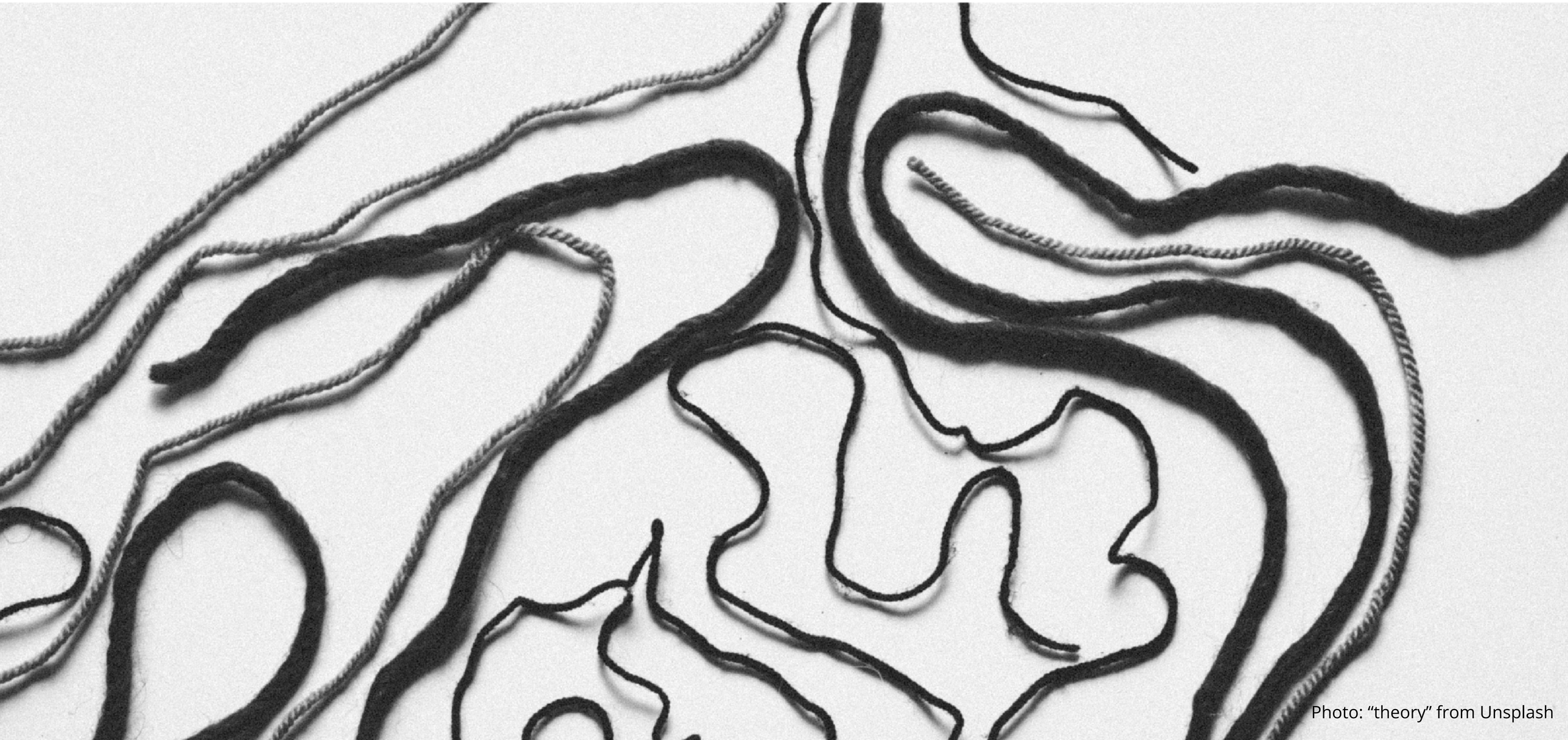


Photo: “theory” from Unsplash

Class 15 agenda

- Studio: Evaluate your scenario in group
- Lecture: Some theories of creativity
- Break
- Seminar: Tools & Direct manipulation interfaces

Evaluating your scenario paper prototype

Qualitative evaluation strategy: cognitive walkthrough

- A cognitive walkthrough requires a **prototype** and a **goal**
- Ask users to “**think aloud**” to understand what is going on cognitively
  - The user should not be silent. They should ideally always be talking!
    - “So I’m clicking this button because…”
    - “Okay, I’m not sure what to do here. My best guess is that I want to click [X] because I think it would [Y]…”

Your turn: paper prototype

Remember to take photos and write notes in your design documentation!

- 3+ roles:
  - WoZ computer: the person who made the prototype. **Computers cannot speak or explain any UI elements** and can only prompt the user with a **goal** and switch out UI elements according to user interaction.
  - User: use the prototype and think aloud
  - Observers: take copious notes on the interaction, write your takeaways/analysis of the situation. What is easy for users to do? What do they struggle with?
- Move on at 3:15 (sorry if you have a large group and don't get to everyone, you can continue this in your weekly meeting)

Theories of creativity

Theories of creativity

- 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 as motivation for your design decisions :)

Action-perception cycle

Goals

User

Action/execution

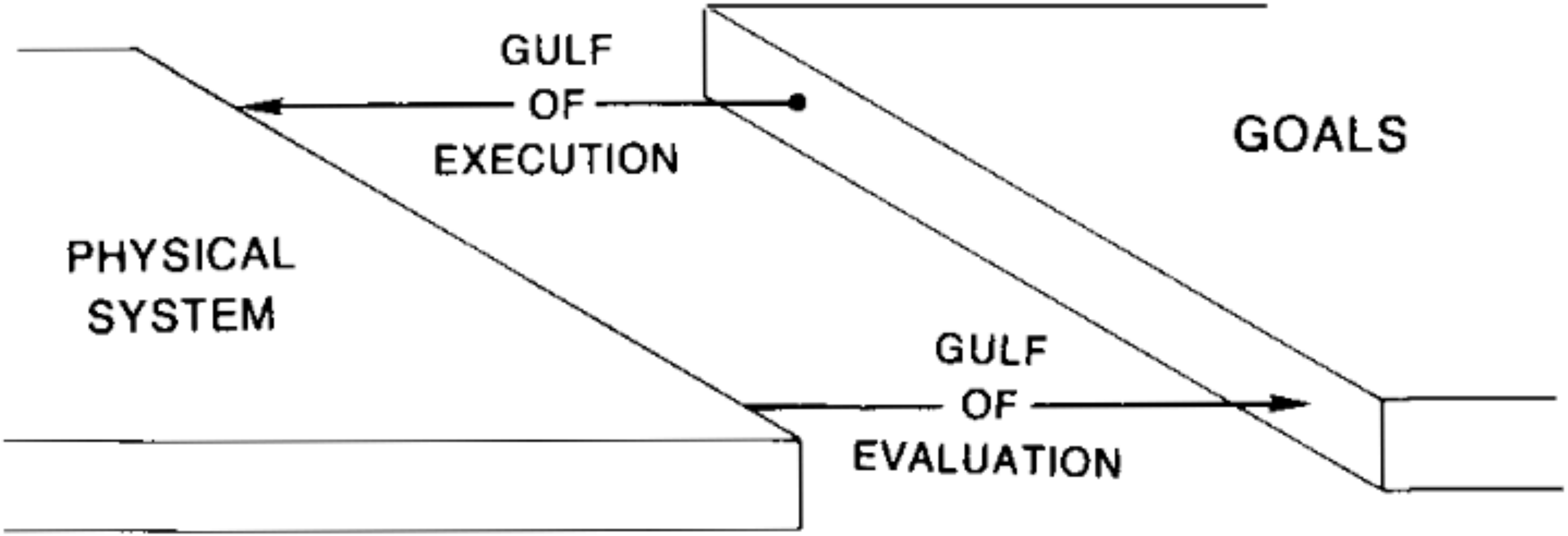
Intention to act
Sequence of actions
Execution of actions

Perception/evaluation

Perceive state of the world
Interpret perception
Evaluate interpretation

System / The world

In other words: gulfs of execution and evaluation



(you read this)

Your goal as designers: minimize the gulfs

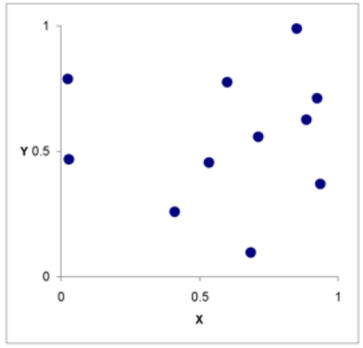
Gulf of evaluation

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

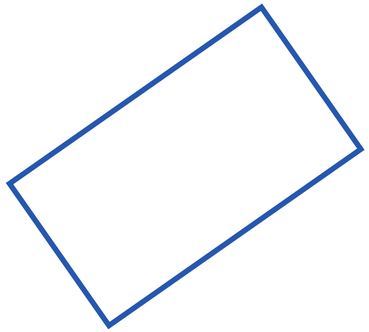
ρ = -.29

Look at correlation coefficient

Your goal as designers: minimize the gulfs

Gulf of execution

Goal: draw this rectangle

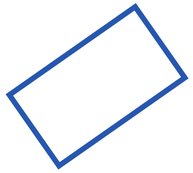


Higher gulf

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

Turtle graphics

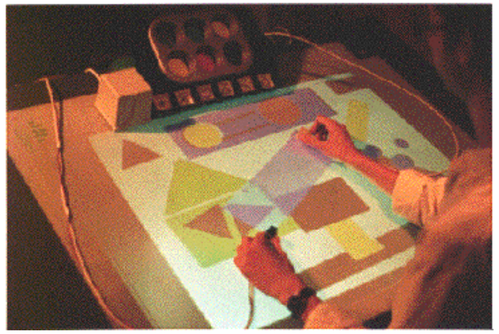
rotate(35)
rectangle(0,0,100,200)



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

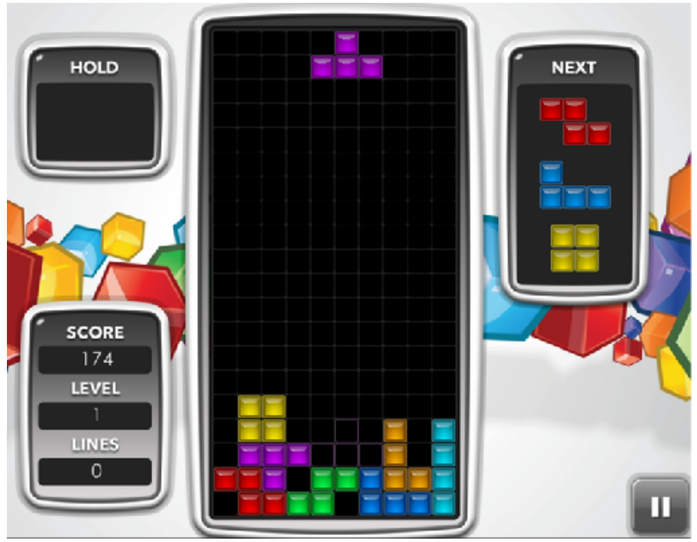
- The knowledge, skills, and abilities someone has that is hard to put into words and communicate (Michael Polanyi, *Personal Knowledge* (1958))
- Example: recognizing faces, motor skills, creative skills
- Ask an artist details of how they make their work and they will struggle to verbalize it since so much of manual work is *tacit knowledge*

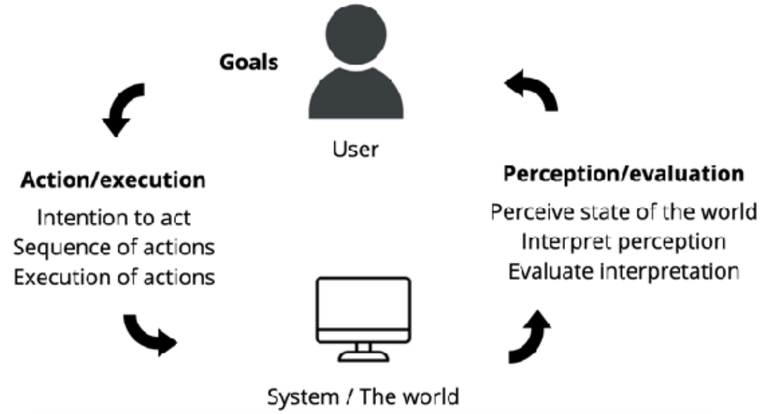
Reflection in action

- 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

- 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 16 recap

- TODO
  - Fri 11:59pm
    - P2M2 - Intro due (Extensions until Sunday OK, I just didn’t want to assign any work over spring break)

- Enjoy your spring break!! Be ready to Figma when we’re back 🌻