Run `git pull` in the main branch to follow along today.

# Best Project 1 Awards, D3.js (Part 2)

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**DSC 106: Data Visualization**

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UC San Diego

# Announcements

Lab 5 due today.

Project 3 checkpoint due Tuesday next week.

Project 2 peer grading coming out next week.

**FAQs:**

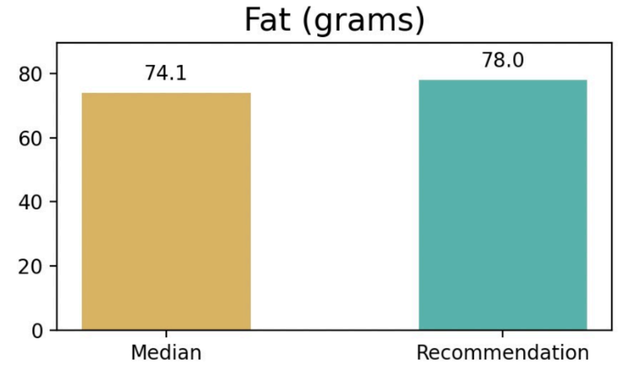
1. **How do I get the Lab 5 extra credit?** Fix the bug described in Step 5.4, then show us the working website in your video.

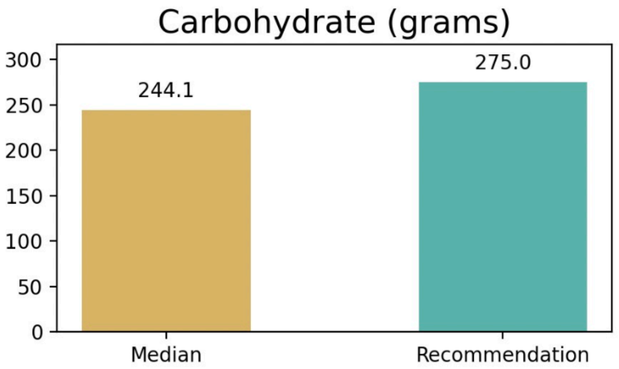
# Project 1 Best Project Awards (top 3%)

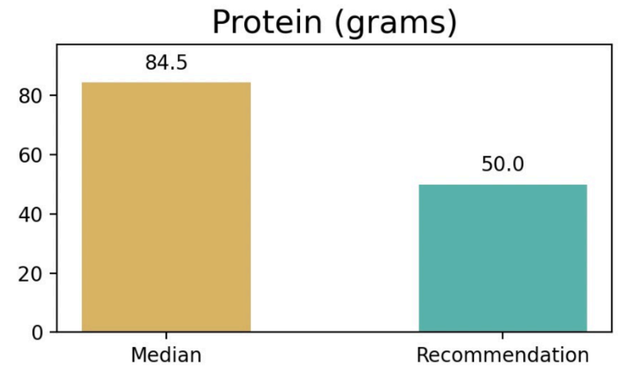
If you got an award, mention it on your resume / portfolio!

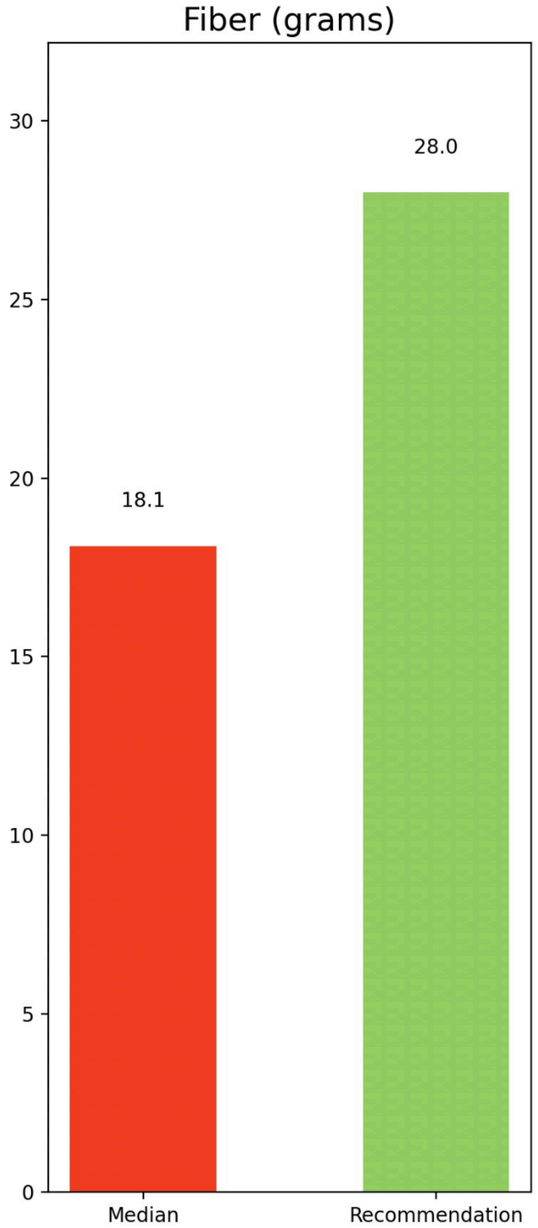
# Balanced Meal... NOT

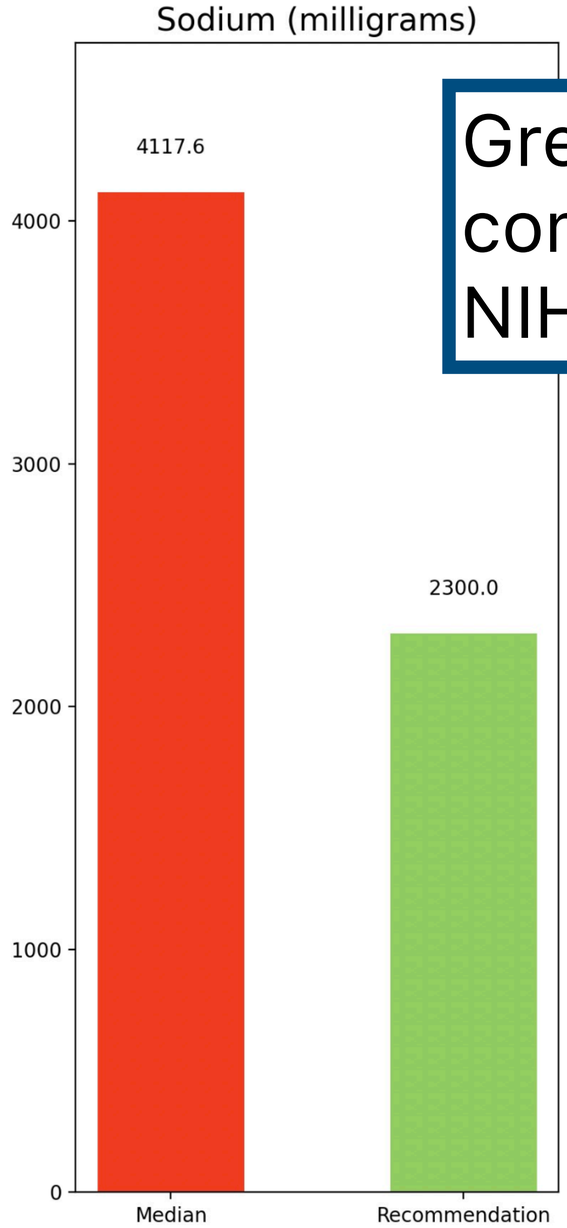
Comparison of prepared meals nutrients vs. NIH recommendations of daily intakes



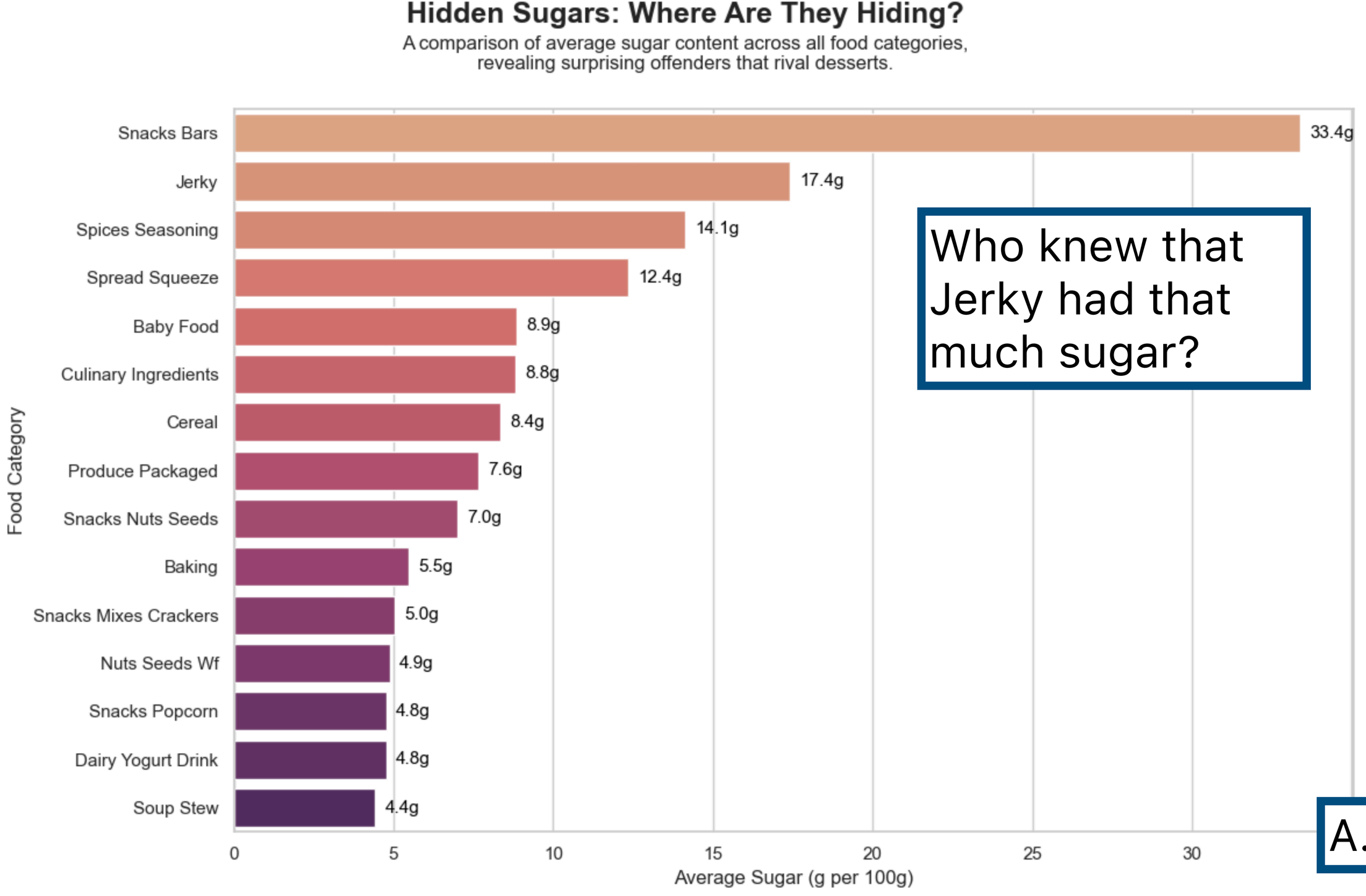



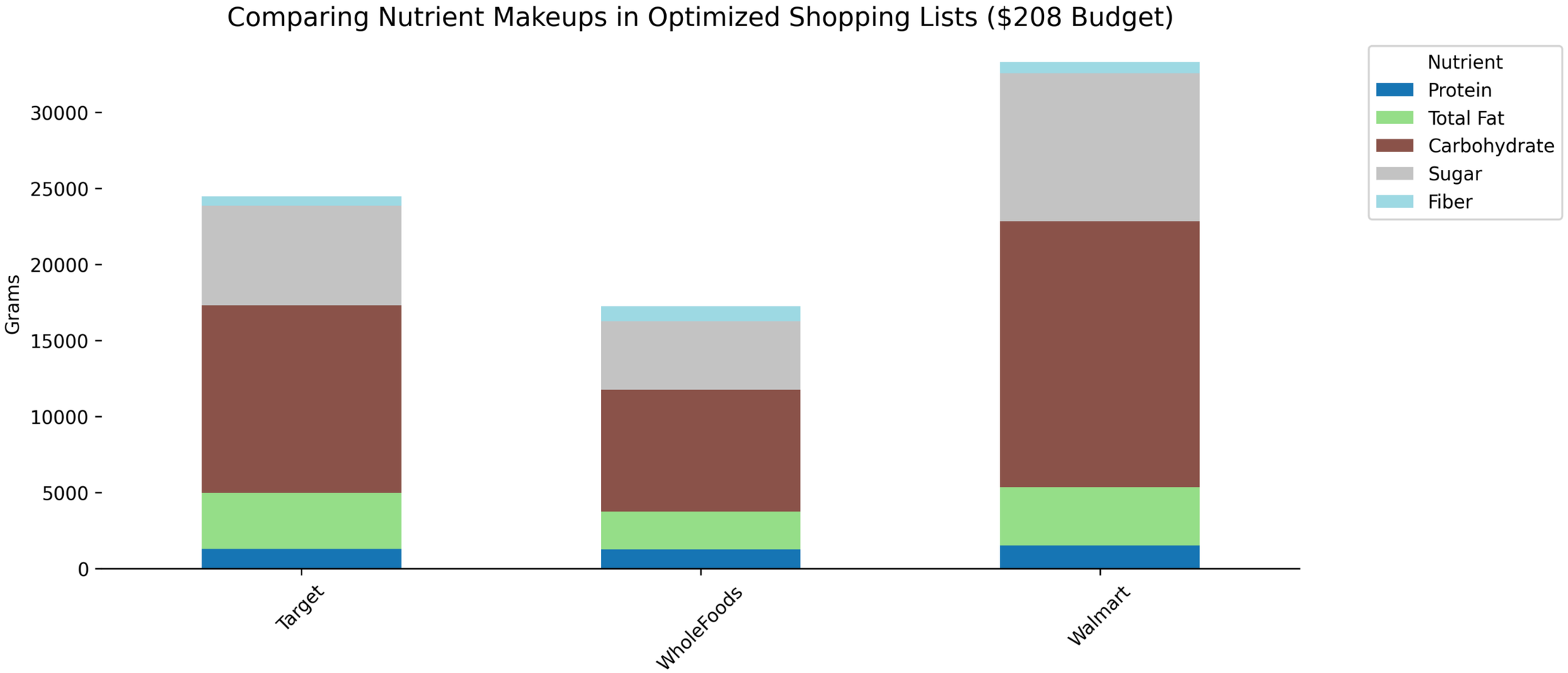

Great idea to compare against NIH recs!

K.C.

All metrics are scaled to 2000 Cal

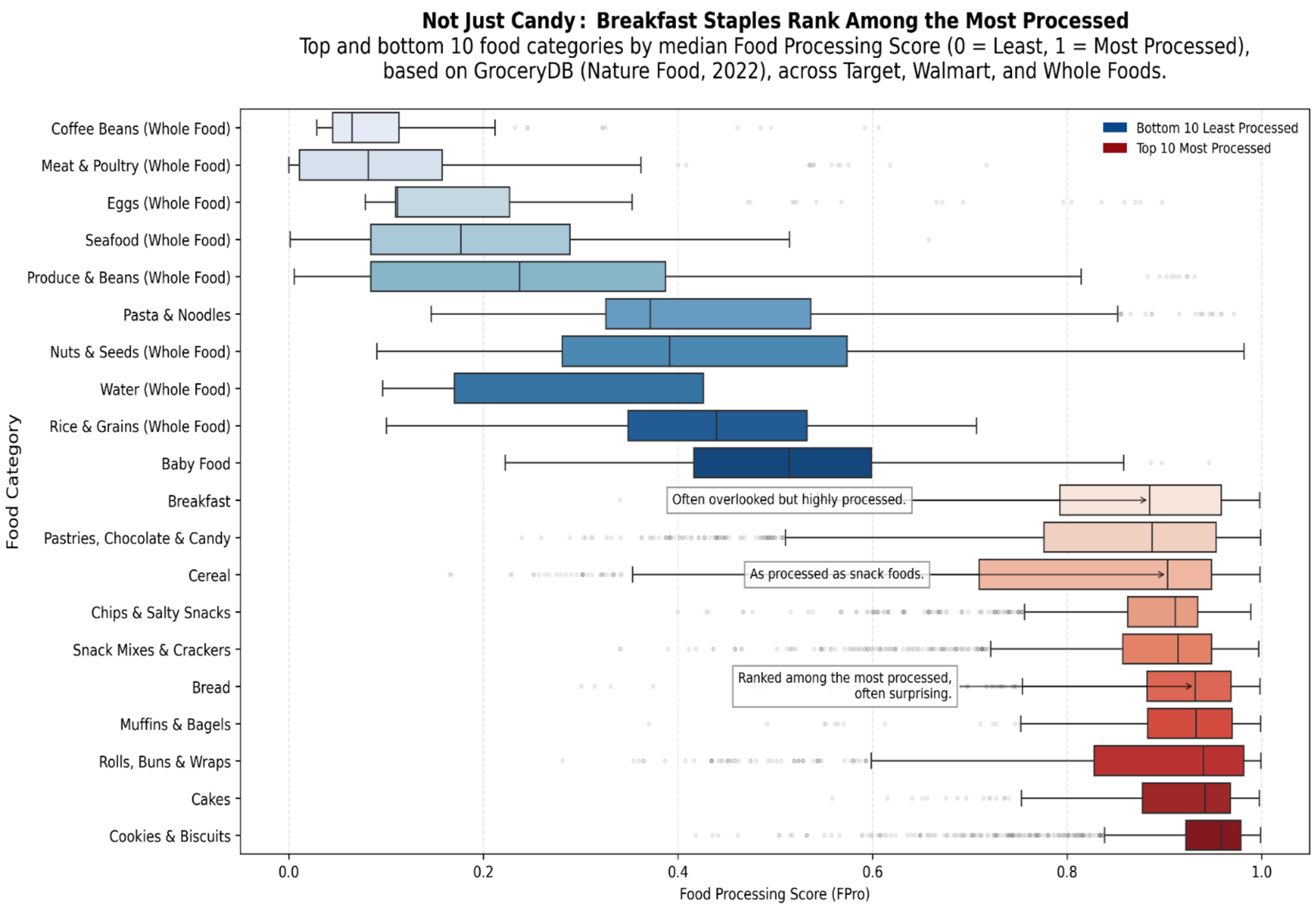

Hidden Sugars: Where Are They Hiding?
A comparison of average sugar content across all food categories,
revealing surprising offenders that rival desserts.
Snacks Bars
Jerky
Spices Seasoning
Spread Squeeze
Baby Food
Culinary Ingredients
Cereal
Produce Packaged
Snacks Nuts Seeds
Baking
Snacks Mixes Crackers
Nuts Seeds Wf
Snacks Popcorn
Dairy Yogurt Drink
Soup Stew
33.4g
17.4g
14.1g
12.4g
8.9g
8.8g
8.4g
7.6g
7.0g
5.5g
5.0g
4.9g
4.8g
4.8g
4.4g
Food Category
0
5
10
15
20
25
30
Average Sugar (g per 100g)
Who knew that Jerky had that much sugar?
A.W.

# Buying in Bulk or Buying to Bulk?




Maybe stacked bars weren’t the best, but $208 average American budget is smart!

A.B.

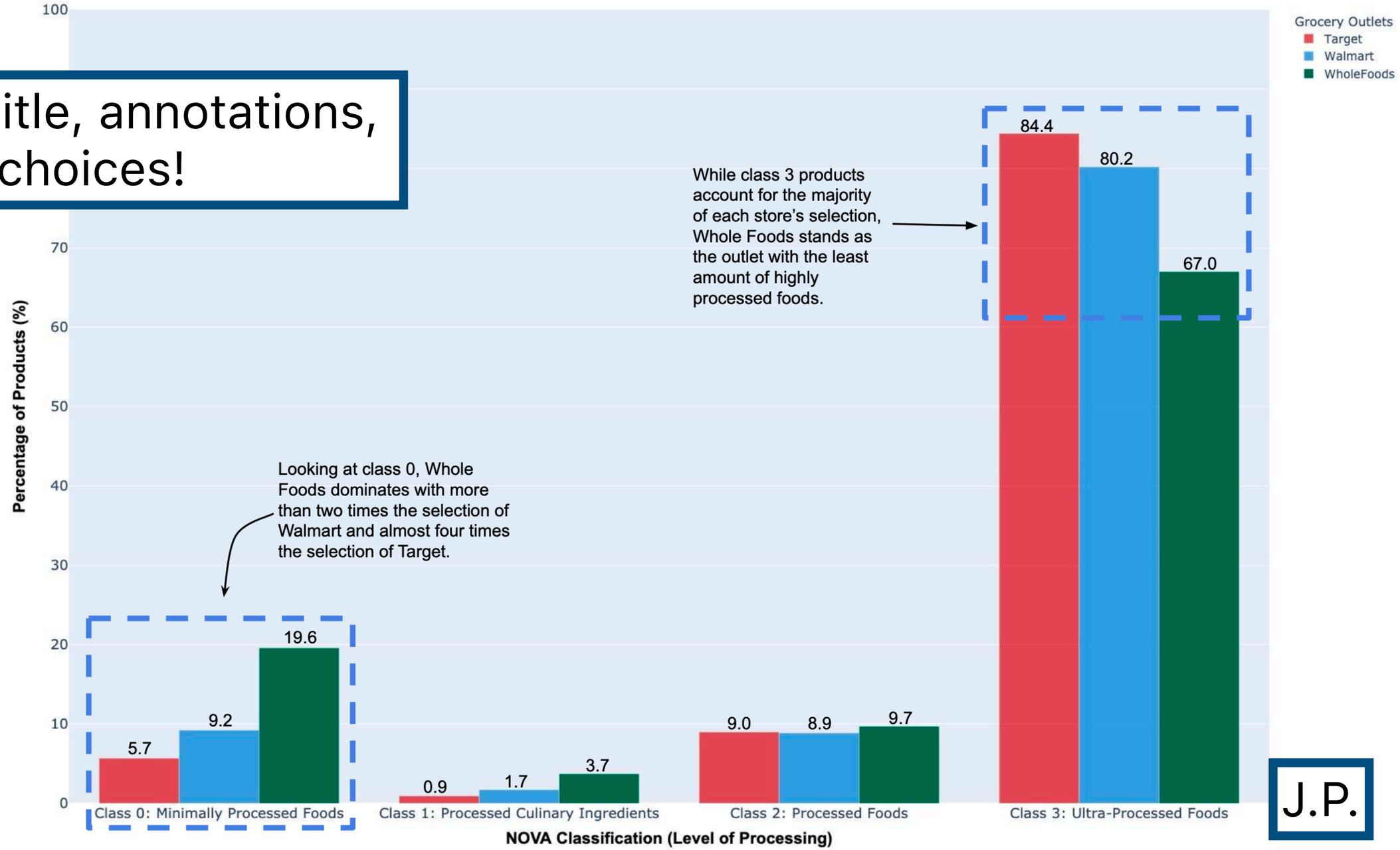



Who knew breakfast, cereal, and bread were that processed? H.M.

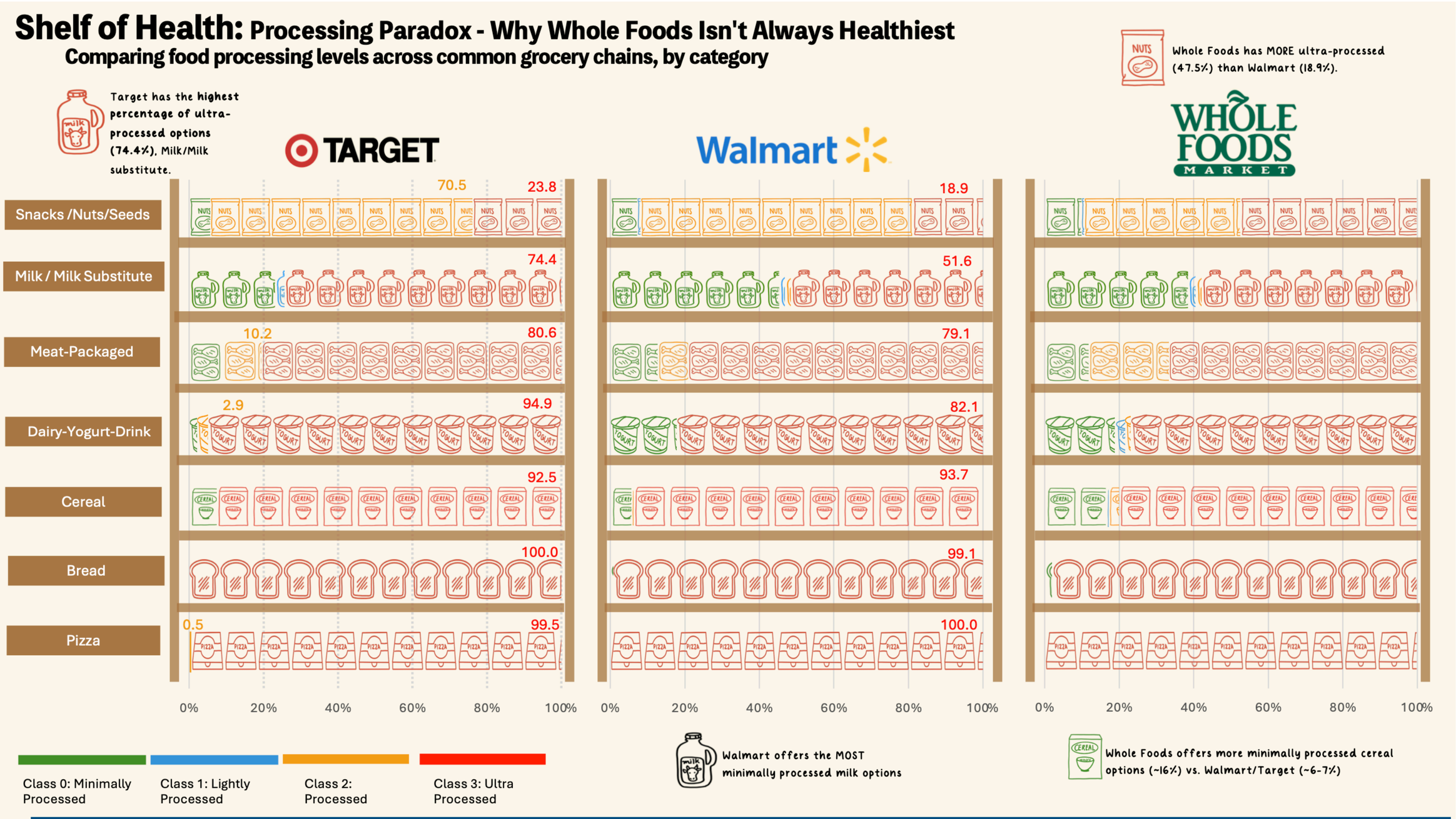
# Who's Wholer than Whole Foods? Exploring Major Grocery Outlets' Selections

The NOVA classification system groups food products based on how processed they are. Class 0 is the classification of whole foods, so does Whole Foods, a store known for organic, high-quality selection, live up to its name compared to Target and Walmart, which are better known for cheaper, more accessible selections?

Nice title, annotations, color choices!




J.P.




C.T.

Really creative and tangible visual encoding!

# Project 2 Peer Feedback

Opportunity to get feedback from your peers.

"I like / I wish / What if?" format.

Worth 5% of your final grade, graded by completion.

# Project 3: Interactive Visualization

Choose a health dataset.

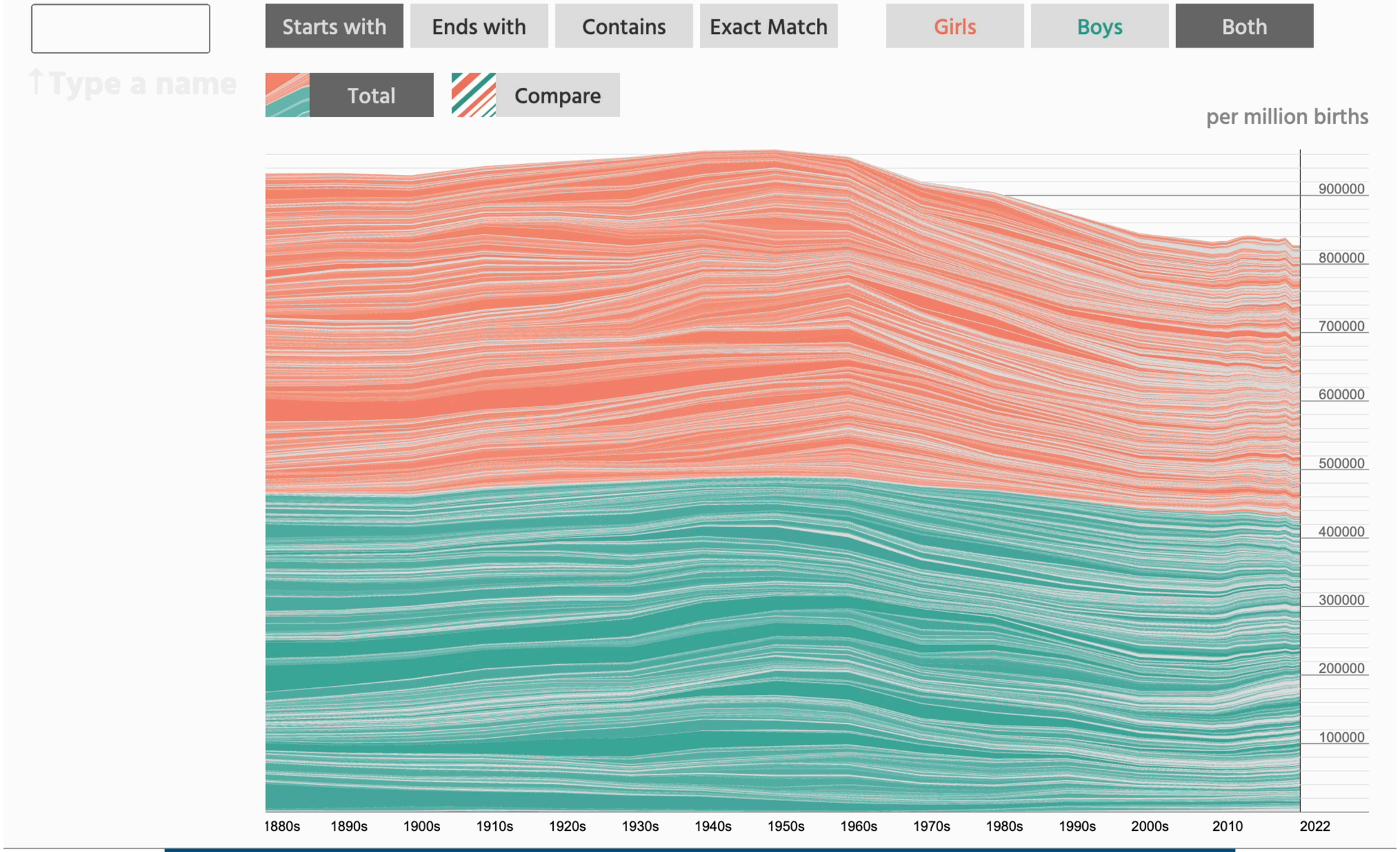
Create **one** interactive graphic to let readers explore the data.

E.g. filtering, zooming, brushing, annotations, etc.

**Must use D3**, no other plotting libraries allowed.

Must complete in teams of 3-4.

Pro-tip: Explore lots of options using pen-and-paper. Then, keep scope of project very tight! Do one thing well.



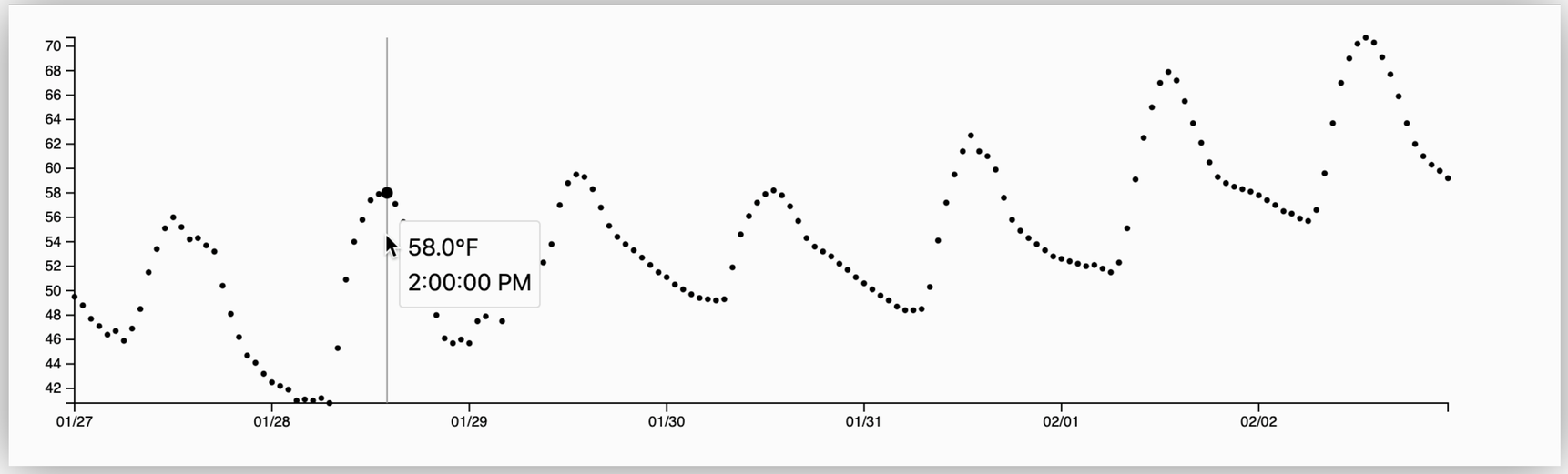

https://namerology.com/baby-name-grapher/

# D3

# Today: Making an interactive scatterplot

Before:

After:



# Step 1: Using D3 instead of plain JS

Before:

After:

But in D3!

**Demo:** `d3-lecture/weather01`

# D3 Selections

Before:

```
const svg = document.querySelector('#weather-plot');
```

After:

```
const svg = d3.select('#weather-plot');
```

This is a D3 selection object, so it has D3 methods (not HTML methods!)

# D3 Selections

Before:

```
const svg = document.querySelector('#weather-plot');
```

```
svg.setAttribute('width', 1000);
svg.setAttribute('height', 500);
```

HTML element method

After:

```
const svg = d3.select('#weather-plot');
```

```
svg.attr('width', 1000);
svg.attr('height', 500);
```

D3 equivalent

Don’t memorize method names, just use Copilot / ChatGPT

But ALWAYS know when you have a D3 vs. native object!

# Data Joins

Before:

```
weatherData.hourly.temperature_2m.forEach((temp, index) => {
  const text = document.createElementNS('http://www.w3.org/2000/svg', 'text');
  text.setAttribute('x', index * 5);
  text.setAttribute('y', 500 - temp * 6);

  text.textContent = temp;
  svg.appendChild(text);
});
```

HTML methods

After:

```
svg
  .selectAll('text')
  .data(weatherData.hourly.temperature_2m)
  .join('text')
  .attr('x', (d, i) => i * 5)
  .attr('y', (d) => 500 - d * 6)
  .text((d) => d);
```

The D3 way

No explicit for loop, but there is one internally!

# Data Joins

```
svg
  .selectAll('text')
  .data(weatherData.hourly.temperature_2m)
  .join('text')
  .attr('x', (d, i) => i * 5)
  .attr('y', (d) => 500 - d * 6)
  .text((d) => d);
```

Match data with text elements

What's not intuitive: You use selectAll() for elements that you want to **CREATE**, but it sounds like you're looking for text elements that already exist.

# Data Joins

```
svg
  .selectAll('text')
  .data(weatherData.hourly.temperature_2m)
  .join('text')
  .attr('x', (d, i) => i * 5)
  .attr('y', (d) => 500 - d * 6)
  .text((d) => d);
```

Create one new text element for each datum

Does more than just create new elements, but good enough analogy for now.

# Data Joins

```
svg
  .selectAll('text')
  .data(weatherData.hourly.temperature_2m)
  .join('text')
  .attr('x', (d, i) => i * 5)
  .attr('y', (d) => 500 - d * 6)
  .text((d) => d);
```

Set the x, y, and text content of each text element

Notice that each .attr() method takes in a **function**. Function gets called with 2 arguments: actual data element and index.

(Actually, called with 3 arguments. But JS functions ignore extra arguments!)

# Data Joins

```
svg
  .selectAll('text')
  .data(weatherData.hourly.temperature_2m)
  .join('text')
  .attr('x', (d, i) => i * 5)
  .attr('y', (d) => 500 - d * 6)
  .text((d) => d);
```

Set the x, y, and text content of each text element

What do the numbers 5, 6, and 500 mean?

Nothing really, why not do that automatically?

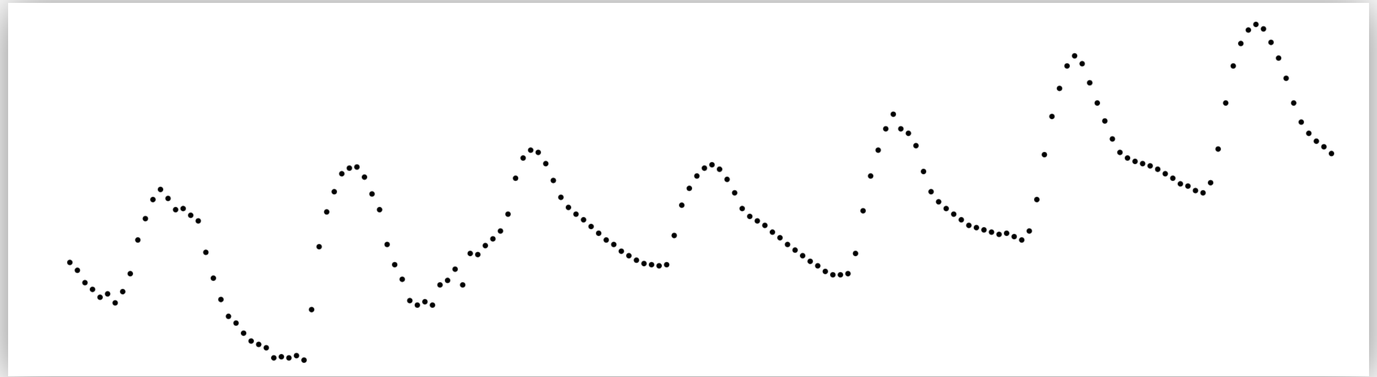
# Submit a question about Step 1

tryclassbuzz.com
Code: **d3-1**

# Step 2: Making circles and using d3 scales

Before:


After:



**Demo:** `d3-lecture/weather02`

# Making circles

Before:

```
svg
  .selectAll('text')
  .data(weatherData.hourly.temperature_2m)
  .join('text')
  .attr('x', (d, i) => i * 5)
  .attr('y', (d) => 500 - d * 6)
  .text((d) => d);
```

After:

```
svg
  .selectAll('circle')
  .data(weatherData.hourly.temperature_2m)
  .join('circle')
  .attr('cx', (d, i) => xScale(i))
  .attr('cy', (d) => yScale(d))
  .attr('r', 2);
```

Just needed to swap out text with circle + set the right attributes.

Circles only have cx and cy, not x and y

# Scales

Before:

```
.attr('cx', (d, i) => i * 5)
.attr('cy', (d) => 500 - d * 6)
```

Magic numbers!

After:

```
.attr('cx', (d, i) => xScale(i))
.attr('cy', (d) => yScale(d))
```

D3 scales

```
const xScale = d3
  .scaleLinear()
  .domain([0, weatherData.hourly.temperature_2m.length - 1])
  .range([margin.left, width - margin.right]);
```

Domain = possible inputs

Range = possible outputs

D3 scales will automatically make plot fit the space.

# Scales

Let’s work out how a scale works by hand.

| | time | temperature_2m |
|---|---|---|
| **0** | 2025-04-24T00:00 | 55.6 |
| **1** | 2025-04-24T01:00 | 55.6 |
| **2** | 2025-04-24T02:00 | 55.2 |
| **3** | 2025-04-24T03:00 | 55.9 |
| **4** | 2025-04-24T04:00 | 56.7 |
| **...** | ... | ... |
| **163** | 2025-04-30T19:00 | 63.4 |
| **164** | 2025-04-30T20:00 | 61.8 |
| **165** | 2025-04-30T21:00 | 61.0 |
| **166** | 2025-04-30T22:00 | 60.9 |
| **167** | 2025-04-30T23:00 | 60.7 |

1000px wide

# Scales

Let’s work out how a scale works by hand.

| | time | temperature_2m |
|---|---|---|
| **0** | 2025-04-24T00:00 | 55.6 |
| **1** | 2025-04-24T01:00 | 55.6 |
| **2** | 2025-04-24T02:00 | 55.2 |
| **3** | 2025-04-24T03:00 | 55.9 |
| **4** | 2025-04-24T04:00 | 56.7 |
| **…** | … | … |
| **163** | 2025-04-30T19:00 | 63.4 |
| **164** | 2025-04-30T20:00 | 61.8 |
| **165** | 2025-04-30T21:00 | 61.0 |
| **166** | 2025-04-30T22:00 | 60.9 |
| **167** | 2025-04-30T23:00 | 60.7 |

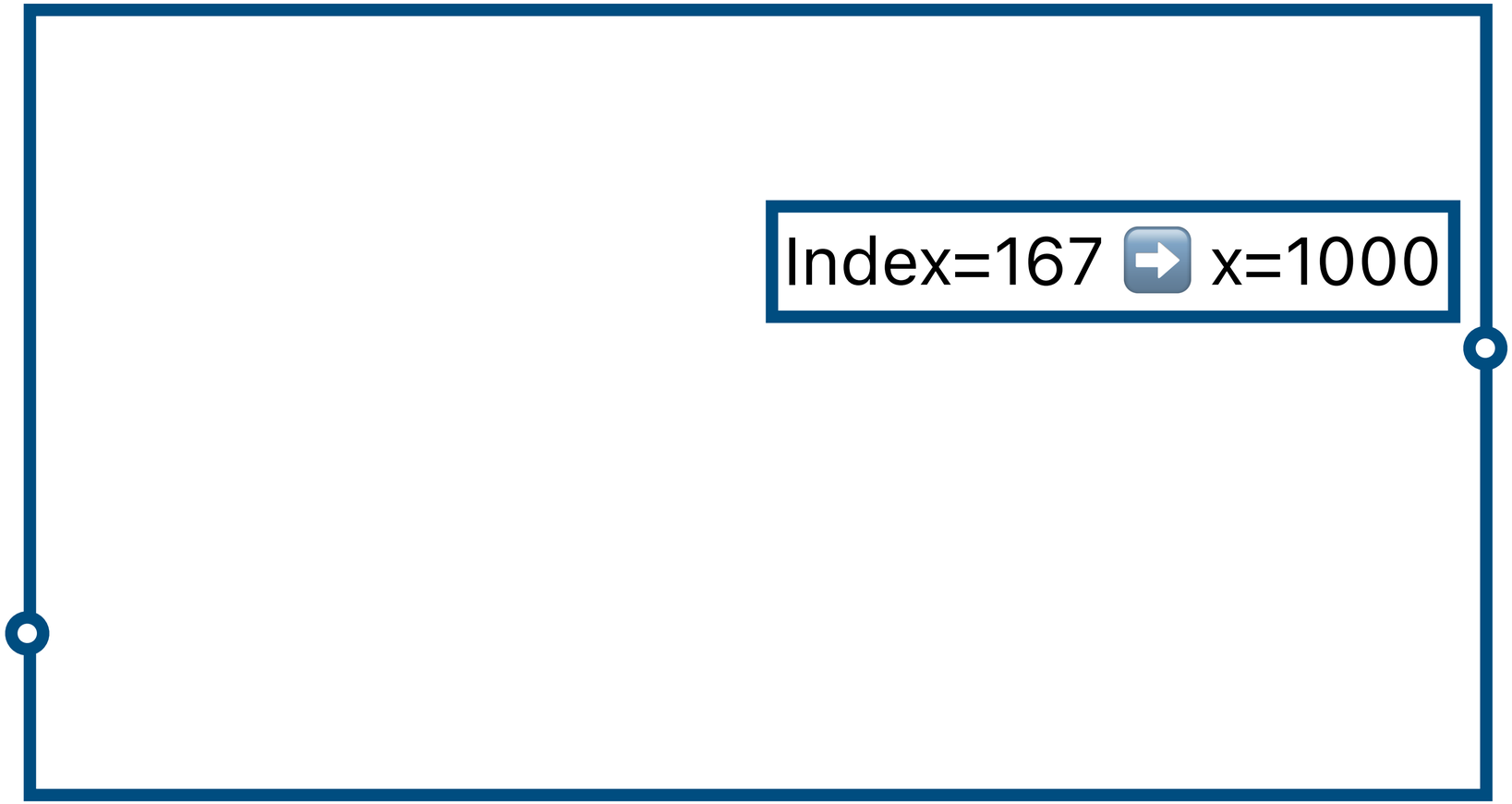
Index=0 ➡️ x=0

1000px wide

# Scales

Let’s work out how a scale works by hand.

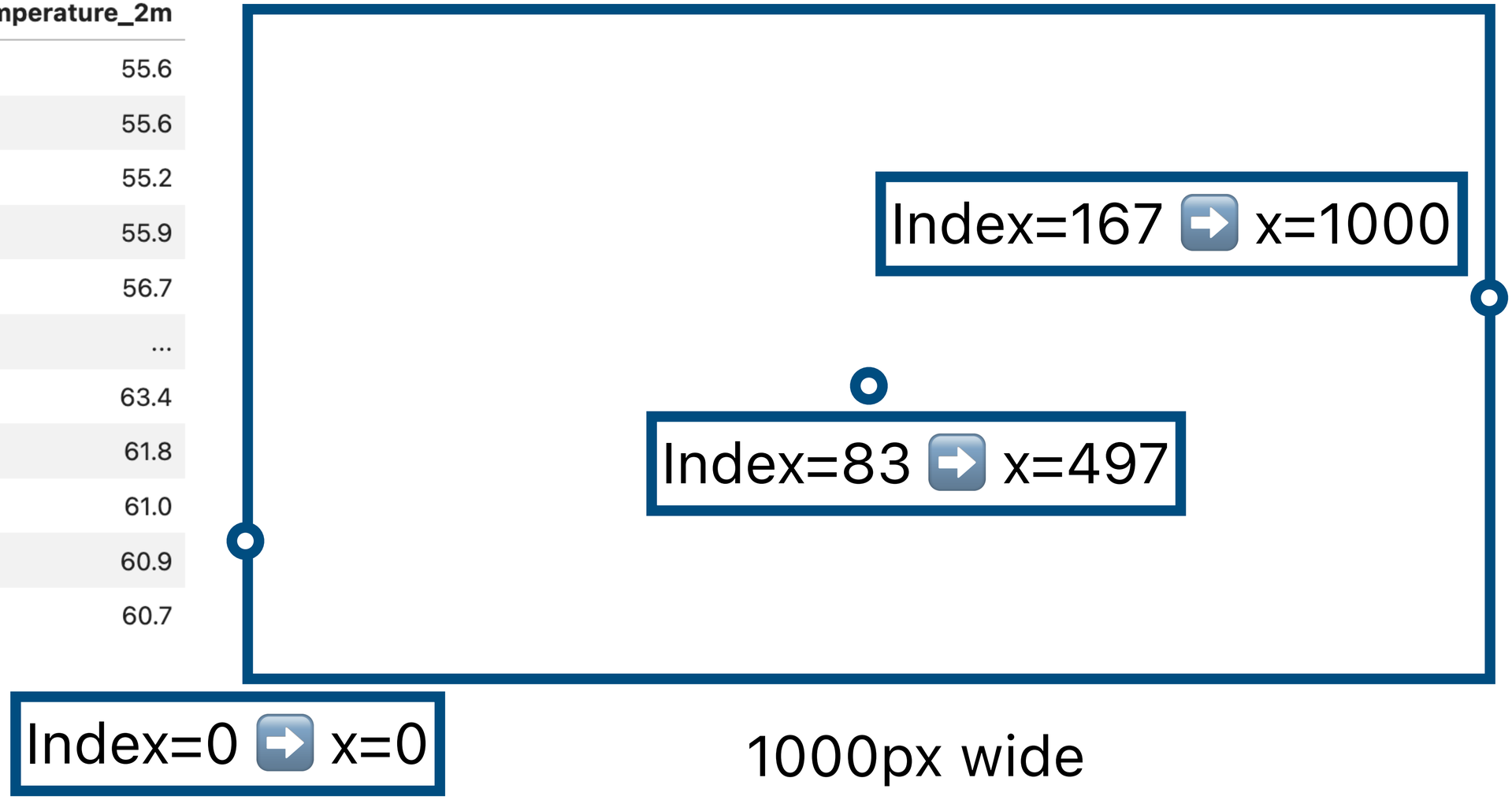
| | time | temperature_2m |
|---|---|---|
| 0 | 2025-04-24T00:00 | 55.6 |
| 1 | 2025-04-24T01:00 | 55.6 |
| 2 | 2025-04-24T02:00 | 55.2 |
| 3 | 2025-04-24T03:00 | 55.9 |
| 4 | 2025-04-24T04:00 | 56.7 |
| … | … | … |
| 163 | 2025-04-30T19:00 | 63.4 |
| 164 | 2025-04-30T20:00 | 61.8 |
| 165 | 2025-04-30T21:00 | 61.0 |
| 166 | 2025-04-30T22:00 | 60.9 |
| 167 | 2025-04-30T23:00 | 60.7 |



# Scales

Let’s work out how a scale works by hand.

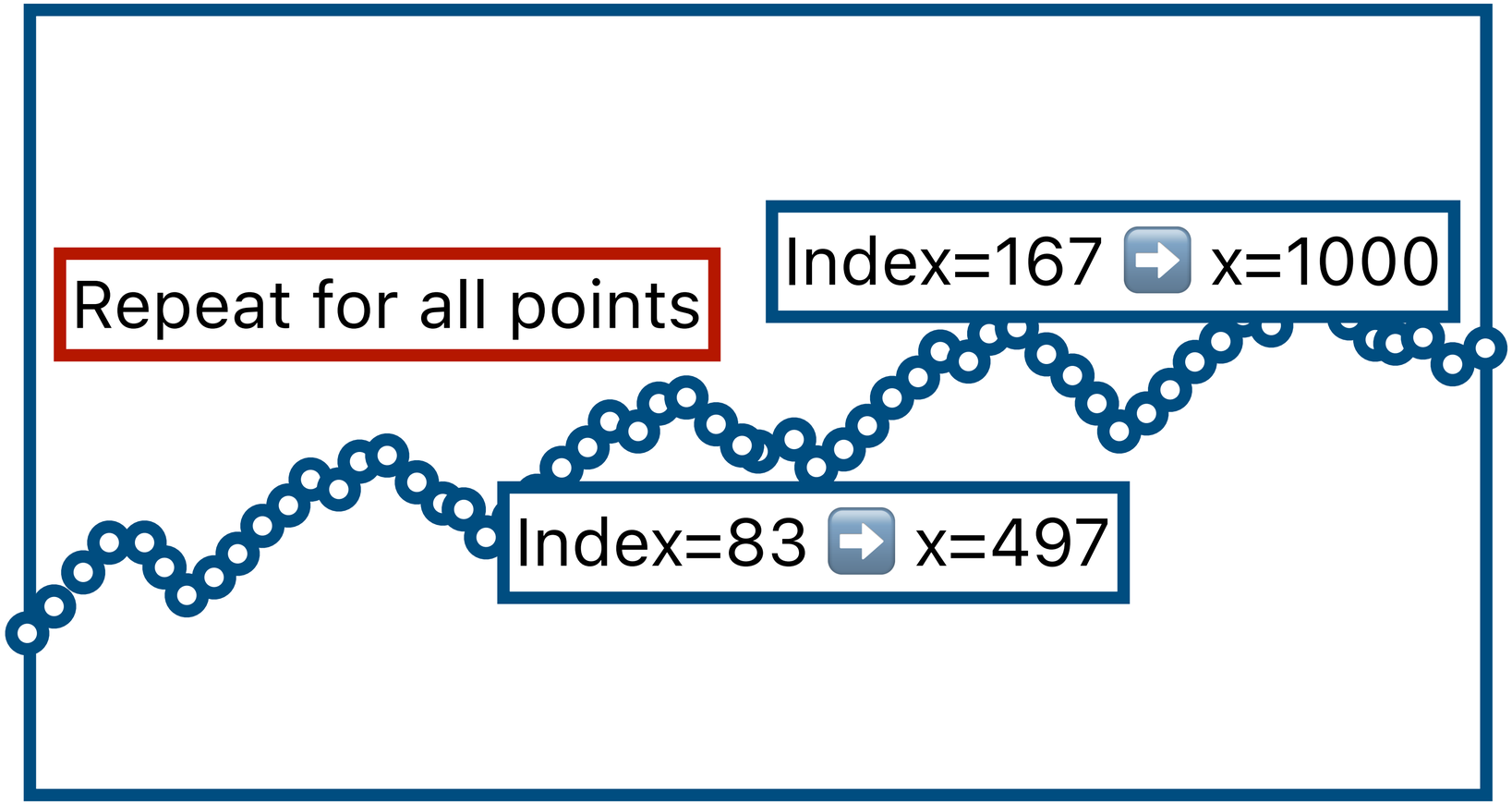
| | time | temperature_2m |
|---|---|---|
| **0** | 2025-04-24T00:00 | 55.6 |
| **1** | 2025-04-24T01:00 | 55.6 |
| **2** | 2025-04-24T02:00 | 55.2 |
| **3** | 2025-04-24T03:00 | 55.9 |
| **4** | 2025-04-24T04:00 | 56.7 |
| **...** | ... | ... |
| **163** | 2025-04-30T19:00 | 63.4 |
| **164** | 2025-04-30T20:00 | 61.8 |
| **165** | 2025-04-30T21:00 | 61.0 |
| **166** | 2025-04-30T22:00 | 60.9 |
| **167** | 2025-04-30T23:00 | 60.7 |



# Scales

Let’s work out how a scale works by hand.

| | time | temperature_2m |
|---|---|---|
| **0** | 2025-04-24T00:00 | 55.6 |
| **1** | 2025-04-24T01:00 | 55.6 |
| **2** | 2025-04-24T02:00 | 55.2 |
| **3** | 2025-04-24T03:00 | 55.9 |
| **4** | 2025-04-24T04:00 | 56.7 |
| **...** | ... | ... |
| **163** | 2025-04-30T19:00 | 63.4 |
| **164** | 2025-04-30T20:00 | 61.8 |
| **165** | 2025-04-30T21:00 | 61.0 |
| **166** | 2025-04-30T22:00 | 60.9 |
| **167** | 2025-04-30T23:00 | 60.7 |

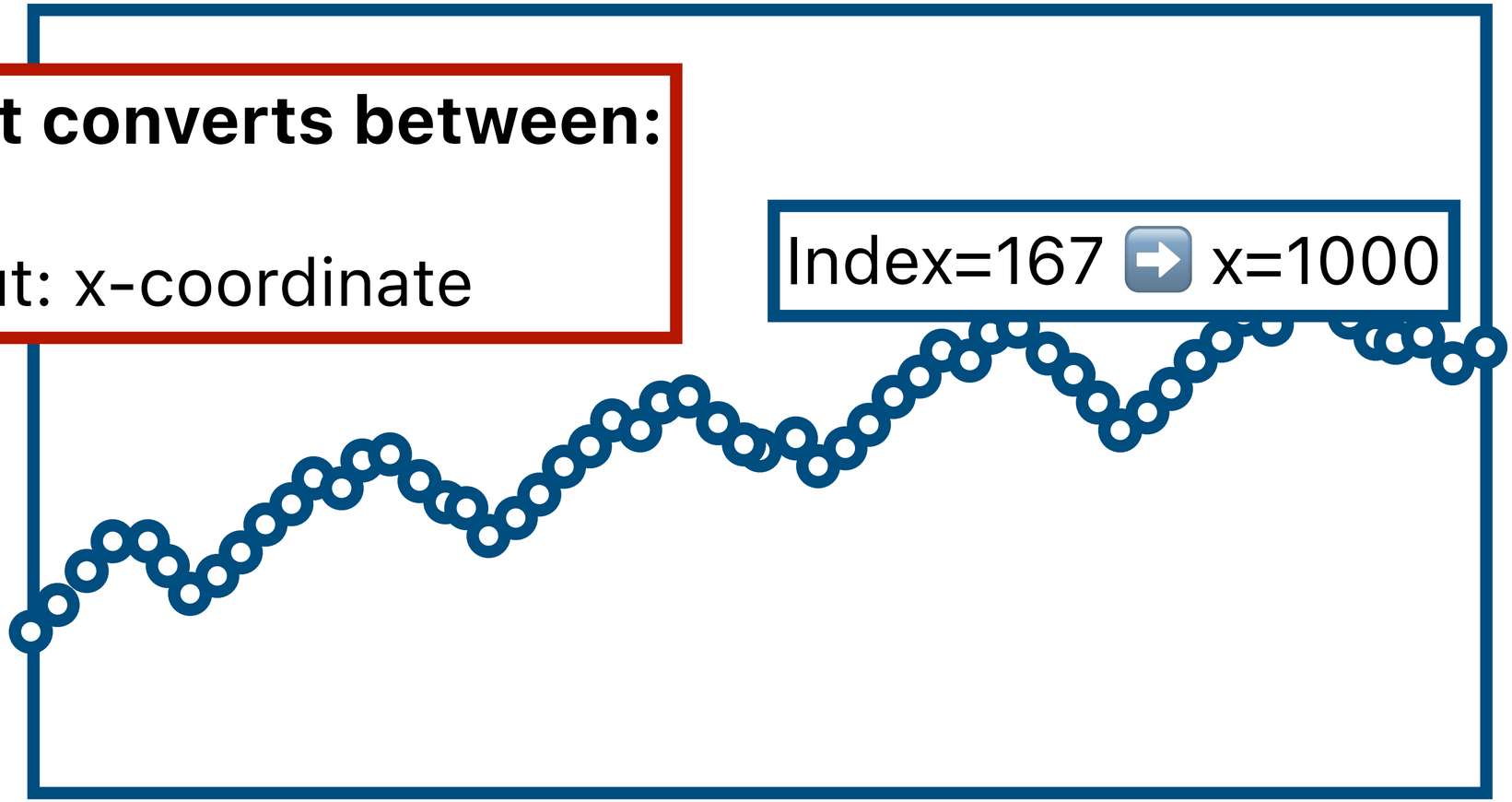


# Scales

Let’s work out how a scale works by hand.

**Want a function that converts between:**

Input: index ➡️ Output: x-coordinate



# Scales

Let’s work out how a scale works by hand.

**Want a function that converts between:**

Input: index ➡️ Output: x-coordinate

Index=167 ➡️ x=1000

```
const xScale = d3
  .scaleLinear()
  .domain([0, weatherData.hourly.temperature_2m.length - 1])
  .range([margin.left, width - margin.right]);
```

Domain = possible inputs

Range = possible outputs

Include margin for axes

Index=0 ➡️ x=0

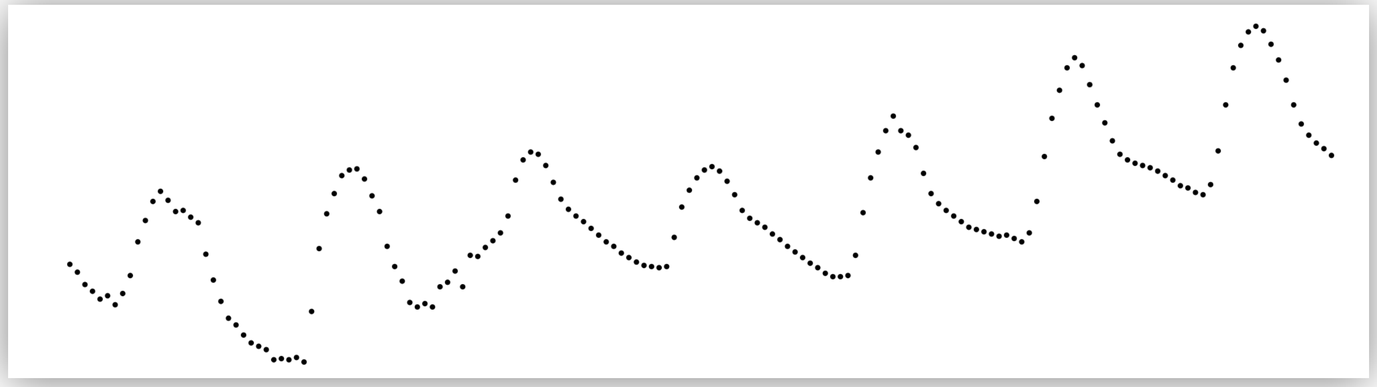
1000px wide

# Submit a question about Step 2

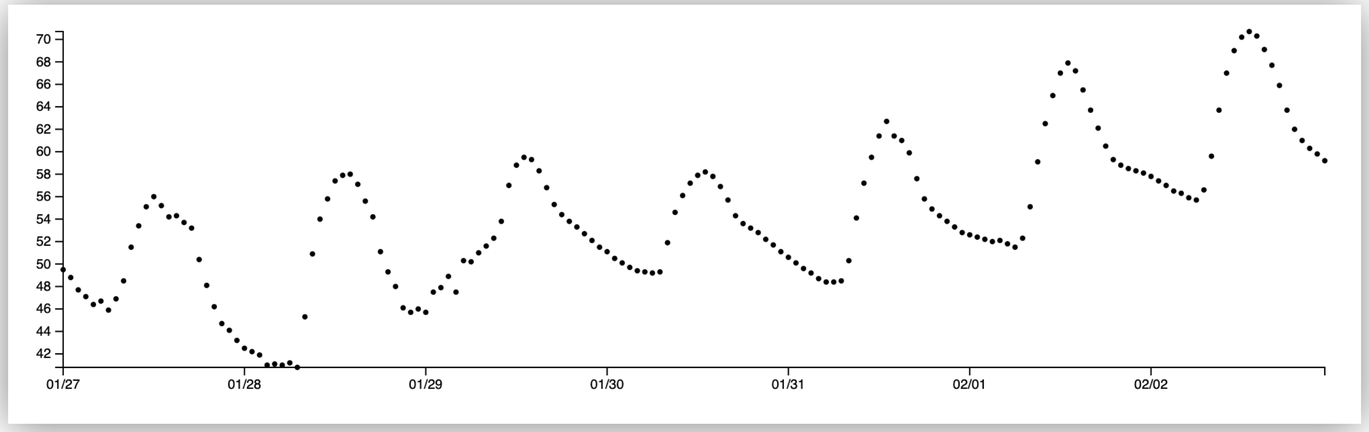
tryclassbuzz.com
Code: **d3-2**

# Step 3: Adding axes

Before:



After:




**Demo:** `d3-lecture/weather03`

# Using a Time Scale

Old:

```
const xScale = d3
  .scaleLinear()
  .domain([0, weatherData.hourly.temperature_2m.length - 1])
  .range([margin.left, width - margin.right]);
```

scaleLinear: number input

New:

```
const xScale = d3
  .scaleTime()
  .domain([
    new Date(weatherData.hourly.time[0]),
    new Date(weatherData.hourly.time[weatherData.hourly.time.length - 1]),
  ])
  .range([margin.left, width - margin.right]);
```

scaleTime: Date() input

Using a scaleTime lets us get date labels on the x-axis for free!

# Axes

```
const yAxis = d3.axisLeft(yScale);
```

Creates a D3 axis object

```
svg
  .append('g')
  .attr('class', 'y axis')
  .attr('transform', `translate(${margin.left}, 0)`)
  .call(yAxis);
```

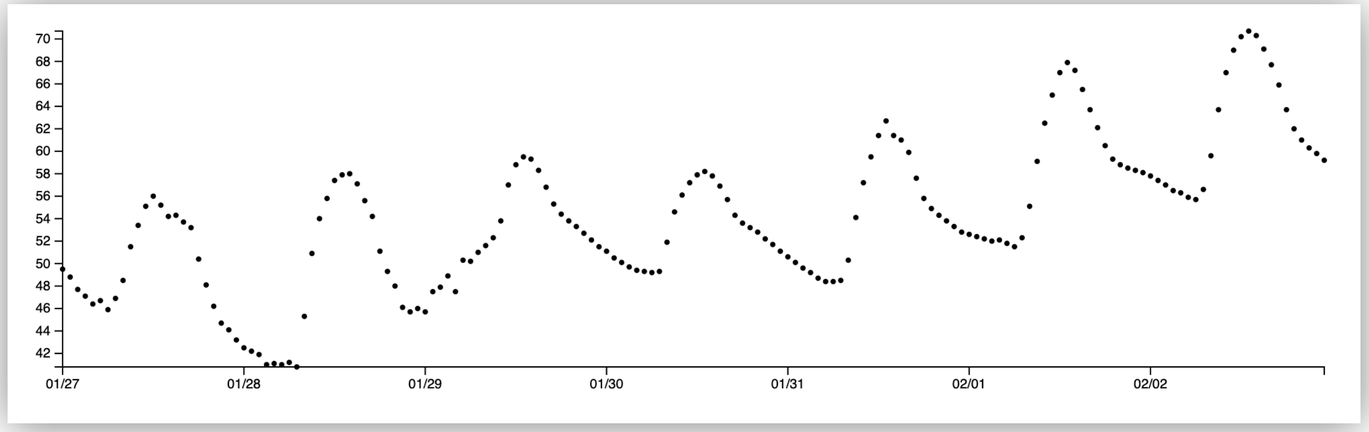
Creates an SVG <g> object, then draws axis into it

# Submit a question about Step 3

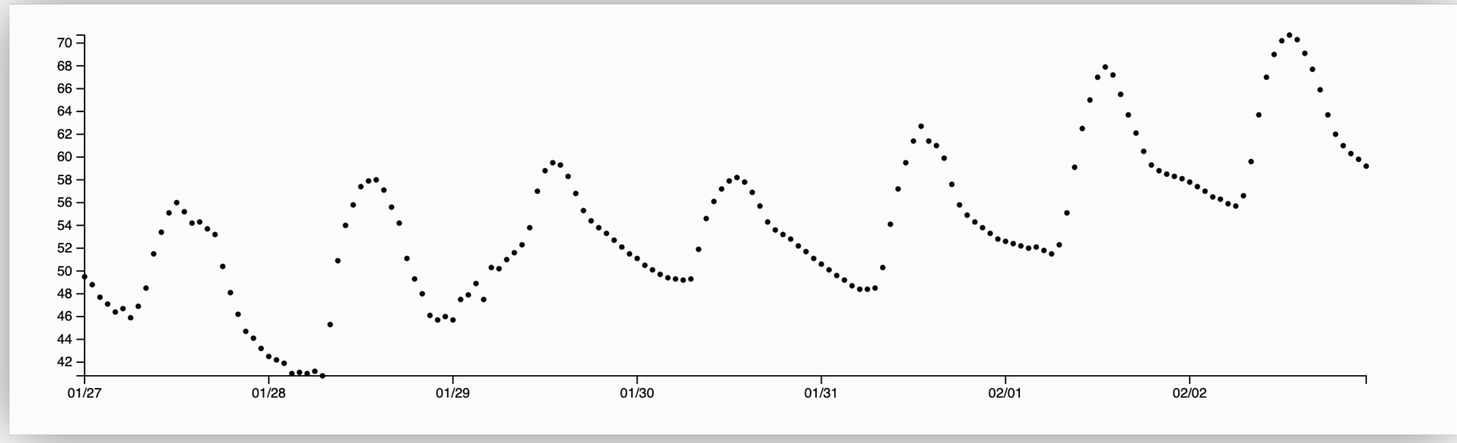
tryclassbuzz.com
Code: **d3-3**

# Step 4: Adding a basic tooltip

Before:




After:




**Demo:** `d3-lecture/weather04`

# Making a tooltip

```
const tooltip = d3
  .select('body')
  .append('div')
  .attr('class', 'tooltip')
  .style('position', 'absolute')
  .style('visibility', 'hidden')
  .style('background-color', 'white')
  .style('border', '1px solid #ddd')
  .style('padding', '5px')
  .style('border-radius', '3px');
```

Creates a , styles it, and hides it so that it'll only show up with interaction

# Adding interaction

```
.on('mouseover', function (event, d) {
  d3.select(this).attr('r', 4); // Increase circle size on hover


  tooltip.style('visibility', 'visible').text(`${d.toFixed(1)}°F`);
})
```

D3 version of event listener + handler

# Adding interaction

```
.on('mouseover', function (event, d) {
  // Increase circle size on hover

  tooltip.style('visibility', 'visible').text(`${d.toFixed(1)}°F`);
})
```

When a circle is moused over...

D3 version of event listener + handler

# Adding interaction

```
.on('mouseover', function (event, d) {
  d3.select(this).attr('r', 4); // Increase circle size on hover
                                                    ${d.toFixed(1)}°F`);
})
```

Make the circle’s radius larger

D3 version of event listener + handler

# Adding interaction

```
.on('mouseover', function (event, d) {
  d3.select(this).attr('r', 4); // Increase circle size on hover

  tooltip.style('visibility', 'visible').text(`${d.toFixed(1)}°F`);
})
```

Make tooltip visible and set its text

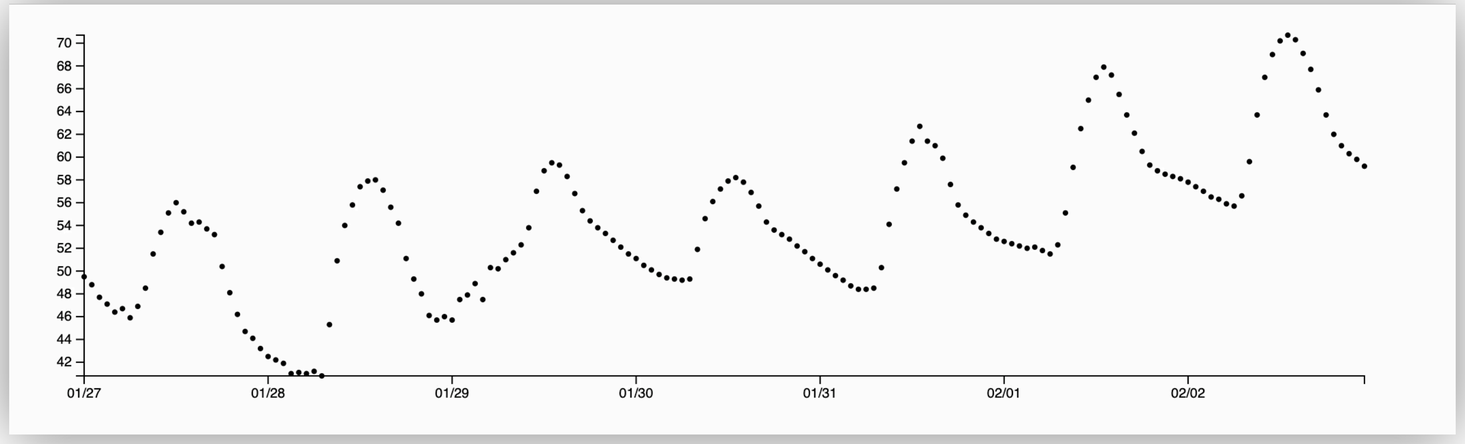
D3 version of event listener + handler

# Submit a question about Step 4

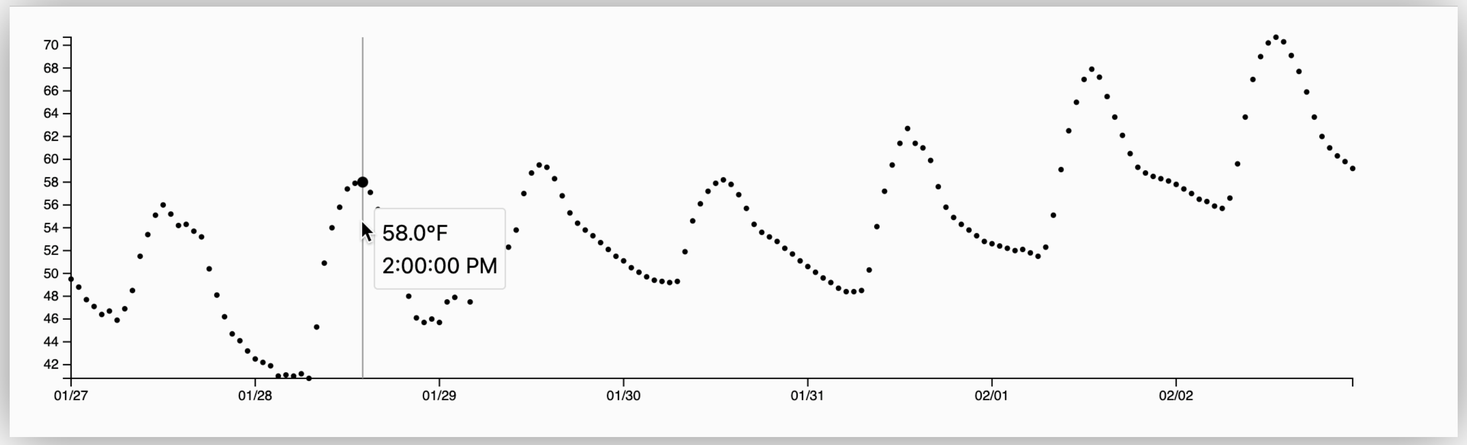
tryclassbuzz.com
Code: **d3-4**

# Step 5: Improving our tooltip

Before:




After:




**Demo:** `d3-lecture/weather05`

# Interacting with the plot, not just points

```
// Create a rect overlay for mouse tracking
const overlay = svg
  .append('rect')
  .attr('class', 'overlay')
  .attr('x', margin.left)
  .attr('y', margin.top)
  .attr('width', width - margin.left - margin.right)
  .attr('height', height - margin.top - margin.bottom)
  .style('fill', 'none')
  .style('pointer-events', 'all');
```

Interaction trick:
Add an invisible rectangle just to capture mouse events

Listening for mouse events on the parent <svg> tag also ok

# Improving interaction

```
.on('mousemove', function (event) {
  const mouseX = d3.pointer(event)[0];
  const xDate = xScale.invert(mouseX);

  // Find the closest data point
  const bisect = d3.bisector((d) => new Date(d)).left;
  const index = bisect(weatherData.hourly.time, xDate);
  const temp = weatherData.hourly.temperature_2m[index];
  const time = new Date(weatherData.hourly.time[index]);
```

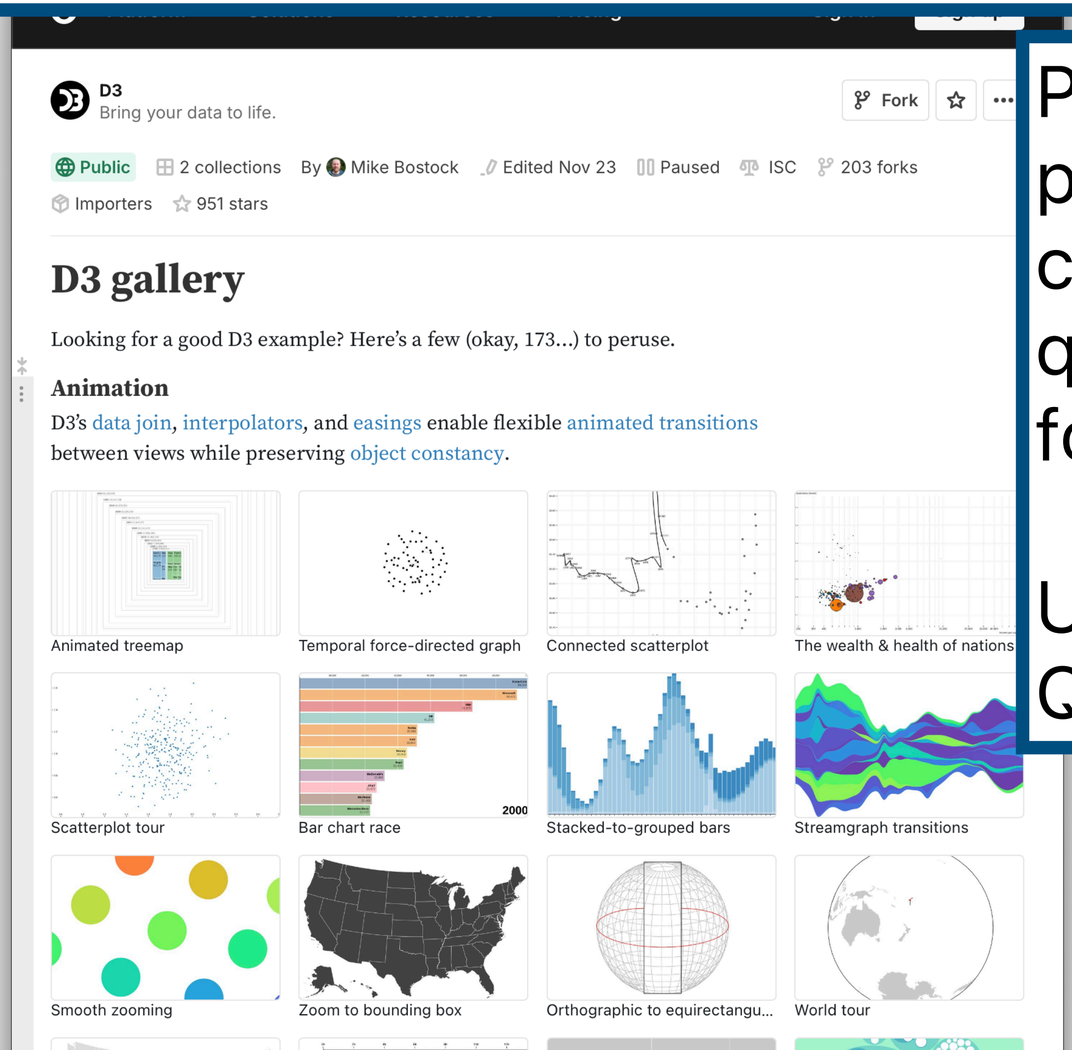
Challenge: since we're not hovering directly over points, we have to use the mouse position to find nearest point

# Submit a question about Step 5

tryclassbuzz.com
Code: **d3-5**

# You Try: Explain D3 code

https://observablehq.com/@d3/gallery




Pick a simple visualization (scatter plot, line plot, bar chart). Explain the code to your neighbor, then write a question about the code using this format:

URL: …
Question: …

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Code: **explain-d3**