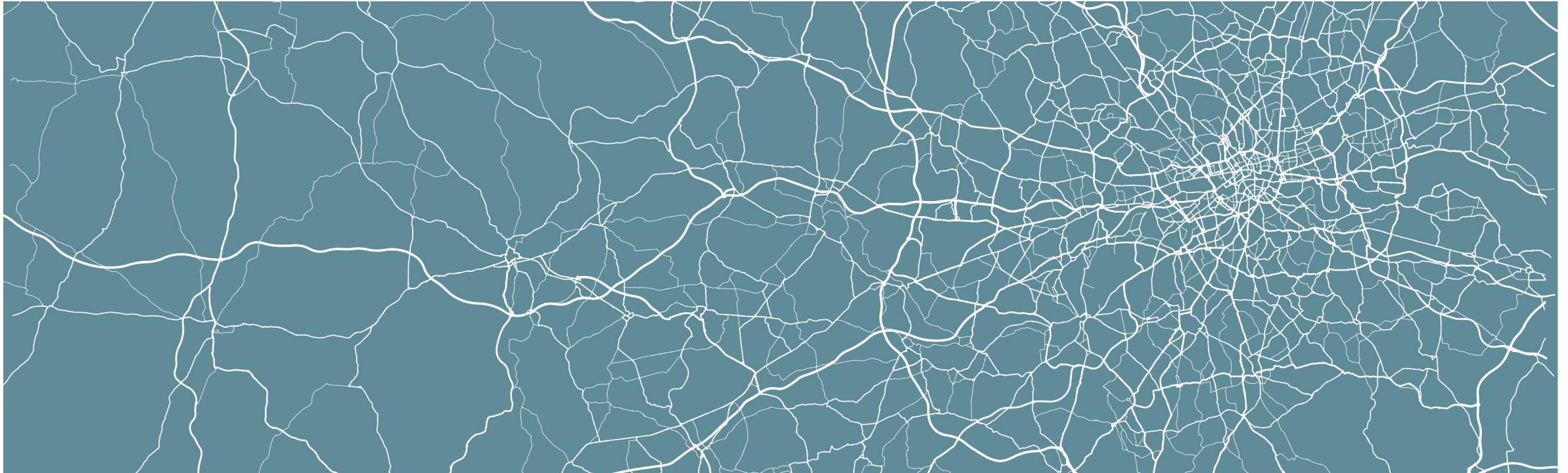


Geocomputation

Geometric Operations and Spatial Queries



Where are we at?

Part I: Foundational Concepts

W1 Geocomputation: An Introduction

W2 GIScience and GIS software

W3 Cartography and Visualisation



QGIS

W4 Programming for Data Analysis



R

W5 Programming for Spatial Analysis

Where are we at?

Part II: Core Spatial Analysis

W6 **Geometric Operations and Spatial Queries**

W7 Spatial Autocorrelation

W8 Point Pattern Analysis



R

Part III: Advanced Spatial Analysis

W9 Rasters, Zonal Statistics and Interpolation



R

W10 Transport Network Analysis

Before we start

- Go to www.menti.com
- Use code: 8700 3744

This week

- Spatial properties
- Spatial operations
- Spatial relationships

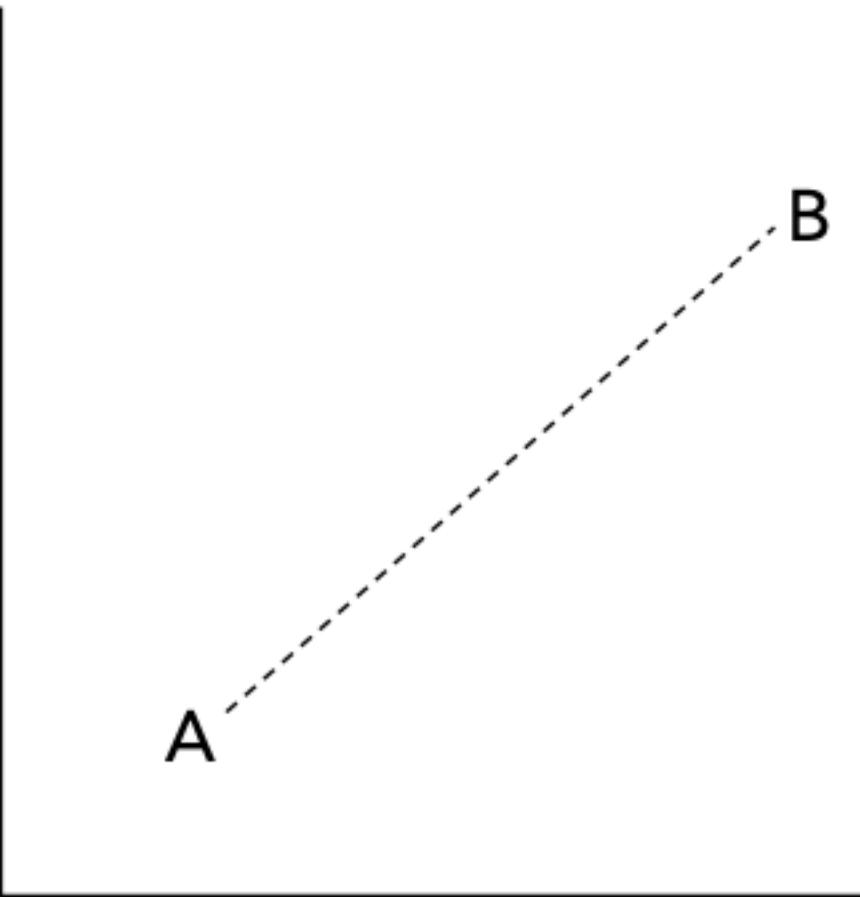
This week



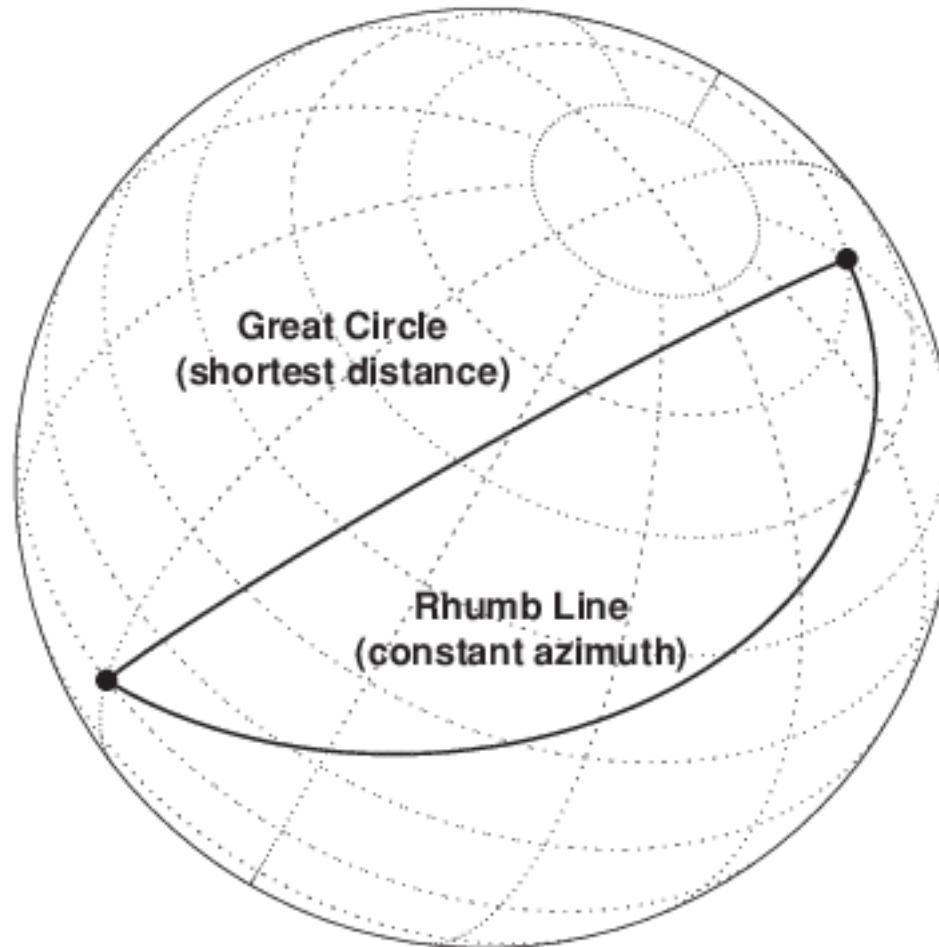
Spatial properties

- Much of spatial data involves the execution of spatial maths on spatial properties.
- We typically work with “*things*” like distance, area, and shape.
- Different ways to think about these properties and how to conceptualise them.

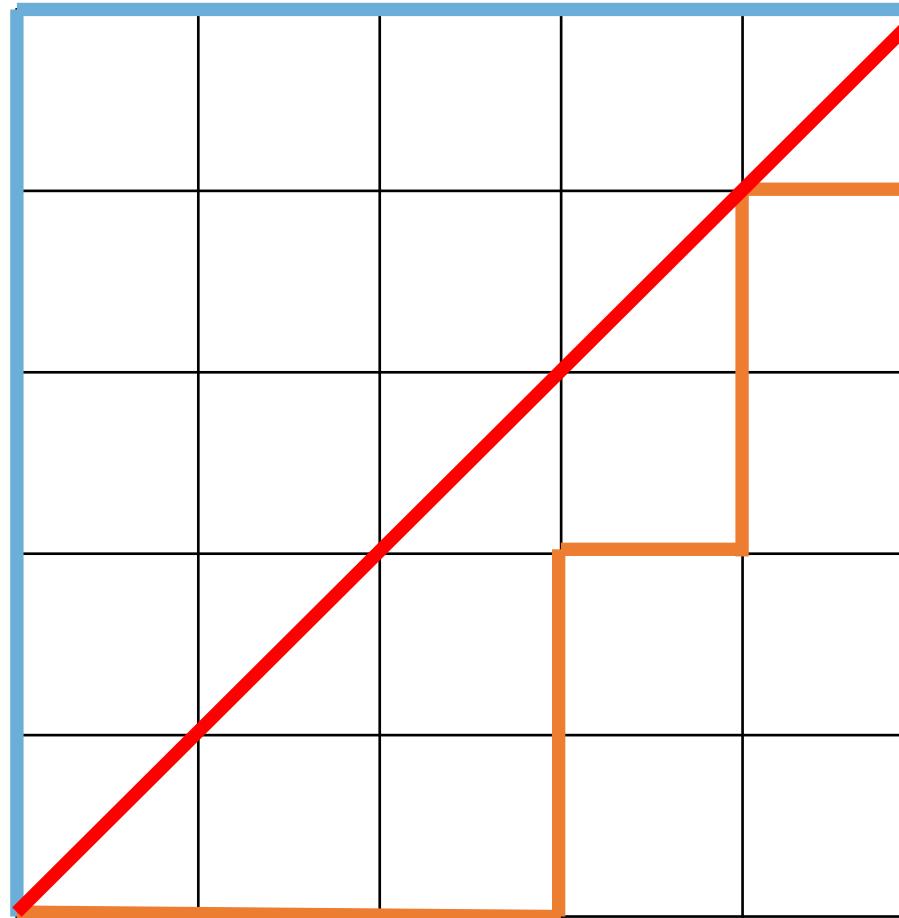
Distance



Distance



Distance



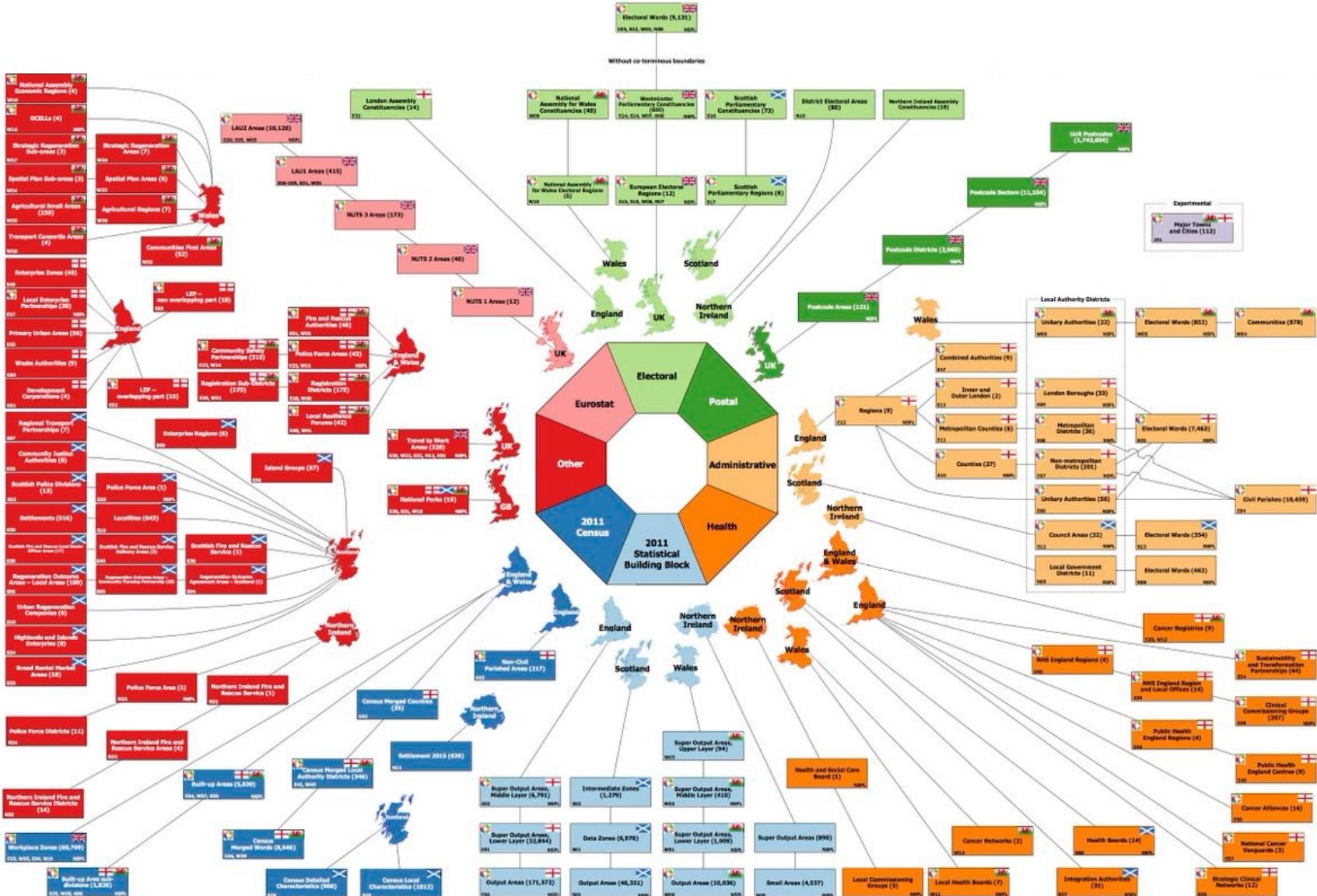
Area



Area

- Precision of the data source will affect calculations (e.g. simplified topology).
- Decision of which geography to use is crucial and depends on what you want to investigate – and keep in mind MAUP.

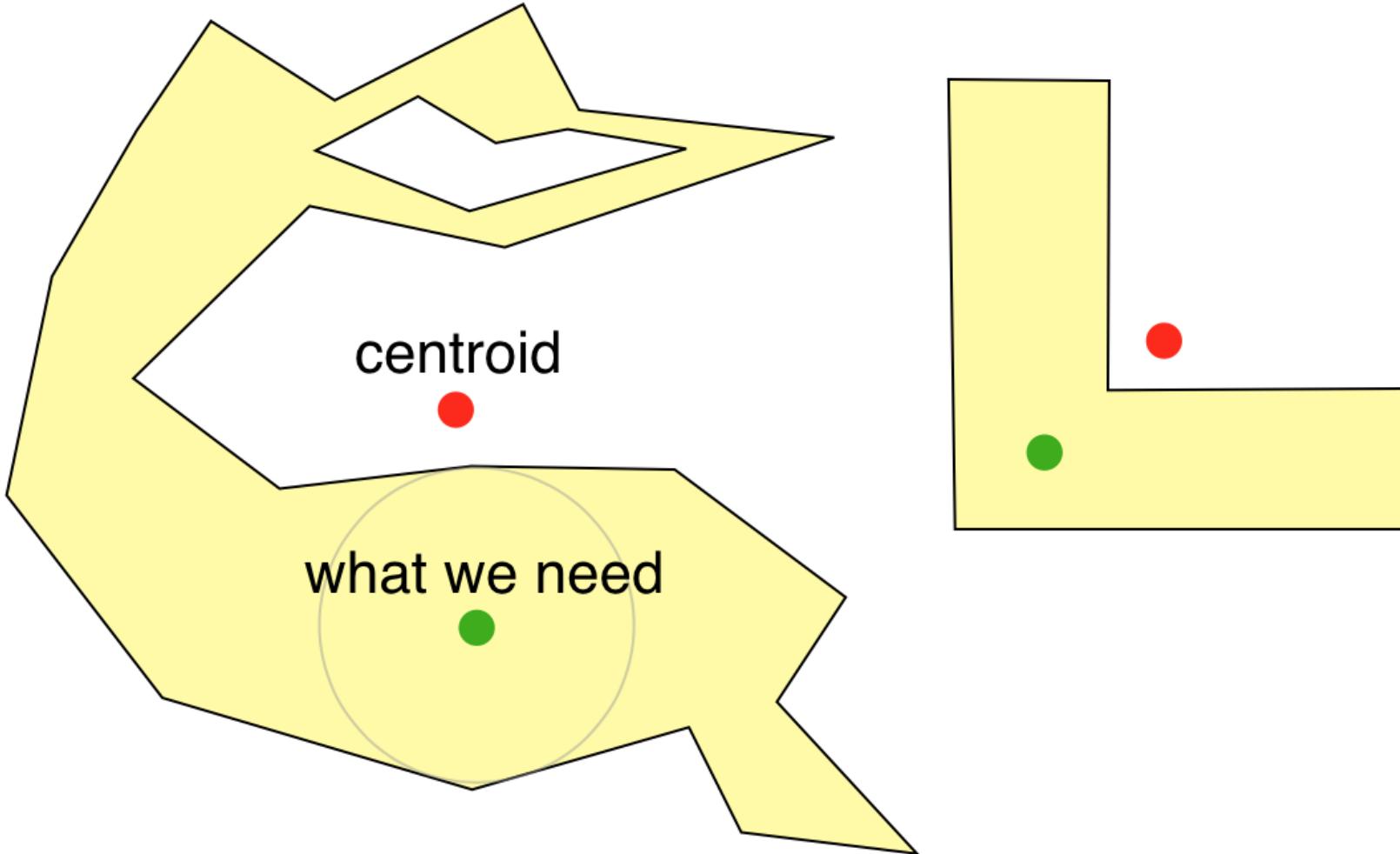
Area



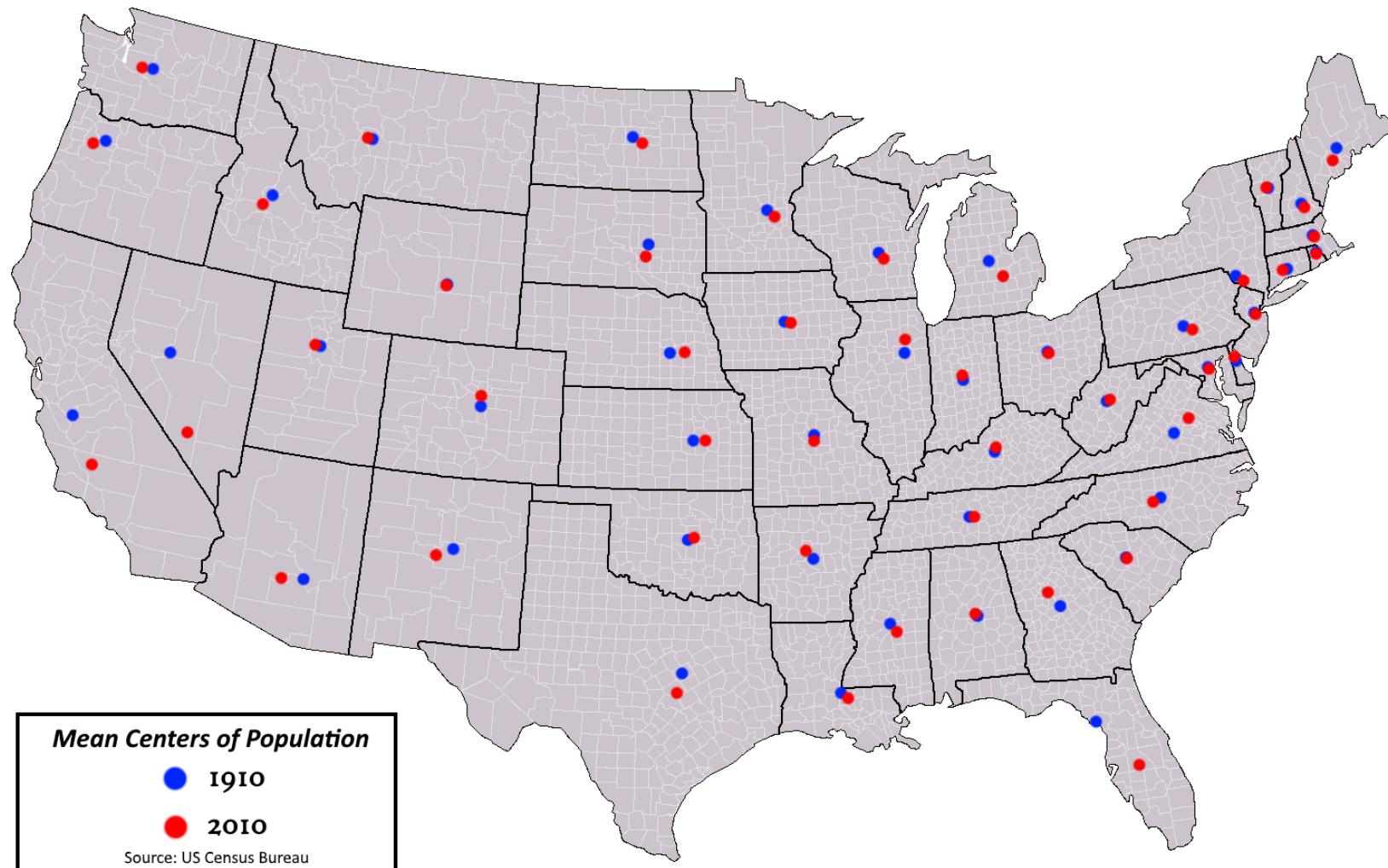
Shape

- Identify and characterise a shape, e.g. following a process of spatially clustering individual objects or geometries.
- Quantifiable with a compactness ratio or perimeter/area ratio.
- Shape can be important to consider when calculating geometric centroids.

Shape



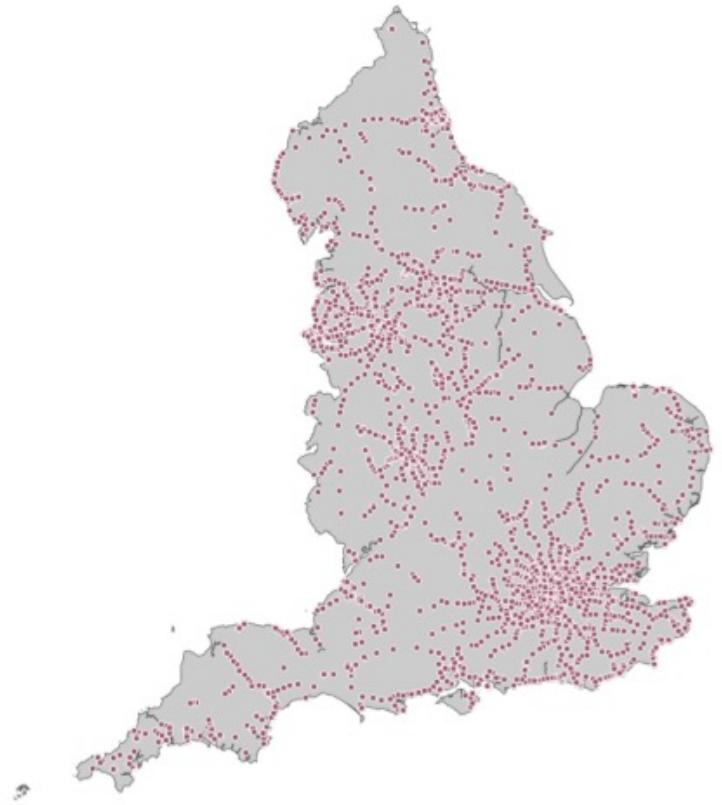
Shape



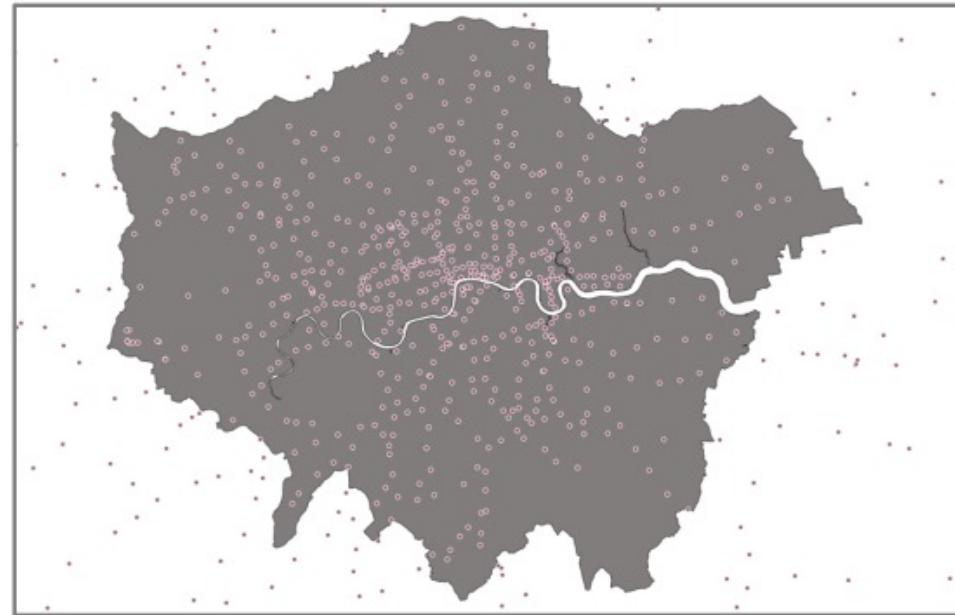
Spatial operations

- Building blocks of spatial data analysis: selecting, filtering, reducing, and merging different geometries.
- Using spatial properties like distance, area, and shape.

Spatial operations



?



Spatial operations

Use of spatial relationships to take data as an input, “do something” with the data and then produce output data that is a derivative of the analysis performed on the input data.

Spatial operations

Use of **spatial relationships** to take data as an input, “do something” with the data and then produce output data that is a derivative of the analysis performed on the input data.



Spatial relationships

- Spatial relationships define how exteriors, interiors, and boundaries of different geometries interact with one another.
- Known as topological relationship.
- Evaluates adjacency, connectivity, and / or containment.

Spatial relationships

Equals A is the same as B	
Touches A touches B	
Overlaps A and B have multiple points in common	
Contains A contains B	
Disjoint A shares nothing with B	
Covers A covers B (or vice versa)	
Crosses A and B have at least one point in common	

Spatial relationships

- There is some spatial mathematics behind calculating the topological relationships between spatial objects.
- “*Does polygon A overlap with Polygon B?*”
 - 1 Establish exterior, interior and boundaries of the geometries of each the object.
 - 2 Calculate the number of times these three properties intersect with one another.
 - 3 Follow the requirements of the function to understand if it is TRUE or FALSE.

Spatial analysis

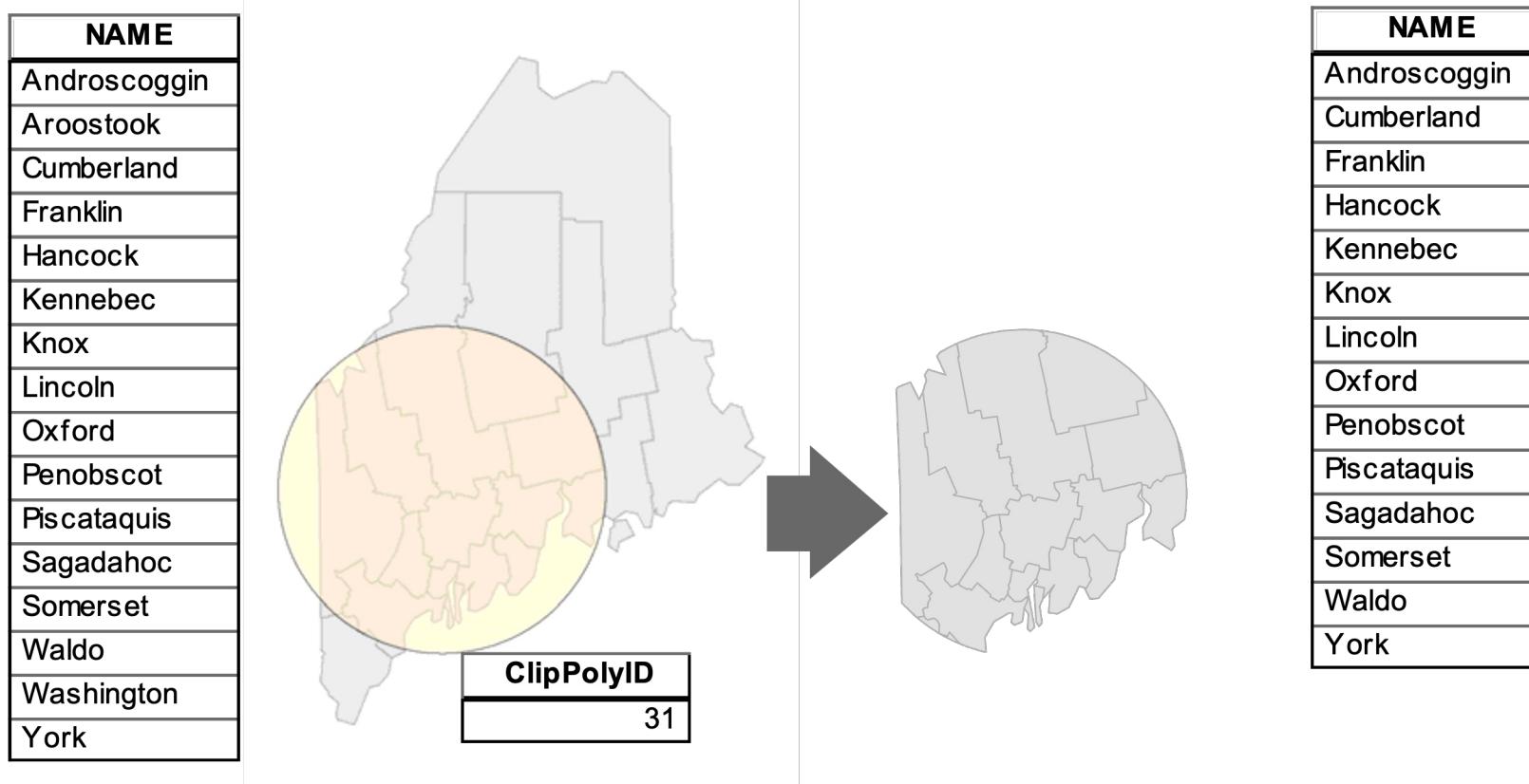
Spatial properties + Spatial Relationships =
Spatial Analysis

Spatial analysis

Spatial analysis =

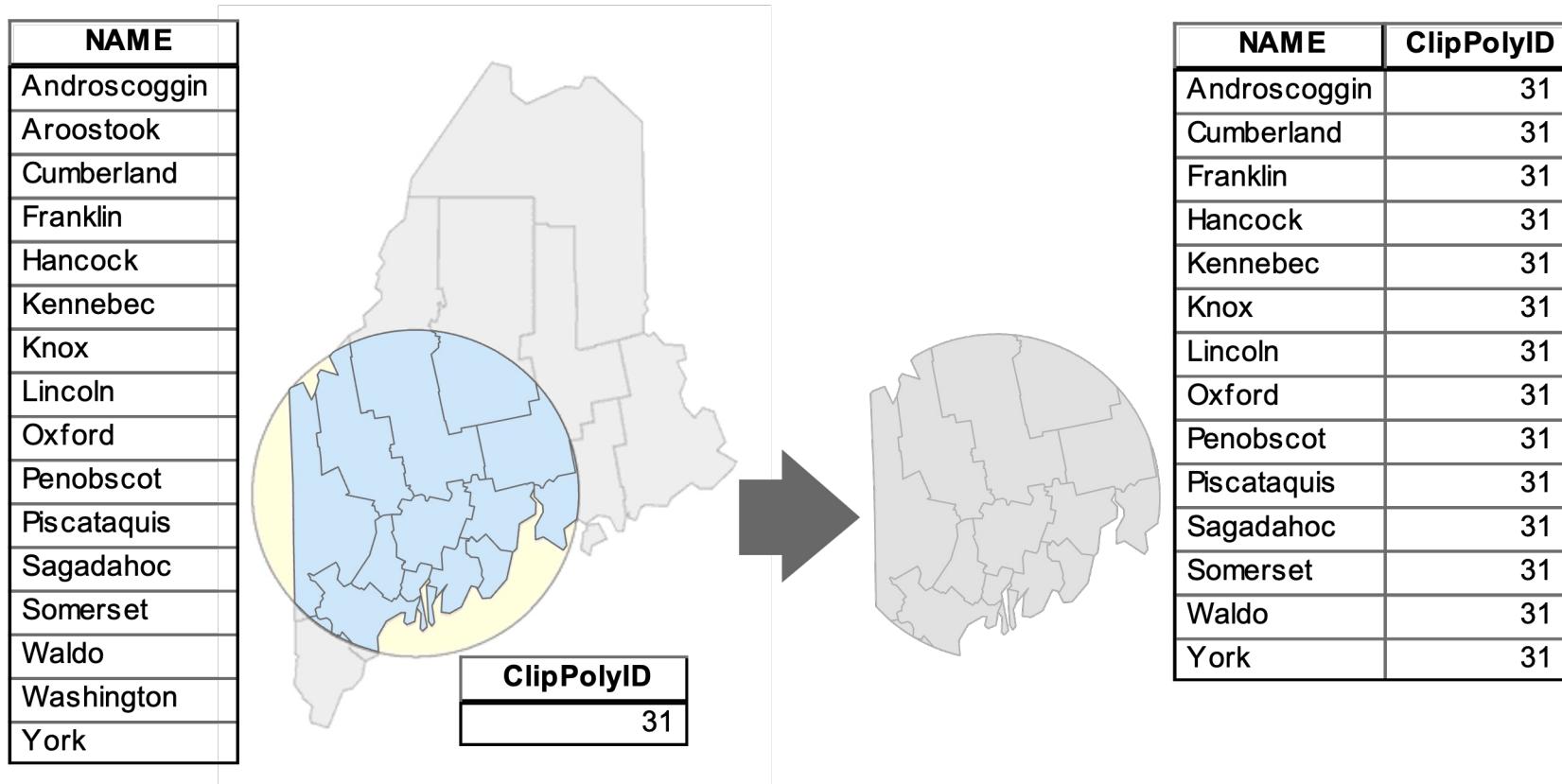
Geometric Operations + Spatial Queries

Vector operations



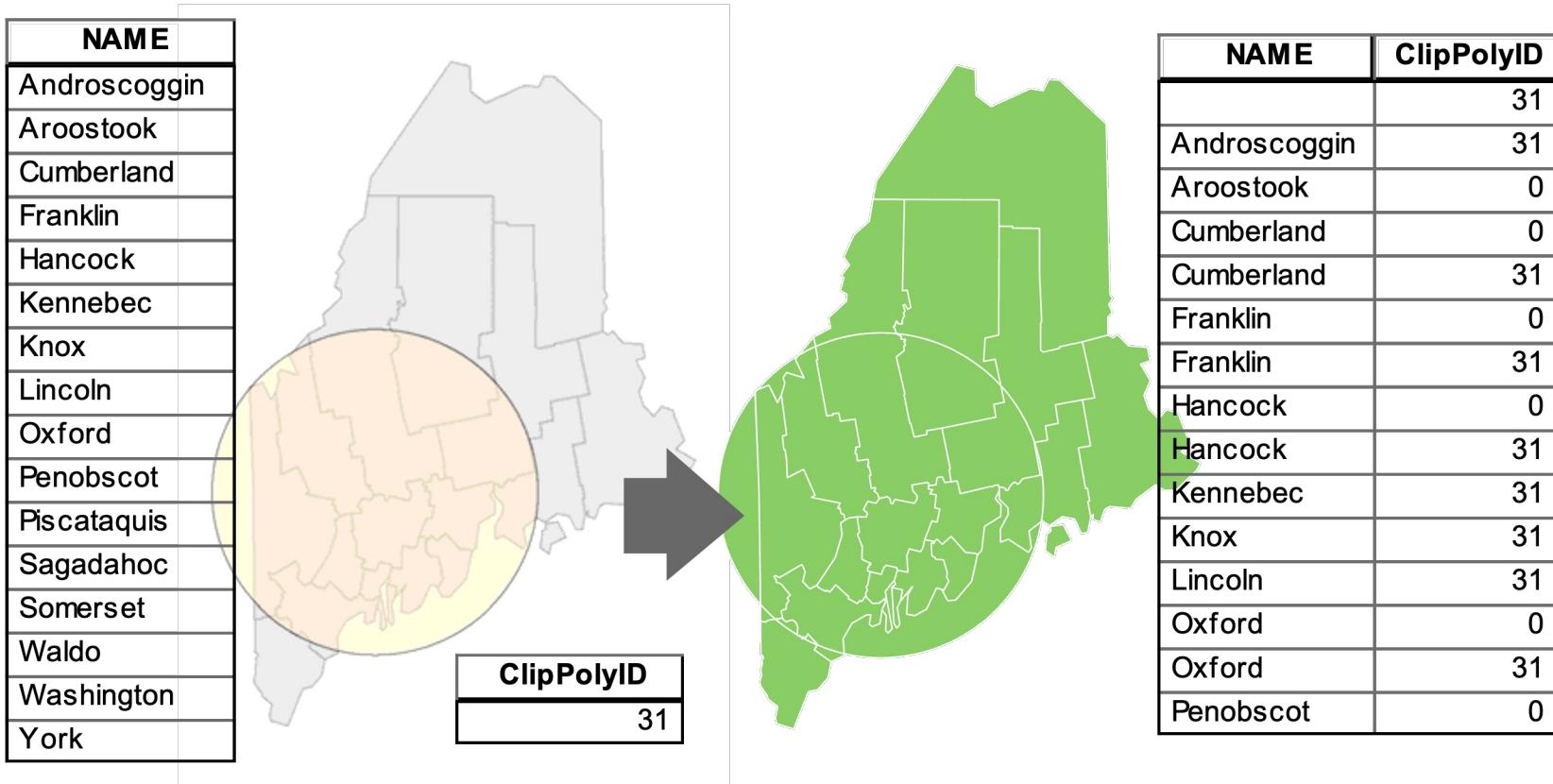
Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations



Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]
<https://mgimond.github.io/Spatial/introGIS.html>

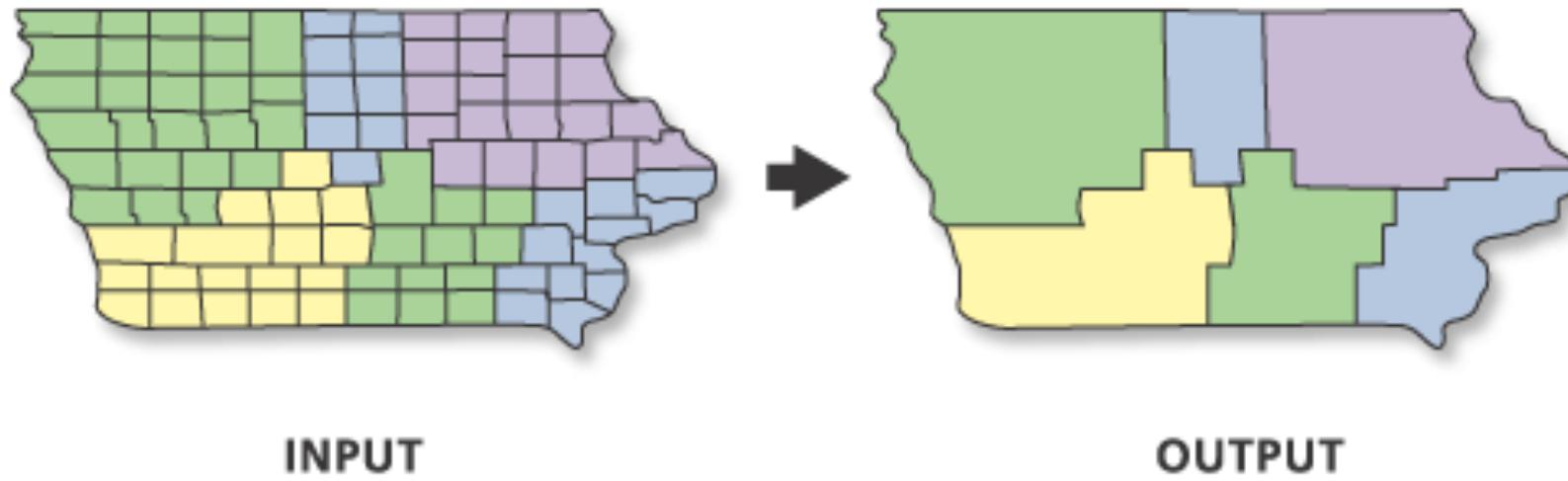
Vector operations



Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]

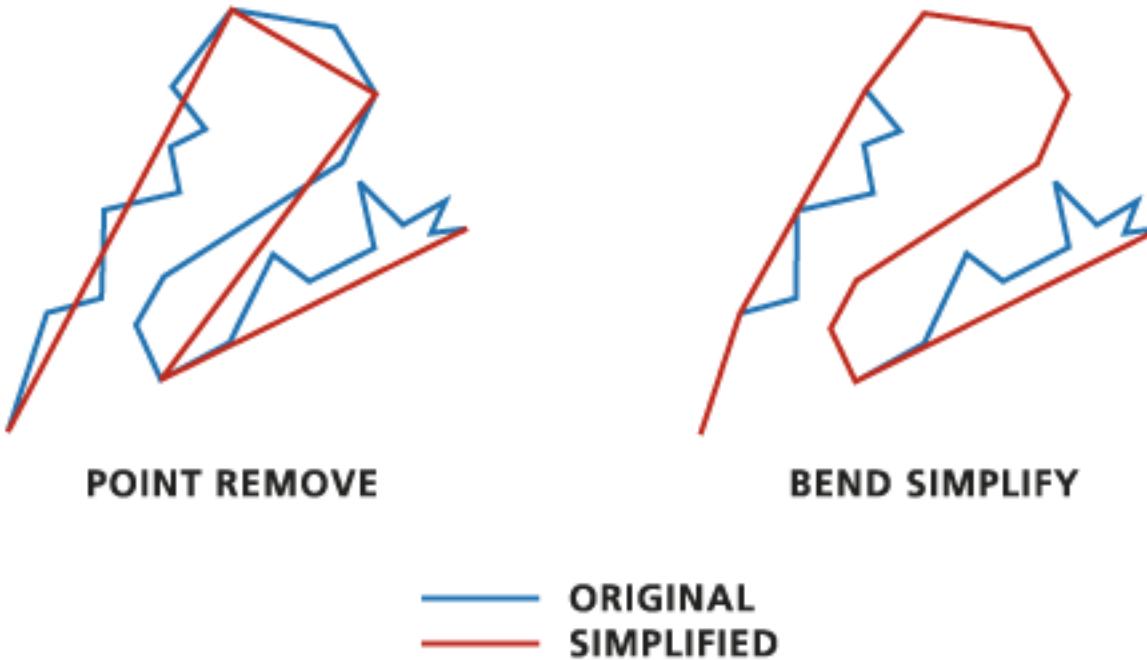
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations - Dissolve



ESRI. 2021. Dissolve. [online]
<https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/dissolve.htm>

Vector operations - Simplify

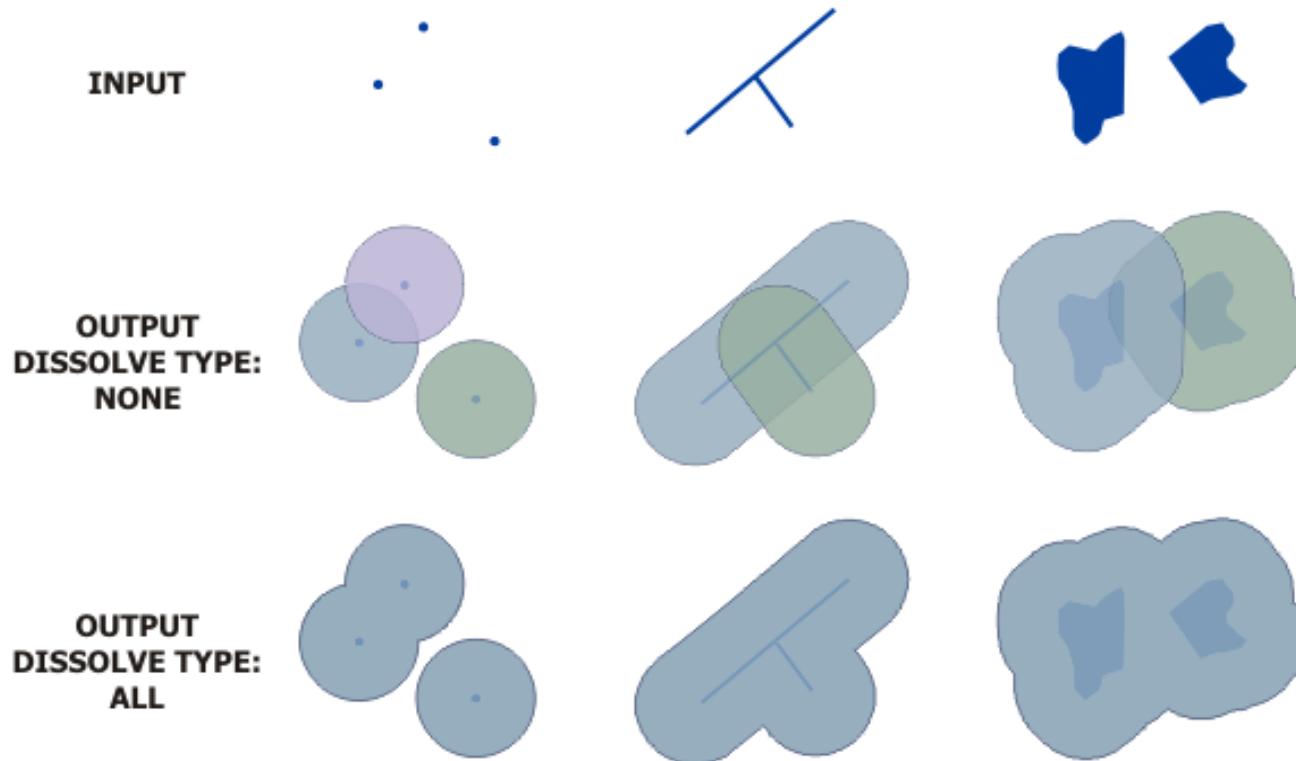


ESRI. 2021. Simplify line. [online]
<https://desktop.arcgis.com/en/arcmap/10.3/tools/cartography-toolbox/simplify-line.htm>

Vector operations - Simplify

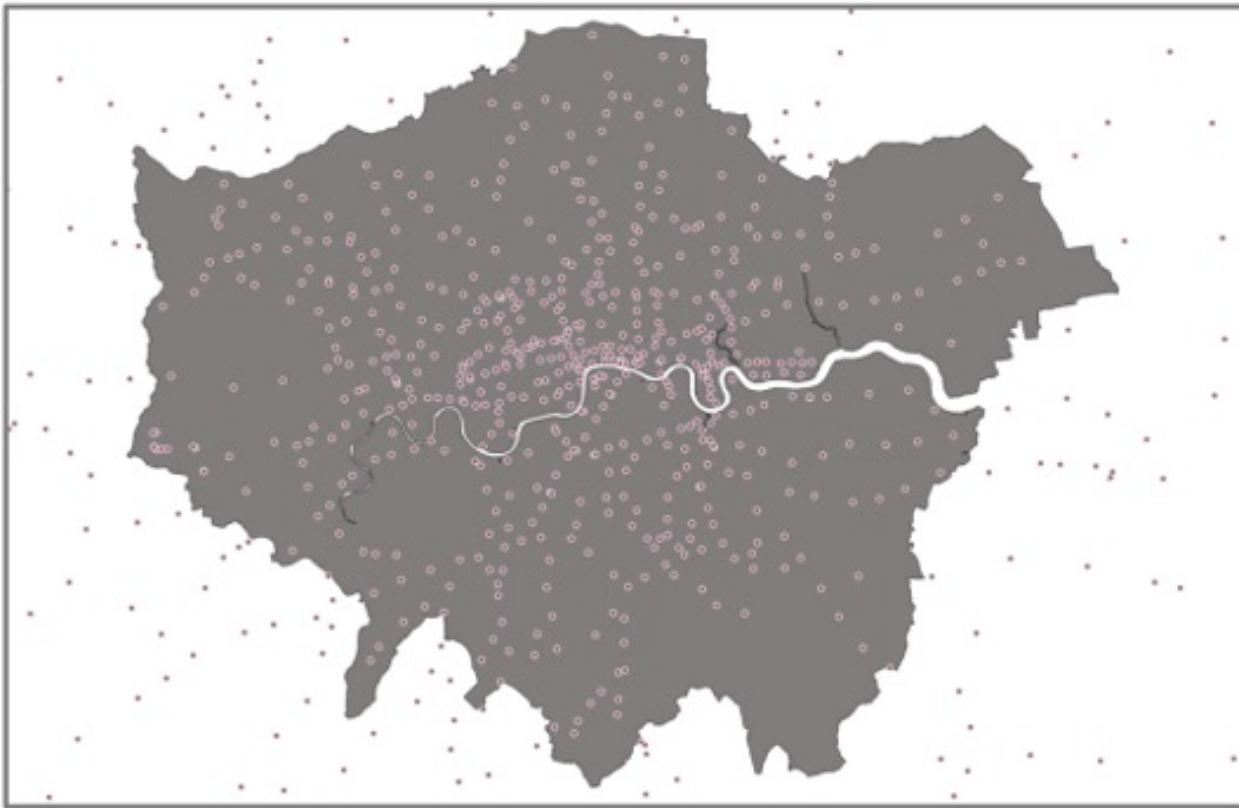


Vector operations - Buffer

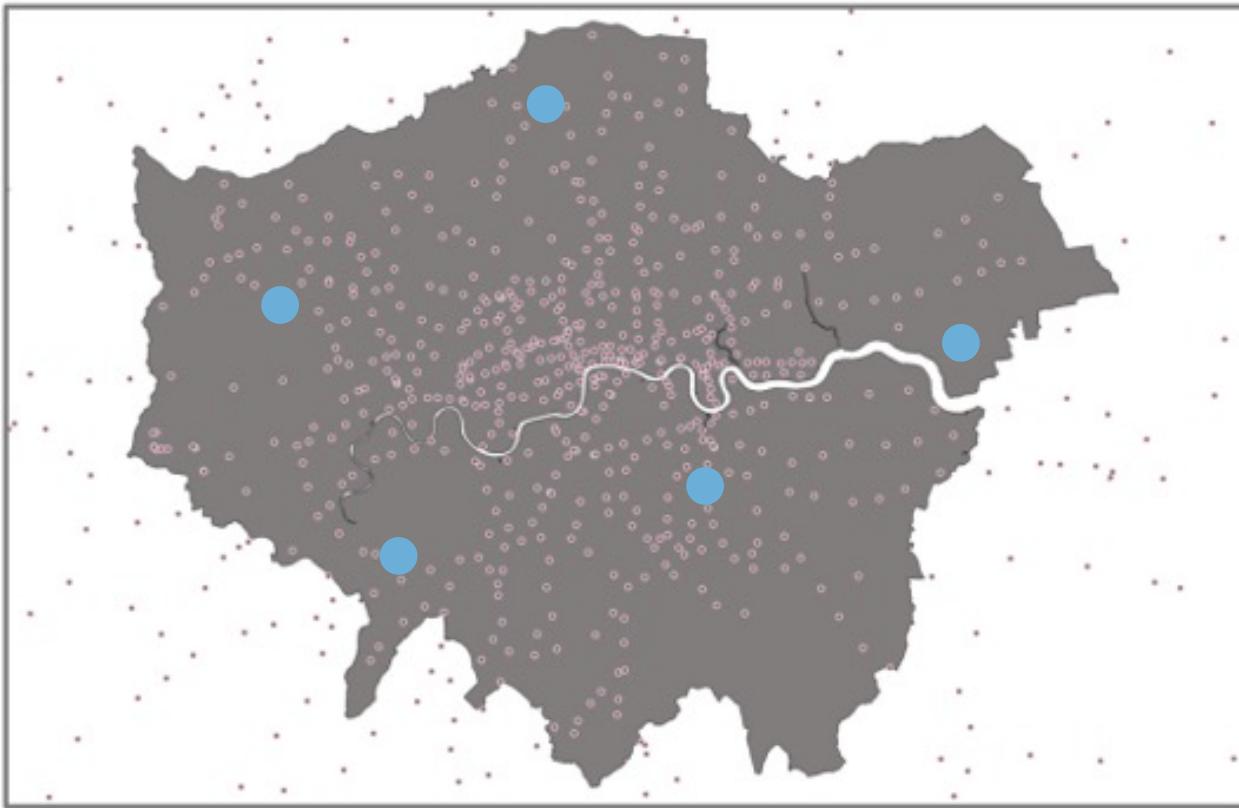


ESRI. 2021. Buffer. [online]
<https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm>

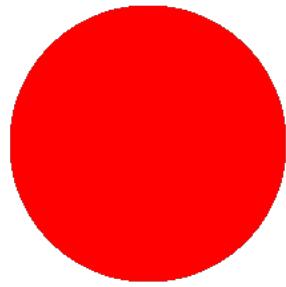
Vector operations – Spatial query



Vector operations – Attribute query



RStudio



LIVE

Conclusion

- The core of spatial analysis comes down to executing geometric operations and spatial queries.
- Spatial analysis relies therewith on the spatial properties of an object as well as on the spatial relationships both *within* and *between* spatial objects.

Assessment

- Social Atlas Coursework Assessment (60%): The first assessment will involve the completion of a spatial analysis project, based on the theory, concepts and application learnt during the module. For this coursework you are required to create a small “social atlas” on a topic or area that interests you. Deadline: April 24 2023.
- On Moodle: guidance as well as examples.

Assessment

- You should create a minimum of 8 maps - and a maximum of 10 - and not exceed 1,500 words.
- You can choose a specific theme, e.g. "Healthy Living", "COVID19 impact across England" or create a research question to answer.
- You should aim to utilise a range of different techniques taught in the Geocomputation module to explore your topic – but make sure you apply the techniques in appropriate manner and with the right data types.
- Data from at least three different data sources.

Assessment

The screenshot shows a Moodle course page for GEOG0030: Geocomputation. The top navigation bar includes links for Home, Events, My courses, This course, Staff Help, Student Help, and Services. The main content area has tabs for Welcome, Keeping In Touch, Module Overview, Assessment (which is selected), and Lecturecast - Video recordings of classes. The Assessment tab contains sections for Module assessment details, Marking criteria, and Instructions and examples. It also lists several attachments: GEOG0030 Assessment: Social Atlas (108KB PDF document), GEOG0030 Assessment: Data Descriptor Table (72.2KB PDF document), GEOG0030 Assessment: Data Descriptor Table [Template] (14.9KB Word 2007 document), and Example 1 - Low 2:1 (507.9KB PDF document). The right sidebar features Contact Details, Module Convenor (Dr Justin van Dijk, email: j.t.vandijk@ucl.ac.uk, office hours: [Link], room: North-West Wing 118), Common Timetable (Personal Timetable, Module Timetable), Library Resources (UCL Explore, LibrarySkills@UCL), and Administration (Course administration, Unenrol me from GEOG0030_22-23, Geocomputation).

Course: GEOG0030: Geocomputation

Welcome Keeping In Touch Module Overview Assessment Lecturecast - Video recordings of classes

Module assessment details

Geocomputation is assessed through two separate assessments:

1. **Social Atlas Coursework Assessment (60%):** The first assessment will involve the completion of a 1,500 word spatial analysis project, based on the theory, concepts and application learnt during the module. For this coursework you are required to create a small "social atlas" on a topic or area that interests you.
2. **Exam Assessment (40%):** The second assessment will take the form of a written 2-hour Exam.

Marking criteria

For the coursework assignment, the marking criteria that will be used can be found in the Geography Coursework Marking Matrix: [\[Link\]](#)

For the exam, the marking criteria that will be used can be found in the Geography Exam Marking Matrix: [\[Link\]](#)

Instructions and examples

- GEOG0030 Assessment: Social Atlas [\[Link\]](#) 108KB PDF document
- GEOG0030 Assessment: Data Descriptor Table [\[Link\]](#) 72.2KB PDF document
- GEOG0030 Assessment: Data Descriptor Table [Template] [\[Link\]](#) 14.9KB Word 2007 document
- Example 1 - Low 2:1 [\[Link\]](#) 507.9KB PDF document

Contact Details

Module Convenor
Dr Justin van Dijk
Email: j.t.vandijk@ucl.ac.uk
Bookable office hours: [\[Link\]](#)
Room: North-West Wing 118

Common Timetable

Personal Timetable
Module Timetable

Library Resources

UCL Explore
LibrarySkills@UCL

Administration

Course administration
Unenrol me from GEOG0030_22-23
Geocomputation

Assessment

The screenshot shows a web browser window with the title "11 Data Sources | GEOG0030". The URL in the address bar is jtvandijk.github.io/GEOG0030/data-sources.html. The browser interface includes standard controls like back, forward, and search.

The main content is titled "11 Data Sources". Below it, a note states: "Below you will find a list of resources that you might want to explore when sourcing data for your coursework assignment or your dissertation. This is by no means an exhaustive list, but simply contains some suggestions of websites that you may want to use." A "Note" box below this says: "You are **not limited** to using these datasets for your coursework assignment or your dissertation."

The sidebar on the left lists various module sections:

- Module Overview
- Module Introduction
- Foundational Concepts
 - 1 Geocomputation: An Introduction
 - 2 GIScience and GIS software
 - 3 Cartography and Visualisation
 - 4 Programming for Data Analysis
 - 5 Programming for Spatial Analysis
- Core Spatial Analysis
 - 6 Analysing Spatial Patterns I: Ge...
 - 7 Analysing Spatial Patterns II: S...
 - 8 Analysing Spatial Patterns III: P...
- Advanced Spatial Analysis
 - 9 Rasters, Zonal Statistics and In...
 - 10 Transport Network Analysis
- Additional Resources
 - 11 Data Sources
 - 11.1 Open Data
 - 11.2 Safeguarded Data

Assessment

TL;DR story of at most 1,500 words tied together by 8-10 related maps.

Geocomputation Help Session

- Friday February 24 from 16h00-17h00 in North-West Wing 3.04.
- Bring your own laptop.
- Not mandatory.

Map challenge



Questions

Justin van Dijk

j.t.vandijk@ucl.ac.uk

