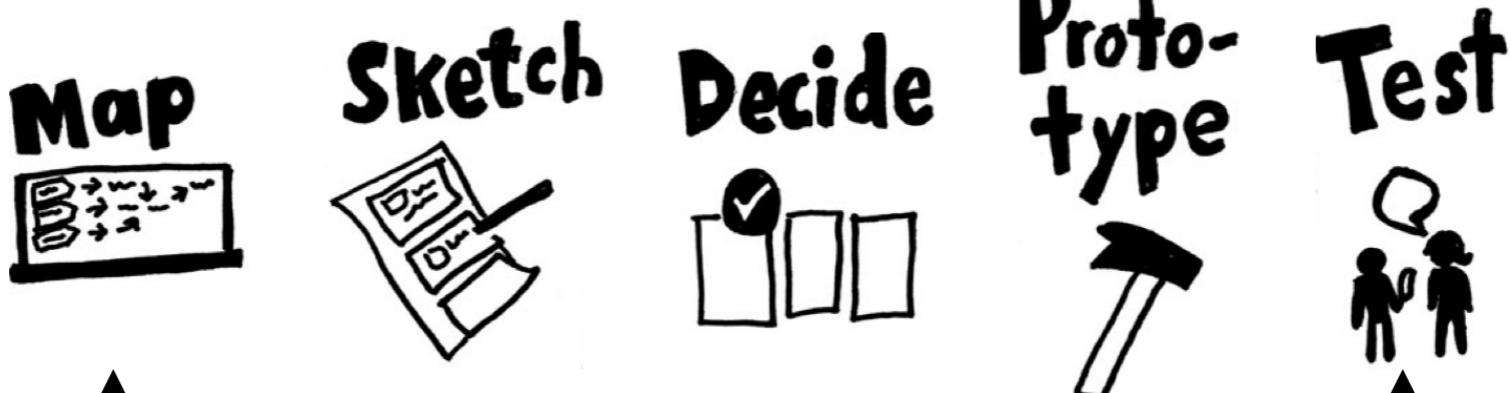


# Course Schedule

Day One: EXPLORE		Day Two: EXPLAIN	
8:00–8:30	Breakfast	8:00–8:30	Breakfast
8:30–9:30	<b>Welcome &amp; Introduction</b> <ul style="list-style-type: none"> <li>▪ What? Why? Who? How?</li> <li>▪ Design Sprint: Overview &amp; Team Formation</li> </ul>	8:30–8:45	<b>Welcome &amp; Review</b>
9:30–10:00	<b>Map - Charts</b> <ul style="list-style-type: none"> <li>▪ What's The Question? Who Is the Audience?</li> </ul>	8:45–10:00	<b>Map - Story</b> <ul style="list-style-type: none"> <li>▪ Data Stories</li> <li>▪ What Is The Message?</li> <li>▪ Design Sprint: Messages</li> </ul>
10:00–10:15	Break	10:00–10:15	Break
10:15–12:00	<b>Map - Charts (cont.)</b> <ul style="list-style-type: none"> <li>▪ Design Sprint: Map</li> <li>▪ What is the data?</li> <li>▪ Tableau: Introduction &amp; Data</li> <li>▪ Effective Visualizations</li> <li>▪ Graphical Integrity &amp; Keep it Simple</li> </ul>	10:15–12:00	<b>Sketch - Story</b> <ul style="list-style-type: none"> <li>▪ Dashboards</li> <li>▪ Design Sprint: Tableau Dashboards</li> <li>▪ Storyboards</li> <li>▪ Design Sprint: Storyboard Sketching</li> </ul>
12:00–1:00	Lunch (Group Photo After Lunch)	12:00–1:00	Lunch
1:00–2:00	<b>Sketch - Charts</b> <ul style="list-style-type: none"> <li>▪ Sketching</li> <li>▪ Choose the Right Chart</li> </ul>	1:00–2:00	<b>Decide &amp; Prototype - Story</b> <ul style="list-style-type: none"> <li>▪ Design Sprint: Tableau Storyline</li> <li>▪ Perception: Contrast, Color, C.R.A.P.</li> <li>▪ Design Sprint: Dashboard Iteration</li> </ul>
2:00–2:10	Break	2:00–2:10	Break
2:10–2:30	<b>Sketch - Charts (cont.)</b> <ul style="list-style-type: none"> <li>▪ Design Sprint: Sketch</li> </ul>	2:10–3:00	<b>Test - Story</b> <ul style="list-style-type: none"> <li>▪ Evaluation Methods</li> <li>▪ Think-Aloud Studies</li> <li>▪ Design Sprint: Test</li> </ul>
2:30–2:45	<b>Decide - Charts</b> <ul style="list-style-type: none"> <li>▪ Design Sprint: Decide</li> </ul>	3:00–3:10	Break
2:45–3:15	<b>Prototype - Charts</b> <ul style="list-style-type: none"> <li>▪ Tableau Prototype</li> </ul>	3:10–4:00	<b>Show &amp; Tell</b> <ul style="list-style-type: none"> <li>▪ Design Sprint: Iteration</li> <li>▪ Show &amp; Tell Presentations</li> </ul>
3:15–3:30	Break	4:00–4:30	<b>Program Wrap-Up (Evaluation, Certificates)</b>
3:30–4:00	<b>Prototype - Charts (cont.)</b> <ul style="list-style-type: none"> <li>▪ Tableau Prototype</li> </ul>		
4:00–4:15	<b>Day 1 Wrap-Up</b>		
4:15–5:00	<b>Reception</b>		

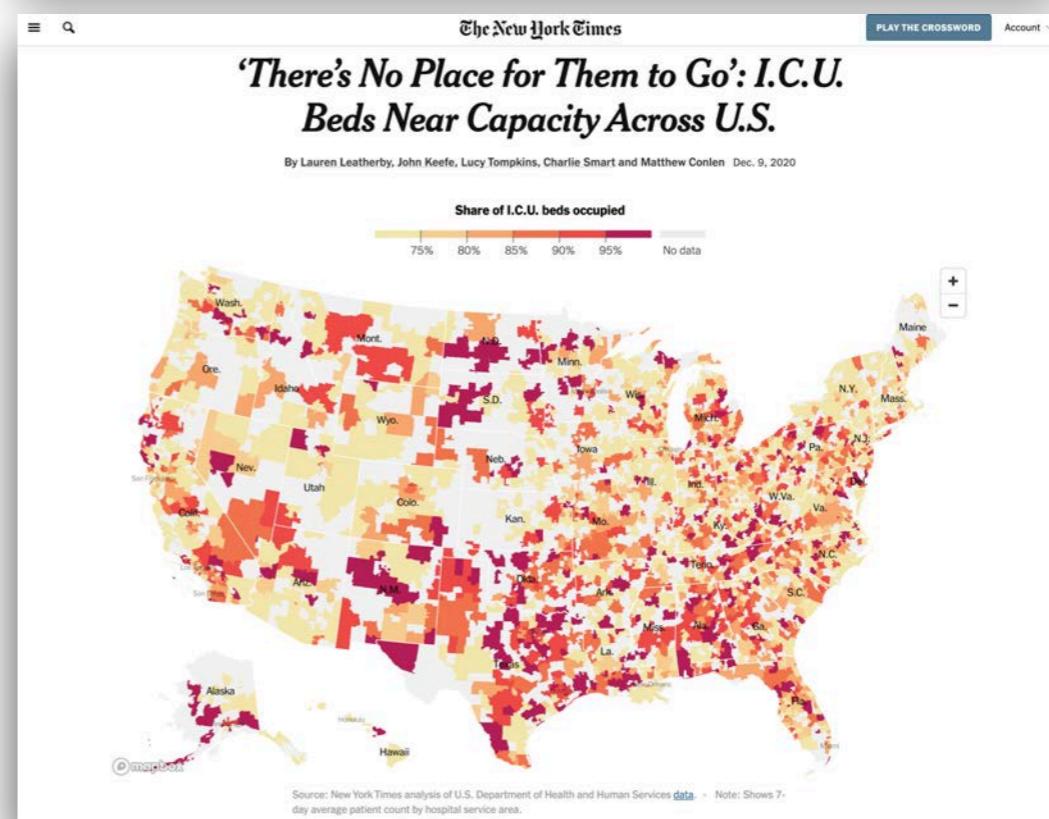
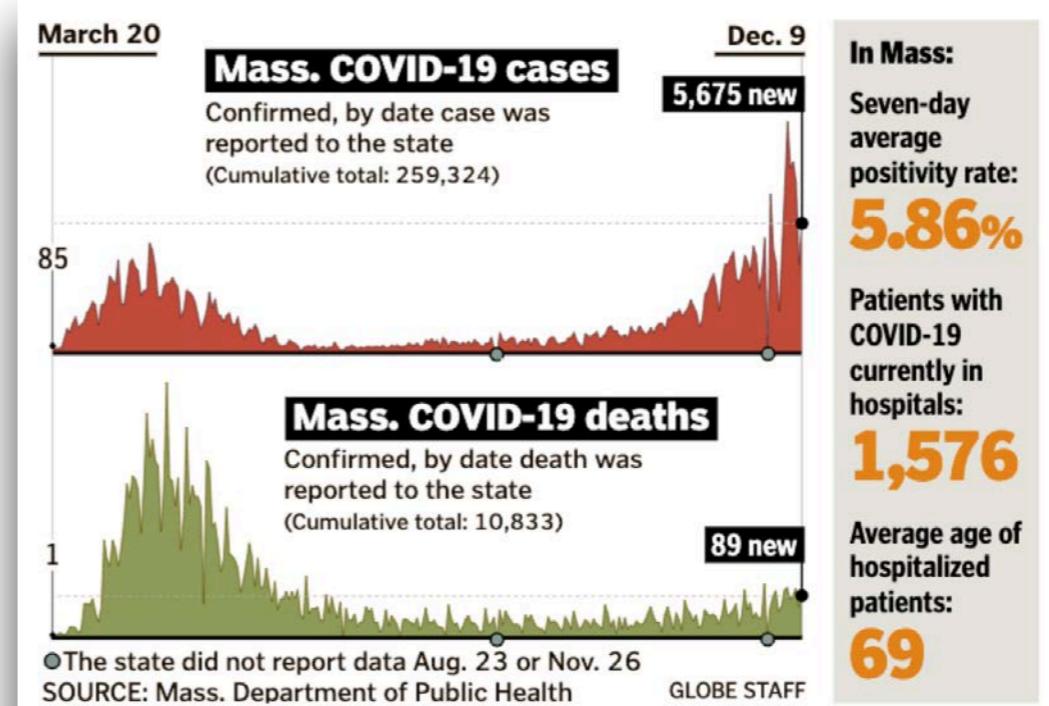
# Introduction

- What? Why? Who? How?
- Design Sprint - Overview & Teams

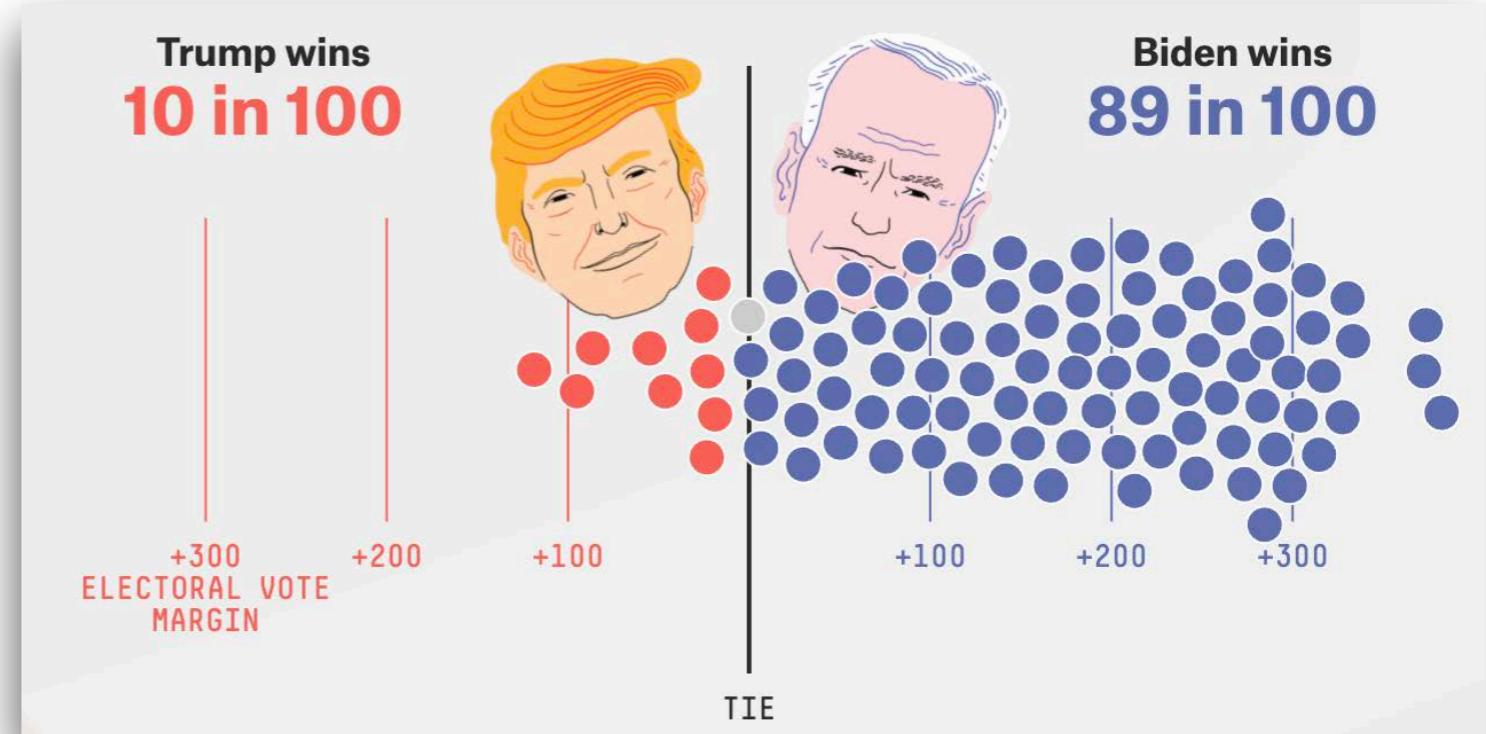
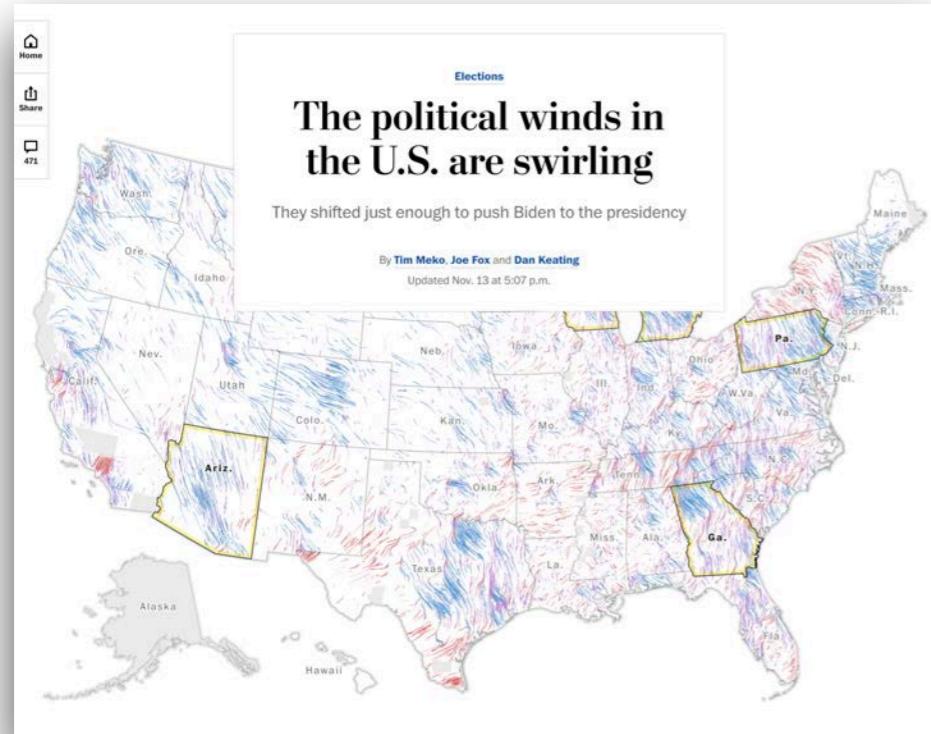
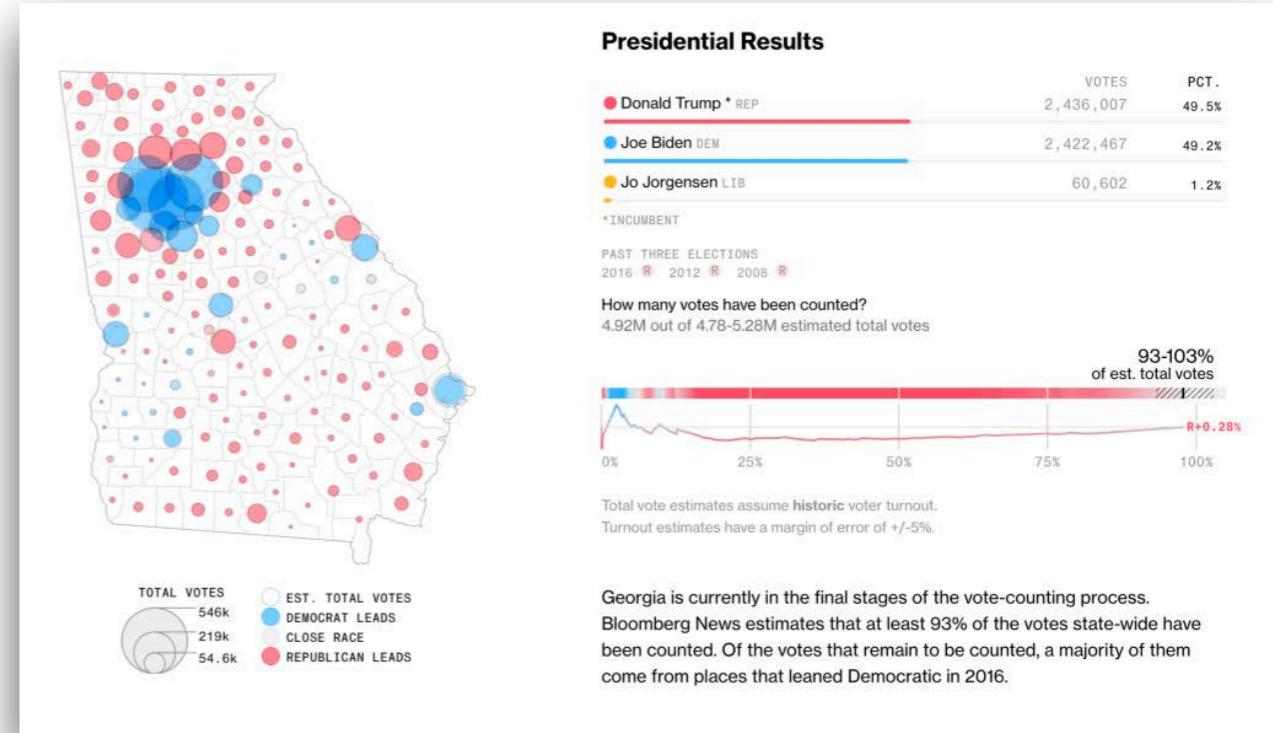
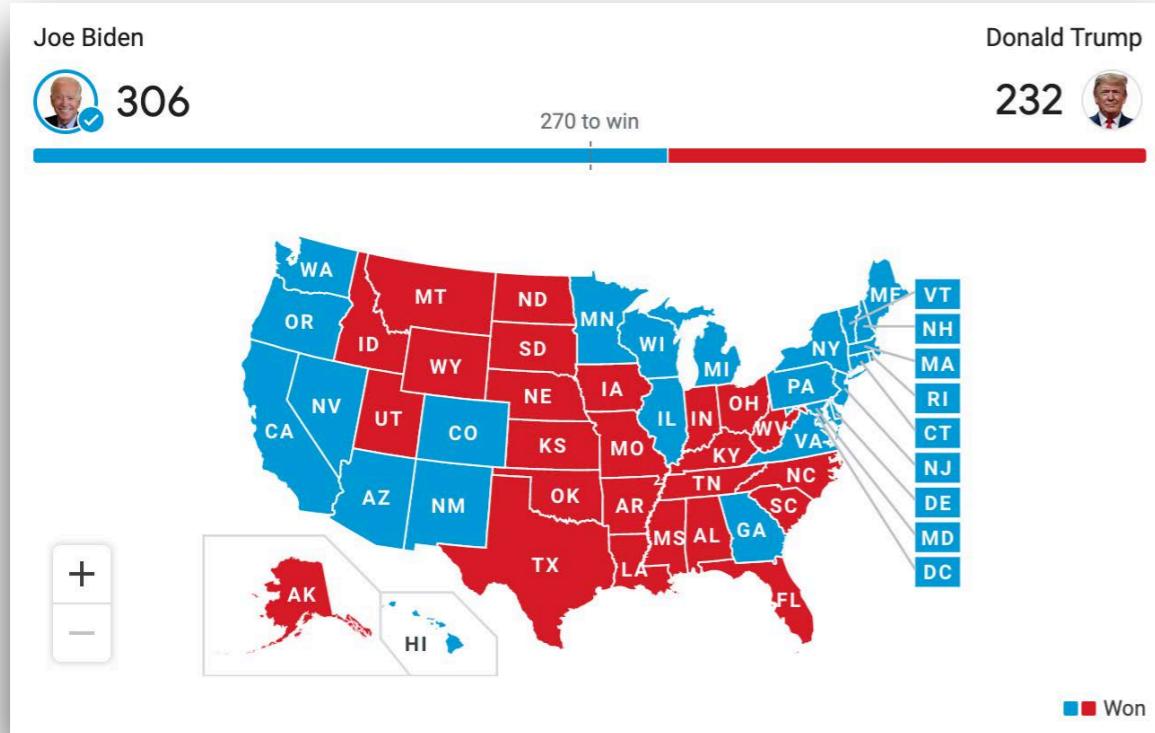


What?

# Visualization in the News



# Visualization in the News



# Activity

The National Association of Law Placement (NALP) reports that in 2012, lawyers made \$80,798 on average in starting salary.

On a sticky note, sketch what you think the distribution of those salaries looks like.

X-axis: salaries

Y-axis: # lawyers with those salaries

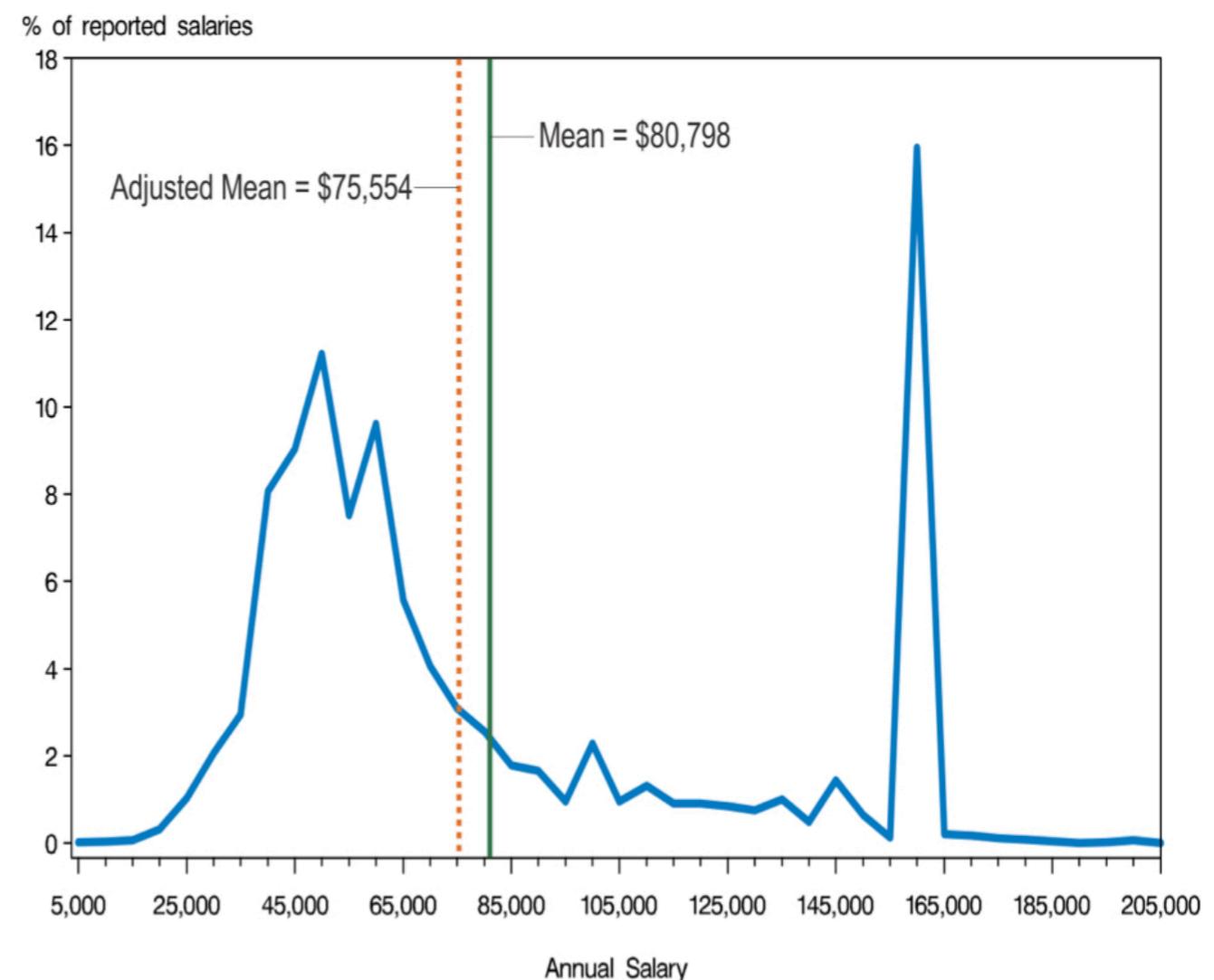
# A Real World Example

## Distribution of starting salaries for new law graduates

The National Association of Law Placement (NALP) reports that in 2012, lawyers made \$80,798 on average in starting salary.

However a look at the salary distribution shows what law salaries really look like:

Bimodal distribution with two peaks



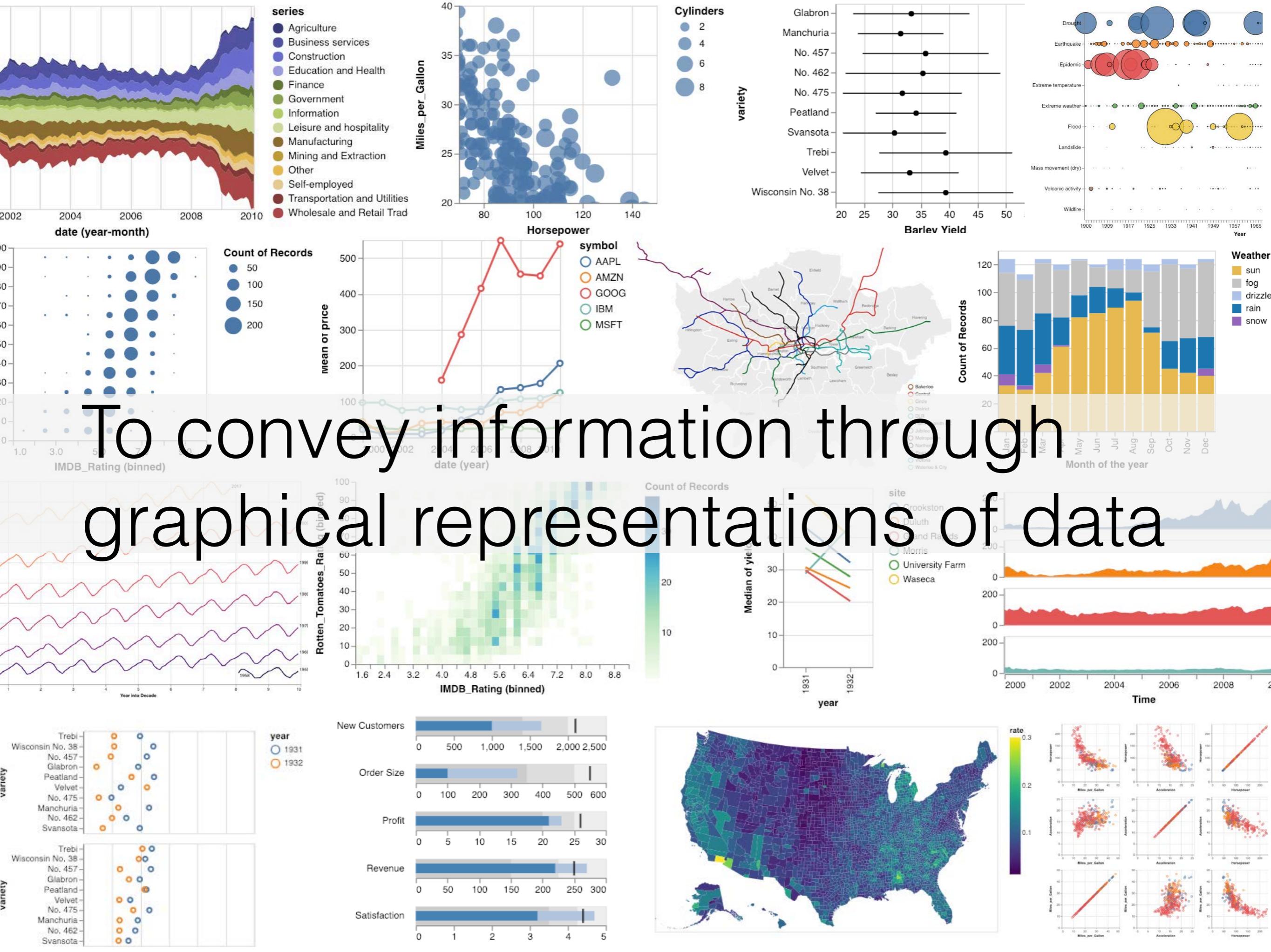
© NALP 2013

# What is visualization?



vi·su·al·i·za·tion

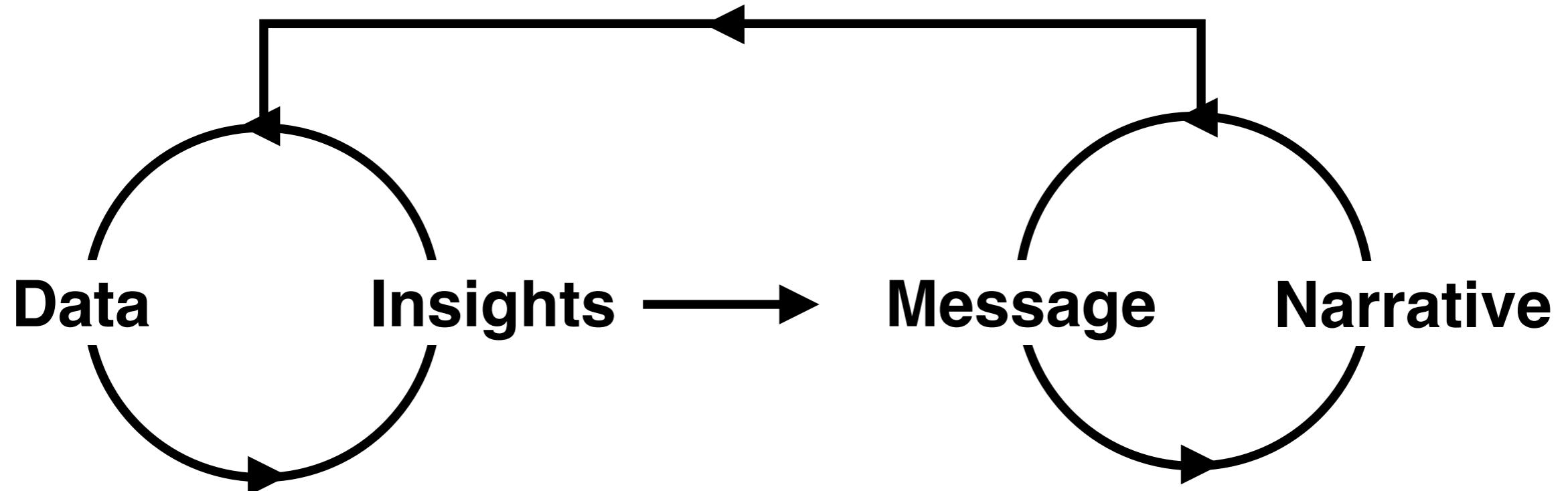
1. Formation of mental visual images
2. The act or process of interpreting in visual terms or of putting into visible form



# Visualization Goals

**Exploration**

**Explanation**



# Data Exploration

[bit.ly/dvc-coronasim](http://bit.ly/dvc-coronasim)

The New York Times

OPINION | Trump Wants to 'Reopen America.' Here's What Happens if We Do.



## Population

Do you want to see outcomes for the U.S.  
or the world?

United States

World

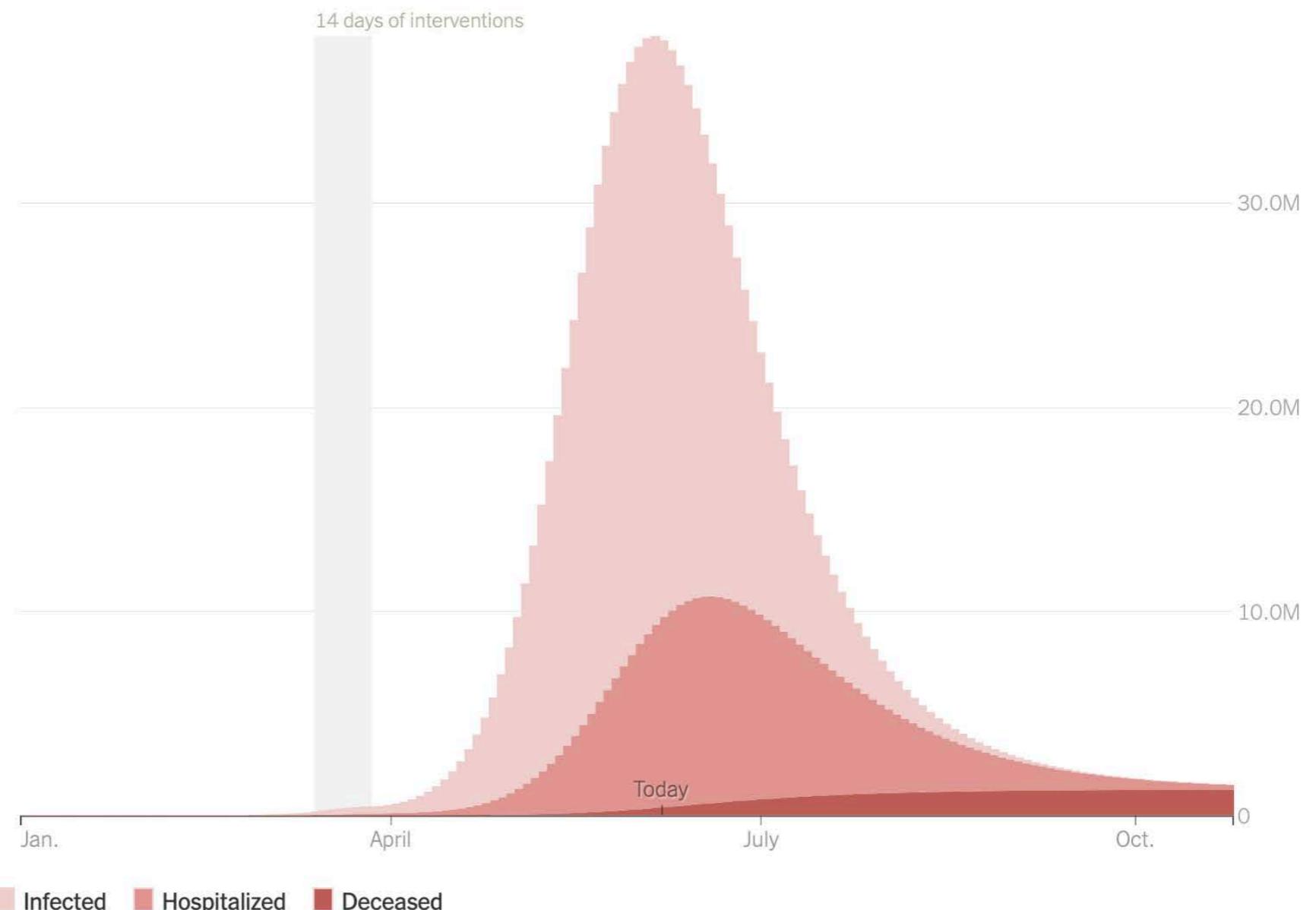
## Length of intervention: 14 days

Will we practice social distancing and other interventions for a long time or just a short while?

Drag

## Intervention level: Moderate

An aggressive response includes drive-thru testing, social distancing and closed businesses and transportation; almost everything shuts down.



NYT, March 25, 2020

# Data Journalism

WORLD COUNTRIES ▾ | U.S.A. STATES ▾ N.Y.C.

## Coronavirus in the U.S.: Latest Map and Case Count

By The New York Times Updated June 6, 2020, 12:18 A.M. E.T.



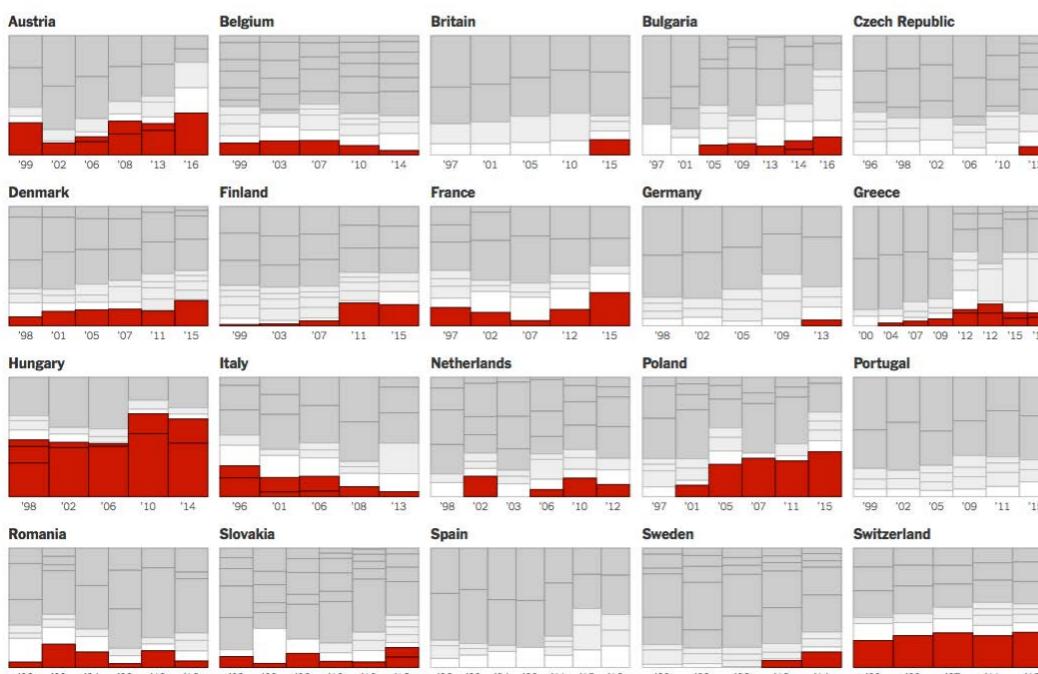
More than 1,911,500 people in the United States have been infected with the coronavirus and at least 109,200 have died, according to a New York Times database. This map shows where the number of new cases is rising and where it is falling in the last 14 days.

## How Far Is Europe Swinging to the Right?

By GREGOR AISCH, ADAM PEARCE and BRYANT ROUSSEAU UPDATED December 5, 2016

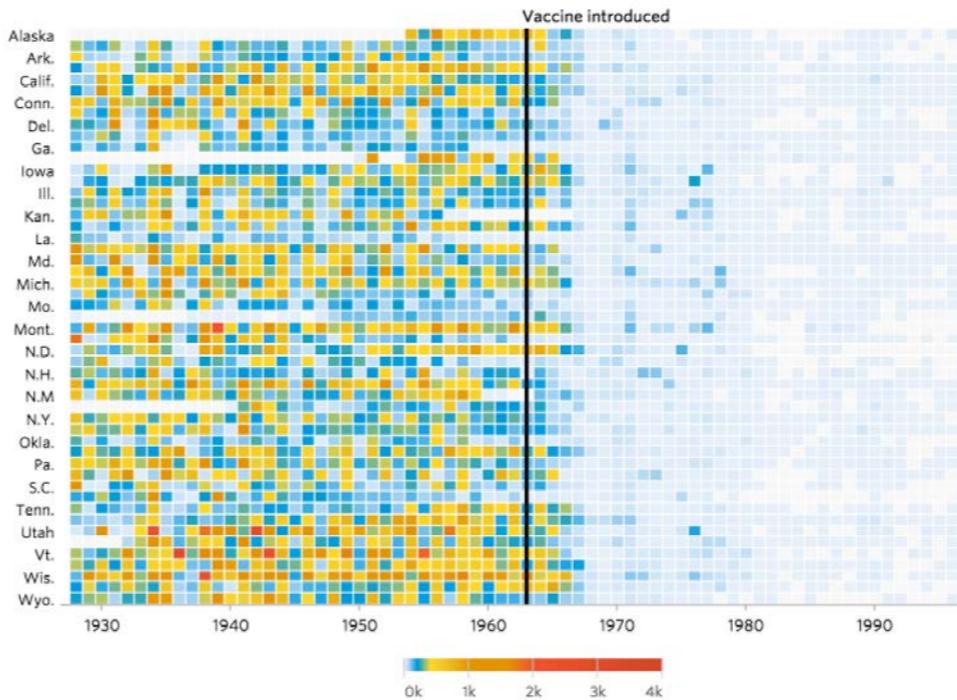
Amid a migrant crisis, sluggish economic growth and growing disillusionment with the European Union, right-wing parties in a growing number of European countries have made electoral gains. The right-wing parties included below range across a wide policy spectrum, from populist and nationalist to far-right neofascist.

Party ideology in parliamentary elections\* Center-left, center-right Other parties Right-wing and far-right

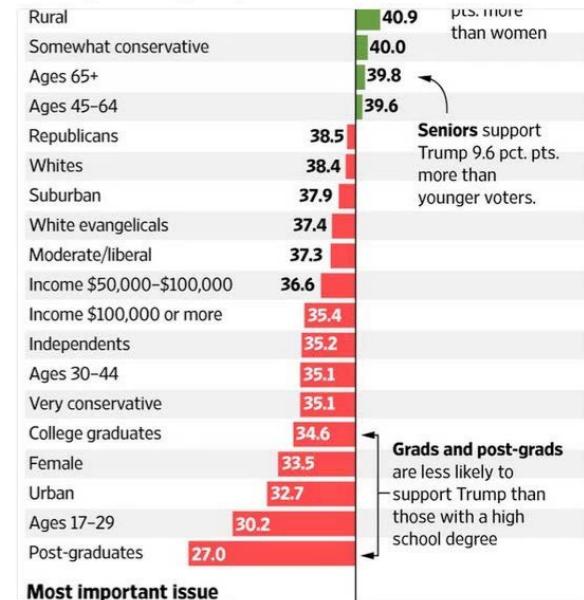


\*The 2016 presidential elections in Austria and Bulgaria and the 2015 French regional elections are included to add a more recent result for those countries.

## Measles



## Inside the Trump coalition: How he performs among voter groups

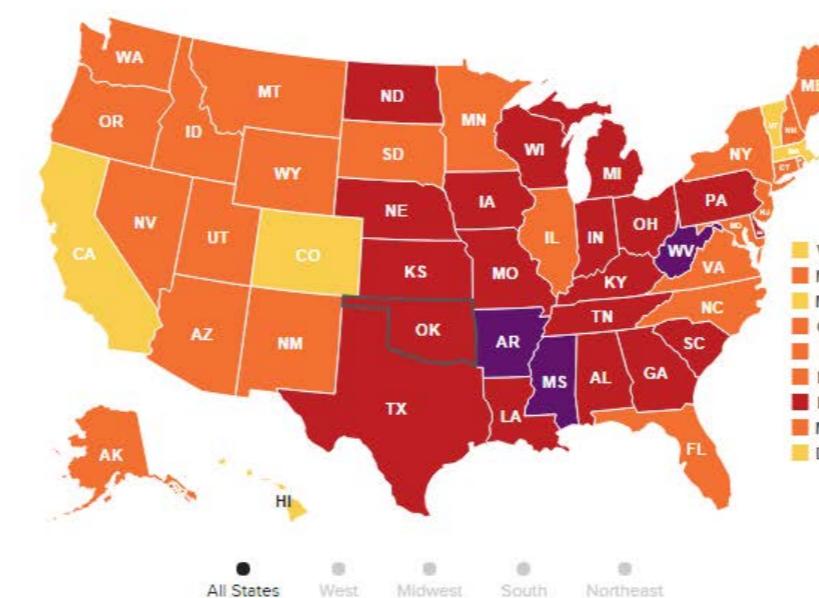


## Adult Obesity Rate by State, 2014

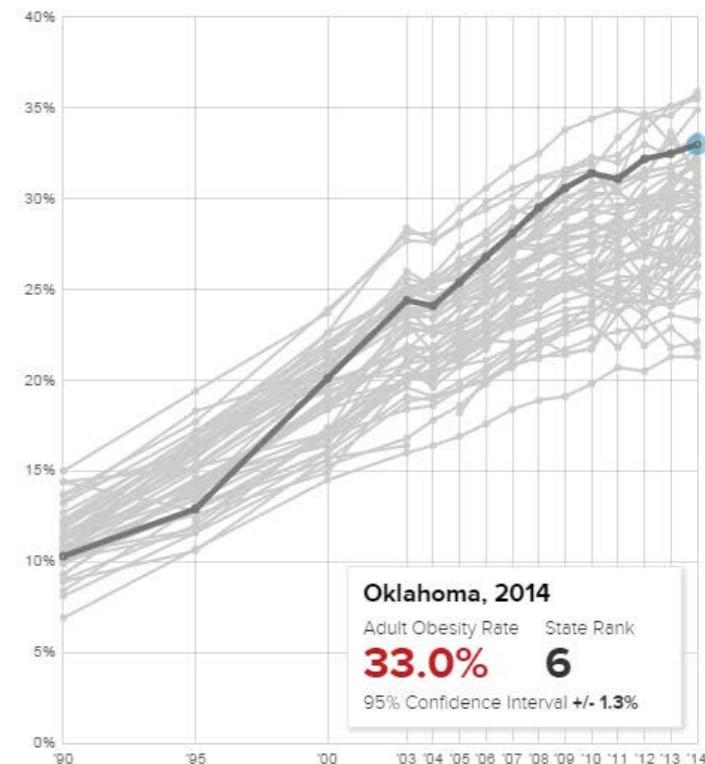
Select years with the slider to see historical data. Hover over states for more information. Click a state to lock the selection. Click again to unlock.

Percent of obese adults (Body Mass Index of 30+)

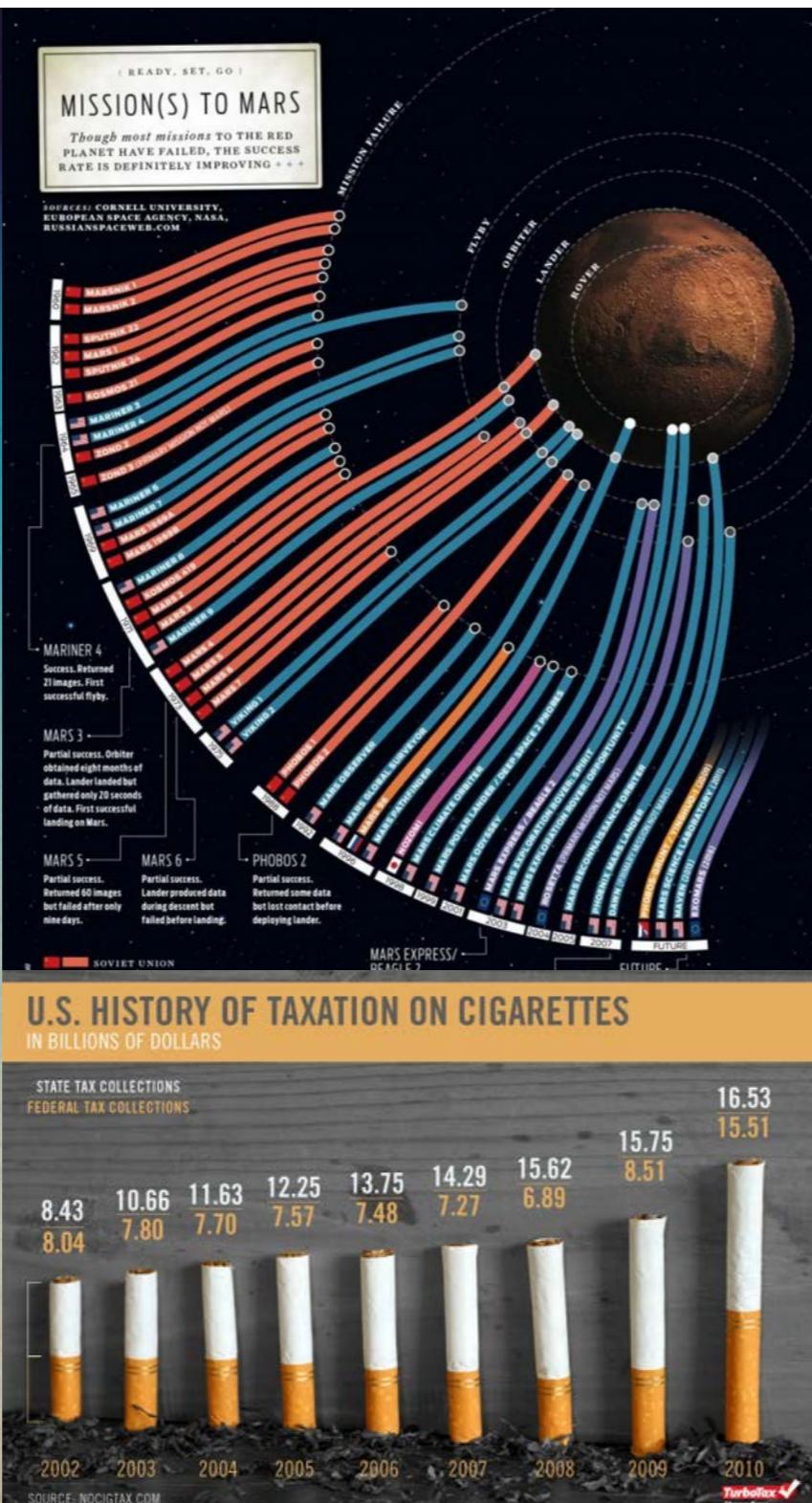
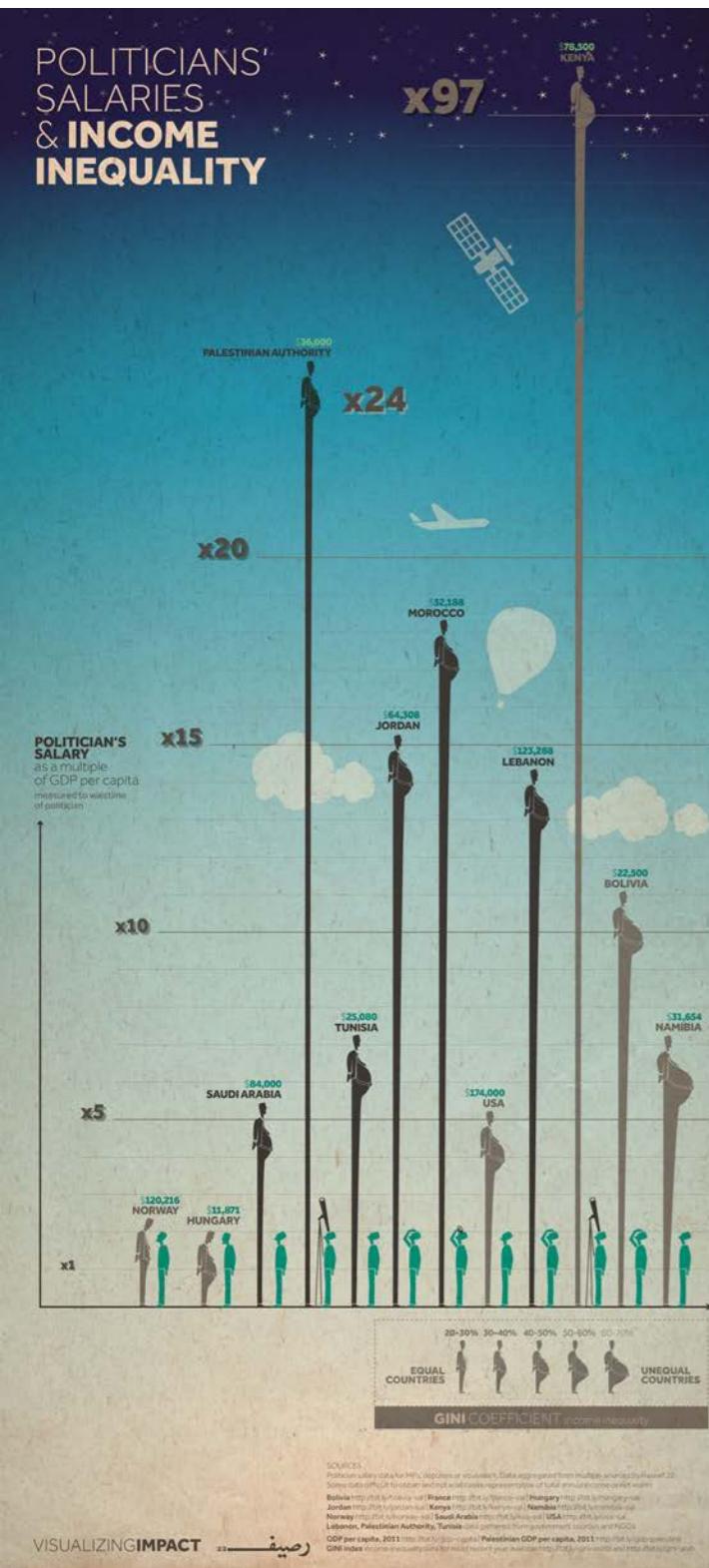
0 - 9.9% 10 - 14.9% 15 - 19.9% 20 - 24.9% 25 - 29.9% 30 - 34.9% 35%+



## Adult obesity rates, 1990 to 2014

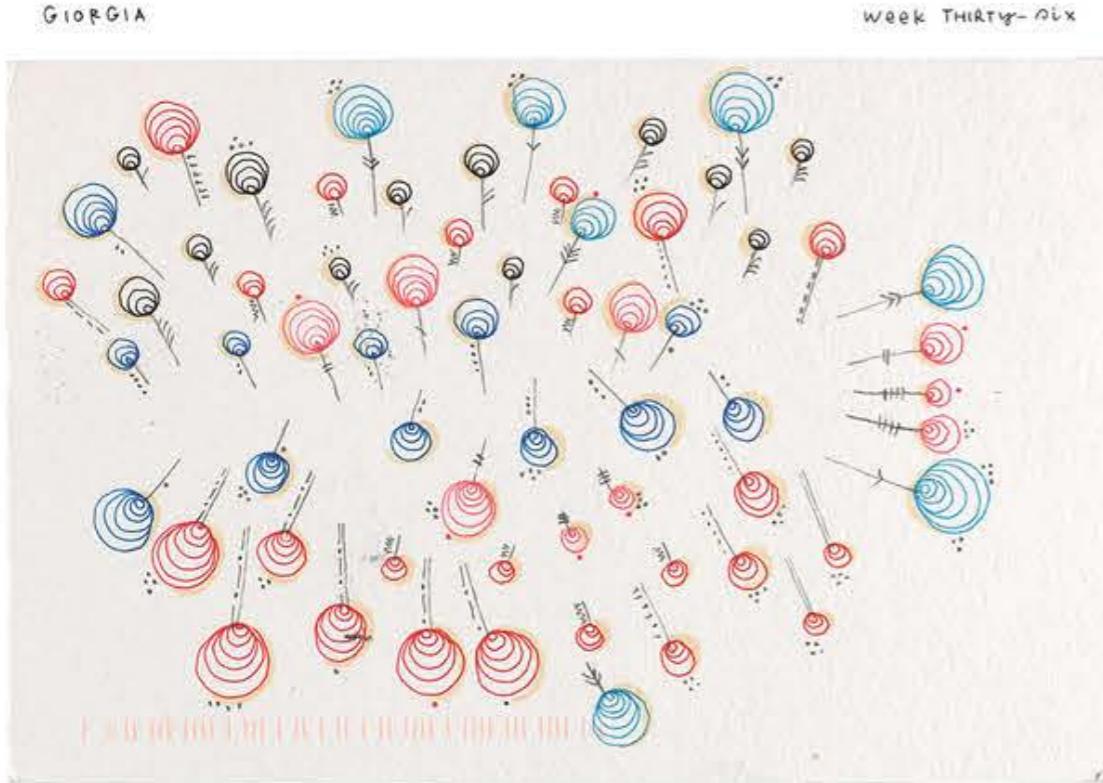


# Infographics



# Data Art

GIORGIA



66 DEAR DATA  
WEEK 36: SHALL I?

HOW TO READ IT:  
Every element (●) represents a moment in the week where I was UNDECIDED about whether to do/think something or not.

ELEMENTS:  
A: solved almost immediately or stopped thinking of it  
B: postponed but solved  
C: still "open" at the end of the week

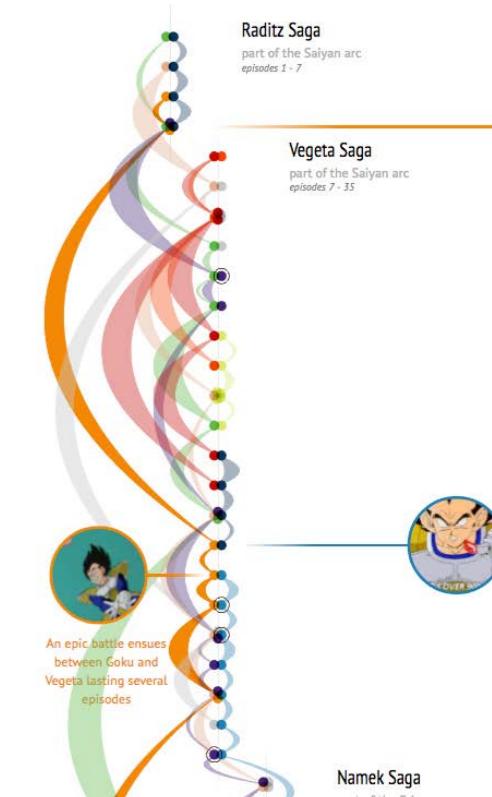
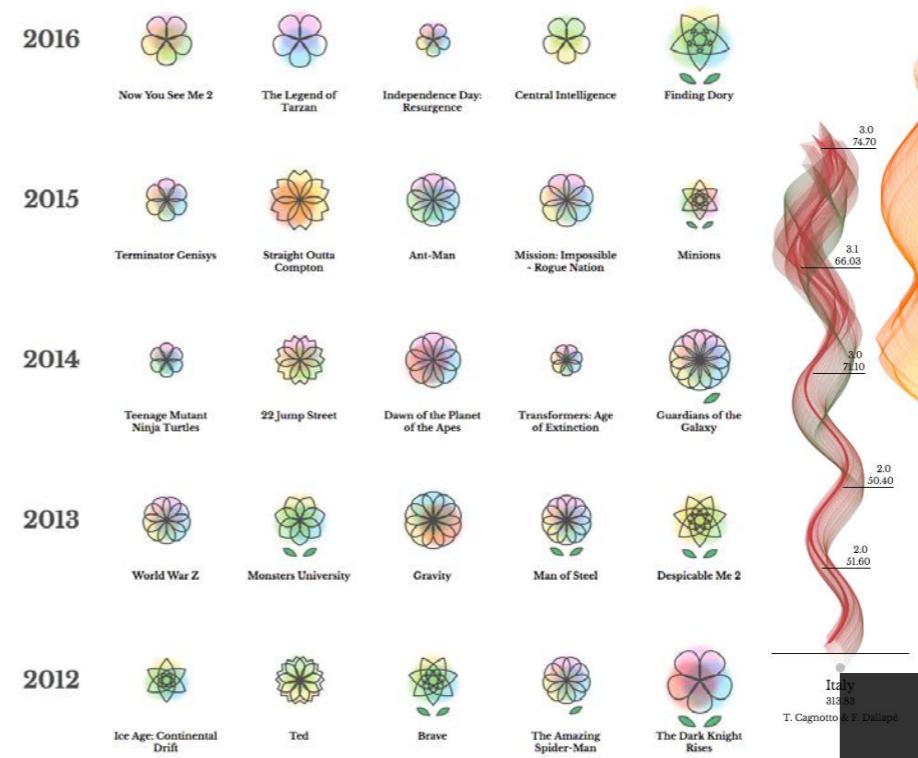
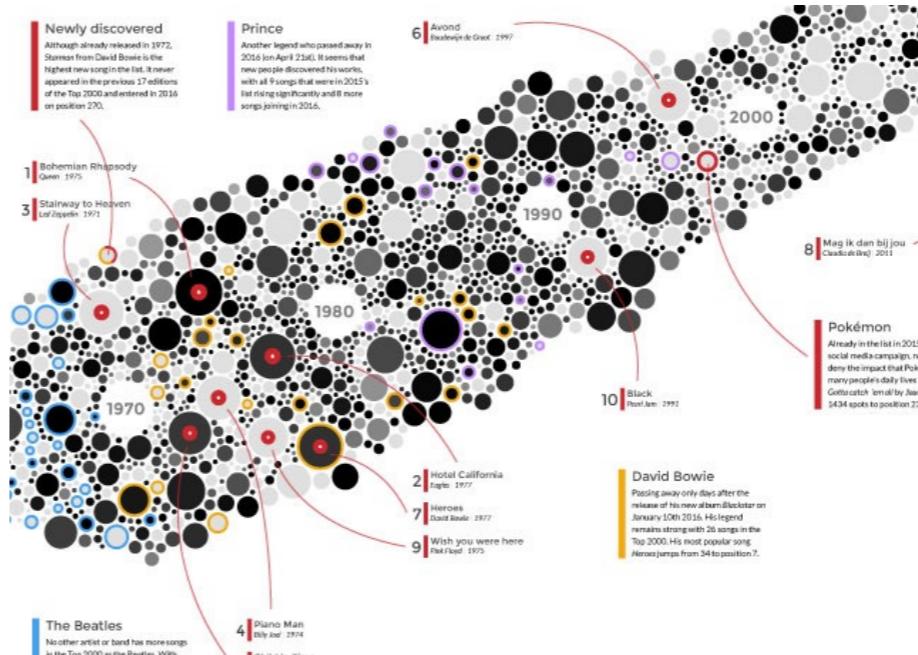
Dimension: level of anxiety that the un-decision got me

Length: how long did it take to decide? (not too much a little fixer!!)

Colors: what was I undecided about?  
work  
postcard  
eyeo  
book  
website  
organizational stuff  
ask to make it work  
personal  
physical



Dear Data  
G. Lupi & S. Posavec



Data Sketches  
N. Bremer & S. Wu

R. L. Chen



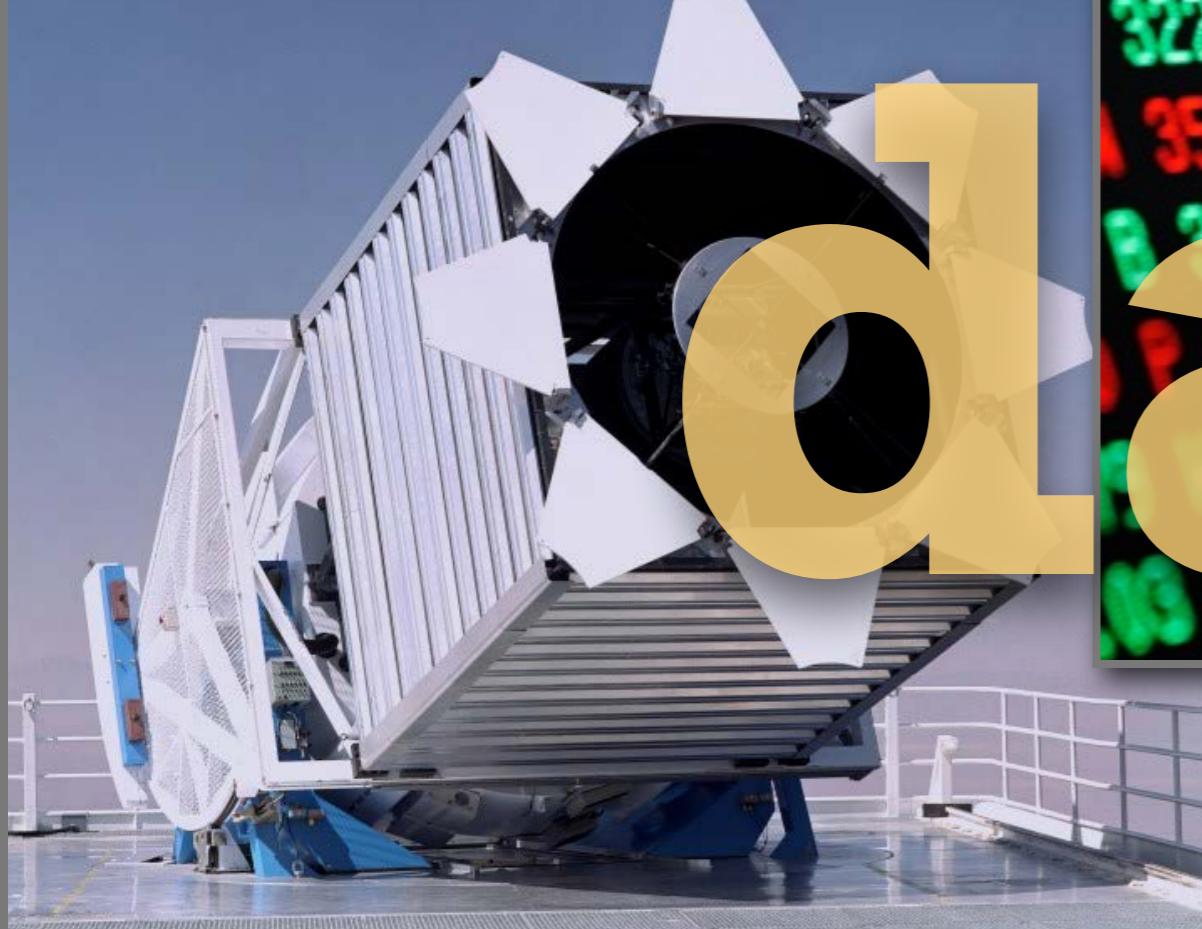
“

Visualization is about  
**external cognition**,  
that is, how resources  
**outside** the mind can  
be used to boost the  
cognitive capabilities  
of the mind.

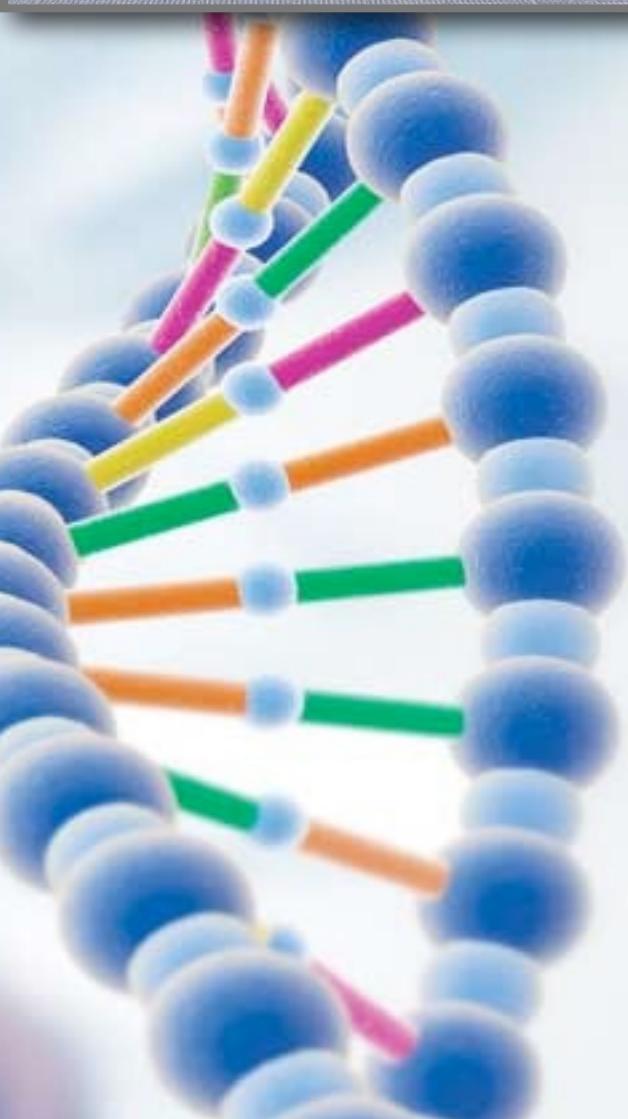
— Stuart Card

# Why?

A large, semi-transparent watermark in yellow, three-dimensional letters spelling "qatar" is centered over the image. The background consists of a blurred stock market ticker board displaying various financial data in red and green text.



# SHAKESPEARE QUARTERLY





# The Industrial Revolution of Data

Joe Hellerstein, UC Berkley, 2008

# How Much Data Do We Create Every Day? The Mind-Blowing Stats Everyone Should Read



**Bernard Marr**, CONTRIBUTOR

[FULL BIO](#) ▾

Opinions expressed by Forbes Contributors are their own.

The amount of data we produce every day is truly mind-boggling. There are [2.5 quintillion bytes of data](#) created each day at our current pace, but that pace is only accelerating with the growth of the Internet of Things (IoT).

Over the last two years alone 90 percent of the data in the world was generated. This is

worth re-reading! While it's almost impossible to wrap your mind around these

# The Limits of Cognition



Daniel Simons 1998

Notice anything changing?  
Get ready!

# Notice Anything Changing?



# Notice Anything Changing?



# Notice Anything Changing?



“ “

“...a wealth of information creates a poverty of attention...”

— Herbert A. Simon

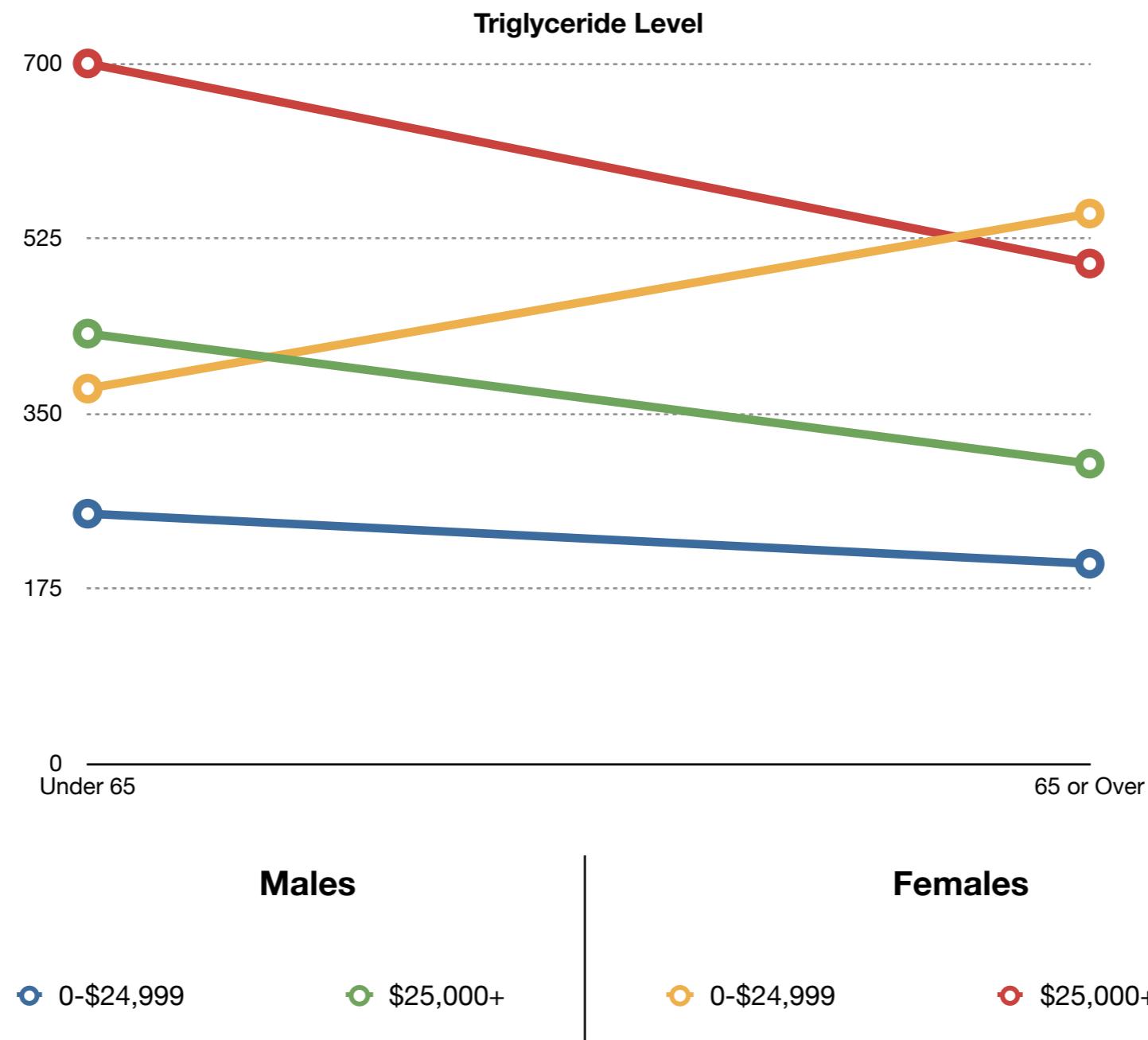


# The Power of Graphs

<b>Income Group</b>	<b>Males</b>		<b>Females</b>	
	Under 65	65 or Over	Under 65	65 or Over
<b>0-\$24,999</b>	250	200	375	550
<b>\$25,000+</b>	430	300	700	500

Which gender or income level group shows different effects of age on cholesterol levels?

# The Power of Graphs



# How many Vs?

MTHIVLWYADCEQGHKILKMTWYN  
ARDCAIREQGHHLVKMFPSTWYARN  
GFPSSVCEILQGKMFPSNDRCEQDIFP  
SGHLMFHKMVPSTWYACEQTWRN

# How many Vs?

MTHIVLWYADCEQGHKILKMTWYN  
ARDCAIREQGHLVKMFPSTWYARN  
GFPSVCEILQGKMFPSNDRCEQDIFP  
SGHLMFHKMVPSTWYACEQTWRN



“

Visualization is about  
**external cognition**,  
that is, how resources  
**outside** the mind can  
be used to boost the  
cognitive capabilities  
of the mind.

— Stuart Card

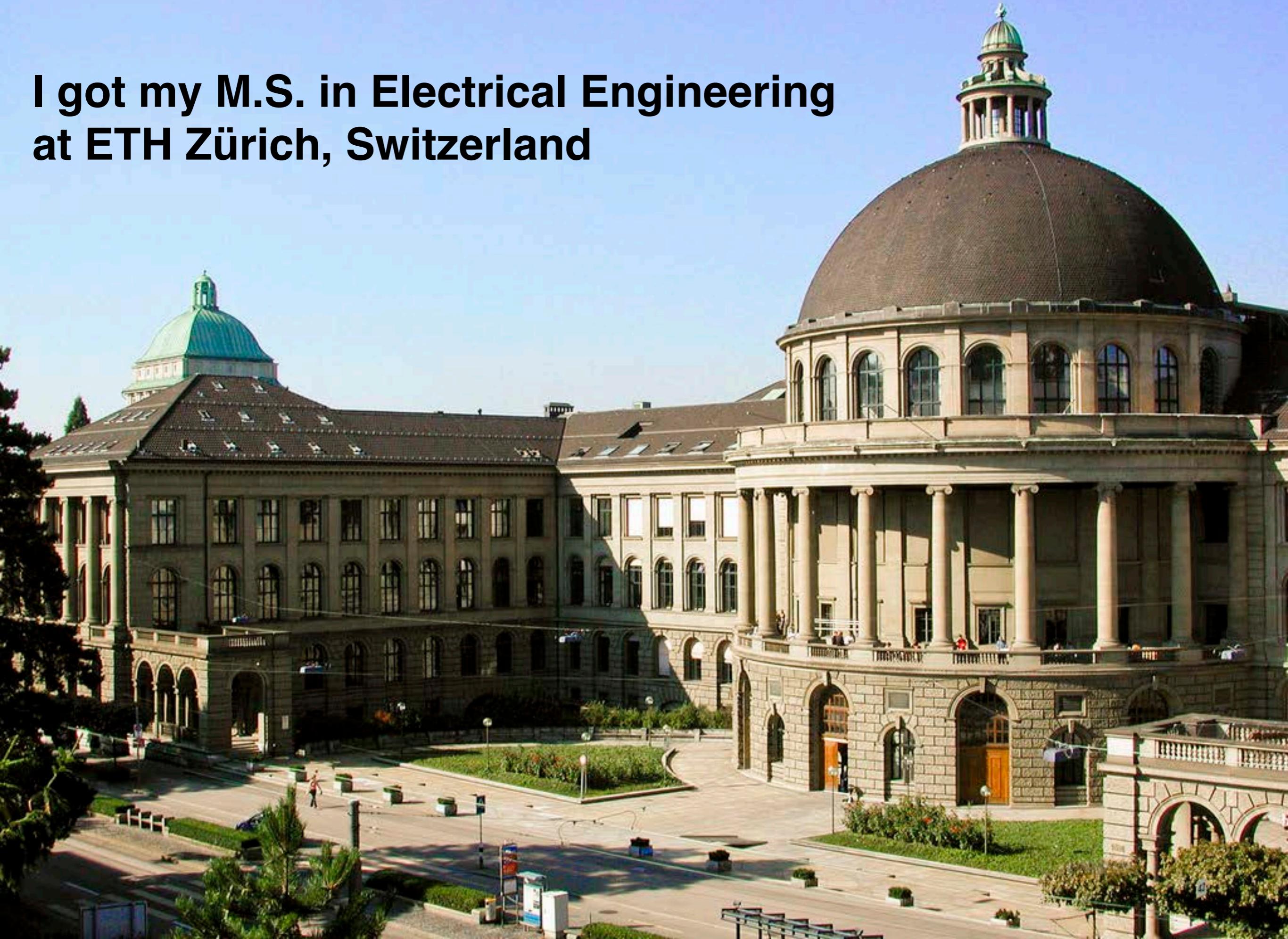
Who?

# Hanspeter Pfister

I grew up in Luzern (Lucerne), Switzerland



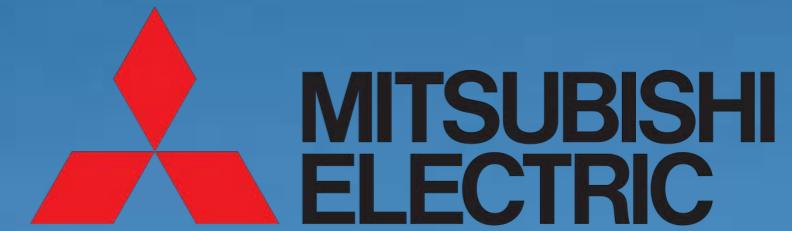
**I got my M.S. in Electrical Engineering  
at ETH Zürich, Switzerland**



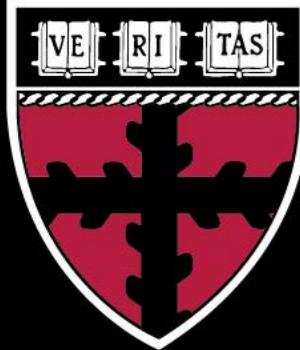
# I did my Ph.D. in Computer Science at Stony Brook University, New York



I worked in industry at Mitsubishi Electric Research Labs (MERL) for 11 years



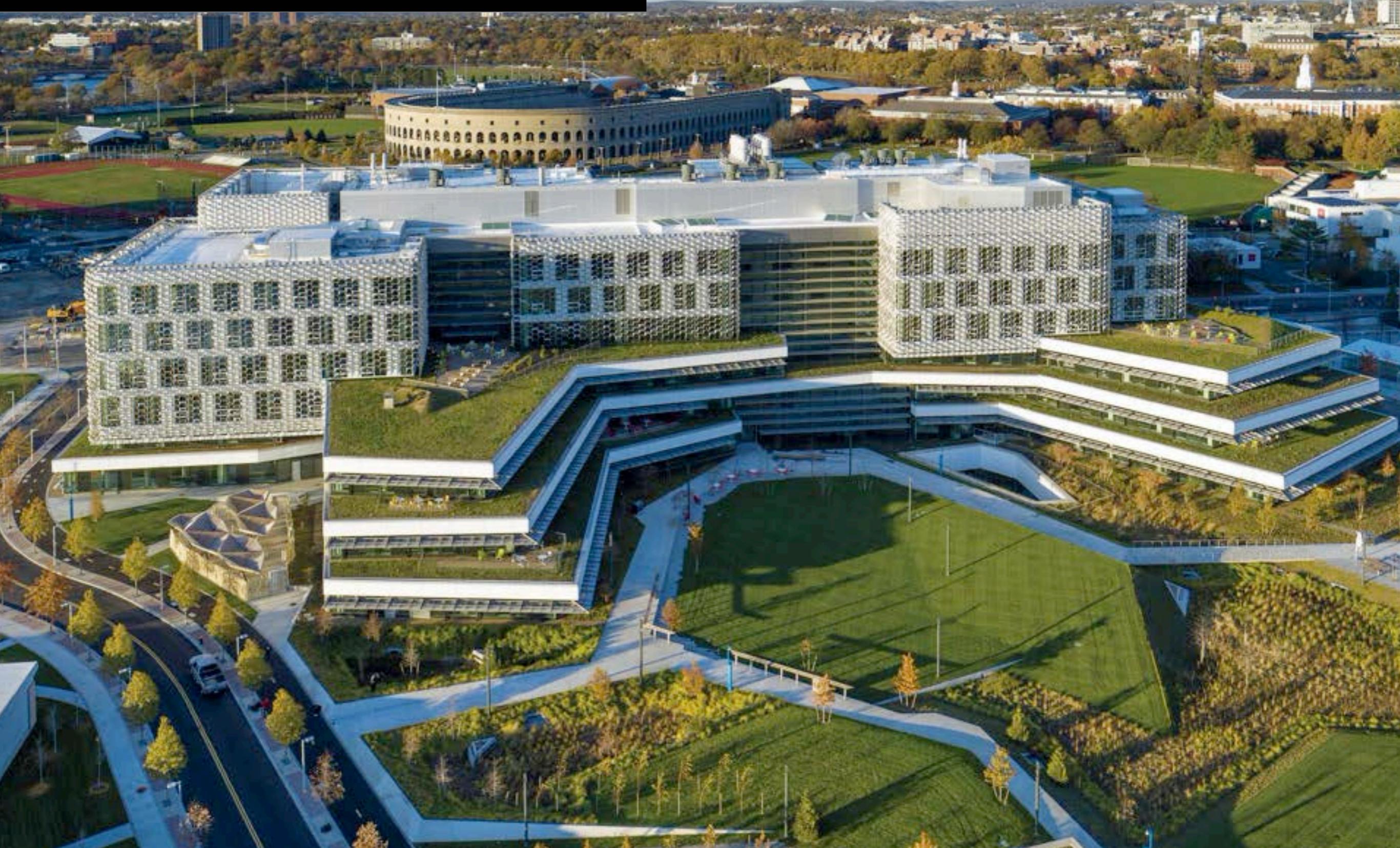
(MERL is in Cambridge, MA, not in Japan)



# HARVARD

School of Engineering  
and Applied Sciences

I've been at Harvard since 2007  
as the An Wang Professor of  
Computer Science



# Dr. Johanna Beyer

Research Scientist, Visual Computing Group

PhD in Computer Science at the  
University of Technology Vienna, Austria



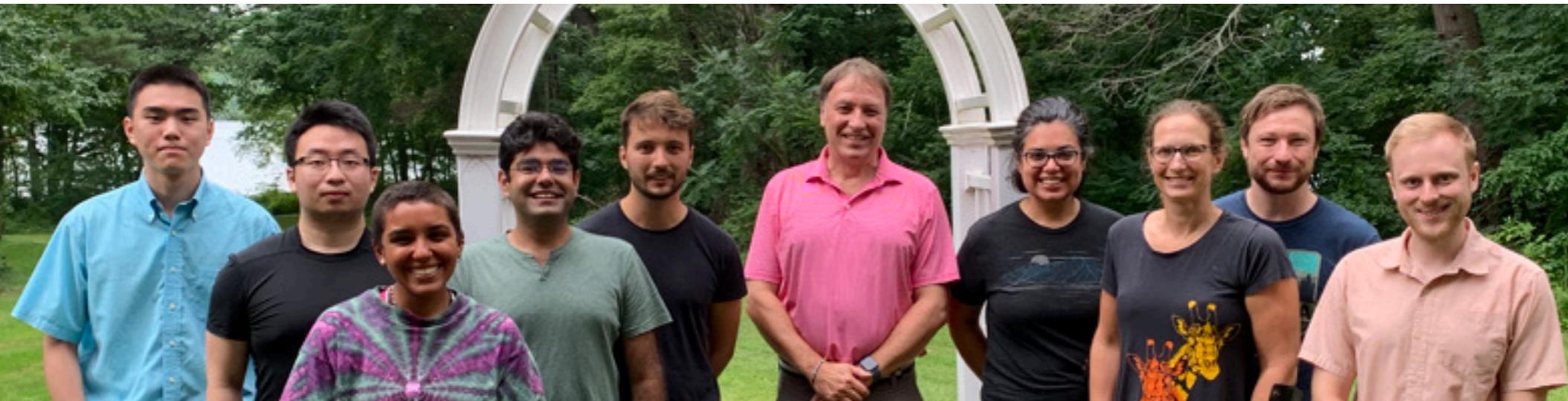
# Dr. Johanna Beyer

Research Scientist, Visual Computing Group

PhD in Computer Science at the  
University of Technology Vienna, Austria



# Visual Computing Group



## **Prof. Hanspeter Pfister**

Dr. Johanna Beyer

Dr. Junsik Kim

Dr. Robert Krueger

Dr. Johannes Knittel

Dr. Siyu Huang

Dr. Zhutian Chen

Kenneth Li

Tica Lin

Spandan Madan

Salma Abdel Magid

Jakob Troidl

Simon Warchol

# Who are you?

- Name?
- What Nissan organization do you work for?
- Briefly, what is your job?
- Do you know Tableau?

How?

# Textbook

cole nussbaumer knaflic

# storytelling with data

a data  
visualization  
guide for  
business  
professionals

WILEY

★★★★★ 317 customer reviews

#1 Best Seller in Library Management

*Data slides are not really about the data, they are about the meaning of the data. Cole Nussbaumer Knaflic understands this and has written a straightforward, accessible guide that will help anyone who communicates with data connect more effectively with their audience.*

*—Nancy Duarte, CEO at Duarte, Inc. and bestselling author*

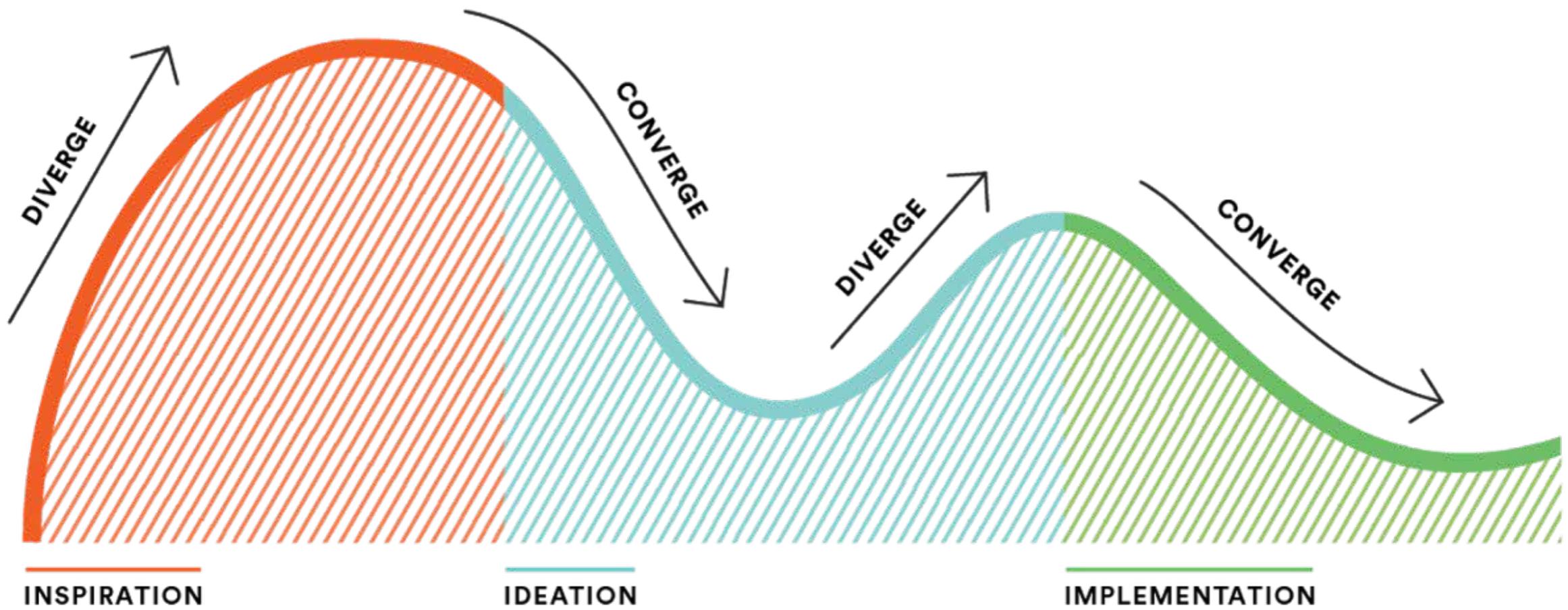
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# Course Goals

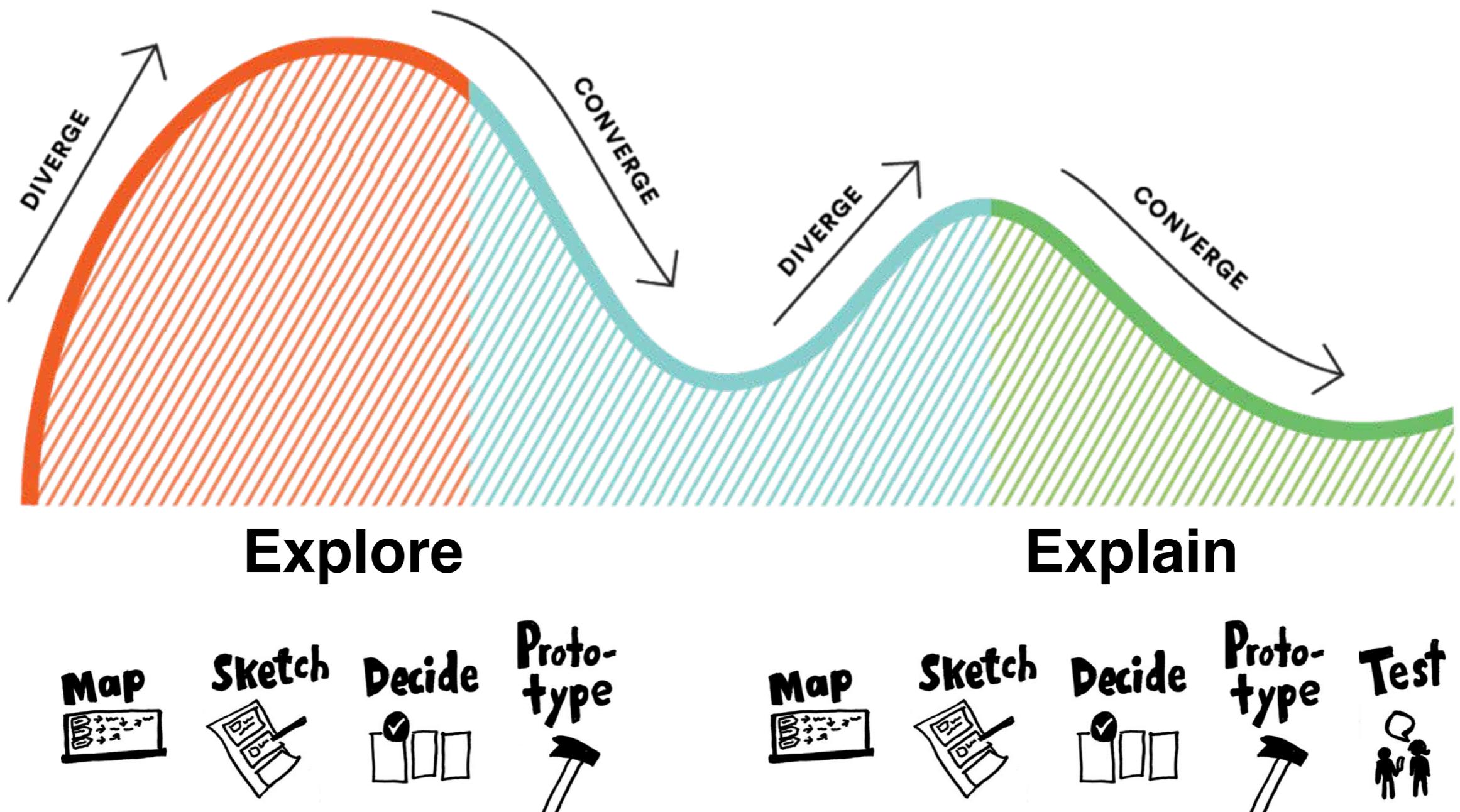
After completion of this workshop, you will be able to:

- **Evaluate** and **critique** visualization designs
- Apply **principles of effective visualizations**
- **Tell stories** with visualizations
- Use **Tableau** to create **interactive** visualizations
- Follow a principled **design process**

# Design Process



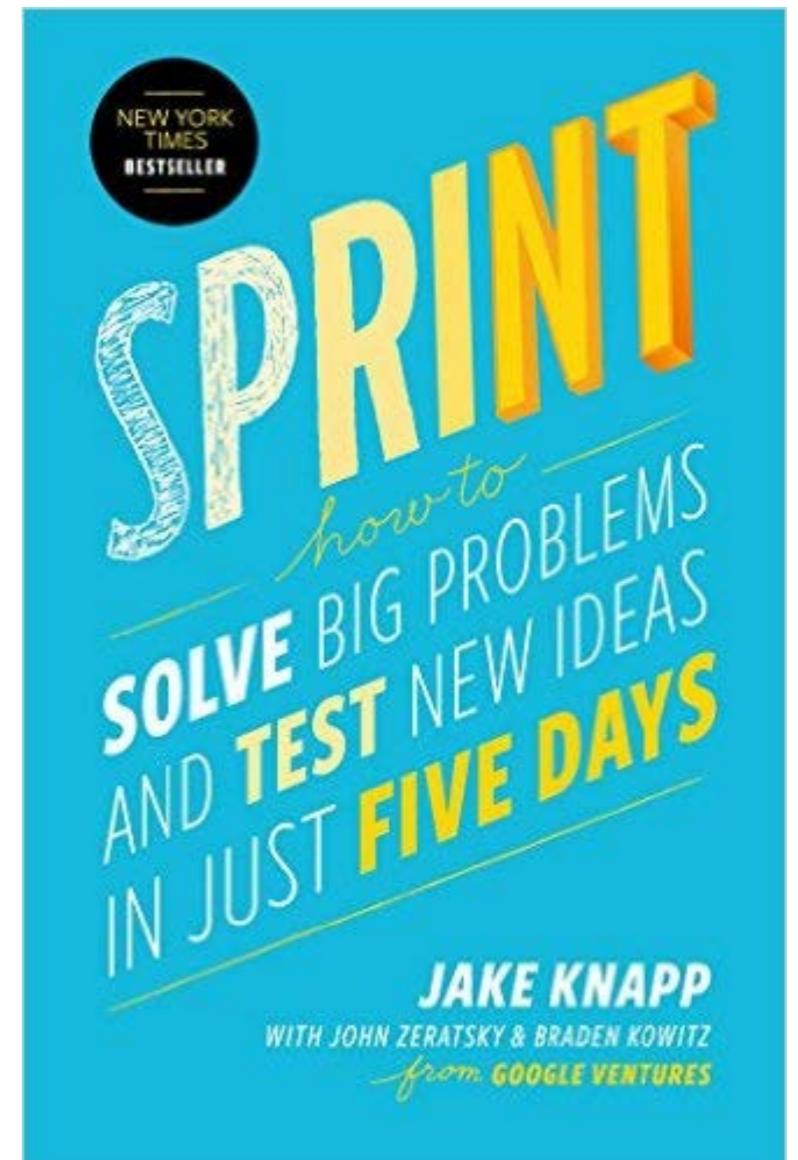
# Design Sprint



# Design Sprint

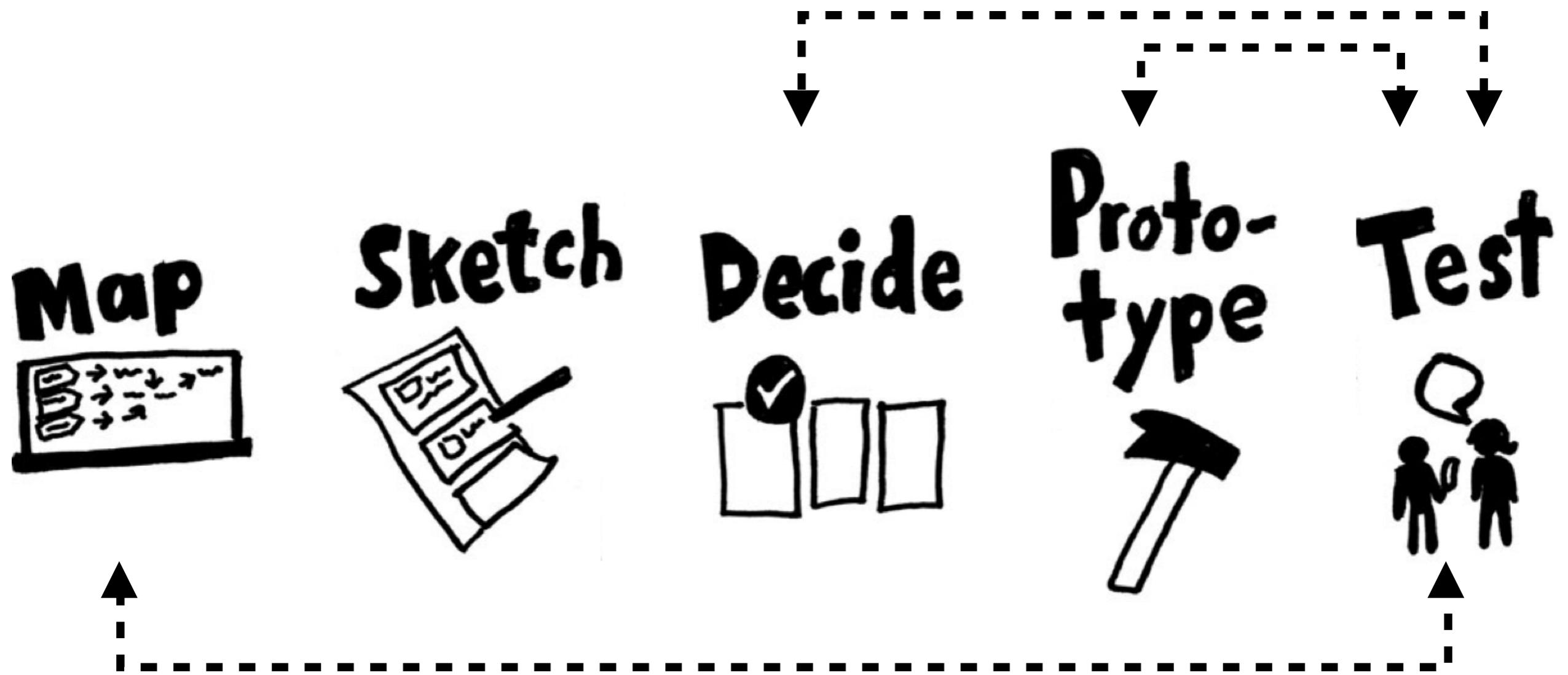
“ The sprint is a ... process for answering critical ... questions through **design, prototyping, and testing ideas** with users.

- Google Ventures



# Design Sprint

The design sprint is an ***iterative*** process.



# Design Sprint Mission



# Drug Prescriptions

AutoSave OFF ⌂ SuperDrugsPrescriptionsV2

Home Insert Draw Page Layout Formulas Data Review View Automate Acrobat Tell me

Cut Copy Format Segoe UI 11 A<sup>^</sup> A<sub>^</sub> Wrap Text General \$ % , Conditional Formatting Insert

Paste Format B I U Merge & Center Format as Table Good Neutral Delete Format

AD48 fx

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	Number of Records
1	Date	Dispensed	Drug Dosag	Drug Name	Drug Route	Drug MDR	Drug Strength	Drug Suppl	Order ID	Order Subit	TableauCeuticalSales	Discount	Gross Profit	Net Profit	Rx Gross Sales	Rx Net Sales	Rx Net Profit	Rx Quantity	Unit Price			
2	2/3/2007	Alan Schoer	TABLET	AMITRIPTY	ORAL	TAB	10MG	Competito	151789	151789-00	\$611,460.00	0.0%	28.0%	28.0%	\$611,460.00	\$611,460.00	\$171,208.80	158,000	\$3.87		1	
3	1/2/2007	Matt Collist	TABLET	AMITRIPTY	ORAL	TAB	75MG	TableauCei	151654	151654-00	\$1,120,520.00	0.0%	46.0%	46.0%	\$1,120,520.00	\$1,120,520.00	\$515,439.20	257,000	\$4.36		1	
4	1/7/2007	Maribeth Sc	CAPSULE	BENZONAT	ORAL	CAP	100MG	Competito	151675	151675-00	\$3,029,992.88	2.5%	28.0%	25.5%	\$3,107,685.00	\$3,029,992.88	\$772,648.18	1,218,700	\$2.55		1	
5	1/3/2007	Alan Schoer	TABLET	BENZTROP	ORAL	TAB	0.5MG	Competito	151657	151657-00	\$545,321.00	0.0%	29.0%	29.0%	\$545,321.00	\$545,321.00	\$158,143.09	151,900	\$3.59		1	
6	2/12/2007	Rick Wilson	TABLET	CARBIDOP	ORAL	TAB	10MG;100MG	Competito	151821	151821-00	\$654,591.00	0.0%	29.0%	29.0%	\$654,591.00	\$654,591.00	\$189,831.39	153,300	\$4.27		1	
7	2/3/2007	Alejandro C	TABLET	CARBIDOP	ORAL	TAB	25MG;100MG	Competito	151788	151788-00	\$2,722,630.22	1.9%	29.0%	27.1%	\$2,774,655.00	\$2,722,630.22	\$738,513.45	790,500	\$3.51		1	
8	2/23/2007	Anthony O'	CAPSULE	CEPHALEXI	ORAL	CAP	500MG	Competito	151859	151859-00	\$802,420.00	0.0%	30.0%	30.0%	\$802,420.00	\$802,420.00	\$240,726.00	151,400	\$5.30		1	
9	1/17/2007	Xylona Pric	CAPSULE	CLINDAMY	ORAL	CAP	150MG	Competito	151722	151722-00	\$686,576.00	0.0%	29.0%	29.0%	\$686,576.00	\$686,576.00	\$199,107.04	206,800	\$3.32		1	
10	1/11/2007	Kristina Nu	TABLET	CLONIDINE	ORAL	TAB	0.2MG	Competito	151699	151699-00	\$491,502.00	0.0%	31.0%	31.0%	\$491,502.00	\$491,502.00	\$152,365.62	203,100	\$2.42		1	
11	2/5/2007	Michael Gra	ELIXIR	DEXAMETH	ORAL	ML	0.5MG/5ML	Competito	151794	151794-00	\$782,808.00	0.0%	29.0%	29.0%	\$782,808.00	\$782,808.00	\$227,014.32	154,400	\$5.07		1	
12	1/29/2007	Cindy Chap	TABLET	DIAZEPAM	ORAL	TAB	2MG	Competito	151769	151769-00	\$876,522.00	0.0%	28.0%	28.0%	\$876,522.00	\$876,522.00	\$245,426.16	208,200	\$4.21		1	
13	2/13/2007	Olvera Toch	TABLET	DICLOFEN	ORAL	TAB	50MG	Competito	151825	151825-00	\$536,734.00	0.0%	29.0%	29.0%	\$536,734.00	\$536,734.00	\$155,652.86	157,400	\$3.41		1	
14	3/21/2007	Victoria Wi	TABLET	DLITIAZEM	ORAL	TAB	30MG	Competito	151953	151953-00	\$517,584.00	0.0%	30.0%	30.0%	\$517,584.00	\$517,584.00	\$155,275.20	157,800	\$3.28		1	
15	2/12/2007	Rick Wilson	TABLET	DLITIAZEM	ORAL	TAB	60MG	Competito	151821	151821-00	\$420,160.00	0.0%	35.0%	35.0%	\$420,160.00	\$420,160.00	\$147,056.00	208,000	\$2.02		1	
16	1/13/2007	Liz Price	TABLET	ETHINYL ES	ORAL-28	TAB	0.03MG;0.15N	Competito	151705	151705-00	\$601,839.00	0.0%	34.0%	34.0%	\$601,839.00	\$601,839.00	\$204,625.26	209,700	\$2.87		1	
17	3/10/2007	Maxwell Sc	TABLET	ETODOLAC	ORAL	TAB	500MG	TableauCei	151910	151910-00	\$1,303,551.90	2.0%	41.0%	39.0%	\$1,330,155.00	\$1,303,551.90	\$508,385.24	265,500	\$5.01		1	
18	2/24/2007	Brian Moss	TABLET	GLIPIZIDE	ORAL	TAB	10MG	Competito	151862	151862-00	\$422,675.00	0.0%	28.0%	28.0%	\$422,675.00	\$422,675.00	\$118,349.00	153,700	\$2.75		1	
19	1/25/2007	Filia McAda	TABLET	GLYBURIDI	ORAL	TAB	3MG	Competito	151757	151757-00	\$498,454.00	0.0%	28.0%	28.0%	\$498,454.00	\$498,454.00	\$139,567.12	152,900	\$3.26		1	
20	3/24/2007	Paul Prost	TABLET	GUANFACI	ORAL	TAB	1MG	Competito	151965	151965-00	\$998,730.00	0.0%	33.0%	33.0%	\$998,730.00	\$998,730.00	\$329,580.90	205,500	\$4.86		1	
21	3/1/2007	Victoria Pis	TABLET	HYDRALAZ	ORAL	TAB	10MG	Competito	151881	151881-00	\$5,857,274.48	2.5%	33.0%	30.5%	\$6,007,461.00	\$5,857,274.48	\$1,786,468.71	1,203,900	\$4.99		1	
22	2/9/2007	Helen Wass	TABLET	HYDROCHL	ORAL	TAB	25MG	Competito	151812	151812-00	\$444,431.00	0.0%	34.0%	34.0%	\$444,431.00	\$444,431.00	\$151,106.54	201,100	\$2.21		1	
23	2/5/2007	Henia Zydlic	CAPSULE	HYDROCHL	ORAL	CAP	25MG;37.5MG	Competito	151791	151791-00	\$6,635,405.40	2.5%	28.0%	25.5%	\$6,805,544.00	\$6,635,405.40	\$1,692,028.38	1,208,800	\$5.63		1	
24	1/27/2007	Ken Brenna	TABLET	HYDROCHL	ORAL	TAB	25MG;37.5MG	Competito	151762	151762-00	\$961,936.00	0.0%	30.0%	30.0%	\$961,936.00	\$961,936.00	\$288,580.80	203,800	\$4.72		1	
25	3/26/2007	Joe Kamber	TABLET	HYDROCOF	ORAL	TAB	20MG	TableauCei	151975	151975-00	\$922,576.00	0.0%	40.0%	40.0%	\$922,576.00	\$922,576.00	\$369,030.40	250,700	\$3.68		1	
26	1/15/2007	Clytie Kelty	CAPSULE	HYDROXYL	ORAL	CAP	500MG	Competito	151713	151713-00	\$334,614.00	0.0%	29.0%	29.0%	\$334,614.00	\$334,614.00	\$97,038.06	154,200	\$2.17		1	
27	1/17/2007	Sanjit Jacob	TABLET	IBUPROFEN	ORAL	TAB	400MG	Competito	151720	151720-00	\$444,460.00	0.0%	28.0%	28.0%	\$444,460.00	\$444,460.00	\$124,448.80	156,500	\$2.84		1	
28	1/26/2007	Giulietta De	TABLET	ISOSORBID	ORAL	TAB	20MG	TableauCei	151760	151760-00	\$487,956.00	0.0%	36.0%	36.0%	\$487,956.00	\$487,956.00	\$175,664.16	103,600	\$4.71		1	
29	1/27/2007	Tanja Norve	TABLET, EX	ISOSORBID	ORAL	TAB	60MG	Competito	151764	151764-00	\$466,466.00	0.0%	32.0%	32.0%	\$466,466.00	\$466,466.00	\$149,269.12	200,200	\$2.33		1	
30	1/1/2007	Darren Bud	TABLET	LISINOPRIL	ORAL	TAB	10MG	Competito	151652	151652-00	\$3,166,903.91	1.9%	29.0%	27.1%	\$3,227,418.00	\$3,166,903.91	\$859,022.69	911,700	\$3.54		1	
31	2/2/2007	Marc Crier	CAPSULE	LITHIUM C	ORAL	CAP	300MG	Competito	151783	151783-00	\$5,071,443.44	1.9%	30.0%	28.1%	\$5,168,350.00	\$5,071,443.44	\$1,426,343.47	939,700	\$5.50		1	
32	2/17/2007	Edward Bec	CAPSULE	LOXAPINE	ORAL	CAP	10MG	TableauCei	151844	151844-00	\$605,968.00	0.0%	38.0%	38.0%	\$605,968.00	\$605,968.00	\$230,267.84	250,400	\$2.42		1	
33	2/23/2007	Peter Buhle	TABLET	MEGESTRO	ORAL	TAB	40MG	Competito	151861	151861-00	\$7,026,462.30	2.5%	30.0%	27.5%	\$7,206,628.00	\$7,026,462.30	\$1,932,277.13	1,259,900	\$5.72		1	
34	3/11/2007	Thomas Bru	TABLET	METHOCAF	ORAL	TAB	750MG	Competito	151913	151913-00	\$777,195.00	0.0%	28.0%	28.0%	\$777,195.00	\$777,195.00	\$217,614.60	151,500	\$5.13		1	
35	1/9/2007	Sandra Flan	TABLET	LOSARTAN	ORAL	TAB	25MG	Competito	151683	151683-00	\$570,620.00	0.0%	28.0%	28.0%	\$570,620.00	\$570,620.00	\$159,773.60	206,000	\$2.77		1	
36	1/4/2007	Alex Russell	TABLET	MEMANTIN	ORAL	TAB	10MG	TableauCei	151659													

# Tableau Dashboard

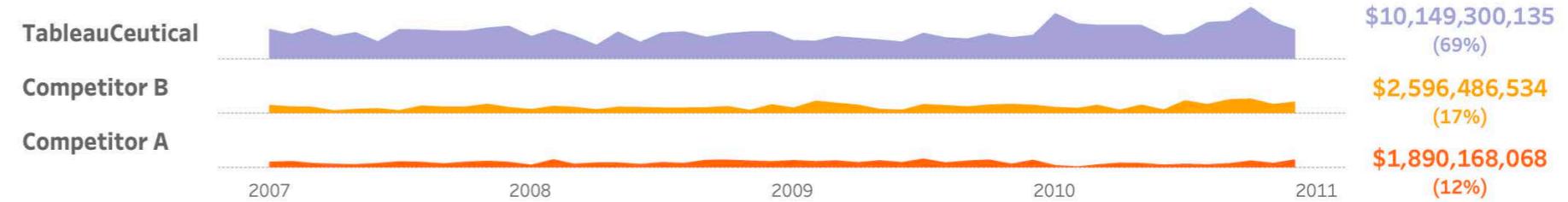
## Super Drugs Executive Exploration Dashboard

I'm interactive! Click to explore.

### Top 5 Performers (by Sales)

1	Tony Sayre	\$119,110,492
2	Brad Thomas	\$113,132,540
3	Adam Hart	\$106,590,921
4	Bill Donatelli	\$102,831,690
5	Darren Budd	\$100,959,450

### Top 3 Suppliers (by Sales)

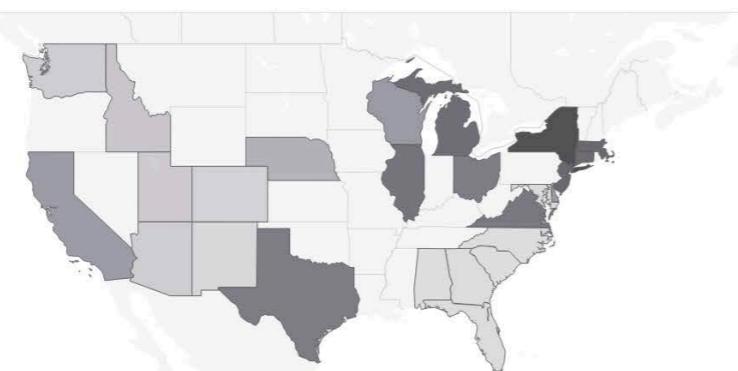


### State Sales Map

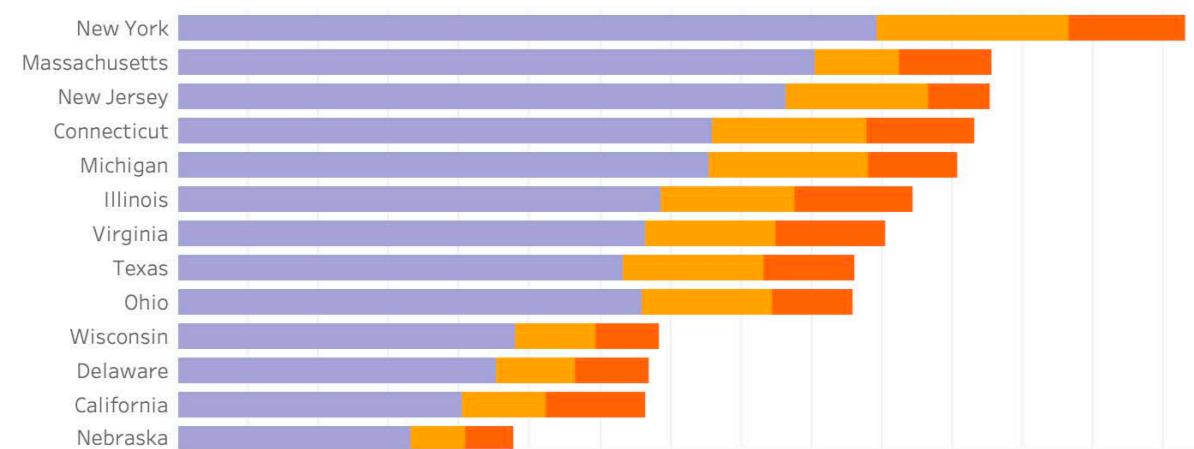
State or Pharmacy   Region   State  
State   (All)   (All)

Sales

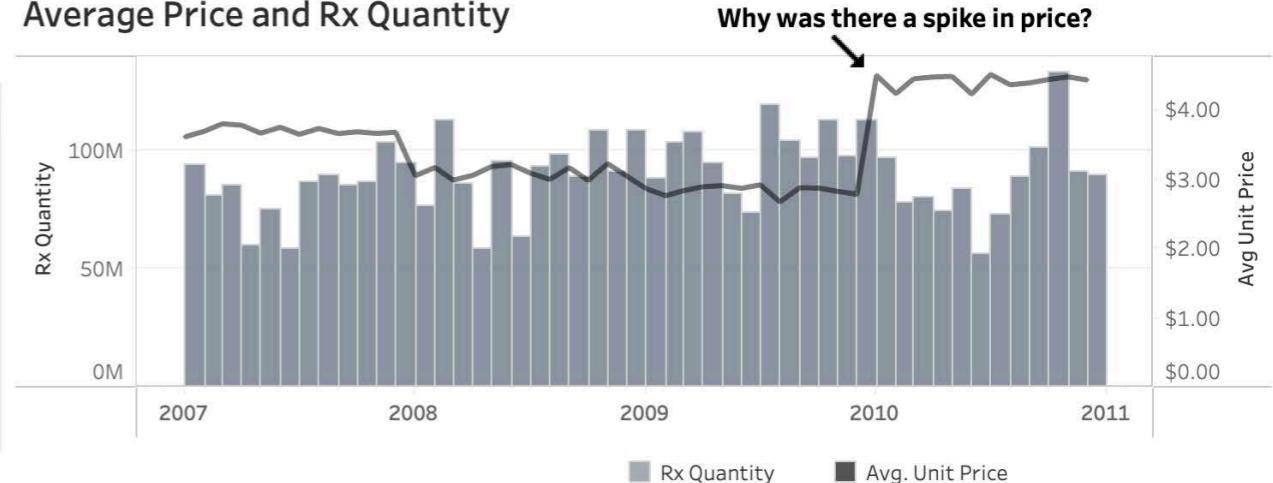
**\$14,635,954,736 \$**



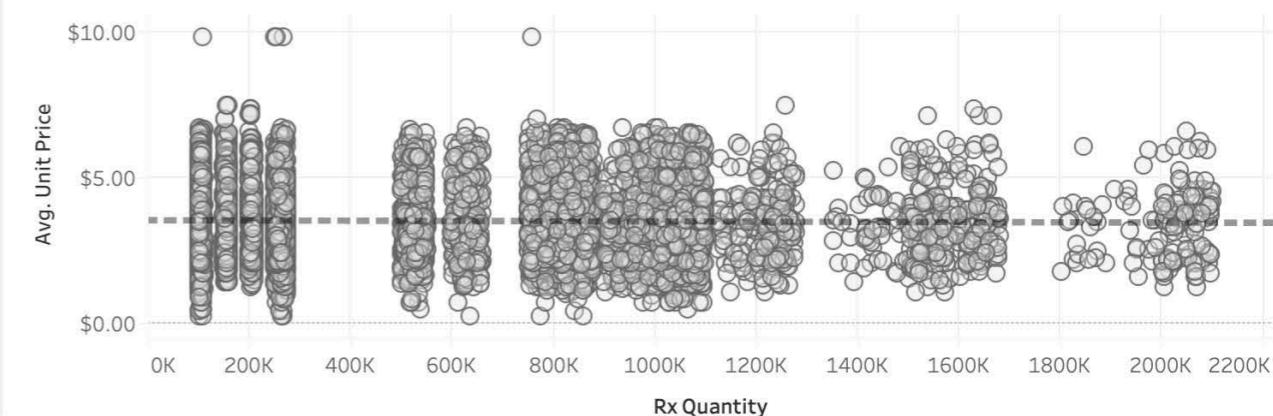
### Sales by State Bar Chart



### Average Price and Rx Quantity



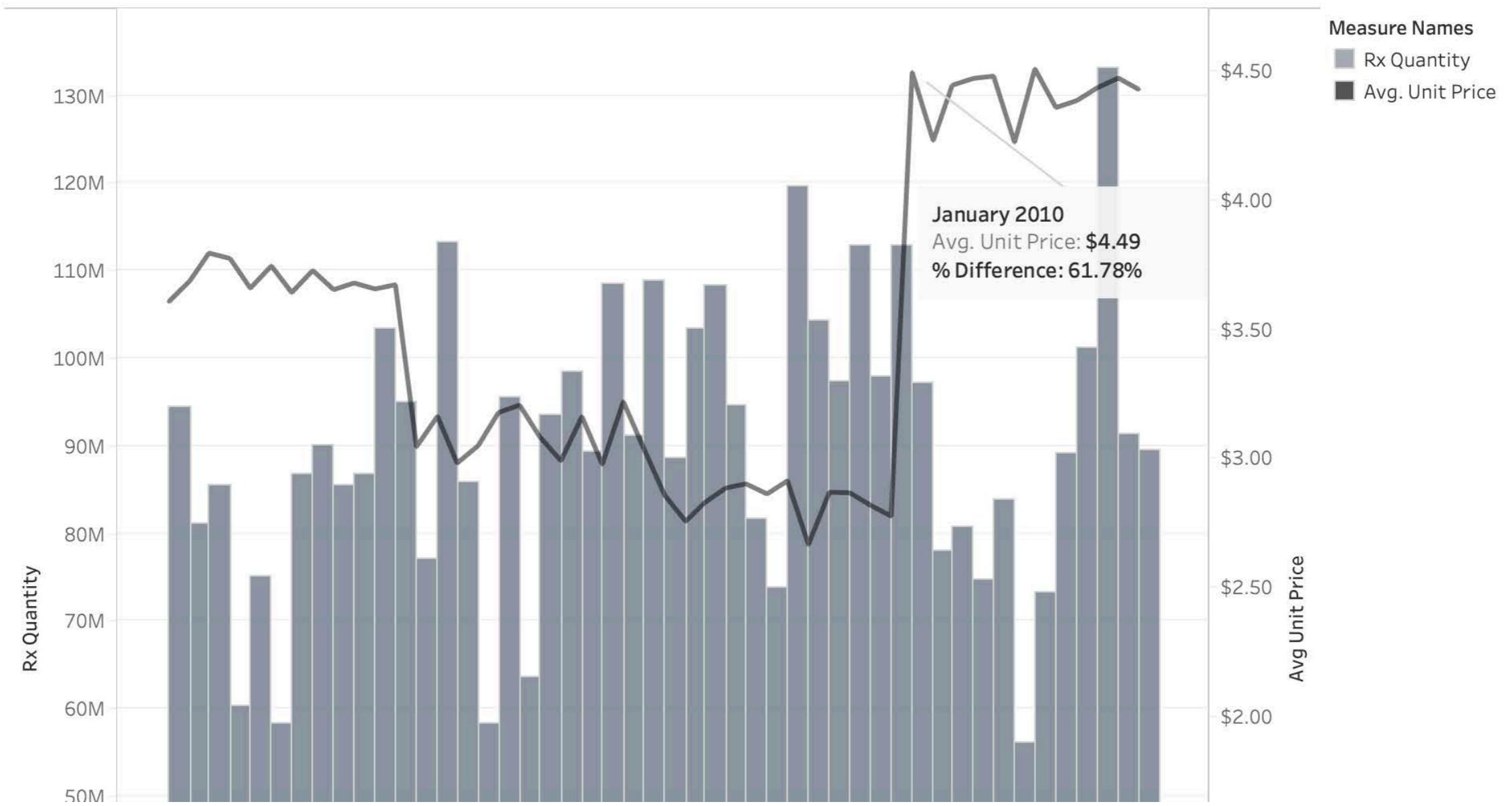
### Average Price and Quantity Correlation: -0.01419



# Tableau Storyline

Why was there a spike in price?

< In Jan 2010, the Industry saw a 62% increase in price.  
Competitors A&B saw a significant drop in quantity.  
This drop was historic for A and drove up all industry prices.  
The first two months in 2010 were the worst in A's history. >



# Team Formation



# Activity

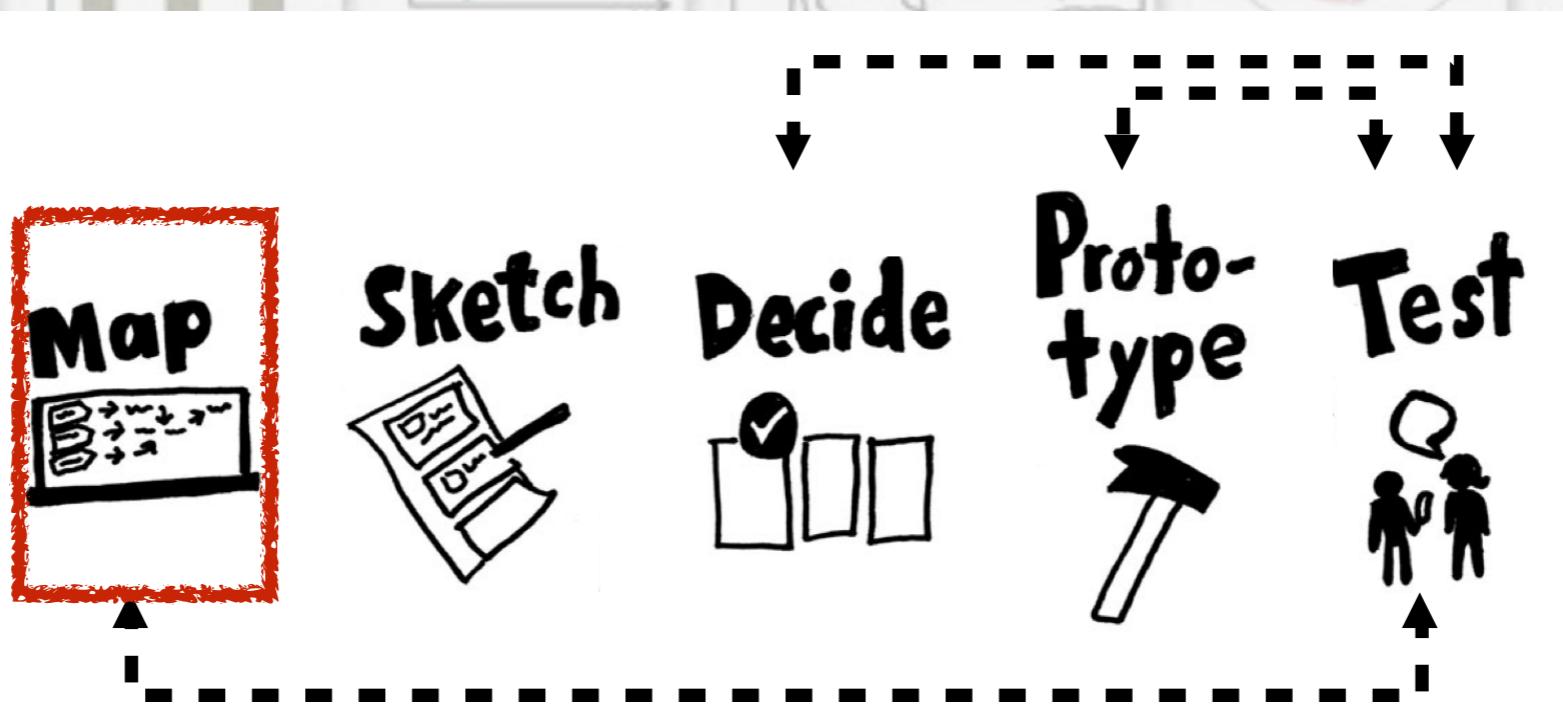
Meet your team. Decide on a team name and write it on top of your posters.

5 min



# Map - Charts

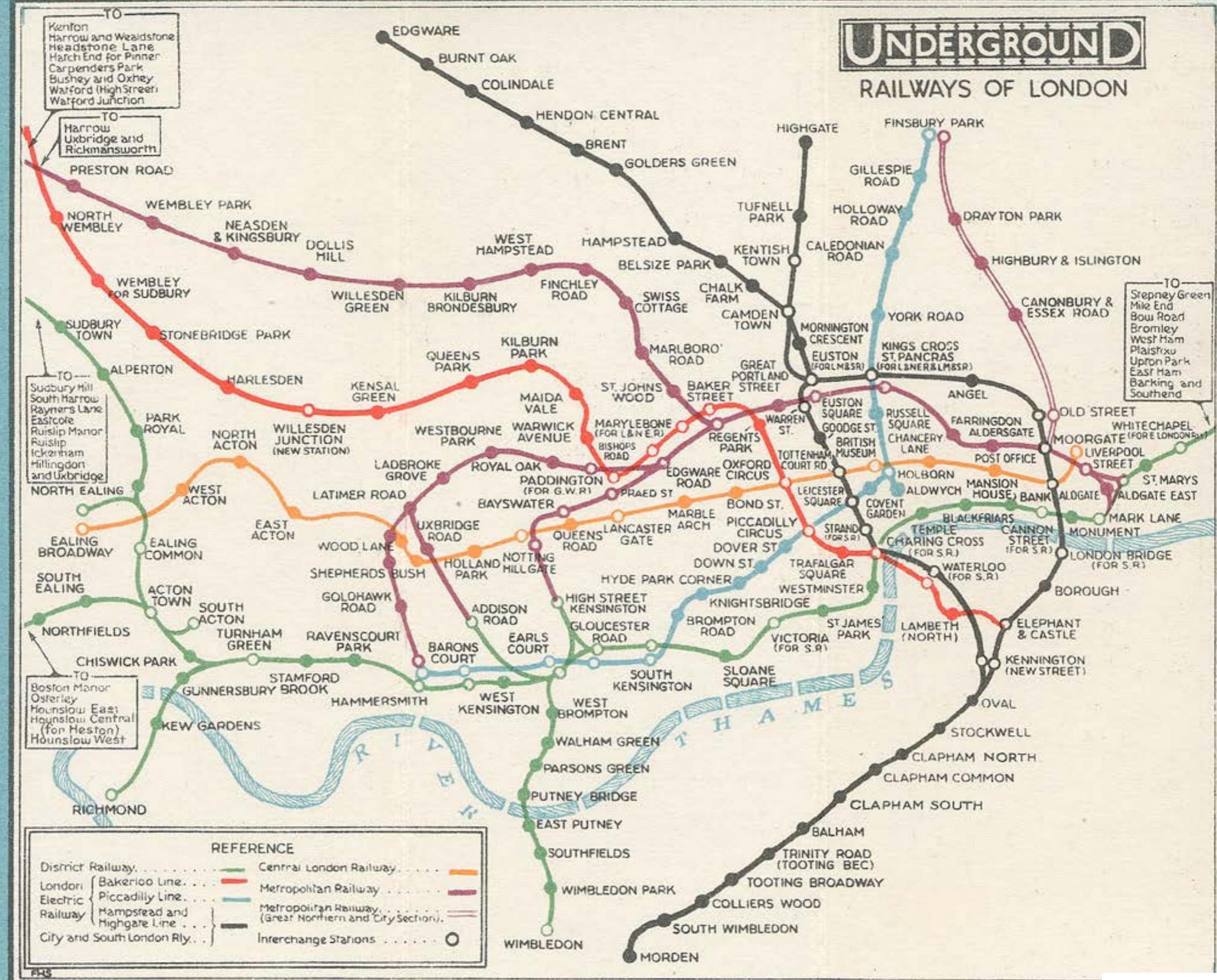
- What is the question?
- Who is the audience?
- What is the data?



What is the question?

# UNDERGROUND

## RAILWAYS OF LONDON





Harry Beck 1933



**Massachusetts Bay Transportation Authority**  
Rapid Transit/Key Bus Routes Map



**Legend**

**RL** RED LINE

**M** MATTAPAN LINE

**OL** ORANGE LINE

**BL** BLUE LINE

**SL** SILVER LINE and branches

**SL1** **SL4**

**SL2** **SL5**

**GL** GREEN LINE and branches

**B** Terminates at Park St

**C** Terminates at N. Station

**E** Terminates at Lechmere

**T** COMMUTER RAIL

**— 000 —** KEY BUS ROUTE

Frequent Service

**—●—** FERRYS

**♿** Accessible station

All MBTA and Massport bus and

ferry services are accessible

**○** Rapid Transit transfer station

**□** Commuter Rail transfer station

**→** Free Logan Airport shuttle bus

**↔** Amtrak service

Back Bay, North & South Stations

\*Boylston: Accessible for Silver Line only

**?** Customer Communications & Travel Info

617-222-3200, 1-800-392-6100,

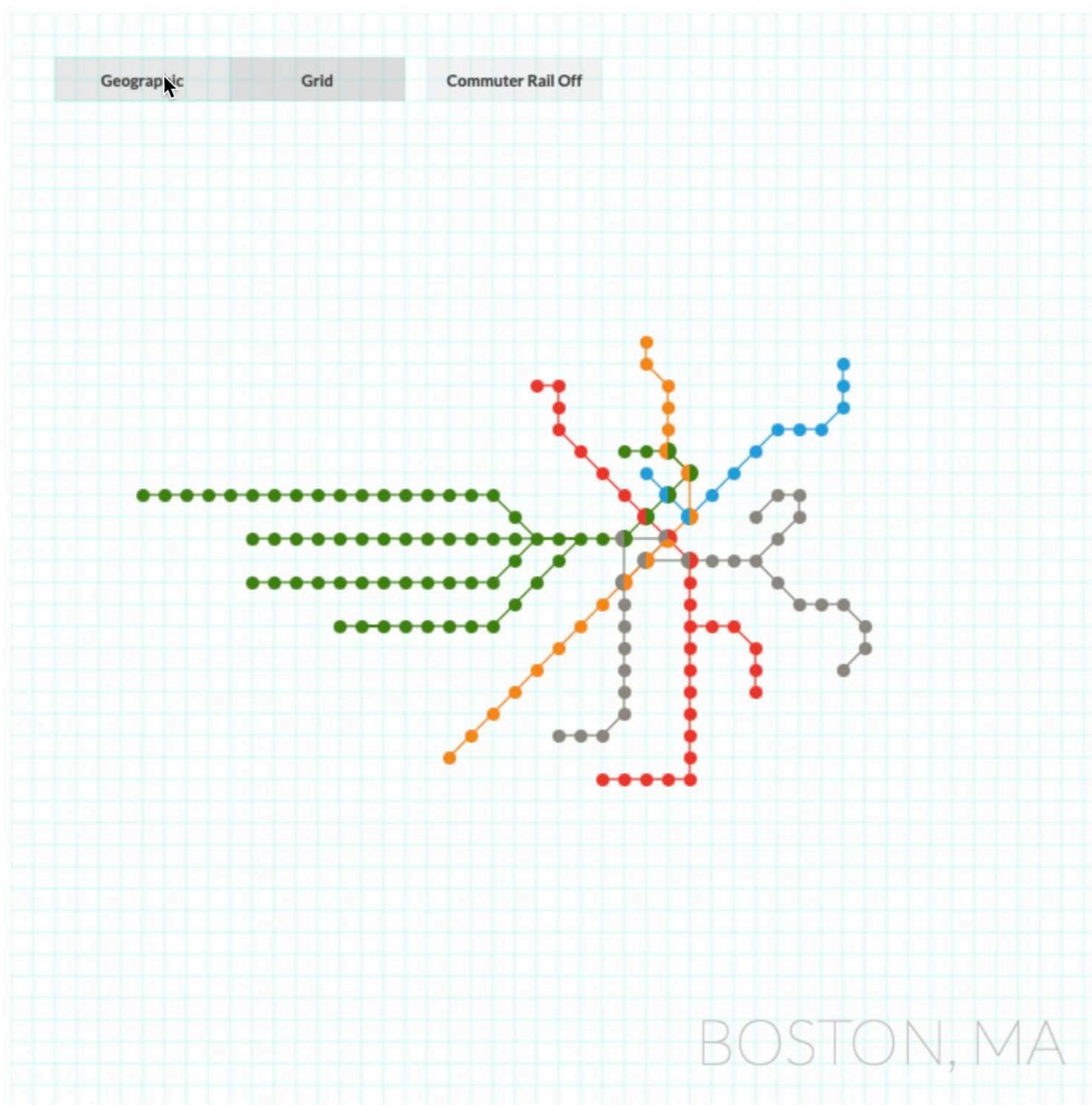
TTY 617-222-5146, www.mtba.com

**?** MBTA Transit Police: 911

TTY 617-222-1200

**?** Elevator/escalator/lift updates: 800-392-6100

Not to scale



Terrence Fradet 2013

# An Overhaul of an Underground Icon

Next month, the Metropolitan Transportation Authority will unveil a resized, recolored and simplified edition of the well-known map, its first overhaul in more than a decade. [Related Article »](#)

FULL MAP

## The New Map



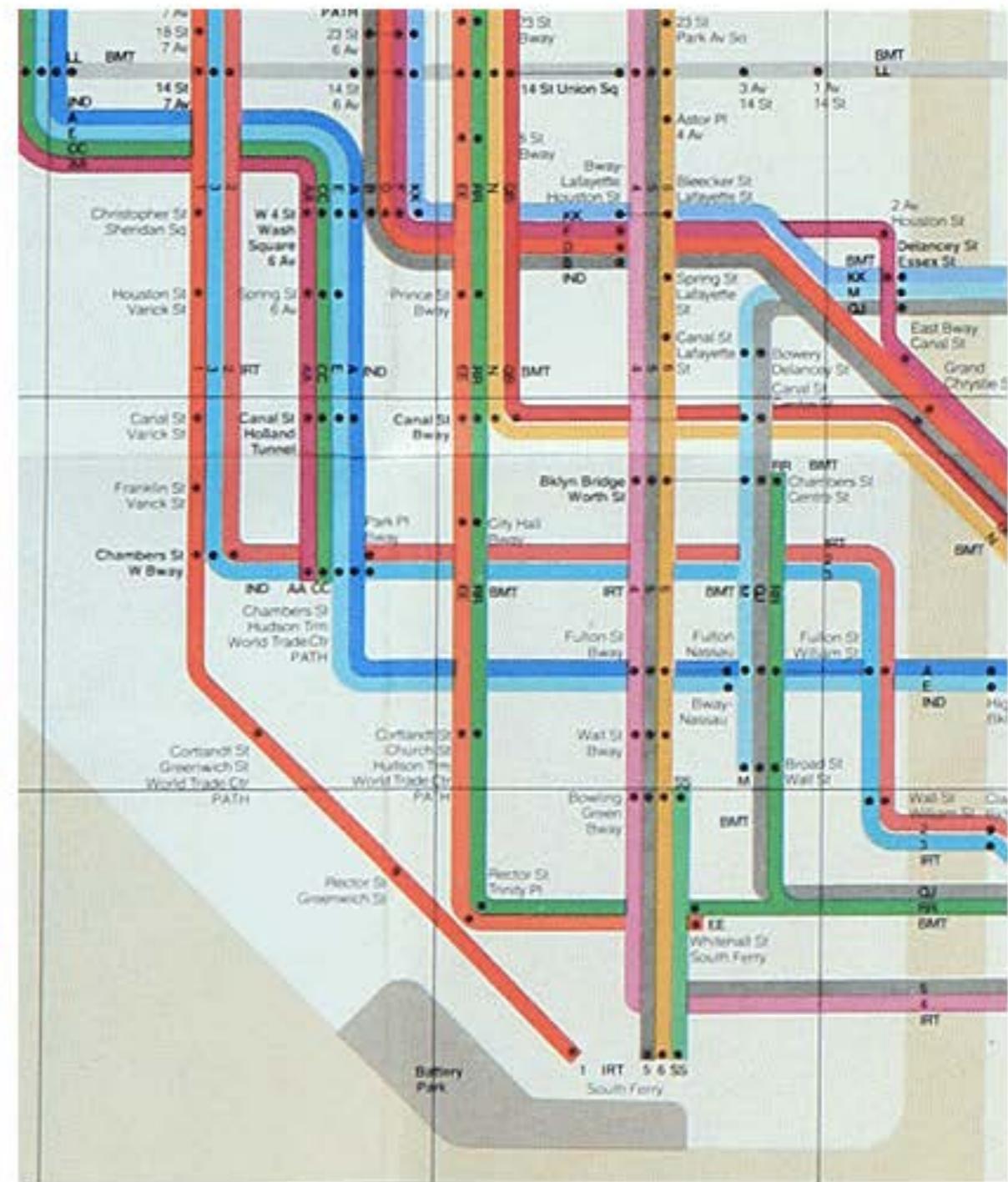
BRONX

BROOKLYN

MANHATTAN

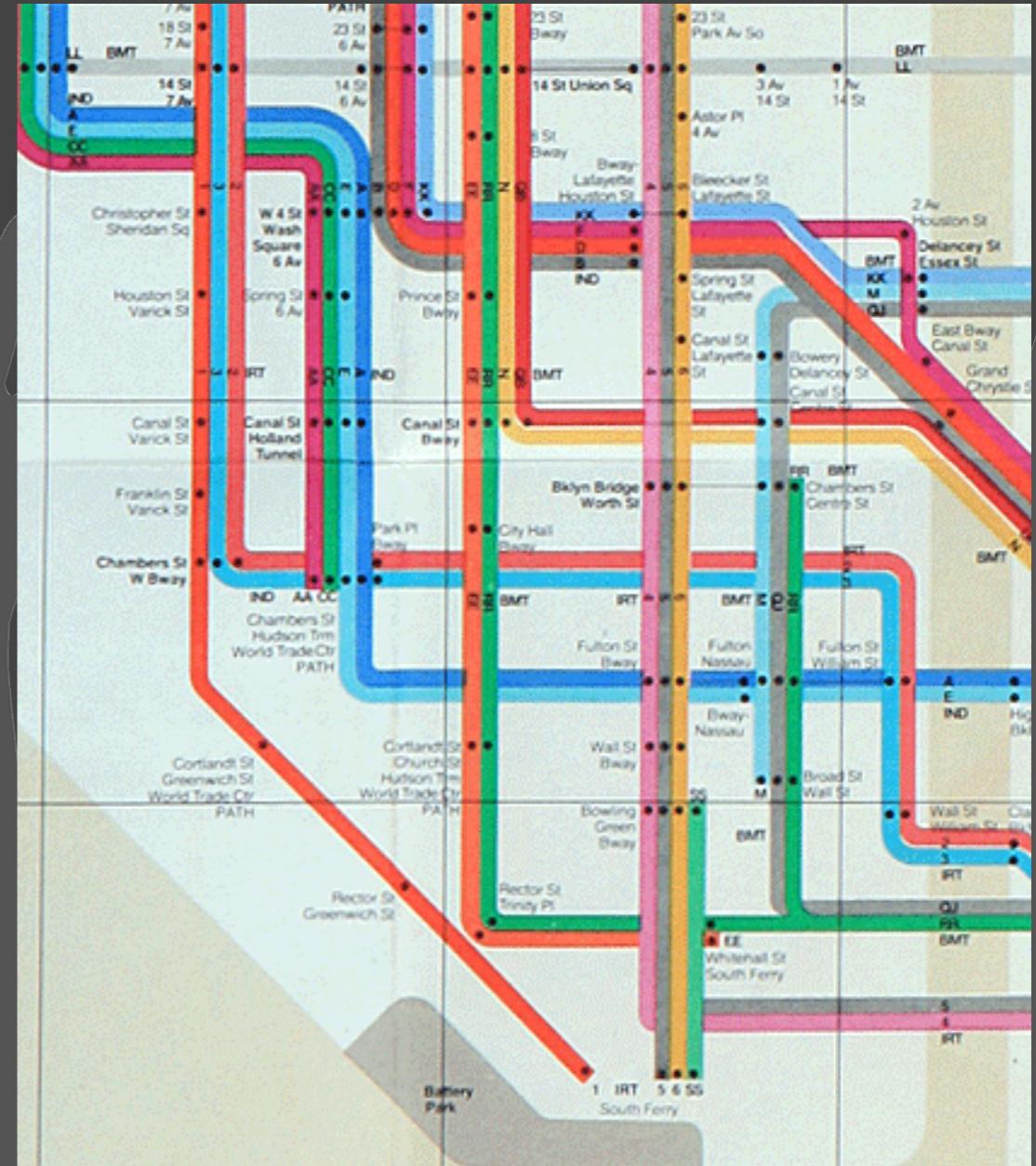
QUEENS

## 1972: Vignelli's Classic

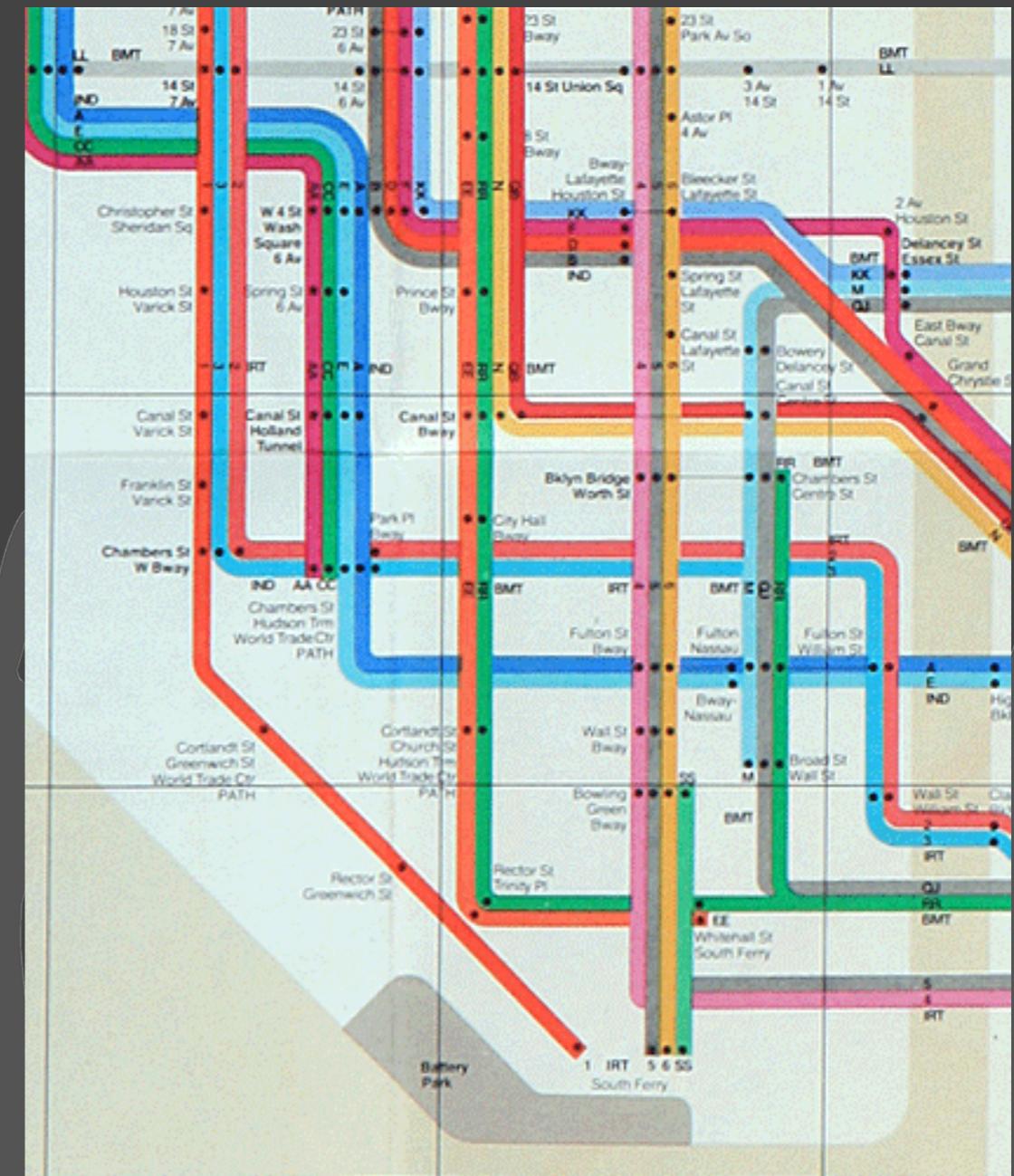


# Activity

- Discuss which of these two subway maps is better? Why?
- Time: 3+5 min



# Activity





← [Mapping Hubway availability](#)

[Halftones: Walsh & Connolly](#) →

## MBTA map redesigns

Posted on [September 11, 2013](#) by [Andy Woodruff](#)

Remember the MBTA map redesign “competition” from the summer? Well, looks like a good number of people were glad to surrender the rights to their work for free, and we the public now get to [vote on six finalists](#). (But don’t miss all the [other submissions](#) too.) To brush up on the problems with the current MBTA map, take a look at the [review](#) by the eminent transit map designer and critic Cameron Booth.

This is a Boston map blog, so what good would we be if we didn’t chime in with a few words on each map? They’ve all got some interesting ideas.

### Map 1, by Michael Kvirivishvili

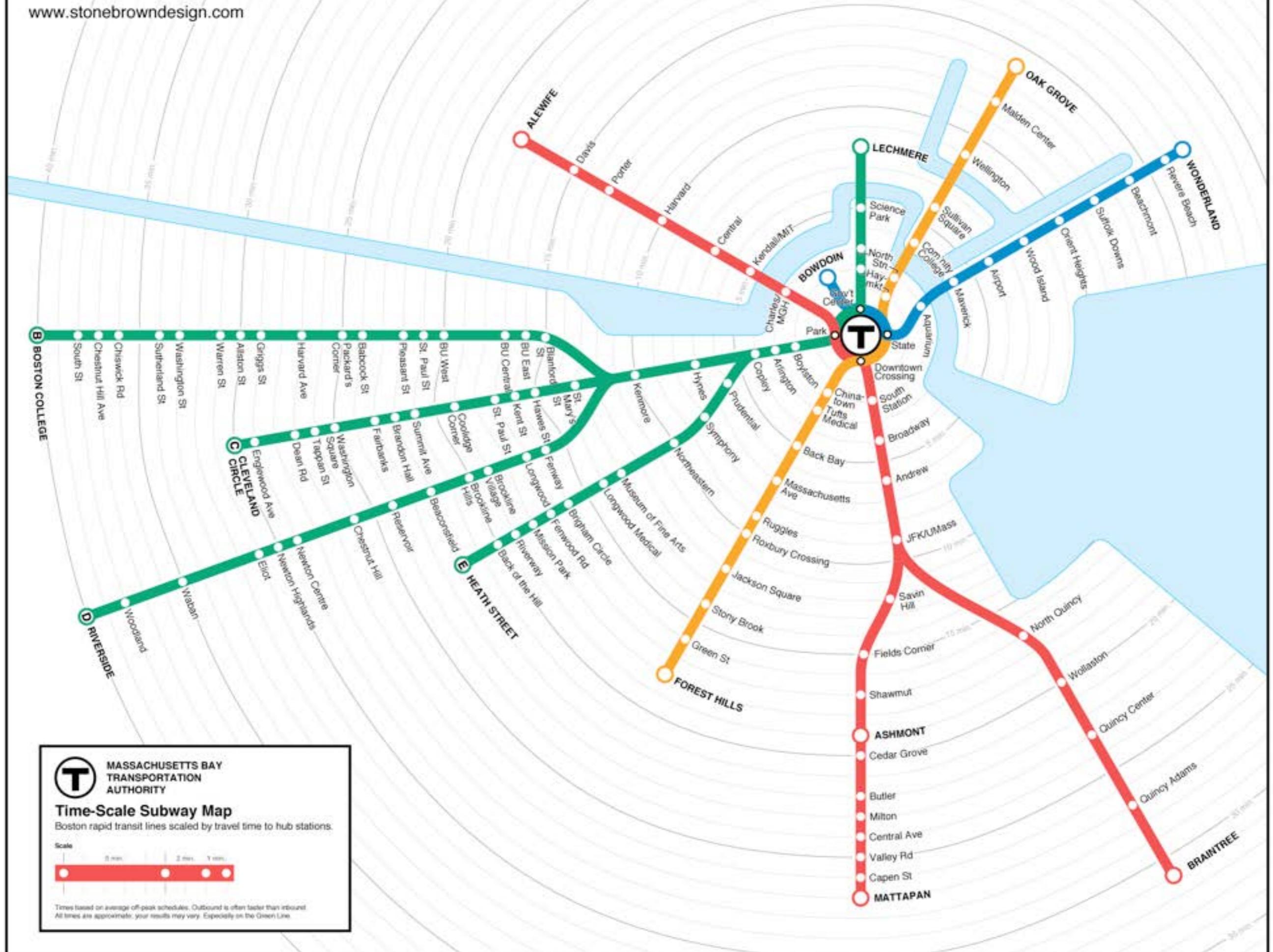




**MASSACHUSETTS BAY  
TRANSPORTATION  
AUTHORITY**

# RAPID TRANSIT MAP

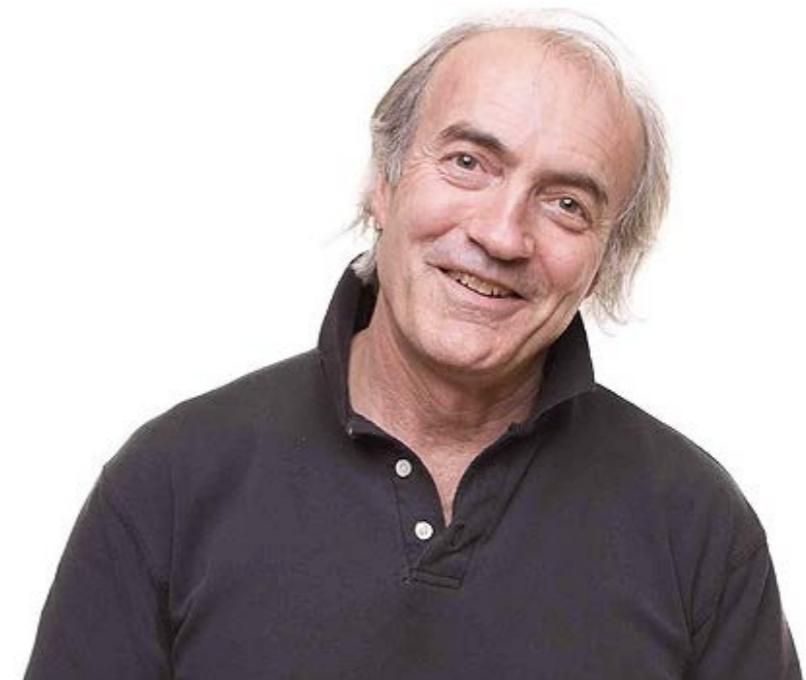




“ “

Everything is **best** for something  
and **worst** for something else.

– Bill Buxton



Who is the audience?

# Know Your Audience



What do they know?

What motivates them?

What experiences do you share?

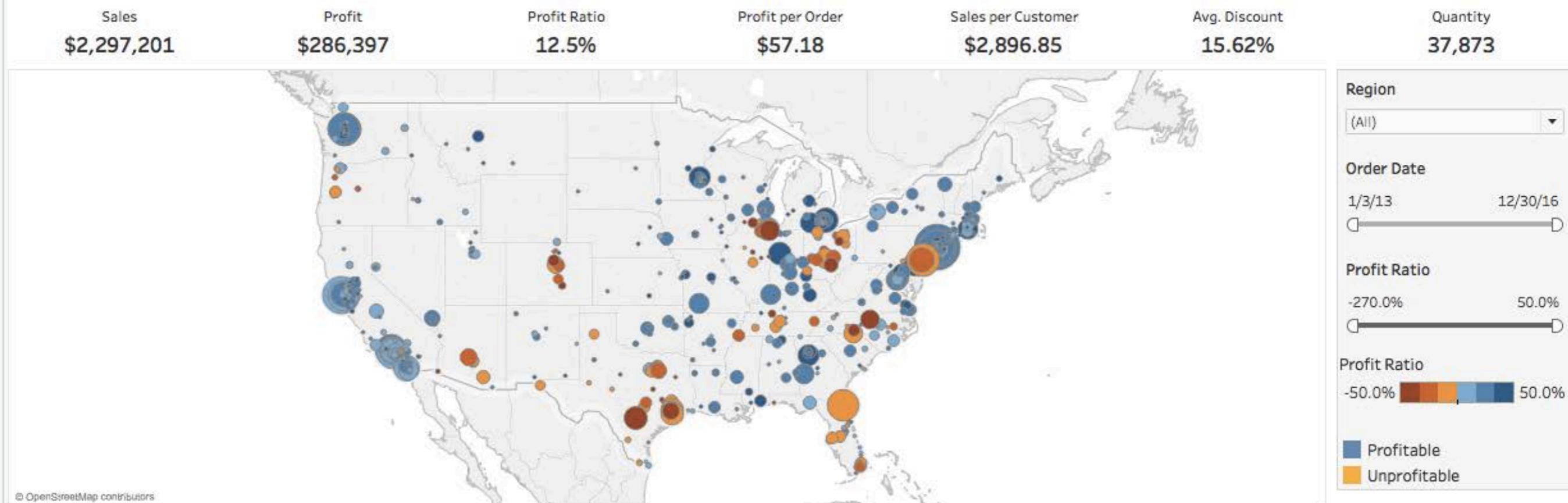
What are common goals?

What insights can you give them?

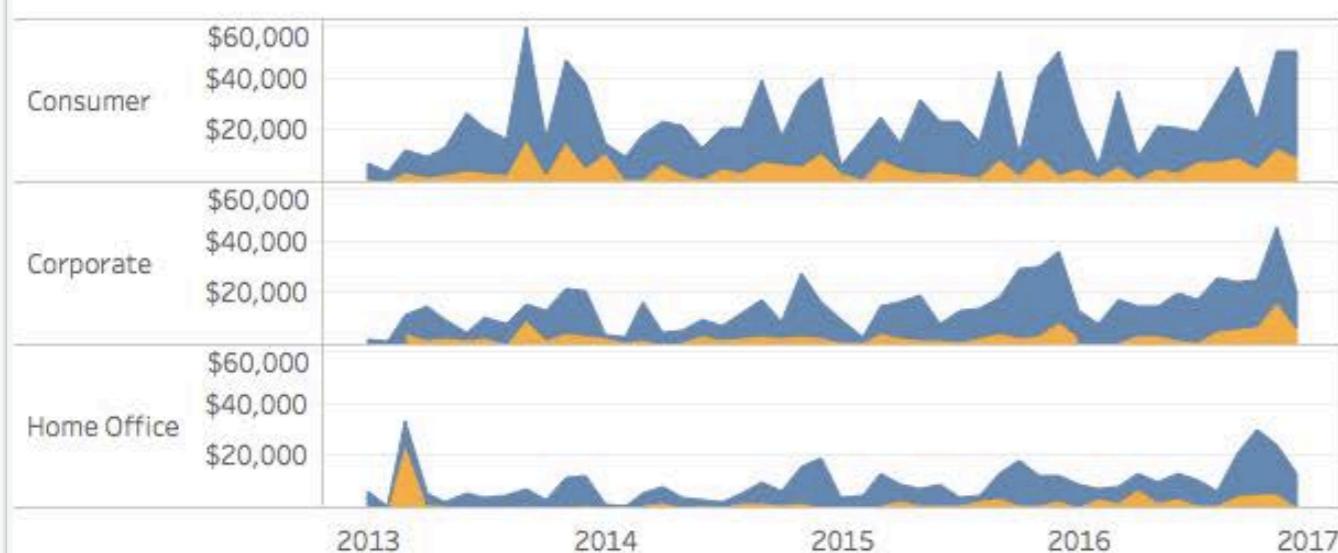
What is the appropriate tone?

# Neutral, analytical

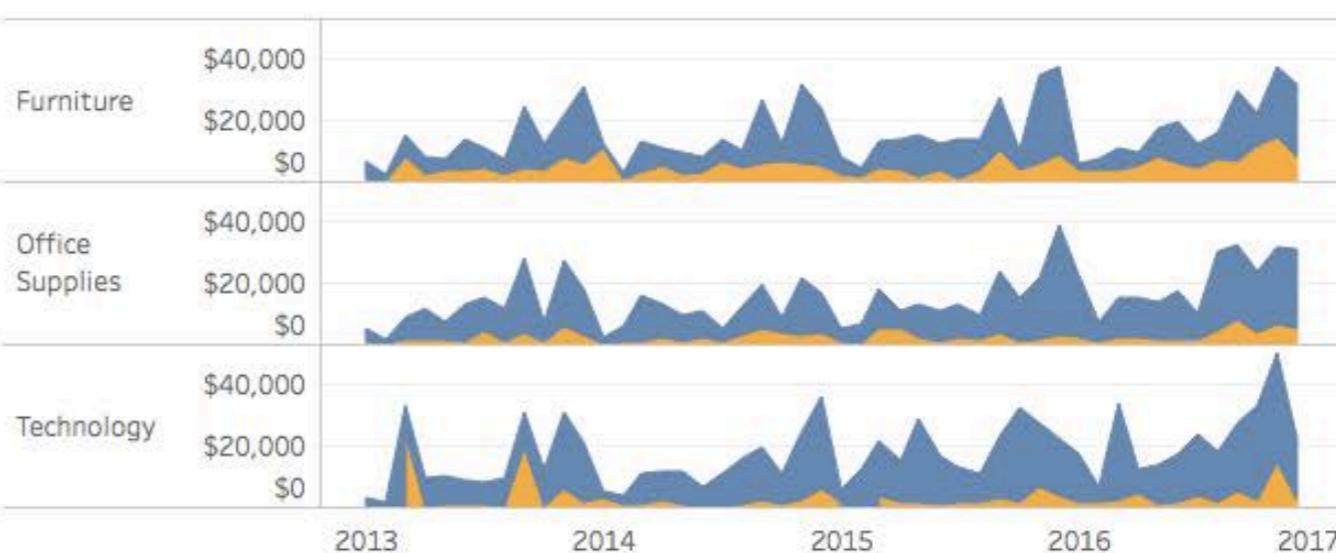
## Executive Overview - Profitability (All)



Monthly Sales by Segment - States: All

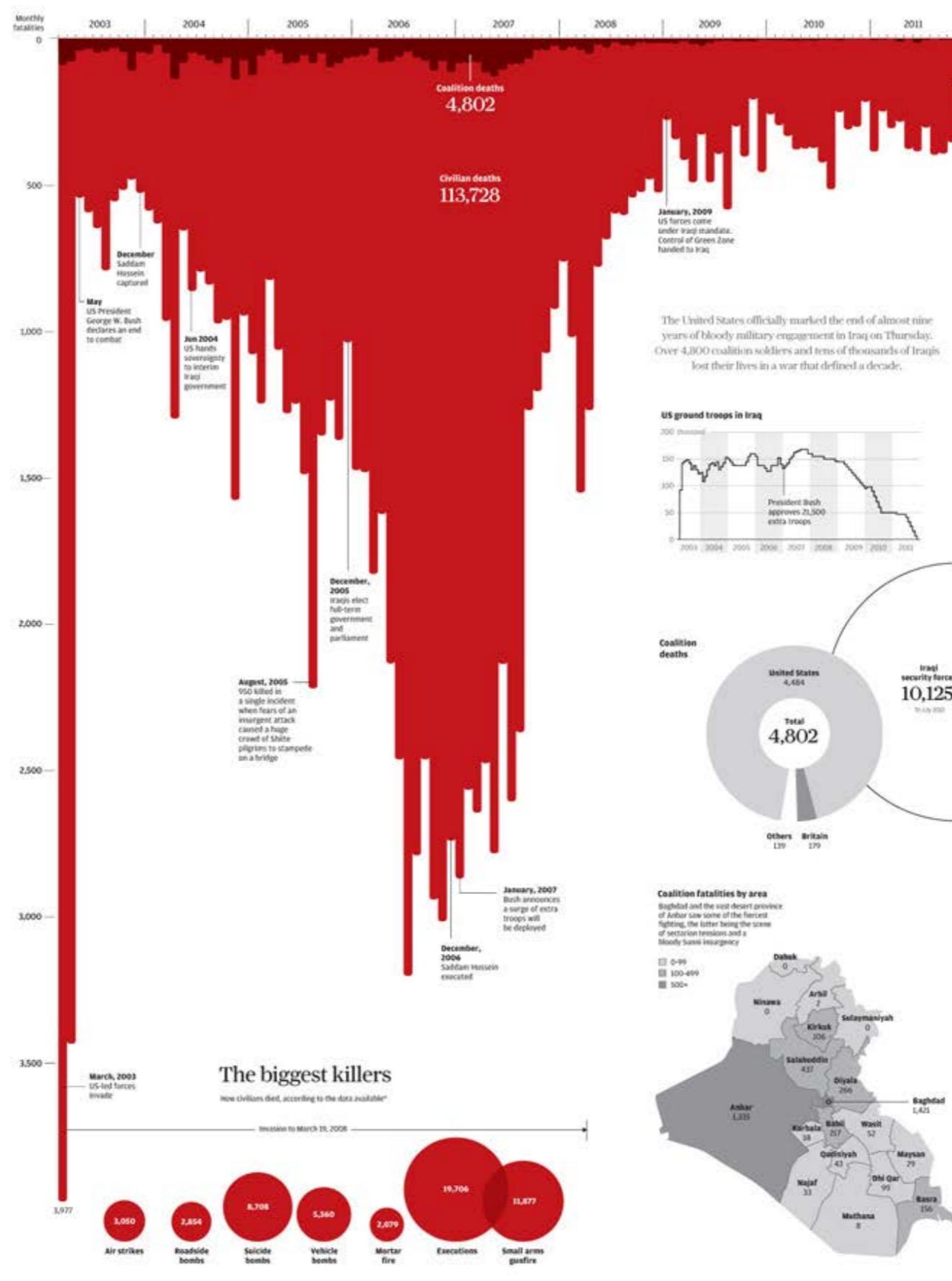


Monthly Sales by Product Category - States: All



# Opinionated, emotive

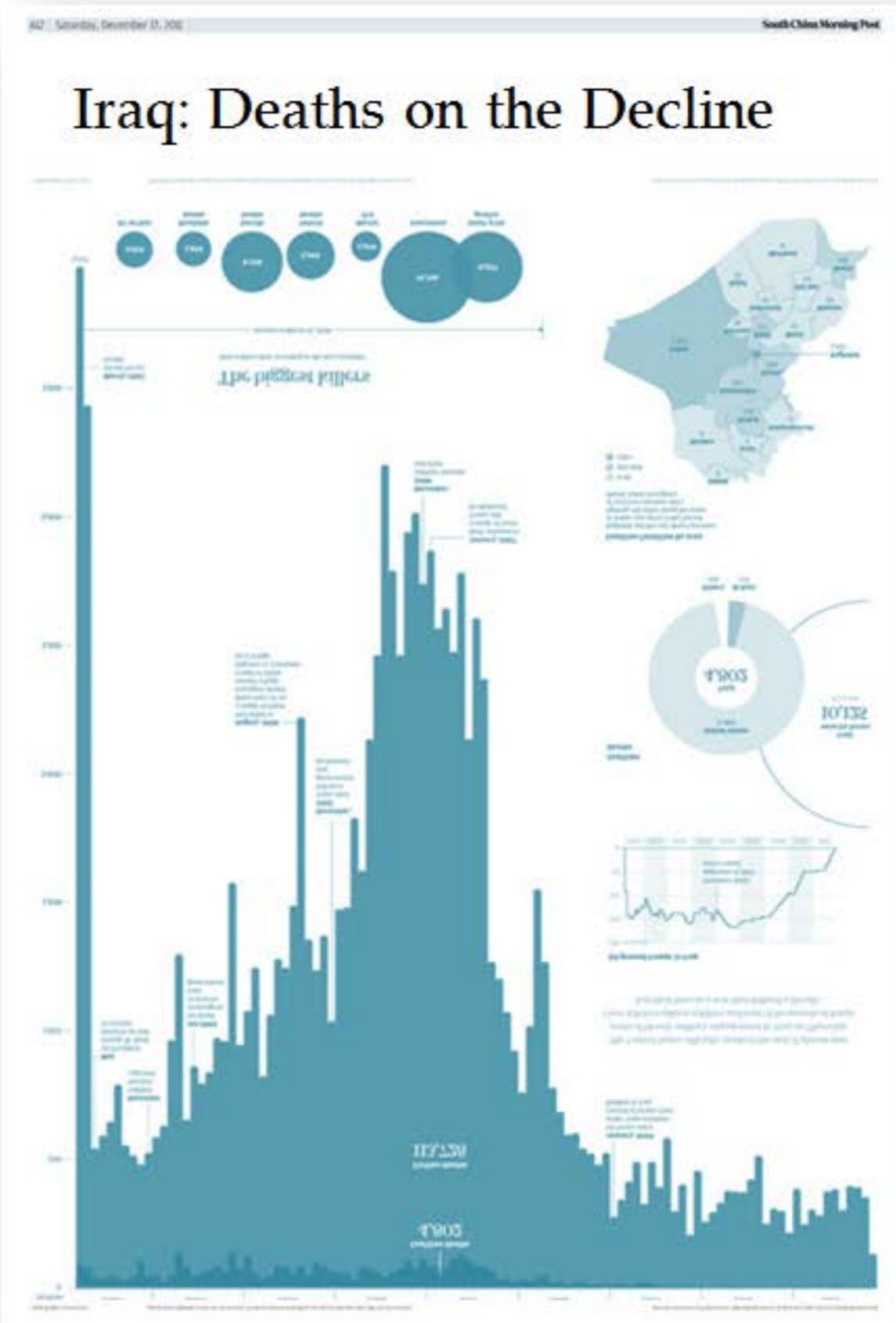
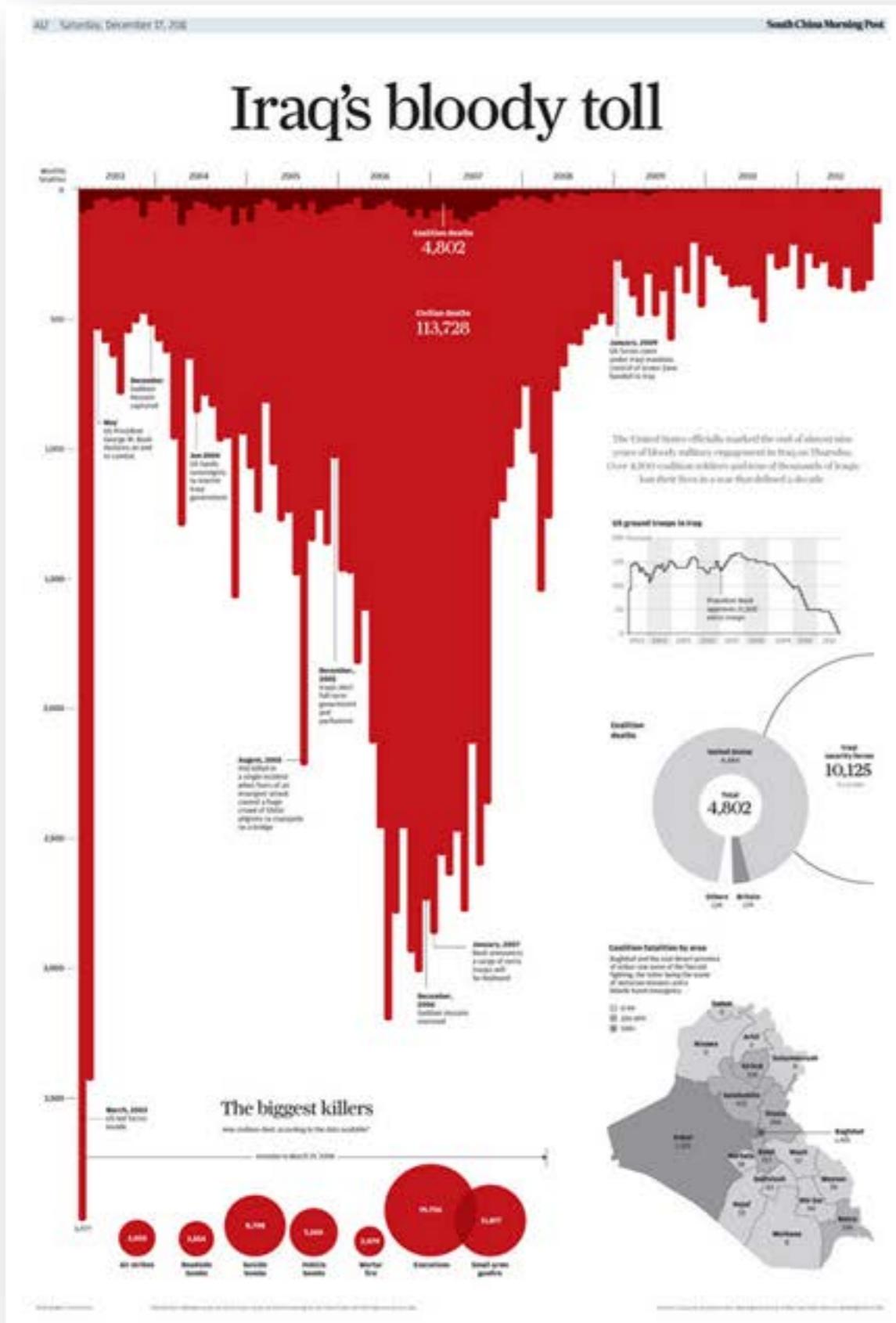
## Iraq's bloody toll



S. Scarr

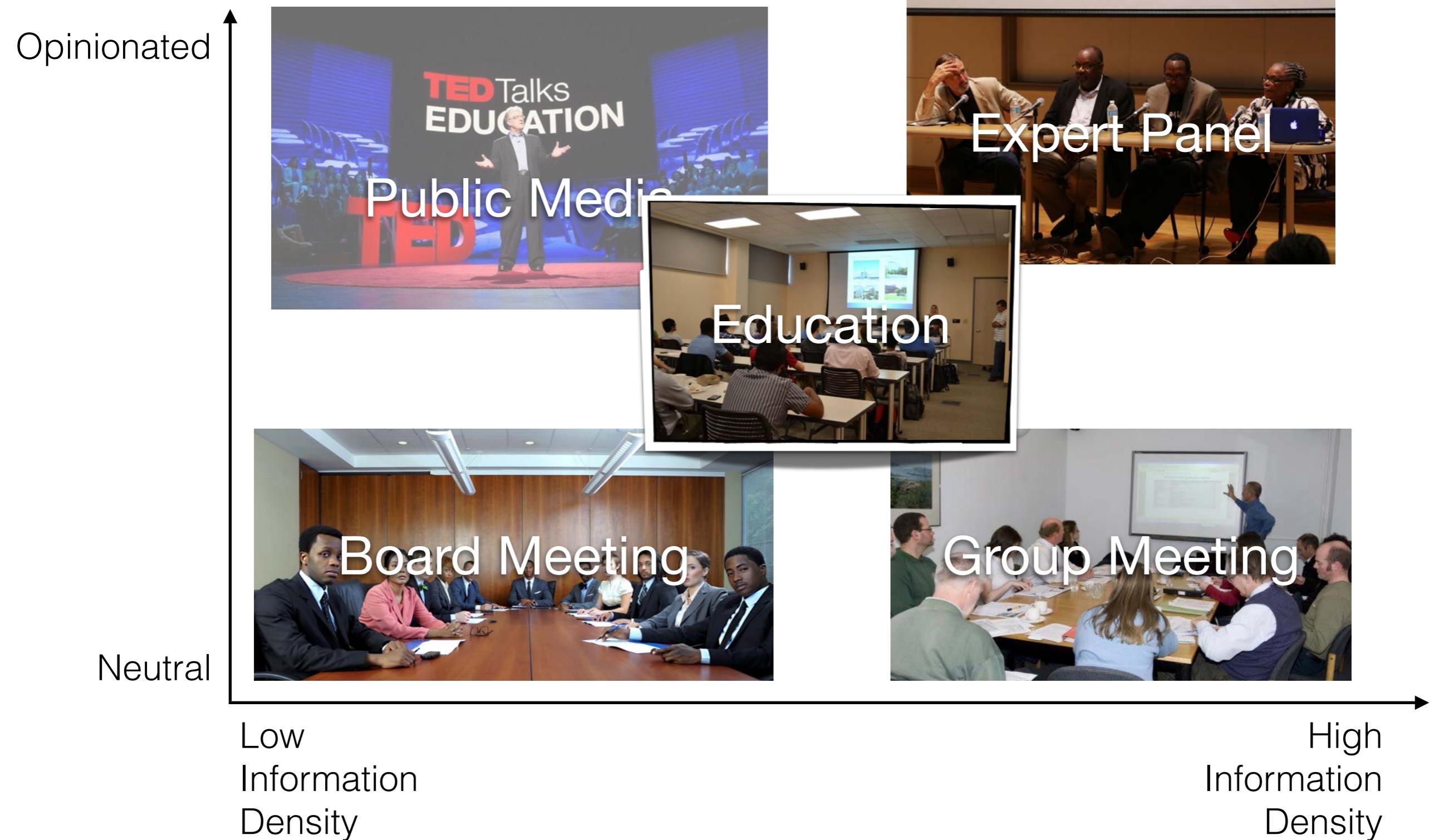
# Opinionated

## Neutral



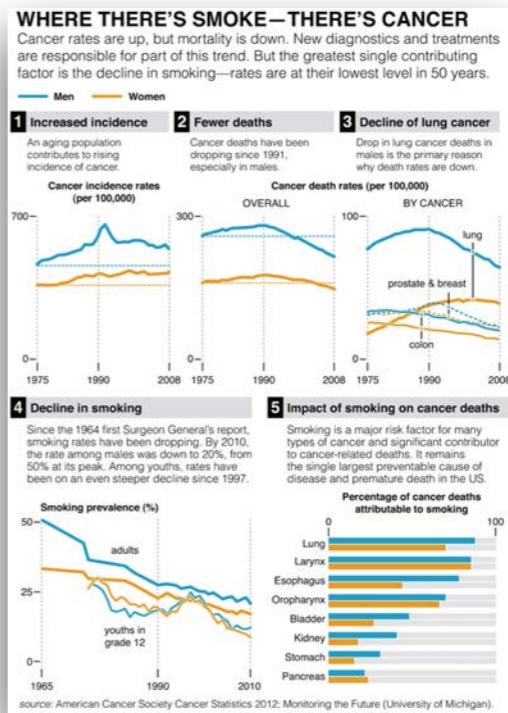
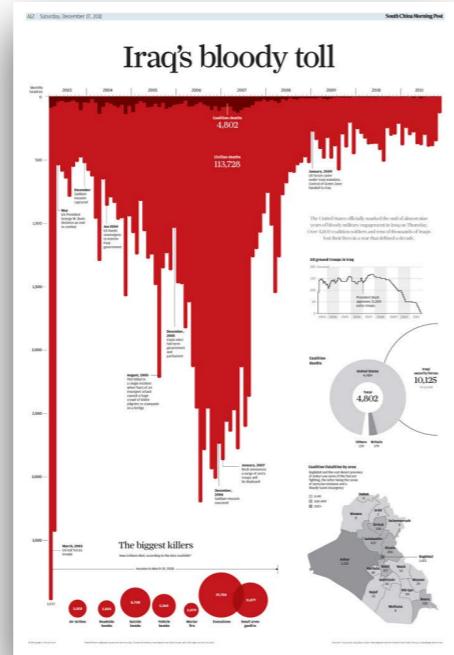
Andy Cotgreave, Tableau

# Adapt to your audience

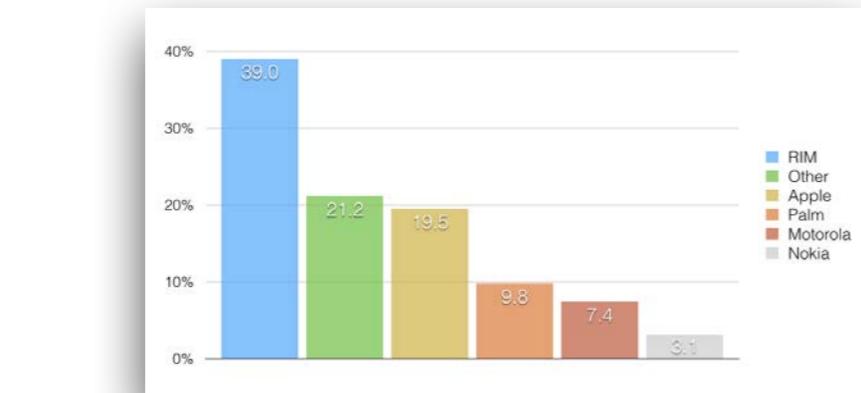


# Adapt to your audience

Opinionated



Neutral



Low  
Information  
Density



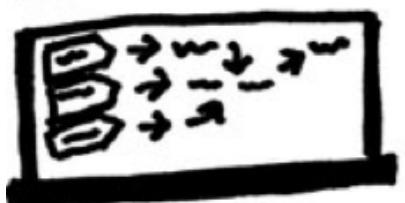
High  
Information  
Density

# Coffee Break



# Design Sprint

Map



Sketch



Decide



Proto-type



Test



# Activity

- Who is the audience for your project?  
Write down a couple of options on  
your poster and pick one.
- Come up with a list of questions that  
your audience may have about your  
data. Write down your questions on  
your poster.
- Please be as specific as possible when  
formulating your questions.

15 mins

What is the data?

# Data Types

- **Categorical (C)**

Are = or  $\neq$  to other values  
Apples, Oranges, Bananas,...



- **Ordinal (O)**

Obey a  $<$  relationship  
Small, medium, large



- **Quantitative (Q)**

Can do arithmetic on them  
10 inches, 23 inches, etc.



A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack	0.55	2/22/08
32	7/16/07	2-High	Small Pack	0.79	7/17/07
32	7/16/07	2-High	Jumbo Box		7/17/07
32	7/16/07	2-High	Medium Box		7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified	Wrap Bag	0.6	6/6/05
70	12/18/06	5-Low	Small Box	0.59	12/23/06
70	12/18/06	5-Low	Wrap Bag	0.82	12/23/06
96	4/17/05	2-High	Small Box	0.55	4/19/05
97	1/29/06	3-Medium	Small Box	0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack		2/22/08
32	7/16/07	2-High	Small Pack		7/17/07
32	7/16/07	2-High	Jumbo Box		7/17/07
32	7/16/07	2-High	Medium Box		7/18/07
32	7/16/07	2-High	Medium Box		7/18/07
35	10/23/07	4-Not Specified	Wrap Bag		10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified	Wrap Bag	0.6	6/6/05
70	12/18/06	5-Low	Small Box	0.59	12/23/06
70	12/18/06	5-Low	Wrap Bag	0.82	12/23/06
96	4/17/05	2-High	Small Box	0.55	4/19/05
97	1/29/06	3-Medium	Small Box	0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08

Attribute  
or Field

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack		2/22/08
32	7/16/07	2-High	Small Pack		7/17/07
32	7/16/07	2-High	Jumbo Box	0.72	7/17/07
32	7/16/07	2-High	Medium Box	0.6	7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified	Wrap Bag	0.6	6/6/05
70	12/18/06	5-Low	Small Box	0.59	12/23/06
70	12/18/06	5-Low	Wrap Bag	0.82	12/23/06
96	4/17/05	2-High	Small Box	0.55	4/19/05
97	1/29/06	3-Medium	Small Box	0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack	0.55	2/22/08
32	7/16/07	2-High	Small Pack	0.79	7/17/07
32	7/16/07	2-High	Jumbo Box	0.72	7/17/07
32	7/16/07	2-High	Medium Box	0.6	7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified		0.6	6/6/05
70	12/18/06	5-Low		0.59	12/23/06
70	12/18/06	5-Low		0.82	12/23/06
96	4/17/05	2-High		0.55	4/19/05
97	1/29/06	3-Medium		0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08

1 = Quantitative  
2 = Categorical  
3 = Ordinal

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack	0.55	2/22/08
32	7/16/07	2-High	Small Pack	0.79	7/17/07
32	7/16/07	2-High	Jumbo Box	0.72	7/17/07
32	7/16/07	2-High	Medium Box	0.6	7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified		0.6	6/6/05
70	12/18/06	5-Low		0.59	12/23/06
70	12/18/06	5-Low		0.82	12/23/06
96	4/17/05	2-High		0.55	4/19/05
97	1/29/06	3-Medium		0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08
194	4/5/08	3-Medium	Wrap Bag	0.84	4/7/08

1 = Quantitative  
2 = Categorical  
3 = Ordinal

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack	0.55	2/22/08
32	7/16/07	2-High	Small Pack	0.79	7/17/07
32	7/16/07	2-High	Jumbo Box	0.72	7/17/07
32	7/16/07	2-High	Medium Box	0.6	7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Box	0.42	3/19/07
66	1/20/05	1-Urgent	Small Box	0.42	1/20/05
69	6/4/05	1-Urgent	Small Box	0.42	6/6/05
69	6/4/05	1-Urgent	Small Box	0.42	6/6/05
70	12/18/06	1-Urgent	Small Box	0.42	12/23/06
70	12/18/06	1-Urgent	Small Box	0.42	12/23/06
96	4/17/05	1-Urgent	Small Box	0.42	4/19/05
97	1/29/06	1-Urgent	Small Box	0.42	1/30/06
129	11/19/08	1-Urgent	Small Box	0.42	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08
194	4/5/08	3-Medium	Wrap Bag	0.84	4/7/08

**Categorical/Ordinal = Dimensions**  
Describe the data, independent variables

**Quantitative = Measures**  
Numbers to be analyzed, dependent variables

# Tableau



# Activity

What are the data fields you can use to match the two tables?

⚠ Distribution — Rx ▾

How do relationships differ from joins? [Learn more](#)

Distribution      Operator      Rx

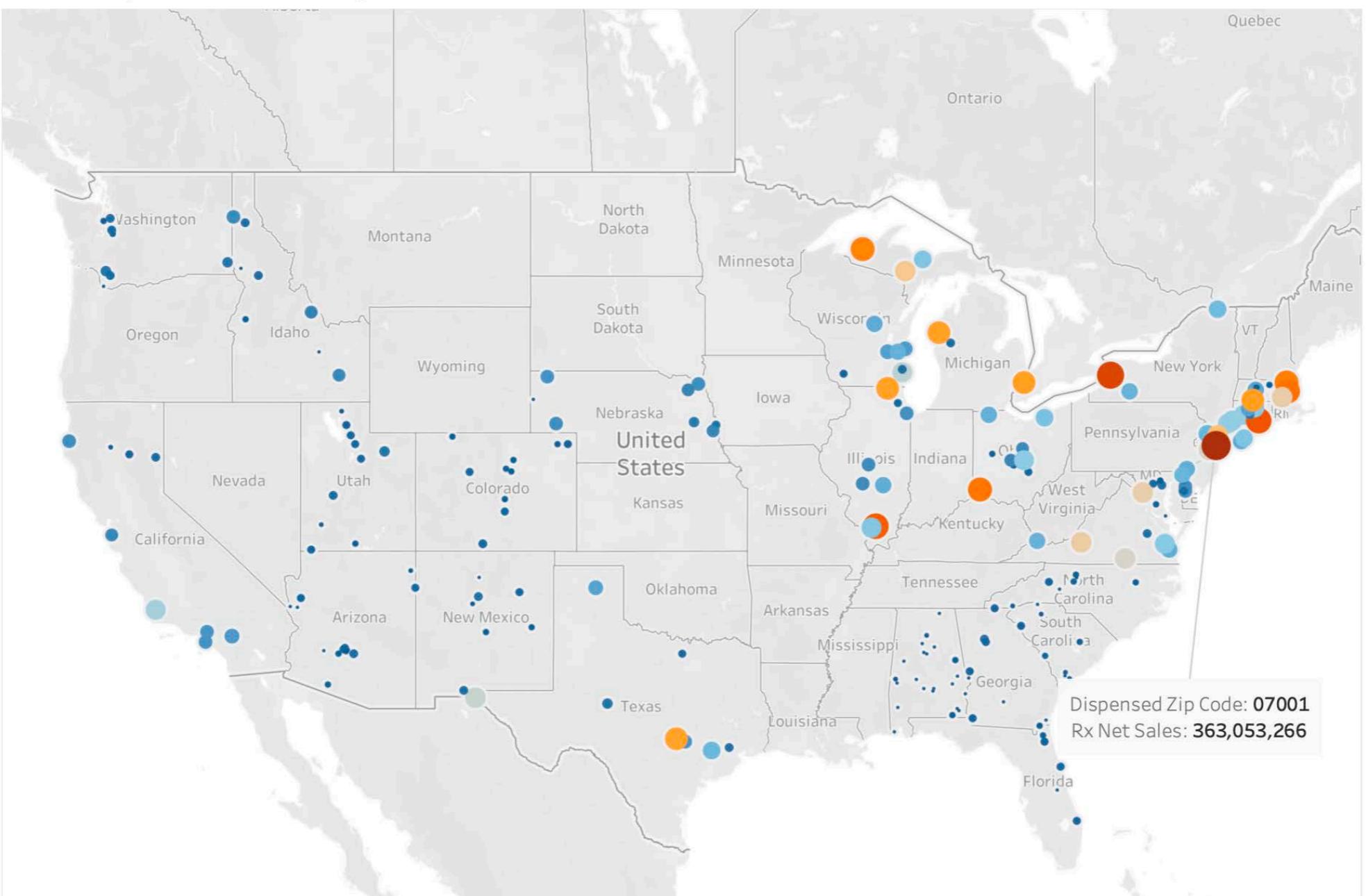
Select a field ▾ = Select a field ▾

⚠ Select matching fields to create this relationship.

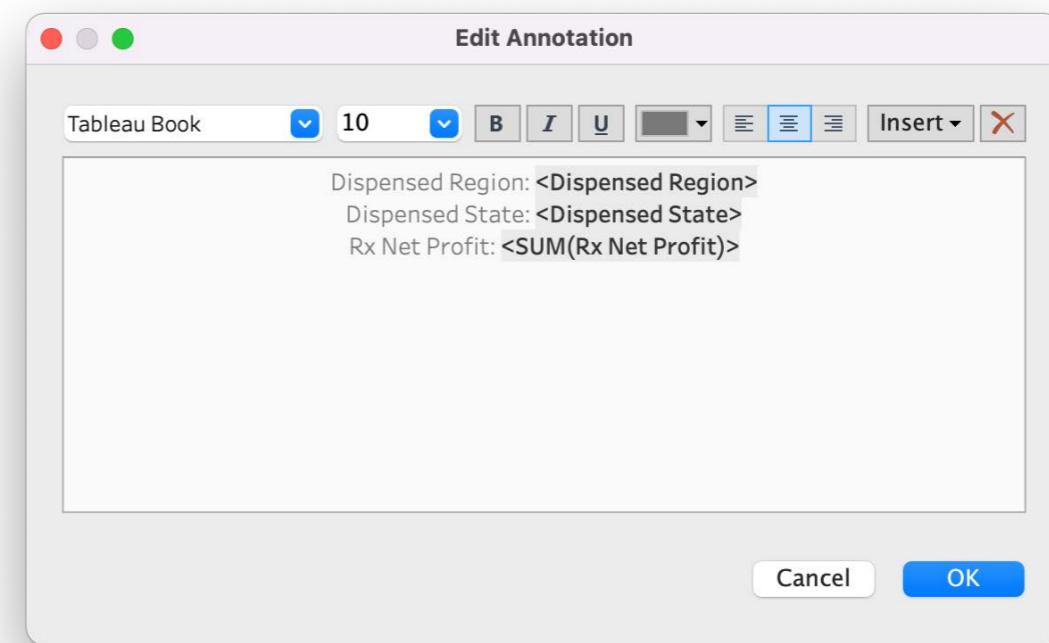
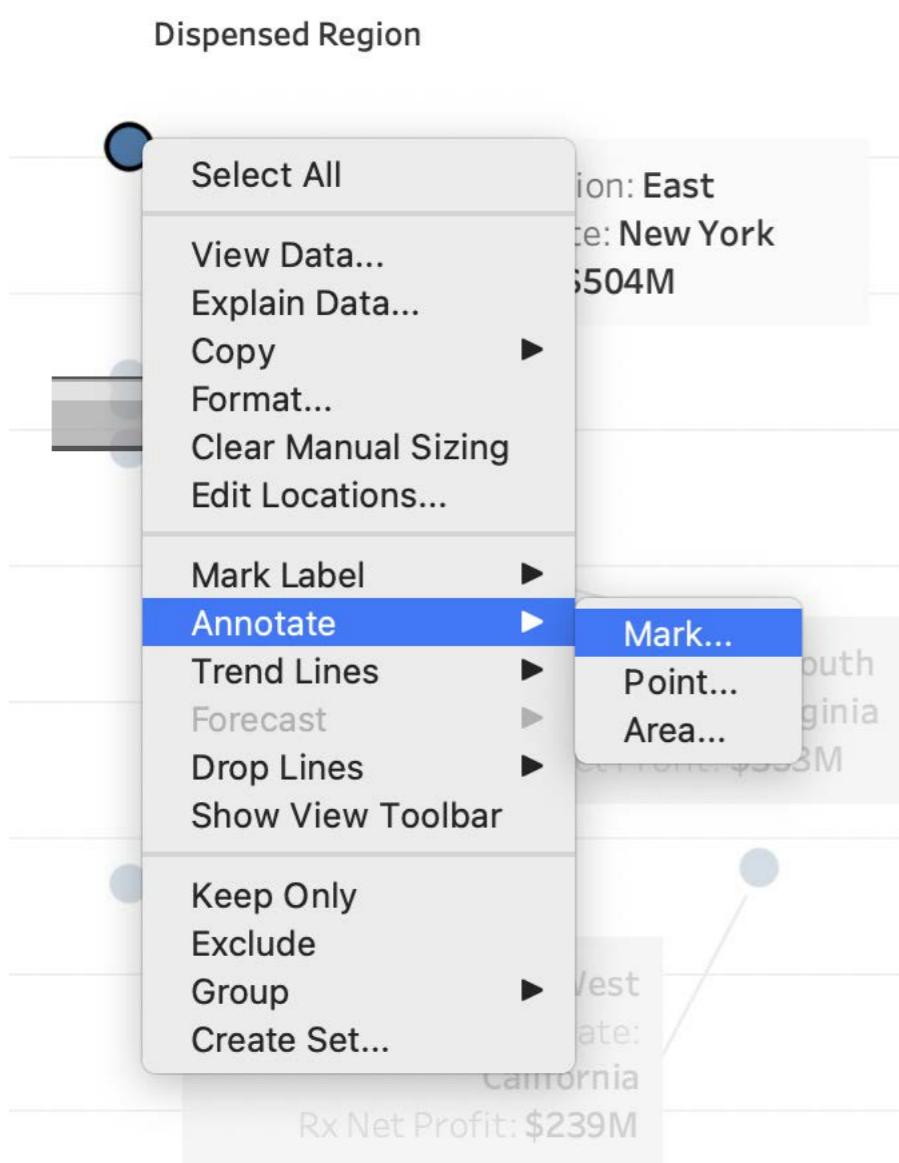
⊕ Add more fields

# Activity

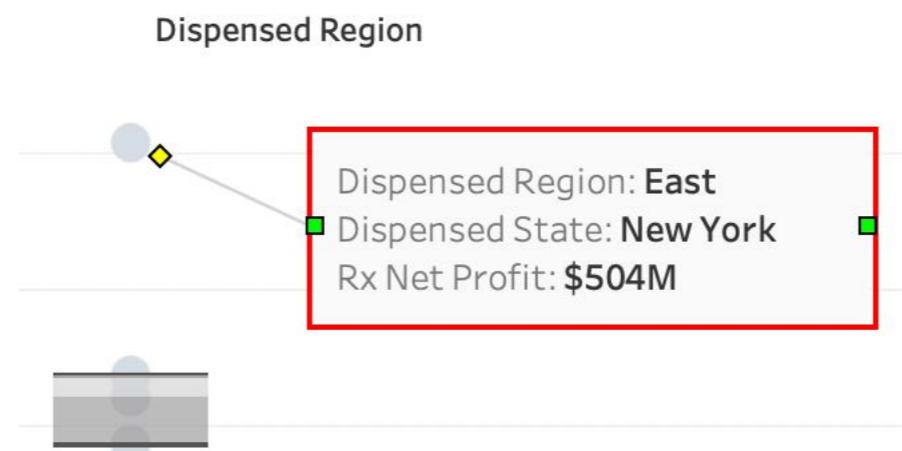
Which zip code has the highest net sales?



# Annotations



## Move & resize annotation



# Activity

Which state had the highest net profits and in what year?

Dispensed State	Order Date			
	2007	2008	2009	2010
Alabama	10,625,847	10,445,161	7,646,089	15,975,223
Arizona	26,189,409	19,835,569	18,231,246	34,903,065
California	60,292,581	66,038,042	43,014,196	69,661,403
Colorado	22,344,448	16,098,347	17,054,421	30,091,139
Connecticut	74,659,393	79,488,818	101,339,847	137,846,613
Delaware	51,780,862	75,645,533	60,005,501	46,208,448
Florida	14,627,991	11,127,884	11,648,136	13,242,501
Georgia	8,905,874	9,531,362	14,212,564	13,924,482
Idaho	33,149,573	24,706,810	27,717,795	34,522,844
Illinois	104,662,814	76,820,150	89,267,919	99,501,550
Maryland	14,043,098	11,226,690	6,050,966	19,209,220
Massachusetts	110,957,968	96,183,905	78,869,543	132,422,070
Michigan	117,769,810	100,880,968	75,543,555	105,048,445
Nebraska	39,259,858	39,182,582	38,135,303	60,699,940
New Jersey	114,570,228	79,279,627	82,496,421	134,335,928
New Mexico	15,354,128	14,553,990	12,352,374	20,324,129
New York	98,326,229	113,850,307	105,972,376	185,611,390
North Carolina	12,319,451	10,433,825	8,613,281	14,842,260
Ohio	71,544,247	78,749,418	86,826,935	100,982,091
South Carolina	13,970,400	8,794,168	9,120,564	11,007,653
Texas	99,494,672	67,452,459	80,466,460	103,611,426
Utah	32,674,893	15,906,268	23,859,494	32,909,080
Virginia	83,811,609	72,512,225	83,107,457	113,937,976
Washington	27,572,090	21,563,071	22,013,933	24,827,352
Wisconsin	49,584,516	56,878,304	50,763,595	85,797,038

# Dimension vs. Measure

How do I want to **segment** the data?

Dispensed Region	Dispensed State	Order Date			
		2007	2008	2009	2010
Central	Illinois	\$105M	\$77M	\$89M	\$100M
	Michigan	\$118M	\$101M	\$76M	\$105M
	Nebraska	\$39M	\$39M	\$38M	\$61M
	Ohio	\$72M	\$79M	\$87M	\$101M
	Texas	\$99M	\$67M	\$80M	\$104M
	Wisconsin	\$50M	\$57M	\$51M	\$86M

Dimension

Qualitative/Ordinal

The way we **segment/facet**  
the data

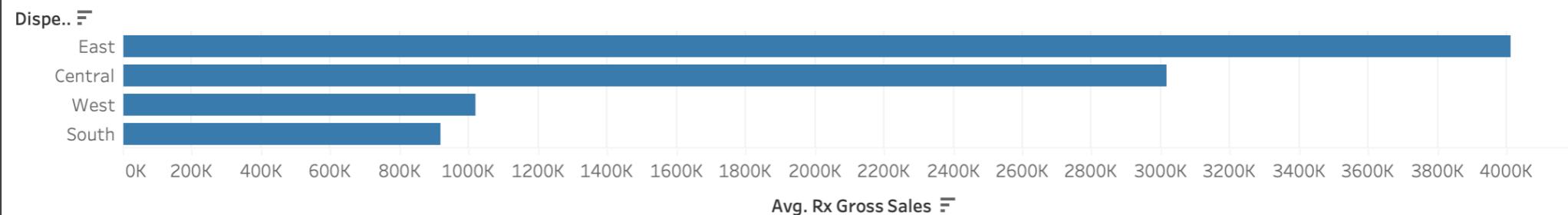
Measure

Quantitative

**Aggregated** (SUM, AVG,...)

# Activity

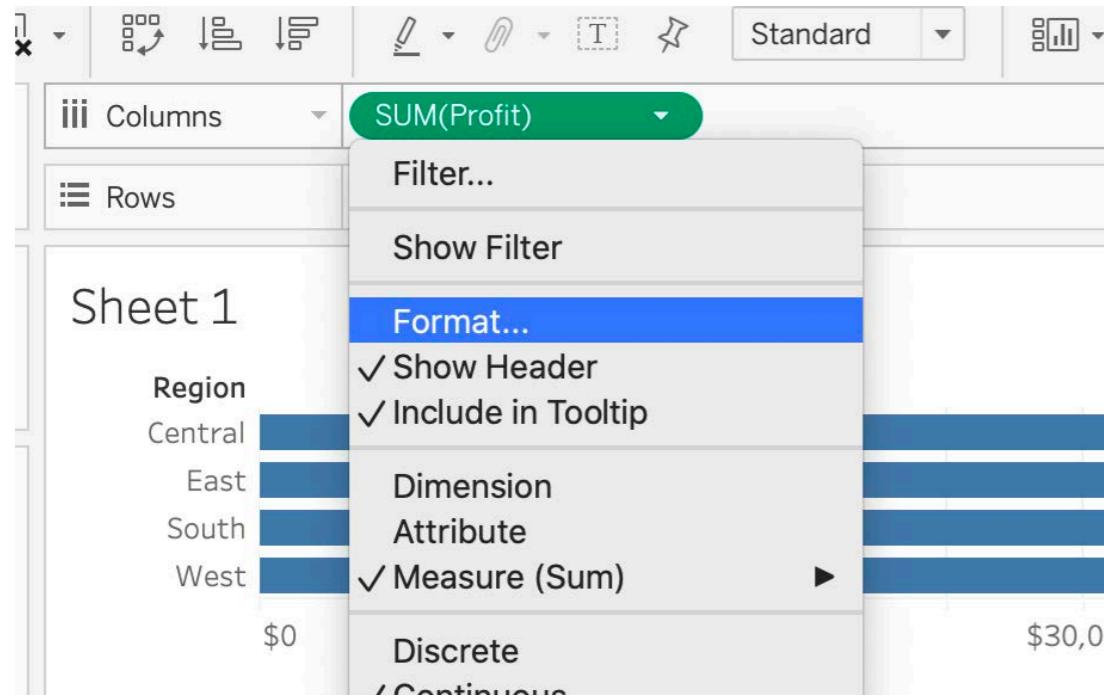
What are the average gross sales per region?



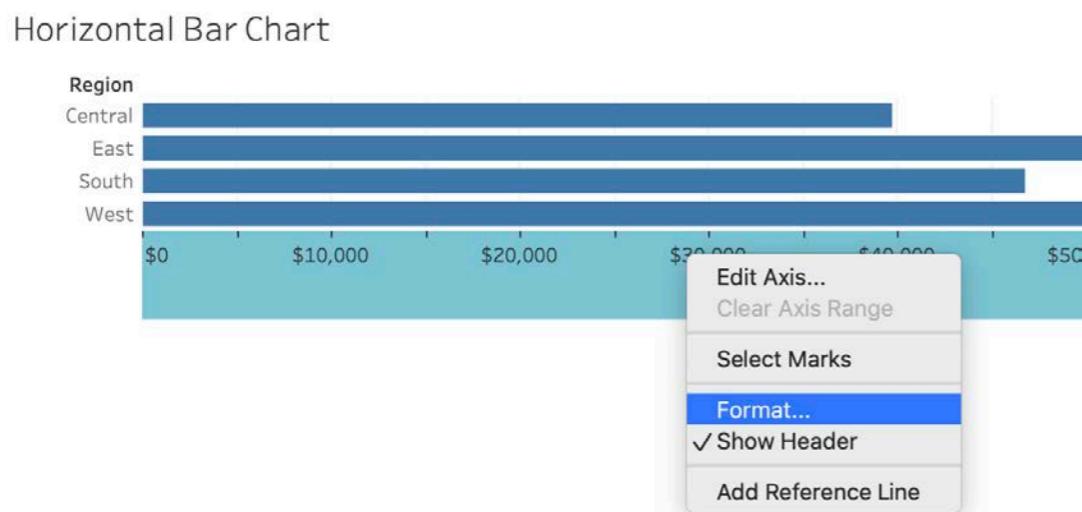
Advanced: Change the axis labels to currency and millions

# Format Options

## Pill dropdown



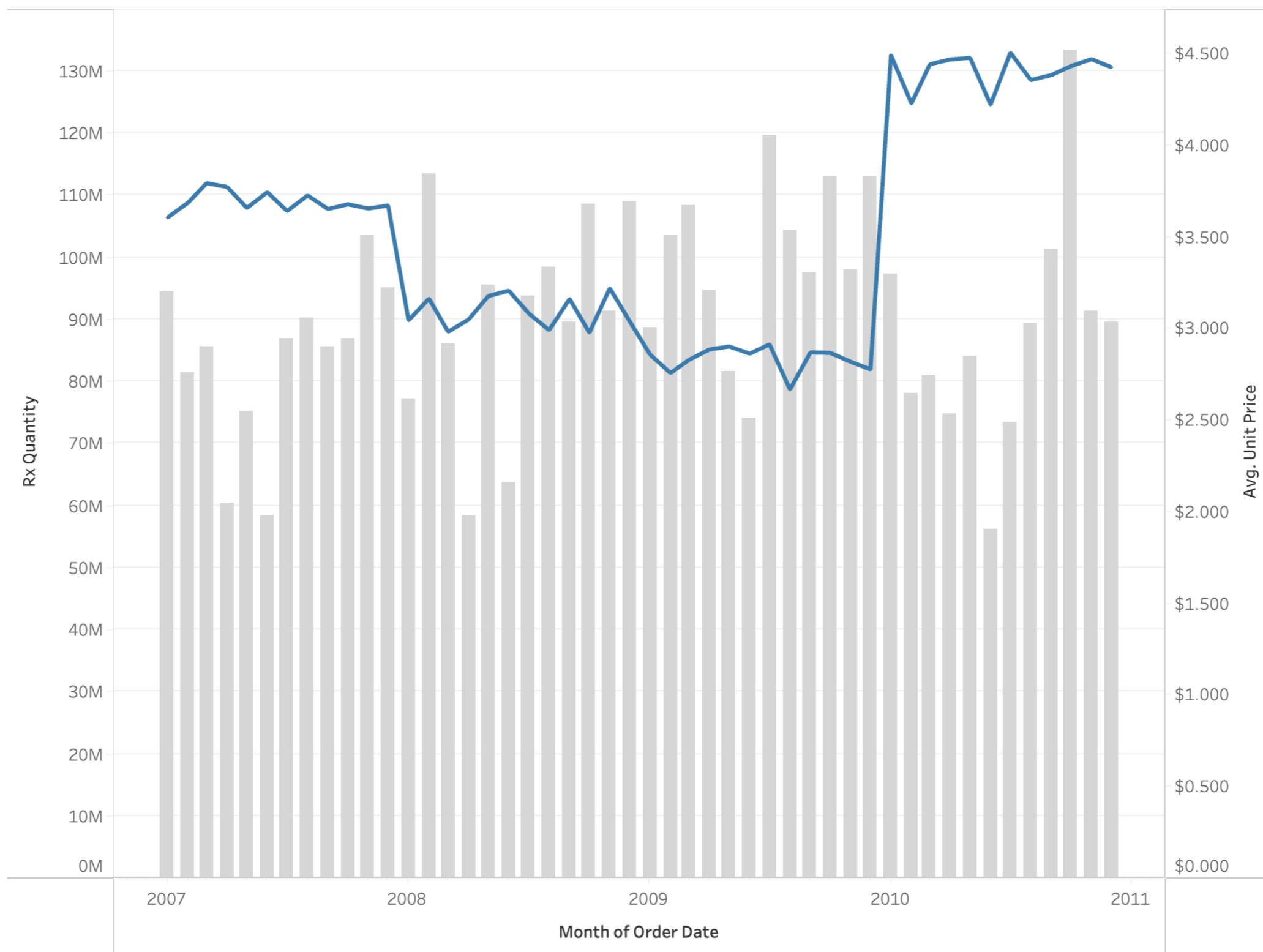
## Axis dropdown



A screenshot of the Tableau Format dialog box for the 'SUM(Profit)' pill. The dialog shows the 'Default' tab with Font set to 'Tableau Bo...' and Shading set to 'Automatic'. The 'Scale' tab shows Ticks and Numbers both set to '\$123,456'. The 'Alignment' tab shows Alignment set to 'Automatic'. The 'Title' tab shows Font set to 'Currency (Custom)'. The 'Marks' tab shows Automatic selected for Color, Size, and Label. The 'Filters' tab is empty. On the right, a preview pane shows a bar chart for 'Sheet 1' with four bars labeled 'Central', 'East', 'South', and 'West' corresponding to the regions. The 'Currency (Custom)' settings are expanded, showing Decimal places set to 0, Negative values set to '(\$1234)', Display Units set to 'None', Prefix / Suffix set to '\$', and a checked checkbox for 'Include thousands separators'.

# Activity

What are the average monthly prescription price and total quantity over time?



# Discrete vs. Continuous

How do I want to **display** the data?

I want to **write => Discrete**

A screenshot of a data visualization interface. At the top, there are two input fields: 'Columns' containing 'iii' and 'YEAR(Date)', and 'Rows' containing '≡'. Below these are two tables. The first table has a header 'Date' with columns for 2007, 2008, 2009, and 2010. The second table has a single column labeled 'Abc' under each year.

Date			
2007	2008	2009	2010
Abc	Abc	Abc	Abc

blue pill = discrete = headers

I want to **draw => Continuous**



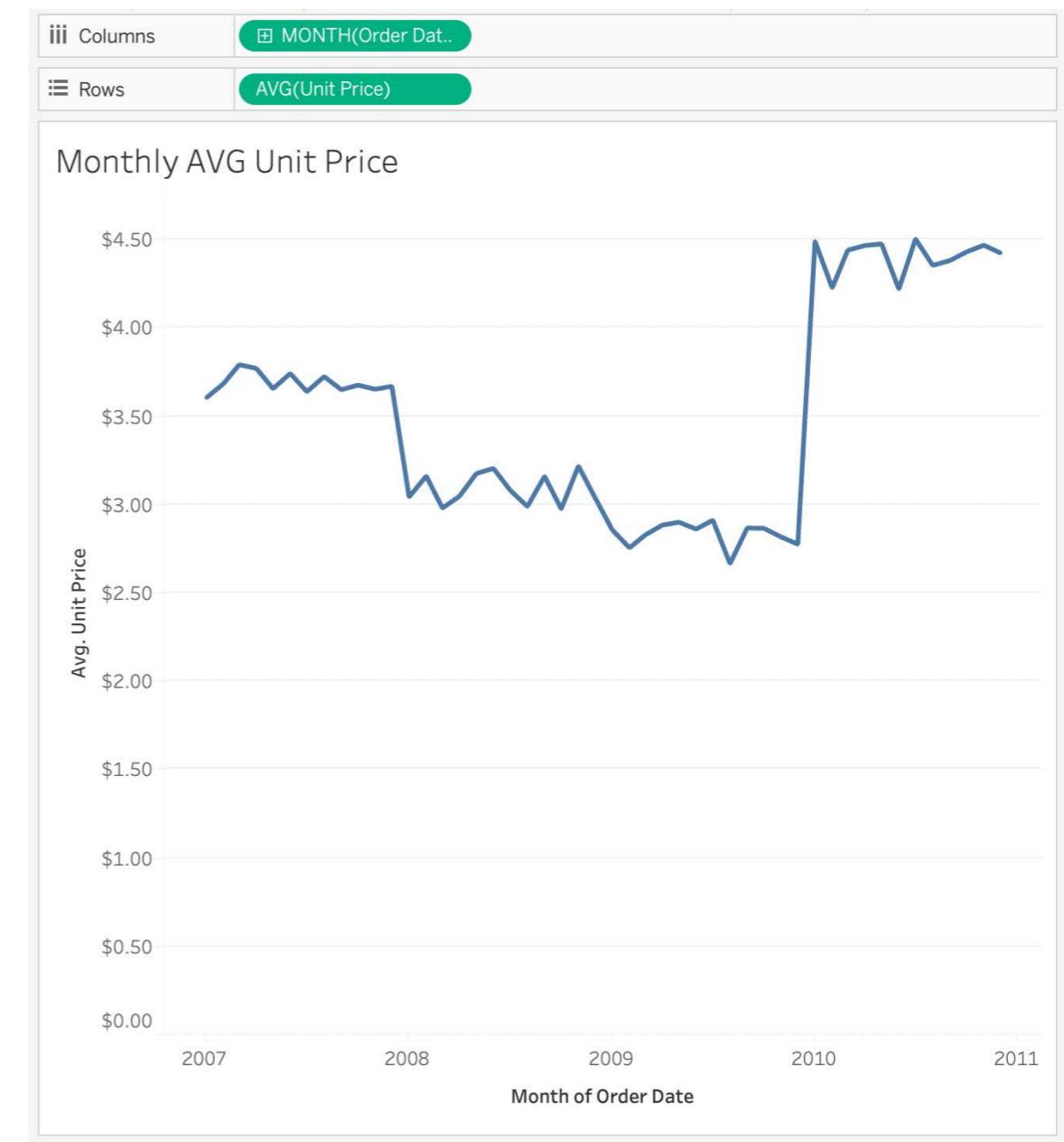
green pill = continuous = axis

# Discrete vs. Continuous

## Discrete Months



## Continuous Months



# Line vs. Bar vs. Line & Bar



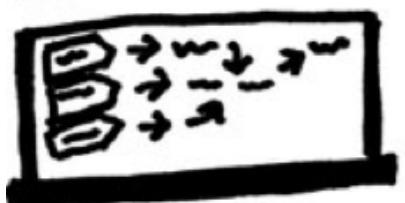
Continuous Data

Discrete Data

Both

# Design Sprint

Map



Sketch



Decide



Proto-type



Test



# Activity

Now focus on your data!

Come up with a list of new questions  
your audience might have about the  
data.

Collect all of them on your posters.

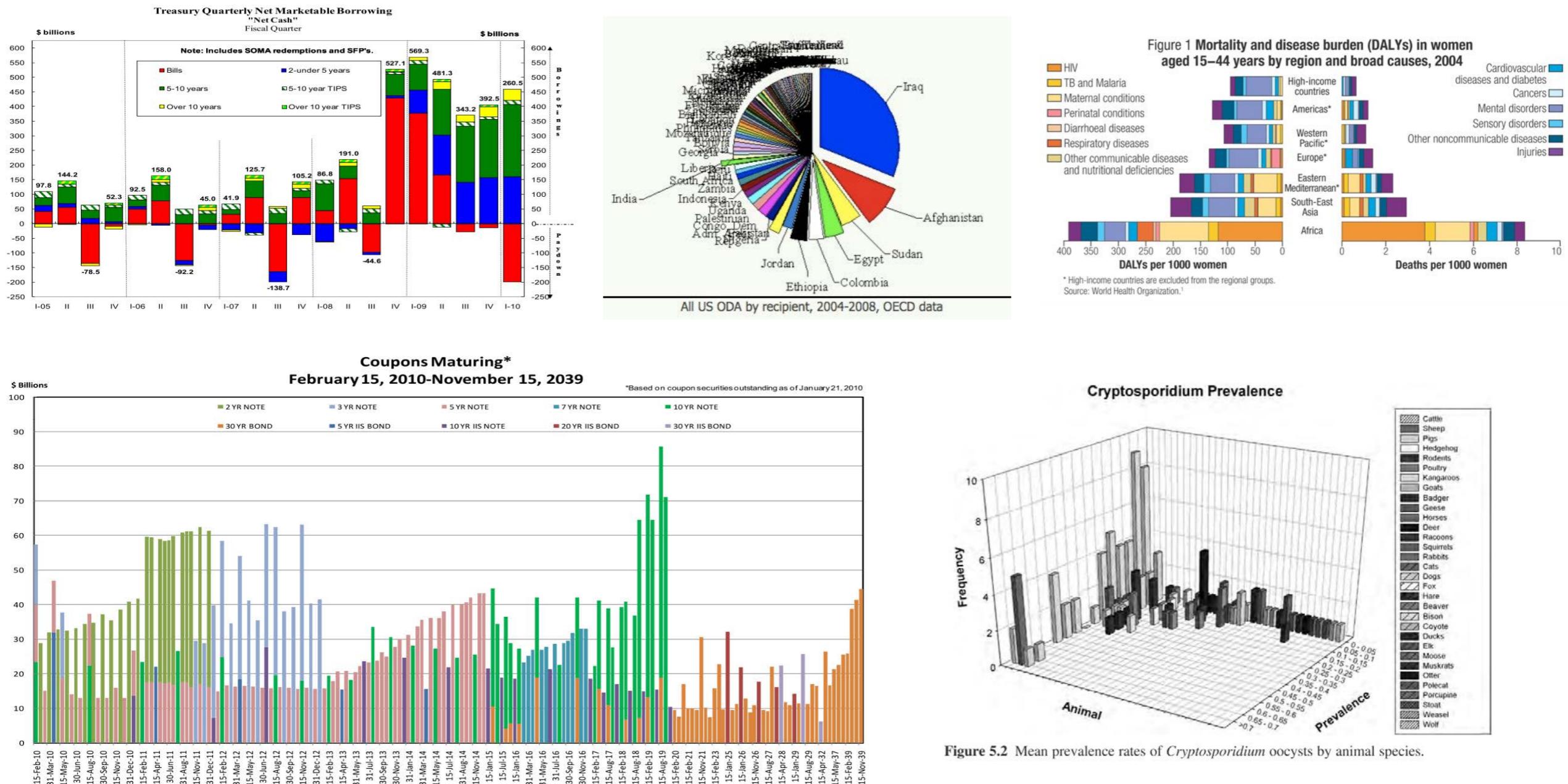
5 min

# Effective Visualizations

- What is effective?
- Graphical Integrity
- Keep it Simple

What is effective?

# Not Effective...



Sources: US Treasury and WHO reports



# WTF Visualizations

Visualizations that make no sense.

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

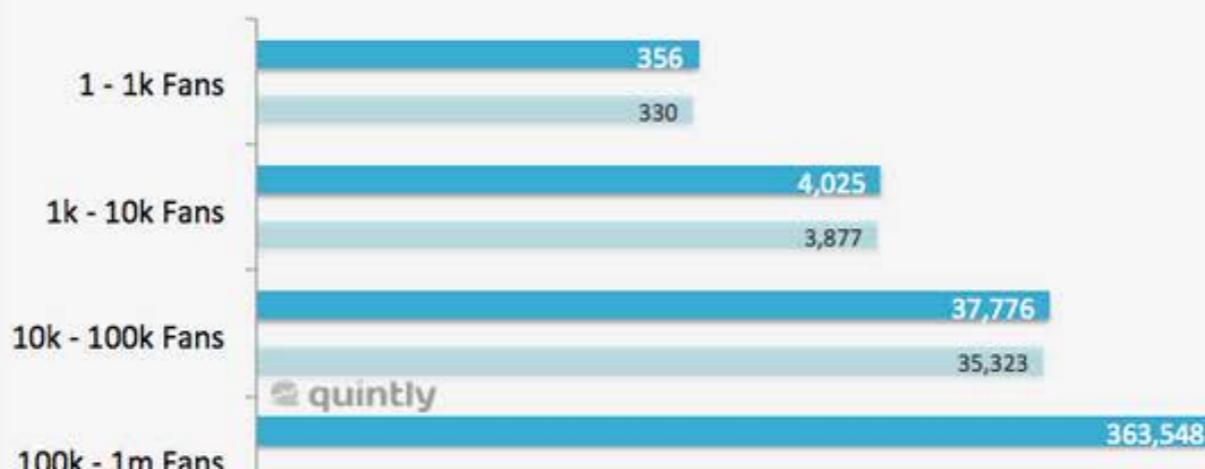
Check out our friends [Thumbs Up Viz](#) and [accidental aRt](#), or [submit](#).



## Average Number Of Facebook Fans

The total number of fans is still one of the most important metrics for Facebook marketers.

Here you can see if your total number of fans is above the average.





# The Schweppes Abbey Well Alternative Facts and Stats of the London 2012 Olympic and Paralympic Games



The best shuttlecocks are said  
to be made from the feathers  
on the left wing of a goose<sup>2</sup>



**165,000**  
towels and  
**22,000**  
pillows will be  
used to kit out the  
Olympic Village<sup>3</sup>



Olympic Rowers could use up  
to **110,000ml** of sunscreen  
during the week long event<sup>4</sup>



**1,630**  
discs ranging from 5kgs to  
25kgs are needed for the  
weightlifting competition<sup>5</sup>



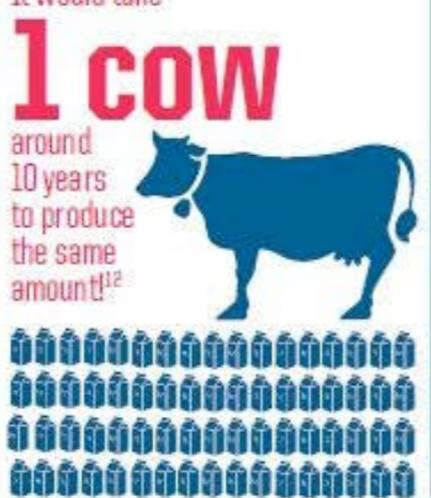
**10 million**  
litres of water will be needed to  
fill the swimming and diving pools  
at the Aquatics Centre - that's  
the same amount of water for  
**1,250,000**  
flushes of a toilet!<sup>6</sup>

Stable workers will  
have the fragrant  
job of clearing up  
a predicted

**32,000**  
piles of manure  
from the equestrian  
events.<sup>7</sup> Nice



Athletes in the Olympic Village  
will consume **75,000 litres**  
of milk over the course of  
the London 2012 Games.  
It would take



around  
10 years  
to produce  
the same  
amount<sup>12</sup>

**17,320**  
beds will be  
housed at the  
Olympic Village



**5,820**  
sacks of hair grass will be set  
out along the Athletes and  
Mascots transport corridor<sup>8</sup>

**3,000**  
tonnes of sand (all of it  
from a quarry in Godstone in  
Surrey) will be dumped on  
Horseguards Parade for the  
Beach Volleyball<sup>9</sup>

Thats over **57**  
times the number of beds in  
London's Savoy Hotel<sup>9</sup>



**Over**  
**4,000**  
trees  
**74,000**  
plants  
**350,000**  
bulbs  
wetlands plants

have been planted in the Olympic  
Village - that's over six times the  
amount of seats in the 80,000  
capacity Olympic Stadium<sup>15</sup>



**5 million**  
litres of bottled water will  
be supplied in the Olympic  
Village supplied by the  
official water sponsor,  
Schweppes Abbey Well<sup>16</sup>



**4,000**  
bins in the Olympic Park  
will be emptied about



**2,000**  
newts were relocated  
from the Olympic Park  
to the Waterworks  
nature reserve<sup>13</sup>



**336,000**  
times throughout the  
London 2012 Olympic and  
Paralympic Games<sup>14</sup>

Competitors in the  
London 2012 boxing  
competition will  
get through



**356**  
pairs of gloves<sup>16</sup>

The lightest piece of  
equipment is the  
women's Javelin which  
weighing a mere  
**600g**  
the same as a  
punnet of grapes!<sup>17</sup>



The official distance  
of the marathon is  
**42,195 metres**  
and the margin of error  
measuring the course is 0.1%<sup>18</sup>

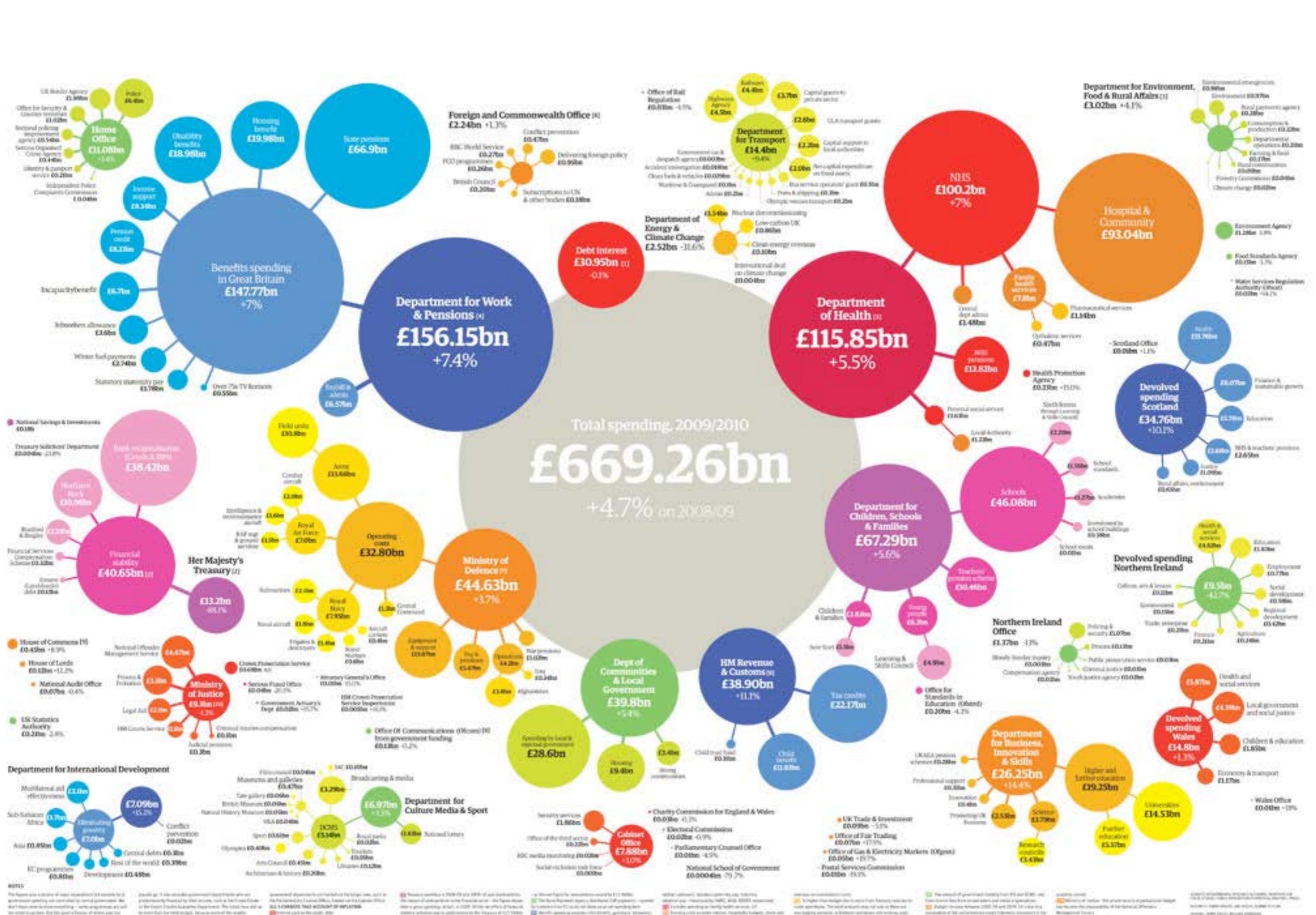


**4,700**  
gold, silver and bronze  
medals will be presented at  
**805** victory ceremonies<sup>19</sup>

<sup>1</sup> LOCOG 2012 in numbers doc. <sup>2</sup> London 2012 website. <sup>3</sup> LOCOG 2012 in numbers doc. <sup>4</sup> London 2012 website. <sup>5</sup> Based on 500 athletes using 1x 200ml bottle of sunscreen throughout the duration of event (London 2012 website). <sup>6</sup> LOCOG 2012 in numbers doc. According to [http://www.wwfuk.org.uk/sites/wwfuk.org.uk/files/how\\_much\\_water\\_and\\_there\\_are\\_8\\_trillion\\_flushes\\_of\\_toilets\\_1\\_290\\_000.xls](http://www.wwfuk.org.uk/sites/wwfuk.org.uk/files/how_much_water_and_there_are_8_trillion_flushes_of_toilets_1_290_000.xls) 10,000,000,000.7 litres from cleaning hairs, 3,000 who have used one 10 pence flush in a day. <sup>7</sup> Based on 200 athletes using 200 toilets across the three aquatics events. 200 X 10 flushes per meal/day = 10 places of waste = 200.000 place of manure. <sup>8</sup> London 2012 website. <sup>9</sup> LOCOG 2012 in numbers doc. According to the London 2012 website they have 200 beds. 57K 300 + 7.2K. <sup>10</sup> Based on 98 artistic gymnasts and 86 rhythmic gymnasts. London 2012 website using 1 standard pack of 10kg grass mats. Each pack of Kirby grass mats costs £30 (individual mats, 99 + 98 X 30 = 5,820.11). <sup>11</sup> Sun supplied by LOCOG and London 2012 website. <sup>12</sup> Athletes will consume 75,000 litres of milk in year (<https://www.amecgroup.org/publications/iceberg/iceberg-milk-in-the-london-2012-games/>). Cow figure based on 1 cow producing 1,400 litres of milk a year (<https://www.amecgroup.org/publications/iceberg/iceberg-milk-in-the-london-2012-games/>). <sup>13</sup> Data supplied by LOCOG. <sup>14</sup> London Organising Committee of the Olympic and Paralympic Games (LOCOG) 2012 in numbers doc. <sup>15</sup> LOCOG 2012 in numbers doc. Based on 3 times being recycled 3 times a day throughout 28 days of events. <sup>16</sup> LOCOG 2012 in numbers doc. London 2012 website. <sup>17</sup> Details from Cleaning Hair Molecular Function. <sup>18</sup> Data supplied by Schweppes Abbey Well who will be supplying 10,000,000 litres of water. Each toilet is 500 ml. 10,000,000 X 500ml = 5,000,000,000 ml which equals 5 billion litres. <sup>19</sup> Details from Cleaning Hair Molecular Function.

**abbey**  
**well**



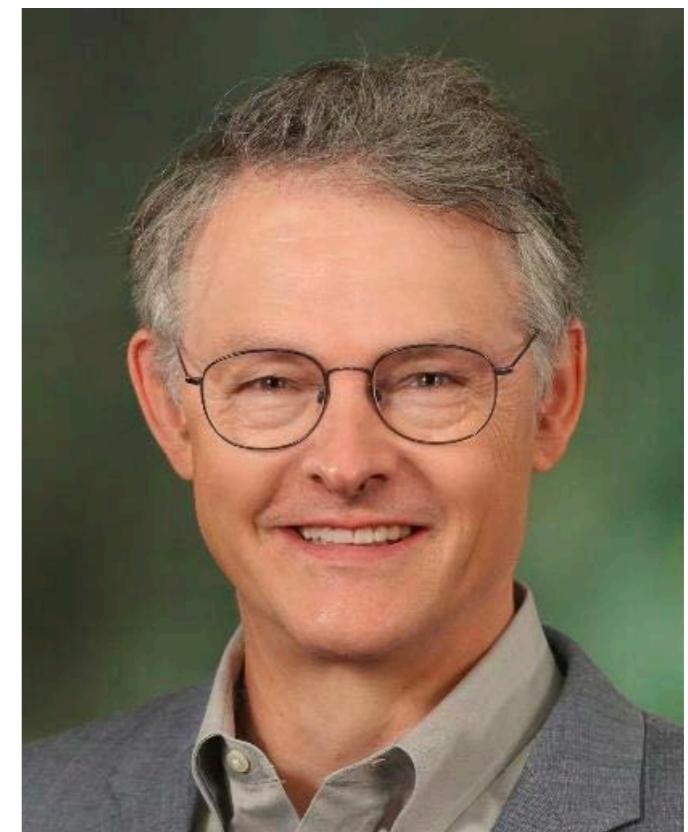


Total spending, 2009/2010  
**£669.26bn**  
+4.7% on 2008/09

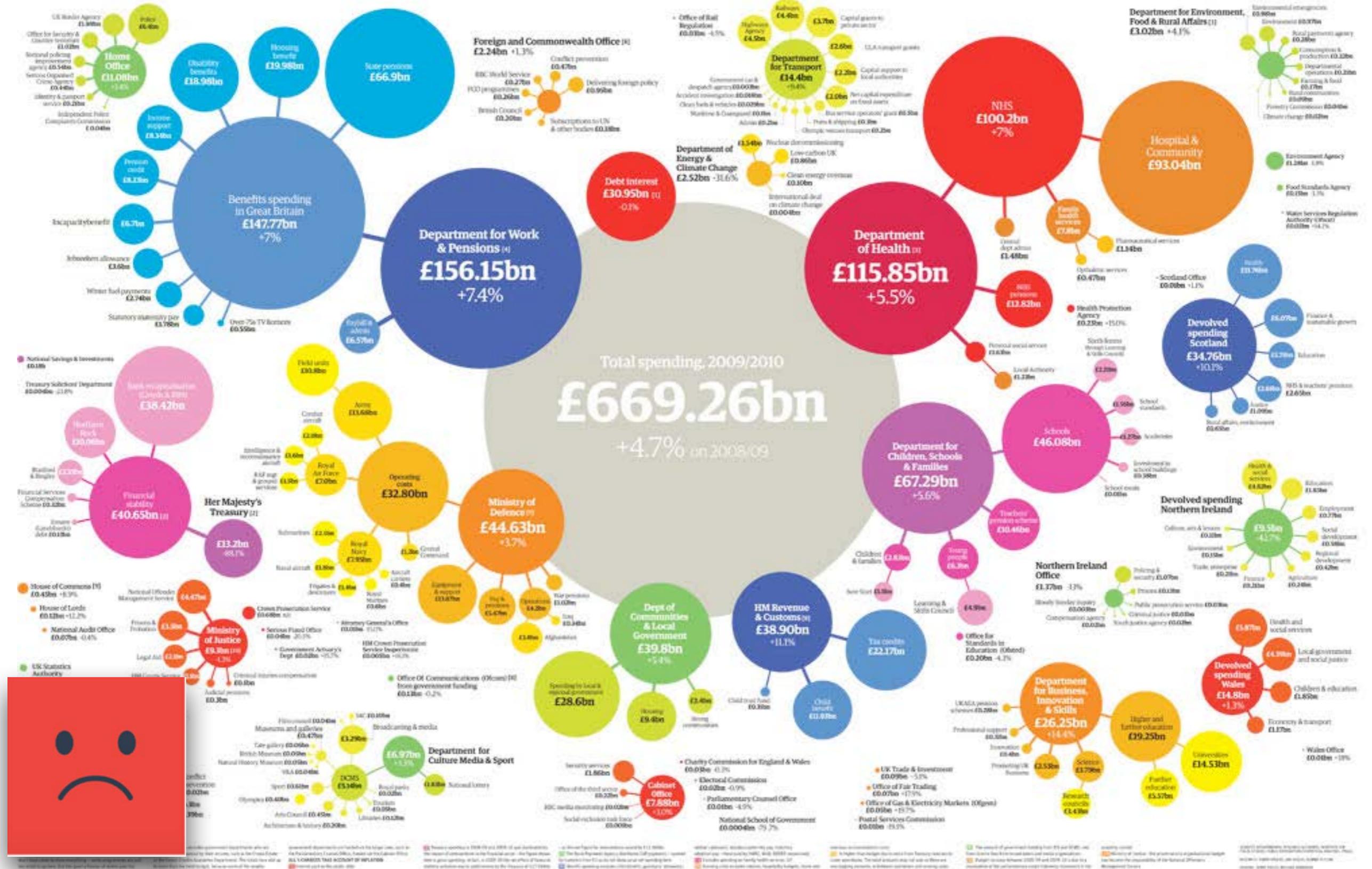
“ ”

A visualization is **more effective** than another visualization **if the information** conveyed by one visualization **is more readily perceived** than the information in the other visualization.”

— Jock Mackinlay, 1986



# Not Effective



# Effective

## Why Peyton Manning's Record Will Be Hard to Beat

By GREGOR AISCH and KEVIN QUEALY OCT. 19, 2014

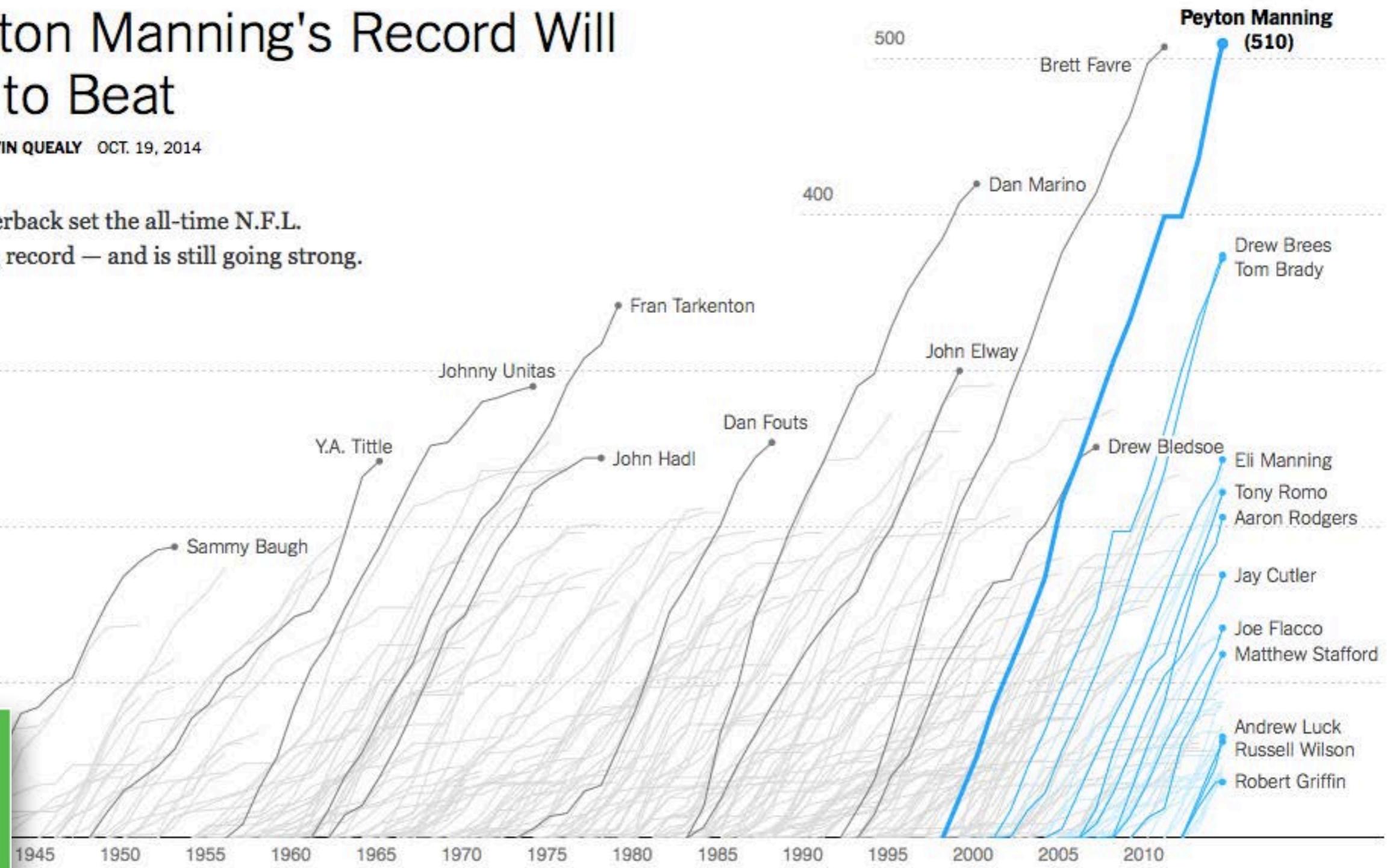
The Broncos quarterback set the all-time N.F.L. touchdown passing record — and is still going strong.

RELATED ARTICLE

300 touchdown passes

200

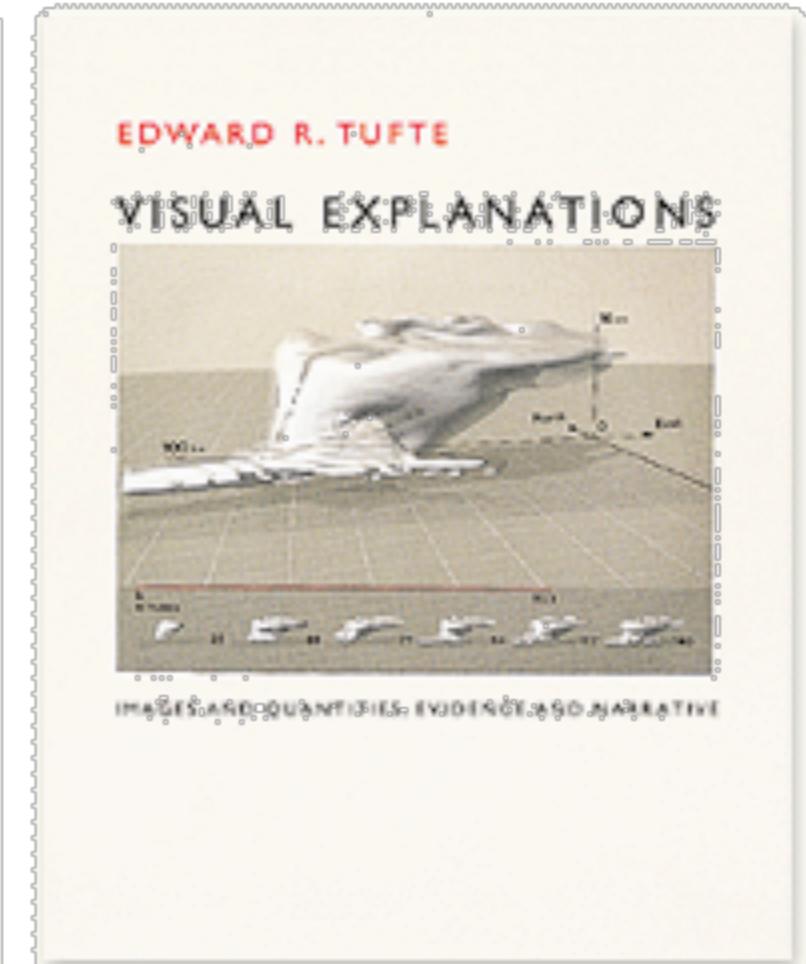
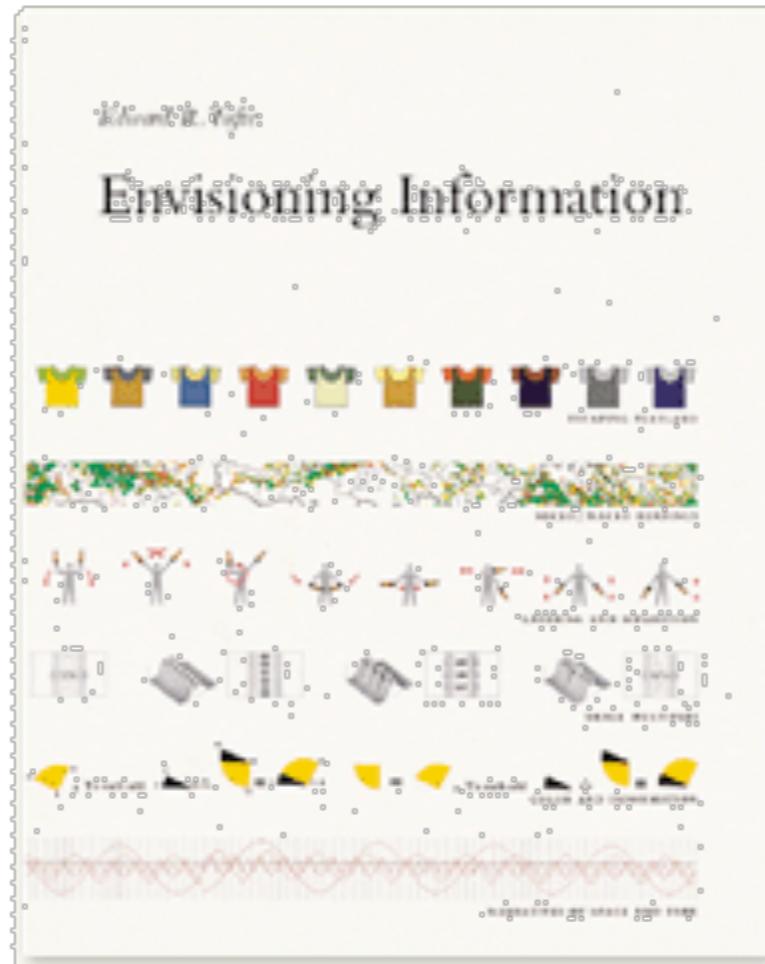
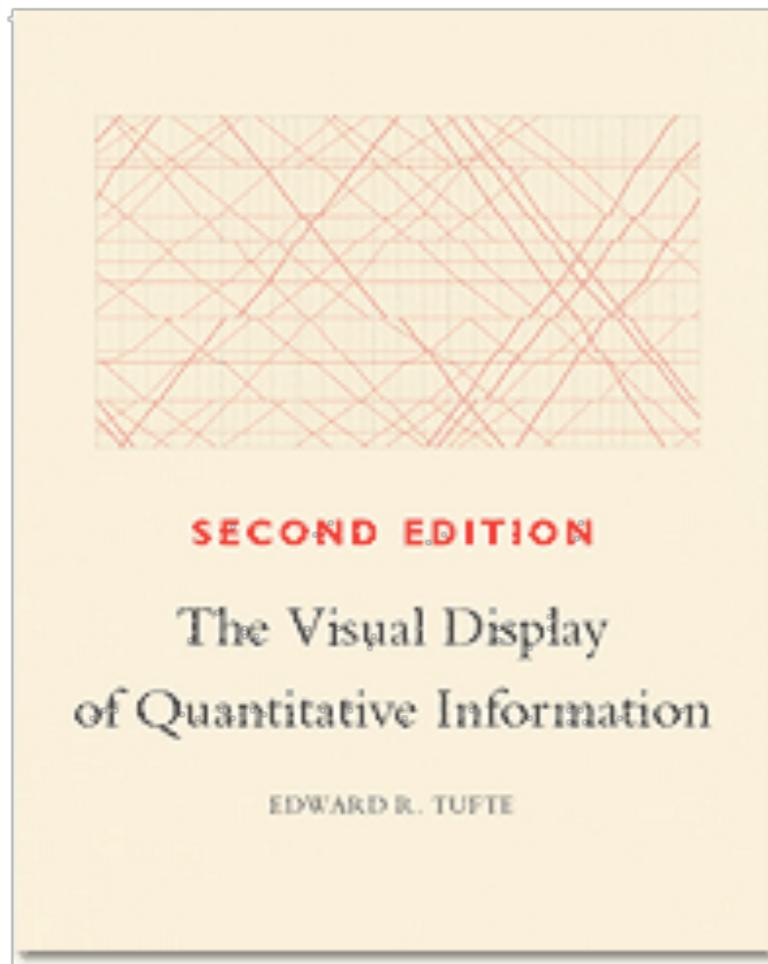
100



Effective visualizations reveal patterns and communicate ideas using the power of perception to offload cognition.

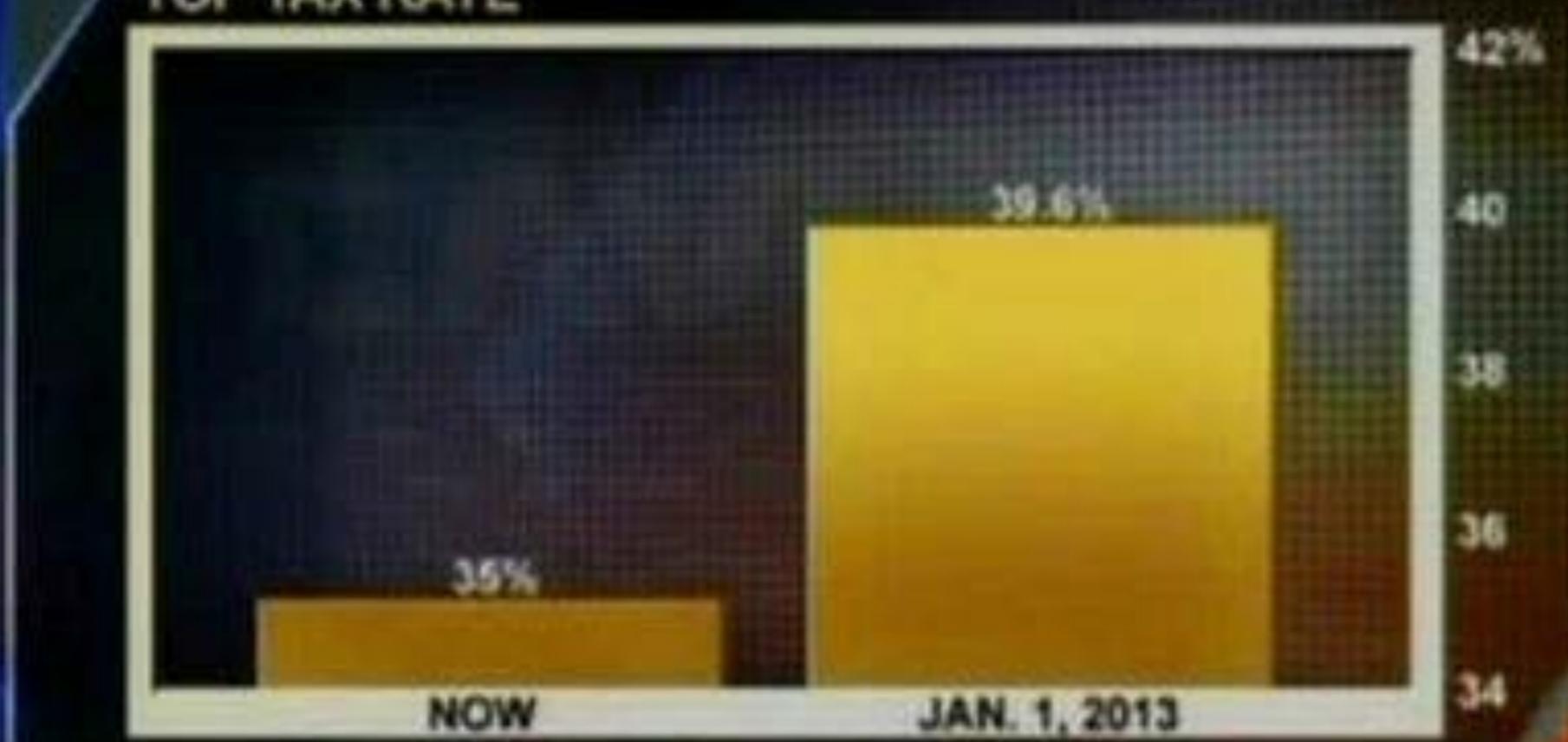
# Graphical Integrity

# Edward Tufte



# IF BUSH TAX CUTS EXPIRE

TOP TAX RATE



8:01 p ET



TOP STORIES

TECHNOLOGY

CONSUMER

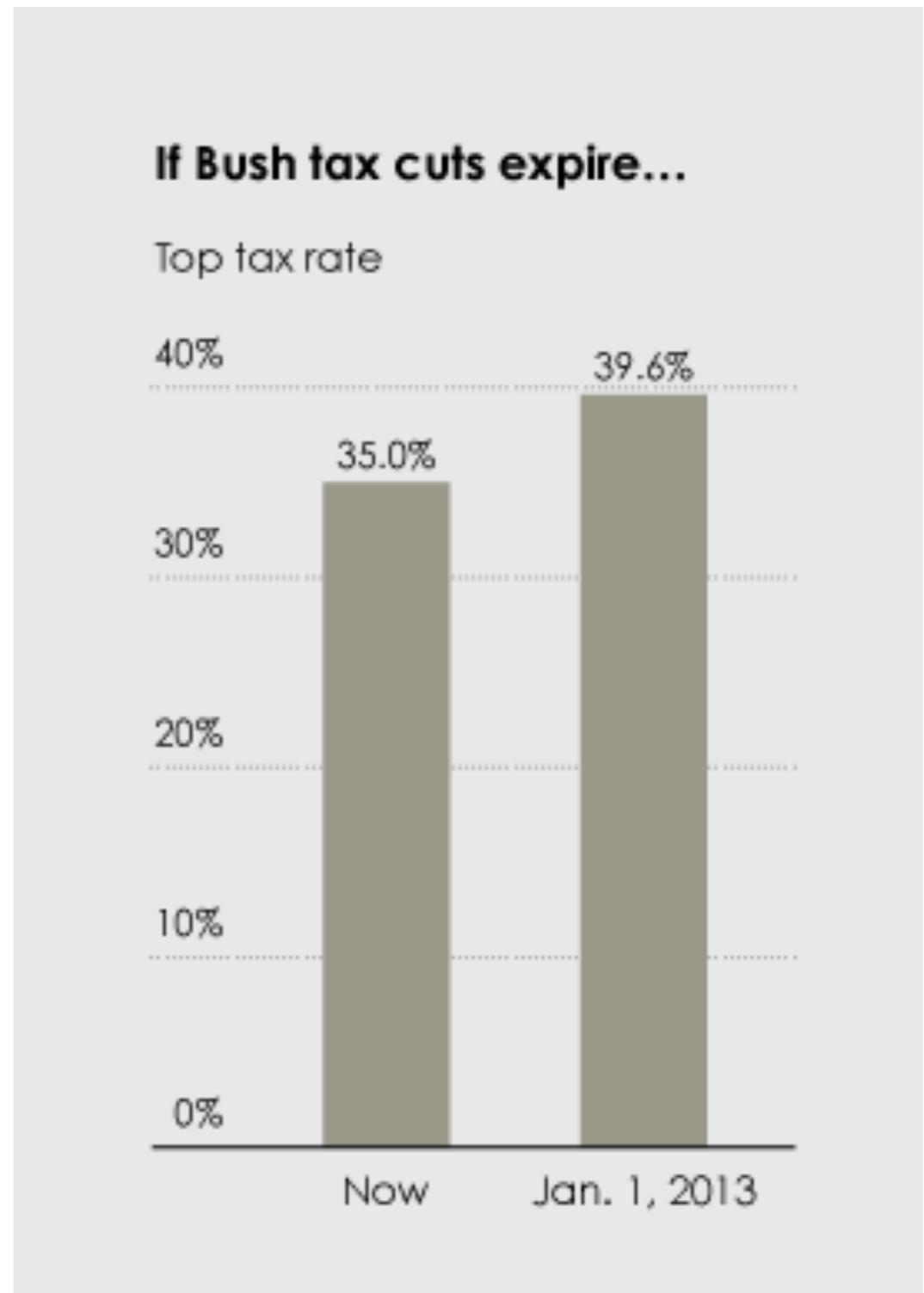
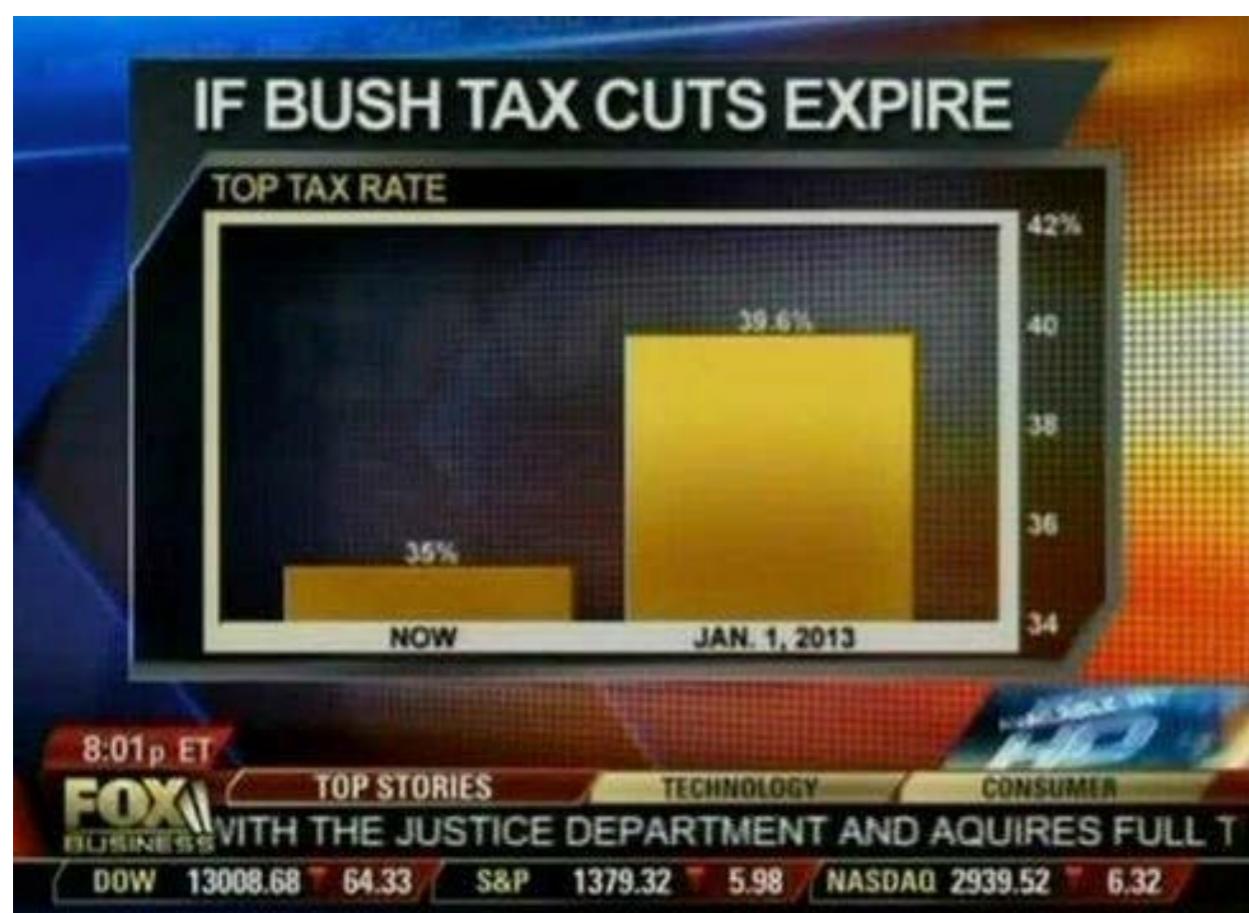


VITH THE JUSTICE DEPARTMENT AND AQUIRES FULL T

N 13008.68 ▲ 64.33

S&P 1379.32 ▲ 5.98

NASDAQ 2939.52 ▲ 6.32



## **JOB LOSS BY QUARTER**



SOURCE: BLS

AMERICA'S  
NEWSROOM



# Scale Distortions

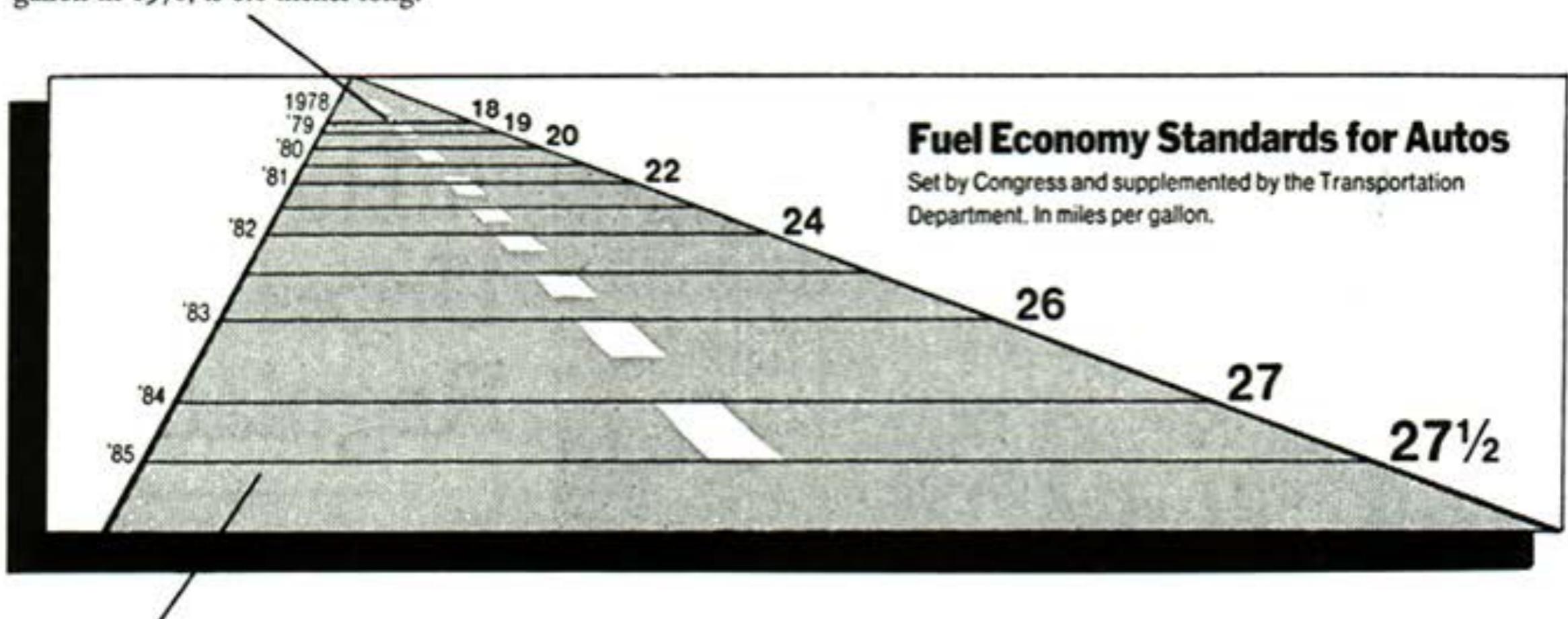


# The Lie Factor

Size of effect shown in graphic

Size of effect in data

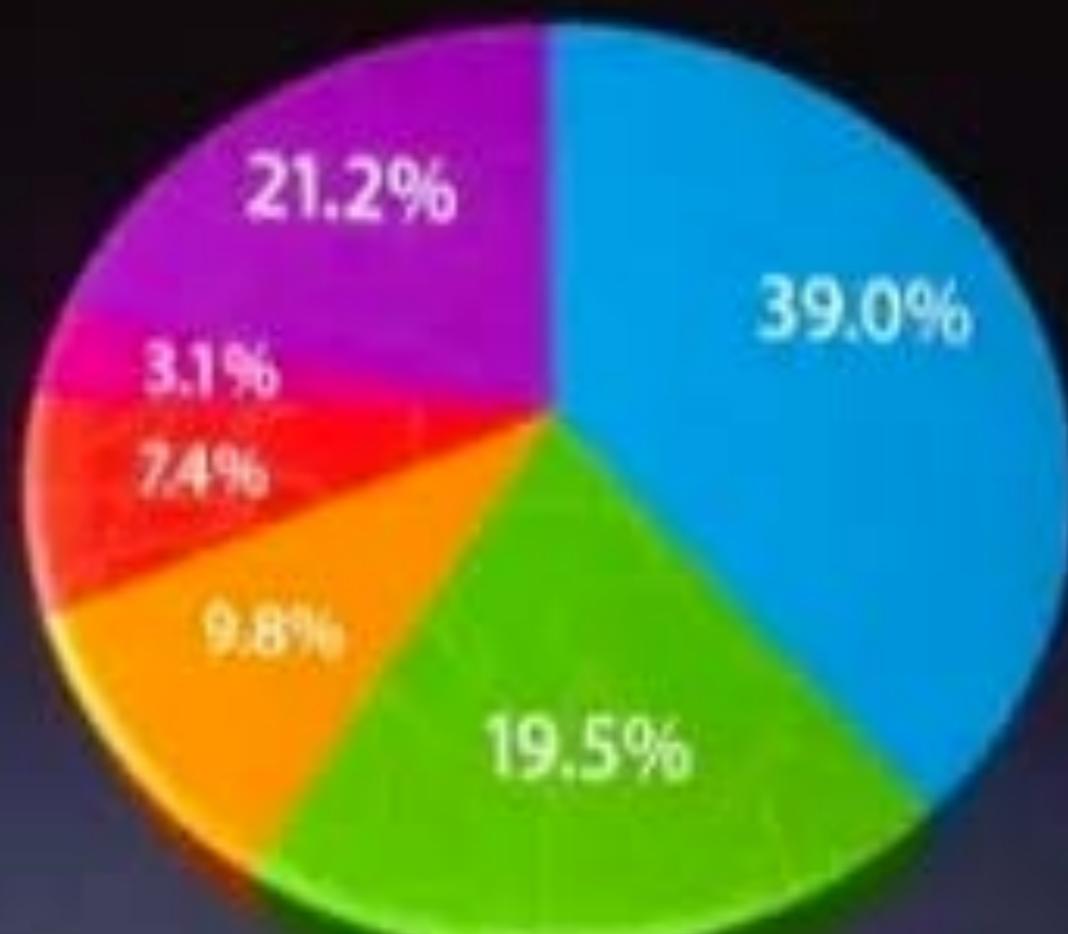
This line, representing 18 miles per gallon in 1978, is 0.6 inches long.



This line, representing 27.5 miles per gallon in 1985, is 5.3 inches long.

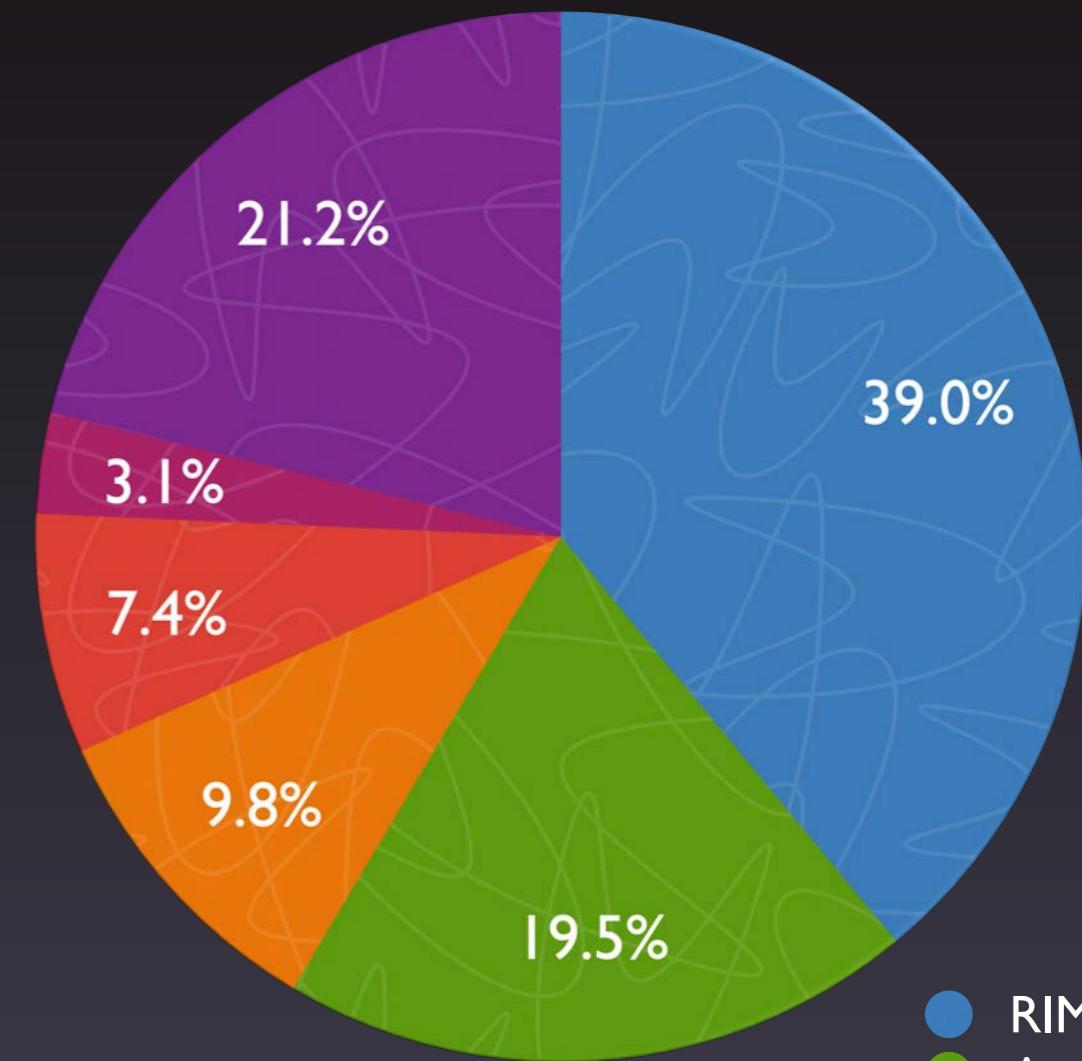
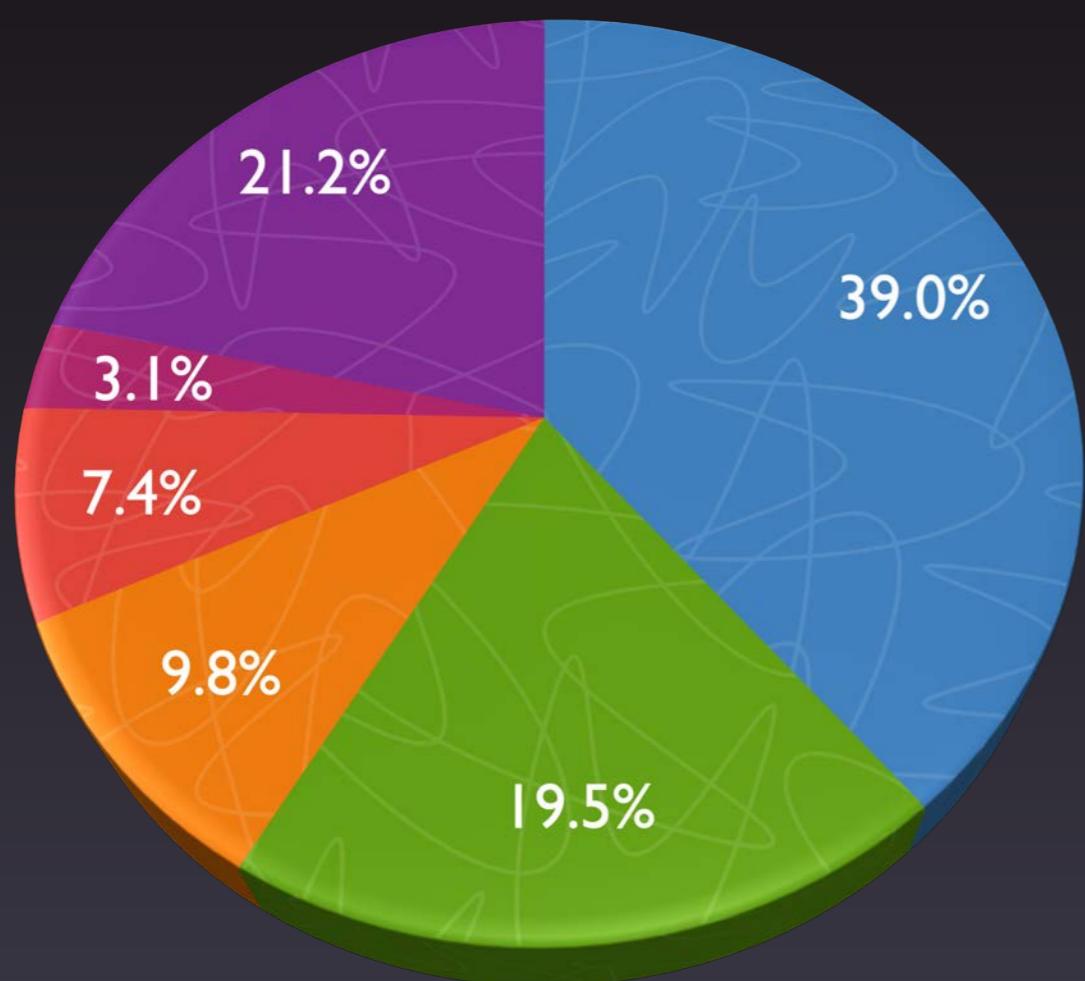
# U.S. SmartPhone Marketshare

- RIM
- Apple
- Palm
- Motorola
- Nokia
- Other



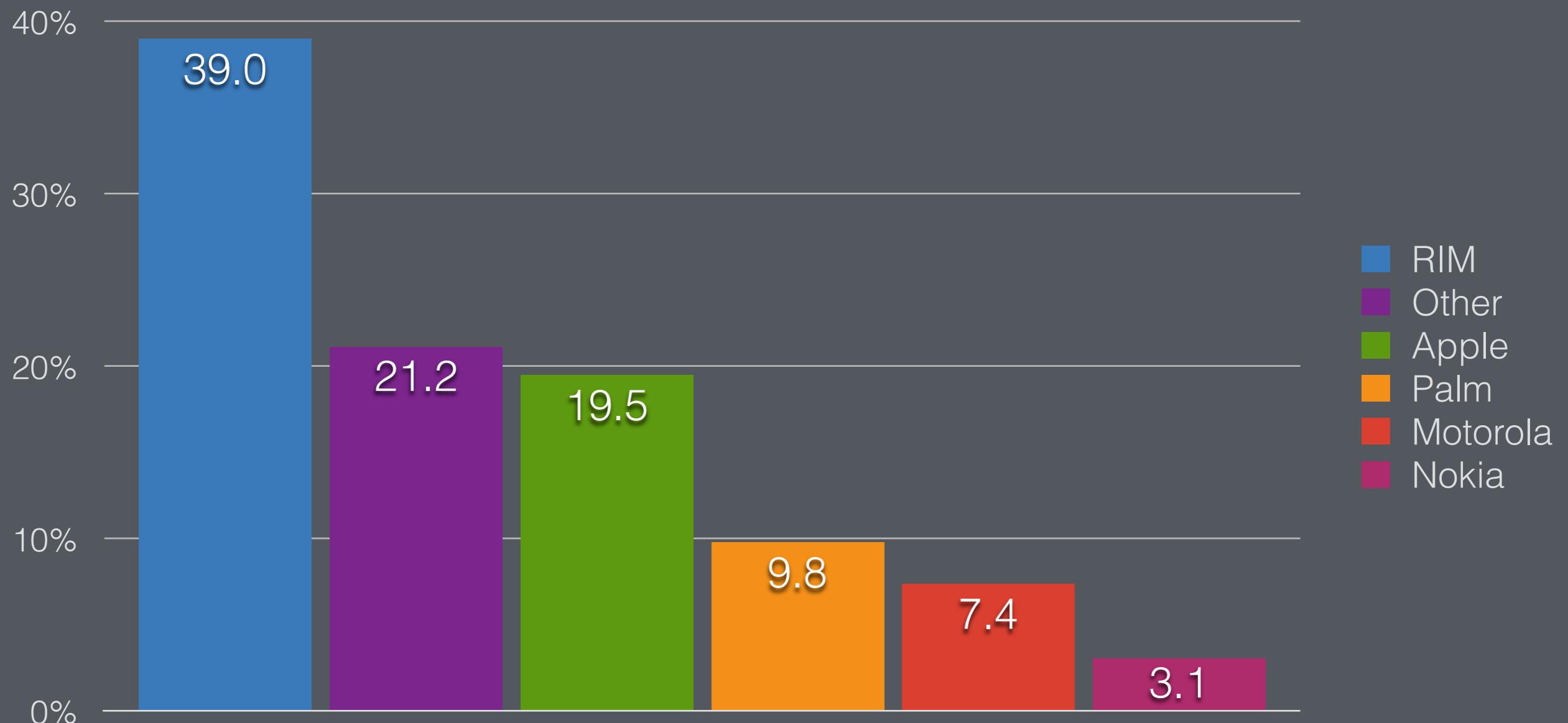
Gartner.fr

# U.S. SmartPhone Marketshare



- RIM
- Apple
- Palm
- Motorola
- Nokia
- Other

# U.S. SmartPhone Marketshare



“

The **representation** of numbers, as physically measured on the surface of the graph itself, should be **directly proportional** to the **numerical quantities** represented.

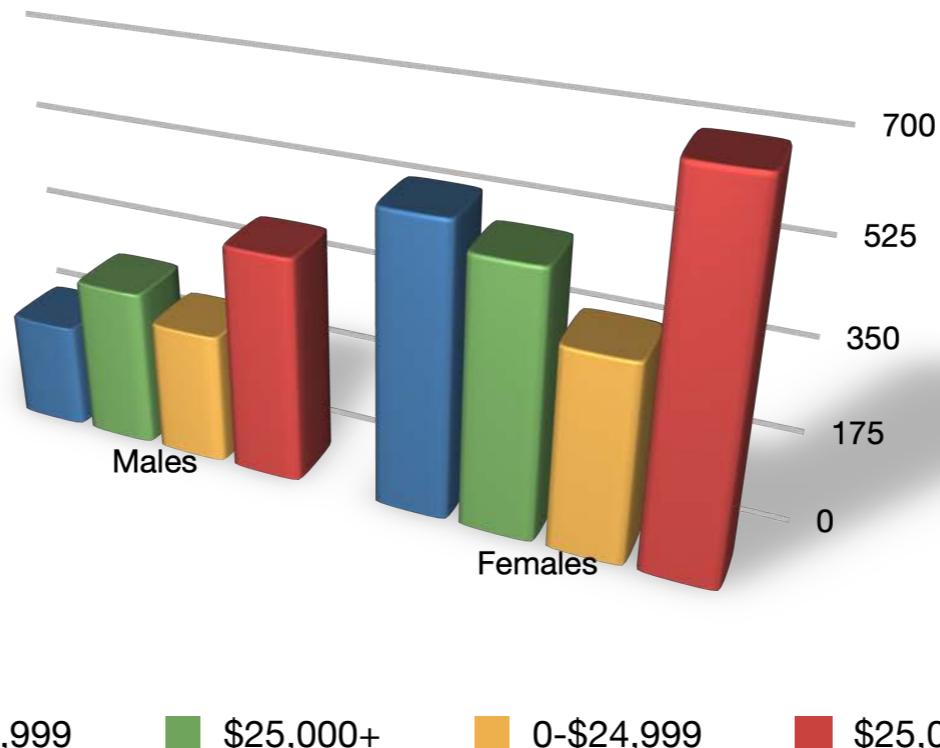
— Eduard Tufte



Keep It Simple

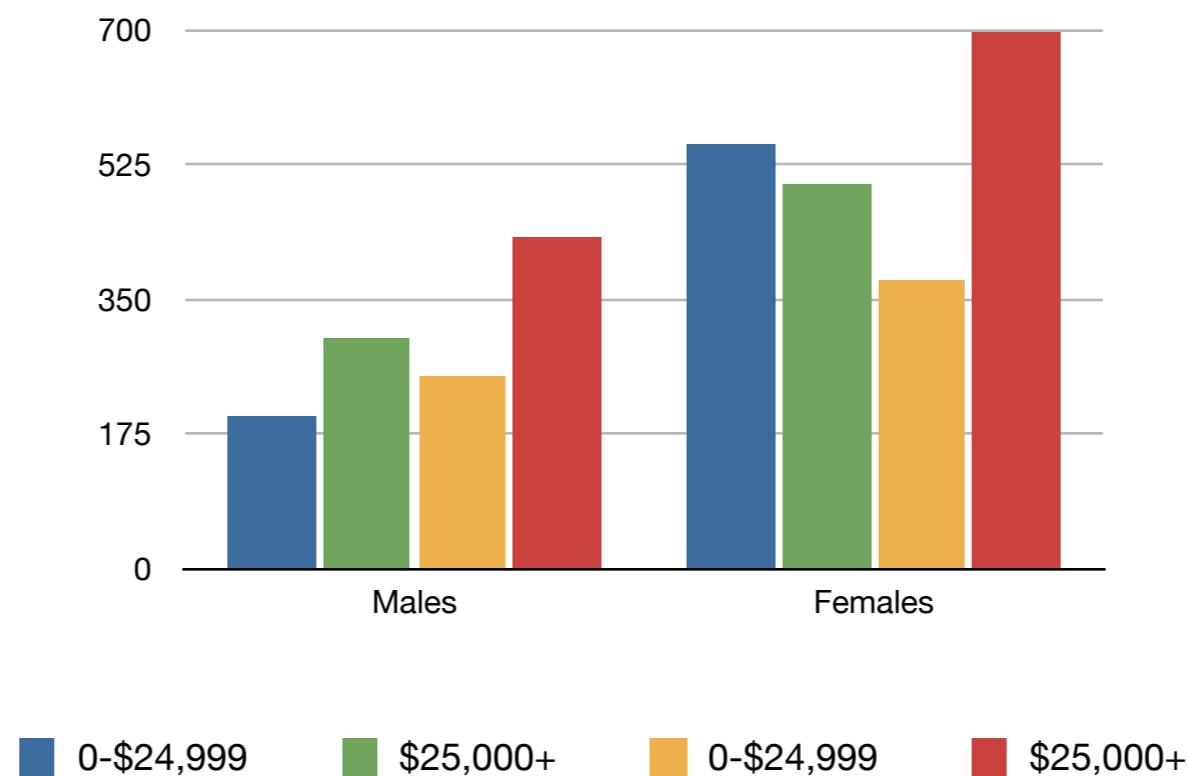
# Maximize Data-Ink Ratio

Data-Ink Ratio =  $\frac{\text{Data ink}}{\text{Total ink used in graphic}}$



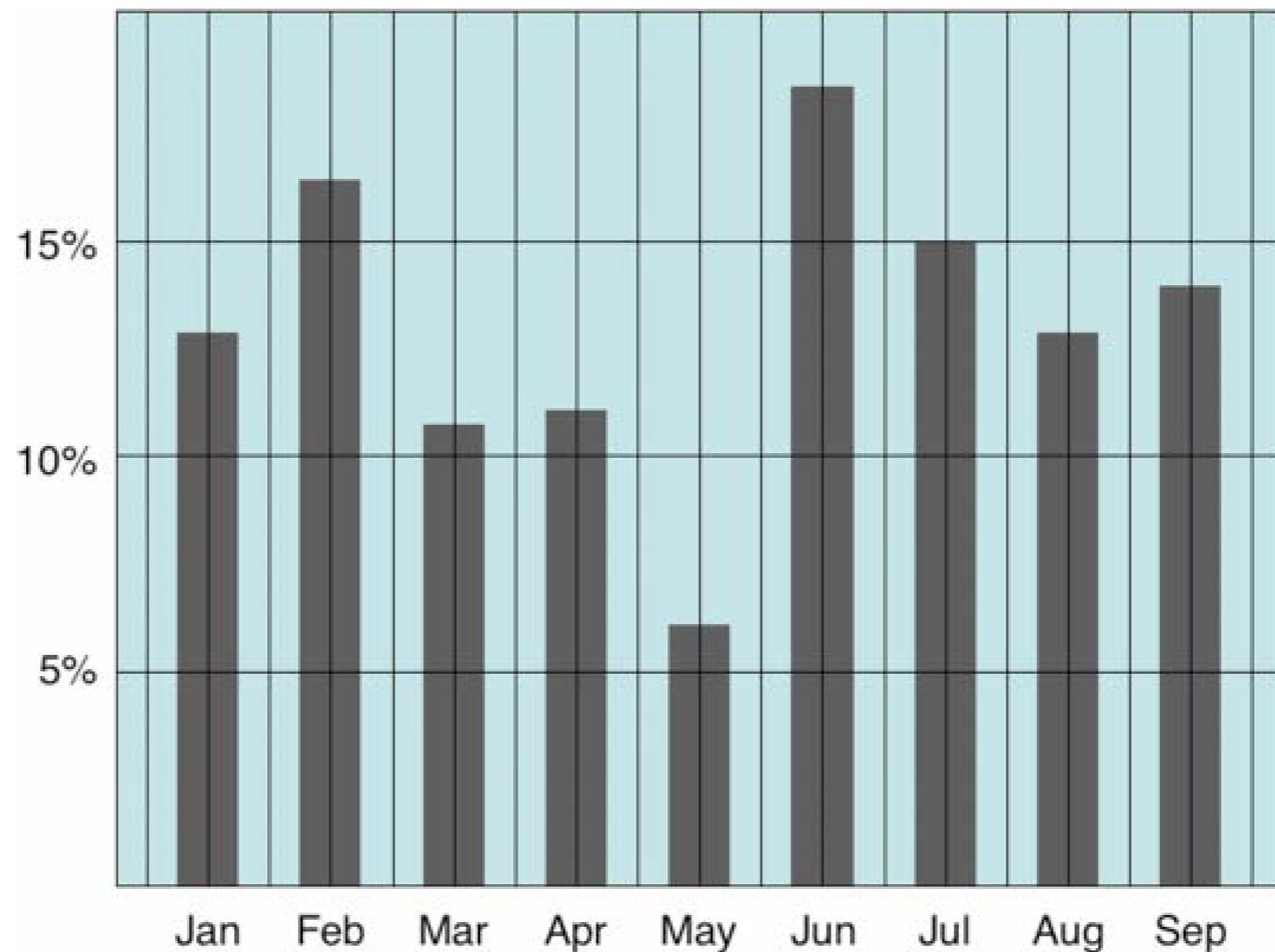
# Maximize Data-Ink Ratio

Data-Ink Ratio =  $\frac{\text{Data ink}}{\text{Total ink used in graphic}}$

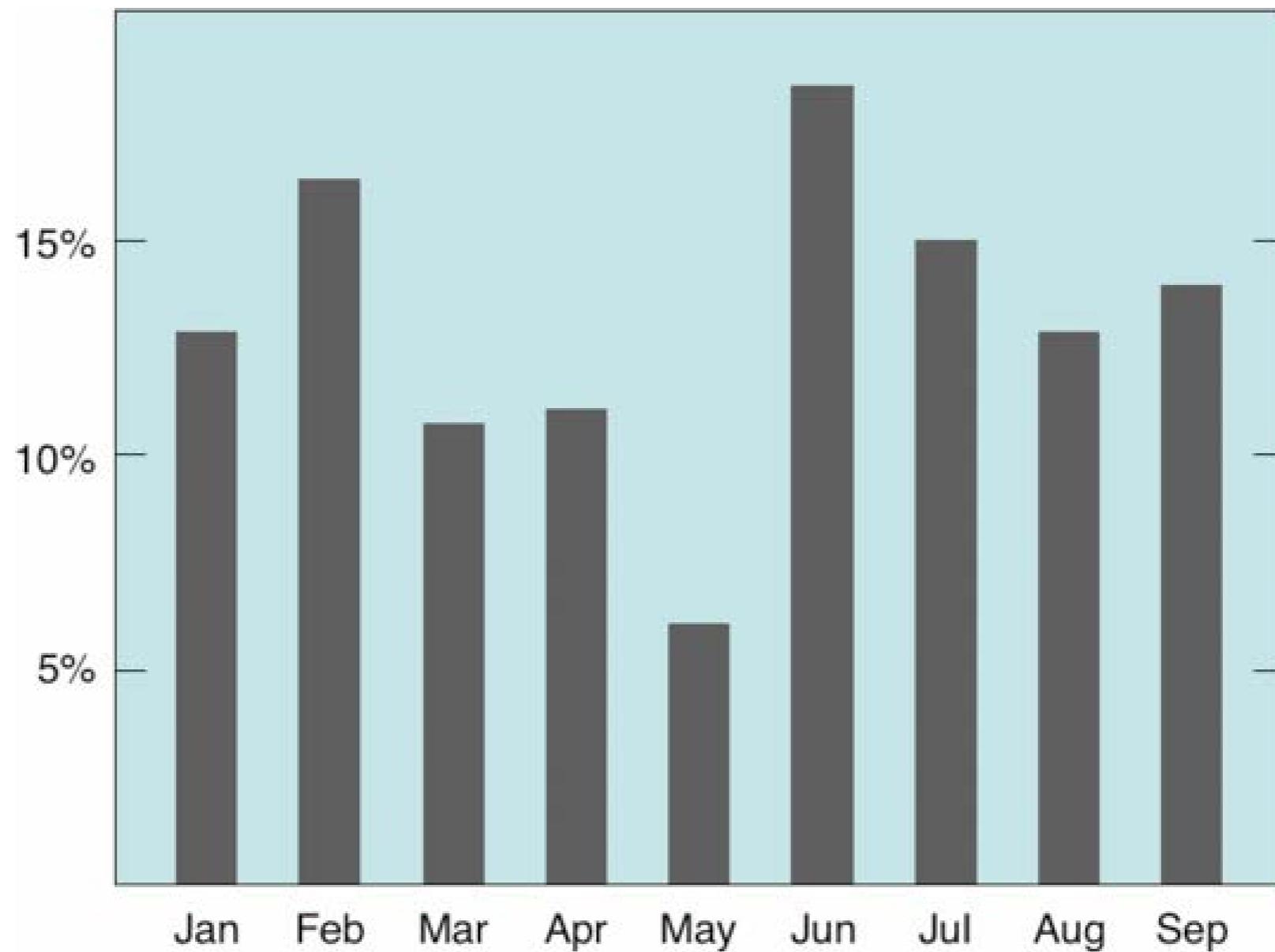


# Avoid Chartjunk

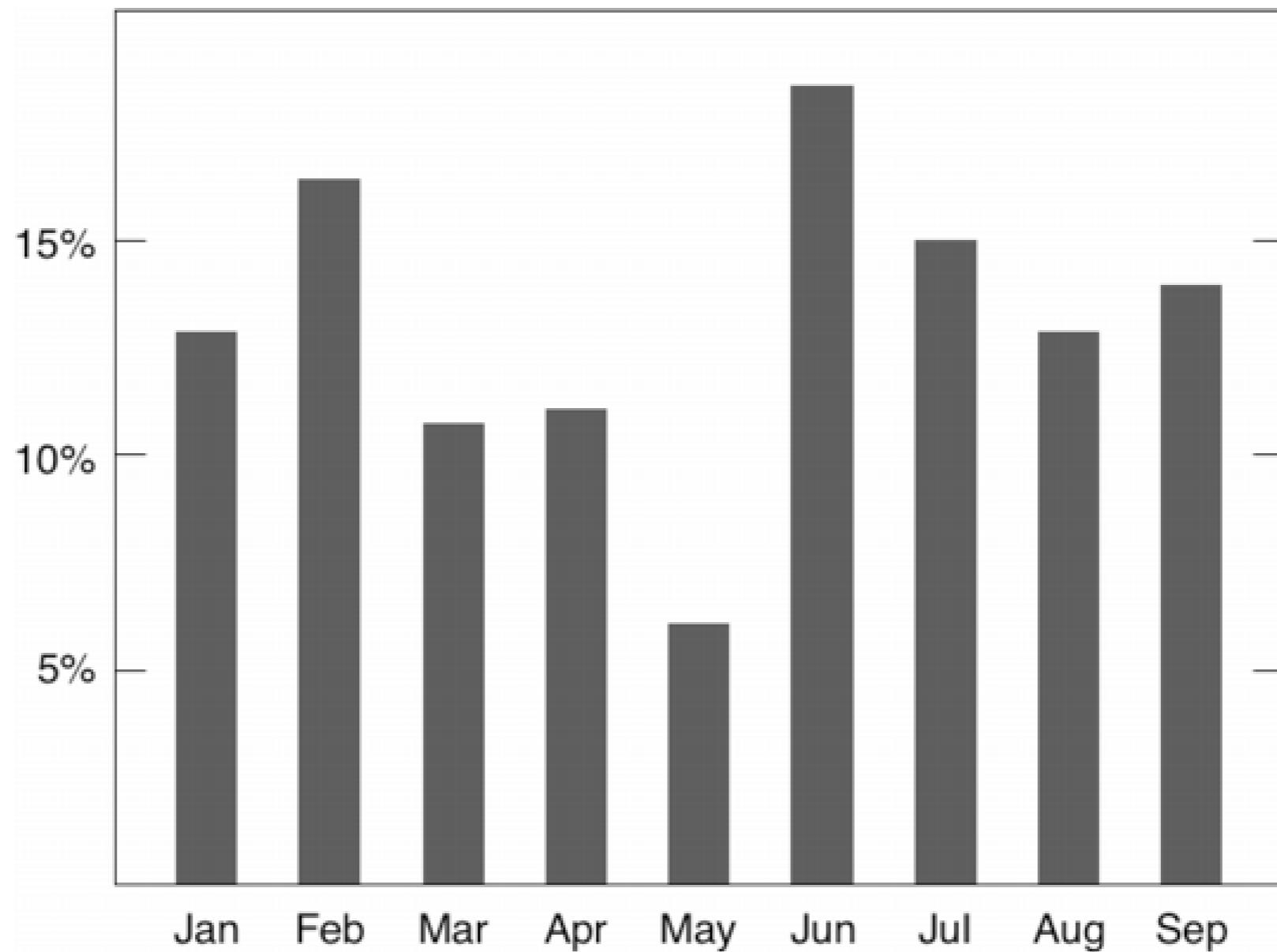
Extraneous visual elements that distract from the message



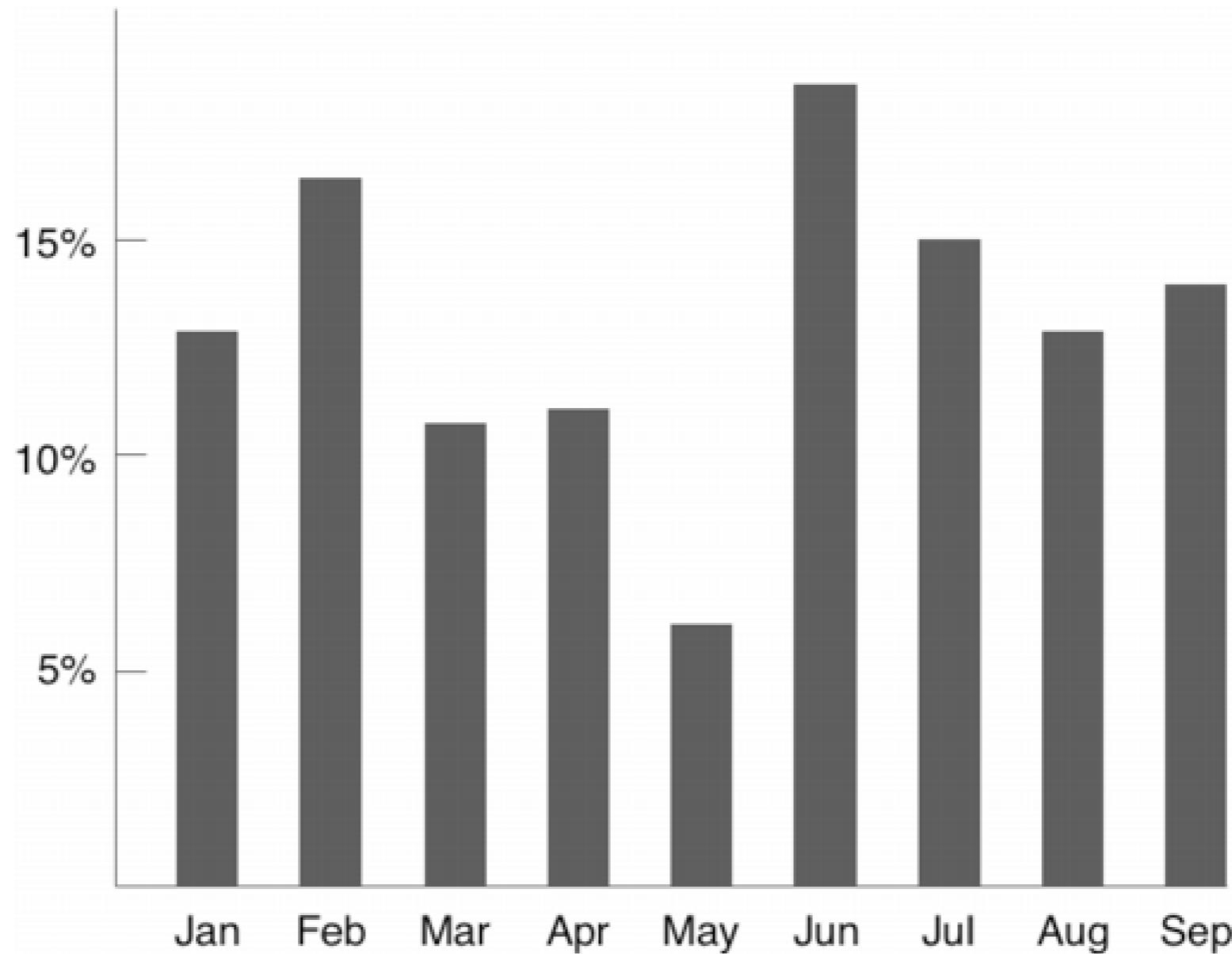
# Avoid Chartjunk



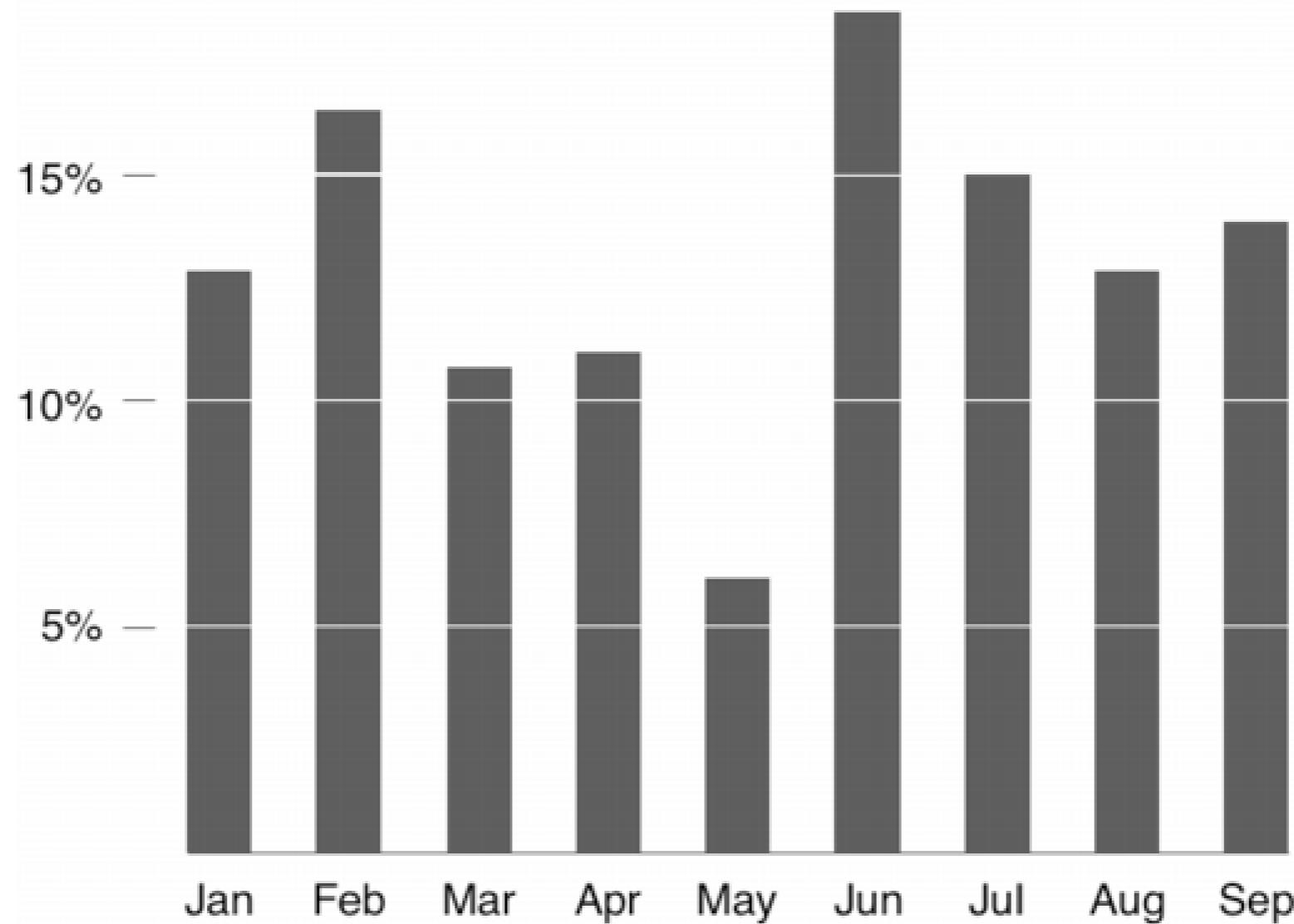
# Avoid Chartjunk



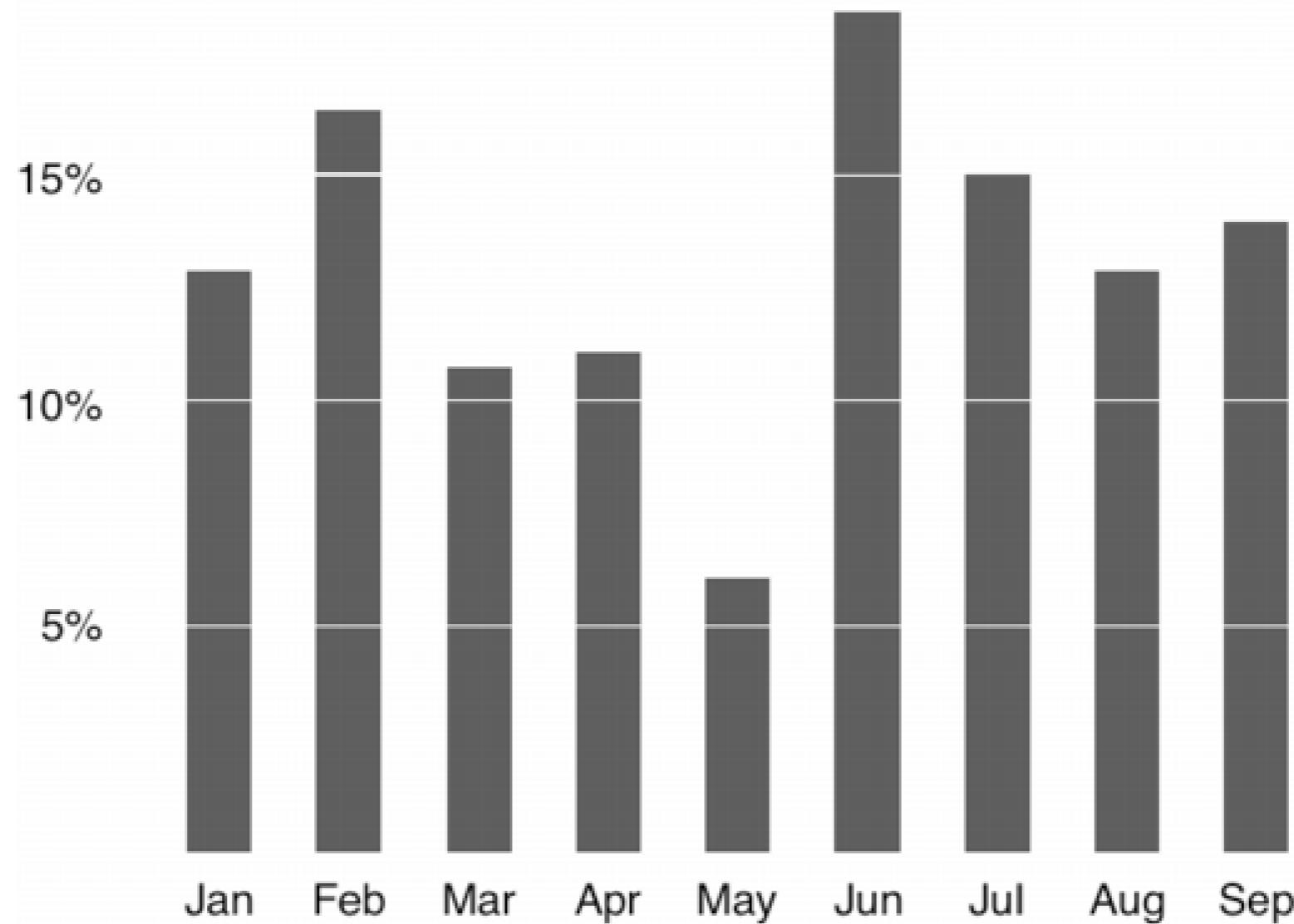
# Avoid Chartjunk



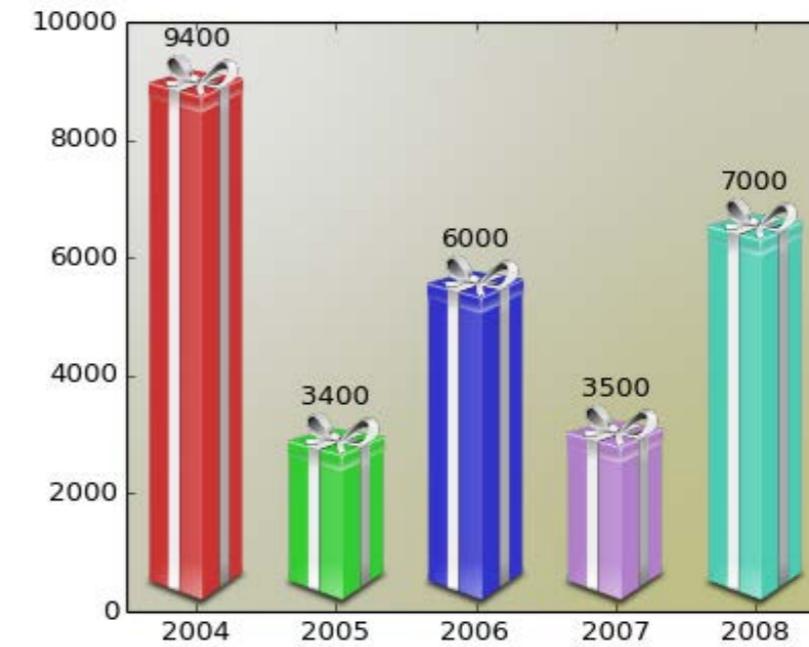
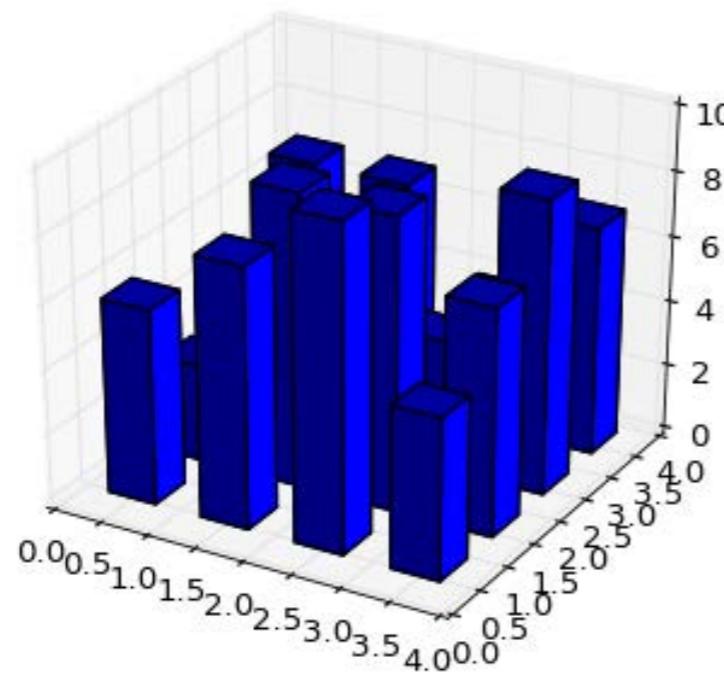
# Avoid Chartjunk



# Avoid Chartjunk

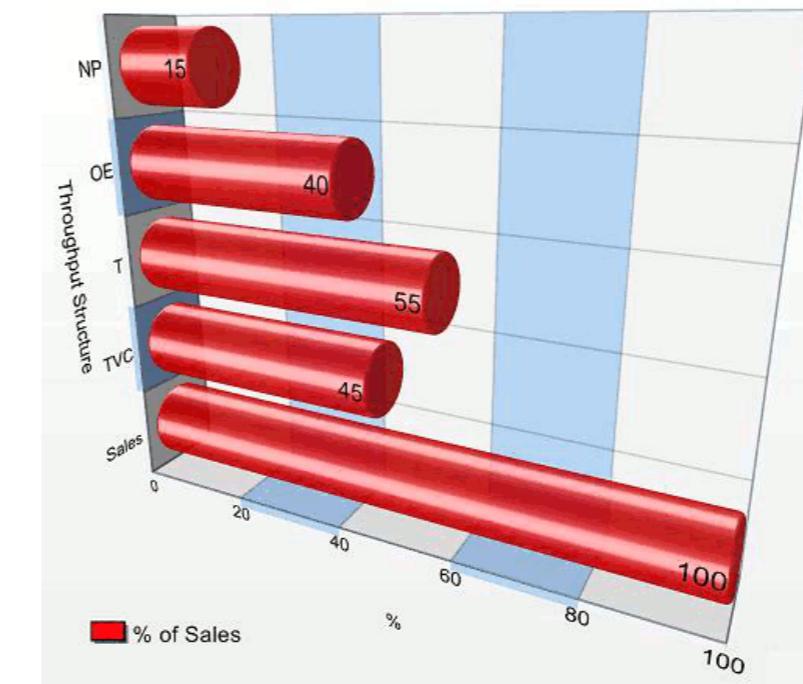
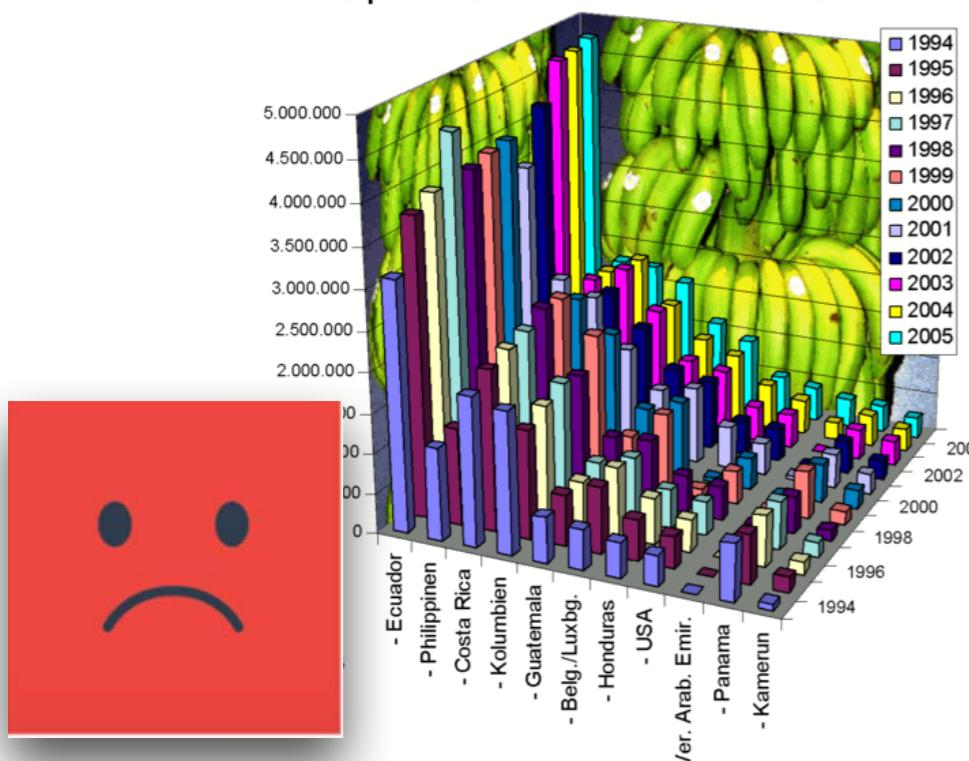


# Don't



matplotlib gallery

Export von Bananen in Tonnen von 1994-2005



Excel Charts Blog

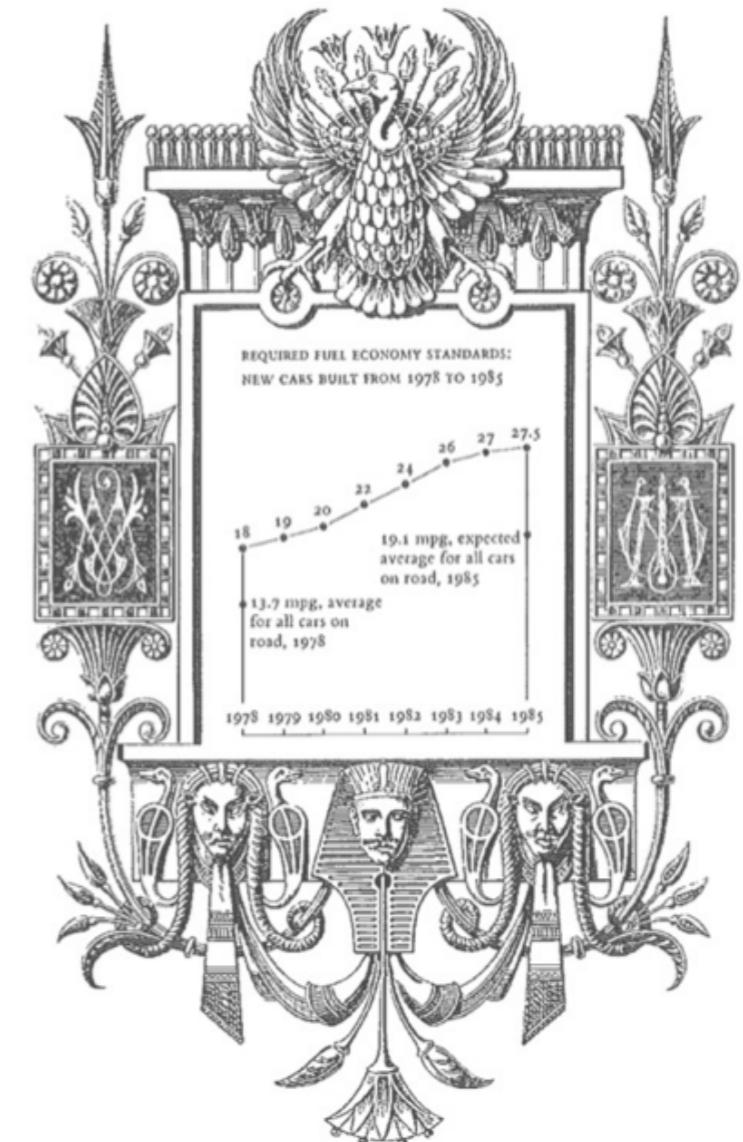
# Tufte's Principles

Have graphical integrity

Mind the lie factor

Maximize data-ink ratio

Avoid chart junk



# REASONS TO GO TO VIZTHINK '08

Does your organization struggle with poor communication? Frustrating design processes? Ineffective learning? Visual Thinking can help. Here are just some of the problems you'll solve and some of the things you'll learn at VizThink '08.

## WHAT YOU WILL SOLVE

...slide 127...we're halfway though now!



DEATH BY POWERPOINT



ANALYSIS PARALYSIS



TEAMWORK

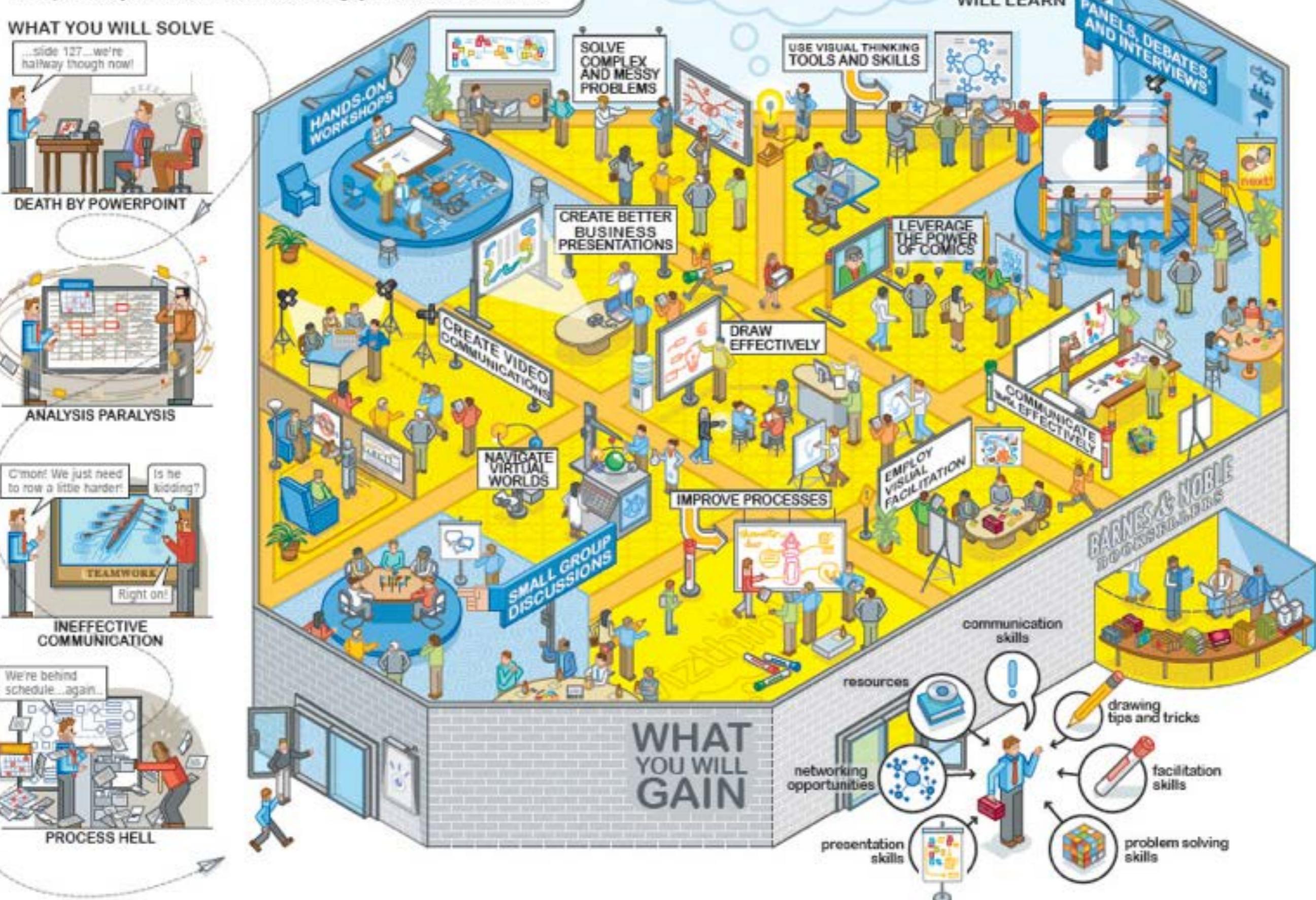
INEFFECTIVE COMMUNICATION



PROCESS HELL

# vizthink'08

## WHAT YOU WILL LEARN



# Subjective Dimensions

- **Aesthetics:** Attractive things are perceived as more useful than unattractive ones
- **Style:** Communicates brand, process, who the designer is
- **Playfulness:** Encourages experimentation and exploration
- **Vividness:** Can make a visualization more memorable
- **Audience:** Your visualization should be adapted to your audience

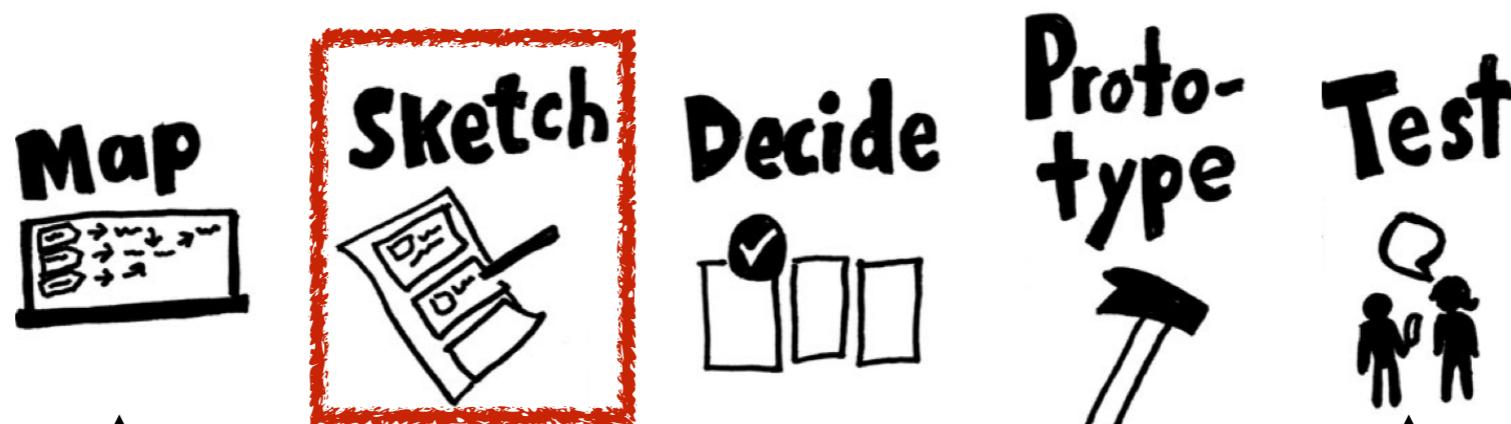
Brooke Lark, Unsplash



Lunch Break

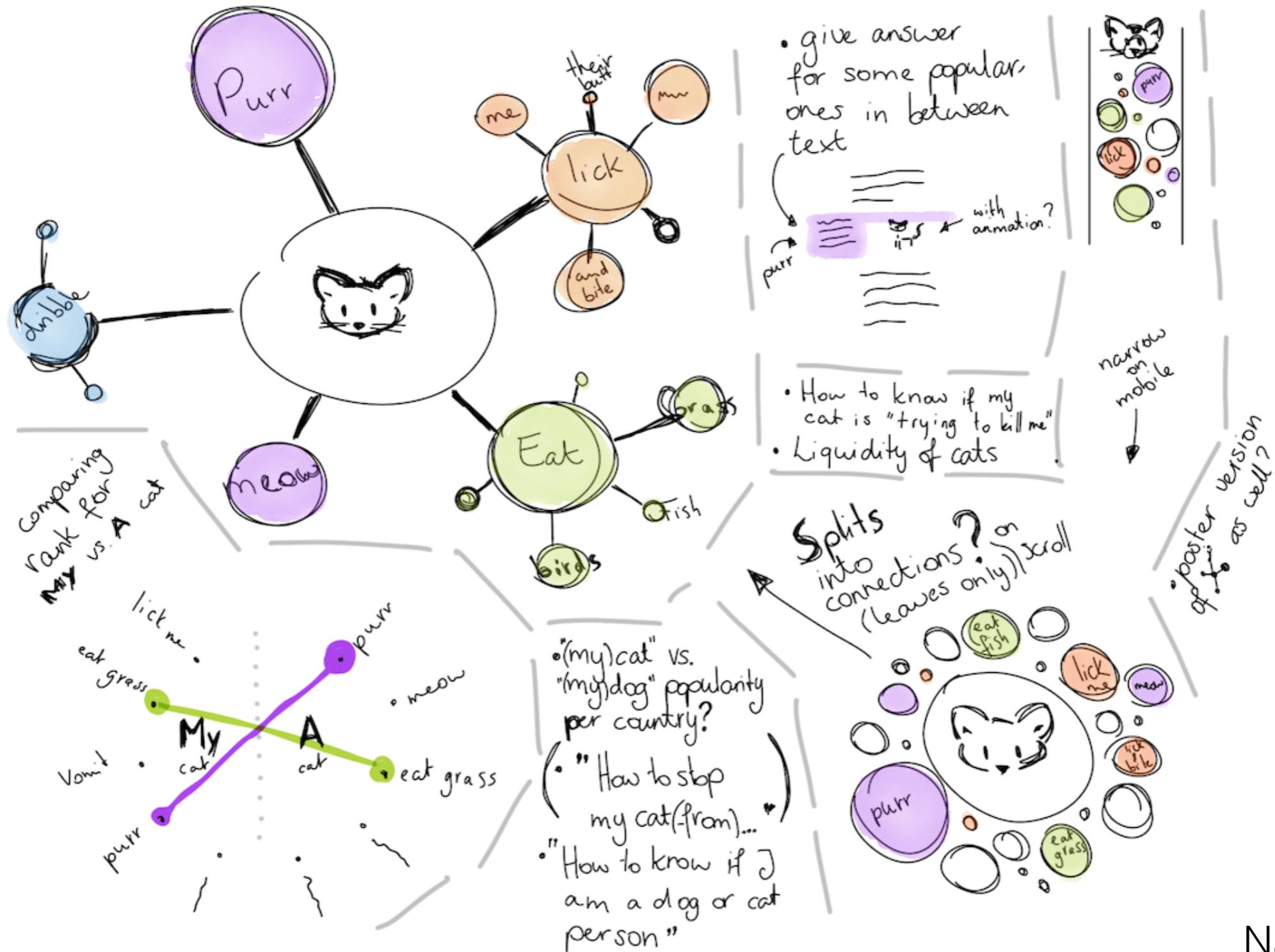
# Sketch - Charts

- Sketching
- Choose the Right Chart



# Sketching

# Sketches are cheap, fast, and easy to “throw away”



“My strategy has always been:  
Be wrong as fast as we can.”

- Andrew Stanton, Pixar

# Activity

Create as many different sketches to visualize these two quantities as you can. (2 min)



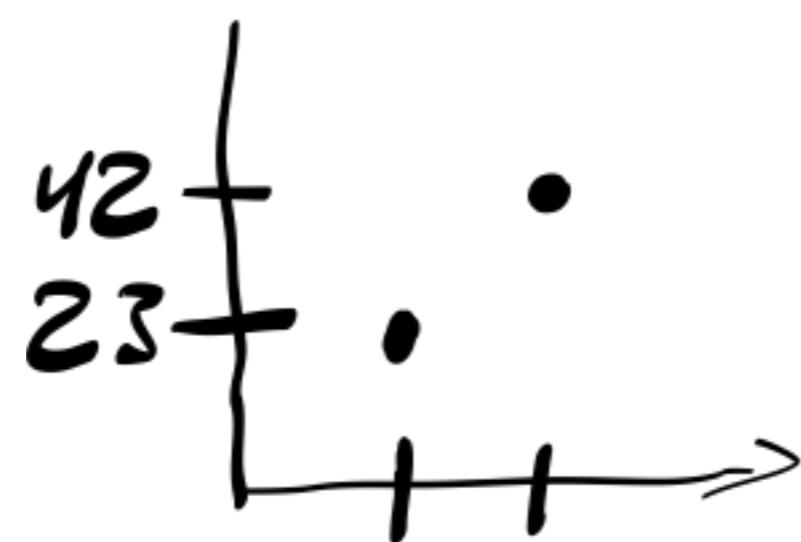
# Most likely results

Pie Chart



Bar Chart

Scatterplot



23  
42

Numbers

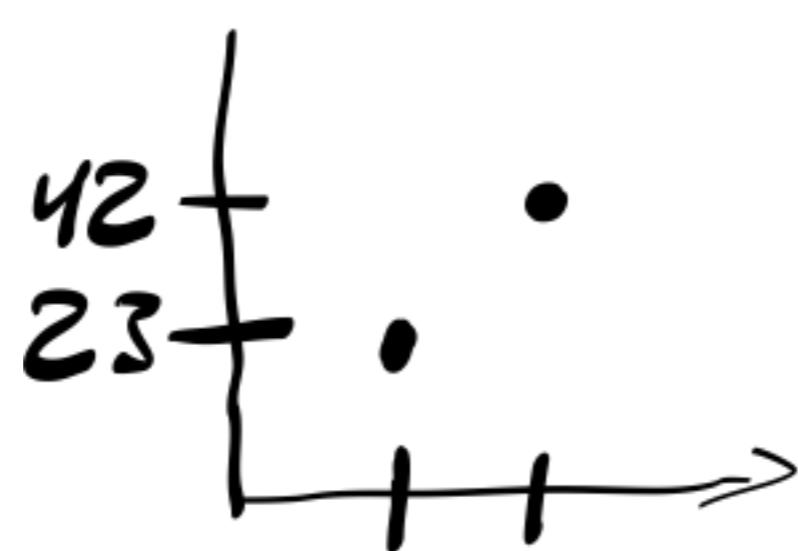
Design Fixation: Blind adherence  
to a set of ideas or concepts

Pie Chart



Bar Chart

Scatterplot



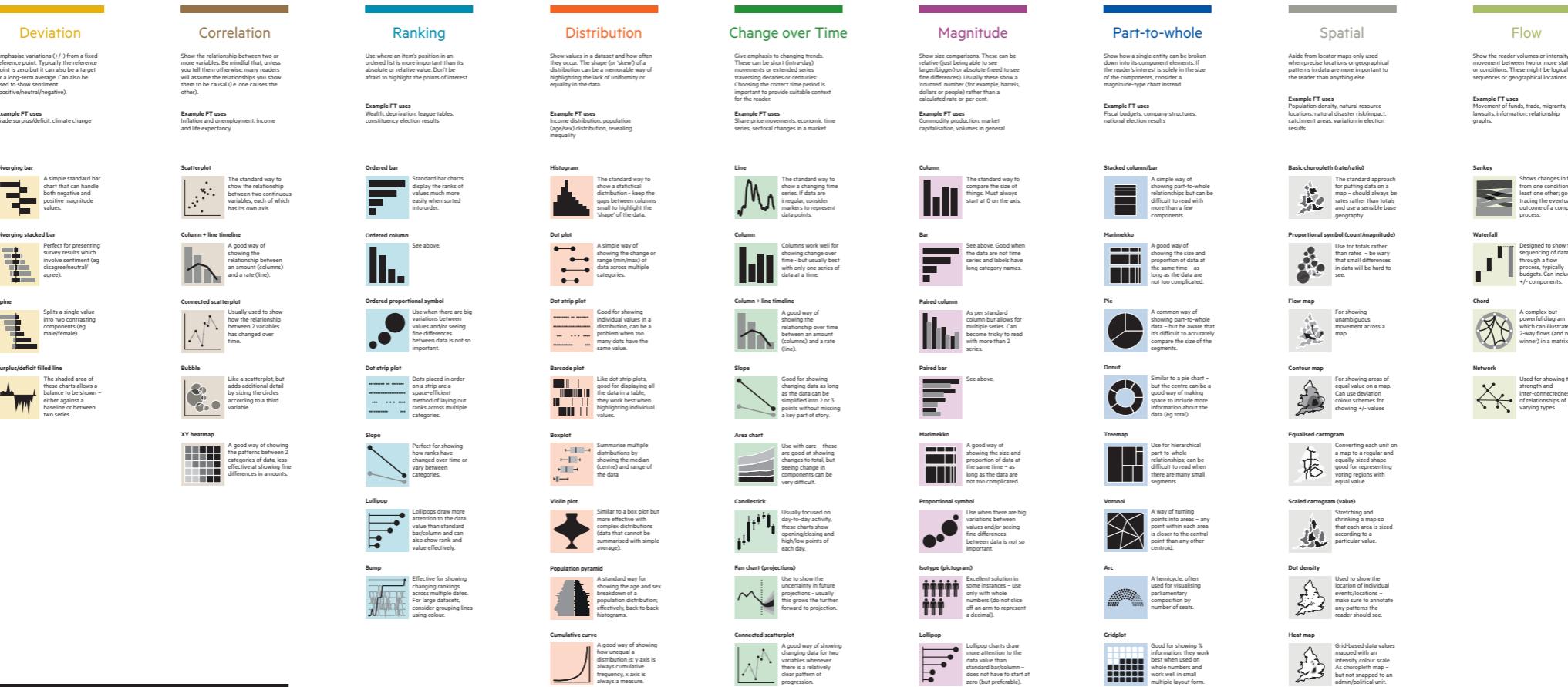
23  
42

Numbers

# Visual Vocabulary

# Visual Vocabulary

[bit.ly/visvocab](http://bit.ly/visvocab)



## Visual vocabulary

### Designing with data

There are so many ways to visualise data - how do we know which one to pick? Use the categories across the top to decide which data relationship is most important in your story, then look at the different types of chart within the category to form some initial ideas about what might work best. This list is not meant to be exhaustive, nor a wizard, but is a useful starting point for making informative and meaningful data visualisations.

FT graphic: Alan Smith; Chris Campbell; Ian Both; Li Faifer; Graham French; Billy Ehrenberg; Shannon; Paul McCallum; Martin Dabek  
Inspired by the Graphic Continuum by Jon Schmid and Seán Ó Ríordáin

[ft.com/vocabulary](http://ft.com/vocabulary)



# Visual Vocabulary in Tableau

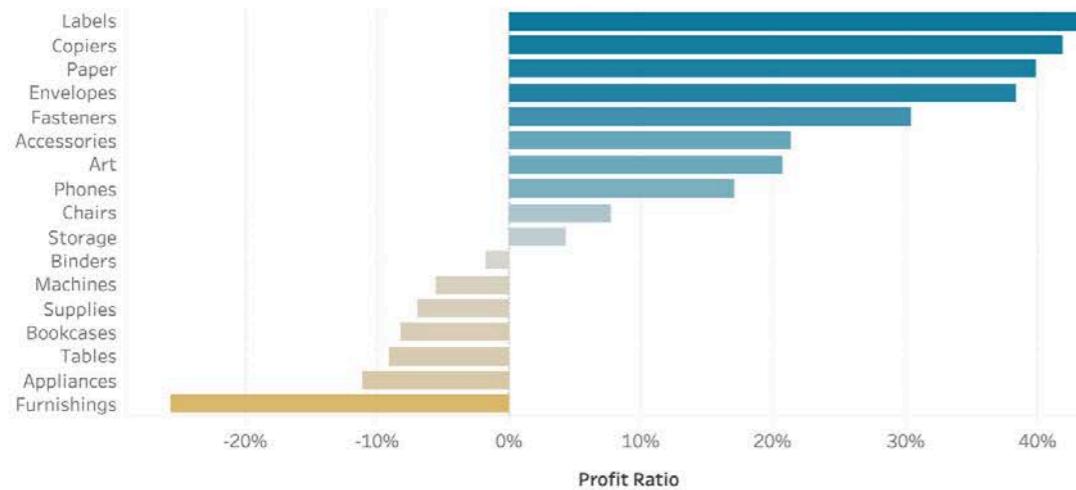
[bit.ly/visvocab-tableau](http://bit.ly/visvocab-tableau)

## Deviation

Emphasise variations (+/-) from a fixed reference point. Typically the reference point is zero but it can also be a target or a long-term average. Can also be used to show sentiment (positive/neutral/negative).

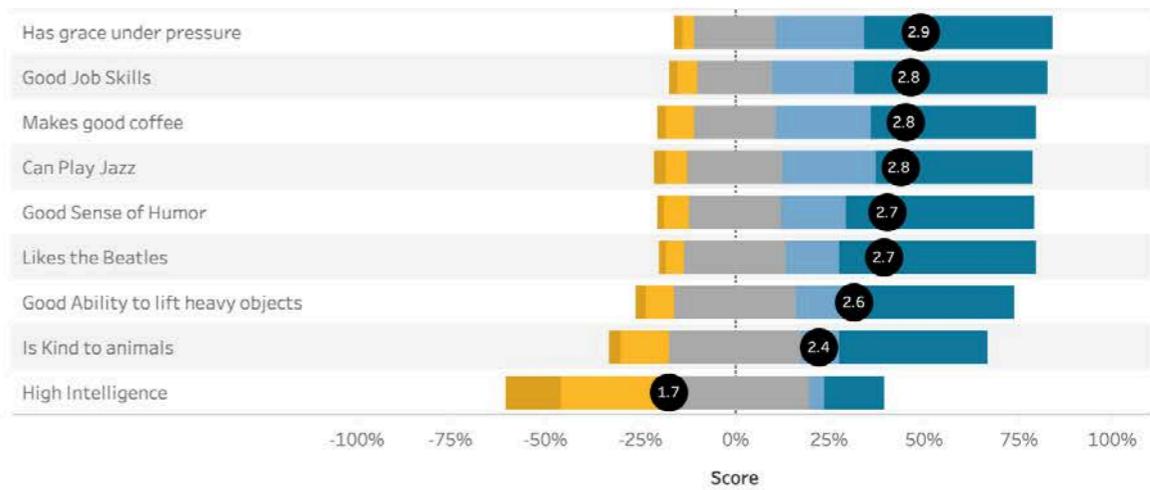
### Diverging Bar

A simple standard bar chart that can handle both negative and positive magnitude values



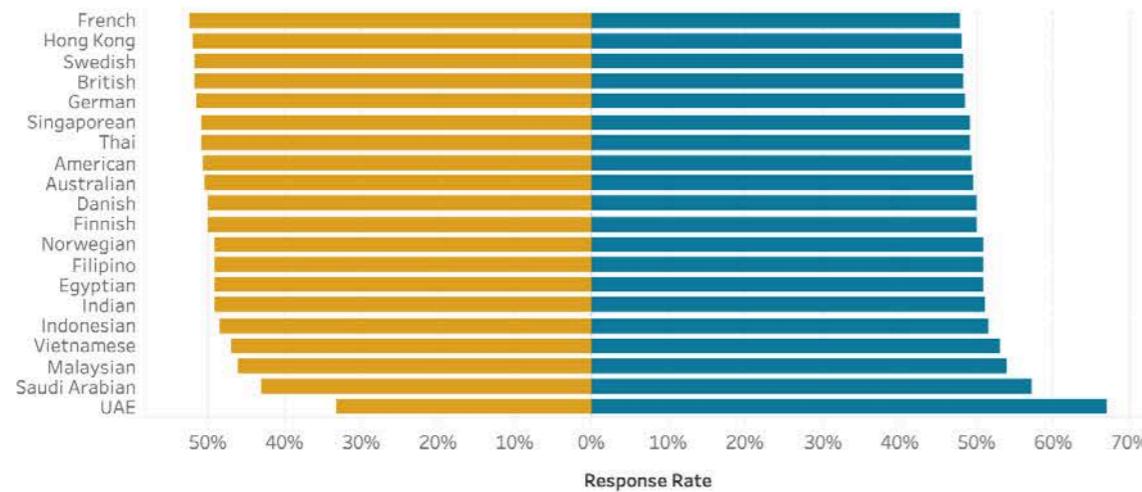
### Diverging Stacked Bar

Perfect for presenting survey results which involve sentiment (e.g., disagree/neutral/agree)



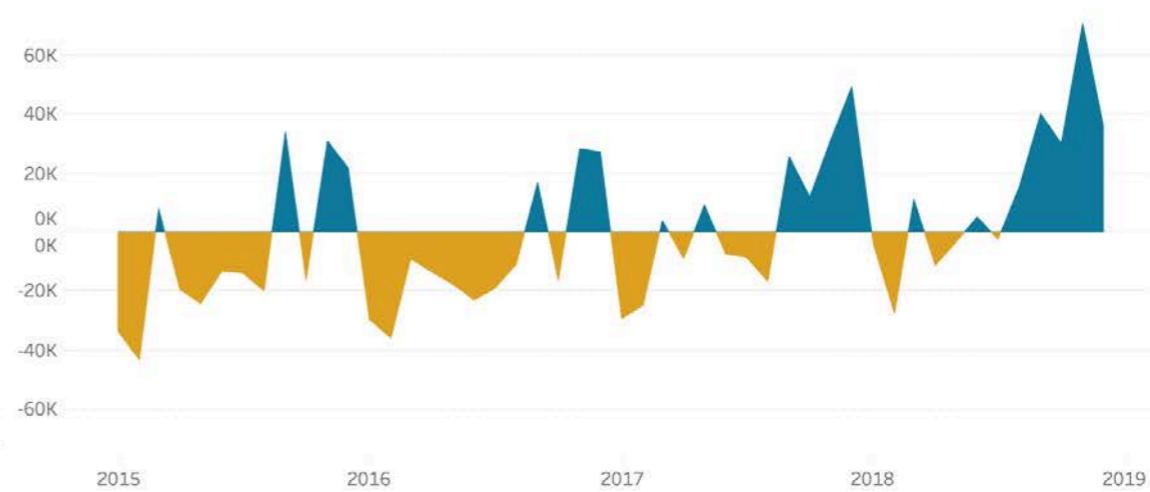
### Spine Chart

Splits a single value into 2 contrasting components (e.g., Male/Female)



### Surplus/Deficit Filled Line

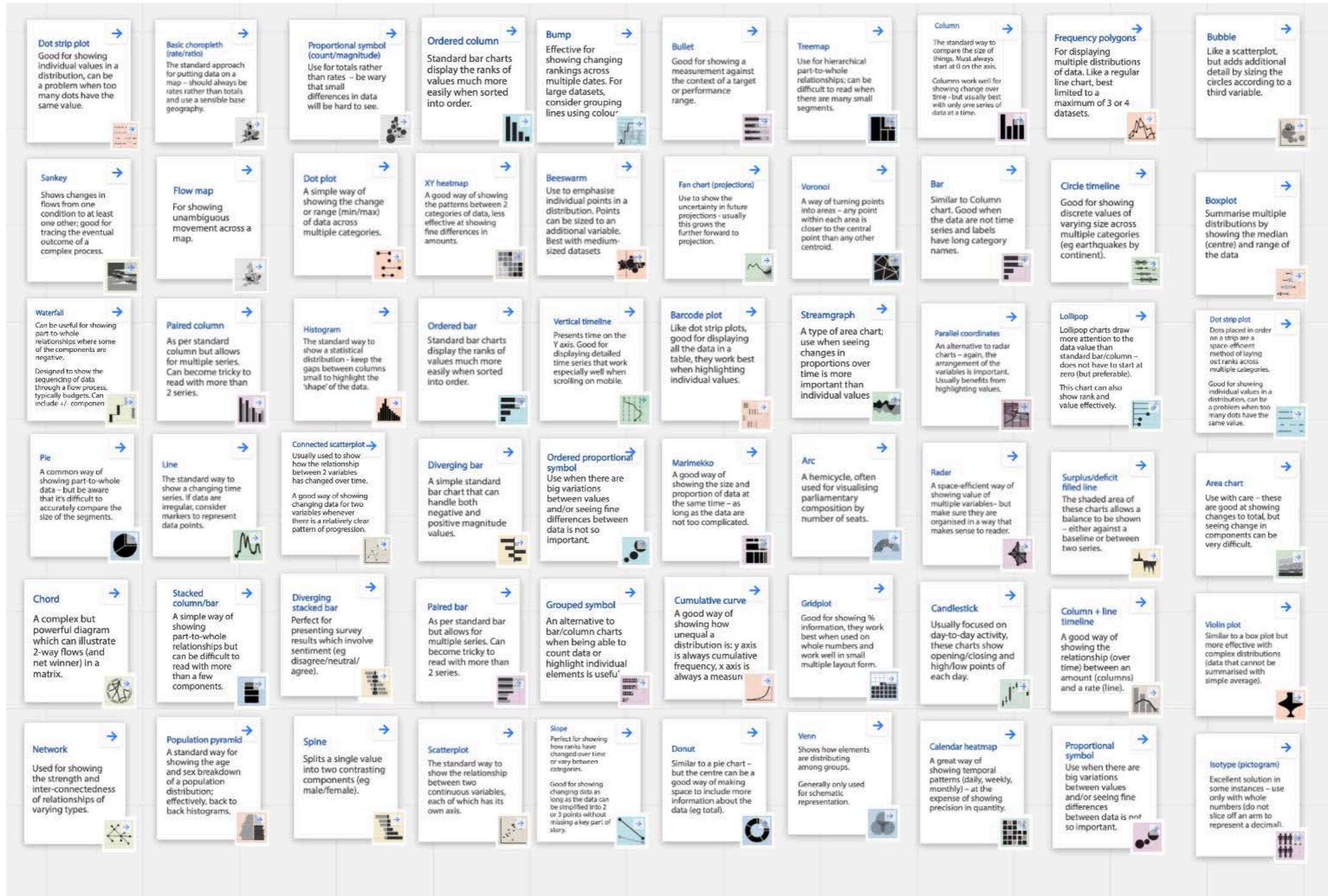
The shaded area of these charts allows a balance to be shown – either against a baseline or between two series.



# bit.ly/miro-visual-vocabulary

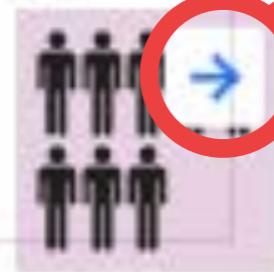


# bit.ly/miro-visual-vocabulary

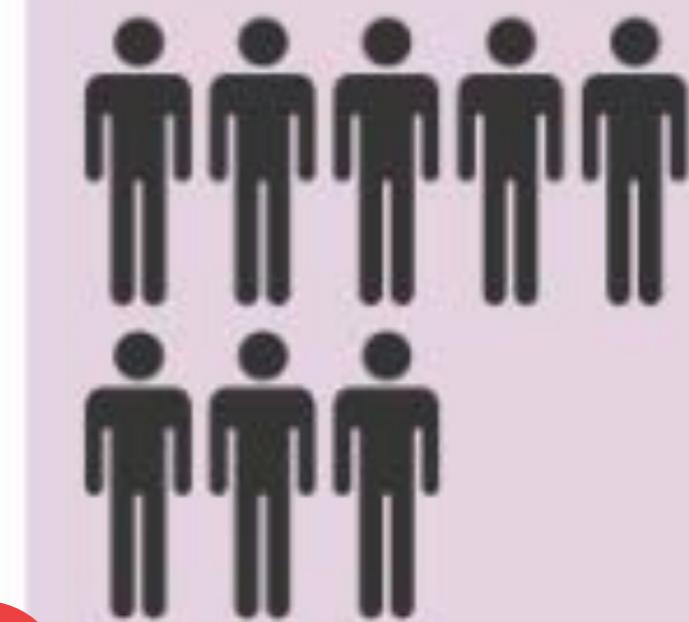


## Isotype (pictogram)

Excellent solution in some instances – use only with whole numbers (do not slice off an arm to represent a decimal).



## Isotype (pictogram)

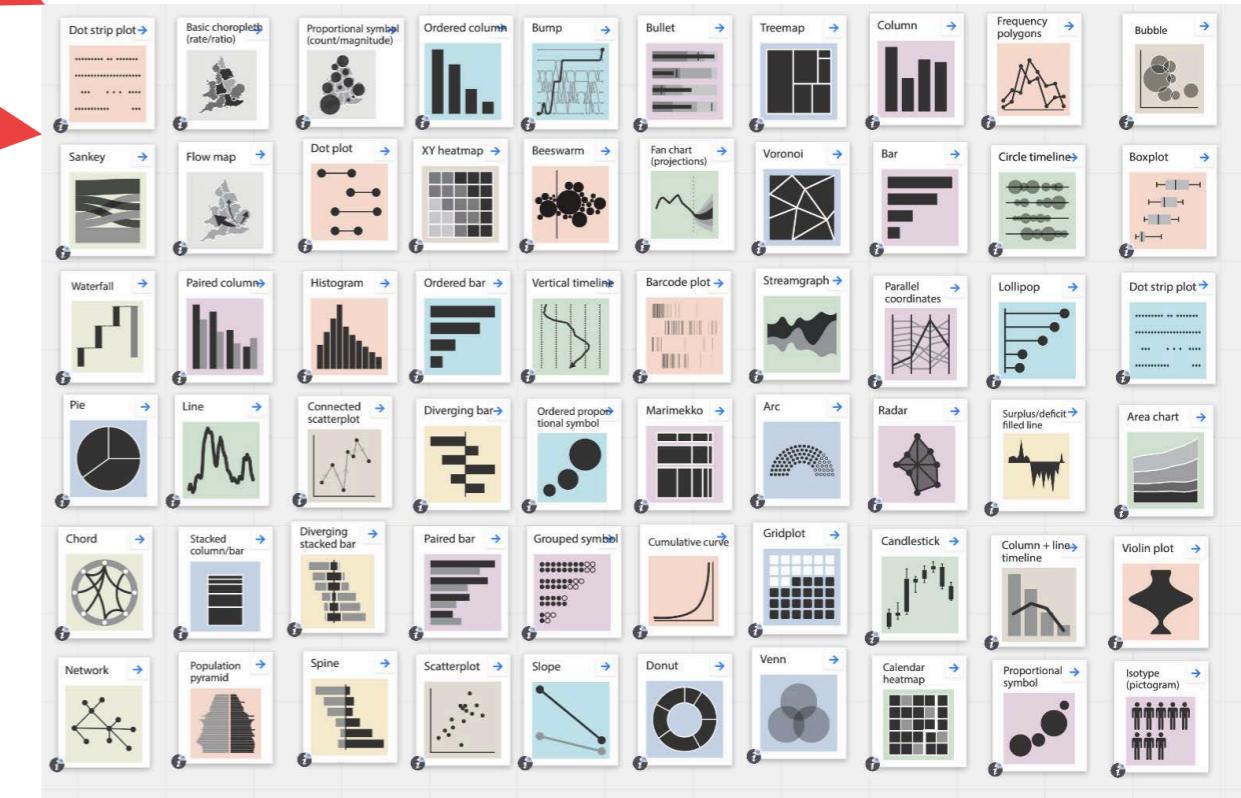


**Isotype (pictogram)**

Excell  
some  
only w  
numb  
slice c  
repre

**Isotype (pictogram)**

A circular icon with a white 'i' and a blue arrow pointing right is located at the bottom left of the slide.



# Activity

Explore the different chart types on the Miro board:

[https://bit.ly/datavis\\_charts](https://bit.ly/datavis_charts)

5 min

# Activity

Miro: [https://bit.ly/datavis\\_charts](https://bit.ly/datavis_charts)

1. Vote for your favorite visualizations to answer the question (2 min)
2. Discuss and defend your choice with your neighbor (2 min)
3. Class discussion of the results (5 min)

Visualize how earthquake magnitudes have changed over the past 10 years in major earthquake zones.

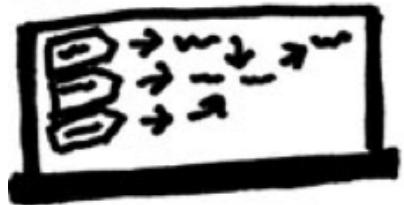
Visualize the distribution of student feedback scores in a class survey.

Visualize the change in the amount of sugar contained in different food groups (cereal, bread, etc) from 1950 to today.

Compare available houses on the market in regards to size, price, number of amenities, and distance to the closest supermarket.

# Design Sprint

Map



Sketch



Decide



Proto-type



Test



# Activity

Individually: Sketch several ideas for possible visualizations to answer your project questions.

Use the right charts from the visual vocabulary.

10 mins

# Coffee Break



# Activity

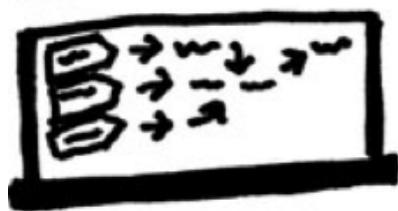
As a group: Explain your visualization sketches to the other group members.

5 mins



# Decide - Charts

Map



Sketch



Decide



Proto-type



Test



# Activity

Cluster sketches based on the question they answer. Move similar sketches next to each other.

10 mins



# Activity

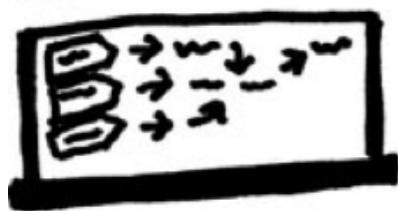
Individually, vote for the sketches that you like the best. Each person gets three votes. You can vote for your own sketch or even for the same sketch twice.

Vote by putting a sticky dot next to the sketch.

5 mins

# Prototype - Charts

Map



Sketch



Decide



Proto-type



Test

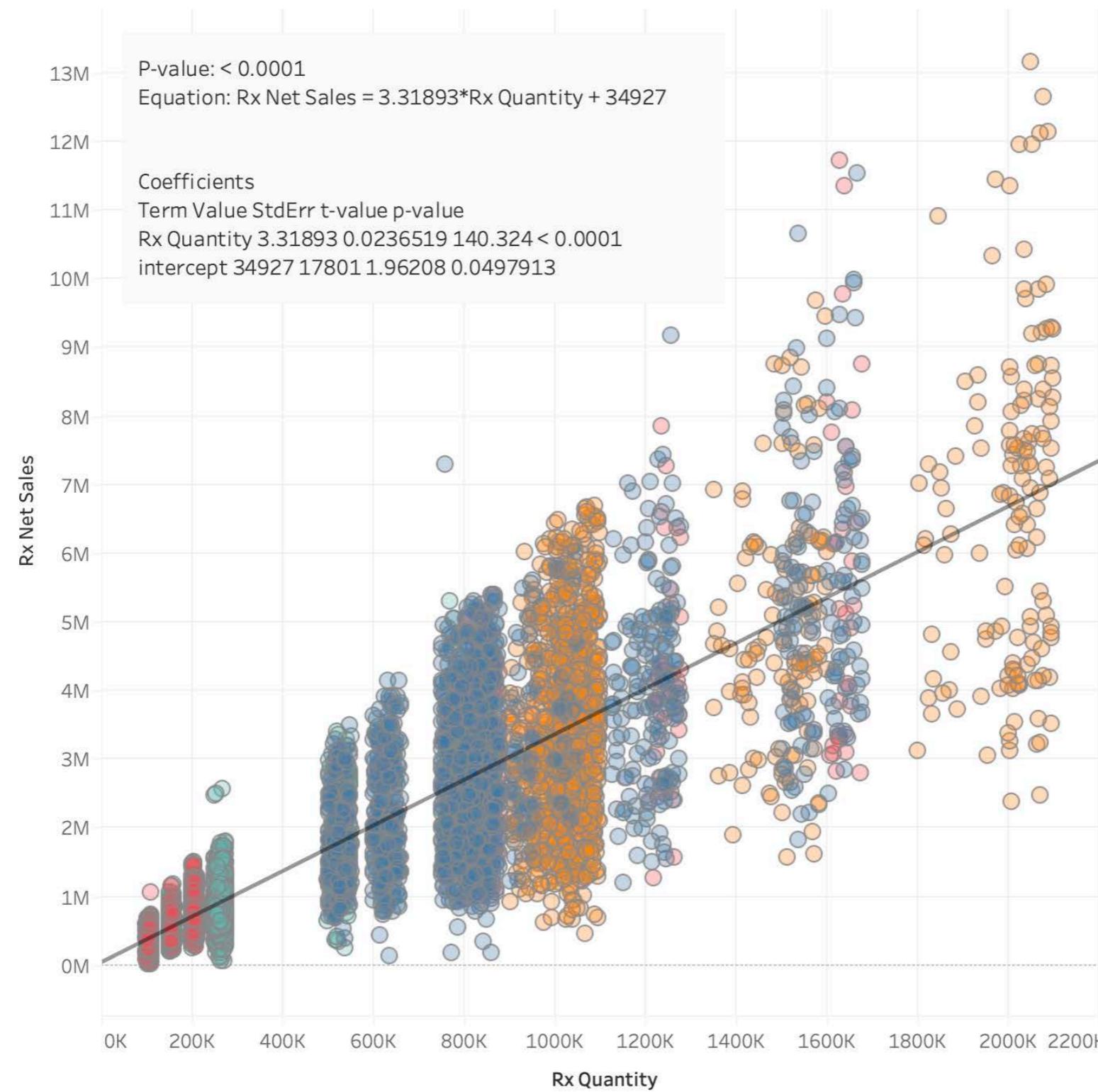


# Tableau

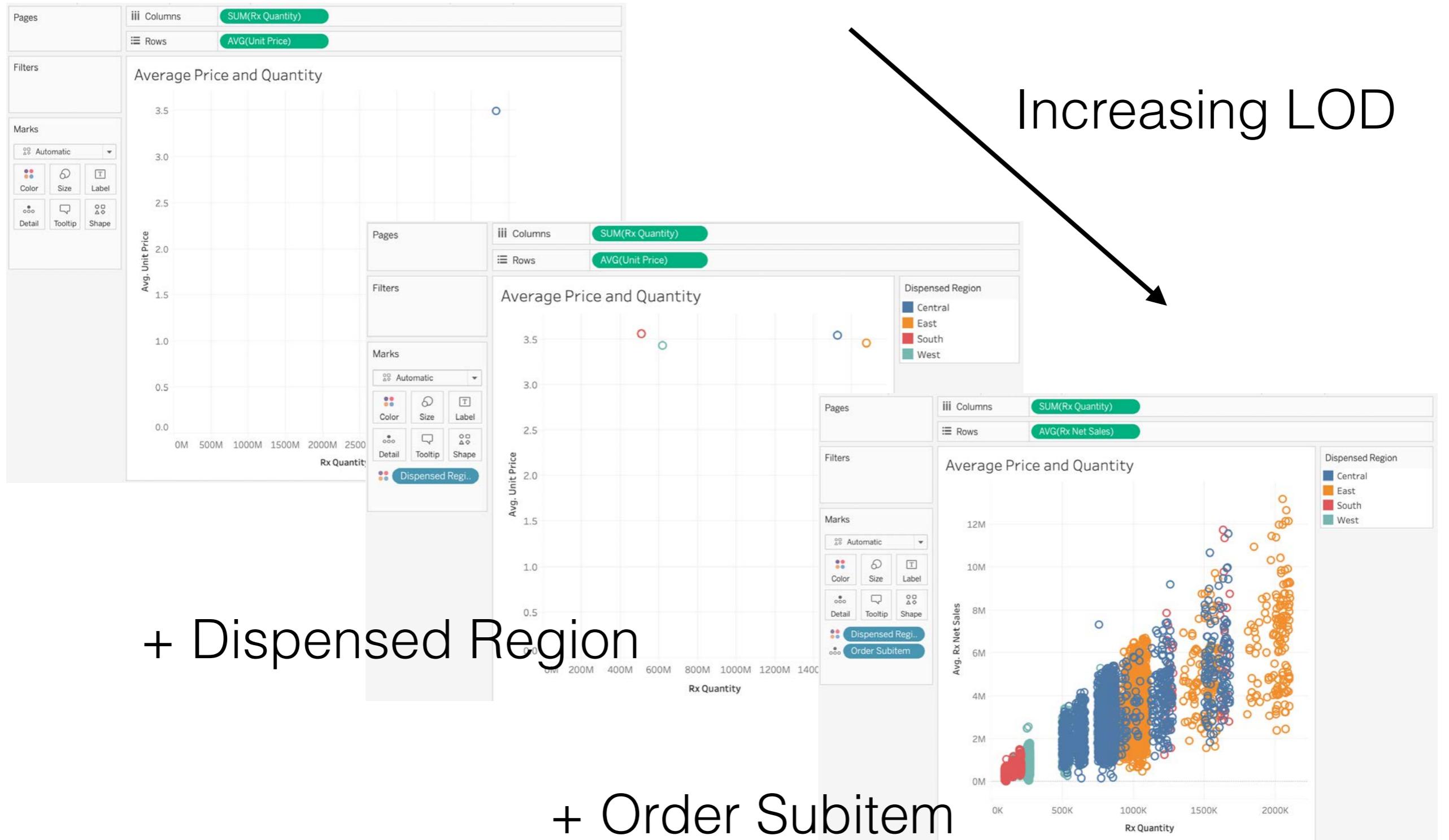


# Activity

What is the trend line equation if you plot total quantity and total net sales by region?

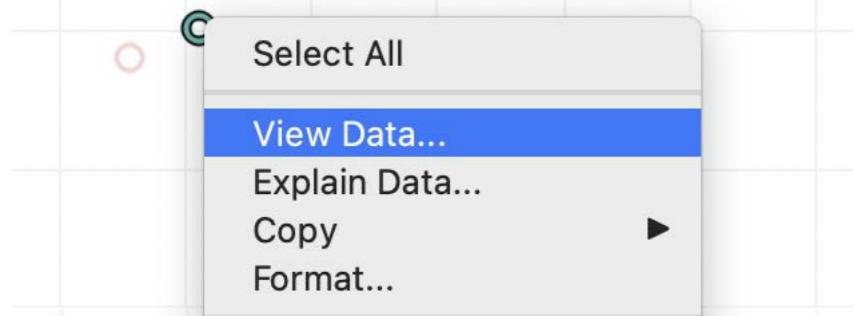


# Level of Detail (LOD)



# View Data

Right click on mark



View Data: Sheet 8 (1 mark)

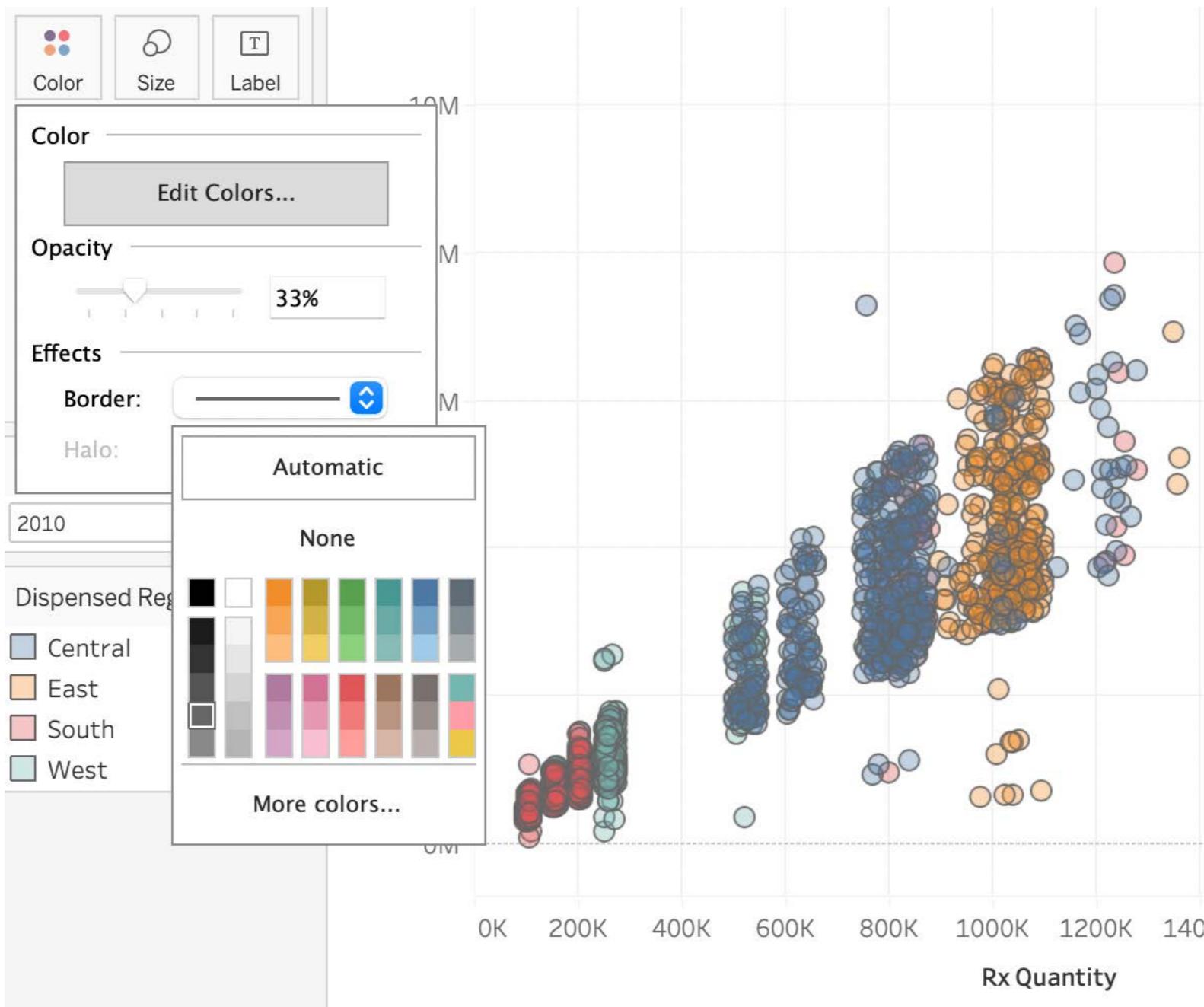
Tabs < Rx 2,087 rows 3 fields + Show Fields Download

Summary Rx

Abc	#	#	
Distribution	Rx	Rx	
Dispensed Region	Rx Net Sales	Rx Quantity	
West	611,460.00	158,000	
West	1,120,520.00	257,000	
West	545,321.00	151,900	
West	654,591.00	153,300	
West	2,722,630.22	790,500	
West	686,576.00	206,800	
West	491,502.00	203,100	
West	876,522.00	208,200	
West	536,734.00	157,400	
West	517,584.00	157,800	
West	420,160.00	208,000	

Select table (Rx) to see all data  
These get aggregated into the displayed values

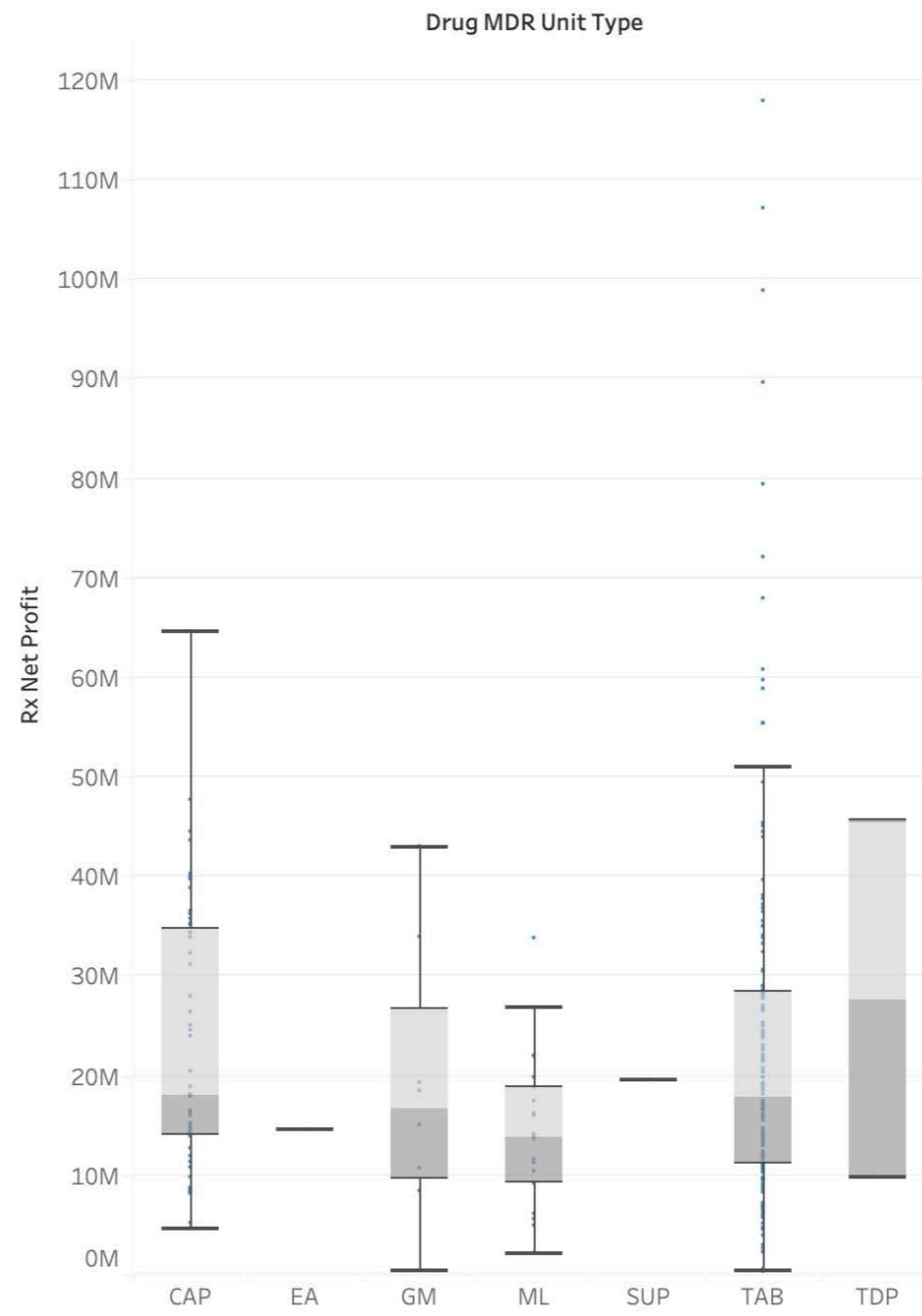
# Change Opacity & Border



# Activity

Use the  
ShowMe  
feature to  
create this  
box plot.

Create a box plot for all products and their profit grouped by MDR unit type.

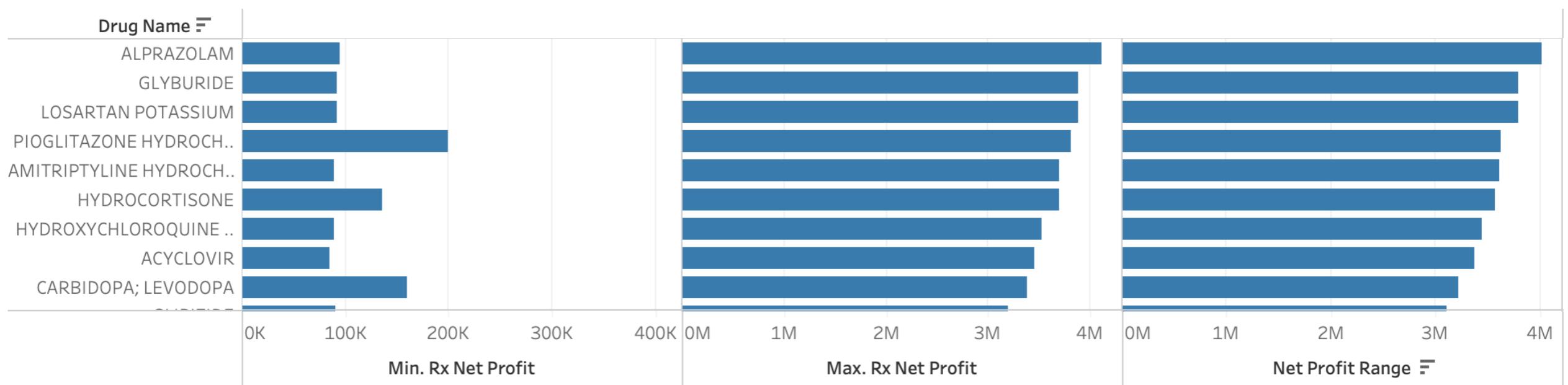


# Activity

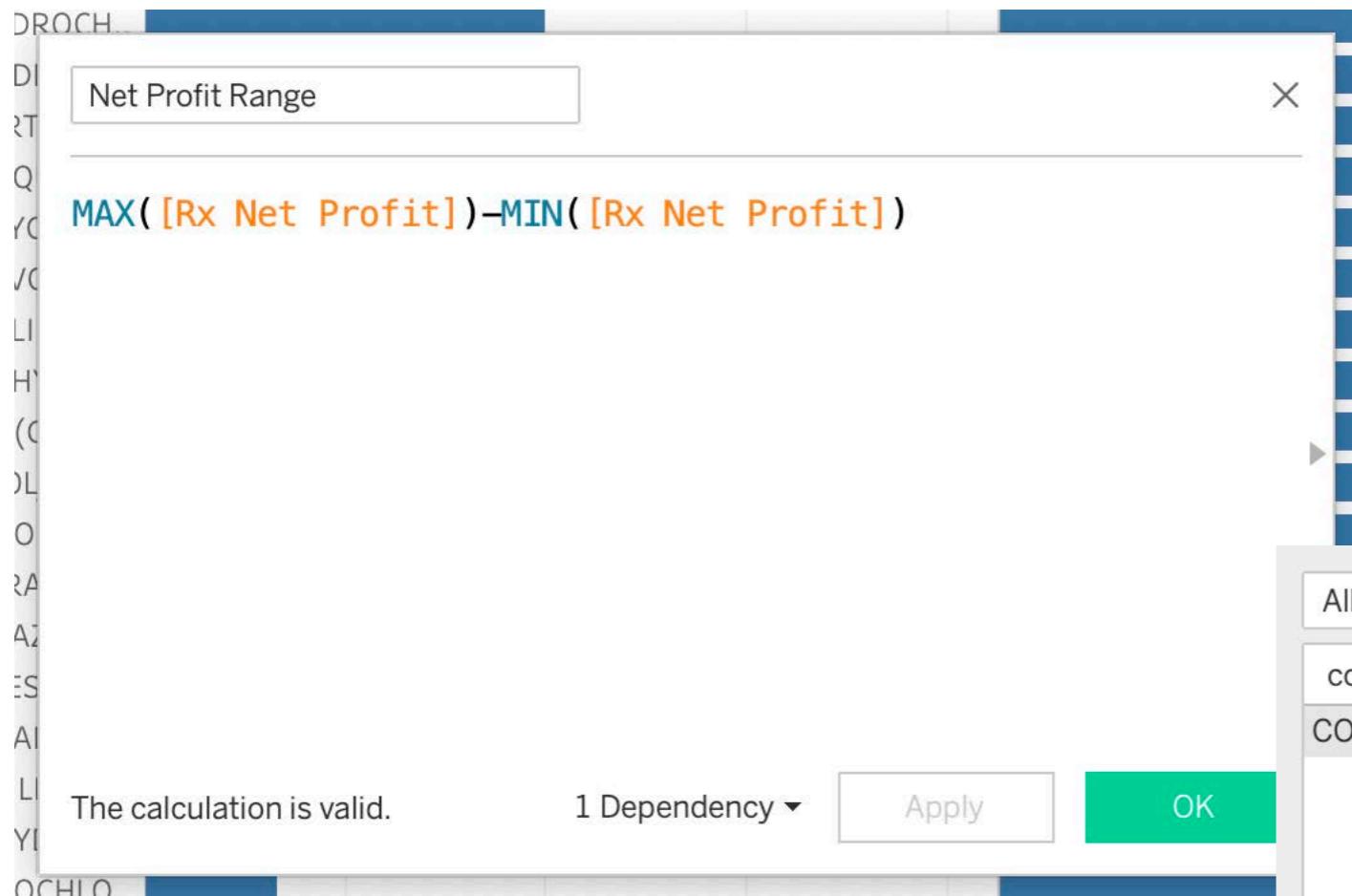
Use a calculated field.

Which drug has the widest net profit range?

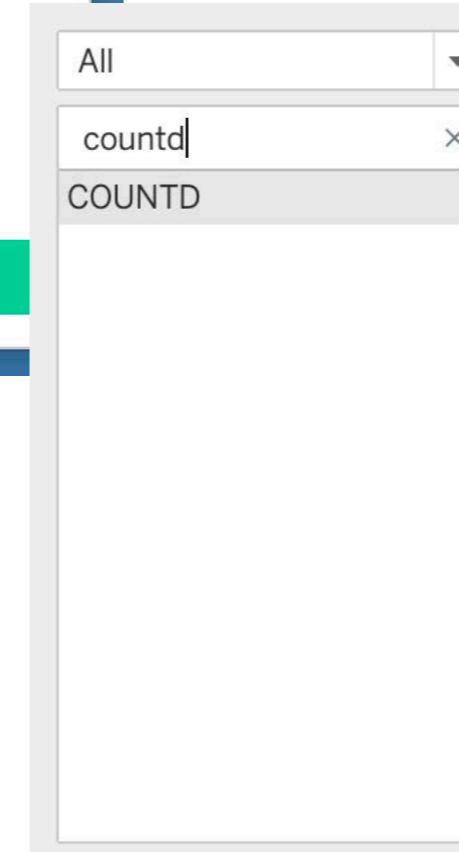
Net Profit Range = max(Net Profit)-min(Net Profit)



# Calculated Fields



Similar to Excel  
Search for functions



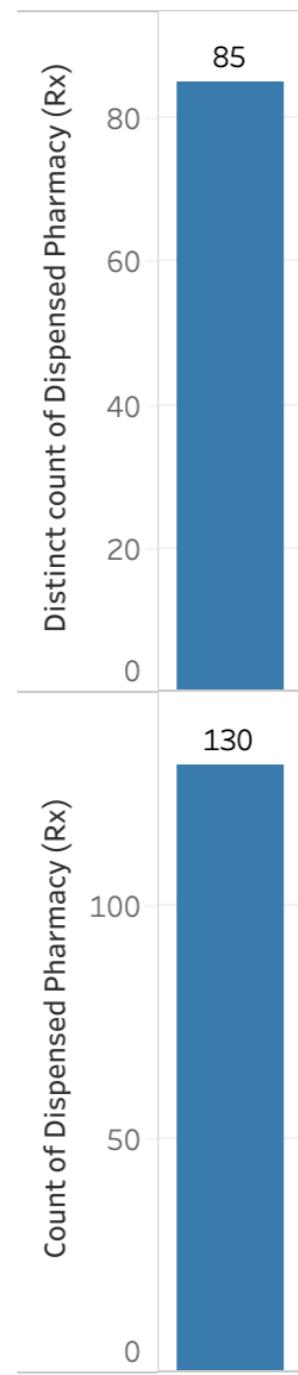
`COUNTD(expression)`

Returns the number of distinct items in a group. NULL values are not counted. Each unique value is counted only once.

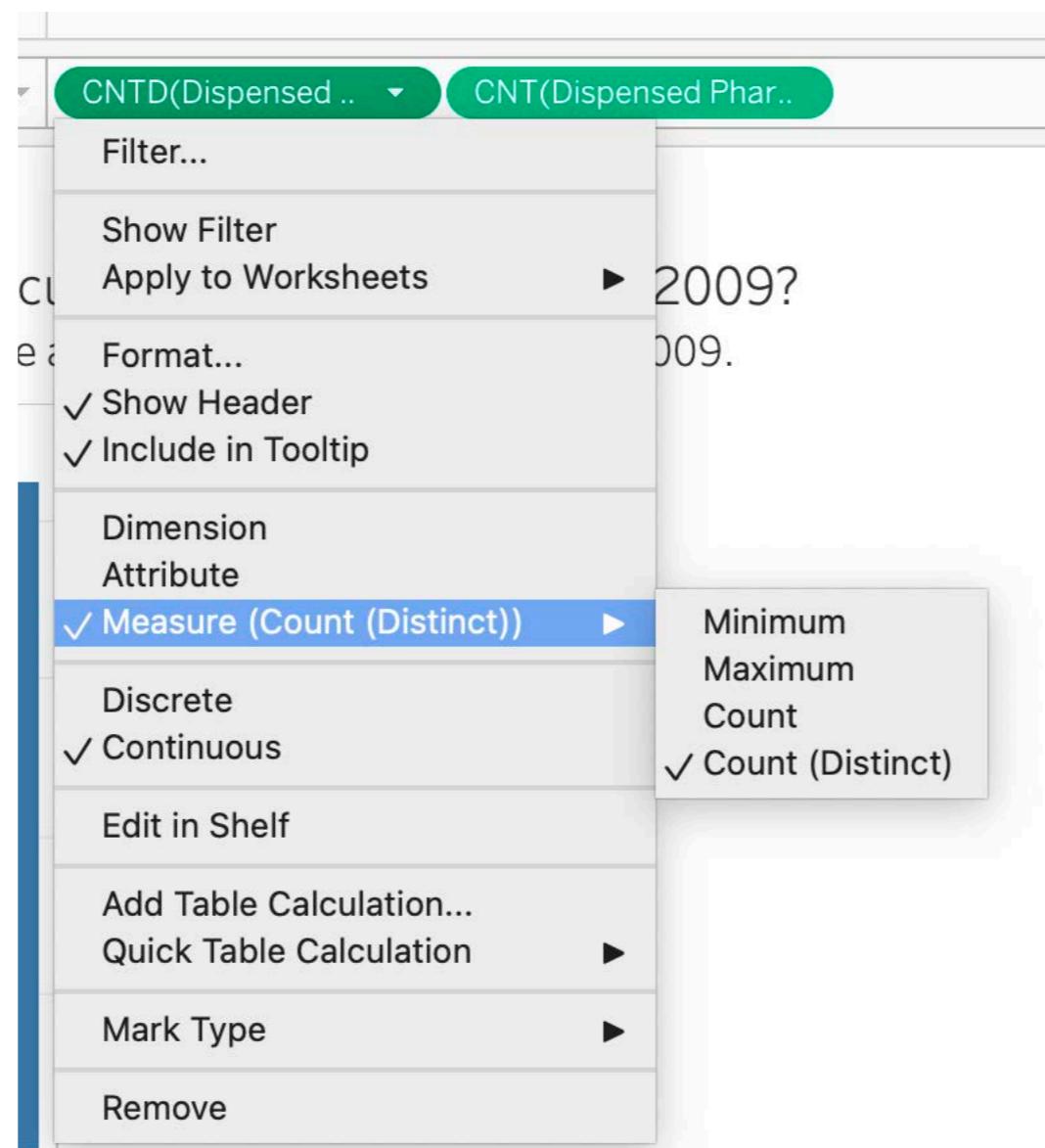
Example: `COUNTD([Region])`

# Activity

How many customers ordered in June 2009?  
I.e., they made an order between June 1 -30, 2009.



# CNTD vs. CNT



# Coffee Break



# Tableau



# Activity

Which customer from each region received the highest discount amount?

Discount amount = discount % \* gross sales



# Table Calculations

The screenshot shows the Tableau interface with two main components:

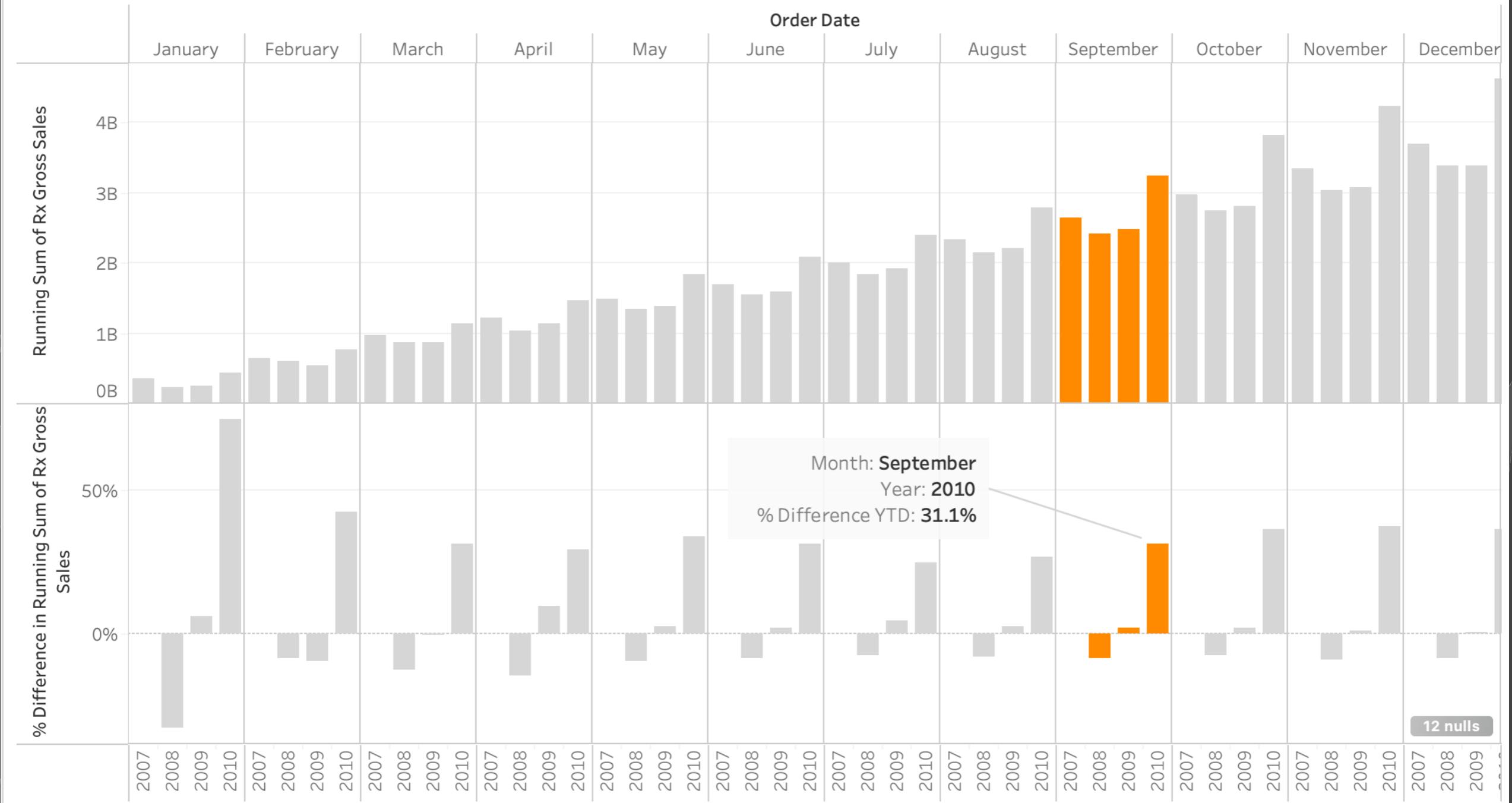
- Table Calculation Dialog:** A floating window titled "Table Calculation" for "Rank of Discount Amount". It includes sections for "Calculation Type" (set to "Rank" and "Descending"), "Compute Using" (set to "Pane (down)", which is highlighted in blue), and "Specific Dimensions" (checkboxes for "Dispensed Pharmacy (Rx)" (checked) and "Dispensed Region").
- Context Menu:** A context menu is open over a data table. The menu items include "Edit Filter...", "Show Filter", "Clear Filter", "Dimension", "Attribute", "Measure (Sum)" (selected, indicated by a checkmark), "Compute Using" (highlighted in blue), "Edit Table Calculation...", "Clear Table Calculation", "Quick Table Calculation", "Apply to Totals", and "Remove".

The data table visible in the background shows four rows of data:

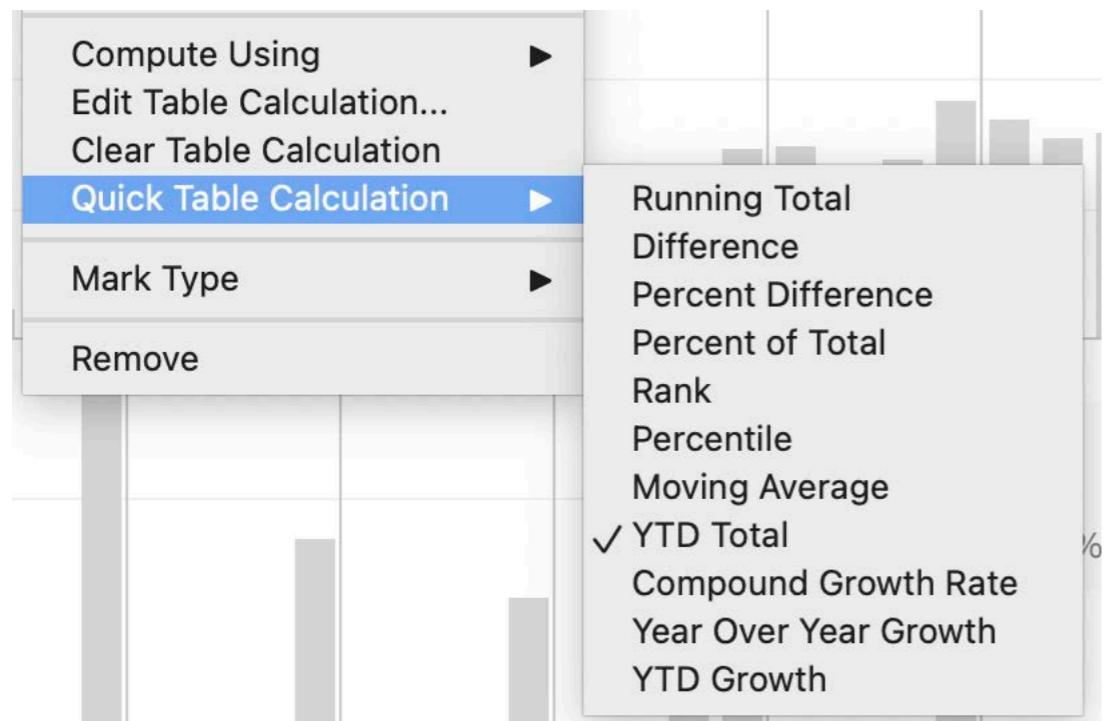
Dispensed ..	Dispensed ..
Brad Thomas	OK
Roy Skaria	
Alan Hwang	
Noel Staavos	

# Activity

Plot year to date total sales for all years and months. How much more or less is the YTD total for Sep 2010 compared to YTD total of the previous year?



# Table Calculations



PREVIOUS VIEWS

Table Calculation  
Running Sum of Rx Gross Sales X

**Calculation Type**

Running Total

Sum

**Compute Using**

Table (across)  
Pane (across)  
Pane (across then down)  
Pane (down then across)  
Cell

**Specific Dimensions**

Year of Order Date  
 Month of Order Date

Restarting every

Sort order

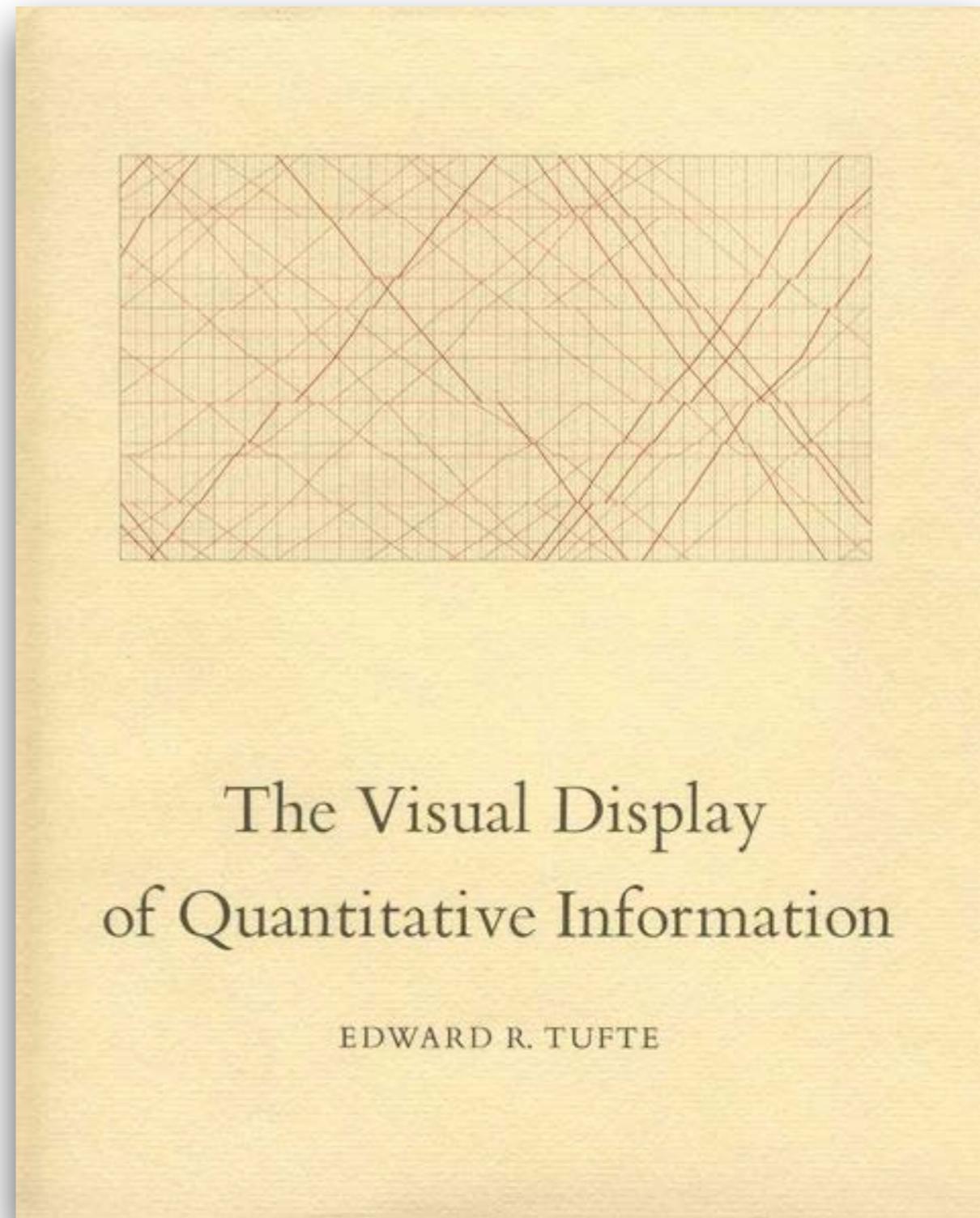
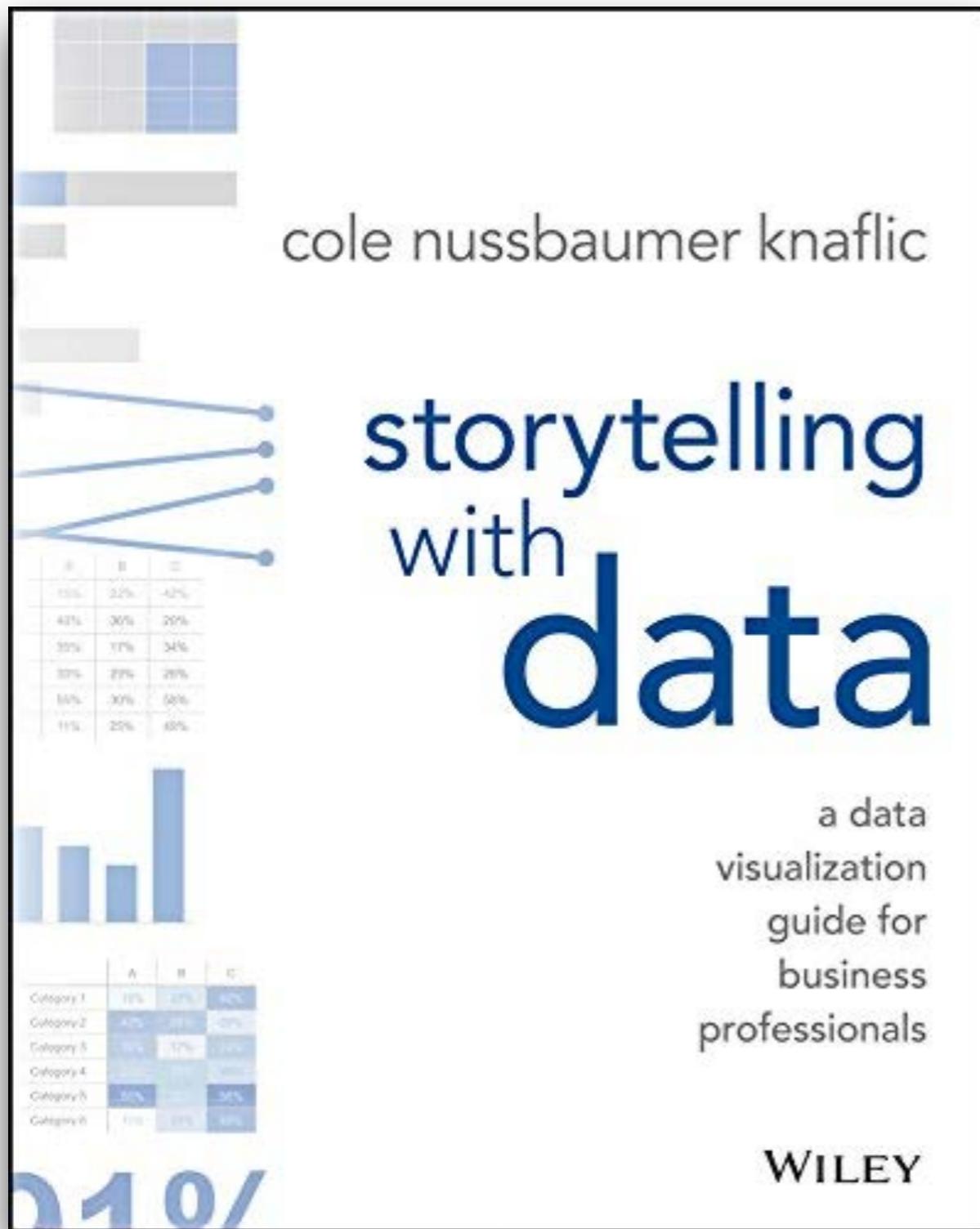
Add secondary calculation  
 Show calculation assistance

# Day 1 Wrap-Up

# Take Aways

- **Visualizations** are graphical representations for the **exploration** or **explanation** of data.
- They use the **power of perception** to expand our **limited cognitive abilities** (attention).
- A **design sprint** is a user-centered design process to quickly create and test visualizations, designs, business ideas, etc.
- The process starts with **mapping** the questions, audience, and data to find out where we want to go.
- **Sketching** and paper prototypes are cheap, fast, and engage the user in discussion and reflection.
- **Graphical integrity**, maximizing data-ink ratio, and avoiding chart junk are the basis of **effective visualizations**.
- Choose the **right chart** to convey the information in your data **efficiently**.
- **Decide** which sketches to implement as a team using clustering and voting.
- **Prototype** your exploratory visualizations in Tableau or any other similar tool.

# Further Reading



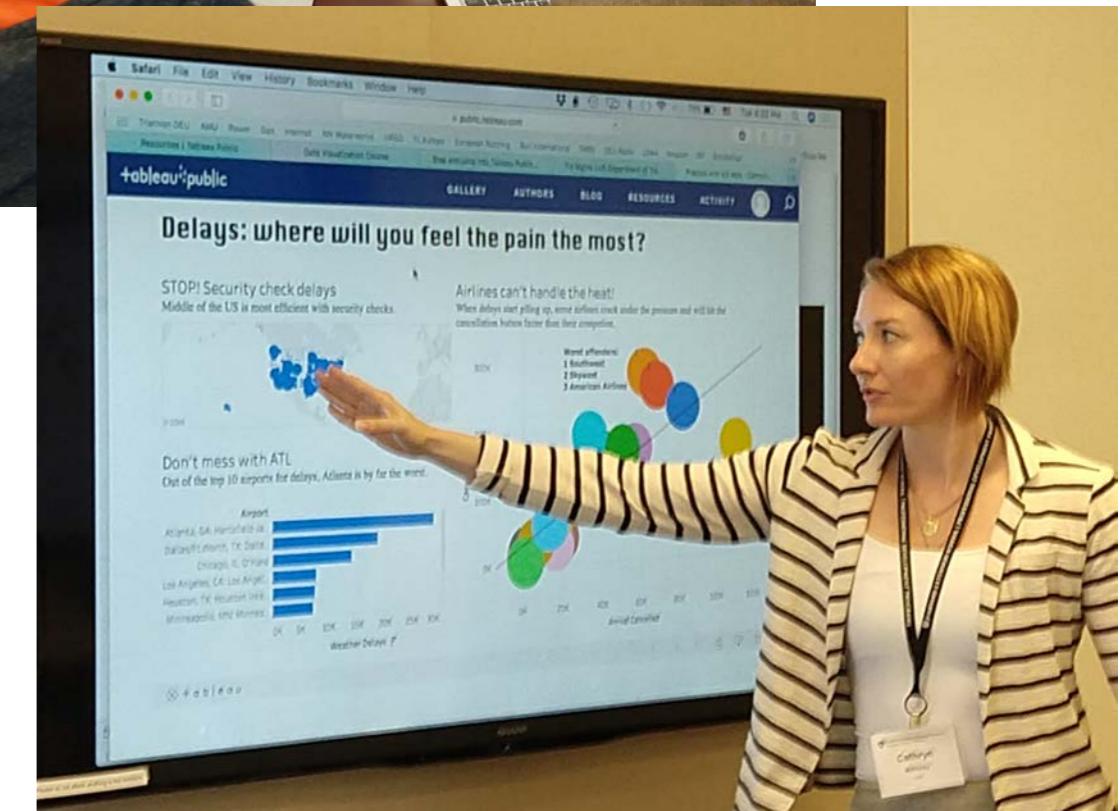
# Homework



- Finish creating visualizations in Tableau based on the questions and sketches you decided on.
- Don't worry if you cannot create them exactly. Play around with the “Show Me” feature in Tableau.
- Alternatively, draw sketches of your visualizations and load them as images into Tableau.

# Day 2

- Storytelling
- Perception
- Dashboard
- Storyboard
- Testing
- Show & Tell



# Thank you!

Thank you all for a *great* day 1!



100

