ITI0209: User Interfaces

14. Visualizations. Storytelling with Data

Martin Verrev

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Data are facts.

Information is the meaning that human being assigns to these facts. It brings context to the data, turning what would otherwise be meaningless content into something comprehensible and usable.

Let's Recap:

Good graphs should tell a story and be memorable, but also have a low information to ink ratio and not mislead the viewer.

Choice of colour when designing charts and graphs is also important to allow for colour blindness and black and white printing.

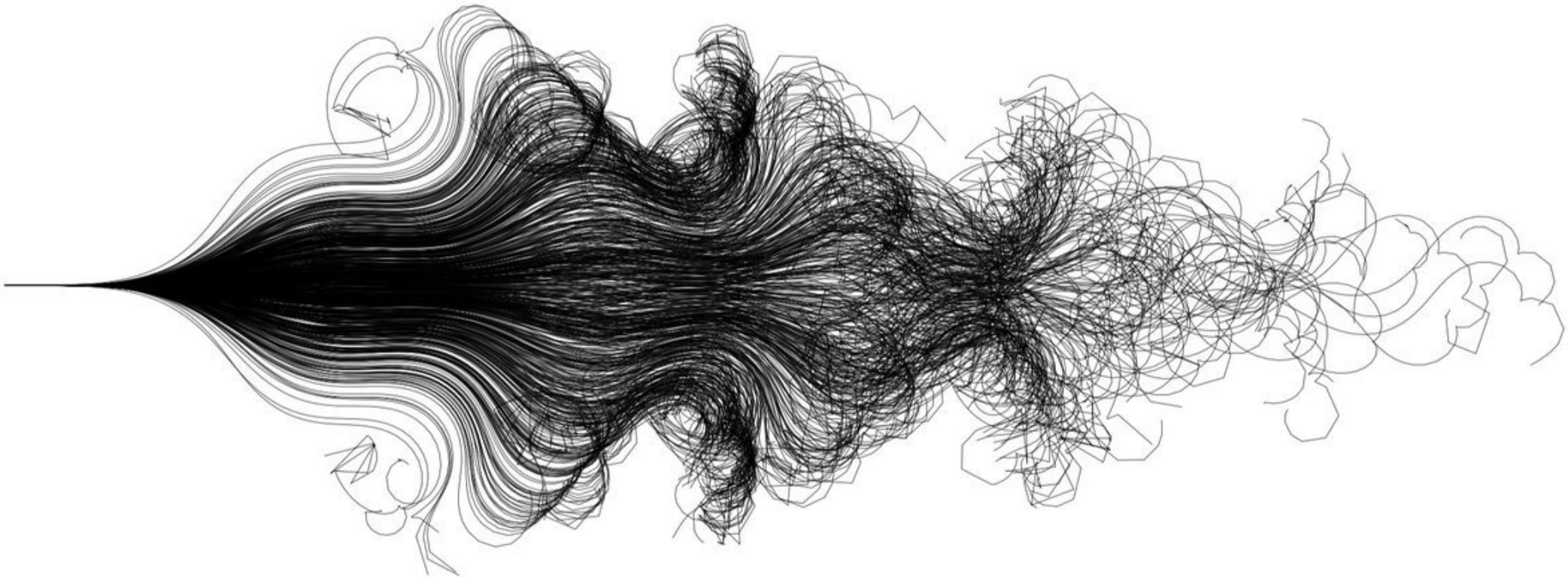


Figure 2: Instability of an unsteered bicycle. This shows 800 runs of a bicycle being pushed to the right. For each run, the path of the front wheel on the ground is shown until the bicycle has fallen over. The unstable oscillatory nature is due to the subcritical speed of the bicycle, which loses further speed with each oscillation.

Source: Matthew Cook. NIPS 2004. https://paradise.caltech.edu/cook/papers/TwoNeurons.pdf

The world is full of things. How you organize them depends on what you want to do.

LATCH stands for the five ways he says that information can be organized: Location, Alphabet, Time, Category, Hierarchy.

LATCH Example

Here is the list of all dog breeds: https://i.imgur.com/yX0EucM.jpeg

- For example organize the dog breeds alphabetically, here is the A group:
- For example organize them by their breed group according to the American Kennel Club. Here is the Sporting group: https://i.imgur.com/ndHFNPu.jpeg and the Toy group: https://i.imgur.com/vKdbYIZ.jpeg
- We could look at dogs from a number of different vantage points and visualize that data in useful ways to convey information and impart knowledge to our audience: https://i.imgur.com/X3BRwD6.png
- Now we can also incorporate narrative to elaborate on an idea through more information design strategies like this https://i.imgur.com/bbRnP3w.jpeg and use data to compare and contrast data: https://i.imgur.com/Z1cTgho.jpeg

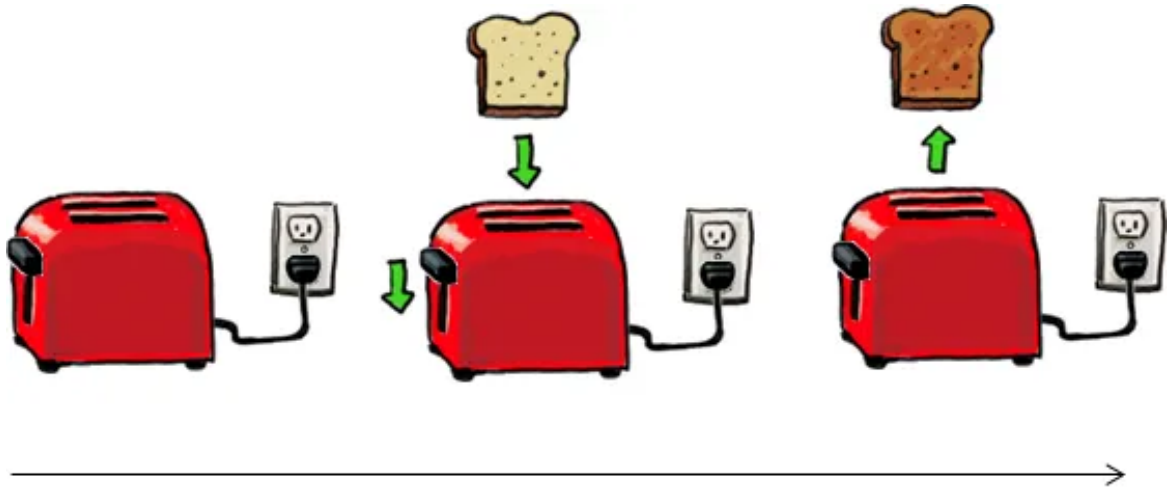
Before you can organize any information you must have a problem or goal. The human perceptual system is by nature selective and goal-oriented.

If you are hungry enough, you will divide all the information in the world into two categories: Things that are edible and things that are inedible.

Organizing principle 1: Sequence.

Organizing by sequence sorts information according to some kind of value.

This could be numerical value (1, 2, 3), relative importance (high, medium, low), difficulty (easy, moderate, difficult), or time (beginning, middle, end).



Organizing principle 2: Comparison.

Organizing by comparison sorts information into categories, according to similarities and differences.

The way to organize information by comparison is to sort them into categories that make sense based on the context of what you are trying to accomplish.

Organizing principle 3: System.

Organizing by system arranges information according to its connections and interrelationships. A map, for example, organizes visual elements so that you can determine where things are relative to everything else.

The operative method for organizing information by system is relationship. Based on a given context, relationships and connections can be explored to flesh out a holistic understanding of a larger system.

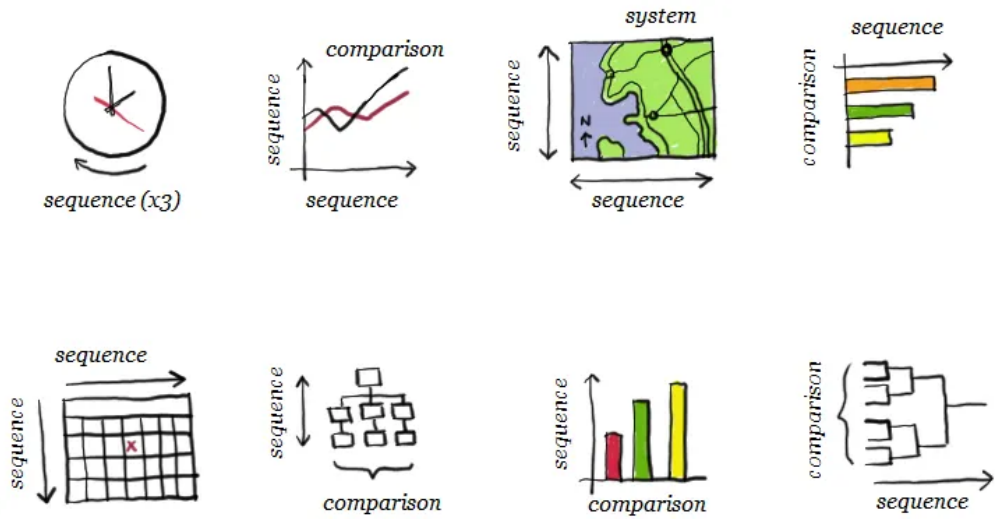
Arrange information systemically by asking: **“What are the relationships?”**

Combining Methods Leads to Insight

You can combine these organizing principles to generate insights. There are an infinite number of possible combinations, but you can generate many possibilities by remembering to ask these three questions:

1. In what order?
2. Compared to what?
3. What are the relationships?

Now I have a question for you: **What can you discover?**



Data Visualization Workflow: 1/6

Understand the context. Who? What? How?

Therefore, the first lesson is to understand the context and then embarking on your journey of utilizing the data as per the understood context.

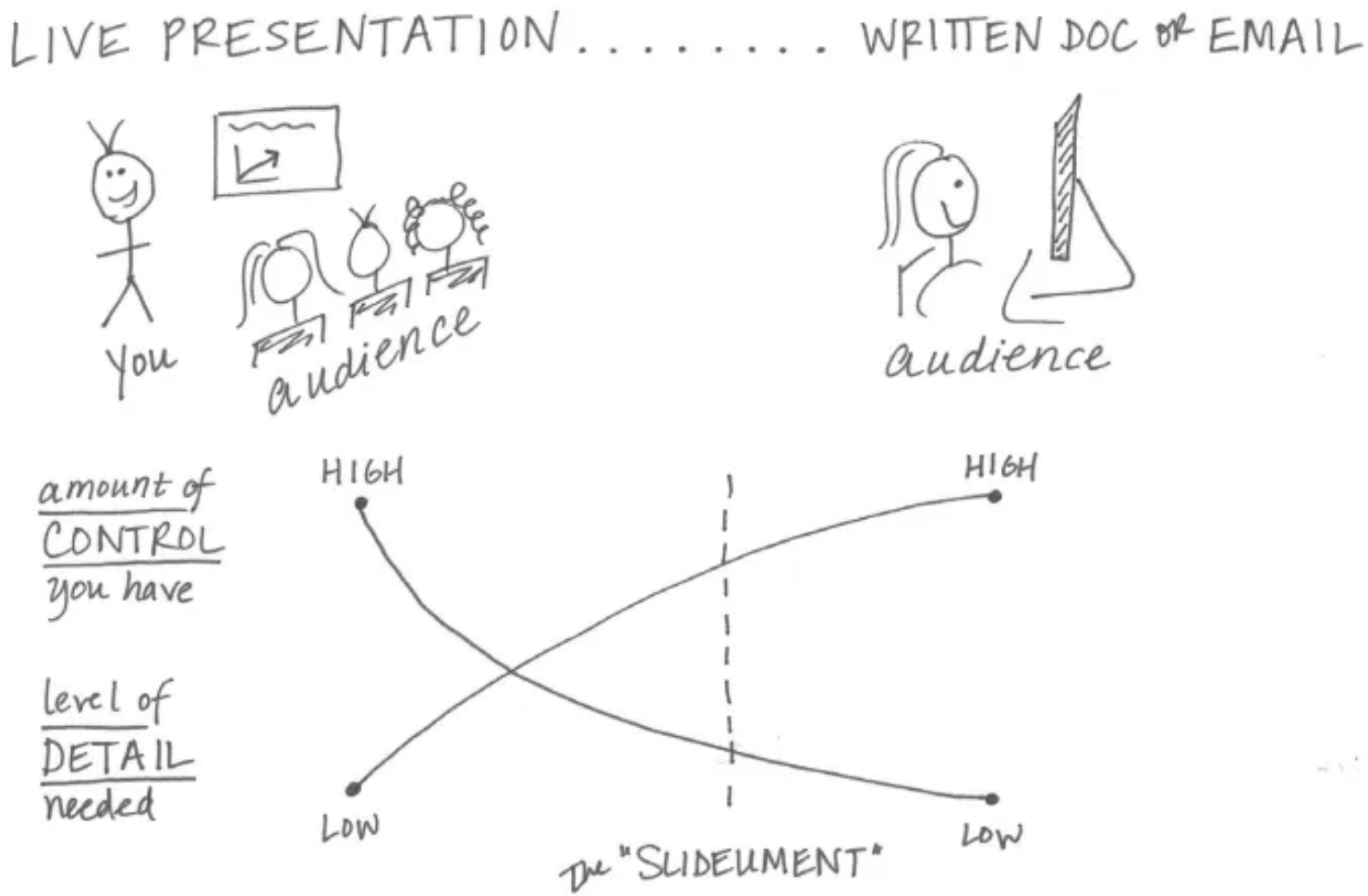


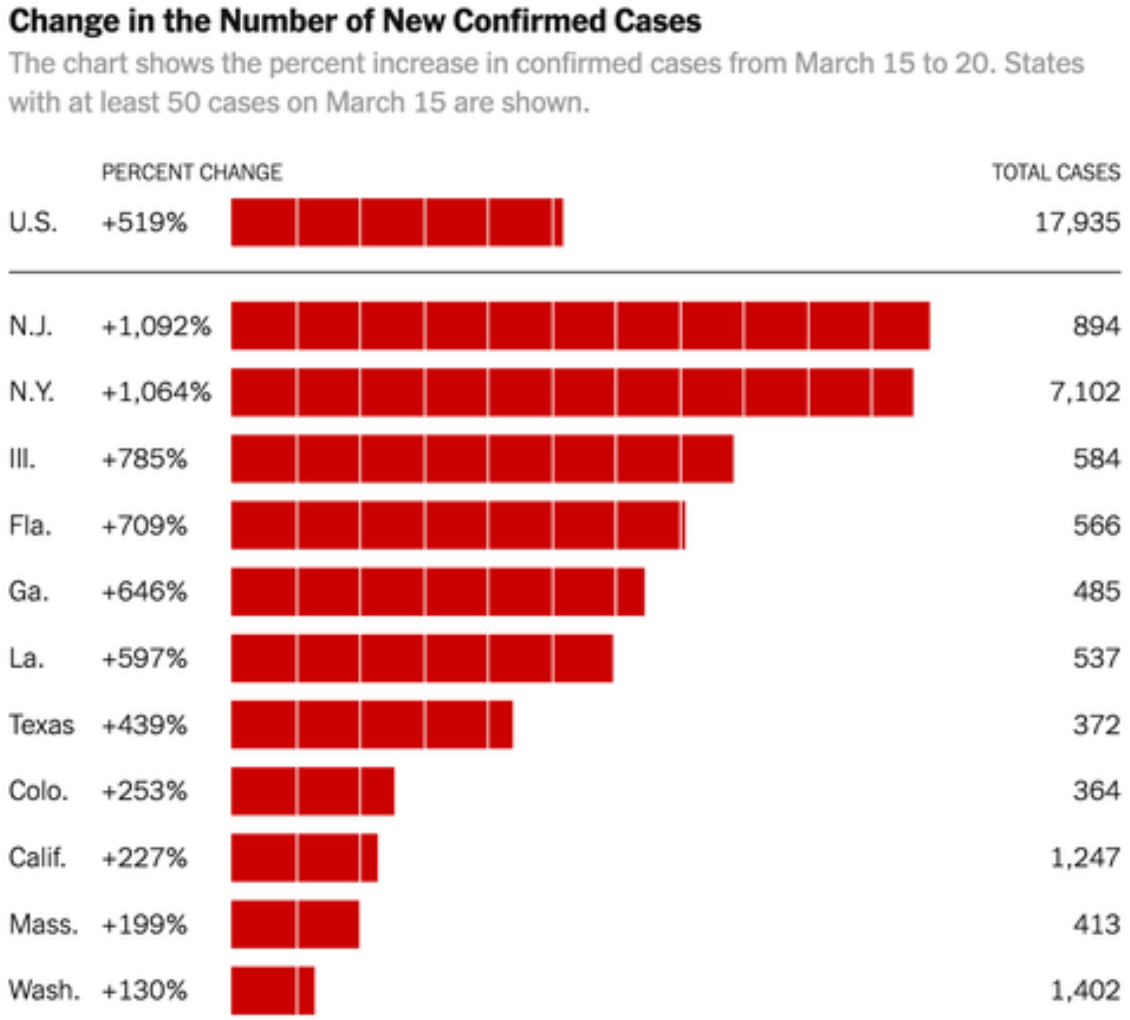
FIGURE 1.1 Communication mechanism continuum

Data Visualization Workflow: 2/6

Choose an appropriate visual display

We covered it during the previous class :)

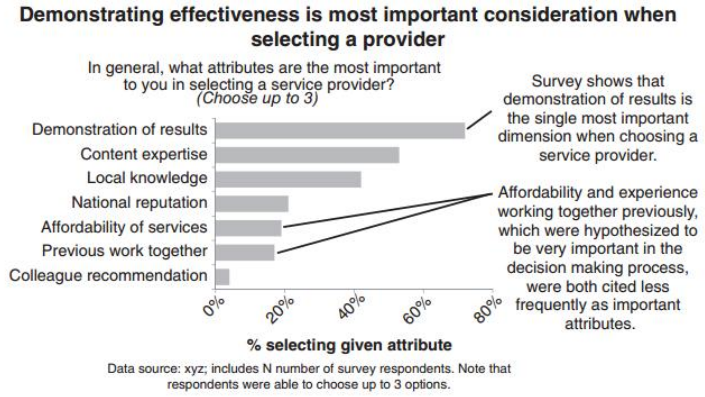
(Nussbaumer, p36)

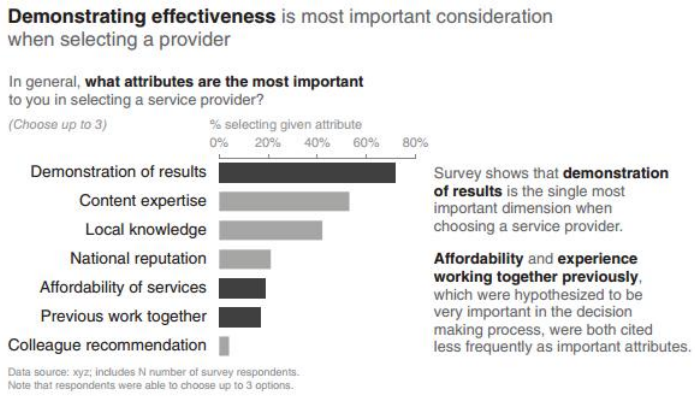


Data Visualization Workflow: 3/6

Eliminate clutter

Clutter is visual elements that take up space but don’t increase understanding.





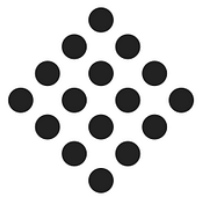
Data Visualization Workflow: 4/6

Focus attention where you want it

- **Proximity** is that human tendency to think physically close object as belonging to the same group.
- **Similarity** means that, objects that are of similar colour, shape, size, or orientation are perceived as related or belonging to part of a group.
- **Enclosure:** we think of objects that are physically enclosed together as belonging to part of a group. Furthermore, humans like simplicity rather than complexity:
- **Continuity** is the human tendency to seek the most smooth path and even create one even if explicitly no such continuity exists.

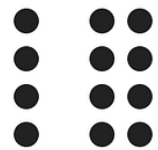
Gestalt Principles

UXCHEAT.com



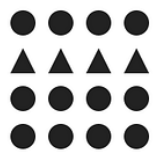
Good Figure

Objects groupped together tend to be perceived as a single figure. Tendency to simplify.



Proximity

Objects tend to be grouped together if they are close to each other.



Similarity

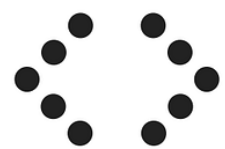
Objects tend to be grouped together if they are similar.

Continuation

When there is an intersection between two or more objects, people tend to perceive each object as a single uninterrupted object.

Closure

Visual connection or continuity between sets of elements which do not actually touch each other in a composition.



Symmetry

The object tend to be perceived as symmetrical shapes that form around their center.

Data Visualization Workflow: 5/6

Think like a designer .. and above all else show data.

Graphical elegance is often found in simplicity of design and complexity of data.

Think like a designer

- **Make it legible:** use a consistent, easy-to-read font (consider both typeface and size). *Make the visual accessible with text.*
- **Keep it clean:** make your data visualization approachable by leveraging visual affordances.
- **Use straightforward language:** choose simple language over complex, choose fewer words over more words, define any specialized language and spell out acronyms.
- **Remove unnecessary complexity:** when making a choice between simple and complicated, favor simple.
- **Align elements to improve aesthetics**

Data Visualization Workflow: 6/6

Tell a story

3-minute story: if you had only three minutes to tell your audience what they need to know, what would you say?’

Therefore it is important to understand the context and then embarking on your journey of utilizing the data as per the understood context.

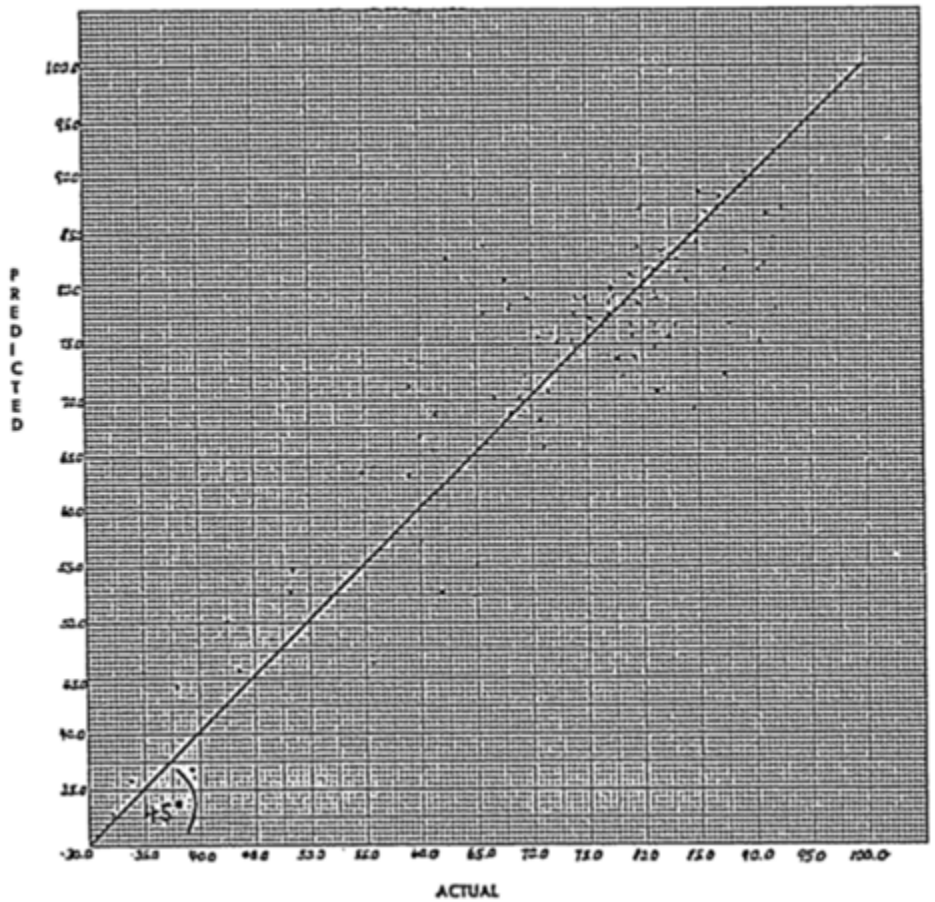
See also: https://www.storytellingwithdata.com/blog/2014/02/the-3-minute-story

20.3
15.2
14.6
11.3
10.1
8.4
5.1
81
123
182
227
255
291
357

Friendly vs Unfriendly Data Graphics

(Tufte. p183, "Aesthetics and Technique in Data Graphical Design)

Relationship of Actual Rates of Registration to Predicted Rates
(104 cities 1960).



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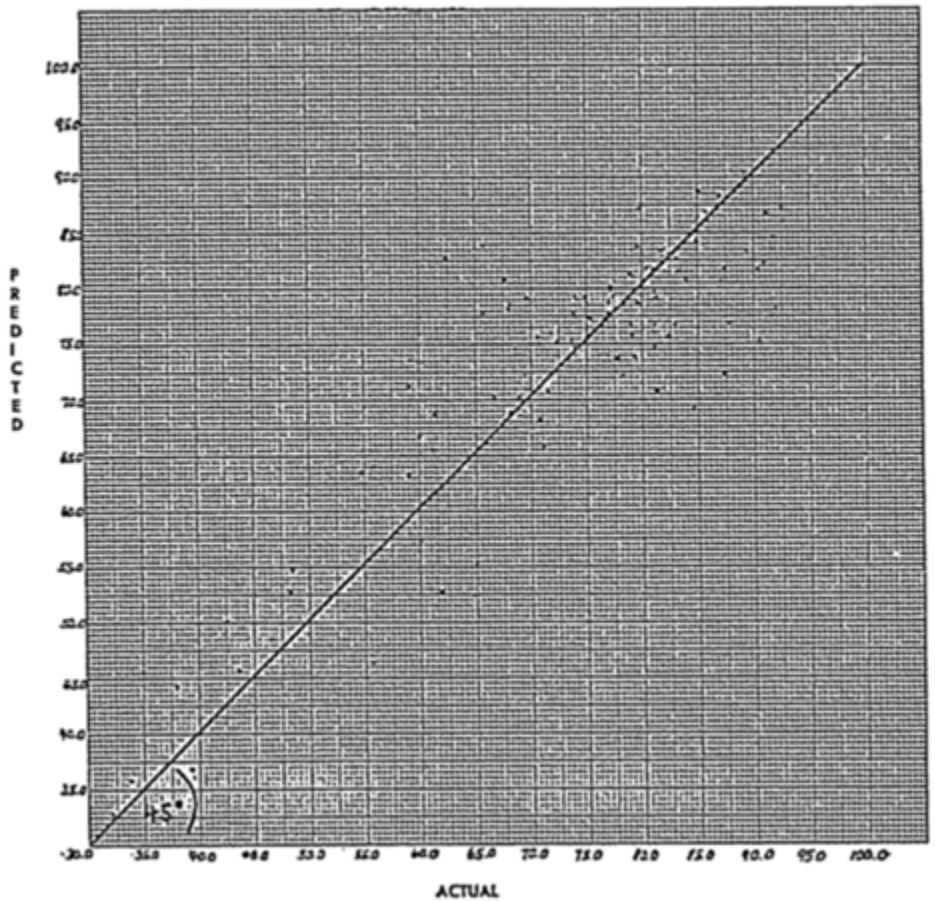
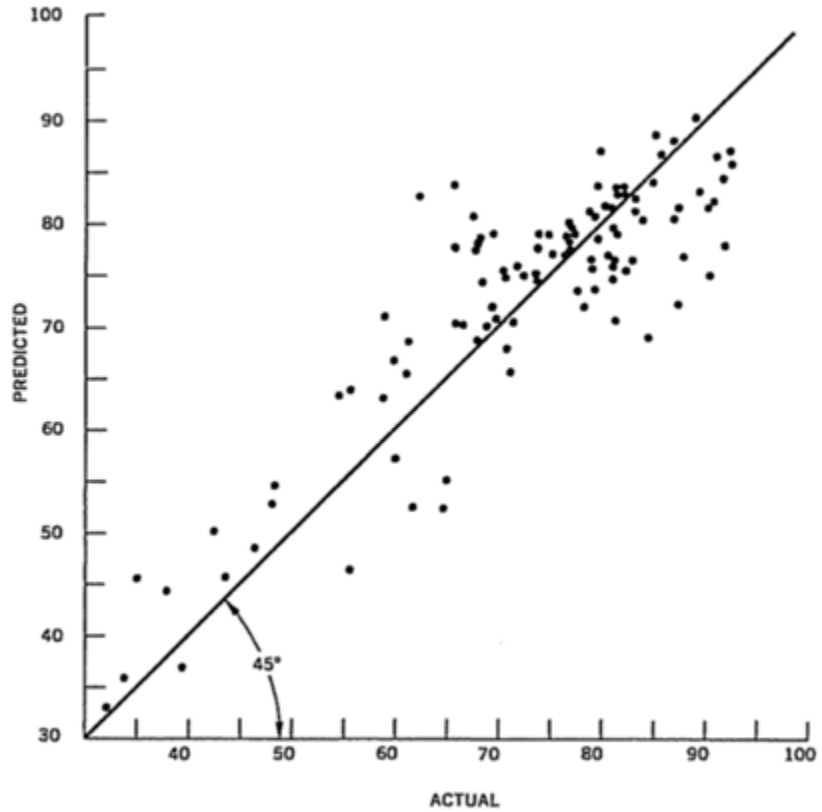




Relationship of Actual Rates of Registration to Predicted Rates (104 cities 1960).

More Tips. Friendly Graphs

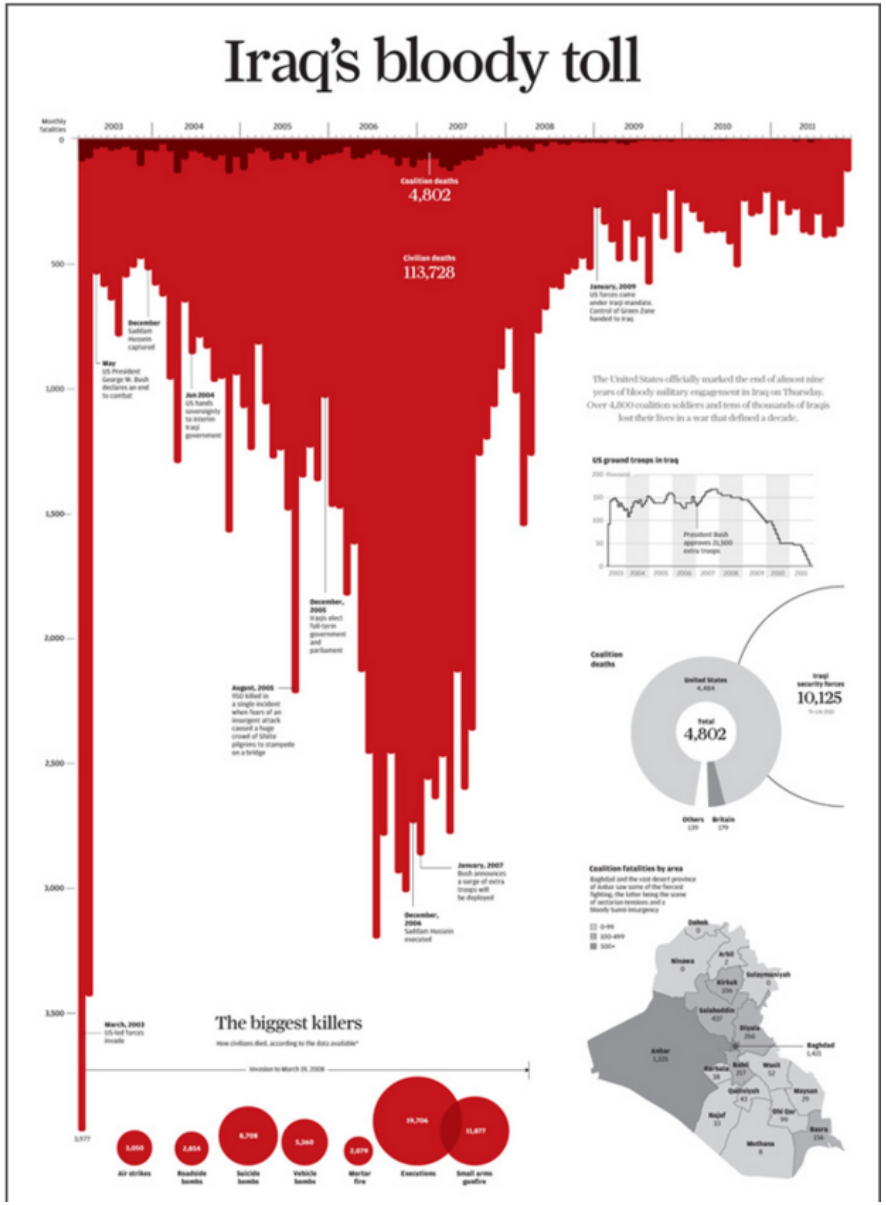
- Words are spelled out, no mysterious encodings
- Words run from left to right
- Little messages help explain data
- Shadings, hatches and colors are avoided.
- Labels are placed on graphics itself, so no legend is required
- Graphics attract viewers, provokes curiosity, every visual characteristic has meaning
- Colors are chosen so color blind can read them
- Type is clear and precise
- Type is upper and lowercase

More tips. Unfriendly Graphs

- Use of abbreviations
- Words run vertically, particularily along y-axis. Words run in different directions
- Graphic is cryptic and needs repeated references to scattered text
- Obscure codings need to go back to legend and graphic
- Chartjunk
- Design insensitive to color defunct
- Type is overbearing
- Type is all capitals

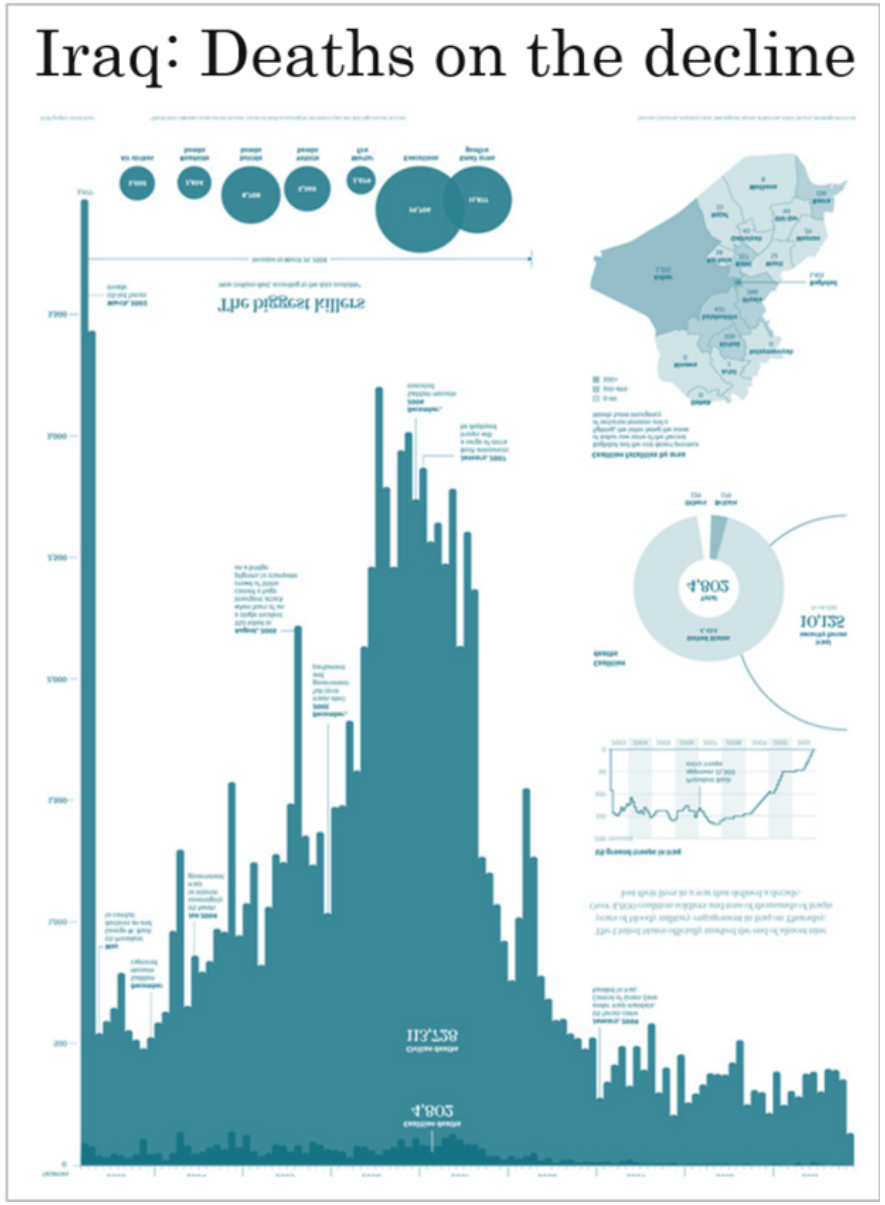
Data can tell multiple stories

“Iraq’s Bloody Toll” appeared in the South China Morning Post in late 2011, designed by Simon Scarr. It shows the number of deaths per month in Iraq from 2003 until the beginning of the US withdrawal of troops at the end of 2011.



Data can tell multiple stories

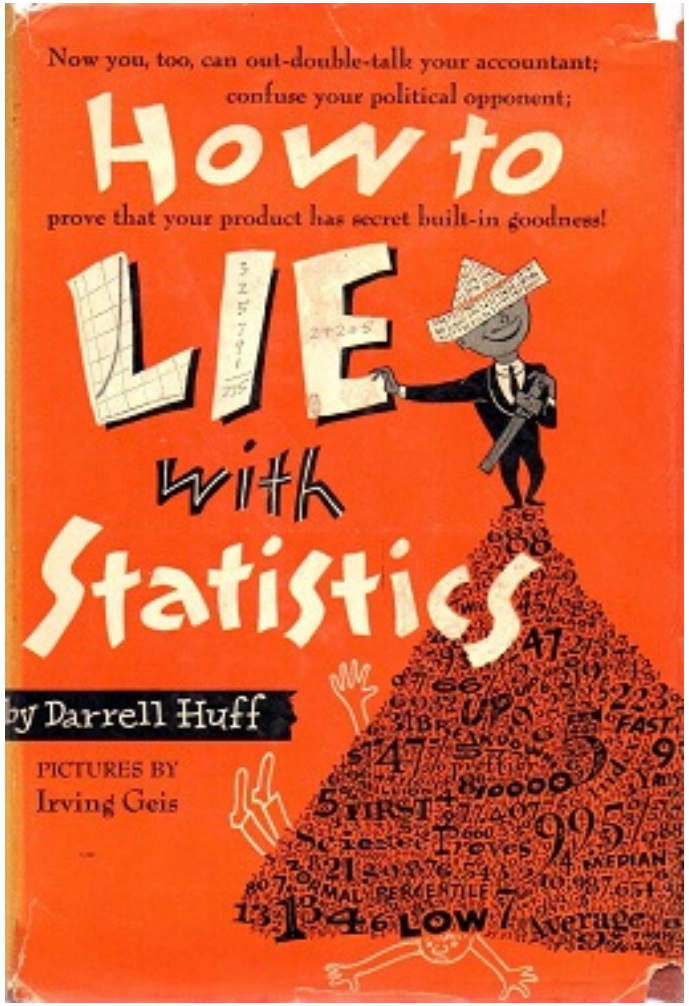
After the combat phase in 2003, deaths dropped. By 2006 and 2007, sectarian violence was ripping Iraq apart. After that, however, deaths again began to drop. Now, instead of “Iraq’s Bloody Toll” we could legitimately call it “Iraq: Deaths on the Decline.”



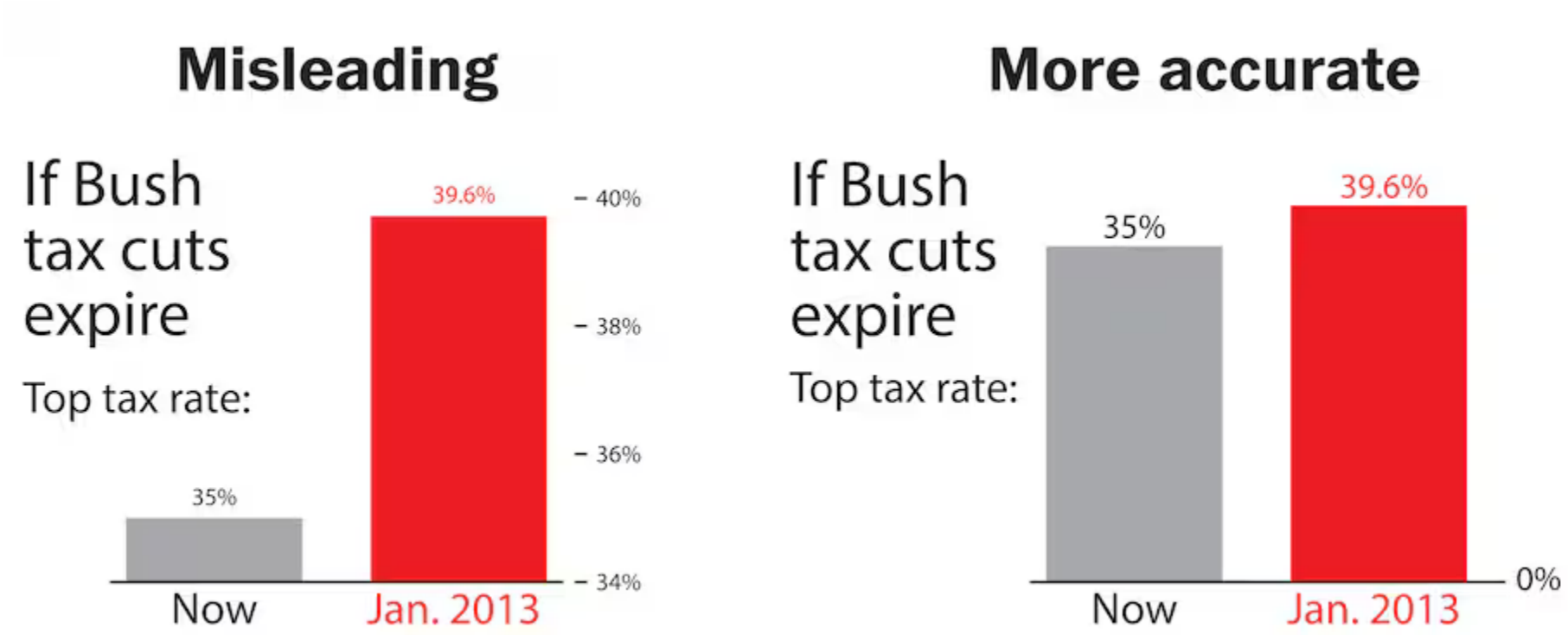
Common Mistakes

- Leaving gaps/changing the scale in vertical axes
- Uneven shading/colours
- Unfair emphasis on some sections
- Distorting areas in histograms (bar widths should always be equal)
- Use of 3-dimensions instead of two
- Misleading use of pictograms

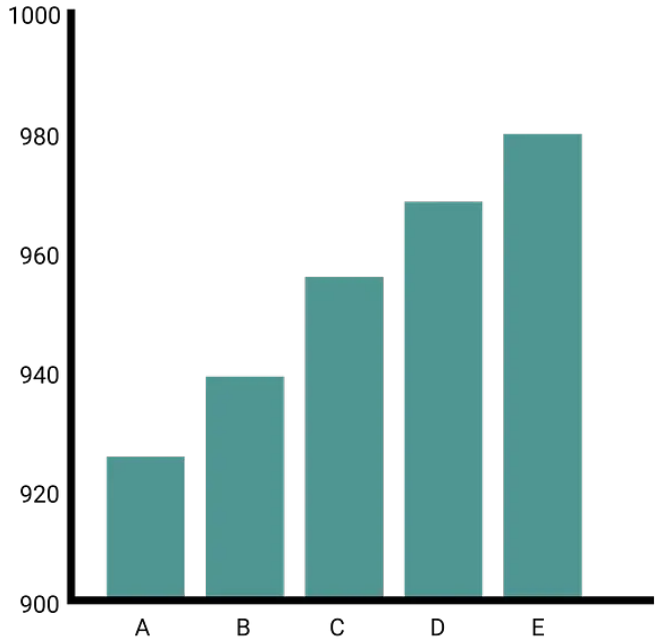
See also: https://mathspace.co/textbooks/syllabuses/Syllabus-463/topics/Topic-8888/



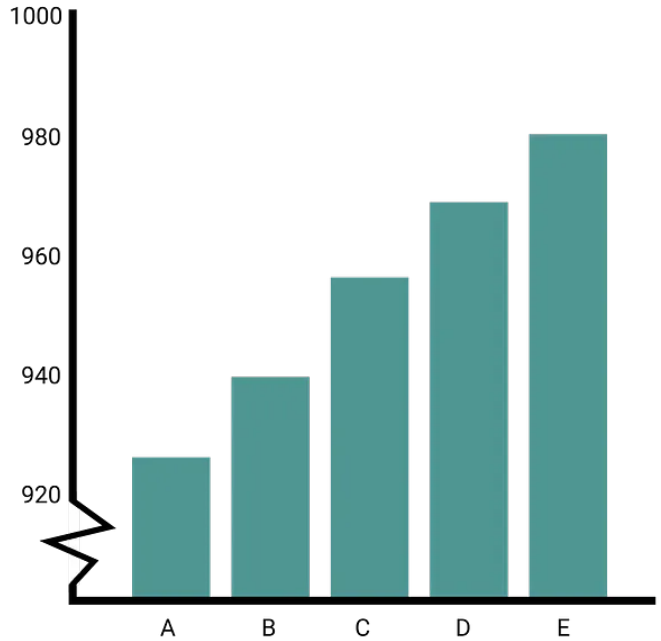
Dodgy Graphs: Gaps in vertical axes



Misleading Graph

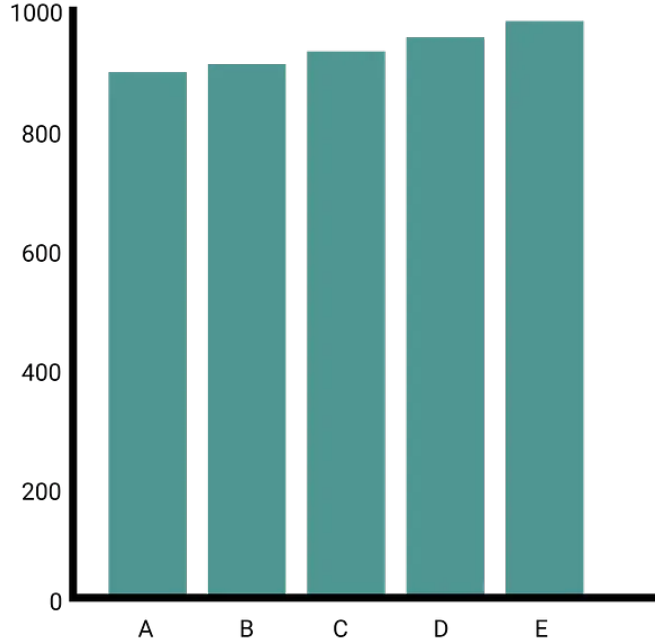


Adding Zero-Break



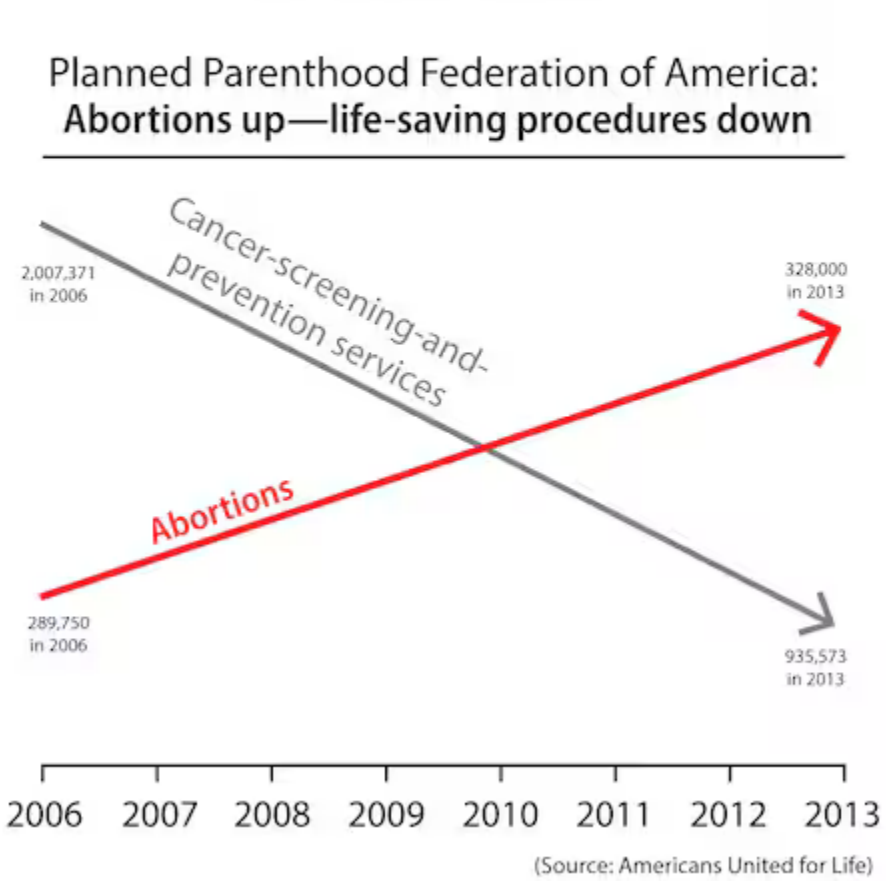
or

Starting from Zero

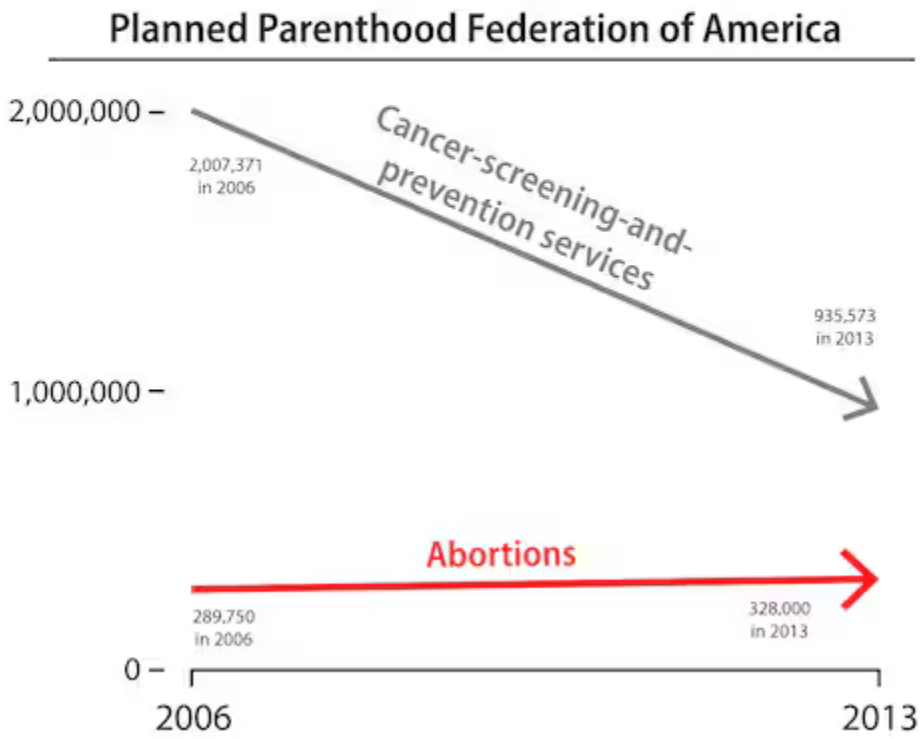


Dodgy Graphs: Changing the scale in value axes

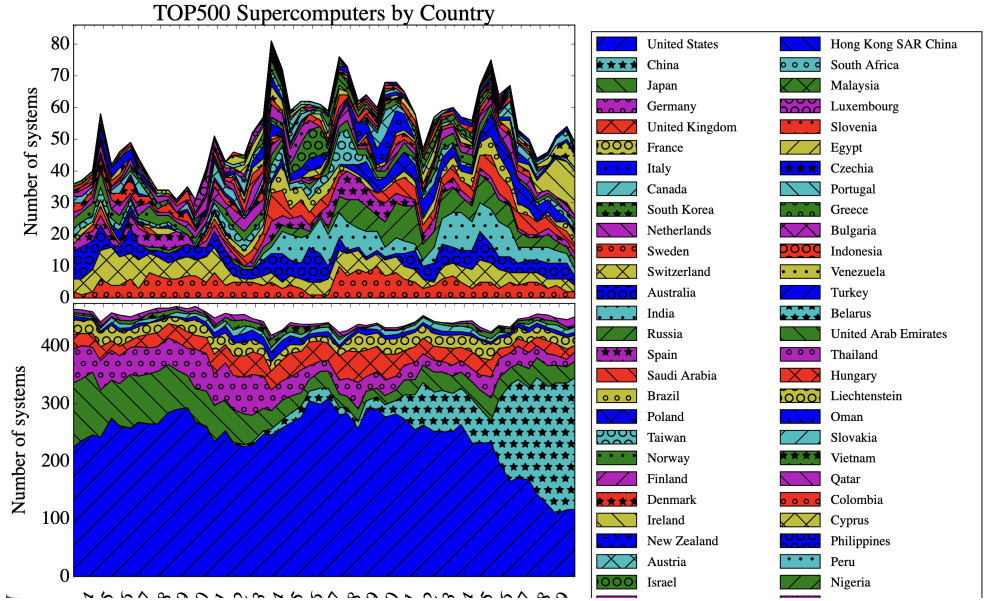
Misleading

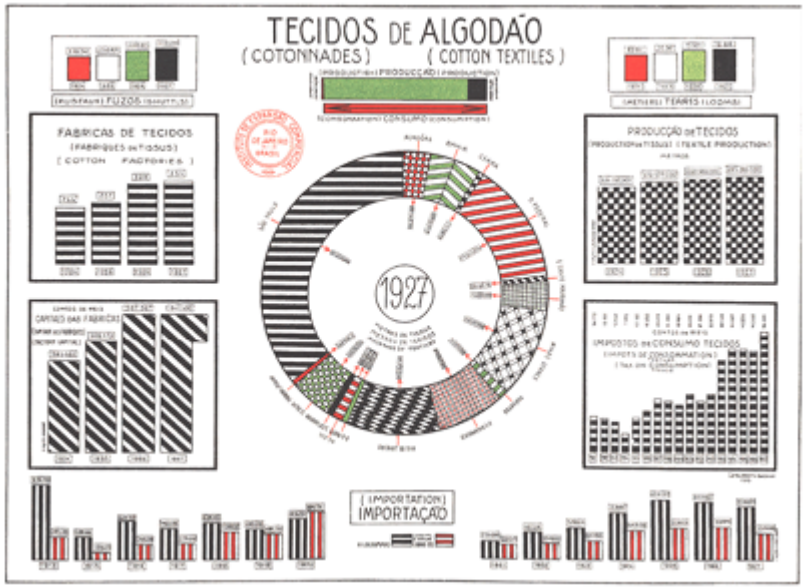


More accurate



Dodgy Graphs: Uneven shading/colours





Dodgy Graphs: 3D

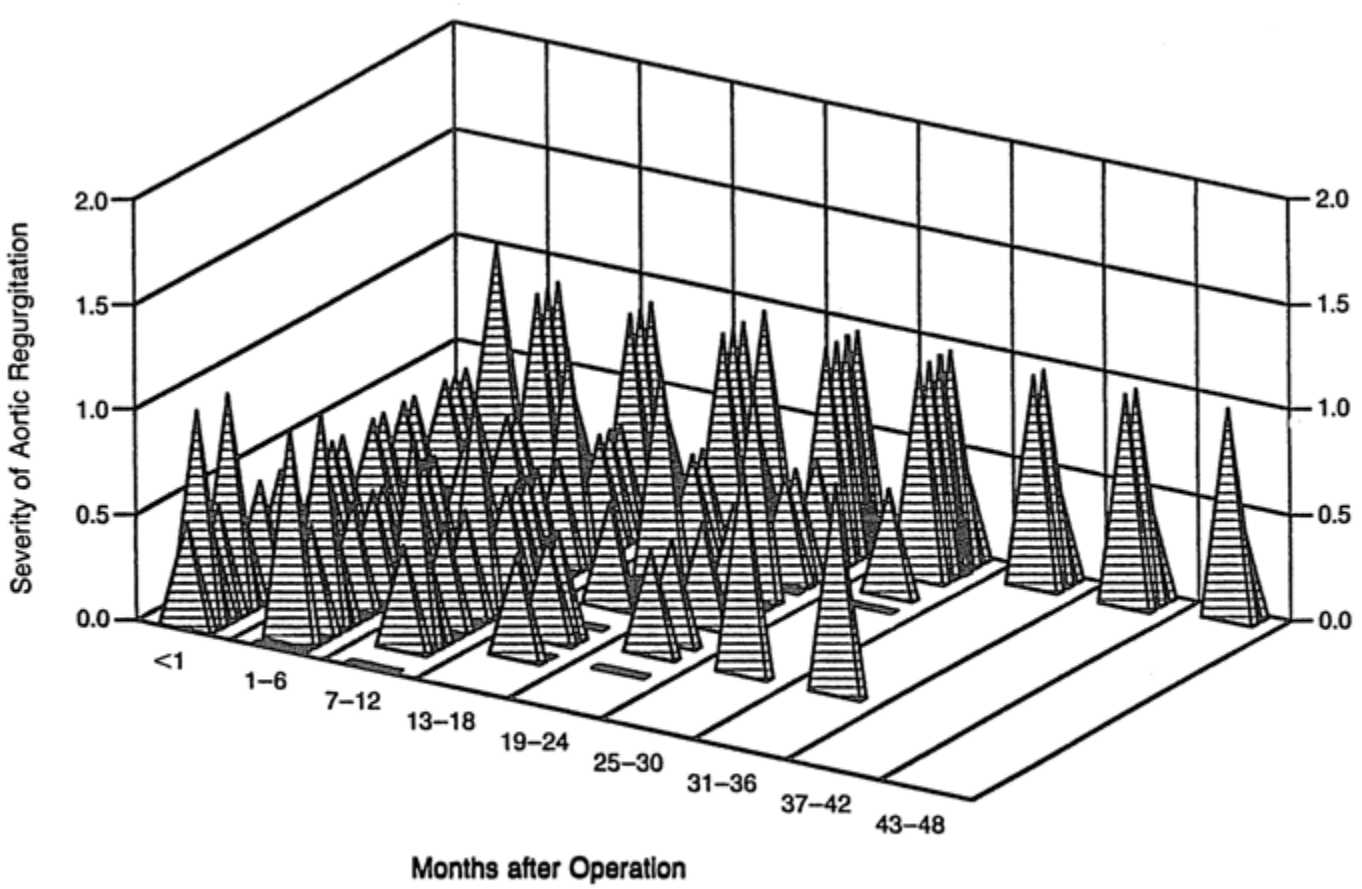
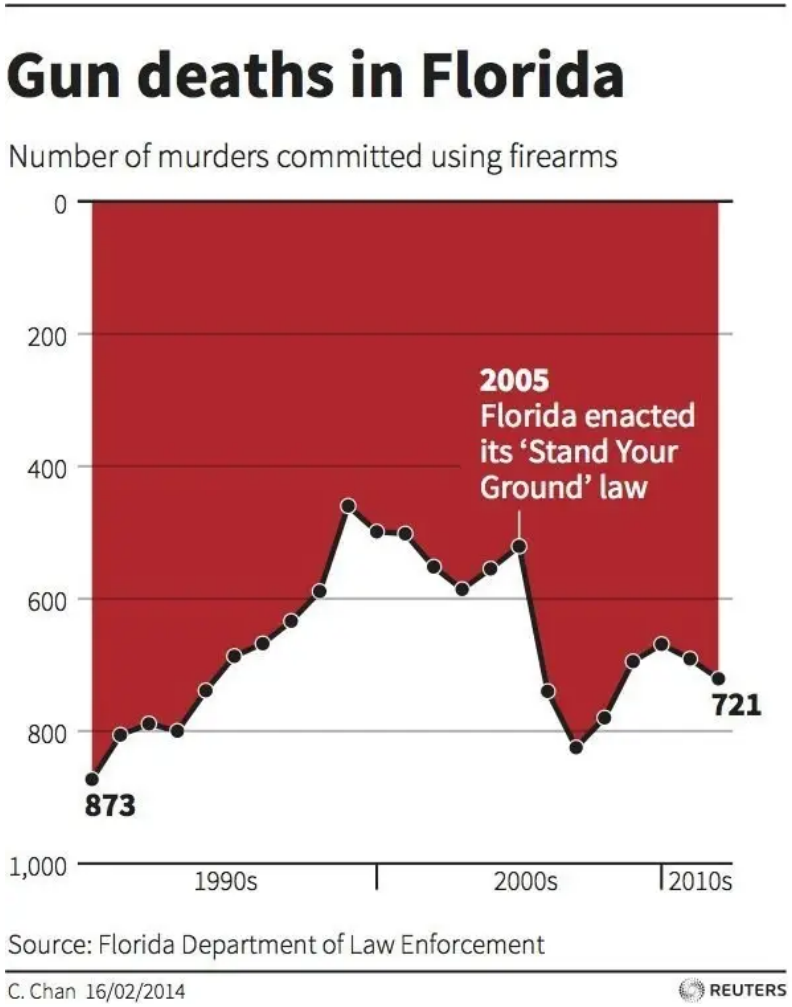
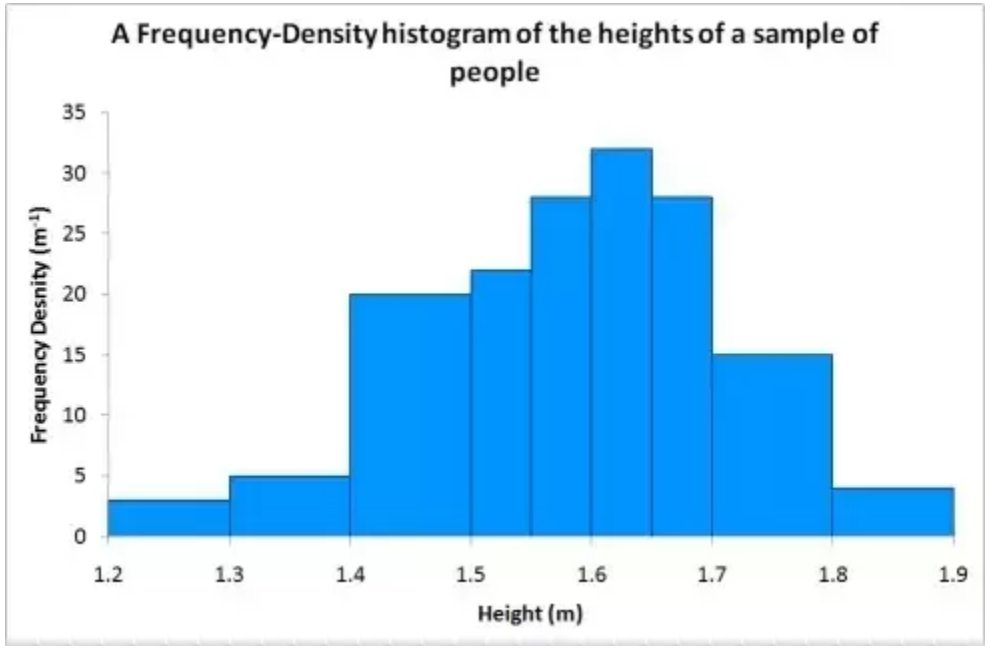


Figure 2. Serial Echocardiographic Assessments of the Severity of Regurgitation in the Pulmonary Autograft in 31 Patients.
The numerical grades were assigned according to the severity of regurgitation, as follows: 0, none; 0.5, trivial; 1.0 to 1.5, mild; 2.0, moderate; and 3.0, severe.

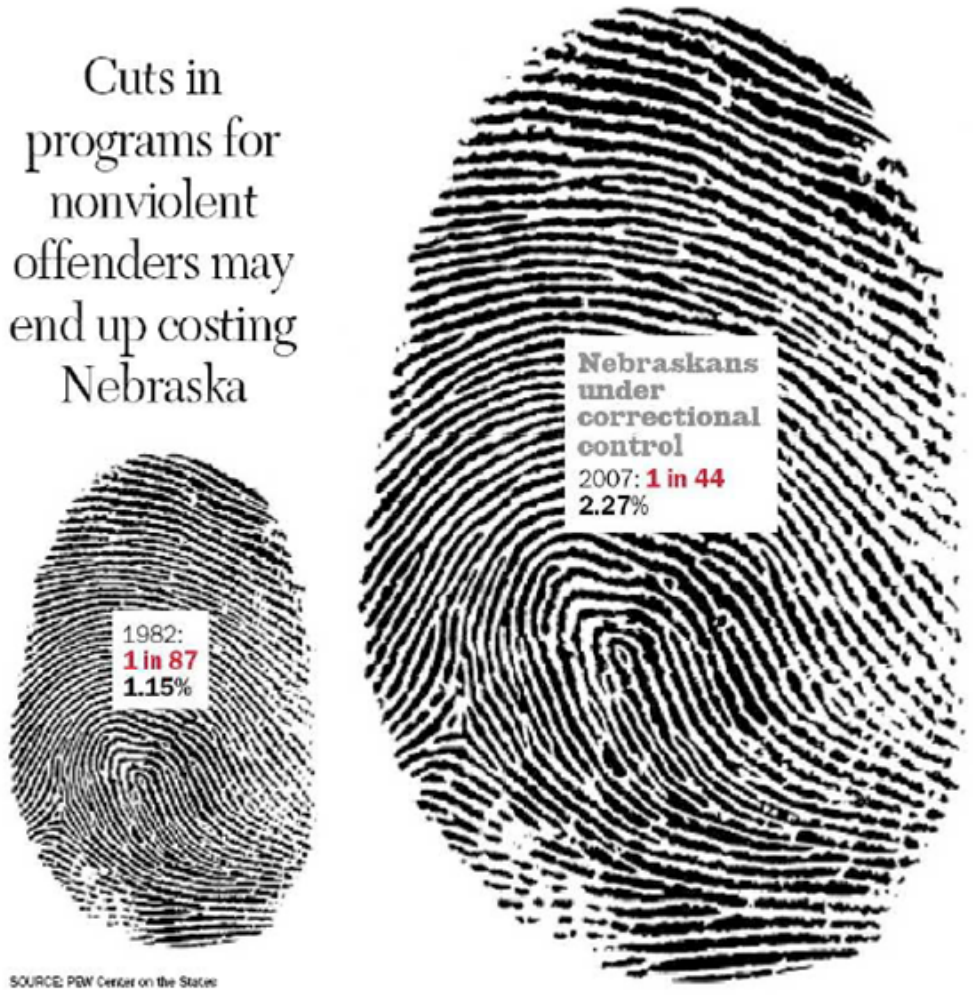
Dodgy Graphs: Unfair emphasis on some sections



Dodgy Graphs: Distorting areas in histograms



Dodgy Graphs: Misleading use of Pictograms



Main Takeaways

- Simpler is most often better.
- More information is better than less information.
- Do not assume your audience is stupid.
- Tables usually outperform graphics in reporting on small data sets of 20 numbers or less.
- Graphical excellence is nearly always multivariate.
- Time-series is the most common graphical design.
- Data is plural for datum. Datum = 1 data point.

Inspiration

- Data is Beautiful Subreddit. https://www.reddit.com/r/dataisbeautiful/
- Visualization Subreddit. https://www.reddit.com/r/visualization/
- Information is Beautiful. https://informationisbeautiful.net/
- Beautiful News. https://informationisbeautiful.net/beautifulnews/
- 10 Of The Best Data Visualization Examples From History & Today. https://www.tableau.com/learn/articles/best-beautiful-data-visualization-examples

De-Inspiration

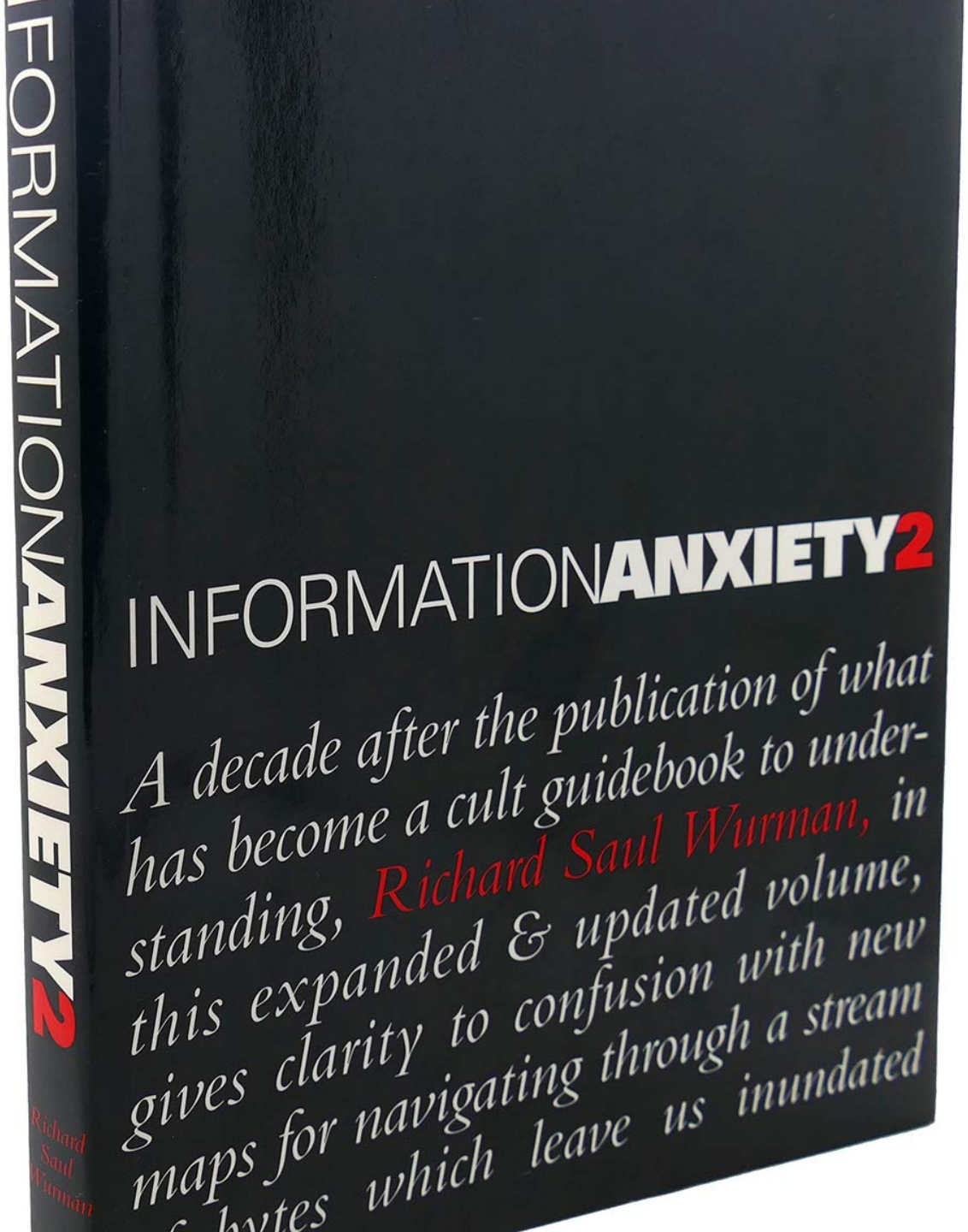
- Data is Ugly Subreddit. https://www.reddit.com/r/dataisugly/
- Bad Visualizations. https://www.tumblr.com/badvisualisations
- Bad Statistics. https://www.reddit.com/r/badstats/
- Shitty Graphs, Plots, and Charts. https://www.reddit.com/r/shittydataisbeautiful/

Information Anxiety 2

Richard Saul Wurman

2000

https://www.goodreads.com/en/book/show/259121.Information_Anxiety_2

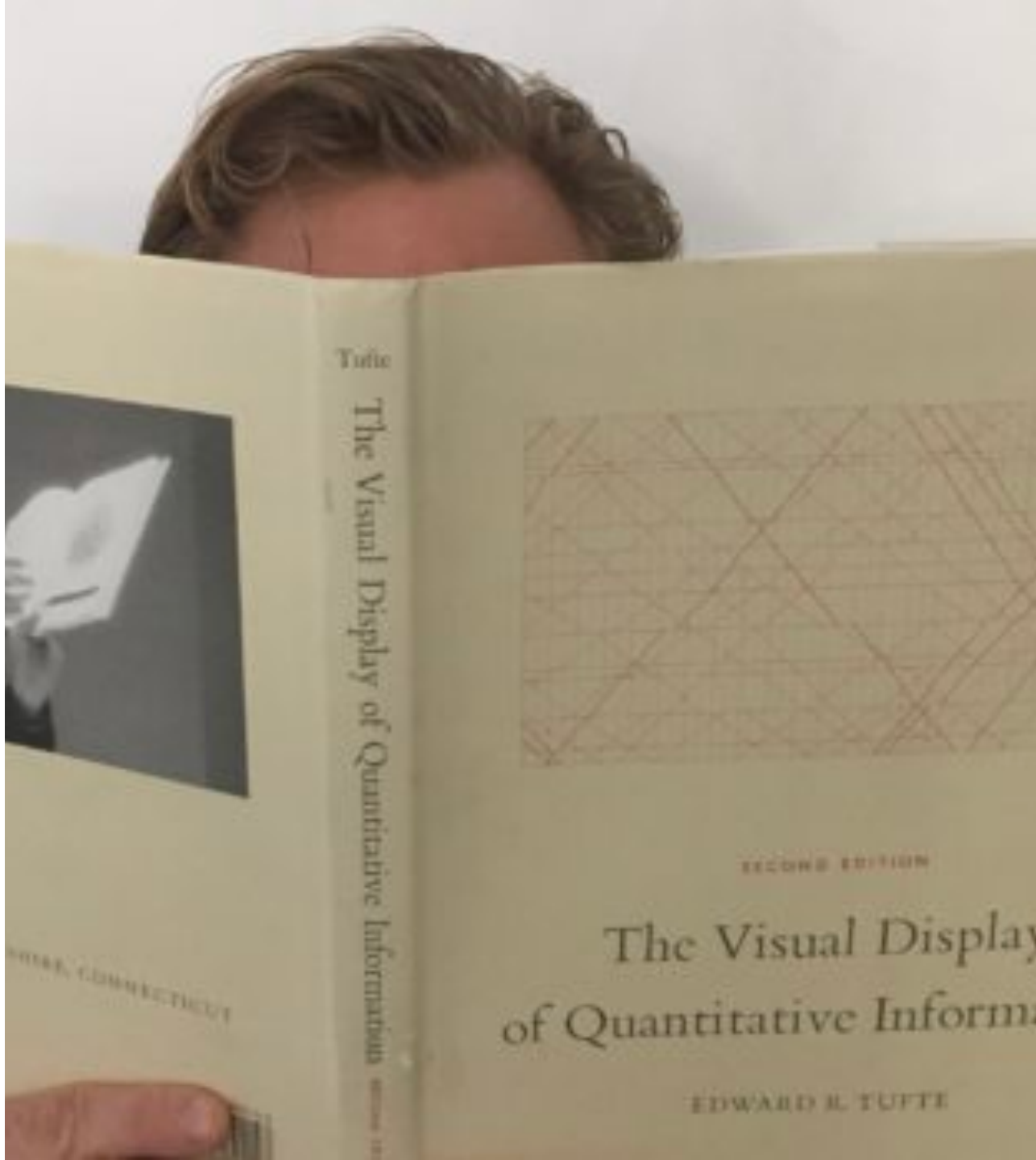


The Visual Display of Quantitative Information

Edward R. Tufte

2001

https://www.goodreads.com/book/show/17744

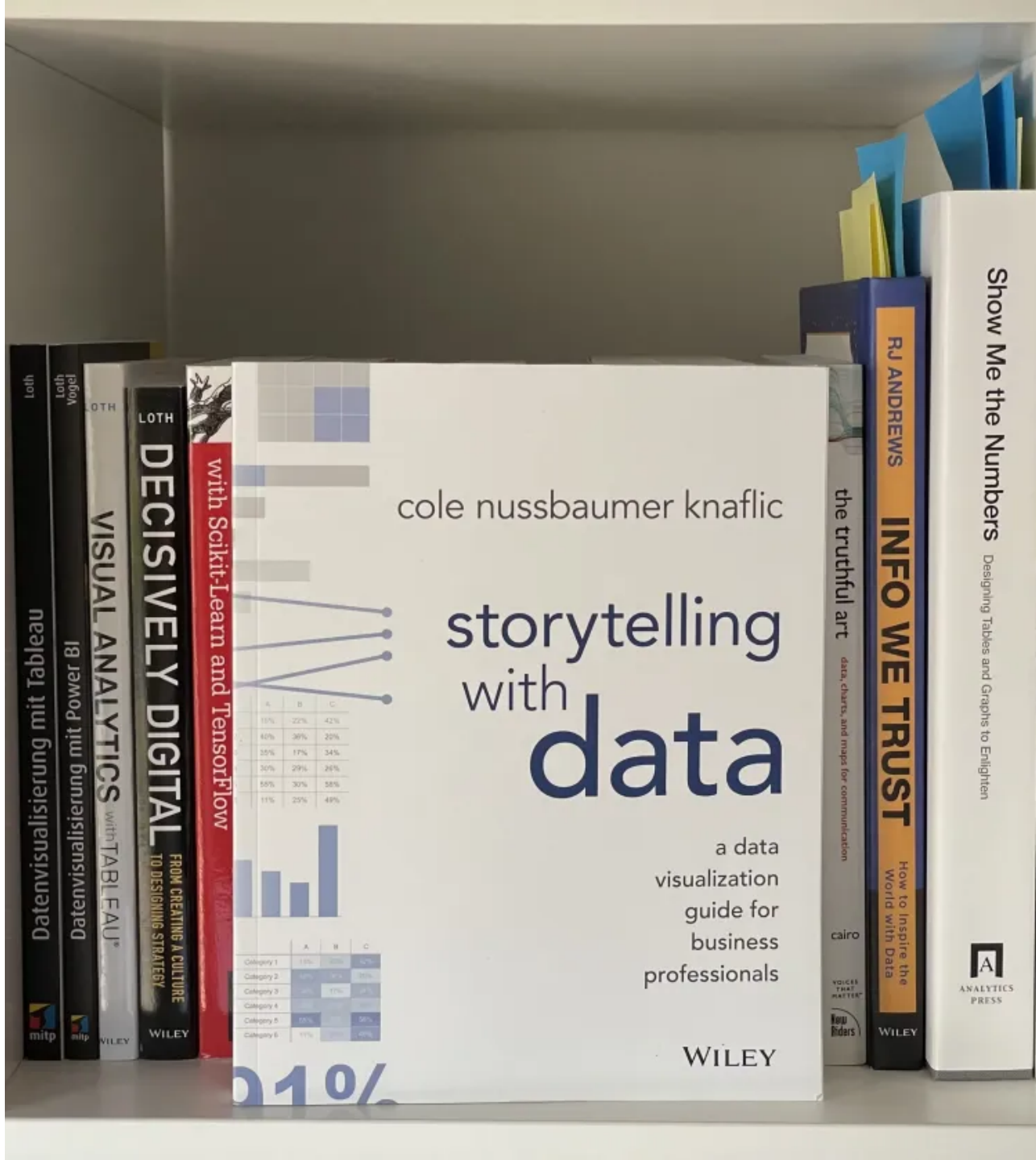


Storytelling with Data: A Data Visualization Guide for Business Professionals

Cole Nussbaumer Knaflic

2015

https://www.goodreads.com/book/show/26535513



References

- 5 Hat Racks Principle: Organize & Present Your Research Insights. https://medium.com/afraid-of-bees/5-hat-racks-principle-organize-present-your-research-insights-41e774aab084
- The beauty of data visualization - David McCandless. https://www.youtube.com/watch?v=5Zg-C8AAIGg
- The Gospel According to Tufte. http://www-personal.umich.edu/~jpboyd/eng403_chap2_tuftegospel.pdf
- Graphical Integrity and Redesign. http://jcsites.juniata.edu/faculty/rhodes/ida/graphicalIntRedes.html
- Easy Graph Mistakes to Avoid. So avoid them. https://nickch-k.github.io/DataCommSlides/Easy_Mistakes_to_Avoid.html

Thank you!