

# Why map? Thinking spatially

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DASC507 – Advanced Biostatistics II  
Analysis Methods for Complex Data Structures

# Outline

- Key terms
- Why map?
  - Case studies of the power of mapping/spatial analysis
  - Importance of thinking spatially
- Types of maps
  - Vector data
  - Raster data
- Criticisms

# Key terms

GIS stands for Geographic Information System

“GIS are computer-based systems for the **integration and analysis of geographic data**” (Cromley and McLafferty, 2012; emphasis my own)

Linked to GIScience which is more critically reflective over the use of GIS and related spatial analysis tools

# Key terms

- There are 3 main functions that a GIS will offer:
  - Spatial database management
  - Visualisation (mapping)
  - Spatial analysis

# Key terms

## Geographic Data Science

“...combines the long-standing tradition and epistemologies of Geographic Information Science and Geography with many of the recent advances that have given Data Science its relevance in an emerging “datafied” world.”  
(Singleton and Arribas-Bel, 2021, p67)

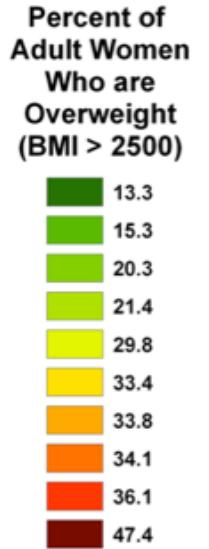
# Key terms

- Five ‘w’s of information gathering:
  - Who
  - What
  - When
  - **Where**
  - How

# Key terms

- Mapping/spatial analysis can be top down or bottom up
  - Top-down: one person (or group) maps a population
  - Bottom-up: public participation of the mapping process i.e. GIS directly created by and serves a population
  - Both create opportunities to improve health and supplement the policy decision making process

# Key terms



An example of a top down approach

(Source:

[http://geog.sdsu.edu/Research/Projects/IPC/publication/Weeks\\_Hill\\_Stoler\\_Spatial%20Inequalities.pdf](http://geog.sdsu.edu/Research/Projects/IPC/publication/Weeks_Hill_Stoler_Spatial%20Inequalities.pdf))

# Key terms

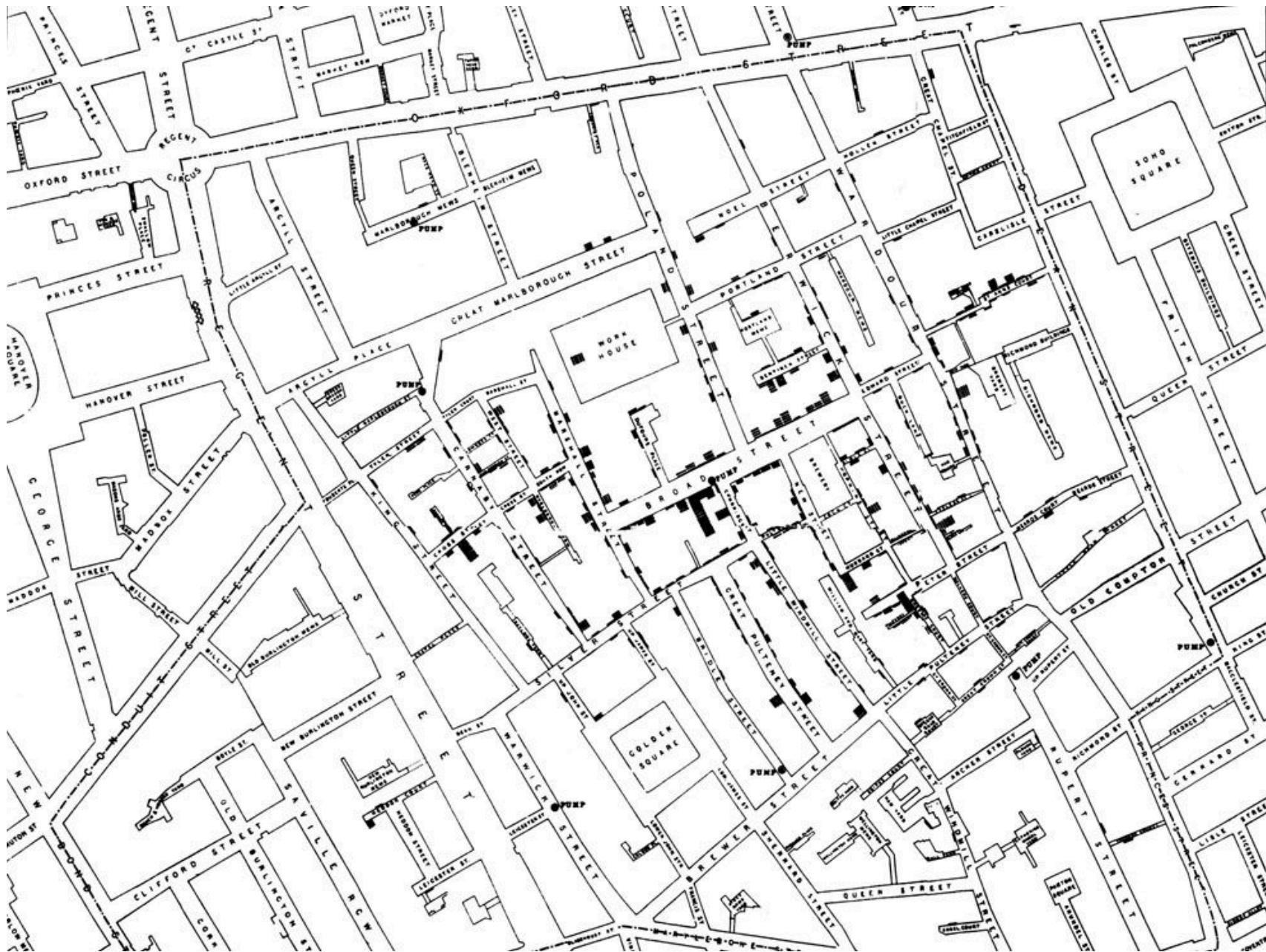
- Example of bottom-up approach
  - Breast Cancer Incidence in Long Island, New York
  - Local community action groups used GIS to explore breast cancer prevalence, which drew attention to the issue and attracted funding for larger research studies examining possible factors identified by the group
  - <http://li-gis.cancer.gov/>

# Why map?

- Makes the spatial explicit
- A picture can say a thousand words
- Can allow users to actively engage with (spatial) data

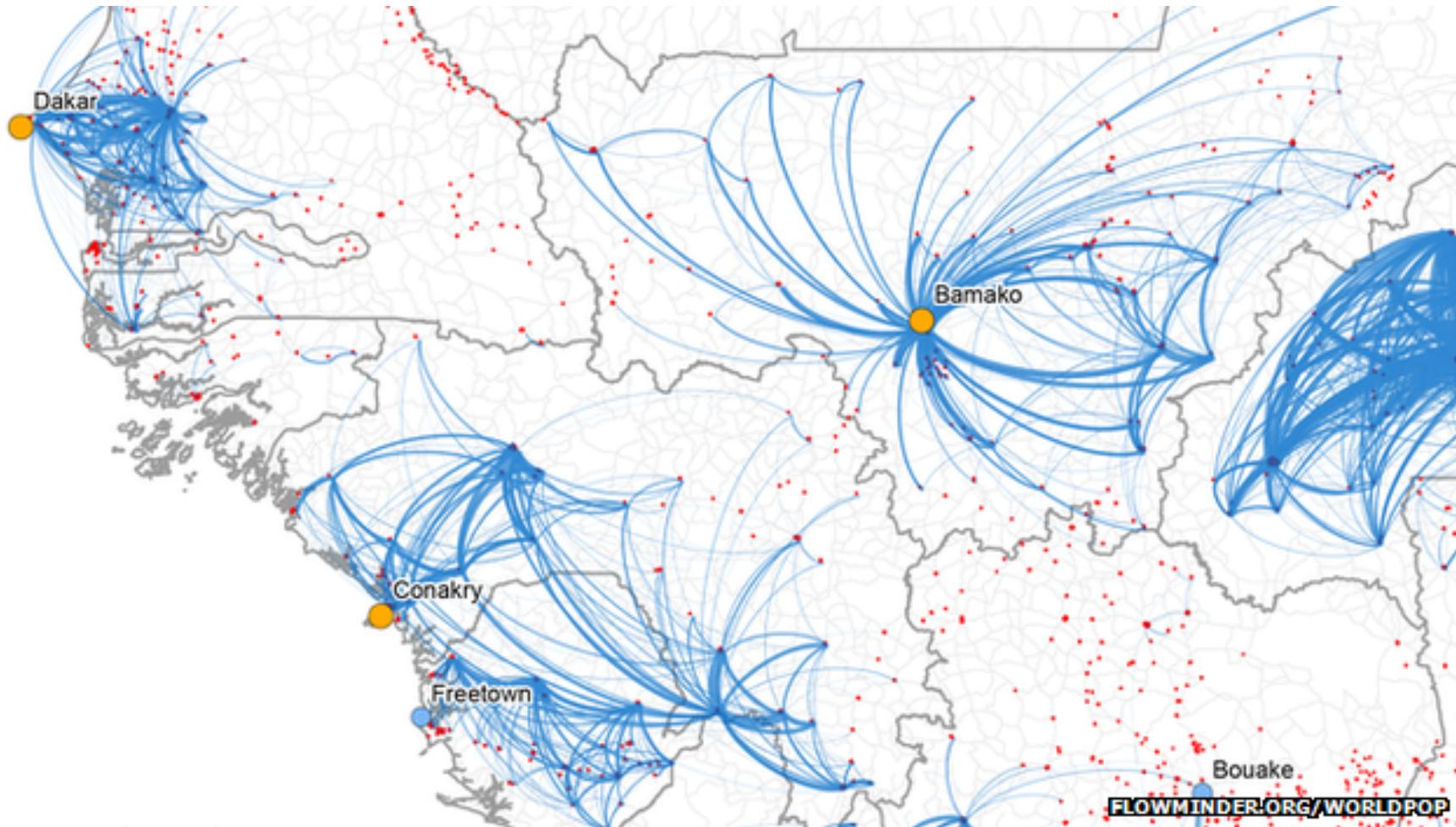
# Why map?

John Snow identified mode of transmission of cholera. Maps helped support his evidence base.  
Notice the clustering of deaths around one particular pump in Soho, London.



# Why map?

In 2015, researchers used IBM mobile phone data and GIS to predict population movements to identify where Ebola might spread to after outbreaks in settlements.



# Why map?



When trying to think about what influences our health, we often focus on the characteristics of individuals...

# Why map?



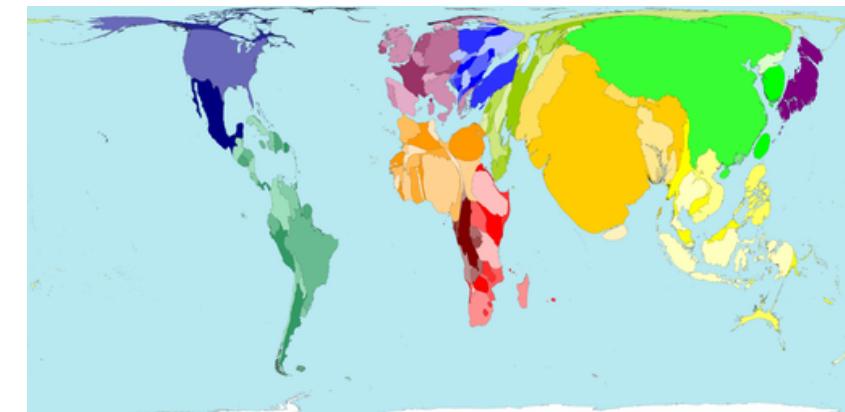
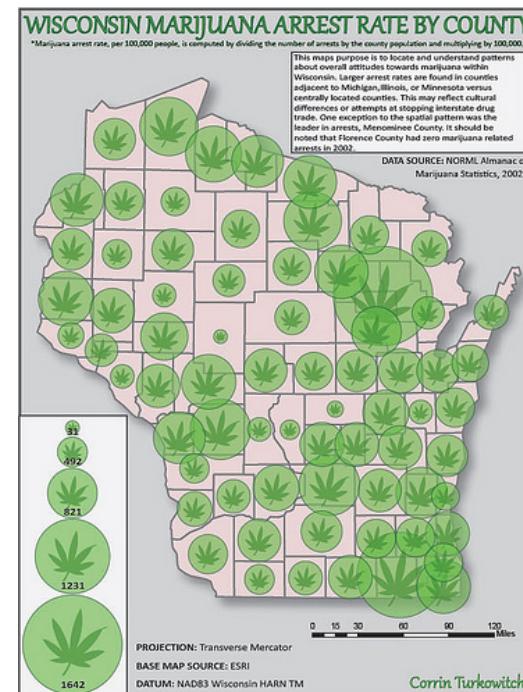
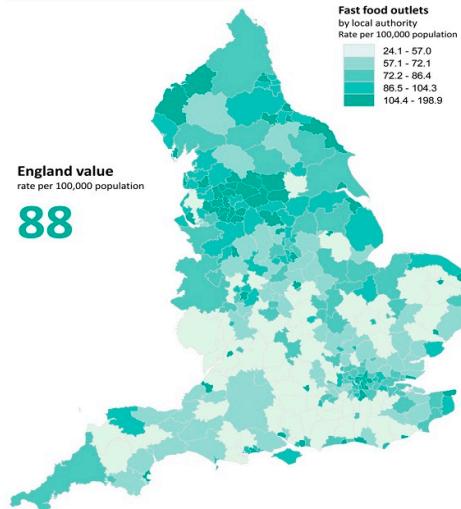
...but individuals don't live in a social vacuum, they interact with society including the neighbourhoods around them

# Types of maps

- Vector data – reproducing features of the World captured through any of the following
  - Points – simple dots e.g. fast food outlet
  - Lines – connecting points e.g. roads
  - Polygons – connection of lines bounded by a closed path e.g. city region
- Commonly visualised using thematic maps

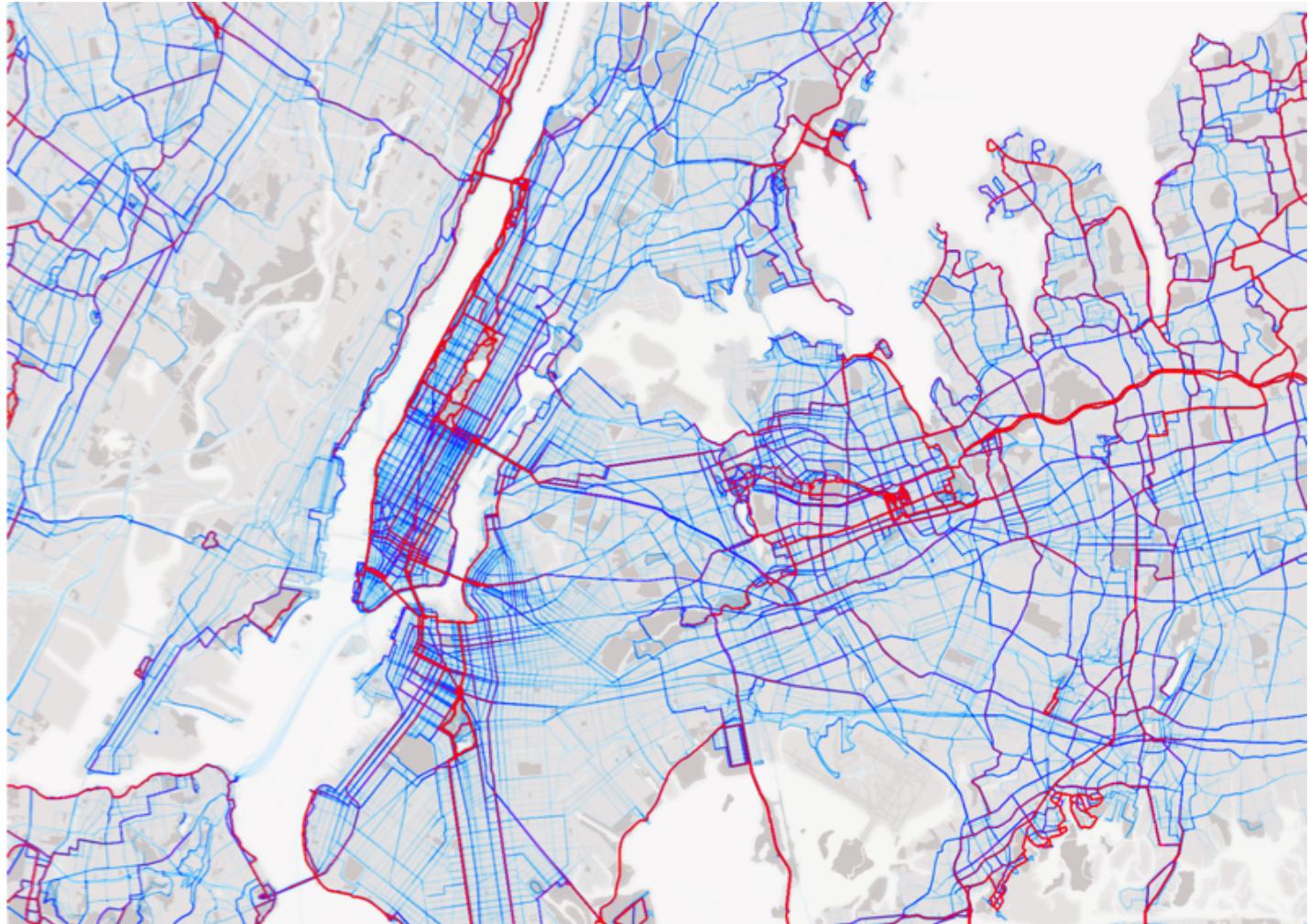
# Types of maps

- Thematic maps
  - Choropleth maps
  - Dot distribution or density maps
  - Graduated symbol
  - Cartograms



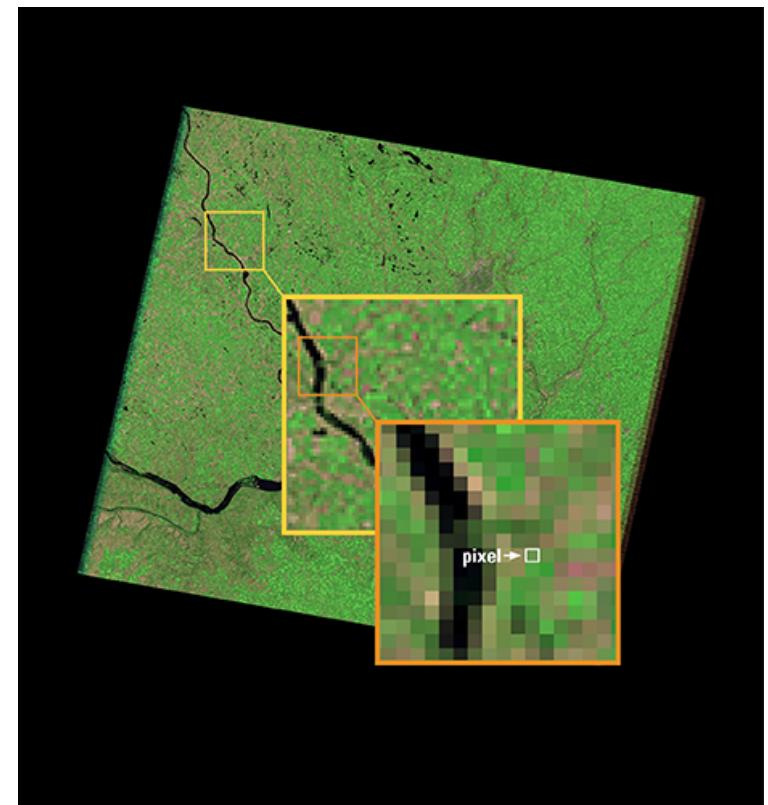
# Types of maps

- Thematic maps
  - Flow maps for representing movement data or data for connected points

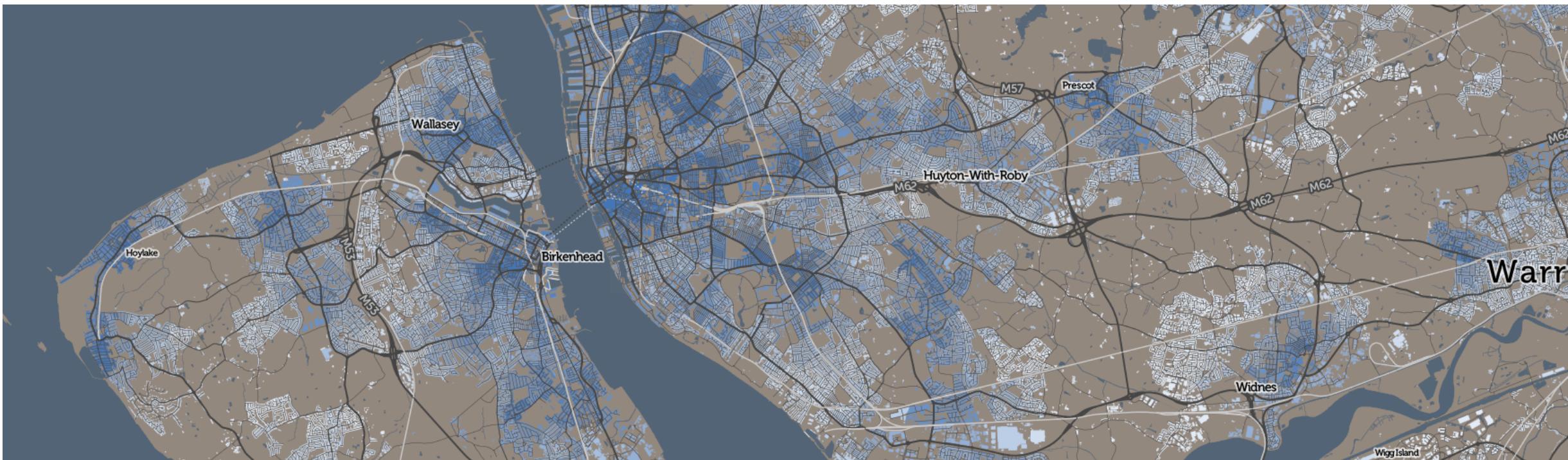


# Types of maps

- Raster data – pixel-based images representing continuous surfaces
  - Remote sensing/satellites (e.g., green space)
  - Modelled surfaces (e.g., air quality)
  - Digital photographs (e.g., john snow map)
- Less common in public health



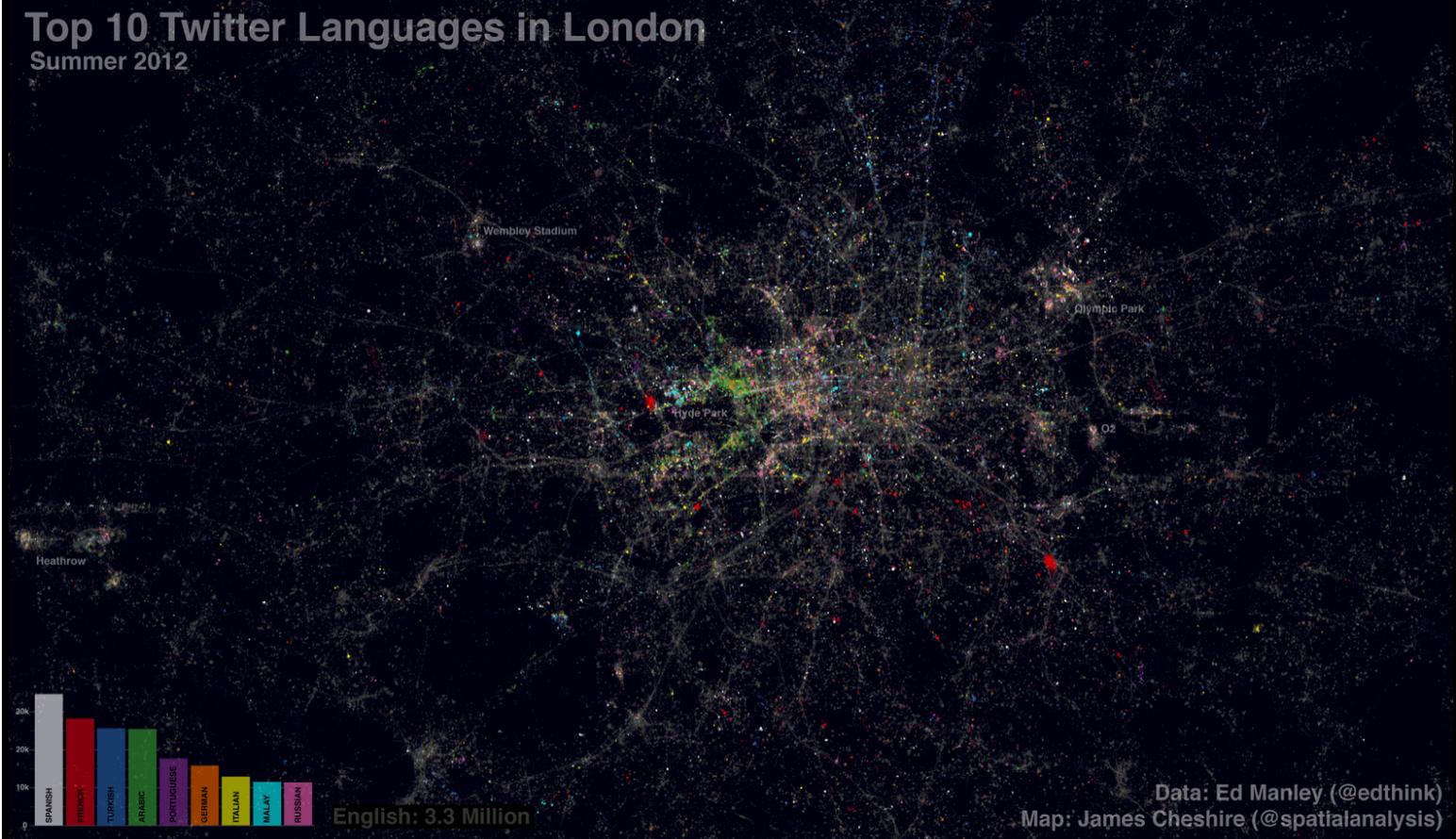
# Types of maps



Maps can be static, dynamic or interactive...

# Types of maps

Recent explosion in spatial (big) data aided by smart phones and geotagged information (e.g. Twitter)

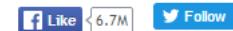


# Types of maps

And this has important implications for understanding and dealing with public health...

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From *The Atlantic*  
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## Can Twitter Predict Where You'll Get Food Poisoning?

A new system tracks food illness by parsing mountains of geo-tagged data.

JENNY XIE | @canonind | Aug 12, 2013 | 2 Comments

# Criticisms

- Spatial health data does not always exist limiting usage
- Ecological fallacy
- Modifiable Areal Unit Problem
- Scale matters (smaller the better)
- Smoothed surfaces or polygons may not reflect underlying geography
- Who is represented in maps?
- Easy to manipulate and mislead the reader (like any visualisation)

# Further reading

- Cromley E, McLafferty S. 2012. *GIS and Public Health*. Guildford Press: New York.
- Musa et al. 2013. Use of GIS Mapping as a Public Health Tool--From Cholera to Cancer. *Health Services Insights* 6: 111-116.  
<https://doi.org/10.4137/HSI.S10471>
- Singleton A, Arribas Bel D. 2021. Geographic Data Science. *Geographical Analysis* 53: 61-75. <https://doi.org/10.1111/gean.12194>