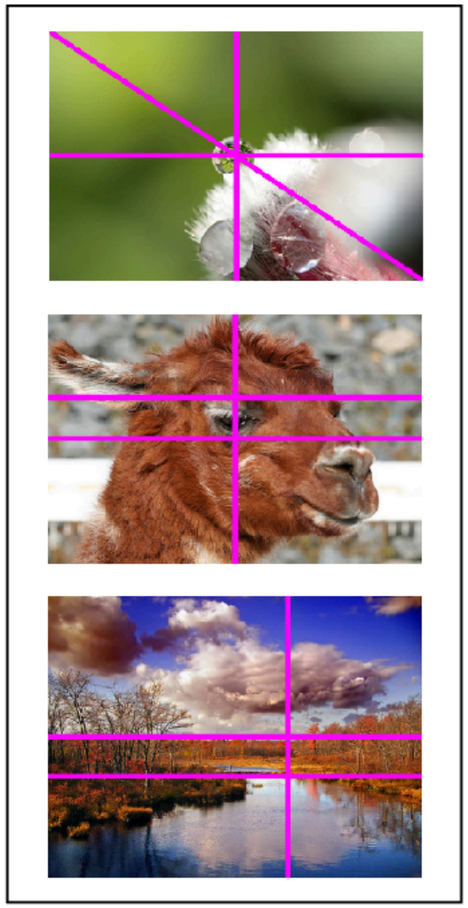
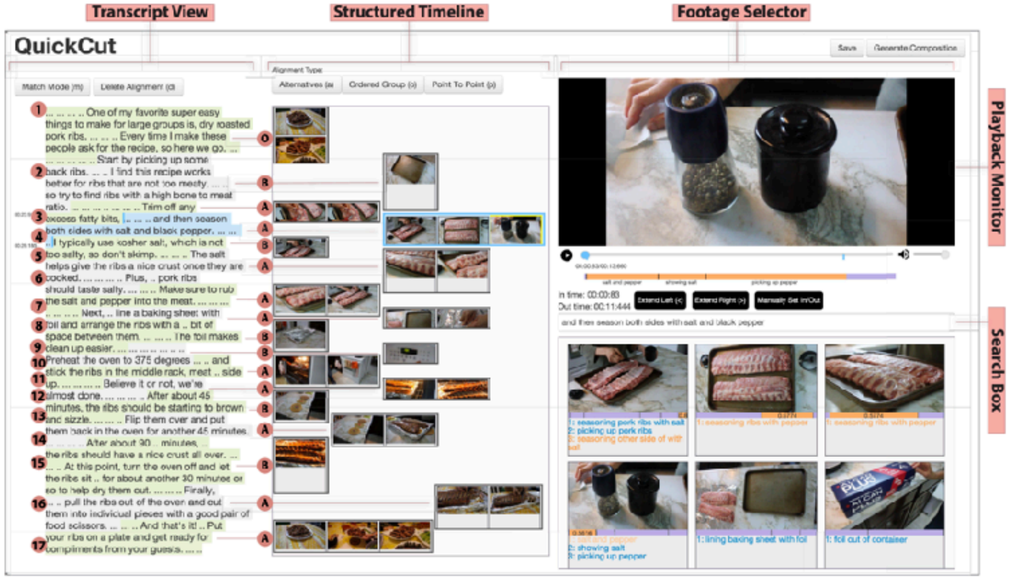
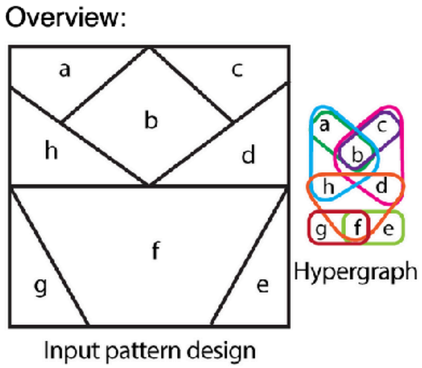
CS122 Class 10: Creativity Support Tools



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



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



Sewn result

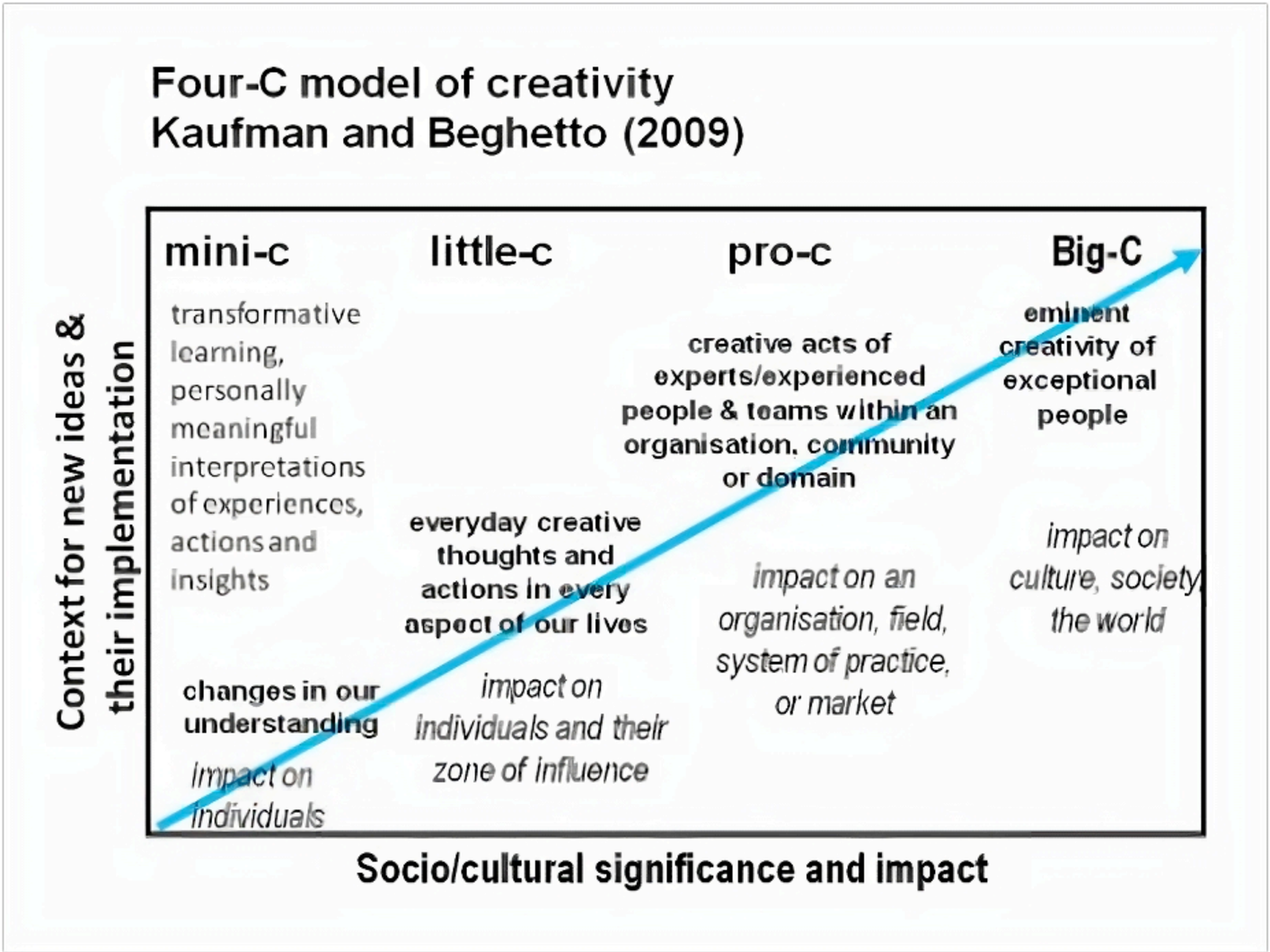
A Mathematical Foundation for Foundation Paper Pieceable Quilts by Leake et al. (SIGGRAPH 2021)

Class 10 agenda

- Zipcrit
- Lecture: What is creativity? How can we build tools to support it?
- Break
- Seminars

What is creativity?

Four-C model of creativity: context matters



- 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

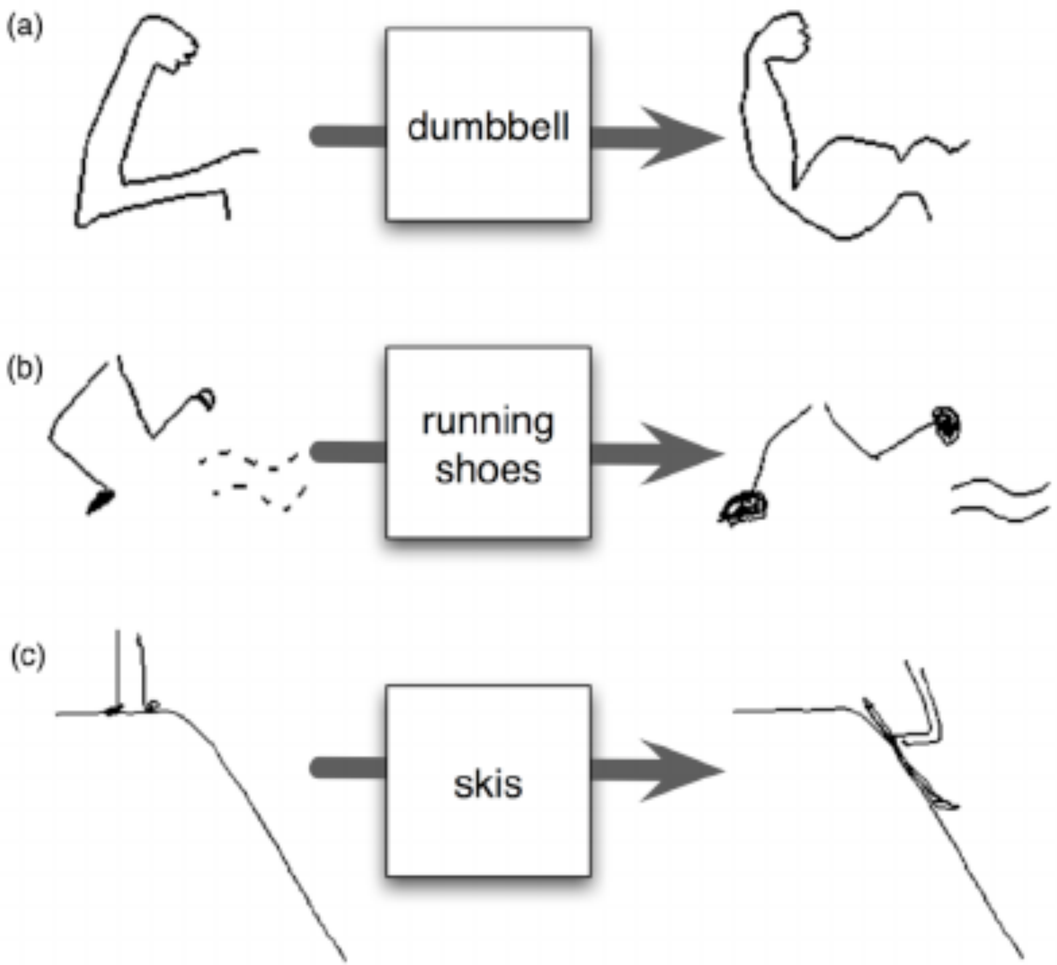
P- vs H-creativity

- P-Creative: Psychological creativity, coming up with a new idea new to the person coming up with it (“personal”)
- H-Creative: Historical creativity, coming up with a new idea new to anyone in history
  - Is research H-creative?
  - Is art H-creative?

Margaret Boden. Creativity in a Nutshell (2009)

How can we build tools to support creativity?

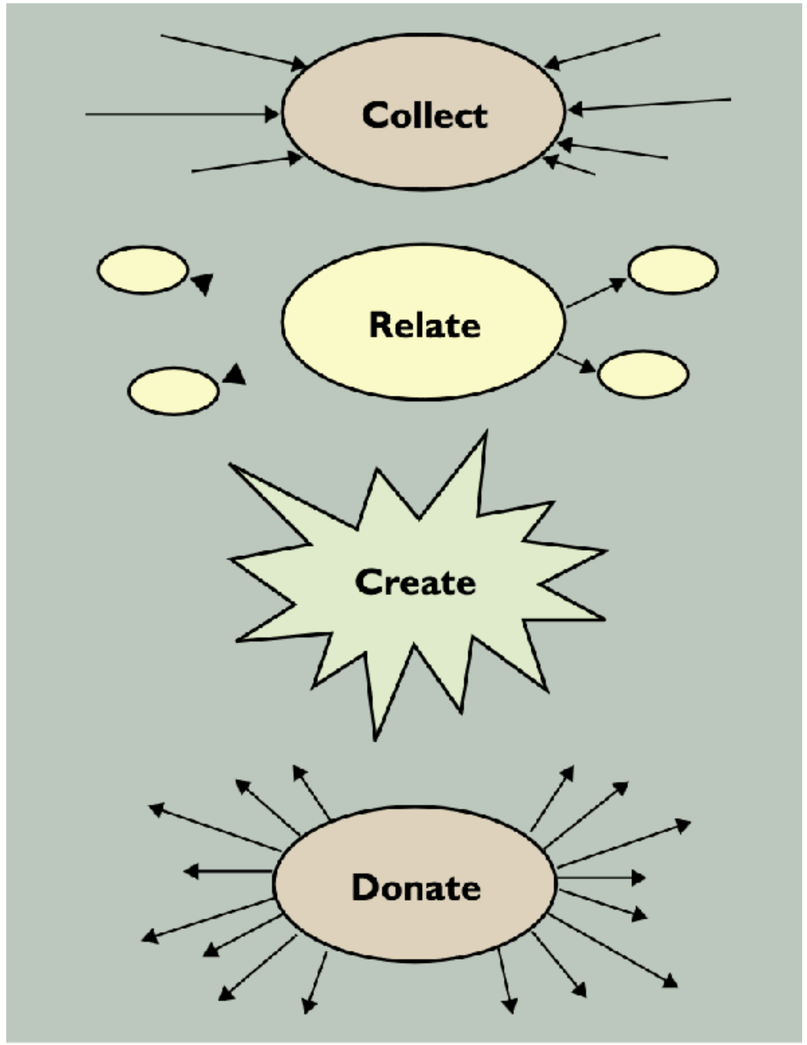
Three metaphors for creativity support tools



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)

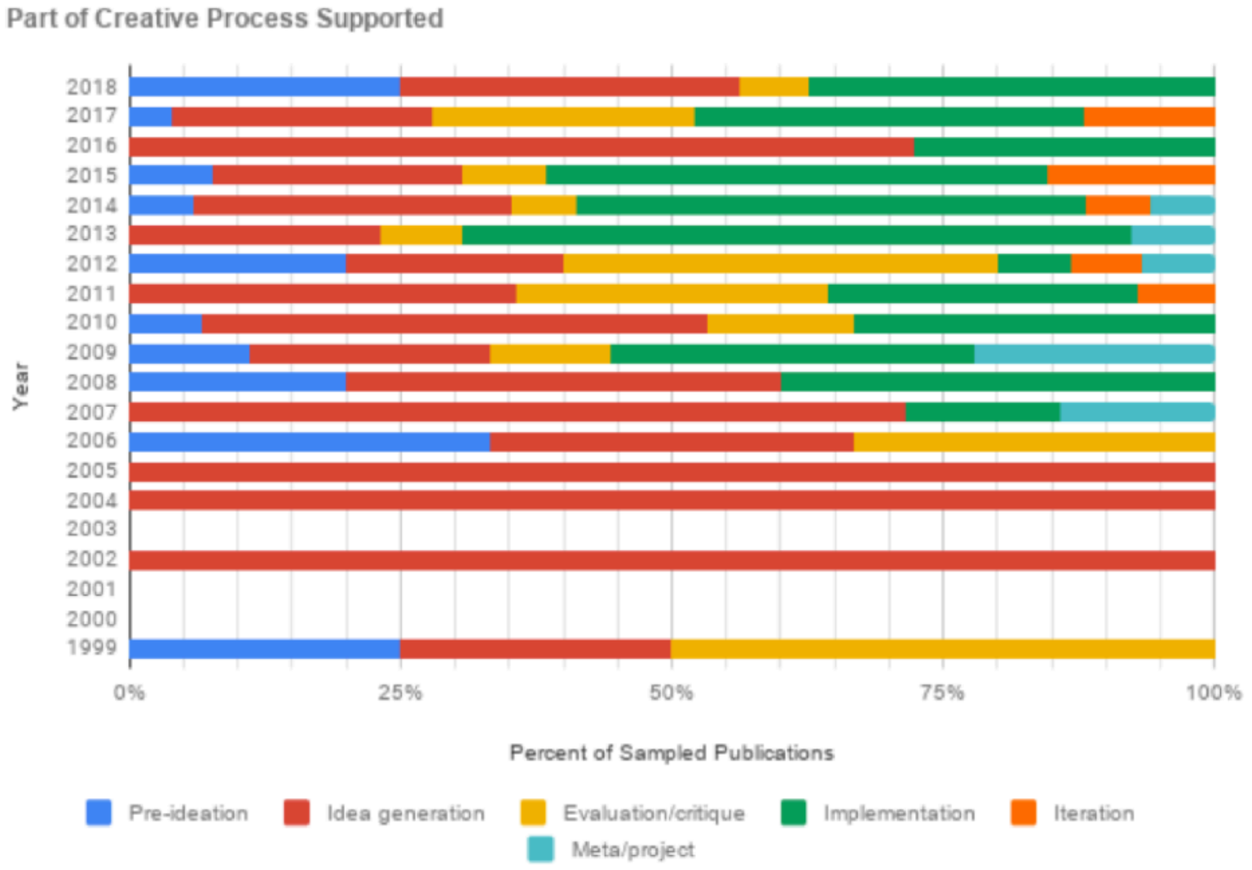


Creativity support tools: accelerating discovery and innovation. Shneiderman 2007.

- 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

Example creation CSTs

What are trends in CST research?



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

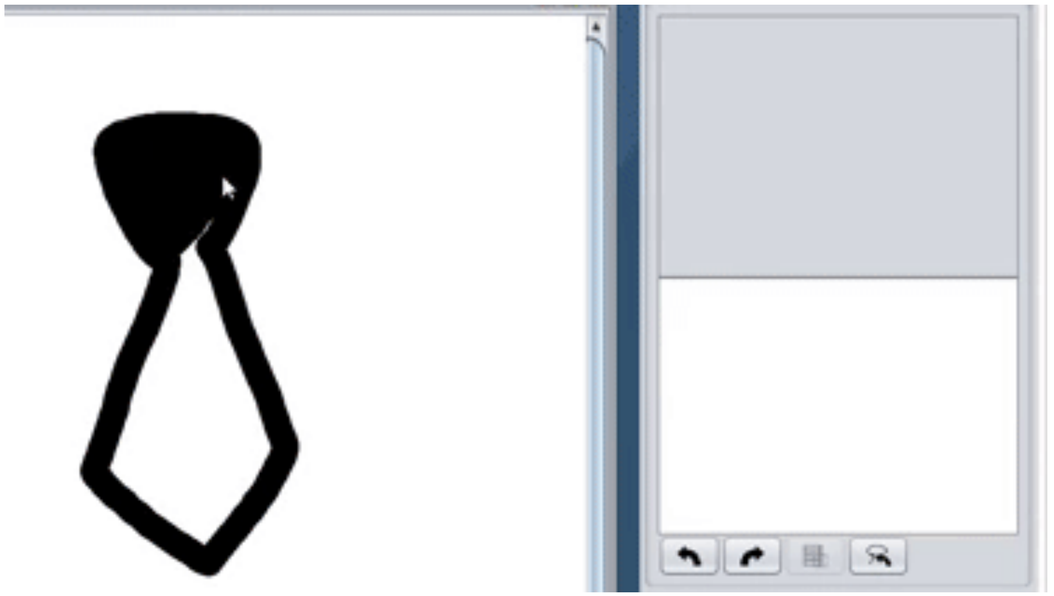
- Reviewed 143 publications from 1999-2018 and looked at device type, complexity, availability, maturity, part of creativity process, user group, evaluation technique, and collaboration
- 92% of CSTs are on digital devices (desktop, tablet)
- 65% of CSTs are high fidelity prototypes (exist as a proof 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?

Selective Undo

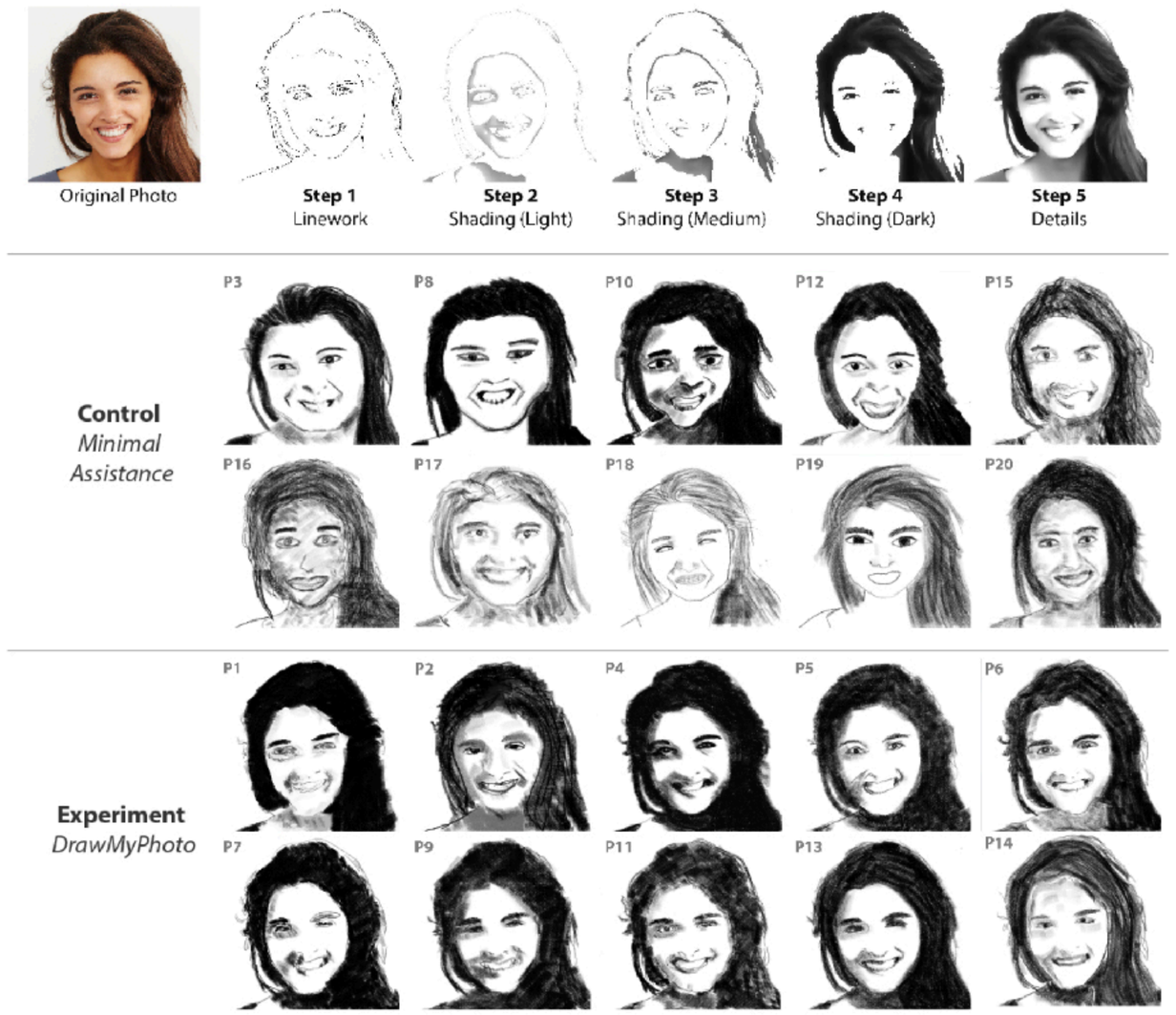
- Who are the users? Individual or group?
  - Individual users, both novice and expert
- What is the domain of use?
  - Digital art drawing applications
- What is the problem?
  - Linear undo
- What is the computational solution?
  - Remove operation from history and re-perform all following actions (script model)



Selective Undo Support for Painting Applications. Meyers et al. 2015.

DrawMyPhoto

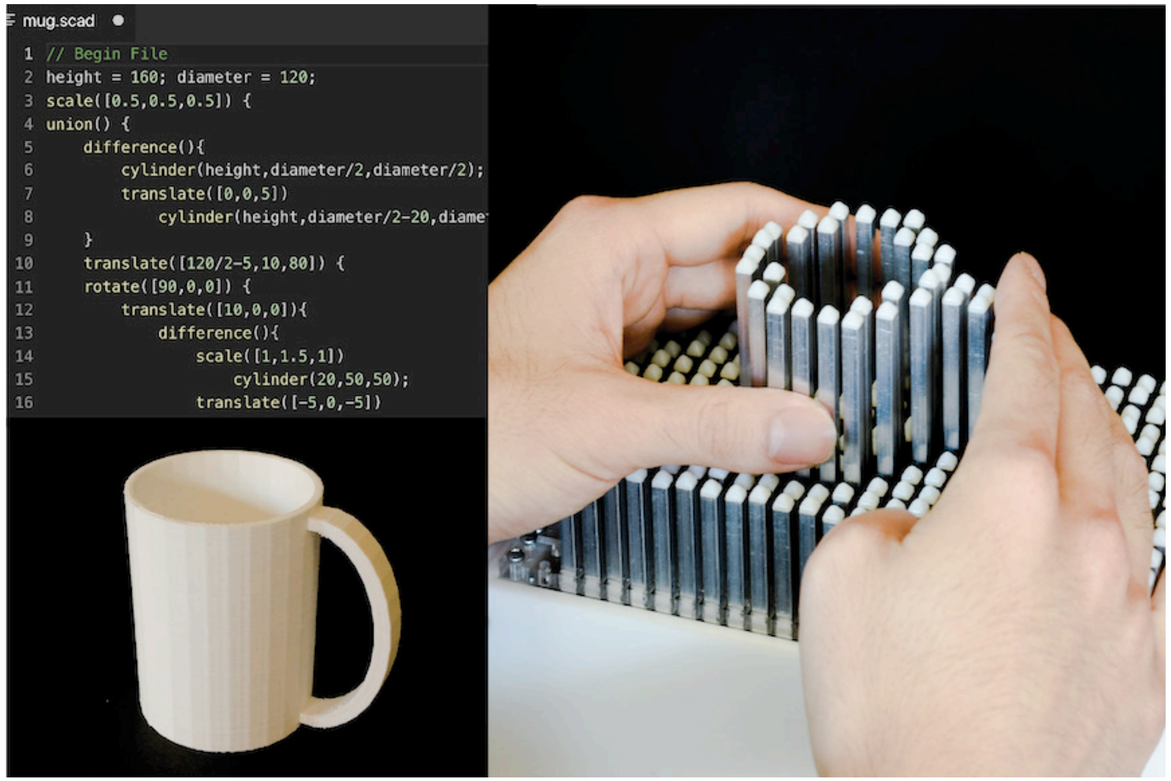
- Who are the users? Individual or group?
  - Individual users, novices
- What is the domain of use?
  - Drawing realistically
- What is the problem?
  - It’s hard to draw accurately
- What is the computational solution?
  - Apply filters on a photograph and show them in specific steps to guide users to draw



DrawMyPhoto: Assisting Novices in Drawing from Photographs. Williford et al. 2019

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

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

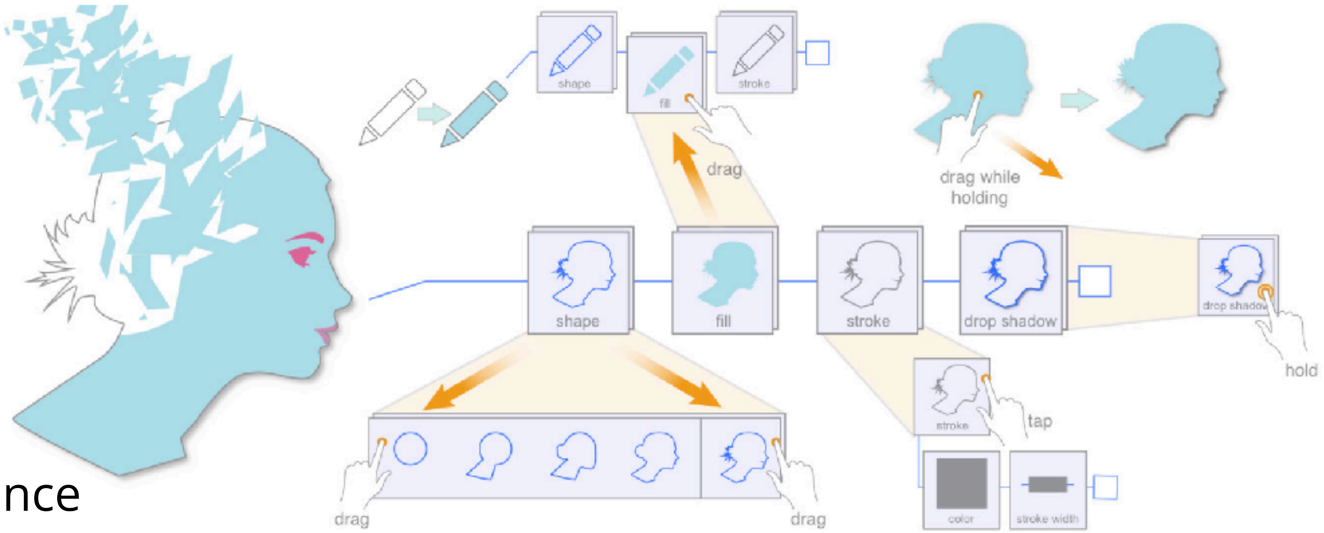
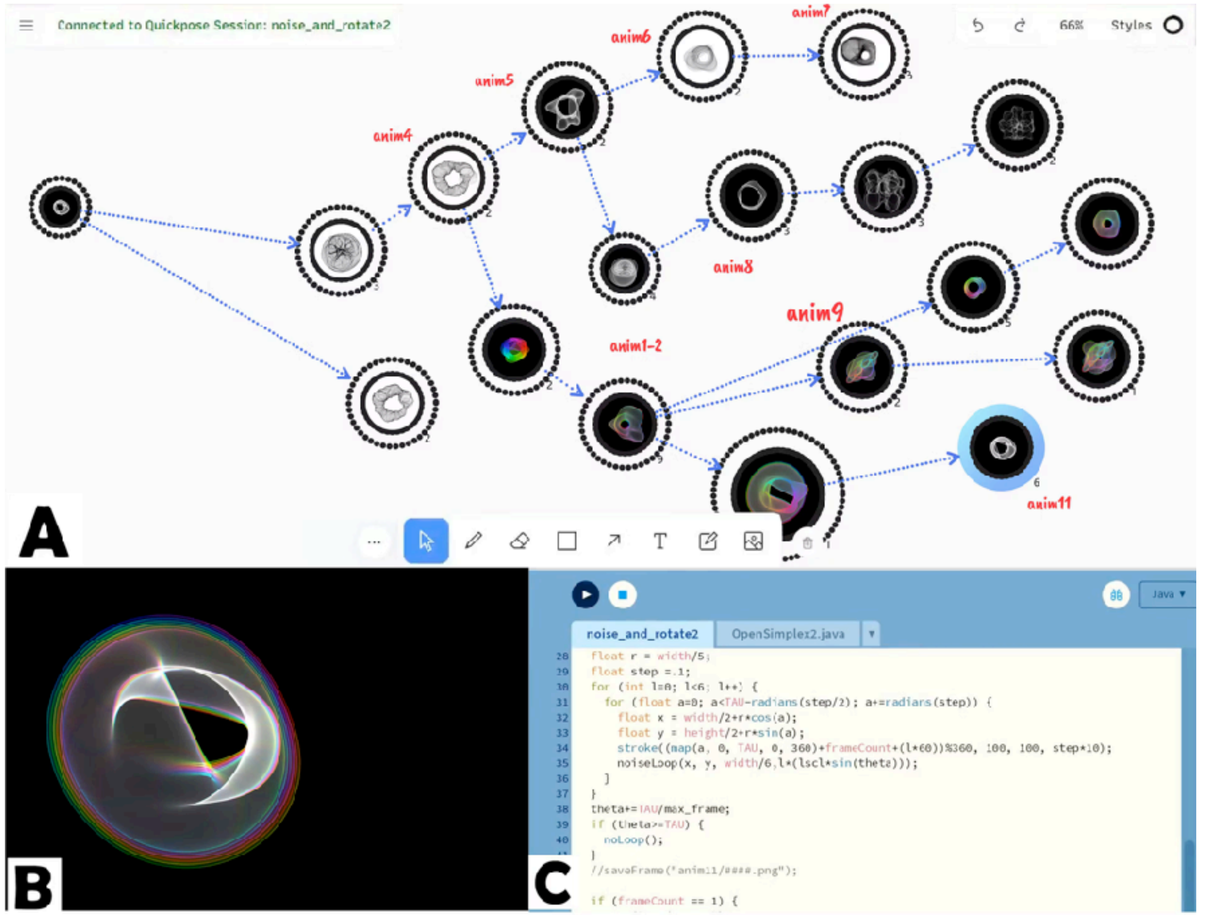


Figure 1. Object-Oriented Drawing replaces most traditional WIMP UI with Attribute Objects which may be directly manipulated with traditional direct-touch gestures. This enables powerful and fluid interaction on touchscreen-based devices.

Object-oriented drawing. Xia et al. 2016.

Quickpose

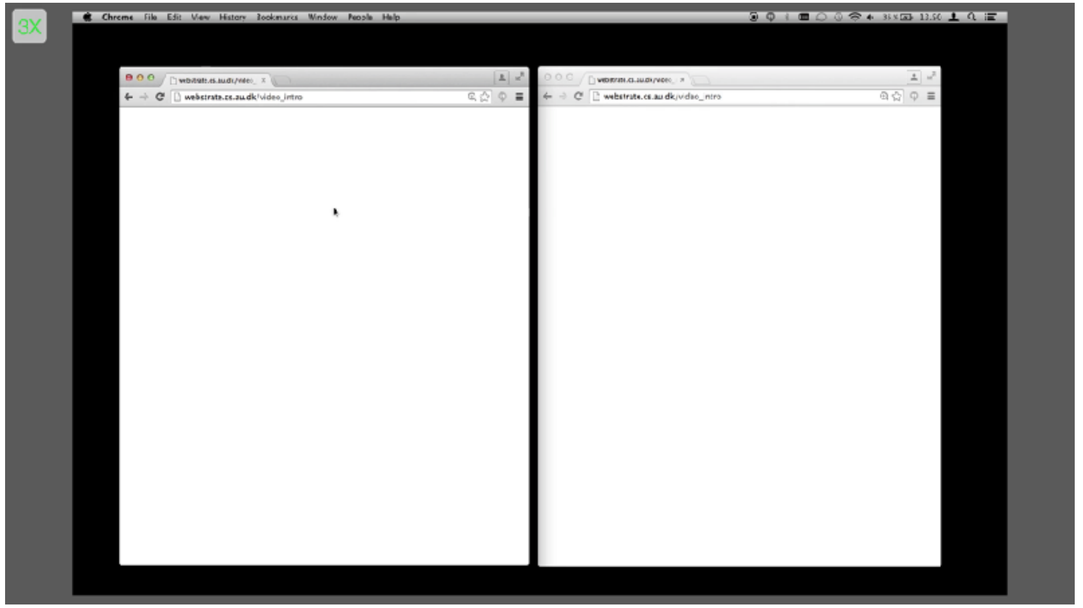
- Who are the users? Individual or group?
  - Individual users, both novice and expert
- What is the domain of use?
  - Creative coding (processing)
- What is the problem?
  - Creative version control is hard. Also version history can itself be a material
- What is the computational solution?
  - Represent version history as a DAG that is browsable and annotatable

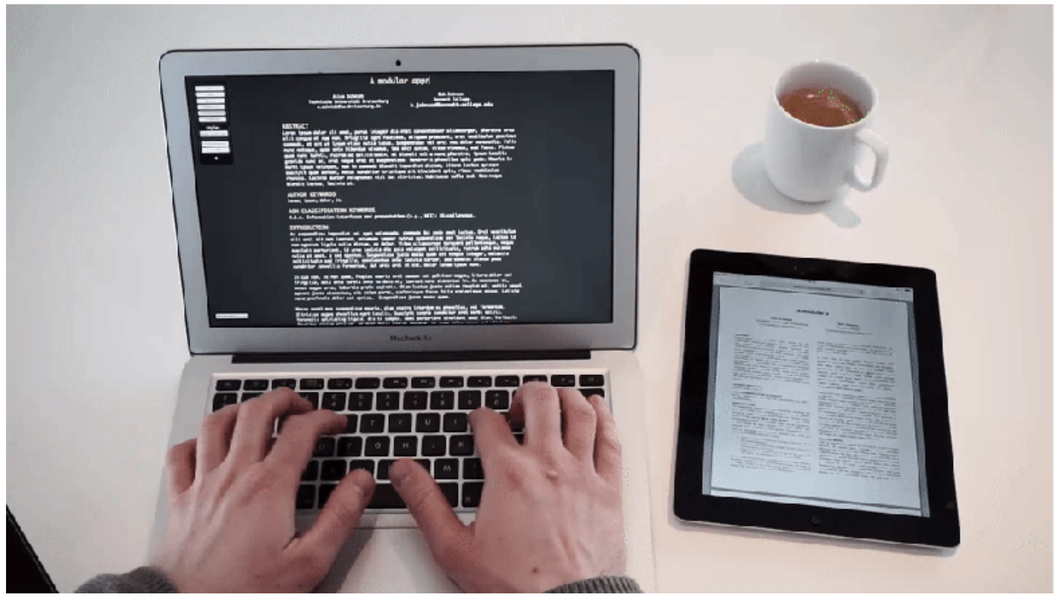


Understanding Version Control as Material Interaction with Quickpose. Rawn et al. 2023

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)

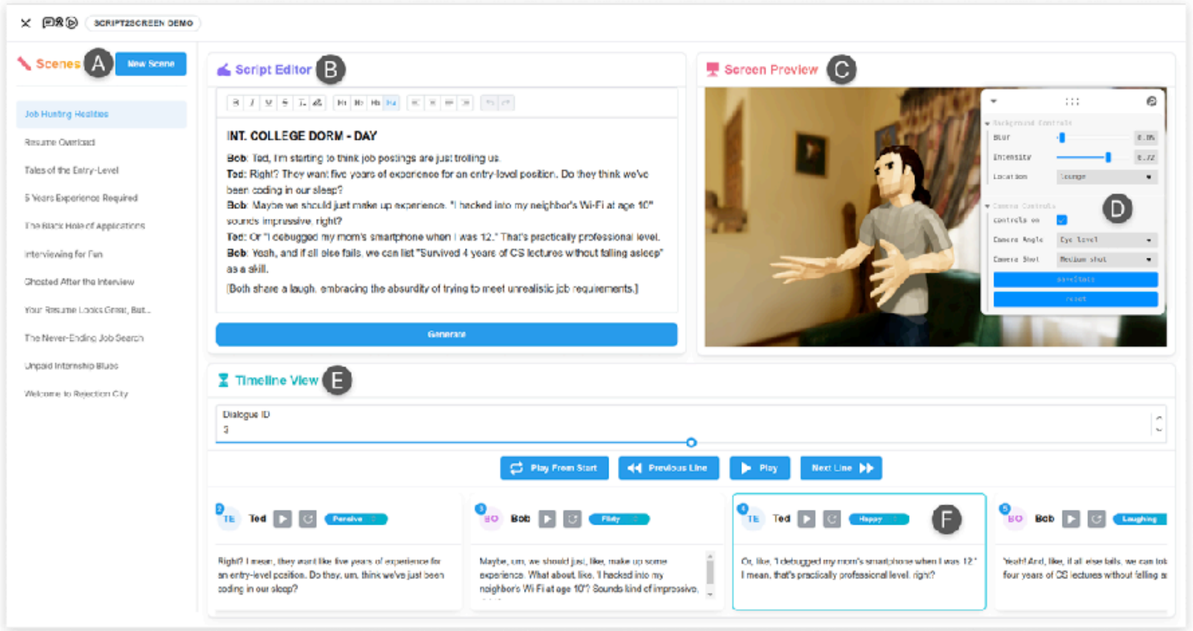


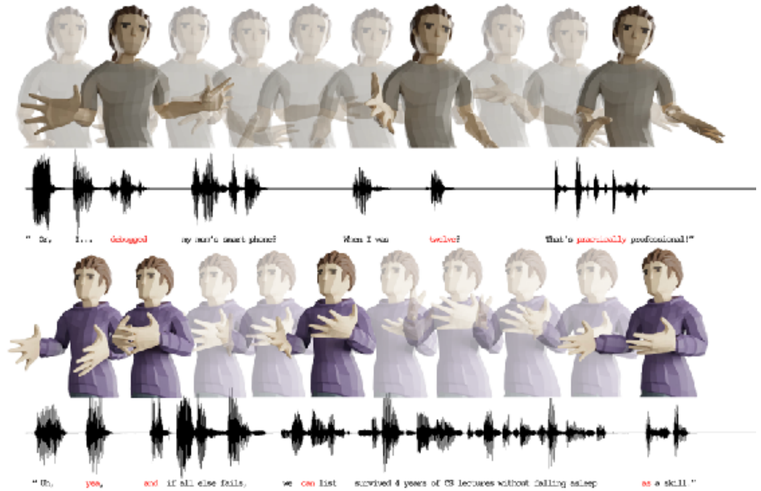


Webstrates: Shareable Dynamic Media.
Klokmose et al. 2015

Script2Screen

- Who are the users? Individual or group?
  - Individual, novice & professional screenwriters
- What is the domain of use?
  - Script writing
- What is the problem?
  - Text based scripts are vague about conveying emotions, gestures, voice, etc.
- What is the computational solution?
  - Use generative AI to generate audio & visuals from a script





Script2Screen: Supporting Dialogue Scriptwriting with Interactive Audiovisual Generation. Wang et al. 2026

CST research pain points

- Often not released to the public; forgotten once paper is published
- May over-fetishize the creation of technology for creation of technology sake or solve a “not real” problem (technosolutionism)
- Less than ideal evaluations
  - More about collecting metrics (likert responses + participant quotes) to prove design was good, rather than study creative practice (the latter is called a “design probe”)
- We’ll see more in seminar and the evaluation class!

Class 10 recap

- TODOs:
  - Monday - **PM4, 3D print for protest**
    - Once again, mentor sessions will be in the HMC makerspace Sun 3-5
  - In class Monday we'll start to brainstorm ideas for the design tool final project; we'll form groups on Weds. **Come to class Weds or you won't be in a group.**
    - ZCs from Vika (Mon) & Claudio (Weds)

Seminars