

Introduction to Information Visualization

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What is information visualization?

“The use of computer-supported, interactive visual representations of abstract data to amplify cognition”

- Card, Mackinlay, and Shneiderman

“... finding the artificial memory that best supports our natural means of perception.” - Jacques Bertin

“The purpose of visualization is insight, not pictures.” - Ben Shneiderman

Why visualization?

There is too much data to even
begin to comprehend it all

Too much data?

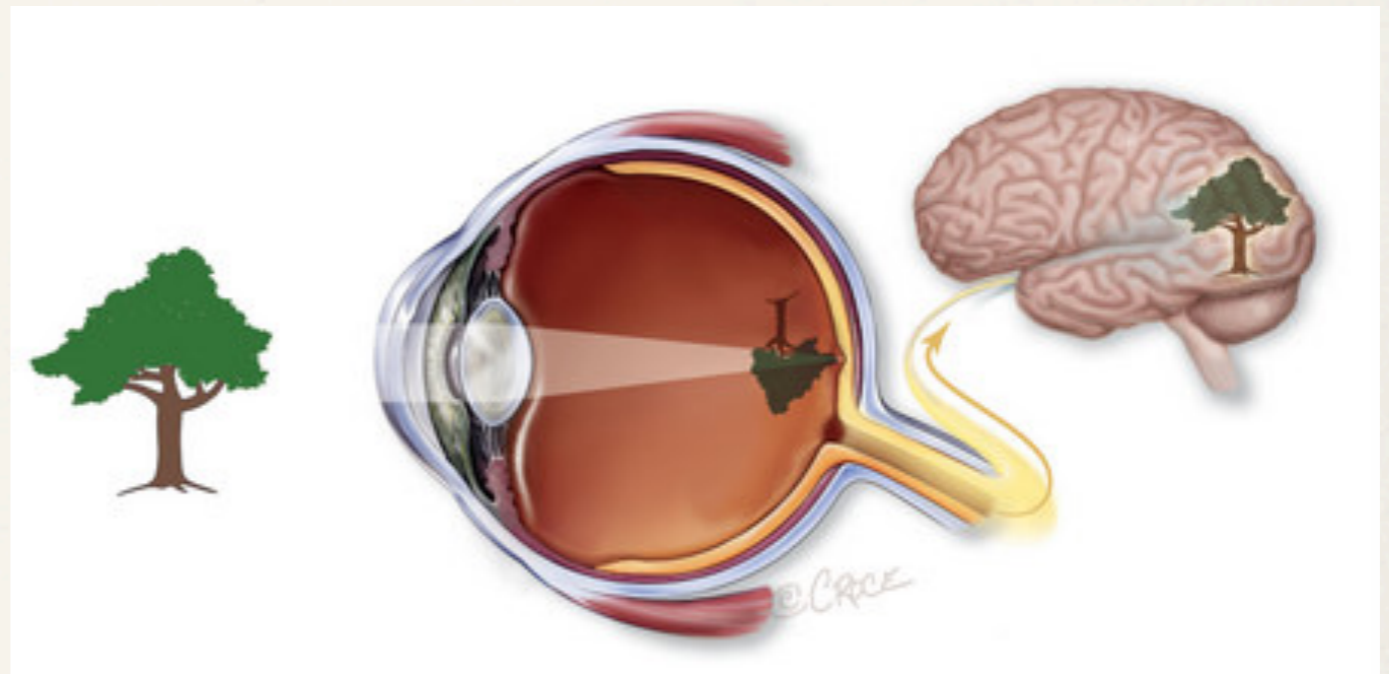
4 zettabytes of data
produced in 2013

4,000,000,000 terabytes

4,000,000,000,000 gigabytes

Why visualization?

- ❖ Vision is the highest bandwidth sense
- ❖ People think visually
- ❖ Vision incorporates
 - ❖ parallel search
 - ❖ pattern recognition
 - ❖ pre-attentive processing
- ❖ Extends cognitive capacity by allowing fast access to the surrounding environment



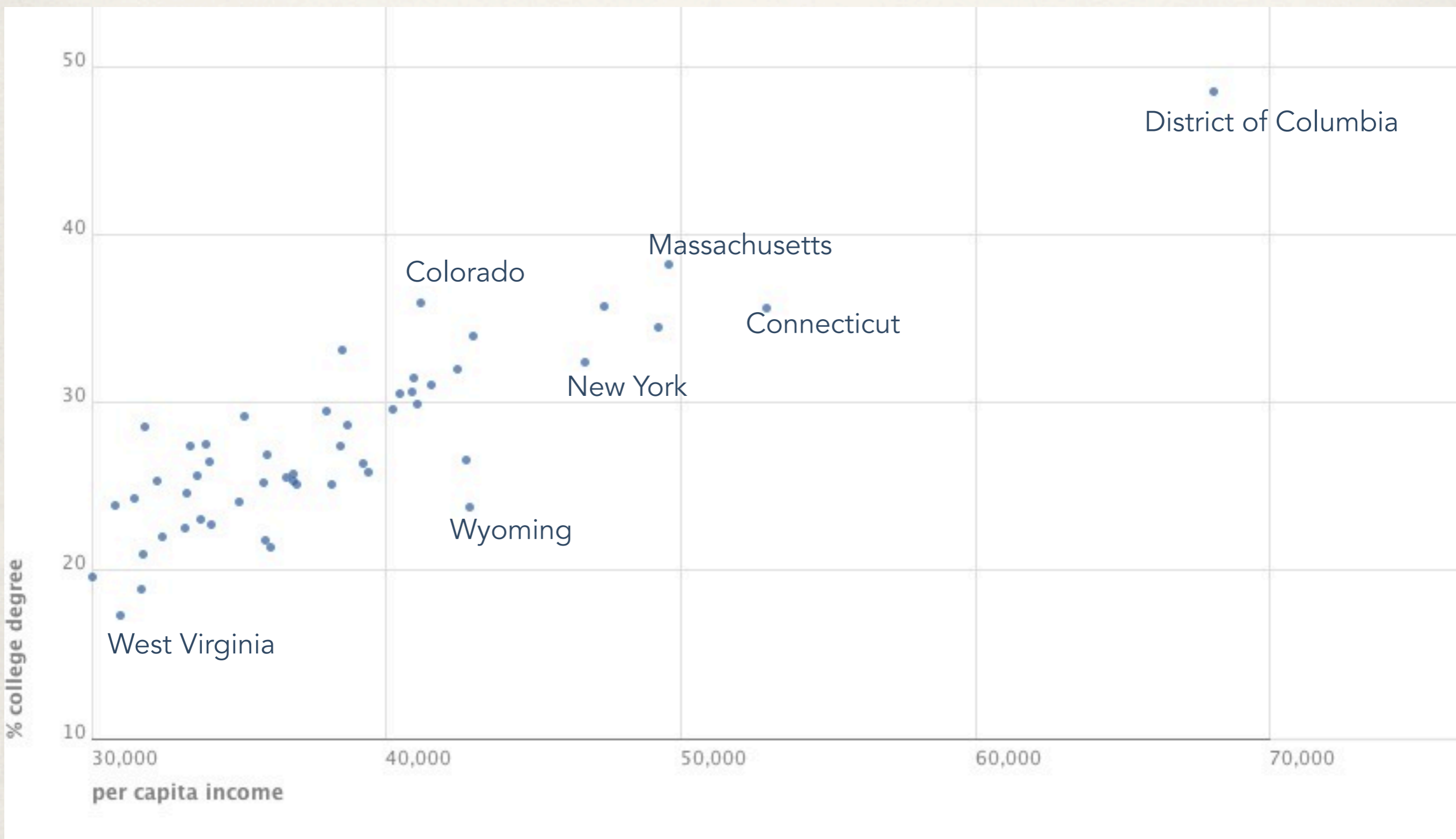
from http://bionicvision.org.au/eye/healthy_vision

2009 US Census data

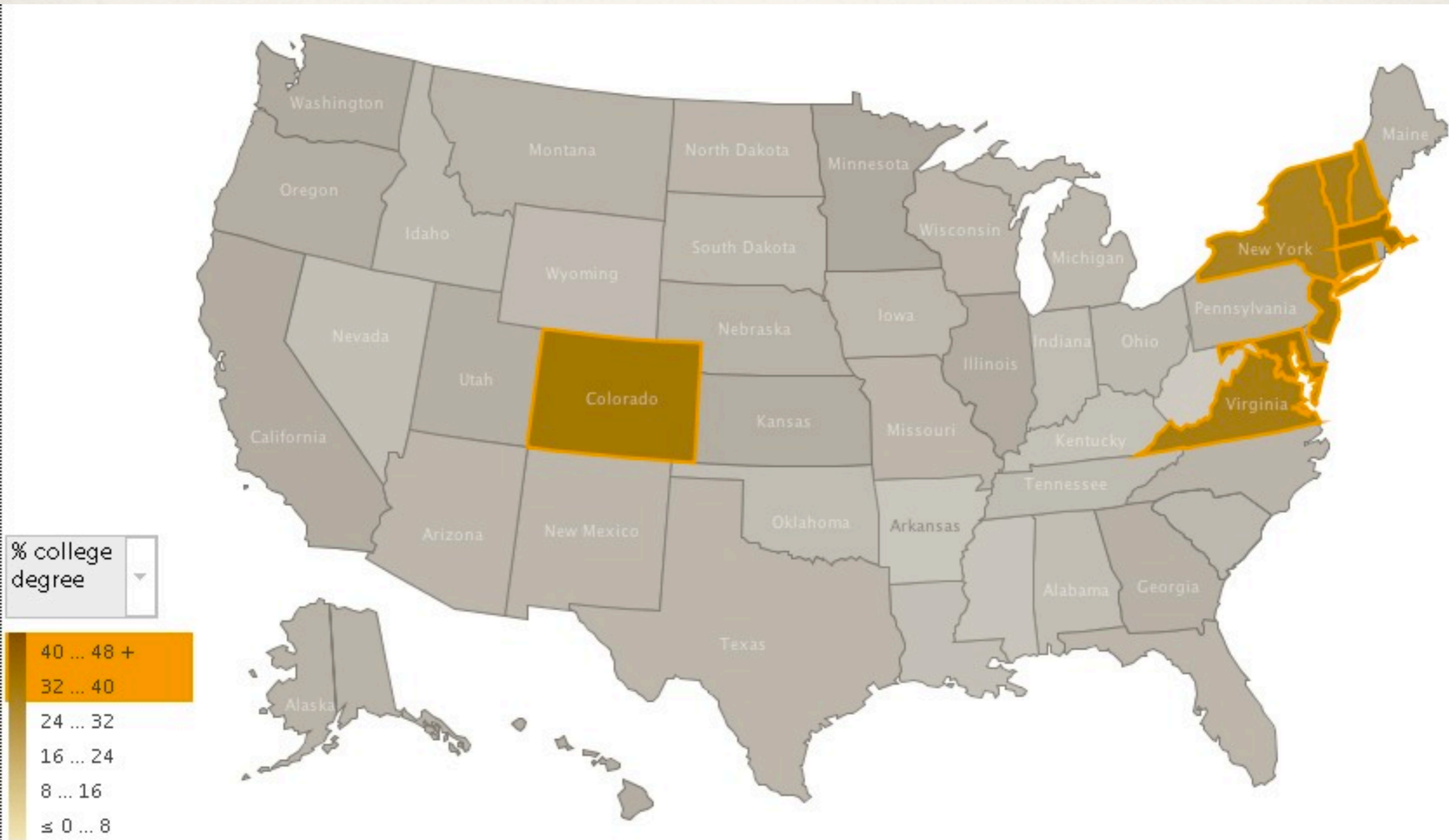
State	income	% degree
Alabama	32,406	22.0
Alaska	42,713	26.6
Arizona	33,560	25.6
Arkansas	31,688	18.9
California	41,034	29.9
Colorado	41,154	35.9
Connecticut	52,900	35.6
Delaware	38,695	28.7
Dist. of Col.	68,093	48.5
Florida	36,849	25.3
Georgia	33,887	27.5
Hawaii	40,242	29.6
Idaho	30,809	23.9
Illinois	40,865	30.6
Indiana	33,163	22.5
Iowa	36,977	25.1
Kansas	37,988	29.5
Kentucky	31,754	21.0
Louisiana	36,062	21.4
Maine	35,981	26.9
Maryland	47,419	35.7
Massachusetts	49,578	38.2
Michigan	33,221	24.6
Minnesota	40,950	31.5
Mississippi	30,013	19.6
Missouri	35,837	25.2

State	income	% degree
Montana	33,364	27.4
Nebraska	38,438	27.4
Nevada	35,919	21.8
New Hampshire	42,418	32.0
New Jersey	49,221	34.5
New Mexico	32,200	25.3
New York	46,739	32.4
North Carolina	34,001	26.5
North Dakota	39,372	25.8
Ohio	35,001	24.1
Oklahoma	34,082	22.7
Oregon	35,159	29.2
Pennsylvania	39,210	26.4
Rhode Island	40,460	30.5
South Carolina	31,448	24.3
South Dakota	38,147	25.1
Tennessee	33,711	23.0
Texas	36,595	25.5
Utah	31,778	28.5
Vermont	38,530	33.1
Virginia	42,929	34.0
Washington	41,504	31.0
West Virginia	30,968	17.3
Wisconsin	36,859	25.7
Wyoming	42,828	23.8

2009 US Census data



2009 US Census data



Visualization goals

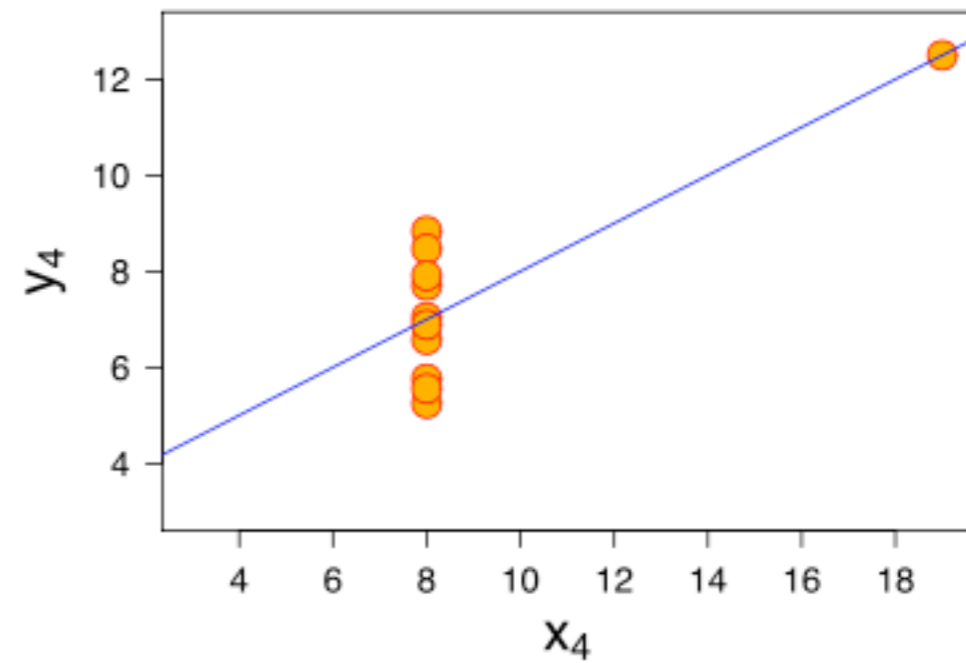
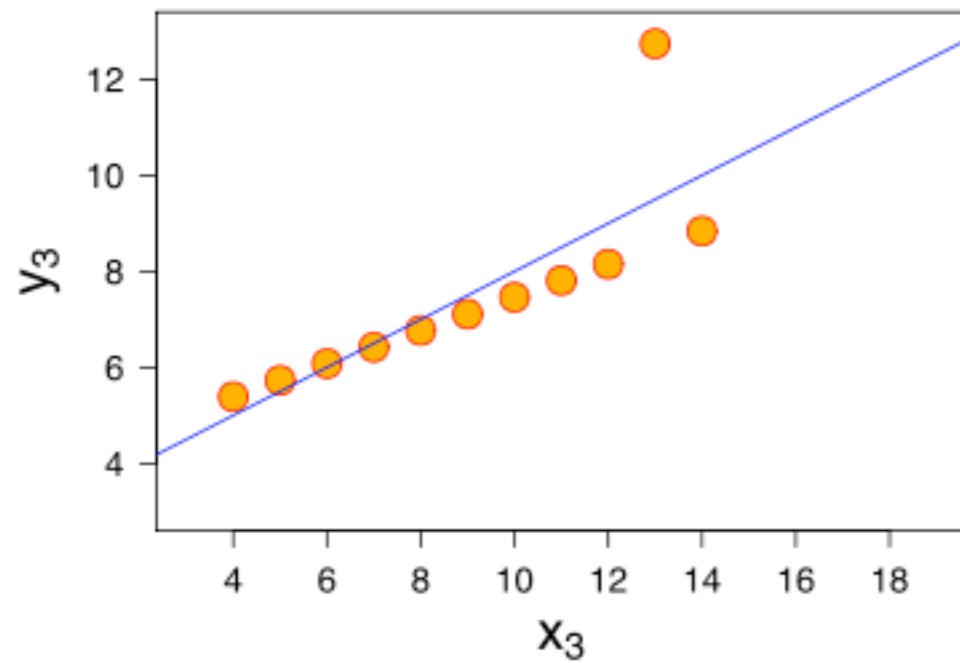
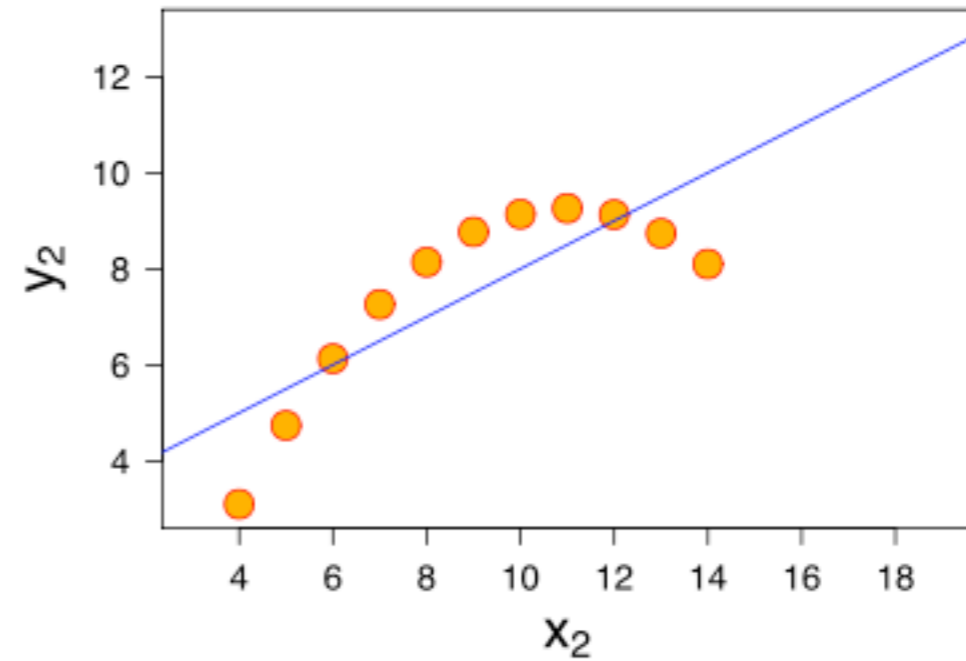
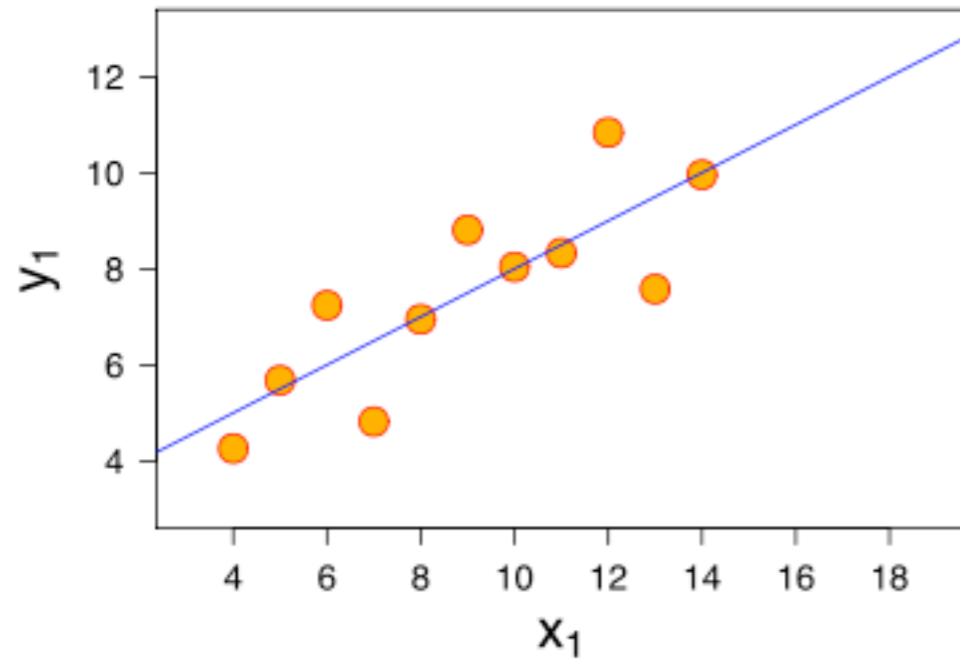
- ❖ Analysis
 - ❖ try to make sense of a large mass of data, figure out what is interesting
 - ❖ look for patterns, trends, outliers, relationships, correlations, clusters, anomalies
- ❖ Overview or monitoring
- ❖ Presentation
 - ❖ tell stories
 - ❖ inform, persuade
 - ❖ collaborate

Anscombe's Quartet

mean of X 9
variance of x 11
mean of y 7.50
variance of y 4.122

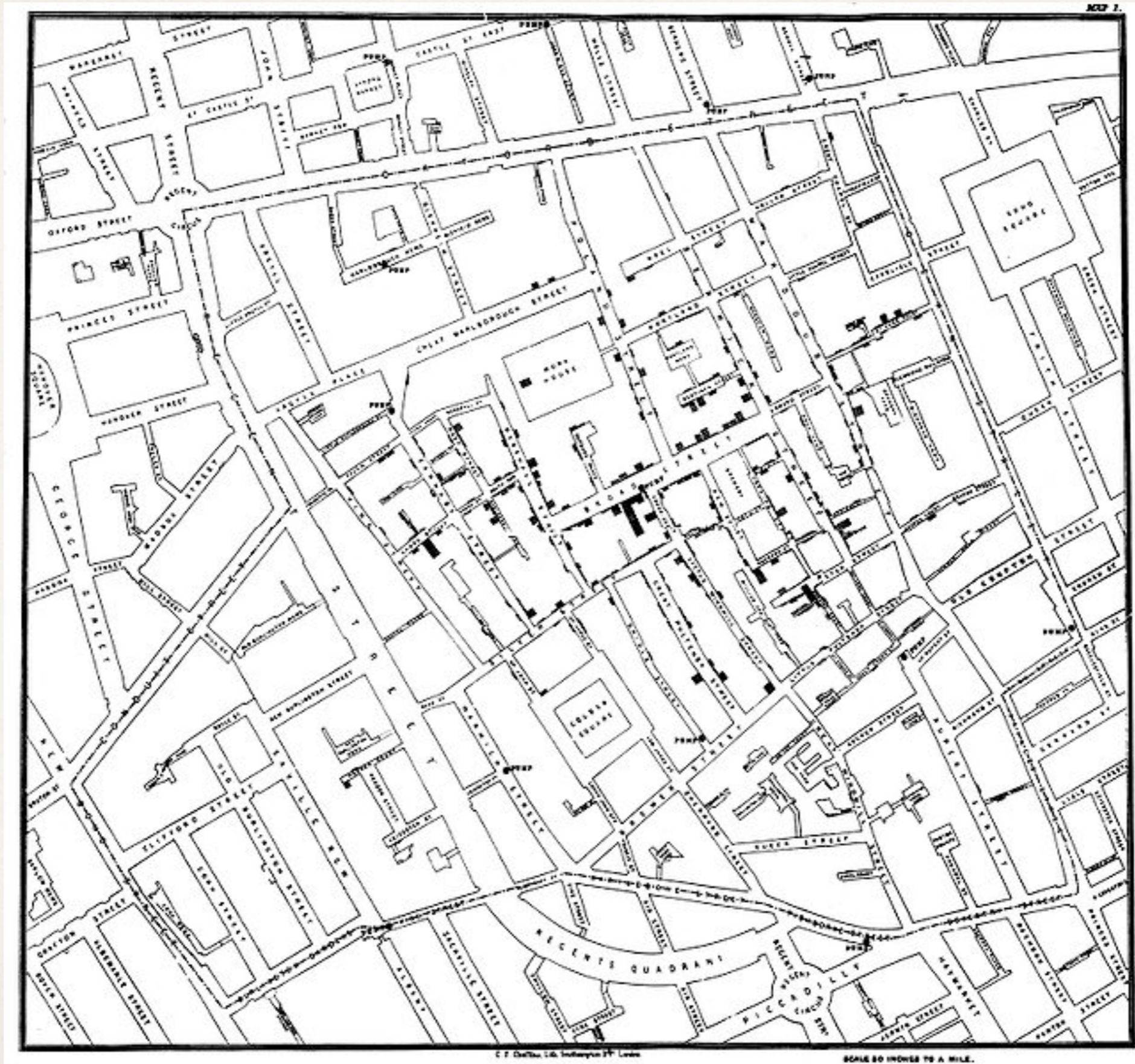
I		II		III		IV	
x	y	x	y	x	y	x	y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	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

Anscombe's Quartet



from Wikimedia Commons: http://en.wikipedia.org/wiki/File:Anscombe%27s_quartet_3.svg

Snow: Cholera Map [1854]

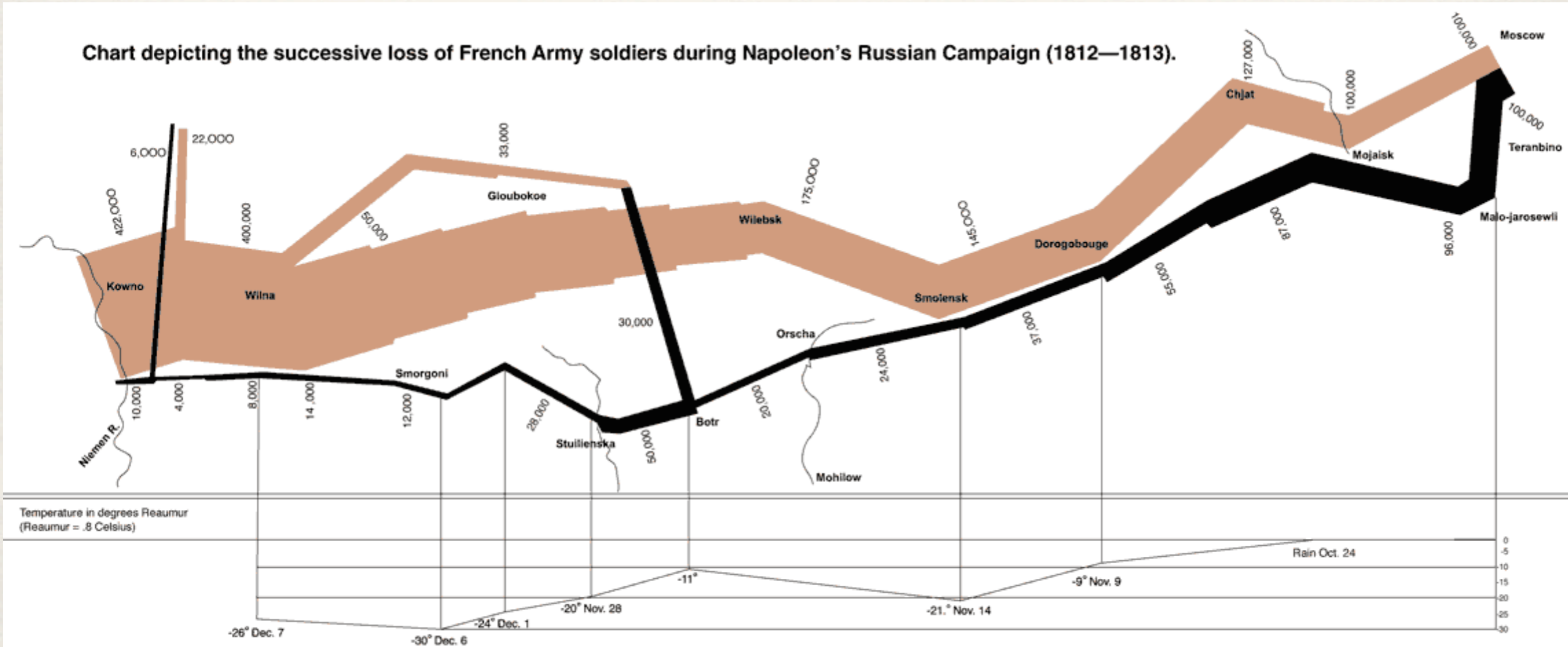


Snow: Cholera Map [1854]



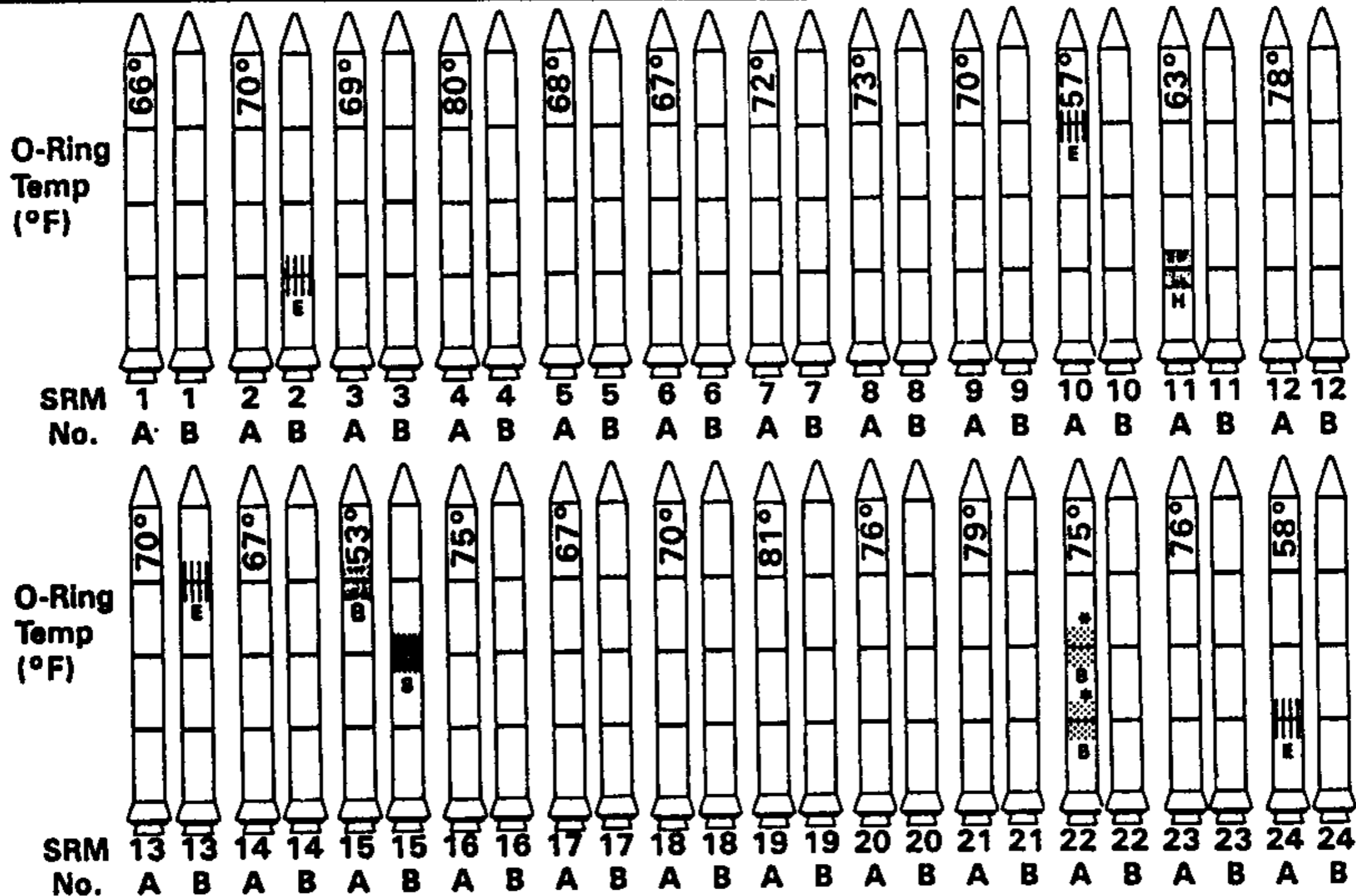
Minard: Napoleon's march [1869]

Chart depicting the successive loss of French Army soldiers during Napoleon's Russian Campaign (1812—1813).



Tufte: Challenger disaster

History of O-Ring Damage in Field Joints (Cont)



MORTON THROKOL, INC.
Wasatch Operations

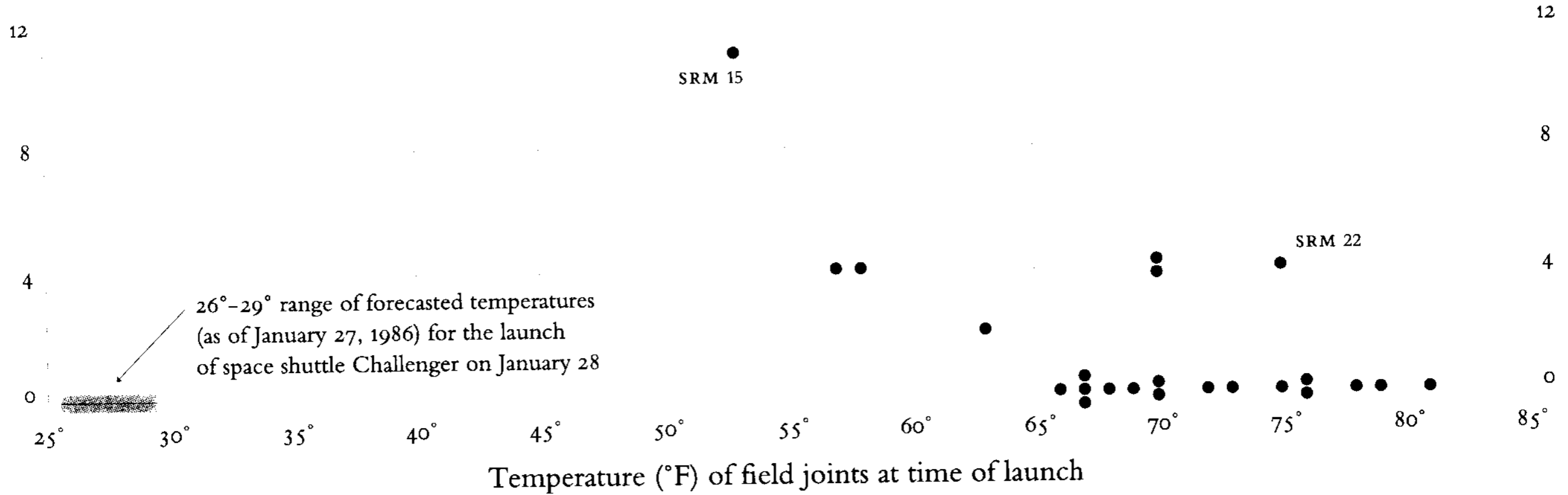
* No Erosion

0000-11

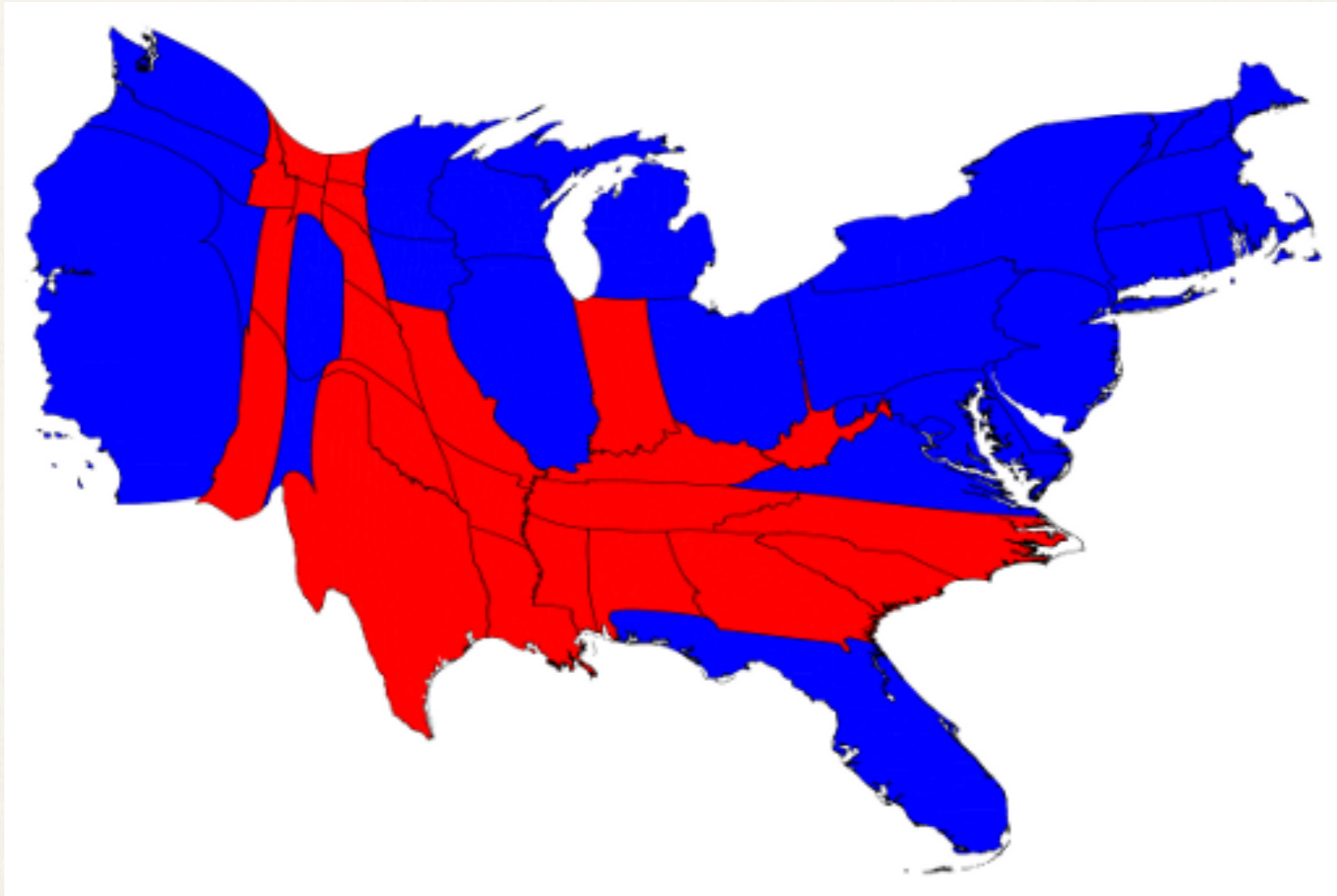
INFORMATION ON THIS PAGE WAS PREPARED TO SUPPORT AN ORAL PRESENTATION
AND CANNOT BE CONSIDERED COMPLETE WITHOUT THE ORAL DISCUSSION

Tufte: Challenger disaster

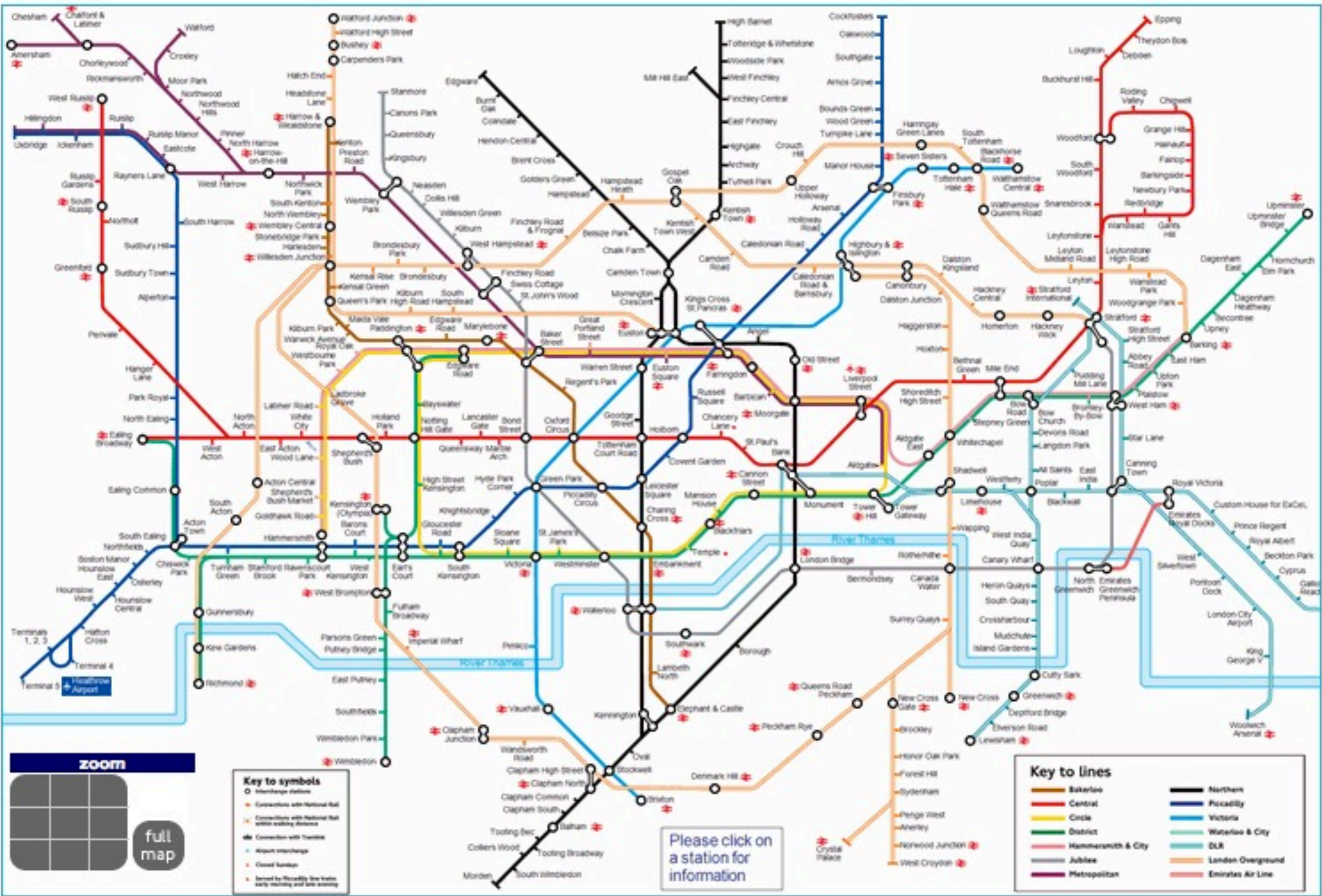
O-ring damage index, each launch

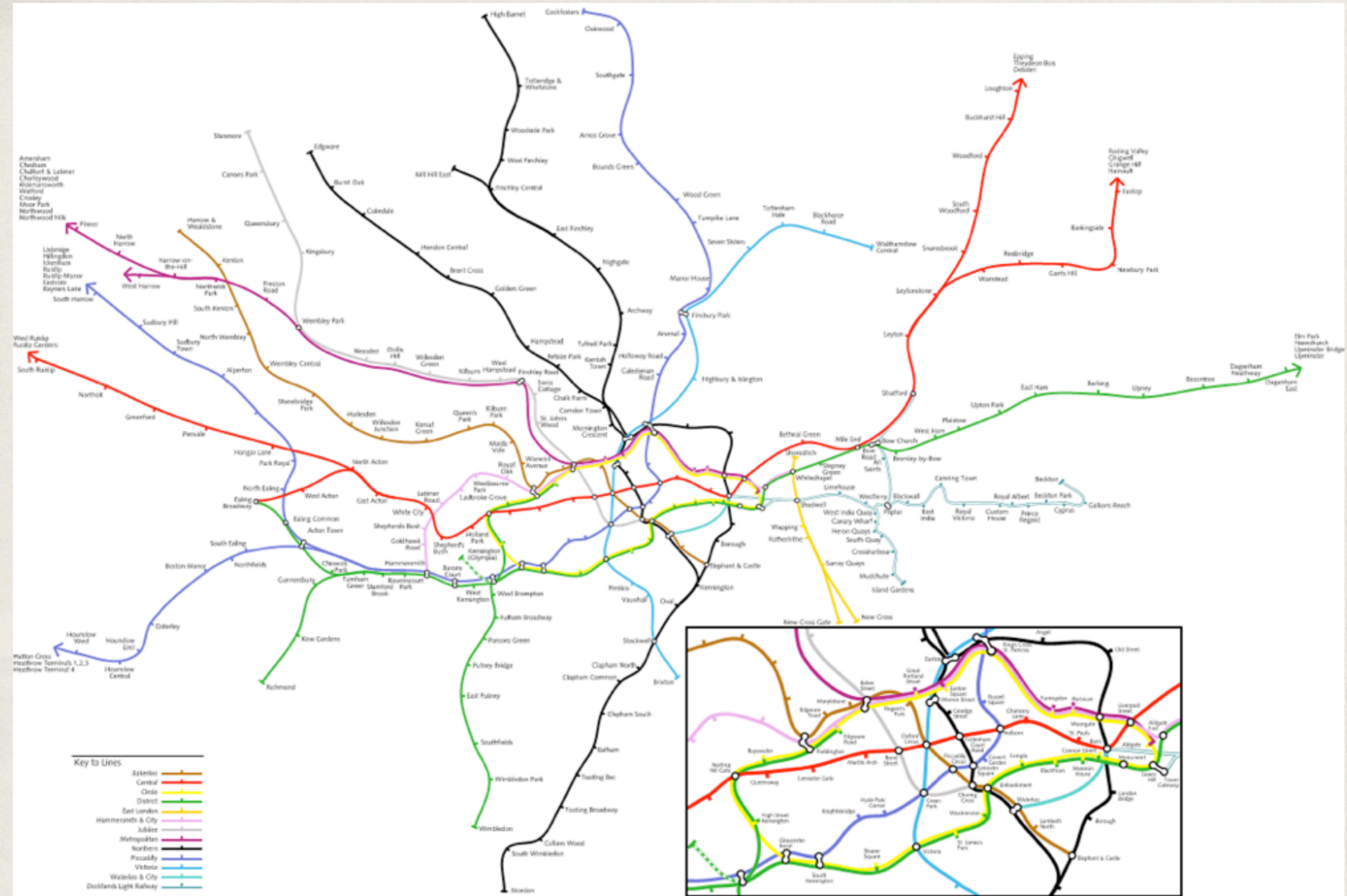


Election results 2012

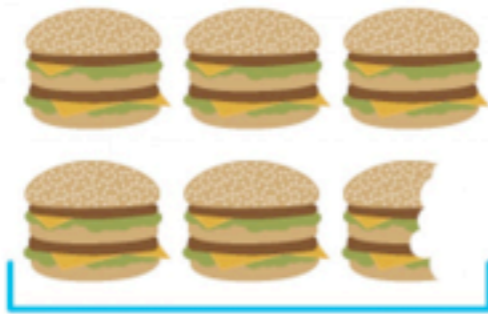


<http://www-personal.umich.edu/~mejn/election/2012/>





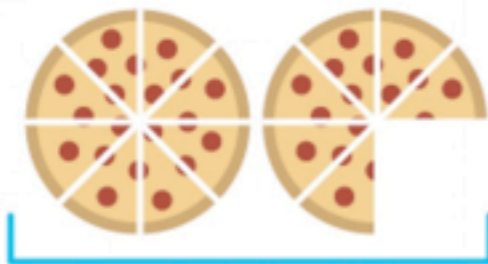
WHAT 3,000 CALORIES LOOKS LIKE IN EVERYDAY FOOD



5.45 BIG MACS



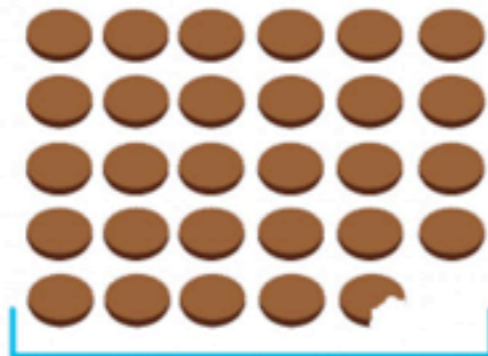
15 KRISPY KREME DOUGHNUTS



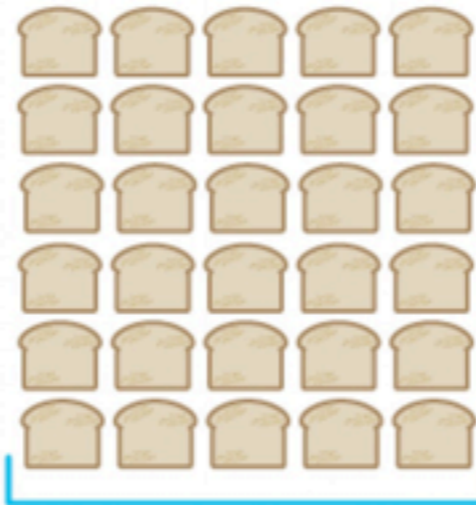
14 SLICES OF DOMINO'S PIZZA
(WITH PEPPERONI)



35 APPLEBEE'S CHICKEN WINGS
(BUFFALO STYLE)



28.6 REESE'S PEANUT BUTTER CUPS



30 SLICES OF WHOLE-WHEAT BREAD



<http://visual.ly/thanksgiving-dinner-what-3000-calories-looks-everyday-food>



SugarStacks.com



SugarStacks.com



SugarStacks.com



SugarStacks.com



SugarStacks.com



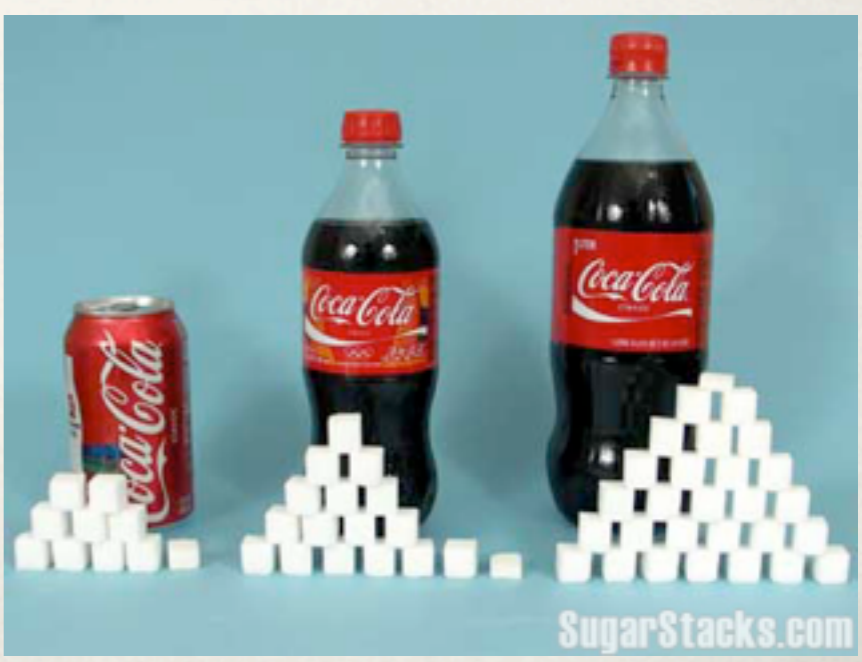
SugarStacks.com



SugarStacks.com

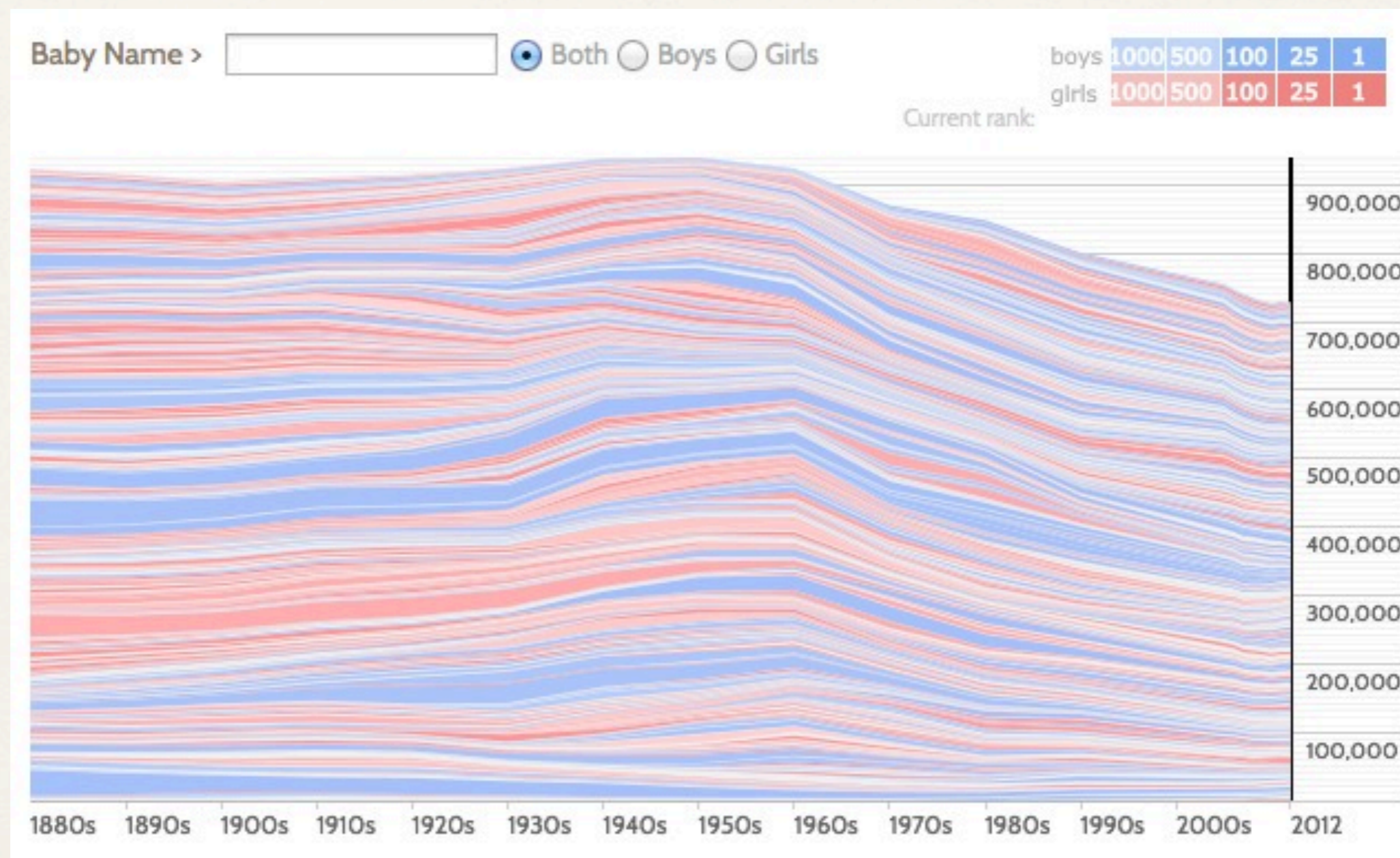


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NameVoyager

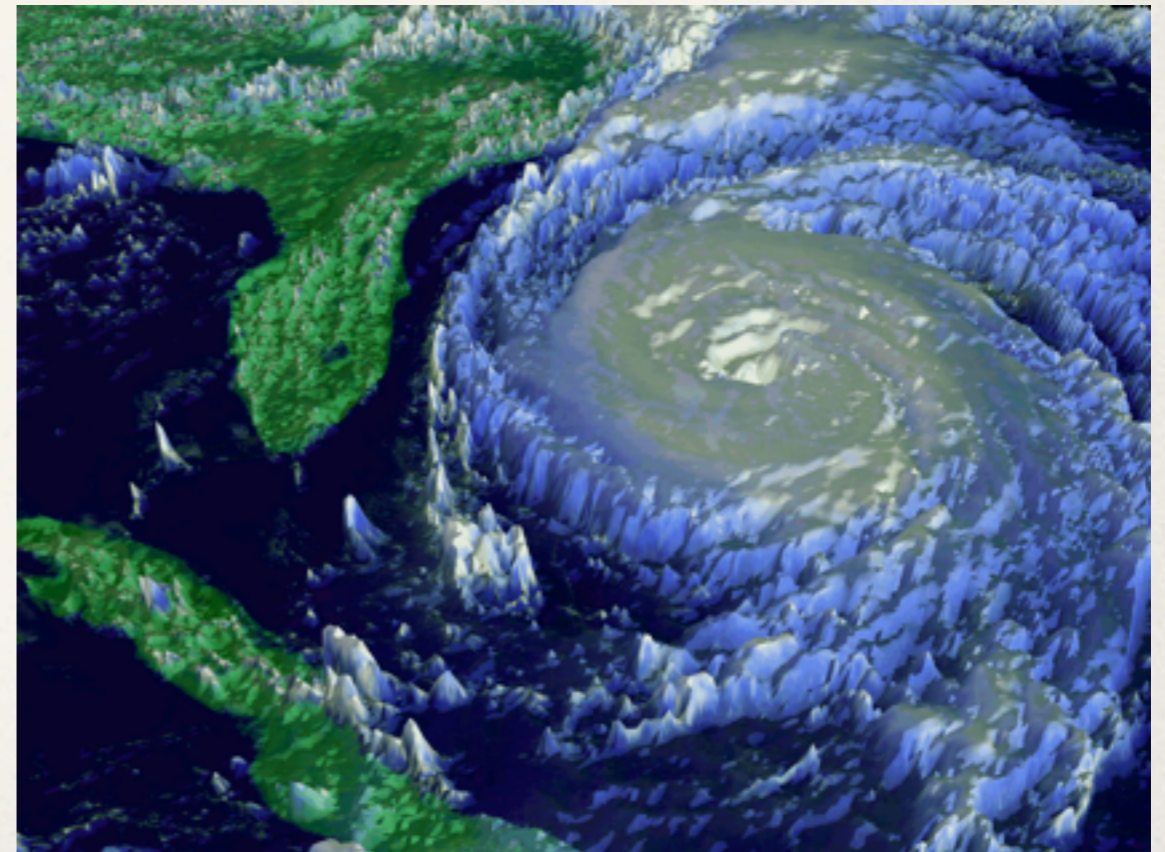
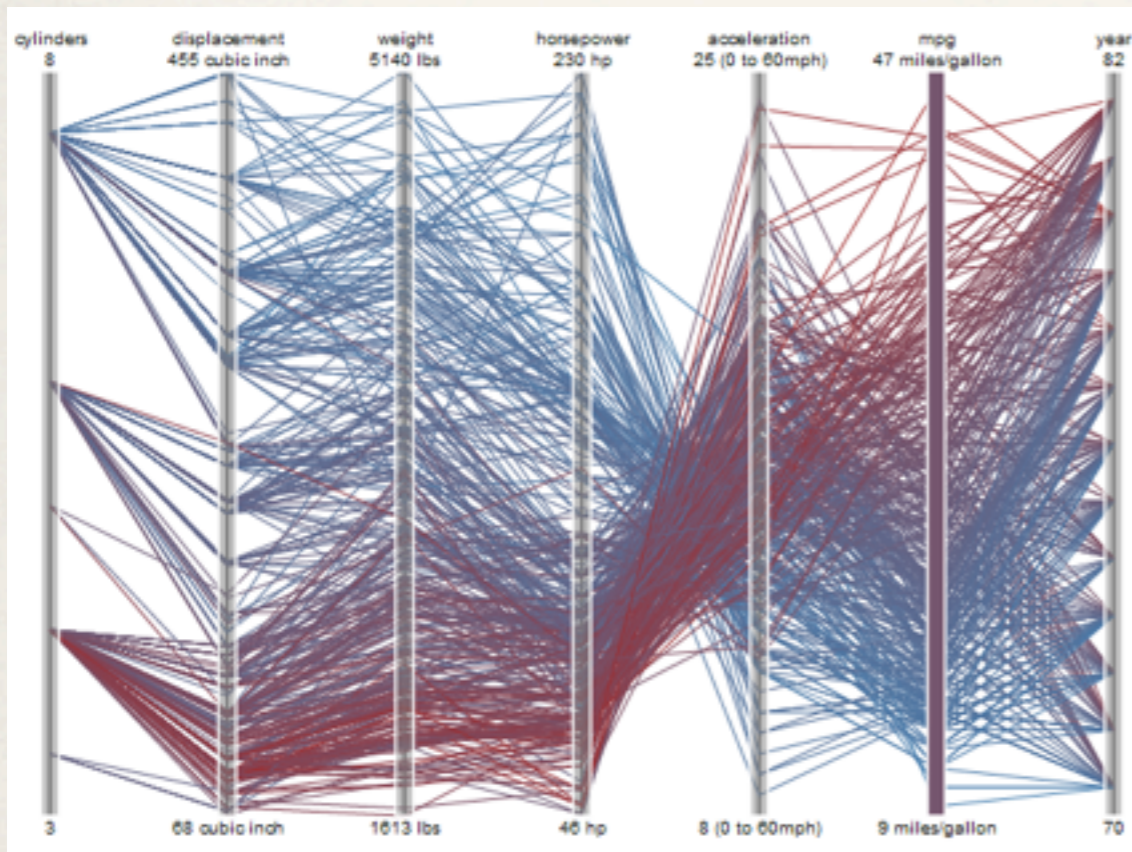


<http://www.babynamewizard.com/voyager#prefix=&sw=both&exact=false>

data visualization

information
visualization

scientific
visualization





<http://www.datavis.ca/gallery/evil-pies.php>