VIS 2023

Data Embroidery with Black-and-White Textures

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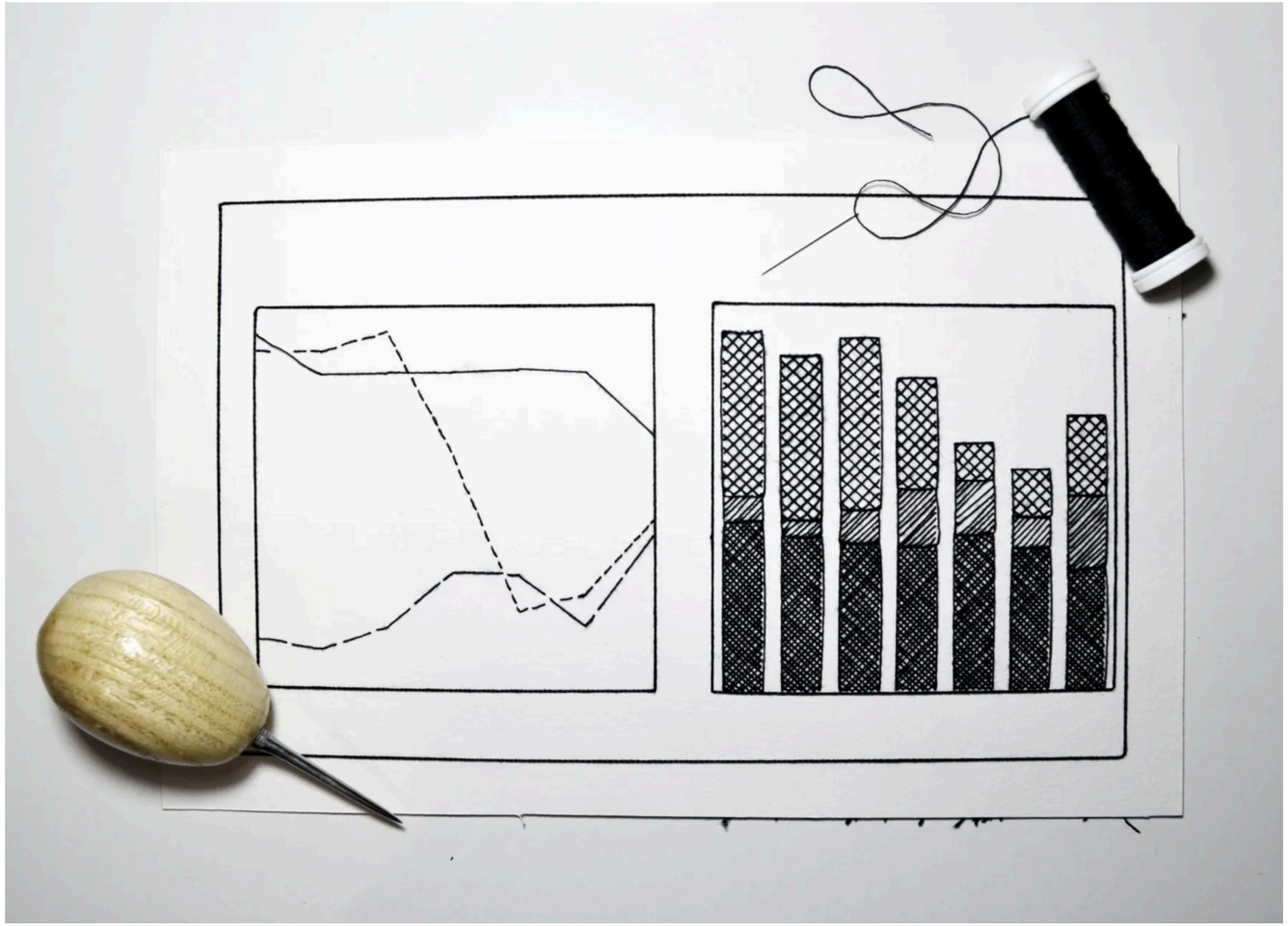
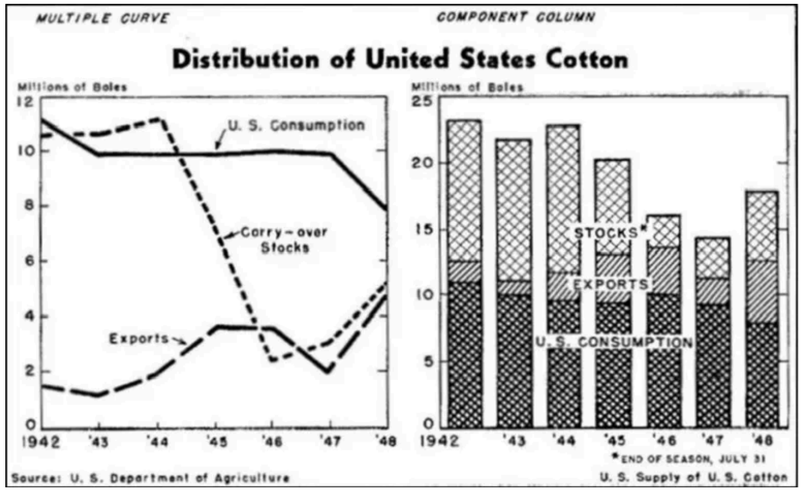
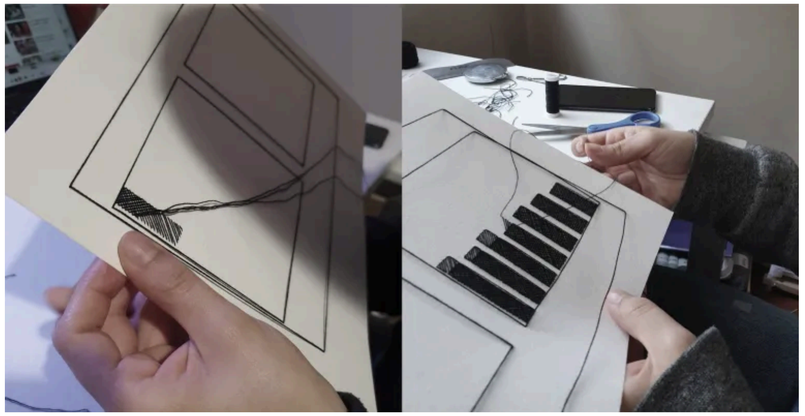
Embroidery

Image from https://unsplash.com/photos/1Ik7gF-pMx0

Hand embroidered visualization by Liz Bravo

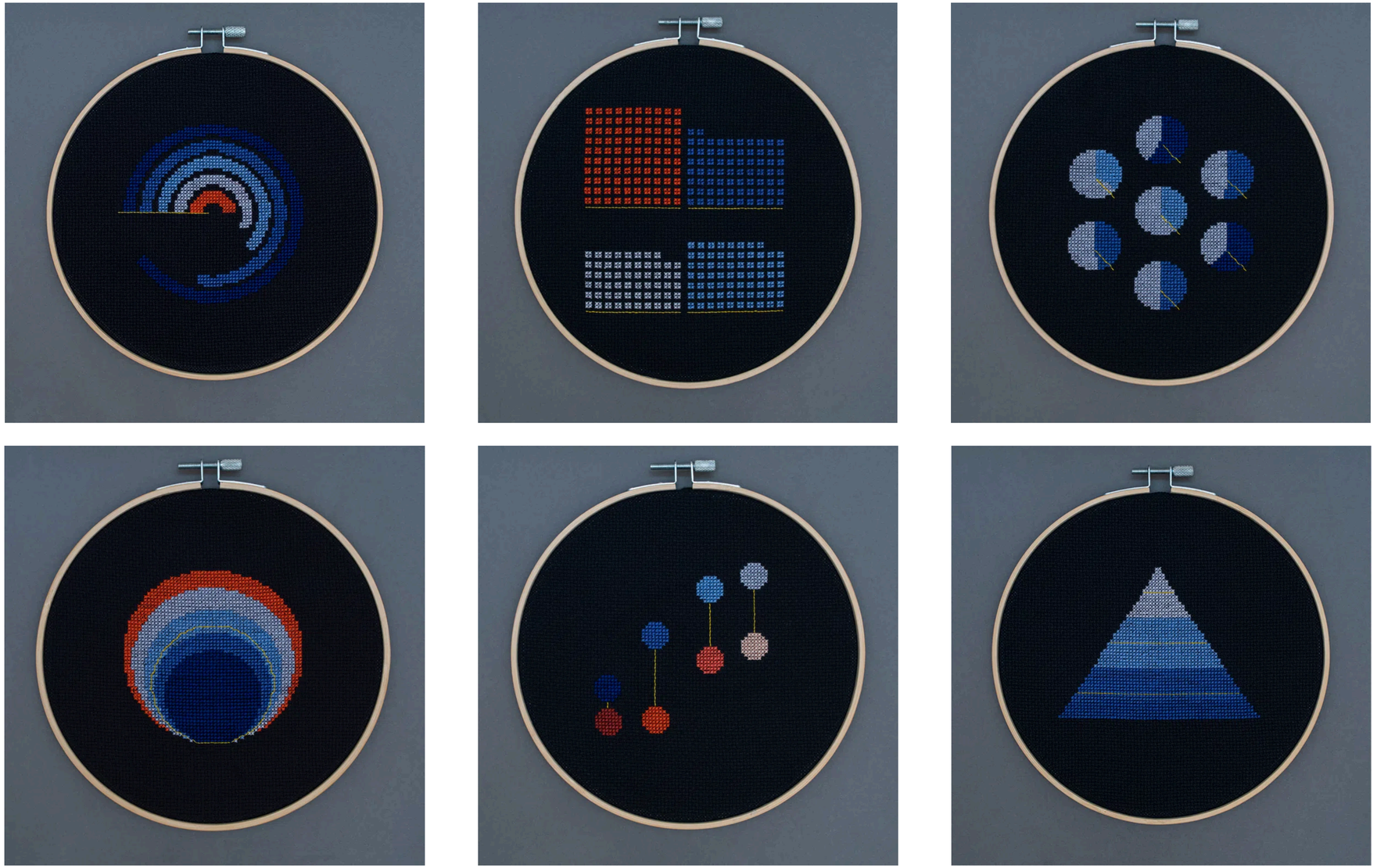






Images from https://nightingaledvs.com/data-and-technique-reflections-on-visualizing-by-hand/

Cross-stitched visualization by Olivia Johnson



Images from https://www.itsnicethat.com/news/olivia-johnson-womens-work-cross-stitch-data-visualisation-illustration-240820

Hand embroidered visualization by Jane Zhang

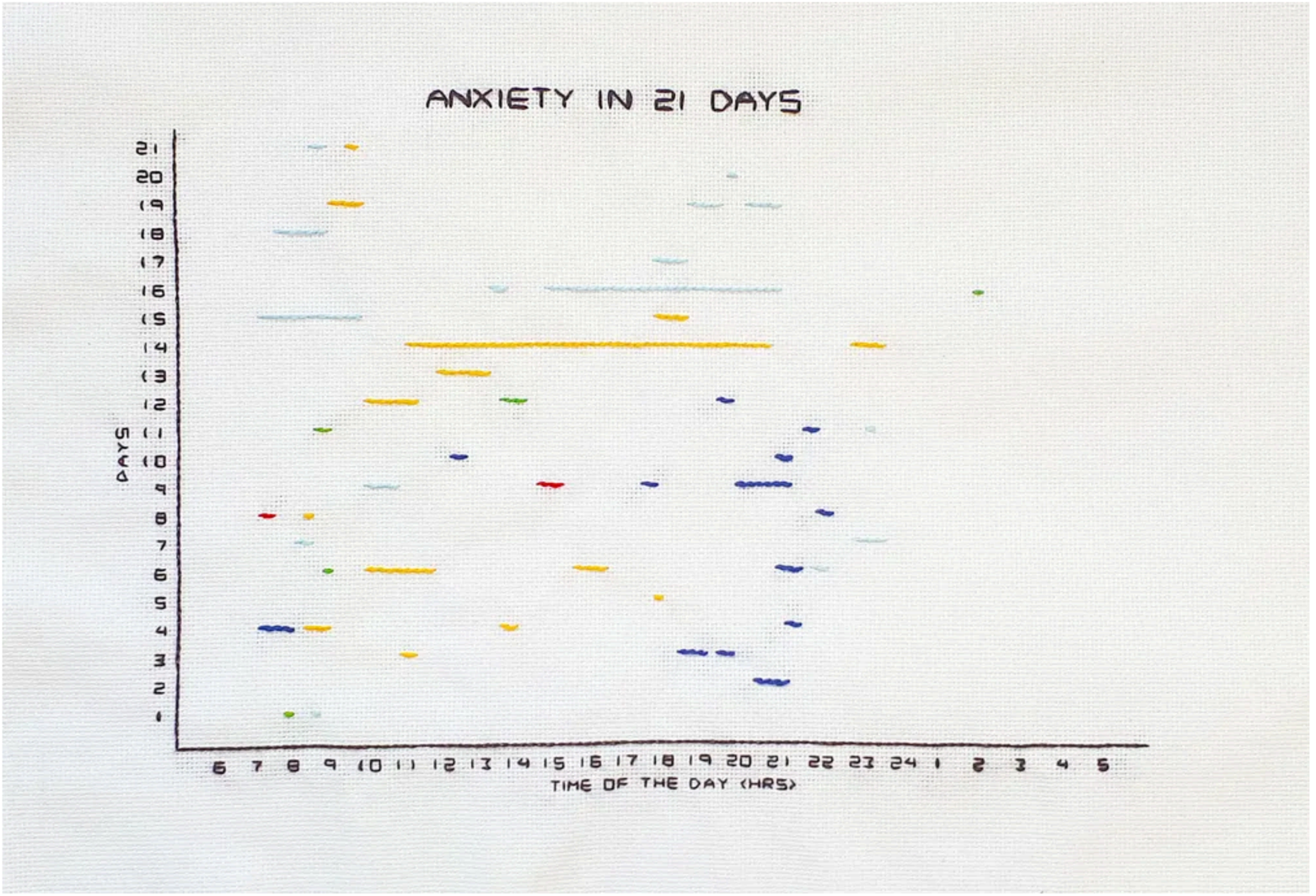
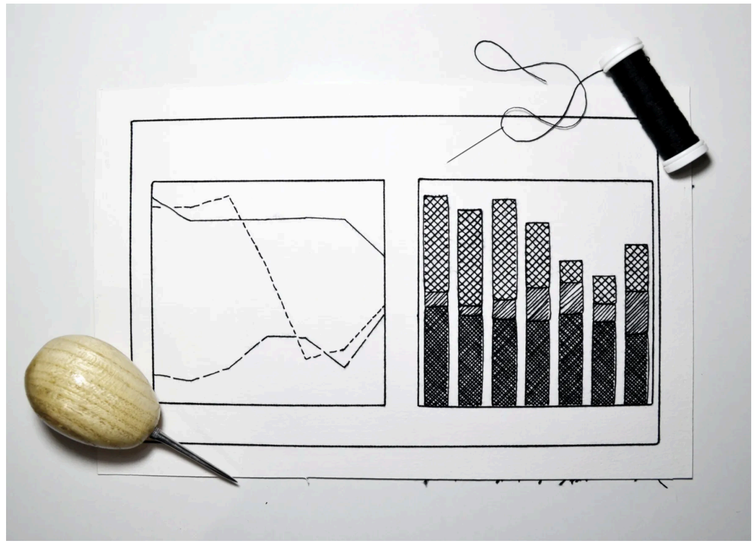


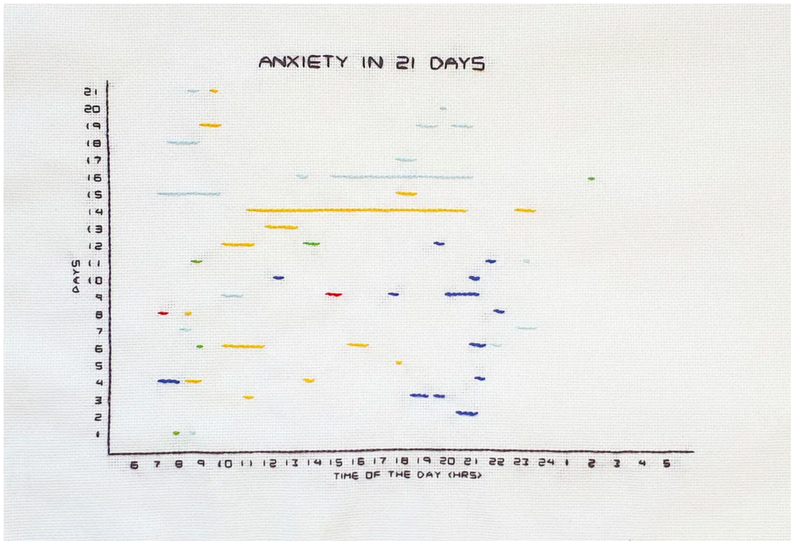
Image from https://janezhgw.medium.com/hacking-social-media-to-tell-meaningful-data-visualization-stories-exploring-anxiety-with-4ff29a8d79e2

Using manual methods for representing data on fabric



By Liz Bravo

By Olivia Johnson

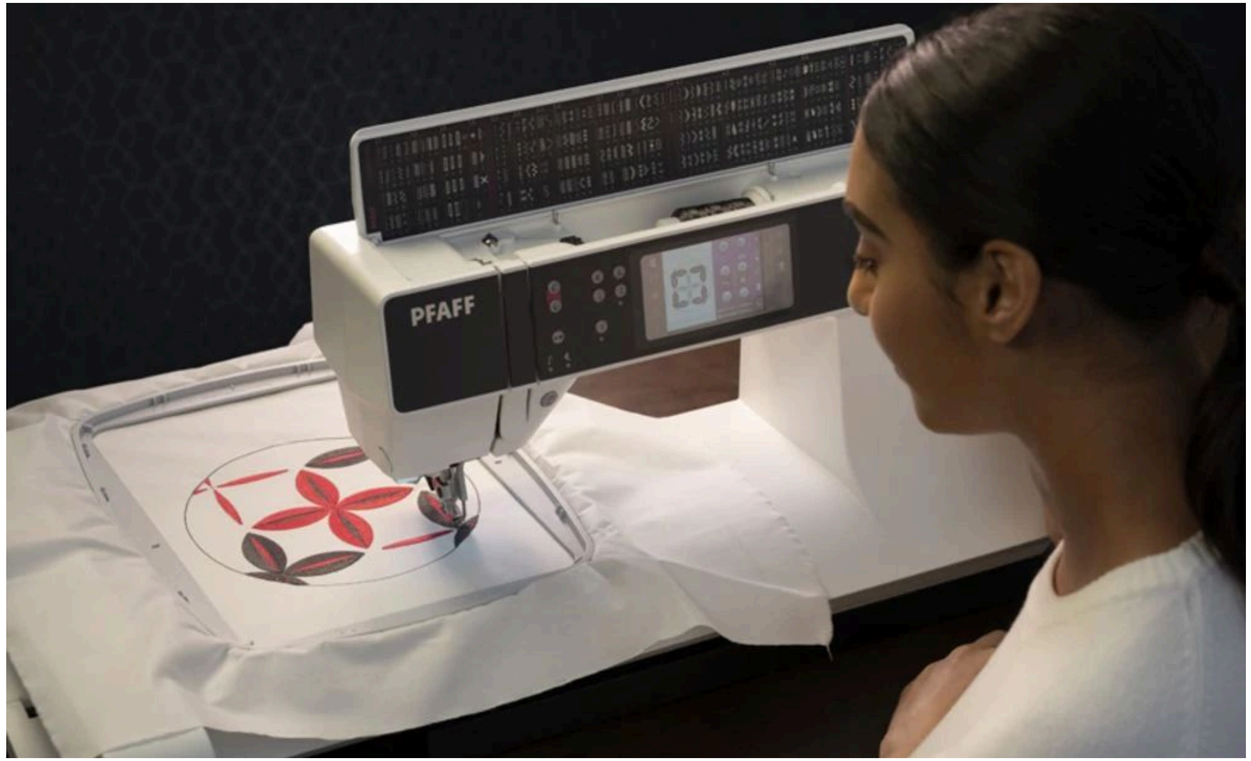


By Jane Zhang

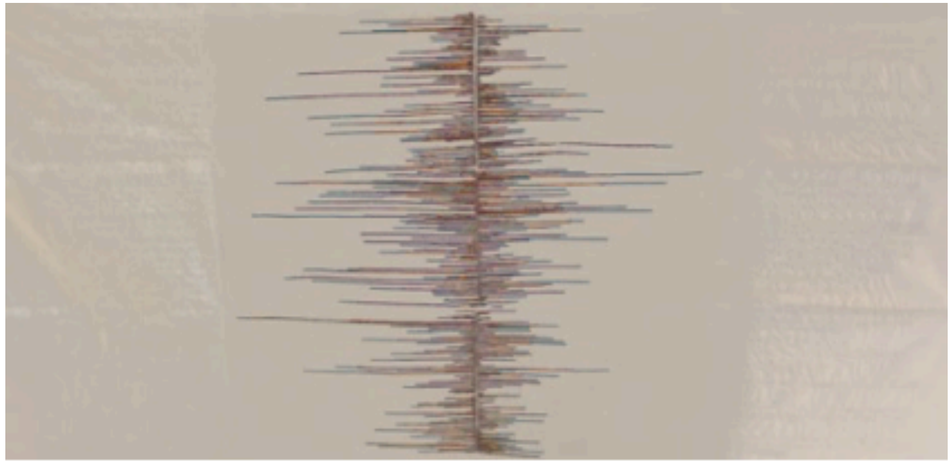
Left image from https://nightingaledvs.com/data-and-technique-reflections-on-visualizing-by-hand/
Middle image from https://www.itsnicethat.com/news/olivia-johnson-womens-work-cross-stitch-data-visualisation-illustration-240820
Right image from https://janezhgw.medium.com/hacking-social-media-to-tell-meaningful-data-visualization-stories-exploring-anxiety-with-4ff29a8d79e2

Machine embroidery

- Computer-numerically controlled (CNC) technology
- Rapidly producing customized embroidery designs
- Considered as an effective medium for presenting personal data [Wannamaker et al., 2019]



Machine embroidery



Embroidered blanket based on text message data
[Wannamaker et al., 2019]

Left image from https://shop.pfaff.com/en-us/machines/creative-30-sewing-and-embroidery-machine

Challenges and limitations of color in machine embroidery

- Lower “color resolution” compared to digital color screens
  - Limited color options based on available threads
- Must pause and manually switch threads for each color change
  - Minimizing color changes can save time

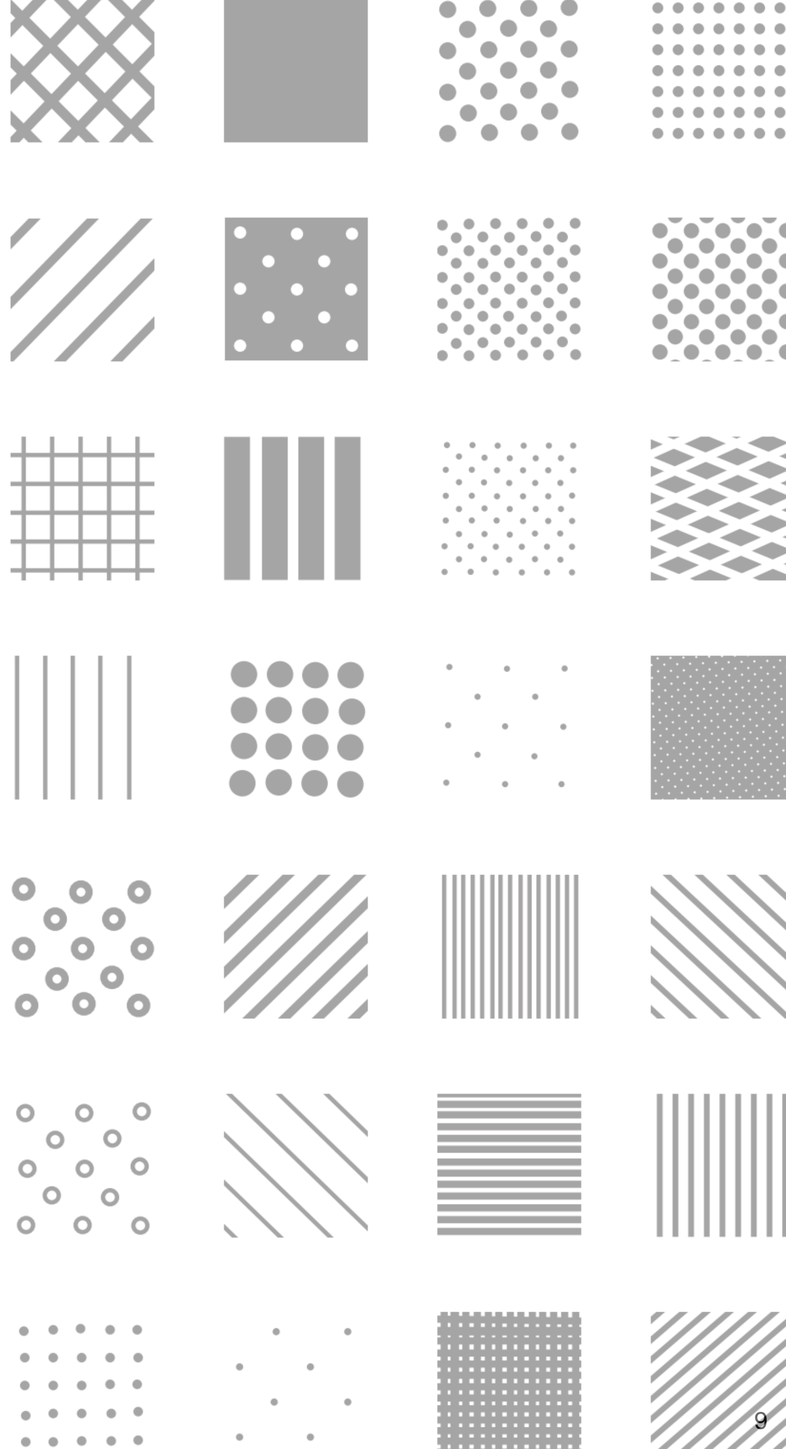
Machine embroidery threads

Thread in the embroidery machine

Left image from https://www.joann.com/gutermann-extra-strong-thread-110yd/xprd1002323.html

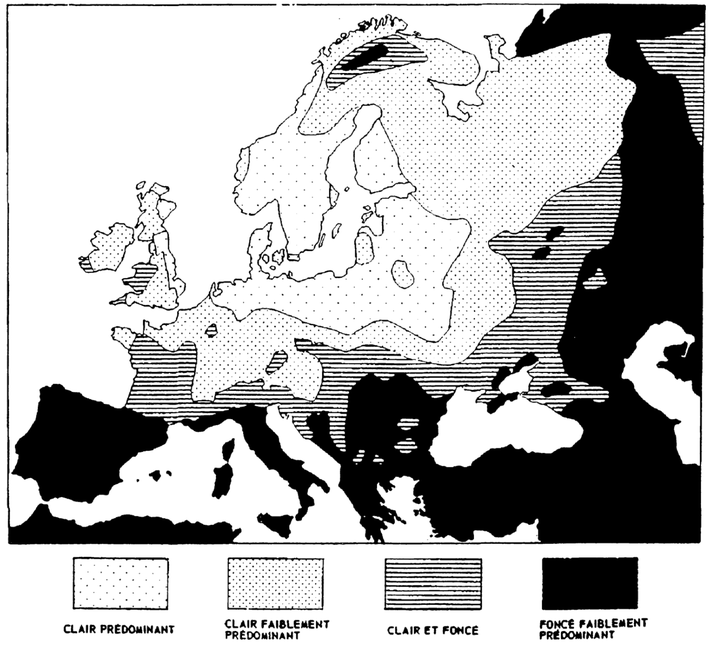
Research Gap:

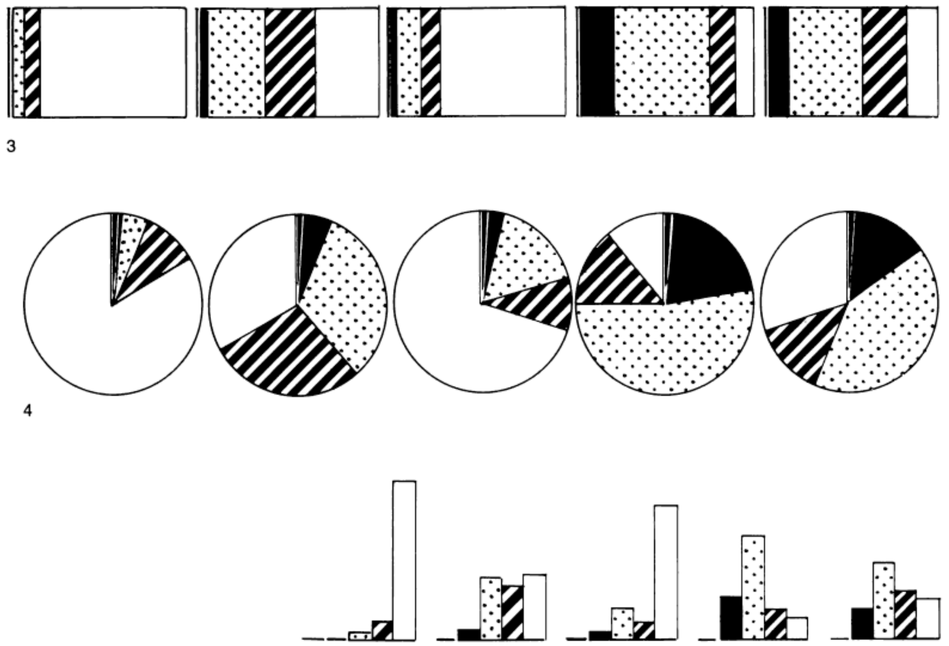
Black-and-White Textures in Data Embroidery

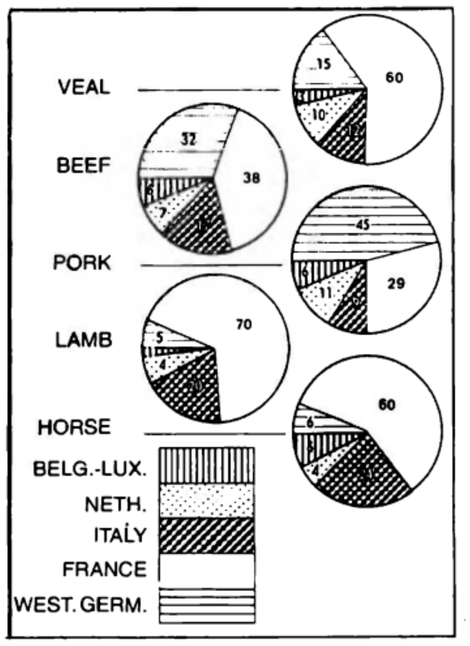


Black-and-white textures

- A historically popular visual channel
- Monochromatic nature → suitable for machine embroidery
  - Easily translated into embroidery files
  - Eliminating the need for multiple thread color changes during the embroidery process







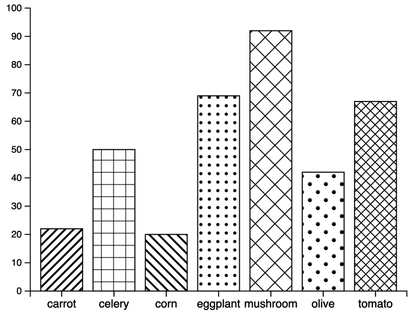
Images from J. Bertin, Semiology of Graphics: Diagrams, Networks, Maps

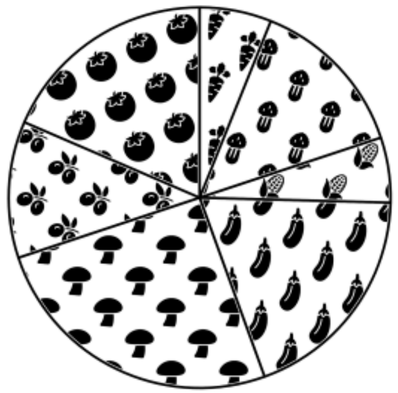
Rich attributes… How well they can be embroidered?

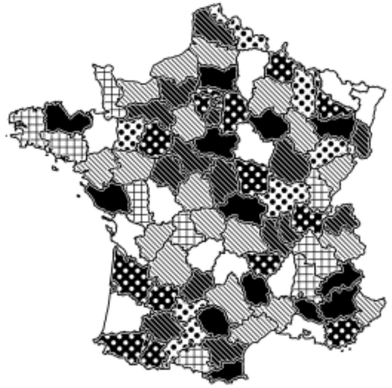
Geometric textures

Iconic textures

Related work: we have a paper on black-and-white textures…







Design characterization of black-and-white textures

Main contribution:

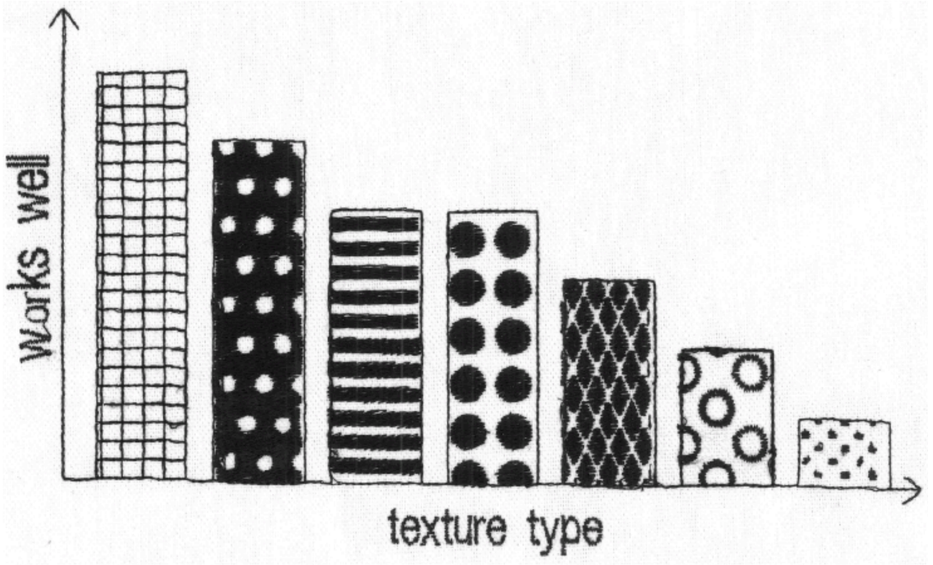
- Summarize the texture attributes
- Collected a set of good texture designs from experts
- Studied the aesthetics and effectiveness of textures

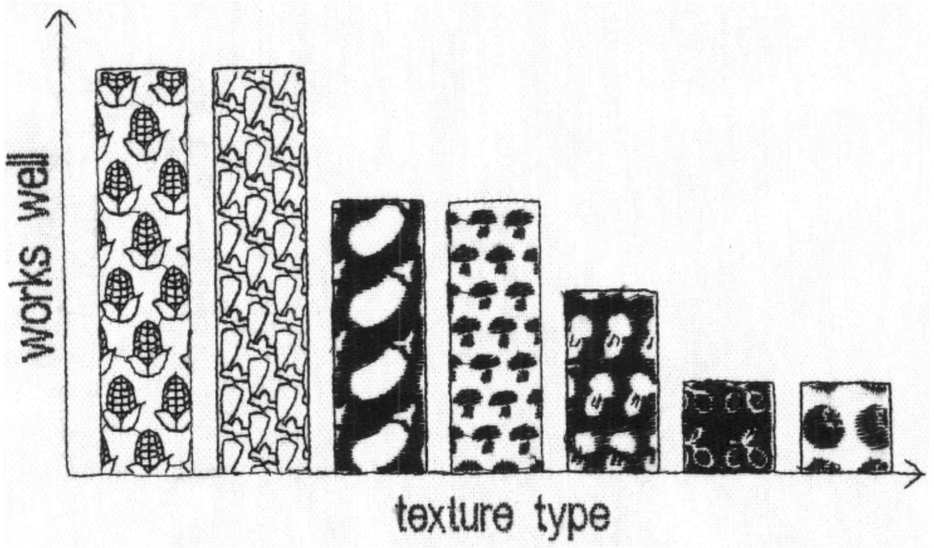
Thursday afternoon: Perception session

2:00pm -3:15pm, Room 105

Test with different textures

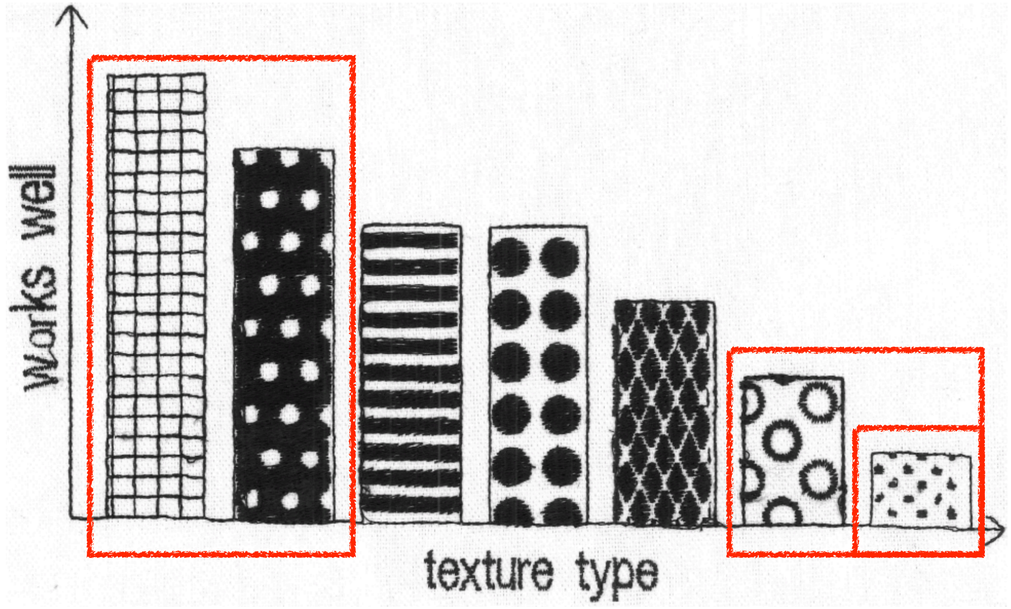
Which textures perform better for embroidery?



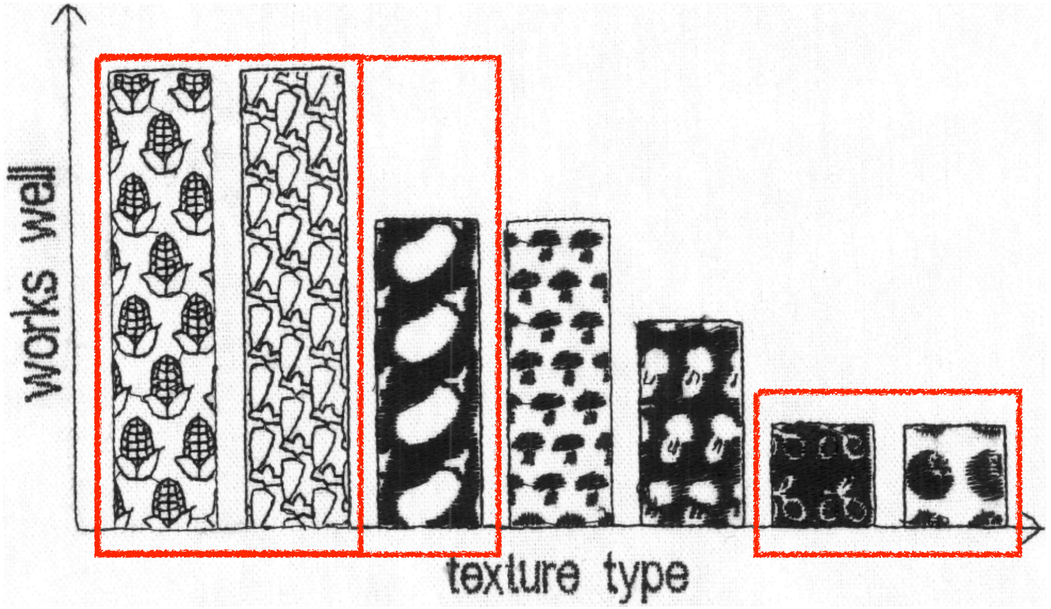


Which textures perform better for embroidery?

- Continuous elements

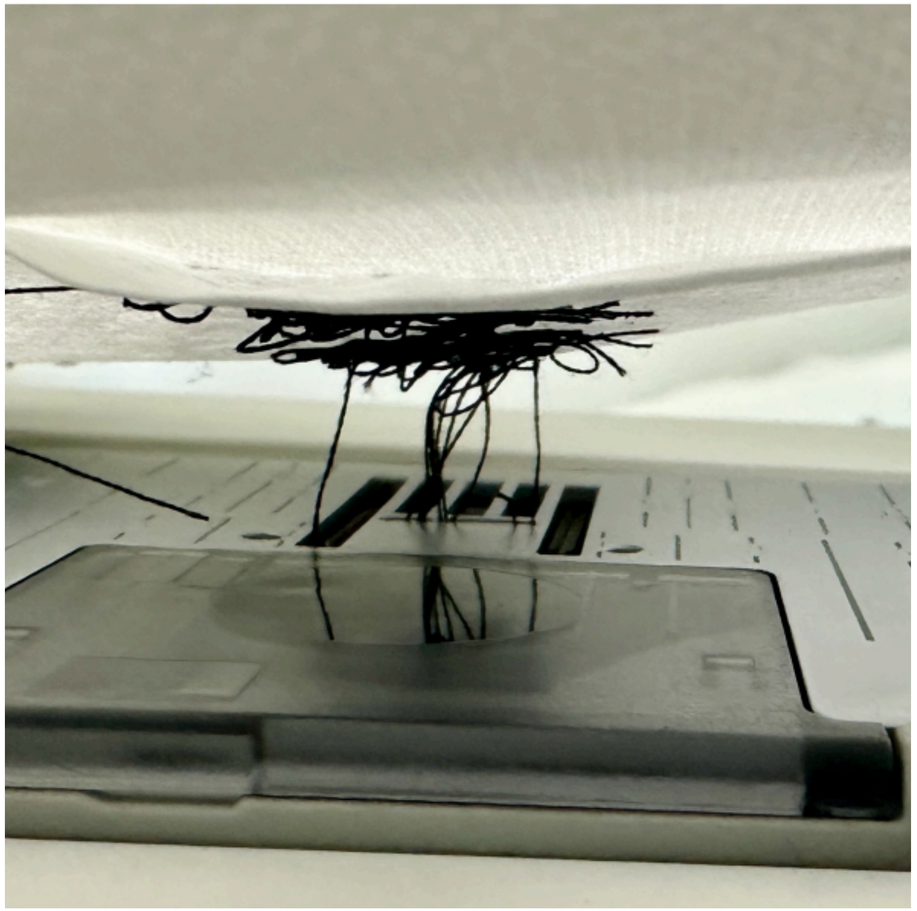


- Scattered elements

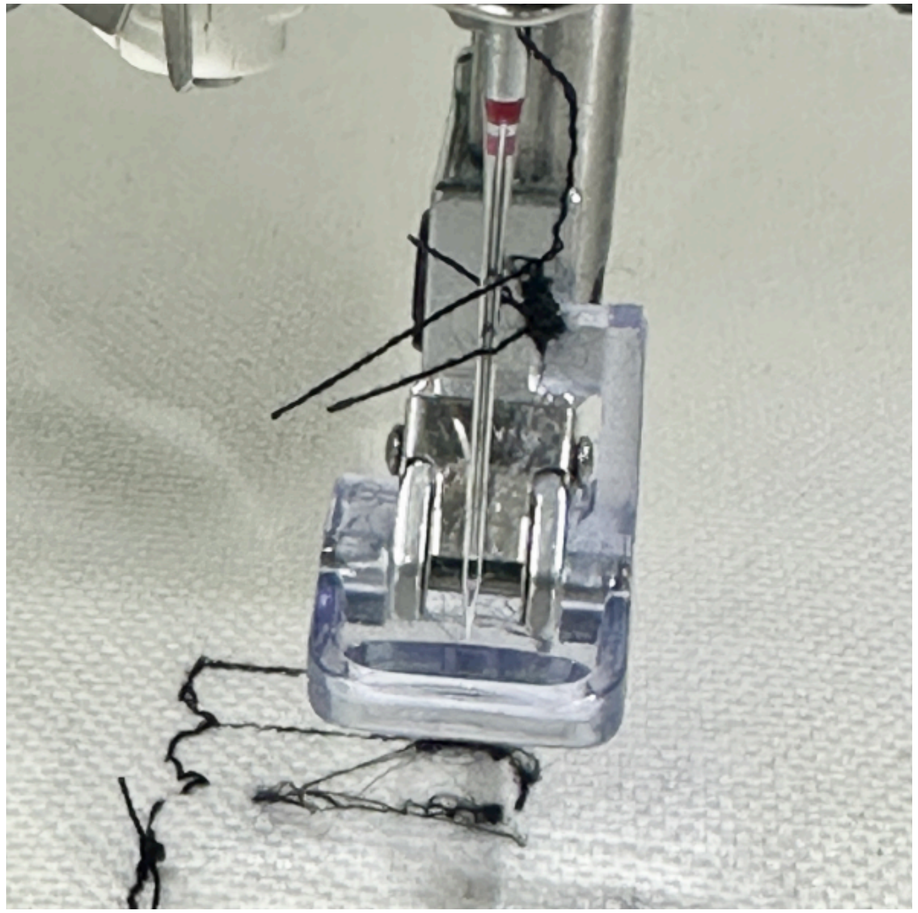


Icons from https://icons8.com/

Errors during the embroidery process

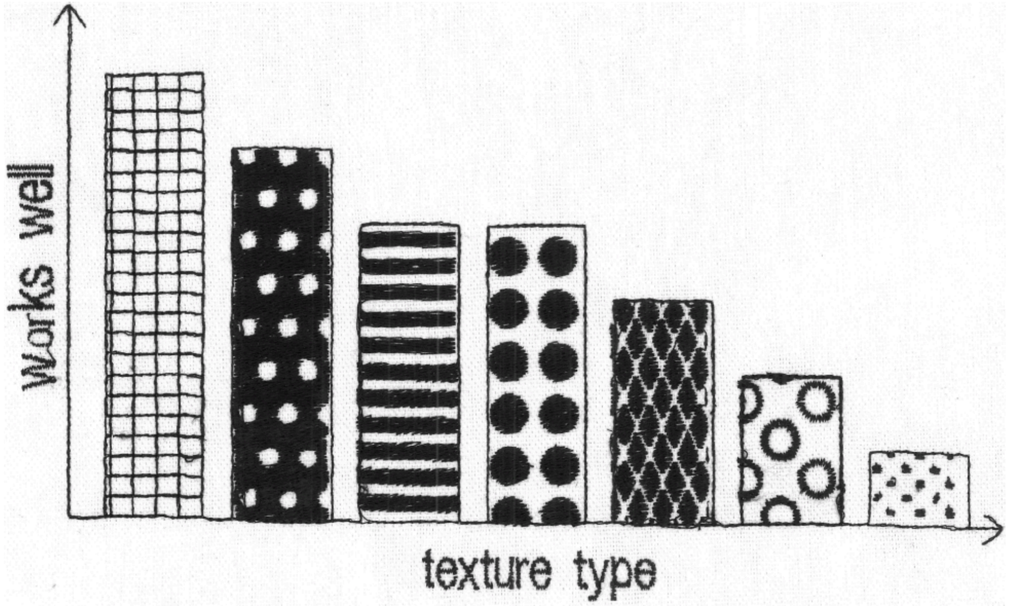


Entangled bobbin thread

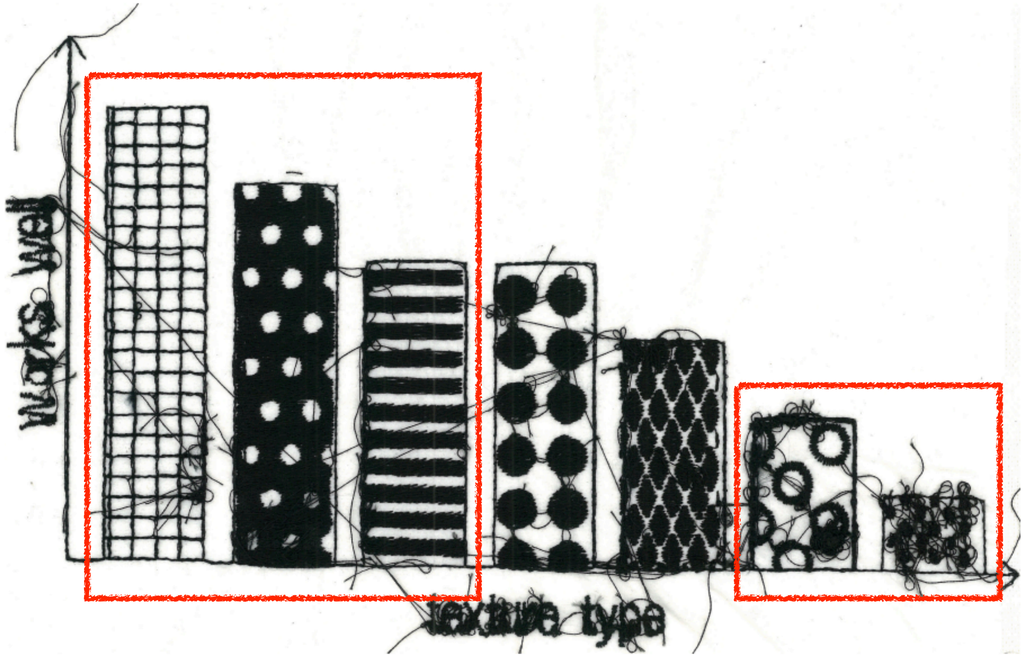


Thread breakage

Reverse side



The front side

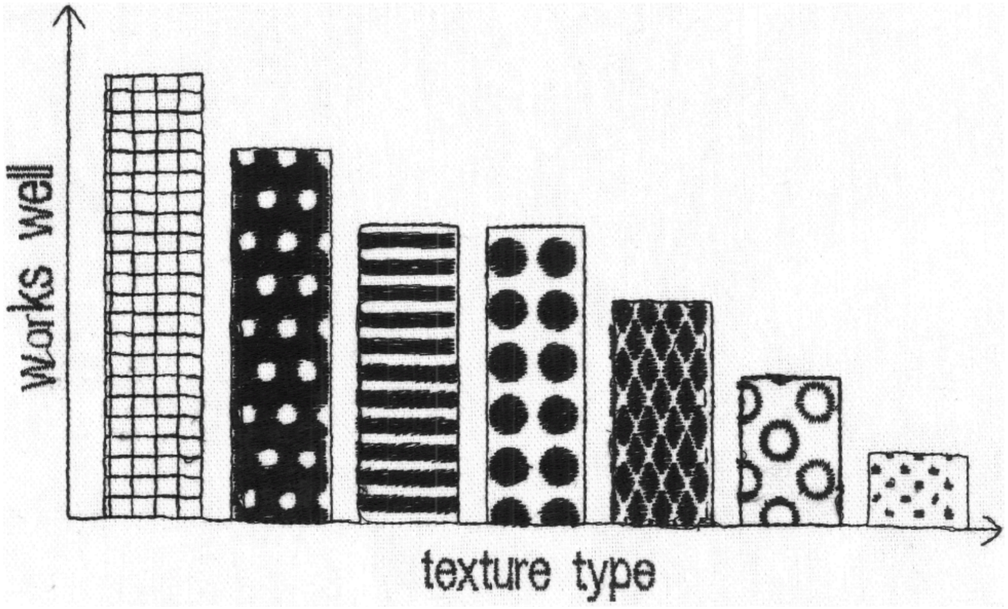


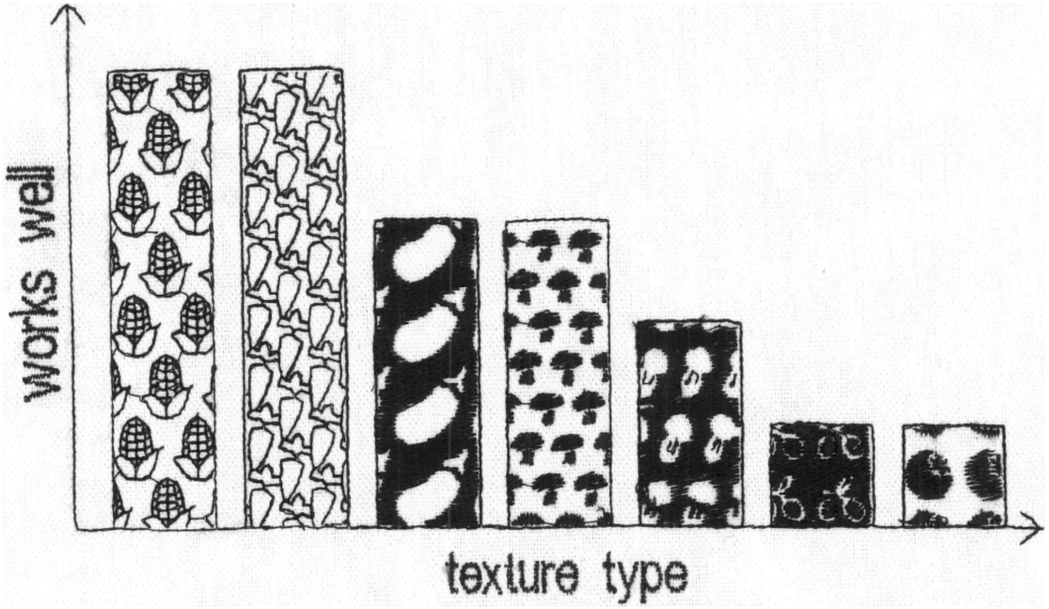
The reverse side

Which textures perform better for embroidery?

- Continuous elements
- Simplicity

- Scattered elements
- Complexity

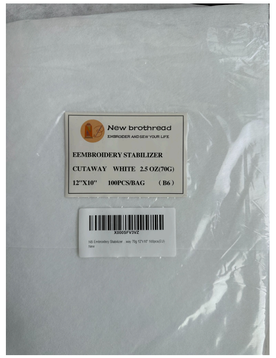




Icons from https://icons8.com/

Embroidery workflow

- Create data embroidery from a chart image
- Decisions we made at various stages of the embroidery process



Embroidery supplies

Detailed workflow (paper)

Family survey

Preferences for vegetables

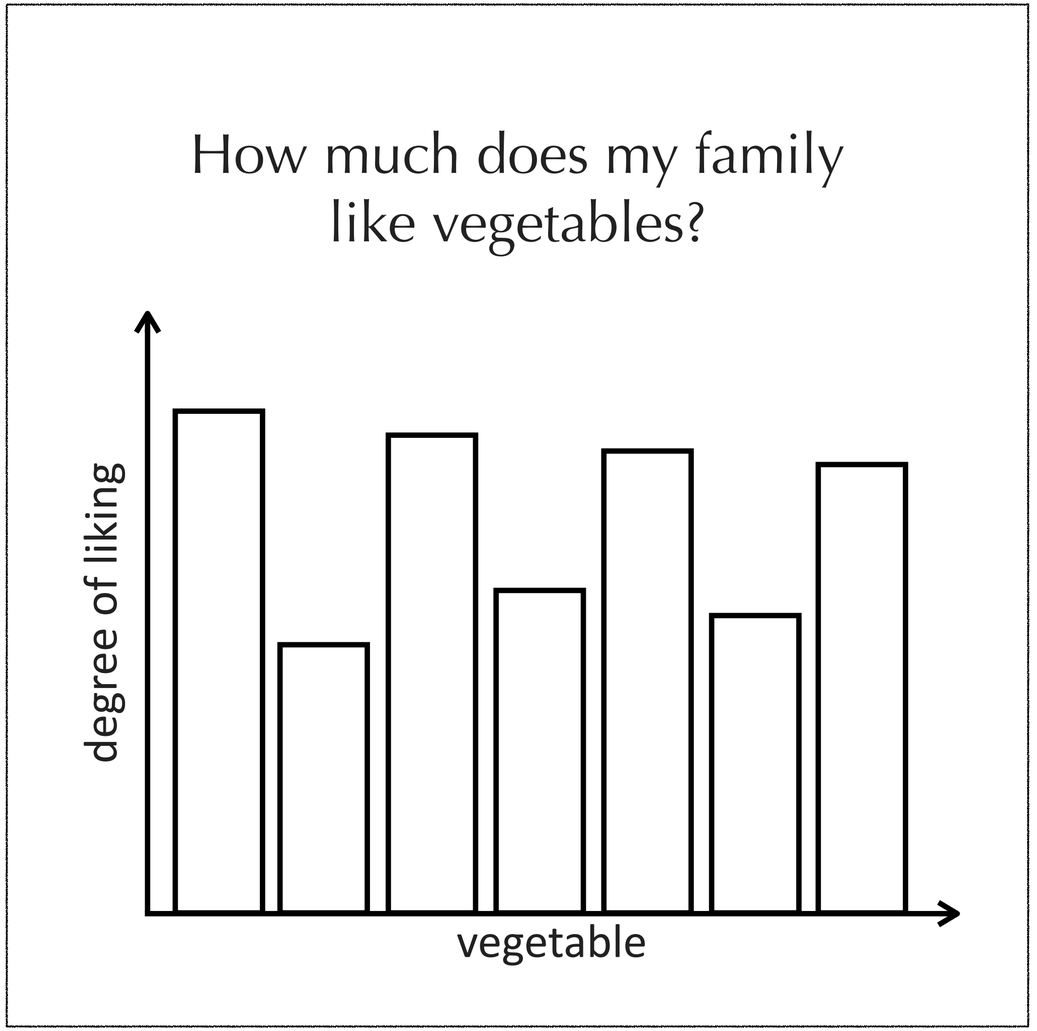
Image from https://unsplash.com/photos/5aJVJvJ9rG8

Family survey

- Preferences for 7 vegetables
- Rate each vegetable on a scale of 1 to 5
- 11 family members participated

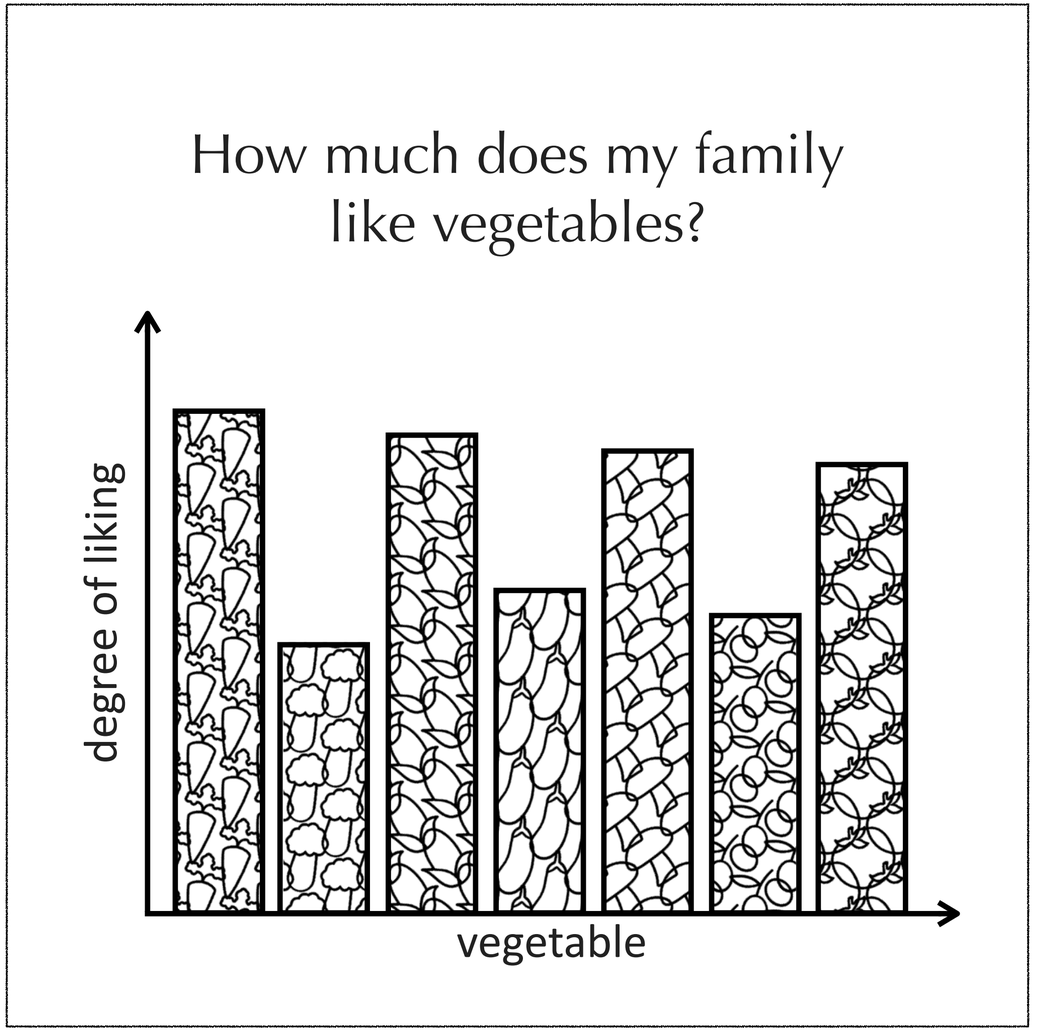
carrots	celery	corn	eggplant	mushrooms	olives	tomatos
4.33	2.33	4.11	2.78	4.00	2.56	3.89

Average rating score for each vegetable

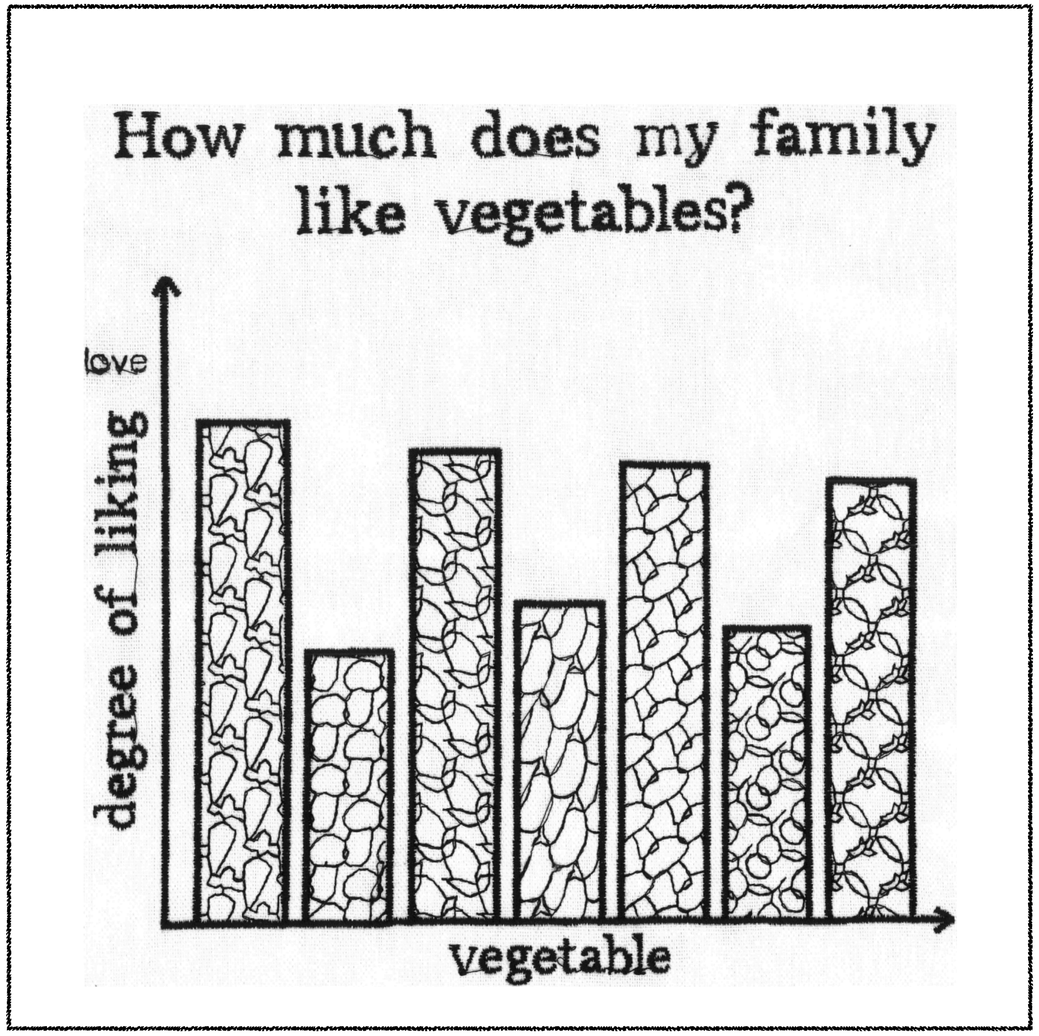


Visual representation

- This texture design looks great
  - Designed by an expert
  - Appealing to a specific family member
- Well-suited for machine embroidery
  - Textures: composed of lines
  - Iconic textures: eliminates the need for labels



260x200

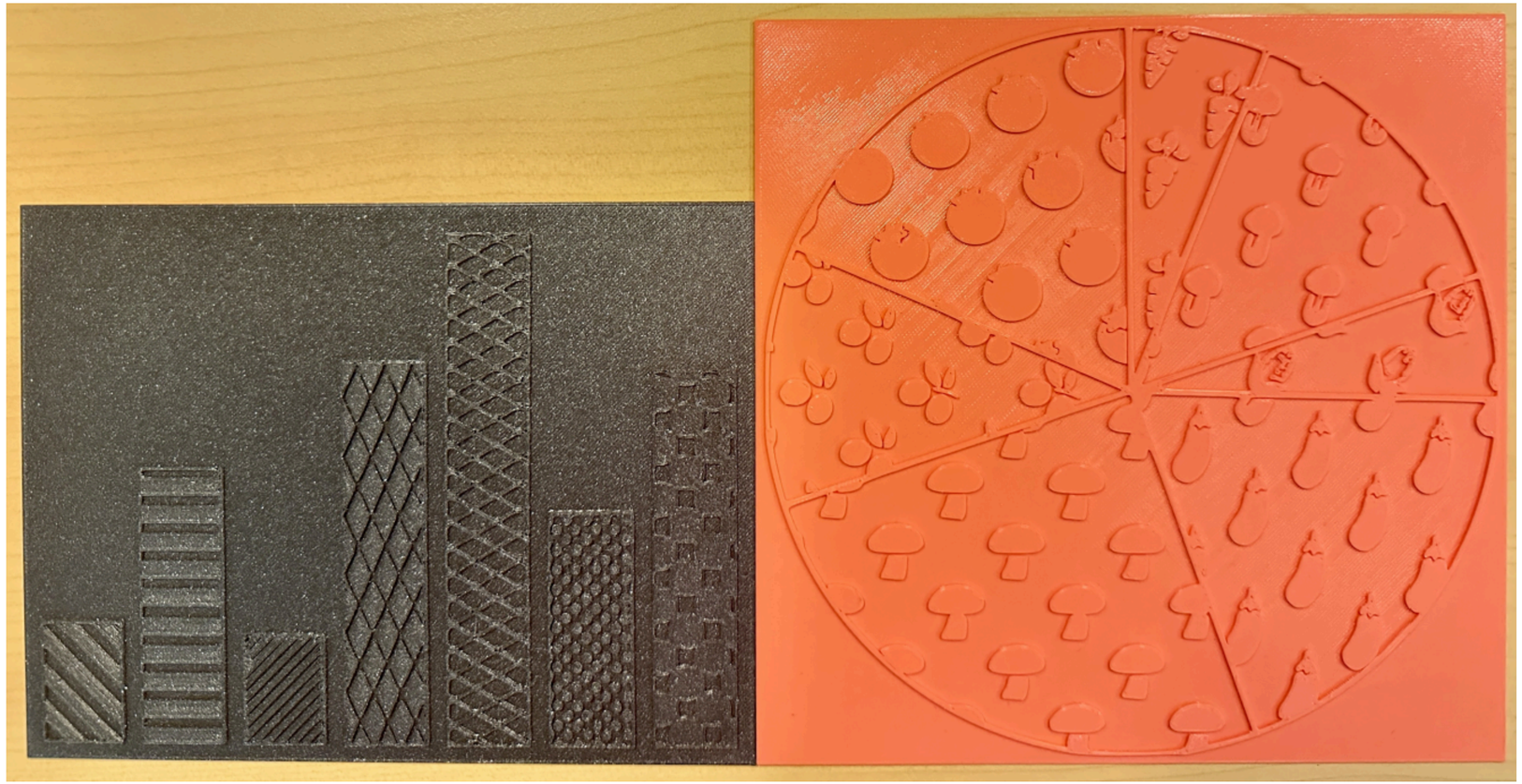

How much does my family like vegetables?
degree of liking
love
vegetable

How much does my family like vegetables?
degree of liking
love
vegetable

A daily reminder of
the family's preferences

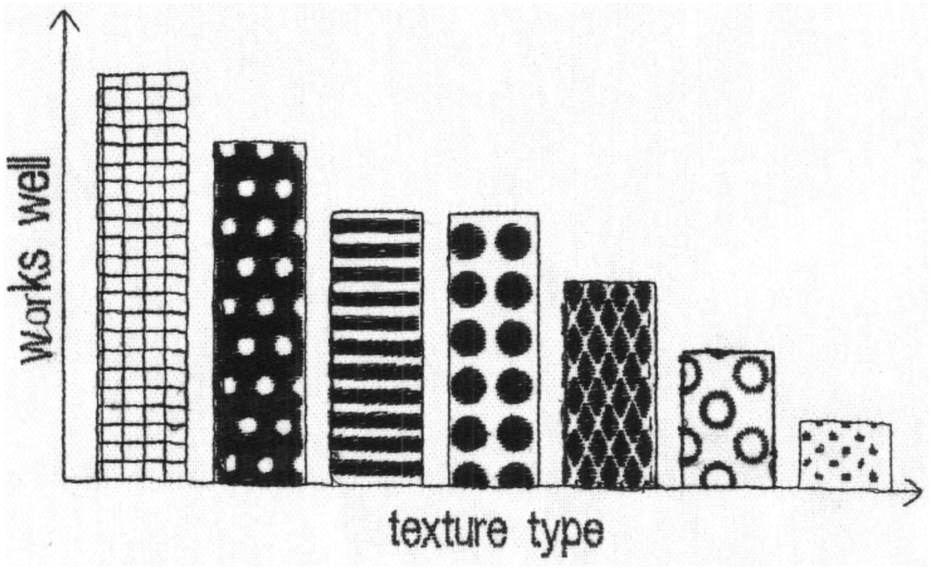
Data physicalization using b/w textures

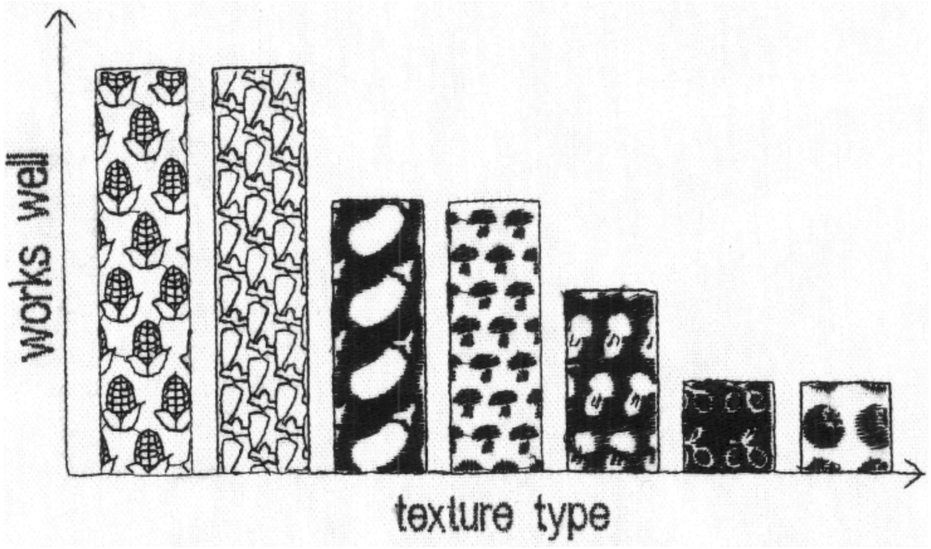
- 3D printing
- Laser engraving
- Vinyl cutting
- Embossing
- …



3D printed textures

B/W textures have a lot of potential, not only for data embroidery but also for data physicalization in general.





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