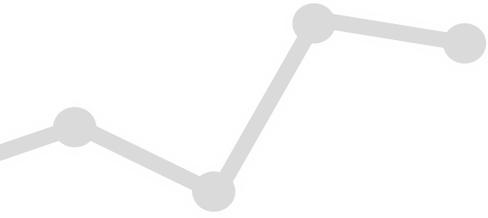


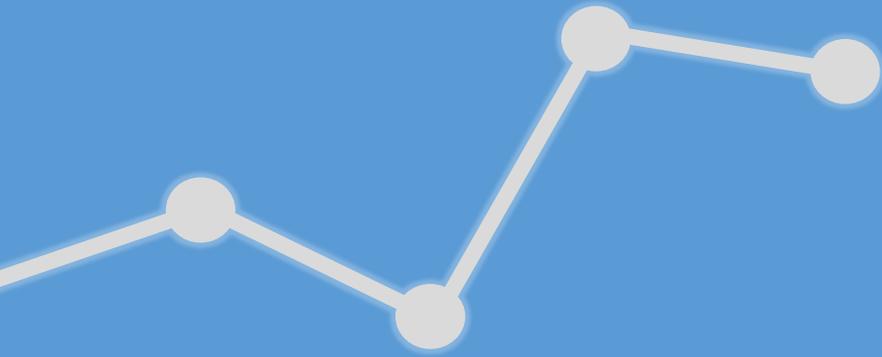
Data Visualization



What is data visualization?

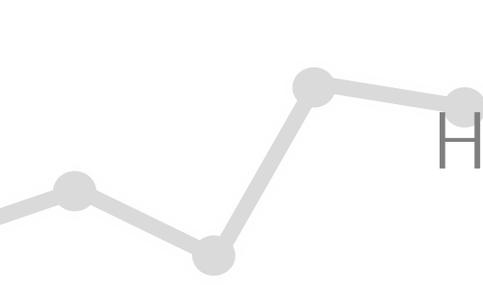
The **representation** and **presentation** of data that exploits our **visual perception** abilities in order to **amplify cognition**

Andy Kirk



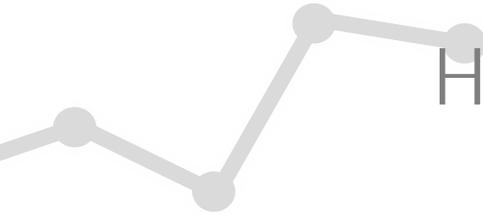
Why Visualize Data?

Visual data helps us think and communicate



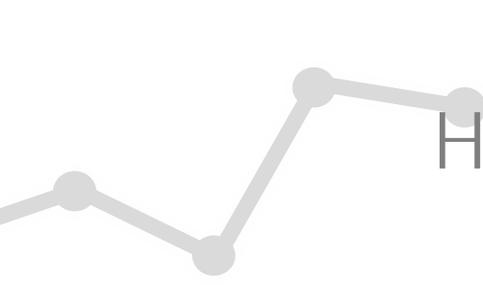
How many nines are there?

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

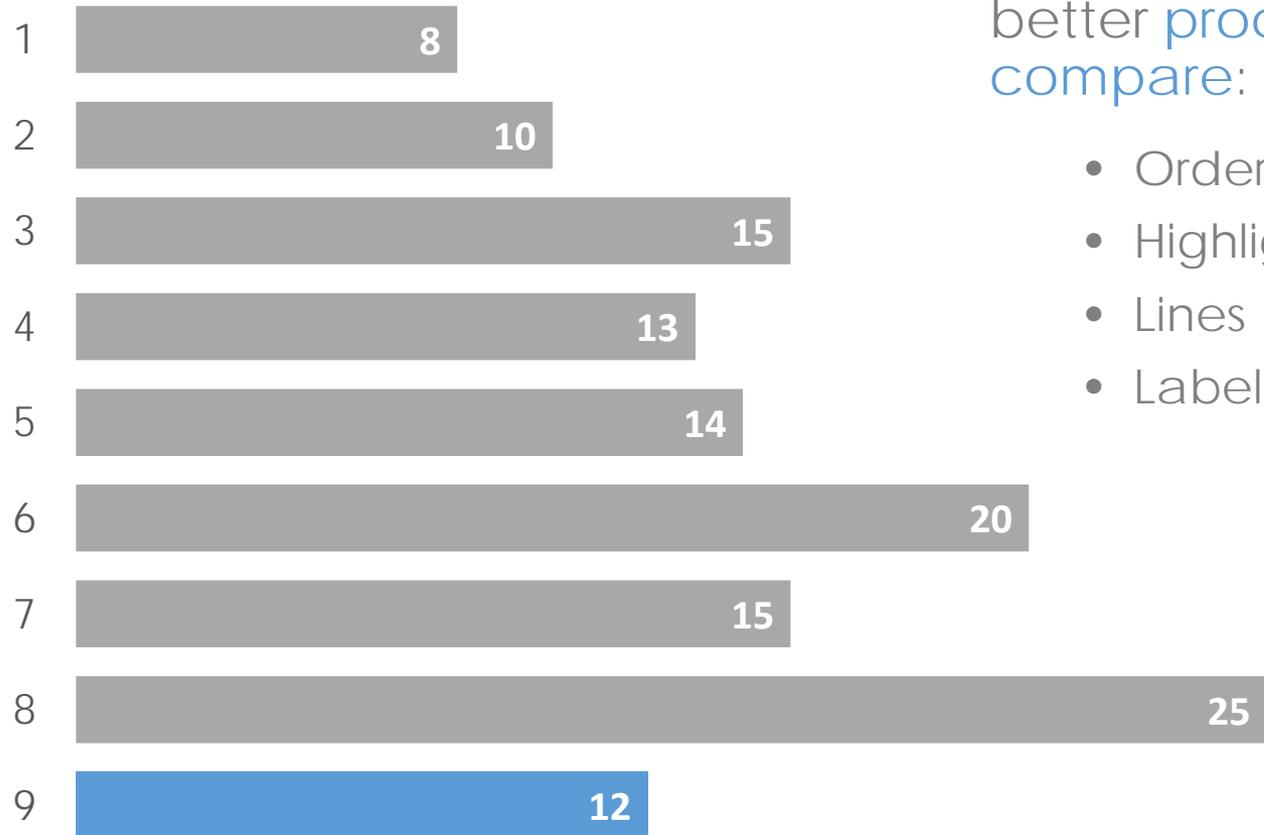


How many nines are there?

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



How many nines are there?



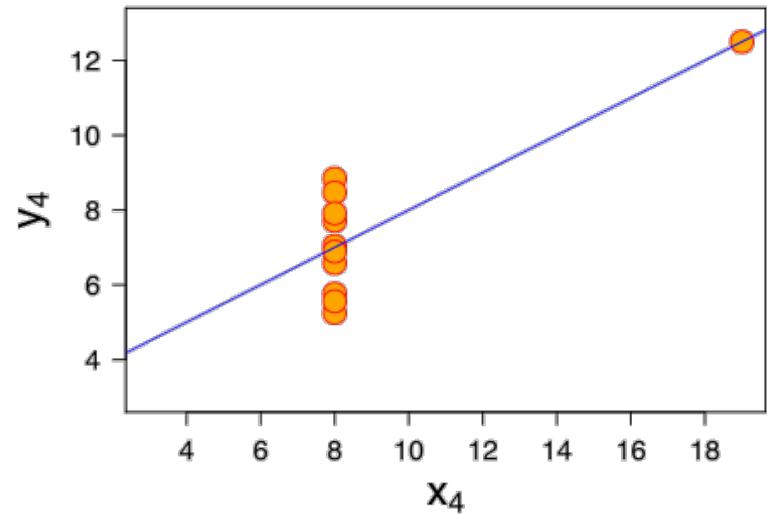
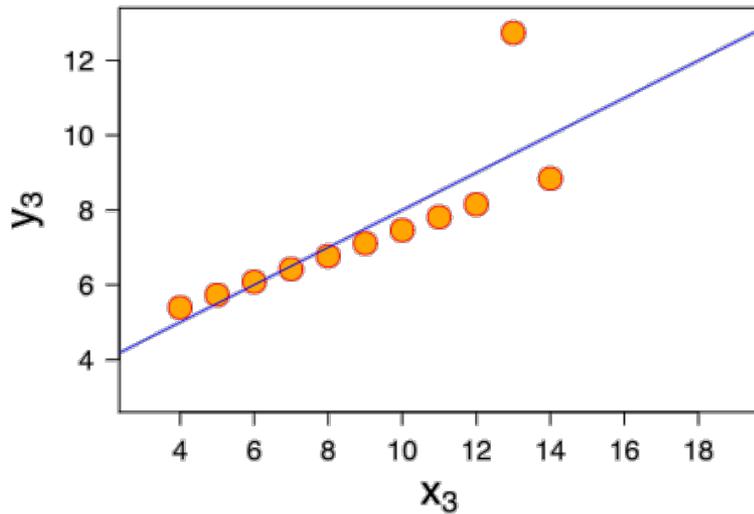
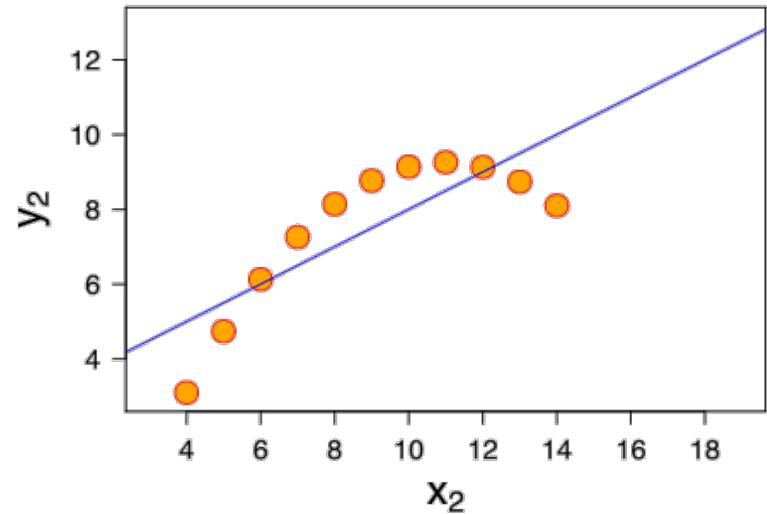
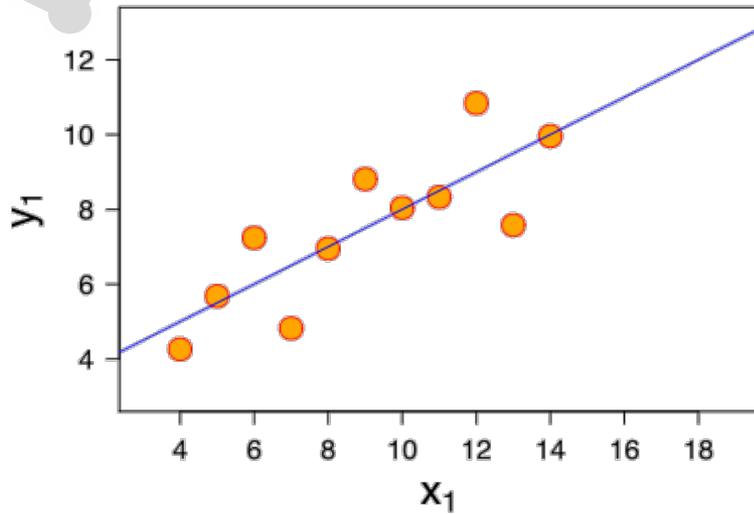
How to **help** your brain better **process** and **compare**:

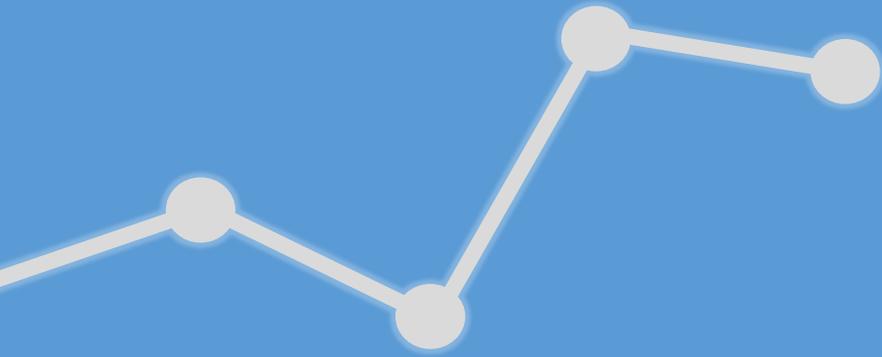
- Order
- Highlight
- Lines
- Labels

What can you gather from this information?

	I		II		III		IV	
	X	Y	X	Y	X	Y	X	Y
	10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
	8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
	13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
	9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
	11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
	14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
	6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
	4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
	12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
	7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
	5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89
Mean	9.0	7.5	9.0	7.5	9.0	7.5	9.0	7.5
Variance	10.0	3.75	10.0	3.75	10.0	3.75	10.0	3.75
Correlation	0.816		0.816		0.816		0.816	

Anscombe's Quartet



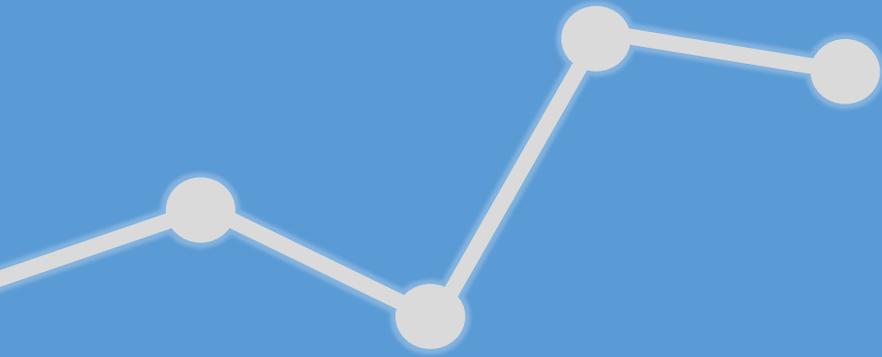


3 Questions for Successful Data Visualization



3 Questions for Data Visualization

1. What's the **story** you're trying to tell?
2. What **chart** will communicate the story **simply** and **effectively**?
3. Who's your **audience**?
(and... what do they want/need?)



Storytelling with Data

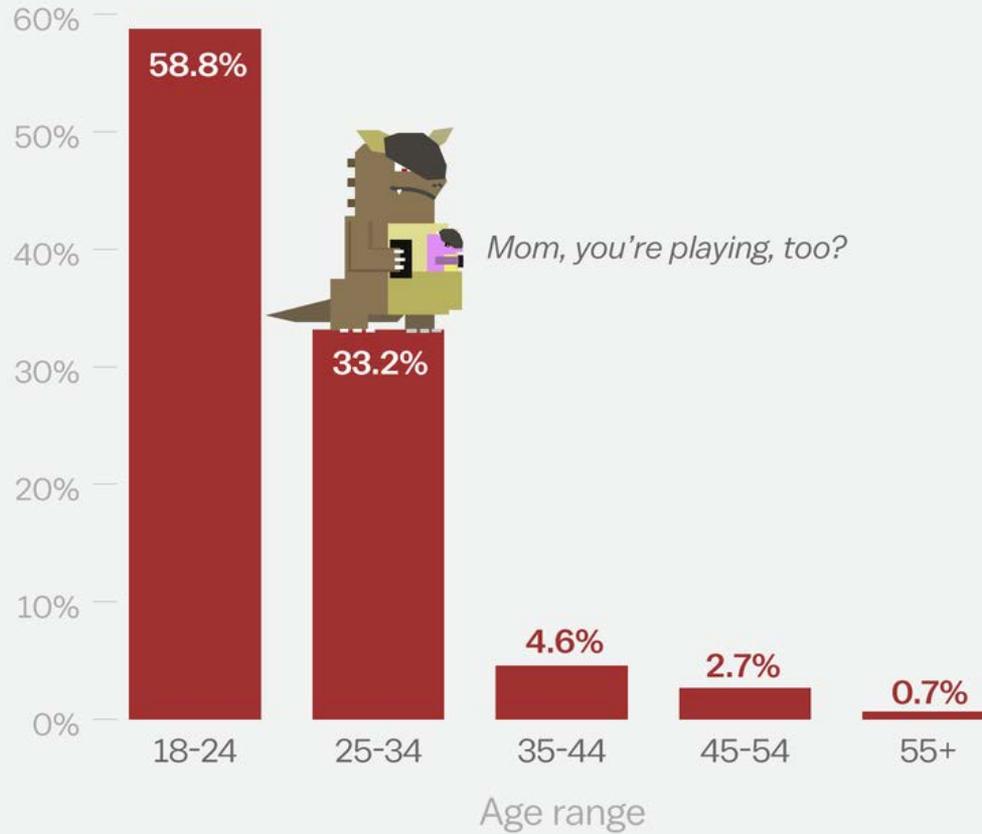
If history were taught in the form of stories,
it would never be forgotten.

Rudyard Kipling



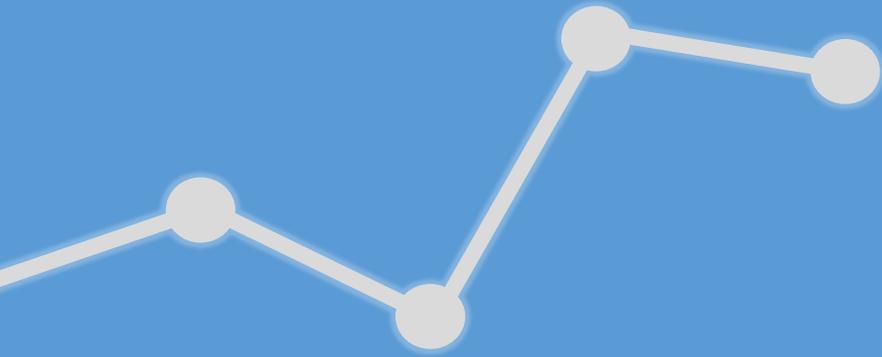
Mom, you're playing too?

More than 40% of adults who have downloaded Pokémon Go are 25 or older



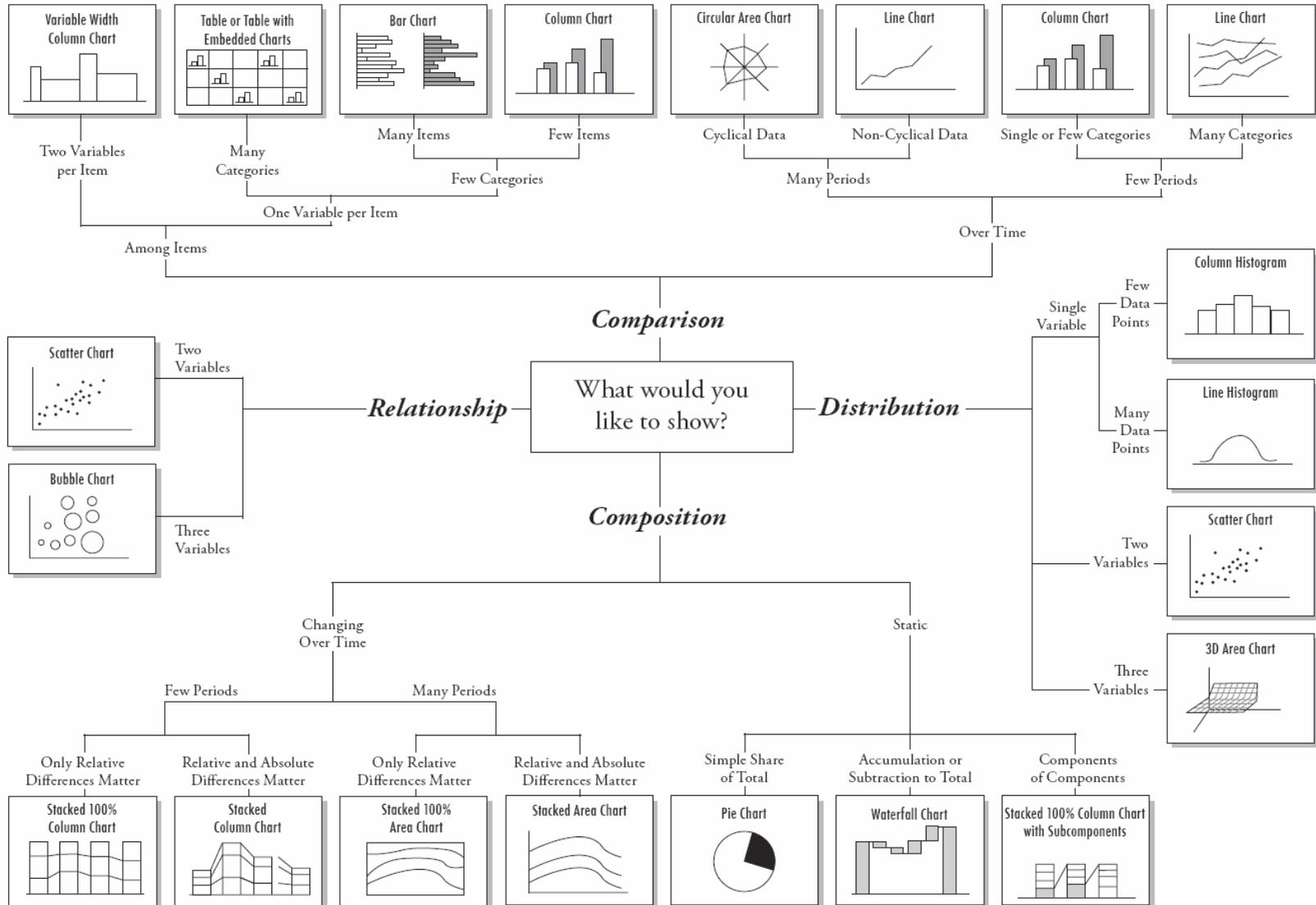
Data from StartApp
Credit: Alvin Chang

Vox



Selecting Charts

Finding the Right Chart



Data Viz Catalogue

Search by Function

View by List



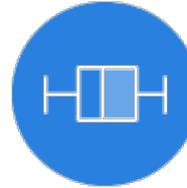
Arc Diagram



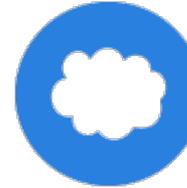
Area Graph



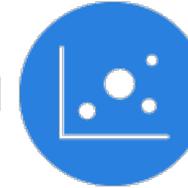
Bar Chart



Box & Whisker Plot



Brainstorm



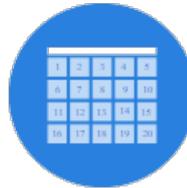
Bubble Chart



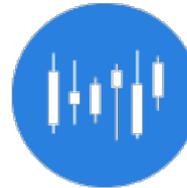
Bubble Map



Bullet Graph



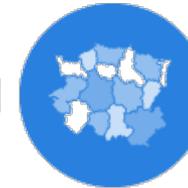
Calendar



Candlestick Chart



Chord Diagram



Choropleth Map



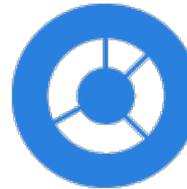
Circle Packing



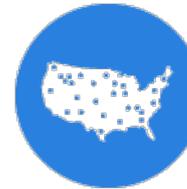
Connection Map



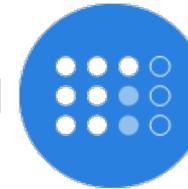
Density Plot



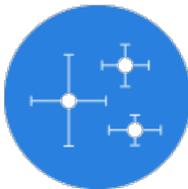
Donut Chart



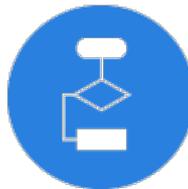
Dot Map



Dot Matrix Chart



Error Bars



Flow Chart



Flow Map



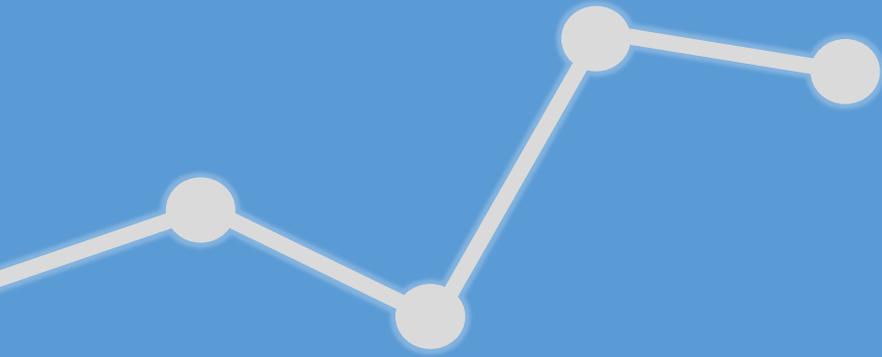
Gantt Chart



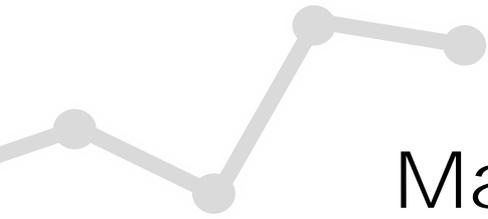
Heatmap



Histogram



Creating Effective Charts



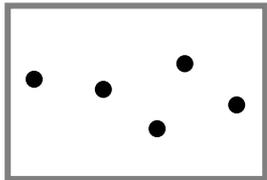
Mark

Channel

Basic geometric elements in an image

A way to control the appearance of marks

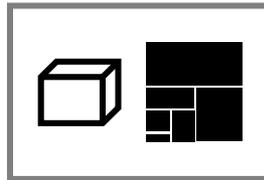
Points



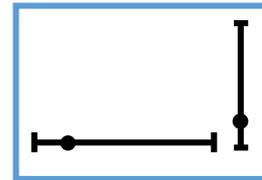
Lines



Areas



Position



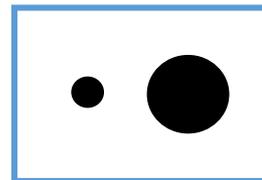
Color



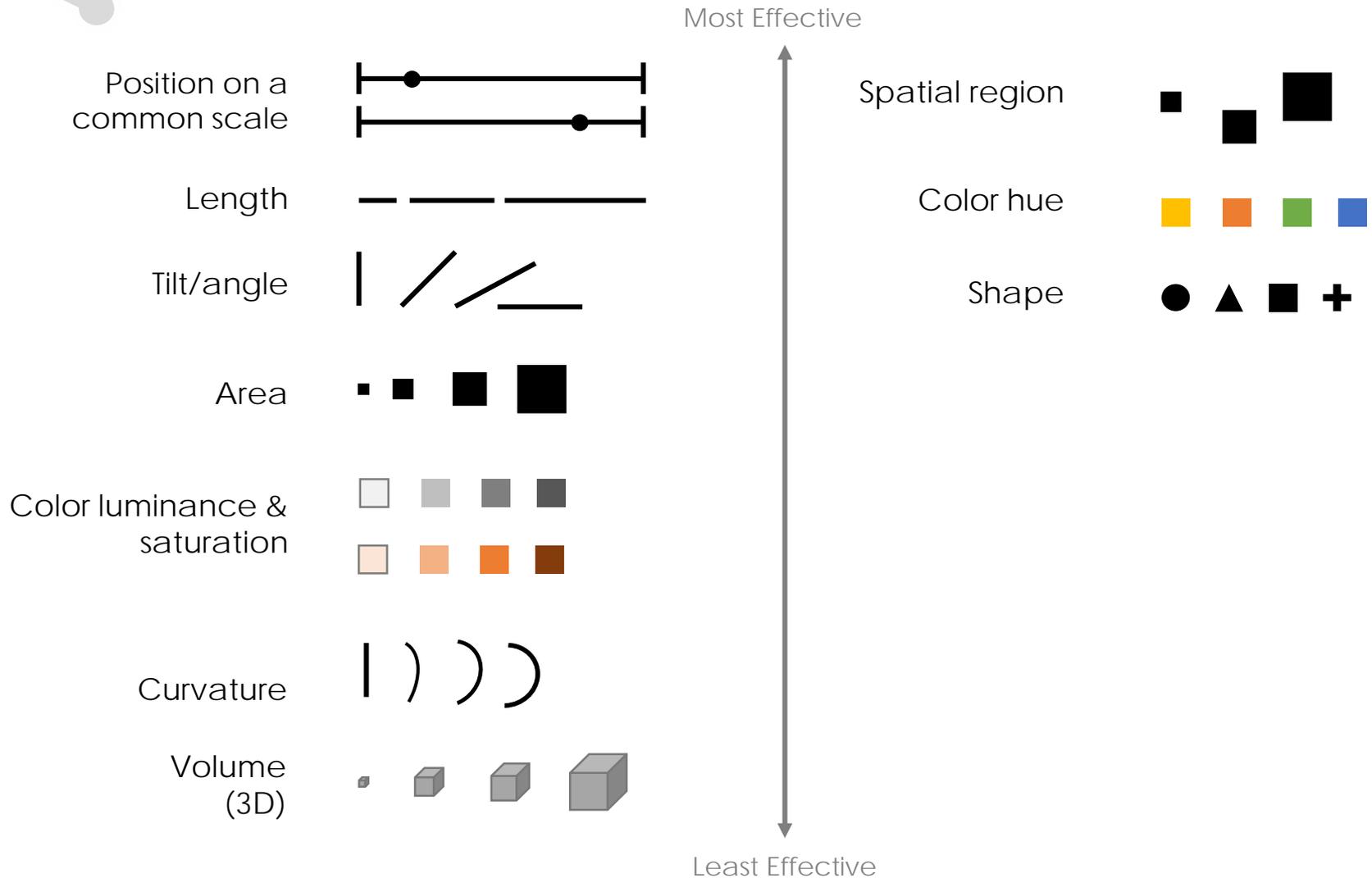
Shape



Size

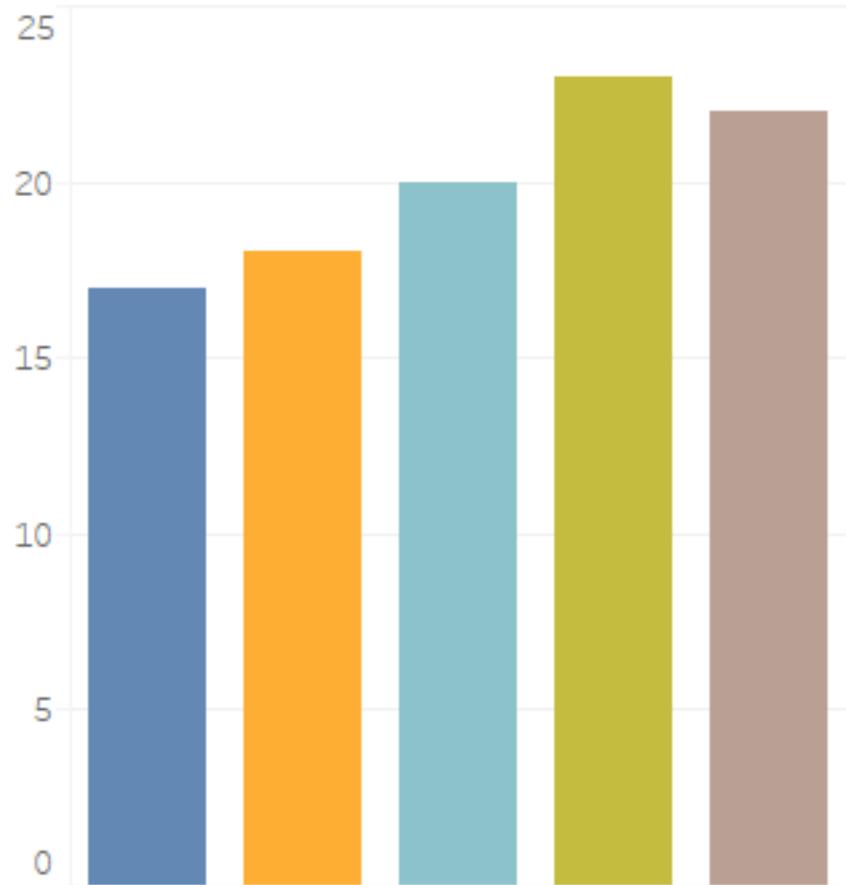


Marks & Channels in Order of Effectiveness



Using Marks and Channels

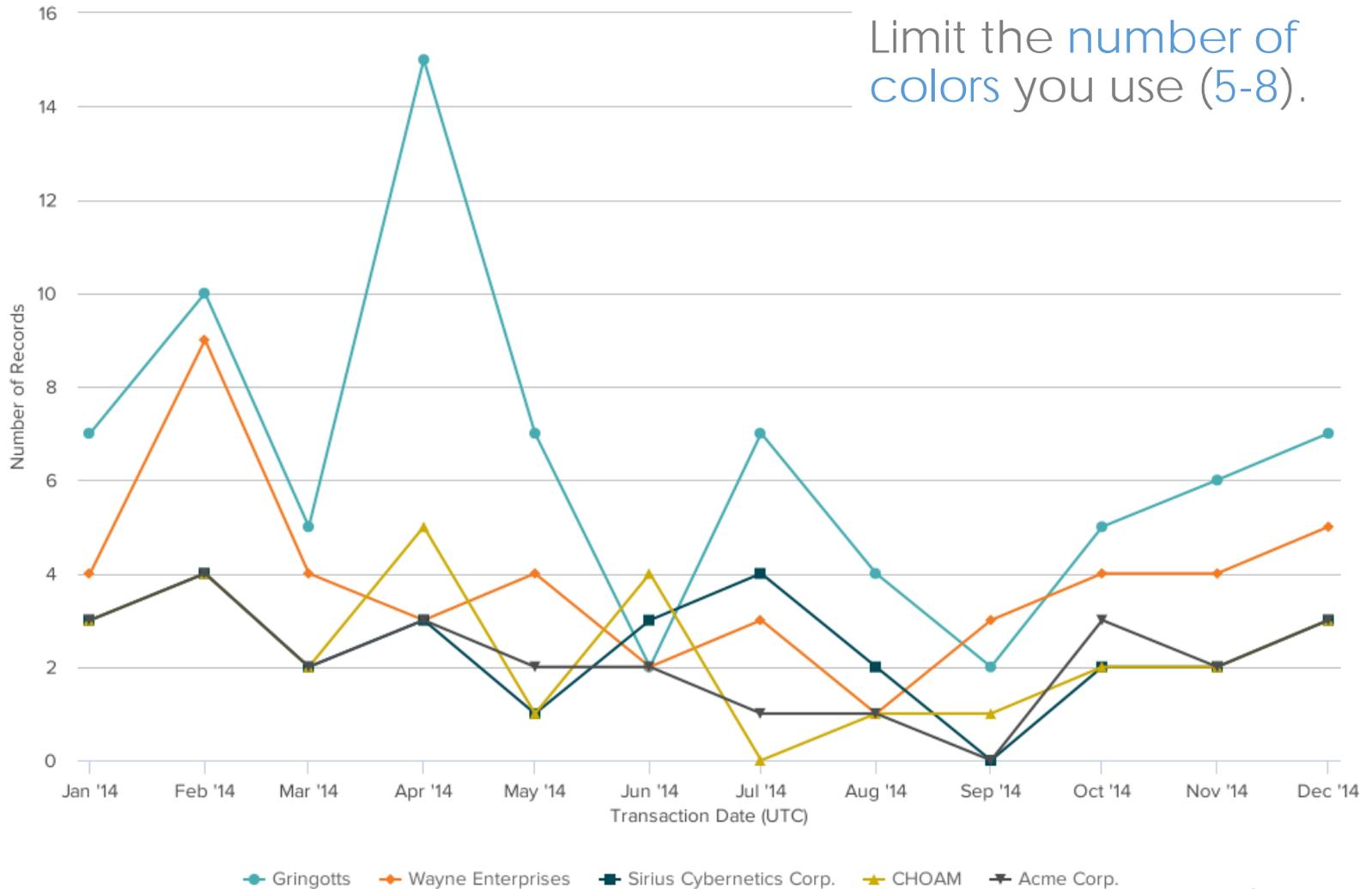
- Position on a common scale
- Length
- Tilt/angle
- Area
- Color luminance & saturation
- Curvature
- Volume (3D)
- Spatial region
- Hue
- Shape



Use of Colors

Top Five Revenue-Contributing Companies

Limit the number of colors you use (5-8).



Reading, Writing, and Earning Money

READING, WRITING, AND EARNING MONEY

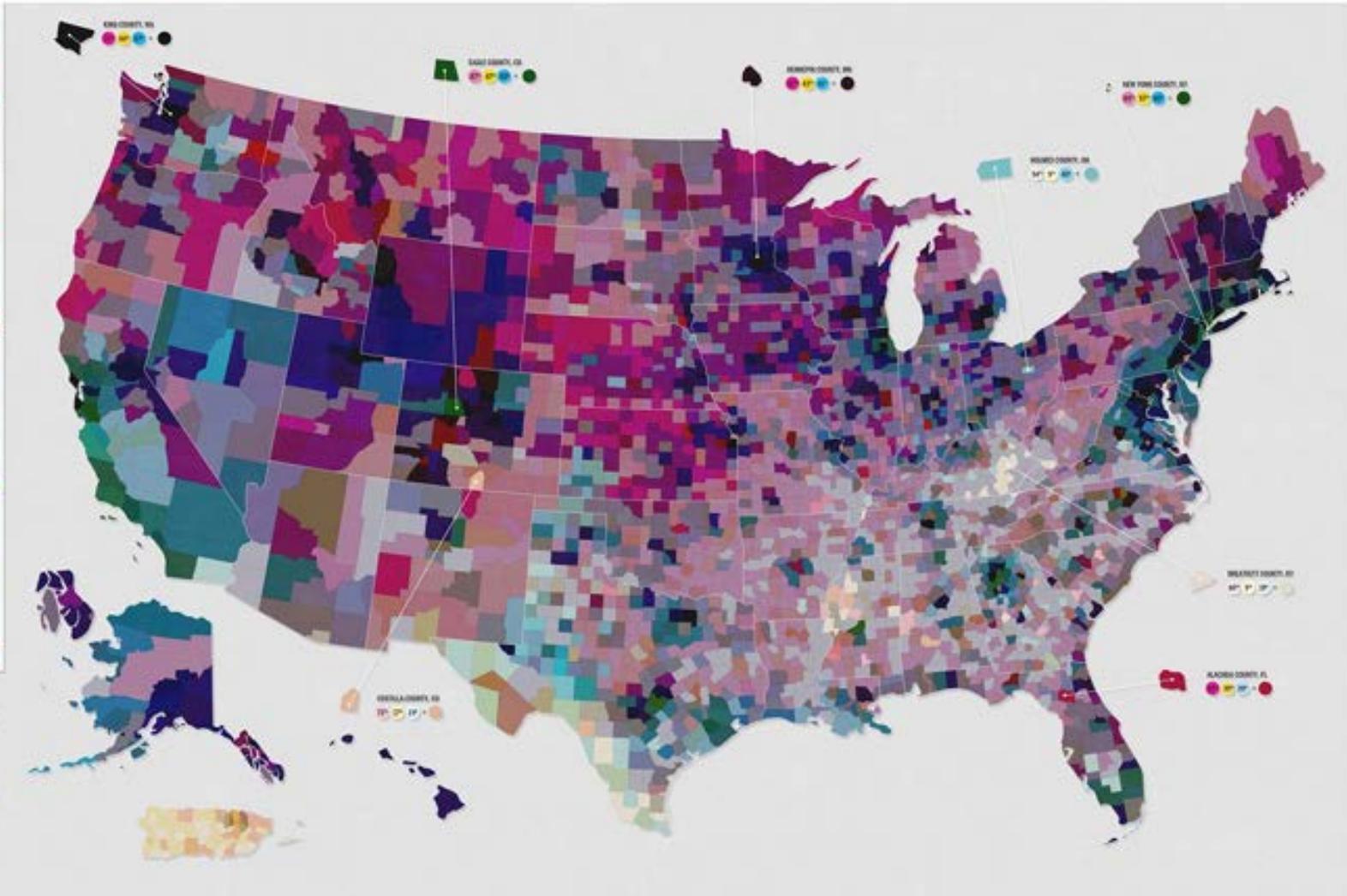
The White House (via the U.S. Census Bureau) has recently found that a surprising portion of the United States' population is based on the three pillars of literacy and the strength of the nation's future, to see where people are going to follow where they're earning money, and if there is any correlation.



The map at right is a product of combining the three sets of data. The correlation is high and often has been produced from the data shown above. In general, higher education requires a strong reading, writing, and quantitative skills. Higher education requirements will be more difficult and more complex.

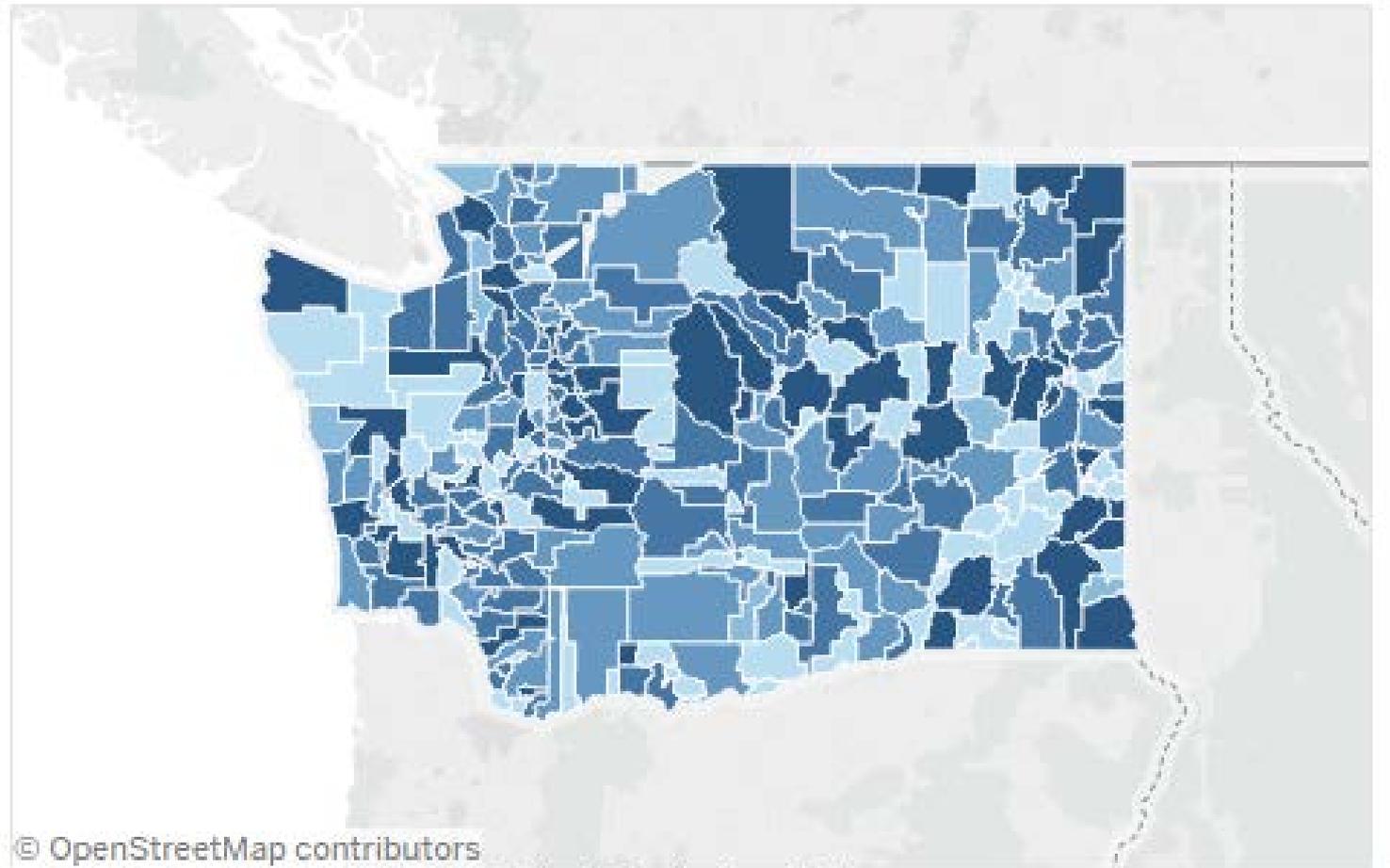


A collaboration between DataCamp and the White House.



Hue, Saturation and Brightness

Graduation Rate



© OpenStreetMap contributors

Average Adjusted 4-Year Cohort Graduation Rate

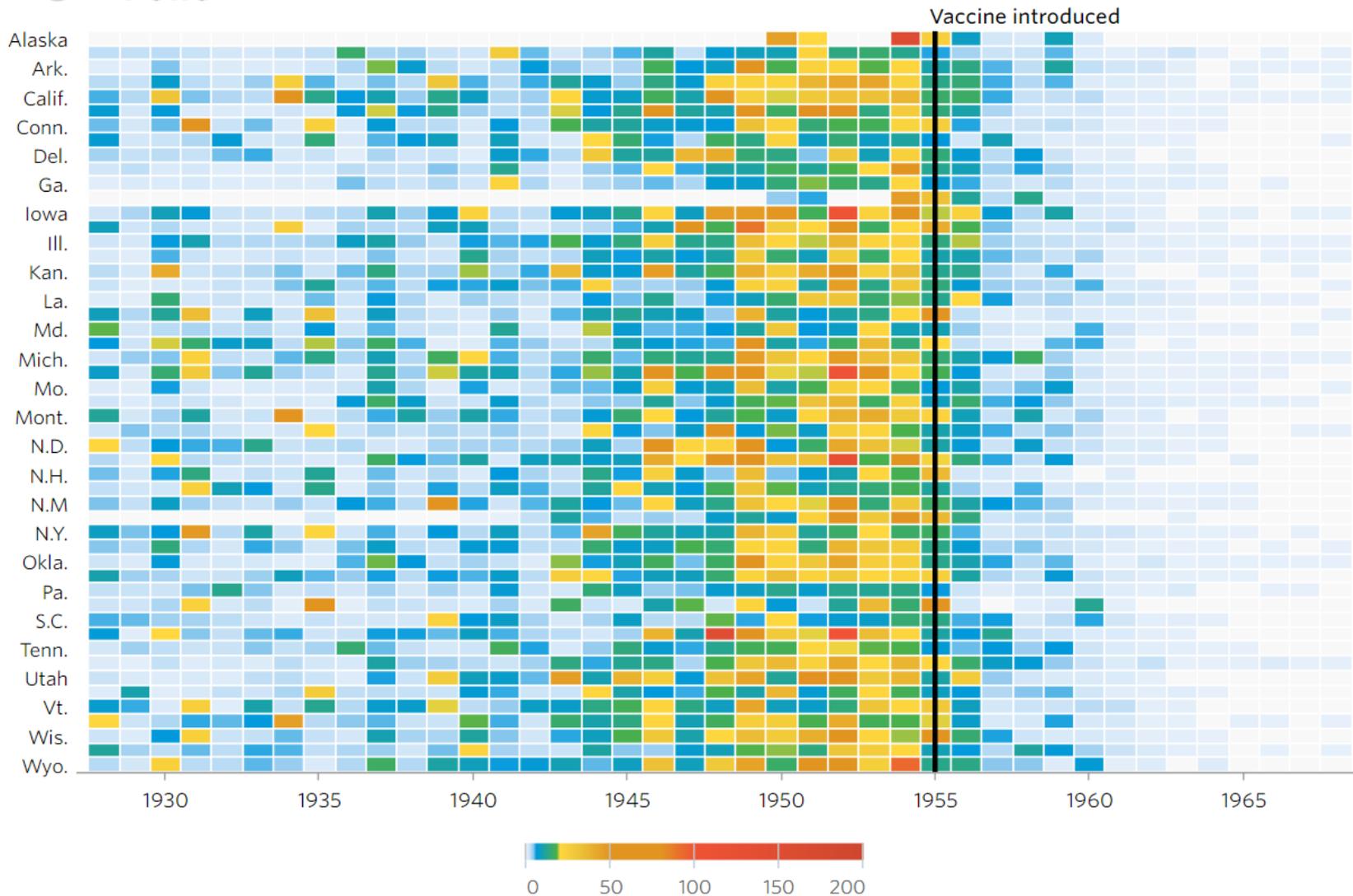
50.00



100.00

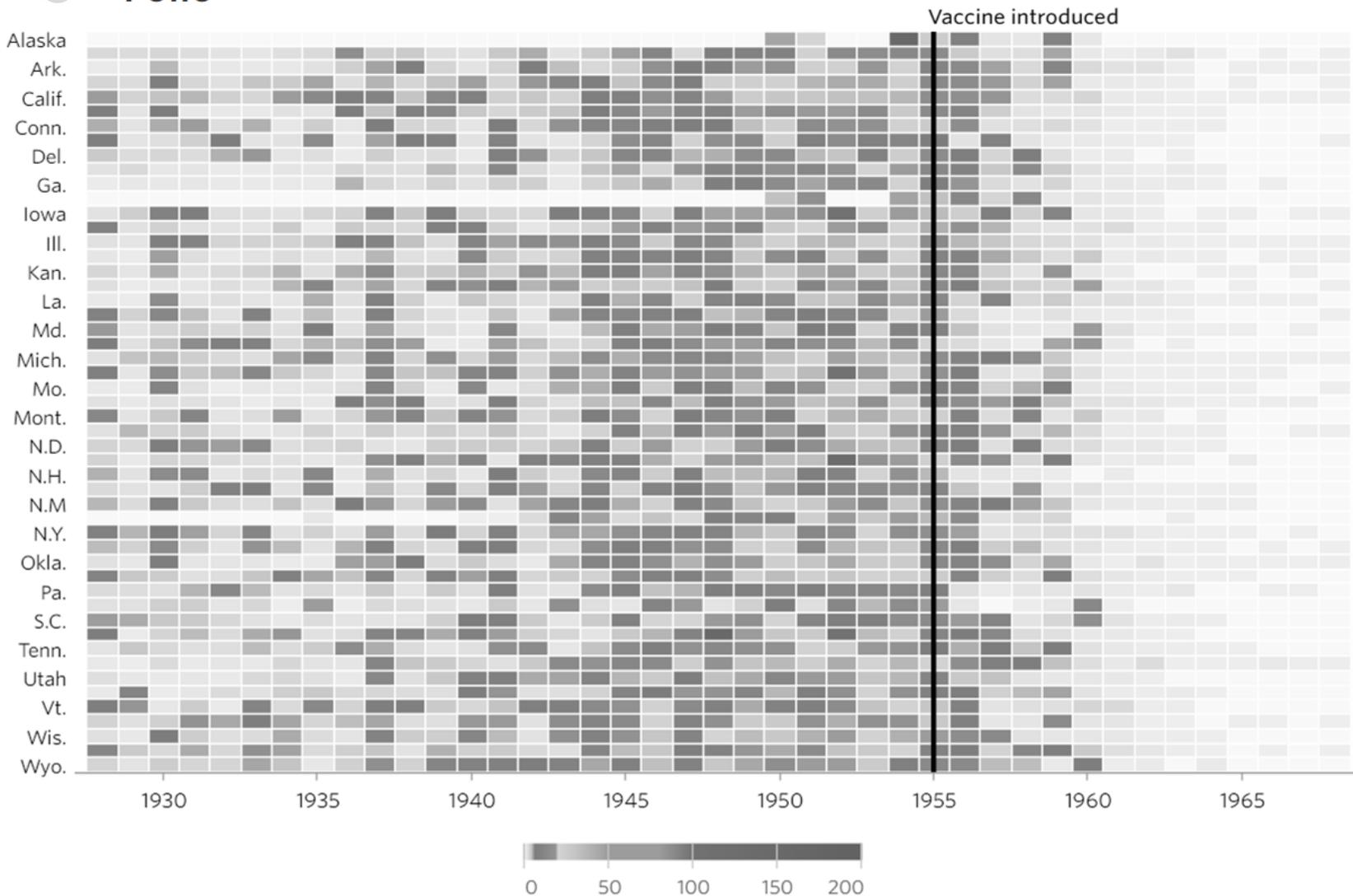
WSJ's Viz on Battling Infectious Diseases

Polio



WSJ's Viz on Battling Infectious Diseases

Polio



Color Blindness Simulator

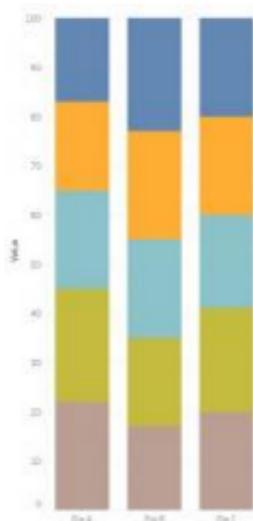
do it yourself

Colour Blindness Simulator

These are the results of your colour blindness simulation.

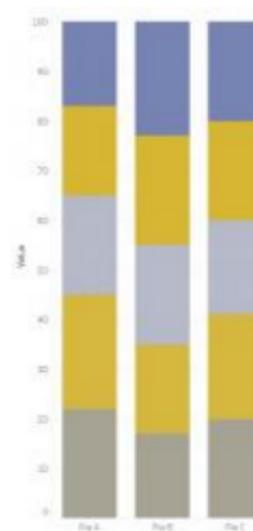
Original

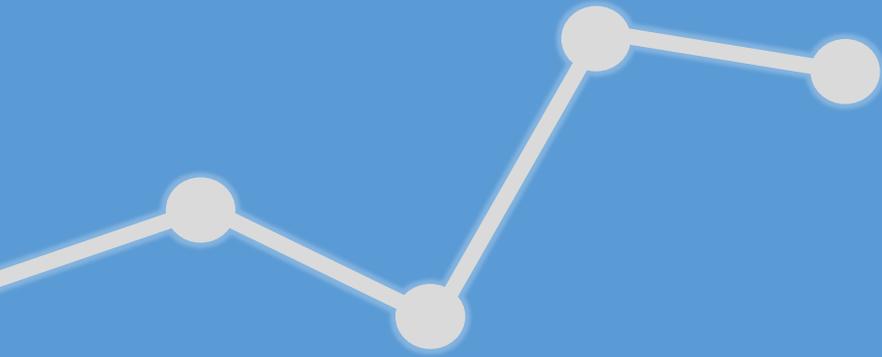
This is the image you uploaded.



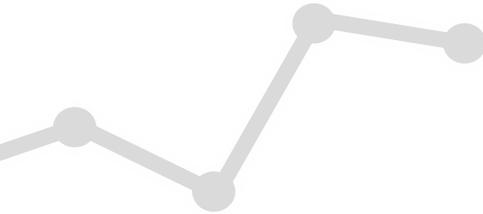
Simulation

This is how your image may appear to a person with protanopia.

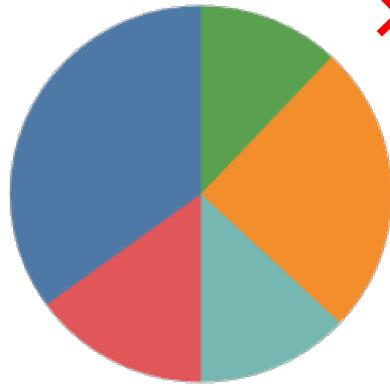




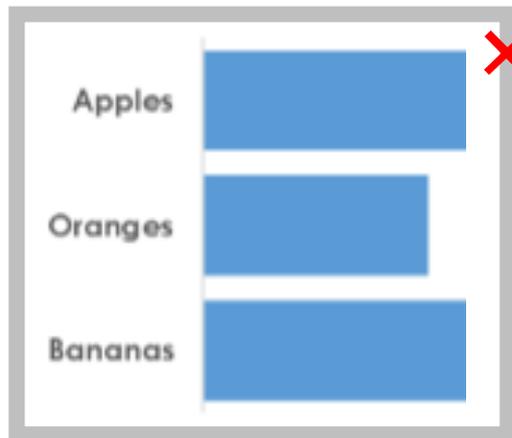
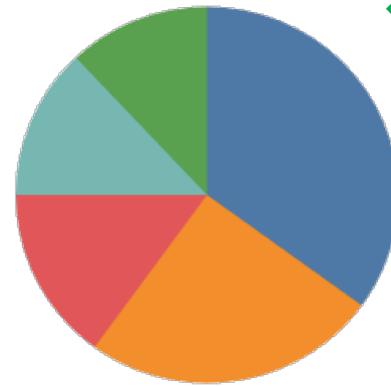
Common Pitfalls to Creating Effective Charts



Not Ordering Your Data



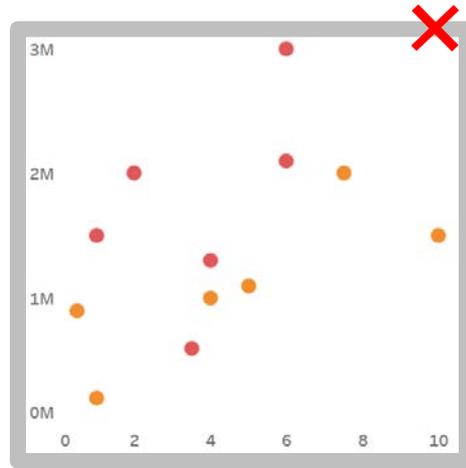
vs.



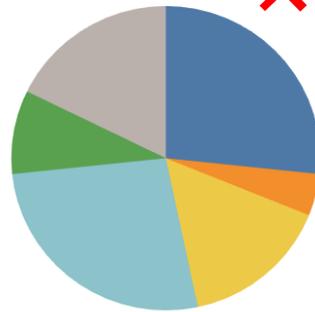
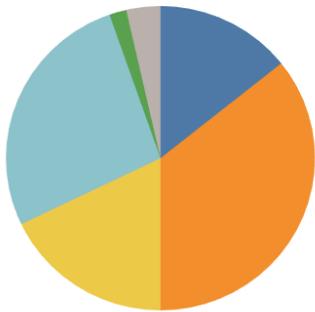
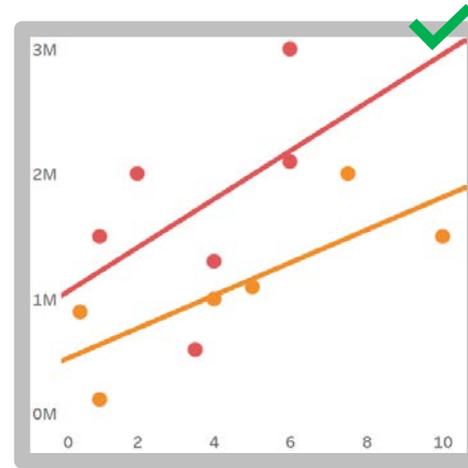
vs.



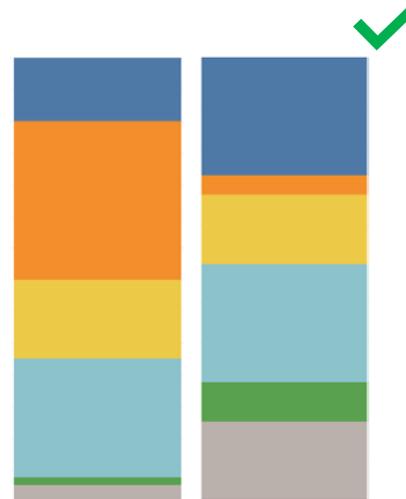
Making the Reader Work

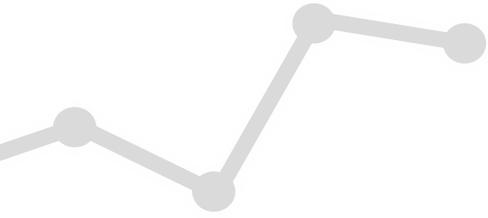


VS.



VS.

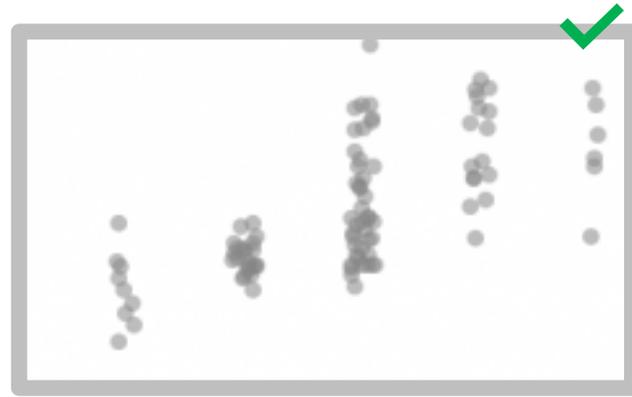




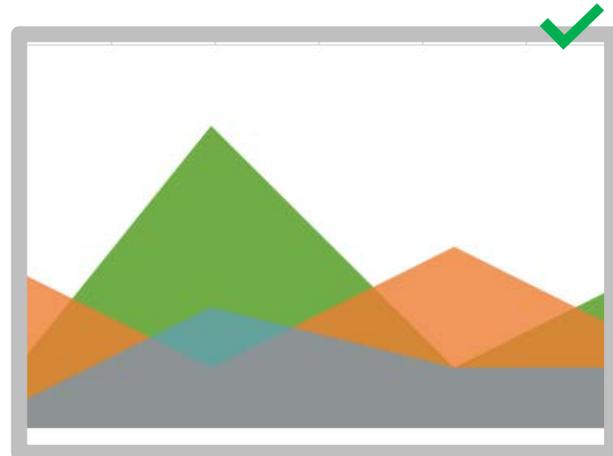
Obscuring Data



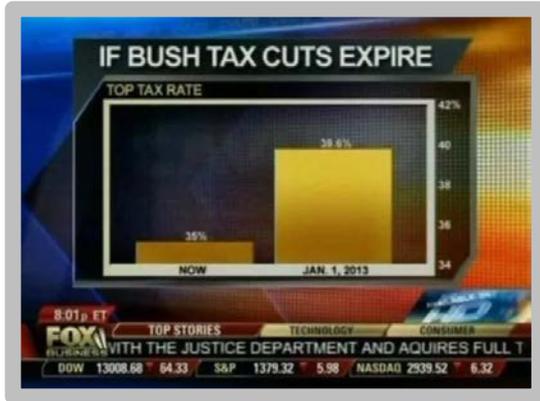
vs.



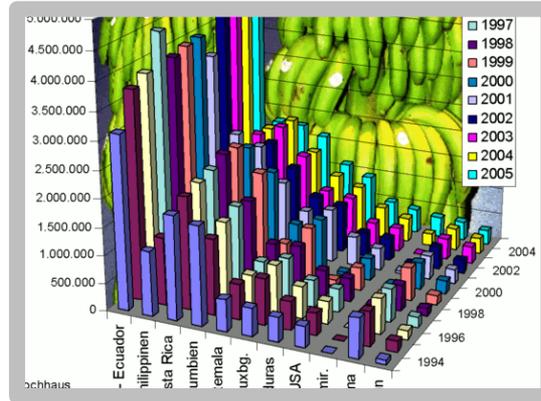
vs.



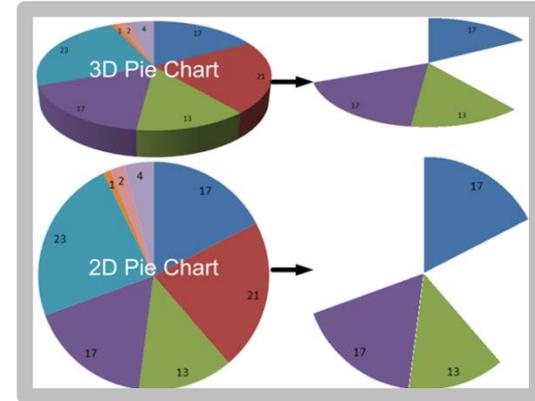
Not Considering Design



Cut your axis

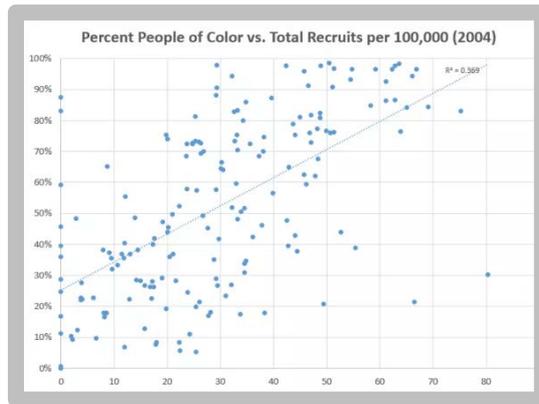


Use noisy patterns, lines or bright colors

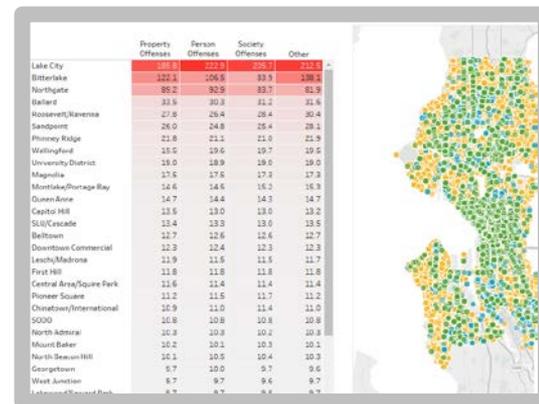


Use 3-D charts

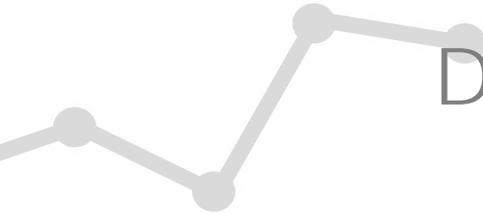
Do



Use text meaningfully yet, sparingly



Use highlighting/interactivity to show relationships



Data Visualization Checklist

Text

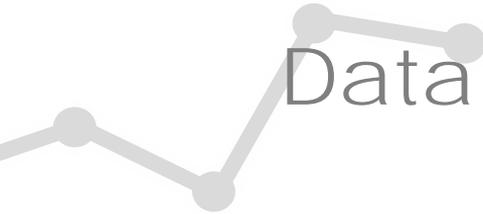
- Short descriptive title
- Subtitle and/or annotations with additional information
- Text size is hierarchical and readable
- Data are labeled directly (rather than using a legend)
- Labels are used sparingly

Arrangement

- Proportions are accurate
- Data intentionally ordered
- Axis intervals are equidistant
- Graph is 2D
- Display is free from decoration

Color

- Color scheme is intentional
- Color is used to highlight key patterns
- Color is legible when printed in black and white
- Color is legible for people with colorblindness
- Text sufficiently contrasts background



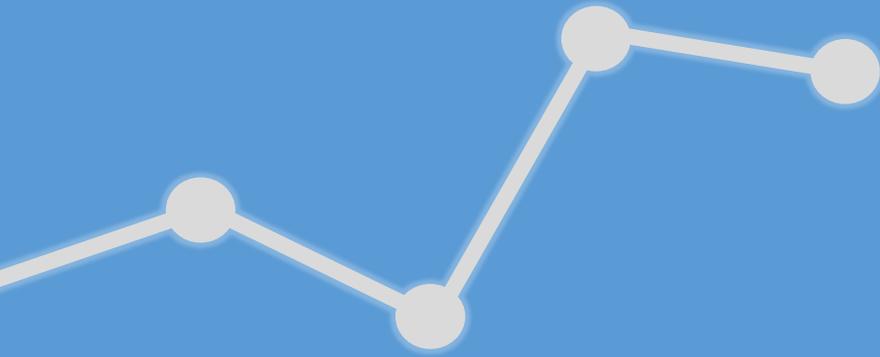
Data Visualization Checklist (part 2)

Lines

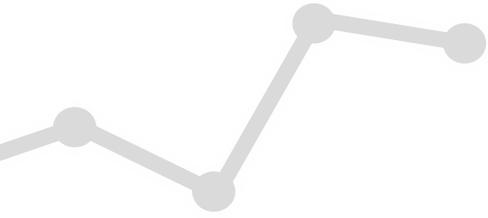
- Gridlines, if present, are muted
- Graph does not have border line
- Axes do not have unnecessary tick marks or axis lines
- Graph has one horizontal and one vertical axis

Overall

- Graph highlights significant finding or conclusion
- The type of graph is appropriate for data
- Graph has appropriate level of precision
- Individual chart elements work together to reinforce takeaway message

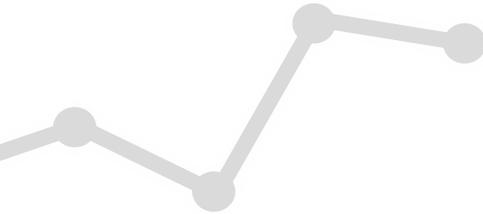


Who's Your Audience?
(and... what do they want/need?)



Surprise the novice,
get the expert to nod.

Mirko Lorenz

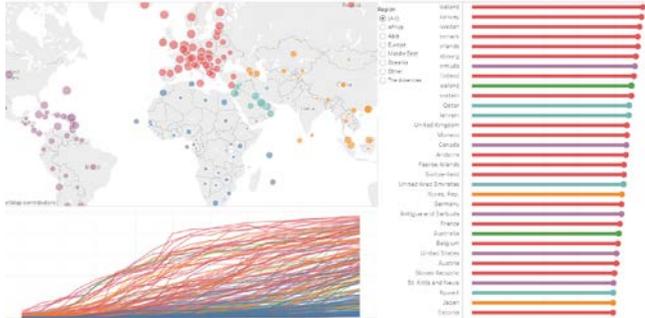


Who's Your Audience?

- Who is your **target audience**?
- What **questions** do they have?
- What **stories** should the audience derive from the visualization?
- What is your **desired effect** on the audience?

Deciding Intent

Read Data



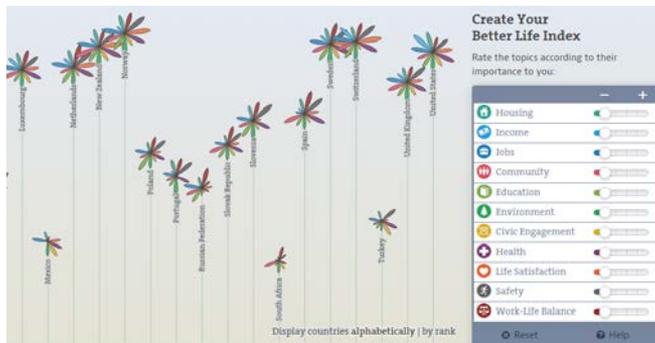
<https://public.tableau.com/profile/tania.fleming4095#!/vizhome/GrowthoftheInternetWorldwide/Dashboard1>



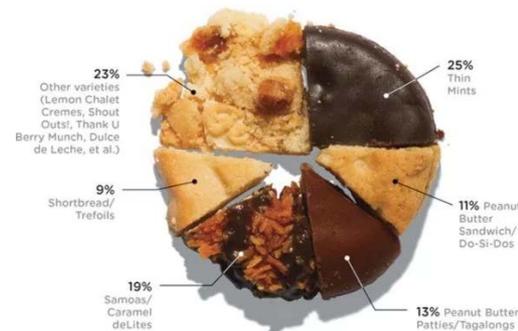
<https://public.tableau.com/profile/tania.fleming4095#!/vizhome/HowAccurateistheZestimate/Dashboard1>

Exploratory

Explanatory



<http://www.oecdbetterlifeindex.org>

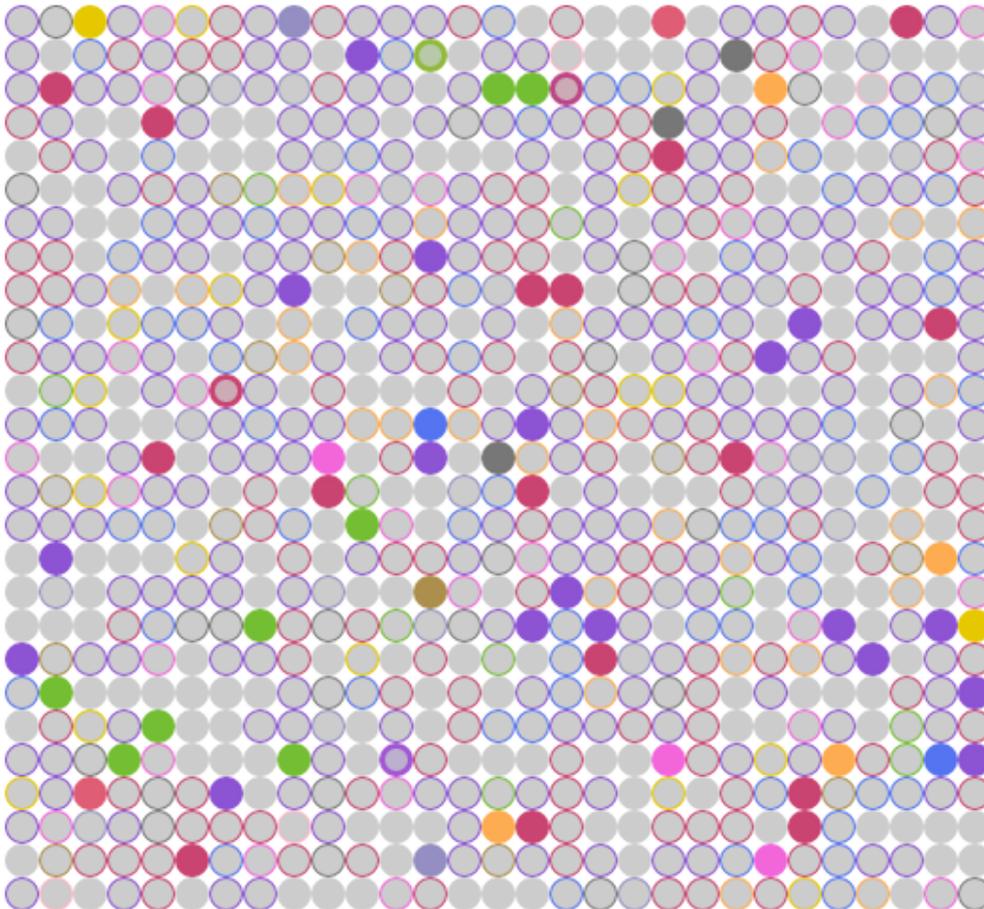


https://www.wired.com/2011/08/st_datagirlscoutcookies/

Feel Data

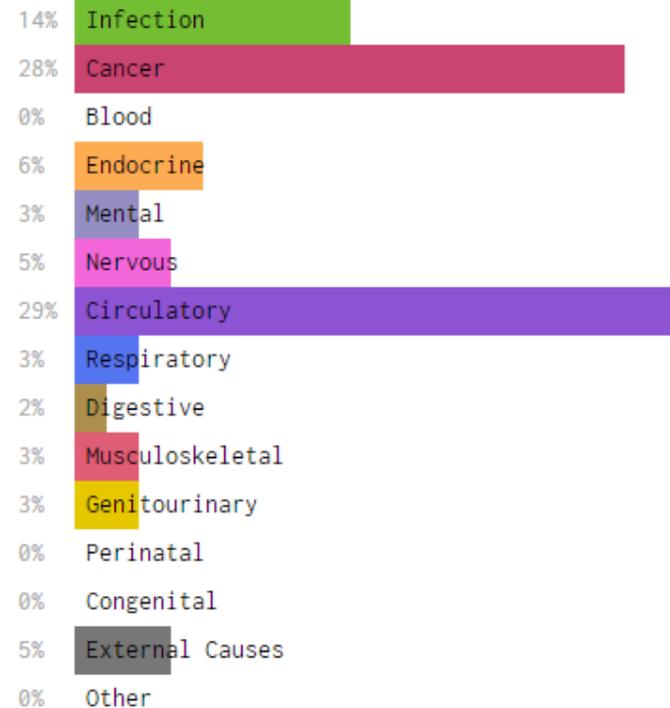
Targeting Your Audience

I am **female** **Black** and currently **32** years old.



AGE OF DEATH	DIED SO FAR	STILL ALIVE
55 years	8%	92%

CAUSE OF DEATH SO FAR



6 Principles of Communicating Data

6 Principles of Communicating Data



1

know
your
goal

- Who? identify your target audience
- What? articulate your intended message
- Why? define the desired effect

2

use the
right
data

- Necessary: get data that supports your point
- Sufficient: enough data to draw conclusions
- Relevant: eliminate any extraneous data

3

select
suitable
visualizations¹

- Quantitative: position > length > angle > area
- Ordinal: position > gray ramp > color ramp
- Nominal: position > shape > color hue

4

design
for
aesthetics

- Clean up fonts, borders, gridlines, alignment
- Add graphic elements that aid cognition
- Ensure data is not occluded or distorted

5

choose
medium &
channel

- Medium: static, interactive, or animated?
- Channel: standalone, recorded, remote, live
- Mode: broadcast or directed?

6

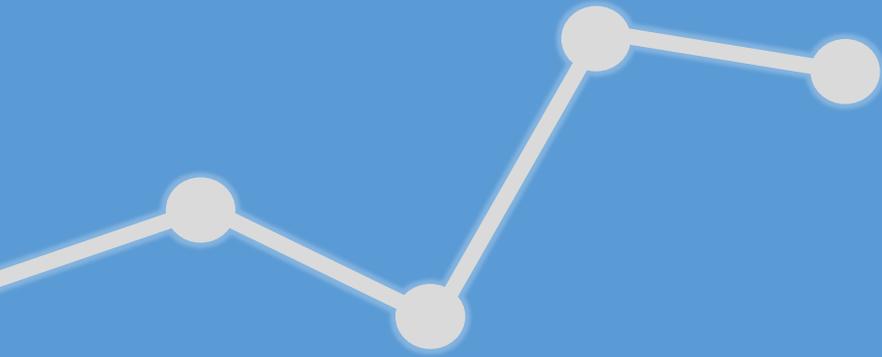
check
the
results

- Reach: did you reach your target audience?
- Understanding: did they get it?
- Impact: did they react in the desired way?

From [Communicating Data With Tableau](#), chapter 1

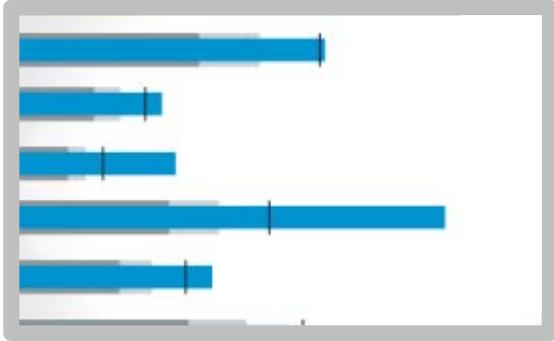
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¹ Ref: Tableau, <http://bit.ly/great-vis>



How To

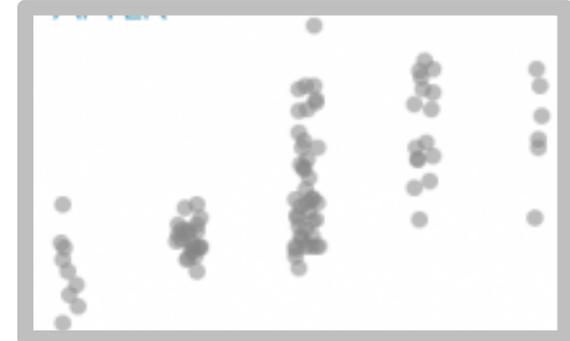
How To



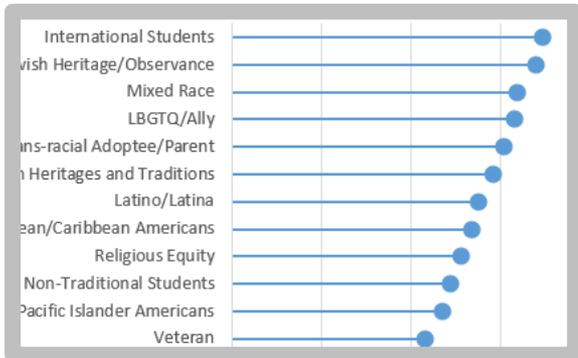
Bullet Graphs



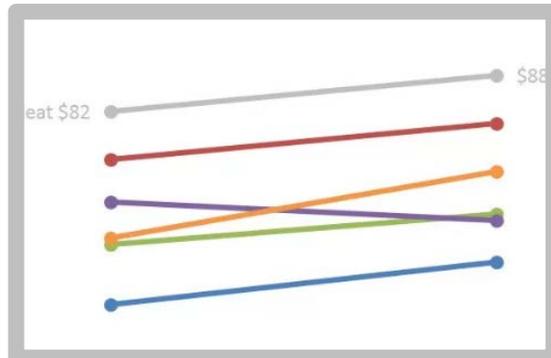
Maps in Excel & Small Multiples



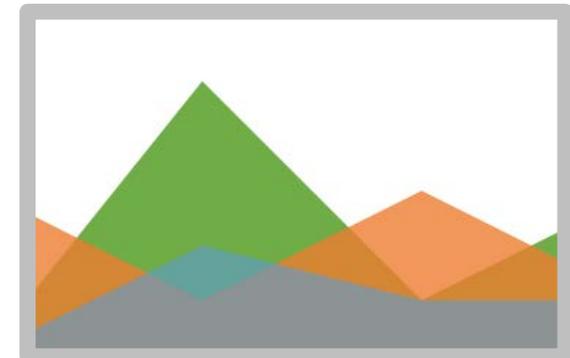
Jittering Points



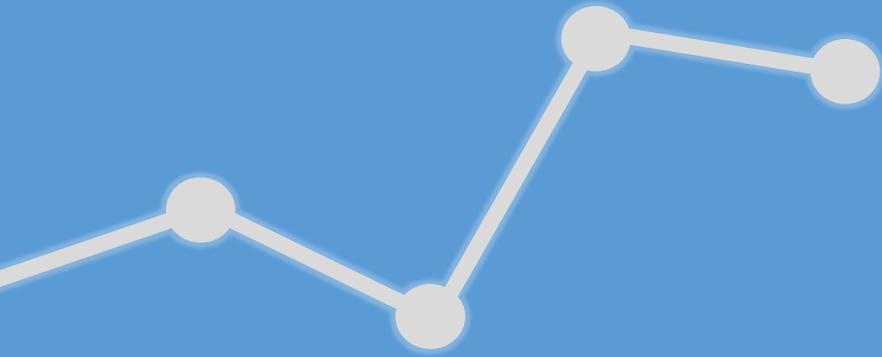
Lollipop Chart



Slope Graphs

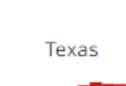
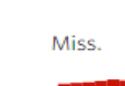
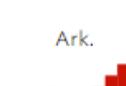
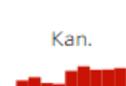
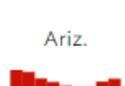
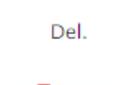
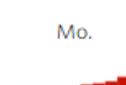
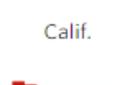
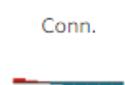
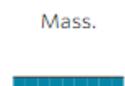
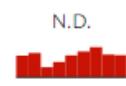
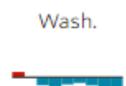
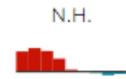
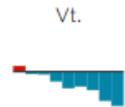
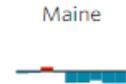


Adjusting Opacity

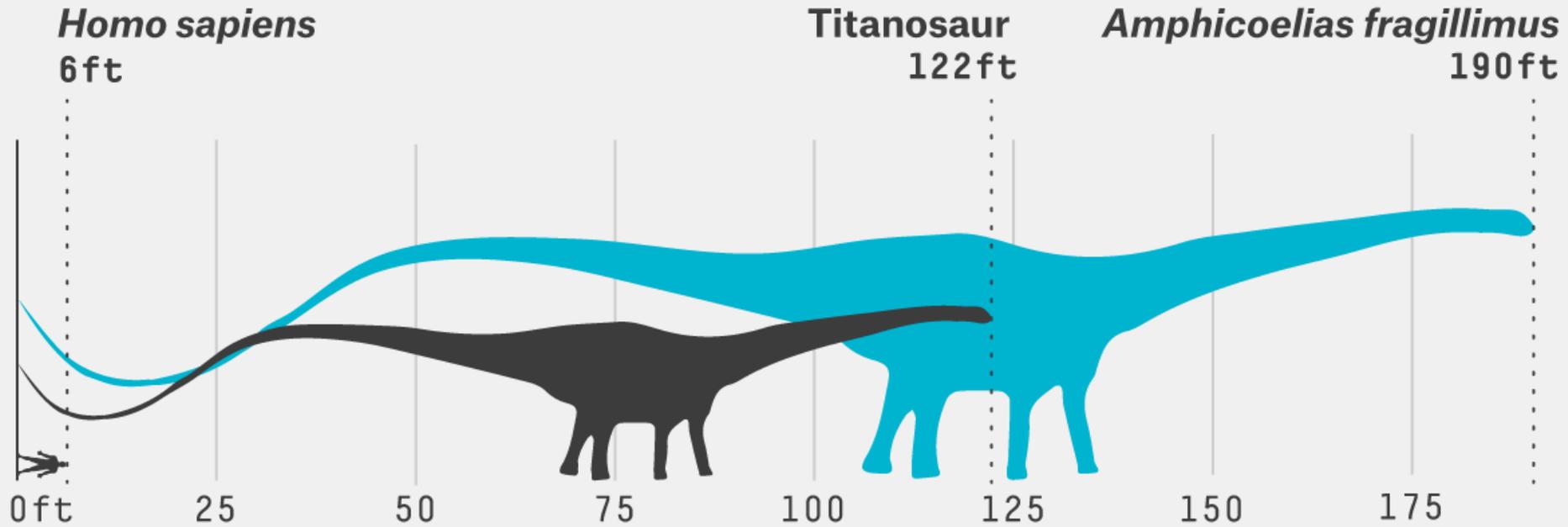


Neat Visualizations

WSJ's Field Guide to Red & Blue America



FiveThirtyEight's Biggest Dinosaur

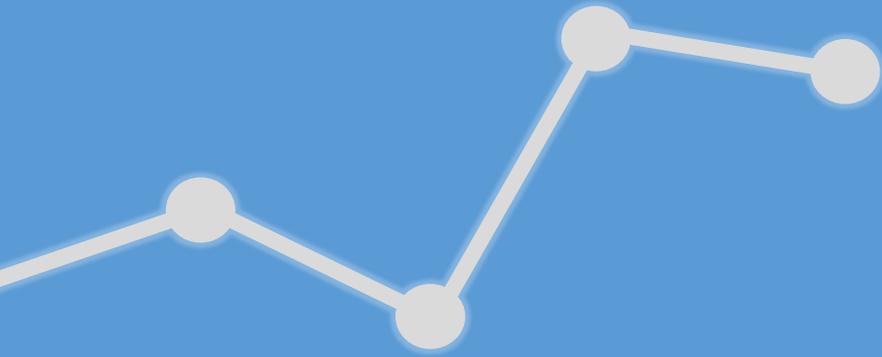


FIVETHIRTYEIGHT

SOURCES: AMERICAN MUSEUM OF NATURAL HISTORY, KEN CARPENTER

Growth of Walmart





1. Tell a Story
2. Choose the Right Visual for Effective Communication
3. Speak to Your Audience