
STA 404/504A Advanced Data Visualization

Spring 2025
Department of Statistics

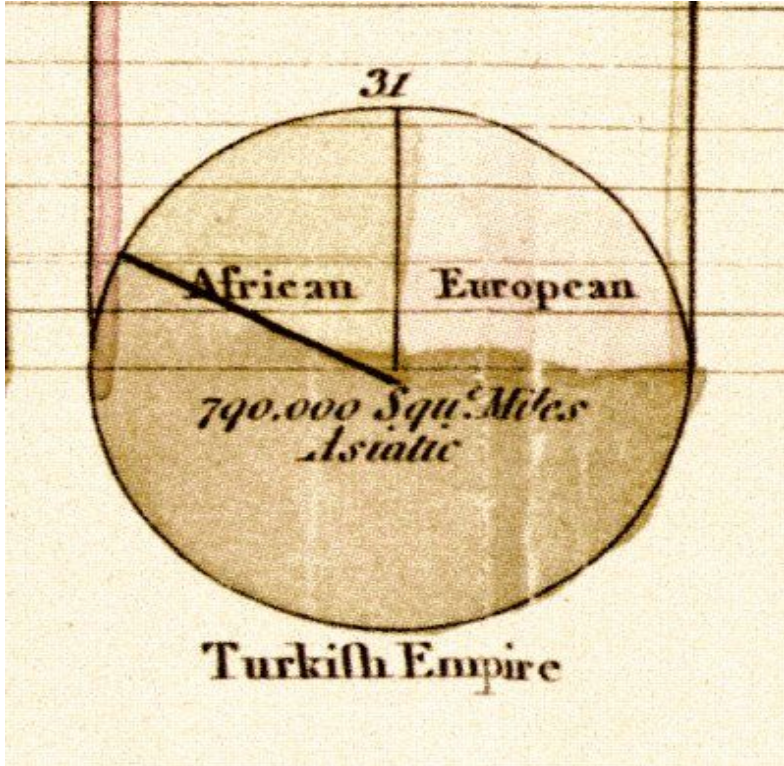


MIAMI UNIVERSITY

What is Data Visualization?

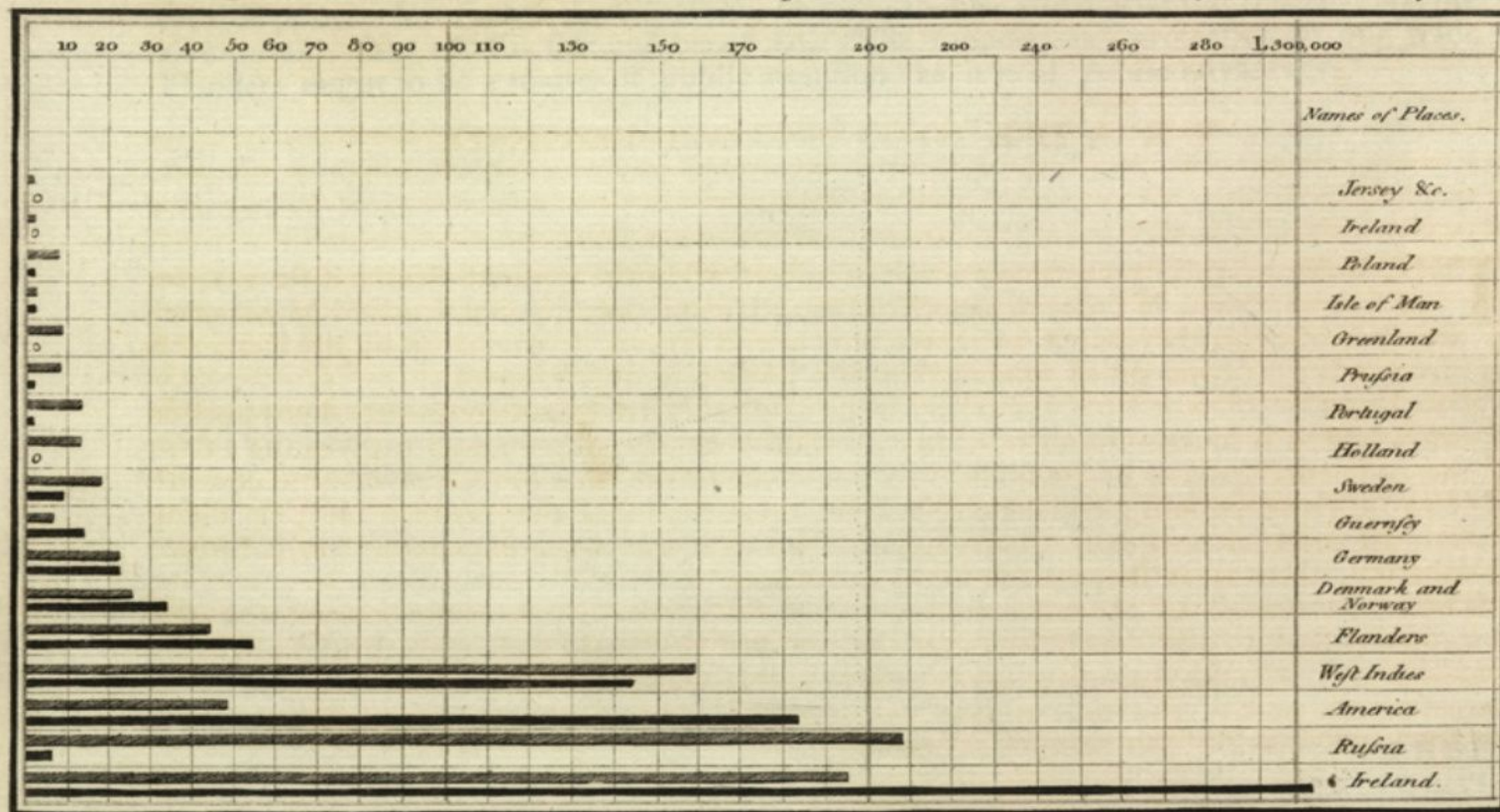
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- >> It is the graphic representation of data. -Wikipedia
 - >> It is the presentation of quantitative information in a graphical form. -Infogram
 - >> It is the presentation of data in a pictorial or graphical format. -SAS
 - >> It is the graphical representation of information and data. -Tableau

History of Data Visualization



- » Late 1700's, William Playfair, a Scottish engineer and political economist, known as "father of statistical graphics".
- » Playfair is credited with having invented the line, bar, and pie chart we use so often today.

Pie chart from Playfair's Statistical Breviary (1801), showing the proportions of the Turkish Empire located in Asia, Europe and Africa before 1789.

Exports and Imports of **SCOTLAND** to and from different parts for one Year from Christmas 1780 to Christmas 1781.

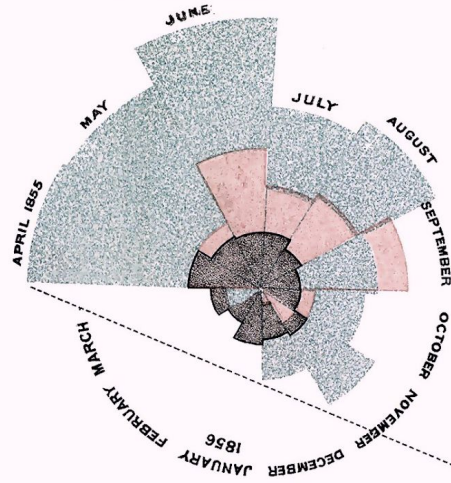
The Upright divisions are Ten Thousand Pounds each. The Black Lines are Exports the Ribbed lines Imports.

History of Data Visualization

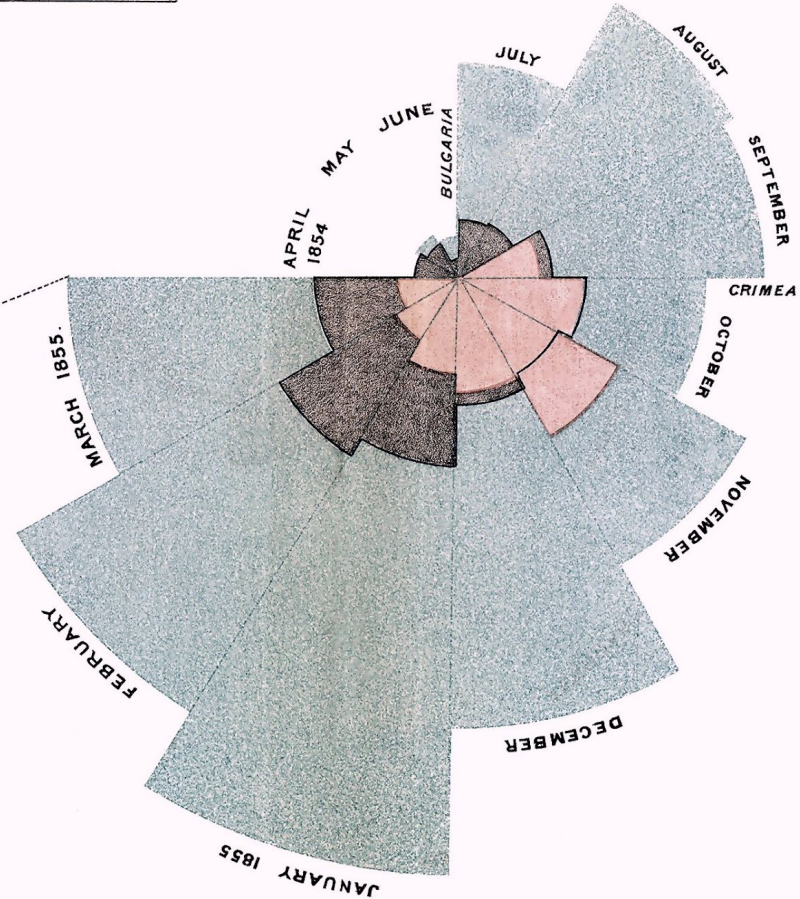
- >> Florence Nightingale is famous for her work as a nurse during the Crimean War, but she was also a data journalist.
- >> “coxcomb” or “rose” diagrams.
- >> It is a variation of a pie chart that represented the number of soldiers using the area of the circle segments instead of the radius. Her message that "more soldiers died from infection than from wounds" could be easily seen.
- >> These revolutionary charts helped her fight for better hospital conditions, and resulted in policy changes that ultimately saves soldiers lives.

DIAGRAM OF THE CAUSES OF MORTALITY IN THE ARMY IN THE EAST.

2.
APRIL 1855 TO MARCH 1856.



1.
APRIL 1854 TO MARCH 1855.



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases, the red wedges measured from the centre the deaths from wounds, & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov. 1854 marks the boundary of the deaths from all other causes during the month.

In October 1854, & April 1855, the black area coincides with the red; in January & February 1856, the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.

History of Data Visualization

- » Charles Joseph Minard was a French civil engineer famous for his representation of numerical data on maps.
- » His most famous work is the map of Napoleon's Russian campaign of 1812 displaying the dramatic loss of his army over the advance on Moscow and the following retreat.
- » It displays six types of data in two dimensions: the number of Napoleon's troops; the distance traveled; temperature; latitude and longitude; direction of travel; and location relative to specific dates without making mention of Napoleon.
- » This type of band graph for illustration of flows was later called a “sankey diagram”, and used only for thematic energy flow.

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite

Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Legur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout, qui avaient été détachés sur Minsk et Moliow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

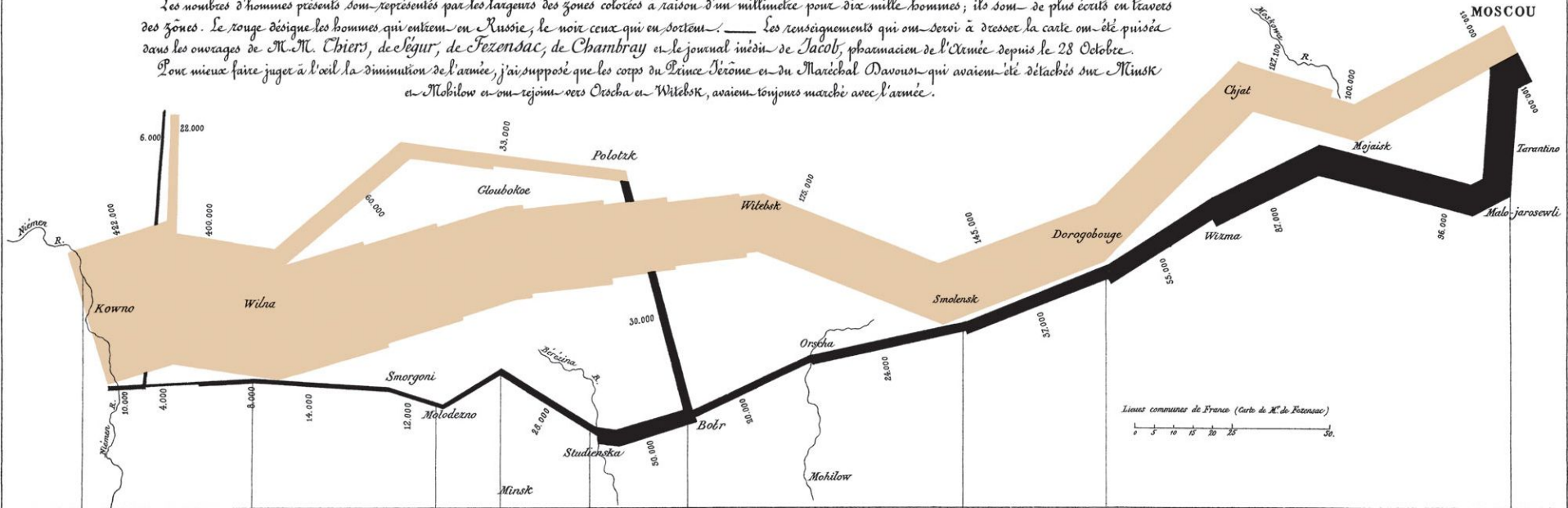
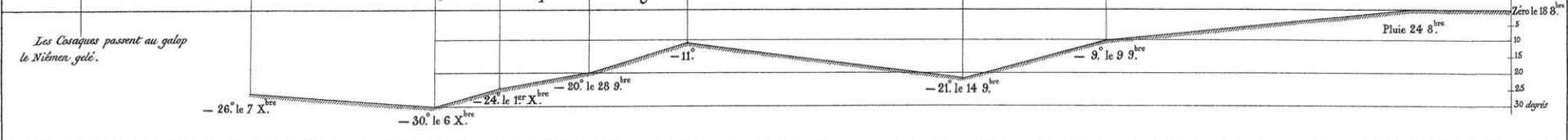


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Autoq. par Regnier, 8. Pas. S^{te} Marie St G^{ain} à Paris.

Imp. Lith. Regnier et Dourdet.

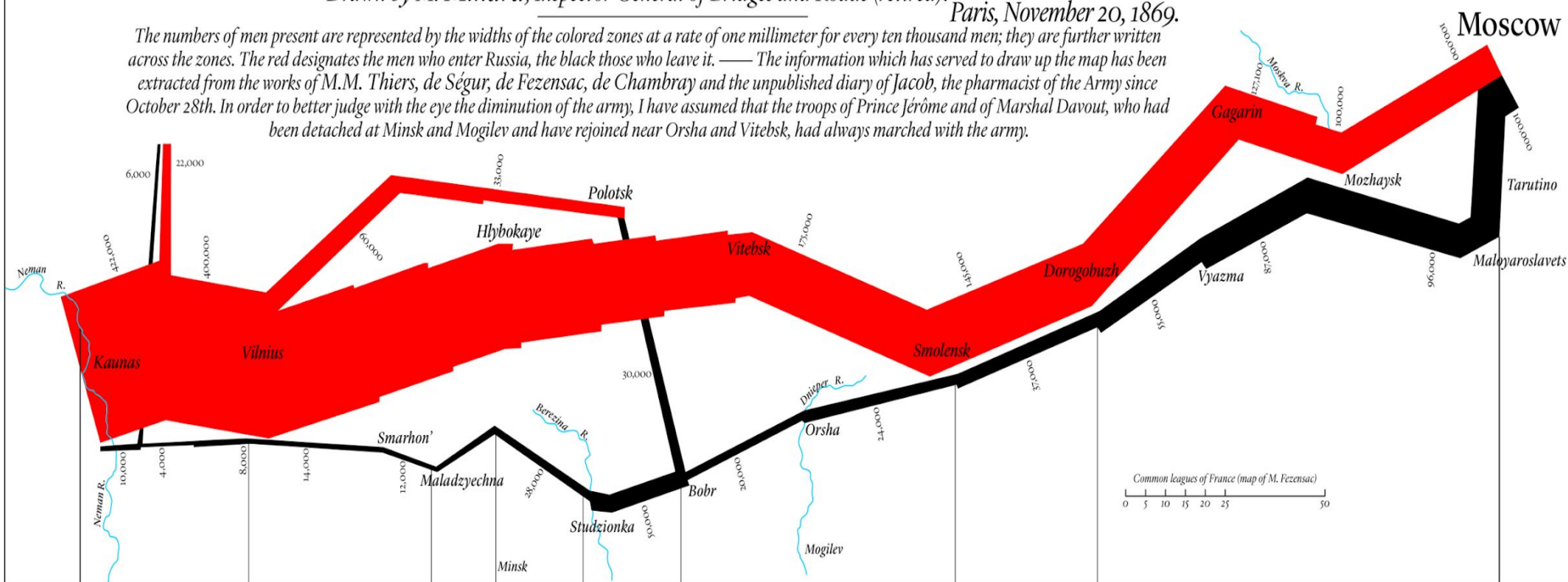
Charles Minard's map of Napoleon's disastrous Russian campaign of 1812.

Figurative Map of the successive losses in men of the French Army in the Russian campaign 1812 ~ 1813

Drawn by M. Minard, Inspector General of Bridges and Roads (retired).

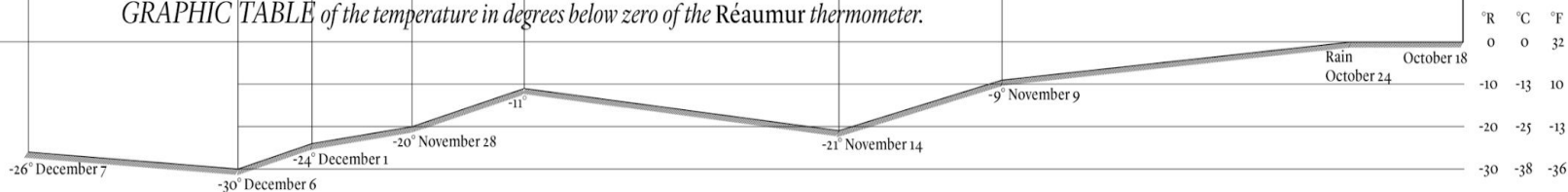
Paris, November 20, 1869.

The numbers of men present are represented by the widths of the colored zones at a rate of one millimeter for every ten thousand men; they are further written across the zones. The red designates the men who enter Russia, the black those who leave it. — The information which has served to draw up the map has been extracted from the works of M.M. Thiers, de Ségur, de Fezensac, de Chambray and the unpublished diary of Jacob, the pharmacist of the Army since October 28th. In order to better judge with the eye the diminution of the army, I have assumed that the troops of Prince Jérôme and of Marshal Davout, who had been detached at Minsk and Mogilev and have rejoined near Orsha and Vitebsk, had always marched with the army.



GRAPHIC TABLE of the temperature in degrees below zero of the Réaumur thermometer.

The Cossacks pass the frozen Neman at a gallop.

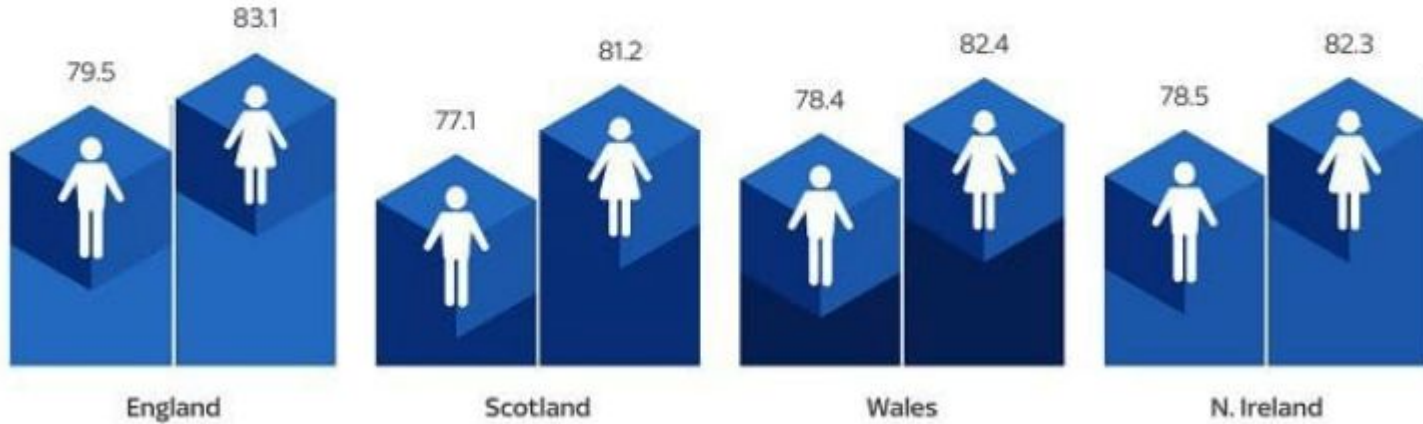


Why Data Visualization?

- >> Make data easier to understand and remember.
- >> Help to identify problems with data.
- >> Help with the decision making process.
- >> Make the presentation and storytelling easy.

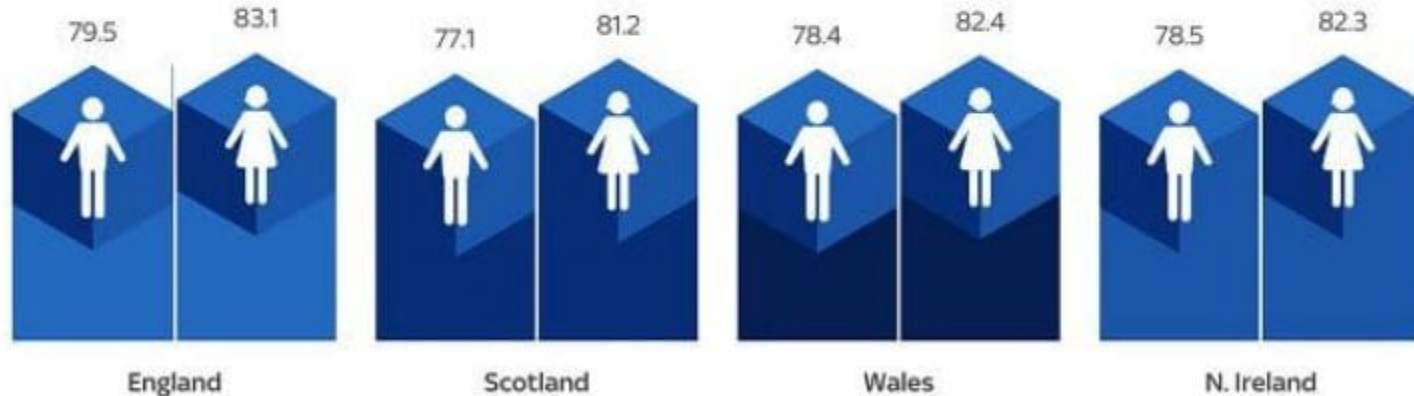
Good or Bad Data Visualization?

81.2 Average UK life expectancy



Good or Bad Data Visualization?

81.2 Average UK life expectancy



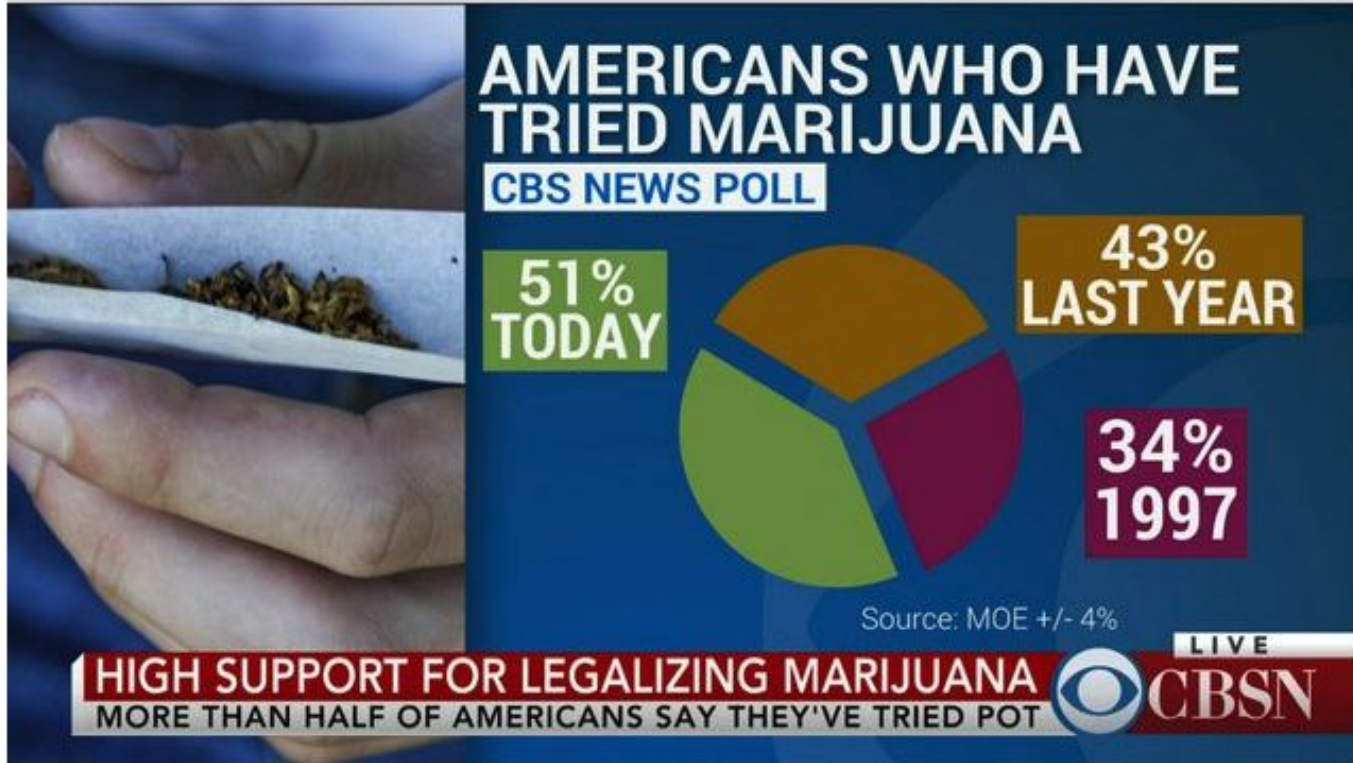
2017 This Is What Happens In An Internet Minute



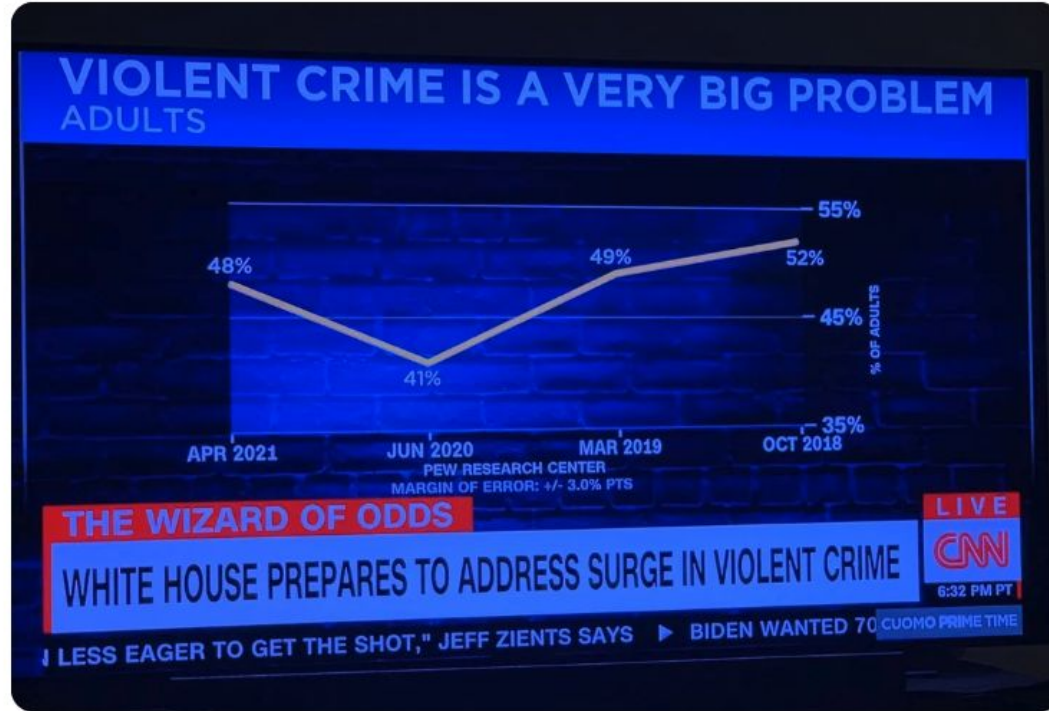
2018 This Is What Happens In An Internet Minute



Good or Bad Data Visualization?

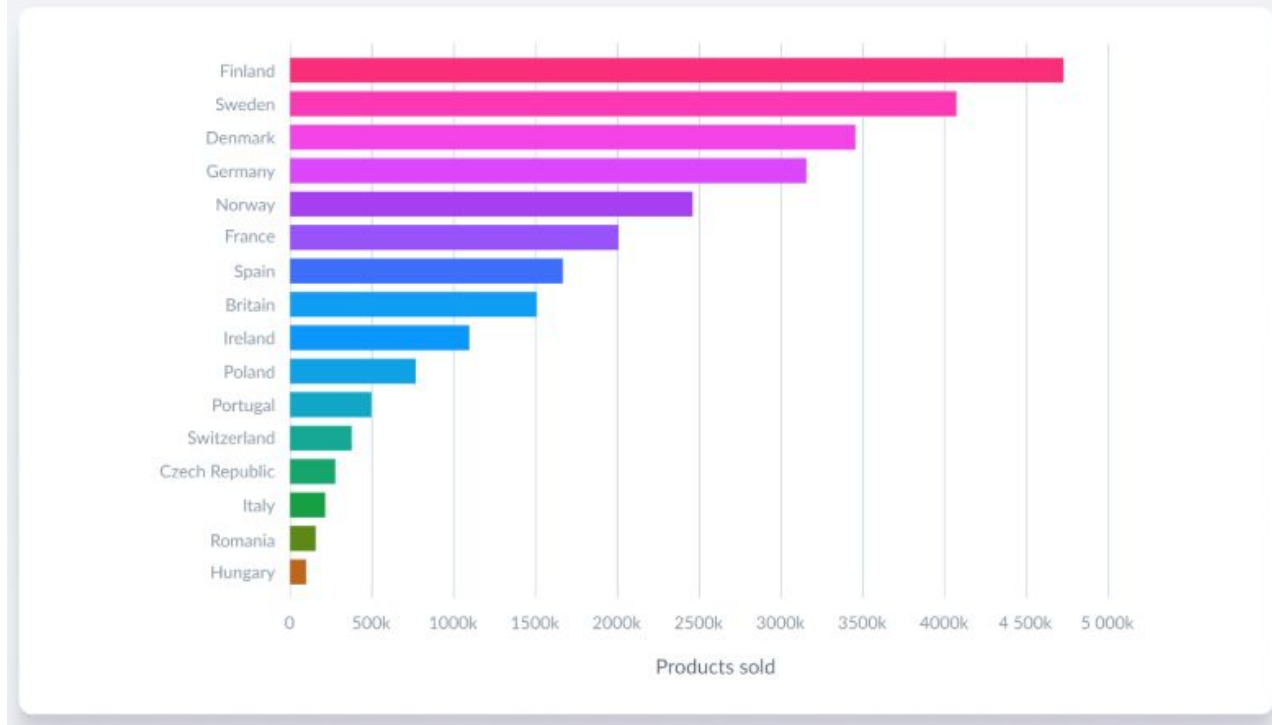


Good or Bad Data Visualization?

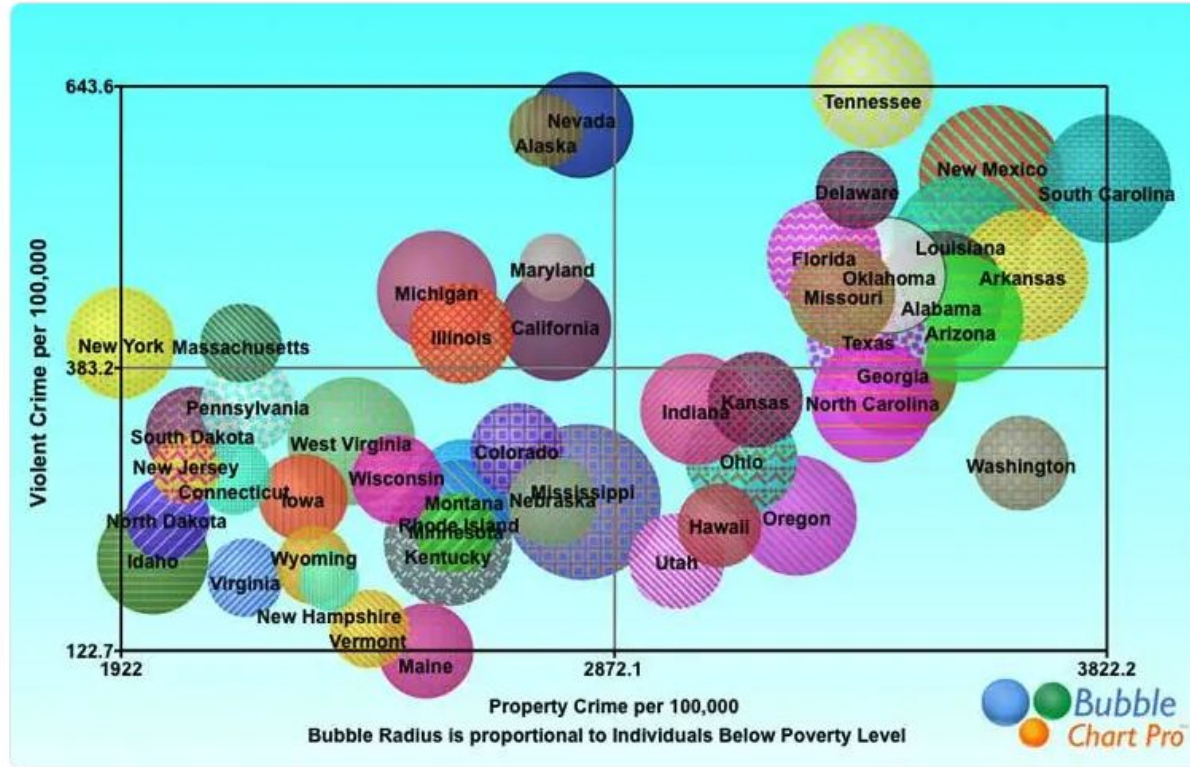


CNN graph on polling about violent crime

Good or Bad Data Visualization?



Good or Bad Data Visualization?



Data Visualization Design Process

- >> Find out your audience, find out the questions.
- >> Get the data, start with basic methods and find ways to show the data according to specific needs.
- >> Convey the information of the figures to your audience, focus your audience's attention.
- >> Refine your work.

Examples of Data Visualization

- >> [Johns Hopkins Coronavirus Resource Center](#)
- >> [Coronavirus tracked: the latest figures as countries fight Covid-19 resurgence](#)
- >> [Why outbreaks like coronavirus spread exponentially, and how to “flatten the curve”](#)
- >> [Data visualization society](#)