



# Introduction to Data Analytics

## Displaying Data

University of Michigan

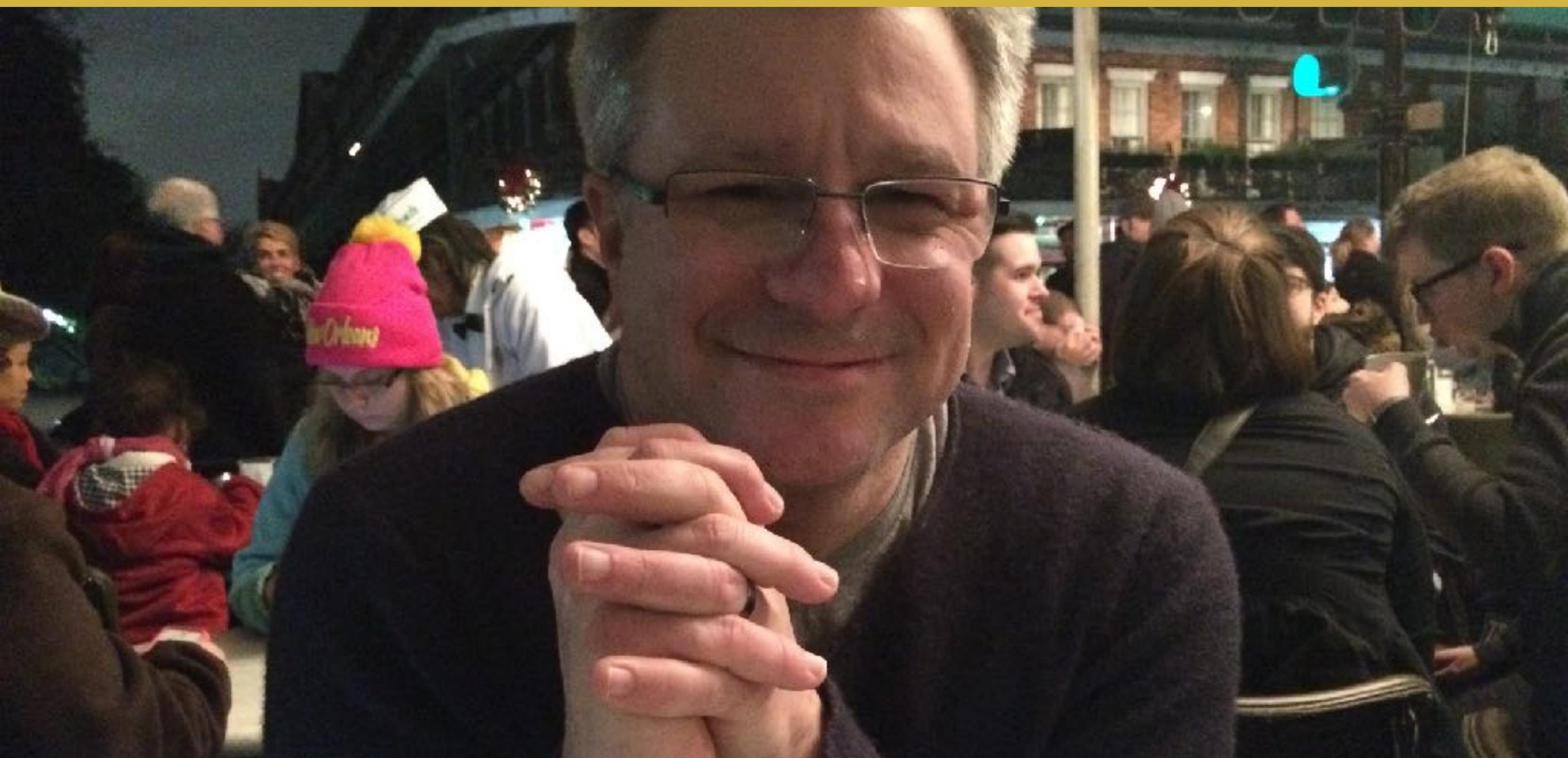
Tom Crawford  
[viznetwork.com](http://viznetwork.com)  
[@viznetwork](https://twitter.com/viznetwork) [@thcrawford](https://twitter.com/thcrawford)

# Introductions

# About Me



# About Me



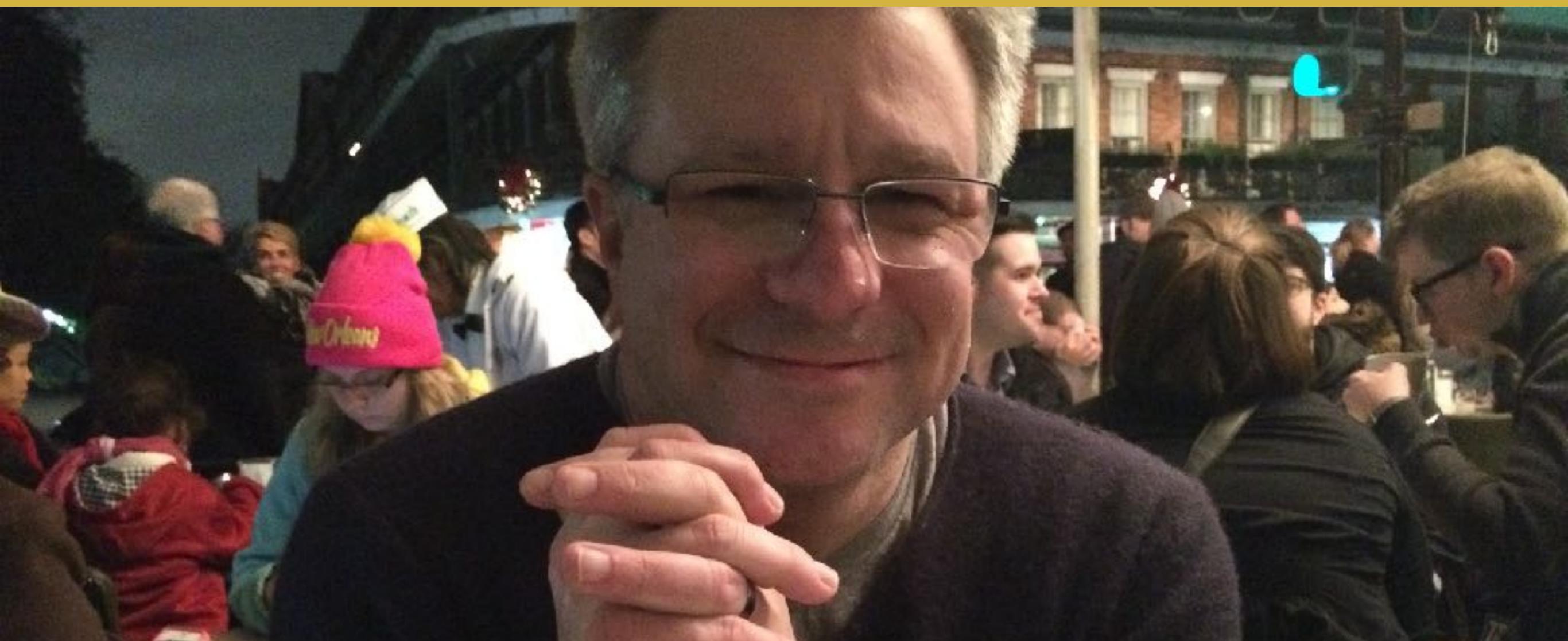
# About Me



# About Me



# About Me



Beaumont<sup>®</sup>

Valassis

root  
people. strategy. results.

masie  
Center

vizthink

Moveable  
Bytes

The  
**IRON  
YARD**

thinkorswim  
by TD Ameritrade

# About You

What's your first name?

What data do you want to visualize?

What do you hope to get out of this class?

# Today

Why Visualize Data?

Types of Data

Selecting Charts & Graphs

Graph Basics

Parts of the Whole

Geographic Data

Text Values, Words & Relationships

Encoding Data

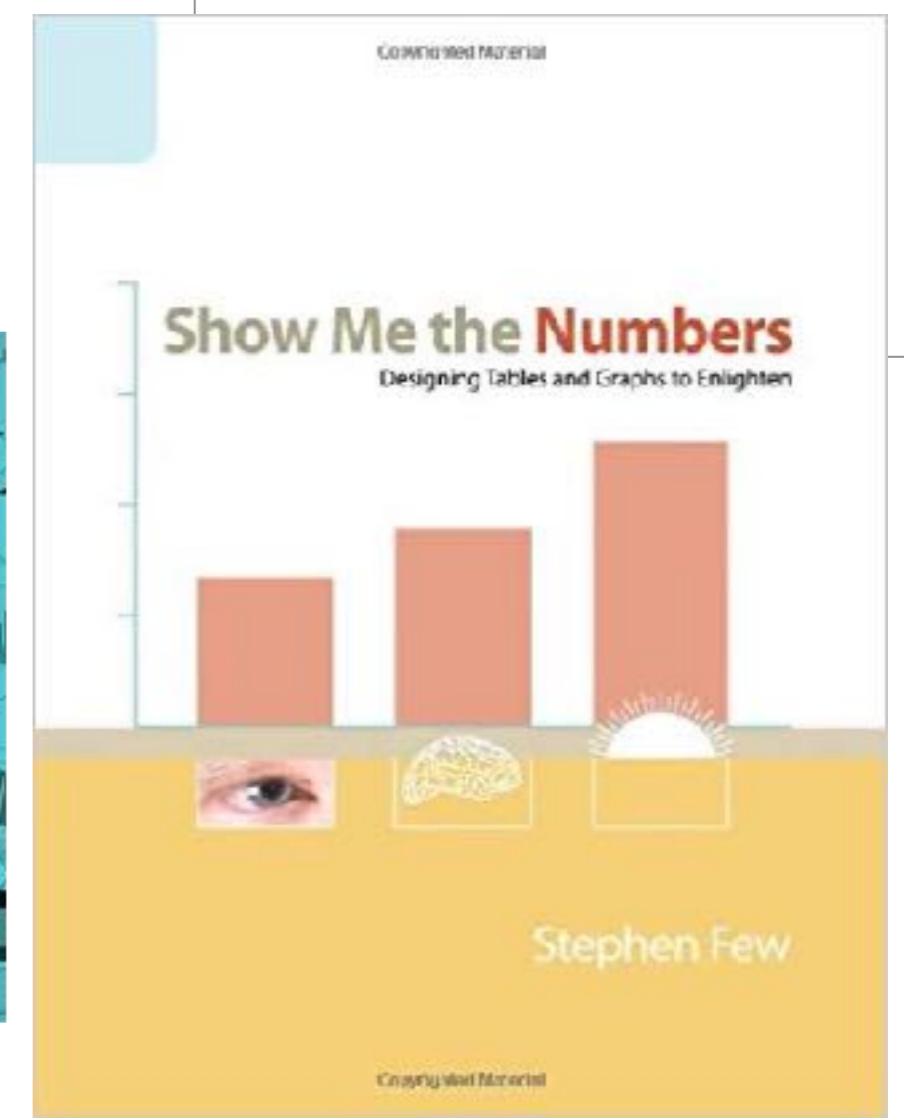
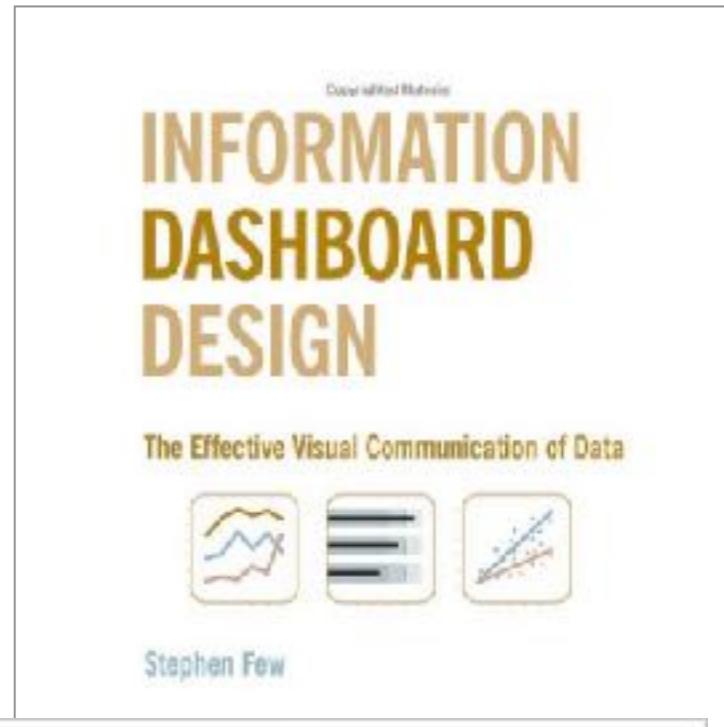
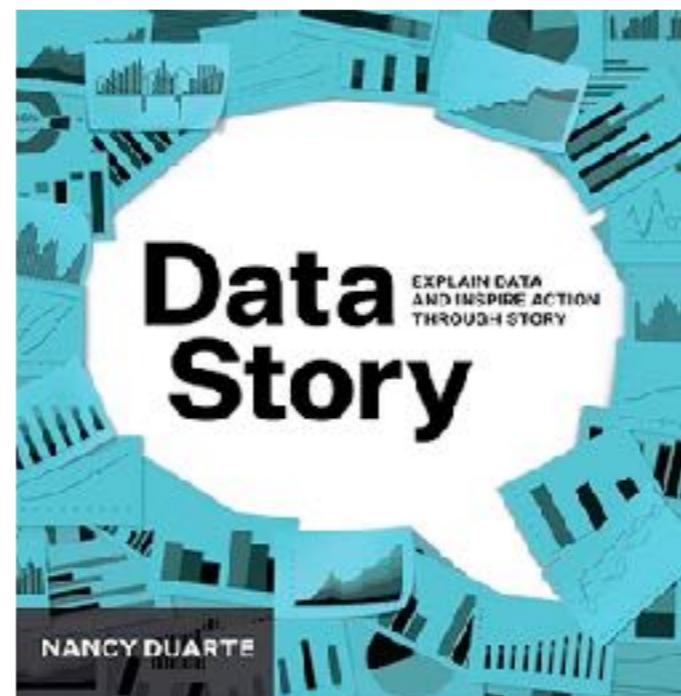
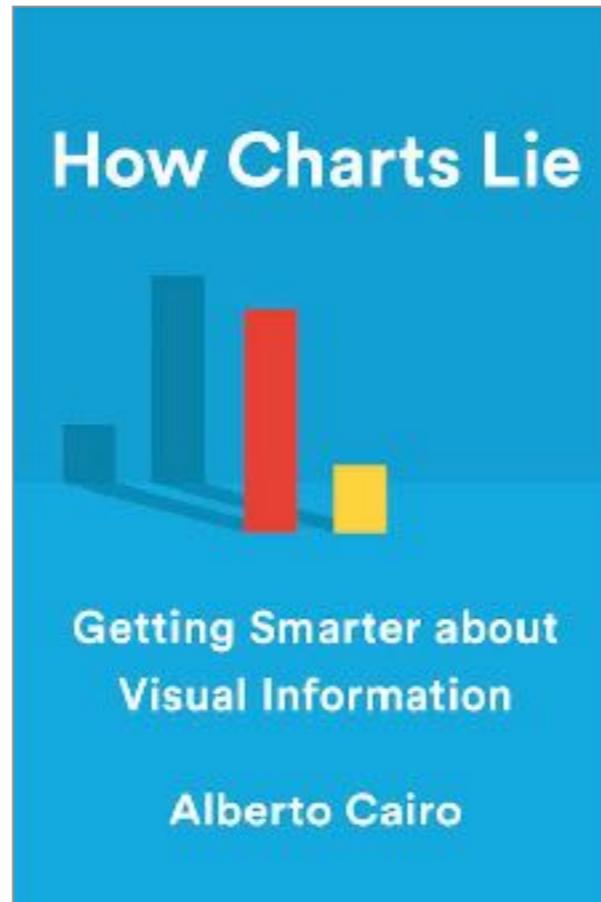
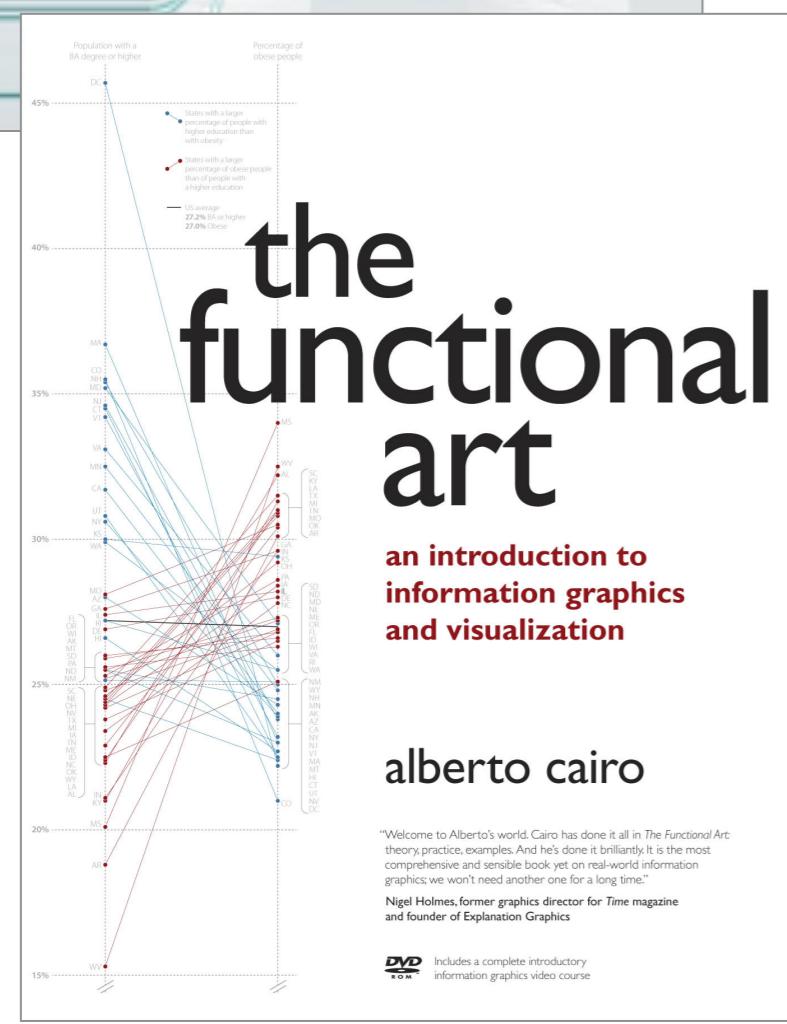
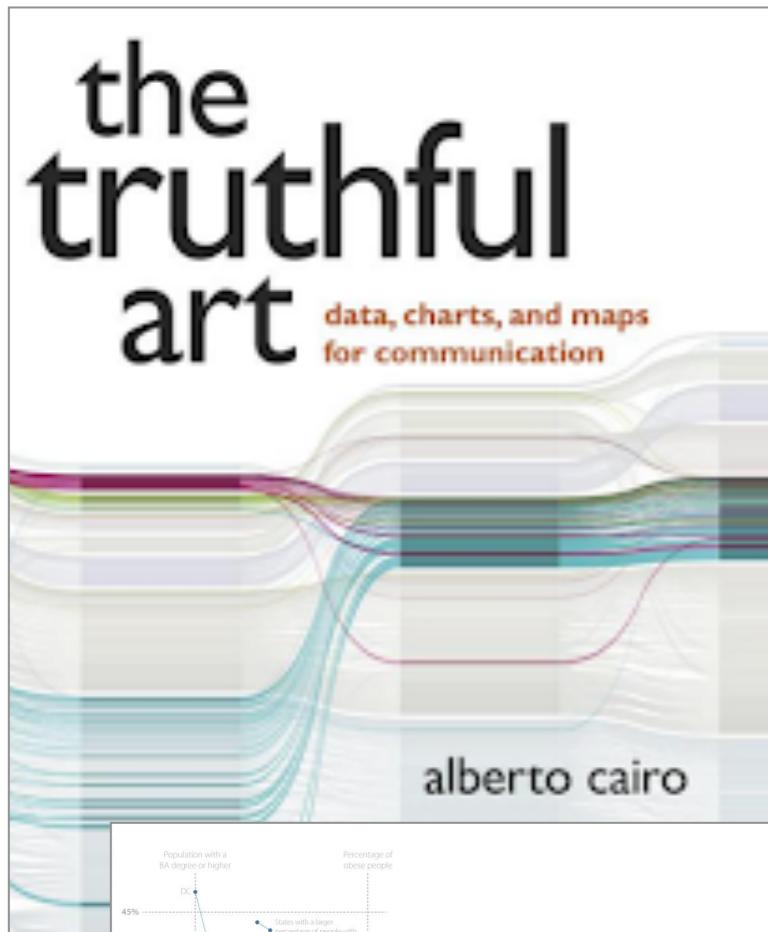
Storytelling, Data-Ink, & Icons

Colors, Fonts, & Animation

How to Lie with Charts & Graphs

<https://github.com/thcrawford/ICPSR>





# Why Visualize Data?



**PBS**

**KIDS**

[pbskids.org](http://pbskids.org)



**PBS**

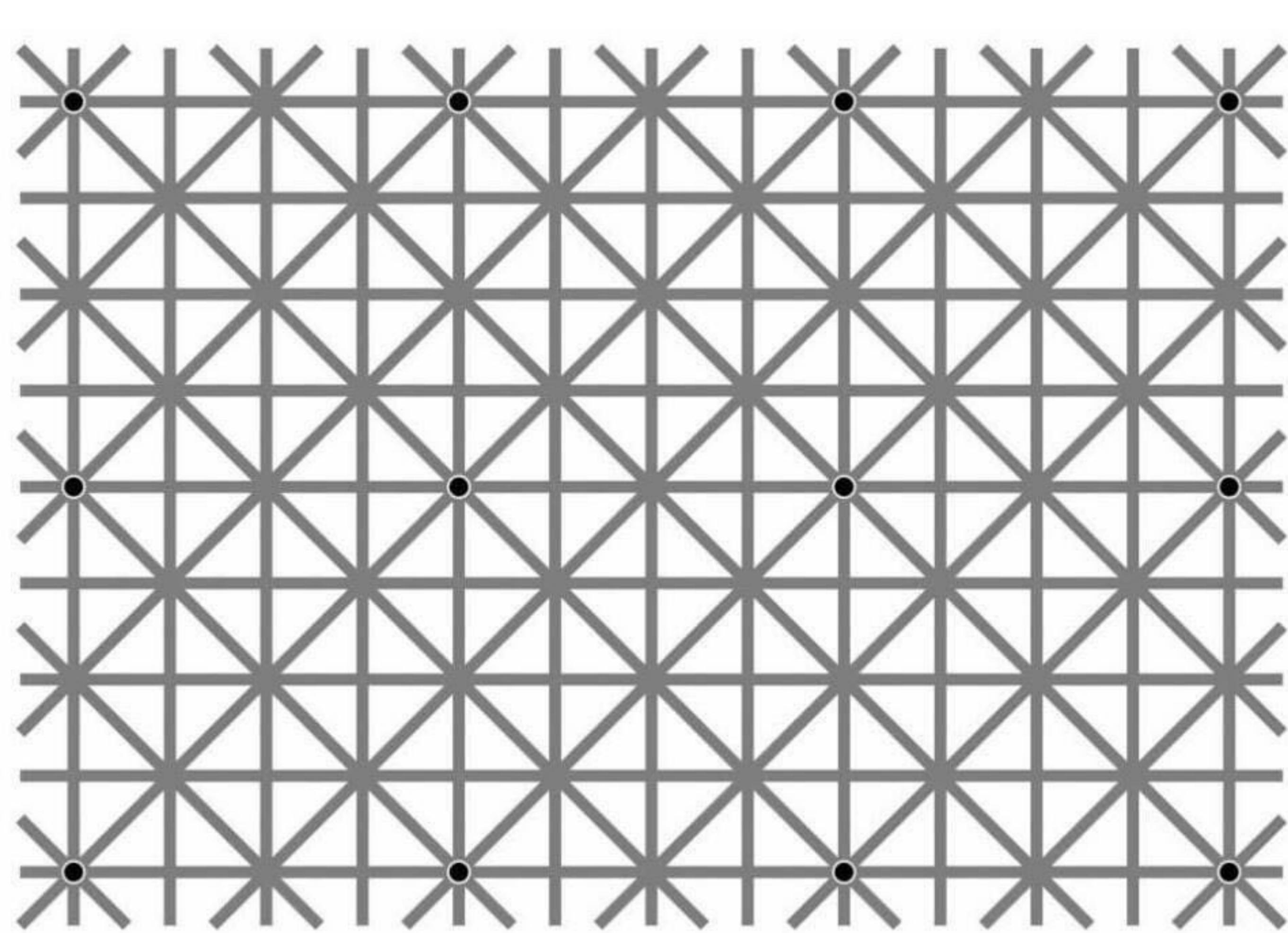
**KIDS**

[pbskids.org](http://pbskids.org)









1	5	8	9	3	5	6	2	3	4
6	7	9	2	4	1	5	6	6	7
8	4	3	1	4	9	7	8	5	9
3	4	2	5	7	2	5	3	1	8
7	9	1	3	4	6	2	5	9	1
3	2	4	3	5	5	2	5	1	4
9	8	7	1	2	3	4	3	2	1
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1	3	7	9	5	7	3	4	6	2
9	2	3	5	7	2	9	4	1	3

# Why Visualize?

- ▶ 4 Data Sets

- ▶ Each has:

Mean of X: 9

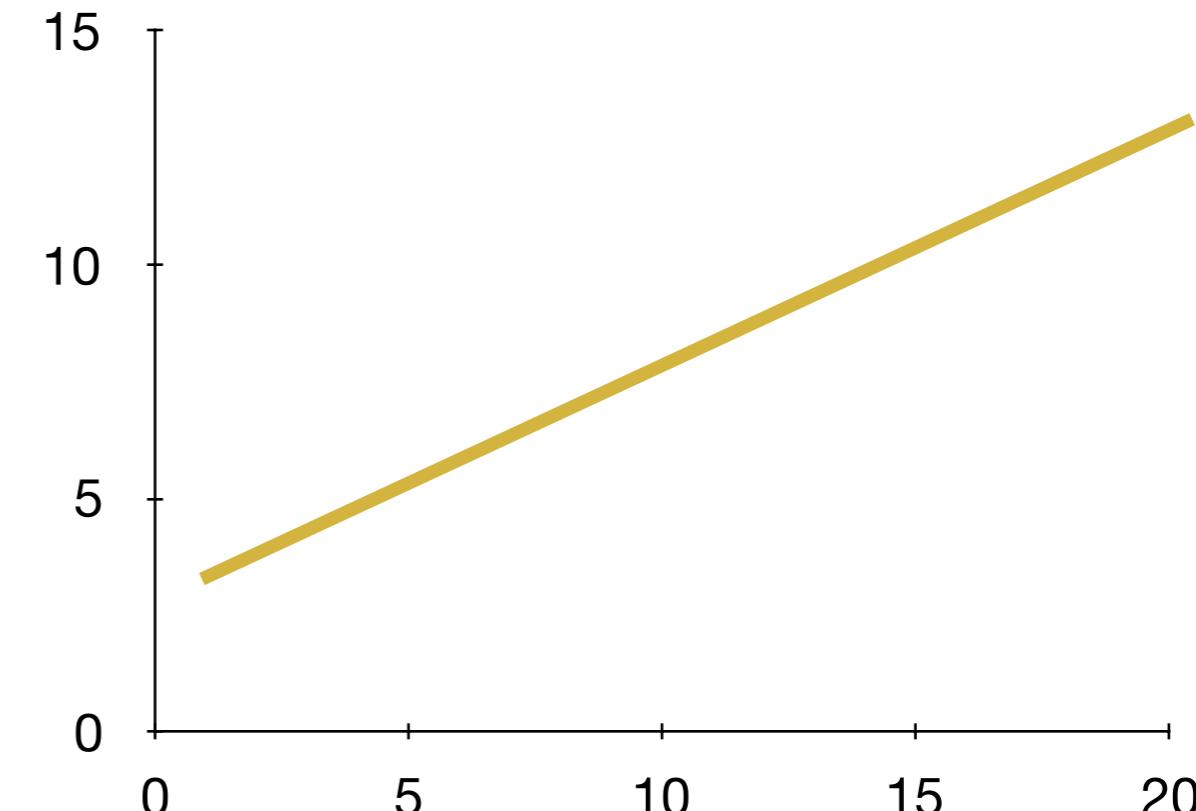
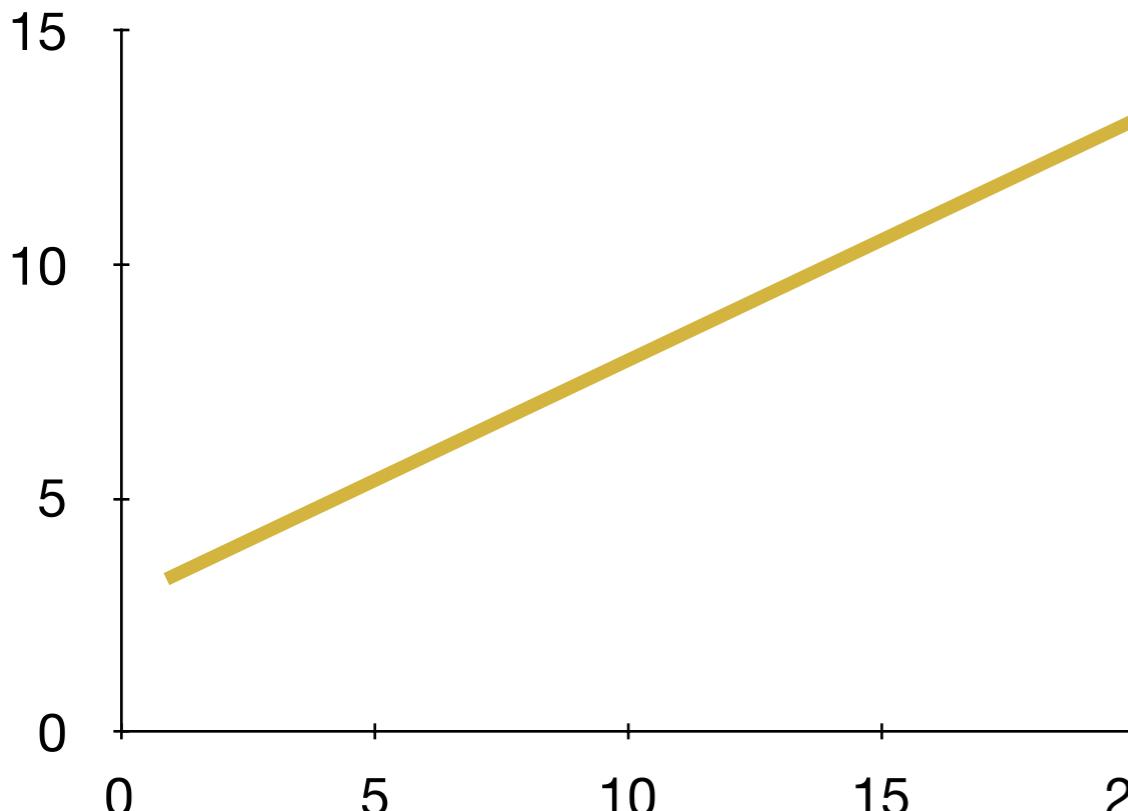
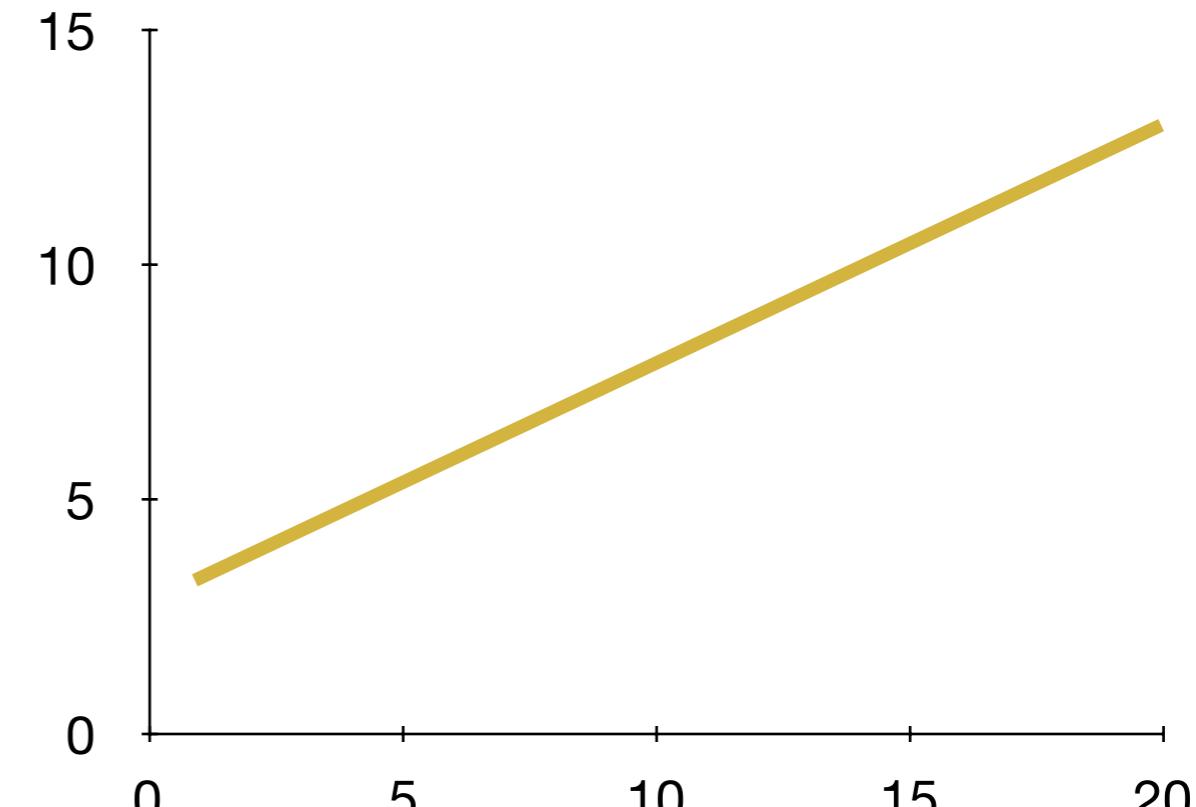
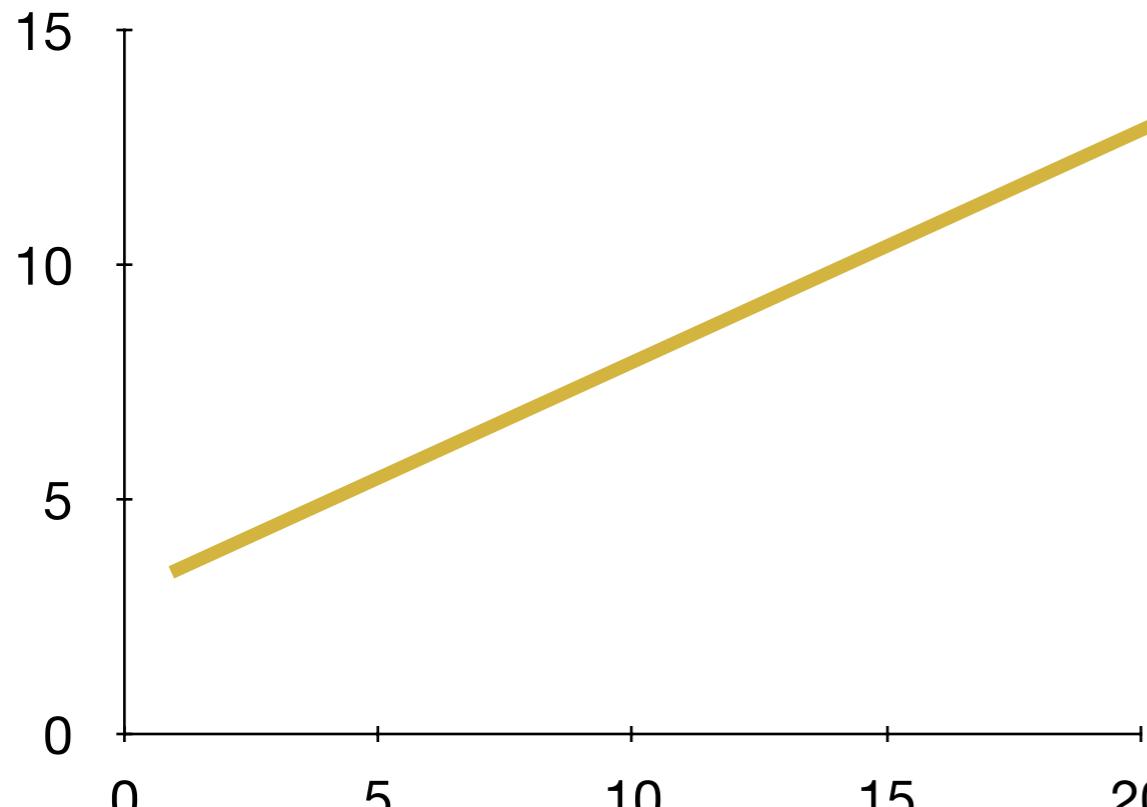
Sample Variance of X: 11

Mean of Y: 7.5

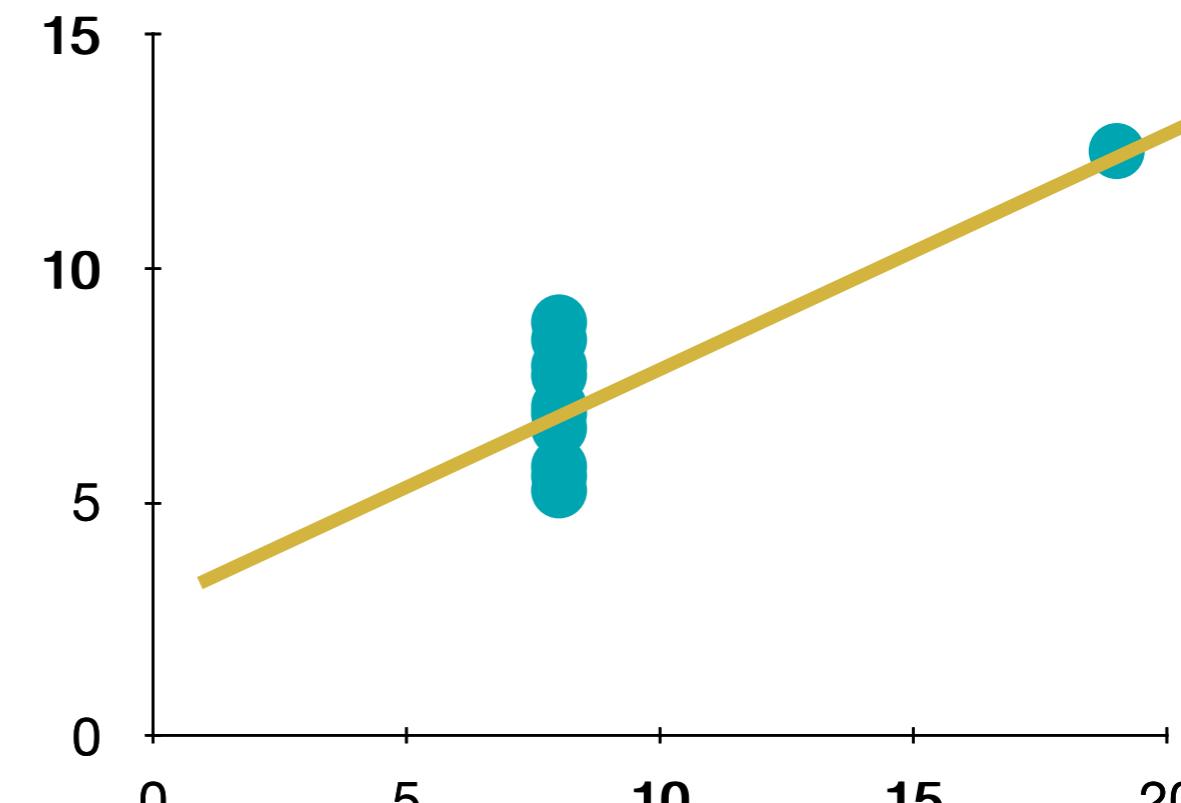
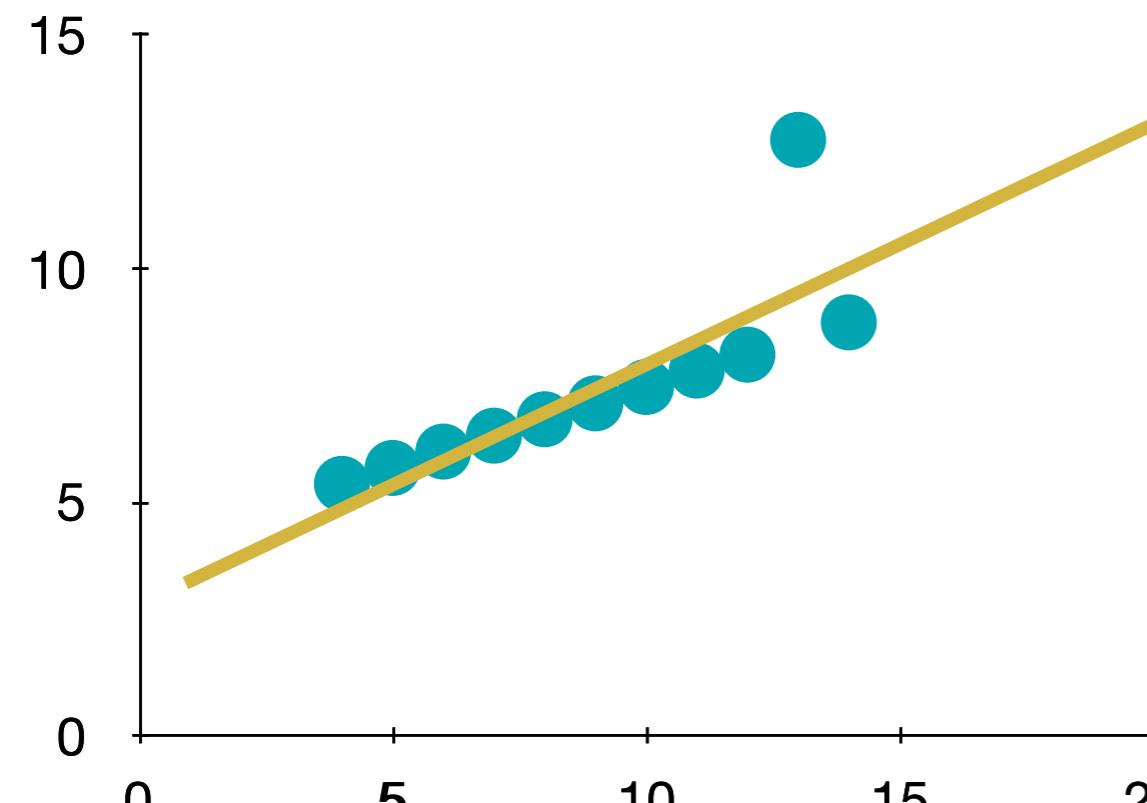
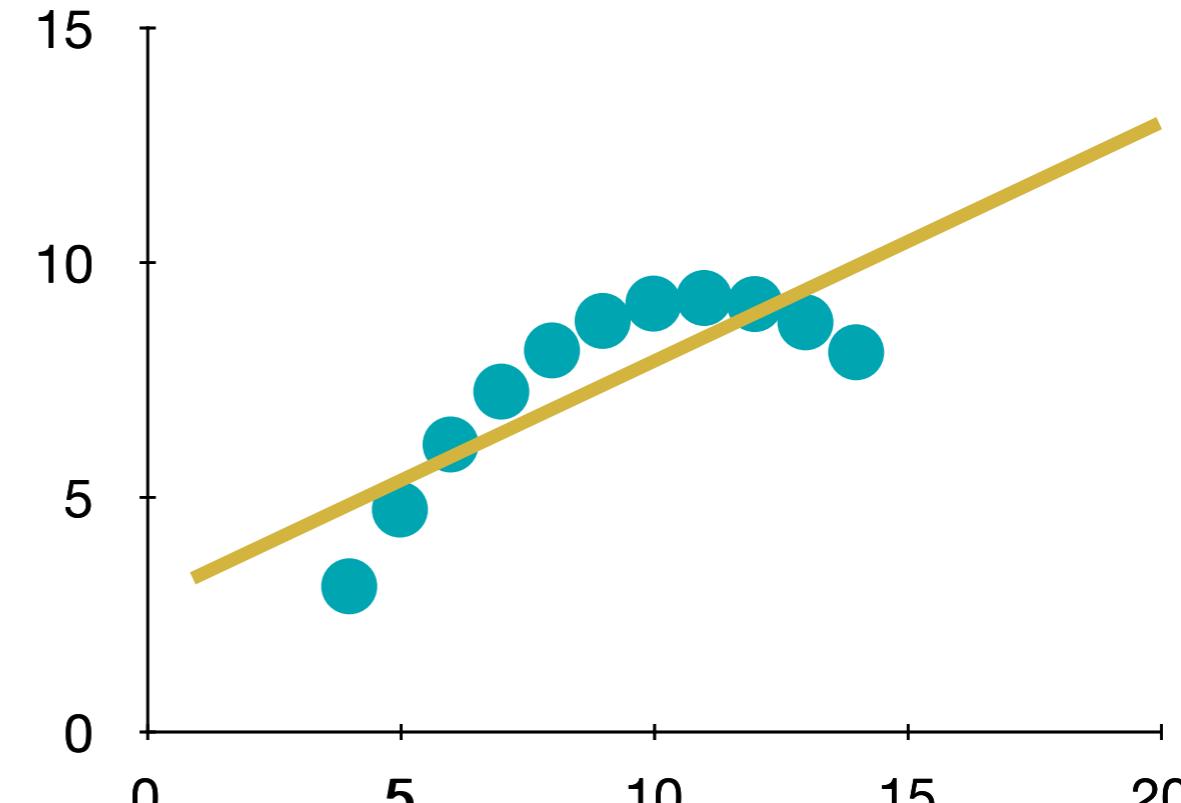
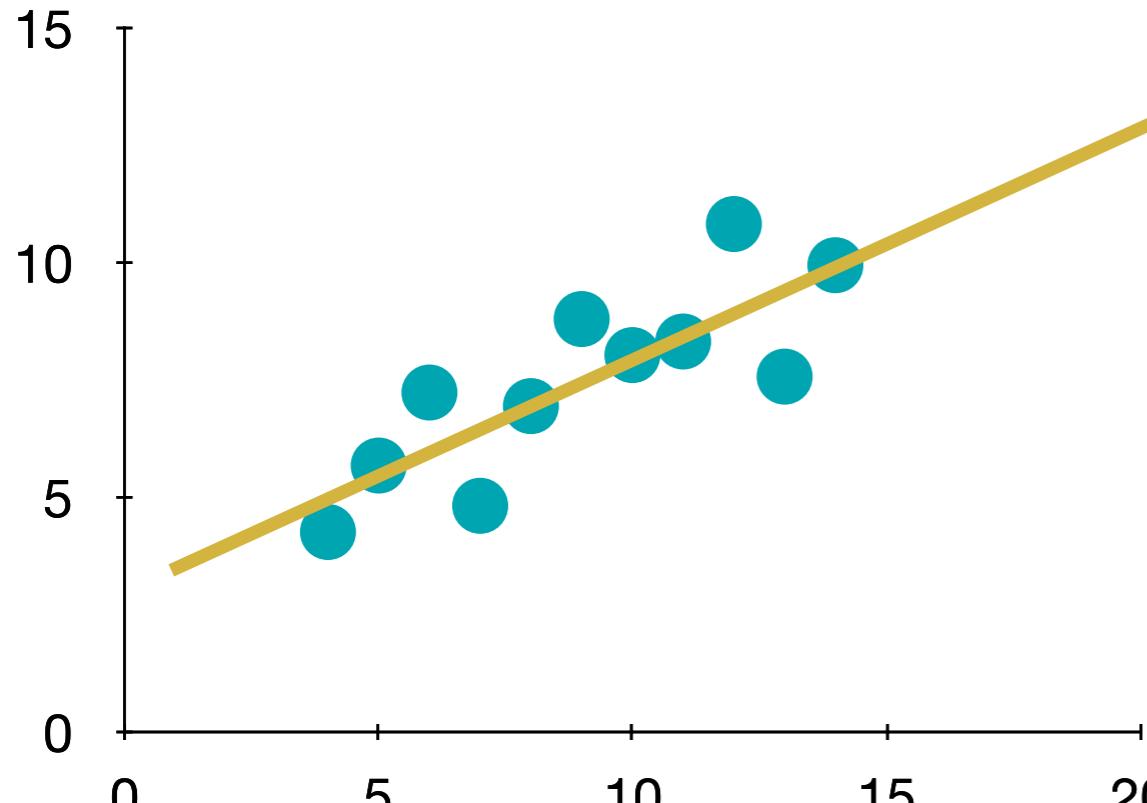
Correlation of X & Y: 0.816

Linear Regression Line:  $Y = 3.00 + 0.500X$

# Why Visualize Data?



# Why Visualize Data?



Source: Anscombe's Quartet

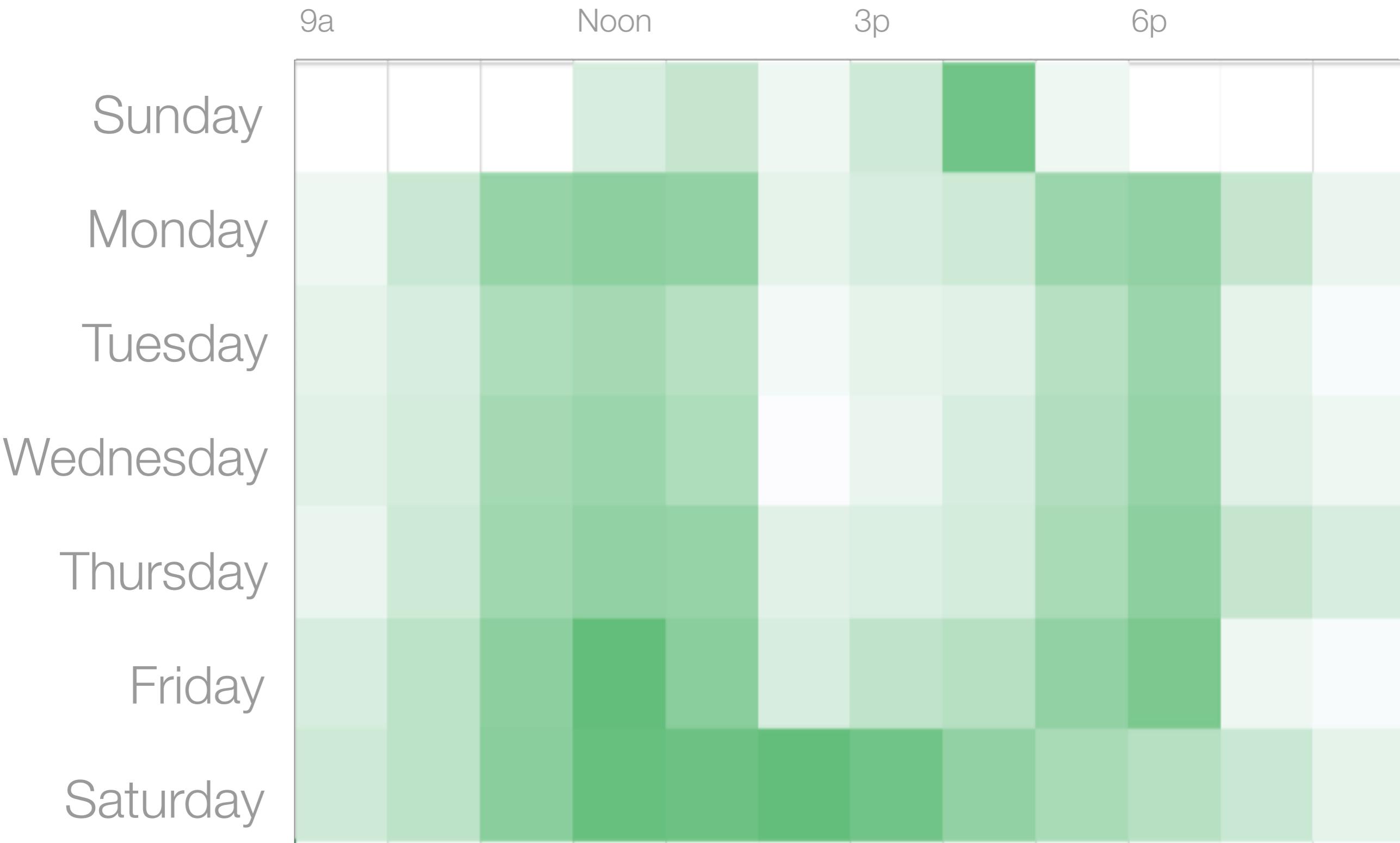
# Why Visualize?

## Store Arrivals

	9a			Noon			3p			6p		
Sunday				10	14	5	12	32	5			
Monday	5	13	24	26	25	7	10	12	23	25	14	6
Tuesday	7	10	19	21	17	4	7	8	17	23	7	3
Wednesday	8	11	21	23	19	2	6	10	18	24	8	5
Thursday	6	12	22	25	24	8	9	11	20	26	14	10
Friday	10	16	26	35	27	10	15	17	25	30	5	3
Saturday	12	16	27	34	33	35	32	25	20	17	13	7

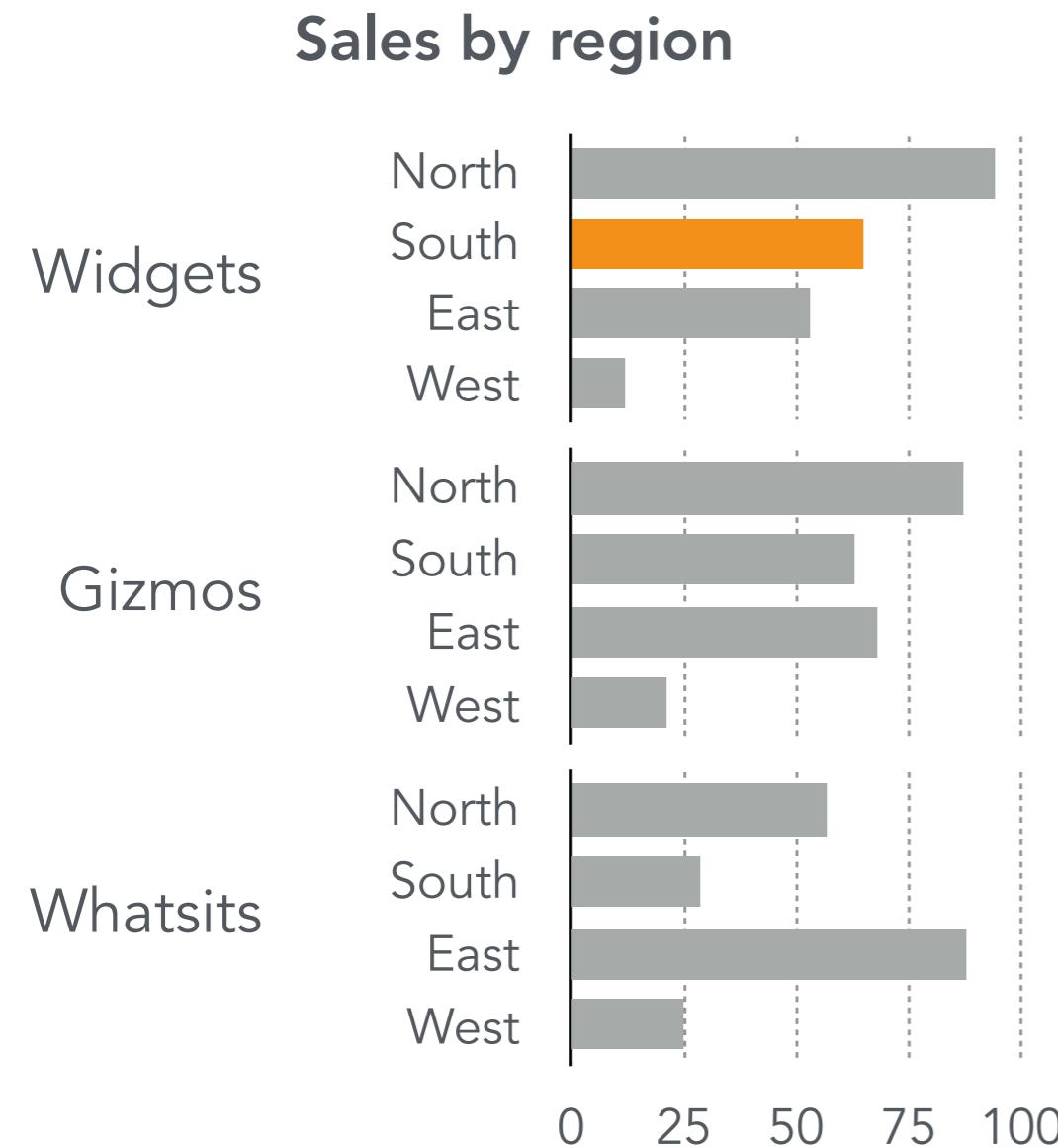
# Why Visualize?

## Store Arrivals



# Why Not Visualize?

How many **Widgets** did the **South** region sell?



**Sales by region**

Region	Widgets	Gizmos	Whatsits	TOTAL
North	94	87	57	238
South	65	63	29	157
East	53	68	38	159
West	12	21	25	58
TOTAL	224	239	149	612

# Selecting Charts & Graphs

# Types of Data

**Where are we?**

**Who am I?**

# Types of Data

## Addition

1 -512

24 thirty nine

5.93 5%

# Types of Data

## Numbers

38°55'7"N 77°13'47"W

Here

48103

888-555-1212

July 4, 1776

Yesterday

Next week

255.255.0.0

google.com

01101000 01101001

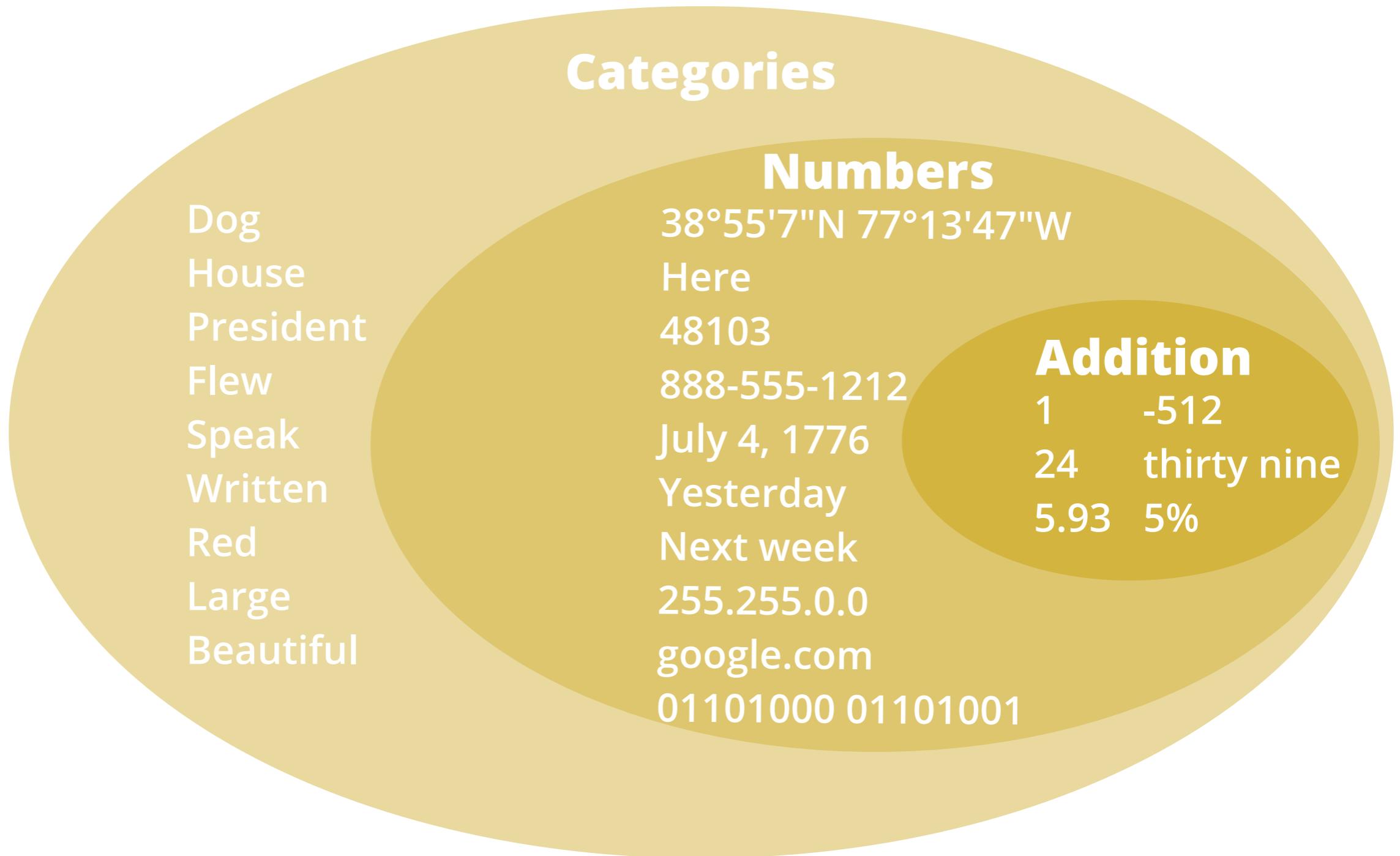
## Addition

1 -512

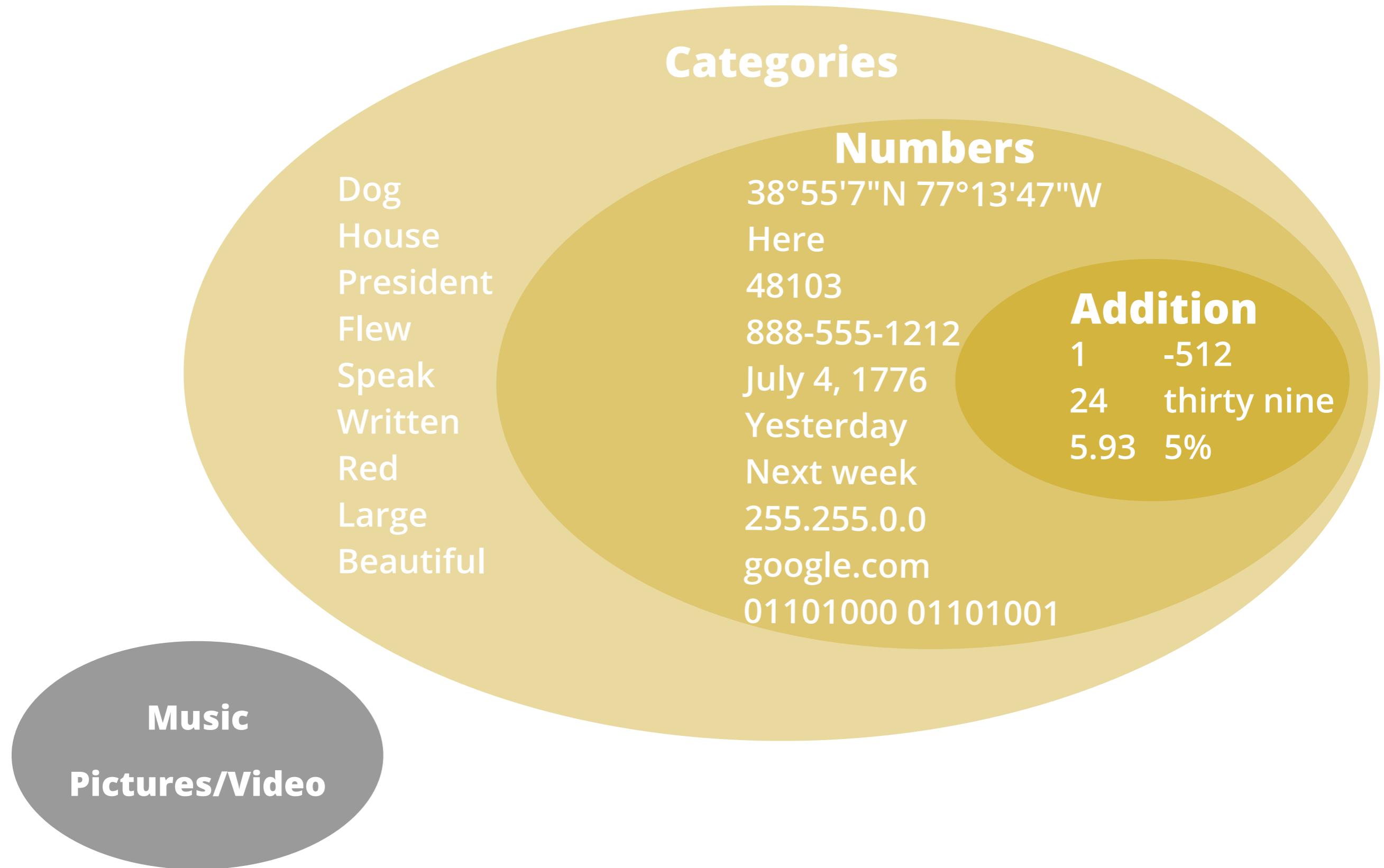
24 thirty nine

5.93 5%

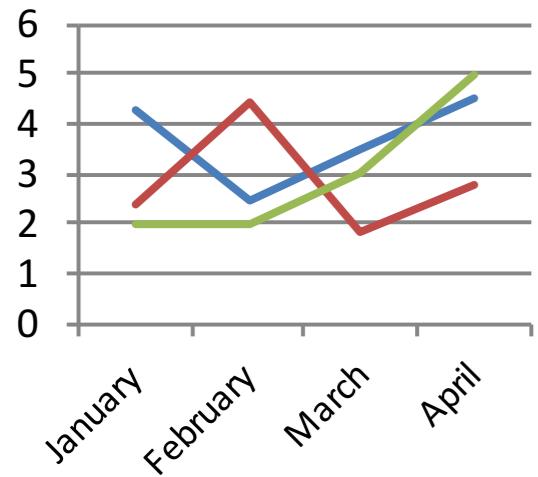
# Types of Data



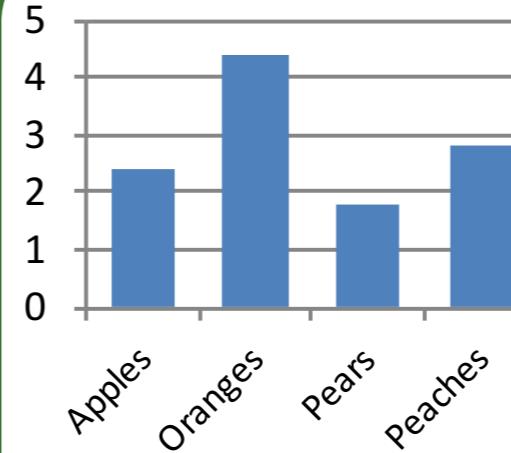
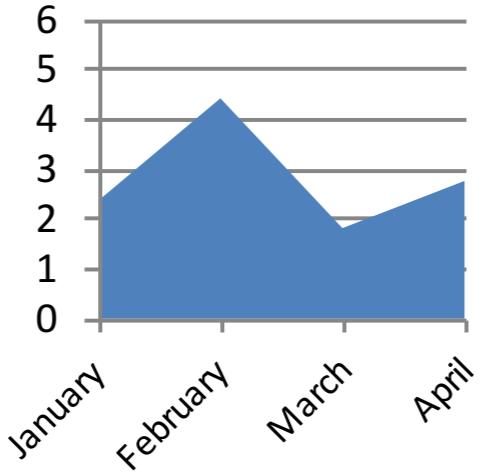
# Types of Data



# 10 Basic Ways to Display Data



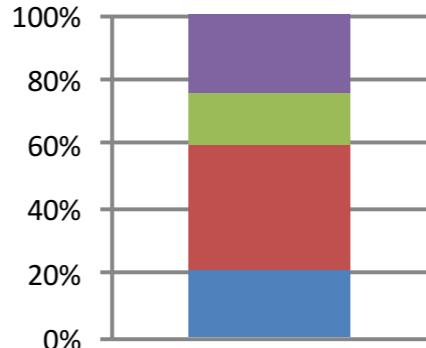
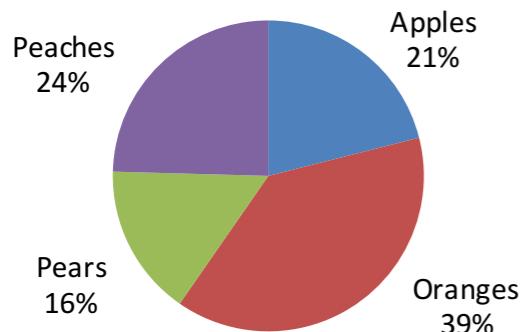
Series  
(ordered)



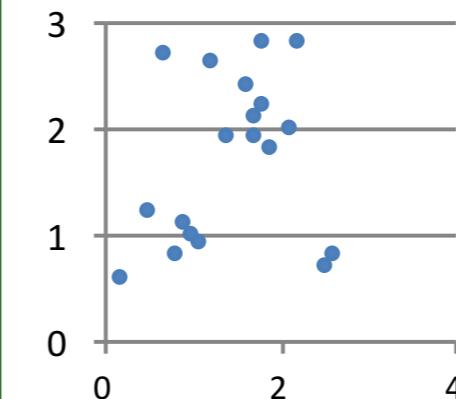
	Sales
Apples	2.4
Oranges	4.4
Pears	1.8
Peaches	2.8

Apples  
21%

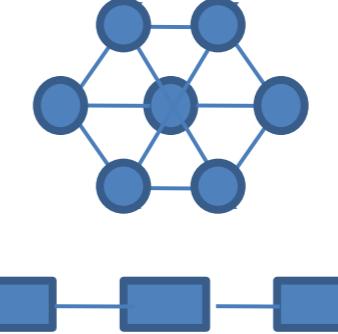
Value



Composition



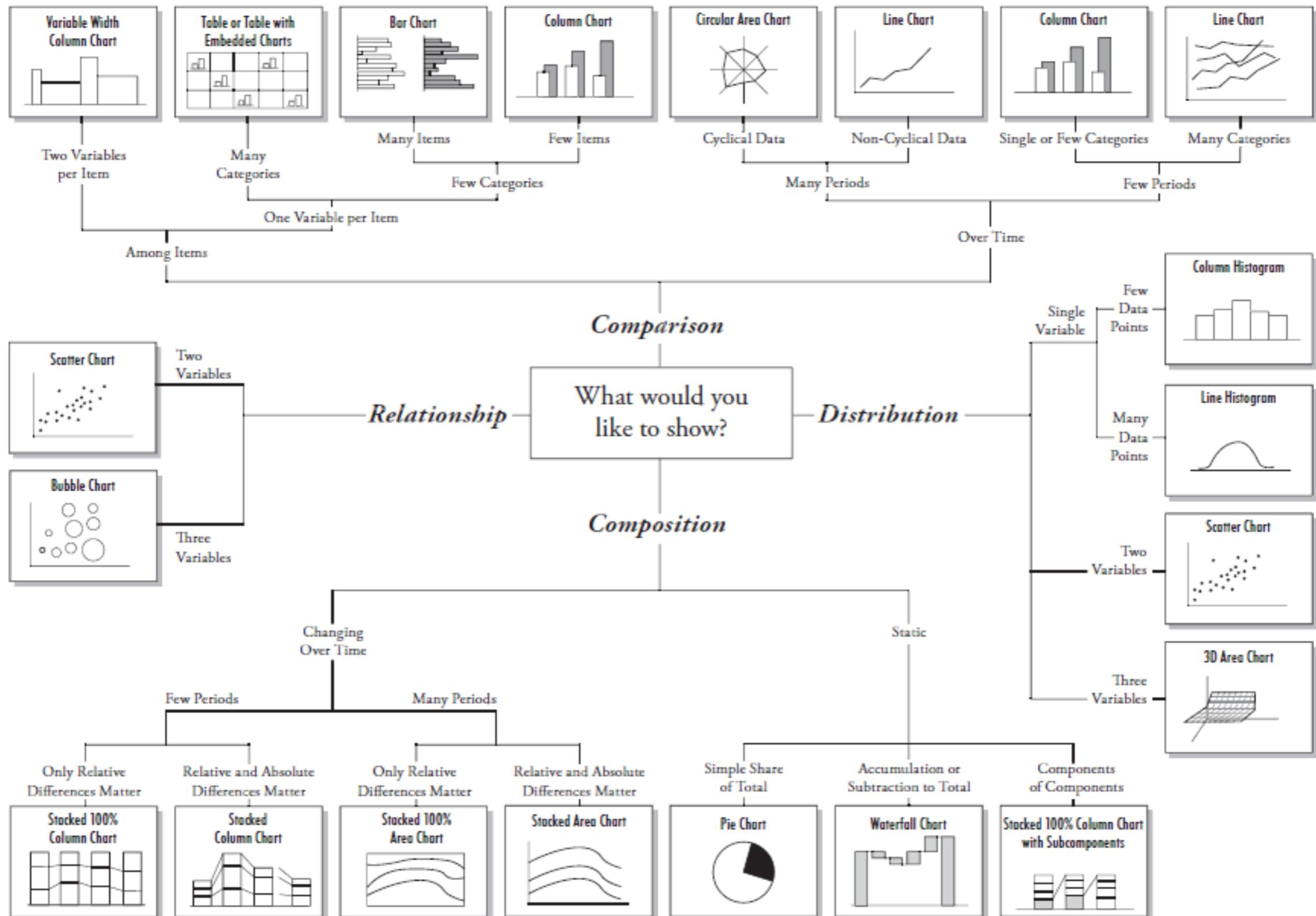
Relationship



Location

# Selecting Charts

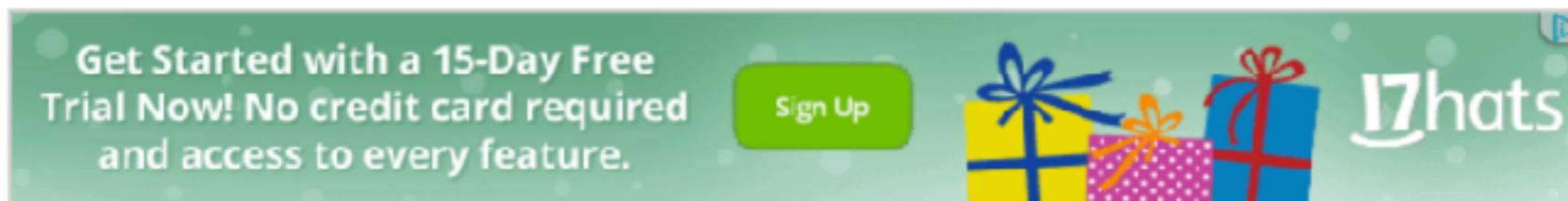
## Chart Suggestions—A Thought-Starter



# Selecting Charts

## The Data Visualisation Catalogue

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[View by List](#)



Arc Diagram



Area Graph



Bar Chart



Box & Whisker Plot



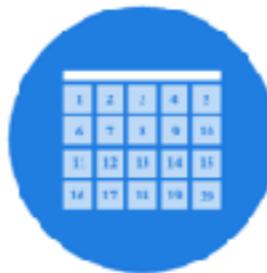
Brainstorm



Bubble Chart



Bubble Map



Calendar



Chord Diagram



Choropleth Map



Circle Packing



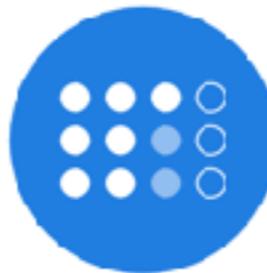
Connection Map



Donut Chart



Dot Map



Dot Matrix Chart



Flow Map



Histogram



Illustration Diagram

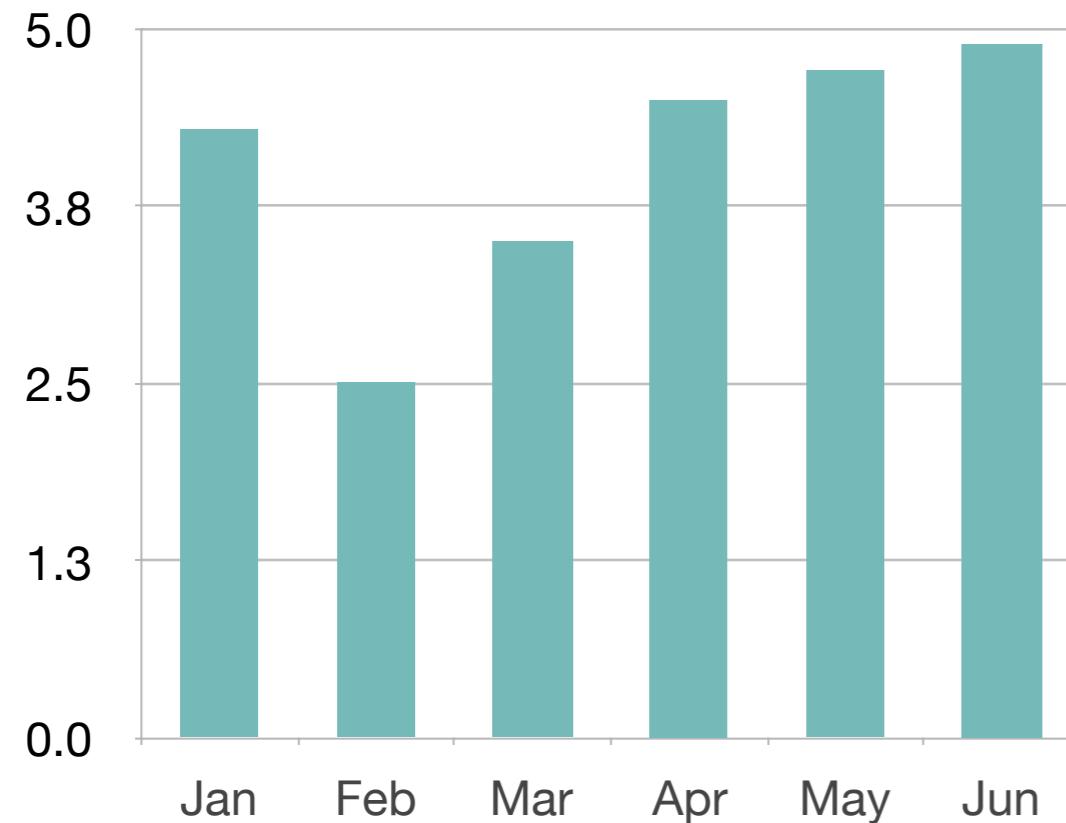
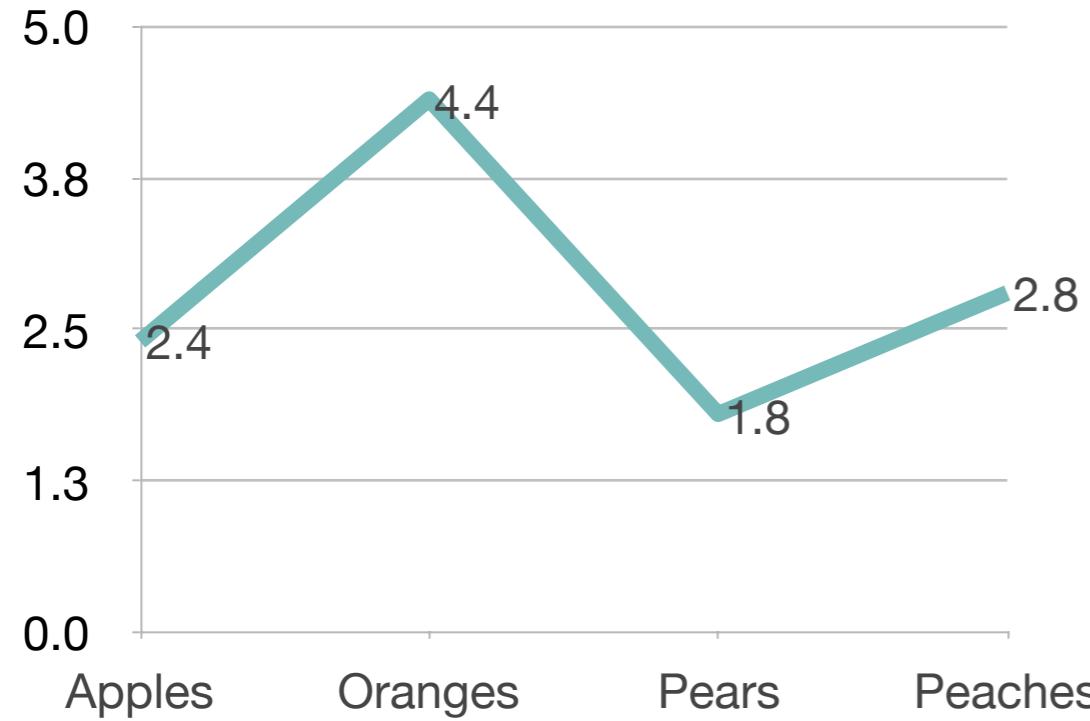
# Selecting Charts

# Visual vocabulary

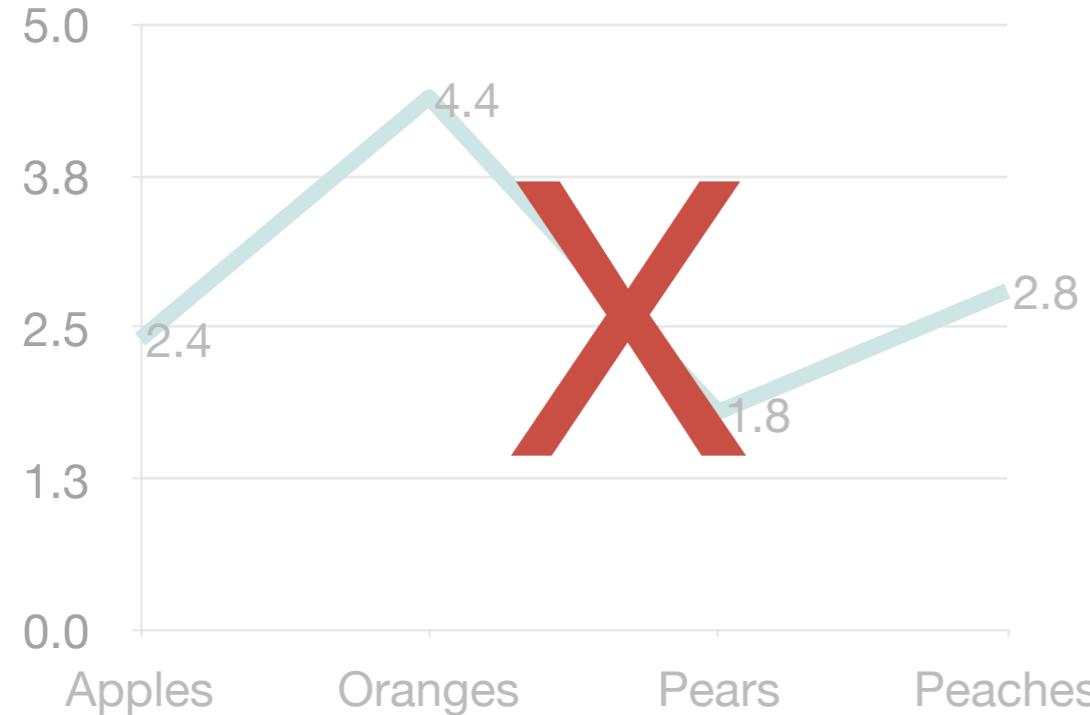
Reasoning with data

# Graph Basics

# Type of Data



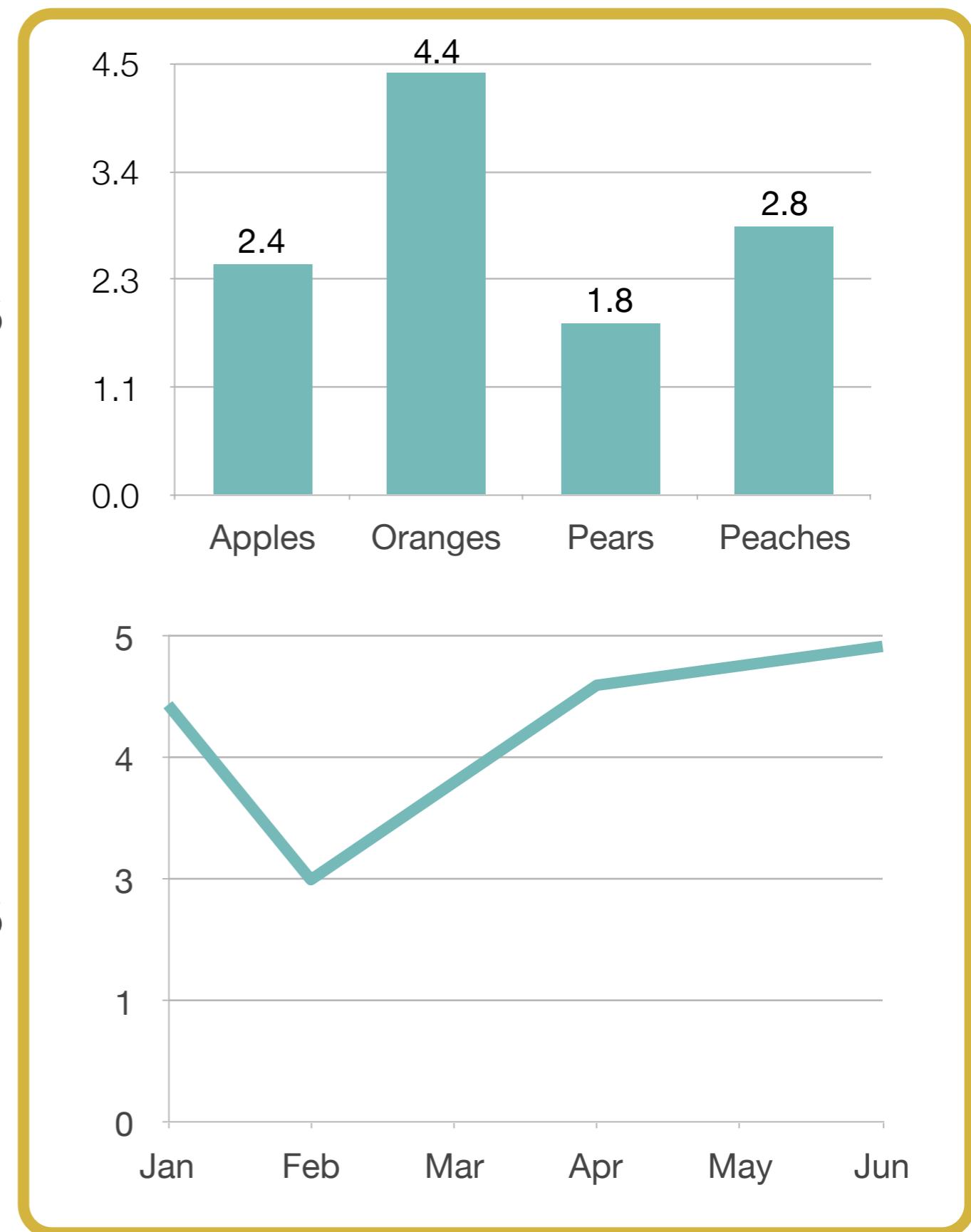
# Type of Data



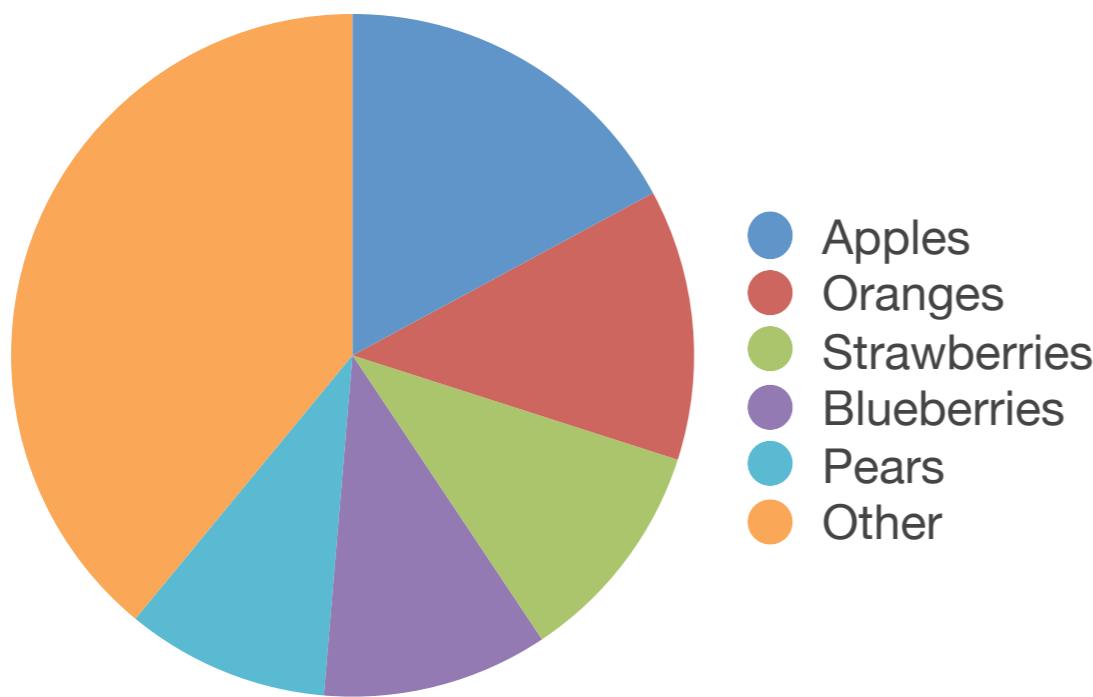
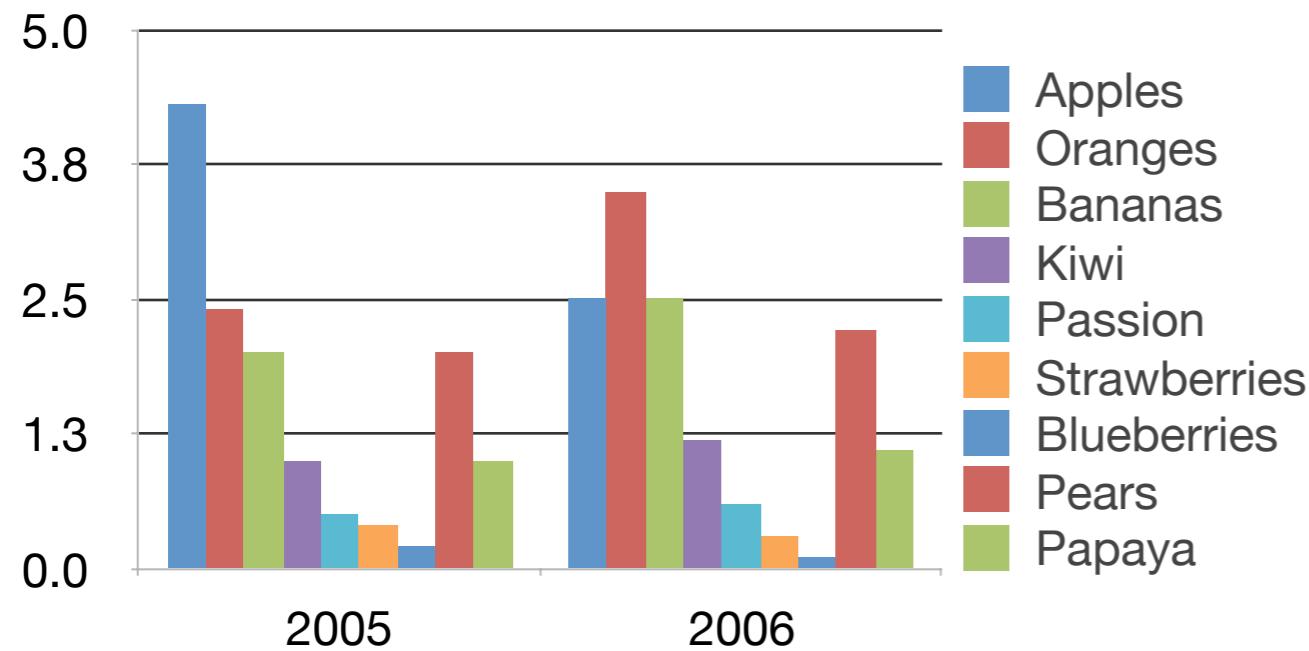
VS



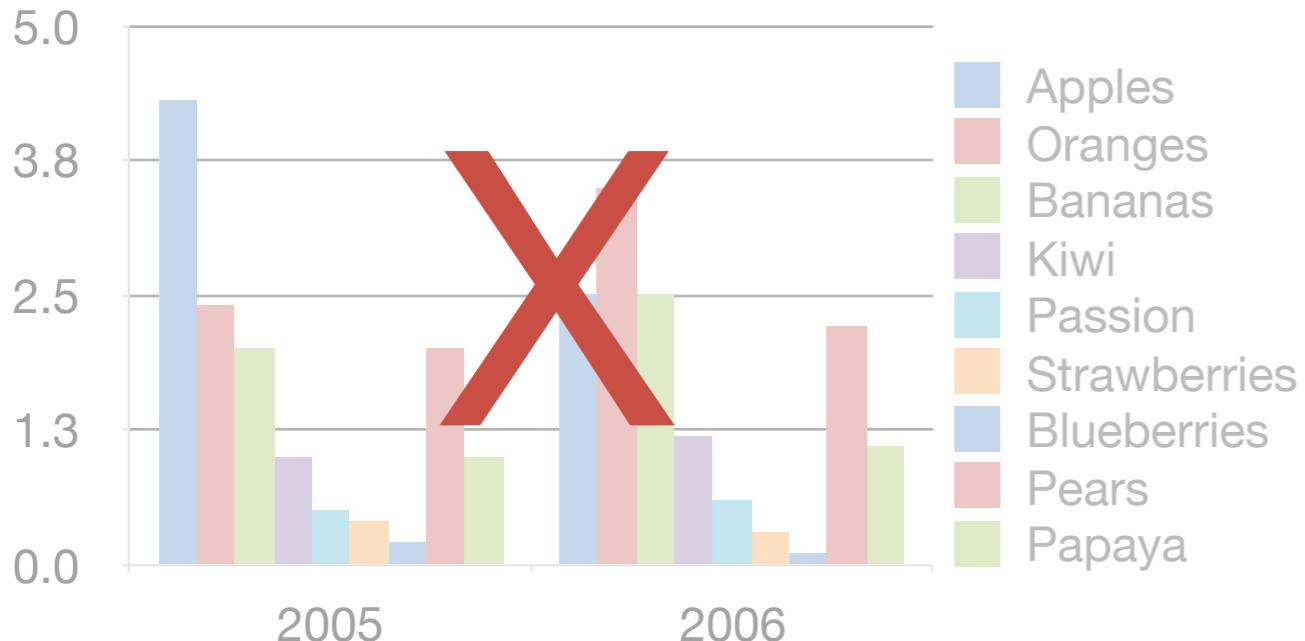
VS



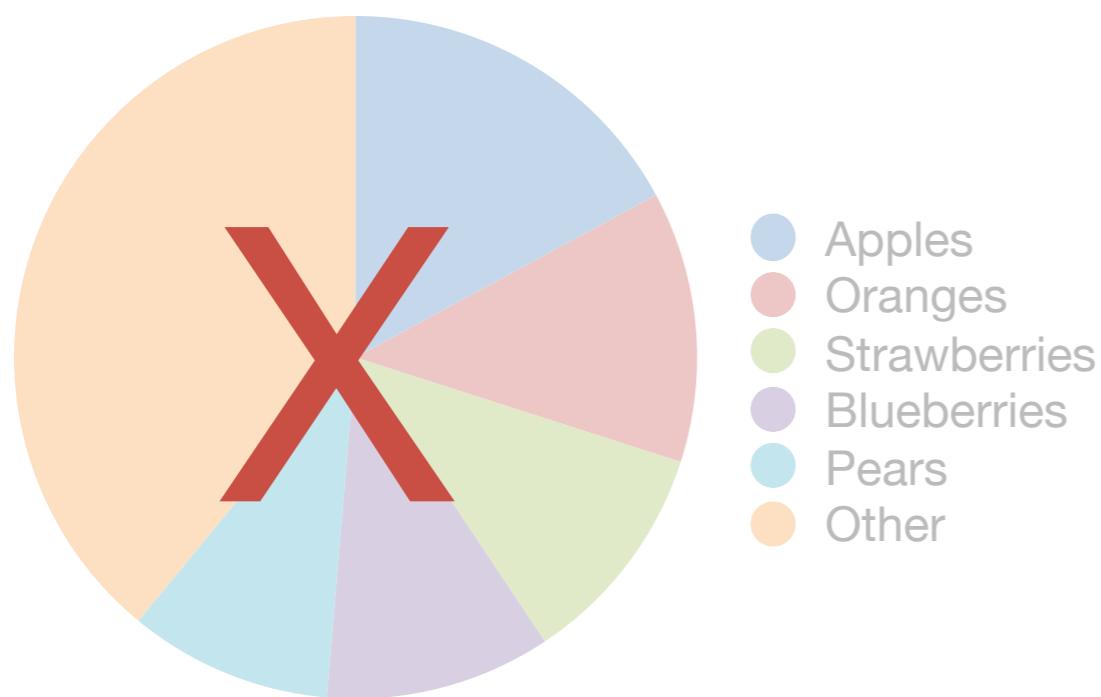
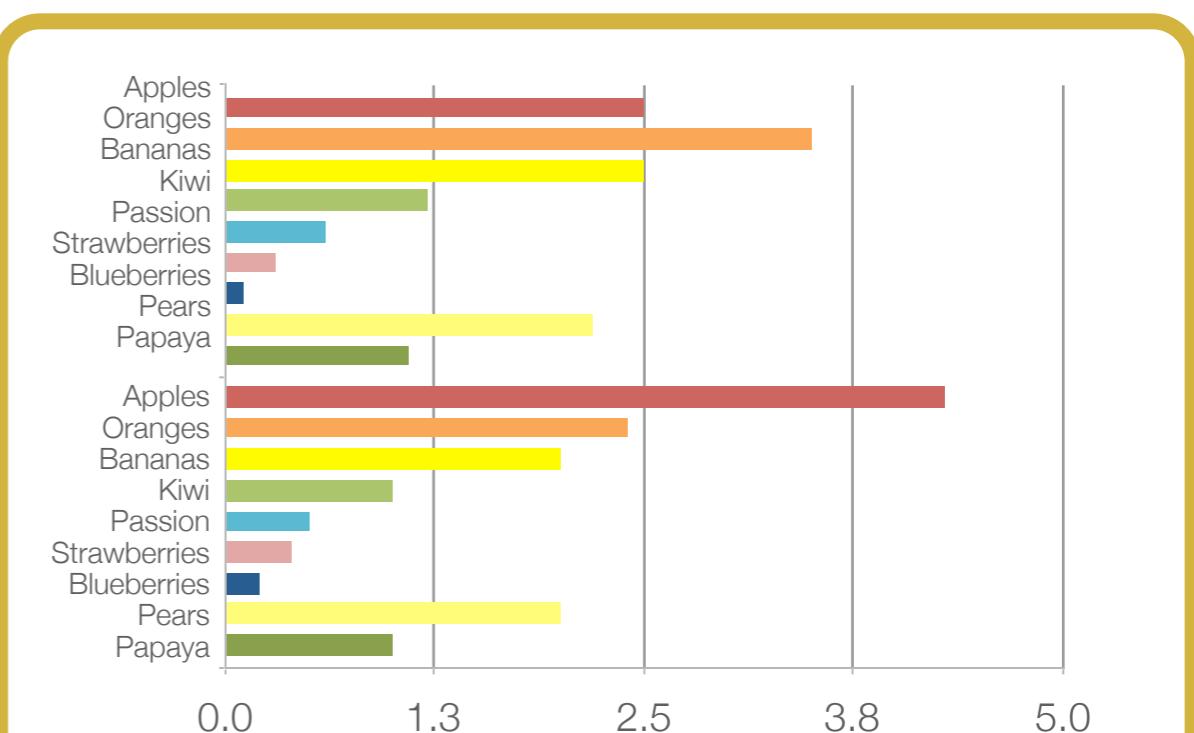
# Legends



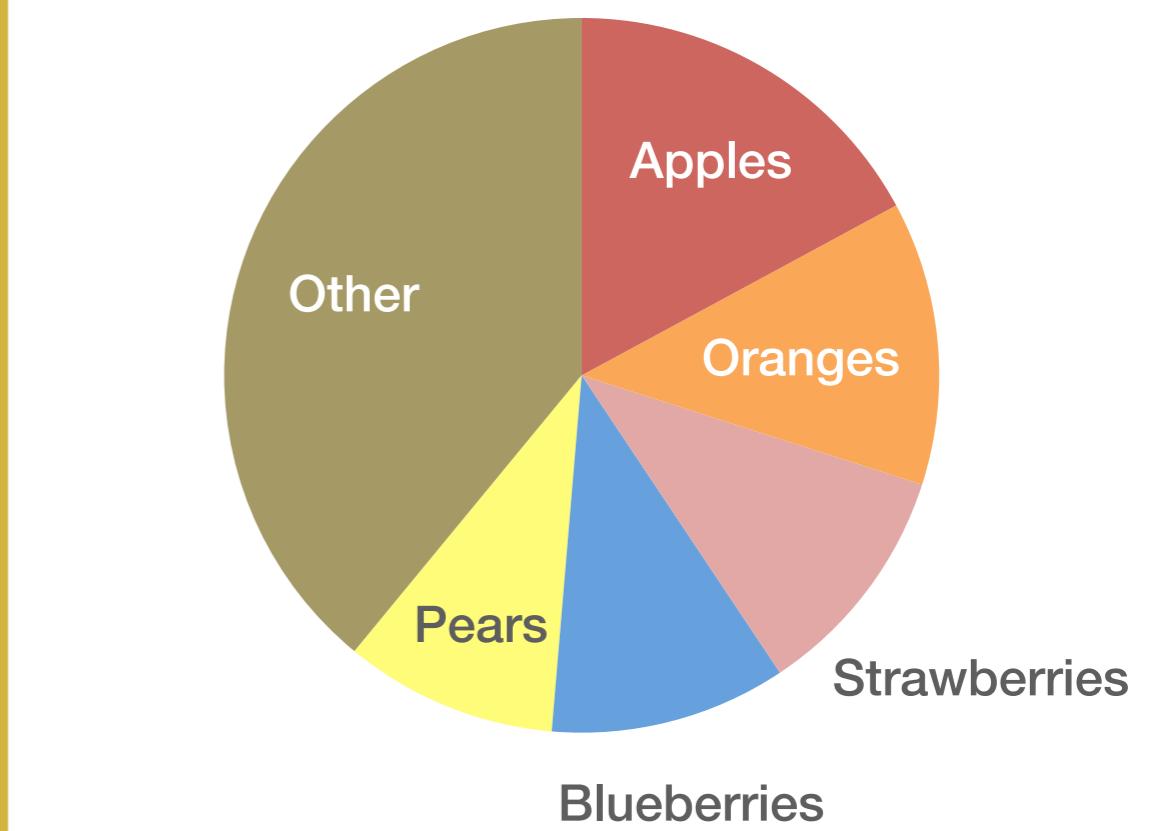
# Legends



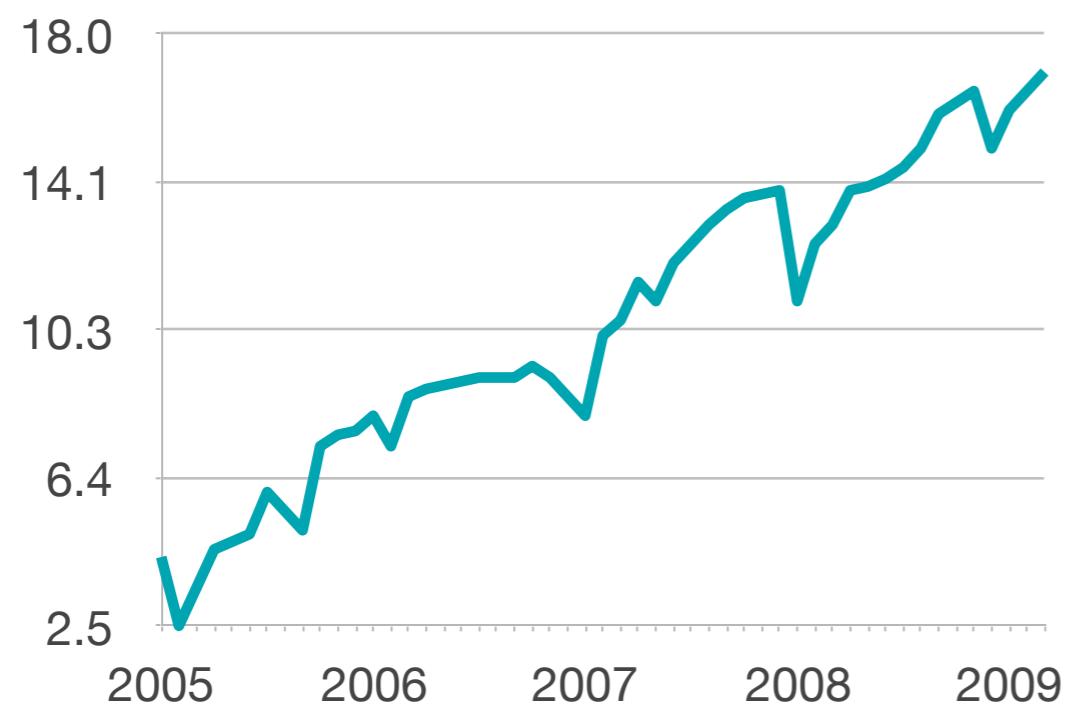
VS



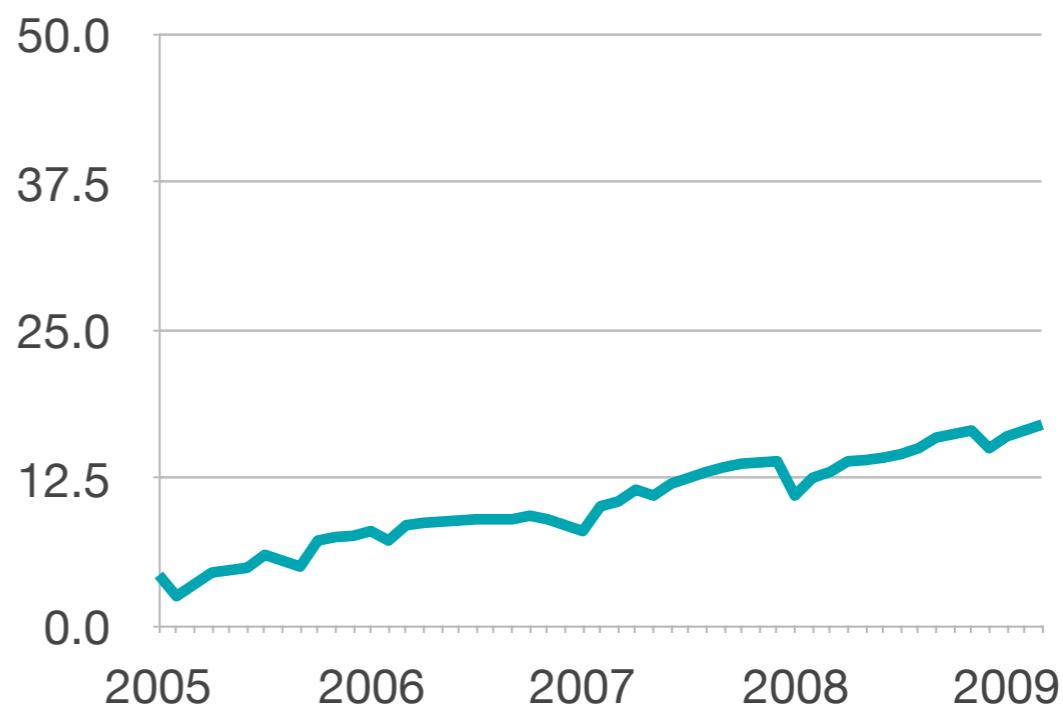
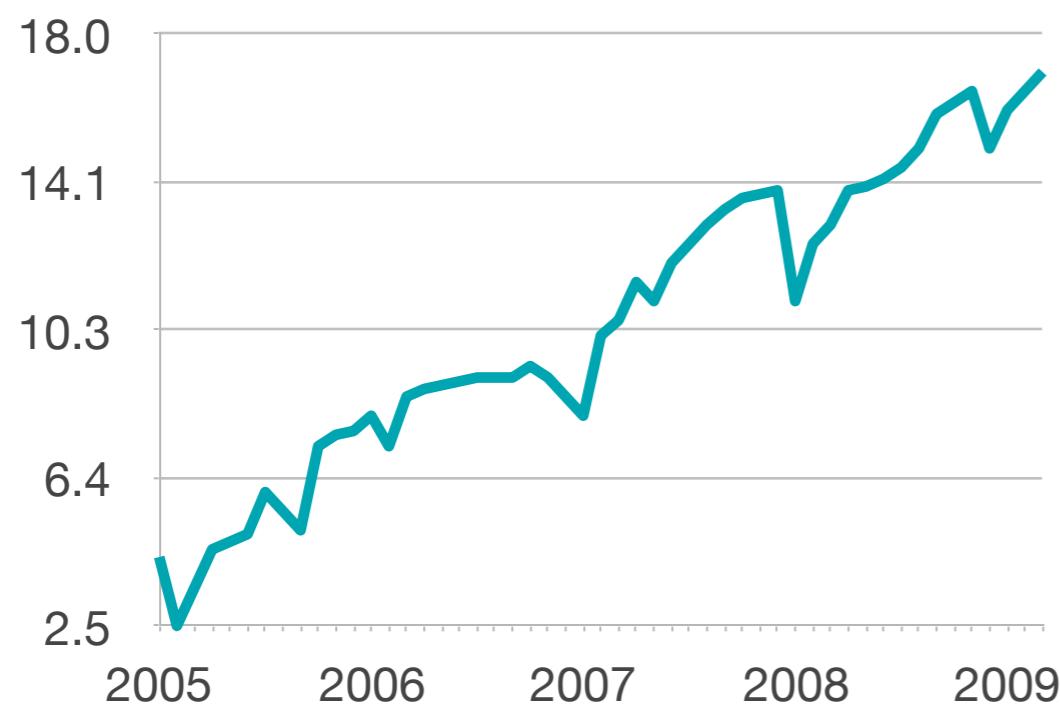
VS



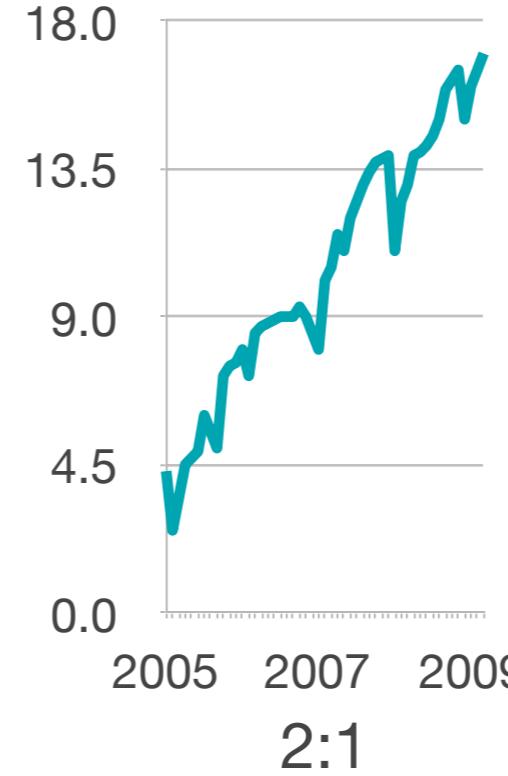
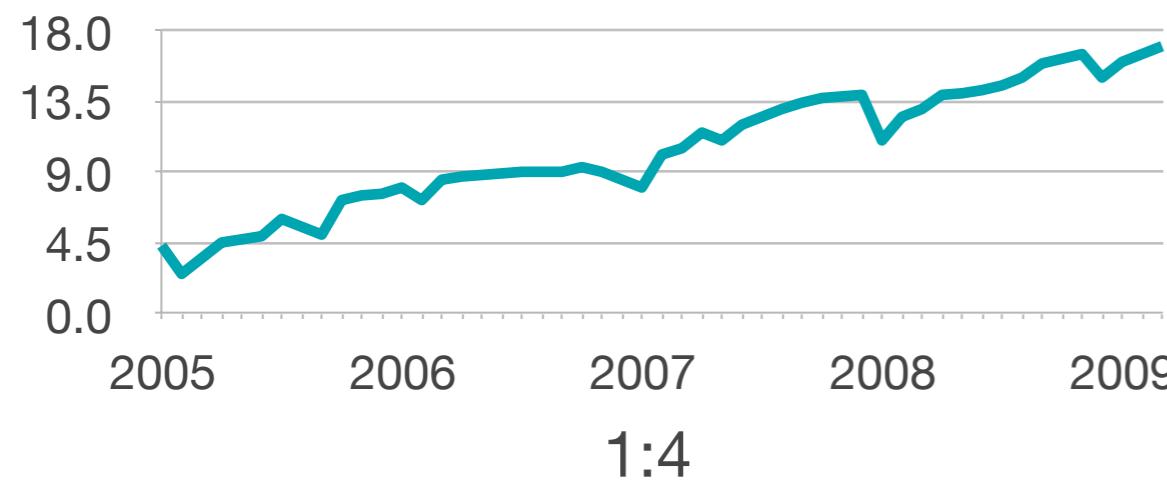
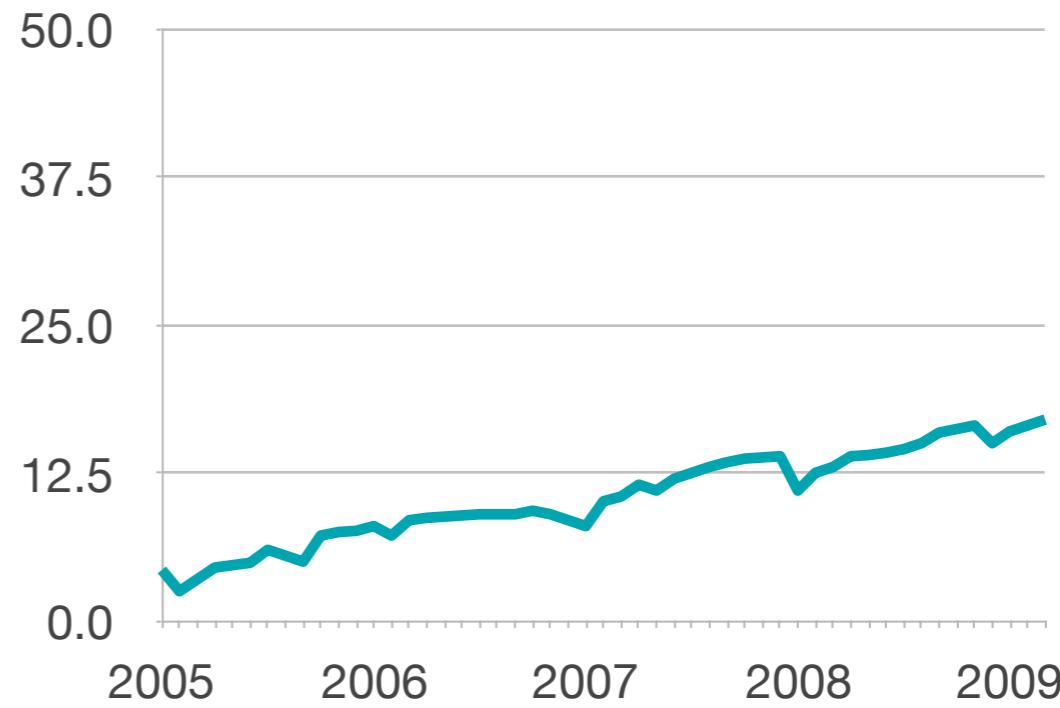
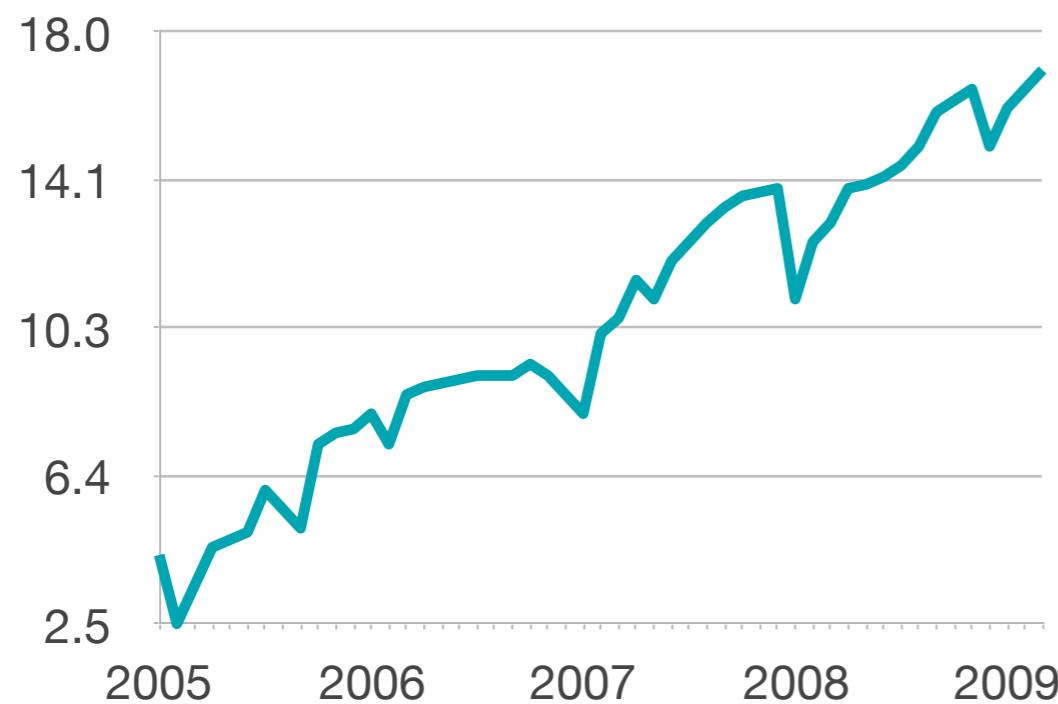
# Range & Scale



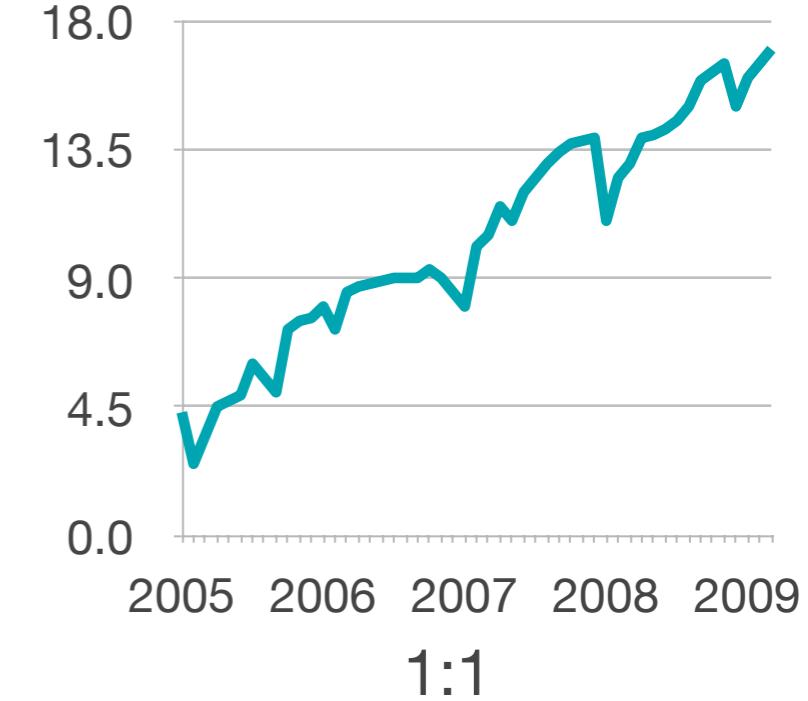
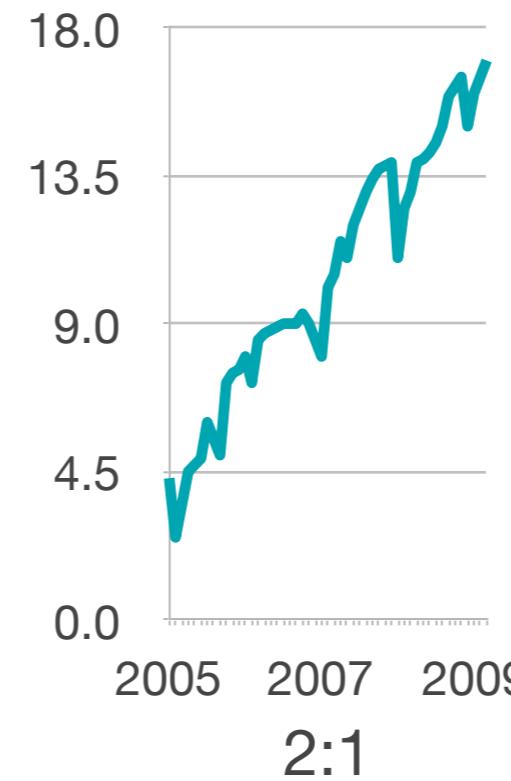
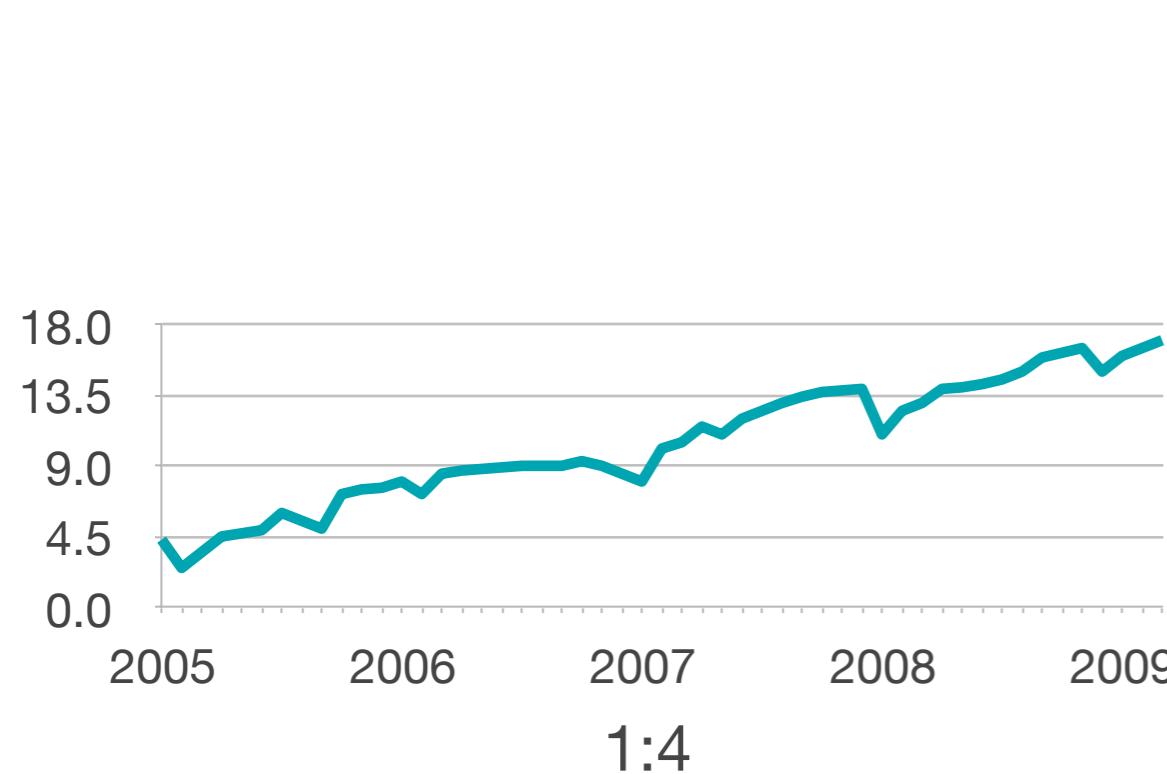
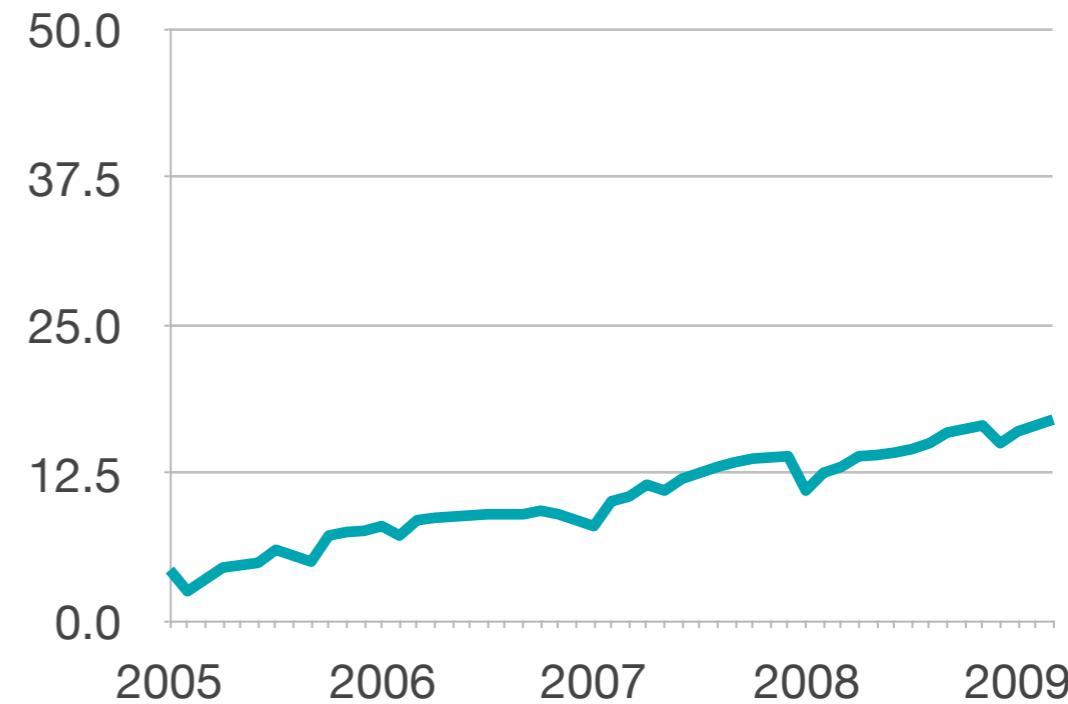
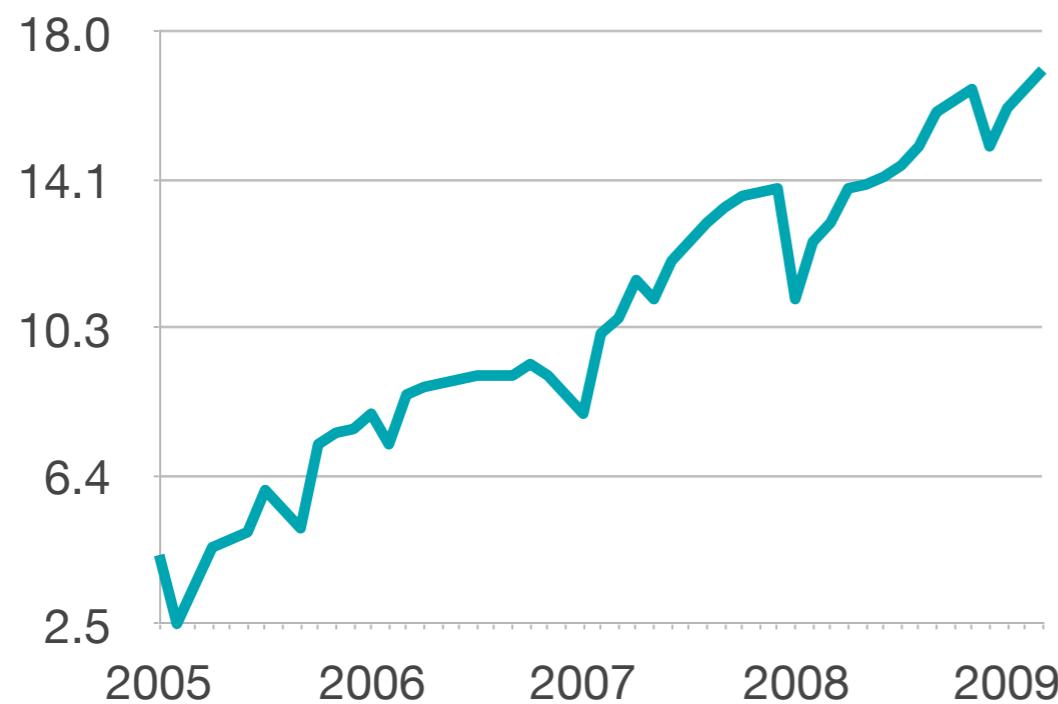
# Range & Scale



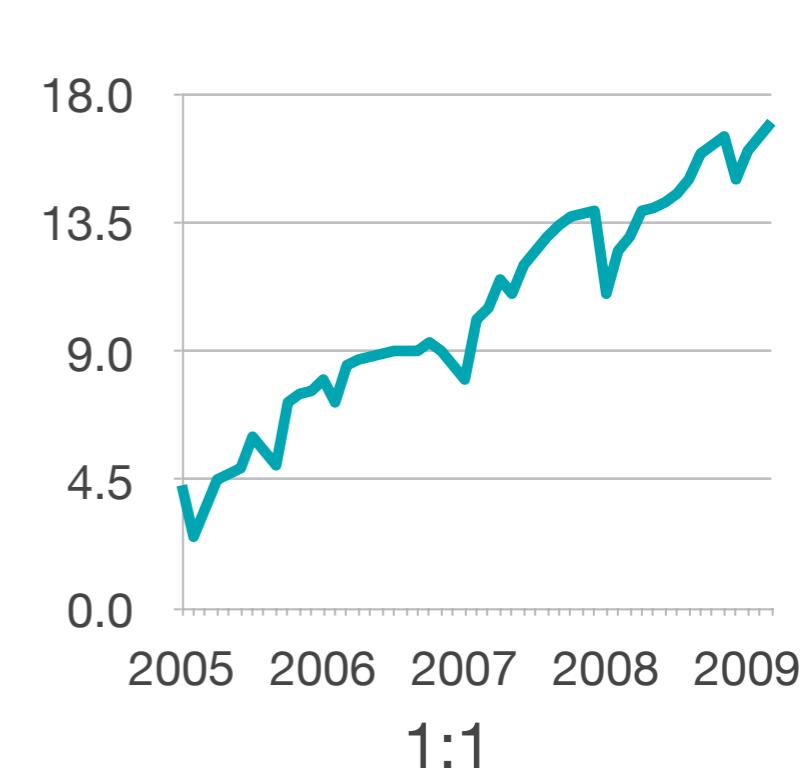
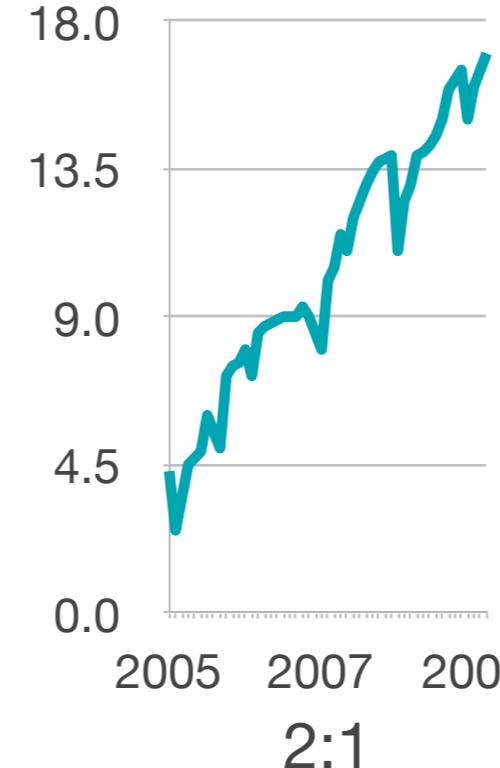
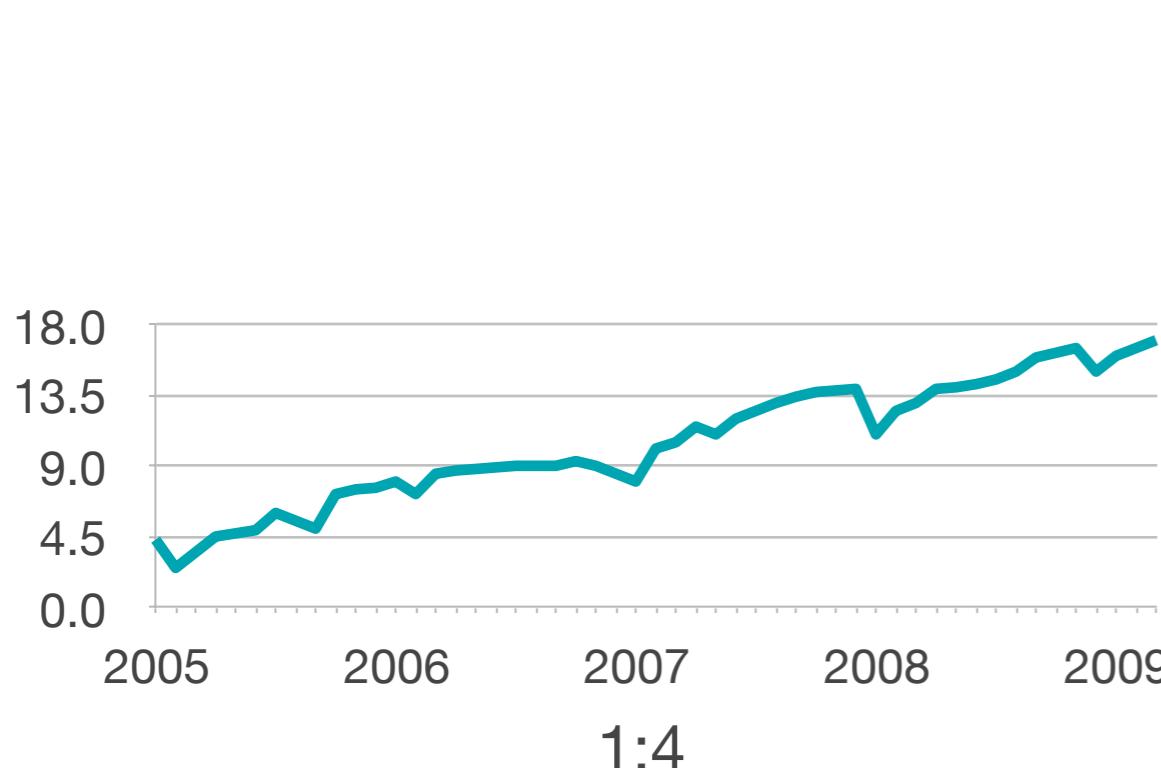
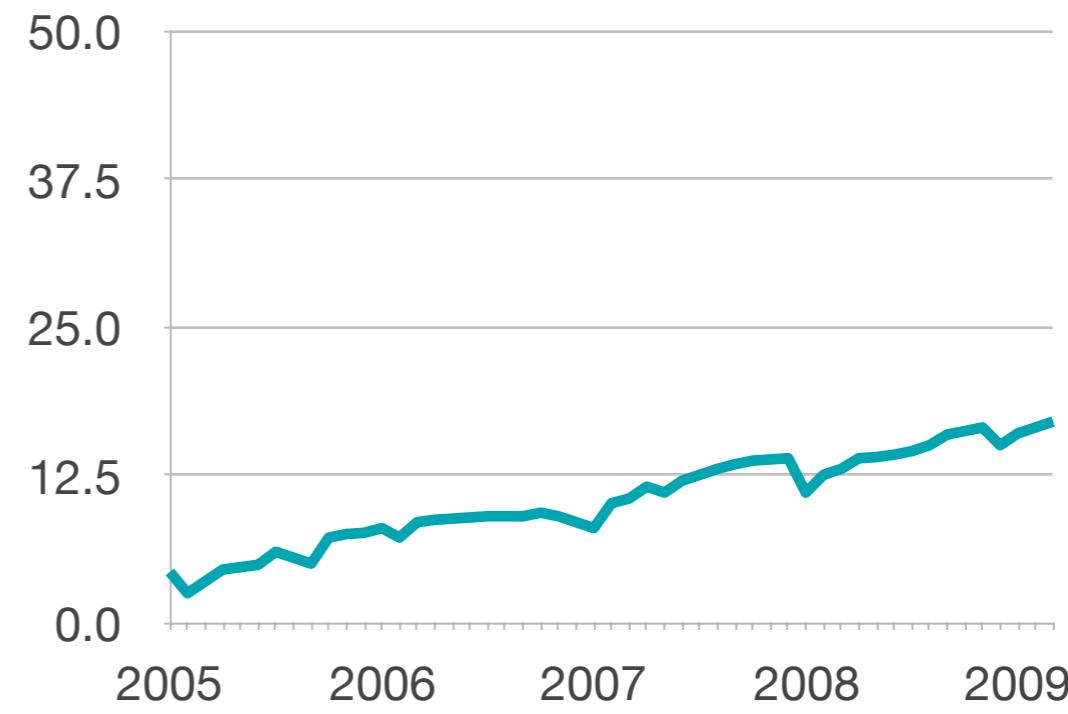
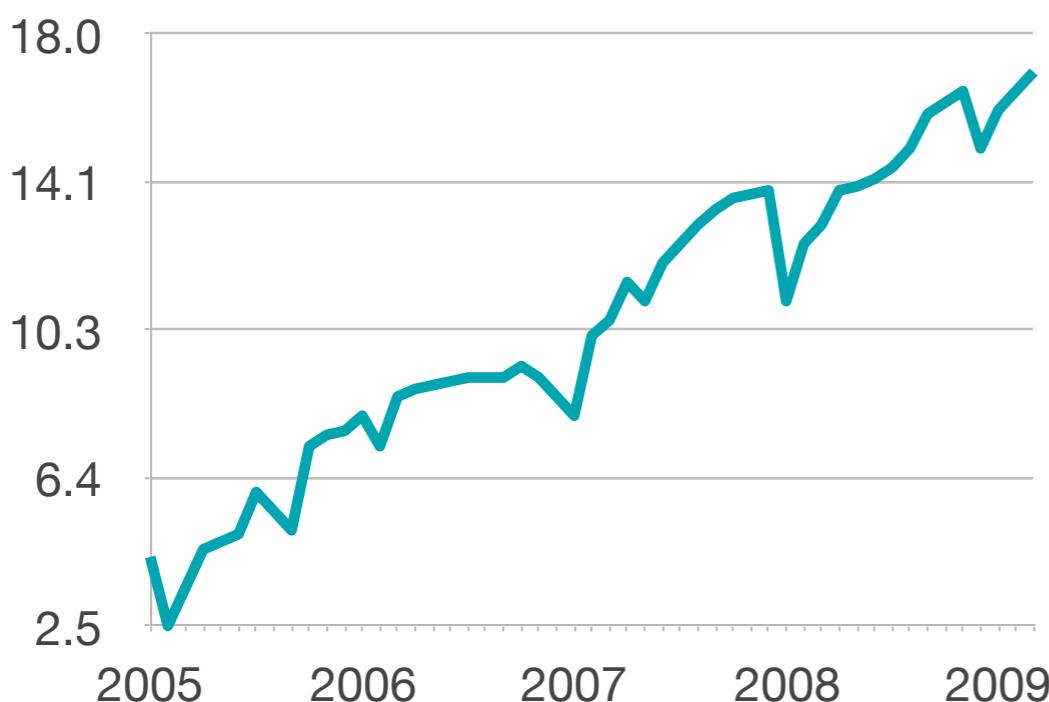
# Range & Scale



# Range & Scale

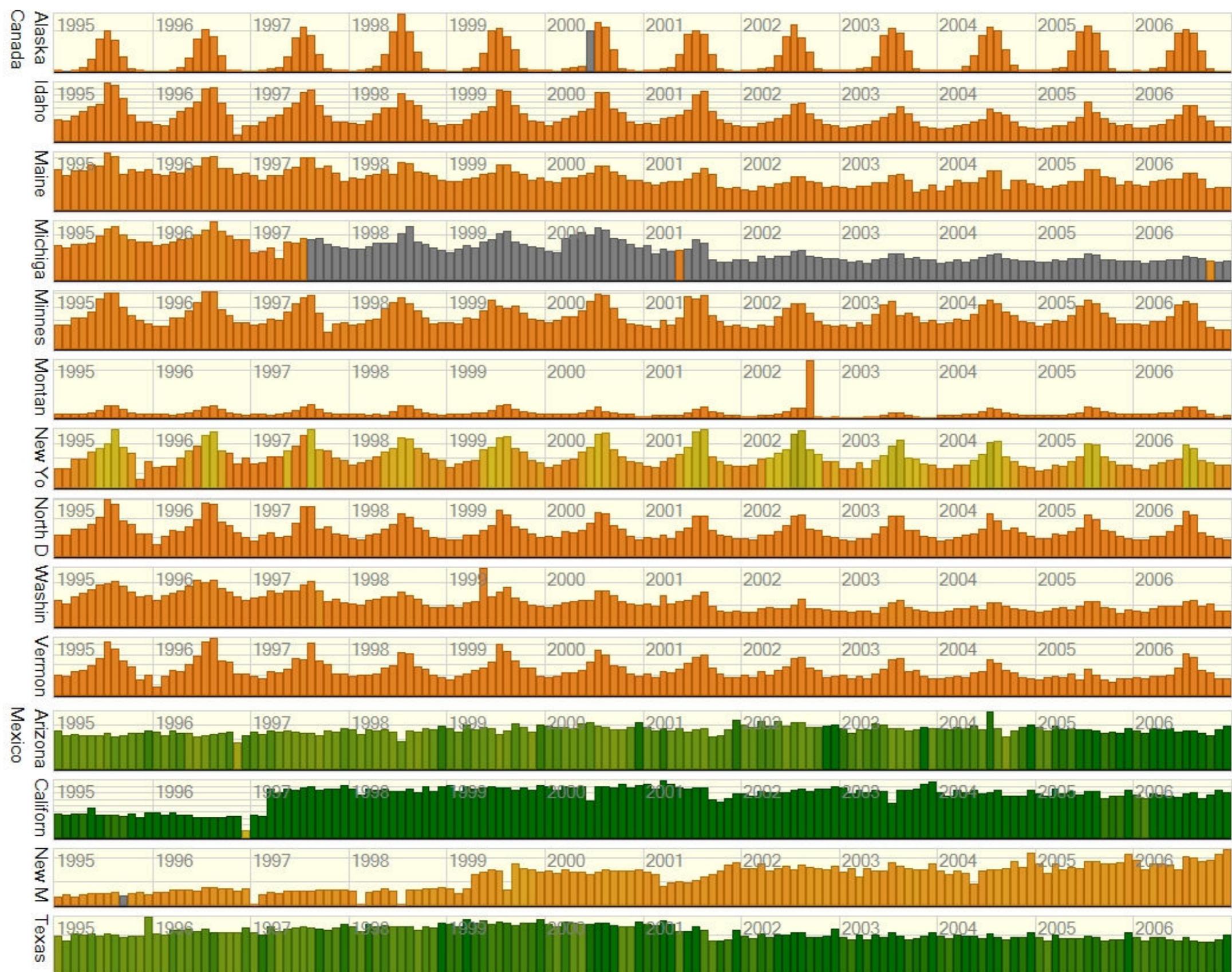


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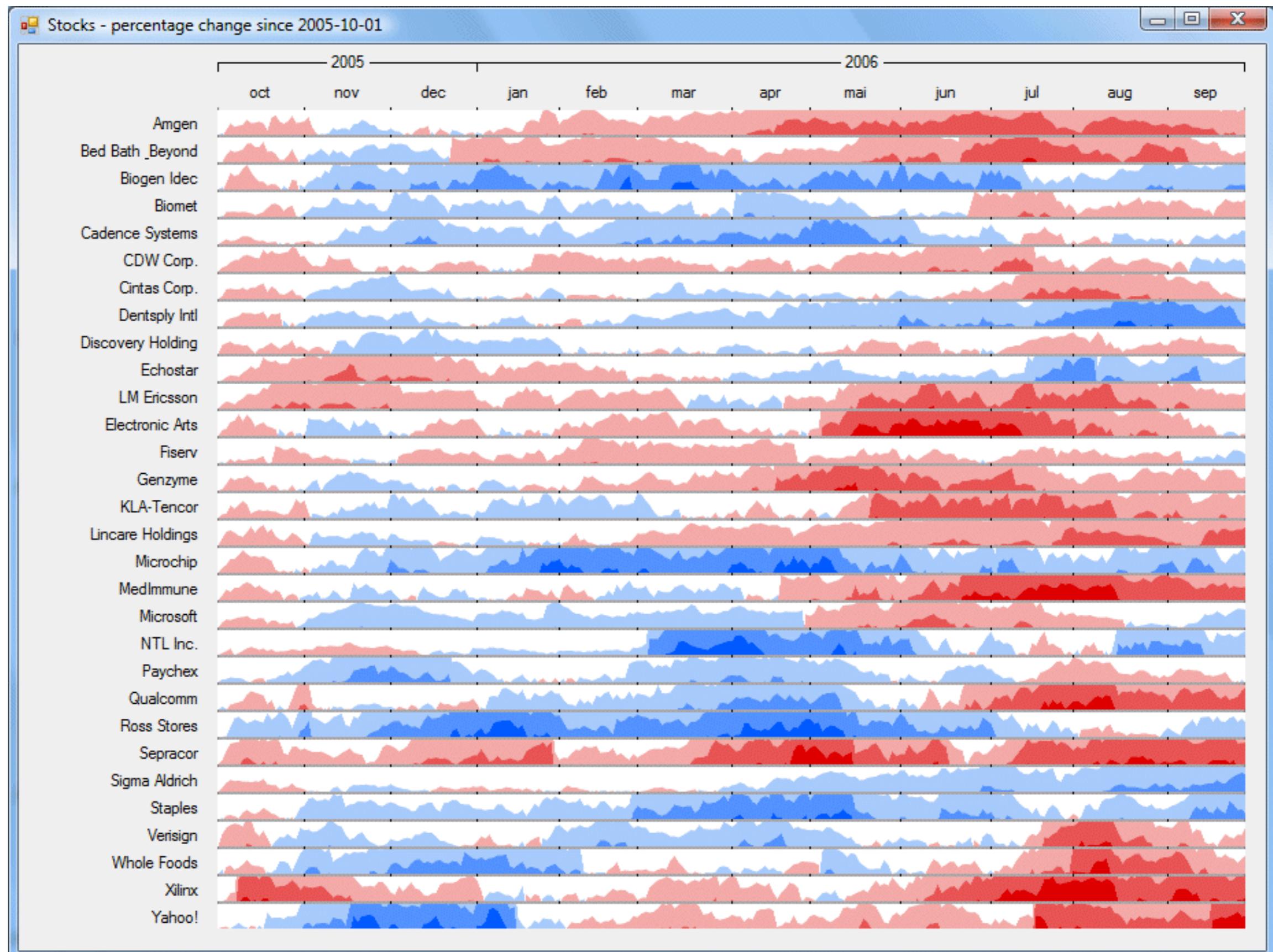
Cairo Principle: Size in Proportion to Change

# Amount of Data



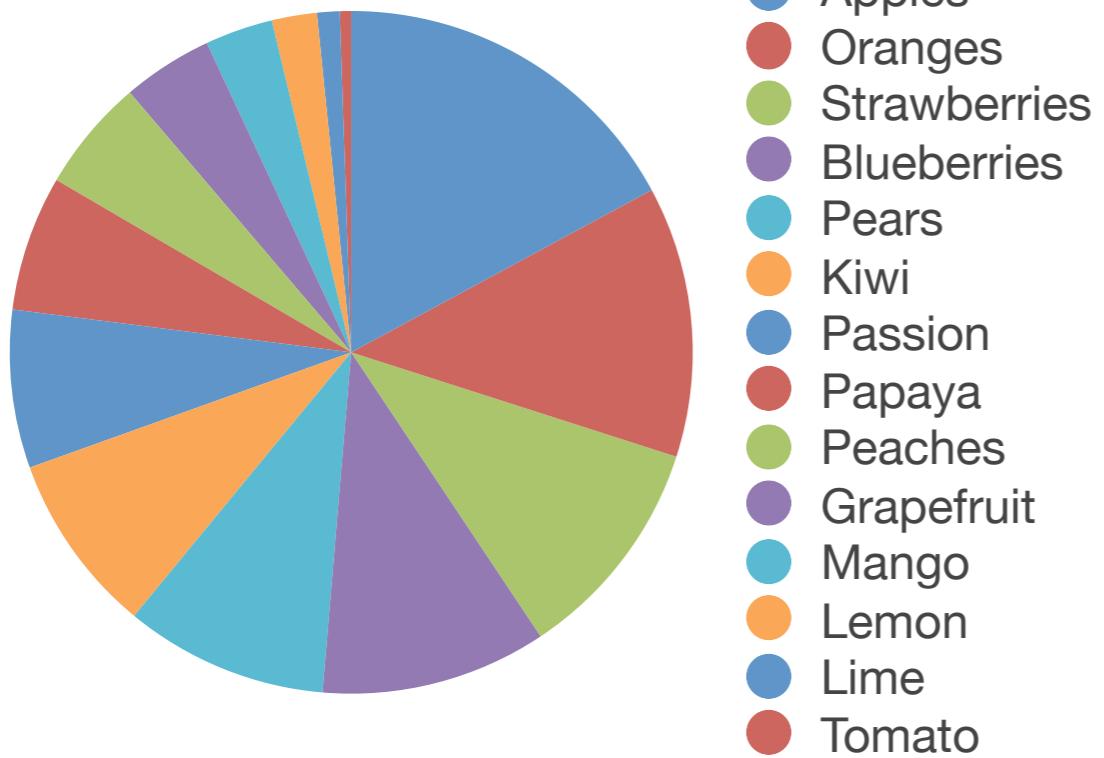
Source: Panopticon

# Amount of Data

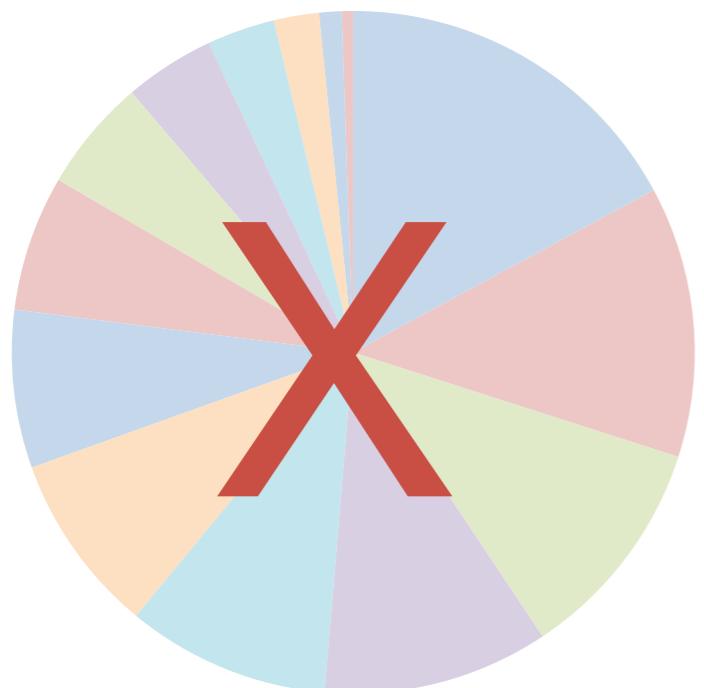


Source: Panopticon

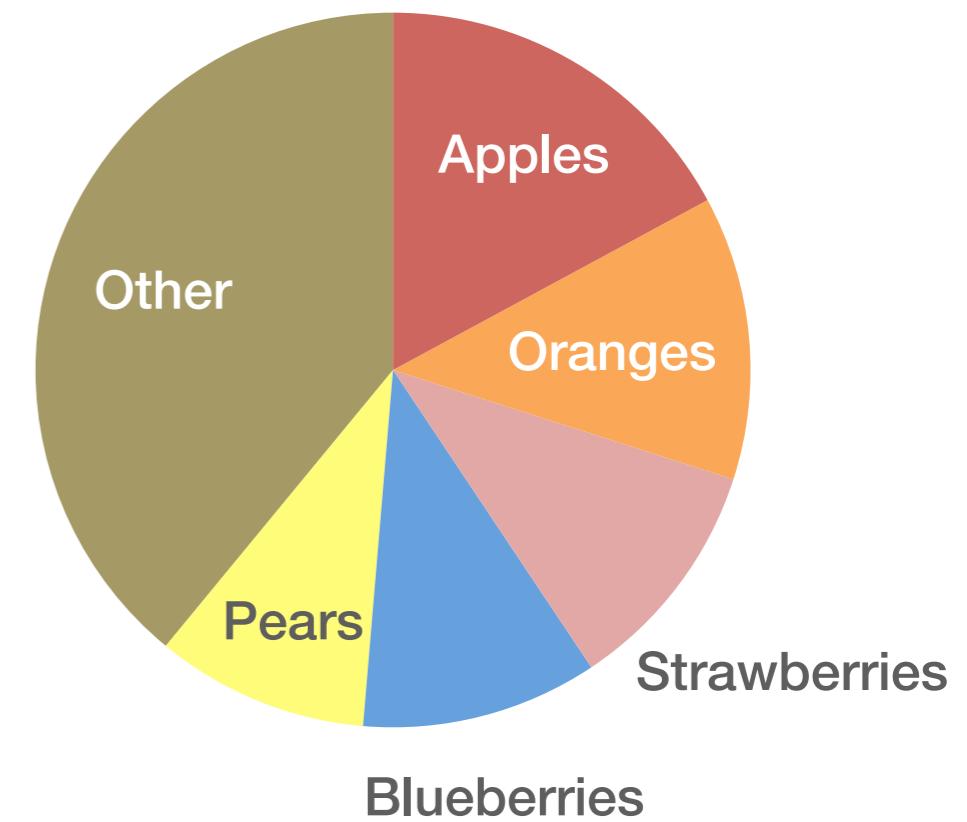
# Amount of Data



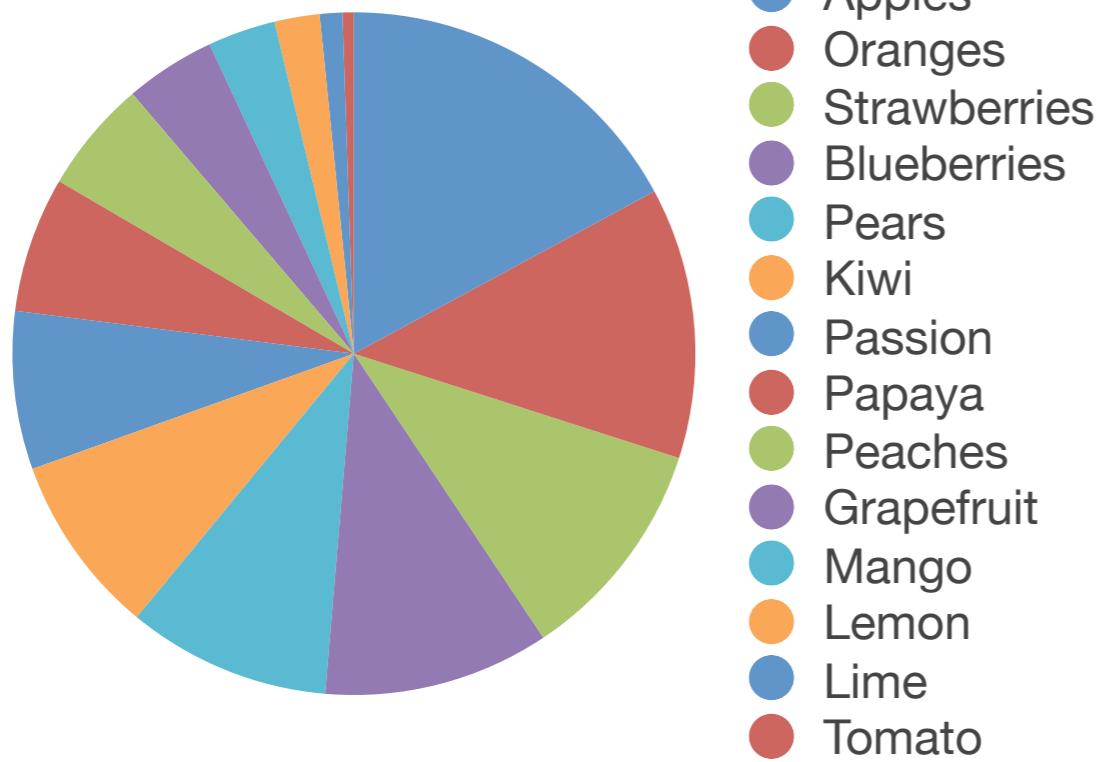
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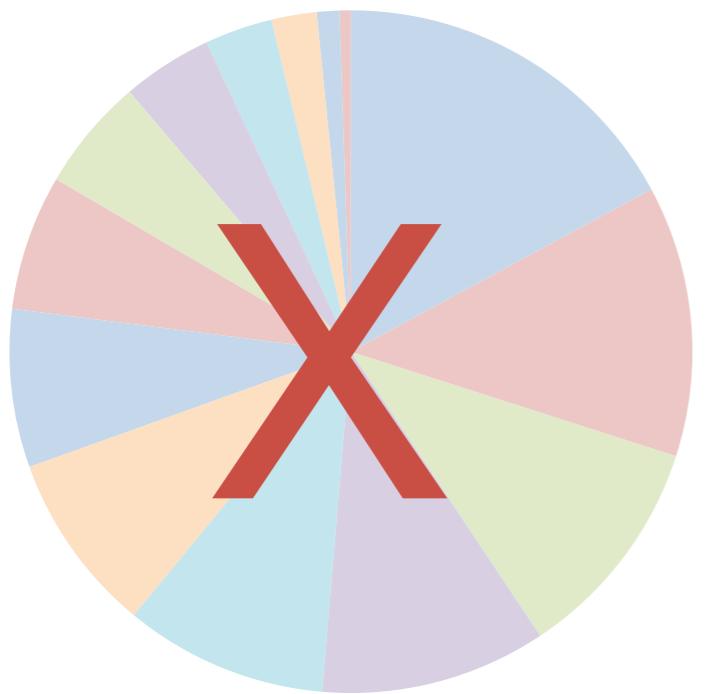
VS



# Amount of Data

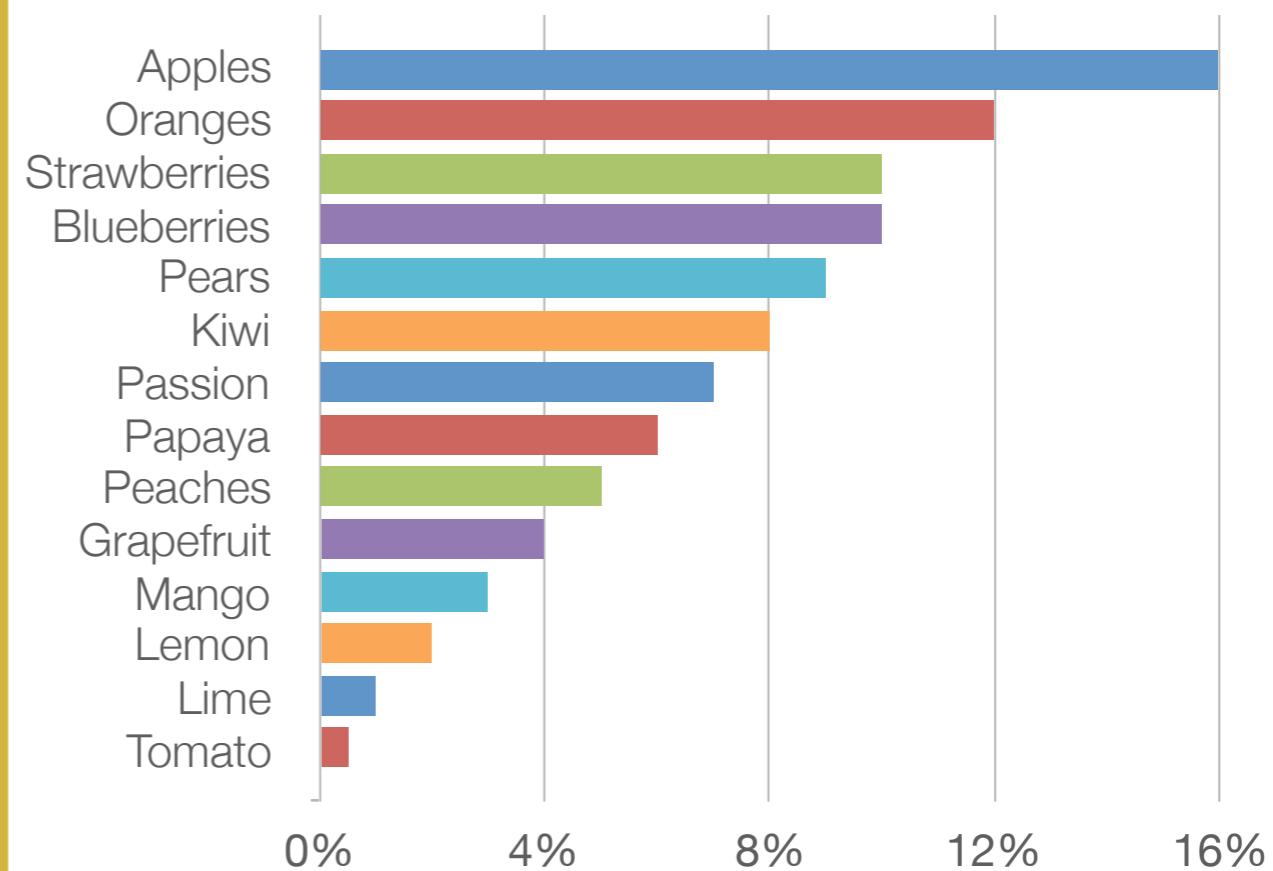


# Amount of Data



- Apples
- Oranges
- Strawberries
- Blueberries
- Pears
- Kiwi
- Passion
- Papaya
- Peaches
- Grapefruit
- Mango
- Lemon
- Lime
- Tomato

VS



# Amount of Data

## [Health Statistics](#) > Tobacco > Adult male smokers (most recent) by country

VIEW DATA: [Totals](#)

[Definition](#)

[Source](#)

[Printable version](#)

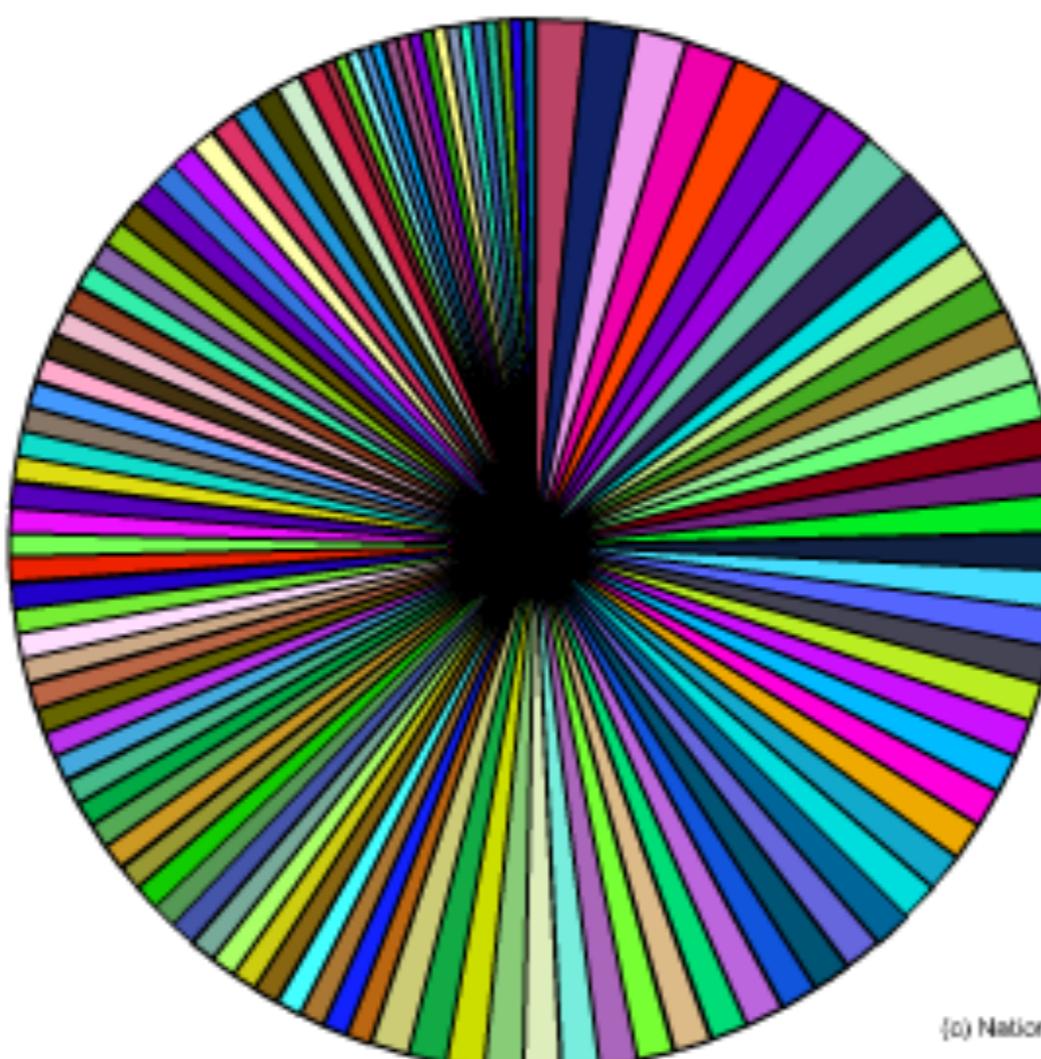
[Bar Graph](#)

[Pie Chart](#)

[Map](#)

[Correlations](#)

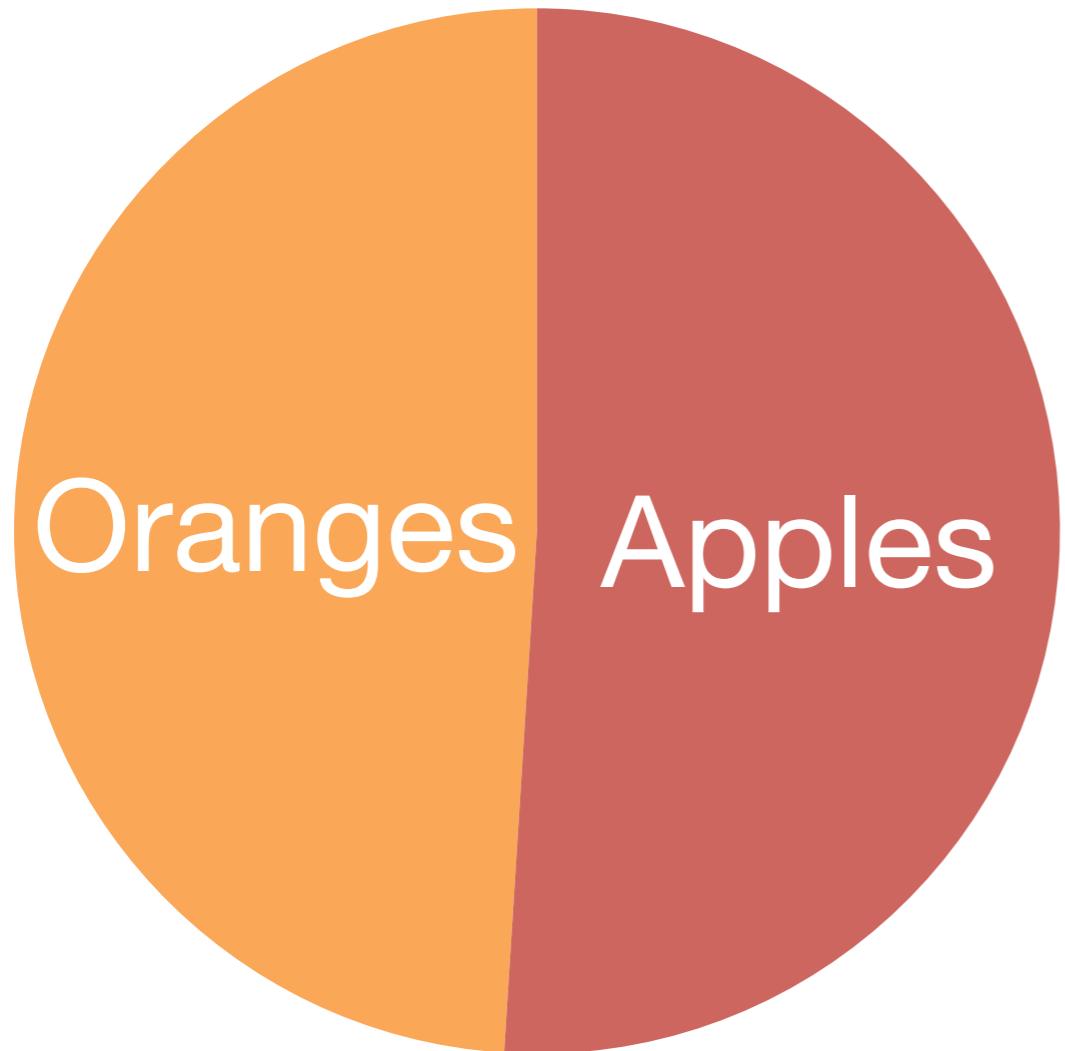
Showing latest available data.



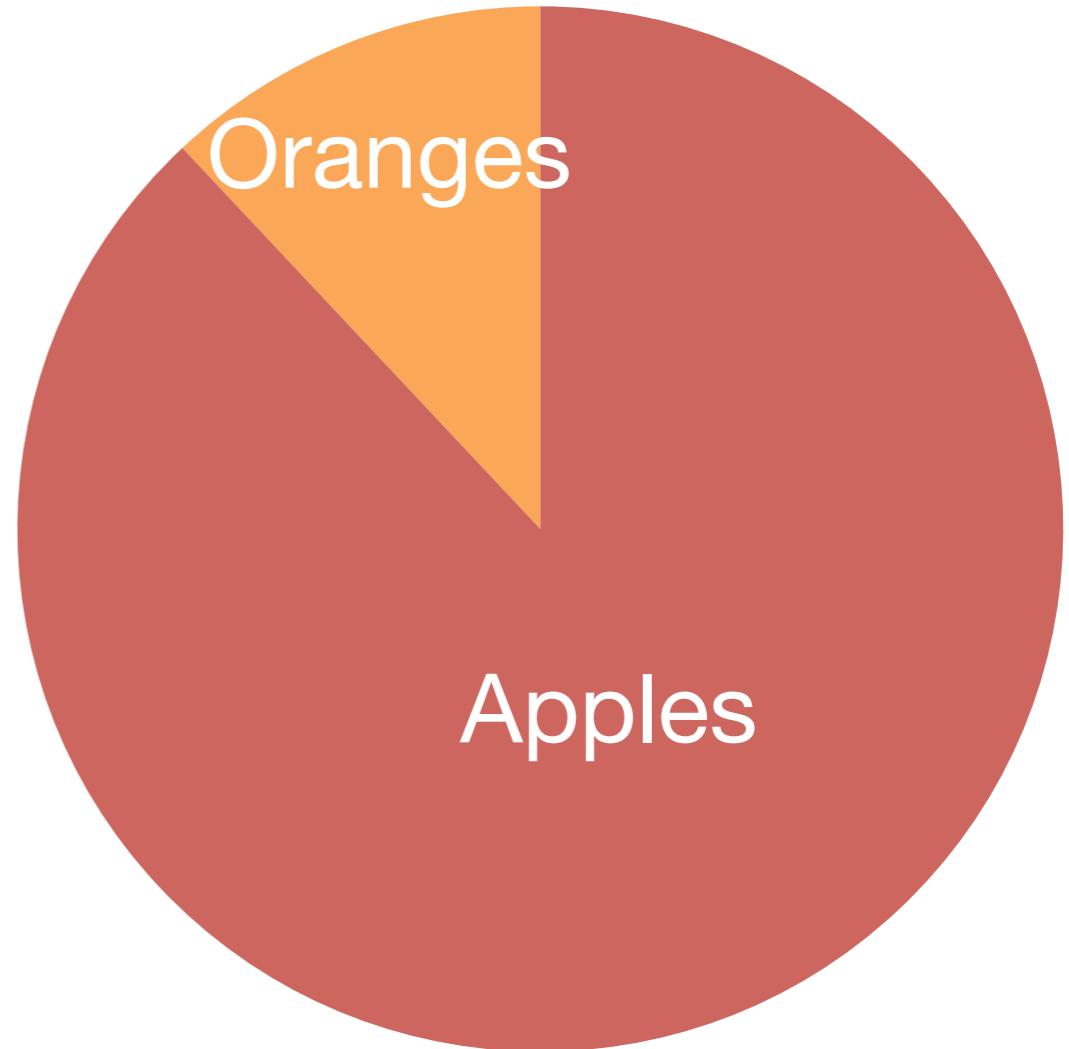
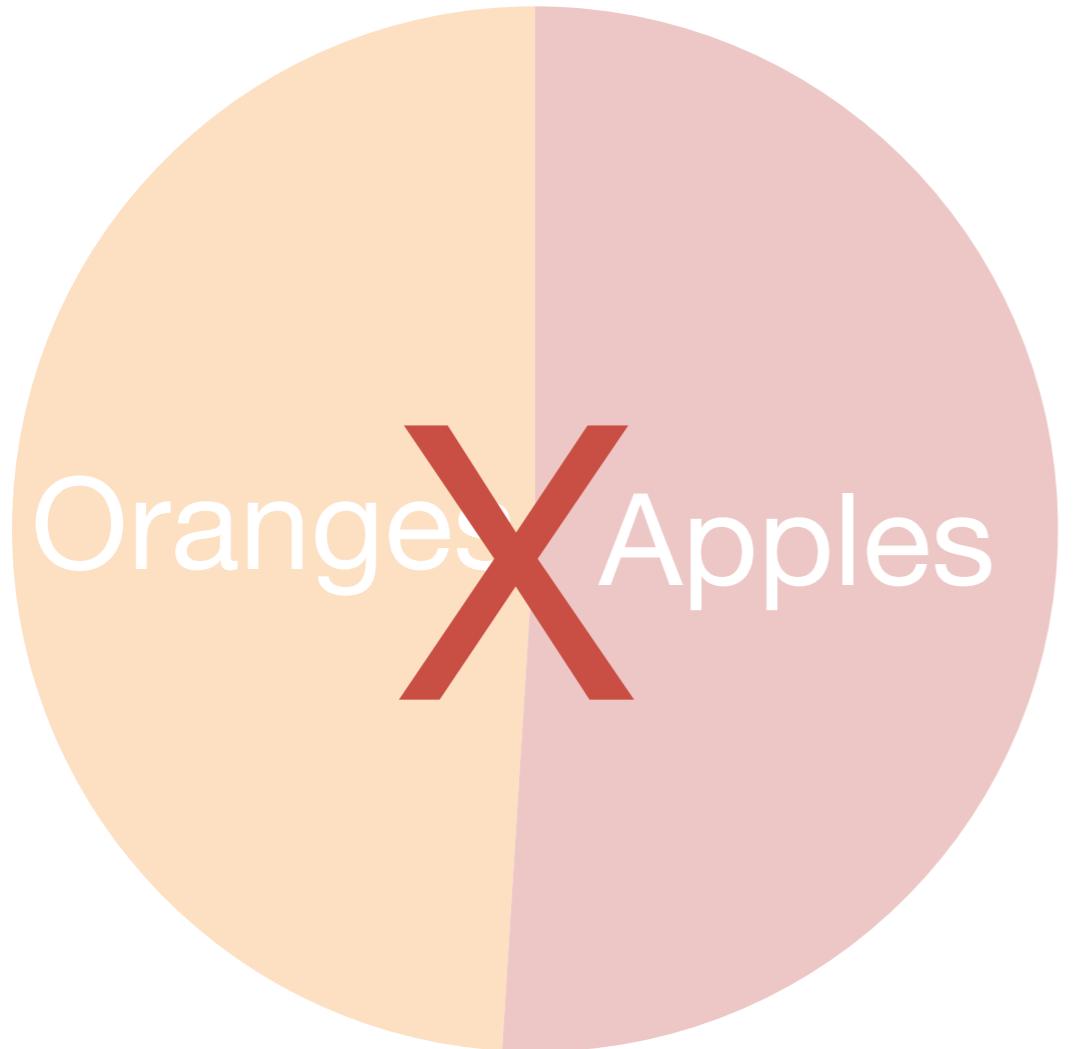
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<a href="#">Mongolia</a>	1.5%
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<a href="#">Kiribati</a>	1.2%

# Amount of Data

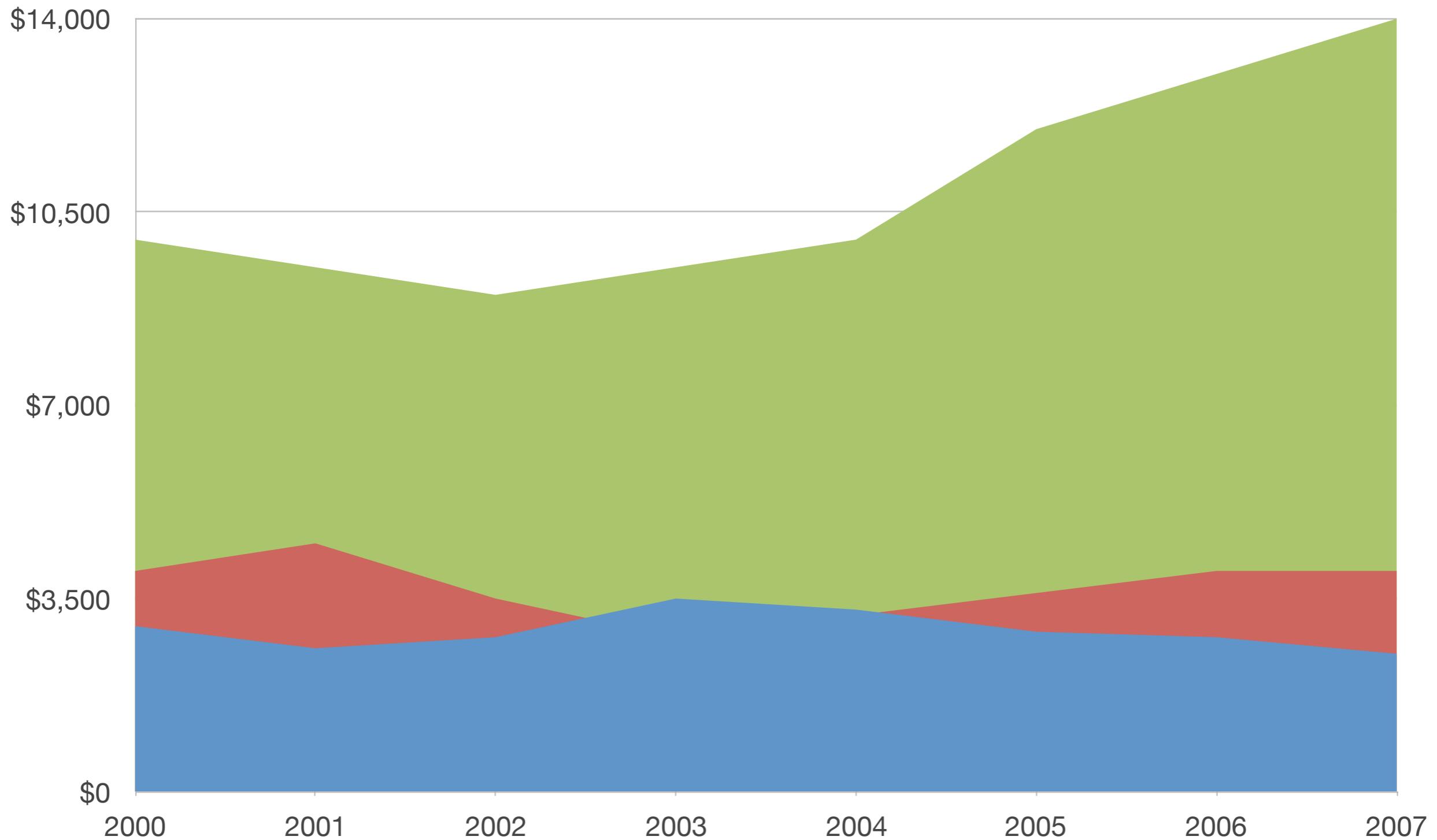


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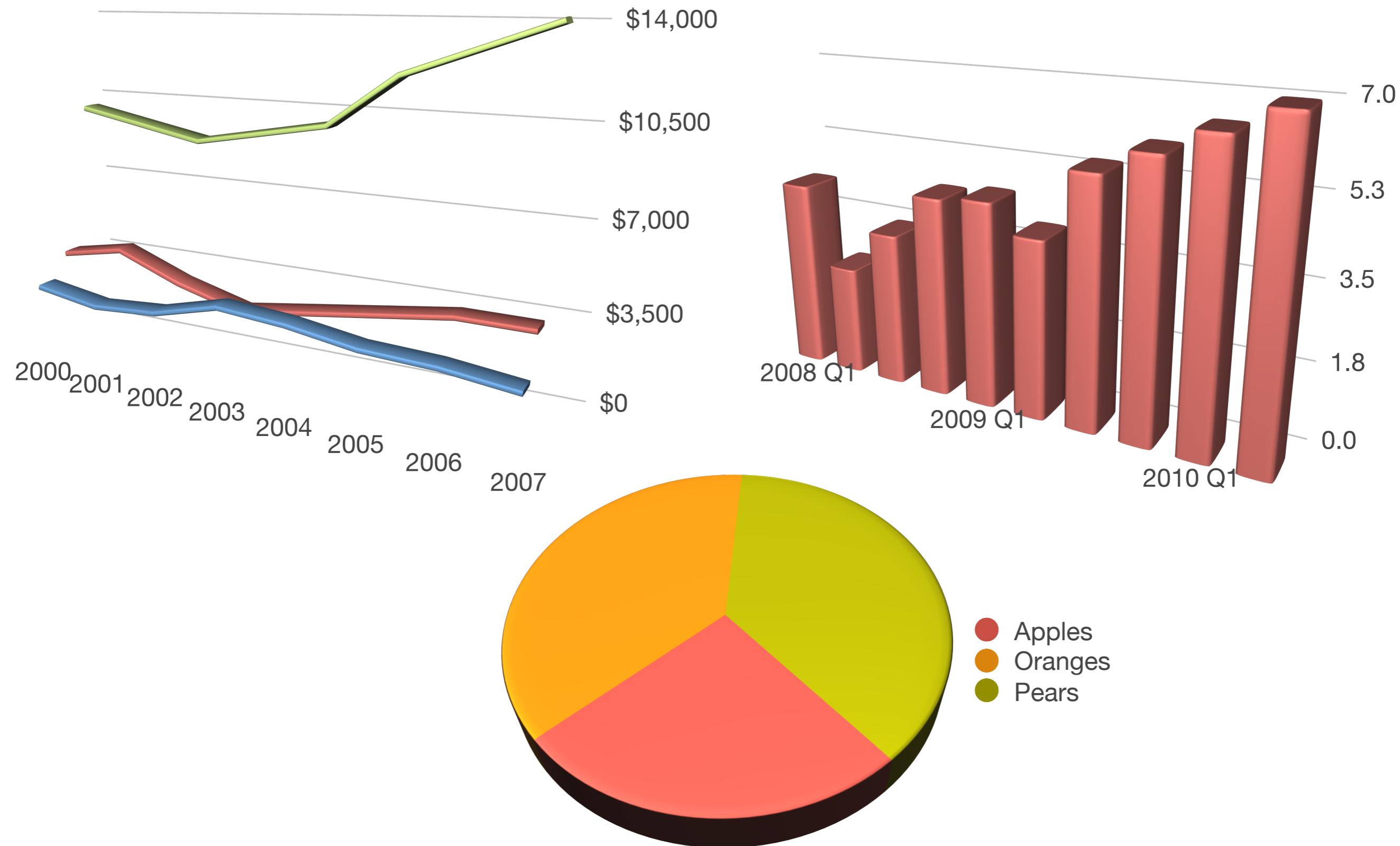


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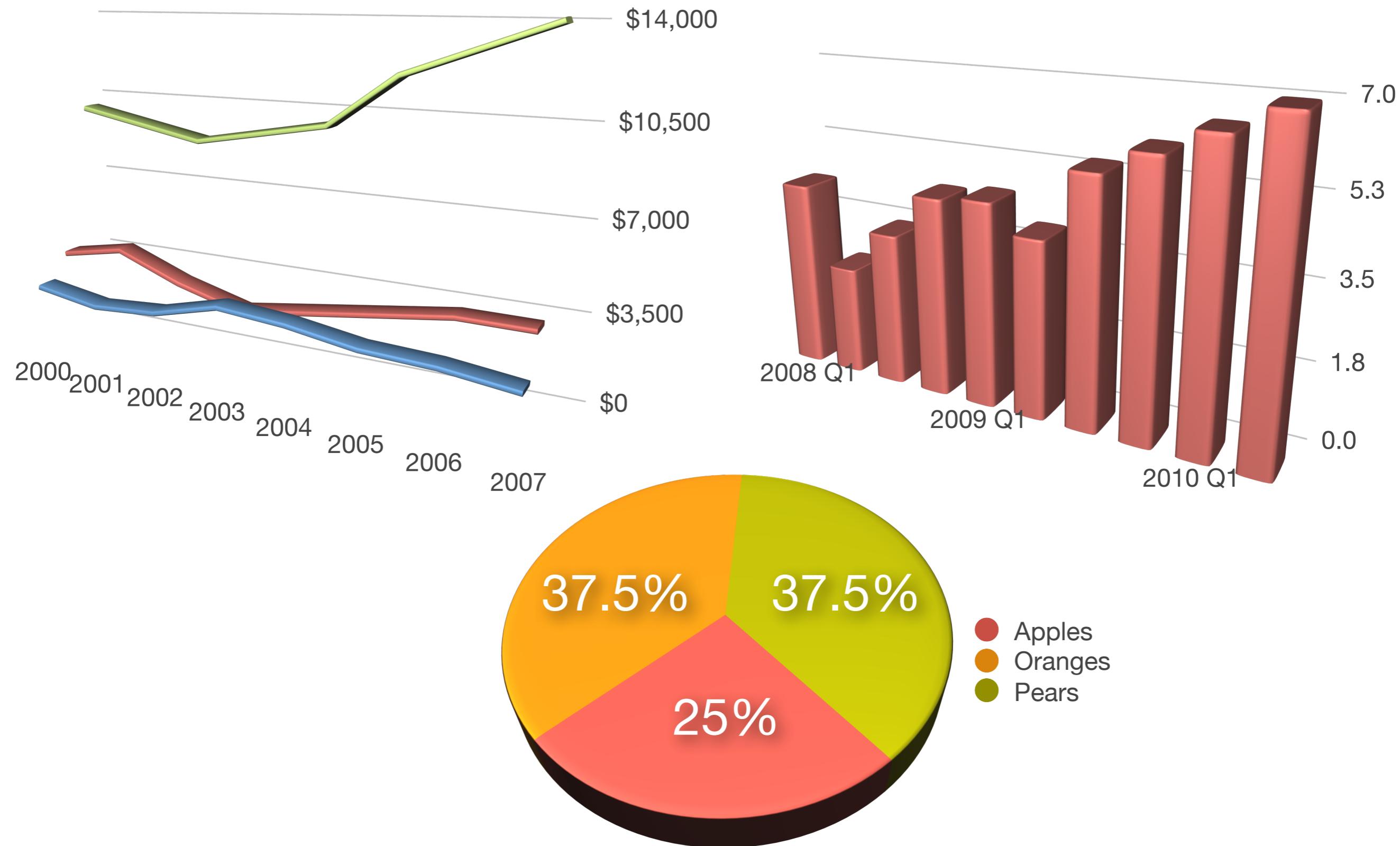
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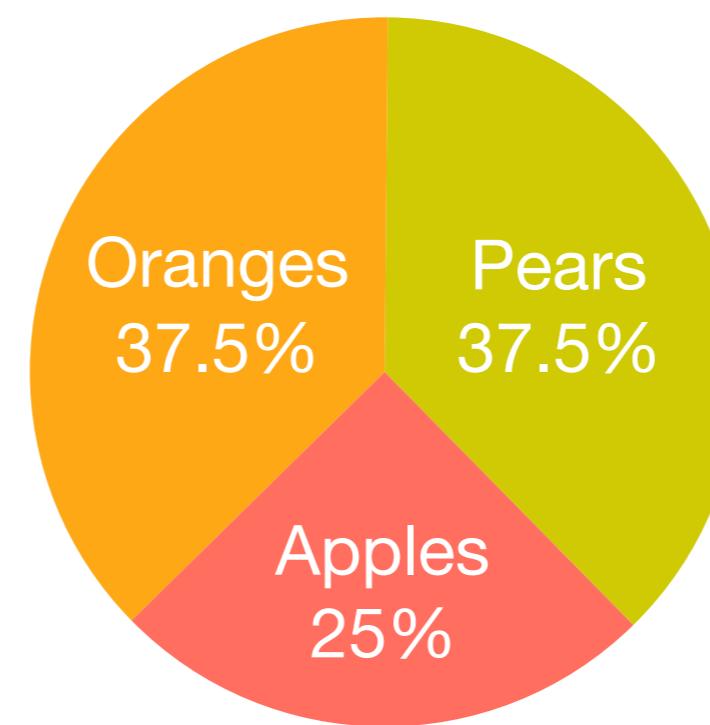
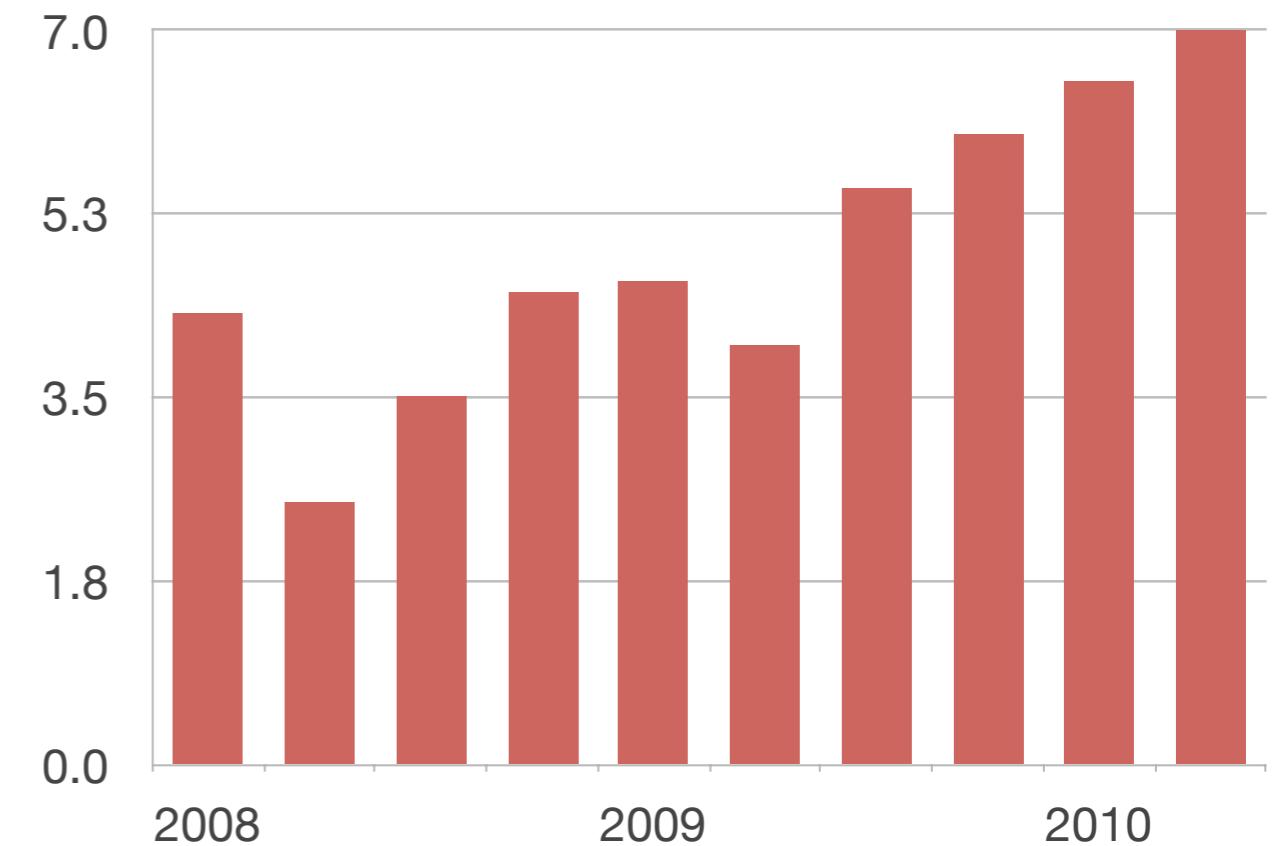
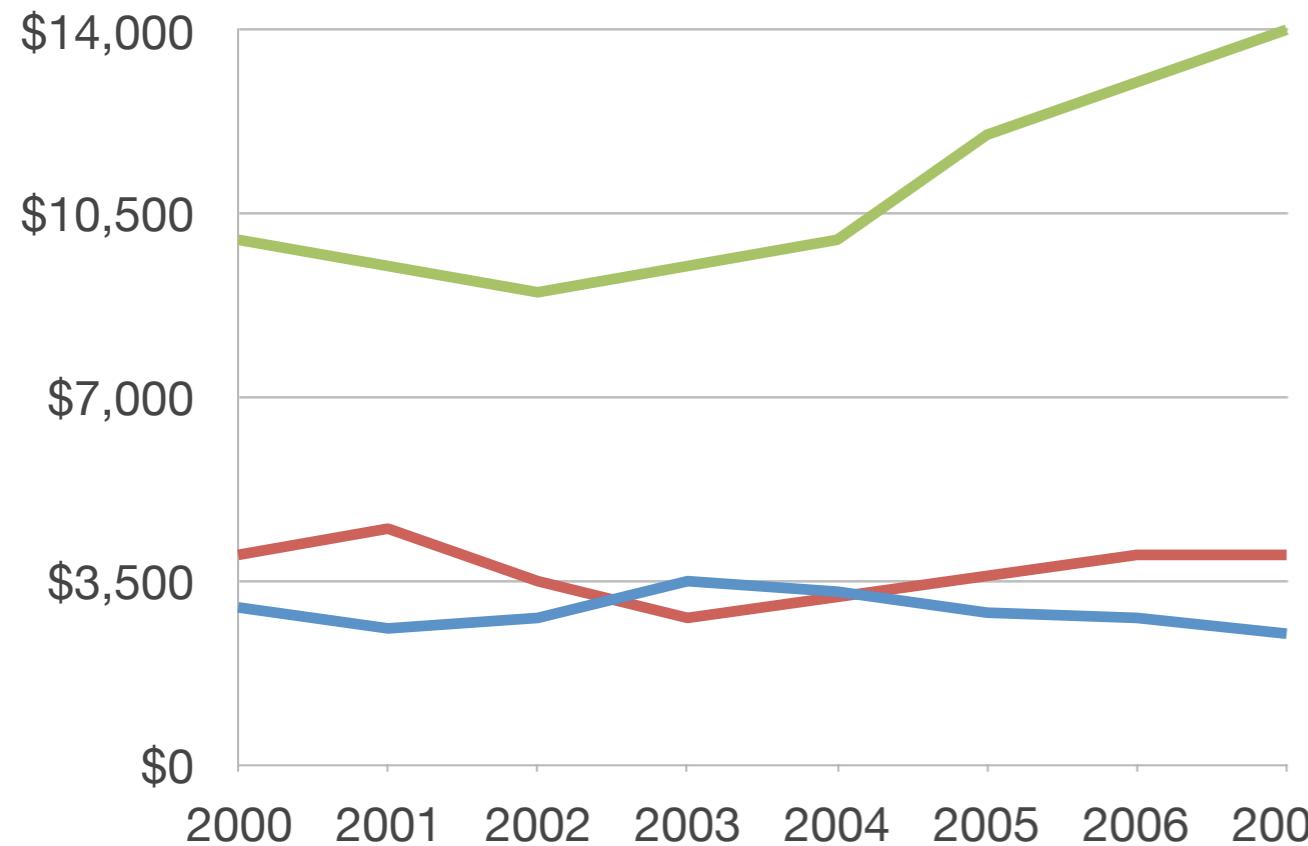
# NEVER Use 3D



# NEVER Use 3D



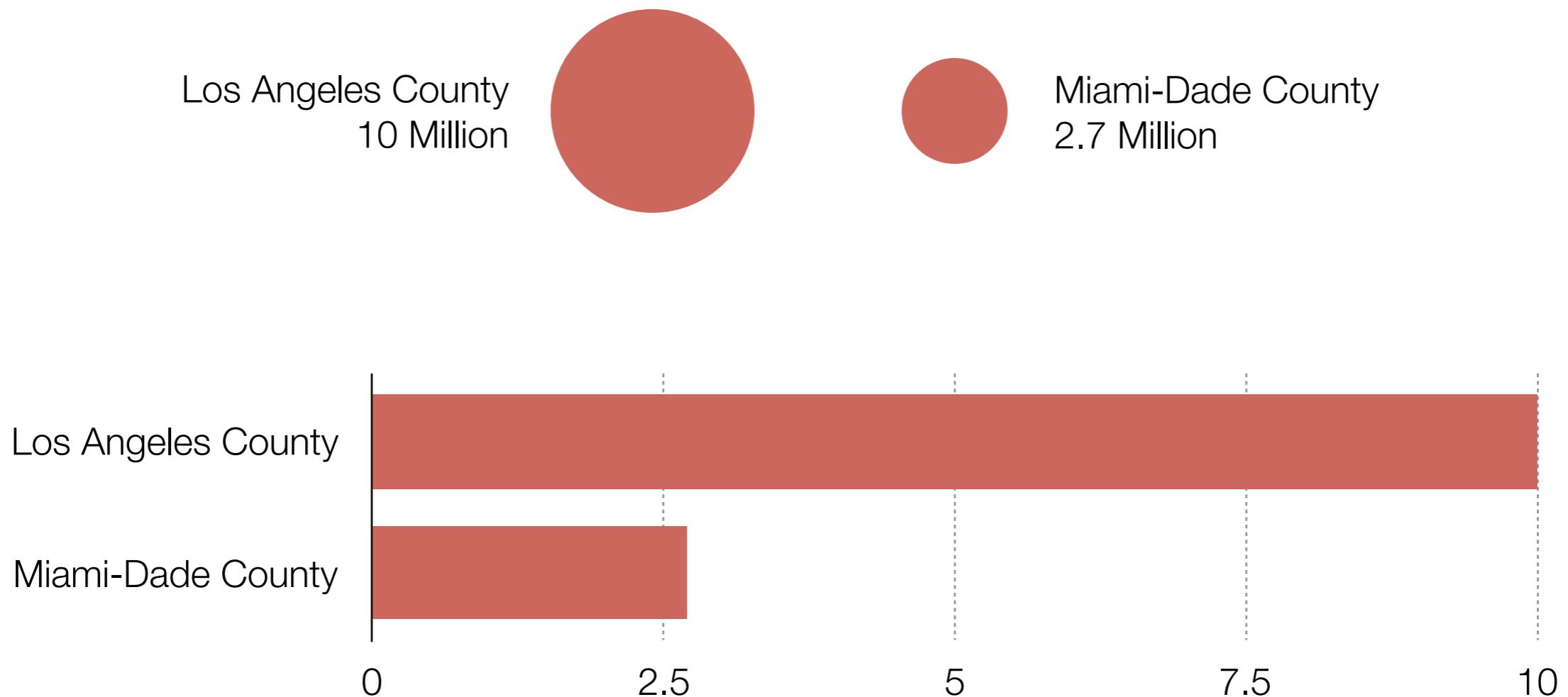
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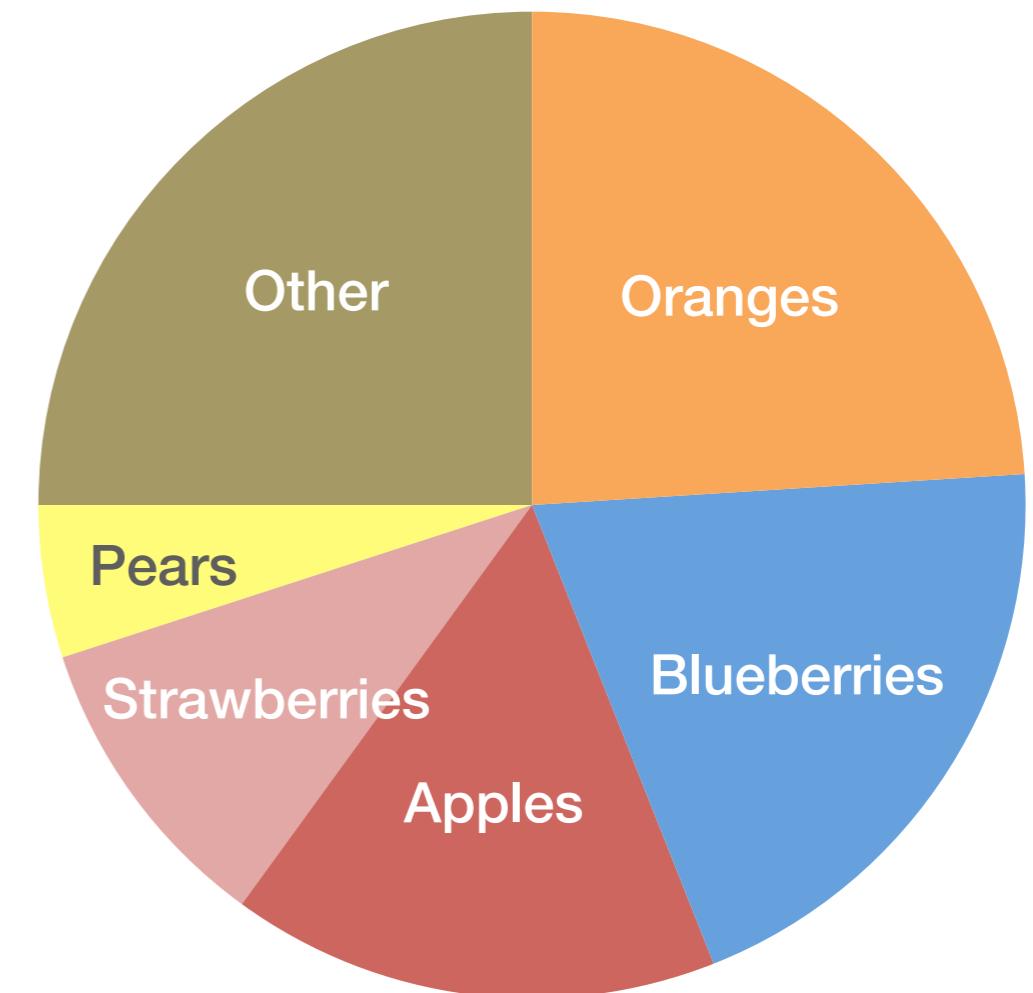
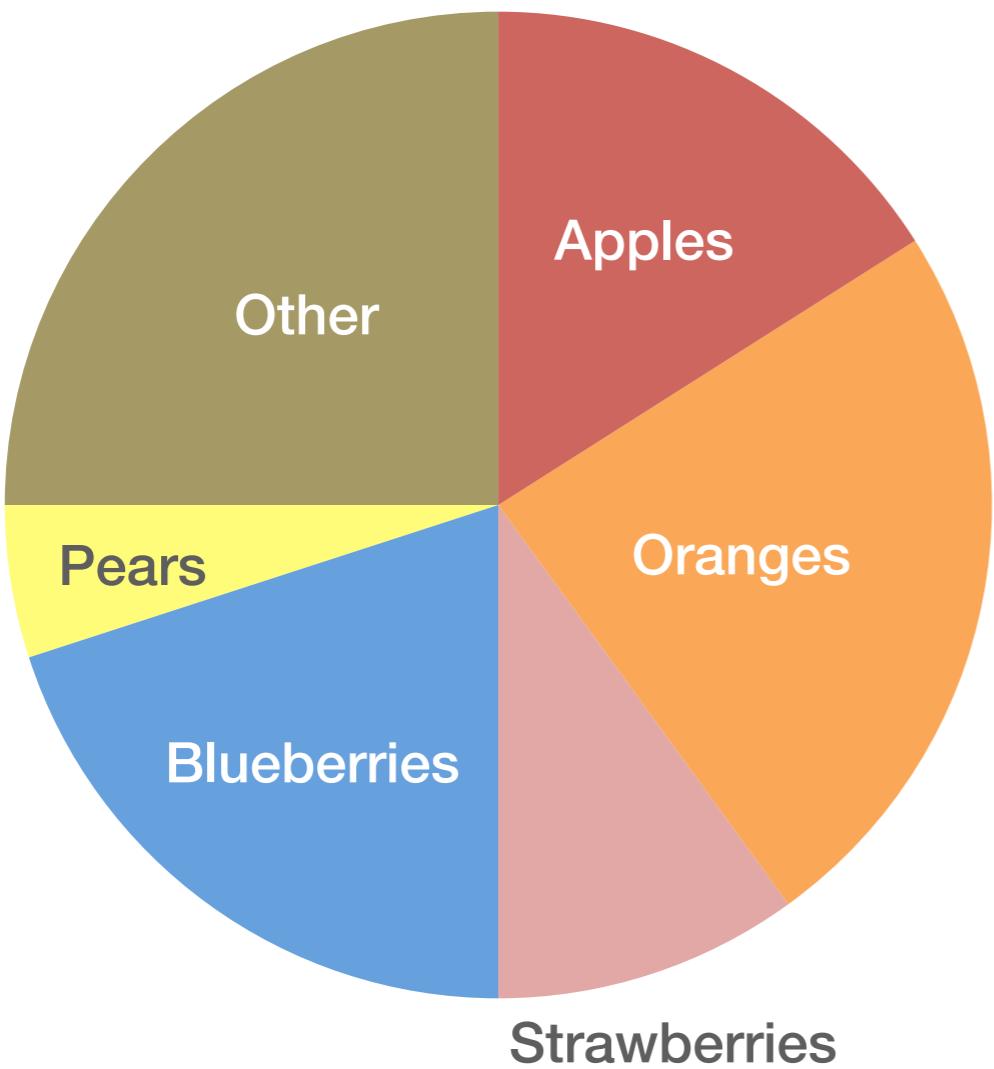
# Parts of the whole



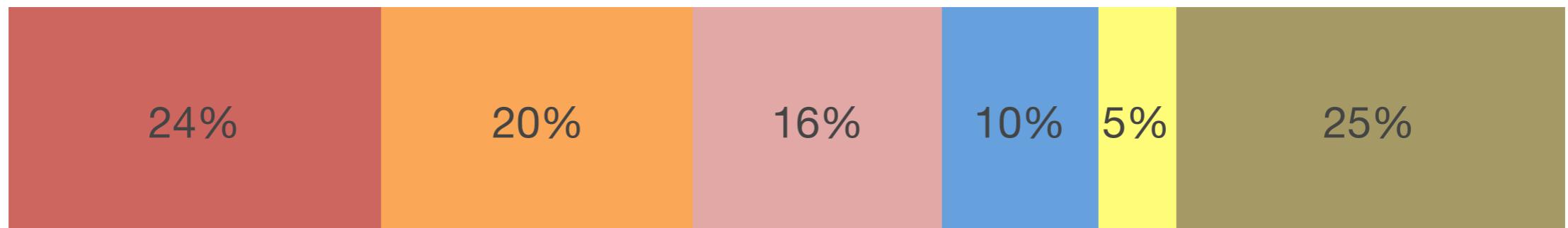
# However....



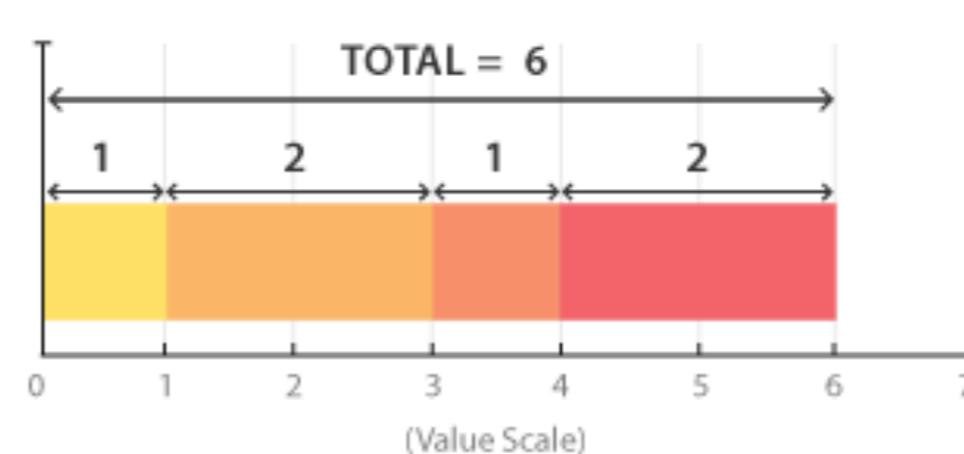
# Order



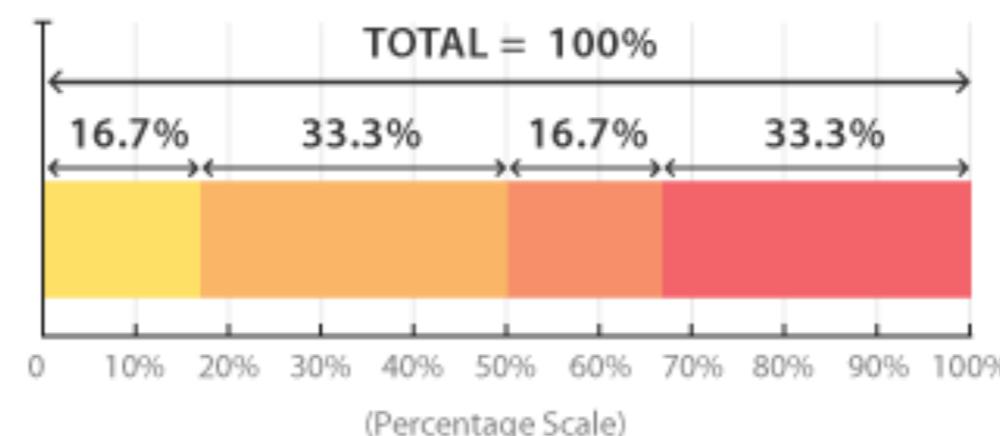
# Stacked Bar Graph



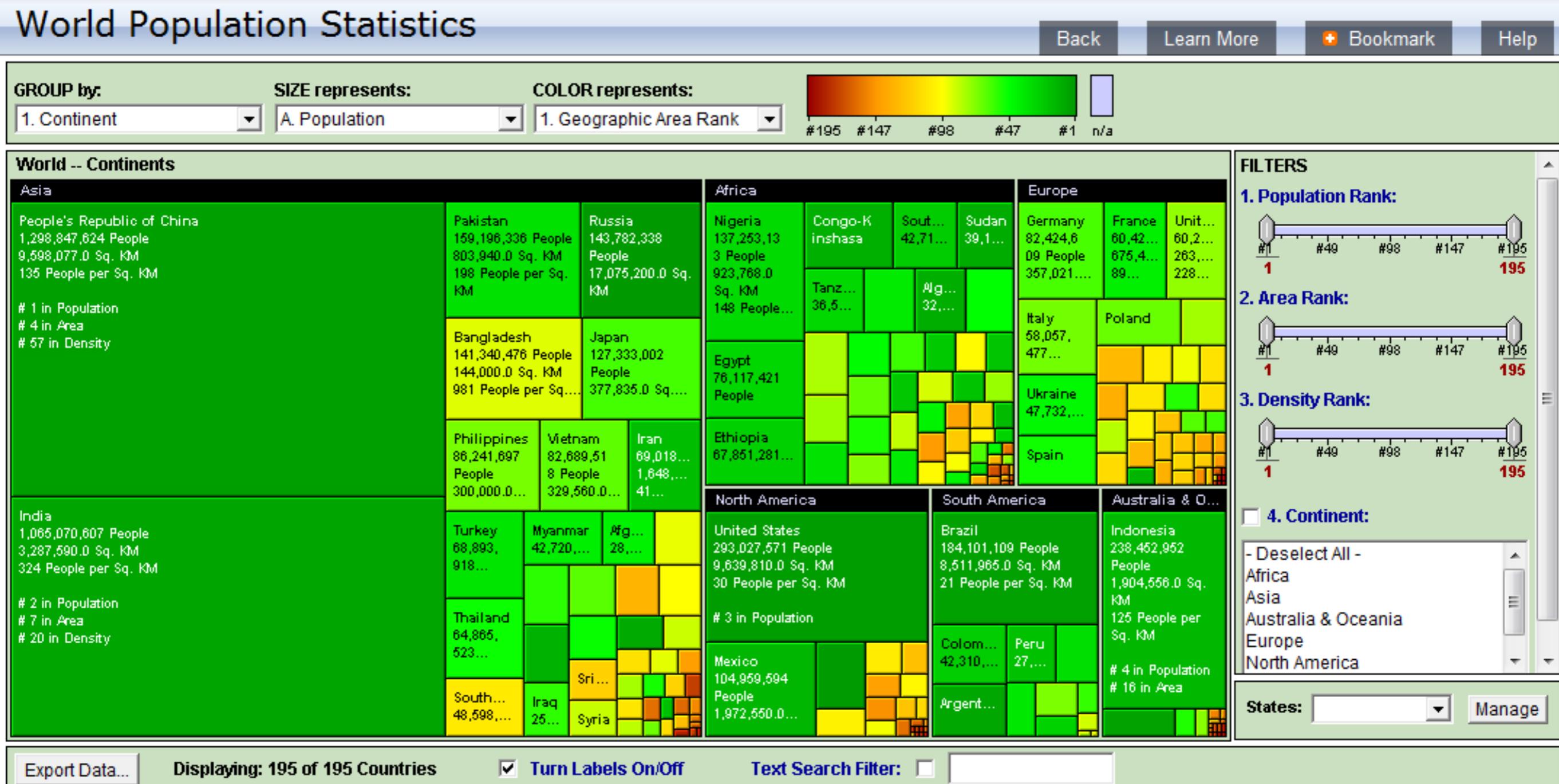
**Simple**



**100%**



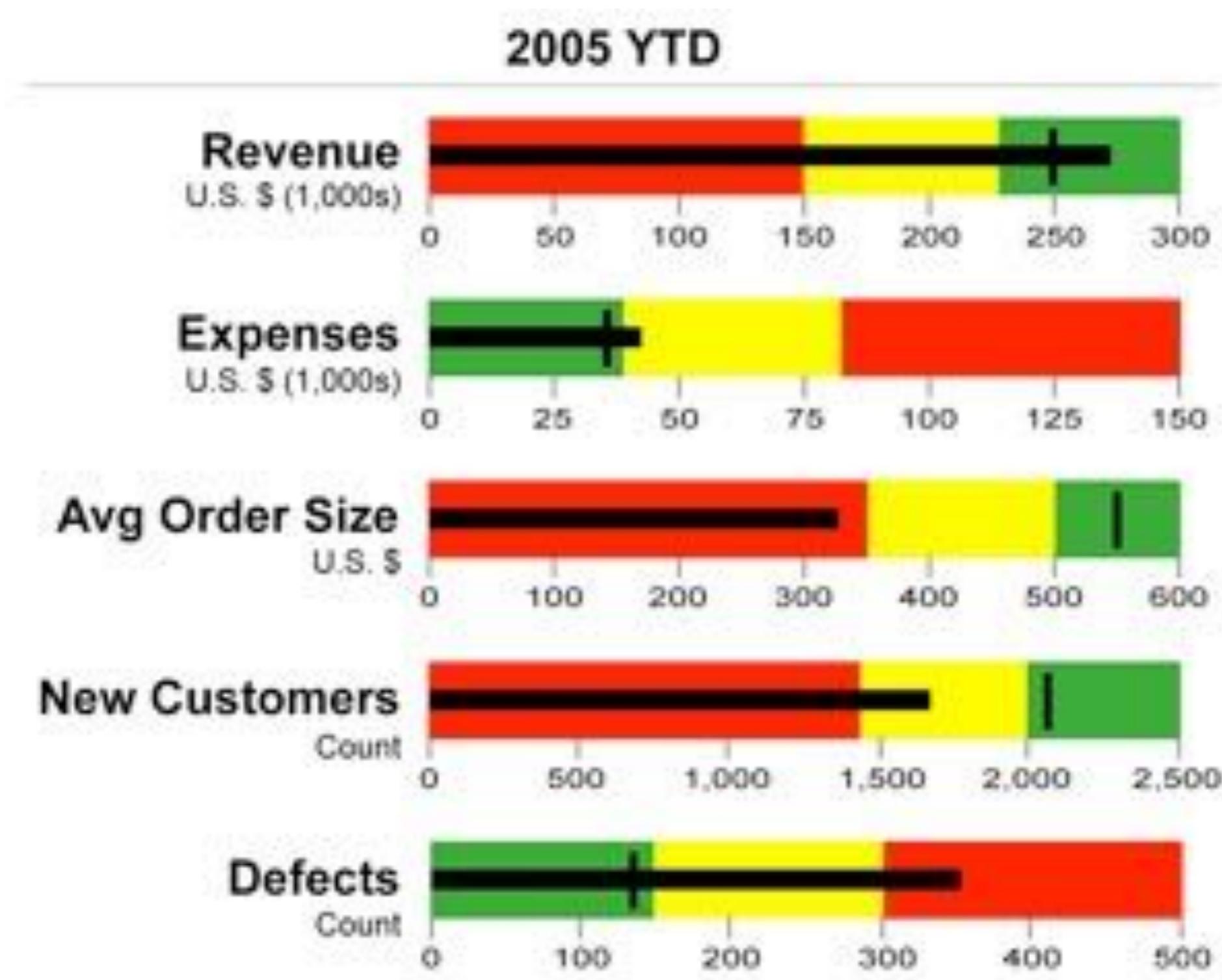
# Tree Maps



Source: giCenter City University London

# Bullet Graphs

# Bullet Graphs

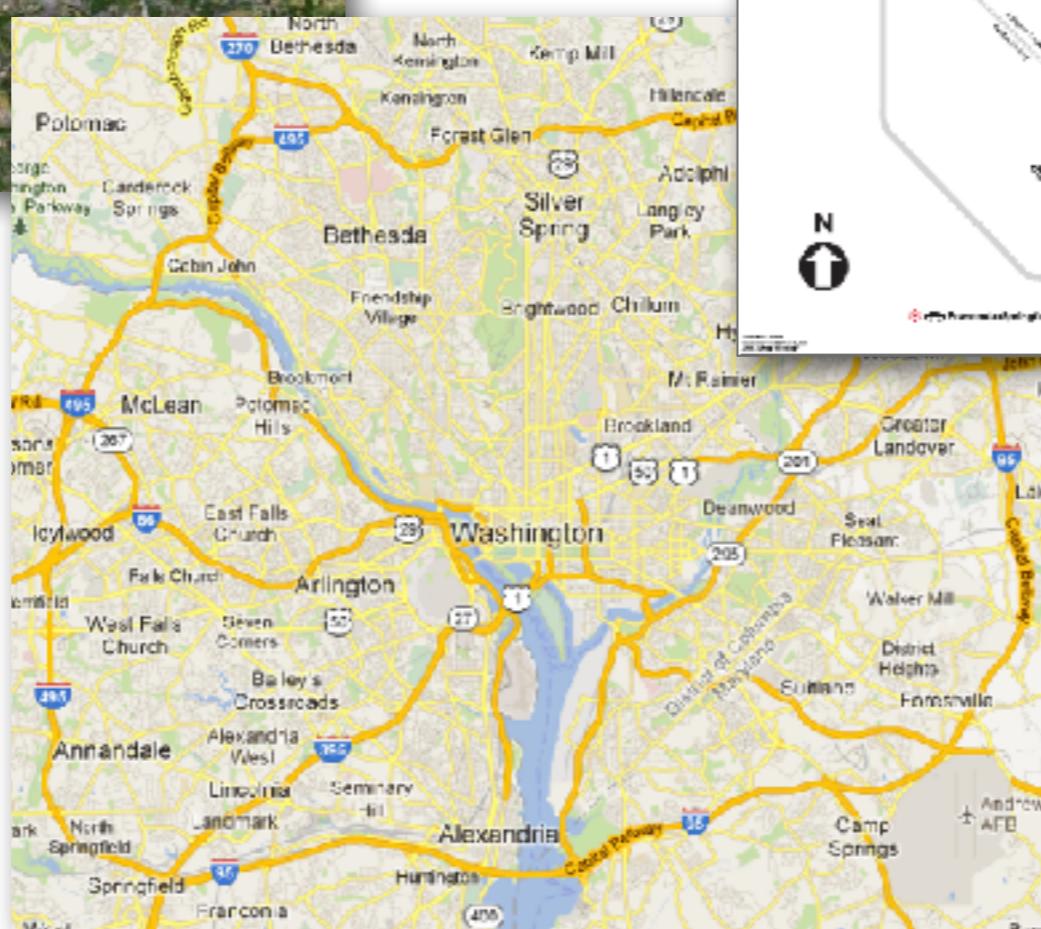
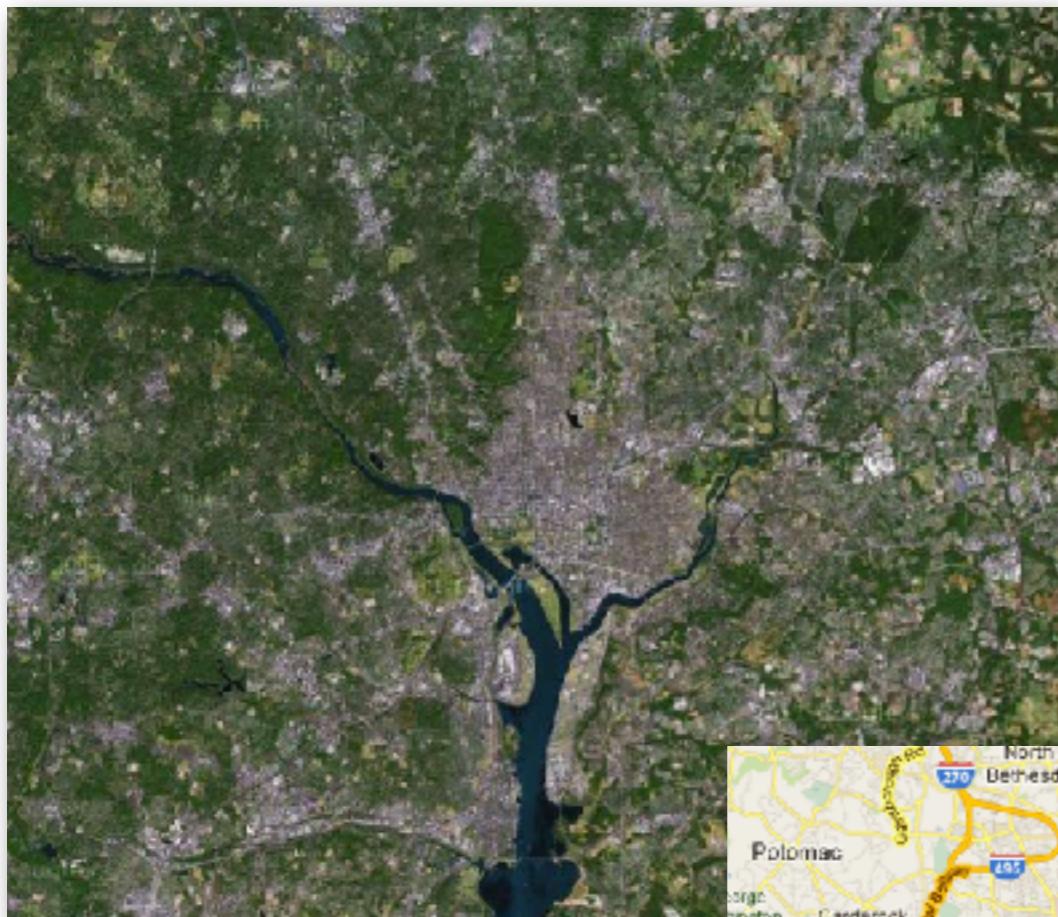


# Geographic Data

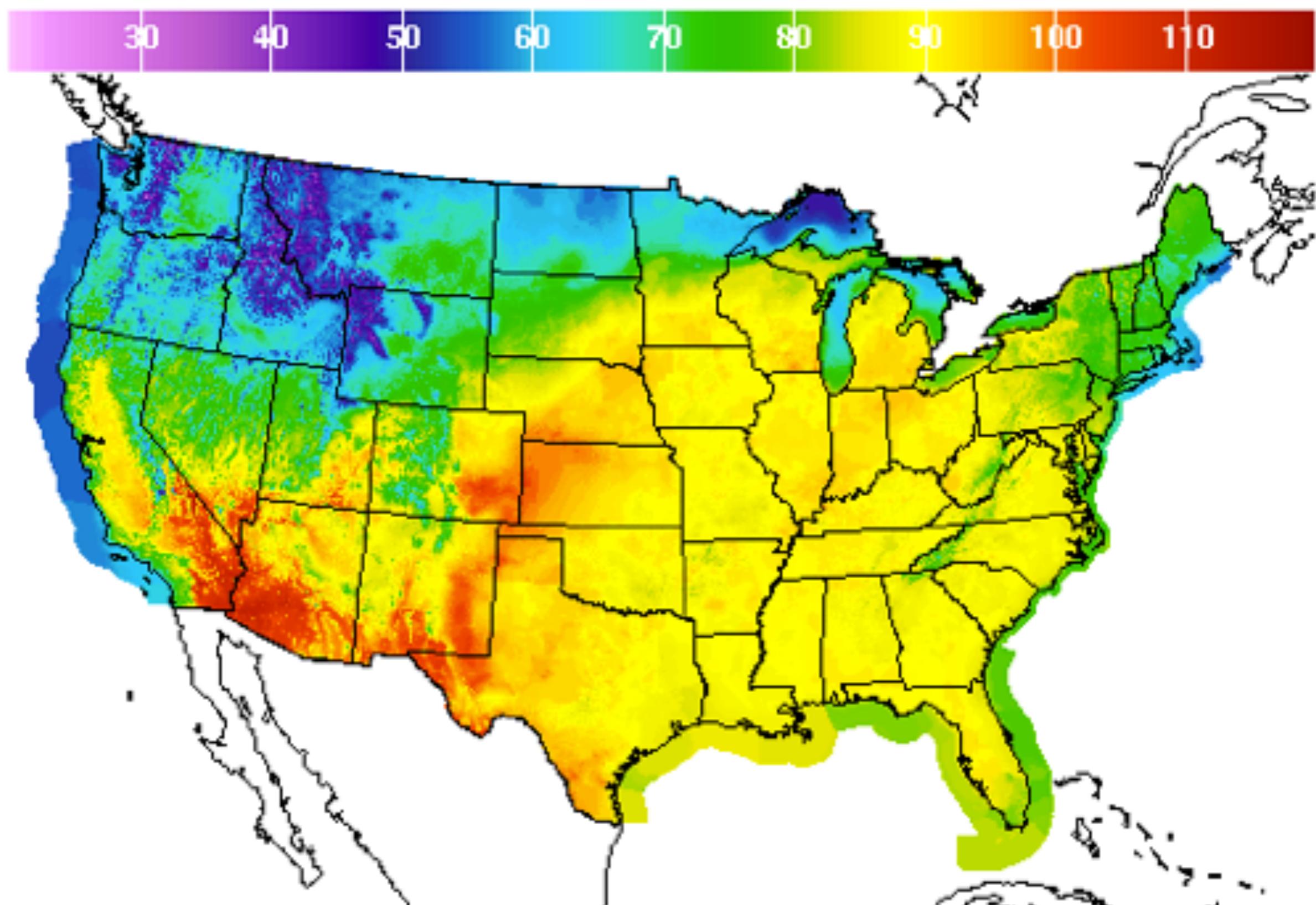
All maps lie.

— Mark Monmonier, Cartographer

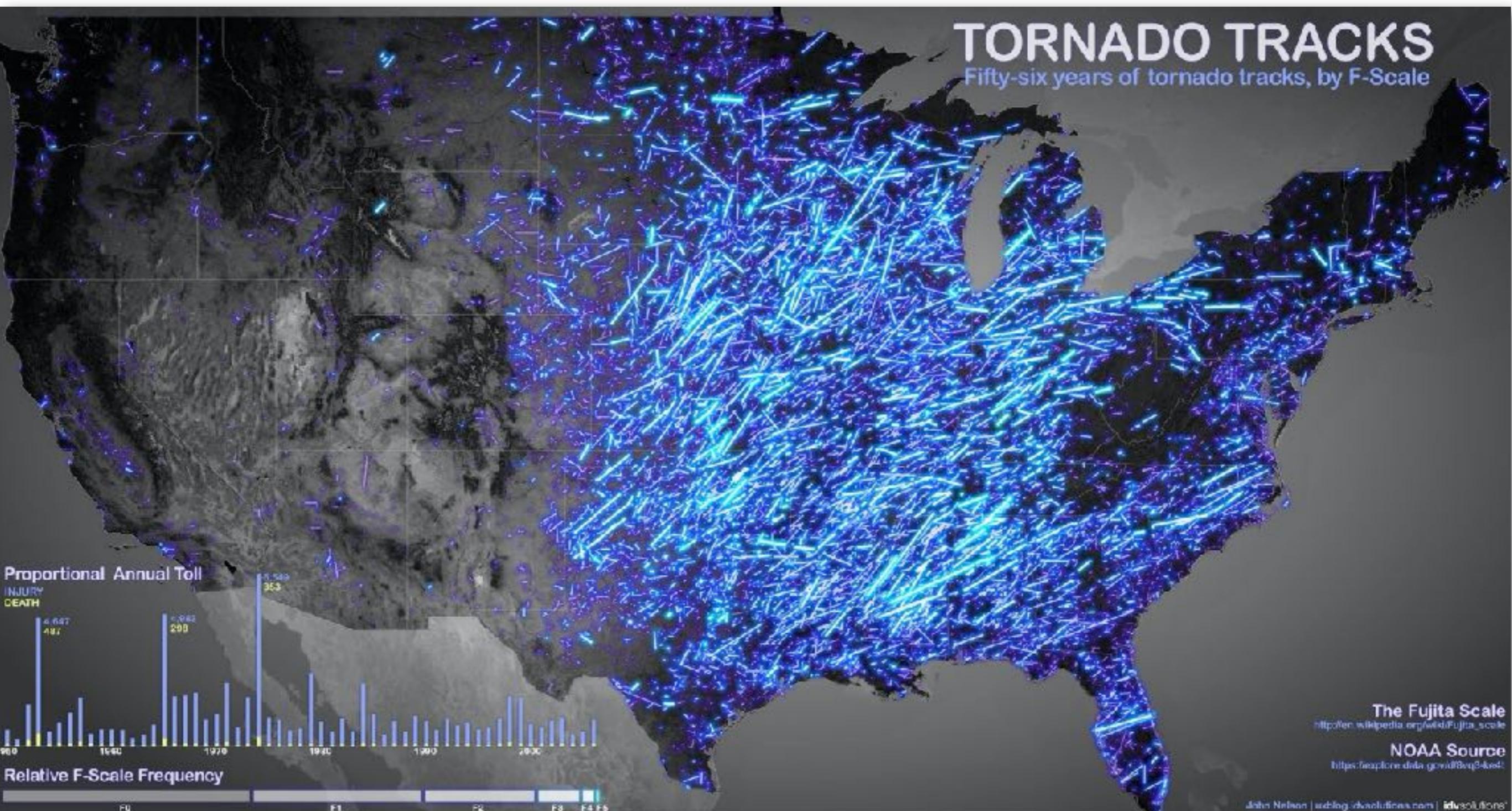
# What Accuracy is Needed?



# Spatial Data



# Spatial Data



# Spatial Data

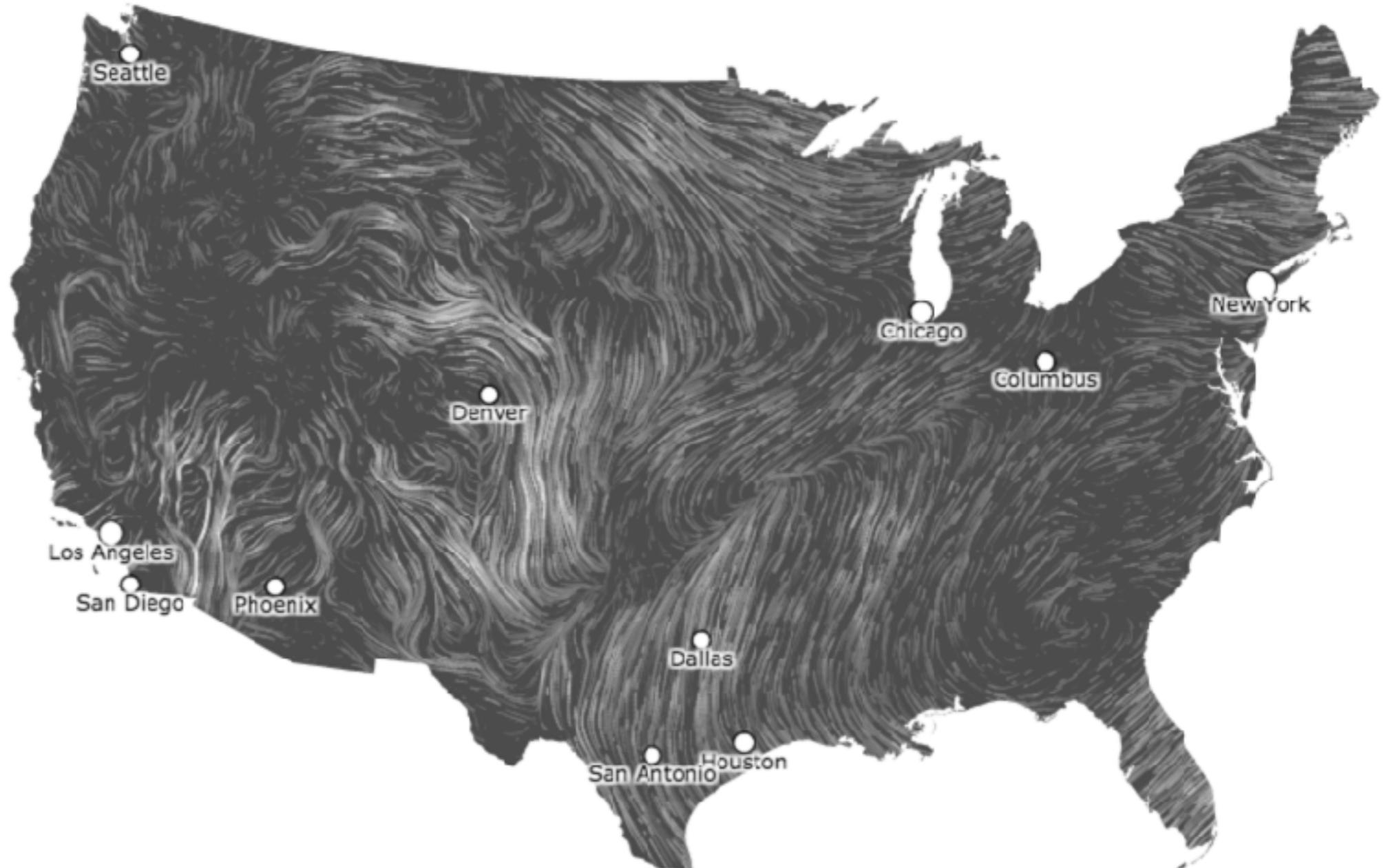
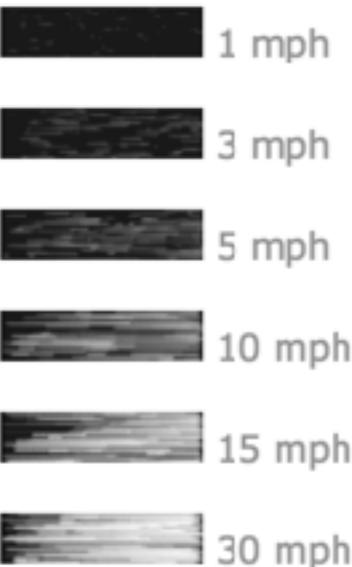
## wind map

October 19, 2016

12:36 pm EST

(time of forecast download)

top speed: 31.3 mph  
average: 7.9 mph



[All Shots](#)[3-Pointers](#)[Midrange](#)[Close Range](#)

Number of attempts

Low

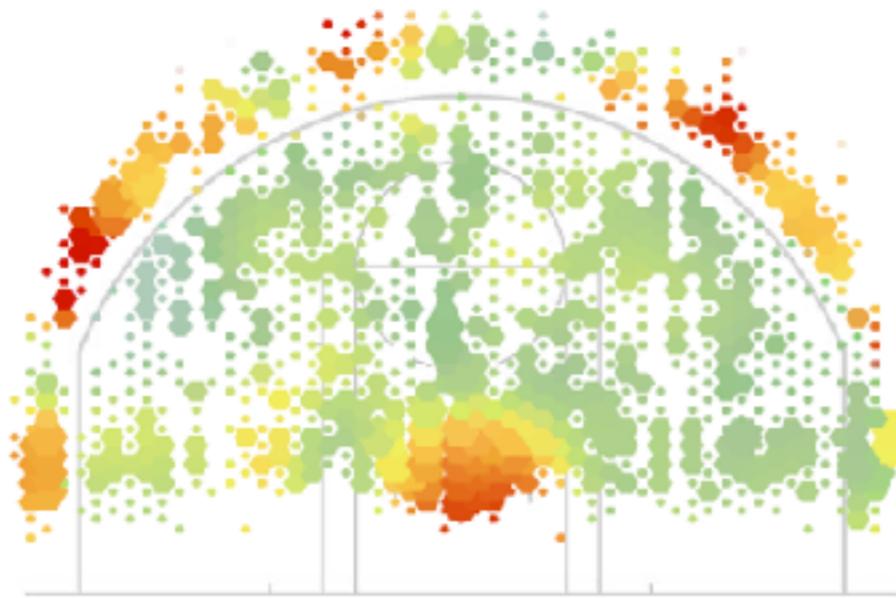
High

Points per region

Low

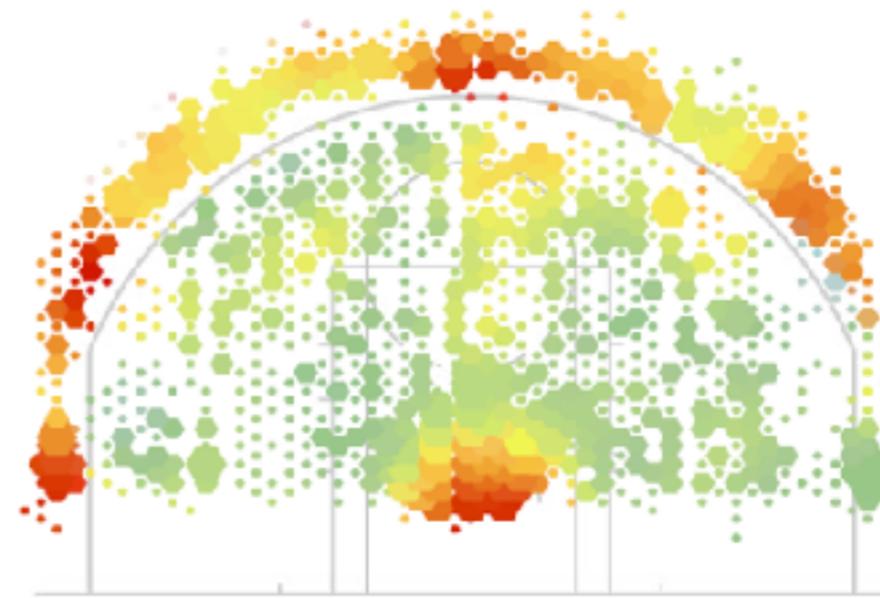
High

## Miami Heat

TOTAL SHOTS **5,209** | POINTS PER SHOT **1.01** | F.G. PERCENT **47%**

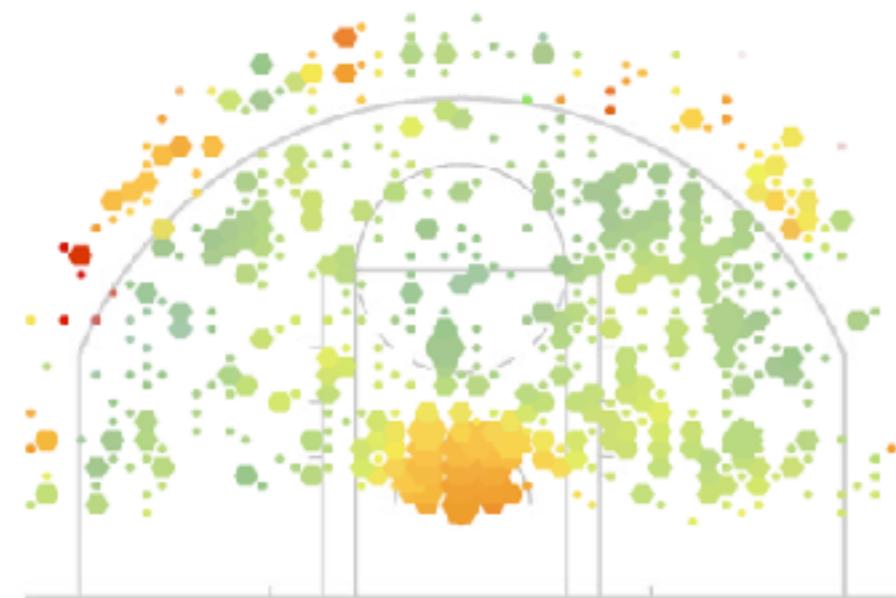
The Heat rely on player positioning to create isolation plays for LeBron James and Dwyane Wade, often on the left side. The Heat take many fewer 3-point shots than the Thunder.

## Oklahoma City Thunder

TOTAL SHOTS **5,228** | POINTS PER SHOT **1.03** | F.G. PERCENT **47.1%**

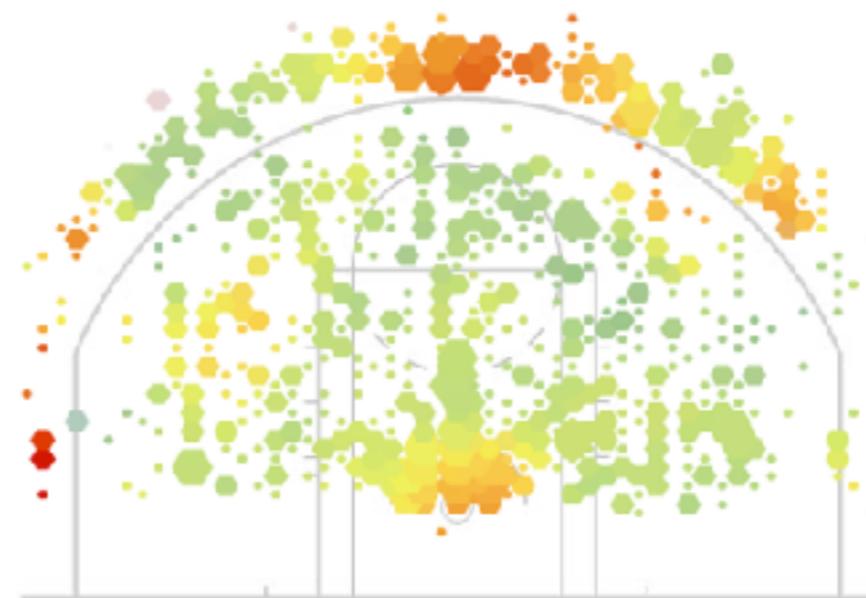
The Thunder are effective from almost any area on the court and shoot many more 3-point shots than the league average. Kevin Durant and James Harden are potent from the top of the arc.

## LeBron James

[VIEW: PHOTO](#) | [GRAPH](#)TOTAL SHOTS **1,169** | POINTS PER SHOT **1.1** | F.G. PERCENT **53.1%**

His athleticism and ball-handling create a lot of high-percentage shots near the basket. He prefers the wing locations beyond the 3-point line. His

## Kevin Durant

[VIEW: PHOTO](#) | [GRAPH](#)TOTAL SHOTS **1,296** | POINTS PER SHOT **1.09** | F.G. PERCENT **49.6%**

Despite his size, he is a very effective midrange shooter, taking nearly half his shots from that zone and another 25 percent from beyond the 3-point arc.



# Mercator Map Projection



Preserves Navigation & Shape, Not Size

# Lambert Map Projection



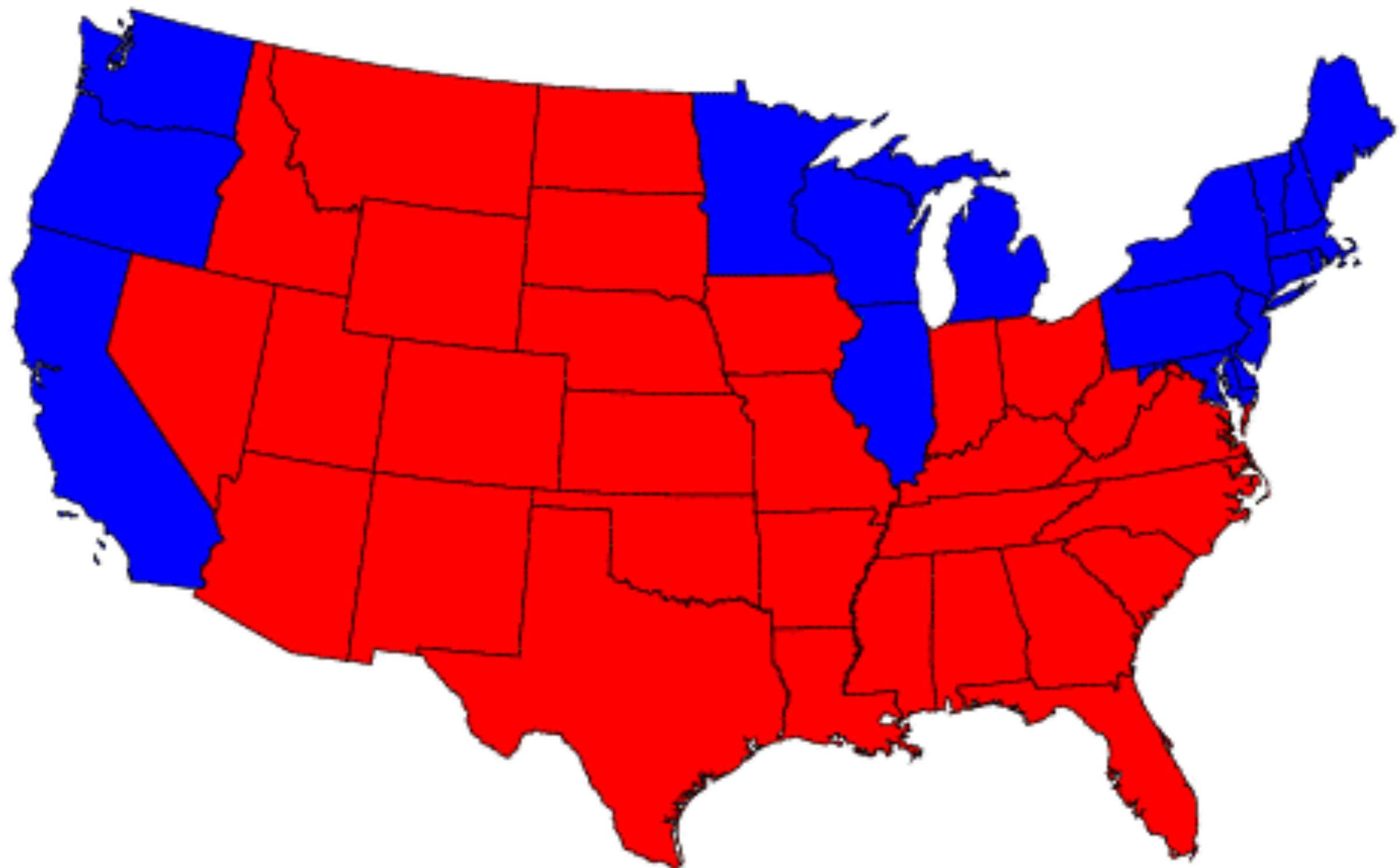
Preserves Navigation & Size, Not Shape

# Robinson Map Projection

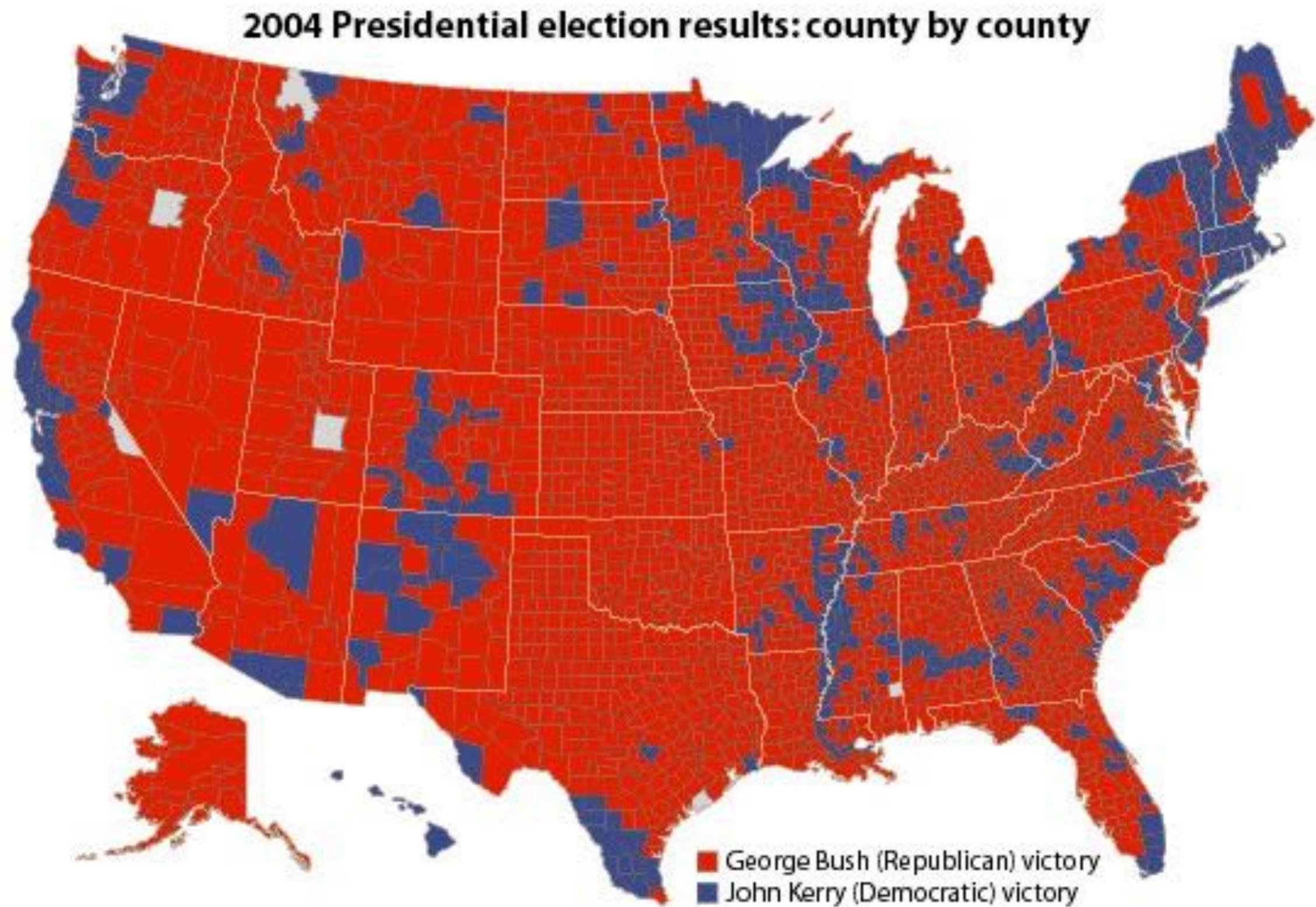


A little bit of size, shape, & navigation

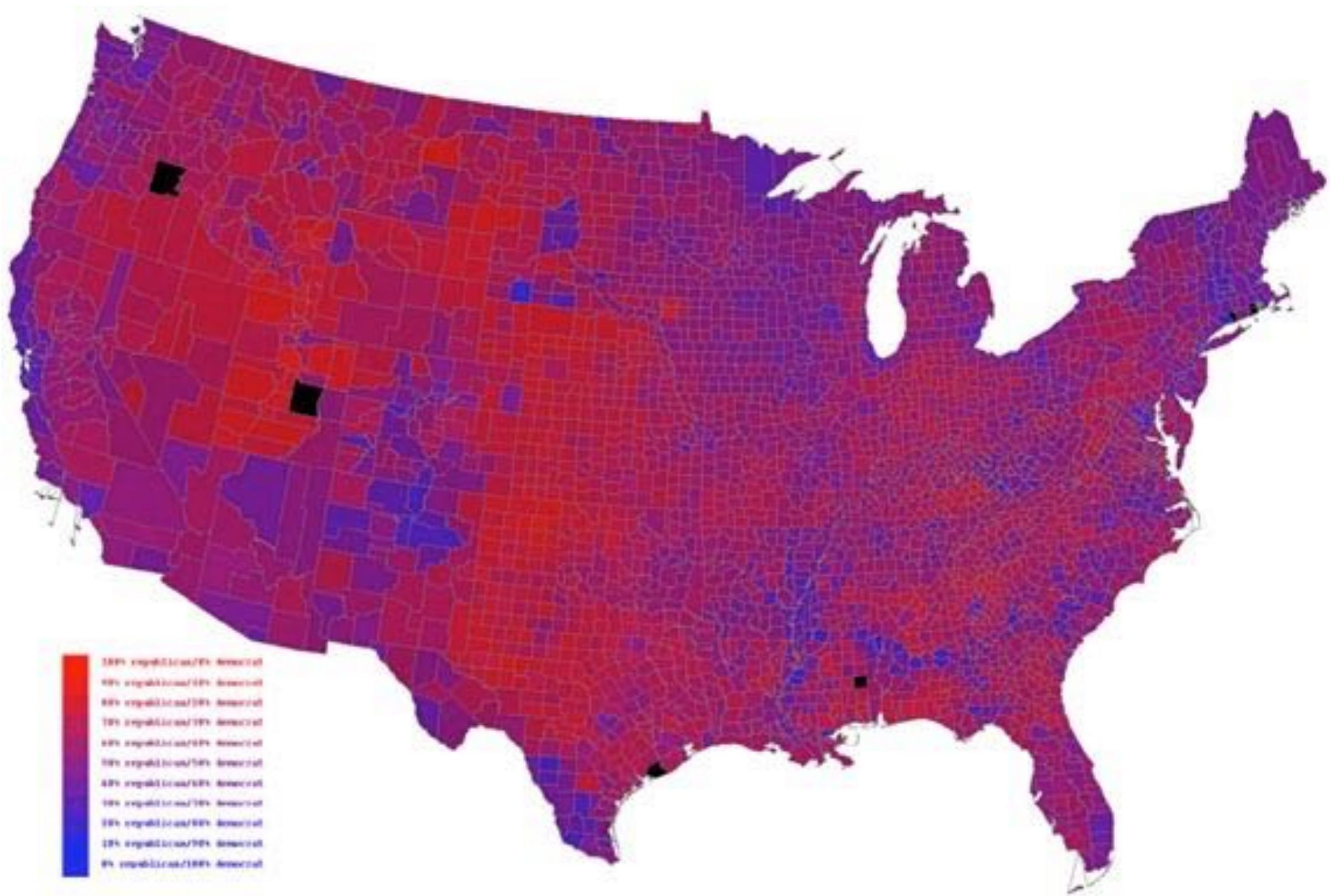
# Non-Spatial Data



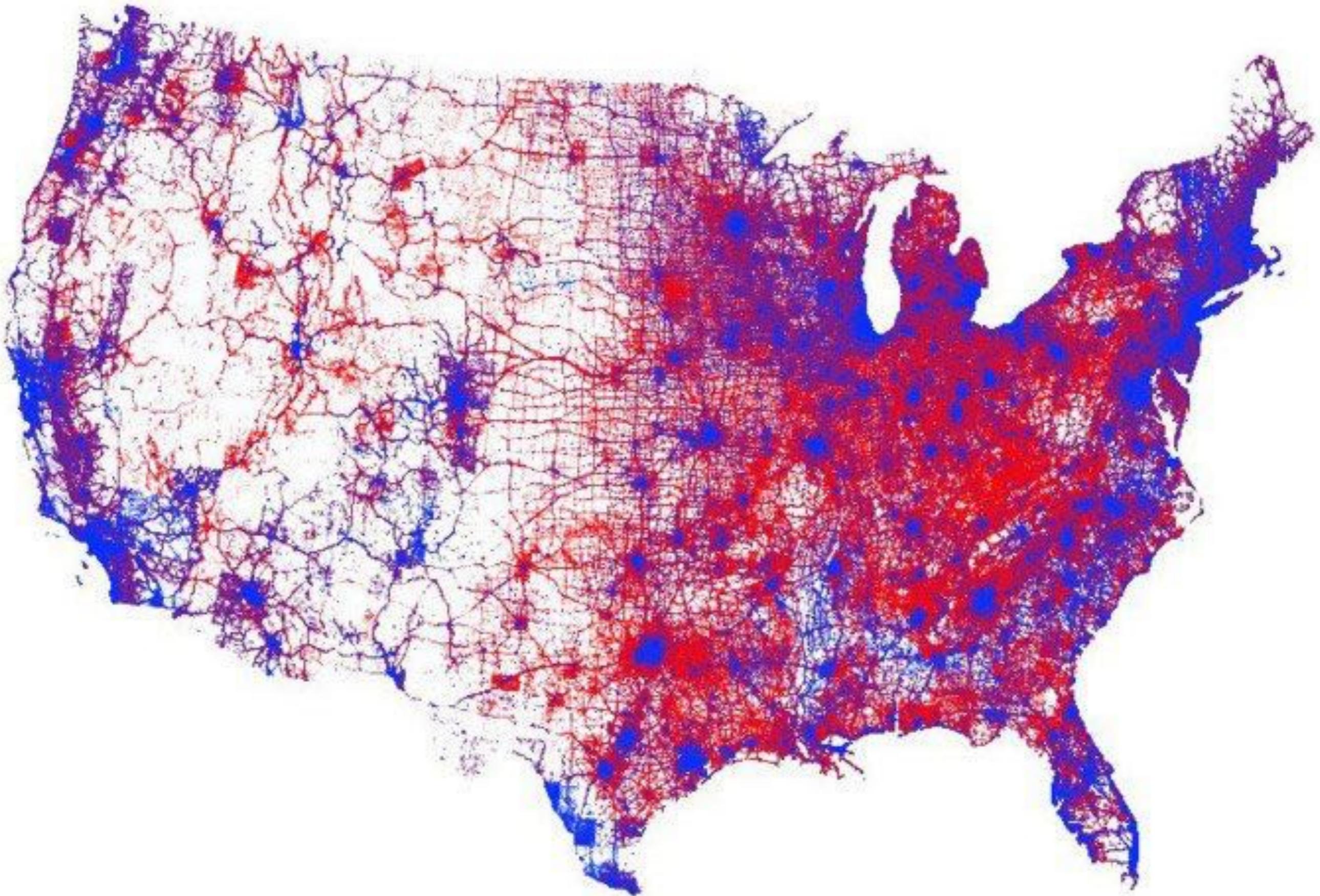
# Non-Spatial Data



# Non-Spatial Data

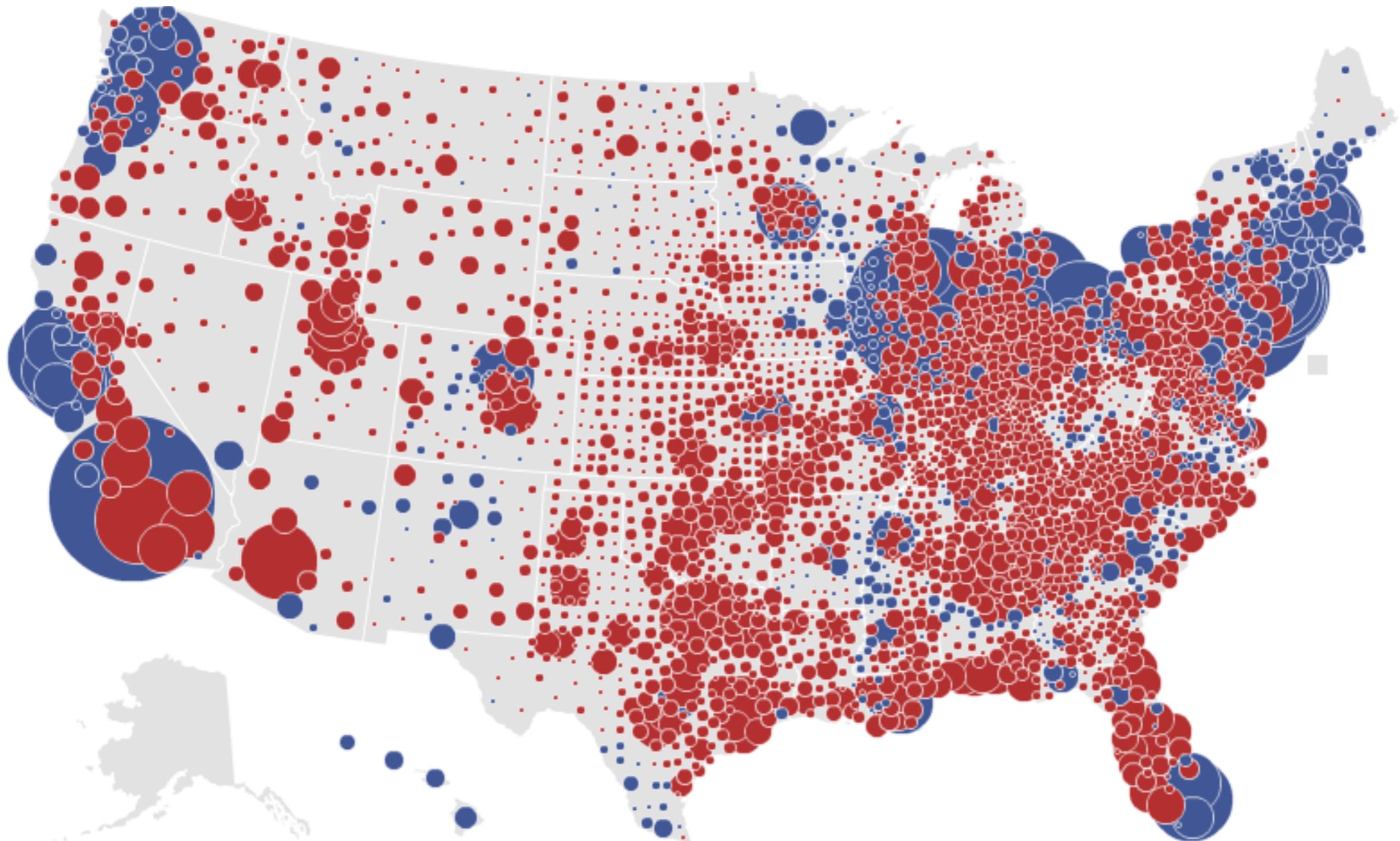


# Non-Spatial Data

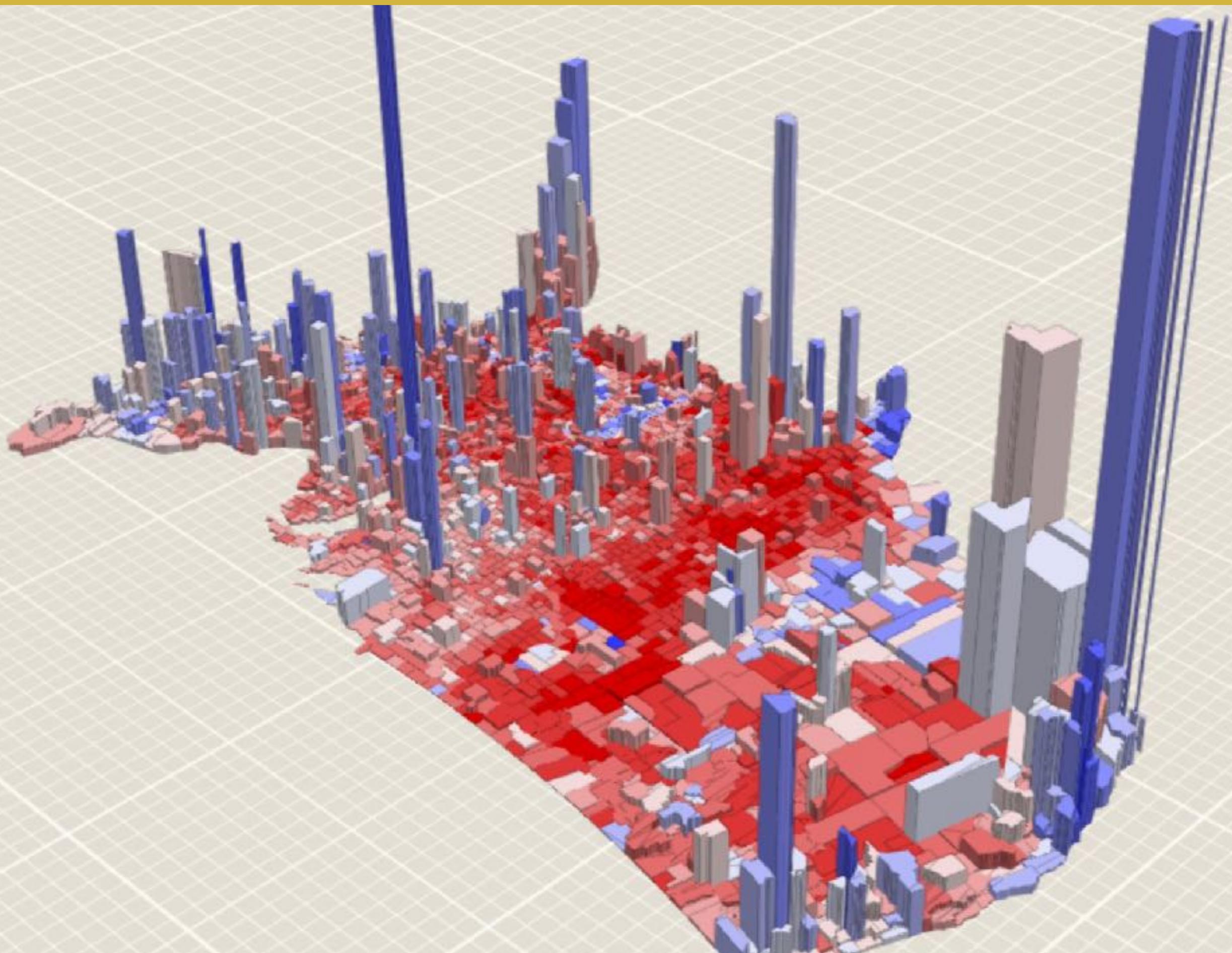


Source: @FrankEskimos

# Non-Spatial Data

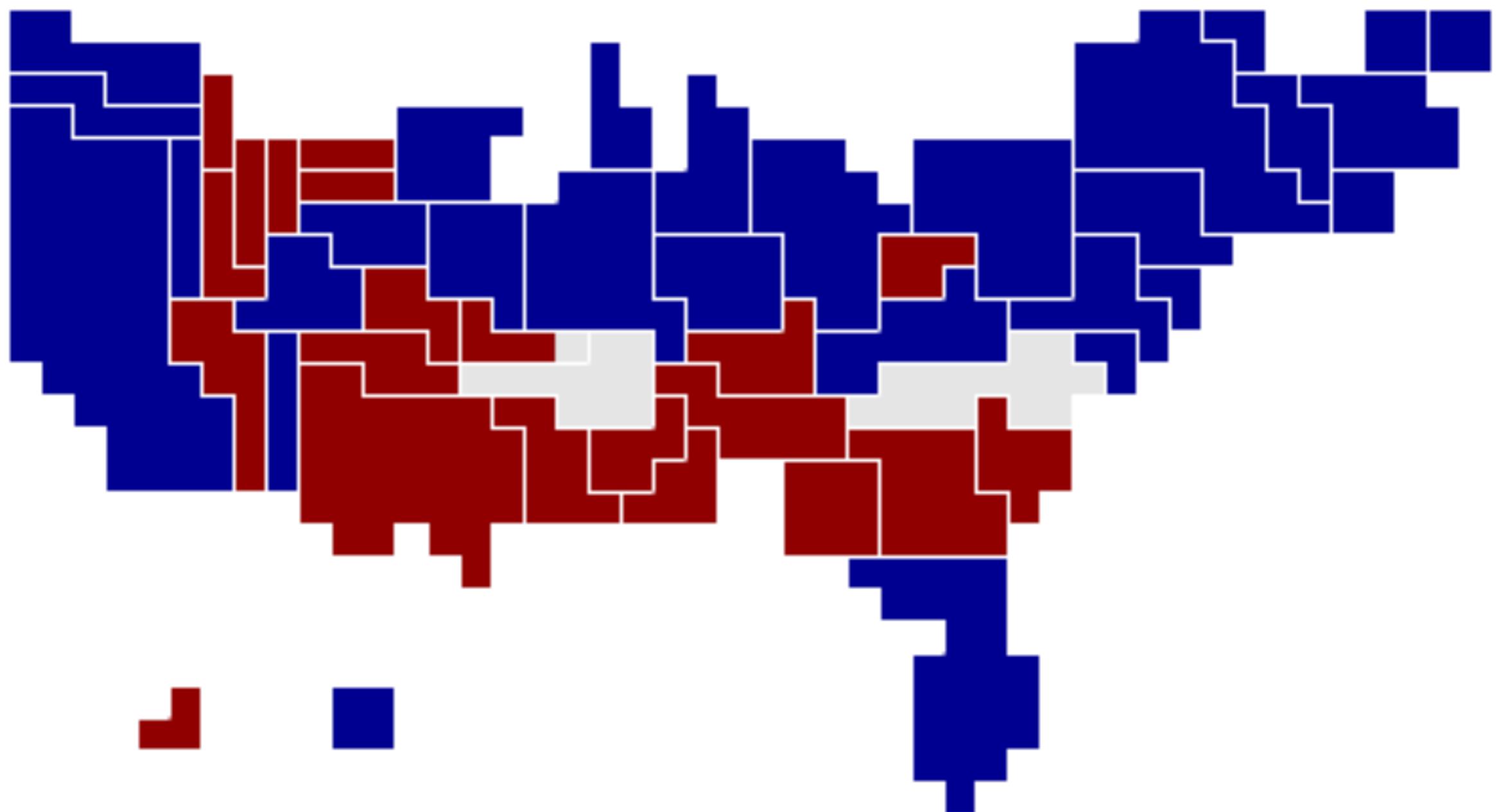


# Non-Spatial Data

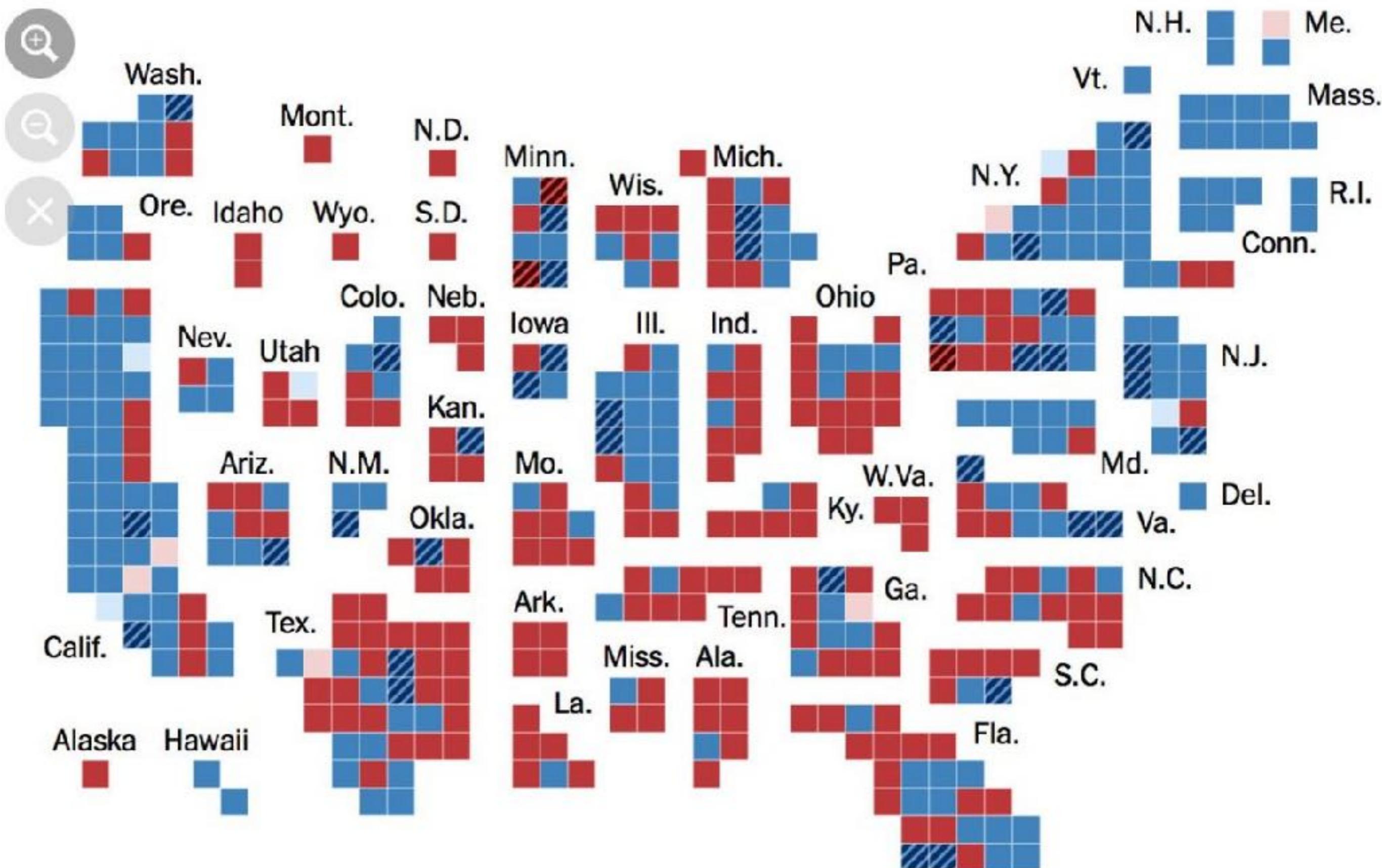


# Non-Spatial Data

■ Rep ■ Dem ■ 3rd Party ■ Partial Result ○ % precincts counted

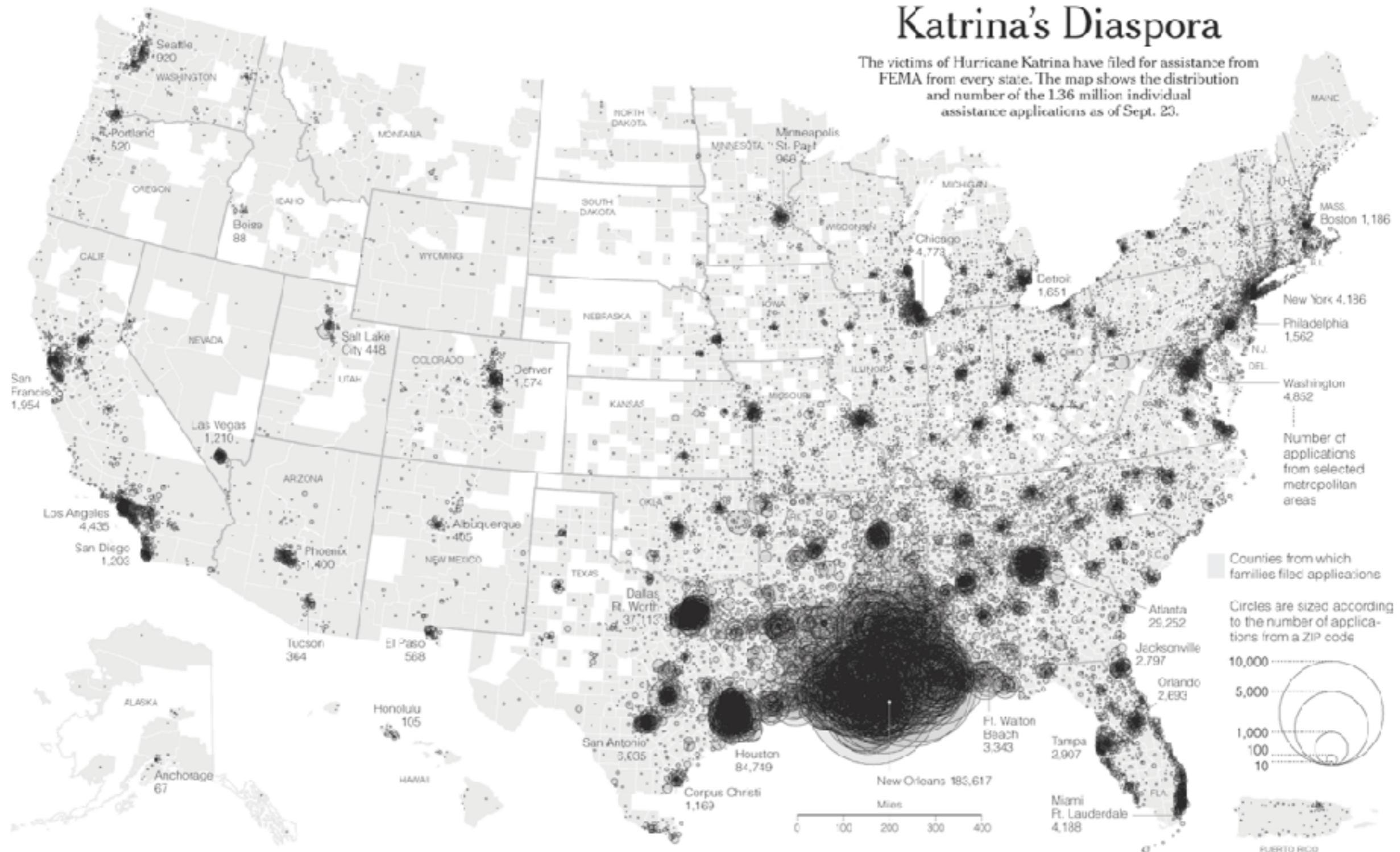


# Non-Spatial Data



# Katrina's Diaspora

The victims of Hurricane Katrina have filed for assistance from FEMA from every state. The map shows the distribution and number of the 1.36 million individual assistance applications as of Sept. 23.



They are scattered through all 50 states, the District of Columbia and Puerto Rico — 523 in Utah, 1,114 in Kansas, 101 way out in Alaska. They are clustered by the thousands in large Southern cities like Dallas, Atlanta and Memphis, and huddled in handfuls in unlikely hamlets like Shell Knob, Mo. (pop. 1,393) and Fountain Run, Ky. (pop. 236).

Evacuees fled Hurricane Katrina and the floods that followed in caravans of cars and fleets of buses, on helicopters and chartered planes, by boat and, a few, on foot. A month after the storm, a map

emerges of where they landed, based on ZIP codes from which applications for aid were submitted to the Federal Emergency Management Agency as of Sept. 23.

Of 1,356,704 applications, 86 percent came from Louisiana, Mississippi, Texas and Alabama. But 35,519 families were more than 1,000 miles from the Gulf — among the farthest: one in Nome, Alaska, 5,931 miles from the French Quarter and another in Lihue, Hawaii, 4,279 miles away.

Residents of New Orleans, a city that was two-thirds black, seem to have flocked to the nation's African-American population

centers. On average, the applicants came from counties where blacks were 28 percent of the population, more than twice the national average.

Baton Rouge, La., appears to be temporary home to 10 percent of evacuees, Houston 6.25 percent. But after the top 18 hubs, applicants are spread like the wind that whipped through their old neighborhoods: none of the other \$100-plus metropolitan areas has even 1 percent of the total.

Some 4,000 ZIP codes — among them Pocahontas, Miss.; Fremont City, Iowa; and Hope, Mich. — had just one applicant.

## Applications by state

State	Applications	Percent
Louisiana	523,149	38.6%
Mississippi	383,340	23.3%
Texas	156,896	11.6%
Alabama	109,469	8.1%
Georgia	35,342	2.6%
Florida	31,005	2.3%
Tennessee	15,529	1.1%
Arkansas	11,027	0.8%
California	10,963	0.8%
Illinois	8,430	0.6%
Others	73,065	5.4%

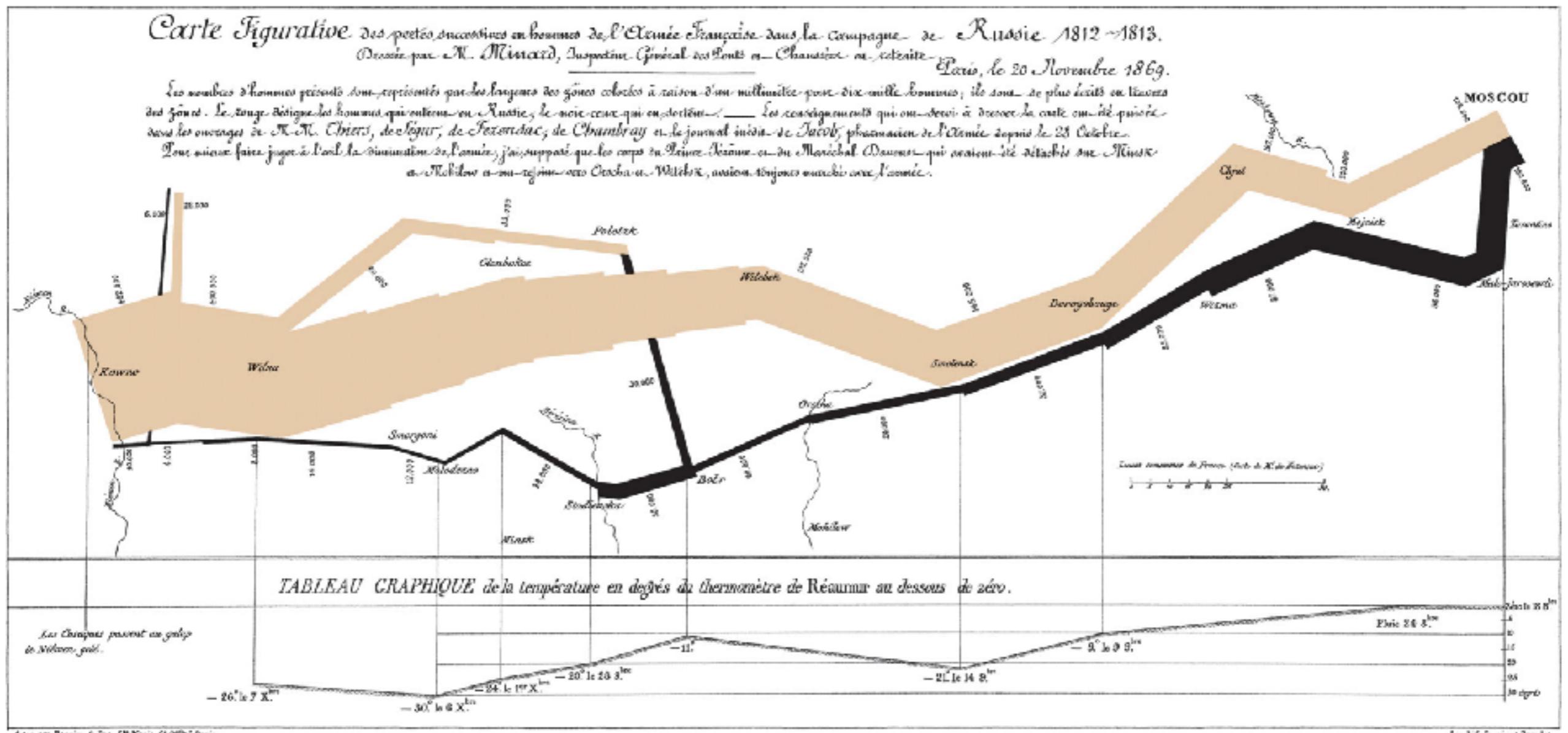
## Applications by distance from New Orleans

Miles	Applicants	Percent
0-100	626,232	46.2%
100-200	338,080	24.9%
200-400	184,169	13.6%
400-800	143,497	10.6%
800-1,800	45,371	3.3%
1,600-3,200	13,403	1.0%
3,200+	232	0.0%

Distances could not be calculated for 0.4 percent of applications

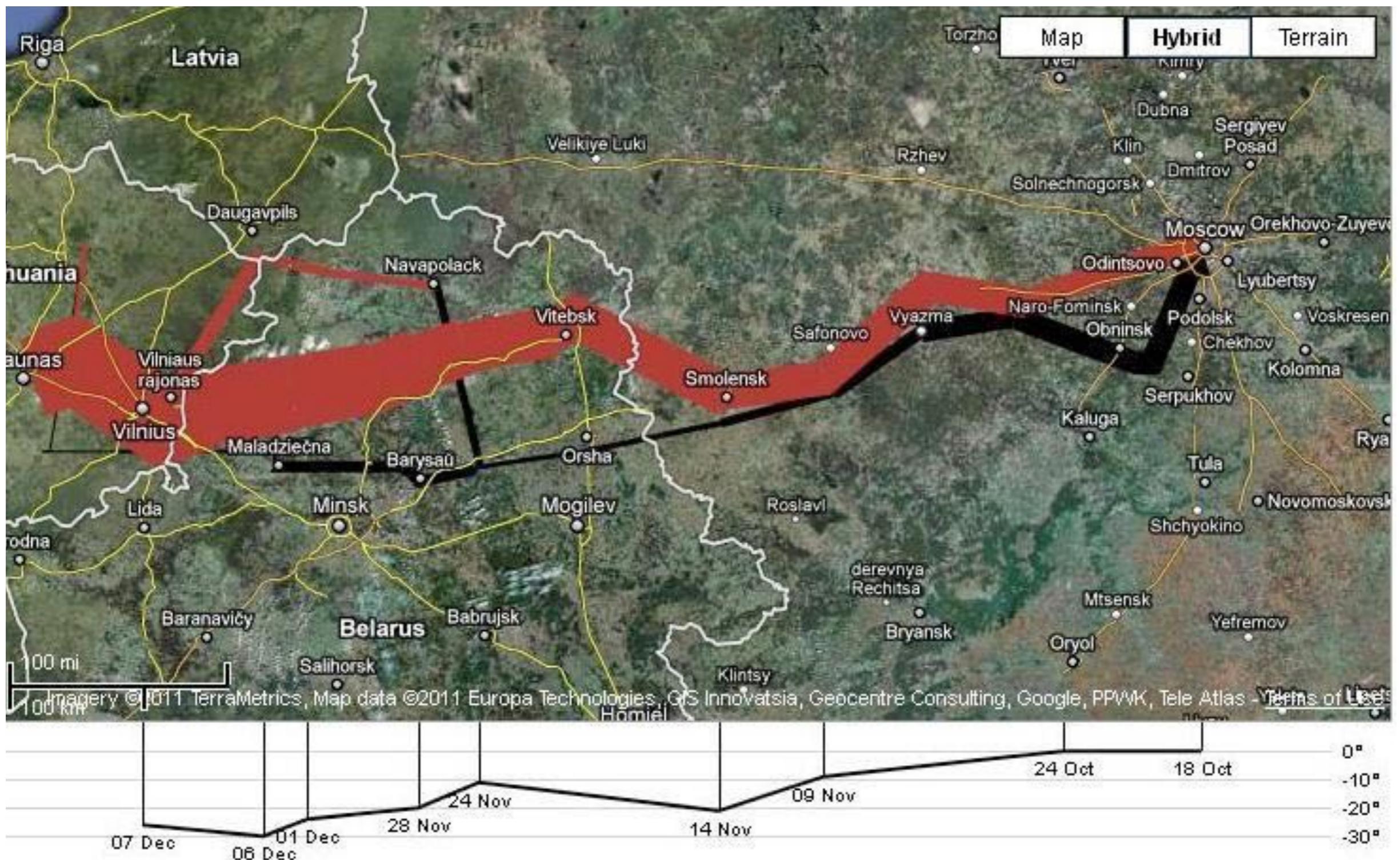
Sources: FEMA; Census Bureau; Queens College Sociology Department  
Matthew Ericson, Archie Tse and Jedi Wiggon/The New York Times

# Time Series Data

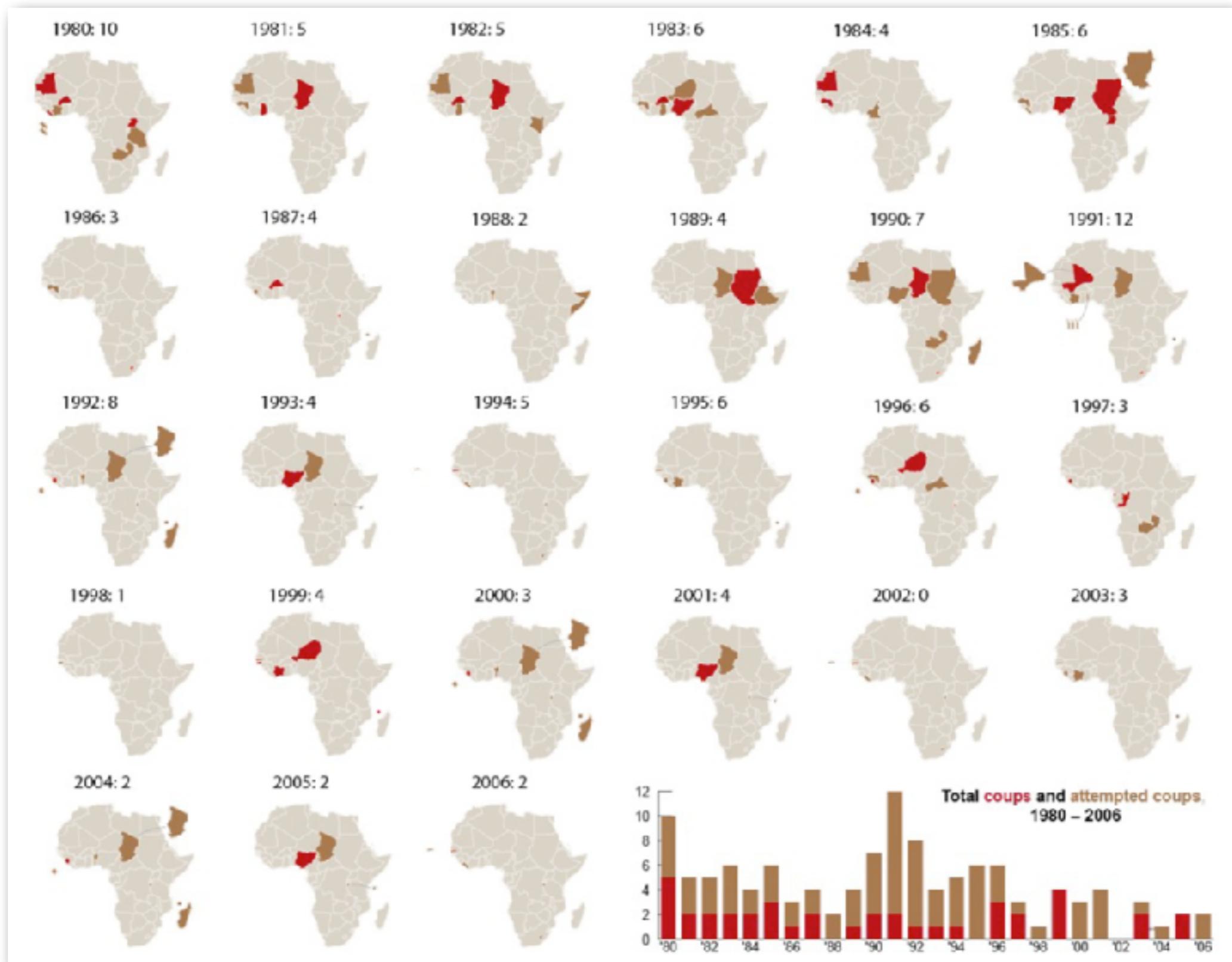


Source: Minard

# Time Series Data

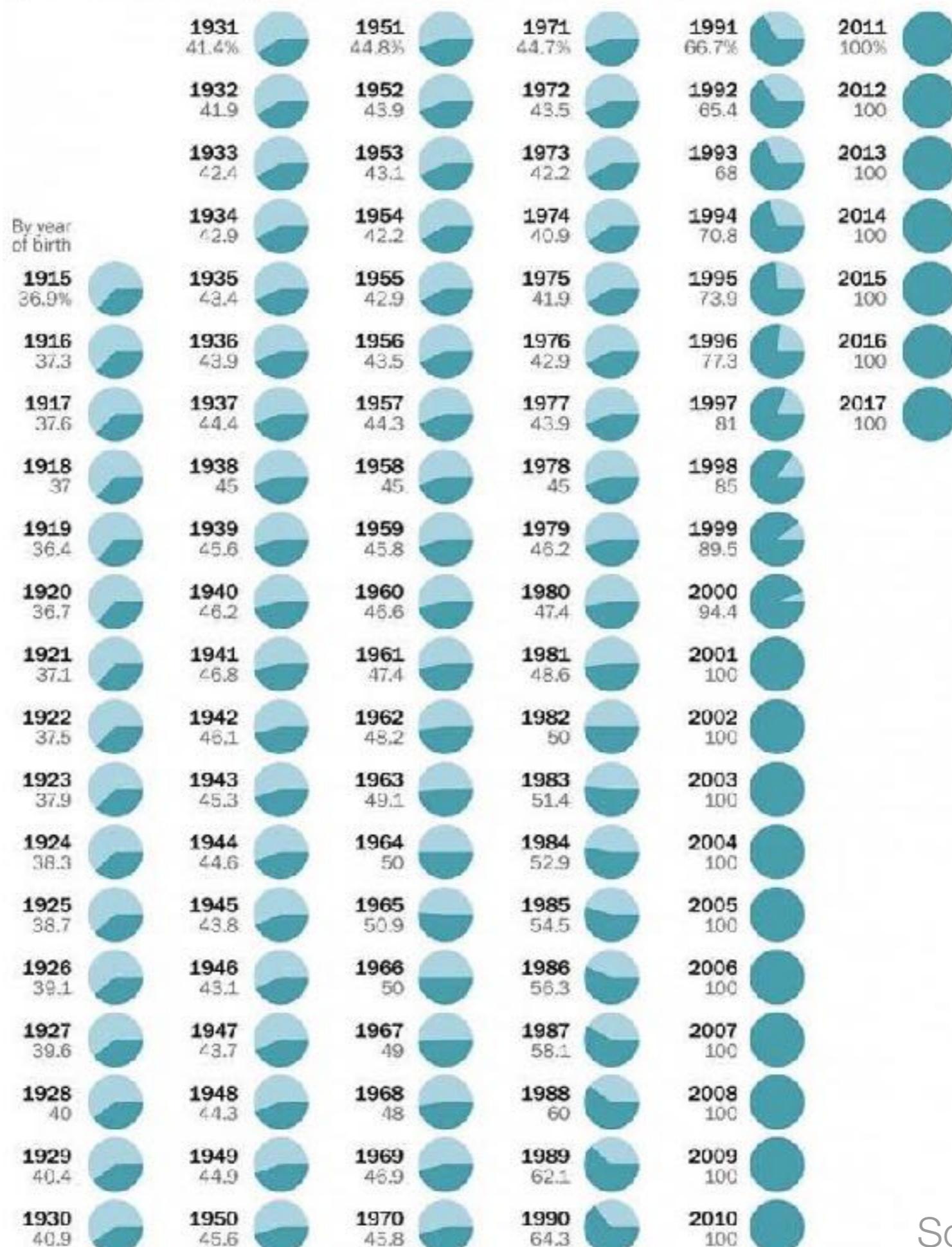


# Time Series Data



Source: Karl Gude

# How much of your life the U.S. has been at war



Source: Washington Post

# Text Values

# I Know You Can't Read This, But...

## 2010 Tax Table



*See the instructions for line 44 on page 35 to see if you must use the Tax Table below to figure your tax.*

**Example.** Mr. and Mrs. Brown are filing a joint return. Their taxable income on Form 1040, line 43, is \$25,300. First, they find the \$25,300–25,350 taxable income line. Next, they find the column for married filing jointly and read down the column. The amount shown where the taxable income line and filing status column meet is \$2,961. This is the tax amount they should enter on Form 1040, line 44.

**Sample Table**

At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
<b>Your tax is—</b>					
25,200	25,250	3,365	2,946	3,365	3,186
25,250	25,300	3,373	2,954	3,373	3,194
25,300	25,350	3,380	2,961	3,380	3,201
25,350	25,400	3,388	2,969	3,388	3,209

If line 43 (taxable income) is—		And you are—			
At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
<b>Your tax is—</b>					
0	5	0	0	0	0
5	15	1	1	1	1
15	25	2	2	2	2
25	50	4	4	4	4
50	75	6	6	6	6
75	100	9	9	9	9
100	125	11	11	11	11
125	150	14	14	14	14
150	175	16	16	16	16
175	200	19	19	19	19
200	225	21	21	21	21
225	250	24	24	24	24
250	275	26	26	26	26
275	300	29	29	29	29
300	325	31	31	31	31
325	350	34	34	34	34
350	375	36	36	36	36
375	400	39	39	39	39
400	425	41	41	41	41

If line 43 (taxable income) is—		And you are—			
At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
<b>Your tax is—</b>					
1,300	1,325	131	131	131	131
1,325	1,350	134	134	134	134
1,350	1,375	136	136	136	136
1,375	1,400	139	139	139	139
1,400	1,425	141	141	141	141
1,425	1,450	144	144	144	144
1,450	1,475	146	146	146	146
1,475	1,500	149	149	149	149
1,500	1,525	151	151	151	151
1,525	1,550	154	154	154	154
1,550	1,575	156	156	156	156
1,575	1,600	159	159	159	159
1,600	1,625	161	161	161	161
1,625	1,650	164	164	164	164
1,650	1,675	166	166	166	166
1,675	1,700	169	169	169	169
1,700	1,725	171	171	171	171
1,725	1,750	174	174	174	174
1,750	1,775	176	176	176	176

If line 43 (taxable income) is—		And you are—			
At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
<b>Your tax is—</b>					
2,700	2,725	271	271	271	271
2,725	2,750	274	274	274	274
2,750	2,775	276	276	276	276
2,775	2,800	279	279	279	279
2,800	2,825	281	281	281	281
2,825	2,850	284	284	284	284
2,850	2,875	286	286	286	286
2,875	2,900	289	289	289	289
2,900	2,925	291	291	291	291
2,925	2,950	294	294	294	294
2,950	2,975	296	296	296	296
2,975	3,000	299	299	299	299
<b>3,000</b>					
3,000	3,050	303	303	303	303
3,050	3,100	308	308	308	308
3,100	3,150	313	313	313	313
3,150	3,200	318	318	318	318
3,200	3,250	322	322	322	322

# Now You Can Read This

## 2010 Tax Table



See the instructions for line 44 on page 35 to see if you must use the Tax Table below to figure your tax.

Example. Mr. and Mrs. Brown's taxable income is \$1,325. They file jointly. Their tax is \$131.

At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
0	5	0	0	0	0
5	15	1	1	1	1
15	25	2	2	2	2
25	50	4	4	4	4
50	75	6	6	6	6
75	100	9	9	9	9
100	125	11	11	11	11
125	150	14	14	14	14
150	175	16	16	16	16
175	200	19	19	19	19
200	225	21	21	21	21
225	250	24	24	24	24
250	275	26	26	26	26
275	300	29	29	29	29
300	325	31	31	31	31
325	350	34	34	34	34
350	375	36	36	36	36
375	400	39	39	39	39
400	425	41	41	41	41

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Sample Table

At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
0	5	2700	2725	271	271
5	15	2725	2750	274	274
15	25	2750	2775	276	276
25	50	2775	2800	279	279
50	75	2800	2825	281	281
75	100	2825	2850	284	284
100	125	2850	2875	286	286
125	150	2875	2900	289	289
150	175	2900	2925	291	291
175	200	2925	2950	294	294
200	225	2950	2975	296	296
225	250	2975	3,000	299	299
250	275				
275	300				
300	325				
325	350				
350	375				
375	400				
400	425				

3,000

At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
3,000	3,050	303	303	303	303
3,050	3,100	308	308	308	308
3,100	3,150	313	313	313	313
3,150	3,200	318	318	318	318
3,200	3,250	322	322	322	322

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1,325  
1,350  
1,375  
1,400

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
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136  
139

131  
134  
136  
139

1,325  
1,350  
1,375  
1,400

131  
134  
136  
139

131  
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136  
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131  
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136  
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131  
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136  
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131  
134  
136  
139

131  
134  
136  
139

1,325  
1,350  
1,375  
1,400

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

131  
134  
136  
139

# Now You Can Really Read This

## 2010 Tax Table



See the instructions for line 44 on page 35 to see if you must use the Tax Table below to figure your tax.

Example: Mr. and Mrs.

Sample Table

At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
----------	---------------	--------	------------------------	---------------------------	---------------------

1,325

1,350

134

134

134

If line 43 (taxable income) is —		And you are —				Income, —				And you are —				Income, —			
At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household	At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household	At least	But less than	Single	Married filing jointly	Married filing separately	Head of a household
		Your tax is —								Your tax is —							
0	5	0	0	0	0	1,300	1,325	131	131	131	131	2,700	2,725	271	271	271	271
5	15	1	1	1	1	1,325	1,350	134	134	134	134	2,725	2,750	274	274	274	274
15	25	2	2	2	2	1,350	1,375	136	136	136	136	2,750	2,775	276	276	276	276
25	50	4	4	4	4	1,375	1,400	139	139	139	139	2,775	2,800	279	279	279	279
50	75	6	6	6	6	1,400	1,425	141	141	141	141	2,800	2,825	281	281	281	281
75	100	9	9	9	9	1,425	1,450	144	144	144	144	2,825	2,850	284	284	284	284
100	125	11	11	11	11	1,450	1,475	146	146	146	146	2,850	2,875	286	286	286	286
125	150	14	14	14	14	1,475	1,500	149	149	149	149	2,875	2,900	289	289	289	289
150	175	16	16	16	16	1,500	1,525	151	151	151	151	2,900	2,925	291	291	291	291
175	200	19	19	19	19	1,525	1,550	154	154	154	154	2,925	2,950	294	294	294	294
200	225	21	21	21	21	1,550	1,575	156	156	156	156	2,950	2,975	296	296	296	296
225	250	24	24	24	24	1,575	1,600	159	159	159	159	2,975	3,000	299	299	299	299
250	275	26	26	26	26	1,600	1,625	161	161	161	161	3,000					
275	300	29	29	29	29	1,625	1,650	164	164	164	164	3,000	3,050	303	303	303	303
300	325	31	31	31	31	1,650	1,675	166	166	166	166	3,050	3,100	308	308	308	308
325	350	34	34	34	34	1,675	1,700	169	169	169	169	3,100	3,150	313	313	313	313
350	375	36	36	36	36	1,700	1,725	171	171	171	171	3,150	3,200	318	318	318	318
375	400	39	39	39	39	1,725	1,750	174	174	174	174	3,200	3,250	322	322	322	322
400	425	41	41	41	41	1,750	1,775	176	176	176	176	3,250	3,300	326	326	326	326

**Words &  
Relationships**

# Word Cloud



# Word Cloud

## Visualizations : Obama's Speech to Congress, 022409 Tag Cloud of Two Words

Creator: VictoriaLHerring

Tags: speech obama

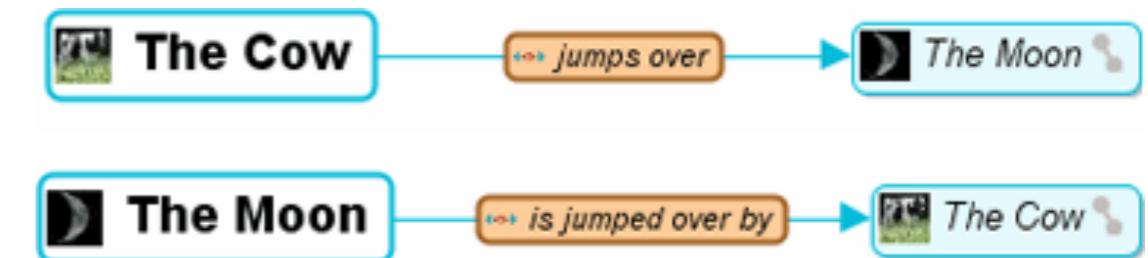
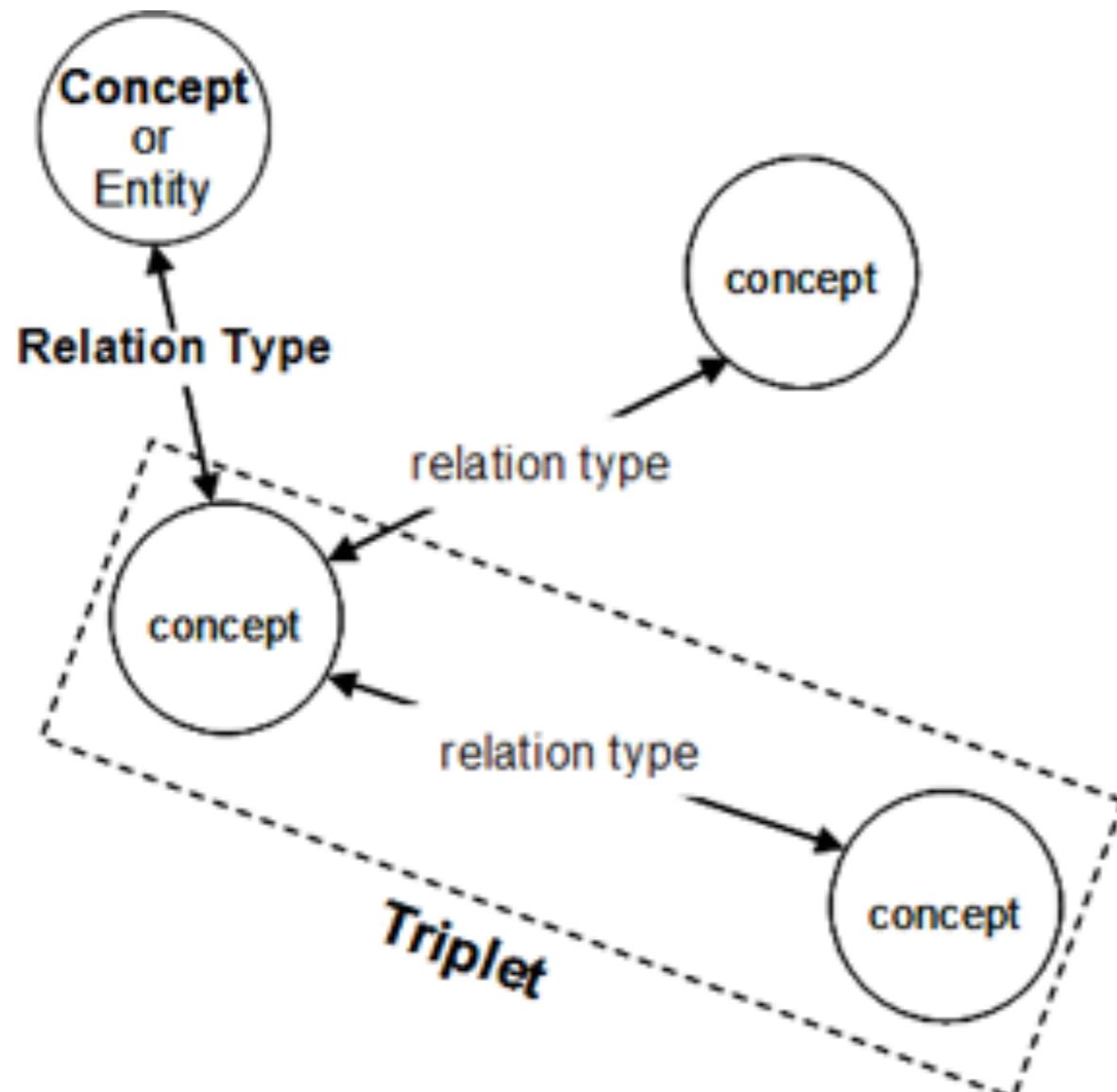
1 word  2 word  Compare

Search:

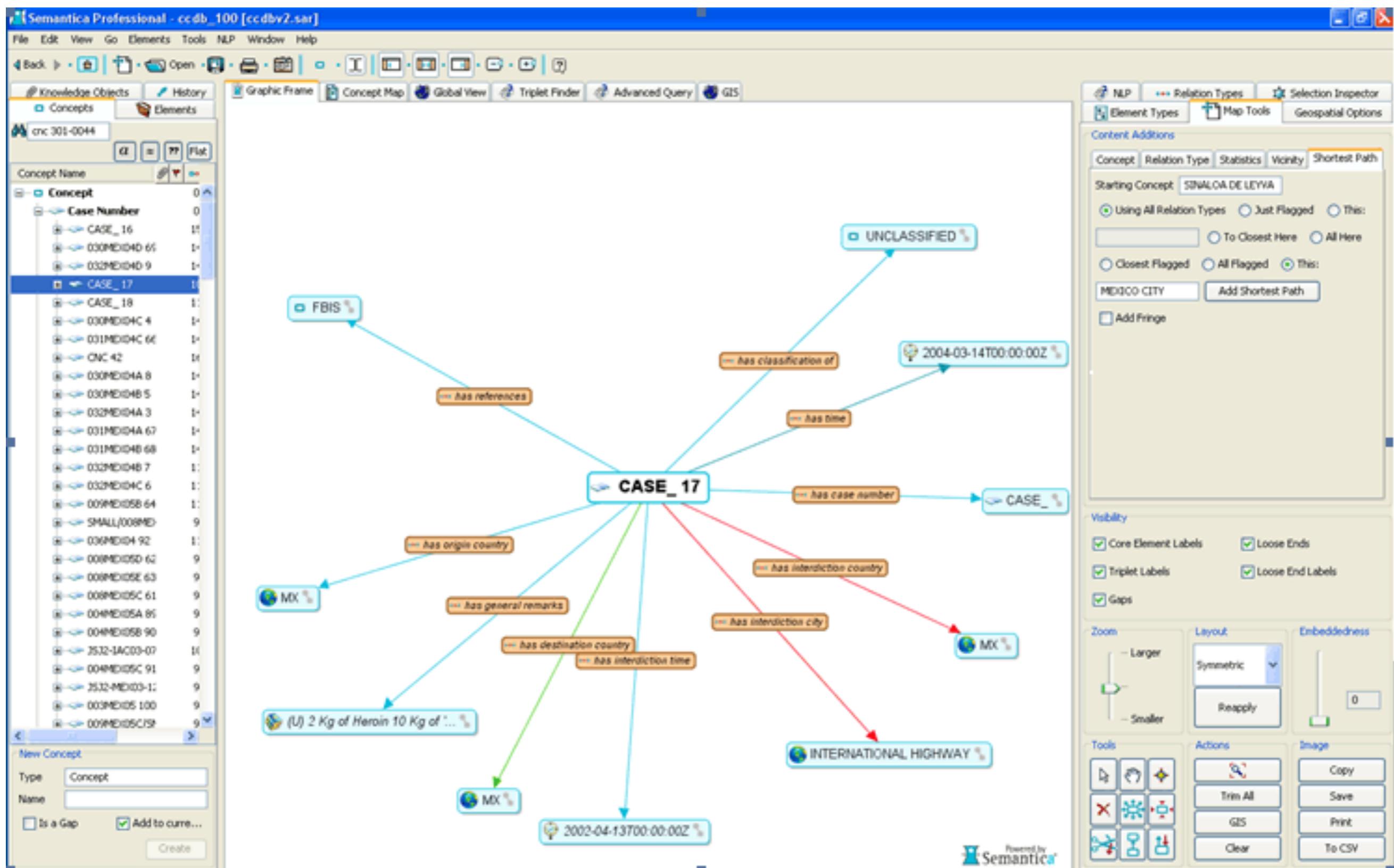
Showing 200 out of 1204

ability accountable act action address administration afford **america american americans** asked back bad banks begin begins bring budget build business businesses buy called **Care** century challenges chamber children clean college community compete comprehensive concern confidence confront congress cost costs country created credit **crisis** cut day days debt decade decisions **deficit** democrats depends difficult dollar dollars easy **economic economy education** effort end **energy** ensure entrepreneurs fact families family federal finally financial force forward foundation **future** global goal govern government great half **health** helping high higher history hold home homes hope housing inherited insurance invest investment iraq issue job **jobs** largest lay layoffs lead lending letter life loans long long-term longer lost made major **make** makes market medicare meet men million moment **money nation** national **new** opportunity part passed pay **people** place plan power president price private problem problems programs promise prosperity provide pushed **put** re-start receive recession **recovery reform** renewable republicans resources **responsibility** restore return **save school schools** sense serve simply single small solar solve speak **spend** spirit stand states step street struggling students support system **tax** taxpayer teacher technology **time times** today **tonight** training understand **united values** watching ways women words **work** workers working **world**

# Concept Cloud

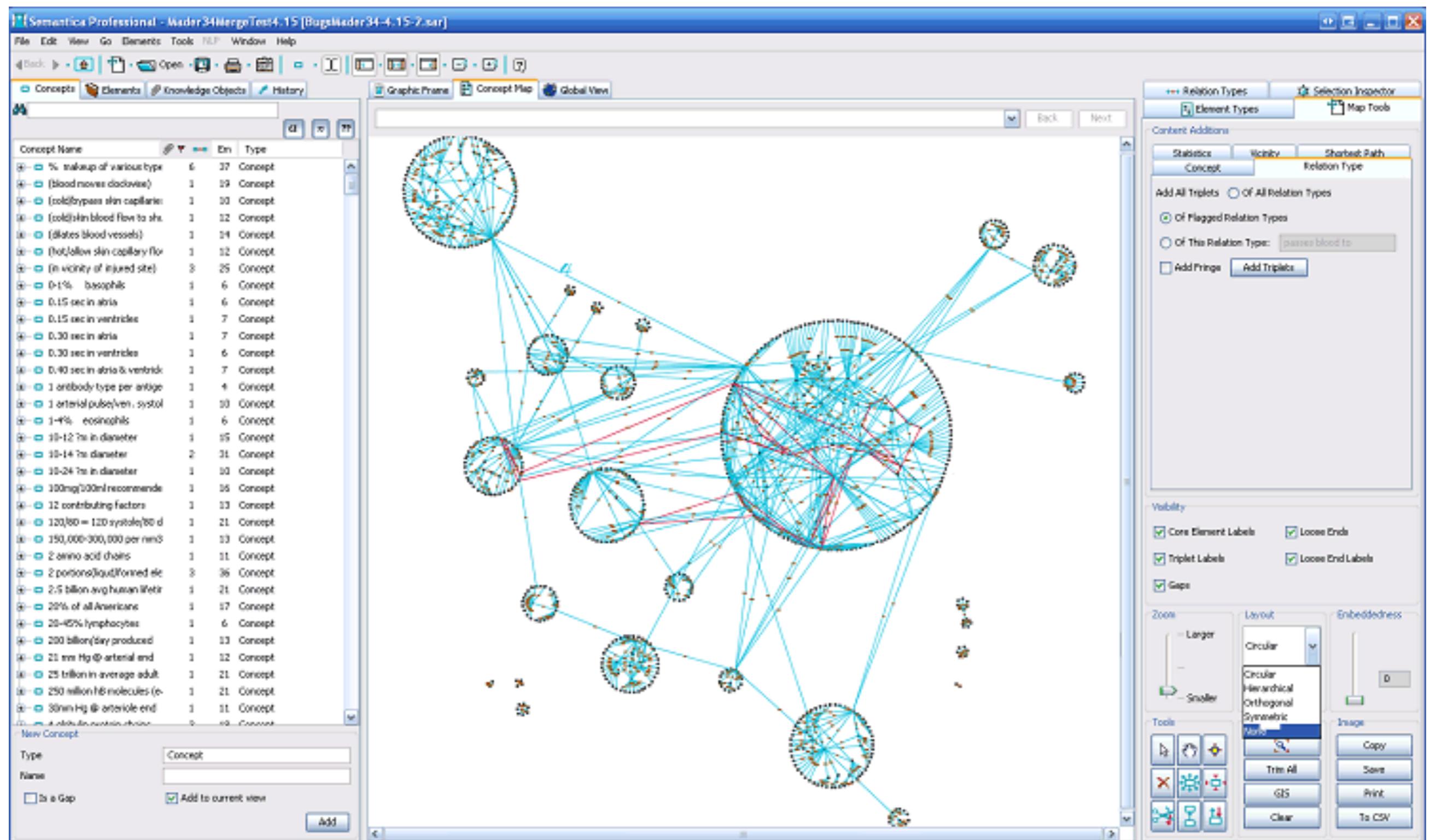


# Concept Cloud



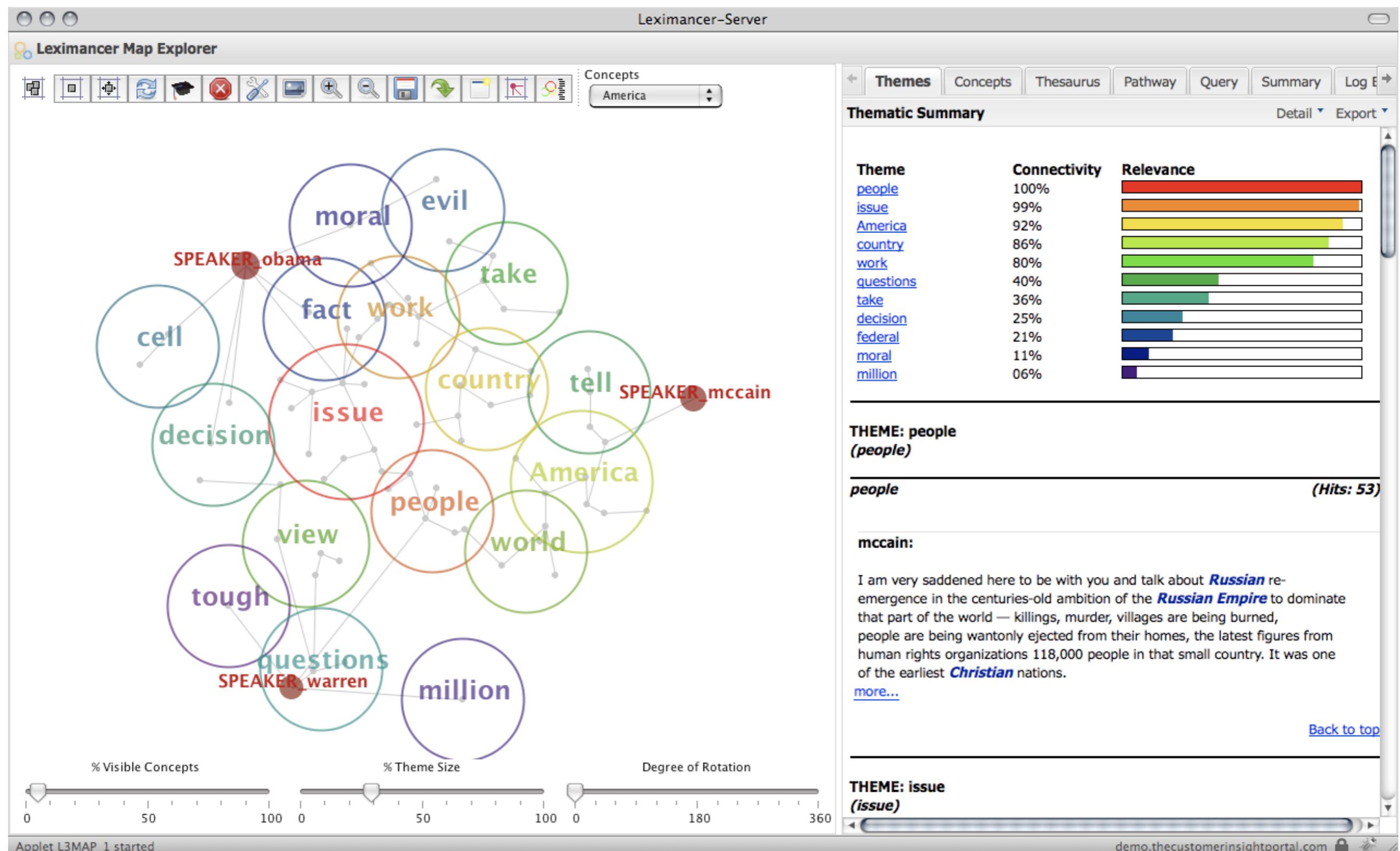
Source: Semantica

# Concept Cloud



Source: Semantica

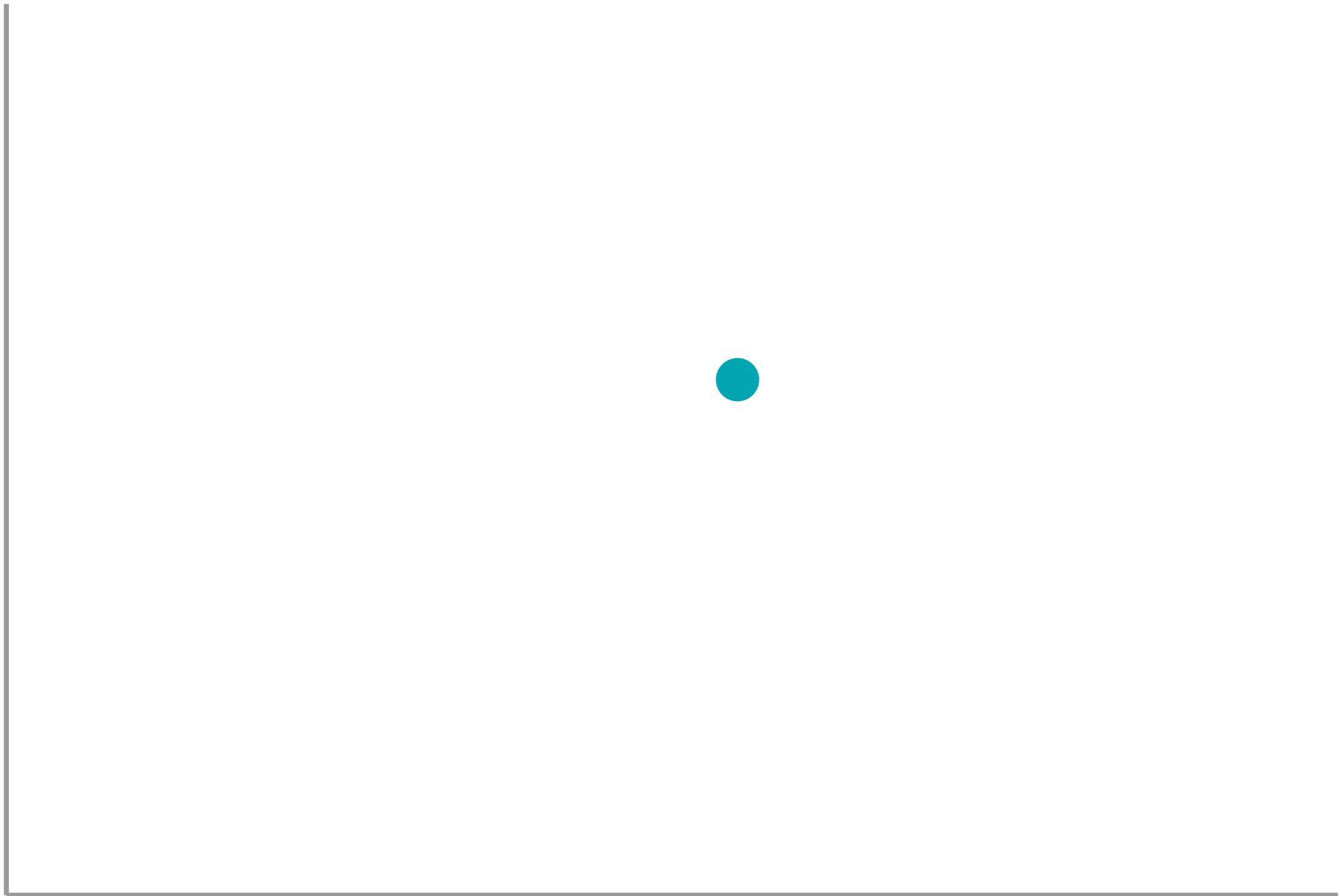
# Concept Cloud



Source: Leximancer

# Encoding Data

# Position



Variables: 1-4

Values: Infinite

Ordered: Yes

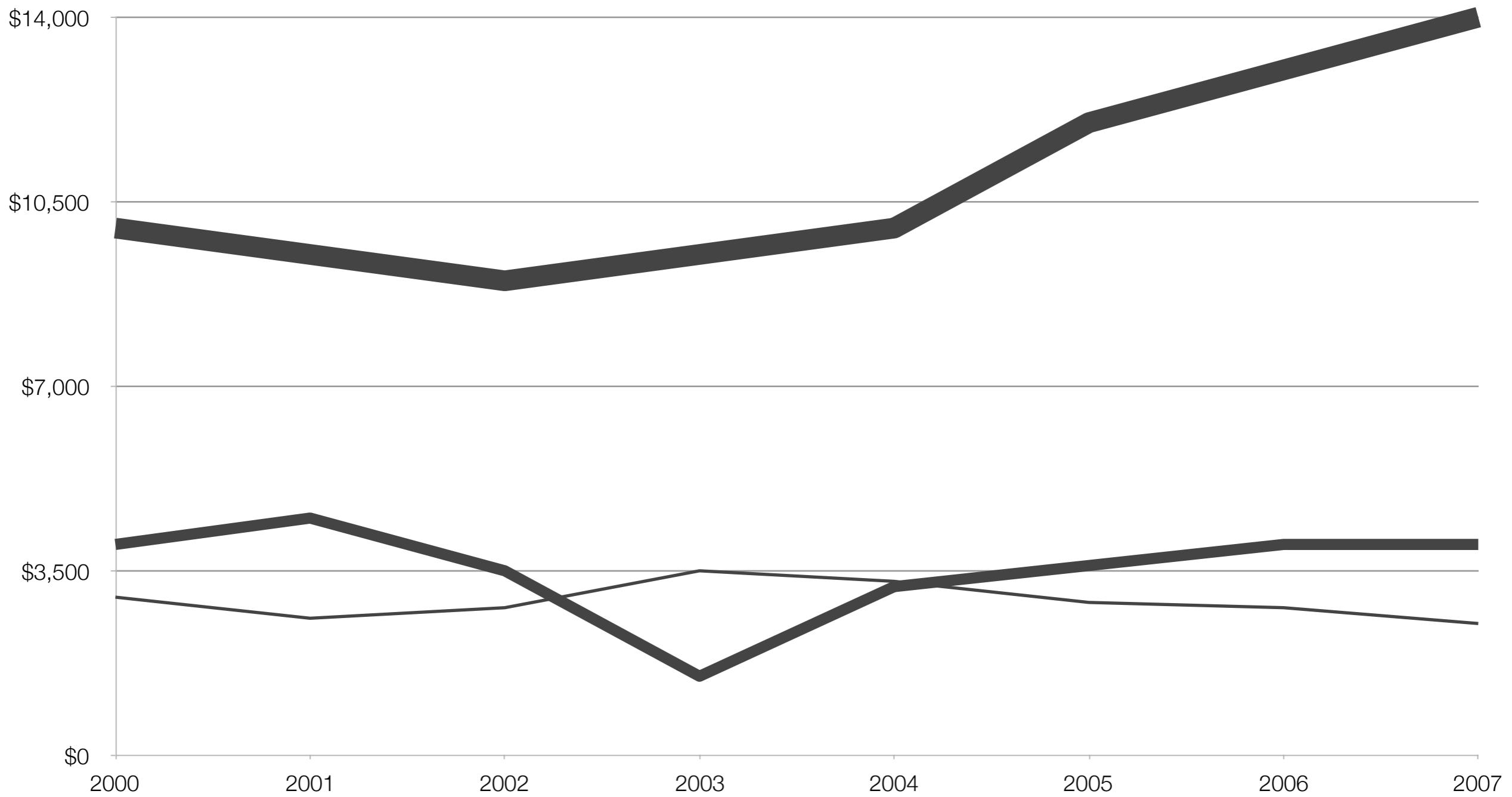
# Length



Values: Infinite

Ordered: Yes

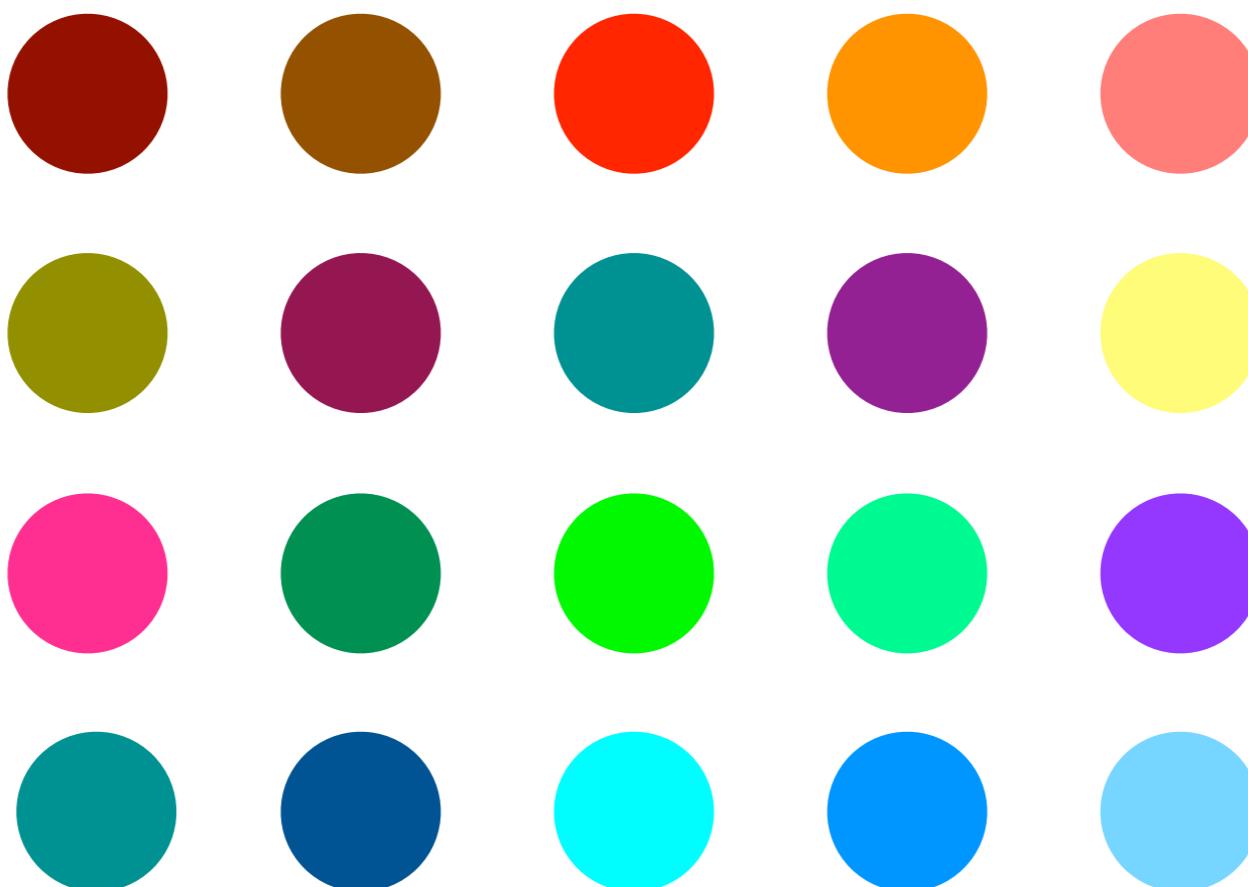
# Width



Values: Practically Limited

Ordered: Yes

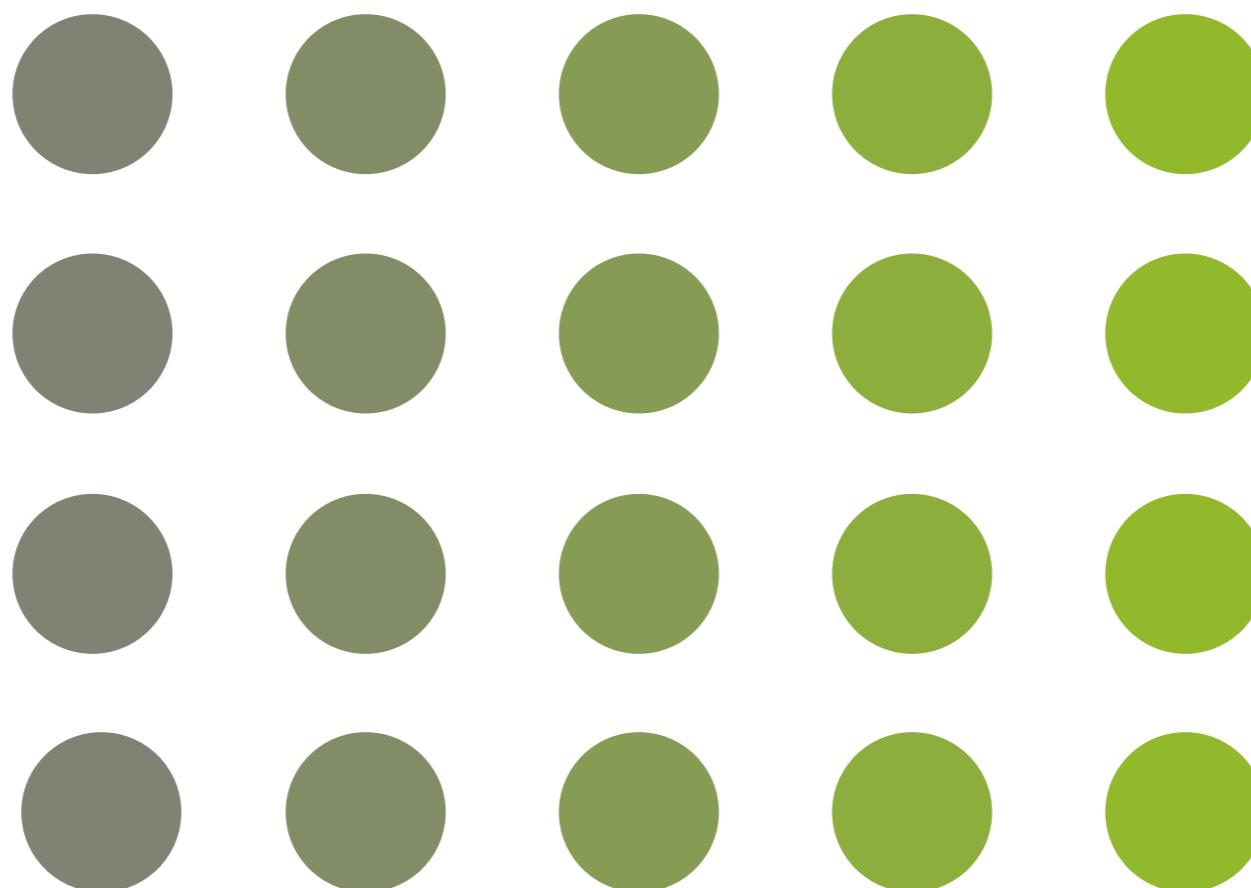
# Hue (Color)



Values: Practically Limited

Ordered: No

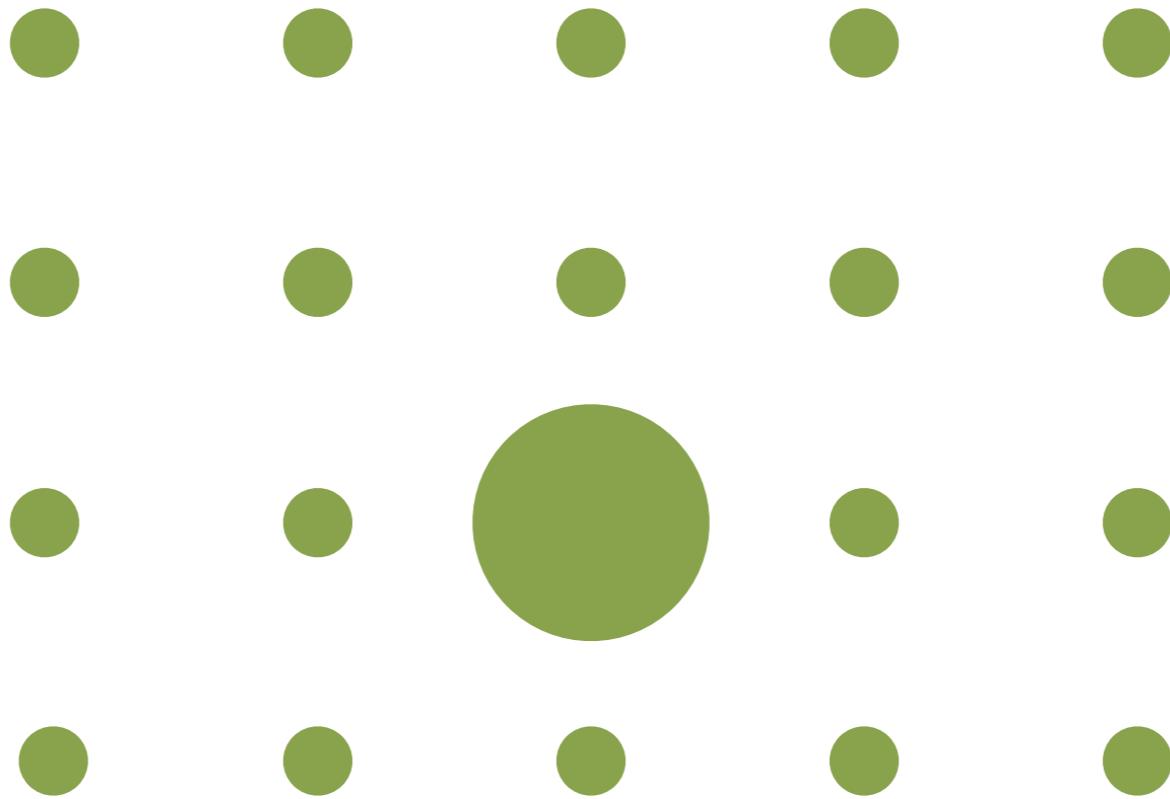
# Saturation/Intensity



Values: Practically Limited

Ordered: Yes

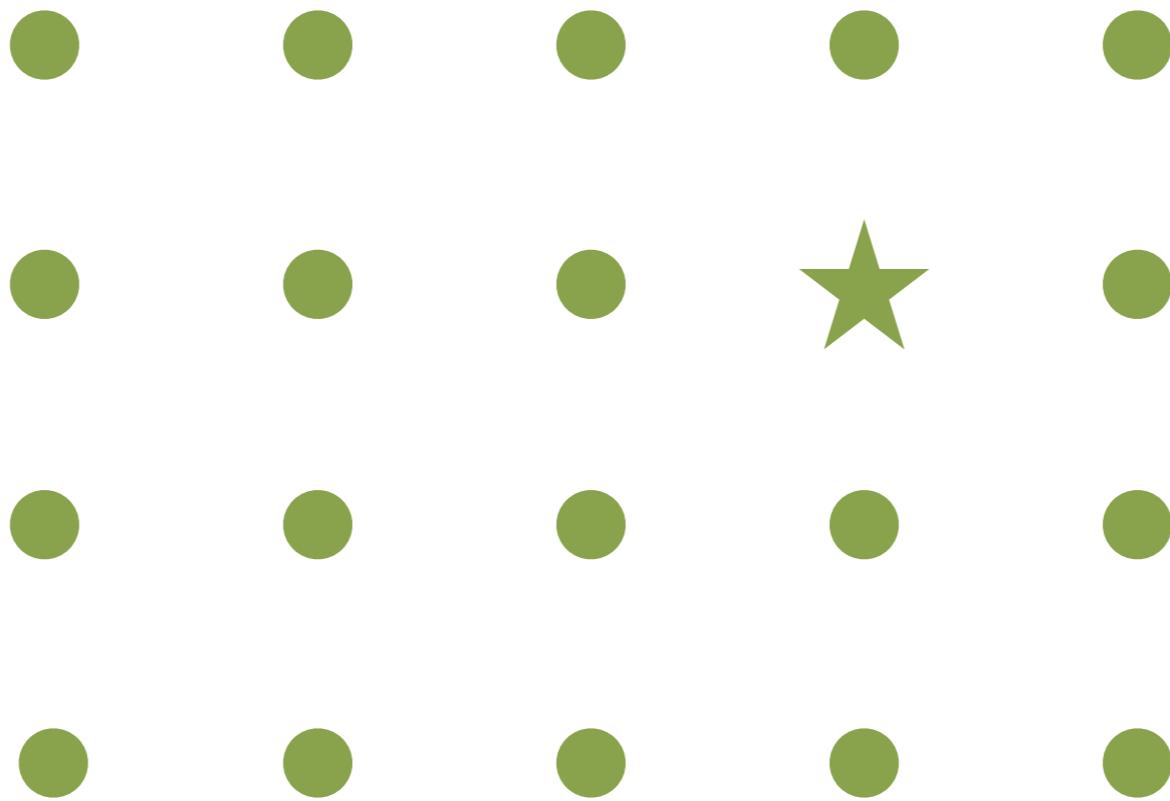
# Size



Values: Practically Limited

Ordered: Yes

# Shape



Values: Practically Limited

Ordered: No

# Labels



Values: Infinite

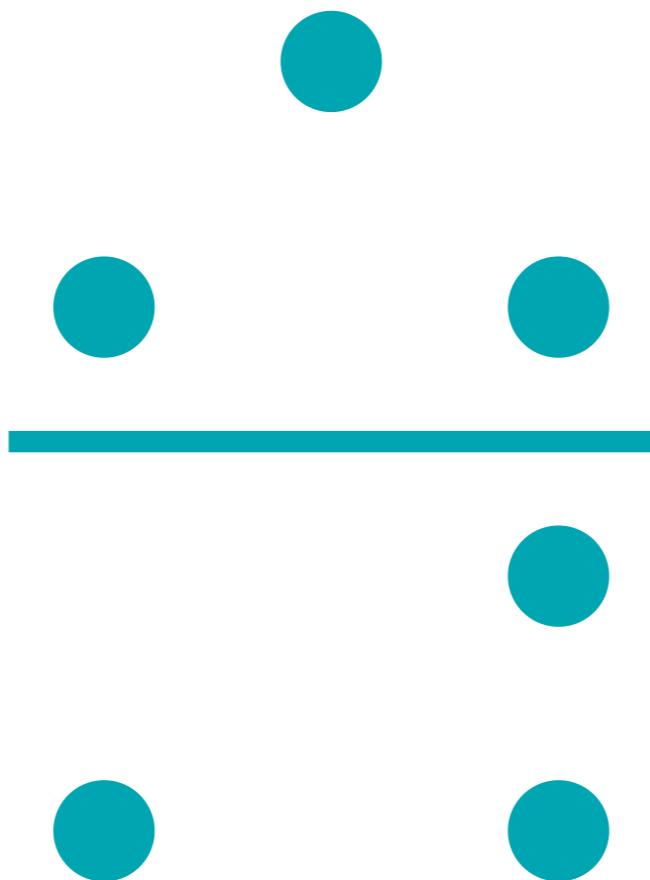
Ordered: Yes

# Orientation



Values: Practically Limited Ordered: Maybe

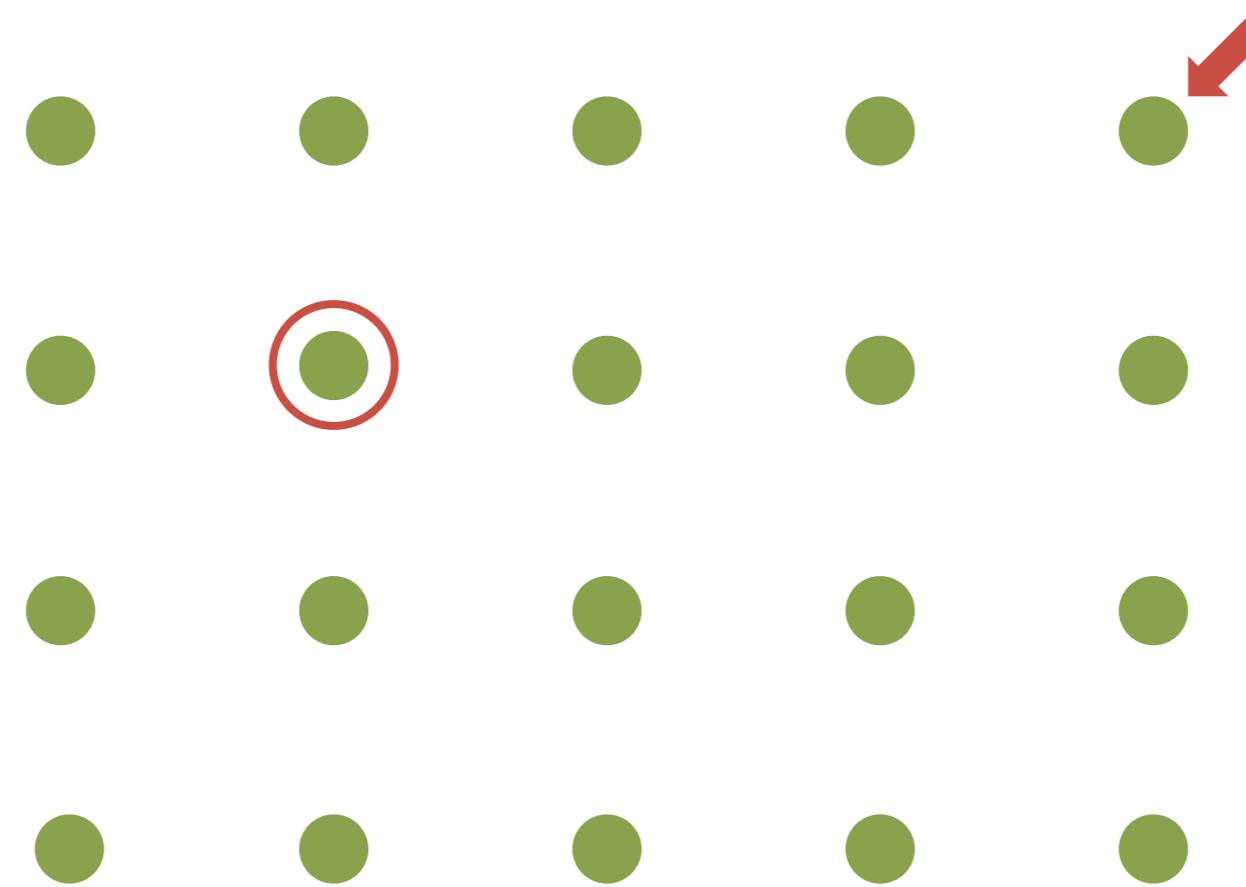
# Grouping



Values: Infinite

Ordered: Possibly

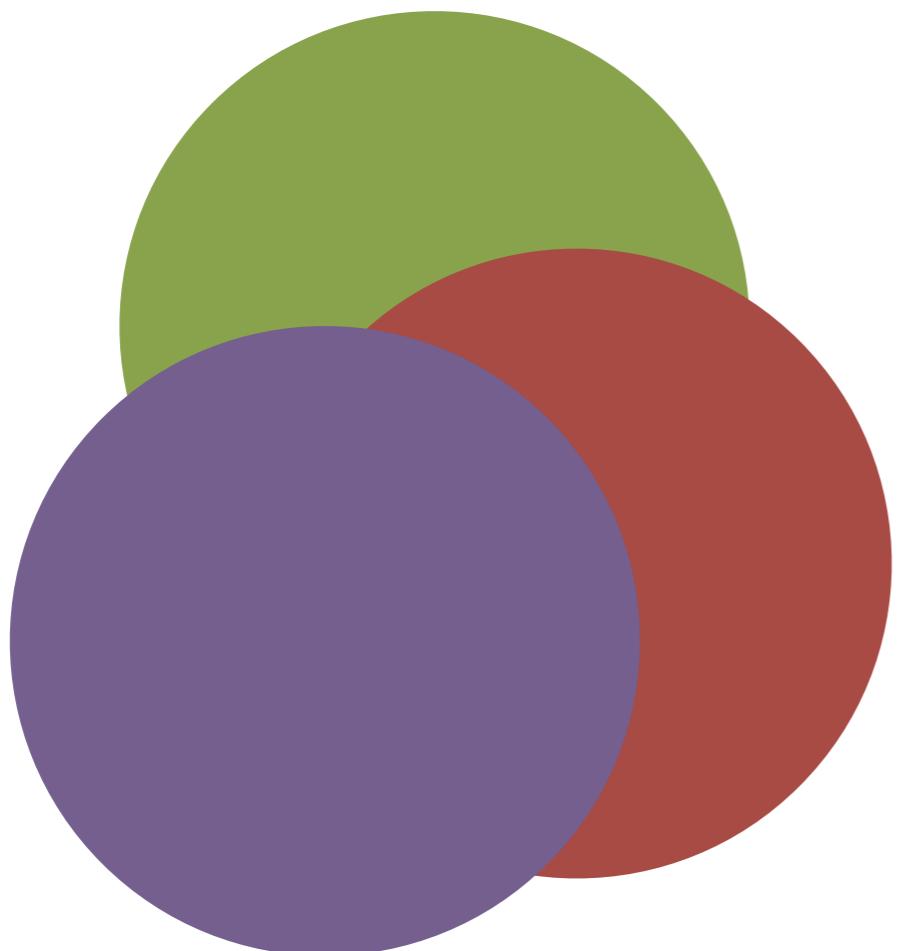
# Highlighting



Values: Very Limited

Ordered: No

# Layers

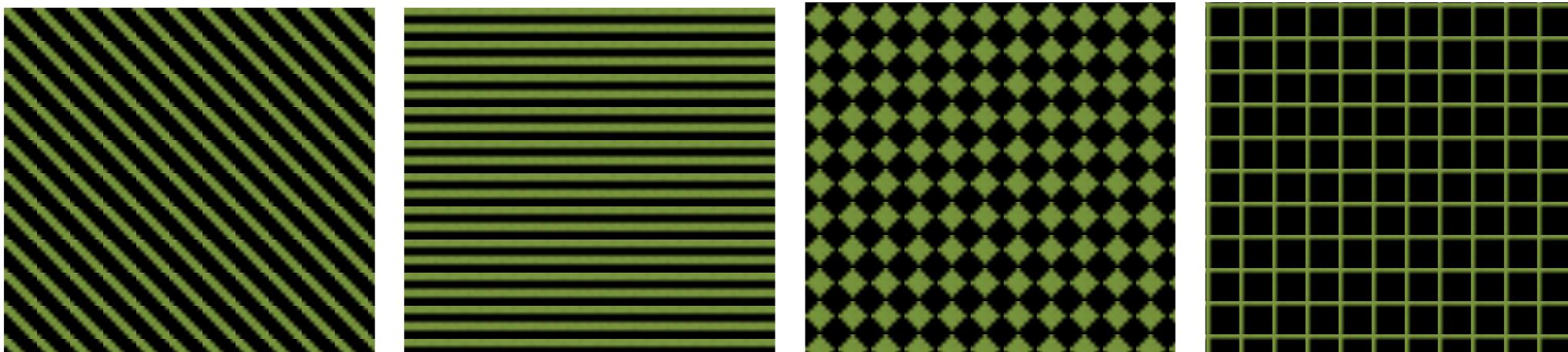
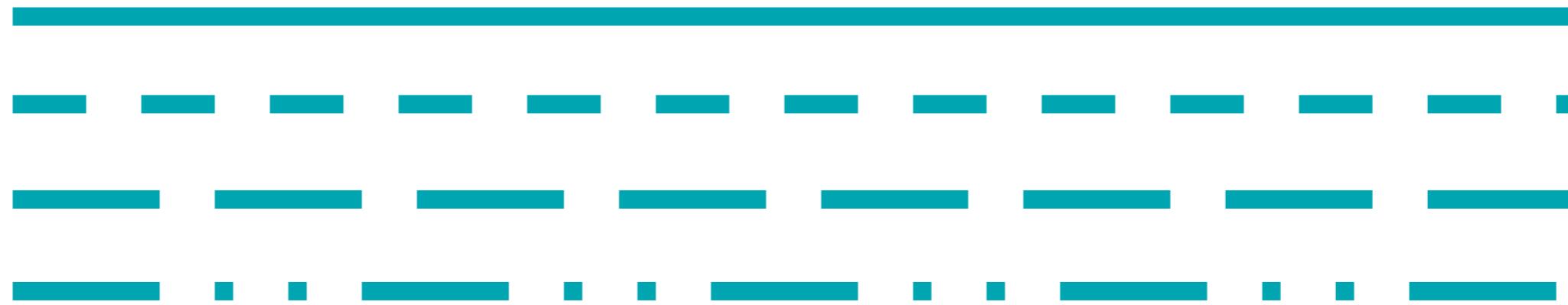


Values: Limited



Ordered: Yes

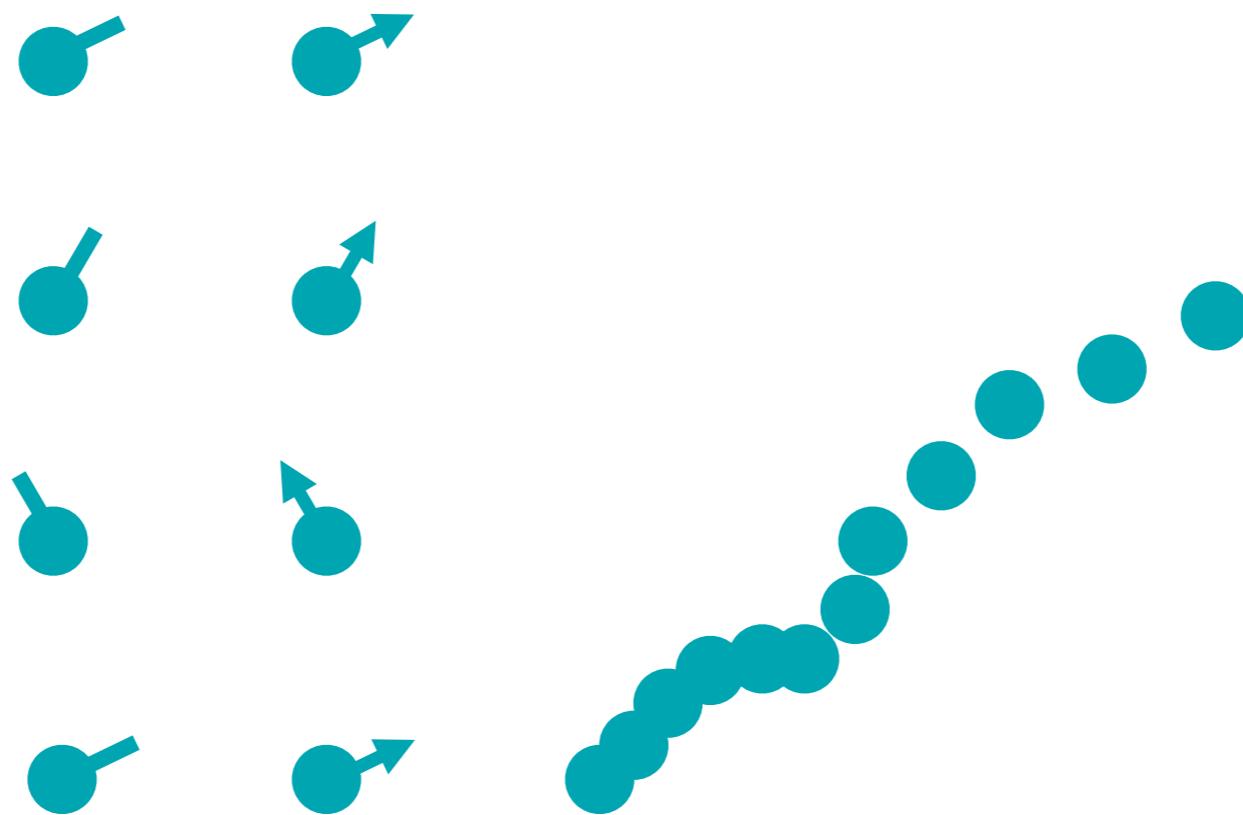
# Patterns



Values: Practically Limited

Ordered: No

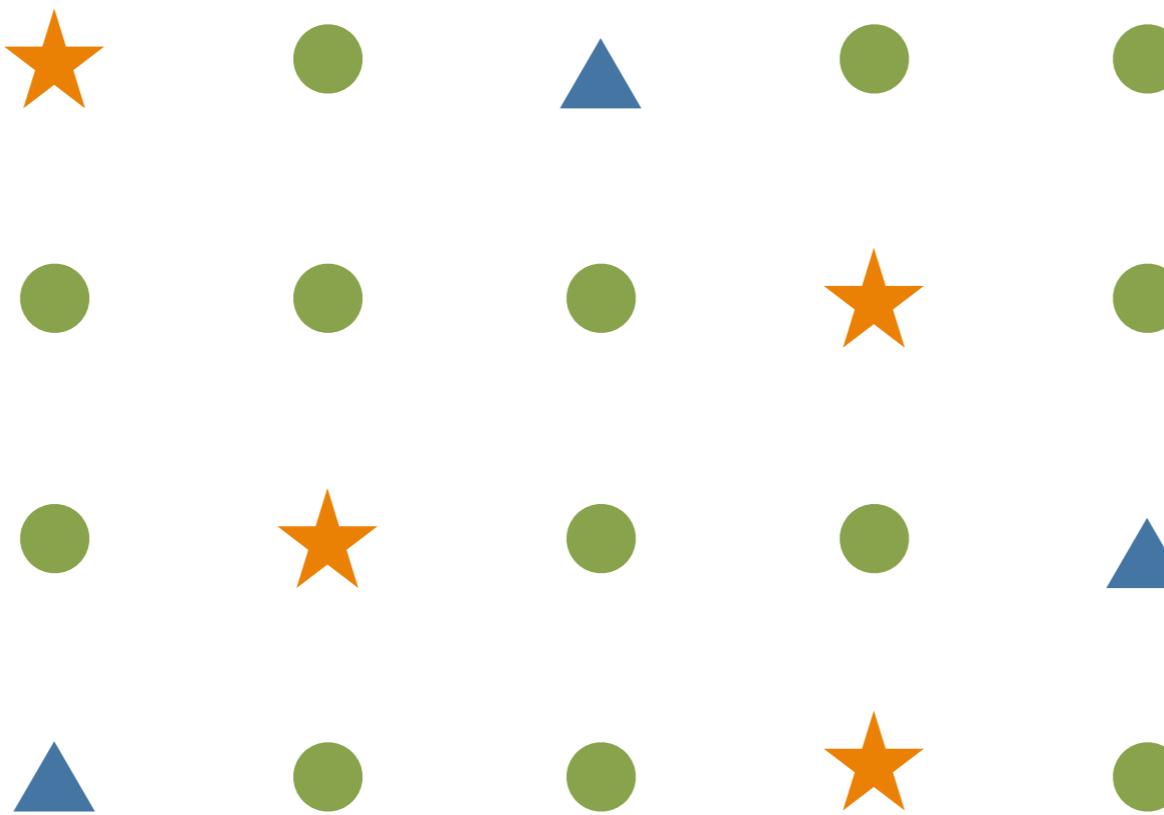
# Motion



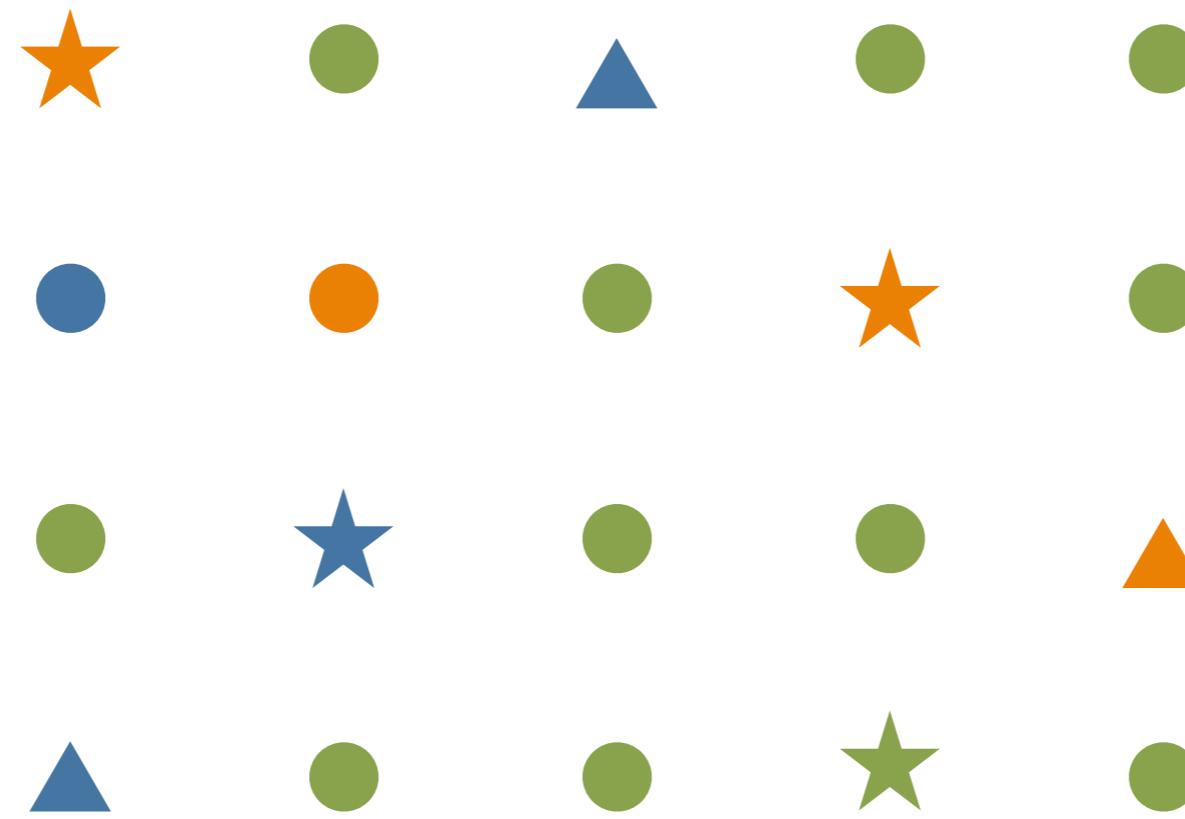
Values: Somewhat Limited

Ordered: Yes

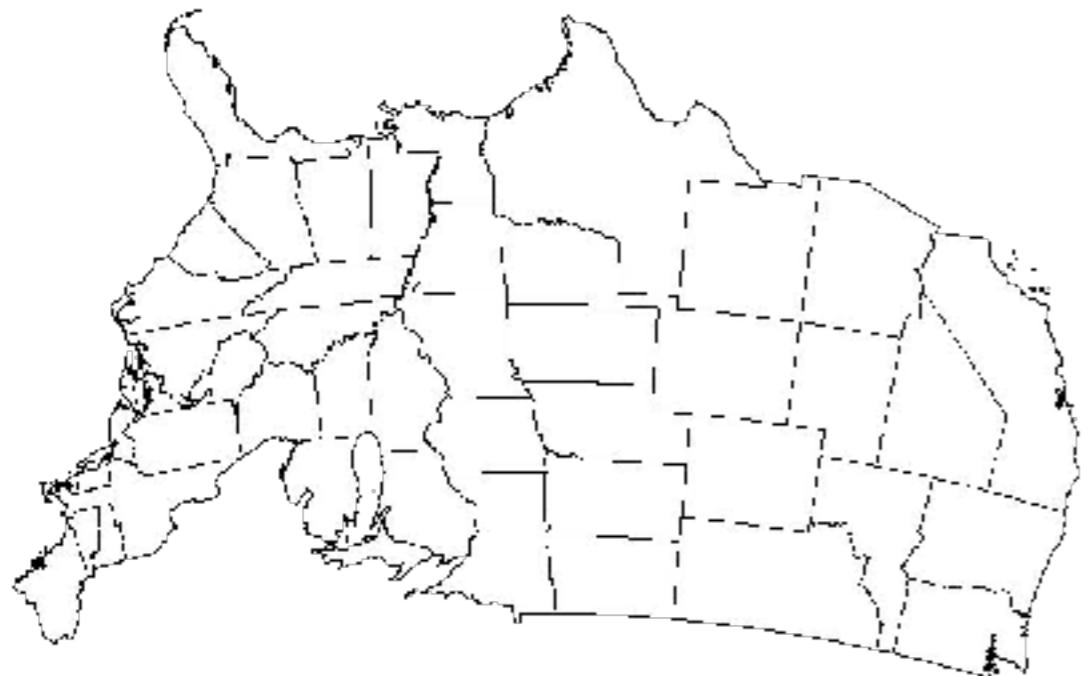
# Redundant Encoding



# Consistency



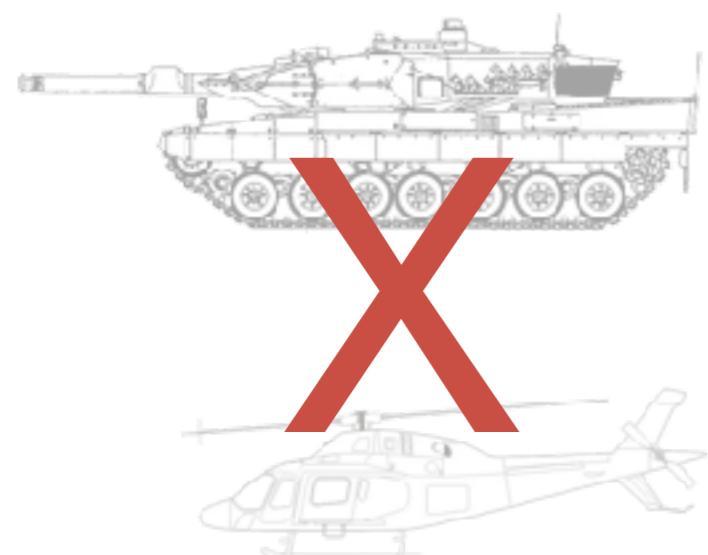
# Natural Encoding



# Natural Encoding



VS

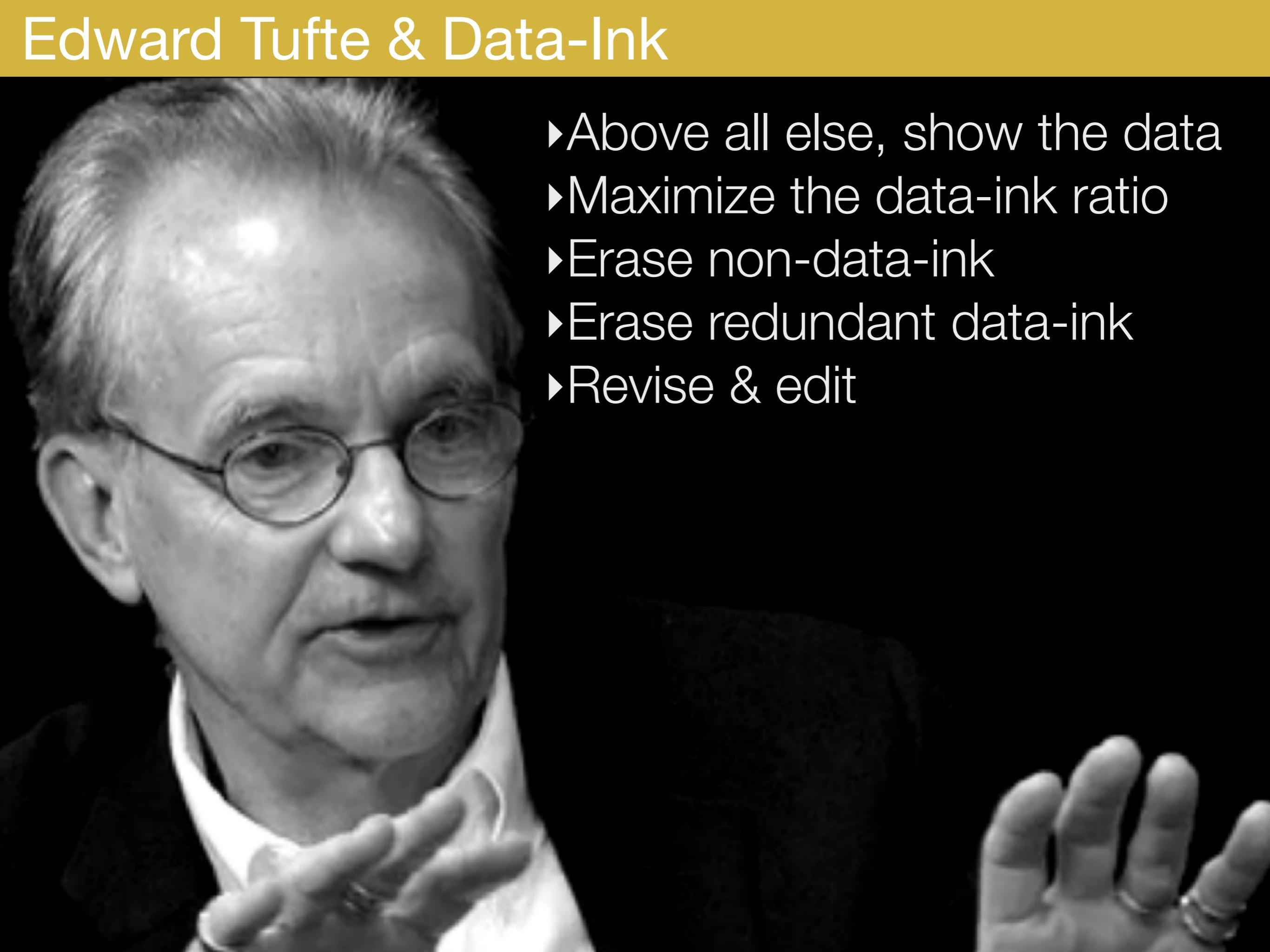


VS

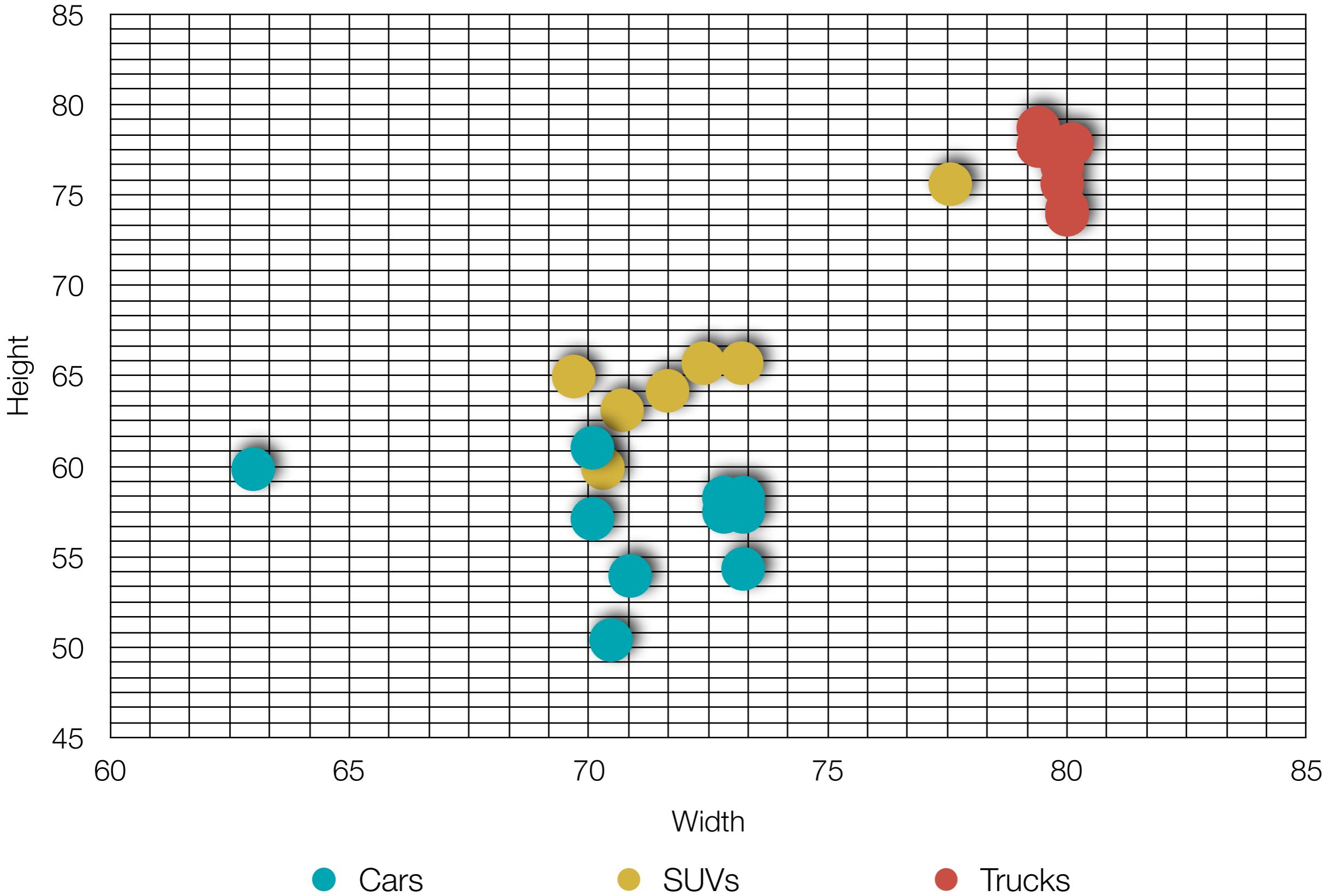


# Data-Ink

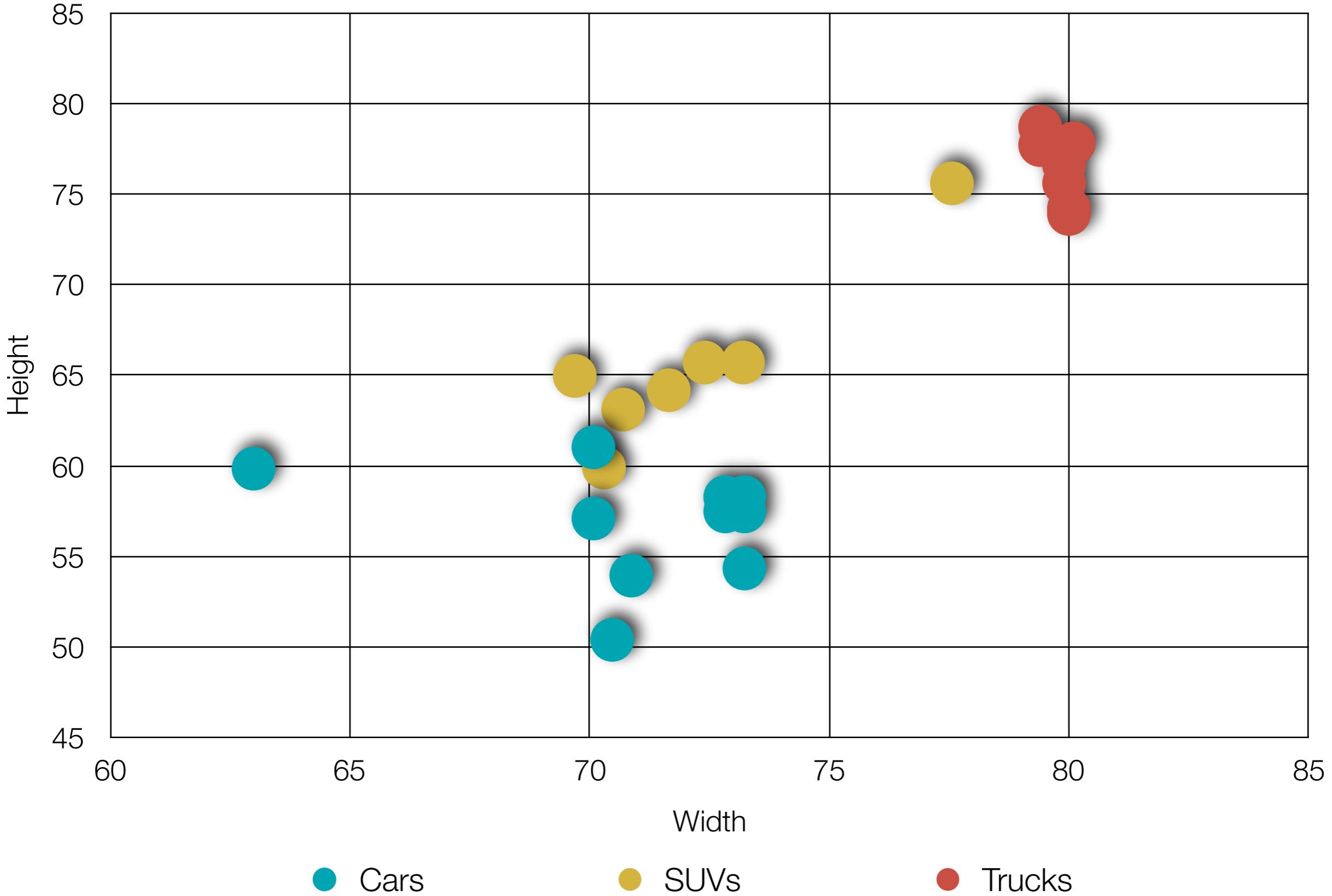
# Edward Tufte & Data-Ink

- 
- A black and white photograph of Edward Tufte, an elderly man with glasses and a suit, gesturing with his hands.
- ▶ Above all else, show the data
  - ▶ Maximize the data-ink ratio
  - ▶ Erase non-data-ink
  - ▶ Erase redundant data-ink
  - ▶ Revise & edit

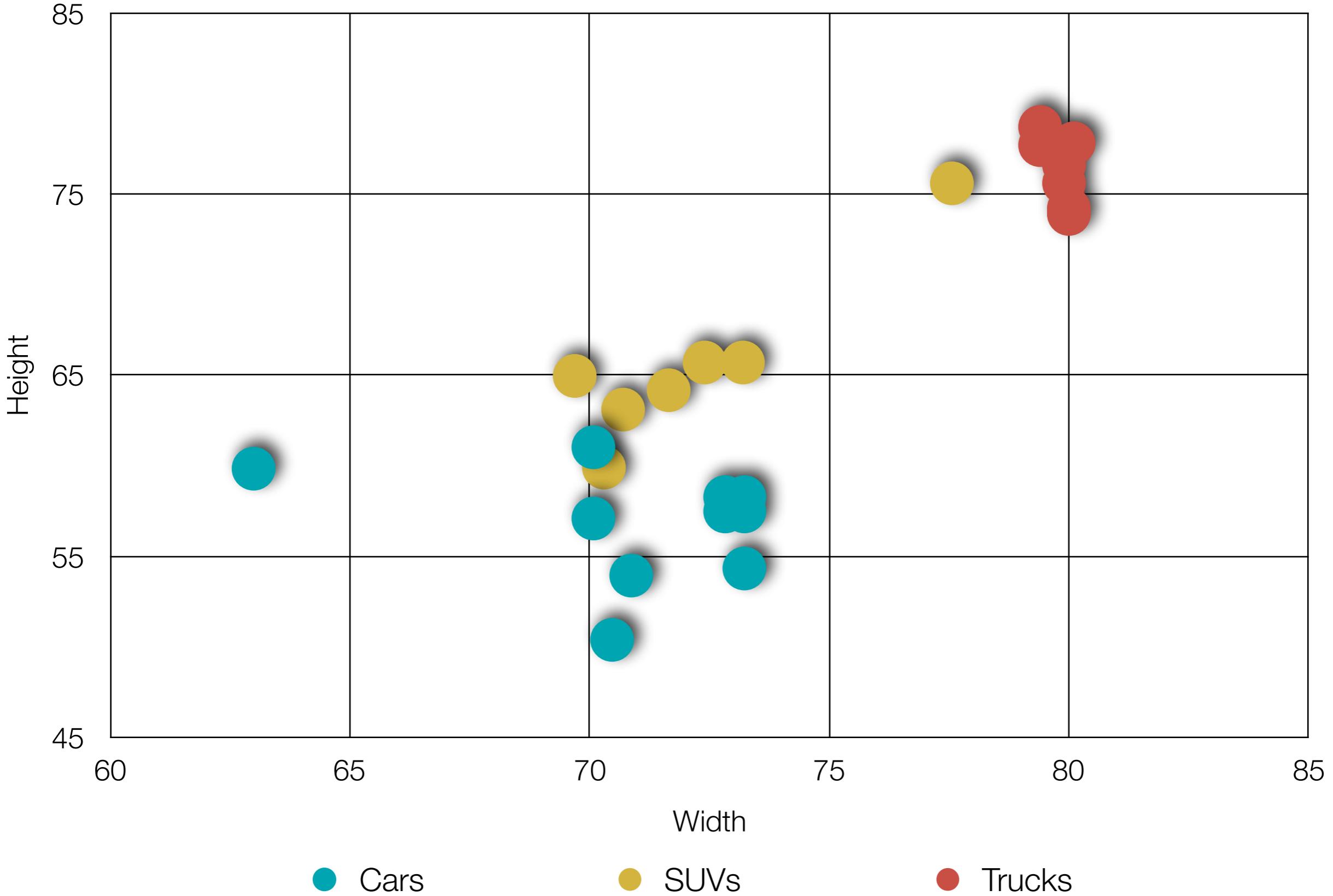
# Vehicle Heights & Widths



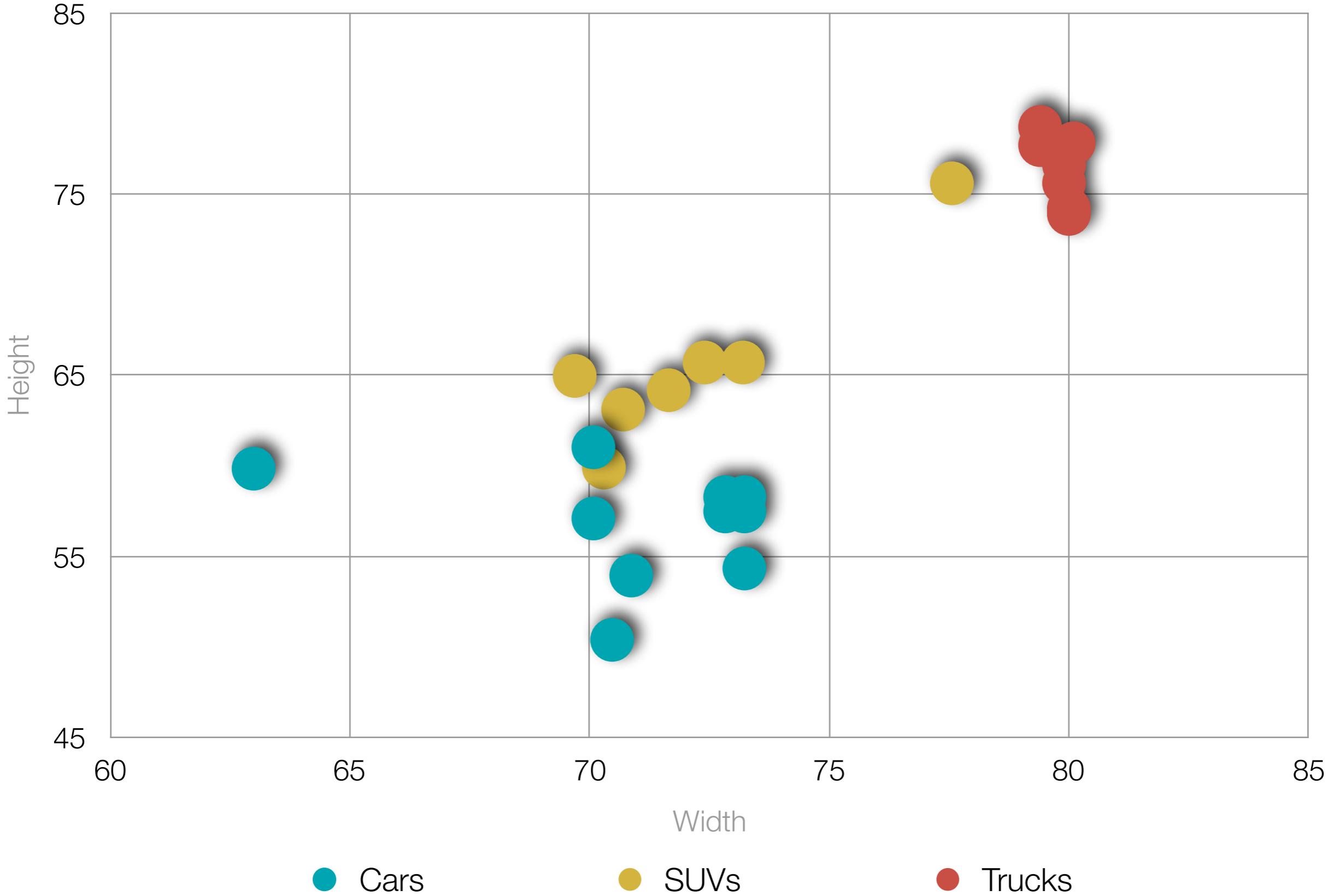
# Vehicle Heights & Widths



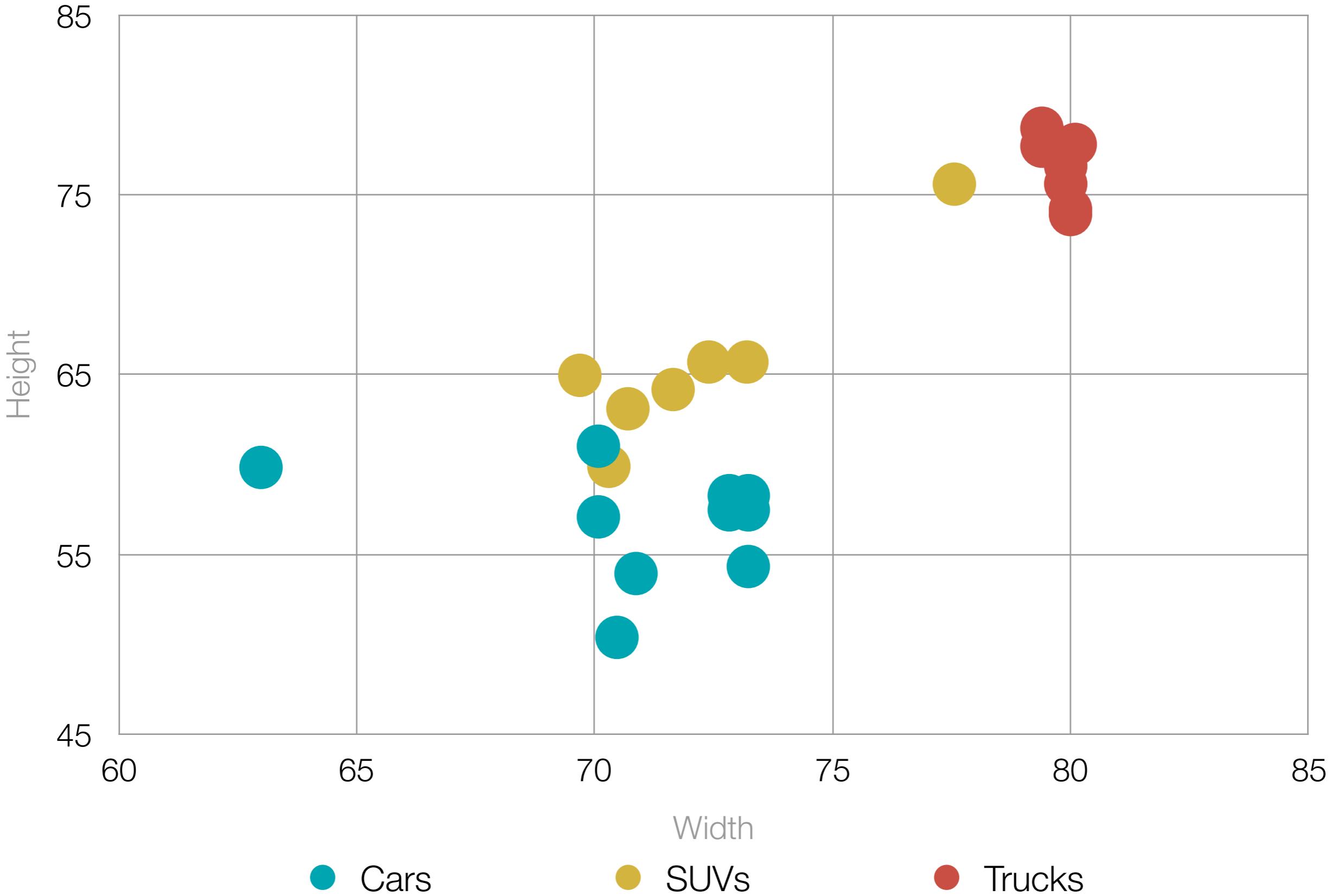
# Vehicle Heights & Widths



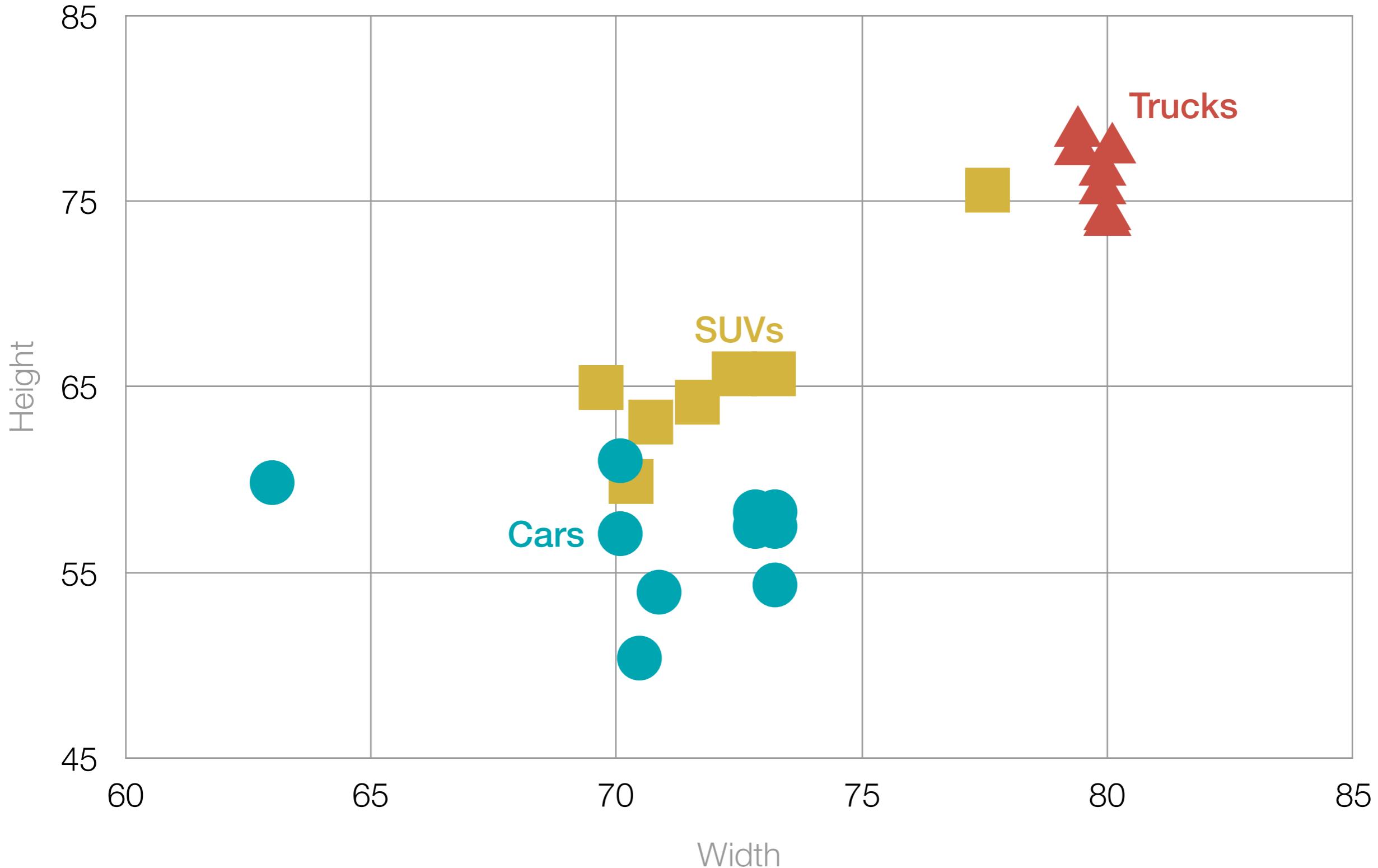
# Vehicle Heights & Widths



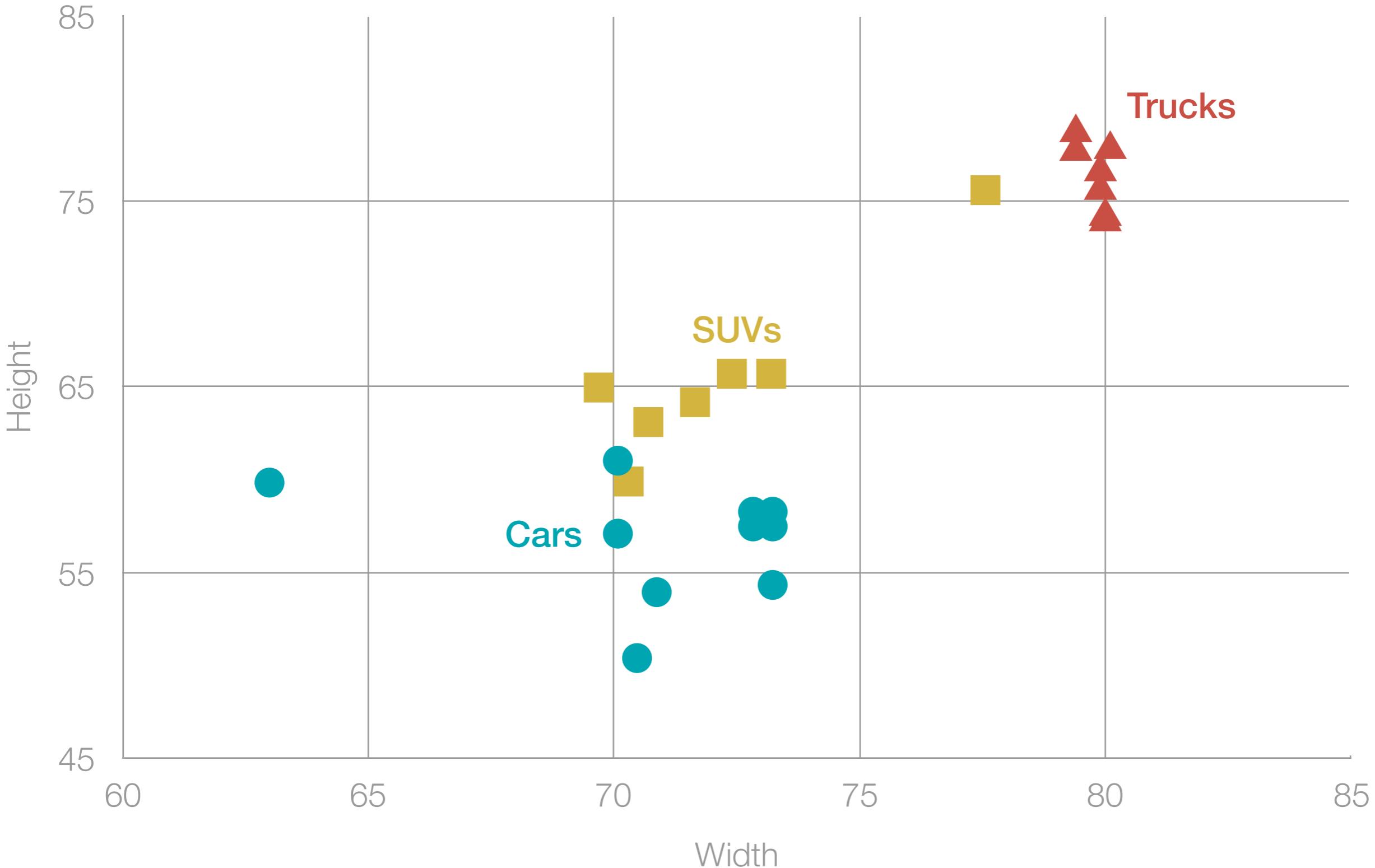
# Vehicle Heights & Widths



# Vehicle Heights & Widths



# Vehicle Sizes



# Storytelling

# Tell Your Story

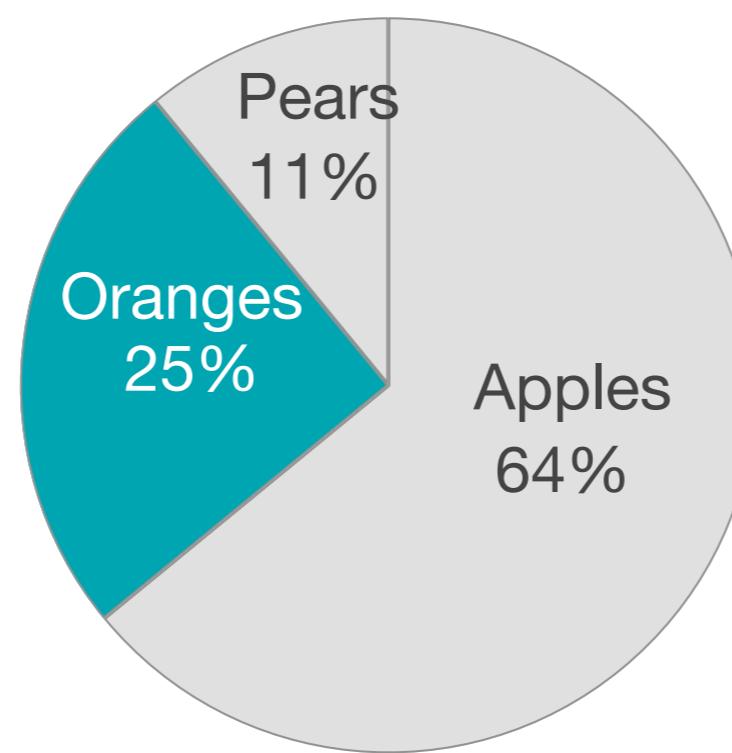
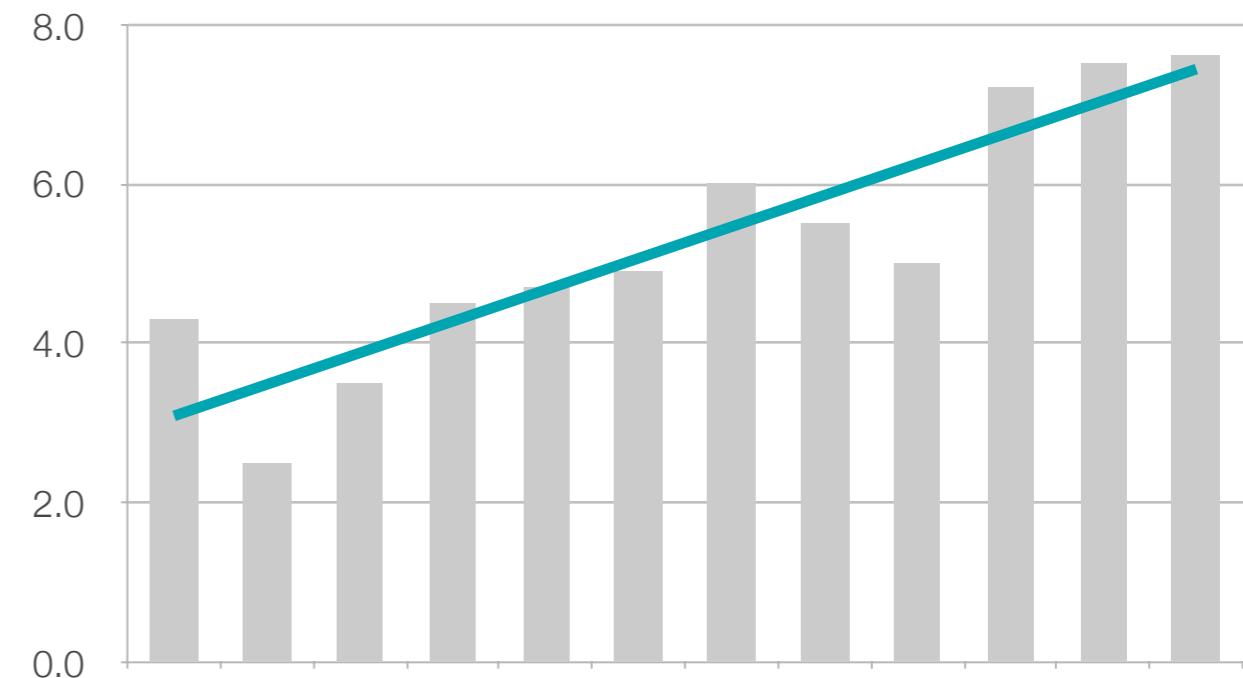
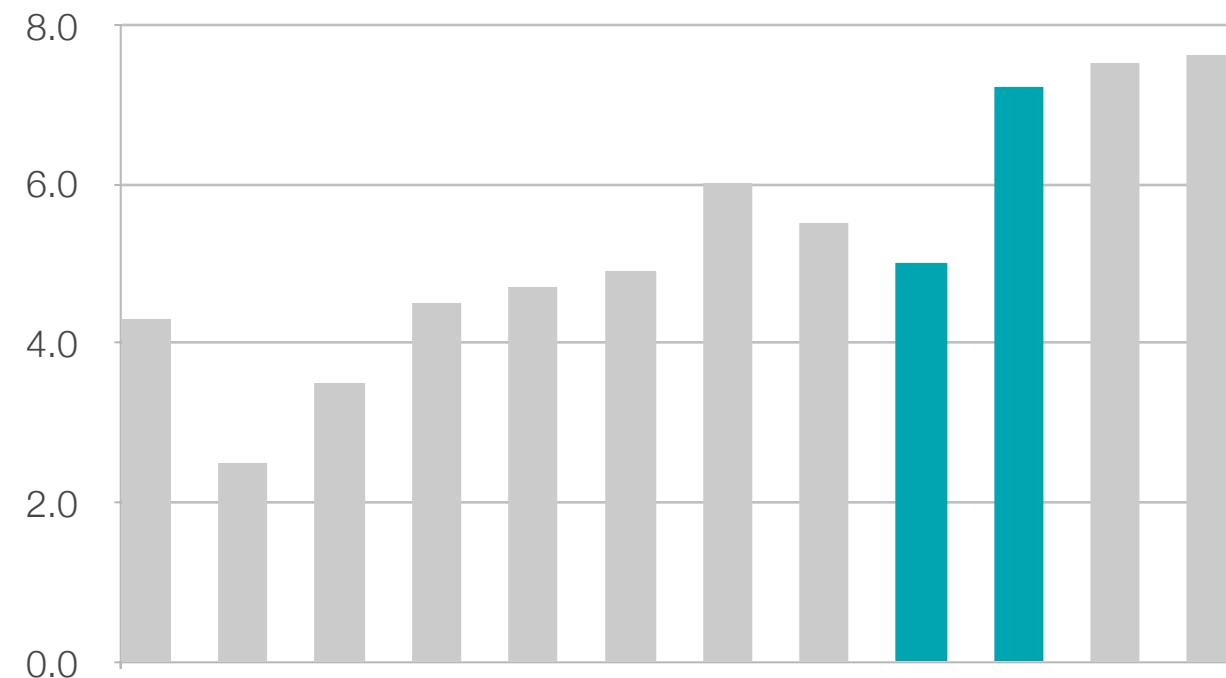
This screenshot shows a Microsoft Excel spreadsheet titled "Ratio Analysis" for Burger King Worldwide Inc. The spreadsheet includes various financial ratios and metrics across multiple years from 2006 to 2023.

**Key Sections:**

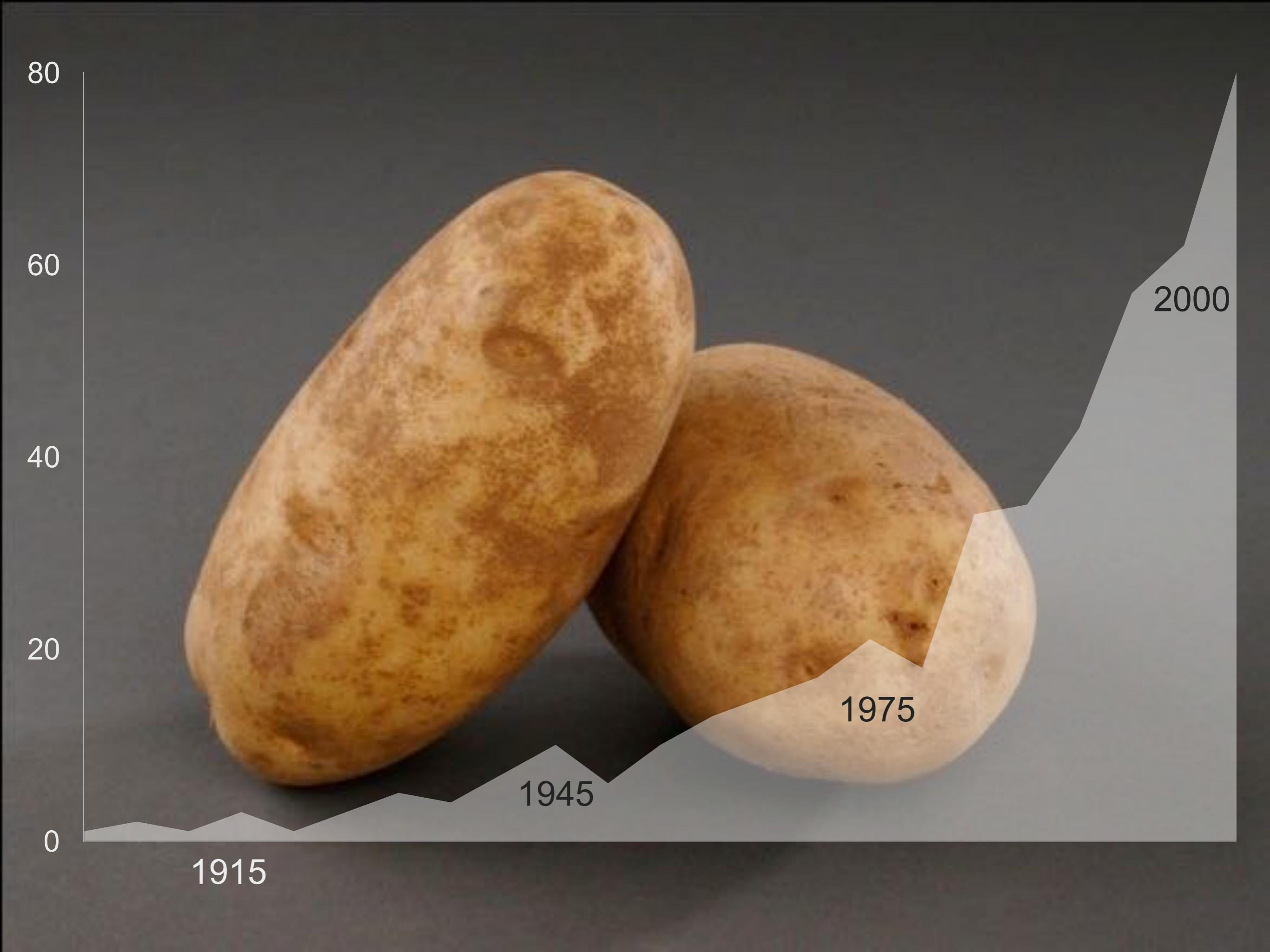
- Company Name:** BURGER KING WORLDWIDE INC
- Fiscal Year End Date:** Actual (2006/06/01 to 2023/06/01), Forecast (2011/06/01 to 2023/06/01)
- Annual Growth Rates:** Sales, Assets, Common Equity, Earnings, Free Cash Flow to Investors, Sustainable Growth Rate
- Profitability:** Return on Equity, Return on Equity (b4 non-recurring), Return on Net Operating Assets
- Basic Dupont Model:** Net Profit Margin, Total Asset Turnover, Total Leverage, Return on Equity
- Advanced Dupont Model:** Net Operating Margin, Net Operating Asset Turnover, Return on Net Operating Assets, Net Borrowing Cost (NDC), Spread (RNOA - NDC), Financial Leverage (LEV), ROE = RNOA + LEV\*Spread
- Margin Analysis:** Gross Margin, EBITDA Margin, EBIT Margin, Net Operating Margin (b4 non-rec.), Net Operating Margin
- Turnover Analysis:** Net Operating Asset Turnover, Net Working Capital Turnover, Avg Days to Collect Receivables, Avg Inventory Holding Period, Avg Days to Pay Payables, PP&E Turnover
- Analysis of Leverage:** Long-Term Capital Structure

**Formatting:** The spreadsheet uses conditional formatting with color coding for different categories. The "Format" tab in the ribbon is visible at the top, showing options for Normal, Bad, Good, and Neutral.

# Tell Your Story







80

60

40

20

0

1915

1945

1975

2000

# Tell Your Story: Before

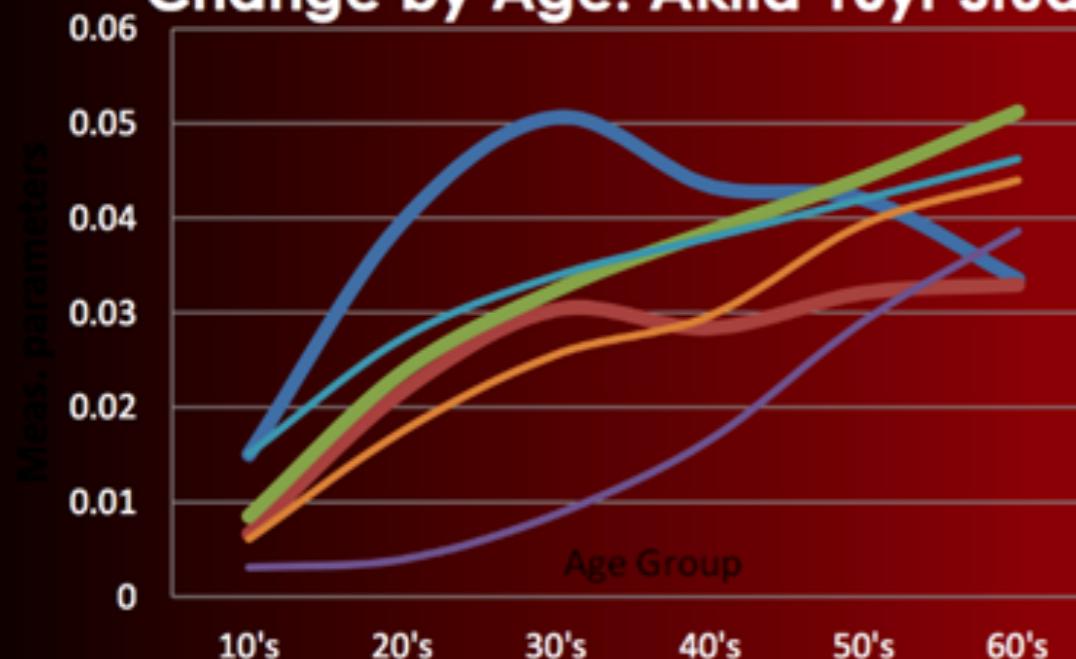
## TOP 3 FEATURES WITH BIGGEST SKIN DEVIATION

TEXTURE

VISIBLE  
PORES

INNER  
RESILIENCE

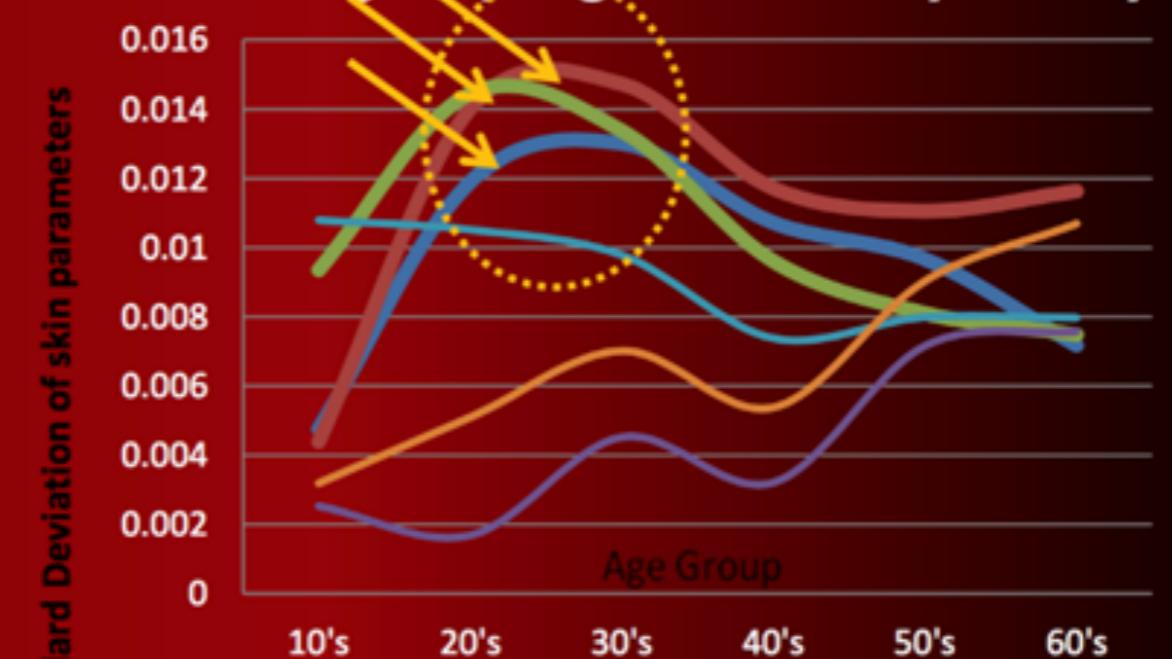
1) Skin Appearance Average Change by Age: Akita 10yr Study



Pore Area Fract.  
Inner Resilience  
Radiance (0-6)

Texture Area Fraction  
Wrinkle Area Fraction  
Spot Area Frac.

2) Skin Appearance Deviation Change by Age: Akita 10yr Study



Pore Area Fract.  
Inner Resilience  
Radiance

Texture Area Fraction  
Wrinkle Area Fraction  
Spot Area Frac.

# Tell Your Story: After

Her skin looks  
like she's

**20**

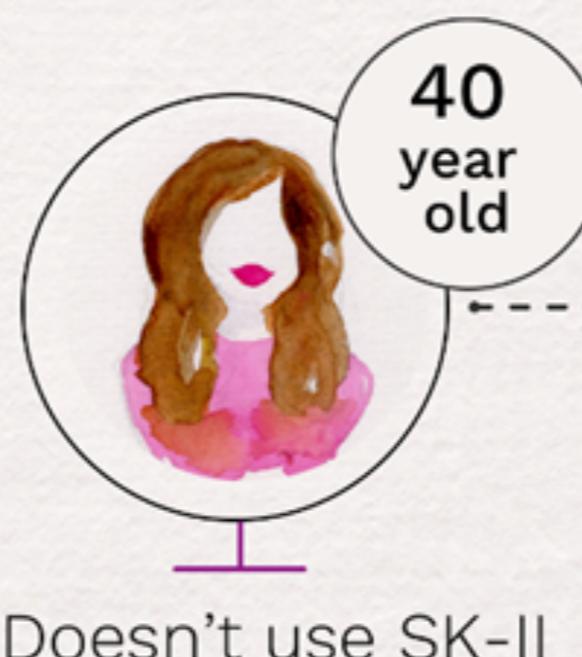
AFTER 10 YEARS  
OF USING SK-II  
PRODUCTS



Her skin looks  
like she's

**45**

AFTER NOT  
USING SK-II  
PRODUCTS

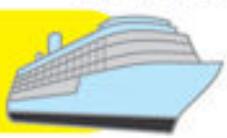


# Icons

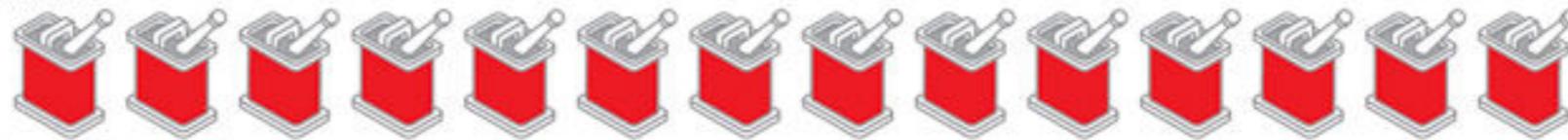
## GETTING AROUND: FUEL USE OF VARIOUS MODES OF TRANSPORTATION

HOW MANY GALLONS OF FUEL PER PASSENGER DOES IT TAKE TO COVER A DISTANCE OF 350 MILES?

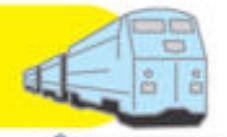
### Cruise Ship



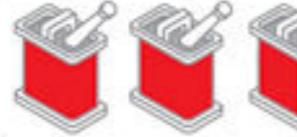
2915 Capacity  
.009 Miles per gallon  
121 Gallons per mile  
10:56 Time to travel 350 miles at 32 mph



### Amtrak



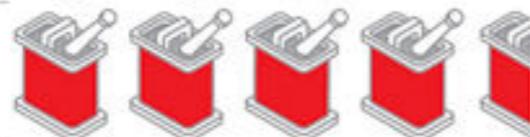
300 Capacity  
.46 Miles per gallon  
2.17 Gallons per mile  
04:22 Time to travel 350 miles at 80 mph



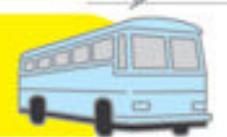
### Boeing 737



175 Capacity  
.42 Miles per gallon  
2.4 Gallons per mile  
00:37 Time to travel 350 miles at 566 mph



### Motor Coach



50 Capacity  
5 Miles per gallon  
.2 Gallons per mile  
05:50 Time to travel 350 miles at 60 mph



### Average SUV



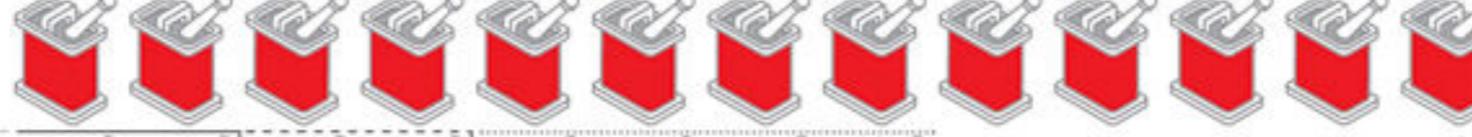
5 Capacity  
21 Miles per gallon  
.048 Gallons per mile  
05:50 Time to travel 350 miles at 60 mph



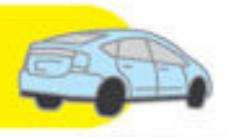
### Average Sedan



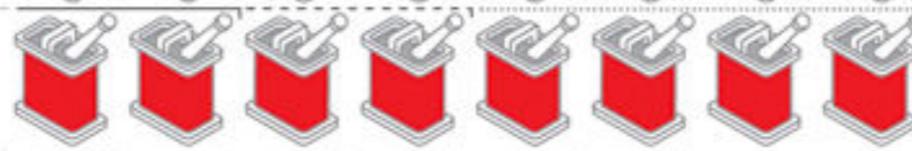
4 Capacity  
27 Miles per gallon  
.037 Gallons per mile  
05:50 Time to travel 350 miles at 60 mph



### Average Hybrid



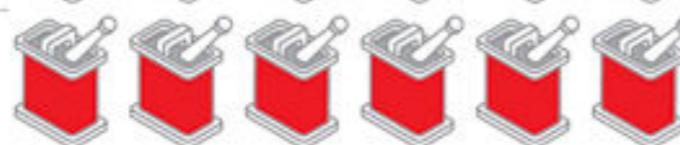
4 Capacity  
46 Miles per gallon  
.022 Gallons per mile  
05:50 Time to travel 350 miles at 60 mph



### Motorcycle



1 Capacity  
56 Miles per gallon  
.017 Gallons per mile  
05:50 Time to travel 350 miles at 60 mph



### Bicycle



1 Capacity  
912 Miles per gallon (caloric conversion)  
.001 Gallons per mile (caloric conversion)  
23:20 Time to travel 350 miles at 15 mph



### Walking



1 Capacity  
211 Miles per gallon (caloric conversion)  
.005 Gallons per mile (caloric conversion)  
100 Time to travel 350 miles at 3.5 mph



-----: FUEL USAGE for driver alone

- - -: FUEL USAGE for driver plus one passenger

—: FUEL USAGE for driver plus three passengers

WHOPPER with cheese is 770 calories.  
EATMEN neither endorses or denounces the  
consumption of Whoppers.

WE'RE EFFICIENT One gallon of gas equals  
approximately 31,000 calories. We only need  
about 2,000 calories a day.

CYCLIST A 175-pound rider, biking 15 miles  
per hour, and burning .049 calories per  
pound per minute.

WALKER A 175-pound pedestrian, walking at  
3.5 miles per hour, and burning .035 calories  
per pound per minute.

NOTE Capacity, fuel economy, and speed  
numbers are, in some cases, averages or  
estimates.

good.is  
Transparency

# REBUILDING PROGRESS IN NEW ORLEANS

BEFORE  
HURRICANE KATRINA

1 YEAR  
LATER

2 YEARS  
LATER

## Households

Actively receiving mail in Orleans Parish



## Labor force

In Orleans Parish



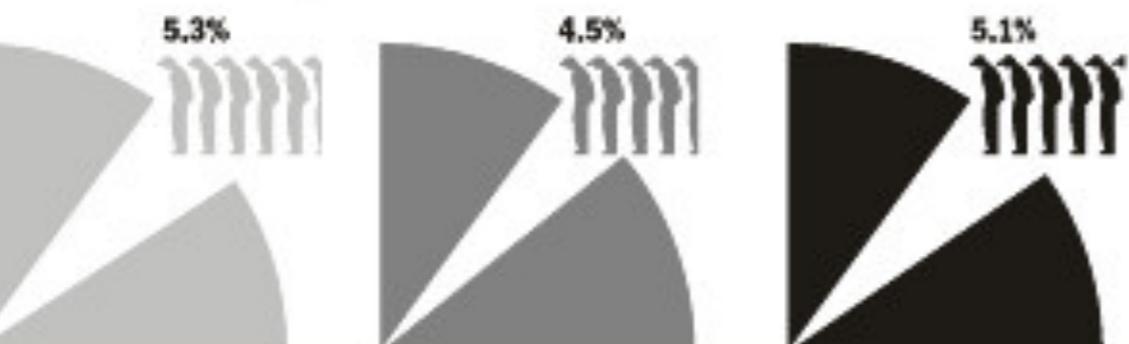
## Buses

Operational in Orleans Parish



## Unemployment

Rate in New Orleans metropolitan area



## House prices

Average sale price, June, in Orleans Parish



## Air passenger traffic

Arriving & departing at Louis Armstrong International Airport, June



## Libraries

Open in Orleans Parish



## Hospitals

Operational in Orleans Parish



## NO ESCAPE FOR TENANTS

Average Manhattan rents in October

Non-doorman buildings

Doorman buildings

\$2,151

Studio

\$2,751

\$2,991

One-bedroom

\$3,787

\$4,069

Two-bedroom

\$5,627

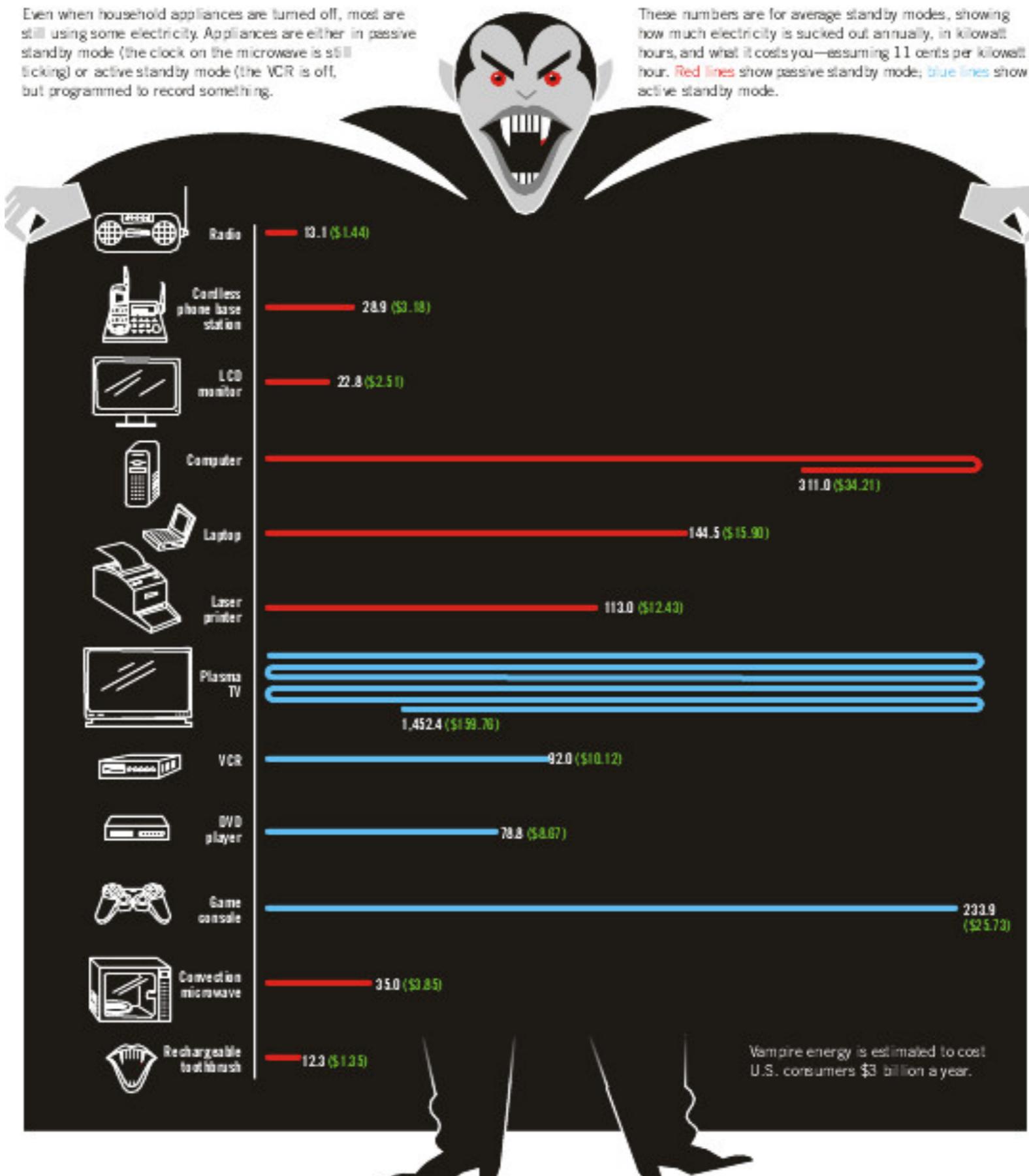


Source: Nigel Holmes

## Vampire Energy

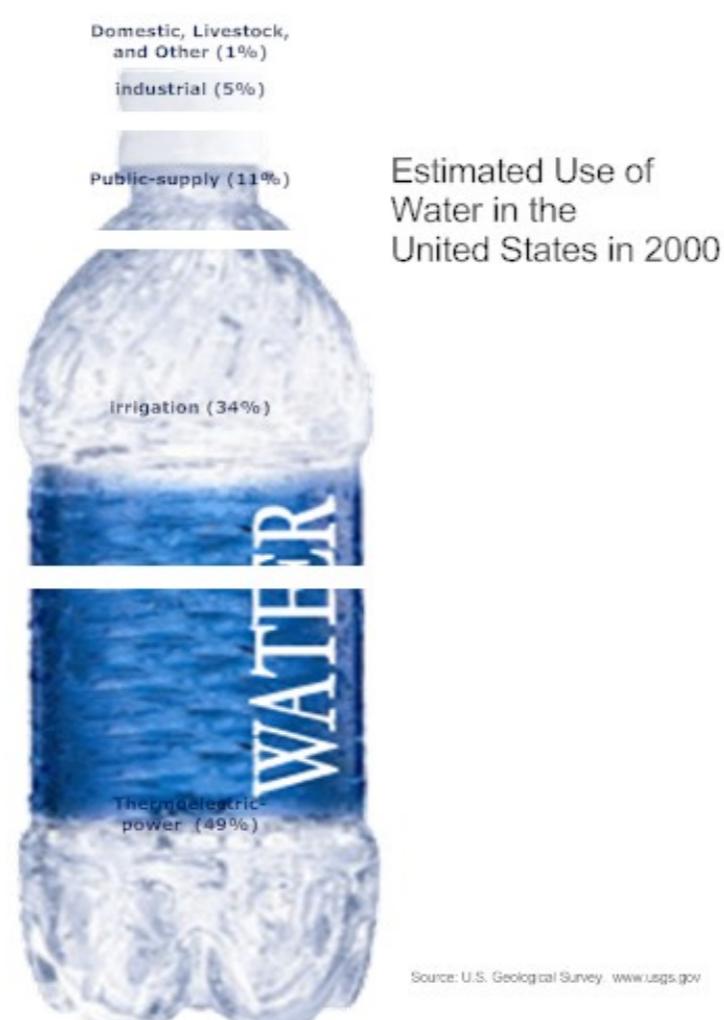
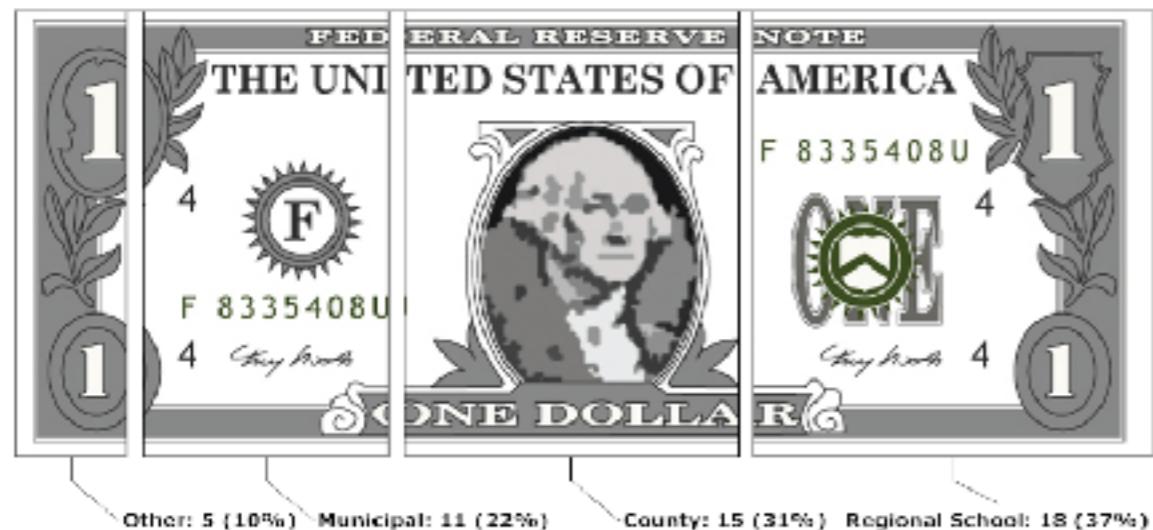
Even when household appliances are turned off, most are still using some electricity. Appliances are either in passive standby mode (the clock on the microwave is still ticking) or active standby mode (the VCR is off, but programmed to record something).

These numbers are for average standby modes, showing how much electricity is sucked out annually, in kilowatt hours, and what it costs you—assuming 11 cents per kilowatt hour. Red lines show passive standby mode; blue lines show active standby mode.

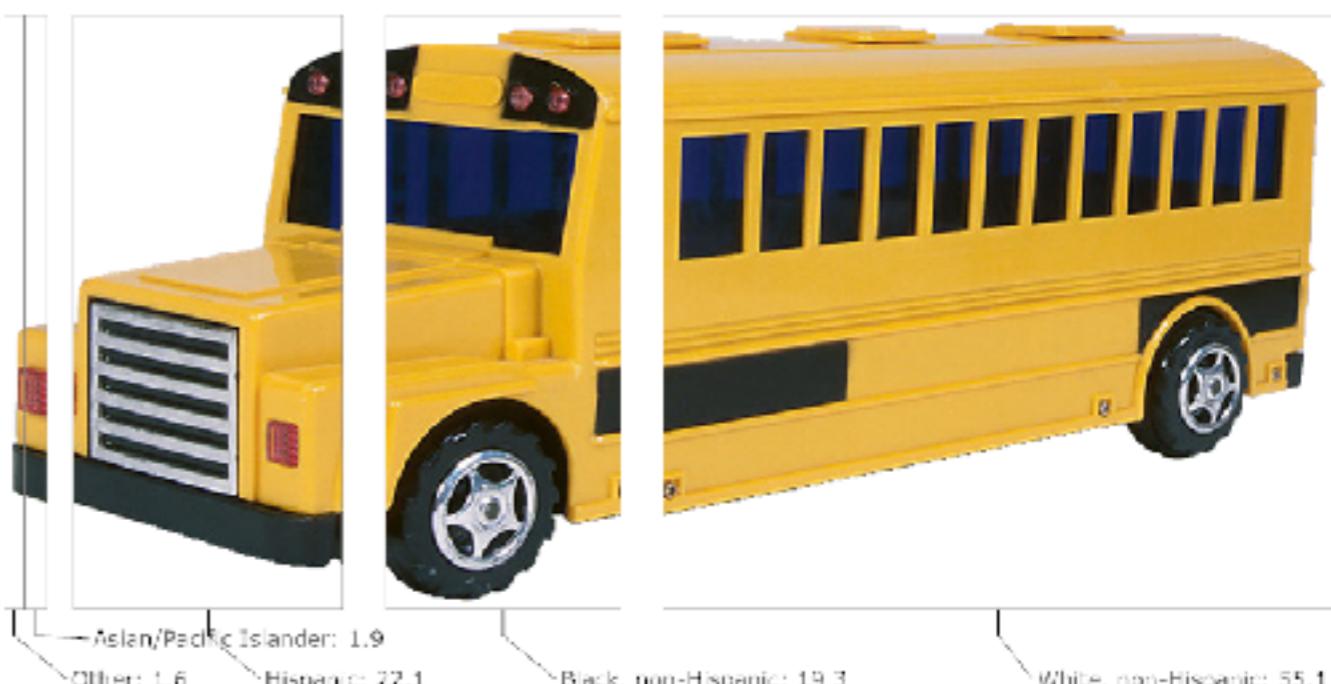


Source: Nigel Holmes

## How Your Tax Dollars Are Spent

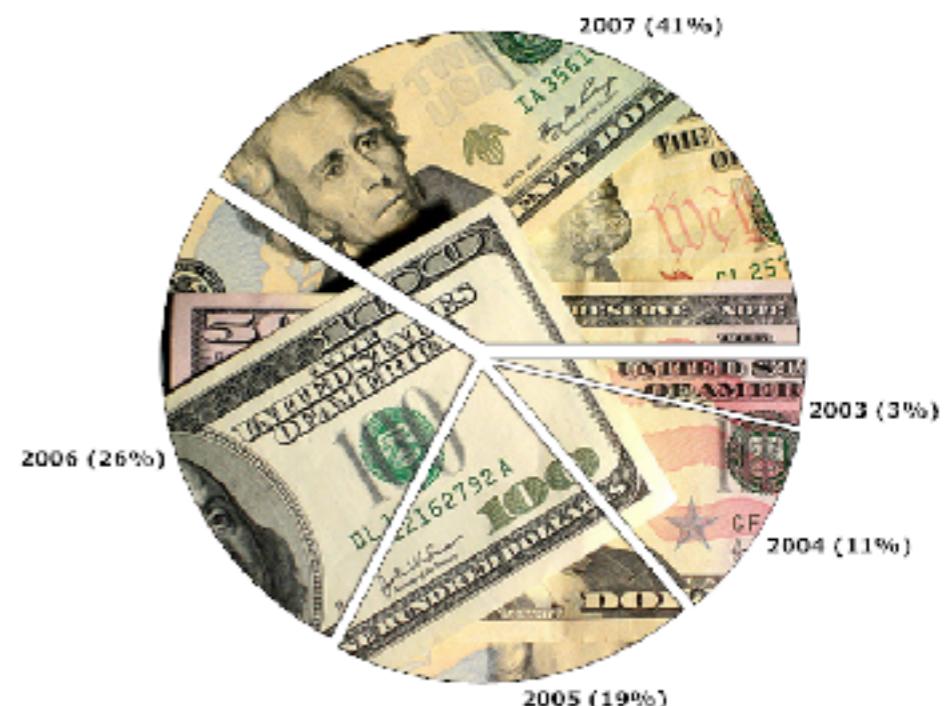


Dropout Rates of 15- through 24-year-olds who dropped out of grades 10–12, by background characteristics: October 2001



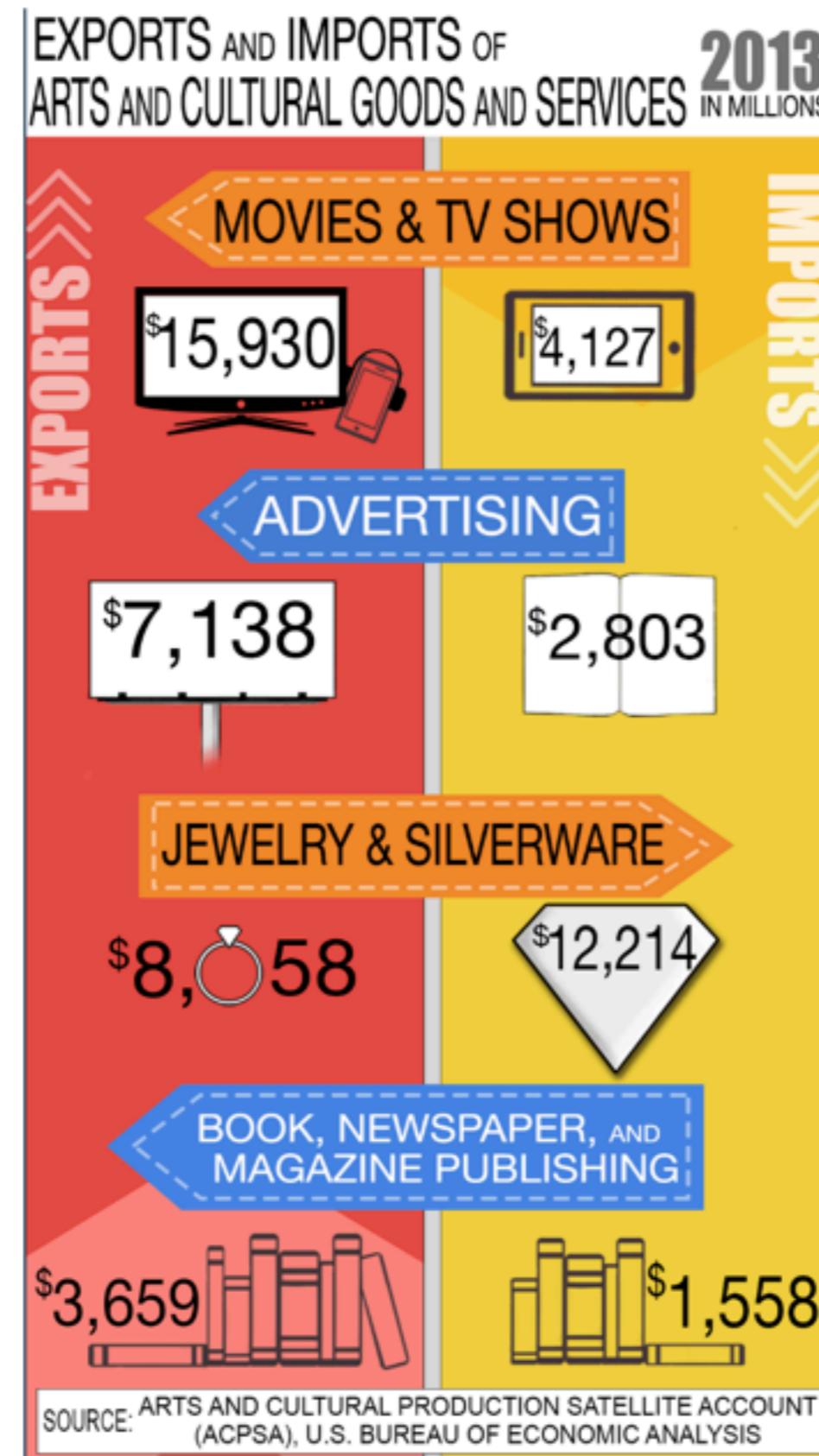
Source: National Center for Education Statistics. [nces.ed.gov](http://nces.ed.gov)

## Assets Under Management

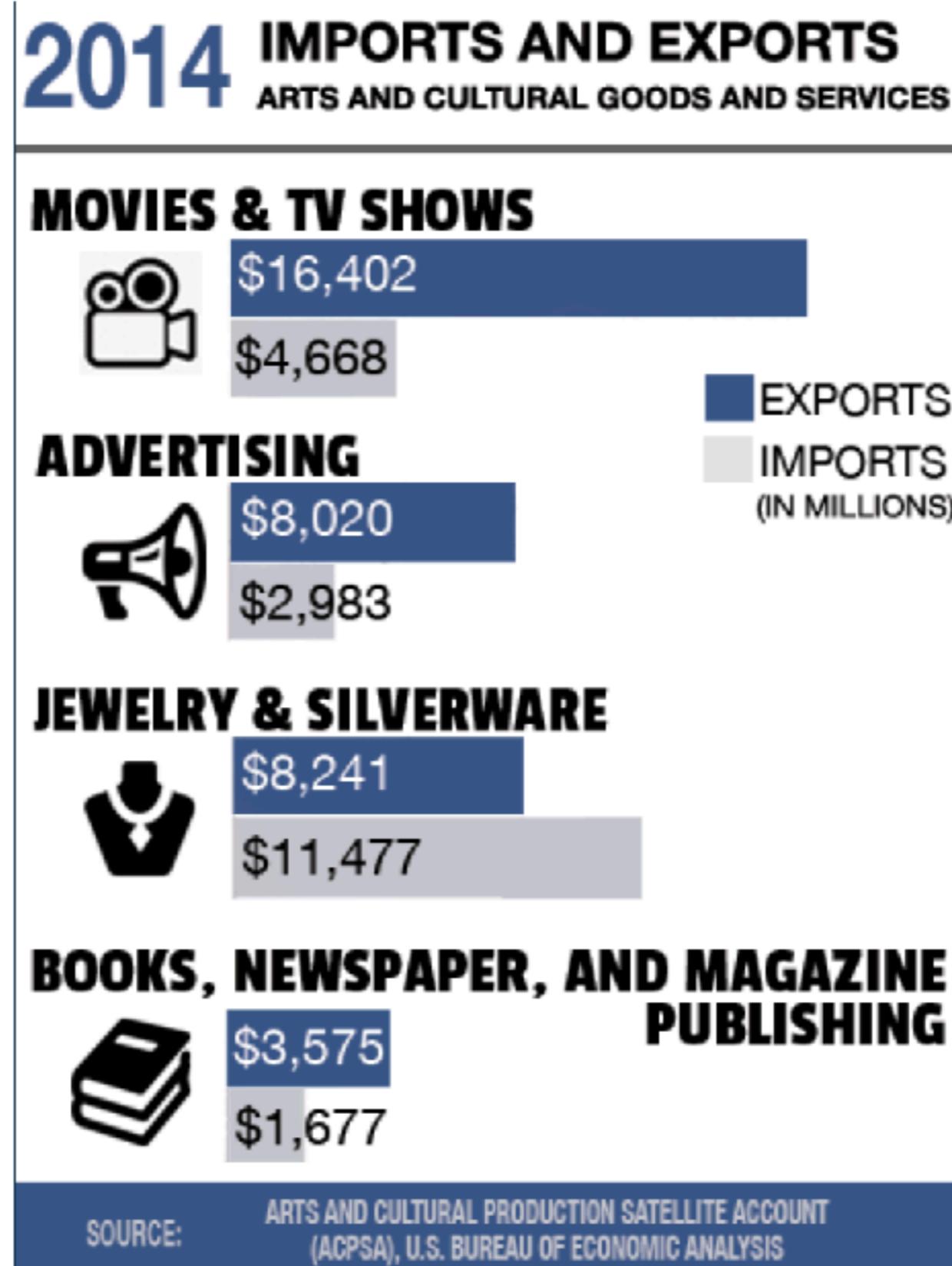


Source: SmartDraw

# Exercise



# Exercise



# Color

# Visual Cues: Color for Search



# Visual Cues: Color for Emotion



# Identity

(colourlovers.com)



(montyne.com)



(Jay Shultz – deviantart.com)

# Metaphor



## Mood

# High Contrast Colors

Very High  
Contrast

Very High  
Contrast

Medium  
Contrast

Medium  
Contrast

Low Contrast

Very Low  
Contrast

# Pay Attention to Color Blindness

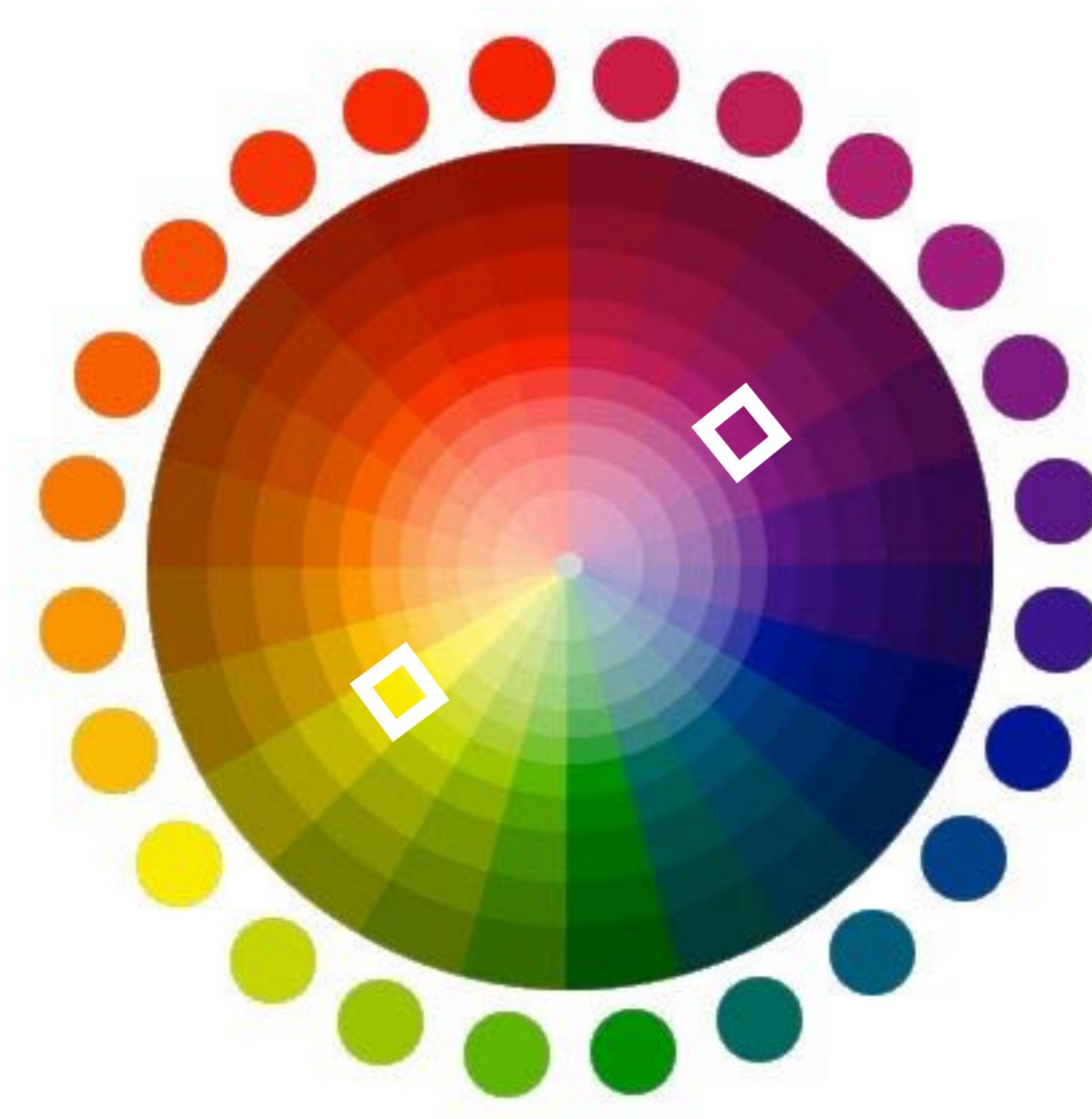


Courtesy: Gregor Aisch

# Selecting Colors



# Selecting Colors



# Selecting Colors



# Selecting Colors



# Selecting Colors

English ▾

Like it? ▾

Paletton Live Colorizer

Mobile [scheduled]

More apps [scheduled]



< UNDO

REDO >

RESET

RANDOMIZE...

MORE INFO ▾



Adjacent colors (4-colors)

with complement

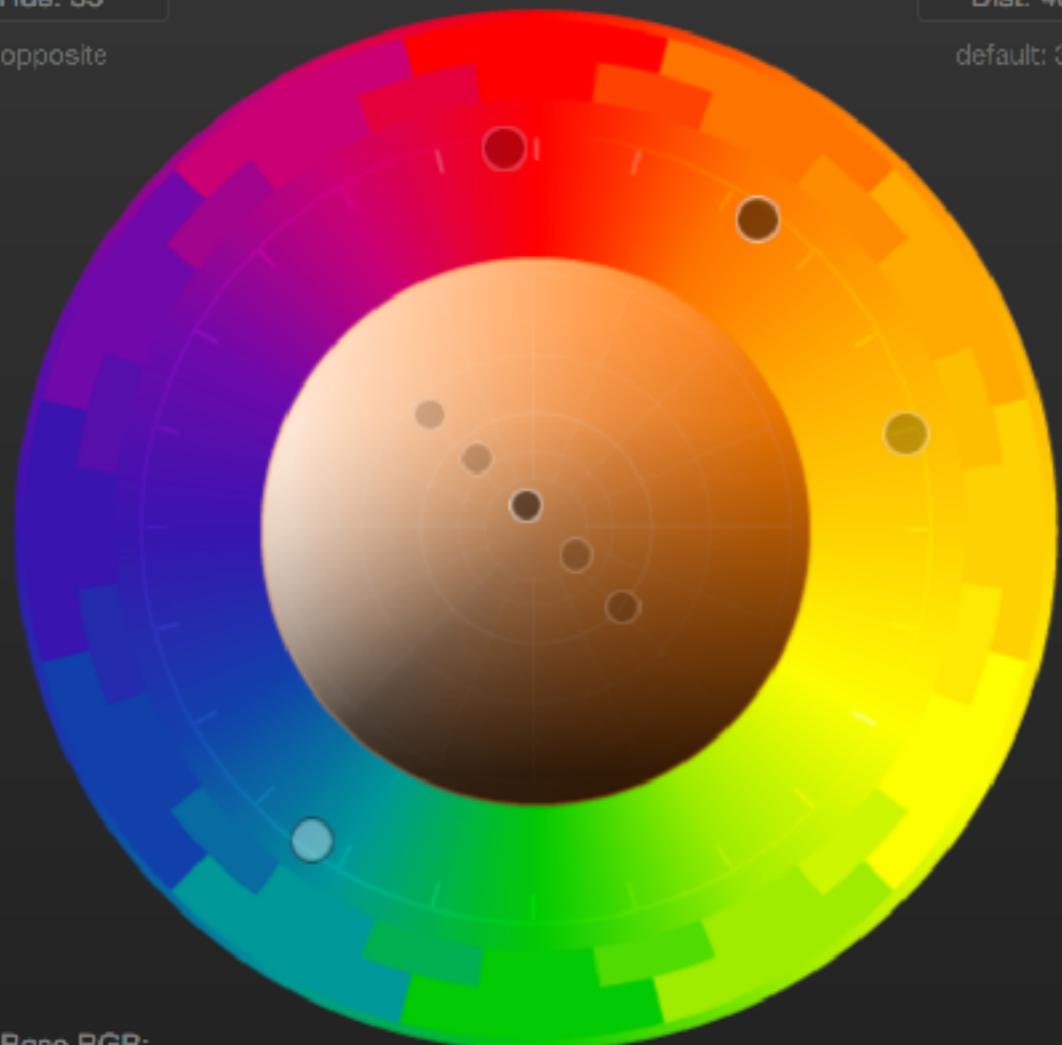
My Palette:



Share palette ▾

Hue: 35°

opposite

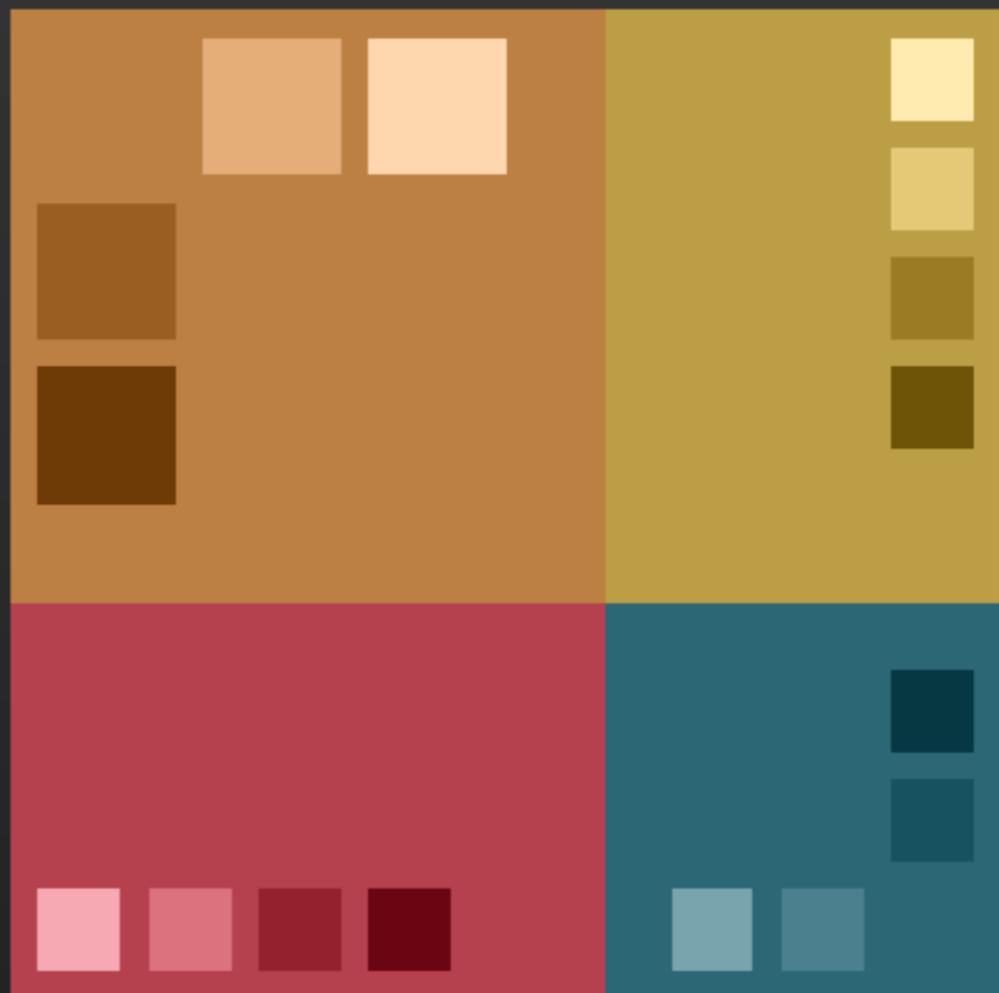


Base RGB:

BC8044

Dist: 40°

default: 30°



COLORS

PRESETS

PREVIEW ▾

EXAMPLES...

TABLES / EXPORT...

Vision simulation ▾

# Selecting Colors

Adobe Color CC    Create    Explore    My Themes    SIGN IN

Save    My Color Theme

Color Rule   
 Analogous



RGB 255 10 222    RGB 188 9 232    RGB 136 2 255    RGB 66 9 232    RGB 10 14 255

# Fonts

Slide Titles

Major Point

Minor point

If in doubt, use the monitor size rule

# Font Type Face

Major Point

Major Point

Major Point

Major Point

Major Point

# Font Type Face

*Major Point*

Major Point

Major Point

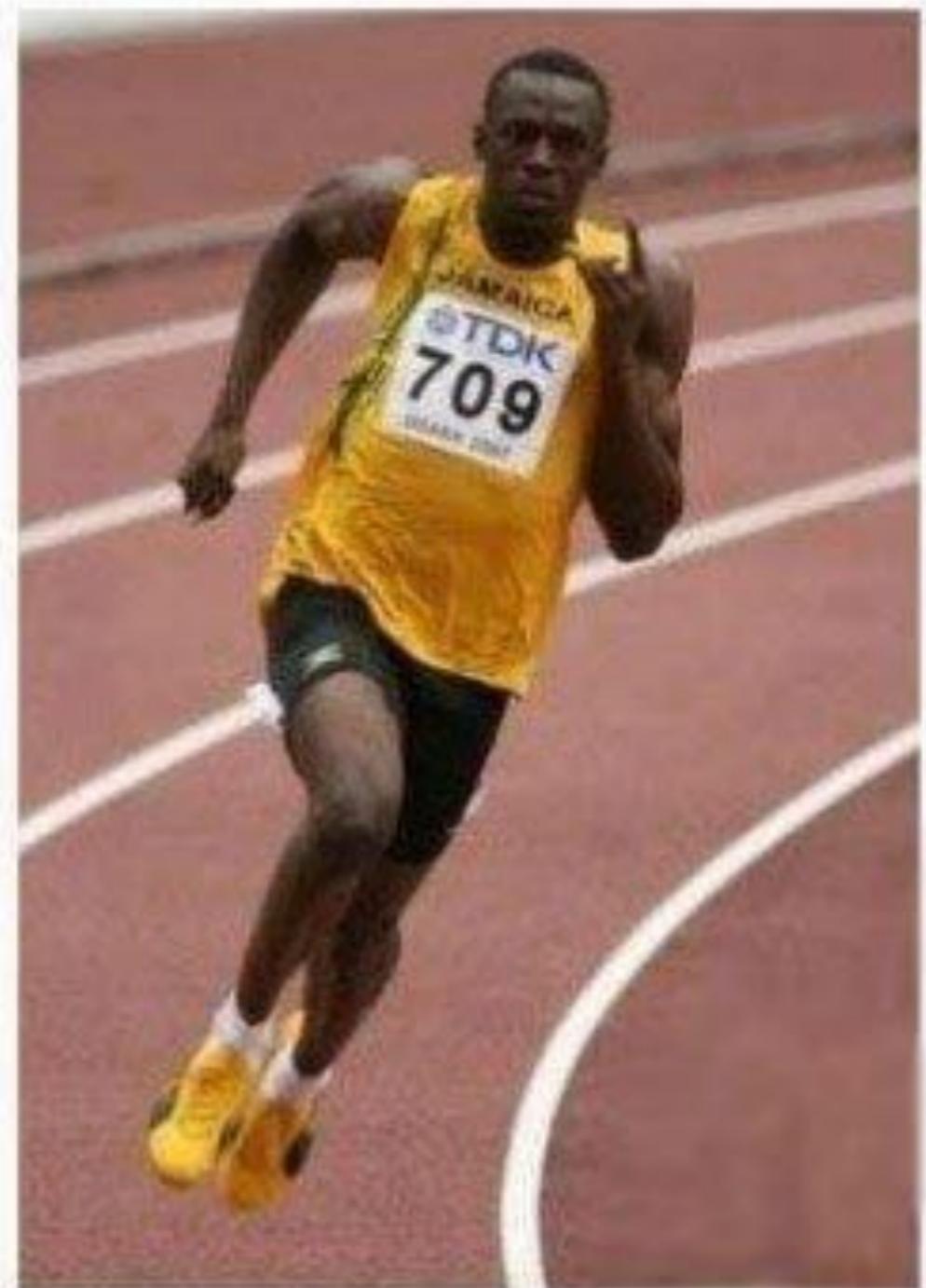
Major Point

Major Point

# Font Type Face



USAIN **BOLD**



USAIN *ITALIC*

# Font Combination



**Find the perfect font combo  
for your next project.**

Select a starter font



# Font Inspiration

typespiration

// treating typography with respect

[home](#) / [about](#) / [request invite](#) / [login](#) /  [rss](#)

[most recent](#) / [featured](#) / [designers](#)

51

824

78

537

18

## Lorem Ipsum

FEBRUARY 18, 2013

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Mauris facilisis, odio eget iaculis mattis, nullam volutpat metus mi ac arcu. Nunc fermentum id fermentum. Ut ac fringilla.

## Snow White

White is her skin, not hint of sun  
Black is her hair; that's coming undone  
Green is her eyes; brighter than safaris  
Red as a rose is her lips. Sweet as nectar

hy and Sweet, Innocent to the core.

She will mark you for shore.  
The queen of the realm.

— by LEXIE NIGHT

## Anti-wrinkle Inje

Dermal Filler is an injection that gently restore structure to the skin. Skin loss is one of the key factors of aging. Dermal fillers can help to rejuvenate the skin.

Fix the detective, had been working on a case which Passepartout had been assigned to. Delaying his departure for Paris, he consulted the priests of the cathedral.

Owing to the delay caused by Fix and the priests reached the conclusion that it was better to let and his servant, the magistrate,

MY DEAR, MY DEAR, MY DEAR  
YOU DO NOT KNOW ME BUT I KNOW YOU

NOW LET ME TELL YOU ABOUT THE FEELINGS  
WHEN I TRY, OR MAKE SOME SORT OF ATTEMPT

DAMN I WISH I WASN'T SUCH A HELL  
'CAUSE THEN I WOULD LET YOU KNOW THAT

AND IF I WAS YOUR MAN THEN I WOULD  
THE ONLY LYING I WOULD DO IS IN THE END  
THEN I SIGNED SINCEBLY THE ONE WHO LOVED ME

PS LOVE ME TENDER...

THE LETTER CAME BACK THREE DAYS  
RETURN TO SENDER... DAMN

8  
MAY

Maecenas a orci sit amet i  
sagittis vestibulum

Ut tellus nunc. Suspendisse ager vestibulum ut, velutbar vel lorem. Cumabitur a augue enim! Quod  
suecet fructuosa lectus et fermentum! Integer semper nullam nebris omnia imperpet. dignissim sagittis vestibula in, venus porta nisi. Fusce quis mauris eros. Praesentally  
Praesentibique vestibulum curius enim sit amet porta. Sed quis nisi nisi. Nullam colo  
vivuntate a spontanotor egositas. Sed non antenon diam consequat tempus. Vivamus  
portitor nulla dictum ac pretium non adscipio. Nulla convallis viverra pasciat! Re  
milia troque seruetus et netus et melissuadie firmas ac turpis egositas. [Read more](#)

AUTHOR  
[JONATHAN HARRIS](#)

CATEGORIES  
[ARTICLES](#) [FEATURES](#) [INTERVIEWS](#)

COMMENTS  
[1 COMMENT](#)

I n old time  
helped on  
whose daughter

But the youngest was s  
has seen so much, was

“

The best and  
most beautif  
things in the

# Animation



Today

> 3,600 years old





Today

1440

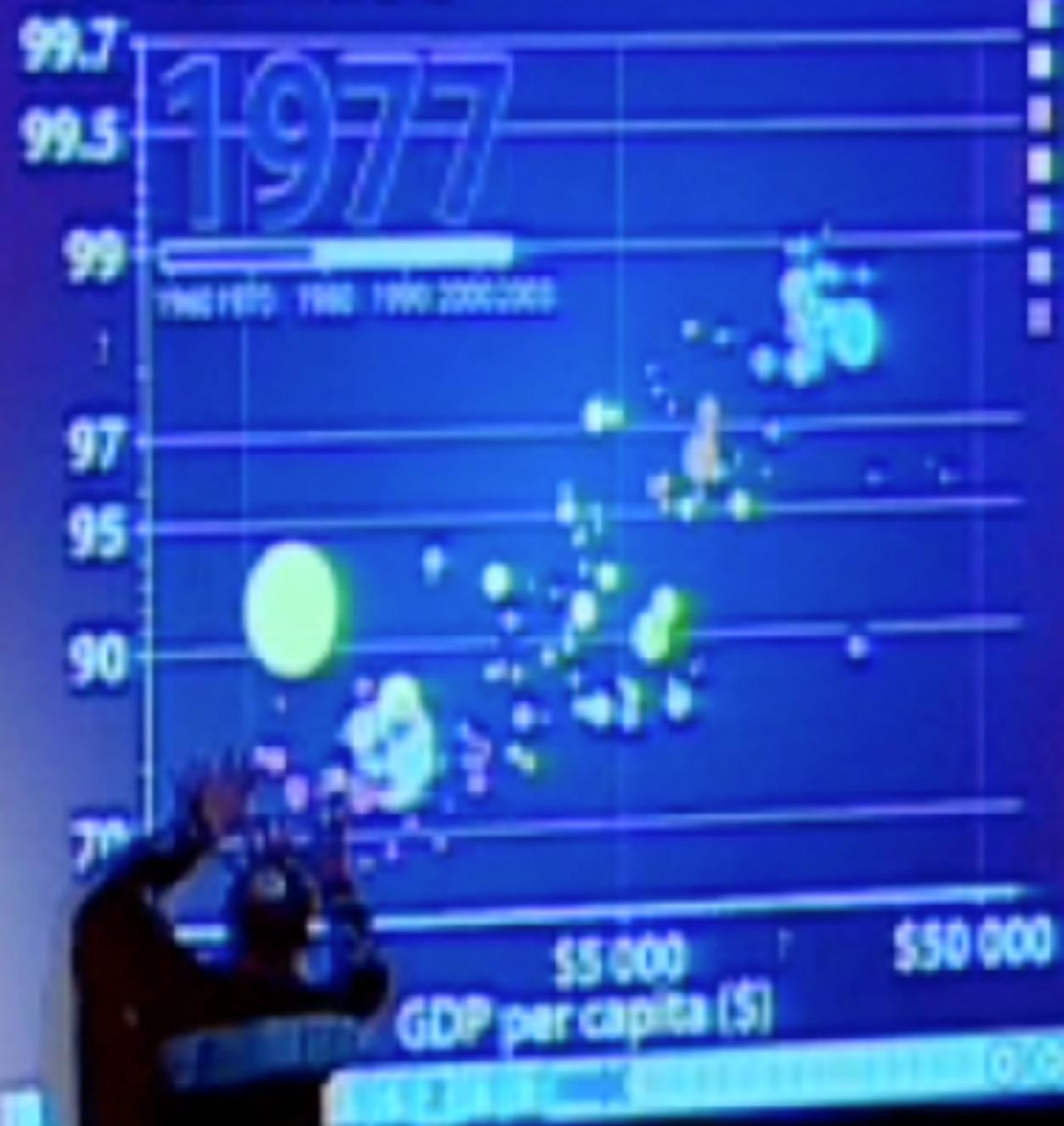


0AD

> 3,600 years old

1600BC

### Child survival (%)

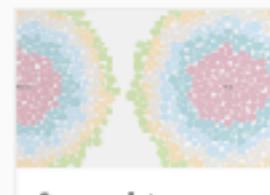


TED

# Examples



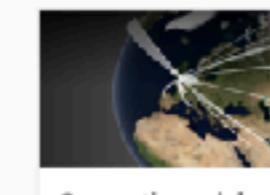
Bar chart race



Survey data



Magic charts



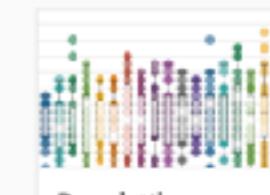
Connections globe



Zoomable hierarchies



Story maps



Box plotting

[Make your own](#)

Flourish makes it easy to create a mobile-friendly animated bar chart race complete with images.

[Click next!](#)

1 of 5

## Urban population by country

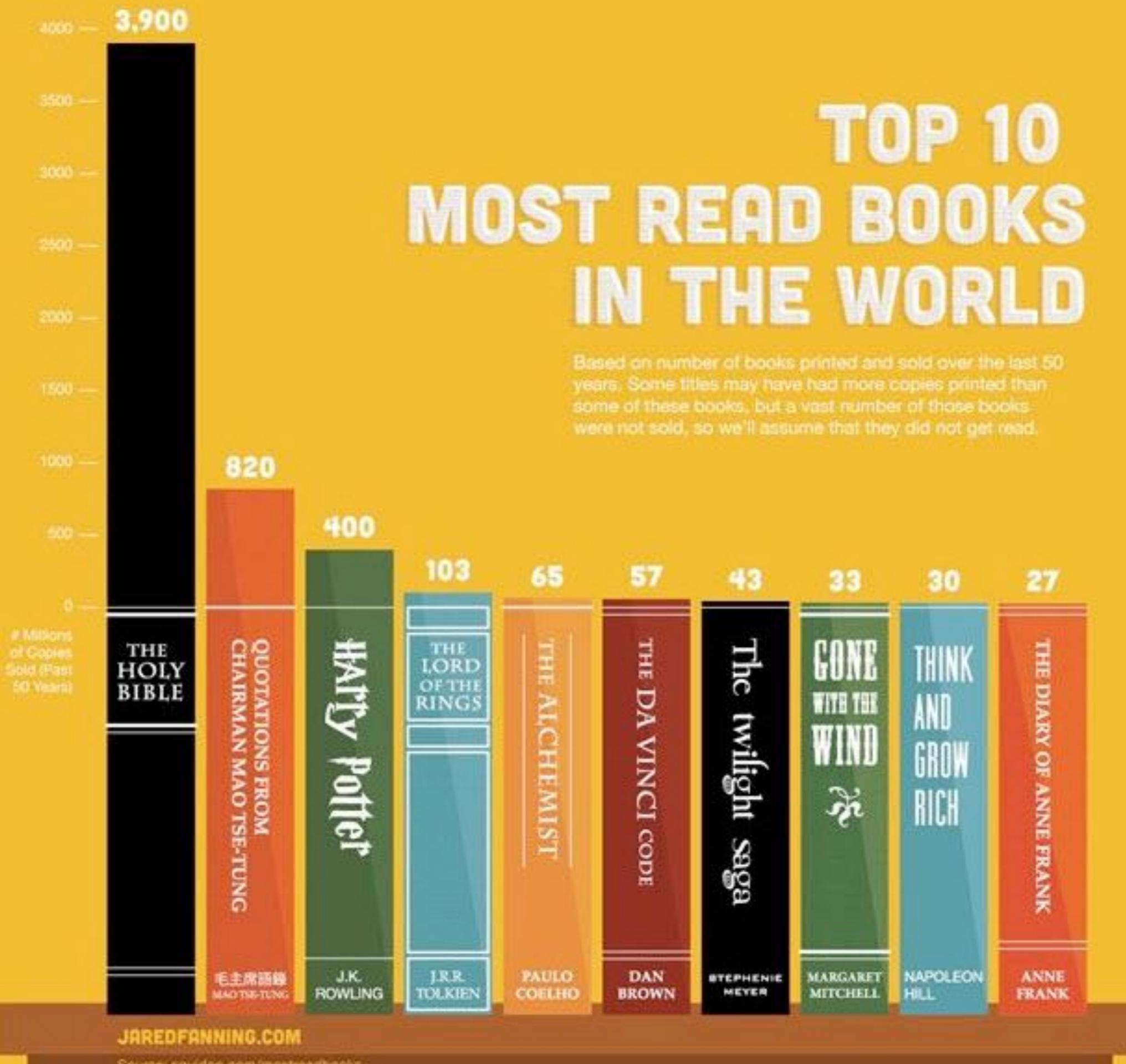
Coloured by continent. Click the legend to filter.

[Replay](#) [Highest](#) [Lowest](#)[Africa](#) [Americas](#) [Asia](#) [Europe](#) [Oceania](#)[Got a question?](#)

# How to Lie with Charts & Graphs

“Don’t assume ill intentions when haste,  
sloppiness, or ignorance is the more  
likely explanation

— Alberto Cairo







NFL / Mountain Dew

From Heinz' wiener dogs to Ryan Reynolds' Hyundai ad to Puppymonkeybaby, this year's ads were upbeat and, at times, hysterical.



Here are 10 of the most talked-about ads of the night. Vote for which one you like in our poll (and watch all the ads below)!

Thank You Kate Hudson - We  
Felt So Comfortable  
Fabletics

## Poll Results - What was your favorite Super Bowl ad?

[More from TODAY.com](#)

Audi – David Bowie

**1062**  
Votes



Mountain Dew – Puppymonkeybaby

**1311**  
Votes

Marilyn Dafoe? Marilyn Monroe?  
Snickers' hilarious Super Bowl a

Doritos – Ultrasound

**5815** Votes

advertisement

Budweiser – The Bud Light Party

**517**  
Votes

IT'S CASH BACK  
WITH A CASH BACK  
ENCORE.

Hyundai – Ryan Reynolds

**1209**  
Votes

THE CITI®  
DOUBLE CASH CARD.

1% ON YOUR PURCHASES + 1% AS YOU PAY FOR THEM



# **Headline News**

**Headline News**

**25,255,000\*\***

**MSNBC**

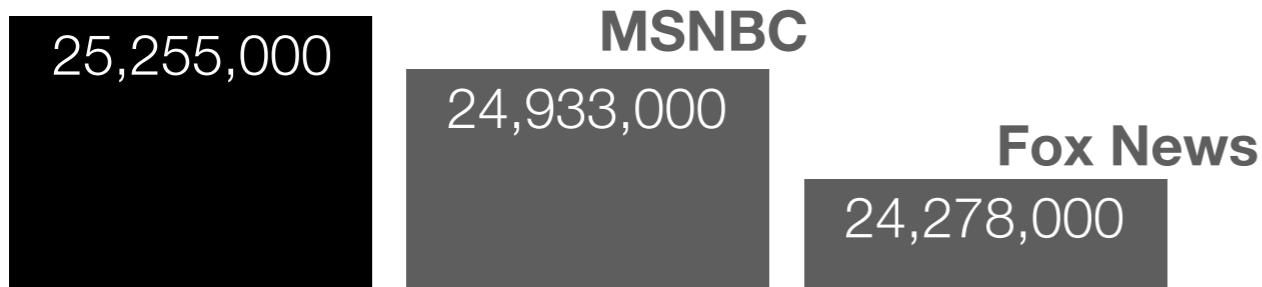
**24,933,000\*\***

**Fox News**

**24,278,000\*\***

**Headline News is watched by more Adults 25-54 each month than MSNBC or Fox News.**

## **Headline News**



**Headline News**

25,255,000

**MSNBC**

24,933,000

**Fox News**

24,278,000

**Headline News**  
**MSNBC**

25,255,000

24,933,000

**Fox News**

24,278,000

# OBAMACARE ENROLLMENT

7,100,000

ACTUAL  
ENROLLMENT

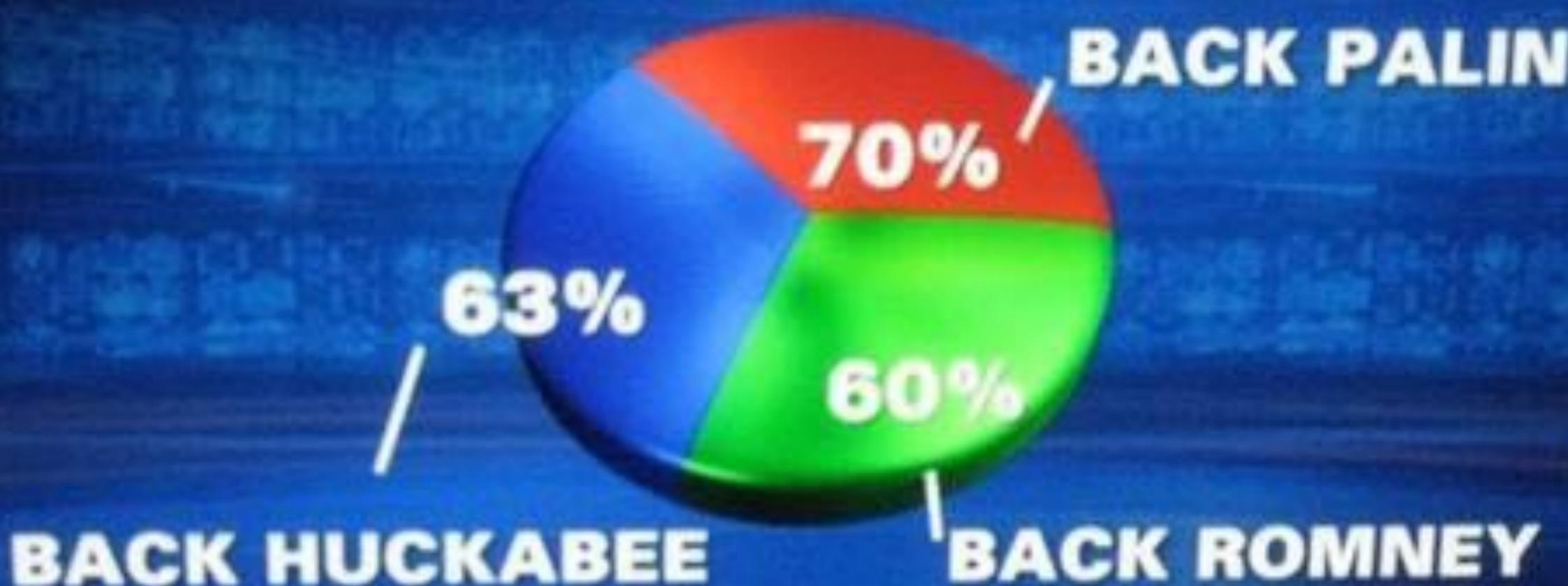
7,000,000

GOAL



# 2012 PRESIDENTIAL RUN

GOP CANDIDATES



SOURCE: OPINIONS  
DYNAMIC



# WHO DO YOU TRUST MORE?

CNN  
MSNBC  
FOX NEWS

NETWORK

48%

45%

30%

TRUMP

35%

32%

20%

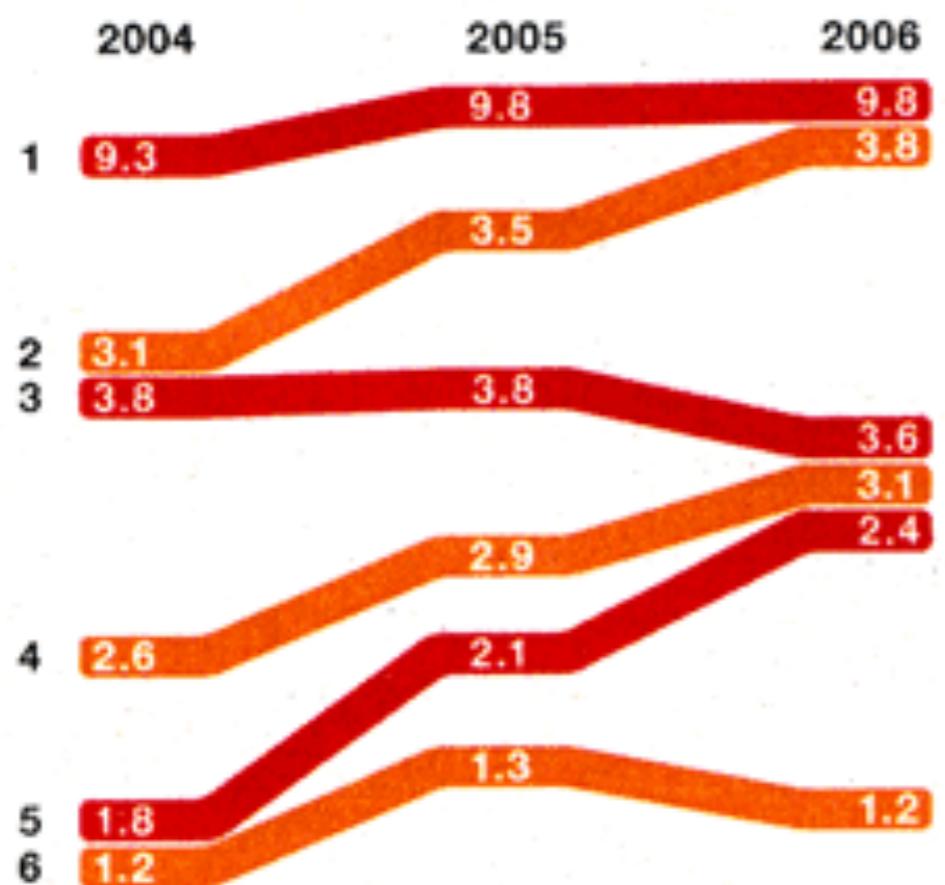


MONMOUTH UNIVERSITY  
MARCH 2-5  
603 ADULTS +/- 3.5%

TIGHT SHOT

## THE AD BUYERS

Advertising spending by selected major industries, in billions.

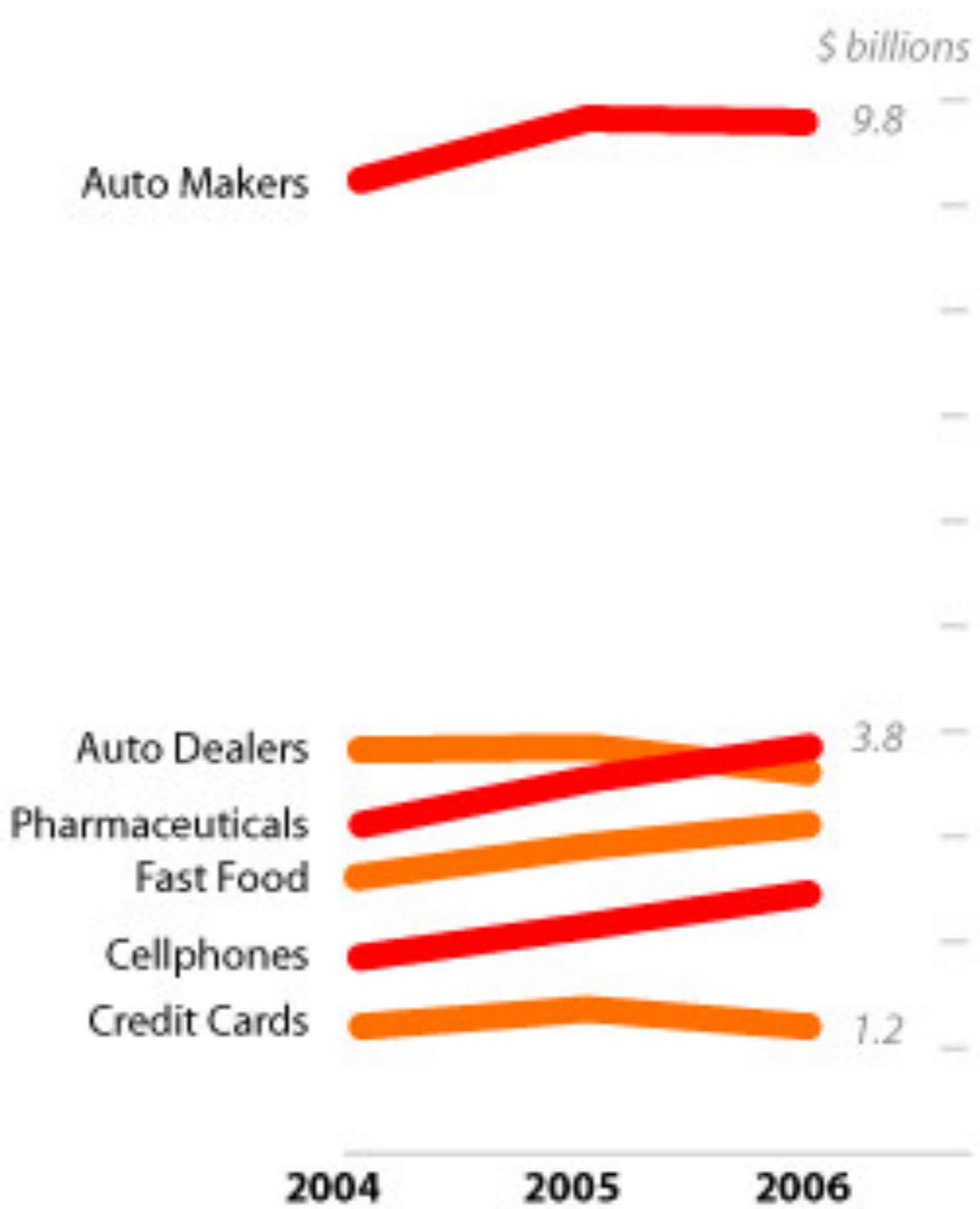
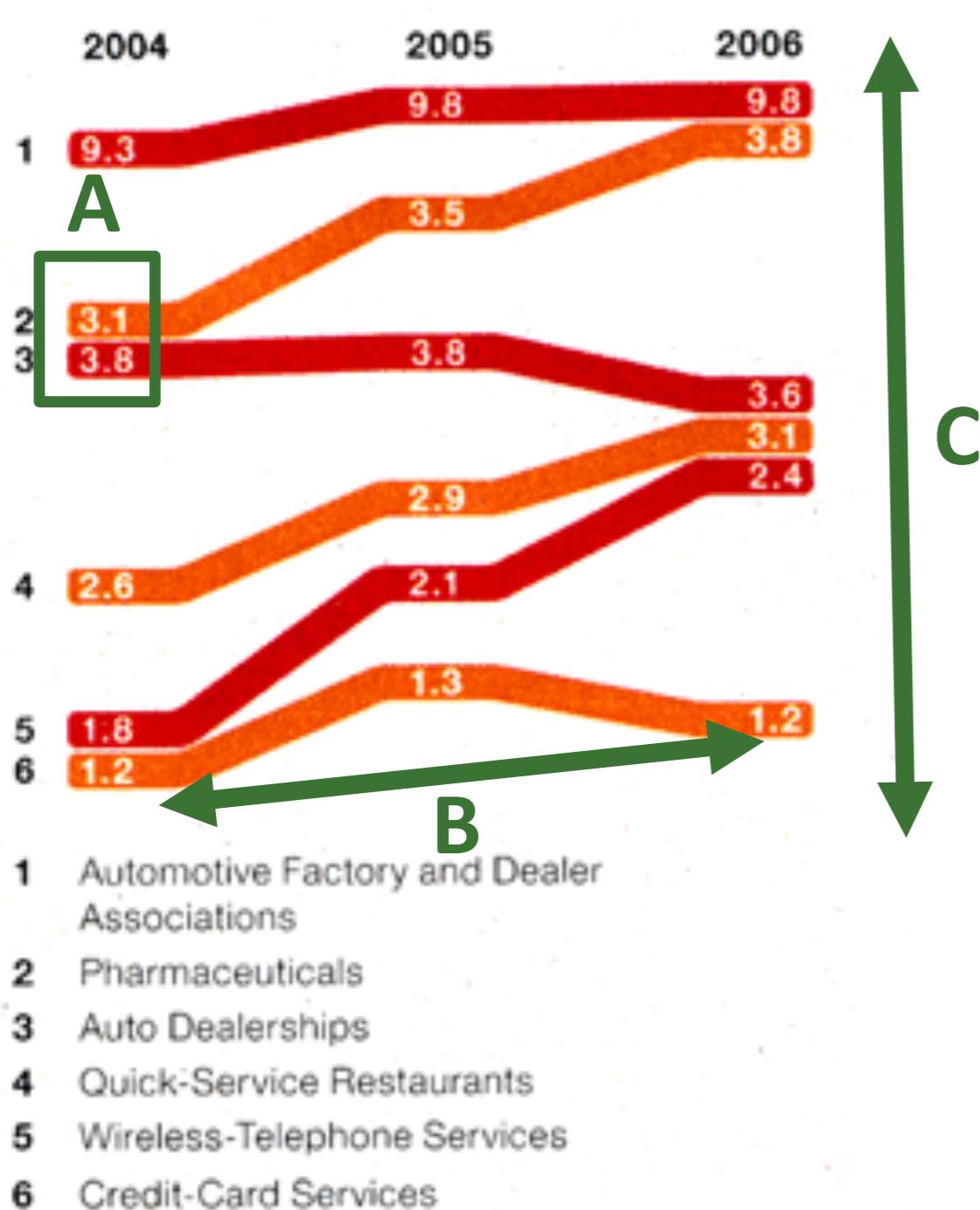


- 1 Automotive Factory and Dealer Associations
- 2 Pharmaceuticals
- 3 Auto Dealerships
- 4 Quick-Service Restaurants
- 5 Wireless-Telephone Services
- 6 Credit-Card Services

Source: Nielsen Monitor-Plus, a service of  
Nielsen Media Research  
Chart by Catalogtree

## THE AD BUYERS

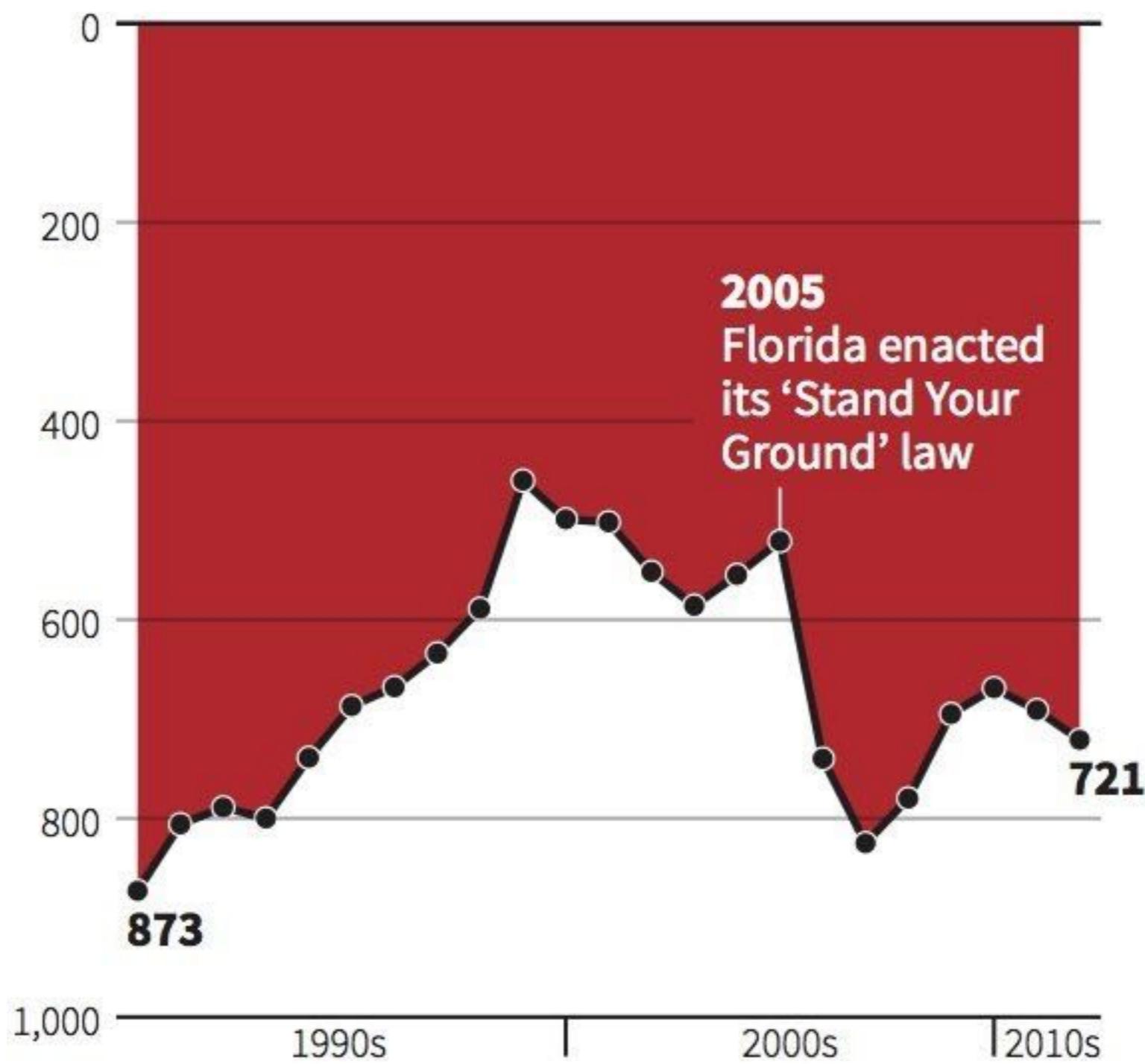
Advertising spending by selected major industries, in billions.



Source: Nielsen Monitor-Plus, a service of  
Nielsen Media Research  
Chart by Catalogtree

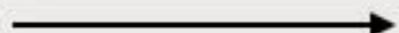
# Gun deaths in Florida

Number of murders committed using firearms

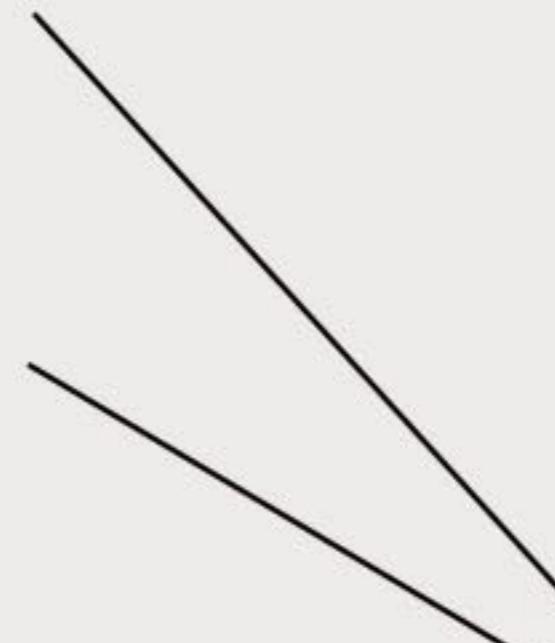


Source: Florida Department of Law Enforcement

MAP



REDUCE



# WTF Visualizations

Visualizations that make no sense.

For a discussion of what is wrong with a particular visualization, tweet at us [@WTFViz](#).

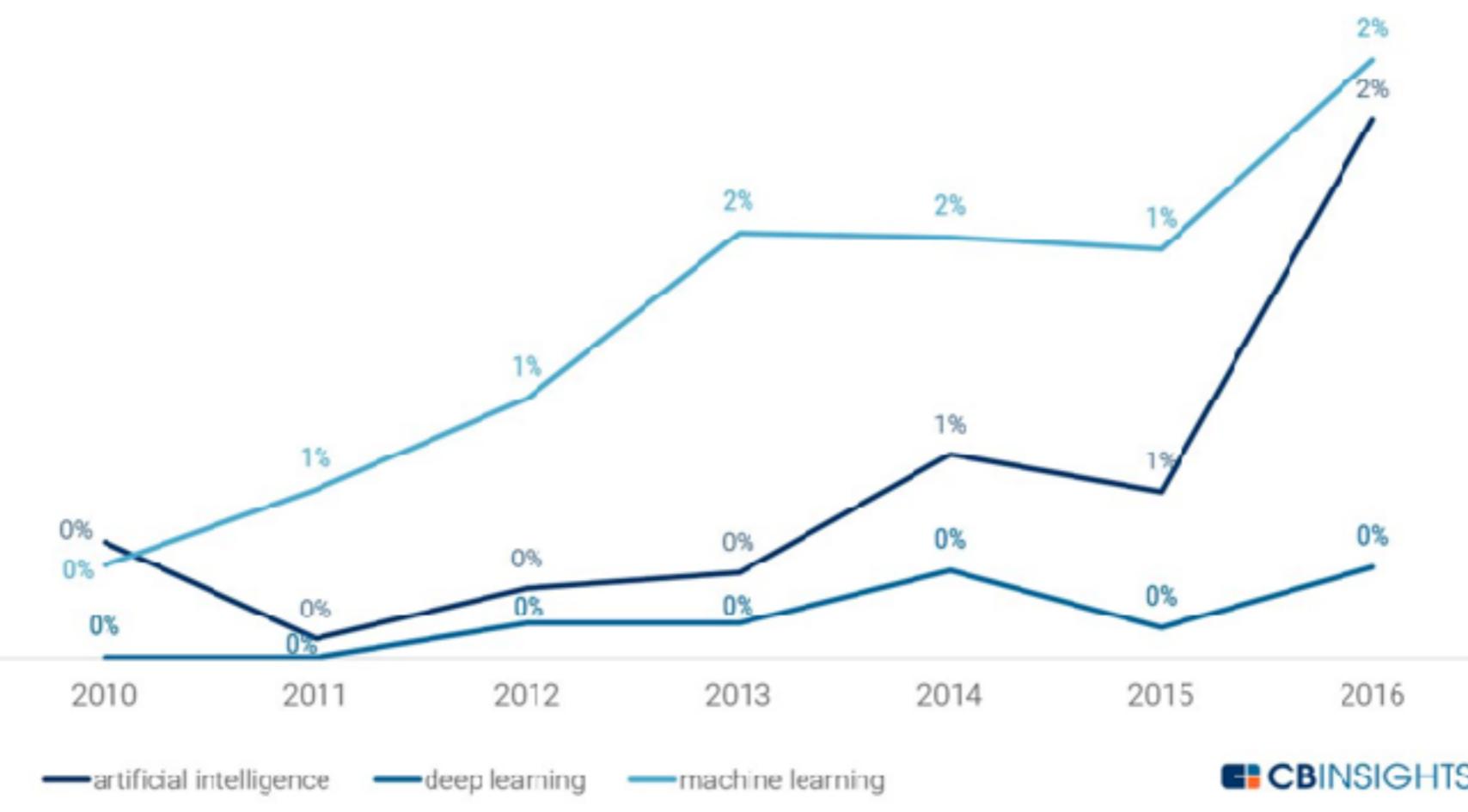
[Submit a WTFViz you found.](#)

[SUBMIT](#)    [ARCHIVE](#)



## LEARNING HOW TO LEARN

Percentage of VC-backed companies with certain words in their company description over time



The largest 0% ... (from [@minamaxlr](#))

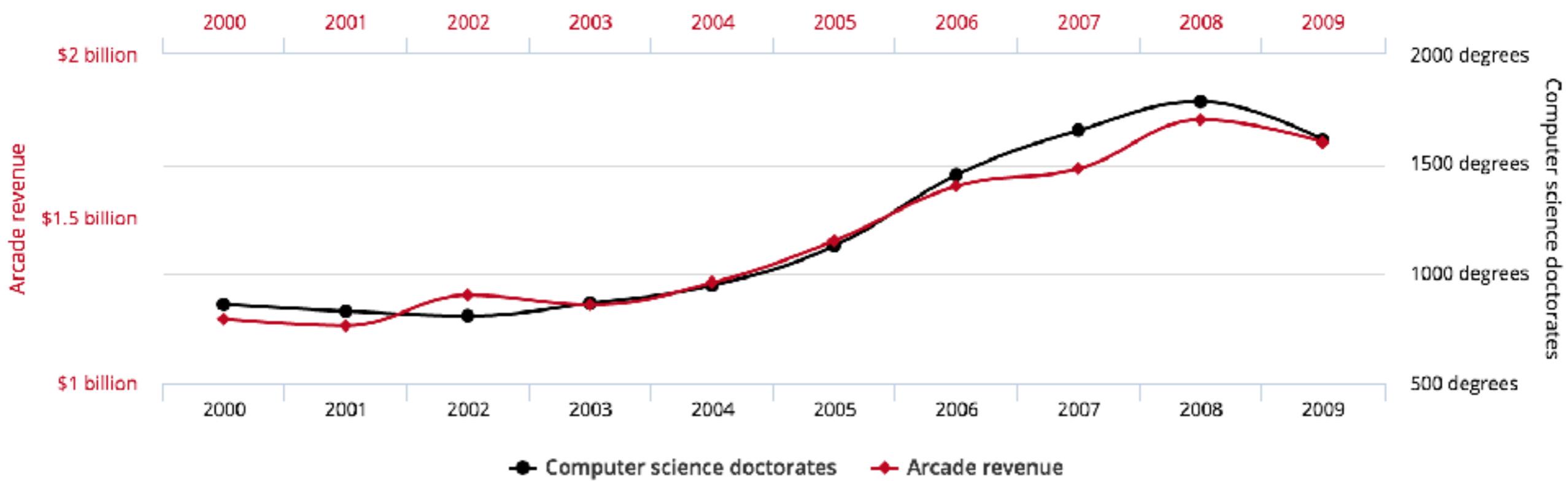
Submit a Viz that makes you go WTF?!

Source: [viz.wtf](#)

# Total revenue generated by arcades correlates with Computer science doctorates awarded in the US



Correlation: 98.51% ( $r=0.985065$ )



Data sources: U.S. Census Bureau and National Science Foundation

[tylervigen.com](http://tylervigen.com)

Source: [tylervigen.com/spurious-correlations](http://tylervigen.com/spurious-correlations)

# Exercises

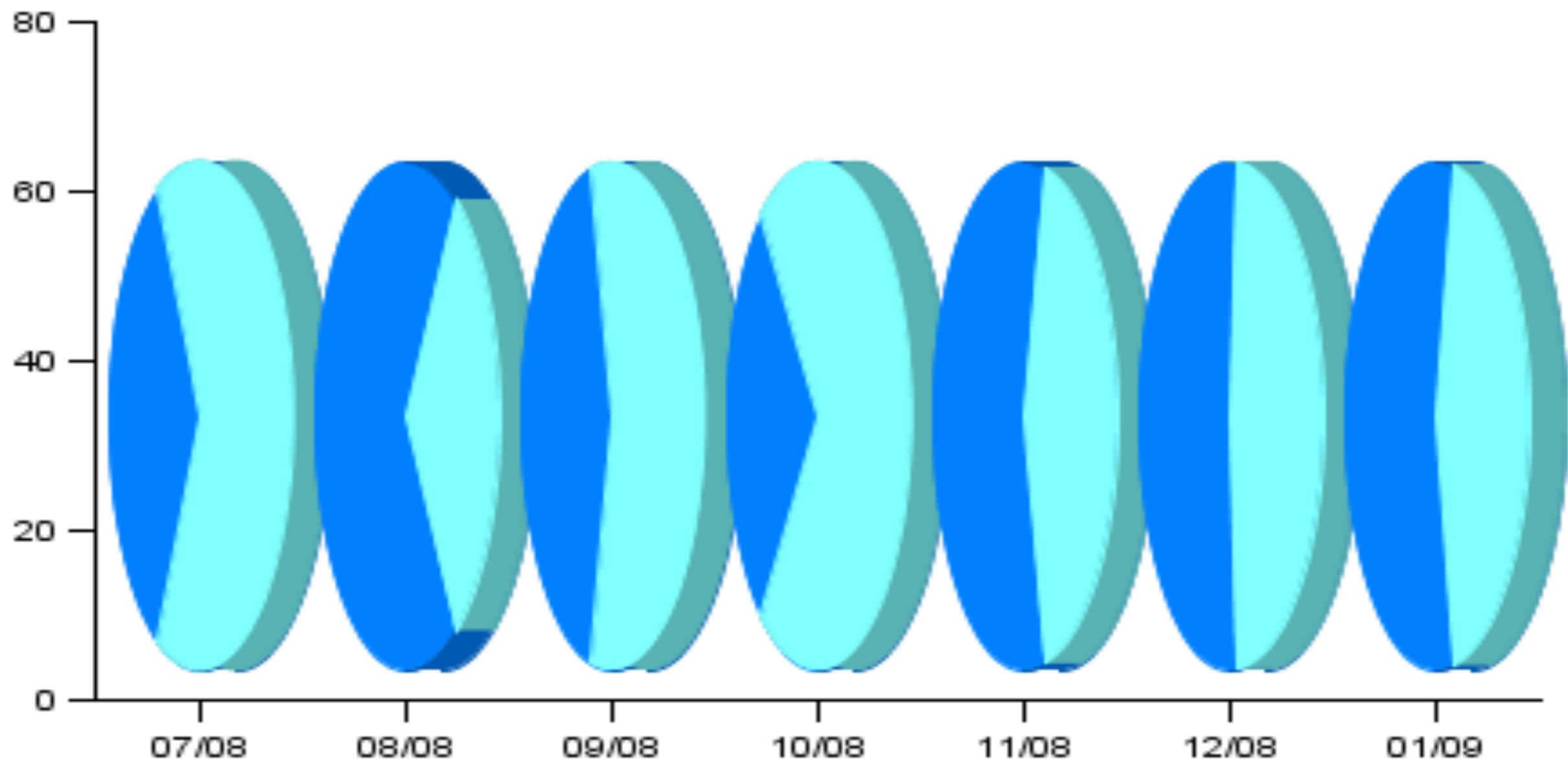
# Exercise

Please evaluate the following as they relate to your perceptions of safety and security	n	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Mean	Sd. Dev.
<b>Feeling of safety and security:</b>							
...inside your residence hall room	5,495	1.0	1.6	49.4	48.0	3.44	0.58
...inside your residence hall in general	5,466	.7	2.3	52.9	44.2	3.41	0.57
...immediately outside and near your residence hall	5,462	.8	5.3	59.5	34.4	3.27	0.60
...on campus in general	5,456	1.0	5.5	65.4	28.1	3.21	0.58

Note: Mean scores are based on the following scale: 1=very dissatisfied to 4=very satisfied.

# Exercise

**Single Series - Vertical - 10 Pixel Depth w/Pie Vertical Bars**



# Tom Crawford

 thcrawford

 @thcrawford  
@viznetwork

 viznetwork.com

