THE POWER OF GEOGRAPHIC DATA VISUALISATION IN STORYTELLING

FOSS4G 2023

Jessica Baker
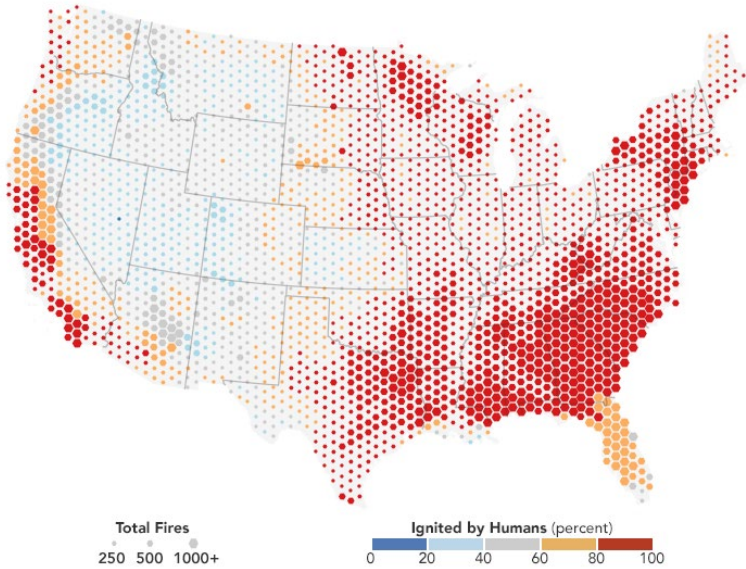
Ordnance Survey

SEE ➤ BETTER PLACE

Agenda

1. Introduction to Geographic Data Visualisation

2. Data, Software and Resources

3. Types of Geographic Data Visualisations – what they are and when to use them

4. Interactive exercise – storytelling with geographic data visualisations

5. Run through exercise and further examples

6. Close + questions

Why do we need to visualize data?

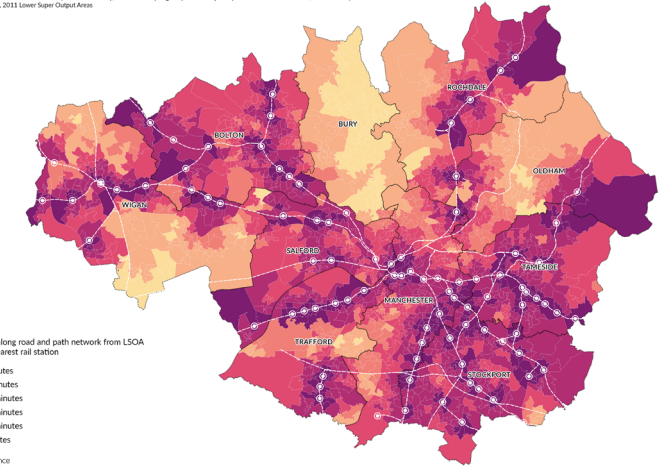**90%** of the world's data today has been created in the last **2 years** alone

What is GeoDataViz?

The benefits of **good** data viz
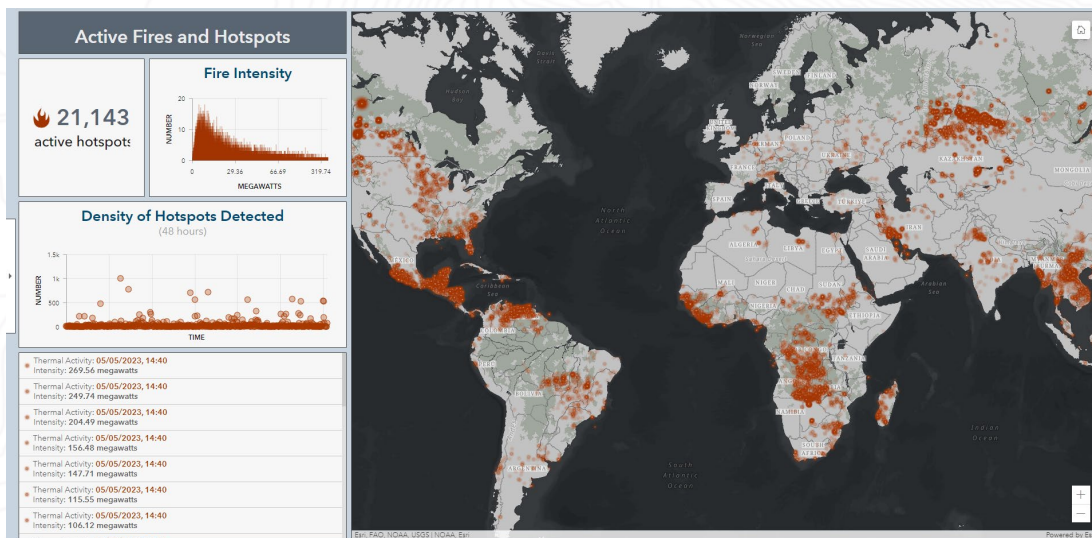
Effective **communication** of information

Turn raw data into actionable **insights**
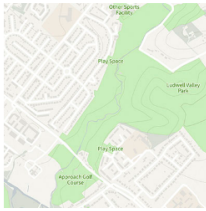
Tell **stories** and deliver powerful messages

Provide elegant **solutions** to complex problems

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

Data, Software and Resources
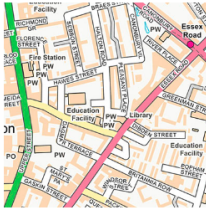
OS Open Greenspace

Covering a range of greenspaces in urban and rural areas including playing fields, sports' facilities, play areas and allotments.

Coverage: All of Great Britain (Option to set a custom area)
Data structure: Vector
Supply format: ESRI® Shapefile, GML, GeoPackage, and Vector Tiles
Version Date: 2023-04
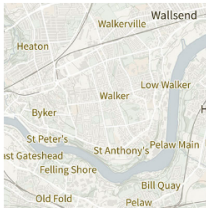
OS OpenMap - Local

Map, visualise and truly understand your data at street level.

Coverage: All of Great Britain (Option to set a custom area)
Data structure: Raster, Vector
Supply format: ESRI® Shapefile, GML, GeoPackage, and GeoTIFF
Version Date: 2023-04

OS Open Names

A comprehensive dataset of place names, roads numbers and postcodes for Great Britain.

Coverage: All of Great Britain
Data structure: Vector
Supply format: CSV, GML, and GeoPackage
Version Date: 2023-07

OS Open UPRN

An open dataset containing all the Unique Property Reference Numbers (UPRNs) found in AddressBase Premium, with their respective geometries in British National Grid and Latitude, Longitude.

Coverage: All of Great Britain
Data structure: Vector
Supply format: CSV, and GeoPackage
Version Date: 2023-07

OS Open USRN

An open dataset of all Unique Street Reference Numbers (USRNs) within OS MasterMap Highways Network, with an associated simplified line geometry representing the geographic extent of each USRN.

Coverage: All of Great Britain
Data structure: Vector
Supply format: GeoPackage
Version Date: 2023-08

OS Open Rivers

Understand how watercourses in Great Britain join up.

Coverage: All of Great Britain
Data structure: Vector
Supply format: ESRI® Shapefile, GML, GeoPackage, and Vector Tiles
Version Date: 2023-04

OS Open Roads

Get a high-level view of the road network, from motorways to country lanes.

Coverage: All of Great Britain
Data structure: Vector
Supply format: ESRI® Shapefile, GML, GeoPackage, and Vector Tiles
Version Date: 2023-04
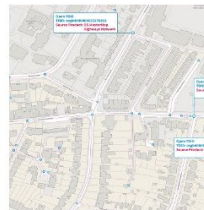
OS Open TOID

An open dataset providing access to a generalised location to key features found in OS MasterMap premium products enabling visualisation of third party data linked to their respective TOID identifier.

Coverage: Set a custom area
Data structure: Vector
Supply format: CSV, and GeoPackage
Version Date: 2023-08

OS Open Zoomstack

A comprehensive basemap of Great Britain showing coverage from national level right down to street detail.

Coverage: All of Great Britain
Data structure: Vector
Supply format: GeoPackage, and Vector Tiles
Version Date: 2023-06
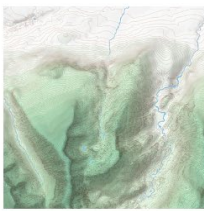
OS Terrain® 50

Visualise simple landscapes in 3D and bring your geographic analysis to life.

Coverage: All of Great Britain
Data structure: Vector
Supply format: ASCII Grid and GML (Grid), ESRI® Shapefile, GML, GeoPackage, and Vector Tiles
Version Date: 2023-07

QGIS
Open Source GIS

Inkscape
Open Source Vector graphics
editor

Tableau Public
Free data visualisation and
dashboard software

Aerialod
Free 3D visualisation
software

Mapbox
Mapping and location
(free version available)

StoryMap
Open source storymaps

Python, R, JavaScript
Code based solutions

GeoDataViz Colour Palettes

Qualitative

#FF1F5B	#00CD6C	#009ADE	#AF58BA	#FFC61E	#F28522		#A0B1BA	#A6761D

#E9002D	#FFAA00	#00B000

Red Amber Green

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

OR

OR

OR

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

70%   60%   50%

Sequential (single and multi-hue)

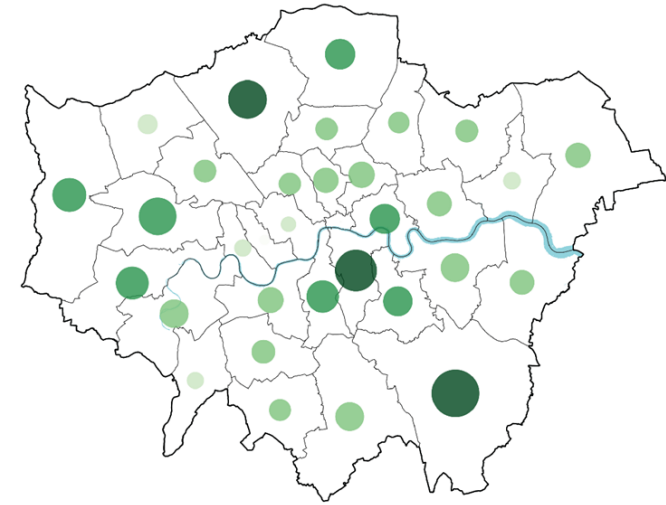| #E4F1F7	#C5E1EF	#9EC9E2	#6CB0D6	#3C93C2	#226E9C	#0D4A70

#B7E6A5	#7CCBA2	#46AEA0	#089099	#00718B	#045275	#003147

#E1F2E3	#CDE5D2	#9CCEA7	#6CBA7D	#40AD5A	#228B3B	#06592A

#FCE1A4	#FABF7B	#F08F6E	#E05C5C	#D12959	#AB1866	#6E005F

#F9D8E6	#F2ACCA	#ED85B0	#E95694	#E32977	#C40F5B	#8F003B

#FFF3B2	#FED976	#FEB24C	#FD8D3C	#FC4E2A	#E31A1C	#B10026

Arial	Times	LITHOS	Garamond	Calibri	Source Sans Pro

SERIF:	Baskerville	Optima	Palatino	Times	Georgia
SANS SERIF:	Century	Futura	OS Gill	Helvetica	Trebuchet

UPPERCASE	lower case	roman	*italic*	**bold**	semi-bold

8pt	12pt	16pt	20pt	24pt	28pt	32pt	36pt

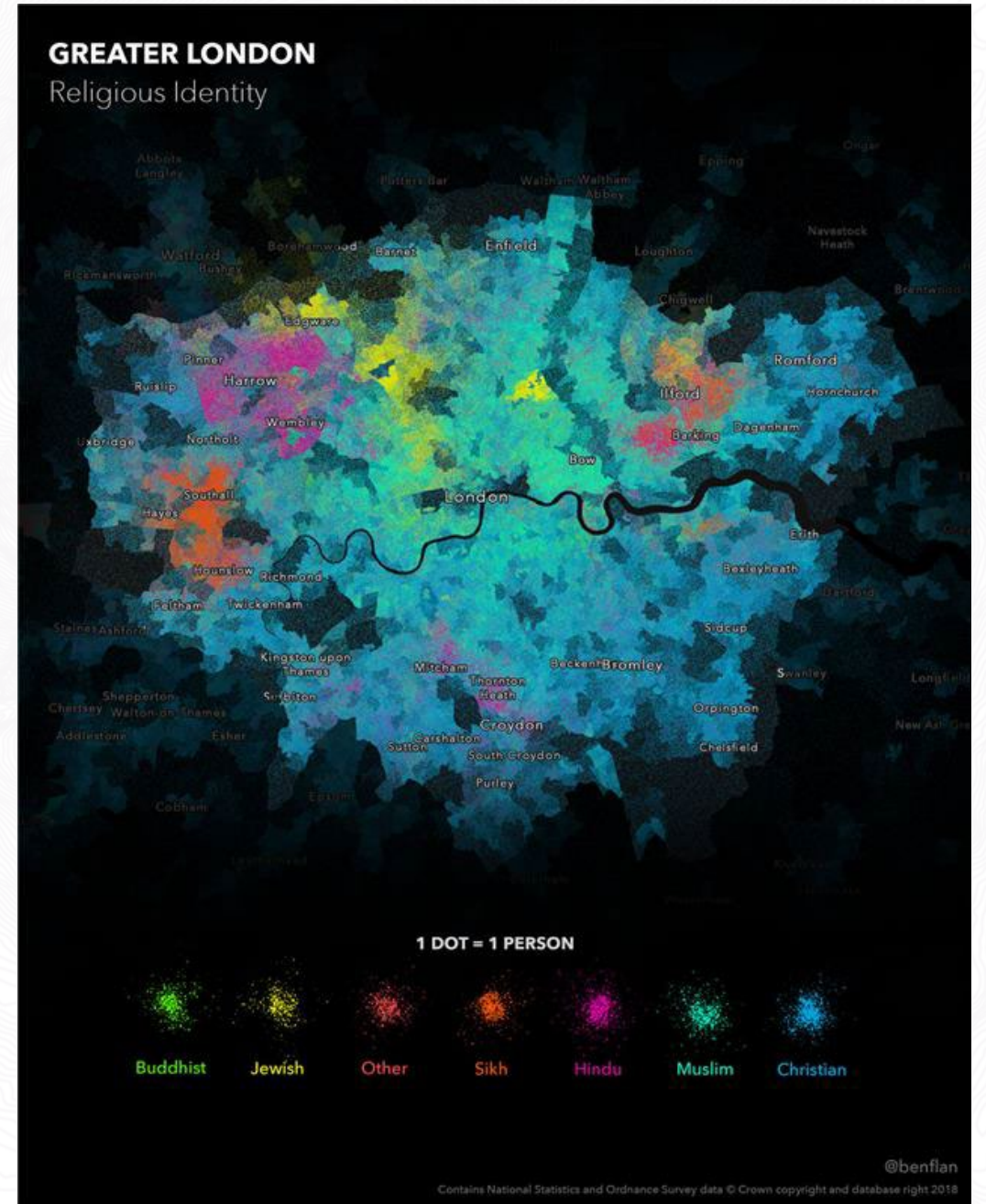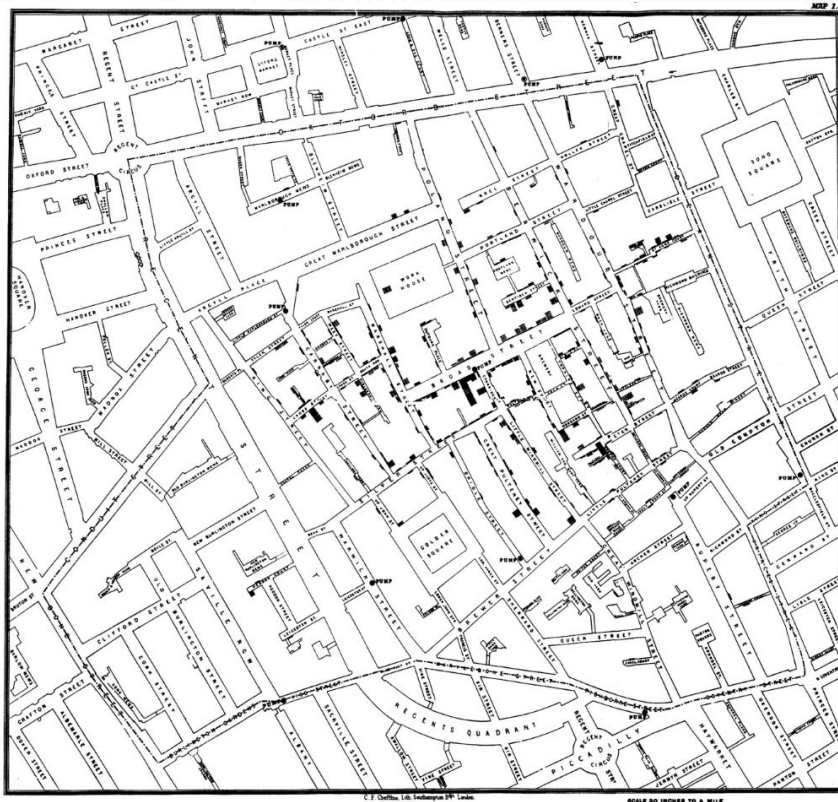letter spaced   extended   condensed

River Thames   Regents Park   CITY   TOWER OF LONDON

Geographic Data Visualisation Techniques

Thematic Maps, Graphs & Charts, Dashboards, Storymaps and Animations

Ordnance Survey

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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.

GREATER LONDON
Religious Identity

1 DOT = 1 PERSON

Buddhist Jewish Other Sikh Hindu Muslim Christian

@benflan

Contains National Statistics and Ordnance Survey data © Crown copyright and database right 2018

Dot Density – Pros & Cons

Pros

- You can map raw data / simple counts e.g. number of GP surgeries
- Work in black in white
- Shows density and distribution across a wide area
- Gives a good visual representation of variations across the data
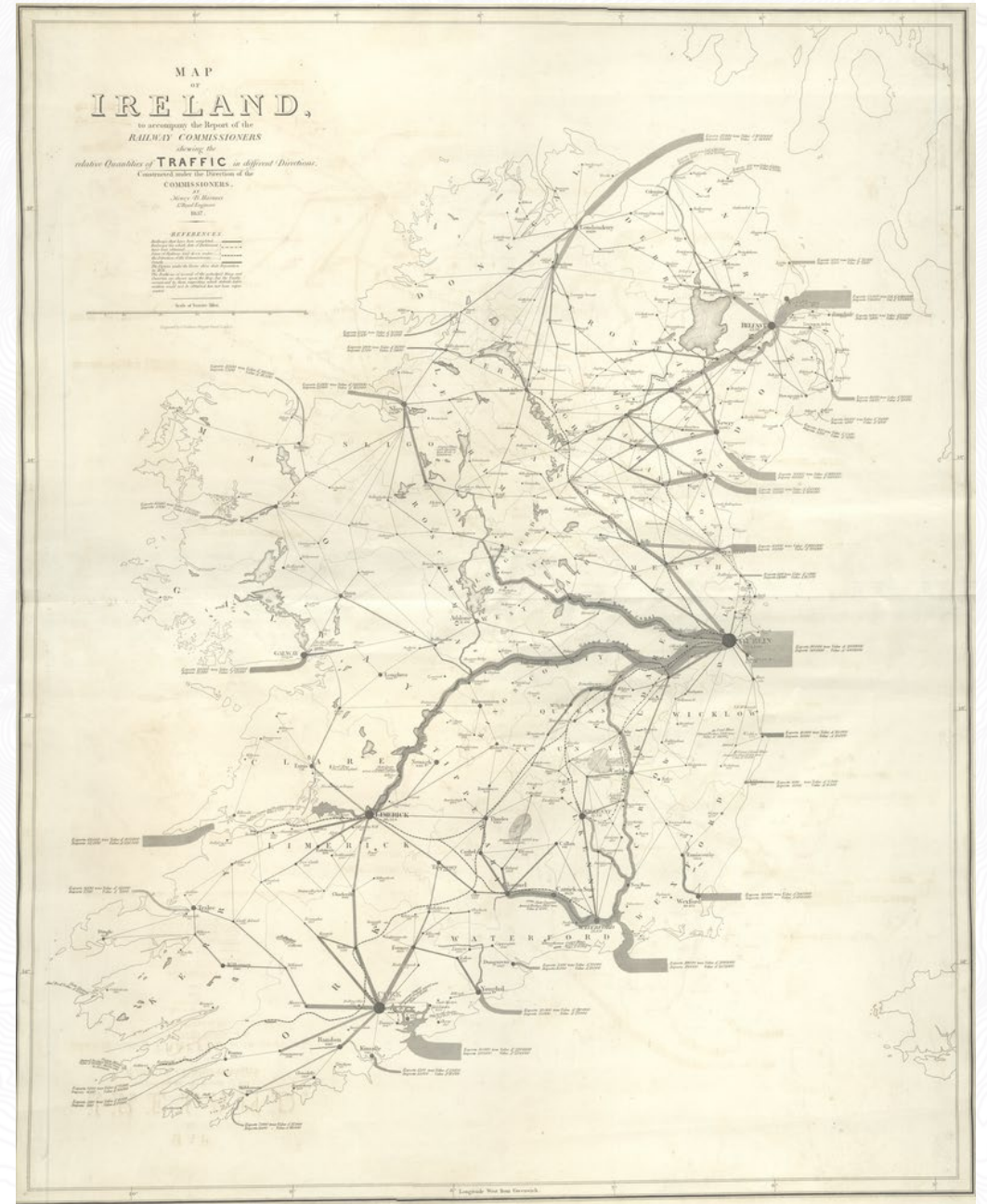
Cons

- Clustering can make data difficult to interpret
- Areas with no dots give a false sense of emptiness (no population)
- Geography can become hidden
- Dots on a one-to-many can be inferred as a single location of something
- Not great for retrieving actual rates or numbers.
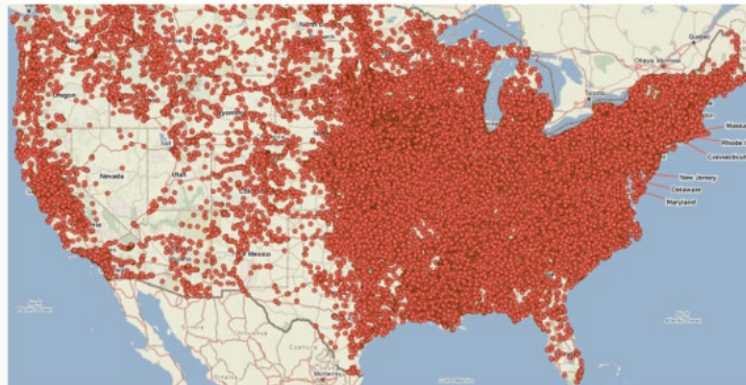
The above map depicts structurally deficient bridges in the United States as of 2017

Proportional Symbol

- A proportional symbol map uses map symbols that vary in size to represent a numeric variable.
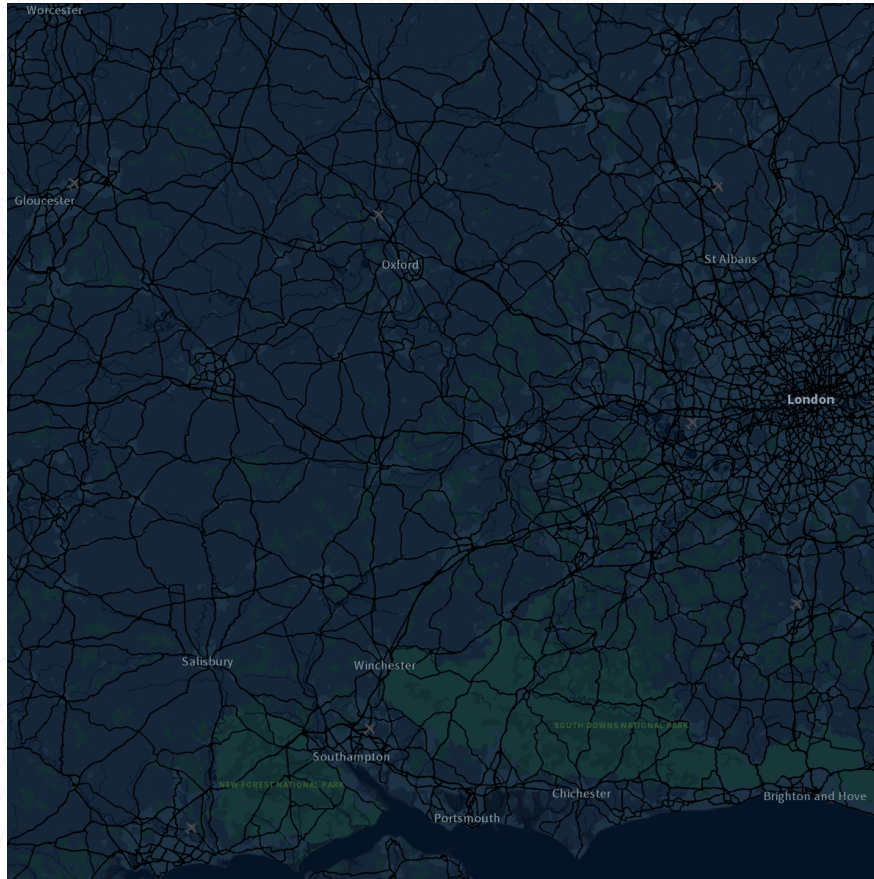
Proportional Symbol – Pros & Cons

Pros

- Large data sets can be interpreted quickly

- Useful for visualising differences between many places

- Easier to extract actual numbers

- Can use raw data (totals or counts) and standardised data (ratios or percentages)

- Smaller geographic regions are not overlooked

Cons

- As values get bigger symbols can begin to overlap

- Size of symbols can obscure location

- Map readers do not always estimate area of symbol well
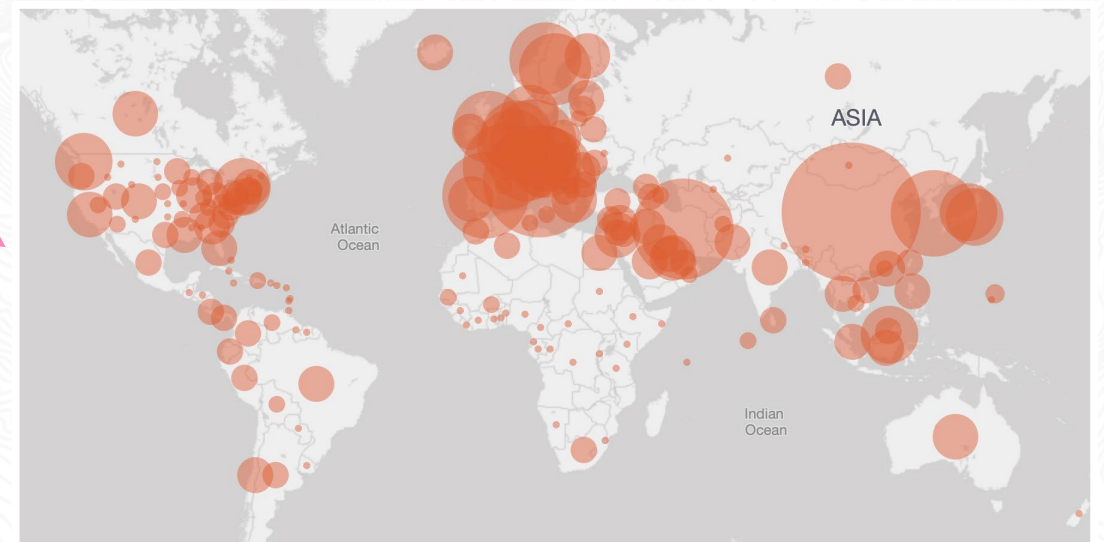
Choropleth Map

- A choropleth map is a map where geographic areas are coloured or styled in relation to a value.
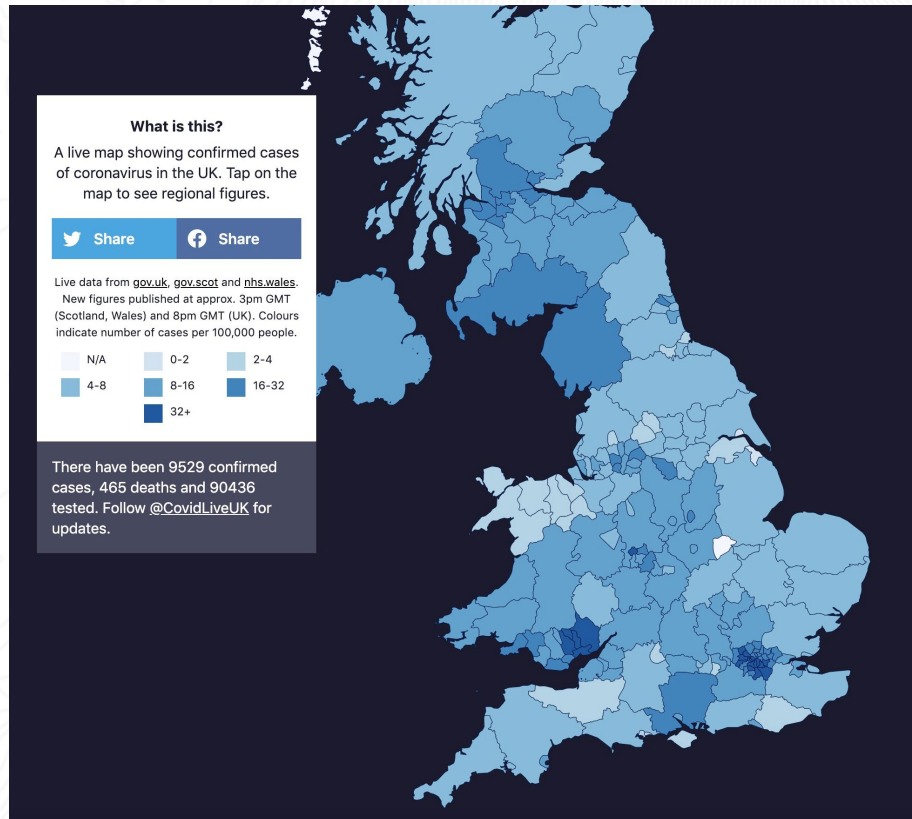
Regional patterns in deaths from alcohol and drugs across the UK

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

Data is not available for Rutland.
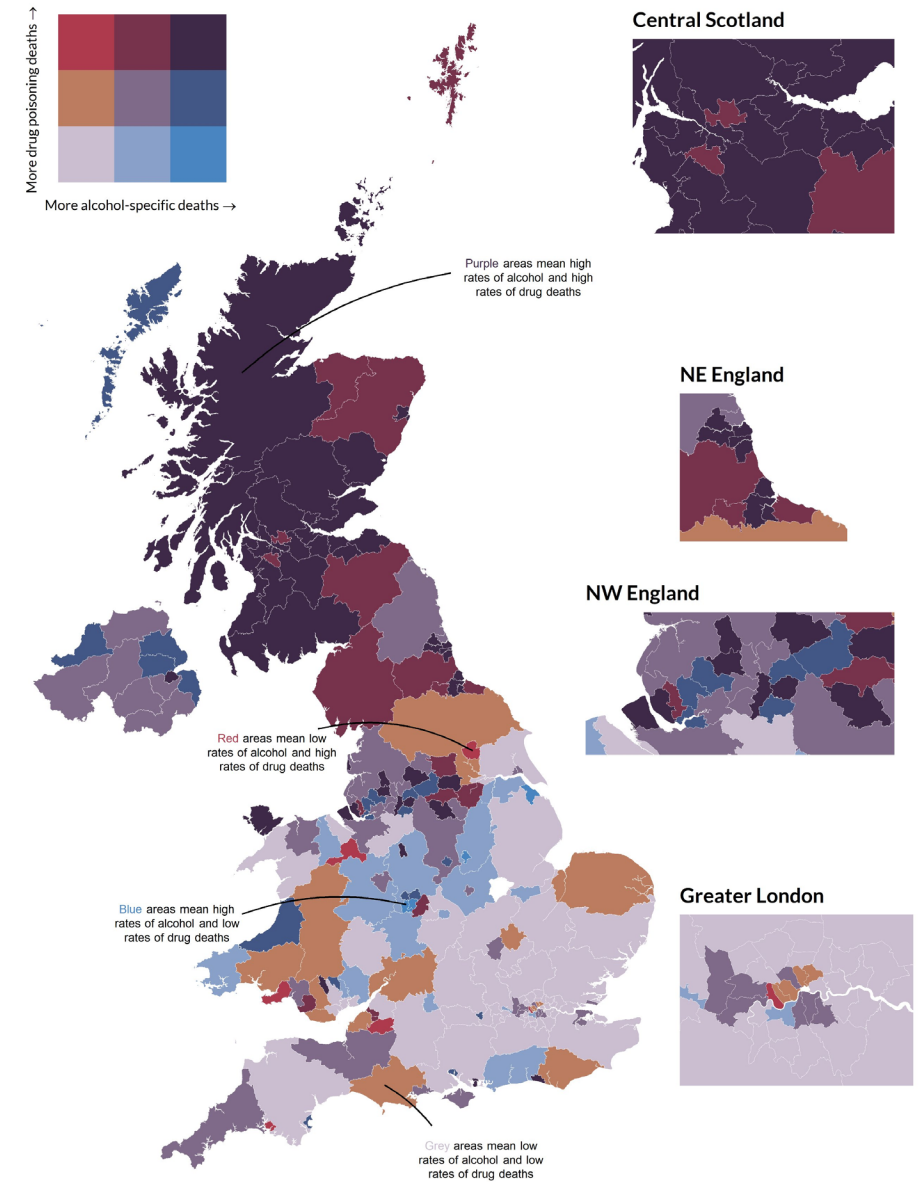
Choropleth Map – Normalise your data!

- Map assumes the region/area has the same value e.g population or size. Normalise!!
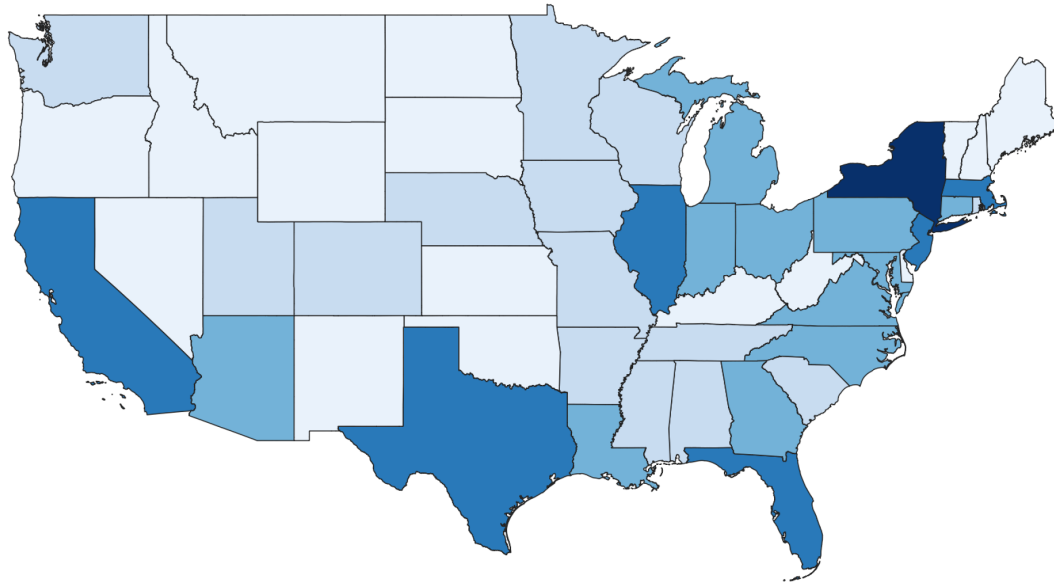
(a) Covid-19 Total Cases
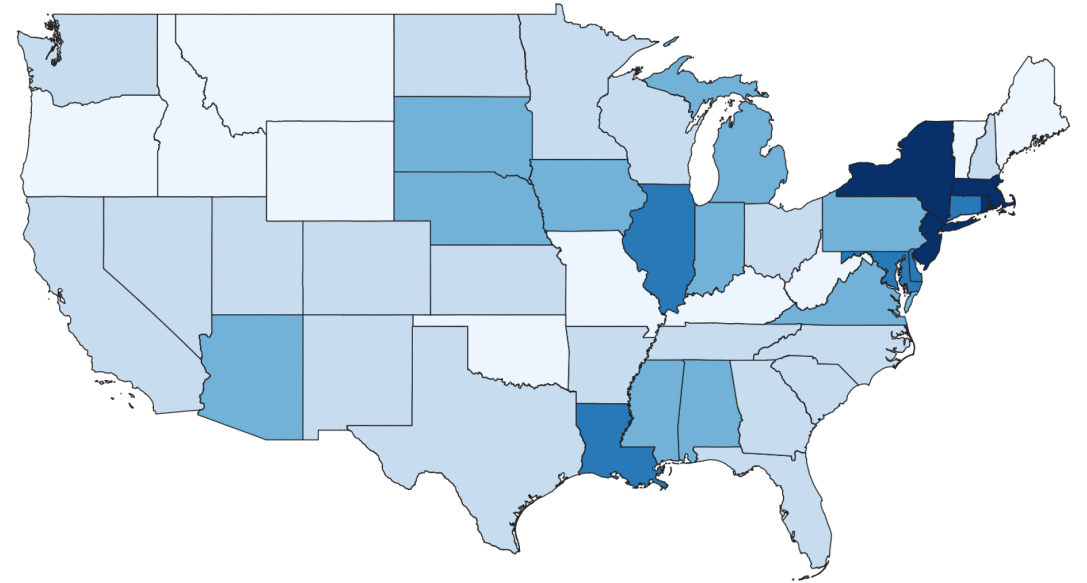
(b) Covid-19 Cases Per Capita

Choropleth Map – Normalise your data!

Choropleth Map – Normalise your data!
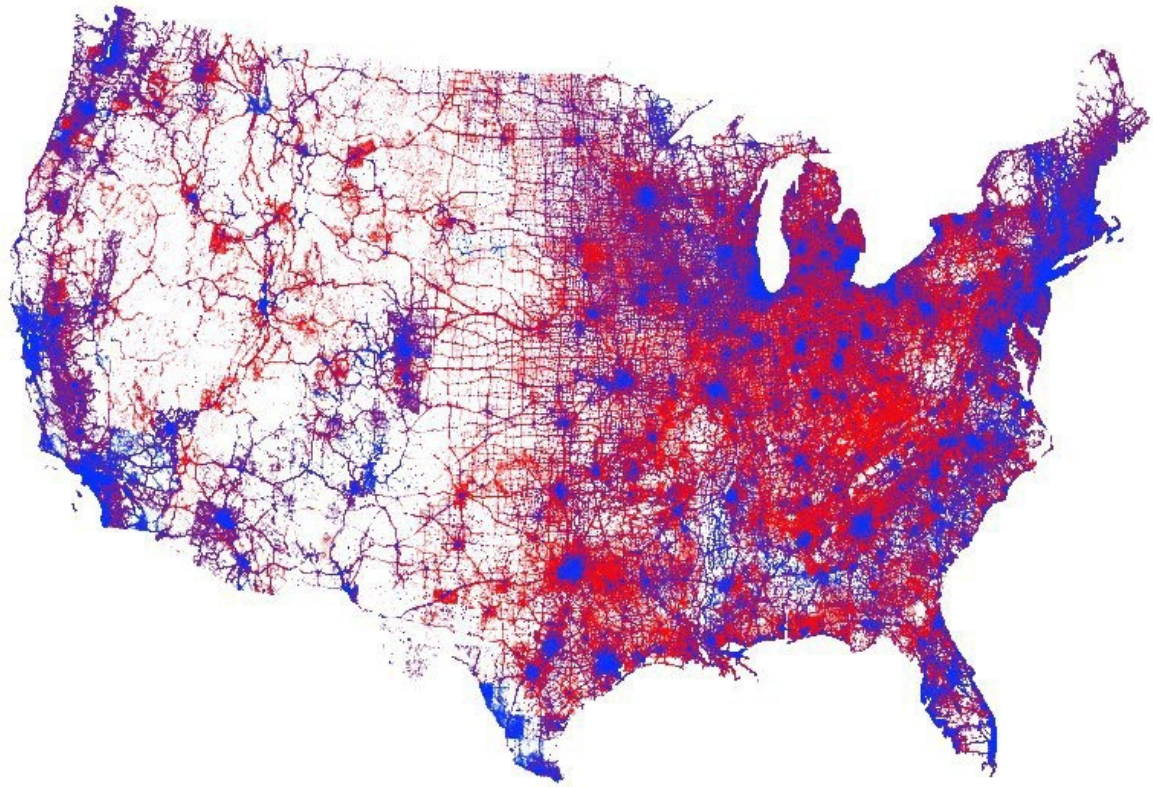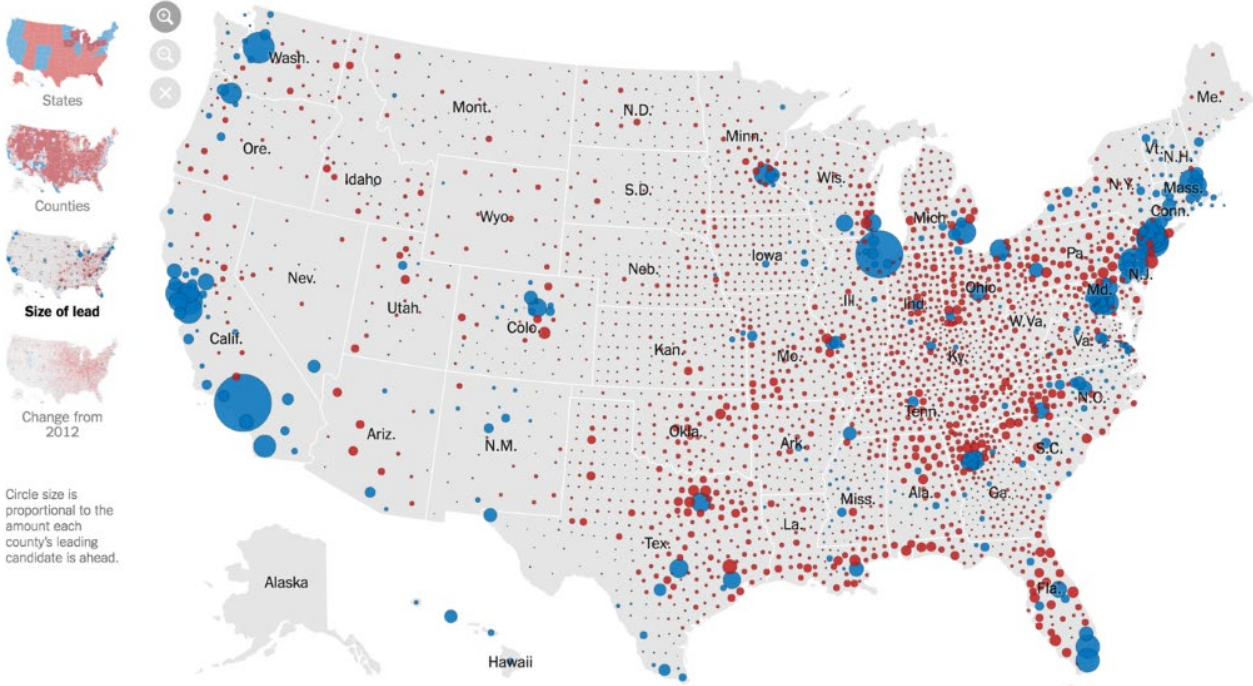
Choropleth Map - Pros & Cons

Pros

- Easy to understand

- Depicts spatial distributions of data really well

- Works at virtually all scales

Cons

- May not work in black and white

- Map assumes the region/area has the same value.

- Smaller regions/areas can get easily overlooked

- Not suitable for raw data - normalise

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.

January 1–20 2020

Beijing
Lanzhou
Wuhan
Shanghai
Chongqing
Hong Kong
500 km

February 10–25 2020

0   125   250   375   ≥500
Mean tropospheric NO_2 density (µmol/m²)

©nature

COLD, ARCTIC AIR WILL PLUNGE SOUTHWARD

Highest temperatures well below freezing

Potential for blizzard conditions

Heavy rain and/or snow predicted

Dangerously low windchill and strong, gusty winds are likely

THE SYSTEM THEN MOVES TO THE NORTHEAST

400 km

Forecasted Surface Temperature Anomaly on December 23 (°C)

-25   -20   -15   -10   -5   0   5   10

Heat Map - Pros & Cons

Pros

- Hot spots in data can be quickly identified and analysed further

- Works well when using temperature or pollution data

Cons

- Excessive use of colour can affect the legibility of the map

- Does not depict data distribution well

- Can you trust your data?

Graphs and Charts

Dashboards

GALLERY   AUTHORS   BLOG   RESOURCES   ACTIVITY   SIGN UP   SIGN IN

‹ cartocraftsman - Profile

☆ Favorite   ⬇ Download
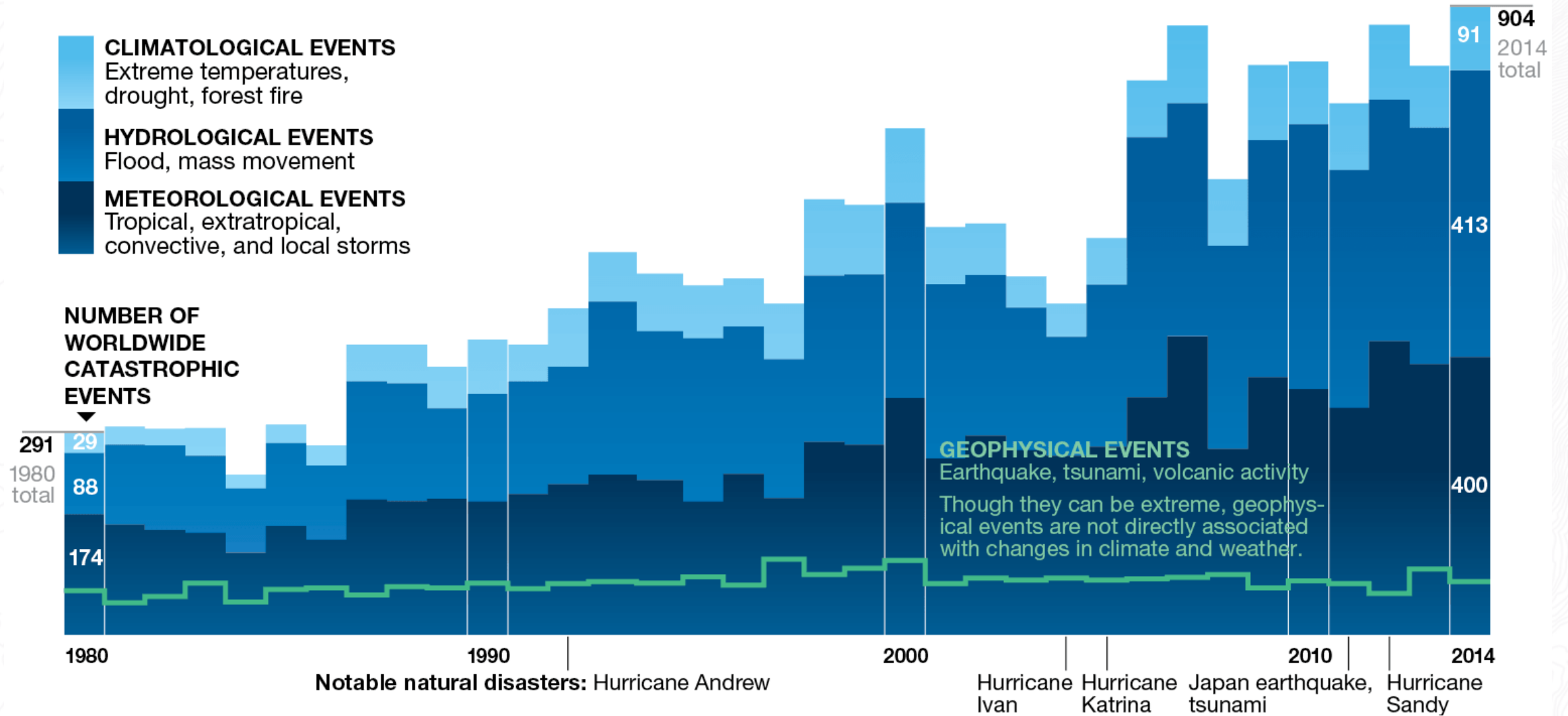
RNLI
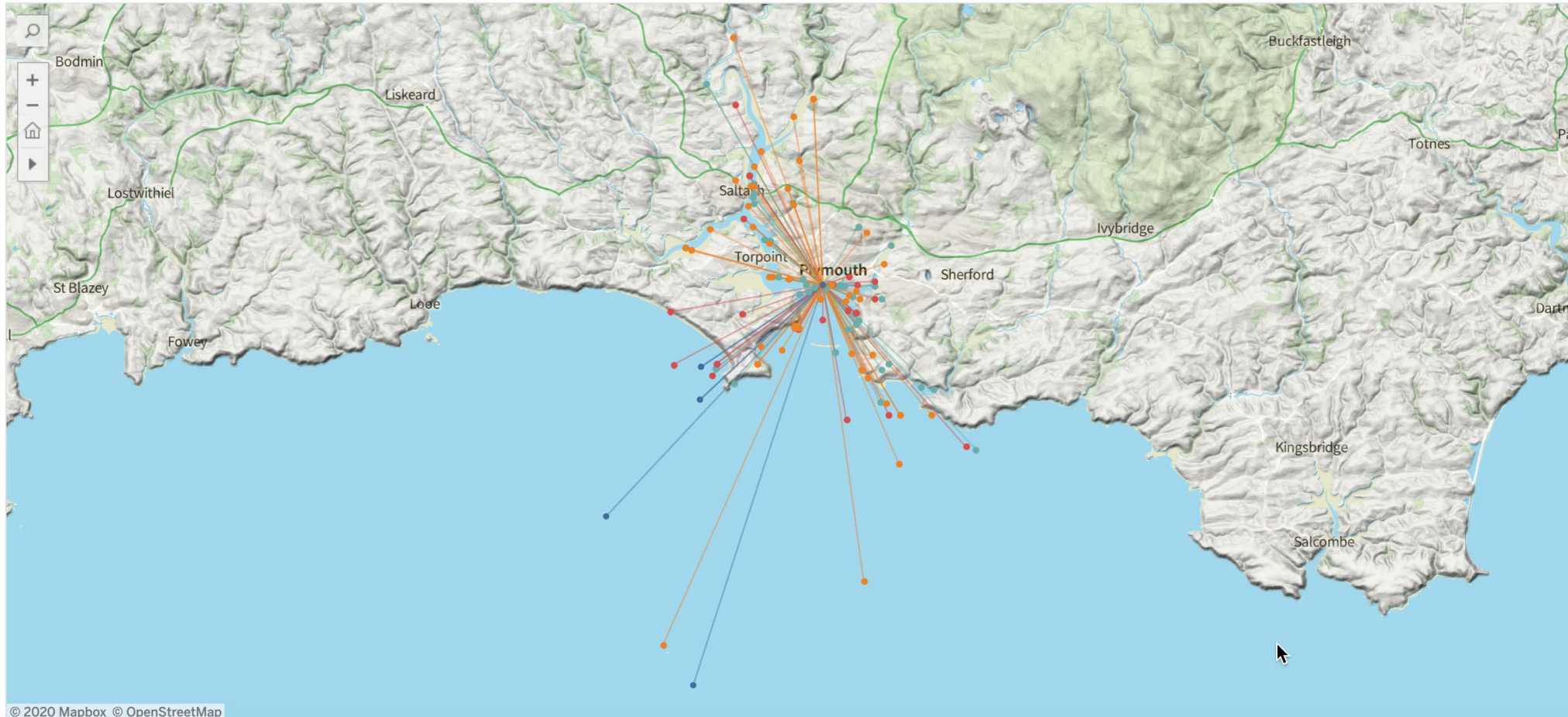
Outcome
False alarm

StationSelected
PLYMOUTH

Casualty
■ COMMERCIAL
■ LEISURE
■ OTHER
■ PEOPLE

Bodmin
Liskeard
Buckfastleigh
Totnes
Pai
Lostwithiel
Saltan
Ivybridge
St Blazey
Torpoint
Plymouth
Sherford
Fowey
Loge
Kingsbridge
Dartm
Salcombe

© 2020 Mapbox © OpenStreetMap

Storymaps

Animations

Grounded container ship causes delays in the Suez Canal

Suez Canal

Cairo

17:35
Mar 21

Source: VesselsValue
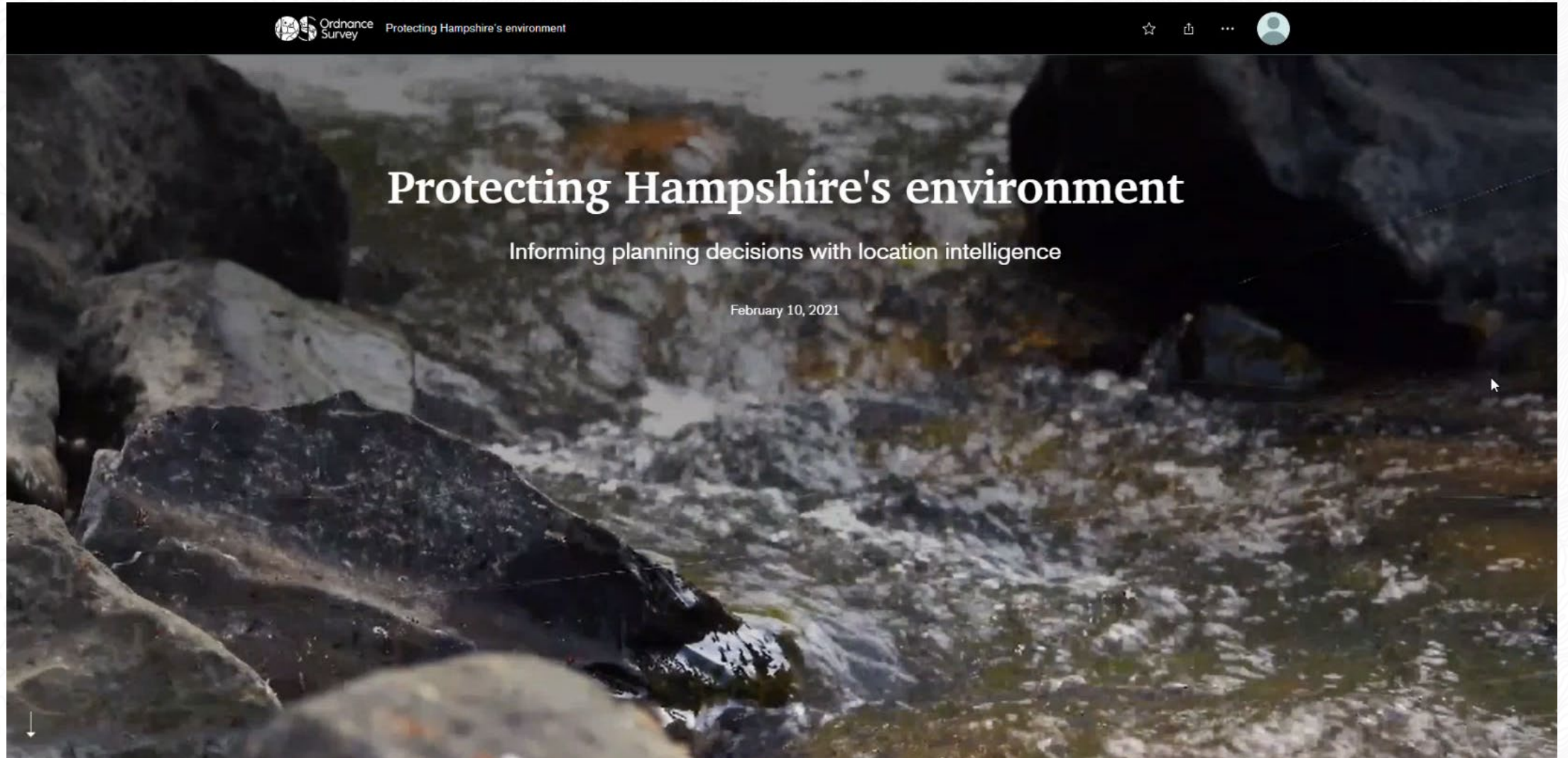
FINANCIAL TIMES

Using colour in Geographic Data Visualisations

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

Qualitative

Sequential

Diverging
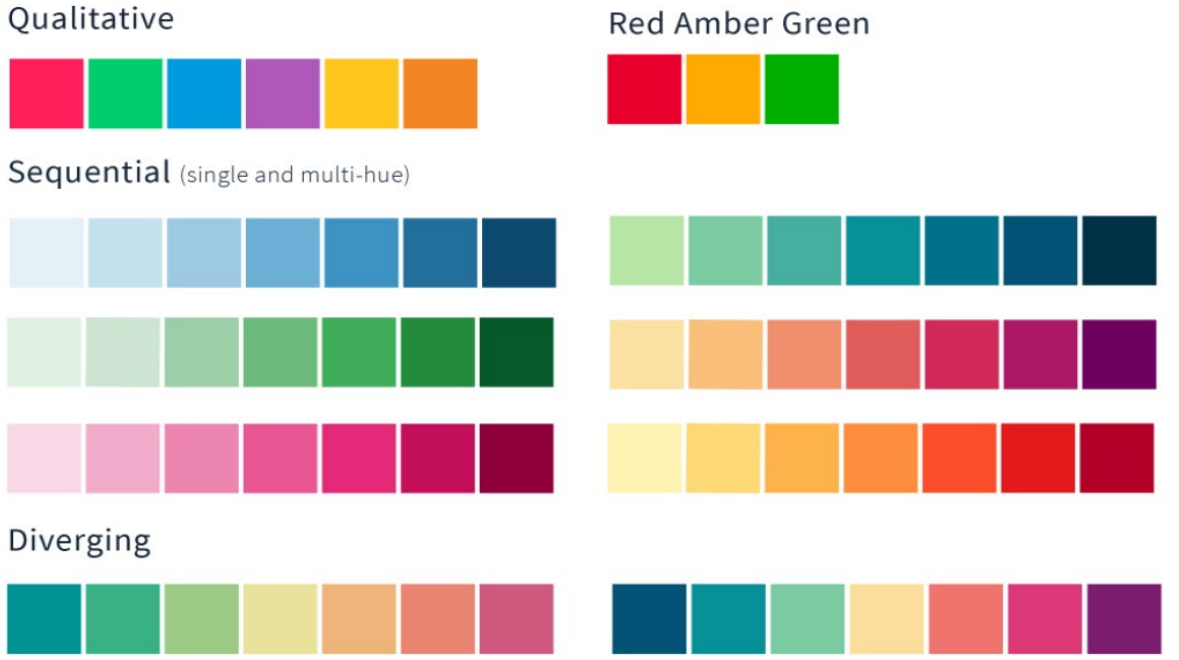
Colour associations

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

Interactive Exercise – Using Geographic Data Visualisations to tell stories

The Ukraine refugee crisis

Ordnance
Survey

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Refugee Crisis - Ukraine

COUNTRY	TOTAL
RUSSIA	2 775 000
POLAND	1 410 000
MOLDOVA	93 000
ROMANIA	81 000
SLOVAKIA	96 000
HUNGARY	30 000
BELARUS	10 000
GERMANY	998 000
CZECH REPUBLIC	440 000
ITALY	170 000
TURKEY	145 000
SPAIN	145 000
UNITED KINGDOM	132 000
FRANCE	105 000
OTHER	909 000
Data correct as of September 2022	

How would you visualise this dataset?

Imagine you are a data journalist tasked with telling the story of the Ukrainian refugee crisis. Discuss how you would present this data in a way that best conveys this information.

COUNTRY	TOTAL
RUSSIA	2 775 000
POLAND	1 410 000
MOLDOVA	93 000
ROMANIA	81 000
SLOVAKIA	96 000
HUNGARY	30 000
BELARUS	10 000
GERMANY	998 000
CZECH REPUBLIC	440 000
ITALY	170 000
TURKEY	145 000
SPAIN	145 000
UNITED KINGDOM	132 000
FRANCE	105 000
OTHER	909 000
Data correct as of September 2022	

© Encyclopædia Britannica, Inc.

The Sun

POLAND
453,000

BELARUS
341

RUSSIA
42,900

SLOVAKIA
67,000

UKRAINE

HUNGARY
116,348

ROMANIA
44,450

MOLDOVA
79,315

100 miles

BBC

Which countries are Ukrainians fleeing to?

400,000
100,000
50,000
5,000

OTHER
EUROPEAN
COUNTRIES

POLAND

BELARUS

RUSSIA

SLOVAKIA

HUNGARY

ROMANIA

MOLDOVA

UKRAINE

200km
200 miles

☐ Russia annexed Crimea in 2014

Source: UNHCR

Google

BBC

Europe's New Migration Crisis

The Russian invasion of Ukraine began on February 24, 2022, with airstrikes hitting across the country, some as far west as Lviv. In addition to widespread destruction, the conflict has caused a migrat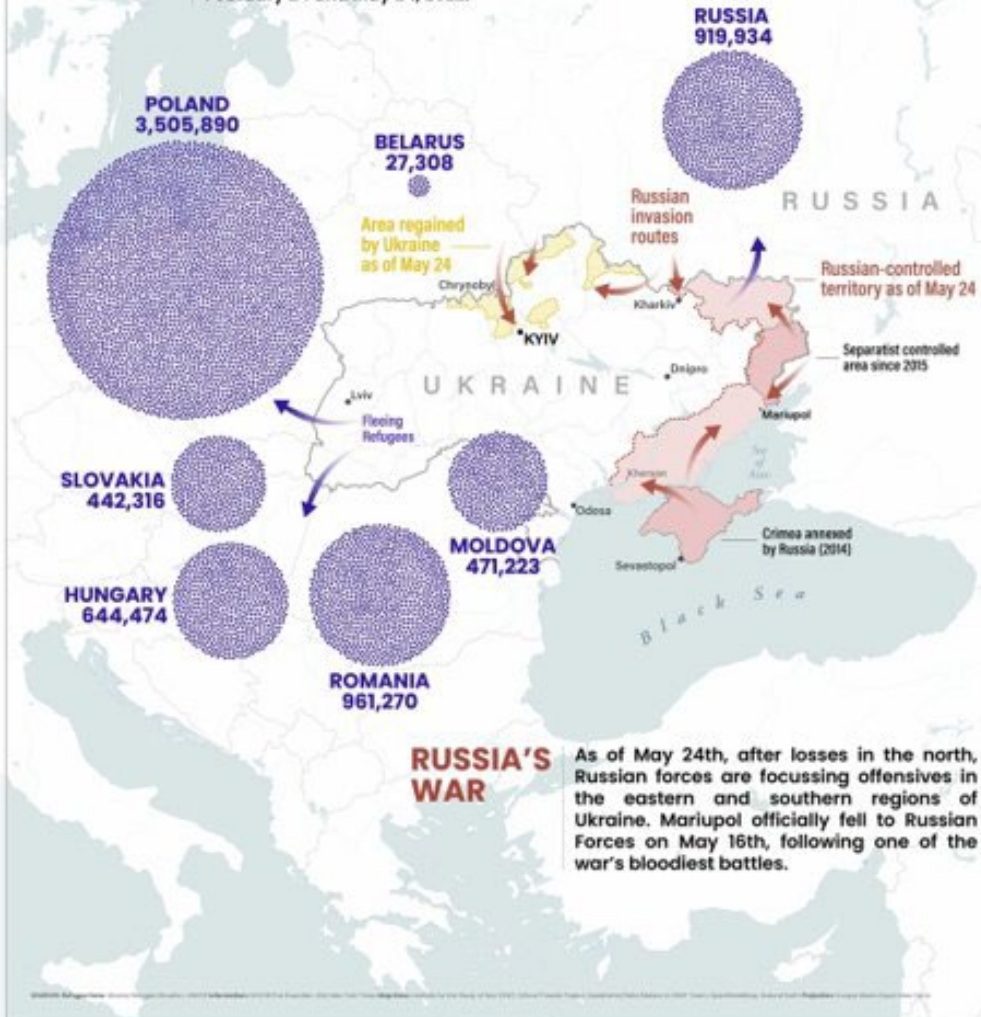ion crisis as over 6 million refugees have fled to neighboring European countries during the first three months of the war.

REFUGEES FLEEING UKRAINE

One dot equals 1,000 refugees

MONTHLY REFUGEE DEPARTURES

May 24, 2022

| | 3,381,925 | 1,591,654 | 1,018,026 |

March — April

Feb. 24, 2022

This map displays the 6,552,971 refugees, mostly women and children, who fled Ukraine between February 24 and May 24, 2022.

RUSSIA
919,934

POLAND
3,505,890

BELARUS
27,308

Area regained by Ukraine as of May 24

Russian invasion routes

RUSSIA

Chornobyl

*KYIV

Kharkiv

Russian-controlled territory as of May 24

Separatist controlled area since 2015

Lviv

UKRAINE

Dnipro

*Mariupol

Fleeing Refugees

SLOVAKIA
442,316

Sea of Azov

Kherson

MOLDOVA
471,223

*Odesa

HUNGARY
644,474

Crimea annexed by Russia (2014)

Sevastopol

Black Sea

ROMANIA
961,270

RUSSIA'S WAR

As of May 24th, after losses in the north, Russian forces are focussing offensives in the eastern and southern regions of Ukraine. Mariupol officially fell to Russian Forces on May 16th, following one of the war's bloodiest battles.

Sumy

Kharkiv

RUSSIA

Kyiv

UKRAINE

Dnieper
River

Dnipro

Luhansk

Donetsk

Melitopol

Mariupol

■ Russian military presence

▨ Russian advances

➤ Direction of Russian advance

100km

100 miles

BBC

Financial Times

BBC

Refugees: more than 2mn people have left Ukraine

Total recorded arrivals from Ukraine between Feb 24 and Mar 8 2022

RUSSIA

99k

A further **96,000** went from Donetsk and Luhansk regions to Russia between Feb 18 and Feb 24

BELARUS **453**

GERMANY

POLAND

1.2mn

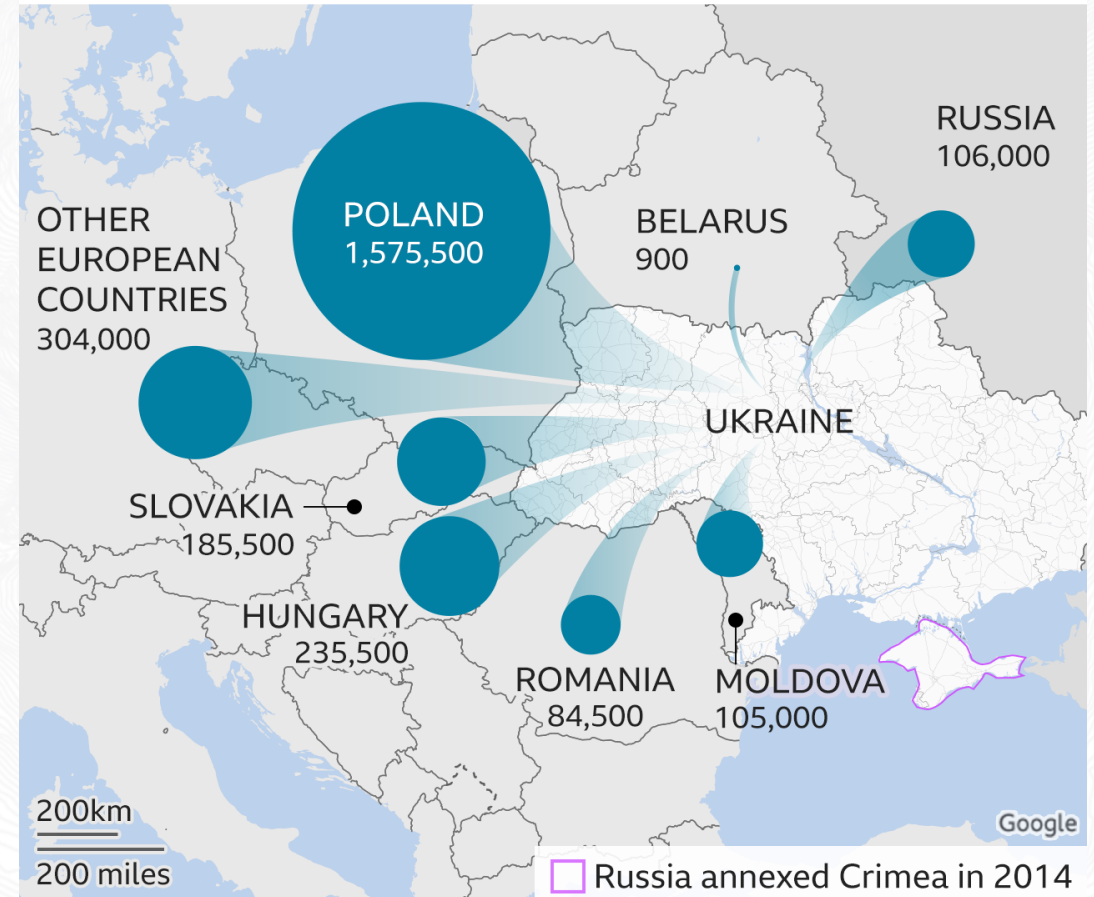**2.01mn**

UKRAINE

CZECH REPUBLIC

SLOVAKIA 141k

HUNGARY

AUSTRIA

191k

MOLDOVA 83k

ROMANIA

82k

210k

Other European countries

CRIMEA*

200 km

Black Sea

Cartography: Steven Bernard and Alan Smith
Source: UNHCR   *Crimea is annexed by Russia but this is not recognised by the international community
© FT

Which countries are Ukrainians fleeing to?

OTHER EUROPEAN COUNTRIES 304,000

POLAND 1,575,500

BELARUS 900

RUSSIA 106,000

UKRAINE

SLOVAKIA — 185,500

HUNGARY 235,500

ROMANIA 84,500

MOLDOVA 105,000

200km

200 miles

□ Russia annexed Crimea in 2014

Google

Source: UNHCR, 12 March

B B C

Thank you – any questions?

jessica.baker@os.uk   @GeospatialJess   Linkedin: Jessica Baker

OS GitHub Repository
github.com/OrdnanceSurvey

GDV Gallery
labs.os.uk/public/os-virtual-gallery/

OS Flickr
flickr.com/photos/ordnancesurvey/albums

Ordnance Survey

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