# Graphical Displays Should

1. Show the Data
2. Provoke Thought About the Subject at Hand
3. Avoid Distorting the Data
4. Present Many Numbers in a Small Space
5. Make Large Datasets Coherent
6. Encourage Eyes to Compare Data
7. Reveal Data at Several Levels of Detail
8. Serve a Reasonably Clear Purpose
9. Be Closely Integrated with Statistical and Verbal Descriptions of the Dataset

— Edward Tufte, *The Visual Display of Quantitative Information*

Principles of Graphical Excellence

- Graphical excellence is the well-designed presentation of interesting data—a matter of *substance*, of *statistics*, and of *design*

- Graphical excellence consists of complex ideas communicated with clarity, precision, and efficiency

- Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space

- Graphical excellence is nearly always multivariate

- And graphical excellence requires telling the truth about the data

— Edward Tufte, *The Visual Display of Quantitative Information*
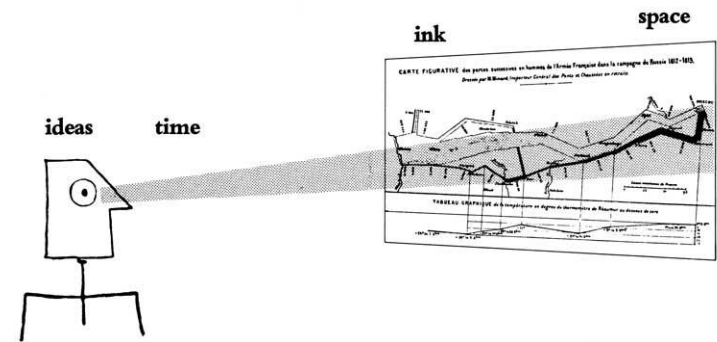
Ten Guidelines

Kellener & Wagener

1. Create the simplest graph that conveys the information you want to convey

2. Consider the type of encoding object and attribute used to create a plot

3. Focus on visualizing patterns or on visualizing details, depending on the purpose of the plot

4. Select meaningful axis ranges

5. Data transformations and carefully chosen graph aspect ratios can be used to emphasize rates of change for time-series data
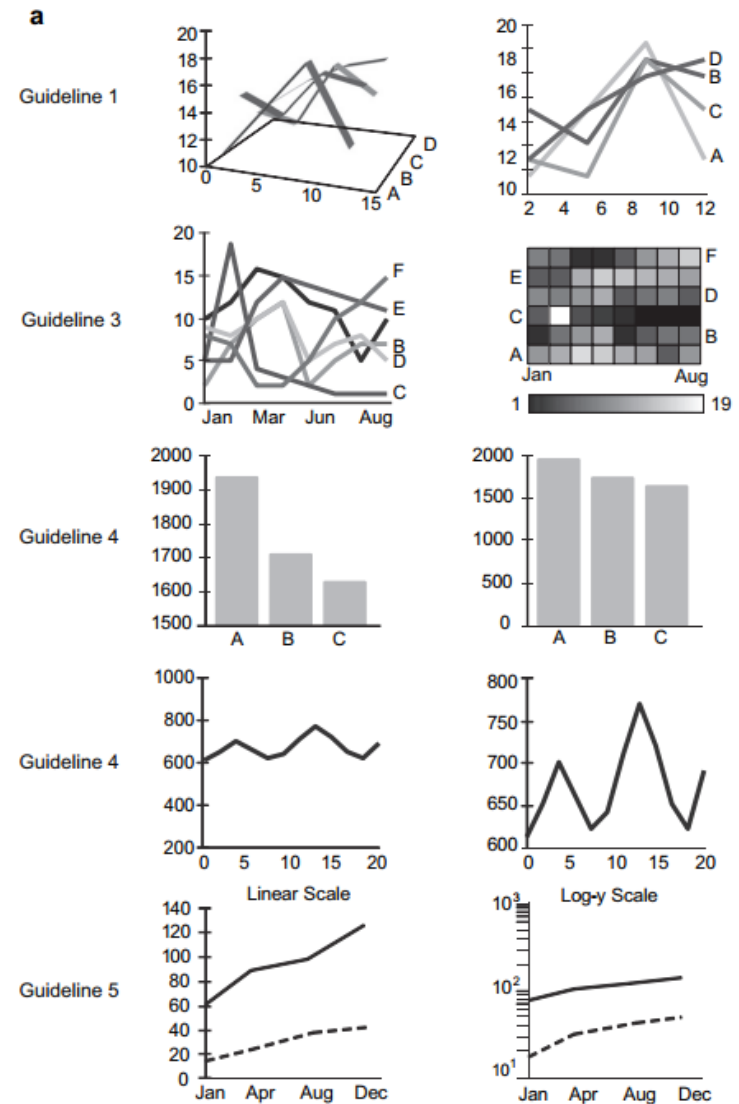
Fig. 1. Visual examples of the guidelines, excluding guideline 2. (a) illustrates guidelines 1, 3, 4 and 5. (b) illustrates guidelines 6 through 10.

Ten Guidelines

Kellener & Wagener

6. Plot overlapping points in a way that density differences become apparent in scatter plots

7. Use lines when connecting sequential data in time-series plots

8. Aggregate larger datasets in meaningful ways

9. Keep axis ranges as similar as possible to compare variables

10. Select an appropriate color scheme based on the type of data

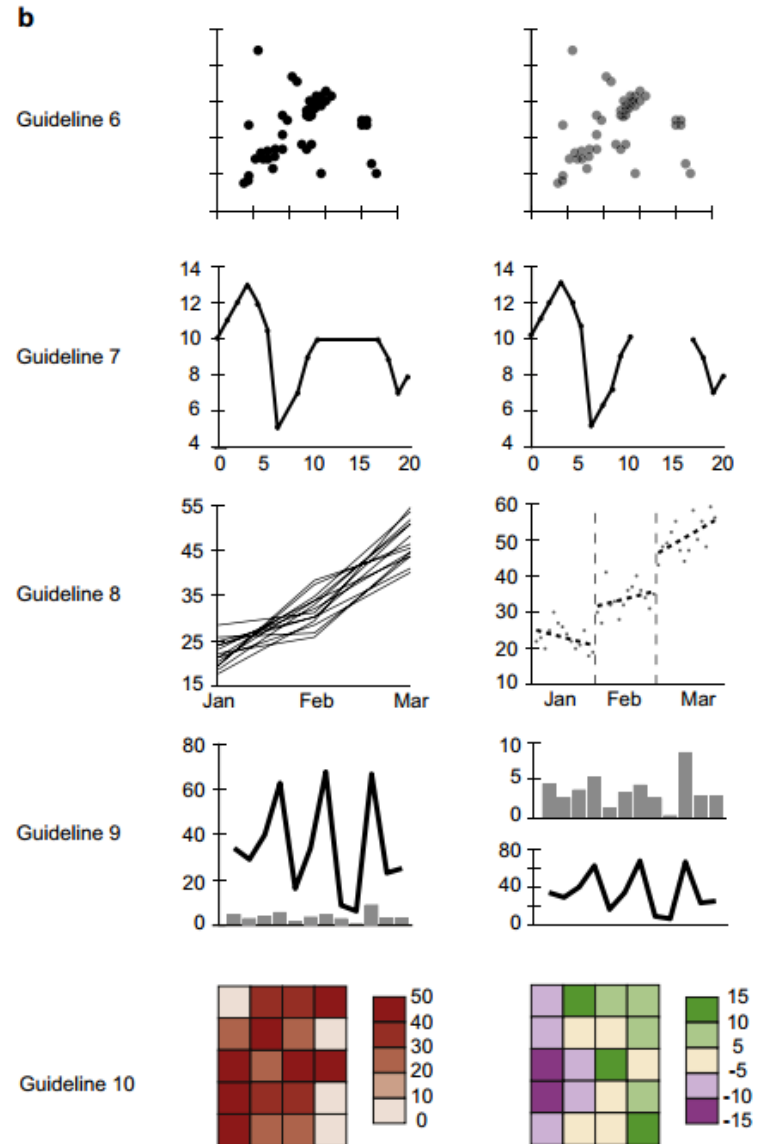C. Kelleher, T. Wagener / Environmental Modelling & Software xxx (2011) 1–6

Fig. 1. (continued).

References

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Stephen Few, *Show Me the Numbers: Designing Tables and Graphs to Enlighten,* 2004

Jessie Kennedy, *Principles of Information Visualization Tutorial Part 1: Design Principles*

Maureen Stone, *Choosing Colors for Data Visualization*, 2006

The Economist, *Numbers Guide: The Essentials of Business Numeracy,* 2014

Kelleher & Wagener, "Ten Guidelines for Effective Data Visualization in Scientific Publications," *Environmental Modelling & Software*, June 2011, pp. 822-827

Edward Tufte, *The Visual Display of Quantitative Information*

Part I GRAPHICAL PRACTICE
- Graphical Excellence
- Graphical Integrity
- Sources of Graphical Integrity and Sophistication

Part II THEORY OF DATA GRAPHICS
- Data-Ink and Graphical Redesign
- Chartjunk: Vibrations, Grids and Ducks
- Data-Ink Maximization and Graphical Design
- Multifunctioning Graphical Elements
- Data Density and Small Multiples
- Aesthetics and Technique in Data Graphical Design