Geographic Data Science

Vector

Elisabetta Pietrostefani & Carmen Cabrera-Arnau

(Geo)visualisation

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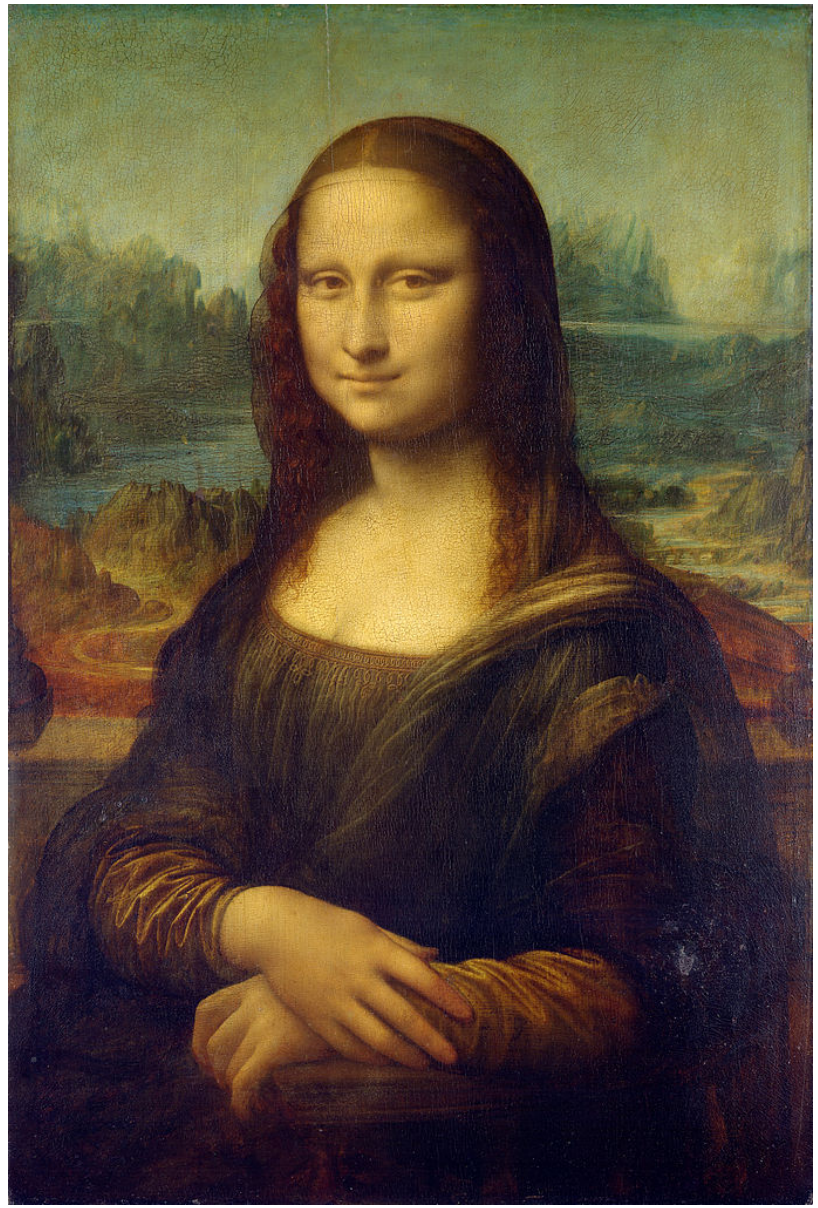


“Data graphics visually display measured quantities by means of the combined use of points, lines, a coordinate system, numbers, symbols, words, shading, and color.”

The Visual Display of Quantitative Information. Edward R. Tufte.

Visualization

By encoding information visually, they allow to present large amounts of numbers in a meaninful way. If well made, visualizations provide leads into the processes underlying the graphic.

The Visual Display of Quantitative Information. Edward R. Tufte.

Geovisualization

Tufte (1983)

“The most extensive data maps […] place millions of bits of information on a single page before our eyes. No other method for the display of statistical information is so powerful”

MacEachren (1994)

“Geographic visualization can be defined as the use of concrete visual representations –whether on paper or through computer displays or other media–to make spatial contexts and problems visible, so as to engage the most powerful human information processing abilities, those associated with vision.”

Geovisualization

- Not to replace the human in the loop, but to augment her/him.
- Augmentation through engaging the pattern recognition capabilities that our brain inherently has.
- Combines cartography, infovis and statistics

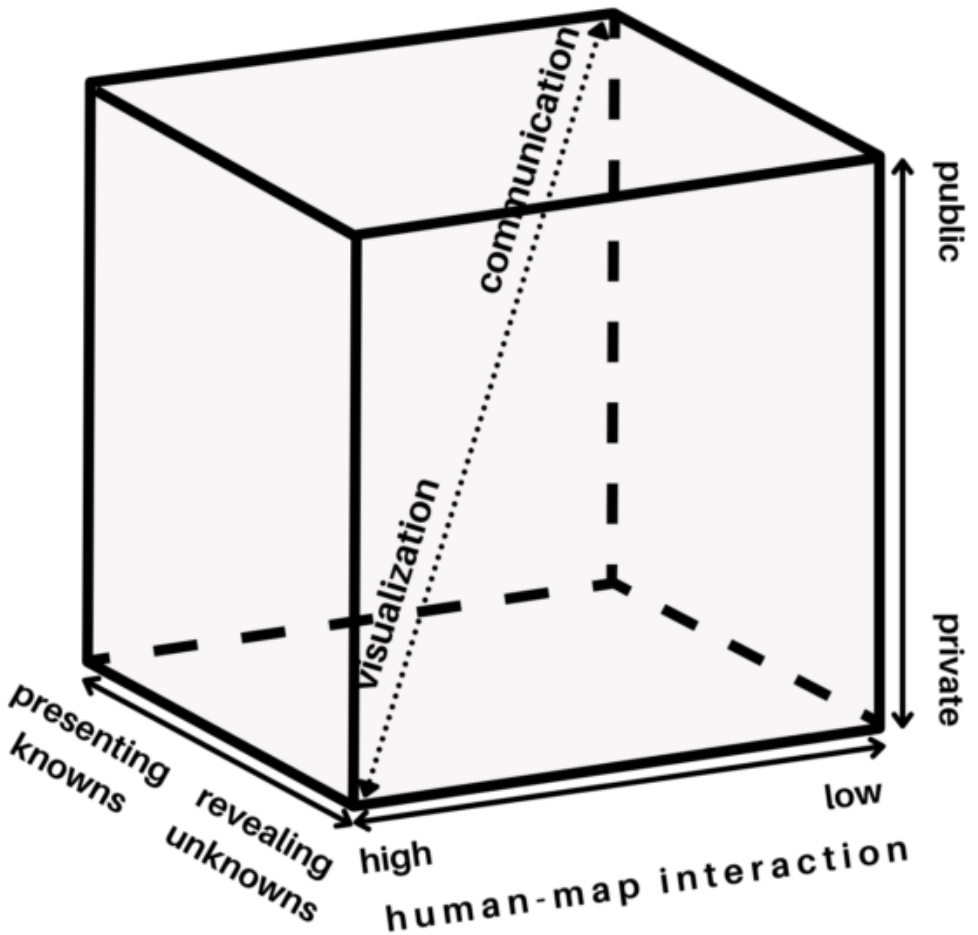
A map for everyone

Maps can fulfill several needs, looking very different depending on the end-goal.

MacEachren & Kraak (1997) identify three main dimensions:

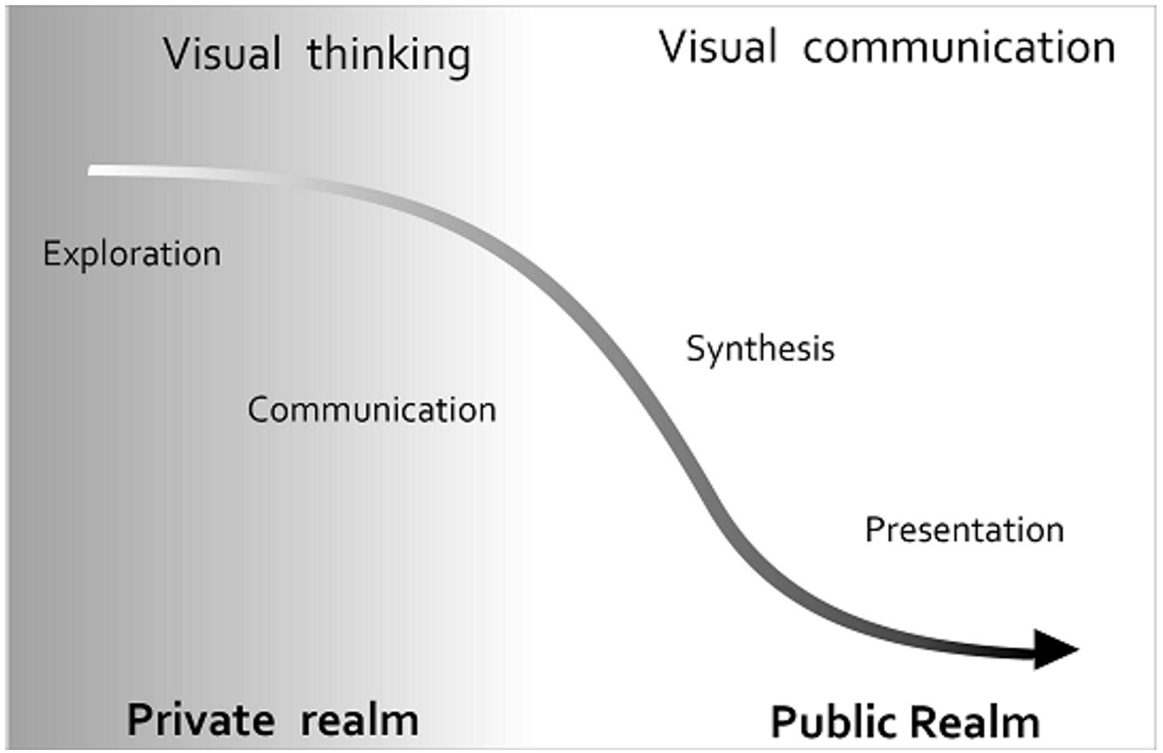
- Knowledge of what is being plotted
- Target audience
- Degree of interactivity

MacEachren & Kraak (1997)



DiBiase's (1990) "Swoopy"

Translating numbers into a (visual) language that the human brain "speaks better"



Exploratory Visualization

“forces us to notice what we never expected to see” (Tukey 1977: vi)

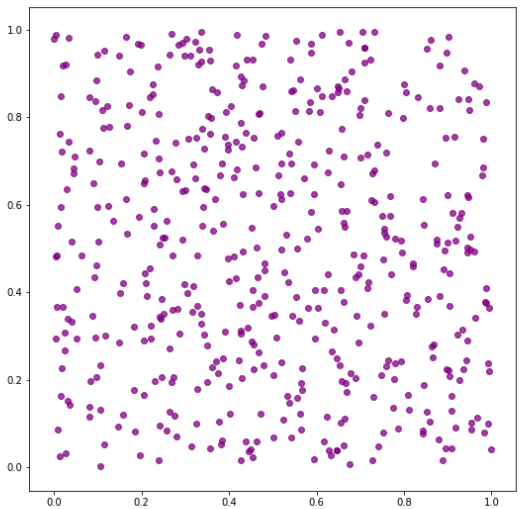
- Mostly for ourselves in the course of the research process.
- Many, quick and dirty, and rather unattractive graphs.

Explanatory Visualization

“forces readers to see the information the designer wanted to convey” (Kosslyn 1994: 271)

- Mostly for others after the research is completed.
- Few, carefully crafted, and attractive graphs.

Modifiable Areal Unit Problem (Openshaw, 1984)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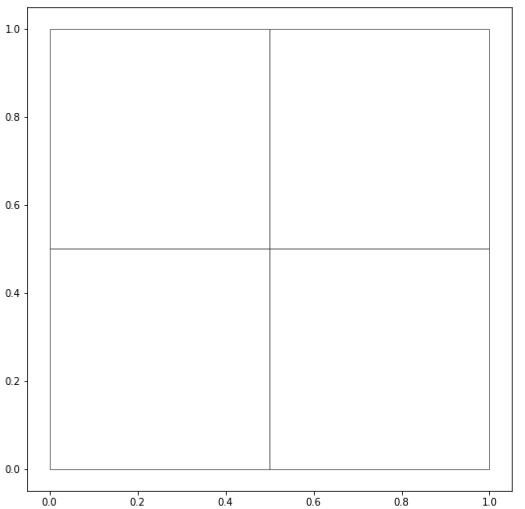
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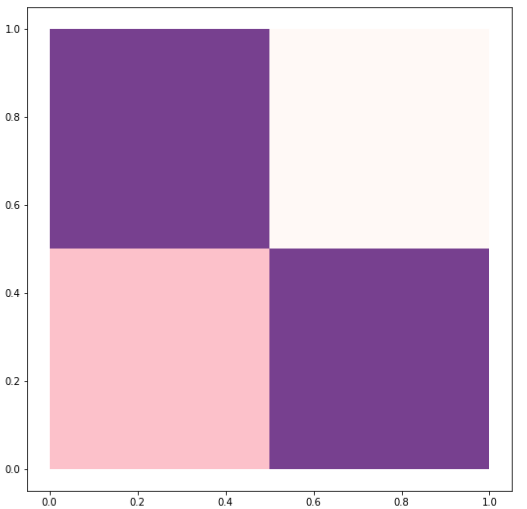
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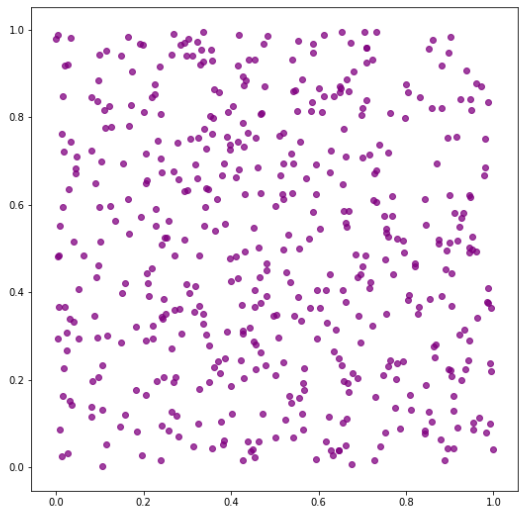
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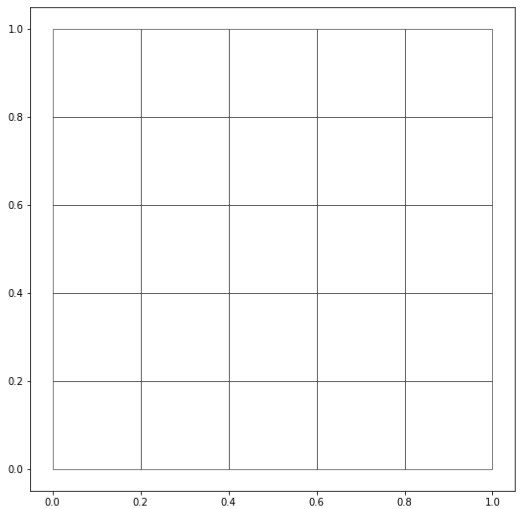
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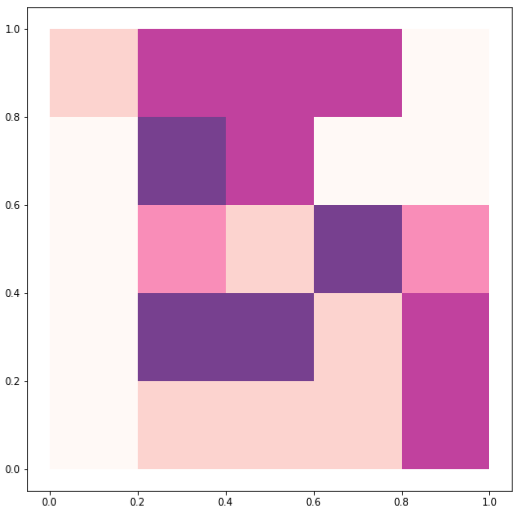
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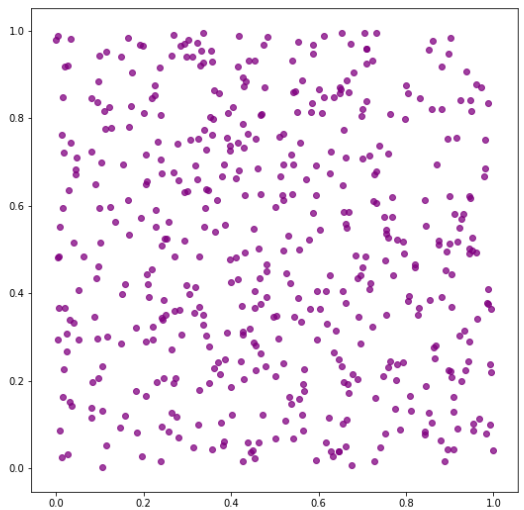
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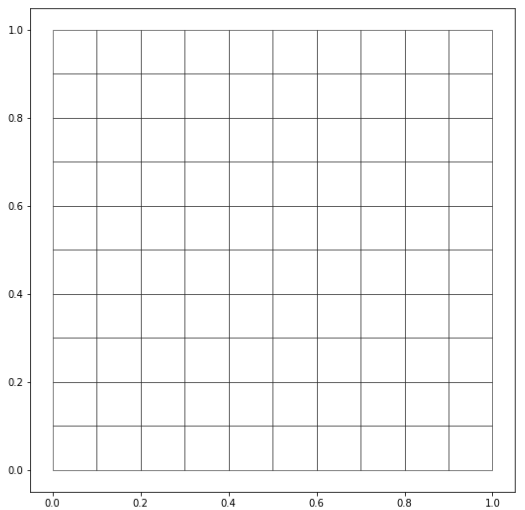
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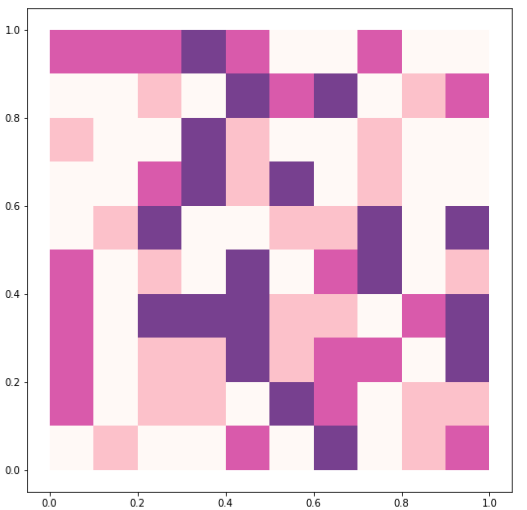
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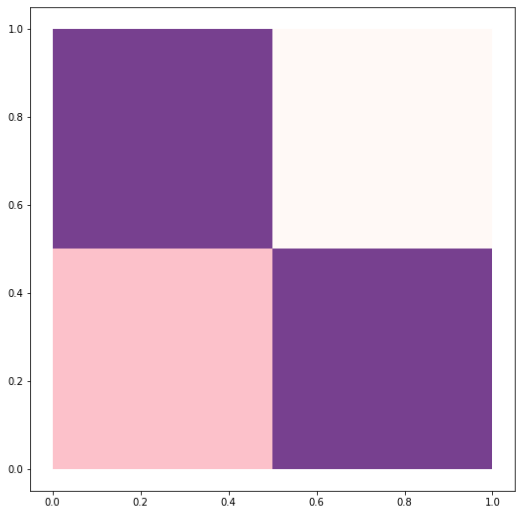
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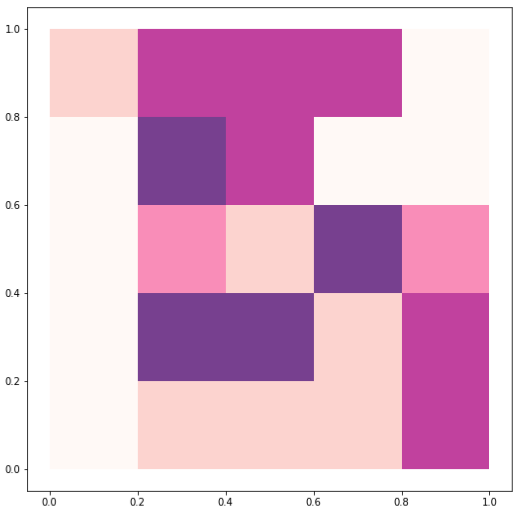
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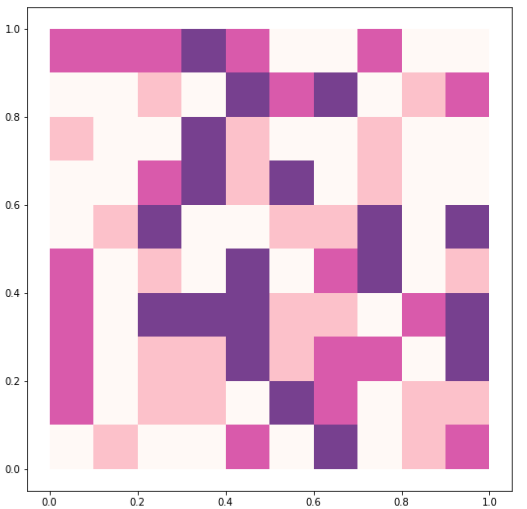
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MAUP

Scale and delineation mismatch between:

- Underlying process (e.g. individuals, firms, shops)
- Unit of measurement (e.g. neighborhoods, regions, etc.)
- In some cases, it can seriously mislead analysis on aggregated data (e.g. Flint)

Always keep MAUP in mind when exploring aggregated data!!!

Choropleths

Choropleths

Thematic map in which values of a variable are encoded using a color gradient of some sort

- Counterpart of the histogram

  Both allows us to gage the distribution of a variable

- **Values** are classified into specific **colours**: value –> bin
- **Information loss** as a trade off for simplicity

Key decision to be made why a given value is a specific colour!

Classification choices

- N. of bins
- How to bin?
- Colours

How many bins?

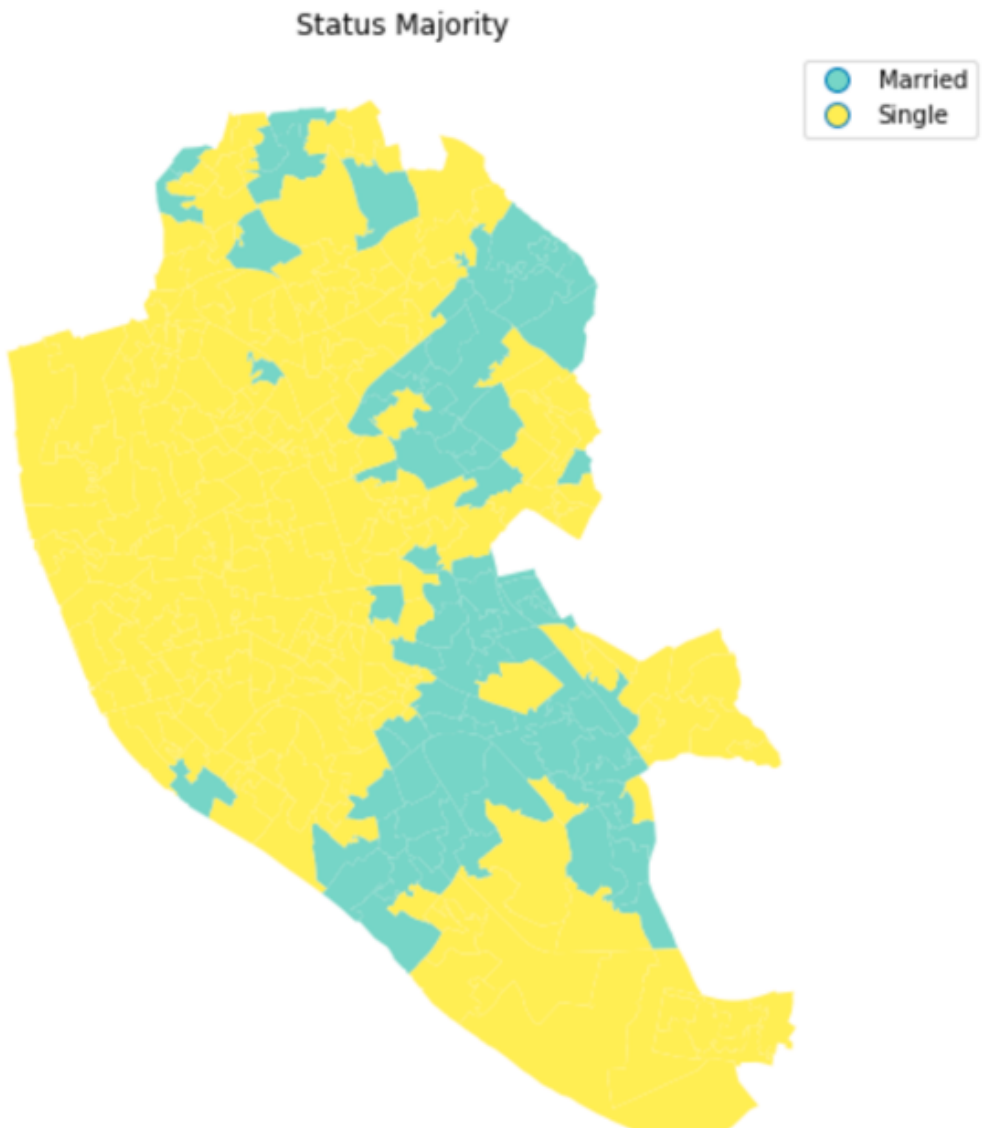
- Trade-off: detail vs cognitive load
- Exact number depends on purpose of the map
- Usually not more than 12

How do we bin?

Essentially a statistical problem

Unique values

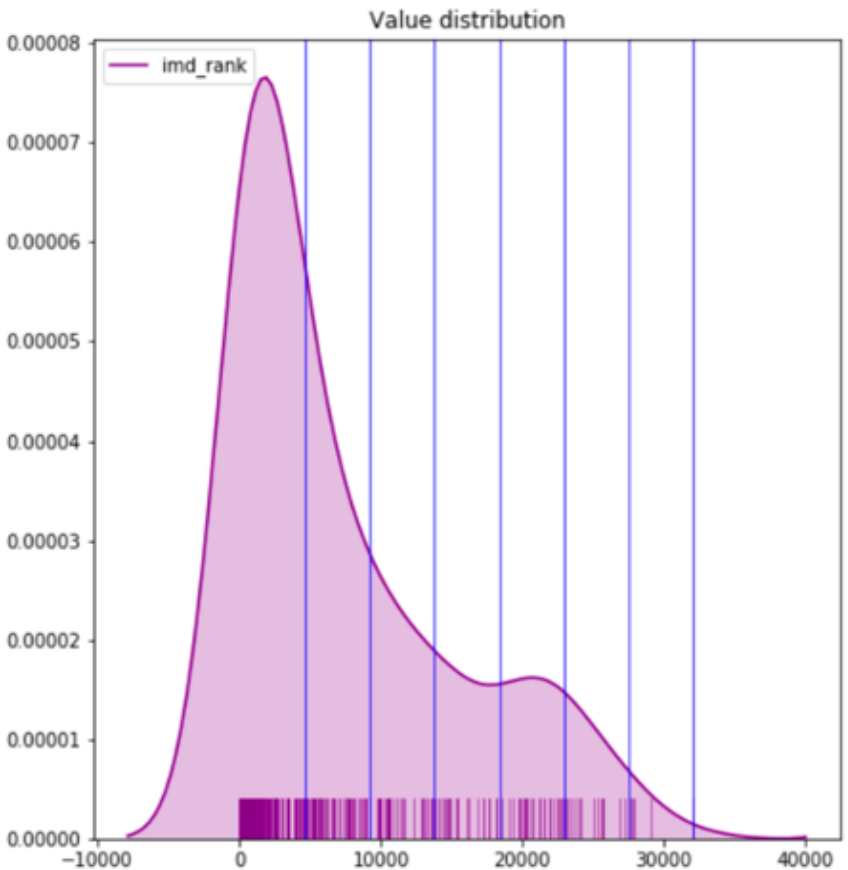
- Categorical data
- No gradient (reflect it with the colour scheme!!!)
- Examples: Religion, country of origin…

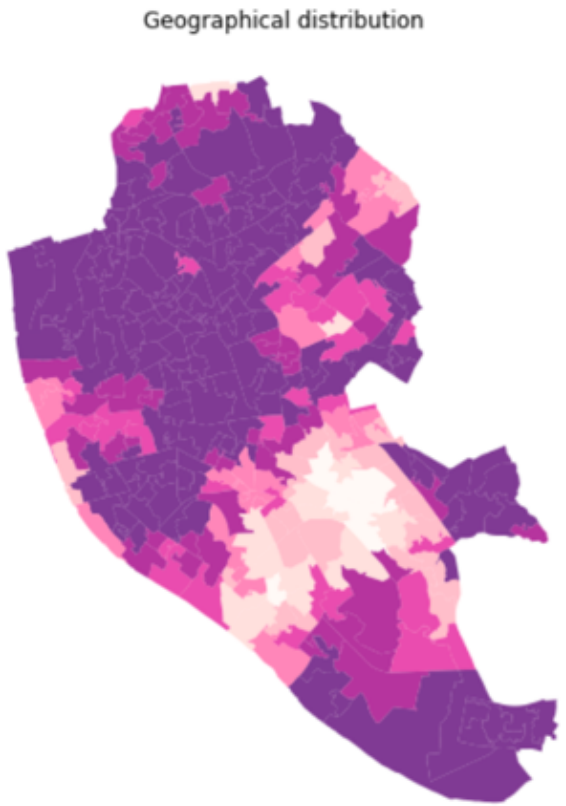

Status Majority
Married
Single

Equal interval (continuous)

- Take the value span of the data to represent and split it equally
- Splitting happens based on the numerical value
- Gives more weight to outliers if the distribution is skewed

equal_interval

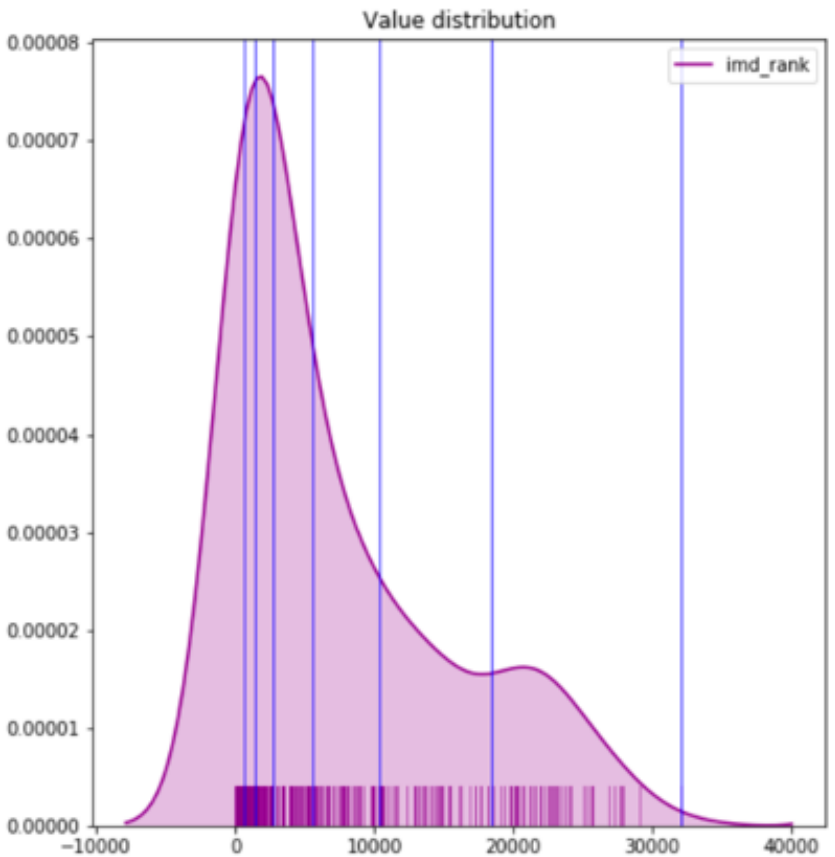




Quantile

- Regardless of numerical values, split the distribution keeping the same amount of values in each bin
- Splitting based on the rank of the value
- If distribution is skewed, it can put very different values in the same bin

quantiles


Value distribution
imd_rank
0.00008
0.00007
0.00006
0.00005
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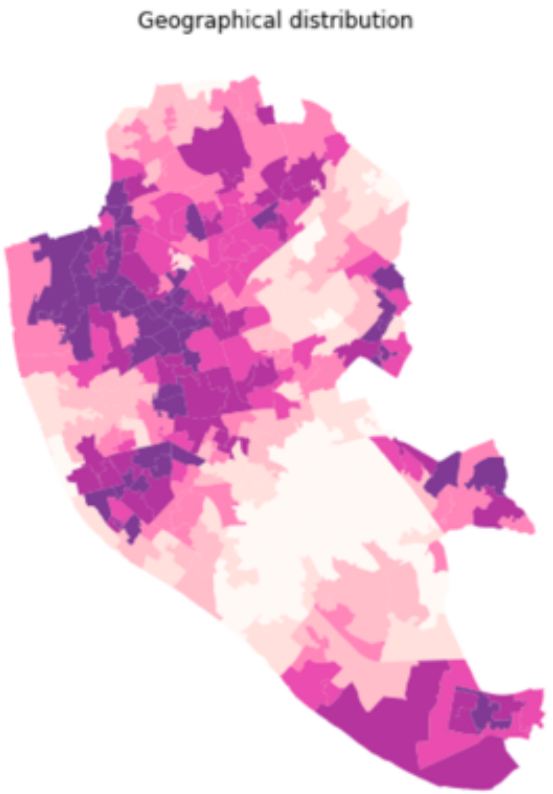

Geographical distribution

Different type of algorithms will optimize for different types of splits

- Fisher-Jenks
- Natural breaks
- Outlier maps: box maps, std. maps…

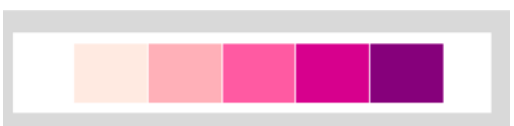
Some involve some fairly fancy statistics.

Colour palette

Categories, non-ordered

Graduated, sequential

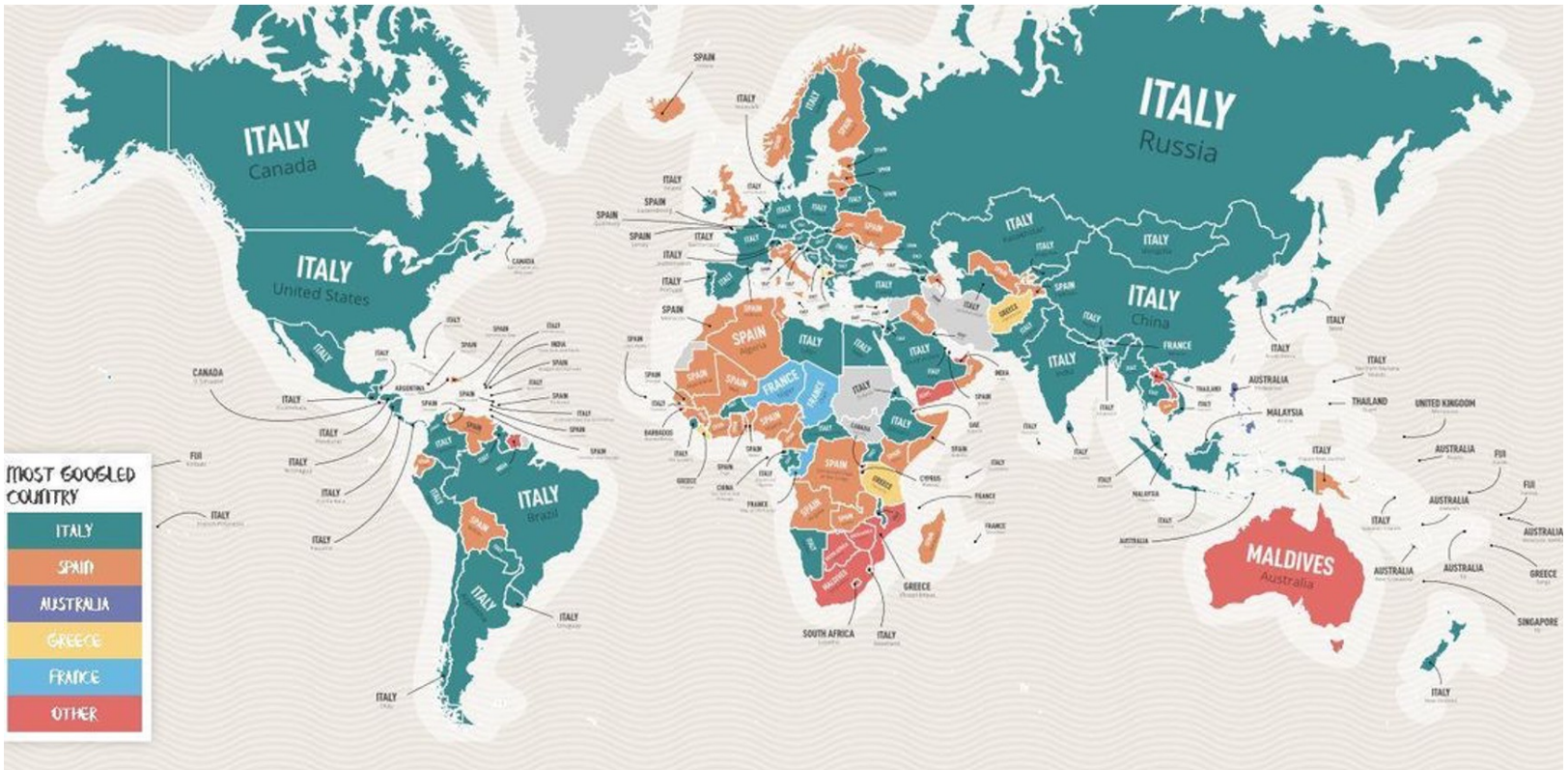
Graduated, divergent



TIP: check ColorBrewer for guidance

Tips

- Think of the purpose of the map
- Explore by trying different classification alternatives
- Combine (geo)visualisation with other statistical devices


MOST GOOGLED COUNTRY
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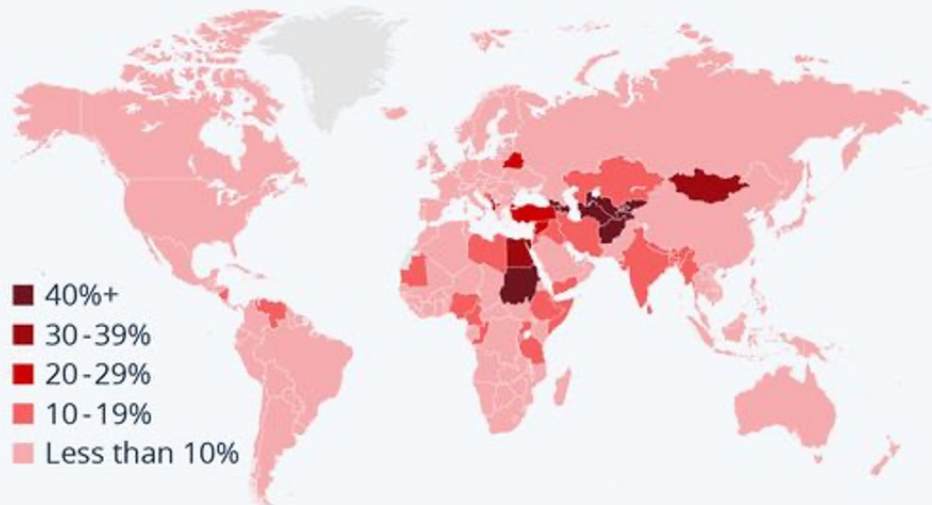
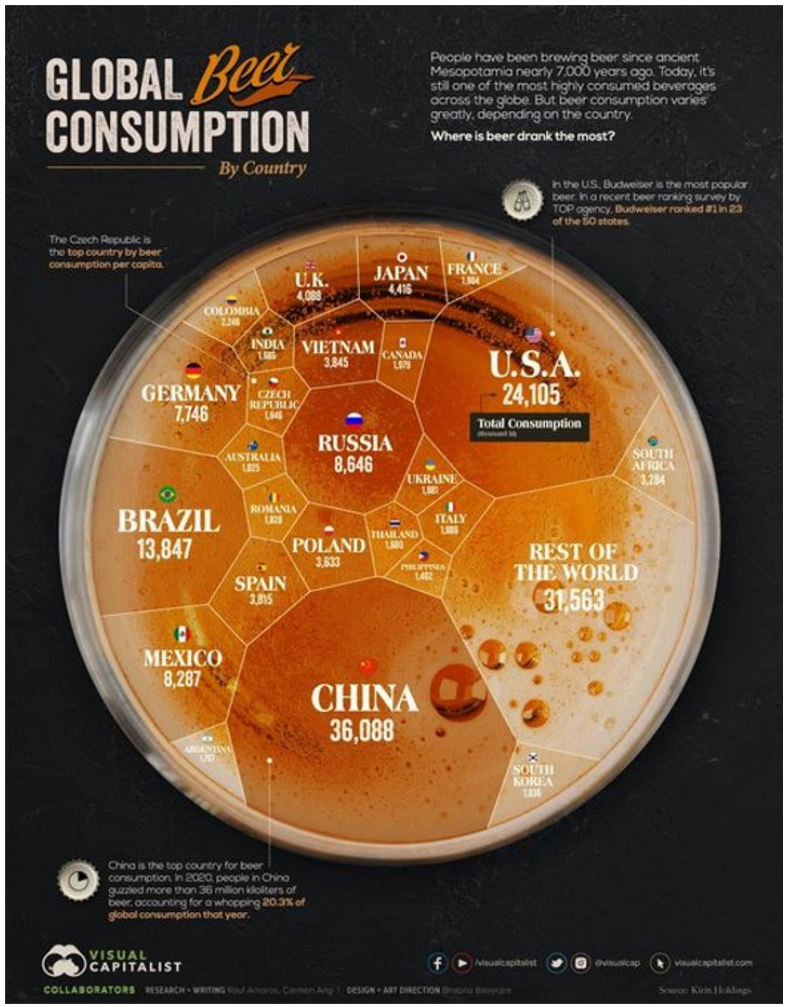
SPAIN
AUSTRALIA
GREECE
FRANCE
OTHER
ITALY
Canada
ITALY
United States
ITALY
Russia
ITALY
China
ITALY
Brazil
MALDIVES
Australia
SPAIN
FRANCE
GREECE
SOUTH AFRICA
AUSTRALIA
SINGAPORE
UNITED KINGDOM
THAILAND
MALAYSIA
FIJI
CANADA

Where Food Imports Are Affected by the Ukraine Crisis

Share of food imports per country affected by export restrictions elsewhere (in percent of calories)



As of August 1, 2022. Excludes exports held back from Ukraine.
Source: International Food Policy Research Institute


GLOBAL Beer CONSUMPTION
By Country
People have been brewing beer since ancient Mesopotamia nearly 7,000 years ago. Today, it's still one of the most highly consumed beverages across the globe. But beer consumption varies greatly, depending on the country.
Where is beer drank the most?
In the U.S., Budweiser is the most popular beer. In a recent beer ranking survey by TOP agency, Budweiser ranked #1 in 23 of the 50 states.
The Czech Republic is the top country by beer consumption per capita.
U.K. 4,088
JAPAN 4,416
FRANCE 1,984
COLOMBIA 2,248
INDIA 1,665
VIETNAM 3,845
CANADA 1,979
U.S.A. 24,105
Total Consumption
GERMANY 7,746
CZECH REPUBLIC 1,946
RUSSIA 8,646
AUSTRALIA 1,825
UKRAINE 1,881
SOUTH AFRICA 3,284
ROMANIA 1,828
ITALY 1,888
BRAZIL 13,847
THAILAND 1,680
POLAND 3,833
PHILIPPINES 1,482
REST OF THE WORLD 31,563
SPAIN 3,815
MEXICO 8,287
CHINA 36,088
ARGENTINA 1,787
SOUTH KOREA 1,838
China is the top country for beer consumption. In 2020, people in China guzzled more than 36 million kiloliters of beer, accounting for a whopping 20.3% of global consumption that year.
VISUAL CAPITALIST
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COLLABORATORS
RESEARCH + WRITING Raul Amoros, Carmen Ang
DESIGN + ART DIRECTION Brabna Banerjee
Source: Kirin Holdings

Questions