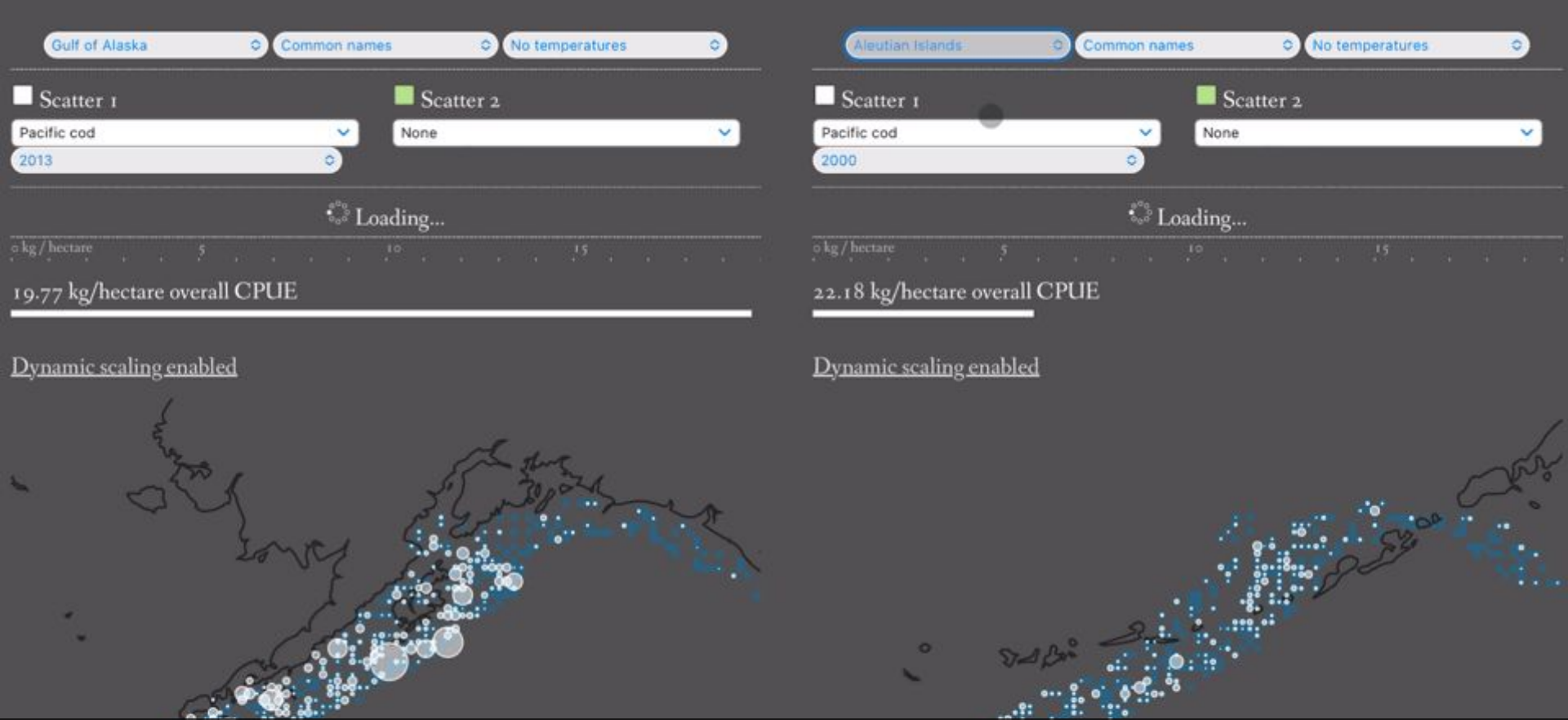


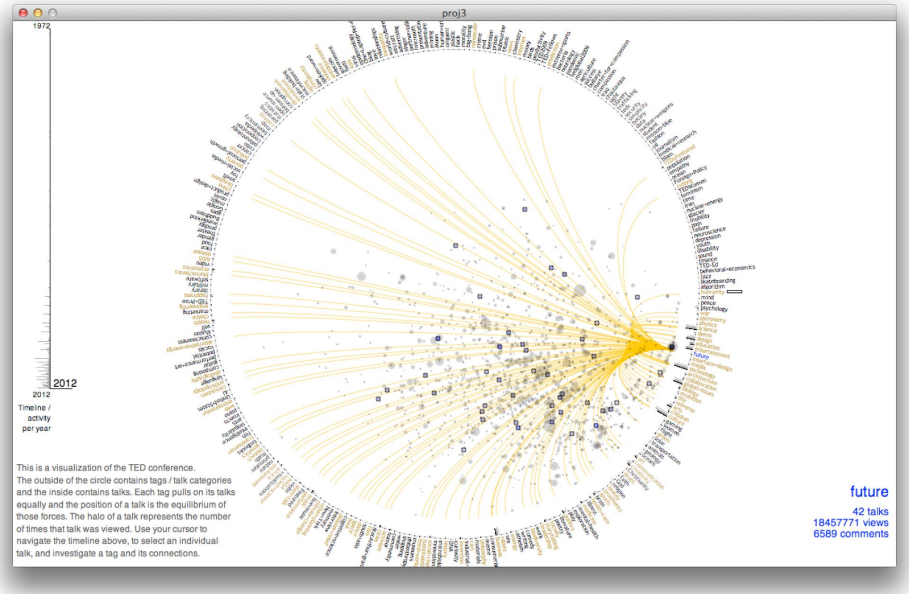
Data Visualization and Interactive Science

A Samuel Pottinger
September 24, 2024
Schmidt Center for Data Sci and Env
EcoTech UC Berkeley Workshop Series

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
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

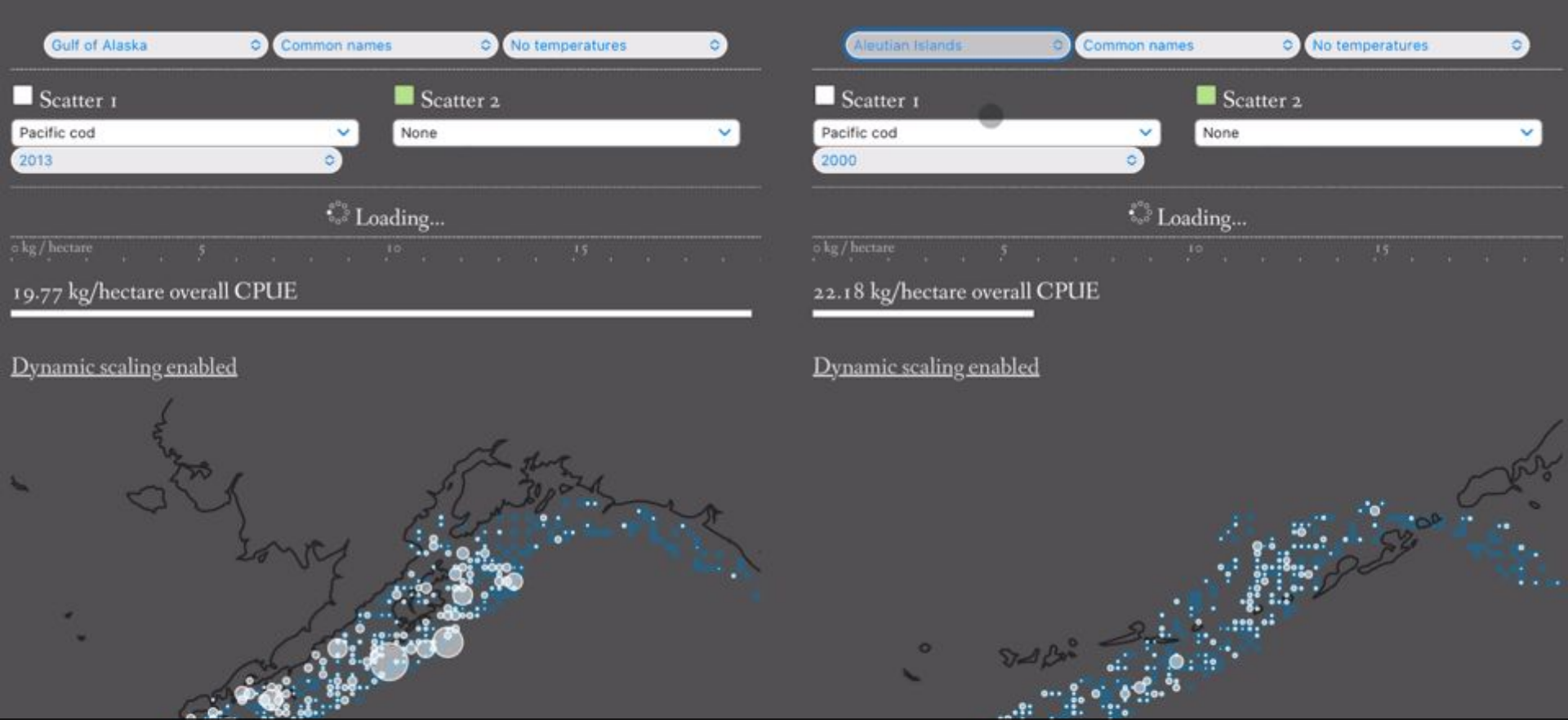


Today

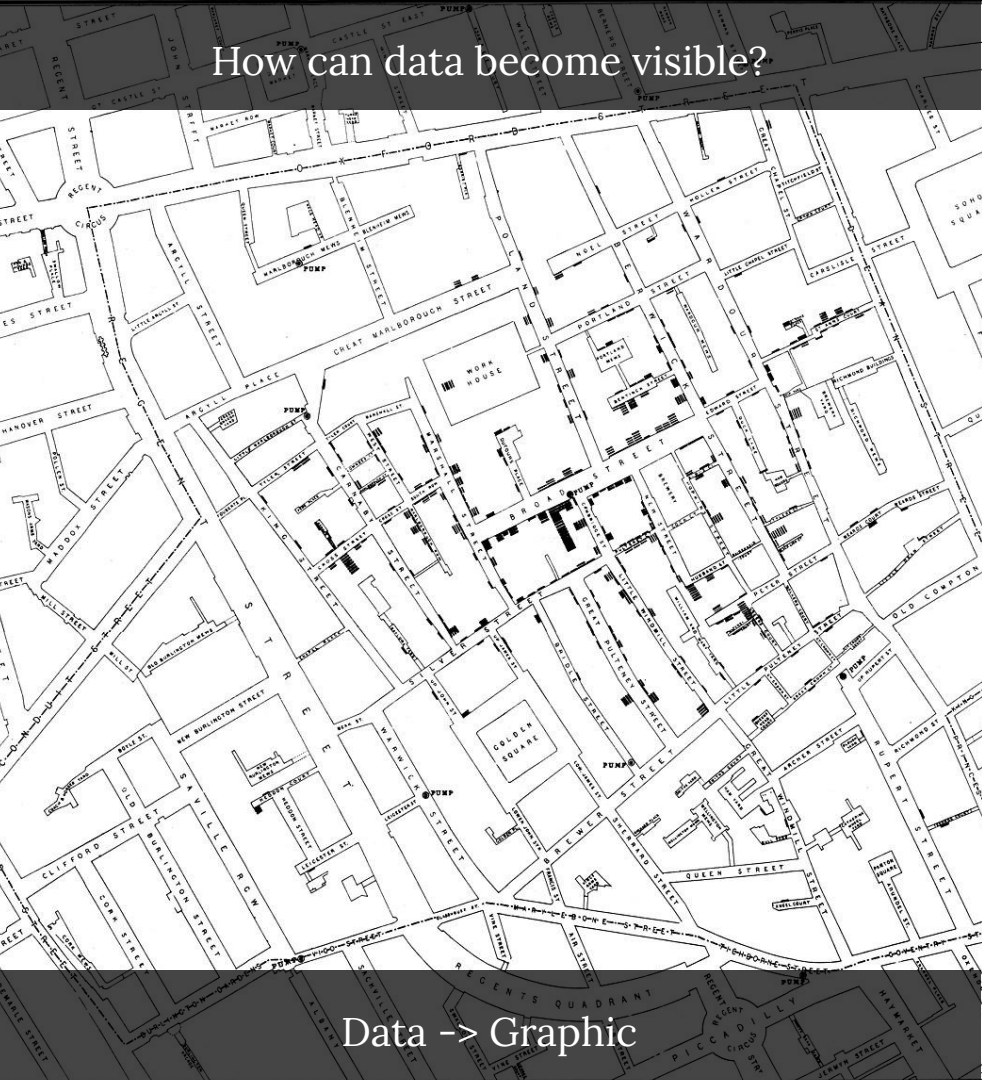
4 different viewpoints on what data visualization is and how to do it well.

Ideas for how to explore data visualization (and interactive science) at a deeper level within your work.

Resources to continue your data viz journey.



Discussion Portion



Data Visualization in 4 Acts

| 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.

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 is the relationship between wolves and moose in Isle Royale?

What year saw the most moose?

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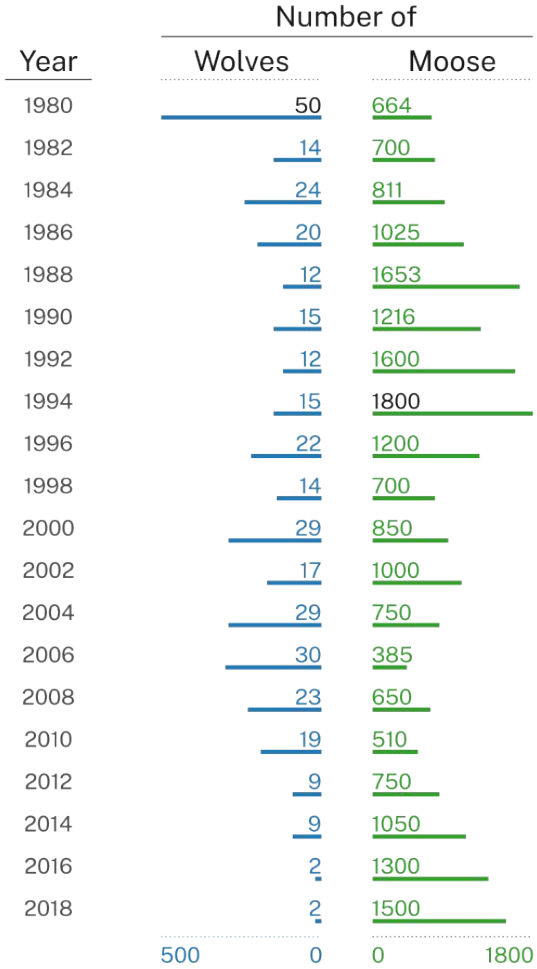

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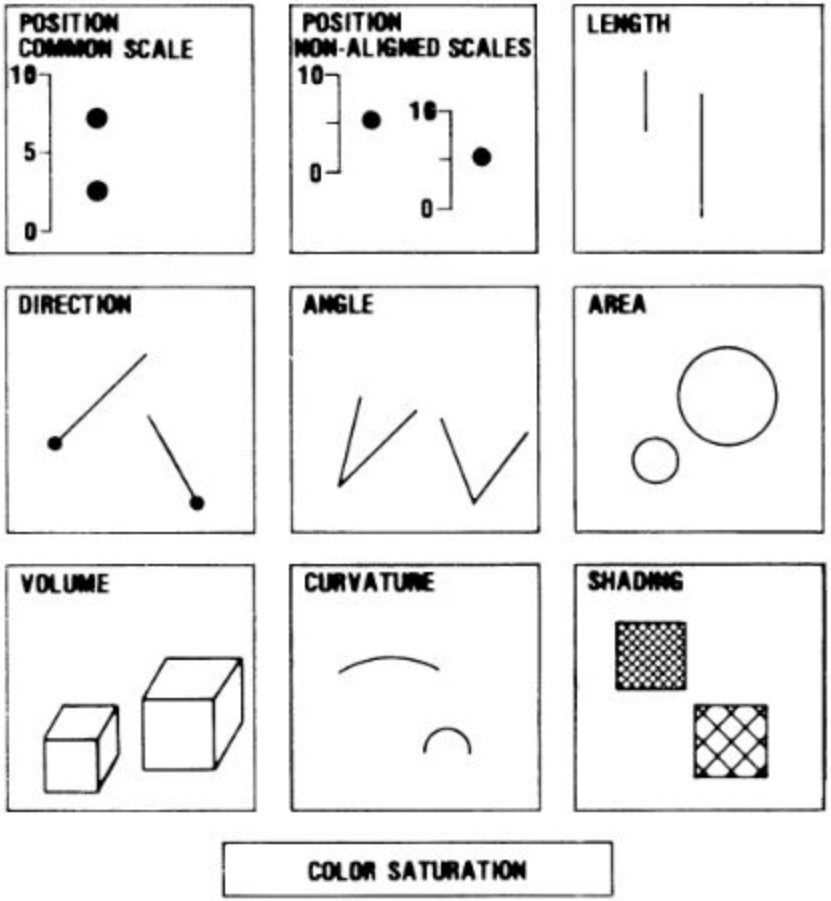


Figure 1. Elementary perceptual tasks.

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?

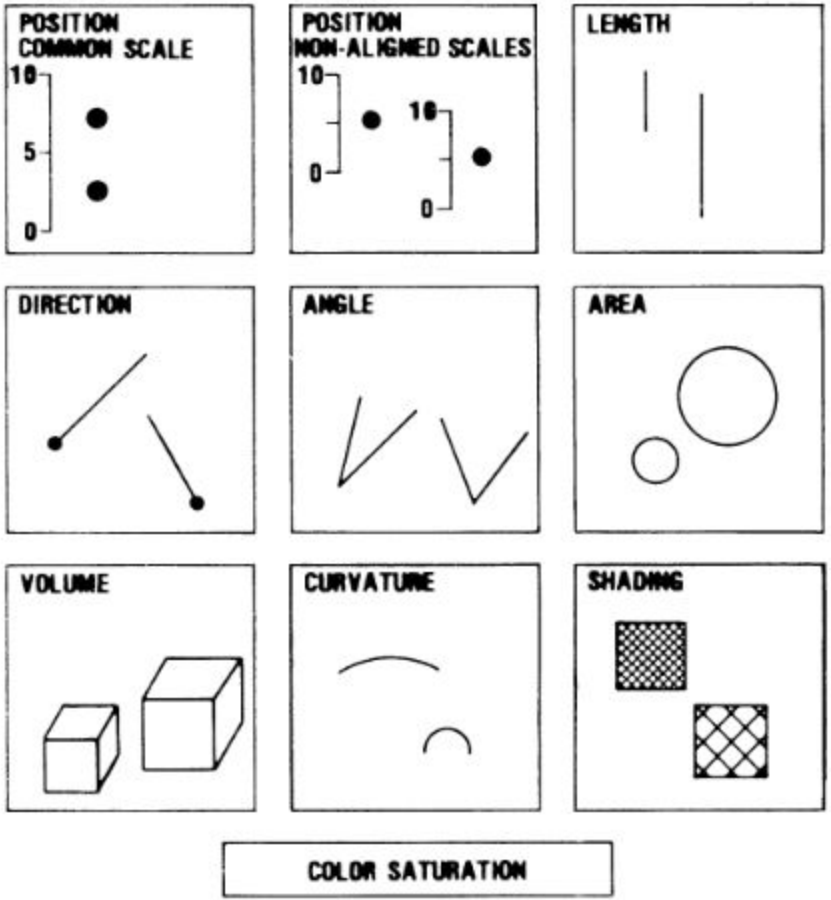


Figure 1. Elementary perceptual tasks.

Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods

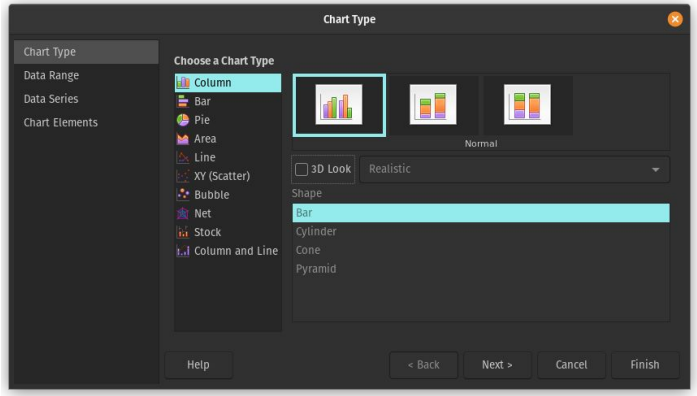
WILLIAM S. CLEVELAND and ROBERT McGILL*

The following are the 10 elementary tasks in Figure 1, ordered from most to least accurate:

1. Position along a common scale
2. Positions along nonaligned scales
3. Length, direction, angle
4. Area
5. Volume, curvature
6. Shading, color saturation

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.



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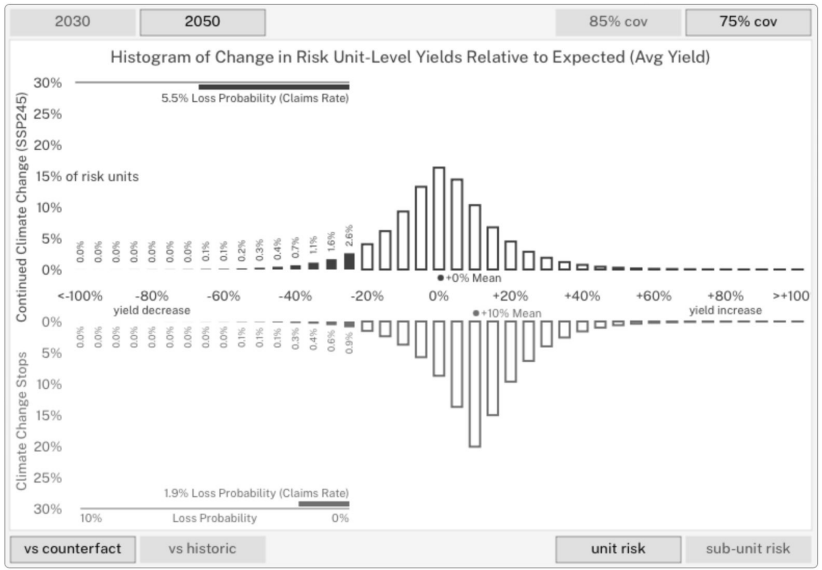

How to use it: Learn more about human visual system to understand when to use different chart types or encoding devices.

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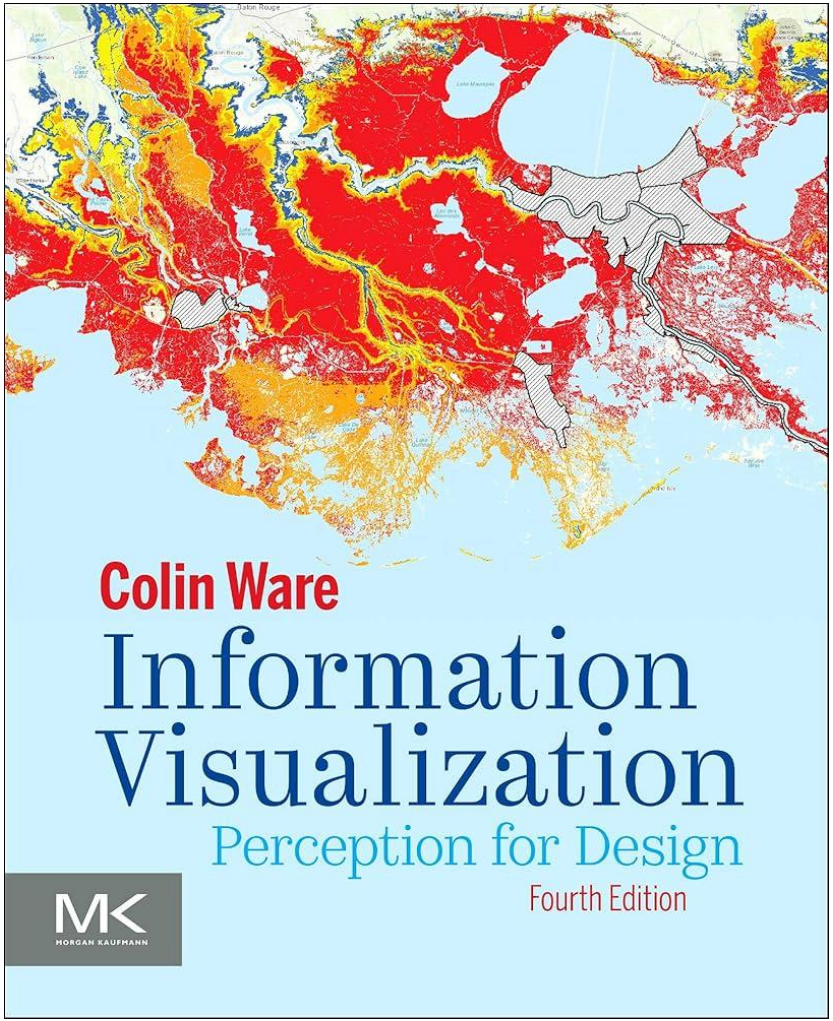
Colin Ware



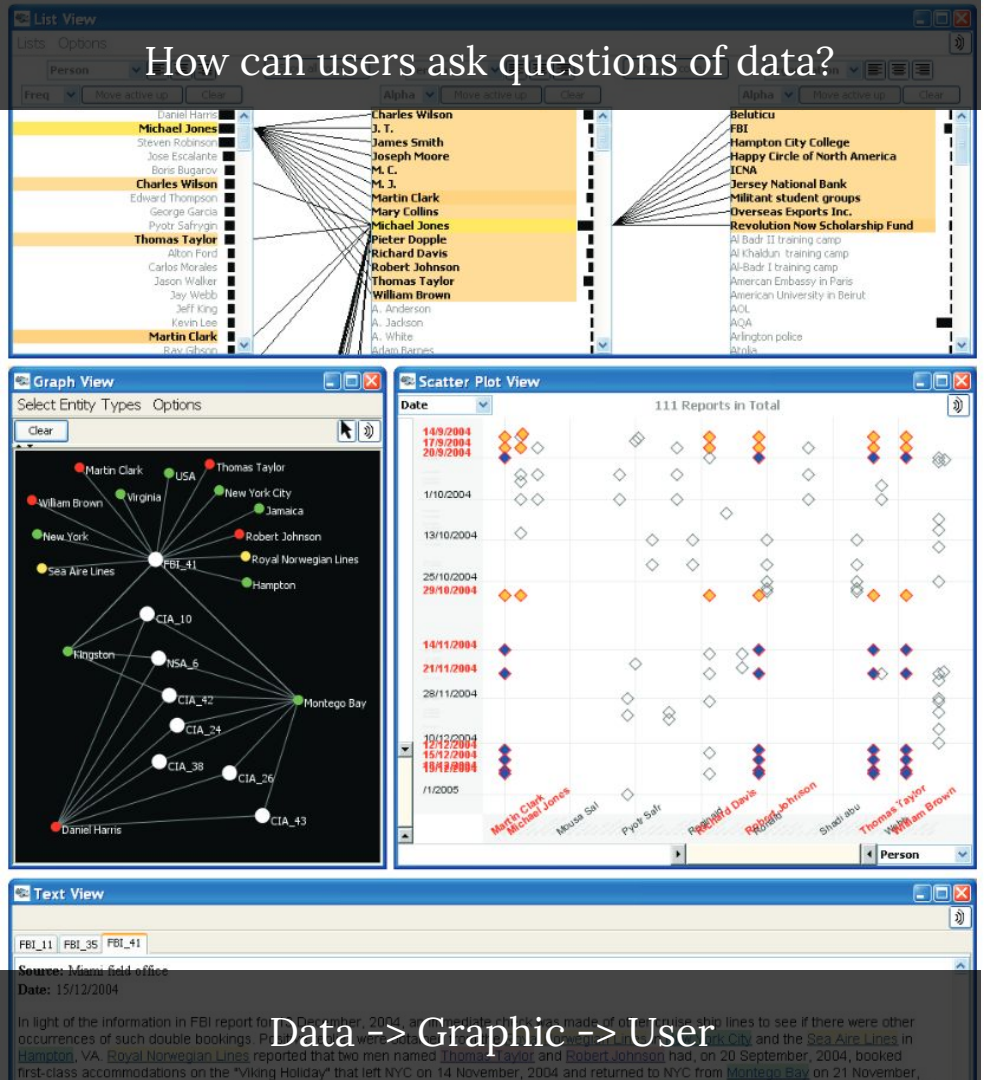
Summary: We use graphics representation of data.

Visual processing

Encoding

Data ink

Accuracy



Data Visualization in 4 Acts

As representation

| As task

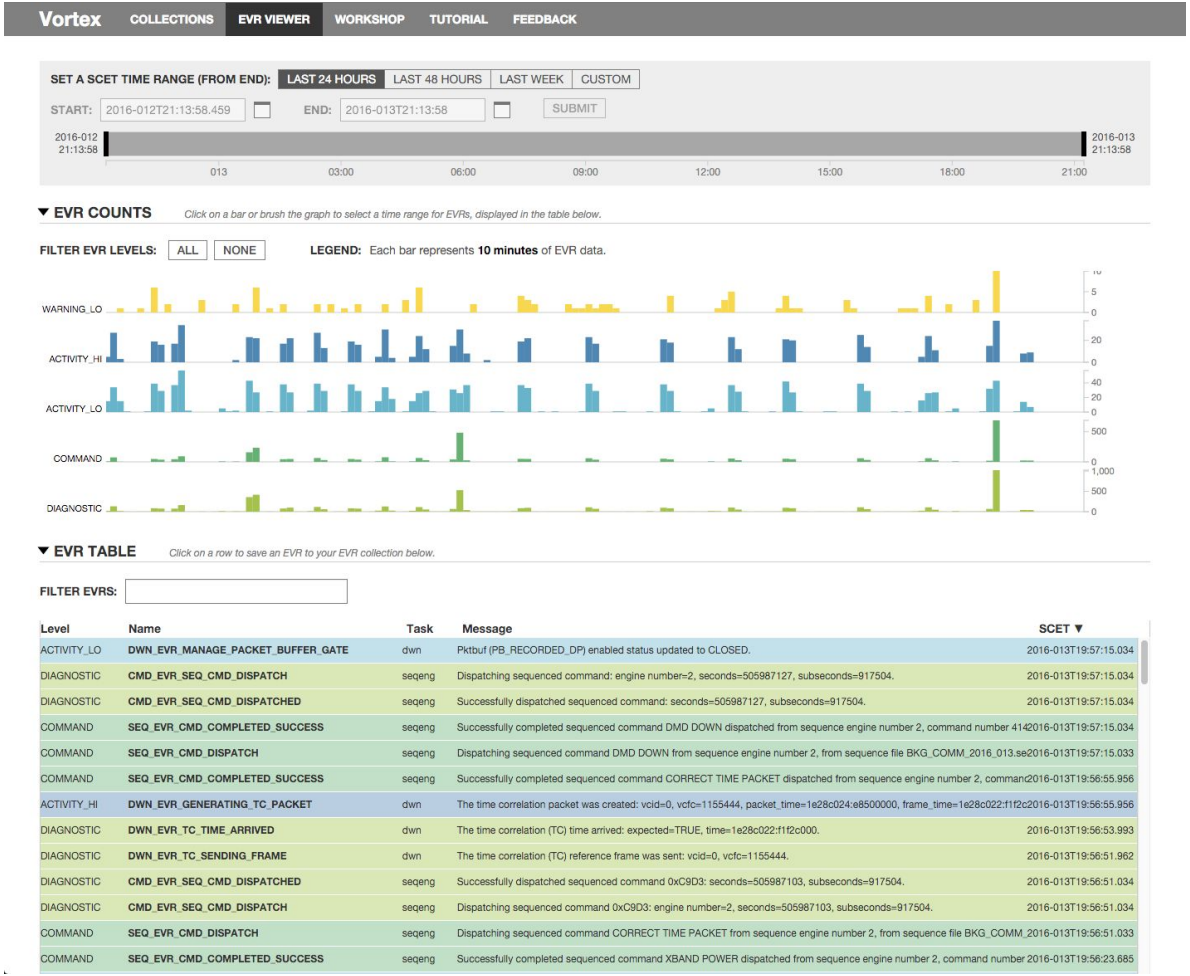
As message

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.



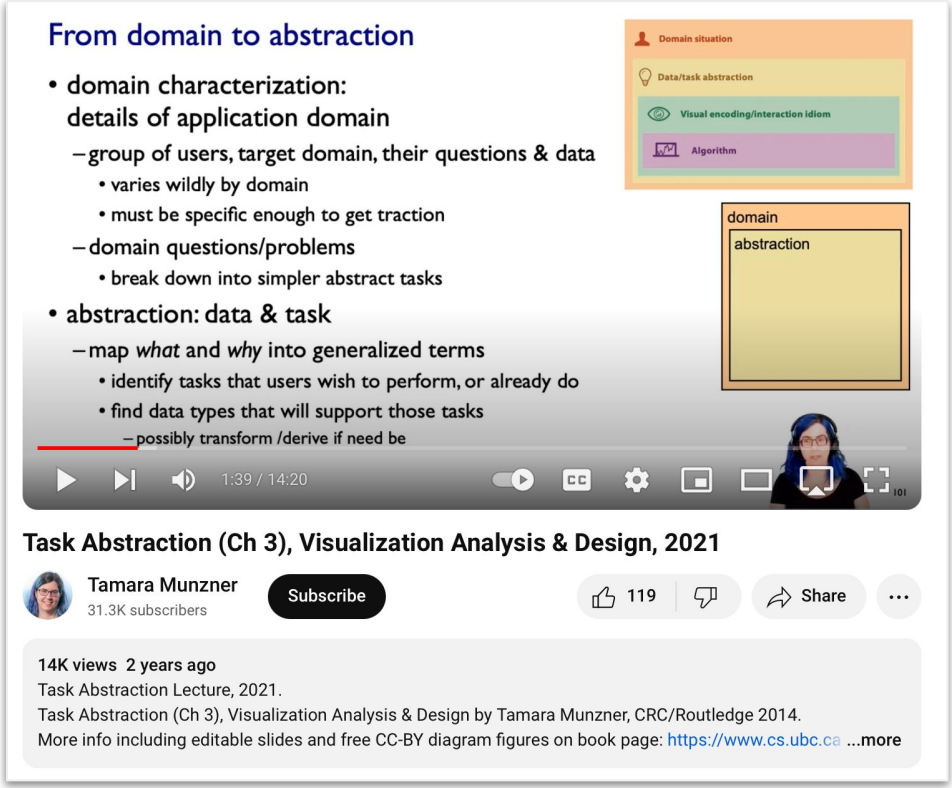
Example: Rachel Binx at NASA.

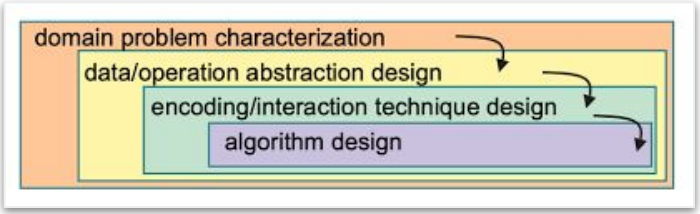
Looking at “event records” sent from spacecraft to NASA.

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.





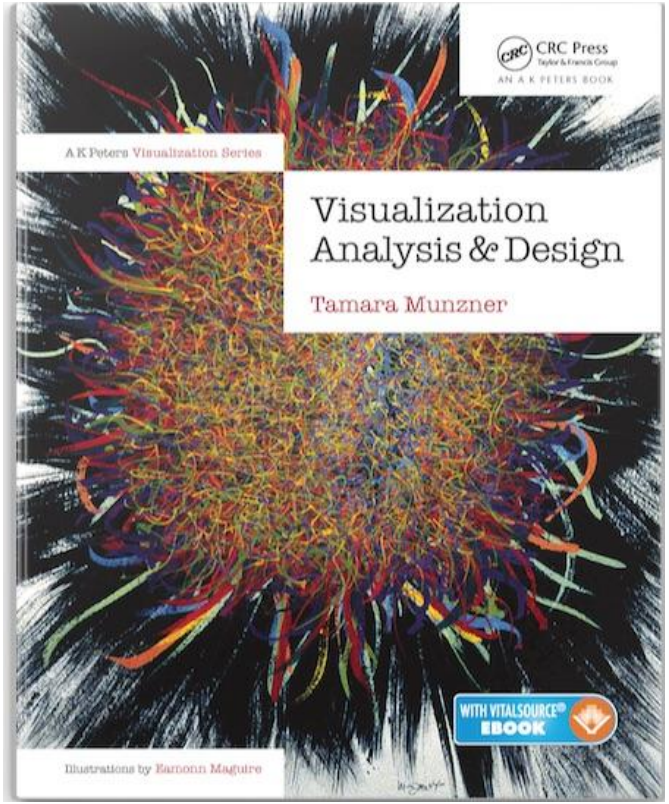
Offers: Structured evidence-based understanding of the user to support them in their tasks.

Oritents around domains, tasks, questions, and data.

Fits within a broader modern user experience design dialogue.

How to use it: Chart out the tasks that you imagine your audience taking and what questions they are asking. The simplest form is chat with some users before building your graphics and later walk through the journey of how those would be answered.

Tamara Munzner



Summary: We use visualizations in tasks.

Domains, questions, data, techniques

User-Centered Design

User journeys

Situated use and diary study

Data Visualization in 4 Acts

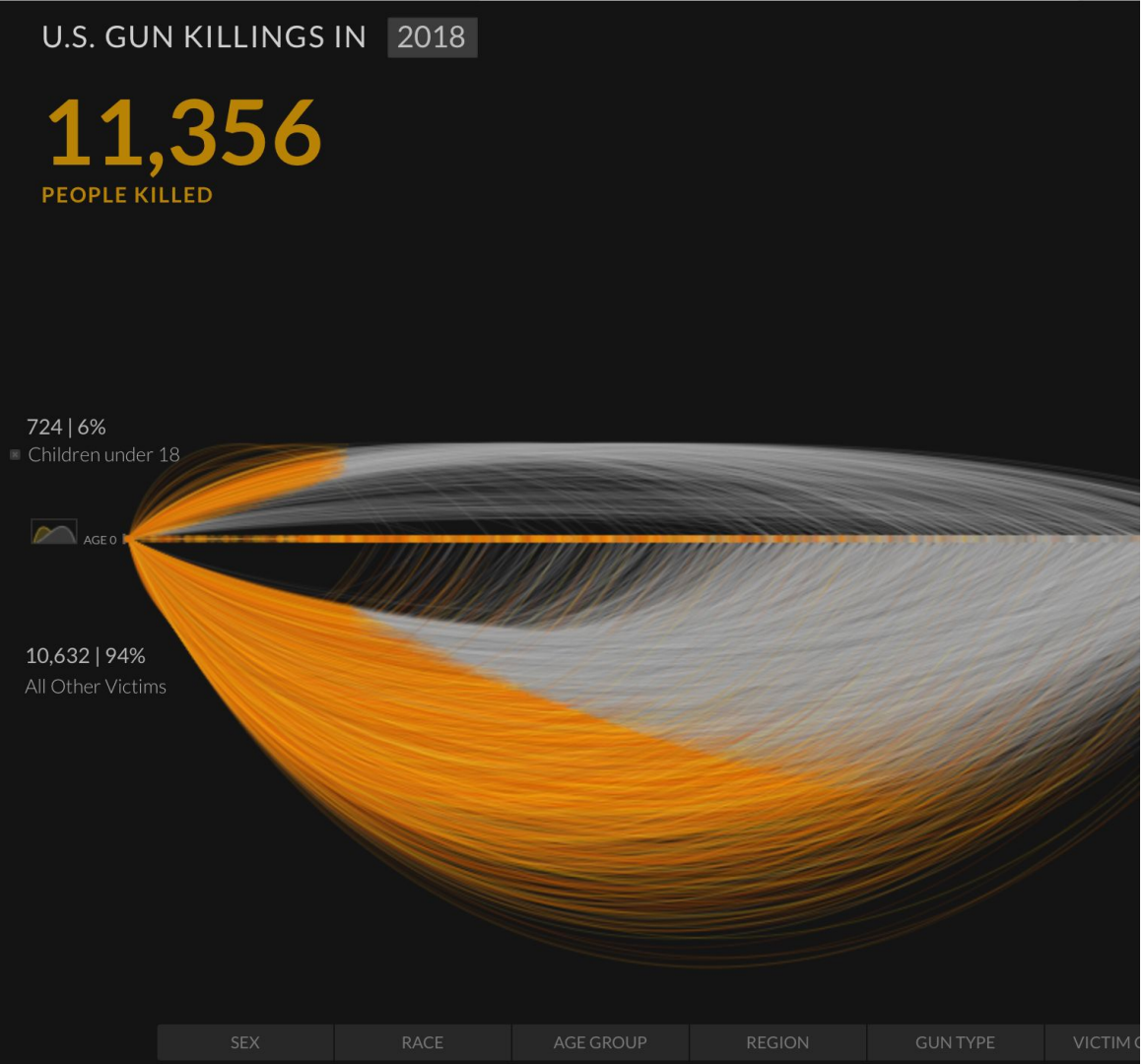
As representation

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?

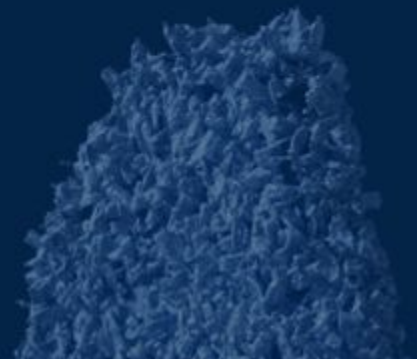
How might we defy reader expectations or have them confront prior held beliefs?

guns.periscopic.com

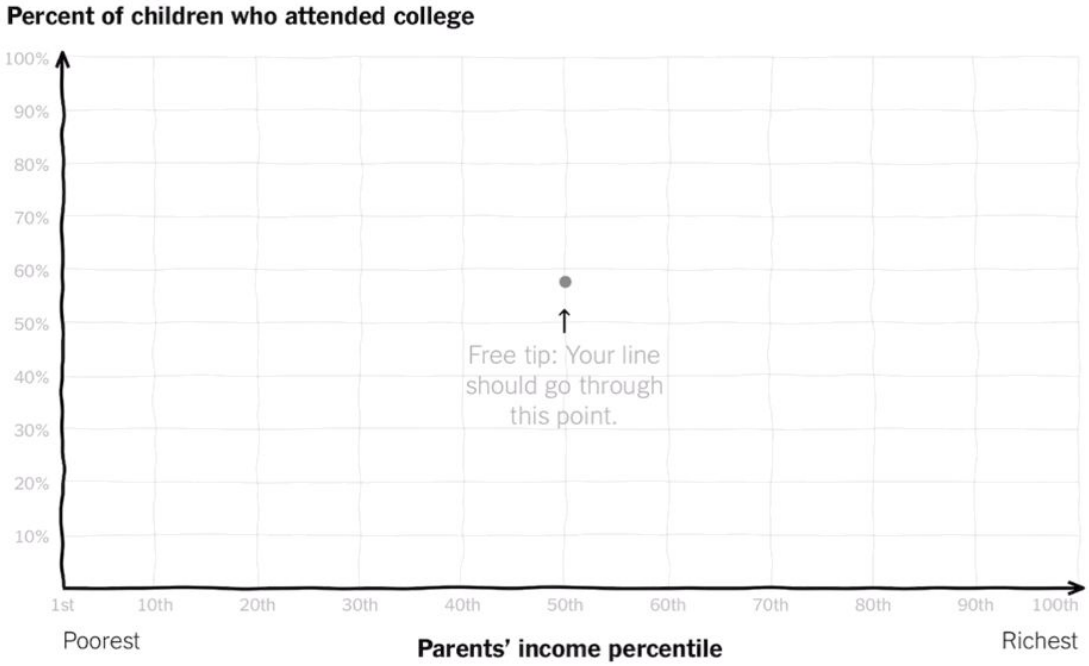
A Treaty To End Plastic Pollution. Forever.

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.

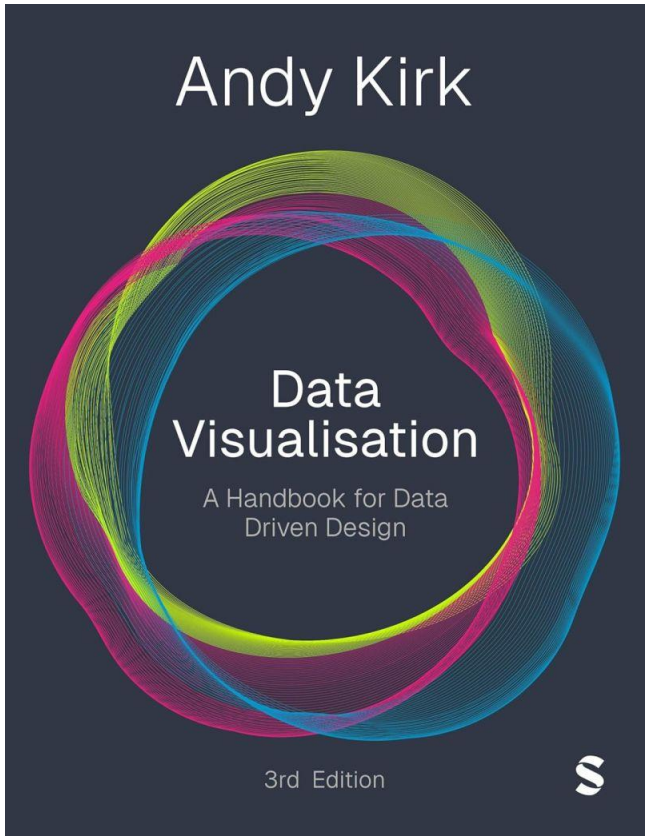
How to invoke emotional response.

How to challenge reader assumptions.

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

How to use it: Chart out the emotional journey you imagine your readers taking. Ask how the graphical decisions help deliver that emotional experience or detract from it. Make choices which trade off the emotional experience with the most direct representation of the data.

Andy
Kirk



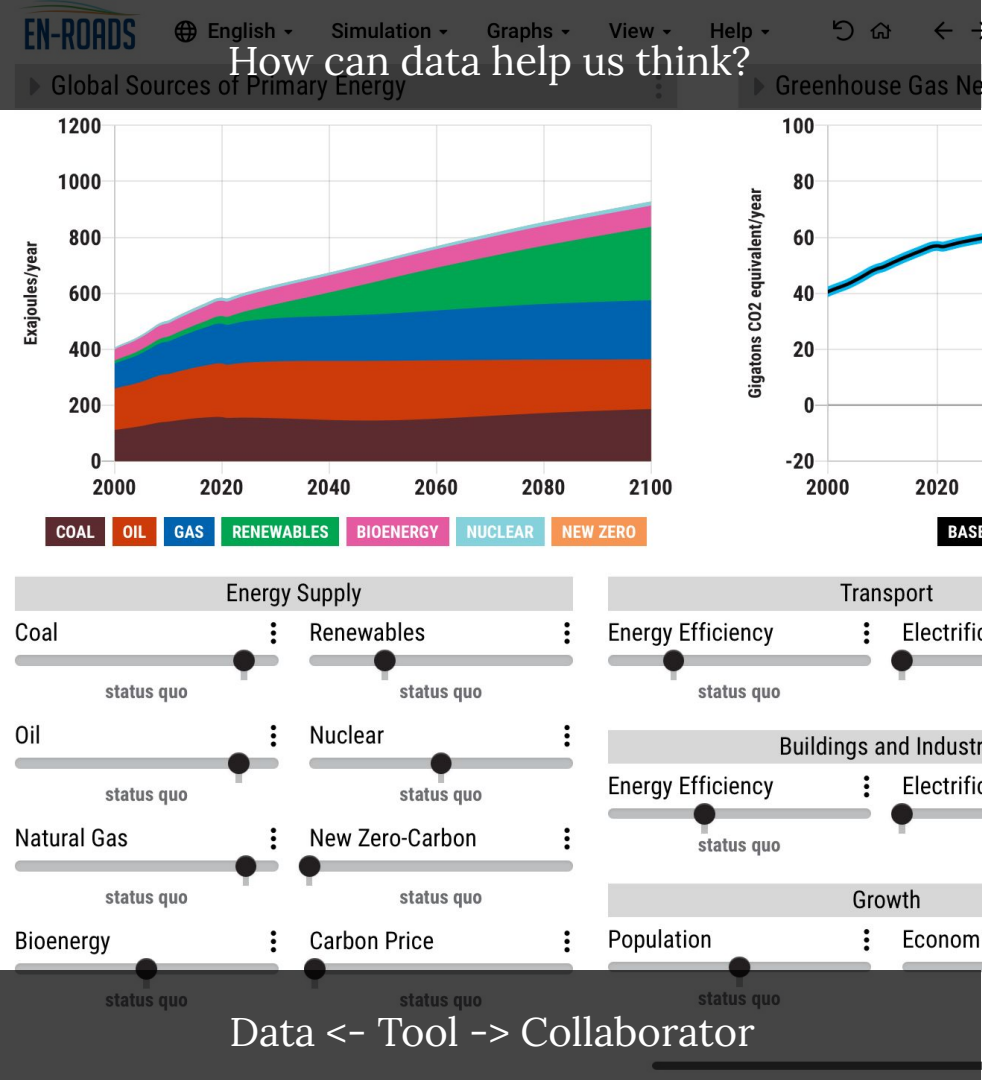
Summary: Visualizations are data experienced.

Movements

Diagrammatic reading

Sketch-based development

Social mediation



Data Visualization in 4 Acts

As representation

As task

As message

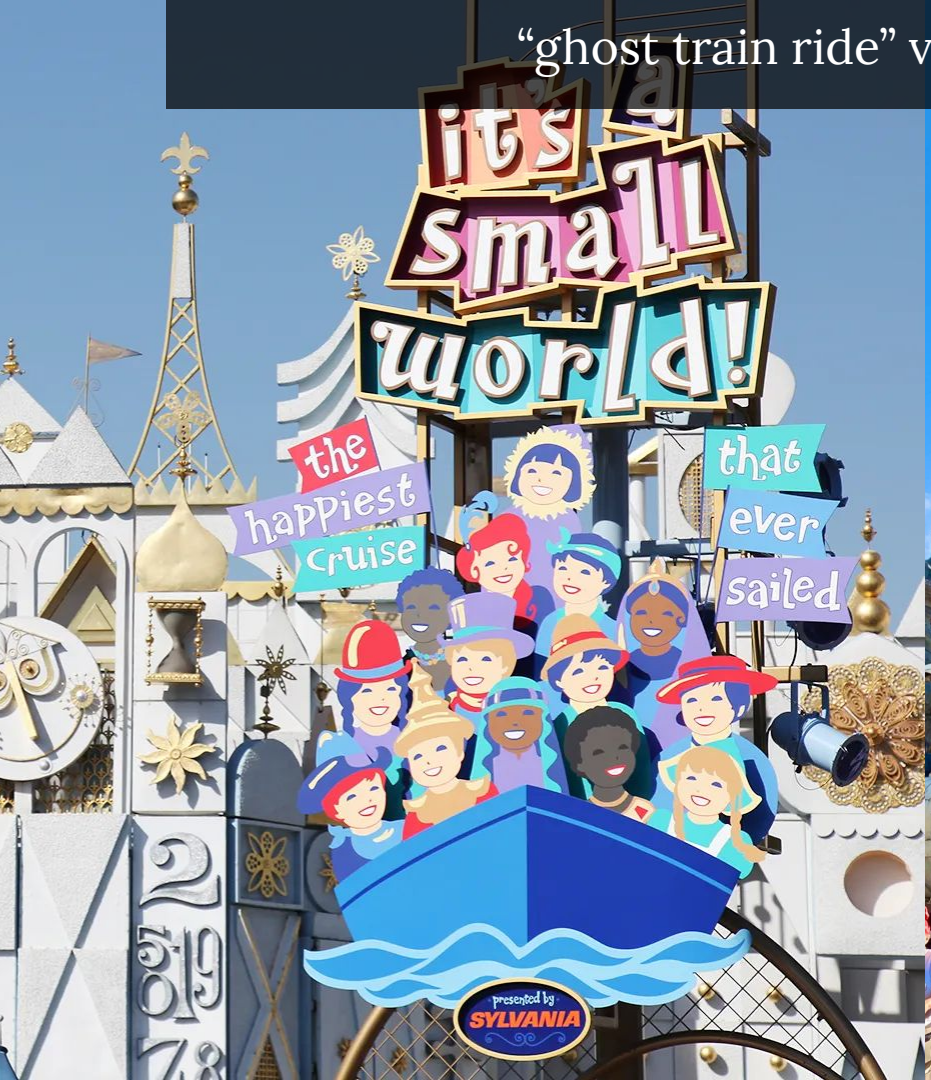
As dialogue

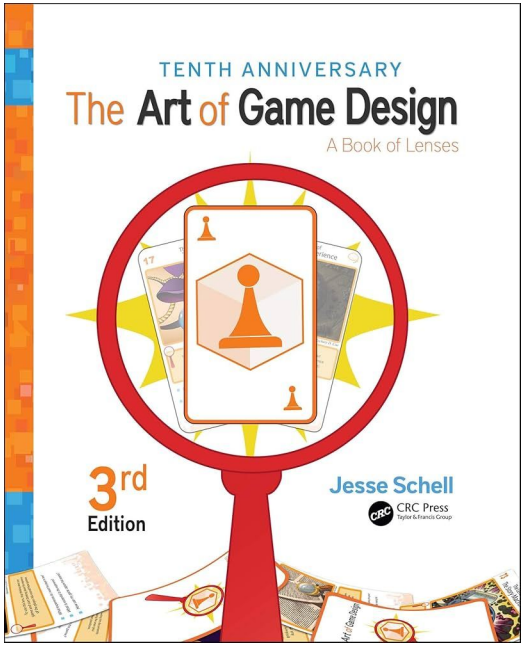
Why and how different groups do data visualization.
How you can think about it in your work.

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”





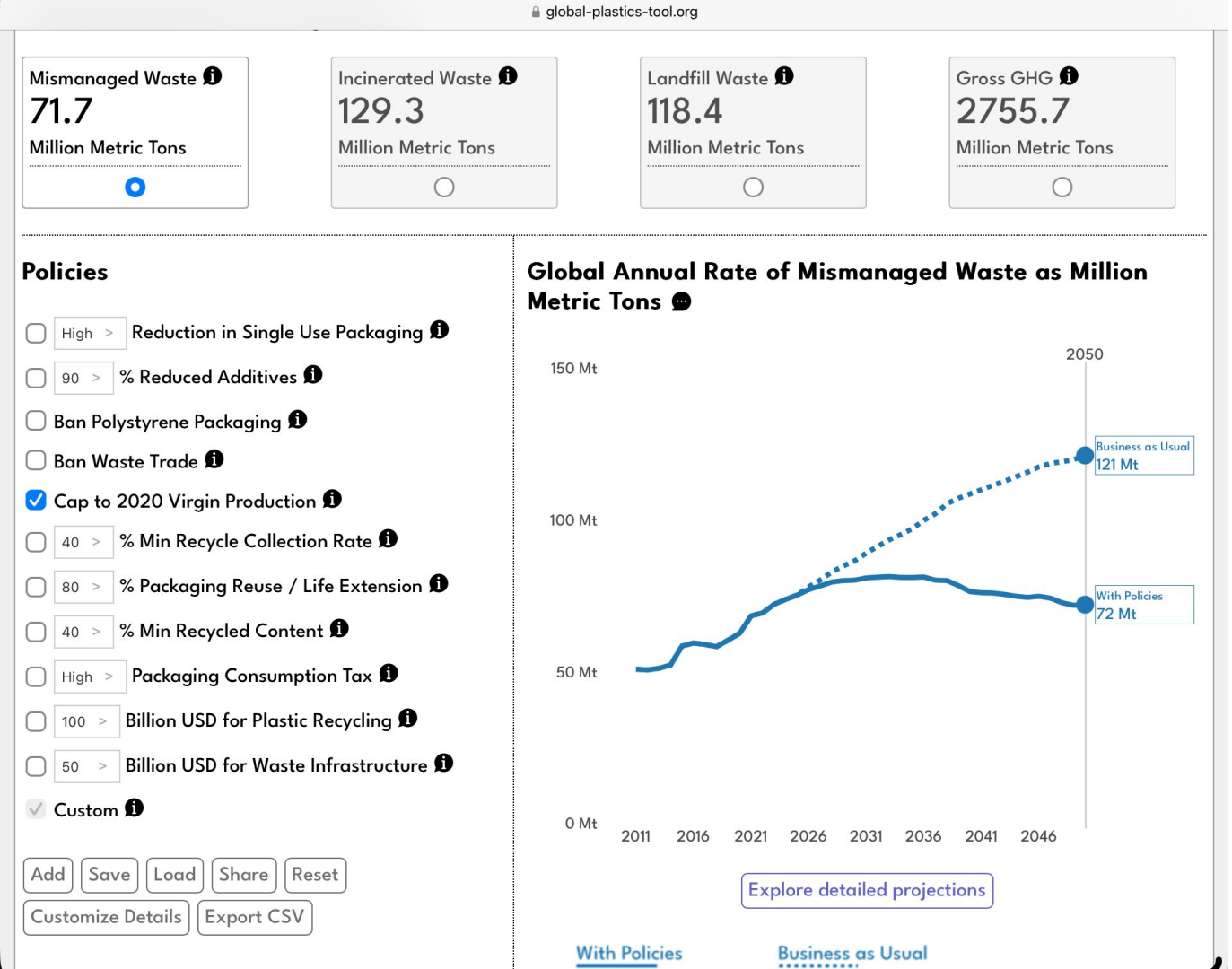
Motivations for Play in Online Games

Author: Nick Yee | AUTHORS INFO & AFFILIATIONS

Publication: CyberPsychology & Behavior • https://doi.org/10.1089/cpb.2006.9.772

Abstract

An empirical model of player motivations in online games provides the foundation to understand and assess how players differ from one another and how motivations of play relate to age, gender, usage patterns, and in-game behaviors. In the current study, a factor analytic approach was used to create an empirical model of player motivations. The analysis revealed 10 motivation subcomponents that grouped into three overarching components (achievement, social, and immersion). Relationships between motivations and demographic variables (age, gender, and usage patterns) are also presented.

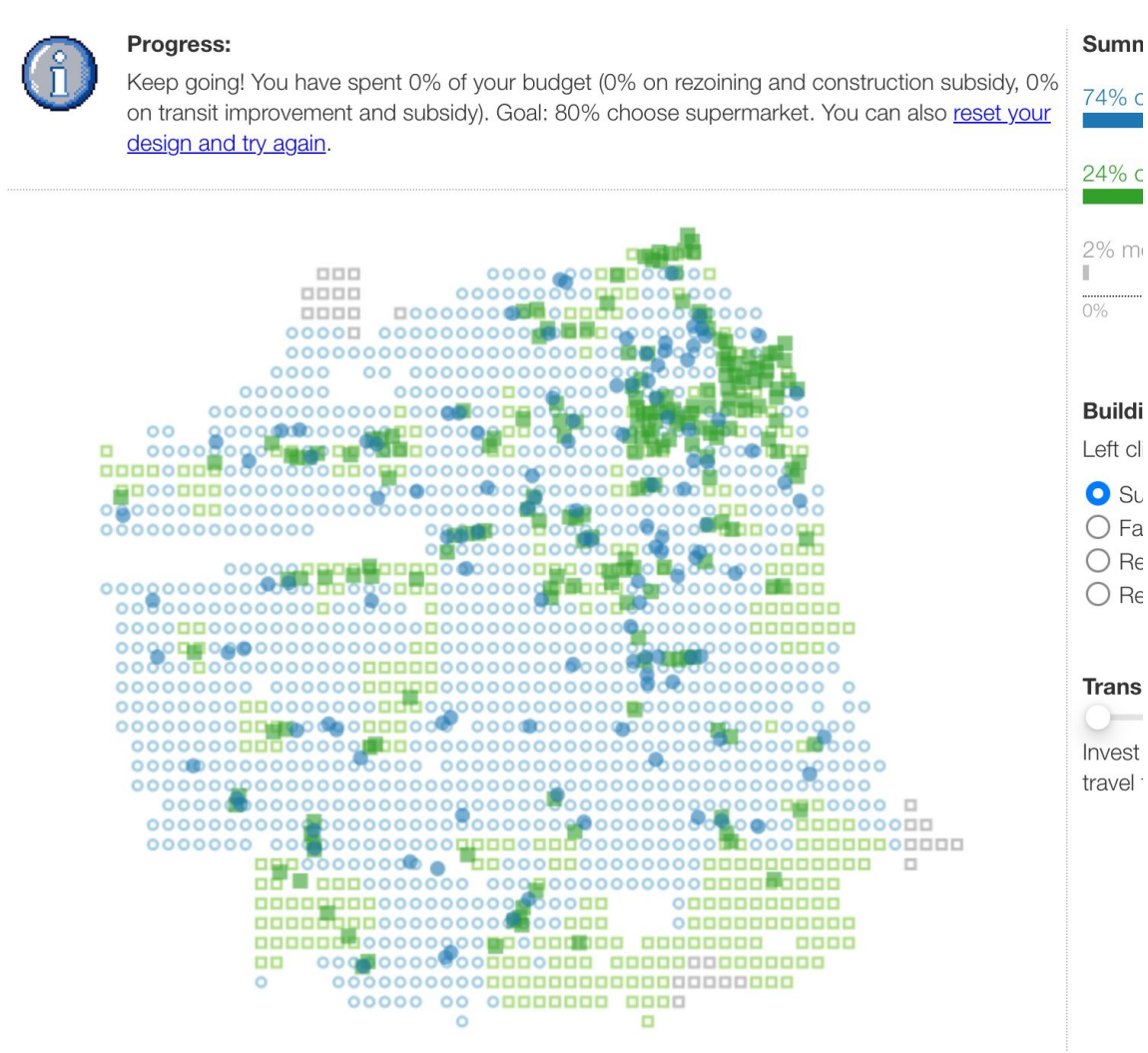


Example: Finding a solution to the plastics crisis.

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



Offers: Co-creation and user agency.

Often leaning on game design concepts.

How to teach with/without tutorializing.

How to create spaces to interrogate assumptions.

How to build media to be repurposed.

How to design experiences where the user is co-author.

How to use it: Think about how your audience could be co-creators with you. What kinds of graphics or experiences allow them to ask questions beyond what you presented. How could your work empower them to take your results and bring them into their own work?

Bret
Victor

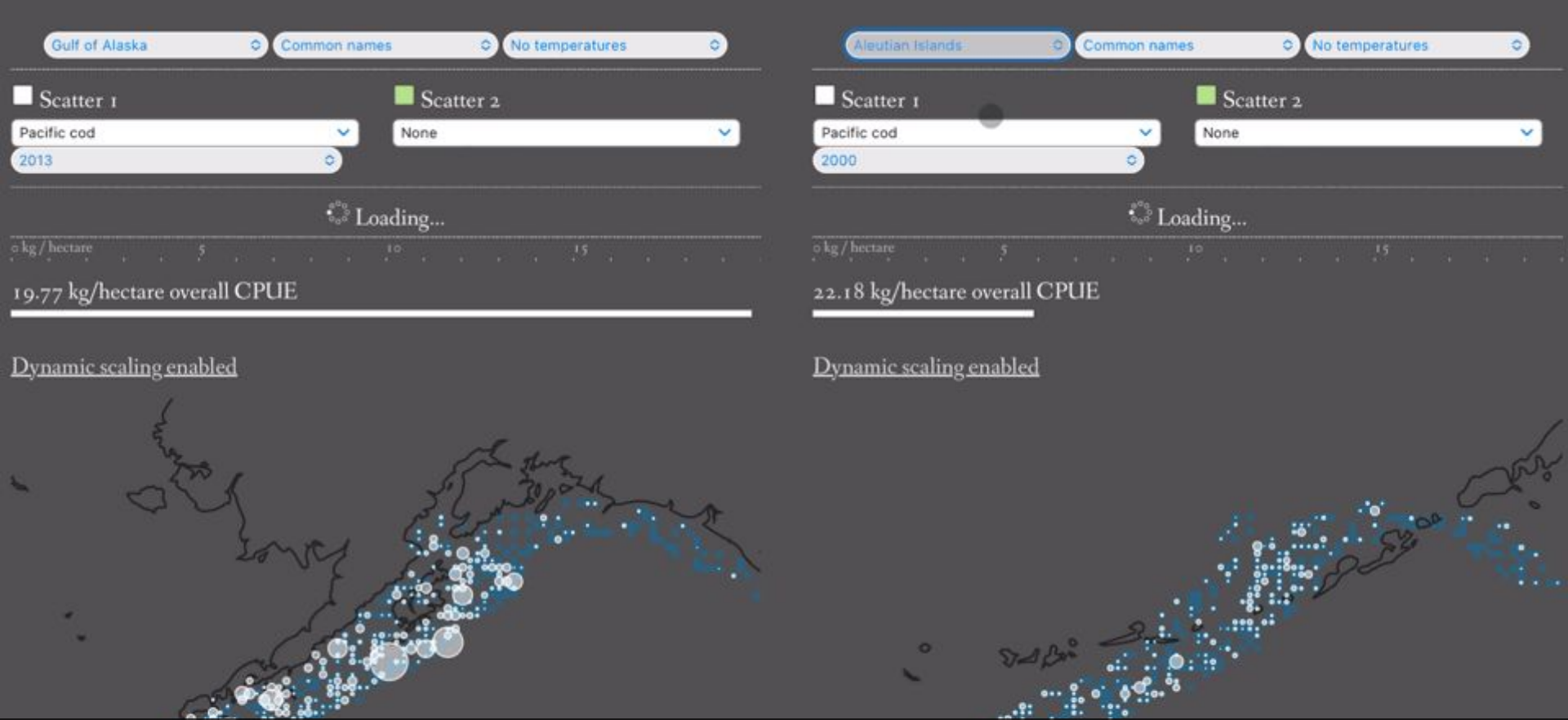
Summary: Create spaces for the user to converse with data.

Kinesthetic projection

Ludonarrative

Player agency

Loop-based design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Common names
No temperatures
Scatter 1
Pacific cod
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Scatter 2
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0 kg / hectare
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Aleutian Islands
Common names
No temperatures
Scatter 1
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10
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Summary

How to use it: Learn more about human visual system to understand when to use different chart types or encoding devices.

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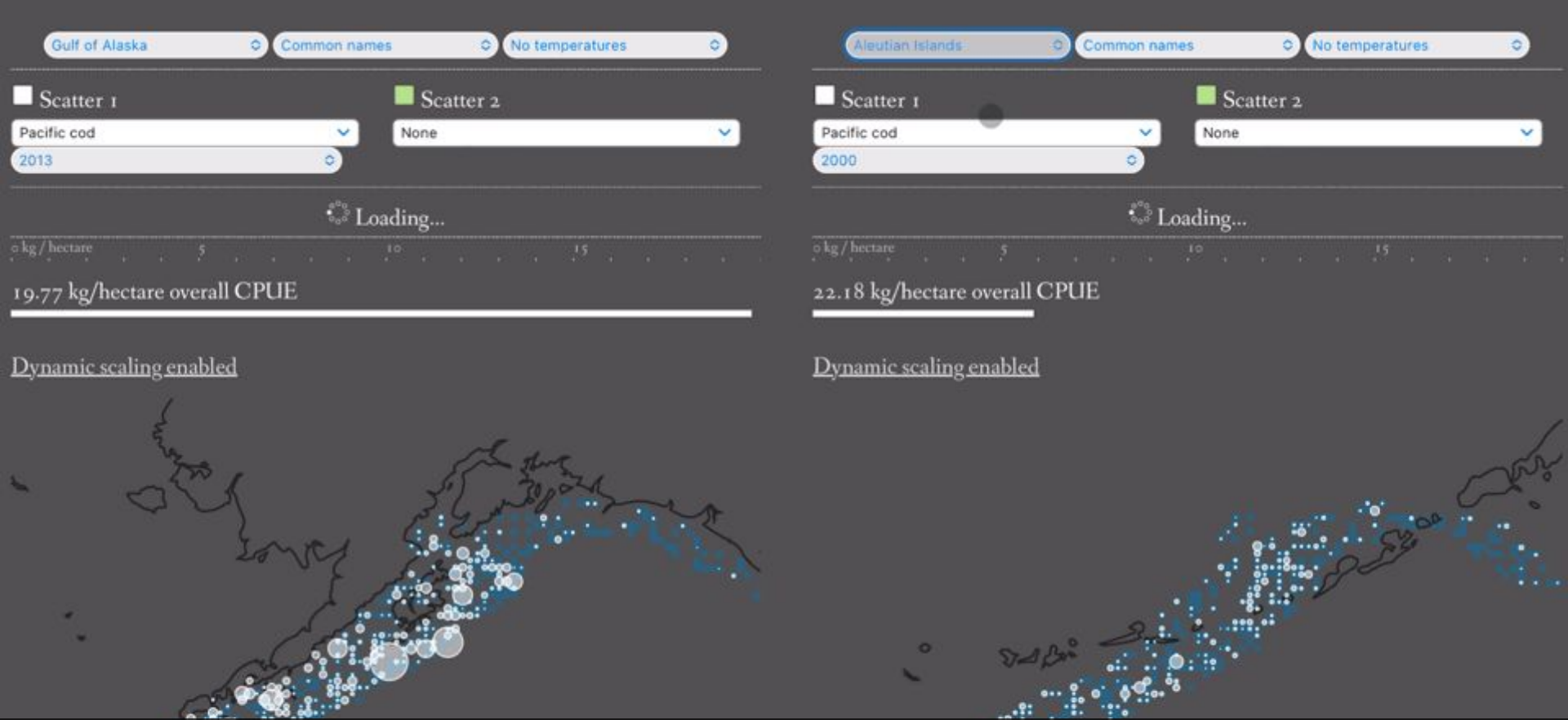
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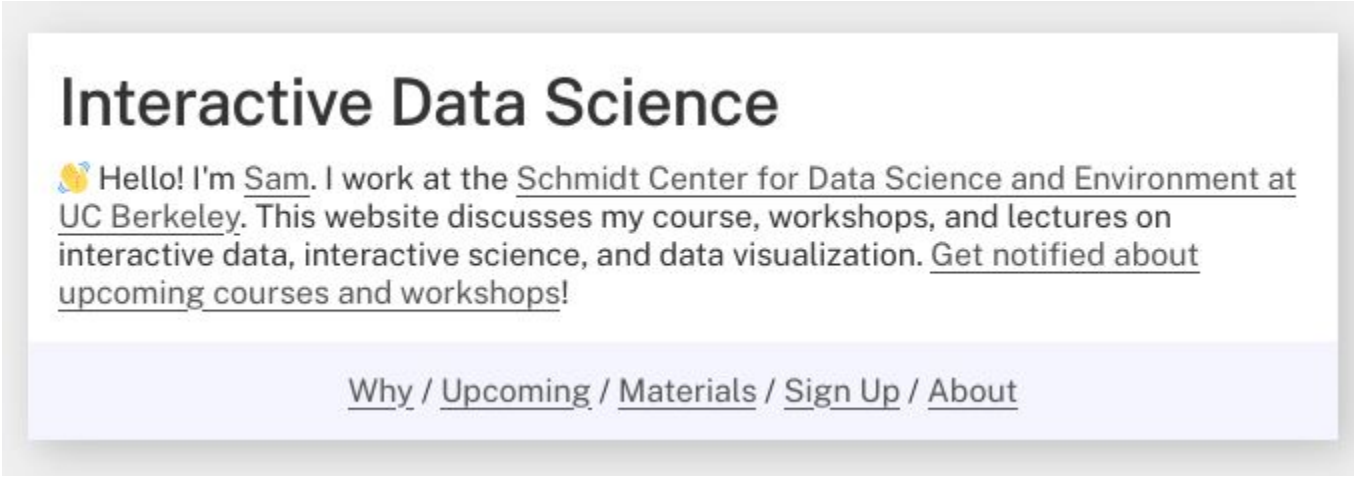
Questions

If you want to learn more...



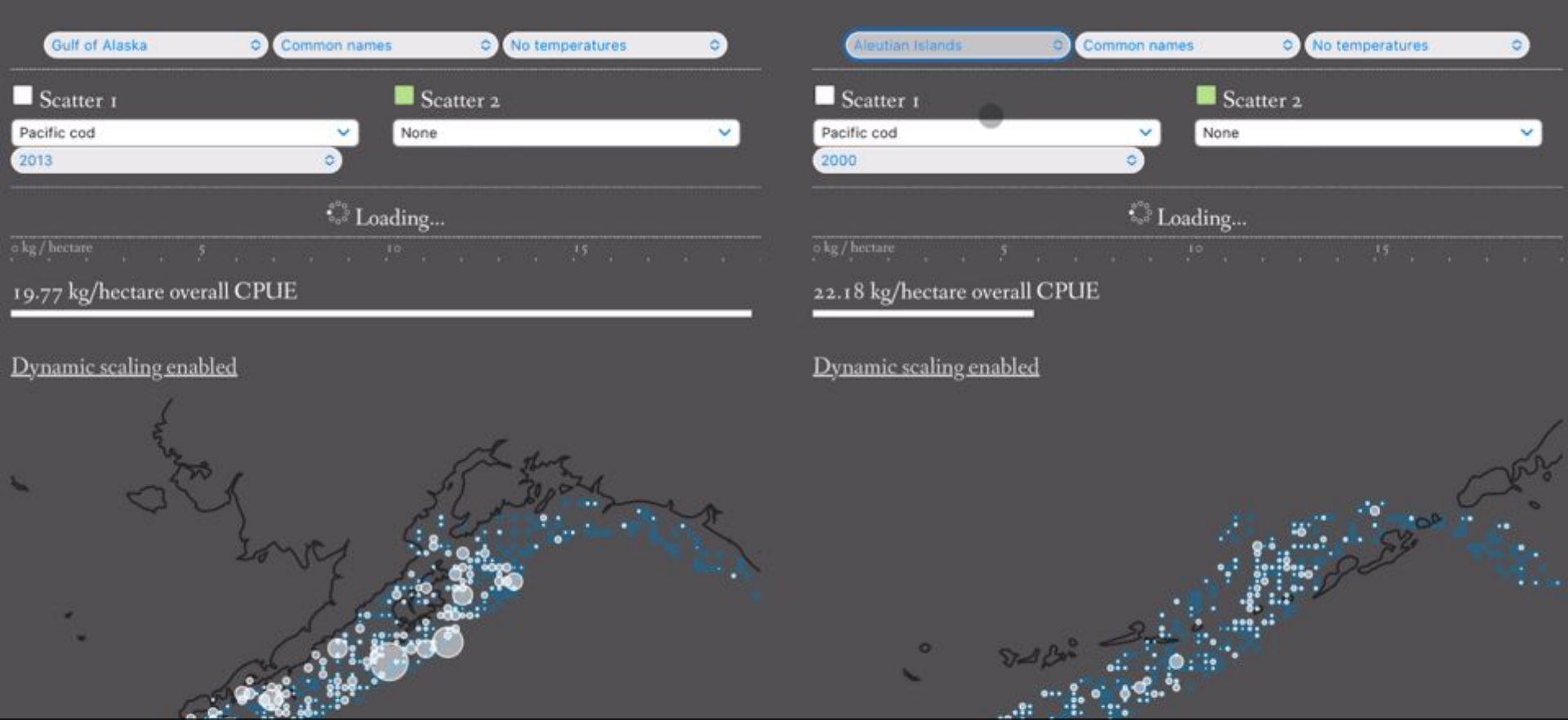
Students: I have upcoming lectures, workshops, and a **Spring 2025 course**. There's more details and a form at:

https://interactivedatascience.courses

If you want to learn more...

Faculty and staff: we have a Slack!

https://dse.berkeley.edu/about/community

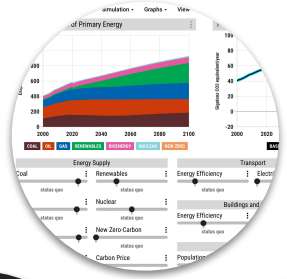


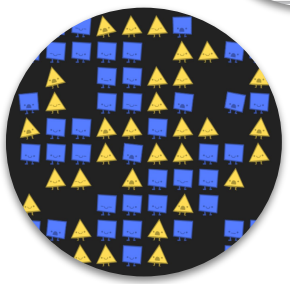
Hands-On Portion

Three examples to consider

Break into three groups: try out a visualization and report back.

en-roads.climateinteractive.org





ncase.me/polygons

incomegaps.com

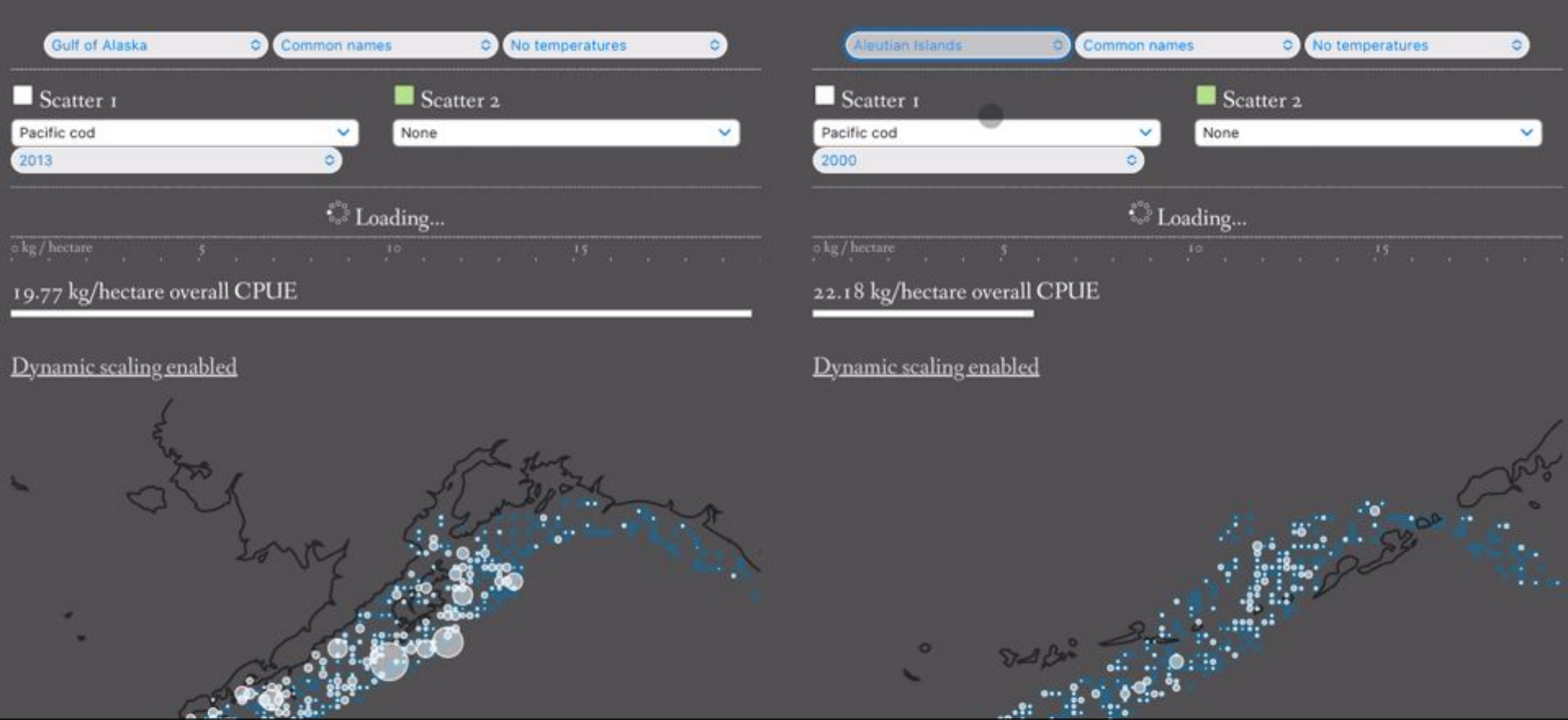
What emphasizes efficiency?

What are the tasks imagined by the designers?

What is the emotional journey of using the visualization?

How is the user a co-author in the experience?

Bonus pending time: foodsimsf.com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