How to make more effective graphs

Training session on data visualization
organized by Manuel Frias
HELCOM Secretariat, 28th November 2018

OBJECTIVE

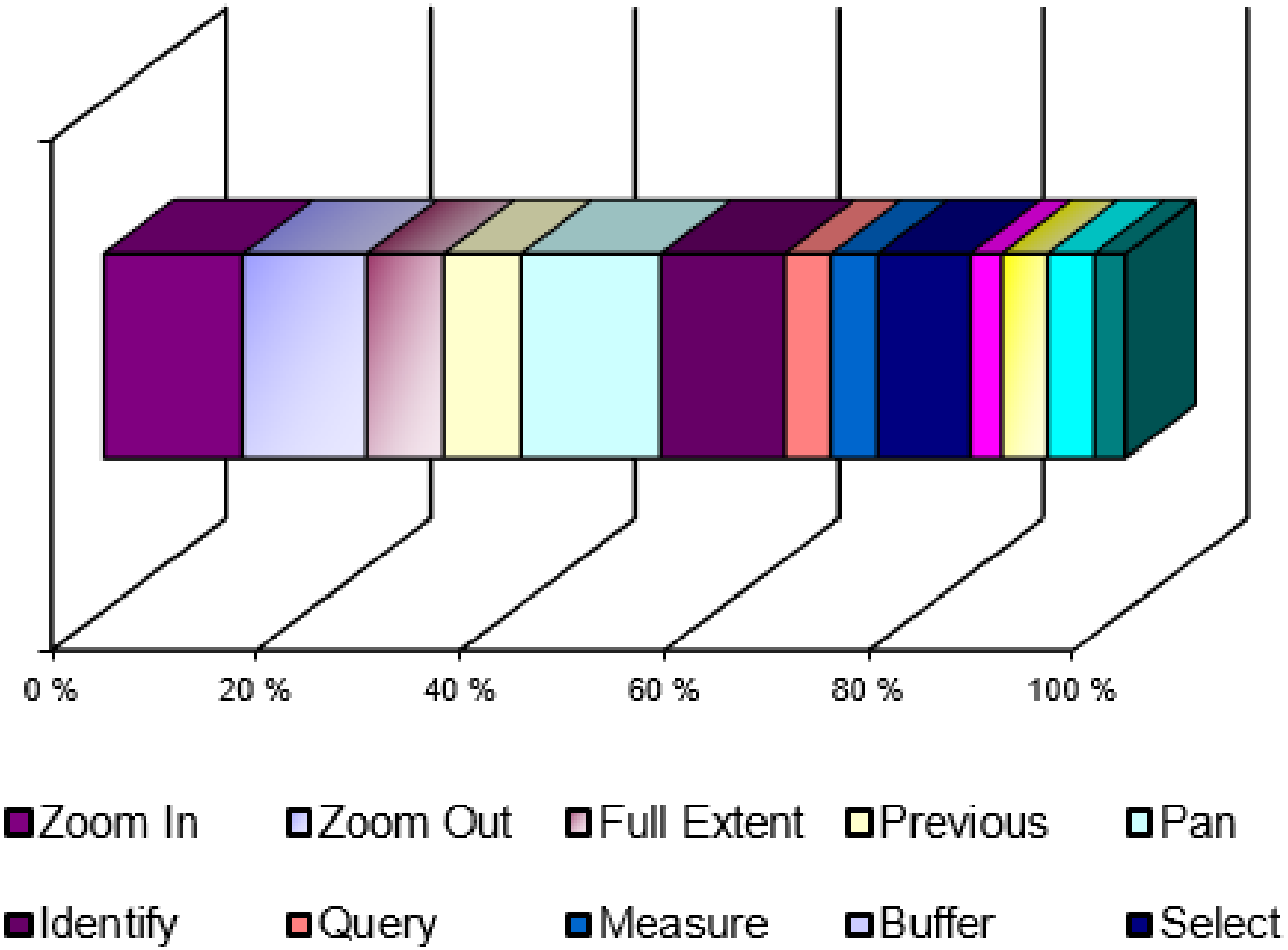
What is an effective data visualization?

What is the right graph for a dataset?

How can we improve the style of a graph?

Once upon a time I used to make graphs like this…

Functionality Which tool do you normally use?



Then, I started to become interested in data visualization and realized that this was not the best way to visualize data

A data visualization should be

Truthful—it must not lie

Functional—you can perform basic operations like compare

Beautiful—it must be pleasant to your eyes

Insightful—you should learn something from the graph

Enlightening—it opens your eyes

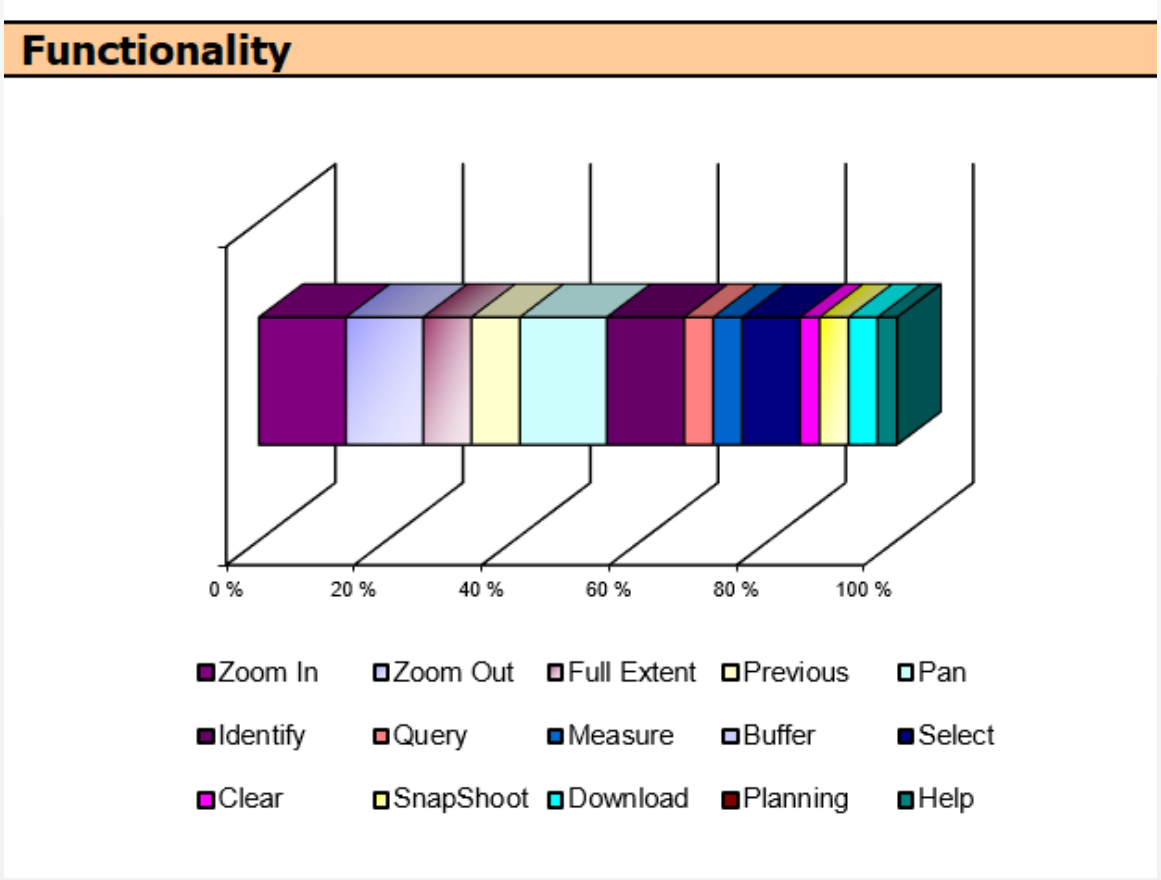
Alberto Cairo, 2016: The truthful art

Let’s test these principles with my (horrendous) graph

Truthful

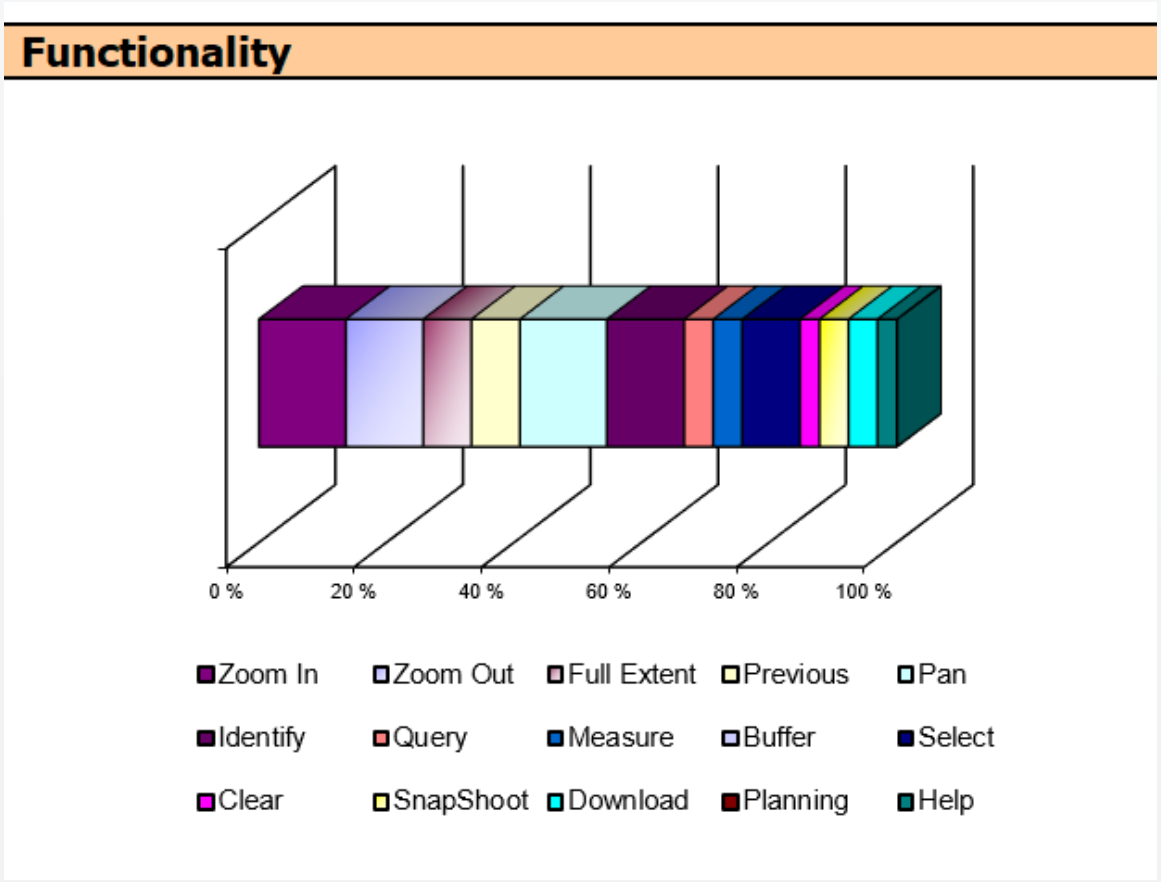


Which tool do you normally use in the map service?



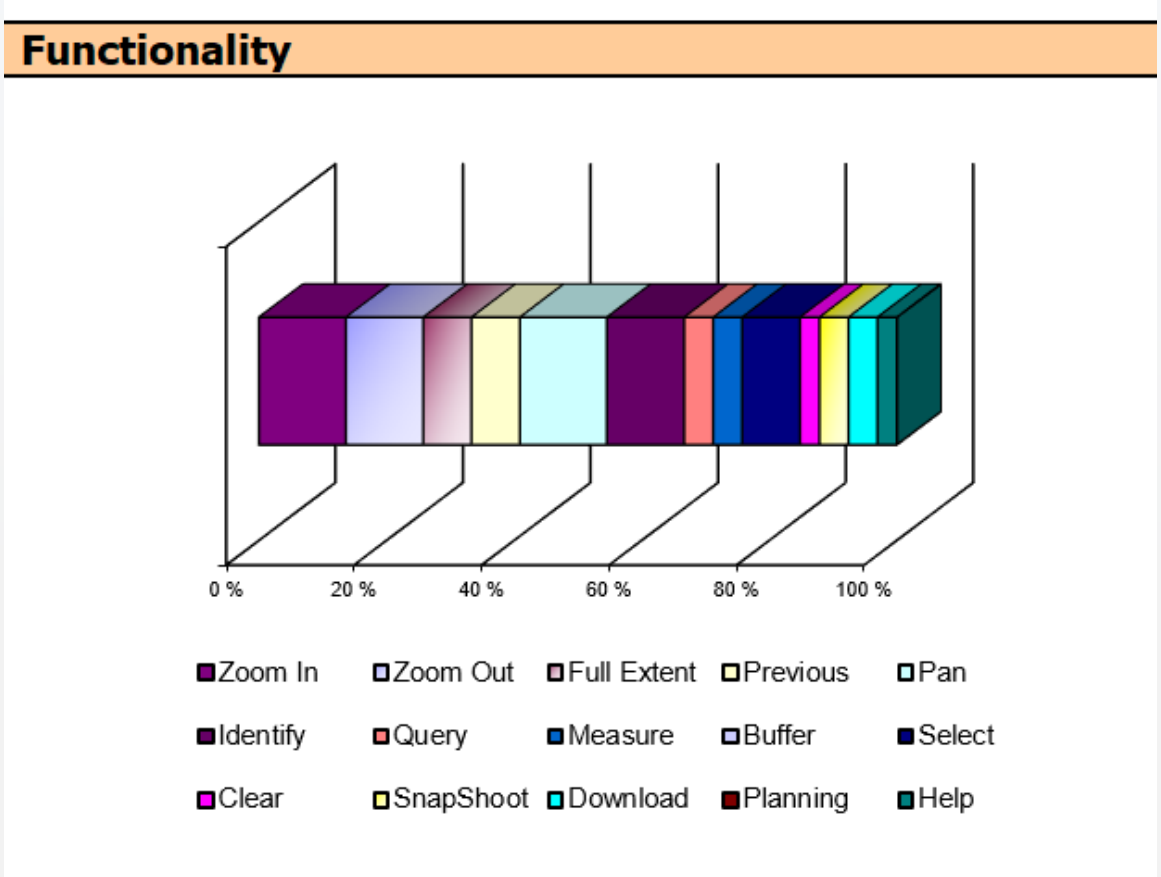
Truthful ✓ Functional ✗

Which tool do you normally use in the map service?



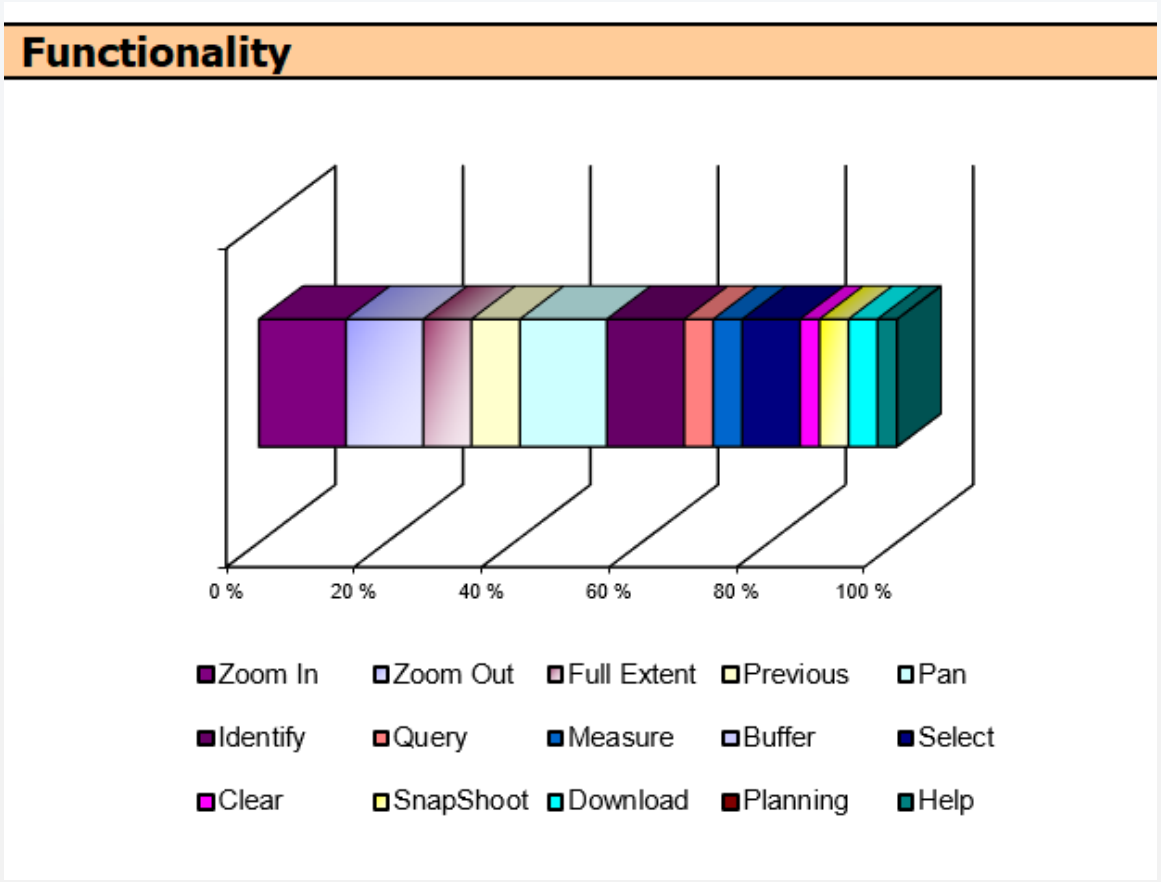
Truthful ✓ Functional ✗ Beautiful ✗

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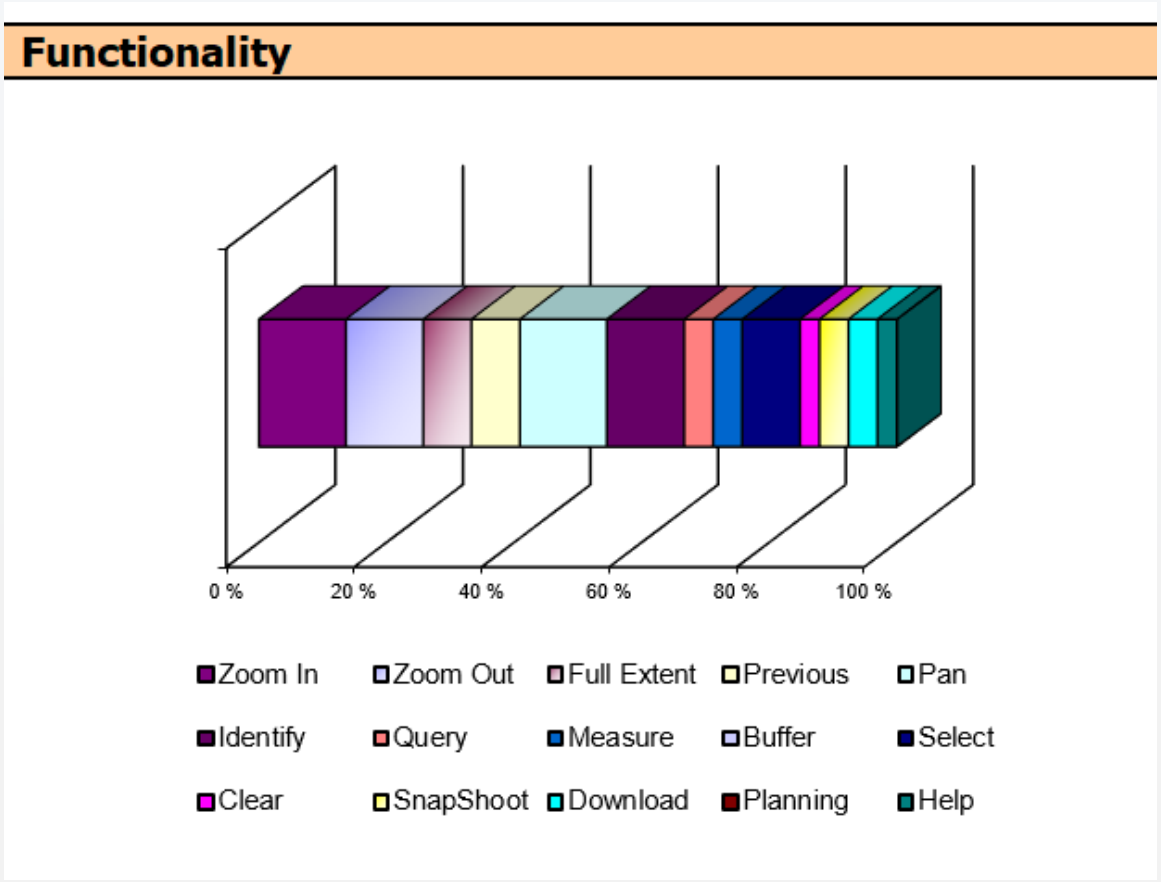
Truthful ✓ Functional ✗ Beautiful ✗ Insightful ✗

Which tool do you normally use in the map service?



Truthful ✓ Functional ✗ Beautiful ✗ Insightful ✗ Enlightening ✗

Which tool do you normally use in the map service?

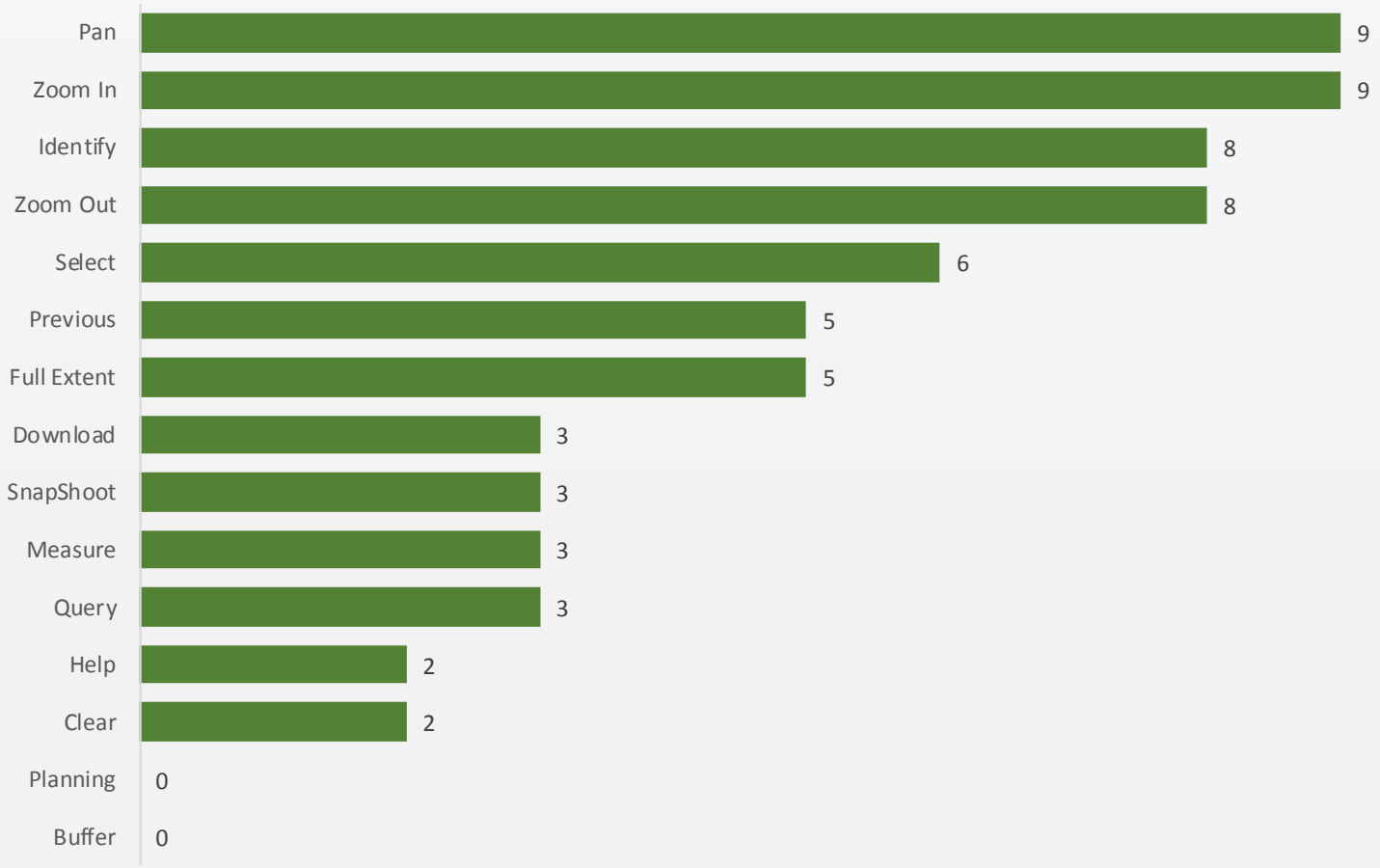


Let’s remake the graph and run the test again…

Truthful

Only basic functionalities are used in the map service

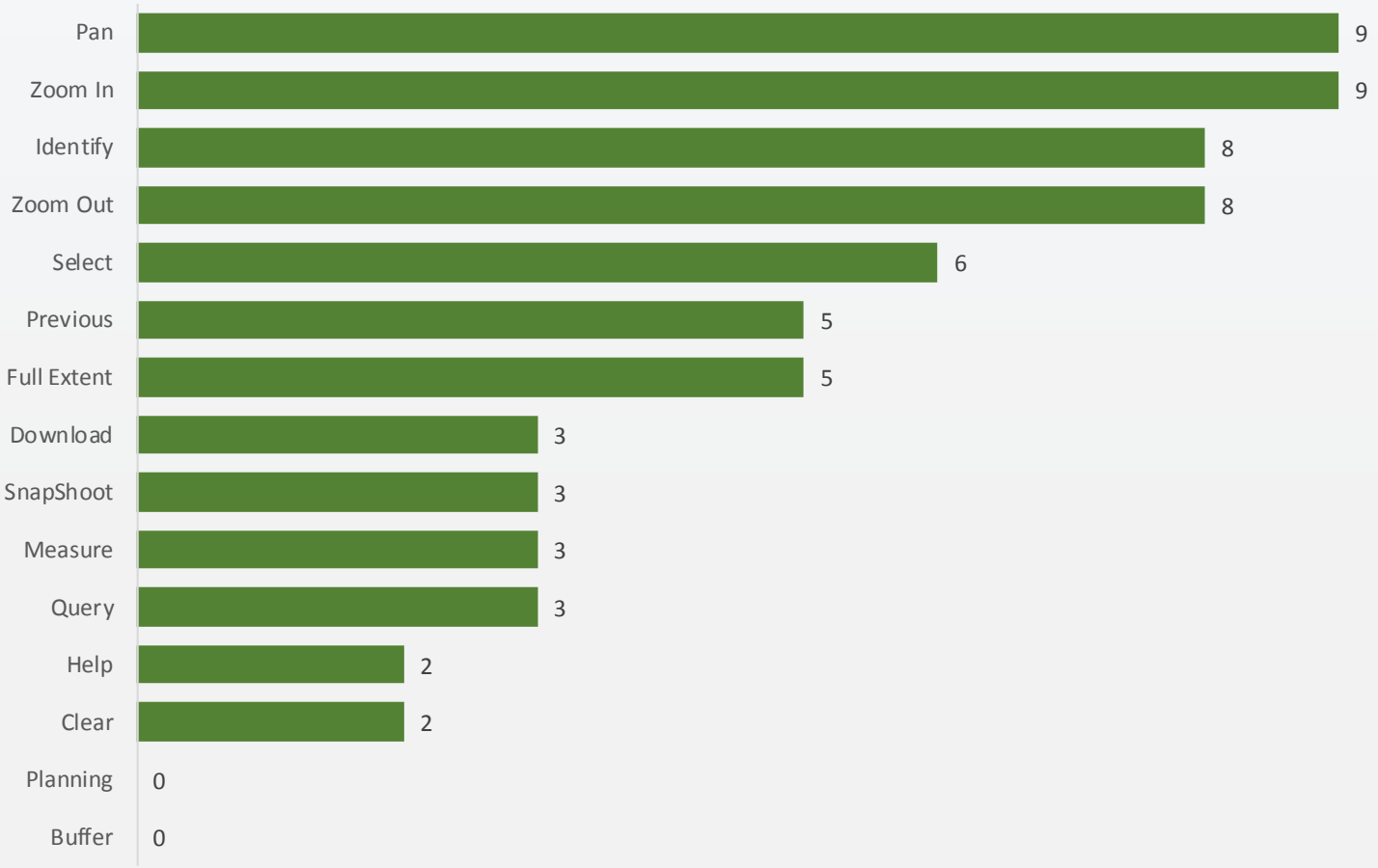
Number of answers to the question "Which tool do you normally use in the map service?"



Truthful ✓ Functional ✓

Only basic functionalities are used in the map service

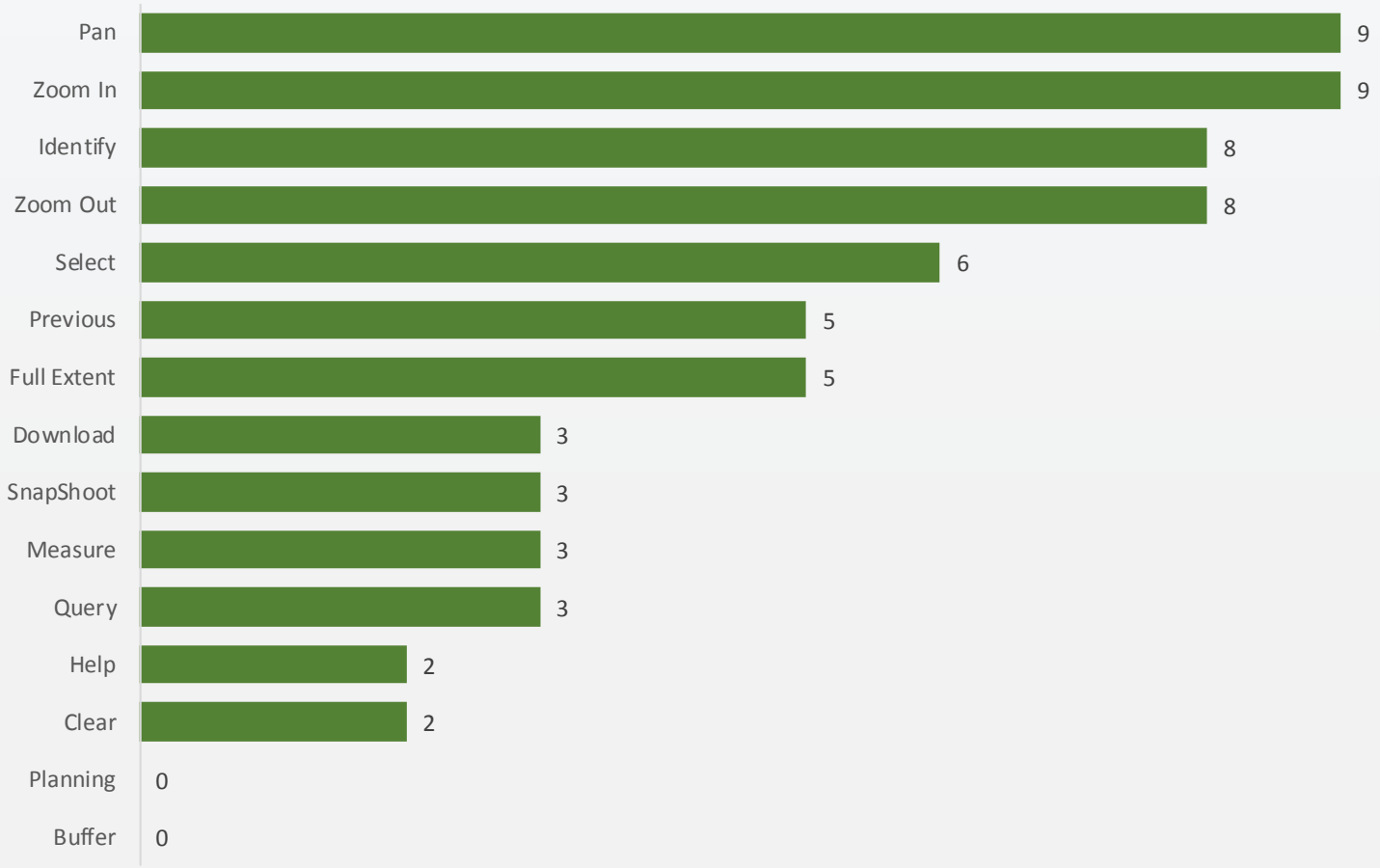
Number of answers to the question "Which tool do you normally use in the map service?"



Truthful ✓ Functional ✓ Beautiful ✓

Only basic functionalities are used in the map service

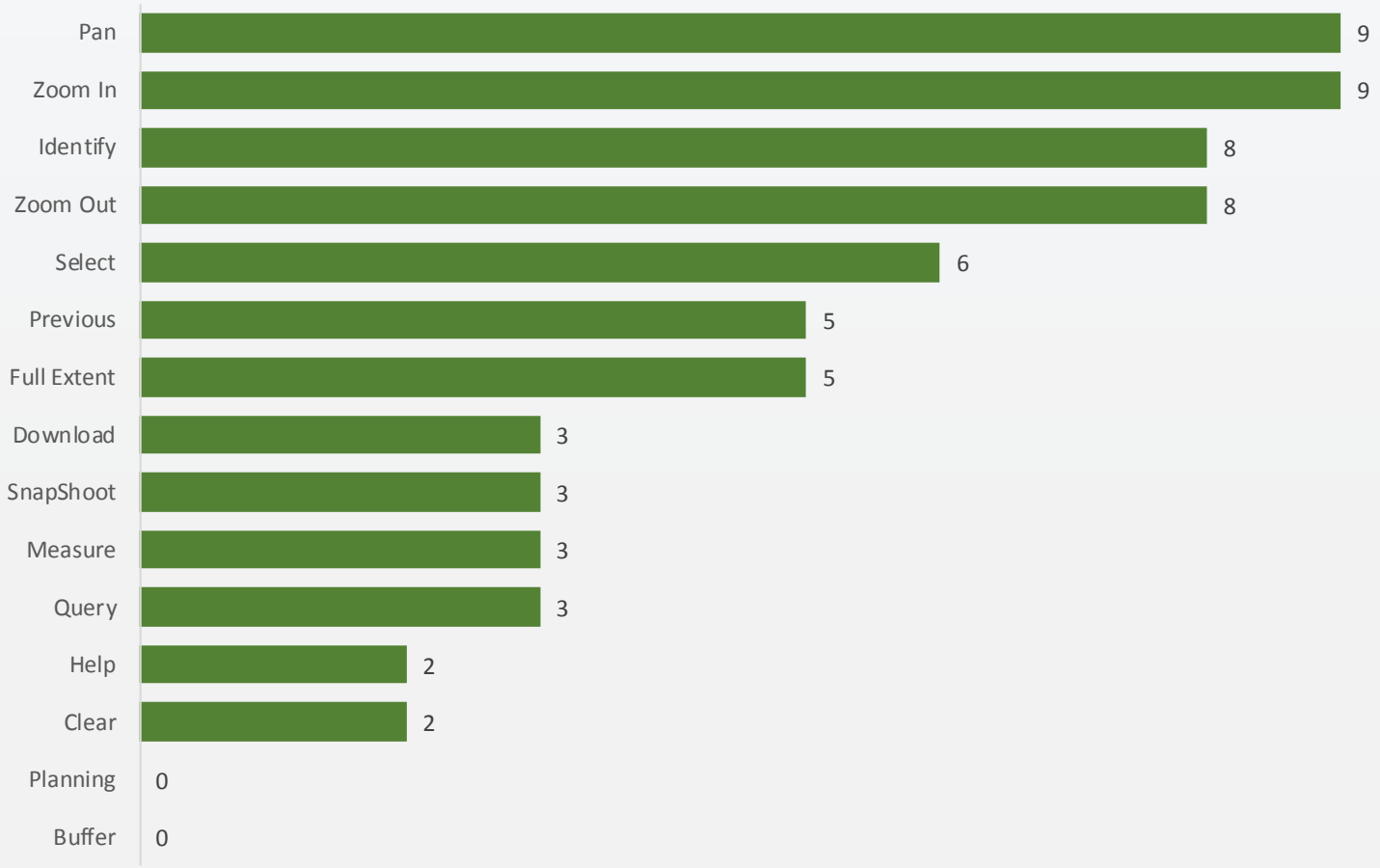
Number of answers to the question "Which tool do you normally use in the map service?"



Truthful ✓ Functional ✓ Beautiful ✓ Insightful ✓

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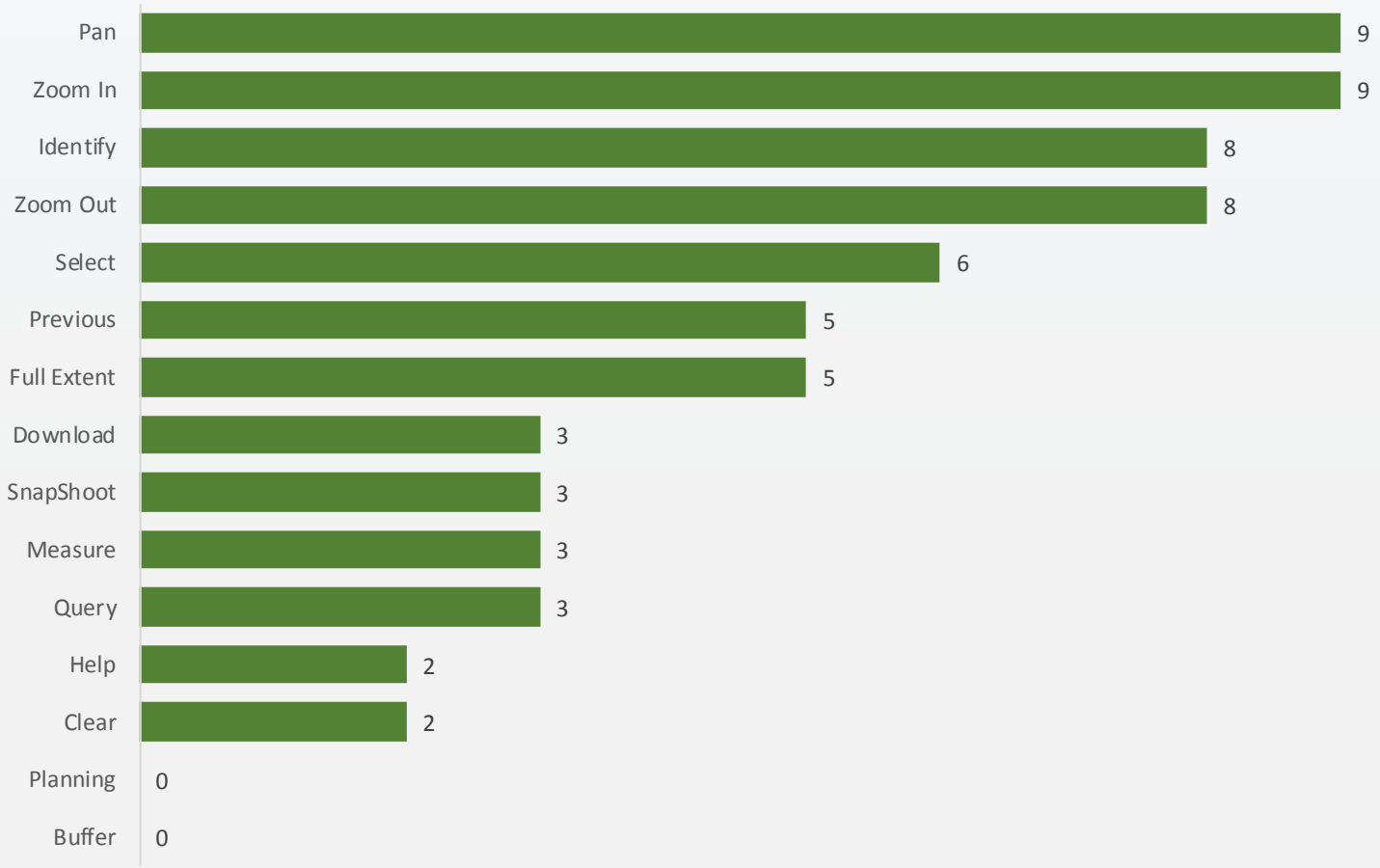
Number of answers to the question "Which tool do you normally use in the map service?"



Truthful ✓ Functional ✓ Beautiful ✓ Insightful ✓ Enlightening ✓

Only basic functionalities are used in the map service

Number of answers to the question "Which tool do you normally use in the map service?"



Very nice but…

HOW?

Steps



Find the message

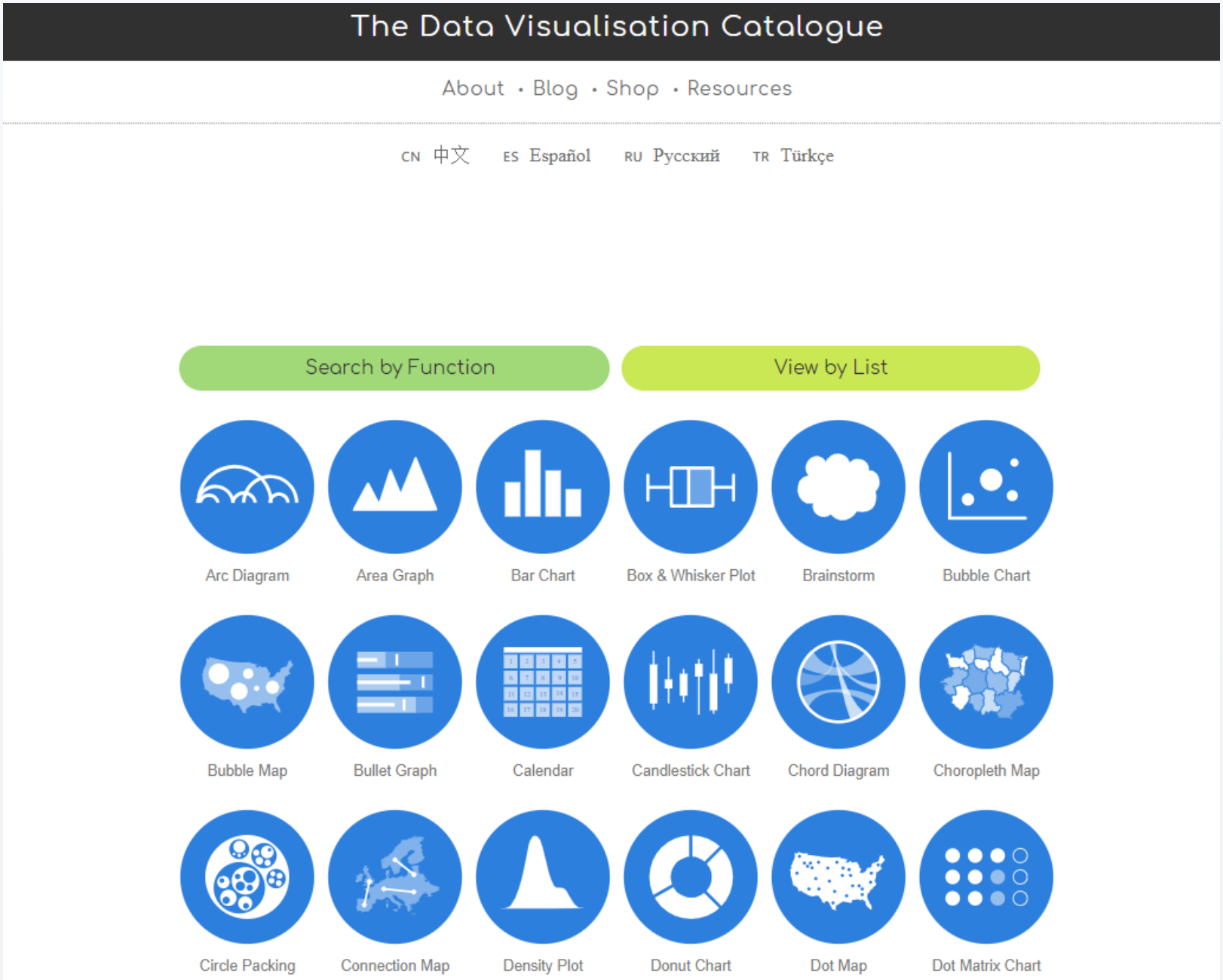


Find the shape of the data

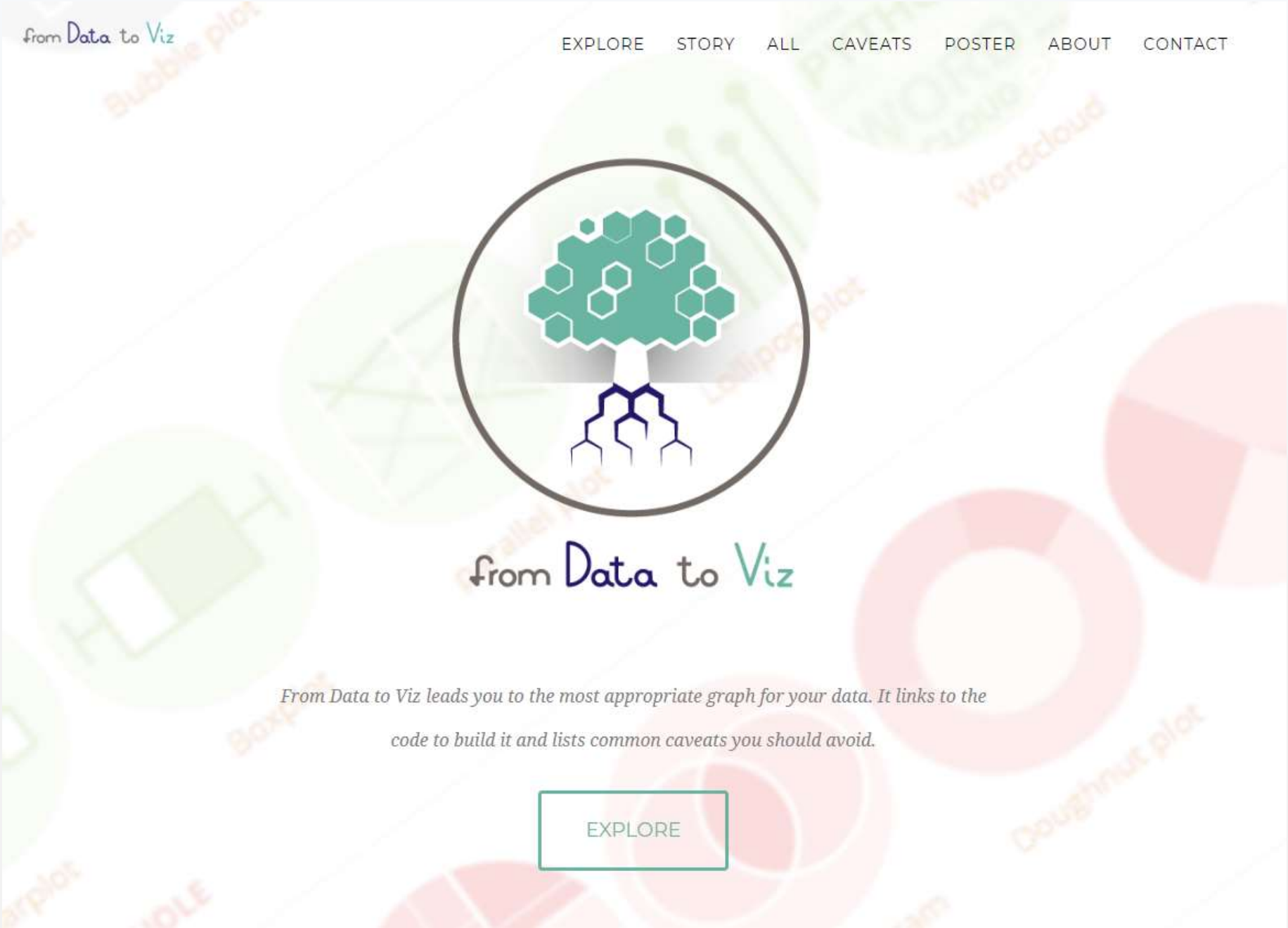
What is the right graph for a dataset?

Alternative 1: follow a guideline

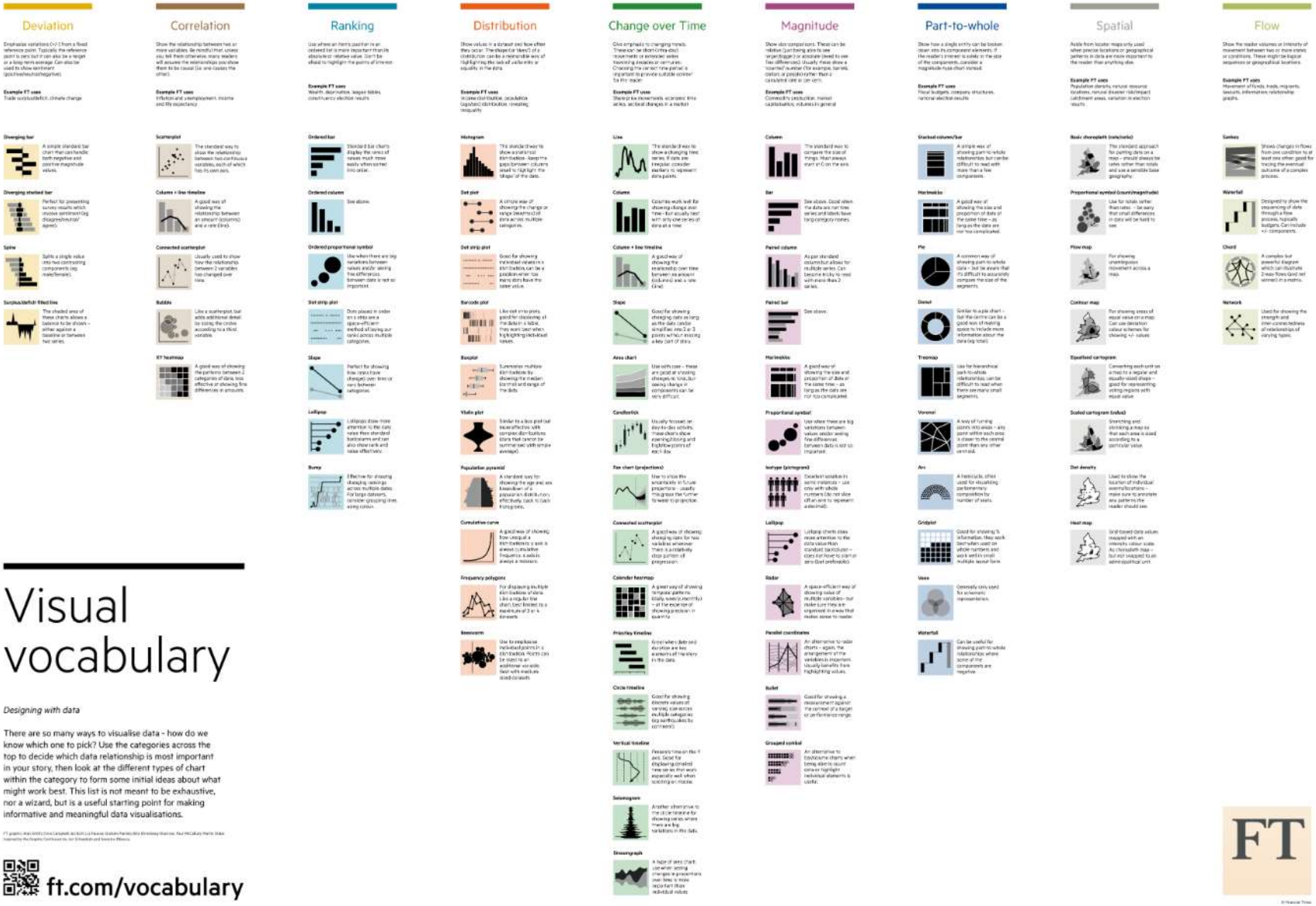
https://datavizcatalogue.com/



https://www.data-to-viz.com/

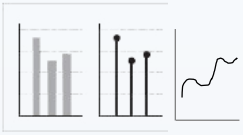


http://ft.com/vocabulary



Alternative 2: learn the basics

Enable accurate comparisons



Position along common scale



Position along common but unaligned scales



Length



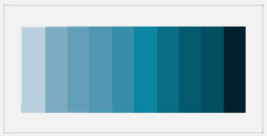
Angle



Area



Volume



Shading

Enable general comparisons



Hue

This scale is from, perhaps, the most famous paper in data visualization

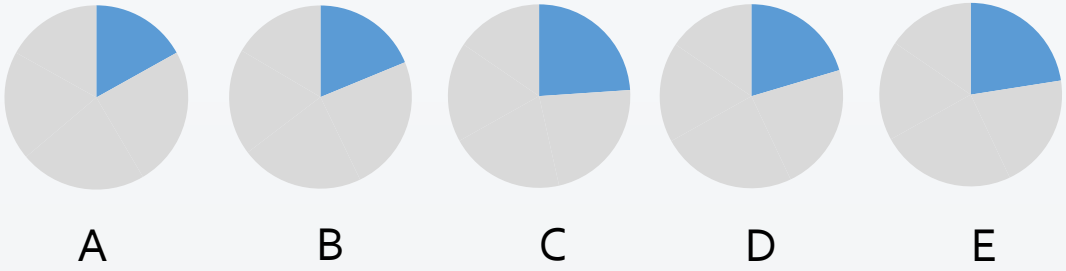
Cleveland, McGill, 1984 adapted from Alberto Cairo, 2016: The truthful art

Let’s put it in practice. What’s the best way to compare this data?

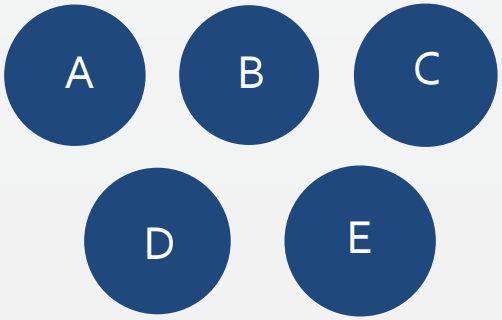
Length



Angle



Area



Shade



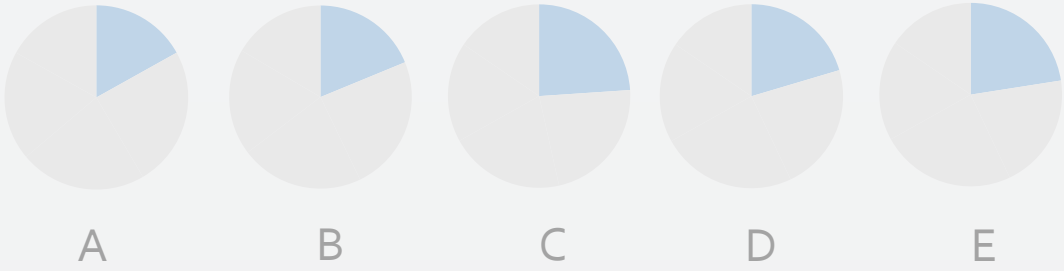
Adapted from Alberto Cairo, 2016: The truthful art

You were right

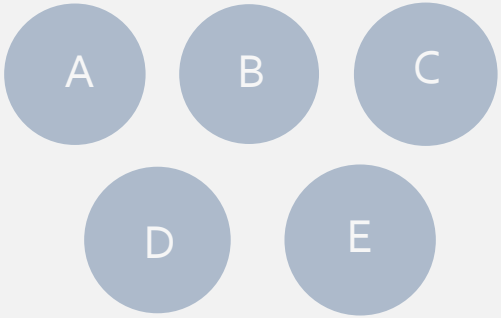
Length



Angle



Area

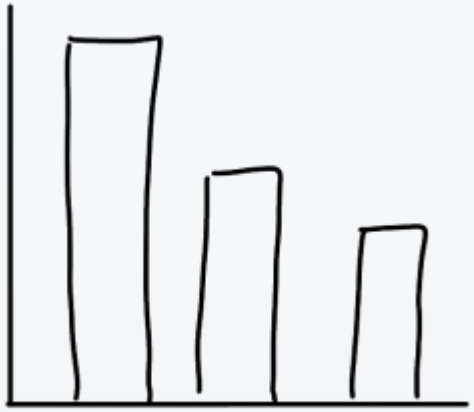


Shade

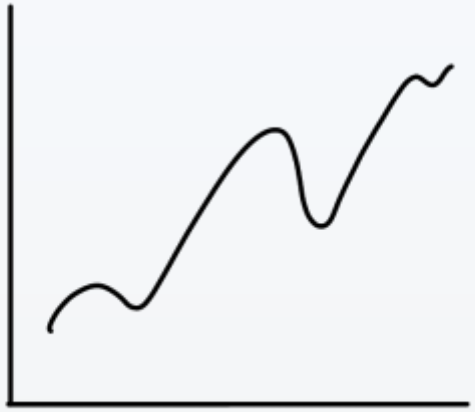


Adapted from Alberto Cairo, 2016: The truthful art

In fact, according to data visualization author Stephen Few, most quantitative analyses can be performed effectively with only four graphs…



Bar



Line



Point



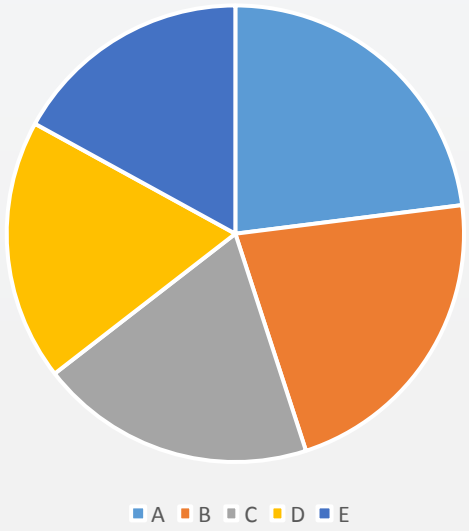
Box

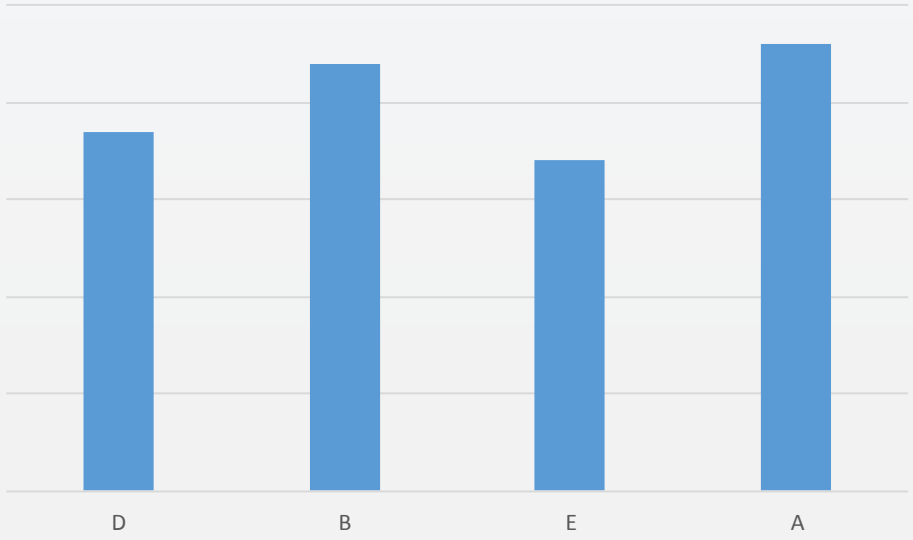
Hold on… where are the pies?

Pies are for eating them!



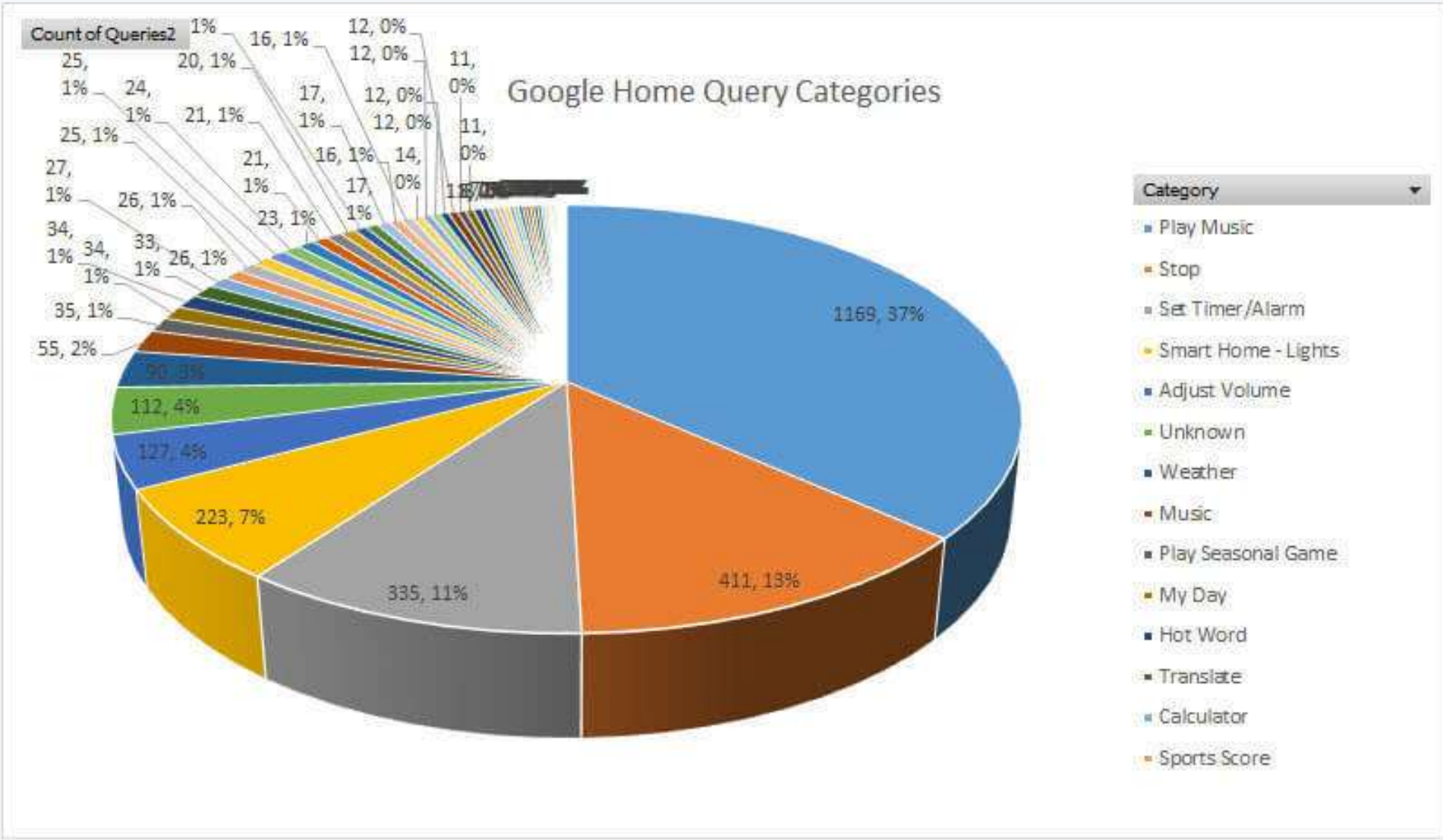
Test: which graph is better to compare values





Inspired by Naomi Robbins, 2013: Creating more effective graphs

Pie charts have been misused…



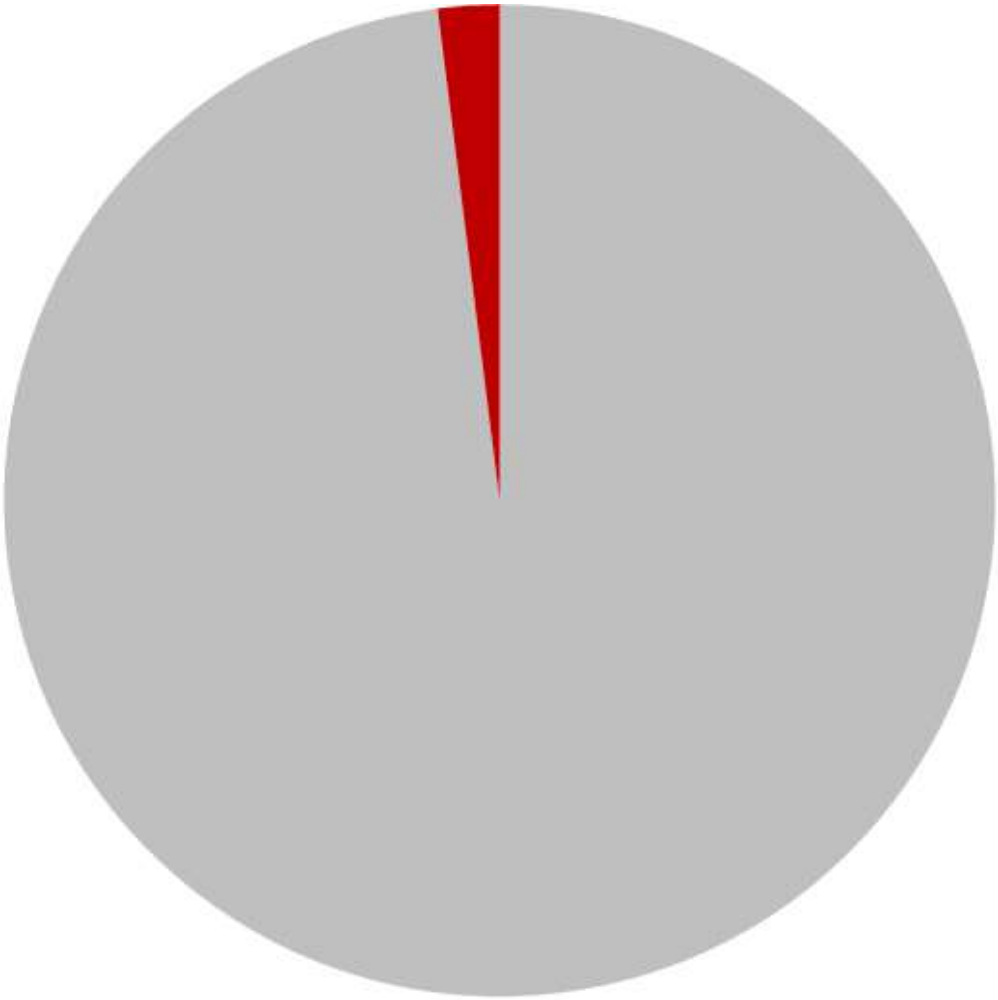
Source: wtf.viz

However, I don't think they are always bad.

The next slide was shown at the Plan Bothnia project final conference. We wanted to show how much time we spent working on the project.

We have worked 18 months

2% of our life!

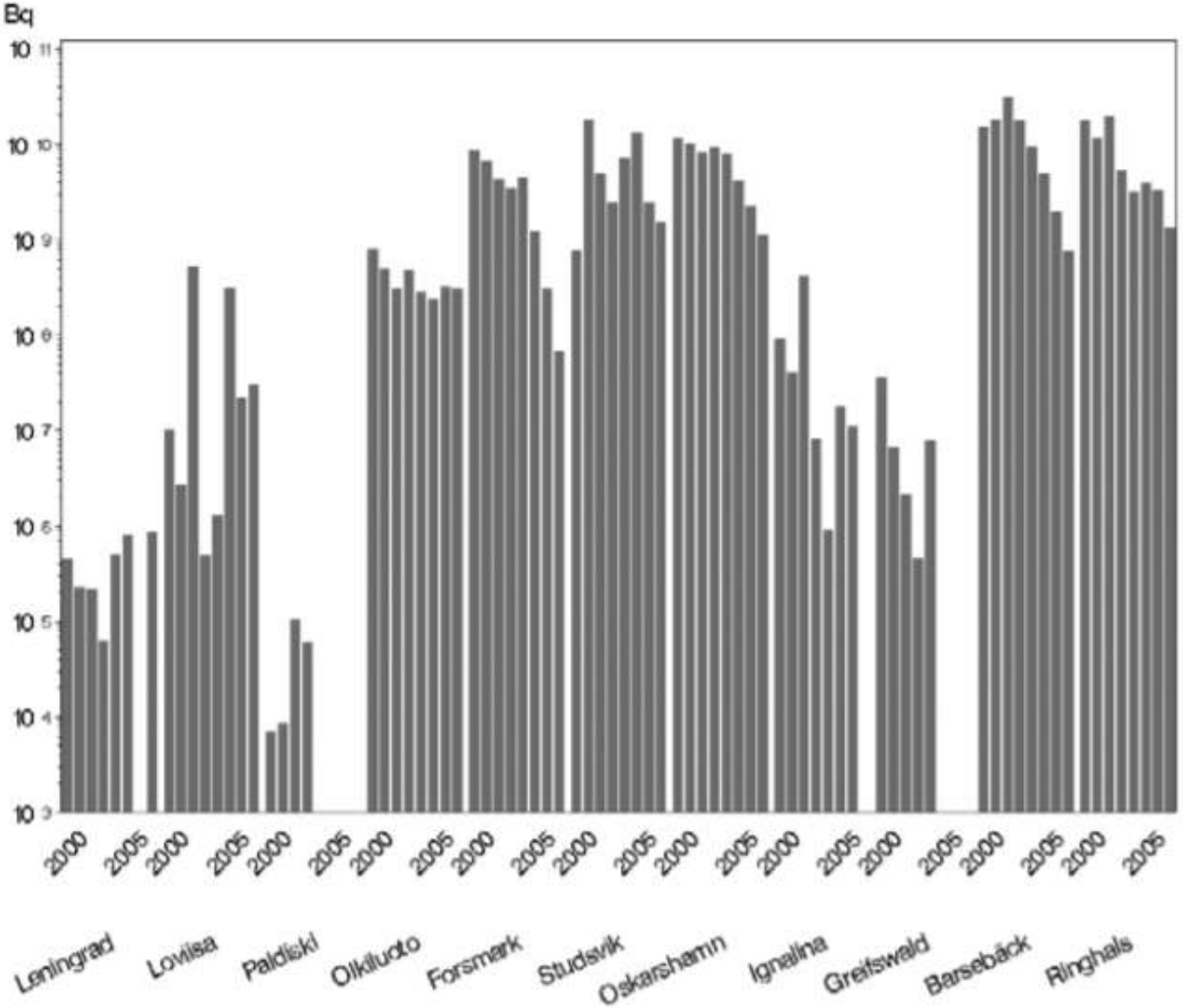


Exercise

Is it effective? Why?

Is there a better alternative? Sketch

Figure 5:
Annual Co-60 discharges from local nuclear facilities into the Baltic Sea 1999-2006.



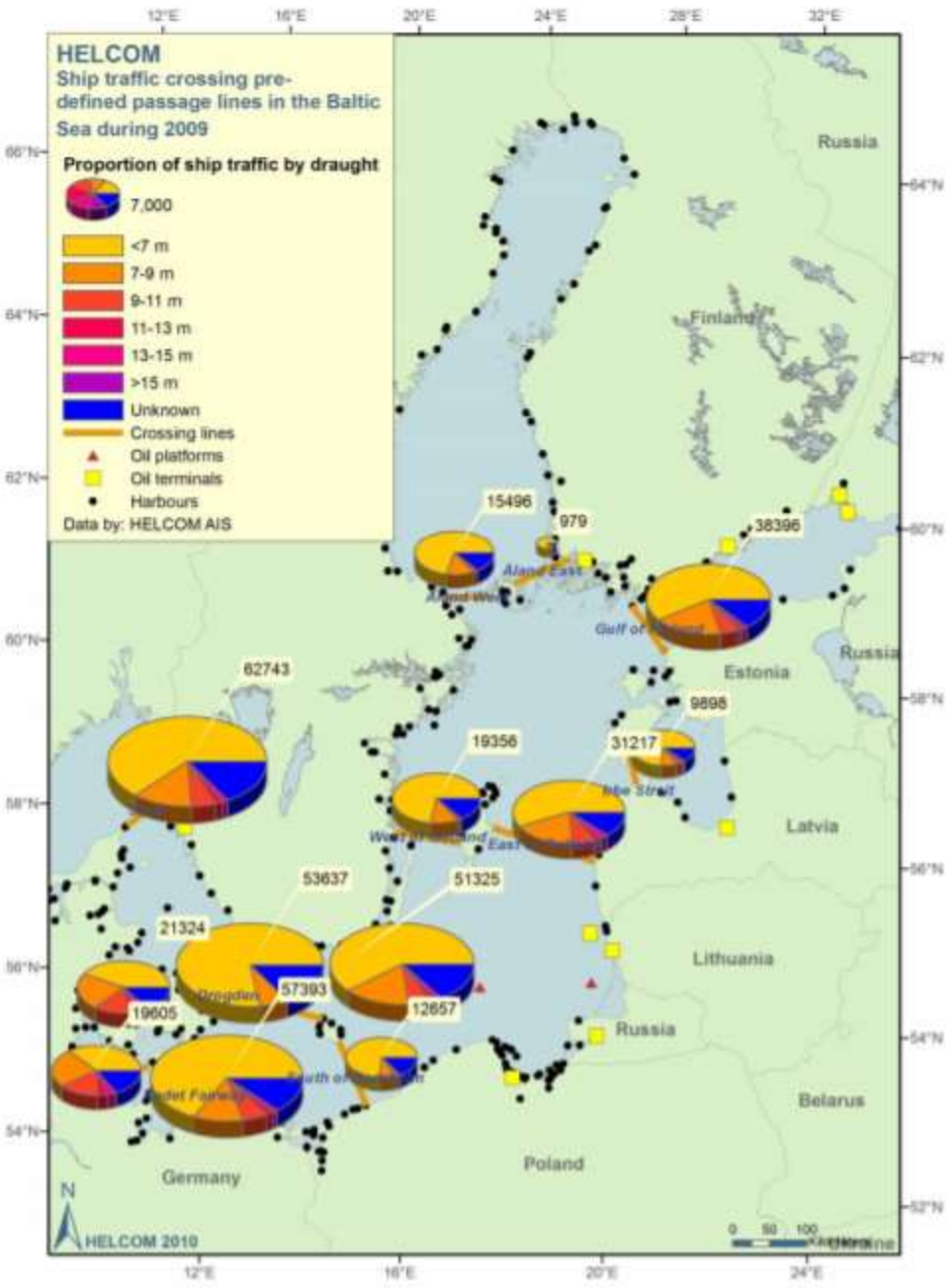


Figure 2. Number of ships crossing AIS fixed lines in the Baltic Sea according to the draught, 2009.

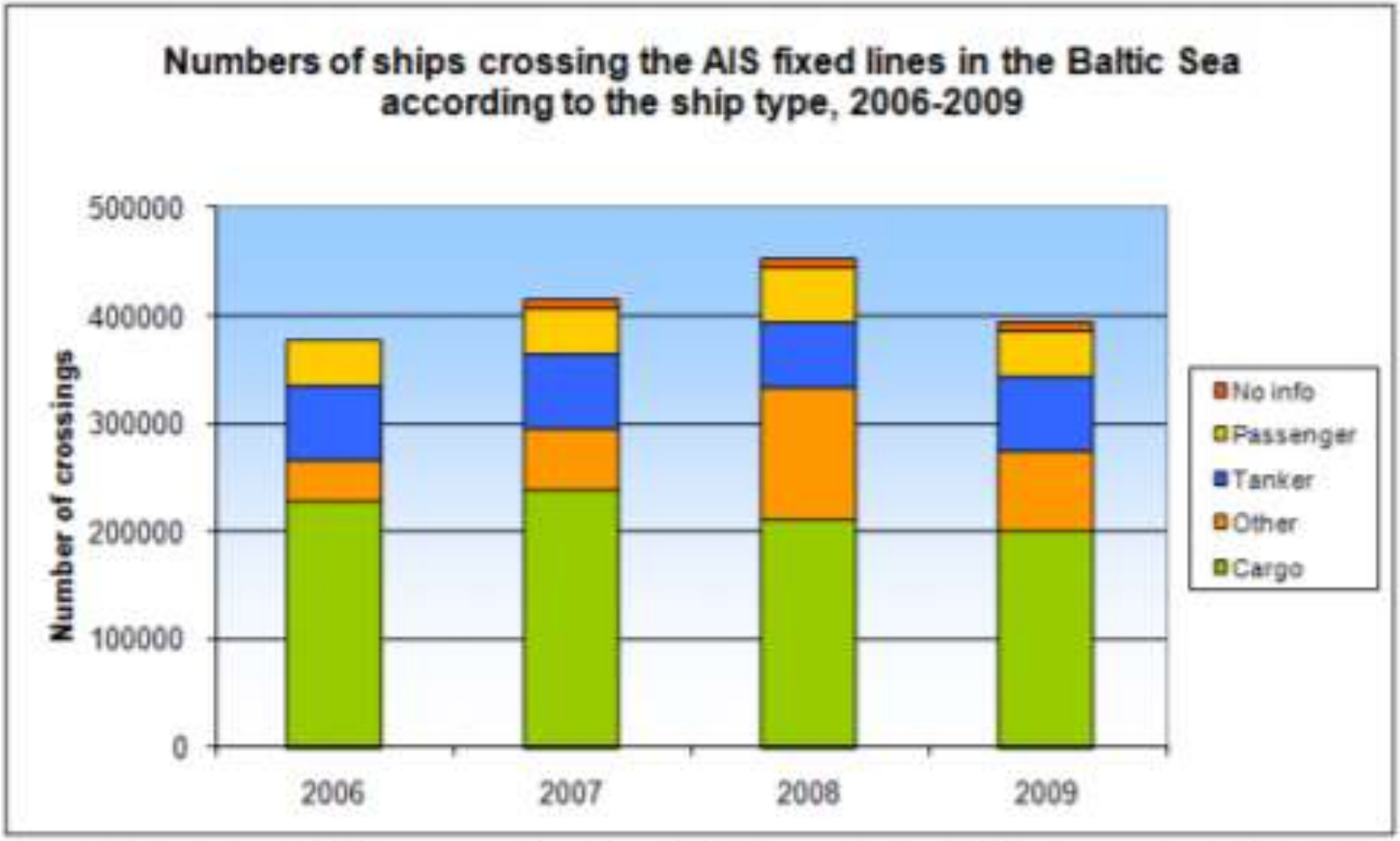


Figure 6. Number of ships crossing fixed AIS lines in the Baltic Sea during 2006-2009, shown here by ship type.

What about other graphs besides bar, line, point and box?


Slope graph


Dot plot


Chord diagram

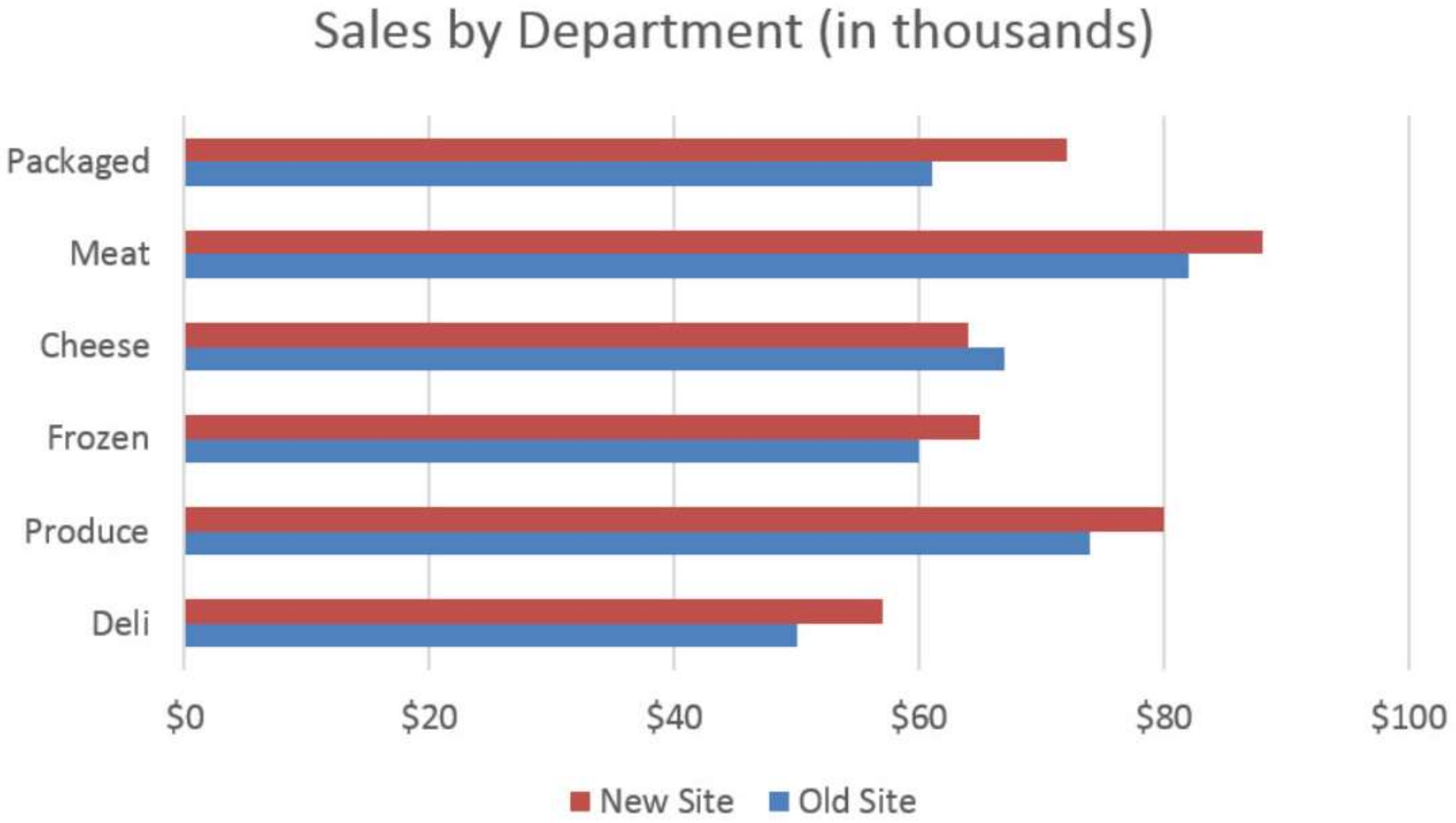

Sankey diagram


Small multiple


Cycle plot

Slope graph

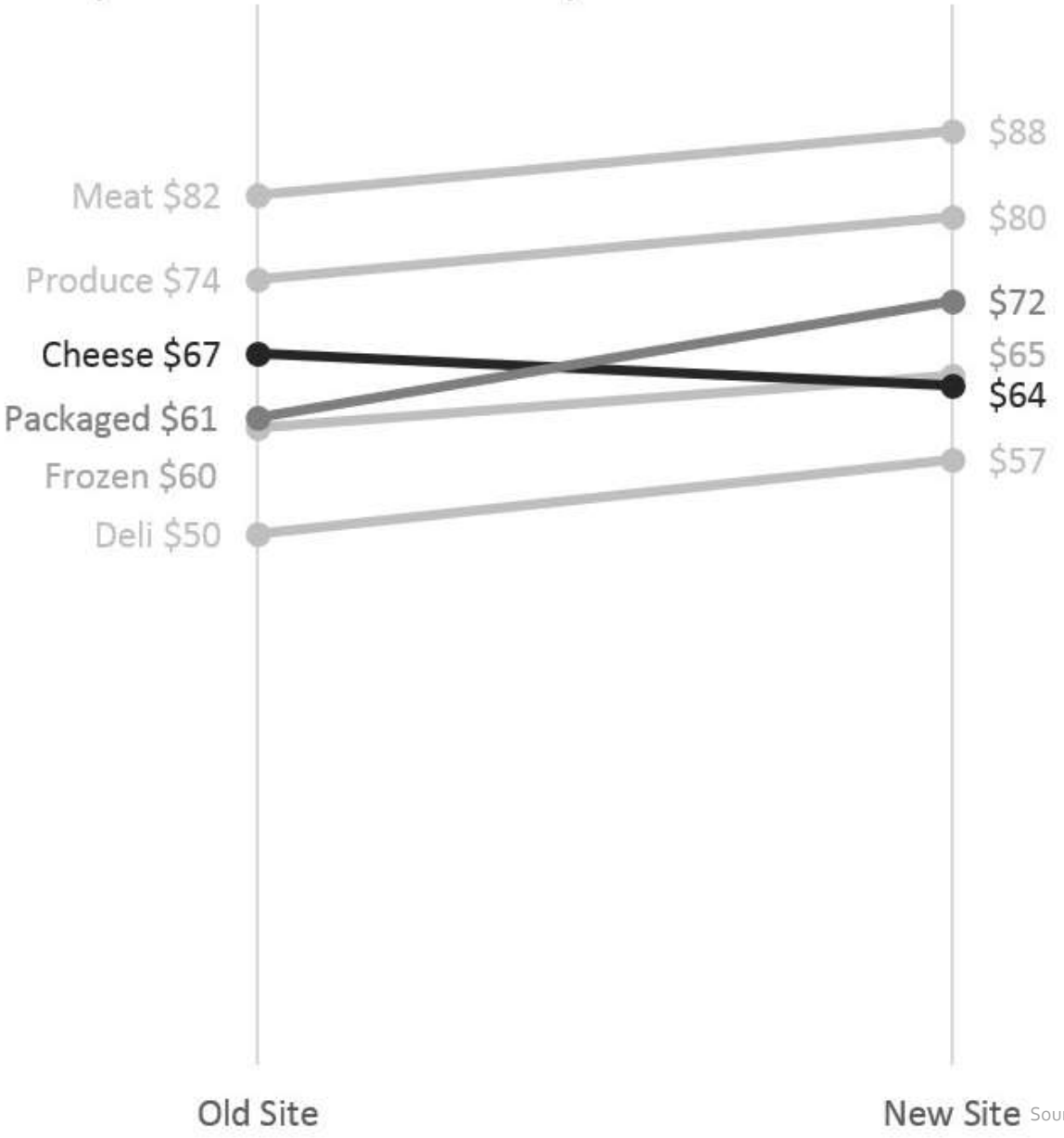
Before



Source: https://stephanieevergreen.com/

After

Sales increased in nearly every department after the move to the new site, with the exception of the Cheese department.



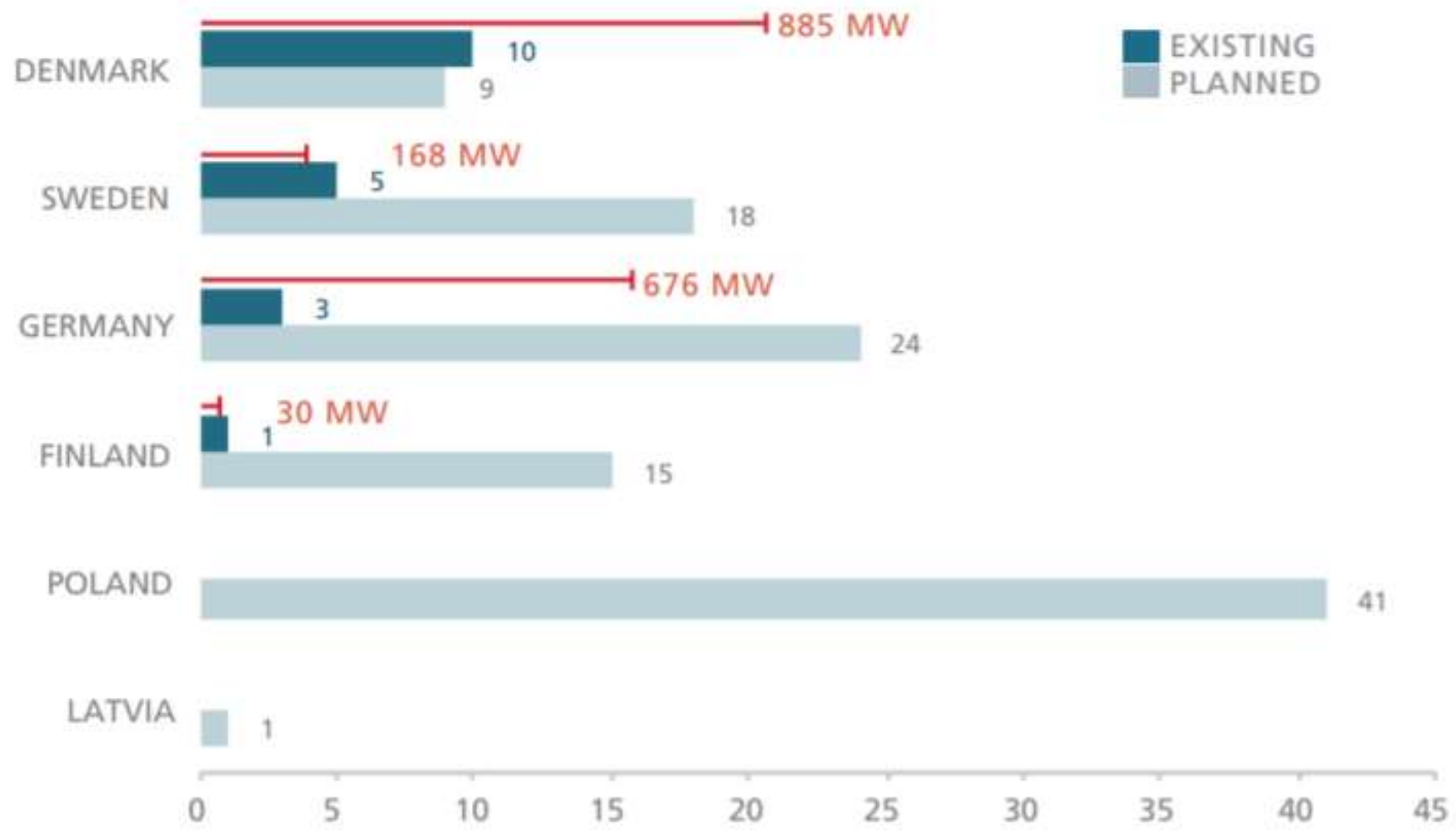
Source: https://stephanieevergreen.com/

Dot plot

OVER 100 NEW OFFSHORE WIND FARMS ARE PLANNED IN THE BALTIC SEA

Number of existing (20) and planned (108) offshore wind farms and production capacity (total 1 762 Megawatts) per country

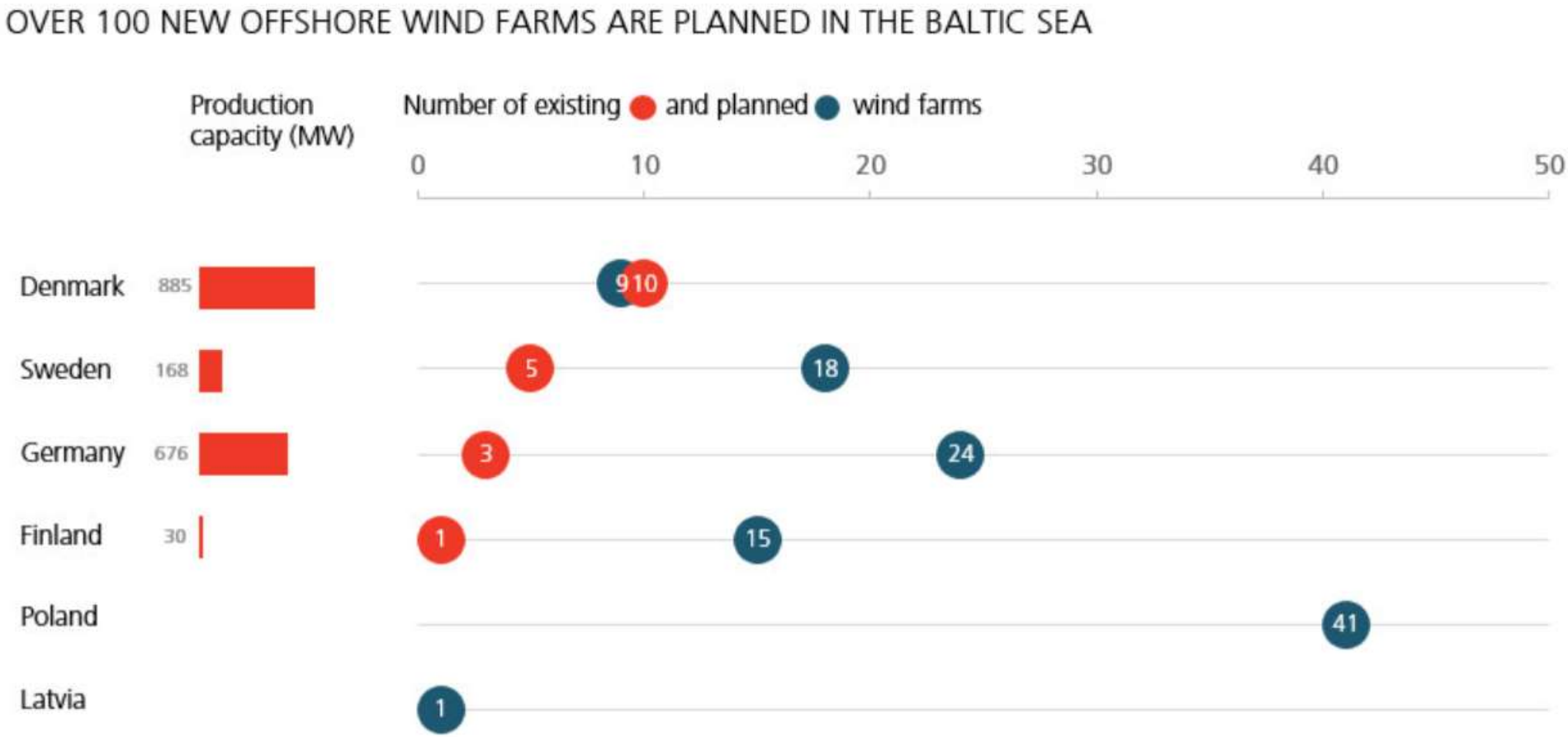
Before



Source: EWEA

Source: HELCOM Maritime Assessment

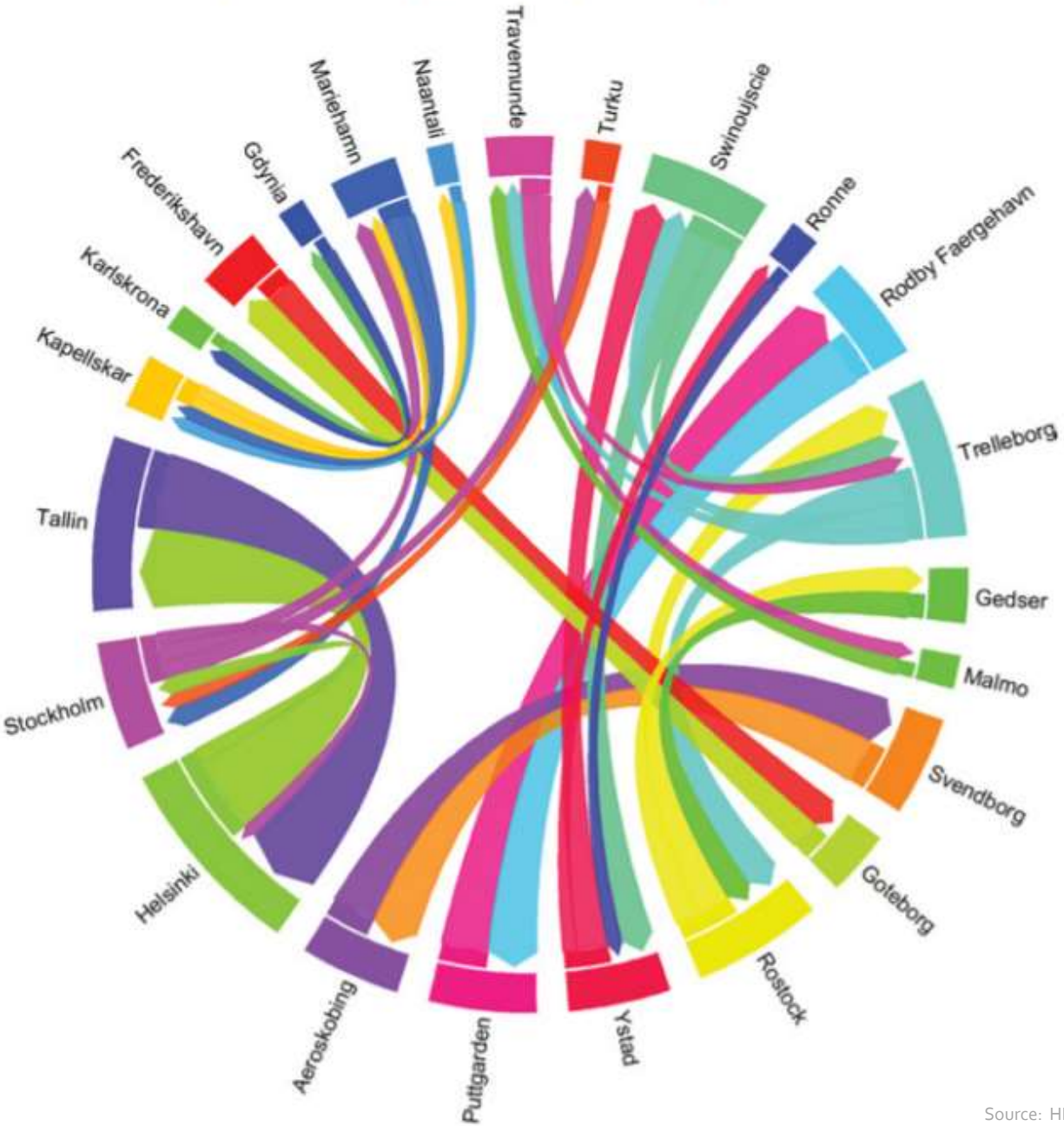
After


OVER 100 NEW OFFSHORE WIND FARMS ARE PLANNED IN THE BALTIC SEA
Production capacity (MW)
Number of existing and planned wind farms
0
10
20
30
40
50
Denmark
885
9
10
Sweden
168
5
18
Germany
676
3
24
Finland
30
1
15
Poland
41
Latvia
1

Chord diagram

Figure 1.15. INTERACTION BETWEEN PORTS (ARRIVALS AND DEPARTURES) IN THE BALTIC SEA

Passenger ship traffic in 2015: 50 biggest ports, minimum of 500 trips



Source: HELCOM Maritime Assessment

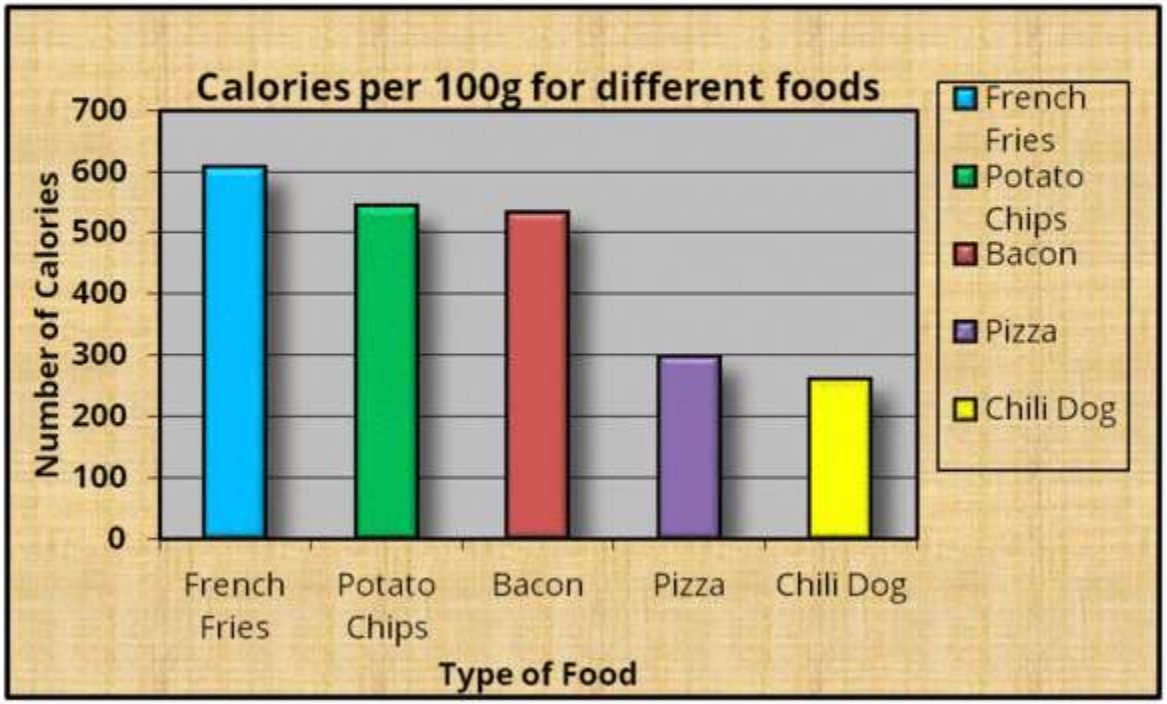
How can we improve the style of a graph?

Remove

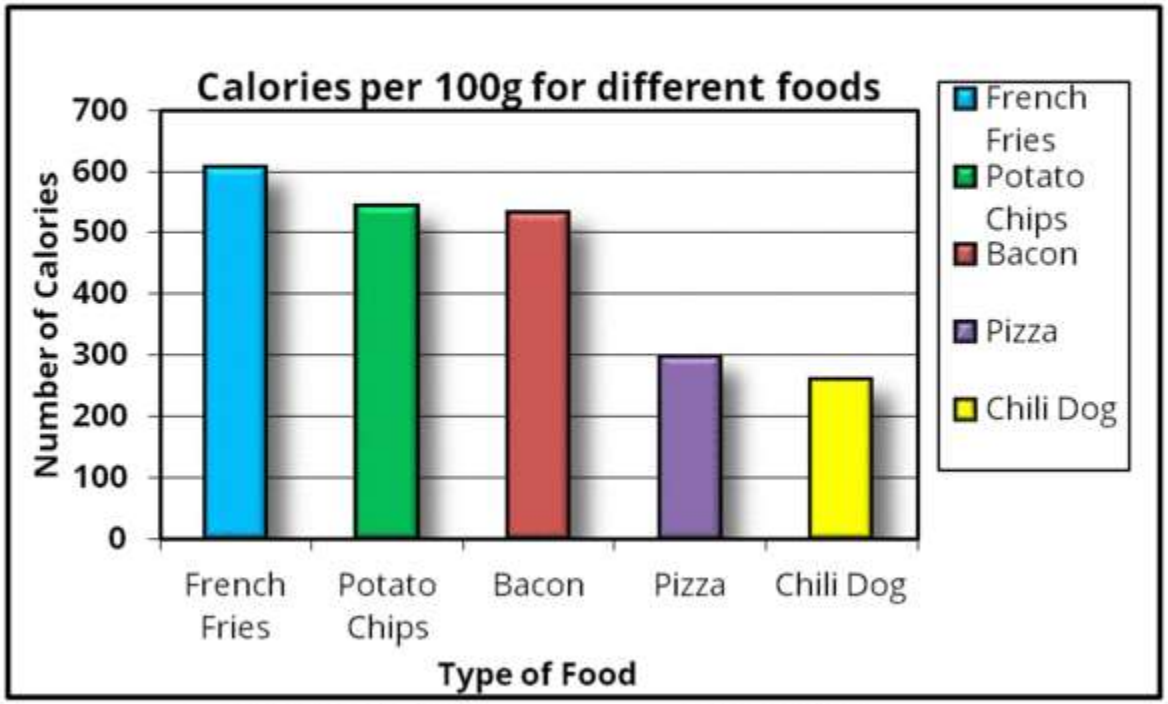
to improve

(the **data-ink** ratio)

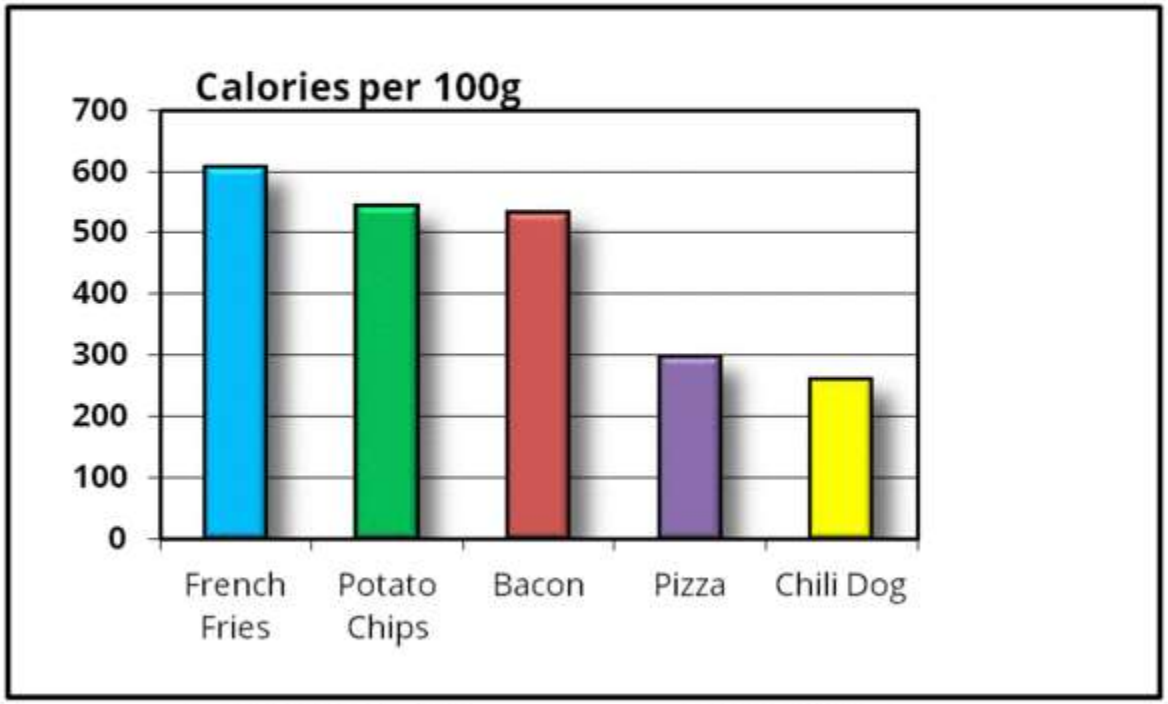
Remove backgrounds



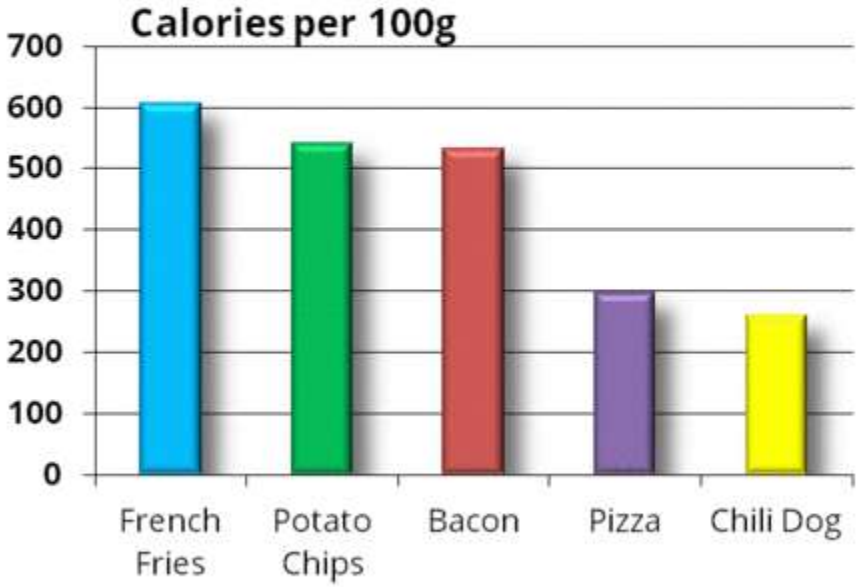
Remove redundant labels



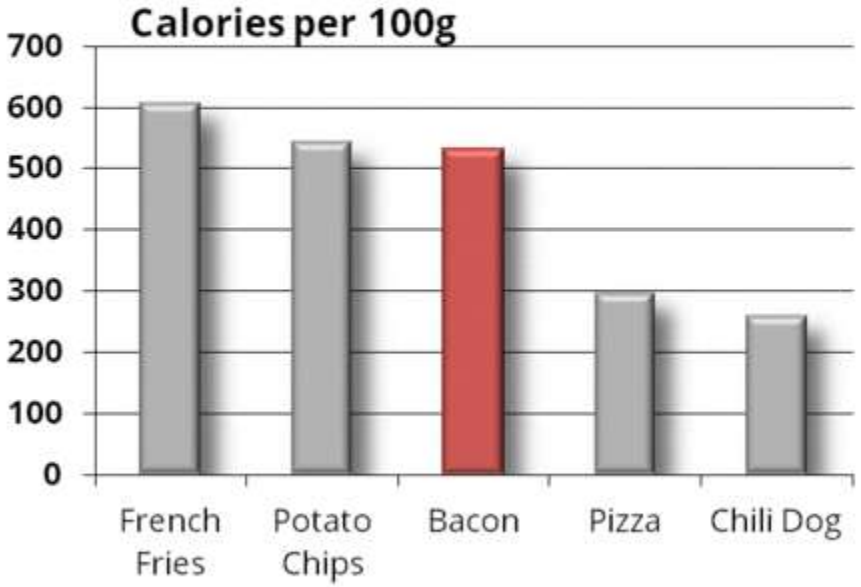
Remove borders



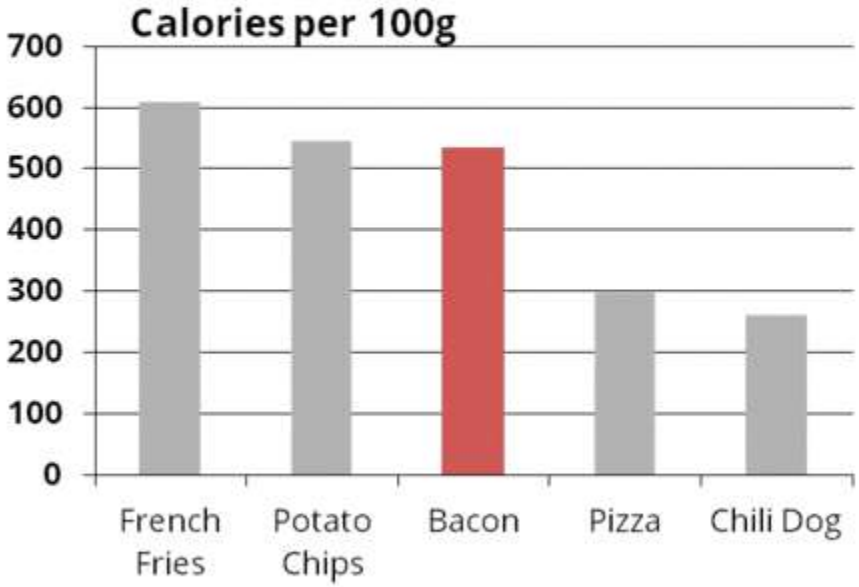
Reduce colors



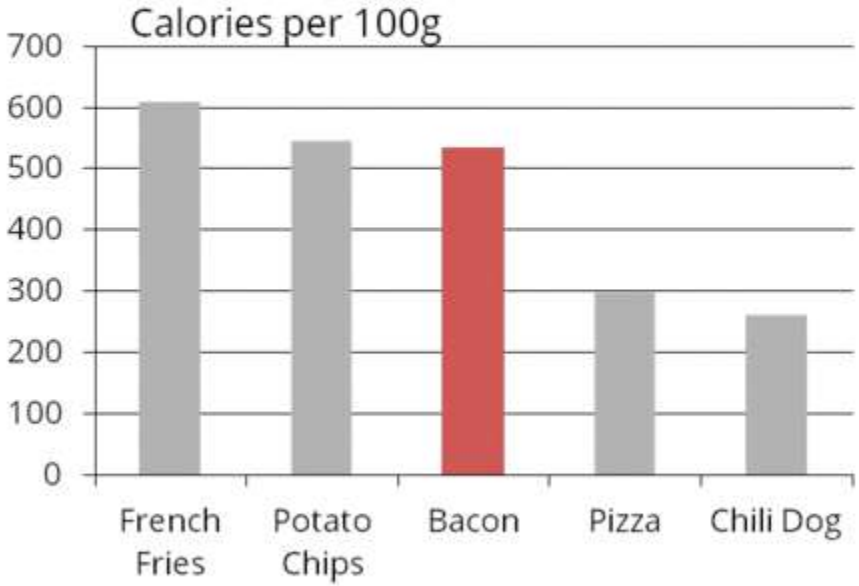
Remove special effects



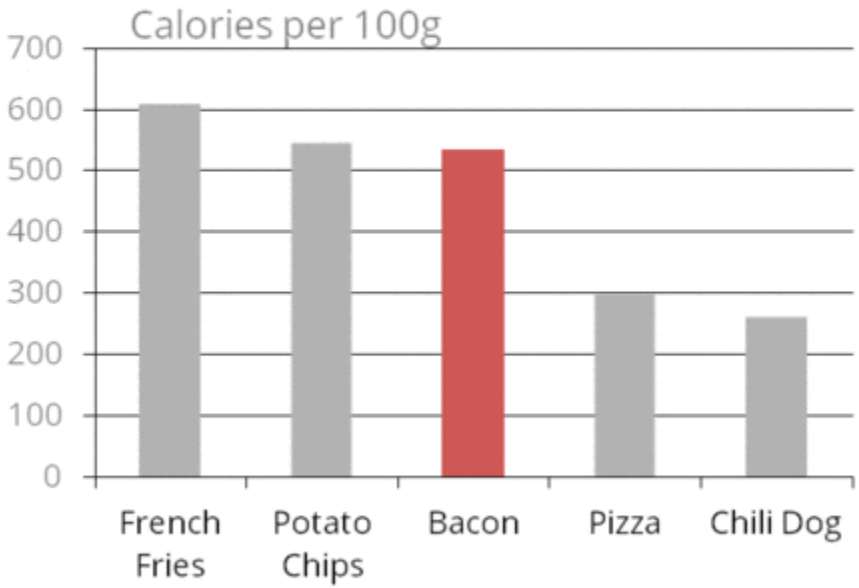
Remove bolding



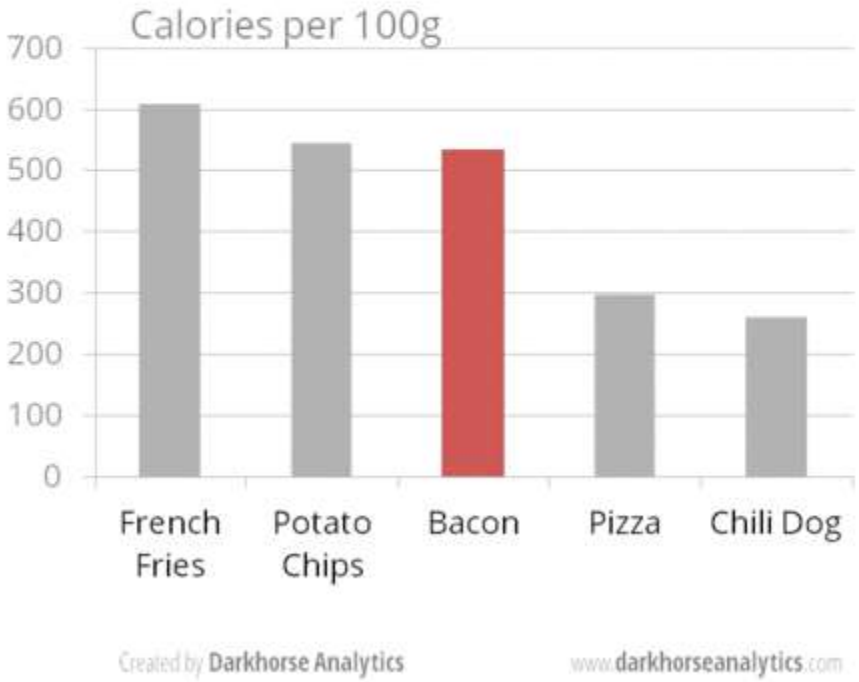
Lighten labels



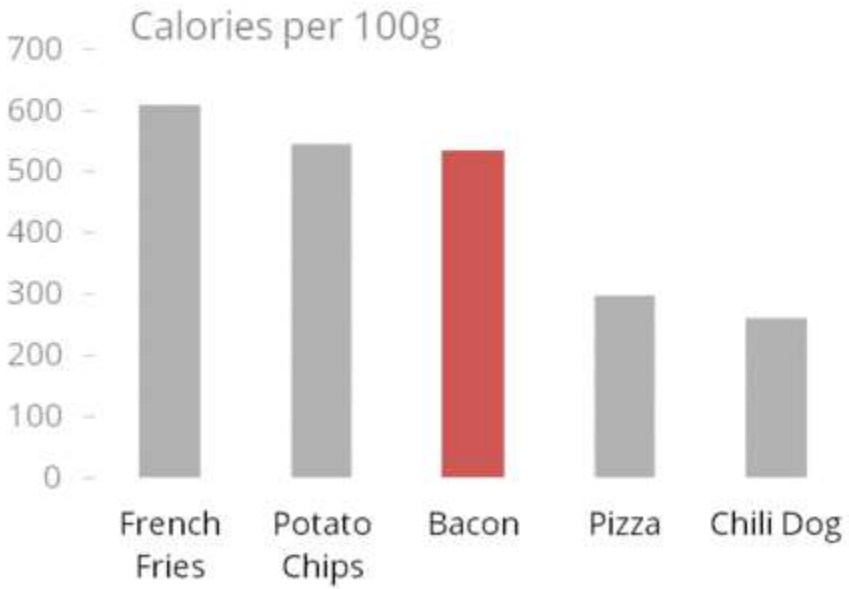
Lighten lines



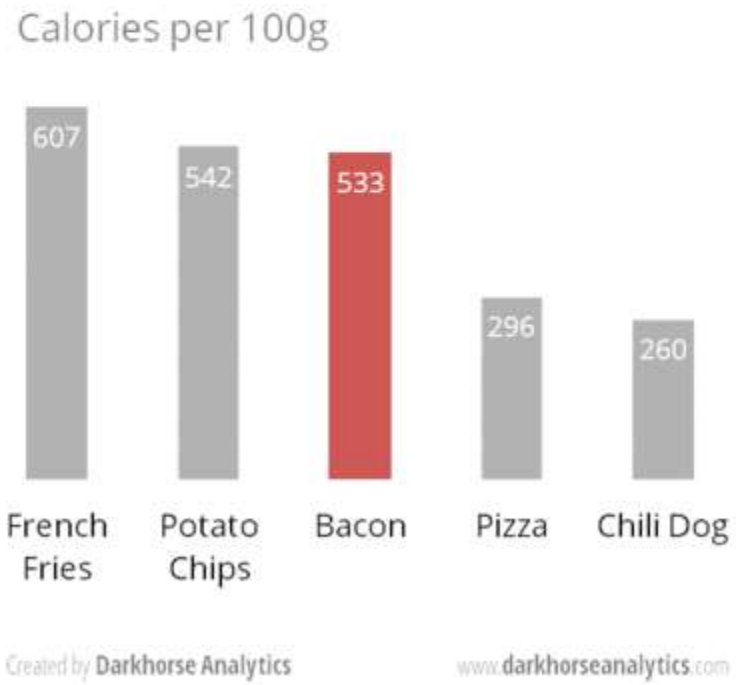
Or remove lines



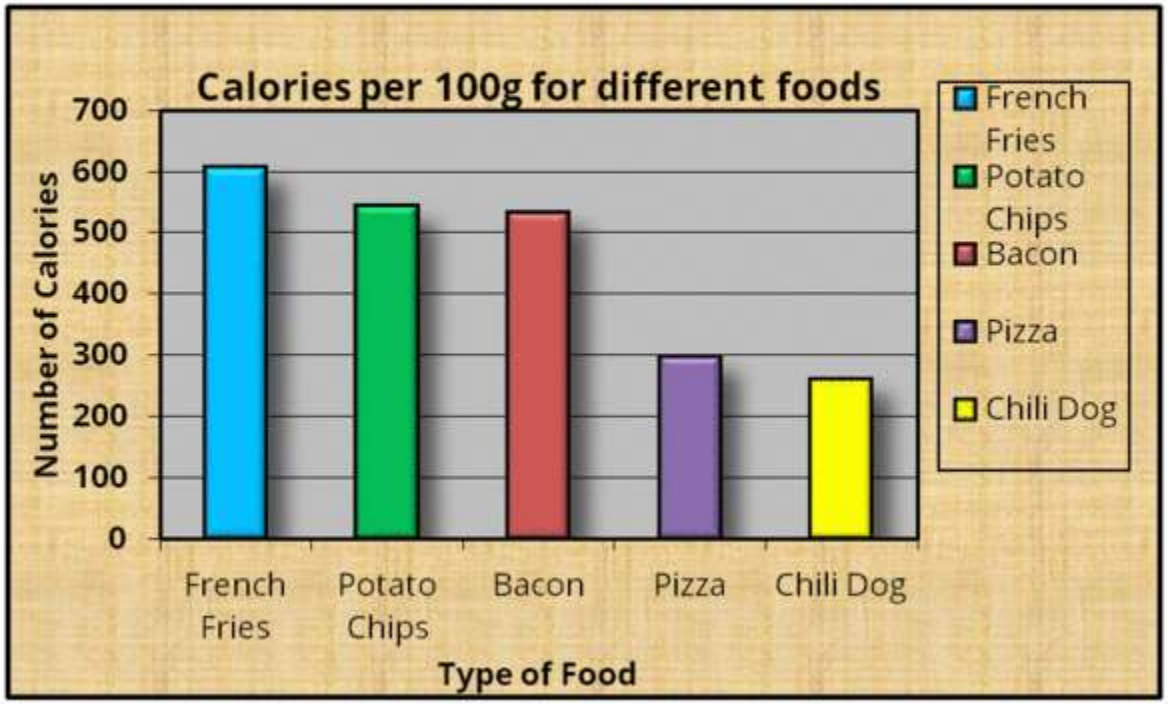
Direct label



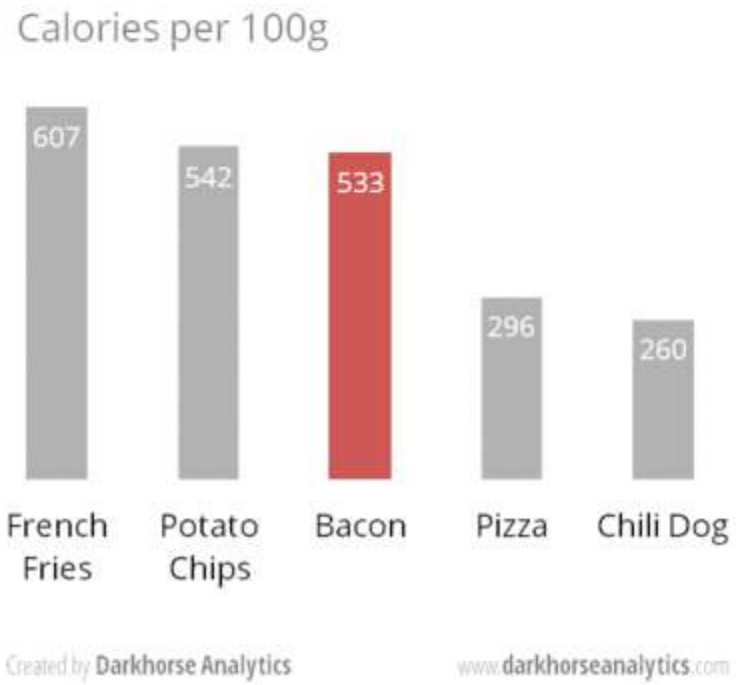
Direct label



Before


Calories per 100g for different foods
Number of Calories
700
600
500
400
300
200
100
0
French Fries
Potato Chips
Bacon
Pizza
Chili Dog
Type of Food
French Fries
Potato Chips
Bacon
Pizza
Chili Dog
Created by Darkhorse Analytics
www.darkhorseanalytics.com

After


Calories per 100g
607
542
533
296
260
French Fries
Potato Chips
Bacon
Pizza
Chili Dog
Created by Darkhorse Analytics
www.darkhorseanalytics.com

Alternative tools


inzight


Flourish

Data-Driven Documents

