



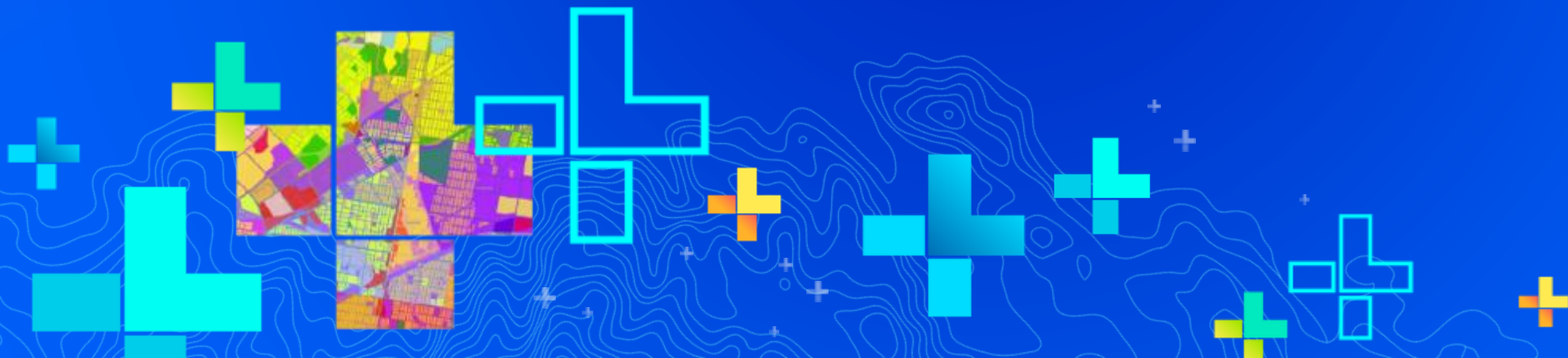
Data Visualization for Spatial Analysis

Lauren Bennett

Flora Vale

esriurl.com/spatialstats

SEE
WHAT
OTHERS
CAN'T



Data visualization as part of the spatial analysis workflow

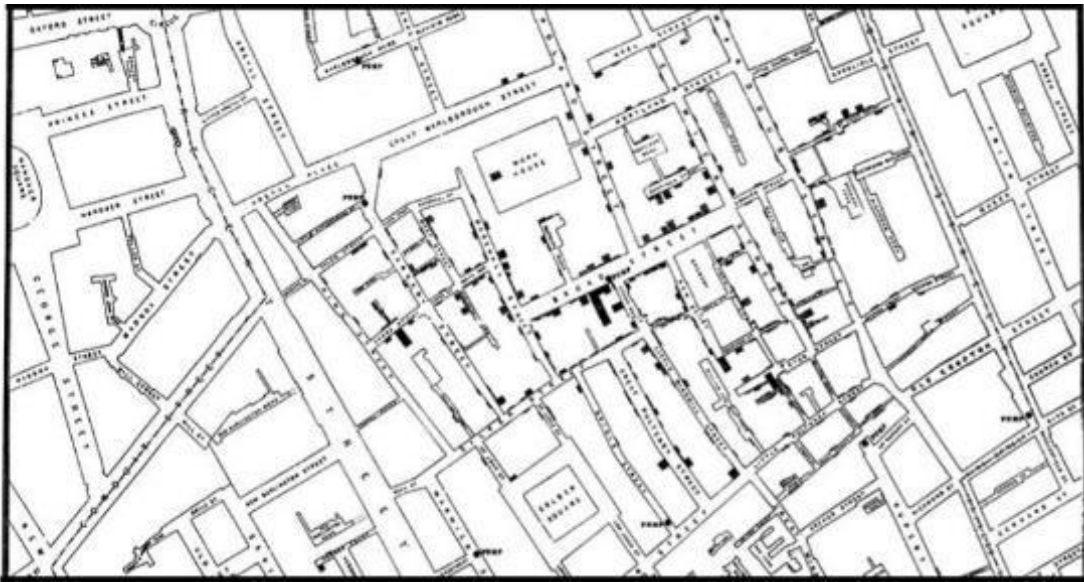
Explore data

Interpret analysis results

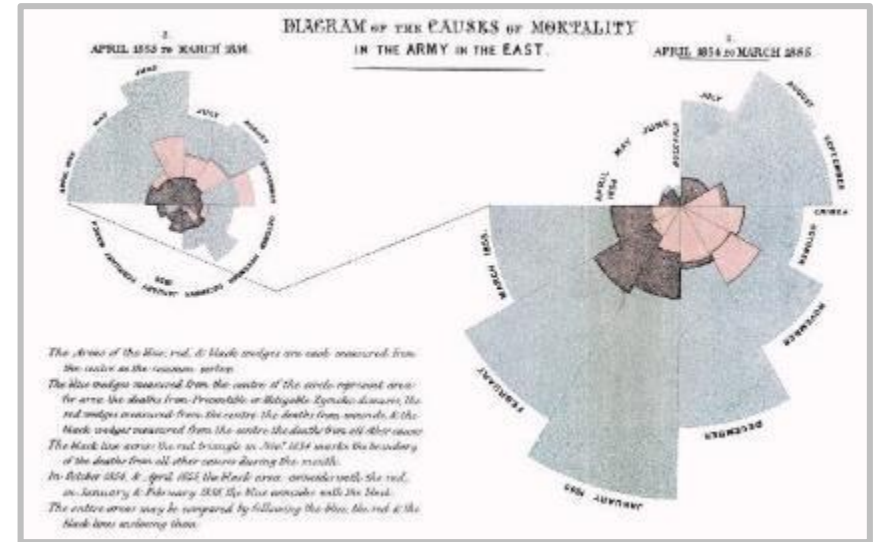
Communicate findings

What is data visualization?

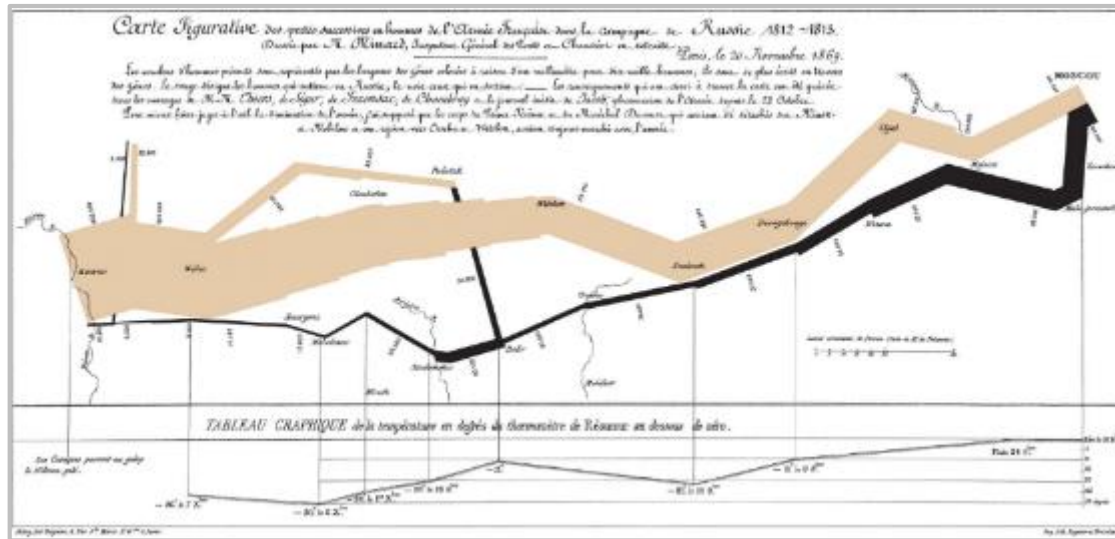




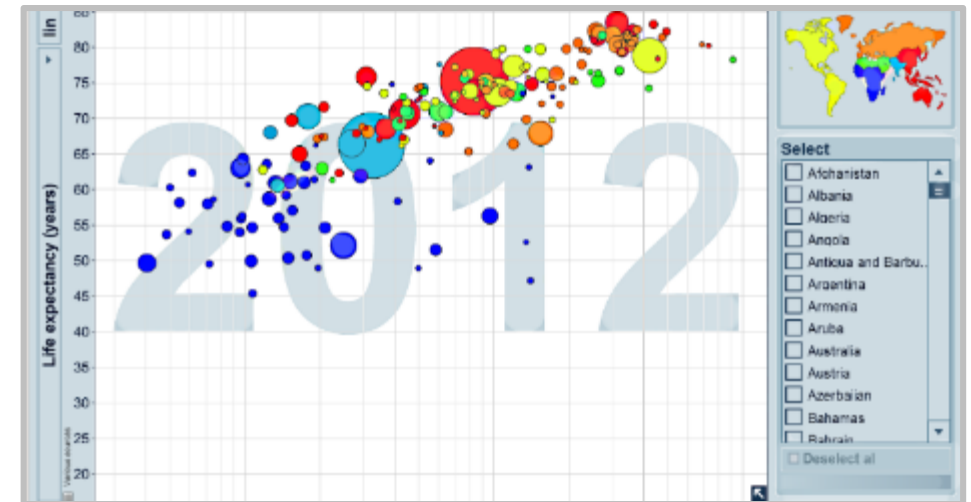
Dr. John Snow's Map of London Cholera Outbreak of 1854



Florence Nightingale's Rose Diagram of the Causes of Mortality in the Army of the East of 1859



Charles Minard's Flow Map of Napoleon's Russian Campaign of 1812



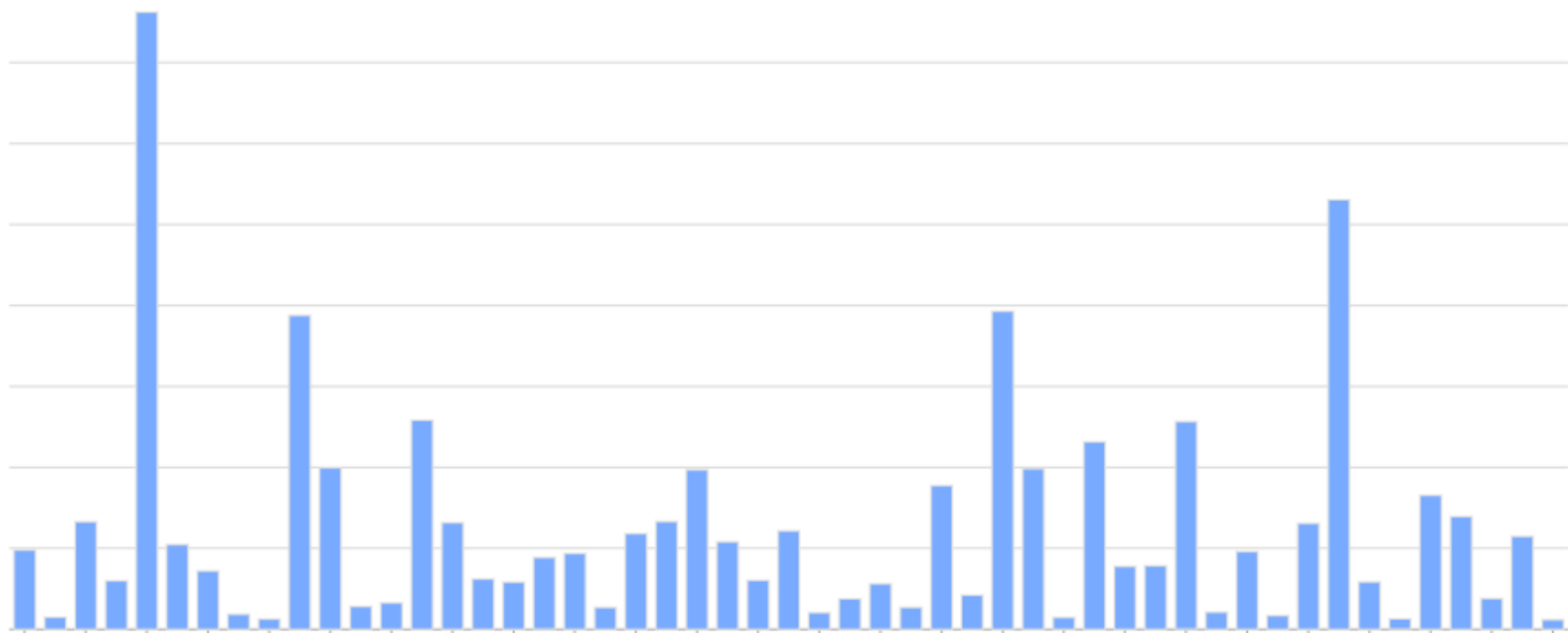
Hans Rosling's Animated Visualization of Global Life Expectancy Over Time from his 2006 TED Talk

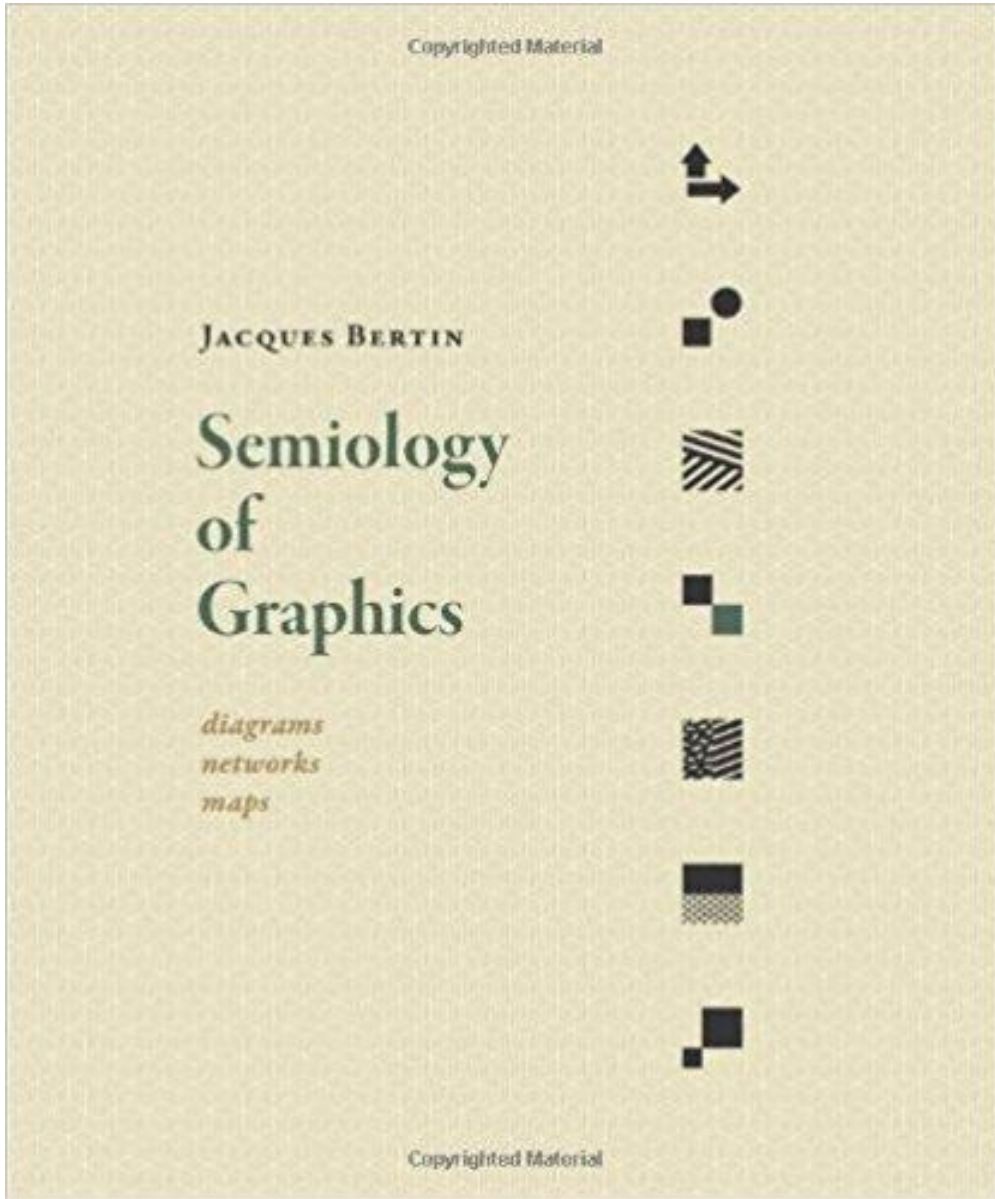
Why visualize data?








Convert slow reasoning tasks
into fast perception tasks



1399683	635200		2908933	2106392
6962578	5401748	8875318	8275961	4885854
	3922722	6581982	6074504	3018484
1019462	1336265	2815039		
1345609	3111844	2917750	6636256	9978939
	6656872	38120066	3880520	4796559
724027	1877879	11575704	9913774	2995330
844322	19631599	12914651	6539407	4681639
			26538203	19383475
587106	12817894	629120		9853722
5731663	3601157	927030	5903286	
1628760	1050228	1885932	5235100	742404
			4419036	





- Position 
- Size 
- Shape 
- Value 
- Hue 
- Orientation 
- Texture 






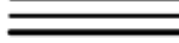






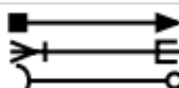



1399683	635200		2908933	2106392
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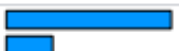









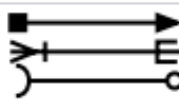

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Properties and Best Uses of Visual Encodings

<u>Example</u>	<u>Encoding</u>	<u>Ordered</u>	<u>Useful values</u>	<u>Quantitative</u>	<u>Ordinal</u>	<u>Categorical</u>	<u>Relational</u>
	position, placement	yes	infinite	Good	Good	Good	Good
1, 2, 3; A, B, C	text labels	optional (alphabetical or numbered)	infinite	Good	Good	Good	Good
	length	yes	many	Good	Good		
	size, area	yes	many	Good	Good		
	angle	yes	medium/few	Good	Good		
	pattern density	yes	few	Good	Good		
	weight, boldness	yes	few		Good		
	saturation, brightness	yes	few		Good		
	color	no	few (< 20)			Good	
	shape, icon	no	medium			Good	
	pattern texture	no	medium			Good	
	enclosure, connection	no	infinite			Good	Good
	line pattern	no	few				Good
	line endings	no	few				Good
	line weight	yes	few		Good		


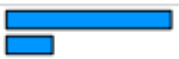










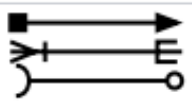



Properties and Best Uses of Visual Encodings

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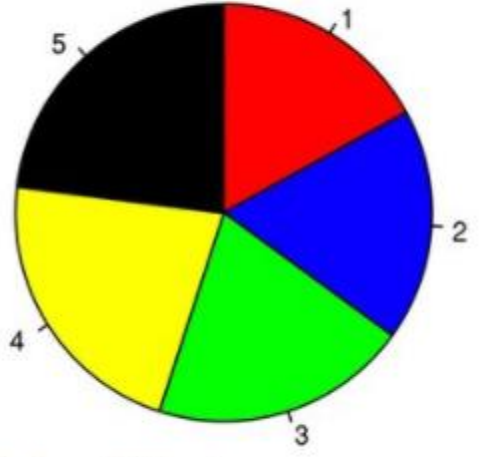
<u>Example</u>	<u>Encoding</u>	<u>Ordered</u>	<u>Useful values</u>	<u>Quantitative</u>	<u>Ordinal</u>	<u>Categorical</u>	<u>Relational</u>
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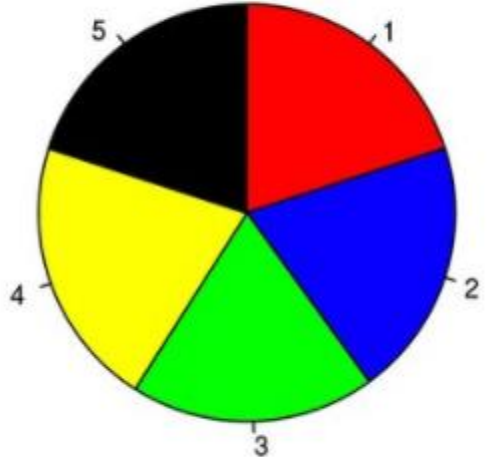
Good Viz vs Bad Viz



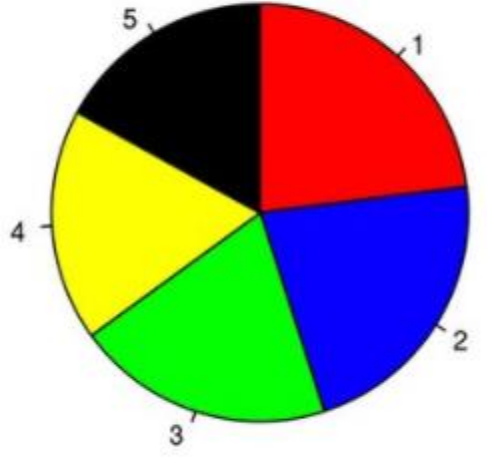
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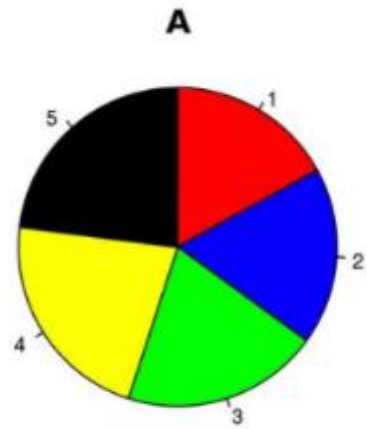
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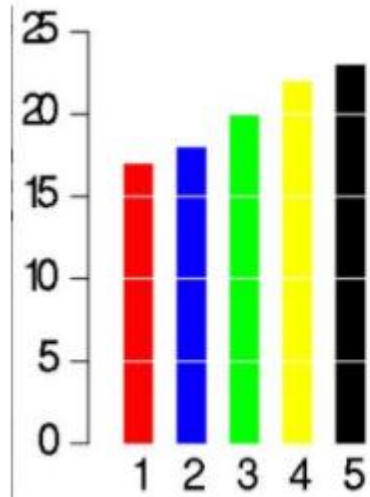
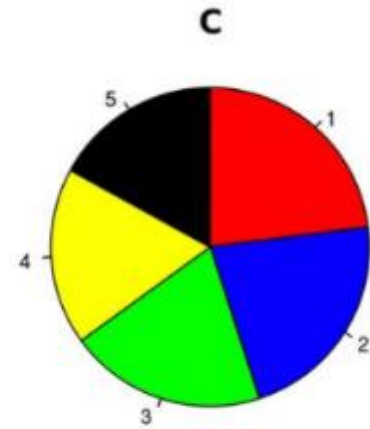
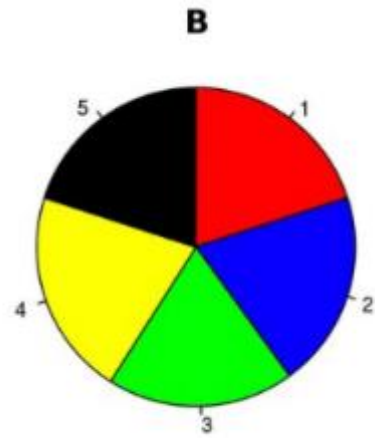
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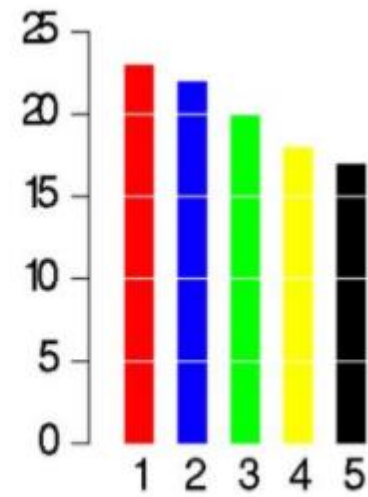
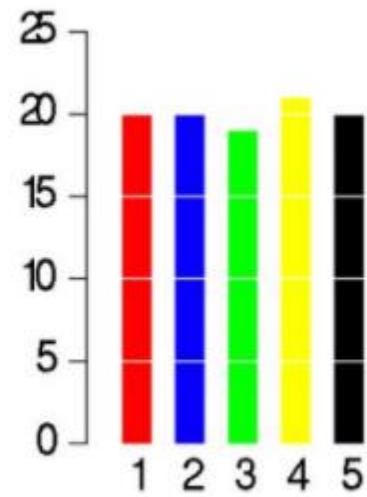
Public Domain/ Wikipedia



Public Domain/ Wikipedia

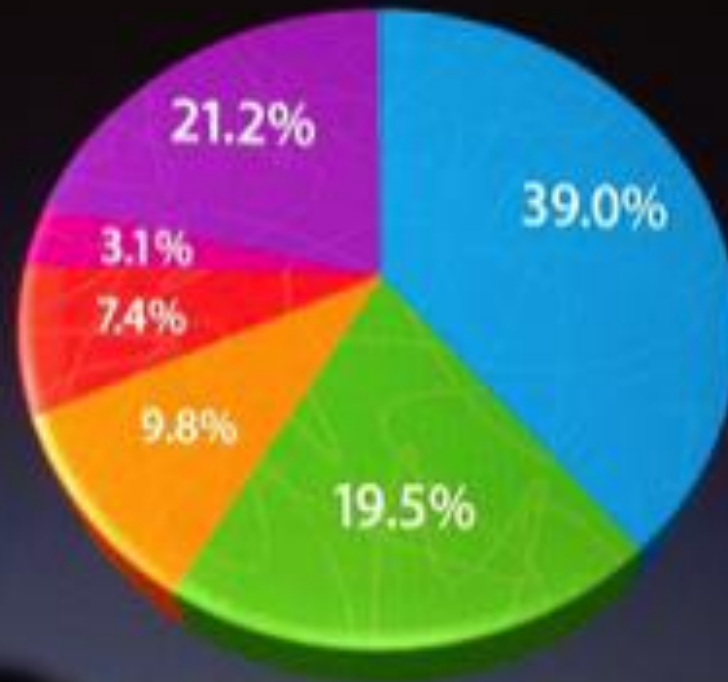


Public Domain/ Wikipedia



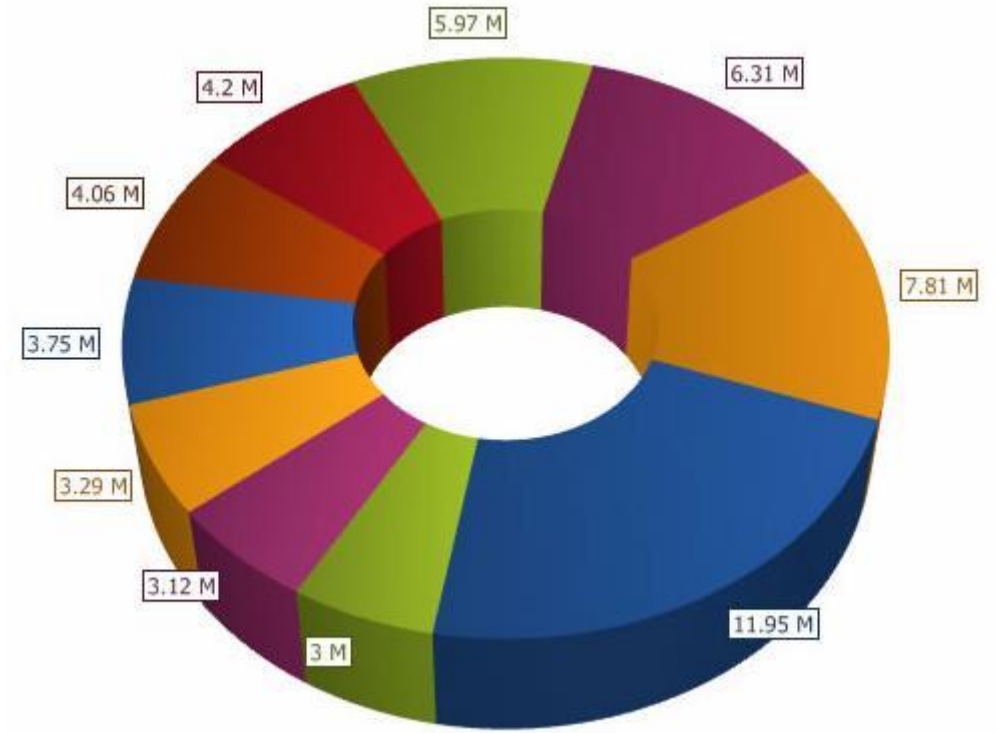
U.S. SmartPhone Marketshare

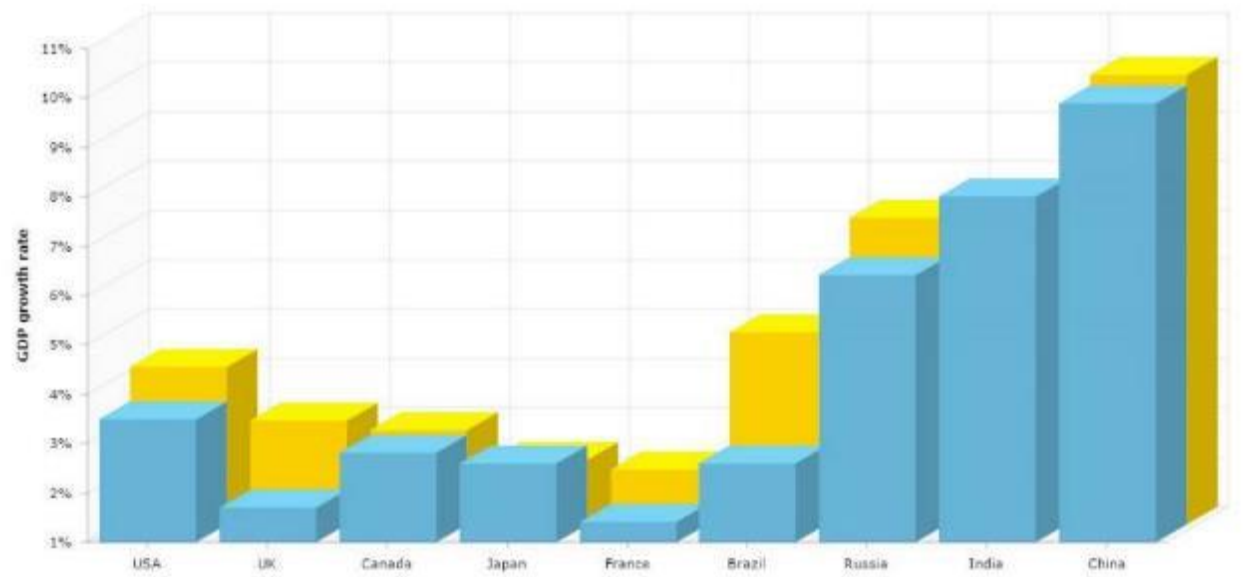
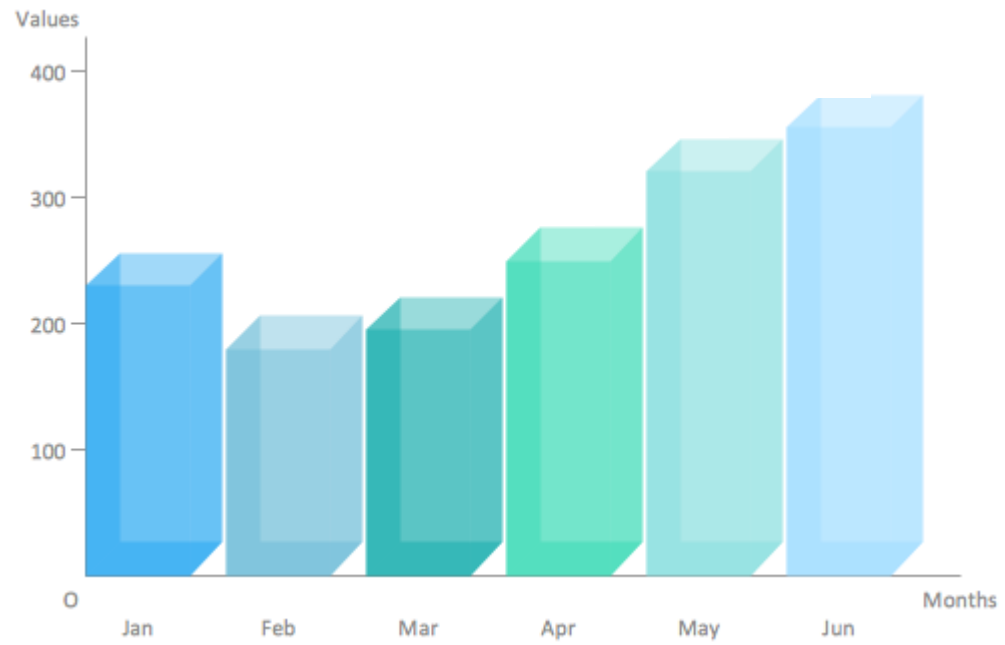
- RIM
- Apple
- Palm
- Motorola
- Nokia
- Other

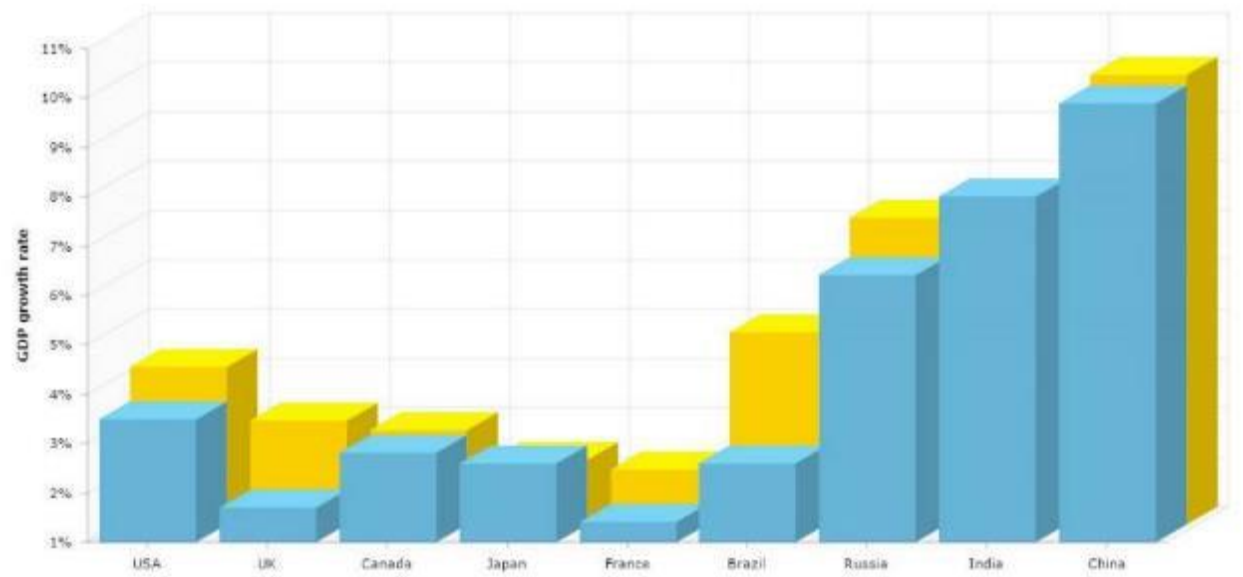
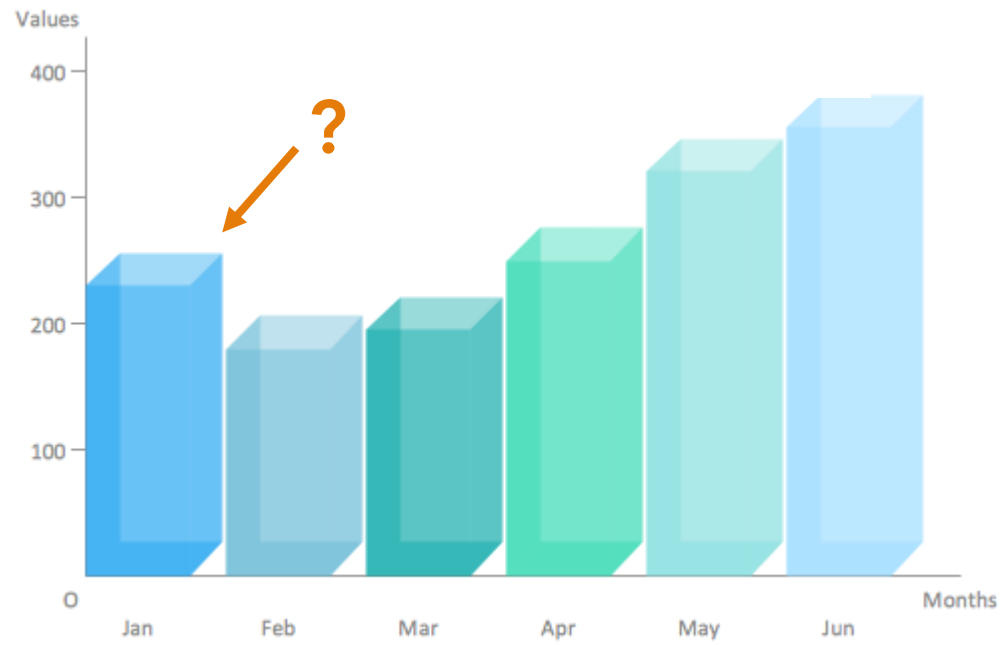


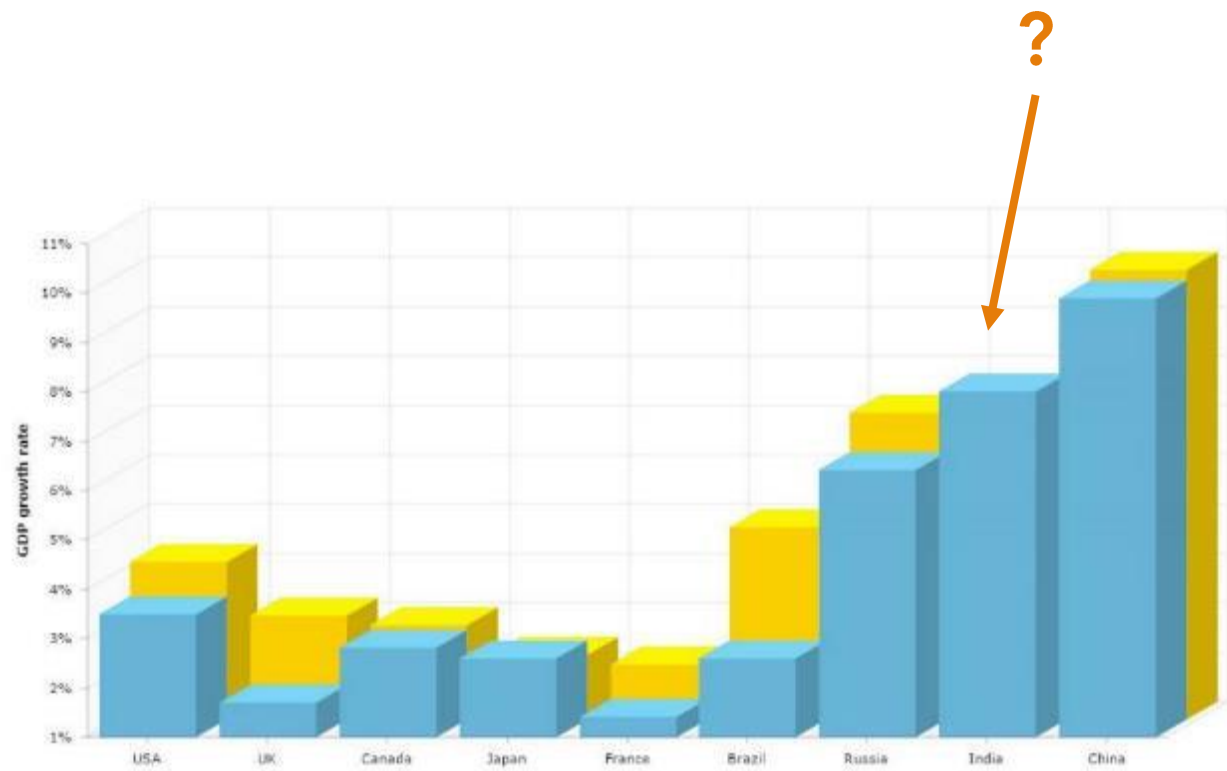
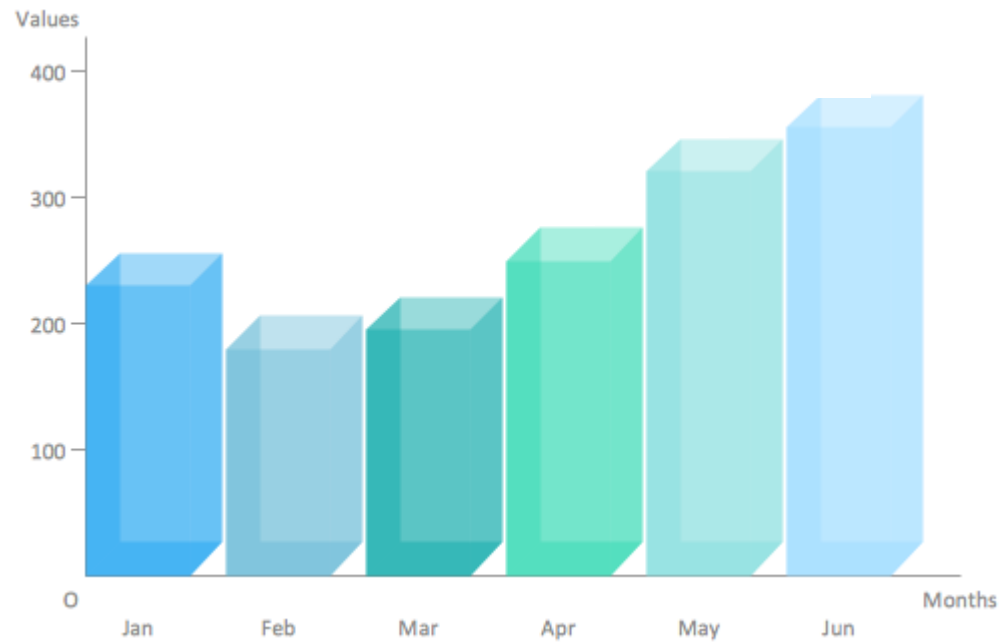


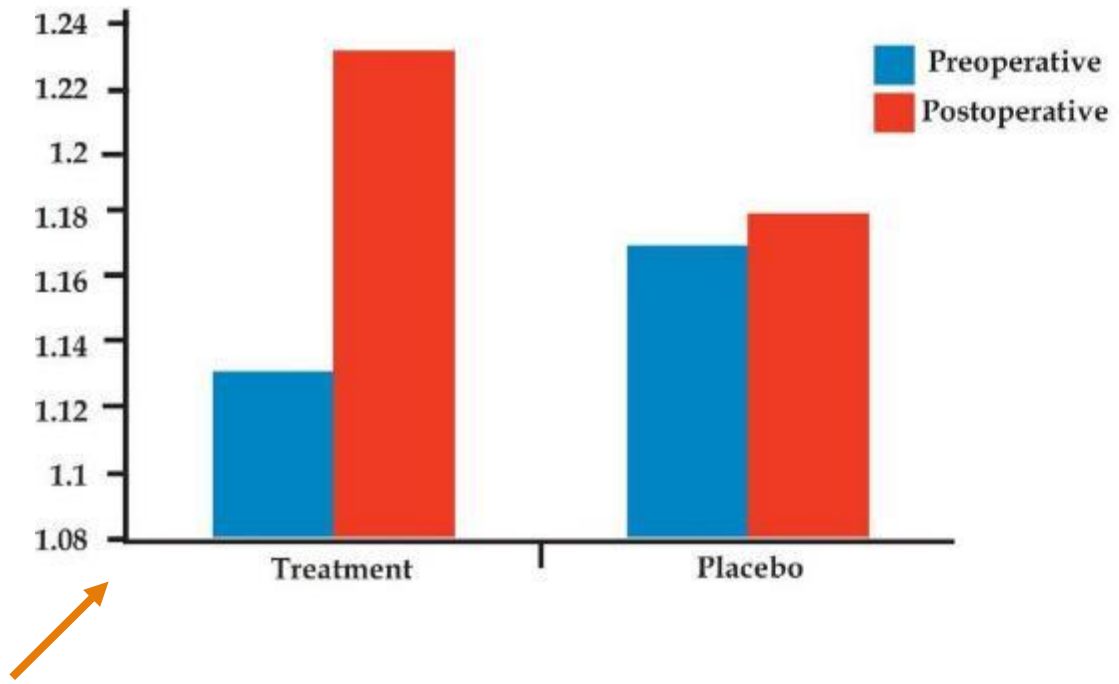


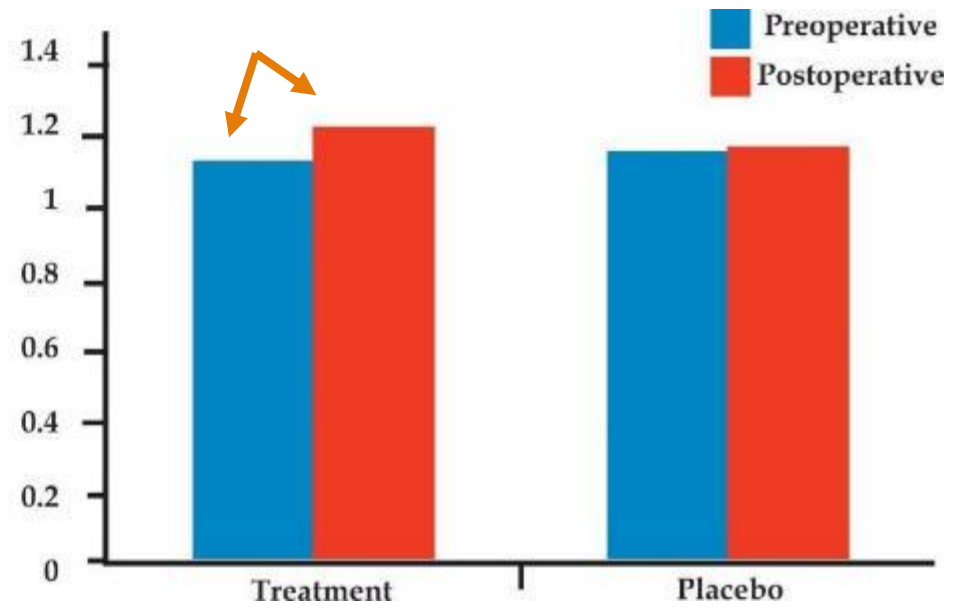
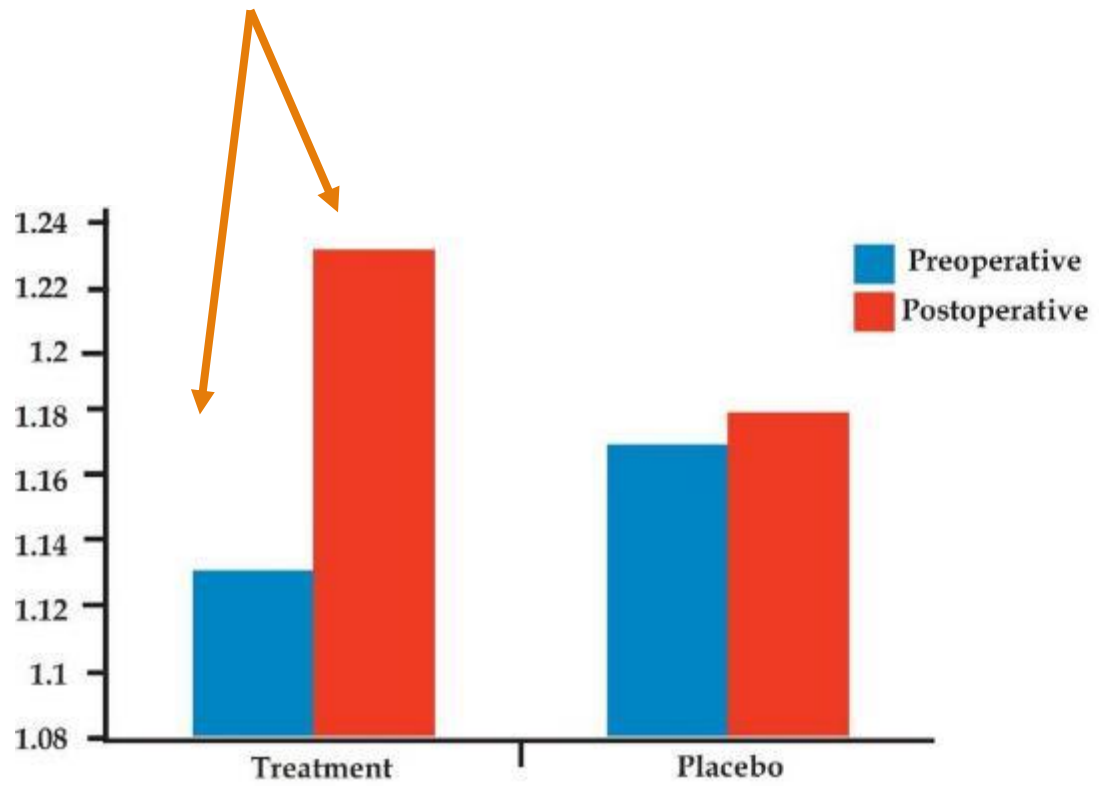


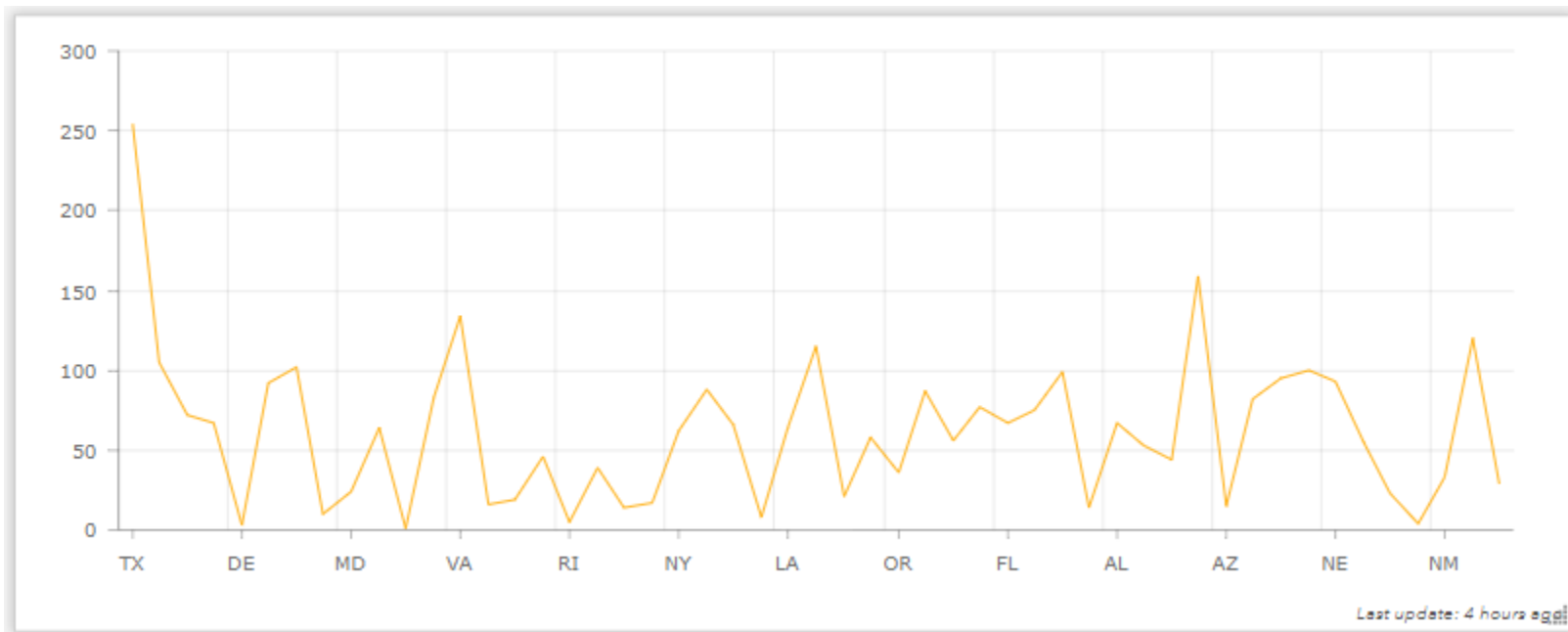


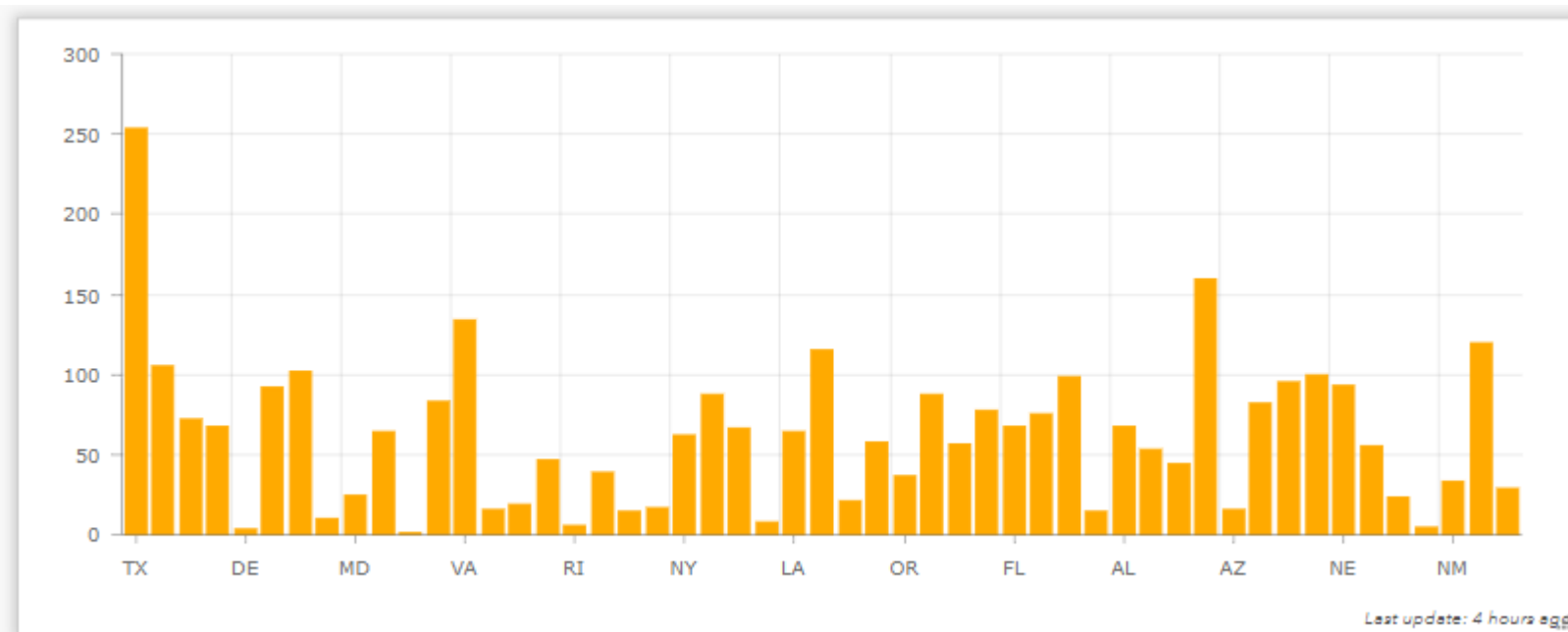
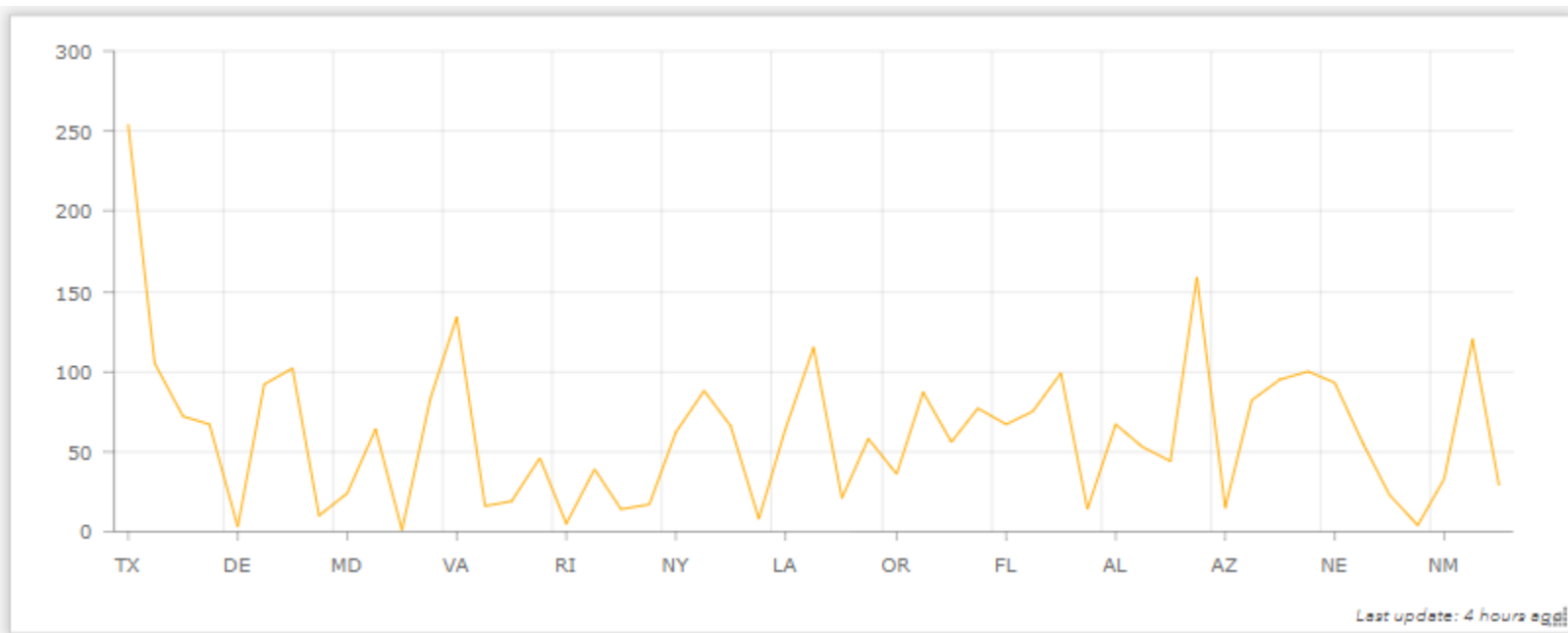












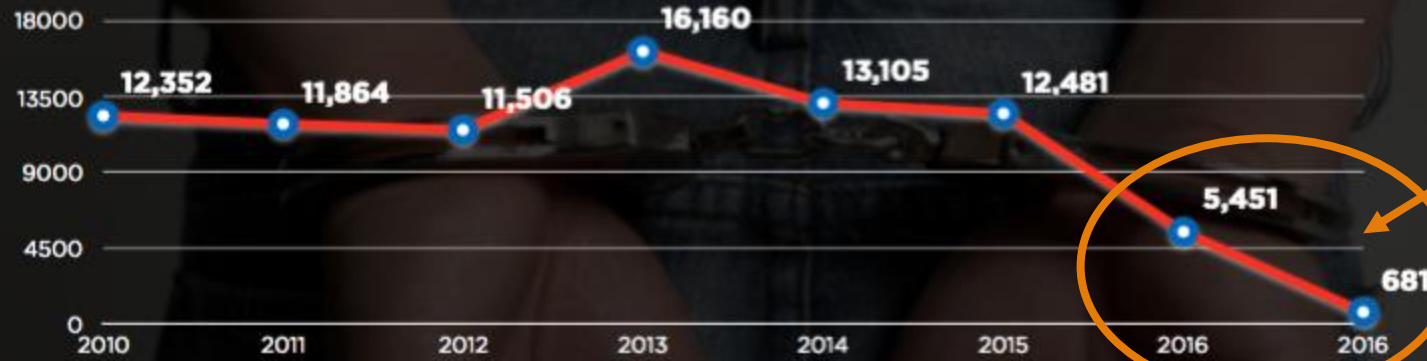
NUMBER OF MURDER AND HOMICIDE CASES REPORTED (2010- AUG 3, 2016)



	2010	2011	2012	2013	2014	2015	2016 JAN-JUNE	2016 JULY 1 - AUG3
Total Murder + Homicide	12, 352	11,864	11,506	16,160	13,105	12,481	5,451	681
Average/ Daily	34	32	32	44	36	34	30	20

Source: PNP Directorate for investigative and detective management

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Visualizations to support spatial analysis

Distributions and frequency

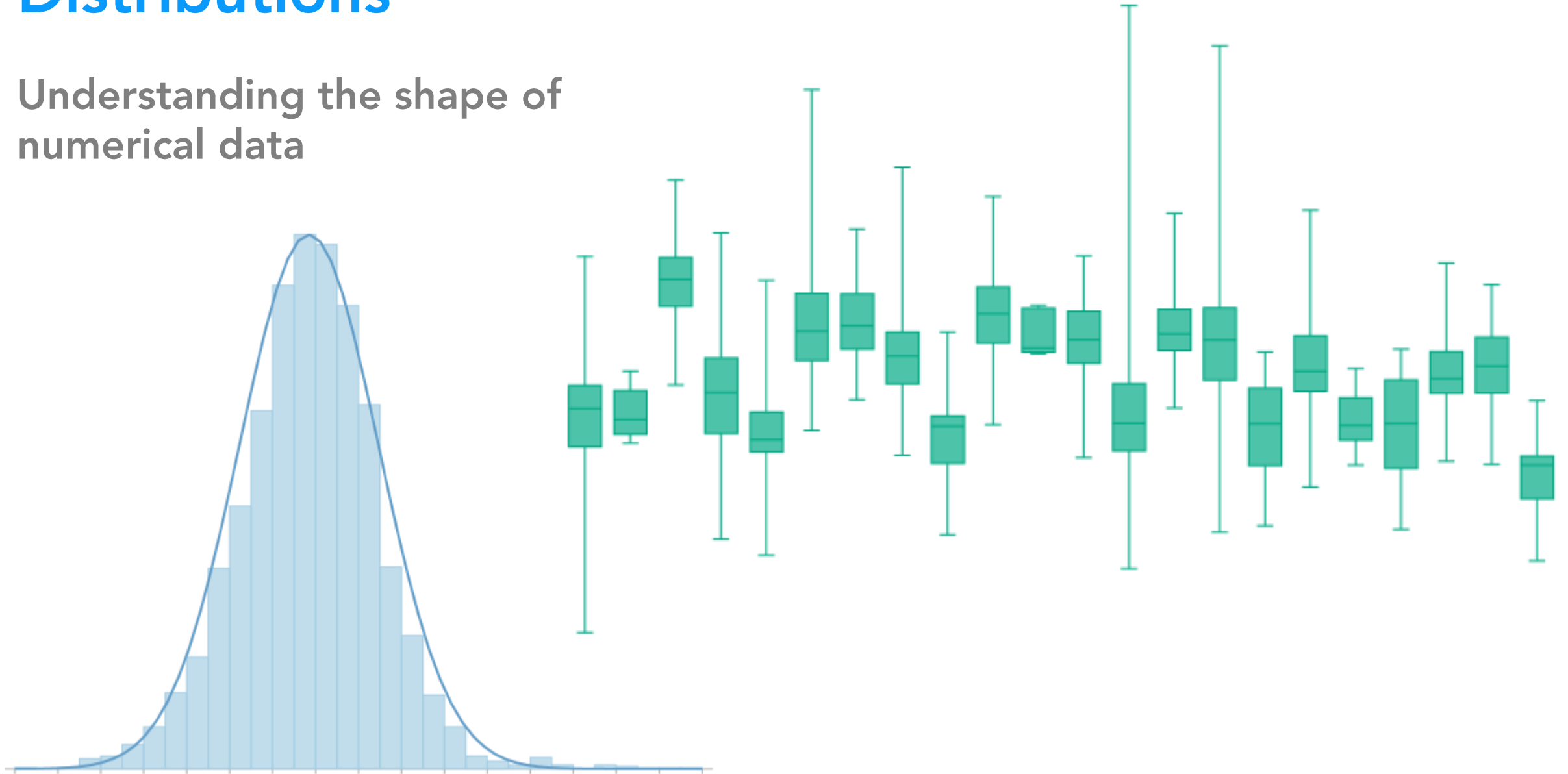
Category comparisons

Relationships and correlations

Change over time or distance

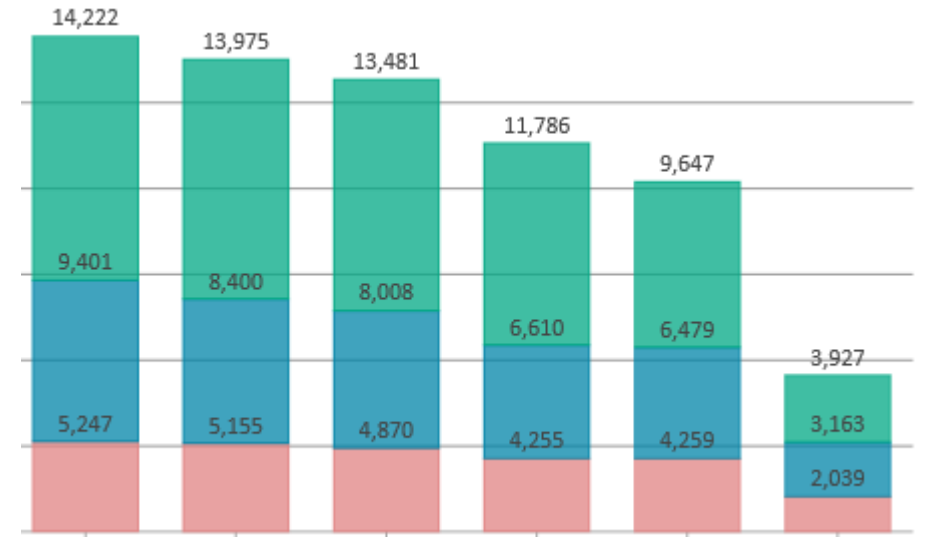
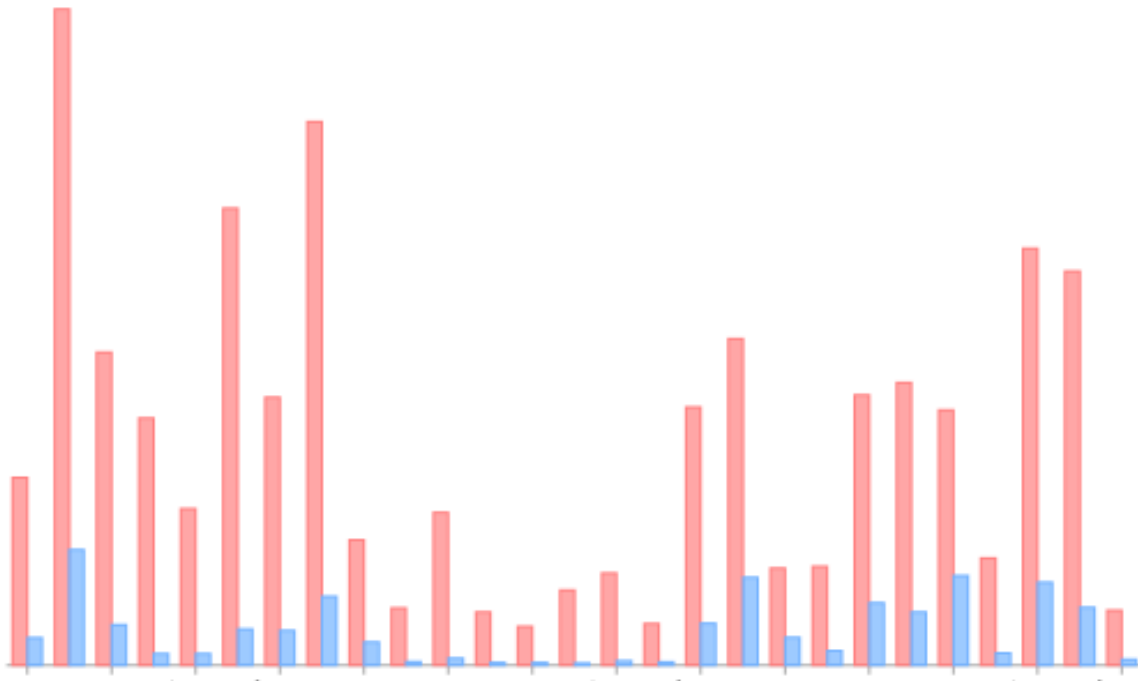
Distributions

Understanding the shape of numerical data



Categories

Summarizing and comparing amounts across categorical data



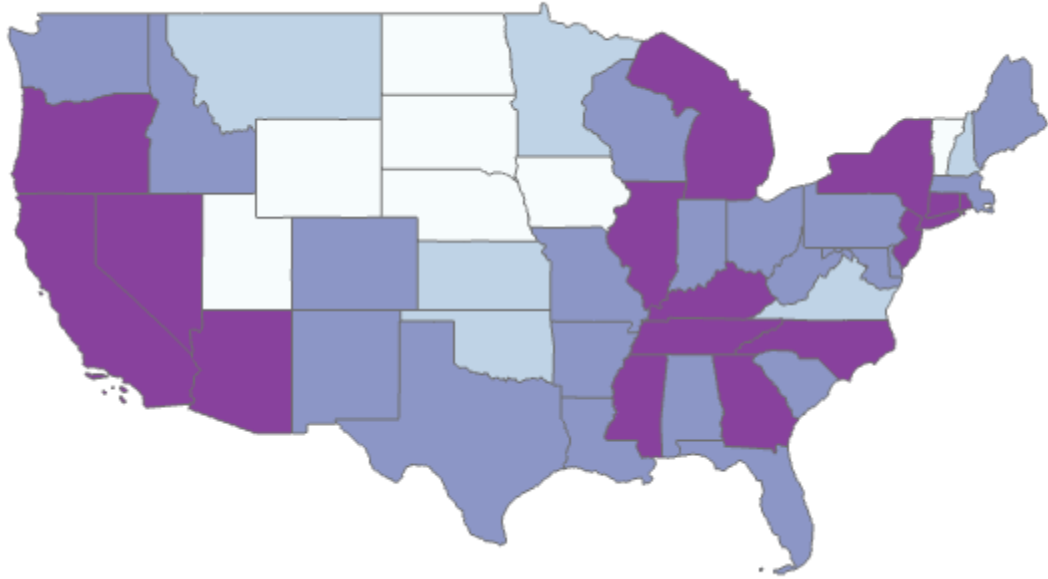
Relationships

Explore correlations and trends

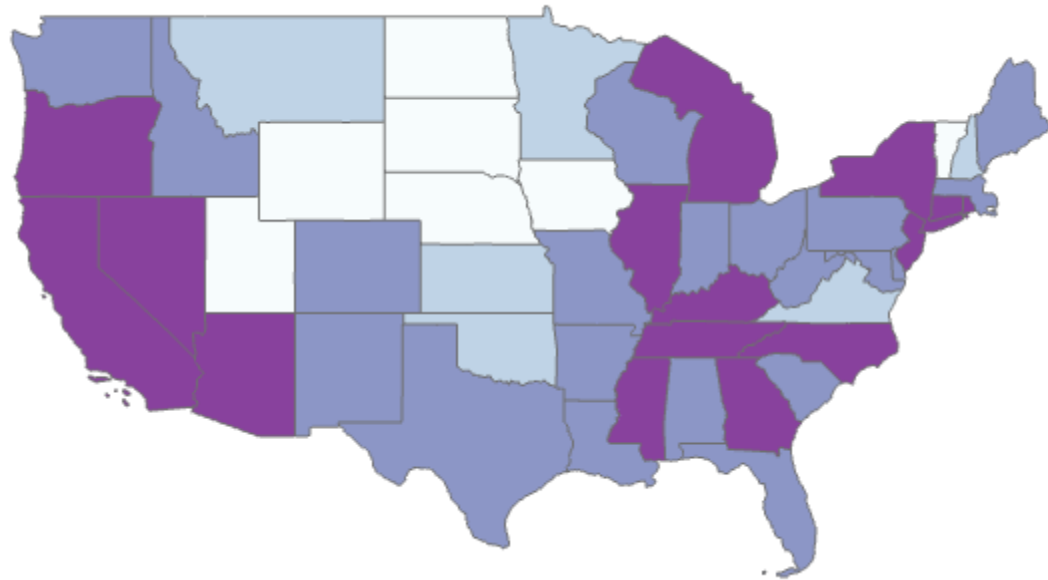


**When a map (alone)
isn't the best option...**

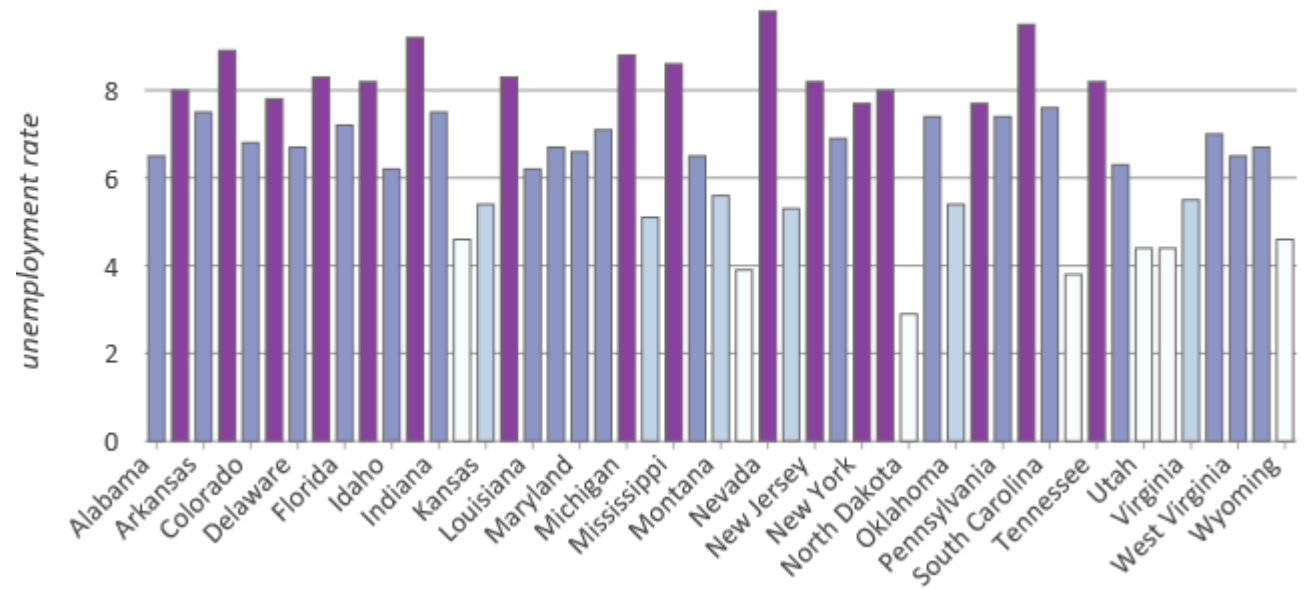
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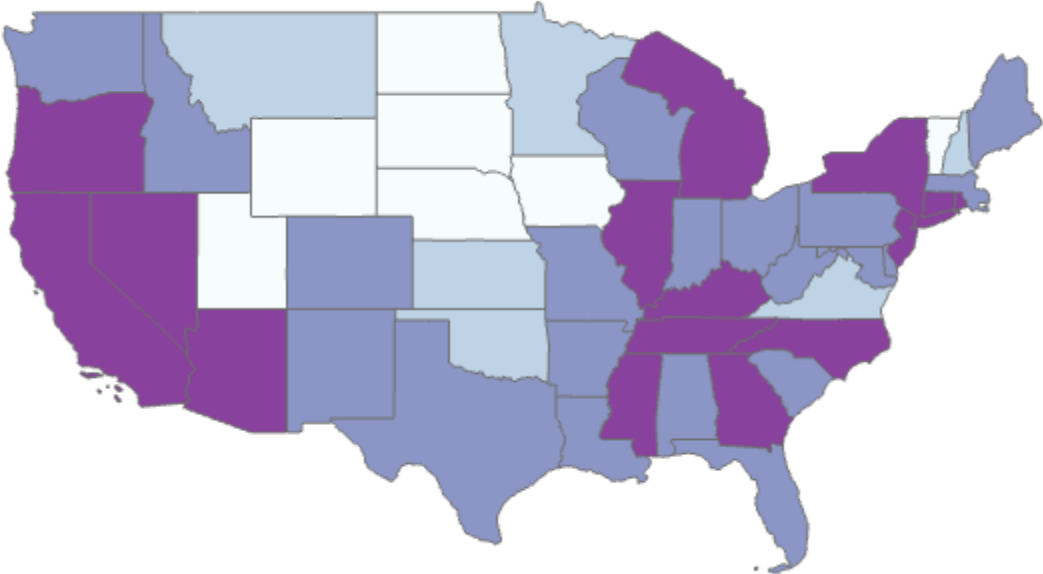
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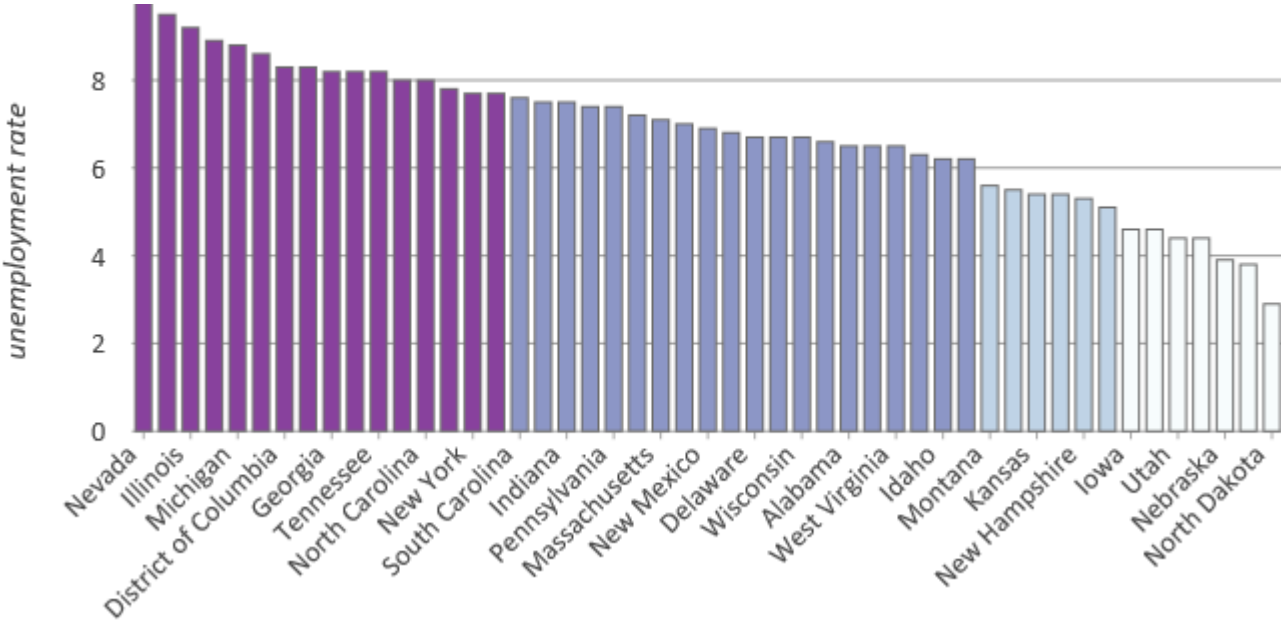
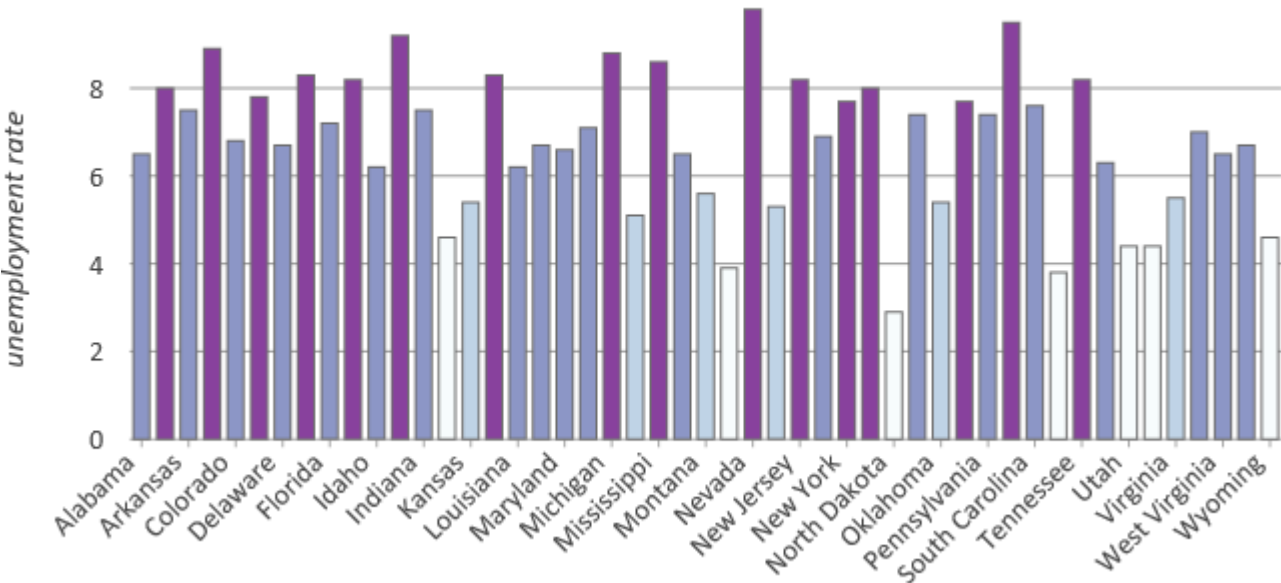
Comparison of unemployment rate by State



When a map (alone) isn't the best option...



Comparison of unemployment rate by State



When a map (alone) isn't the best option...

I

10	8.04
8	6.95
13	7.58
9	8.81
11	8.33
14	9.96
6	7.24
4	4.26
12	10.84
7	4.82
5	5.68

II

10	9.14
8	8.14
13	8.74
9	8.77
11	9.26
14	8.1
6	6.13
4	3.1
12	9.13
7	7.26
5	4.74

III

10	7.46
8	6.77
13	12.74
9	7.11
11	7.81
14	8.84
6	6.08
4	5.39
12	8.15
7	6.42
5	5.73

IV

8	6.58
8	5.76
8	7.71
8	8.84
8	8.47
8	7.04
8	5.25
19	12.5
8	5.56
8	7.91
8	6.89

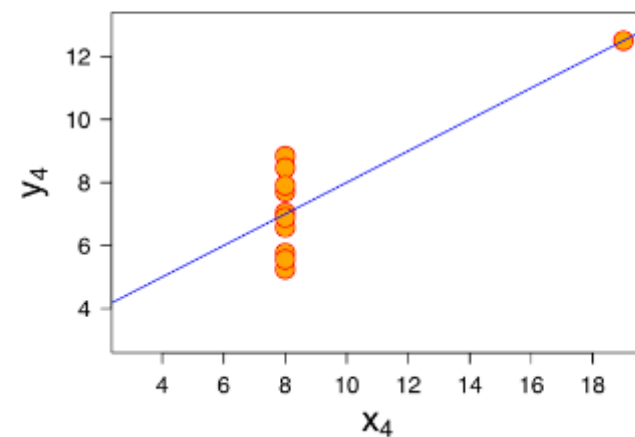
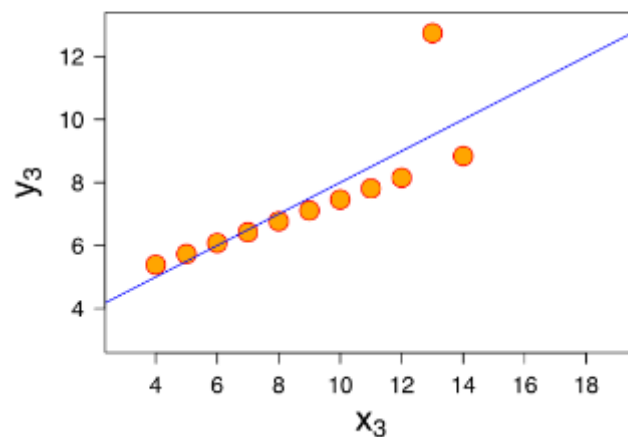
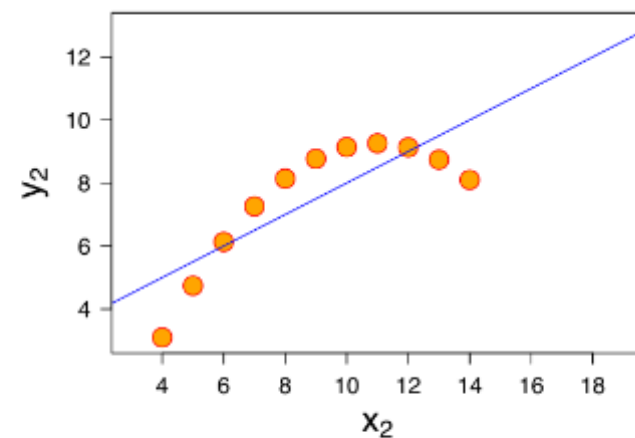
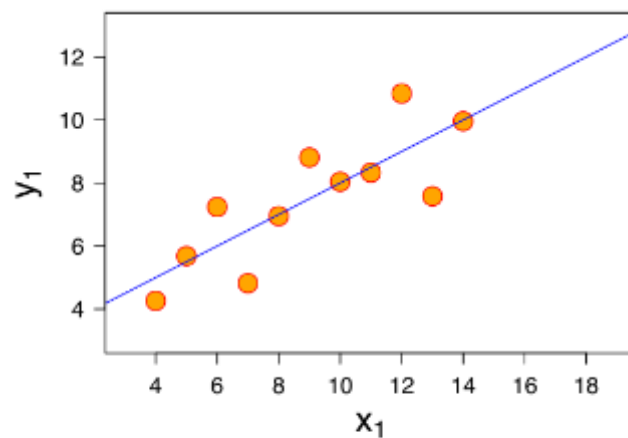
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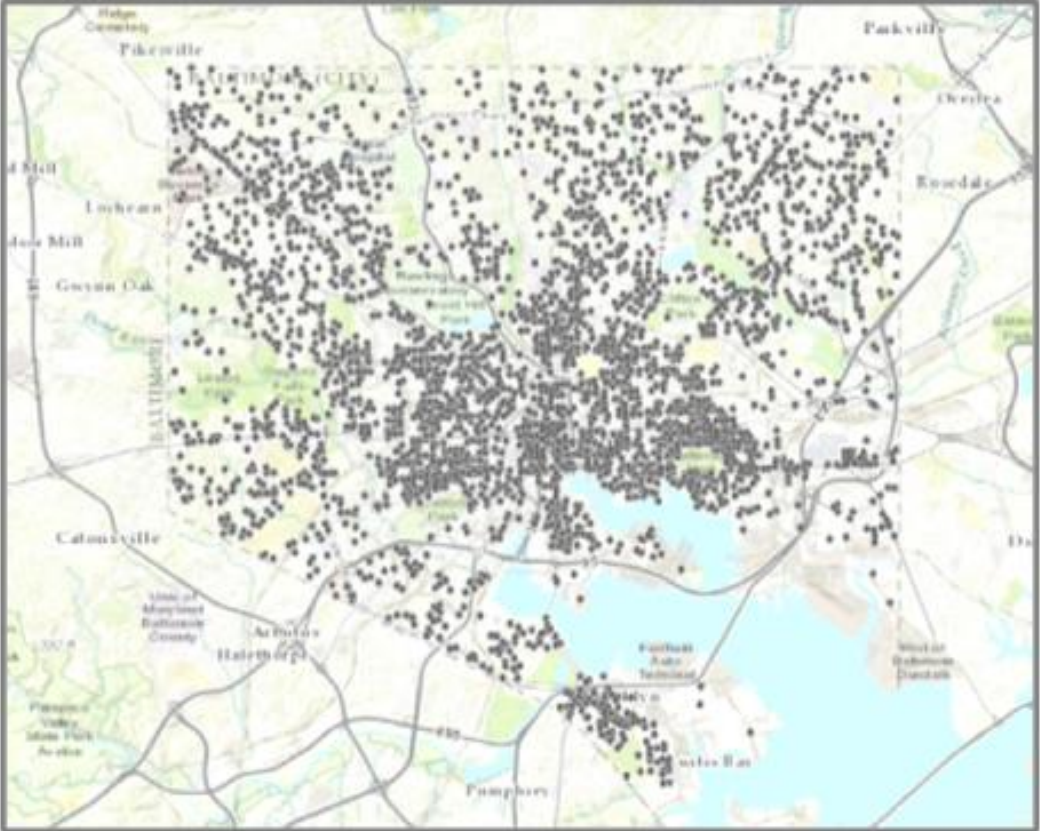
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4	3.1
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III	
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13	12.74
9	7.11
11	7.81
14	8.84
6	6.08
4	5.39
12	8.15
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5	5.73

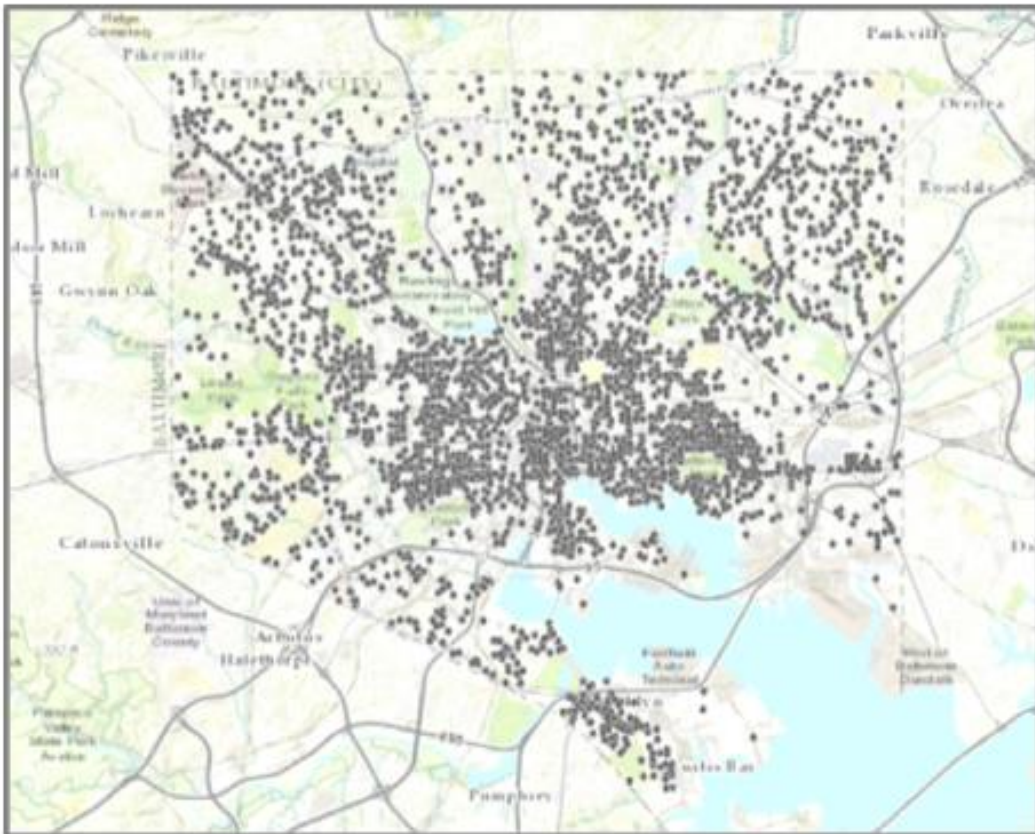
IV	
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8	6.89



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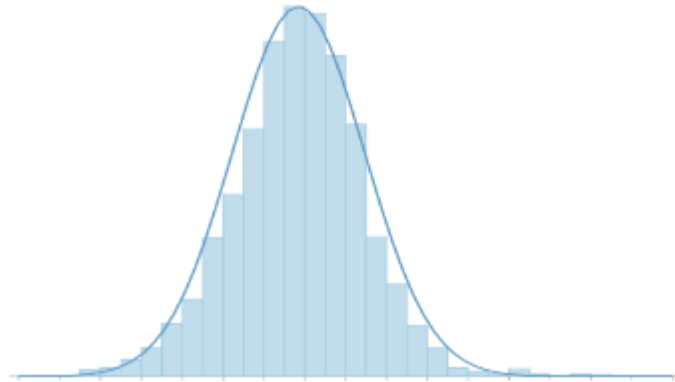


When a map (alone) isn't the best option...



Demo

data exploration



Spatial analysis

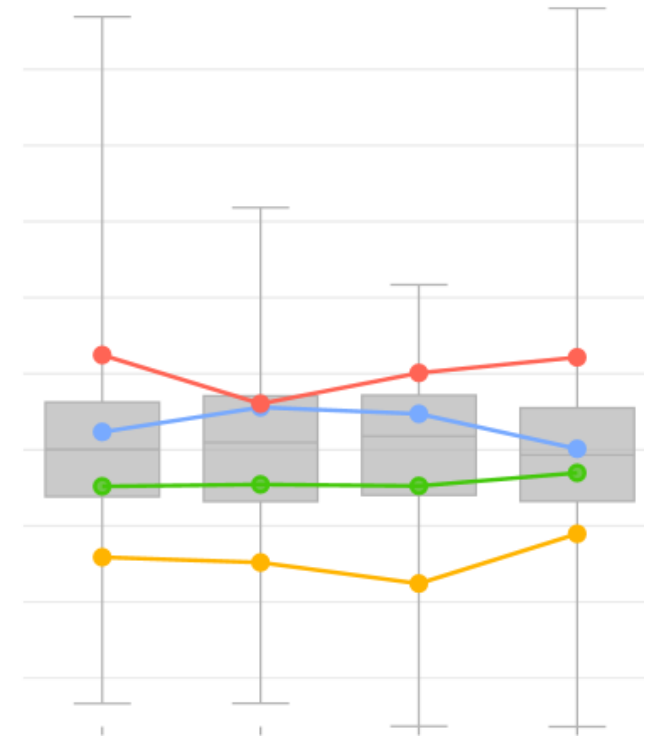
seeing is believing

“Through collaboration with artists and designers, we can work toward the demystification of climate science because when science becomes understandable to the public, people become interested in not only the results but the scientific process, discussions, and, most importantly, solutions.”

Tosca, M. (2019), Transcending science: Can artists help scientists save the world?, Eos, 100, <https://doi.org/10.1029/2019EO127493>. Published on 02 July 2019.

Demo

interpreting analysis





esriurl.com/spatialstats