ELEC-D7010

Sketching and Prototyping

Lecture 7

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About me

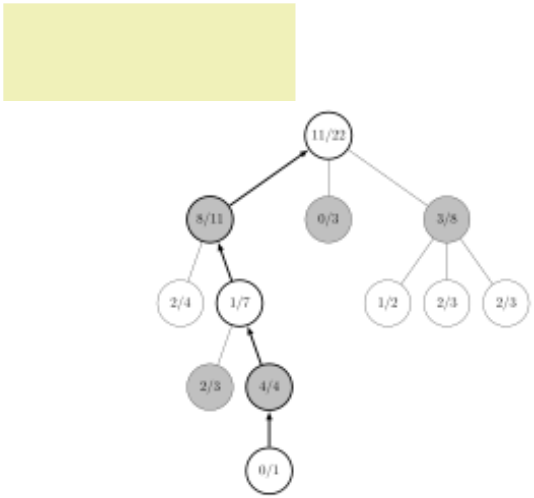
Hi! I am **Lena Hegemann**

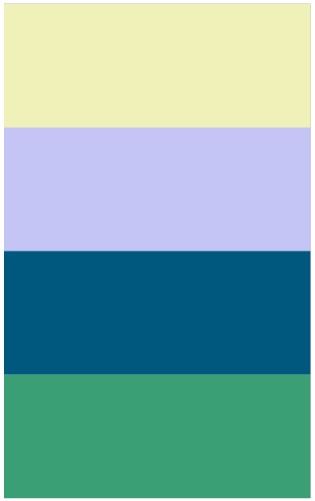
- **PhD student** at the User Interfaces Group
- Background in Human-Computer Interaction and Design

This was my favourite prototype

Research on AI Design Assistants

https://data.vision.ee.ethz.ch/sagea/lld/





- Data based approaches
- User models
- Augmenting design tools

Today’s agenda

1. Why sketching
2. How to sketch
3. Prototyping

Learning outcome

1. Understanding of the purpose of sketches and when to use them
2. Applying common sketching methods
3. Understanding of different kinds of prototypes and when to use them

Reference – Bill Buxton

https://www.billbuxton.com/

http://sketchbook.cpsc.ucalgary.ca/

1. Why Sketching

Task: Sketch Definition

Discuss in breakout rooms for 3 minutes

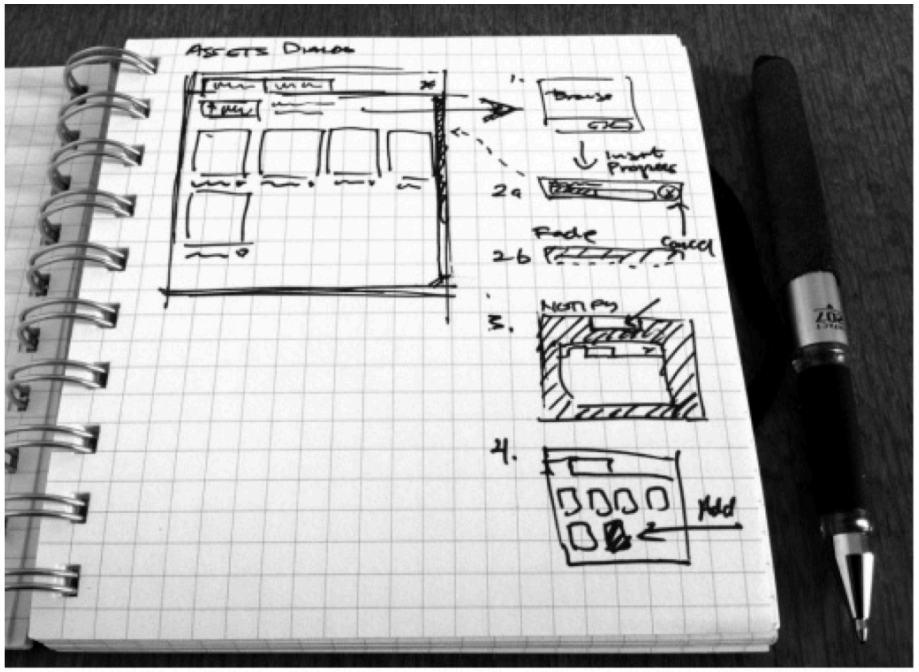
What is a sketch?

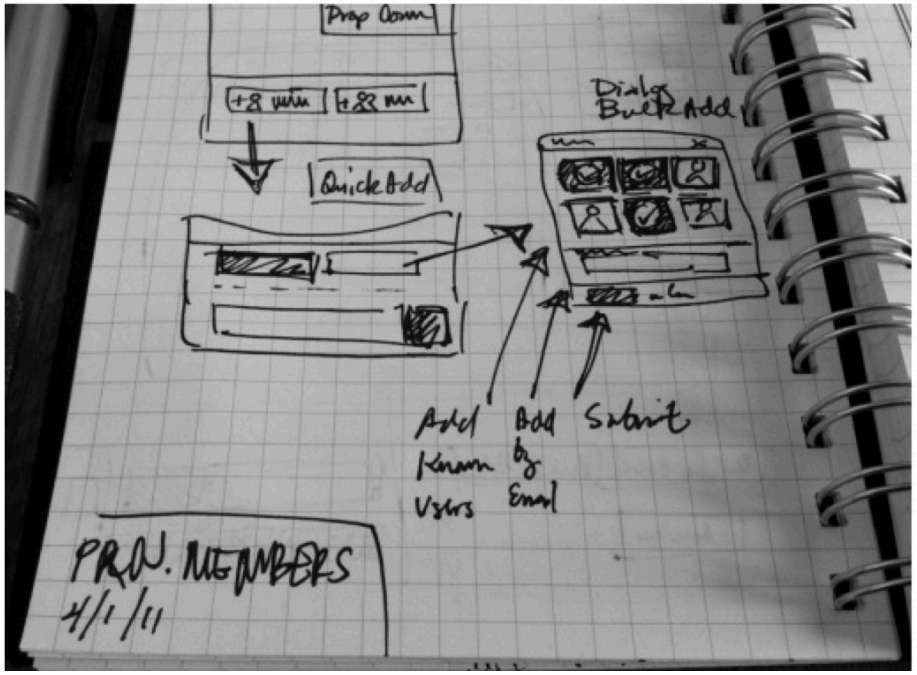
What is it used for?

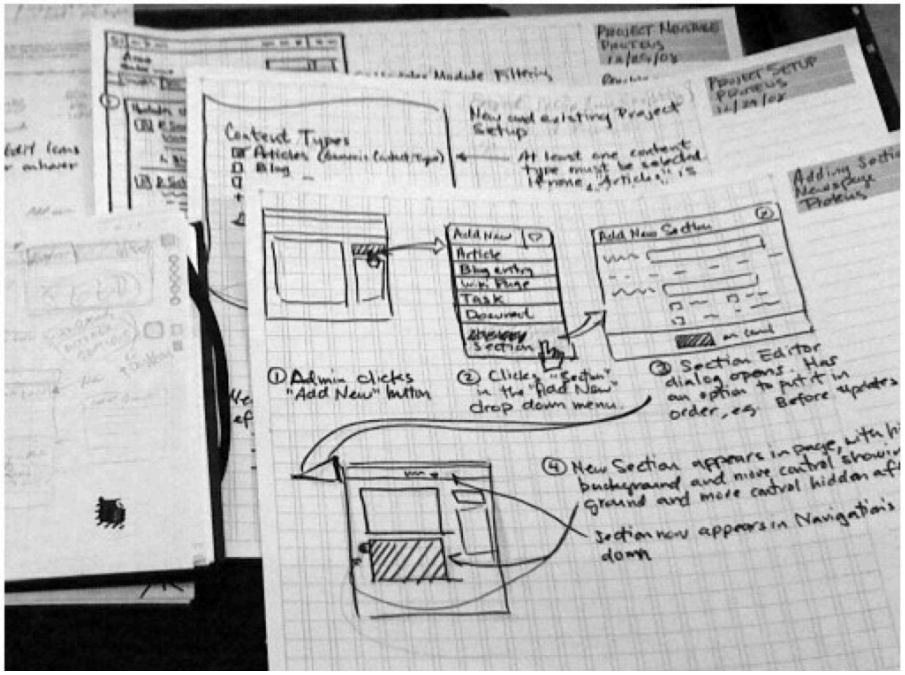
Come up with a definition “A sketch is…”

After I close the rooms, send your definition to the chat of the class.

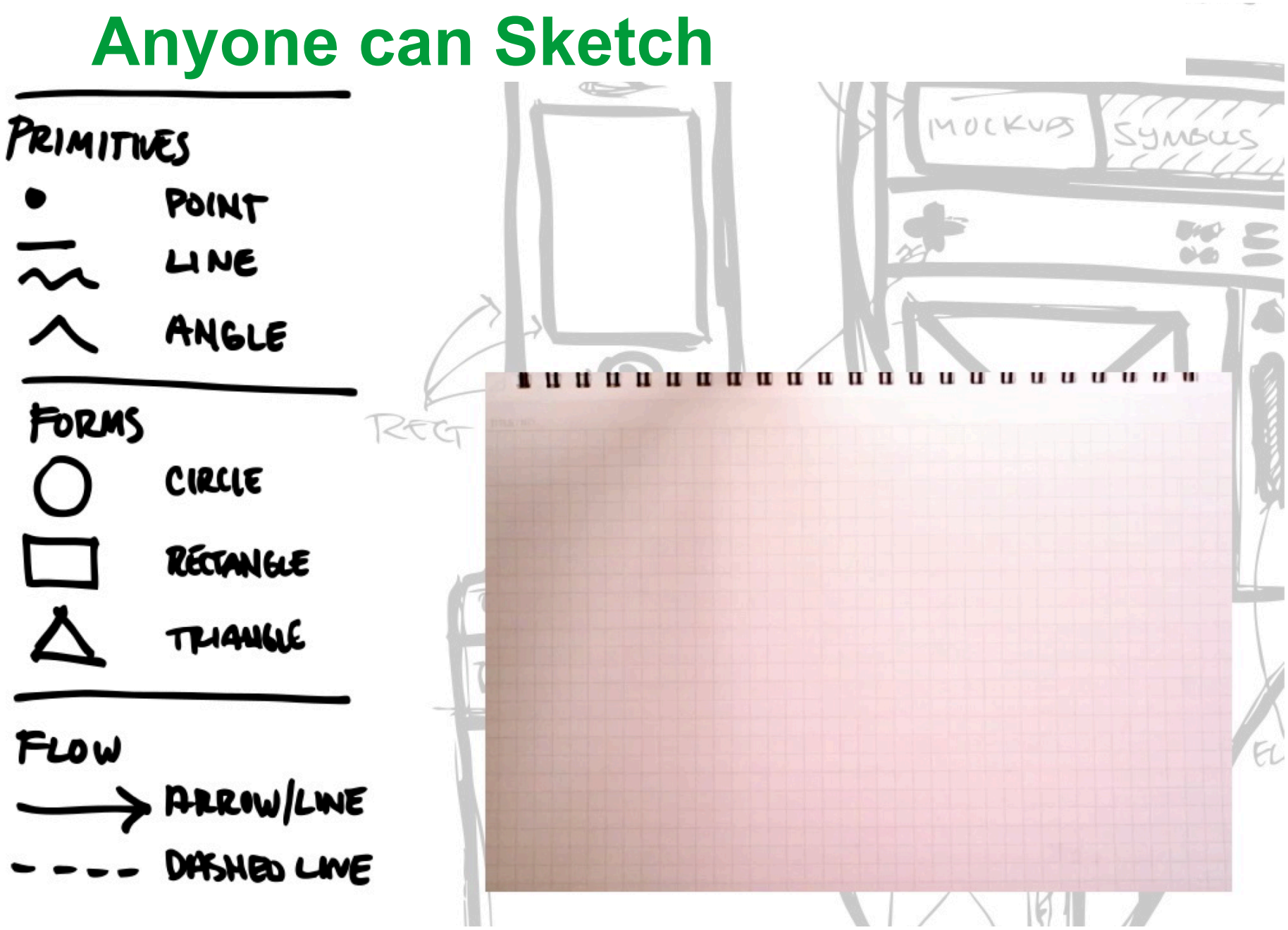
Sketching
!=
Drawing



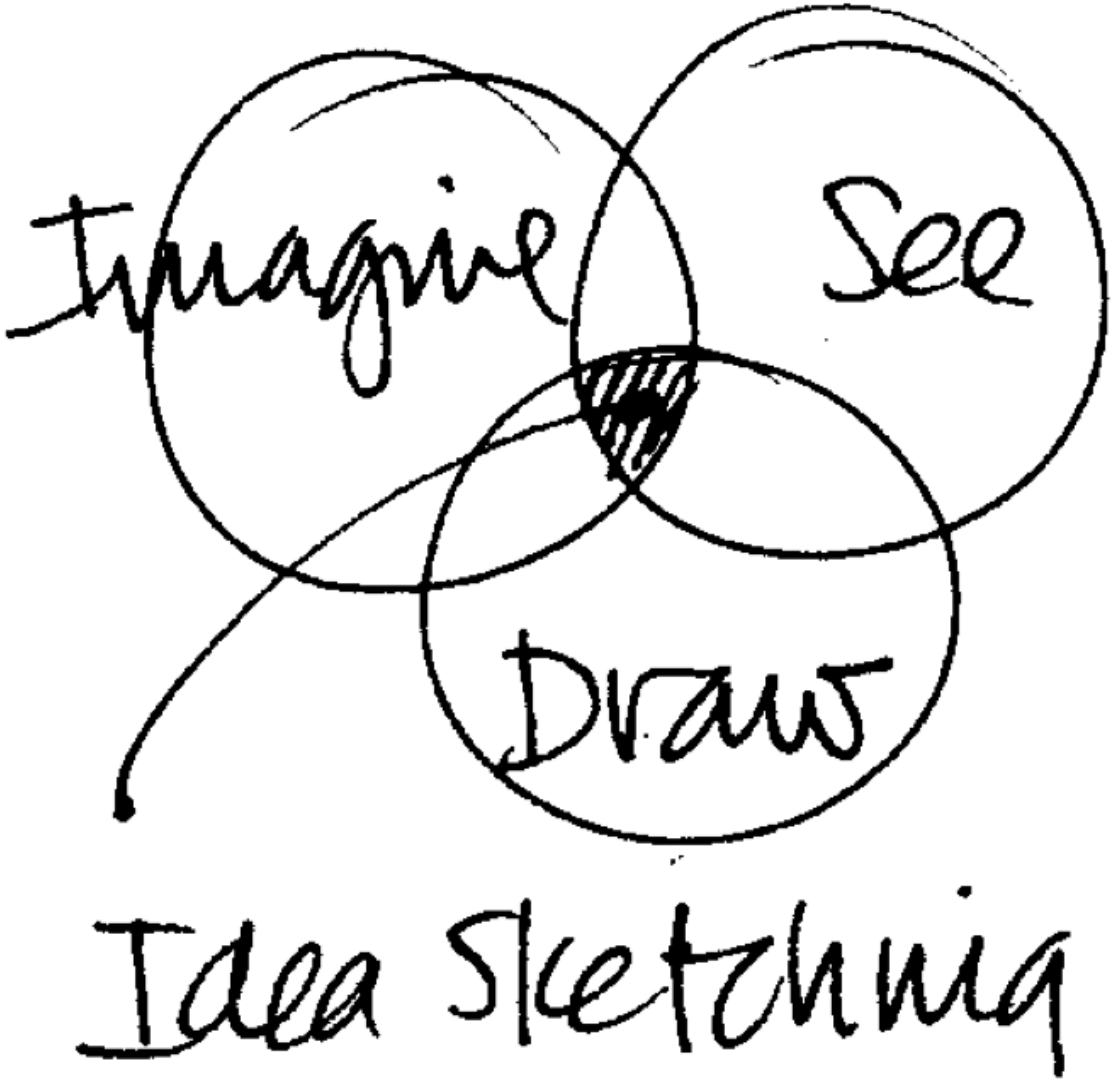




Anyone can Sketch



A process of imagining and learning



Cognitive function of sketching

- Yi-Luen Do & Gross:

"The linked acts of drawing and looking invite designers to recognize new interpretations of the alternatives they propose. By drawing and looking, designers find visual analogies, remember relevant examples, and discover new shapes based on previously unrecognized geometric configurations in their sketches. "

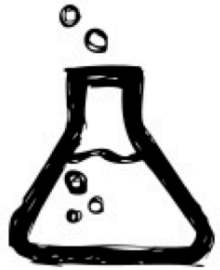
Table 1. Parallel activities in Design, Interpreting and Drawing.

Design	Interpreting	Drawing
reference analogy abstraction refinement evaluation search	attention focus recognition restructure filtering recall context	overtracing speed pressure erase shape specification shape generalization symbols hatching

WHY WE SKETCH

TO THINK

TO DOCUMENT



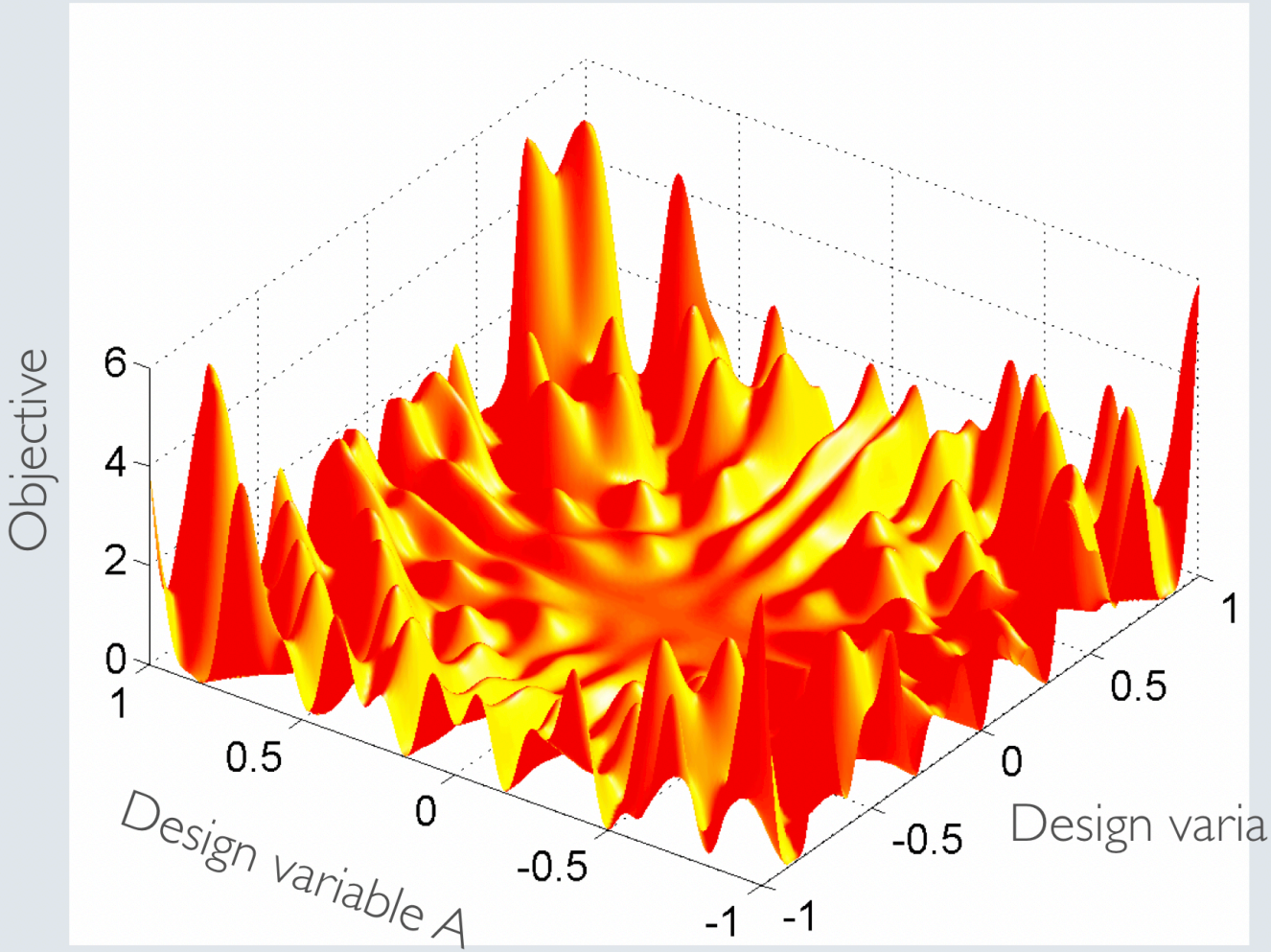
TO EXPERIMENT

TO EXPLAIN + COMMUNICATE

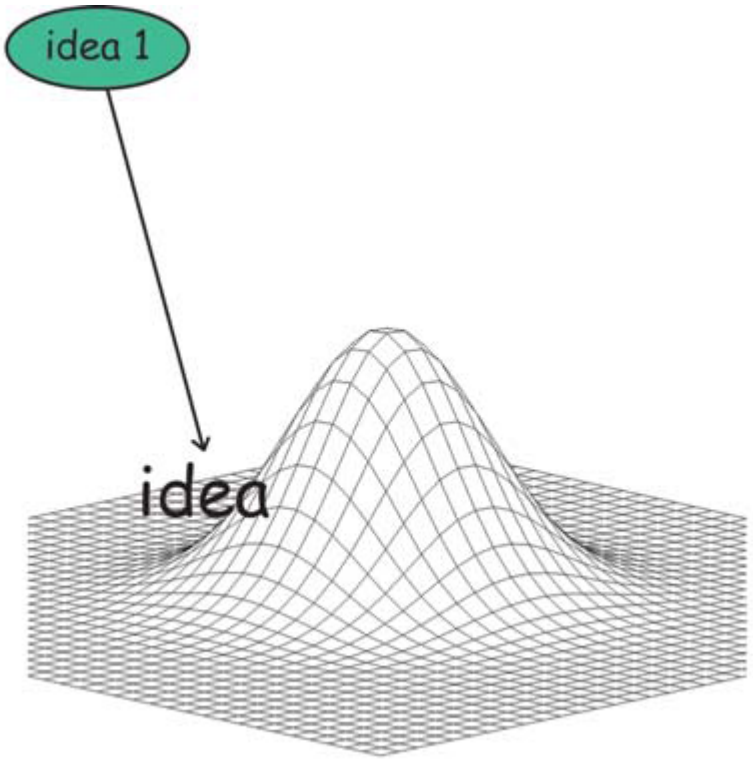
TO FAIL FASTER

TO FIND THE RIGHT DESIGN

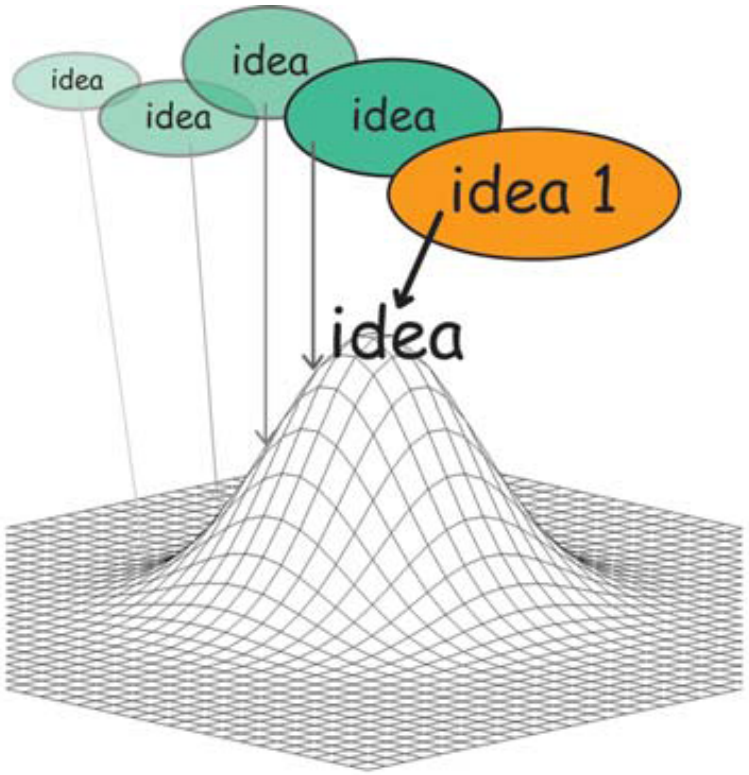
SEARCH LANDSCAPE



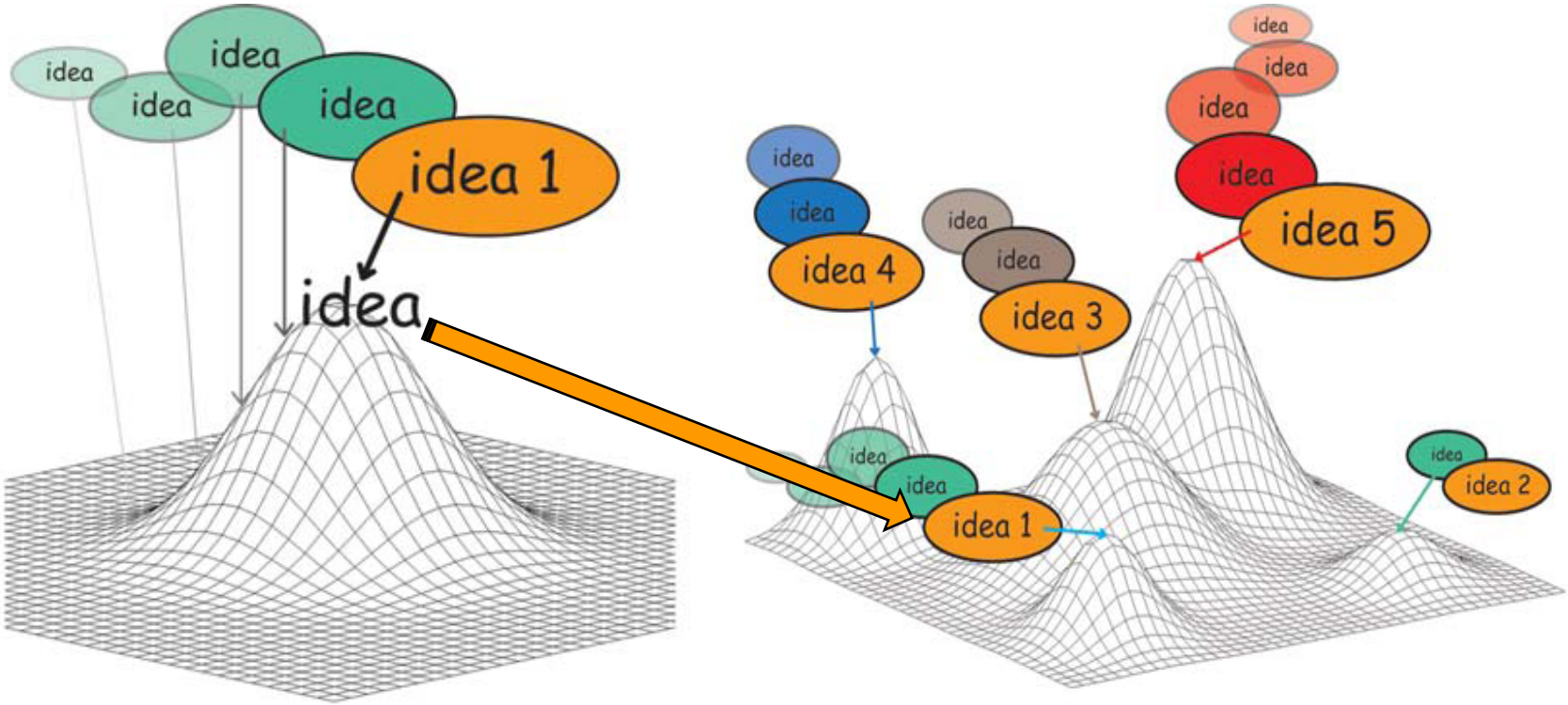
Generate an Idea



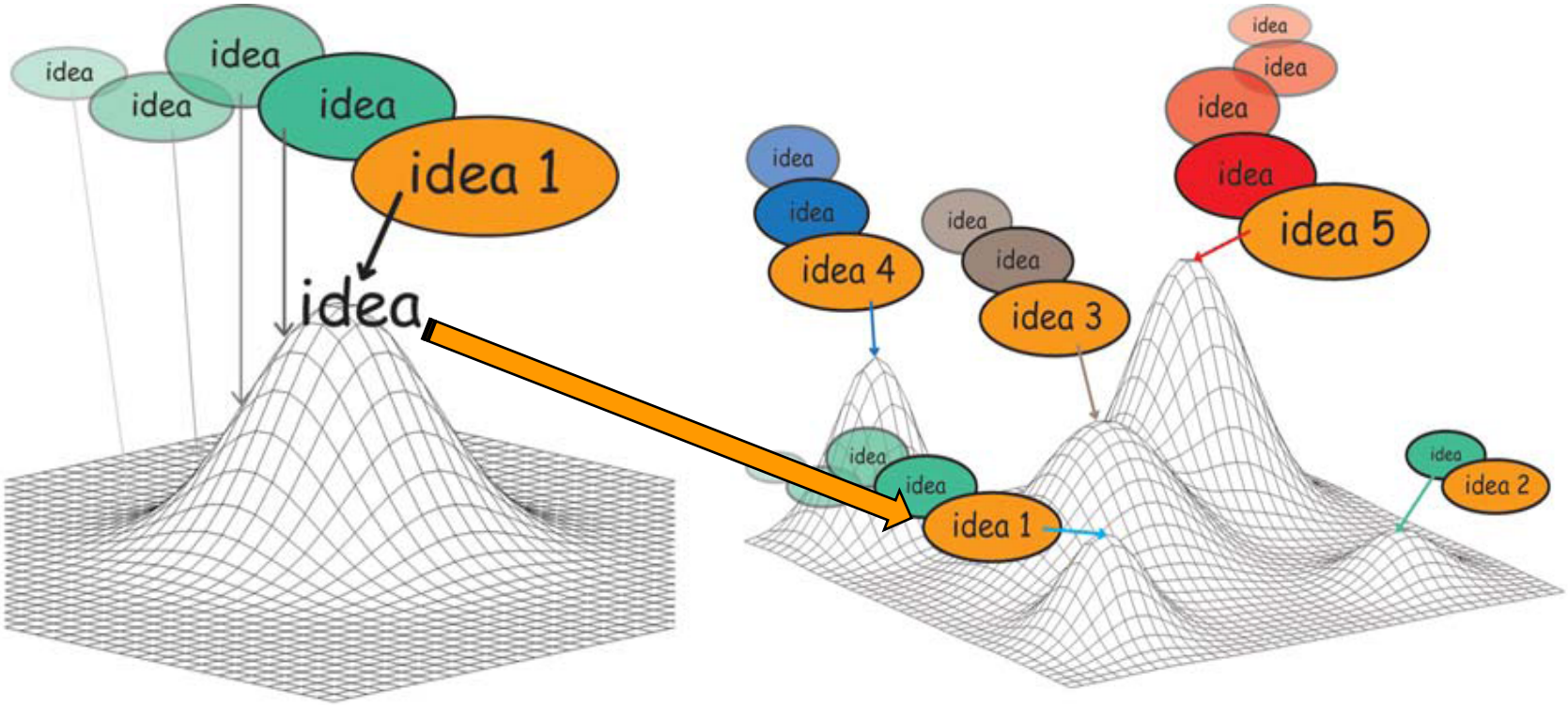
Develop the idea



Is is a local or global maximum?

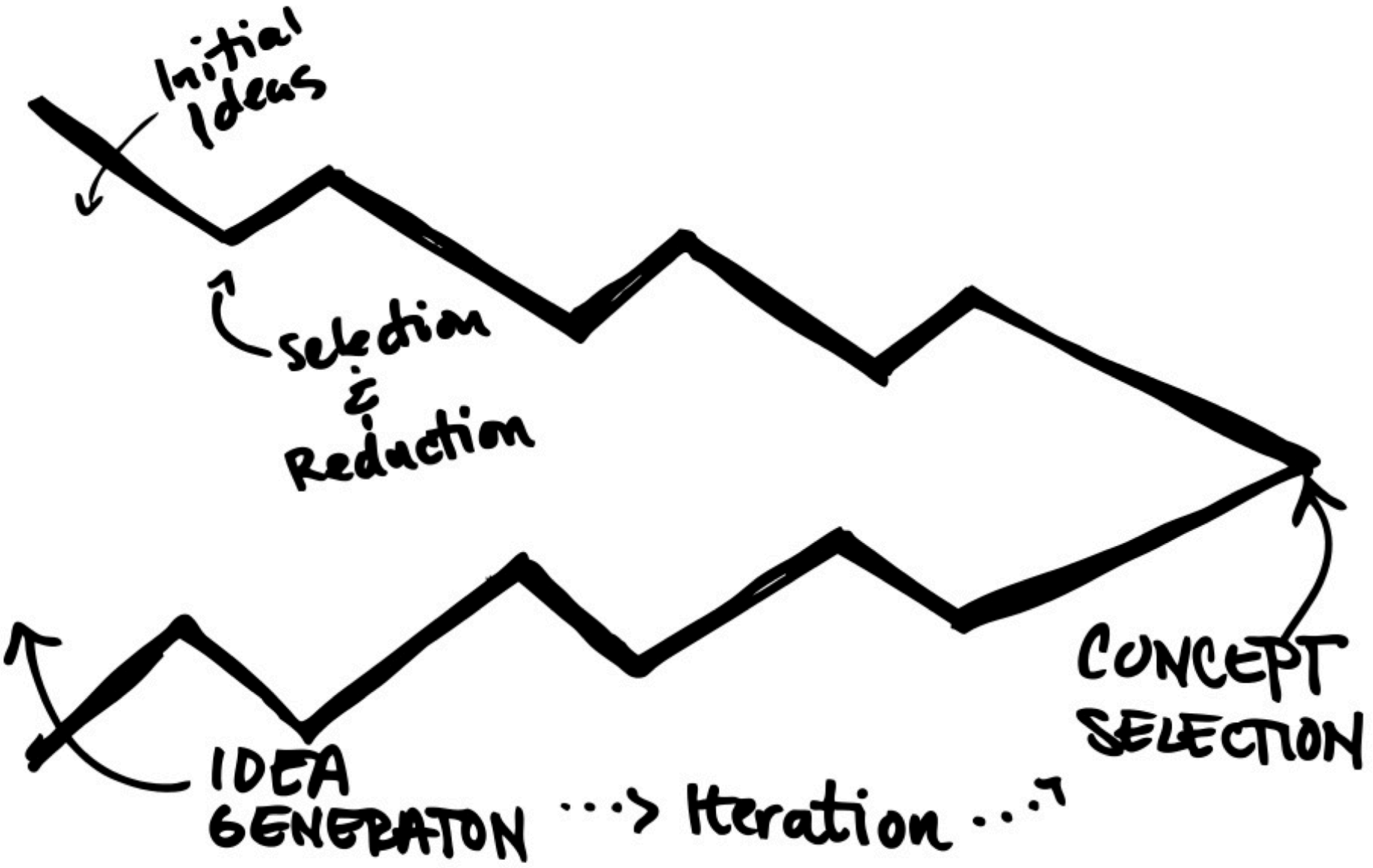


Is is a local or global maximum?

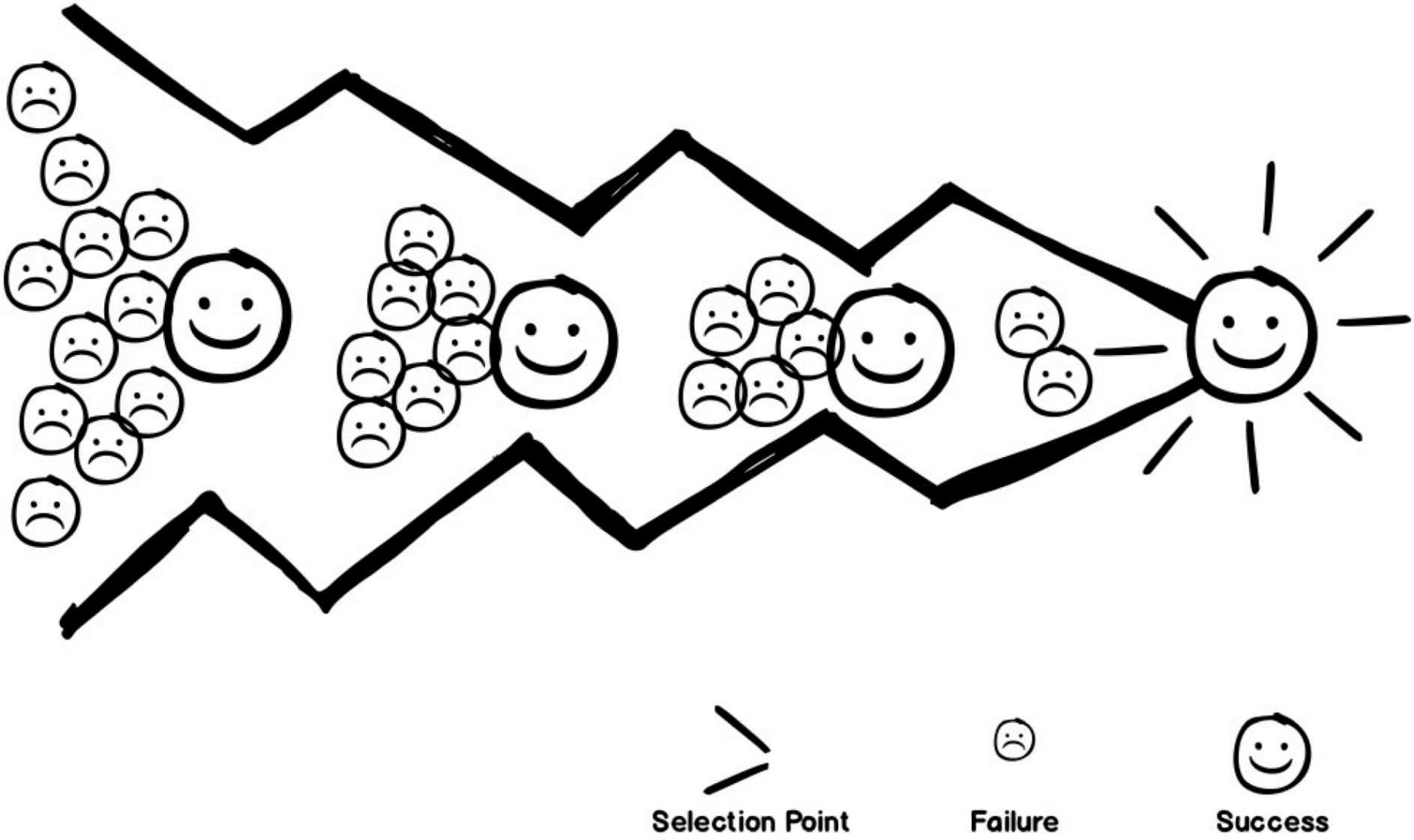


Considering **alternatives** helps finding really good designs

Design Process as a Funnel (Buxton)



To fail faster



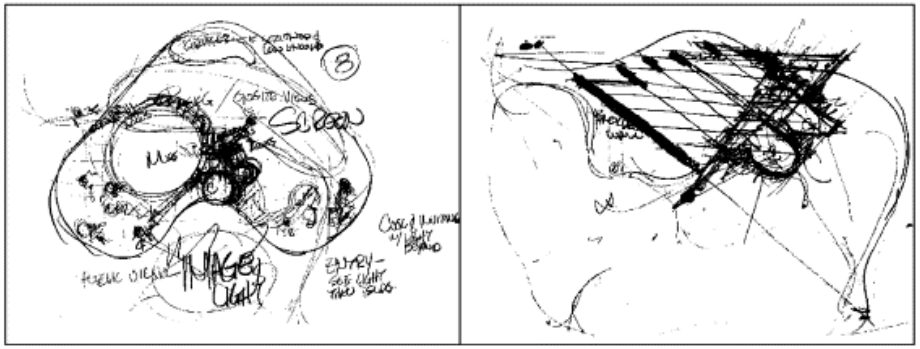
Attributes of Sketches

- Quick
- Timely
- Inexpensiv
- Disposable
- Plentiful
- Show they are a sketch
- Minimal detail
- Appropriate degree of refinement
- Suggest and explore
- Ambiguous, Open – foster discussion

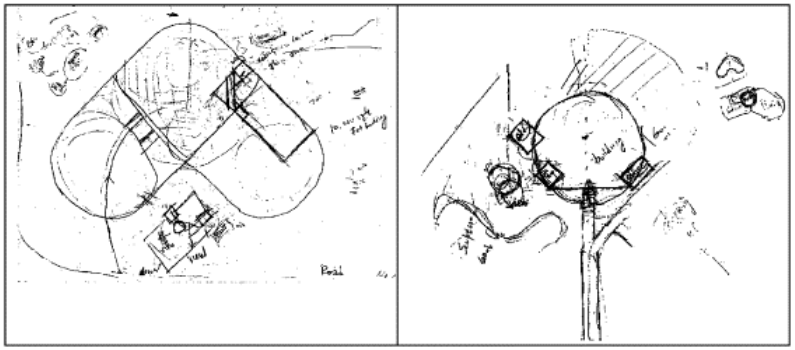
What makes experts more successful?

[Kavakli & Gero, 2002; Kavakli et al. 1999]

- Number and quality of eventual ideas
- Systematic exploration of design space; focus
- Structured tree-like representation of the problem space
  - "The expert's cognitive activity is based on a tree structure including a small group of concurrent actions in each branch (up to five in the primary and up to six in the secondary levels of cognitive processing)"
  - "The novice deals with three times as many concurrent actions as the expert, whereas the expert seems to have control of his cognitive activity and governs his performance in a more efficient way than the novice, because his cognitive actions are well organized and clearly structured."



Expert



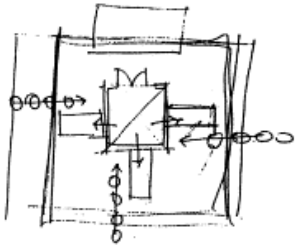
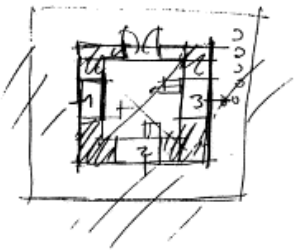
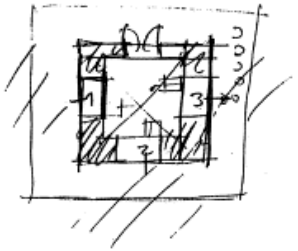
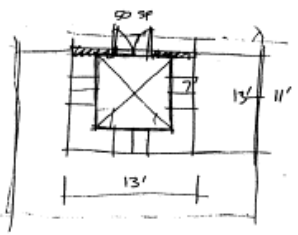
Novice

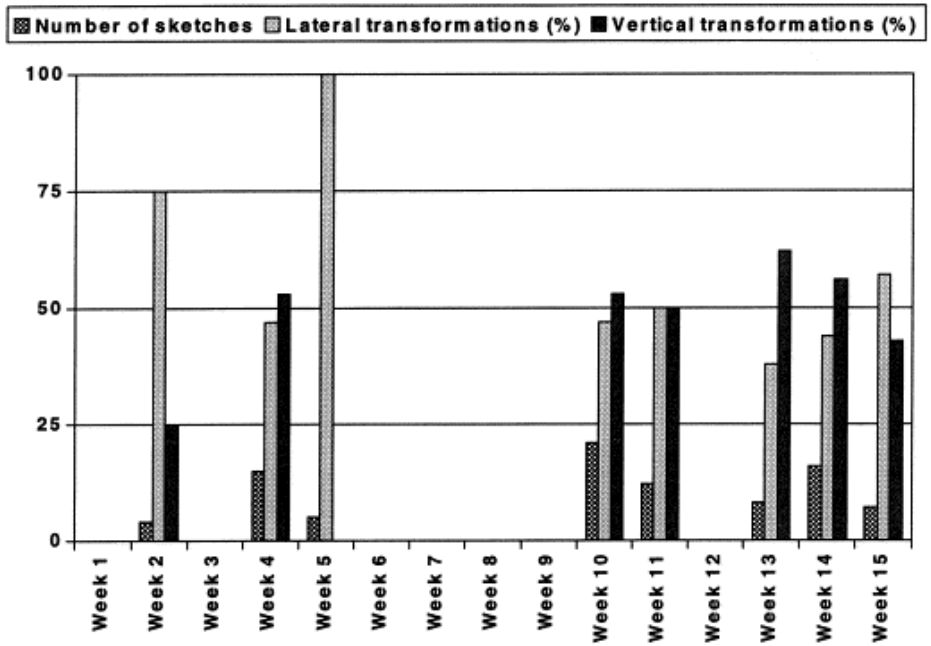
Other supportive factors

- **Number of sketches**
  - correlates with the quality of outcomes [Song & Agonino, 2004; Yang, 2009]
  - correlates with design students' grade [Song & Agonino, 2004]
- **Quantity of "morphological alternatives"**
  - predicts quality of design outcomes [Yang, 2009]
- **Restructuring and combination** activities during design [Verstijnen et al. 1998]
- **Strong interaction with one's sketches**
  - Not drawing skills per se

Long-term sketching projects

- Switching between lateral transformations, vertical transformations, duplications [Rodgers, Green, McGown, 2000]
  - Unsuccessful designers get stuck, not able to switch

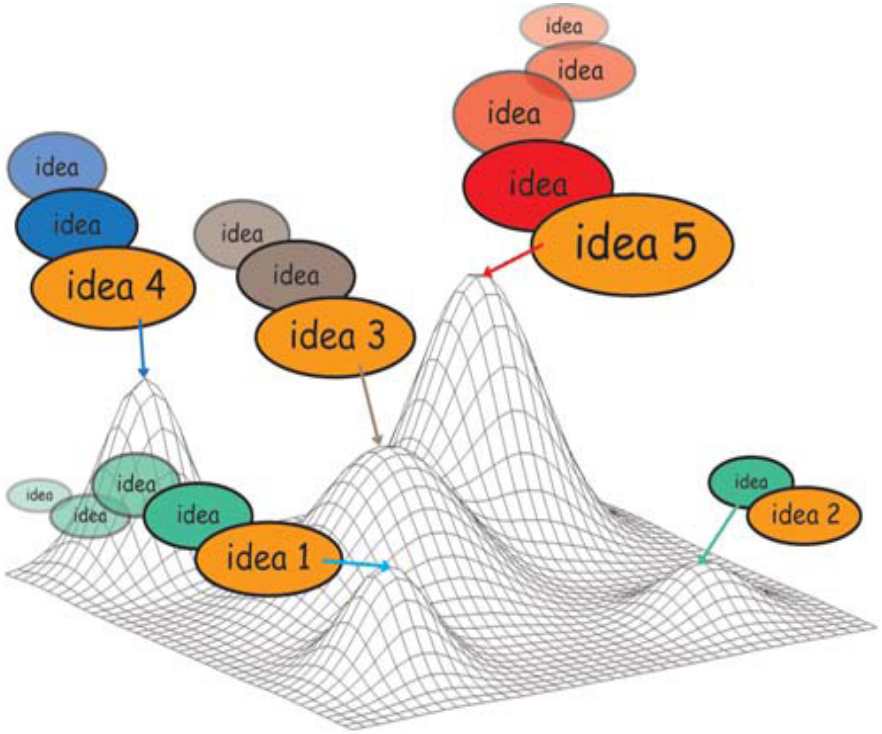
Lateral (divergent)	 Figure A	 Figure B
Vertical (convergent)	 Figure B	 Figure C



Long-term sketching projects

Vertical transformations move up- or downhill

Lateral transformations move to another part of the space

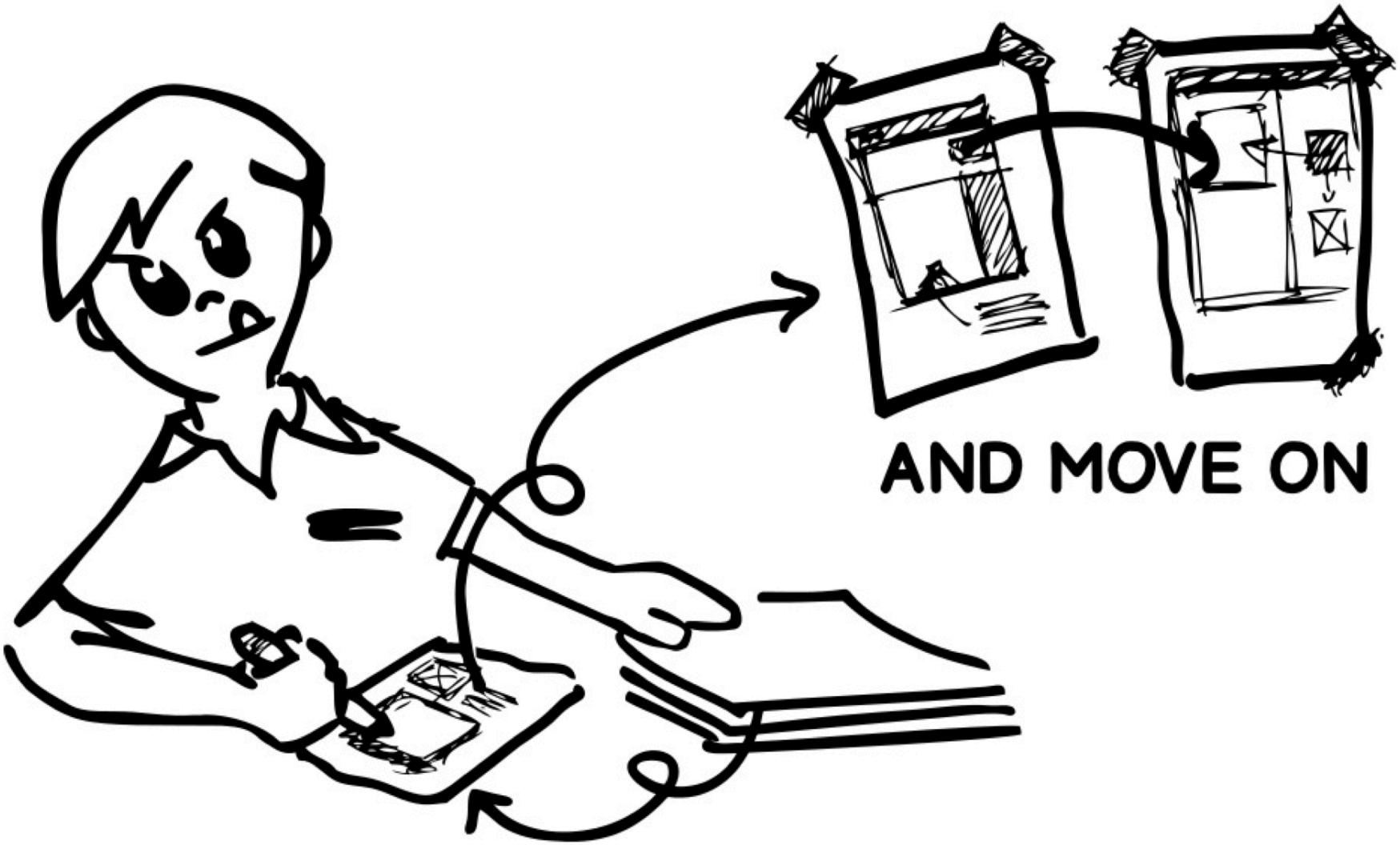


Sketching is a tool for ideating, thinking, reflecting, communicating and designing.

Questions?

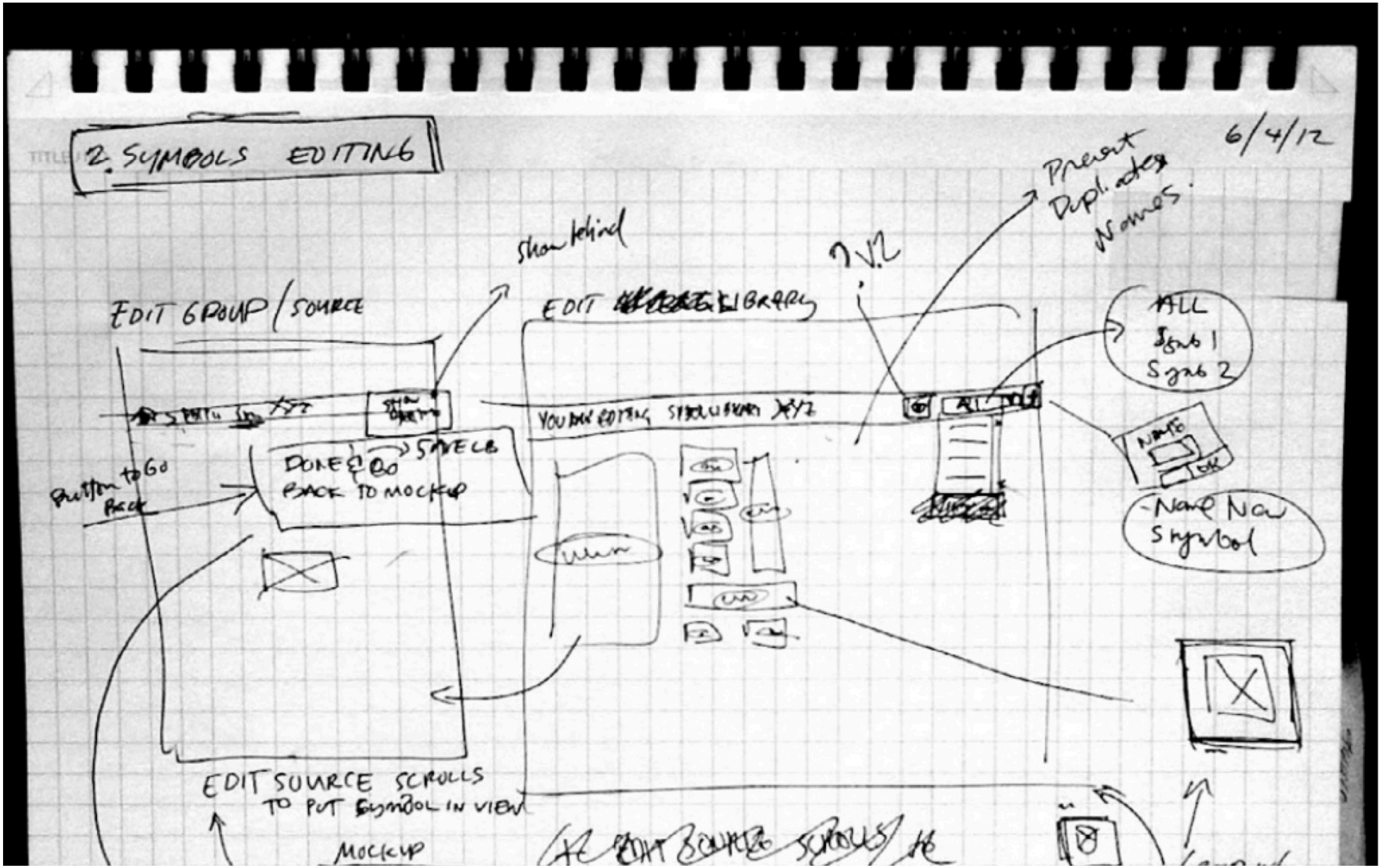
2. How to sketch?

CAPTURE THE ESSENCE

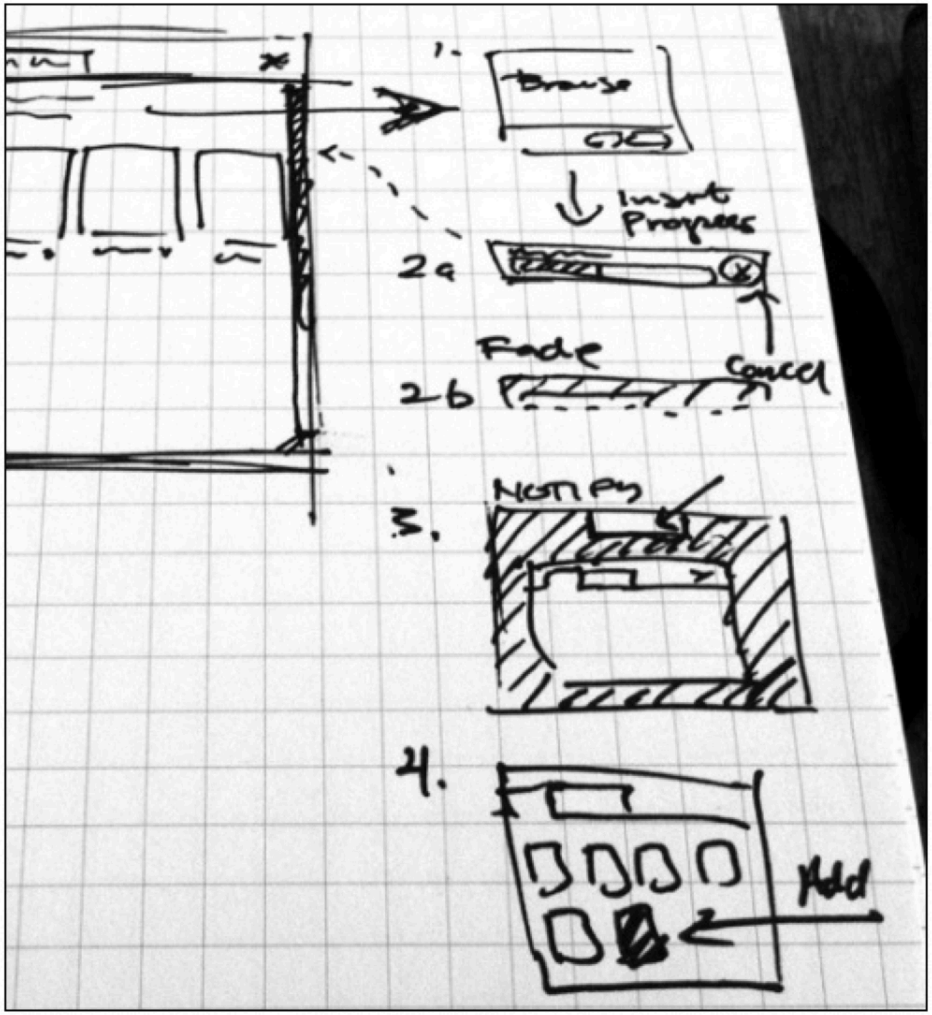



WORK
FAST
MORE IS BETTER

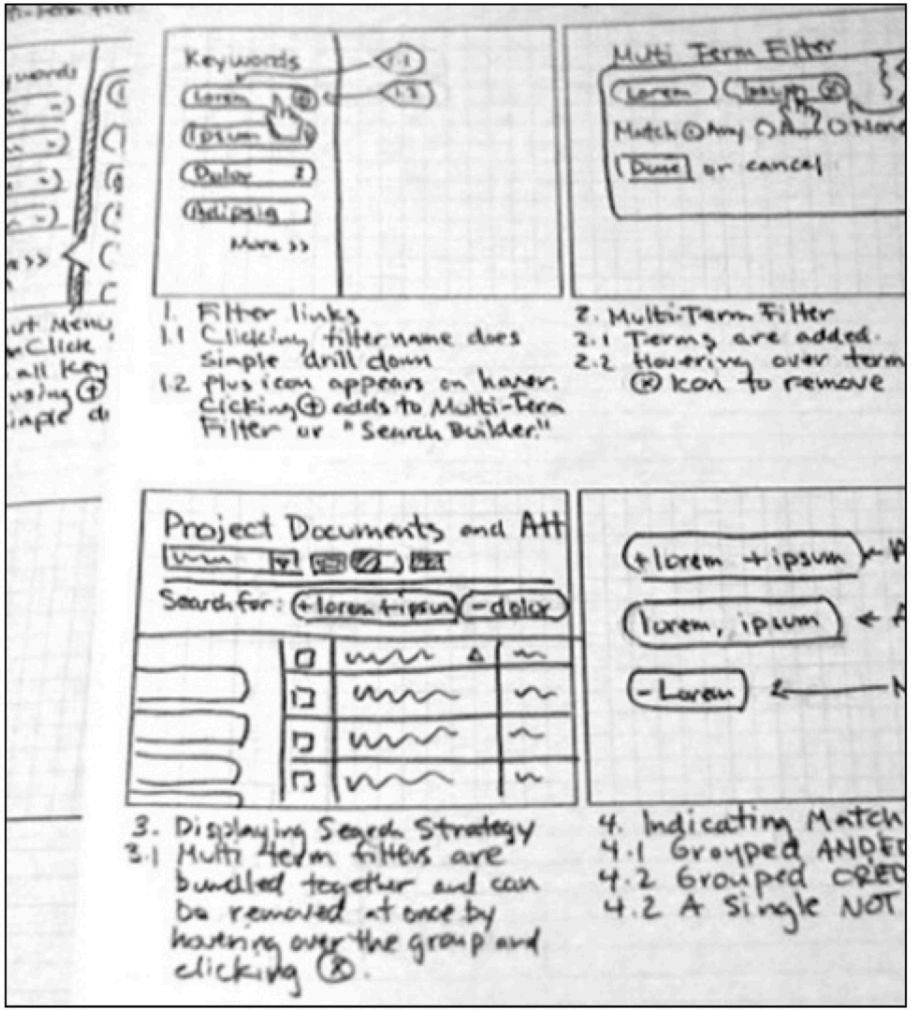
UGLY IS THE POINT



1-2 LEVELS OF FIDELITY



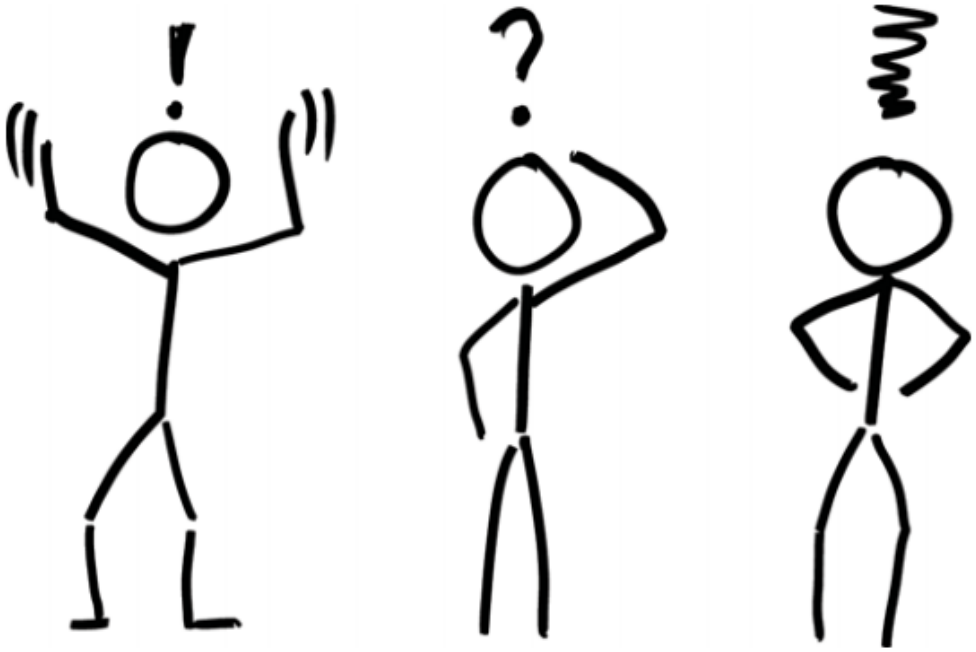
ABSTRACT
(Thumbnails)



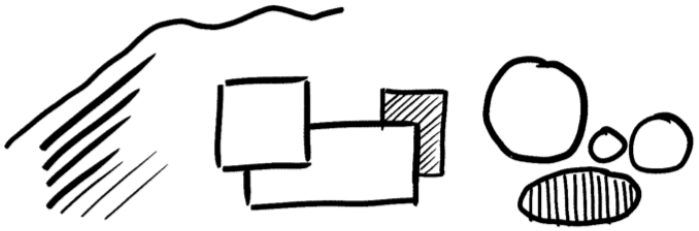
DETAILED
(Words + Controls)

DO 👍	DO NOT 👎
Work fast and loose; More is better	Get precious
Embrace constraints; 1 pen / 1 color	Focus on details too early
Explain your work	Forget the bigger picture
Stop and build	

Develop a Sketching Vocabulary



Develop a Sketching Vocabulary

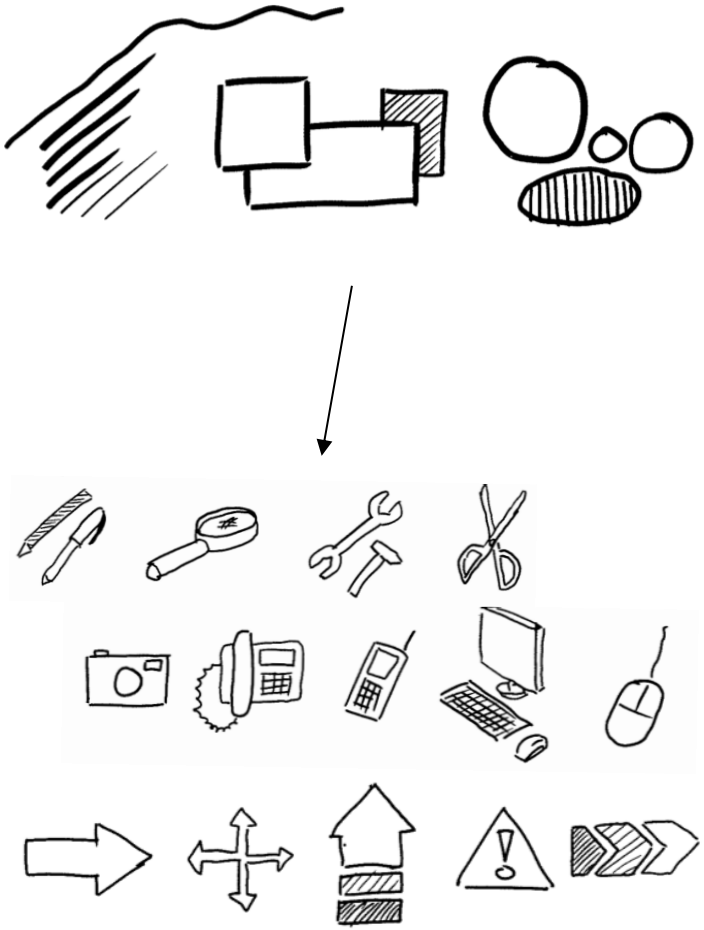


Many sketches are composed out of simple elements.

Get familiar with basic lines, rectangles, circles etc.

Source: Bill Boxton, http://sketchbook.cpsc.ucalgary.ca/?page_id=64

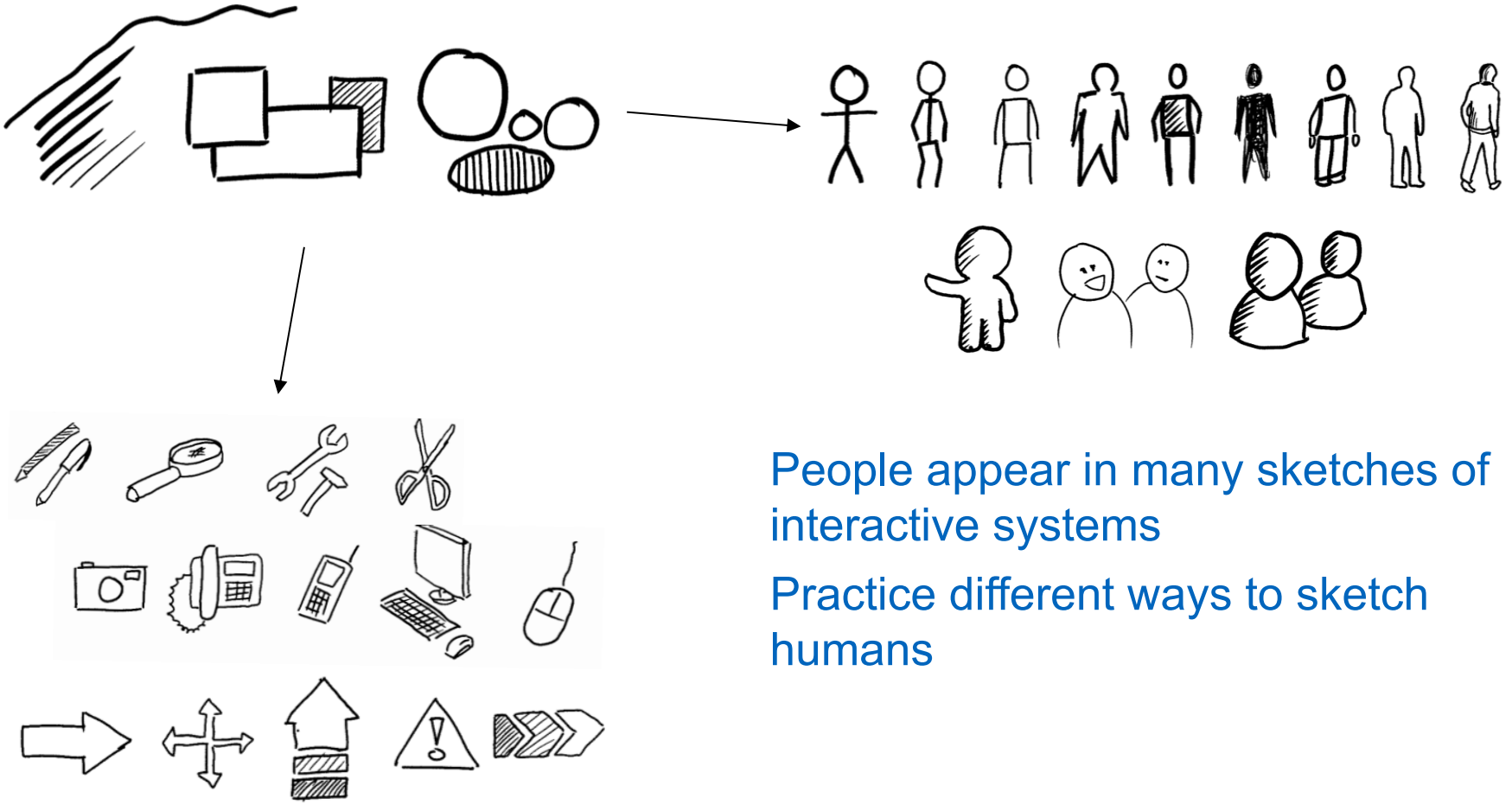
Develop a Sketching Vocabulary



Combine simple shapes to a variety of objects

Icons can be a source of inspiration

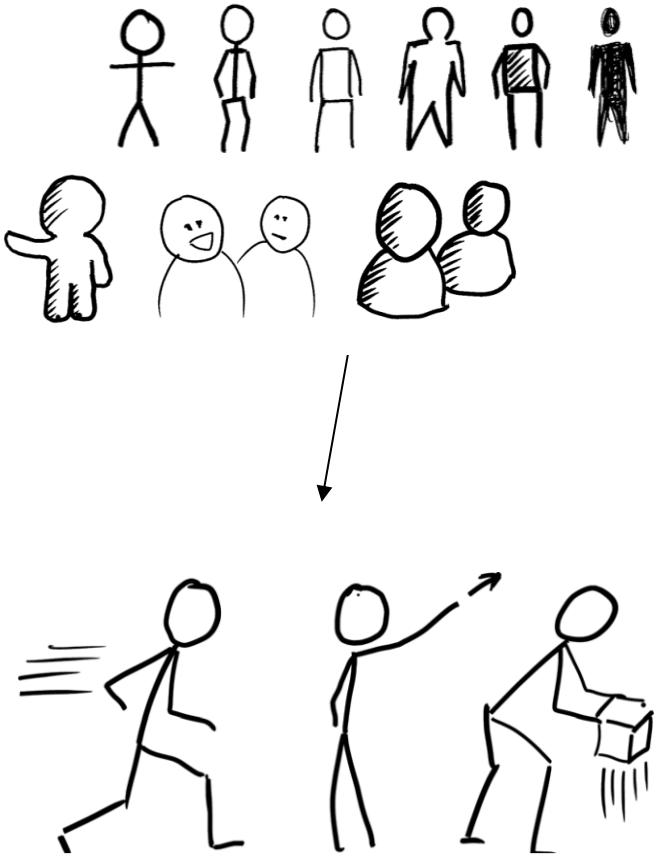
Develop a Sketching Vocabulary



People appear in many sketches of interactive systems

Practice different ways to sketch humans

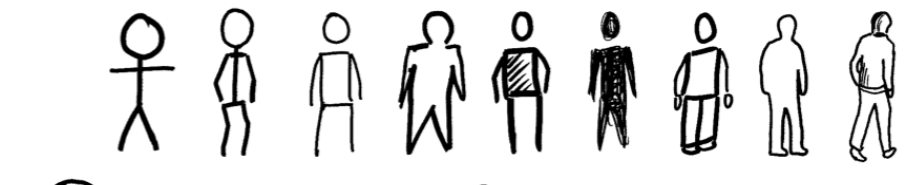
Develop a Sketching Vocabulary

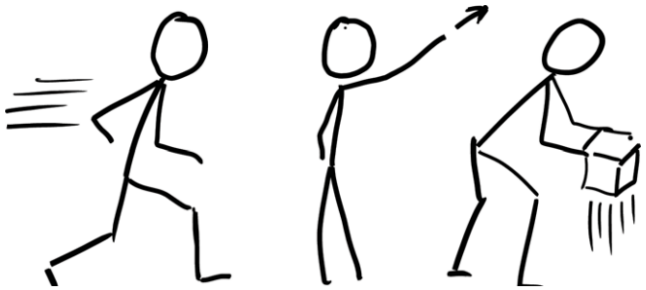


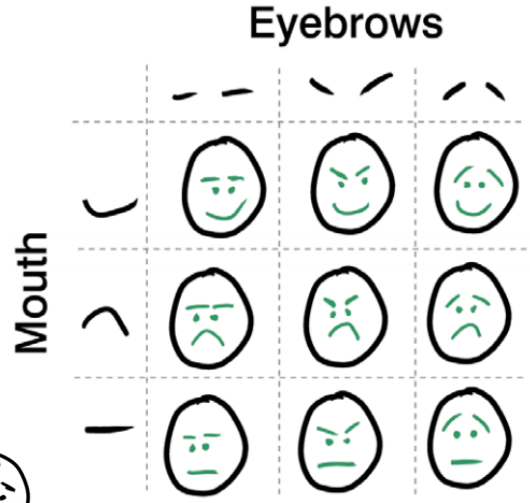
Express activities with different poses

Action lines emphasize movement

Develop a Sketching Vocabulary







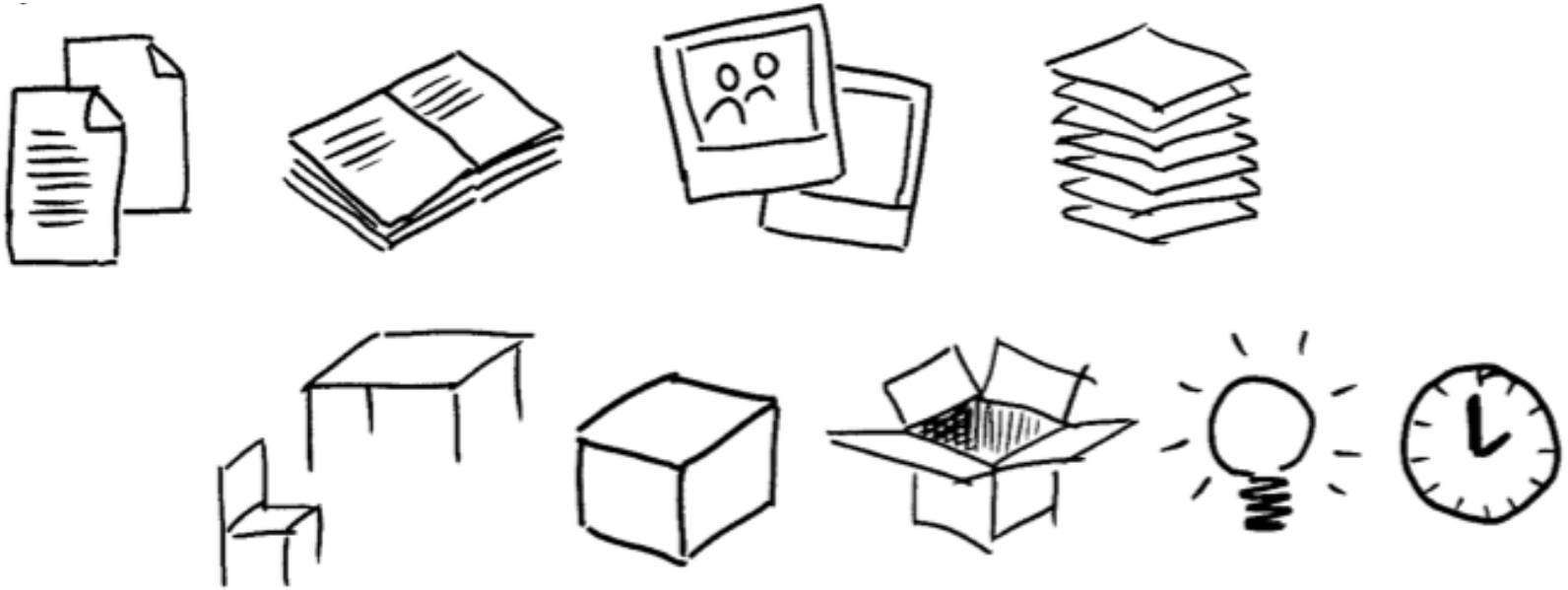
Simple variations of the face can depict a variety of emotions

Posture can further emphasize them

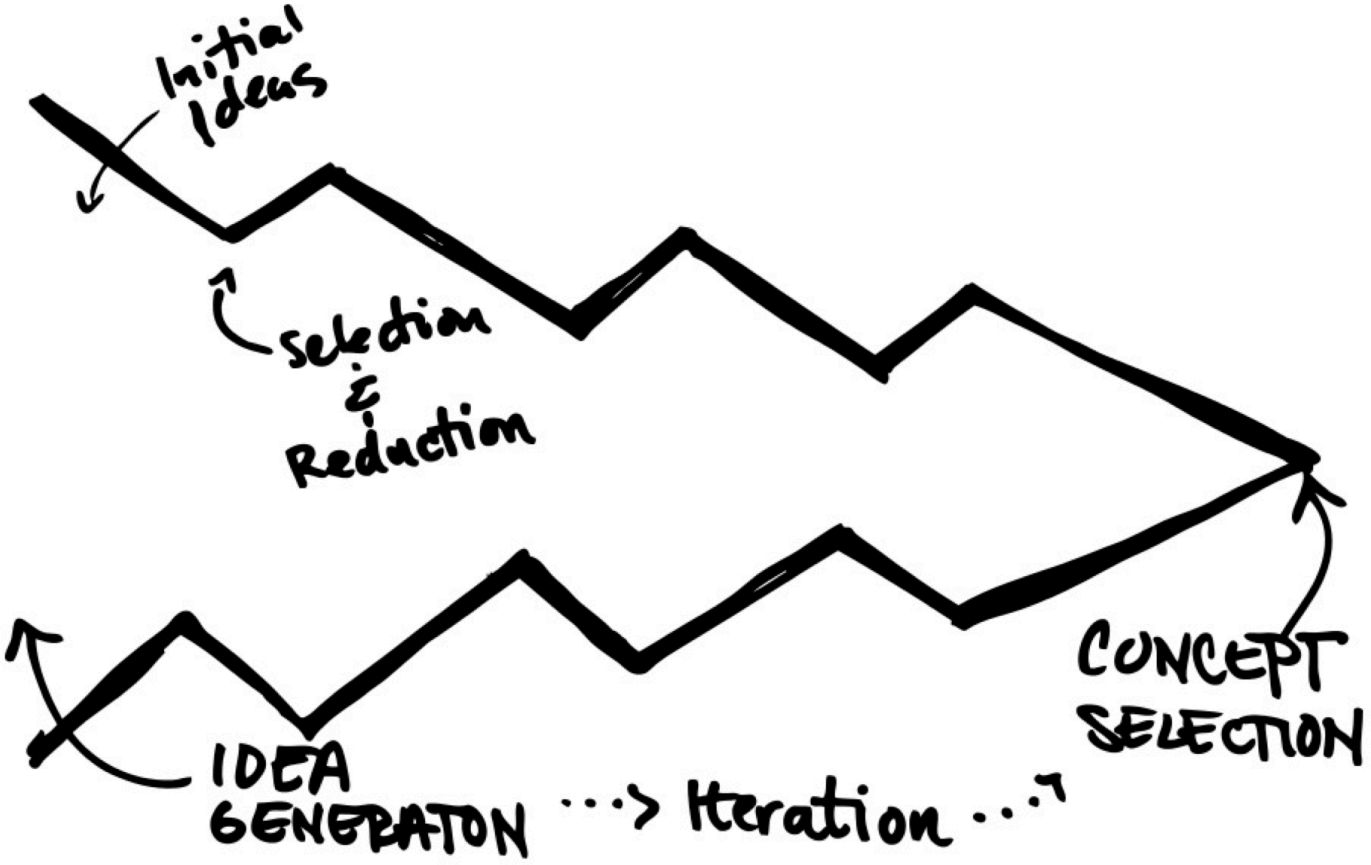
Task: Sketching Warm Up (5 min)

Individually sketch 10 objects of your choice composed out of basic shapes

Try to be quick. You have 30 seconds per object. If you manage to sketch one object in less time, sketch more versions. Include a sketch of a human.



10 plus 10 method



10 plus 10 method

1. State your design challenge
    - problem to solve
    - client need
    - novel system that takes advantage of particular technology…
2. Generate 10+ ideas that address that challenge
    - brainstorming
    - be as creative and diverse as possible
    - don’t judge designs
    - capture essence of idea, not details

10 plus 10 method

3. Reduce the number of ideas
    - review all designs
    - discard ones that don’t have merit
    - use sketch to explain and get feedback on remaining designs from others
    - gather reactions (including your own)
4. Choose the most promising concept(s)
    - Your starting point

10 plus 10 method

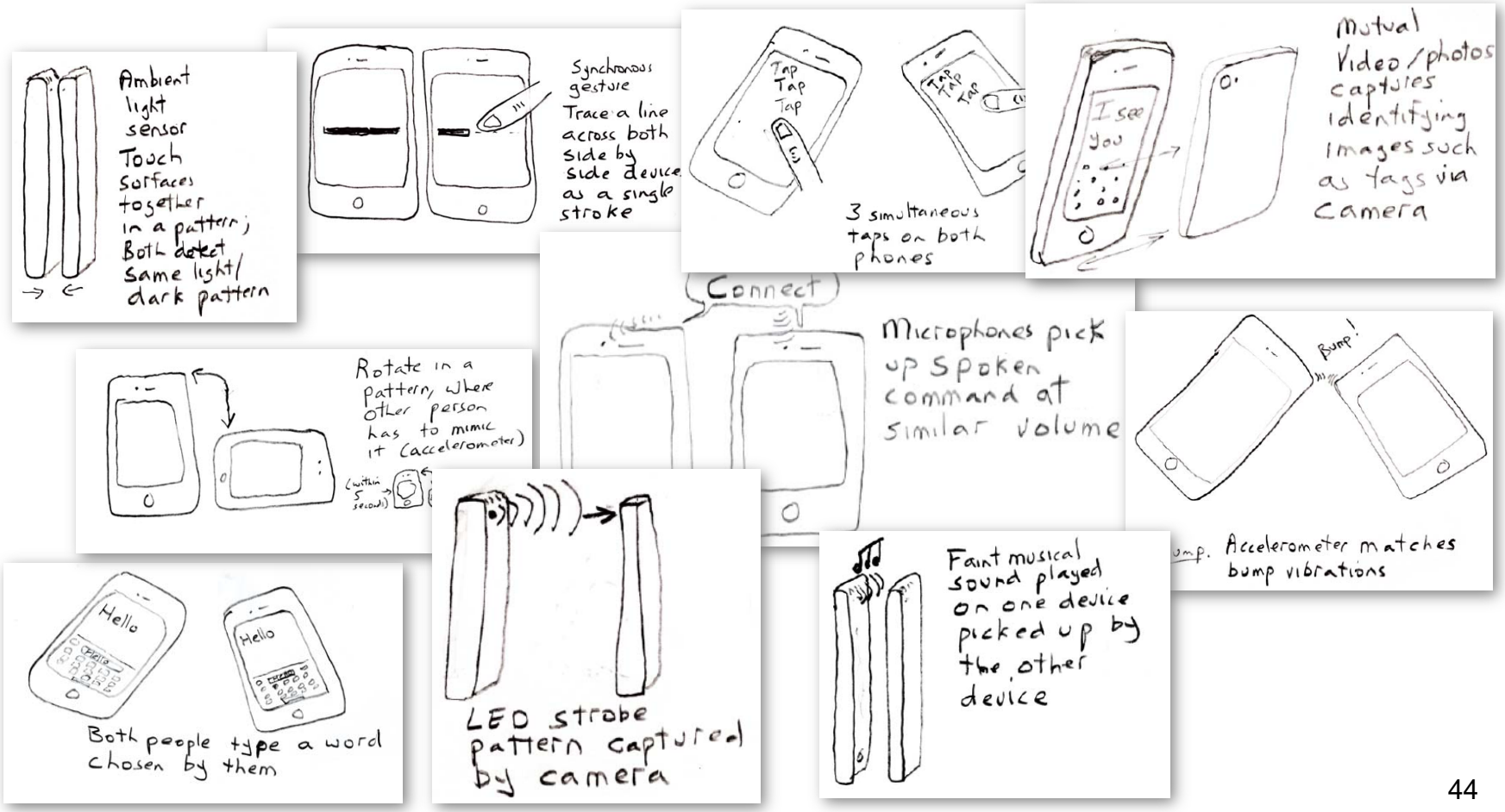
5. Produce 10 details / variations of that concept
    - explore the concept
    - generate different ways of realizing the concept
    - dig deeper in a particular way (i.e., flesh out details)

6. Present your ideas to a group
    - coffee / donuts go a long way
    - solicit feedback (positive, what could be improved, etc.)
    - Suggestions about redesigns

7. As your ideas change, sketch them out
    - that is, go back to step 1, but deeper into the design funnel

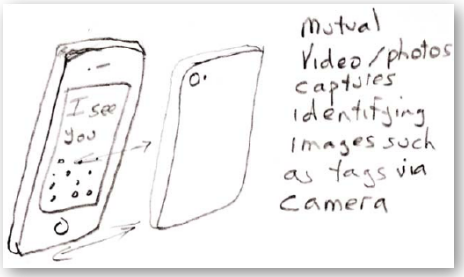
Example: How to connect devices

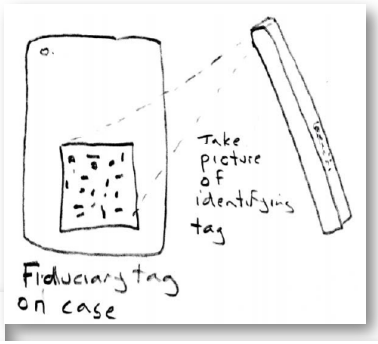
Sketches of 10 competing concepts

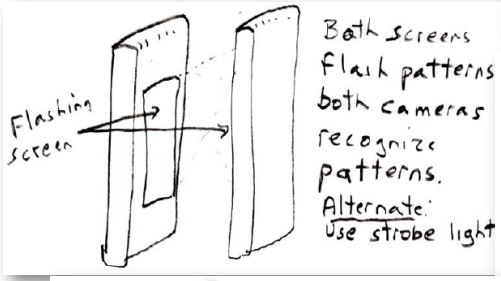


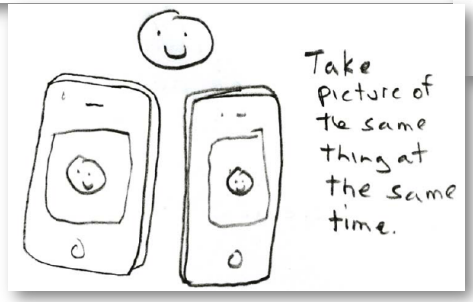
Example: How to connect devices

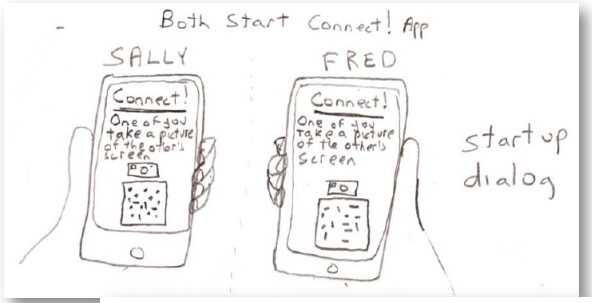
Brainstorm variations and details

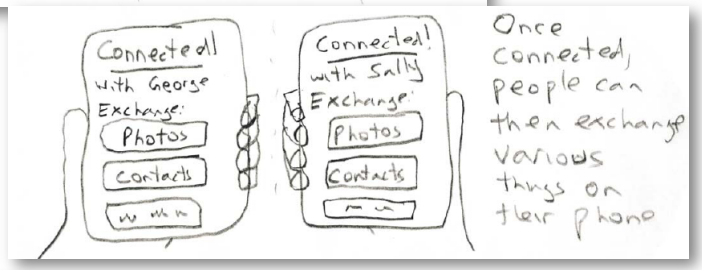


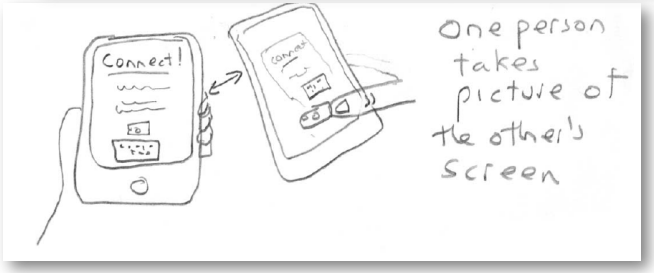












Brainsketching

Jay, V. (2014). Brainsketching: Collaborative Interaction Design.
User Experience Magazine, 14(1).

Task: 9 plus 9 Brainsketching

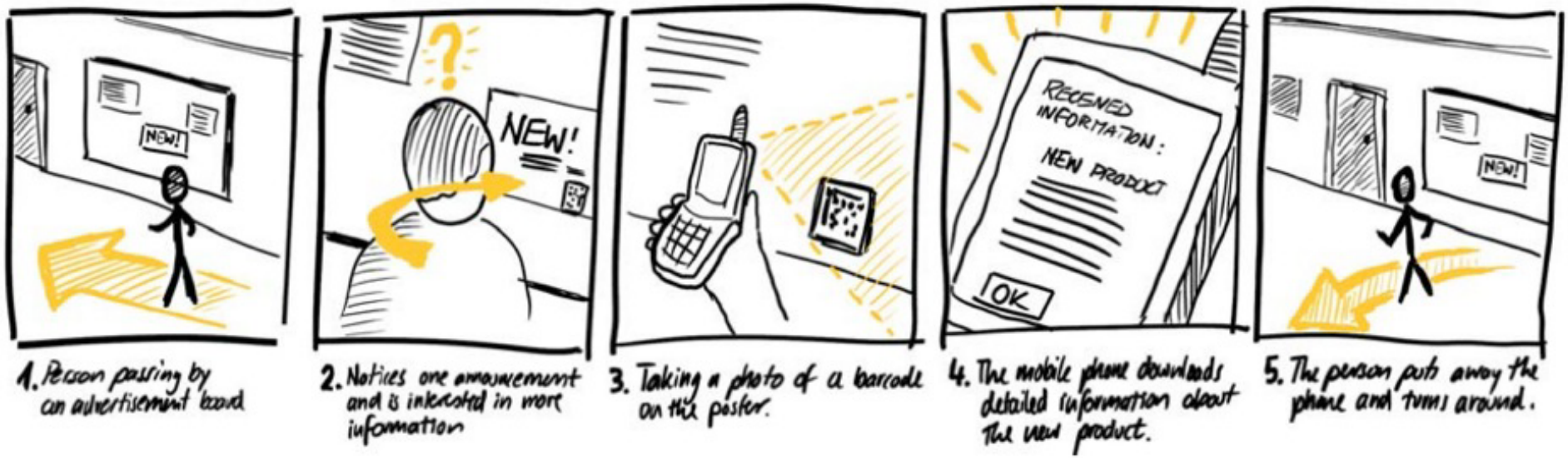
Challenge: How to establish a habit of not touching ones own face?

1. Individually sketch several distinct concepts. Don't judge your ideas sketch what comes to mind (4 min)
   Try to make it 3-4 concepts
2. Make your sketches available to the others in your breakout room (e.g. share google drive link). Understand the other sketches. Ask for clarifications if needed (4 min)
3. Make 2-4 sketches of variations or details inspired by the sketches of your team members (4min)
4. Also share the second round of sketches with the group. Have a short discussion which ones you would pick for further development if you were to continue with this challenge. (4 min)

How did it go?

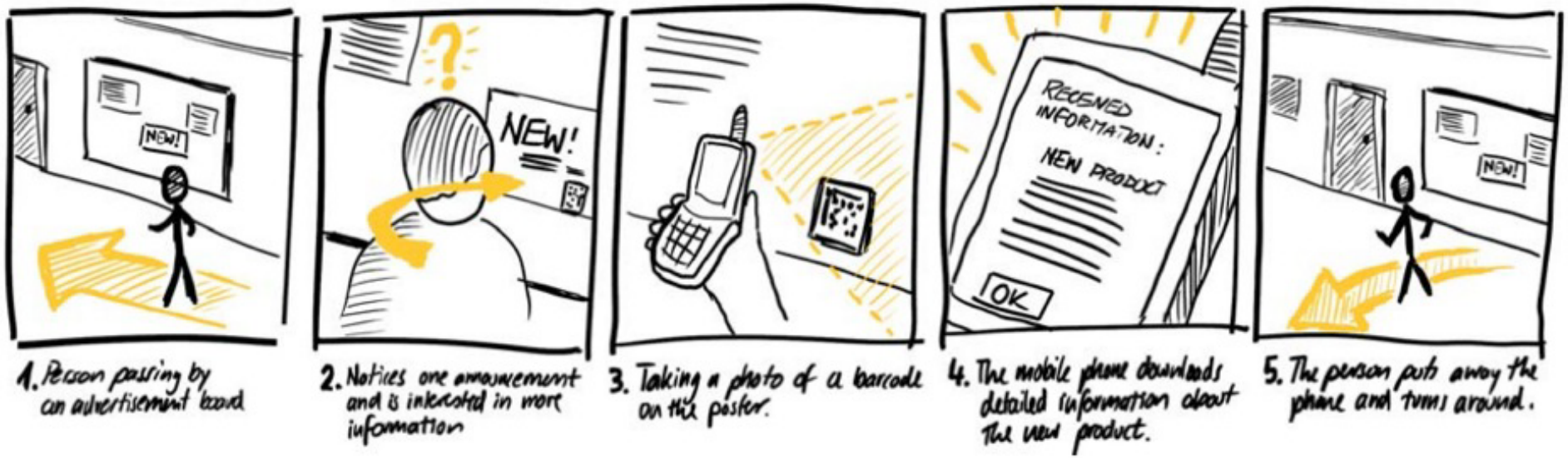
Storyboards

- Sequence of sketches - frames
- Visualize a narrative
- Communicate context and dynamics of interaction
  - User actions
  - Responses of the system
  - Environment



Storyboards - Dos

- Create a persona and scenario
- Focus on user behaviours
  - **One** frame for each action that is key for understanding the scenario
- Annotate



Everybody can sketch. Developing a sketching vocabulary can get you started.

Sketch quickly, plentiful and focus on the essence.

Storyboards are sequences of sketches which communicate a scenario.

Questions?

3. Prototyping

What is a Prototype?

A prototype is a model of the final design.

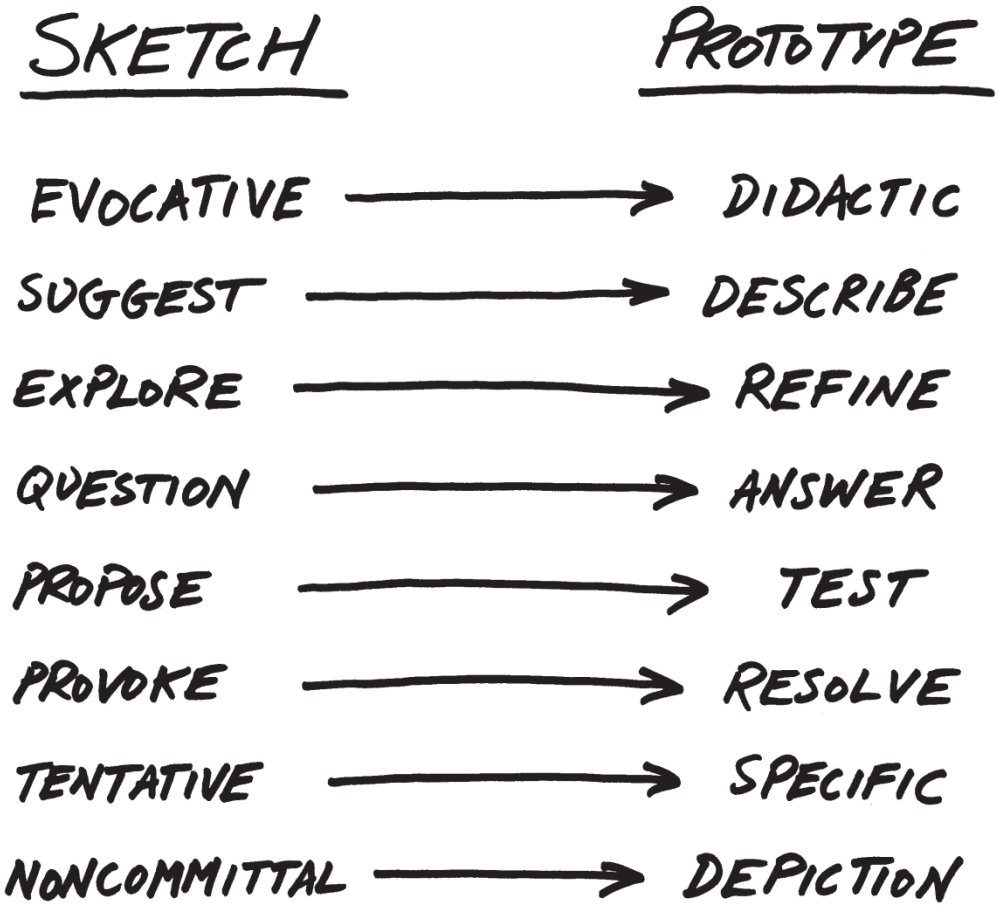
Can be “look like”, ”work like”, “behave like”…

It can range from a series of sketches to
something very close to the final version.

Why build prototypes?

- Encorages reflection
- Improves communication
- Tests feasibility
- Enables hands-on experience
- Allows making changes early on

The sketch-to-prototype continuum



Low fidelity prototypes

Used for exploration at the beginning of the development

Cheap and quick to produce

Easy to change

High fidelity prototypes

Used at later stages when open design questions are smaller

Look more like the final product

Prototyping Tools

Paper prototypes

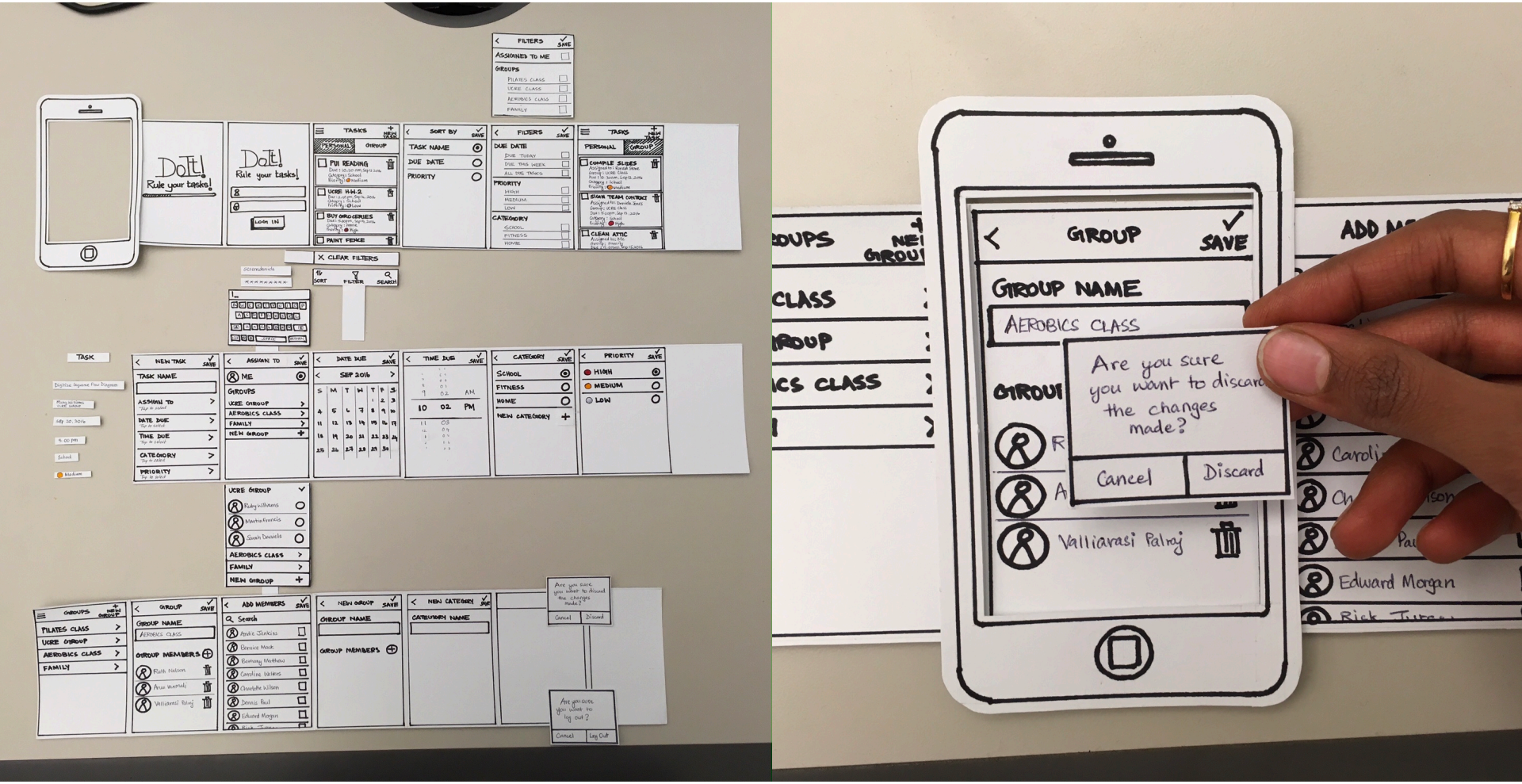
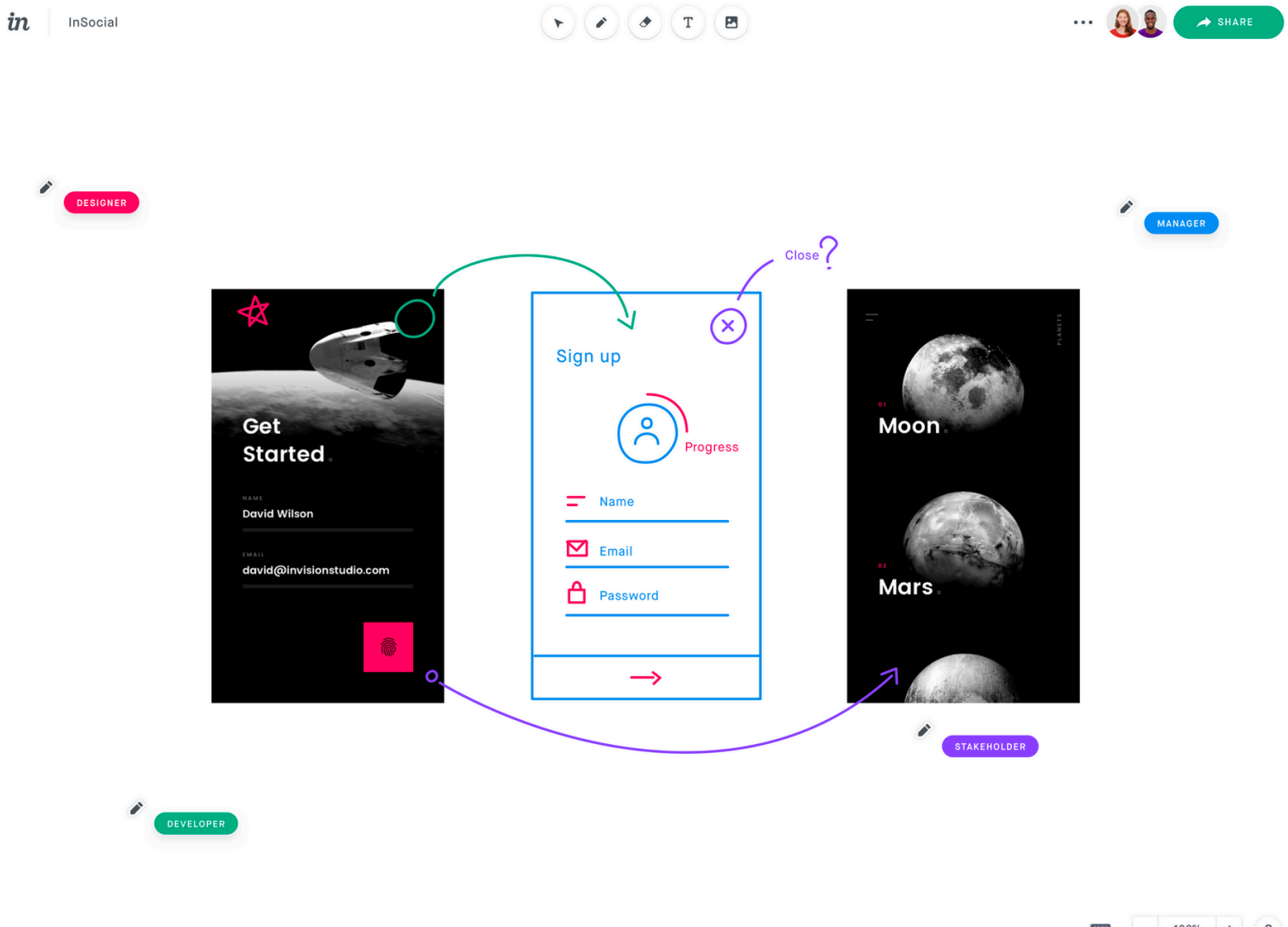


Image: Sharon Rajkumar https://www.behance.net/gallery/43064215/Power-Paper-Prototyping

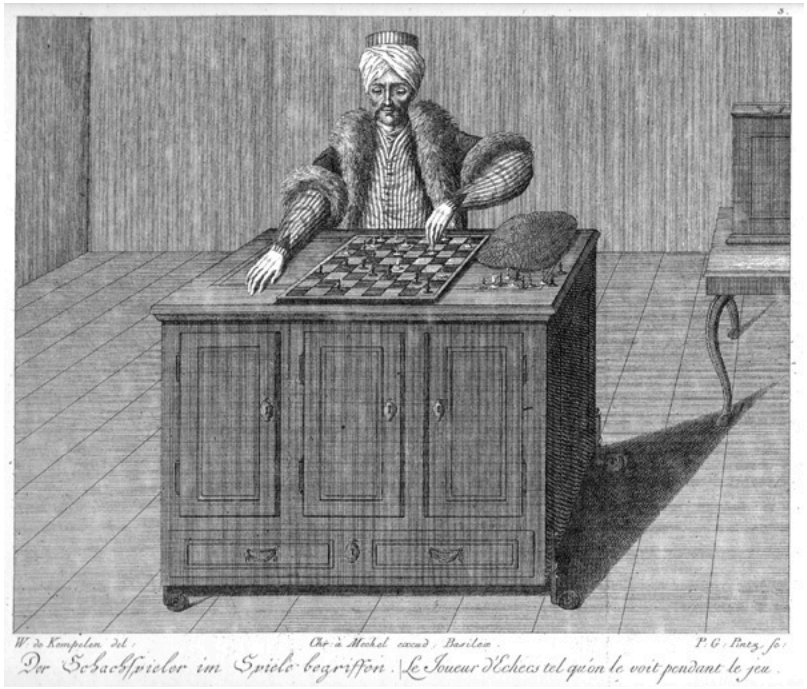
Screenshots, Mockups

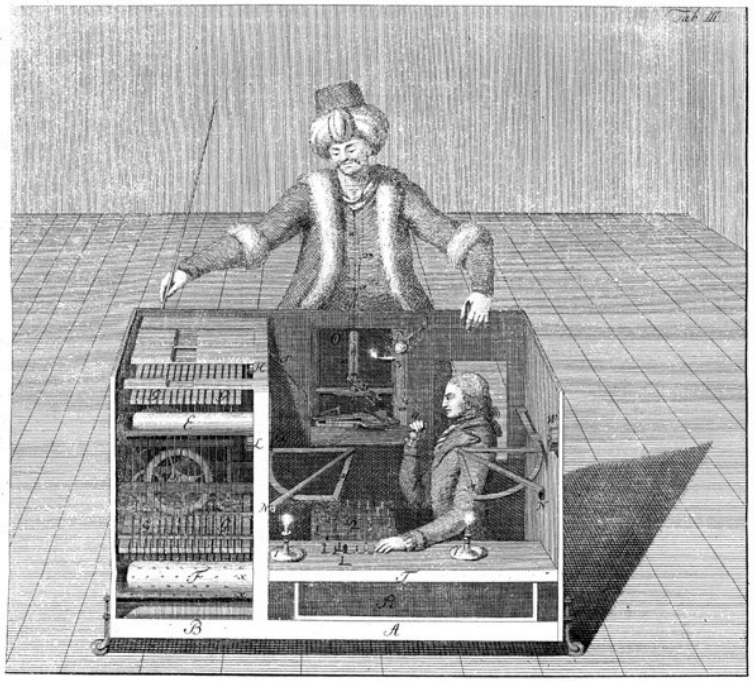


Added interactivity

There are many tools to make UI prototypes interactive

Wizard of Oz

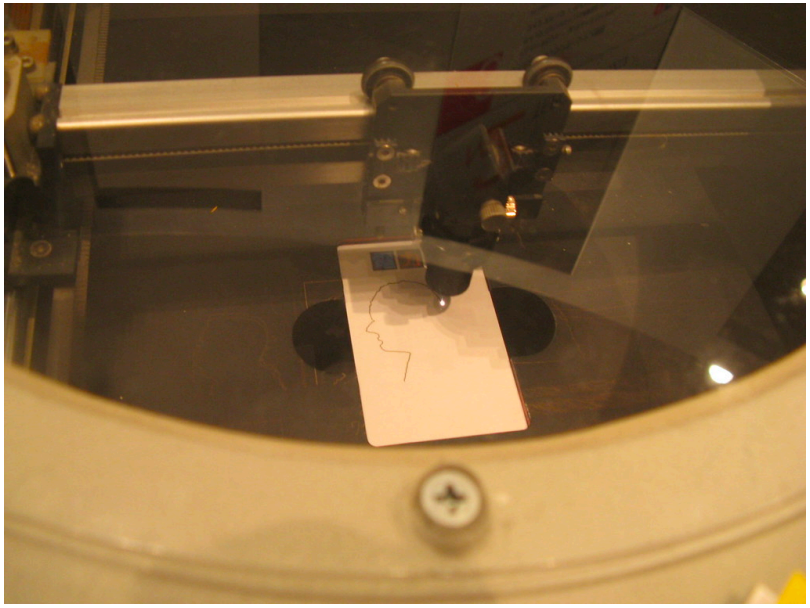


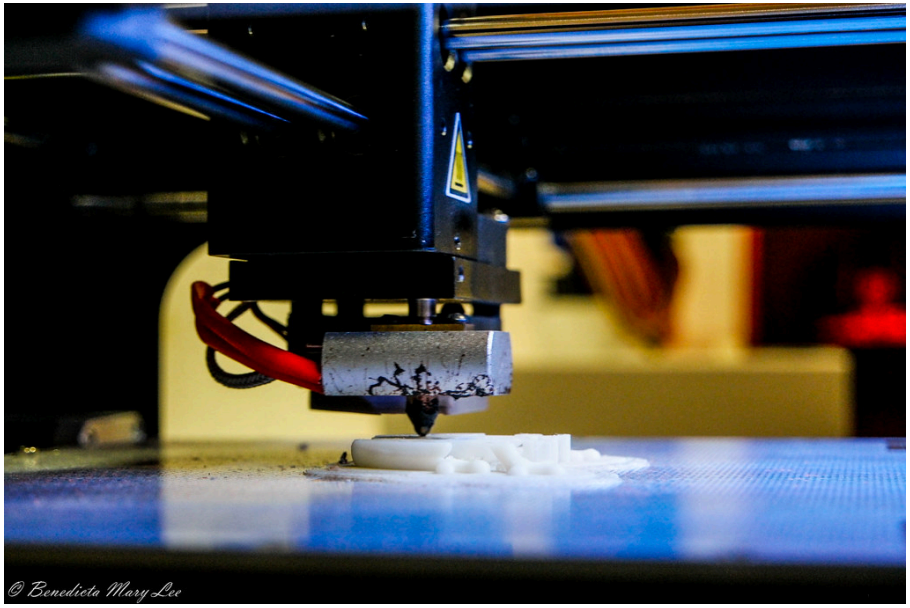


https://en.wikipedia.org/wiki/File:Turk-engraving5.jpg
https://upload.wikimedia.org/wikipedia/commons/2/22/Tuerkischer_schachspieler_racknitz3.jpg

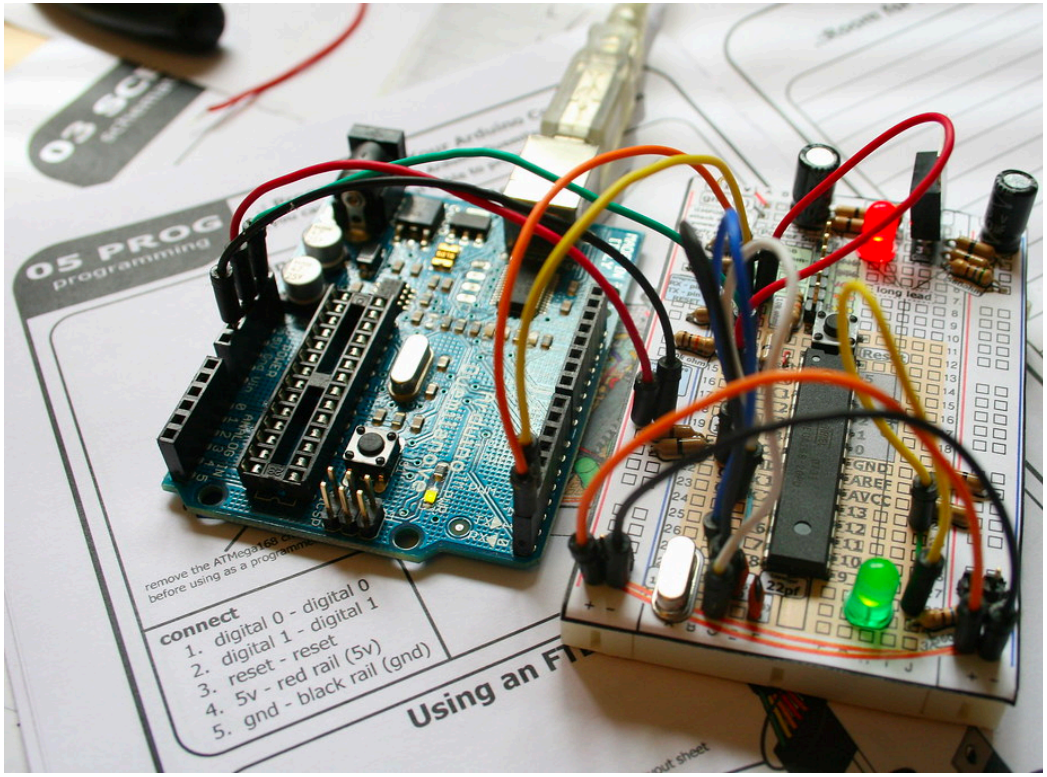
Physical Prototypes

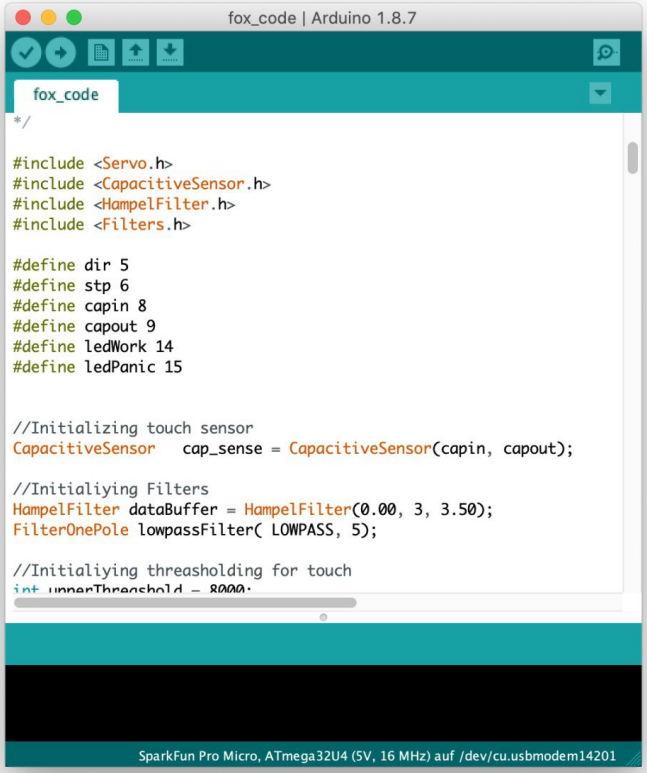
Digital Fabrication



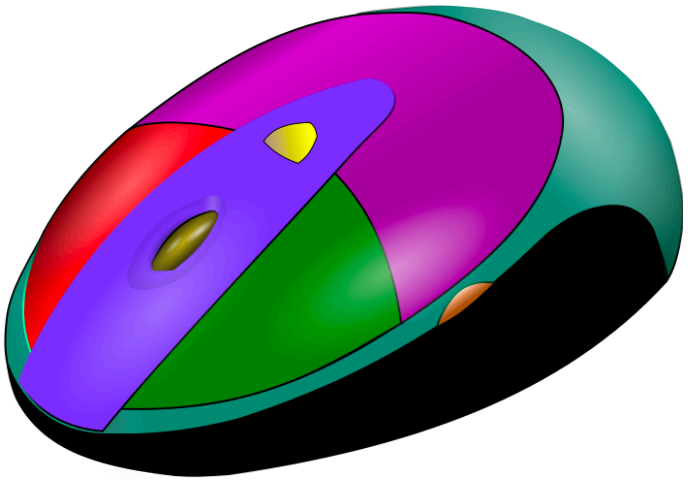


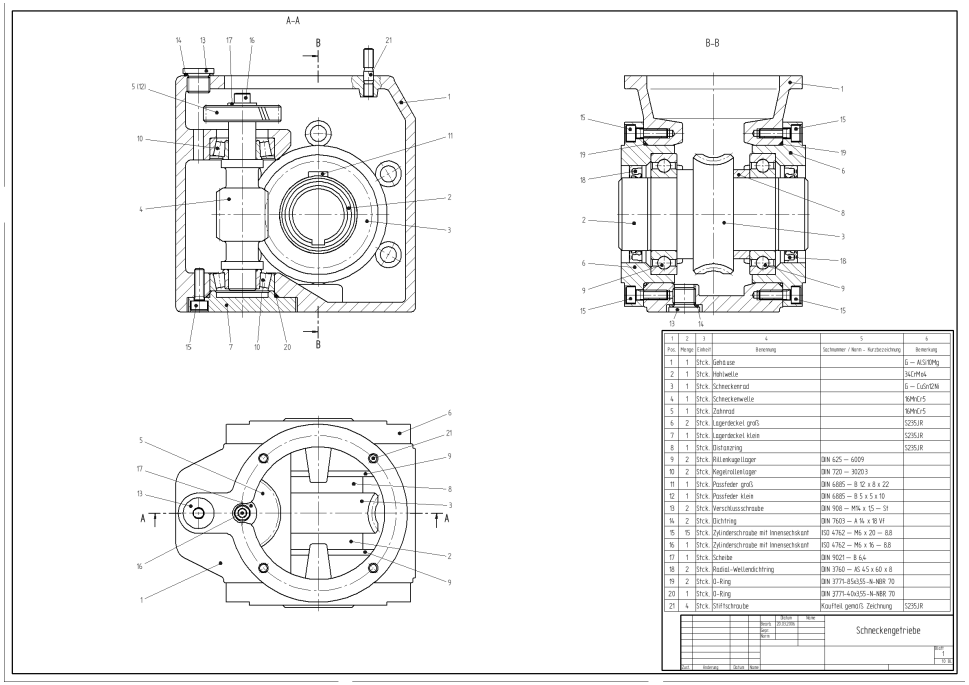
Interactive physical prototypes





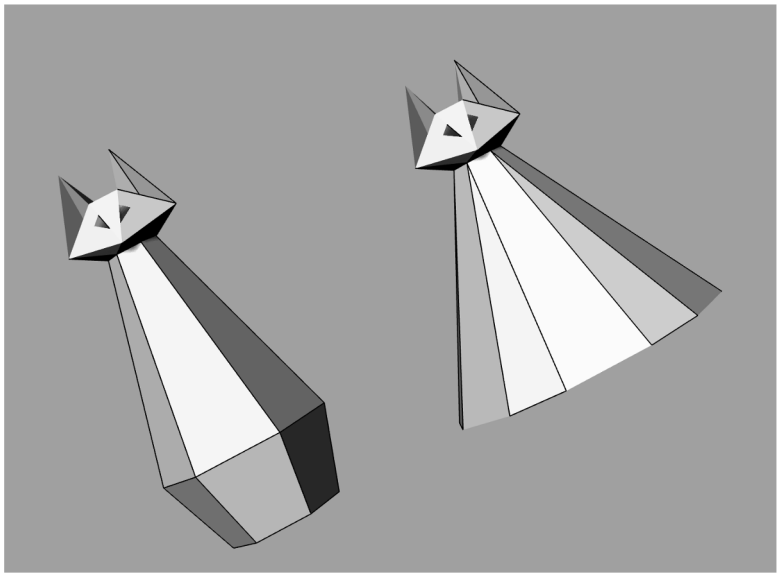
CAD tools

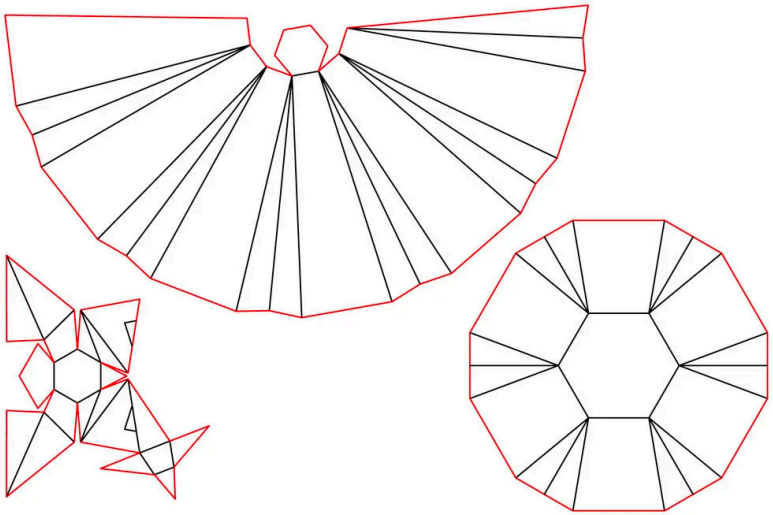


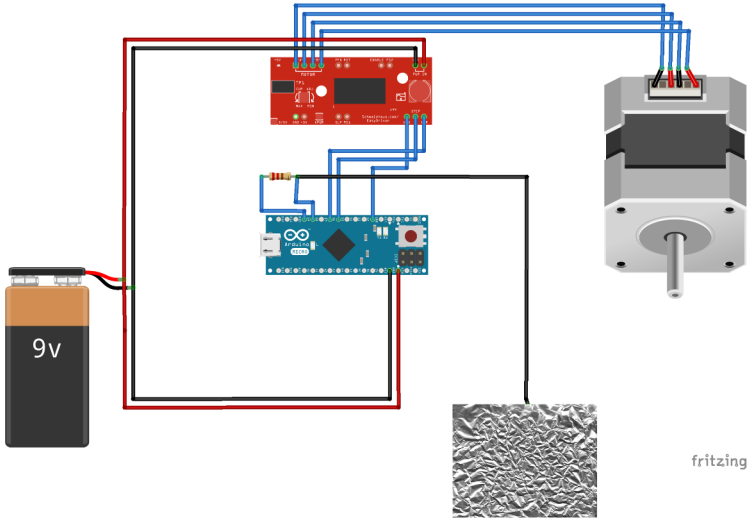


Engineering drawing (with BOM) of a worm gear, created with Solid Edge, Thorsten Hartmann CC BY-SA 3.0

Example







Prototypes are models of the final design. They can be high or low fidelity and usually focus on a specific aspect of the design.

Questions?

Assignment

- Applying the 10 plus 10 method (smaller scope)
- Storyboarding