What is Visualization

Data Management and Visualization

SOftEng
http://softeng.polito.it

Docente

- Marco Torchiano
  - Dip. Automatica e Informatica
    - IV Piano, Ufficio 4E-33

☎ 011 564 7088

✉ marco.torchiano @ polito.it

http://softeng.polito.it/torchiano

@mtorchiano

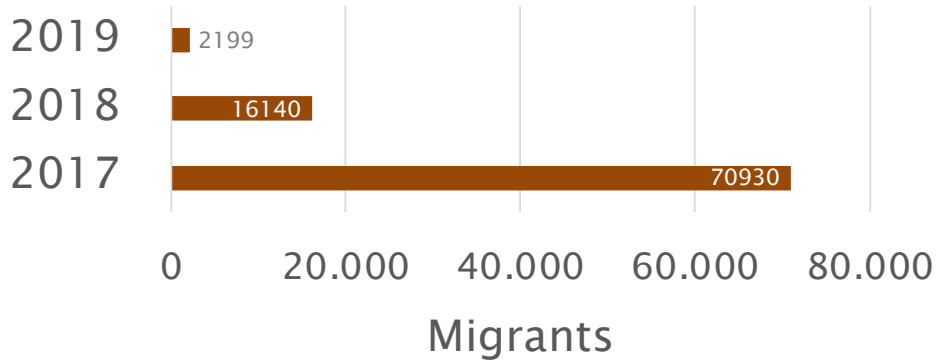
Definition

Visualization:

Usage of visual features to encode data in order to convey useful information

WHY VISUALIZATION?

Migrants arrived in period January – June



http://www.interno.gov.it/sites/default/files/cruscotto_statistico_giornaliero_19-06-2019.pdf

The **accidents at work** happened and reported to Inail in first quarter 2019 have been 131 thousand (109 thousand at work and 22 thousand while traveling), on the rise by 1,7% (+2 thousand reports) with respect to first quarter 2018

https://www.istat.it/it/files//2019/06/NotaTrimestrale-Occupazione-I_2019.pdf

Motivation

- Information retrieval
  - After 3 days
    - Text alone: 10%
    - Text + visuals: 65%

[John Medina, Brain Rules, 2008]

Motivation

Information retrieval

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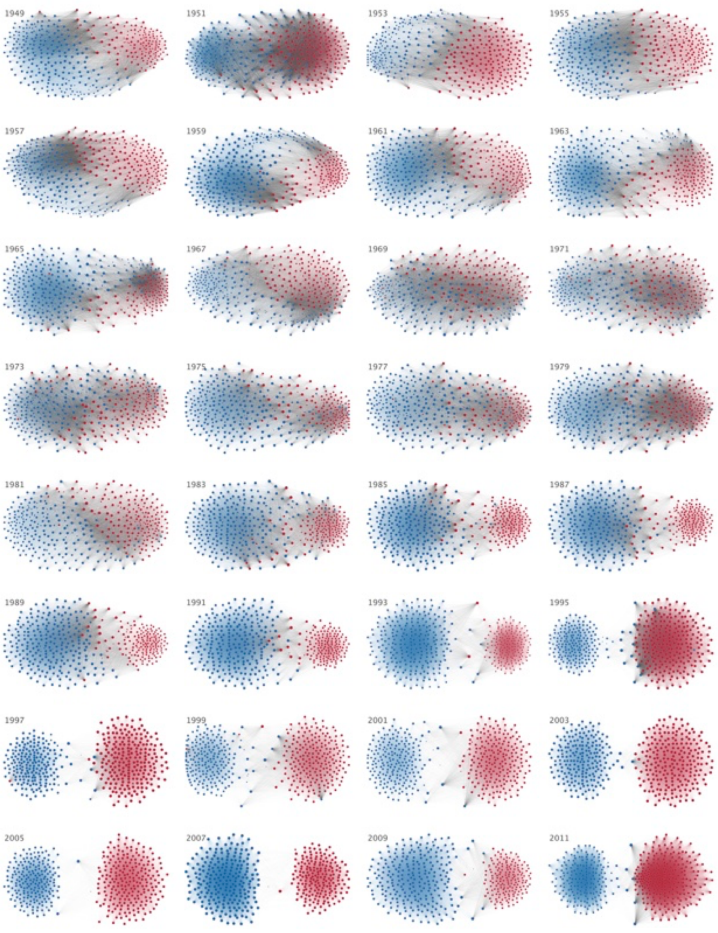
Motivation

Information retrieval

Information density

- In principle every single pixel in an image could encode a datum
  - Screen (1024x768) ~ 1 M pixels
  - 1 M characters ~ 250 pages



http://www.mamartino.com/projects/rise_of_partisanship/index.html

Motivation

Information retrieval

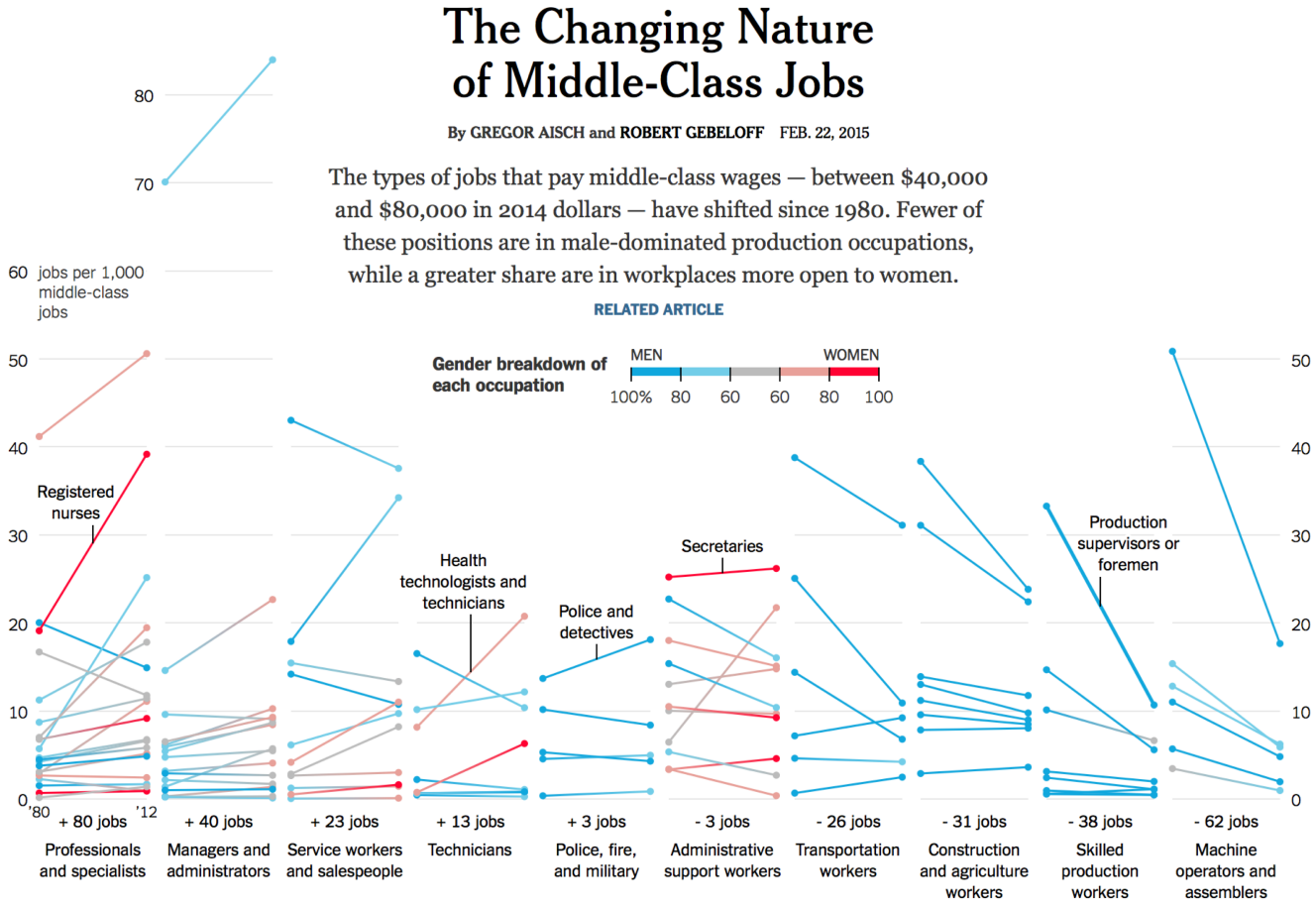
Information density

Information context

Visualization compares multiple values and puts the information into context.

A single number means nothing.

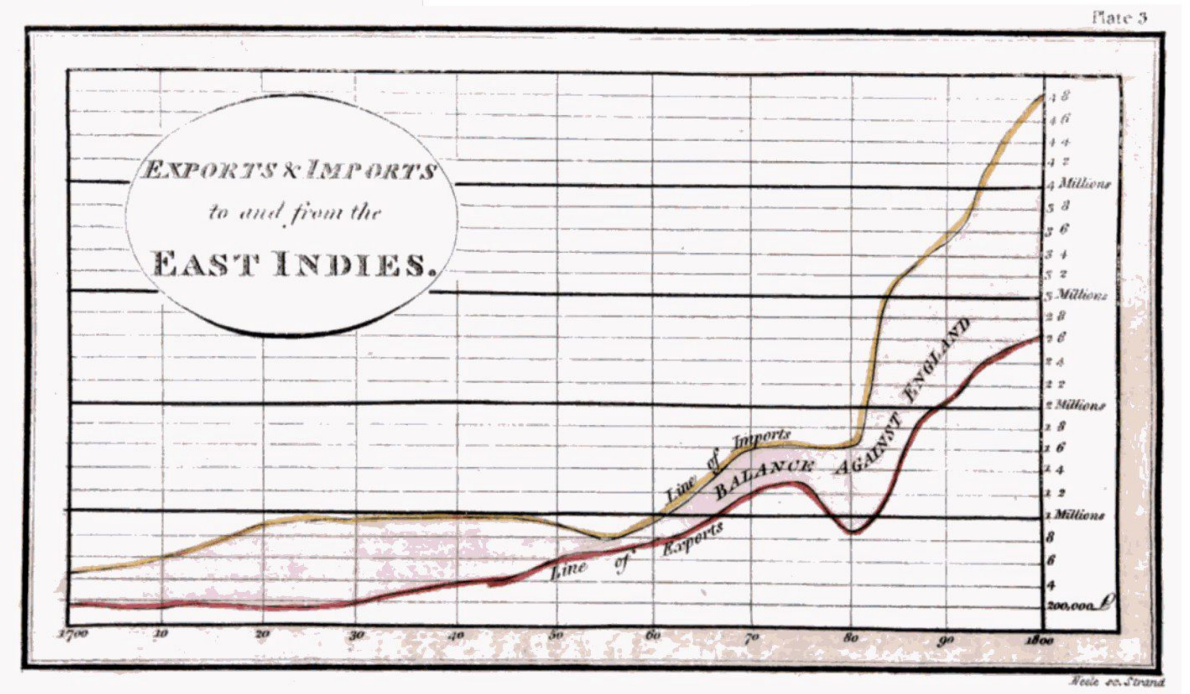
[Randy Krum presentation at Malofiej 23 (March 2015)]



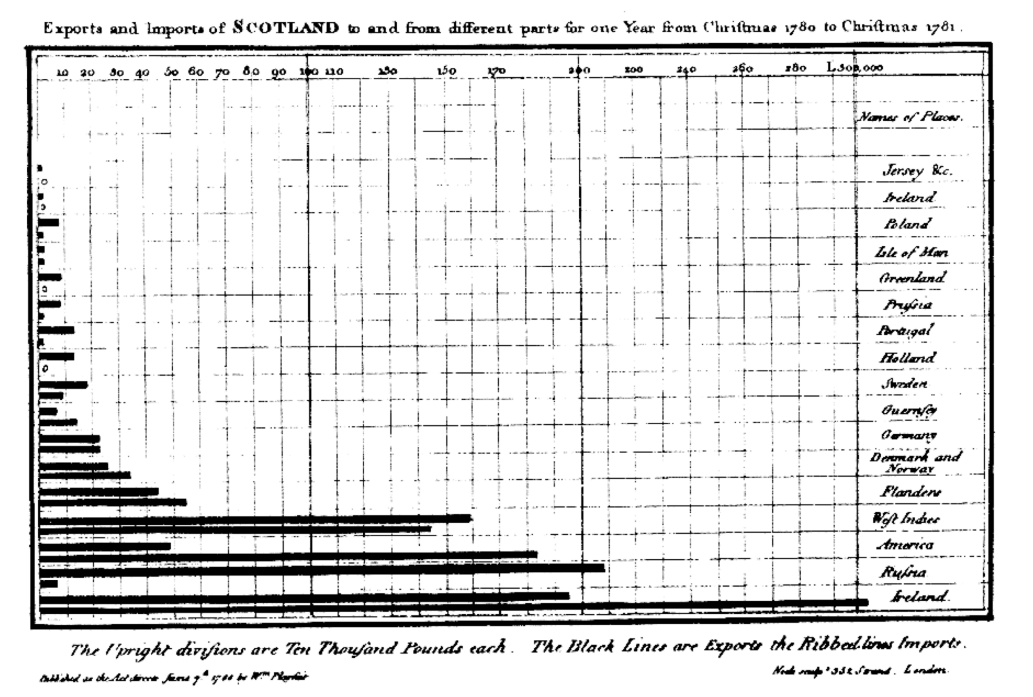
http://www.nytimes.com/interactive/2015/02/23/business/economy/the-changing-nature-of-middle-class-jobs.html

HISTORY

William Playfair



W.Playfair, The Commercial and Political Atlas, London 1786



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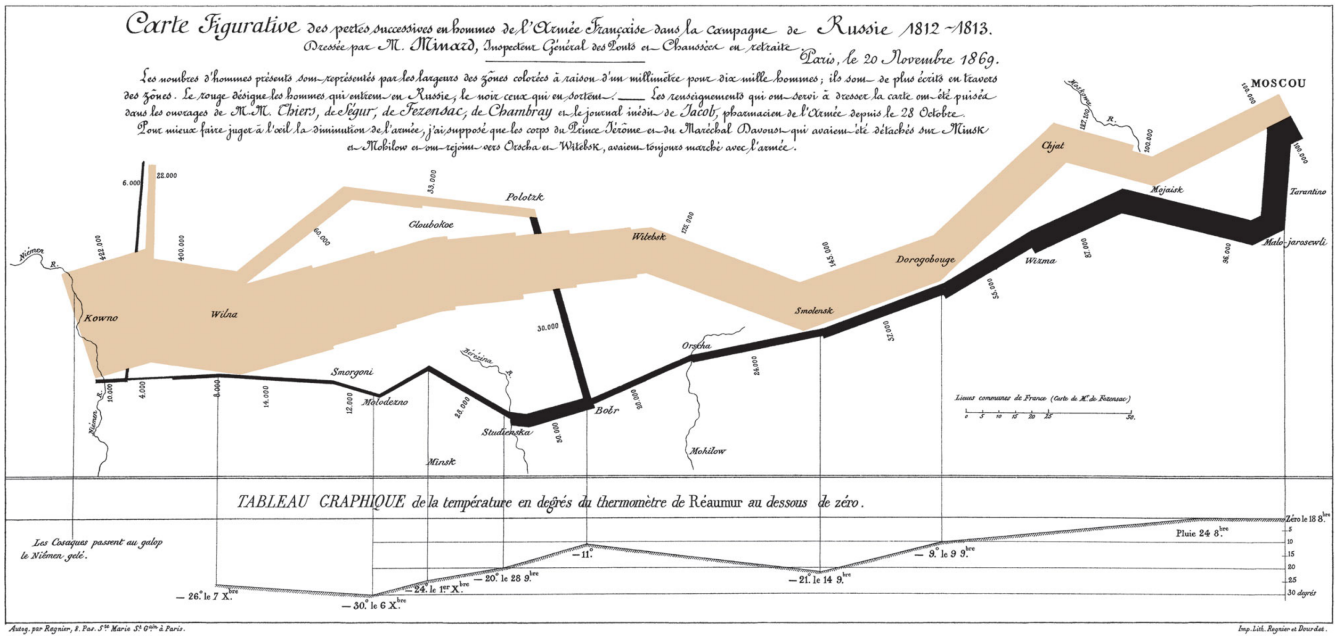
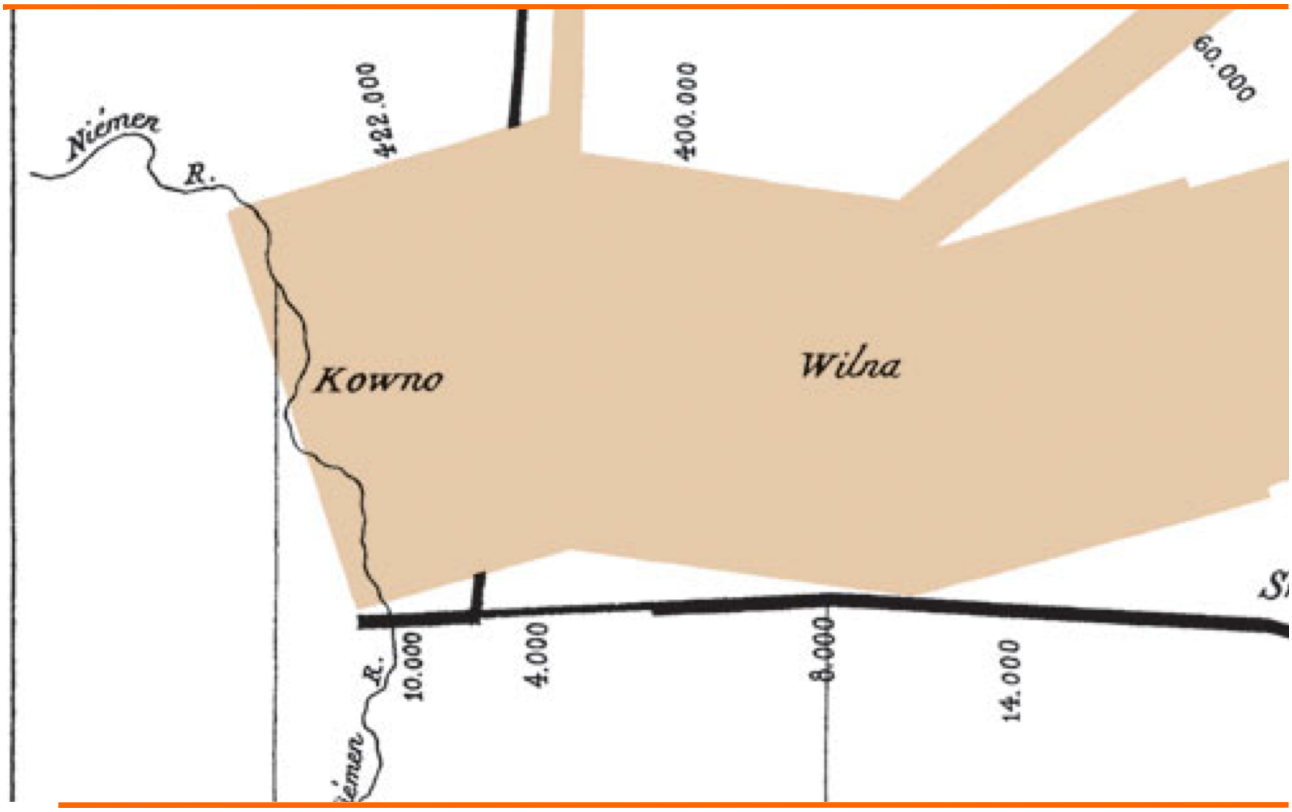
Charles Joseph Minard

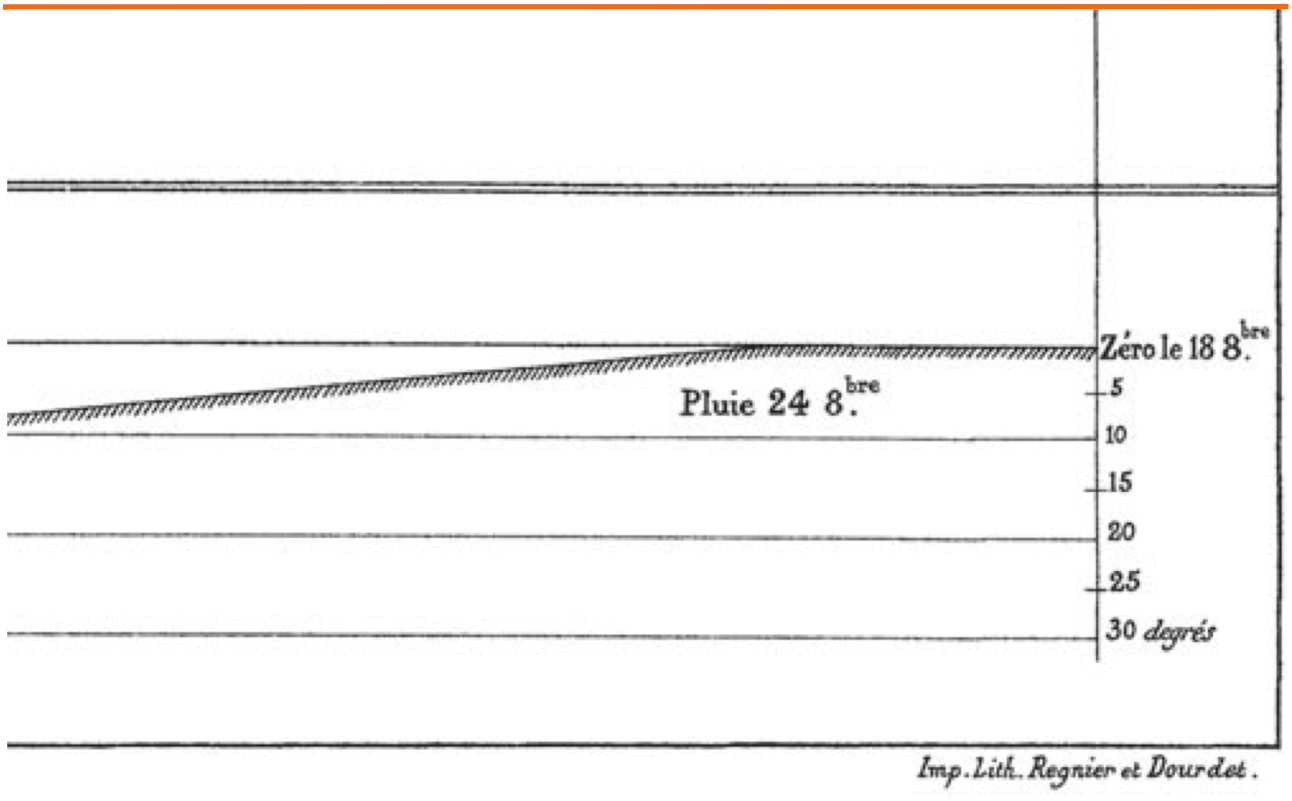


https://en.wikipedia.org/wiki/Charles_Joseph_Minard

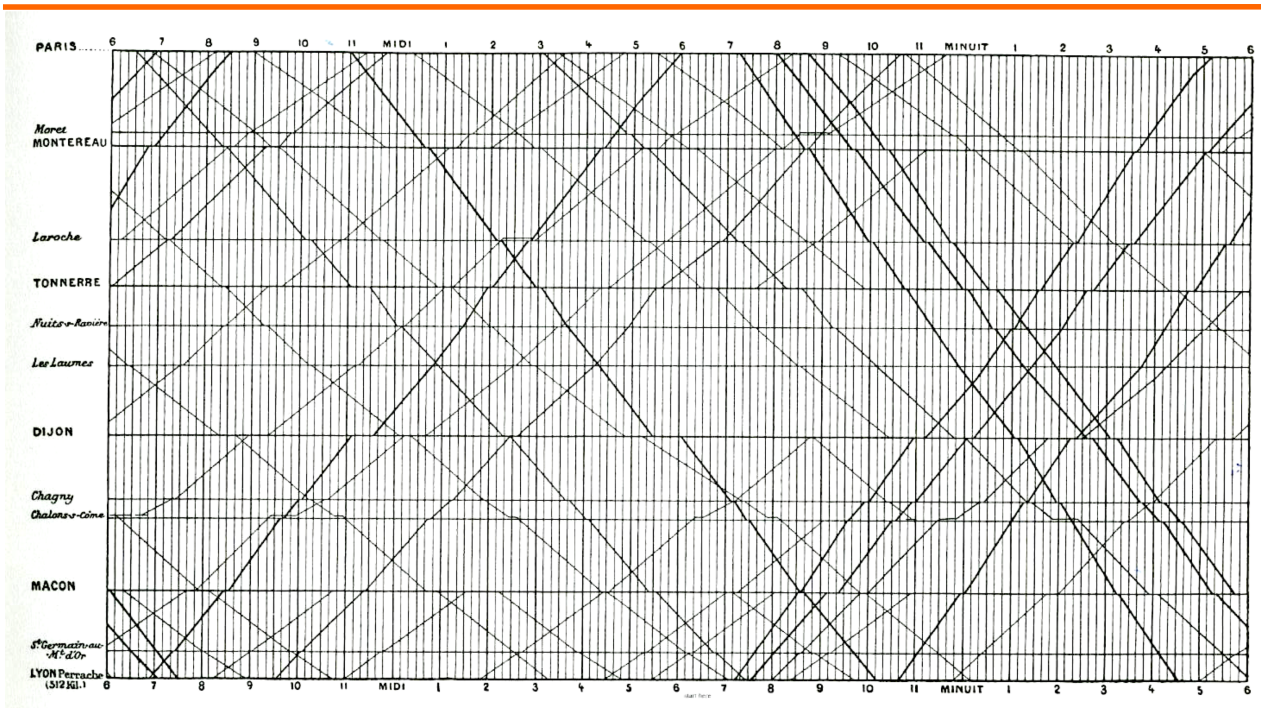
Numbers and direction



Temperature



Étienne-Jules Marey

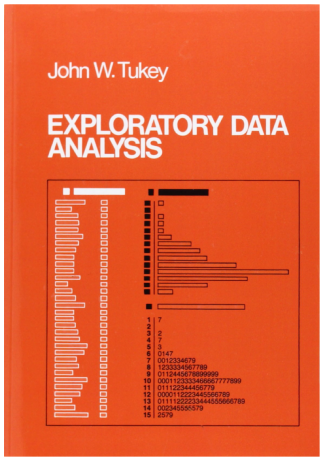


La Méthode graphique dans les sciences expérimentales et principalement en physiologie et en medicine, 1885 https://archive.org/details/lamthodegraphiq00maregoog

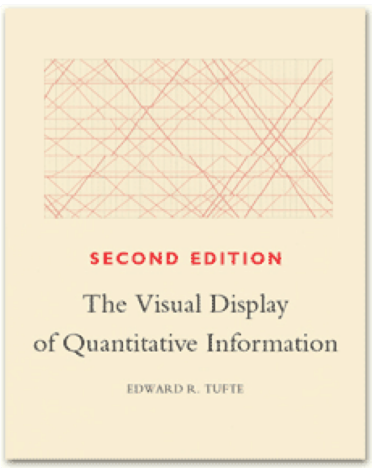
XX Century

- http://www.datavis.ca/milestones/

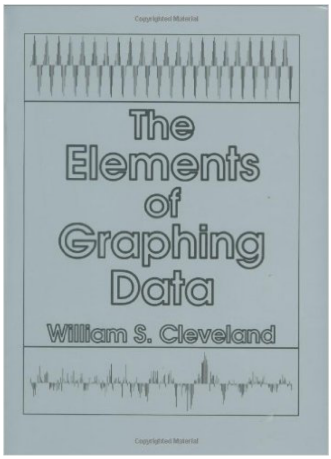
1977



1983



1985



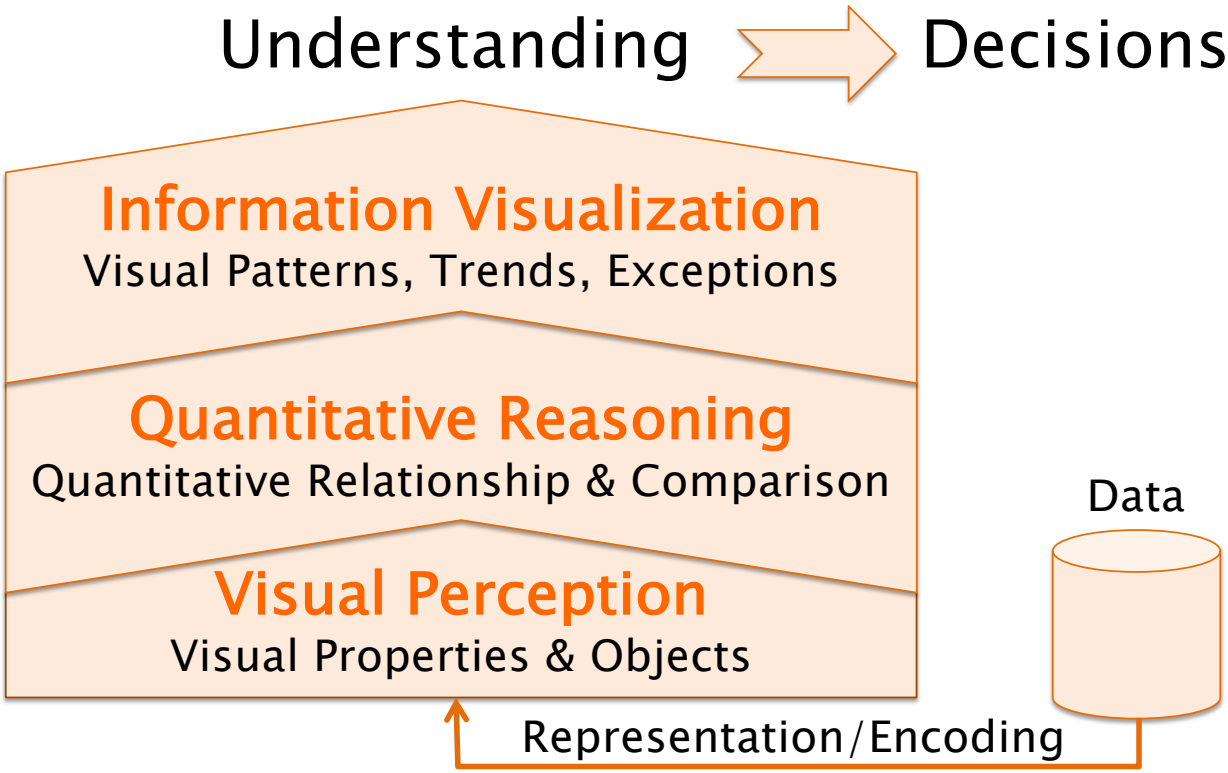
INFORMATION VISUALIZATION

Information visualization

The use of computer-supported, interactive, visual representations of abstract data to amplify cognition

Readings in Information Visualization: Using Vision to Think.
S.K.Card, J.D.Mackinlay, and B.Shneiderman, Academic Press, 1999

Overview



Quantitative message

- Quantitative values
  - Express measures

+

- Categories
  - Identify what entities the values refer to
  - Define groups of entities

Understanding tasks

- Variation within quantitative measures
  - Distribution
  - Deviation
  - Correlation
- Variation within category
  - Ranking
  - Part-to-whole
  - Time
  - Space
- Multivariate

Visualization instruments

- Tables
  - Textual information
- Graphs
  - Visual information

Tables

- Main features
  - Data arranged in rows and columns
  - Data encoded as text
- Strengths
  - Easy look-up of values
  - Precise values
    - Allow selected comparisons
  - Several units of measure are possible

Graphs

- Main features
  - One or more axes delineate the display area where values are shown
  - Values encoded as visual objects in relation to axes
  - Axes provide scales
    - Assign values and labels to visual objects
    - Both categorical and quantitative
- Strengths
  - Overall shape of data (holistic)

Graphs

- Show
  - Trend
    - Pattern of change over time
  - Comparison of subsets
    - Overall
    - Spot similarities and differences
  - Highlight exceptions
- Display relationships among multiple quantitative values by giving them shape

In general

Use tables to	Use graphs to
Look up individual values	Focus on the shape of values
Compare individual values	Reveal relationships among multiple values
Precise values are required	
There is more than one unit of measure	

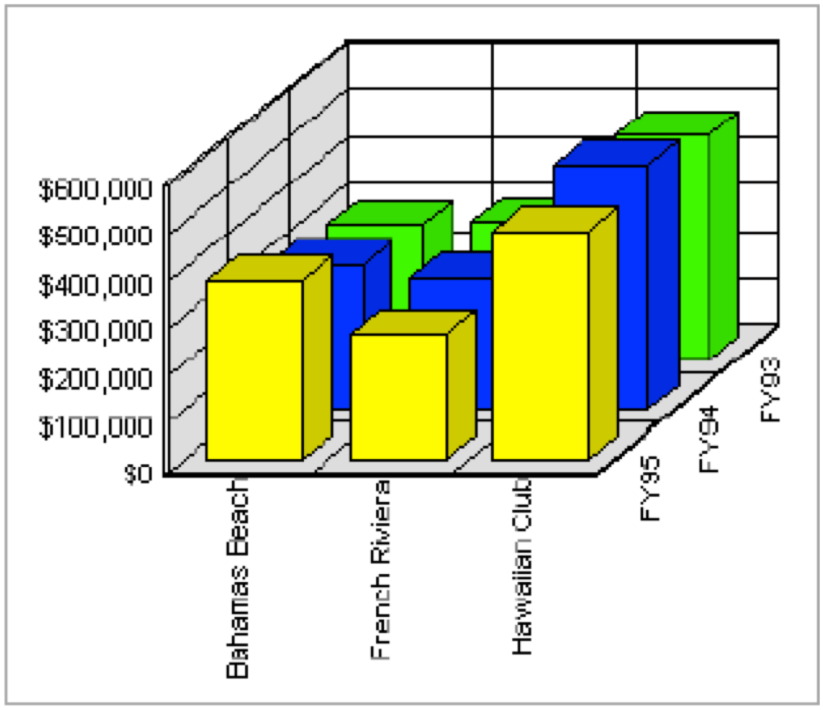
EXAMPLES

Good and Poor visualization

- Like good writing, good graphical displays of data communicate ideas with clarity, precision, and efficiency.
- Like poor writing, bad graphical displays distort or obscure the data, make it harder to understand or compare, or otherwise thwart the communicative effect which the graph should convey.

Friendly, Michael, and Daniel J. Denis. (2001)
"Milestones in the history of thematic cartography, statistical graphics, and data visualization."
http://www. datavis. ca/milestones

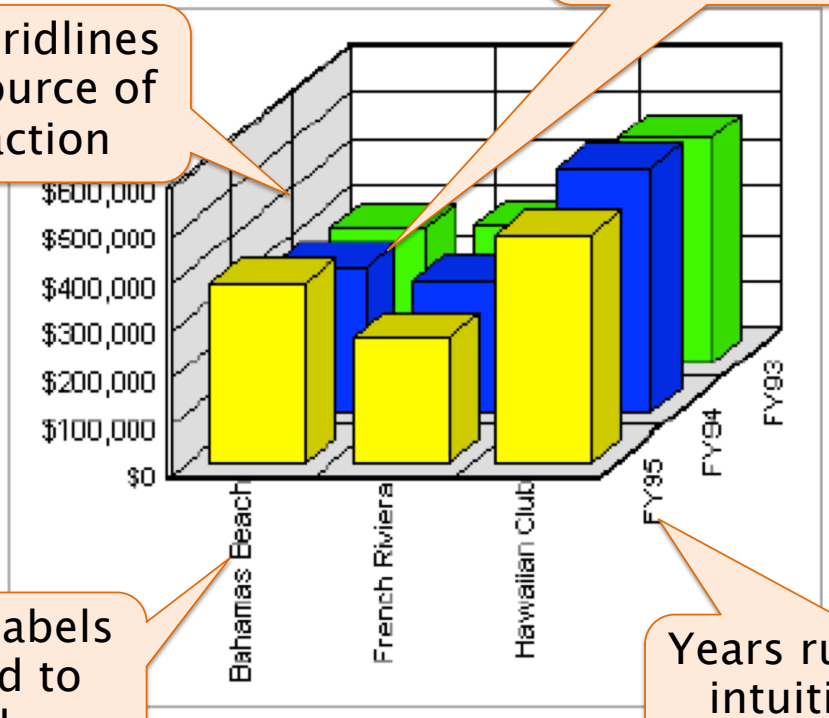
A bar graph



A bad bar graph

3D bars are impossible to read

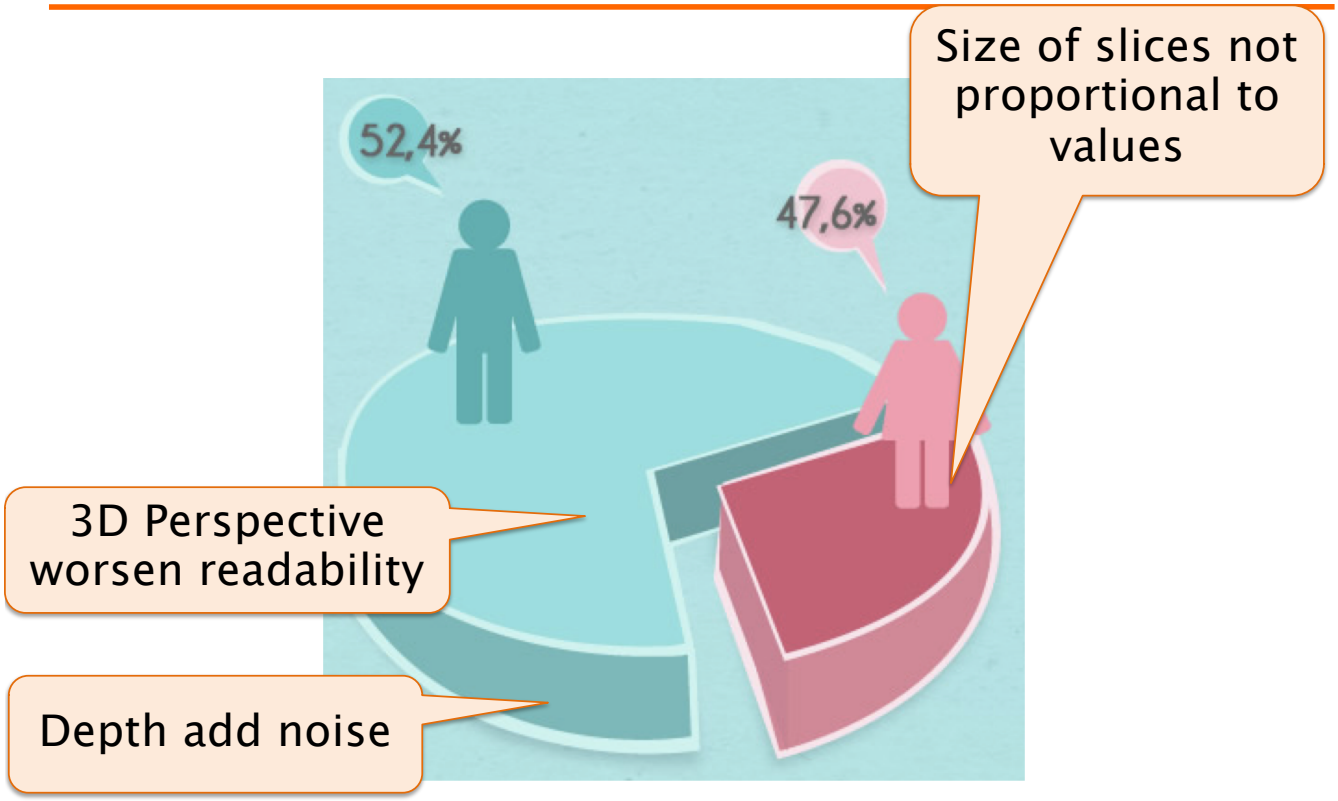
Heavy gridlines are a source of distraction



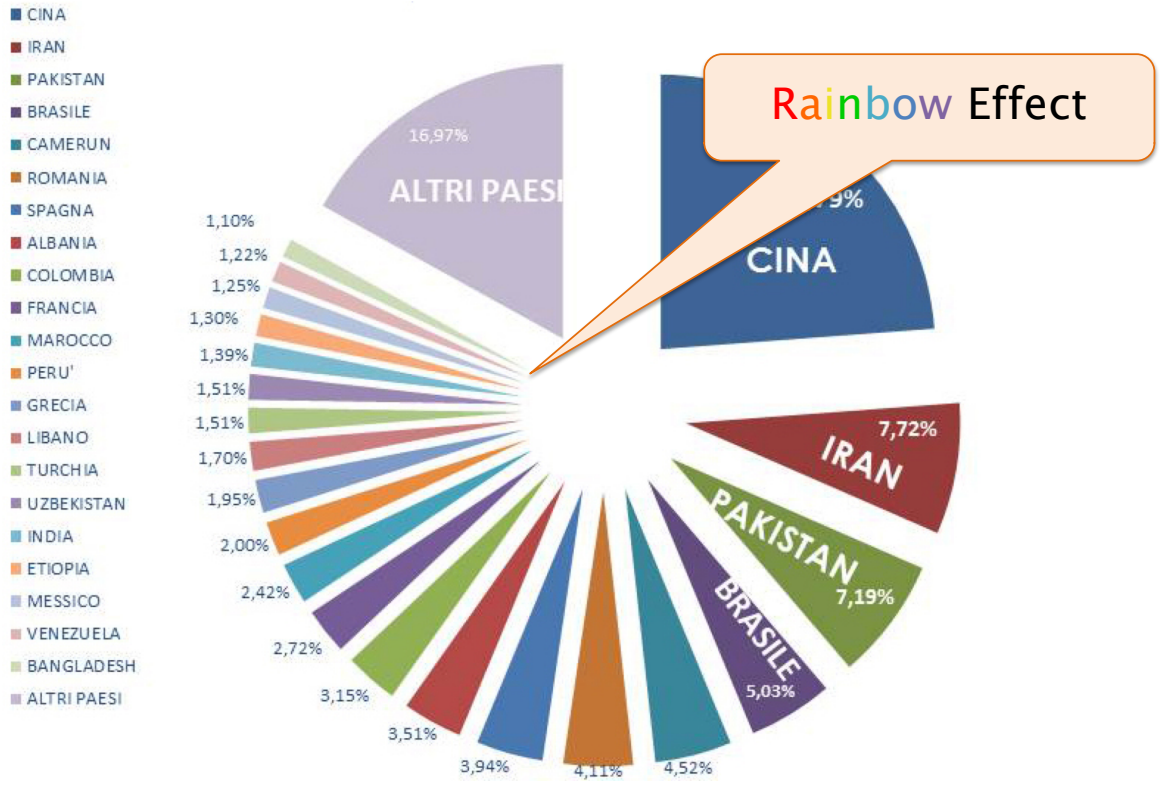
Vertical labels are hard to read

Years run counter-intuitively from back to front

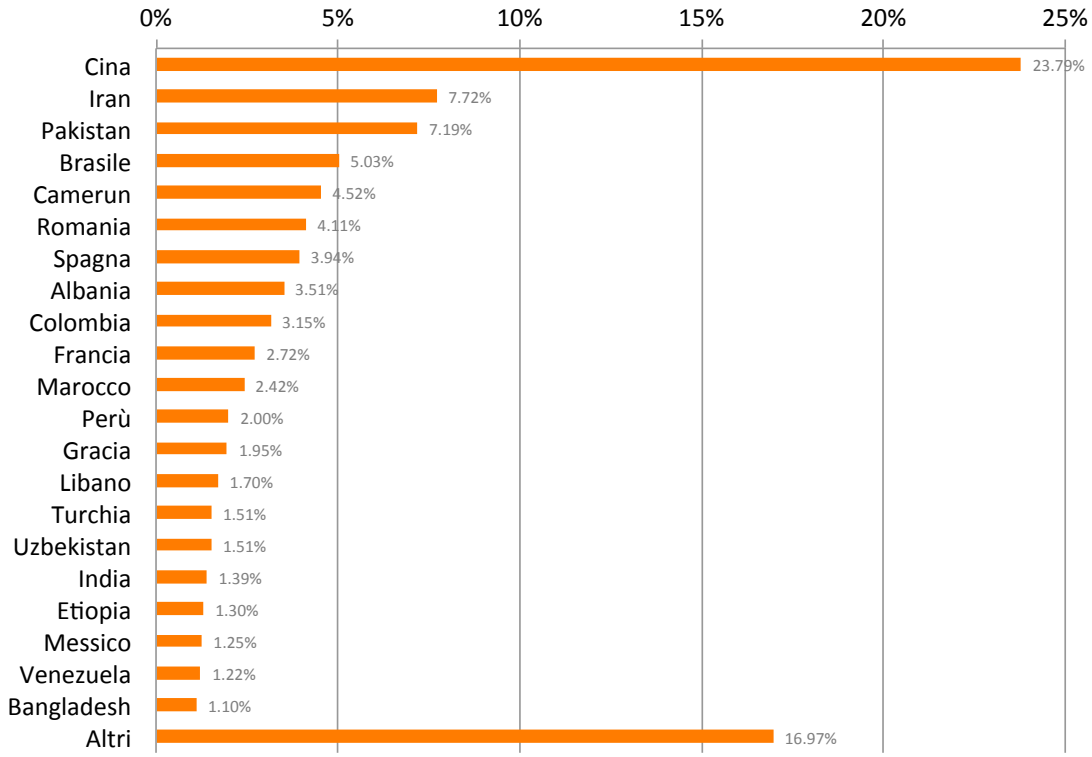
A pie chart



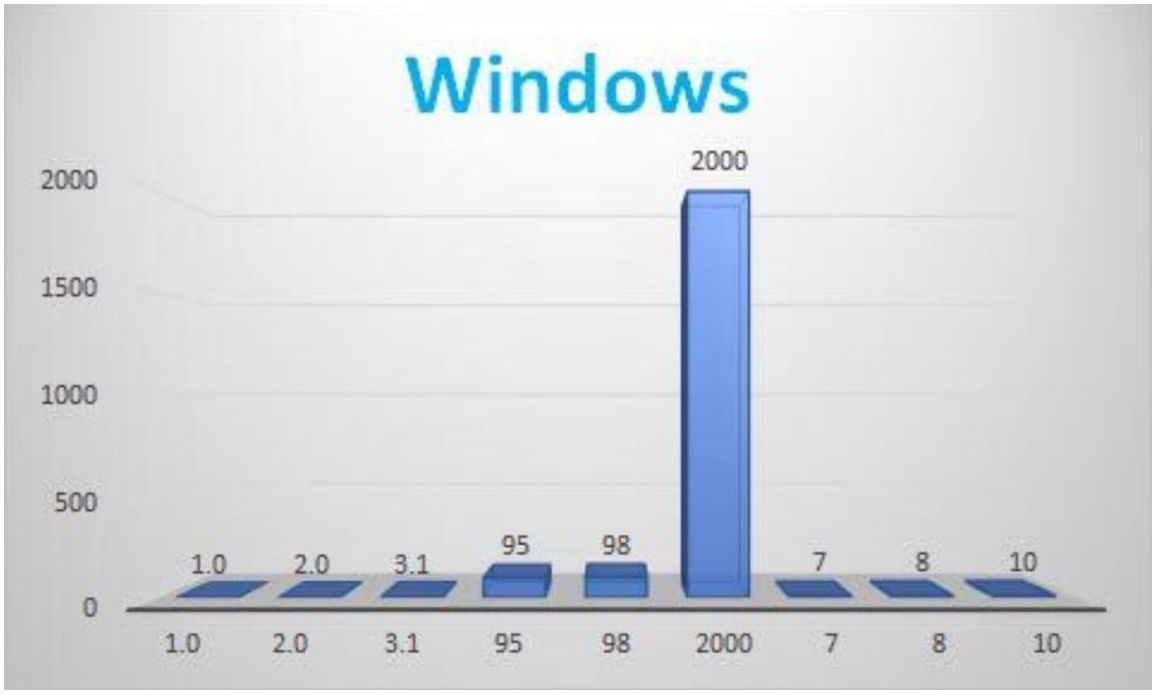
Pie chart (original)



Bar chart (redesign)

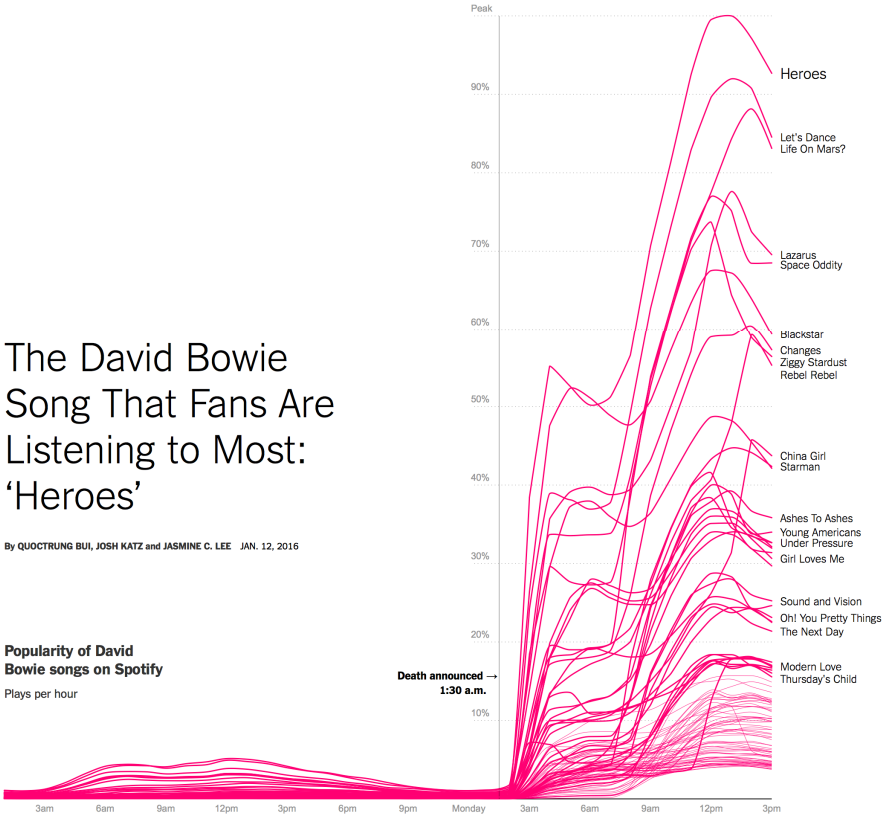


Meaningless Data



The David Bowie Song That Fans Are Listening to Most: 'Heroes'

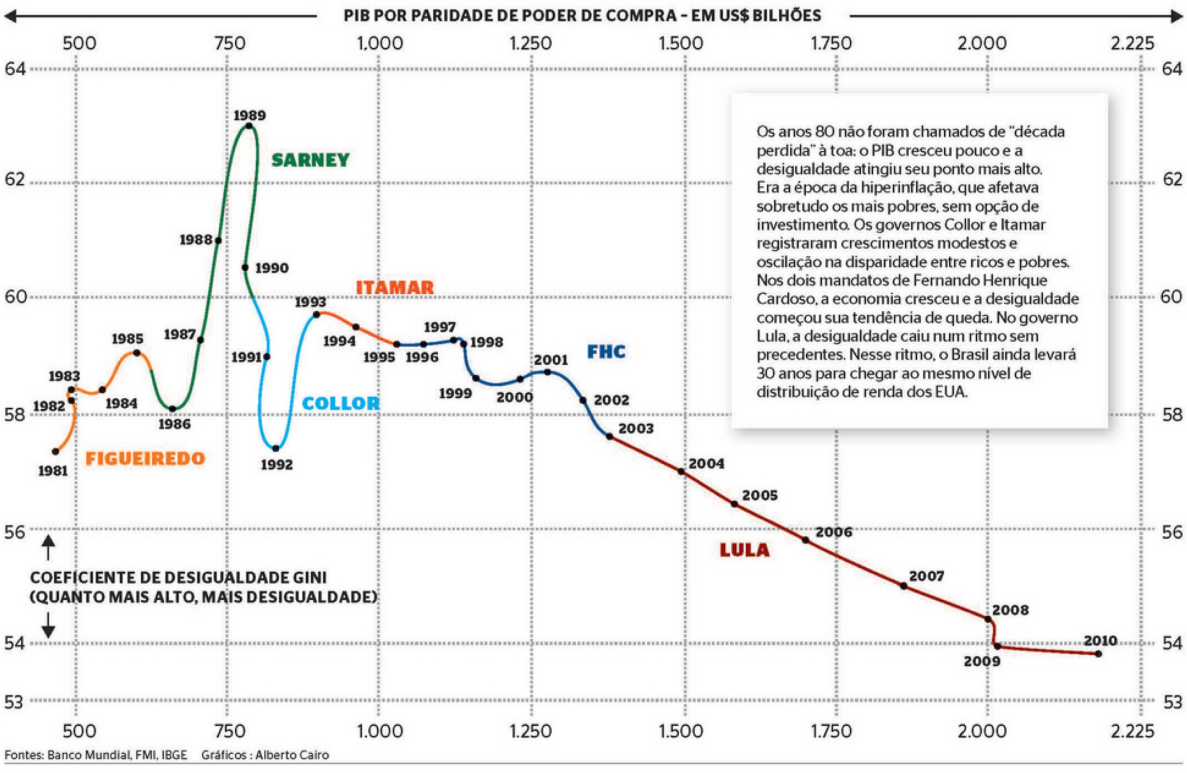
By QUOCTRUNG BUI, JOSH KATZ and JASMINE C. LEE JAN. 12, 2016



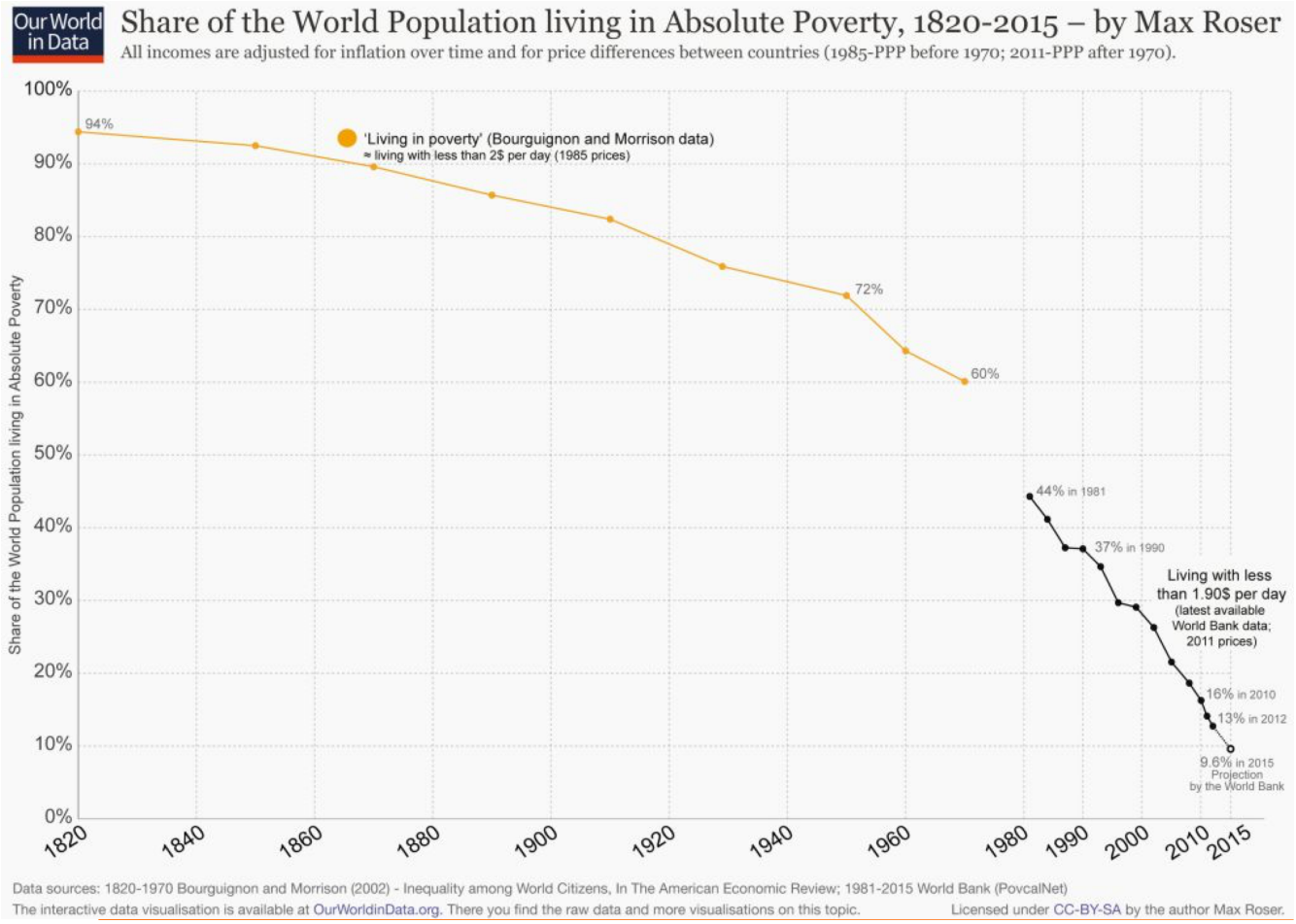
http://www.nytimes.com/interactive/2016/01/12/upshot/david-bowie-songs-that-fans-are-listening-most-heroes-starman-major-tom.html

Quando o PIB cresce, nem sempre a desigualdade cai

O gráfico abaixo mostra o avanço do PIB comparado à evolução da desigualdade no Brasil desde 1980. Nem sempre o crescimento econômico levou a uma redução proporcional na disparidade de renda entre os mais pobres e os mais ricos



http://www.visualisingdata.com/2011/08/data-visualisation-stories-from-brazil-by-alberto-cairo/



http://ourworldindata.org/data/growth-and-distribution-of-prosperity/world-poverty/

Migrants arrived in period January – June

2019

2018

2017

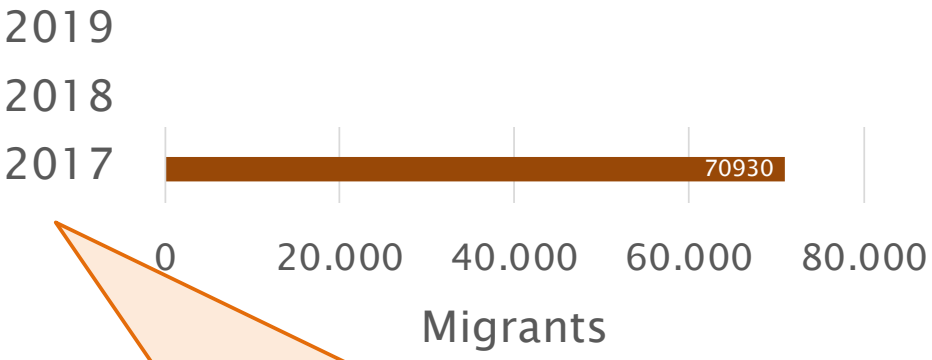
The **accidents at work** happened and reported

Migrants arrived in period January – June

What is the order of magnitude of migrants arrived in 2017?

1k, 10k, 20k, 40k, 80k

Migrants arrived in period January – June



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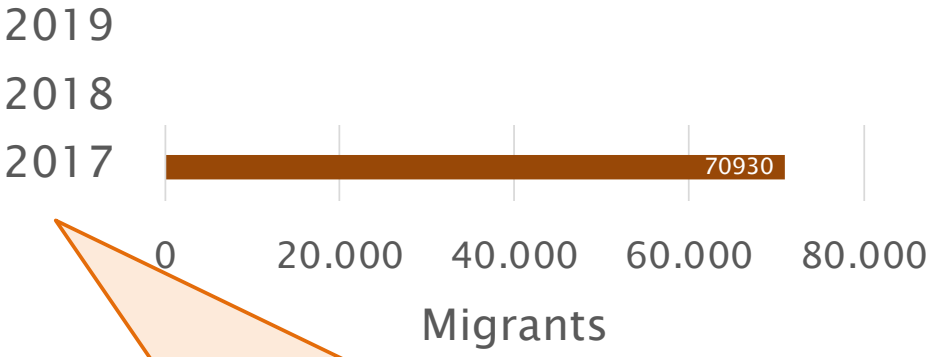

The ratio of number of migrants in 2018, with respect to 2017 is

1:1 , 1:2 , 1:4 , 1:10 , 1:20

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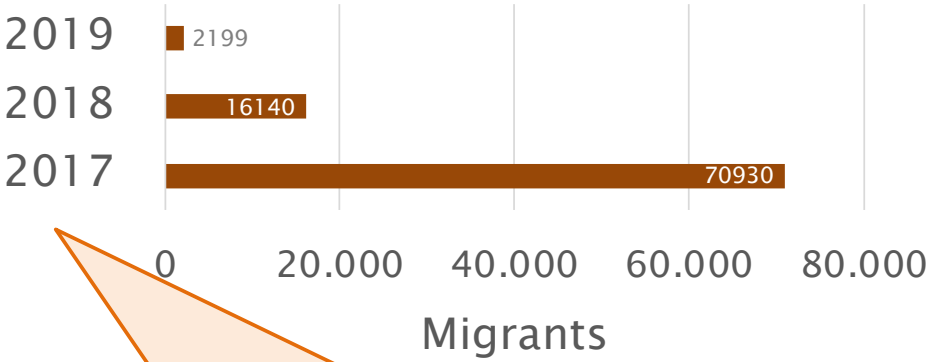

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What is the order of magnitude of accidents in Q1 2019?

1k, 50k, 100k, 200k, 500k

The **accidents at work** happened and reported to Inail in first quarter 2019 have been

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With respect to Q1 2018 how much have changed accidents in Q1 2019?

−5k , −2k , ±500 , +2k , +5k

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Hans Rosling (1948-2017)

- 200 Countries, 200 Years, 4 Minutes
  - The Joy of Stats - BBC 4
    - http://www.bbc.co.uk/programmes/b00wgq0l
    - https://www.youtube.com/watch?v=jbkSRLYSojo

References

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