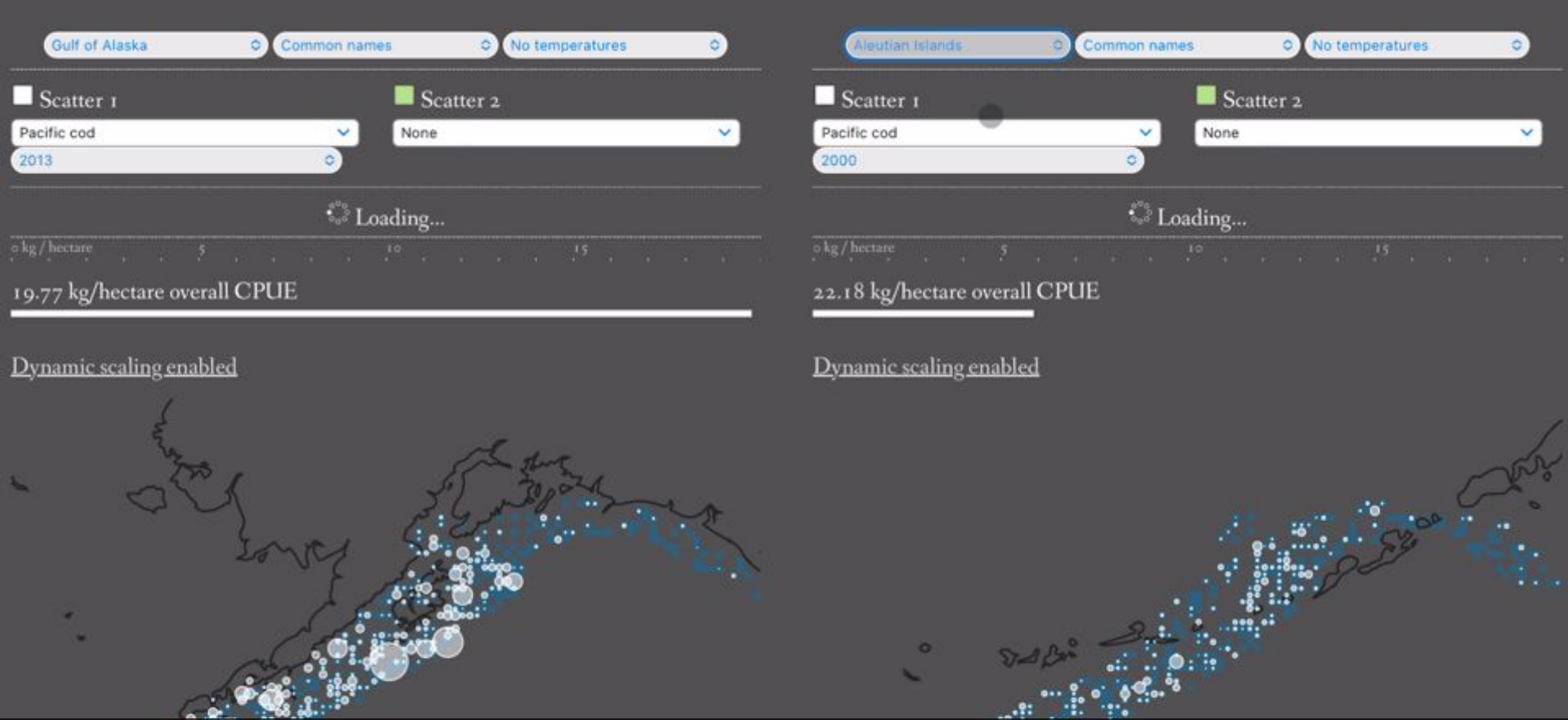


Visualization, Interactivity, Co-Design

in Exploring Humanity and the Built Environment through Data

A Samuel Pottinger

Mar 3, 2026

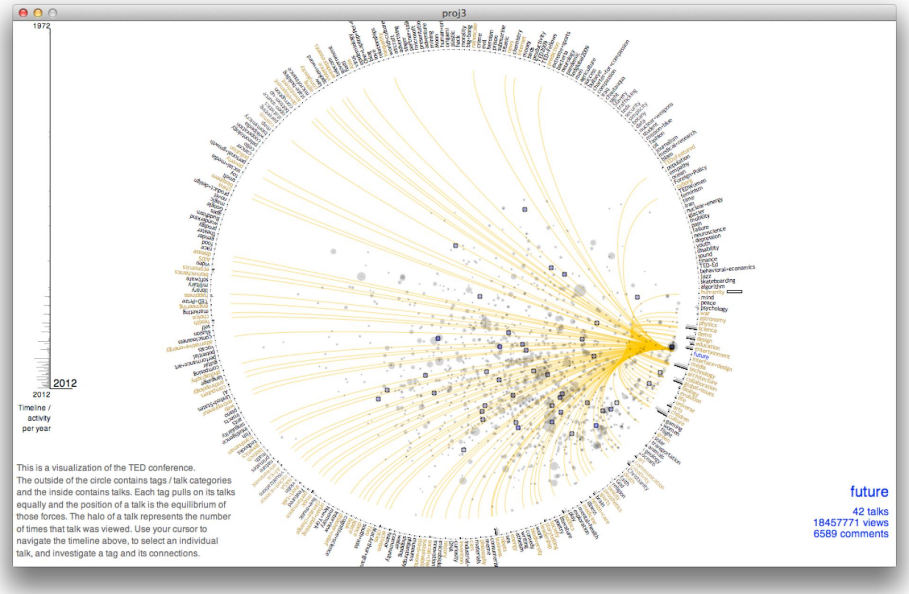
Introduction to Urban Data Analytics

Hello! I'm a data scientist, software engineer, and information designer.

Sam Pottinger
A more human-centered AI/ML
https://gleap.org

UC Berkeley | Data + Environment / Teaching
EVERY | Data + Synthetic Biology
IDEO | Data + Design
Plenty | Data + Indoor Agriculture
Apple | Data + Engineering
Google | Data + Visualization
LabJack | Data + Hardware

Processing | Data + Love in Java
Sketchingpy | Data + Love in Python



Today

Why engage data visualization at all?

Ingredients of data visualization.

Designing data visualizations.

Visualization and the built environment.

Year	Number of Wolves	Number of Moose
1980	50	664
1982	14	700
1984	24	811
1986	20	1025
1988	12	1653
1990	15	1216
1992	12	1600
1994	15	1800
1996	22	1200
1998	14	700
2000	29	850
2002	17	1000
2004	29	750
2006	30	385
2008	23	650
2010	19	510
2012	9	750
2014	9	1050
2016	2	1300
2018	2	1500

Premise: The human visual system is good at spotting patterns.

What year saw the most moose?

🎮 Raise your hand when you have it.

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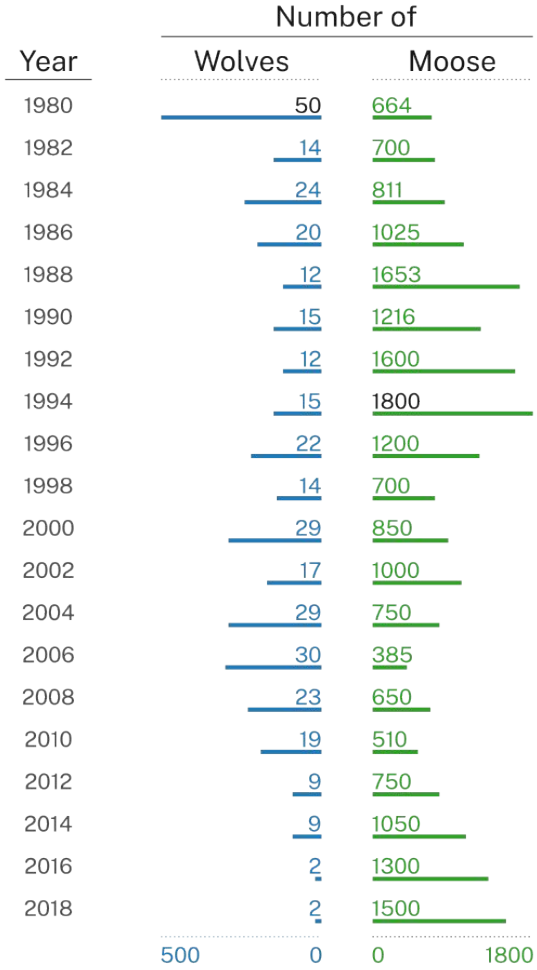

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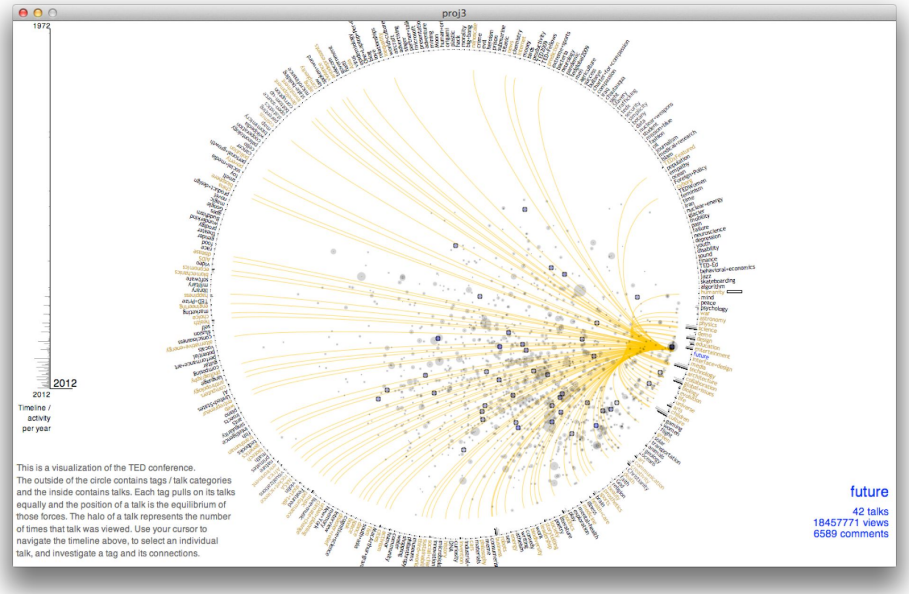
	500 0	0 1800

Premise: The human visual system is good at spotting patterns.

What is the relationship between wolves and moose in Isle Royale?

🎮 Raise your hand when you have it.



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Cleveland and McGill

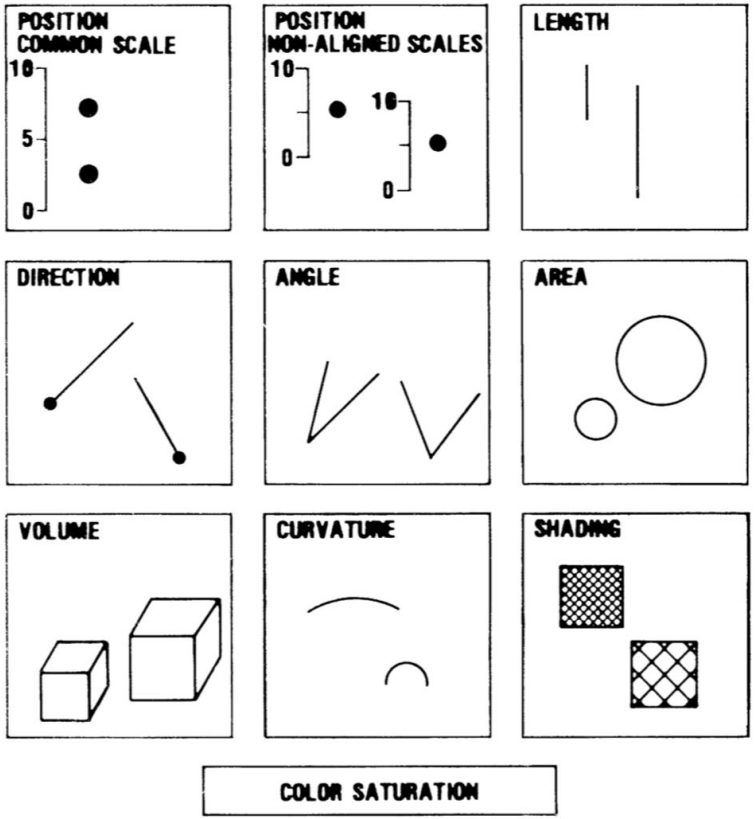


Figure 1. Elementary perceptual tasks.

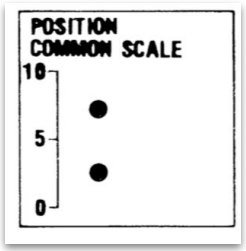
Evolution gives us preattentive features.

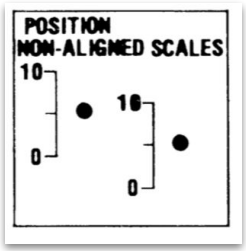
However, what is the right design of using those features?

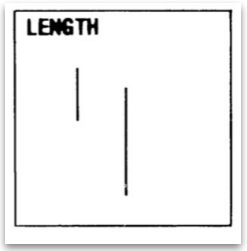
Presenting on Cleveland and McGill in addition to some work that came after as cited.

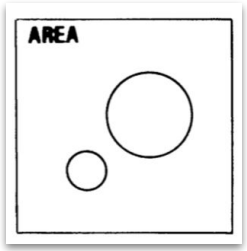
Fairly robust hierarchy

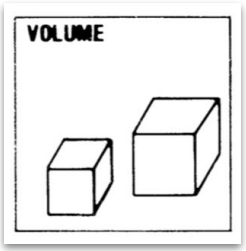
Higher Accuracy — Lower or Inconsistent

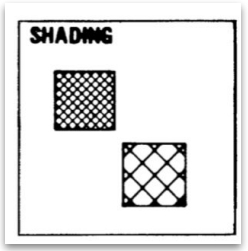


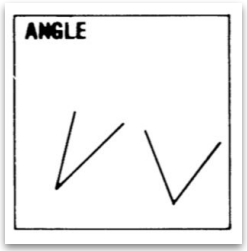




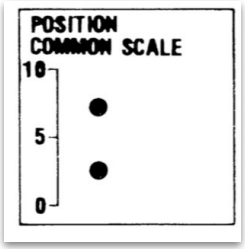




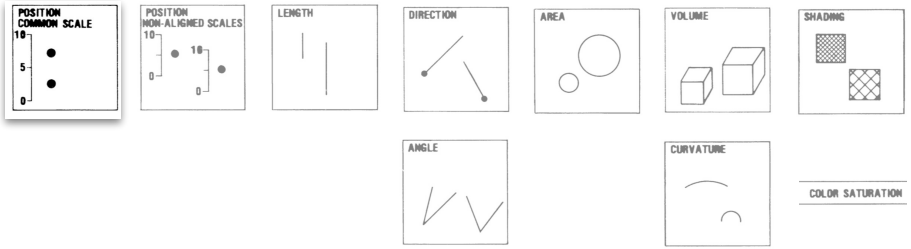




Fairly robust hierarchy



The highest accuracy encoding device is potentially not surprising as it underpins common patterns like scatter plots.



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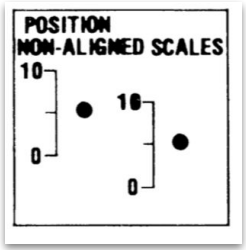
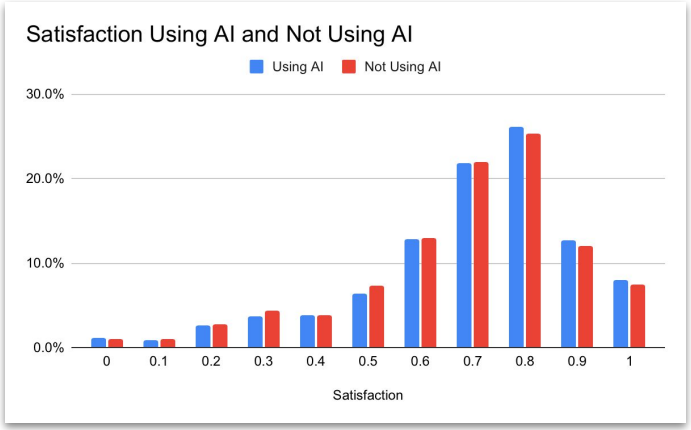
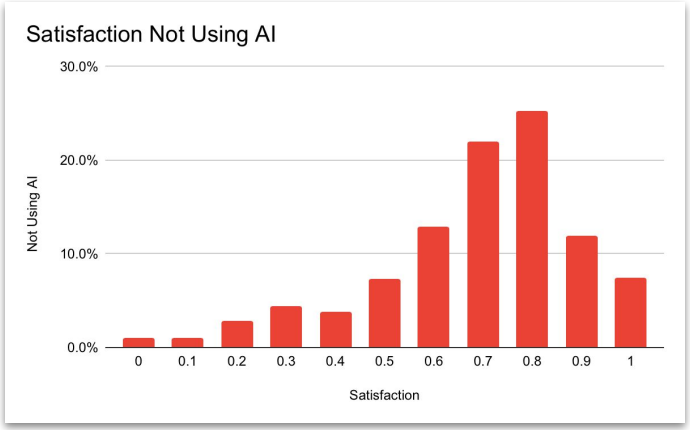
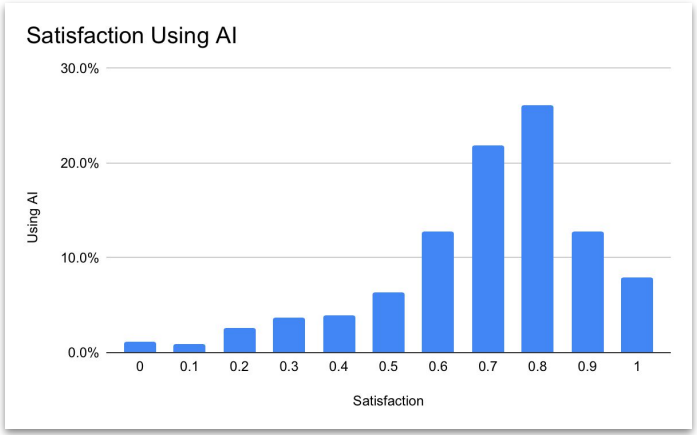
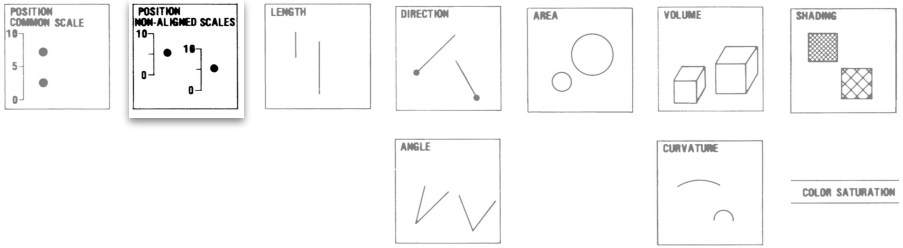


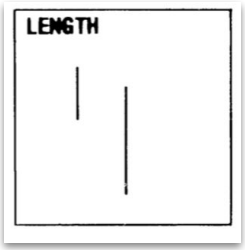


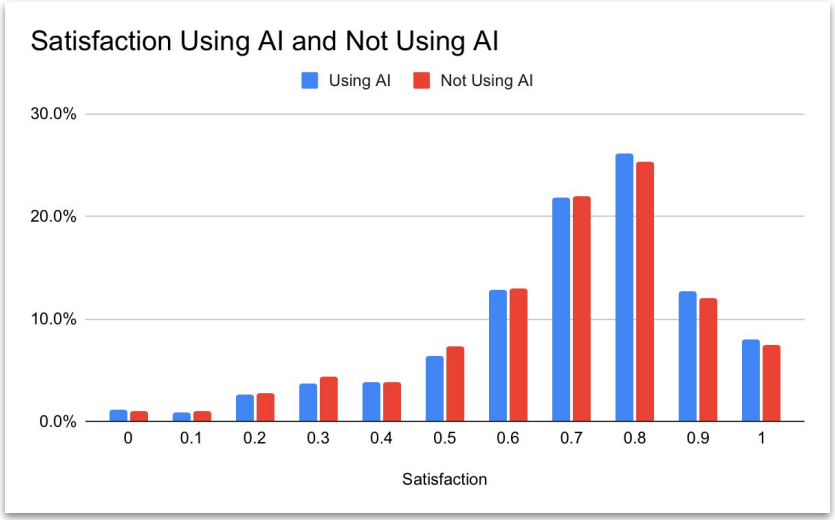


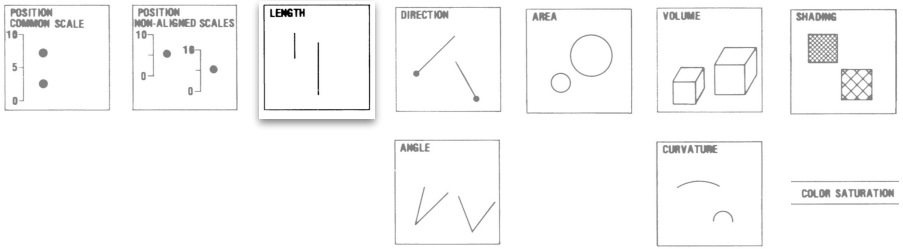




Fairly robust hierarchy



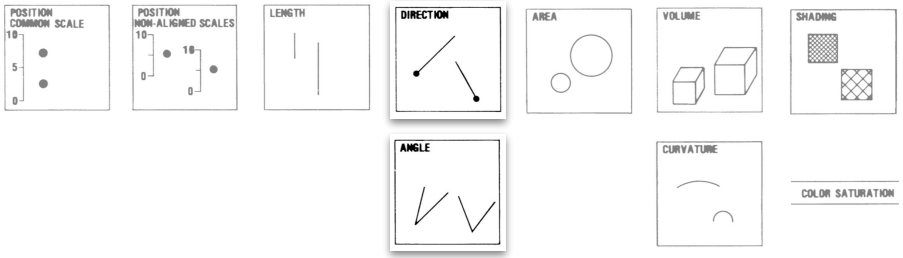




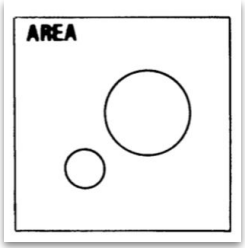
Fairly robust hierarchy

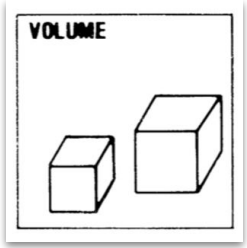
I am placing length higher than direction (slope) and angle because of consistency. There's evidence that we do better with angle closer to cardinal directions.

This is why pie charts may perform relatively poorly. Length typically has an easy fix: align against a common axis.



Fairly robust hierarchy

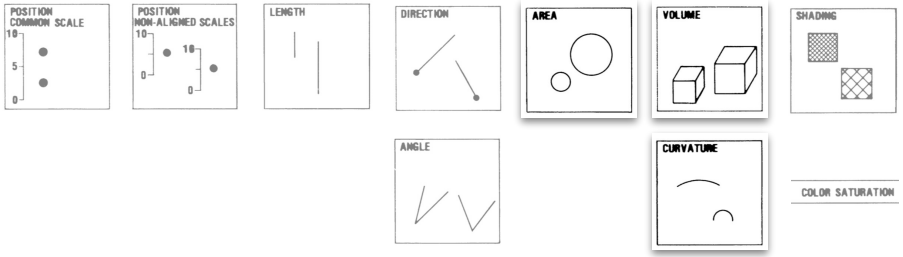




Volume generally goes poorly. This may be partially due to 3D representation within 2D media.

In general, area is good for less important “contextualizing” metrics.

Area has an issue: area vs radius.



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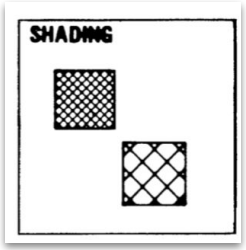
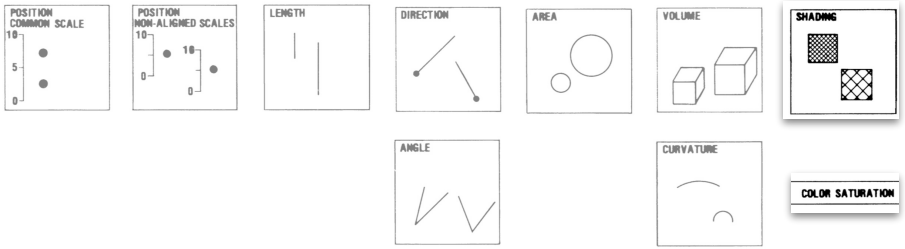


Color is fairly unreliable. It is often better for branding or complementing a message through emotion and aesthetic than it is for conveying quantitative information.

It may still serve a purpose for a limited number of qualitative groups.

Lightness generally better than hue.

Accessibility issues: readability and color-blindness.

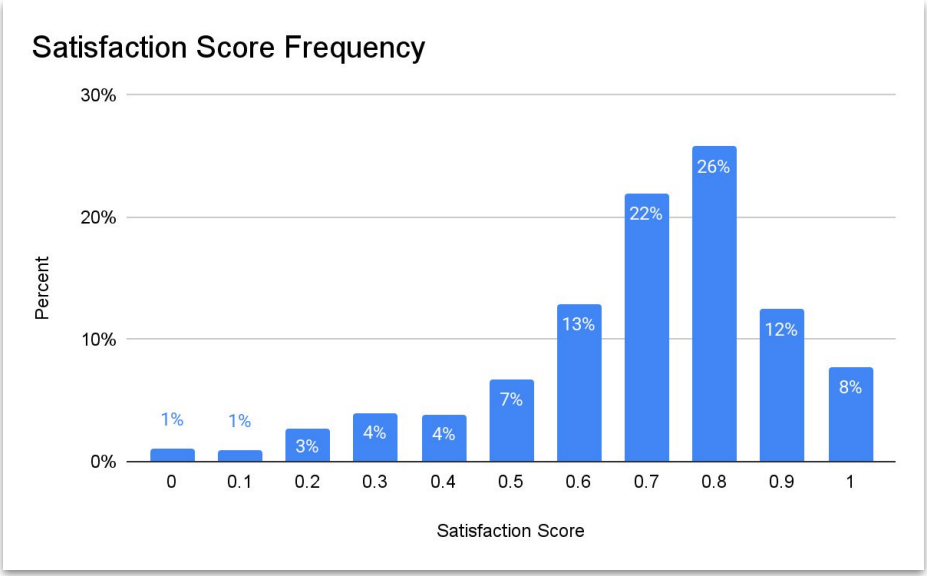


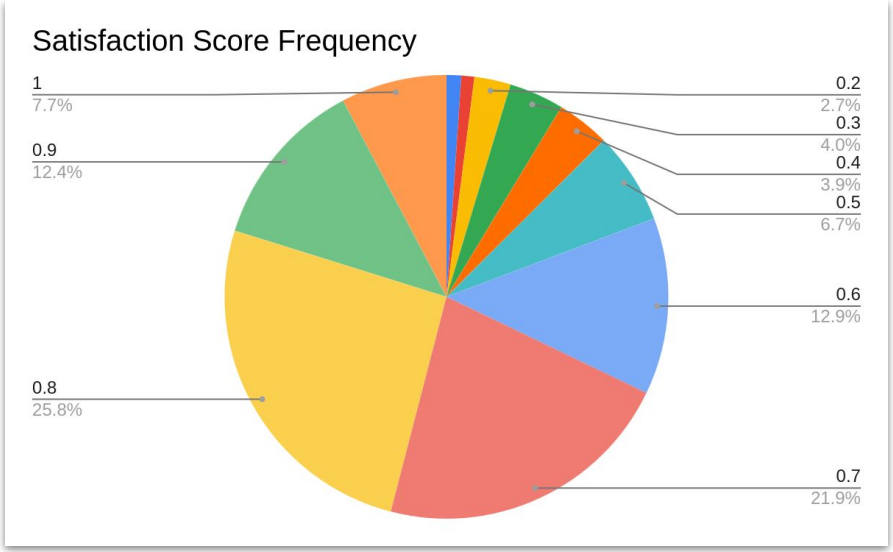
Group Activity

🎮

Which graphic is more likely to be read accurately?

Which one is more likely to be successful?





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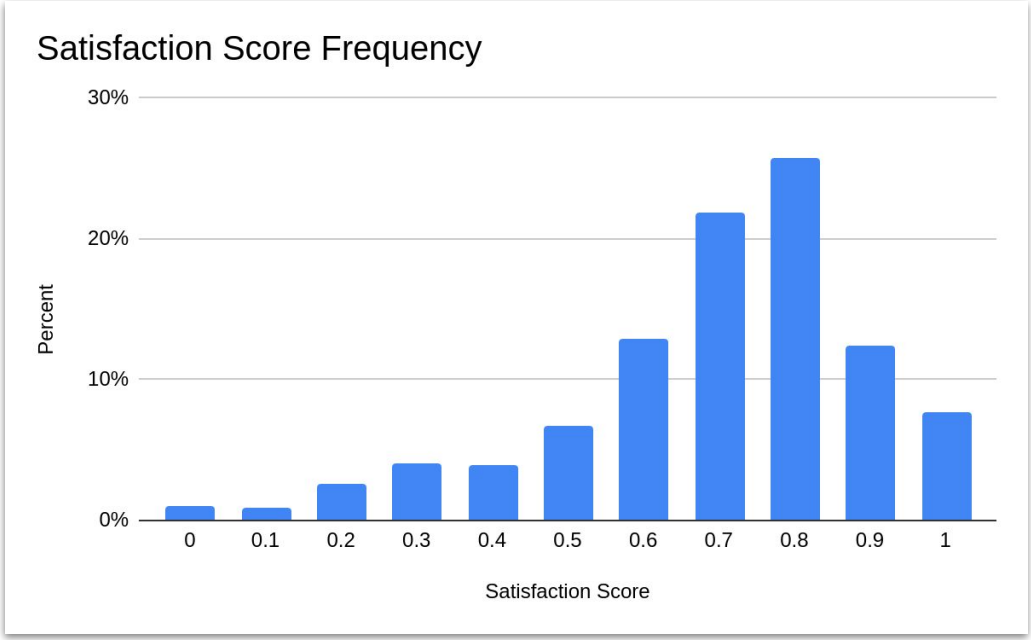
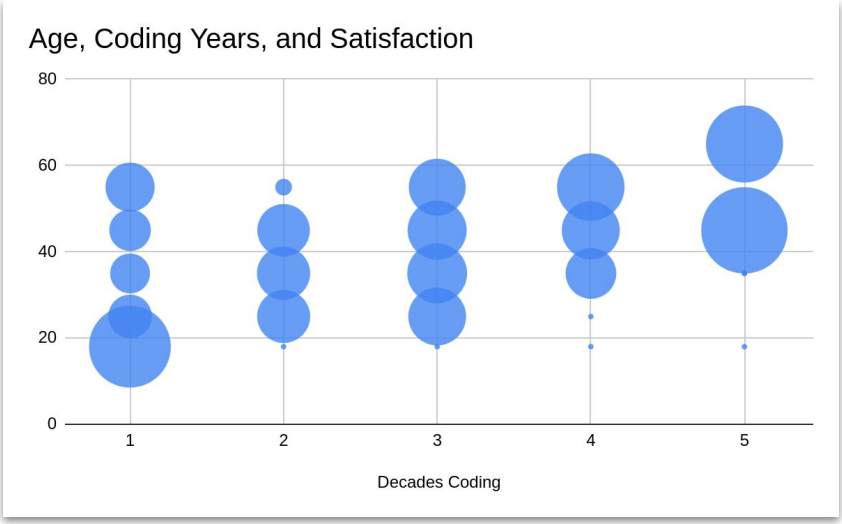


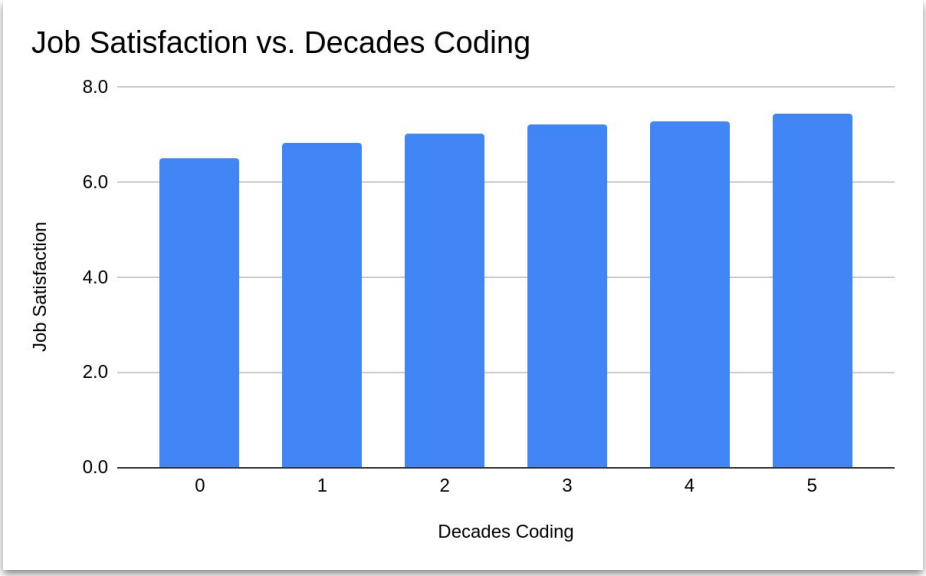
Satisfaction Score	Percent
0	
0.1	
0.2	
0.3	
0.4	
0.5	
0.6	
0.7	
0.8	
0.9	
1	

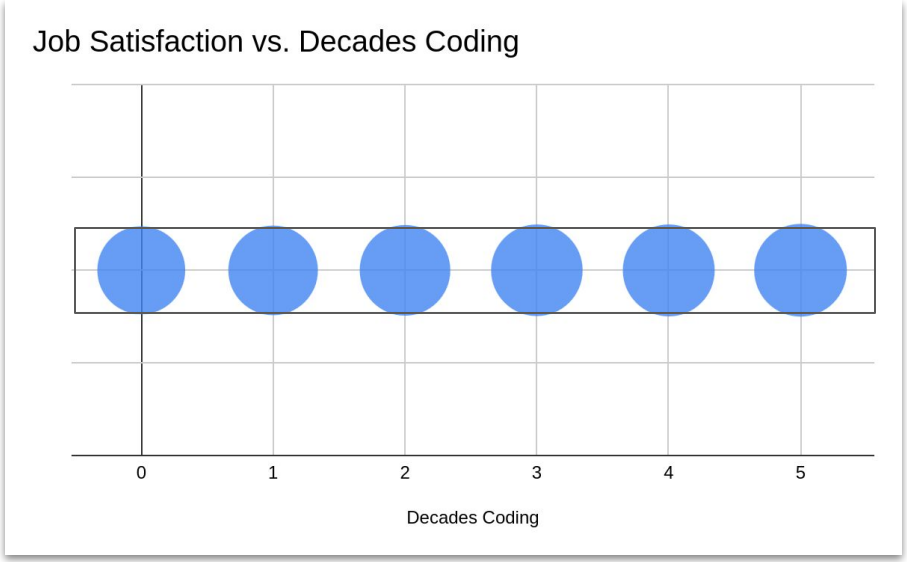
Which one is more likely to be successful?



Age Group	Decades Coding				
	1	2	3	4	5
65					1
55	1	1	1	1	
45	1	1	1	1	1
35	1	1	1	1	
25	1	1	1		
18	1				

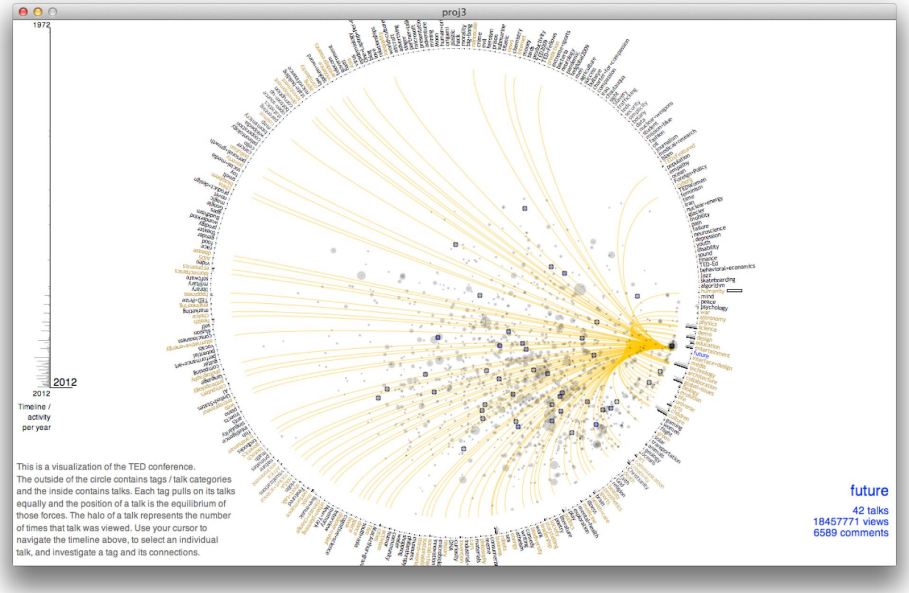
Which one is more likely to be successful?





Pause here

If you got here, you did great!
Please wait and we will reconvene as a group!



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Ingredients of data visualization.

Designing data visualizations.

Visualization and the built environment.

How can data become visible?

Data -> Graphic

4 Perspectives

| As representation

As task

As message

As dialogue

Why and how different groups do data visualization. How you can think about it in your work.

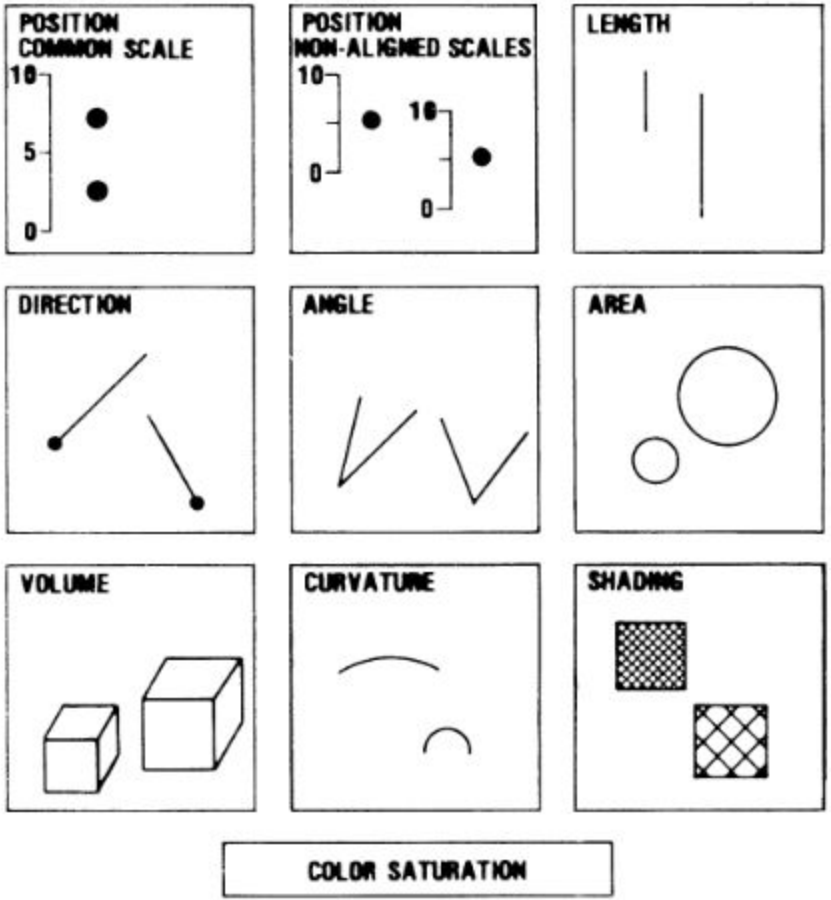


Figure 1. Elementary perceptual tasks.

Example: This first way of thinking about data visualization focuses on encoding.

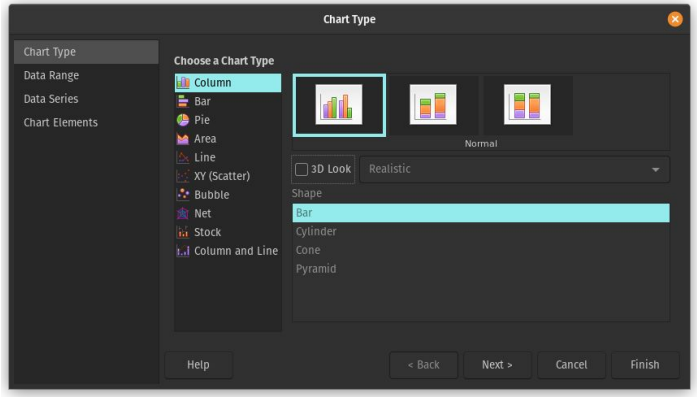
How do we “map” attributes of data to visual attributes?

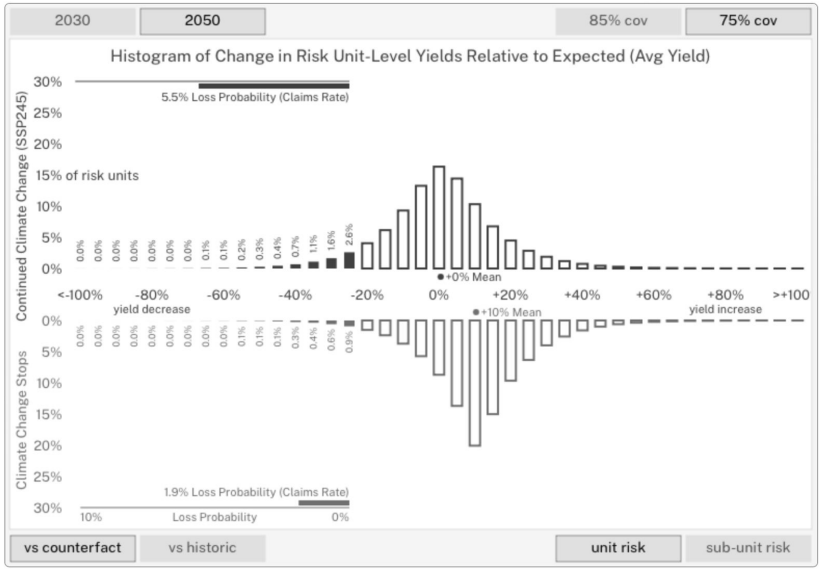
What visual encodings are better than others?

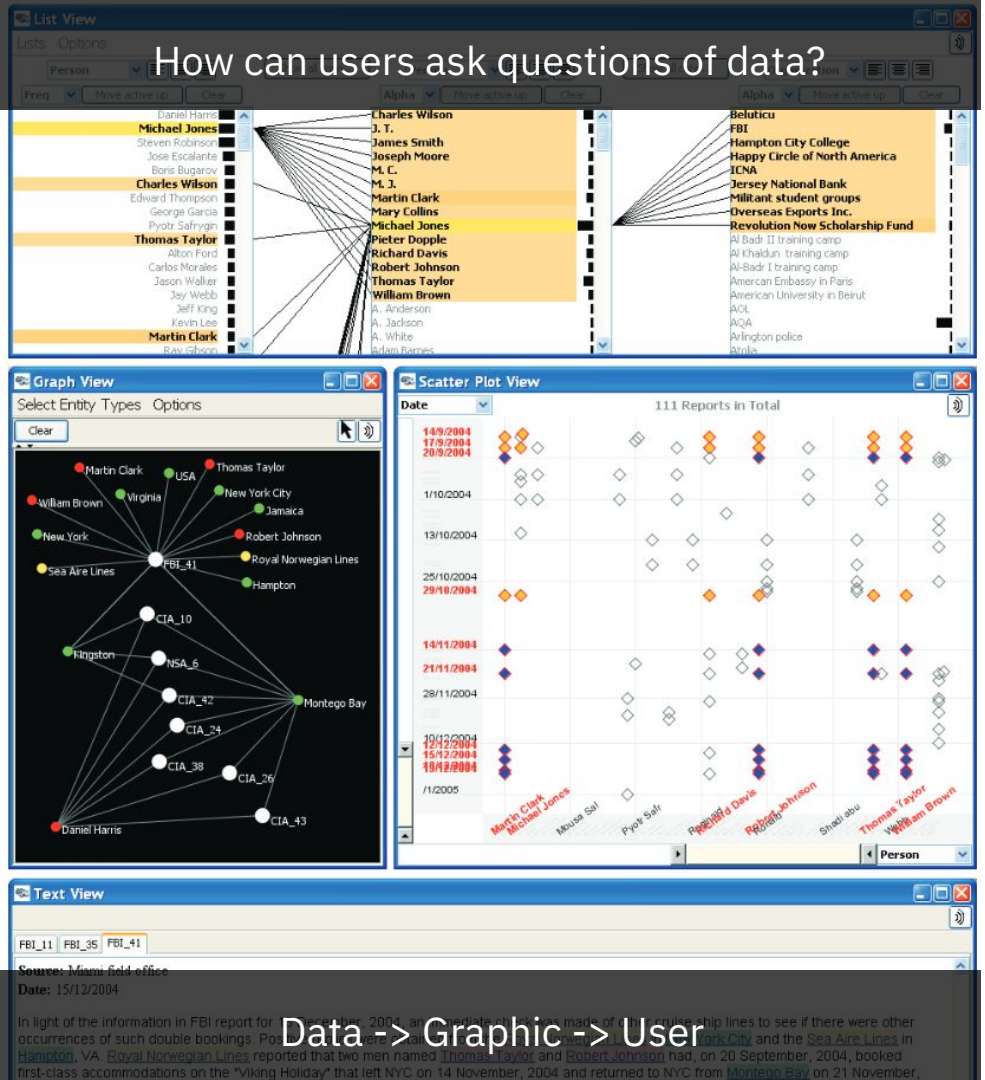
How do we make visualizations accessible?

Offers: Flexibility beyond the chart wizard but principles to guide us.

Gives us the basic building blocks for how humans process visual information but lets us use that understanding in many different ways.







4 Perspectives

As representation

| As task

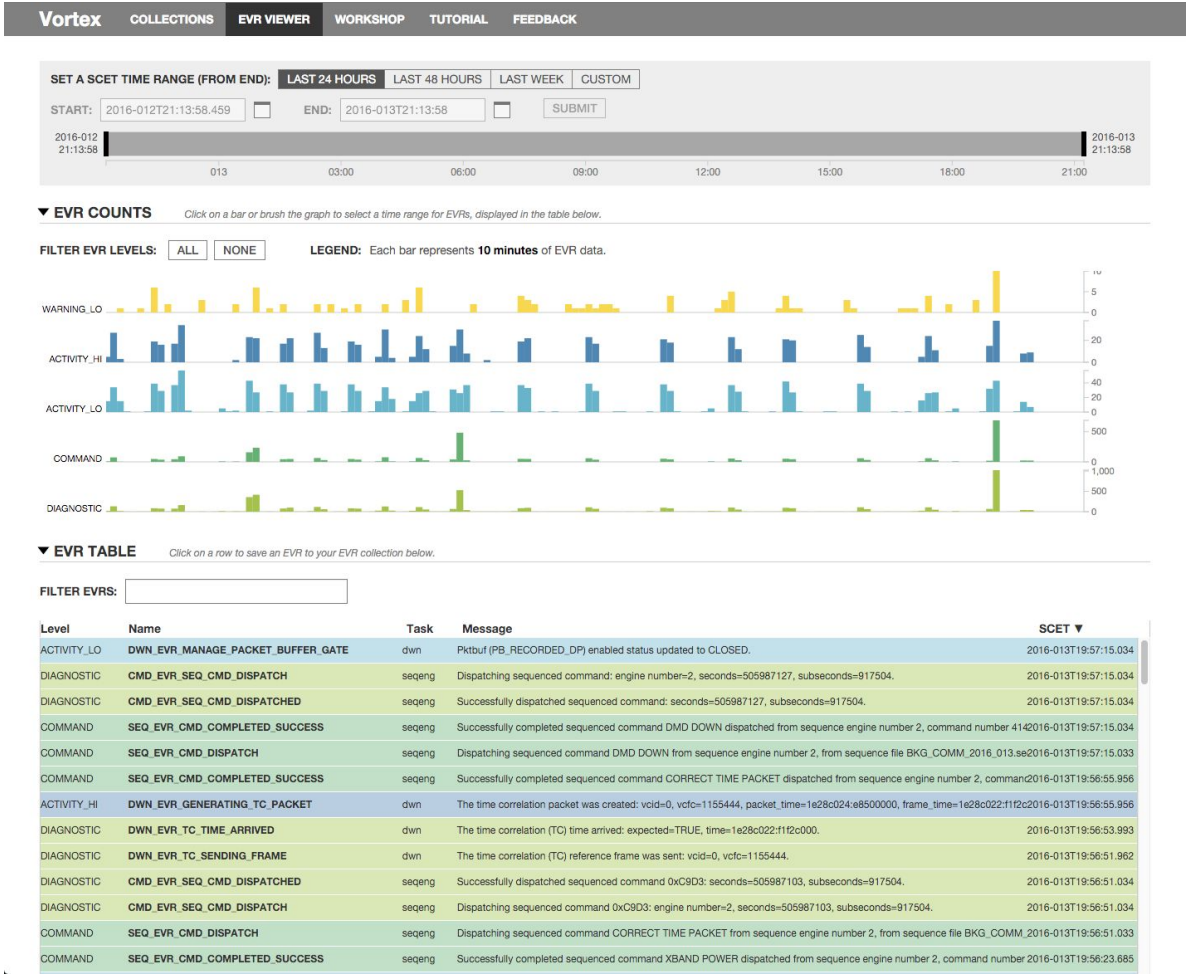
As message

As dialogue

Why and how different groups do data visualization. How you can think about it in your work.

Premise: Visualizations are part of a broader user journey.

A structured way to think about the user in the context of data visualization.



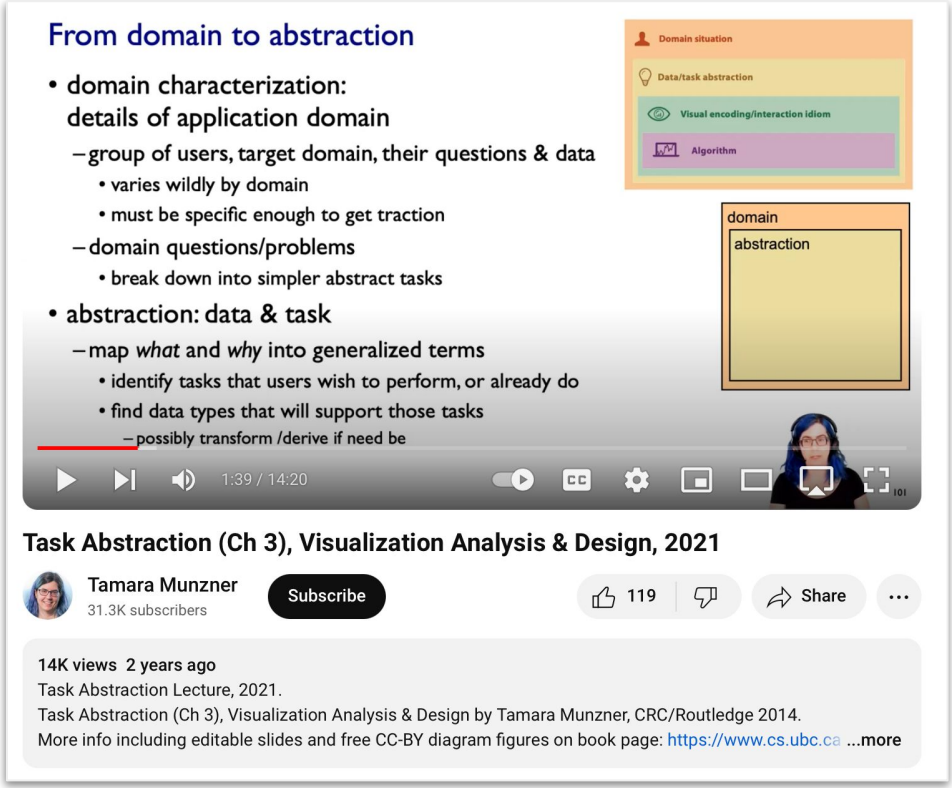
Example: Rachel Binx at NASA.

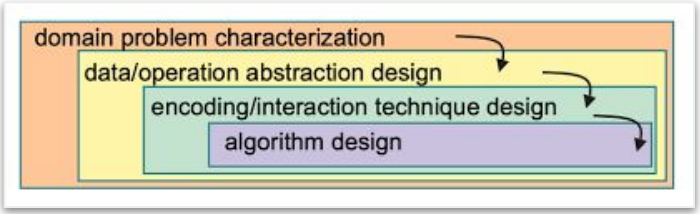
Looking at “event records” sent from spacecraft to NASA.

Interviewed a bunch of users to figure out how they worked with these data previously (log files).

Binx talks about how people had never seen their data before visually and the periodicity of events was revelatory for example.

Boils down into “tasks” the user executes and build user experiences to support those tasks.





Offers: Structured evidence-based understanding of the user to support them in their tasks.

Oritents around domains, tasks, questions, and data.

Fits within a broader modern user experience design dialogue.

Hello! Are you here?
What does it mean to be here?
How can I help you be here?
Please let me know after checking in.

Note: there will be a brief mention of gun violence I will offer a heads up.

How can data tell stories?

Data -> Graphic -> Audience

4 Perspectives

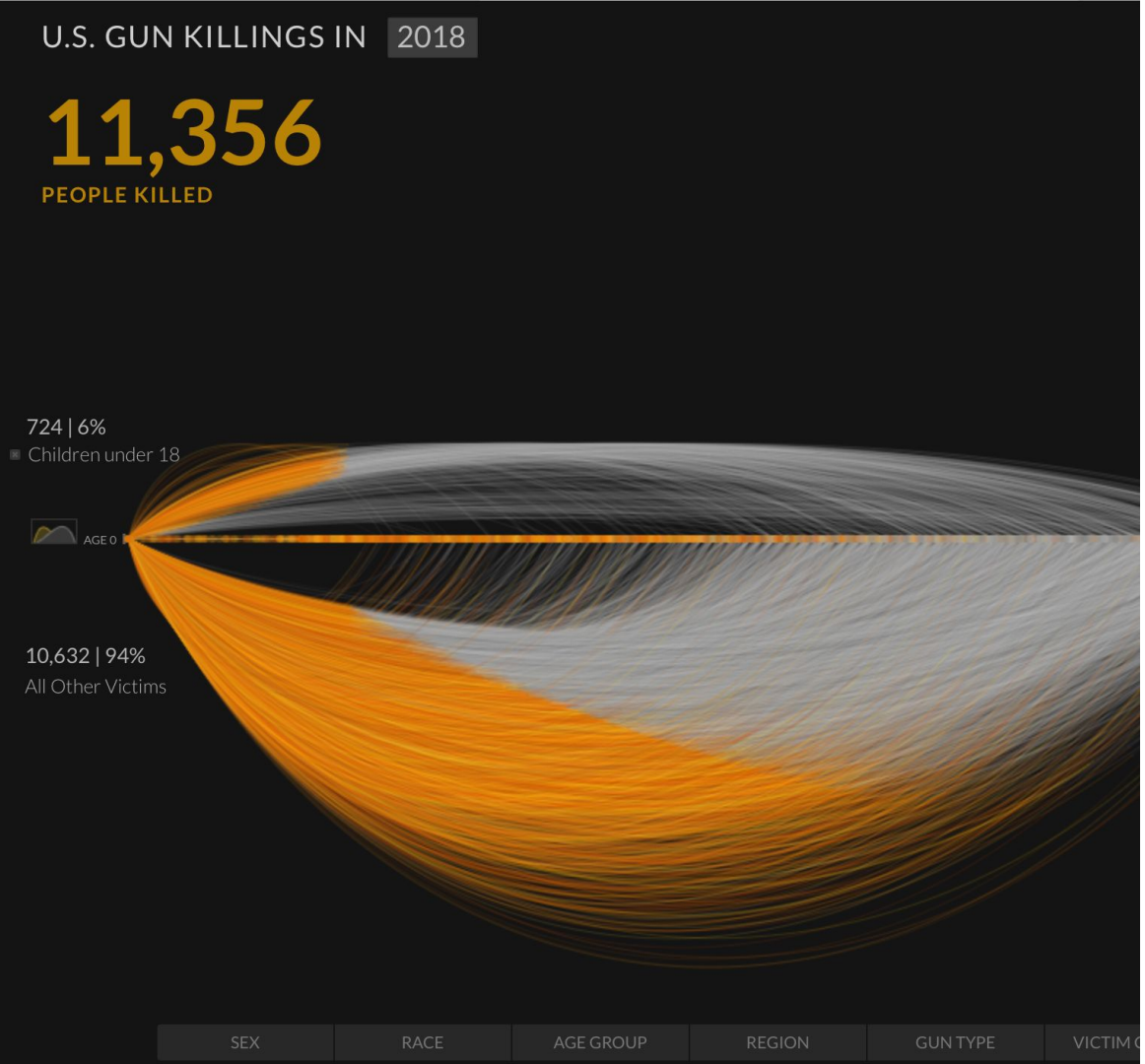
As representation

As task

| As message

As dialogue

Why and how different groups do data visualization. How you can think about it in your work.



Premise: Forms given to data enable authors to convey a message to a reader.

How does the reader feel when going through a visualization?

Where is efficiency helpful but where does it conflict with the message of the piece?

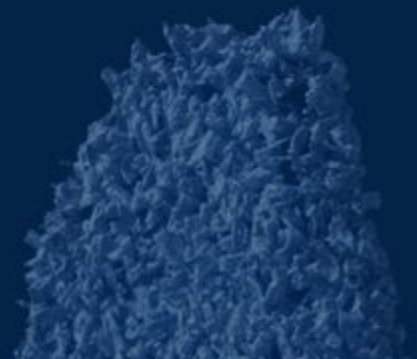
How might we defy reader expectations or have them confront prior held beliefs?

guns.periscopic.com

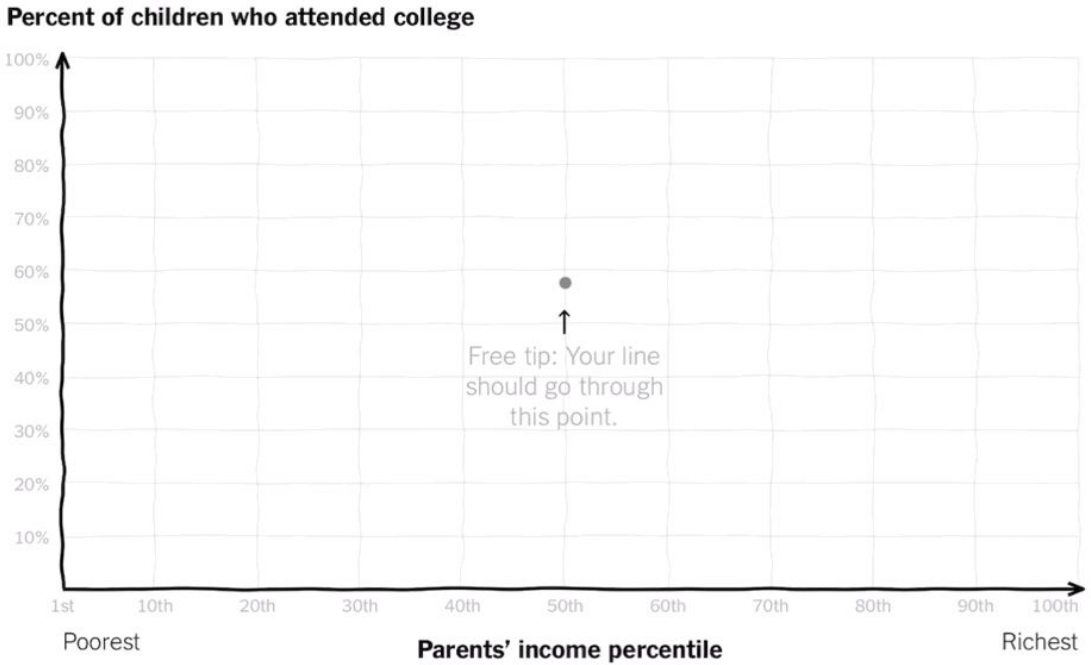
A Treaty To End Plastic Pollution. Forever.

World leaders must take steps to drastically limit the impact of plastics on the environment and human health

CHOOSE OUR FUTURE



Draw your line on the chart below



I'm done

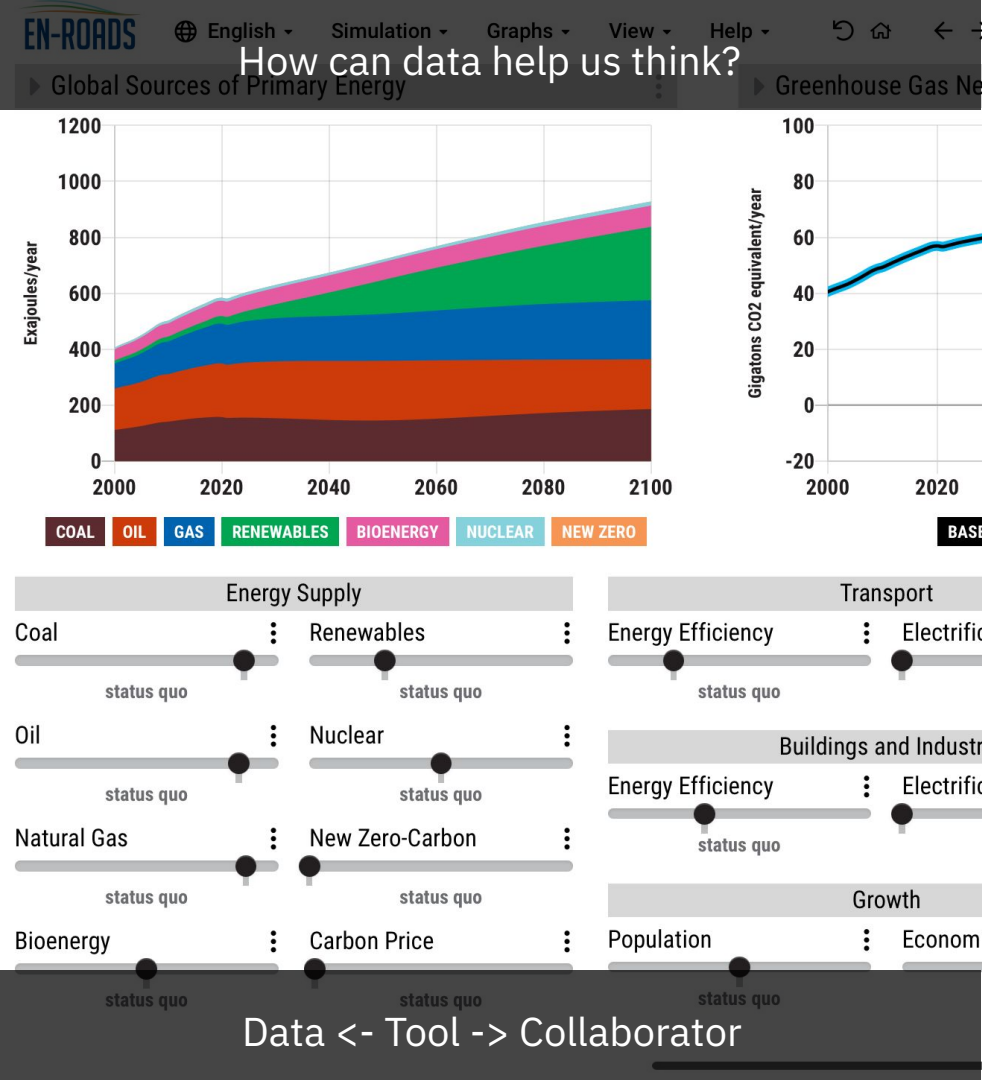
Start over

Offers: A way to convey messages with logos and pathos.

How to invoke emotional response.

How to challenge reader assumptions.

How to understand the process by which messages and meaning are interpreted.



4 Perspectives

As representation

As task

As message

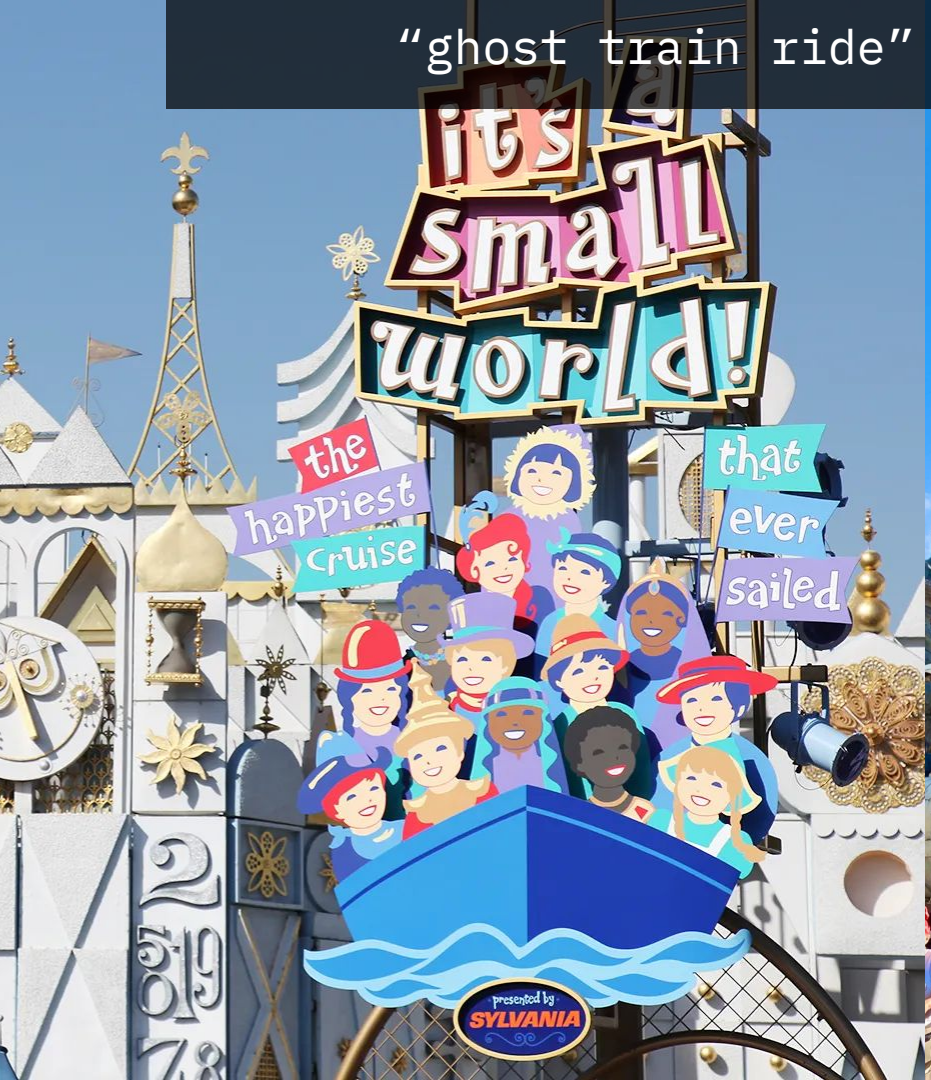
| As dialogue

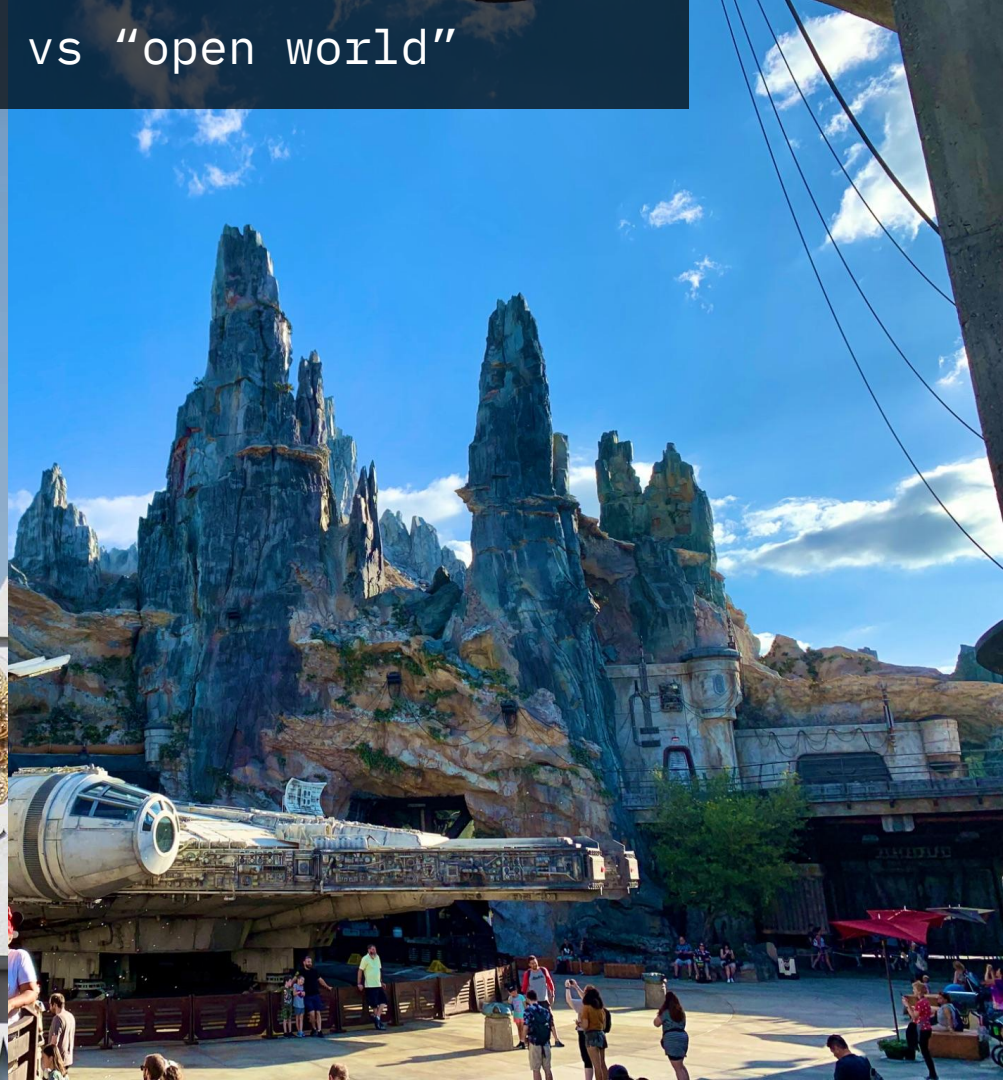
Why and how different groups do data visualization. How you can think about it in your work.

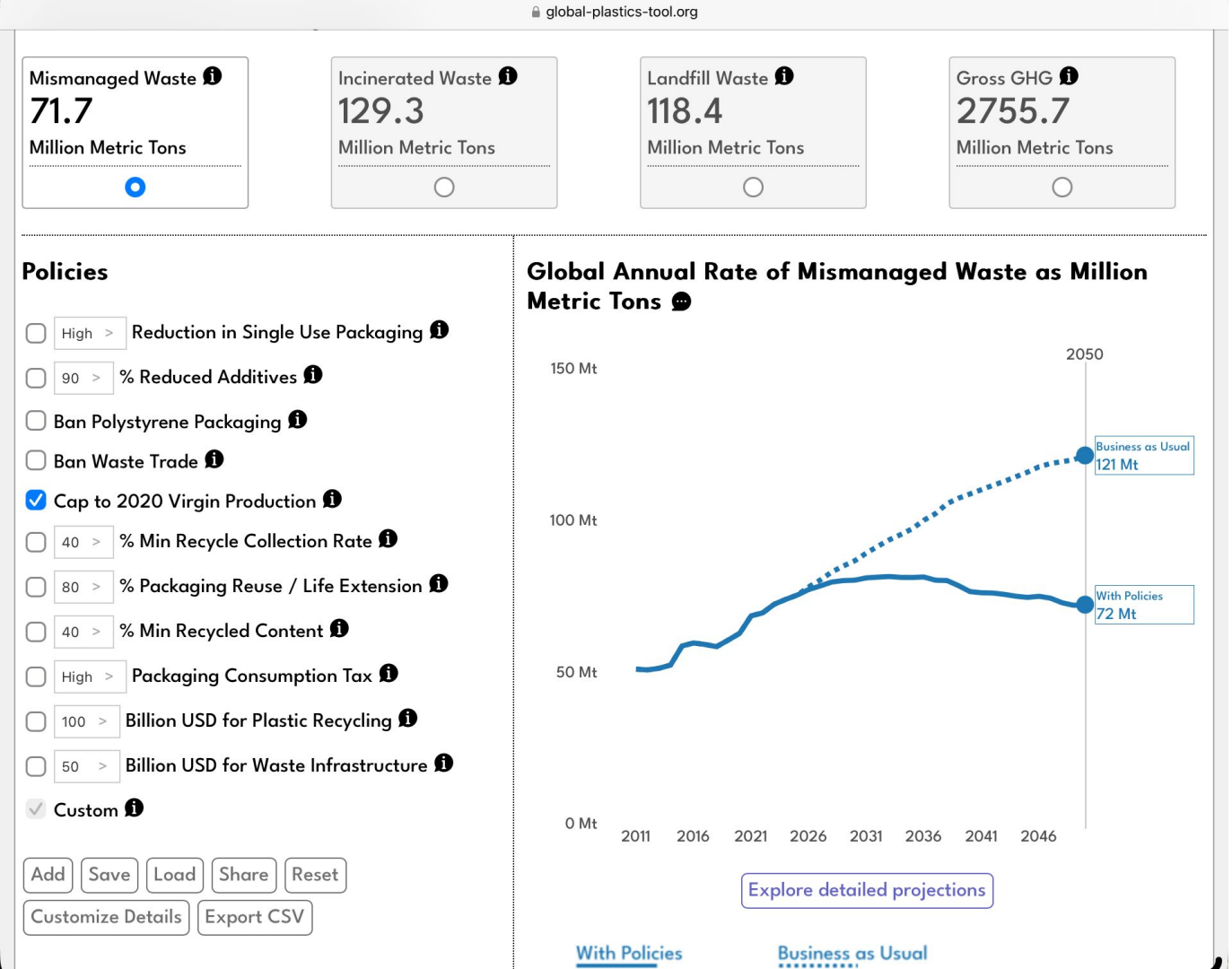
Premise: Data as humane dynamic media.

The designer creates media for thought, elevating the reader to an author of tools and co-creator of meaning.

“ghost train ride” vs “open world”







Example:
Finding a solution to the plastics crisis.

A layered experience in which the user can simulate different policies.

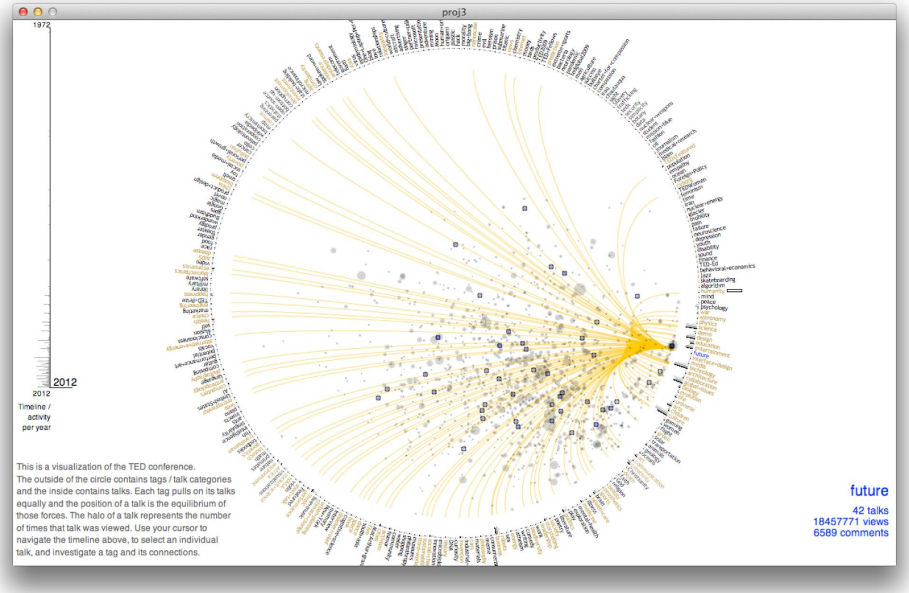
An invitation to build outside the original designer's intention.

🎮

https://global-plastics-tool.org

Let’s zoom out: What does good data visualization mean?

Perspective	**Good**	**Measurement**
Representation	Expedient	Controlled experiment
Task	Efficient	Think-aloud
Message	Expressive	Exposure / reflection
Dialogue	Explorable	Diary studies



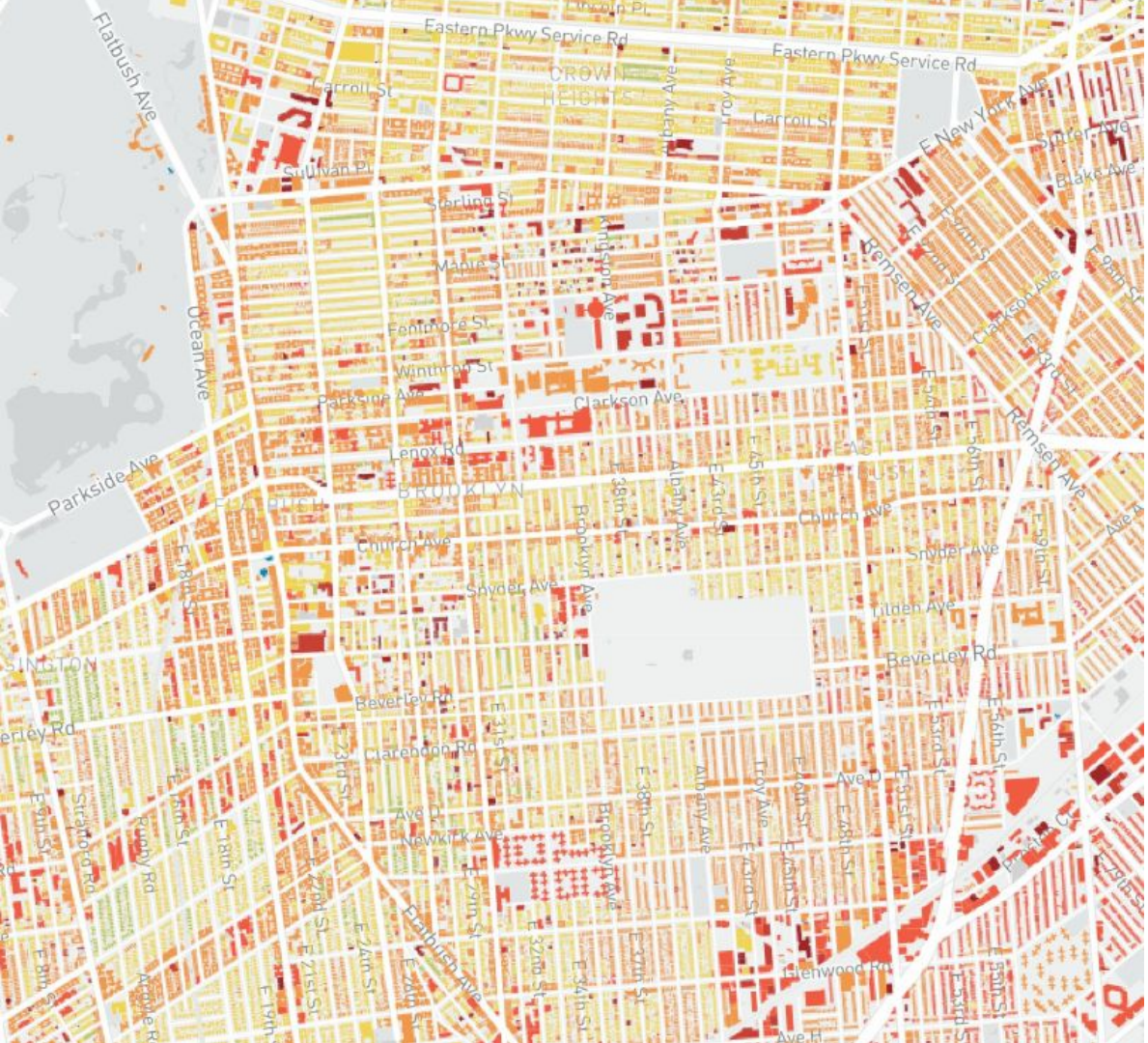
Today

Why engage data visualization at all?

Ingredients of data visualization.

Designing data visualizations.

Visualization and the built environment.



Let's start with a map.

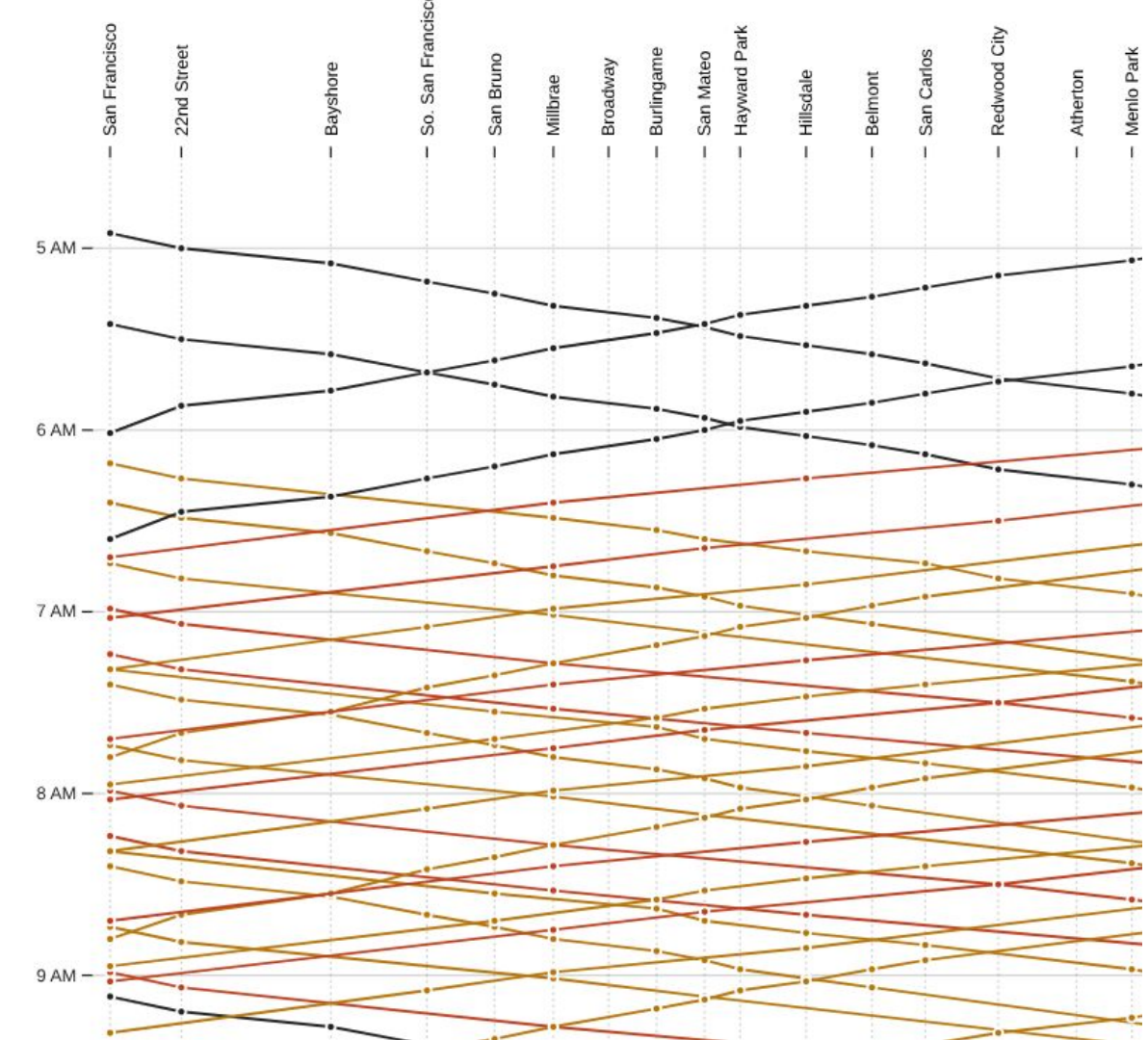
Maps are a common way of thinking about the built environment.

What are the encodings here?

What is good about a map?
What might be a drawback?

🎮

https://www.bklynr.com/block-by-block-brooklyns-past-and-present/



Let's try something else.

What if we don't use a map?

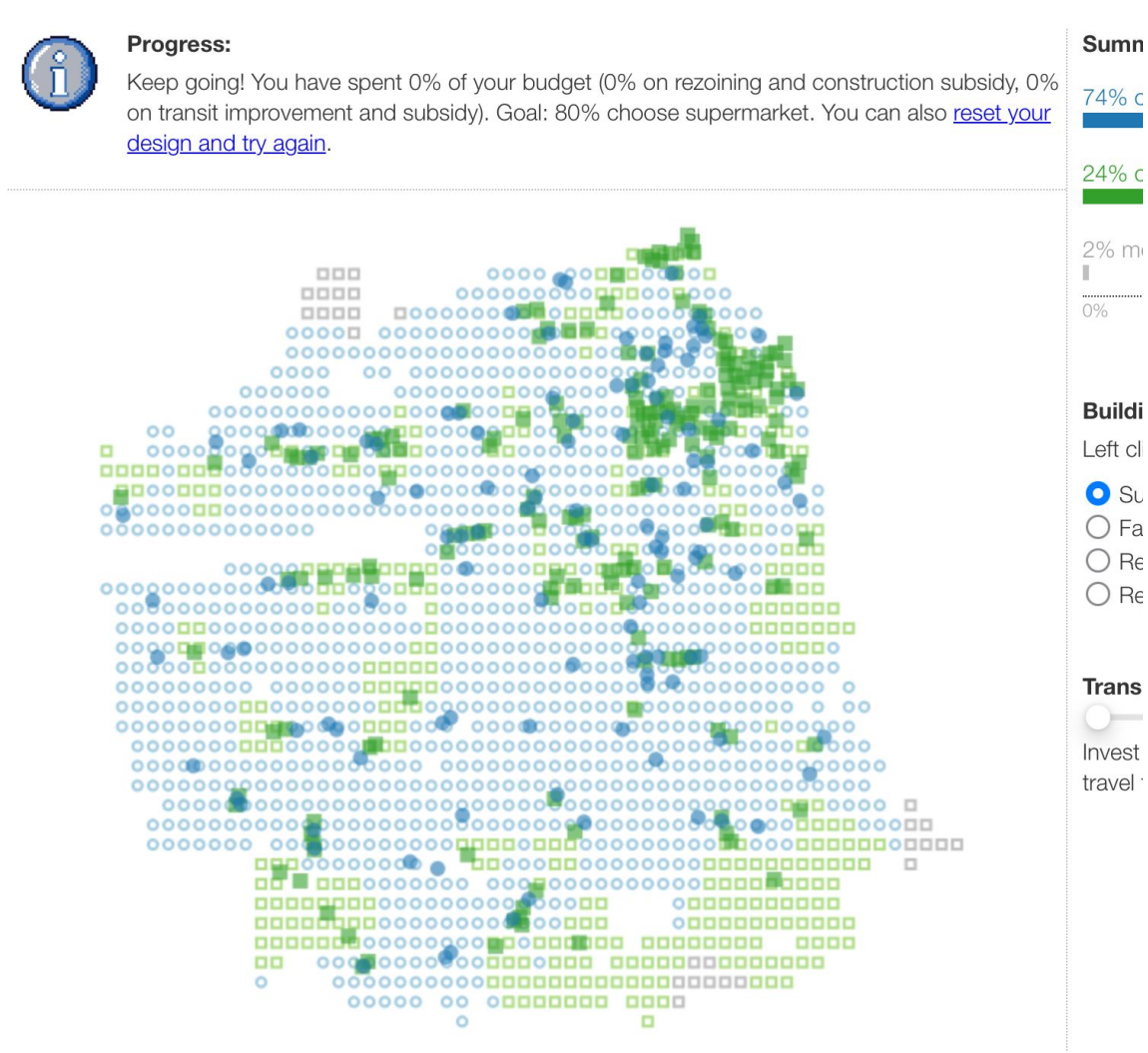
What is made visible here?

What is hidden?

How is geography experienced differently?

🎮

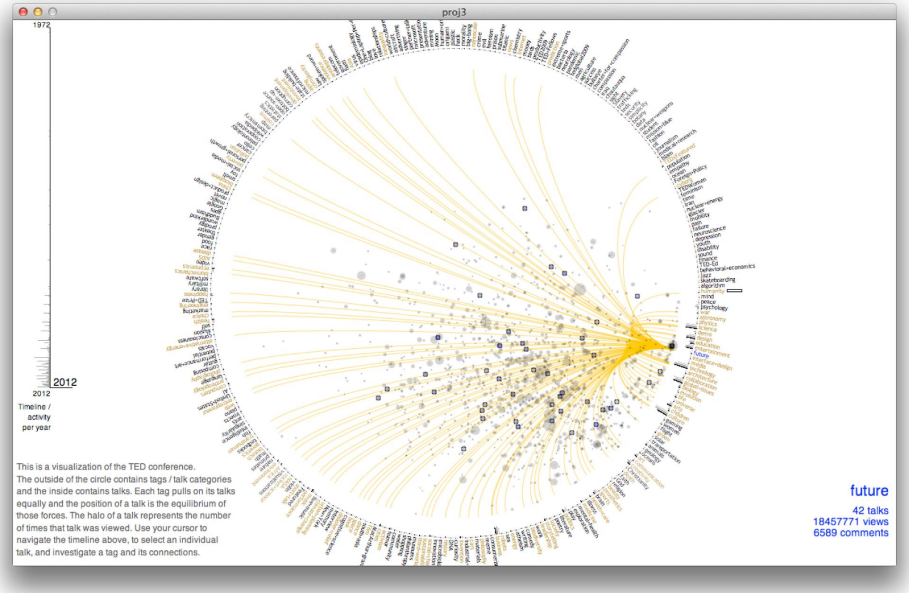
https://observablehq.com/@d3/mareys-trains



You are designing geography.

What is an interface and how does it prescribe framing or invite it?

🎮 foodsimsf.com



Today

Why engage data visualization at all?

Ingredients of data visualization.

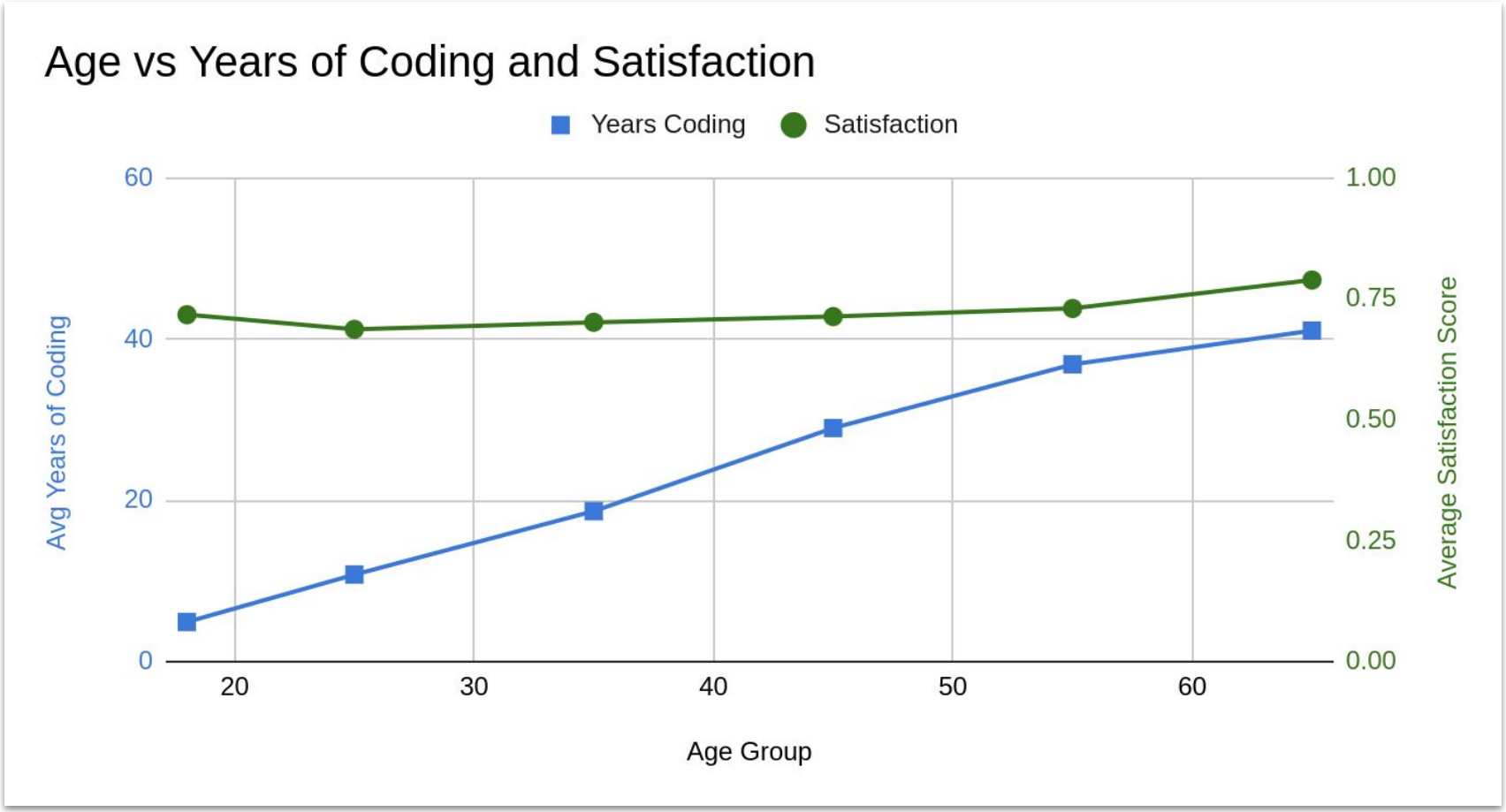
Designing data visualizations.

Visualization and the built environment.

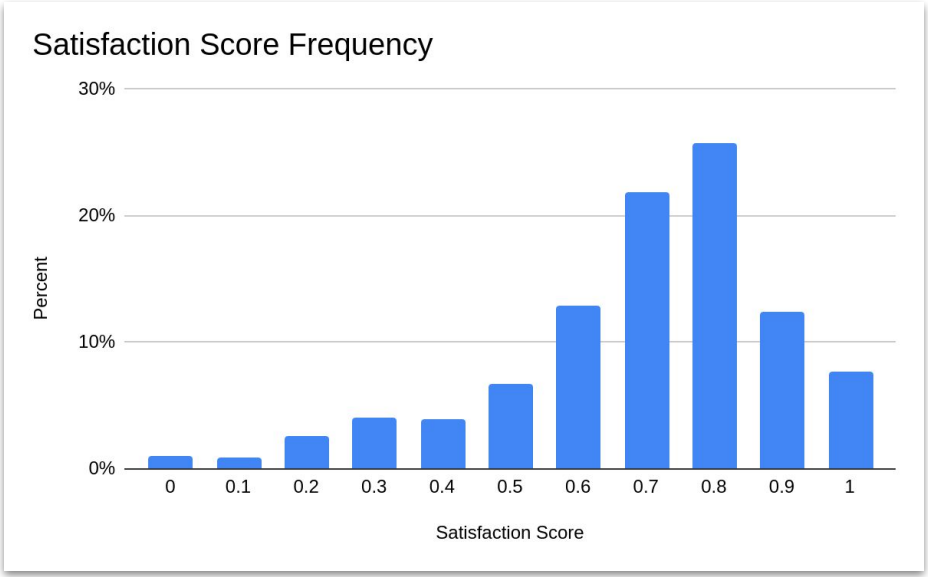
Keep it going: Check-in before we go to future.

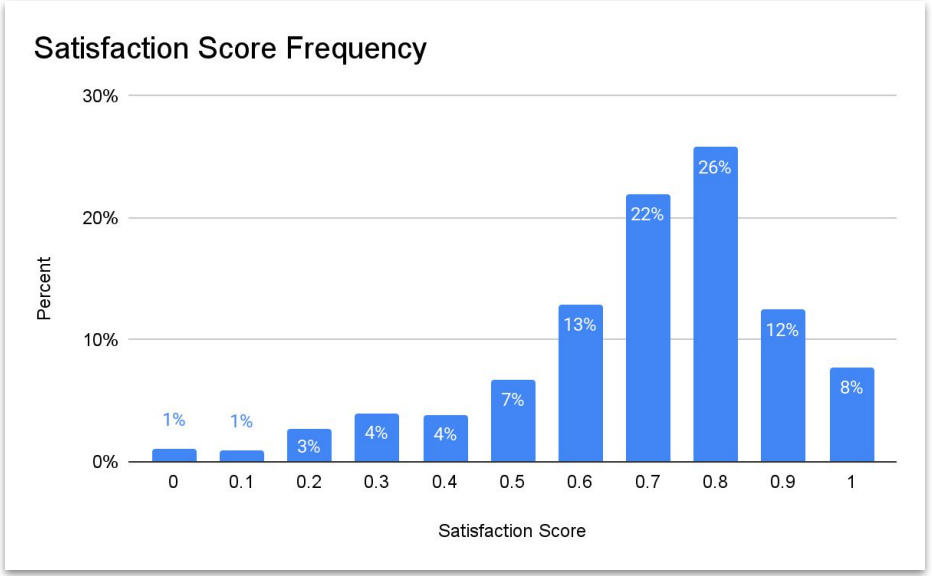
What’s something you learned today?

A few tricks: **Dual Axes**

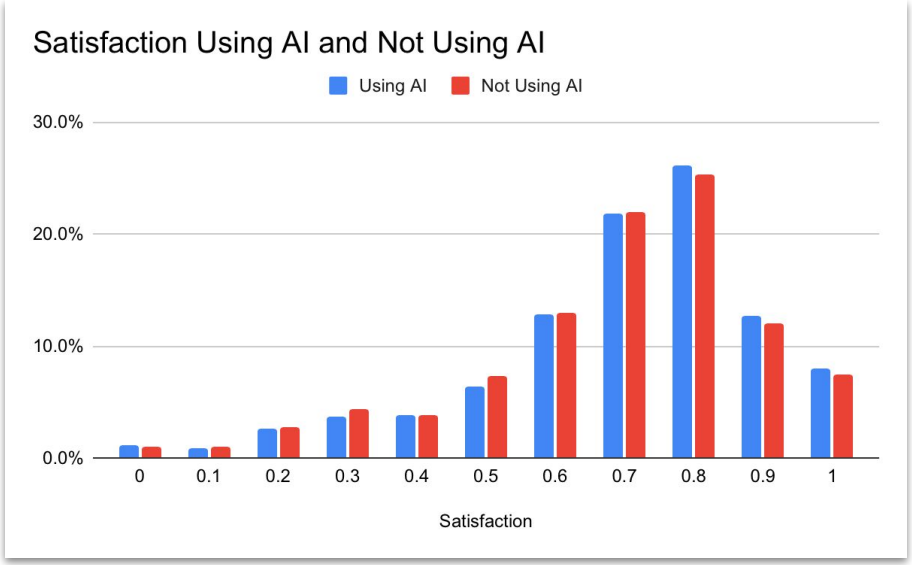


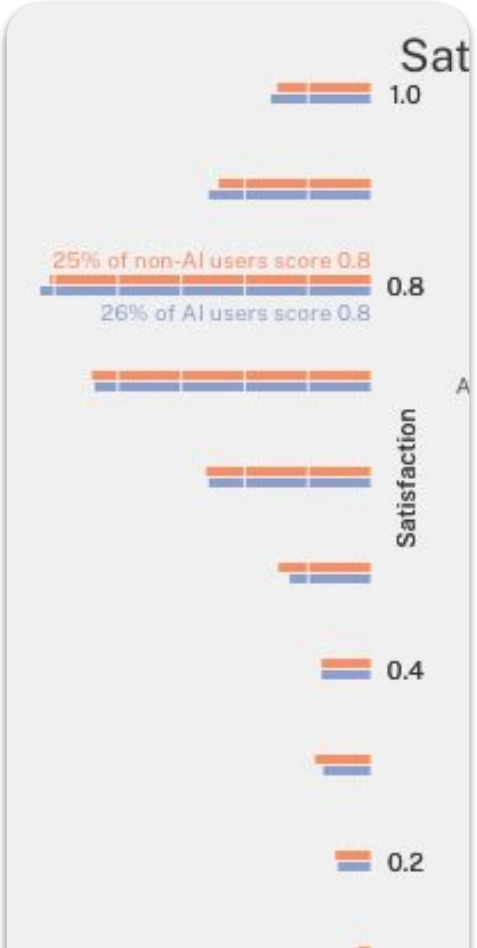
A few tricks: **Direct Labeling**

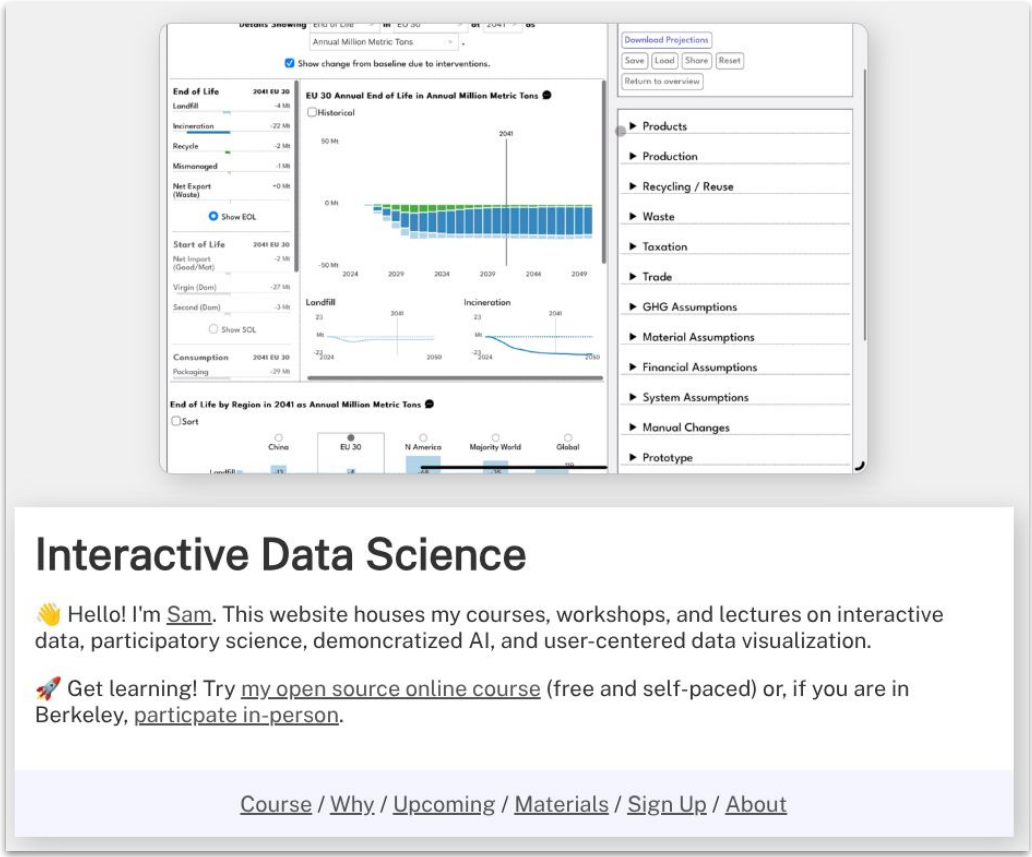




A few tricks: **Keeping channels clear**

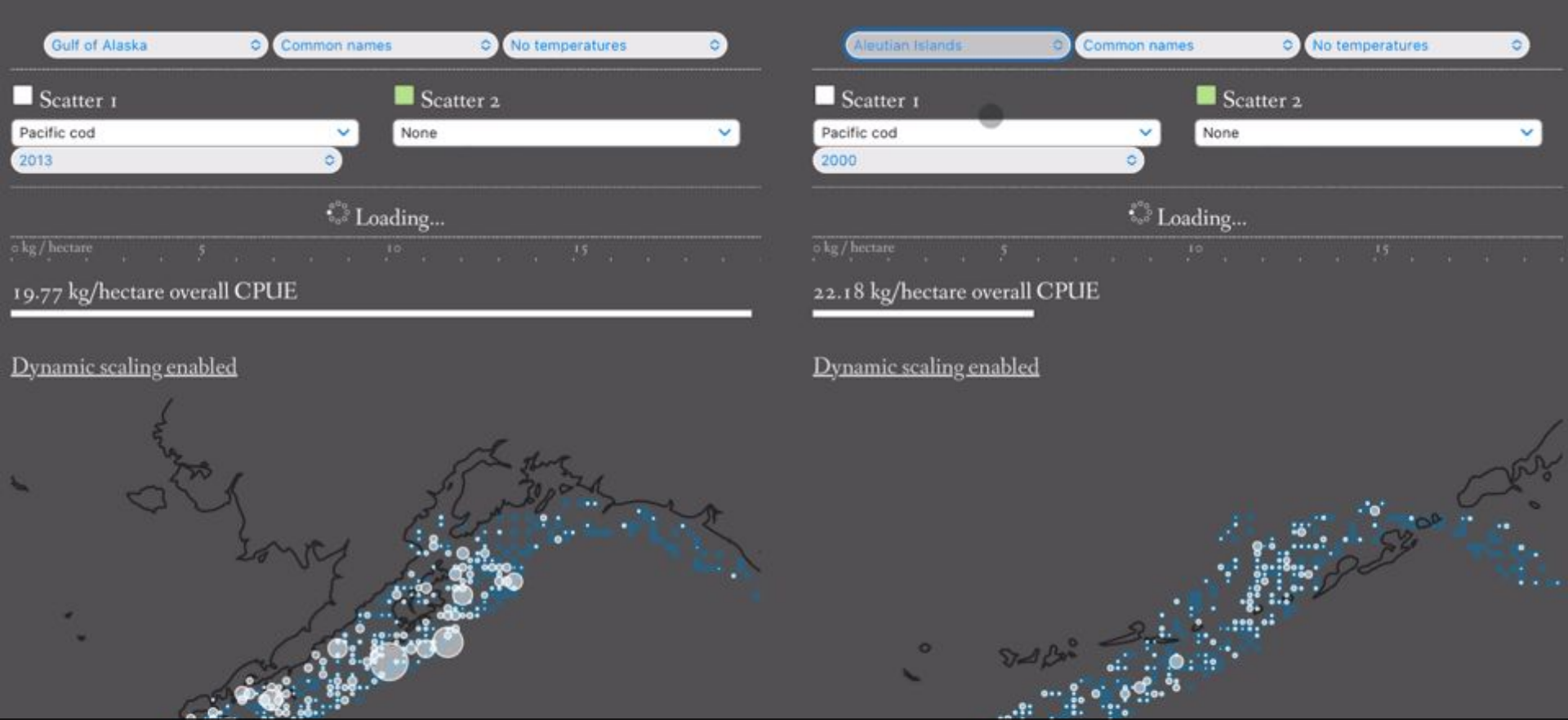






Keep going:
Resources online.

https://
interactive
data
science
.courses



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