

Gulf of Alaska

Common names

No temperatures

Aleutian Islands

Common names

No temperatures

Scatter 1

Scatter 2

Scatter 1

Scatter 2

Pacific cod

Pacific cod

Pacific cod

2013

2000

None

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kg / hectare

kg / hectare

5

10

15

20

5

10

15

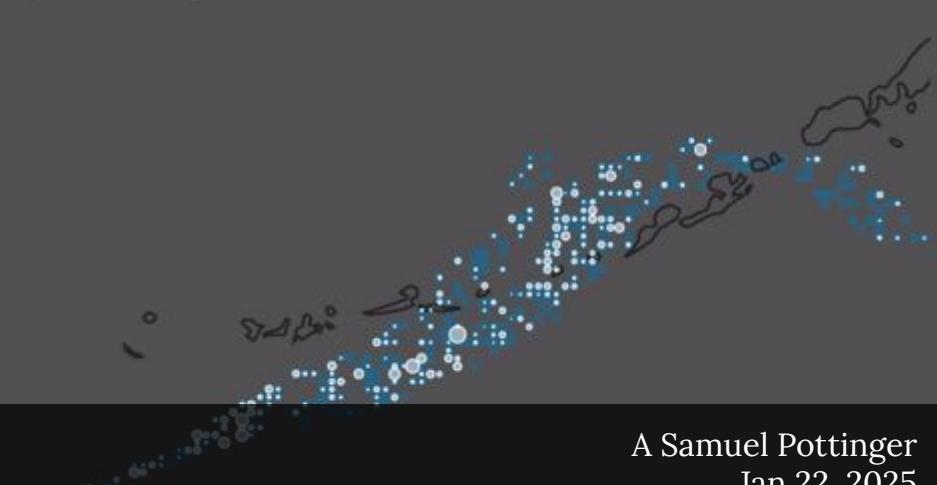
20

19.77 kg/hectare overall CPUE

22.18 kg/hectare overall CPUE

Dynamic scaling enabled

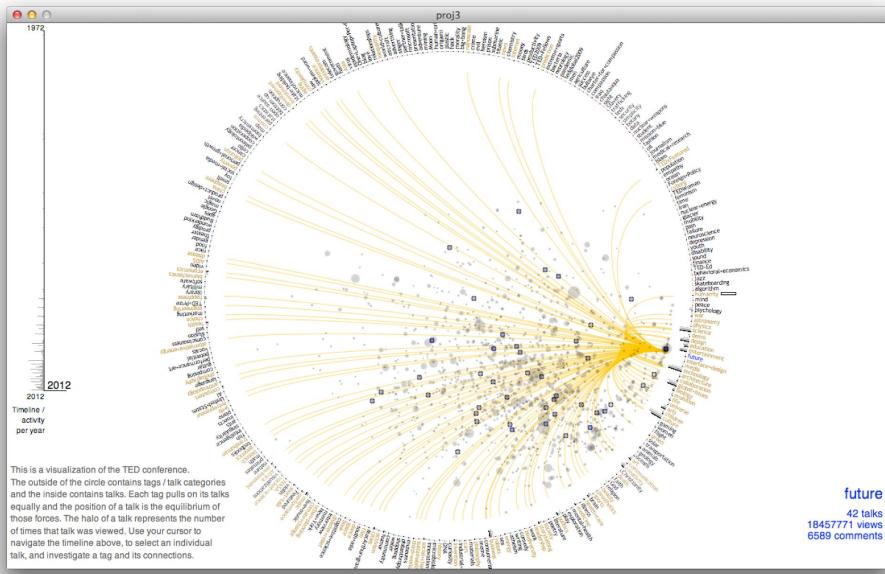
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Lecture 1

A Samuel Pottinger
Jan 22, 2025

Stat 198: Interactive Data
Science and Visualization



Today

About the course

Overview of concepts

Some logistics

Gulf of Alaska

Common names

No temperatures

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kg / hectare

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19.77 kg/hectare overall CPUE

22.18 kg/hectare overall CPUE

Dynamic scaling enabled

Dynamic scaling enabled



About the Course



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
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



I'd love to learn more about you and for you to meet some of your fellow students.

Our first homework assignment will test drive the Zulip to do introductions. Keep an eye on #learner-graded and #learner-audit for more information.

What you will be able to do after the course.

- Build data visualizations and other interactive experiences to **share your findings** with others.
- Tell **impactful stories** that engage your readers emotionally through data.
- Invite your audience in as **co-creators** to build new meaning alongside you in your work and collaborate with AI / ML to design solutions and make decisions.
- **Craft tools to explore data-heavy questions** and uncover insights.
- Incorporate **ethics and accessibility** into your data visualization work.

What we will cover together

Section Concepts

Tech

Hello

Overview of data visualization.

(Creative) Python

Primitives

Perception / cognitive science for viz.

Sketchingpy, Matplotlib

Combination

Data viz within human-centered design.

Geospatial and graph data

Conversation

Game design.

Alternative user inputs

Context

Accessibility and ethics.

Adaptive technologies

Skills

Iterative process.

JavaScript, D3, P5.js

What we will do together

Weekly
Exercises

Weekly Reading

Interactive
Experience

Final Project
+ Present

What we will do together

Weekly
Exercises

Weekly Reading

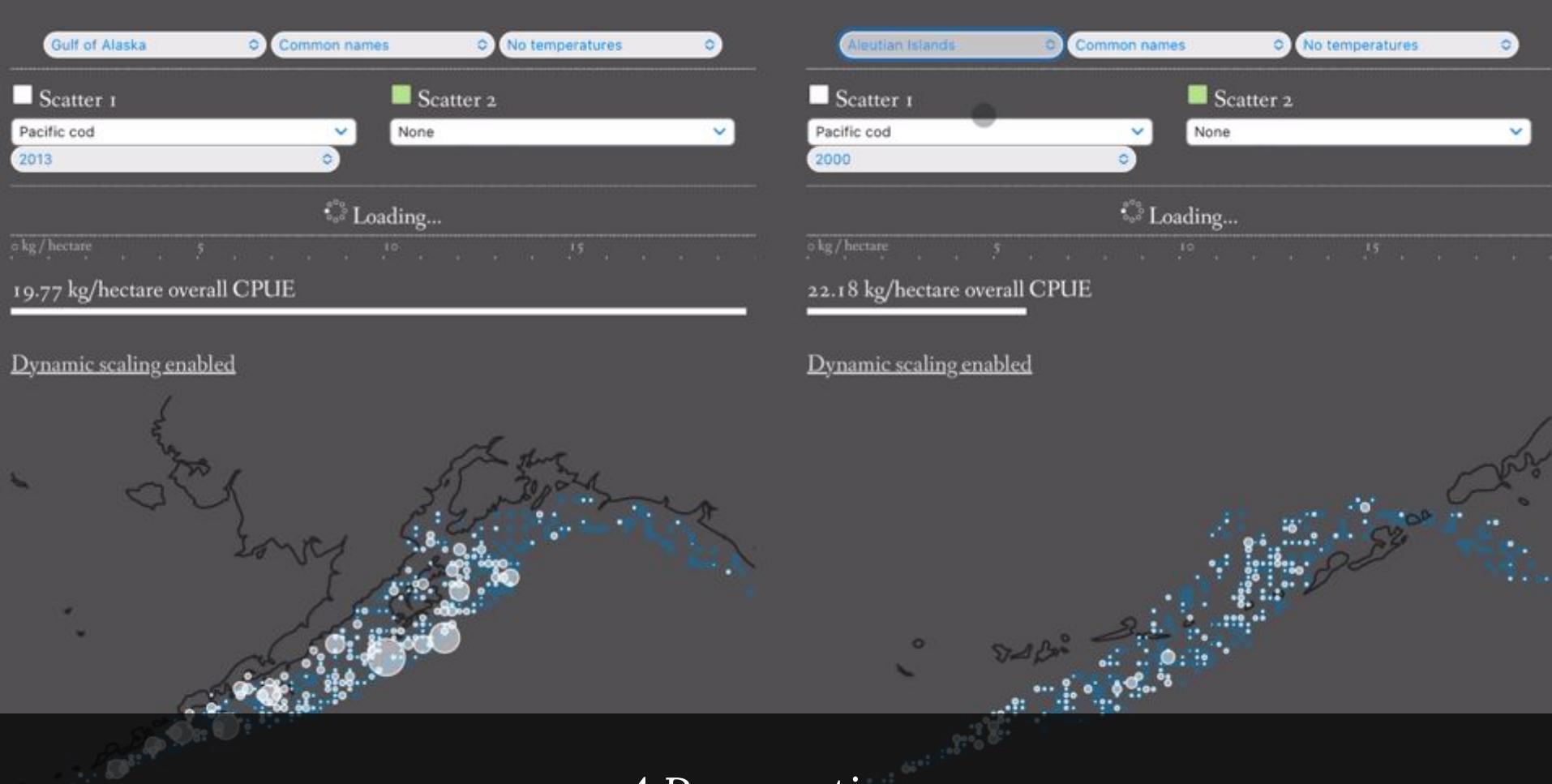
Interactive
Experience

Final Project
+ Present

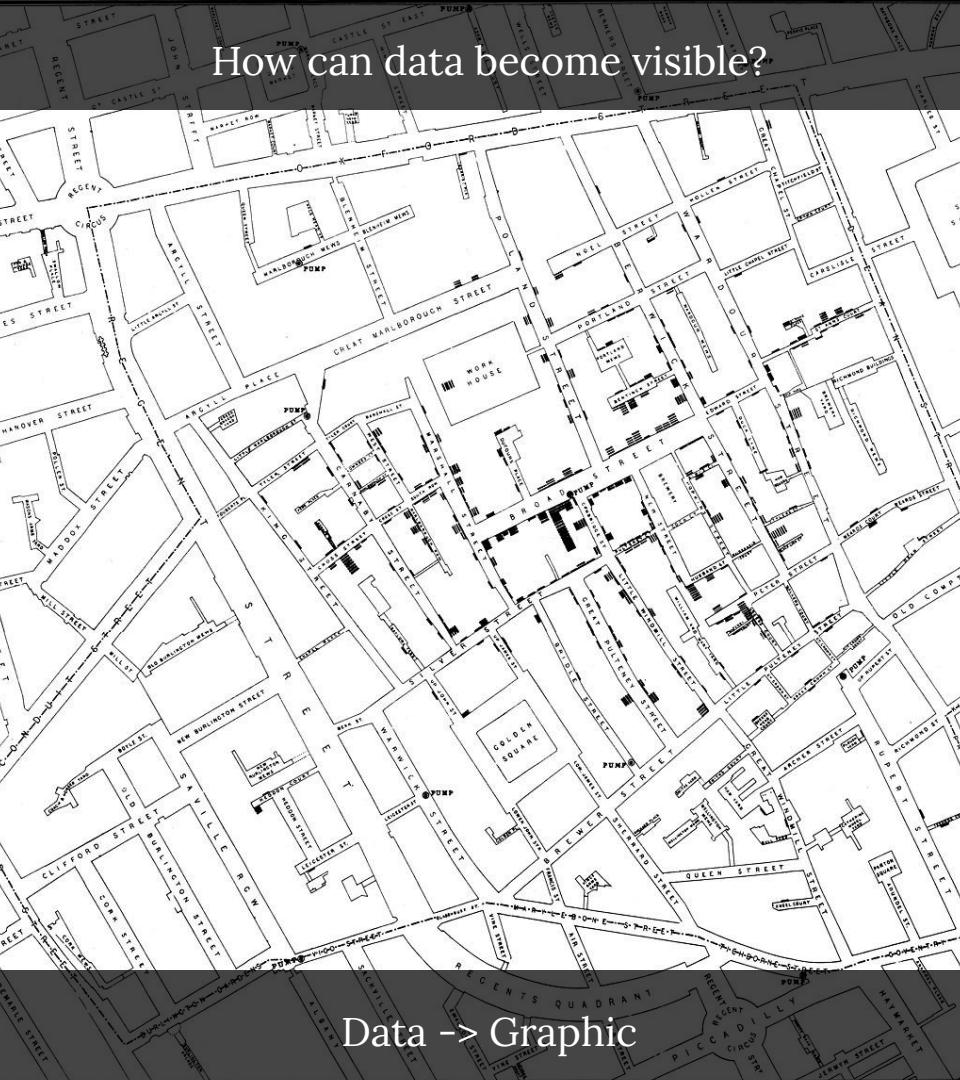
**Check out the course manual for more
information.**

Some things we won't do

- A deep investigation of data manipulation / cleaning.
- Full treatment of evaluative methods.
- Server-side engineering.
- Tableau, PowerBI, ...



How can data become visible?



Data -> Graphic

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?

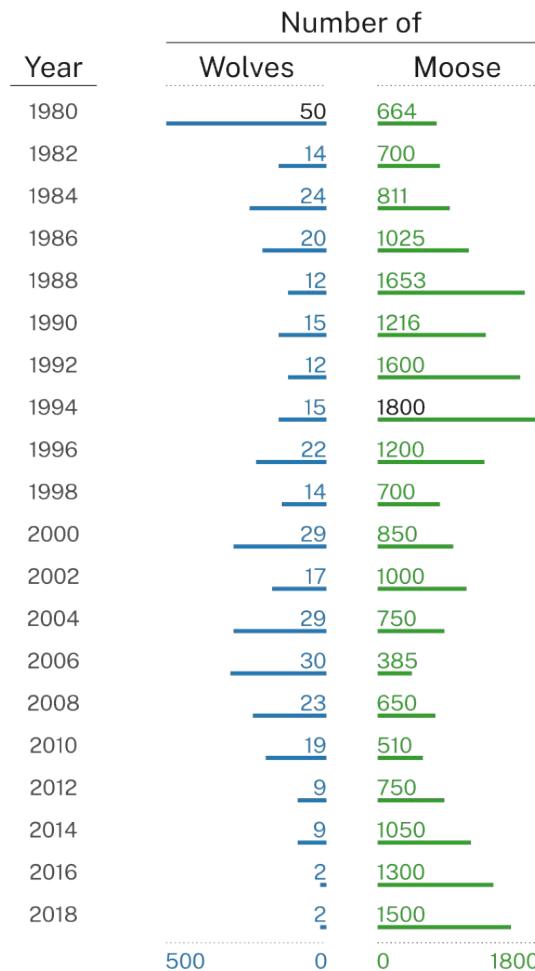
What year saw the most moose?

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
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1996	22	1200
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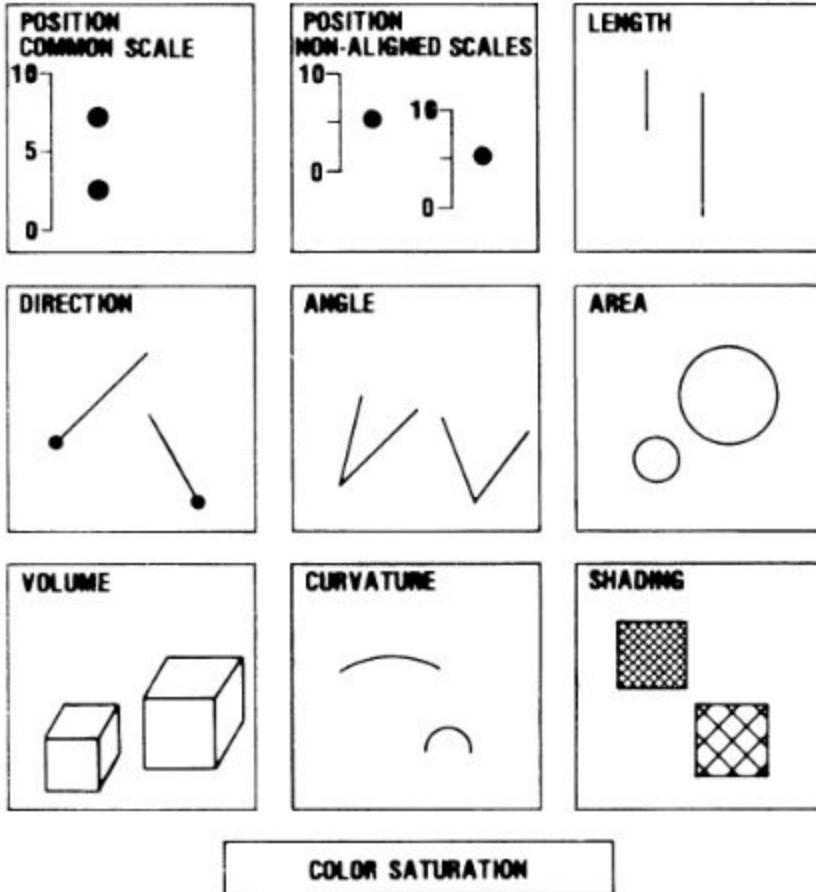


Figure 1. Elementary perceptual tasks.

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

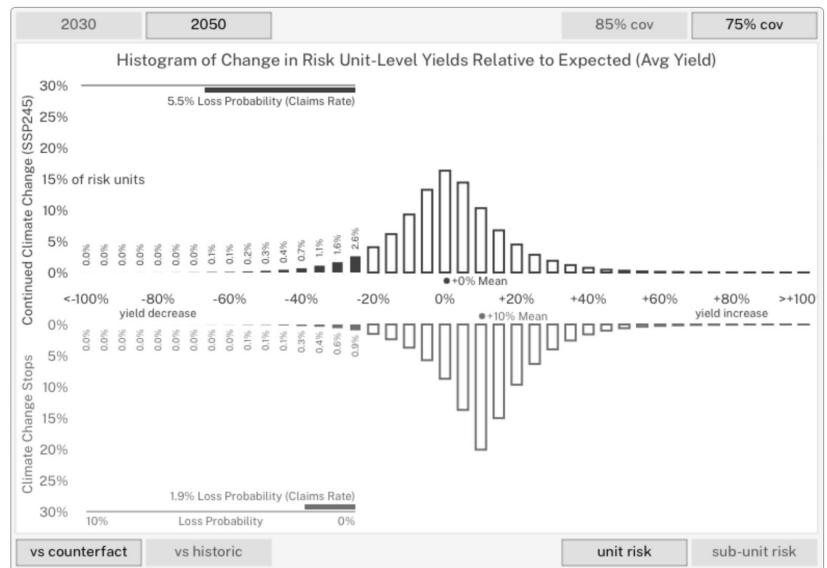
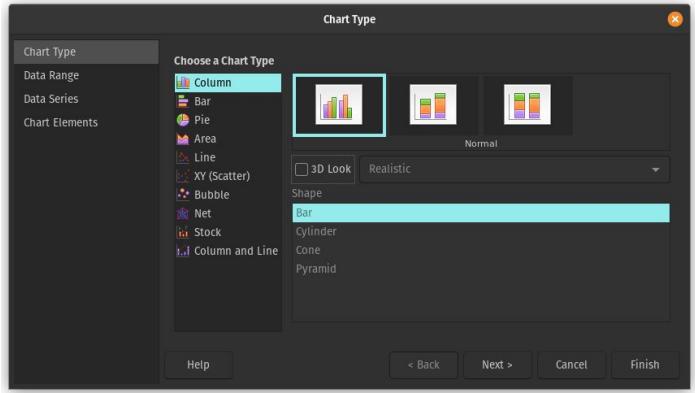
How do we “map” attributes of data to visual attributes?

What visual encodings are better than others?

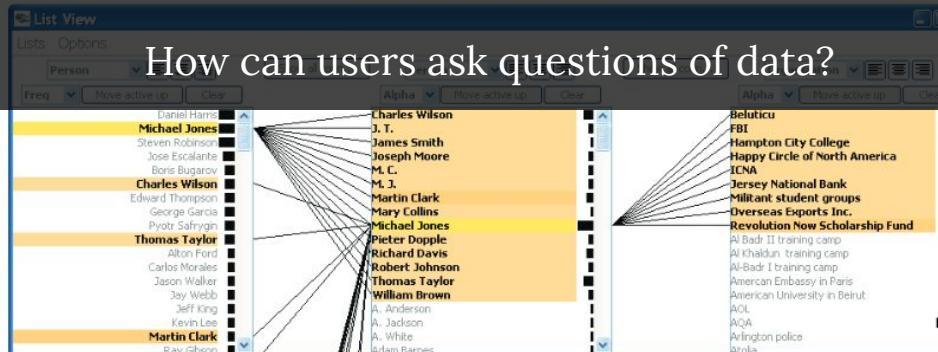
How do we make visualizations accessible?

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

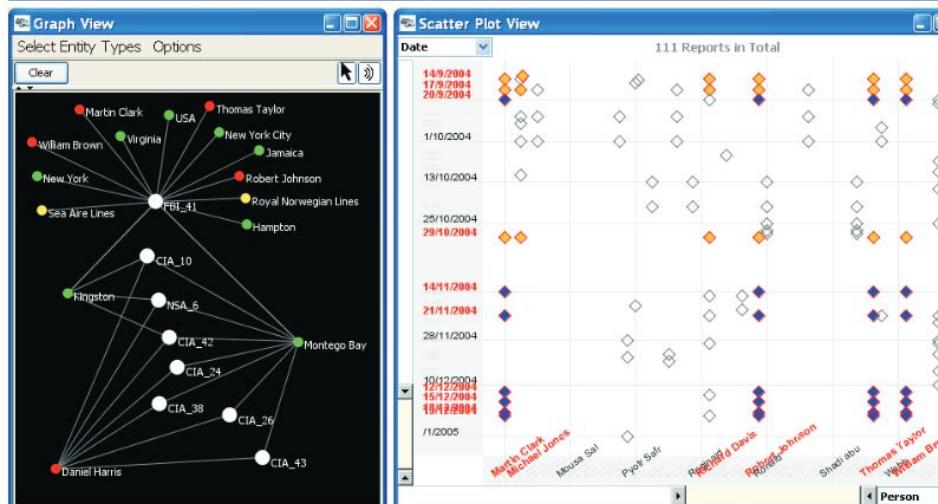
Gives us the basic building blocks for how humans process visual information but lets us use that understanding in many different ways.



Where this will come back: Learn more about human visual system to understand when to use different chart types or encoding devices.



How can users ask questions of data?



Data -> Graphic -> User

Data Visualization in 4 Acts

As representation

| As task

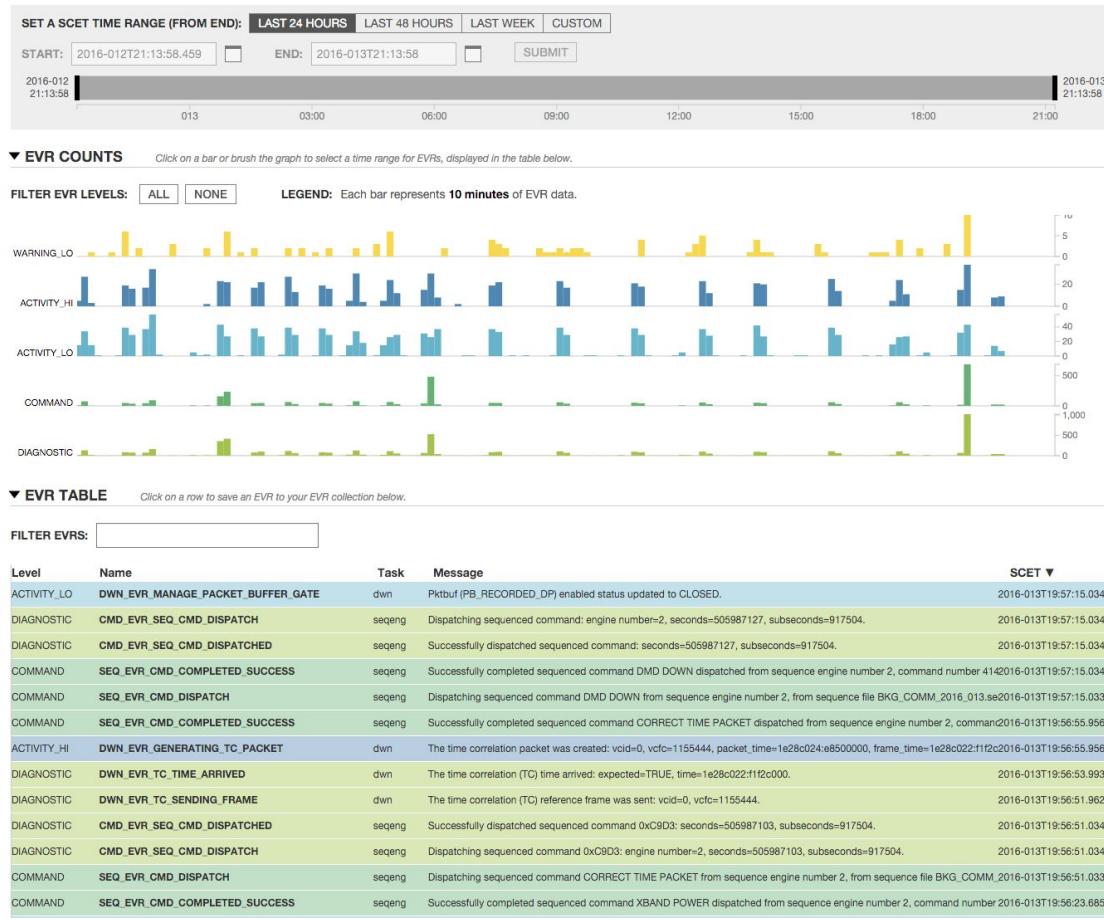
As message

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.

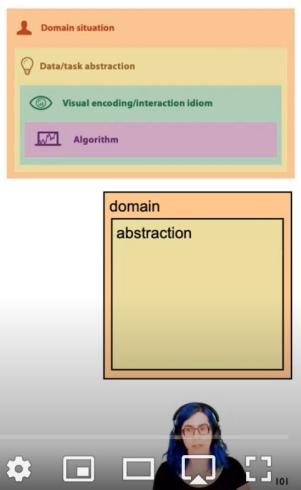
Interviewed a bunch of users to figure out how they worked with these data previously (log files).

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.

From domain to abstraction

- domain characterization:
details of application domain
 - group of users, target domain, their questions & data
 - varies wildly by domain
 - must be specific enough to get traction
 - domain questions/problems
 - break down into simpler abstract tasks
- abstraction: data & task
 - map *what* and *why* into generalized terms
 - identify tasks that users wish to perform, or already do
 - find data types that will support those tasks
 - possibly transform /derive if need be



Task Abstraction (Ch 3), Visualization Analysis & Design, 2021



Tamara Munzner
31.3K subscribers

Subscribe

119



Share

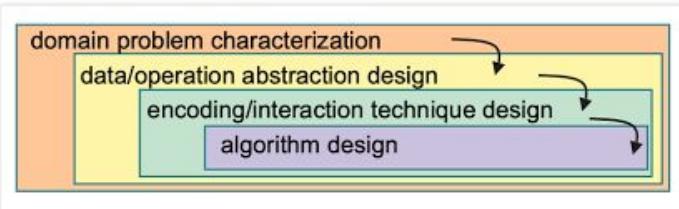
...

14K views 2 years ago

Task Abstraction Lecture, 2021.

Task Abstraction (Ch 3), Visualization Analysis & Design by Tamara Munzner, CRC/Routledge 2014.

More info including editable slides and free CC-BY diagram figures on book page: <https://www.cs.ubc.ca> ...more



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

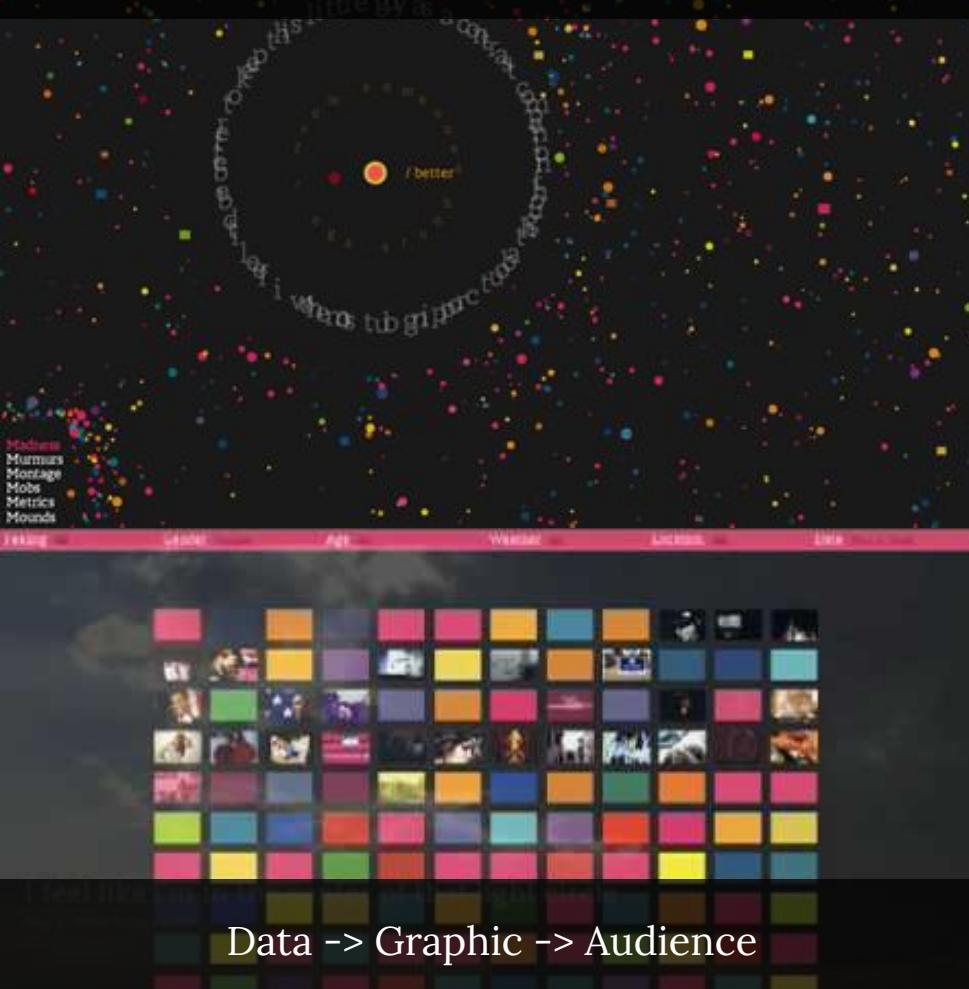
Oriented around domains, tasks, questions, and data.

Fits within a broader modern user experience design dialogue.



Where this comes back: Discussion of how to use more traditional design concepts including those employed in other forms of product and UX design as part of data visualization and interactive data experiences.

How can data tell stories?



Data -> Graphic -> Audience

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.

11,356

PEOPLE KILLED



SEX

RACE

AGE GROUP

REGION

GUN TYPE

VICTIM C

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.

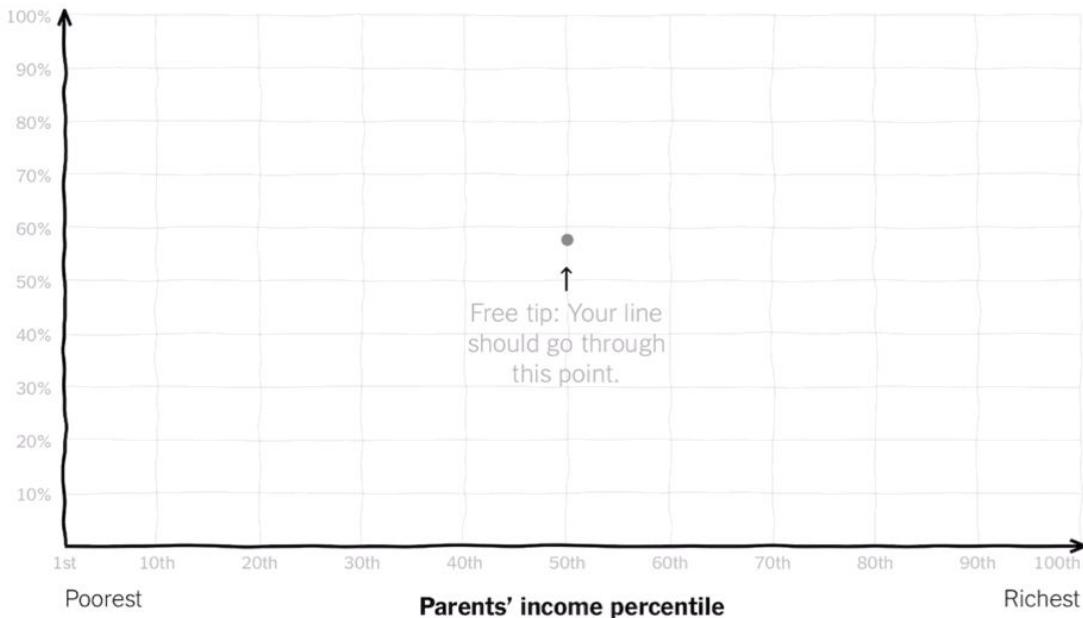
World leaders must take steps to drastically limit the
impact of plastics on the environment and human
health

CHOOSE OUR FUTURE



Draw your line on the chart below

Percent of children who attended college



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.

I'm done

Start over

11,356

PEOPLE KILLED



SEX

RACE

AGE GROUP

REGION

GUN TYPE

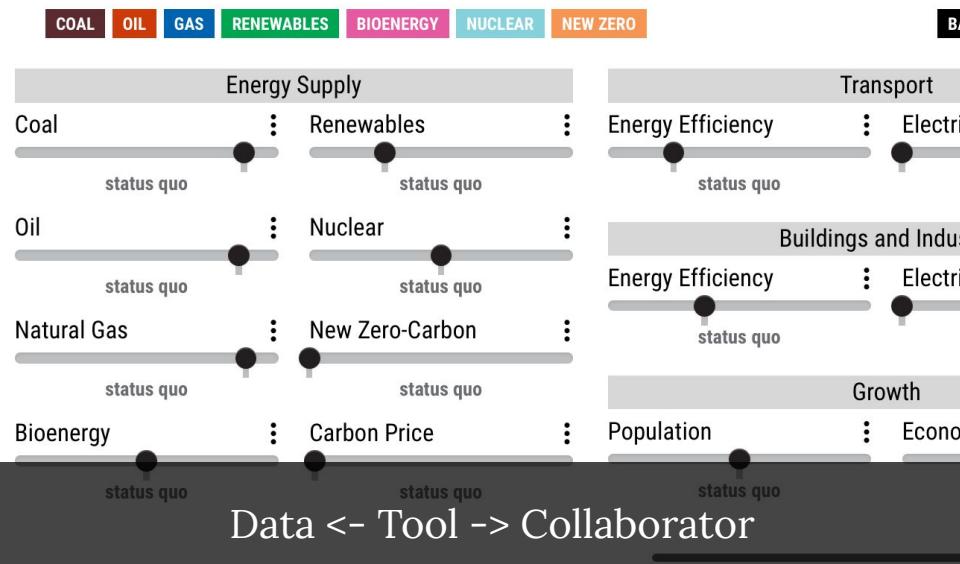
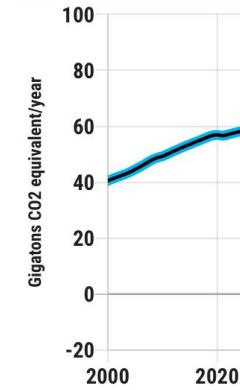
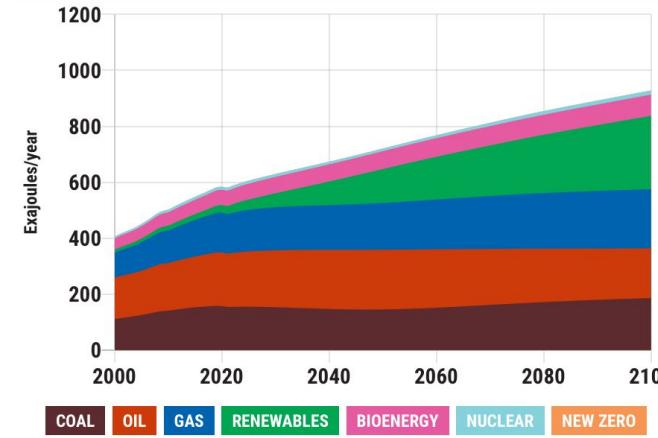
VICTIM C

Where this will come back: Techniques we can borrow from art and design to guide and evoke an emotional response.

How can data help us think?

▶ Global Sources of Primary Energy

▶ Greenhouse Gas Ne



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.



```
function drawScene (canvas) {
    ctx = canvas.getContext("2d");
    extendCanvasContext(ctx);

    canvasWidth = parseInt(canvas.getAttribute("width"));
    canvasHeight = parseInt(canvas.getAttribute("height"));

    drawSky();
    drawMountains();
    drawTree();
}

//-----
// sky
//-----

function drawSky () {
    ctx.save();

    var gradient = ctx.createLinearGradient(0,0,0,canvasHeight);
    gradient.addColorStop(0, "#b4c0fe");
    gradient.addColorStop(1, "#d3f8ff");

    ctx.fillStyle = gradient;
    ctx.fillRect(0,0,canvasWidth,canvasHeight);

    ctx.restore();

    ctx.fillStyle = "#ecff80";
    ctx.fillCircle(388, 99, 67);
}

//-----
```

“ghost train ride” vs “open world”



Mismanaged Waste ⓘ**71.7**

Million Metric Tons

**Incinerated Waste** ⓘ**129.3**

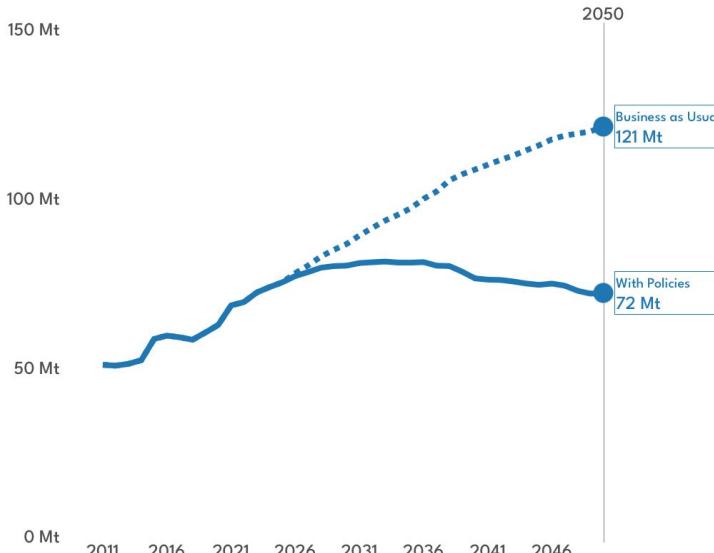
Million Metric Tons

**Landfill Waste** ⓘ**118.4**

Million Metric Tons

**Gross GHG** ⓘ**2755.7**

Million Metric Tons

**Policies** High > Reduction in Single Use Packaging ⓘ 90 > % Reduced Additives ⓘ Ban Polystyrene Packaging ⓘ Ban Waste Trade ⓘ Cap to 2020 Virgin Production ⓘ 40 > % Min Recycle Collection Rate ⓘ 80 > % Packaging Reuse / Life Extension ⓘ 40 > % Min Recycled Content ⓘ High > Packaging Consumption Tax ⓘ 100 > Billion USD for Plastic Recycling ⓘ 50 > Billion USD for Waste Infrastructure ⓘ Custom ⓘ**Add** **Save** **Load** **Share** **Reset****Customize Details** **Export CSV****Global Annual Rate of Mismanaged Waste as Million Metric Tons** ⓘ**Explore detailed projections****With Policies****Business as Usual**

Example: Finding a solution to the plastics crisis.

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

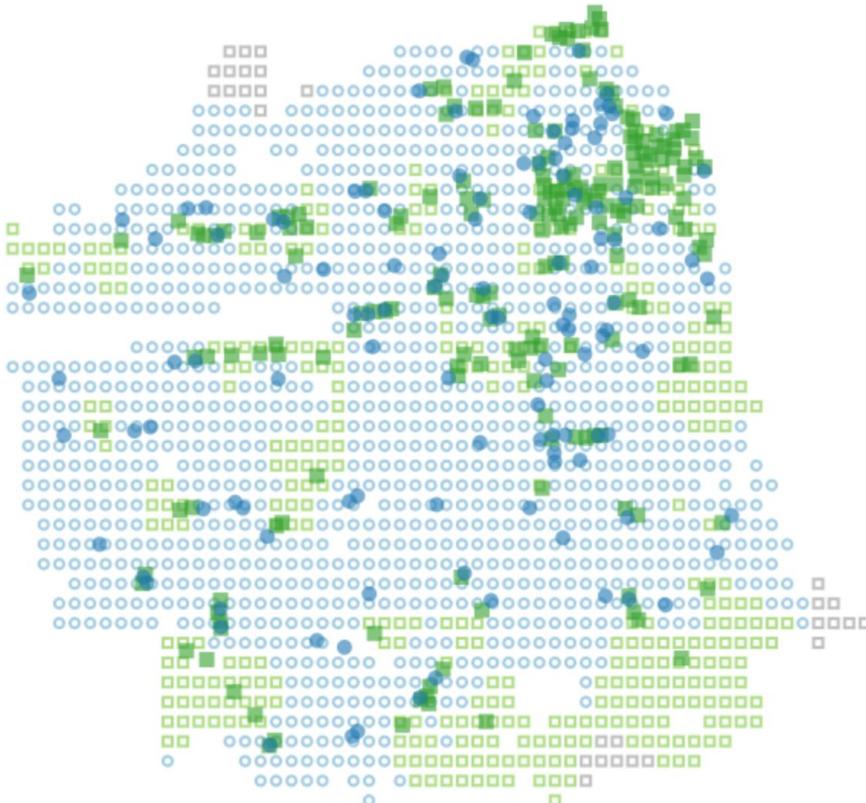
An invitation to build outside the original designer's intention.

<https://global-plastics-tool.org>



Progress:

Keep going! You have spent 0% of your budget (0% on rezoning and construction subsidy, 0% on transit improvement and subsidy). Goal: 80% choose supermarket. You can also [reset your design and try again](#).



Summ

74% c

24% c

2% m

0%

Buildi

Left cl

- Su
- Fa
- Re
- Re

Trans

-
- Invest
- travel
- .

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.

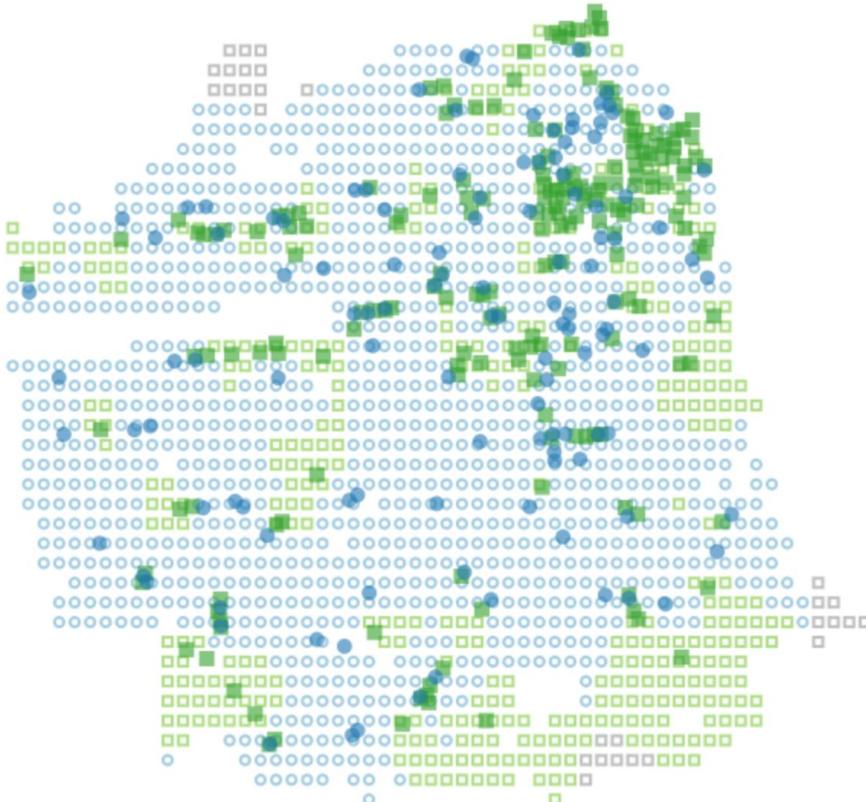
How to build media to be repurposed.

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



Progress:

Keep going! You have spent 0% of your budget (0% on rezoning and construction subsidy, 0% on transit improvement and subsidy). Goal: 80% choose supermarket. You can also [reset your design and try again](#).



Summ

74% c

24% c

2% mi

0%

Buildi

Left cl

- Su
- Fa
- Re
- Re

Trans

- Invest
- travel

Where this comes back:
How to employ interaction and game design to create digital spaces where users can explore data more freely and go beyond your own narrative.

Gulf of Alaska

Common names

No temperatures

Aleutian Islands

Common names

No temperatures

Scatter 1

Scatter 2

Pacific cod

Scatter 1

Scatter 2

Pacific cod

2013

2000

>Loading...

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kg / hectare

kg / hectare

5

10

15

20

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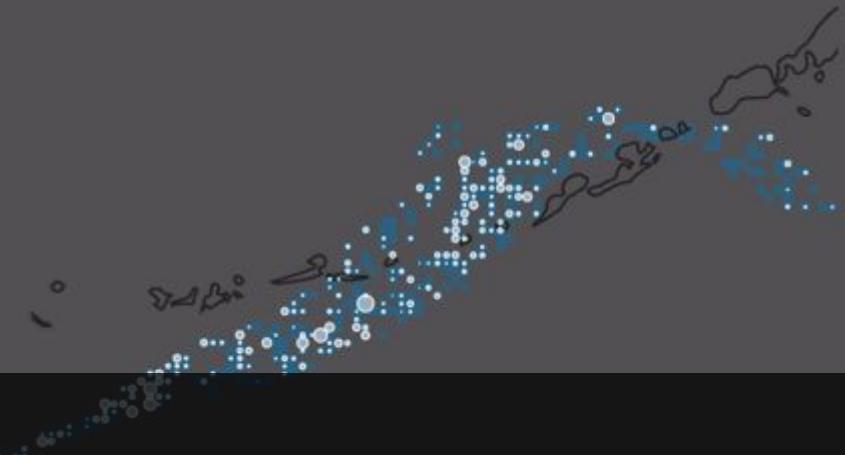
15

19.77 kg/hectare overall CPUE

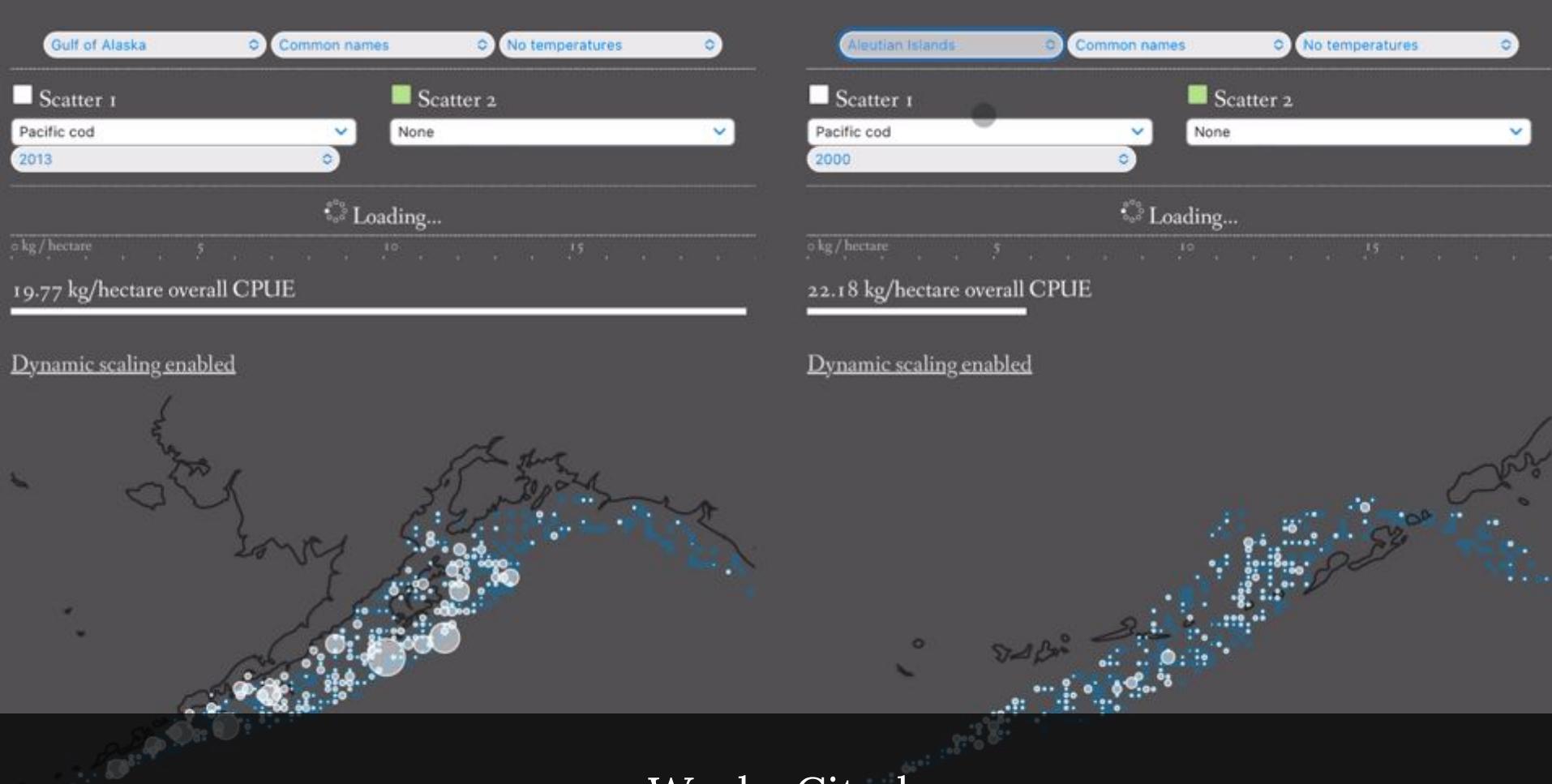
22.18 kg/hectare overall CPUE

Dynamic scaling enabled

Dynamic scaling enabled



Logistics



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