

# Introduction to Information Visualization

C. Andrews

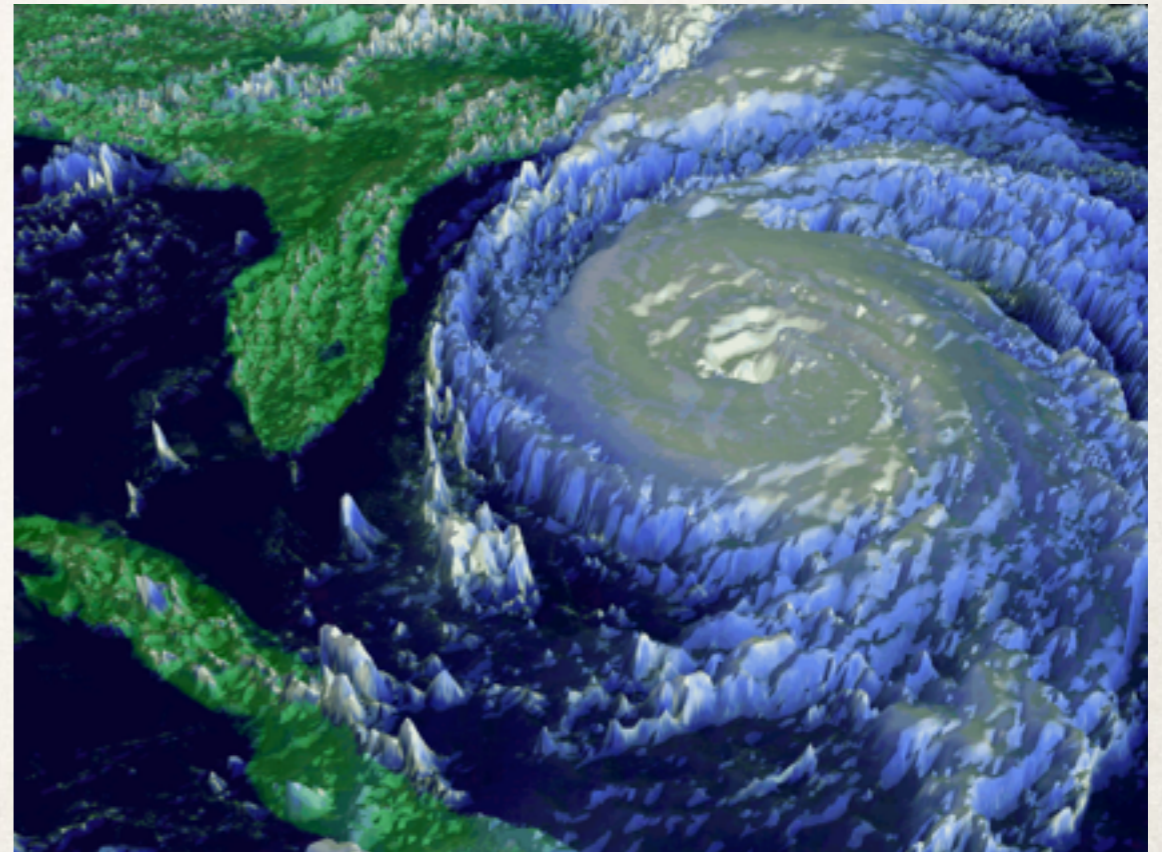
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2015-02-15

data visualization

information  
visualization

scientific  
visualization



# 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

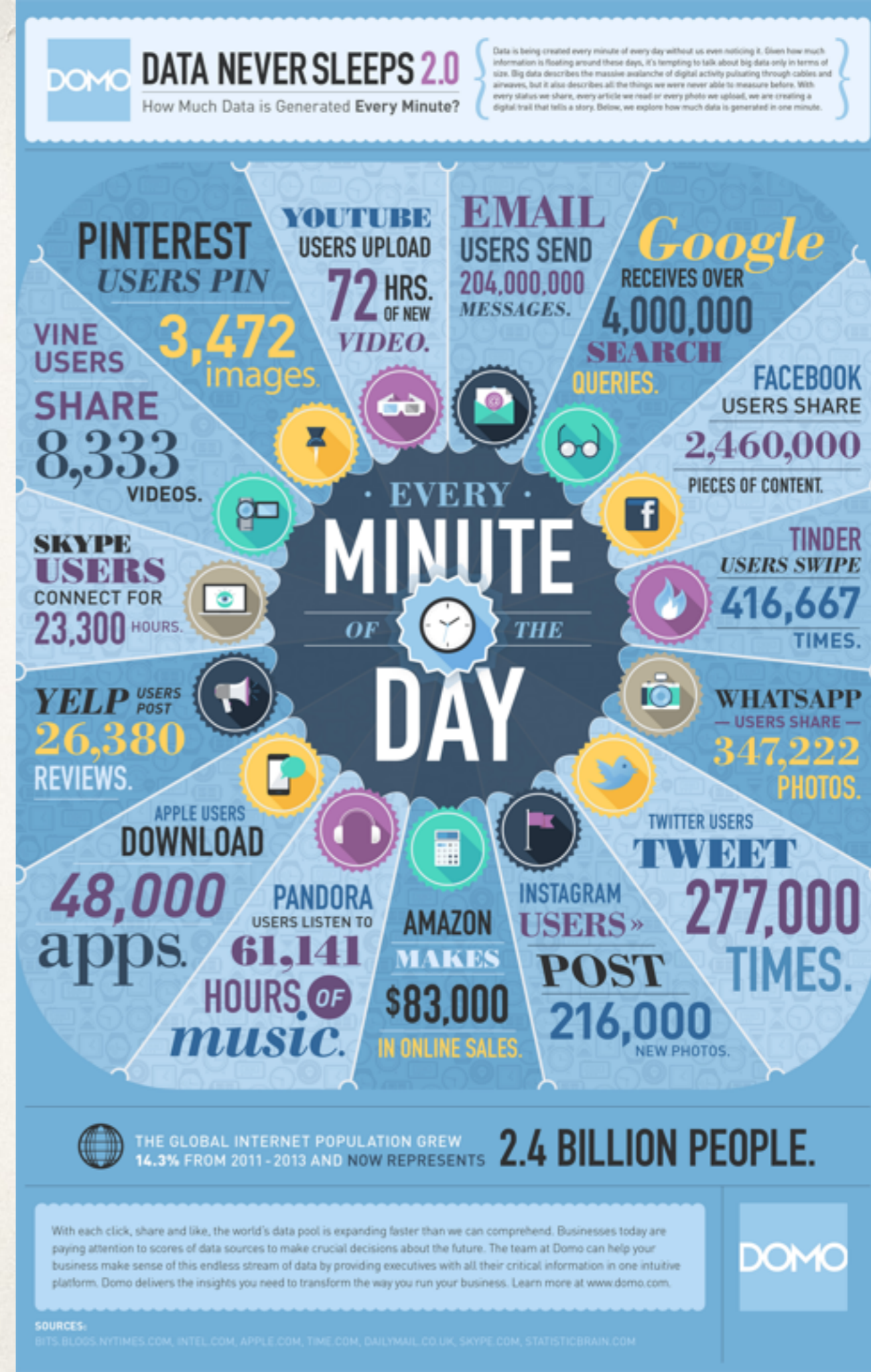
## Too much data?

2.5 Quintillion bytes of data  
produced every day

2,500,000,000,000,000,000 bytes!

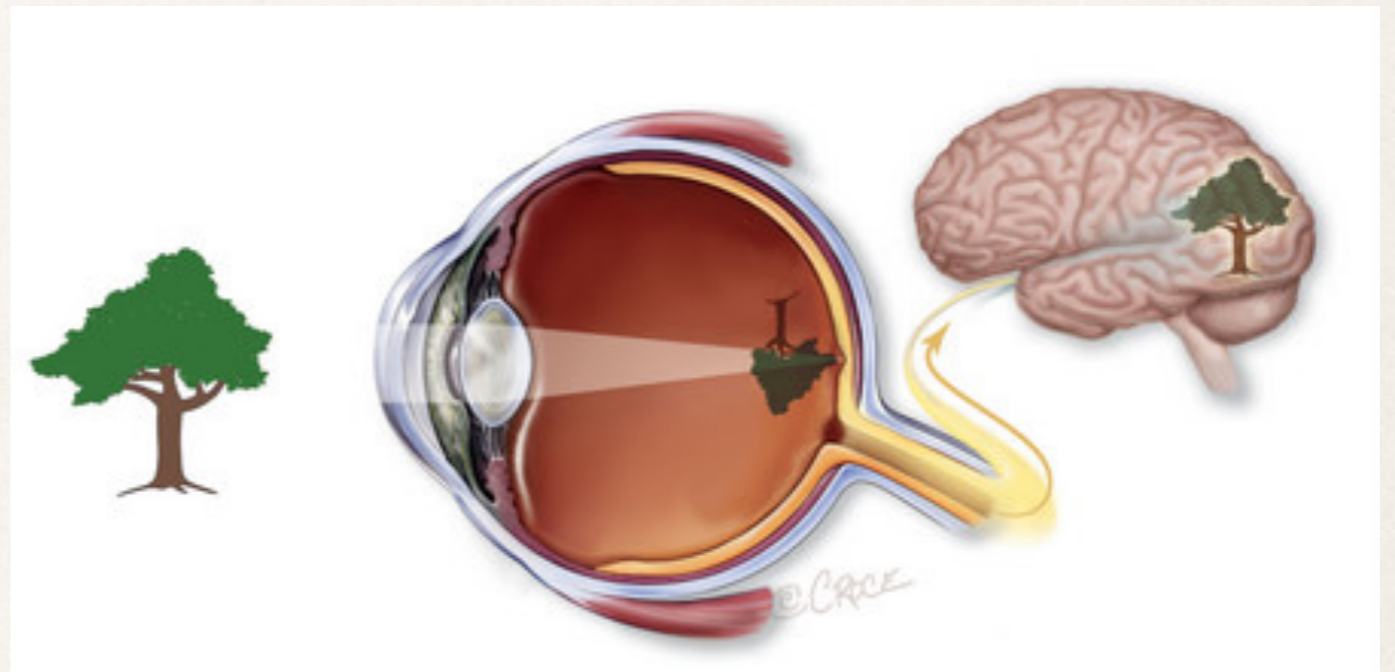
# Too much data

No one said it was all interesting...  
but how to know the difference?



# 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](http://bionicvision.org.au/eye/healthy_vision)

# 2010 US Census data

State	income	% degree
Alabama	23,587	22.3
Alaska	32,537	27.5
Arizona	25,571	26.6
Arkansas	22,007	19.8
California	29,551	30.5
Colorado	31,039	36.7
Connecticut	37,807	36.2
Delaware	29,733	28.5
Dist. of Col.	45,004	51.2
Florida	26,451	26.2
Georgia	25,309	27.8
Hawaii	29,227	29.6
Idaho	22,581	24.7
Illinois	29,519	31.1
Indiana	24,558	23.0
Iowa	26,545	25.3
Kansas	26,845	30.0
Kentucky	23,210	21.0
Louisiana	24,264	21.4
Maine	26,464	27.3
Maryland	36,056	36.3
Massachusetts	35,485	39.0
Michigan	25,547	25.5
Minnesota	30,656	32.2
Mississippi	20,670	20.0
Missouri	25,546	25.8

State	income	% degree
Montana	25,002	28.5
Nebraska	26,523	28.1
Nevada	27,003	22.2
New Hampshire	32,758	33.4
New Jersey	35,928	35.4
New Mexico	23,749	25.6
New York	32,104	32.8
North Carolina	25,285	26.8
North Dakota	28,700	27.1
Ohio	25,857	24.7
Oklahoma	24,046	23.2
Oregon	26,702	29.2
Pennsylvania	28,190	27.0
Rhode Island	30,005	30.8
South Carolina	23,906	24.6
South Dakota	25,570	26.0
Tennessee	24,294	23.5
Texas	25,809	26.3
Utah	23,794	29.9
Vermont	28,846	34.2
Virginia	33,326	34.7
Washington	30,661	31.6
West Virginia	22,482	17.9
Wisconsin	27,426	26.4
Wyoming	28,858	24.3

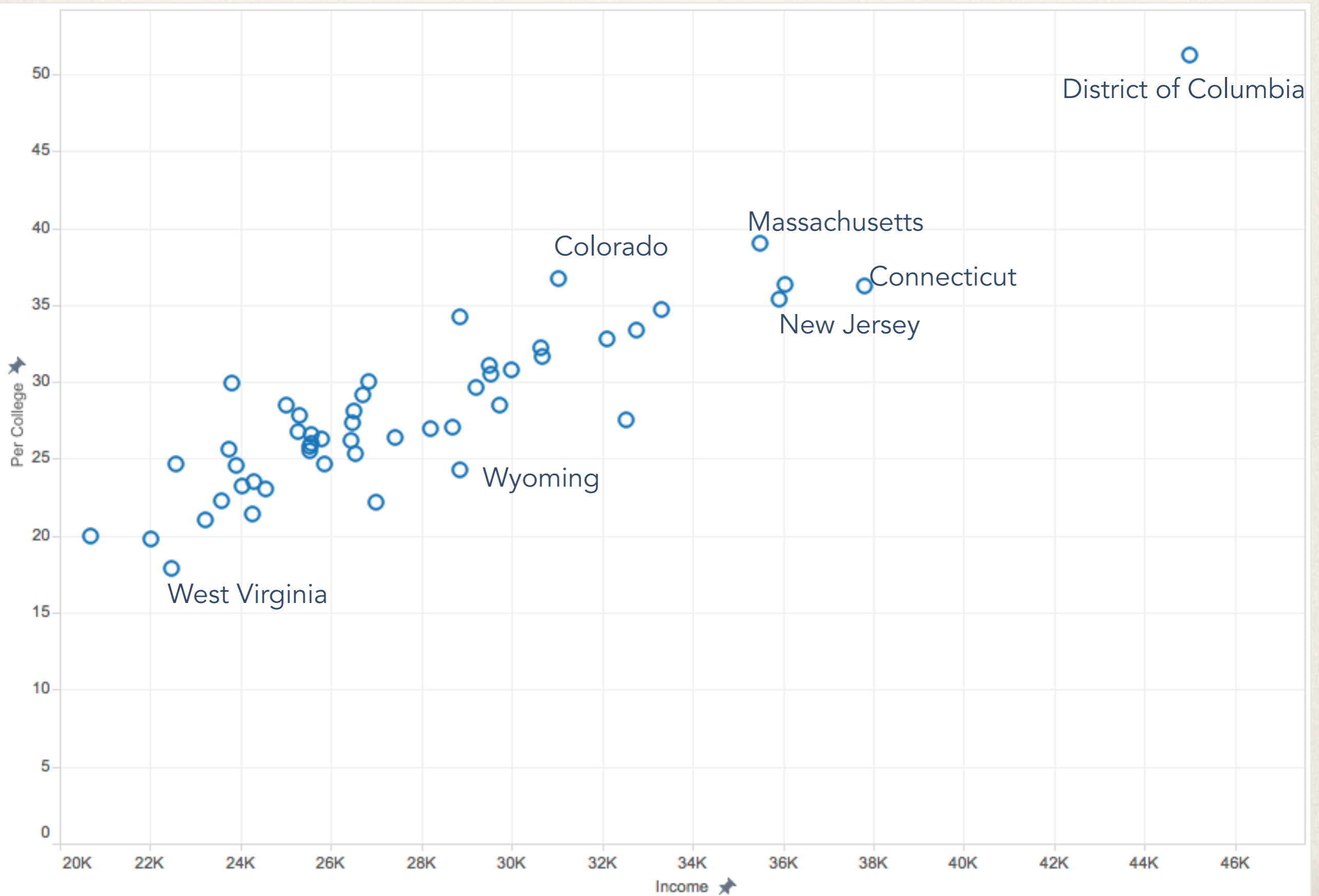


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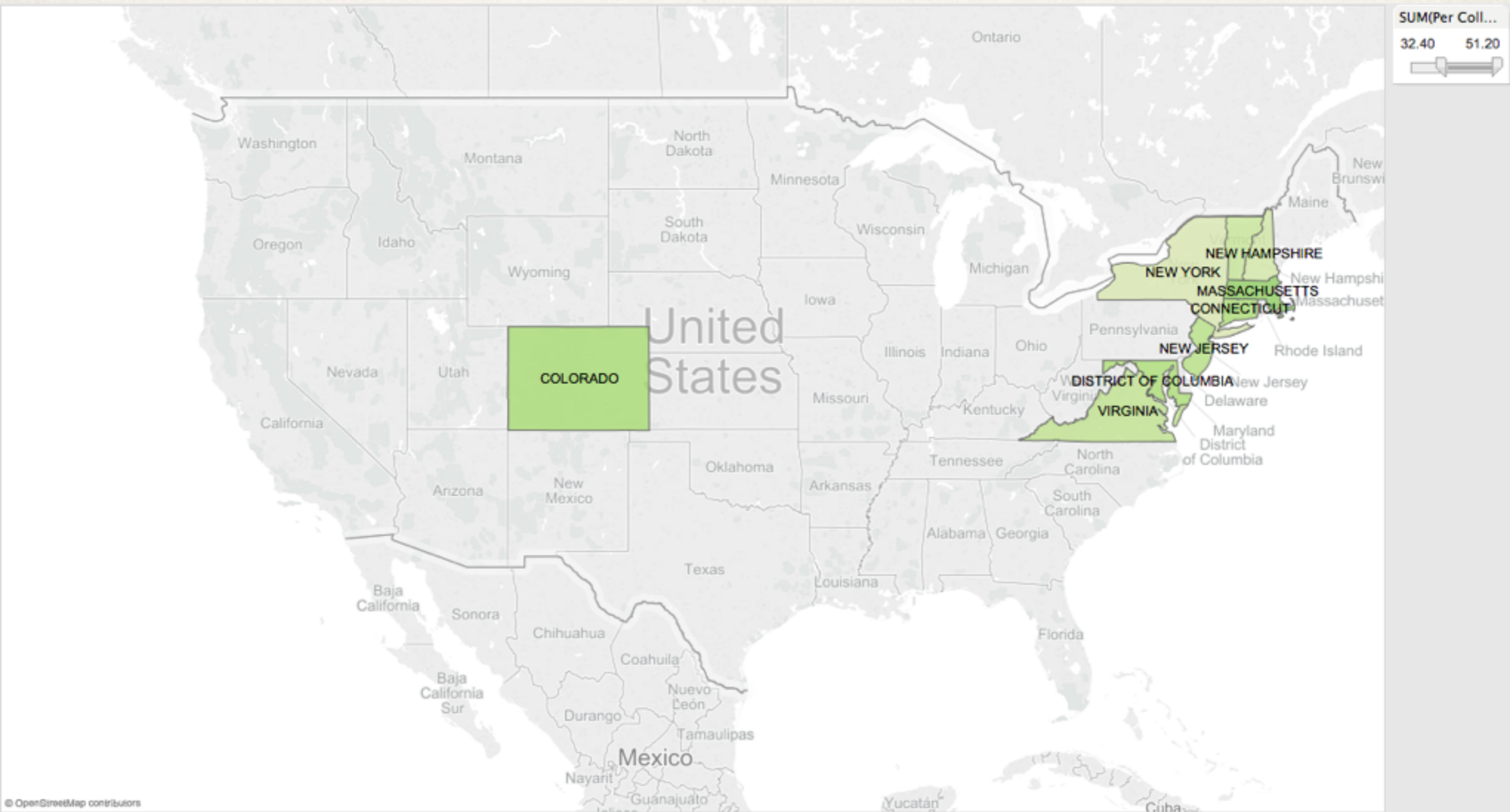
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# 2010 US Census data



# 2010 US Census data



# Visualization goals

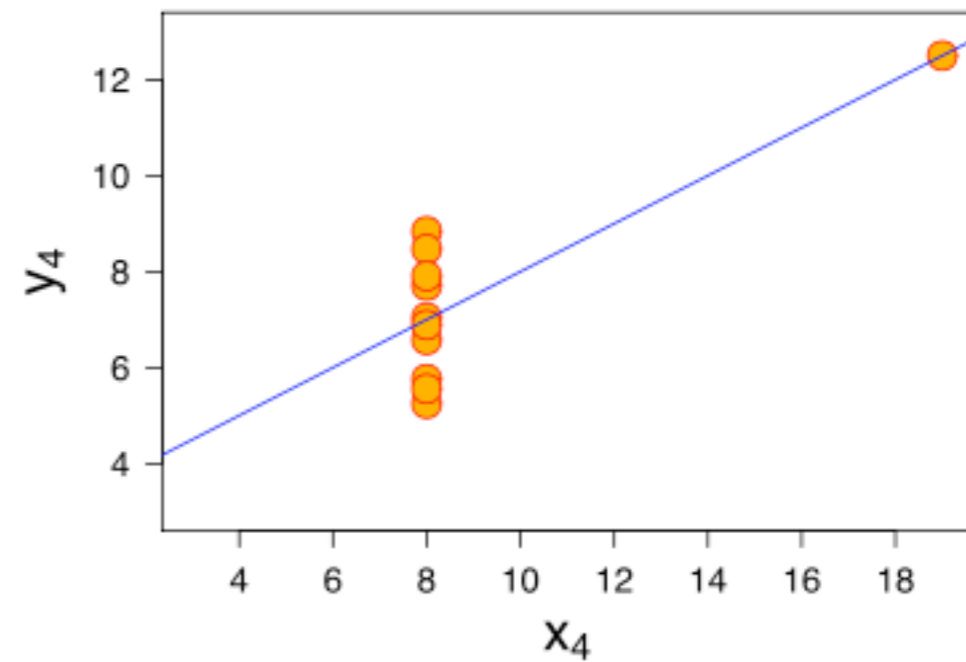
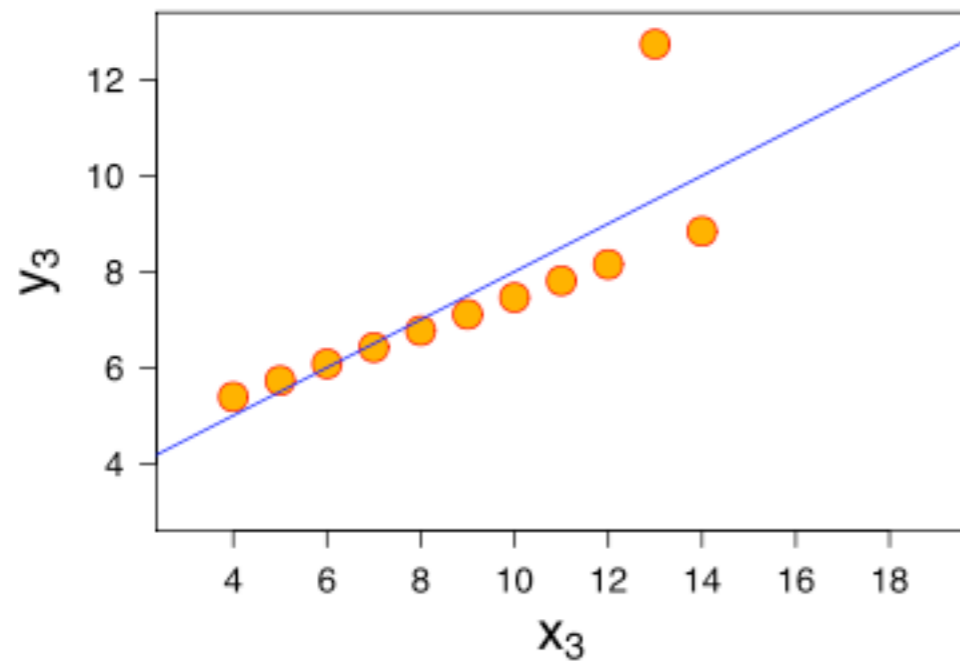
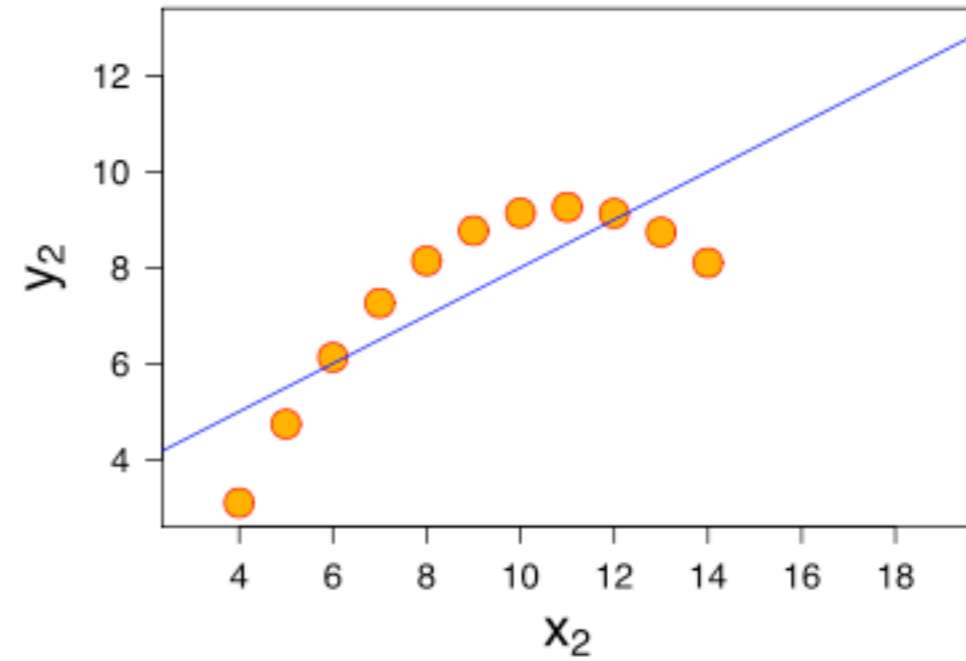
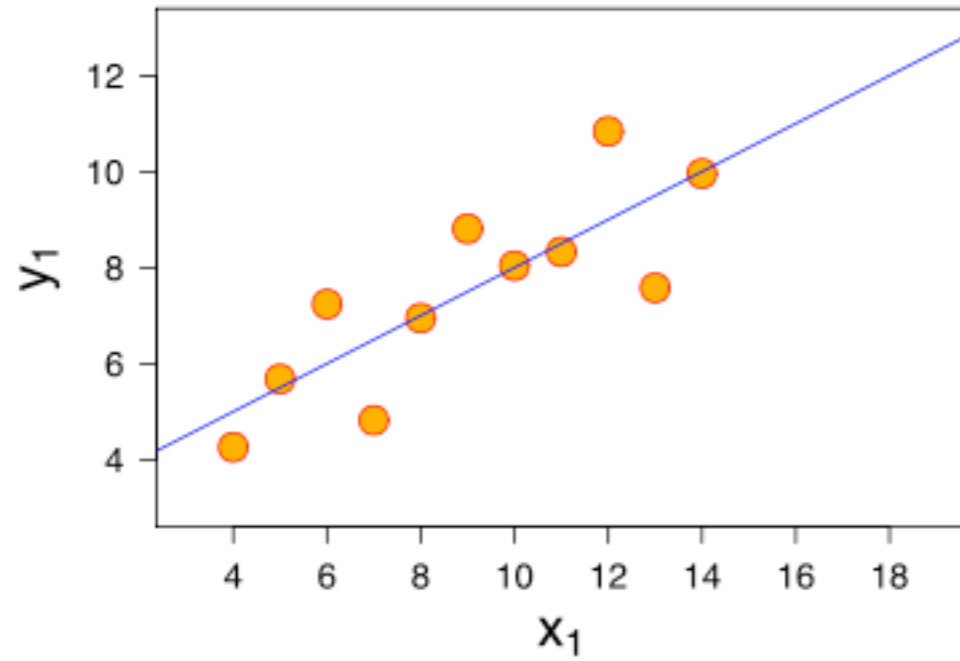
- ❖ Presentation
  - ❖ tell stories
  - ❖ inform, persuade
  - ❖ collaborate
- ❖ Overview or monitoring
- ❖ Analysis
  - ❖ try to make sense of a large mass of data, figure out what is interesting
  - ❖ look for patterns, trends, outliers, relationships, correlations, clusters, anomalies

# Anscombe's Quartet

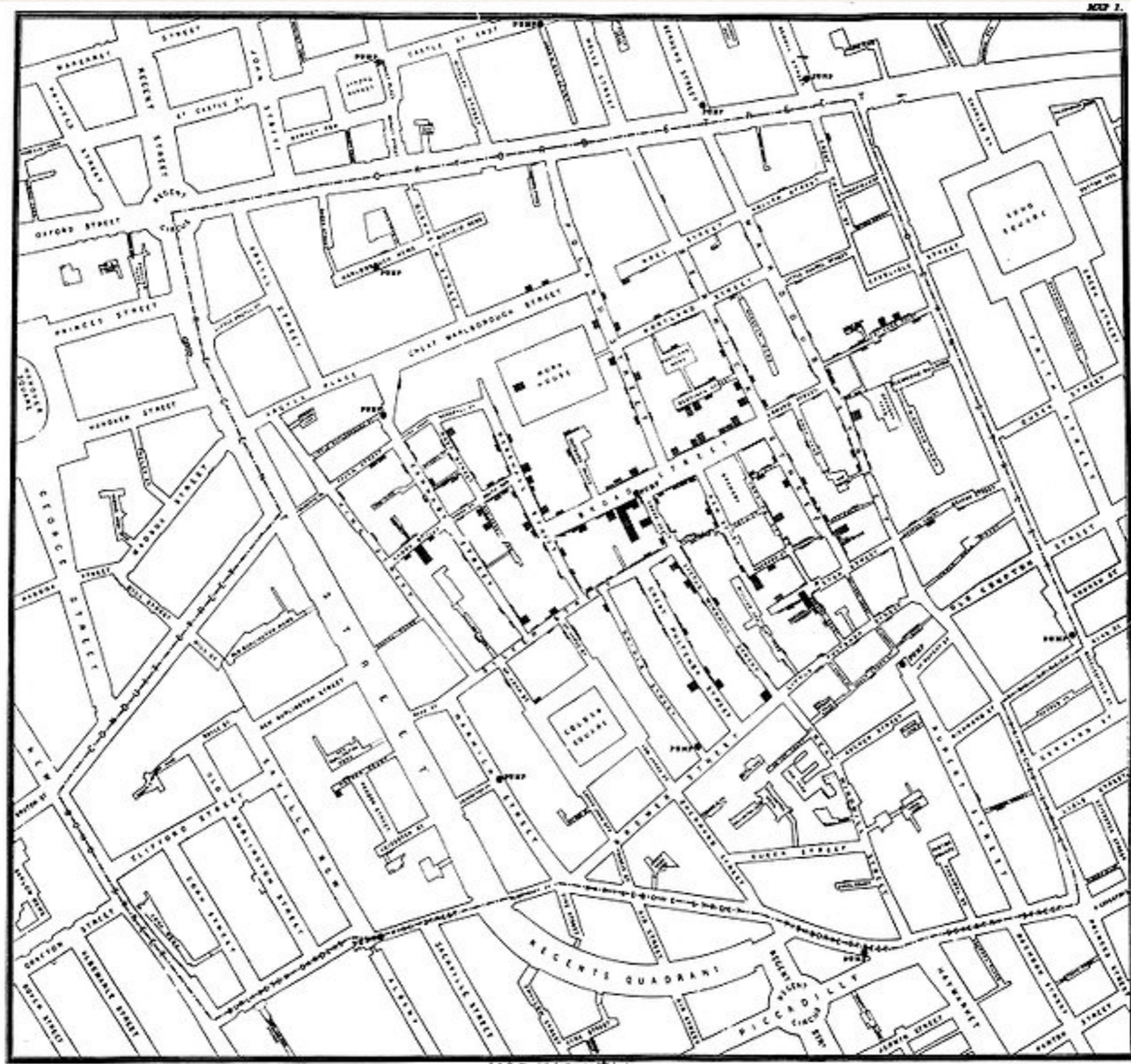
**mean of X**      9  
**variance of x**    11  
**mean of y**      7.5  
**variance of y**    4.122

I		II		III		IV	
x	y	x	y	x	y	x	y
10	8.04	10	9.14	10	7.46	8	6.58
8	6.95	8	8.14	8	6.77	8	5.76
13	7.58	13	8.74	13	12.74	8	7.71
9	8.81	9	8.77	9	7.11	8	8.84
11	8.33	11	9.26	11	7.81	8	8.47
14	9.96	14	8.1	14	8.84	8	7.04
6	7.24	6	6.13	6	6.08	8	5.25
4	4.26	4	3.1	4	5.39	19	12.5
12	10.84	12	9.13	12	8.15	8	5.56
7	4.82	7	7.26	7	6.42	8	7.91
5	5.68	5	4.74	5	5.73	8	6.89

# Anscombe's Quartet



# Snow: Cholera Map [1854]



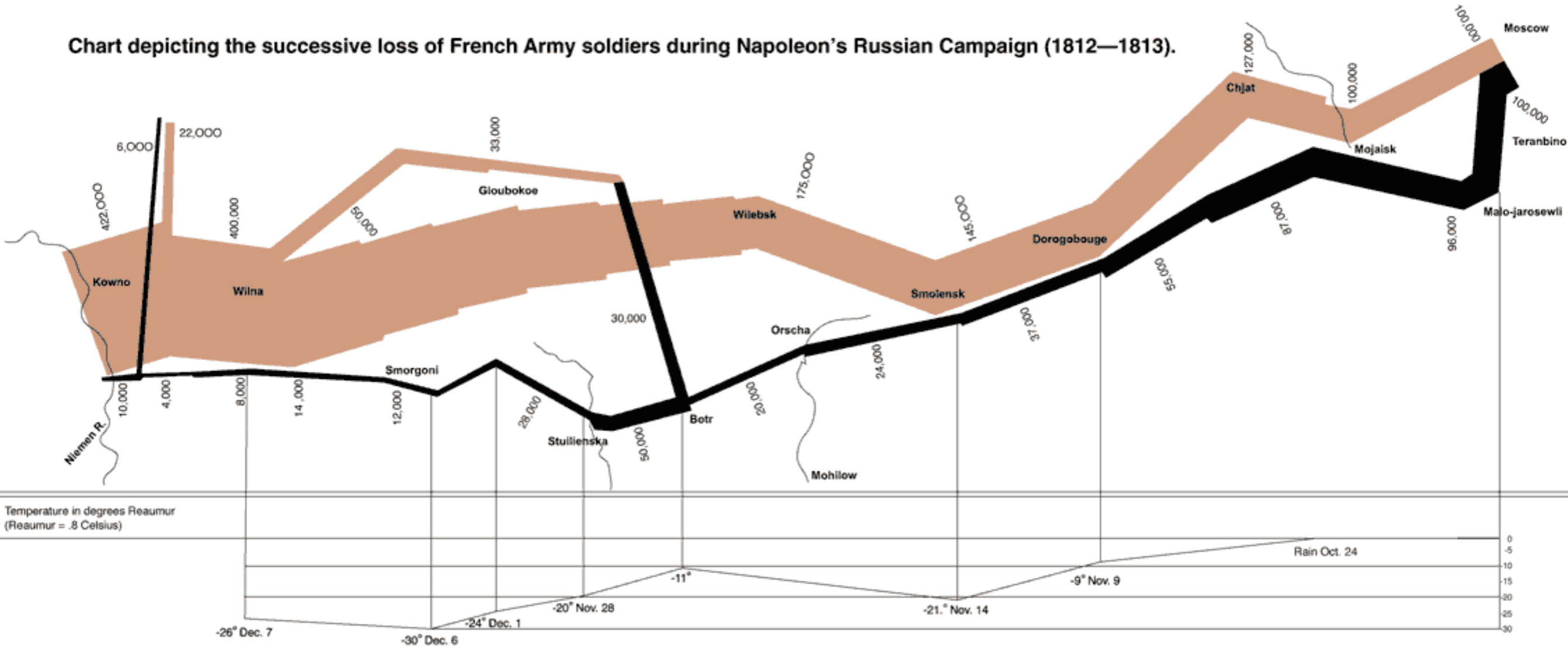
# Snow: Cholera Map [1854]





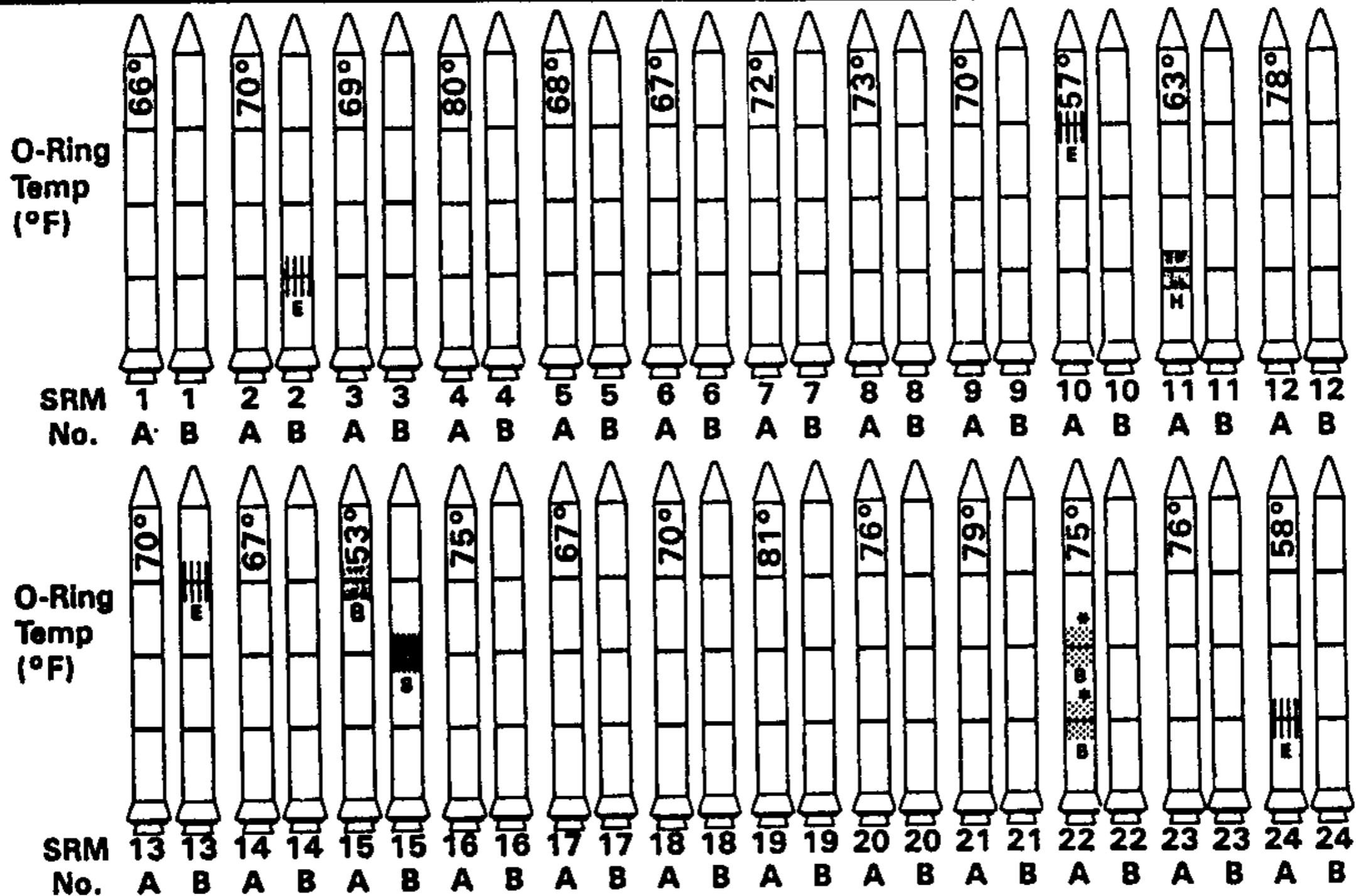
# Minard: Napoleon's march [1869]

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)



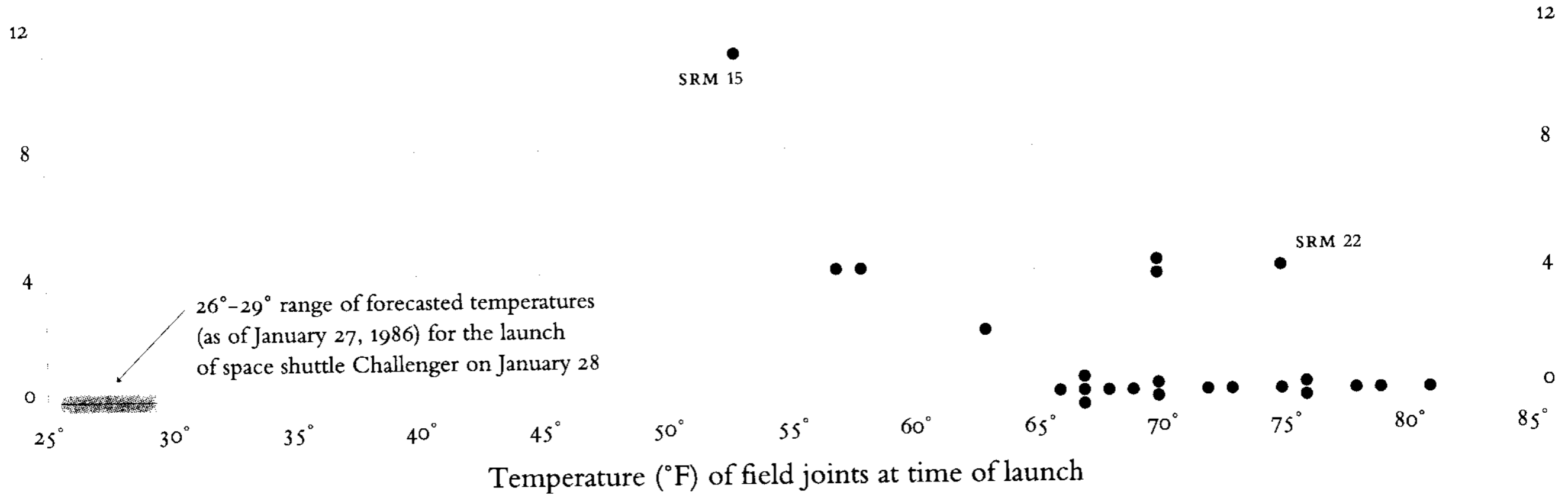
MORTON THIKOL, INC.  
Wasatch Operations

\* No Erosion

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





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SugarStacks.com



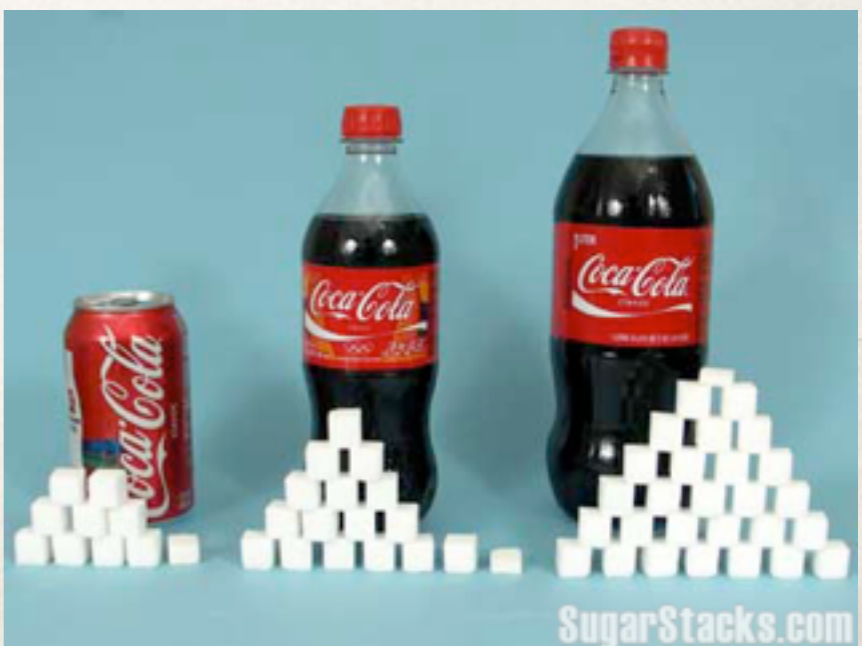
SugarStacks.com



SugarStacks.com

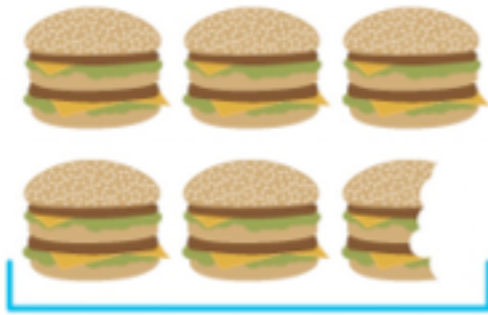


SugarStacks.com



SugarStacks.com

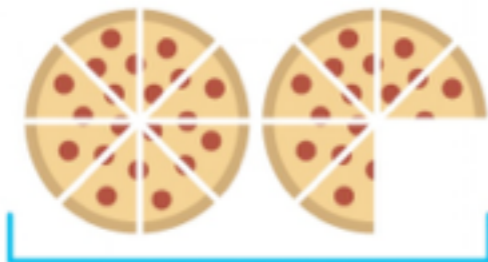
# WHAT 3,000 CALORIES LOOKS LIKE IN EVERYDAY FOOD



5.45 BIG MACS



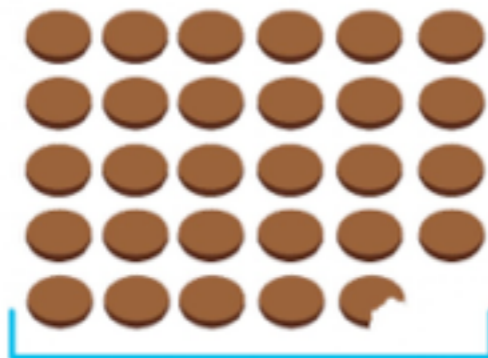
15 KRISPY KREME DOUGHNUTS



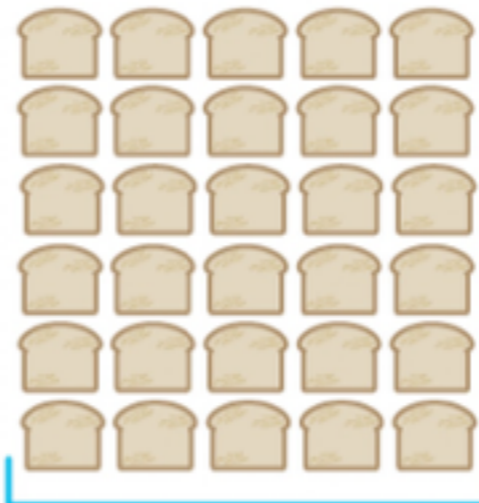
14 SLICES OF DOMINO'S PIZZA  
(WITH PEPPERONI)



35 APPLEBEE'S CHICKEN WINGS  
(BUFFALO STYLE)



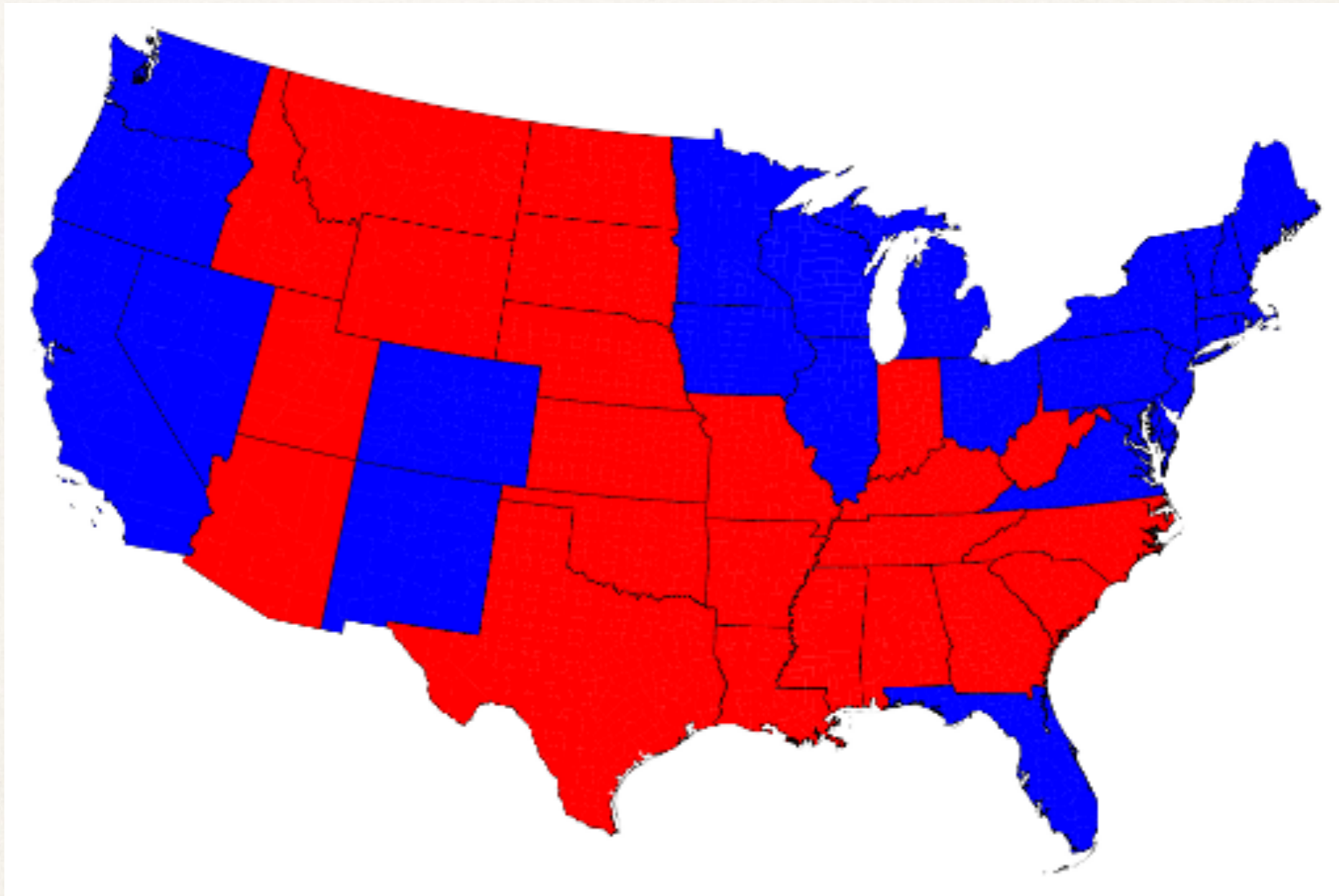
28.6 REESE'S PEANUT BUTTER CUPS



30 SLICES OF WHOLE-WHEAT BREAD

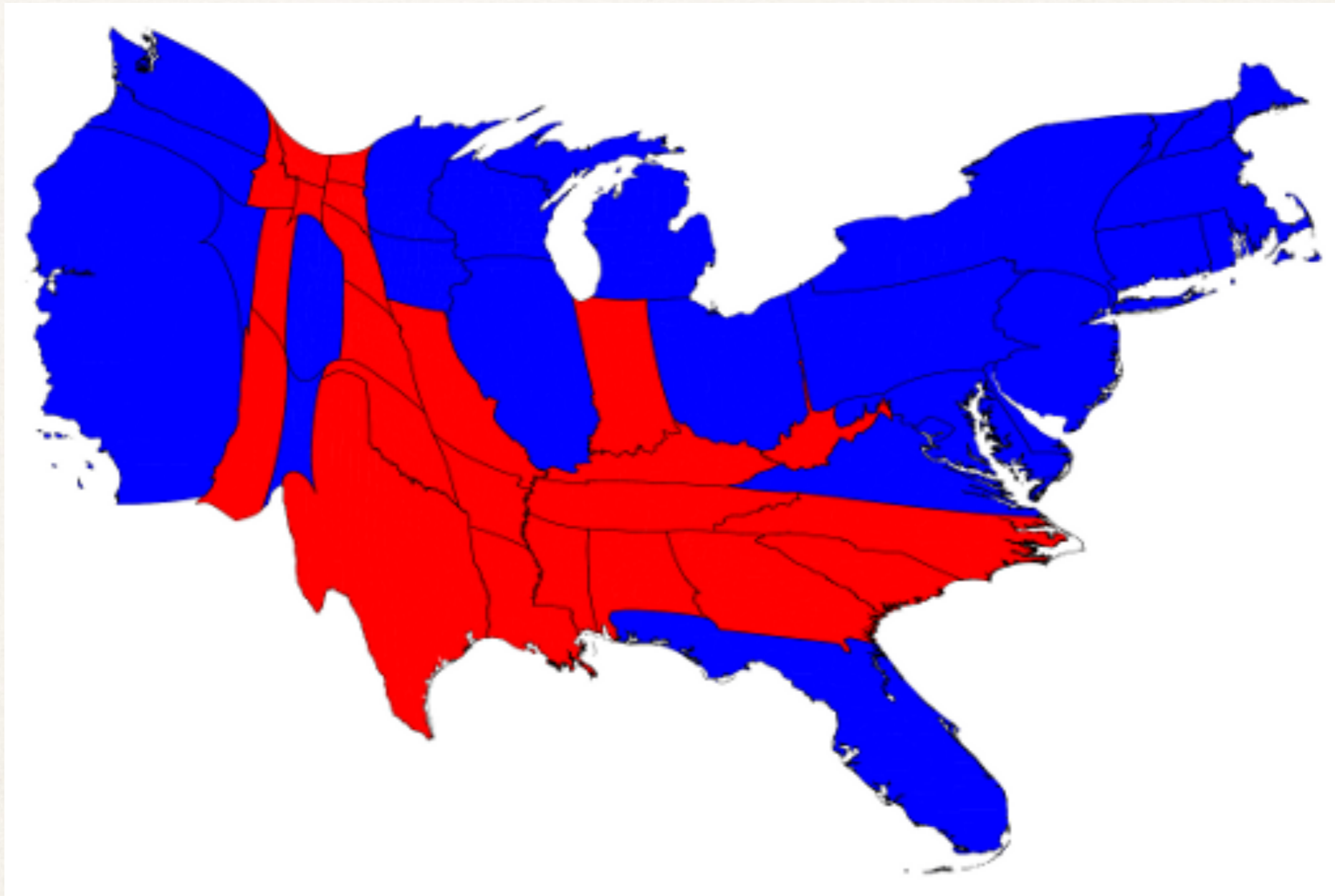


# Election results 2012



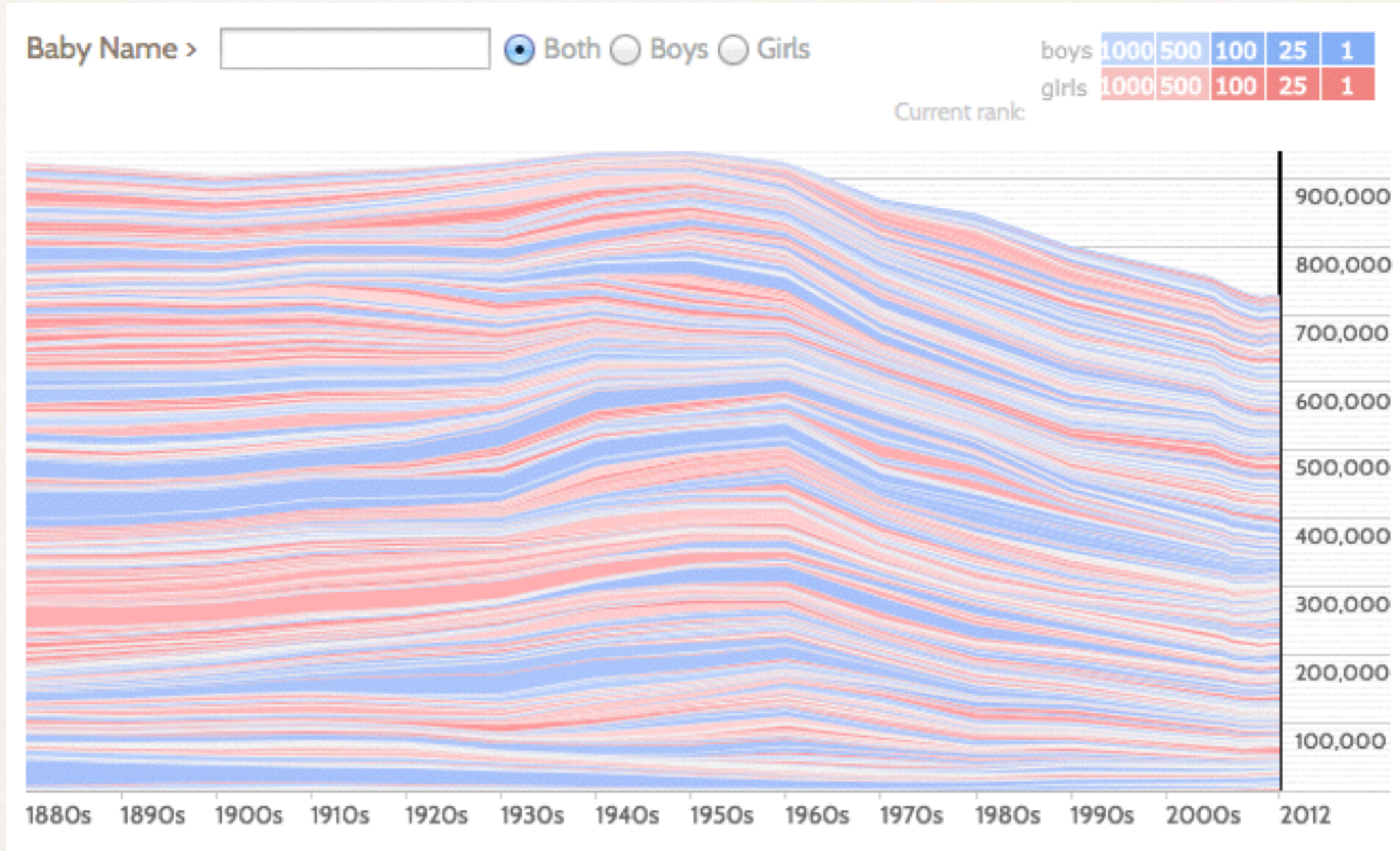
<http://www-personal.umich.edu/~mejn/election/2012/>

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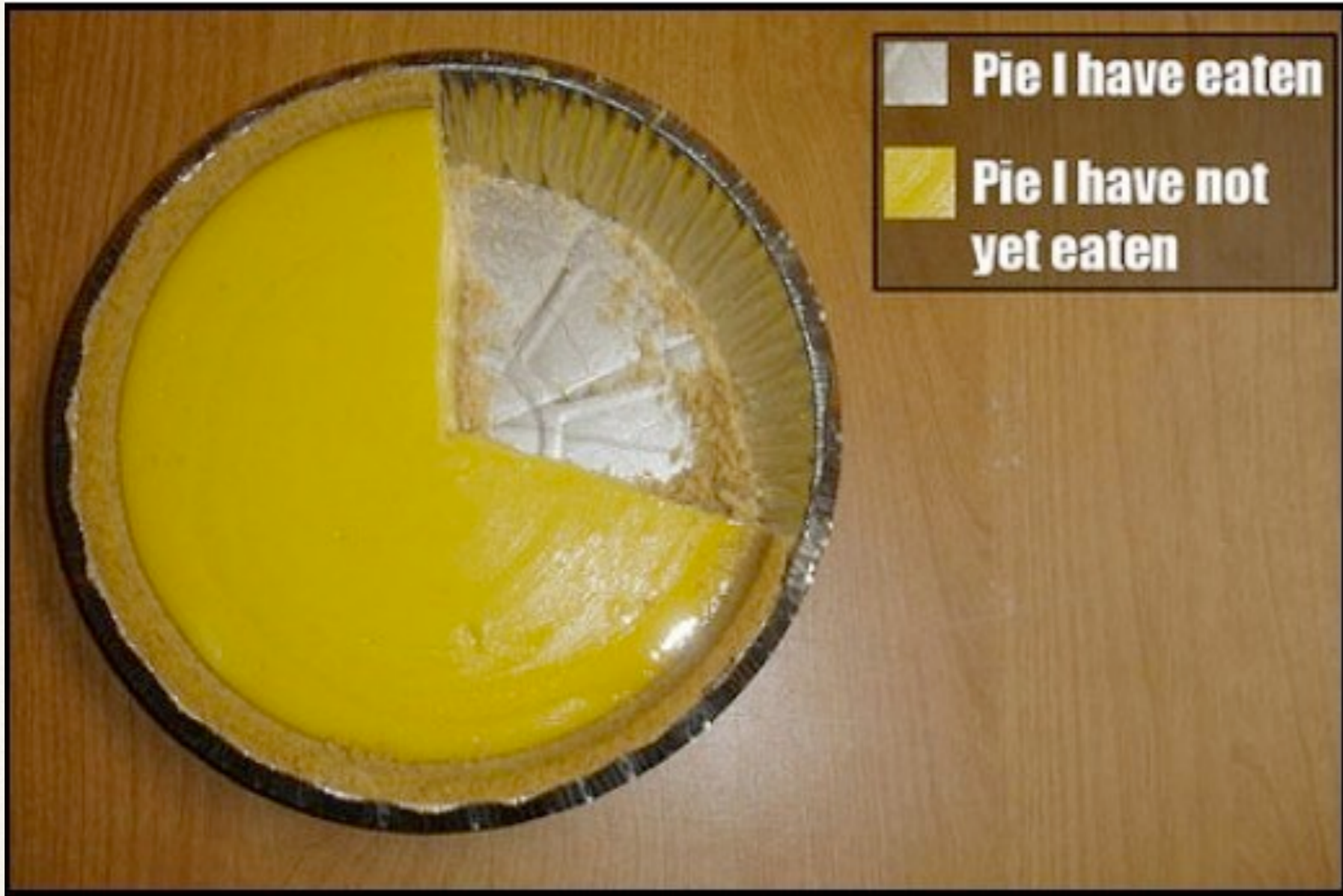
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# NameVoyager



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





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