

Visualization  
Design

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# Visualization Design

## Graphical Perception and Colors

S. Santoni<sup>1,2</sup>

<sup>1</sup>Bayes Business School

<sup>2</sup>Soundcloud

MSc in Business Analytics, 2022/23

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# The Data Visualization Process according to Cairo

Data, information, knowledge, wisdom

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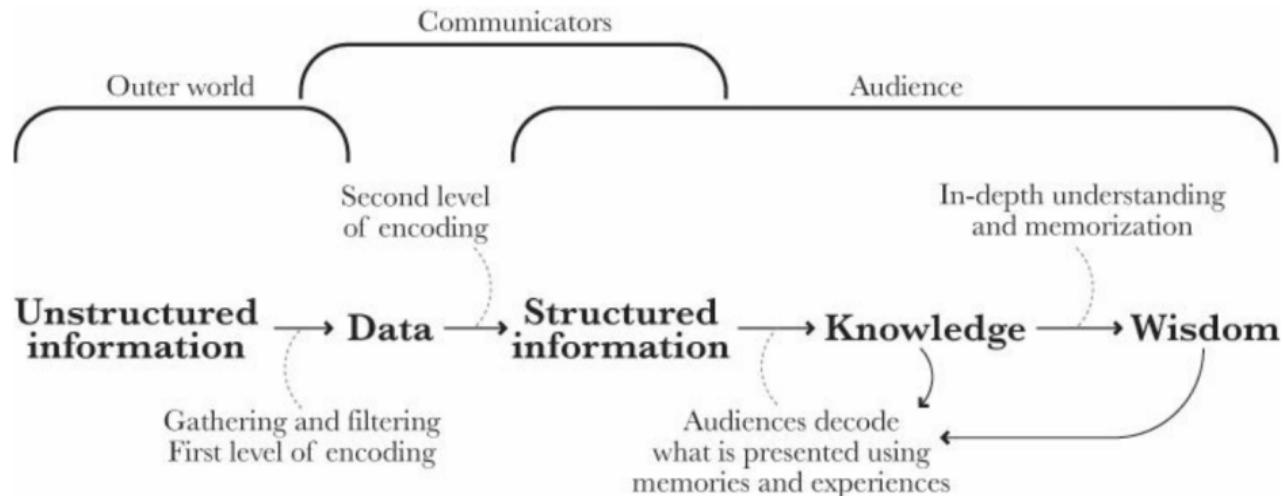
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**Figure 1.8. From reality to people's brains.**

Source is [1, page 29]

# How to Navigate the Data Visualization Process?

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Tufte [2, page 92] suggests to adhere to a basic design principle:

*The principle is the basis for a theory, for a theory of data graphics. Show the data.*

*The principle is the basis for a theory, for a theory of data graphics.*

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# Fine — So What?!

# Maximize the Data-Ink Ratio!!

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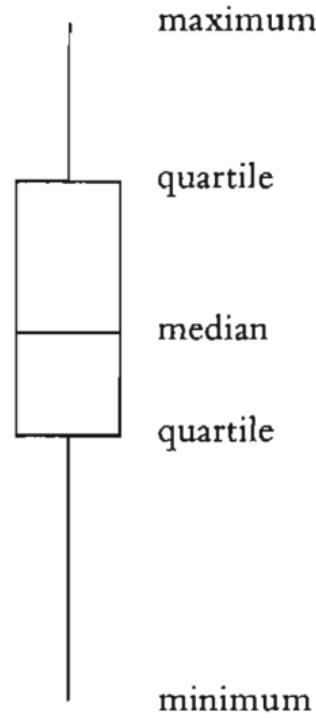
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$$\text{Data-Ink ratio} = \frac{\text{data-ink}}{\text{total ink used to print the graphic design}}$$

**Data-ink** is the non-erasable core of a graphic, the non-redundant ink arranged in response to variation in the numbers represented.

# John Tukey's Box Plot



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# A Box Plot with a Limited Data-Ink Ratio

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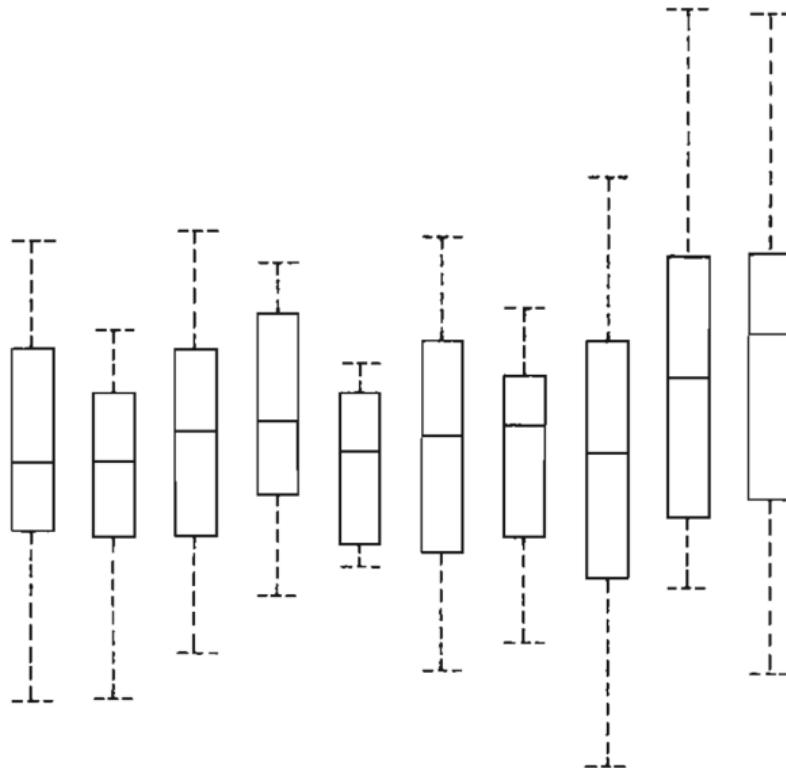
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## Tufte-Alike Box Plot

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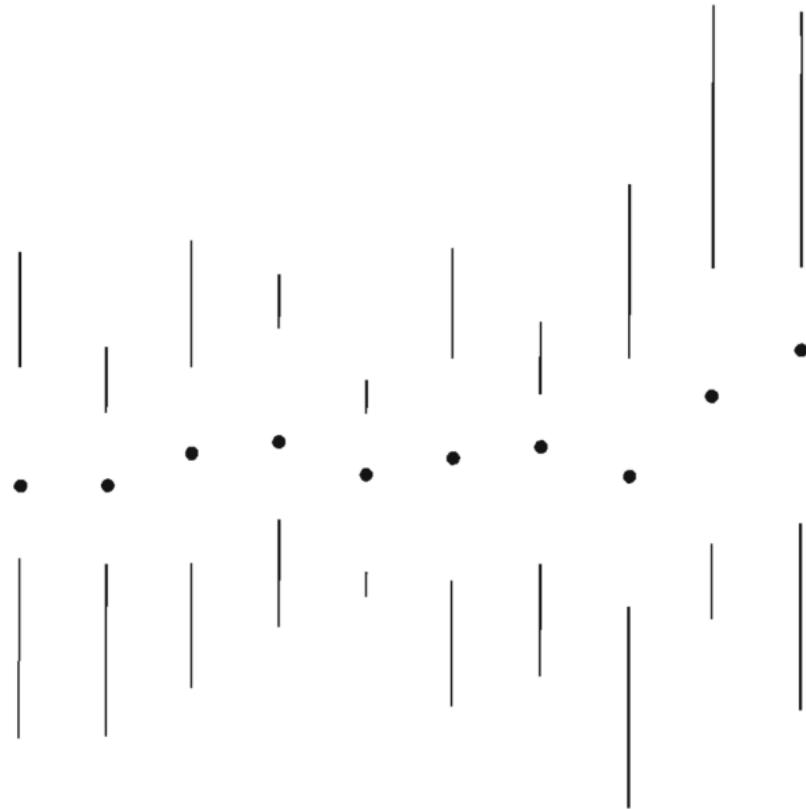
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# A Bar Chart with a Limited Data-Ink Ratio

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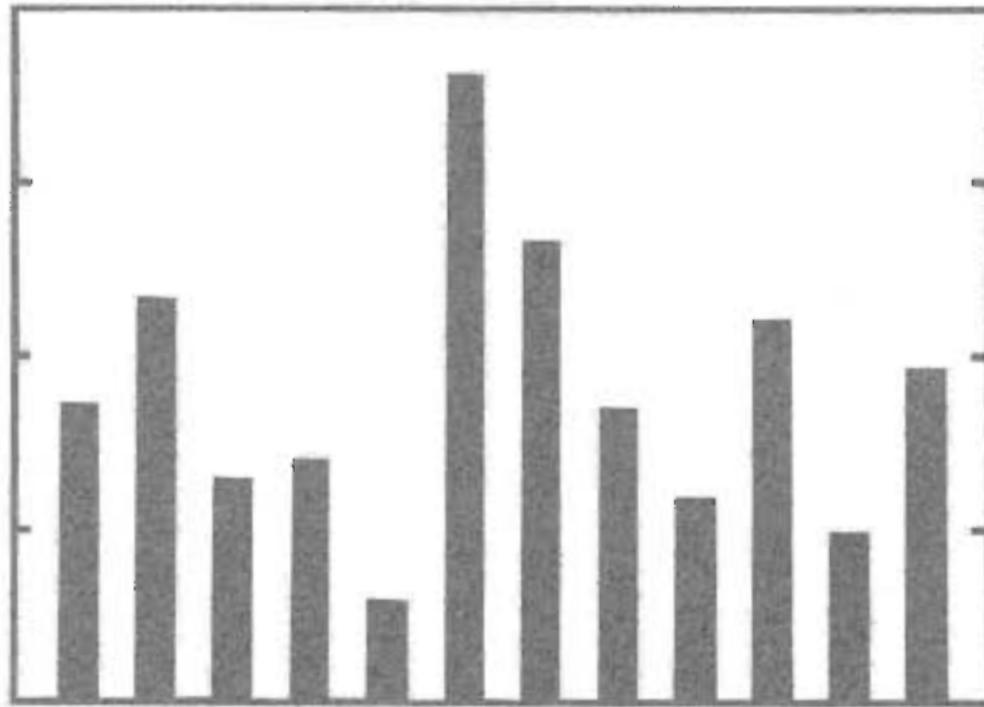
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# Tufte-Alike Bar Chart

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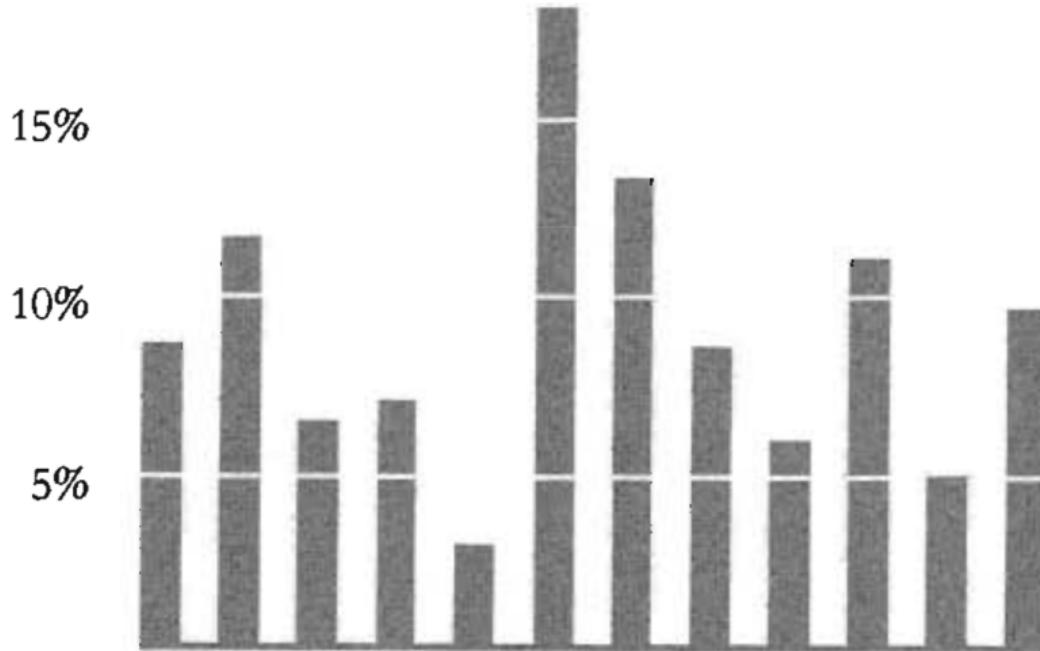
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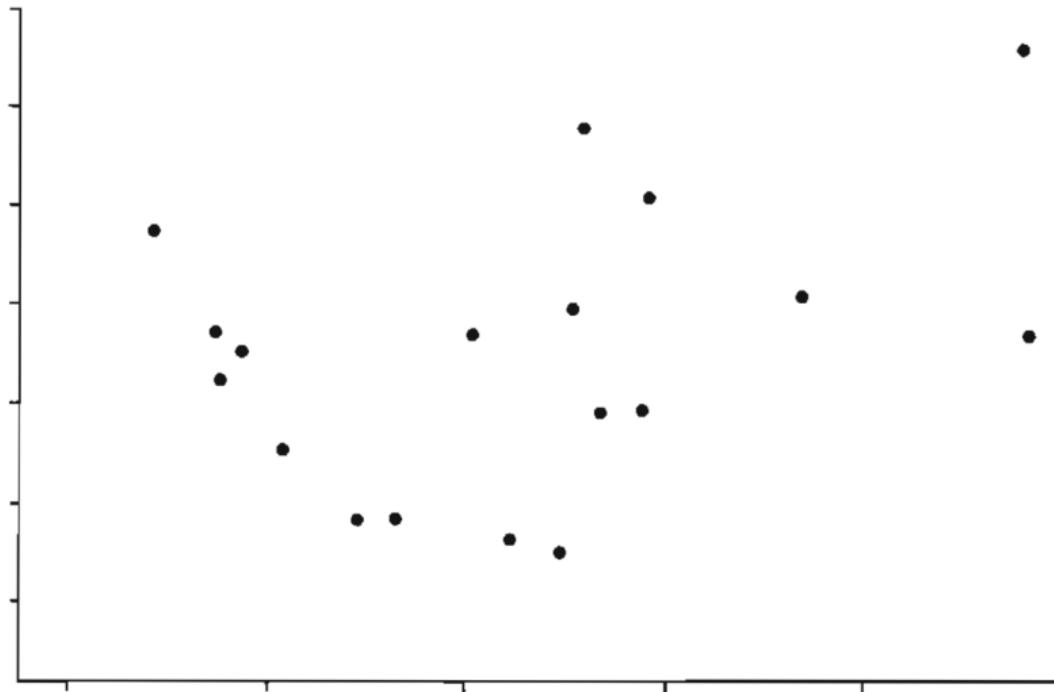
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# A Bare-Bone Scatter Diagram

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# Tufte-Alike Scatter Diagram

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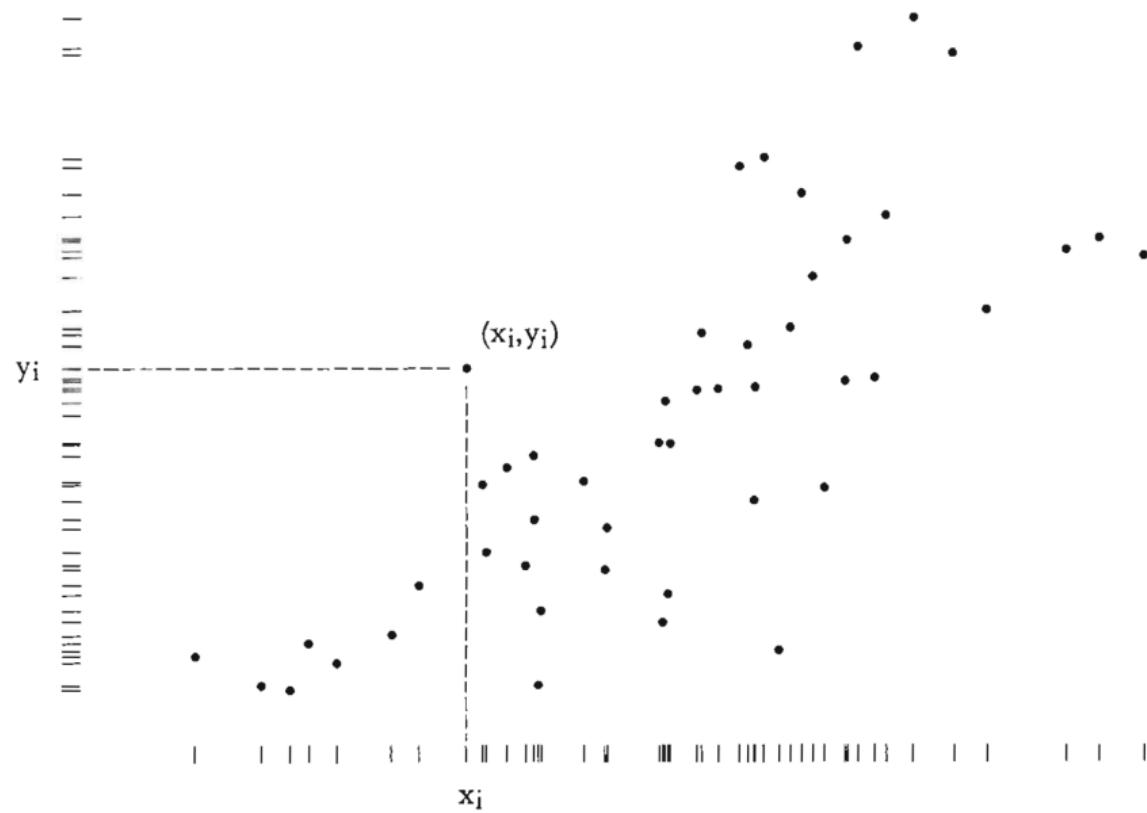
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# Tufte-Alike Scatter Diagram

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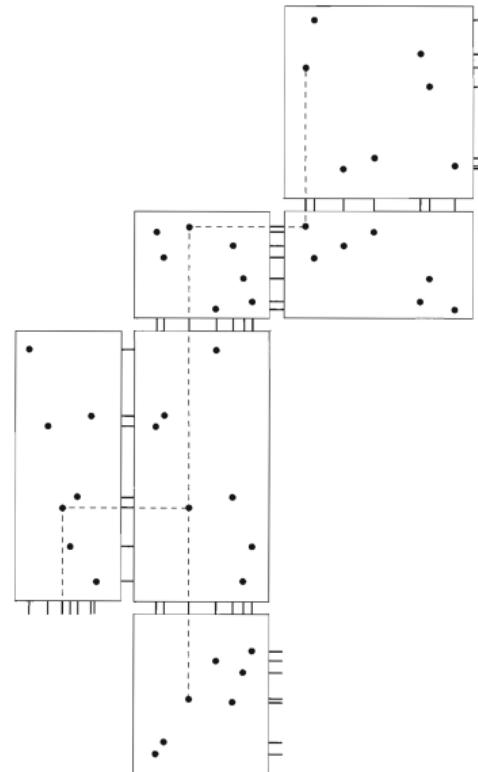
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## How does EDA relate to Cairo's model?

# The Data Visualization Process according to Cairo

Data, information, knowledge, wisdom

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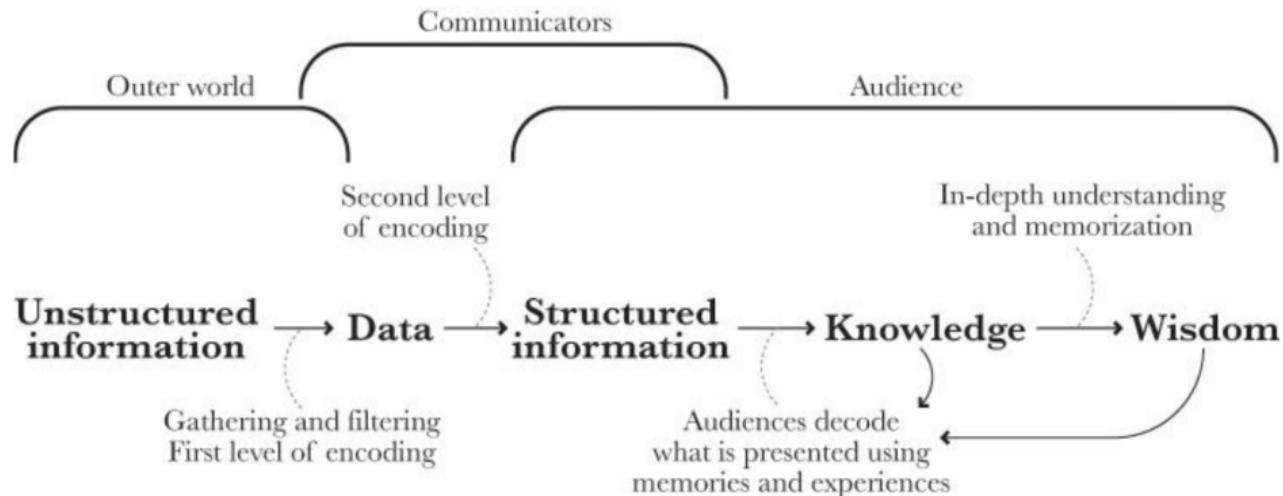
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**Figure 1.8. From reality to people's brains.**

Source is [1, page 29]

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# Time for the Python code and collective discussion!

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# Let Us Play a Classification Game!

Which outlet does the data visualization come from?

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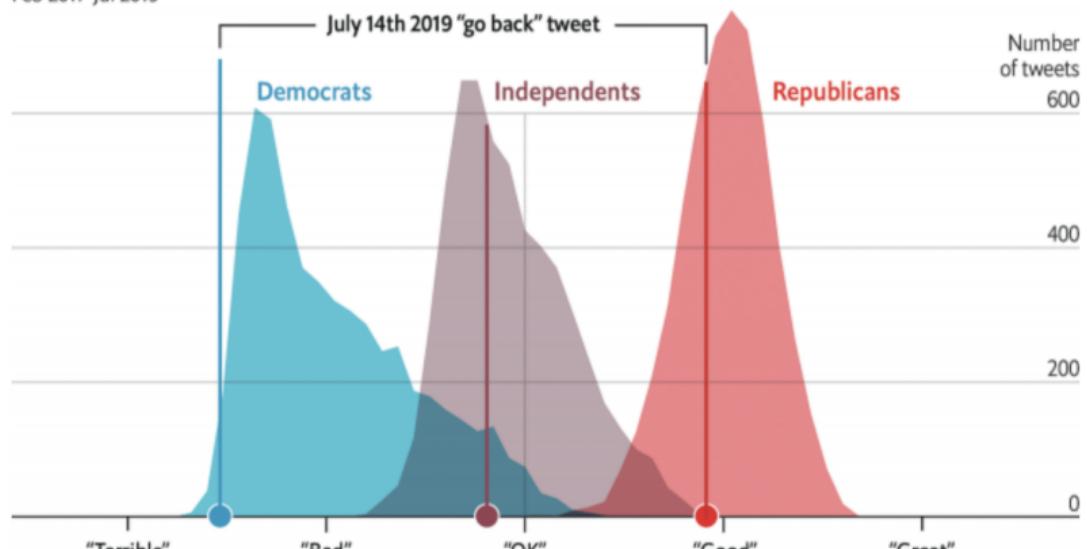
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## The good, the bad and the ugly

Opinion of Donald Trump's tweets

Feb 2017-Jul 2019



Source: YouGov

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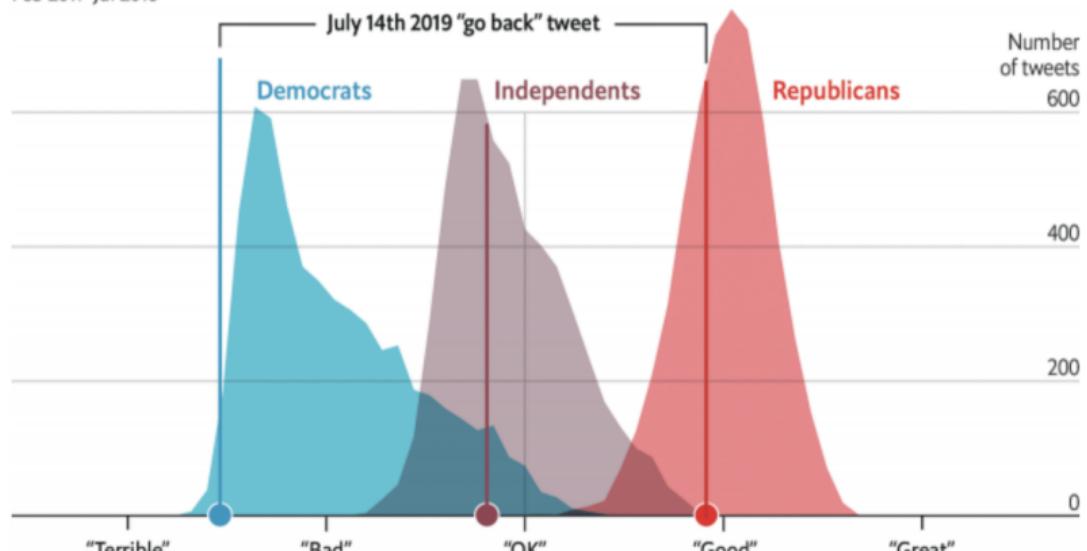
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## The good, the bad and the ugly

Opinion of Donald Trump's tweets

Feb 2017-Jul 2019



Source: YouGov

The Economist

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## Visualization Design

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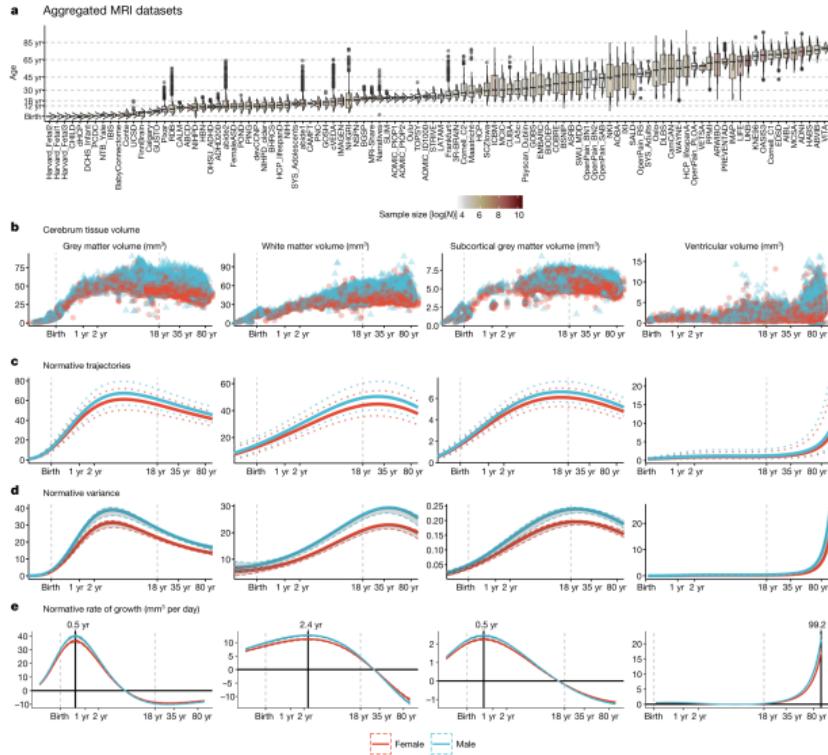
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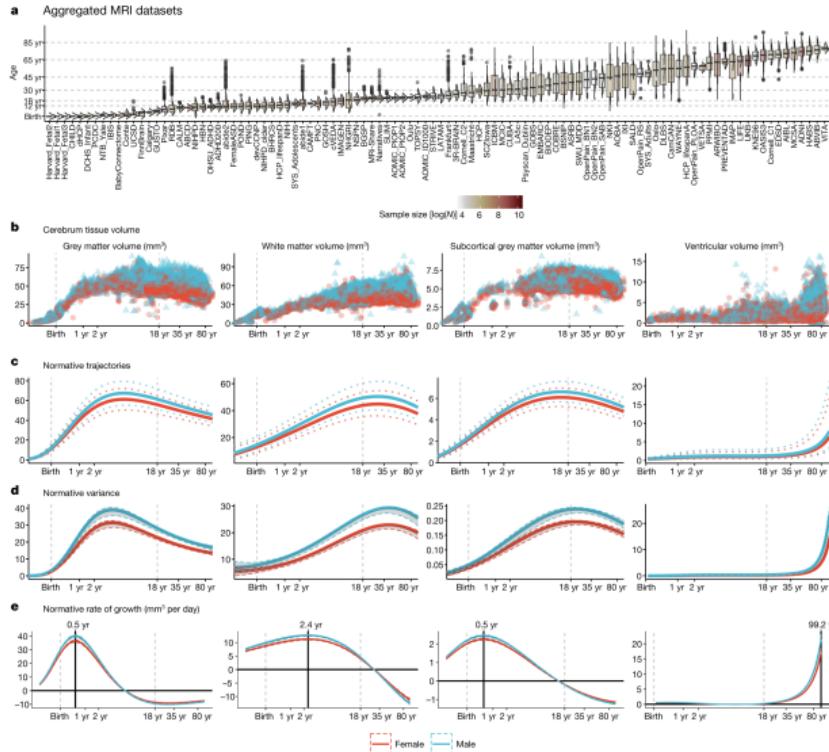
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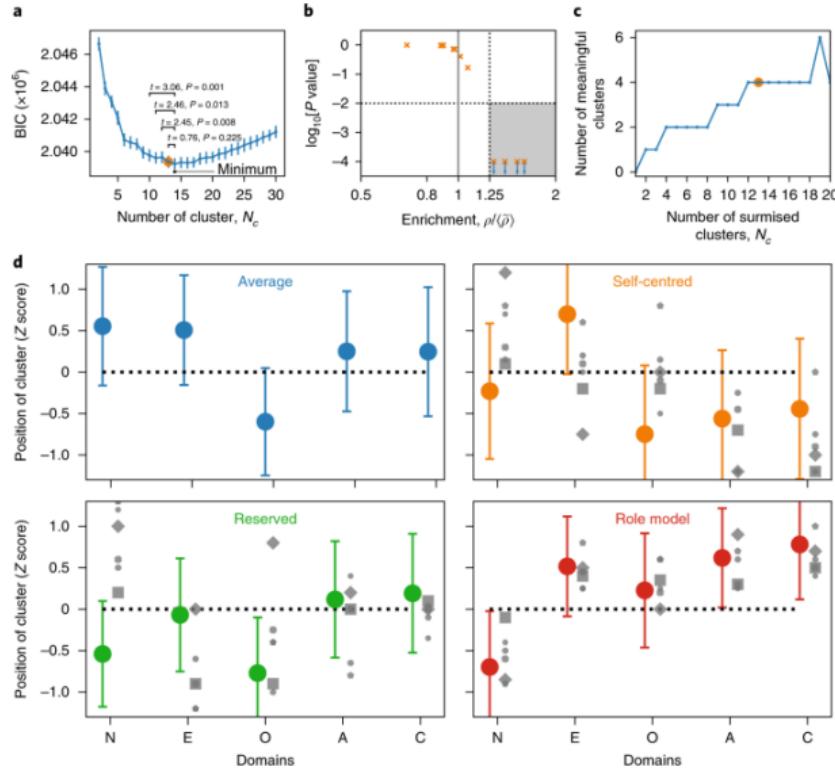
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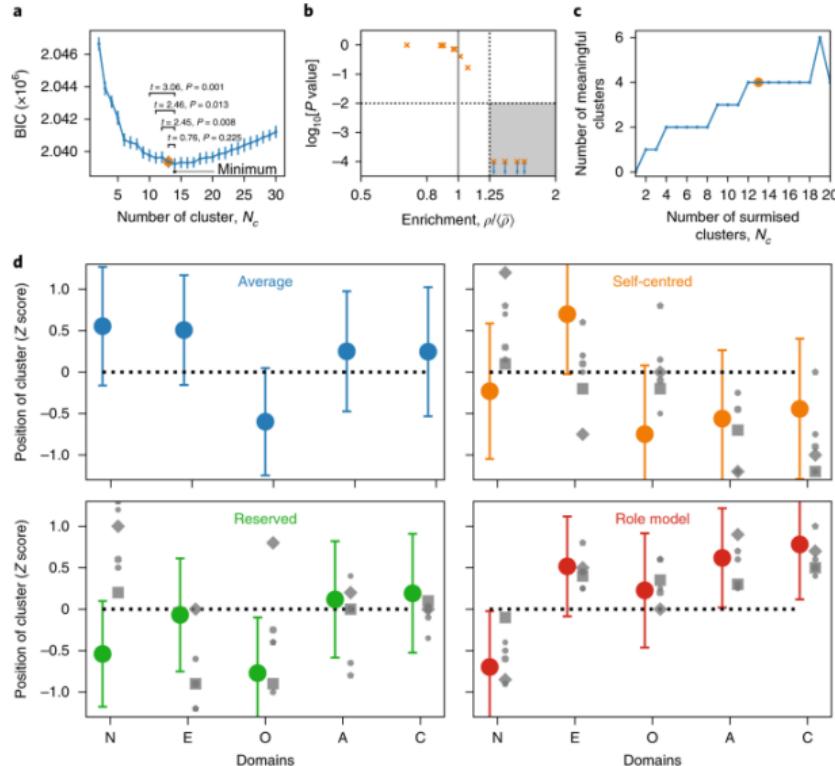
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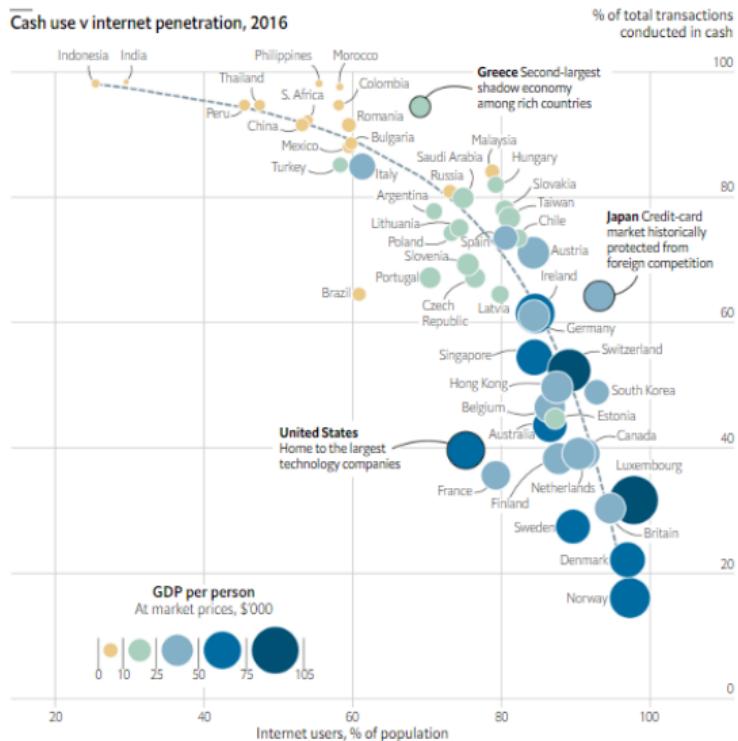
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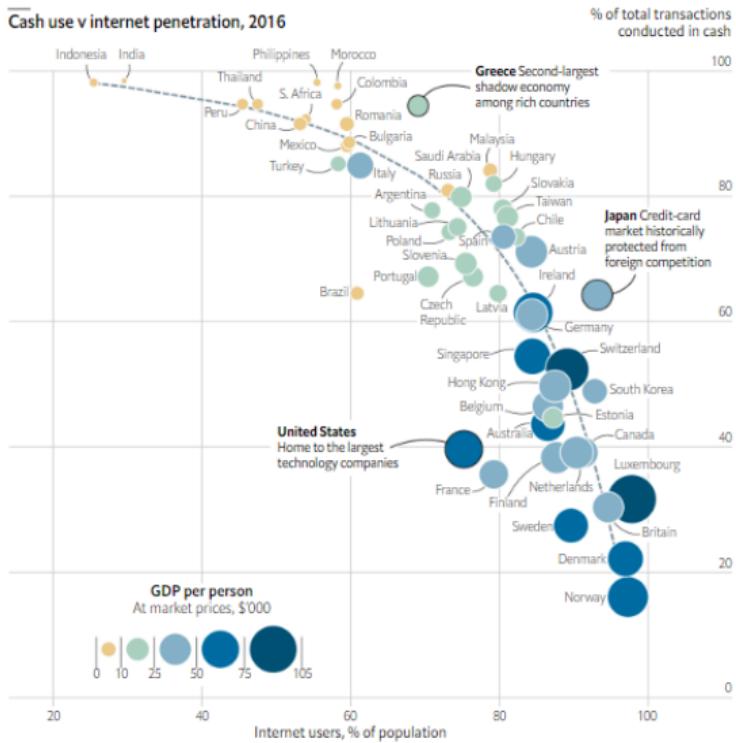
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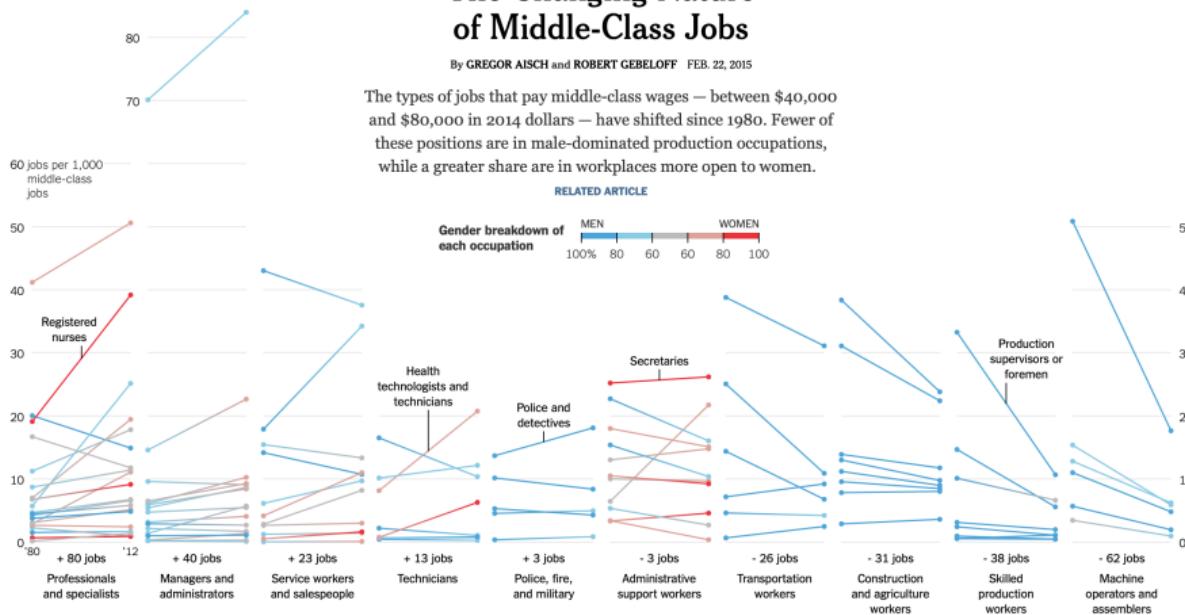


## The Changing Nature of Middle-Class Jobs

By GREGOR AISCH and ROBERT GEBELOFF FEB. 22, 2015

The types of jobs that pay middle-class wages — between \$40,000 and \$80,000 in 2014 dollars — have shifted since 1980. Fewer of these positions are in male-dominated production occupations, while a greater share are in workplaces more open to women.

## RELATED ARTICLE



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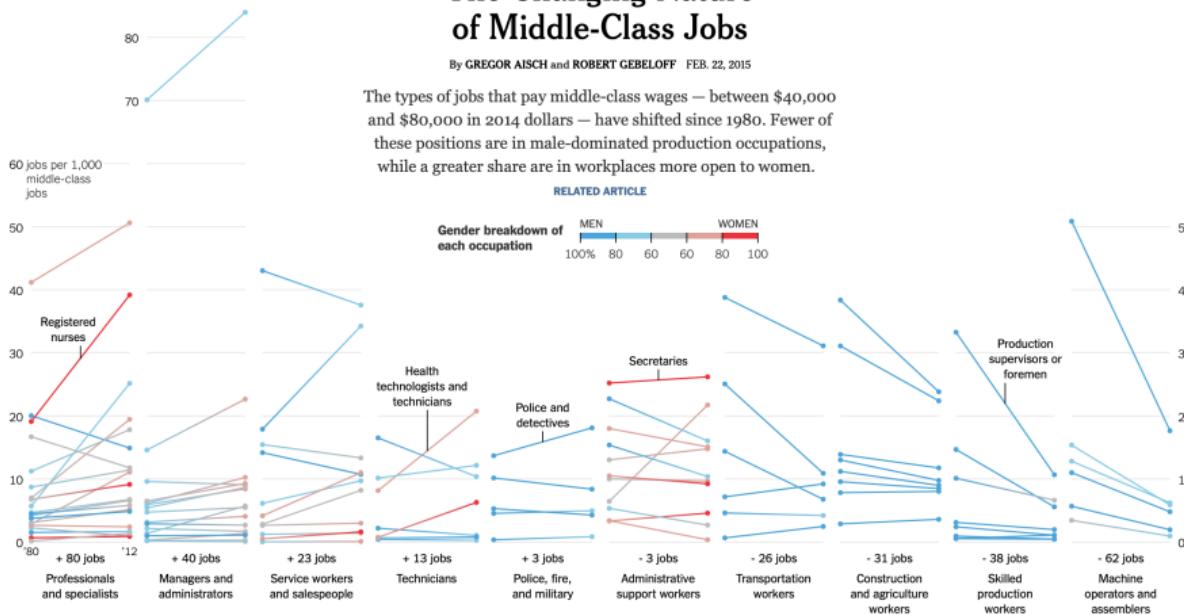
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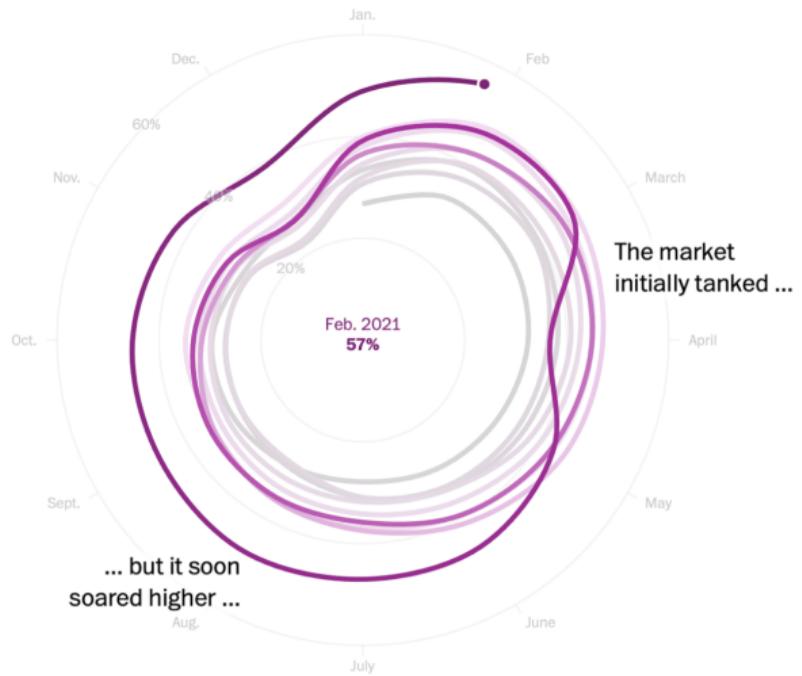
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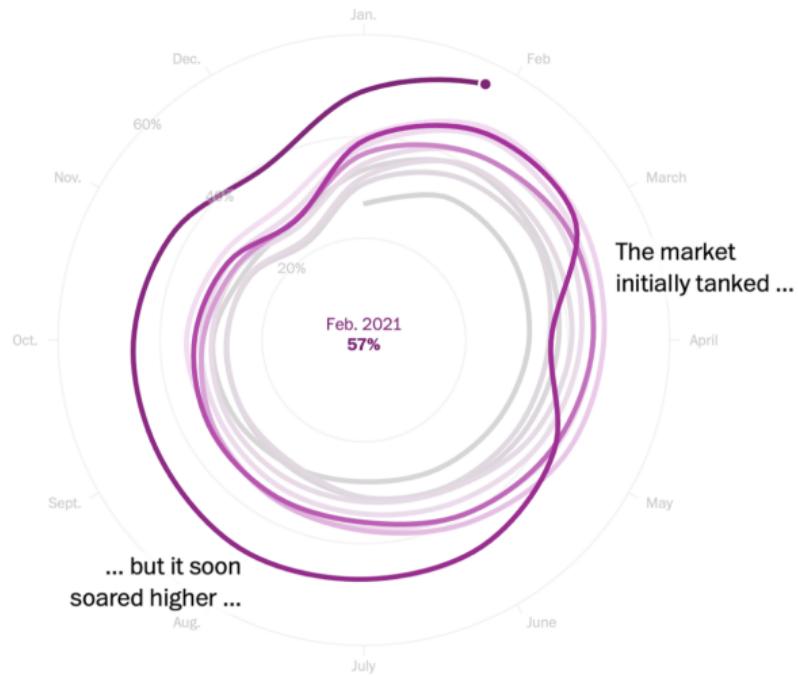
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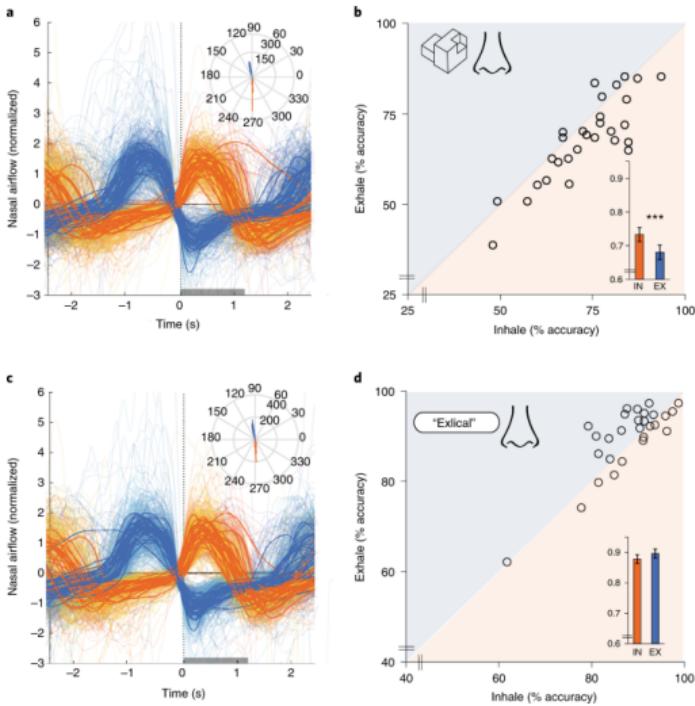
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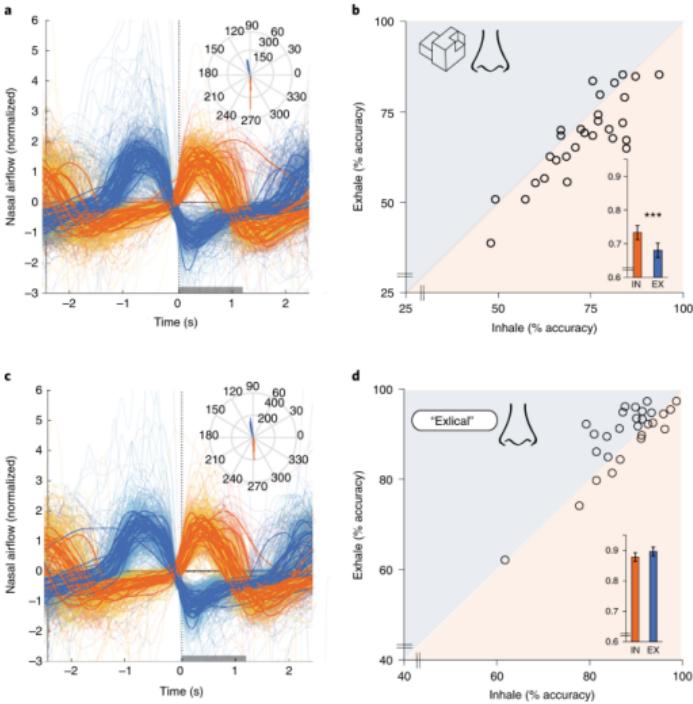
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What is the take-home message from the comparison of different data viz examples?

# Designing the 'Lower-Level' Features of a Chart

Source [1, page 61]

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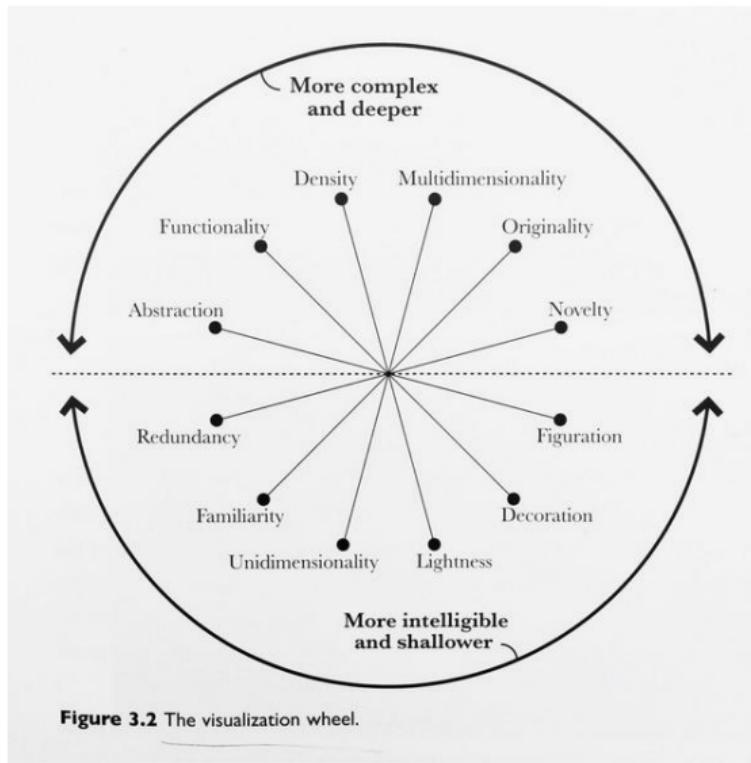
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# Designing the 'Lower-Level' Features of a Chart

Source [1, page 63]

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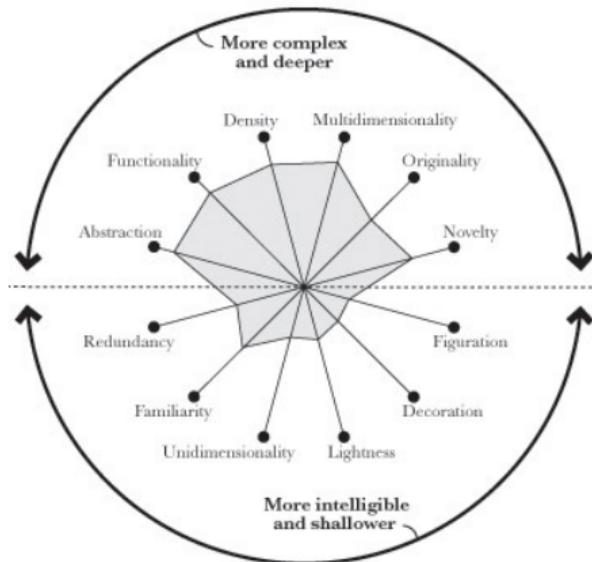
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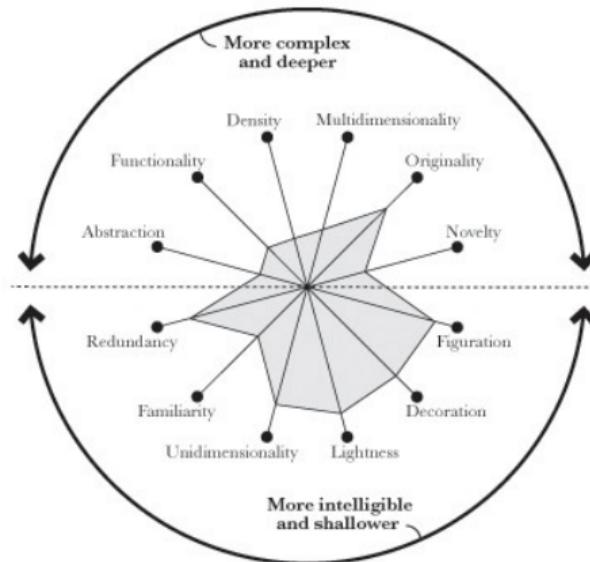
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The wheel preferred by scientists and engineers



The wheel favored by artists, graphic designers, and journalists



# Chartjunk?

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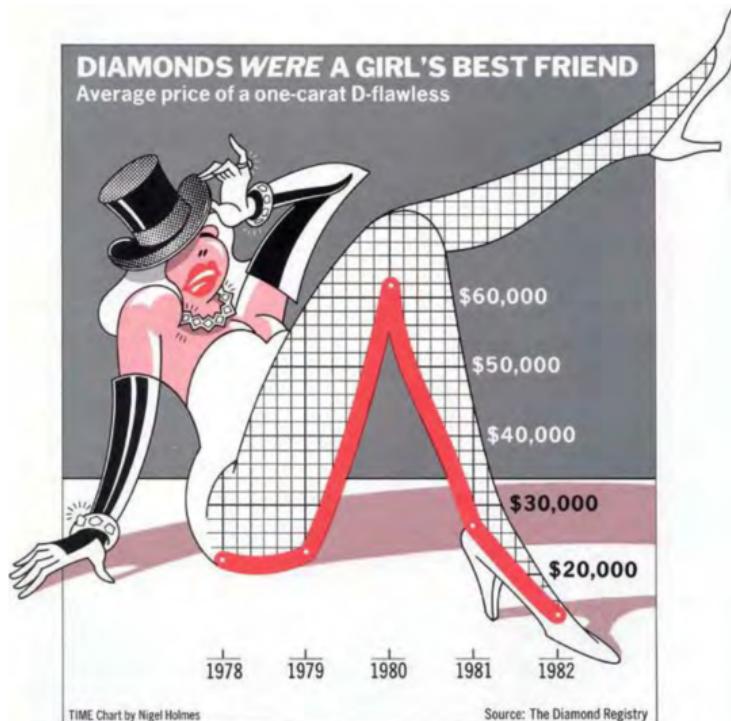


Figure 3.12. Chart by Nigel Holmes for Time magazine. (Reproduced with permission.)

# Chartjunk or Memorable?

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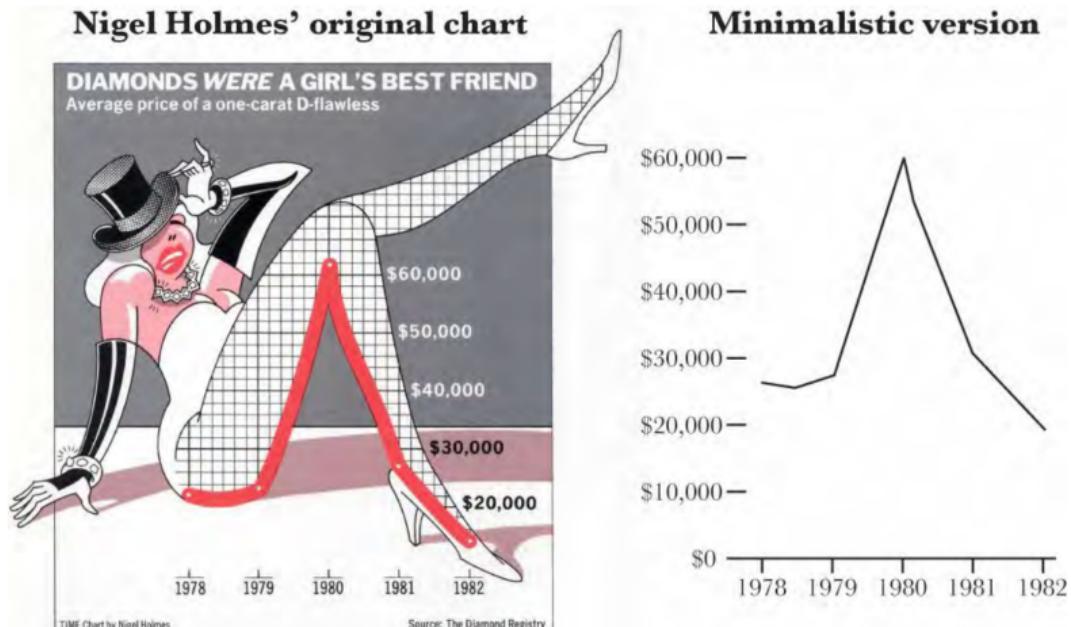
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**Figure 3.15. The original graphic is not very appealing, but the stripped-down version was not easily remembered.**

## What Makes a Visualization Memorable?

Michelle A. Borkin, *Student Member, IEEE*, Azalea A. Vo, Zoya Bylinskii, Phillip Isola, *Student Member, IEEE*, Shashank Sunkavalli, Aude Oliva, and Hanspeter Pfister, *Senior Member, IEEE*

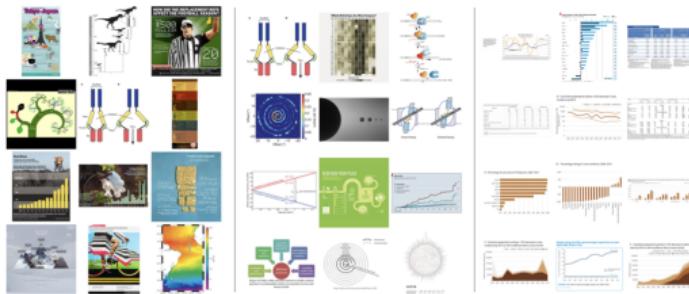


Fig. 1. **Left:** The top twelve overall most memorable visualizations from our experiment (most to least memorable from top left to bottom right). **Middle:** The top twelve most memorable visualizations from our experiment when visualizations containing human recognizable cartoons or images are removed (most to least memorable from top left to bottom right). **Right:** The twelve least memorable visualizations from our experiment (most to least memorable from top left to bottom right).

**Abstract**—An ongoing debate in the Visualization community concerns the role that visualization types play in data understanding. In human cognition, understanding and memorability are intertwined. As a first step towards being able to ask questions about impact and effectiveness, here we ask: “What makes a visualization memorable?” We ran the largest scale visualization study to date using 2,070 single-panel visualizations, categorized with visualization type (e.g., bar chart, line graph, etc.), collected from news media sites, government reports, scientific journals, and infographic sources. Each visualization was annotated with additional attributes, including ratings for data-ink ratios and visual densities. Using Amazon’s Mechanical Turk, we collected memorability scores for hundreds of these visualizations, and discovered that observers are consistent in which visualizations they find memorable and forgettable. We find intuitive results (e.g., attributes like color and the inclusion of a human recognizable object enhance memorability) and less intuitive results (e.g., common graphs are less memorable than unique visualization types). Altogether our findings suggest that quantifying memorability is a general metric of the utility of information, an essential step towards determining how to design effective visualizations.

**Index Terms**—Visualization taxonomy, information visualization, memorability

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# Time to wrap up!

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- [1] Alberto Cairo. *The Functional Art: An Introduction to Information Graphics and Visualization*. New Riders, 2012.
- [2] *The Visual Display of Quantitative Information*. Second edition. Graphics Press LLC, 2001.