Tabulation and Visualization

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London School of Economics and Political Science

Problem Set 1

- Generally good, but some aspects could be improved across the board
  - Academic style and format
  - Precision in language
  - Focus less on who is making the claim and how, and more on what the claim precisely is (what concepts are at stake? is it descriptive, causal, predictive, normative?)
  - Reflection is key
- Administrative points
  - Submit anonymously
  - Follow guidance on formatting

Looking Ahead

- PS 2 covers material on concepts and operationalization (Nov 8)
- PS 3 covers today's material (Nov 22)
- PS 4 will involve group work (Dec 13)
- Start thinking about topics in political science that interest you (Nov/Dec)

Types of Measures

1. Categorical
   - Binary
2. Ordinal
3. Interval

Qualitative: Categorical, Ordinal

Quantitative: Ordinal, Interval

Note: *Ratio* scale measures are interval measures with a non-arbitrary zero value

Definitions

- Statistic: "a quantitative summary of a variable for a set of units"

Central Tendency

- Mean (average): $\bar{Y} = \frac{1}{n} \Sigma_{i=1}^{n} Y_i$

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  - Trimmed mean
- Median: Middle value
- Mode: Most common value
  - Unimodal, bimodal, multimodal

Dispersion/variation

- (Element) Variance:

$$Var(Y) = s_Y^2 = \Sigma_{i=1}^{n} \frac{(Y_i - \bar{Y})^2}{n-1}$$

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- Median absolute deviation (MAD):

$$MAD = median(|Y_i - median(Y)|)$$

Shape

- Skewness

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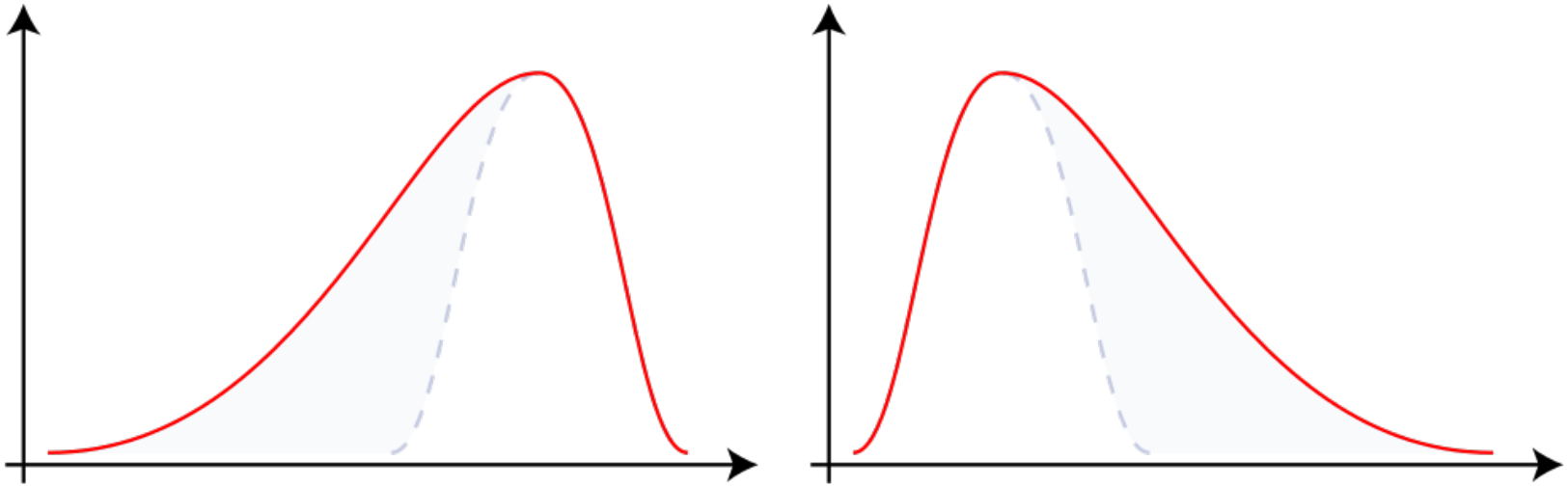
- Skewness
  - Positive/right skew
  - Symmetric
  - Negative/left skew

Shape

- Skewness
  - Positive/right skew
  - Symmetric
  - Negative/left skew
- Kurtosis: peakedness of a distribution

Skewness



Source: Rodolfo Hermans (Wikimedia)

Relationship

- Covariation:

$$Cov(X, Y) = \Sigma_{i=1}^{n} \frac{(X_i - \bar{X})(Y_i - \bar{Y})}{n - 1}$$

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$$Cov(X, Y) = \sum_{i=1}^{n} \frac{(X_i - \bar{X})(Y_i - \bar{Y})}{n - 1}$$

- Correlation:

$$Corr(X, Y) = r_{x,y} = \sum_{i=1}^{n} \frac{(X_i - \bar{X})(Y_i - \bar{Y})}{(n - 1)s_x s_y}$$

In R...

- `mean()`
- `median()`
- `var()`
- `sd()`
- `cov()`
- `cor()`

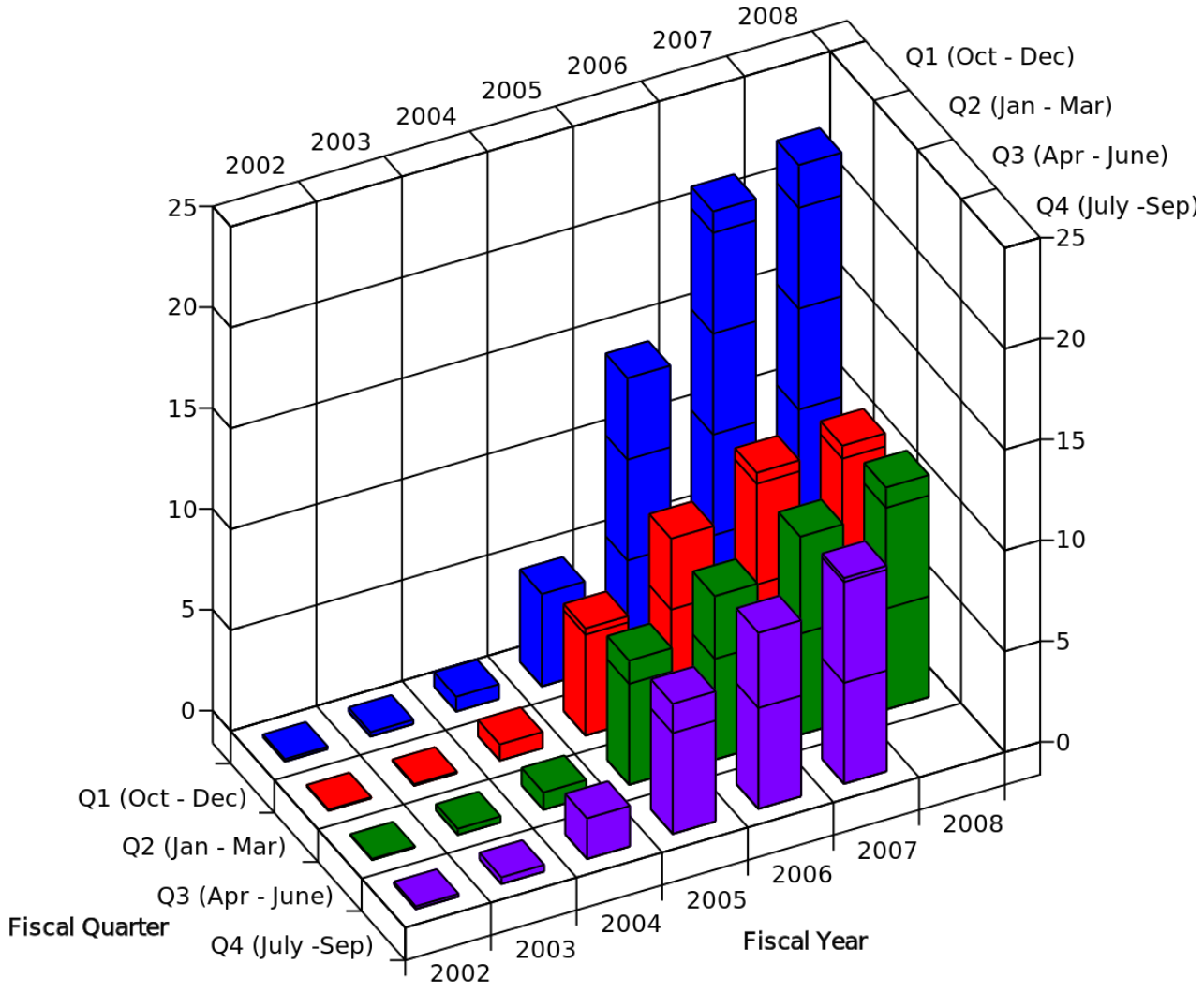
Table

- Definition: “an arrangement of information into rows and columns”
- Tables can show:
  - Values
  - Counts
  - Proportions
  - Summary statistics

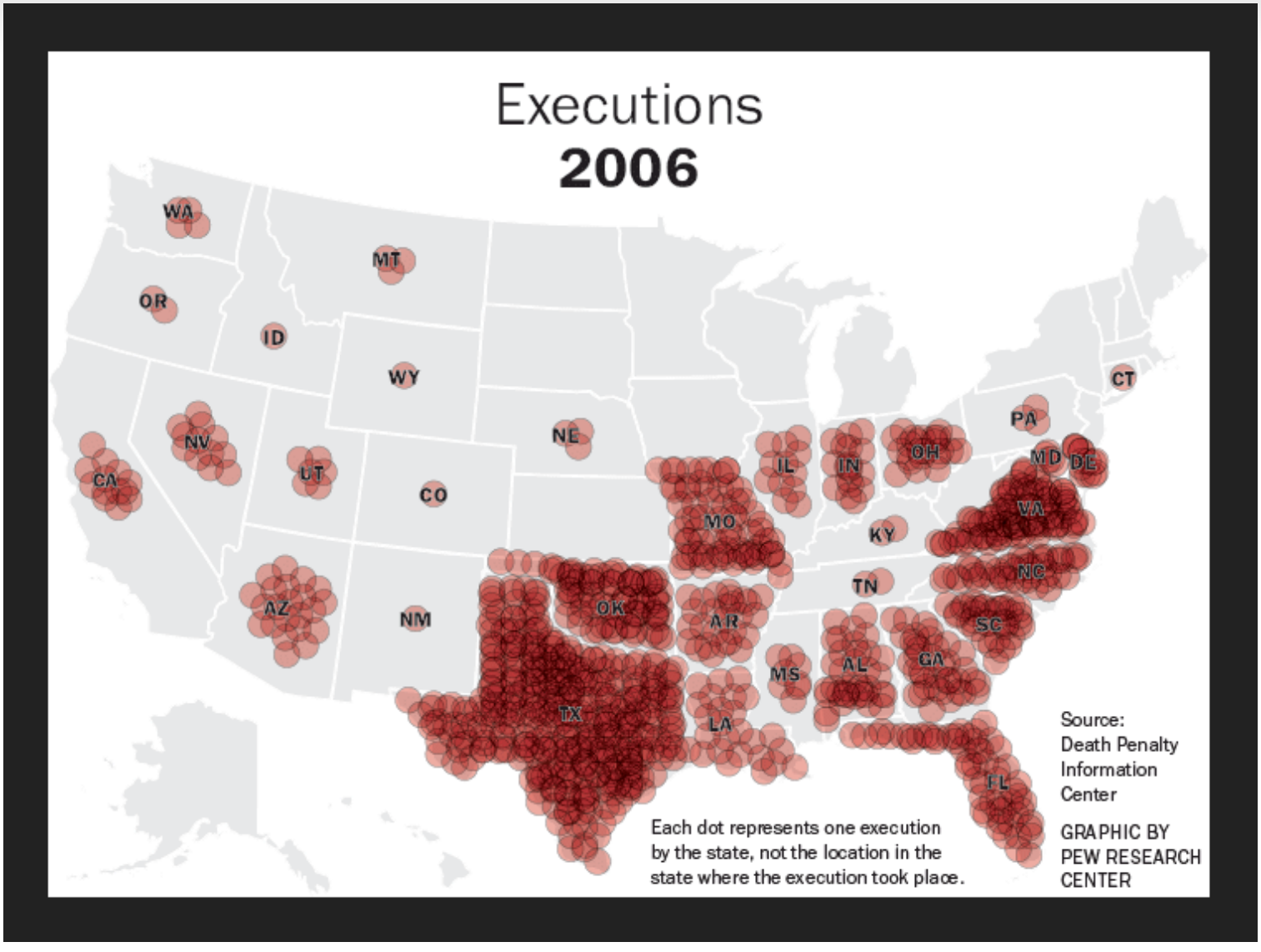
In R...

- `table()`
- `prop.table()`
- `ftable()`
- `aggregate()`

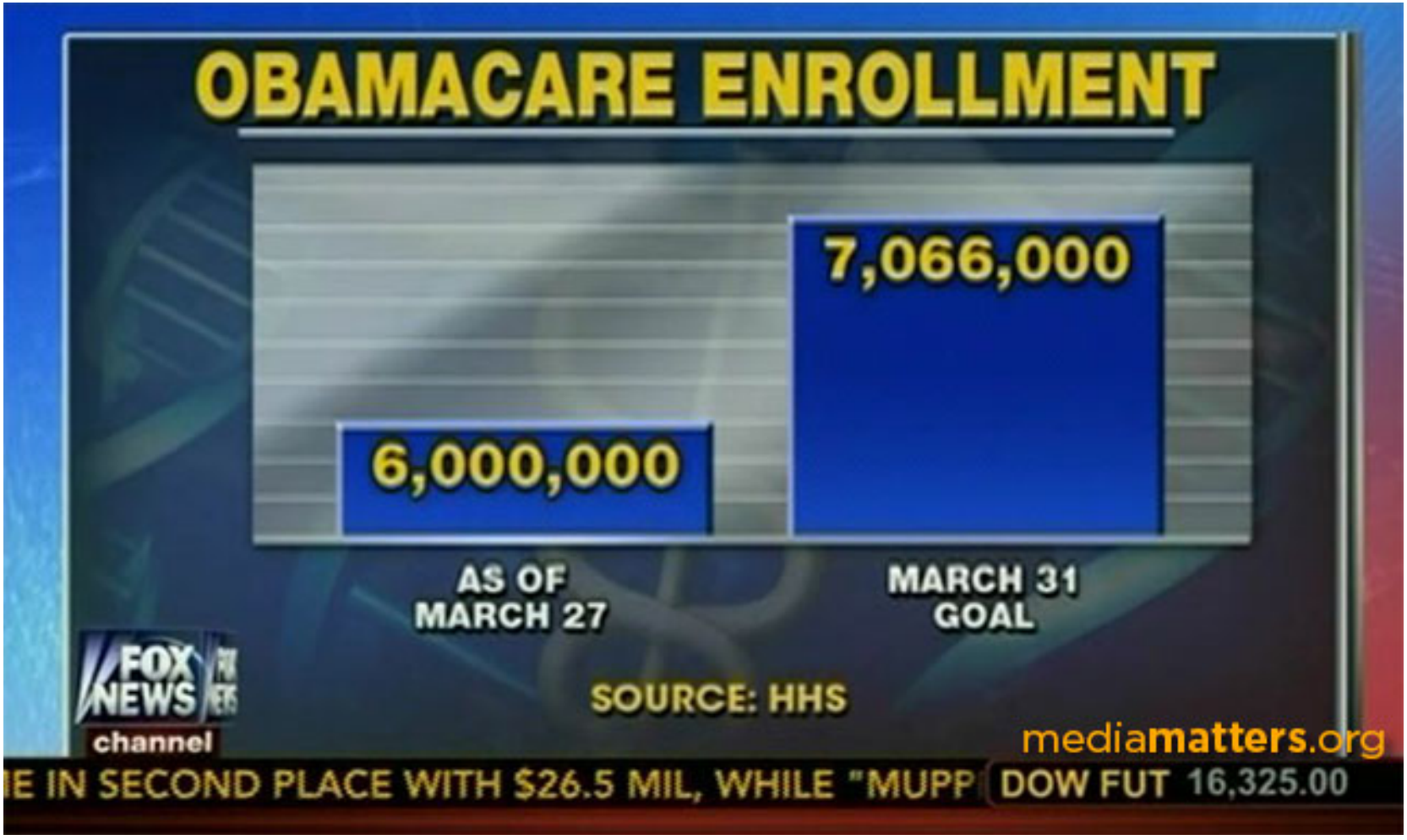
Bad visualizations. . .



Source: Wikimedia



Source: JunkCharts



Source: MediaMatters

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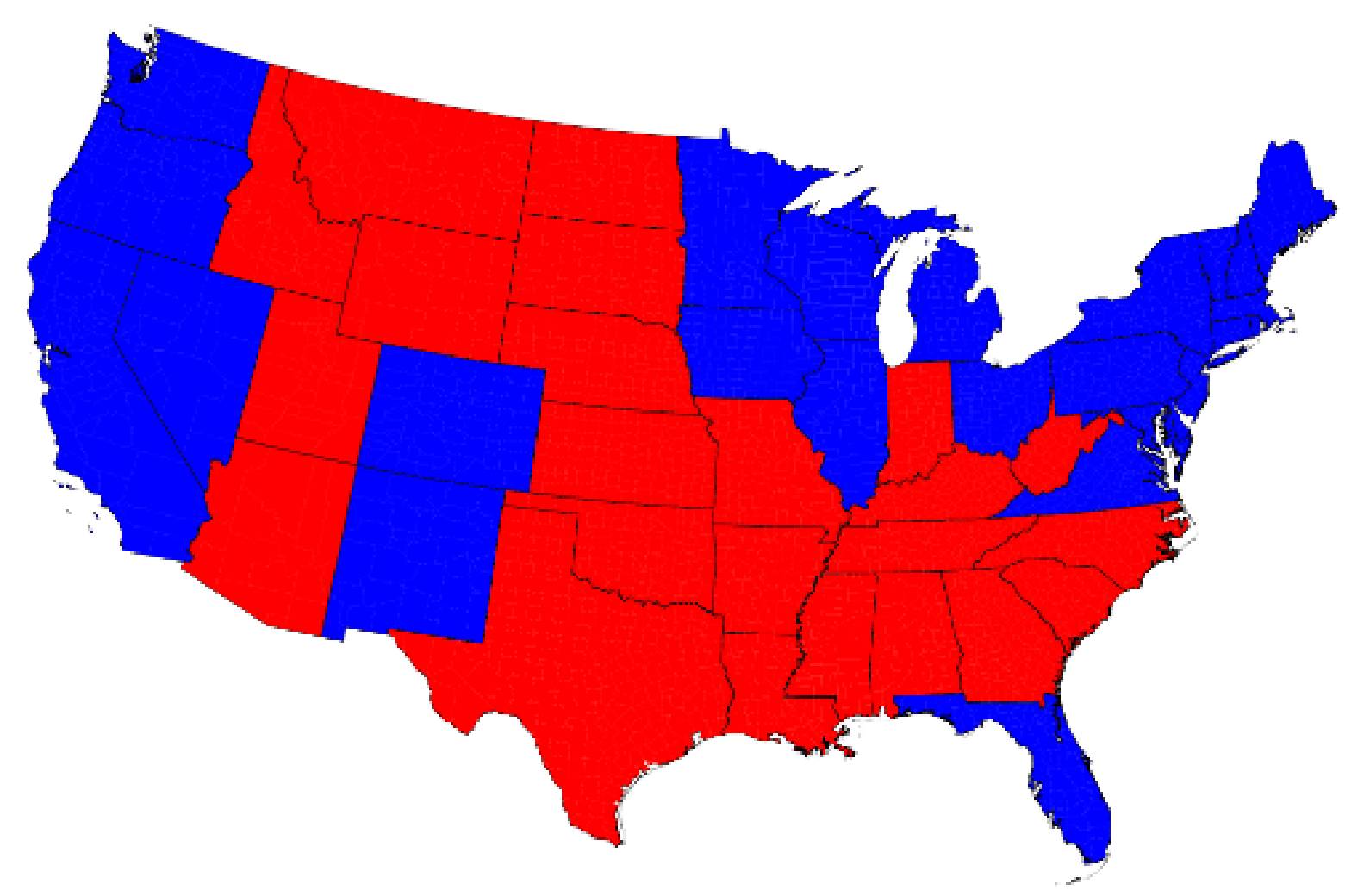
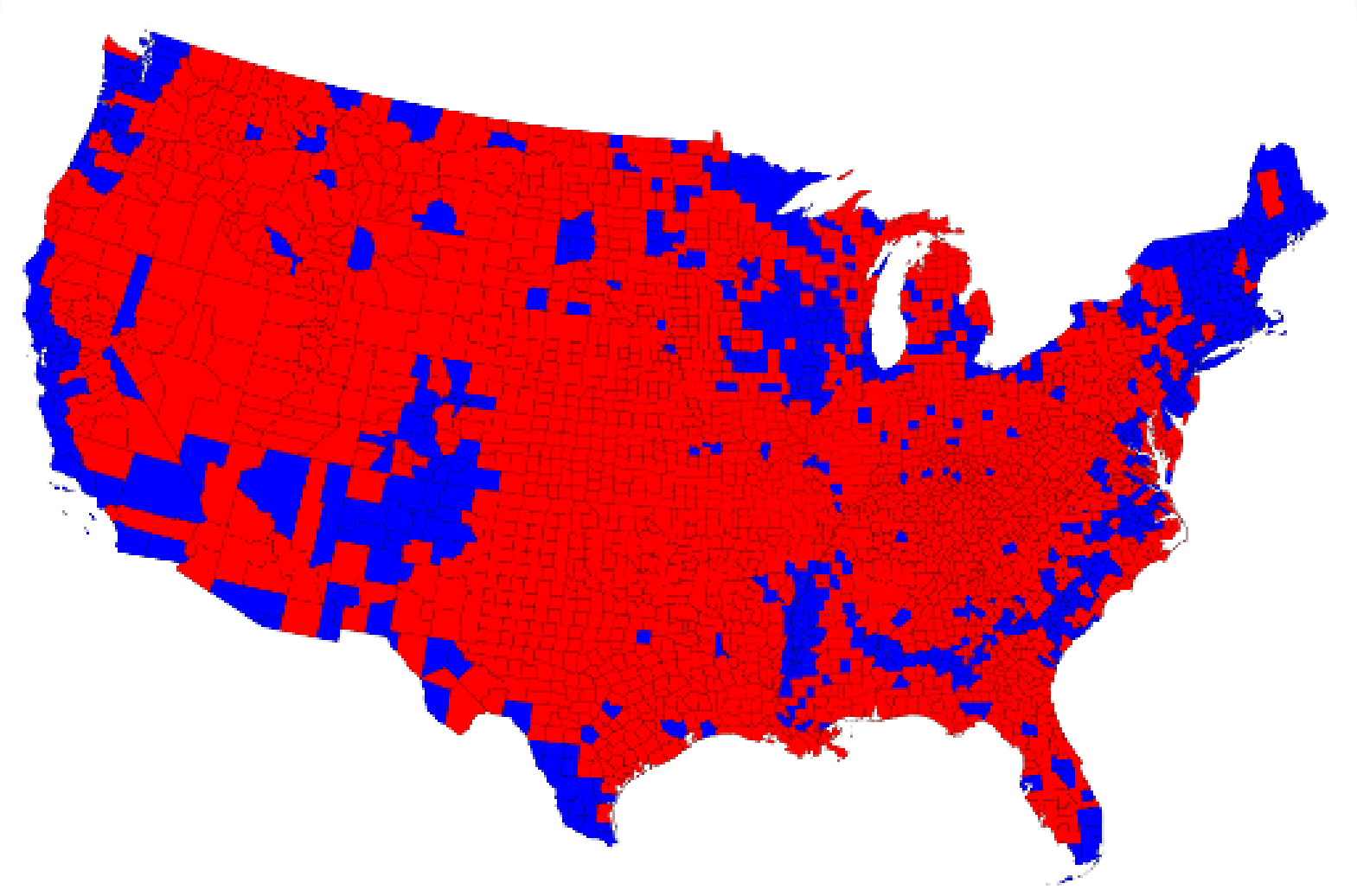


Source: (c) Mark Newman



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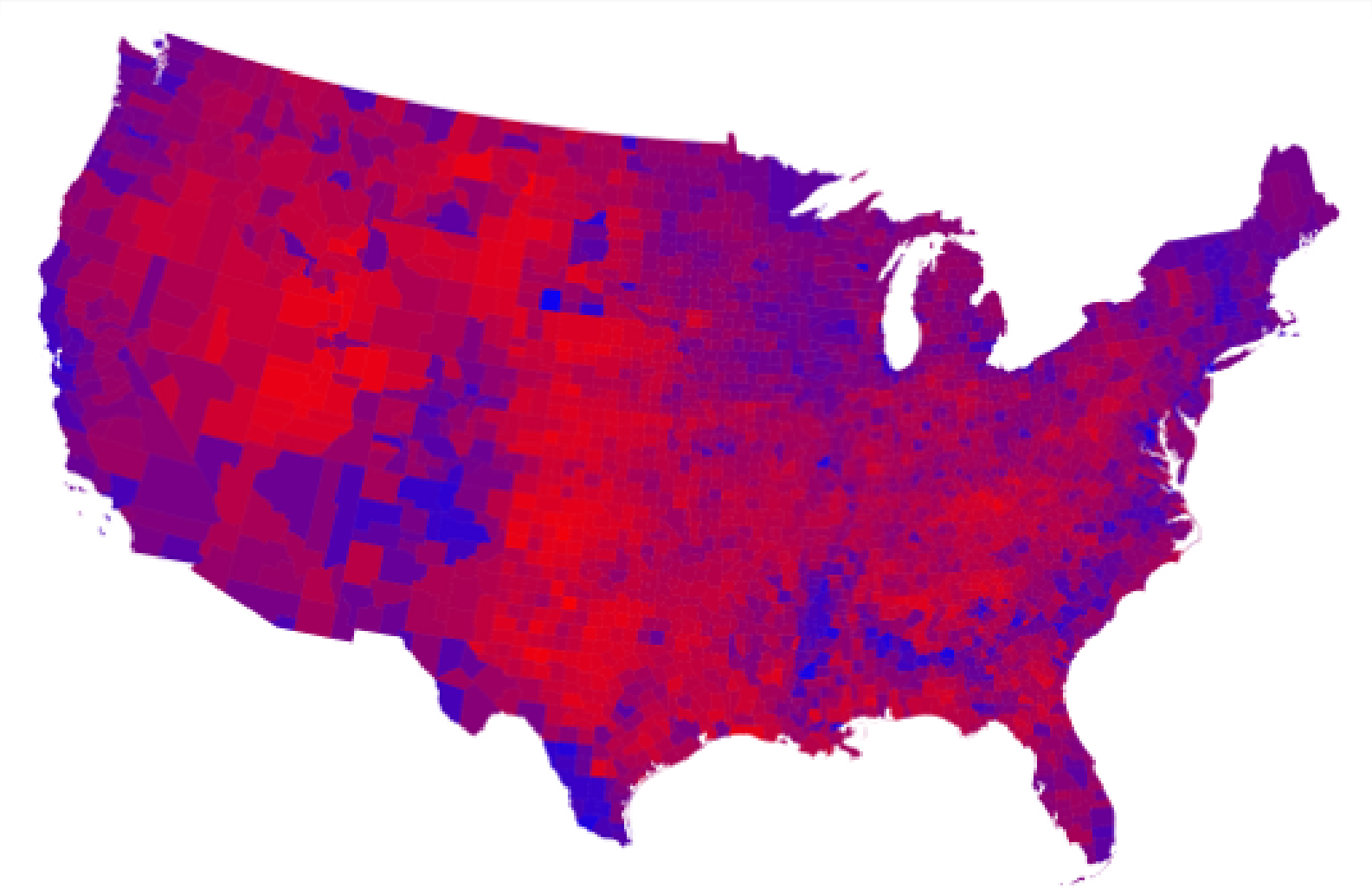

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Visualizations

- Definition: "Data graphics visually display measured quanitittes by means of the combined use of points, lines, a coordinate system, numbers, symbols, words, shading, and color." (Tufte, 2001)

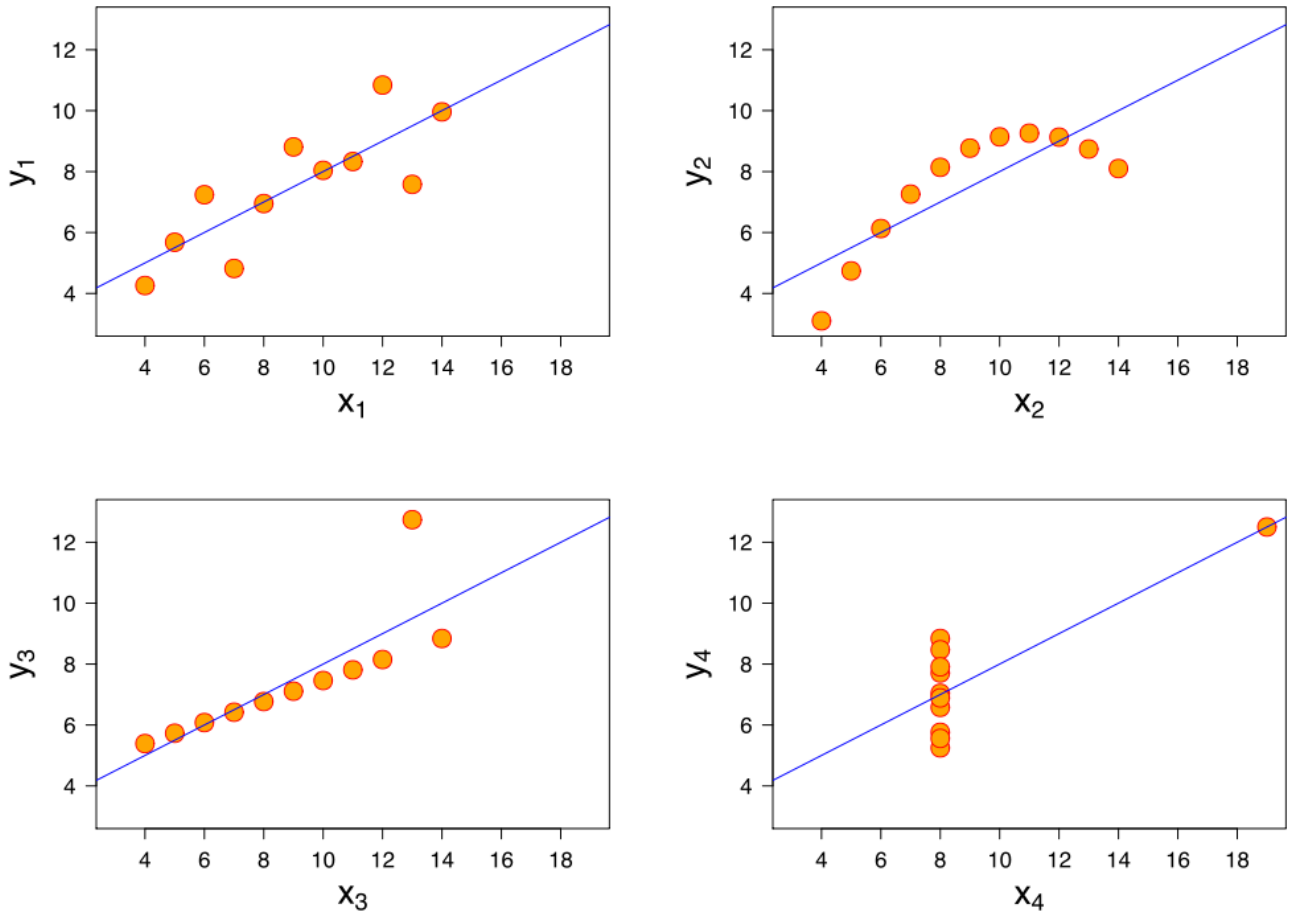
Tufte, E. 2001. *The Visual Display of Quantitative Information*. Graphics Press.

Anscombe's Quartet

I		II		III		IV	
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

$$\bar{X} = 9,\ Var(X) = 11,$$
$$\bar{Y} = 7.5,\ Var(Y) = 4.12,$$
$$Corr(X, Y) = 08.16$$

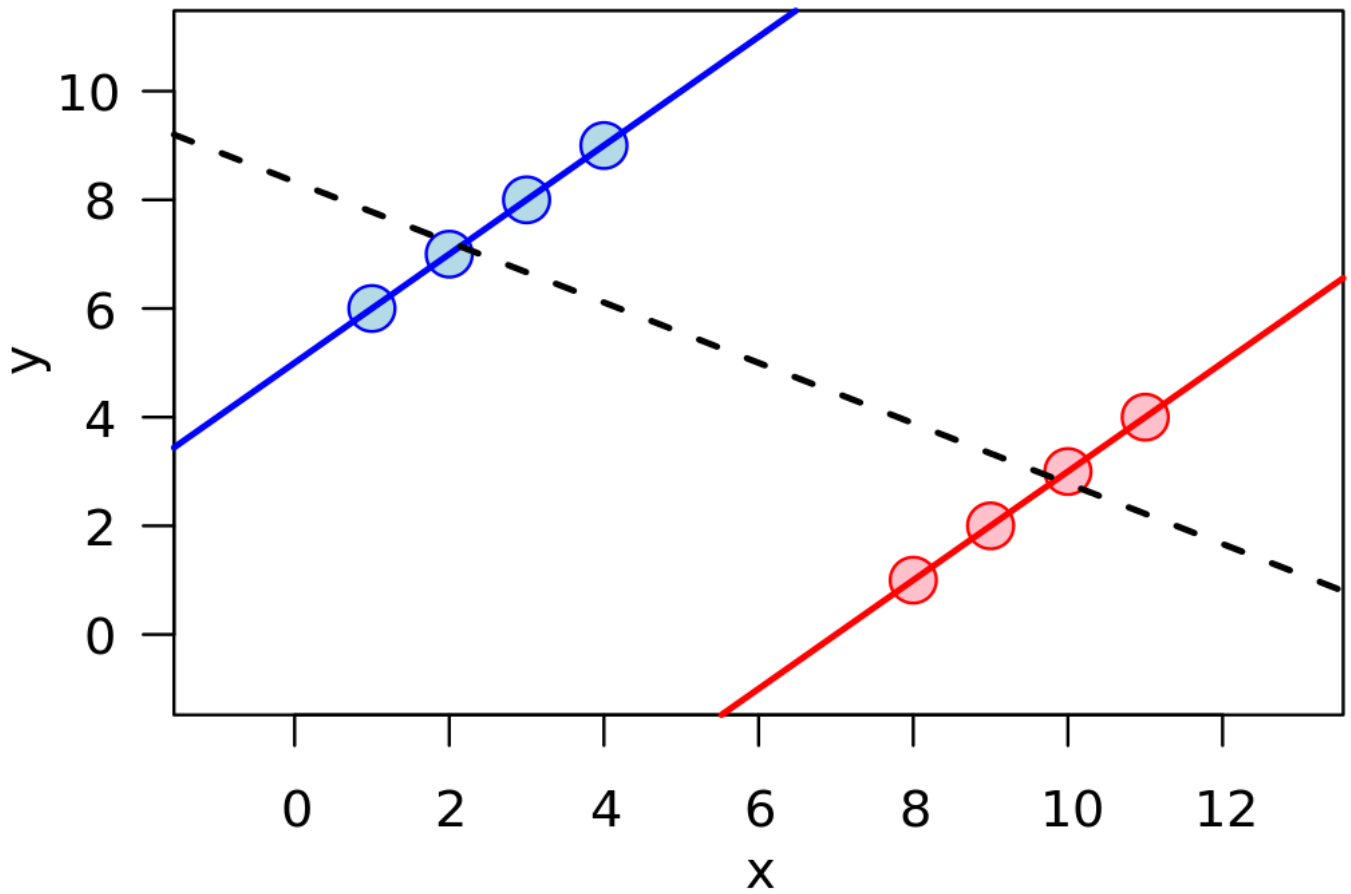
Anscombe's Quartet



Simpson's Paradox

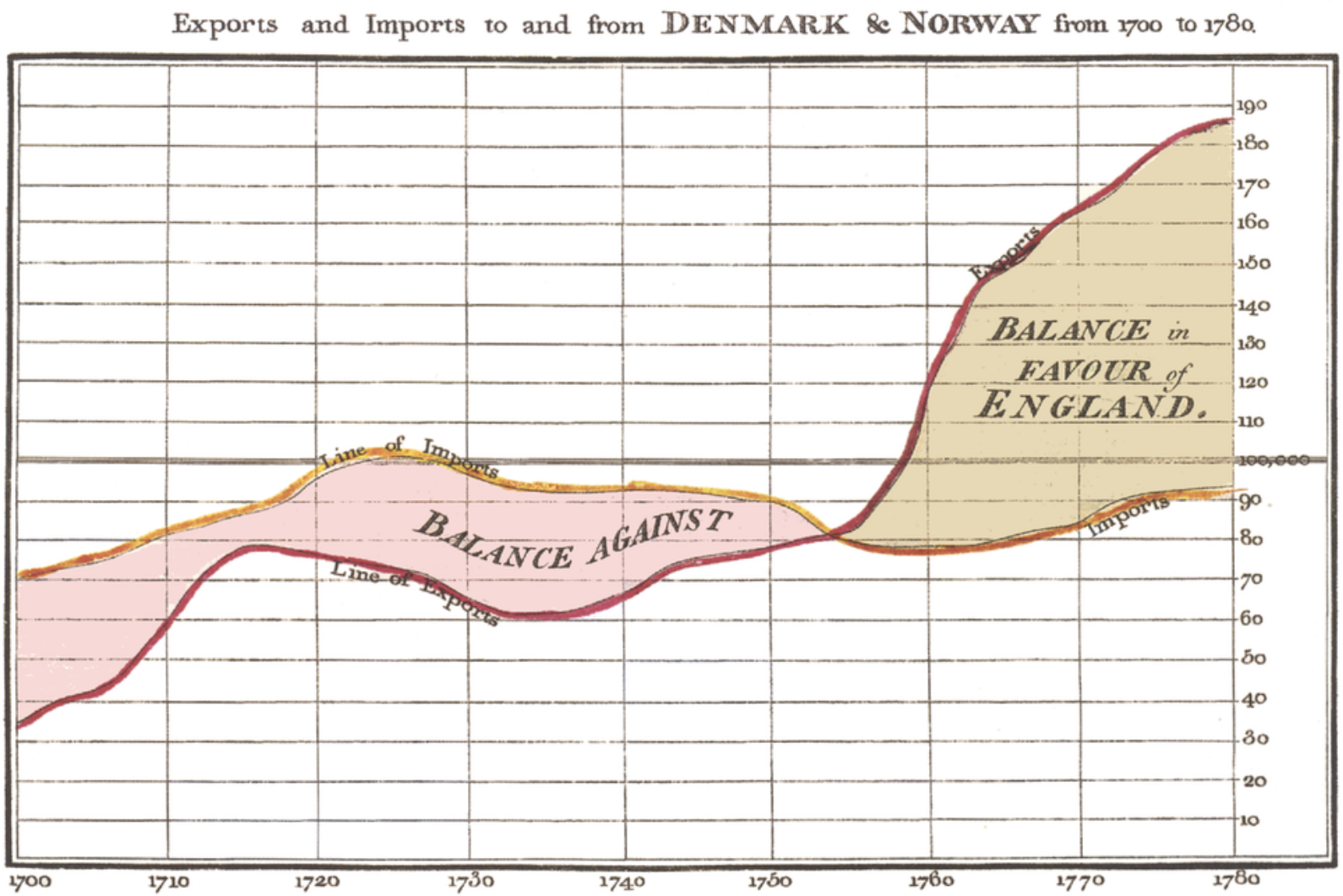
Source: Wikimedia

Simpson's Paradox

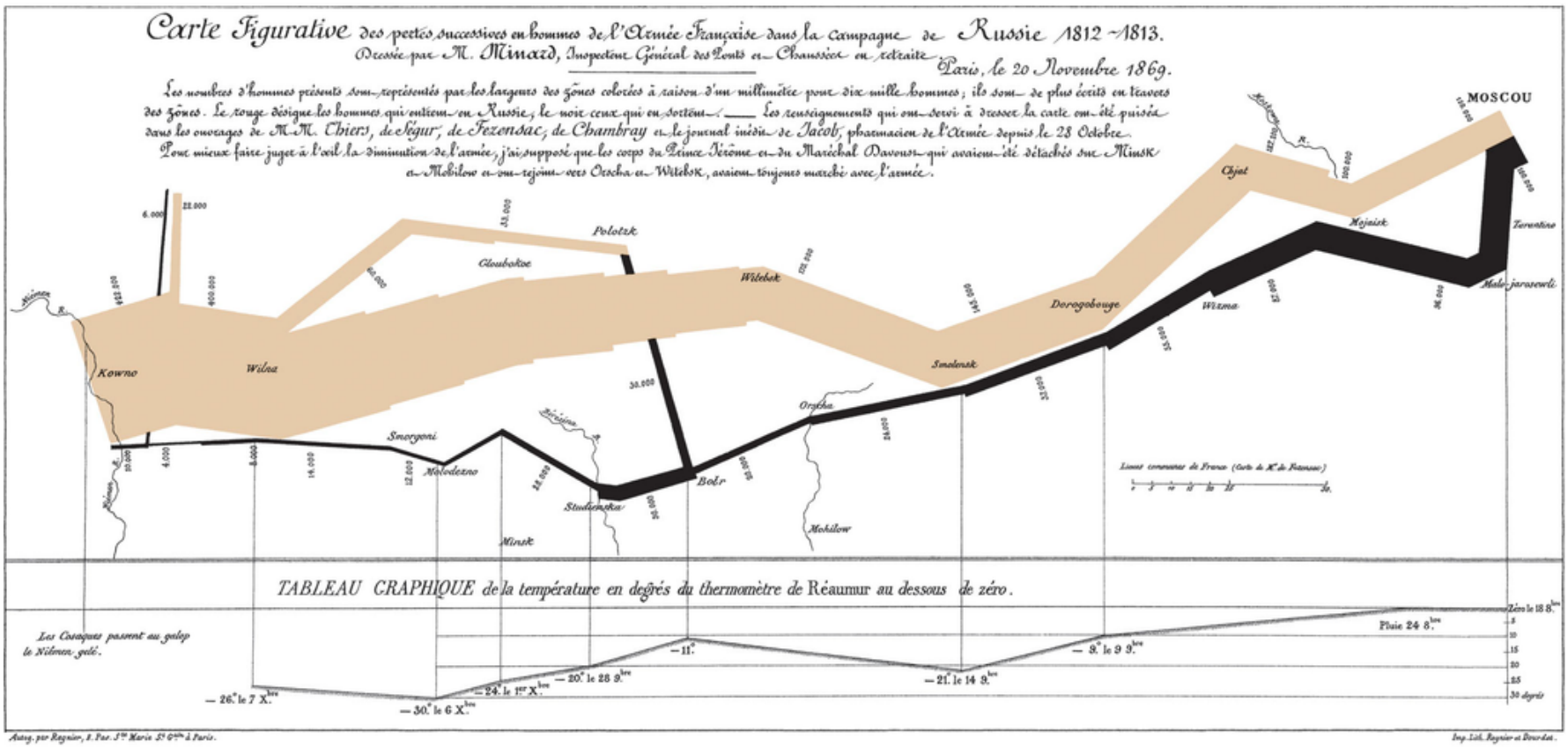


Source: Wikimedia

William Playfair



Charles Minard



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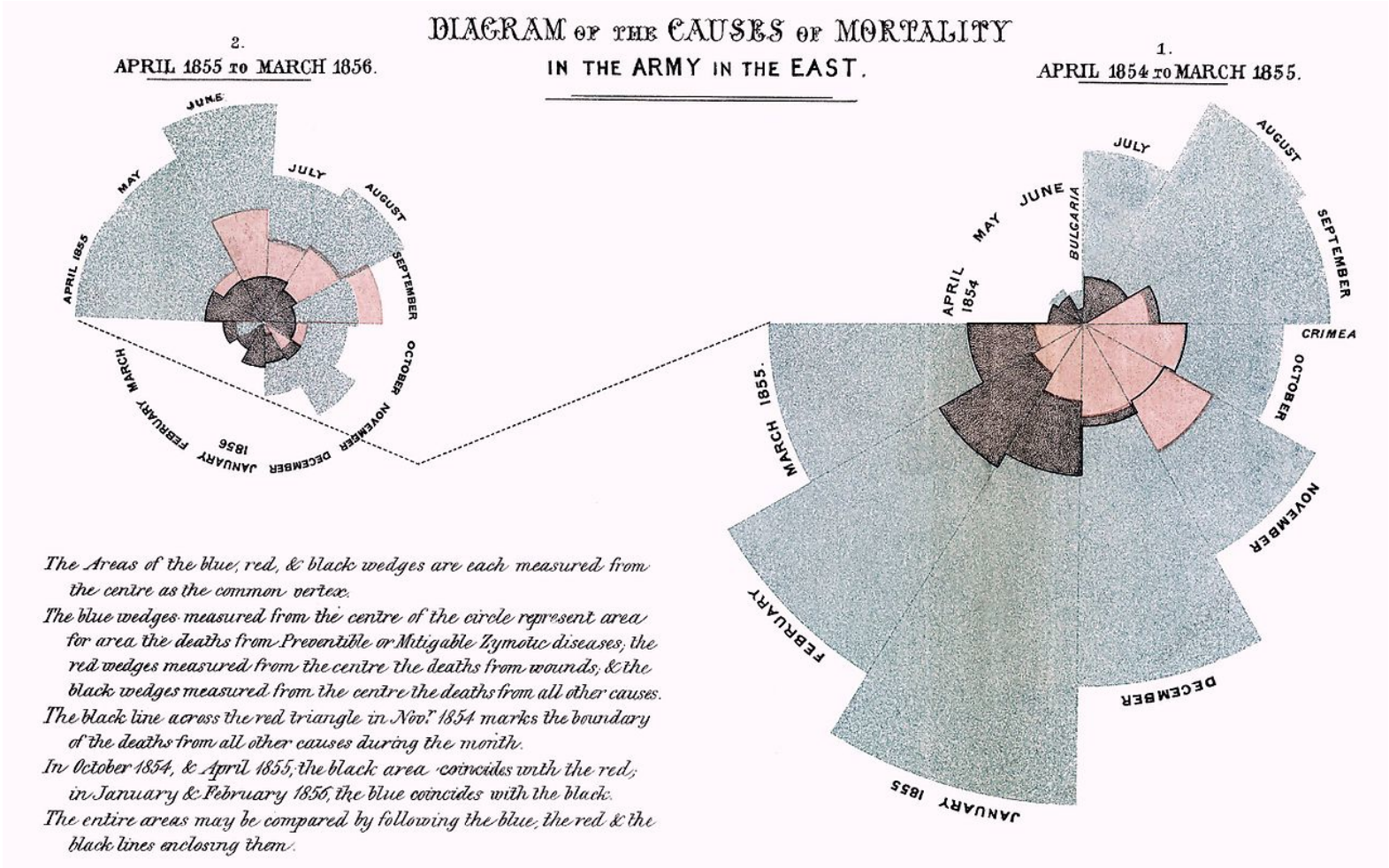
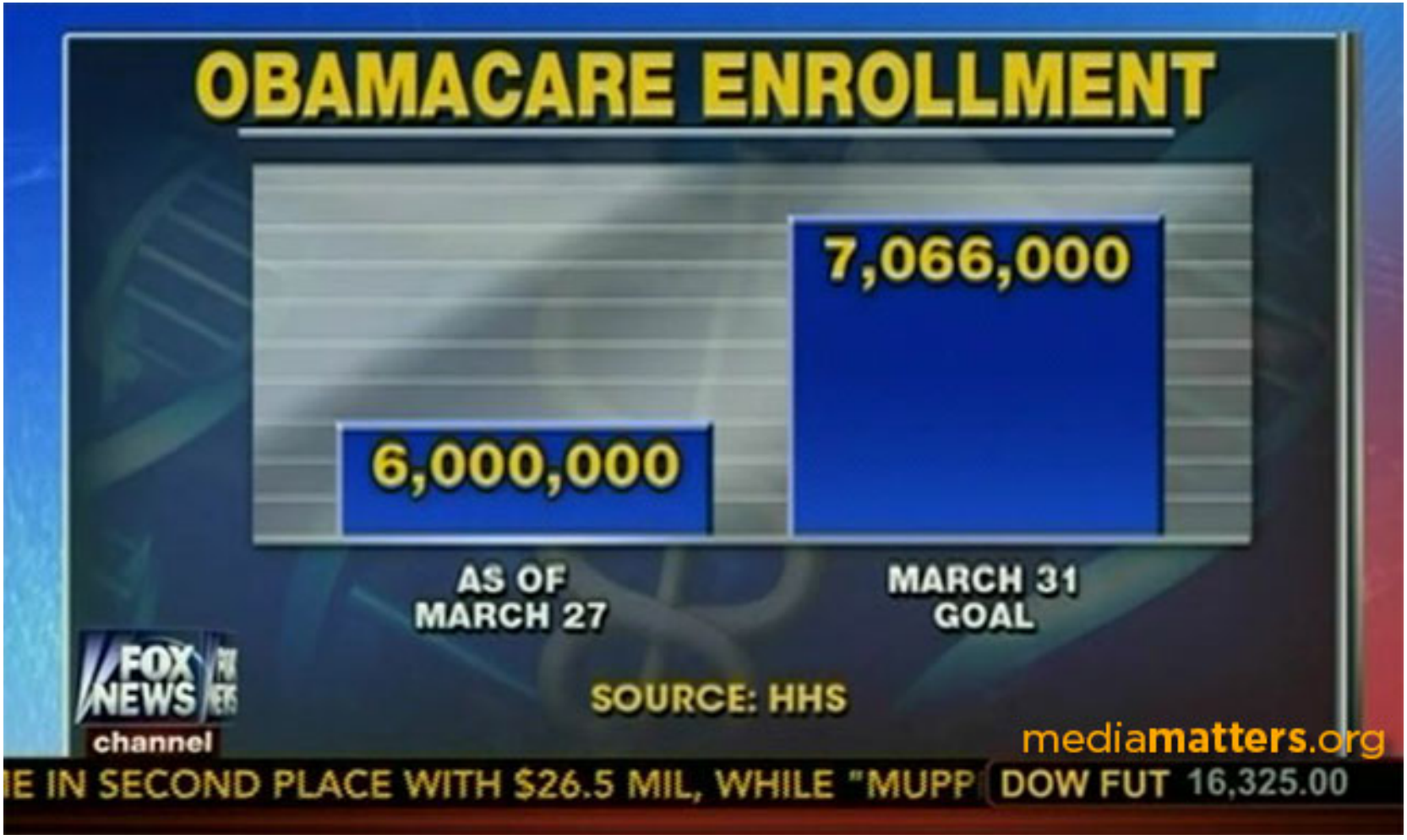
Florence Nightingale



Source: Wikimedia

1 Be honest



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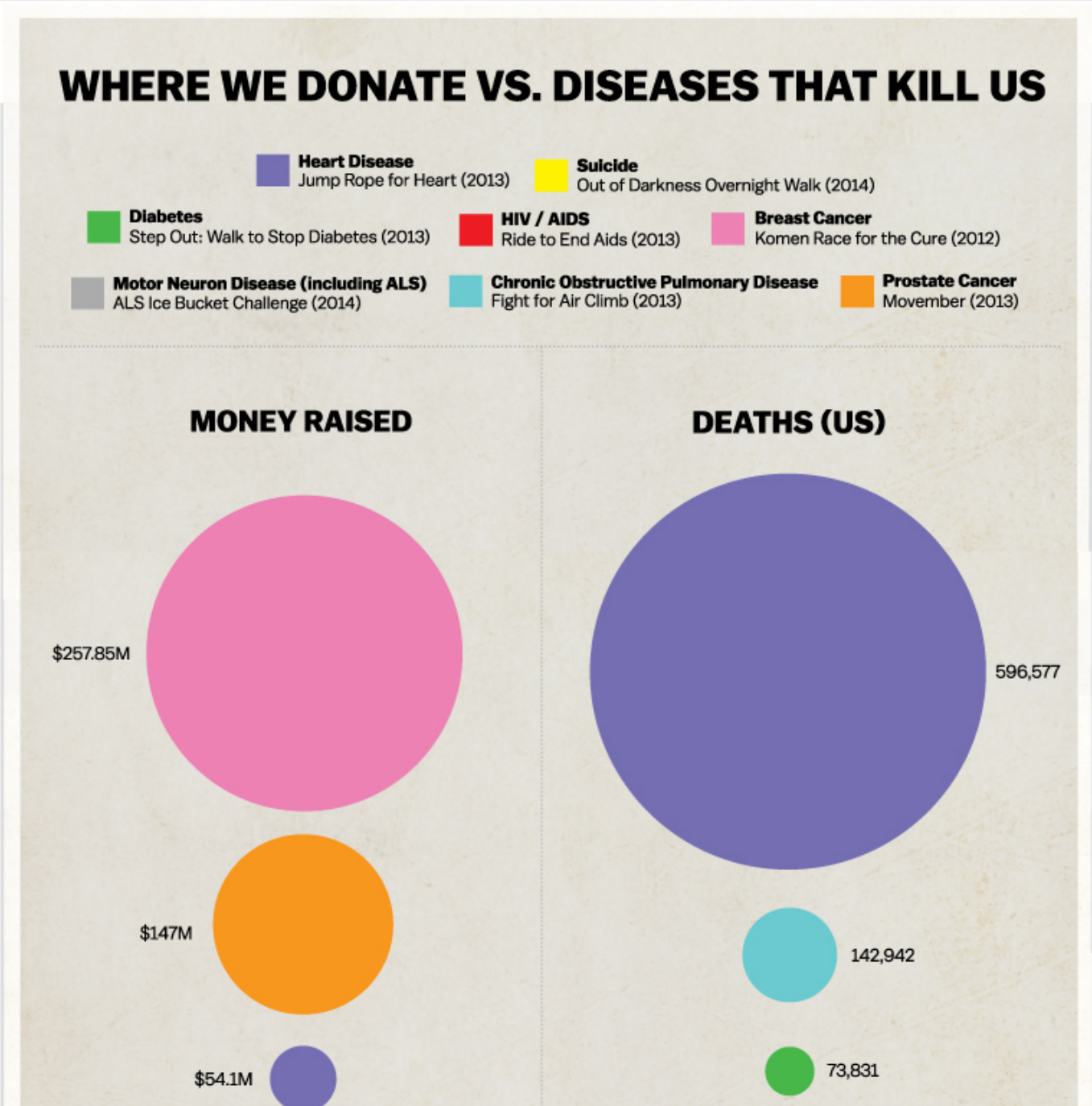
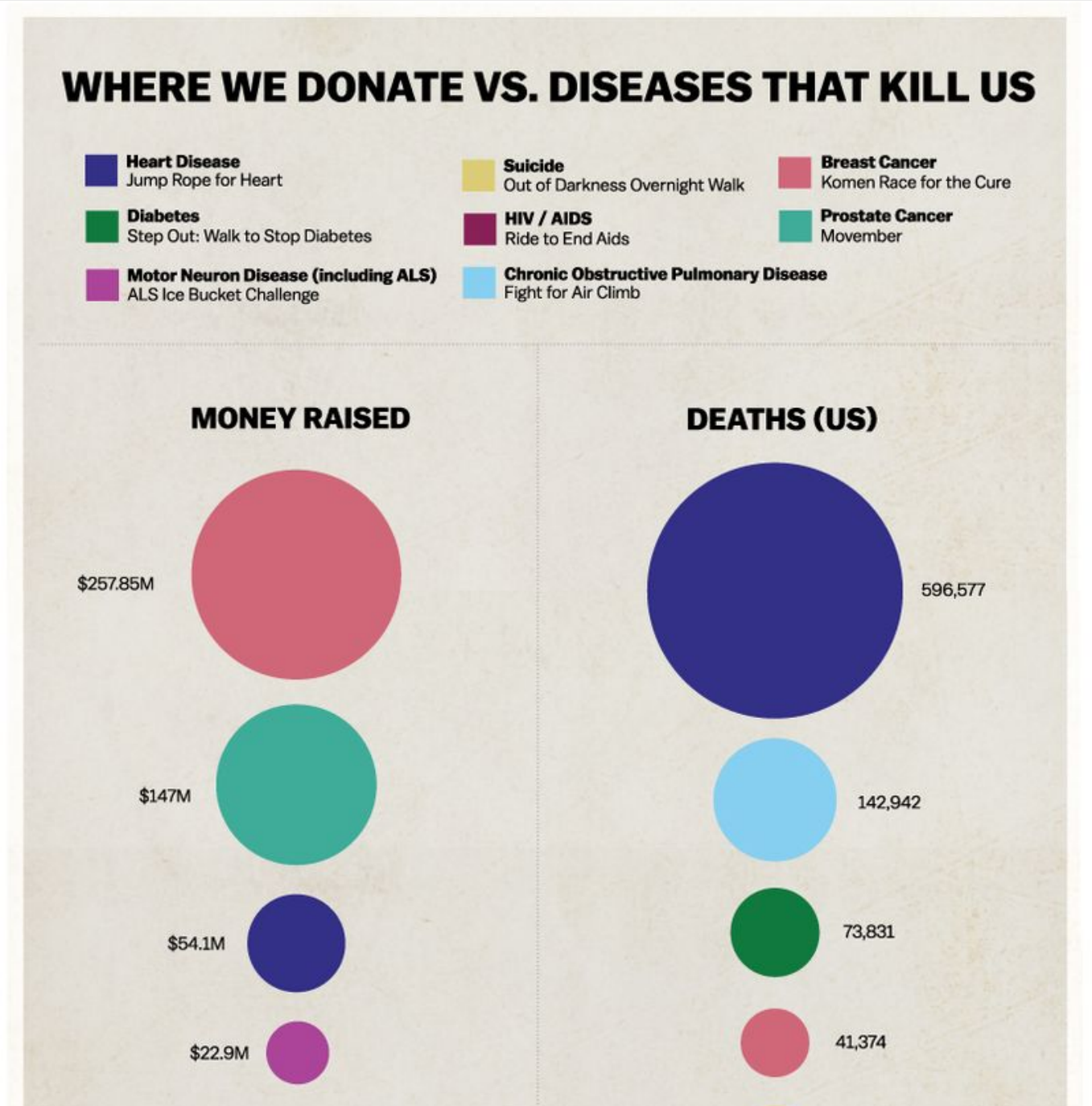

WHERE WE DONATE VS. DISEASES THAT KILL US
Heart Disease
Jump Rope for Heart (2013)
Suicide
Out of Darkness Overnight Walk (2014)
Diabetes
Step Out: Walk to Stop Diabetes (2013)
HIV / AIDS
Ride to End Aids (2013)
Breast Cancer
Komen Race for the Cure (2012)
Motor Neuron Disease (including ALS)
ALS Ice Bucket Challenge (2014)
Chronic Obstructive Pulmonary Disease
Fight for Air Climb (2013)
Prostate Cancer
Movember (2013)
MONEY RAISED
$257.85M
$147M
$54.1M
DEATHS (US)
596,577
142,942
73,831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1 Be honest

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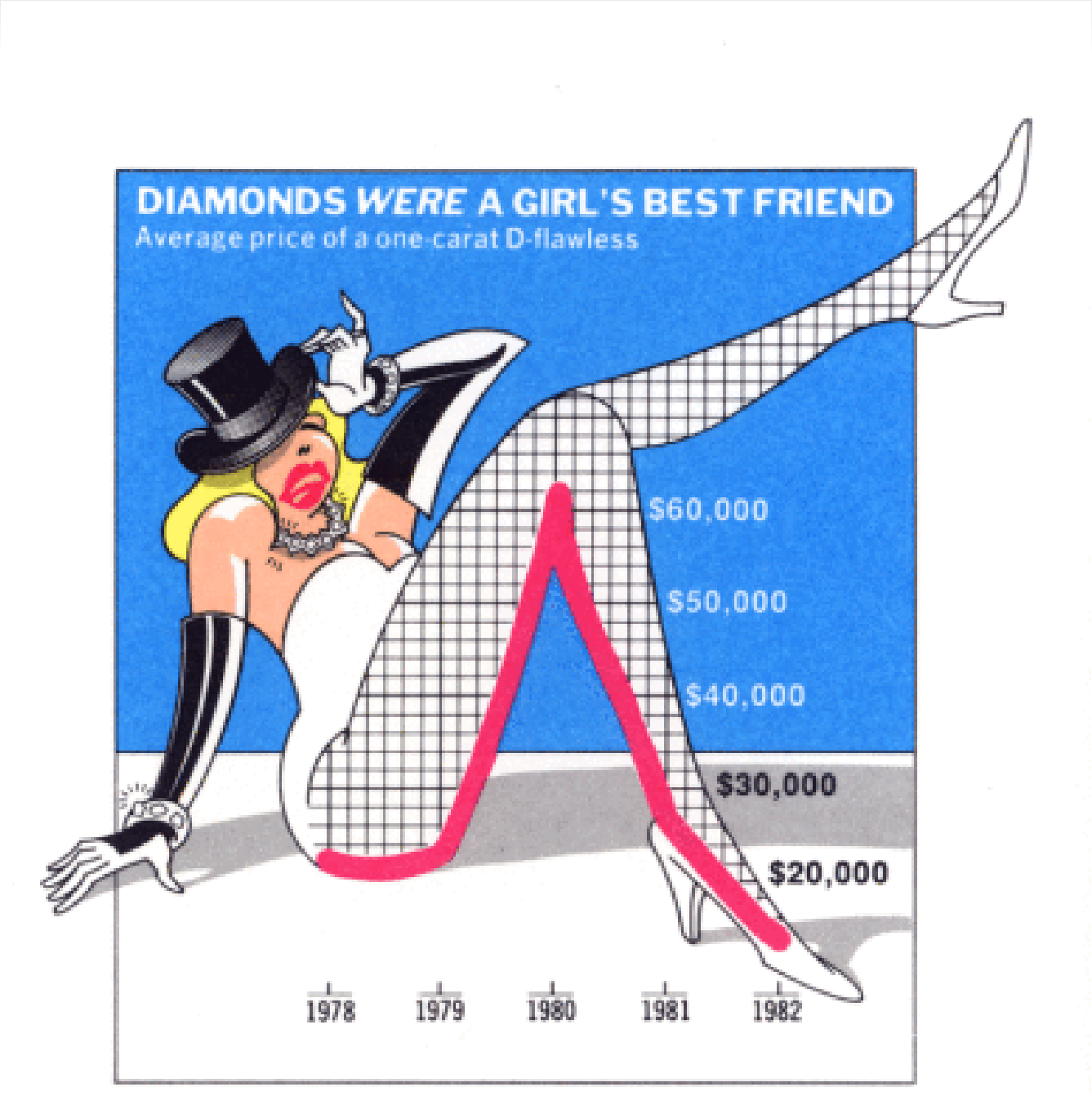
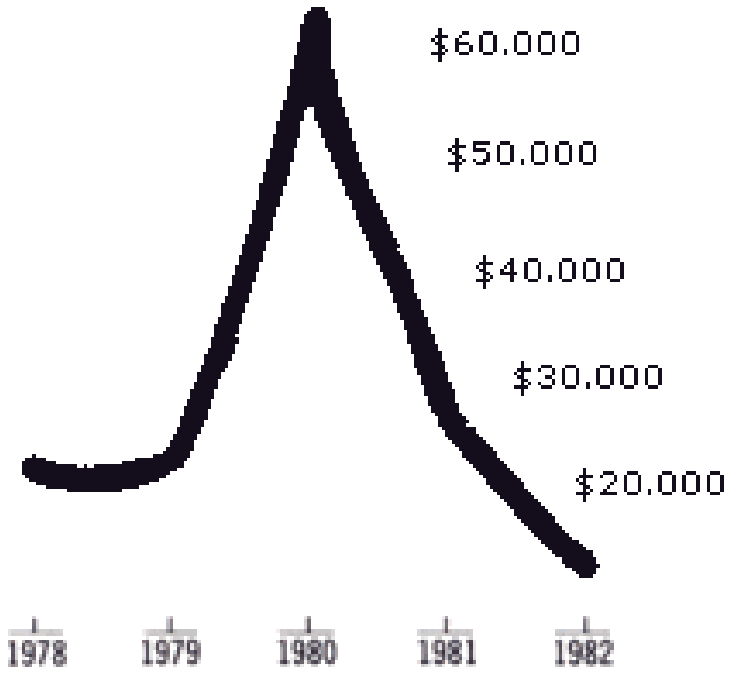
2. Data-Ink Ratio


DIAMONDS *WERE* A GIRL'S BEST FRIEND
Average price of a one-carat D-flawless
$60,000
$50,000
$40,000
$30,000
$20,000
1978
1979
1980
1981
1982


$60.000
$50.000
$40.000
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1980
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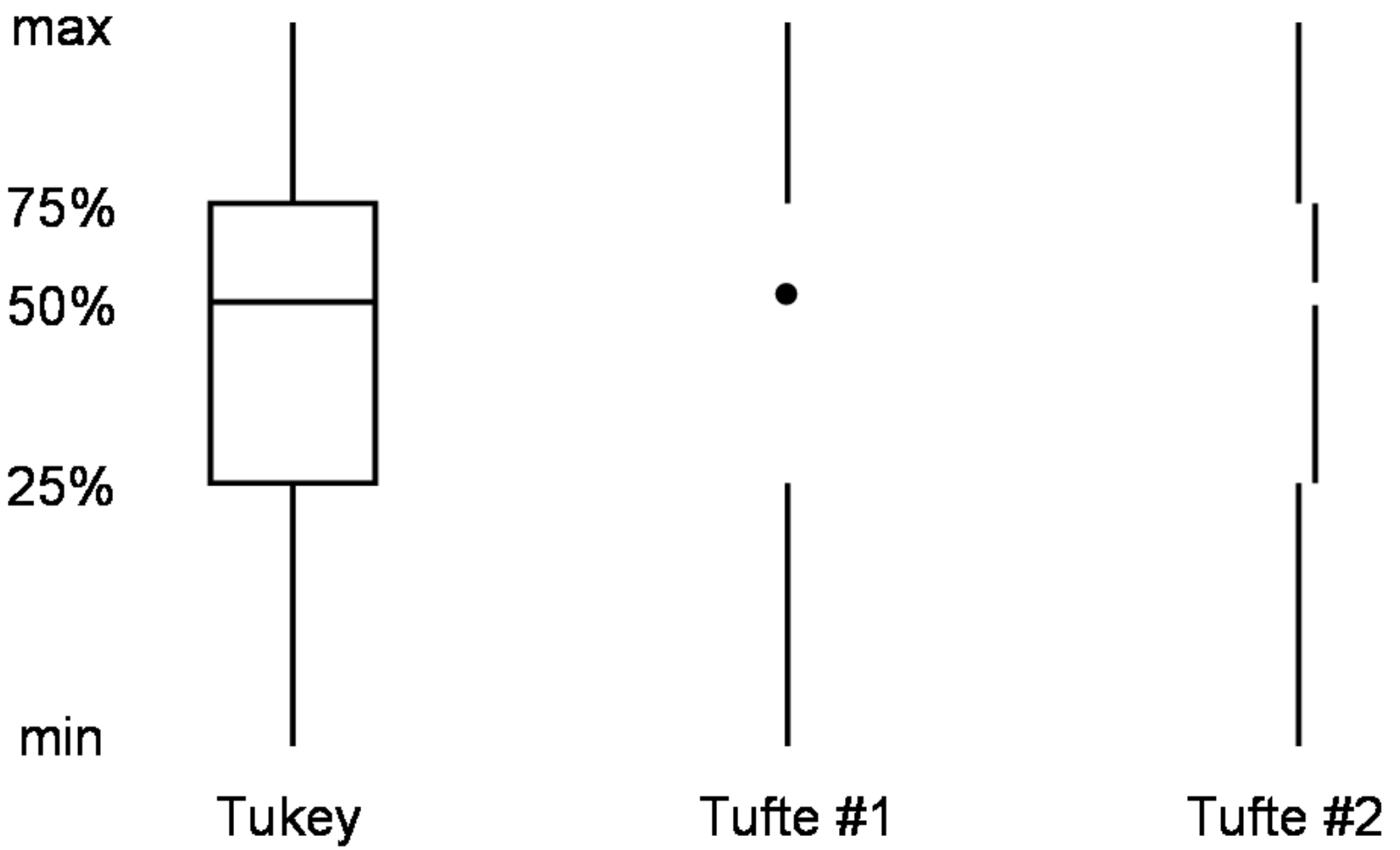
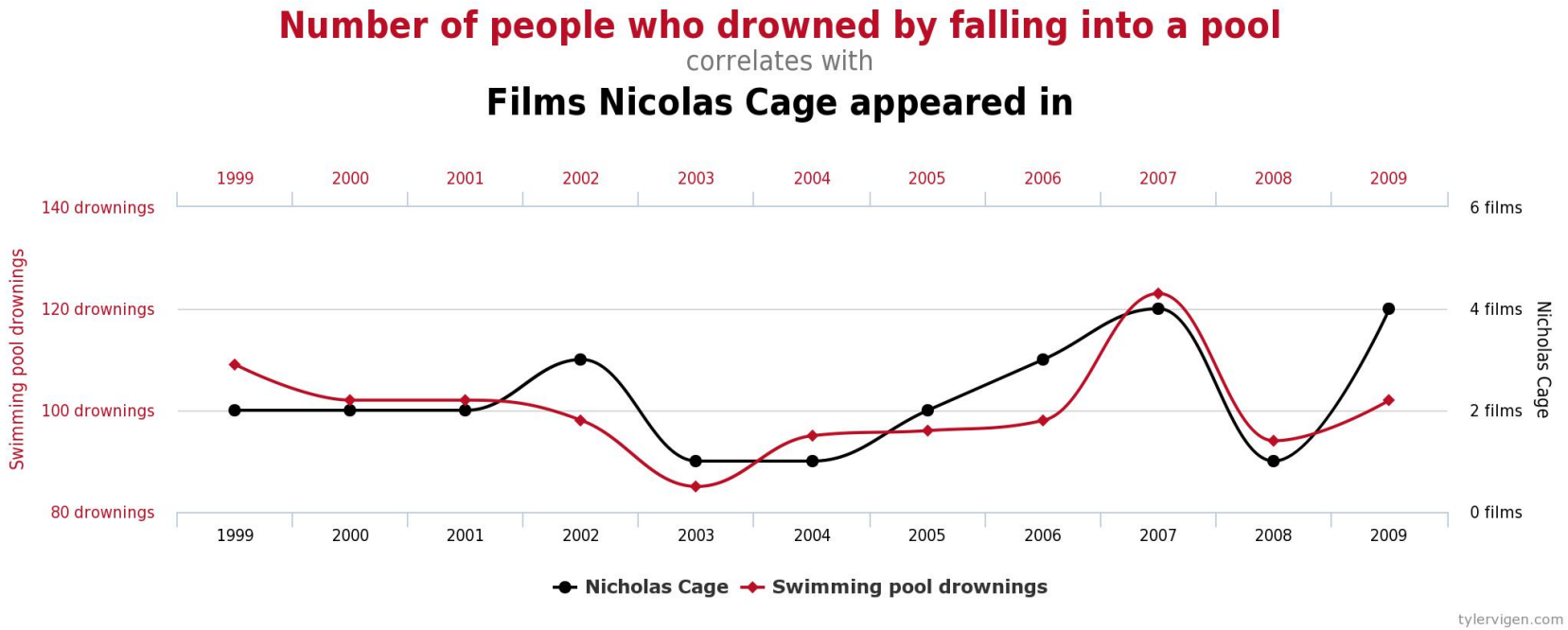
1982



Source: StackOverflow

1. Be honest
2. Data-Ink Ratio

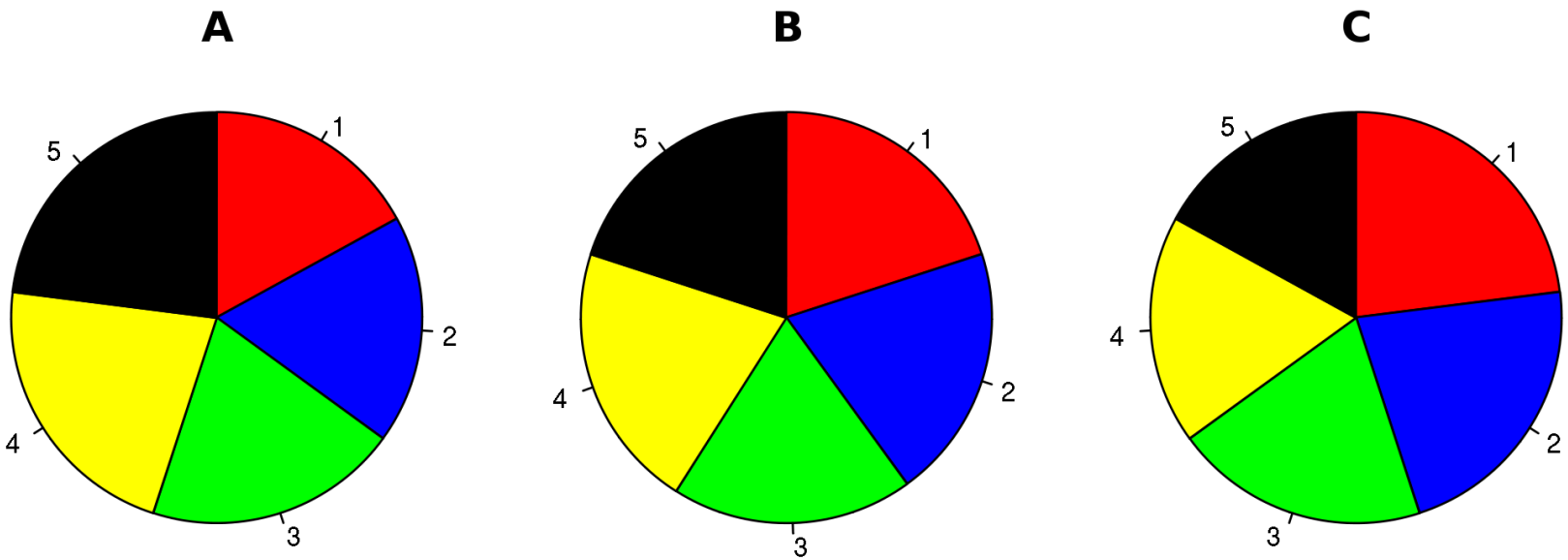
1. Be honest
2. Data-Ink Ratio
3. Tell a story



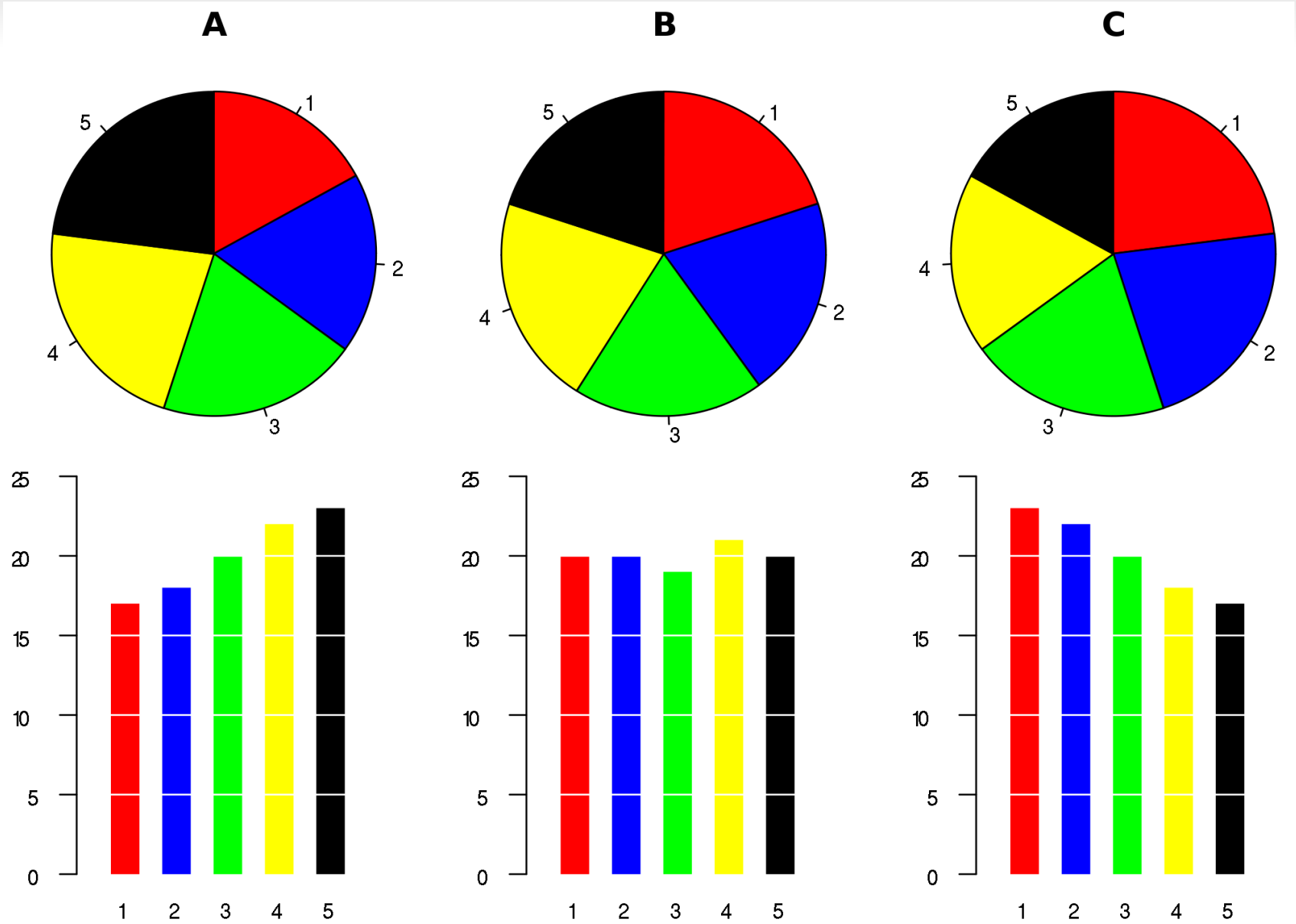
Source: CC-BY Tyler Vigen

1. Be honest
2. Data-Ink Ratio
3. Tell a story

1. Be honest
2. Data-Ink Ratio
3. Tell a story
4. Steer reader's attention



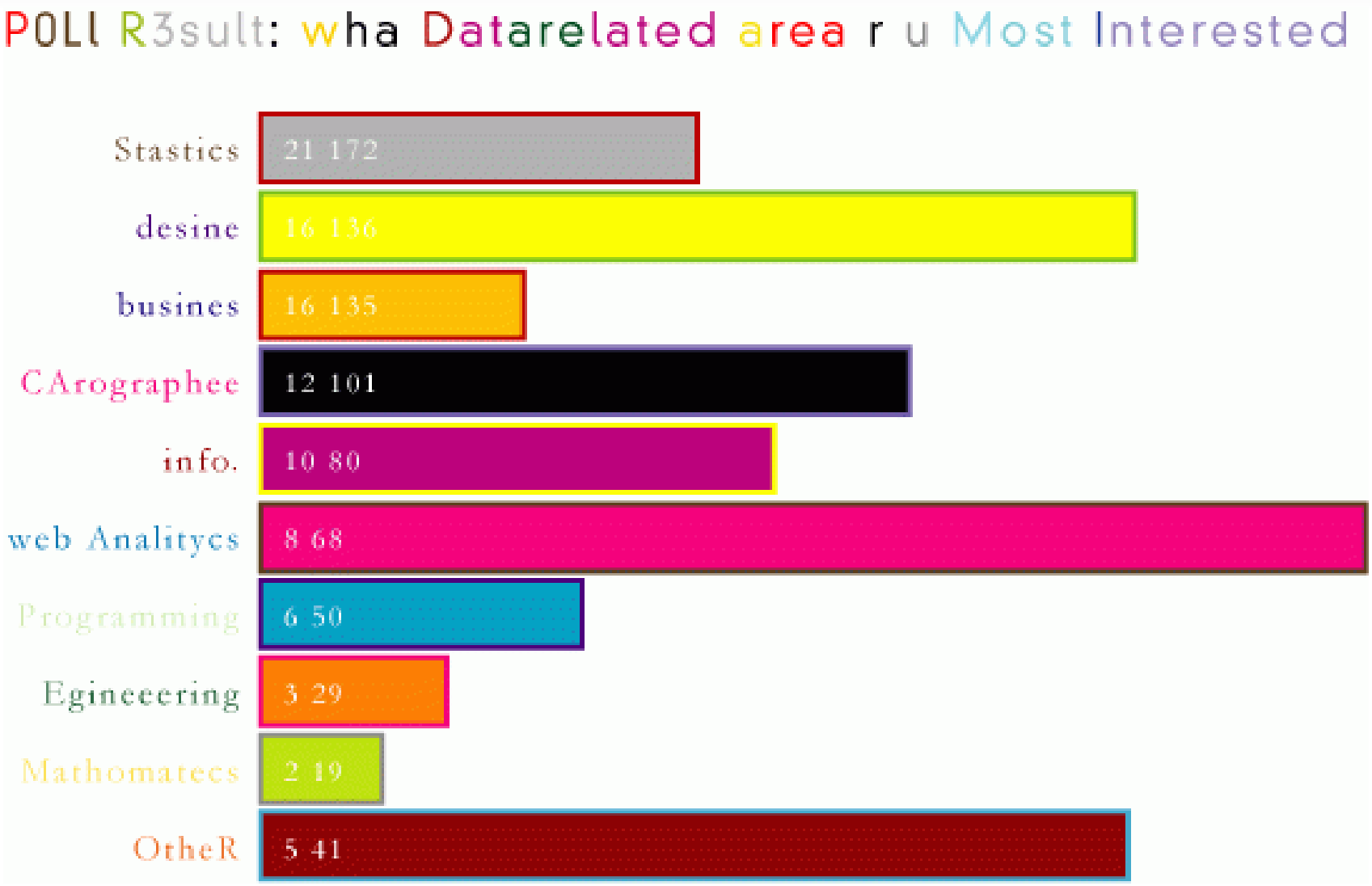
Source: Wikimedia



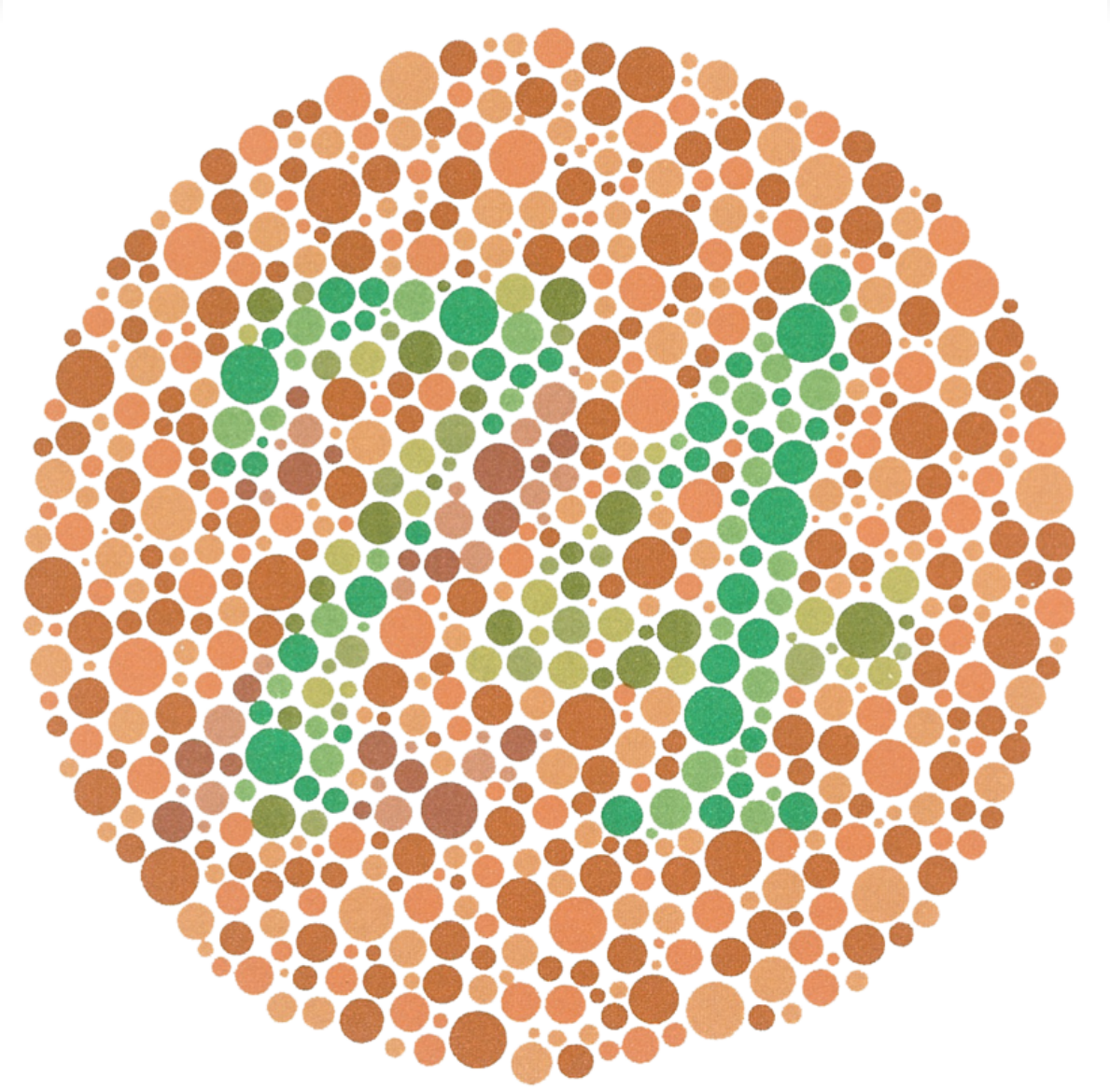
Source: Wikimedia

1. Be honest
2. Data-Ink Ratio
3. Tell a story
4. Steer reader's attention

1. Be honest
2. Data-Ink Ratio
3. Tell a story
4. Steer reader's attention
5. Use balanced colour palettes



Source: Flowing Data



Source: Wikimedia

The bottom line

A visualization should be a display of quantitative (and/or qualitative) data that tells an information-rich story in an honest and beautiful manner.

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Questions?

Homework

1. Find a visualization anywhere on the internet.
2. Post a link to the visualization to the Moodle forum.
3. Include the visualization as an image.
4. Describe:
   - What is being visualized
   - Strengths of the visualization
   - Weaknesses of the visualization

In R...

R has 5+ graphics "systems"

- Base graphics
- The **lattice** package
- The **ggplot2** package
- The **plotrix** package
- The **htmlwidgets** package + JavaScript's d3 library

ggplot2

- Most coherent graphics system
- Based on a "grammar" of graphics
- Easily customized using various "themes"
  - Some built-in to ggplot2
  - Some in an add-on package (**ggthemes**)

A bit about the grammar

- `ggplot()` creates a plot object
- `aes` describes a mapping of data to a visual element (e.g., color, shape, etc.)
- `geom_()` displays a particular graphical representation
- `scale_()` modifies the axes
- `coord_()` modifies the coordinate system
- `theme_()` modifies the overall look
- `facet_()` creates small multiples

Ways to display a variable

In a scatterplot, `geom_point()` allows us to display a variable as:

- X/Y Axis variable (via `aes(x=, y=)`)
- Colour (via `aes(color=)`)
- Alpha (via `aes(alpha=)`)
- Size (via `aes(size=)`)
- Shape (via `aes(shape=)`)
- Facets (via `facet_wrap()`)
- Animation (e.g., `http://www.gapminder.org/world`)

Tools Beyond R

- GUI-based tools:
  - Inkscape
  - GIMP
- Command line tools:
  - ImageMagick

ggplot2 Resources

- http://docs.ggplot2.org/current/
- https://www.rstudio.com/wp-content/uploads/2015/03/ggplot2-cheatsheet.pdf
- https://github.com/jennybc/ggplot2-tutorial
- http://inundata.org/2013/04/10/a-quick-introduction-to-ggplot2/
- http://www.cookbook-r.com/Graphs/

General Resources

- http://www.edwardtufte.com/tufte/
- http://www.informationisbeautiful.net/
- http://flowingdata.com/
- http://ourworldindata.org/
- http://www.thefunctionalart.com/
- http://www.visualisingdata.com/
- http://www.braumoeller.info/dataviz/

```
library("rio")
d <- import("http://www.qogdata.pol.gu.se/data/qog_std_cs_jan15.dta")

summary(d$wef_lifexp) # life expectancy
summary(d$fh_polity2) # Polity scores
summary(d$gle_cgdpc)  # GDP
summary(d$dpi_finter) # executive term limits
summary(d$bti_cr)     # civil rights index

library("ggplot2")
p <- ggplot(d)
p + aes(x = fh_polity2) + geom_density()
p + aes(x = fh_polity2) + geom_histogram()

p + aes(x = bti_cr) + geom_bar()

p + aes(x = gle_cgdpc, y = wef_lifexp) + geom_point() +
    scale_x_log10() + scale_y_log10()

p + aes(1, fh_polity2) + geom_boxplot()
p + aes(factor(bti_cr), fh_polity2) + geom_boxplot()

p + aes(x = gle_cgdpc, y = wef_lifexp) + geom_point(aes(color = fh_polity2))
p + aes(x = fh_polity2, y = wef_lifexp) + geom_point(aes(size = gle_cgdpc))

p + aes(x = fh_polity2, y = wef_lifexp) + geom_point() + theme_bw()
```