

# GEOGRAPHIC DATA VISUALISATION

Data Science Graduate Program

Paul Naylor & Hannah Wright

# Agenda

Introduction

Part 1

What is GeoDataViz

The Benefits of GeoDataViz

Visualisations that changed the way we see the world

Part 2

Visual Communication: Top Tips (design principles)

Part 3

Thematic Mapping & Storytelling

Exercise

Part 4

Map Critique

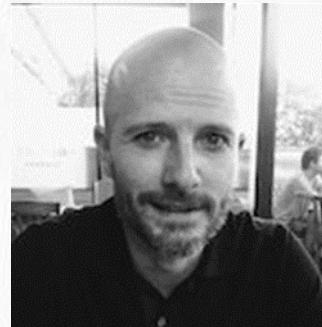
Exercise

Summary

# Who are we and what do we do?

# The GeoDataViz Team

Paul Naylor



Hannah Wright



Jess Baker

Supporting **customers** across the public sector and beyond  
to make sense of **complex data** through **compelling visuals**

# What do we do?



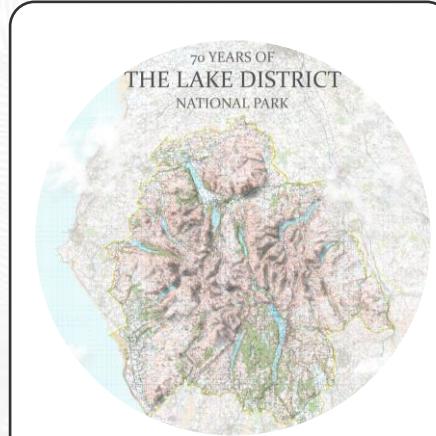
Design  
products and  
support OS  
internally



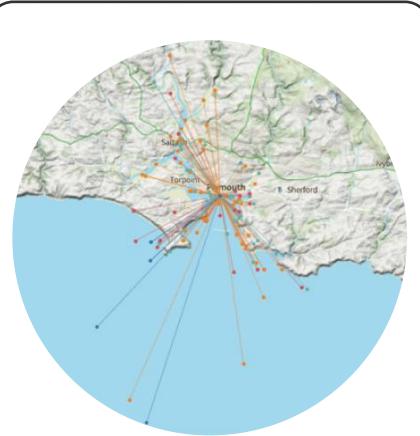
Use different  
mapping  
techniques to tell  
stories



Support  
customers and  
partners



Craft bespoke maps for publicity and social channels



Innovate and  
push the  
boundaries of  
what's possible  
with geospatial  
data

# Why do we need to visualize data?



**90% of the world's  
data today has  
been created in the  
last 2 years alone**

# The benefits of good data viz



Effective  
**communication** of  
information



Turn raw data  
into actionable  
**insights**



Tell **stories** and  
deliver powerful  
messages



Provide elegant  
**solutions** to  
complex problems



Identify **trends**,  
**patterns** and  
**relationships**

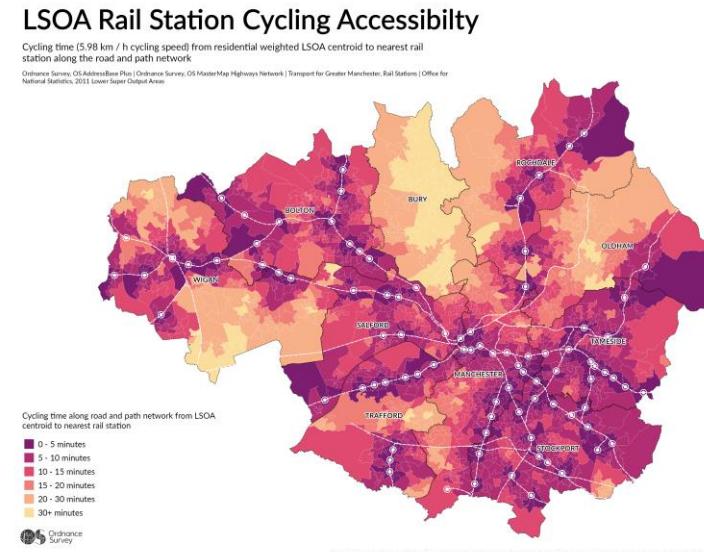
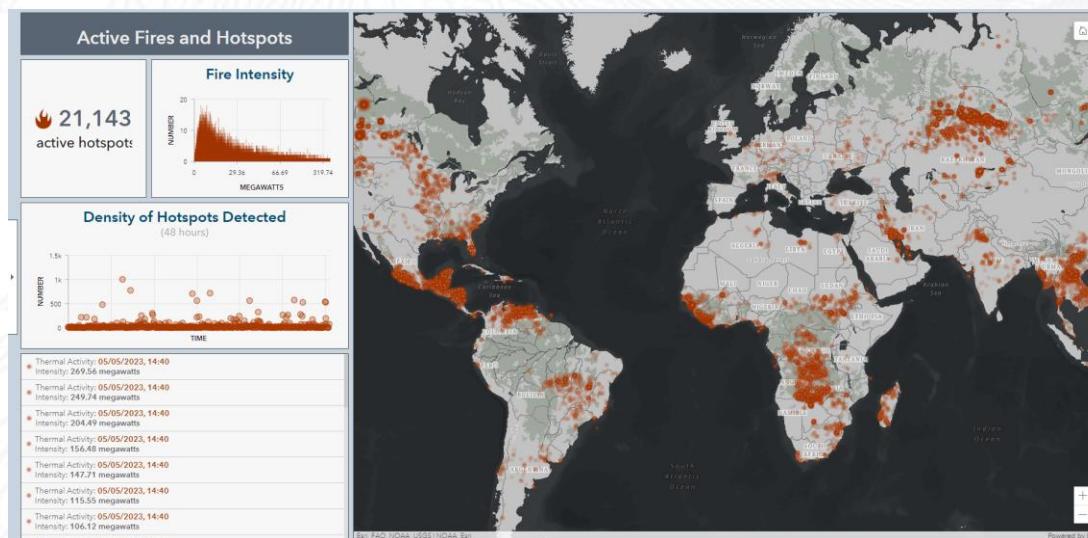
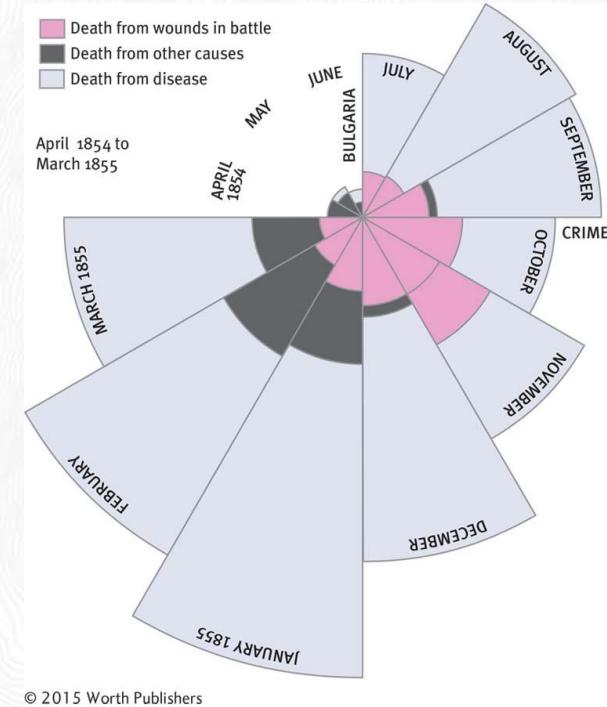
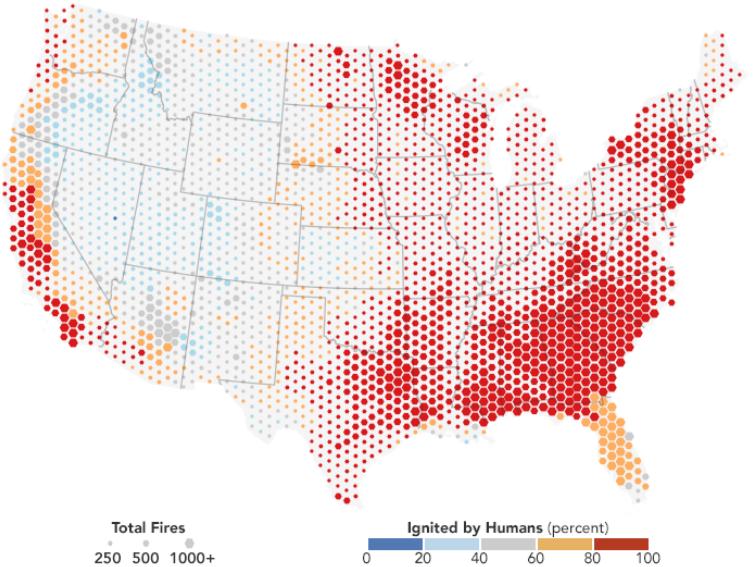
# What is geographic data?

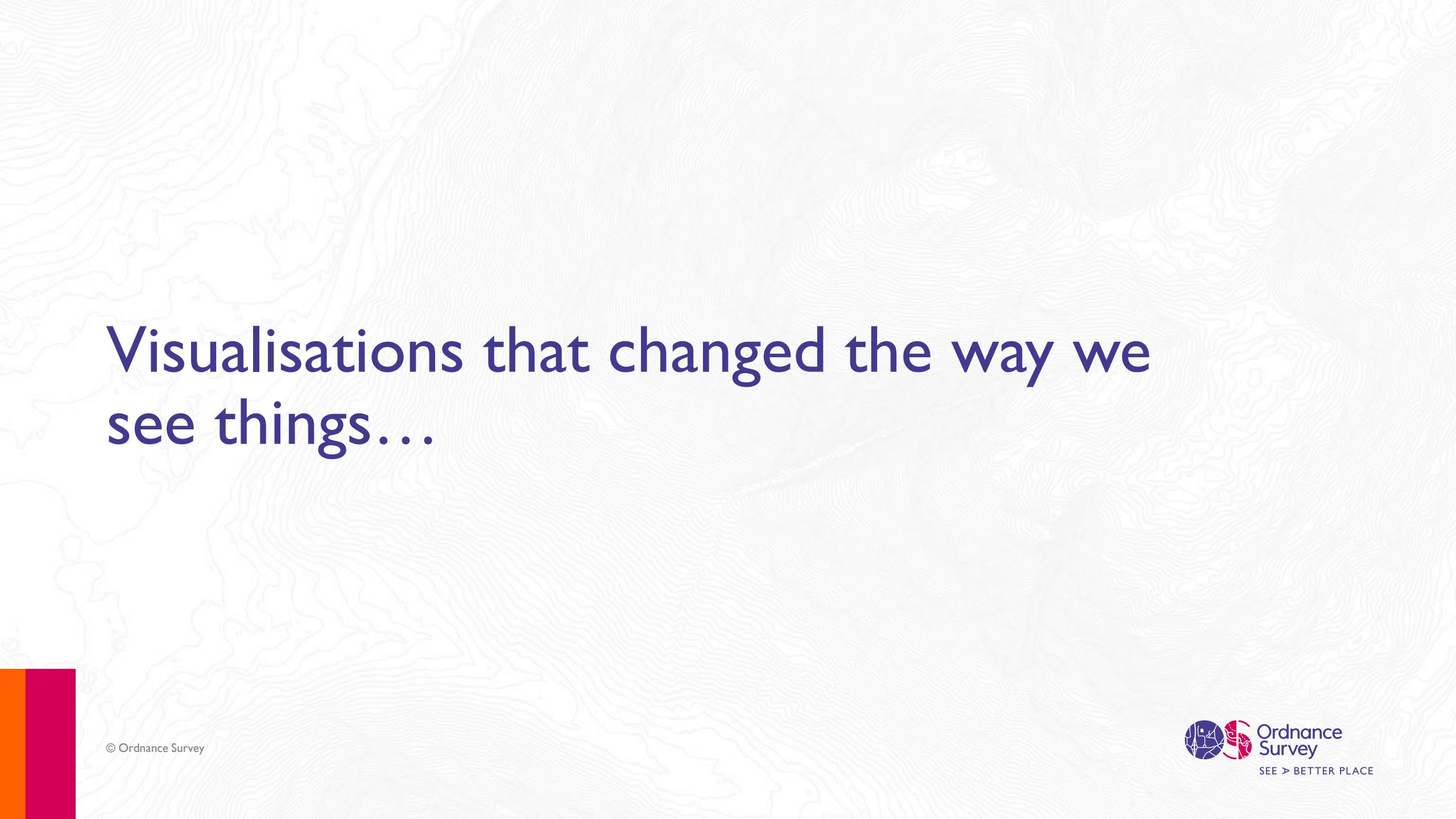
Data which has a location associated with it...

- Real world objects
- Events which happen/happened at a location
- People associated with a location (e.g. place of work or home address)



# What is DataViz?

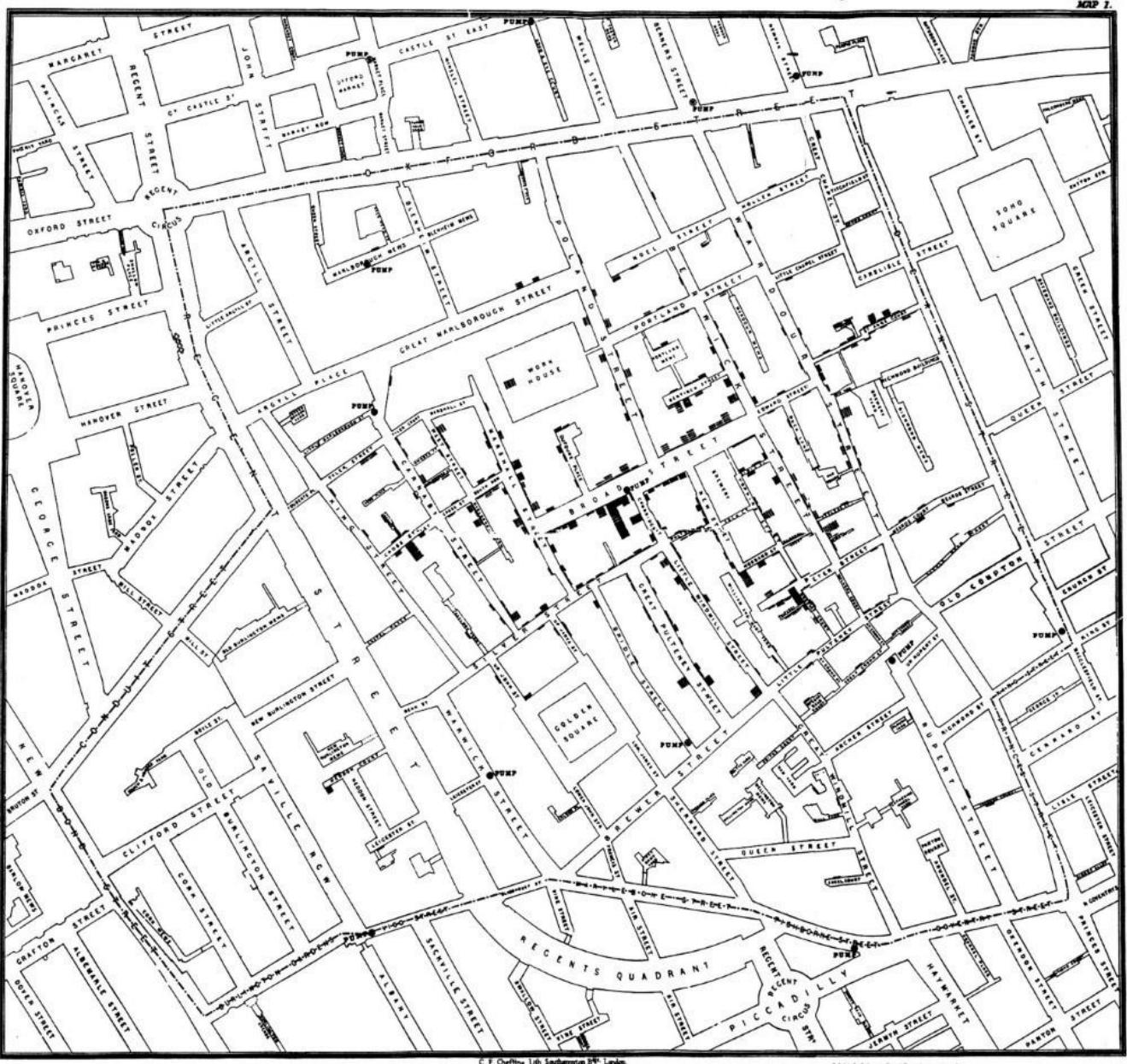




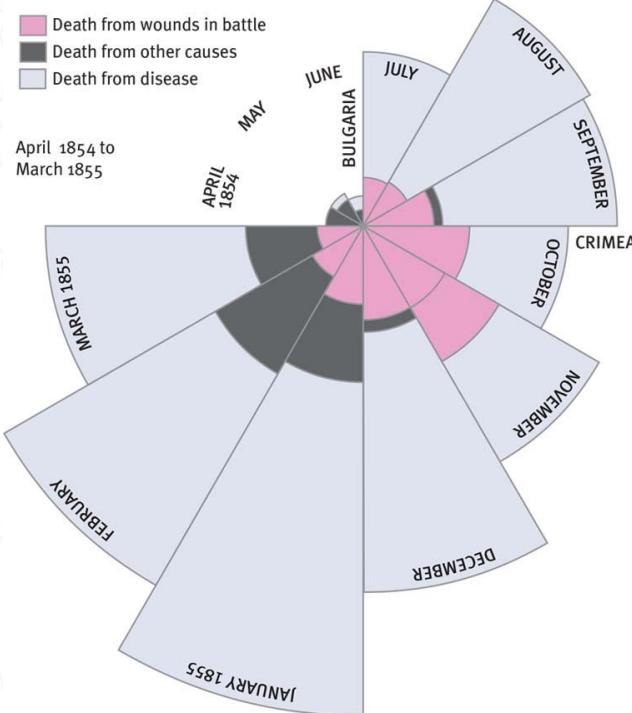
# Visualisations that changed the way we see things...

# John Snow Cholera Map

1854

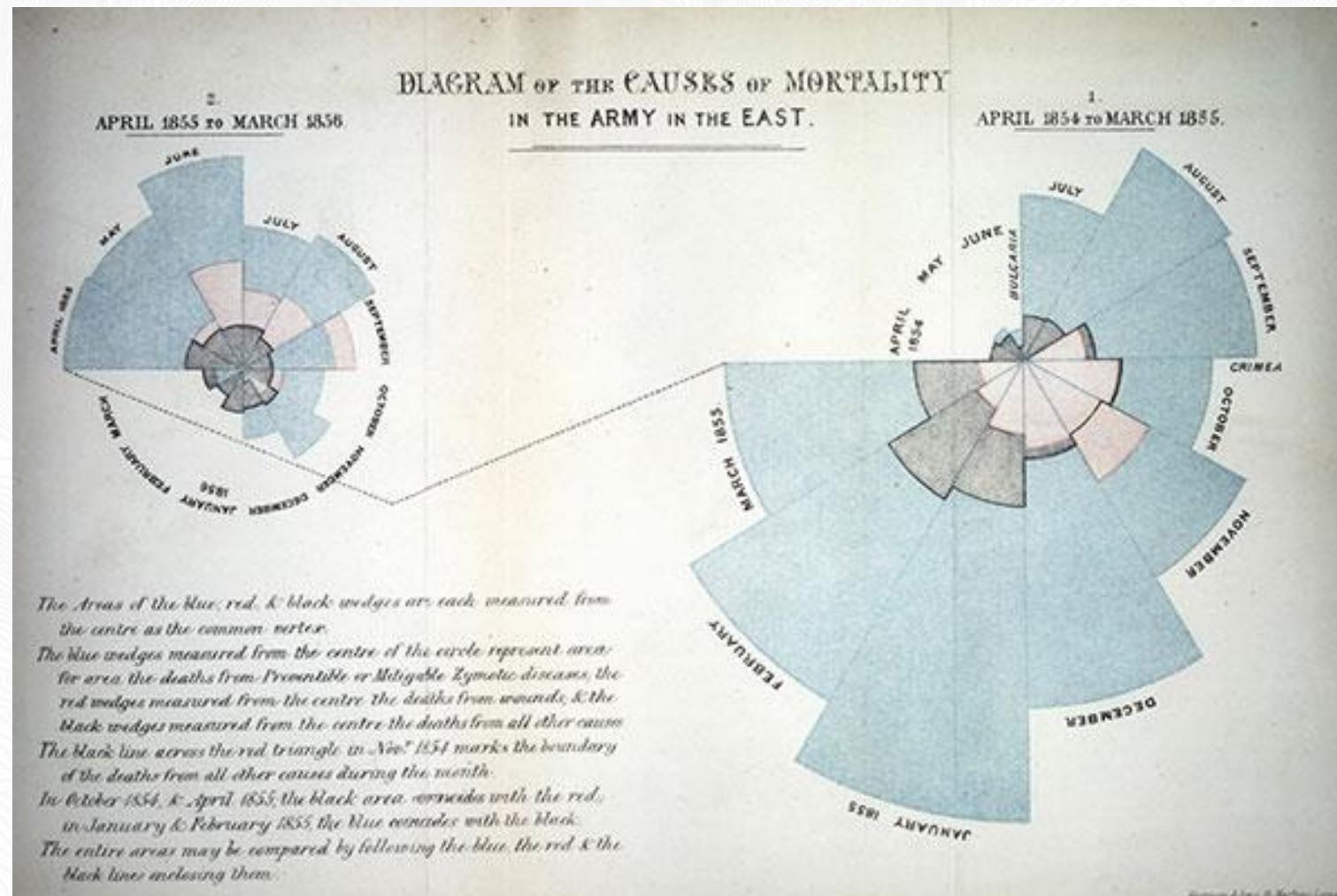


# Florence Nightingale Coxcomb Diagram



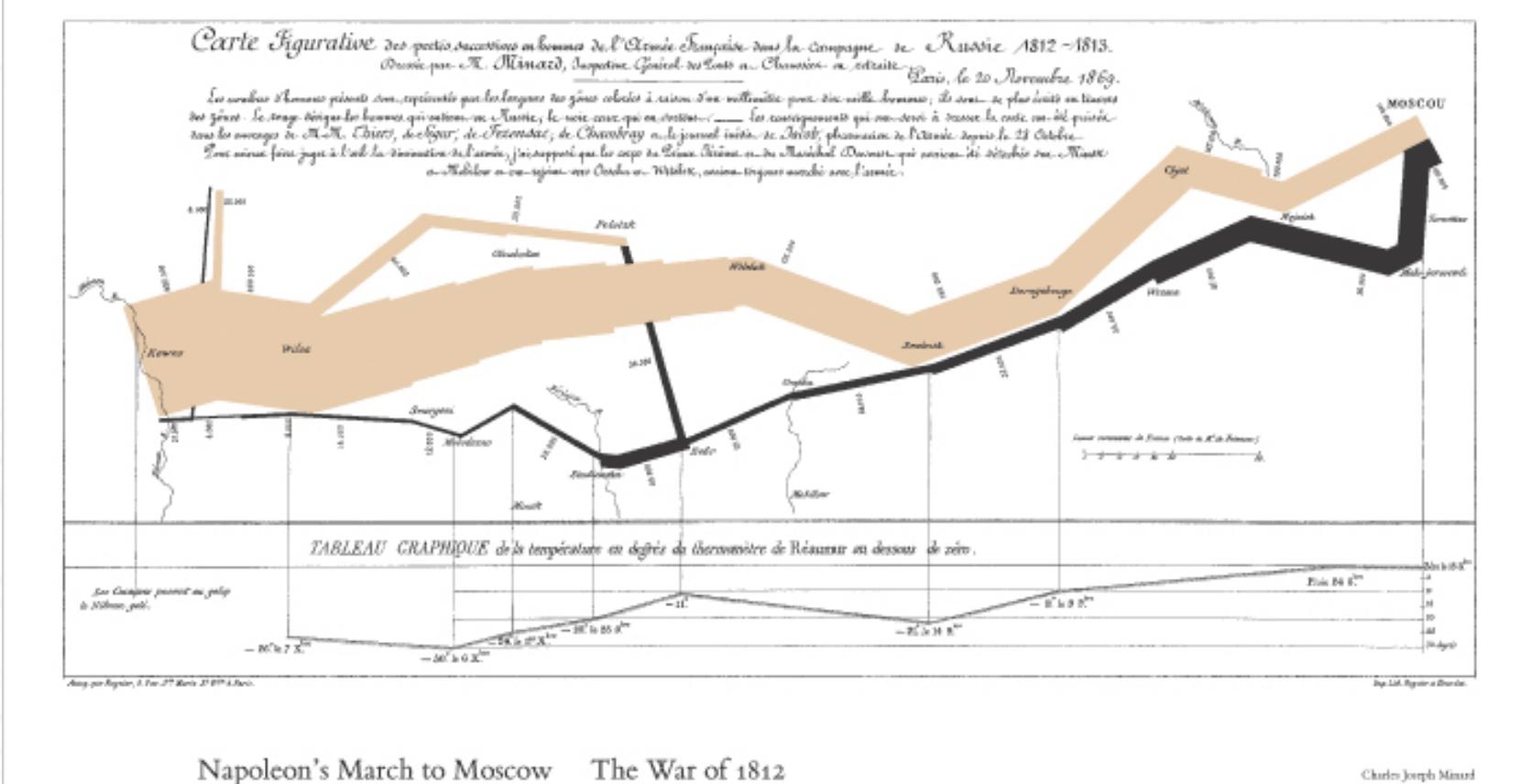
© 2015 Worth Publishers

1858



# Minard

## Napoleonic's March



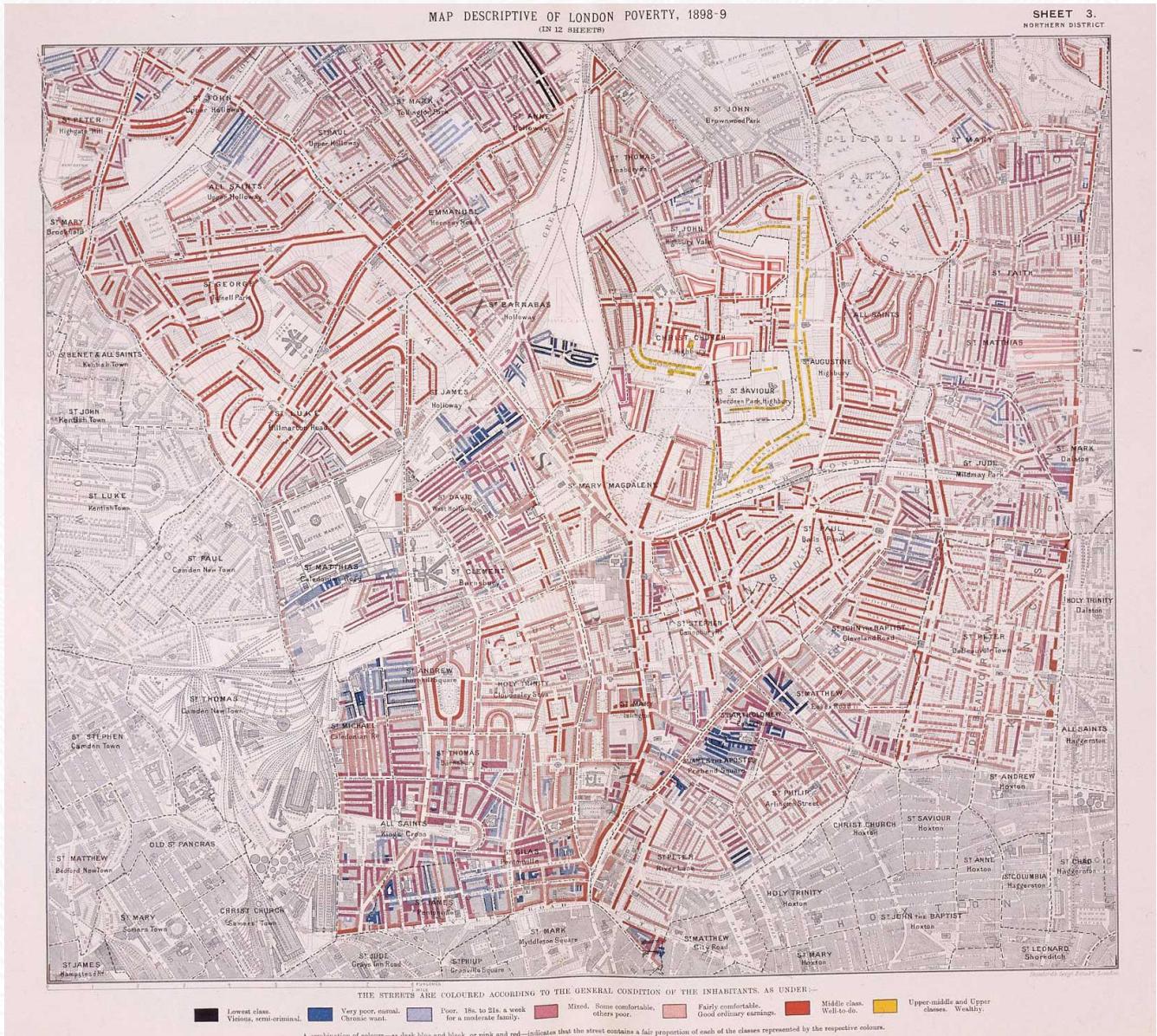
1869

Napoleon's March to Moscow The War of 1812

Charles Joseph Minard

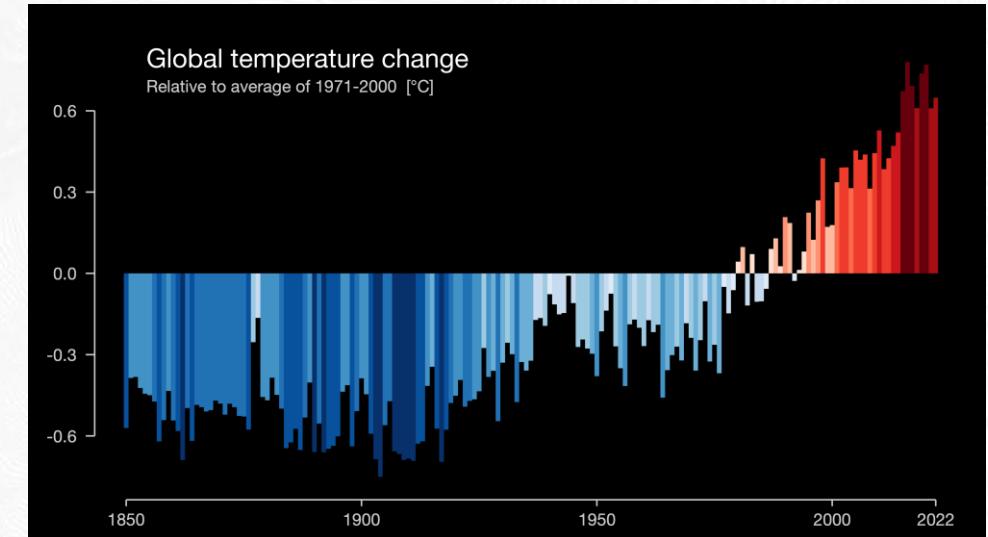
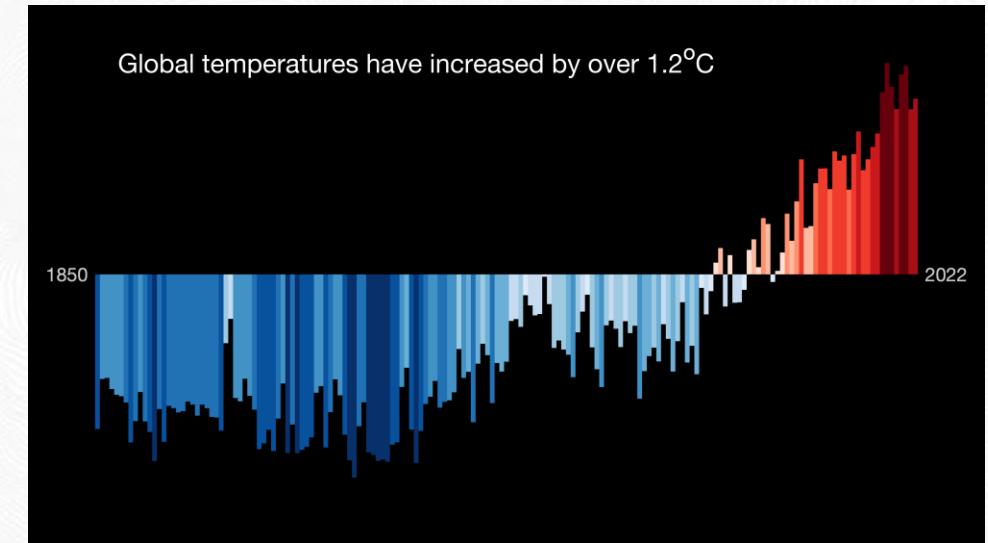
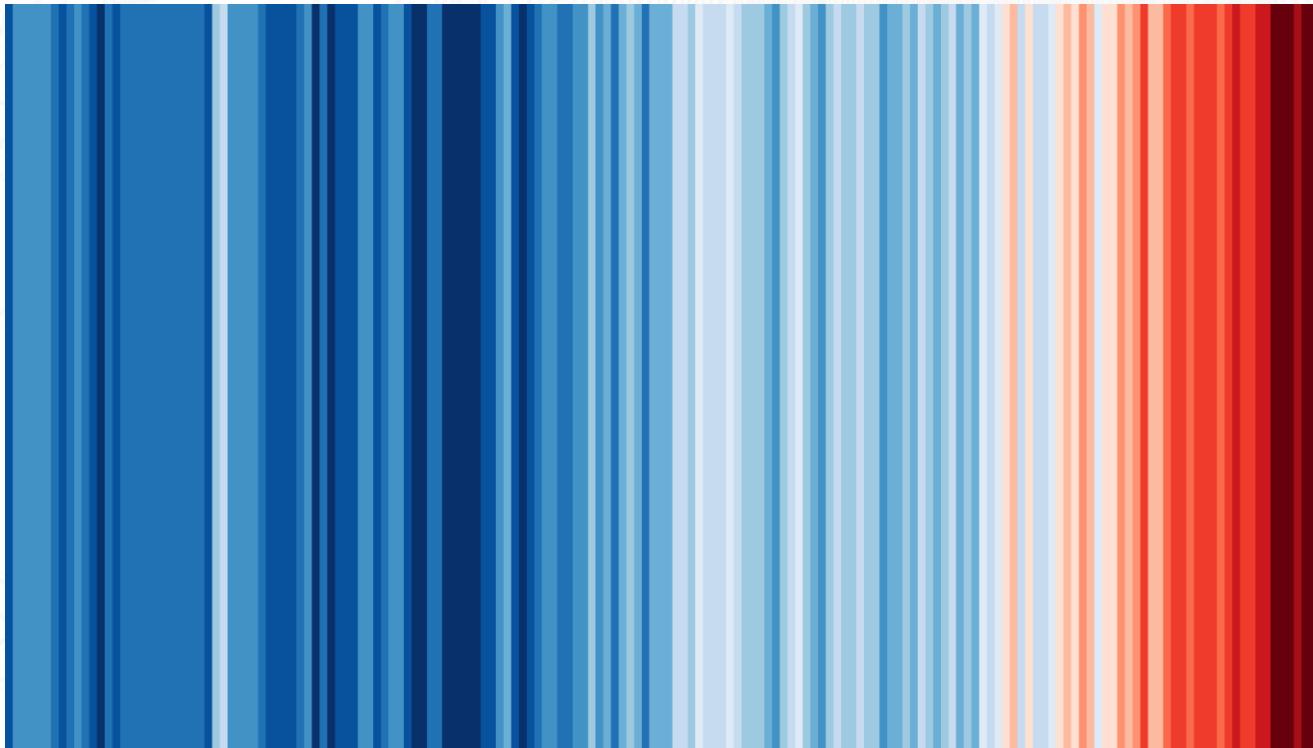
# Charles Booth Poverty Map

1898



# Ed Hawkins

## Warming Stripes



2018

# The benefits of good data viz.... a quick revisit



Effective  
**communication** of  
information



Turn raw data  
into actionable  
**insights**



Tell **stories** and  
deliver powerful  
messages



Provide elegant  
**solutions** to  
complex problems



Identify **trends**,  
**patterns** and  
**relationships**



# Can you think of any good examples of data visualisations?

Feel free to post them in the chat with what they are why you like them over the course of this session.

# Visual Communication: Top Tips for Success

(Cartographic Design Principles)

# Cartographic (and Data Viz) design principles



1. Understanding user requirements
2. Consideration of display format
3. Clear visual hierarchy
4. Simplicity
5. Legibility
6. Consistency
7. Accessibility
8. Good Composition

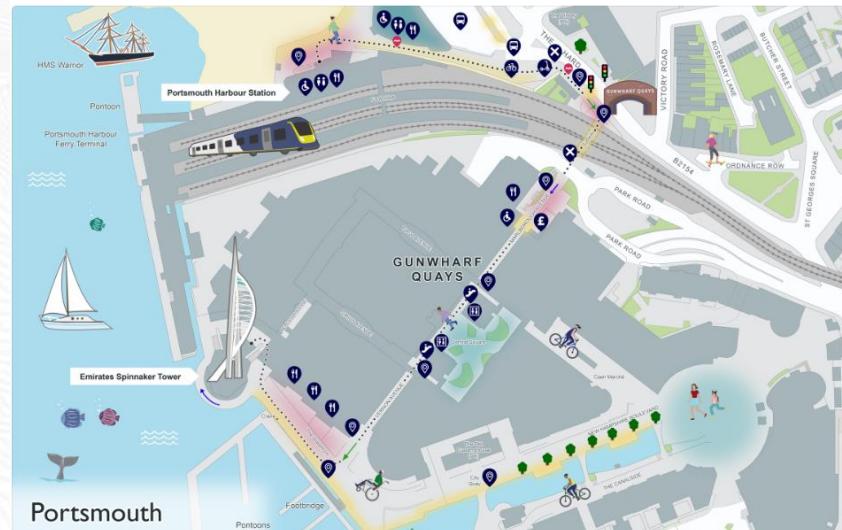
## Design principles

### Understanding of user requirements

This is absolutely vital to the success of any data visualisation! An effectively designed visual is one in which the intended message is clearly communicated to the user. This is only possible by fully understanding what that message is and how the visualisation is intended to be used.

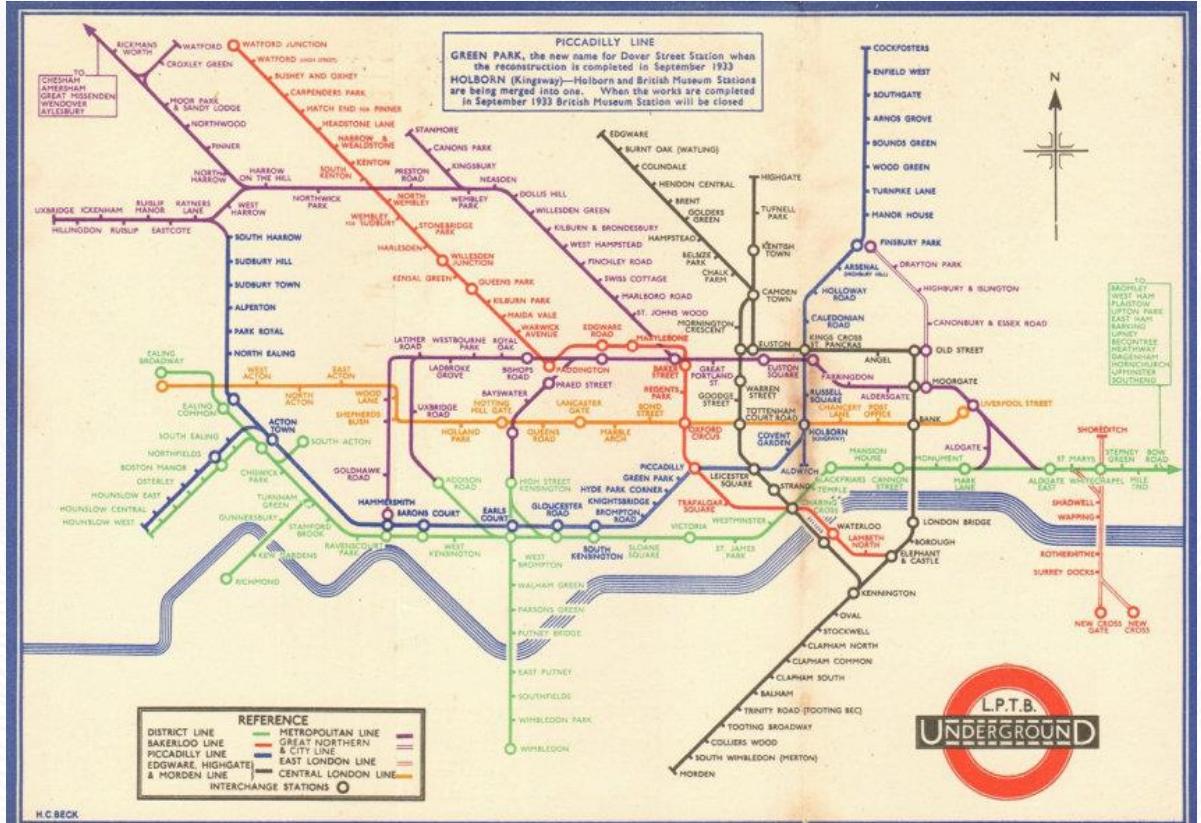
The design process must start by identifying and fully understanding real user needs. What information does the user require? How will they be using the visualisation? It is important that all design decisions along the way consider the answers to these questions in order to create the visualisation that the user really wants. A user will often evaluate a product or service by comparing their response to their expectation.

Focussing on needs allows the map design to concentrate on the elements that deliver the most value to the user, hence the greater chance of making the visualisation a success; similarly it will lead to the avoidance of including unnecessary information that will only result in distraction or cause confusion.

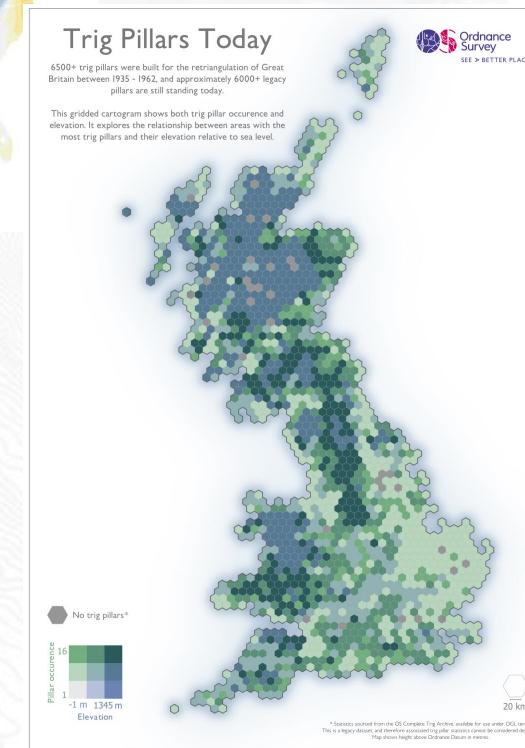
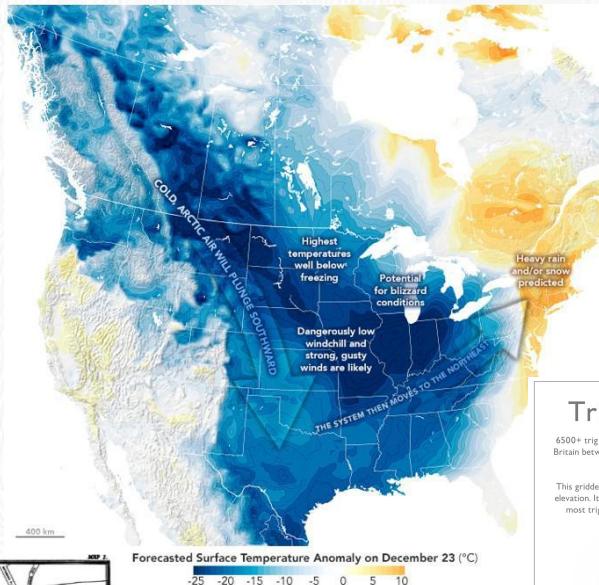
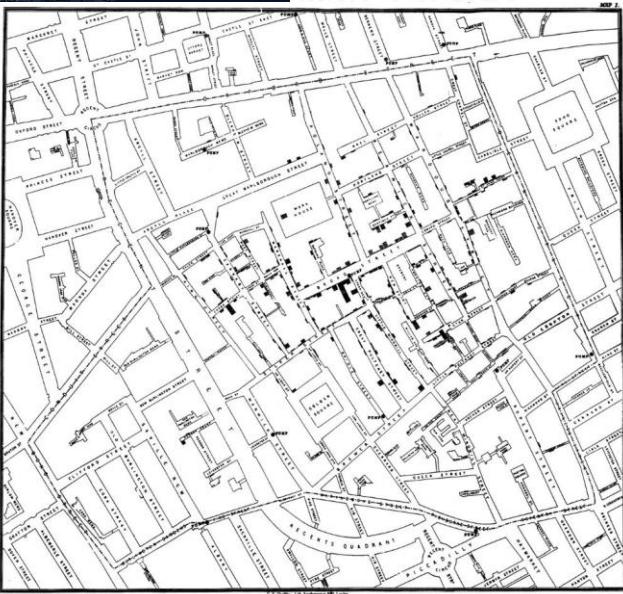
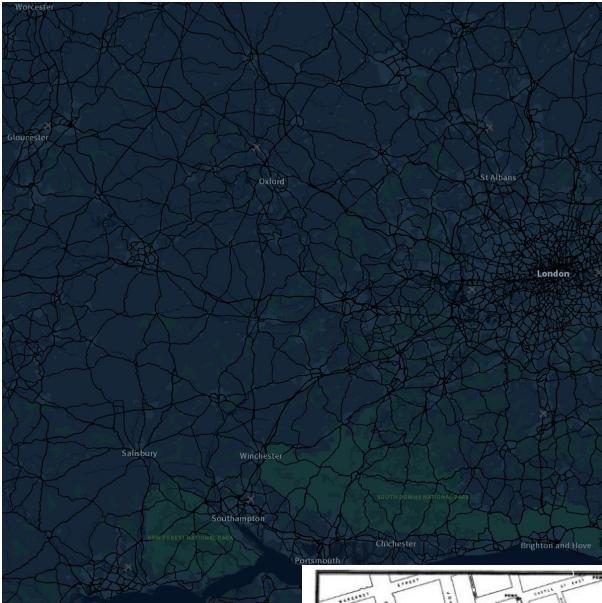


# I. Think about the USER!

- Who is the user?
- What are you trying to tell them?
- What information does the user need/ not need?
- How and where will they use your data viz?
- Does it need to be interactive?

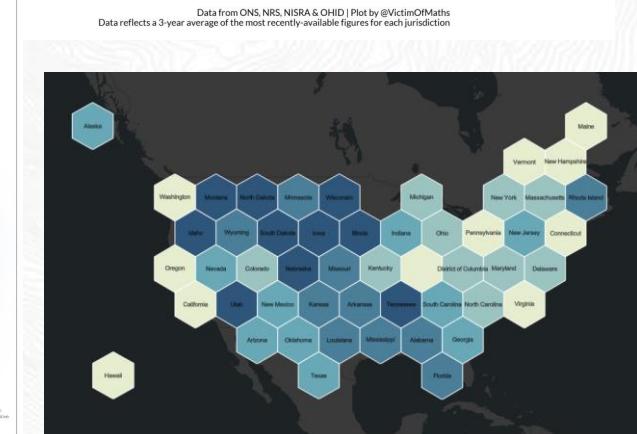
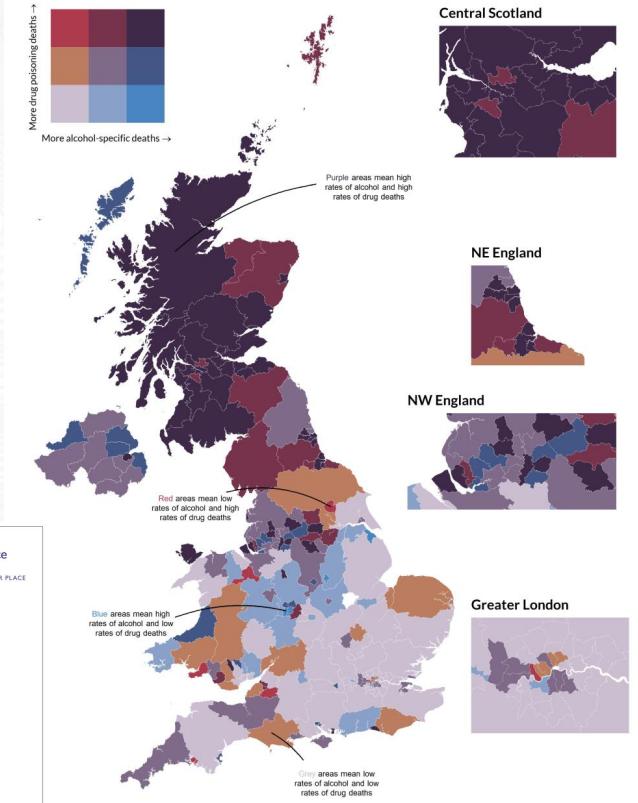


## 2. Pick the right tool for the job



**Regional patterns in deaths from alcohol and drugs across the UK**  
Comparative rates of alcohol-specific deaths and deaths from drug misuse by Local Authority.

Data is not available for Rutland.



# But which map?

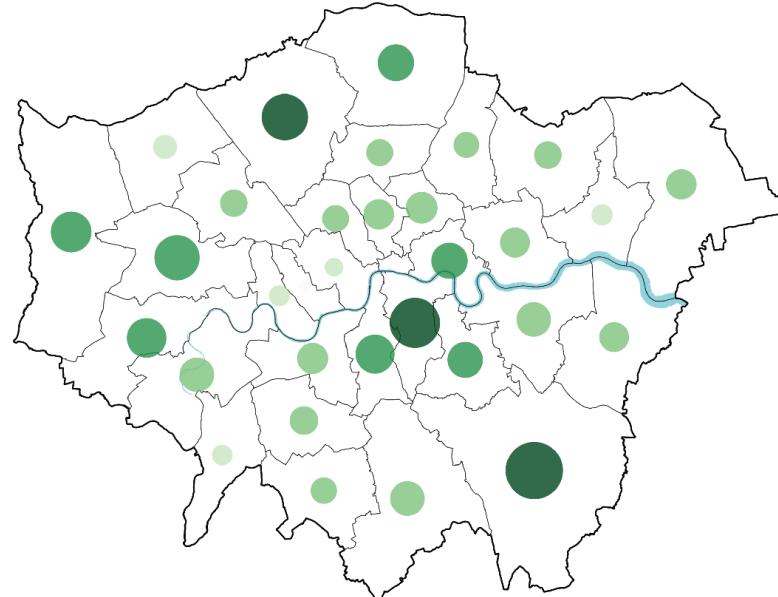
## THEMATIC MAPPING TECHNIQUES

### DOT DENSITY



## THEMATIC MAPPING TECHNIQUES

### PROPORTIONAL SYMBOL

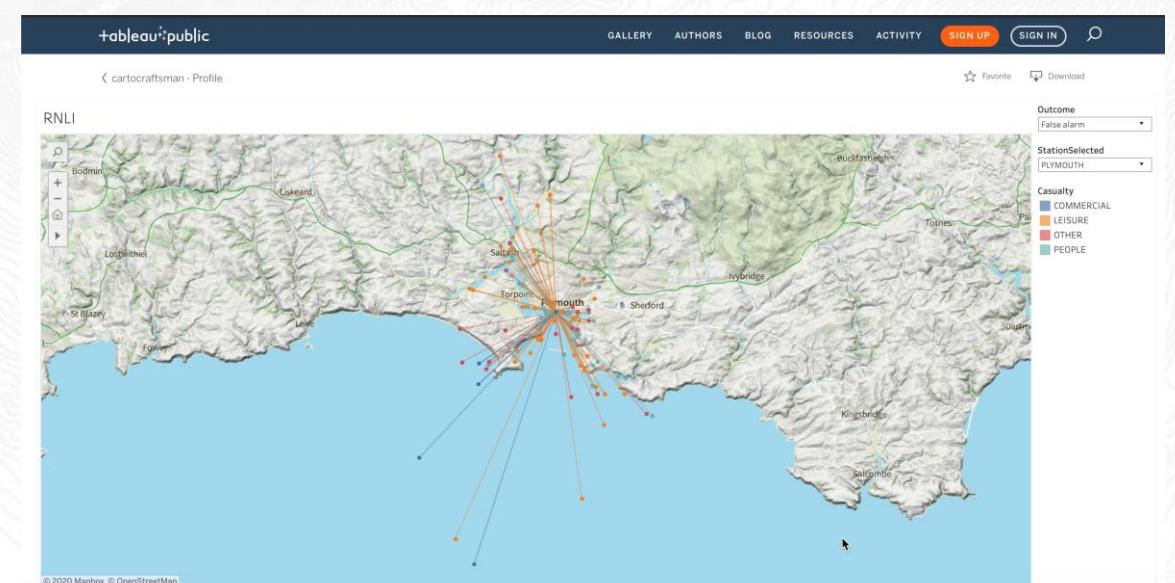
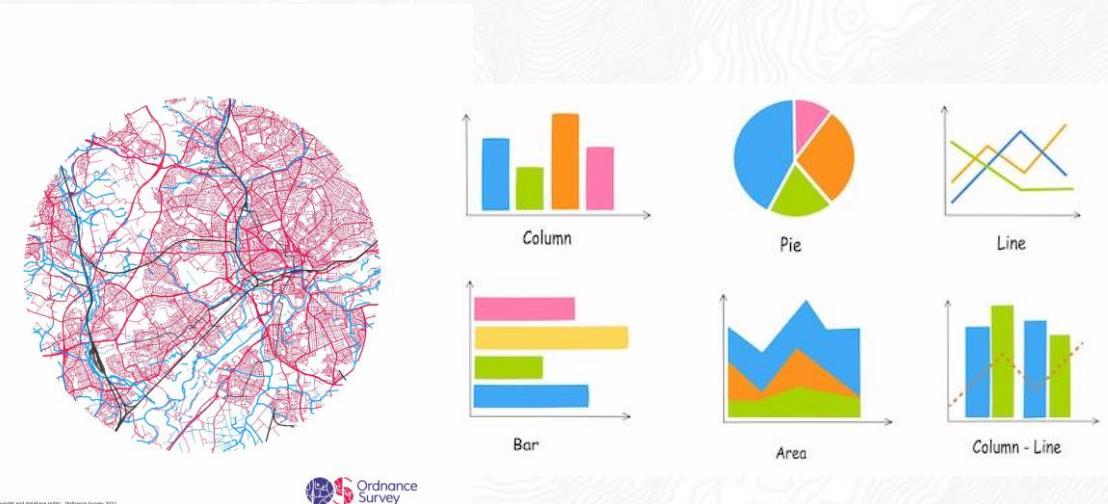
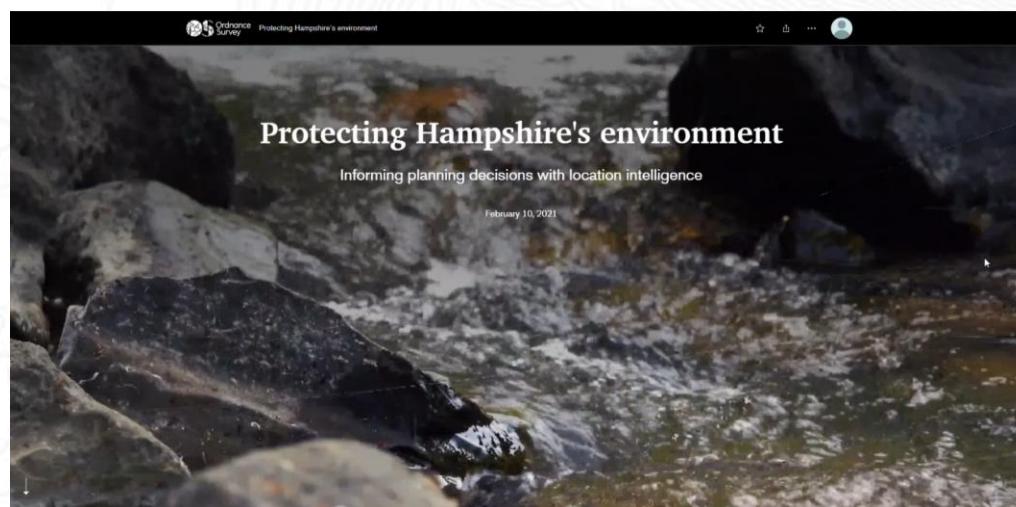
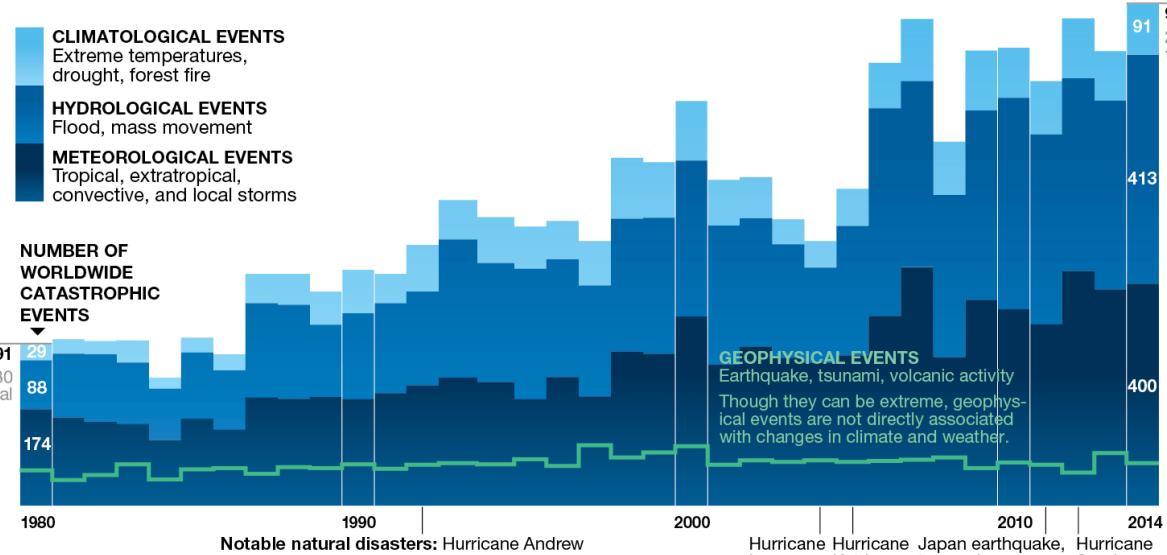


## THEMATIC MAPPING TECHNIQUES

### CHOROPLETH



# It doesn't have to be a map...



### 3. Keep it simple



'It seems that perfection is reached not when there is nothing left to add, but when there is nothing left to take away'  
- Antoine de Saint-Exupéry

'Less is more'  
- Mies van der Rohe

# 4. Make sure it's legible

Elements of your visualisation need to be **readable**, **understandable**, and **recognisable**

Dependant on **size** and **colour**

**Proximity** of elements to each other can impact their visual relationship and way they're interpreted, as well as overall legibility

How much of your salary do you need to spend to rent accommodation in London?

Set a gross salary  
£19,400

Average graduate salary\* (£22.4k)

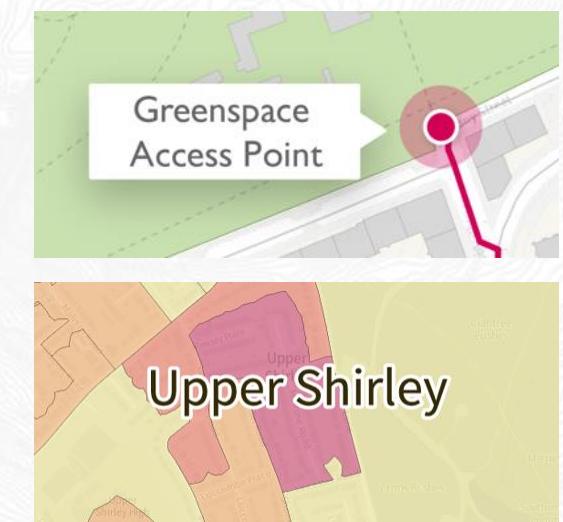
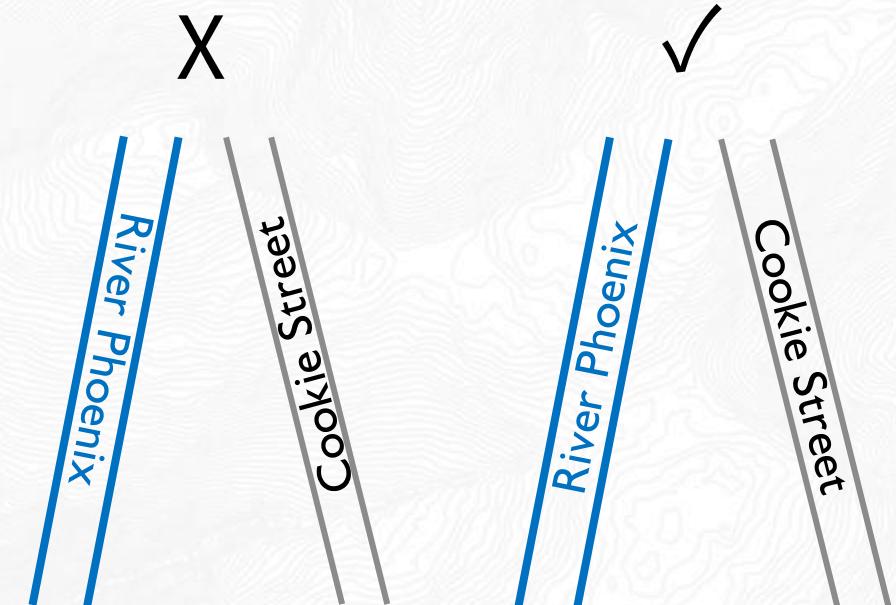
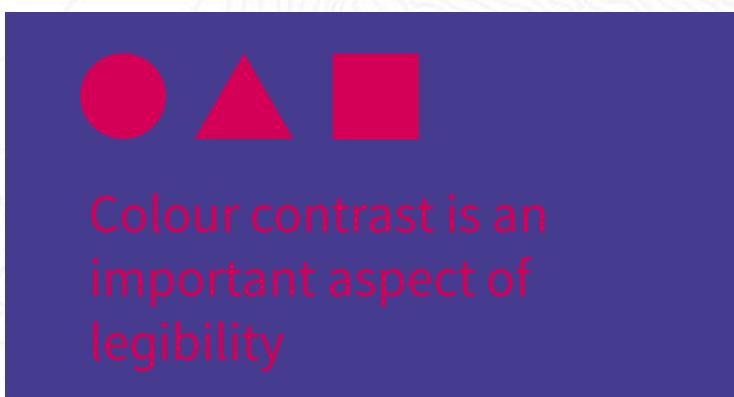
Choose a property type  
 house  flat

Number of bedrooms (map is based on cost per bedroom)  
1 2 3 4



# Legibility top tips

- Good choice of font (simple and easy to read)
- Text contrast against background
- Text big enough to read
- Character spacing
- Masks/halos behind text can improve legibility
- Don't overlap things
- Don't put text upside-down



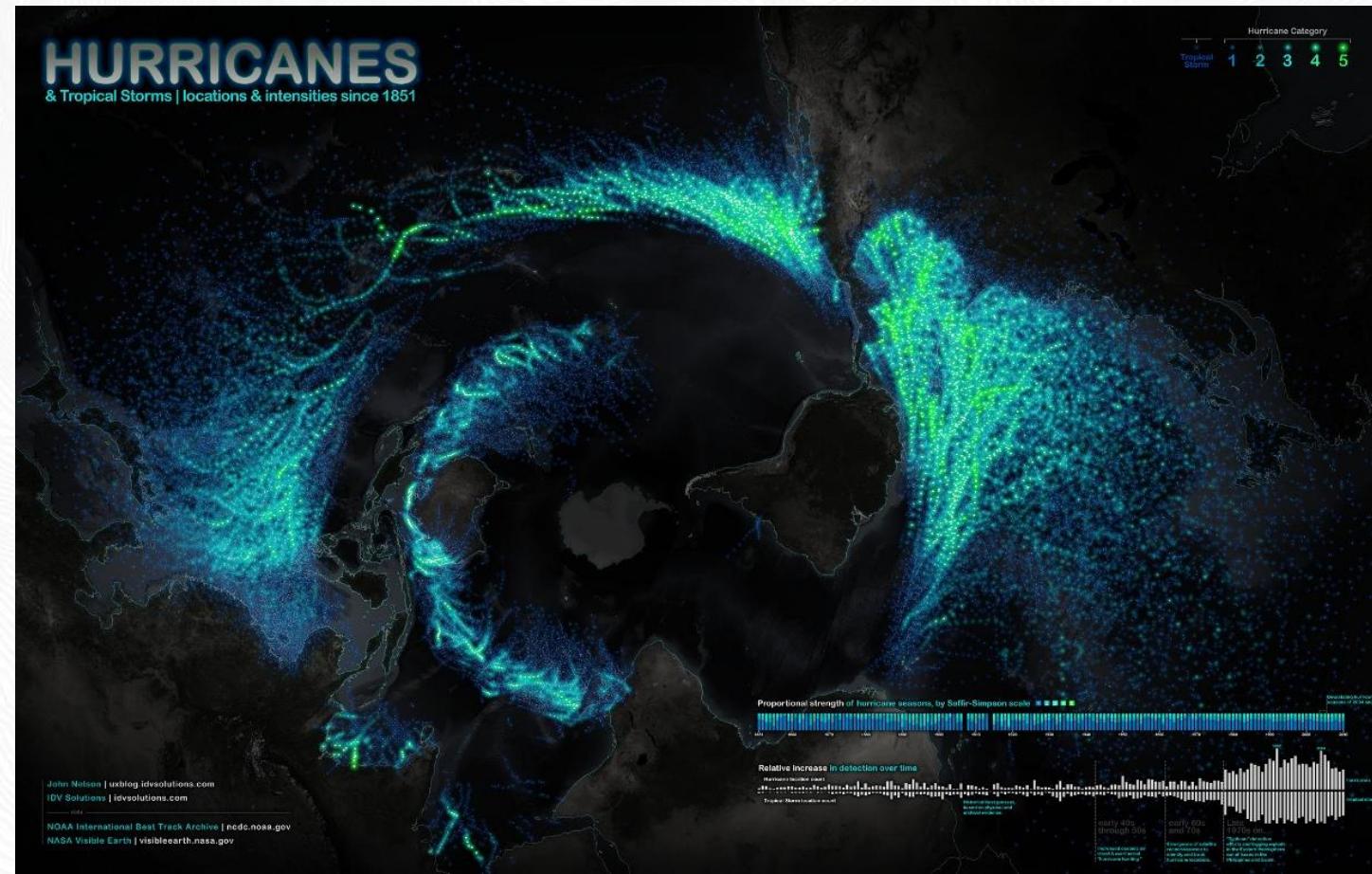
## 5. Use a clear visual hierarchy

**Draw attention to certain elements**

Push those of less importance further down the visual plane.

If a feature is not required – remove it.

**Colour, SIZE, proximity, patterns, transparency, orientation, graphic effects**



## 6. Use colour to your advantage

To work out which colours to choose, you need to know what type of data you're working with.

Qualitative

Sequential

Diverging

Qualitative



Sequential (single and multi-hue)



Red Amber Green



Diverging



Take it easy – you can overdo it with colour – stick to a limited colour pallet

# Colour associations

**Red**

Excitement  
Strength  
Danger  
Love

**Orange**

Creativity  
Confidence  
Warmth  
Bravery

**Yellow**

Happiness  
Youthfulness  
Energy  
Friendship

**Green**

Calm  
Nature  
Balance  
Jealousy

**Blue**

Trust  
Peace  
Water  
Relaxation

**Navy**

Professional  
Responsibility  
Finance  
Security

**Purple**

Wealth  
Imagination  
Mystery  
Spirituality

**Pink**

Playfulness  
Femininity  
Compassion  
Beauty

**Black**

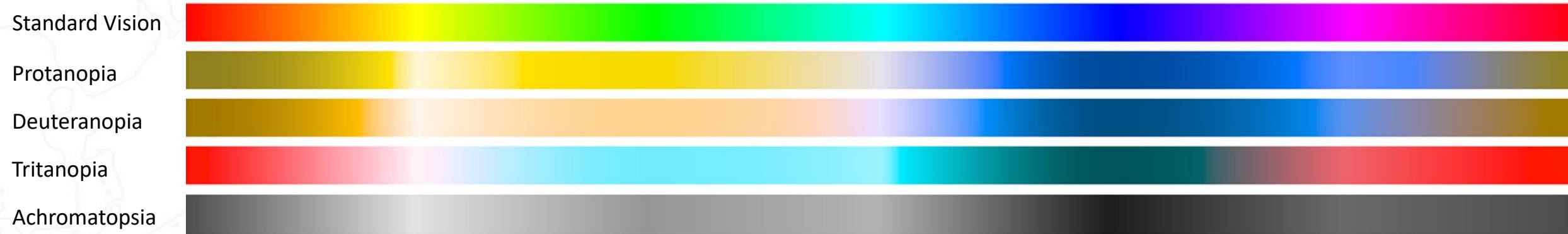
Power  
Elegance  
Discipline  
Formal

**White**

Pure  
Fresh  
Hope  
Simplicity

## 7. Make sure it's accessible

- CVD = Colour Vision Deficiency
- Deutanopia and Protanopia (R-G), Tritanopia (B-Y), and Achromatopsia (monochrome)
- Affects ~8% of men and 0.8% of women in the UK



# COLORBREWER 2.0

color advice for cartography

Number of data classes: 3

Nature of your data:  sequential  diverging  qualitative

Pick a color scheme:

Sequential

3-class Dark2

Only show:  colorblind safe  print friendly  photocopy safe

Context:  roads  cities  borders

Background:  solid color  terrain

color transparency

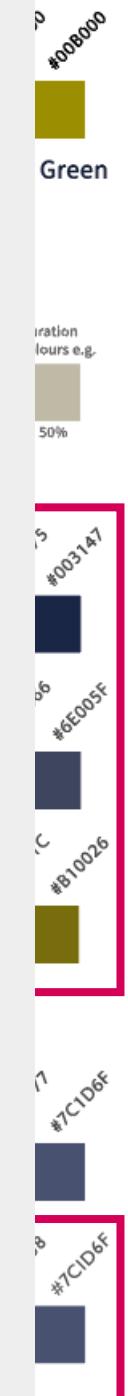
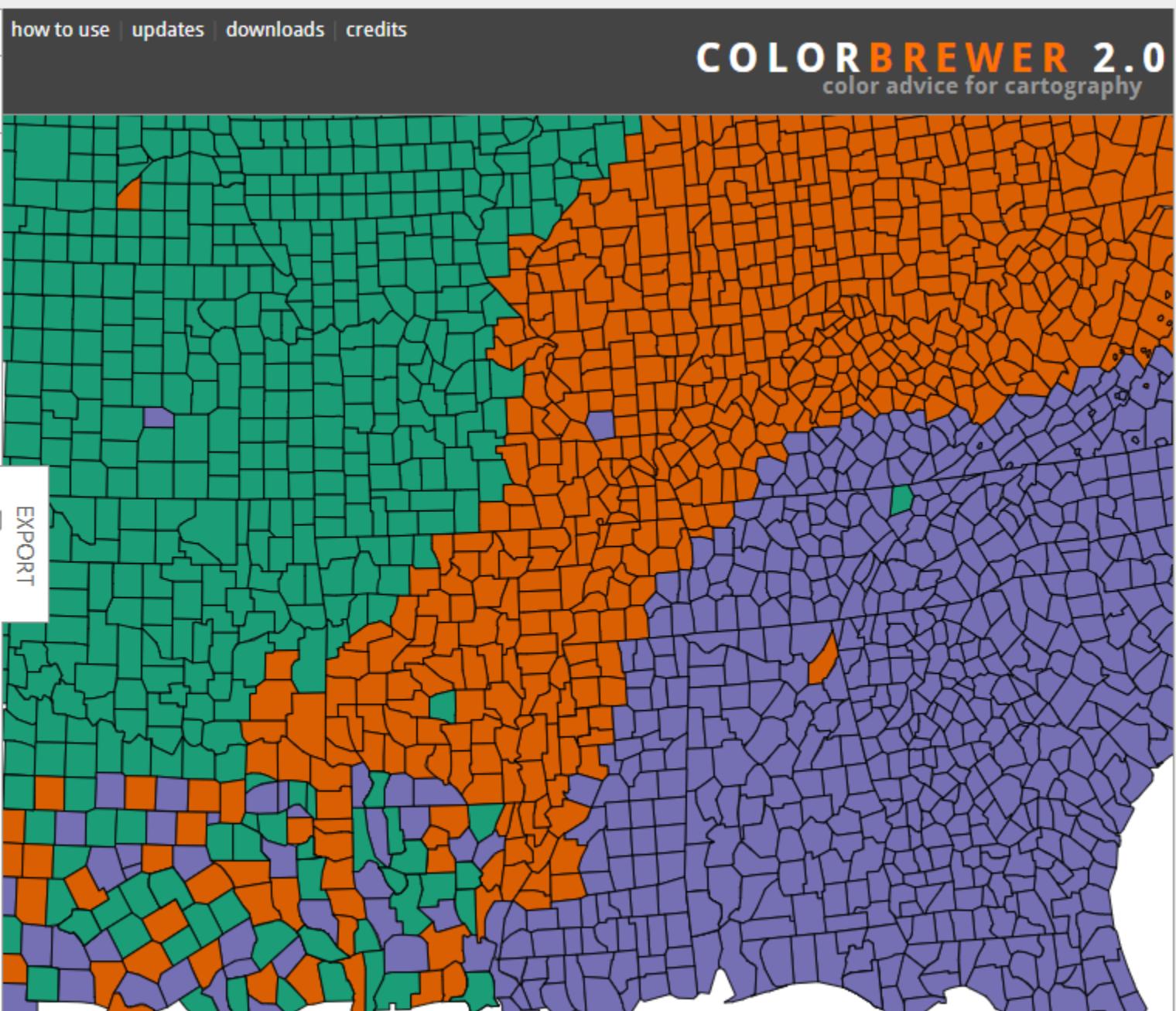
hex: #1b9e77, #d95f02, #7570b3

EXPORT

© Cynthia Brewer, Mark Harrower and The Pennsylvania State University

Source code and feedback

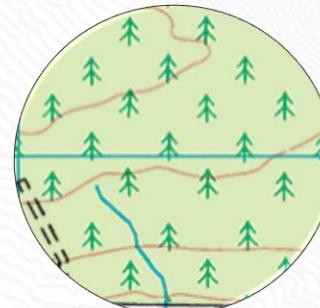
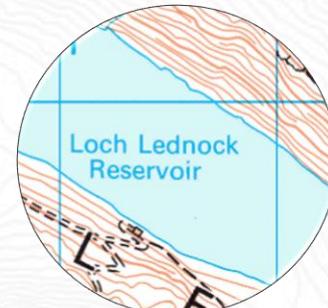
Back to Flash version



# Accessibility top tips

A few general principles:

- ✓ Use labels
- ✓ Alternative fill patterns
- ✓ If it works in monochrome, it's likely to be more accessible
- ✗ Use red and green as 'good' and 'bad'
- ✗ Colour as the only indicator
- ✗ Using colours similar in contrast



## **8. Critique your work!**

Praise makes you **feel good**  
**Critique** makes you **better**

# DataViz Quiz

Slido.com #9071980

# Lunch

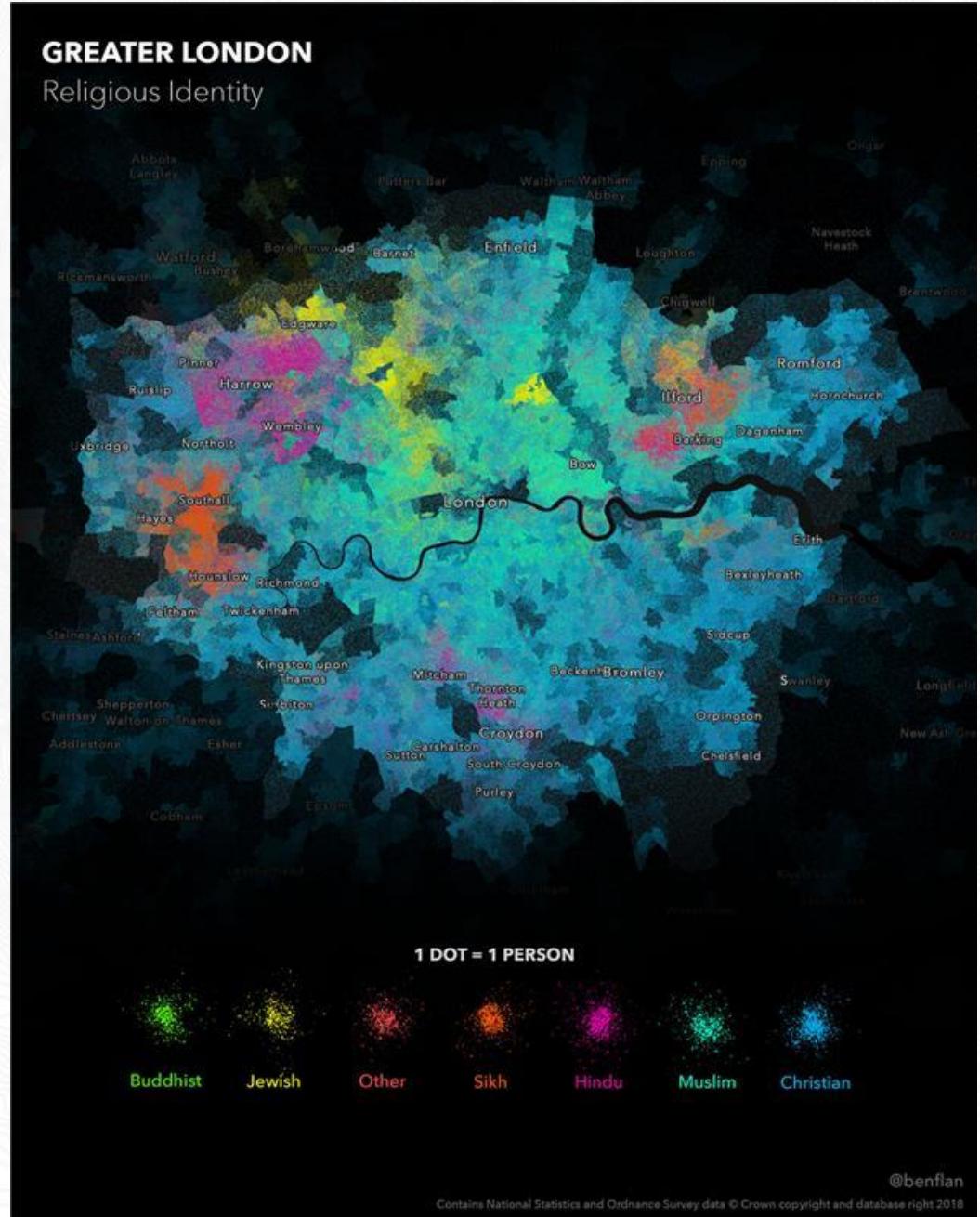
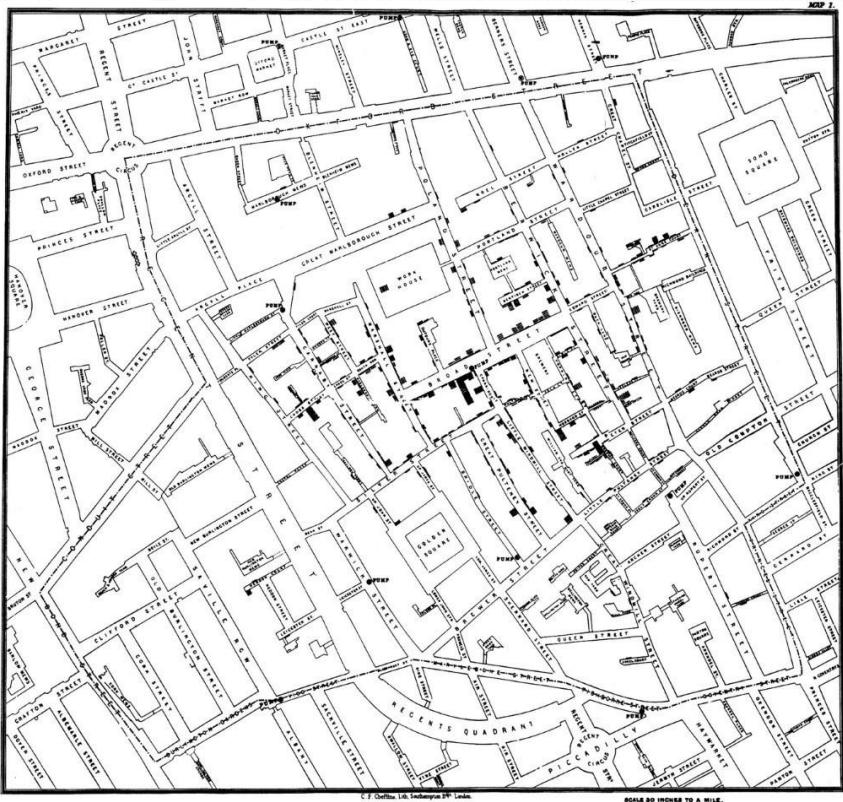
Session resumes @ 2pm

# Data Visualisation Techniques

Maps, Graphs, Charts and more...

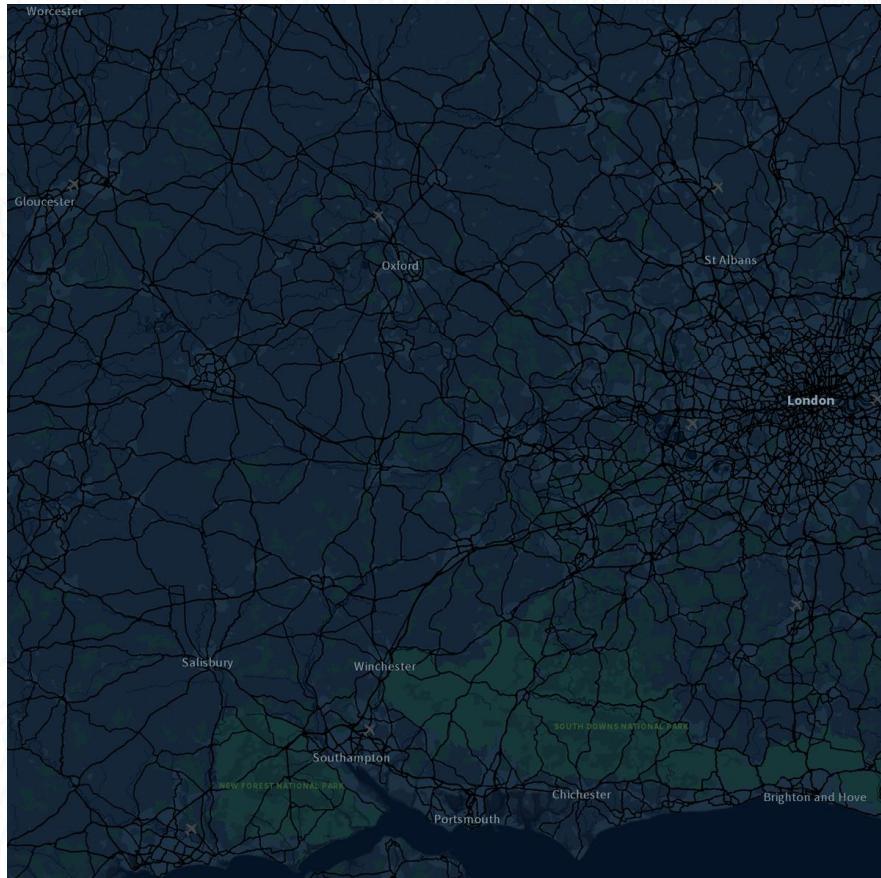
# Dot Density Map

- A dot density map is a map that uses a dot symbol to represent a **feature**.
- One-to-one or one-to-many.



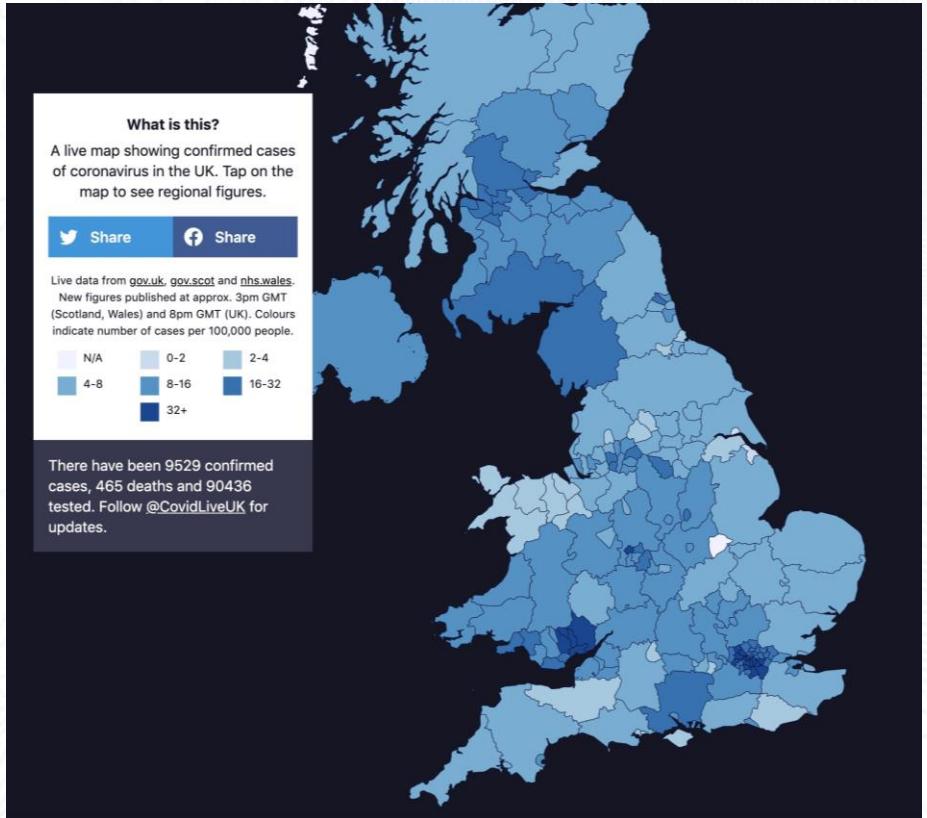
# Proportional Symbol

- A proportional symbol map uses map symbols that vary in **size** to represent a **numeric variable**.



# Choropleth Map

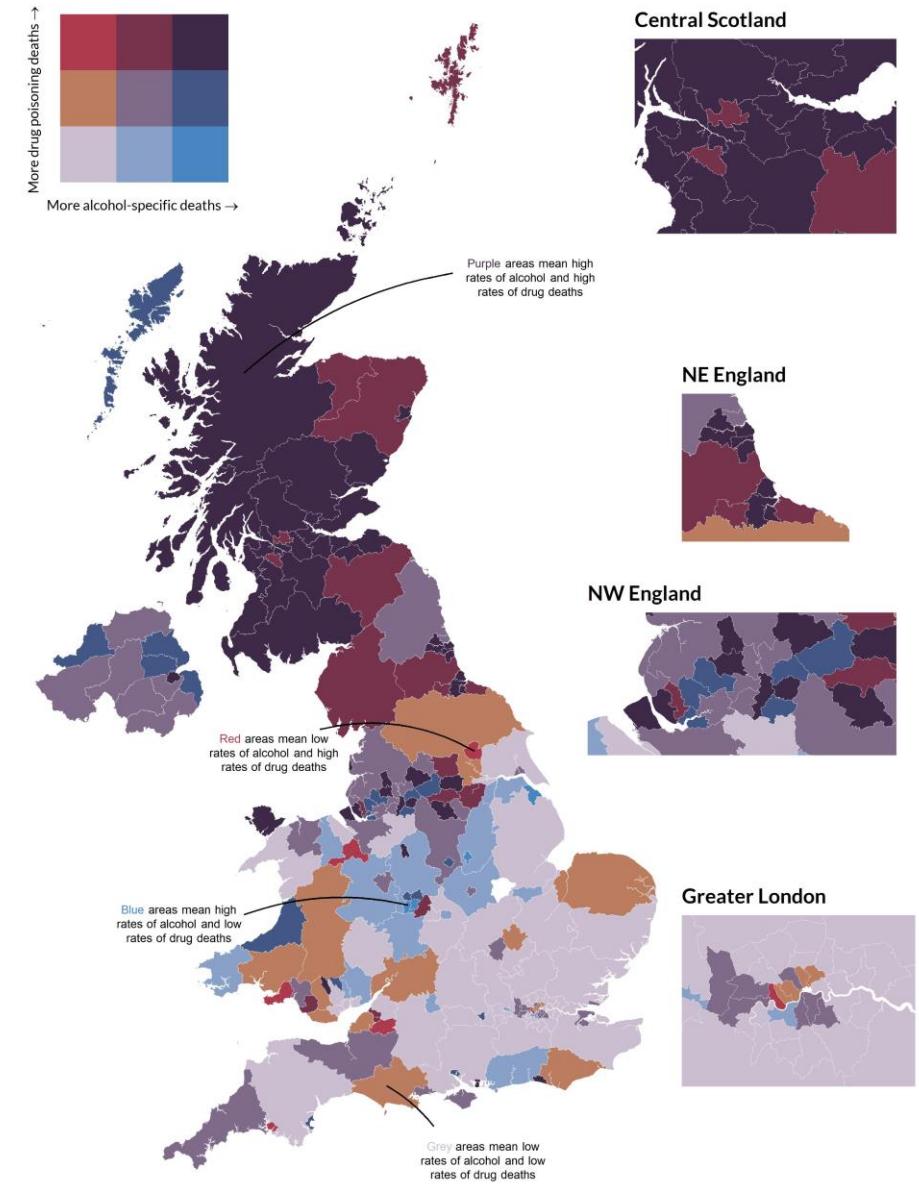
- A choropleth map is a map where **geographic areas** are coloured or styled in relation to a **value**.



## Regional patterns in deaths from alcohol and drugs across the UK

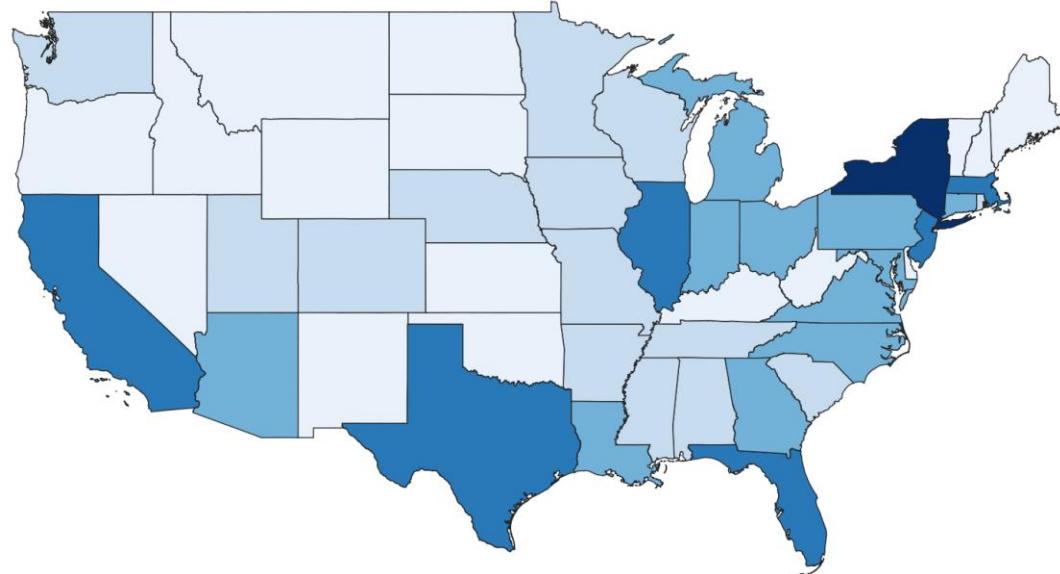
Comparative rates of alcohol-specific deaths and deaths from drug misuse by Local Authority.

Data is not available for Rutland.

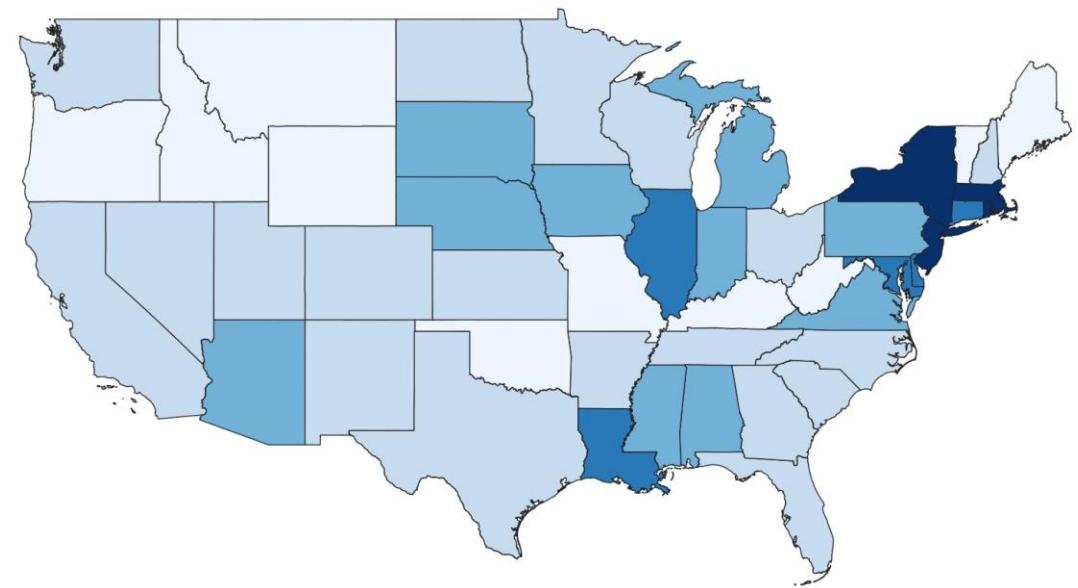


# Choropleth Map – Normalise your data!

- Map assumes the region/area has the same value e.g population or size.  
Normalise!!



(a) Covid-19 Total Cases



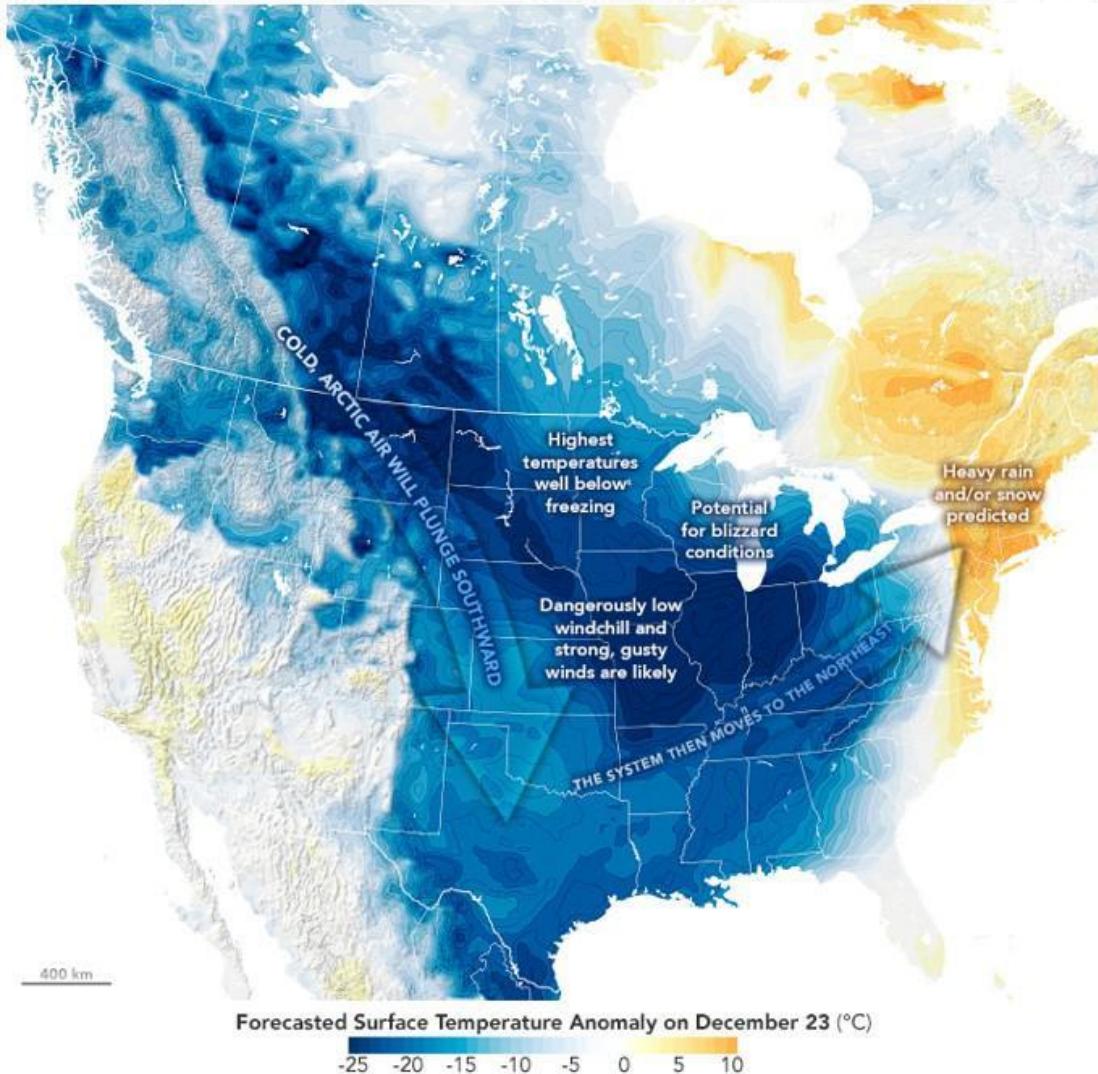
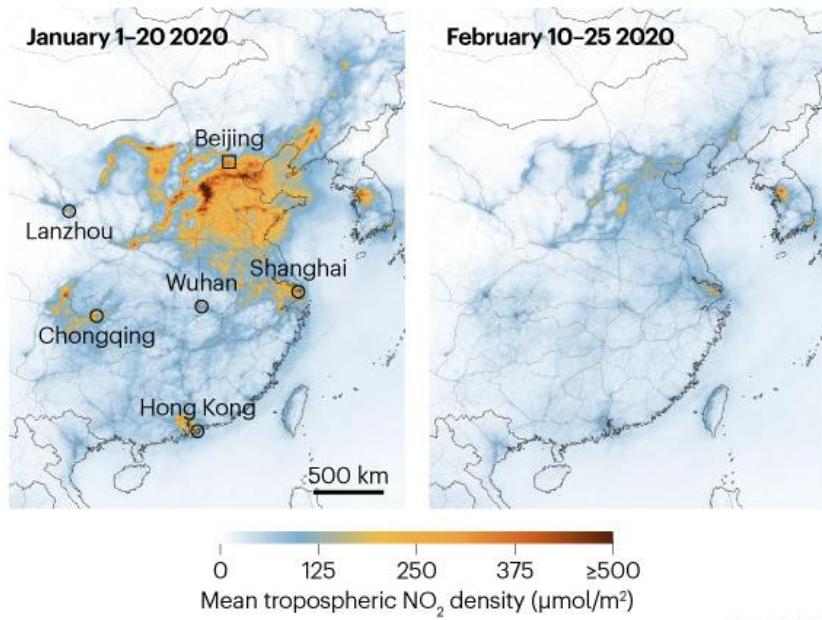
(b) Covid-19 Cases Per Capita

# Heat Map

- A heat map is used to represent the **density of data** in gradients of colour.

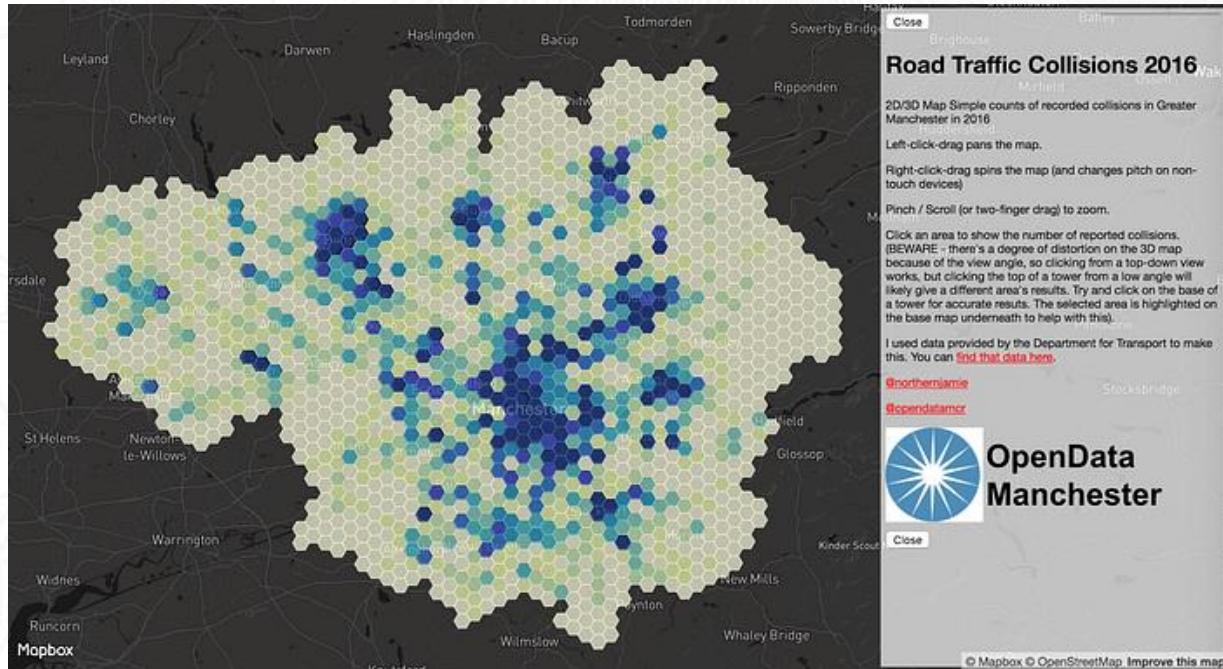
## CLEANER AIR

Measures to contain the coronavirus outbreak seem to have reduced nitrogen dioxide pollution across China.



# Hexbin (grid map)

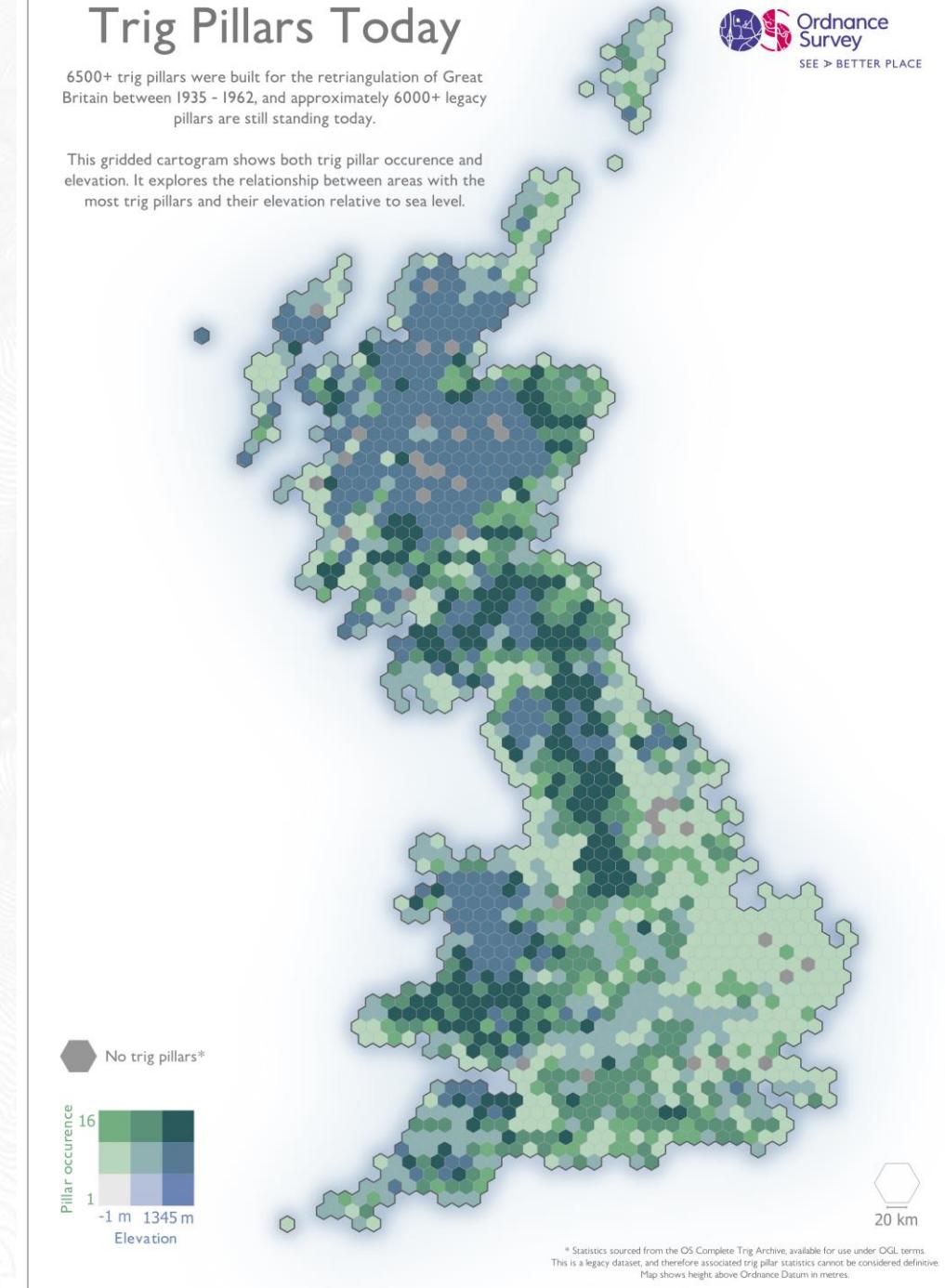
- Uses hexagons (or squares) to split a larger area into equally sized smaller parts which are coloured based on a value



## Trig Pillars Today

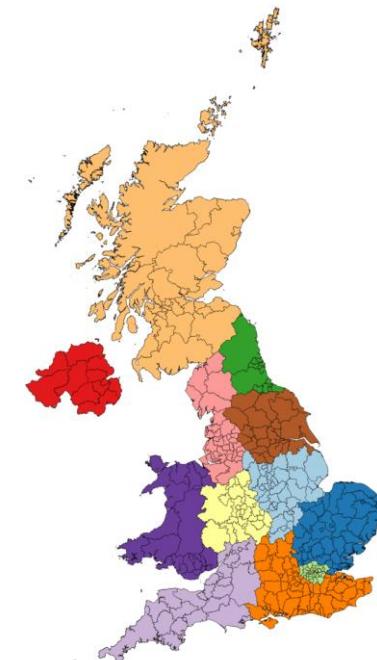
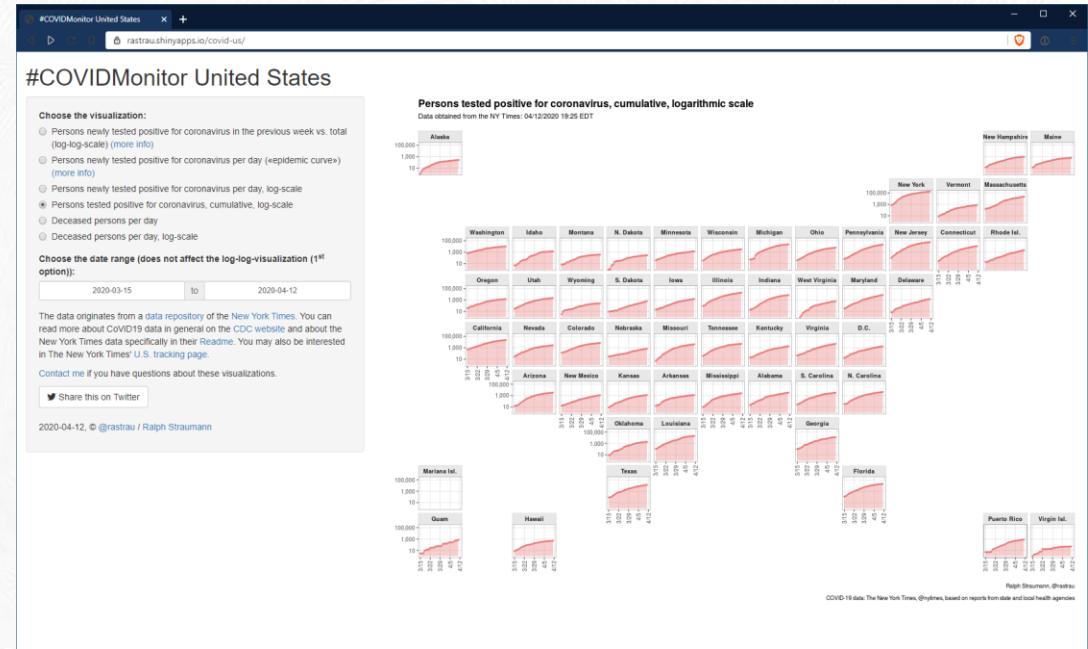
6500+ trig pillars were built for the retriangulation of Great Britain between 1935 - 1962, and approximately 6000+ legacy pillars are still standing today.

This gridded cartogram shows both trig pillar occurrence and elevation. It explores the relationship between areas with the most trig pillars and their elevation relative to sea level.

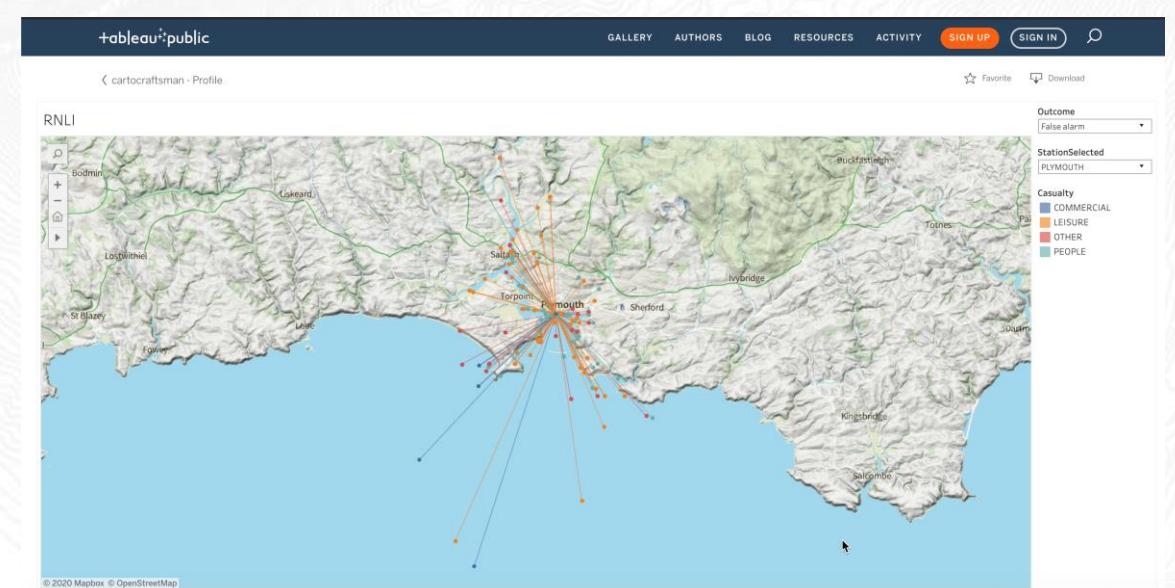
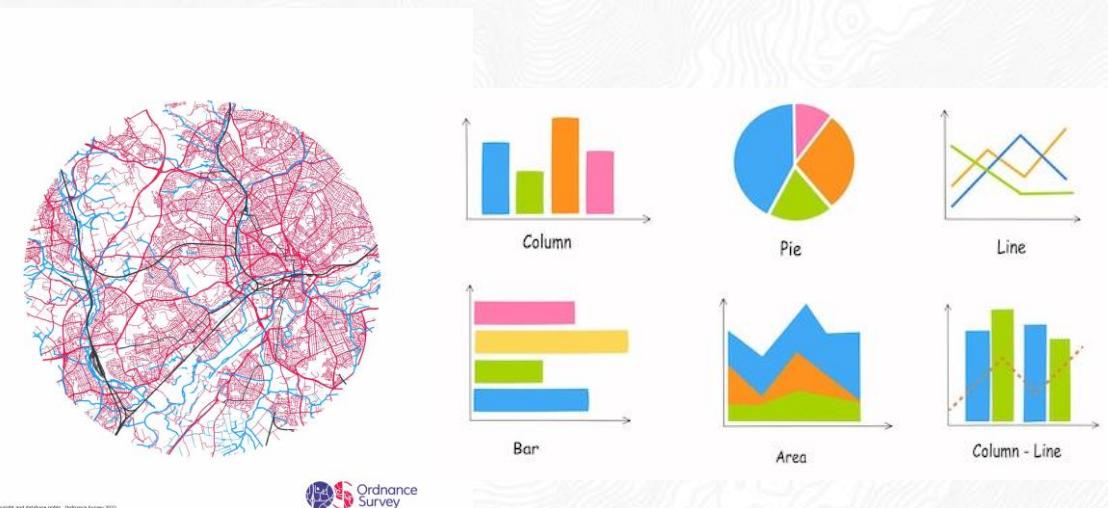
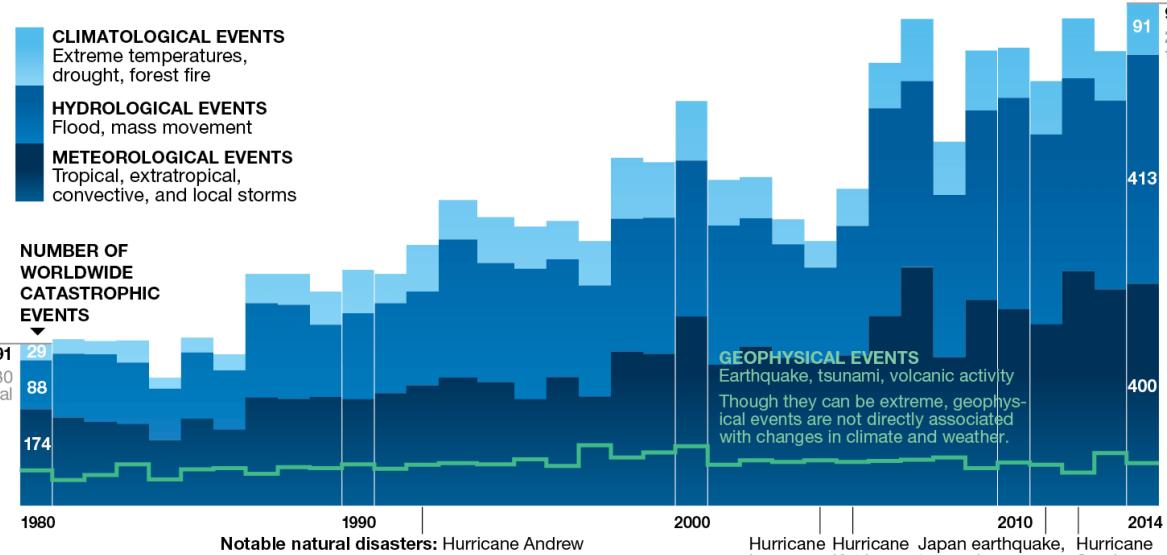


# Equal Area Cartograms

- Cartograms use geographic shapes (e.g. countries) and distort the size of regions based on a data value.
- Equal Area Cartograms however use the same size shape for each area



# It doesn't have to be a map...

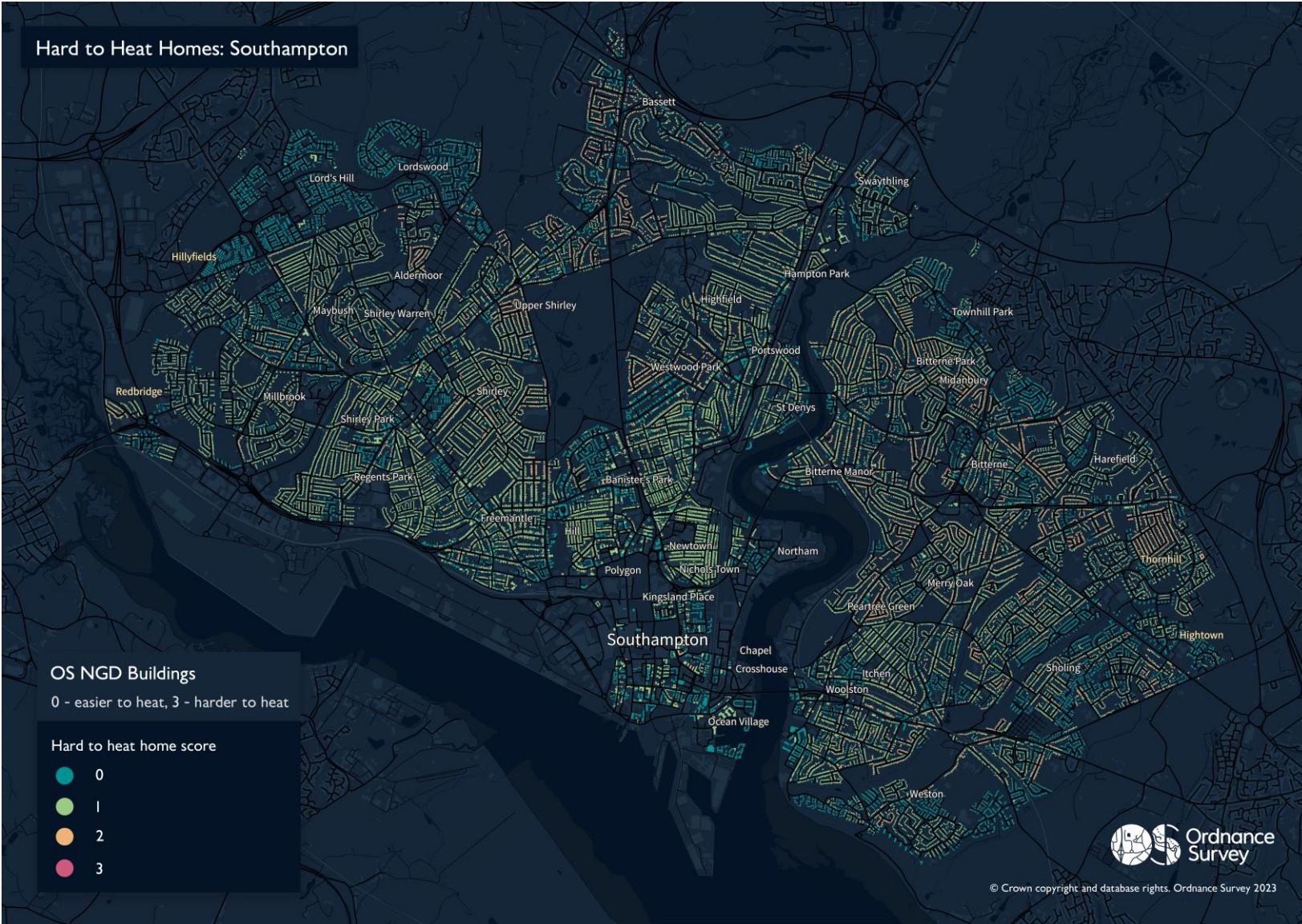


# Story telling

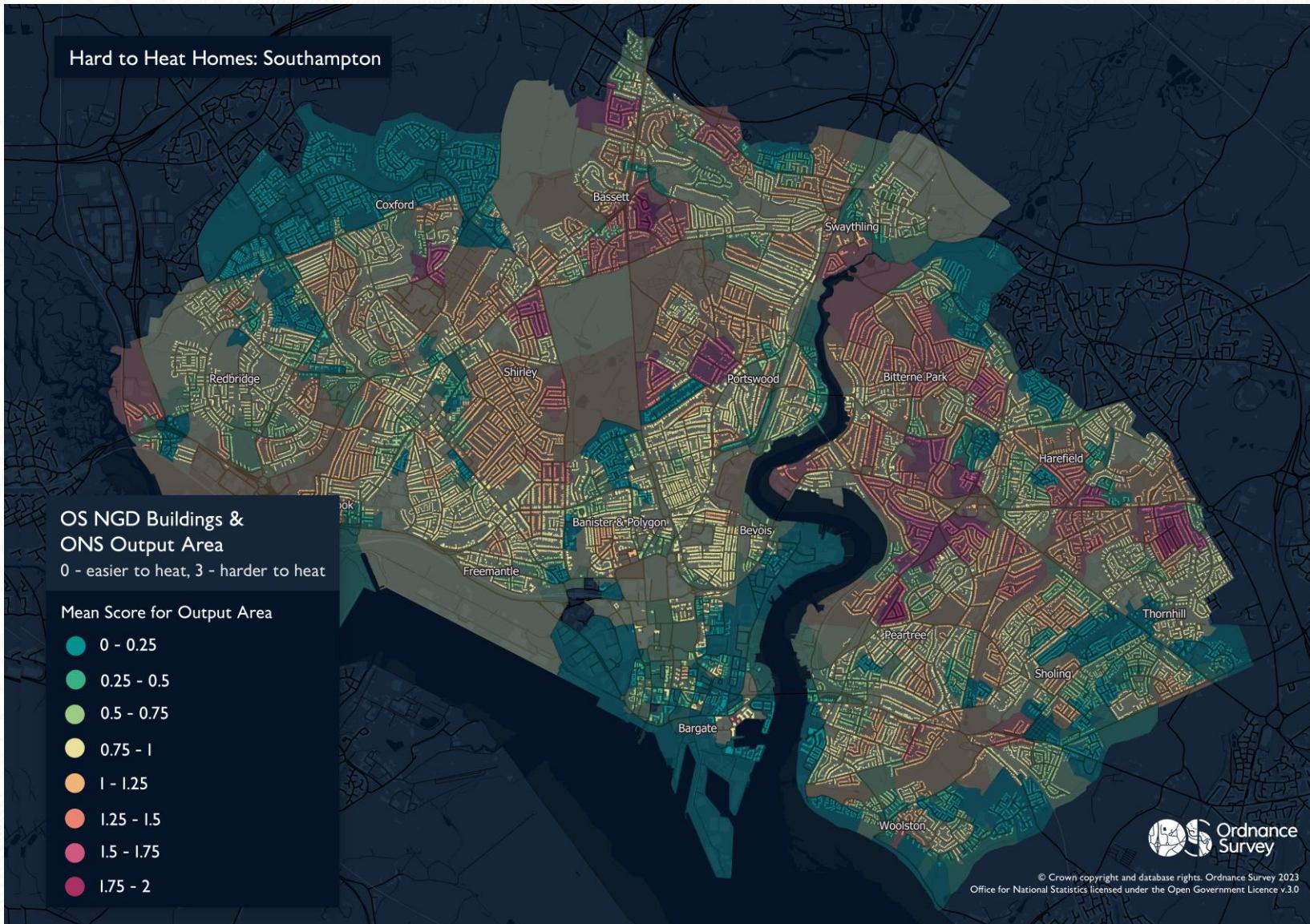
# What story are you trying to tell?



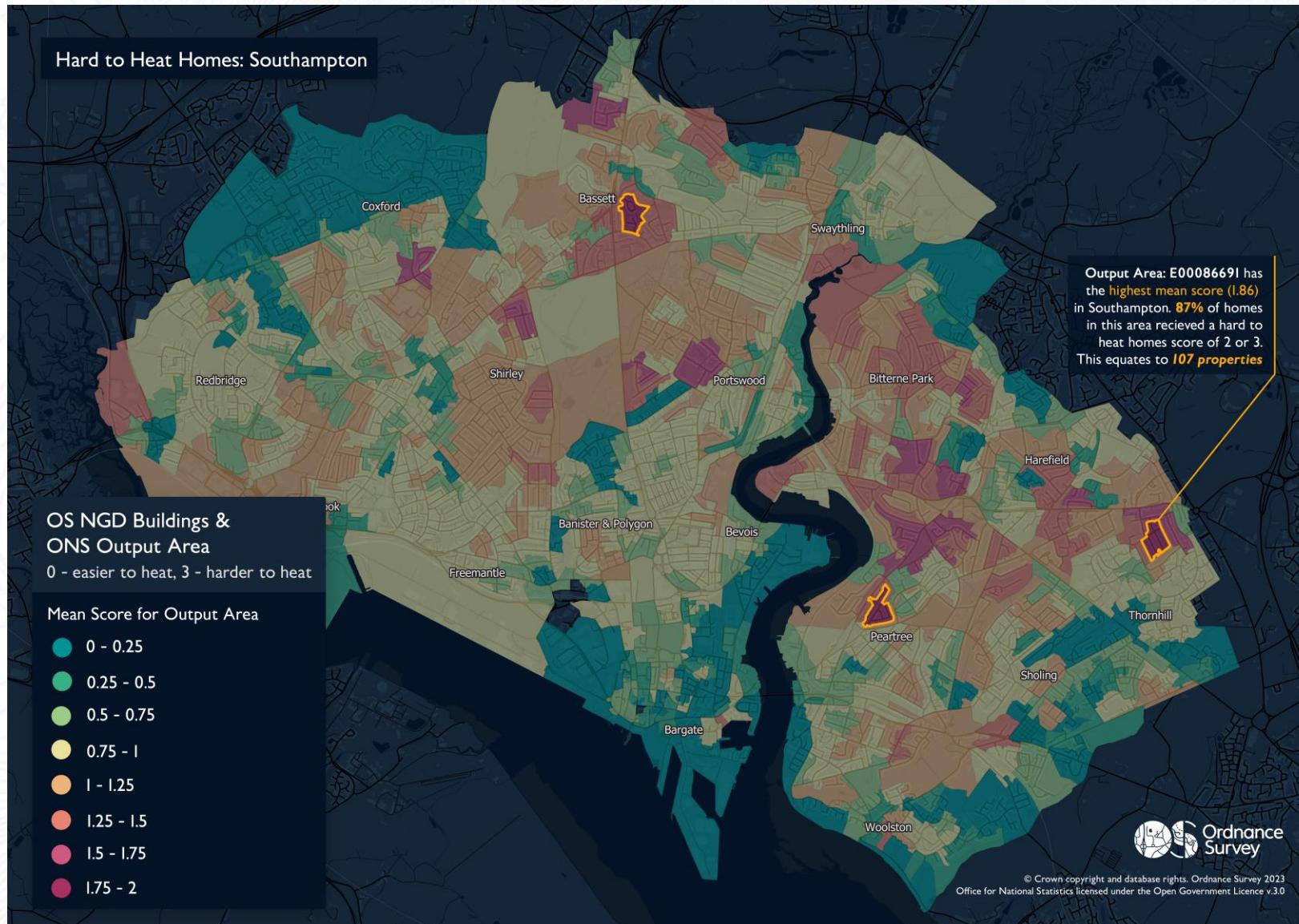
# What story are you trying to tell?



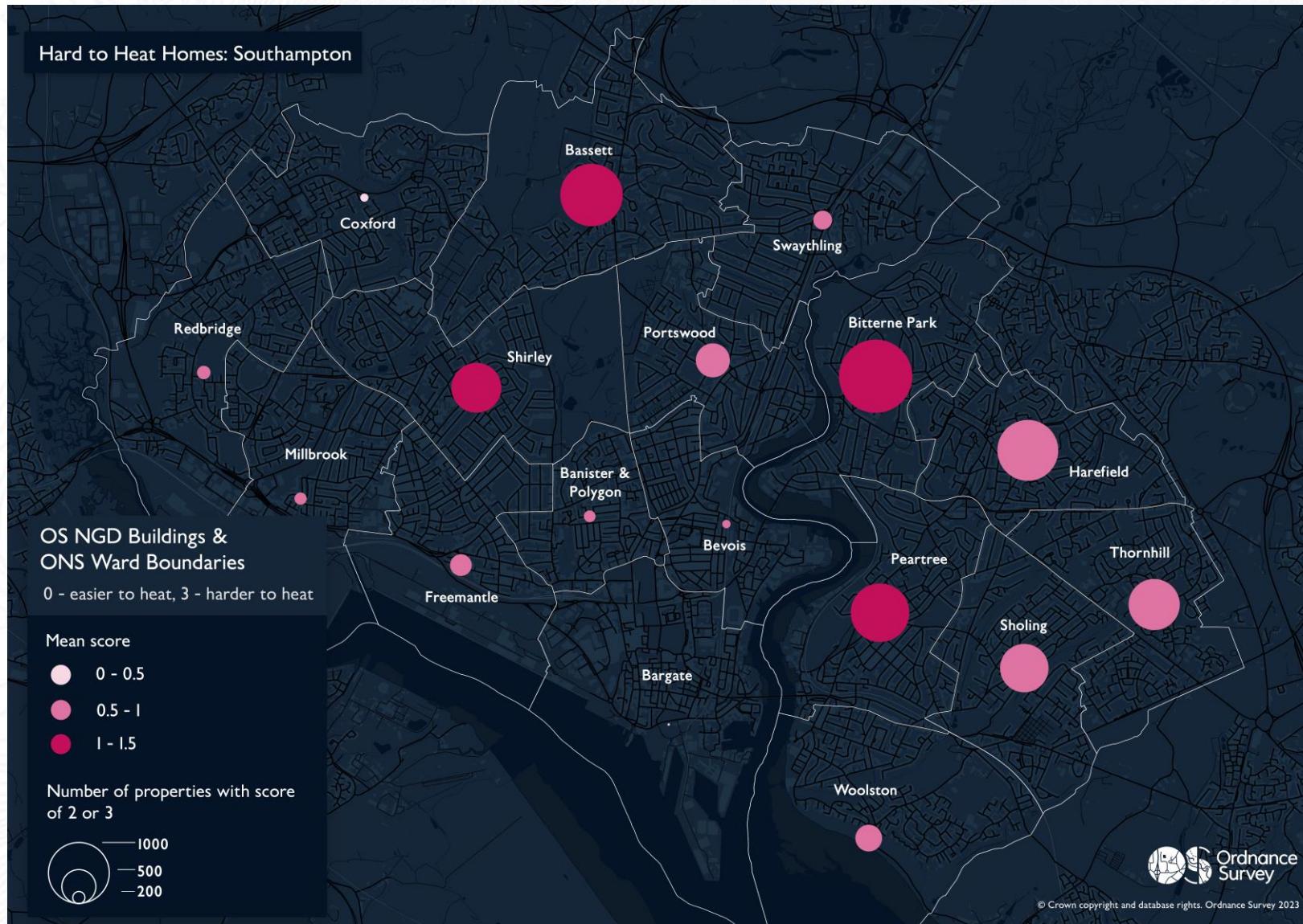
# What story are you trying to tell?



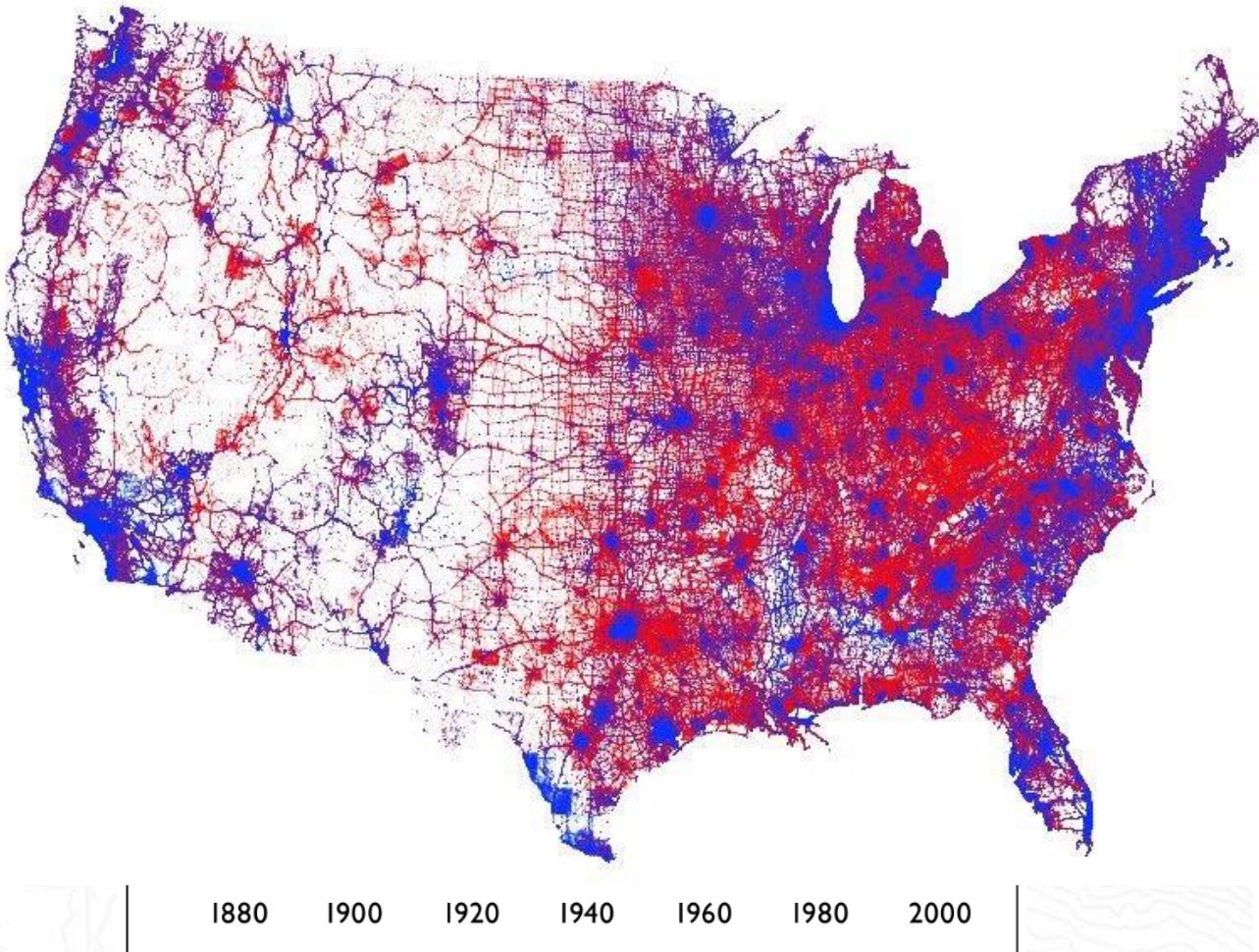
# What story are you trying to tell?



# What story are you trying to tell?



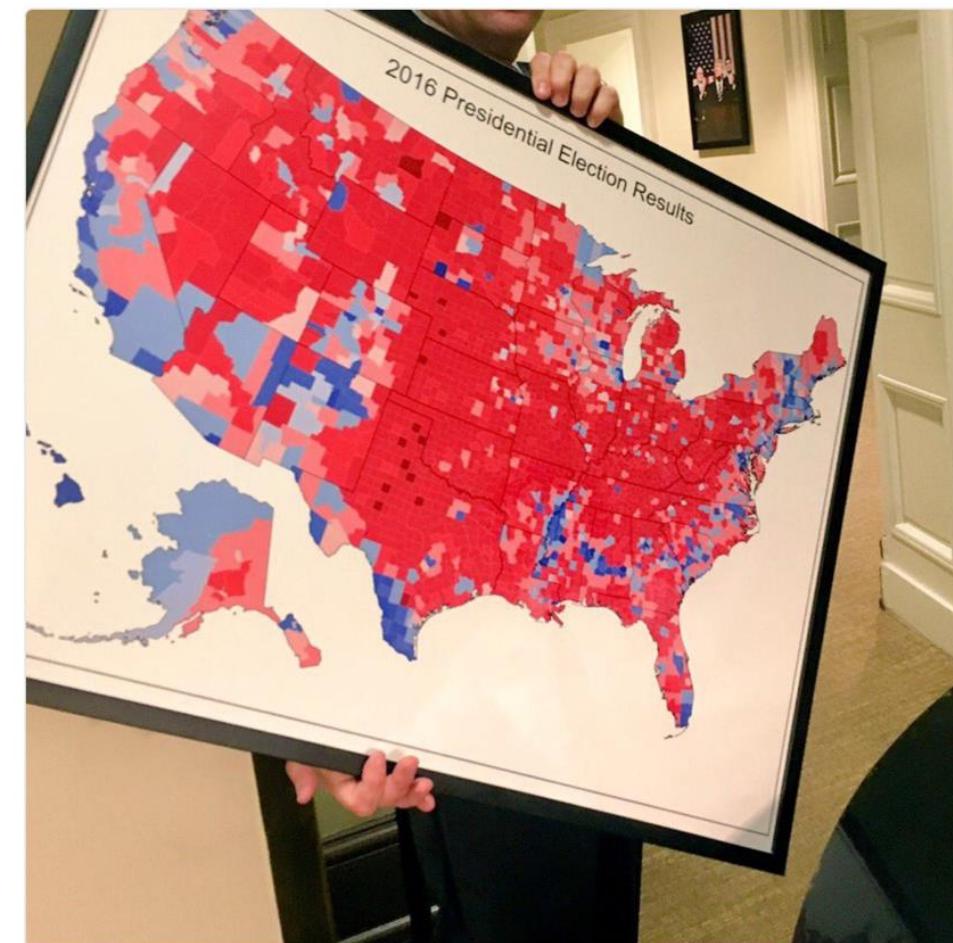
# Be ethical...



Trey Yingst @TreyYingst

Follow

Spotted: A map to be hung somewhere in the West Wing



RETWEETS

4,375

LIKES

8,877



7:03 am - 11 May 2017

1.5K

4.4K



8.9K

# Story Telling Exercise



# Refugee Crisis - Ukraine



Ukraine\_Refugee\_Data.xlsx Saved to Drive

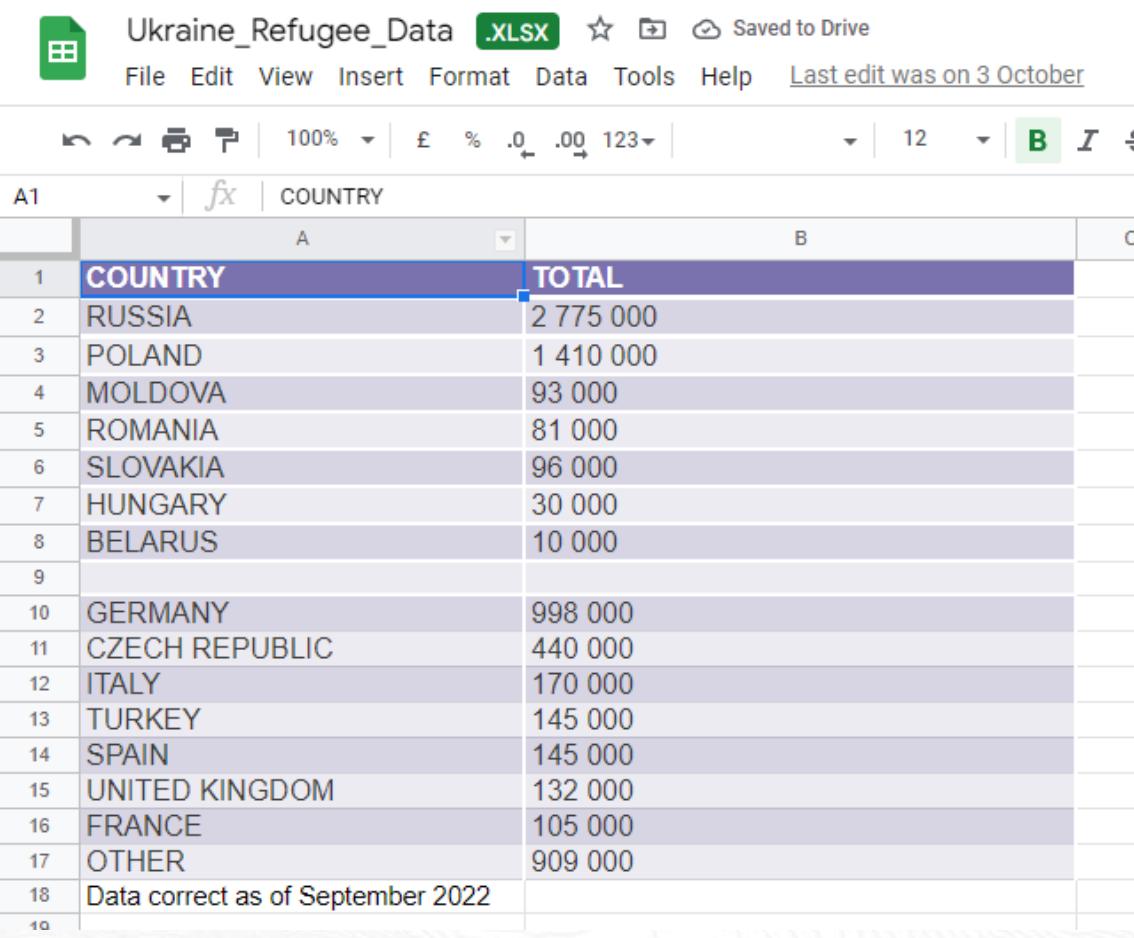
File Edit View Insert Format Data Tools Help Last edit was on 3 October

A1 fx COUNTRY

	A	B	C
1	COUNTRY	TOTAL	
2	RUSSIA	2 775 000	
3	POLAND	1 410 000	
4	MOLDOVA	93 000	
5	ROMANIA	81 000	
6	SLOVAKIA	96 000	
7	HUNGARY	30 000	
8	BELARUS	10 000	
9			
10	GERMANY	998 000	
11	CZECH REPUBLIC	440 000	
12	ITALY	170 000	
13	TURKEY	145 000	
14	SPAIN	145 000	
15	UNITED KINGDOM	132 000	
16	FRANCE	105 000	
17	OTHER	909 000	
18	Data correct as of September 2022		
19			

# 10 minutes

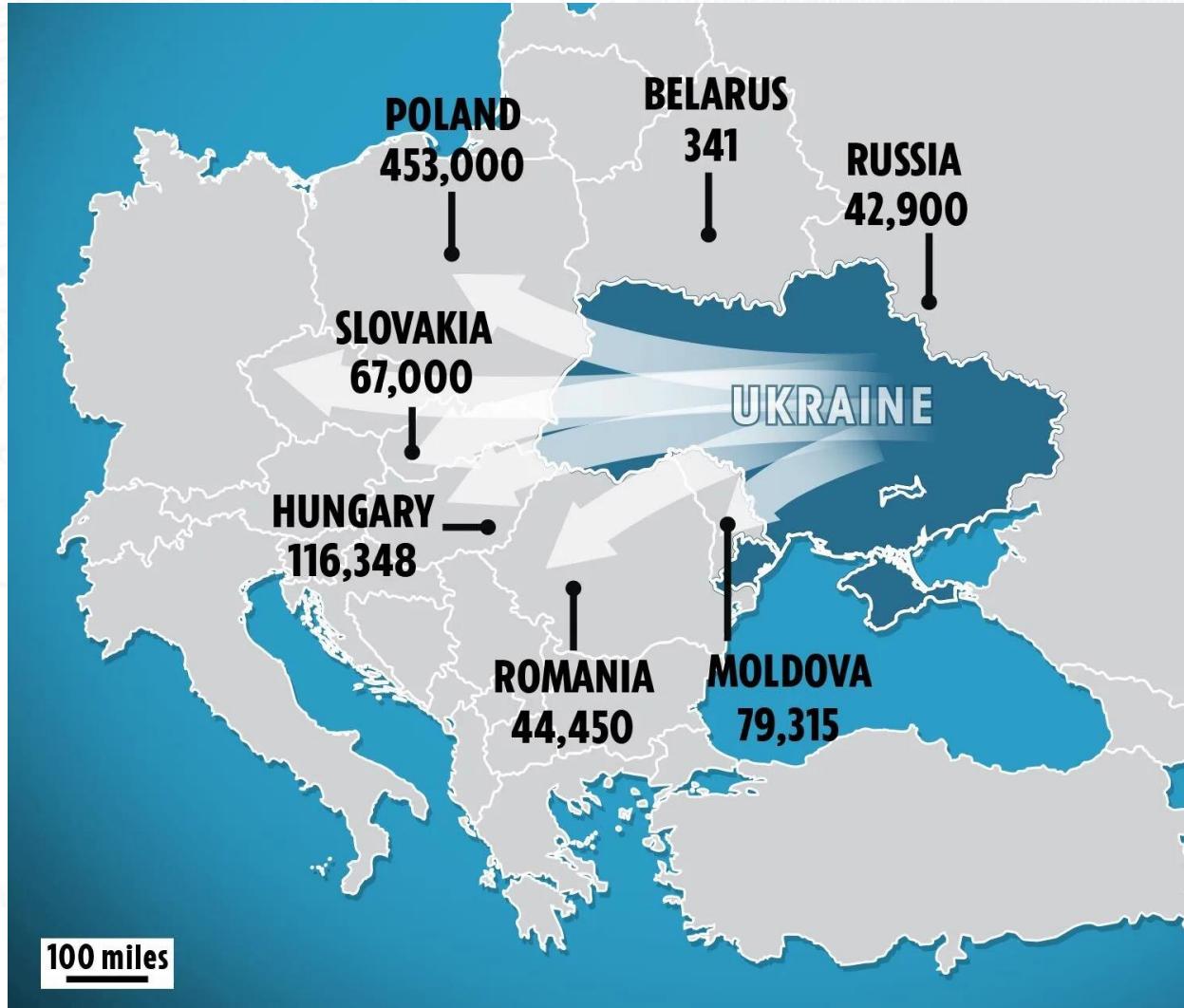
Think about how as a data journalist you would present this data in a way that it tells a story



The screenshot shows a Google Sheets document with the title "Ukraine\_Refugee\_Data .XLSX". The document has a single sheet named "Sheet1" which contains a table of refugee data. The table has two columns: "COUNTRY" and "TOTAL". The data is sorted by total count in descending order. The top 18 countries listed are:

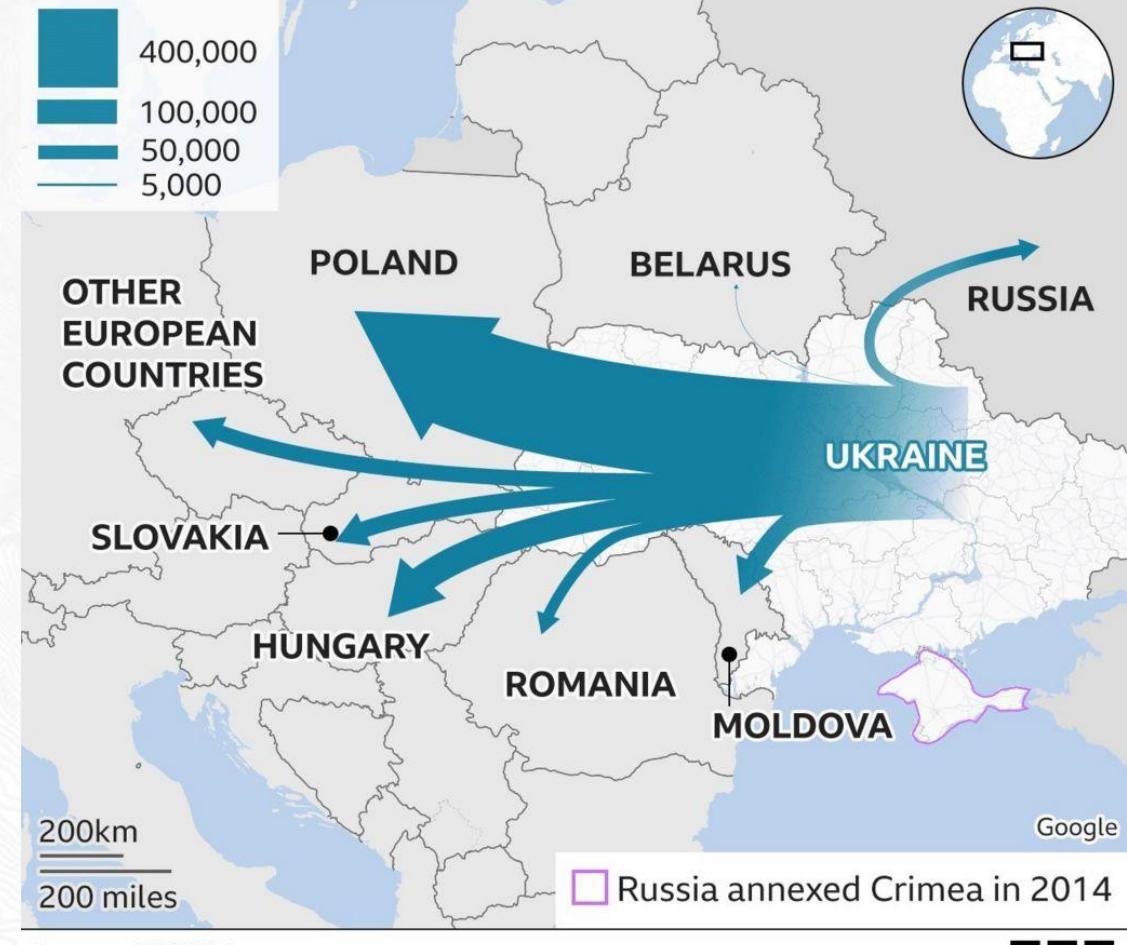
	A	B	C
1	COUNTRY	TOTAL	
2	RUSSIA	2 775 000	
3	POLAND	1 410 000	
4	MOLDOVA	93 000	
5	ROMANIA	81 000	
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16	FRANCE	105 000	
17	OTHER	909 000	
18	Data correct as of September 2022		

# The Sun



# BBC

Which countries are Ukrainians fleeing to?



BBC





James Cheshire  
@spatialanalysis

...

Here's my more detailed thoughts this map and how we might do better when charting the flow of people from Ukraine (and elsewhere)  
[jcheshire.com/resources/more...](http://jcheshire.com/resources/more...)

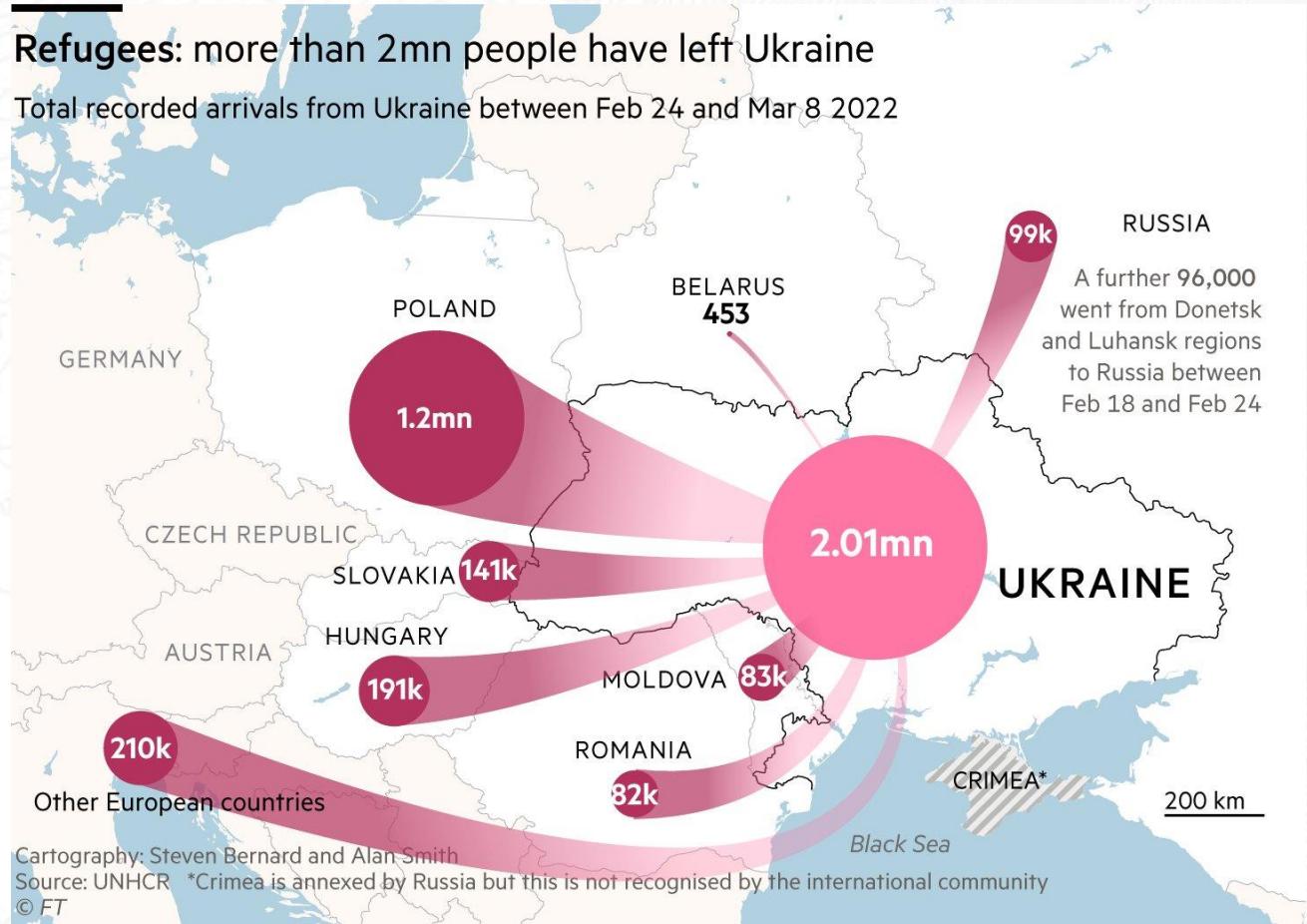


• Daniel P. Huffman and 8 others

6:08 PM · Mar 4, 2022 · Twitter Web App

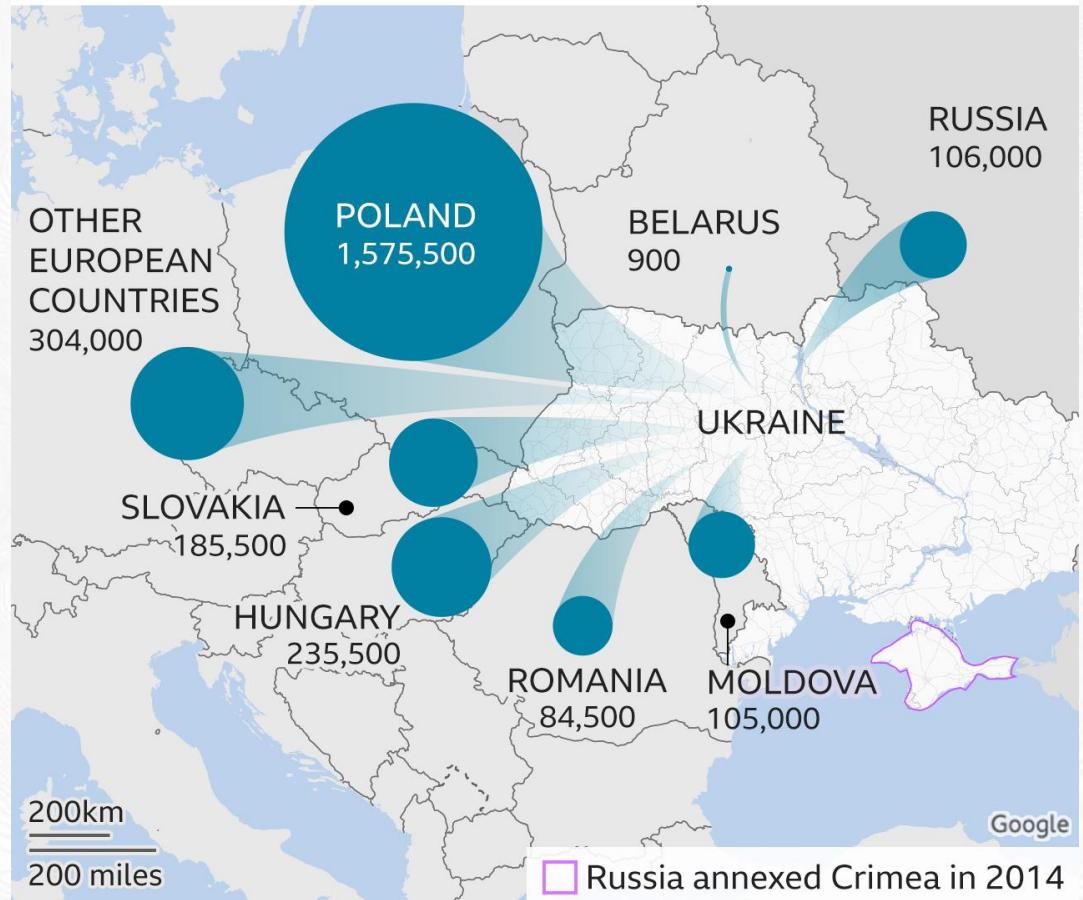
47 Retweets 21 Quote Tweets 169 Likes

# Financial Times



# BBC

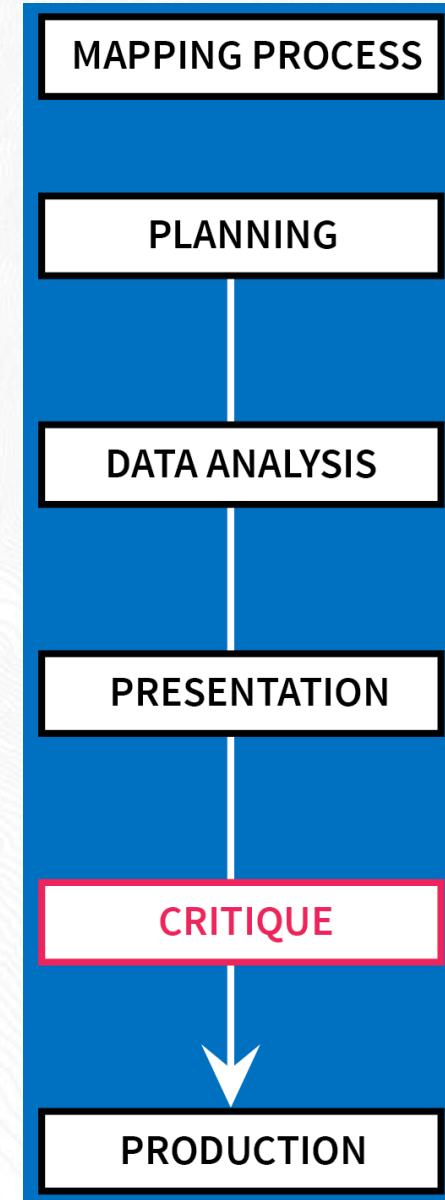
## Which countries are Ukrainians fleeing to?



BBC

# Data Viz Critique

Praise makes you **feel good**  
Critique makes you **better**



# Critique: A few tips

## When **giving** feedback:

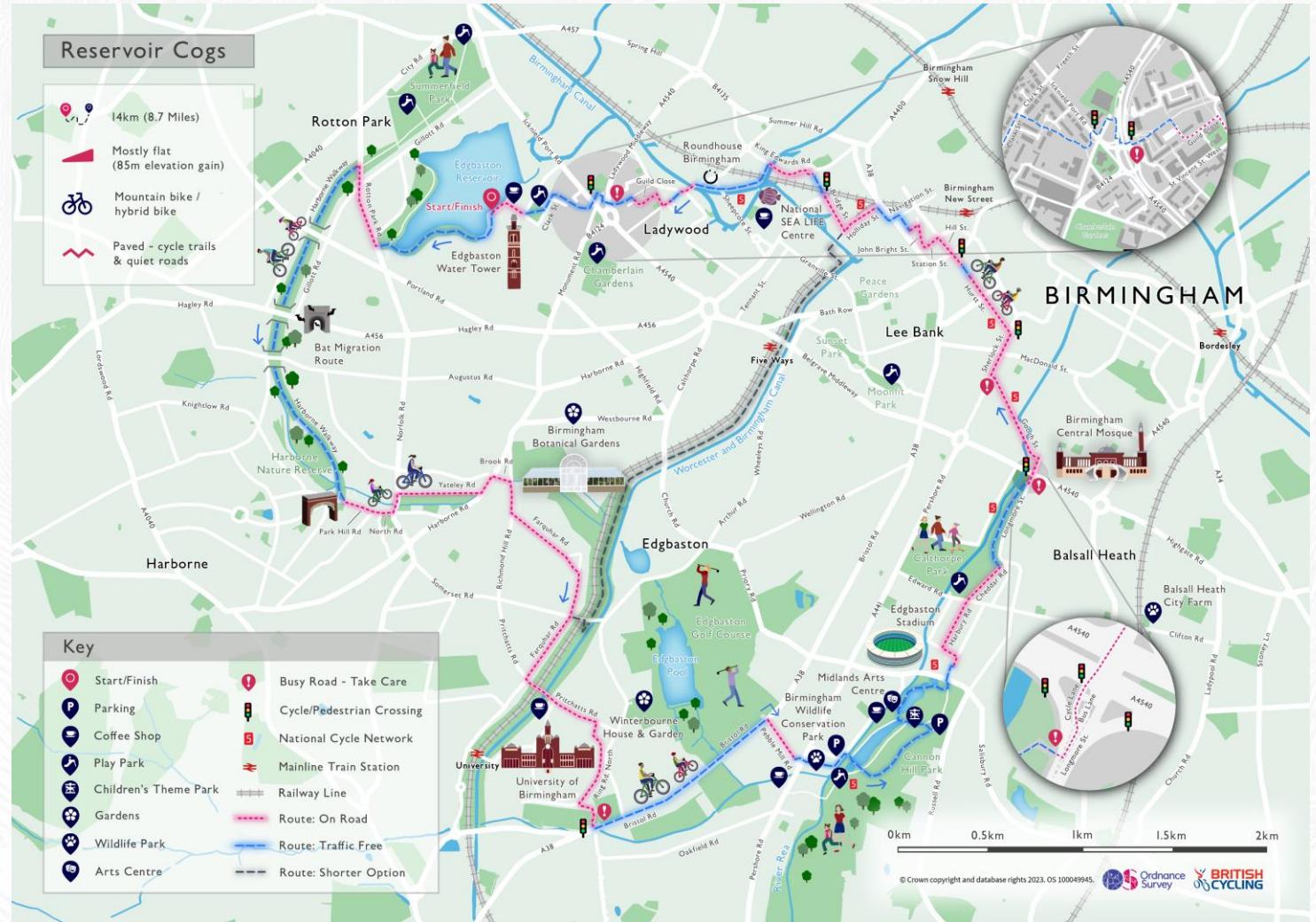
- ✓ Base it on these top tips and design principles
- ✓ Be respectful, objective and constructive
- ✓ Offer suggestions and not problems
- ✓ Outline the positives too

## When **receiving** feedback:

- ✓ It's not personal
- ✓ Use it as a tool for growth and learning – it will ultimately make you better
- ✓ It's ok to ask someone why they have offered a specific piece of feedback
- ✓ Design can be subjective

# Critique ideas...

- Purpose
- Content
- Visualisation Method
- Legend
- Colour
- Layout
- Title
- Labels/Fonts/Symbology
- Scale
- Projection (if appropriate)
- Unnecessary information

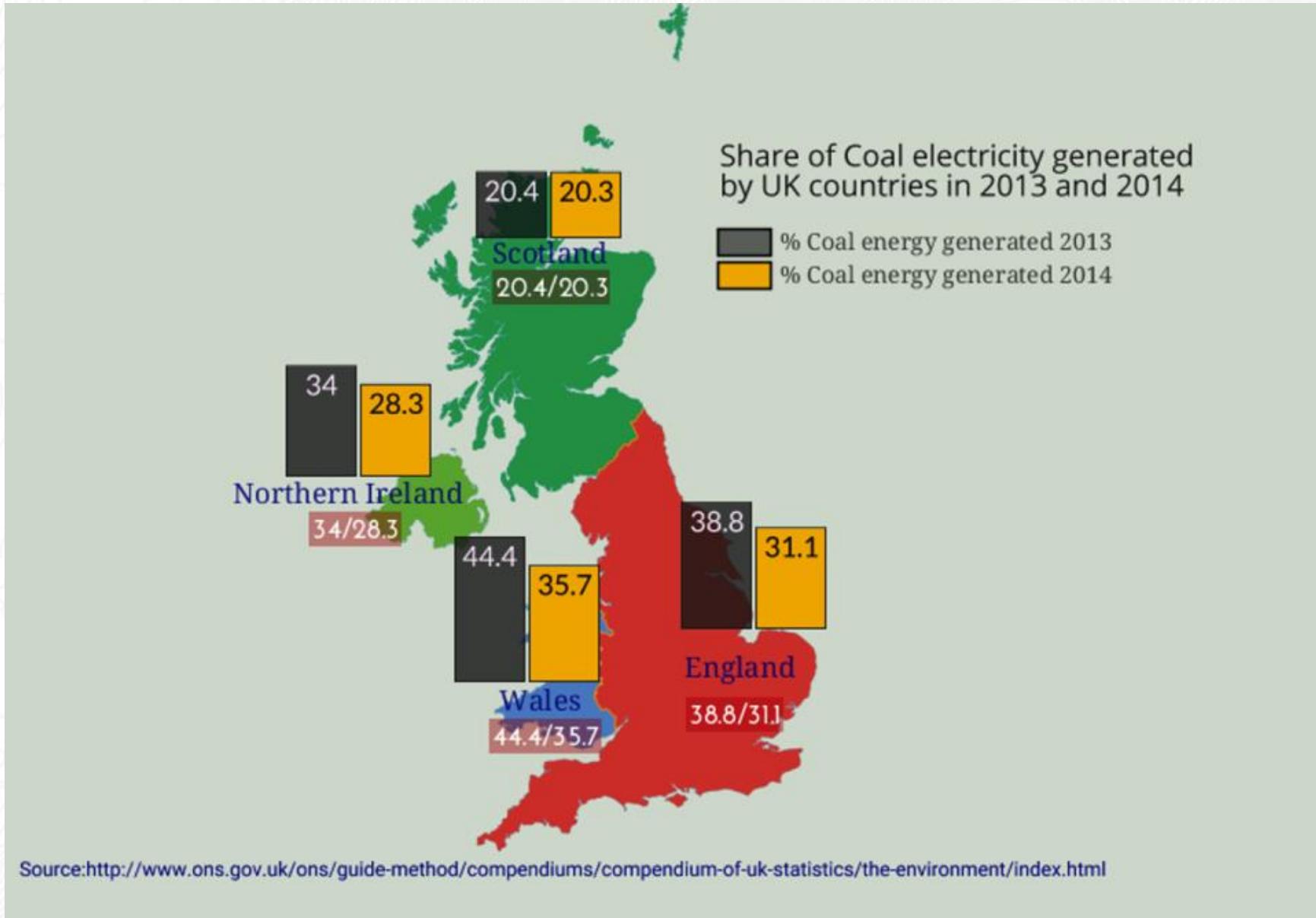


# DataViz Critique Exercise

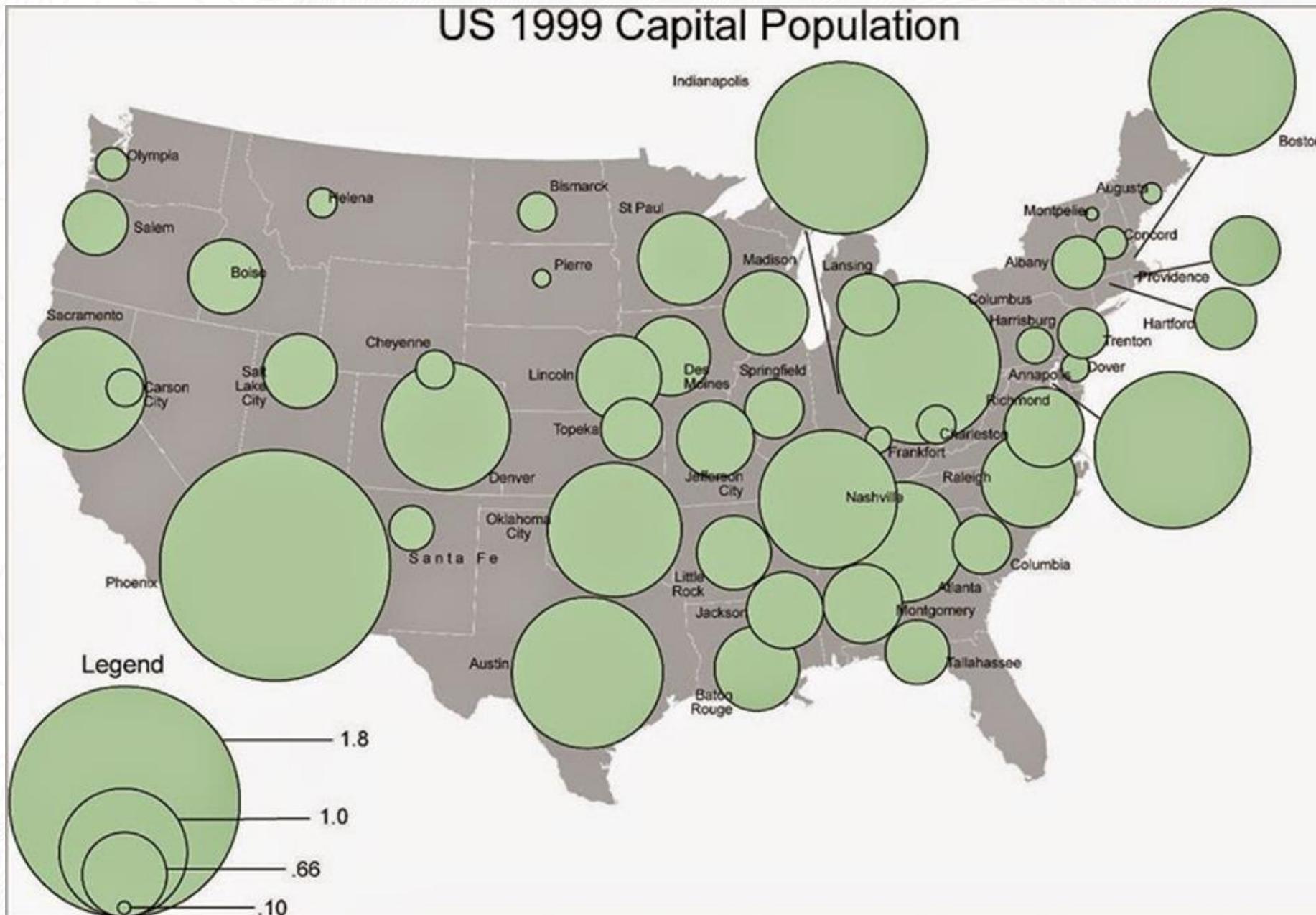
Slido.com: #4094391

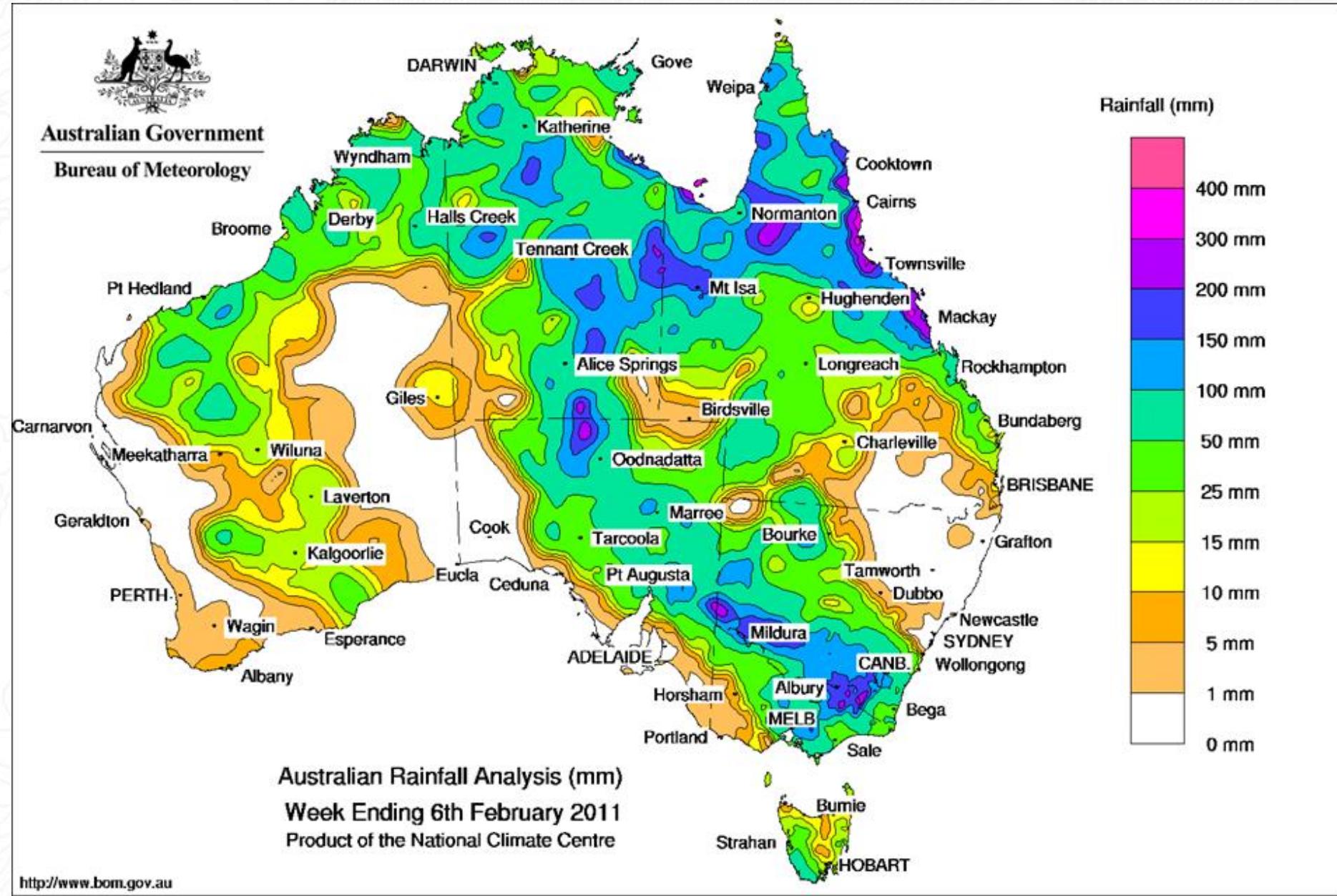
1. Rating out of 10
2. What you like?
3. What could be improved?



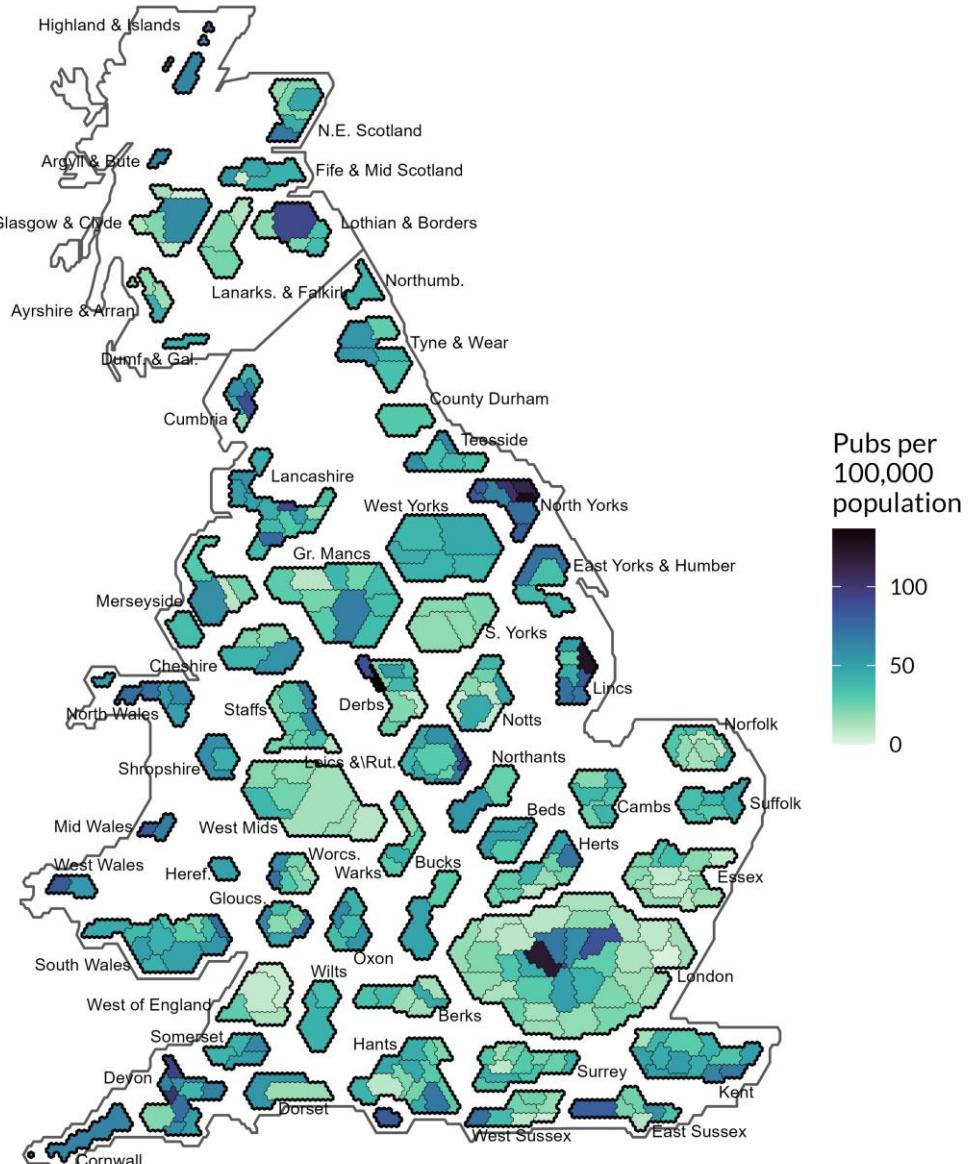


## US 1999 Capital Population





## How many locals for the locals? Number of pubs and bars per capita in Great Britain



Data from OpenStreetMap  
Cartogram by Carl Baker  
Map by @VictimOfMaths

# Tools and Advice

# More than Maps



More than Maps

## GEOGRAPHIC DATA VISUALISATION

Guide to cartography >

**Guide to data visualisation** >

GeoDataViz resources >

## DATA IN ACTION

Examples

Case studies >

## TUTORIALS

GIS >

Web >

APIs >

## DEEP DIVE

Powered By GitBook

## Guide to data visualisation



Introduction to data visualisation



GeoDataViz design principles



Types of visualisation



Thematic mapping techniques



Data visualisation critique

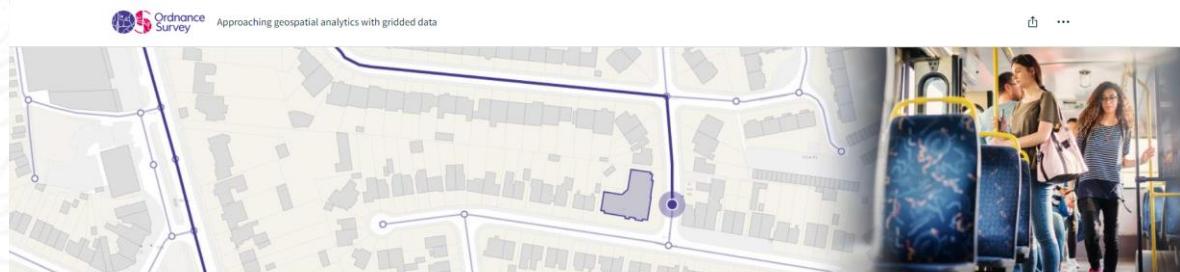


Accessible data visualisation



<https://docs.os.uk/more-than-maps/>

# More than Maps



## Approaching geospatial analytics with gridded data

## Using gridded geographies to make geospatial analysis more accessible - a study of 20 minute neighbourhoods

The screenshot shows the Product Viewer Beta interface. On the left, there is a sidebar with a search bar and a list of data layers:

- OS Open Rivers
- OS Open Roads
- OS MasterMap Water
- OS MasterMap Highways**
- Height and Imagery
- OS Topography
- Building Height Attribute
- OS MasterMap Greenspace
- Open Greenspace
- OS MasterMap Sites

The main area displays a map with several colored lines representing different types of infrastructure or data layers. A red line is prominent, followed by a black line, a purple line, and other orange and yellow lines. The map also features a grid pattern and some street names like "Pettico Ave", "Rivermead Rd", "Toplins Rd", "Buckland Ave", and "Beech Rd". The top left corner of the interface has the text "Product Viewer Beta".

## **Addressing & location demonstrators**



What address product?



## AddressBase



AddressBase Core



AddressBase Plus



#### AddressBase Premium



## Address classifications



<https://docs.os.uk/more-than-maps/>

# GDV Toolkit

## Colour palettes

## Map symbols

[github.com/OrdnanceSurvey/GeoDataViz-Toolkit](https://github.com/OrdnanceSurvey/GeoDataViz-Toolkit)  
or search for 'GeoDataViz Toolkit'

### Using these symbols

Customise the colours - Once downloaded you can customise the look and feel of these symbols by changing the colour to suite your visualisation.



Try using the GeoDataViz colour palettes.

Mix and match - You can edit and combine the symbols to create new custom symbols. For example, you can add any other symbol into the centre of a map pin.



Flexible - You can use these symbols for web mapping, desktop GIS or even graphic design. You can also convert SVG into many other image formats.

## GeoDataViz Colour Palettes

### Qualitative



Use these groupings where possible as they are colour-blind safe.

OR

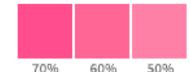
OR

OR

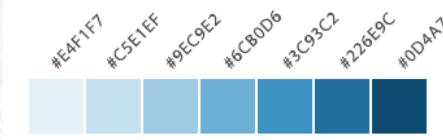


Red Amber Green

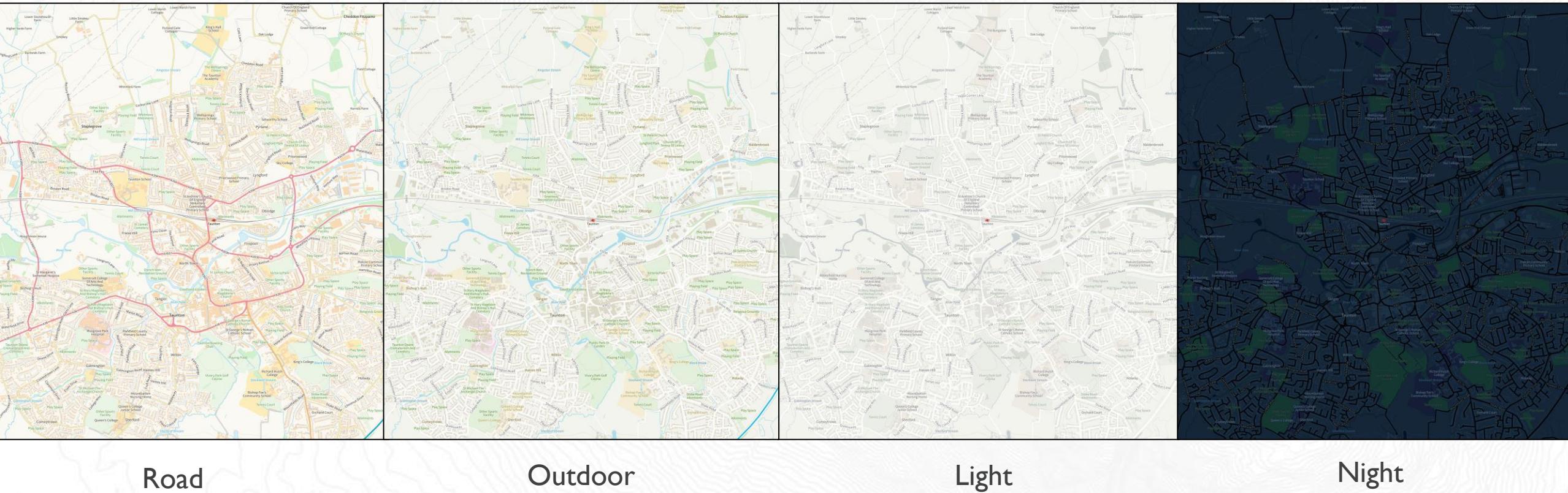
You can tweak the saturation levels to lighten the colours e.g.



### Sequential (single and multi-hue)



# Stylesheets



Road

Outdoor

Light

Night

[github.com/OrdnanceSurvey/](https://github.com/OrdnanceSurvey/)  
and search for 'Stylesheets'

# British Cartographic Society: OS Award



An award to encourage:

Innovative use of OS data

and

Excellence in cartographic design

More information about the award can be found on the British Cartographic Society Website.

<https://www.cartography.org.uk/awards>.

Deadline: 23<sup>rd</sup> June 2024.

# Questions

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[hannah.wright@os.uk](mailto:hannah.wright@os.uk)

GDV Gallery

[labs.os.uk/public/os-virtual-gallery/](http://labs.os.uk/public/os-virtual-gallery/)

OS Flickr

[flickr.com/photos/ordnancesurvey/albums](http://flickr.com/photos/ordnancesurvey/albums)

Linkedin: Paul Naylor

Linkedin: Hannah Wright