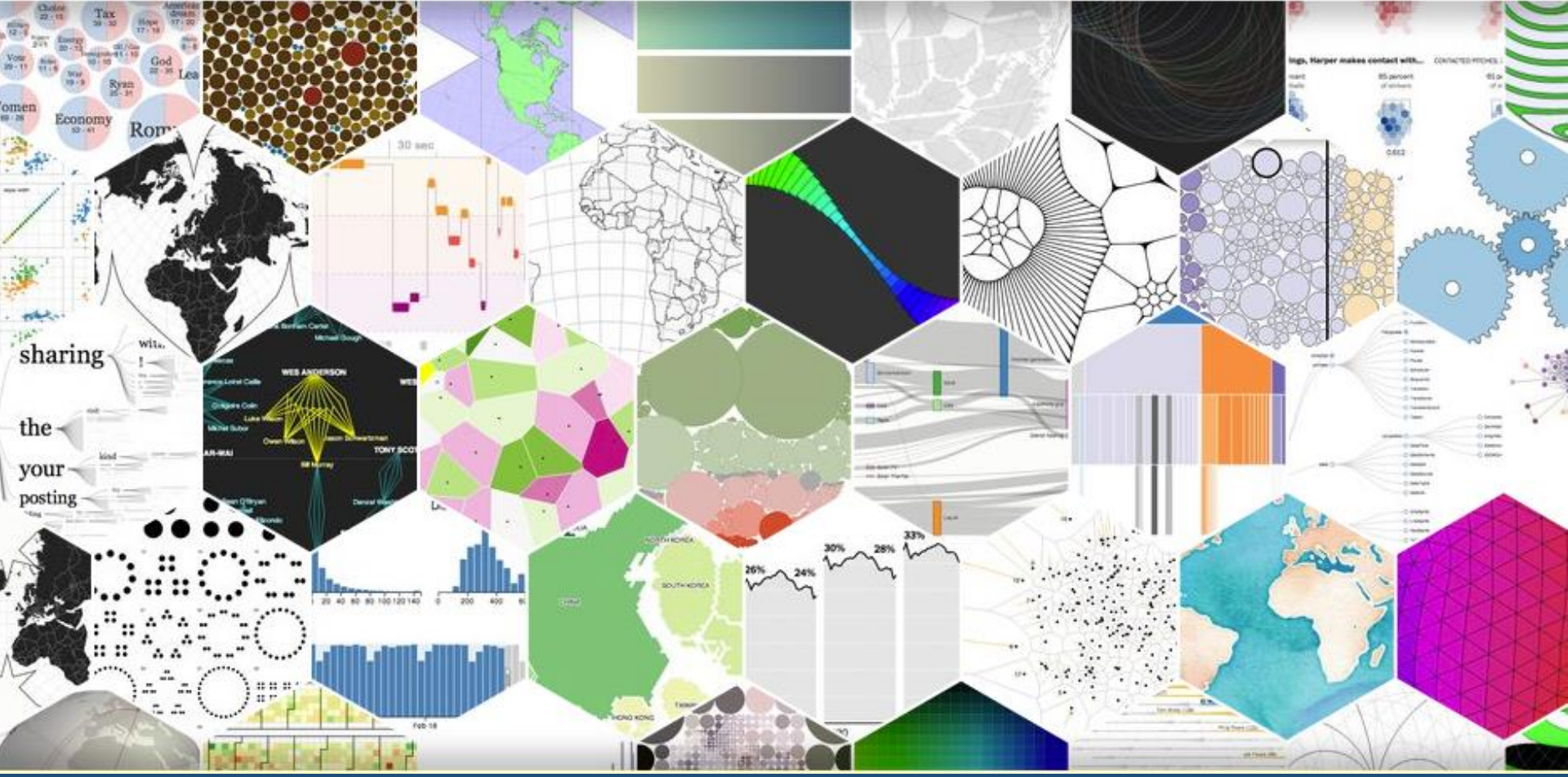


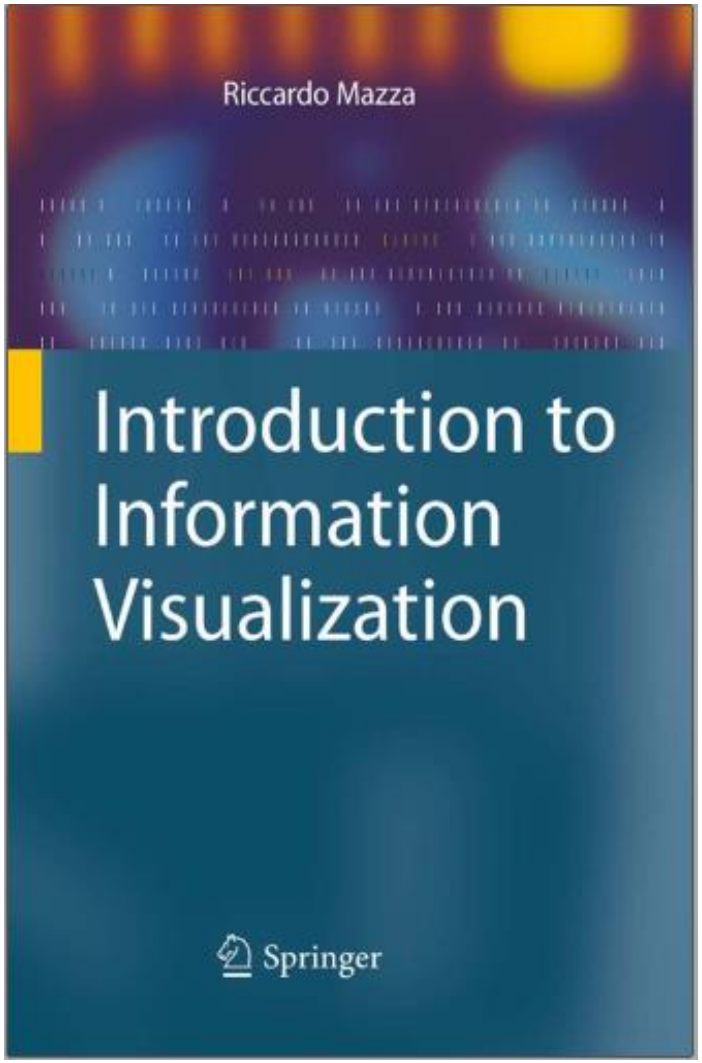
Introduction to Visual Representations

Visualisasi Data dan Informasi - Farid Ridho

Outline

- Introduction
- Presentation
- Explorative Analysis
- Confirmative Analysis
- Information Visualization
- From Data to Wisdom
- Scientific Visualization
- Criteria for Good Visual Representations

Reference


Riccardo Mazza
Introduction to Information Visualization
Springer

Introduction

- how much information we have to take in every day as part of our routine activities?
- E-mails arrive on our computers, credit card statements arrive from the bank every month, and last-minute holiday offers, stock market index variations, and advertising leaflets fill the mailbox.

Introduction

- Perhaps we haven't even realized, but in the last decade, the quantity of information that we all have to process has increased enormously.
- The globalization of economy and communication, but above all the rapid advances in technology (and not only communication and information technology), have brought us in, recent years, to what some noted scholars define as ***information pollution***.

A Minute on the Internet in 2019

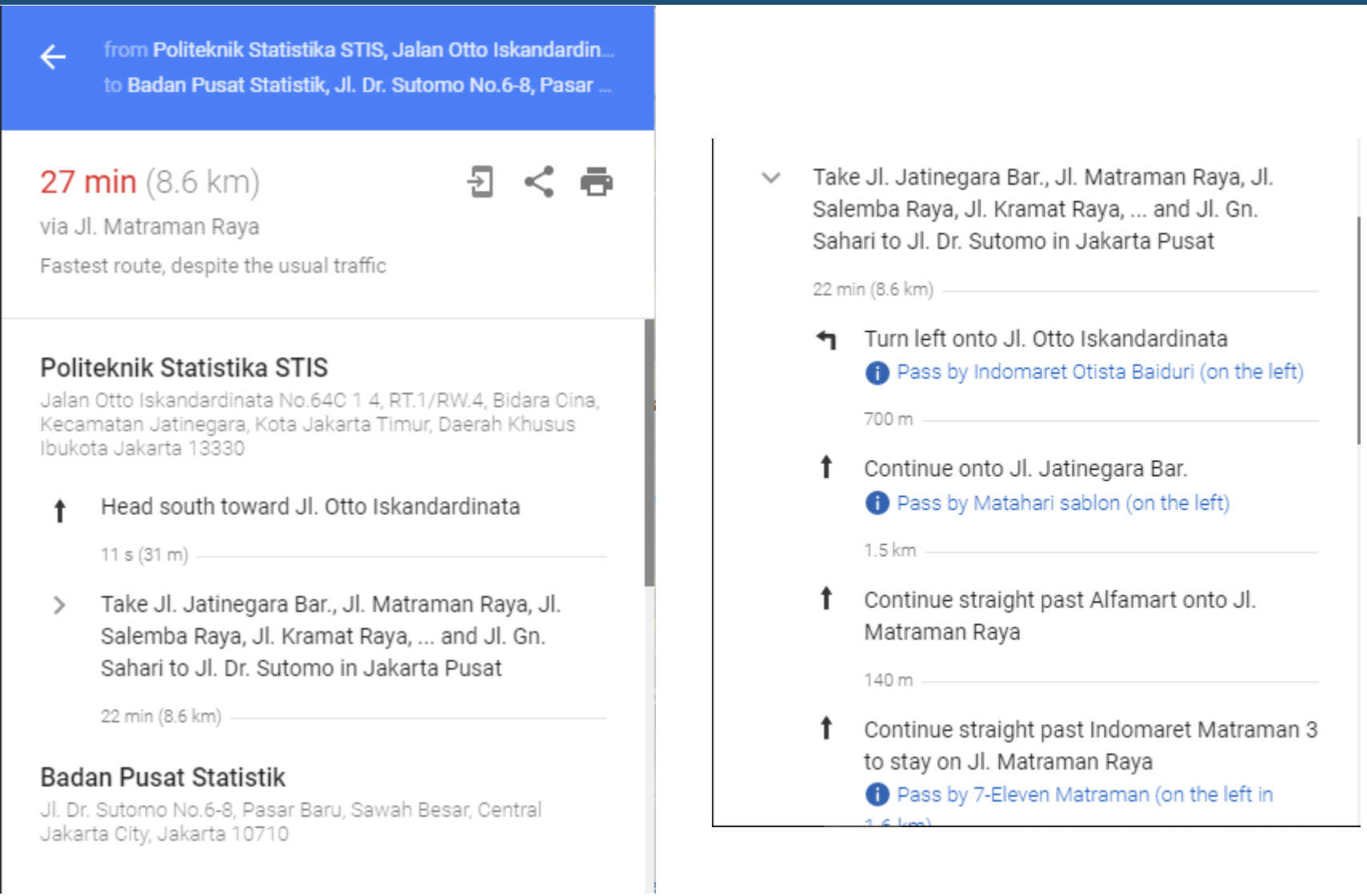
Estimated data created on the internet in one minute

Sources: Lori Lewis & Officially Chad via Visual Capitalist

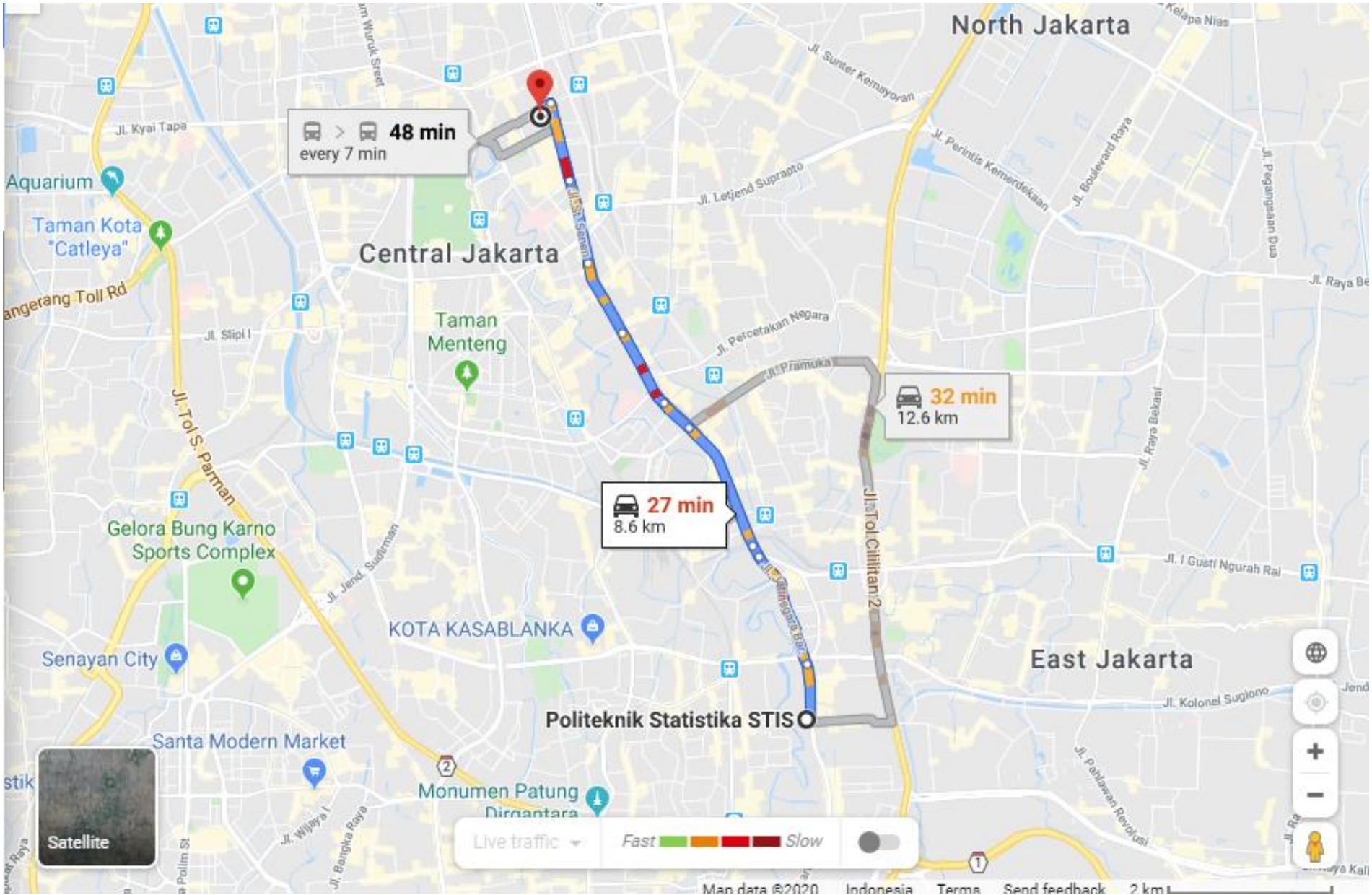
Introduction

- There are numerous situations in which we use visual representations to understand the various data.
- This could involve anything from last week's stock market trends to a travel itinerary or even the weather forecast for various geographical areas.
- Thanks to our visual perception ability, a visual representation is often more effective than written text.

Rute Polstat STIS - BPS



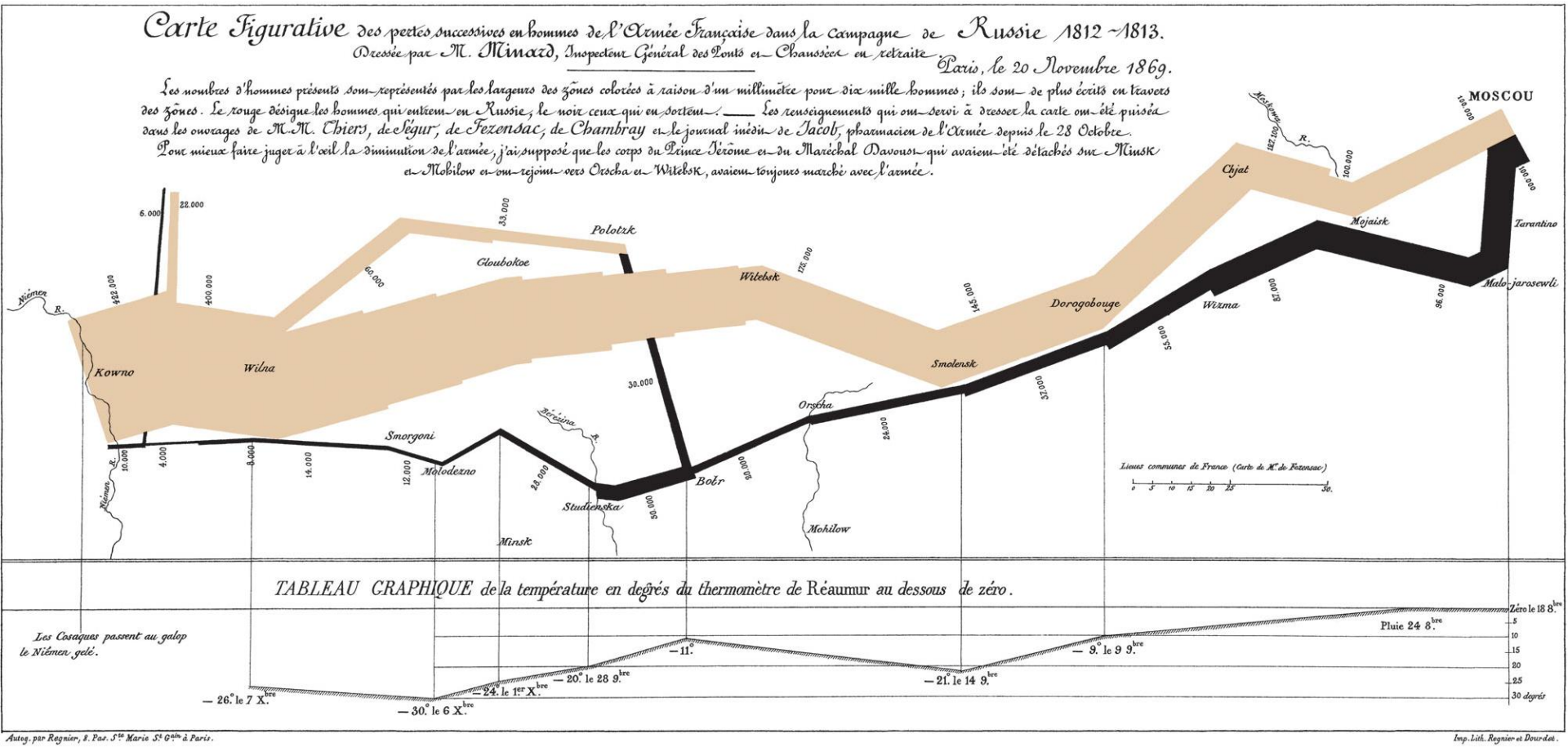
Rute Polstat STIS - BPS



Presentation

- When we want to communicate an idea, we sometimes use a picture.
- It could be a sketch on paper, a drawing on a blackboard, or images projected on a slide or transparency.
- The visual representations help us to illustrate concepts that, if expressed verbally, we would find difficult to explain clearly to a listener.
- The difficult part is in defining the representations that effectively achieve their goal.

Representasi Visual

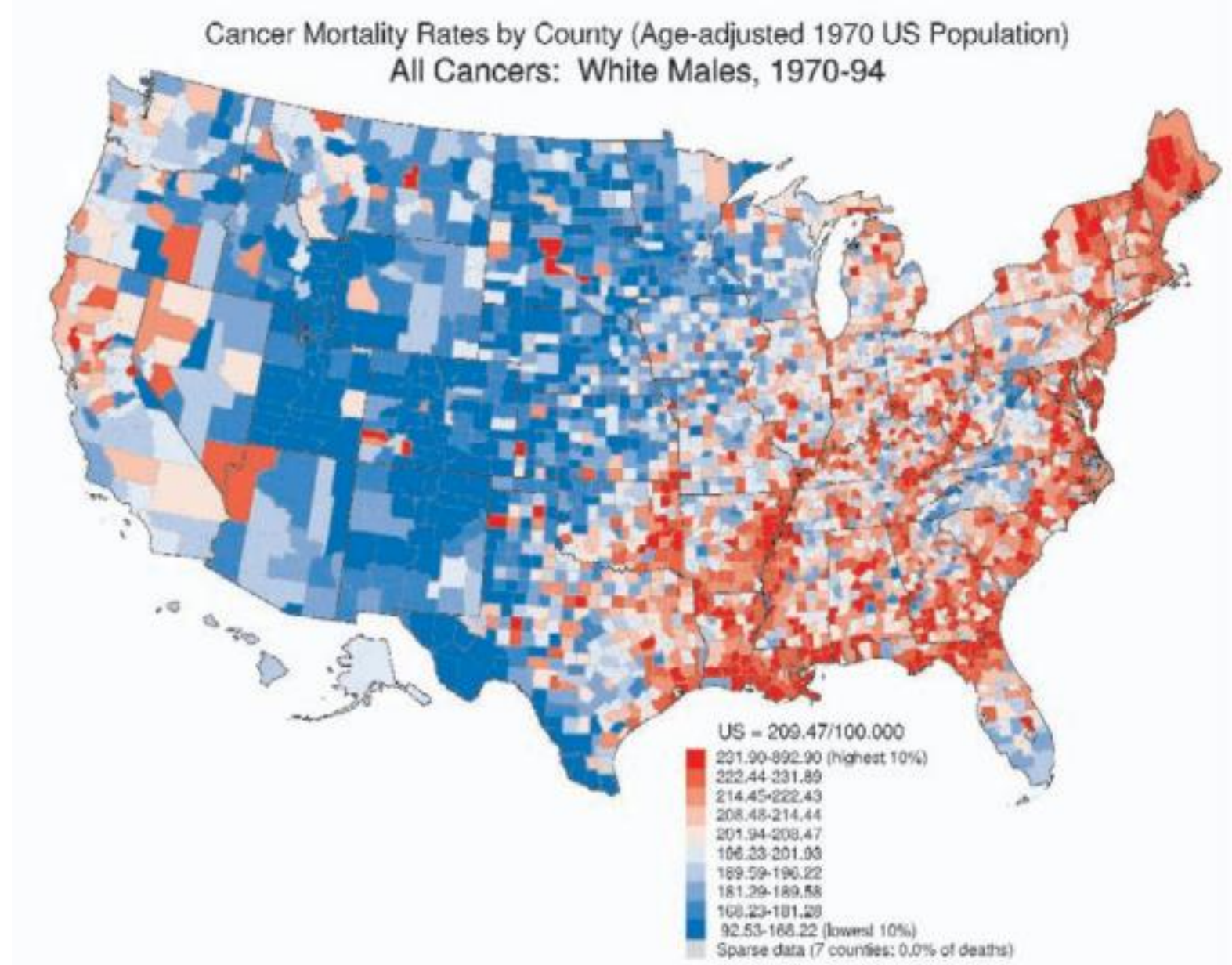


Napoleon's army in the Russian campaign of 1812
Charles Joseph Minard (1869)

Explorative Analysis

- The explorative analysis of data is one of the applications that benefits the most from visual representations and the ability of analysis by visual perception and the human cognitive system.
- This has been used for years to identify properties, relationships, regularities, or patterns.

Explorative Analysis



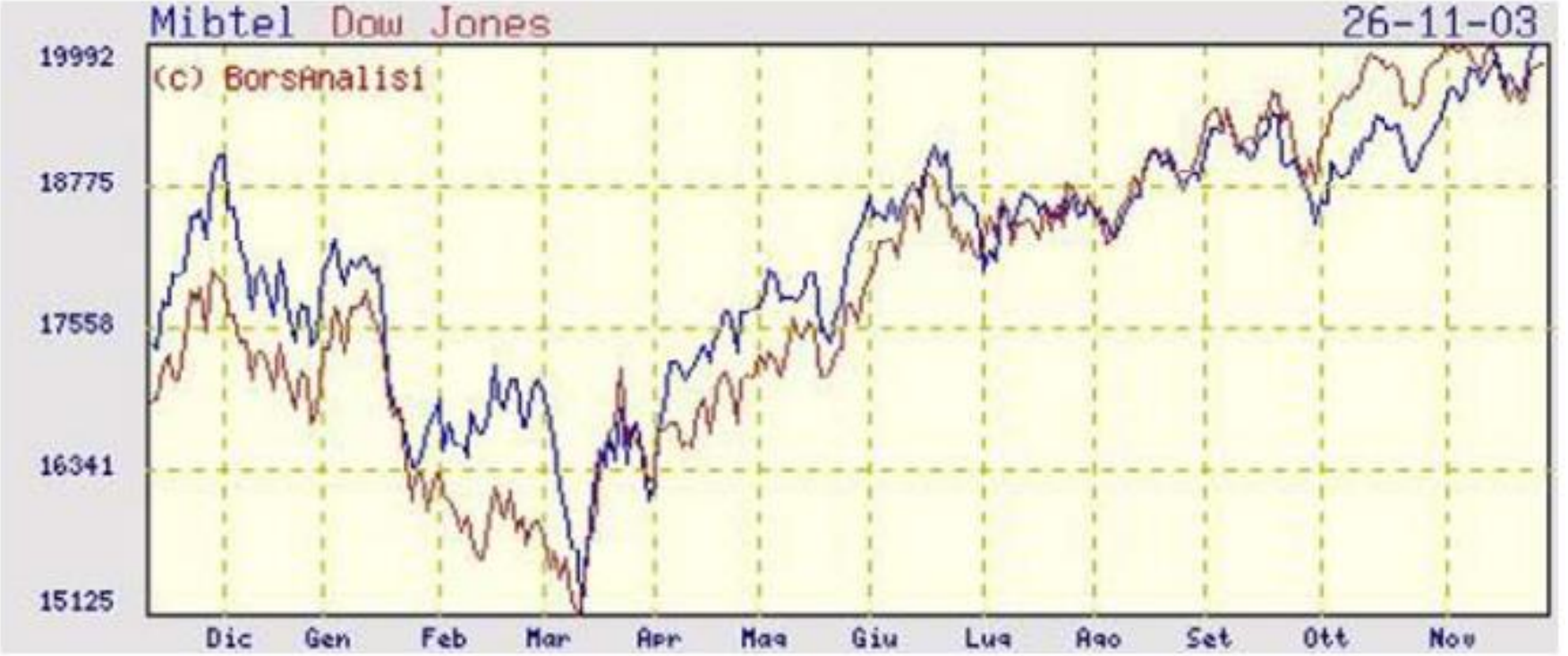
Explorative Analysis

- The representation in Figure does not provide an explanation as to why the incidence of death is higher in certain counties than in others but can suggest that researchers carry out epidemiological studies in determined regions, which may throw some light on factors that increase the risk of cancer
- For instance, in the past, thanks to a visual representation of this type, a high number of cases of lung cancer were found in the coastal areas of Georgia, Virginia, north east Florida, and Louisiana.
- Researchers found that these cases were connected to **asbestos powder**, inhaled by workers in the shipyards during the Second World War.

Confirmative Analysis

- Visual representation is also a visual means of carrying out confirmative analysis on structural relationships between series of data, to confirm or infirm hypotheses on the data.
- For example, stock market workers are well aware that the stock exchange of various nations is influenced by events.

Confirmative Analysis



Information Visualization

- Eminent authors often refer to visual or graphical representations by the term *visualization* (or *visualisation* in the less common British version of the term).
- In this text, we use the expression *visual representation* rather than other synonyms.
- Obviously, this is not a casual choice; we use the terminology that is most in keeping with the subject at hand.

Information Visualization

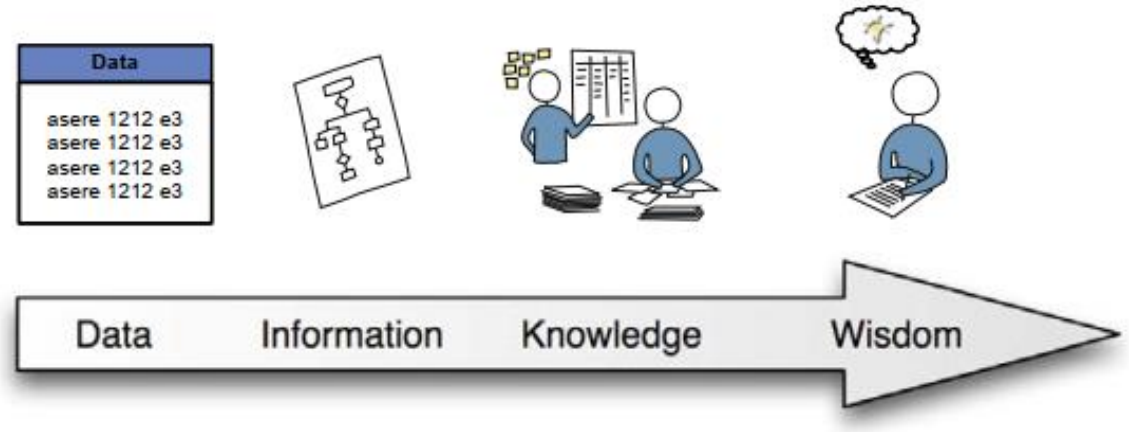
- A quick check in a dictionary reveals that “visualization” is an activity in which humans beings are engaged as an internal construction in the mind .
- It is something that cannot be printed on paper or displayed on a computer screen.
- Taking this into consideration, we can summarize that **visualization** is a **cognitive activity**, facilitated by external visual representations from which people build an internal mental representation of the world

From Data to Wisdom

- But just how is information created from the data that we represent in visual form?
- We have already mentioned that we are constantly solicited by a great amount of data arriving from numerous sources.

From Data to Wisdom

- Shedroff defines this process as the “continuum of understanding” and describes it as a continuum that generates information from data.



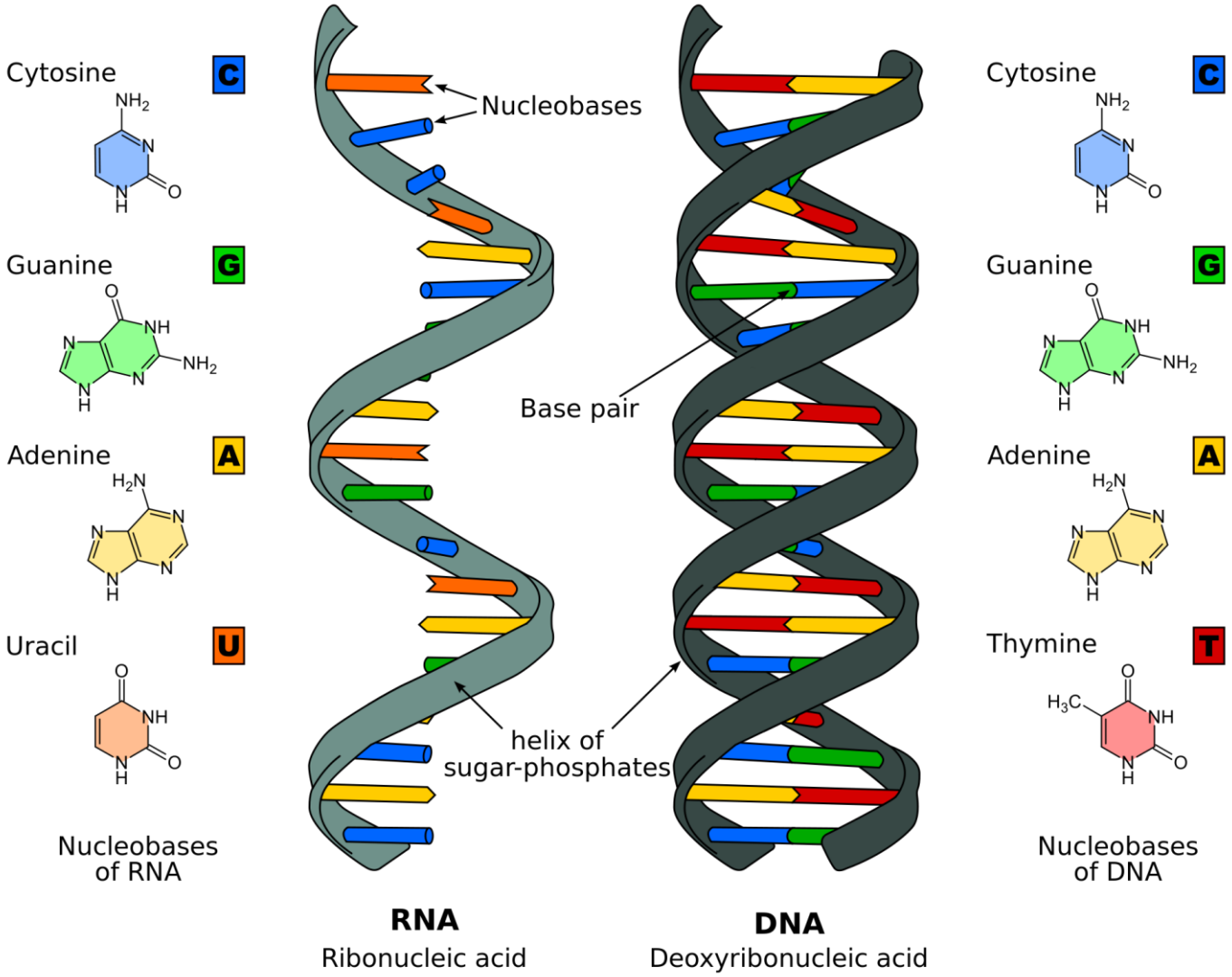
From Data to Wisdom

- **Data** are entities that, of themselves, lack any meaning
- Data alone are not enough to establish a communicative process, data must first be processed, organized, and presented in a suitable format. This transformation and manipulation of the data produces **information**
- When **information** is integrated with experience, it creates knowledge
- **Wisdom** is the highest level of comprehension

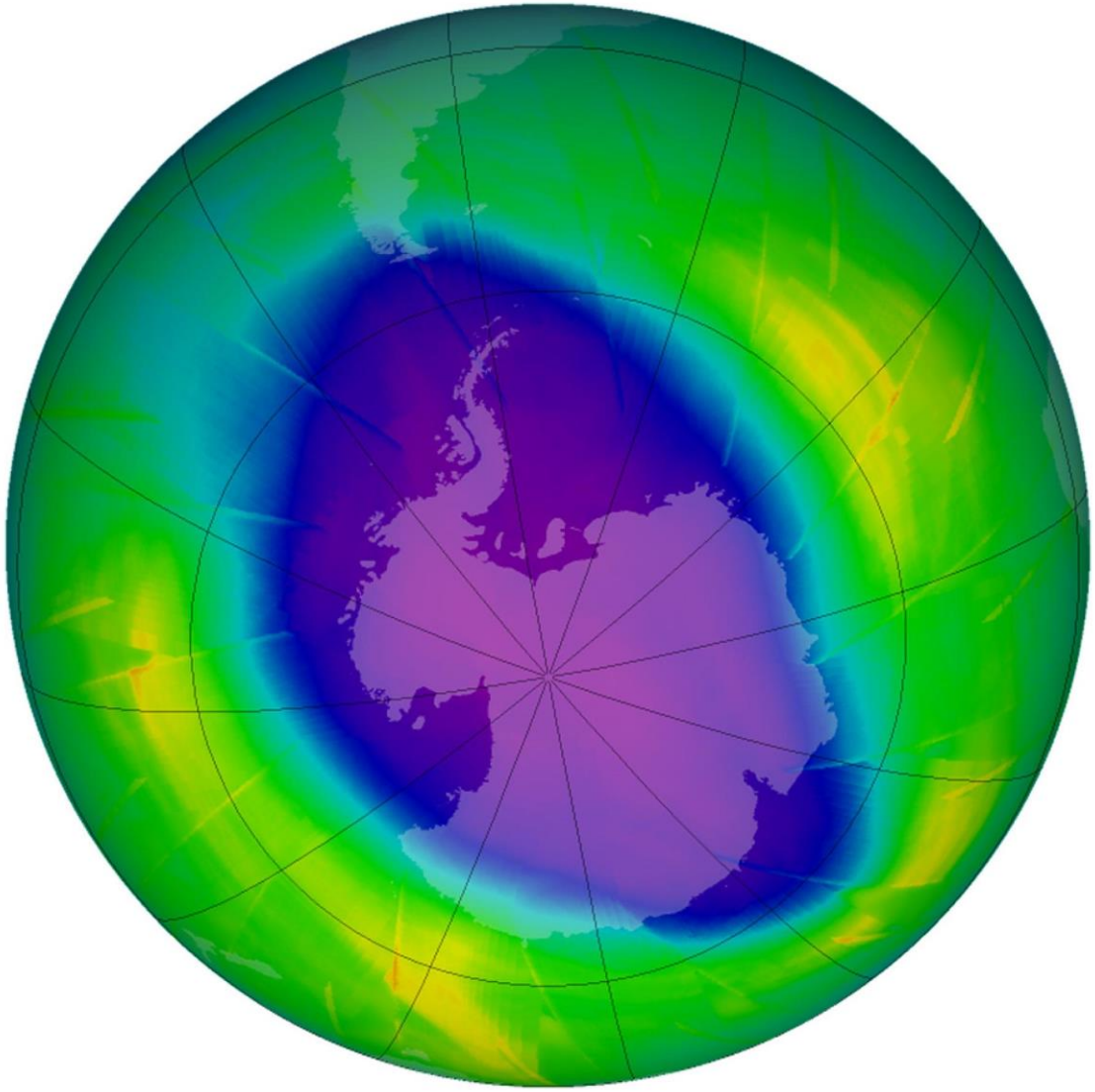
Scientific Visualization

- When we have to visually represent data, we have to deal with the problem of their nature.
- Data themselves can have a wide variety of forms, but we can distinguish between data that have a physical correspondence and are closely related to mathematical structures and models

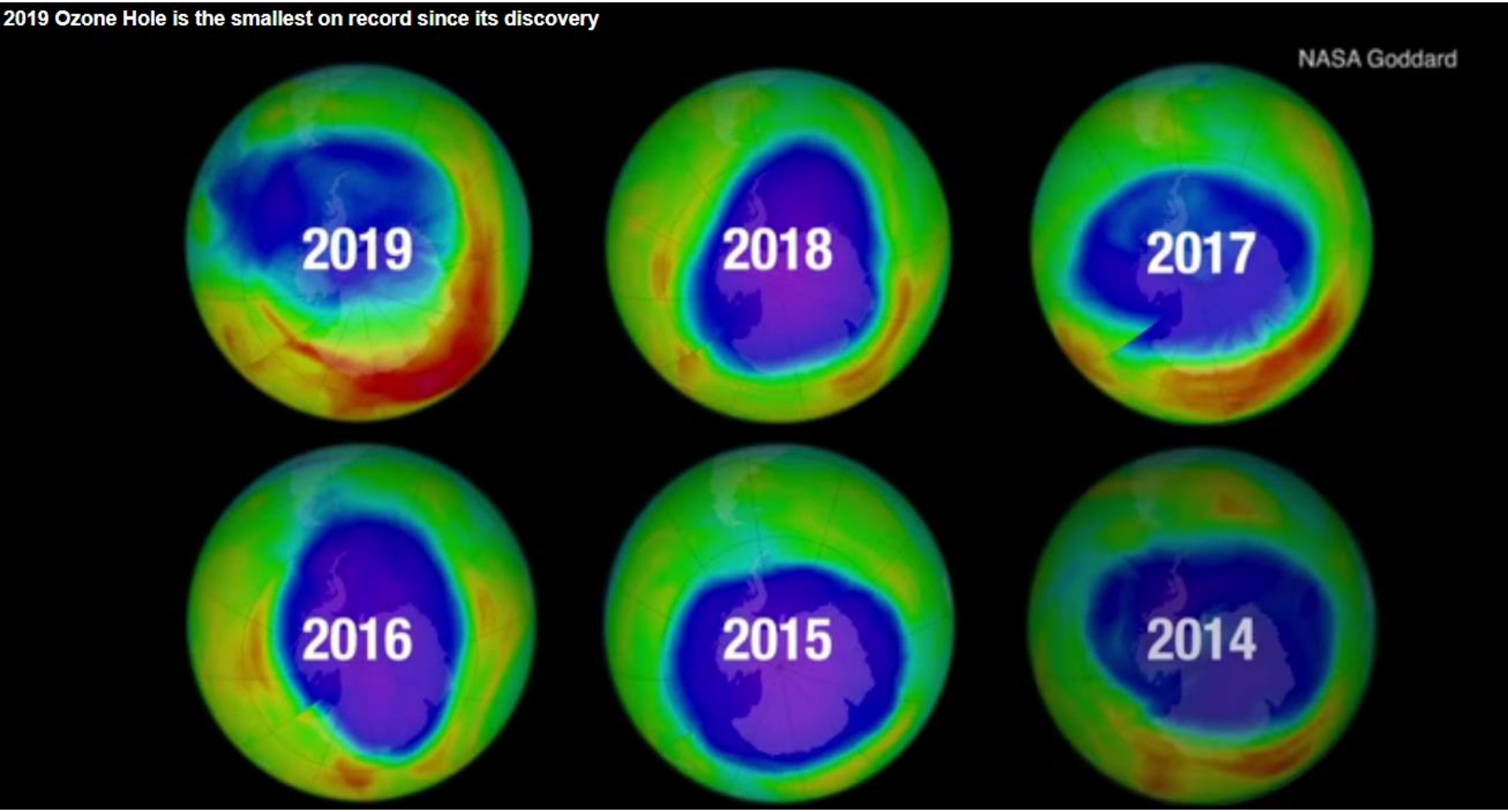
DNA Structure



Ozone Hole



Ozone Hole

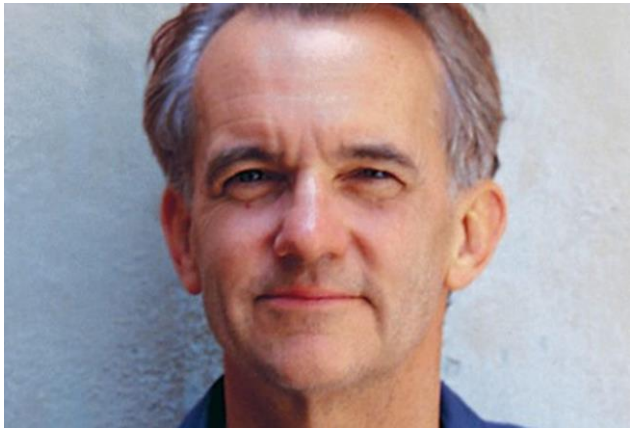

2019 Ozone Hole is the smallest on record since its discovery
NASA Goddard
2019
2018
2017
2016
2015
2014

Criteria for Good Visual Representations

- ***Graphical Excellence***
- ***Graphical Integrity***
- ***Maximize the Data–Ink Ratio***
- ***Aesthetics***

Graphical Excellence

- Edward Tufte is certainly the most prominent expert in the world of statistical graphics for all that involves the excellence of visual representation.
- His works *The Visual Display of Quantitative Information*, *Envisioning Information*, *Visual Explanations*, and his latest work, *Beautiful Evidence*



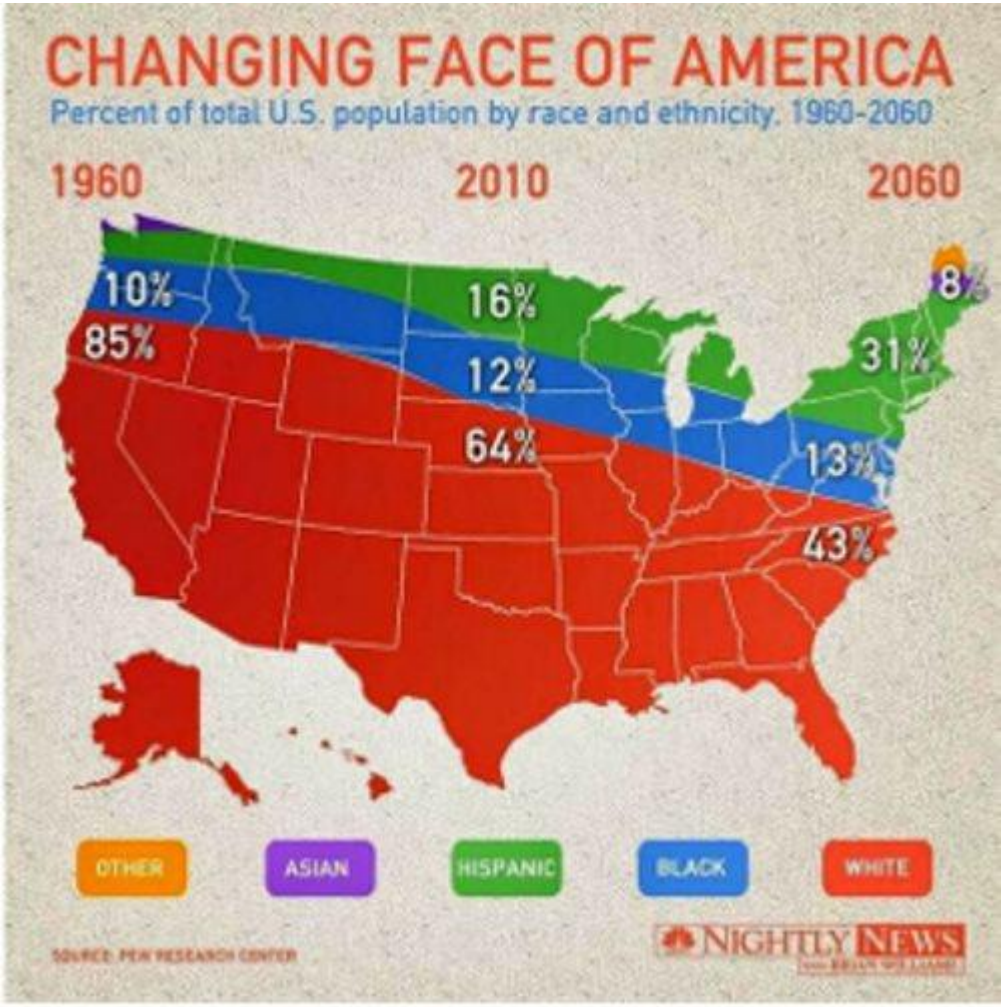
Graphical Excellence

- According to Tufte, a good picture is a well-built presentation of “interesting” data.
- It is something that brings together substance, statistic, and design. It aims to clearly, precisely, and efficiently present and communicate complex ideas.
- More generally, it aims to provide the viewer with “the greatest number of ideas, in the shortest time, using the least amount of ink, in the smallest space”

Graphical Integrity

- Tufte and Bertin report numerous cases of visual representation that, more or less intentionally, may lead to wrong interpretations.
- Tufte emphasizes what he defines with the term “visual integrity”: The picture should not in any way distort or create false interpretations of the data.

Graphical Integrity

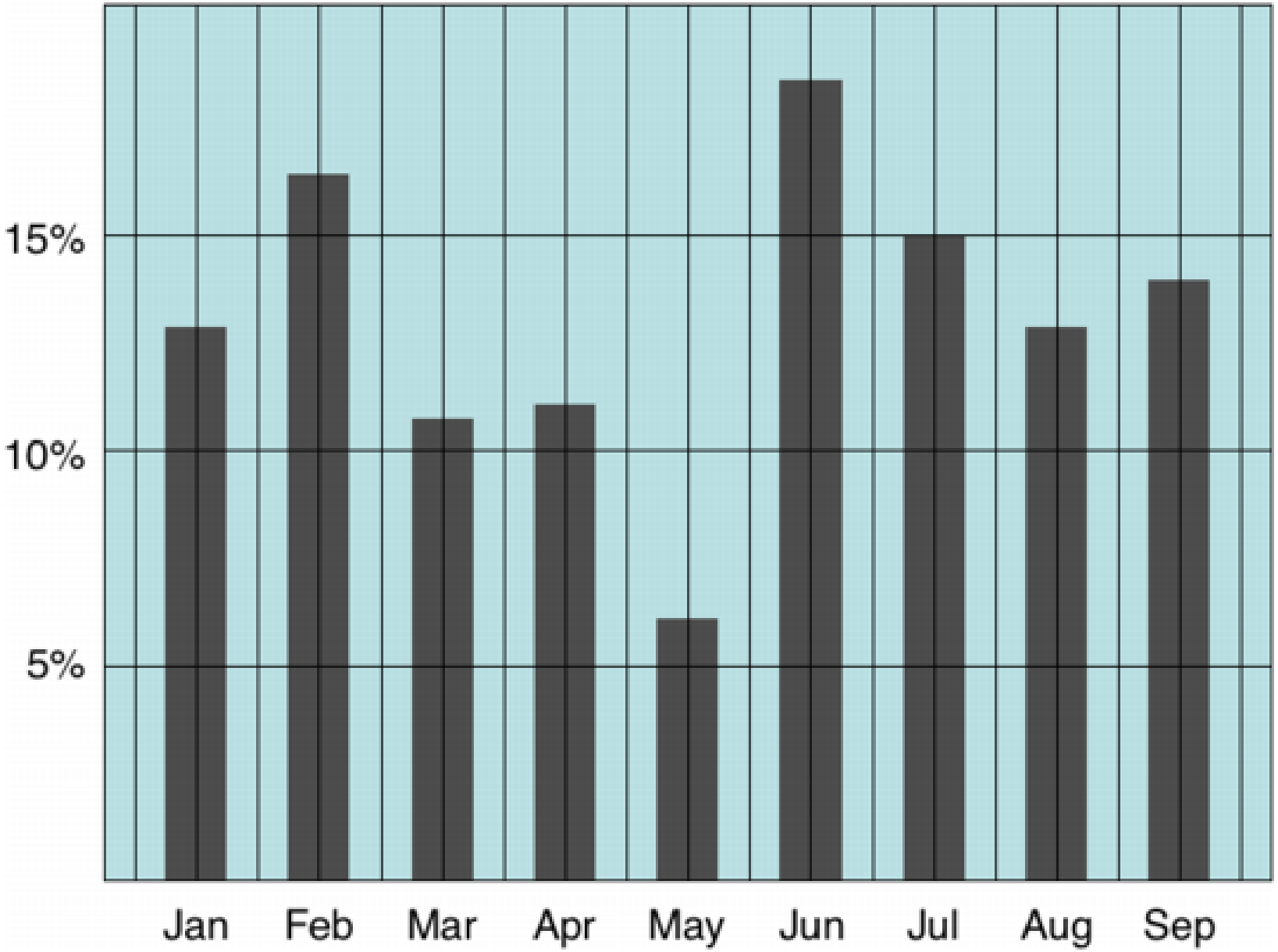


Maximize the Data–Ink Ratio

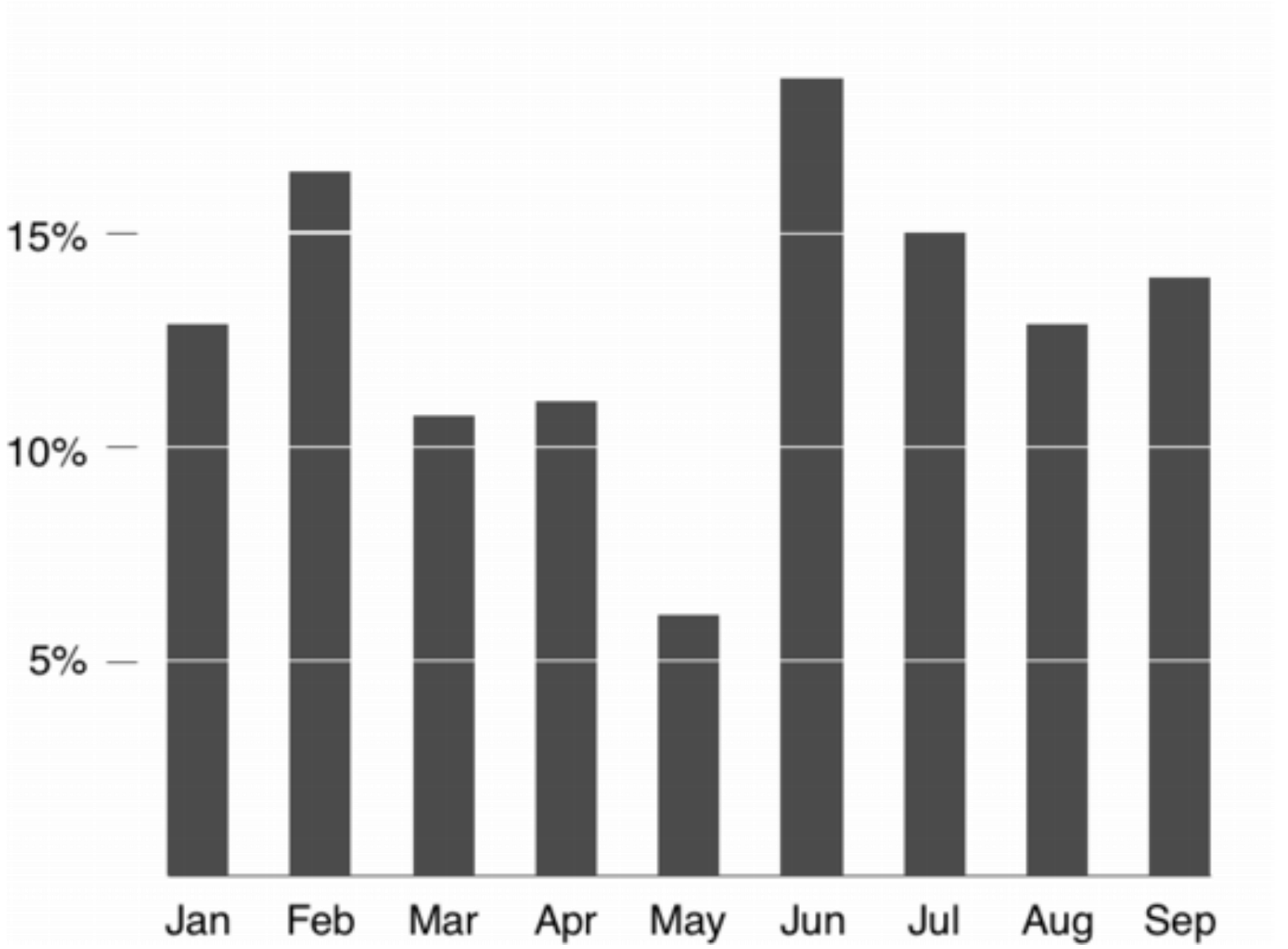
- The aim is to maximize the data–ink ratio, eliminating any non essential elements.
- One way to do this is to review and redesign the graphic, gradually eliminating the decorative elements, the insets, the borders, and all of the visual elements not pertaining to the data.

$$data-ink\ ratio = \frac{data\text{–}ink}{total\ ink\ used}.$$

Maximize the Data–Ink Ratio



Maximize the Data–Ink Ratio



Maximize the Data–Ink Ratio

- https://www.youtube.com/watch?v=JlMUzJzqaA8

Graphical Mediocrity and Excellence