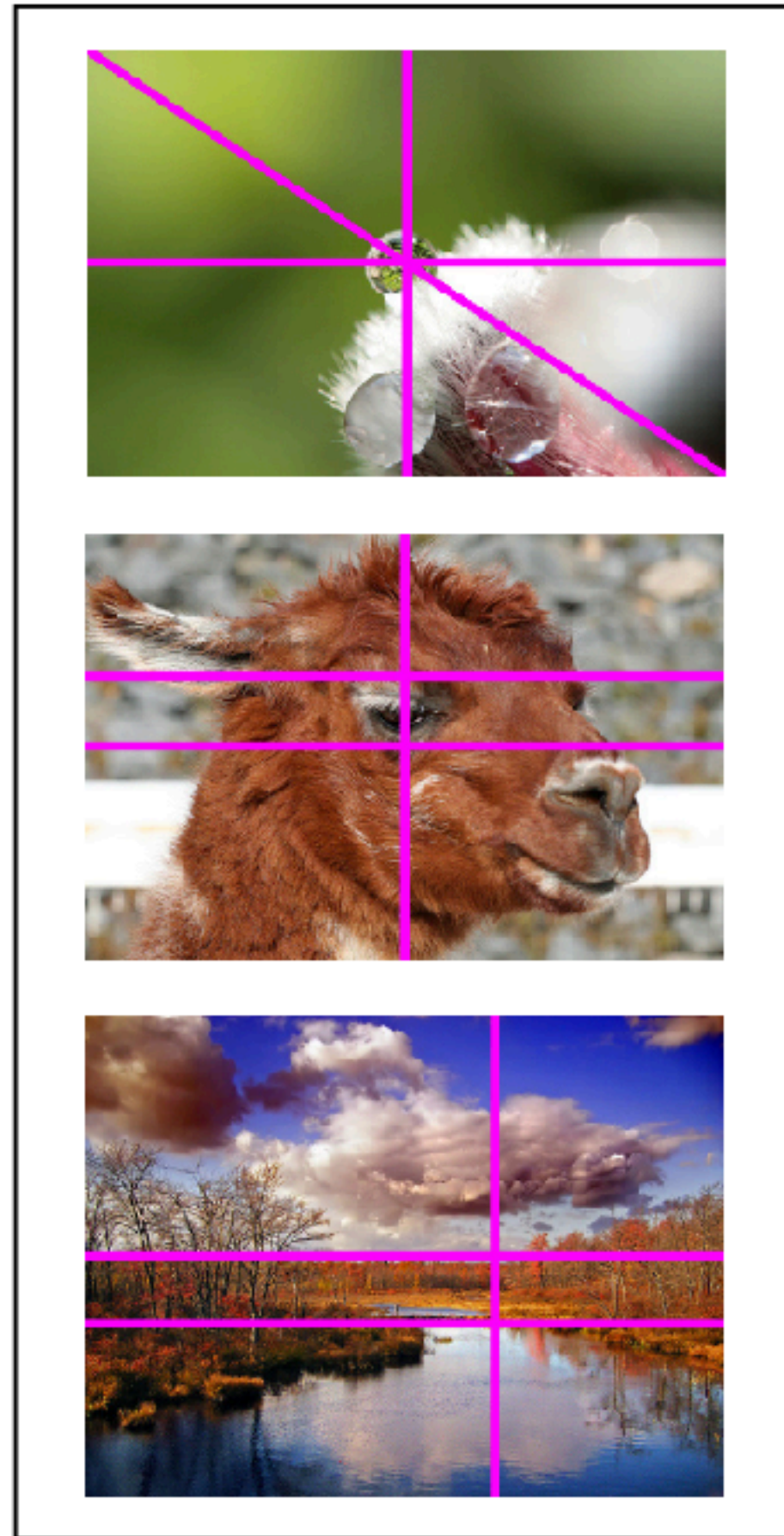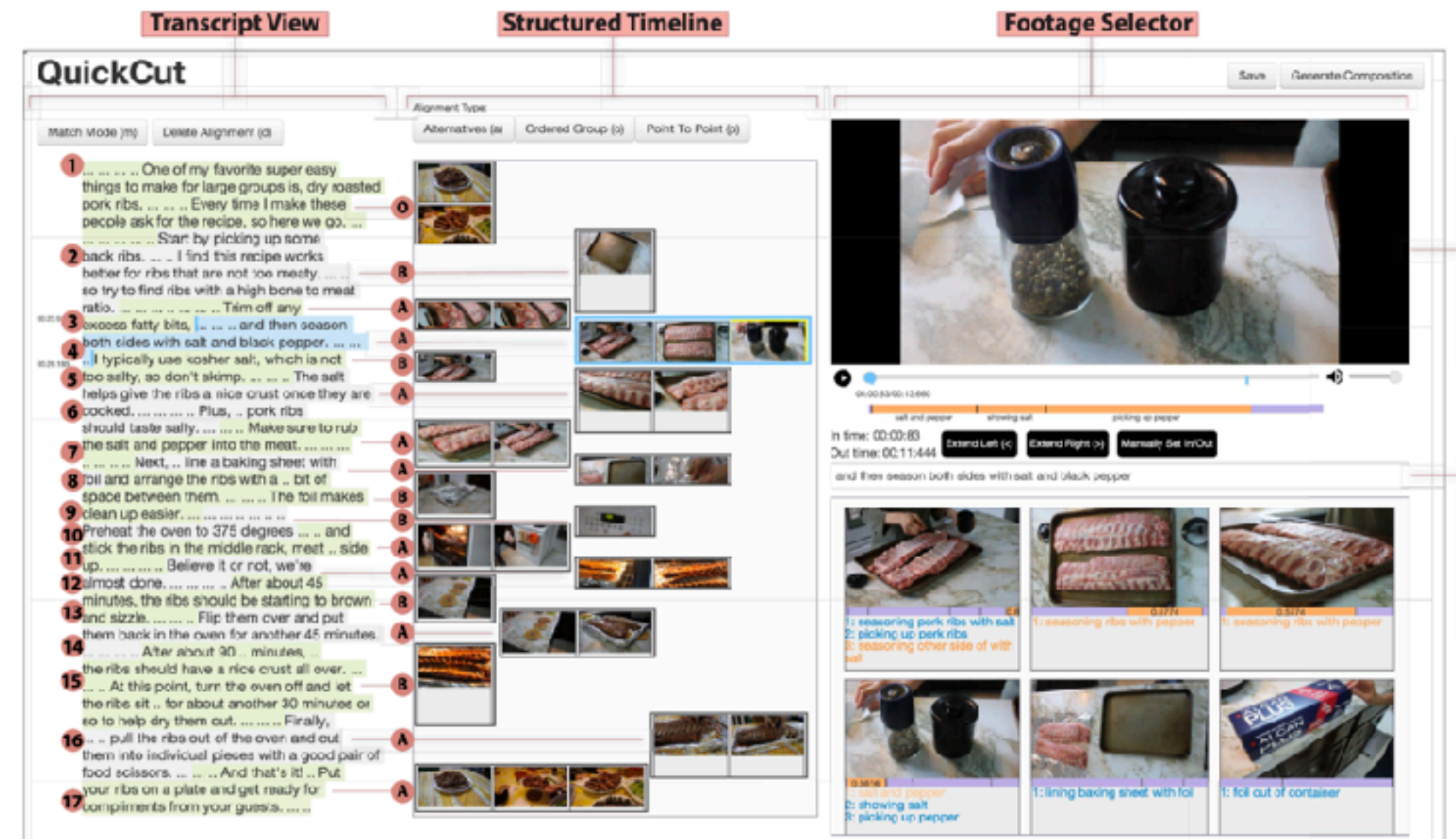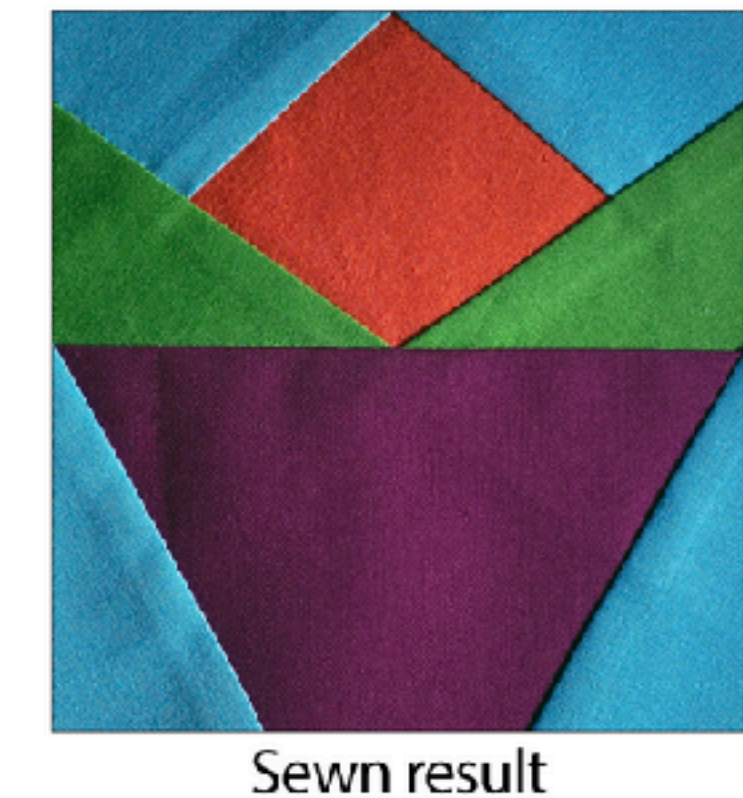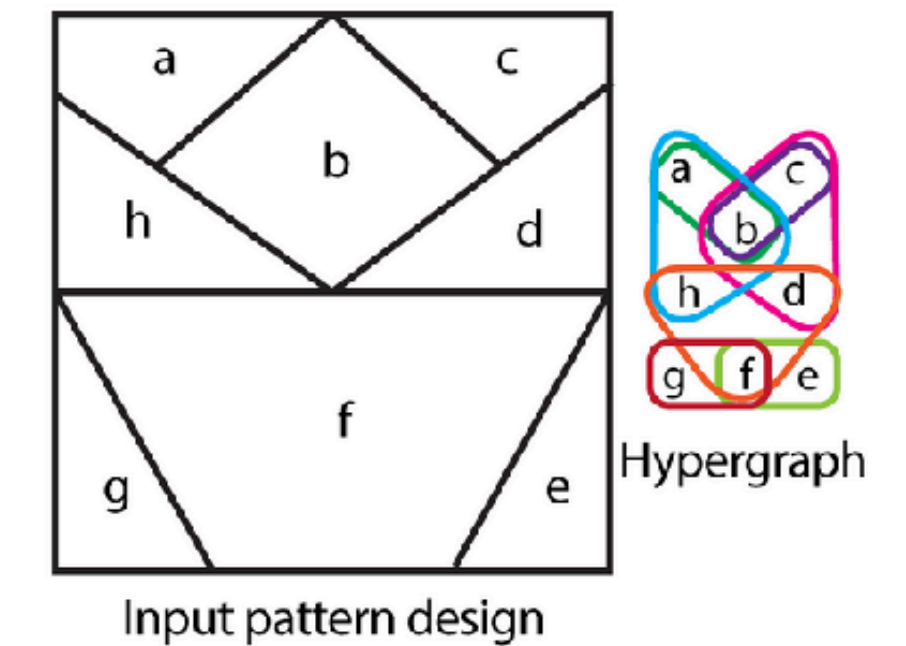# CS181DT Class 11: Creativity support tools

Adaptive Photographic Composition Guidance by E et al. (CHI 2020)

QuickCut: An Interactive Tool for Editing Narrated Video by Truong et al. (UIST 2016)

A Mathematical Foundation for Foundation Paper Pieceable Quilts by Leake et al. (SIGGRAPH 2021)

Class 11 agenda

• Zipcrit

• Scaling back work

• Lecture: What is creativity? How can we build tools to support it?

• Break

• Seminar: 3 specific creativity support tools

Changes

- I acknowledge last week was by far the heaviest workload week of the class (nothing in the future will be as busy)

- 4 more sketchnotes total left in the class

- No PM4 (tool reflection), merging that with P2 project ideas and trimming it down

- I acknowledge doing "creative" assignments can be stressful

  - Unlike CS problem sets, no "right" answer

  - Even though 95% of the class gets checks (As) and you can redo the assignment if you don't get an A, you can stress yourself out by holding yourself to a high standard or comparing with your classmates

  - The important thing is to meet the (often explicitly stated) learning goals

- In general, if you do find yourself spending too many hours on this class, please come talk to me in OH

  - We can develop a plan together!

What is creativity?

# Four-C model of creativity: context matters

Four-C model of creativity
Kaufman and Beghetto (2009)
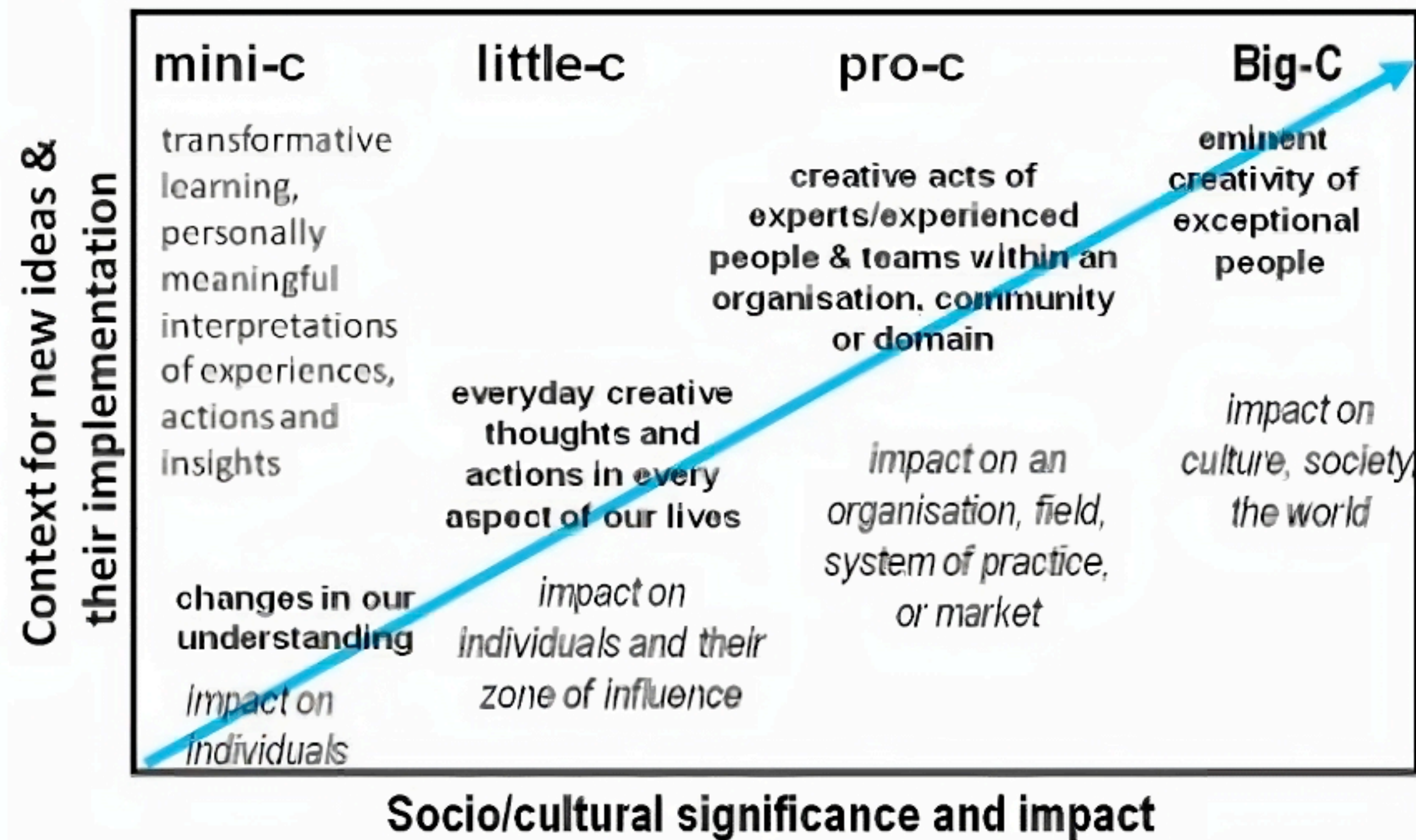
- Big-C: Picasso, Beyoncé, Einstein

- pro-c: professionals

- little-c: mundane creativity like taking an art class, your hacks

- mini-c: more around gaining personal skills, like kids' fridge artworks

How can we build tools to support creativity?

Three metaphors for creativity support tools

Meanings of Tools, Support, and Uses for Creative Design Processes. Nakakoji 2006.
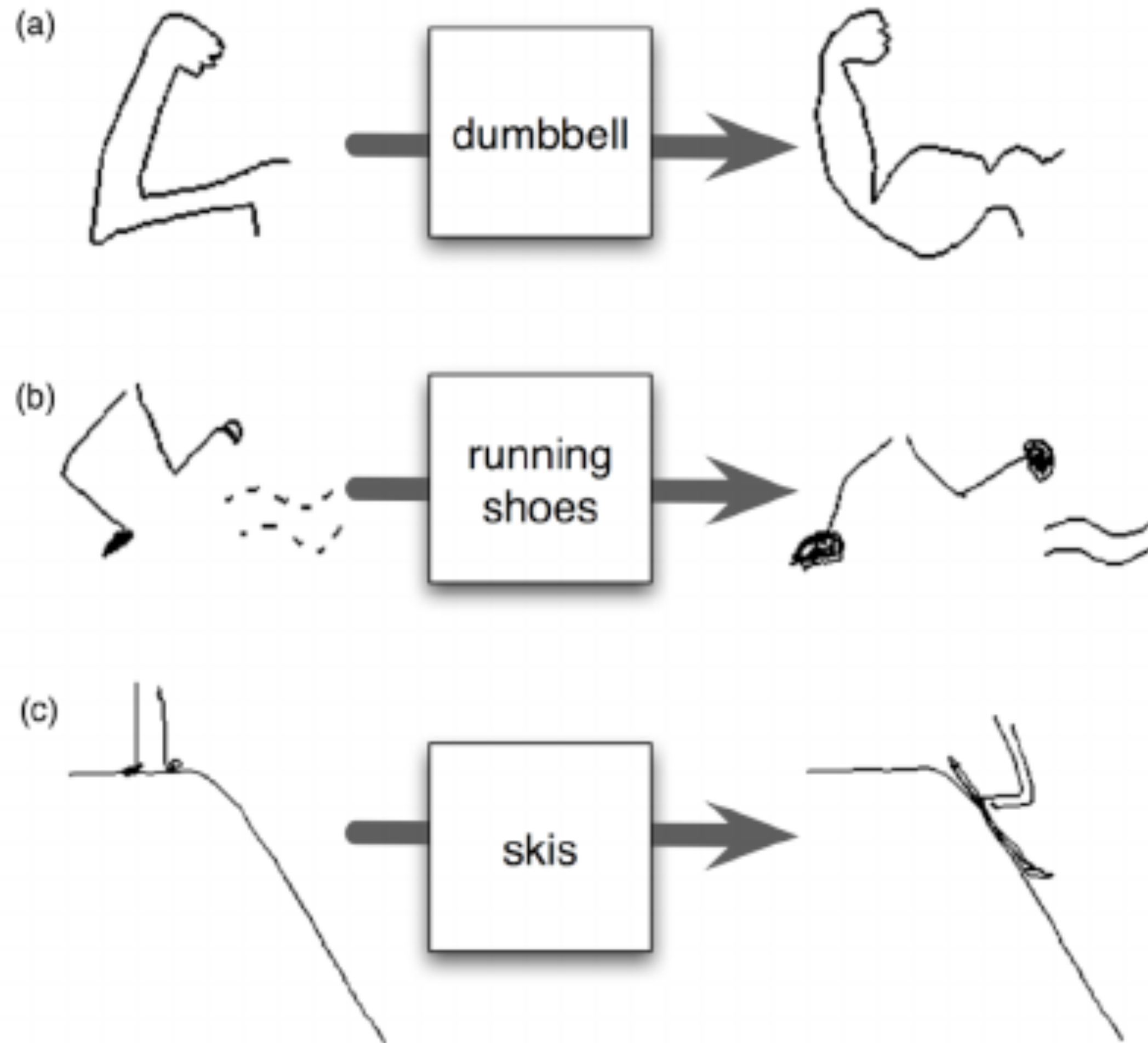
- **Dumbbells** help you build muscle

  - Tools to help you learn and build skills but aren't your "end goal", e.g., bezier game

- **Running shoes** help you run faster

  - Tools to make an existing task easier, e.g., using Photoshop instead of MS Paint

- **Skis** enable you to ski; without them you can't

  - Tools that enable a new experience, e.g., Powerpoint/Keynote for creating slides
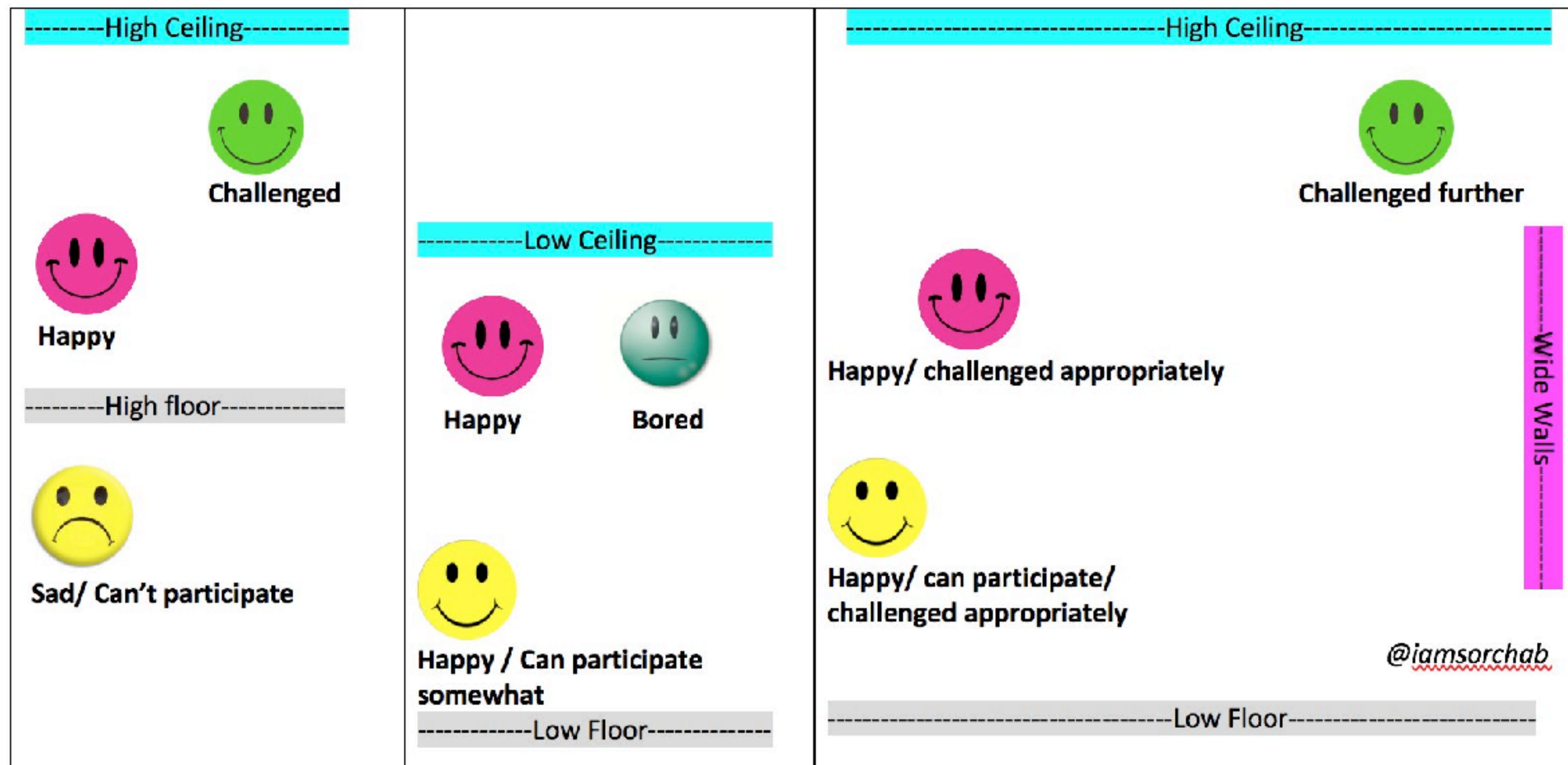
Creativity support tools (Shneiderman)
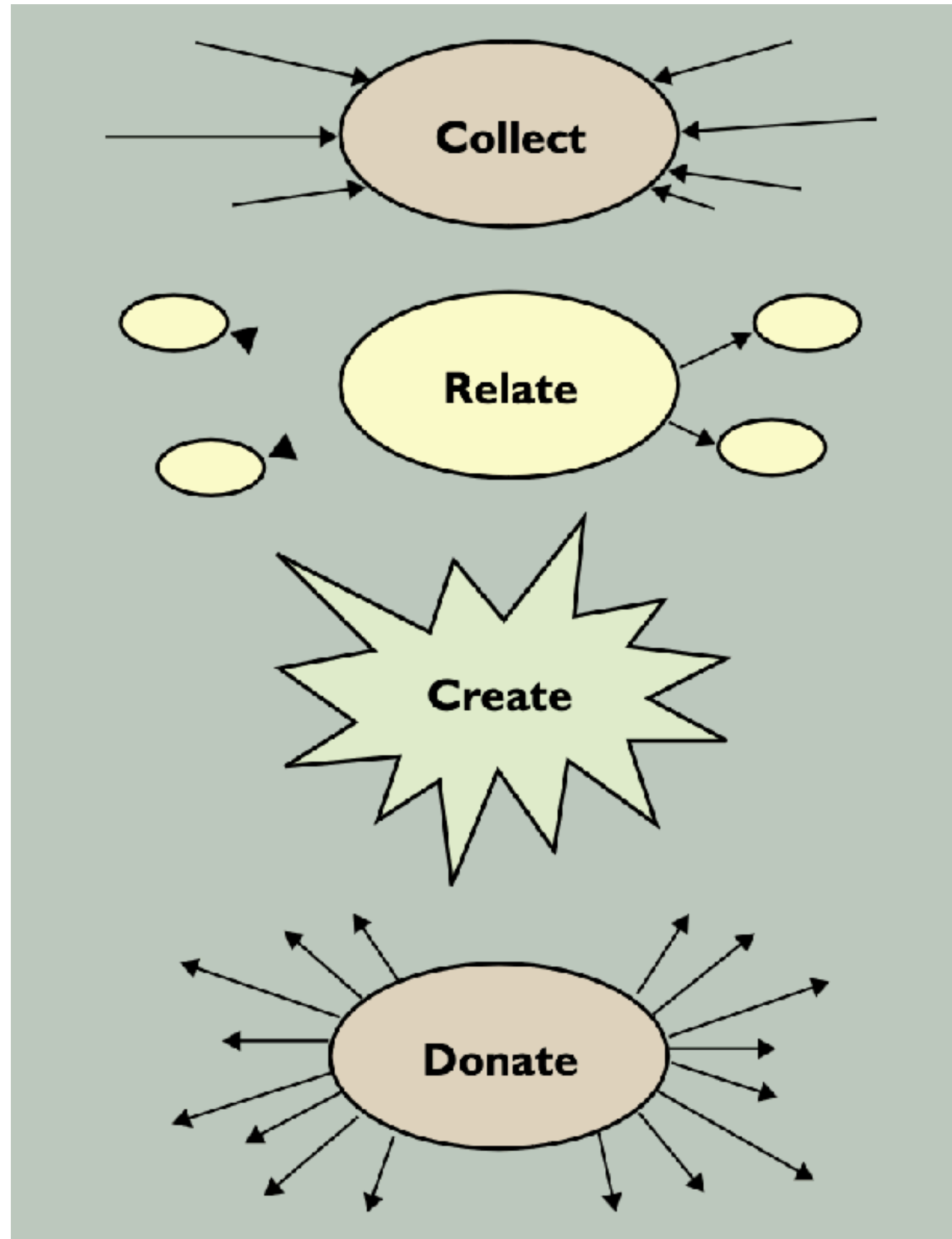
Creativity support tools: accelerating discovery and innovation. Shneiderman 2007.

- 4 **activities** to support creativity: collect (brainstorm/ inspiration), relate (consult others), create (actually make the thing), donate (share results)

- 8 **tasks** that people do during these activities

  - searching

  - visualizing

  - consulting

  - thinking

  - exploring

  - composing ⟵ lots of tools

  - reviewing

  - disseminating
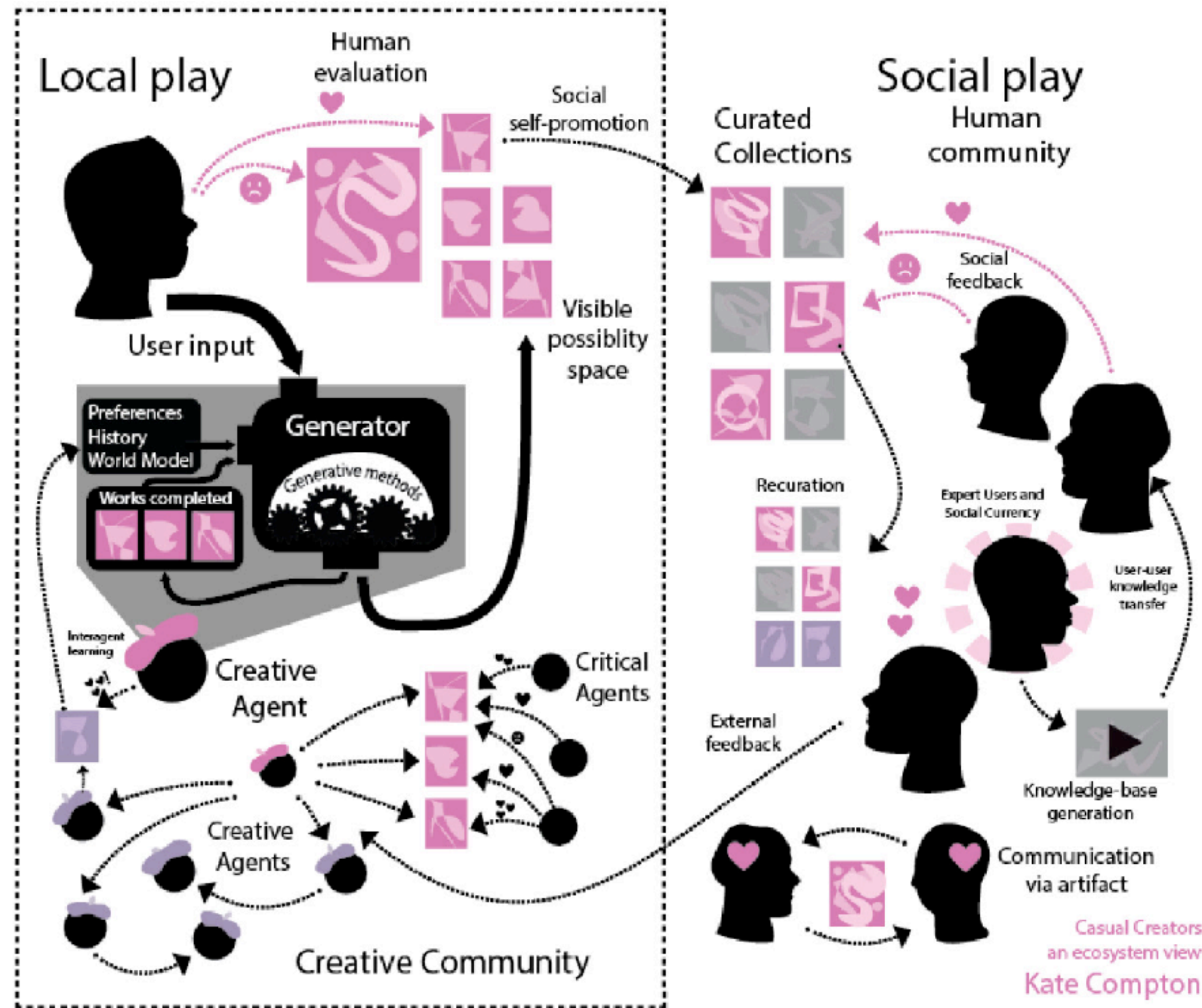
Low floors, high ceilings, wide walls

Graphic from https://twitter.com/iamsorchab/
status/1322120755296018439

Some Reflections on Designing Construction Kits
for Kids. Resnick et al. 2005.

- Floor - barrier for entry

- Ceiling - skill cap, level of
  sophistication

- Walls - range of
  exploration and possibility

Casual Creators

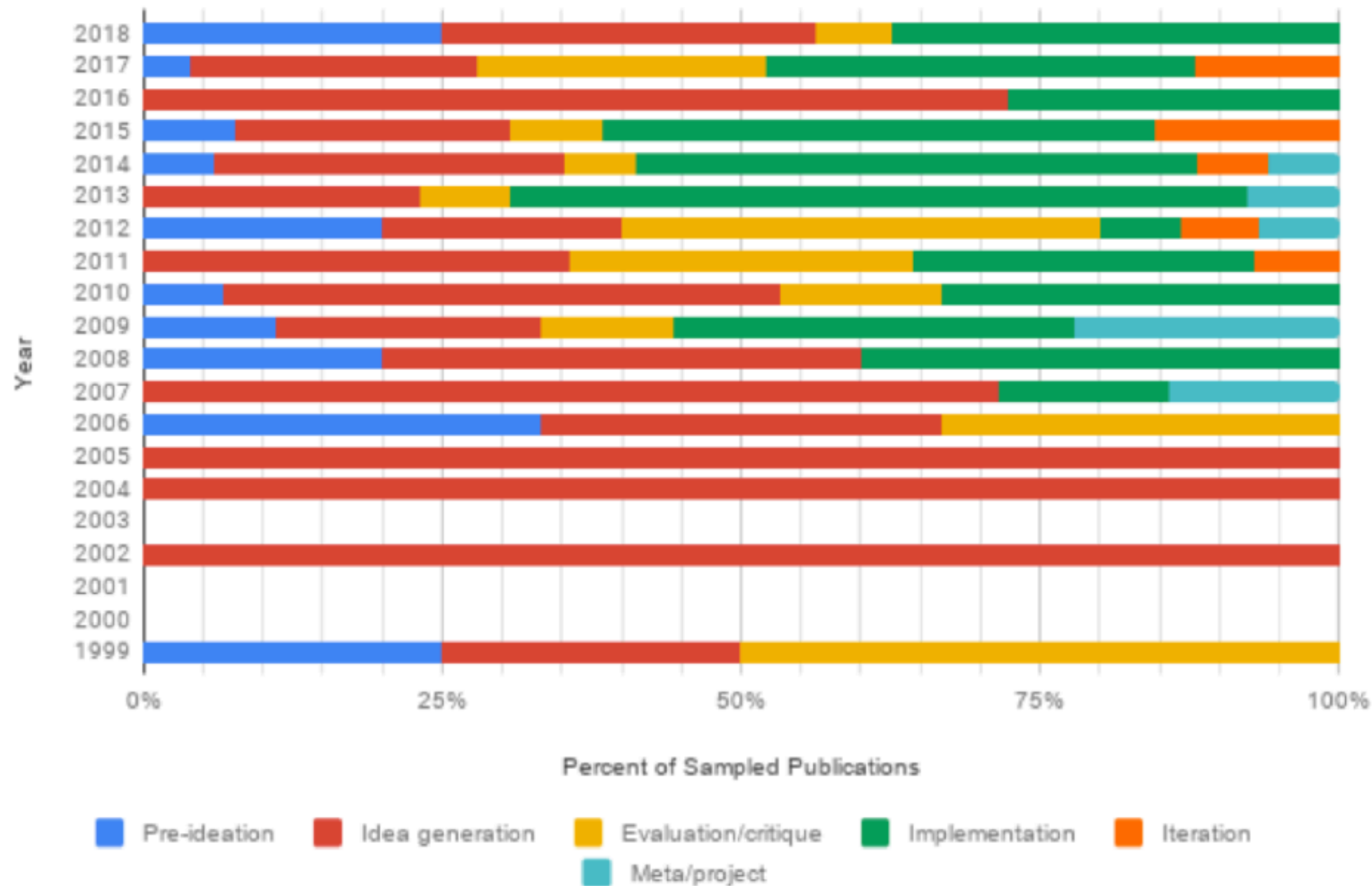Casual creators. Compton 2015.

- "A Casual Creator is an interactive **system** that encourages the fast, confident, and pleasurable exploration of a possibility space, resulting in the creation or discovery of surprising new artifacts that bring feelings pride, ownership, and creativity to the users that make them."

- Framing as creativity as an intrinsically pleasurable activity, rather than an extrinsically motivated way to accomplish tasks

- Ex: video games like Spore, character creators, Animal Crossing Happy Home Designer

Example implementation CSTs

What are trends in CST research?

Part of Creative Process Supported

Percent of Sampled Publications

Pre-ideation · Idea generation · Evaluation/critique · Implementation · Iteration · Meta/project

Mapping the Landscape of Creativity Support Tools in HCI. Frich et al. 2019.

- Reviewed 143 publications from 1999-2018 and looked at device type, complexity, availability, maturity, part of creativity process, user group, evaluation technique, and collaboration

- 92% of CSTs are on digital devices (desktop, tablet)

- 65% of CSTs are high fidelity prototypes (exist as a proof of concept but not available for public download)

- CSTs target expert designers (33%) followed by "novices" (17%)

How to analyze CSTs

- Who are the users? Individual or group?

- What is the domain of use?

- What is the problem?

- What is the computational solution?

Also questions to ask yourself for P2 brainstorming!

Selective Undo

- Who are the users? Individual or group?

  - Individual users, both novice and expert

- What is the domain of use?

  - Digital art drawing applications

- What is the problem?

  - Linear undo

- What is the computational solution?

  - Remove operation from history and re-perform

    all following actions (script model)
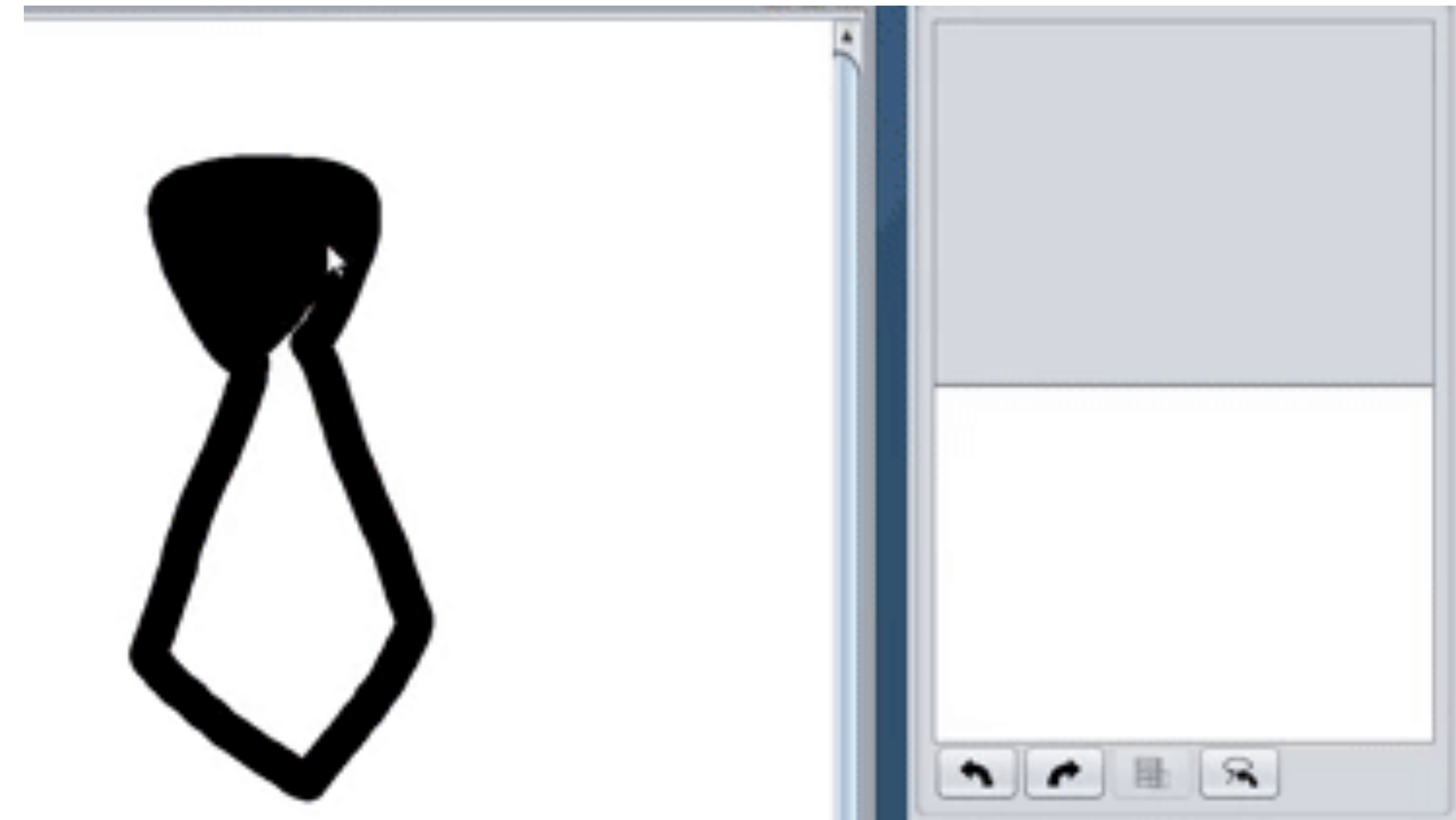
Selective Undo Support for Painting
Applications. Meyers et al. 2015.

Object Oriented Drawing

- Who are the users? Individual or group?

  - Individual users, both novice and expert

- What is the domain of use?

  - Vector graphics

- What is the problem?

  - Hard to edit style attributes of graphics at once

- What is the computational solution?

  - Create object-oriented "Attribute objects" where you
    can directly manipulate styles and drag to apply to
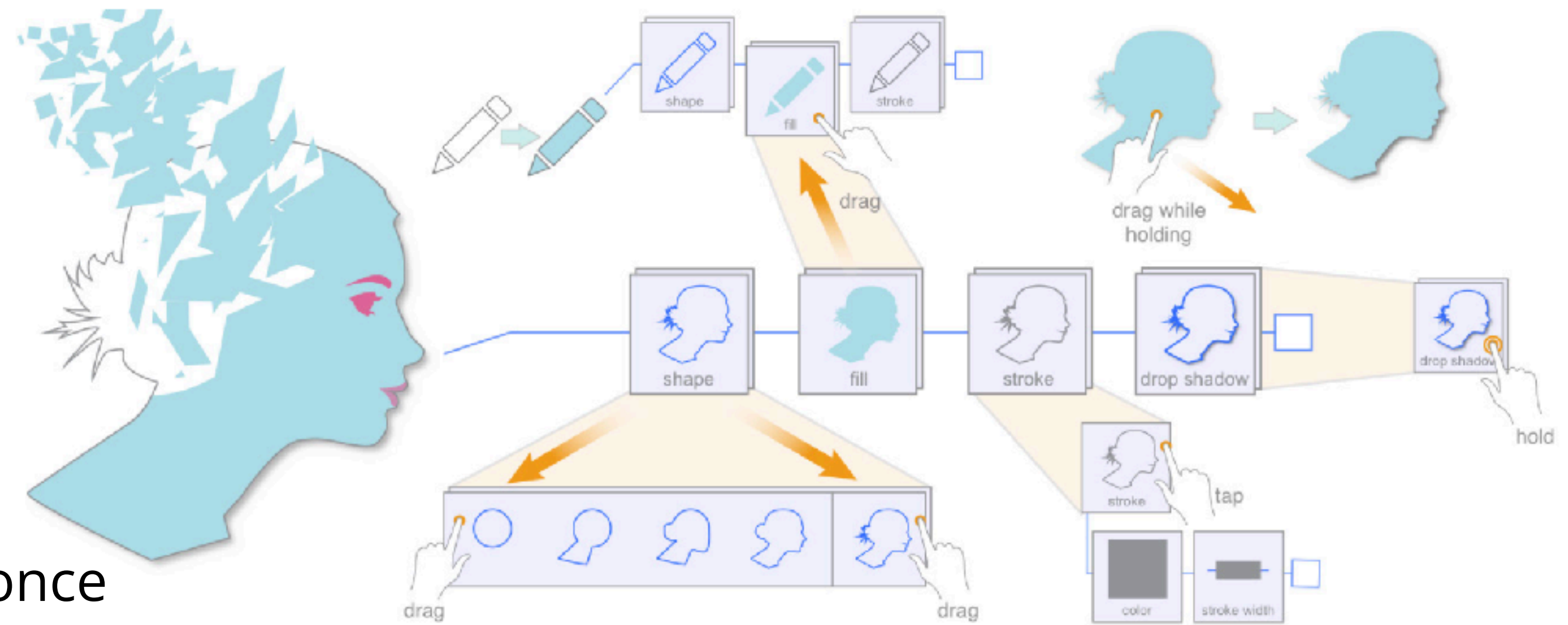   many different geometries

Figure 1. Object-Oriented Drawing replaces most traditional WIMP UI with Attribute Objects which may be directly manipulated with traditional direct-touch gestures. This enables powerful and fluid interaction on touchscreen-based devices.

Object-oriented drawing. Xia et al. 2016.

Quickpose

- Who are the users? Individual or group?

  - Individual users, both novice and expert

- What is the domain of use?

  - Creative coding (processing)

- What is the problem?

  - Creative version control is hard. Also version

    history can itself be a material

- What is the computational solution?

  - Represent version history as a DAG that is

    browsable and annotatable
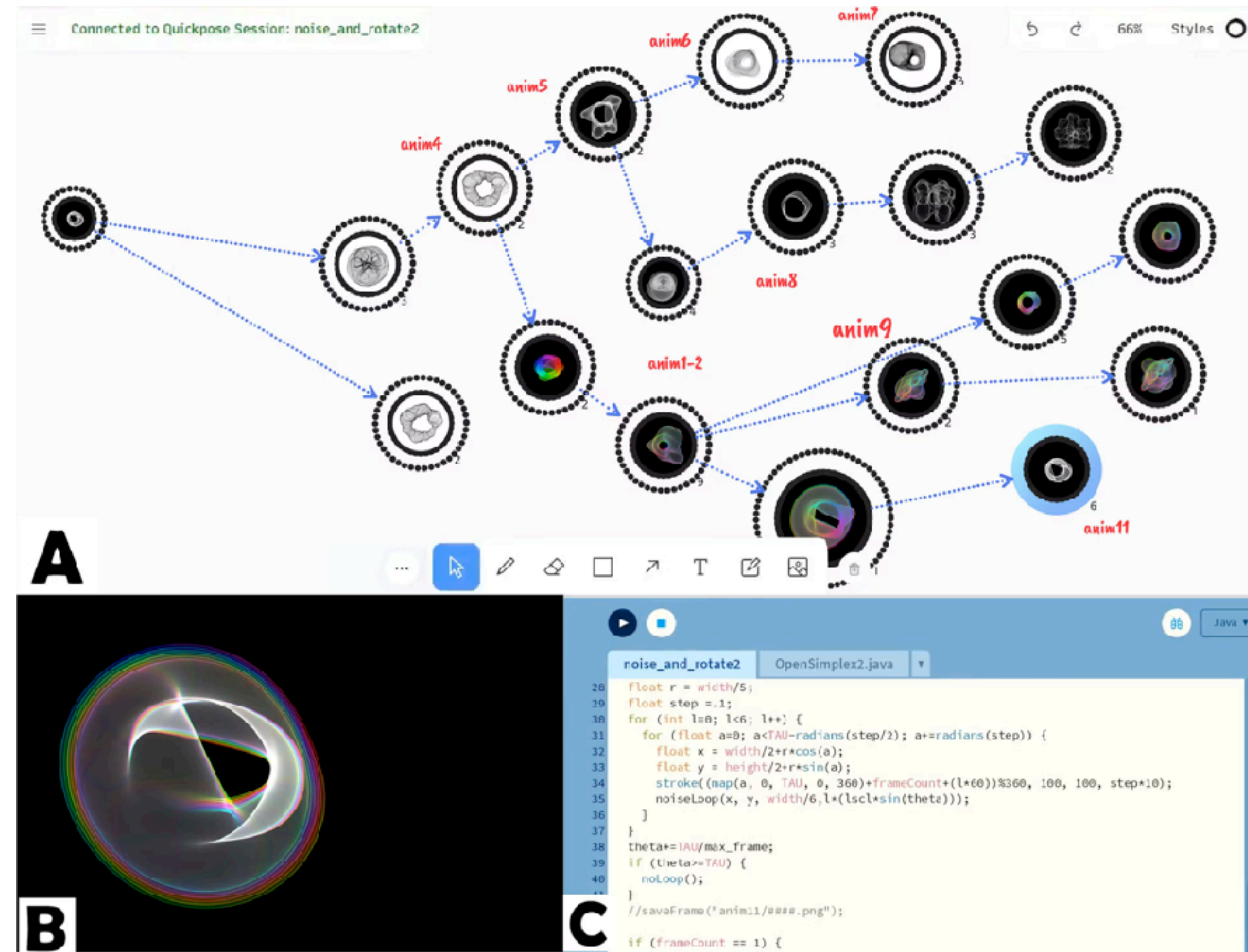
Understanding Version Control as Material
Interaction with Quickpose. Rawn et al. 2023

DrawMyPhoto

- Who are the users? Individual or group?

  - Individual users, novices

- What is the domain of use?

  - Drawing realistically

- What is the problem?

  - It's hard to draw accurately

- What is the computational solution?

  - Apply filters on a photograph and show

  them in specific steps to guide users to draw
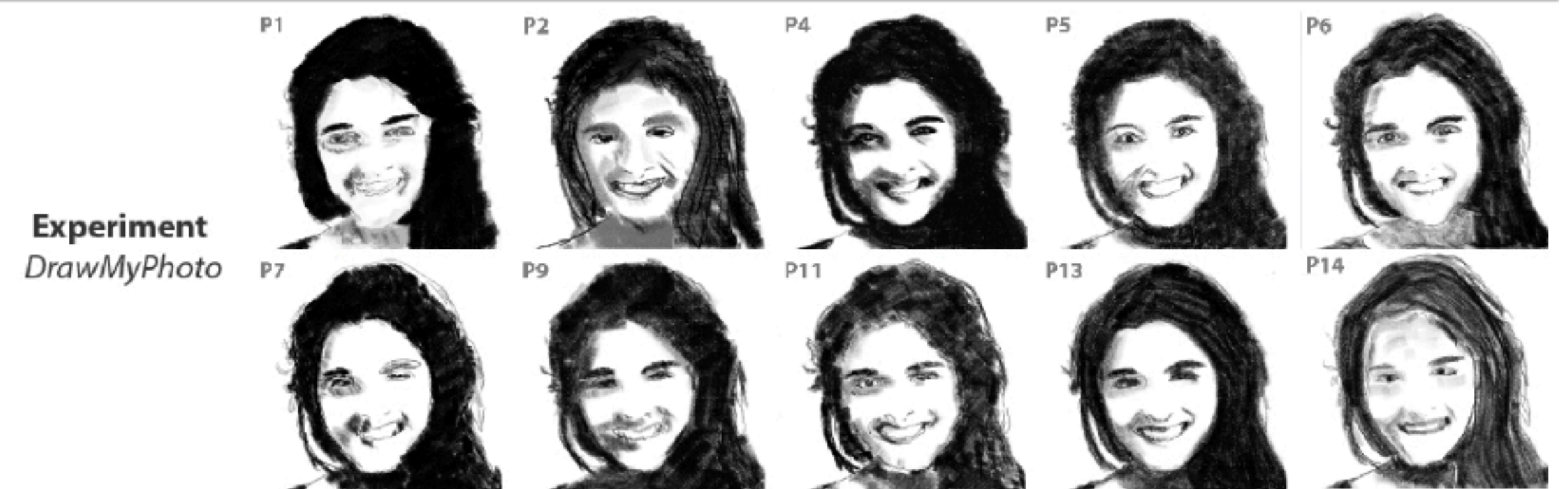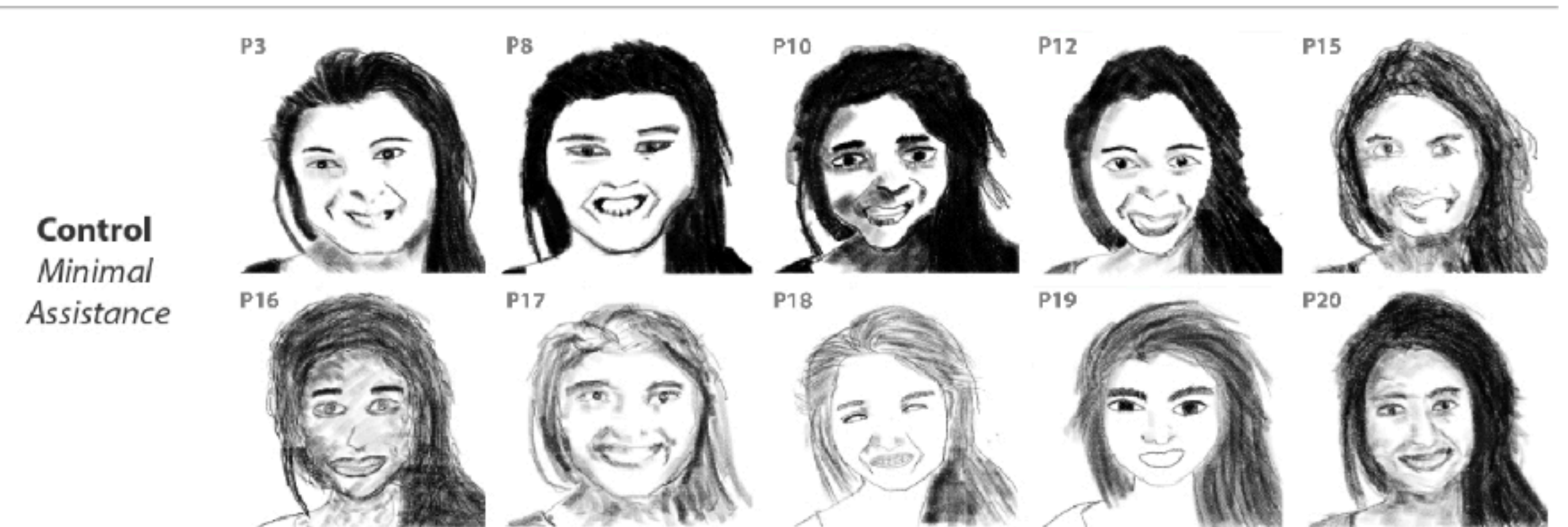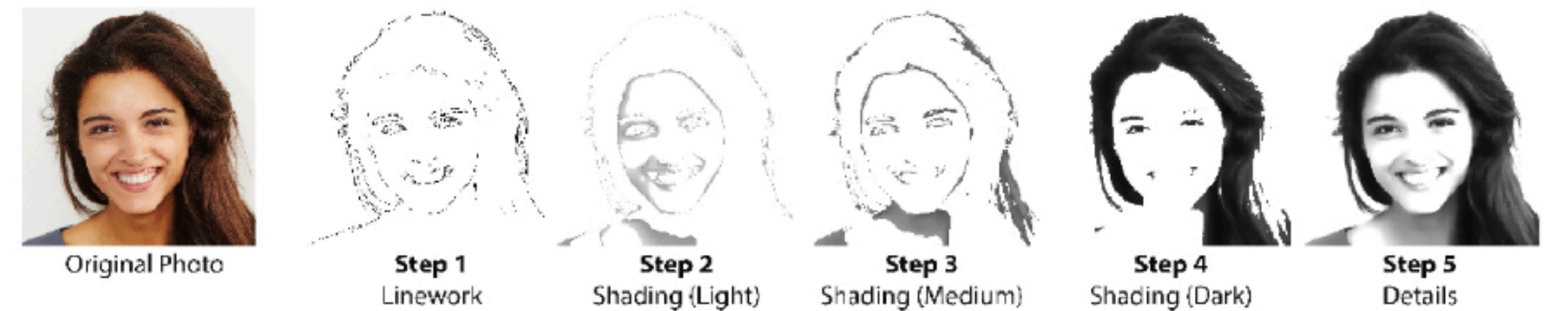
DrawMyPhoto: Assisting Novices in Drawing
from Photographs. Williford et al. 2019

Webstrates

- Who are the users? Individual or group?

  - Group, people who want to edit documents

- What is the domain of use?

  - Collaborative, synced web media

- What is the problem?

  - It's hard to flexibly collaborate on media

- What is the computational solution?

  - No servers: store everything in the DOM
    (inject CSS for different UIs)
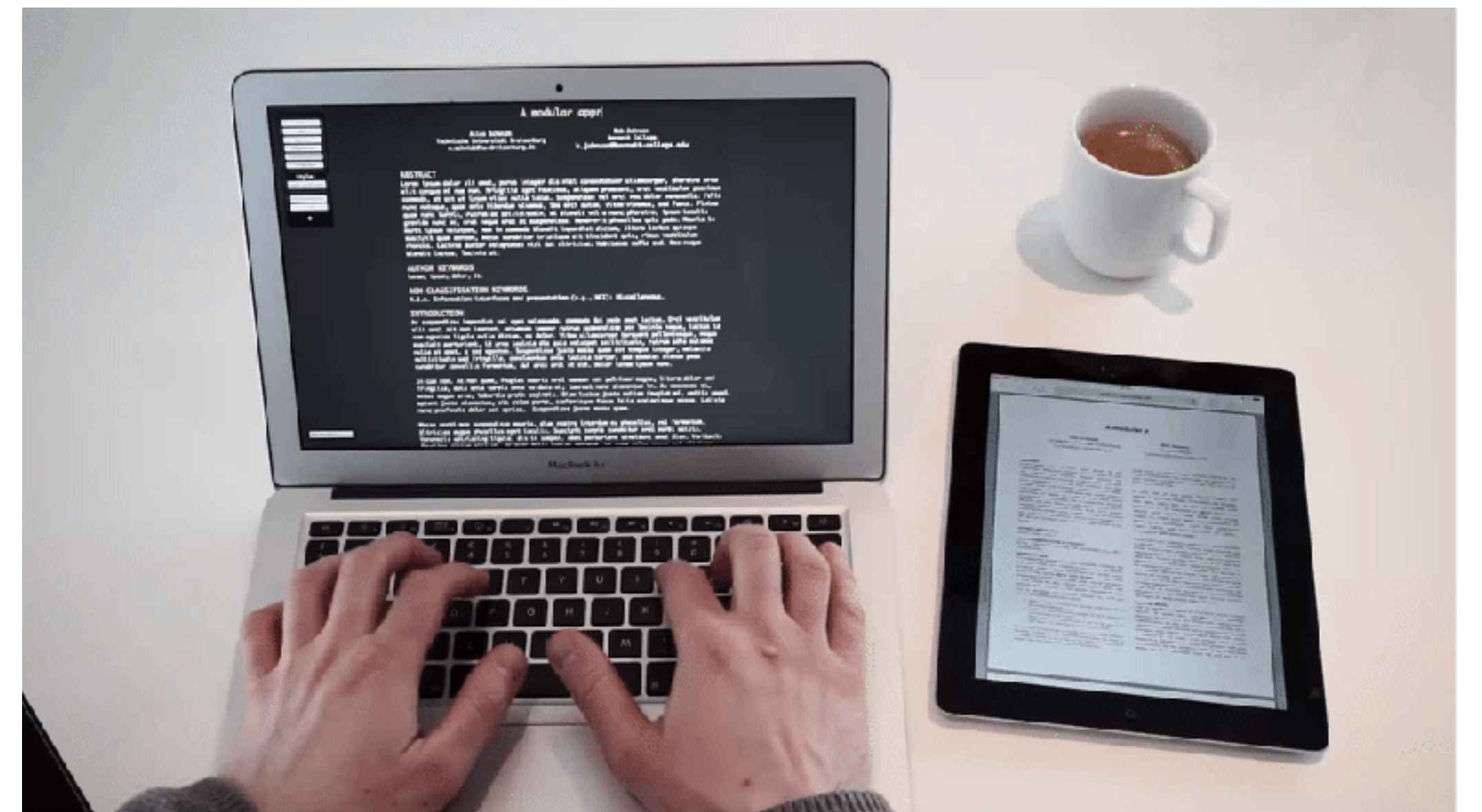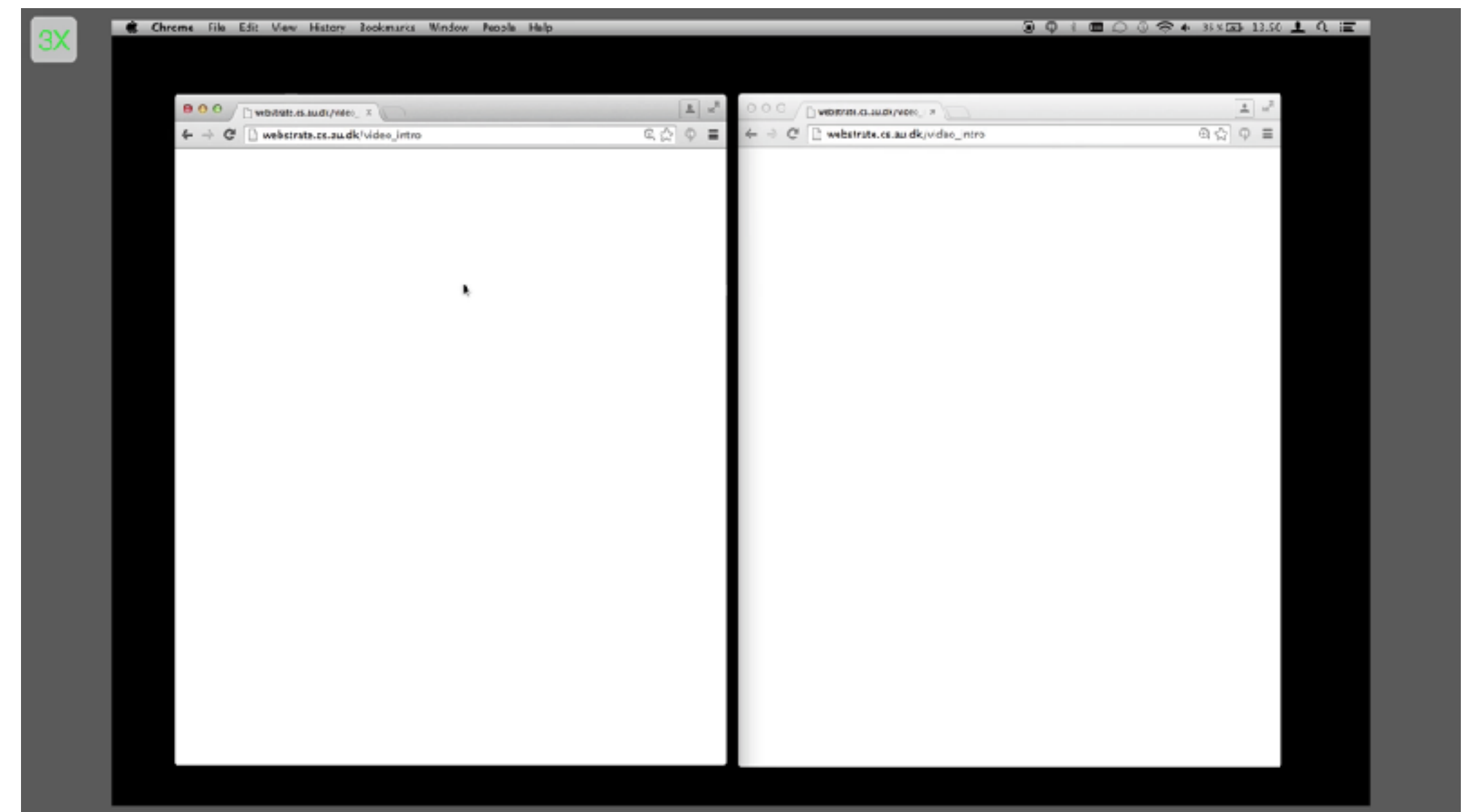
Webstrates: Shareable Dynamic Media.
Klokmose et al. 2015

shapeCAD

- Who are the users? Individual or group?

  - Individual, people who are blind or visually impaired

- What is the domain of use?

  - 3D modeling

- What is the problem?

  - Feedback on 3D models is visual

- What is the computational solution?

  - Use a screenreader to write code to generate 3D models and render them on a 2.5D pin display
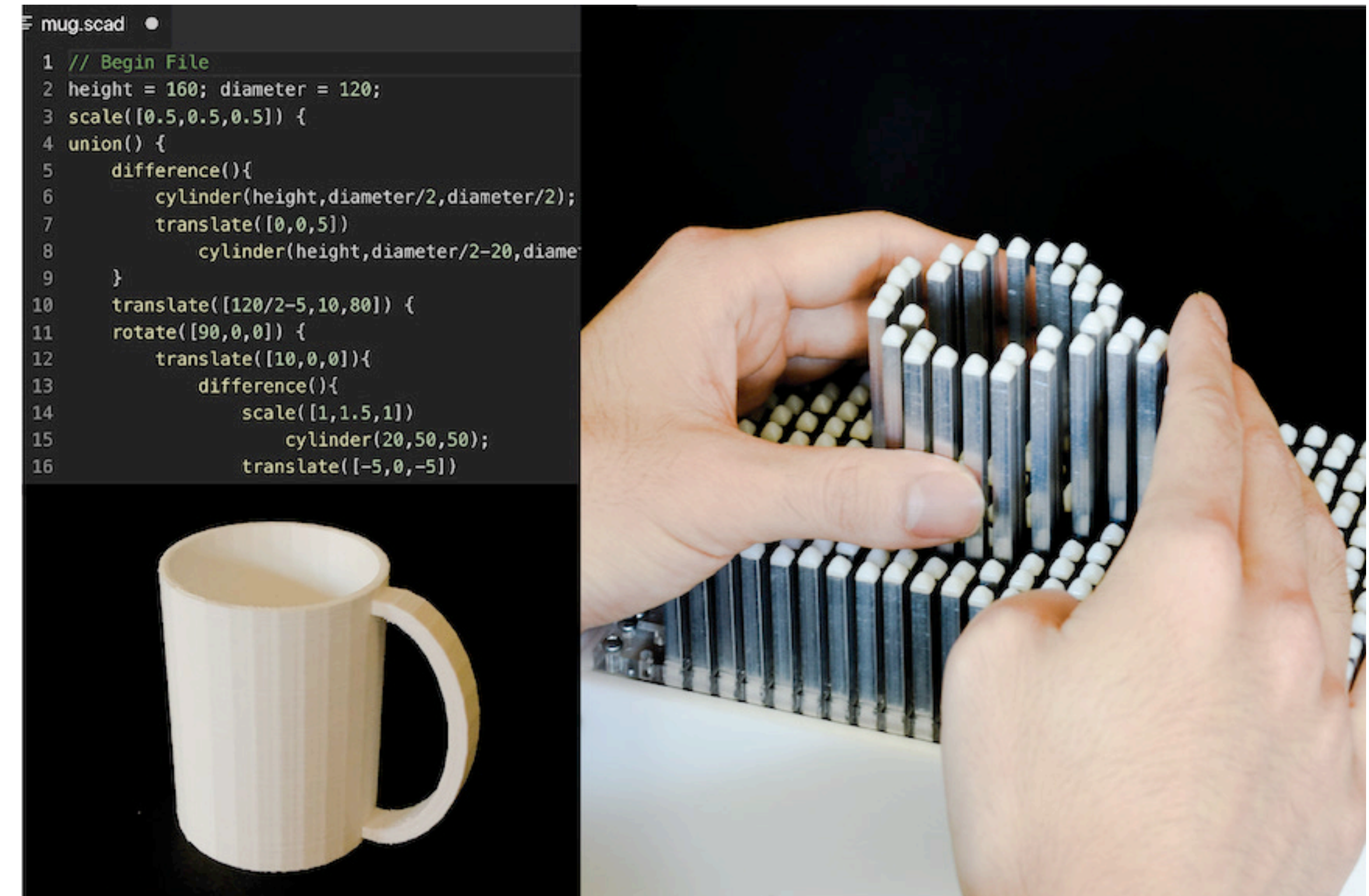
shapeCAD: An Accessible 3D Modelling Workflow for the Blind and Visually-Impaired Via 2.5D Shape Displays. Siu et al. 2019

Why do CST research?

- Research should result in *generalizable* knowledge

- Build a tool to show **new** ways of **interaction** or **new artifacts** that can be possible because of computation

    - Selective Undo, Object Oriented Drawing, shapeCAD

- Design probes to **understand** something more about **people** and creative practice

    - Quickpose, Webstrates

CST (digital design tool) strategies

- Create new **computational constraints** to help with "traditional" workflows (DrawMyPhoto, Lillicon, Object Oriented Drawing, selective undo)

- Make things easier by **prioritizing a certain kind of task** (I/O brush, Draco)

- Create new interfaces that generate new mental models (Quickpose, shapeCAD)

- Automate and encode **domain knowledge** (DrawMyPhoto)

- Can help with other aspects of the creative process rather than implementation: idea generation (computers are great at generating things), reflection, critique, etc.

Seminar

Class 11 recap

- TODOs:
  - Thurs
    - Zipcrit by Shuyan
    - P2 specs will be released & we'll have time to brainstorm project ideas in class