Designing Effective Visualizations

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Outline

- Effective Visualizations
- Use of color
- Comparison
- Copy & labels
- Ordering & aligning data

Outline

- **Effective Visualizations**
- Use of color
- Comparison
- Copy & labels
- Ordering & aligning data

Effective Visualizations

- Main goal of visualization:
  - Communicate [a message/data…]
- Visualization will be **effective** if:
  - Message has been transmitted
  - Data has been properly understood
- Visualization will be **ineffective** if:
  - Visualization is too complex: user is unable to get the message
  - Visualization is misleading: user is unable to grasp the data

Effective Visualizations

- Effective visualization. Elements to consider
  - Data density
    - We want information-rich visualizations
  - Visual mappings
    - Observers must understand the depiction without effort
  - Amount of information
    - Keys, labels [grids, legends, ticks…] help understanding the data
  - Color usage
    - Influences perception and attention

Effective Visualizations

- Requirements
  - Legibility
  - Clarity
  - and optionally, Attractiveness

Effective Visualizations

- Legible
  - Are all elements discernable?
  - Does text contrast well with background?
  - Is there simultaneous contrast?

- Variables that influence legibility
  - RESOLUTION
  - PARSABILITY
  - COLOR

Effective Visualizations

- Clear
  - Does the reader see the noise or trends?
  - Message delivered?
  - Are there redundant or ornamental elements?
- Variables that influence clarity:
  - MESSAGE EMPHASIS
  - EXCESS INK
  - REDUNDANCY
  - GLYPHS
  - OUTLIER HIJACK

Effective Visualizations

- Attractive
  - Are spacing and orientation of visual cues consistent?
  - Are the colors harmonic?
  - Are the elements properly aligned?

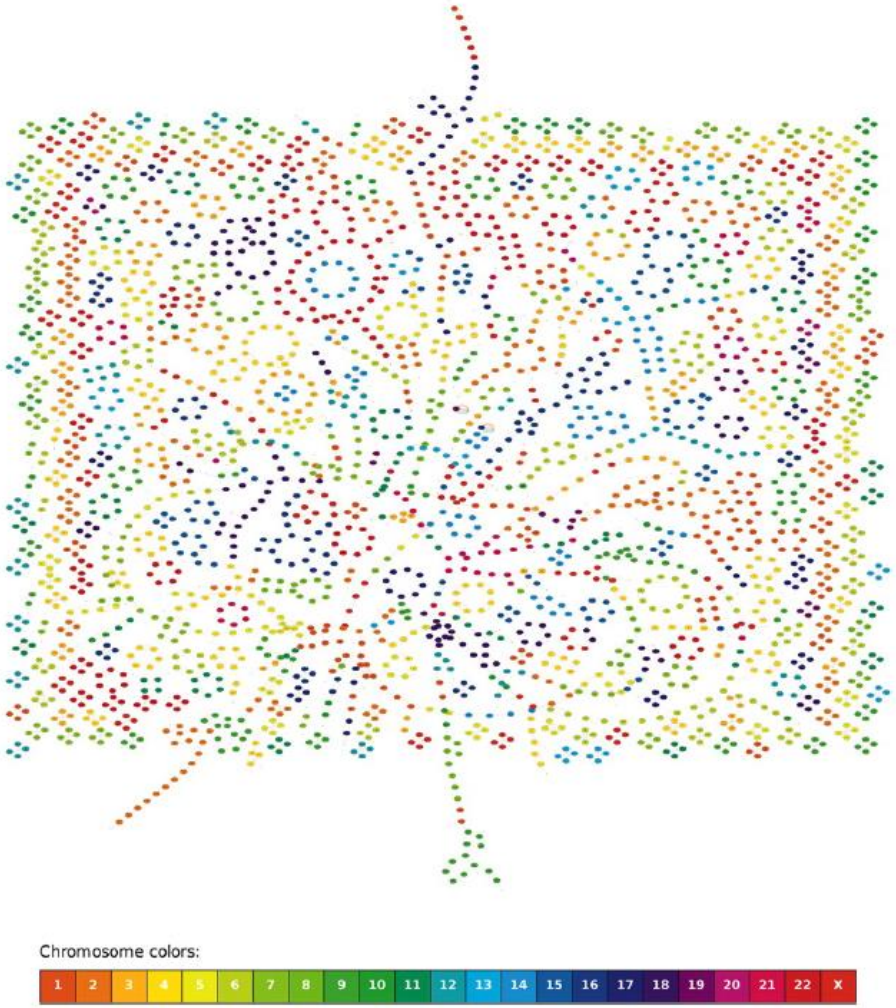
- Variables that influence attractiveness
  - GRID LAYOUT
  - COLOR PALETTES

Effective Visualizations

- Visualization analysis
  - Do I have a message?
    - Have I communicated it?
      - Explanatory visualization
  - Does the data contain some important insights?
    - Does the visualization allow the user to find/understand those?
      - Exploratory analysis

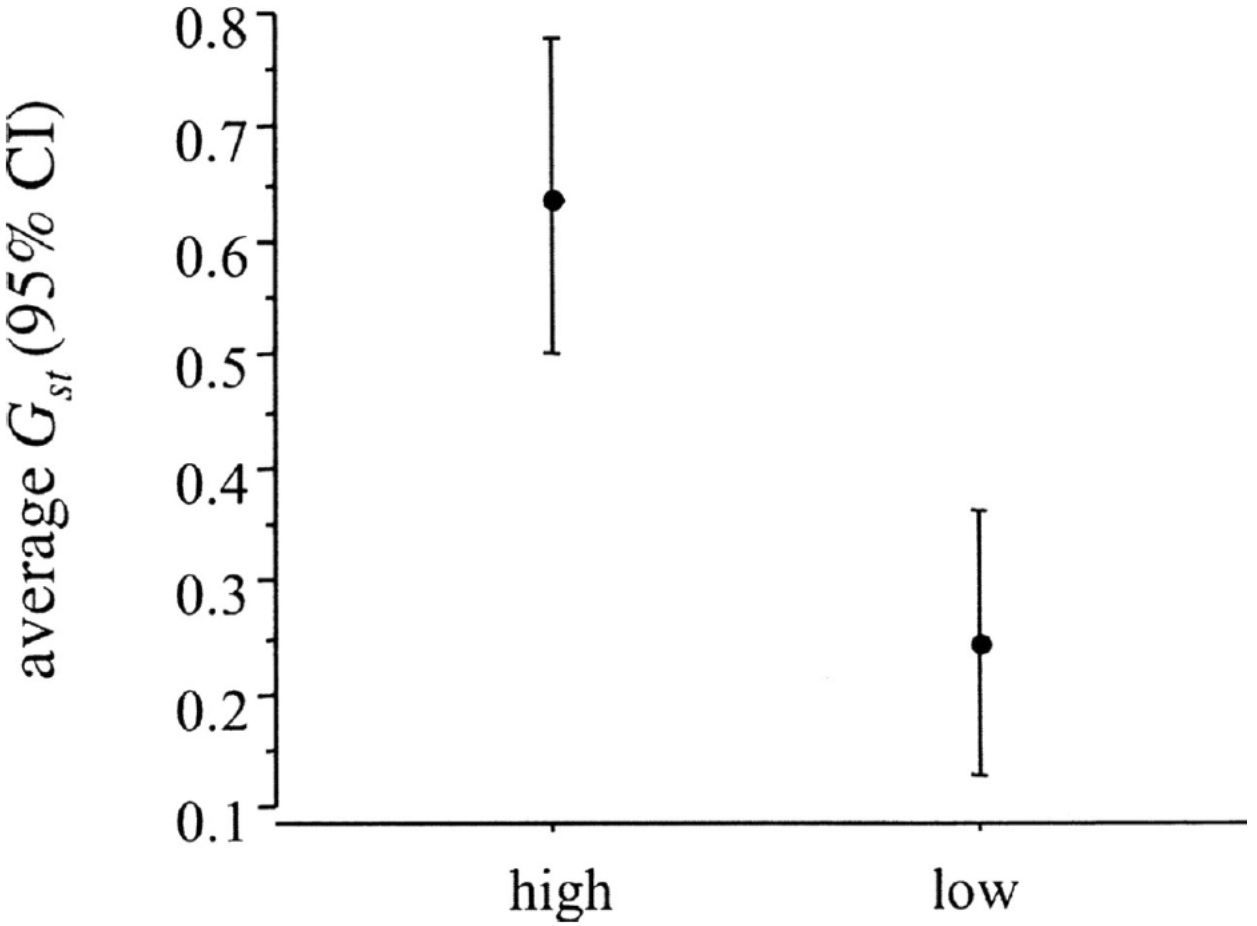
Effective Visualizations

- Information rich, not informative

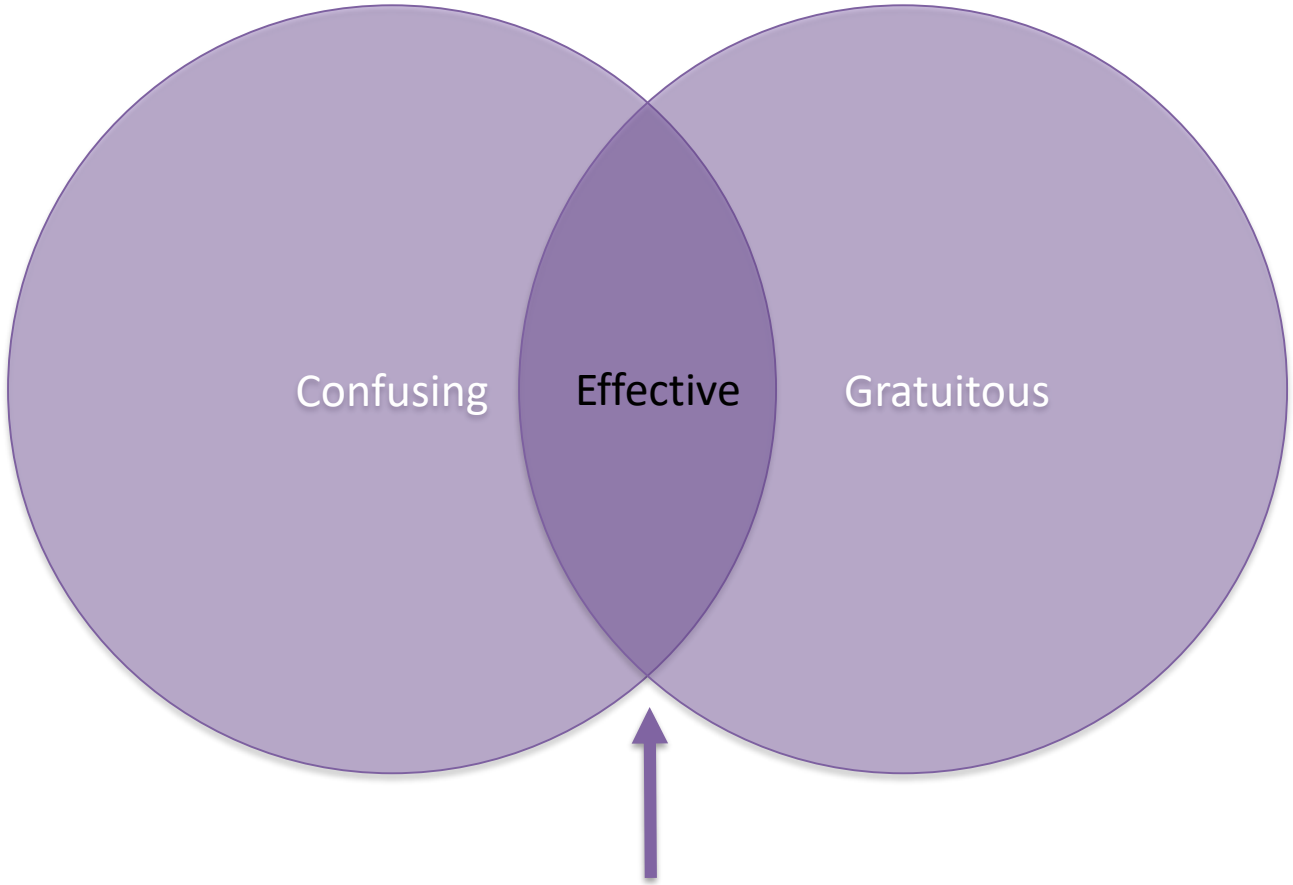


Effective Visualizations

- Informative, not information-rich

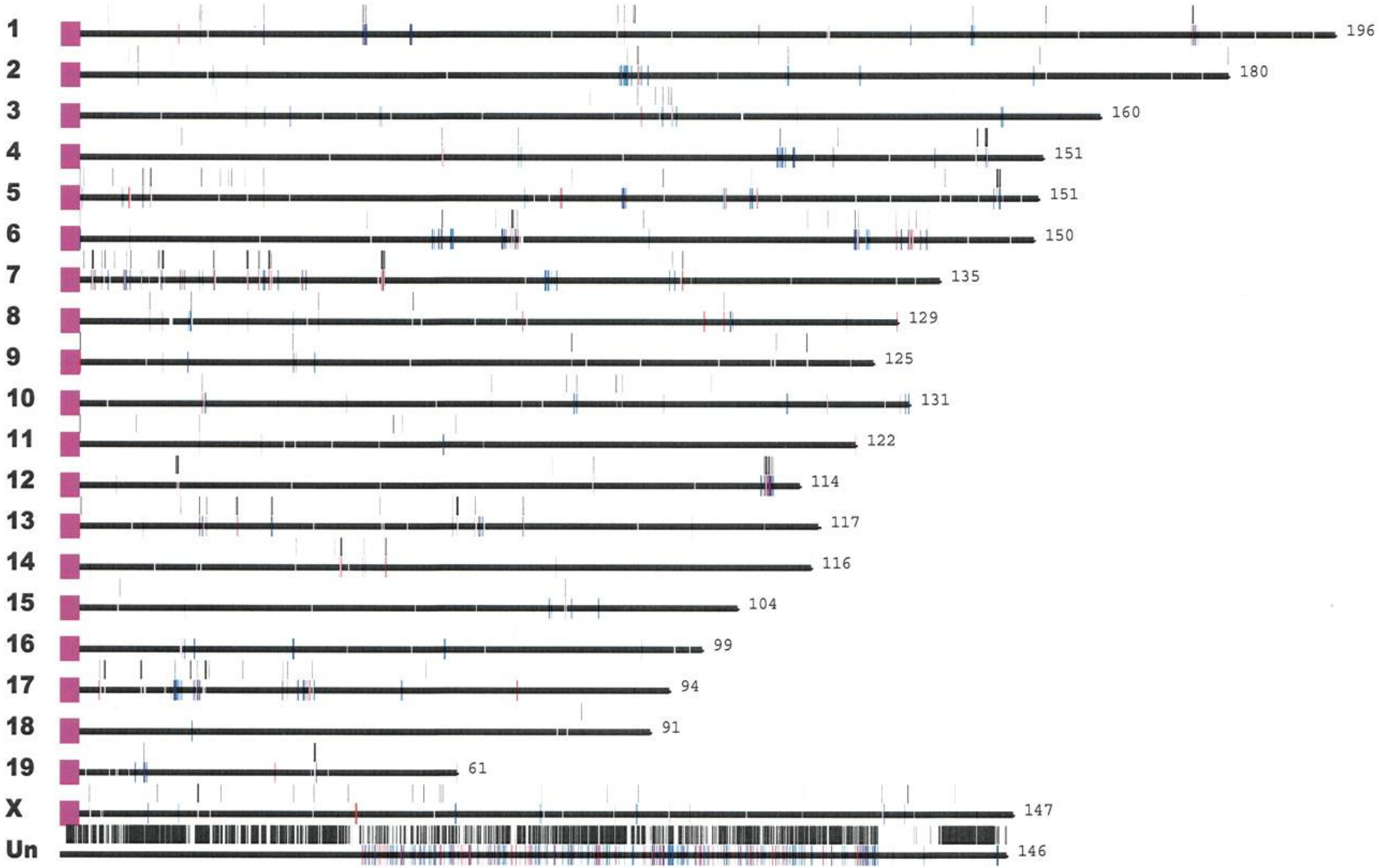


Effective Visualizations



Clear message
High data-to-ink ratio
Accessible complexity

Effective Visualizations. Legibility



Effective Visualizations. Legibility

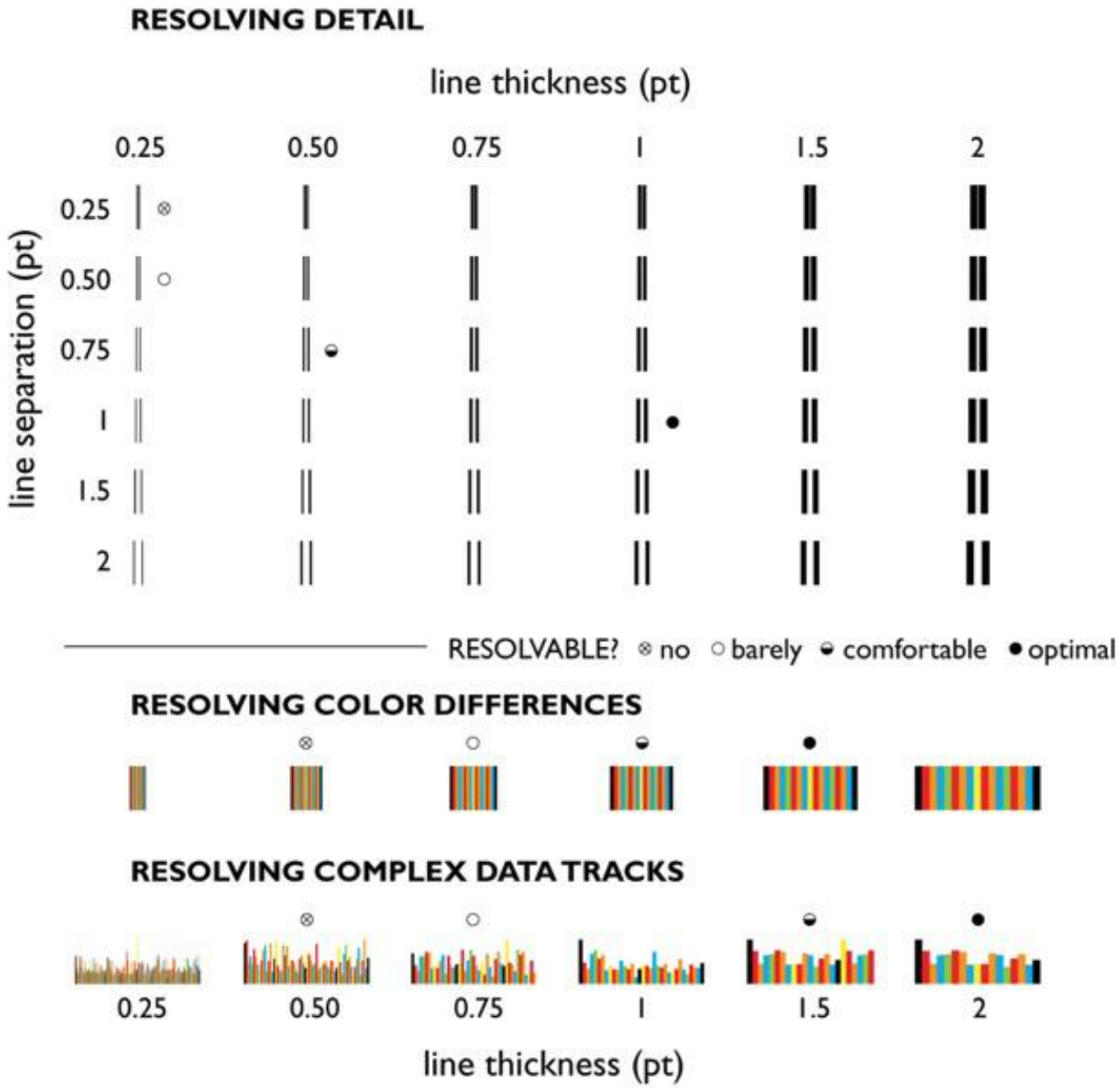
- The resolving power of the eye is approximately 50 cycles per degree (*see next slide*).
  - This limits us from distinguishing features smaller than 0.1 mm at a reading distance of 30 cm.
  - Larger features must be used to maintain legibility and comprehension. 1 point = 1/72 inch = 0.0353 cm

Effective Visualizations. Legibility

- Cycles per degree (aka **acuity**):
  - Spatial resolving capacity of the visual system
  - Ability of the eye to see fine detail
  - Refers to the highest resolution we can see with the fovea
- Each cycle represents an element we can see isolated:
  - Commonly taken as a line pair: a black and white strokes together

- Other acuity limits: https://entokey.com/visual-acuity-2/

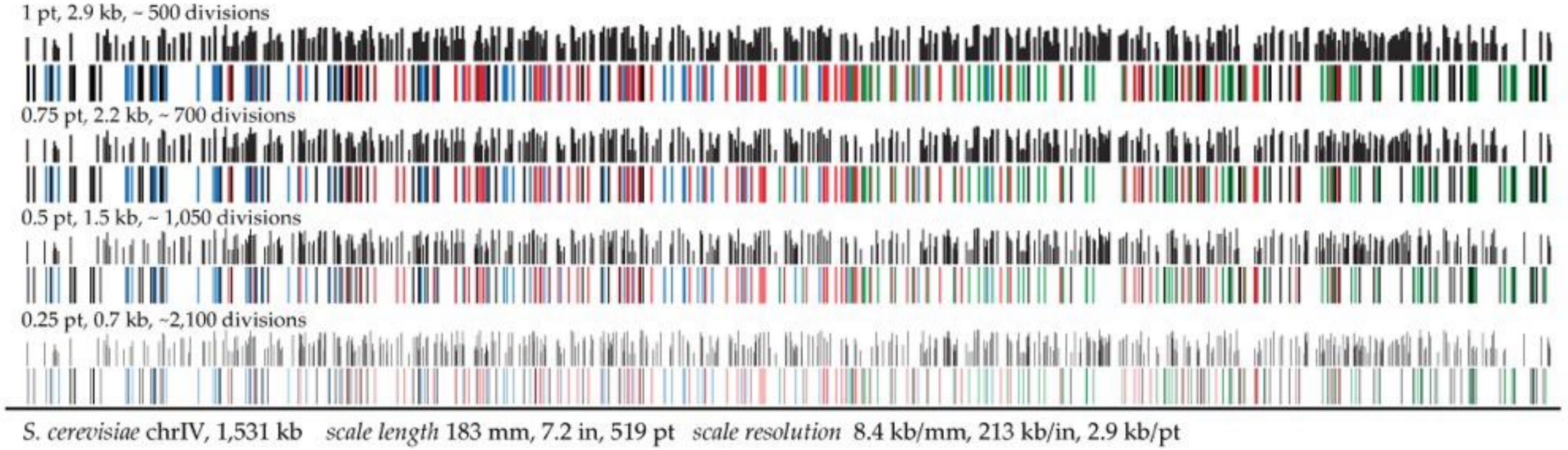
Effective Visualizations. Legibility



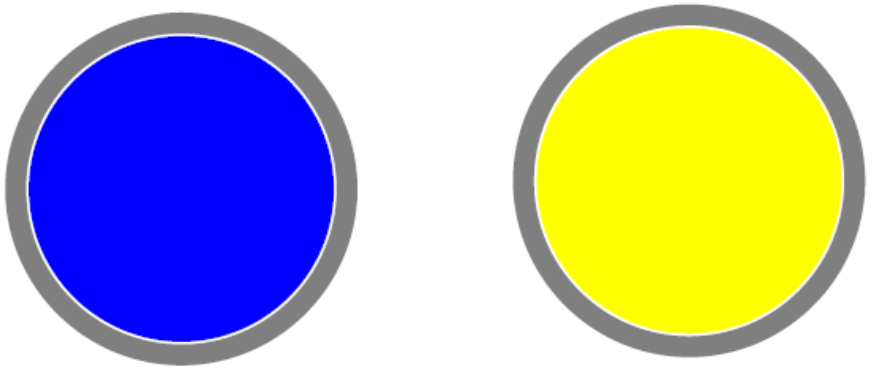
point
PRINT LENGTH UNIT
1 pt = 1/72 inch

Effective Visualizations. Legibility

- As a rule of thumb, do not divide scale into more than 500 intervals per 216mm (US letter size).
  - 1 pt on a 183 mm figure, 4 pixels on a 1920 horizontal resolution display, or 2 pixels on a typical LCD projector

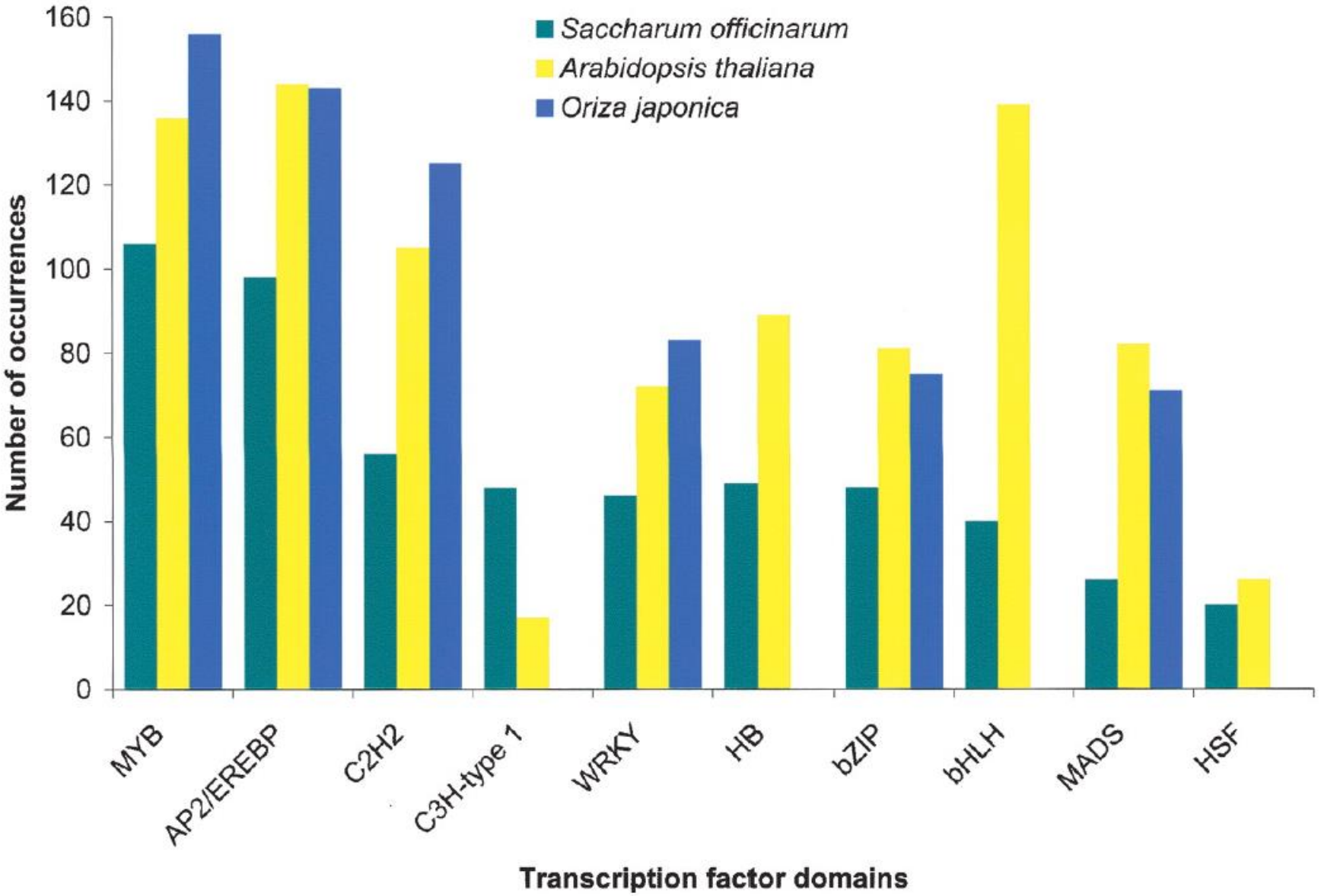


Effective Visualizations. Legibility. Color

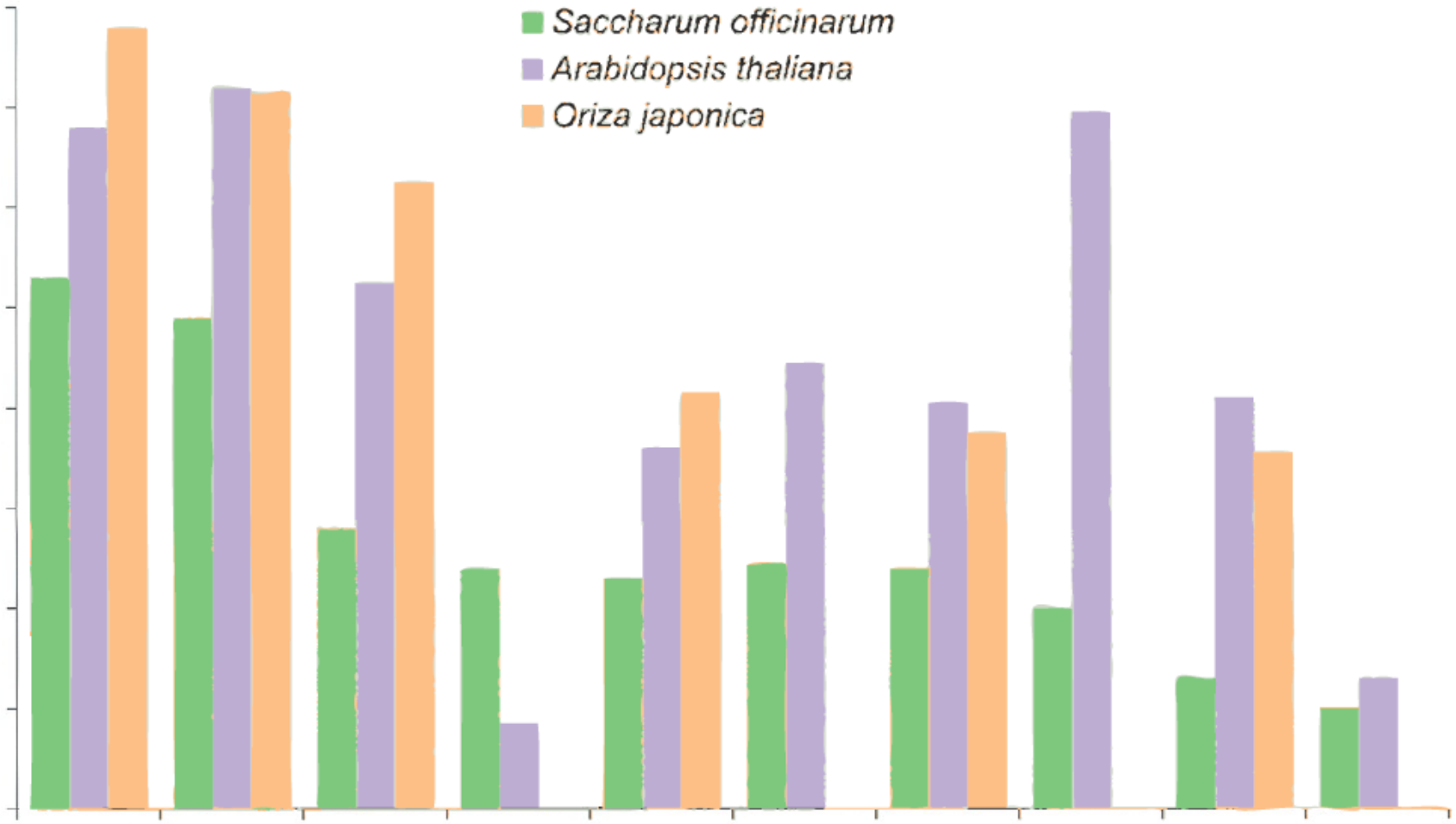


HSB COLOR SPACE		
HUE	240	60
SATURATION	1	1
BRIGHTNESS	1	1
LCH COLOR SPACE		
HUE	266	86
CHROMA	130	107
LIGHTNESS	0.32	0.97

Effective Visualizations. Legibility. Color



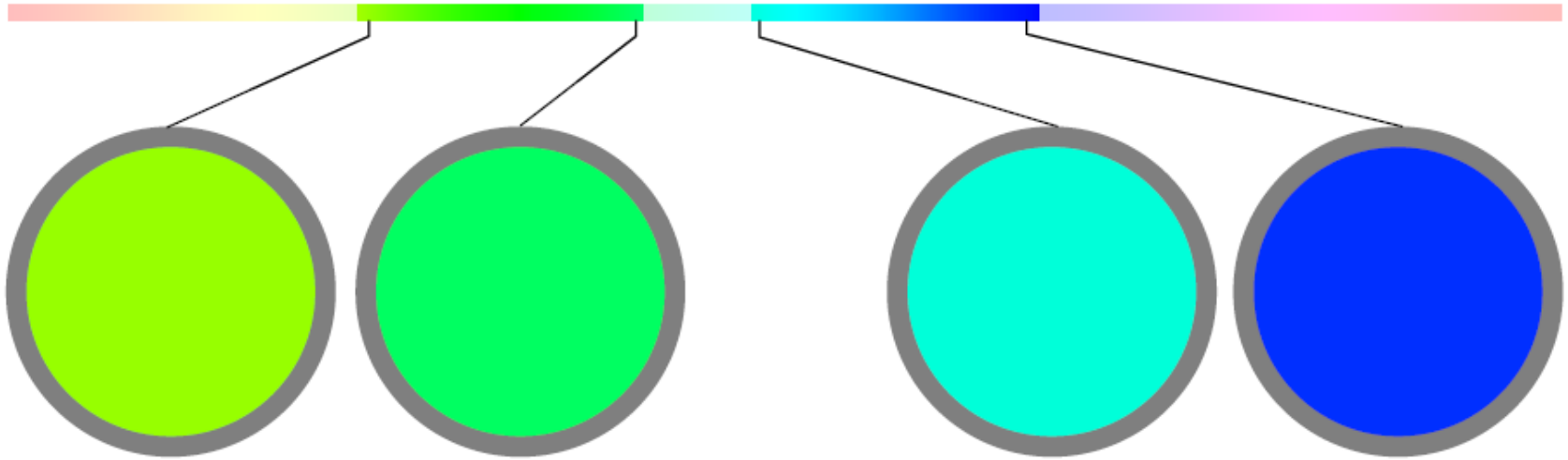
Effective Visualizations. Legibility. Color



BREWER QUALITATIVE 3-COLOR PALETTES

ACCENT PASTEL 1 SET 2

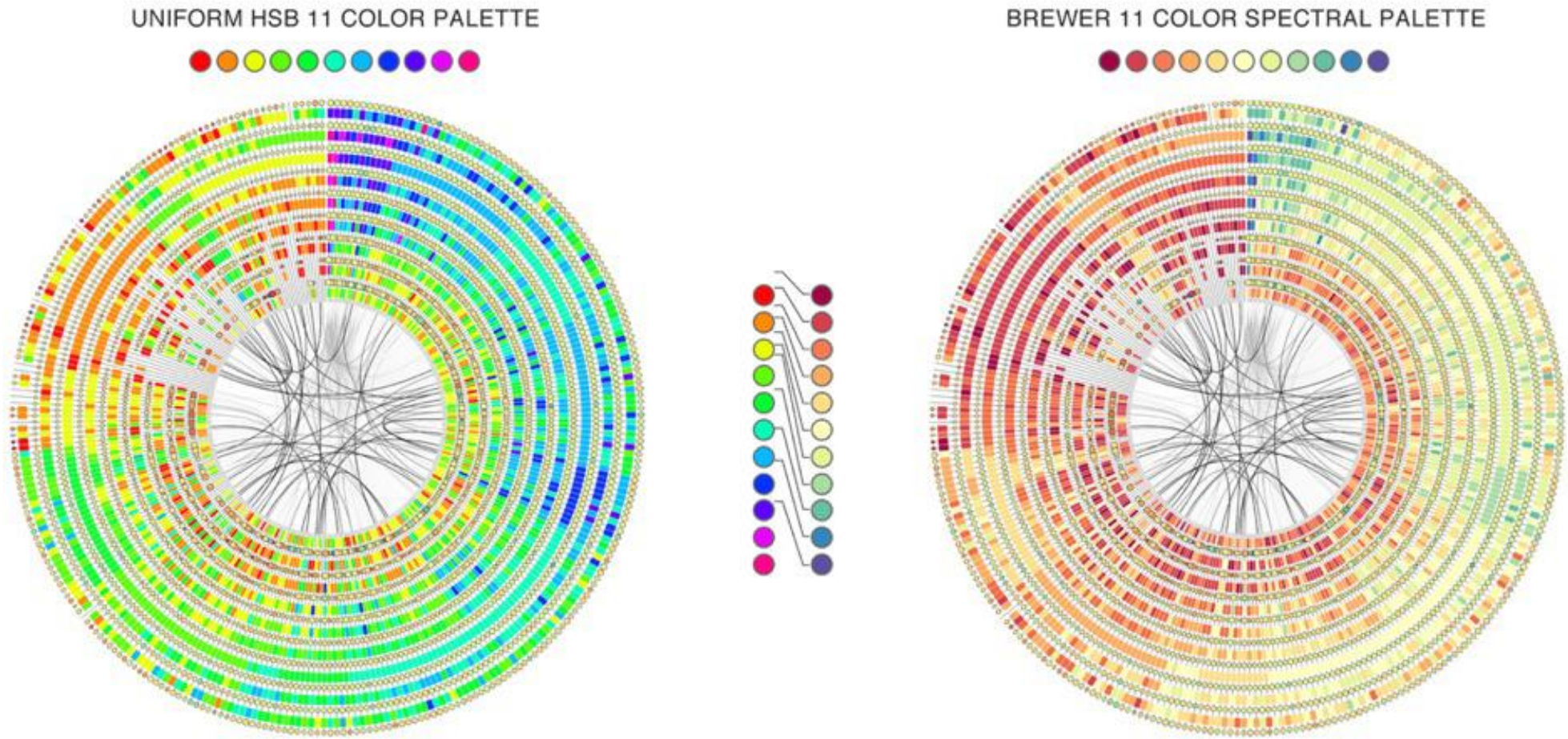
WWW.COLORBREWER.ORG



HSB COLOR SPACE	ΔH = 60		ΔH = 60	
HUE	83	143	171	231
SATURATION	1	1	1	1
BRIGHTNESS	1	1	1	1

Lab COLOR SPACE	$\Delta E_{ab} = 35$		$\Delta E_{ab} = 176$	
L	91	88	90	35
a	-59	-81	-58	70
b	87	60	4	-102

Effective Visualizations. Legibility. Color



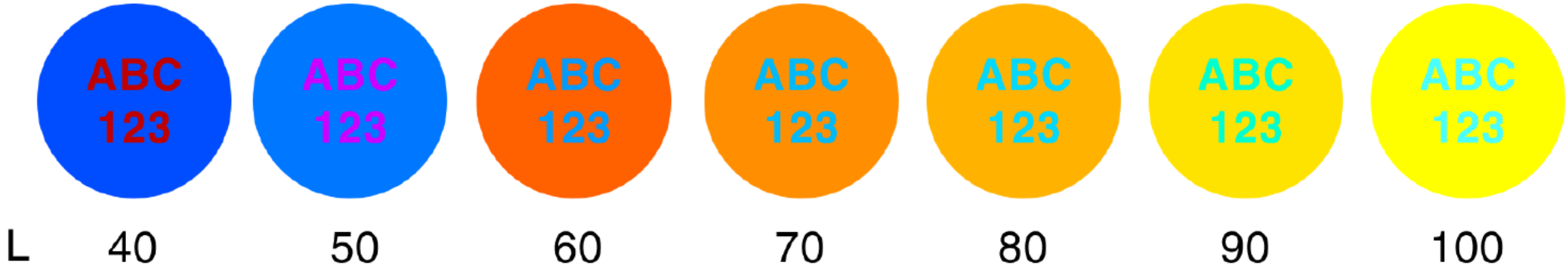
Effective Visualizations. Legibility. Contrast

- Simultaneous contrast occurs when two pure colors are adjacent

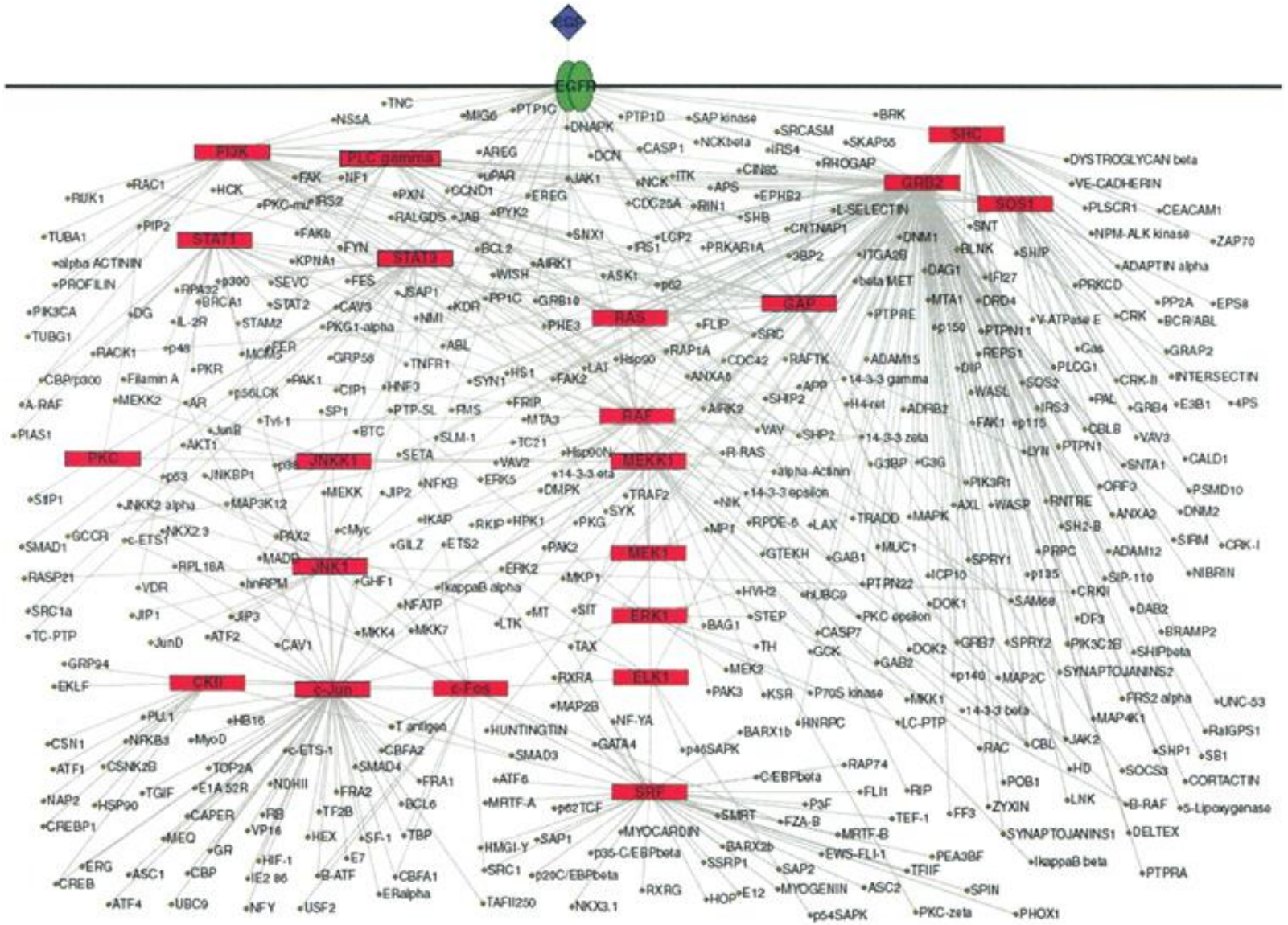
Effective Visualizations. Legibility. Contrast

- Poor contrast occurs when two colors have similar luminance (perceived brightness)

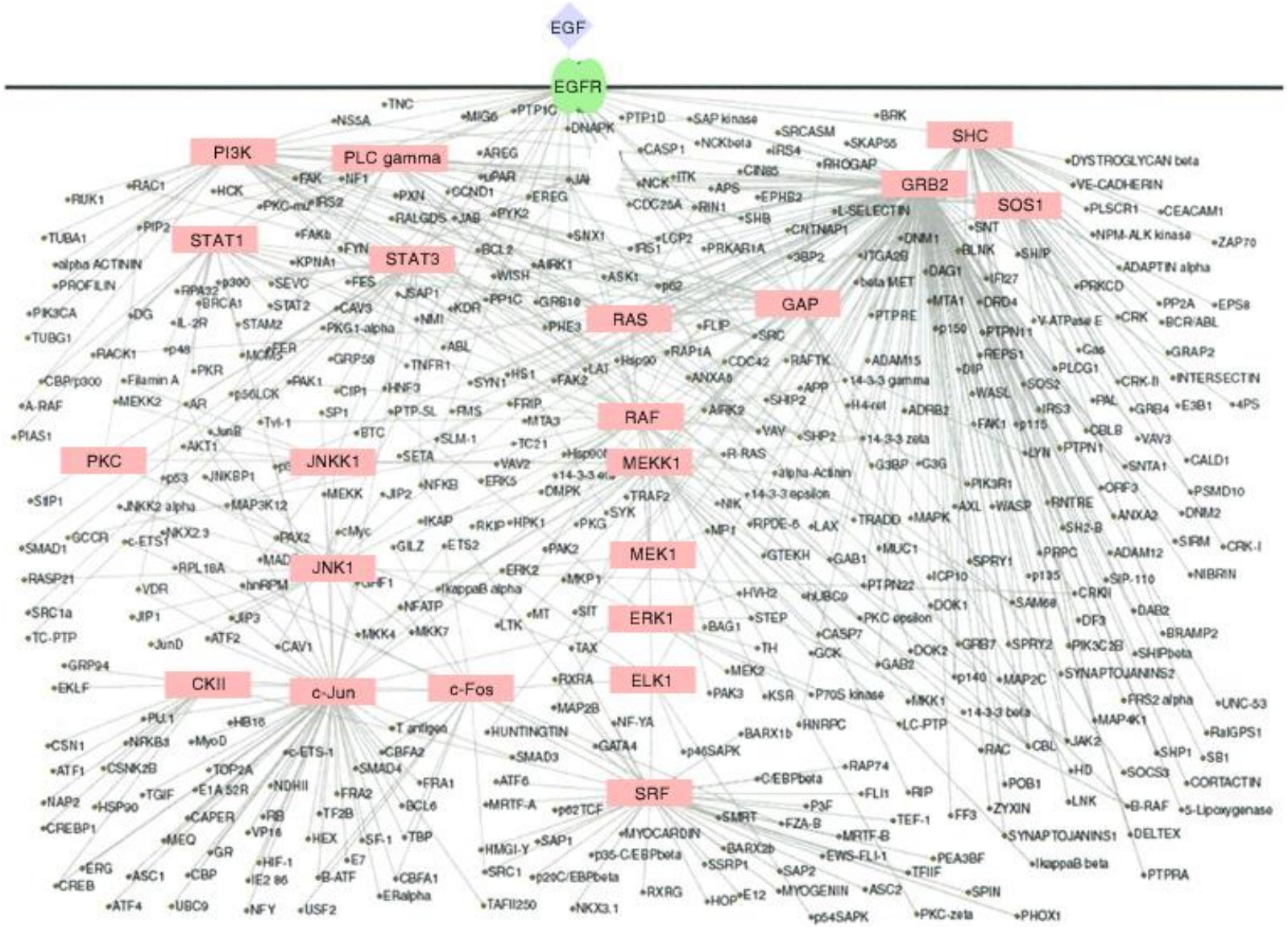
$$\Delta L = 0$$



Effective Visualizations. Legibility. Contrast



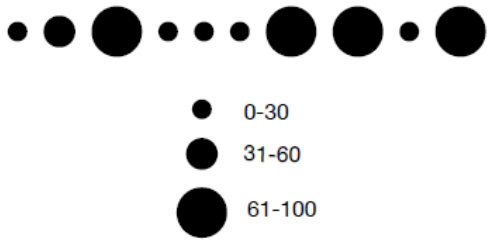
Effective Visualizations. Legibility. Contrast



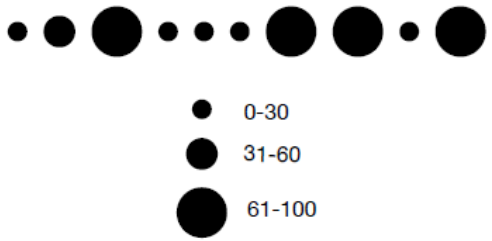
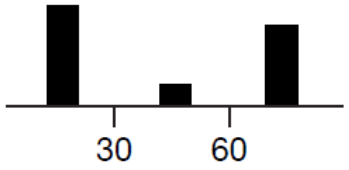
Effective Visualizations. Crafting a message

WHAT IS SHOWN?		WHAT IS COMMUNICATED?	WHAT IS INTERPRETED?
RAW DATA	12 54 82 29 25 22 67 61 23 79	NO CLEAR MESSAGE.	UNKNOWN. READER IS ON THEIR OWN.

Effective Visualizations. Crafting a message

WHAT IS SHOWN?		WHAT IS COMMUNICATED?	WHAT IS INTERPRETED?
RAW DATA	12 54 82 29 25 22 67 61 23 79	NO CLEAR MESSAGE.	UNKNOWN. READER IS ON THEIR OWN.
DISCRETIZED		SCALE	THREE RANGES ARE IMPORTANT. INDIVIDUAL VALUES WITHIN A RANGE ARE NOT.

Effective Visualizations. Crafting a message

WHAT IS SHOWN?		WHAT IS COMMUNICATED?	WHAT IS INTERPRETED?
RAW DATA	12 54 82 29 25 22 67 61 23 79	NO CLEAR MESSAGE.	UNKNOWN. READER IS ON THEIR OWN.
DISCRETIZED		SCALE	THREE RANGES ARE IMPORTANT. INDIVIDUAL VALUES WITHIN A RANGE ARE NOT.
BINNED		DISTRIBUTION	THERE ARE FEWER MEDIUM-SIZED VALUES.

Effective Visualizations. Crafting a message

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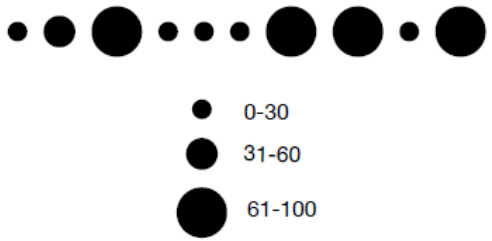
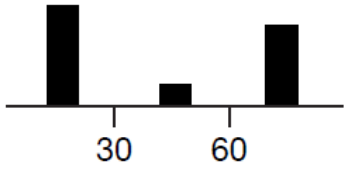
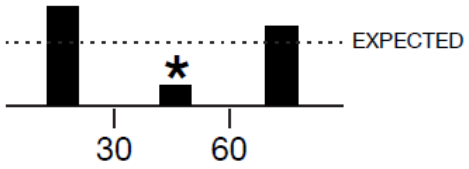
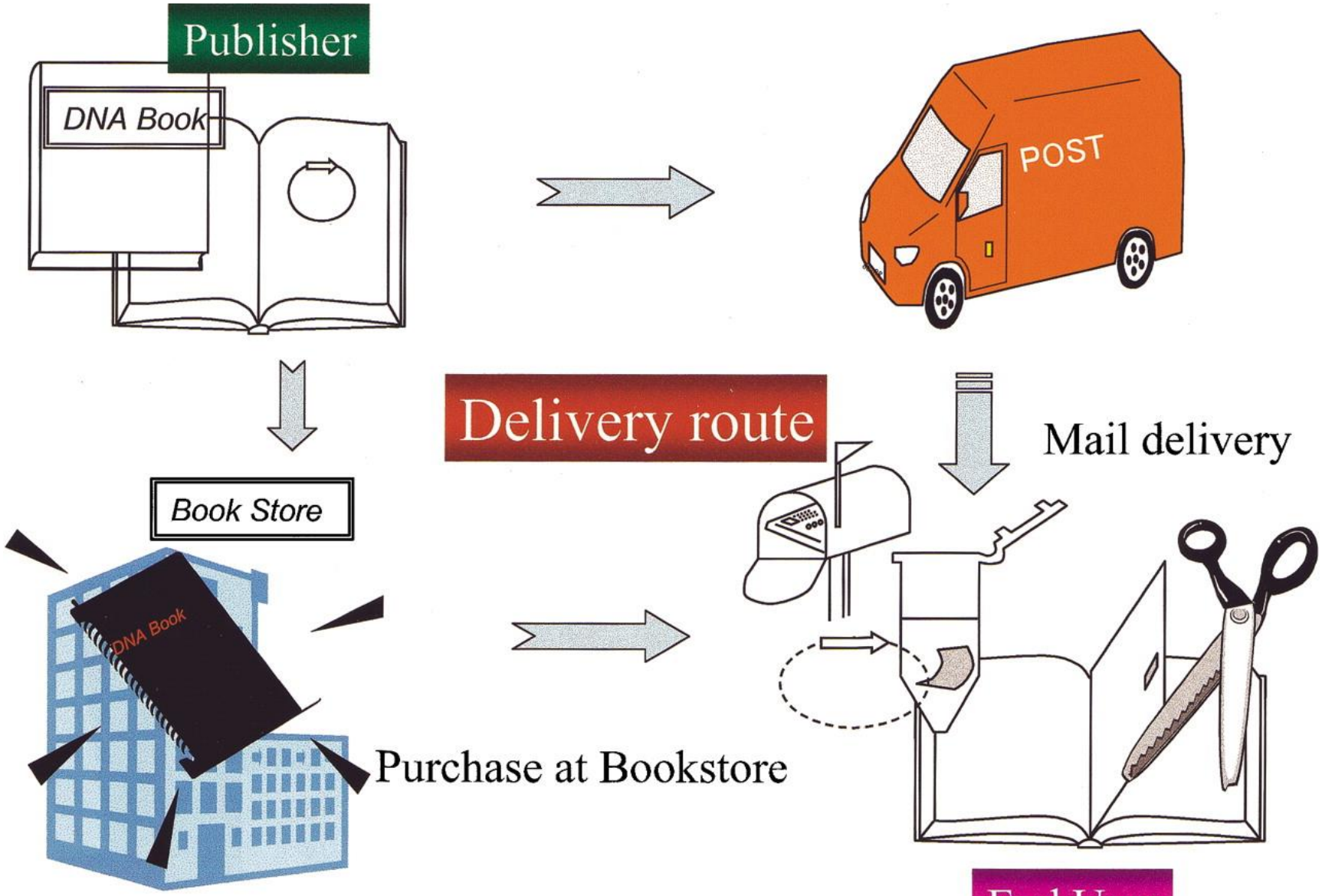
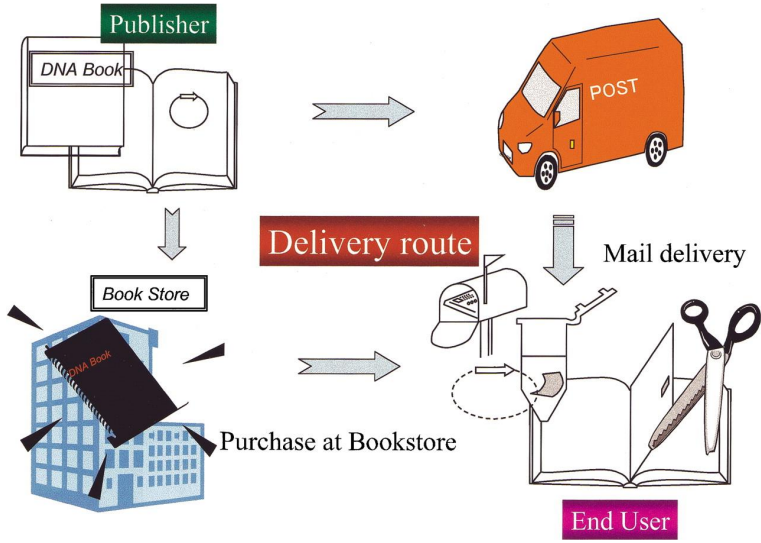
DISCRETIZED		SCALE	THREE RANGES ARE IMPORTANT. INDIVIDUAL VALUES WITHIN A RANGE ARE NOT.
BINNED		DISTRIBUTION	THERE ARE FEWER MEDIUM-SIZED VALUES.
TREND		SIGNIFICANCE	THERE ARE SIGNIFICANTLY FEWER MEDIUM-SIZED VALUES.

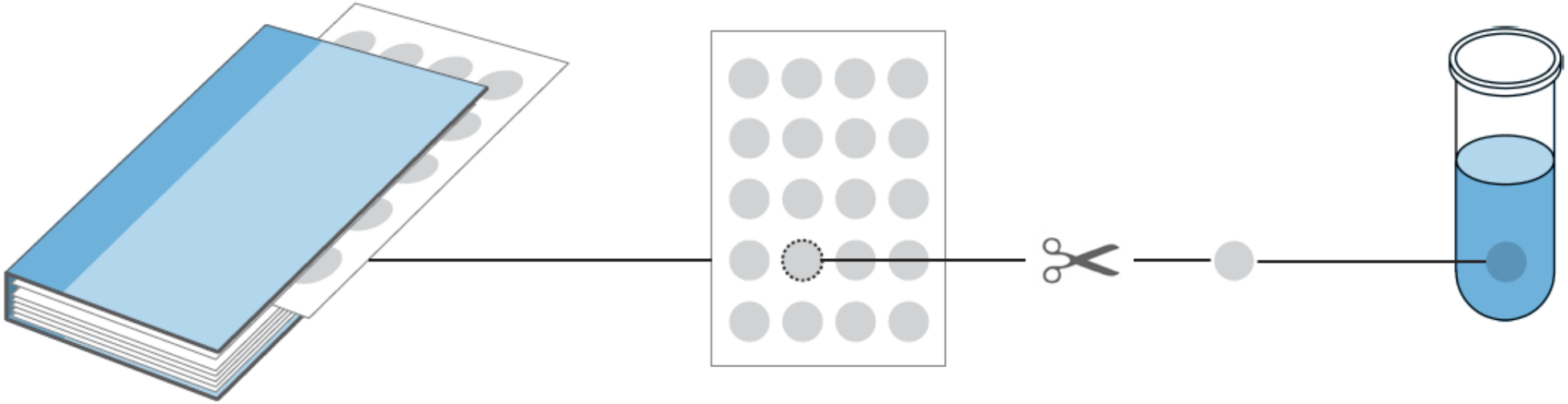
Effective Visualizations. Crafting a message



Concept of the “DNA Book.” Kawai, J. and Y. Hayashizaki, DNA book. Genome Res, 2003. 13(6B): p. 1488-95.

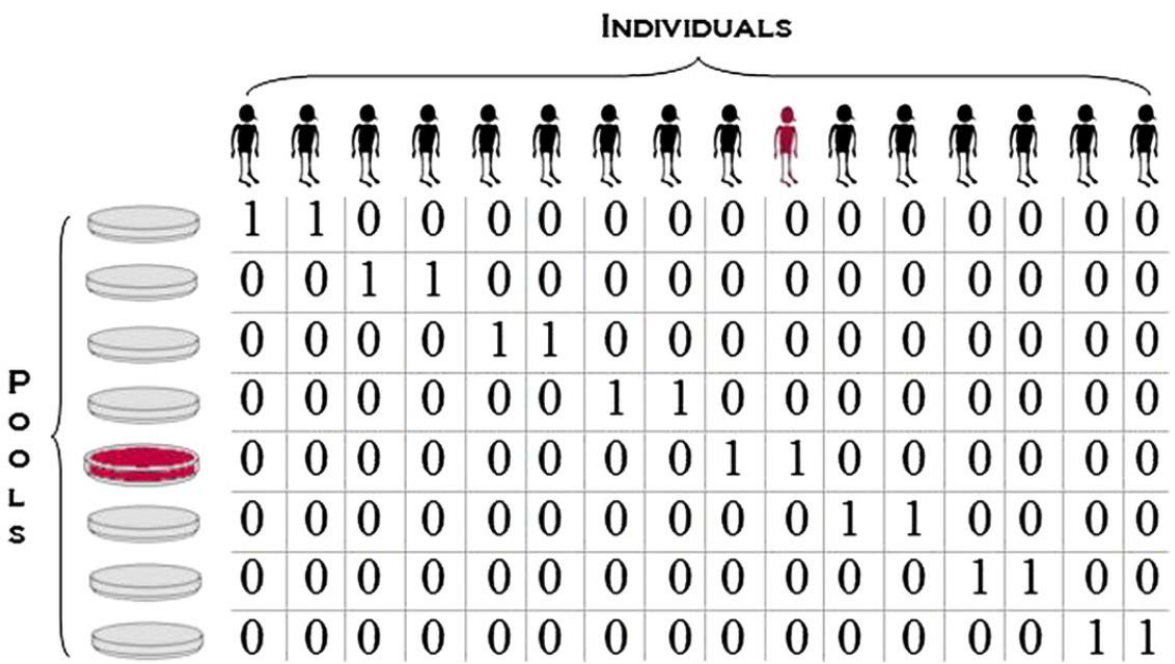
Effective Visualizations. Crafting a message

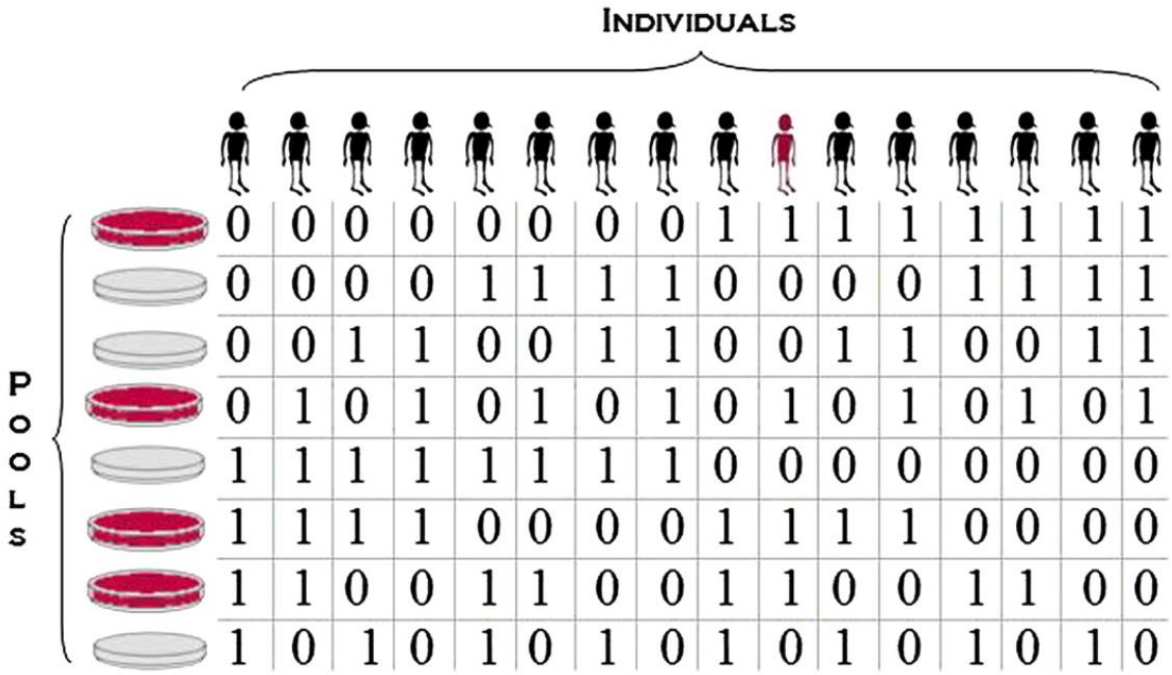




Effective Visualizations. Excess Ink

- Excess ink competes with message





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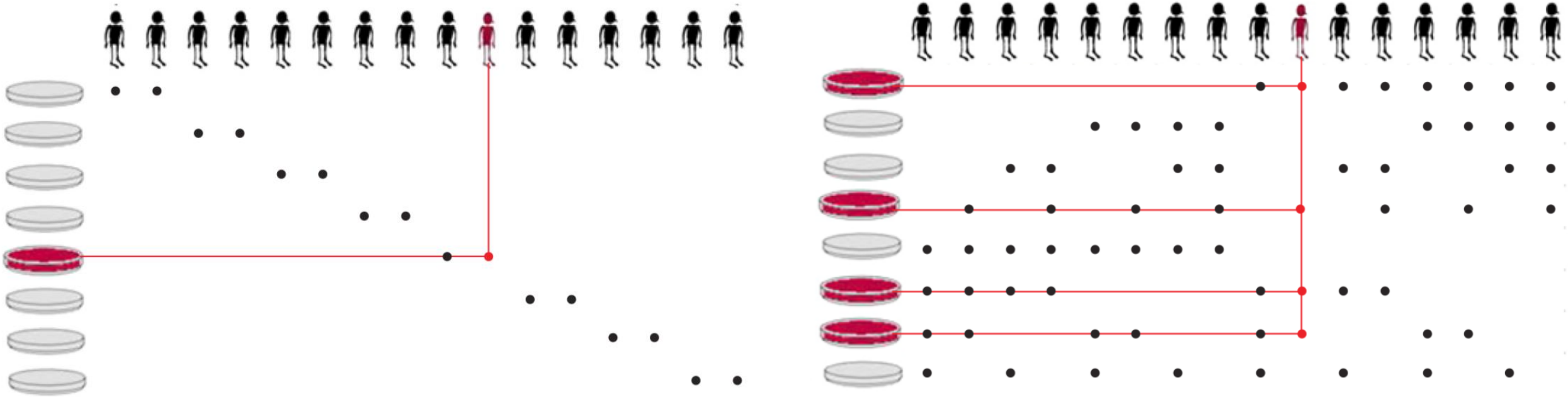
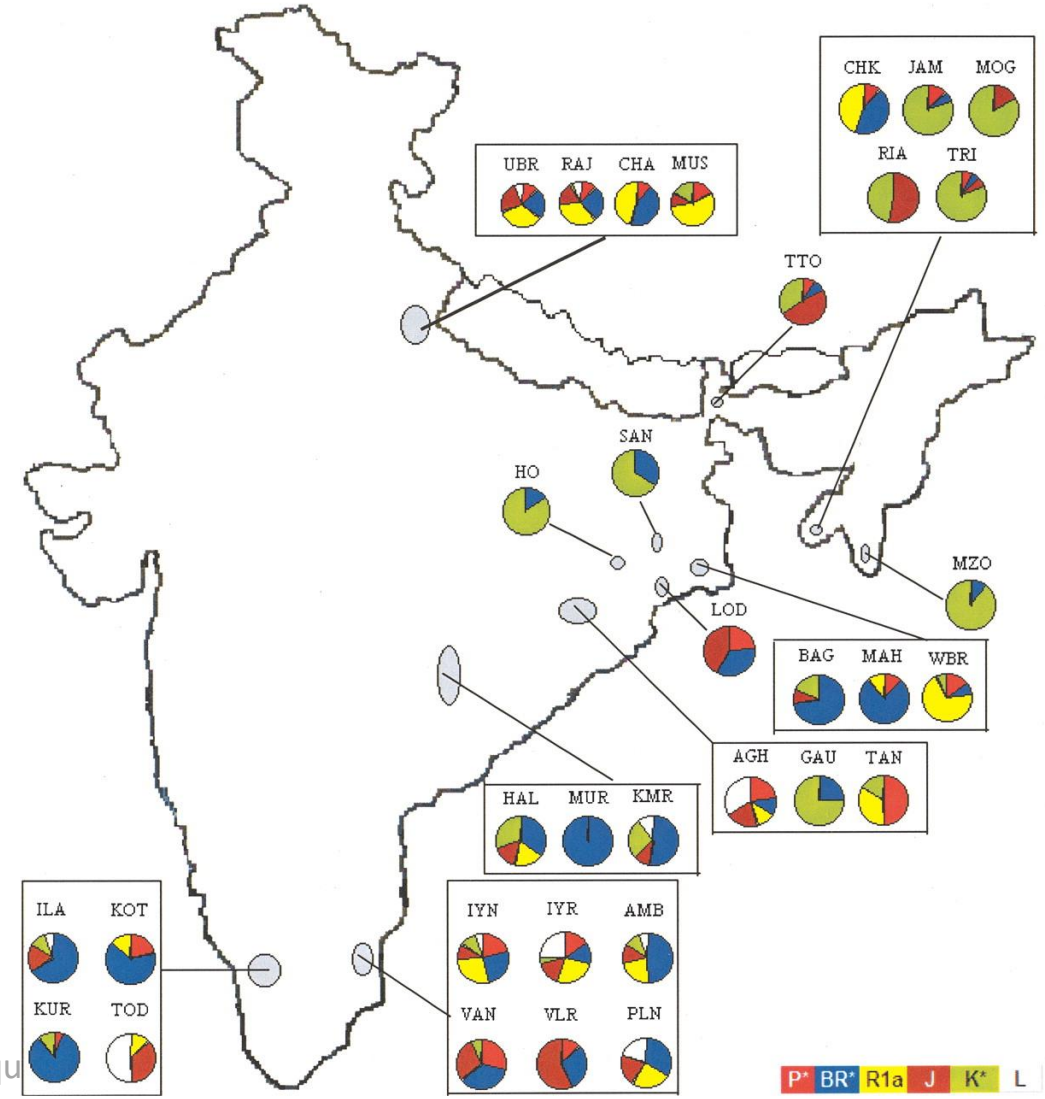


Resequencing with naïve and log pool designs. Prabhu, S. and I. Pe'er, Overlapping pools for high-throughput targeted resequencing. Genome Res, 2009. 19 (7): p. 1254-61.

Effective Visualizations. Attractiveness

- The importance of grids



Frequencies (%) of Y-chromosomal haplogroups among ethnic populations. Basu, A., et al., Ethnic India: a genomic view, with special reference to peopling and structure. Genome Res, 2003. 13(10): p. 2277-90..

Effective Visualizations. Attractiveness

- The importance of grids
  - Redesign

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Effective Visualizations. Attractiveness

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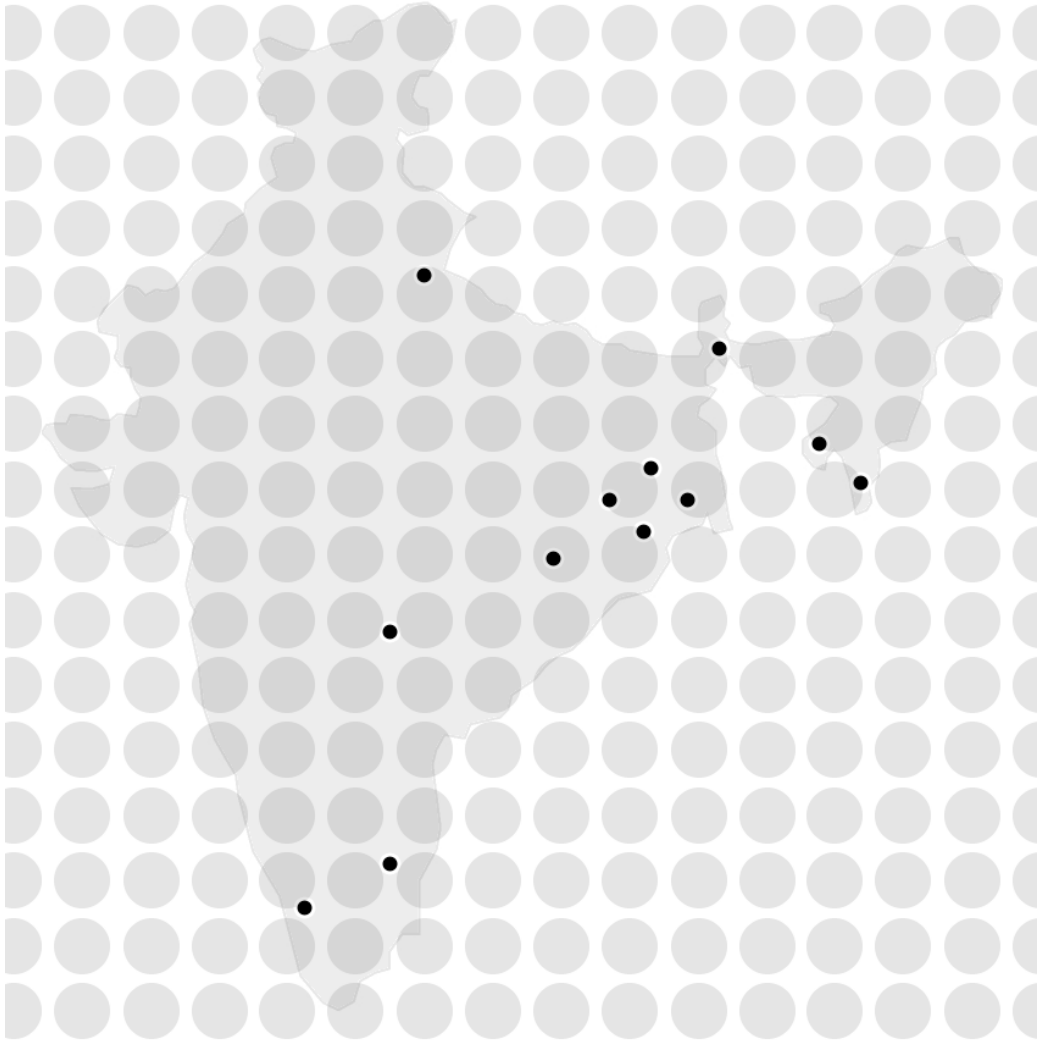

Effective Visualizations. Attractiveness

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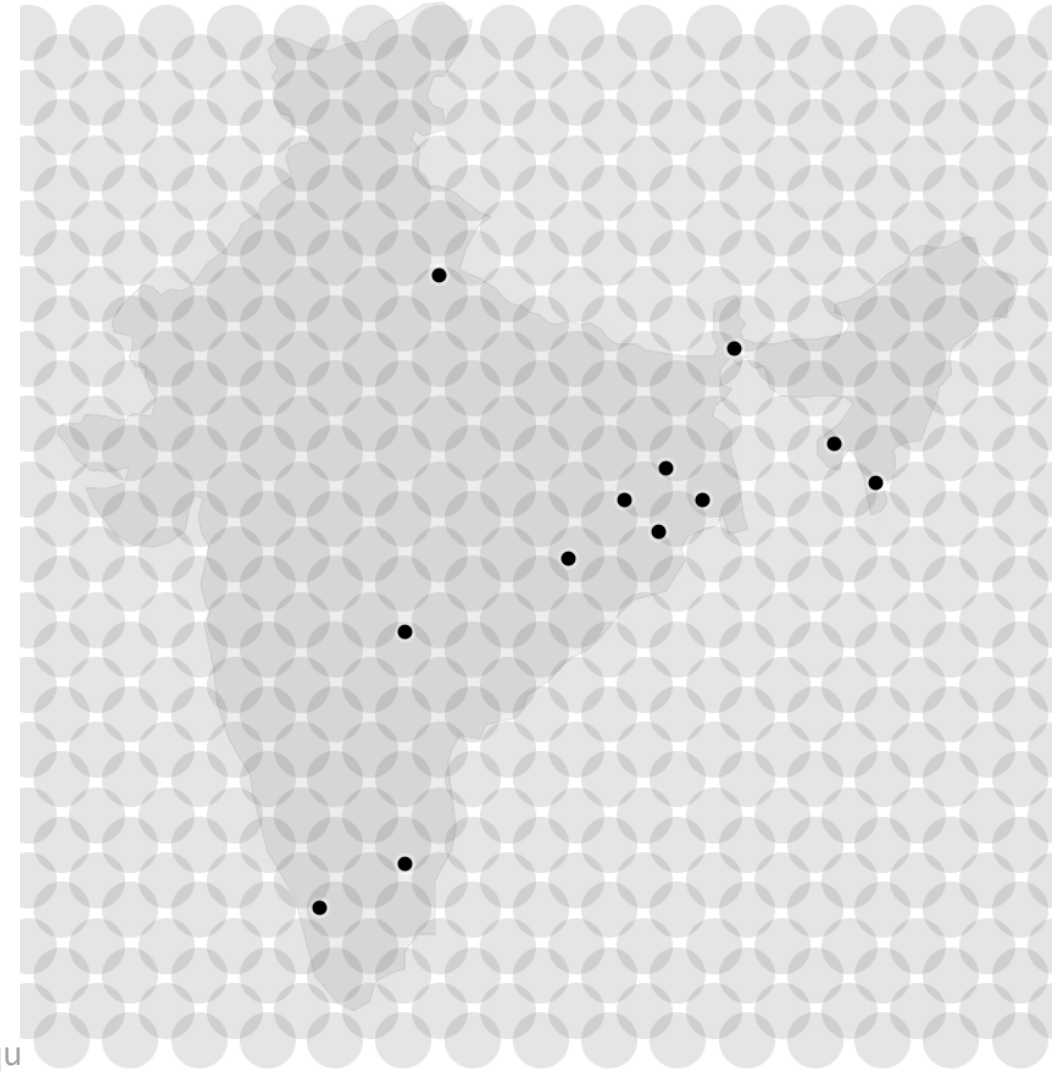

Effective Visualizations. Attractiveness

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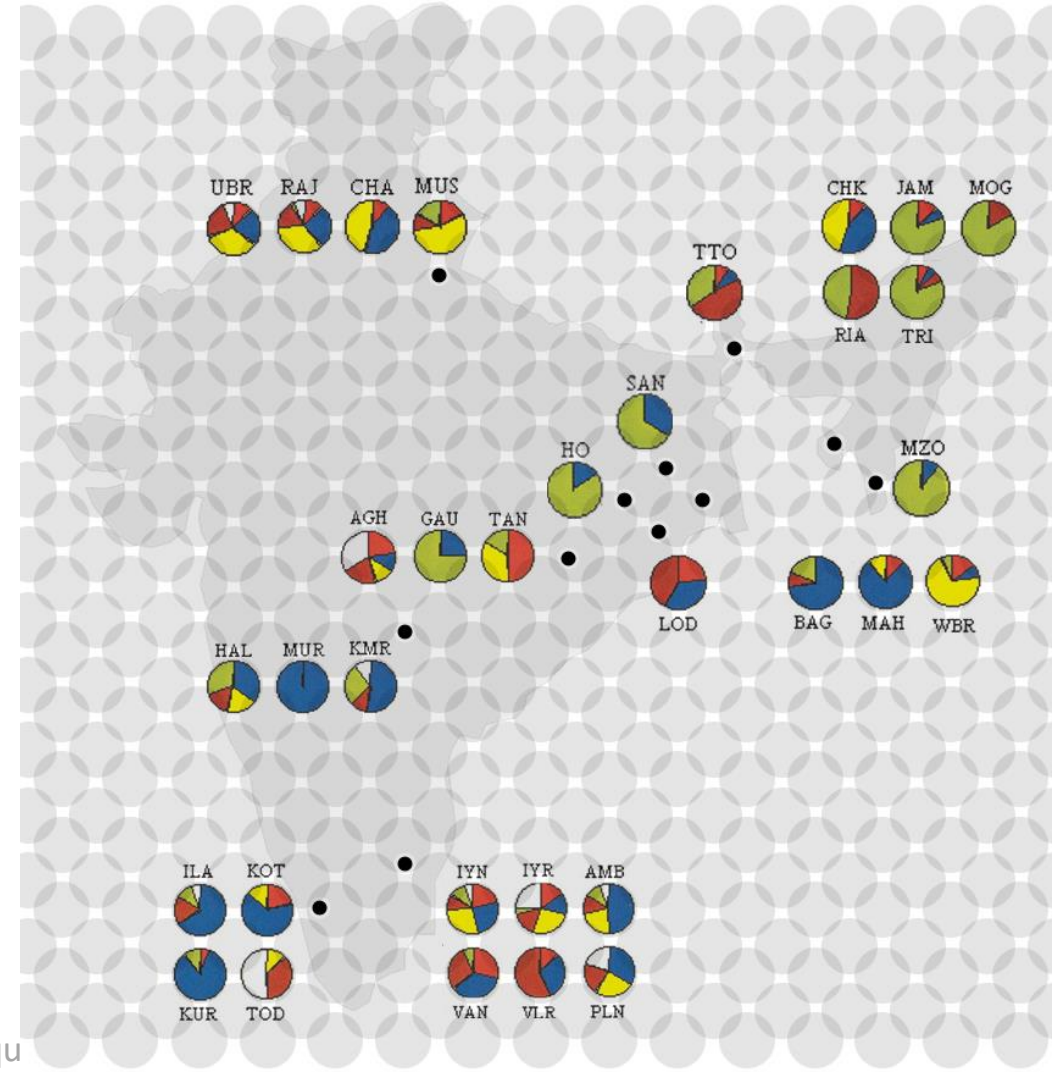

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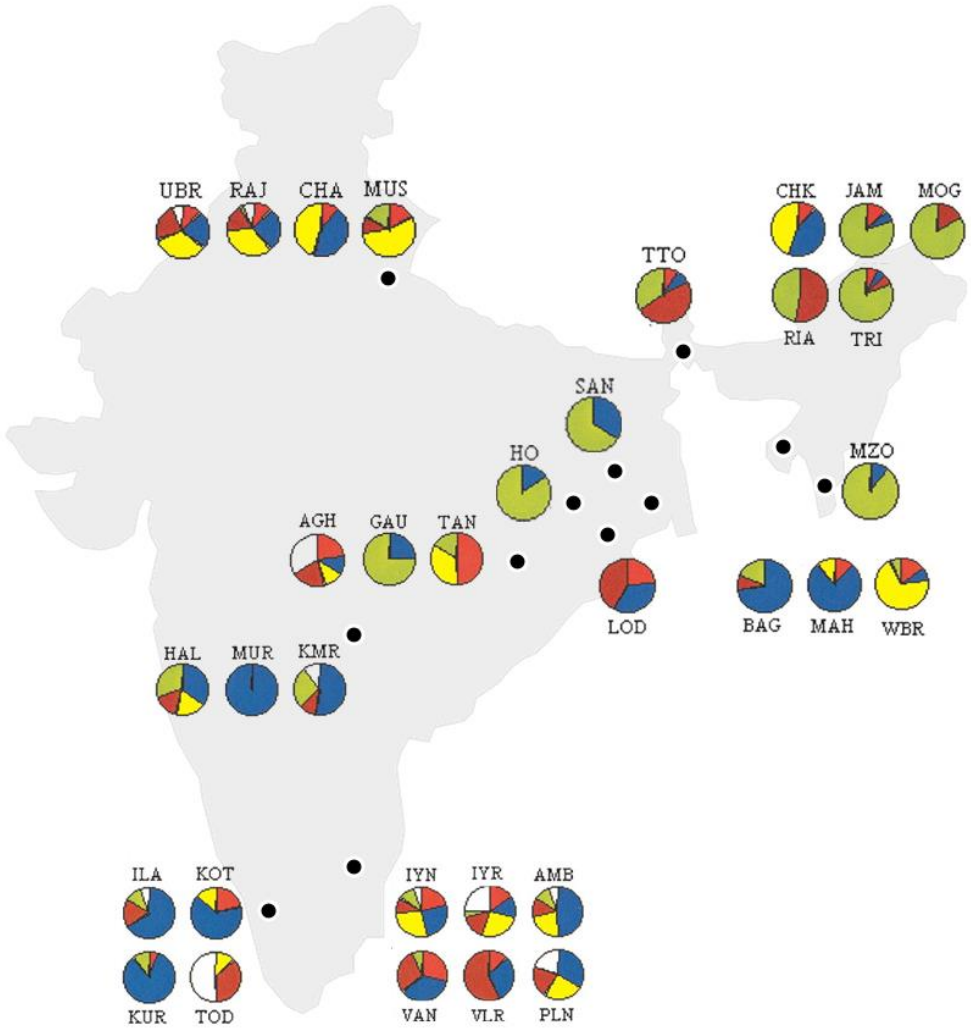

Effective Visualizations. Attractiveness

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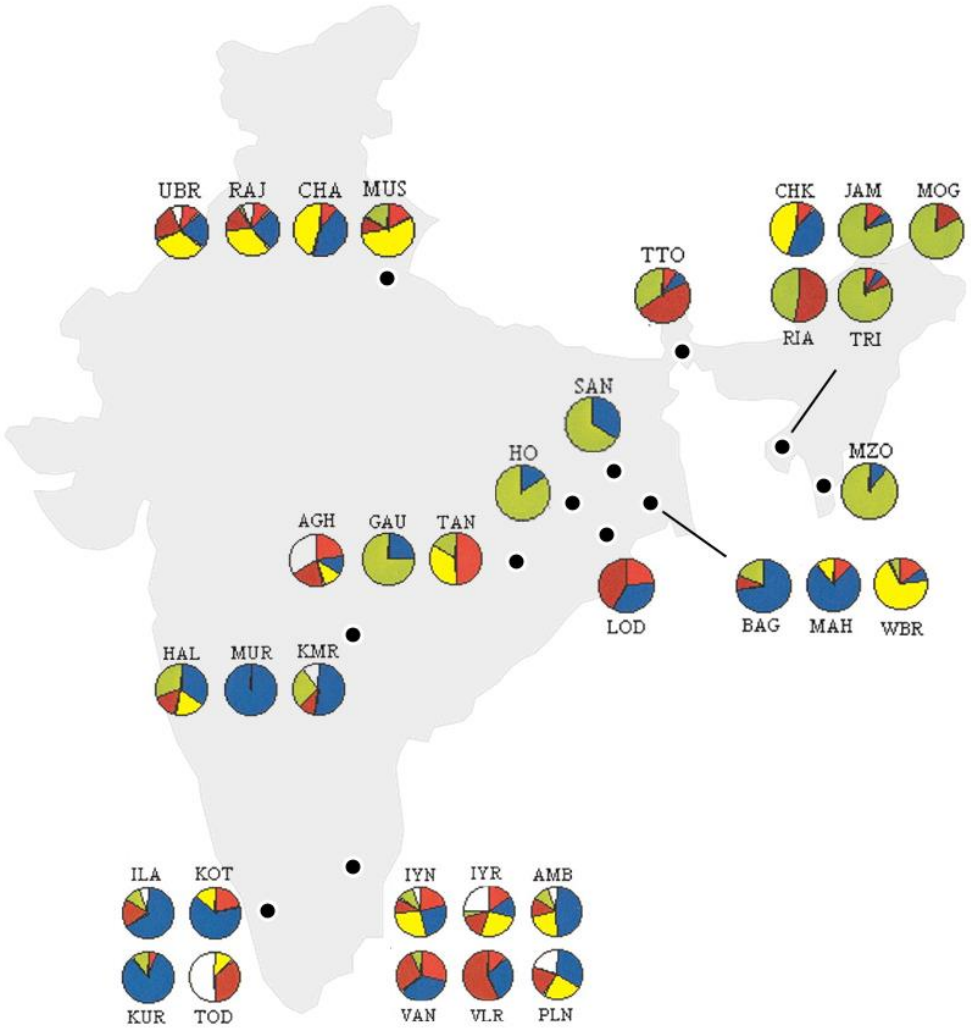

Effective Visualizations. Attractiveness

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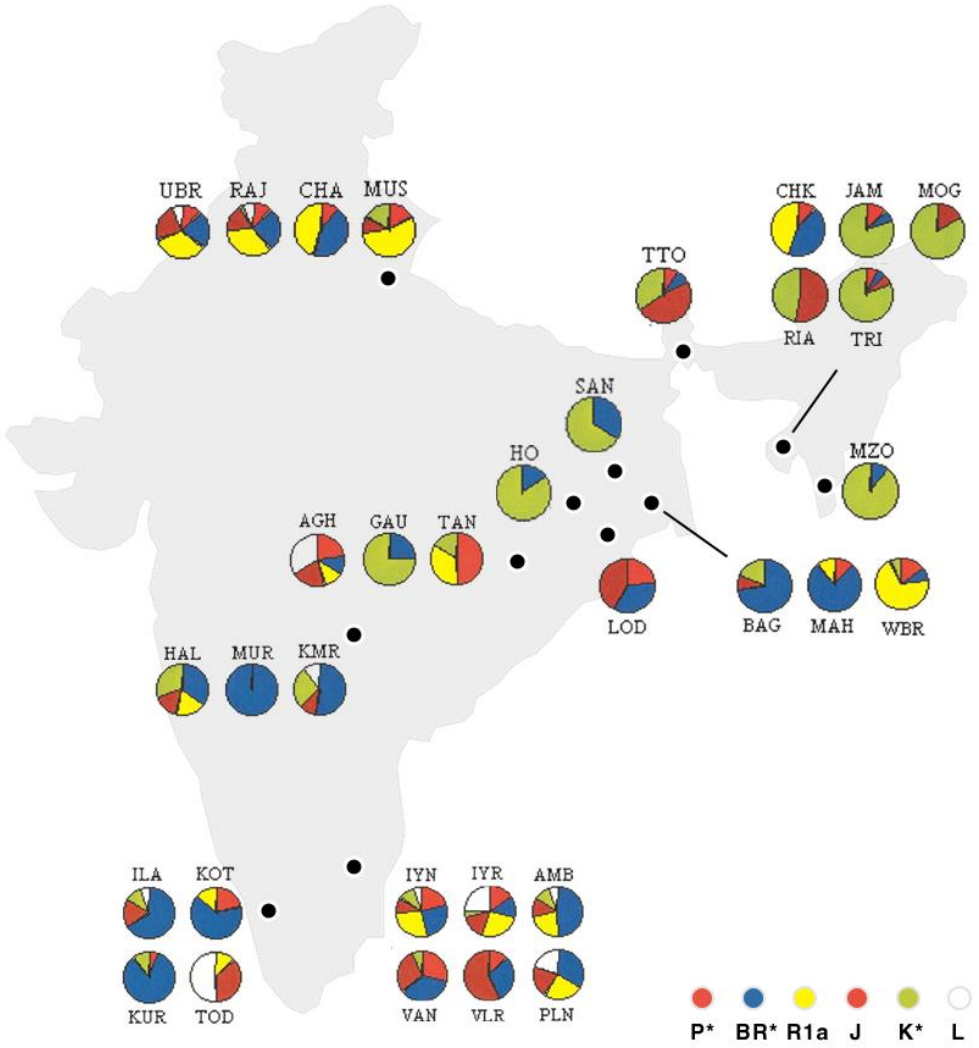

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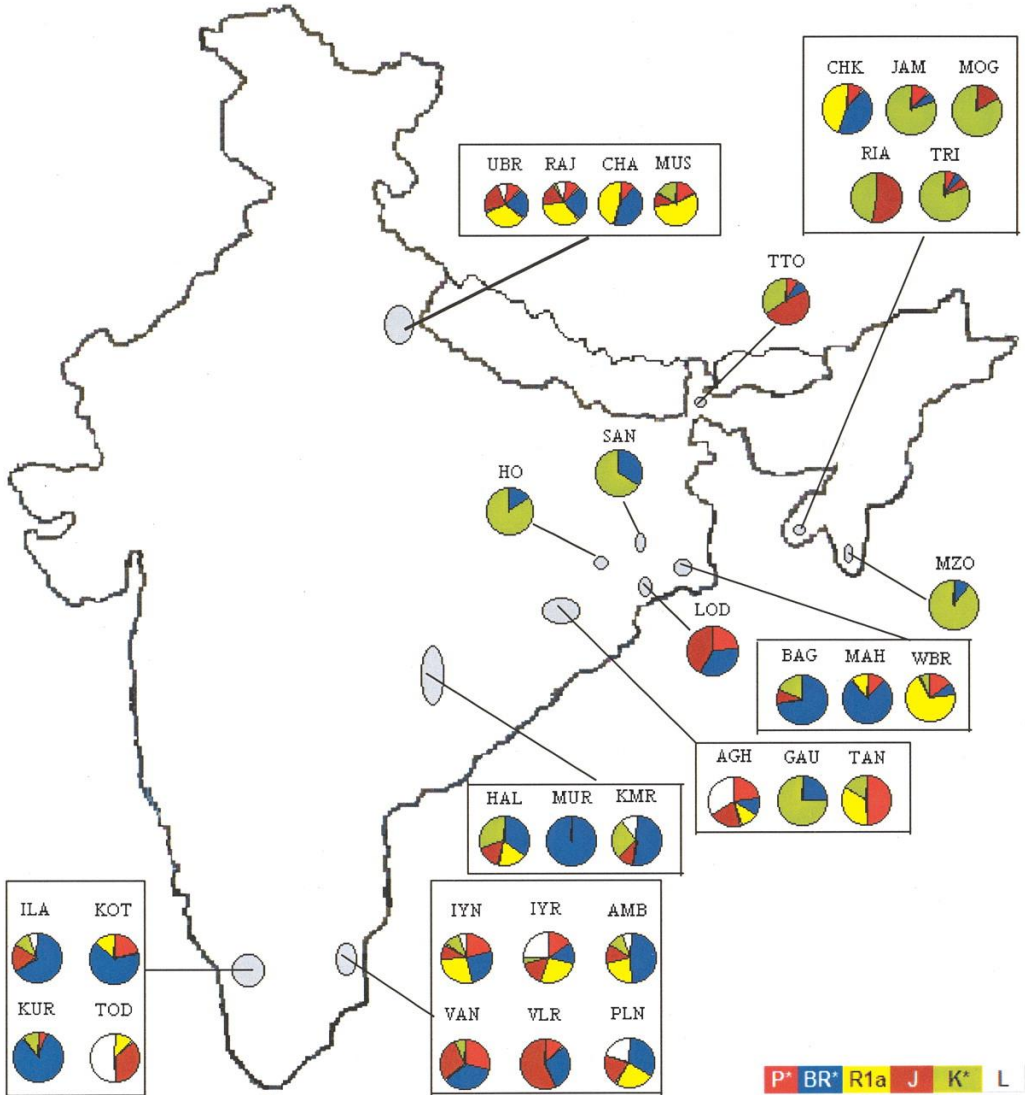
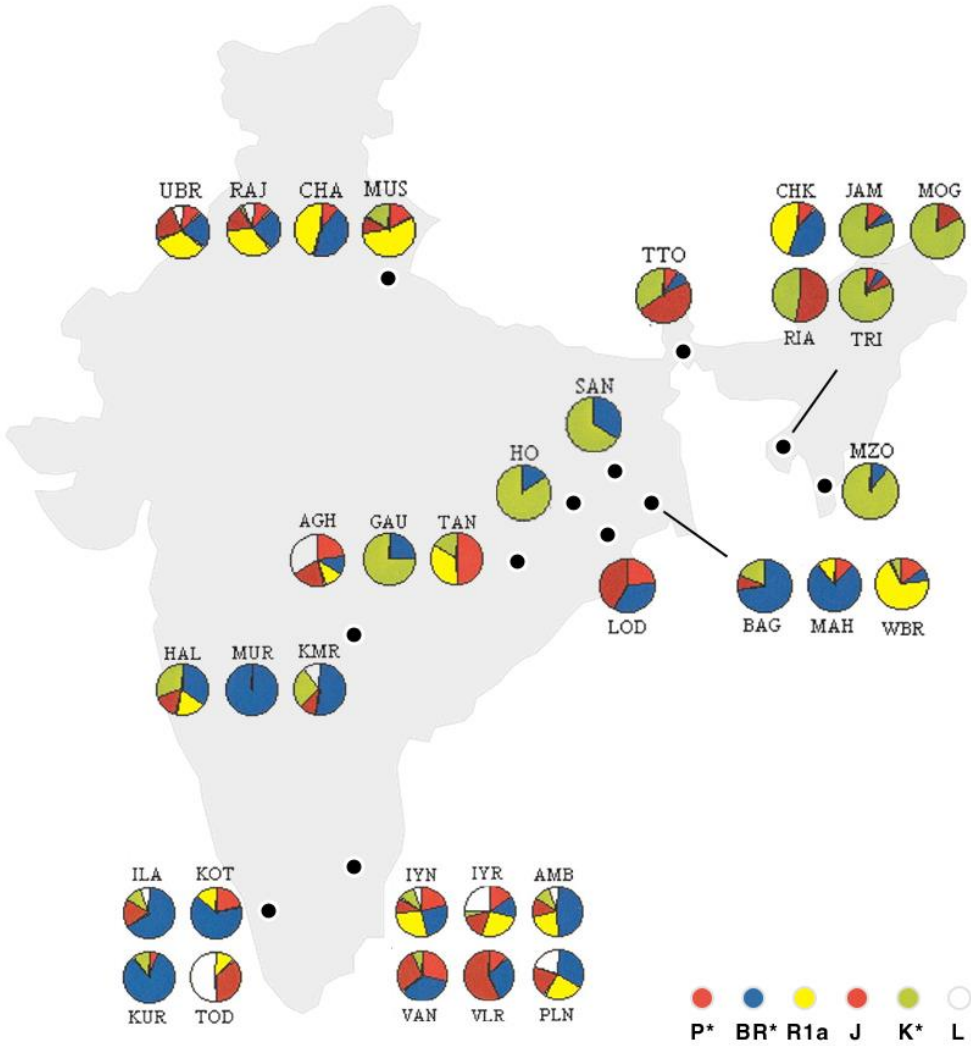




Outline

- Effective Visualizations
- **Use of color**
- Comparison
- Copy & labels
- Ordering & aligning data

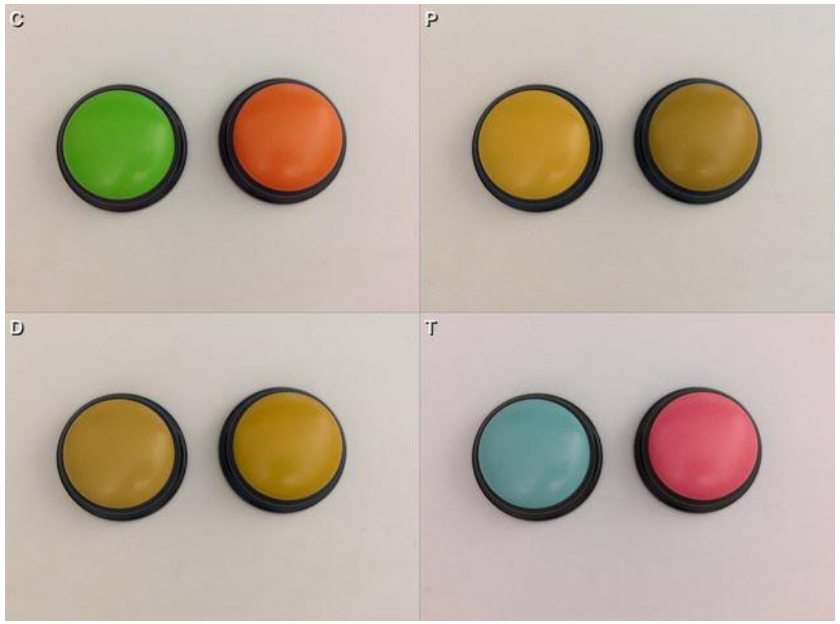
Use of Color. Background

- Color blindness:
  - Inability to distinguish the colors the same way than non-color impaired people
- Most common types of colour blindness are:
  - **Deuteranopia (M cones):** Reduced sensitivity to green light.
  - **Protanopia (L cones):** Reduced sensitivity to red light.
  - **Tritanopia (S cones):** Reduced sensitivity to blue light, not very common.
  - **Achromatopsia:** Cannot see any colour at all. Also not very common.

Use of Color. Background

- Color blindness simulation (affects the three channels):

Original



Pronatopia (no L)
- Black with many shades of R
- Dark brown with dark G, orange and R
- Some B with some R, …
- Mid-G with some oranges

Deuteranopia (no M,…)

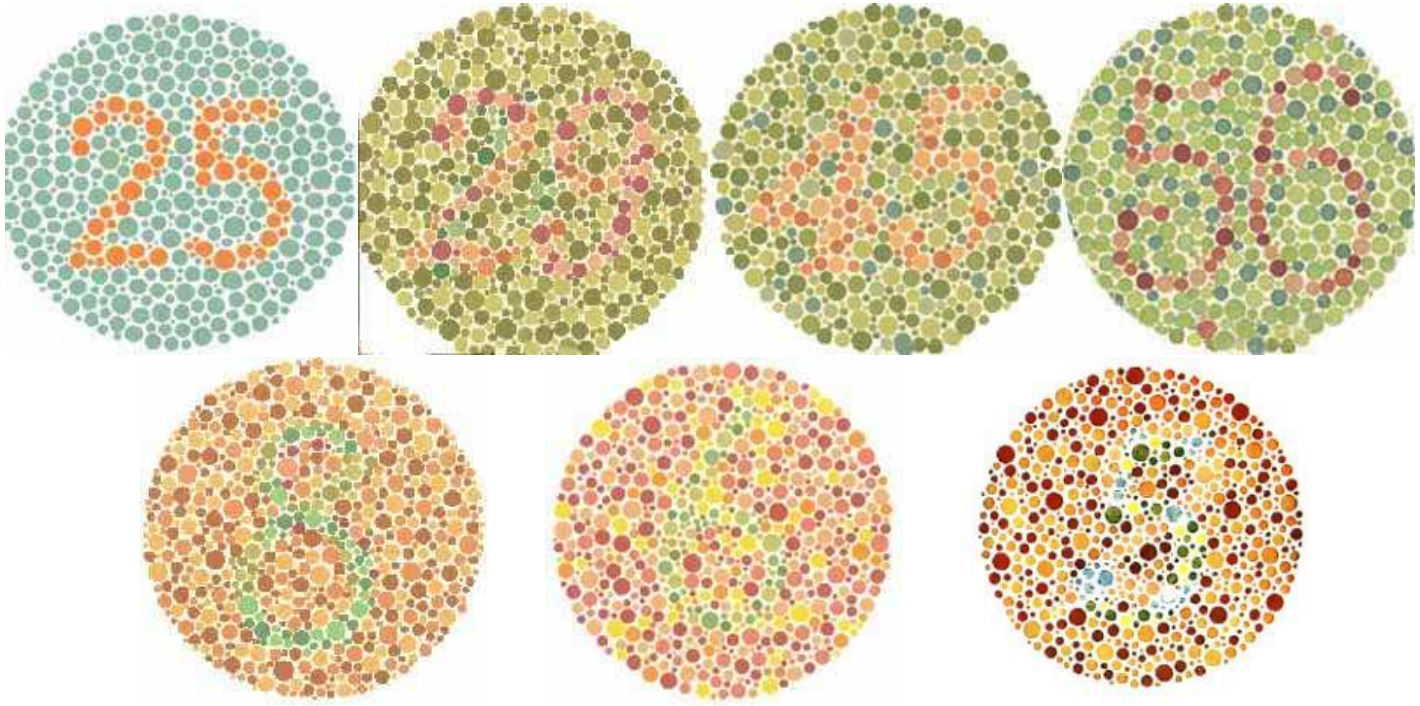
Trinatopia (no S,…)

Use of Color. Background

- Color blindness:
  - Inability to distinguish the colors the same way than non-color impaired people
    - 5-10% of men
    - 1-2% of women
  - Relatively easy to detect
    - Ishihara tests

Use of Color. Background

Ishihara test images



Use of Color. Background

- Other vision problems:
  - About 4% of the population have low vision (0.6% are blind)
  - Low-vision conditions increase with age
    - Half of people over 50 have some degree of low-vision condition
  - Worldwide, the fastest-growing population is 60+ years
    - Over 40, almost everyone needs corrected vision to clearly see small objects or text
    - Age-related vision problems include macular degeneration, diabetic retinopathy, cataracts, and retinitis pigmentosa

Use of Color. Background

- Supporting packages and webpages:
  - **Colorblindor:** Color-blindness simulator. http://www.color-blindness.com/coblis-color-blindness-simulator/
  - **Chromatic Vision Simulator:** Simulates three forms of colour deficiencies: Protanopia, Deuteranopia and Tritanopia.
    - Available for Android and iOS
  - **VisionSim:** Developed by the Braille Institute. It simulates a variety of low-vision conditions.
    - Available for Android and iOS

Use of Color. Background

- Size and spatial frequency are also important in perception
  - The higher the spatial frequency the lower the saturation
    - e.g. chessboard
- Chromatic adaptation:
  - Illumination changes affect the colours drama
    - Human perception adapts to changes
      - Does not perceive those changes linearly

Use of Color. Background

- Color friendly design (most concepts based on HSV model):
  - Few colors. Similar colors should infer a similarity among objects
    - p.e. red for error, green for success, yellow for alert, blue information
  - Avoid using adjacent strongly saturated colors
  - Contrast dark colors against light colors
  - Content areas should be monochromatic with the font color and background at the opposite ends of the color saturation poles
  - Elements of navigation, headers and sub-headers, require some extra visual enhancement

Use of Color. Tips for color selection

- Color design rules:
  - Use color only when needed to serve a particular communication goal.

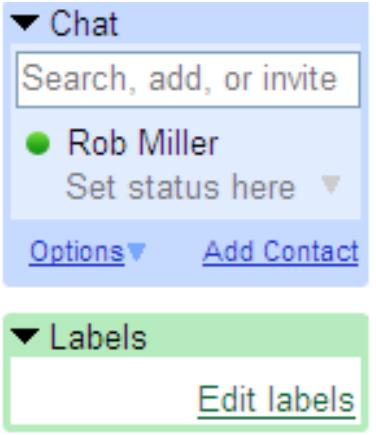
Use of Color. Tips for color selection

- Use small number of colors (hues). Use color only when needed to serve a particular communication goal.

- Many colors appears more complex
- More difficult perception
- More effective: one hue, weakly saturated and combined with black/white/gray

Use of Color. Tips for color selection

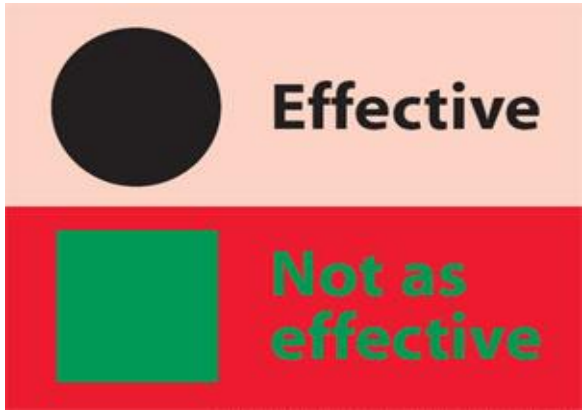
- Avoid strongly saturated colors

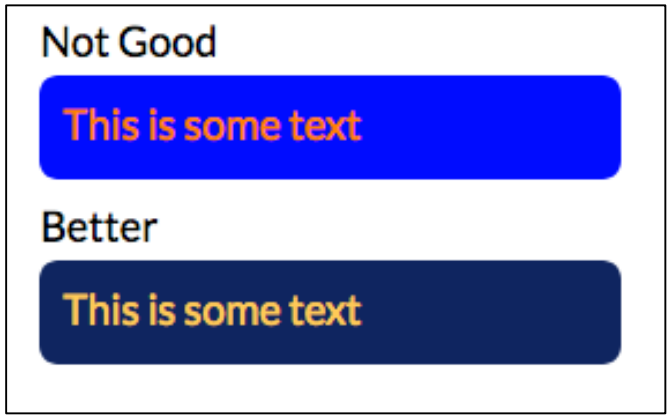


  - They can cause visual fatigue
  - More effective: “pastel” colors

Use of Color. Tips for color selection

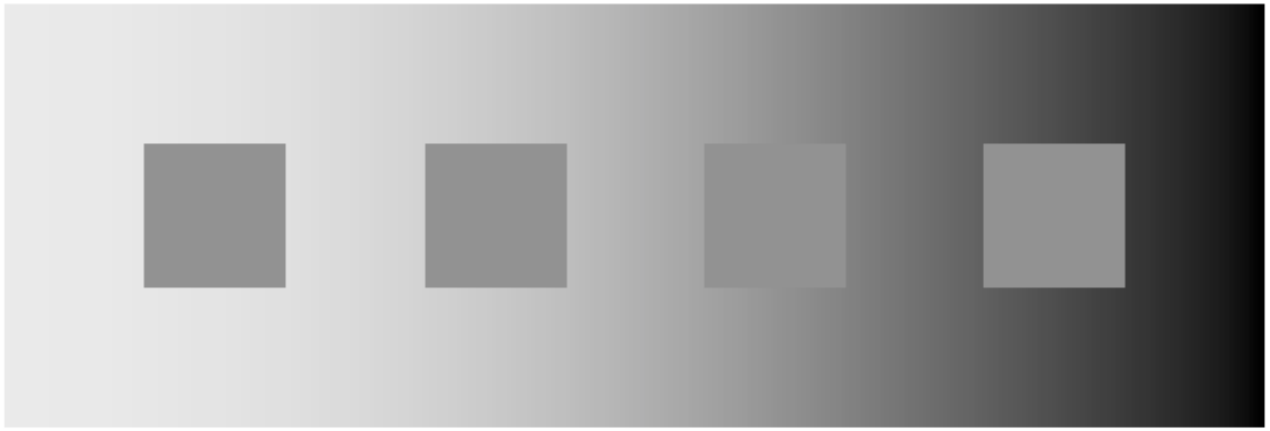
- Color design rules:
  - If you want objects to be easily seen, use a background color that contrasts sufficiently with the object
  - For text is usually needed a combination of contrast of Hue + V & S
  - Contrast “dark” (high S, Low V) with “light” colors (Low S, high V)





Use of Color. Tips for color selection

- Color design rules:
  - If you want different objects of the same color to look the same, make sure that the background -the color that surrounds them- is consistent



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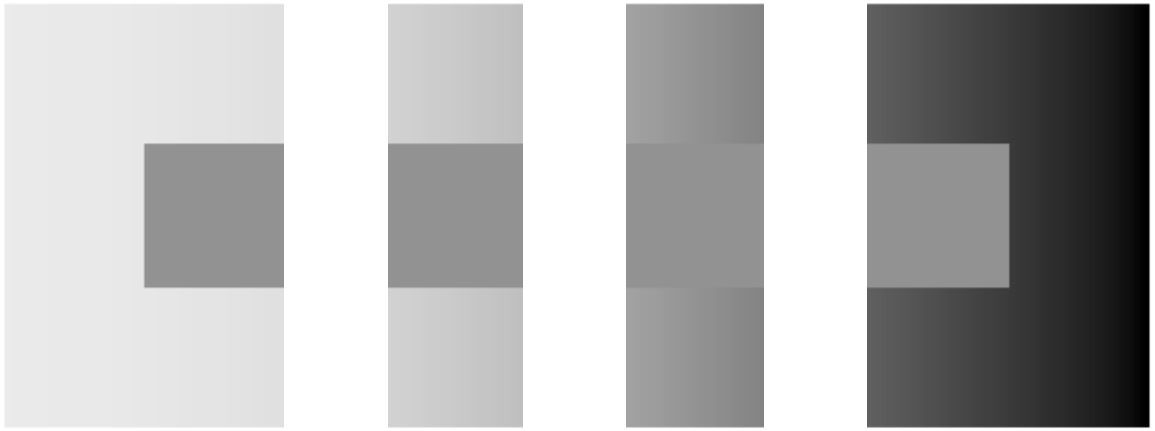

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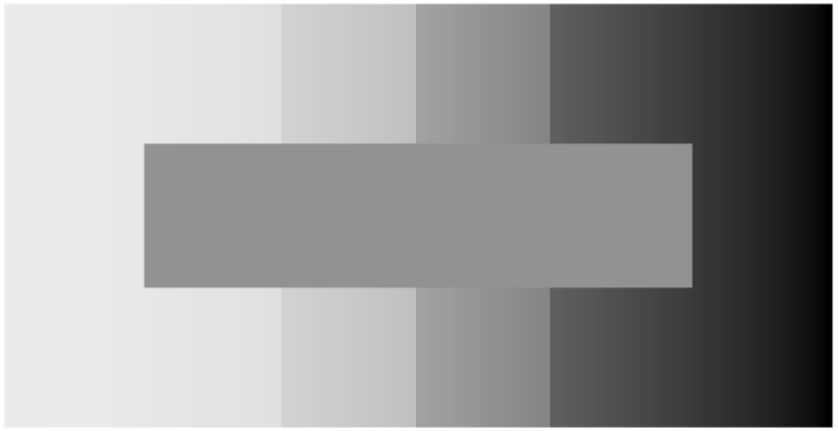
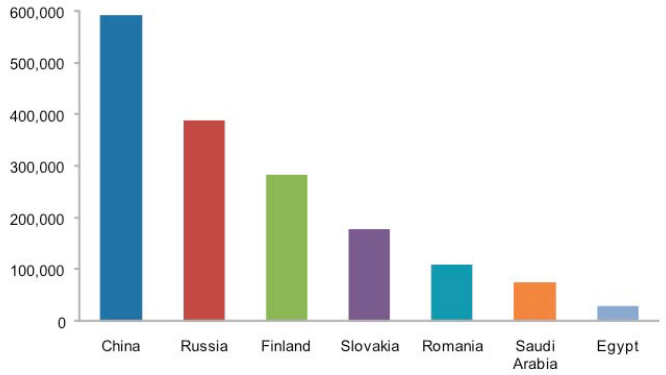
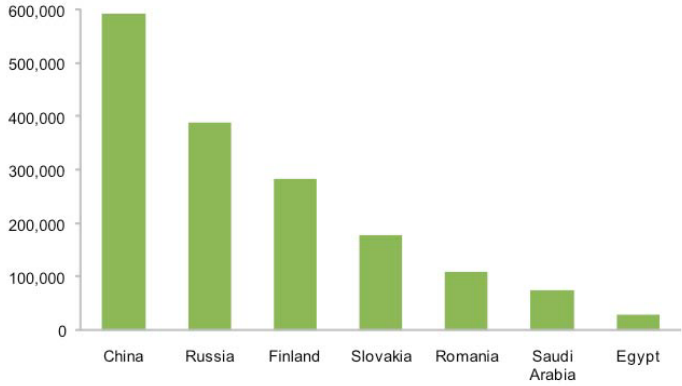


Use of Color. Tips for color selection

- Color design rules:
  - Use different colors only when they correspond to differences of meaning in the data.
    - Highlight particular data, group items, encode quantitative values…





Use of Color. Tips for color selection

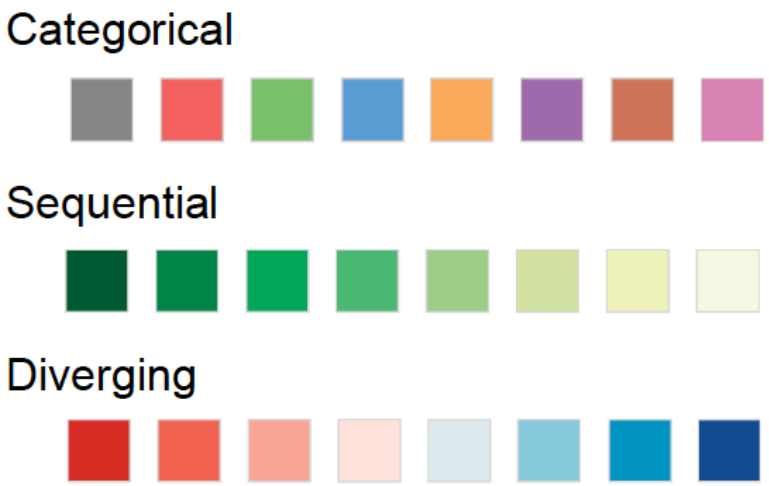
- Color design rules:
  - Use soft, natural colors to display most information and bright and/or dark colors to highlight information that requires greater attention.

Use of Color. Tips for color selection

- Color design rules (palettes):
  - *When using color to encode a sequential range of quantitative values:*
    - Use a single hue (or a small set of closely related hues) and vary intensity ..
    - …from pale colors for low values …
    - ...to increasingly darker and brighter colors for high values

Use of Color. Tips for color selection

- Color design rules: Color palettes
  - Use http://colorbrewer2.org

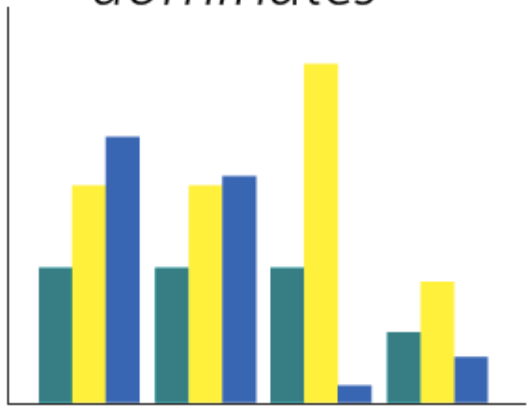


No order required

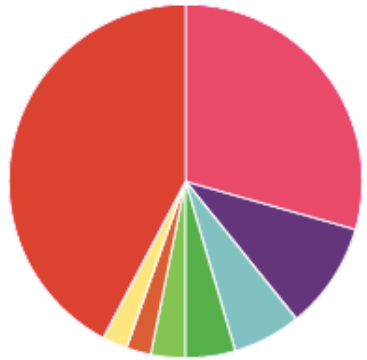
Order required but no neutral value

Order required **and** neutral value

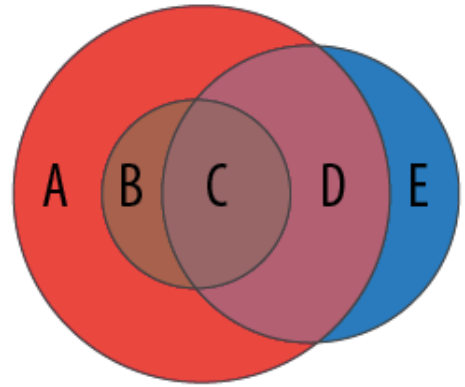
one color dominates



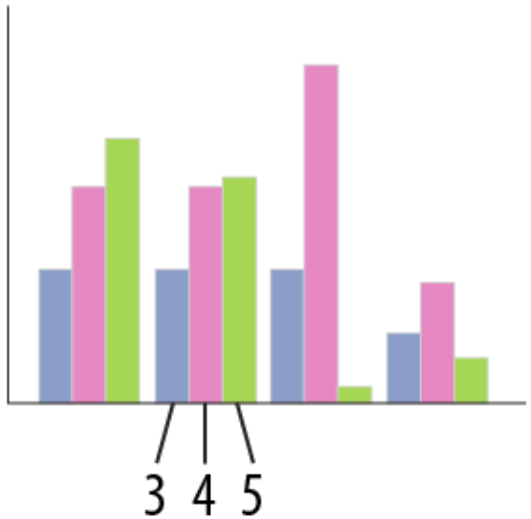
difficult to distinguish

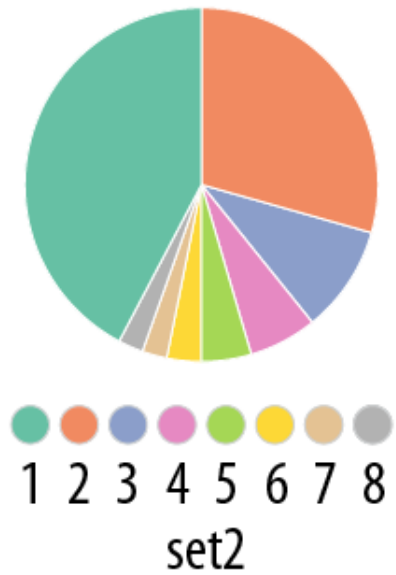


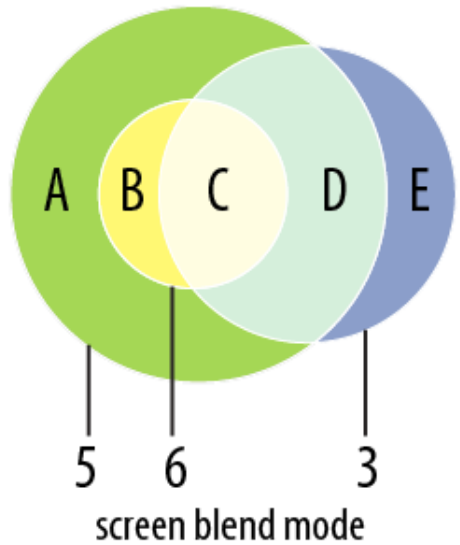
murky



recolored with Brewer palettes





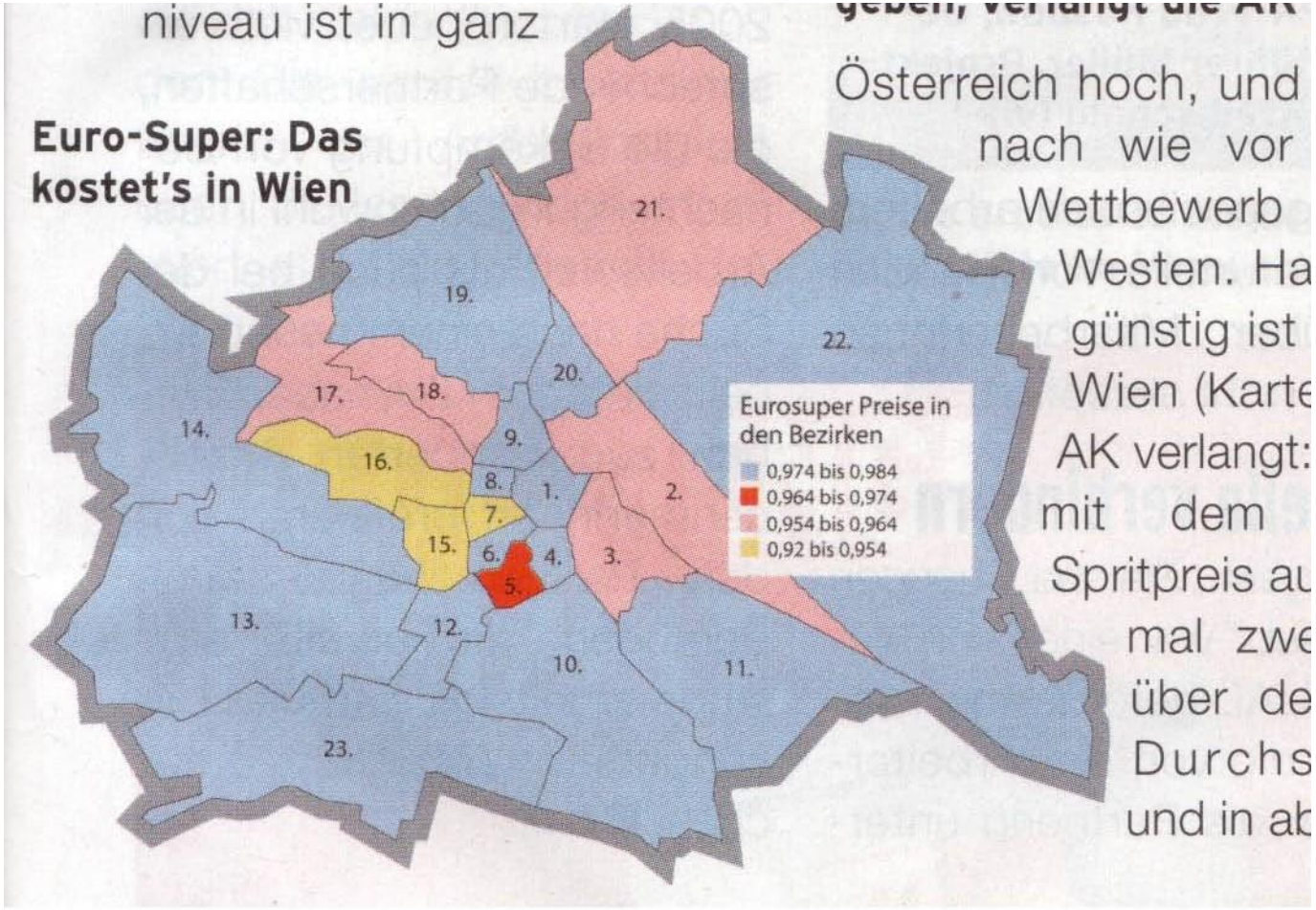


Use of Color. Color design rules

- Color design rules (in charts/tables):
  - Non-data components of tables and graphs should be displayed just visibly enough to perform their role, but no more so, for excessive salience could cause them to distract attention from the data

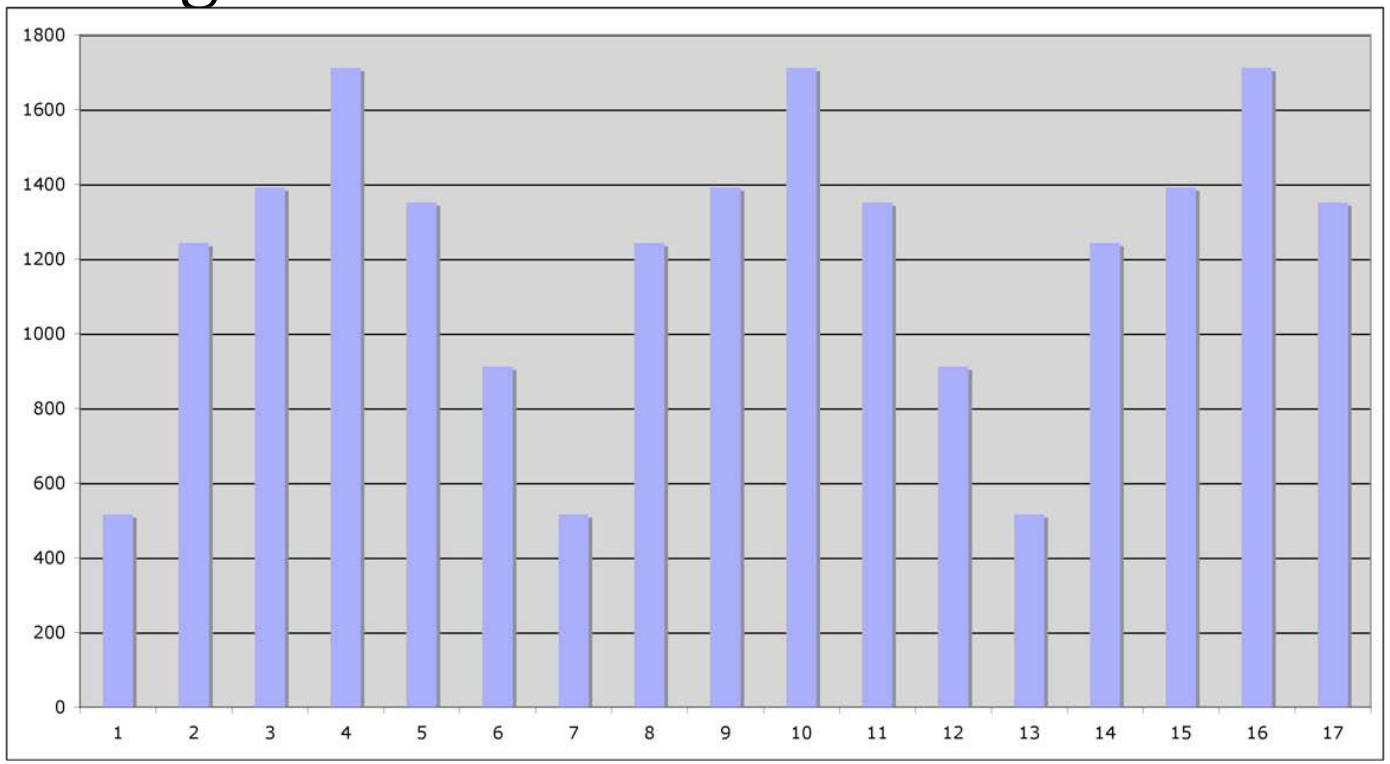
Use of Color. Color design rules

- Color usage rules (in charts/tables). Salience:



Use of Color. Color design rules

- Color design rules:
  - De-emphasizing…



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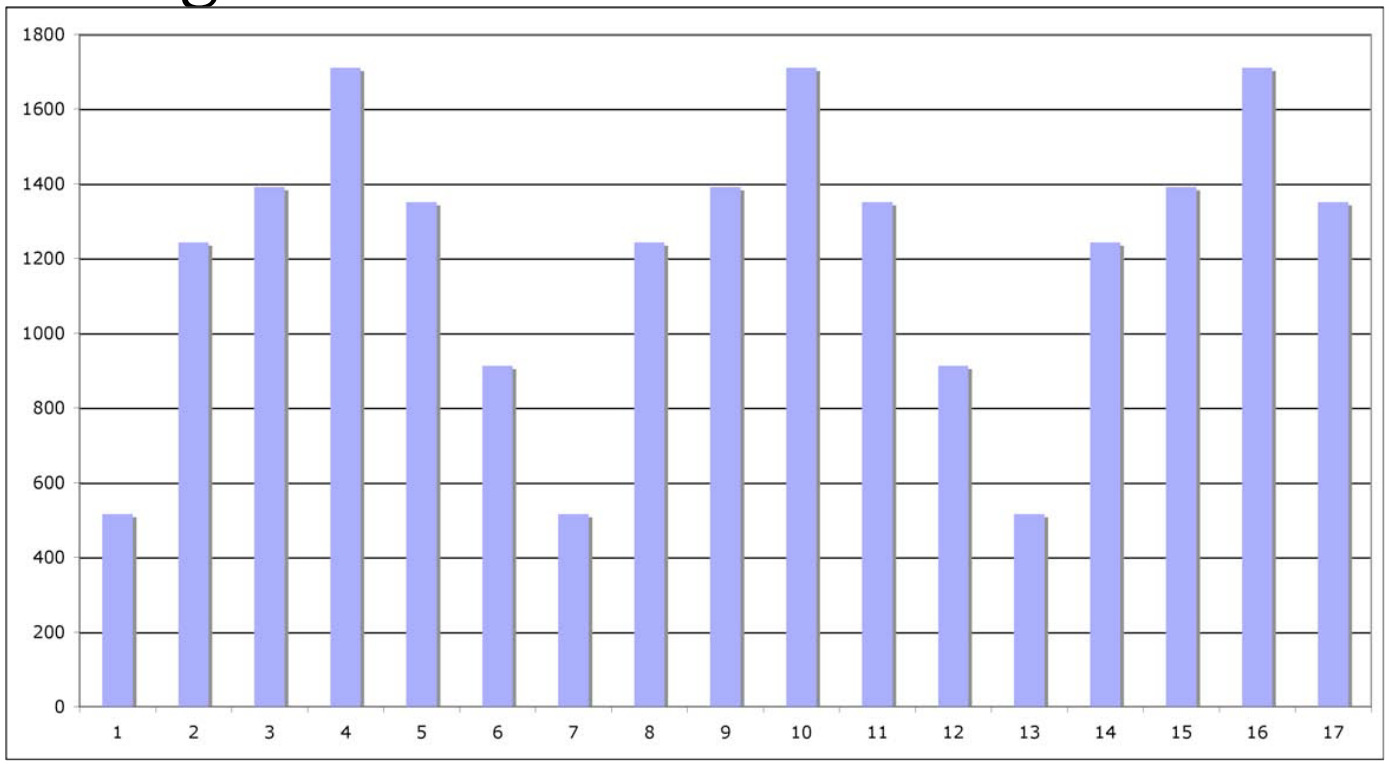

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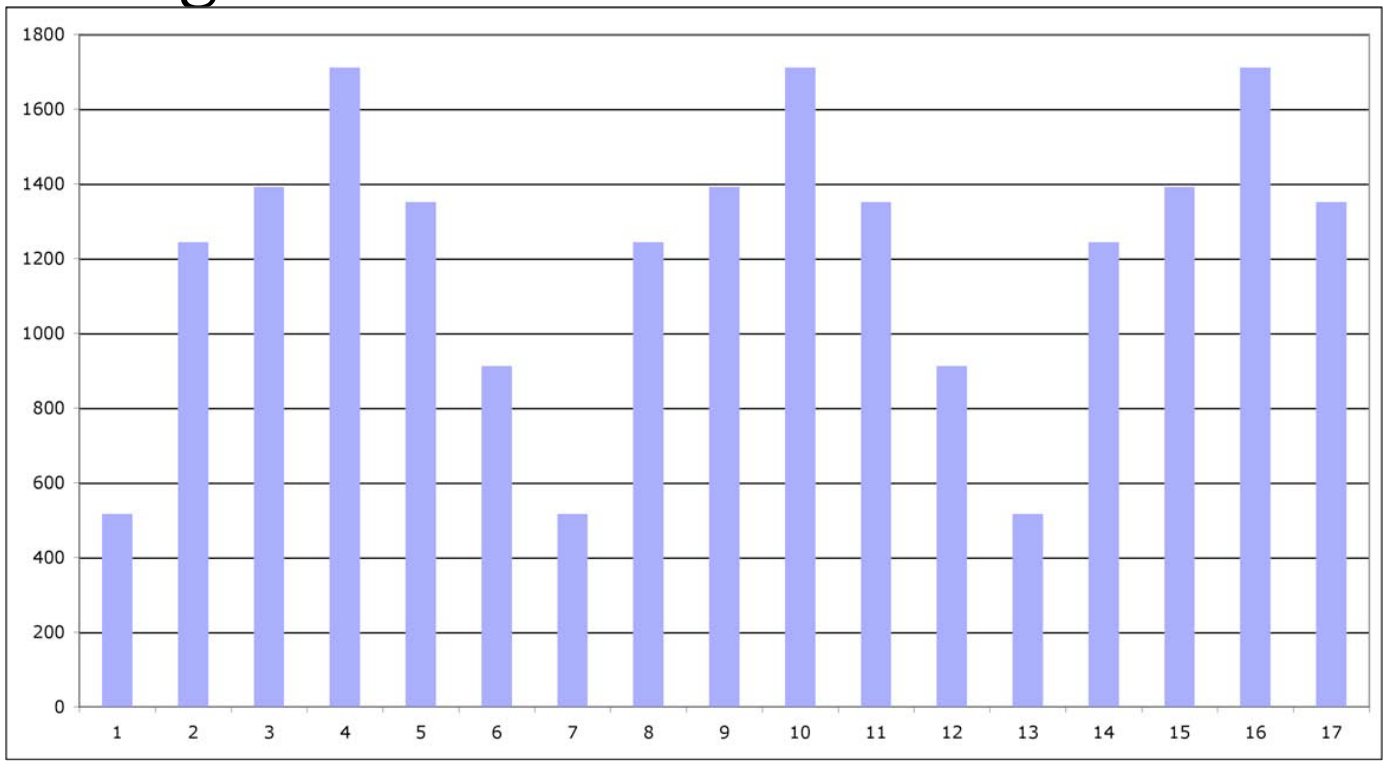

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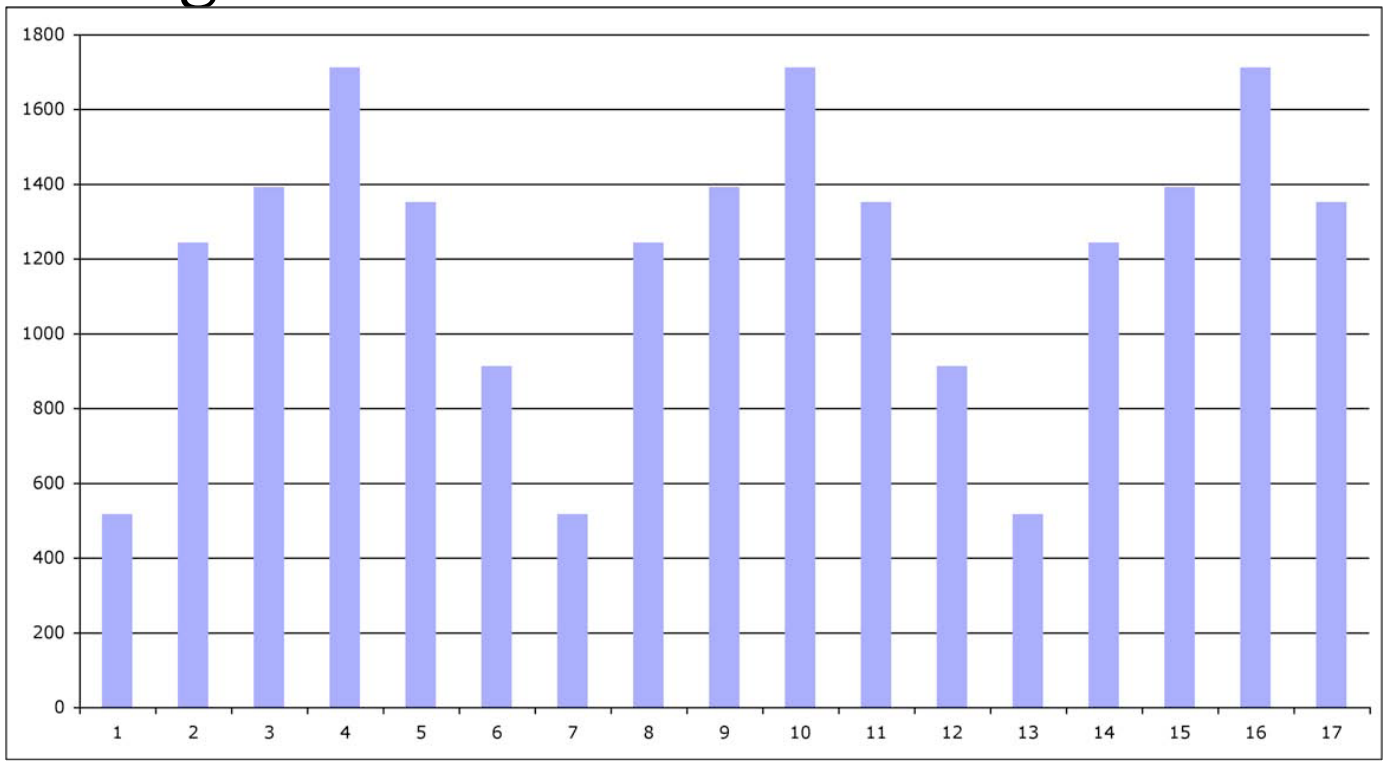

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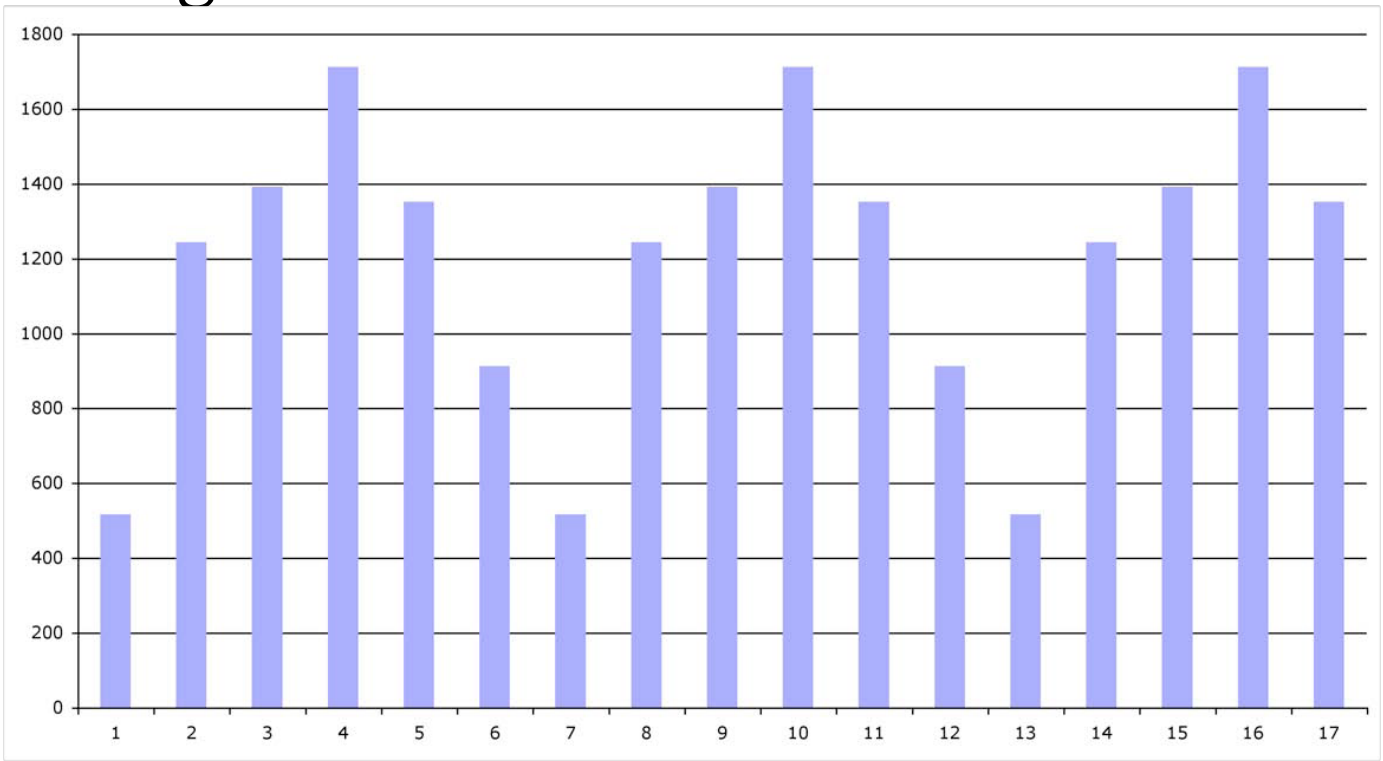

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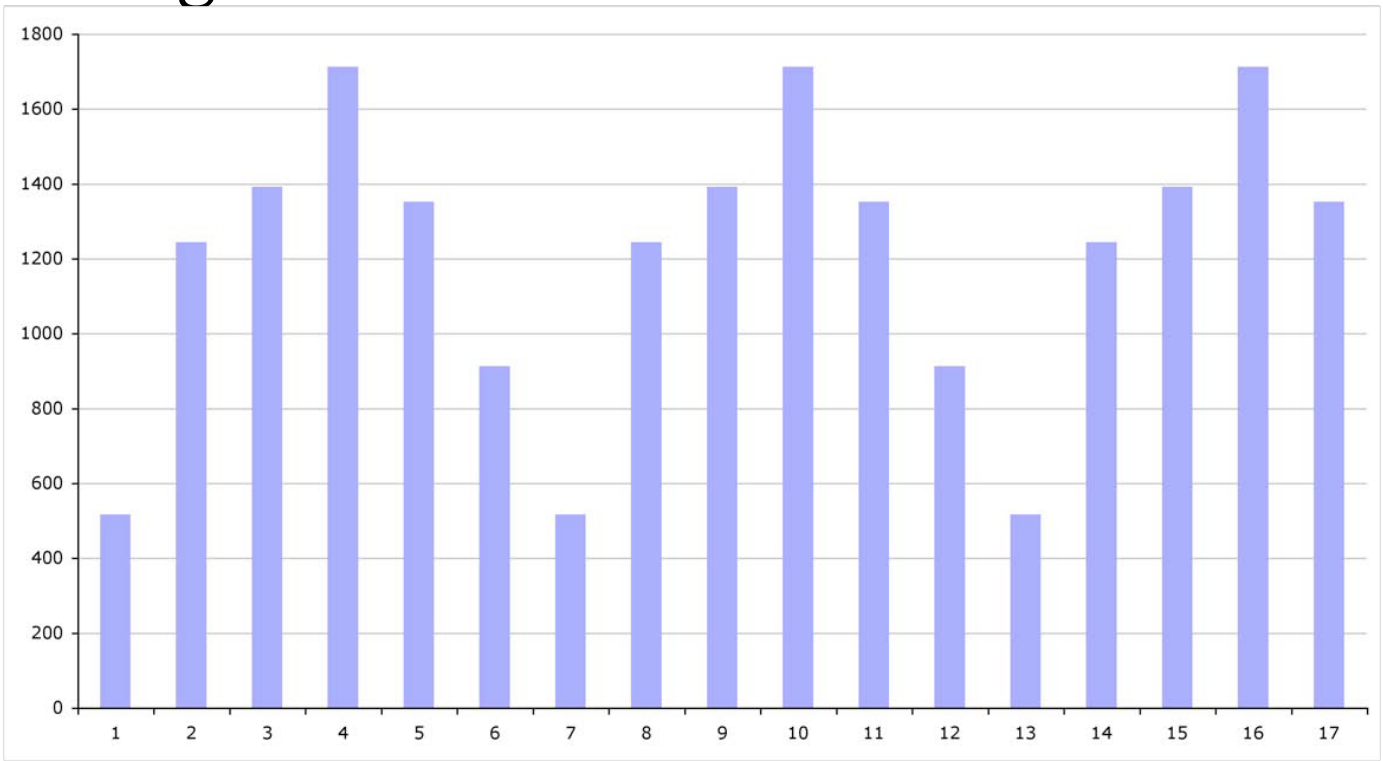

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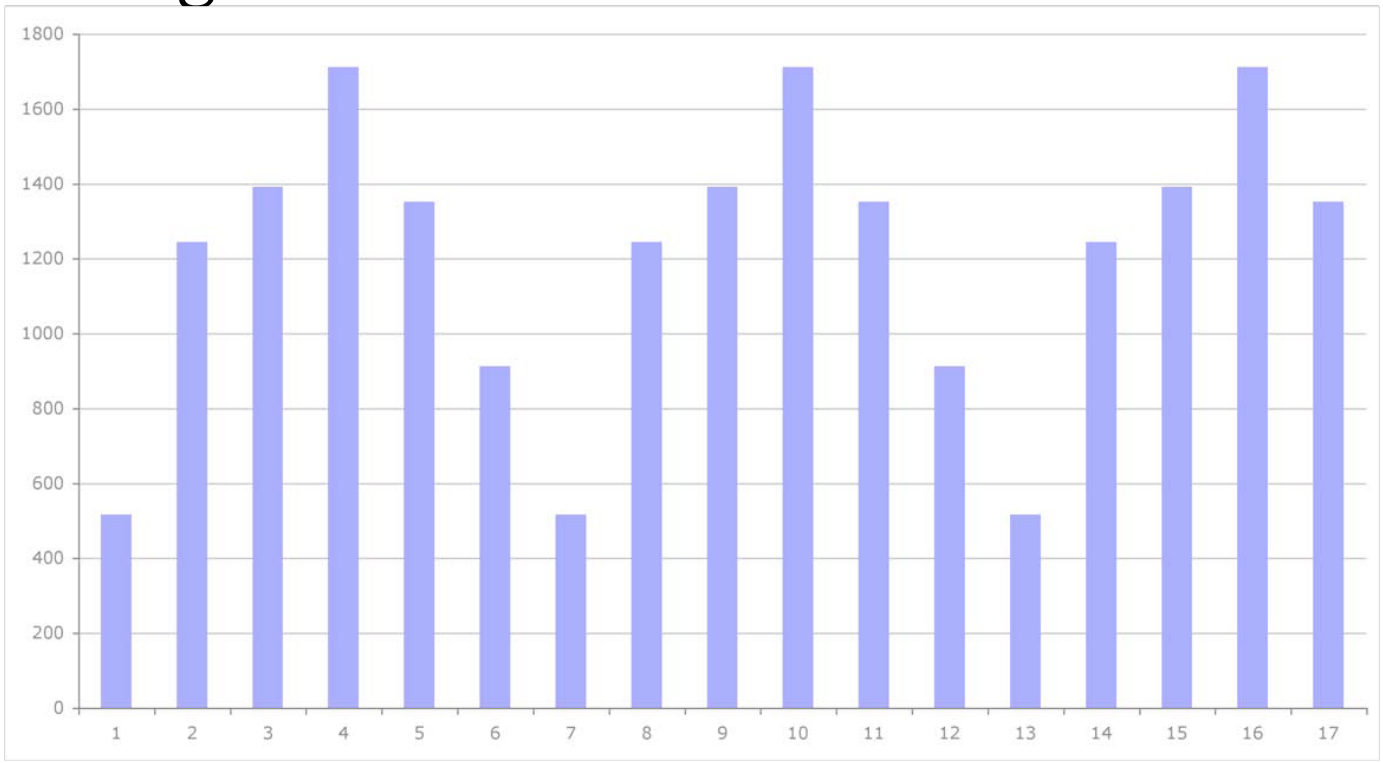

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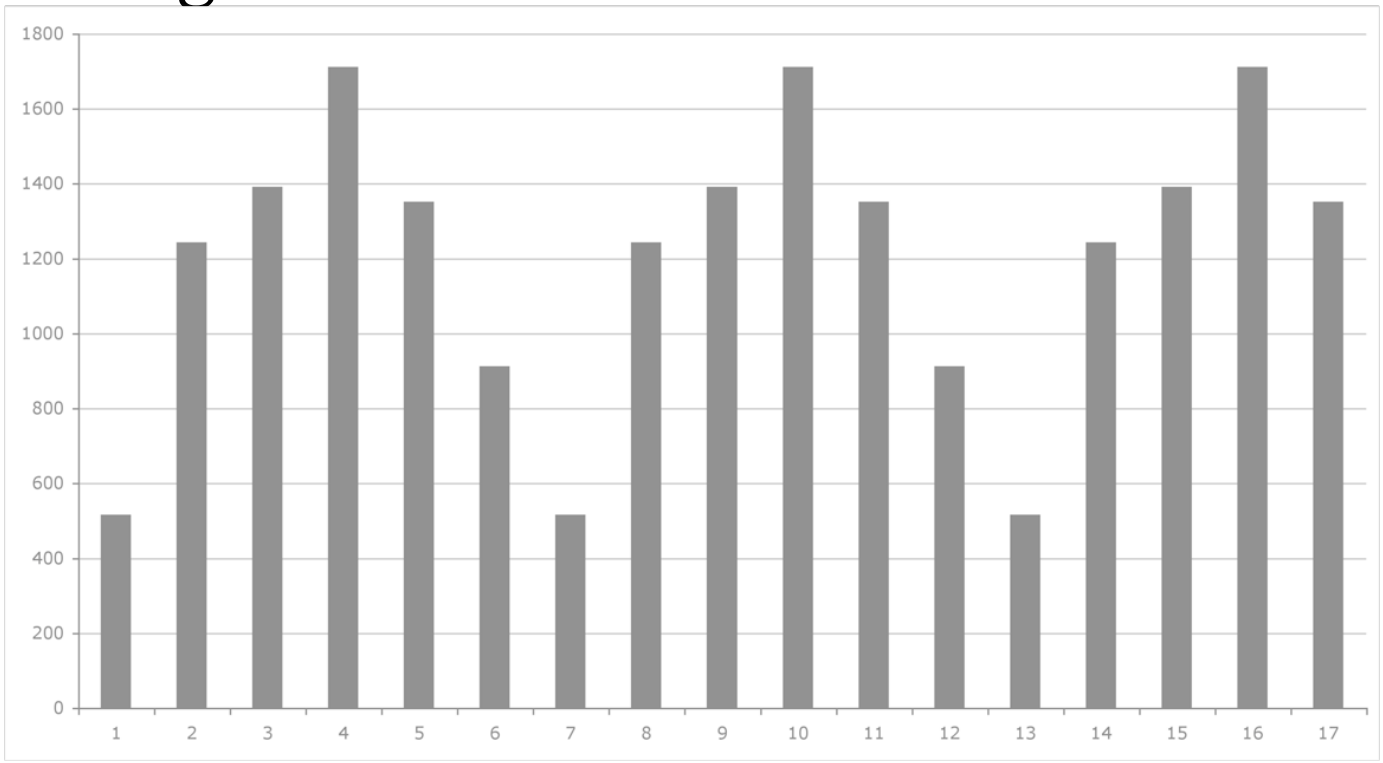

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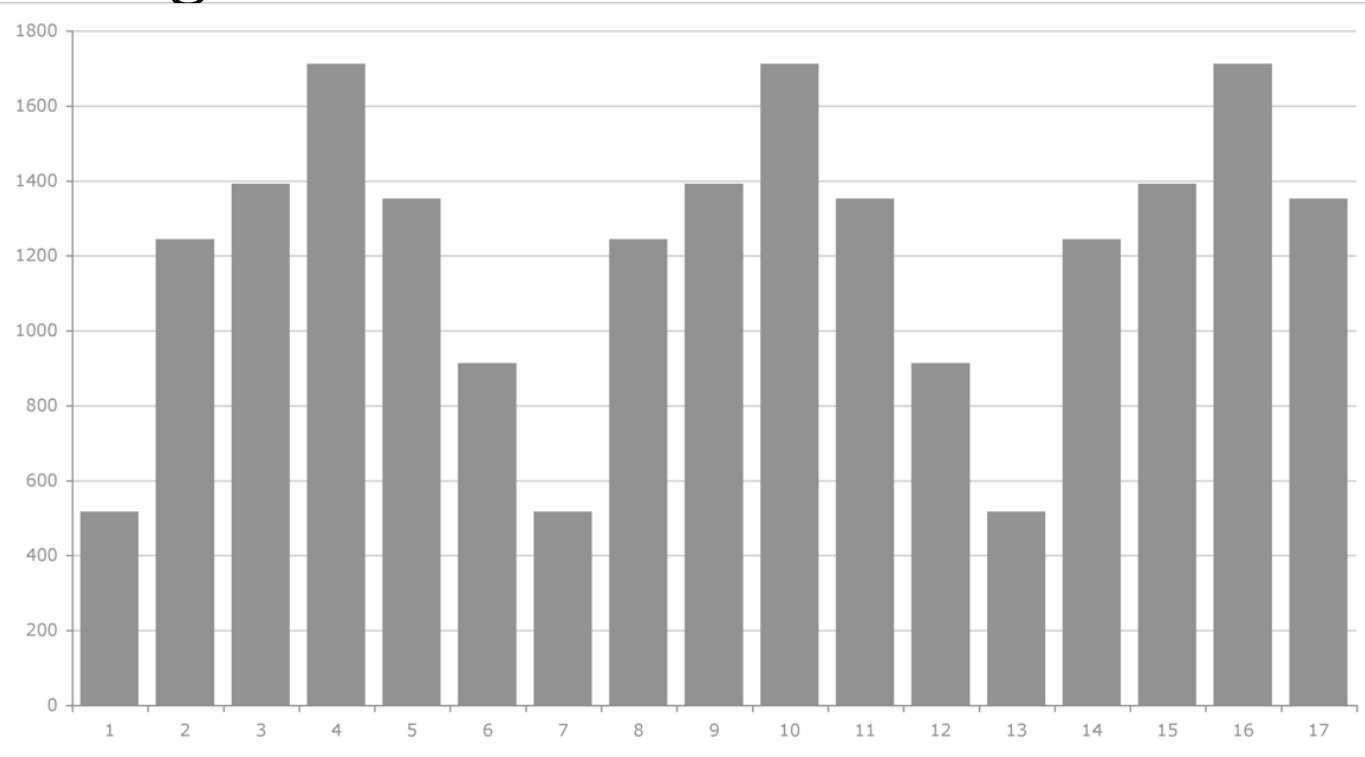

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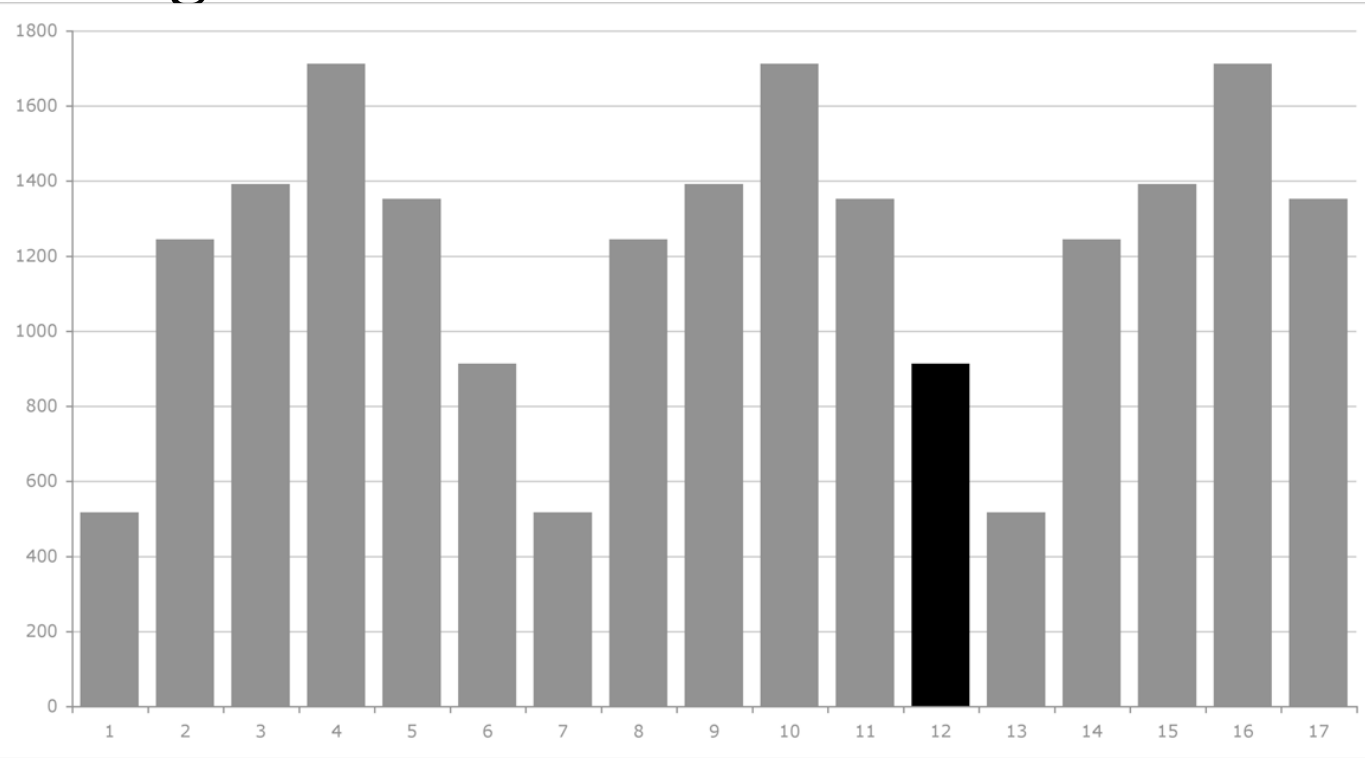

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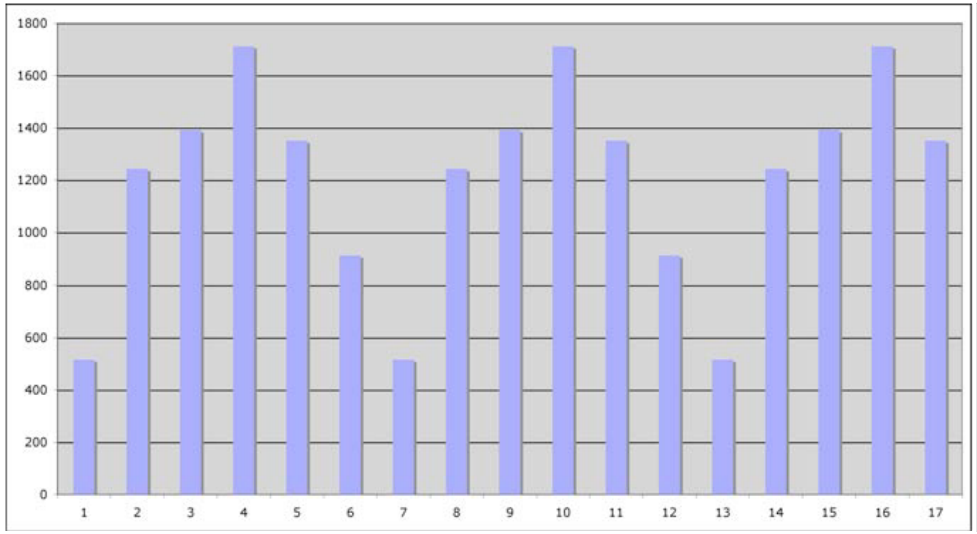

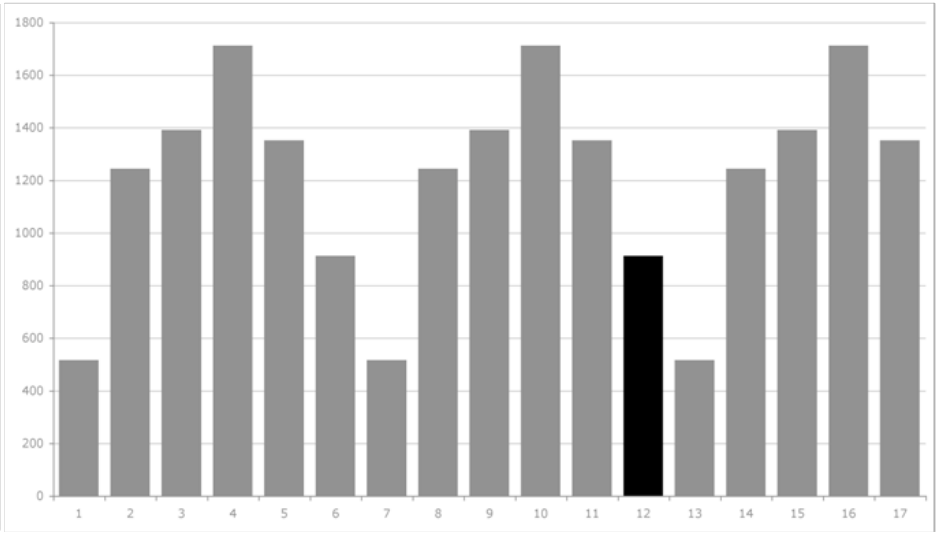

Use of Color. Color design rules

- Color design rules:
  - Avoid using a combination of red and green in the same display

Use of Color. Color design rules

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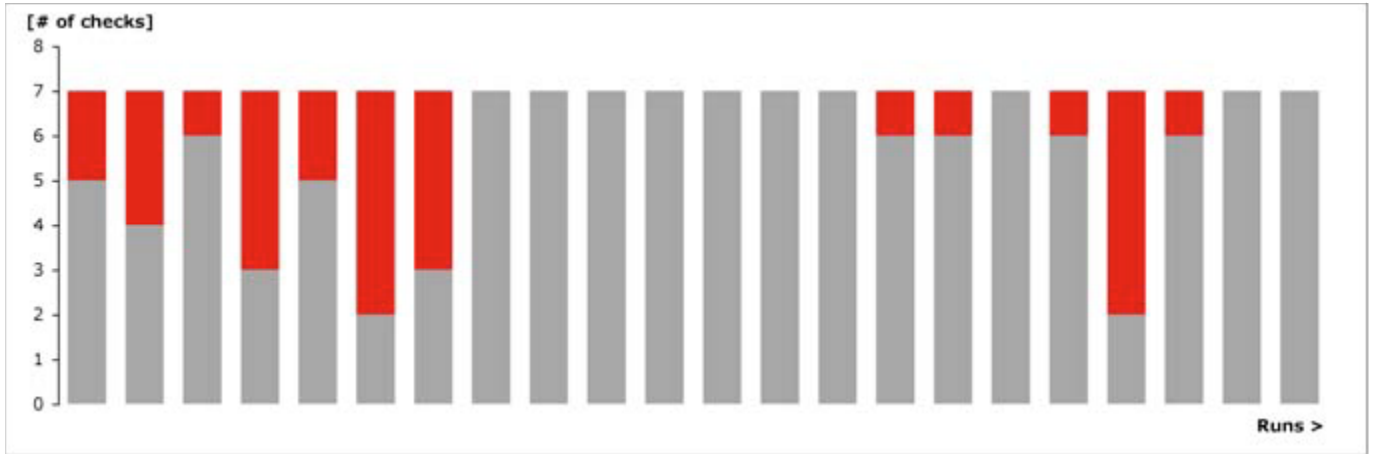


Use of Color. Color palettes

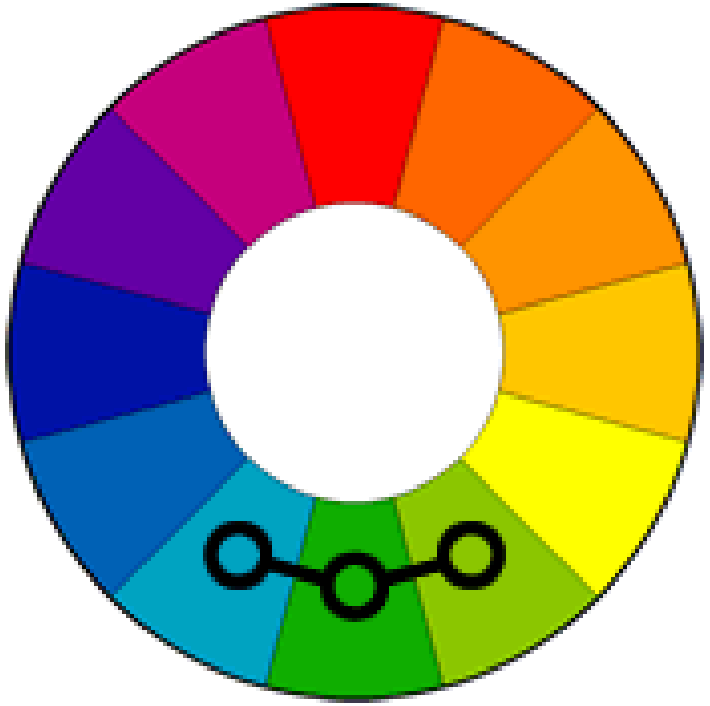
- Use opposite colors

Use of Color. Color palettes

- Color Wheels

Use of Color. Color palettes

- Analogous colors

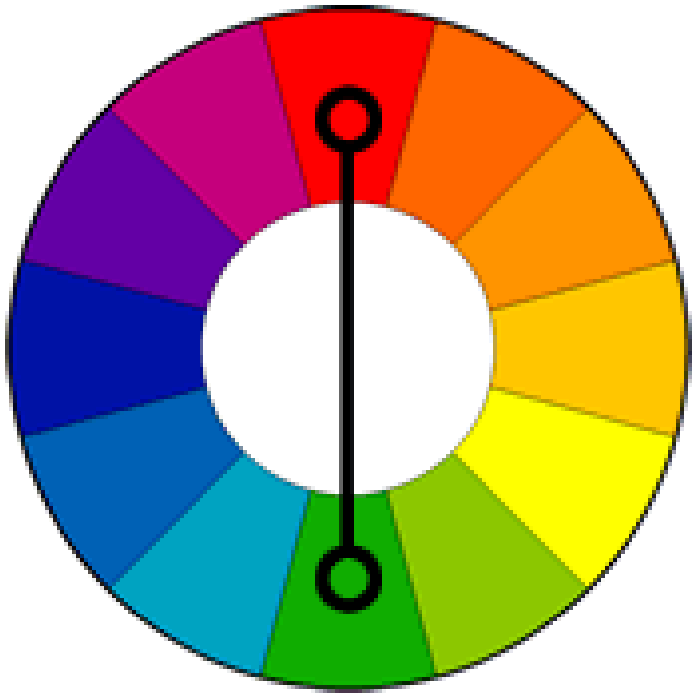


Use of Color. Color palettes

- Analogous colors

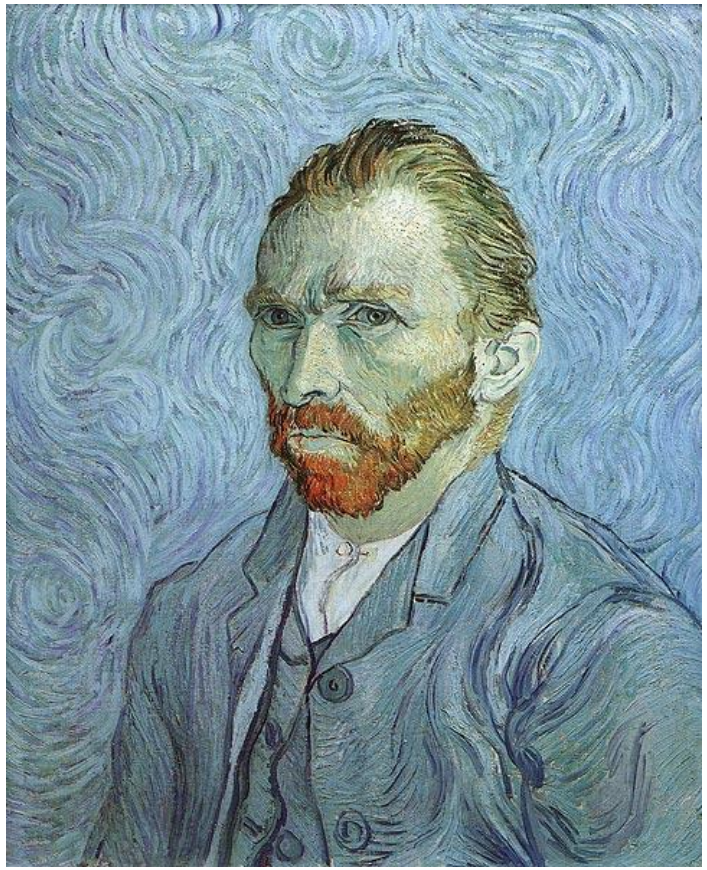
Use of Color. Color palettes

- Complementary colors



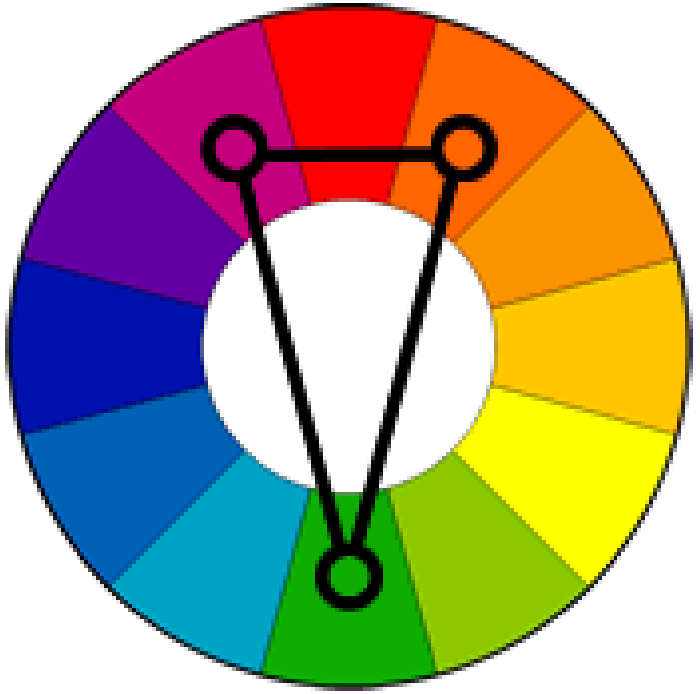
Use of Color. Color palettes

- Complementary colors



Use of Color. Color palettes

- Split-complementary colors

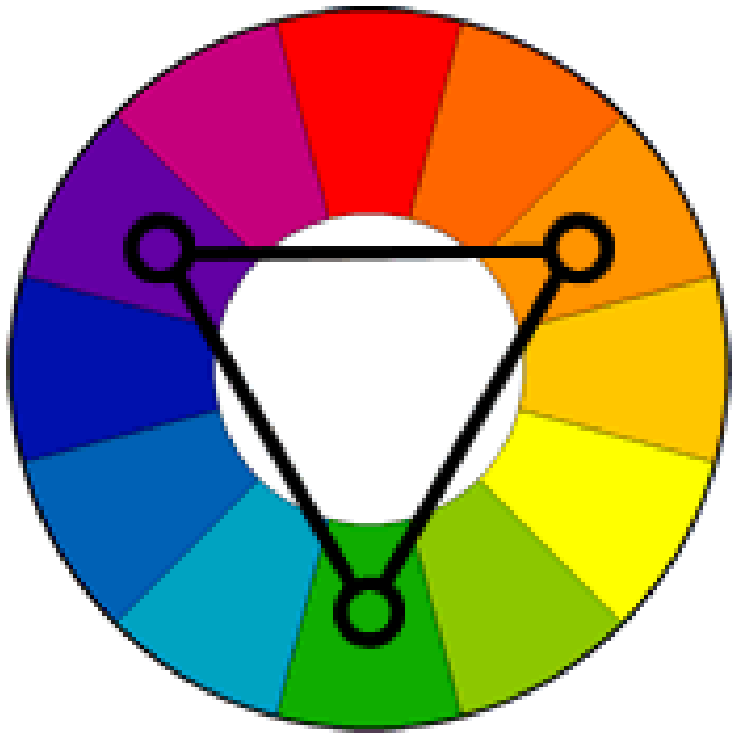


Use of Color. Color palettes

- Complementary colors

Use of Color. Color palettes

- Triad relationship



Use of Color. Color palettes

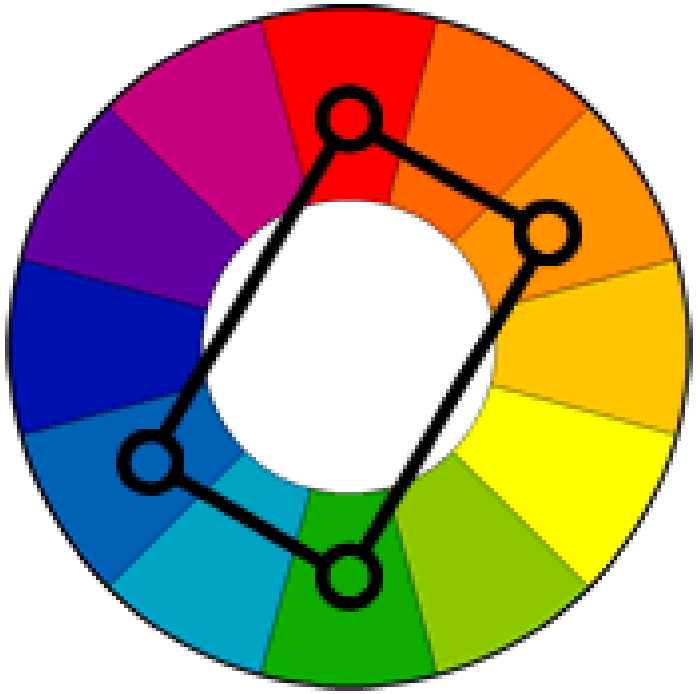
- Triad relationship

Use of Color. Color palettes

- Triad relationship

Use of Color. Color palettes

- Tetrad relationship



Use of Color. Color palettes

- Tetrad relationship

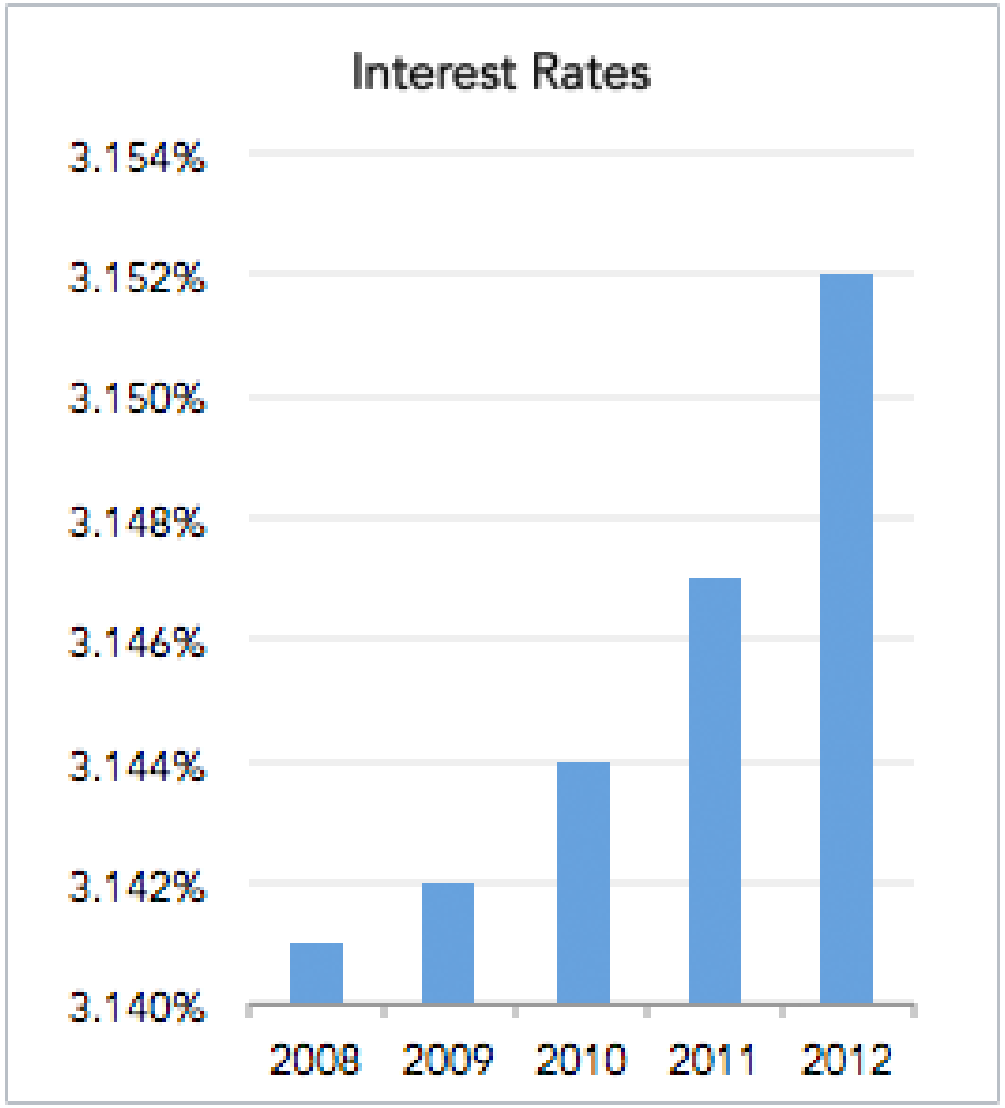
Outline

- *Effective Visualizations*
- *Use of color*
- **Comparison**
- Copy & labels
- Ordering & aligning data

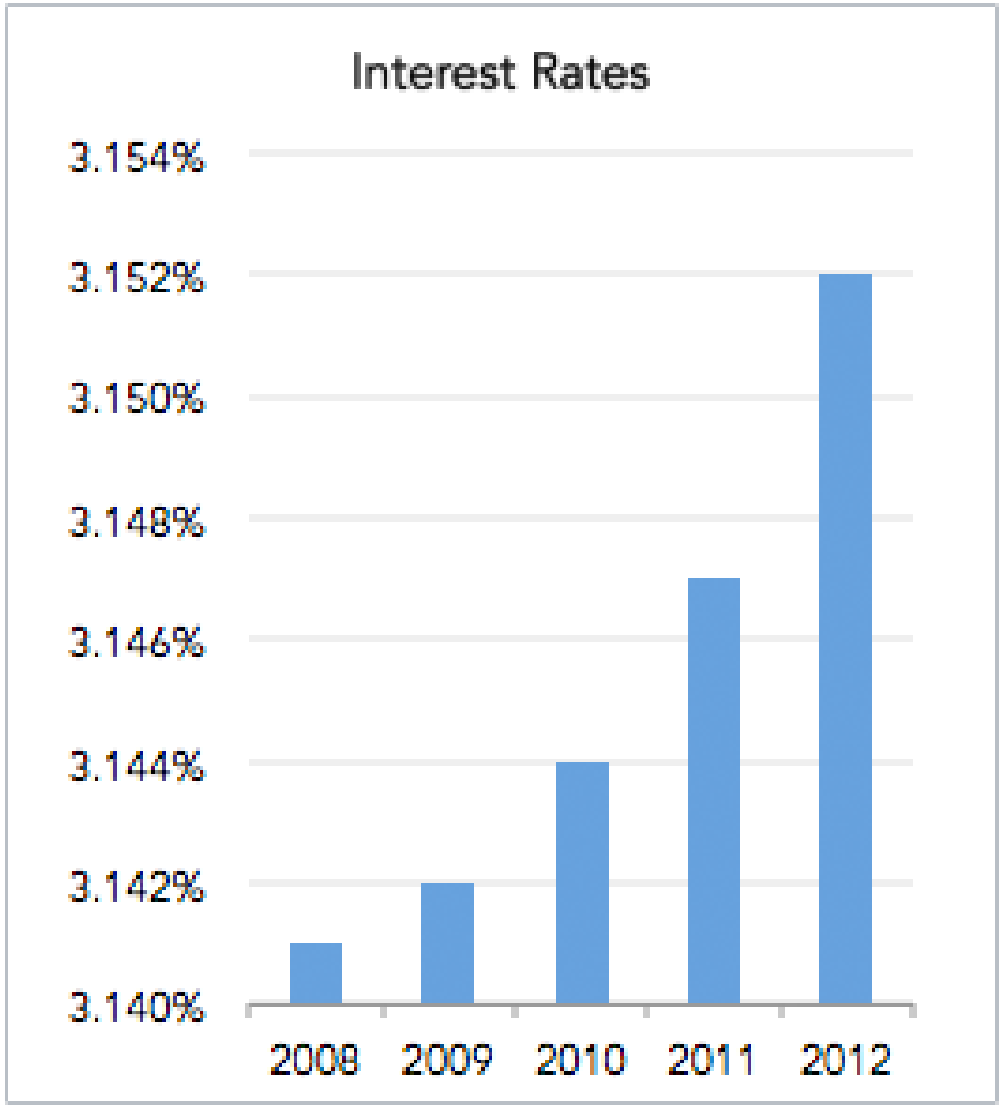
Comparison

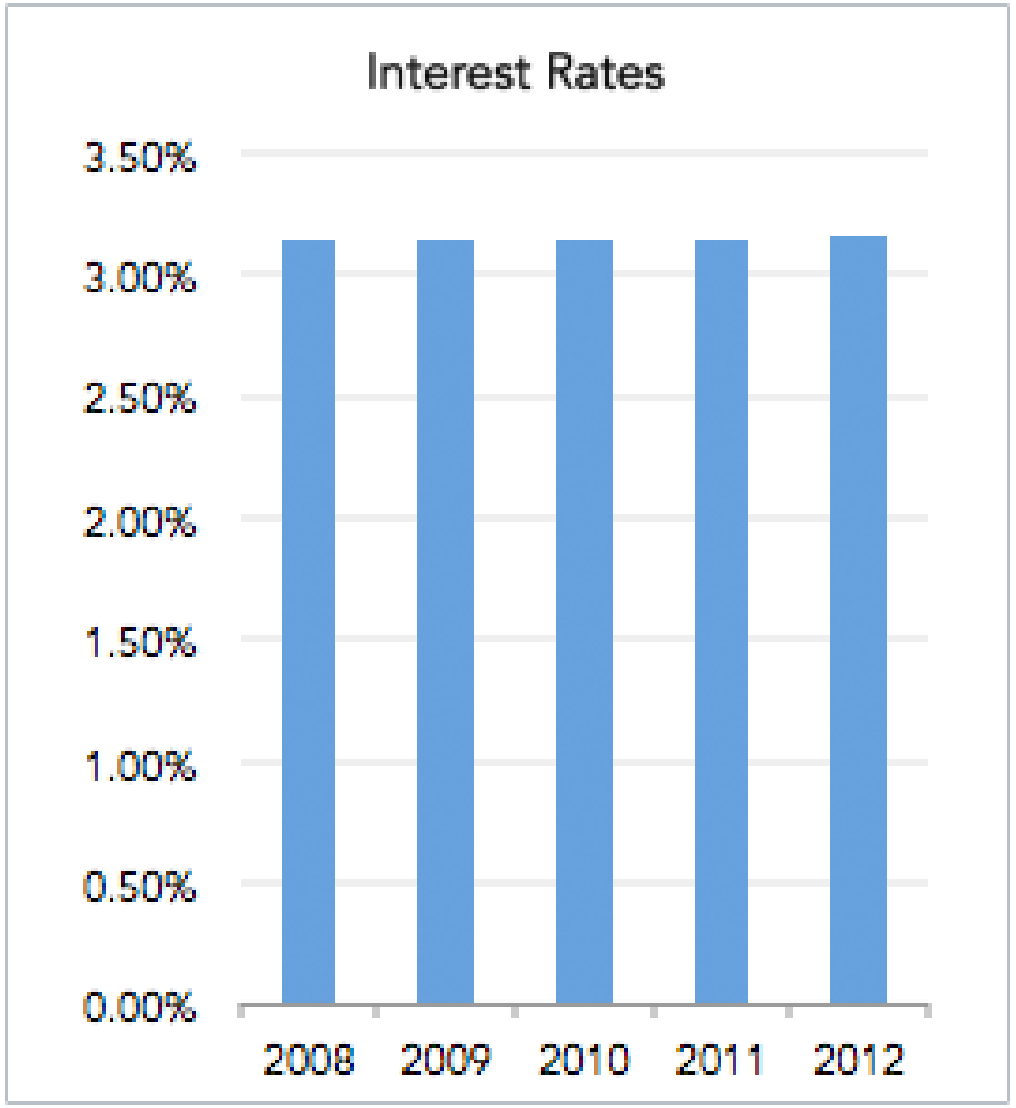
- Visual comparison one of most common tasks
- Tips to take into account
  - Zero baseline if possible
  - Choose the most effective visualization
  - Place elements to facilitate comparison
    - Distances, positions matter
  - Tell the whole story

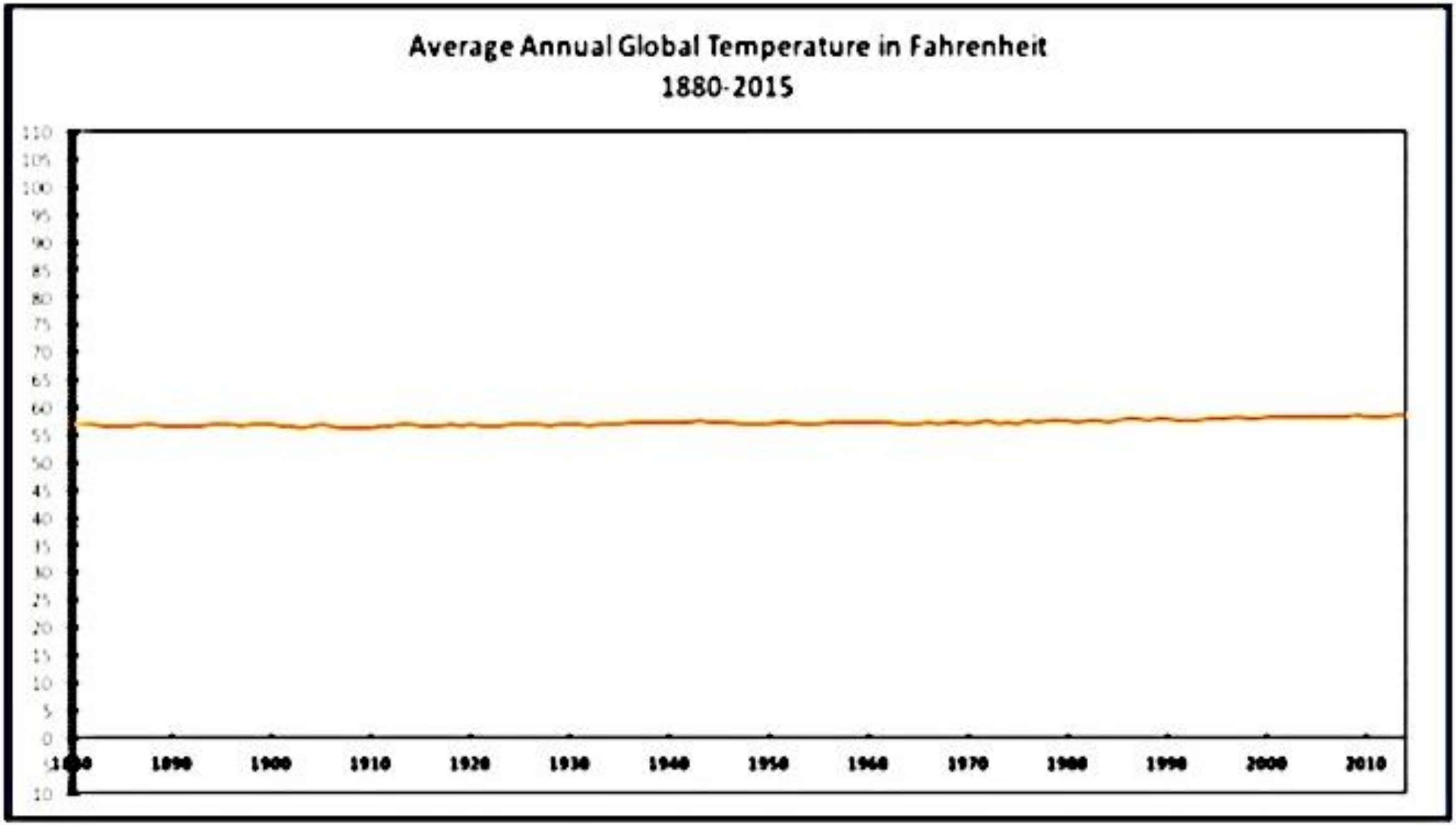
Comparison. Zero baseline

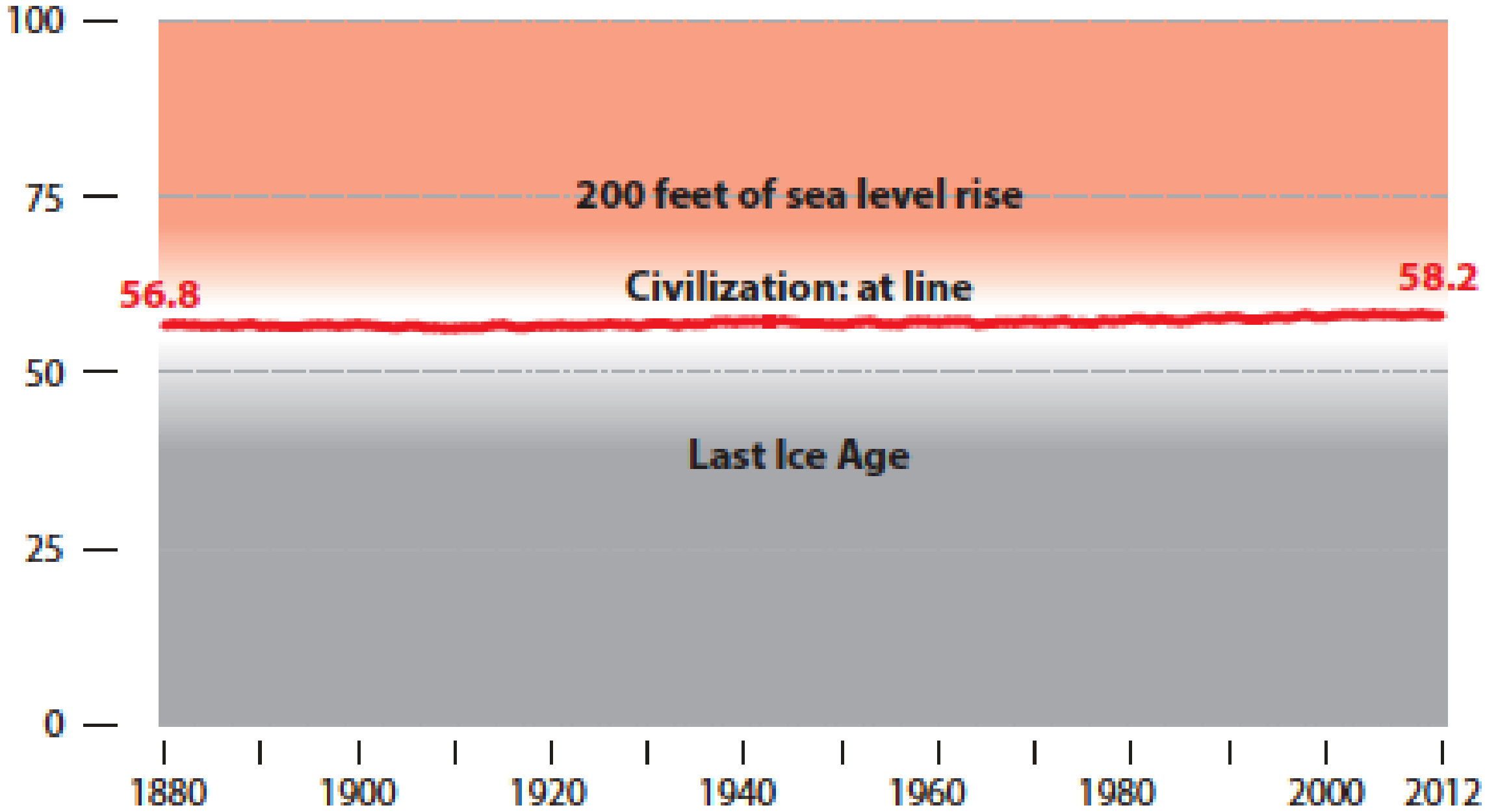


Comparison. Zero baseline

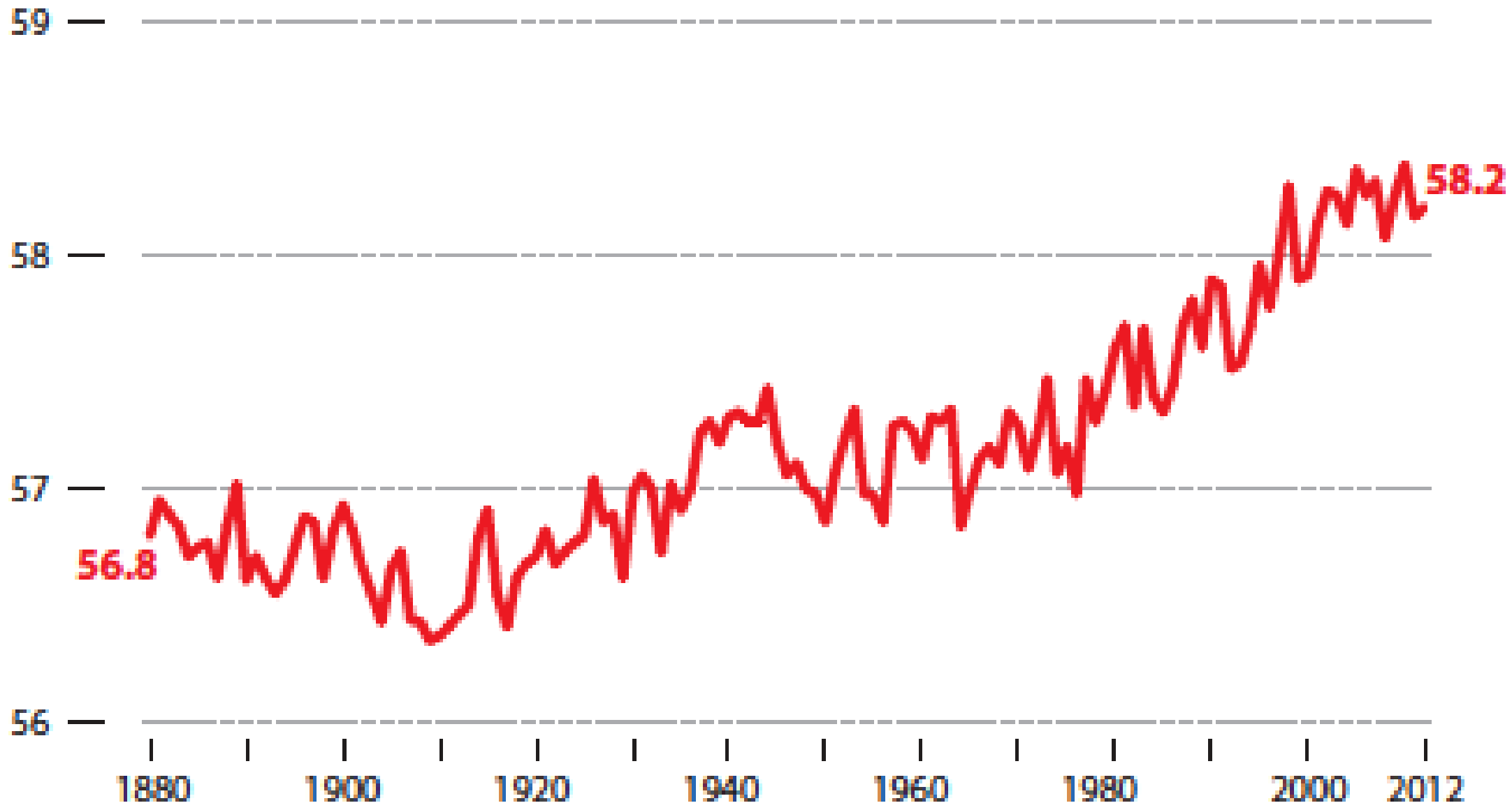


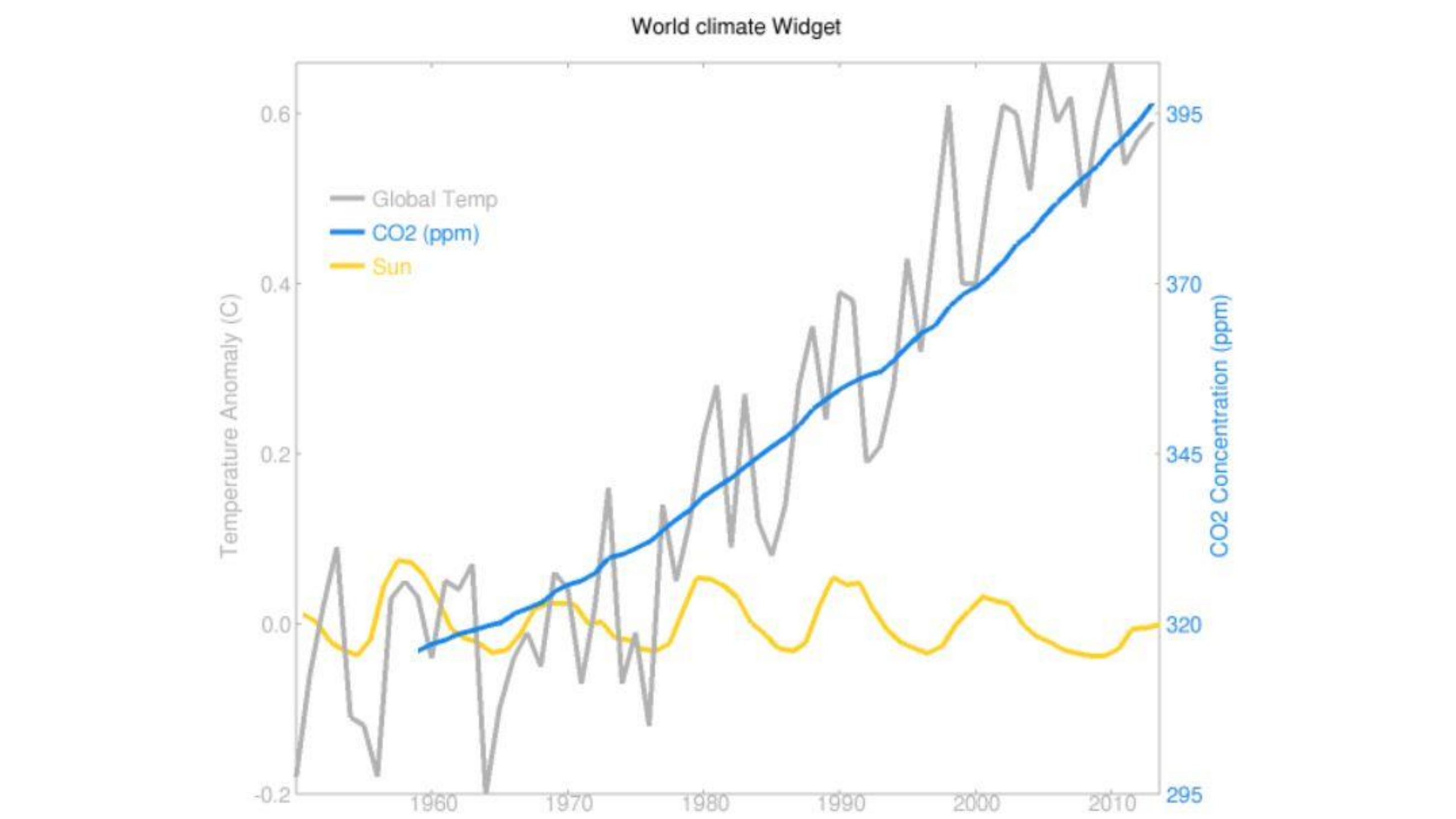


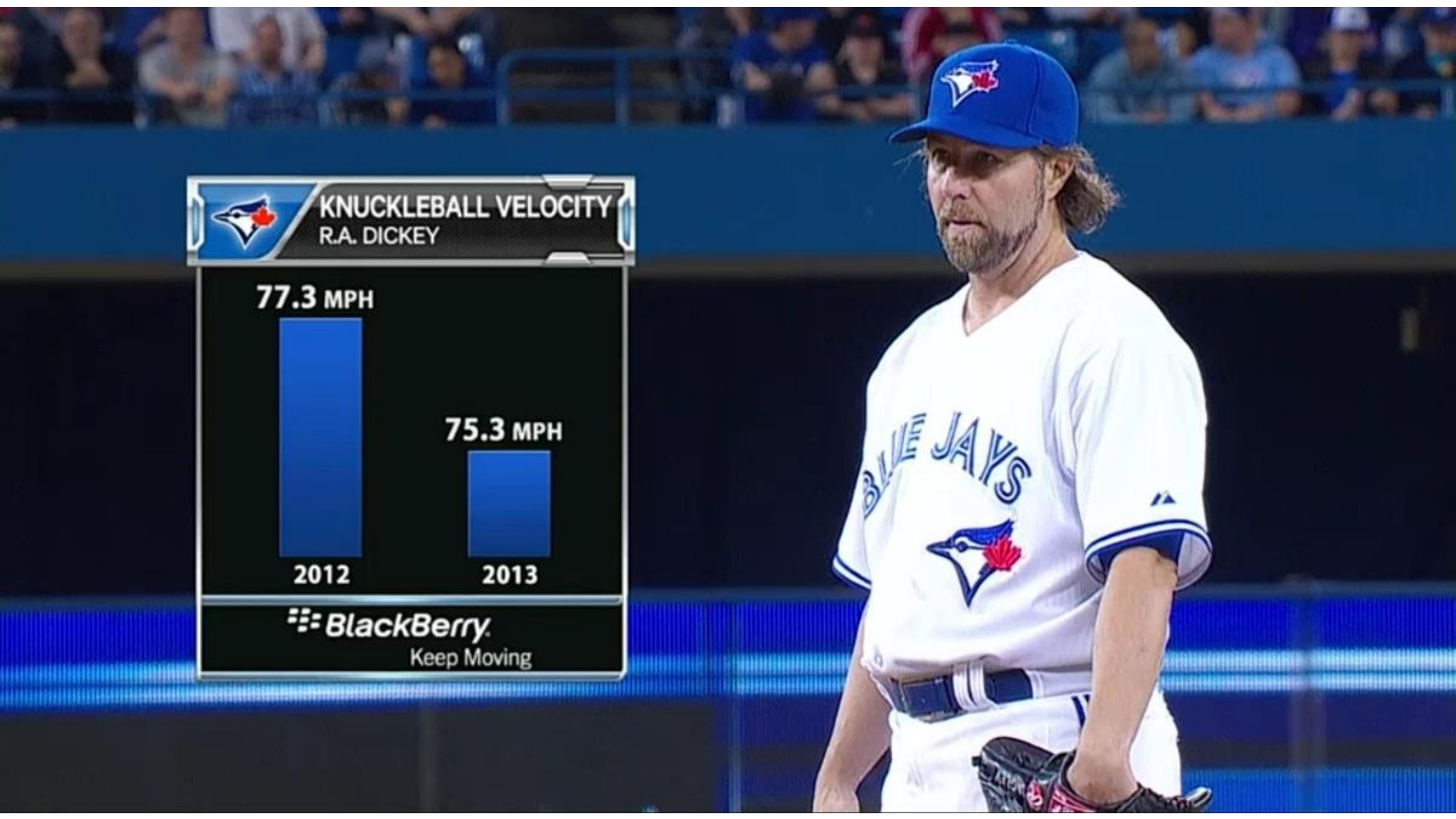

Average Annual Global Temperature in Fahrenheit
1880-2015
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010


100
75
50
25
0
200 feet of sea level rise
Civilization: at line
56.8
58.2
Last Ice Age
1880
1900
1920
1940
1960
1980
2000
2012

Average annual global temperature in degrees Fahrenheit



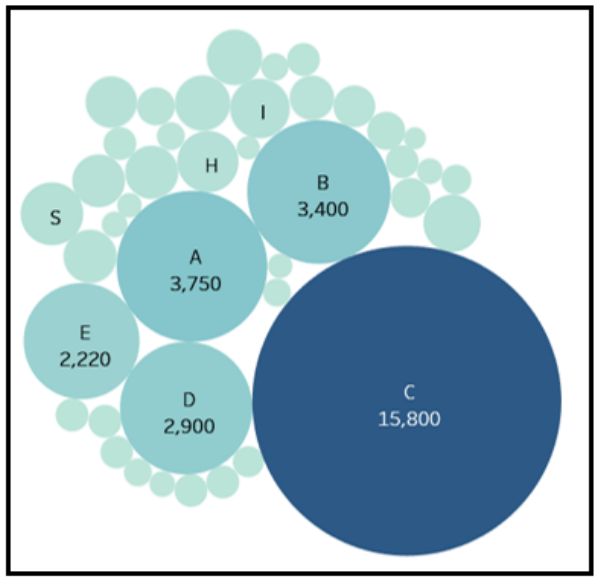

World climate Widget
Global Temp
CO2 (ppm)
Sun
Temperature Anomaly (C)
CO2 Concentration (ppm)
0.6
0.4
0.2
0.0
-0.2
395
370
345
320
295
1960
1970
1980
1990
2000
2010

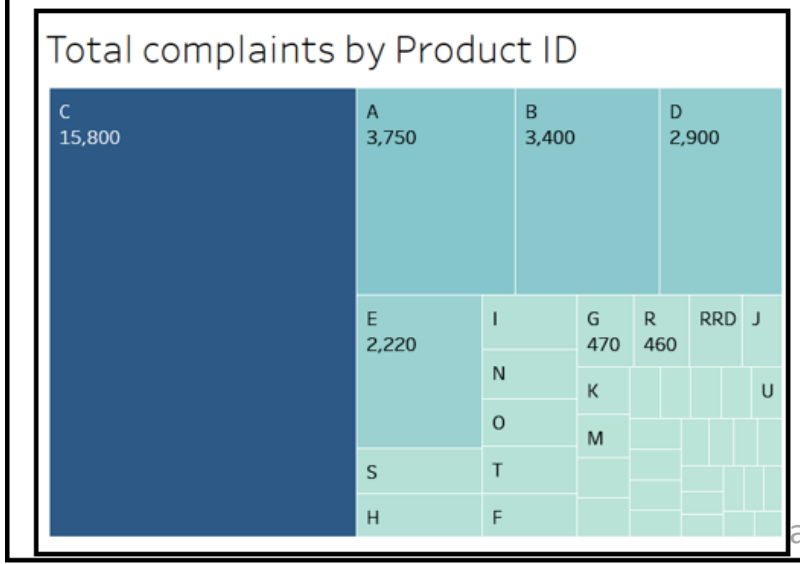

KNUCKLEBALL VELOCITY
R.A. DICKEY
77.3 MPH
75.3 MPH
2012
2013
BlackBerry
Keep Moving
BLUE JAYS

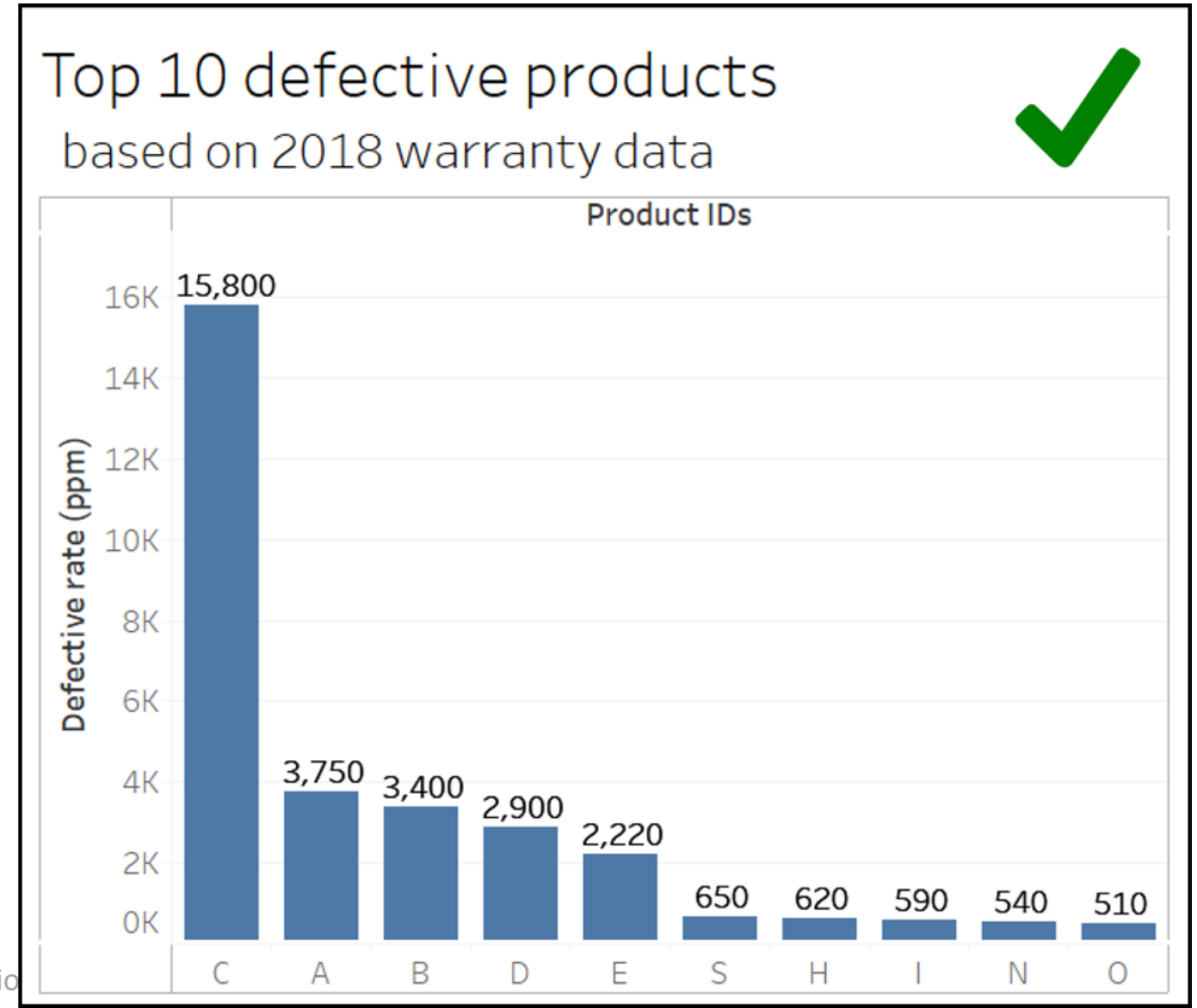
Comparison. Most effective visualization

- Many visual depictions may communicate the same data correctly
  - But some are more difficult to understand than others
    - Need more time/cognitive effort
- Always select the most effective ones
  - In terms of time, space, cognitive effort…

Comparison. Most effective visualization







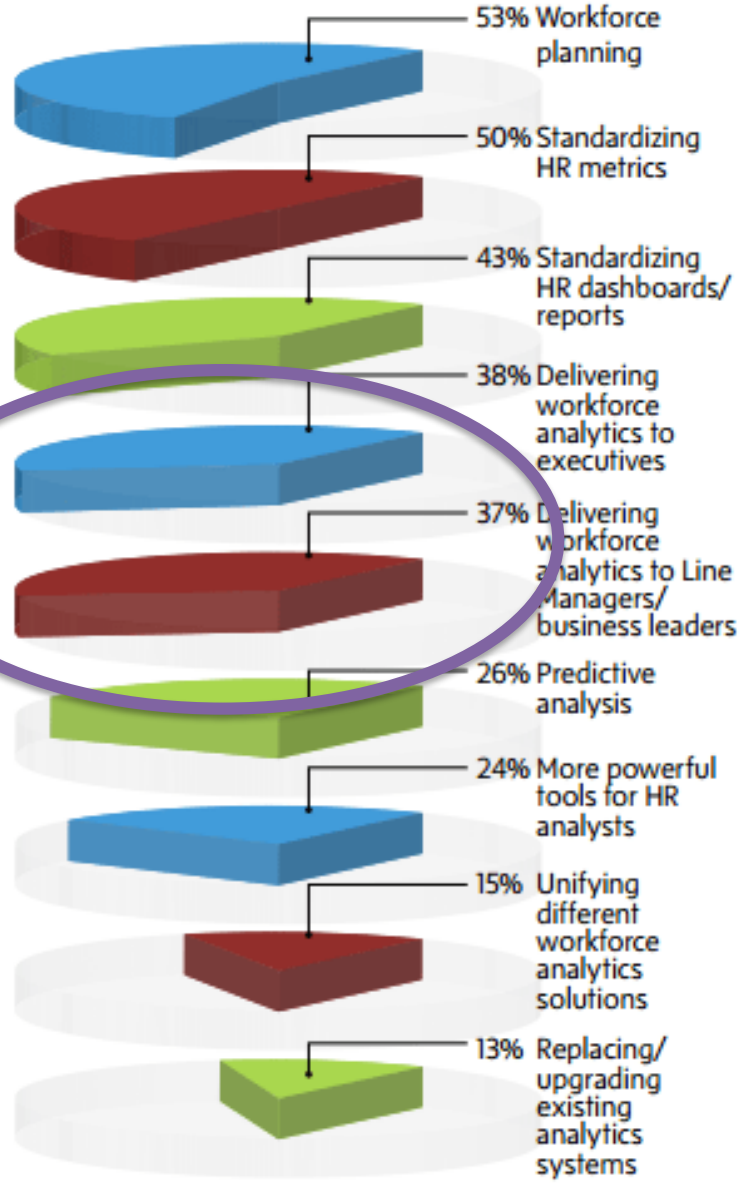
Comparison. Placement

- Place elements to facilitate comparison
  - Distances, positions…

Comparison. Placement

- Place elements to facilitate comparison
  - Distances, positions…

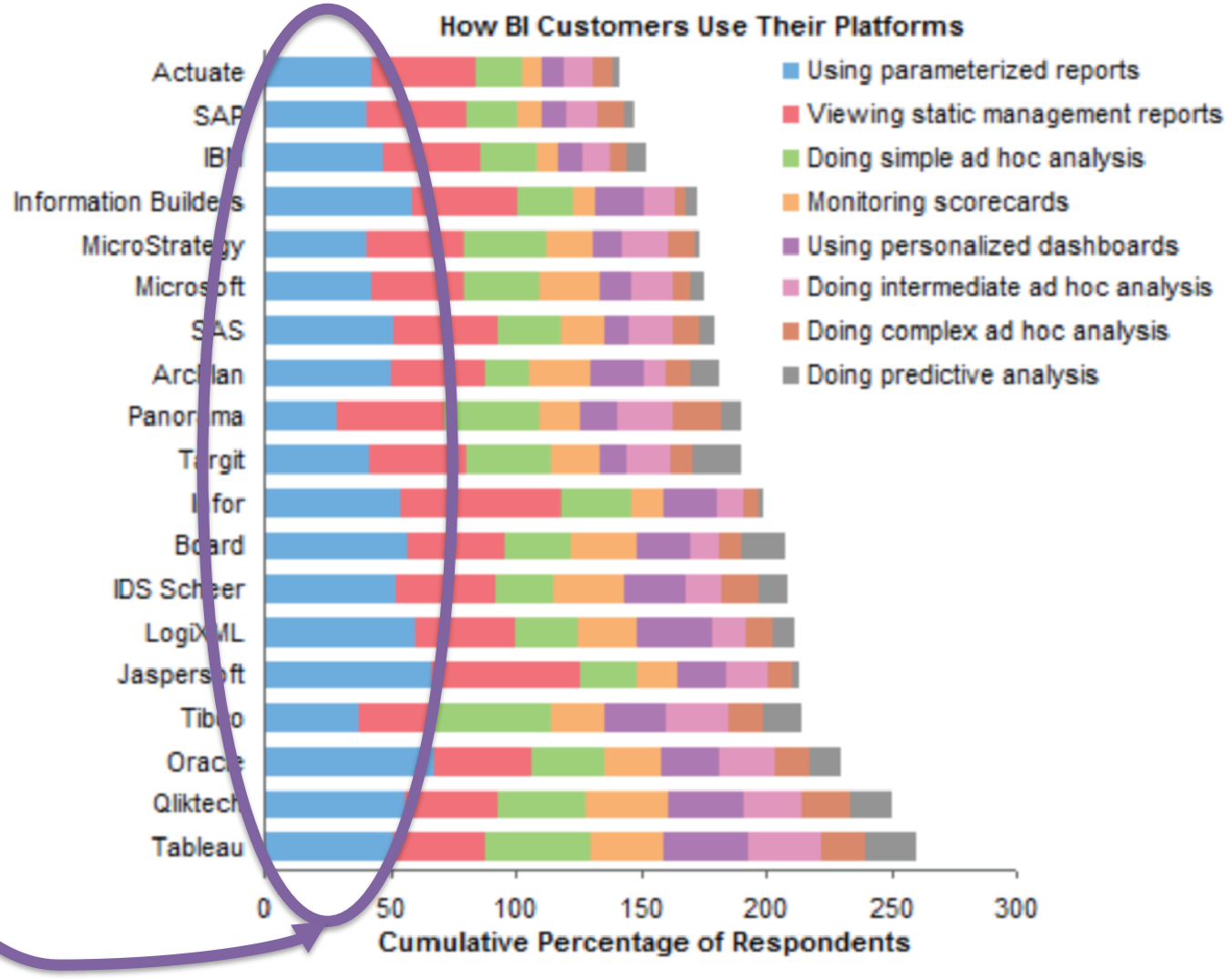
Relative sizes?



https://flowingdata.com/2013/08/07/piemaster/

Comparison. Placement

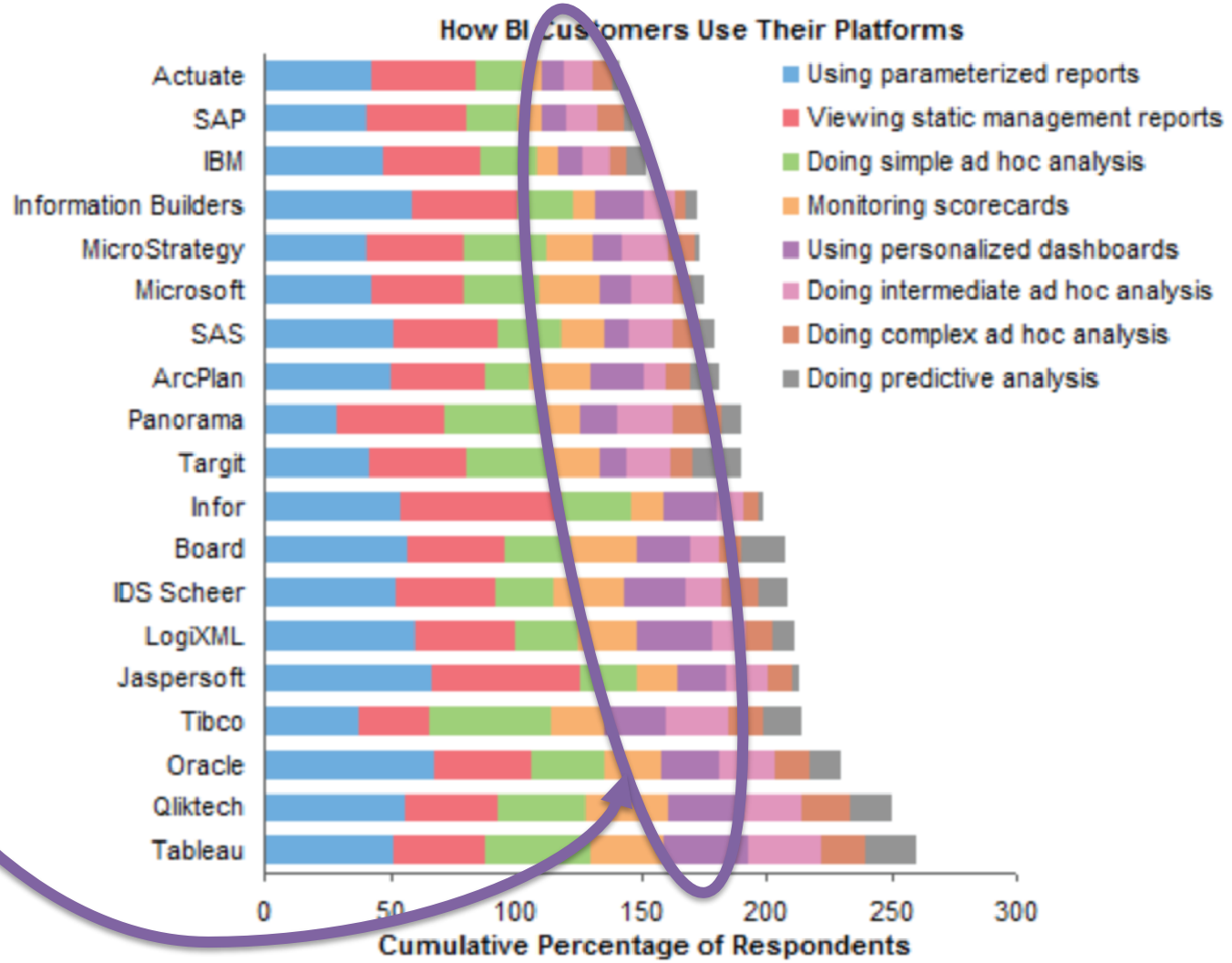
Smallest?



https://venngage.com/blog/how-to-choose-the-best-charts-for-your-infographic/

Comparison. Placement

Smallest?



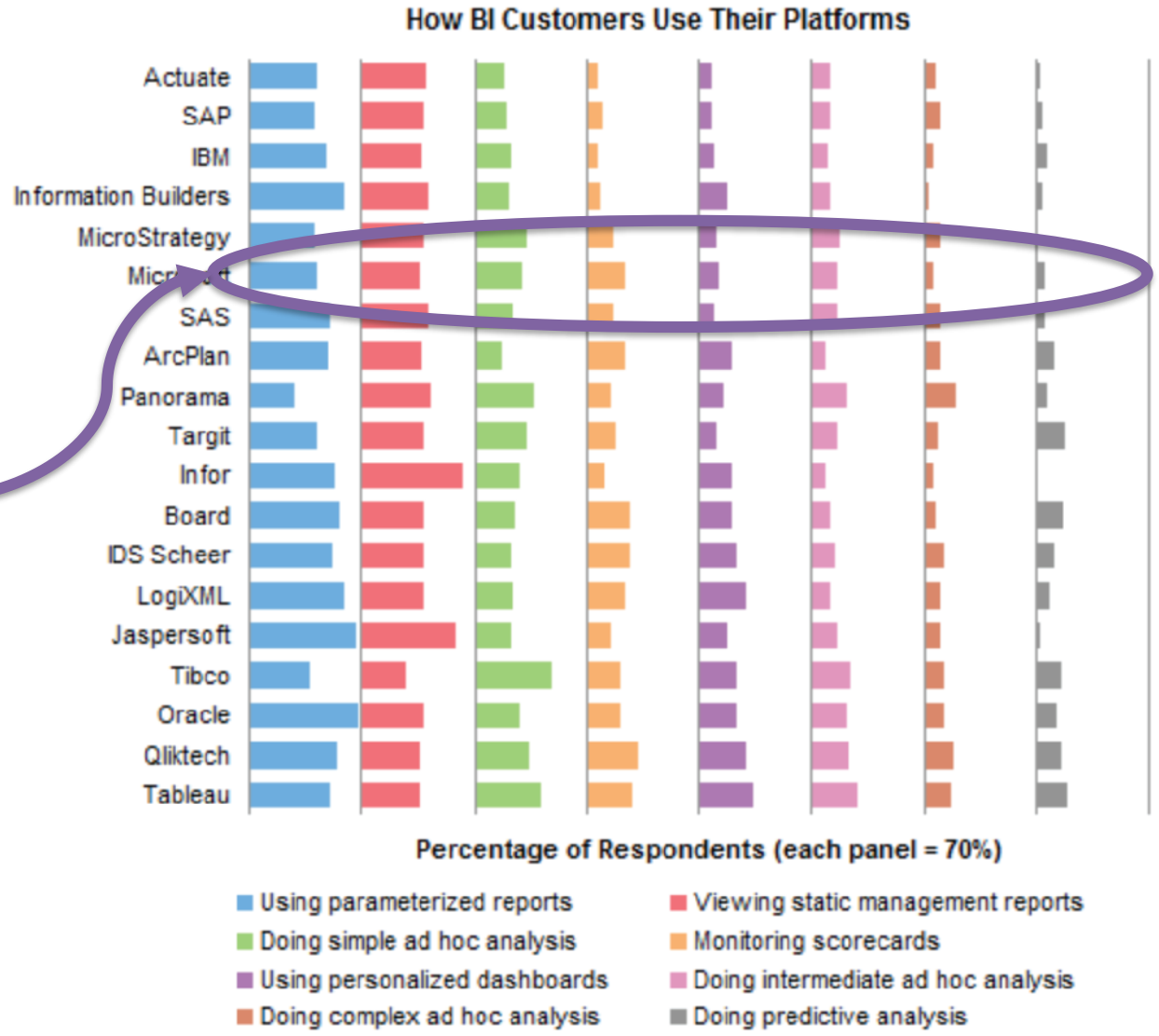
https://venngage.com/blog/how-to-choose-the-best-charts-for-your-infographic/

Comparison. Placement

Largest?

https://venngage.com/blog/how-to-choose-the-best-charts-for-your-infographic/

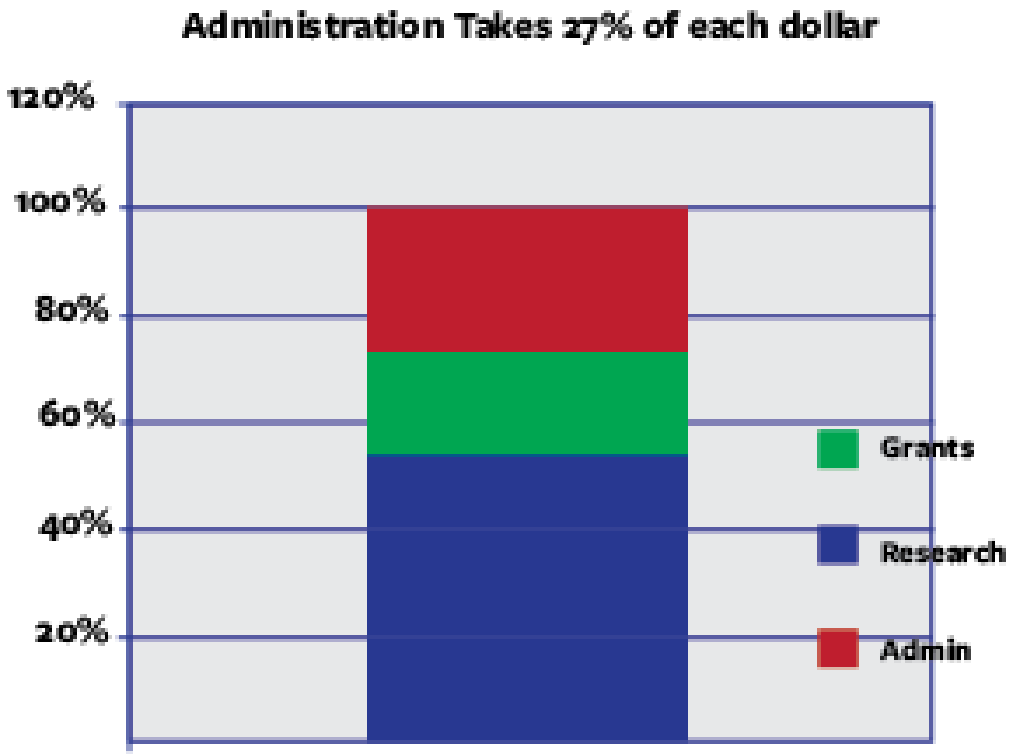
Comparison. Placement

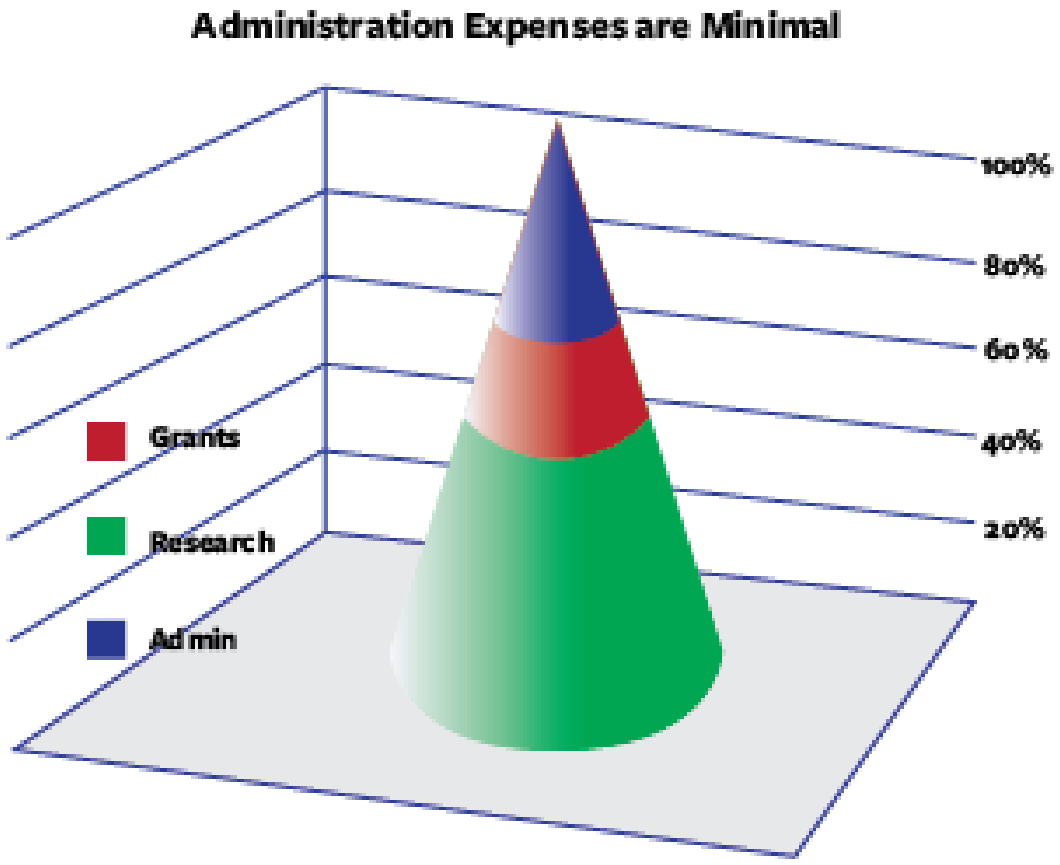


Largest?

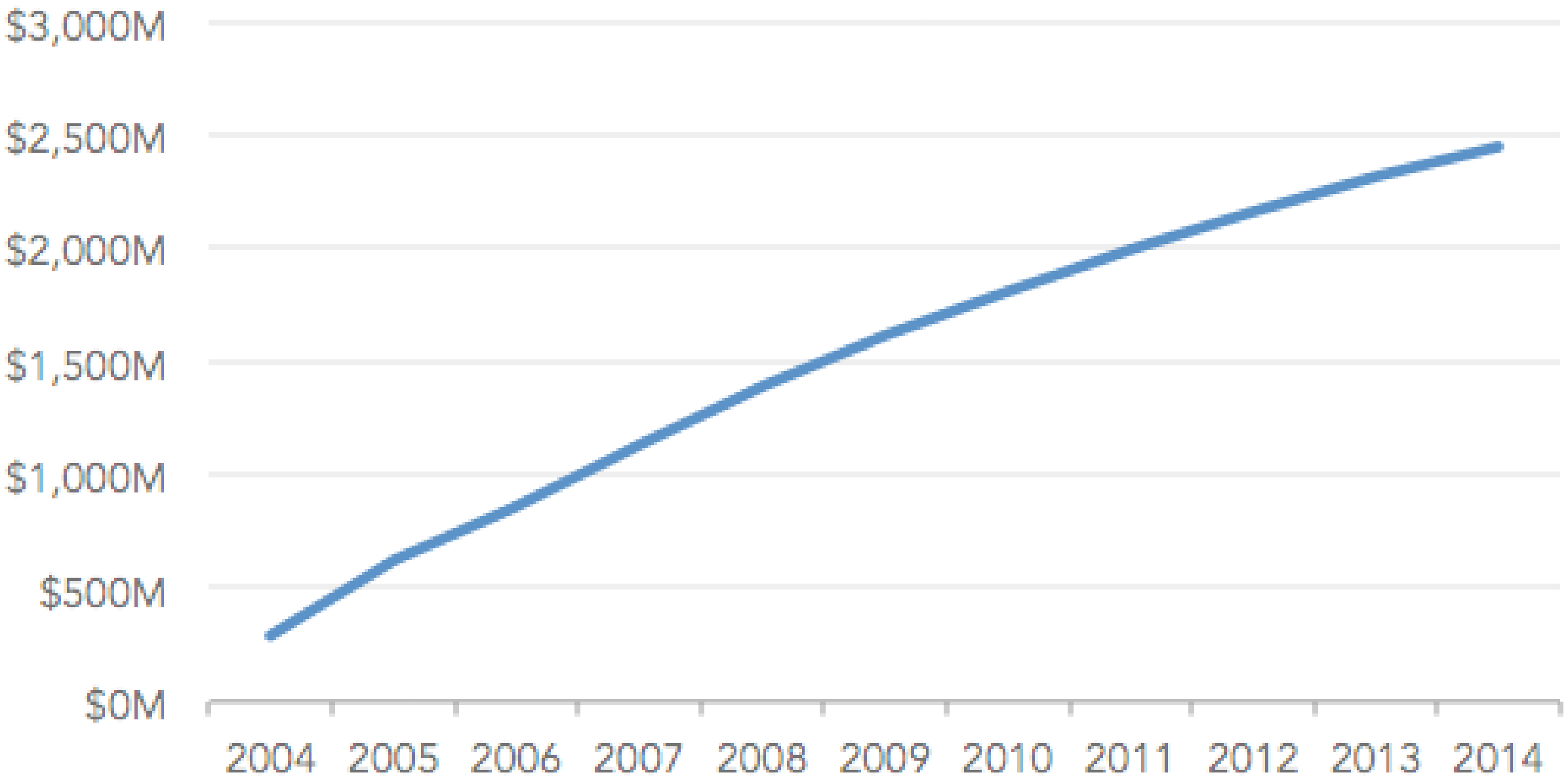
https://venngage.com/blog/how-to-choose-the-best-charts-for-your-infographic/

Comparison. Placement





Cumulative Annual Revenue

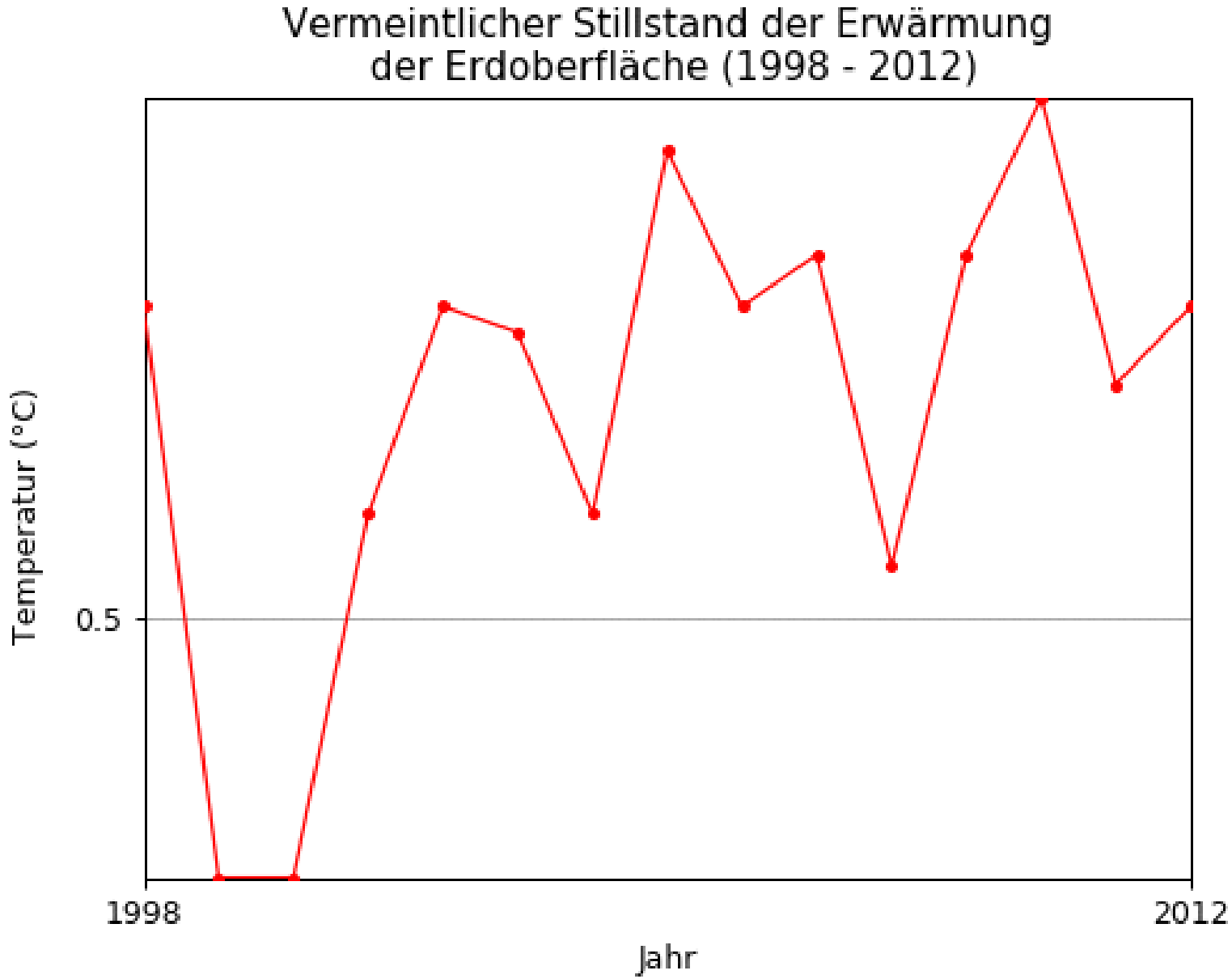


Annual Revenue

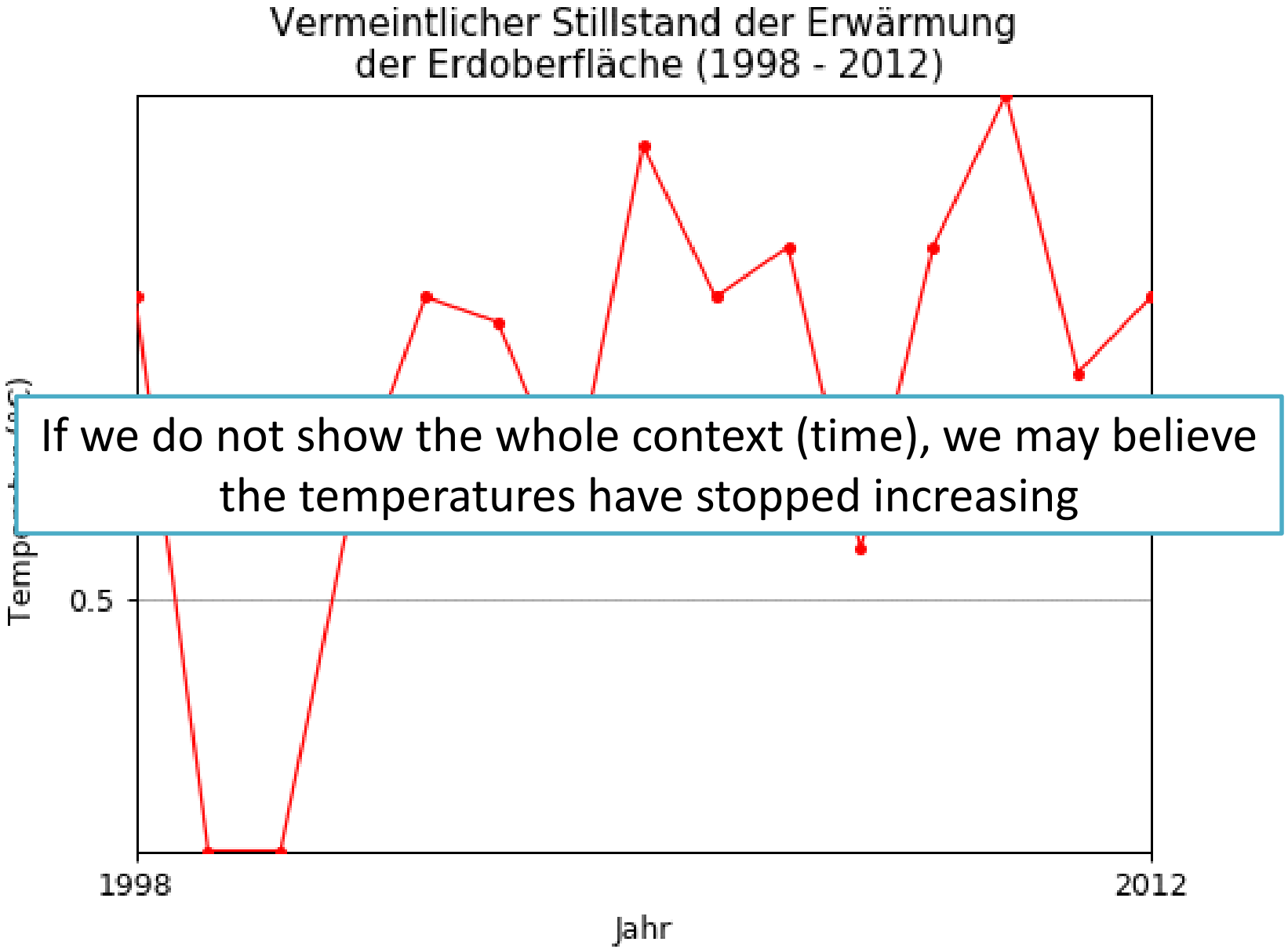
Comparison. Whole story

- Tell the whole story
  - Omitting data may be misleading
  - But extra data can also be misleading

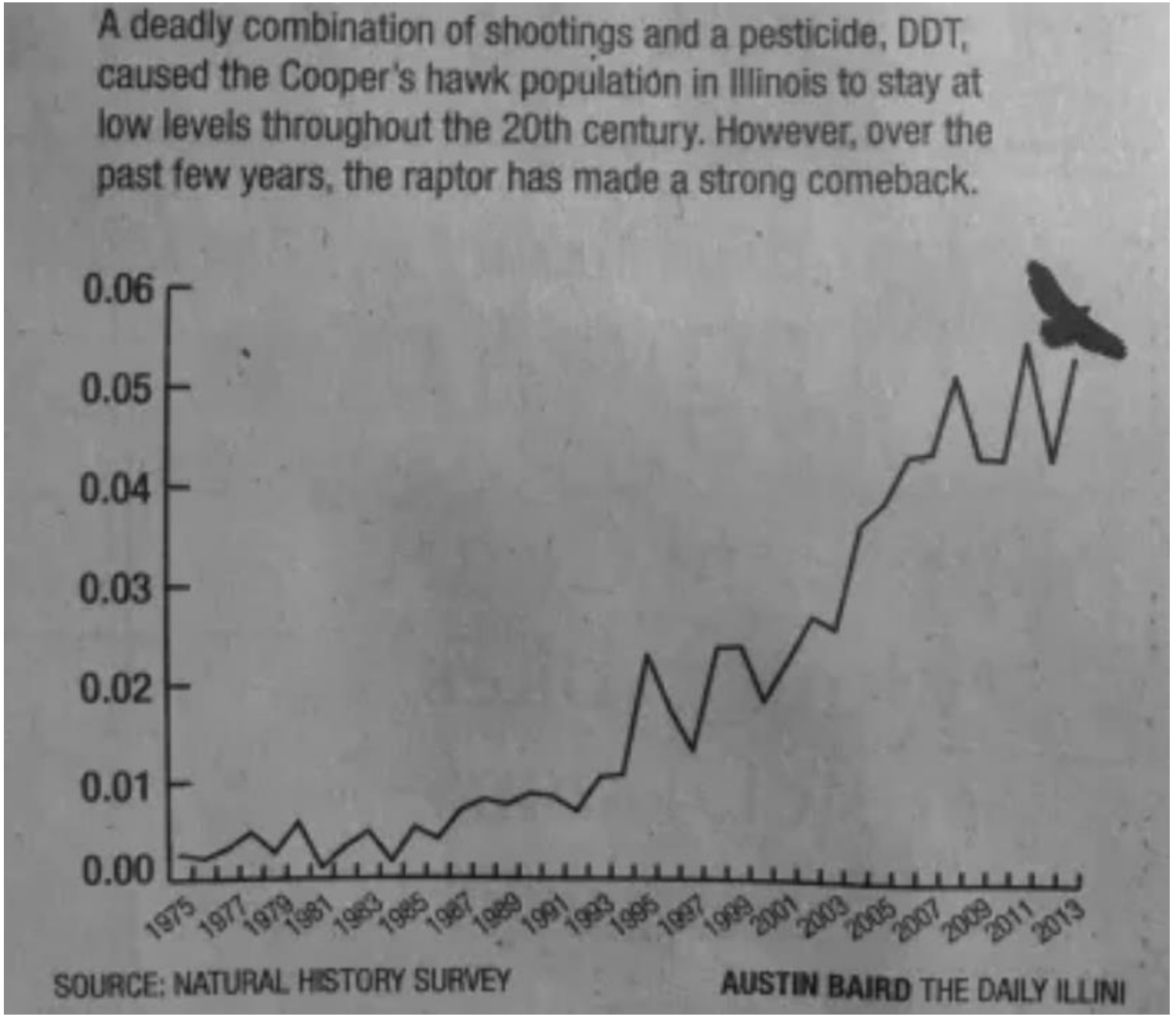
Comparison. Whole story



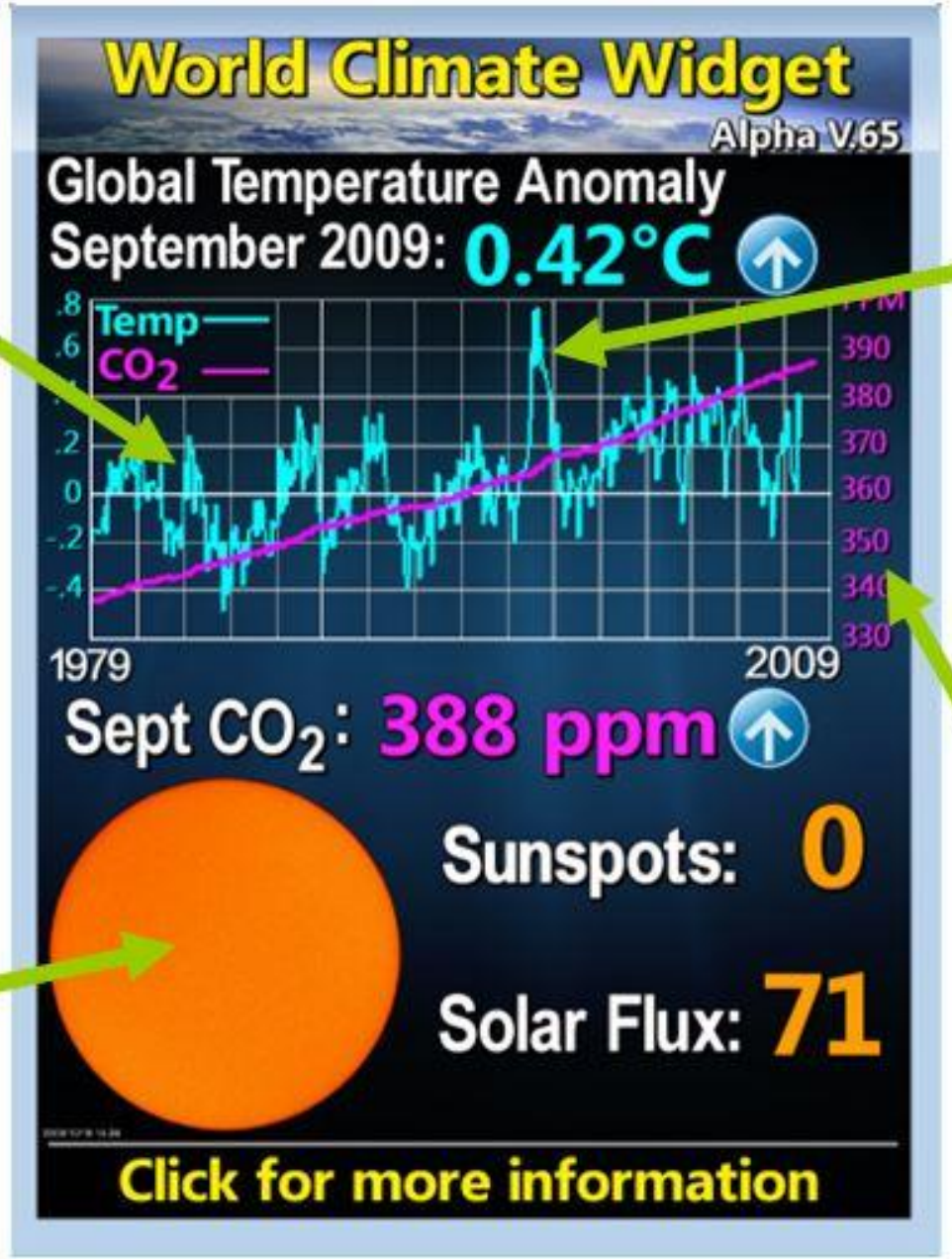
Comparison. Whole story



If we do not show the whole context (time), we may believe the temperatures have stopped increasing


A deadly combination of shootings and a pesticide, DDT, caused the Cooper's hawk population in Illinois to stay at low levels throughout the 20th century. However, over the past few years, the raptor has made a strong comeback.
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
SOURCE: NATURAL HISTORY SURVEY
AUSTIN BAIRD THE DAILY ILLINI

Ploy #1: Monthly data are shown. These show large variations due to the weather, so the trend looks relatively small.



Ploy #2: Shown is not the surface temperature but that from several km up in the troposphere. This shows larger variability, e.g. the El Niño peak of 1998 is twice as high as at the surface. This makes the climate trend look smaller.

Ploy #3: A scale is chosen where the CO_2 rise appears much too steep. 70 ppm corresponds to 1,4 °C; that is about two and a half times faster than the relation predicted by climate science.

Ploy #4: A snapshot of the sun and the daily sunspot number suggests an important role of the sun. Not shown is the time series of sunspot numbers which shows it has almost nothing to do with global temperature.

Outline

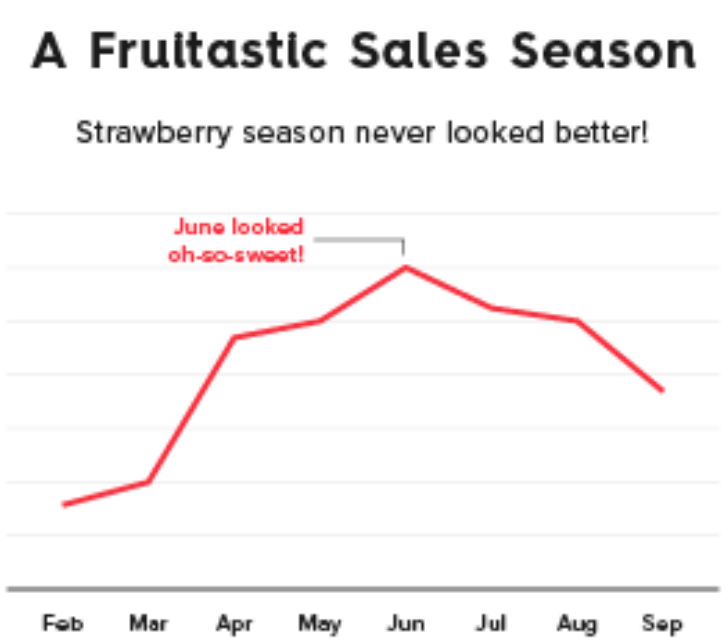
- *Effective Visualizations*
- *Use of color*
- *Comparison*
- **Copy & labels**
- Ordering & aligning data

Copy & labels

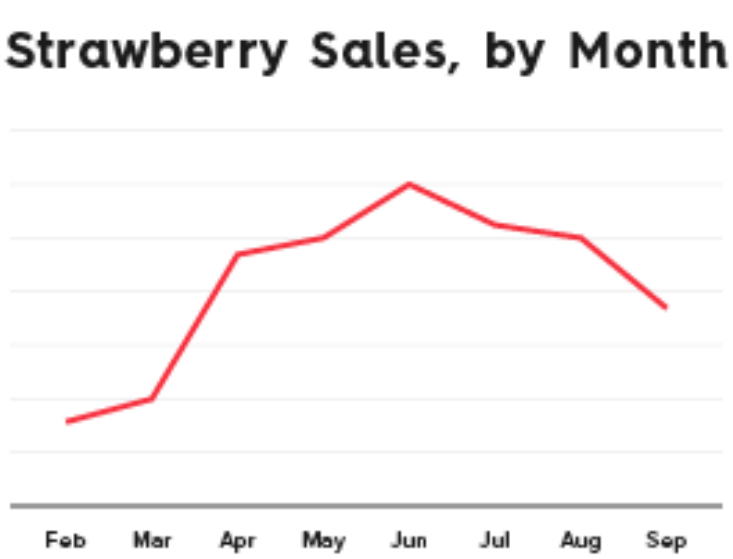
- Copy refers to the text font, size, color…
  - We can use font changes to emphasize information, headings, etc.
- Some tips:
  - Use only the minimum amount of text
    - Don’t over explain
  - Keep headers simple
  - Use contrast effectively
  - Don’t use distracting fonts/elements

Copy & labels. Minimum amount of text

INCORRECT

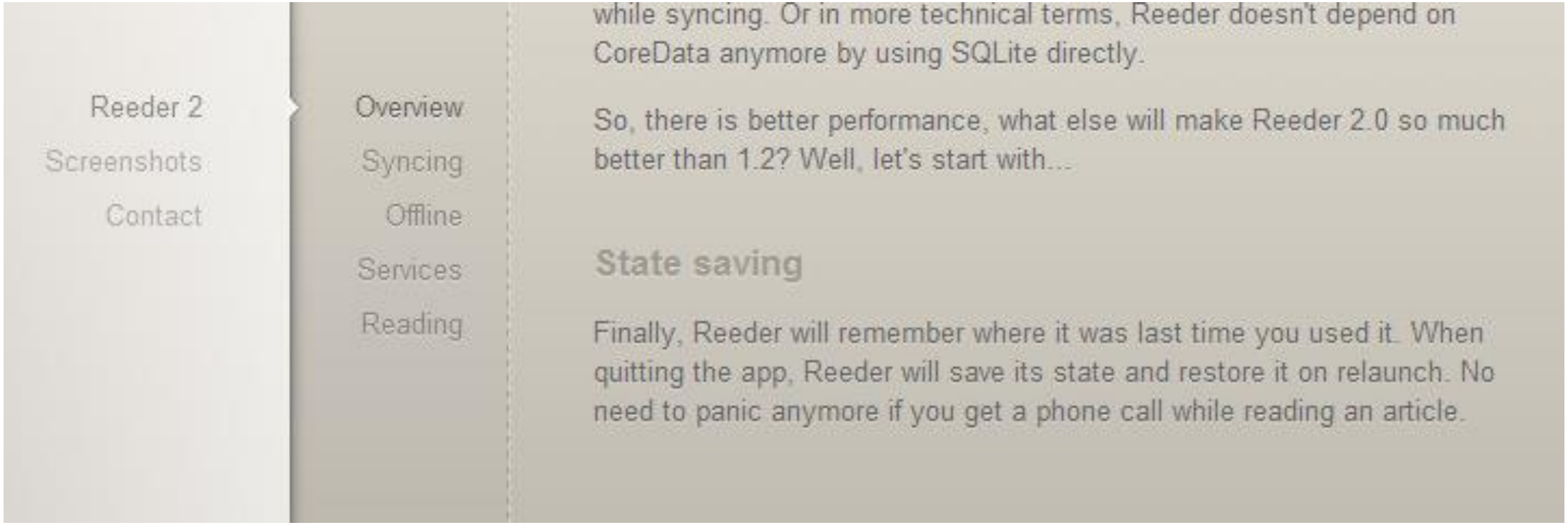


CORRECT



Copy & labels. Contrast

- Use contrast effectively



Copy & labels. Contrast

- Problems with contrast
  - Elderly users with bad vision
  - Low quality monitors
  - Bad lighting conditions and glare
  - Reading on tiny screens

Copy & labels. Contrast

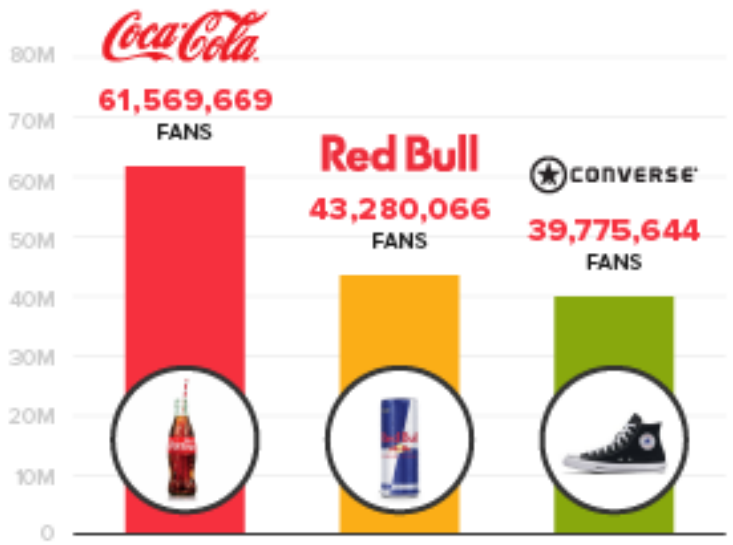
- Reading on a computer screen is harder than reading printed material (e.g. https://www.nngroup.com/articles/how-little-do-users-read/)
  - Reading time is lower when there is high contrast between text and background
  - Mobile is worse (e.g. https://www.nngroup.com/articles/mobile-content/)

Copy & labels

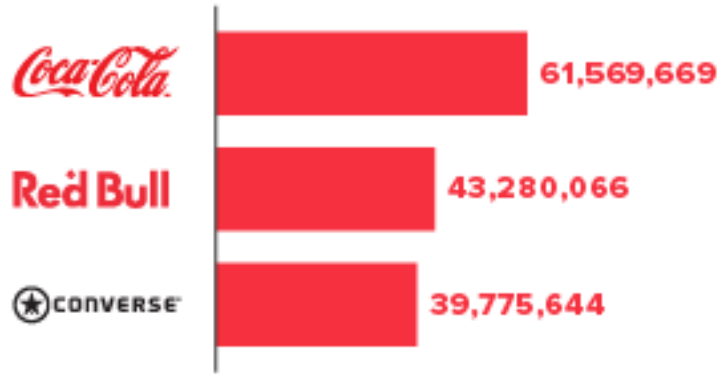
- Labels: Text that identifies elements
- Some tips:
  - Ensure that everything is labeled
  - Ensure labels are visible
  - Label the lines directly
  - Don’t over label

Copy & labels. Don’t over label

INCORRECT



CORRECT



Outline

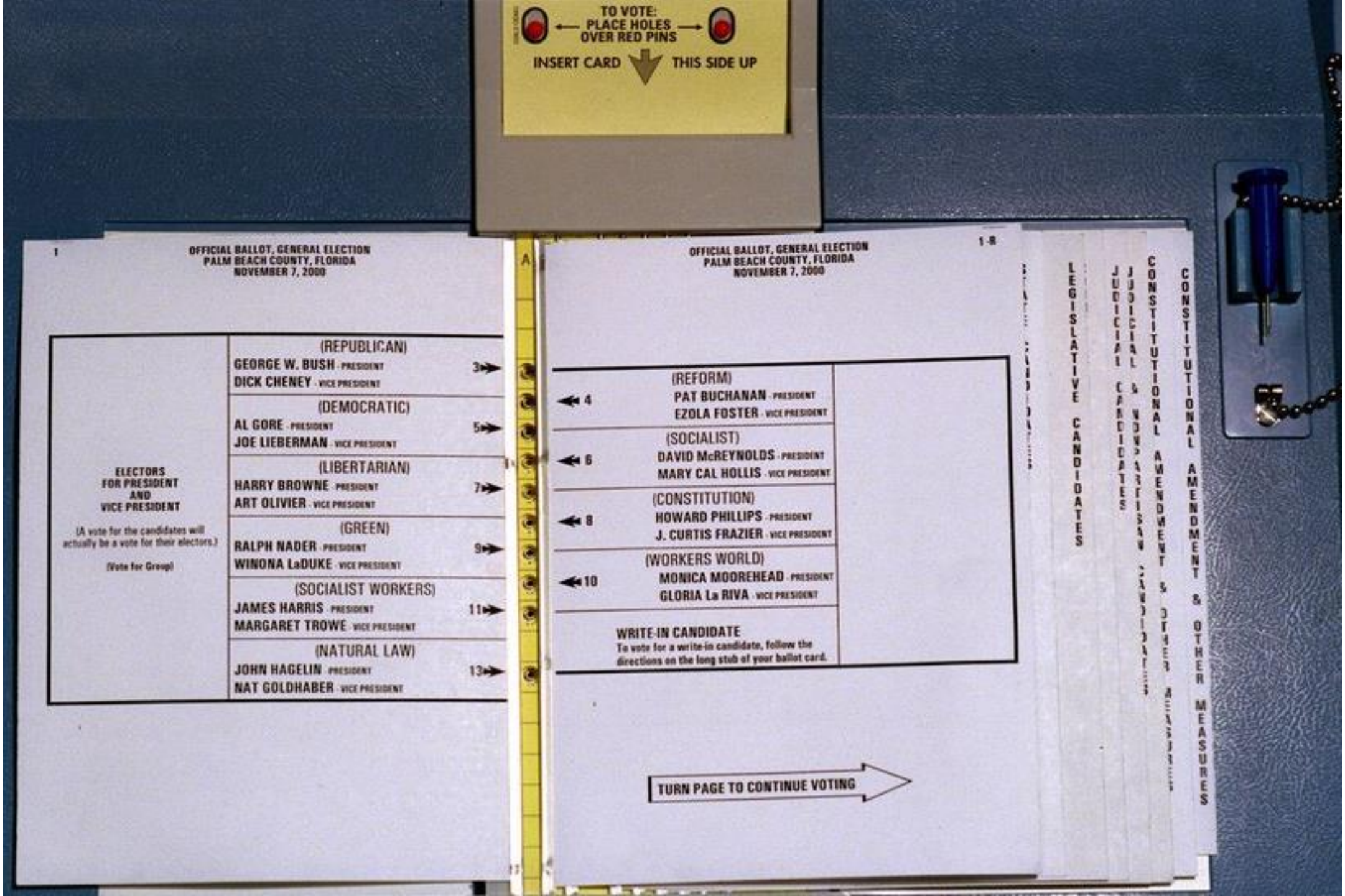
- *Effective Visualizations*
- *Use of color*
- *Comparison*
- *Copy & labels*
- **Ordering & aligning data**

Ordering data

- LATCH principle. Information organized according to:
  - Location: Information comes from different places (e.g. geographically)
  - Alphabet: Usually for large amounts of data
  - Time: Events with fixed durations
  - Category: To classify goods/elements of similar importance
  - Hierarchy: By magnitude, order of importance

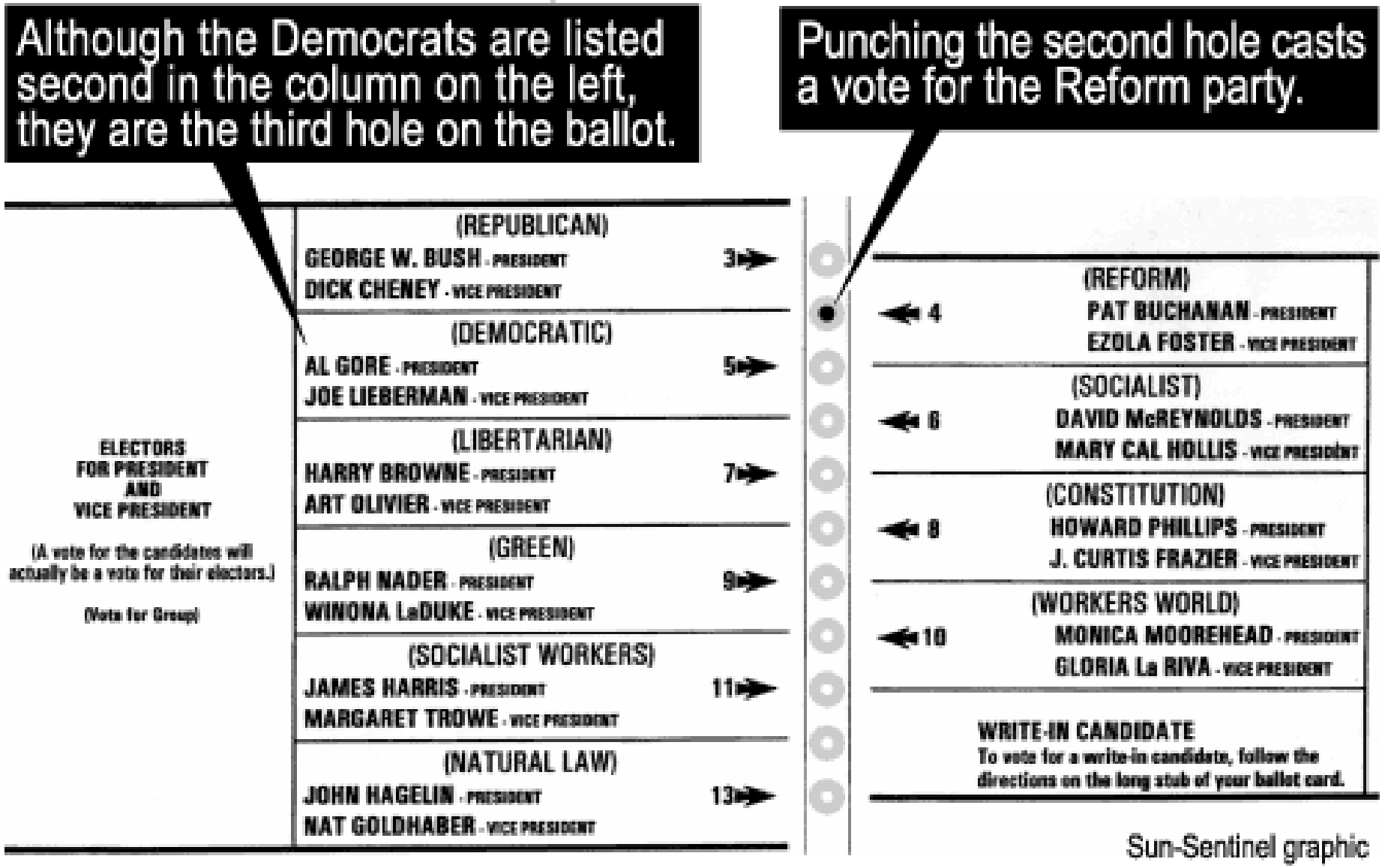
Aligning data

- Correct alignment
  - Elements must be aligned, this creates a sense of unity and cohesion, as well as facilitates reading
  - Incorrect alignment can lead to dramatic consequences…


TO VOTE:
PLACE HOLES
OVER RED PINS
INSERT CARD
THIS SIDE UP
1
OFFICIAL BALLOT, GENERAL ELECTION
PALM BEACH COUNTY, FLORIDA
NOVEMBER 7, 2000
ELECTORS
FOR PRESIDENT
AND
VICE PRESIDENT
(A vote for the candidates will actually be a vote for their electors.)
(Vote for Group)
(REPUBLICAN)
GEORGE W. BUSH - PRESIDENT
DICK CHENEY - VICE PRESIDENT
3
(DEMOCRATIC)
AL GORE - PRESIDENT
JOE LIEBERMAN - VICE PRESIDENT
5
(LIBERTARIAN)
HARRY BROWNE - PRESIDENT
ART OLIVIER - VICE PRESIDENT
7
(GREEN)
RALPH NADER - PRESIDENT
WINONA LaDUKE - VICE PRESIDENT
9
(SOCIALIST WORKERS)
JAMES HARRIS - PRESIDENT
MARGARET TROWE - VICE PRESIDENT
11
(NATURAL LAW)
JOHN HAGELIN - PRESIDENT
NAT GOLDHABER - VICE PRESIDENT
13
OFFICIAL BALLOT, GENERAL ELECTION
PALM BEACH COUNTY, FLORIDA
NOVEMBER 7, 2000
1-B
(REFORM)
4
PAT BUCHANAN - PRESIDENT
EZOLA FOSTER - VICE PRESIDENT
(SOCIALIST)
6
DAVID McREYNOLDS - PRESIDENT
MARY CAL HOLLIS - VICE PRESIDENT
(CONSTITUTION)
8
HOWARD PHILLIPS - PRESIDENT
J. CURTIS FRAZIER - VICE PRESIDENT
(WORKERS WORLD)
10
MONICA MOOREHEAD - PRESIDENT
GLORIA La RIVA - VICE PRESIDENT
WRITE-IN CANDIDATE
To vote for a write-in candidate, follow the directions on the long stub of your ballot card.
TURN PAGE TO CONTINUE VOTING
LEGISLATIVE CANDIDATES
JUDICIAL CANDIDATES
CONSTITUTIONAL AMENDMENT & OTHER MEASURES

Confusion at Palm Beach County polls

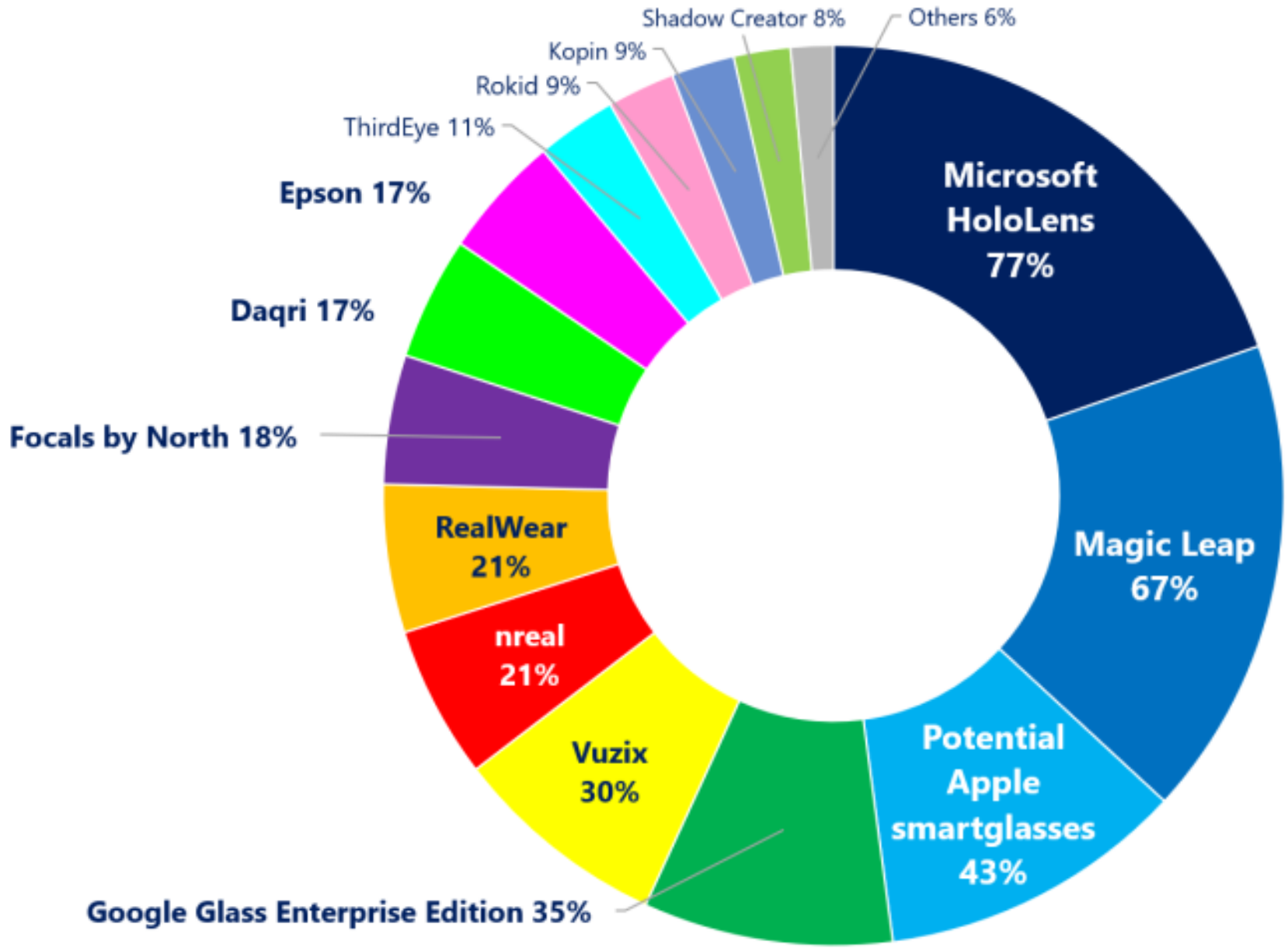
Some Al Gore supporters may have mistakenly voted for Pat Buchanan because of the ballot's design.



Sun-Sentinel graphic

Bonus charts

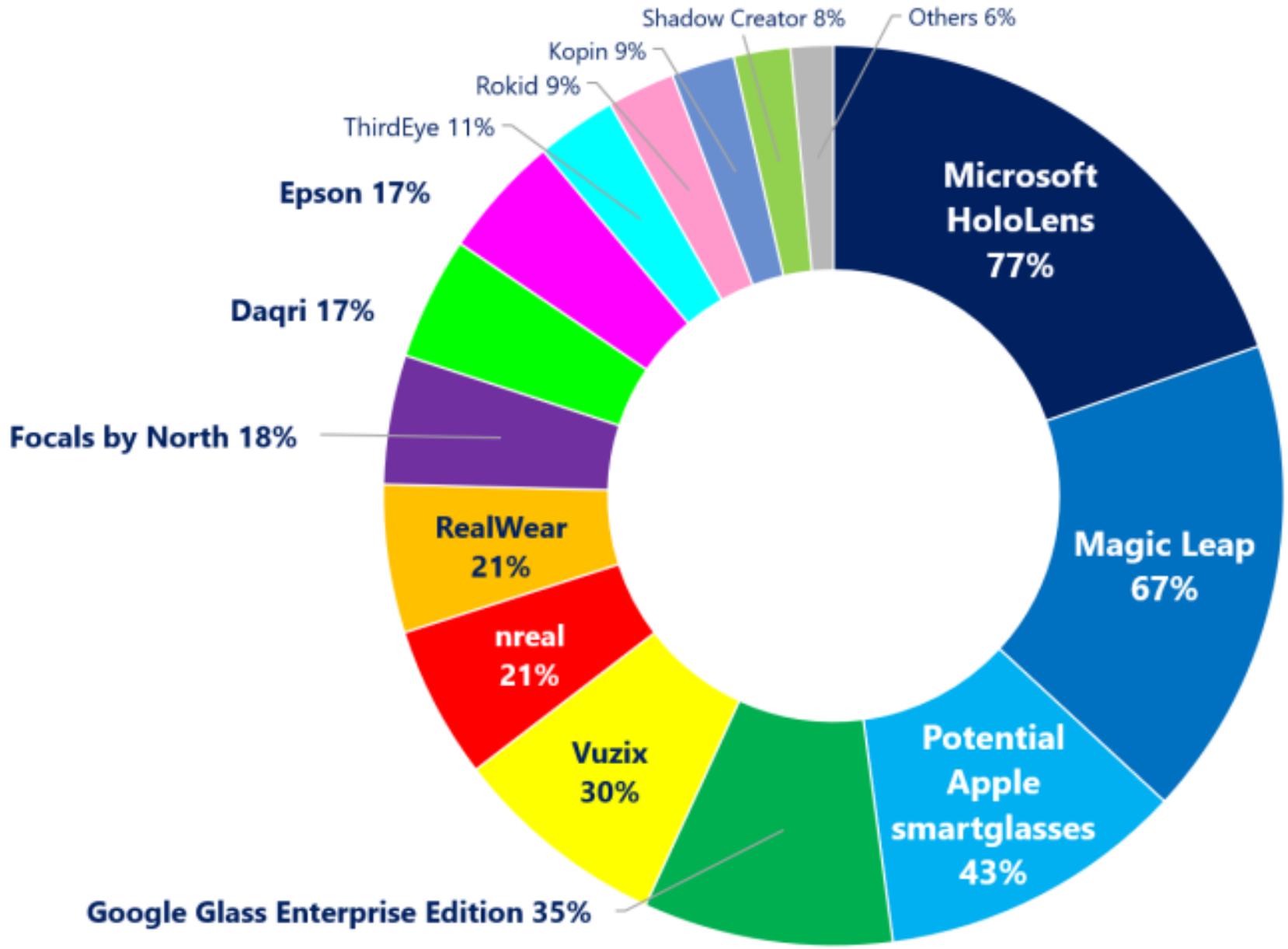
Industry smartglasses platform focus



Digi-Capital

Notes: Percentages not cumulative, "Others" include DreamGlass, EverySight, Glassear, IMMY, Iristick, Lenovo, Letinar, Lumus, Optinvent, Realmax, Snap Spectacles, Tilt Five

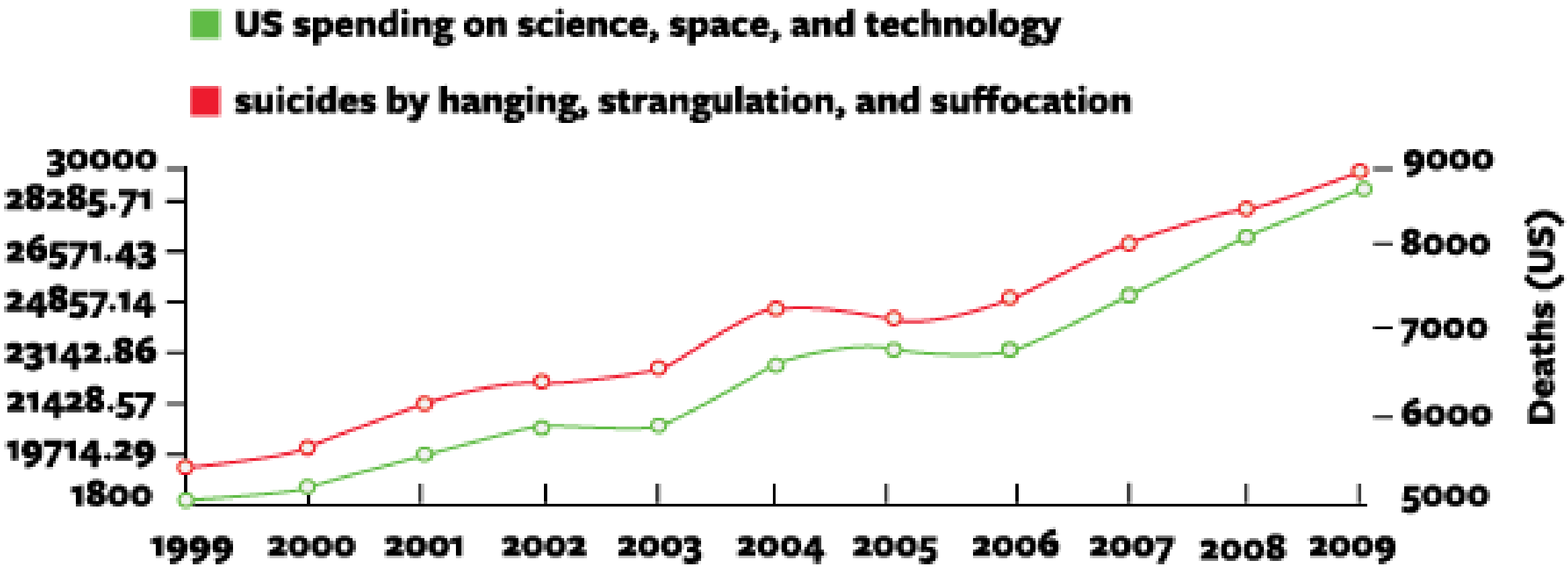
Industry smartglasses platform focus

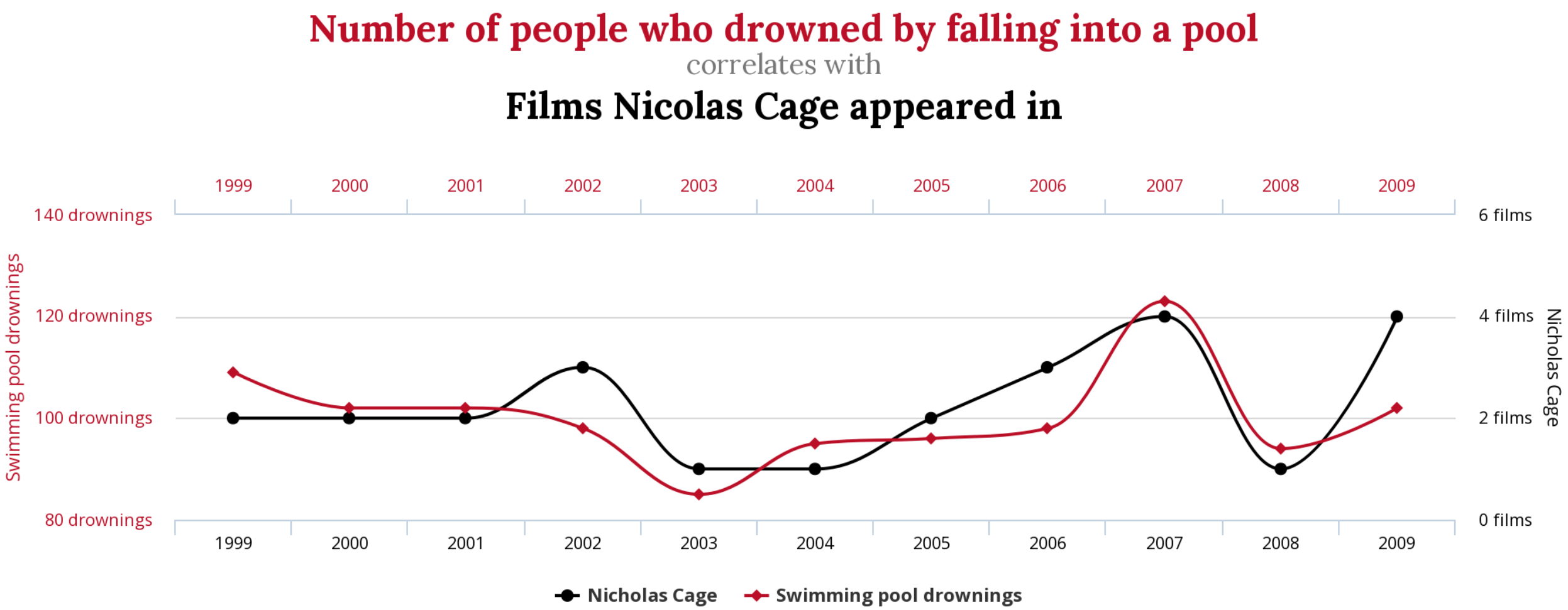


389% total in this pi
chart?!?
Digi-Capital is asking
people to pay $1500
for this report!

Digi-Capital

Notes: Percentages not cumulative, "Others" include DreamGlass, EverySight, Glassear, IMMY, Iristick, Lenovo, Letinar, Lumus, Optinvent, Realmax, Snap Spectacles, Tilt Five

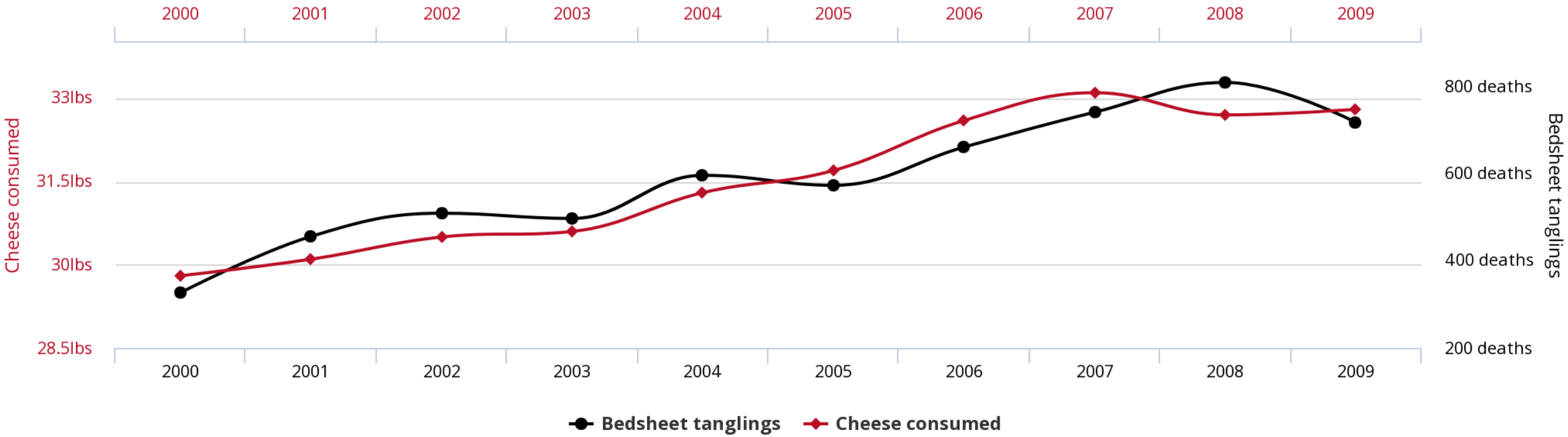

US spending on science, space, and technology
suicides by hanging, strangulation, and suffocation
30000
28285.71
26571.43
24857.14
23142.86
21428.57
19714.29
1800
9000
8000
7000
6000
5000
Deaths (US)
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009


Number of people who drowned by falling into a pool
correlates with
Films Nicolas Cage appeared in
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
140 drownings
120 drownings
100 drownings
80 drownings
Swimming pool drownings
6 films
4 films
2 films
0 films
Nicholas Cage
Nicholas Cage
Swimming pool drownings
tylervigen.com

Per capita cheese consumption

correlates with

Number of people who died by becoming tangled in their bedsheets

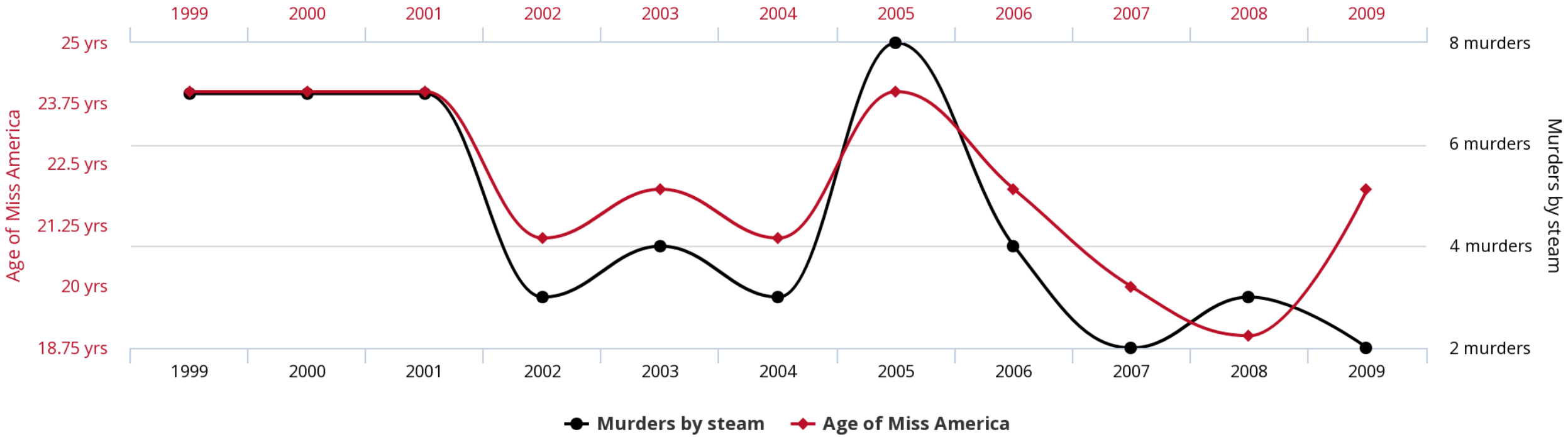


tylervigen.com

Age of Miss America

correlates with

Murders by steam, hot vapours and hot objects

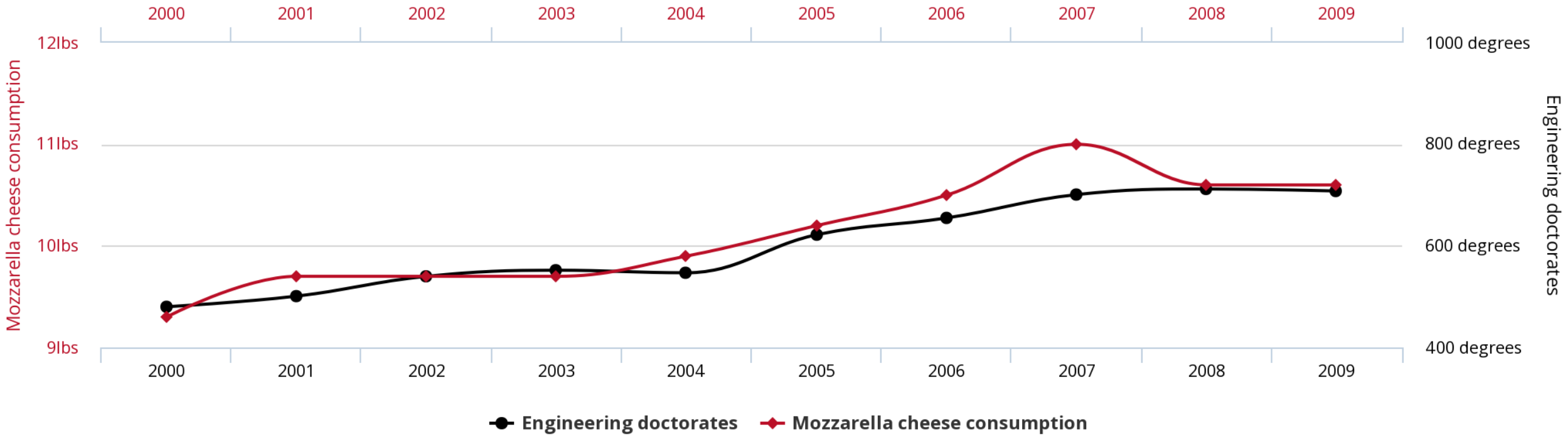


tylervigen.com

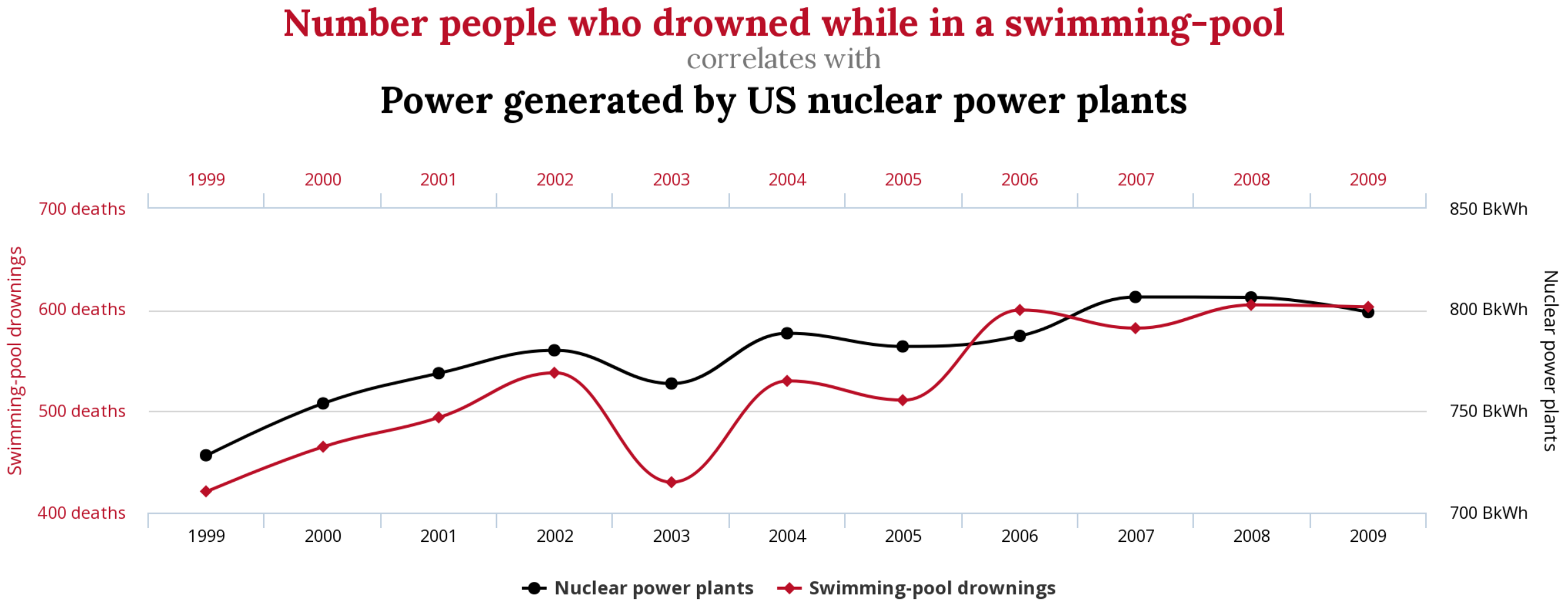
Per capita consumption of mozzarella cheese

correlates with

Civil engineering doctorates awarded



tylervigen.com


Number people who drowned while in a swimming-pool
correlates with
Power generated by US nuclear power plants
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
700 deaths
600 deaths
500 deaths
400 deaths
Swimming-pool drownings
850 BkWh
800 BkWh
750 BkWh
700 BkWh
Nuclear power plants
Nuclear power plants
Swimming-pool drownings
tylervigen.com

Sources of information

- Information take from slides/webpages/books by: Martin Krzywinski, colorbrewer2.org, towardsdatascience.com, E. Tufte…

Designing Effective Visualizations

Pere-Pau Vázquez – Dept. Computer Science – UPC