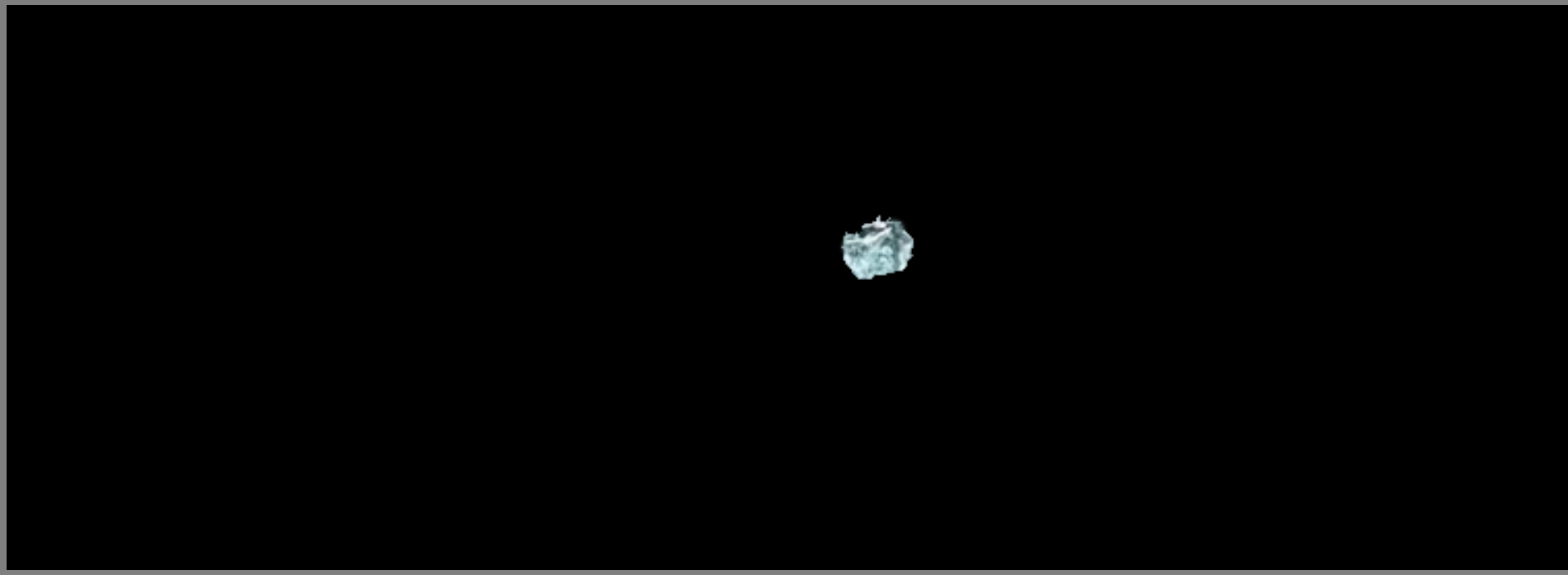
Data Visualization

Andreas Paepcke

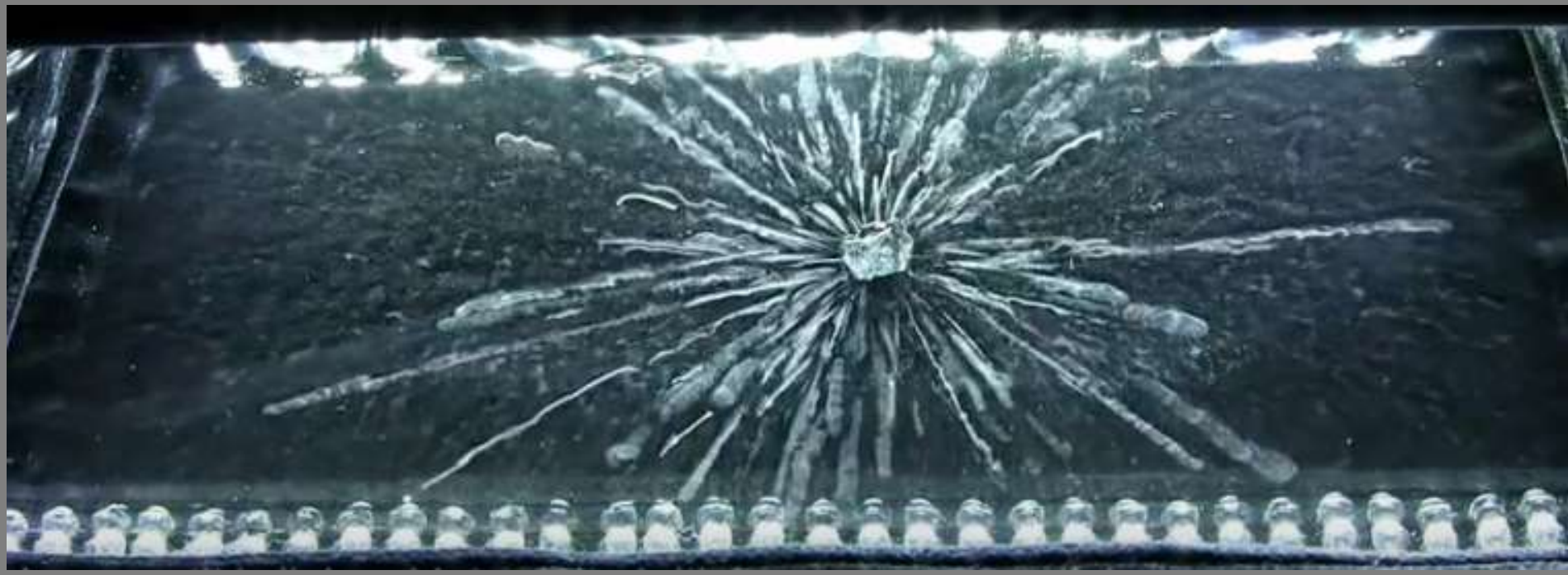
Roadmap

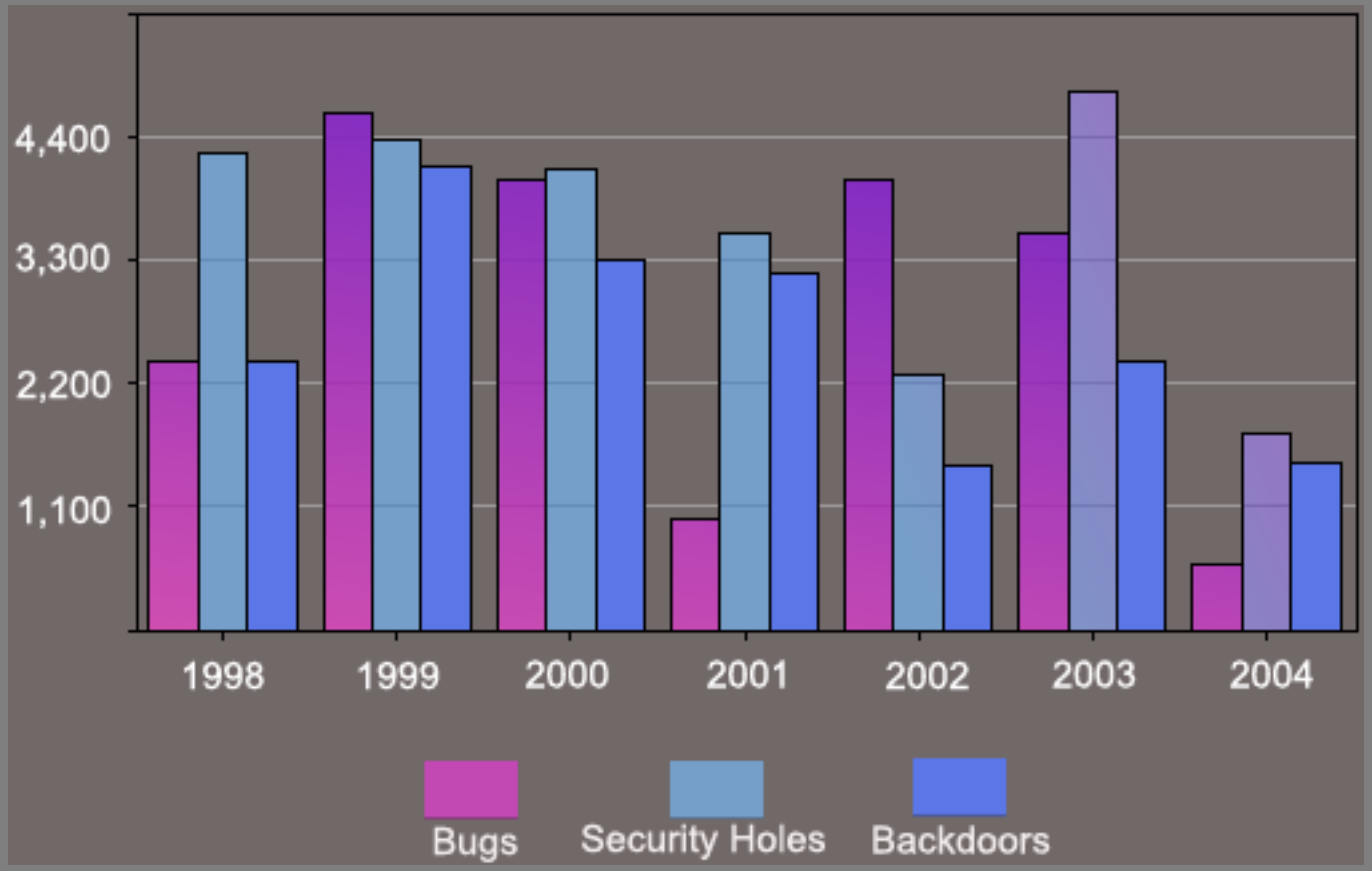
- Purpose of visualization
- Exercise
- History
- Scale types and their viz
- Multidimensional data
- Animation
- What to avoid; deception
- Exercise

A Piece of Rock



A Piece of Rock in Visualization Device




4,400
3,300
2,200
1,100
1998
1999
2000
2001
2002
2003
2004
Bugs
Security Holes
Backdoors

Reasons for visualizing?

Why Visualize?

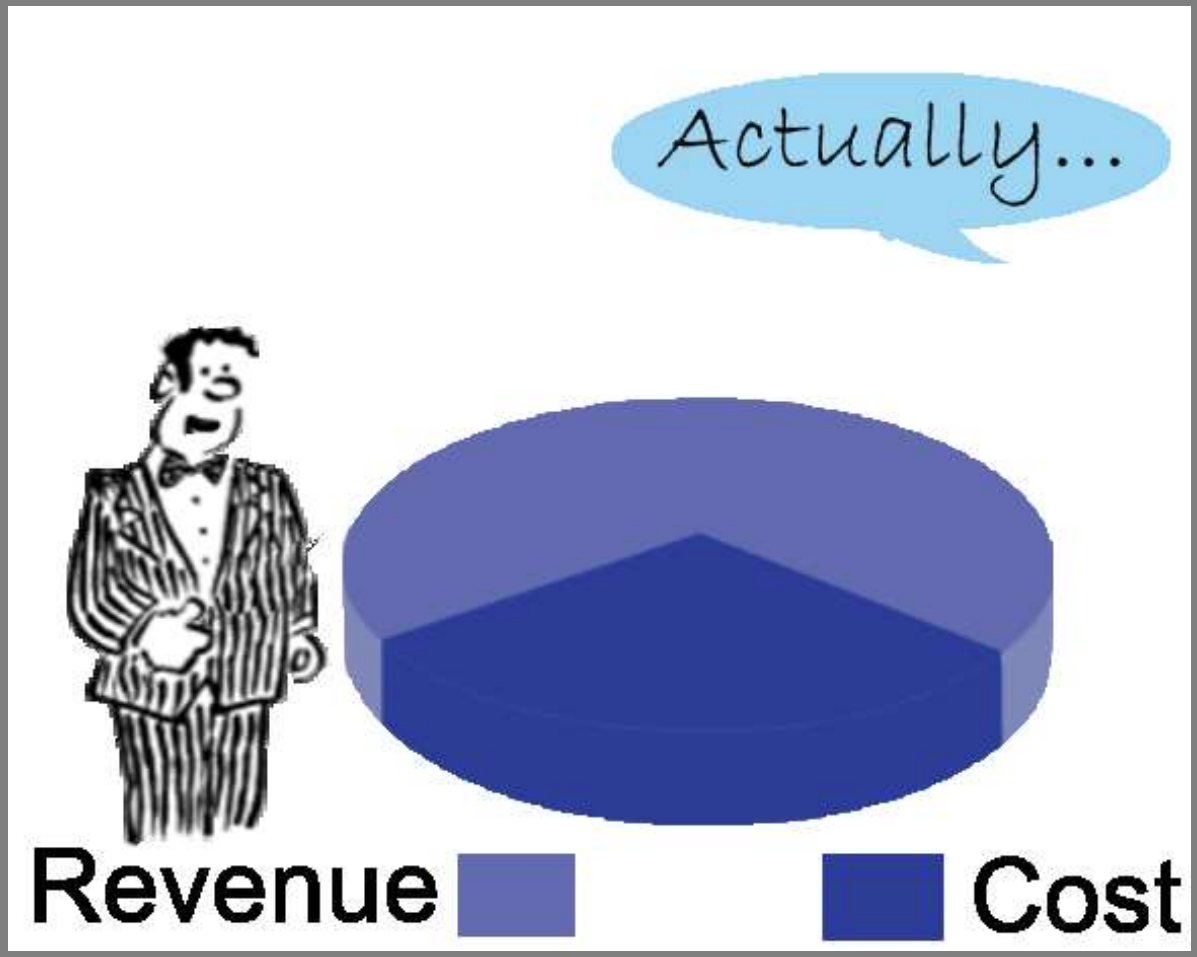
Explanation

Why Visualize?

Convince

Why Visualize?

Deceive



Why Visualize?

Discover

Wait for it…

a few slides on…

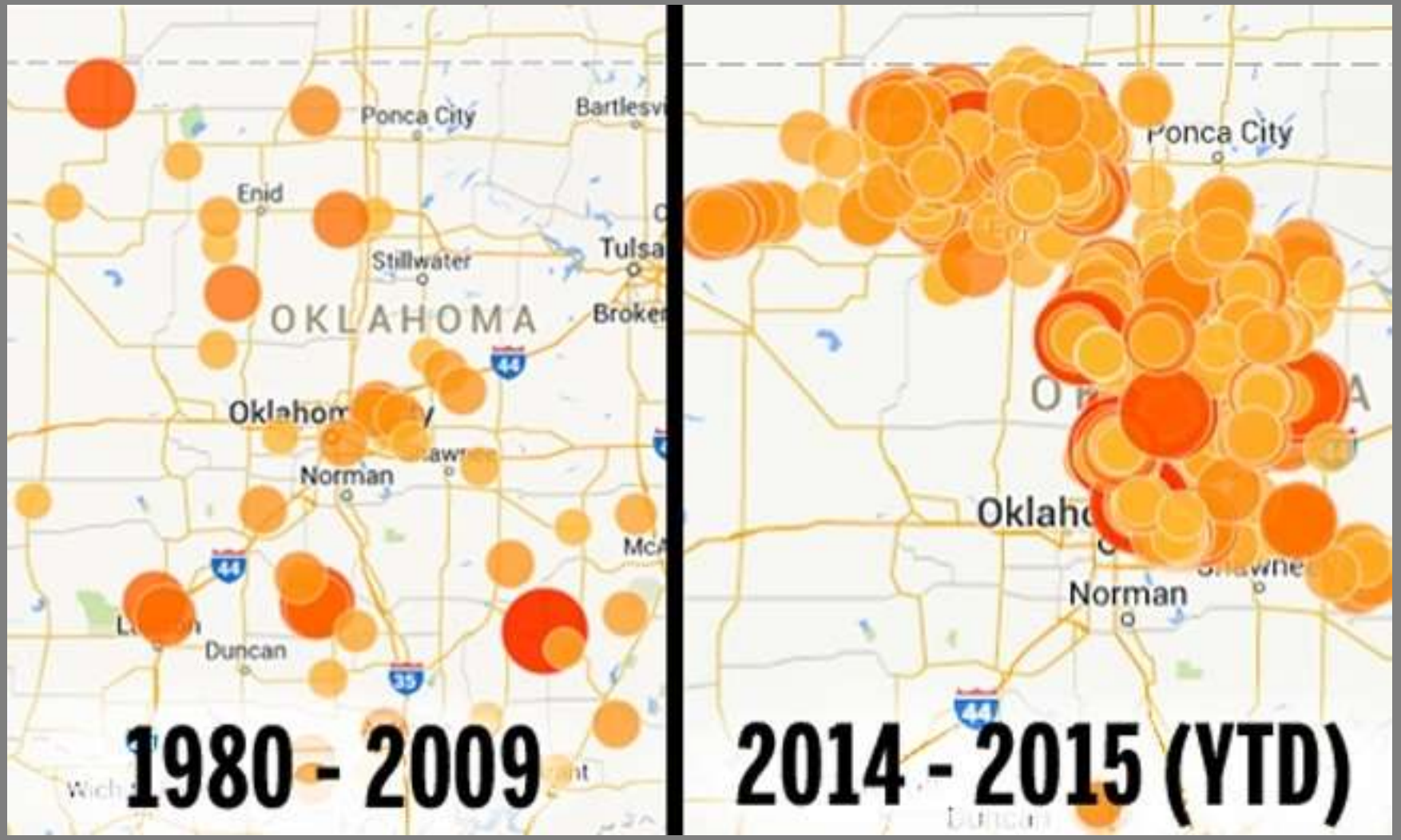
Why Visualize?

Art

Slide cursor to bottom of black rectangle

Data to Music

2005 – June 2015


Ponca City
Enid
Stillwater
OKLAHOMA
Norman
Duncan
1980 - 2009
Ponca City
Norman
2014 - 2015 (YTD)

Exercise: Evidence of Alzheimer's

Novel	Age	Distinct Words	Repeated phrases	Indefinite Words (%)
Styles	28	5027	7623	0.27
Adversary	32	5576	7320	0.39
Ackroyd	34	4833	7905	0.48
Orient	43	4692	8184	0.3
Appointment	47	4985	8071	0.39
Curtain	50	5131	7846	0.43
Towards Zero	51	4941	7680	0.5
Announced	59	5181	7596	0.45
Destination	63	5442	7426	0.36
Ordeal	67	4440	8221	0.58
Clocks	72	4827	8014	0.61
Endless	76	4159	8559	0.78
Frankfurt*	79	5583	7418	0.71
Nemesis	80	4631	8103	0.66
Elephants	81	3762	8821	1.02
Postern	82	4275	8249	1.23

Analysis of Agatha Christie novels

Repeated phrases:

"That sort of thing"

"All things considered"

Indefinite words:

"A horrible incident shocked Lord Ackley's staff"

VS.

"Something horrible shocked Lord Ackley's staff"

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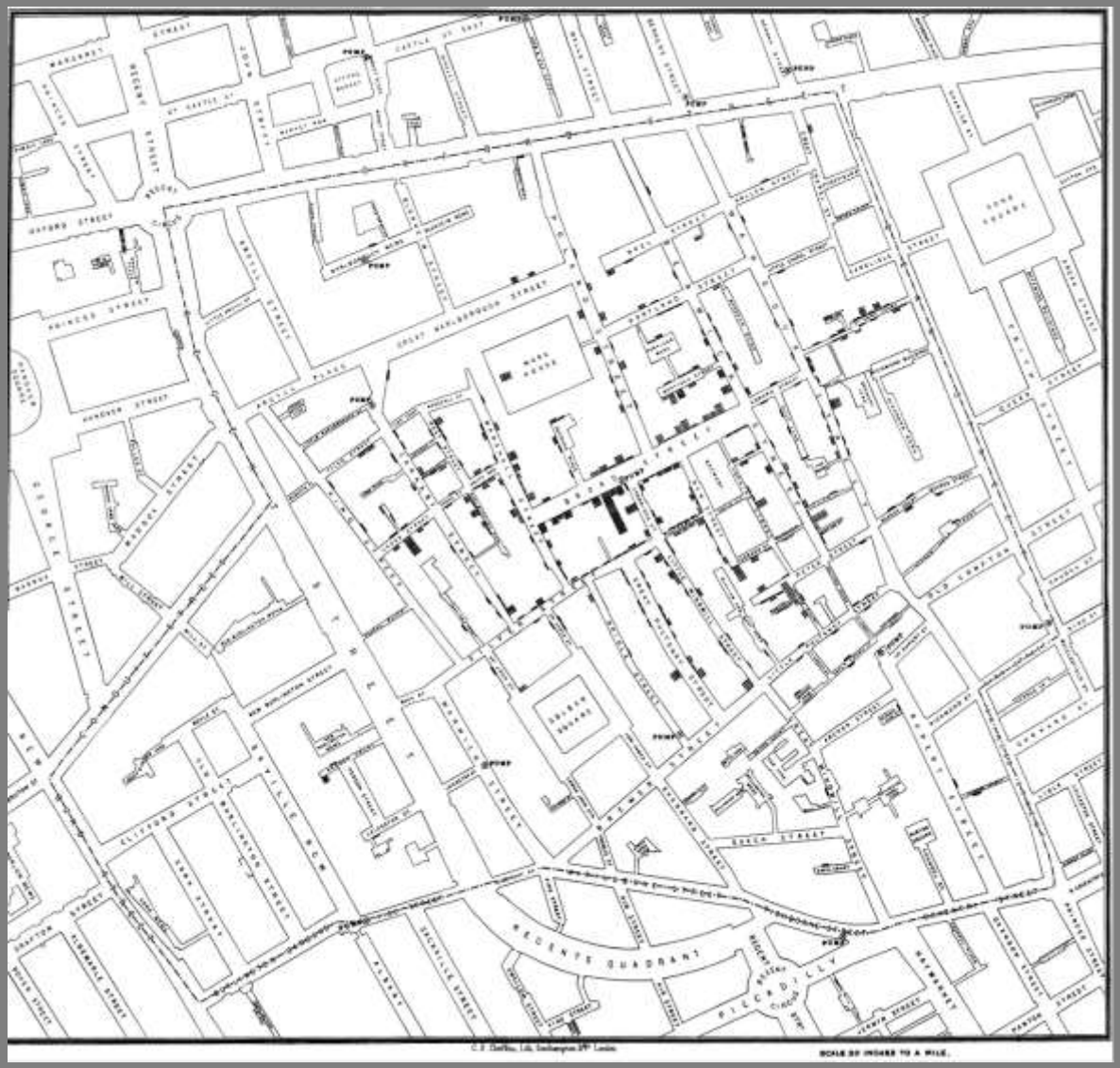
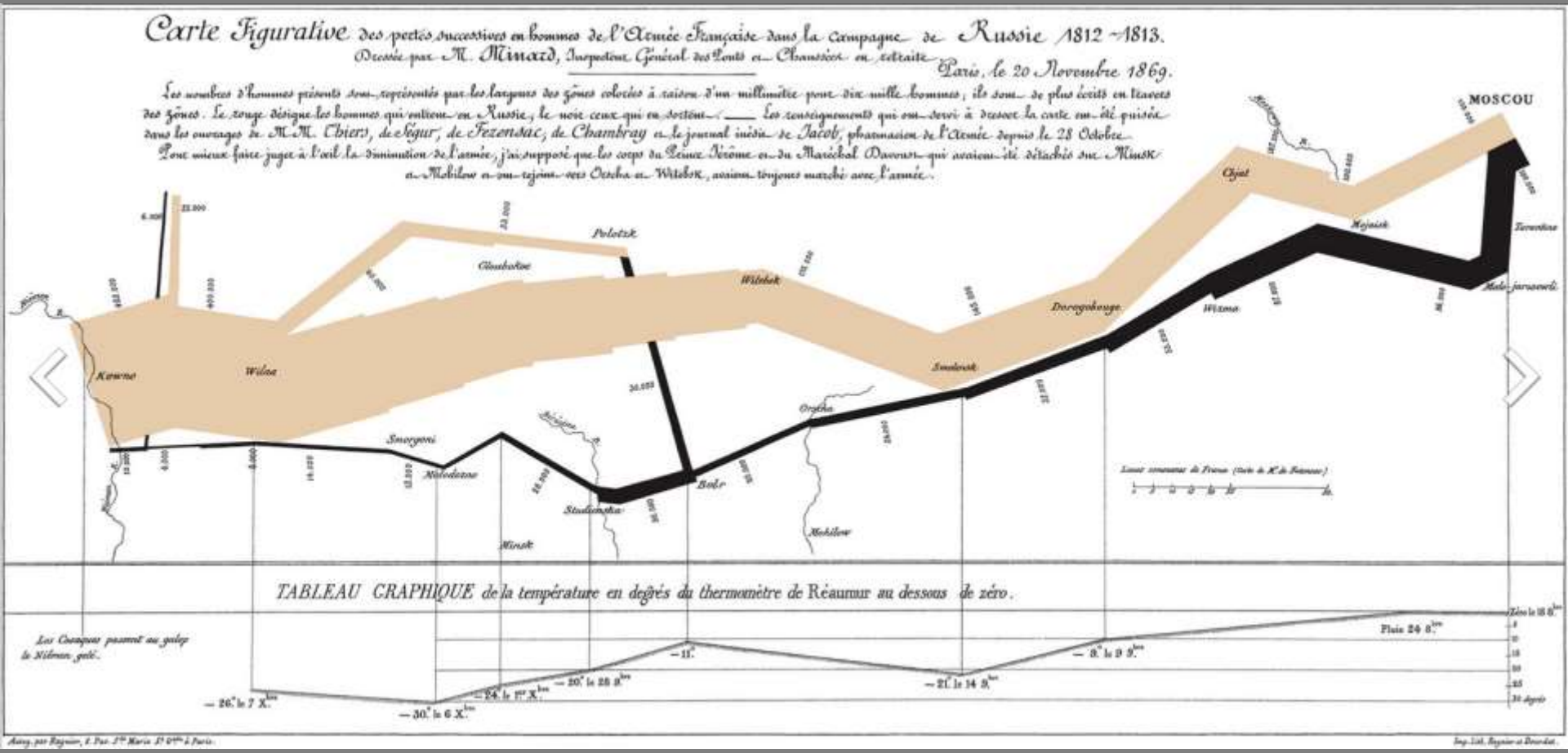
John Snow: London Cholera Map

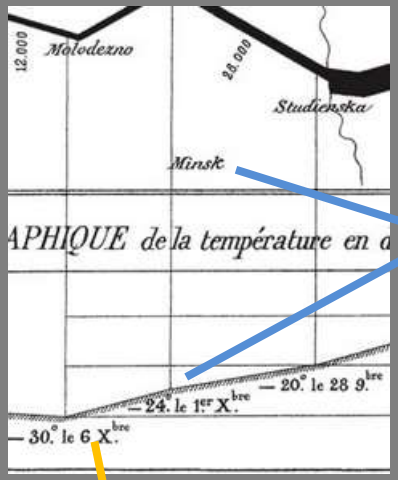
1854 Cholera outbreak
Soho, London:



John Snow: London Cholera Map

Charles Minard 1869: Napoleon Expedition

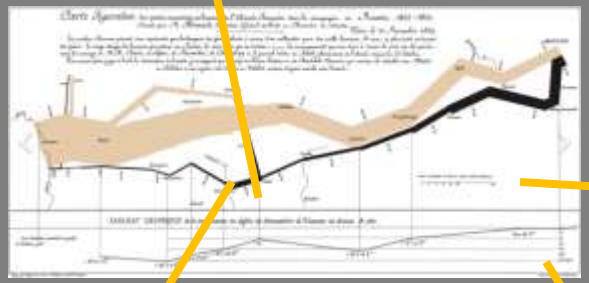




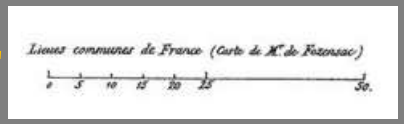
Location (labels)

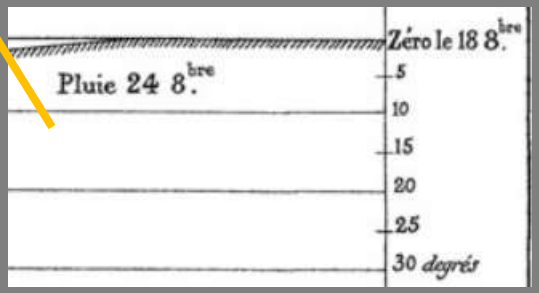
Location/Time (relative positioning)

Direction (color)

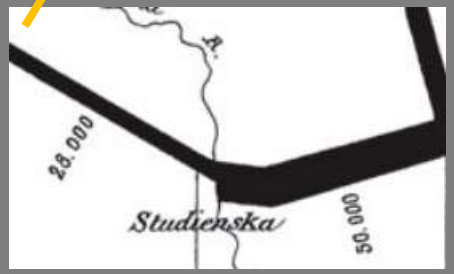


Distance (scale)





Temparatur (grid)



Troup strength (thickness)

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Variables Represent Data of Specific Types

Population and steel production in different world regions (Jan-Aug 2015):

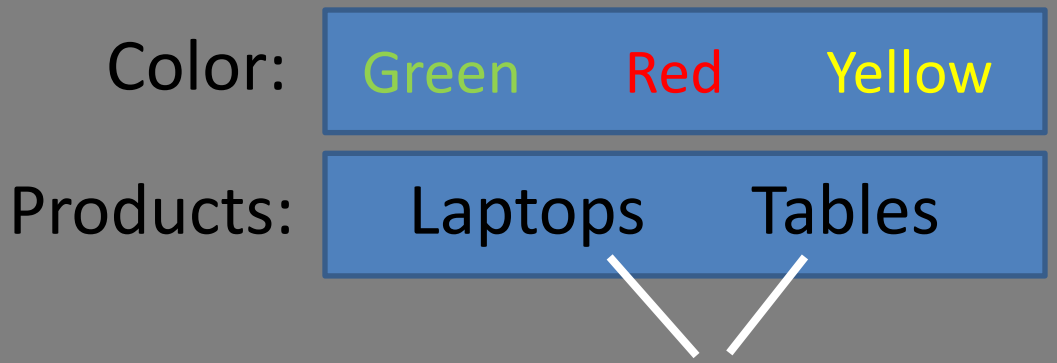
World Region	Europe	North America	Australia
Population	743M	529M	23M
Steel Production	136.792 megatons	75.516 megatons	3.265 megatons

Variable "*worldRegion*" {Europe, North America, Australia}
Variable "*population*" a number >= 0
Variable "*steelProduction*" a number >= 0

Types of Scales

Nominal ≡ Categorical:

- Mutually exclusive
- No numerical significance



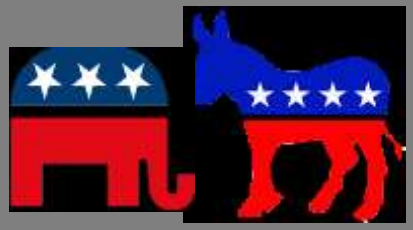
If only two categories: *Dichotomous*

Nominal: “Name”

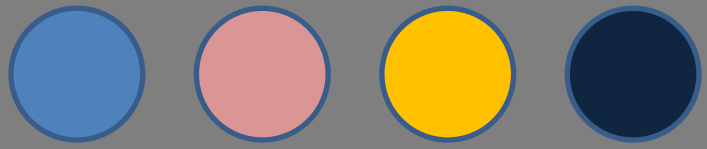
Example Visualizations

Nominal ≡ Categorical:

Shape:



Color:



Labels: Vanilla Chocolate Strawberry

Types of Scales

Ordinal:

- Order is significant…
- Difference is not

Milk shakes: Small Medium Large

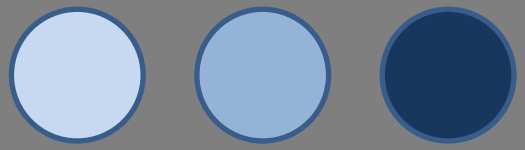
Mood: Unhappy Neutral Happy Ecstatic

Ordinal: “Order”

Example Visualizations

Ordinal:

Order: Dissatisfied ○ Satisfied ○ Highly satisfied ○

Color intensity: 

Types of Scales

Interval ≡ Continuous:

- Order is significant…
- Differences known
- No zero value

Time:

10am	11am	12pm

Temperature:
(Fahrenheit)

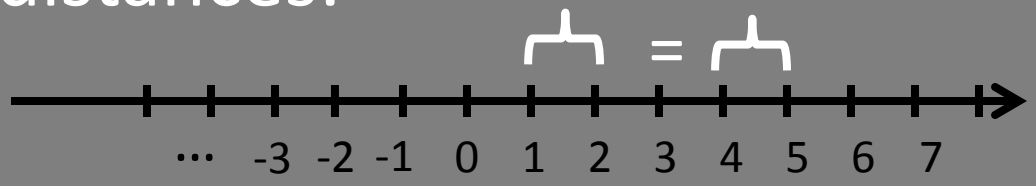
70F	80F	90F	100F

Interval: “Inter-value”

Example Visualizations

Interval:

Use distances:



Use height:

Types of Scales

Ratio:

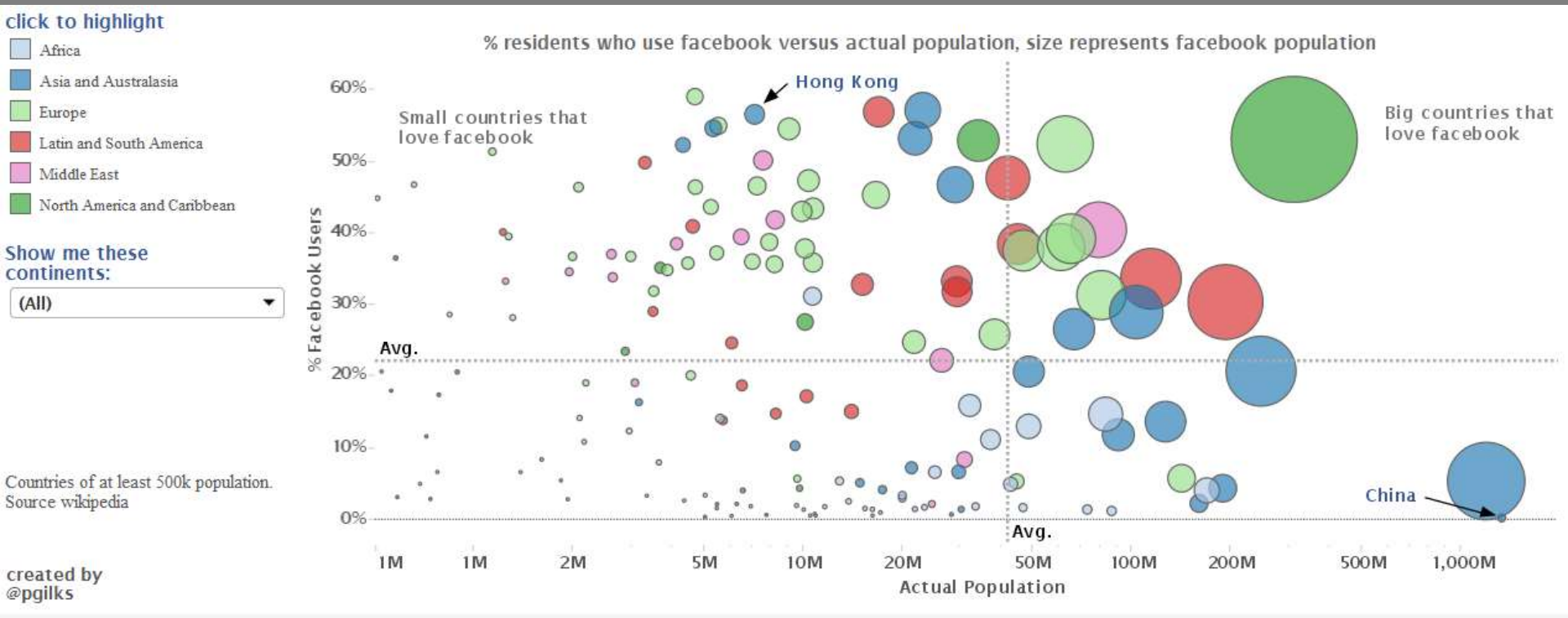
- Order is significant…
- Differences known
- Zero value exists

Width:

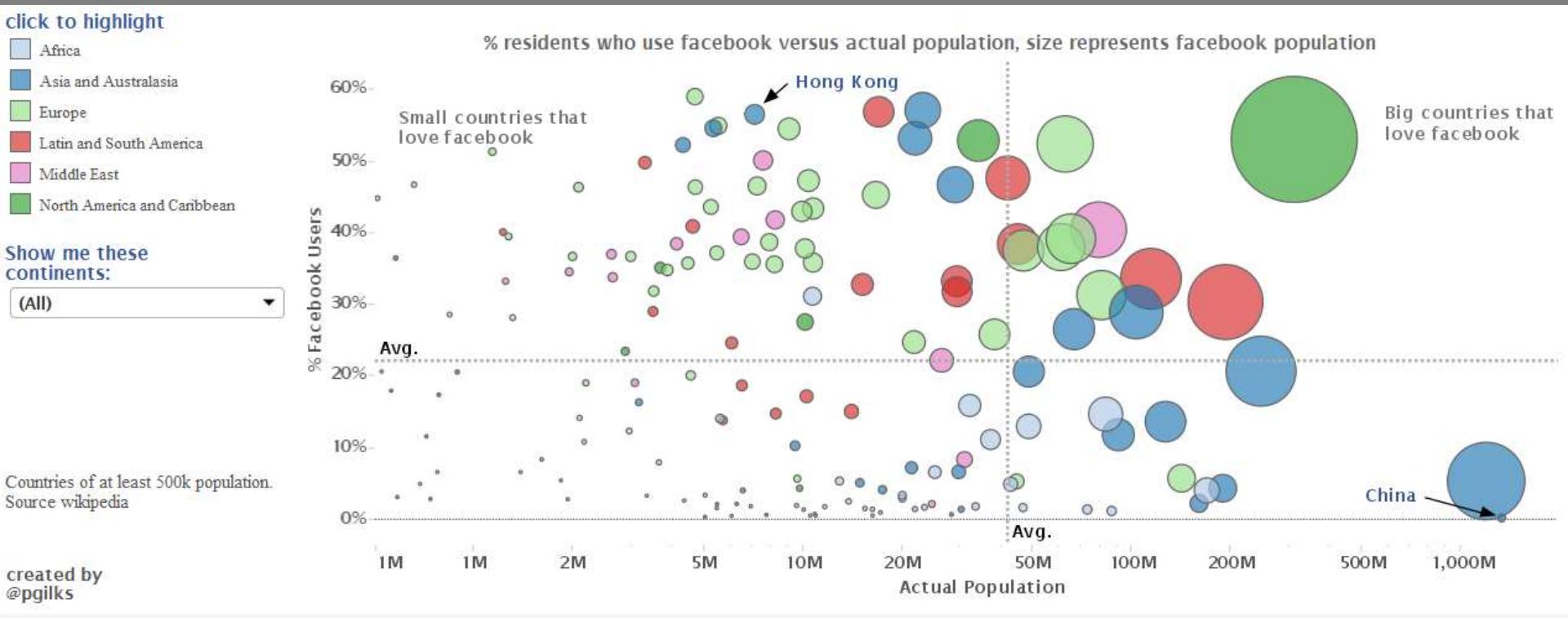
Temperature:
(Kelvin)

Ratio: “Comparable”

Putting it Together

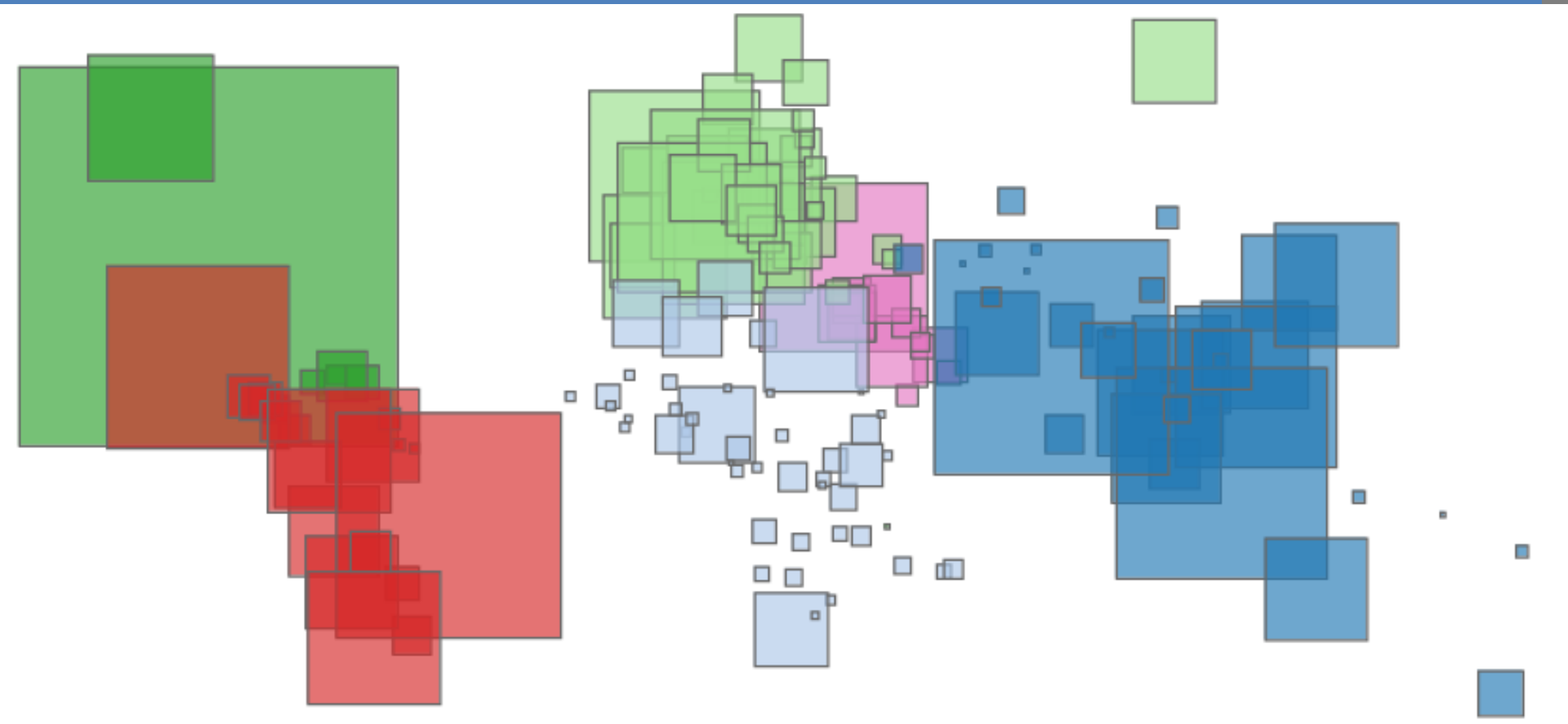


Putting it Together



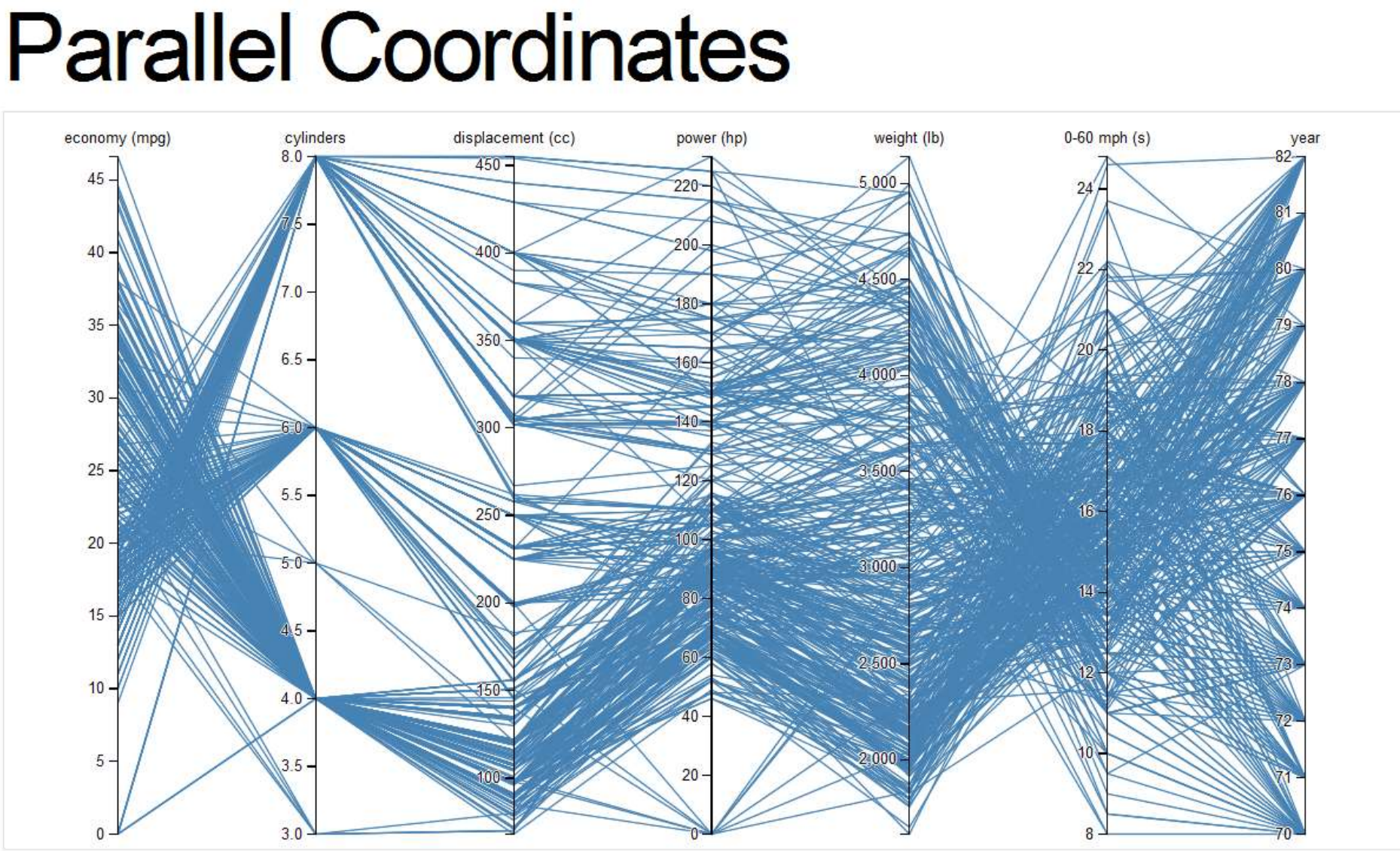
Position-X:	Actual population; ratio
Position-Y:	Percentage Facebook users; ratio
Color:	Continents; nominal
Size:	Facebook population; ratio
Dropline:	Identify point in ratio: Avg

Countries by Facebook Population

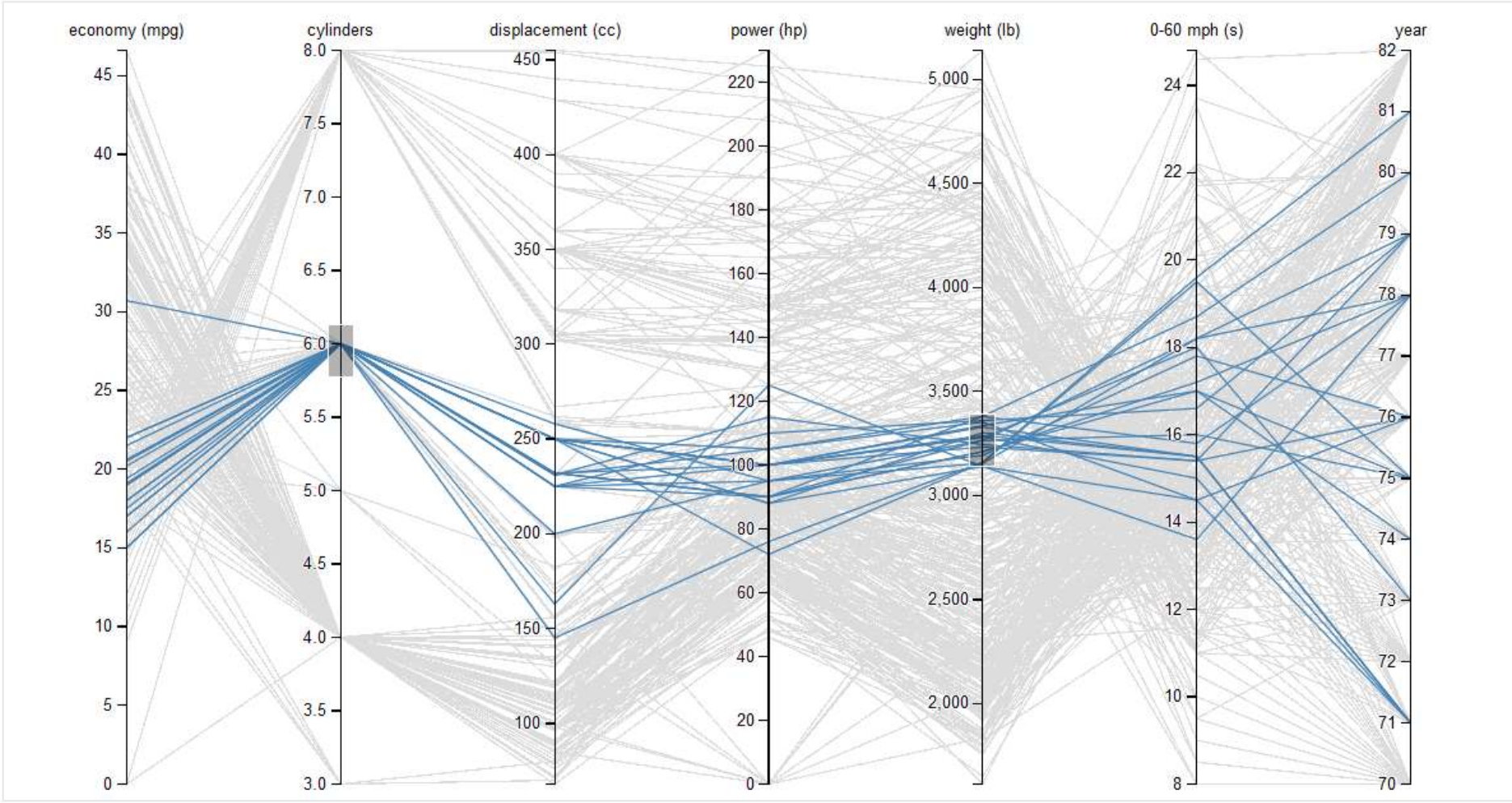


What If I Have More Dimensions?

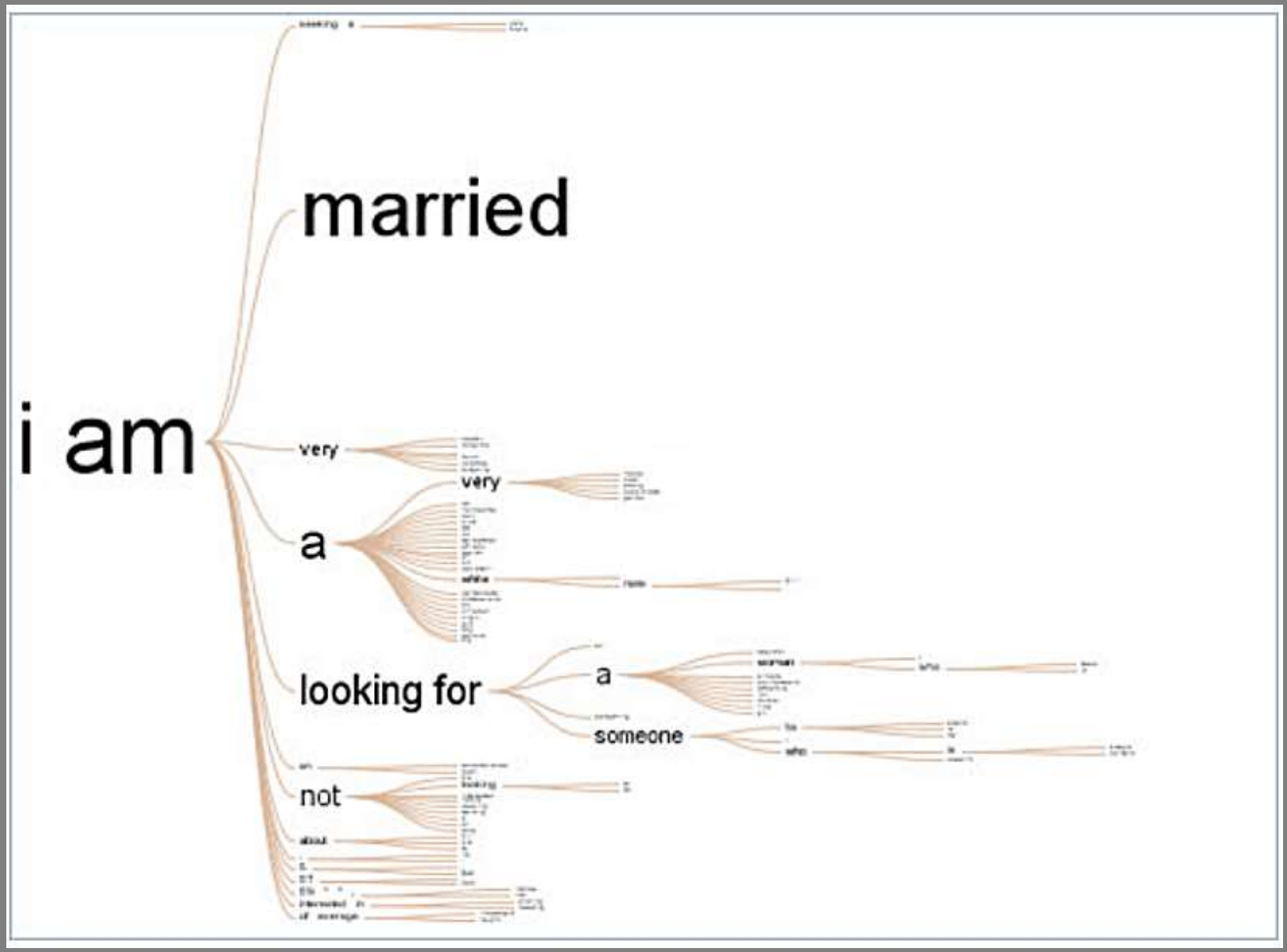
…or: Use Still Images



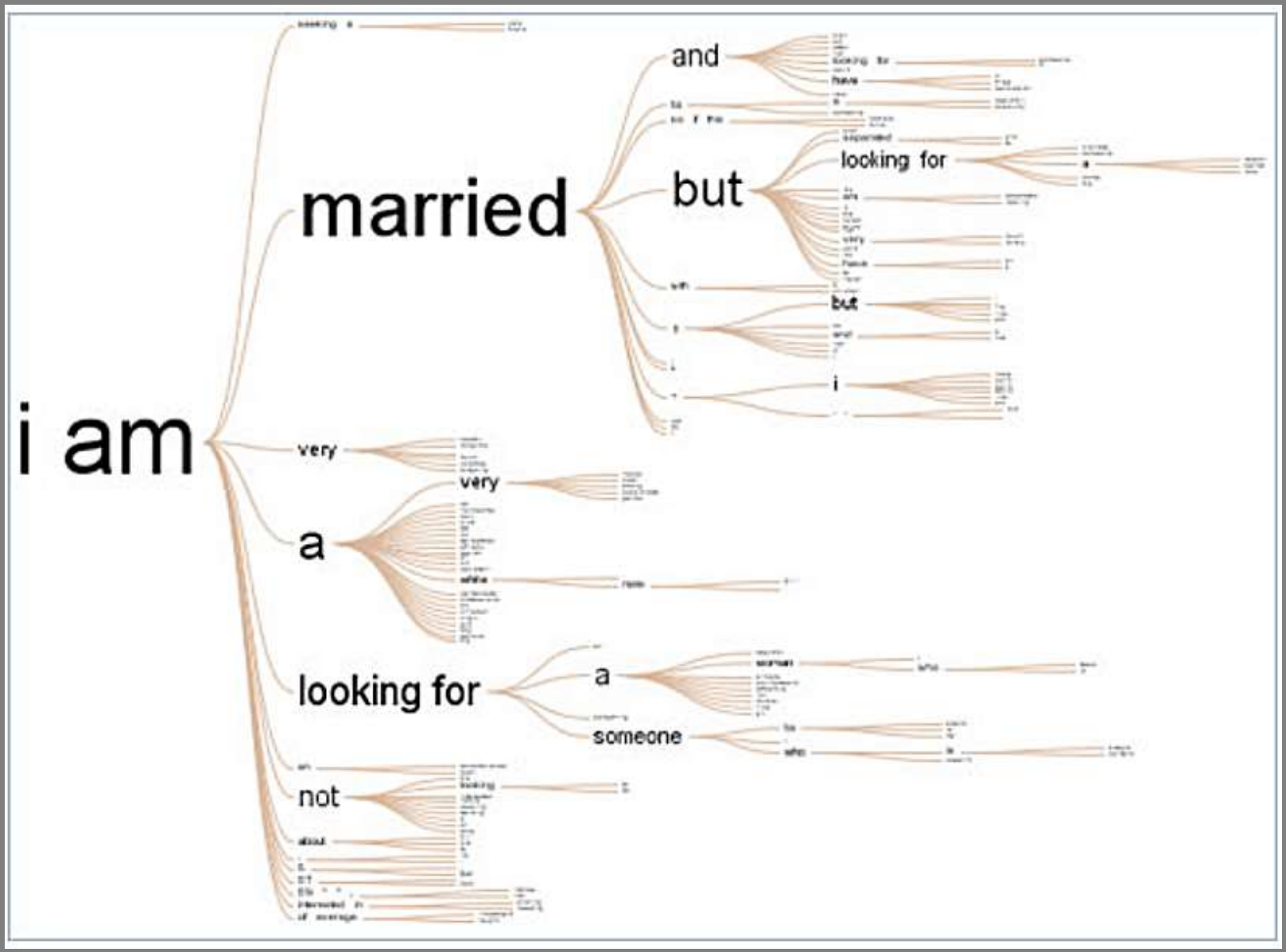
Parallel Coordinates



Visualizing Text



Visualizing Text



BBC FOUR

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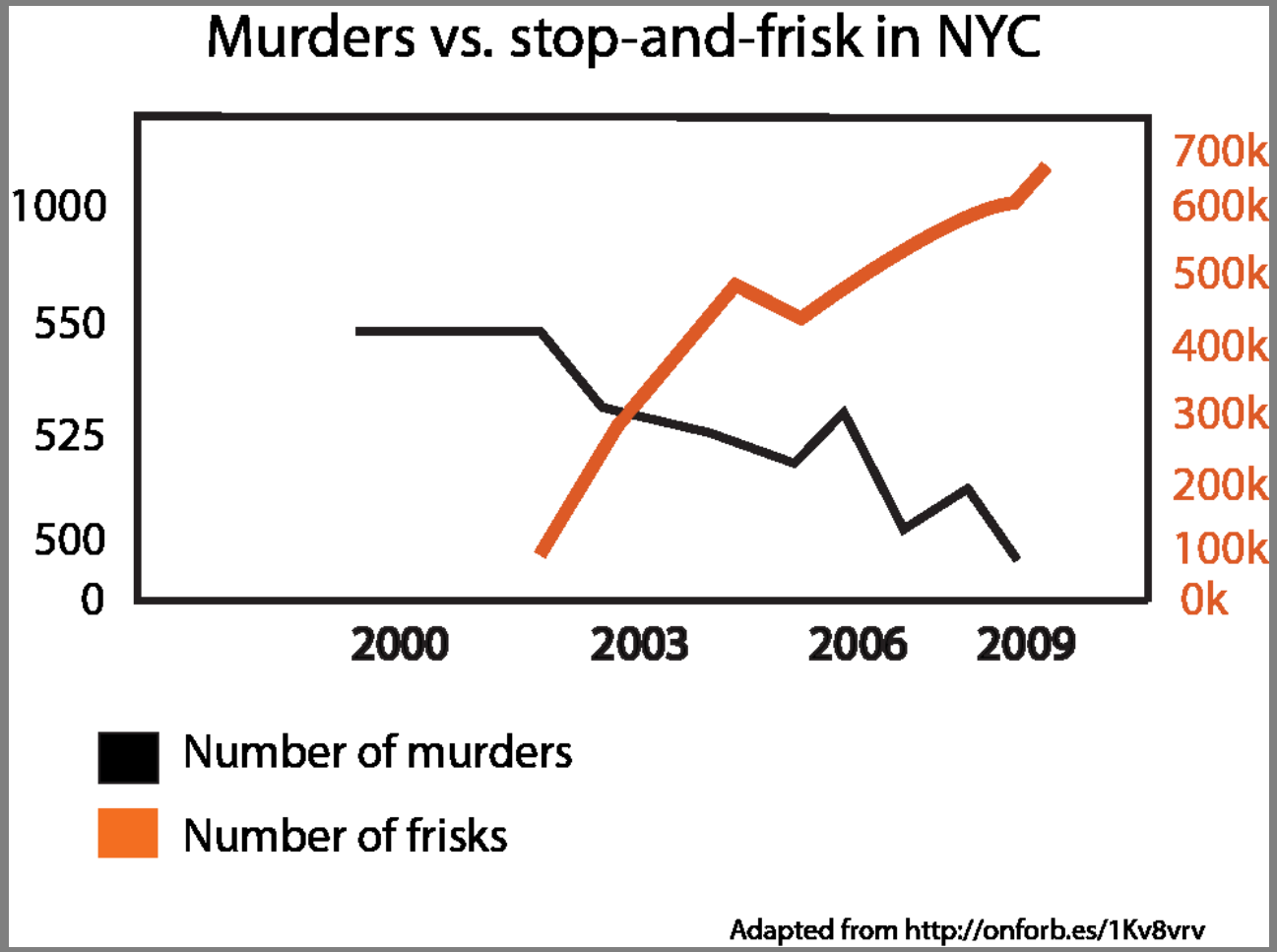
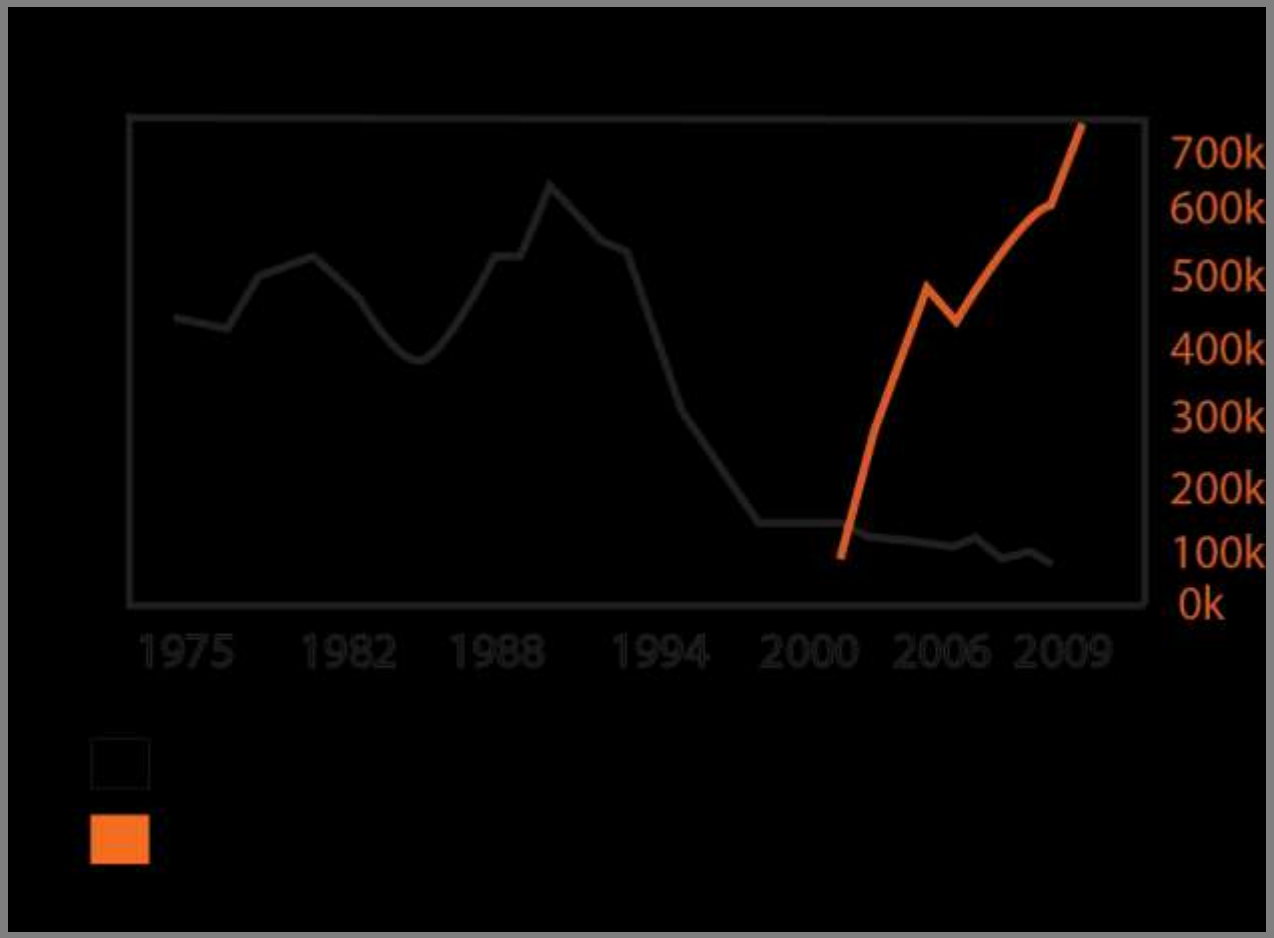
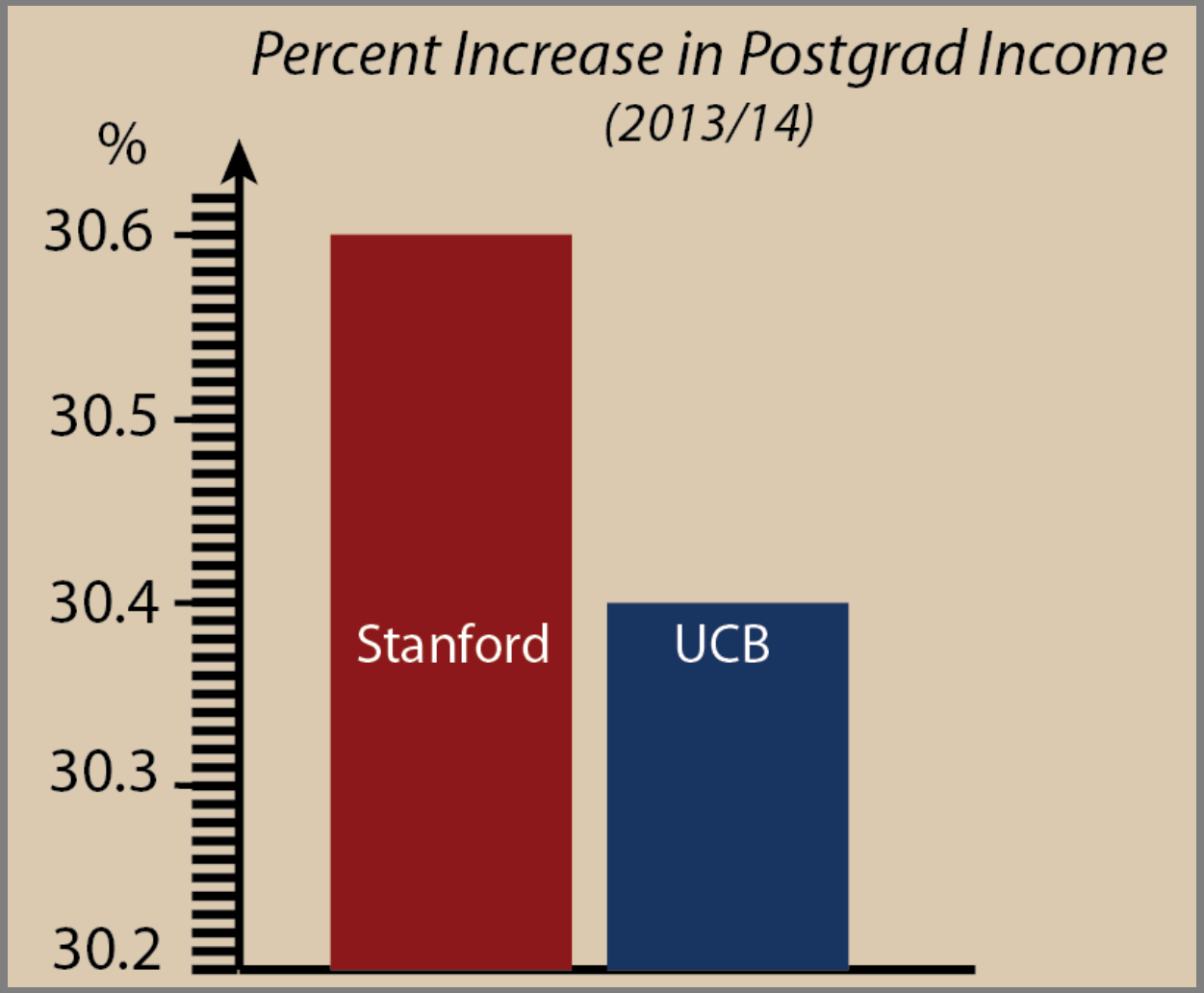
Stop-and-Frisk Prevents Murders



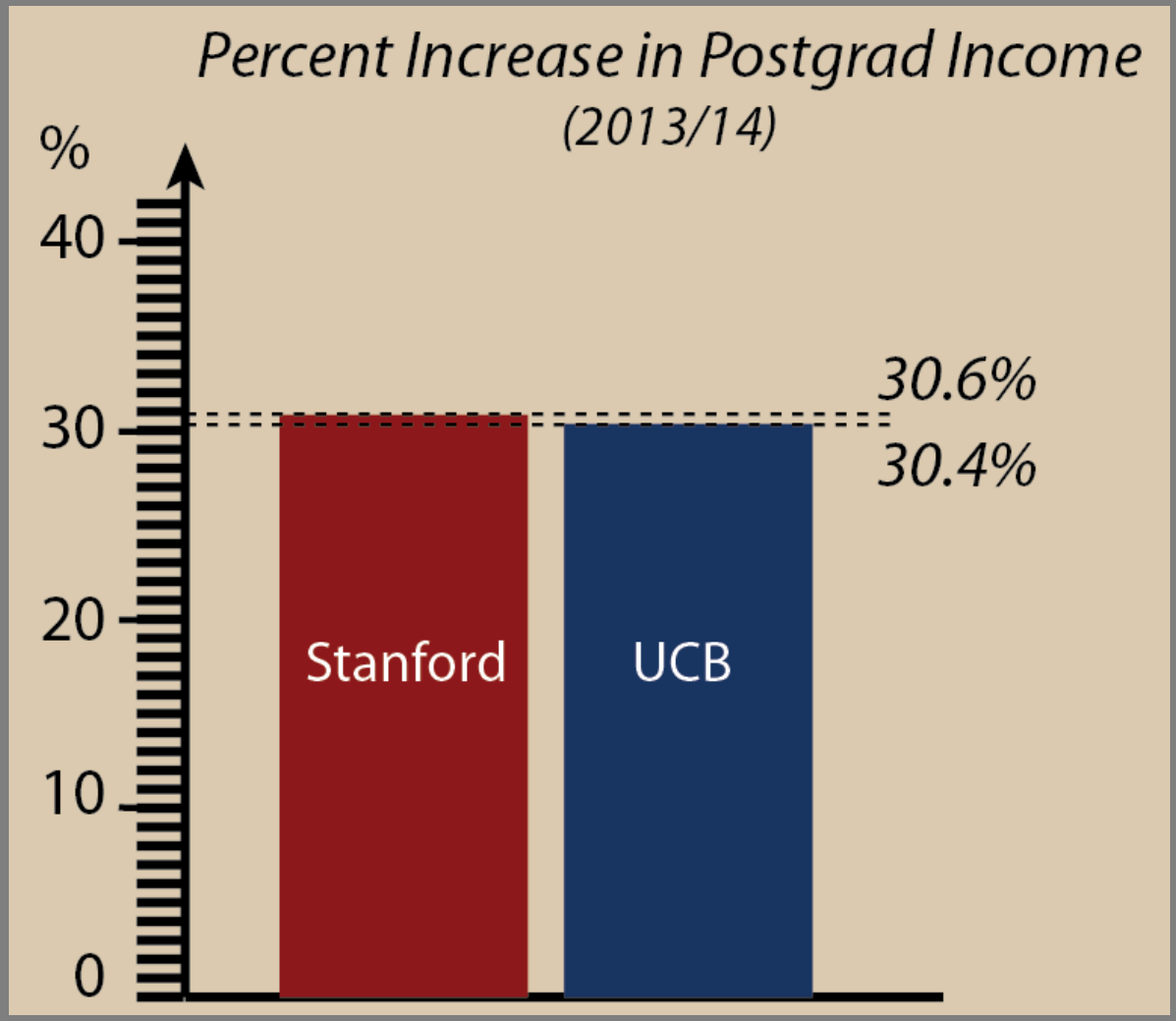
Implied Causation

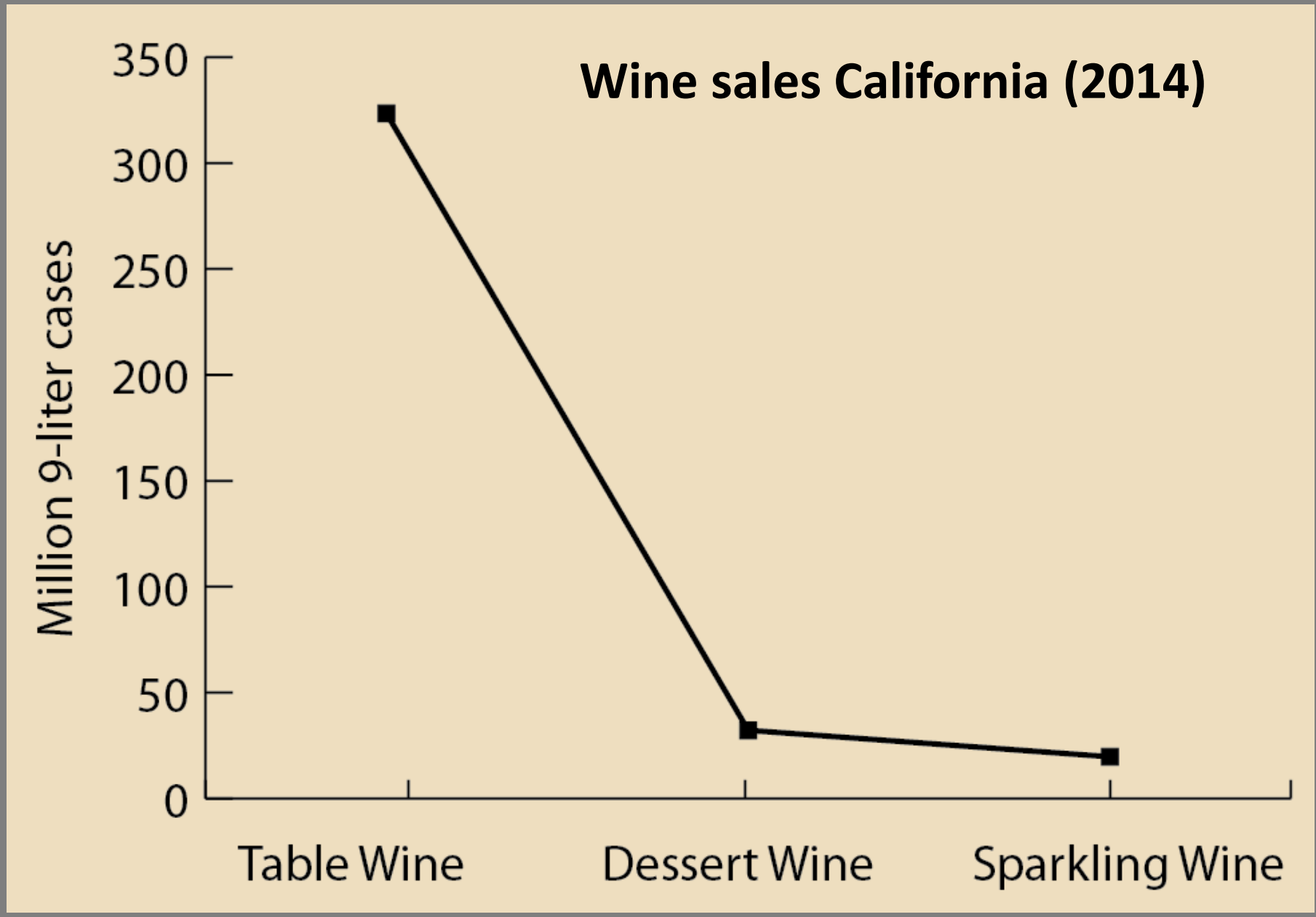


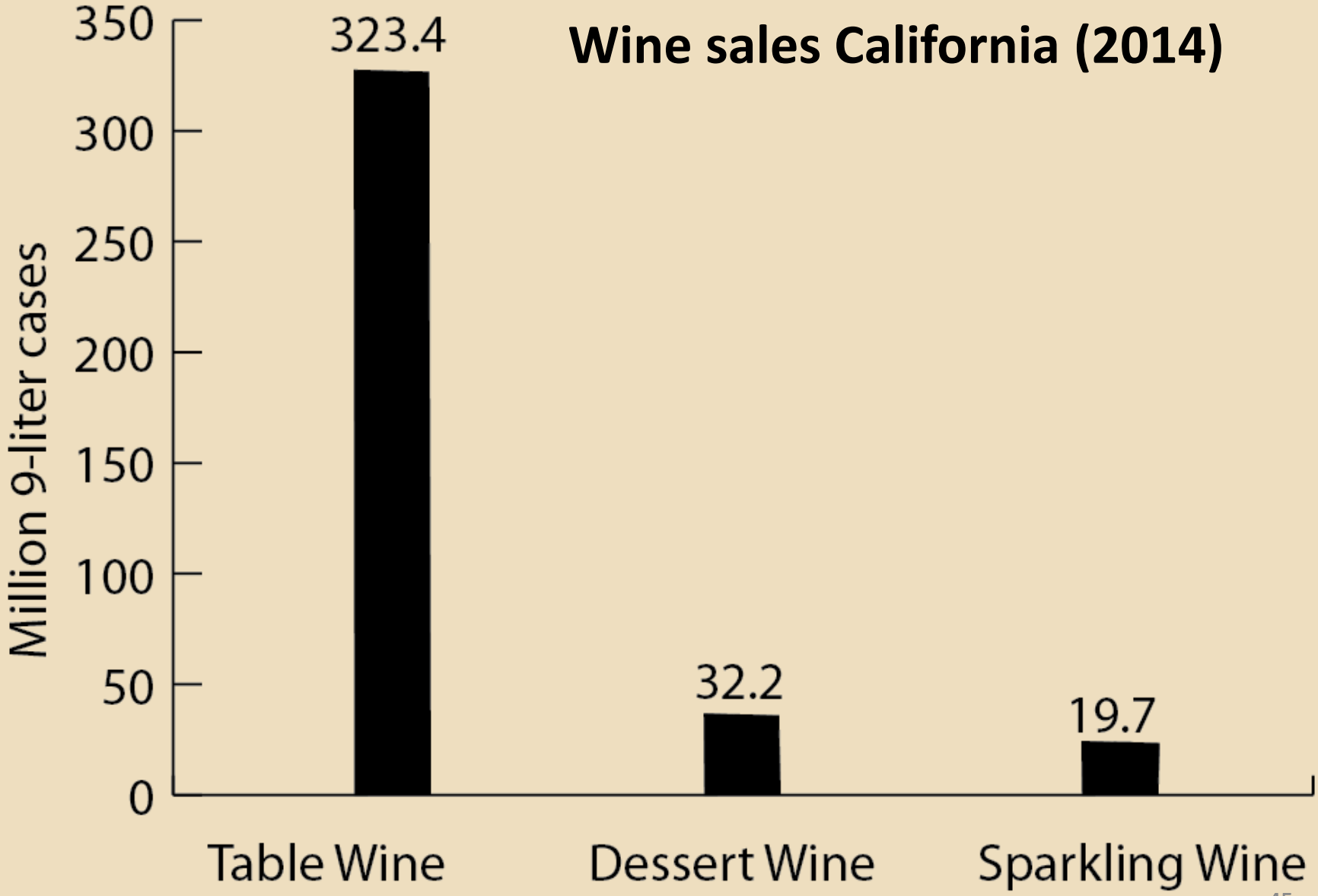
Stanford Grads Richer Quicker



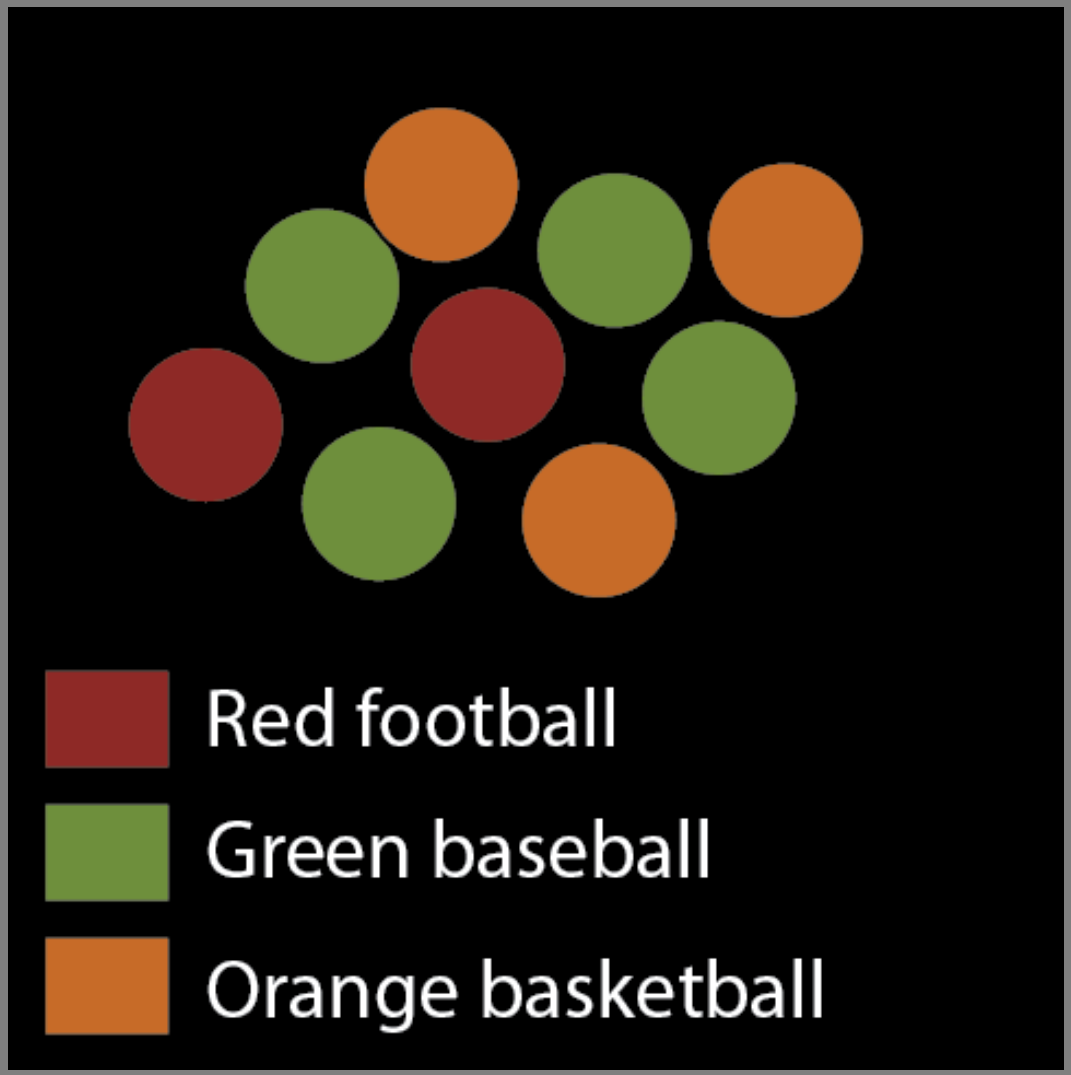
Partial Scale was Used




Wine sales California (2014)
Million 9-liter cases
350
300
250
200
150
100
50
0
Table Wine
Dessert Wine
Sparkling Wine

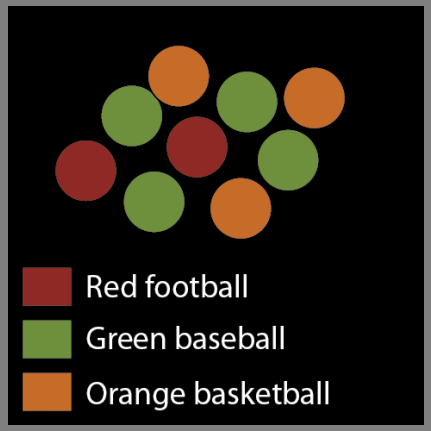

Wine sales California (2014)
Million 9-liter cases
350
300
250
200
150
100
50
0
323.4
32.2
19.7
Table Wine
Dessert Wine
Sparkling Wine

Careful With Color

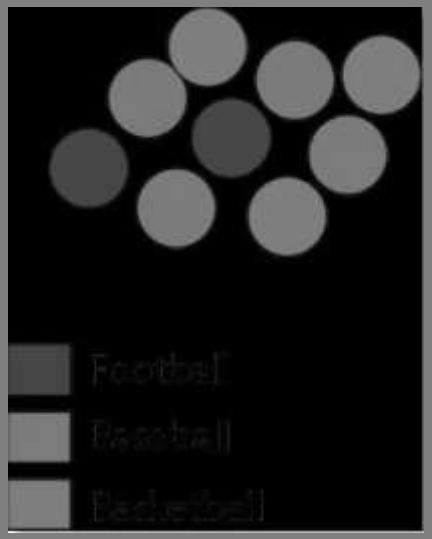


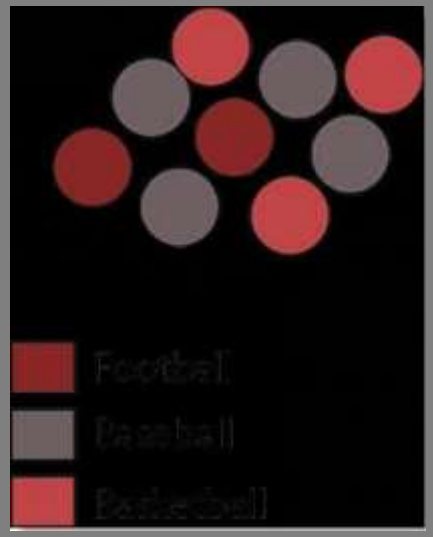
Test your charts at http://bit.ly/1qSSJSu

Careful With Color



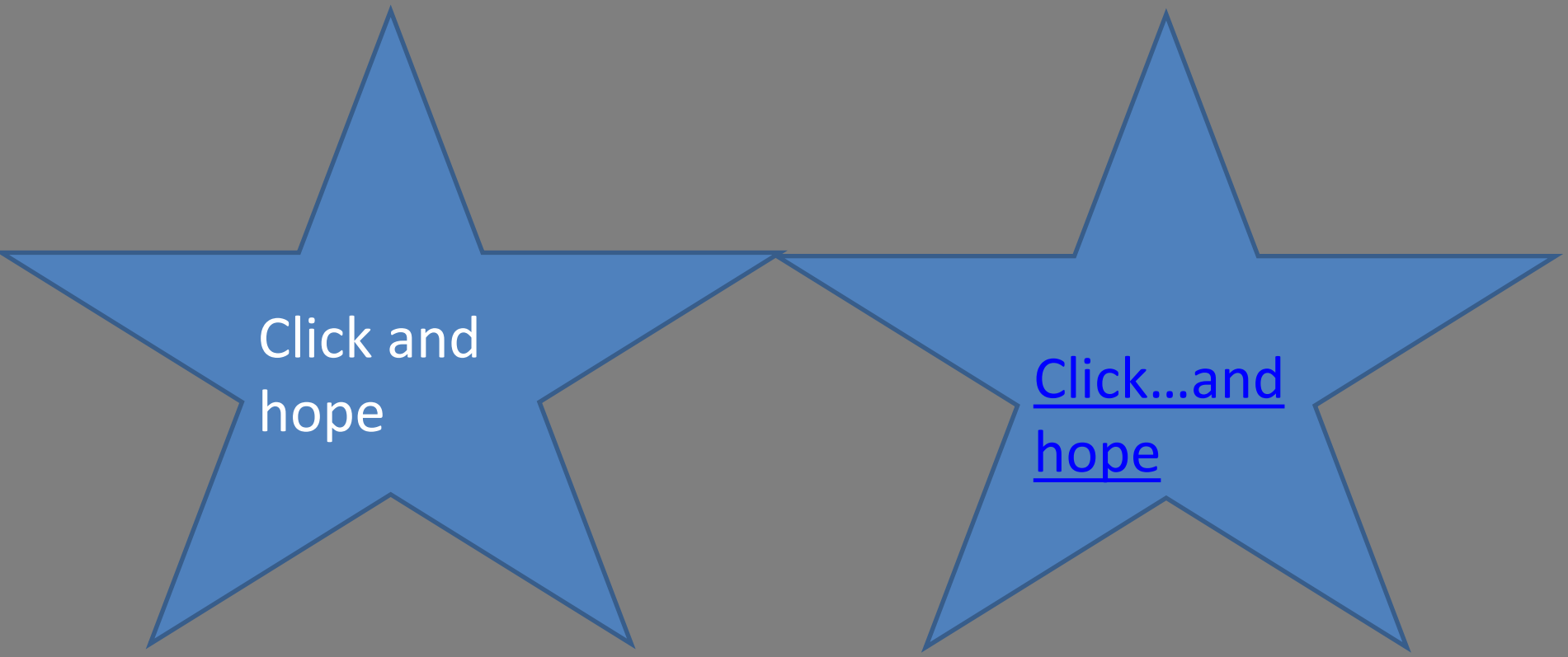
Original





Test your charts at http://bit.ly/1qSSJSu

Exercise: Presidential Greatness/IQ



Class page: Pick up CSV data

Tool: Past CSV data