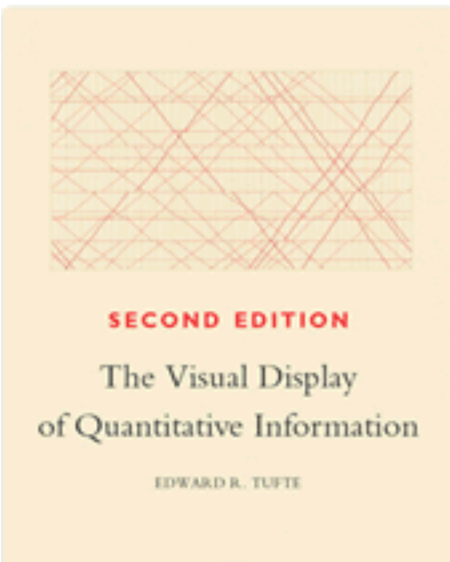
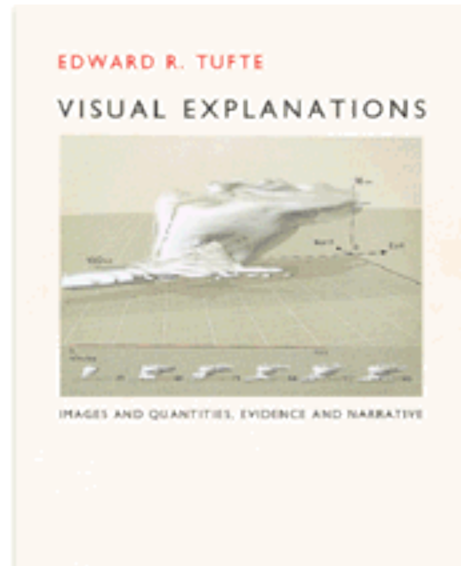


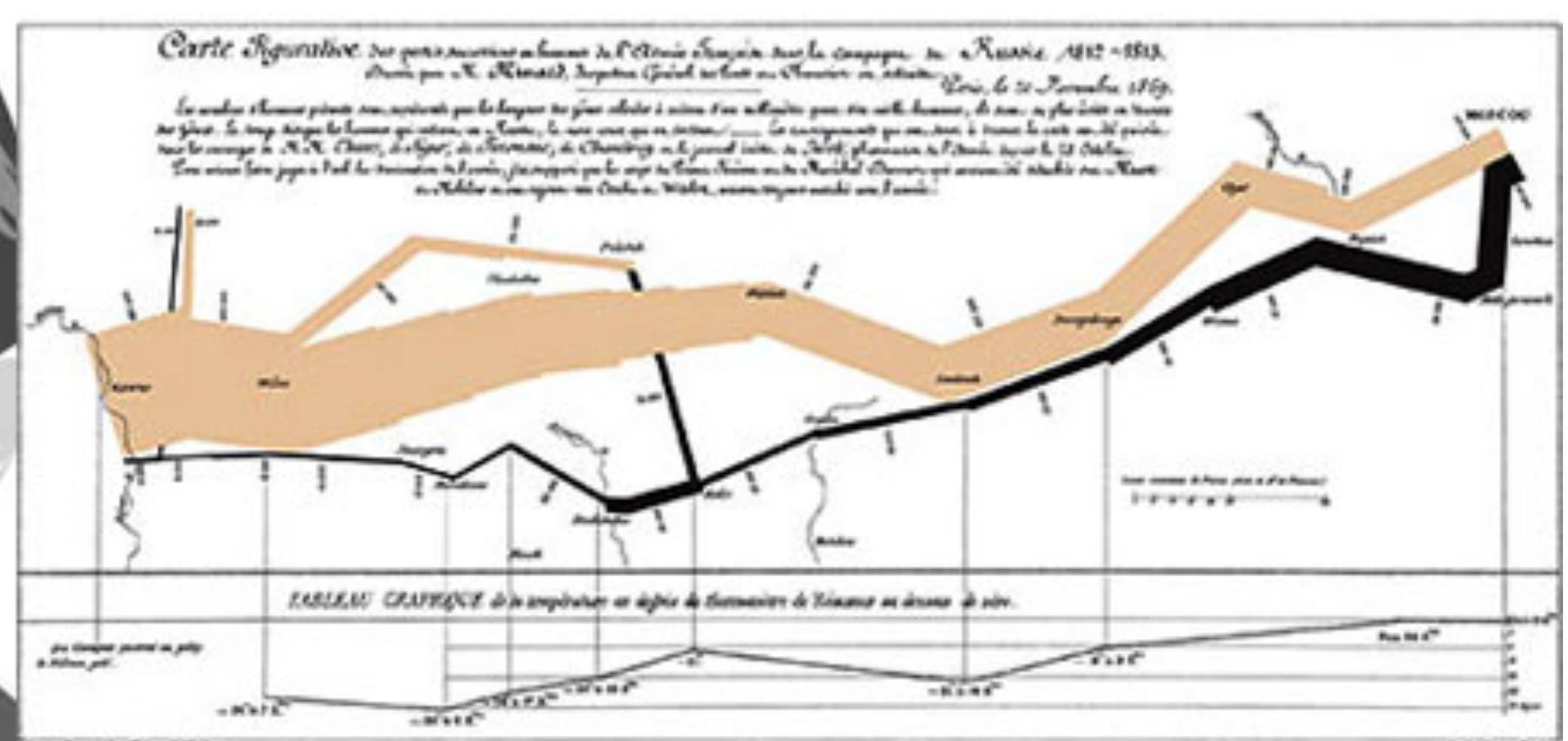


LESSONS FROM
EDWARD TUFTE

WHO IS EDWARD TUFTE?

an analytical design theorist, educator, and landscape sculptor best known for his self-published books on analytical design

Illustrated by Merchant for the Brunswick Review



1

STRIVE FOR
GRAPHICAL INTEGRITY

Visual representations of data

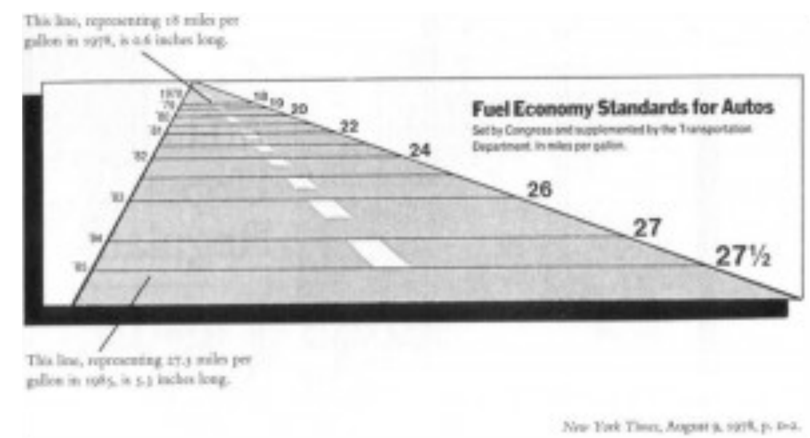
must tell the truth.

1 GRAPHICAL INTEGRITY

THE LIE FACTOR

Calculated by dividing the size of the effect shown in the graphic by the size of the effect in the data.

If the Lie Factor is greater than 1 the graph overstates the effect.

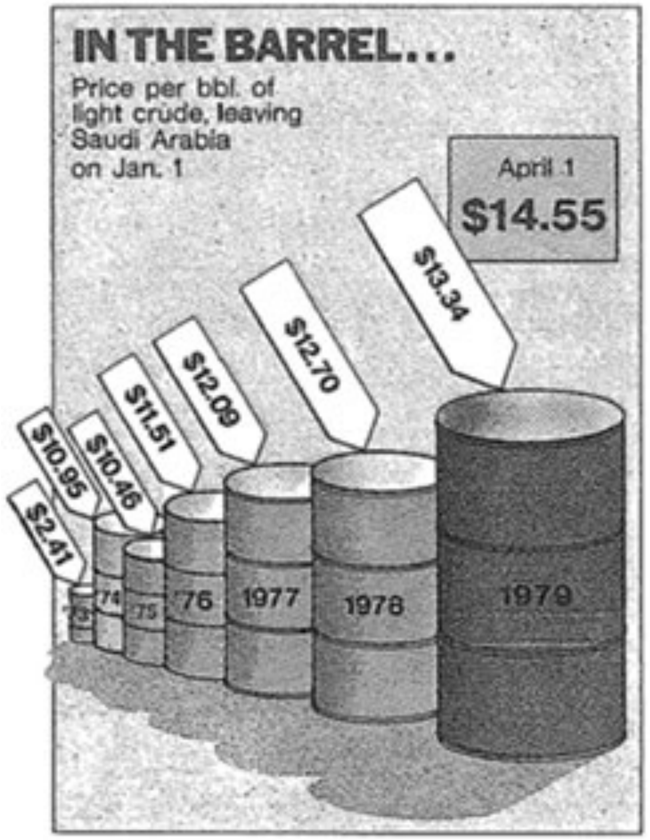


According to Tufte the Lie Factor of this graph is 14.8. A numerical change of 53% is represented by a graphical change (size of horizontal lines) of 783%.

1 GRAPHICAL INTEGRITY

1ST PRINCIPLE

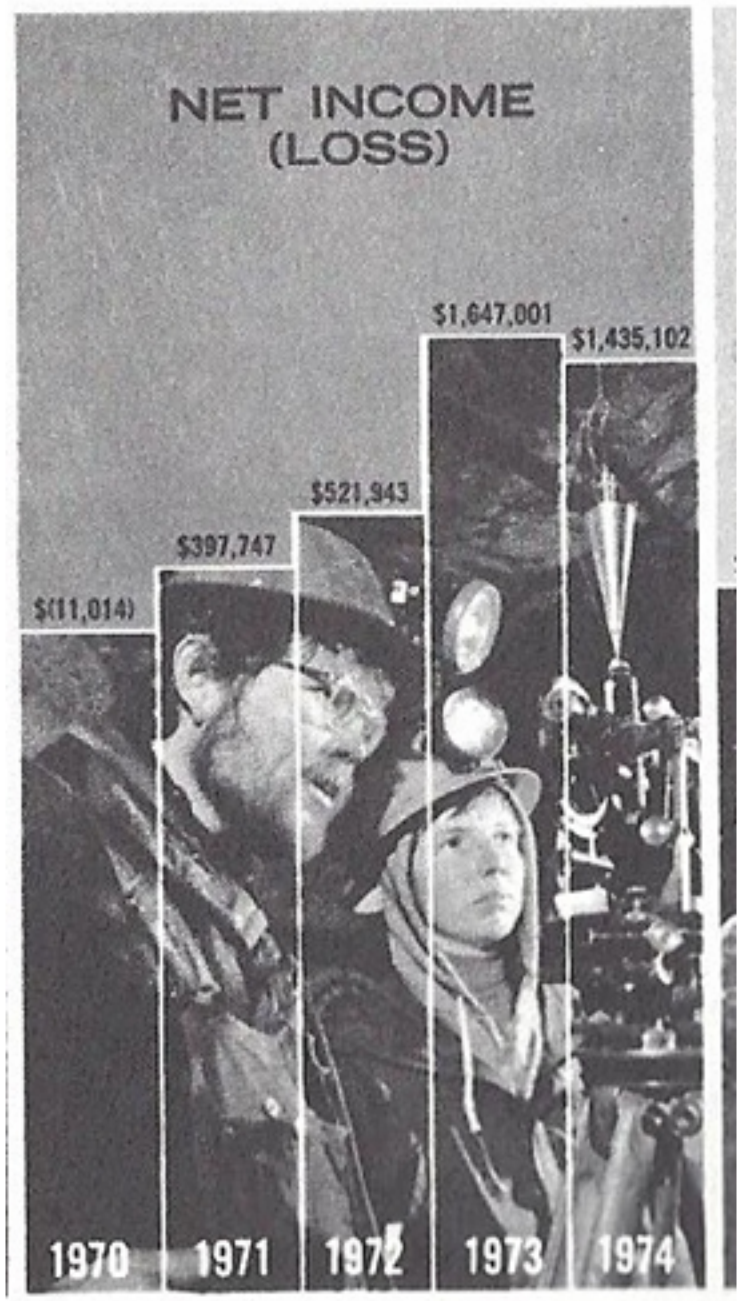
The representation of numbers, as physically measured on the surface of the graph itself, should be directly proportional to the numerical quantities represented



1 GRAPHICAL INTEGRITY

2ND PRINCIPLE

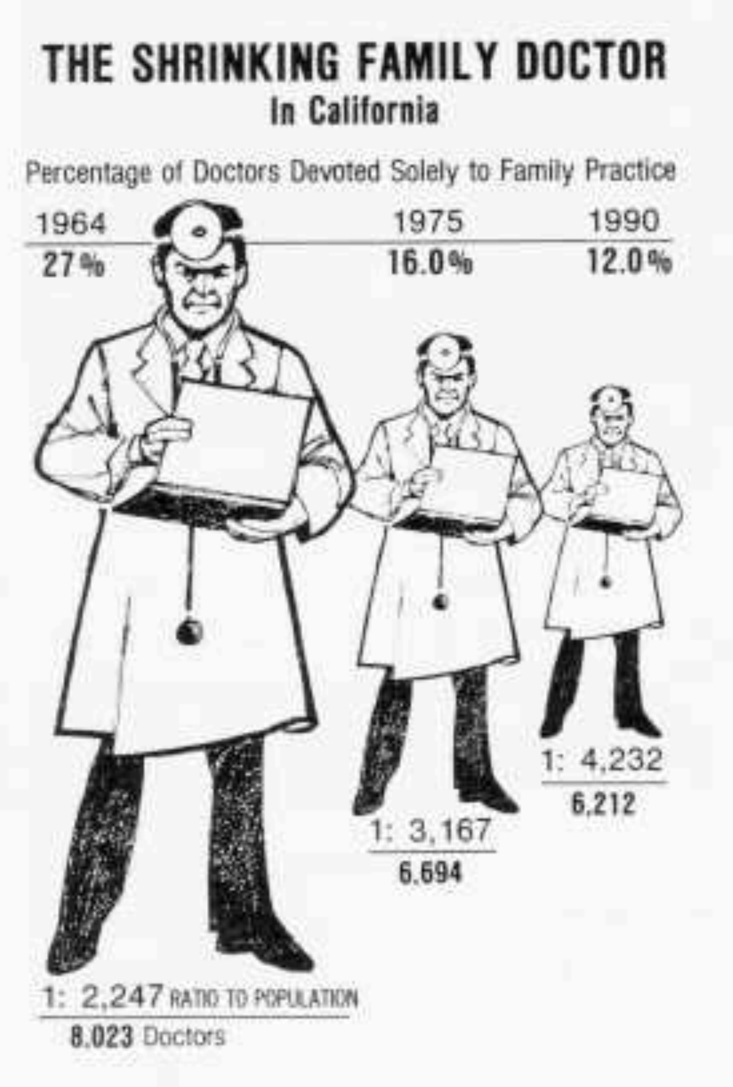
Clear, detailed and thorough labeling should be used to defeat graphical distortion and ambiguity. Write out explanations of the data on the graph itself. Label important events in the data.



1 GRAPHICAL INTEGRITY

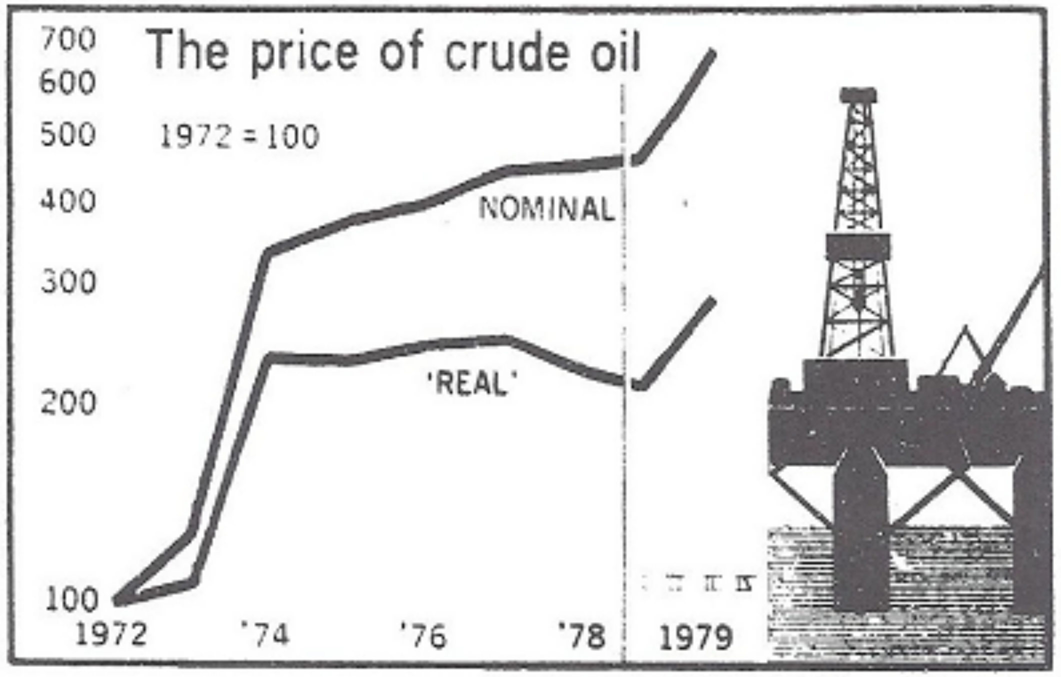
3RD PRINCIPLE

Show data variation, not design variation.



4TH PRINCIPLE

In time-series displays of money, deflated and standardized units of monetary measurement are nearly always better than nominal units.

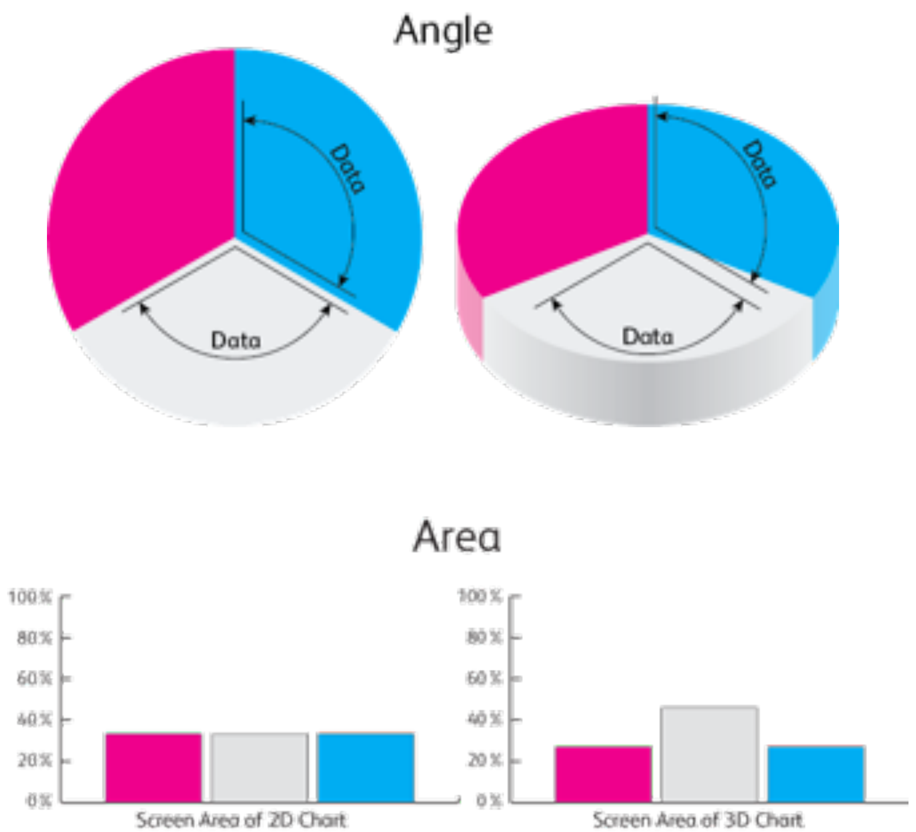


1 GRAPHICAL INTEGRITY

5TH PRINCIPLE

The number of information carrying (variable) dimensions depicted should not exceed the number of dimensions in the data.

Graphics must not quote data out of context.



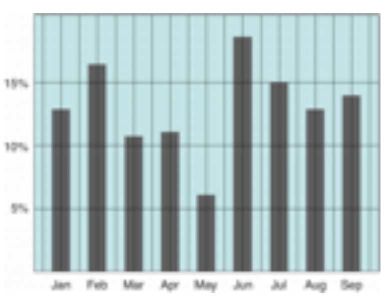
2

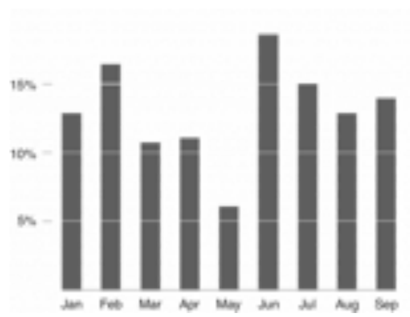
MAXIMIZE
DATA INK

The ink on a graph that represents data. Good graphical representations maximize data-ink and erase as much non-data-ink as possible.

The data-ink ratio is calculated by 1 minus the proportion of the graph that can be erased without loss of data-information.

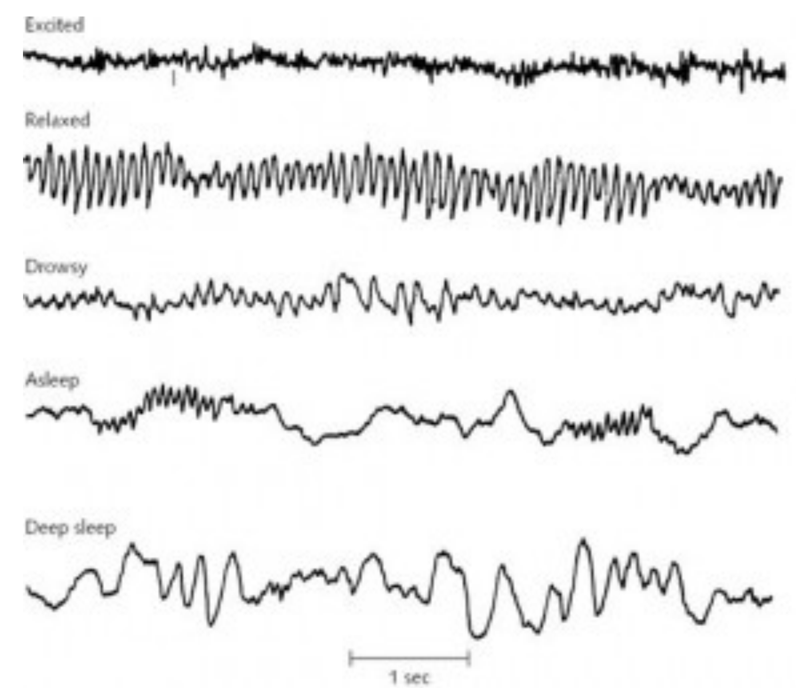
2 DATA INK





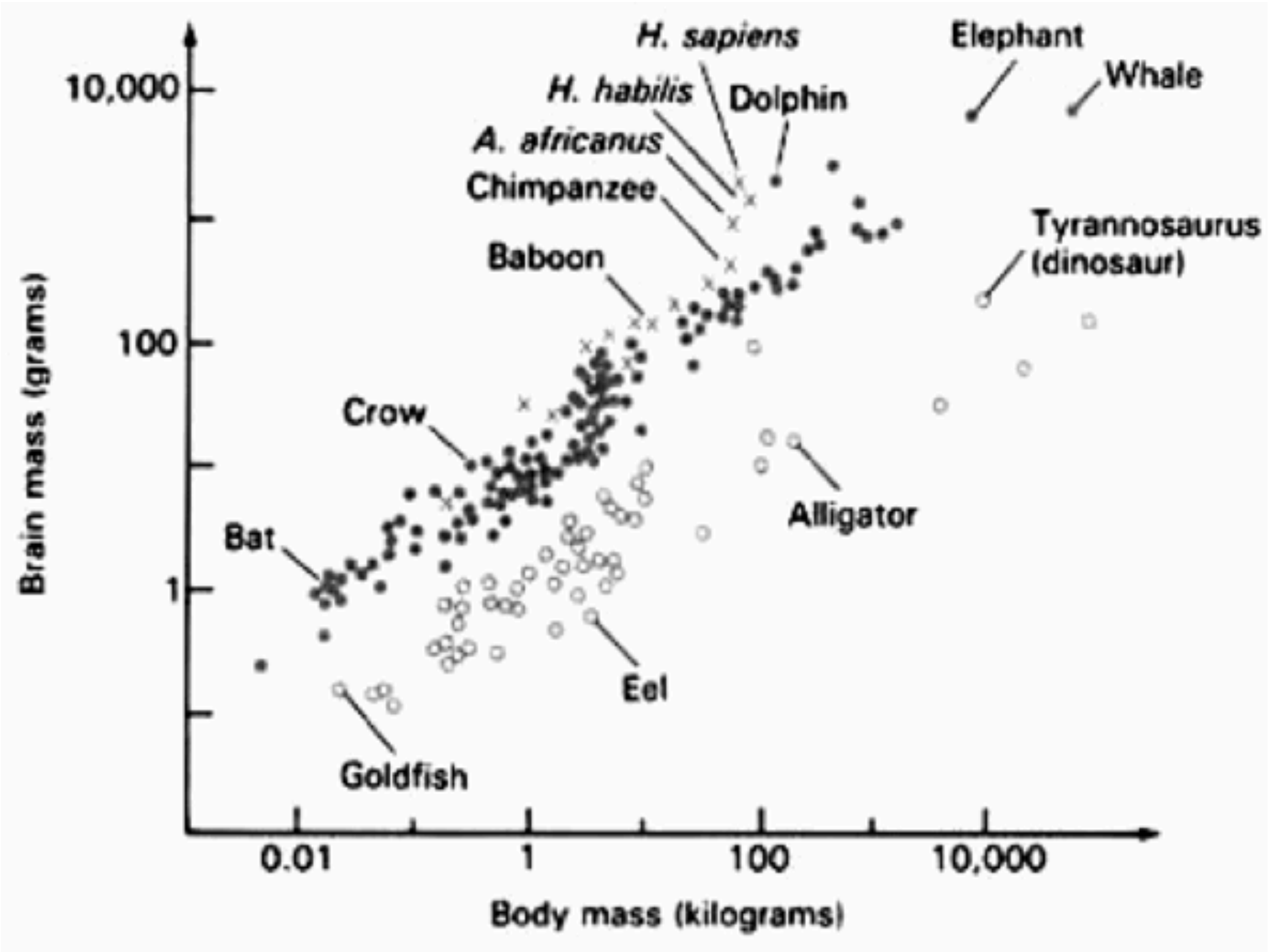
5 PRINCIPLES

1. Above all else show data.
2. Maximize the data-ink ratio.
3. Erase non-data-ink.
4. Erase redundant data-ink.
5. Revise and edit



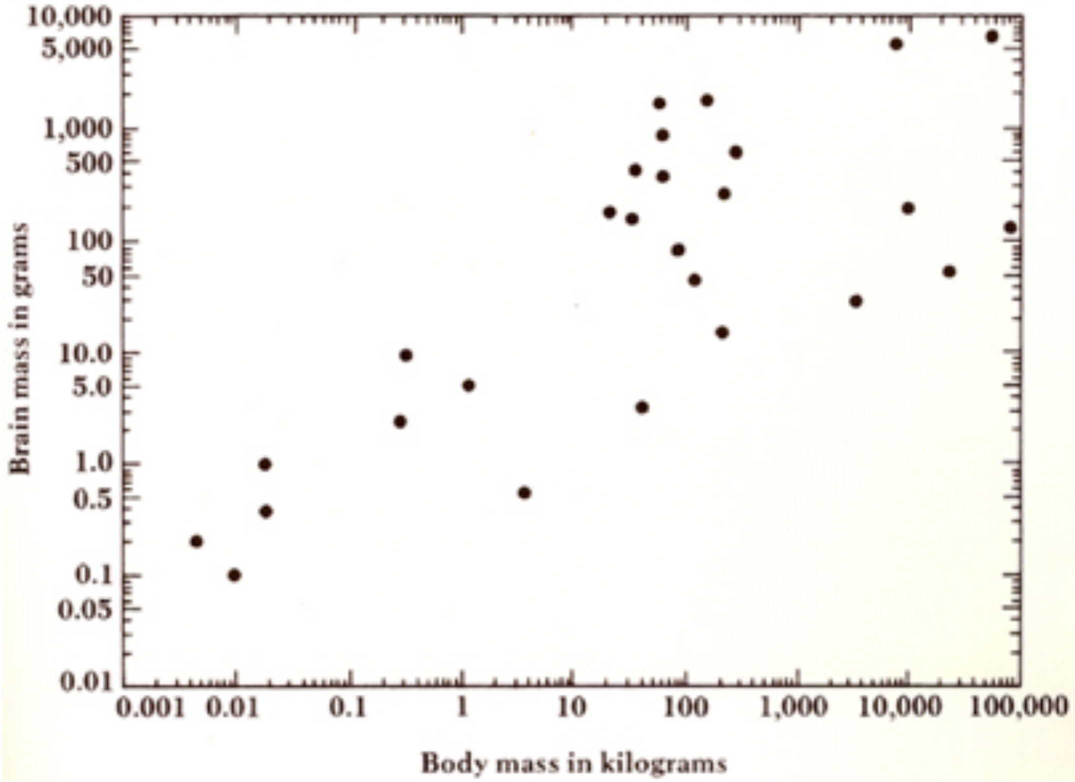
It's an electroencephalogram – a graph that records the electrical activity from the brain. This graph would have a very high data-ink ratio of 1.

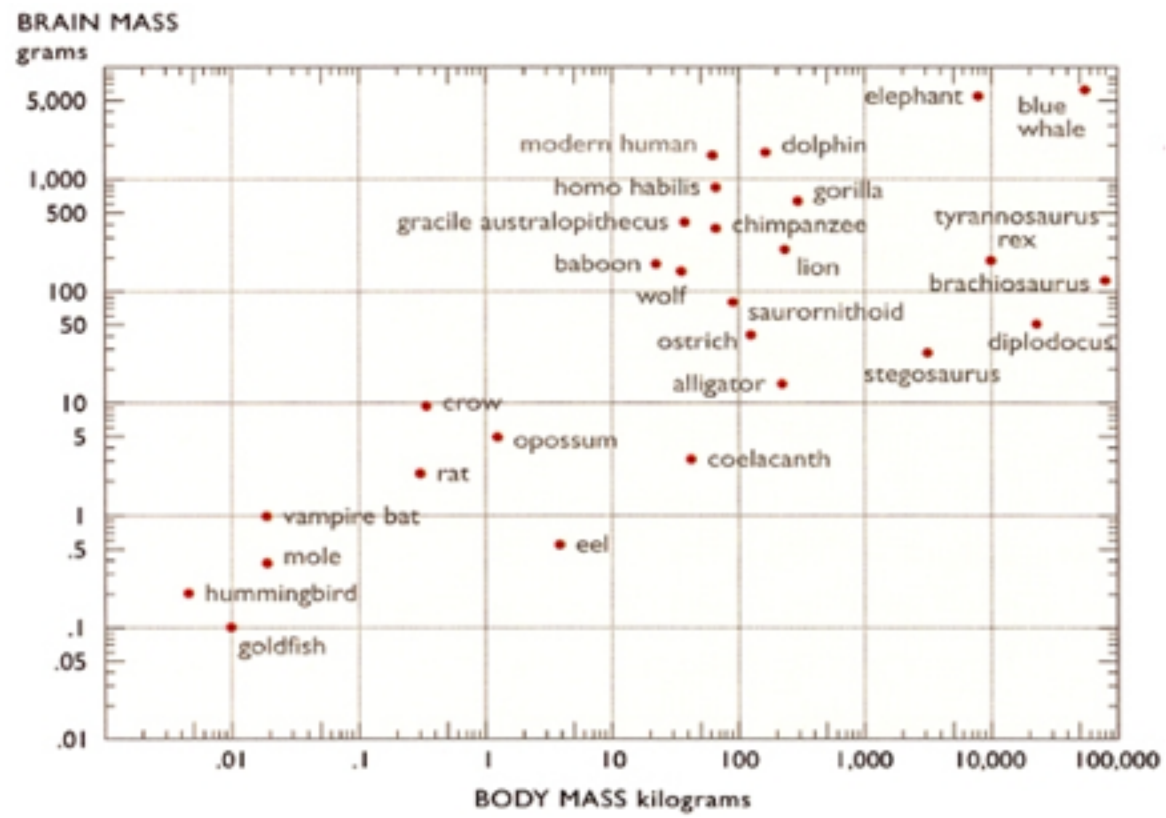
2 DATA INK



Graph from Carl Sagan's The Dragons of Eden

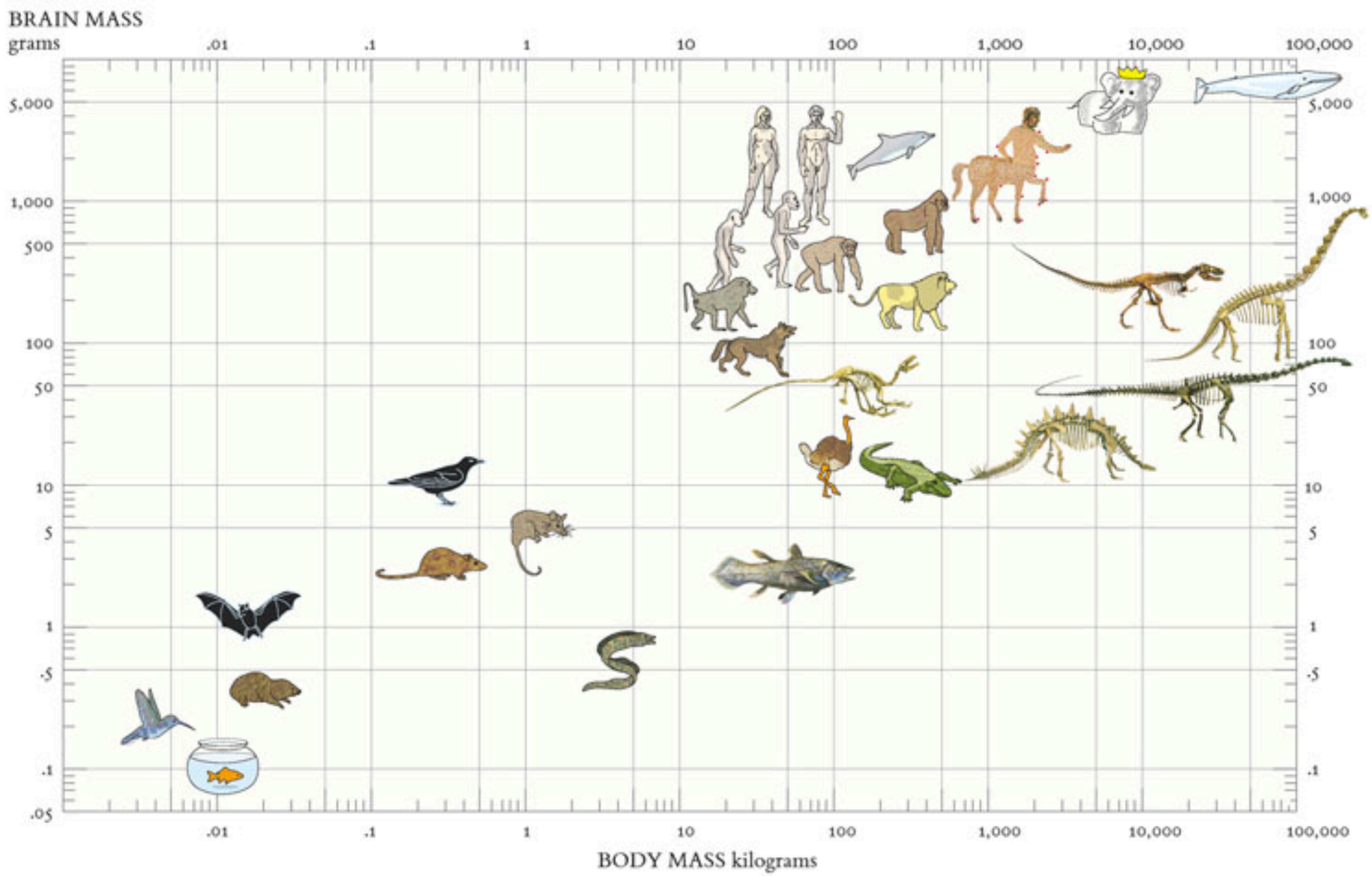
2 DATA INK





Tufte's redesign

2 DATA INK



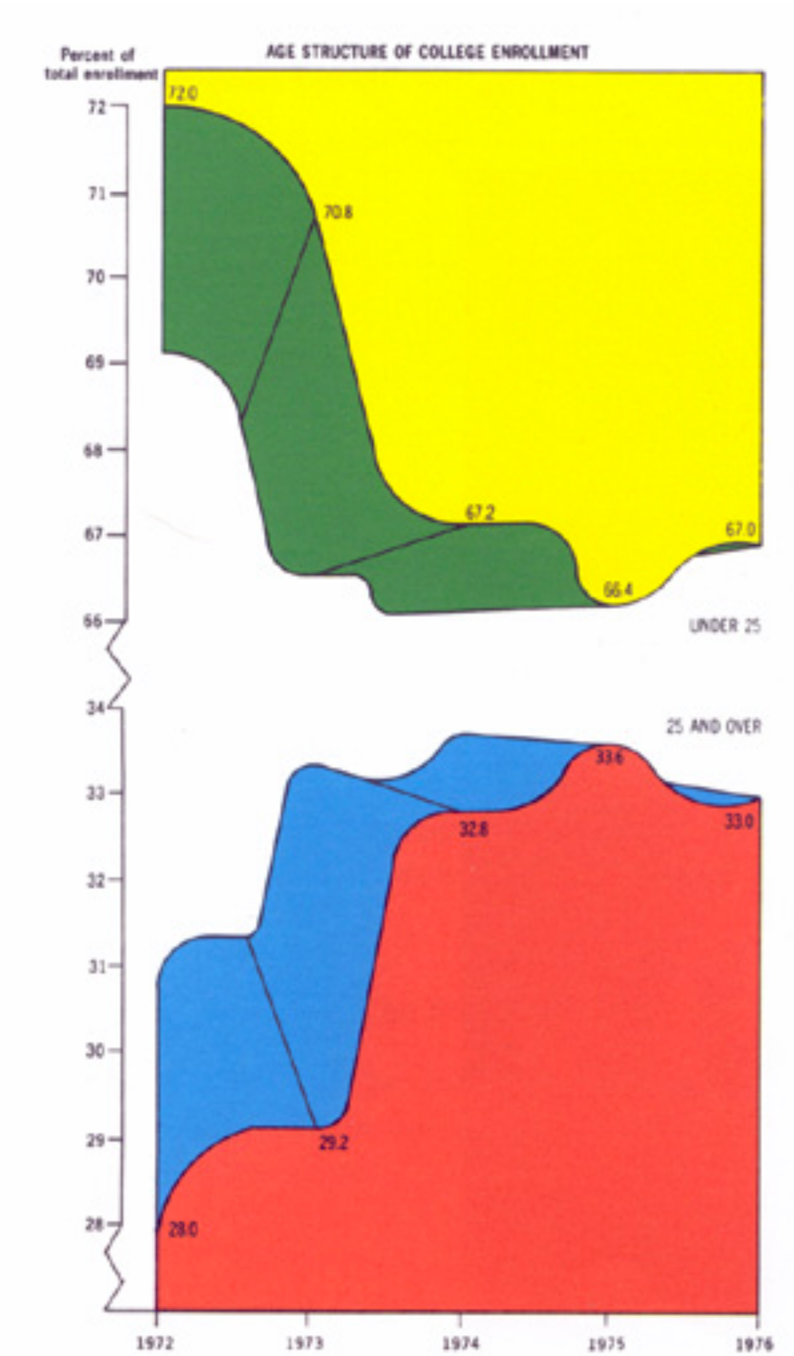
Tufte's redesign from Beautiful Evidence

3

AVOID
CHART JUNK

The excessive and unnecessary use of graphical effects in graphs used to demonstrate the graphic ability of the designer rather than display the data.

3 CHART JUNK



This is according to Tufte possibly the worst graph ever :

"A series of weird three-dimensional displays appearing in the magazine of American Education in the 1970's delighted the connoisseurs of the graphically preposterous. Here five colors report, almost by happenstance, only 5 pieces of data (since the division within each adds to 100%). This may well be the worst graphic ever to find its way into print."

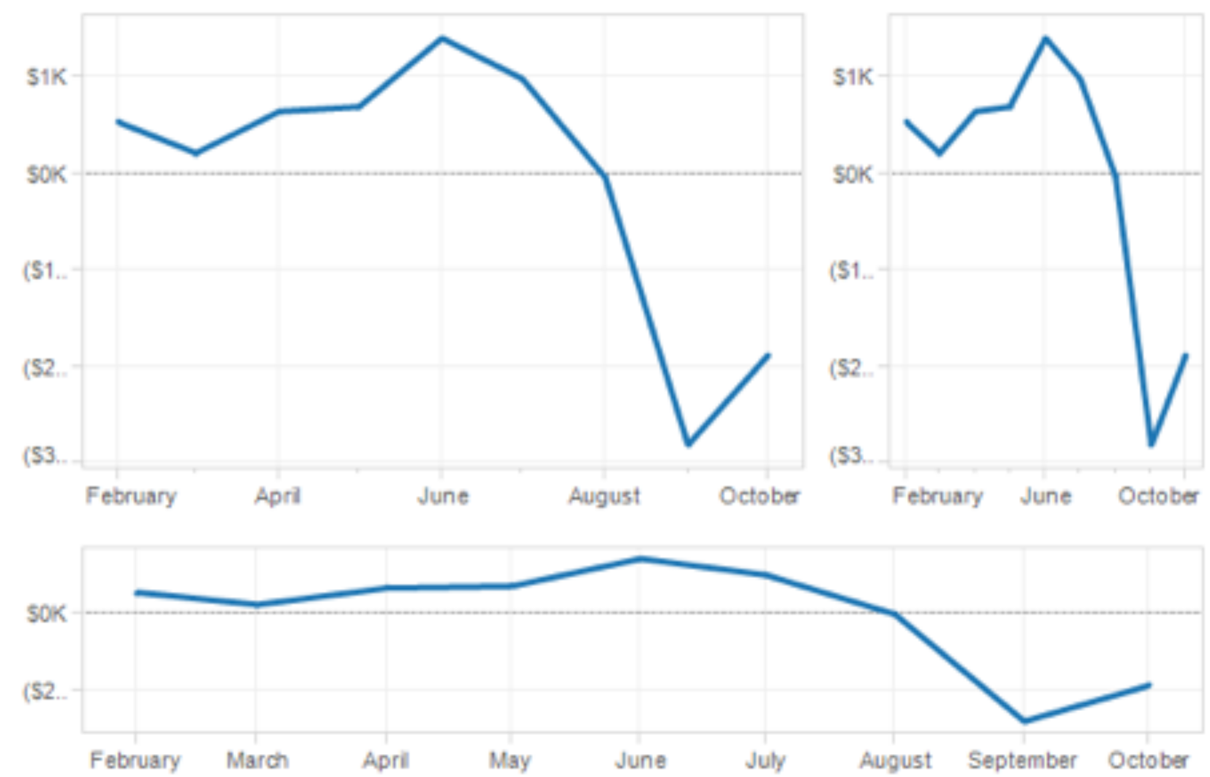
4

AIM FOR HIGH
DATA DENSITY

The proportion of the total size of the graph that is dedicated displaying data.

SHRINK PRINCIPLE

Maximize data density and the size of the data matrix within reason. One way of achieving this is through the Shrink Principle. Most graphs can be shrunk way down without losing legibility or information.



5

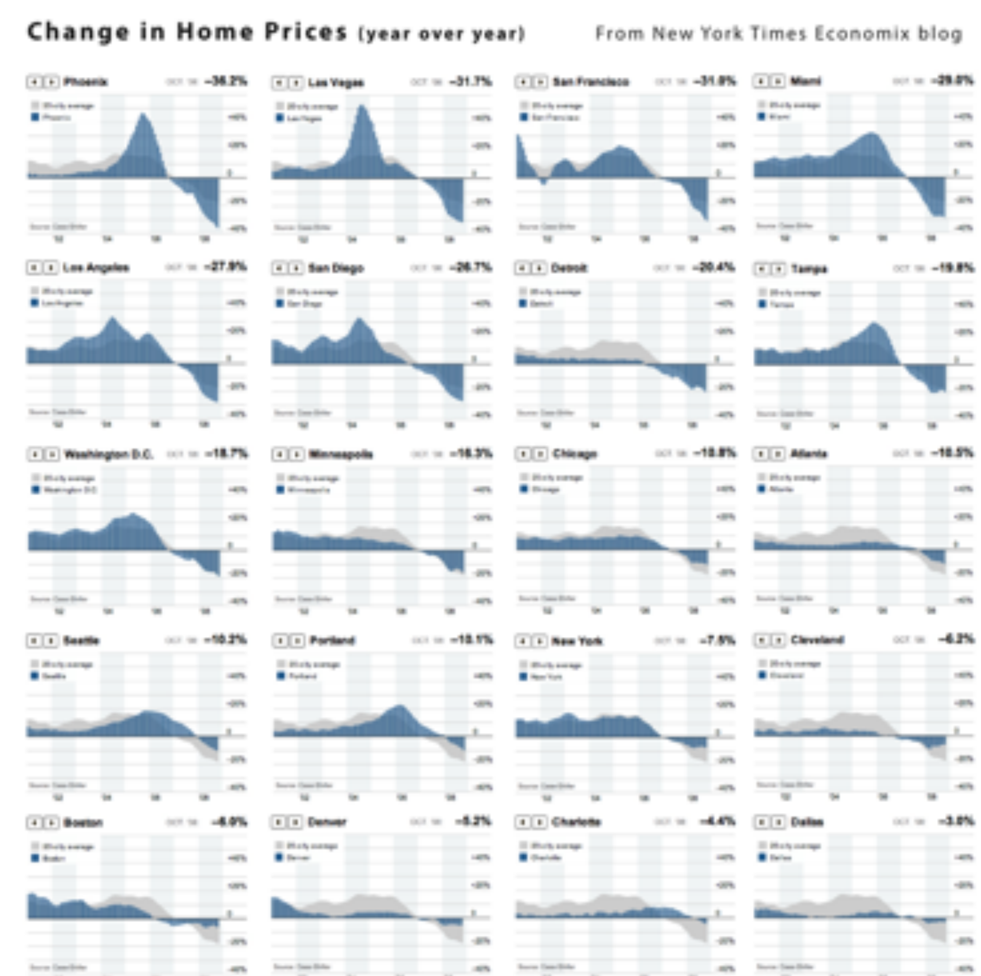
USE

CLASSIC DESIGN SOLUTIONS

5 DESIGN SOLUTIONS

SMALL MULTIPLES

Series of the same small graph repeated in one visual.

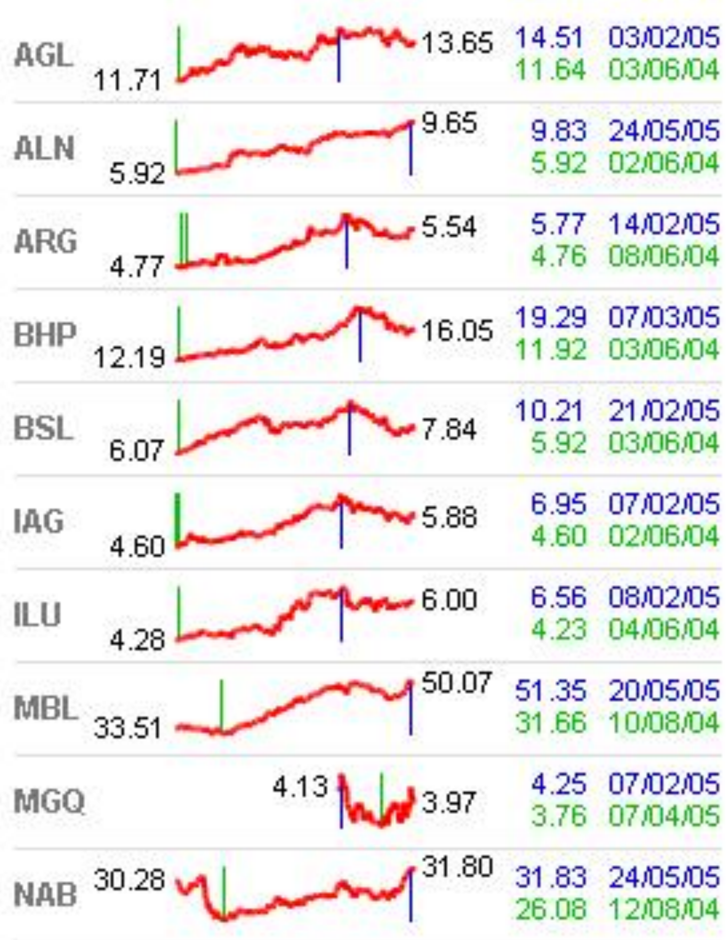


5 DESIGN SOLUTIONS

SPARKLINES

Small multiples are a great tool to visualize large quantities of data and with a high number of dimensions.

Sparklines are data-intense, design-simple, word-sized graphics.



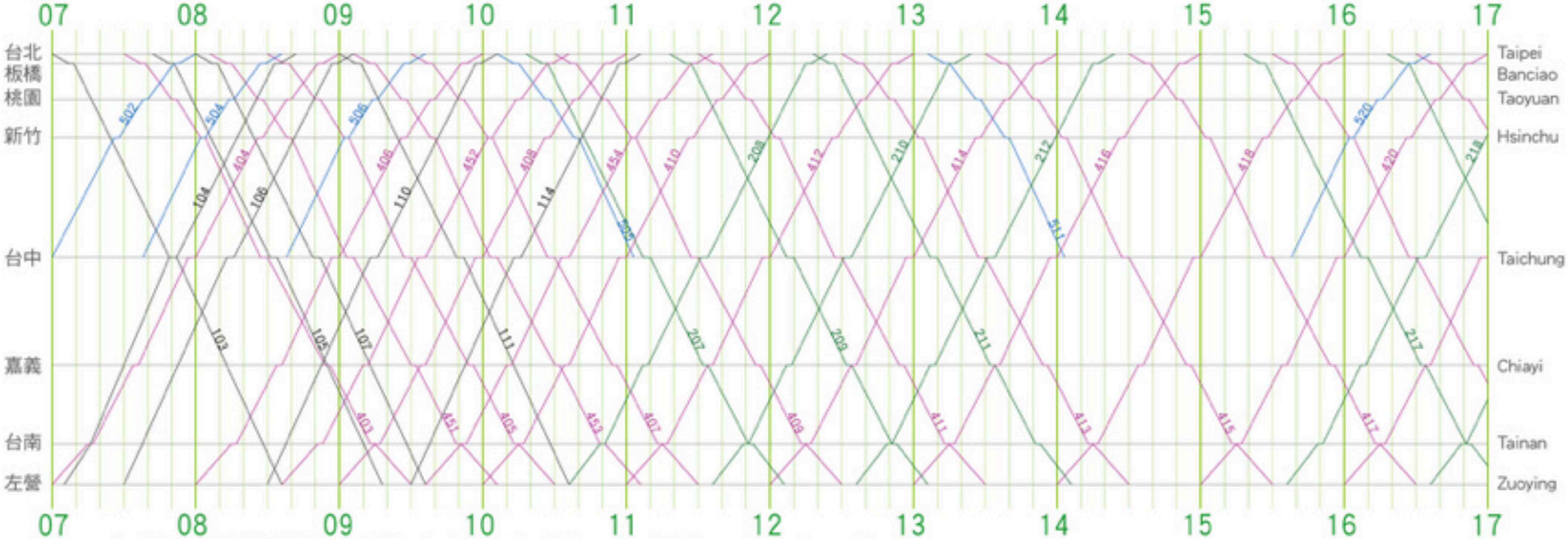
TIME SERIES

The most frequently used form of graphic design.

One dimension, usually the horizontal, is time, and the graphics march along showing variation as time proceeds. Most visualization time-series works are videos, which show time by changing the picture, requiring the user to remember what came before.

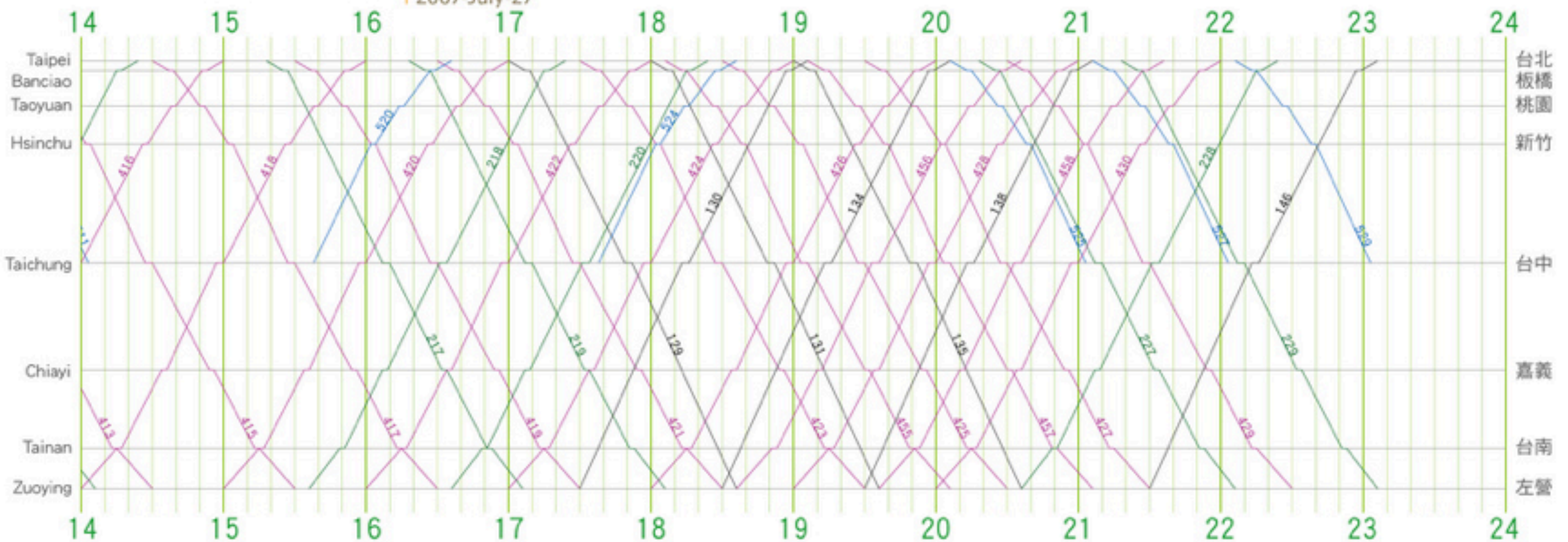
MICRO/MACRO COMPOSITION

Refers to an approach where a visualization contains enormous detail, but an overall pattern emerges. Panorama, vista, and prospect deliver to viewers the freedom of choice that derives from an overview, a capacity to compare and sift through detail. And that micro-information, like smaller texture in landscape perception, provides a credible refuge where the pace of visualization is condensed, slowed, and personalized.



台灣高鐵列車運行圖 | Train Operation Diagram of Taiwan High Speed Rail

2007-July-27



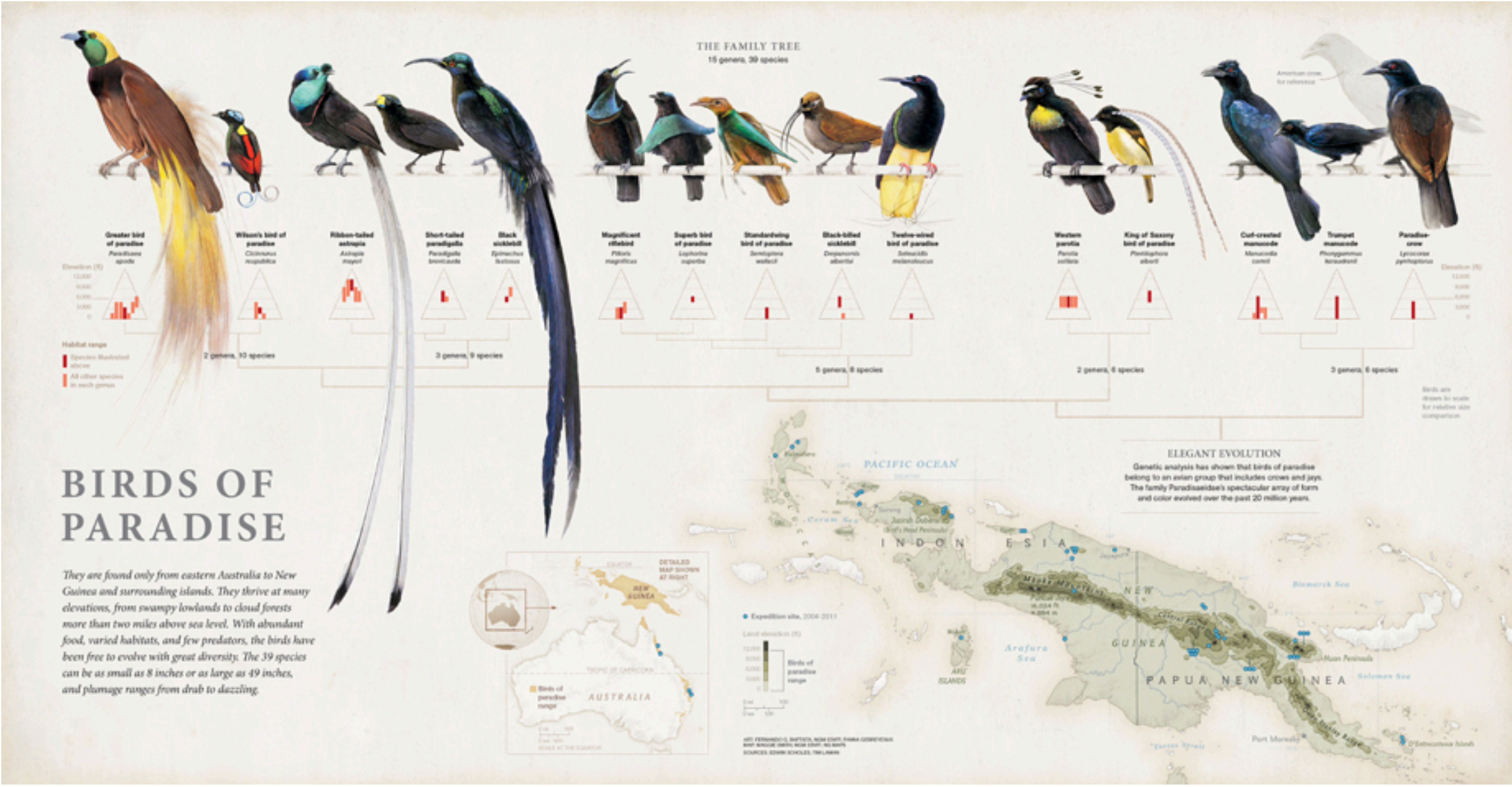
6

APPLY

AESTHETICS & TECHNIQUE

6 AESTHETICS & TECHNIQUE

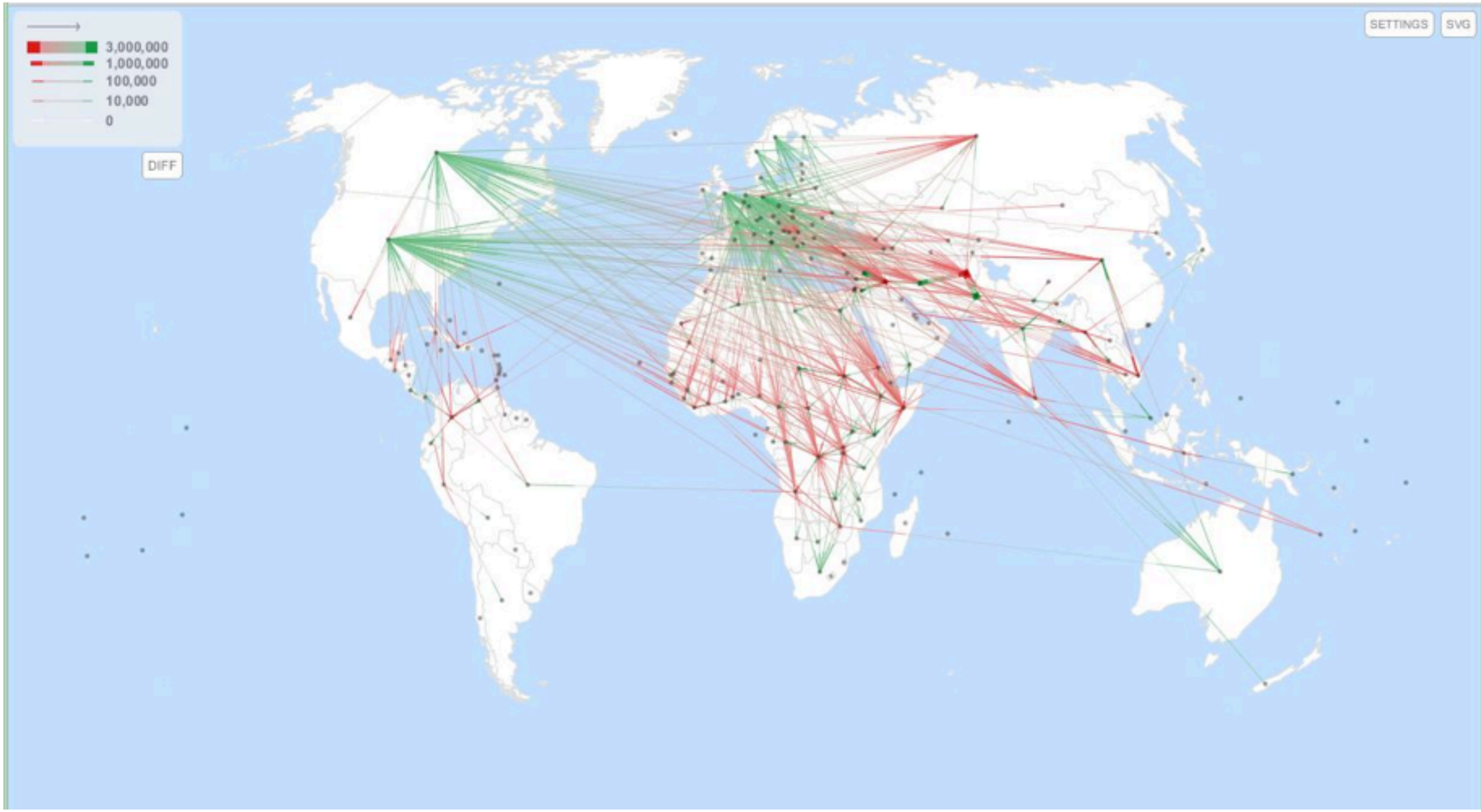
- have a properly chosen format and design
- use words, numbers, and drawing together
- reflect a balance, a proportion, a sense of relevant scale
- display an accessible complexity of detail
- have a narrative quality, a story to tell about the data
- draw elements in a professional manner, with the technical details of production done with care
- avoid content-free decoration, including chartjunk



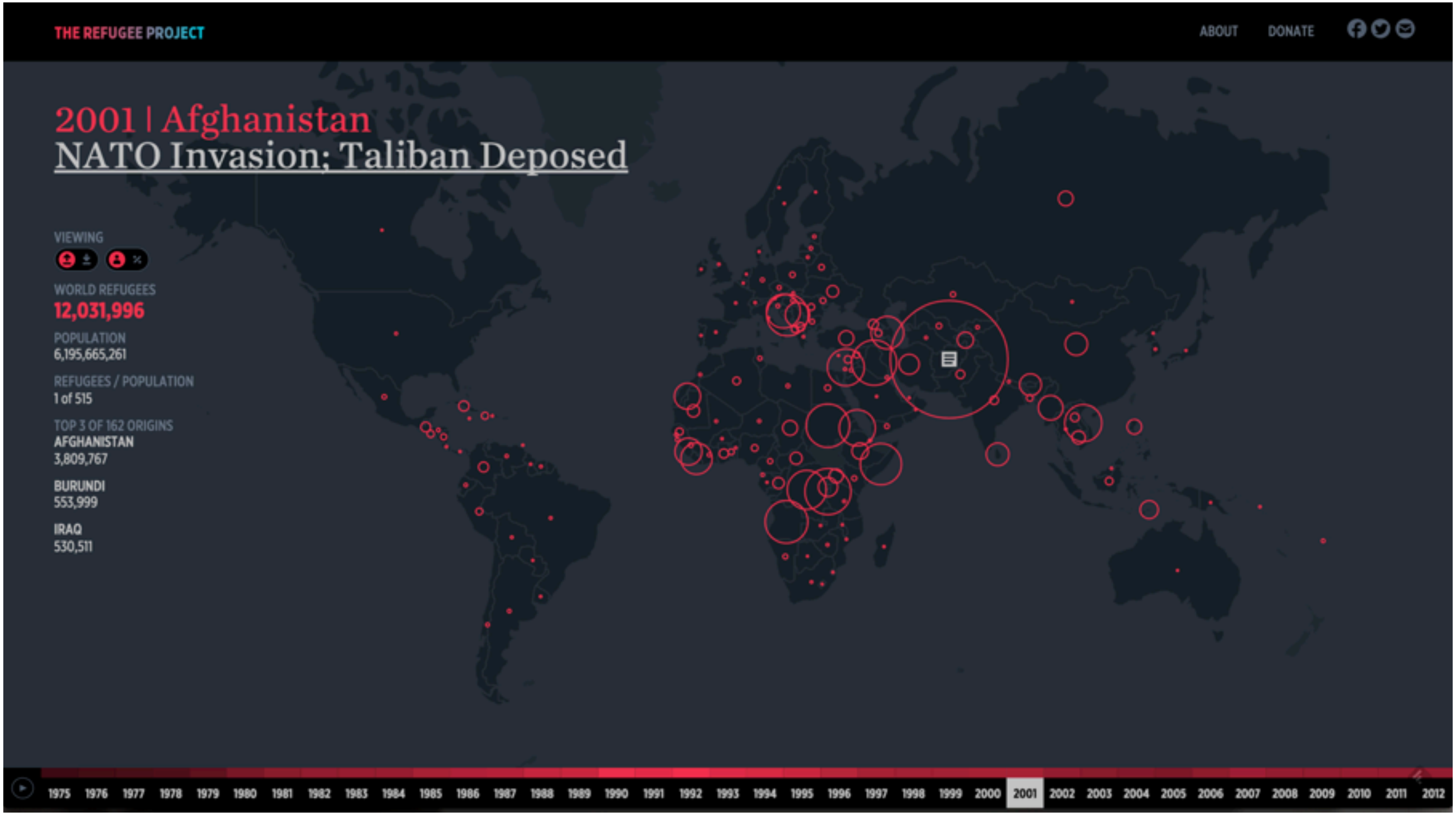
Juan Velasco
Cornell ornithologist Edwing Scholes and biologist/photographer Tim Laman
Senior Graphics Editor Fernando Baptista, Graphics Specialist Maggie Smith and freelance researcher Fanna Gebreyesus
National Geographic

CLUTTER

- If a visualization is too cluttered, don't remove data, change the design. Credibility comes from detail and in many cases one can clarify a design by adding detail.
- High-density designs also allow viewers to select, to narrate, to recast and personalize data for their own uses.
- Data-thin, forgetful displays move viewers toward ignorance and passivity, and at the same time diminish the credibility of the source.



JFlowMap is a research prototype developed at the University of Fribourg that experiments various visualization techniques for spatial interactions, i.e. interactions between pairs of geographic locations. These can be migrations, movement of goods and people, network traffic, or any kind of entities “flowing” between locations.



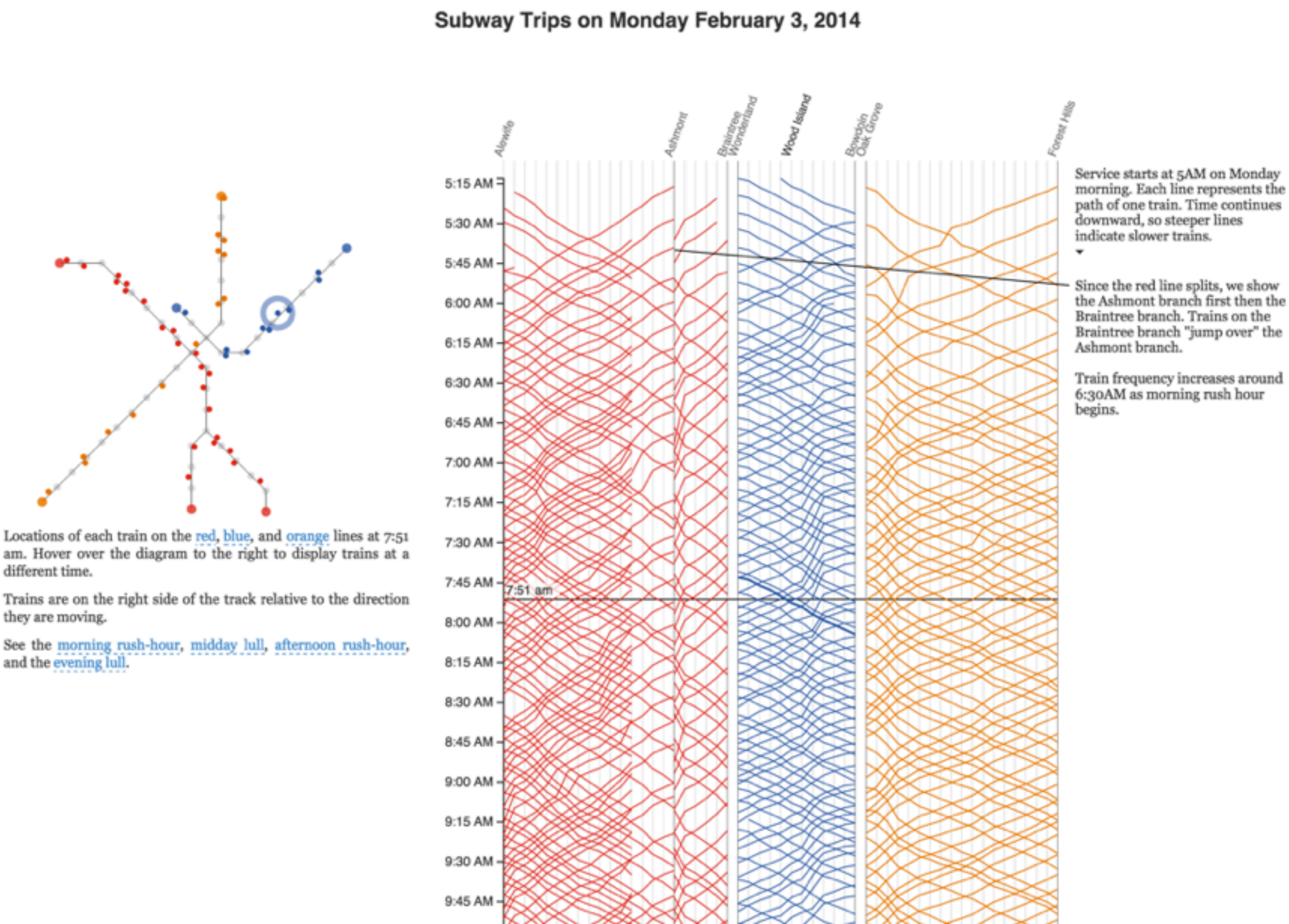
Hyperakt and Ekene Ijeoma visualized migrations over time and space in The Refugee Project
http://www.therefugeeproject.org

6 AESTHETICS & TECHNIQUE

CLUTTER

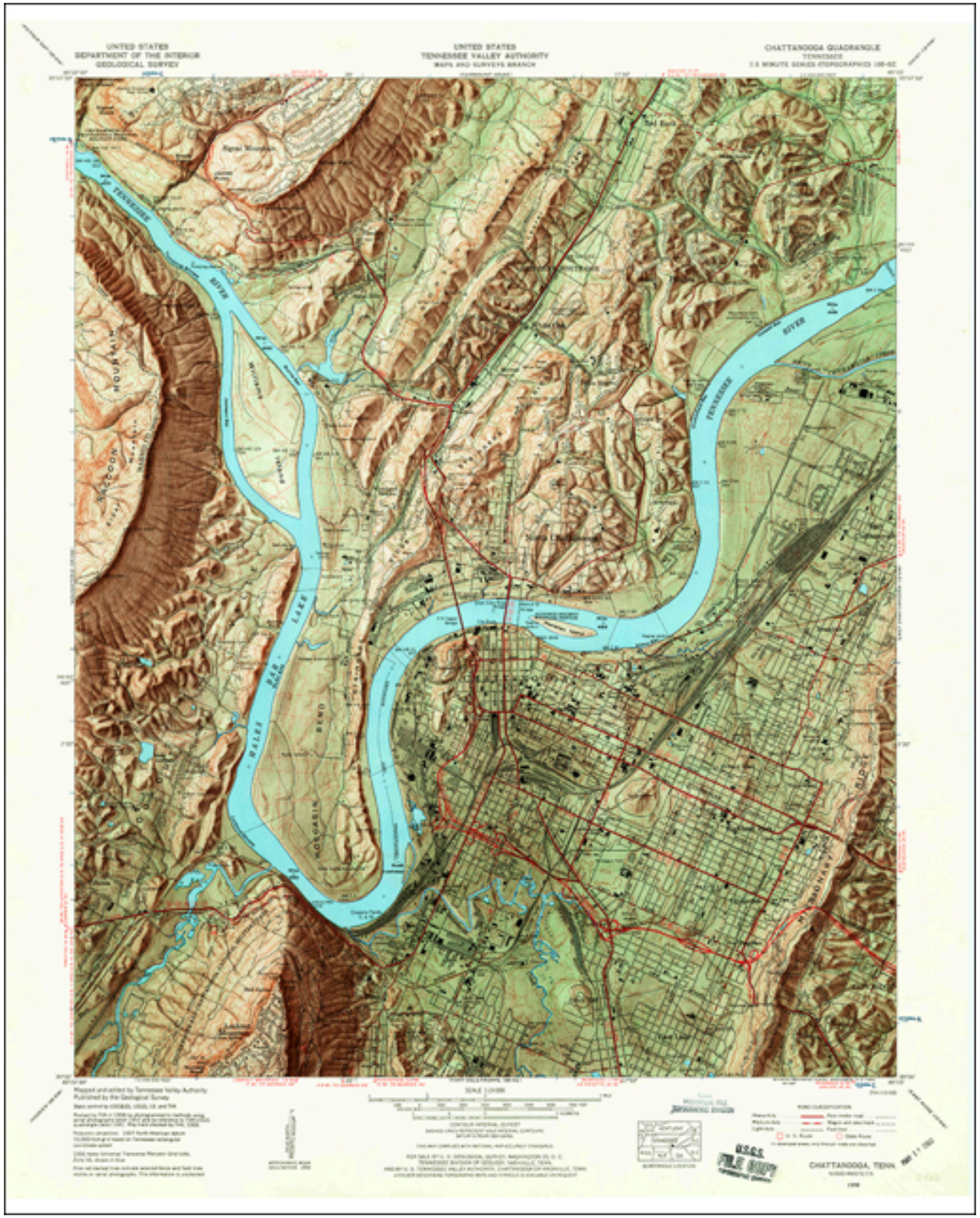
- Empty space may reduce clutter, but it is not how much empty space there is, but rather how it is used. It is not how much information there is, but rather how effectively it is arranged.
- Low density computer displays lead to spreading information out over many screens or dialog boxes. Place information adjacent in space, not stacked in time, to avoid the `Where am I?' problem.

For a graduate project, Michael Barry and Brian Card explored the Boston subway system through a set of annotated interactives that show train routes, usage, and scheduling.
http://mbtaviz.github.io/



LAYERING AND SEPARATION

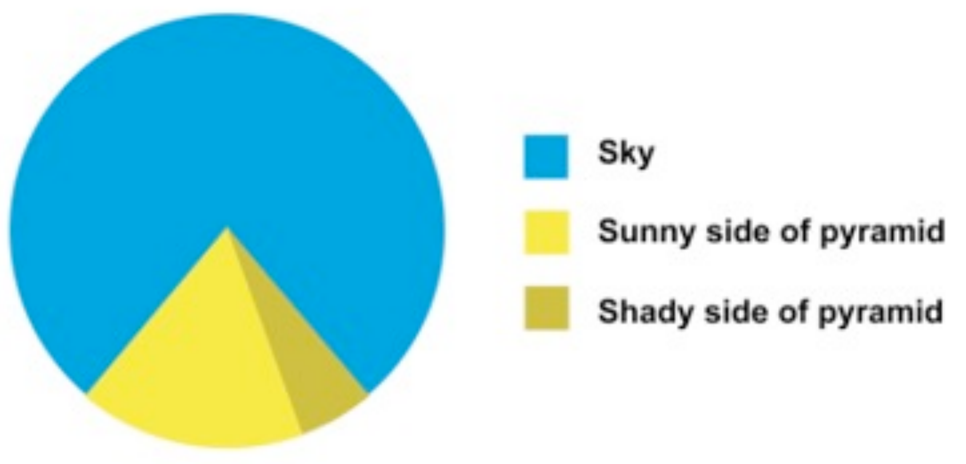
Implies using color or other differentiation to separate important classes of information. Consider a colormapped surface that requires annotation. If the colormap uses all possible colors, positioning annotation will be difficult because of color clashes. A better approach might be to use intensity of a single hue for the colormap, leaving visual space for addition information; i.e., the annotation.



Muted colors, subtle shading and thin contour lines allow multiple types of data to be layered together in this 1958 topographic map of Chattanooga, Tennessee.

1 + 1 = 3 OR MORE

Effective layering of information is often difficult because an omnipresent, yet subtle, design issue is involved: the various elements collected together interact, creating non-information patterns and texture.



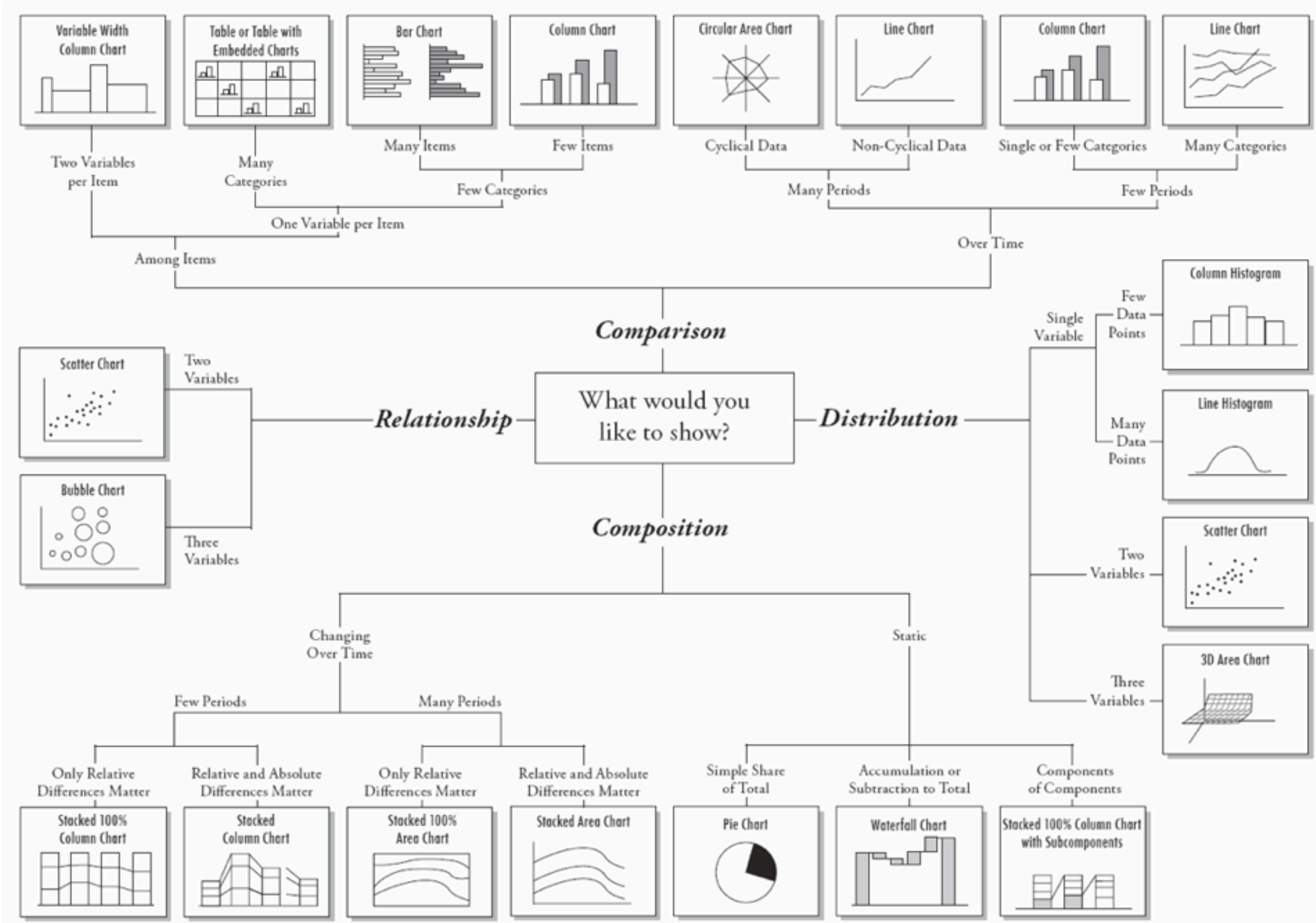


Chart by Andrew Abela

FOR MORE TIPS

HTTP://WWW.SLIDESHARE.NET/MCGARRAHJESSEE/MCJEDWARD-TUFTENOTES