

DATA VISUALISATION

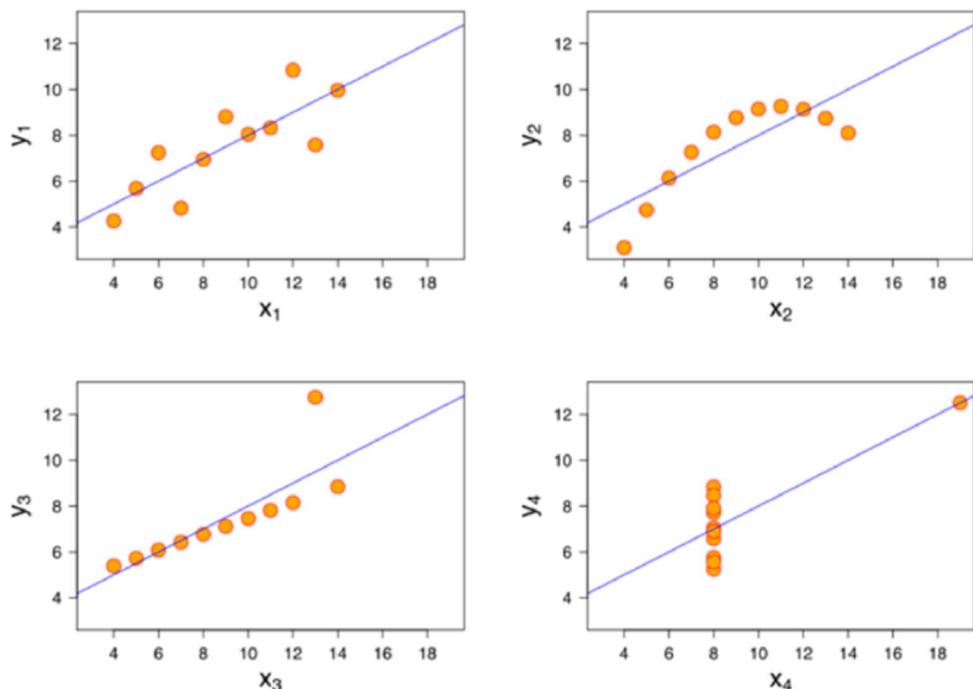
DR DANNY POO

BIG DATA ANALYTICS AND VISUALISATION

What do you see?

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

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



Anscombe's Quartet (1970s)

Because people tended to favour summarized statistics over visualisations, Francis Anscombe illustrated the importance of graphing your data.

All 4 datasets have nearly identical descriptive statistics, but appear very differently when graphed visually:

- Mean of x: 9
- Sample variance of x: 11
- Mean of y: 7.50
- Sample variance of y: 4.125
- Correlation between x and y: 0.816
- Linear regression line: $y = 3.00 + 0.500x$

How to Communicate Data?

Through **data visualization** that make the data attractive and easy to understand.

Data

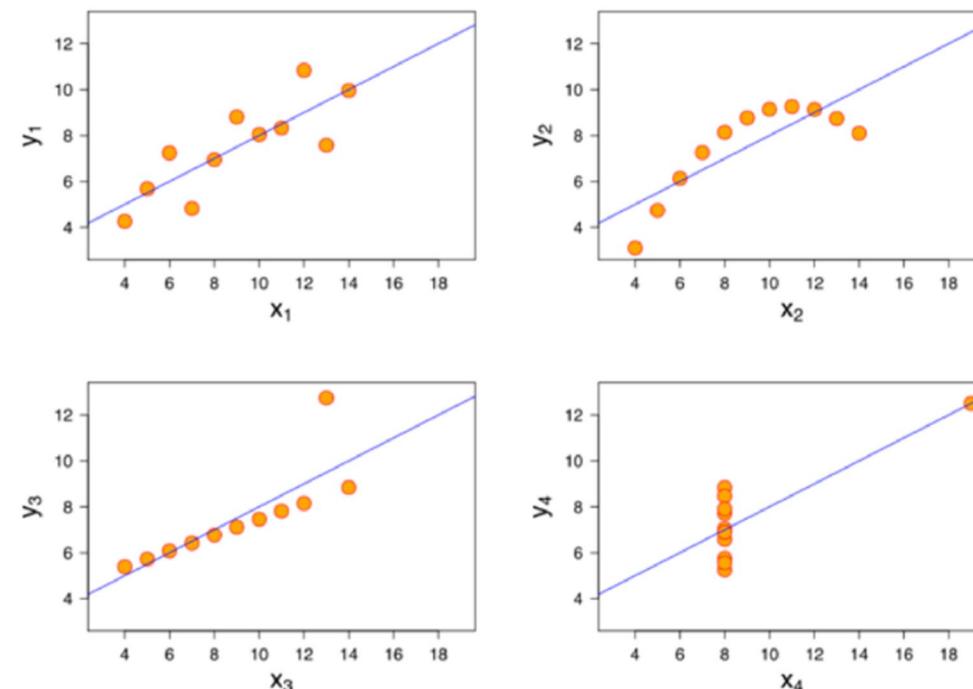
Worth very little unless you can turn it into insights and action!

The easier it is to understand the data and pull out key insights, the easier it is for people to make decisions and act on that data.

Through Visualisation

we seek to **portray data** in ways that allow us to see it in a new light, to visually **observe patterns, exceptions, and the possible stories** that sit behind its raw state.

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

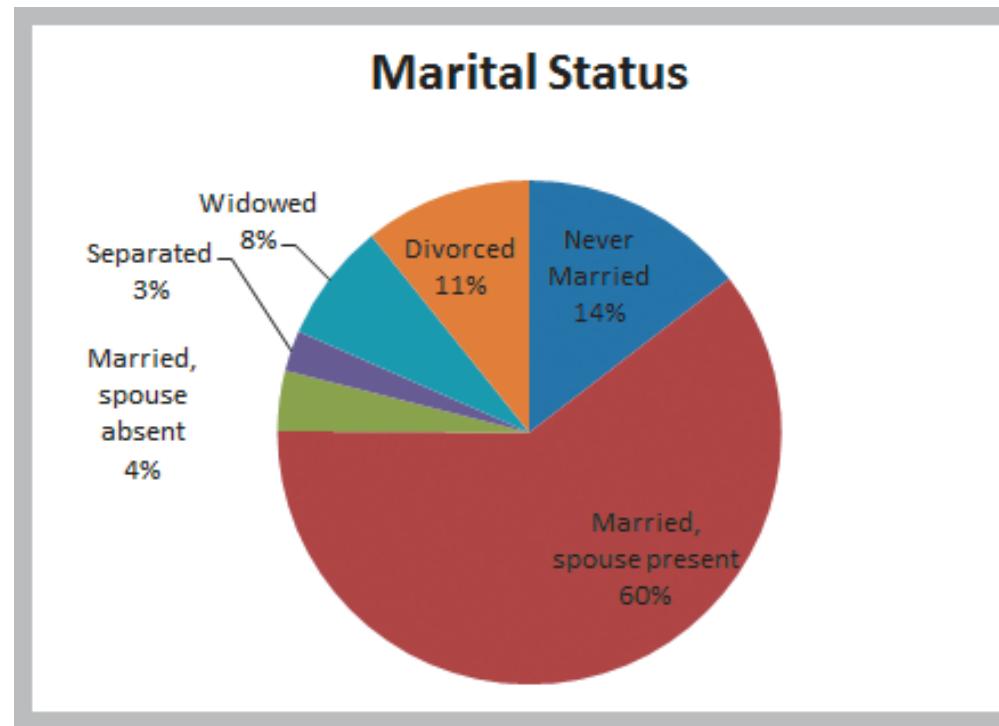


**“THE GREATEST VALUE
OF A PICTURE IS WHEN IT
FORCES US TO NOTICE
WHAT WE NEVER
EXPECTED TO SEE.”**

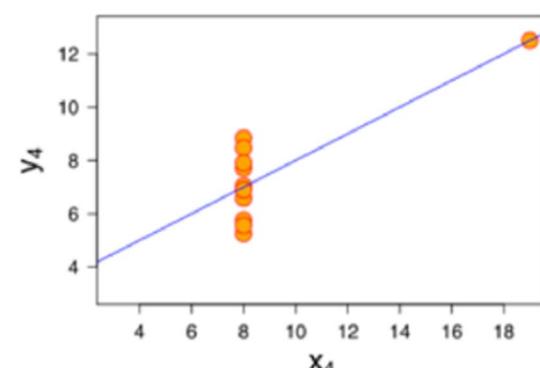
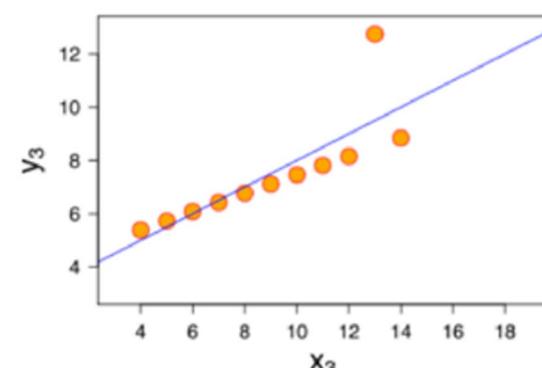
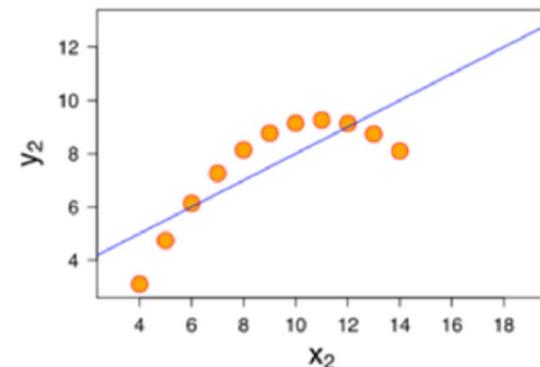
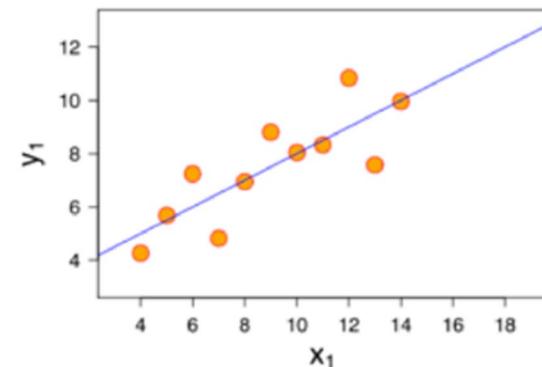
John W Tukey (*Exploratory Data Analysis*)

5, 10, 13, 19, 21, 25, 22, 18, 15, 13, 11, 12, 15, 20, 18, 17, 16, 18, 23, 25

	A	B
18	Marital Status	
19	Never Married	25,752,000
20	Married, spouse present	107,008,000
21	Married, spouse absent	6,844,000
22	Separated	4,605,000
23	Widowed	13,577,000
24	Divorced	19,030,000



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

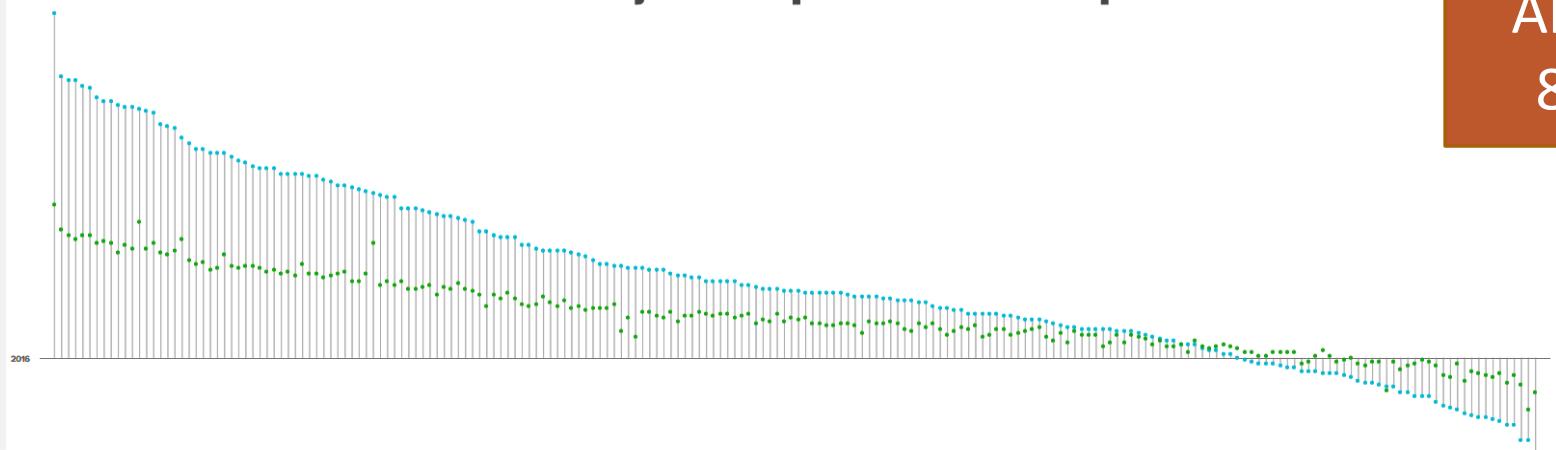


	POPULATION, HEALTH, AND ENVIRONMENT DATA AND ESTIMATES FOR THE COUNTRIES AND REGIONS OF THE WORLD													
	Population mid-2016 (millions)	Births per 1,000 Population	Deaths per 1,000 Population	Net Migration Rate per 1,000	Population		Infant Mortality Rate ^a	Total Fertility Rate ^b	Percent of Population		GNI per Capita (\$US)	Percent of Married Women 15-49 Using Contraception ^c		
					mid-2030 (millions)	mid-2050 (millions)			Ages <15	Ages 65+		Percent Urban	All Methods	Modern Methods
WORLD	7,418	20	8	-	8,539	9,869	36	2.5	26	8	15,415	54	62	56
MORE DEVELOPED	1,254	11	10	3	1,298	1,322	5	1.7	16	18	39,963	78	70	62
LESS DEVELOPED	6,164	22	7	-0	7,241	8,548	39	2.6	28	7	10,214	49	61	55
LEAST DEVELOPED (Excl. China)	4,778	24	7	-1	5,821	7,195	43	2.9	31	5	8,936	47	54	46
AFRICA	1,203	36	10	-1	1,681	2,527	57	4.7	41	4	4,802	41	35	30
SUB-SAHARAN AFRICA	974	37	11	-0	1,388	2,128	62	5.0	43	3	3,606	39	31	26
NORTHERN AFRICA	229	29	6	-1	293	400	29	3.4	32	5	9,799	51	52	46
WESTERN AFRICA	359	39	11	-1	515	800	64	5.4	44	3	4,135	45	18	13
Benin	10.8	36	9	-0	16.6	24.0	66	4.7	45	3	2,100	44	18	12
Burkina Faso	19.0	41	10	-1	28.2	47.0	65	5.7	49	3	1,640	30	21	20
Cape Verde	0.5	21	5	-4	0.6	0.7	19	2.3	28	6	6,390	66	61	57
Côte d'Ivoire	23.9	37	13	0	33.0	50.1	69	4.9	42	3	3,240	54	18	12
Gambia	2.1	41	9	-1	3.2	5.1	45	5.6	46	2	1,580	60	9	8
Ghana	28.2	33	8	-1	37.1	50.4	41	4.2	39	5	4,070	54	35	29
Guinea	11.2	37	10	-0	18.3	27.5	67	5.1	43	3	1,120	37	6	5
Guinea-Bissau	1.9	37	12	-1	2.5	3.6	88	4.9	43	3	1,450	49	16	14
Liberia	4.6	35	9	-1	6.4	9.4	54	4.7	42	3	720	50	20	19
Mali	17.3	44	13	-3	26.1	43.6	56	6.0	47	3	2,360	40	16	15
Mauritania	4.2	31	8	-1	5.7	8.0	72	4.2	40	3	3,710	60	11	10
Niger	19.7	49	9	-0	34.3	68.9	56	7.6	50	3	3,950	22	14	12
Nigeria	186.5	39	13	-0	261.9	397.5	69	5.5	43	3	5,800	48	15	10
Senegal	14.8	38	6	-1	21.6	34.4	39	5.0	44	4	2,390	45	23	21
Sierra Leone	6.6	37	14	-1	8.9	12.6	89	4.9	42	3	1,560	40	17	16
Togo	7.5	36	9	-0	10.9	17.4	47	4.7	42	3	1,320	38	20	17
EASTERN AFRICA	394	36	9	-1	561	844	51	4.8	43	3	2,019	26	40	37
Burundi	11.1	42	10	0	17.2	30.4	63	6.1	46	2	730	12	32	30
Comoros	0.8	33	7	-3	1.0	1.4	36	4.3	40	3	1,430	28	19	14
Djibouti	0.9	25	9	-3	1.1	1.2	53	3.2	33	4	—	77	19	18
Eritrea	5.4	34	7	-5	7.3	10.4	43	4.2	43	3	—	23	8	7
Ethiopia	101.7	30	7	-0	132.9	168.6	47	4.2	41	3	1,620	20	37	36

Can you estimate about what percent of the world's countries have growing populations?

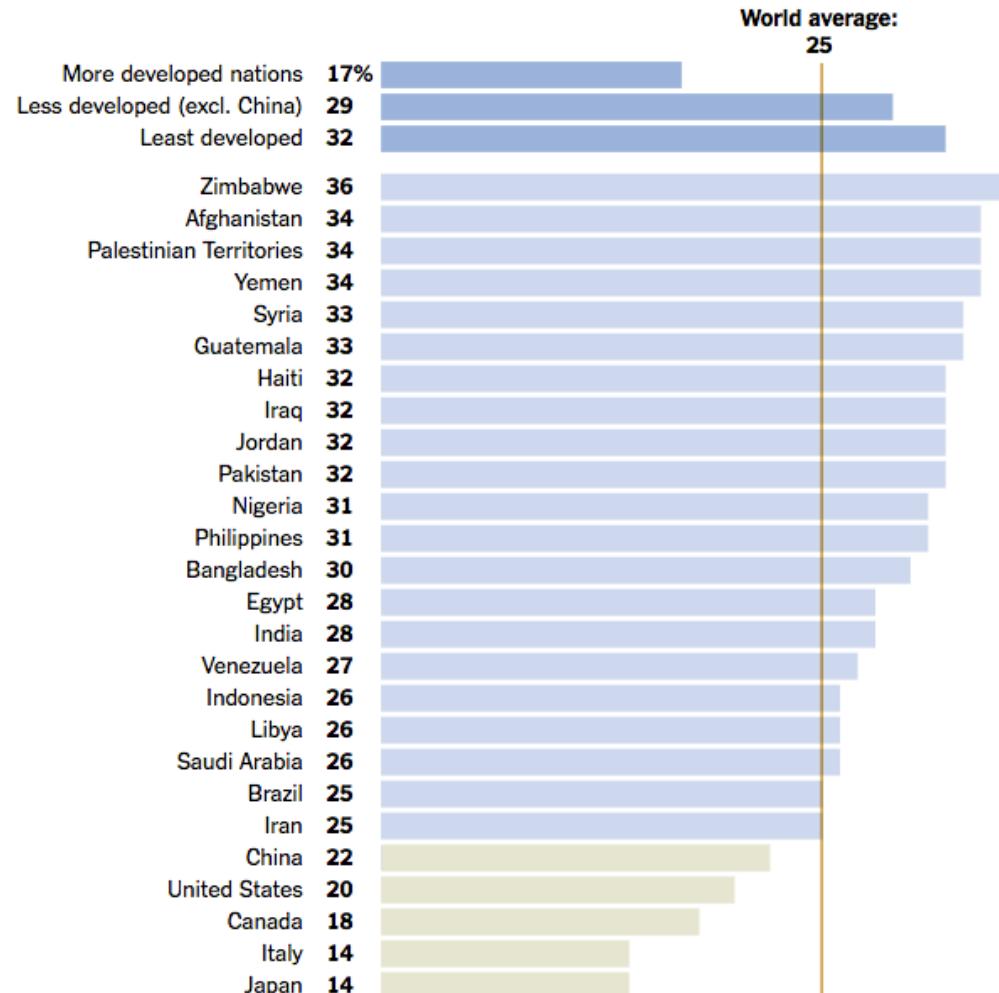
2030 and 2050 Projected Population as a Multiple of 2016

About 80%



The Youth Bulge

Percent of total population ages 10–24 in 2013.



Source: Population Reference Bureau

By The New York Times

Crowd Size

14

So Far Today

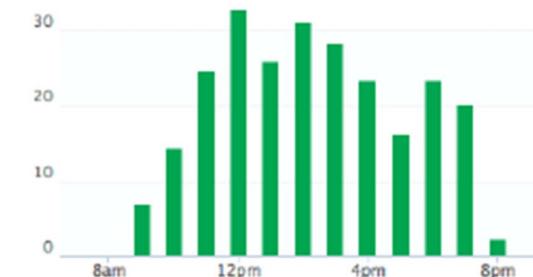
▲ 25% vs. last Monday
▲ 16% vs. average Monday

Busiest Days »



Typical Day »

Based on average count over the last seven days



Activity

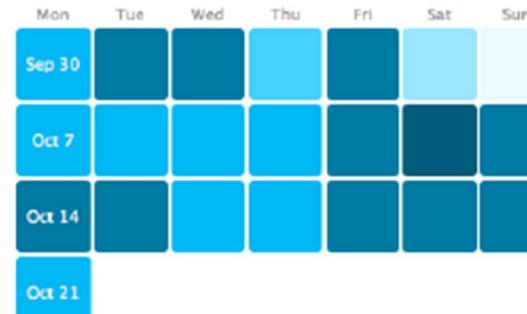
Today

10.6

Average activity

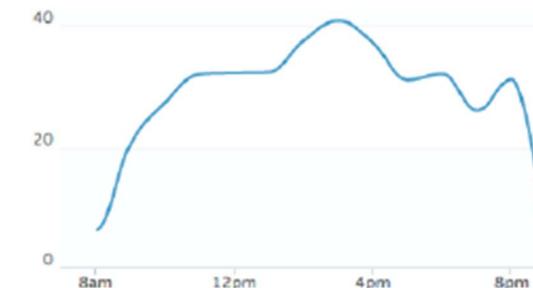
▼ 6% vs. last Monday
▼ 30% vs. average Monday

Most Active Days »



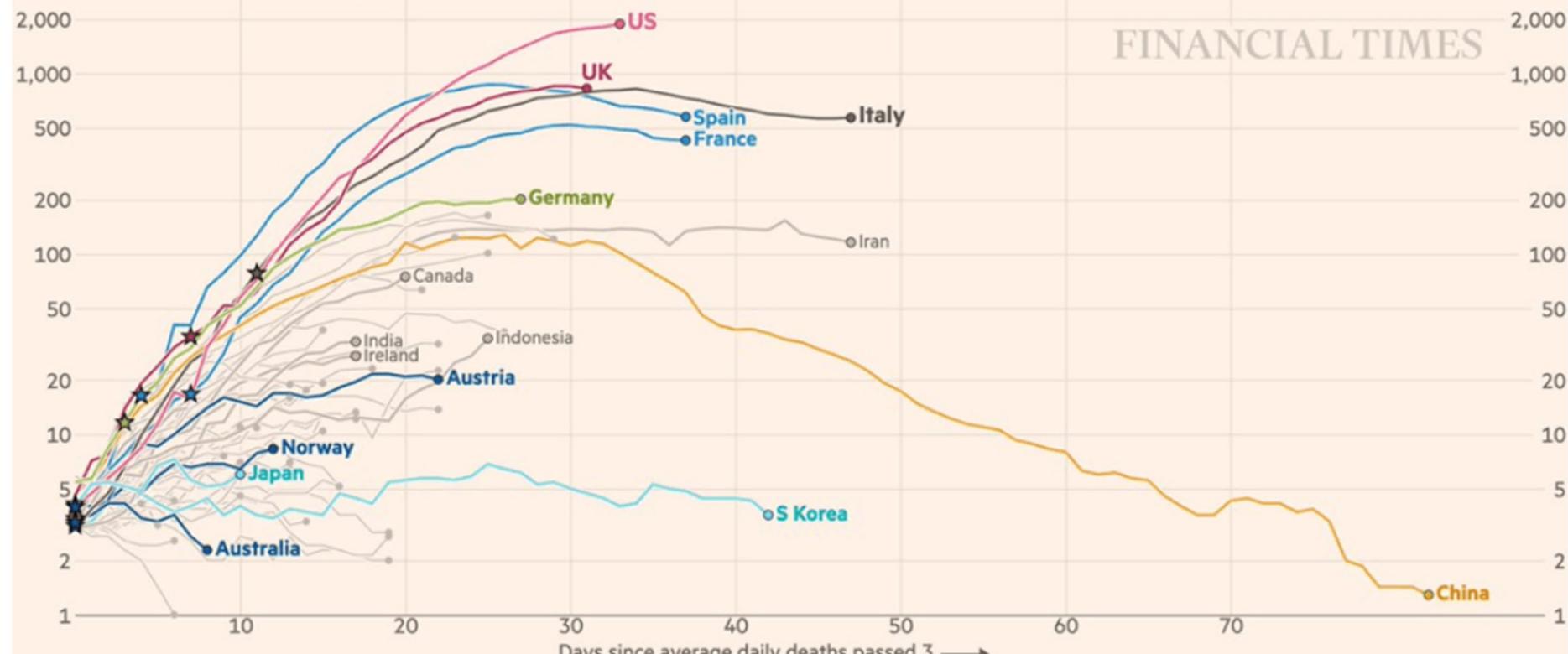
Typical Day »

Based on average activity over the last seven days



Italy and Spain's daily death tolls are falling; in the UK and US daily deaths may be plateauing

Daily deaths with coronavirus (7-day rolling average), by number of days since 3 daily deaths first recorded
Stars represent national lockdowns ★



FT graphic: John Burn-Murdoch / @burnmurdoch
Source: FT analysis of European Centre for Disease Prevention and Control; FT research. Data updated April 15, 19:00 GMT
© FT

Financial Times' defining COVID19 chart and more...

<https://www.ft.com/content/a2901ce8-5eb7-4633-b89c-cbdf5b386938>

Dashboard of the COVID-19 Virus Outbreak in Singapore

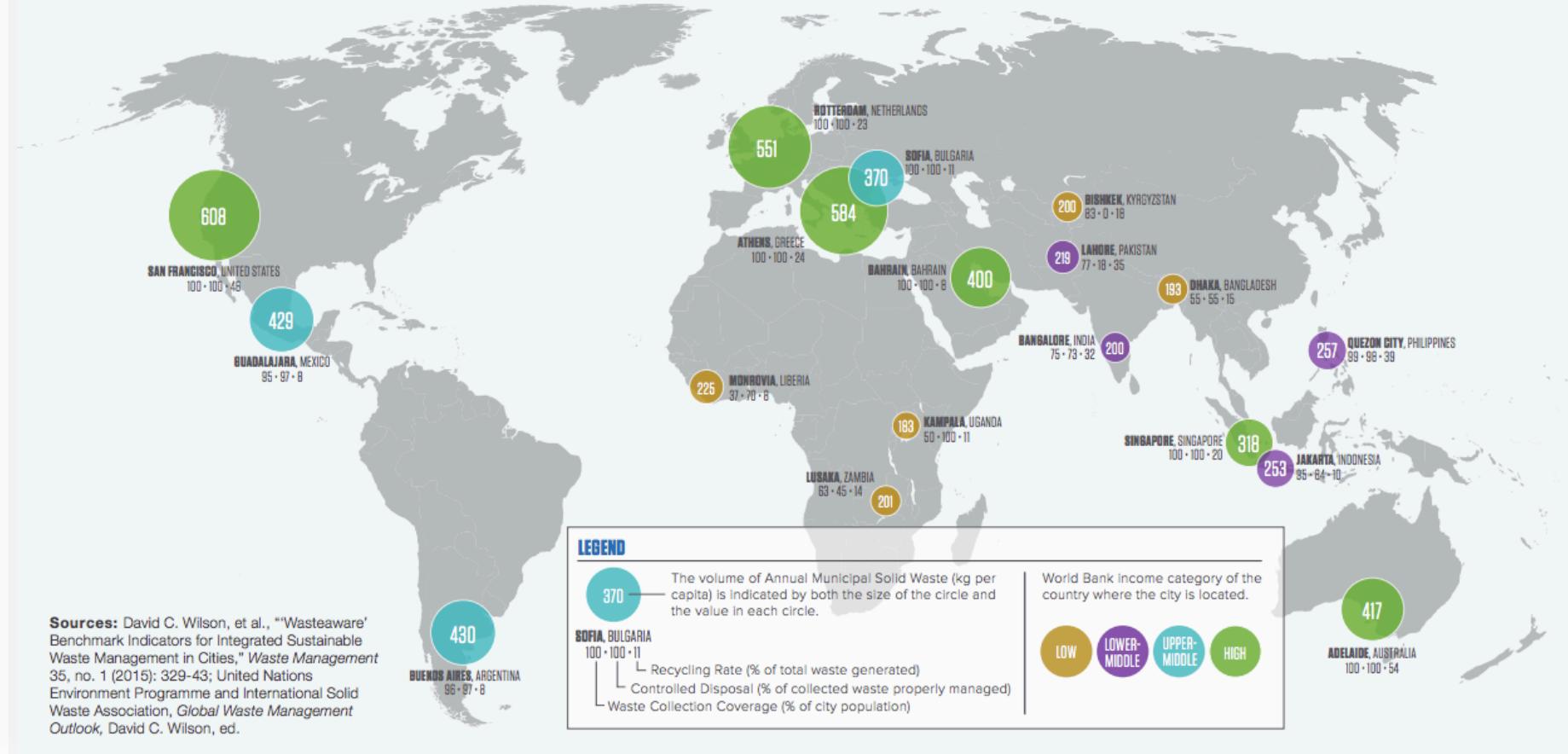
21 JANUARY 2020 TO 13 JANUARY 2021



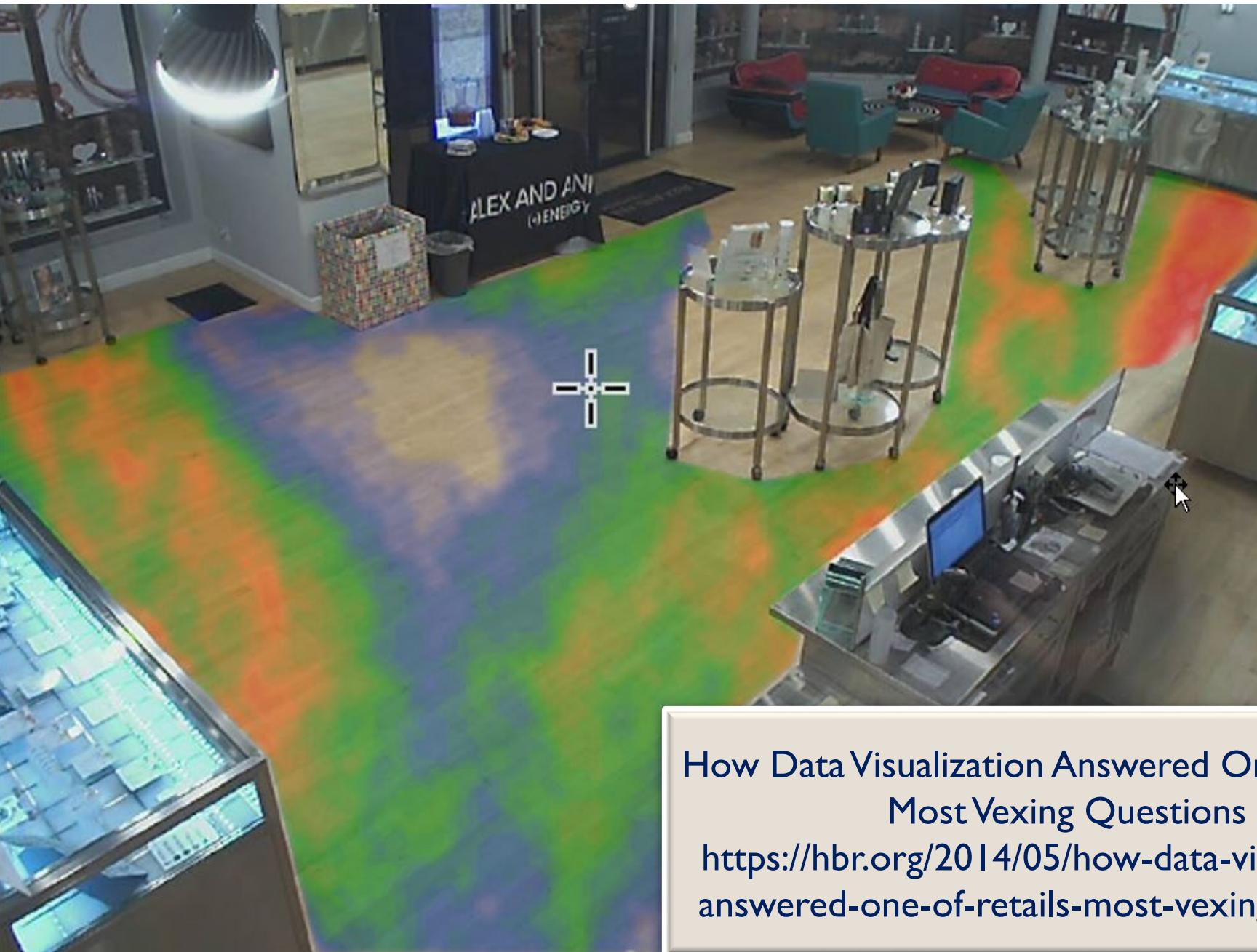
Dashboard of the COVID-19 outbreak in Singapore
<https://co.vid19.sg/singapore/dashboard>

Municipal Waste Volumes per Capita Rise With Income

Proper municipal waste disposal is a public health and environmental priority as urban populations grow. City residents without regular refuse collection services risk exposure to contaminants that spread into soil, streets, and water. Uncontrolled dumpsites taint water tables and release airborne toxins as unsorted refuse is burned. Global municipal waste data show that per capita volumes tend to rise with average income levels but negative impacts lessen as wealthier cities improve waste processing systems. While some cities in lower-income countries have expanded collection coverage, many still lag in proper waste processing—or controlled disposal. Collection in Lahore, Pakistan covers 77 percent of the population but only 18 percent of collections go to a controlled disposal facility. Lusaka, Zambia has 63 percent coverage and a 45 percent rate of controlled disposal. Recycling rates reach relatively high levels in some lower-income countries, often due to informal recycling networks.



Sources: David C. Wilson, et al., "Wasteaware' Benchmark Indicators for Integrated Sustainable Waste Management in Cities," *Waste Management* 35, no. 1 (2015): 329-43; United Nations Environment Programme and International Solid Waste Association, *Global Waste Management Outlook*, David C. Wilson, ed.



How Data Visualization Answered One of Retail's
Most Vexing Questions
<https://hbr.org/2014/05/how-data-visualization-answered-one-of-retails-most-vexing-questions>

WHAT IS DATA VISUALISATION?

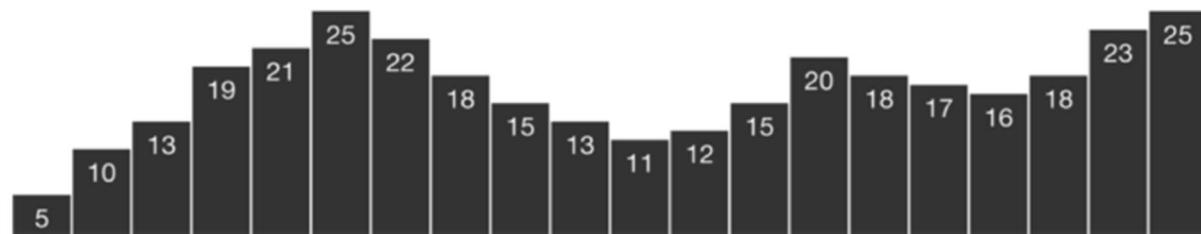
“Visualisation” is the visual/graphical/pictorial representation of data and analyses.

Data Visualisation

Just like words can be used to represent an idea, visualisations can be used to represent data.

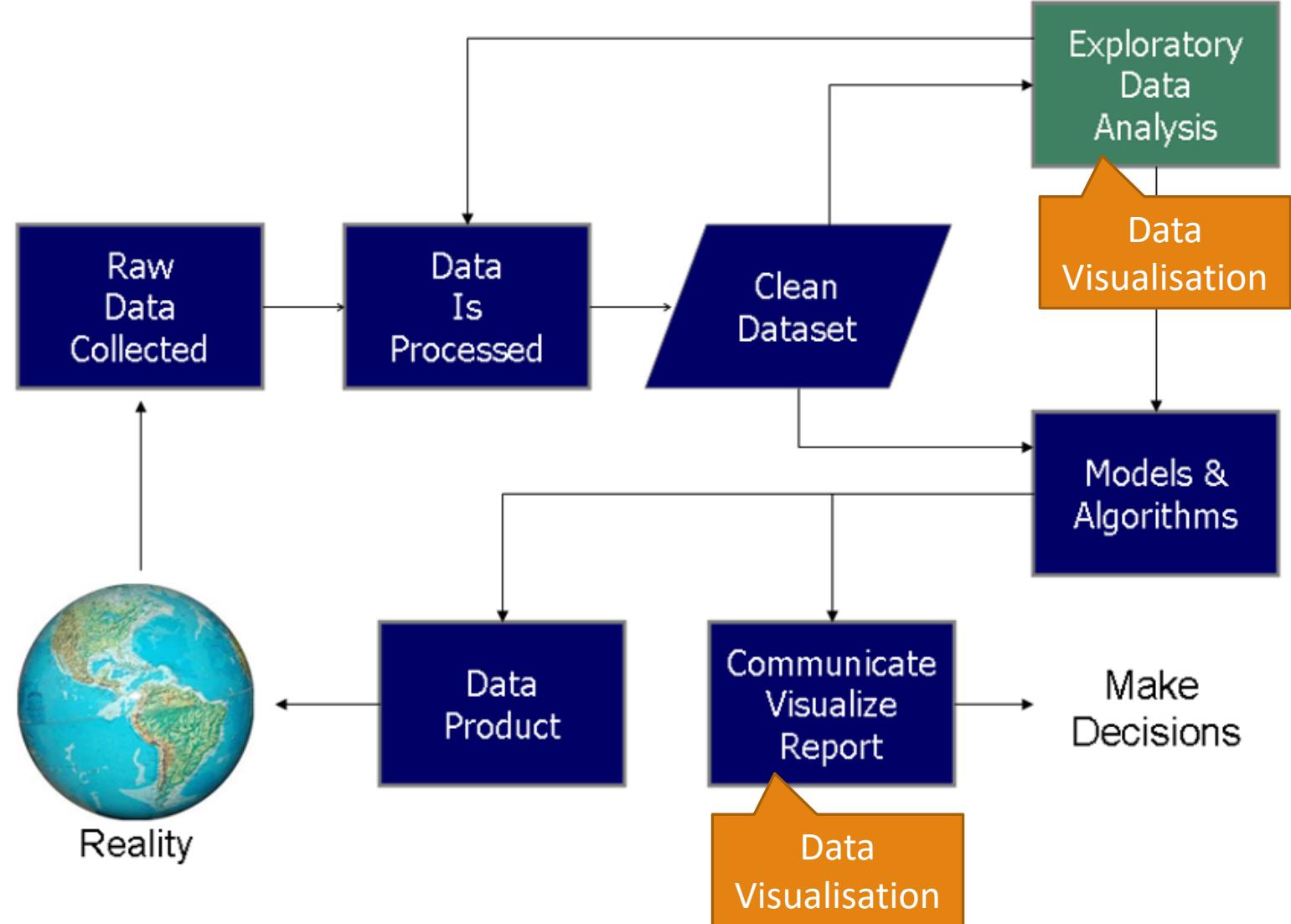
5, 10, 13, 19, 21, 25, 22, 18, 15, 13, 11, 12, 15, 20, 18, 17, 16, 18, 23, 25

vs.



Data Analysis Process

- Data Visualisation is a critical part of Data Analytics
- It allows us to understand our data – see **patterns, outliers, trends and context** – and therefore make decisions and take actions that are relevant for our business.



Why Visualize Data?

Humans are able to perceive visual data more easily.

A well-designed visualisation also helps by being more **persuasive**, **memorable** and creating an **emotional** response.

“NICELY DESIGNED POSTERS WITH
A FEW NUMBERS ON THEM
AREN’T REALLY DATA
VISUALISATION.”

Amanda Cox
Editor of Upshot, New York Times

“[I EMPHASIZE] VISUALIZATIONS THAT DO SOME WORK; THEY PERSUADE, THEY EXPLAIN, THEY EXPLORE.

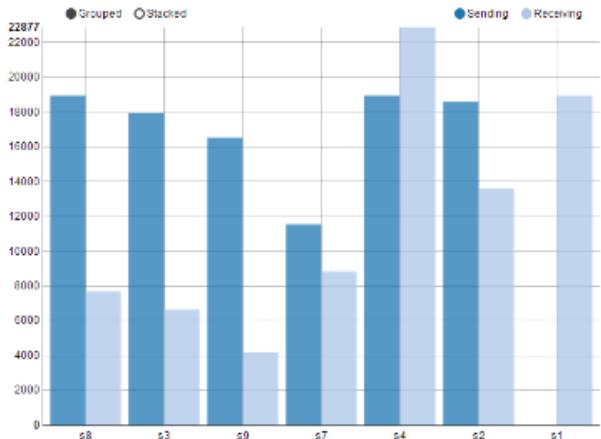
BEAUTY IS DESIRABLE, BUT I’M NOT EXCITED BY PRETTY CHARTS THAT ARE ALSO PRETTY USELESS.”

Graham Wills
Data Science and Visualization Expert at IBM

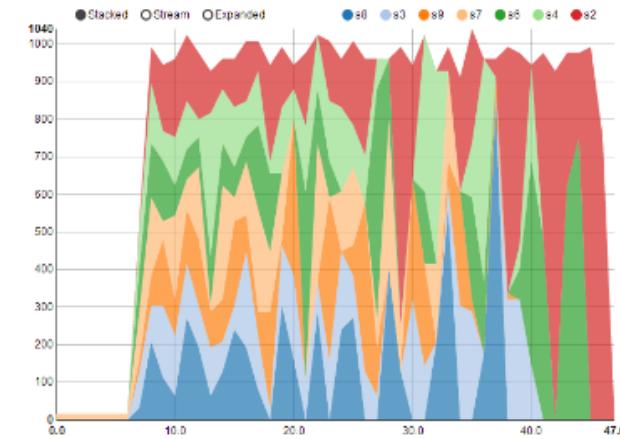
A Formal Definition

Data Visualisation is the **representation and presentation** of data that exploits our **visual perception abilities** in order to **amplify cognition**.

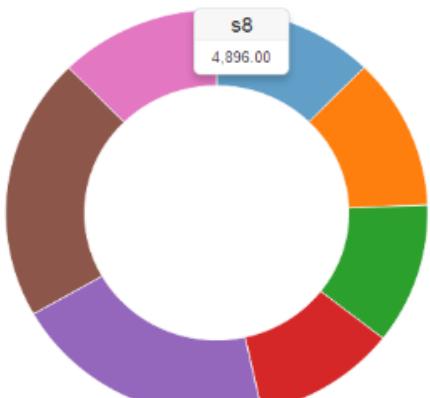
Representation of Data is the way data is depicted.



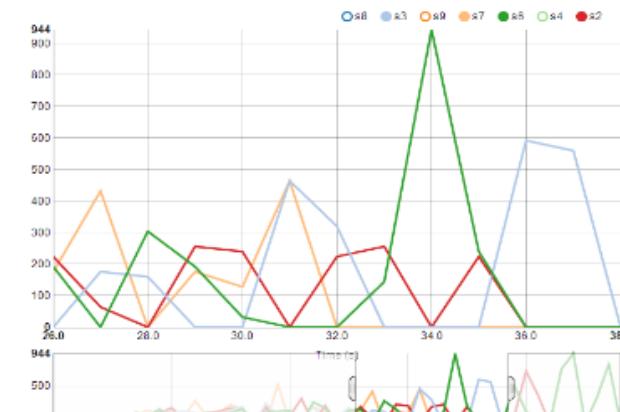
(1) Bar Chart



(2) StackArea Graph

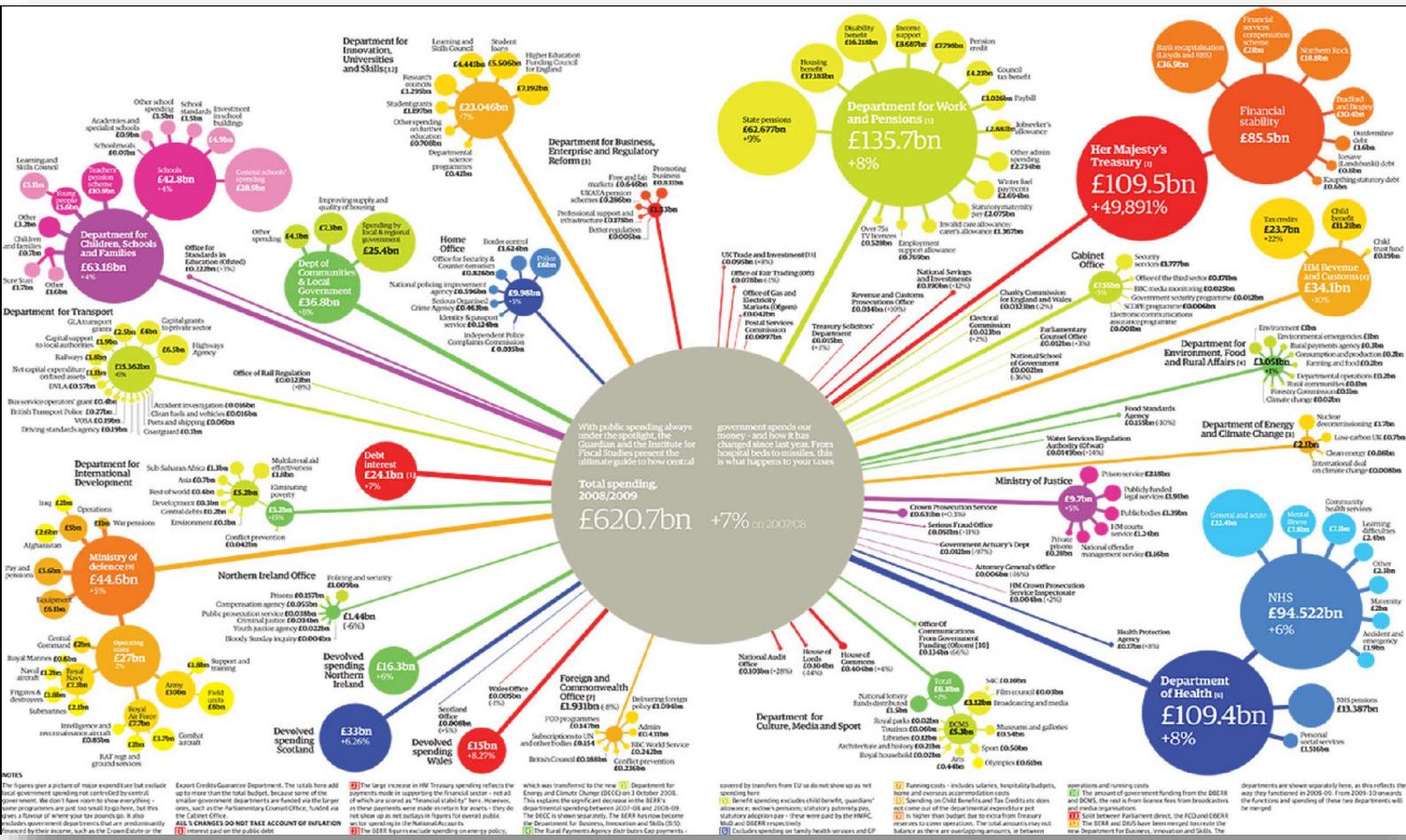


(3) Pie Chart



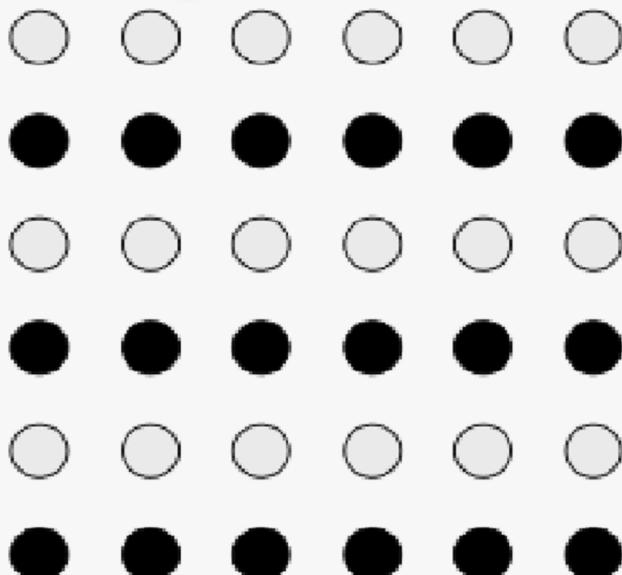
(4) Line Graph

Presentation of Data concerns how data is integrated into the overall communicated work including choice of **colours**, annotations, and interactive features.



Visual Perception Abilities relates to the scientific understanding of how our eyes and brains process information most effectively.

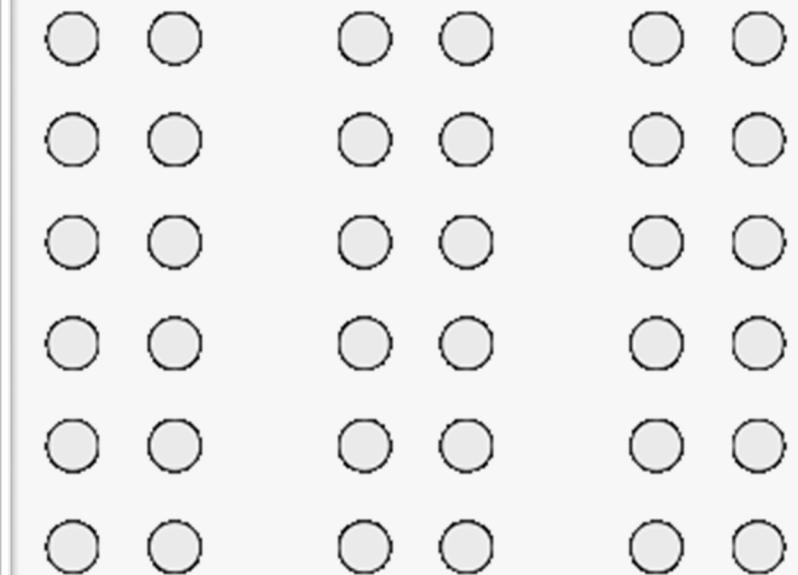
Similarly shaded circles are grouped and separated from non-shaded rows.



Preattentive Reaction

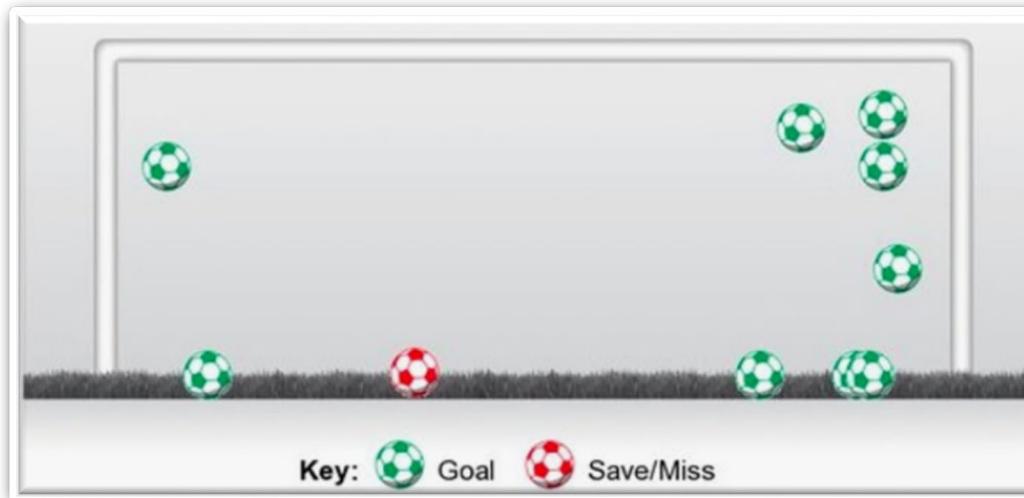
Gestalt Laws of Similarity

We do not really see six columns, rather we view them as three clusters.



Gestalt Laws of Proximity

Preattentive Visual Perception



Amplify Cognition

is about maximizing how efficiently and effectively we are able to process the information into thoughts, insights, and knowledge.

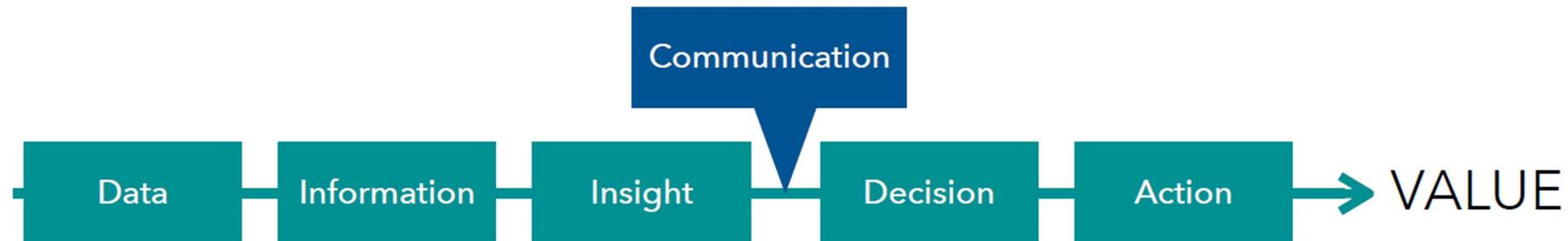
Ultimately,

the objective of data visualisation should be to make a reader or users feel like they have become better informed about a subject.

From Analytics to Visualisations

The goal of business analytics is to derive insights and have them drive individual/organisational decision making and action.

This only happens when there is **effective communication** and understanding of the insight.



That communication is done using **visualisation**.

Visualisations are a useful and powerful way to communicate our data and analyses.

3. Narratives

- Use visualisations to tell a “data story”.

Three elements work together in a visualisation.

1. Data

- The facts to be presented in visualisations.

2. Visuals

- People have (naturally) highly developed perception-to-cognition capabilities.
- Visualisations allow people to see patterns, trends, context.

Visual + Data = **Enlightening**, but what decision should I be taking?

Moonville: active users over time



Data source: ABC Report. For purpose of analysis "active user" is defined as the number of unique users in the past 30 days.

Visual + Data + Narrative = Action

Moonville: active users over time

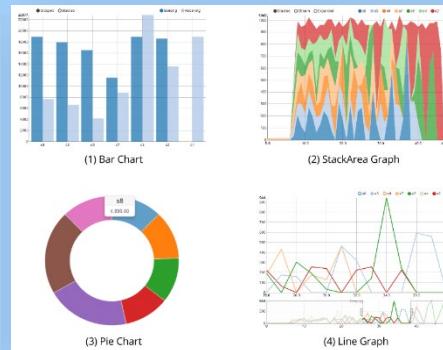


Data source: ABC Report. For purpose of analysis "active user" is defined as the number of unique users in the past 30 days.

DATA REPRESENTATION

DATA REPRESENTATION

How to give form using “visual variables”
to construct **chart or graph types**.



“Obesity is, on average, inversely proportional to the average education of a population”.

How can you show the evidence for this?

Example: Obesity

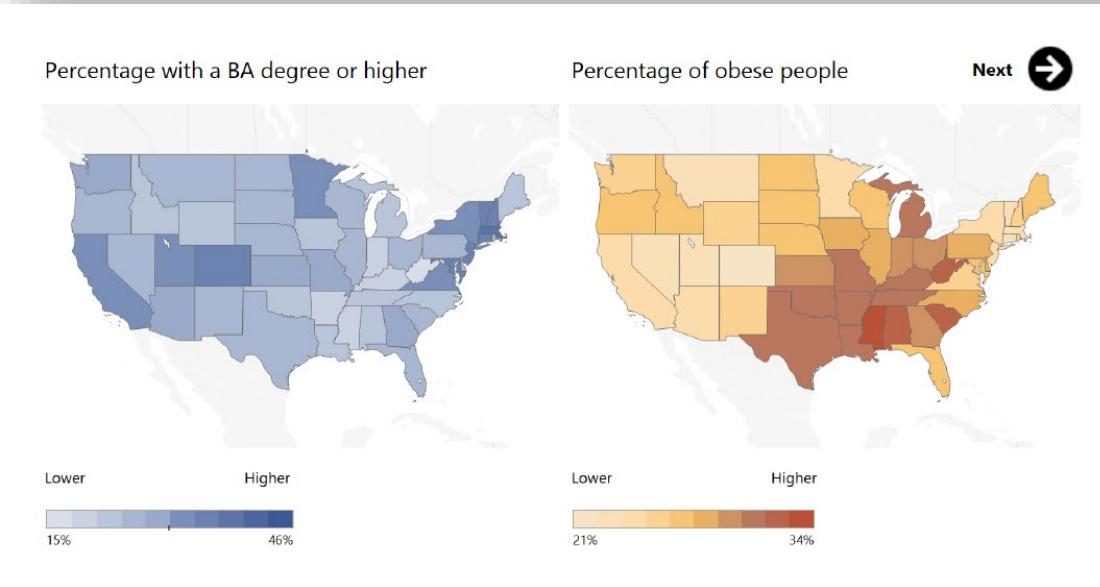
How would we visualise this?

“Obesity is, on average, inversely proportional to the average education of a population”.

Attempt 1:
Circle Maps

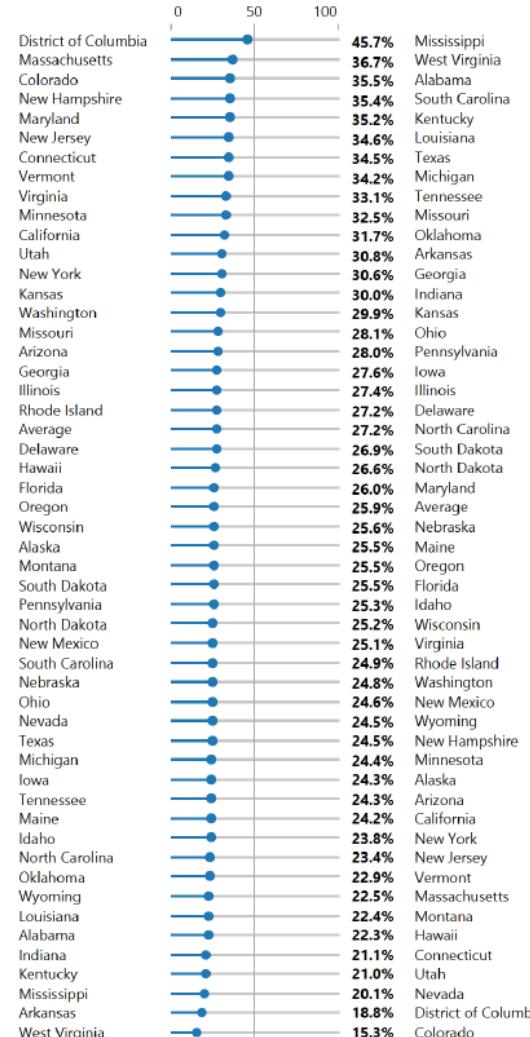


Attempt 2:
Filled Maps



“Obesity is, on average, inversely proportional to the average education of a population”.

Percentage with a BA degree or higher



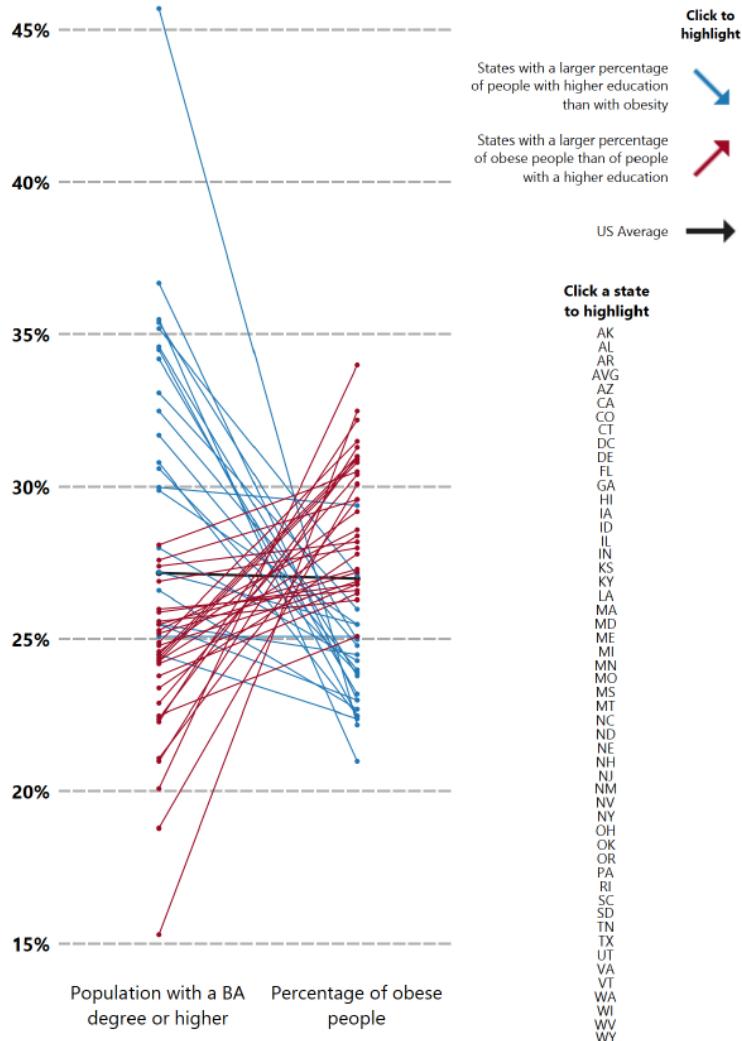
Percentage of obese people

Next →

Attempt 3:
Lollipops

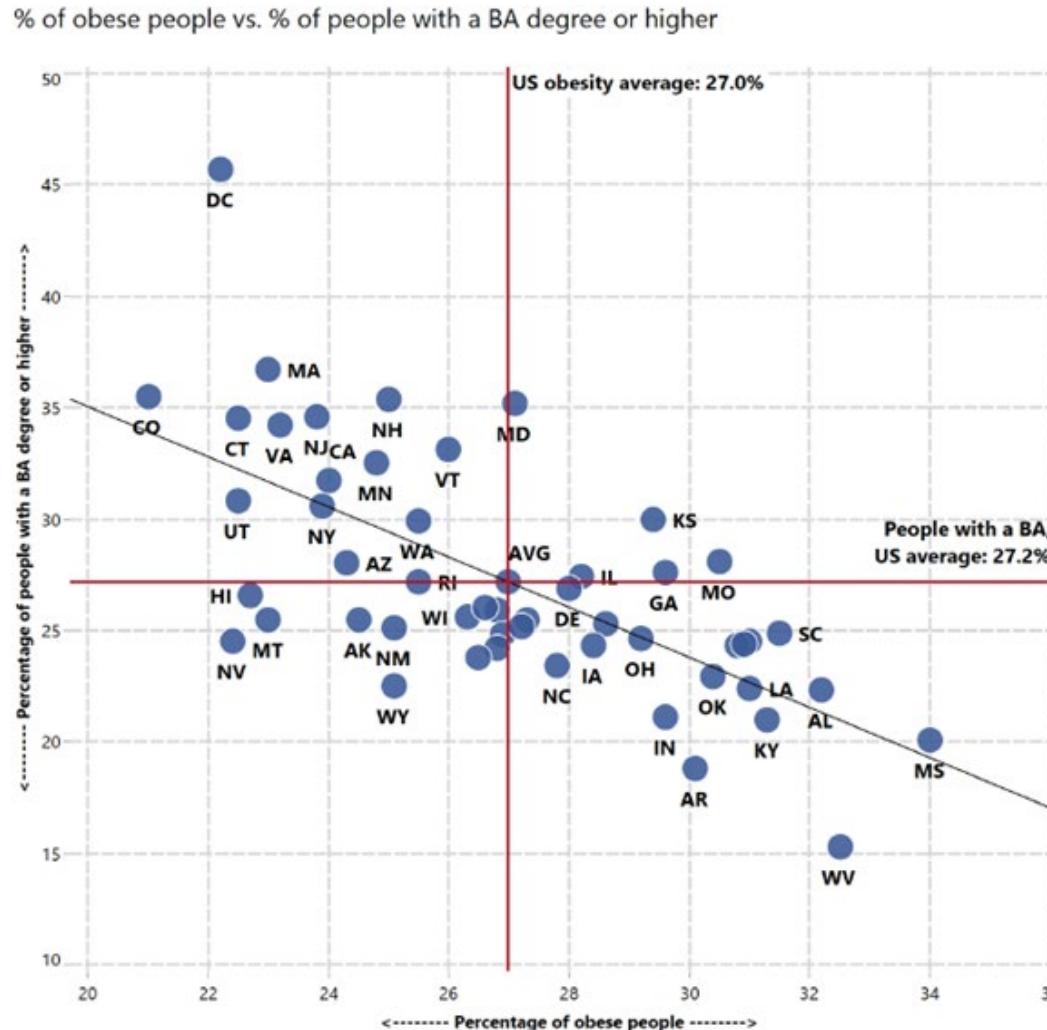
Attempt 4:
Slope
Graph

Obesity is, on average, inversely proportional to the average education of the population



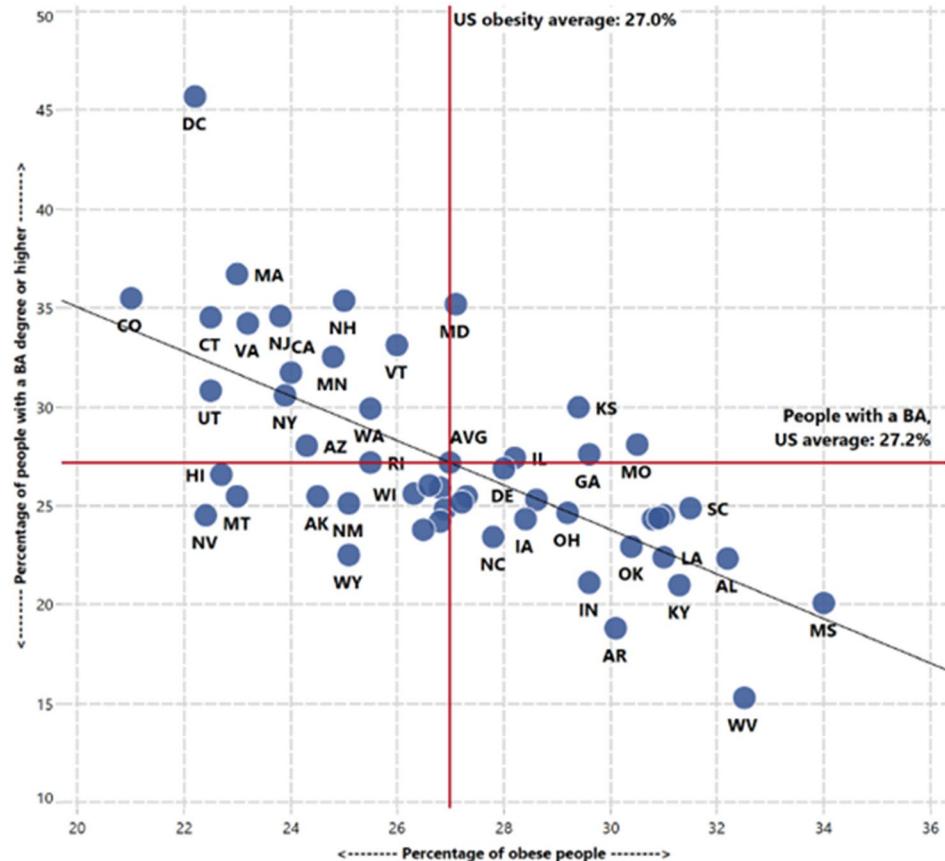
“Obesity is, on average, inversely proportional to the average education of a population”.

Attempt 5:
Scatterplot

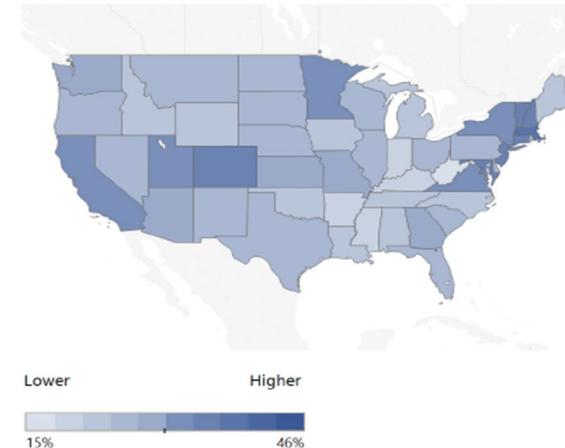


Scatterplot is a Better Representation

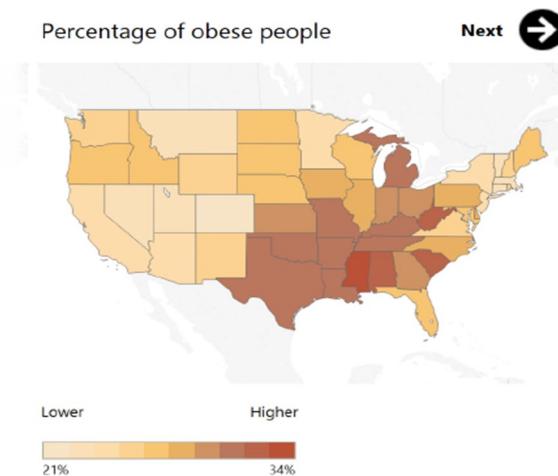
% of obese people vs. % of people with a BA degree or higher



Percentage with a BA degree or higher

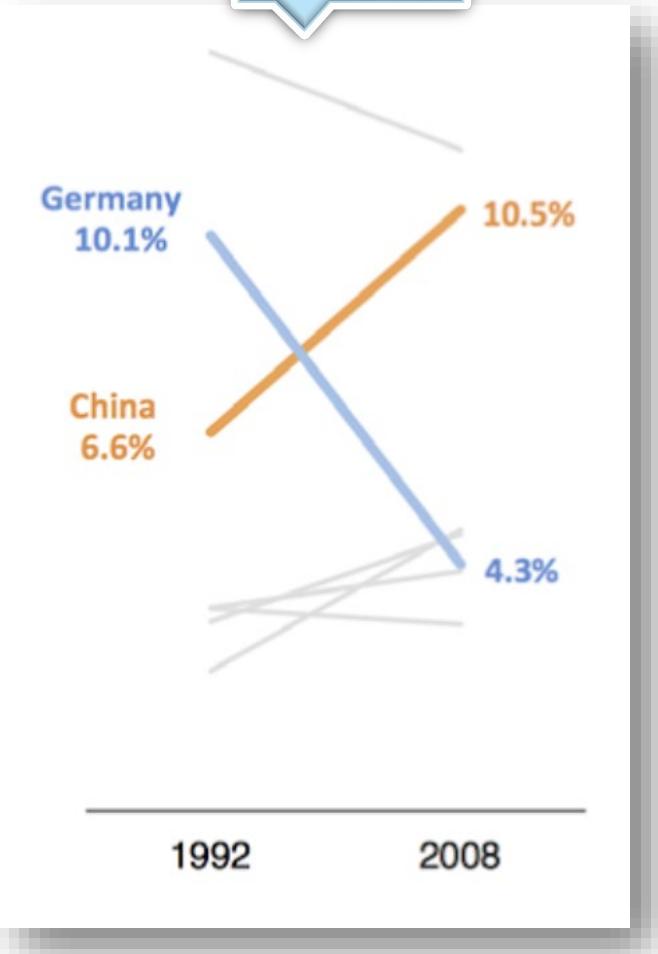


Percentage of obese people

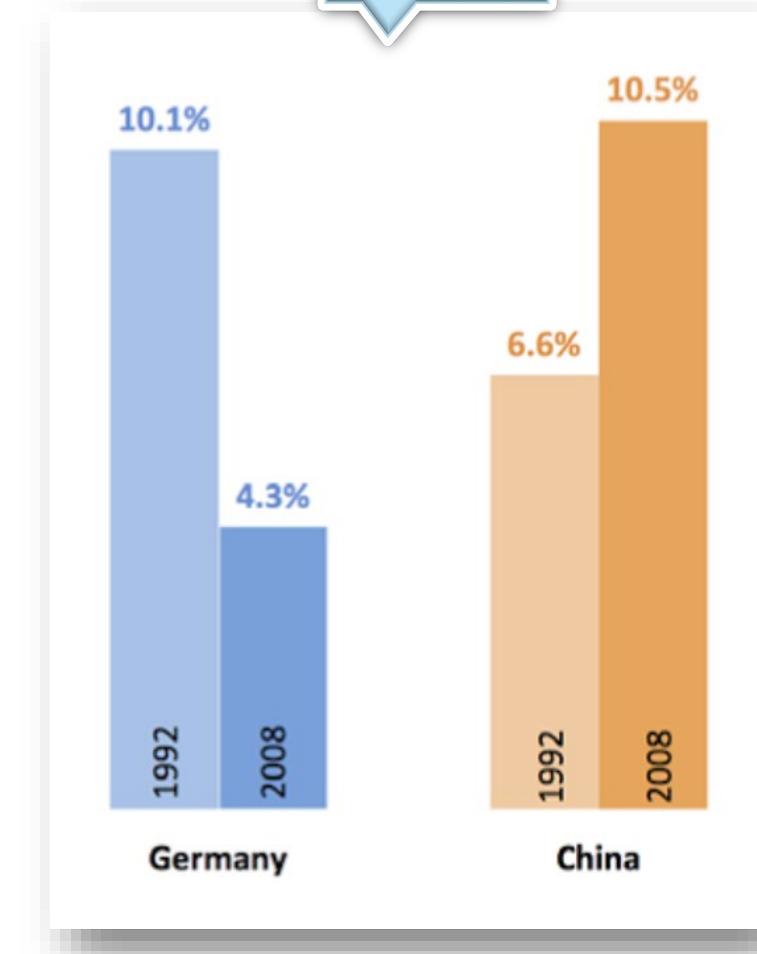


Some visualisations **work better** than others ..1/2

Slope Graph

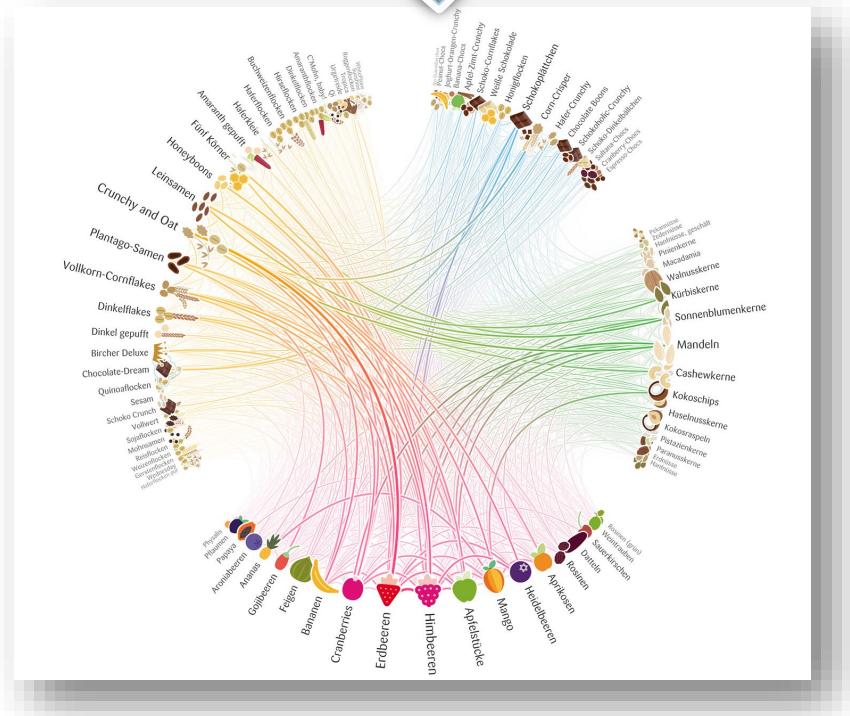


Bar Chart

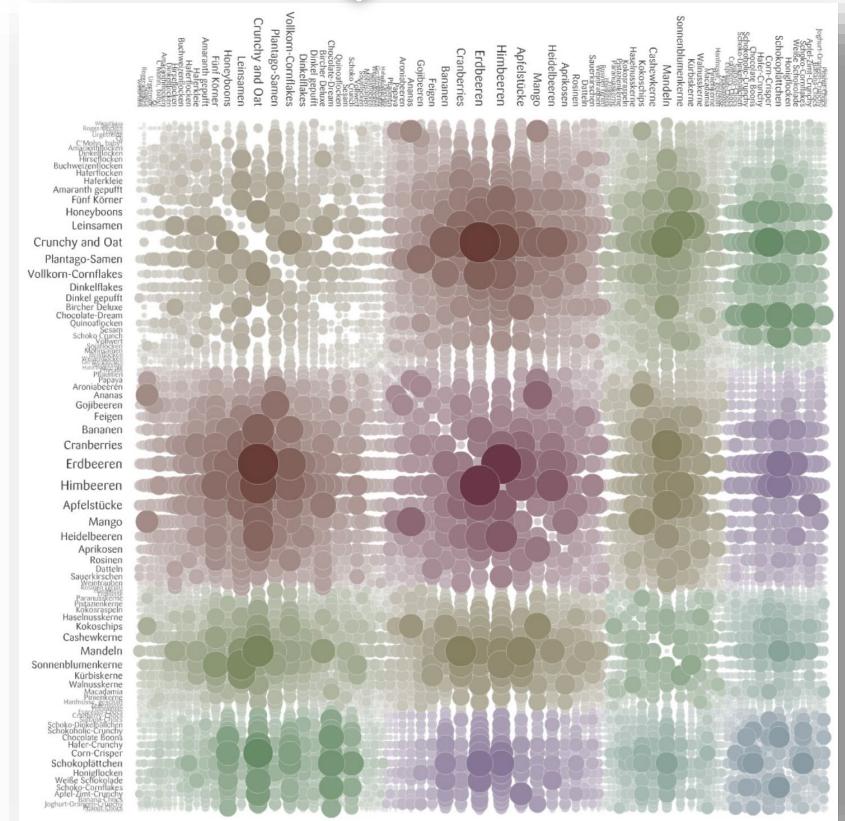


Some visualisations **work better** than others ..2/2

Radial Network Diagram



Matrix Chart

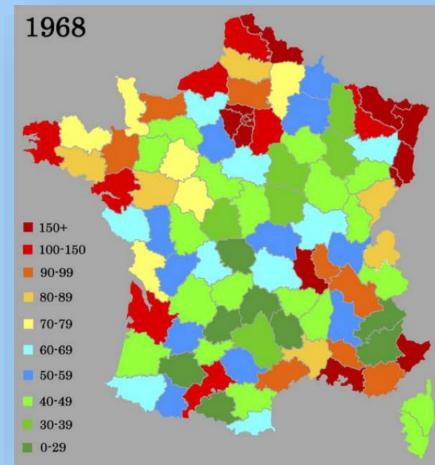


DATA PRESENTATION

DATA PRESENTATION

About delivery format, appearance, and synthesis of the entire design.

It concerns the layers of colour use, interactivity, annotation, and the arrangement of all elements.



Using Colours

Guiding decisions about using colour:

- Make sure it is used unobtrusively.
- It does not mislead by implying representation when it should not be.

As with all design layers, the sensible objective should be to **achieve for elegance** rather than **novelty, eye-candy, or attractiveness**.

To achieve this, important to be aware of the different functions, choices, and potential issues surrounding colour deployment.

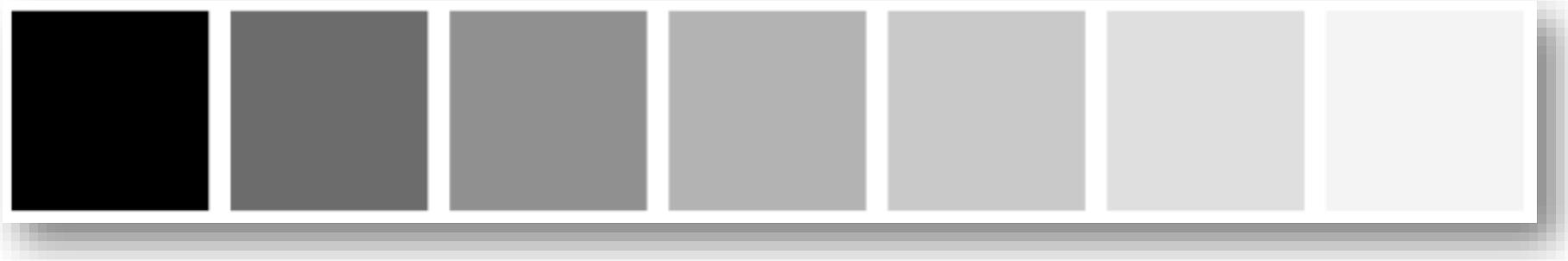
Which is Bigger?
Green or Blue?



Using Colour to represent
quantitative data is a mistake!

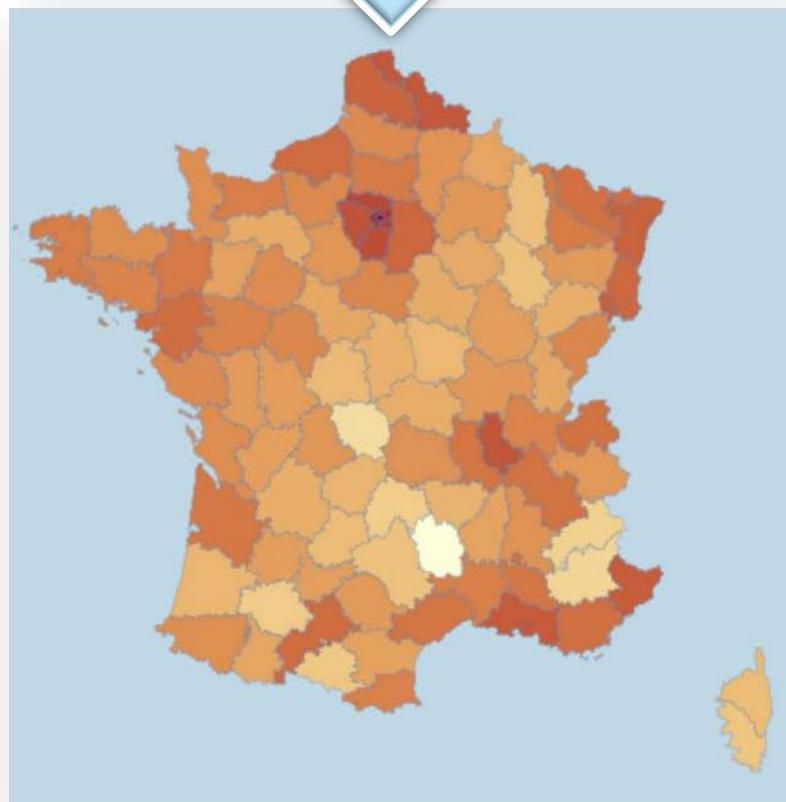
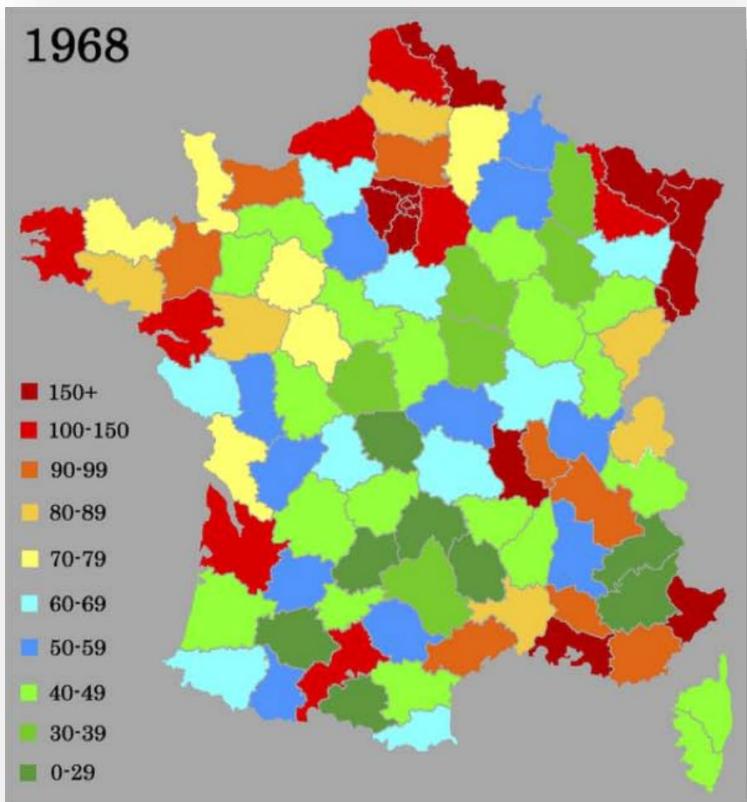
Use lightness property of colour
to effectively depict a range of
quantitative values!

From the most intense through
to increasing amounts of white.



Which is preferred?

Preferred



Colour Shaded Table provides Clarity

Plain Table

Category	Year of Ord..	Order Date											
		January	February	March	April	May	June	July	August	September	October	November	December
Furniture	2014	\$6,243	\$1,840	\$14,574	\$7,945	\$6,913	\$13,206	\$10,821	\$7,320	\$23,816	\$12,304	\$21,565	\$30,646
	2015	\$11,740	\$3,134	\$12,500	\$10,476	\$9,375	\$7,714	\$13,674	\$9,639	\$26,273	\$12,027	\$30,881	\$23,086
	2016	\$7,623	\$3,926	\$12,801	\$13,212	\$15,120	\$13,071	\$13,069	\$12,483	\$27,263	\$11,873	\$31,784	\$36,679
	2017	\$5,964	\$6,866	\$10,893	\$9,066	\$16,958	\$19,009	\$11,813	\$15,442	\$29,028	\$21,884	\$37,057	\$31,407
Office Supplies	2014	\$4,851	\$1,072	\$8,606	\$11,155	\$7,136	\$12,953	\$15,121	\$11,379	\$27,423	\$7,211	\$26,862	\$18,006
	2015	\$1,809	\$5,368	\$15,883	\$12,559	\$9,114	\$10,648	\$4,720	\$11,735	\$19,306	\$8,673	\$21,218	\$16,202
	2016	\$5,300	\$6,794	\$17,347	\$10,647	\$13,035	\$10,902	\$12,924	\$8,960	\$23,264	\$16,282	\$20,487	\$37,998
	2017	\$21,274	\$7,408	\$14,550	\$15,072	\$13,737	\$16,912	\$10,241	\$30,060	\$31,896	\$23,037	\$31,472	\$30,437
Technology	2014	\$3,143	\$1,609	\$32,511	\$9,195	\$9,600	\$8,436	\$8,004	\$9,210	\$30,538	\$11,938	\$30,201	\$20,893
	2015	\$4,625	\$3,449	\$10,344	\$11,161	\$11,643	\$6,435	\$10,371	\$15,525	\$19,017	\$10,705	\$23,874	\$35,632
	2016	\$5,620	\$12,259	\$21,568	\$14,891	\$28,833	\$16,372	\$13,269	\$9,672	\$22,883	\$31,533	\$27,141	\$22,323
	2017	\$16,733	\$6,027	\$33,429	\$12,383	\$13,567	\$17,061	\$23,210	\$17,619	\$26,943	\$32,856	\$49,919	\$21,985

Colour
Shaded

Category	Year of Ord..	Order Date											
		January	February	March	April	May	June	July	August	September	October	November	December
Furniture	2014	\$6,243	\$1,840	\$14,574	\$7,945	\$6,913	\$13,206	\$10,821	\$7,320	\$23,816	\$12,304	\$21,565	\$30,646
	2015	\$11,740	\$3,134	\$12,500	\$10,476	\$9,375	\$7,714	\$13,674	\$9,639	\$26,273	\$12,027	\$30,881	\$23,086
	2016	\$7,623	\$3,926	\$12,801	\$13,212	\$15,120	\$13,071	\$13,069	\$12,483	\$27,263	\$11,873	\$31,784	\$36,679
	2017	\$5,964	\$6,866	\$10,893	\$9,066	\$16,958	\$19,009	\$11,813	\$15,442	\$29,028	\$21,884	\$37,057	\$31,407
Office Supplies	2014	\$4,851	\$1,072	\$8,606	\$11,155	\$7,136	\$12,953	\$15,121	\$11,379	\$27,423	\$7,211	\$26,862	\$18,006
	2015	\$1,809	\$5,368	\$15,883	\$12,559	\$9,114	\$10,648	\$4,720	\$11,735	\$19,306	\$8,673	\$21,218	\$16,202
	2016	\$5,300	\$6,794	\$17,347	\$10,647	\$13,035	\$10,902	\$12,924	\$8,960	\$23,264	\$16,282	\$20,487	\$37,998
	2017	\$21,274	\$7,408	\$14,550	\$15,072	\$13,737	\$16,912	\$10,241	\$30,060	\$31,896	\$23,037	\$31,472	\$30,437
Technology	2014	\$3,143	\$1,609	\$32,511	\$9,195	\$9,600	\$8,436	\$8,004	\$9,210	\$30,538	\$11,938	\$30,201	\$20,893
	2015	\$4,625	\$3,449	\$10,344	\$11,161	\$11,643	\$6,435	\$10,371	\$15,525	\$19,017	\$10,705	\$23,874	\$35,632
	2016	\$5,620	\$12,259	\$21,568	\$14,891	\$28,833	\$16,372	\$13,269	\$9,672	\$22,883	\$31,533	\$27,141	\$22,323
	2017	\$16,733	\$6,027	\$33,429	\$12,383	\$13,567	\$17,061	\$23,210	\$17,619	\$26,943	\$32,856	\$49,919	\$21,985

Types of Functions and Features in Interactivity

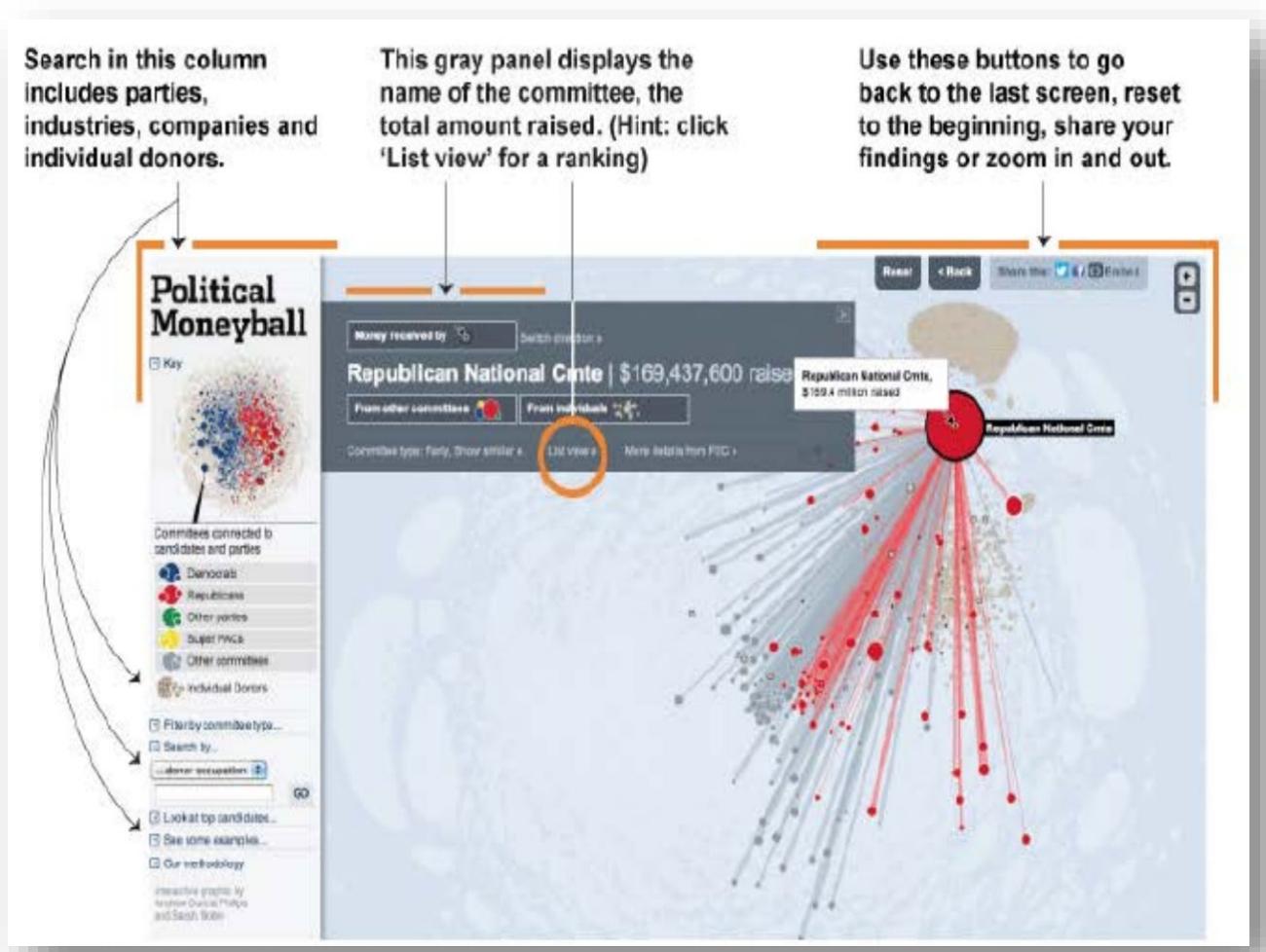
Manipulating variables and parameters

Adjusting the view

Annotated details

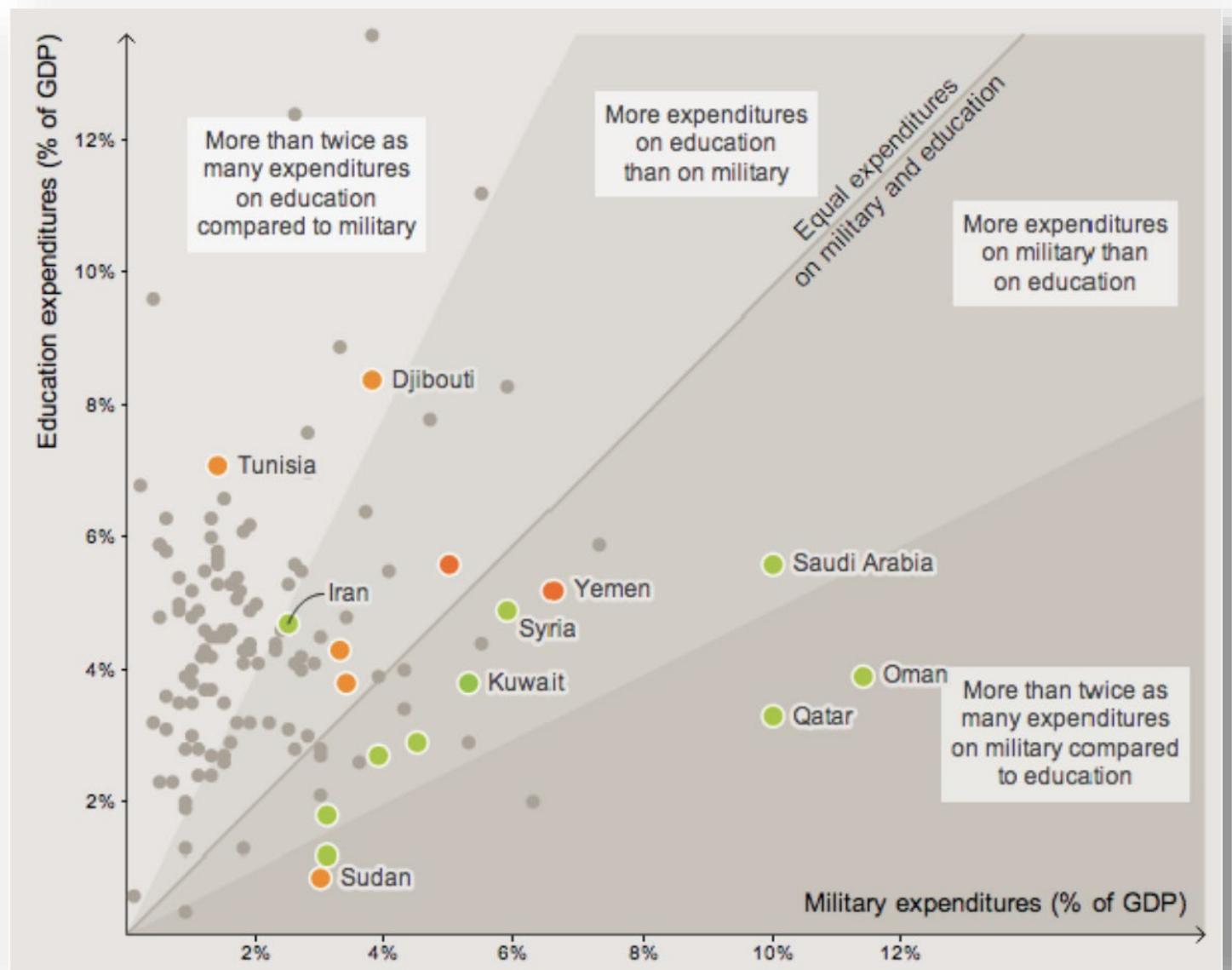
Animation: [Visualizing US expansion through post offices](#)
(<https://vimeo.com/27376376>)

Annotation can help explain and facilitate the viewing and interpretive experience!



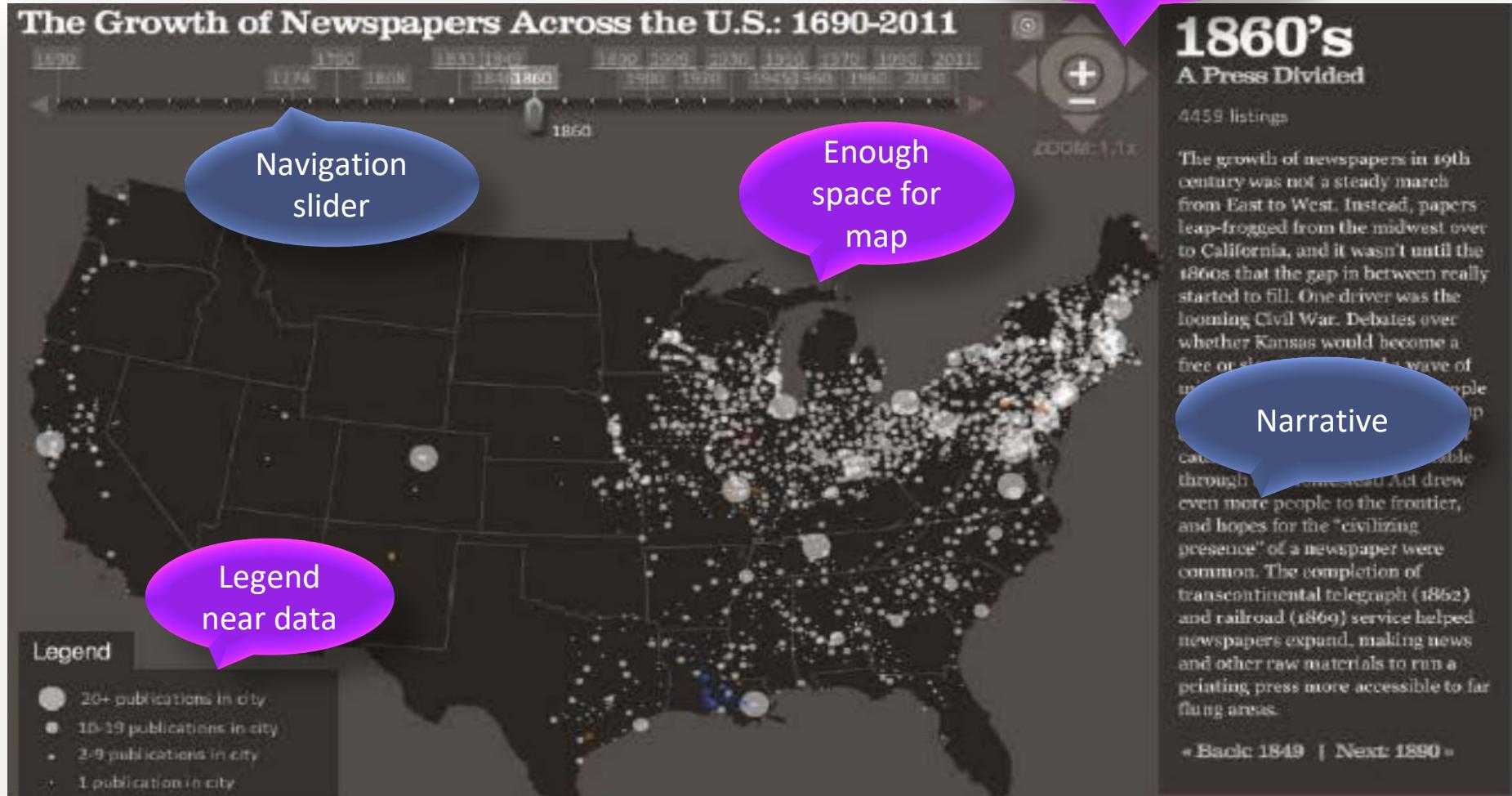
Consider: Titles, Introductions, User guides, Labels, Captions and narrative.

Visual annotation



Consider: Visual annotation (using chart or graphic devices), Legends and keys, Units, Data sources, Attribution.

Decisions meant to maximize:
The logic and meaning behind layout of project's data,
interactive features and annotated elements.



DATA REPRESENTATION AND PRESENTATION TOGETHER

Representation and presentation choices are important!
They help viewers create a mental model, interpret and understand data, as they **decode** the visualization.

Perceiving

The attempt of viewers to efficiently decode the representations of the data, as displayed through a visualisation, and then convert them into perceived values.

Comprehending

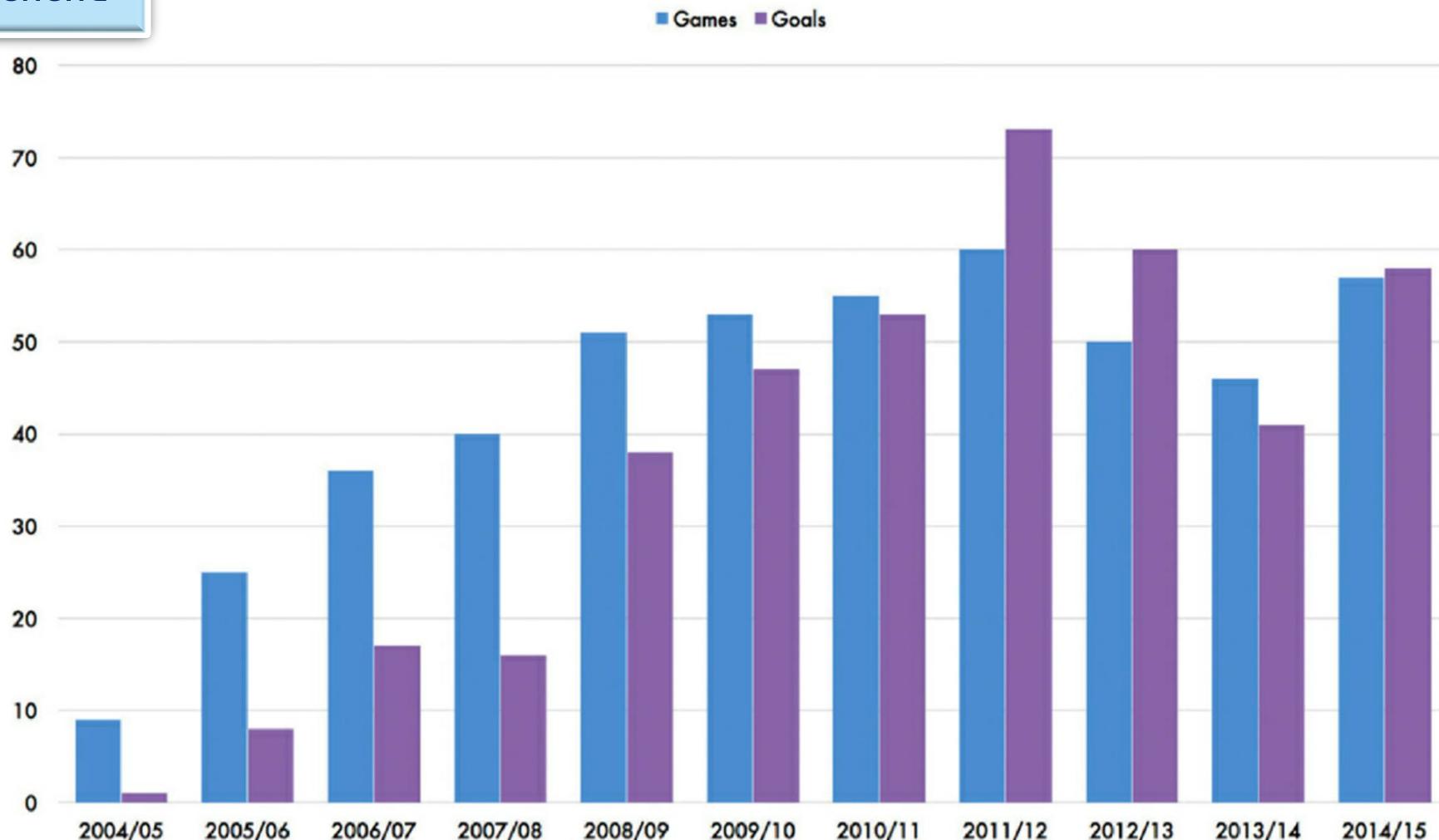
Reasoning the consequence of the perceiving and interpreting stages to arrive at a personal reflection of what all this means.

**But how does this decoding process work, cognitively?
In 3 steps.**

Interpreting

The viewer's ability to form interpretations is influenced by their pre-existing knowledge about the portrayed subject matter, and their capacity to utilise that knowledge to frame the implications of what has been read/viewed.

Lionel Messi: Games and Goals for FC Barcelona



WHAT MAKES FOR A GOOD DATA VISUALIZATION?

A Good Data Visualisation

Must be accurate and not misrepresent data.

Must be easy to understand.

Relates to your audience.

Only shows what is necessary.

SOME DESIGN PRINCIPLES

Some Design Principles

Use your ink strategically.

Use good text design.

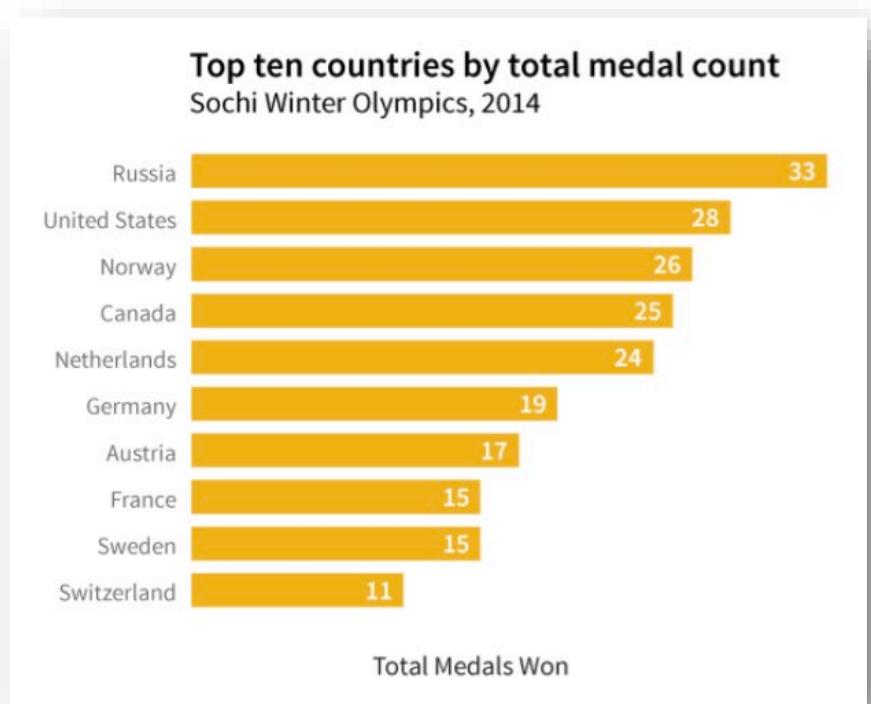
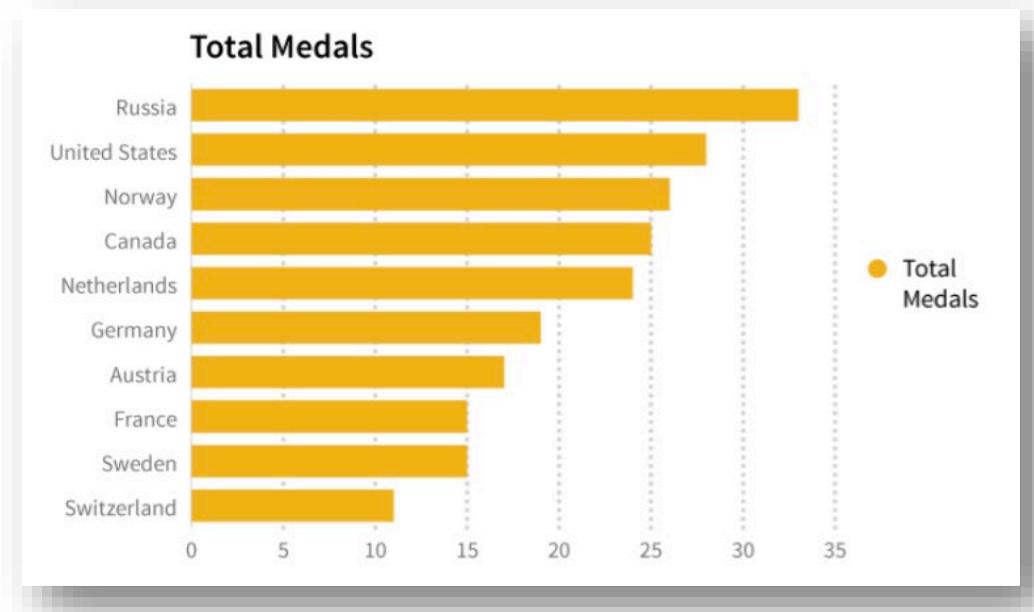
Use good colour design.

Use icons, photography and interactivity appropriately.

Use Your Ink Strategically

Every single line, word, and shape should aid in the understanding of the graphic. If not, delete.

Add elements when helpful.



Use Good Text Design

Use sans serif fonts (**Helvetica, Arial, Gill Sans are good options**).

Ways to create emphasis: **ALL CAPS, bold, italics, bigger.**

Keep fonts consistent.

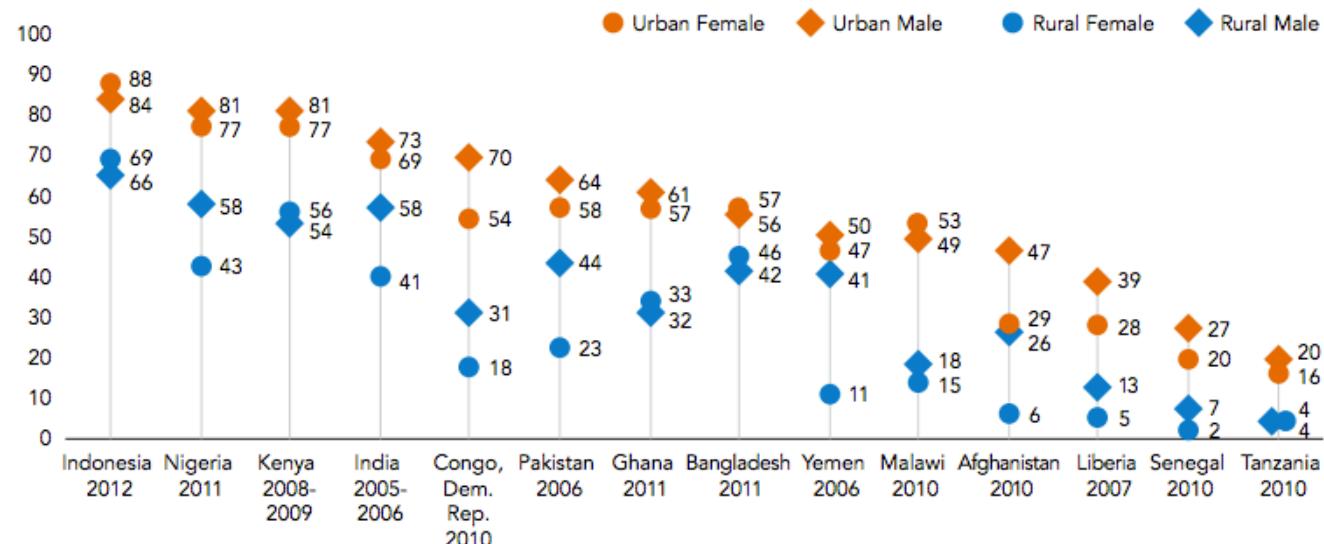
Can use title text for takeaway message.

Put the Key Message Right in the Title

Young People in Urban Areas Are Likely to Stay in School Longer.

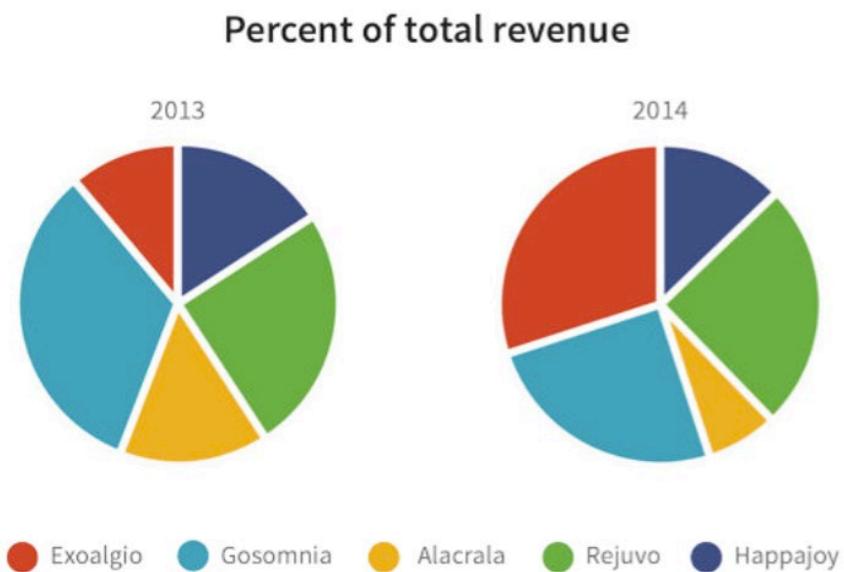
Overall, young people in urban areas have a greater chance of completing lower secondary school than their rural counterparts. Young men have more educational advantages and higher completion rates in both urban and rural settings, with a few exceptions. Gender gaps in education can vary widely in both urban and rural areas, as seen in Afghanistan, Kenya, and Yemen. While the gender gap may be closing in some countries, the gap between urban and rural educational attainment remains wide.

Percent of Young People Ages 15-24 Who Have Completed Lower Secondary School



Source: UNESCO, World Inequality Database on Education. Based on original data from ICF International, Demographic and Health Surveys and UNICEF, Multiple Indicator Cluster Surveys.

Use Text Instead of Graph



Exoalgio's revenue grew
| | 0%
between 2013 and 2014.

Colour Tips

Darker/brighter colours will read as “more”.

Use grey to denote neutral or unimportant data.

Utilize white space.

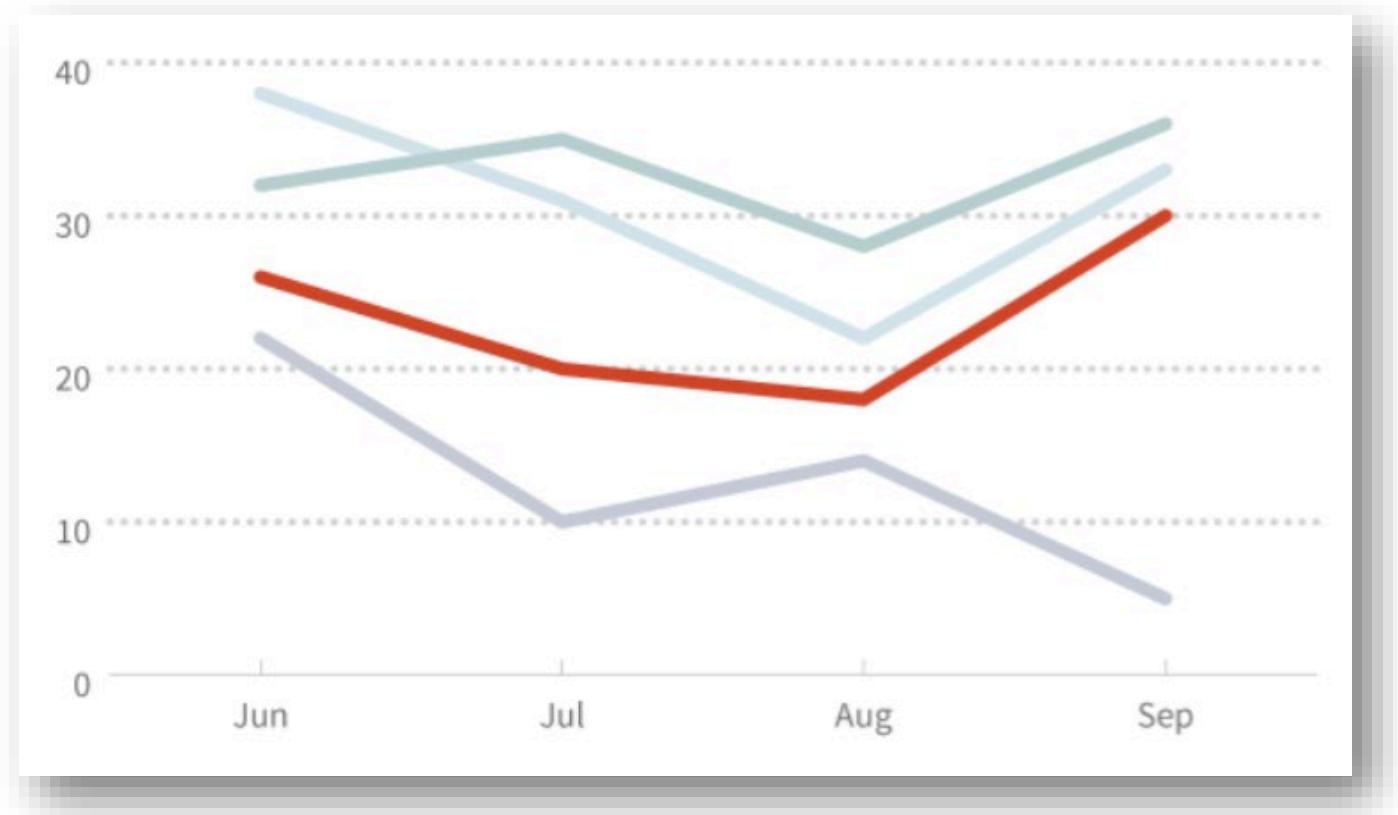
Every colour used must have a reason for being there and should be distinct.

Choose appropriate colour palette and keep them consistent.

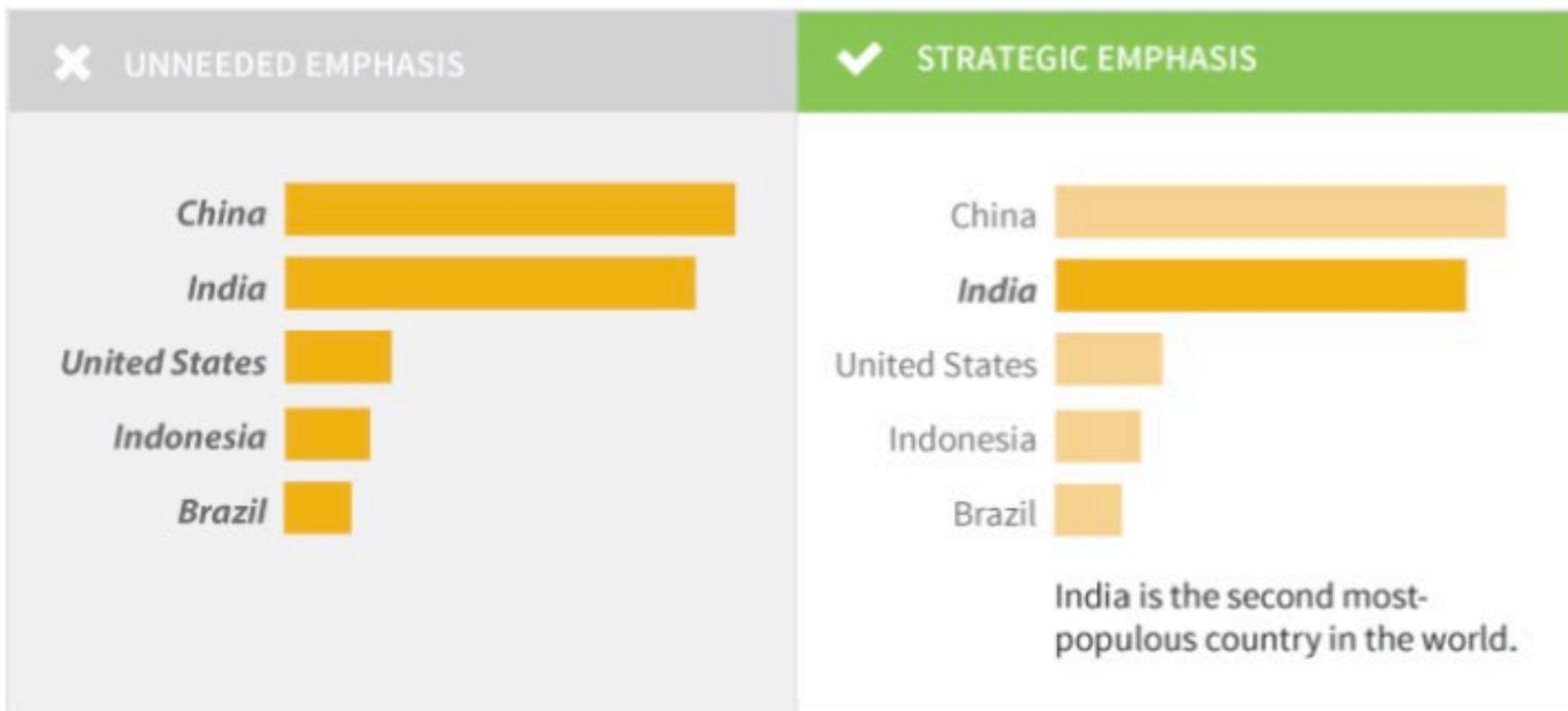
Colour Has Meaning

The higher the contrast between objects, the more differently they are perceived.

Colours also have symbolic meaning.

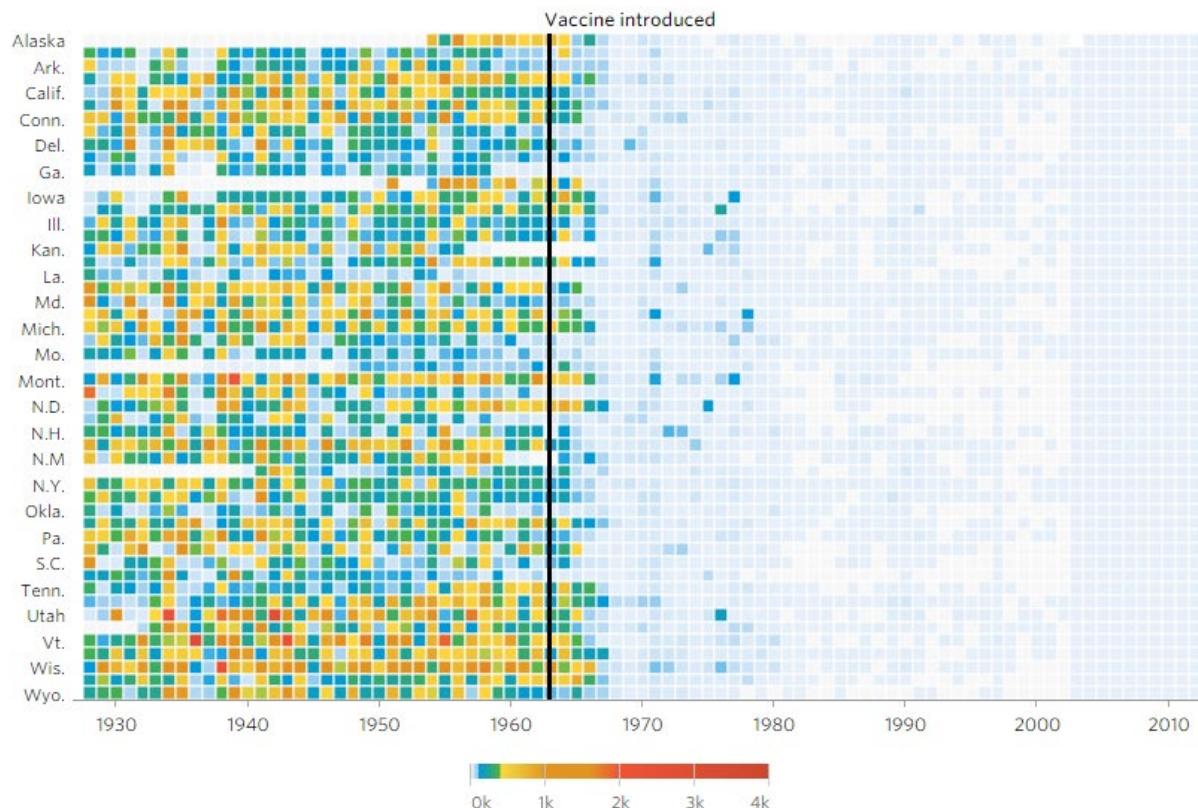


Colour Ideas ..1/2



Colour Ideas ..2/2

Measles



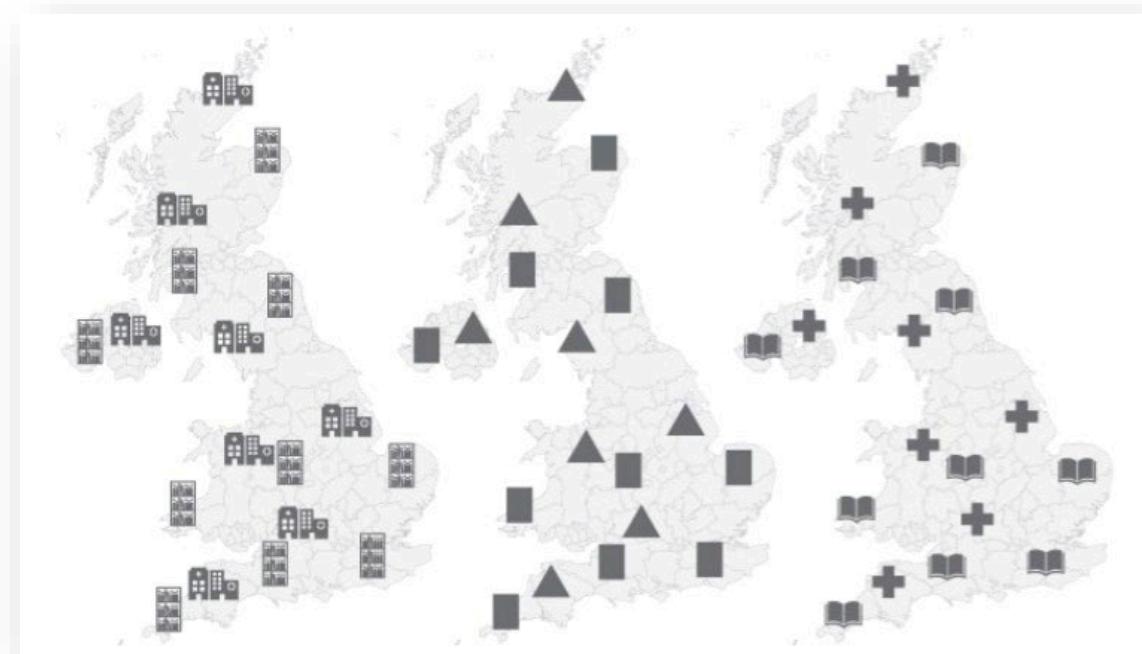
Use Icons, Photography and Interactivity Appropriately



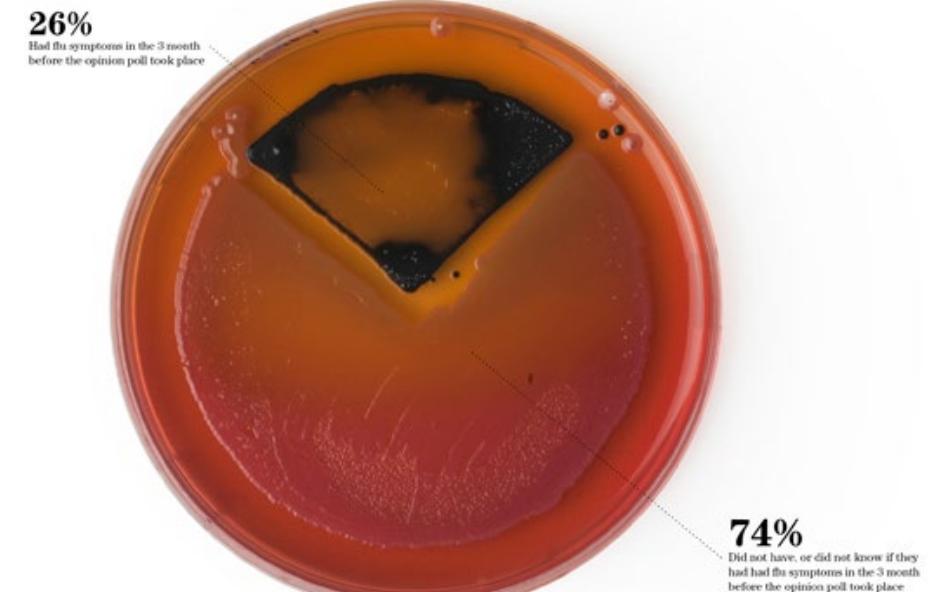
FAMILY PLANNING &
REPRODUCTIVE HEALTH

Icons

Can you tell which map is showing
libraries and hospitals?



Photography

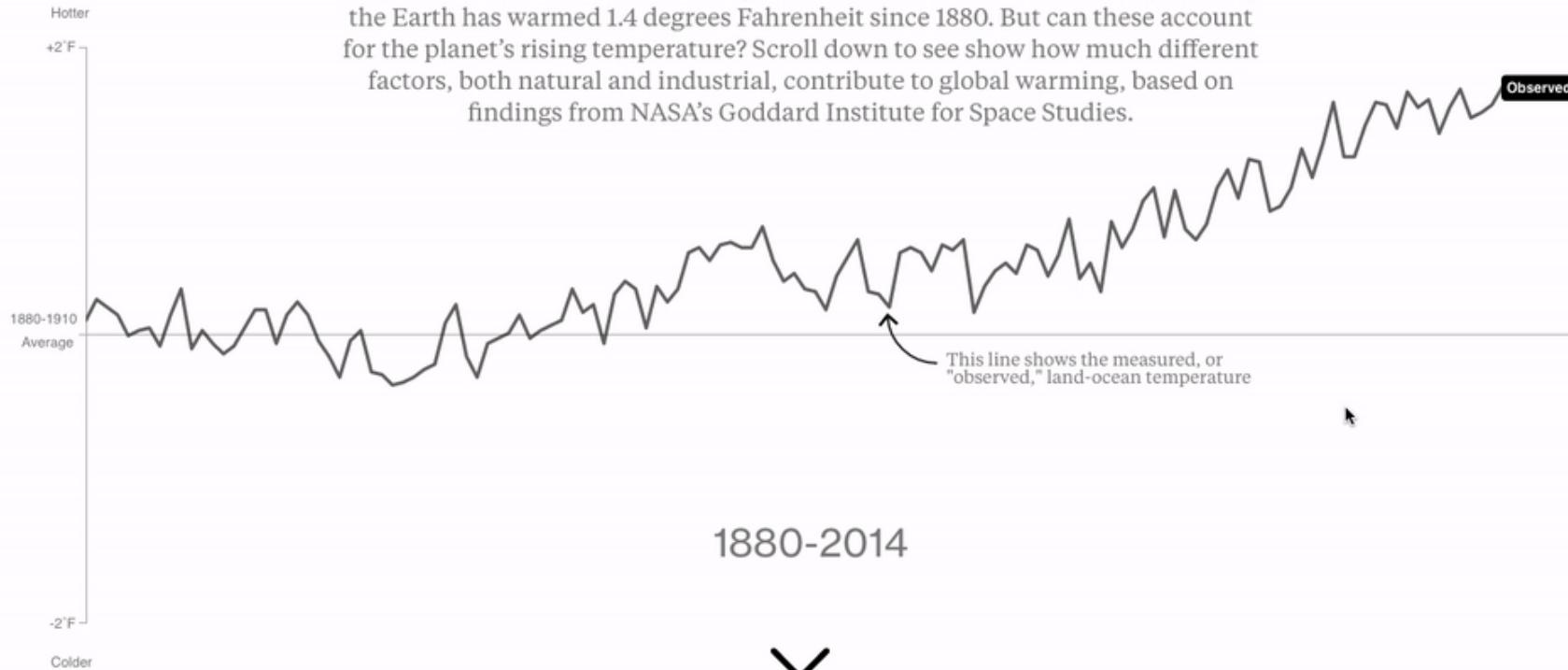


Interactivity

What's Really Warming the World?

By Eric Roston  and Blacki Migliozi  | June 24, 2015

Skeptics of manmade climate change offer various natural causes to explain why the Earth has warmed 1.4 degrees Fahrenheit since 1880. But can these account for the planet's rising temperature? Scroll down to see how much different factors, both natural and industrial, contribute to global warming, based on findings from NASA's Goddard Institute for Space Studies.



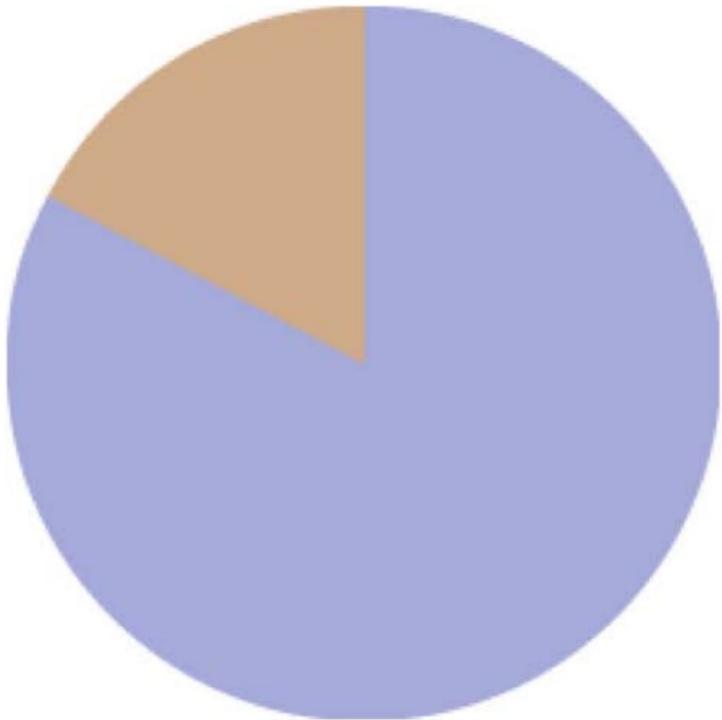
DO NOT DECEIVE!

Do Not Deceive the Audience ..1/4

Ineffective and inappropriate data representation could lead to potential deception, intentionally or otherwise.

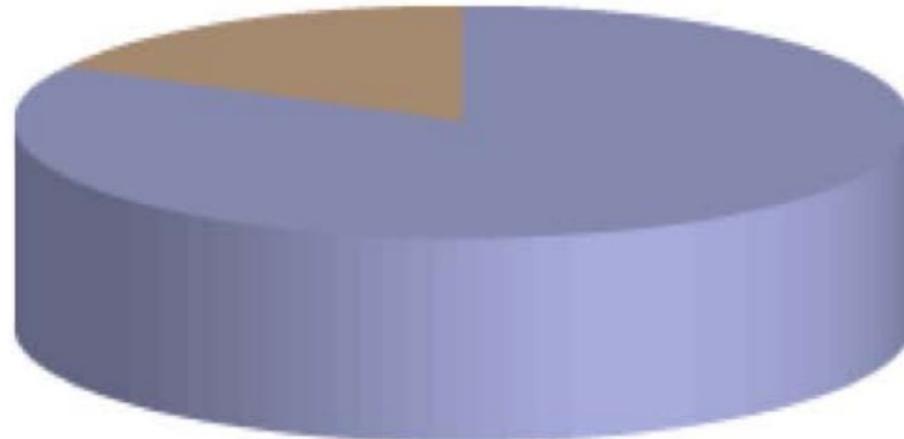
This is often due to a simple lack of understanding of visual perception.

Do Not
Deceive the
Audience
.2/4



Actual:

Purple = 82% segment
Brown = 18% segment



Perceived as:

Purple = 91% segment
Brown = 9% segment

Do Not
Deceive the
Audience
.3/4



Perspective has
its problem.
It can be
misread!

Do Not
Deceive the
Audience
.4/4

Wikipedia is there when you need it — now it needs you.

\$0.8M USD

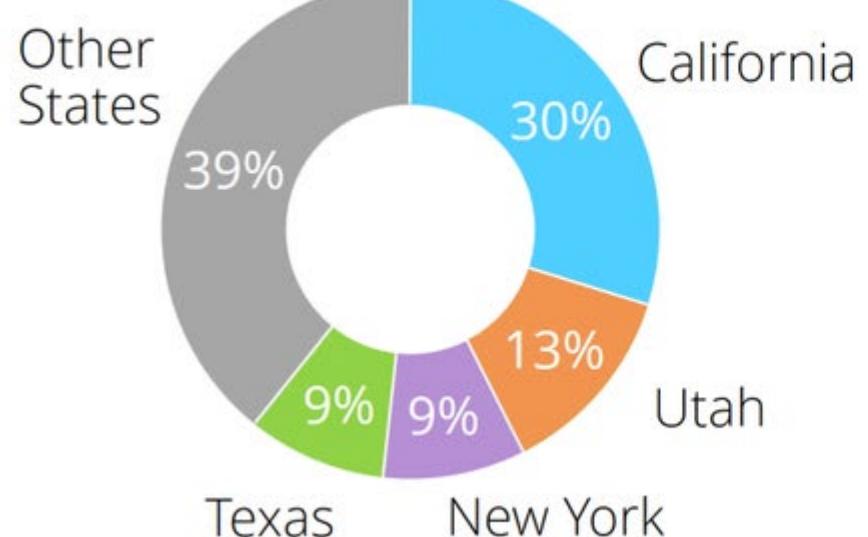
\$7.5M USD



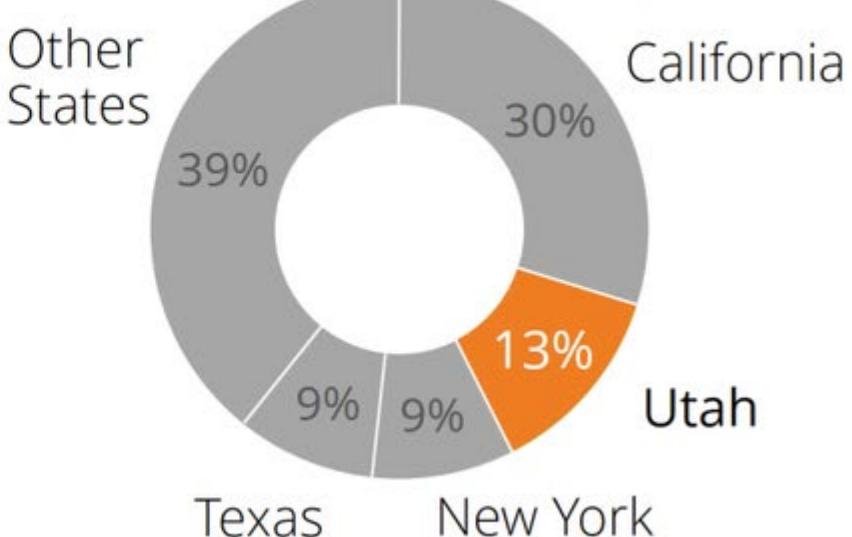
SOME FURTHER CONSIDERATIONS

More Does
Not Mean
Good!

Many different
potential stories
competing for
attention



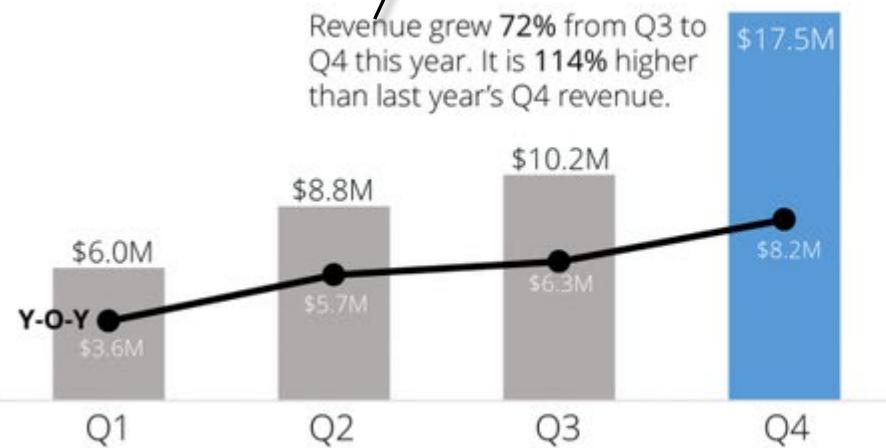
Be specific:
support a
better data
story



Have Explanatory, Not Descriptive Text!

Descriptive text of what happened with revenue between Q3 and Q4.

Explanatory text helps to increase the audience's understanding of what happened.



VISUALISATION'S FUNCTIONS

3 Types of Function

Exploratory: Provide an interface to data in order to facilitate visual exploration.

Explanatory: Convey an explanatory portrayal of data to a reader.

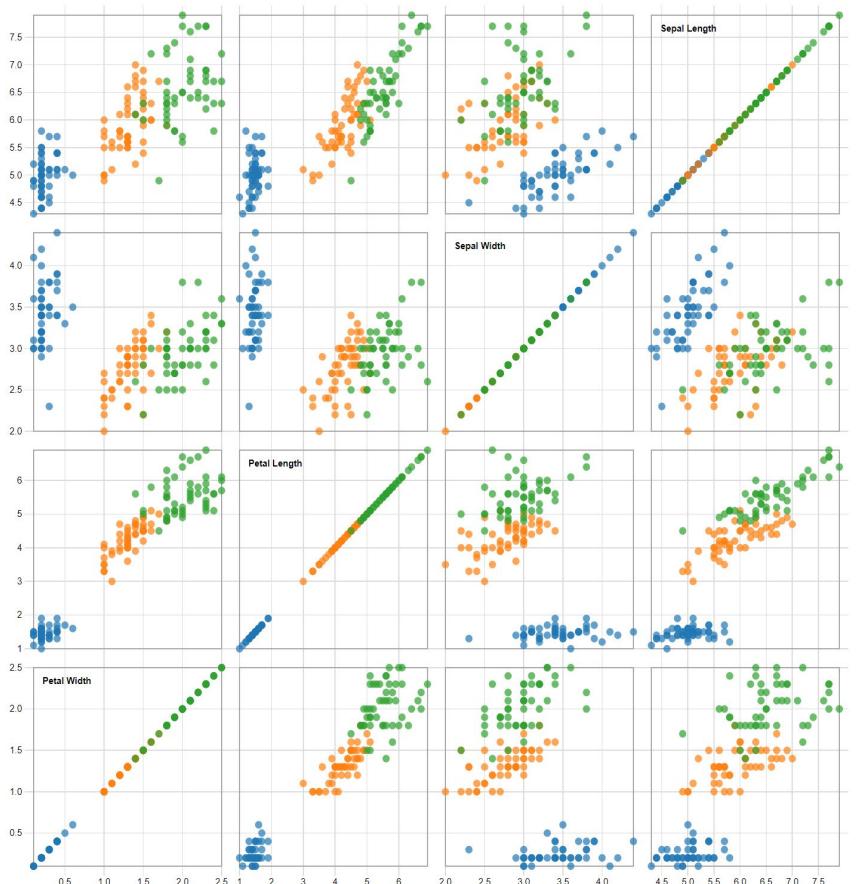
Exhibition: Use data as an exhibition of self-expression.

Exploratory

They are more about **visual analysis** than just the visual presentation of data.

Aim to provide user with an interface to **visually explore the data**; to seek out personal **discoveries, patterns, relationships**, thereby triggering and iterating curiosities.

Example: Exploratory



A **scatterplot matrix** visualization.

A method used to **reveal correlations across a multivariate dataset**, enabling the eye to efficiently scan the entire matrix to quickly identify variable pairings with strong or weak relationships.

A perfect example of an **exploratory visualization design**.

Explanatory

Explanatory data visualization is about **conveying information** to a reader in a way that is based around a **specific and focused narrative**.

It requires a **designer-driven, editorial approach** to synthesize the requirements of your target audience with the key insights and most important analytical dimensions you are wishing to convey.

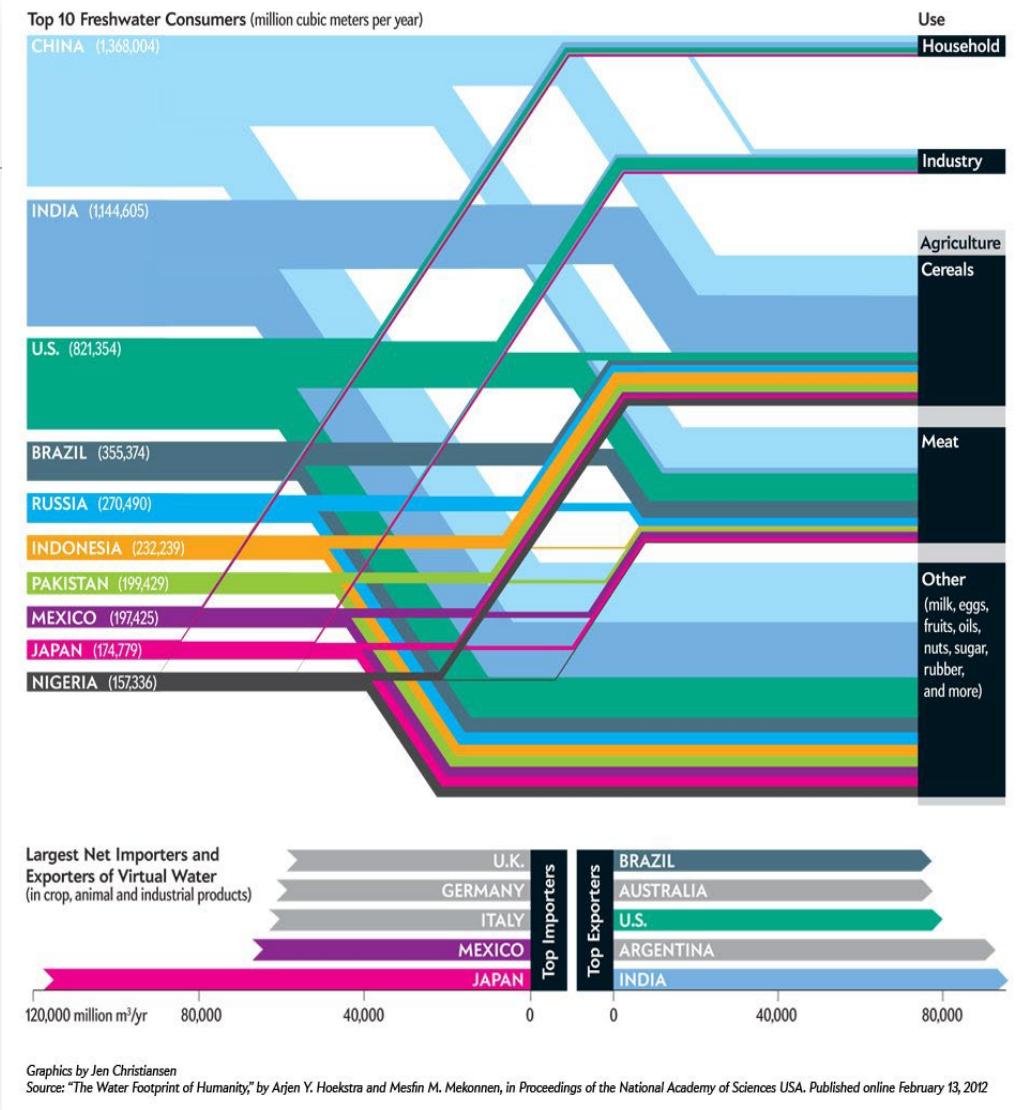
Example: Explanatory

A Sankey diagram with explanatory visualisation.

Portrays analysis of the top ten freshwater-consuming countries and the breakdown of its usage.

Explanatory visualizations are not limited to just being static in design.

Some of the most impactful, narrative-driven pieces can be framed within an interactive or animated construction.



Exhibition

Objective: exhibition or **self-expression** through data representation.

Commonly known as “**data art**” which is characterized by a lack of structured narrative and absence of any visual analysis capability.

Motivation: to create an artifact, an aesthetic representation or perhaps a technical/technique demonstration.

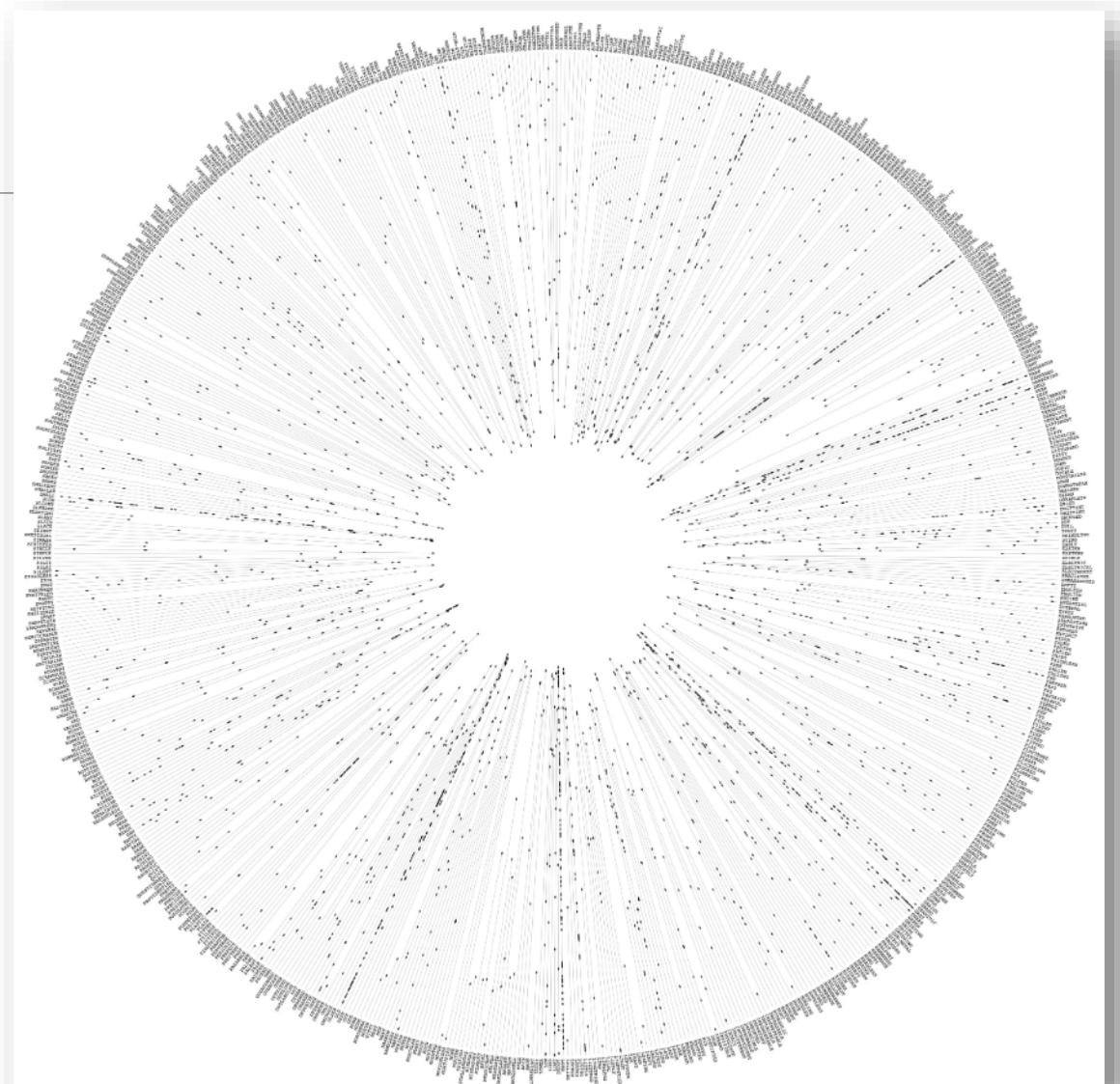
- Sometimes, guided by the idea of fun or playfulness or maybe the creation of ornamentation.

Example: Exhibition

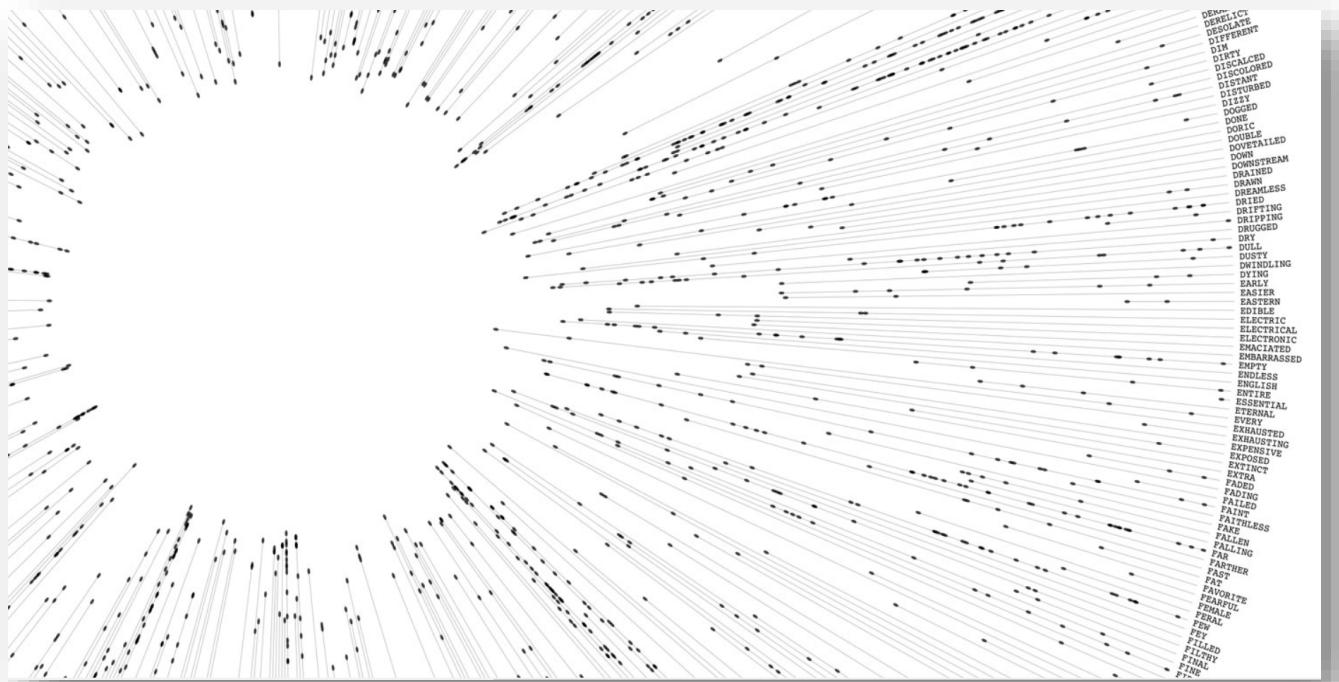
An example of data art that visualizes all the adjectives used in Cormac McCarthy's book "**The Road**".

The **adjectives** are **arranged radially** in alphabetical order.

- Each line represents a **timeline** of the book beginning at the perimeter of the circle and ending toward the center.
- The **points along each line** mark the **position in the book** where that particular adjective was used.



Example: Exhibition



Effect: an interesting artifact to look at and its construction is representative of an impressive technical or algorithmic solution, but its primary intent is not to easily allow us to learn about the language in the book.

This is between **exploratory visualization** and **data art (exhibition)**.

VISUALIZATION'S TONES

Two Ends of a Spectrum

Visualisation's tone is on a continuum from

- a **pragmatic and analytical portrayal** through to
- a more **emotive and abstract concept**.

Pragmatic and Analytical Tone

It is about recognizing a need for a design that **delivers fast, efficient and precise portrayals of data.**

Typically, you will have a captive audience e.g. a corporate environment.

Designs that fit this classification use **bar charts, line charts and dot plots.**

Emotive and Abstract Tone

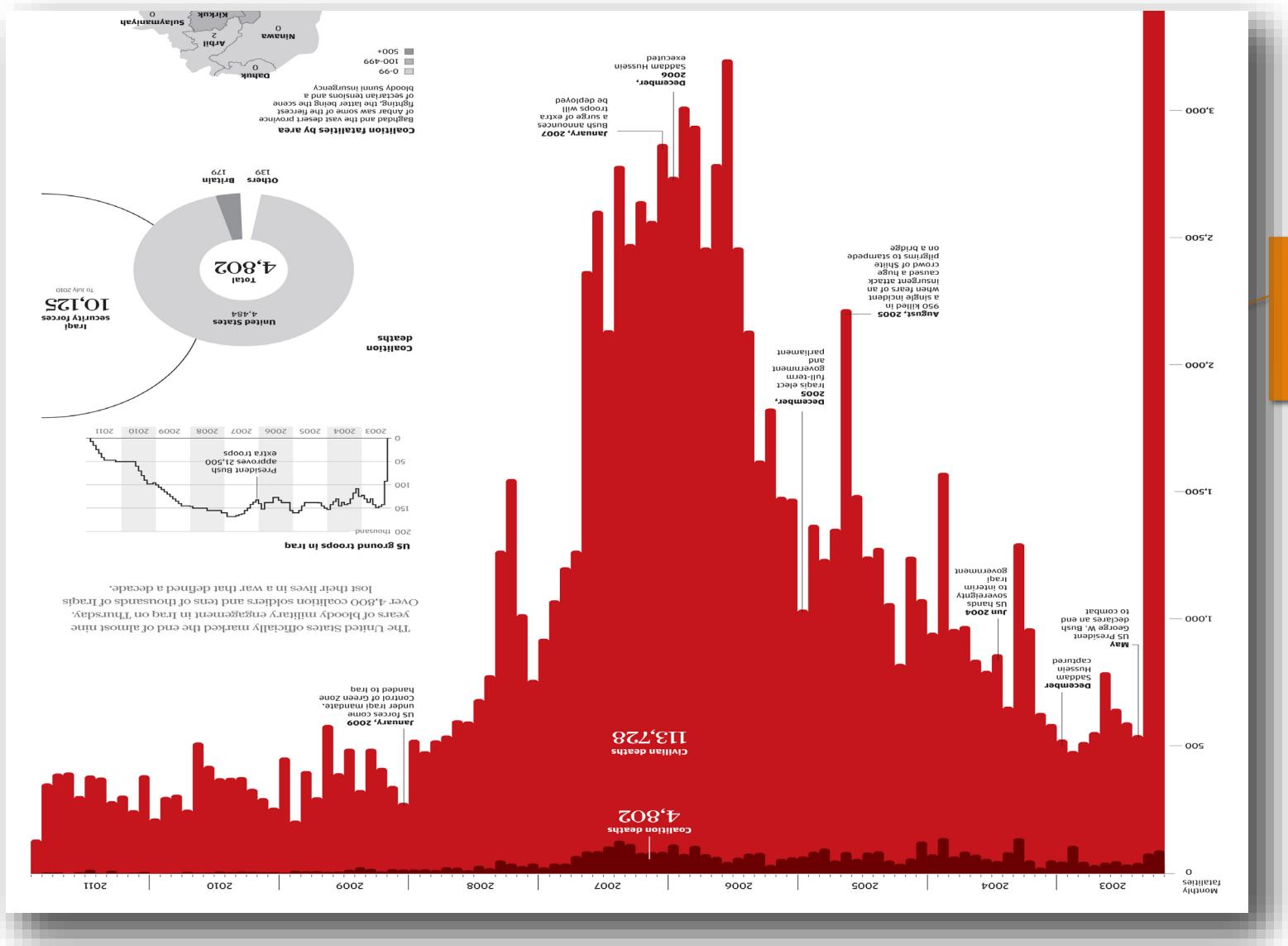
Abstract visualisation, in terms of its tone, is more about creating an aesthetic that portrays a general story or sense of pattern.

Might not be able to pick out every data point or category.

Consequences of such choice:

- Known reduction in accuracy of value perception.

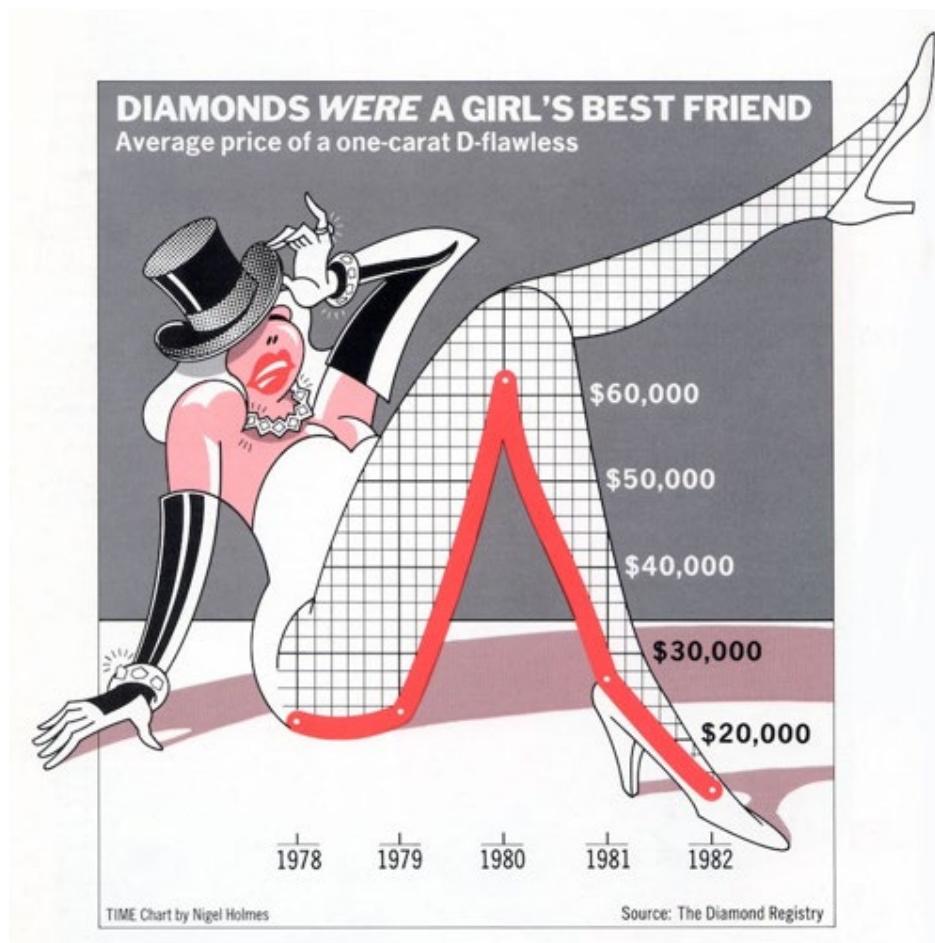
Iraq's bloody toll



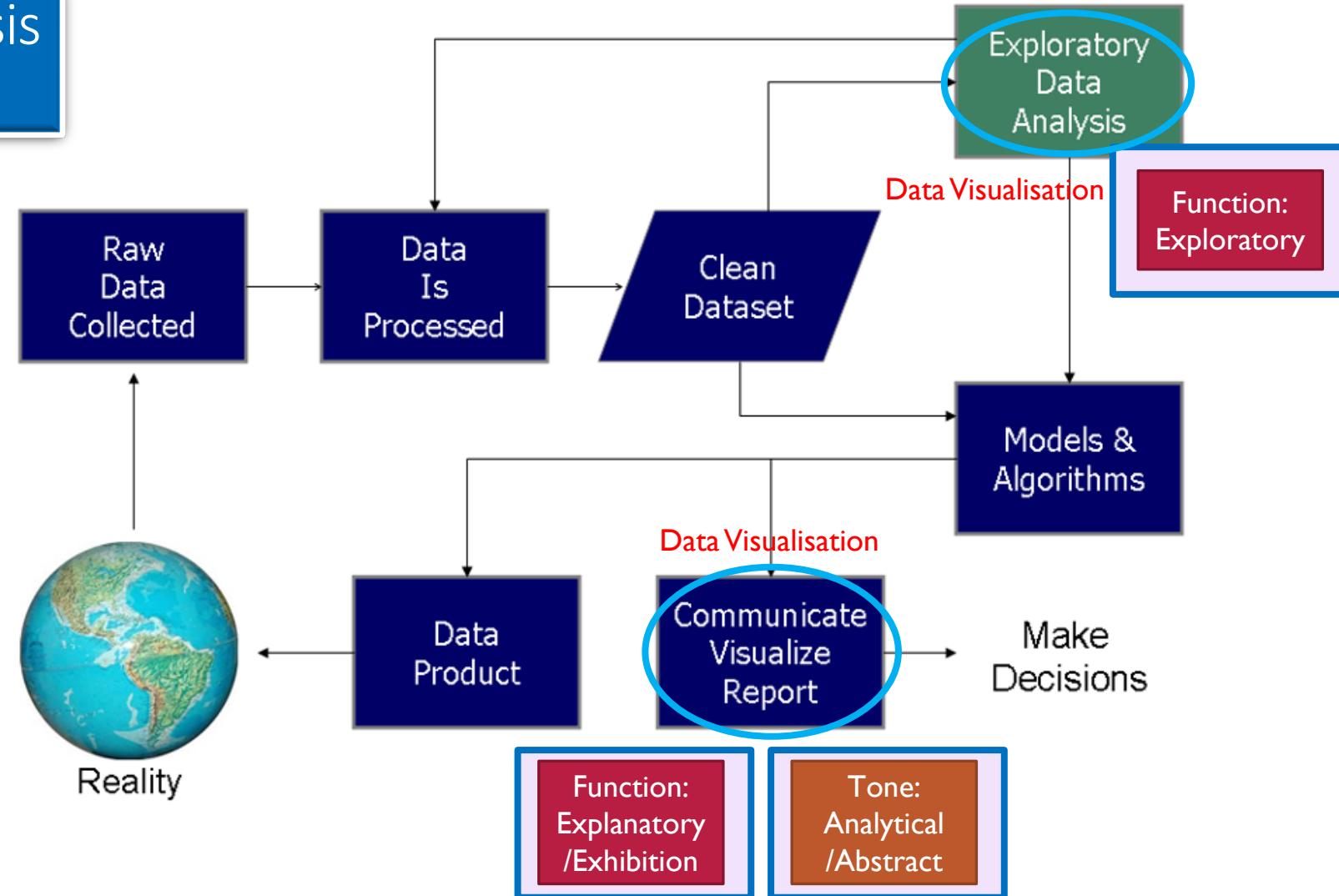
Do Not Stretch Too Far

DATA VISUALISATION is a means to an end, not an end in itself.

It is a bridge connecting the messenger to the receiver and its limitations are framed by our own inherent irrationalities, prejudices, assumptions, and irrational tastes.



Data Analysis Process



Summary

Communicate data with data visualisation

What is data visualisation

Data Representation

Data Presentation

Bringing Data Representation and Data Presentation together

What makes for a good data visualisation?

Visualisation's functions and tones

DATA VISUALISATION

DR DANNY POO

BIG DATA ANALYTICS AND VISUALISATION