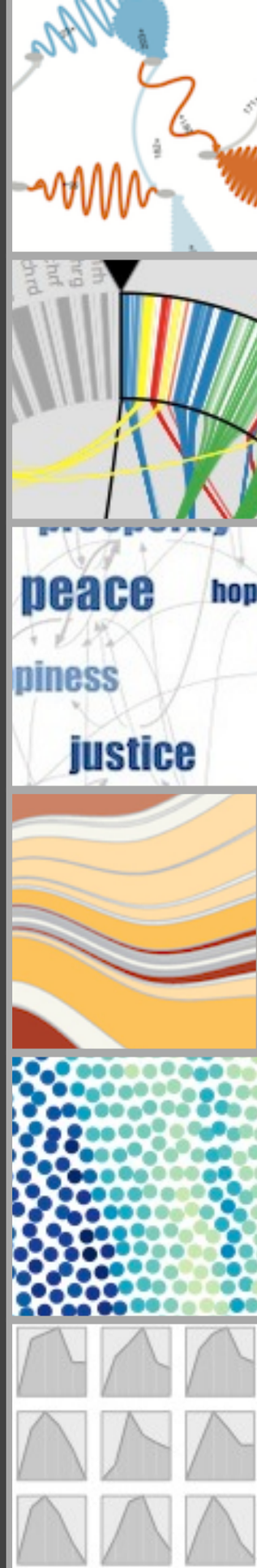
cs6964 | Jan 12 2012

DESIGN

Miriah Meyer
University of Utah



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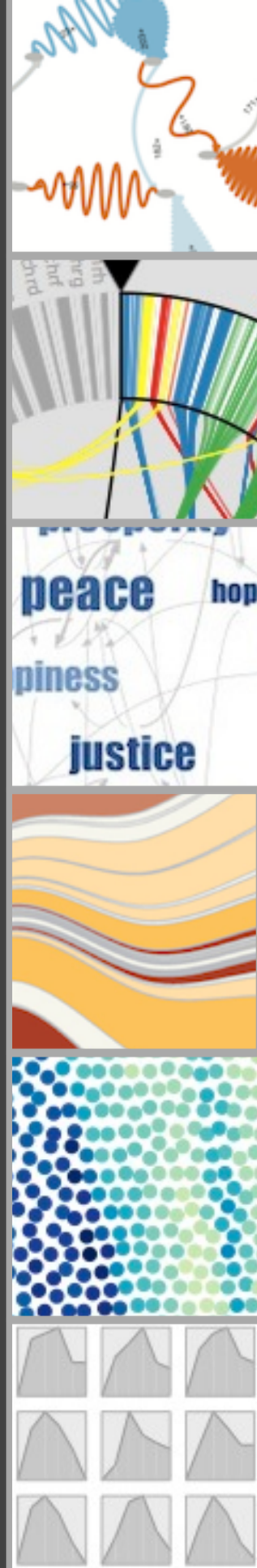
slide acknowledgements:
Hanspeter Pfister, Harvard University
John Stasko, Georgia Tech



LAST TIME

VISUALIZATION . . .

1) uses perception to free up cognition

2) serves as an external aid to augment working memory

VISUALIZATION GOALS

-**record** information

-**analyze** data to support reasoning

-**confirm** hypotheses

-**communicate** ideas to others

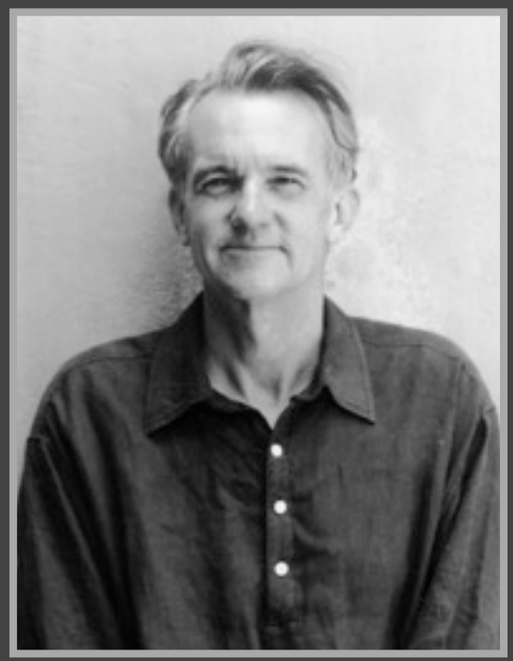
SciVis

- continuous data
- inherent spatial position
- from computer graphics
- algorithmic focus

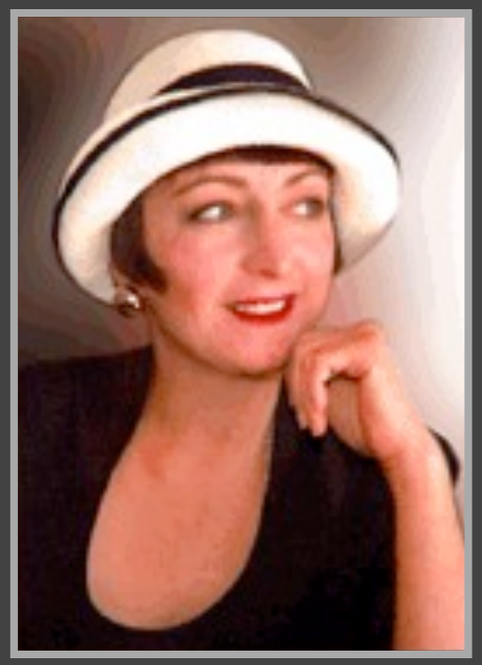
InfoVis

- discrete data
- abstract
- from HCI
- usability focus

- TUFTE'S PRINCIPLES
  - integrity
  - design



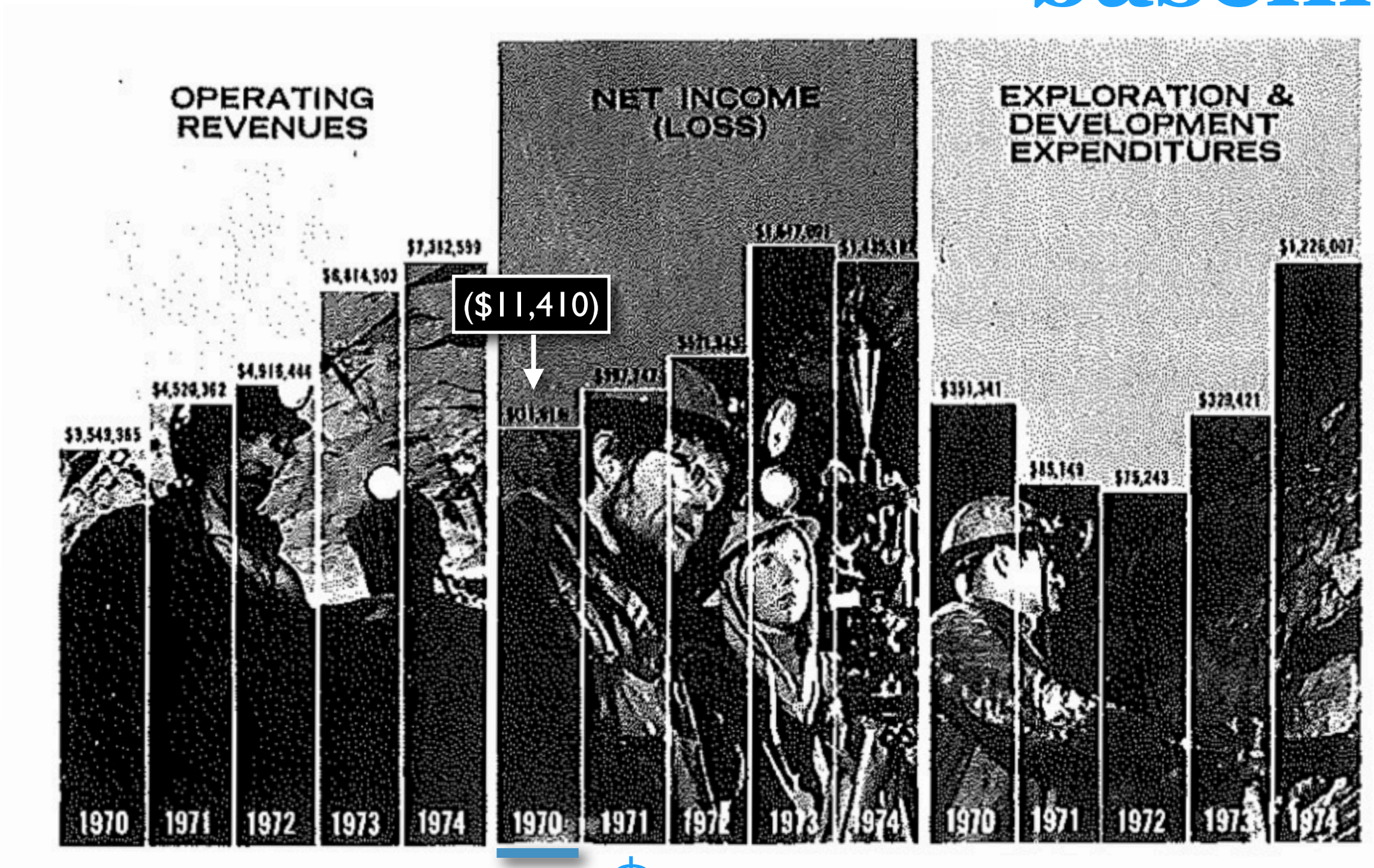
- WILLIAM'S PRINCIPLES
  - C.R.A.P. & layering



TUFTE: GRAPHICAL INTEGRITY

MISSING SCALES

baseline?



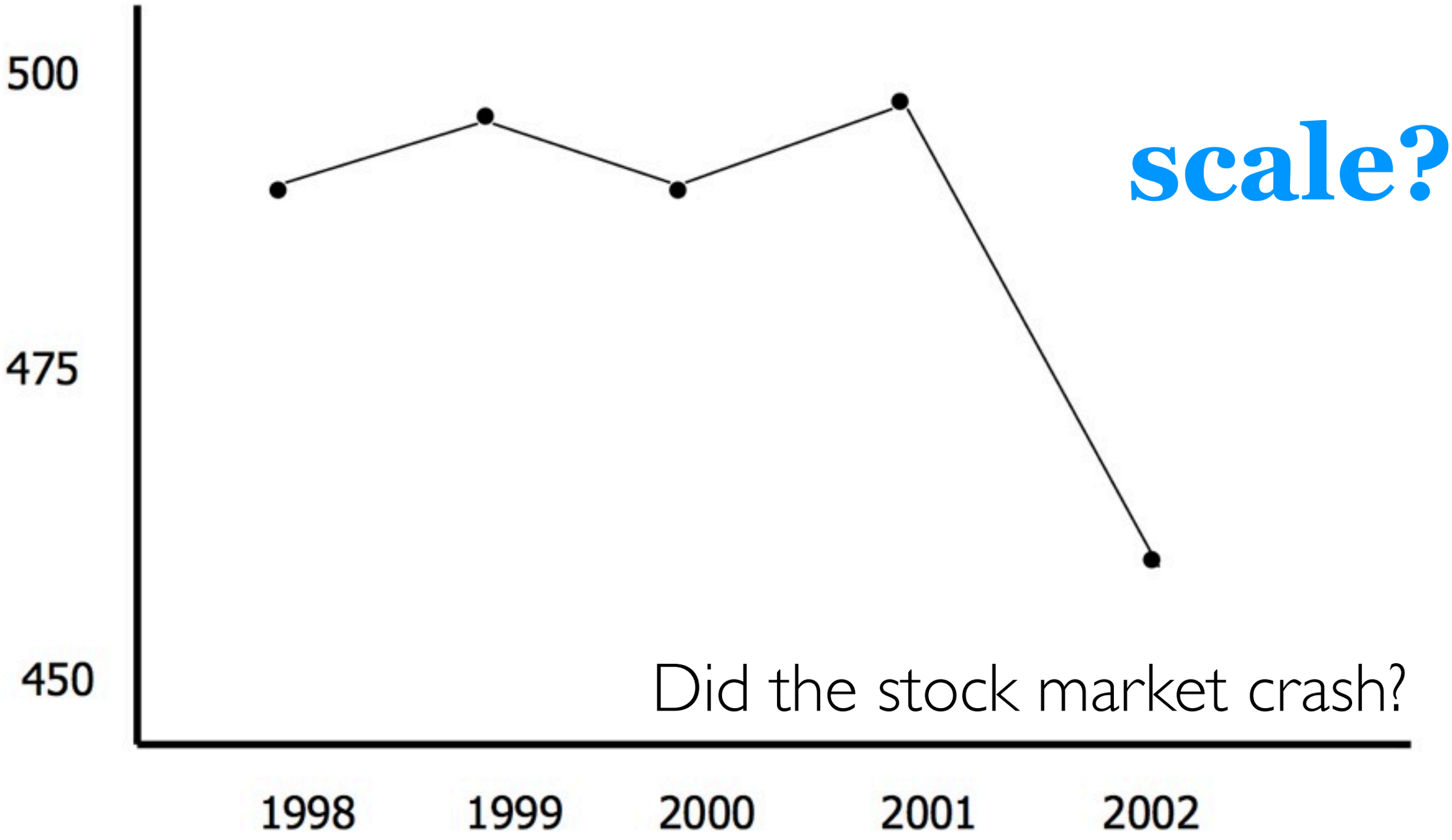
-$4,200,000

Tufte 1997

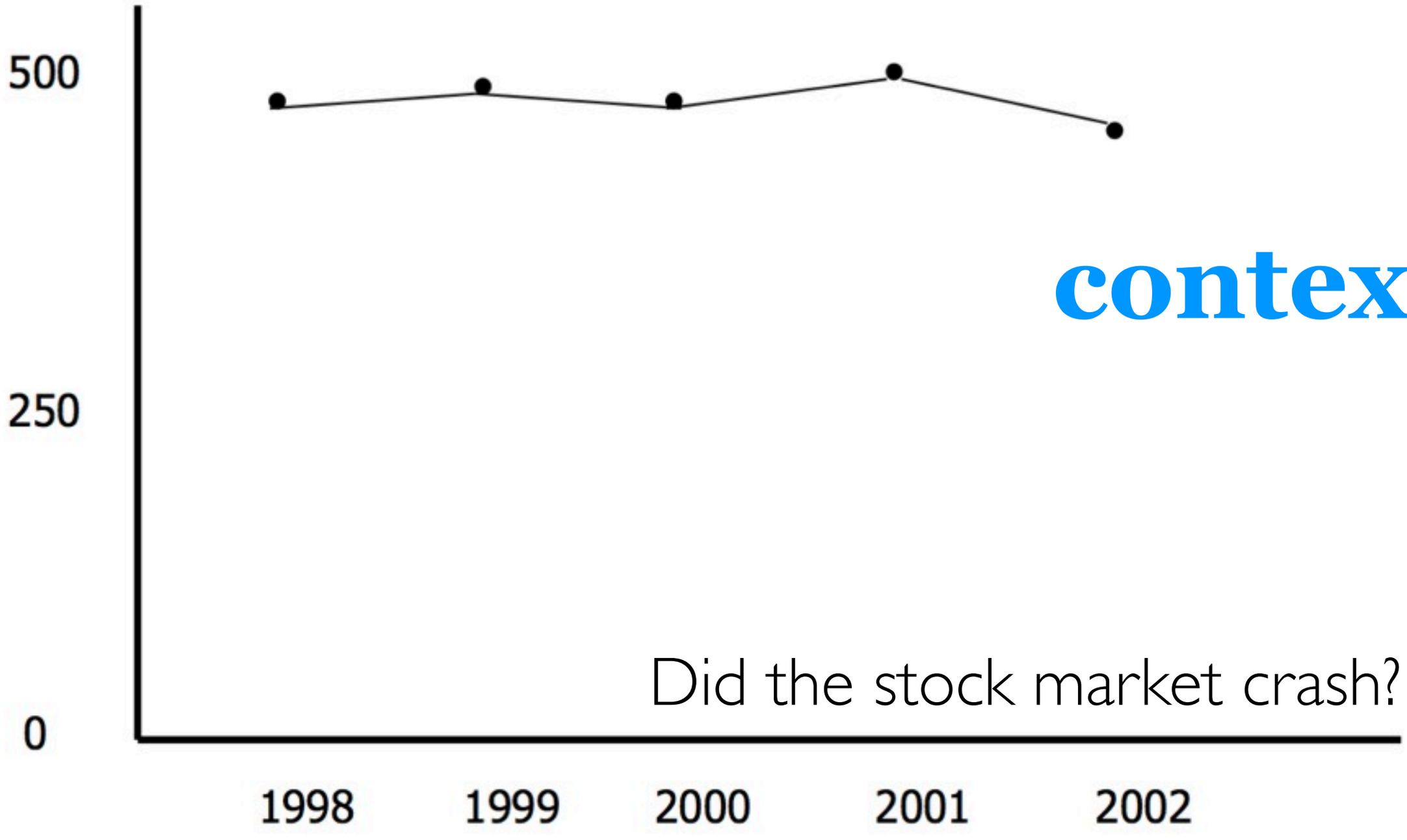
Tufte's integrity principles

Clear, detailed, and thorough labeling should be used to defeat graphical distortion and ambiguity.

SCALE DISTORTION

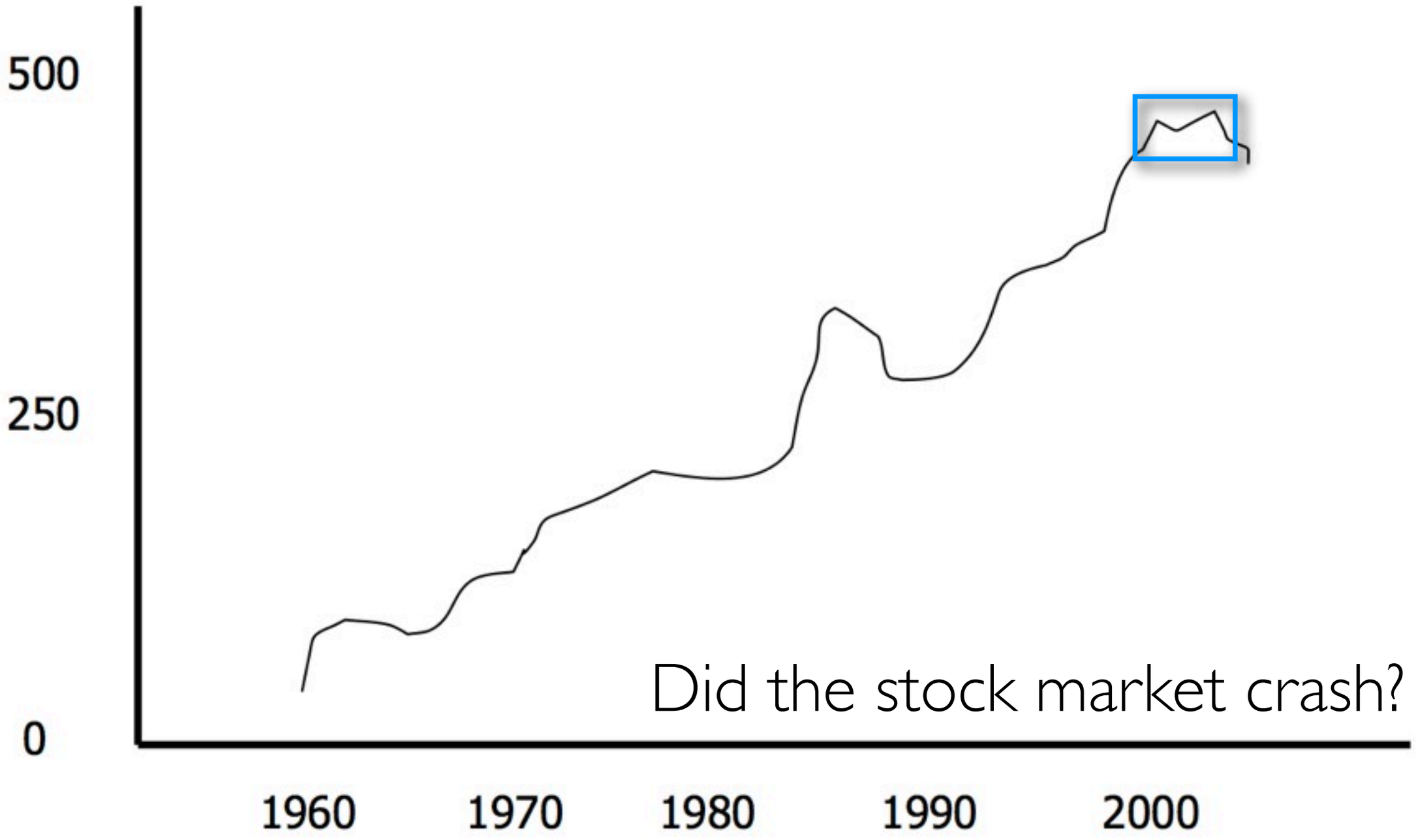


SCALE DISTORTION



context?

SCALE DISTORTION



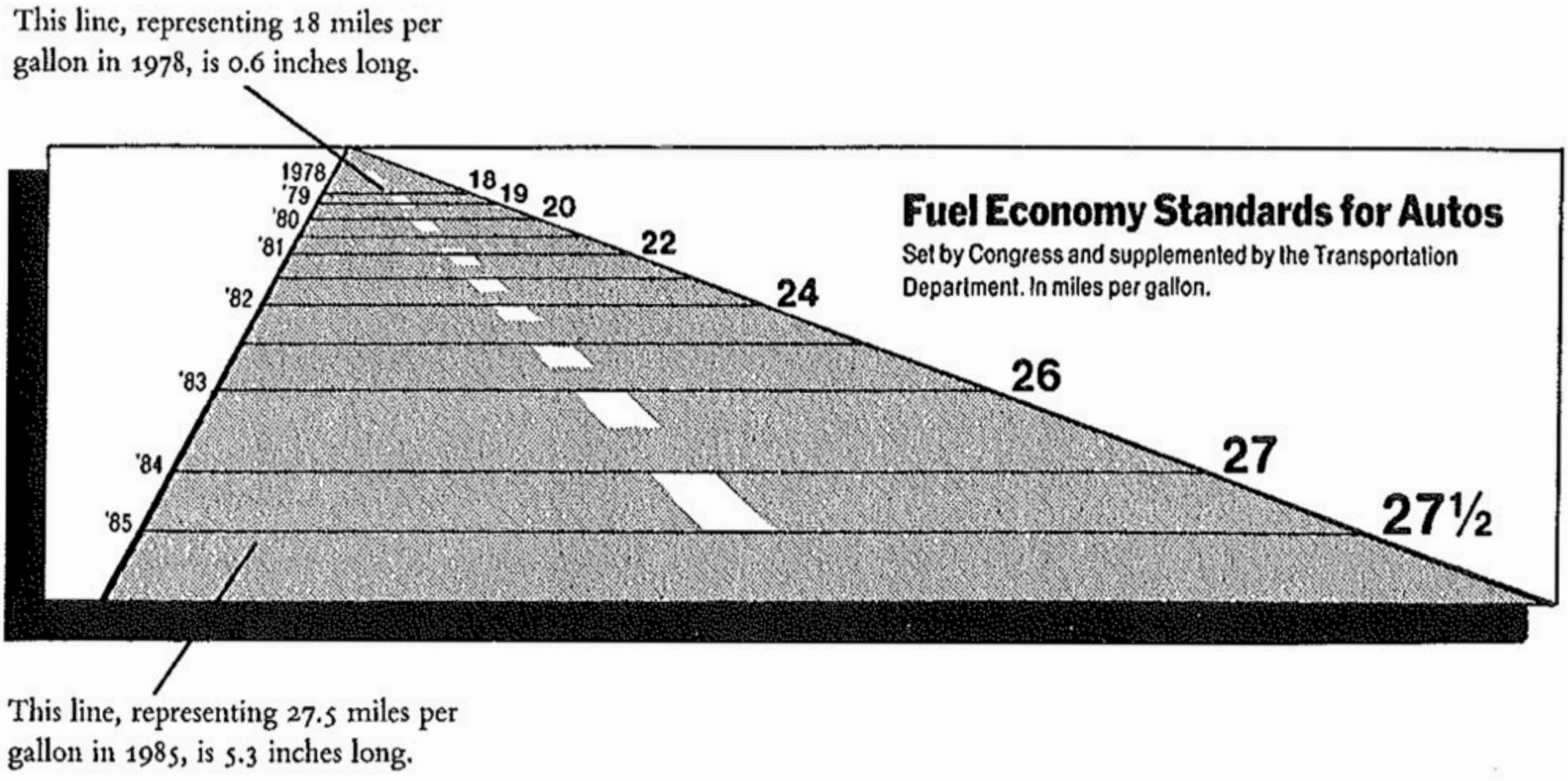
Tufte's integrity principles

Clear, detailed, and thorough labeling should be used to defeat graphical distortion and ambiguity.

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

$$\textbf{The Lie Factor} = \frac{\text{size of effect shown in graphic}}{\text{size of effect in data}}$$

DISTORTION



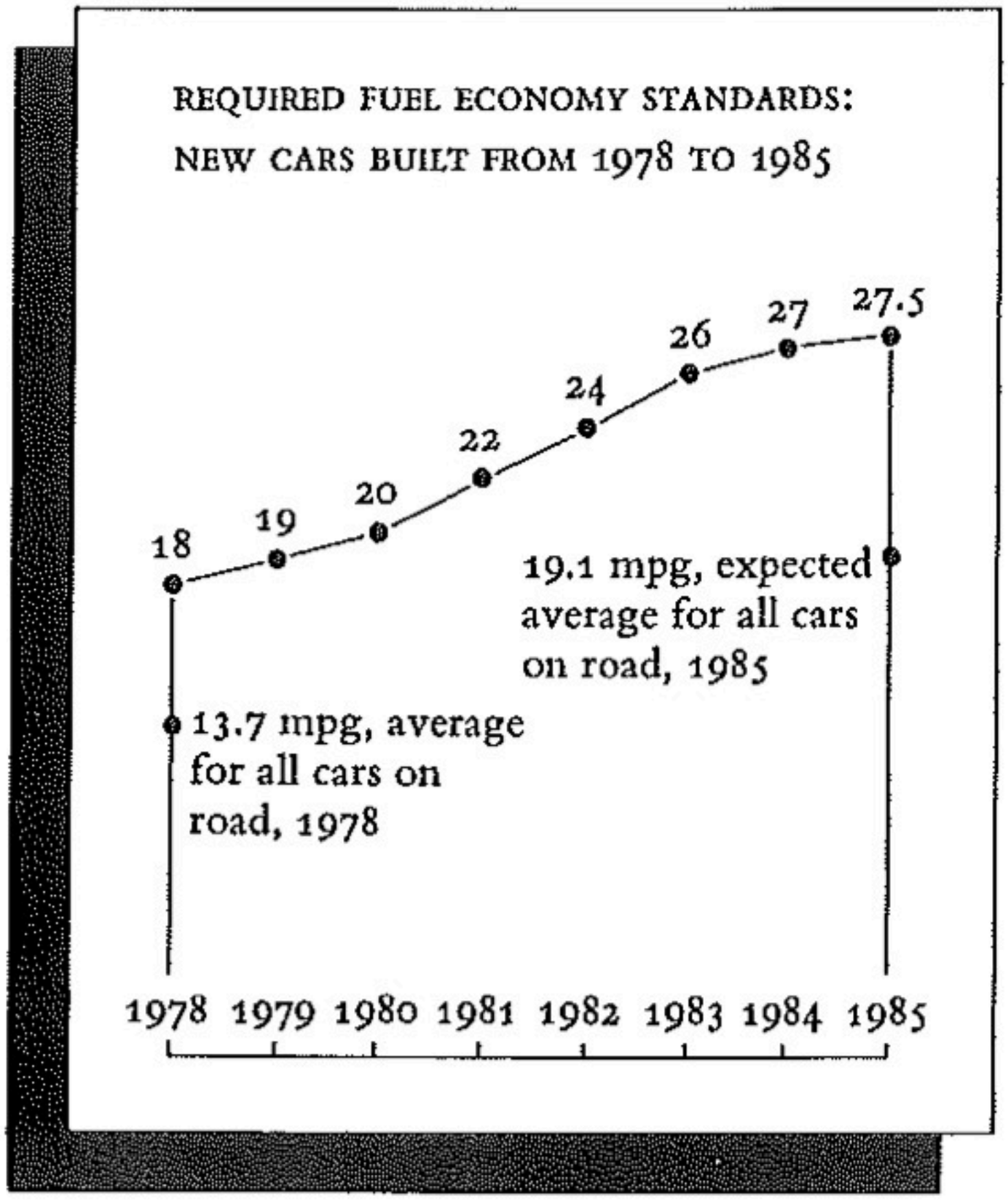
Tufte 1997

$$\textbf{The Lie Factor} = \frac{\text{size of effect shown in graphic}}{\text{size of effect in data}}$$

$$\text{GRAPHIC} \quad \frac{5.3 - 0.6}{0.6} \times 100\% = 783\%$$

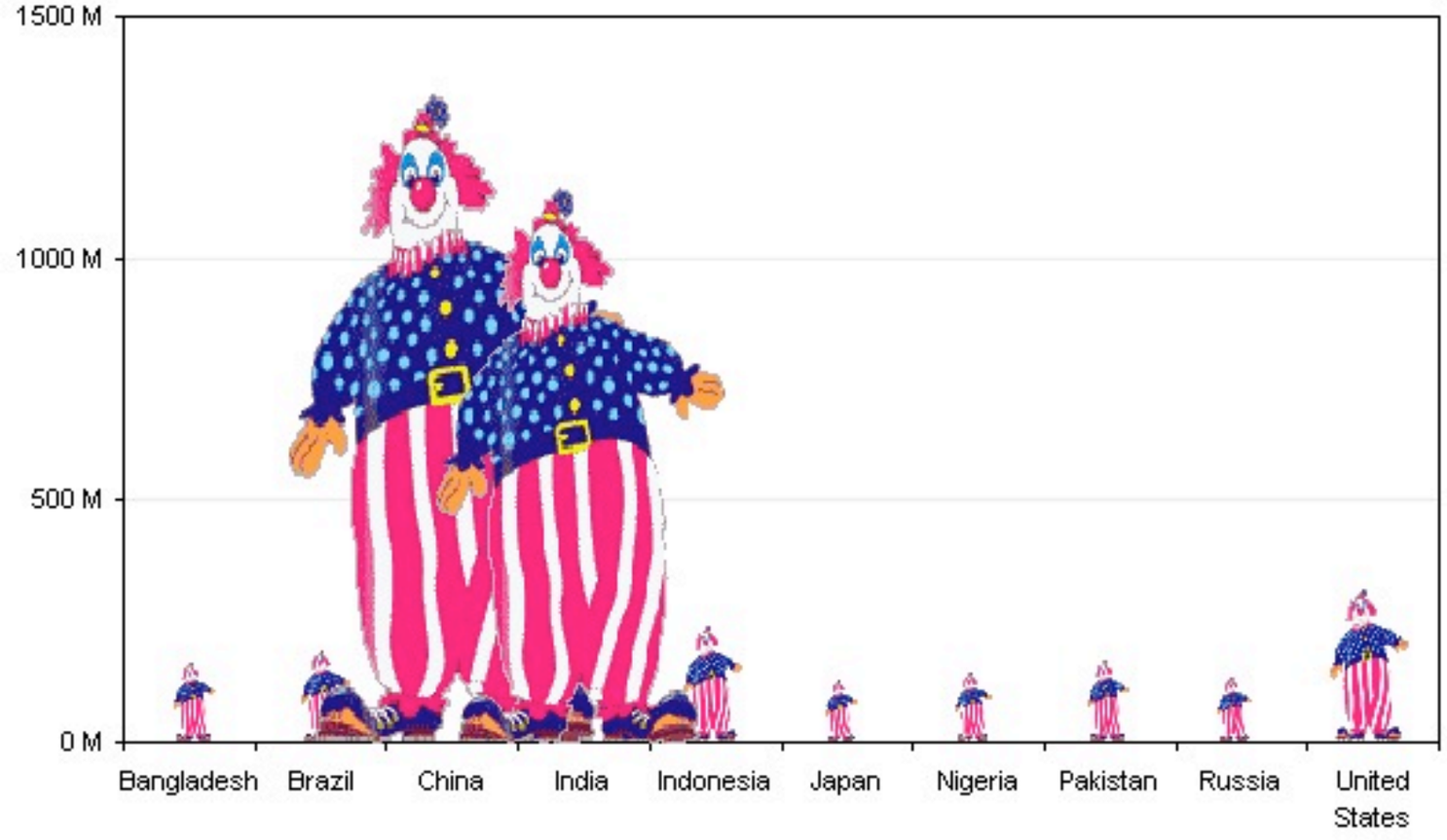
$$\text{DATA} \quad \frac{27.5 - 18.0}{18} \times 100\% = 53\%$$

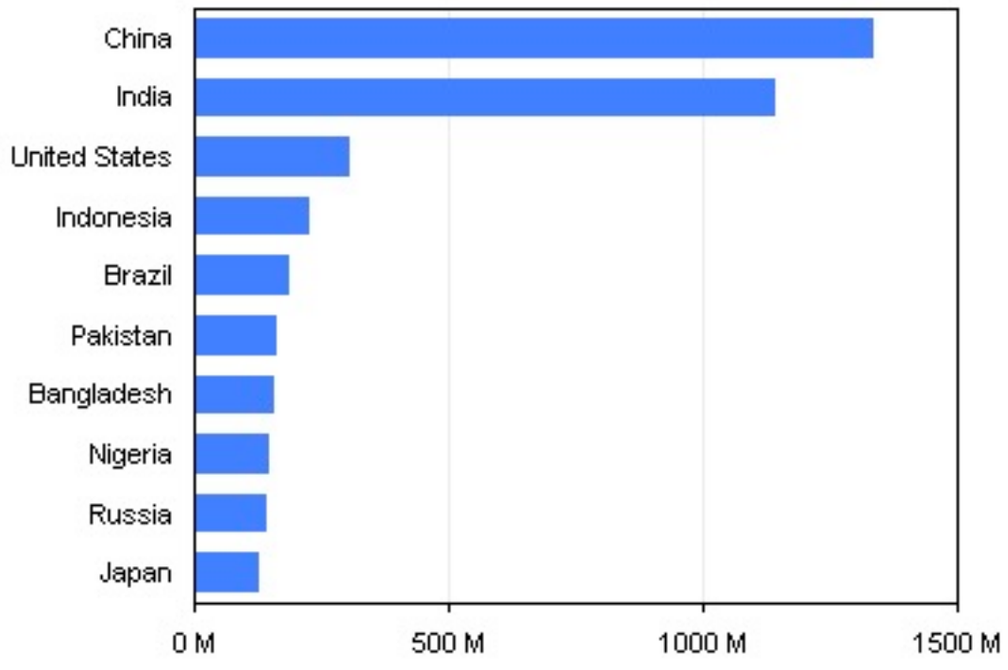
$$\text{LIE FACTOR} = \frac{783}{53} = 14.8$$


REQUIRED FUEL ECONOMY STANDARDS:
NEW CARS BUILT FROM 1978 TO 1985
18
19
20
22
24
26
27
27.5
19.1 mpg, expected average for all cars on road, 1985
13.7 mpg, average for all cars on road, 1978
1978 1979 1980 1981 1982 1983 1984 1985

Tufte 1997

UNINTENDED SIZE CODING





http://peltiertech.com/WordPress/bad-bar-chart-practices-or-send-in-the-clowns/

Tufte's integrity principles

Clear, detailed, and thorough labeling should be used to defeat graphical distortion and ambiguity.

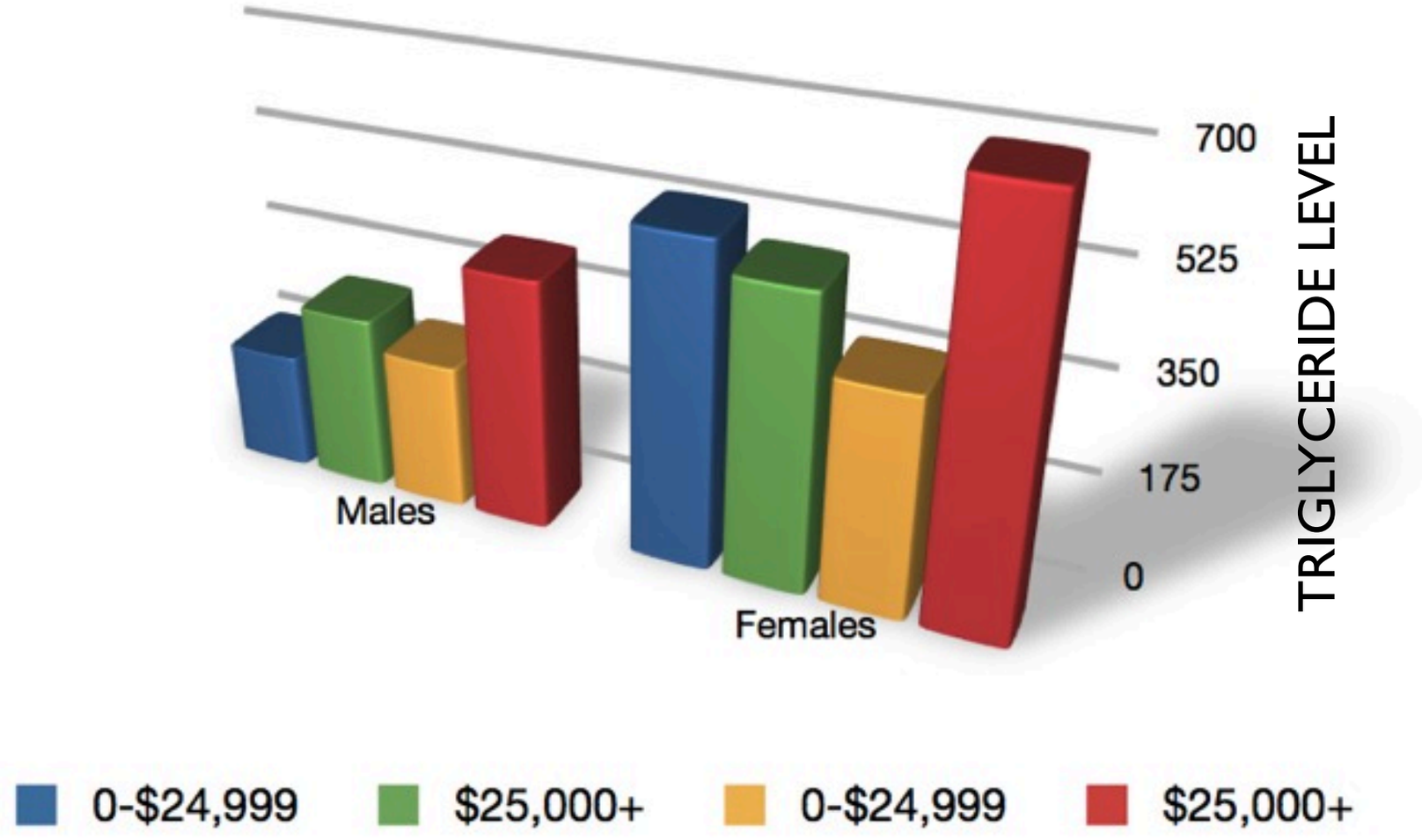
The representation of numbers, as physically measured on the surface of the graphic itself, should be directly proportional to the numerical quantities represented.

Show data variation, not design variation.

TUFTE: DESIGN PRINCIPLES

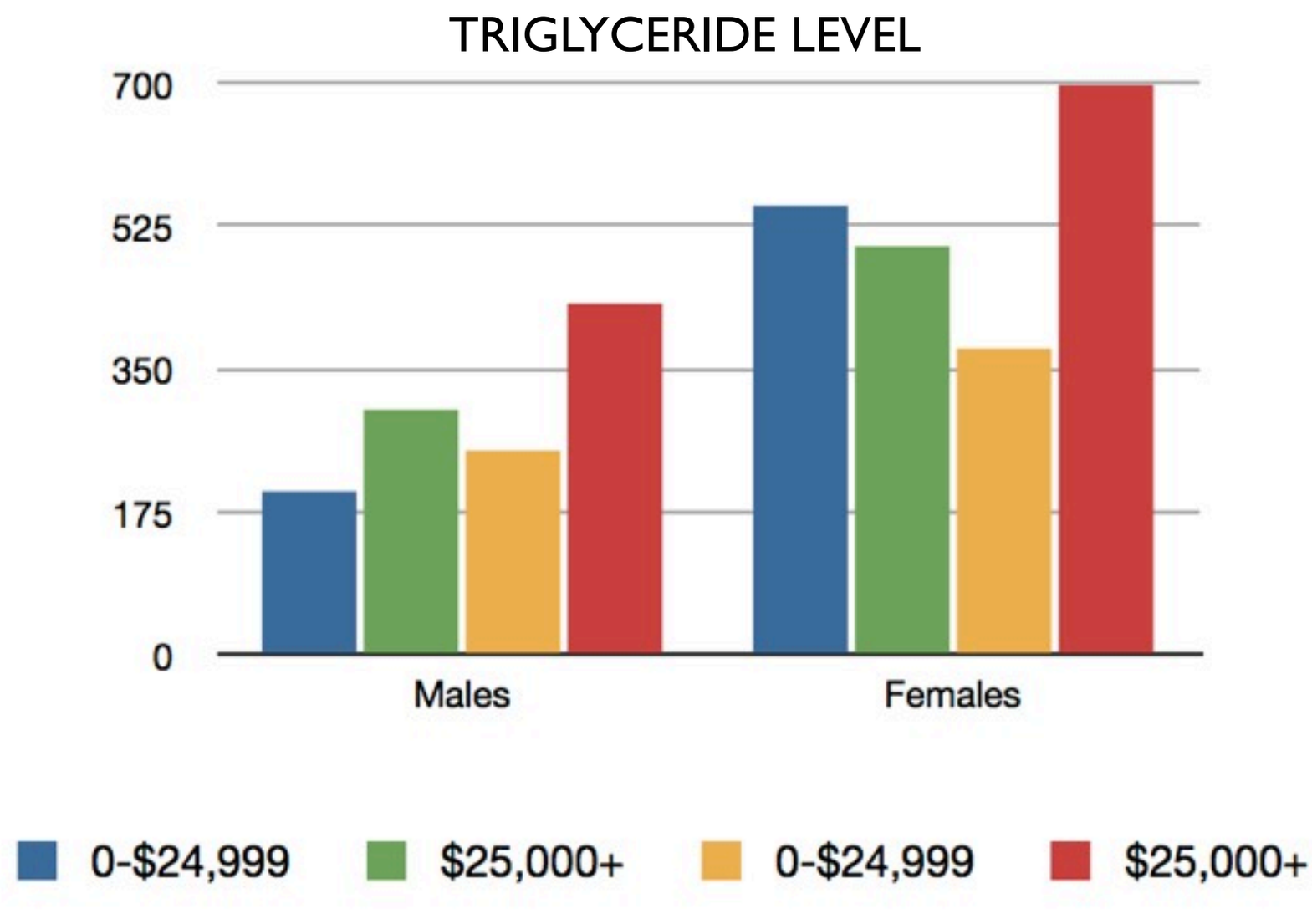
maximize the

Data-ink Ratio = $\dfrac{\text{data-ink}}{\text{total ink used in graphic}}$



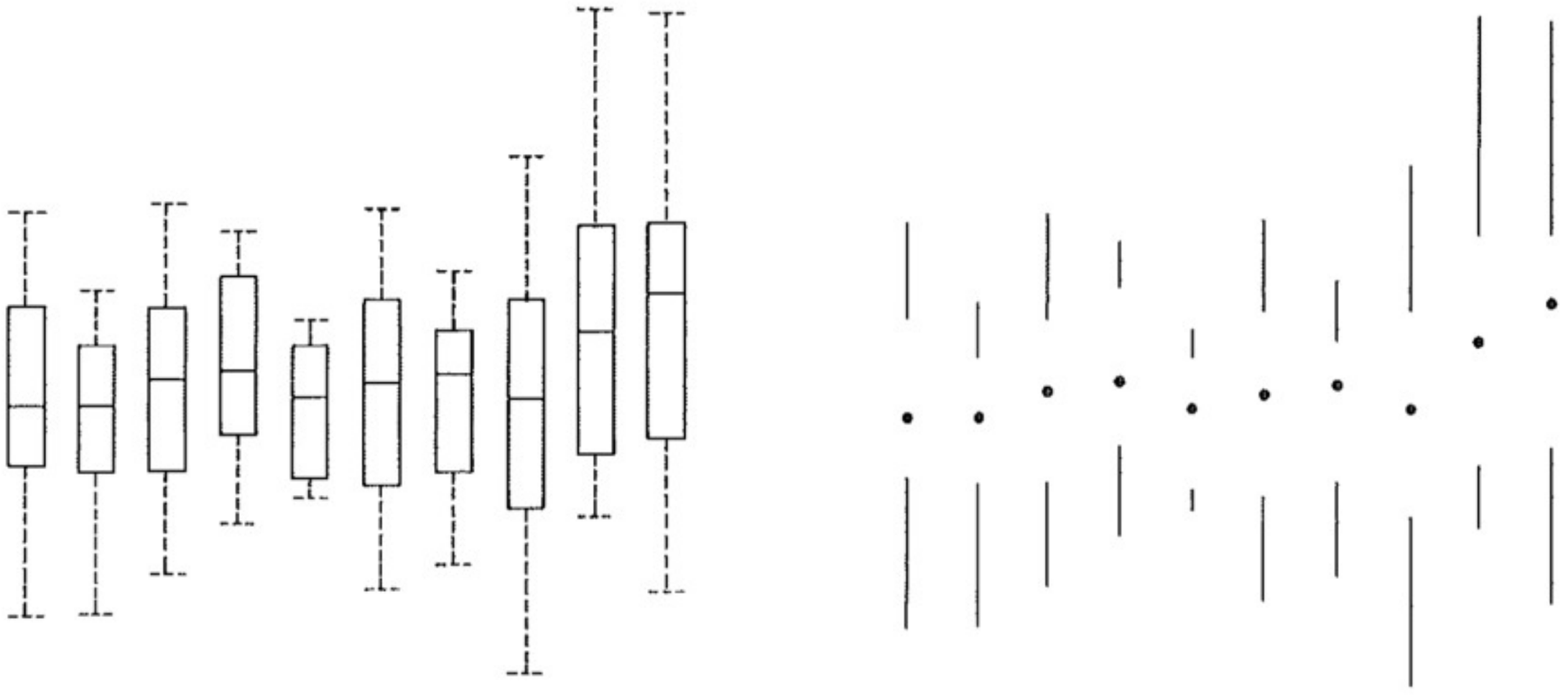
maximize the

Data-ink Ratio = $\dfrac{\text{data-ink}}{\text{total ink used in graphic}}$



maximize the

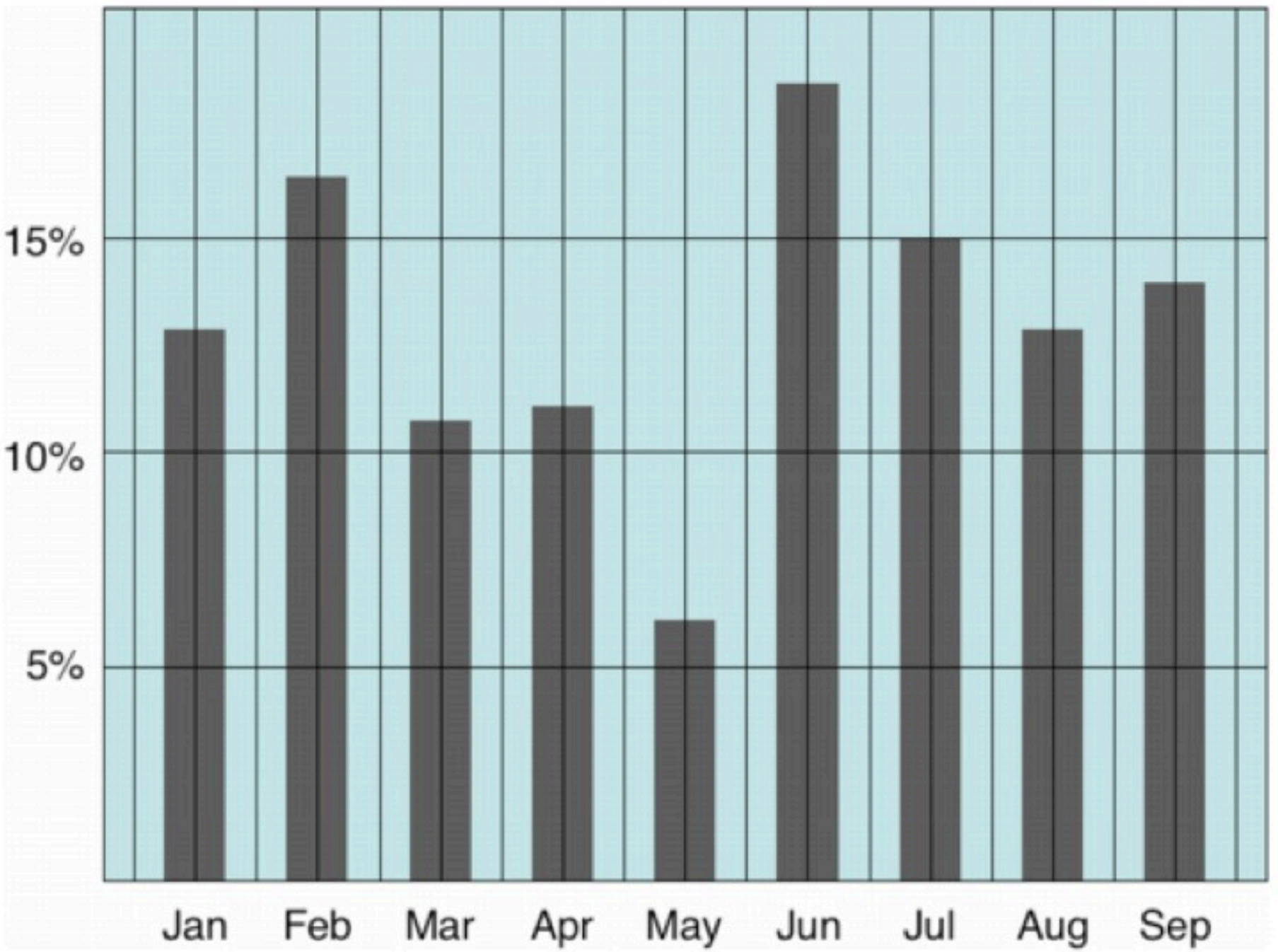
Data-ink Ratio = $\dfrac{\text{data-ink}}{\text{total ink used in graphic}}$



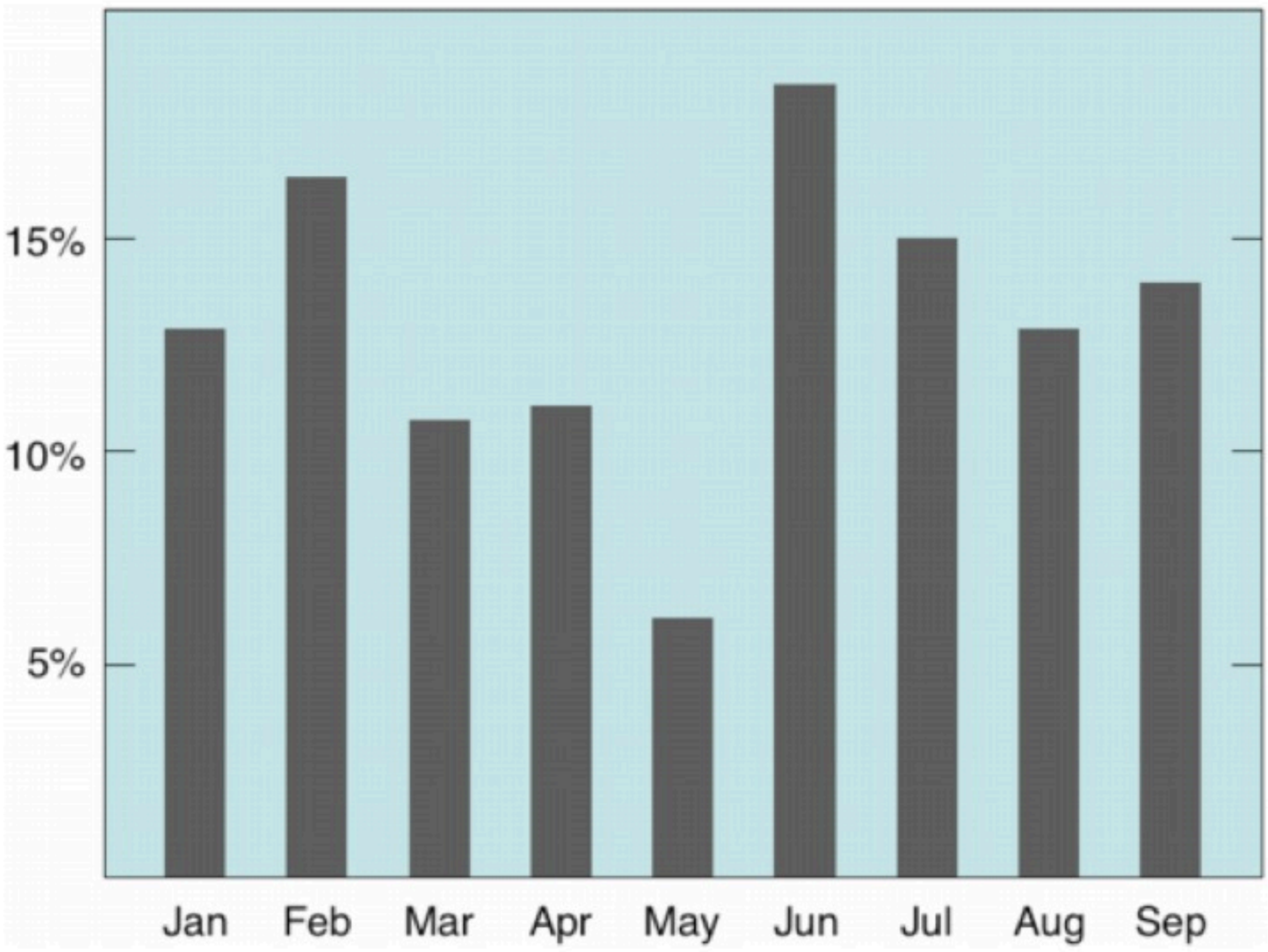
What Gestalt principle is Tufte relying on?

Tufte 1997

AVOID CHART JUNK



AVOID CHART JUNK



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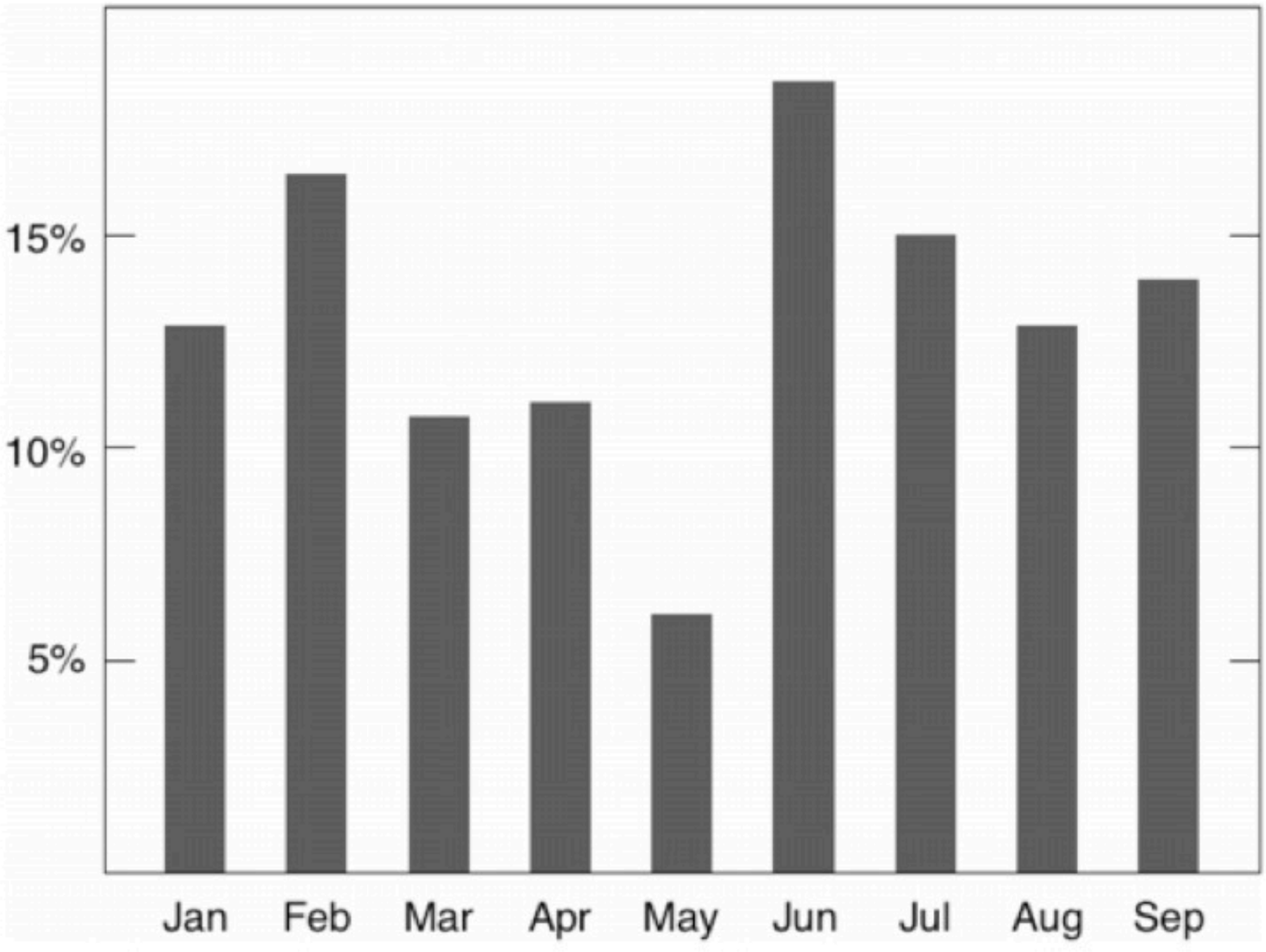

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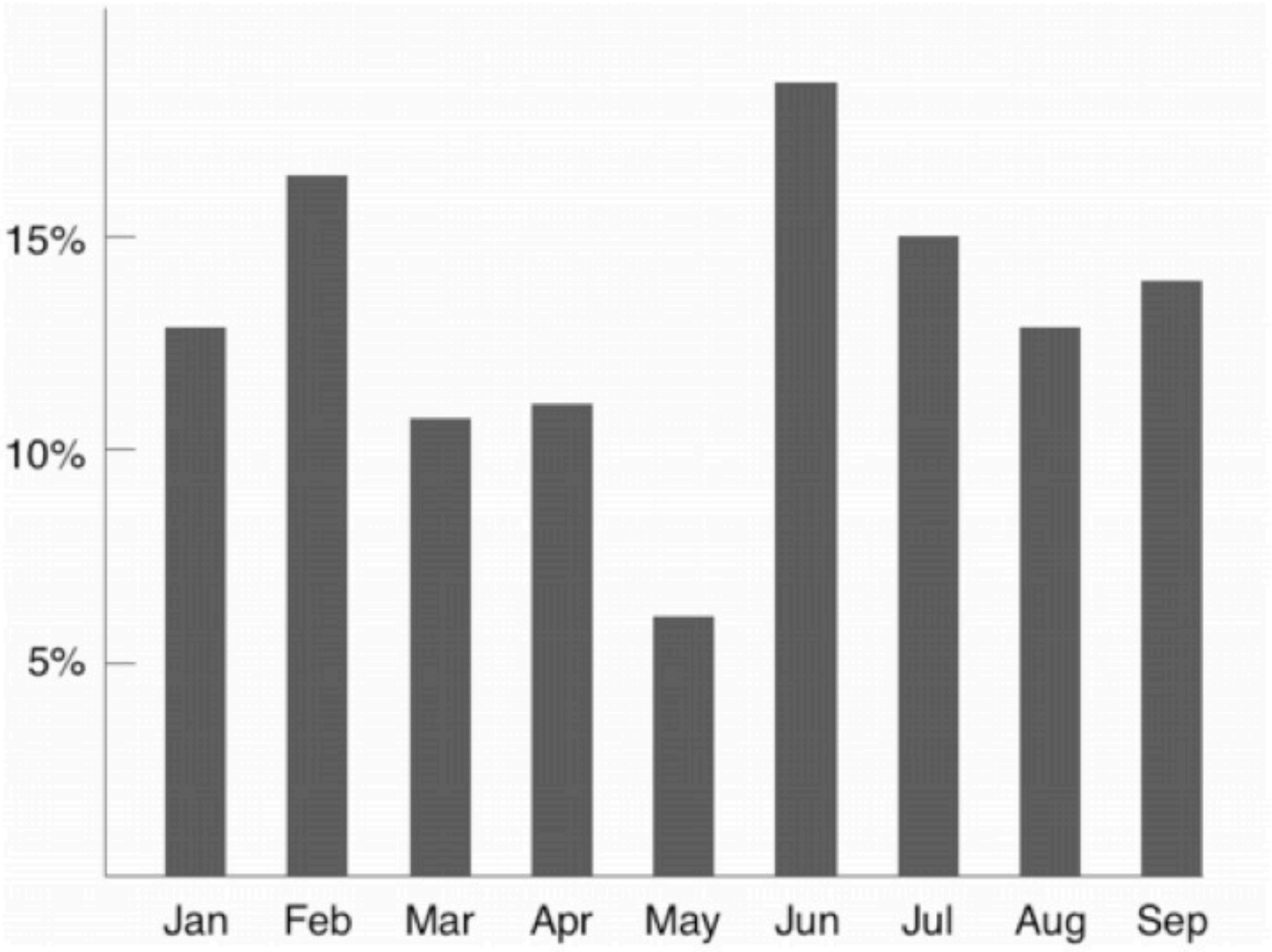

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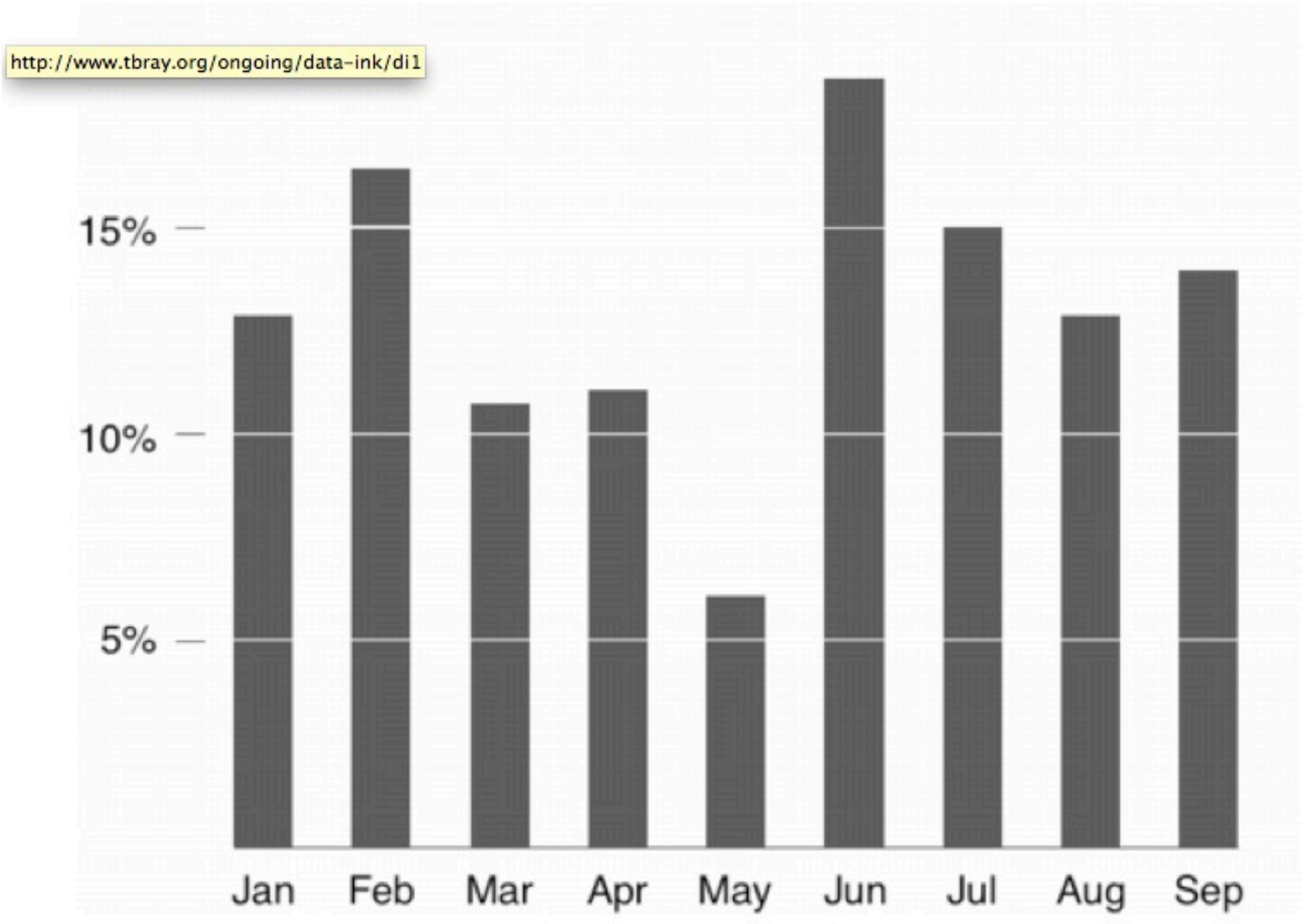

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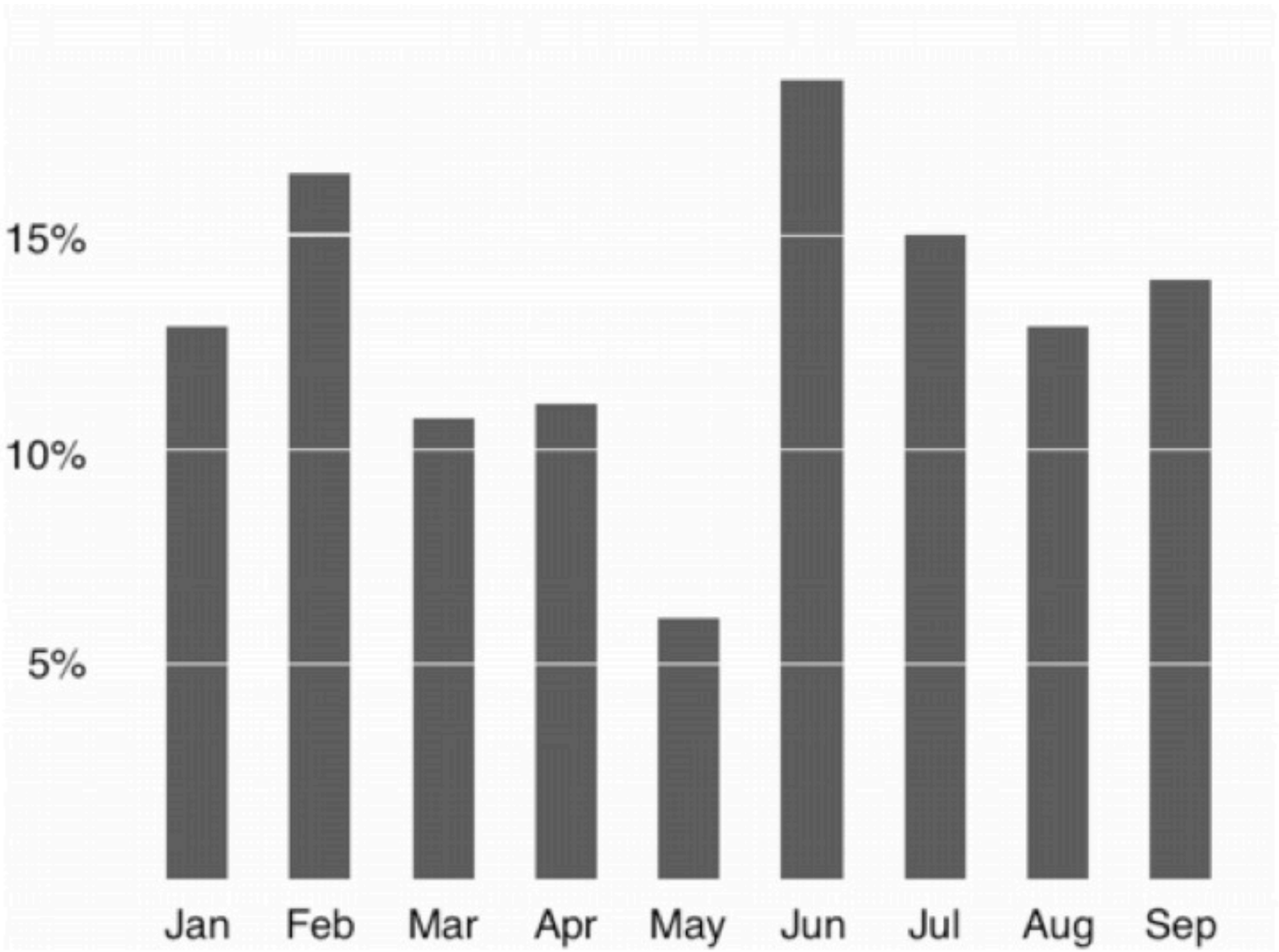
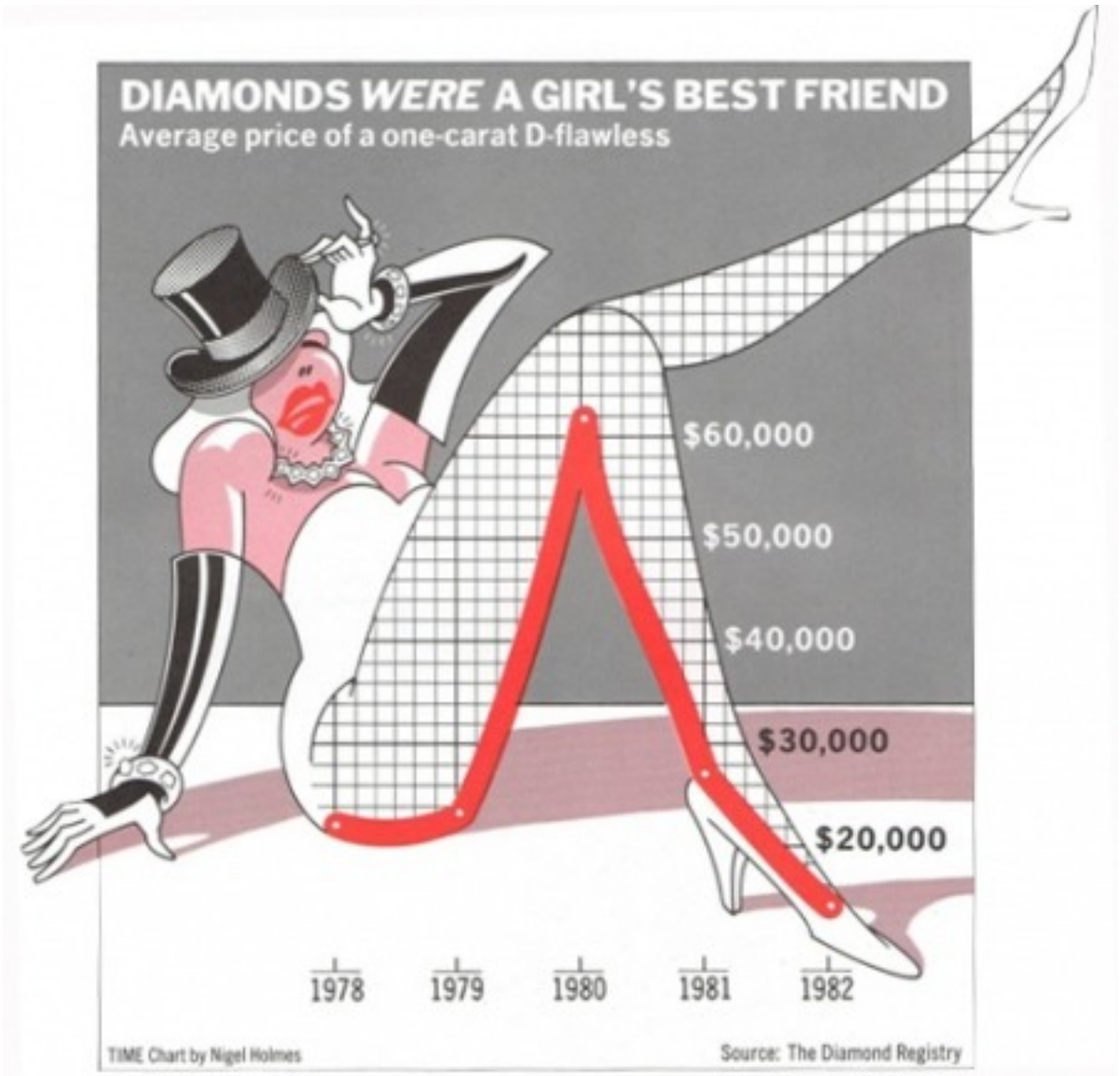
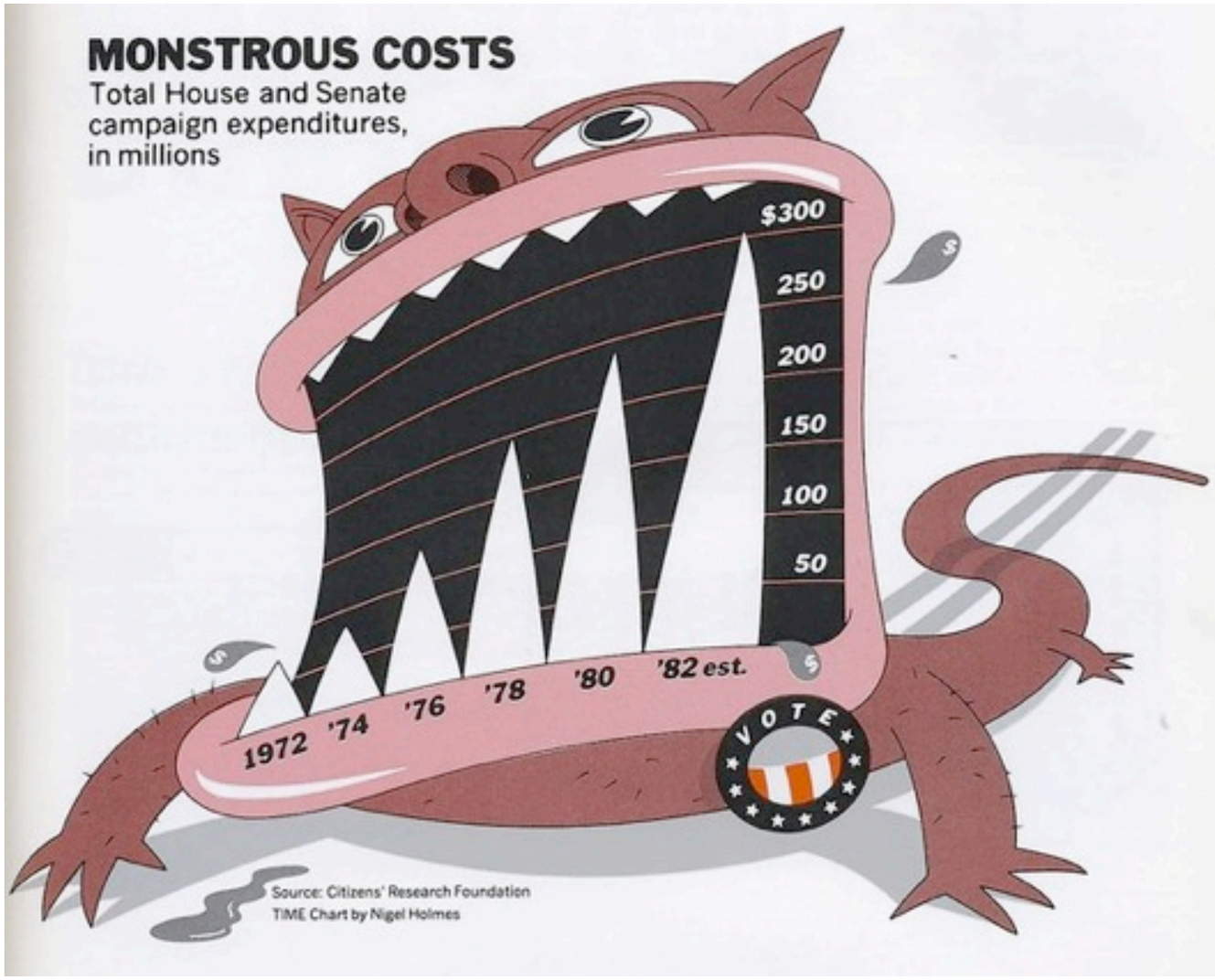


redesign exercise . . .





Nigel Holmes, TIME Magazine

Useful Junk? The Effects of Visual Embellishment on Comprehension and Memorability of Charts

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Aaron Genest, David McDine, Christopher Brooks
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ABSTRACT
Guidelines for designing information charts often state that the presentation should reduce 'chart junk' – visual embellishments that are not essential to understanding the data. In contrast, some popular chart designers wrap the presented data in detailed and elaborate imagery, raising the questions of whether this imagery is really as detrimental to understanding as has been proposed, and whether the visual embellishment may have other benefits. To investigate these issues, we conducted an experiment that compared embellished charts with plain ones, and measured both interpretation accuracy and long-term recall. We found that people's accuracy in describing the embellished charts was no worse than for plain charts, and that their recall after a two-to-three-week gap was significantly better. Although we are cautious about recommending that all charts be produced in this style, our results question some of the premises of the minimalist approach to chart design.

Author Keywords
Charts, information visualization, imagery, memorability.

COUNTER-POINT

Despite these minimalist guidelines, many designers include a wide variety of visual embellishments in their charts, from small decorations to large images and visual backgrounds. One well-known proponent of visual embellishment in charts is the graphic artist Nigel Holmes, whose work regularly incorporates strong visual imagery into the fabric of the chart [7] (e.g., Figure 1).

EXPERIMENTAL QUESTIONS

1) whether visual embellishments do in fact cause comprehension problems

2) whether the embellishments may provide additional information that is valuable for the reader

EXPERIMENTAL RESULTS

1) **No significant difference** between plain and image charts for interactive **interpretation accuracy**

2) **No significant difference** in **recall accuracy** after a five-minute gap

3) **Significantly better recall** for Holmes charts of both the chart topic and the details (categories and trend) after long-term gap (2-3 weeks).

4) Participants **saw value messages** in the Holmes charts **significantly more often** than in the plain charts.

5) Participants found the Holmes charts **more attractive**, **most enjoyed** them, and found that they were **easiest and fastest to remember**.

take away …

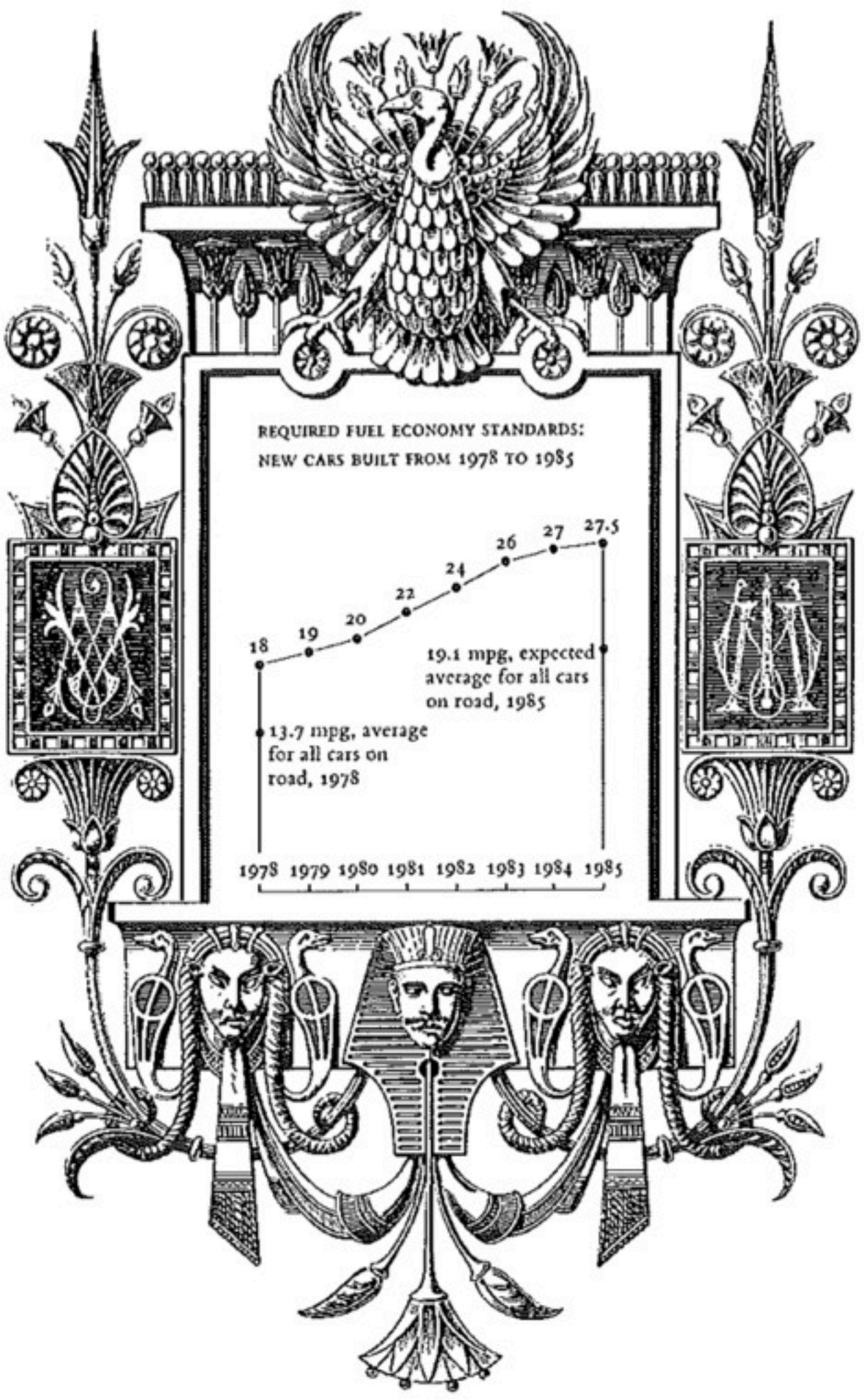
CHART JUNK? IT DEPENDS

PROS

- persuasion
- memorability
- engagement

CONS

- unbiased analysis
- trustworthiness
- interpretability
- space efficiency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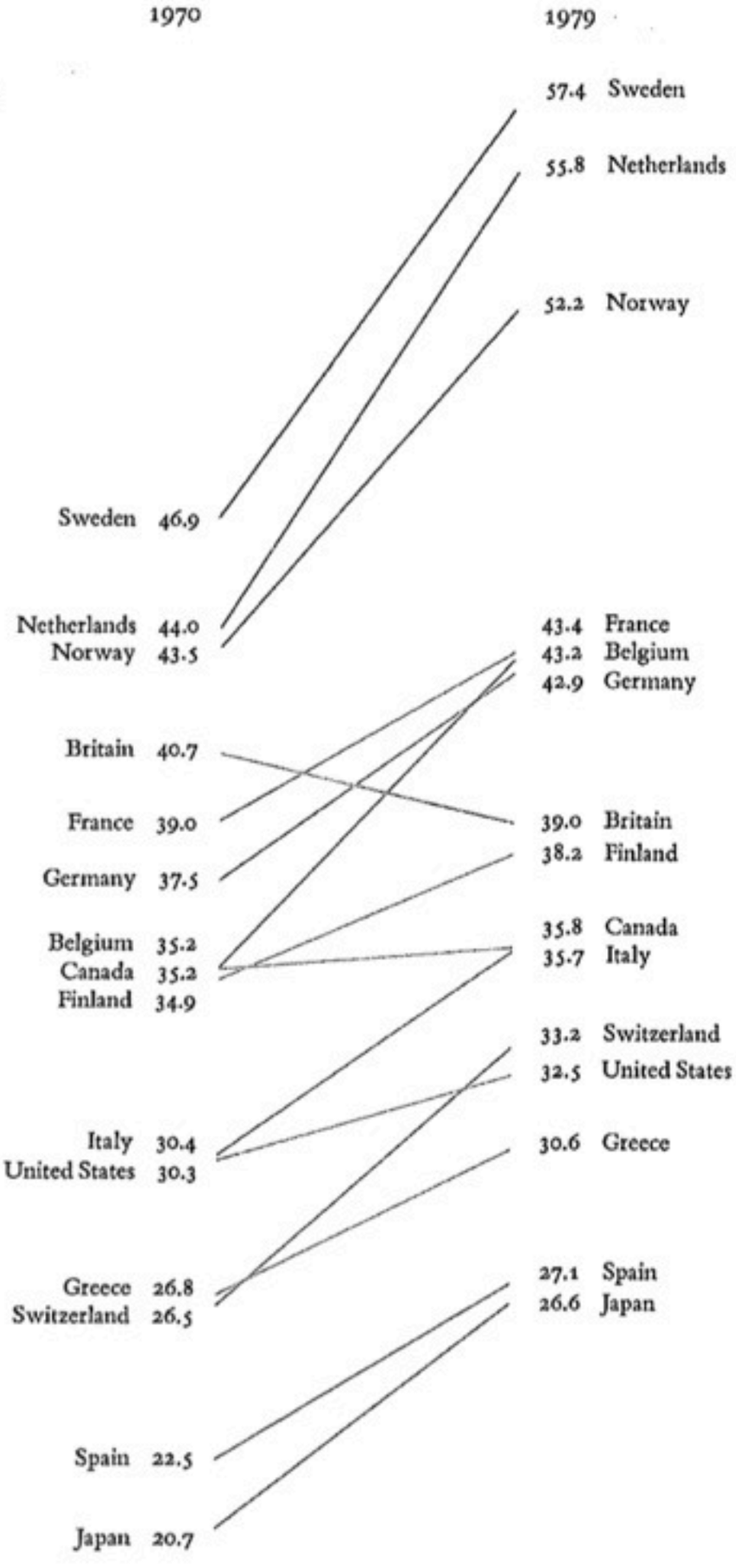
1978 1979 1980 1981 1982 1983 1984 1985

Tufte 1997

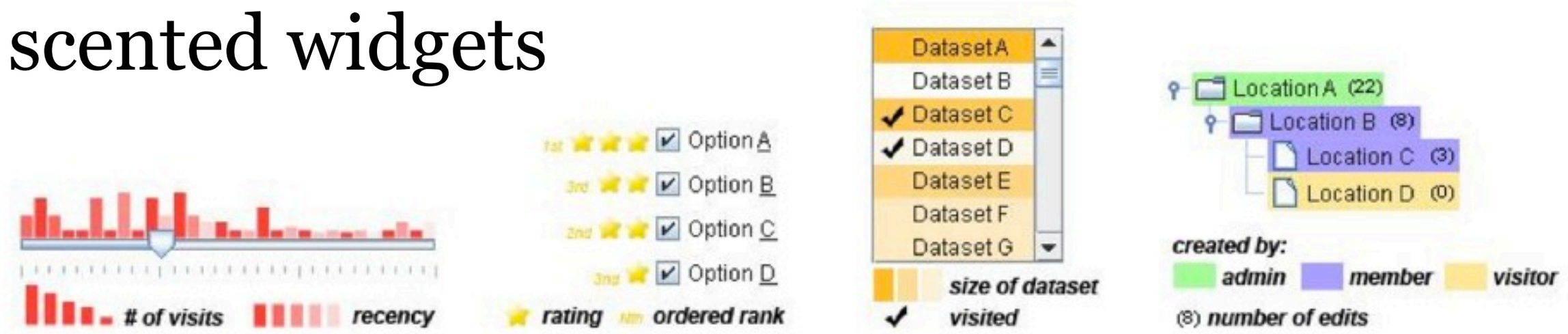
MULTIFUNCTIONING ELEMENTS



Tufte 1997

MULTIFUNCTIONING ELEMENTS

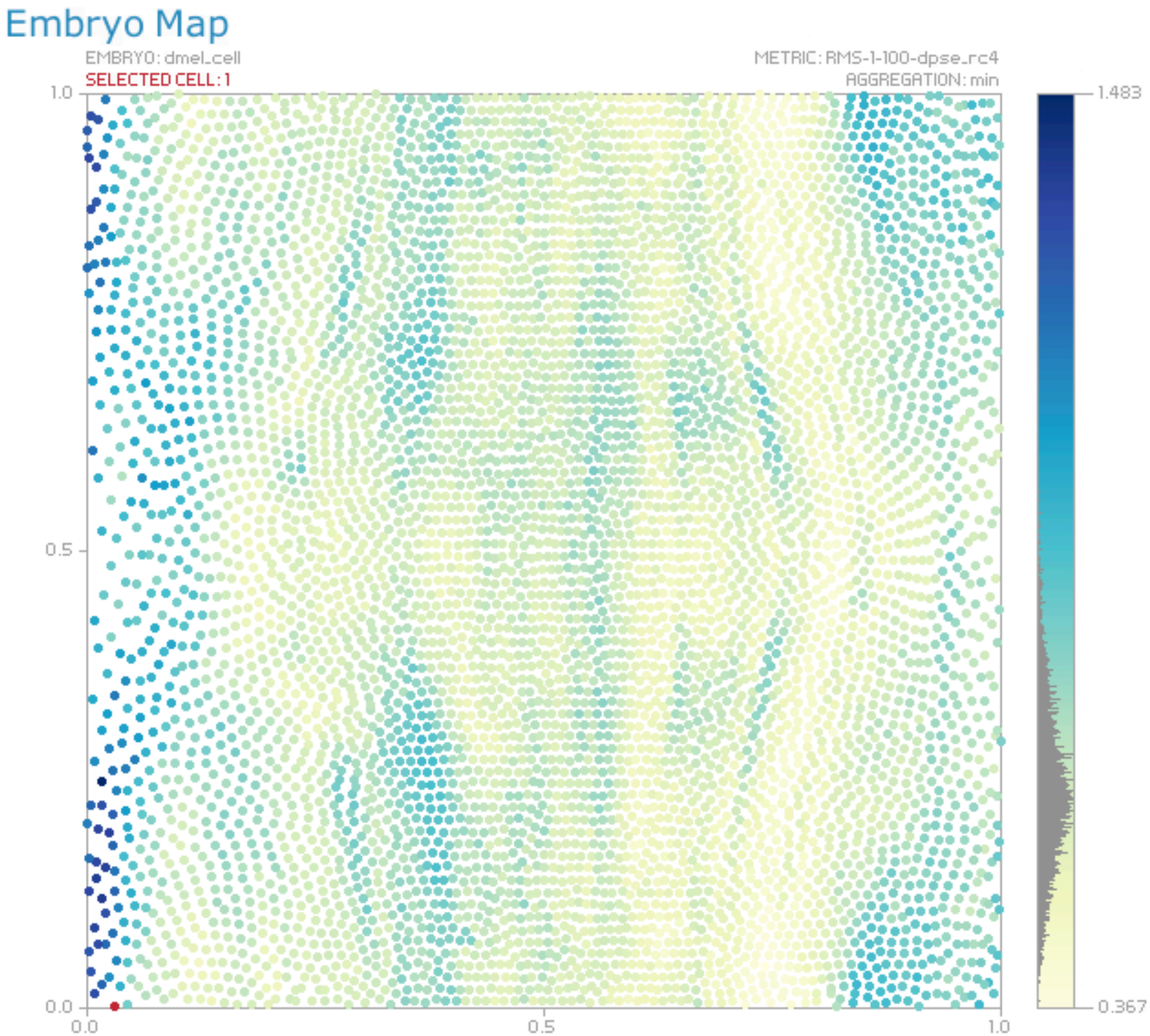
scented widgets



Willett et al 2007

MULTIFUNCTIONING ELEMENTS

interactive legend



Meyer et al 2010

LAYERING

Train No.	3701	3301	3801	3542	3765
New York	12:10	1:30	3:45	7:30	4:33
Newark, N. J.	1:43	10:30	5:21	8:50	11:45
North Elizabeth	....	.....	.....	.....	6:45
Elizabeth	3:33	2:05	.....	.....	7:05
Peekskill	5:34	6:40	.....	7:20	8:50
Ediison, N. J.	4:45	5:20	4:40	2:10	11:05
Princeton, N. J.	1:30	.....	.....	3:30	7:30

New York	12:10	1:30	3:45	7:30	4:33
Newark, N. J.	1:43	10:30	5:21	8:50	11:45
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Peekskill	5:34	6:40	.....	7:20	8:50
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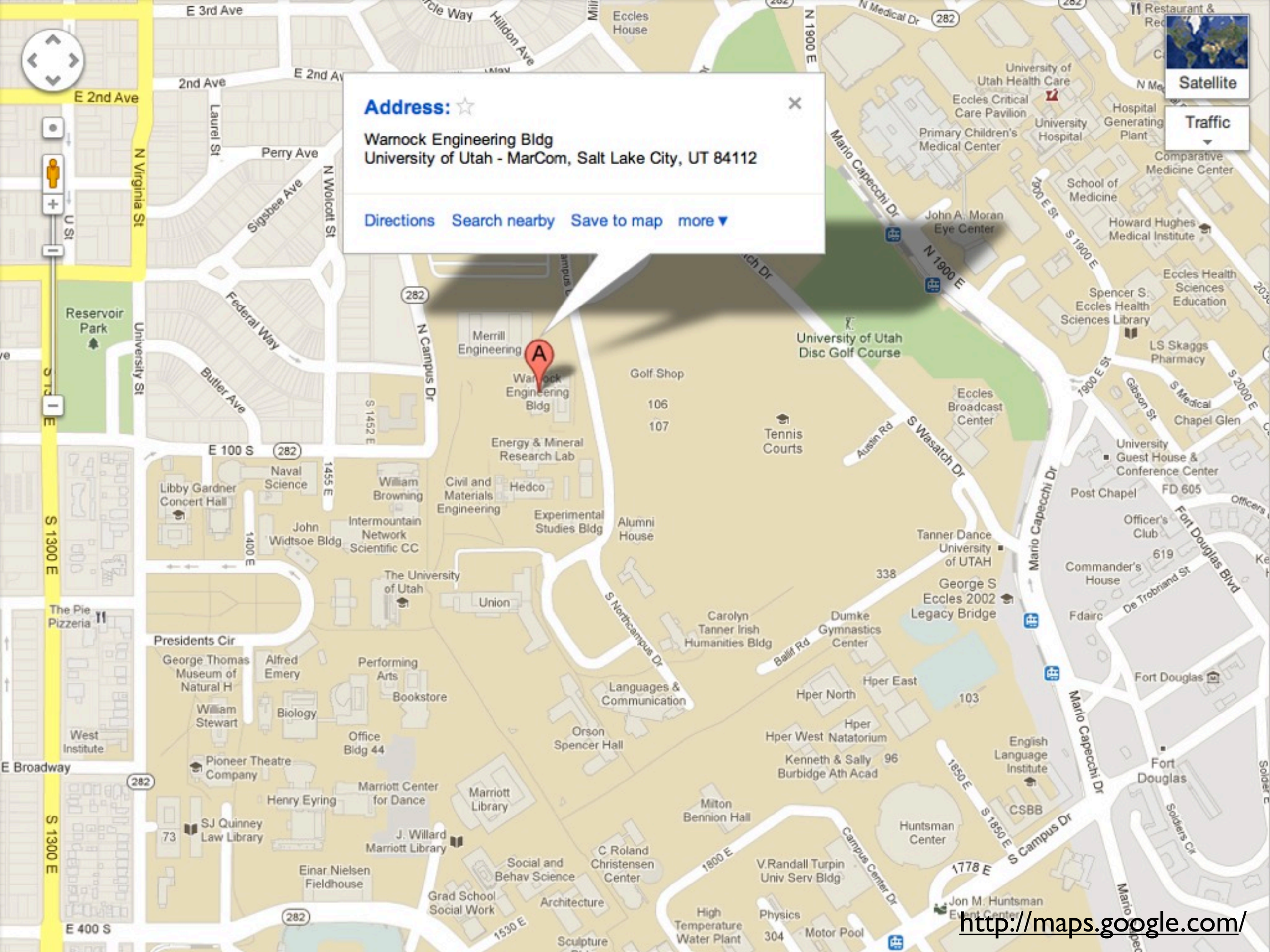
Tufte 1997

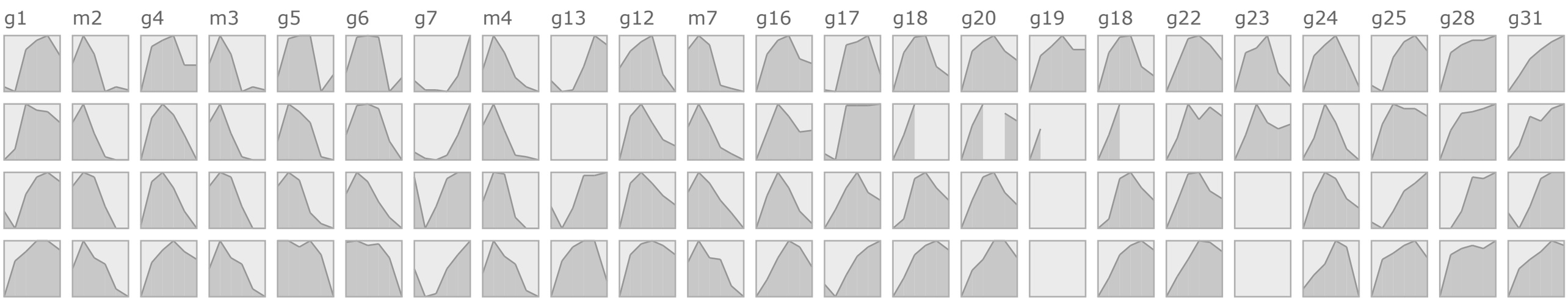


http://maps.google.com/

maximize the

$$\textbf{Data Density} = \frac{\text{number of entries in data array}}{\text{area of data graphic}}$$

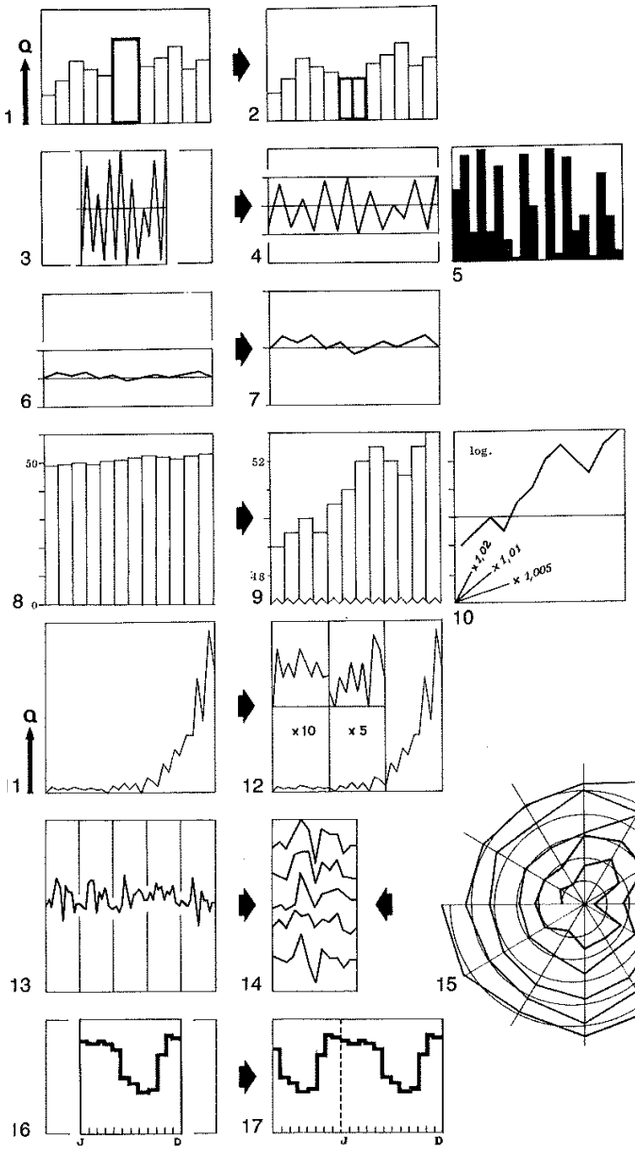
SHRINK THE GRAPHICS



SMALL MULTIPLES

Meyer et al 2010

SHRINK THE GRAPHICS



GRAPHIC PROBLEMS POSED BY TIME SERIES

Scale in years
With a scale in years, a two-year total (figure 1) should be divided by 2 (figure 2). A total for six months should be multiplied by 2.

Pointed curves
For overly pointed curves (figure 3), the scale of the Q should be reduced; optimum angular perceptibility occurs at around 70 degrees (figure 4).

If the curve is not reducible (large and small variations), filled columns can be used (figure 5).

Flat curves
For overly flat curves (figure 6), the scale of the Q should be increased (figure 7).

Small variations
For small variations in relation to the total (figure 8), the total loses its importance, and the zero point can be eliminated, provided the reader is made aware of this elimination (figure 9). The graphic can be interpreted as an acceleration if a precise study of the variations is necessary; here, we use a logarithmic scale (figure 10). (See also page 240.)

Large range
For a very large range between the extreme numbers (figure 11), we must either:
(1) leave out the smallest variations;
(2) be concerned only with relative differences (logarithmic scale), without knowing the absolute quantities;
(3) select different parts (periods) within the ordered component and treat them on different scales above the common scale (figure 12).

Obvious periodicity
If there is obvious periodicity (figure 13), and the study involves a comparison of the phases of each cycle, it is preferable to break up the cycles in order to superimpose them (figure 14). A polar construction can be used, preferably in a spiral shape (figure 15), but we should not begin with too small a circle. As striking as it seems, it is less efficient than an orthogonal construction.

Annual curves
For annual curves of rainfall or temperature, if a cycle has two phases (figure 17), why depict only one (figure 16)?

A contrast
Unlike what we see in figure 18, the pertinent or "new" information must be separated from the background or "reference" information. The background involves: (a) the invariant, highlighted by a heading (Port St. Michel); (b) the highly visible identification of each component (tonnage and dates). The new information (the curve) must stand out from the background (figure 19).

Reference points
It is impossible to utilize a graphic such as figure 20, except in a general manner. There is confusion concerning the position of the points, and no potential comparison is possible, as it is in figure 21.

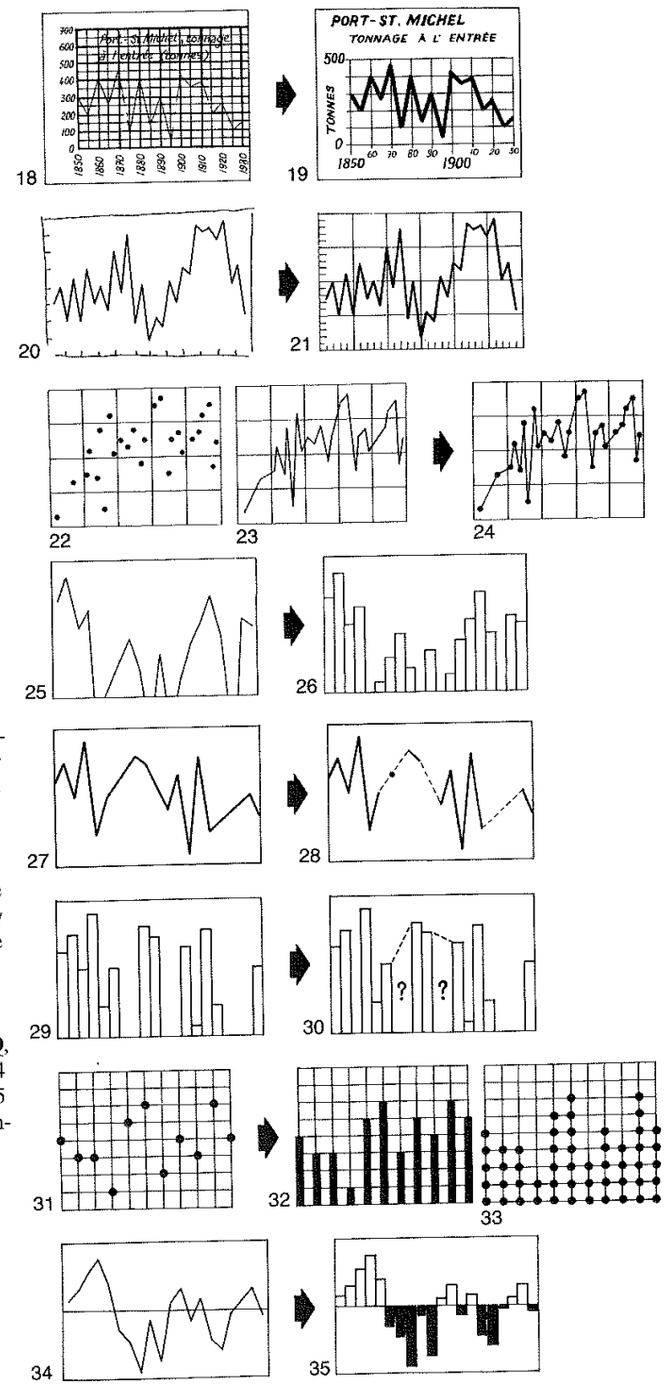
Precision reading
A precision reading (utilization on the elementary level, as in figure 24) is difficult in figure 22, which results in a poor reading of the order of the points, and in figure 23, where there is ambiguity concerning the position of the points. On the other hand, figure 22 does favor overall vision (correlation).

Null boxes
Curves accommodate null boxes poorly (figure 25). Columns (figure 26) are preferable.

Unknown boxes
The drawing must indicate the unknowns of the information in an unambiguous way (figures 28 and 30).The reader might interpret figure 27 as a change in the structure of the curve and figure 29 as involving null values.

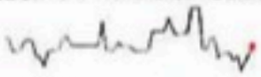
Very small quantities
Except in seeking a correlation (quite improbable here) the number of ships entering into a port is represented better by figure 33 than by figures 31 or 32. The reader can perceive the numerical values at first glance.

Positive-negative variation
This is in fact a problem involving three components O, Q, ≠ (+ –), and it must be visually treated as such. Figure 34 can be improved by utilizing a retinal variable (in figure 35 a value difference: black–white) to differentiate the ≠ component and thus highlight positive-negative variation.



Bertin 1967

SHRINK THE GRAPHICS

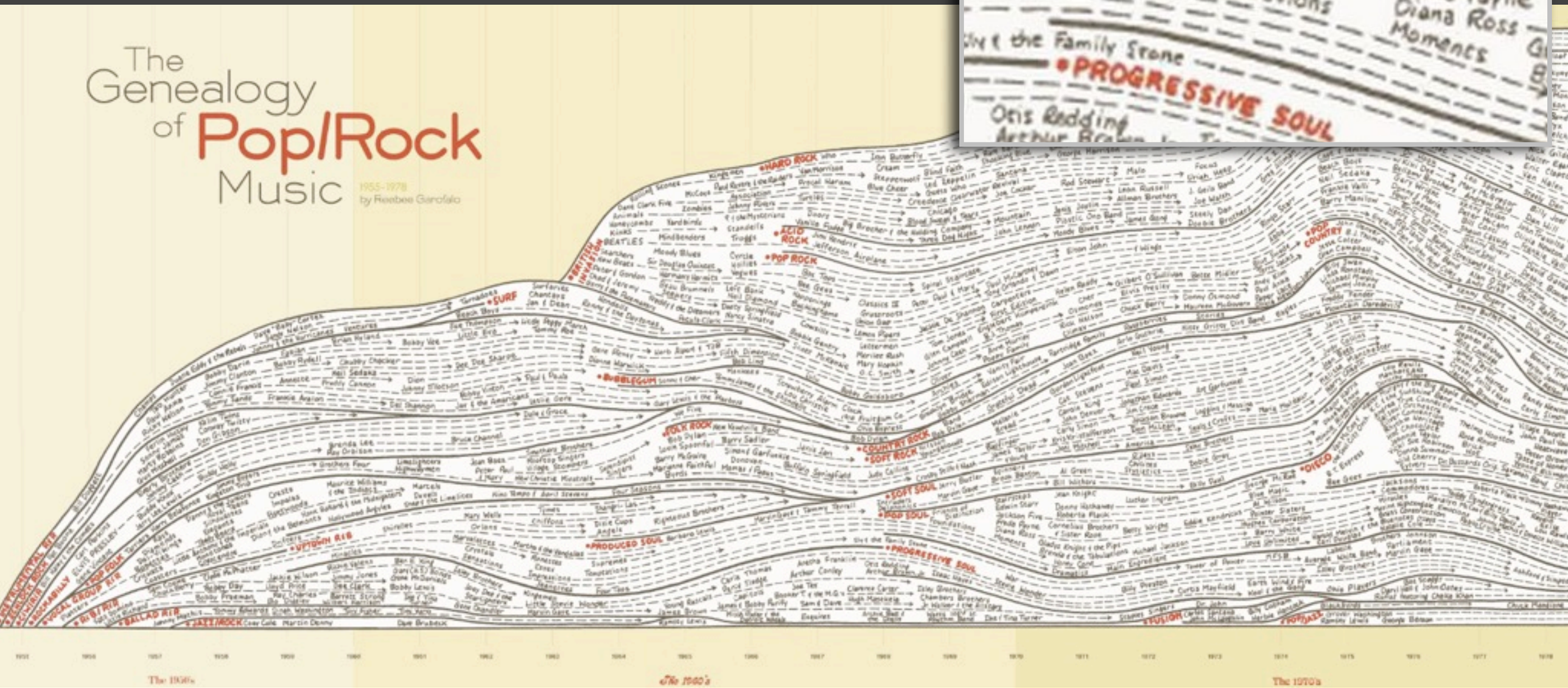
Dequantification In exchange for an enormous increase in graphical resolving power, the wordlike size of sparklines precludes the overt labels and scaling of conventional statistical displays. Most of our examples have, however, depicted *contextual methods* for quantifying sparklines: the gray bar for normal limits and the red encoding to link data points in sparklines to exact numbers  glucose 6.6 ; global scale bars and labels for sparkline clusters; and, probably best of all, surrounding a sparkline with an implicit data-scaling box formed by nearby numbers that label key data points (such as beginning/end, high/low) 1.1025  1.1907 1.0783 1.2858. And now and then sparklines might be scaled by very small type: 

Production methods Data lines produced by conventional statistical graphics programs must be gathered together, rescaled, and resized into sparklines. Sometimes this can be quickly done by cutting and pasting data lines, then resizing the printed output to sparkline resolutions. To produce and display really decent sparklines, however, currently requires elaborate (3) a *statistical analysis* program to generate hundreds of chartjunk-free sparklines for export into design and layout operations. Once the basic templates for sparklines are worked out, then ongoing production and

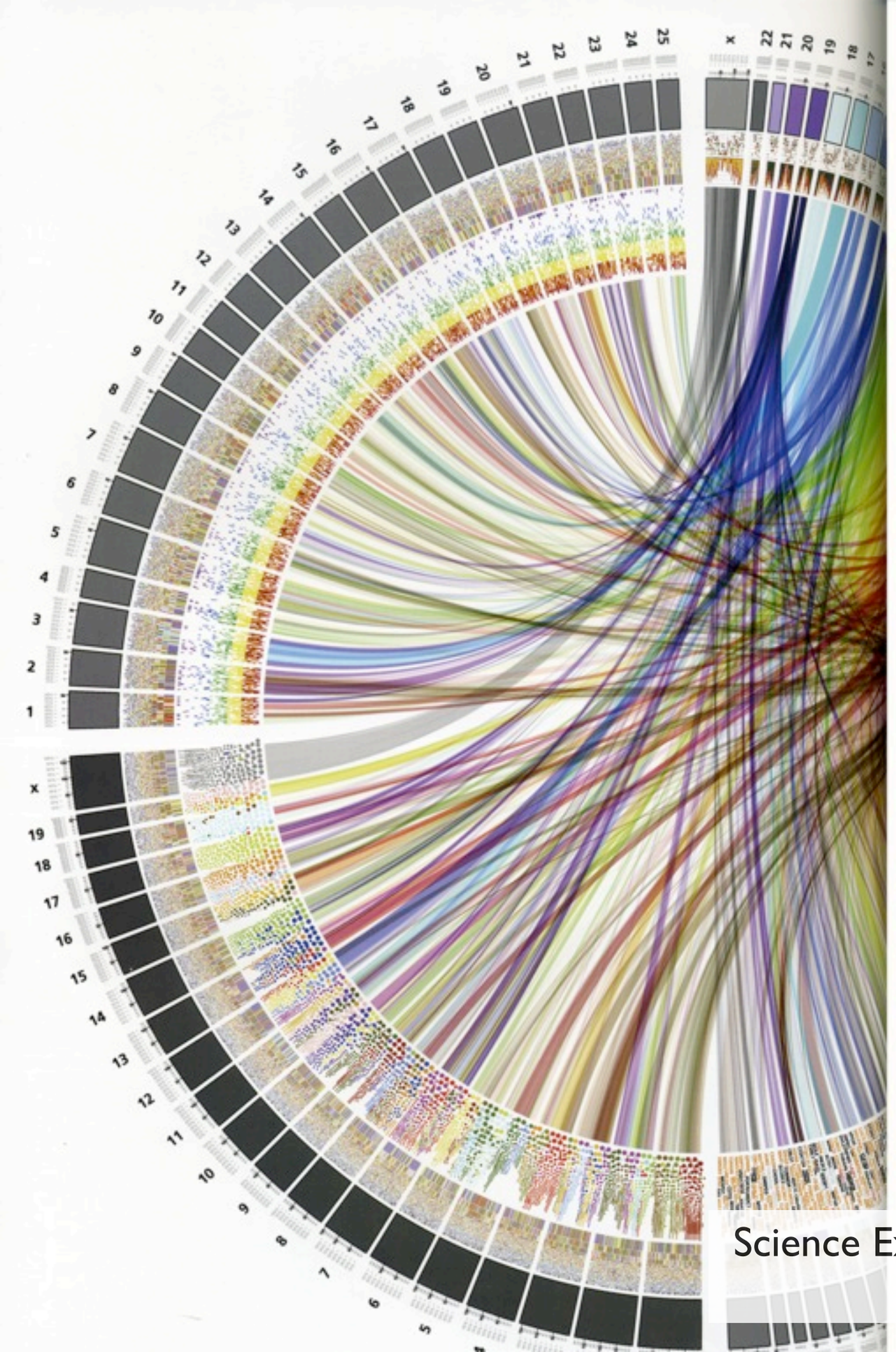
SPARKLINES

Tufte 2006

MAXIMIZE AMOUNT OF DATA SHOWN



Steve Chappel and Reebe Garofalo
in Rock 'N' Roll is Here to Pay: The History and Politics of the Music Industry, 1977



On the road to a digital society

Computer technology is an ubiquitous element of our world, and fast networks are spanning the globe. This is changing the way we live and work and communicate. A new digital world is emerging, an environment in which creativity and innovation can flourish in many new ways. As a result, science and research have a greater influence on our life in the 21st century than ever before. This is attributable to massive investments in research and development, but also to intensive cooperation and tough competition. The convergence of nano-, bio-, information- and neurotechnologies facilitates completely new applications. Taking its place beside the more traditional factors of land, capital and employment, knowledge is fast becoming the decisive factor for prosperity – and also for the resolution of global problems. In this, the appropriate balance between digital freedom and digital security must be maintained.

Science 2020: Systematically surveying the world *Millions of scientists are getting to the bottom of the secrets of our world, across the whole spectrum of space, time, energy and complexity. Fundamentally new knowledge is emerging from research into inter-disciplinary topics or extreme states of matter. Science long ago escaped the constraints of working only in the realm of our natural living conditions and our perceptions. Considerable investment is flowing into efforts to decode the smallest building blocks of our world and to understand how their interplay produces brand new qualities. The drivers of innovation in research today are data capture via digital sensors; storage, analysis and visualisation via computer and software; and the global exchange of information and knowledge.*

The cost of new knowledge is rising There is now no part of our life that is not the subject of research. At the same time, it is becoming ever more difficult to generate new knowledge. These days, new research methods and technologies enable us to study even the ›farthest frontiers‹ of the world: extremely fast or slow processes, the tiniest building blocks or the largest structures, extreme cold or extreme heat.

Networked knowledge takes on global challenges *Thanks to worldwide information and communication networks, the challenges our civilisation faces in the long term are known to us sooner and more clearly than ever before. We can start developing solutions together at an earlier stage. Research on many topics is global – taking place in close cooperation or in international competition for the fastest and best solutions. National boundaries are becoming irrelevant. Millions of scientists work across countries, continents and time zones in thousands of labs. Their global networking enhances the diversity and efficiency of science and technology. And this, in turn, reinforces globalisation and networking. In a world changing at such a pace, each country must redefine its place.*

The end of distance Mankind faces enormous challenges both locally and globally – the challenge of using resources sustainably and of organising a global economy. Across the globe, complex processes are being recorded in detail, collated in databases and analysed in computer networks. New visualisation techniques make it possible to analyse larger and larger data records and to draw conclusions from the results.

Global networking as the driving force of science In the early days, the Internet linked up scientists, large-scale equipment and information; now it networks computational power and enormous amounts of data through grid and cloud computing. A global Semantic Web is emerging, bringing together data, expertise and knowledge that had previously been distributed among virtual libraries and observatories. The information is being intelligently developed, new forms of cooperation are arising, and research is becoming more productive

Science Express: How Science and Technology change our life.
Herausgegeben von der Max-Planck-Gesellschaft

Unseen and Unaware: Implications of Recent Research on Failures of Visual Awareness for Human–Computer Interface Design

D. Alexander Varakin and **Daniel T. Levin**
Vanderbilt University

Roger Fidler
Kent State University

COUNTER-POINT

ABSTRACT

Because computers often rely on visual displays as a way to convey information to a user, recent research suggesting that people have detailed awareness of only a small subset of the visual environment has important implications for human–computer interface design. Equally important to basic limits of awareness is the fact that people often over-predict what they will see and become aware of. Together, basic failures of awareness and people's failure to intuitively understand

ILLUSIONS OF VISUAL BANDWIDTH

people over-predict what they will see and become aware of

- **overestimate of breadth**
  - belief that viewers can take in all (or most) of the details of a scene at once
  - adding extra visual features makes it harder to find specifics bits of information

- **overestimate of countenance**
  - belief that user will attend to a higher proportion of the display than they do
  - users typically have expectations about where in a display to look

- **overestimate of depth**
  - belief that attending to an object leads to more complete and deep understanding than is the case

Tufte's design principles

- maximize the data-ink ratio

- avoid chart junk (***sometimes***)

- use multifunctioning elements

- layer information

- maximize the data density

    - shrink the graphics
    - maximize the amount of data shown (***sometimes***)

WILLIAMS: DESIGN PRINCIPLES

"Once you can name something, you're conscious of it"

Robin Williams

Williams's design principles

Contrast

Repetition

Alignment

Proximity

PRINCIPLE OF CONTRAST

If two items are not exactly the same, then make them different. Really different.

Don’t be a wimp.

ANOTHER NEWSLETTER!

January First 2005

Exciting Headline

Wants pawn term dare worsted ladle gull hoe hat search putty yowler coils debt pimple colder Guilty Looks. Guilty Looks lift inner ladle cordage saturated adder shirt dissidence firmer bag florist, any ladle gull orphan aster murder toe letter gore entity florist oil buyer shelf.

Thrilling Subhead

"Guilty Looks!" crater murder angularly. "Hominy terms area garner asthma suture stooped quiz-chin? Golter door florist? Sordidly NUT!"

"Wire nut, murder?" wined Guilty Looks, hoe dint peony tension tore murder's scaldings.

"Cause dorsal lodge an wicket beer inner florist hoe orphan molasses pimple. Ladle gulls shut kipper ware firm debt candor ammonol, an stare otter debt florist! Debt florist's mush toe dentures furry ladle gull!"

Another Exciting Headline

Wail, pimple oil-wares wander doe wart udder pimple dum wampum toe doe. Debt's jest hormone nurture.

Wan moaning, Guilty Looks dissipater murder, an win entity florist. Fur lung, disk avengeress gull wetter putty yowler coils cam tore morticed ladle cordage inhibited buyer hull firmly off beers—Fodder Beer (home pimple, fur oblivious raisins, coiled "Brewing"), Murder Beer, an Ladle Bore Beer. Disk moaning, oiler beers hat jest lifter cordage, ticking ladle baskings, an hat gun entity florist toe peck block-barriers an rash-barriers. Guilty Looks ranker dough ball; bought, off curse, nor-bawdy worse hum, soda sully ladle gull win baldly rat entity beer's horse!

Boring Subhead

Honor tipple inner darning rum, stud tree boils fuller sop—wan grade bag boiler sop, wan muddle-sash boil, an wan tawny ladle boil. Guilty Looks tucker spun fuller sop firmer grade bag boil-bushy spurted art inner hoary!

"Arch!" crater gull, "Debt sop's toe hart—barns mar mouse!"

Dingy traitor sop inner muddle-sash boil, witch worse toe coiled. Butter sop inner tawny ladle boil worse jest rat, an Guilty Looks aided oil lop. Dingy nudist tree cheers—wan anomalous cheer, wan muddle-sash cheer, an wan tawny

Another Newsletter!

January First 2525

Exciting Headline

Wants pawn term dare worsted ladle gull hoe hat search putty yowler coils debt pimple colder Guilty Looks. Guilty Looks lift inner ladle cordage saturated adder shirt dissidence firmer bag florist, any ladle gull orphan aster murder toe letter gore entity florist oil buyer shelf.

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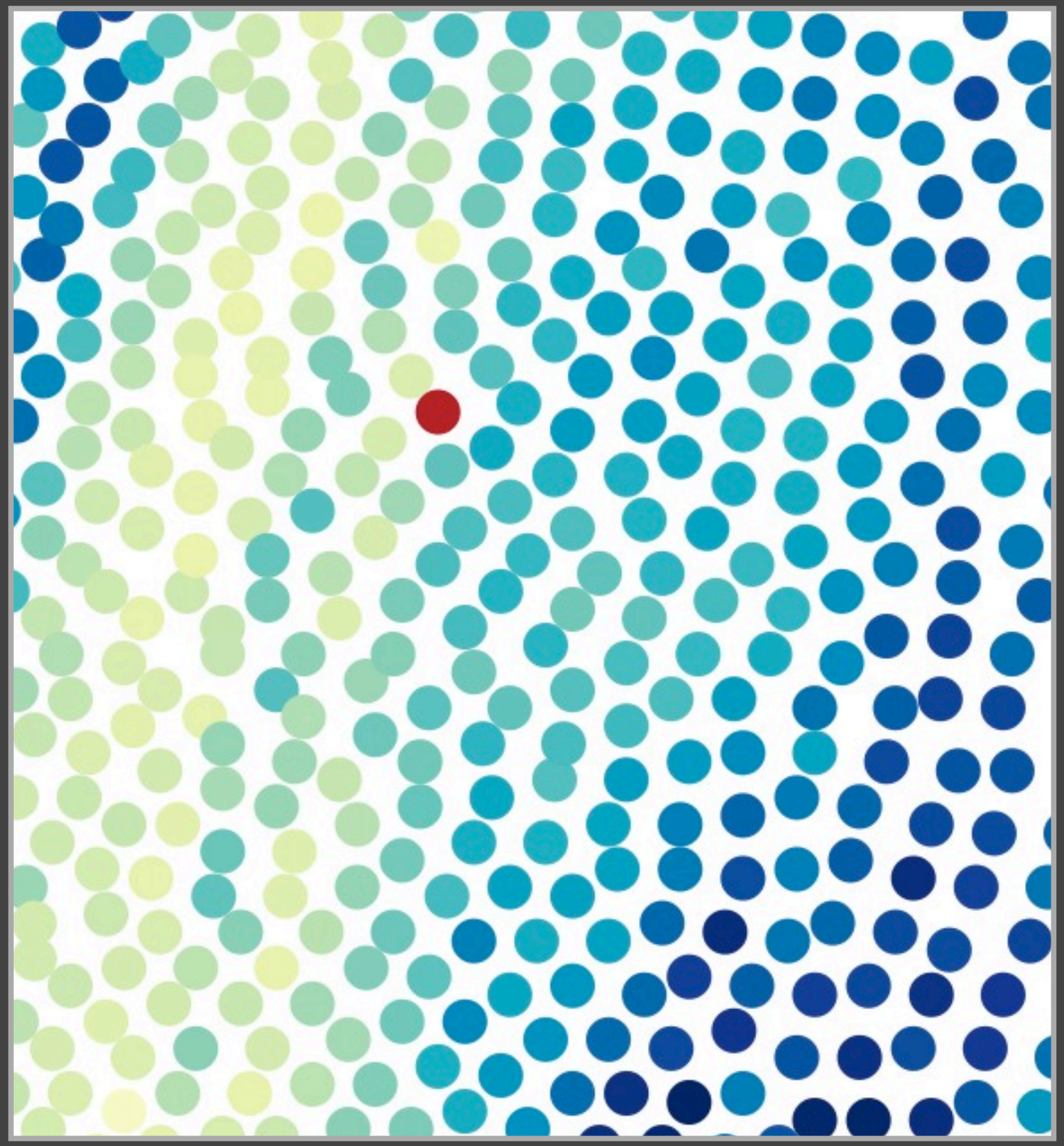
Williams 1994



PRINCIPLE OF CONTRAST

- PURPOSE
  - aid in organization and create interest on page

- HOW
  - contrast through typeface, line thickness, colors, shapes, sizes, space, etc

- AVOID
  - subtle contrast. DON'T BE A WIMP.

Williams's design principles

Contrast

Repetition

Alignment

Proximity

PRINCIPLE OF REPETITION

Repeat some aspect of the design throughout the entire piece.

Terence English

- Stratford-upon-Avon, England

Objective

- To make money

Education

- Stratford Grammar School, I think
- Definitely not University

Employment

- Actor
- Play broker
- Shareholder of Globe Theatre

Favorite Activities

- Suing people for small sums
- Chasing women

References available upon request.

REPETITIONS

bold typeface
light typeface
square bullets
indents
spacing
alignments

Williams 1994

Faces of the Dead

Each United States service member who has died in Iraq or Afghanistan and been identified by the Defense Department is represented by a small square to the right. The squares are ordered by date of death, with the most recent deaths appearing in the upper left corner.

Learn about the individuals by clicking on any square to see information about that person. Or search for a person by last name, home state or hometown. Search results are ordered by date of death.

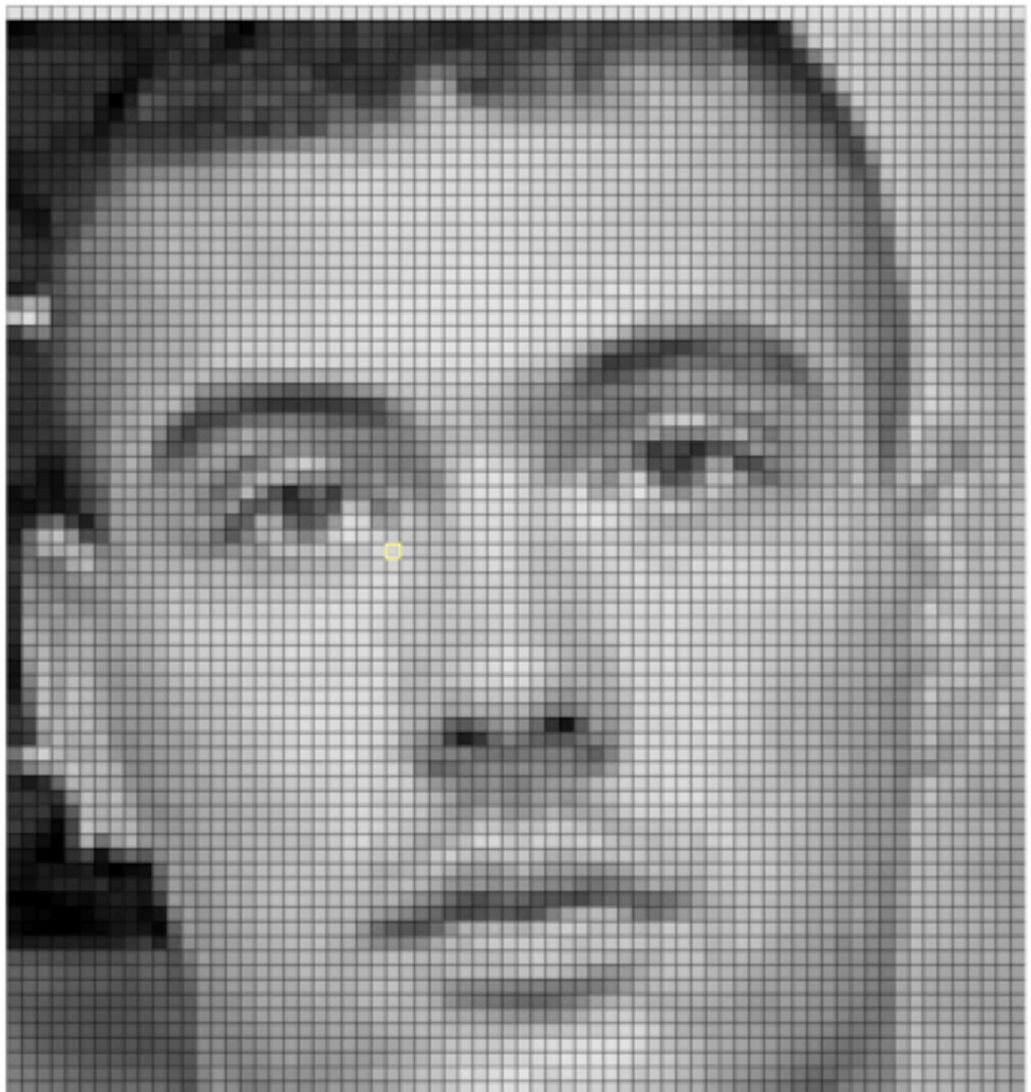
Last Name | State | Hometown

Enter Last Name

Search

All | Afghanistan | Iraq

PHOTOS | CHART



DIED 2007-03-31

Shank, Neale M.

AGE
25

BRANCH
Army

HOMETOWN
Fort Wayne, IN

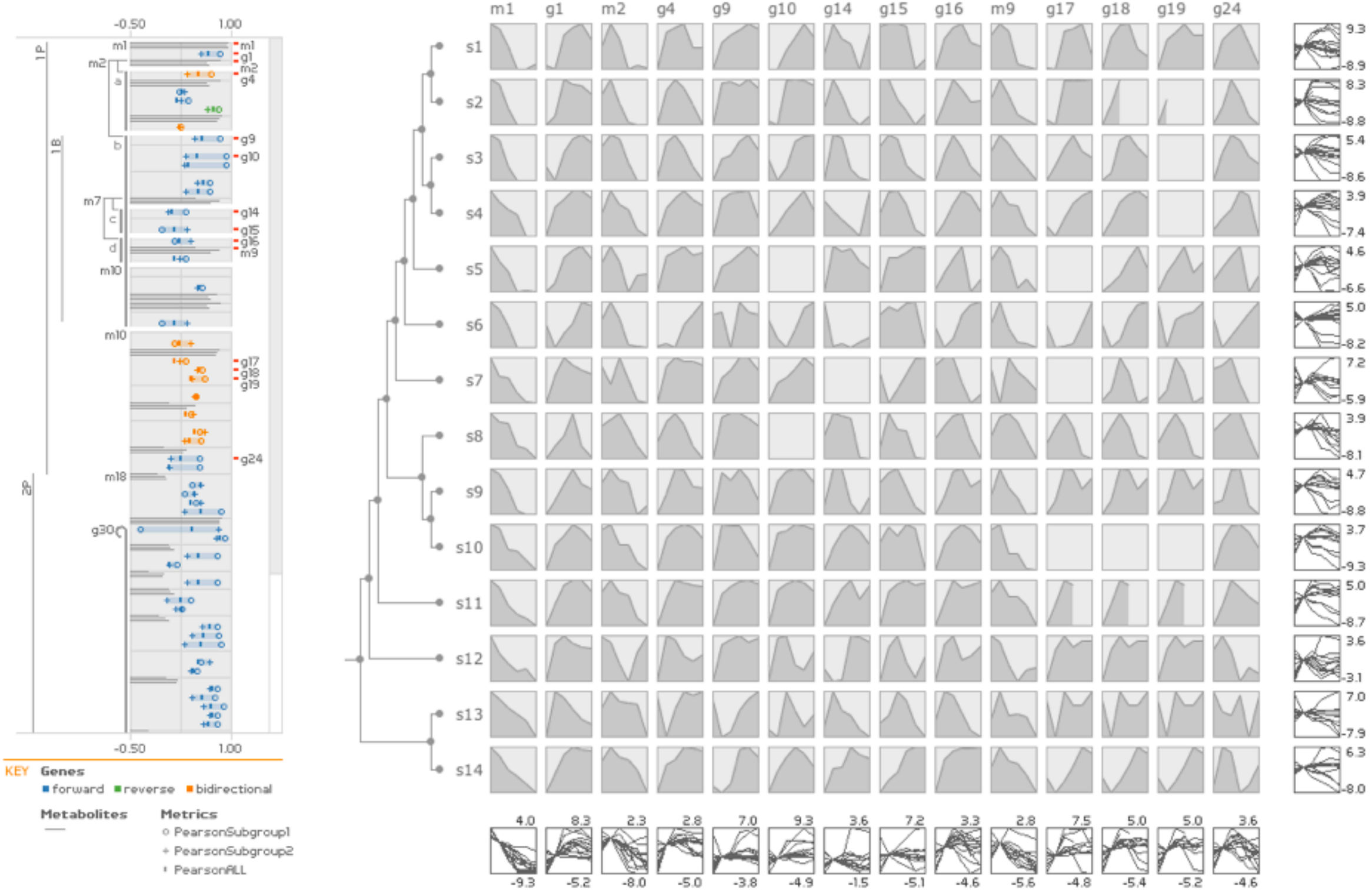
THEATER
Iraq

Pathline

PATHLINE

A TOOL FOR COMPARATIVE FUNCTIONAL GENOMICS

PATHWAY METRIC OVERVIEW SPECIES CURVEMAP OVERLAYS



Meyer et al 2010

PRINCIPLE OF REPETITION

- PURPOSE
  - to unify and add visual interest
- HOW
  - push existing consistencies further
- AVOID
  - repeating element so much that it becomes annoying or overwhelming

Williams's design principles

Contrast

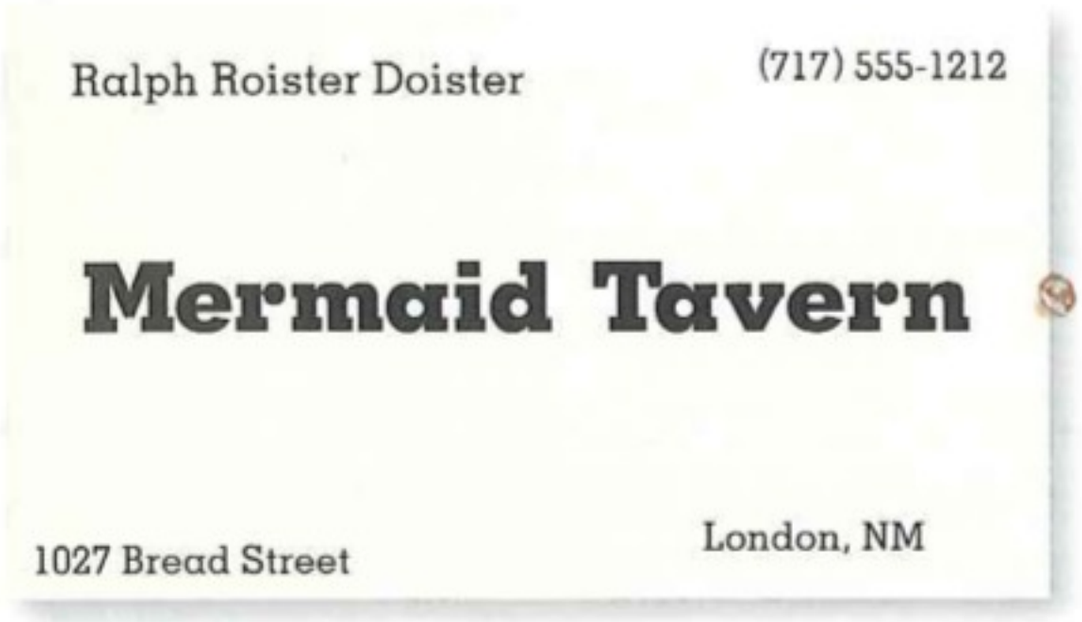
Repetition

Alignment

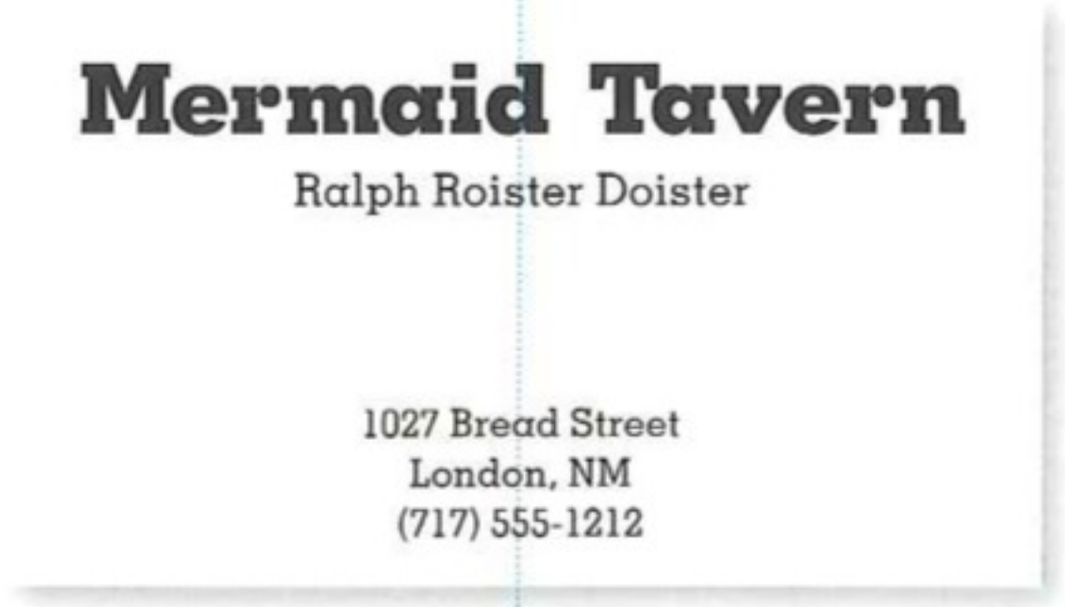
Proximity

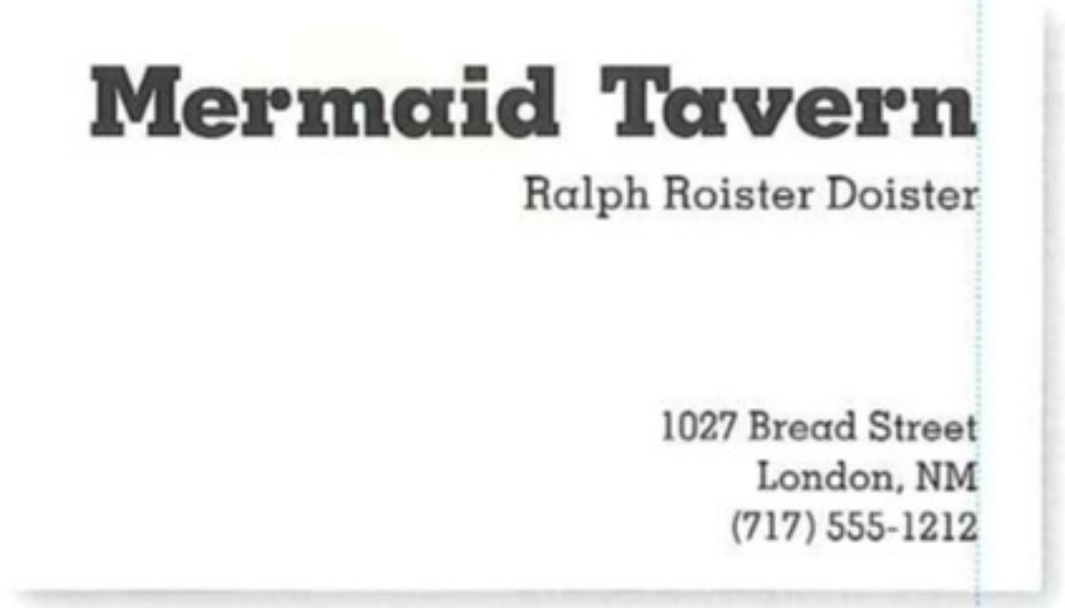
PRINCIPLE OF ALIGNMENT

Nothing should be placed on the page arbitrarily. Every item should have a visual connection with something else.



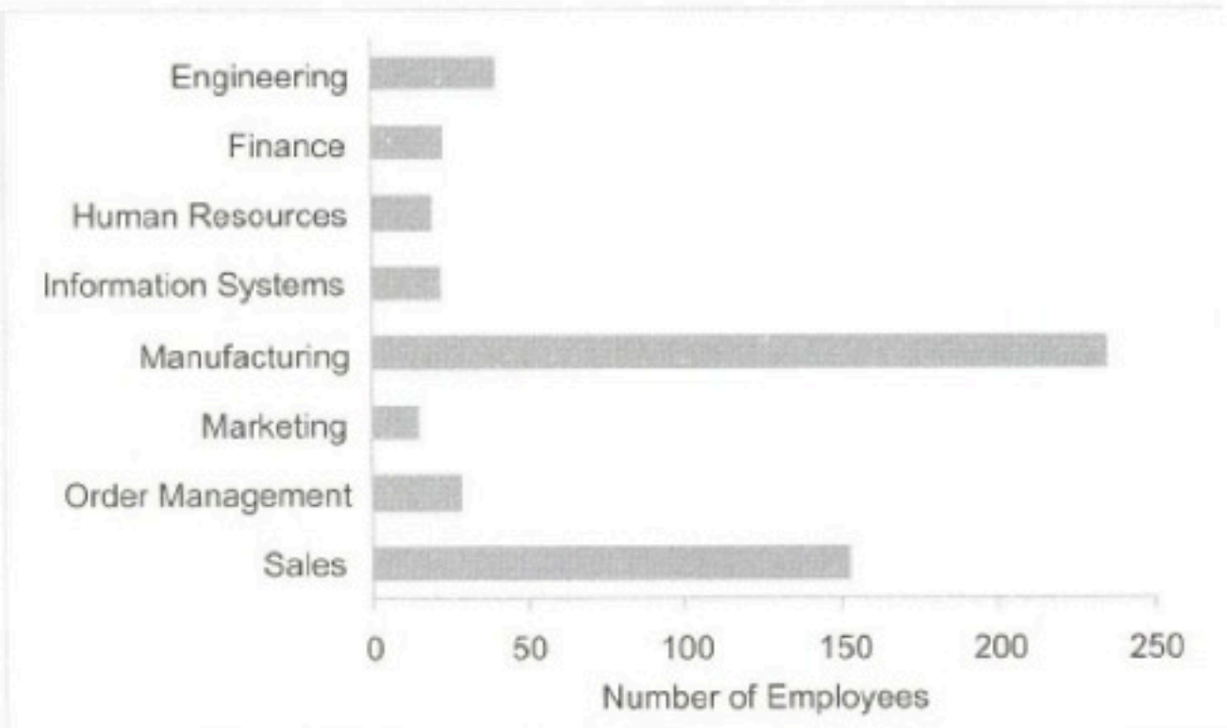
strength of edge gives strength to the layout



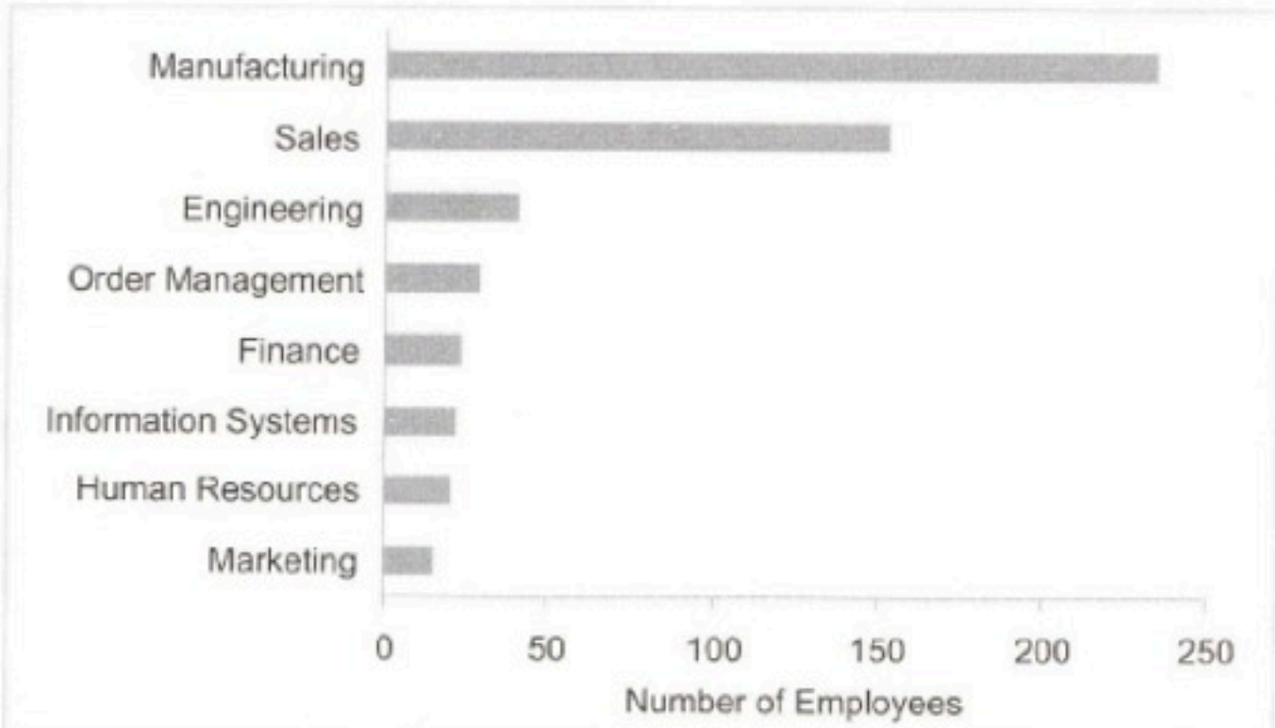


Williams 1994

Before



After



Stephen Few 2004

InSite

100 kittens

north

elephant

1

2

3

monkey

1

2

3

south

elephant

1

2

3

monkey

1

2

3

east

elephant

1

2

3

monkey

1

2

PRINCIPLE OF ALIGNMENT

- PURPOSE
    - unify and organize a page
- HOW
    - be concious of where you place elements
- AVOID
    - center alignment

Williams's design principles

Contrast

Repetition

Alignment

Proximity

PRINCIPLE OF PROXIMITY

Group related items together . . . as physical closeness implies a relationship.

Correspondences
Flowers, herbs, trees, weeds
Ancient Greeks and Romans
Historical characters
Quotes on motifs
Women
Death
Morning
Snakes
Language
Iambic pentameter
Rhetorical devices
Poetic devices
First lines
Collections
Small printings
Kitschy
Dingbats
Thematic
Villains and saints
Drinks and recipes
Music
Quizzes
Fun but difficult quizzes

Correspondences
Flowers, herbs, trees, weeds
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Poetic devices
First lines

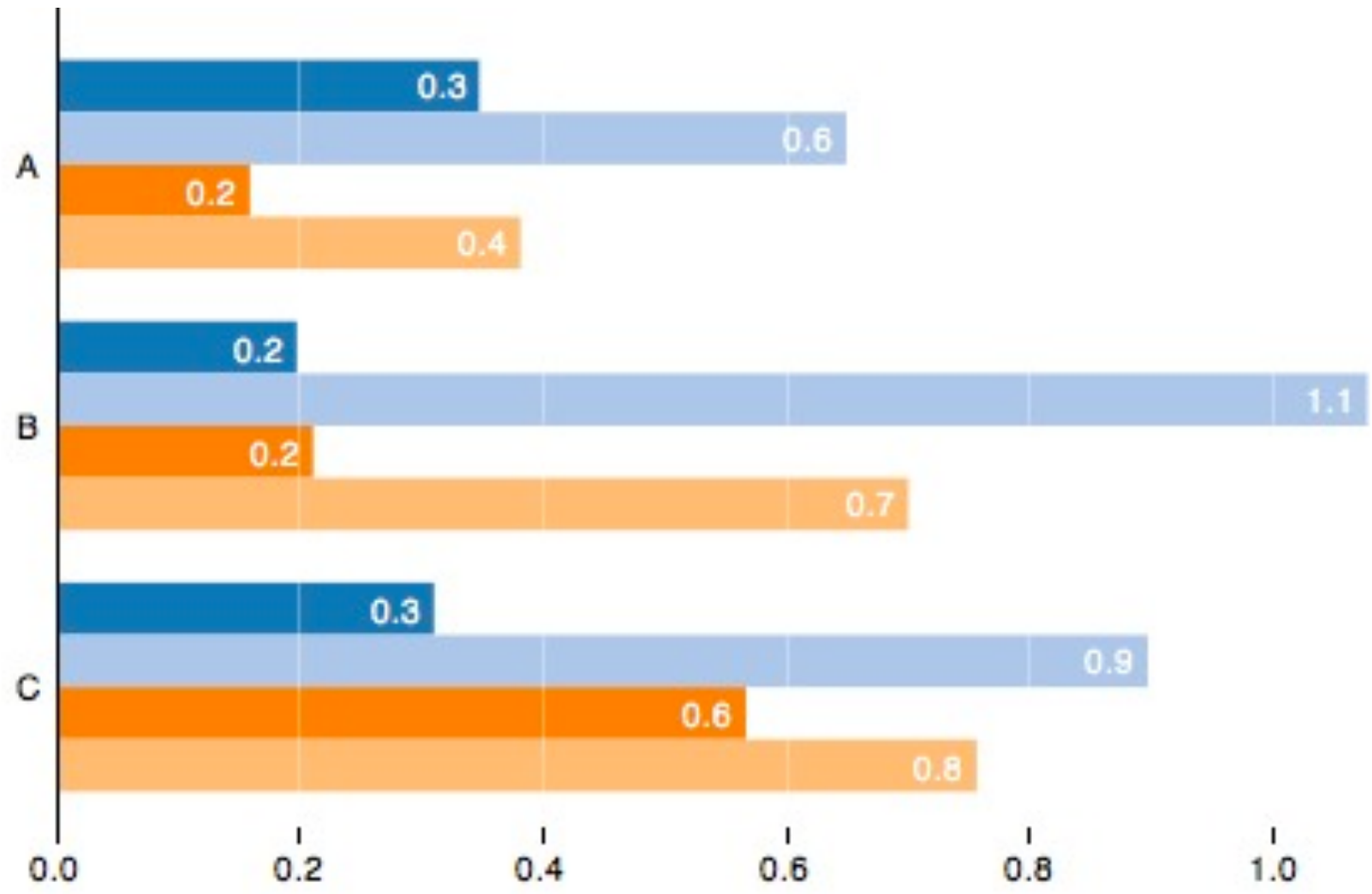
Collections
Small printings
Kitschy
Dingbats

Thematic
Villains and saints
Drinks and recipes
Music

Quizzes
Fun but difficult quizzes

Williams 1994

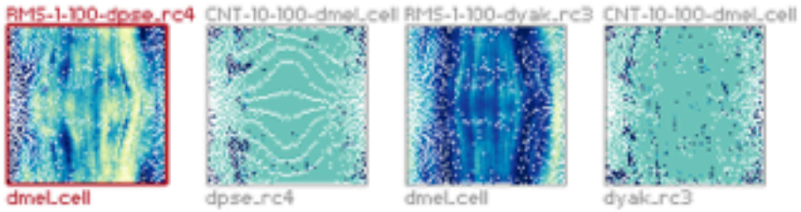
nested bar chart



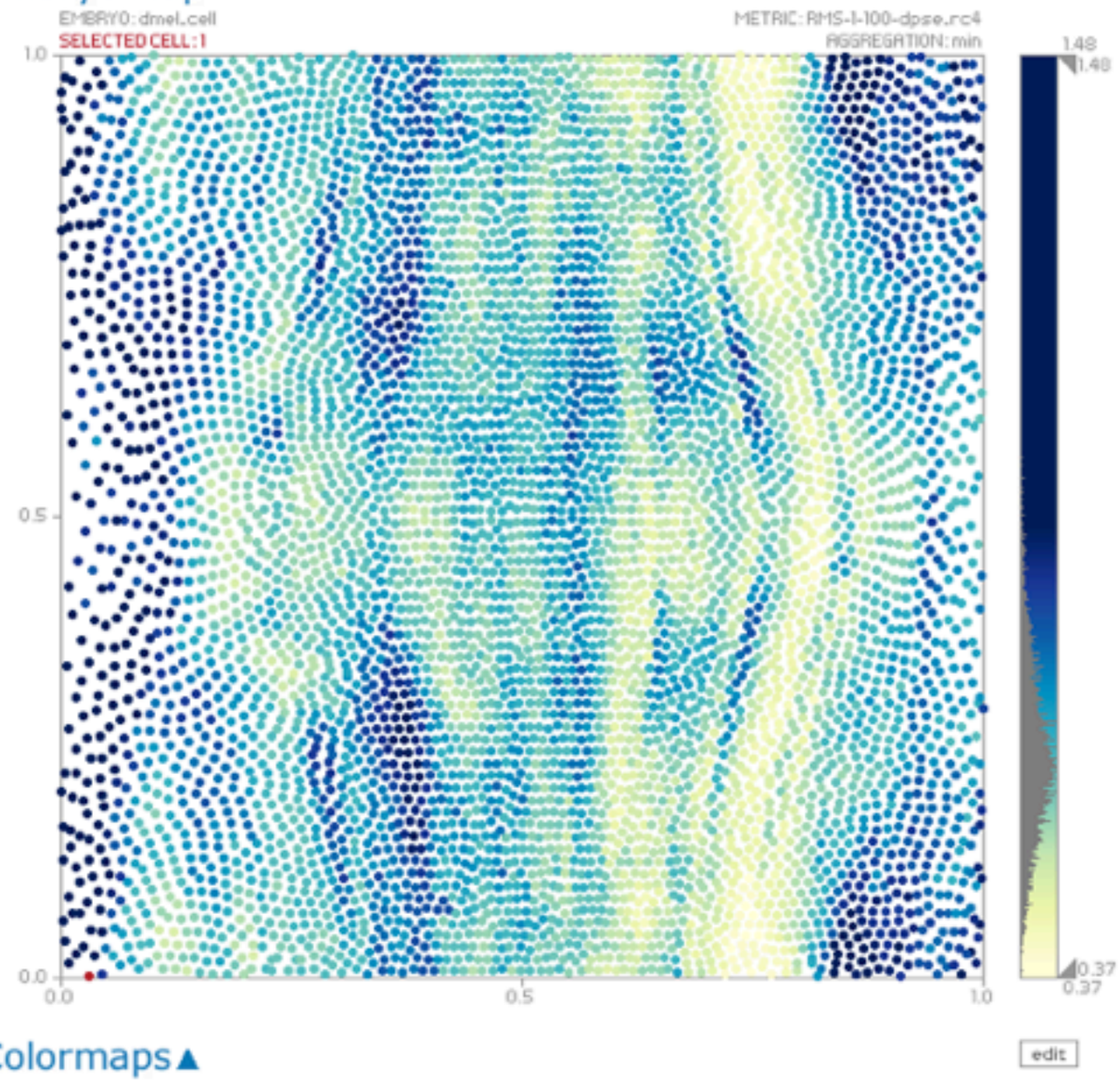
http://mbostock.github.com/protovis/ex/group.html

MulteeSum

Summaries

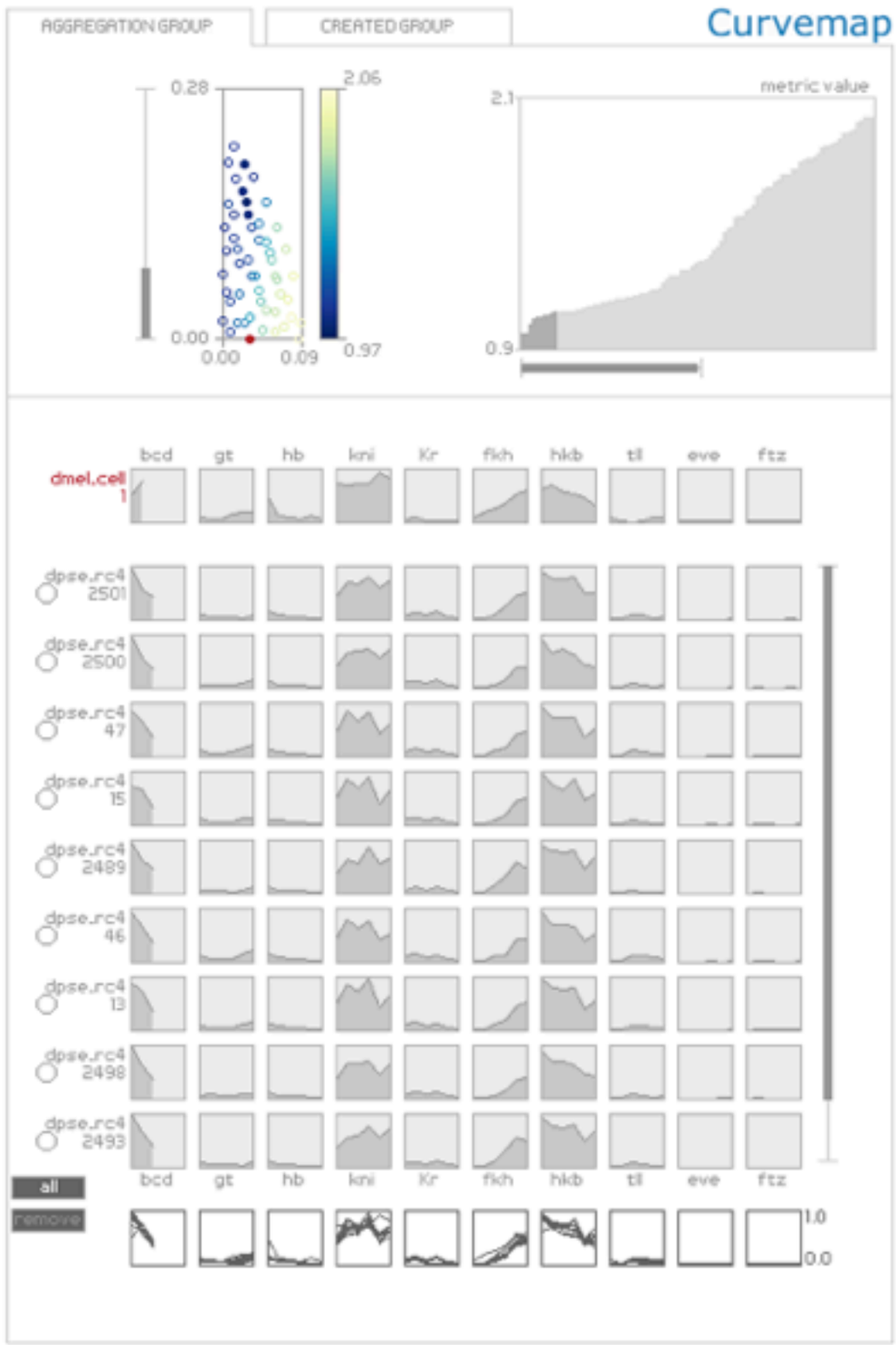


Embryo Map



Colormaps▲

Curvemap



Meyer et al 2010

PRINCIPLE OF PROXIMITY

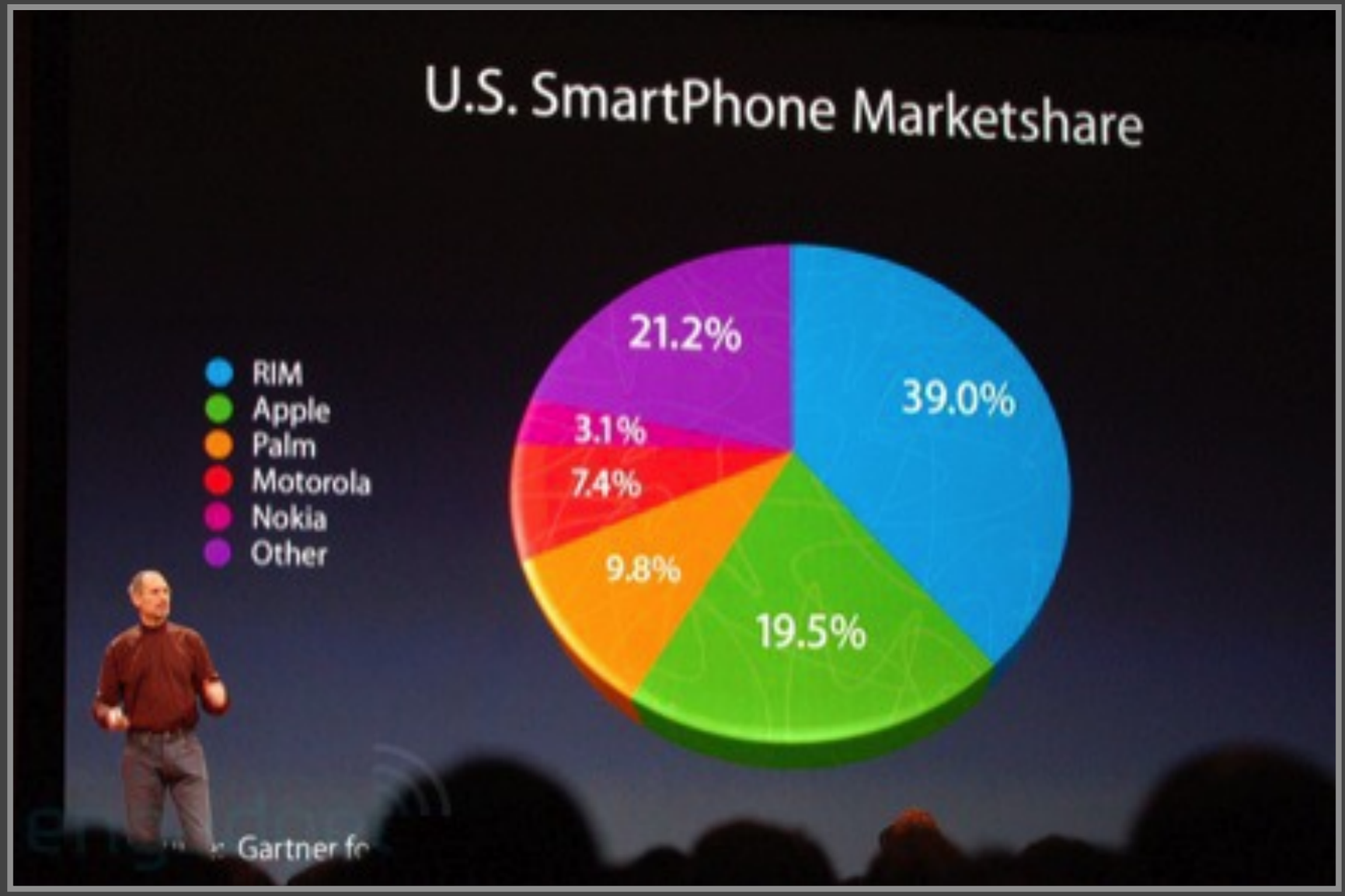
- PURPOSE
  - organization through creation of white space

- AVOID
  - too many elements
  - grouping unrelated elements

Williams's design principles

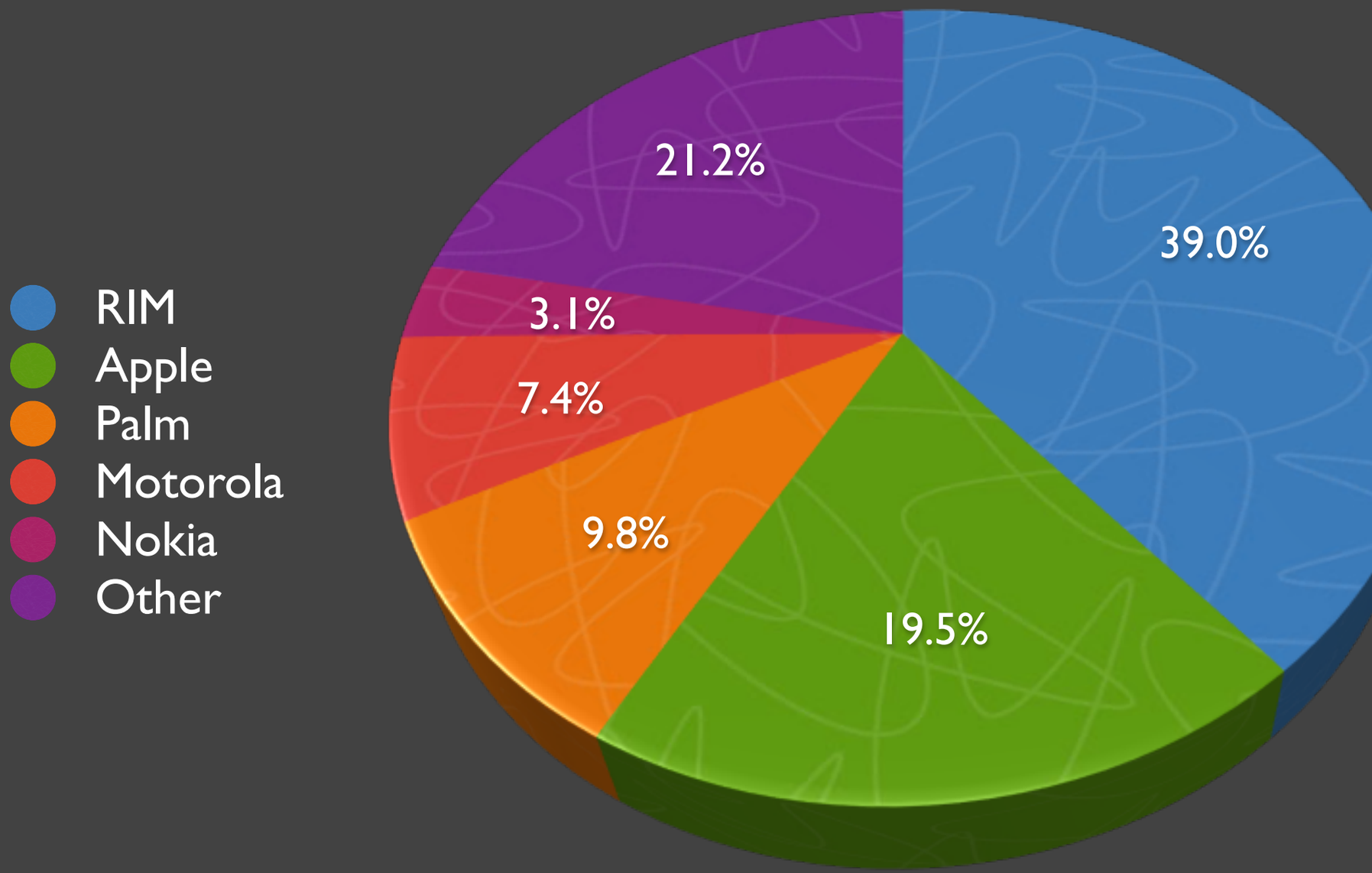
Contrast
Repetition
Alignment
Proximity

CRITIQUES

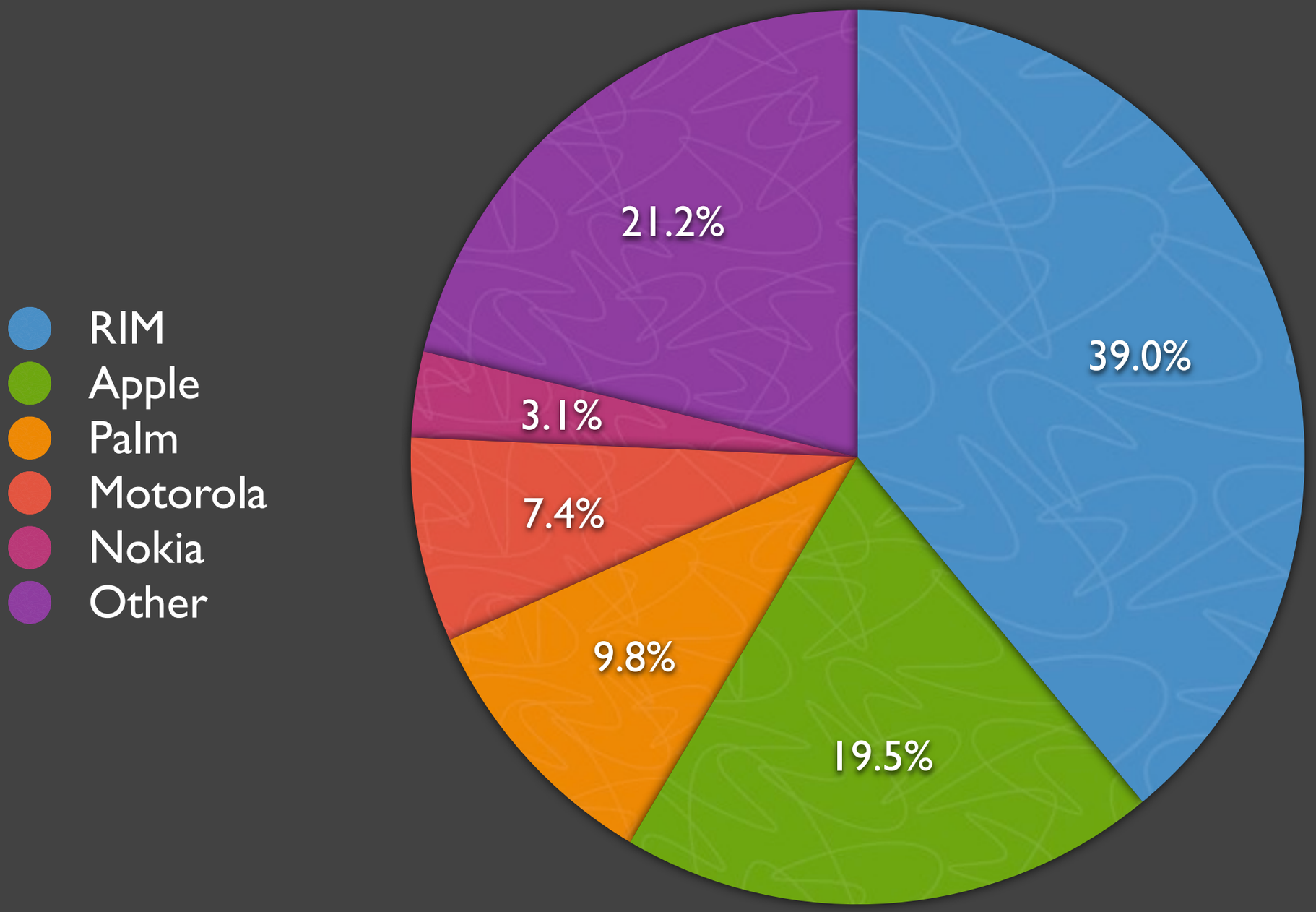


http://www.guardian.co.uk/technology/blog/2008/jan/21/liesdamnliesandstevejobs

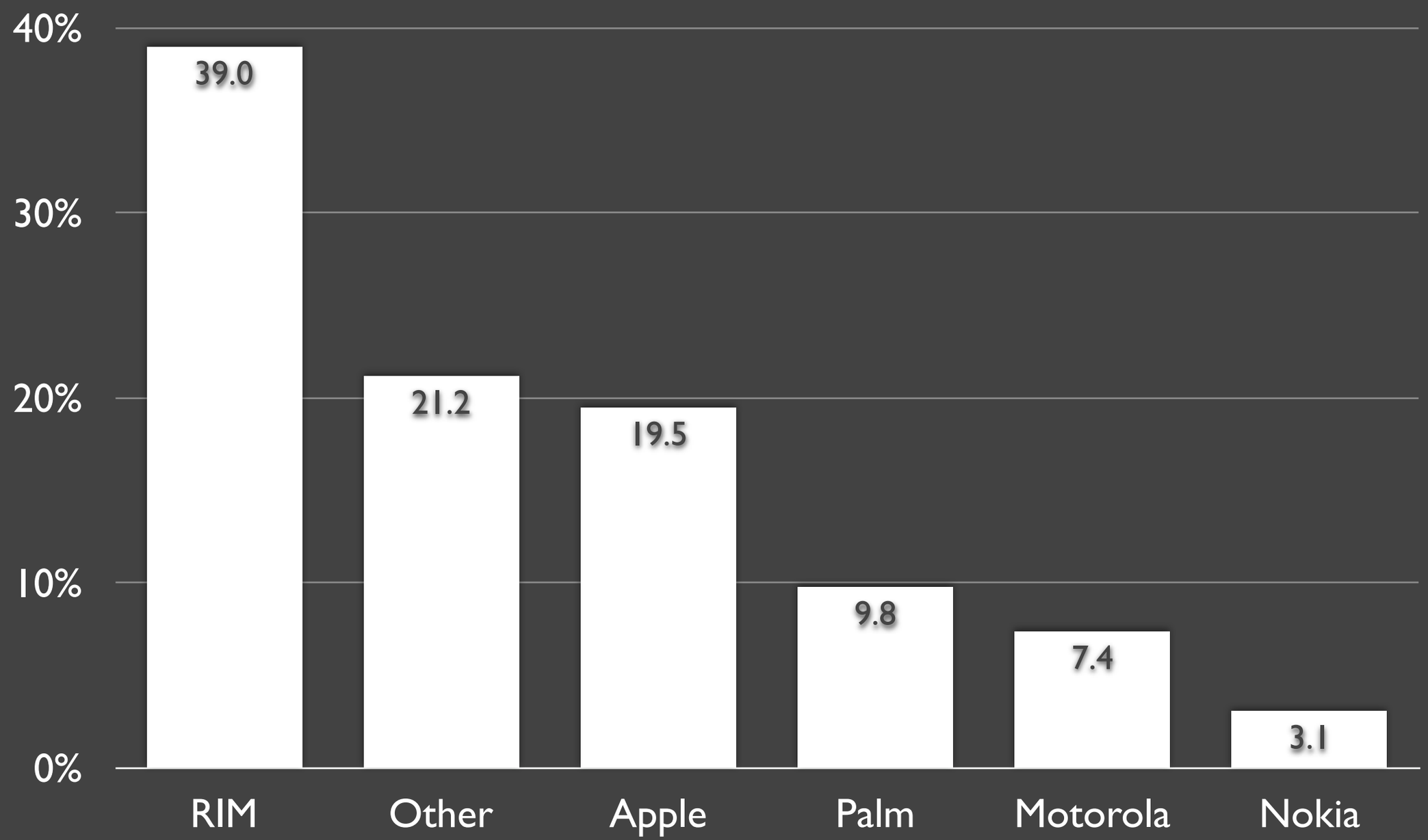
U.S. SmartPhone Marketshare



U.S. SmartPhone Marketshare

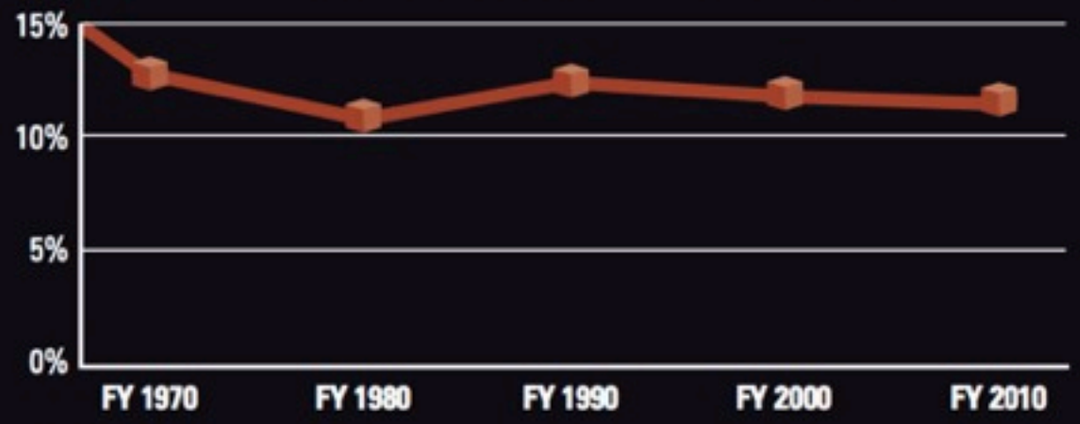


U.S. SmartPhone Marketshare



① An Unchanging Slice of the Pie

Total R&D as Percent of Discretionary Spending



SOURCE: OMB

② Who Spends Federal Dollars

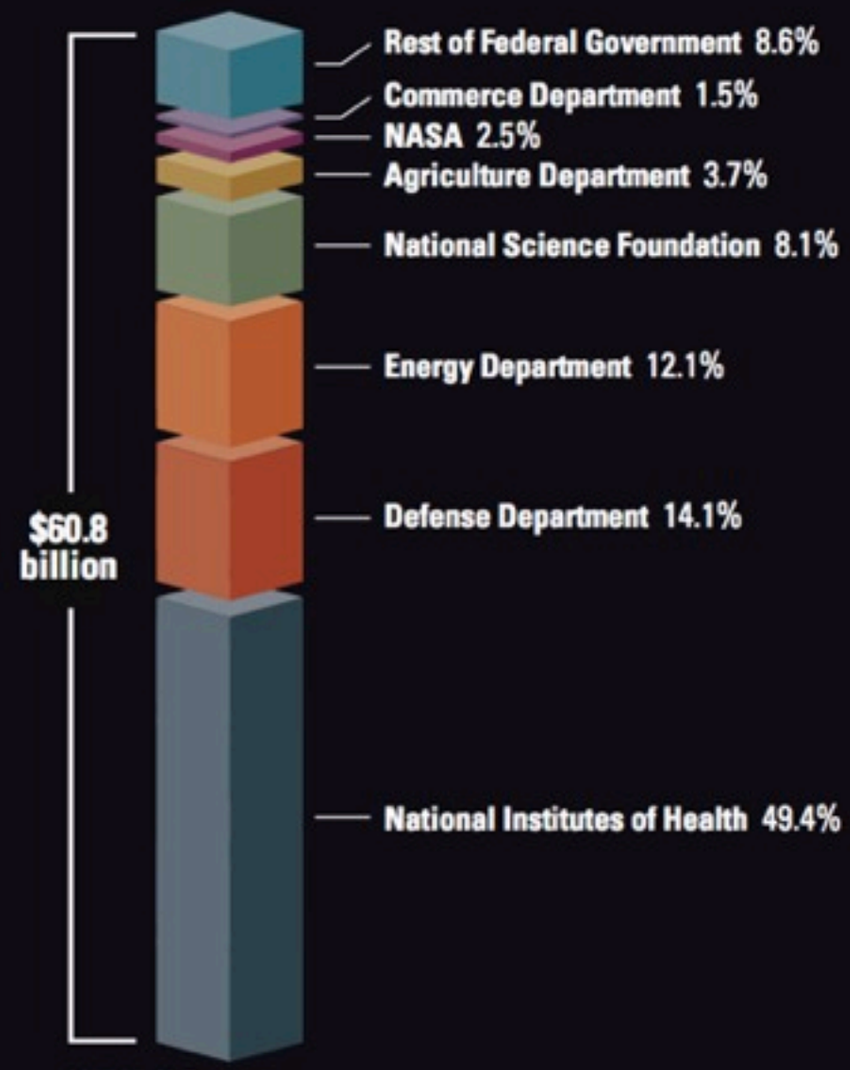
Federal R&D by Performer, FY 2009

$116.6 billion

Industry $46.6 billion · Intramural $26.6 billion · Universities/Colleges $26.0 billion · National Labs $10.4 billion · Other $6.9 billion

④ The Biggest Research Agencies

Spending on basic and applied research in FY 2010



SOURCE: OMB

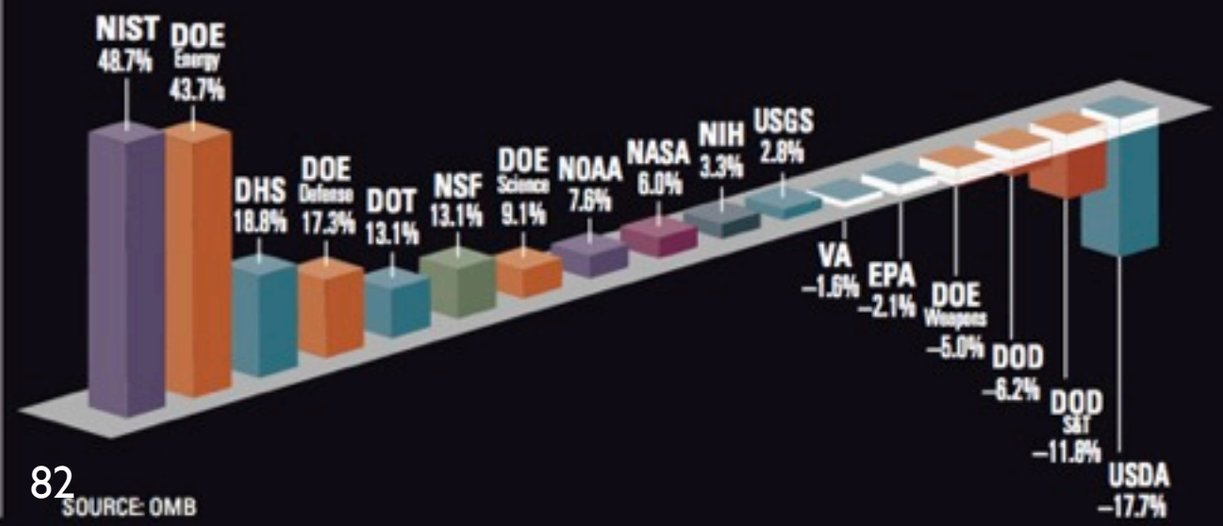
Who Funds Academic Research

R&D Expenditures at Colleges and Universities, FY 2009

Federal Government 59.3% · Institutional Funds 20.4% · All Other Sources 7.8% · State and Local Government 6.6% · Industry 5.8%

SOURCE: NSF

③ Winners/Losers in the President's FY 2012 Request



SOURCE: OMB

PERCENTAGE OF PUPILS GAINING 5 OR MORE GCSEs AT GRADES A*-C, INCLUDING ENGLISH AND MATHS, IN 2010 BY LOCALITY

Source: Warwickshire County Council (CYPF Directorate), Warwickshire Observatory

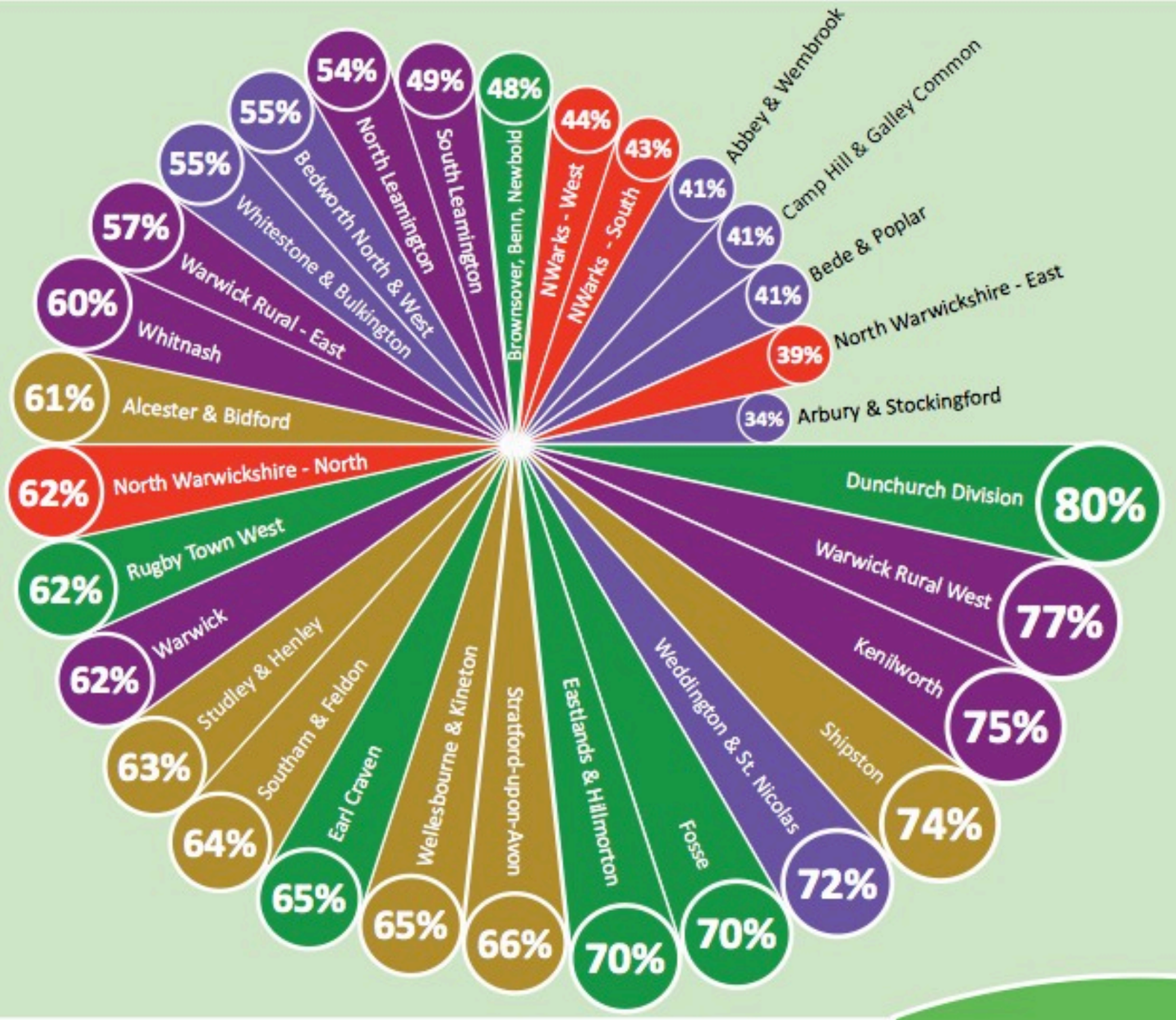
48% NORTH WARWICKSHIRE BOROUGH

47% NUNEATON & BEDWORTH BOROUGH

62% RUGBY BOROUGH

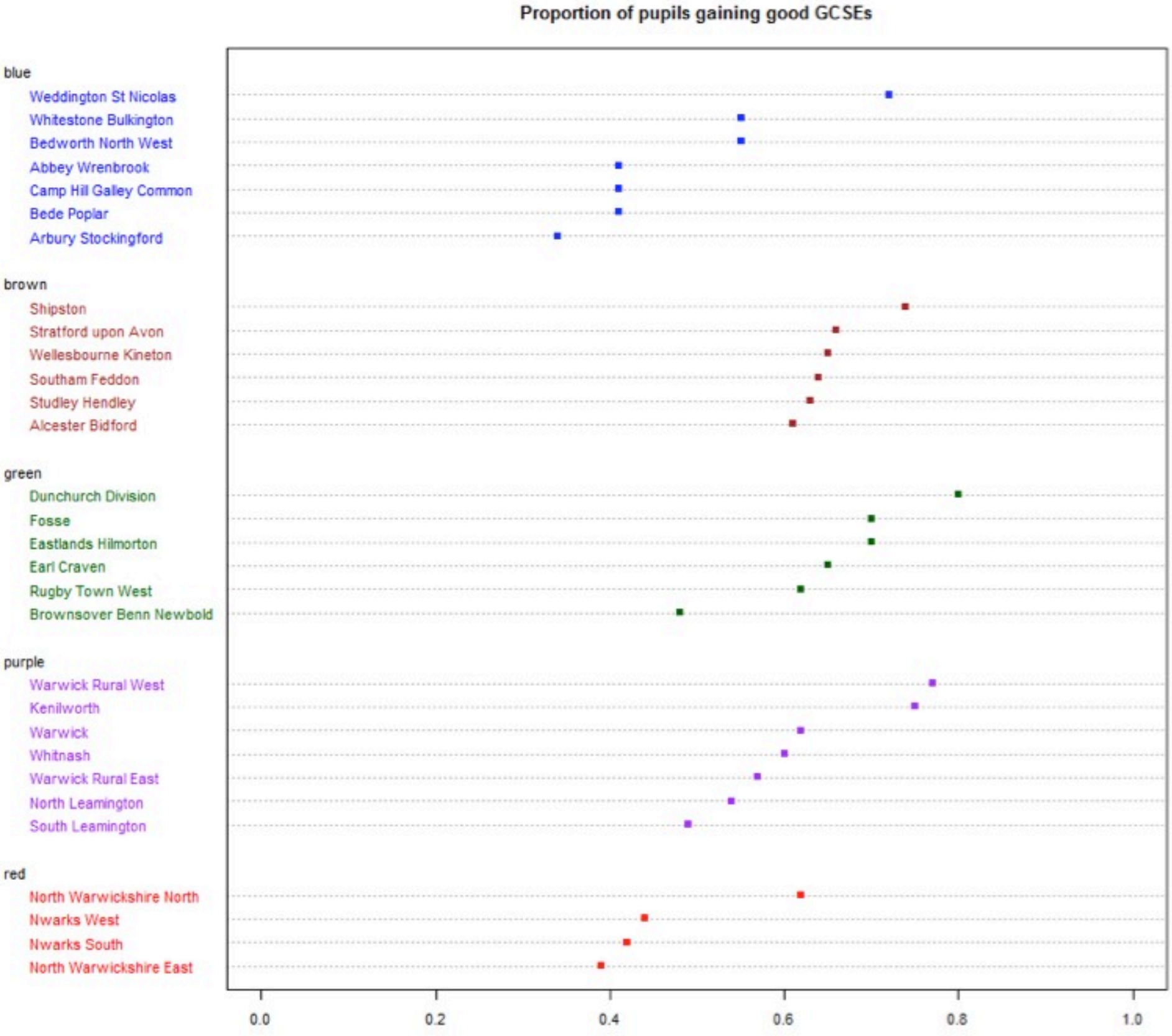
65% STRATFORD-ON-AVON DISTRICT

63% WARWICK DISTRICT



Based on residence, not school location

http://junkcharts.typepad.com/junk_charts/2011/11/ornaments-or-fireworks-for-christmas.html



http://junkcharts.typepad.com/junk_charts/2011/11/ornaments-or-fireworks-for-christmas.html

L3: Process

REQUIRED READING

1

Visualization Design

Computer-based **visualization** systems provide interactive visual representations of datasets intended to help people carry out some task more effectively.

When we design a visualization, how do we figure out if we have succeeded? There are many criteria we might use. We could ask whether somebody using the system can do something better. But what does *better* mean? Do they get something done faster? Do they have more fun doing it? Can they work more effectively? But what does *effectively* mean? How do we measure *insight* or *engagement*? And better than *what*? Another visualization system? Doing the same things manually, without visual support? Doing the same things completely automatically? And to do *something* better - what sort of thing? That is, how do we decide what sort of task they should do when testing the system? And who is this *somebody*? An expert who has done this task for decades, or a novice who needs the task explained before they begin? Are they familiar with how the system works from using it for a long time, or are they seeing it the first time? Even a concept like *faster* that might seem straightforward gets tricky. Are they limited by the speed of their own thought process, or their ability to move the mouse, or simply the speed of the computer in drawing each picture?

Considering all these questions at the same time is difficult and confusing. This book is structured around a breakdown of the visualization design process into four levels, based on a common set of threats to their validity at each level. This chapter first defines these four levels, and then covers the threats to their validity and appropriate methodologies for validation

DOI:10.1145/1924421.1924439

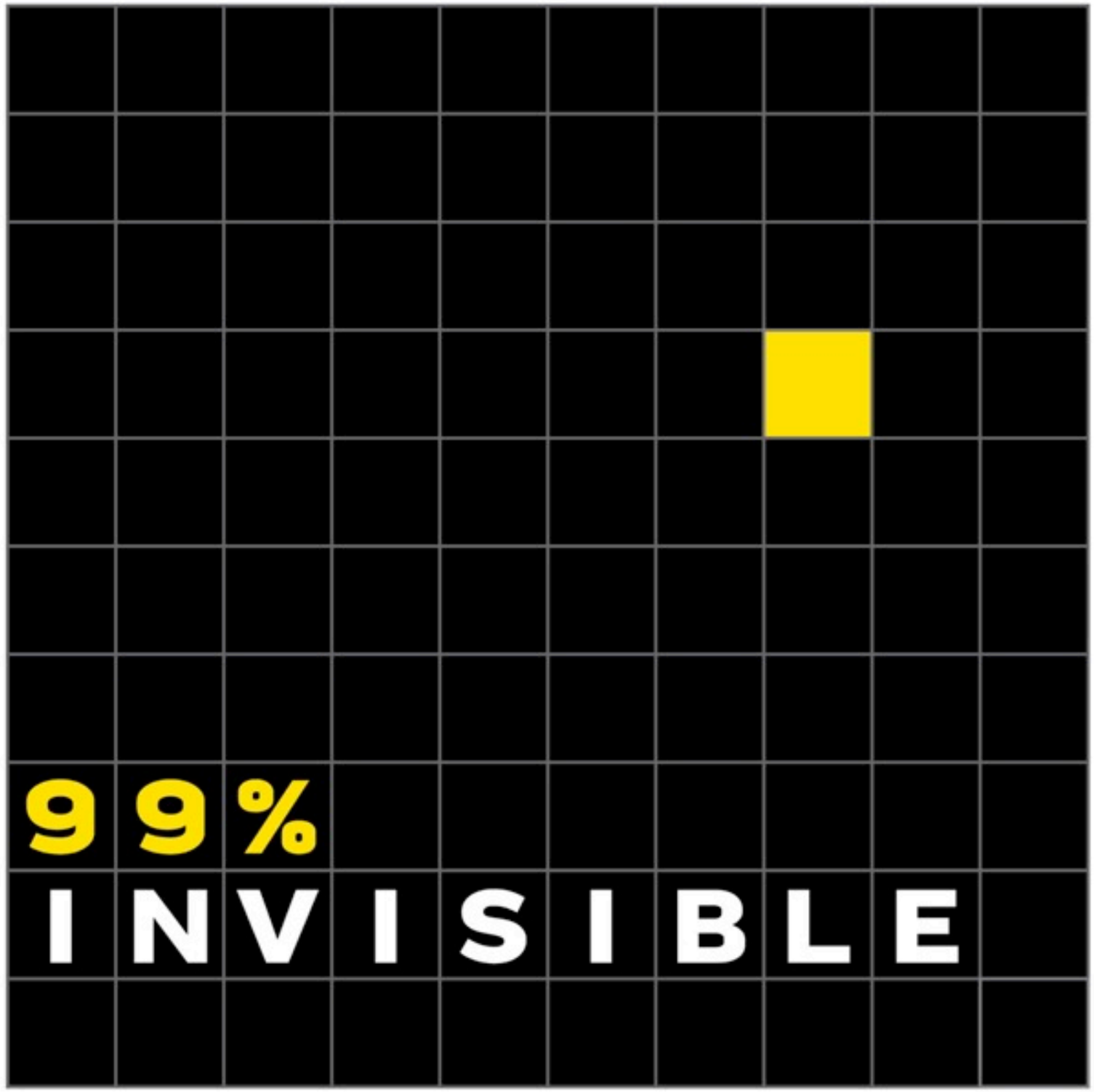
How to identify, instantiate, and evaluate domain-specific design principles for creating more effective visualizations.

BY MANEESH AGRAWALA, WILMOT LI, AND FLORAINE BERTHOUZOZ

Design Principles for Visual Communication

requires considerable effort. Moreover, the rate at which people worldwide generate new data is growing exponentially year to year. Gantz et al.[5] estimated we collectively produced 161 exabytes of new information in 2006, and the compound growth rate between 2007 and 2011 would be 60% annually. We are thus expected to produce 1,800 exabytes of information in 2011, 10 times more than the amount we produced in 2006. Yet acquiring and storing this data is, by itself, of little value. We must understand it to produce real value and use it to make decisions.

The problem is that human designers lack the time to hand-design effective visualizations for this wealth of data. Too often, data is either poorly visualized or not visualized at all. Either way, the results can be catastrophic; for example, Tufte[24] explained how Morton Thiokol engineers failed to visually communicate the risks of launching the Challenger Space Shuttle to NASA management in 1986, leading to the vehicle's disasterous



A TINY RADIO SHOW ABOUT DESIGN

WITH ROMAN MARS