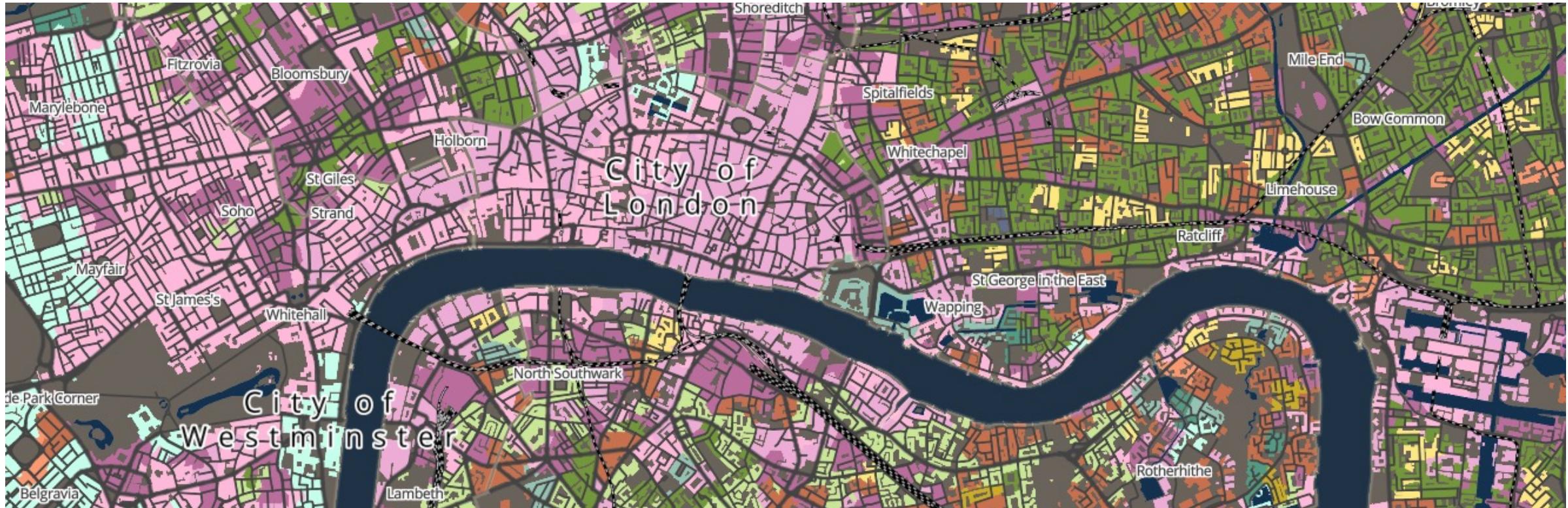


Geocomputation

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

W5 Programming for Spatial Analysis



R

Where are we at?

Part II: Core Spatial Analysis

W6 **Geometric Operations and Spatial Queries**

W7 Point Pattern Analysis

W8 Spatial Autocorrelation

R

Part III: Advanced Spatial Analysis

W9 Rasters, Zonal Statistics and Interpolation

W10 Transport Network Analysis

R

Before we start

- Go to www.menti.com
- Use code: 4293 9206

This week

- Spatial properties
- Spatial operations
- Spatial relationships

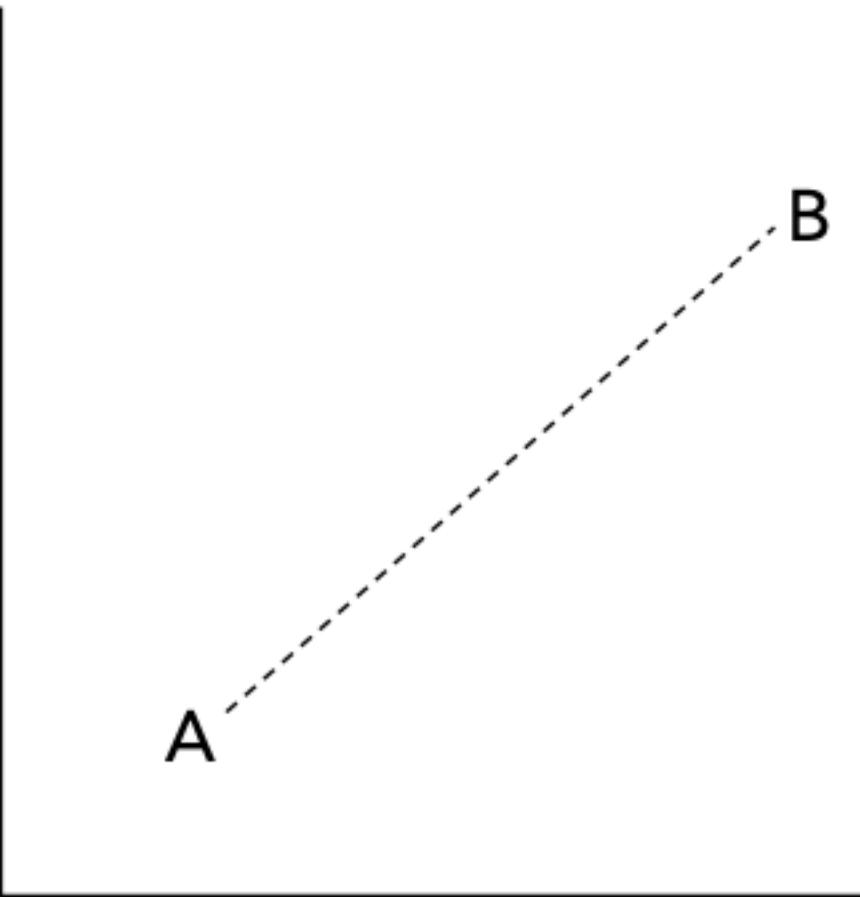
This week



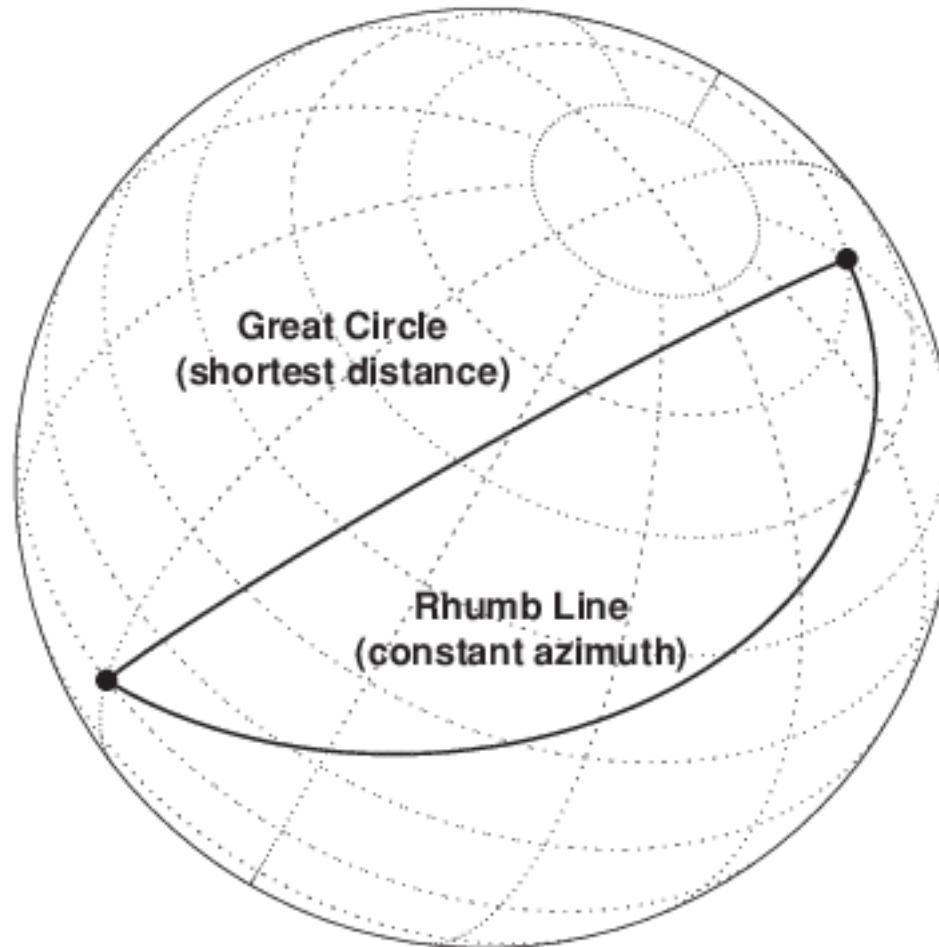
Spatial properties

- 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.

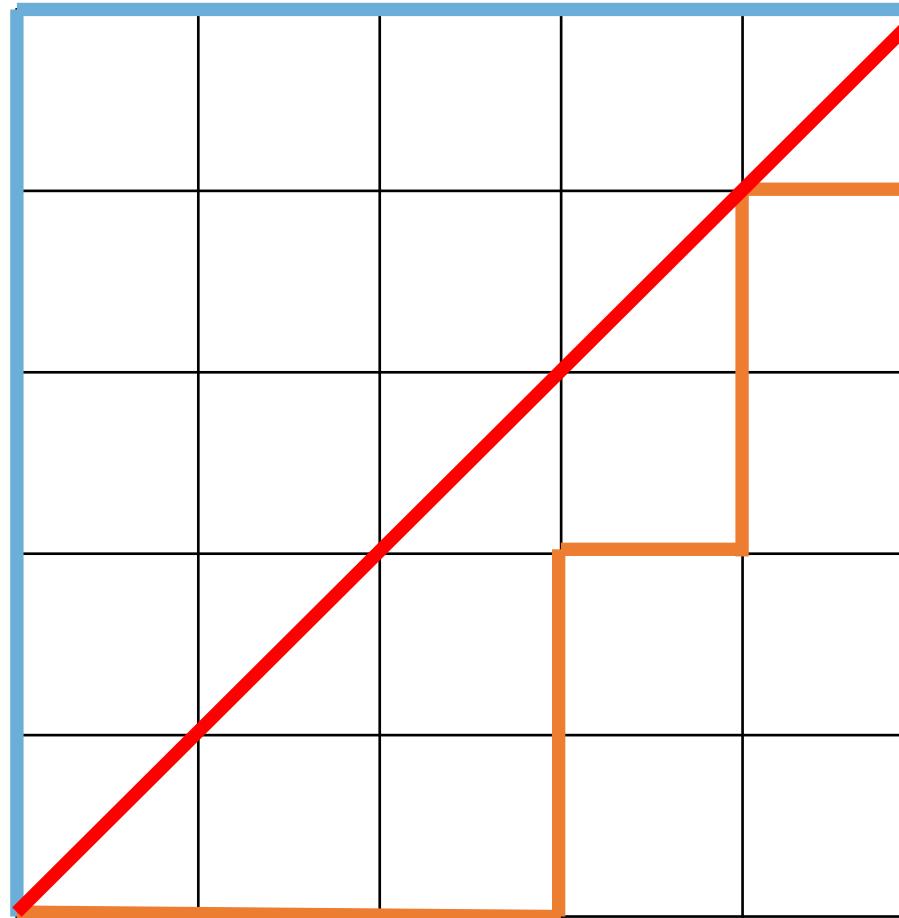
Distance



Distance



Distance



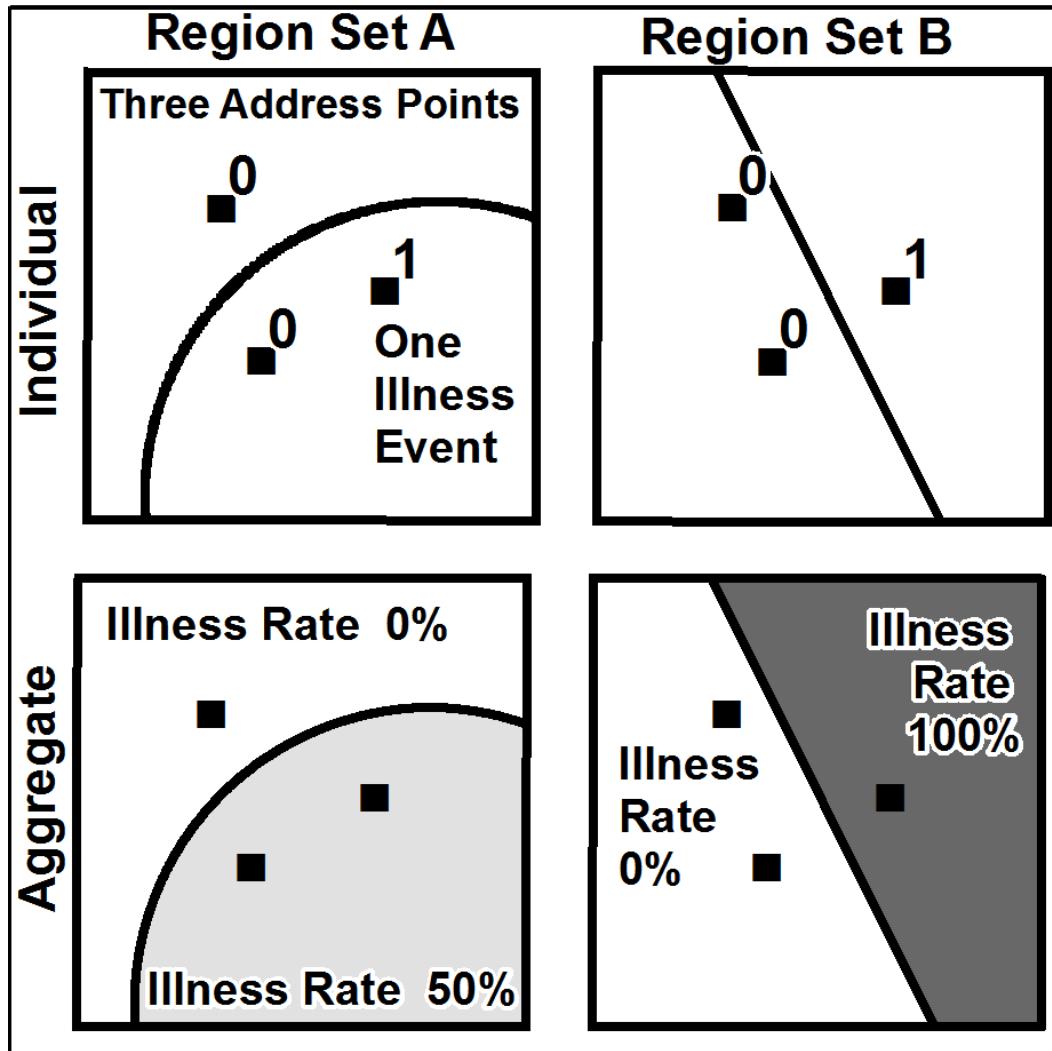
Area



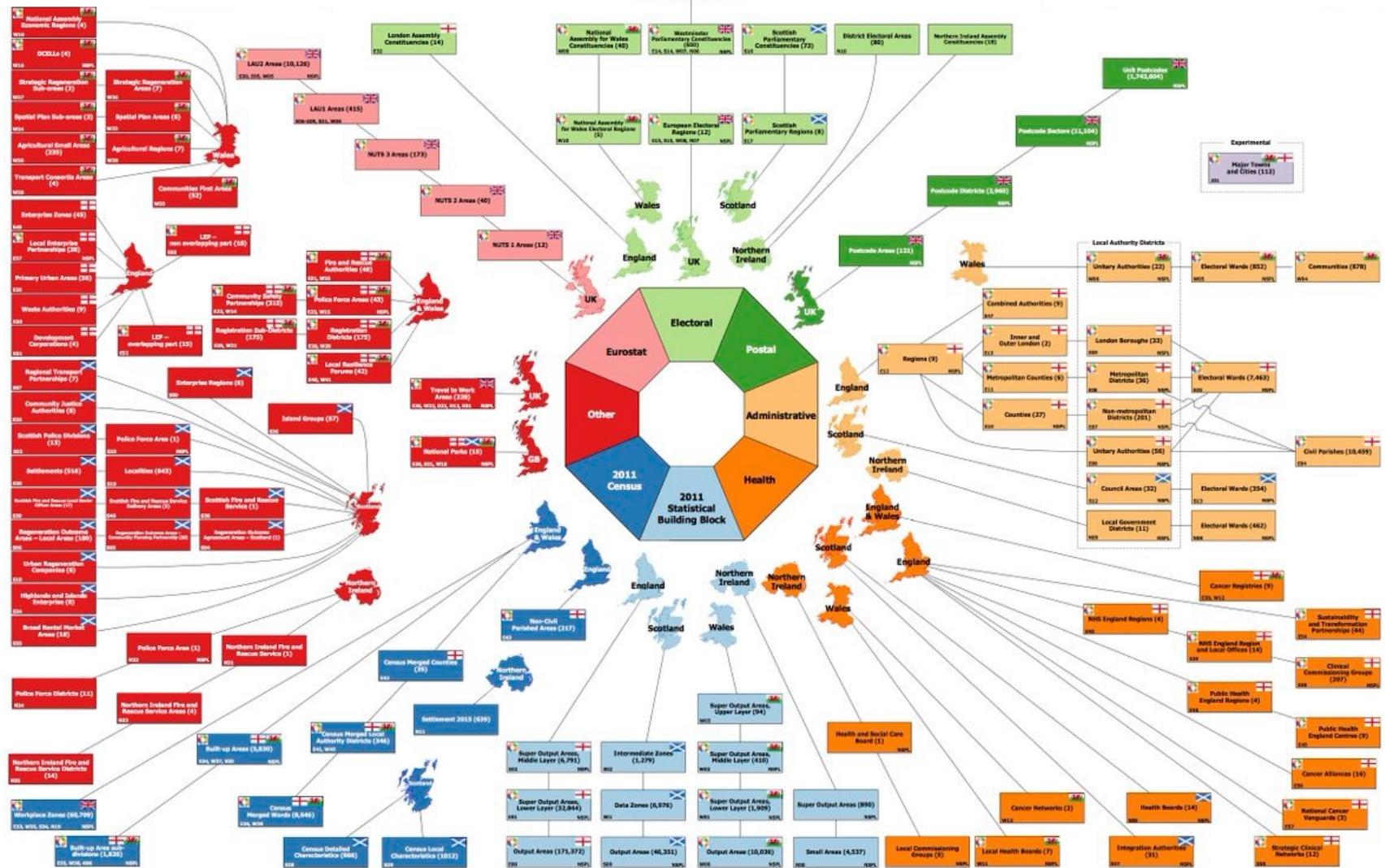
Area

- 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 the Modifiable Areal Unit Problem in mind.

Modifiable Areal Unit Problem



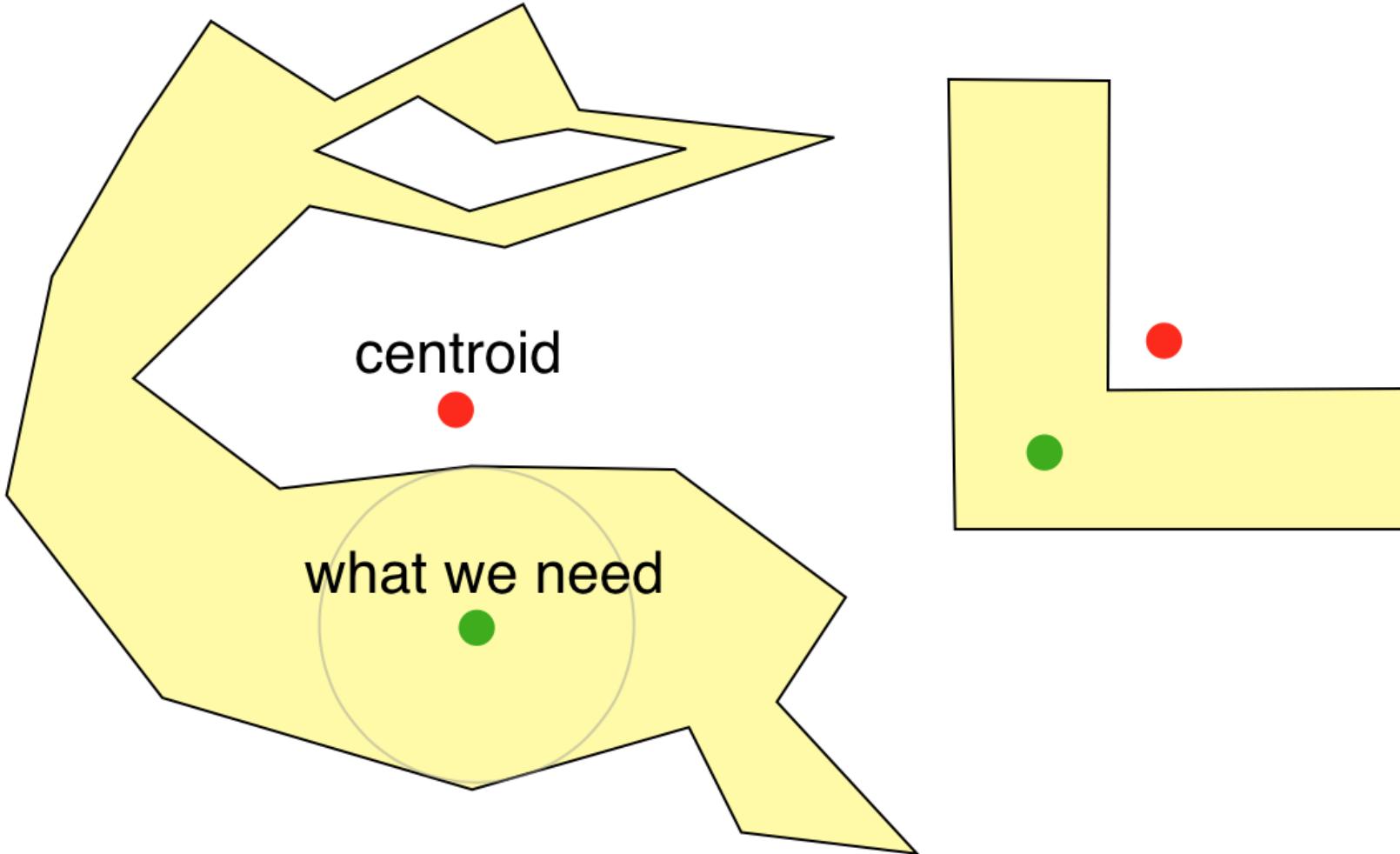
Administrative Geographies



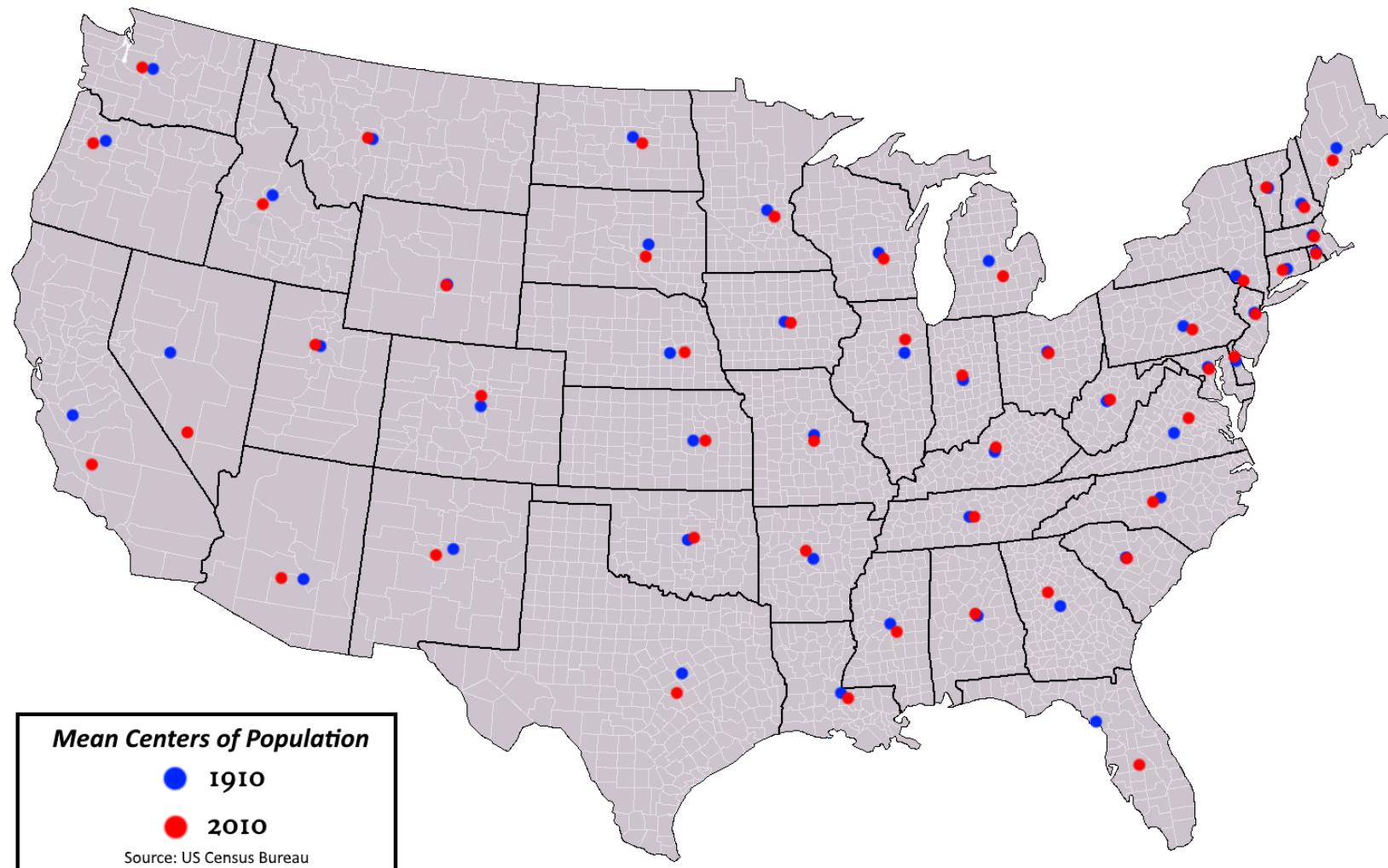
Shape

- 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



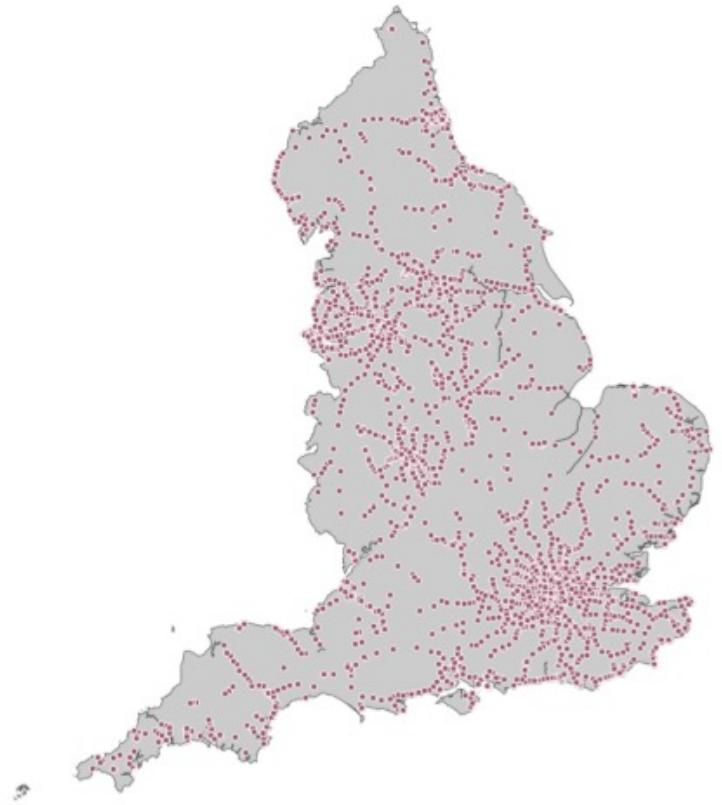
Shape



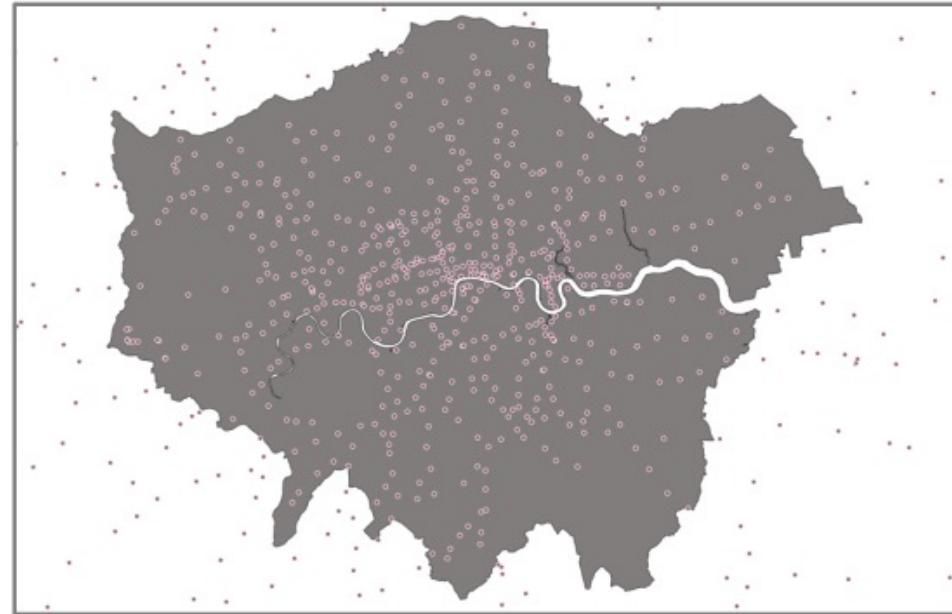
Spatial operations

- 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

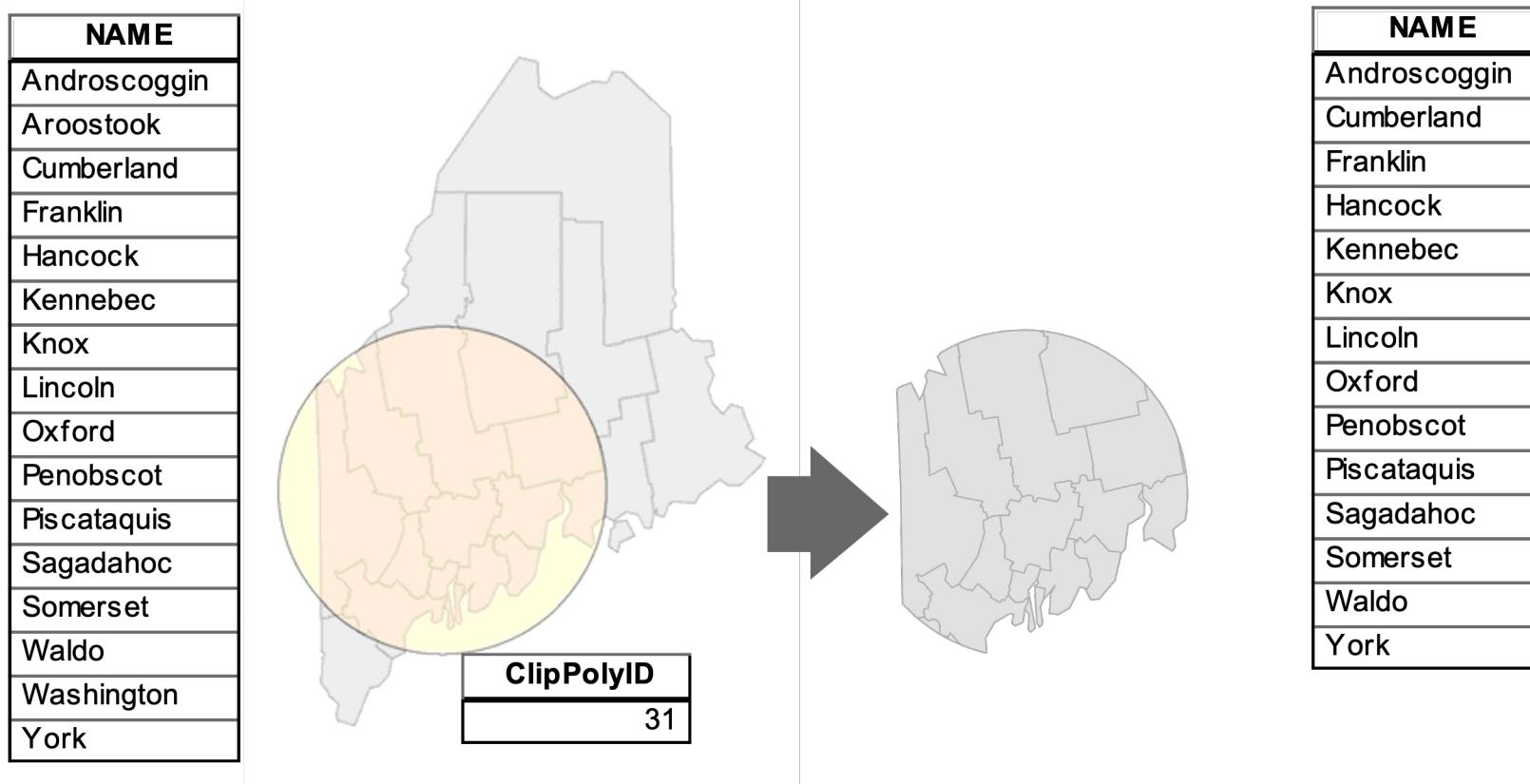
Spatial properties + Spatial Relationships =
Spatial Analysis

Spatial analysis

Spatial analysis =

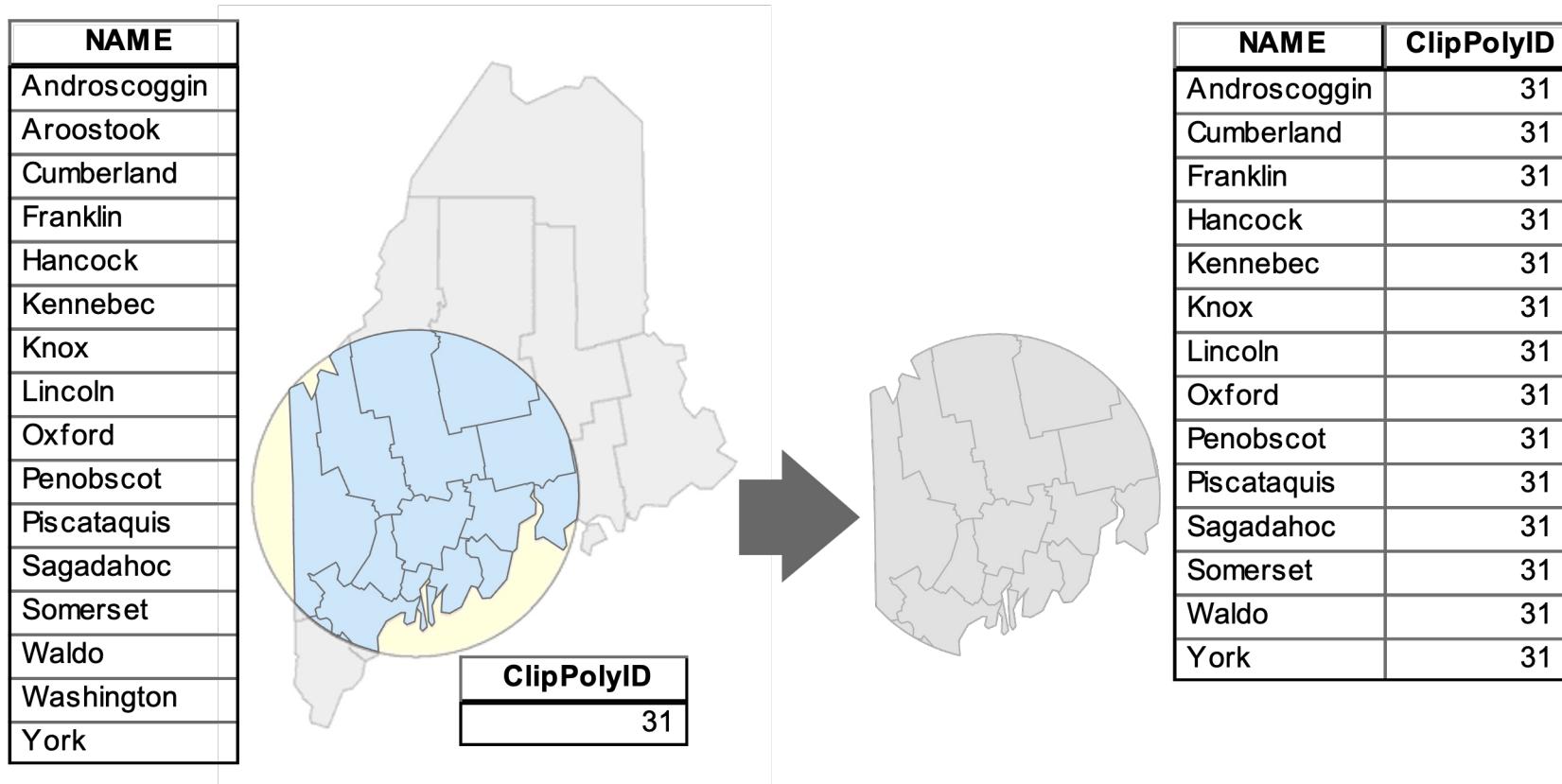
Geometric Operations + Spatial Queries

Vector operations



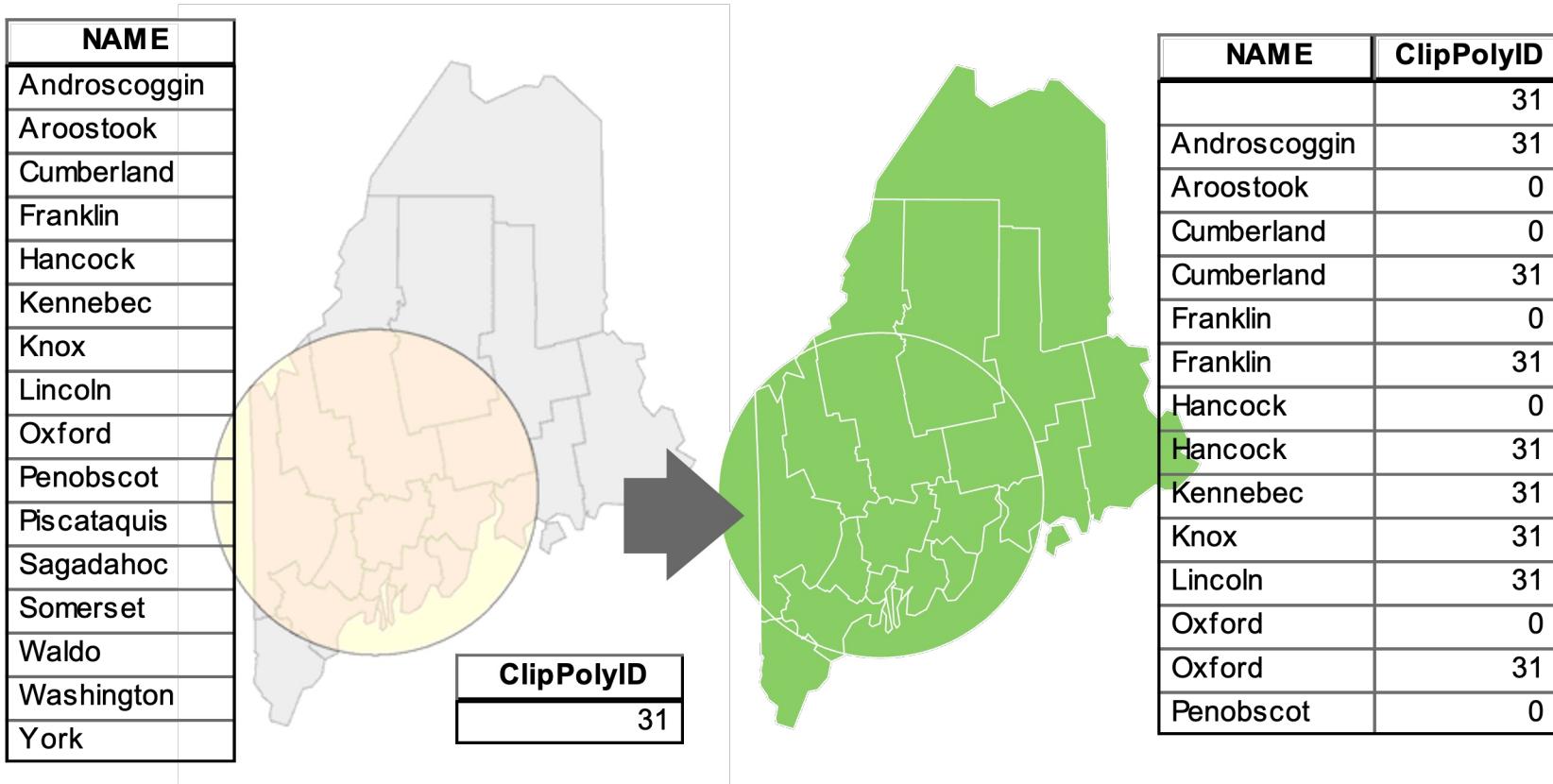
Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations



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

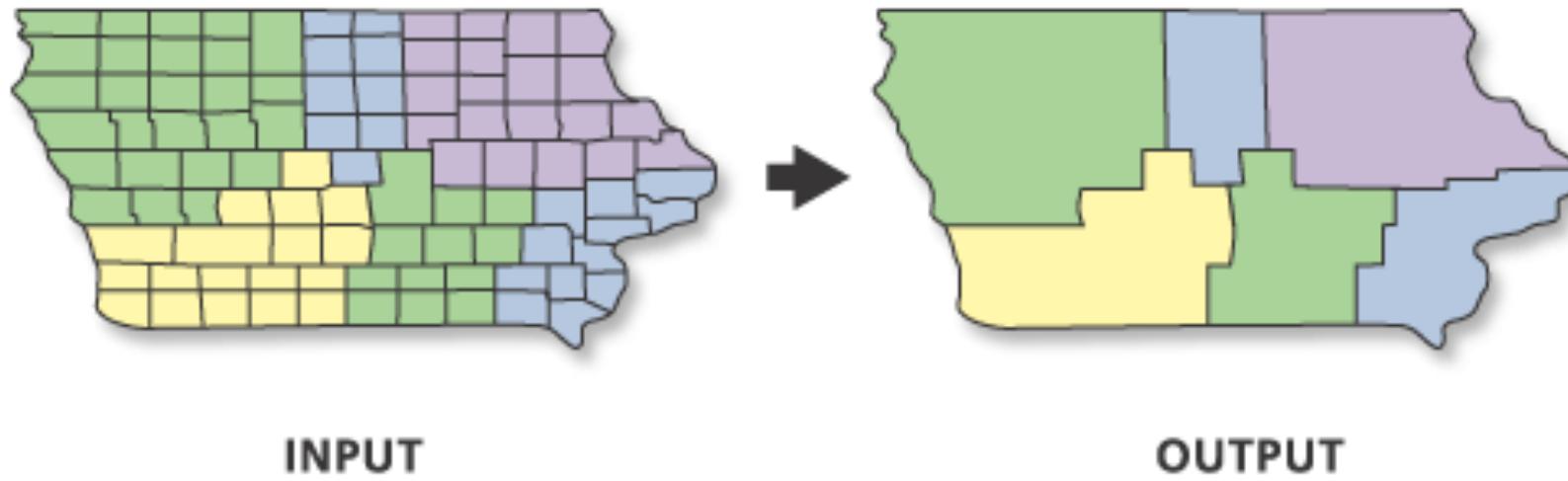
Vector operations



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

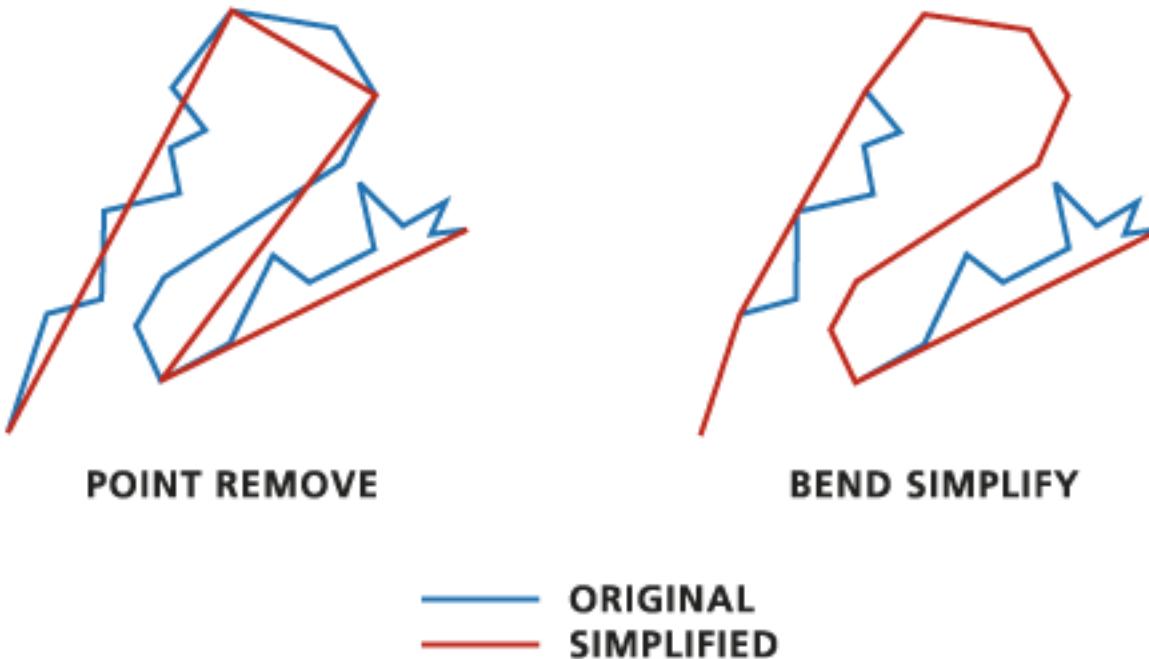
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations - Dissolve



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

Vector operations - Simplify

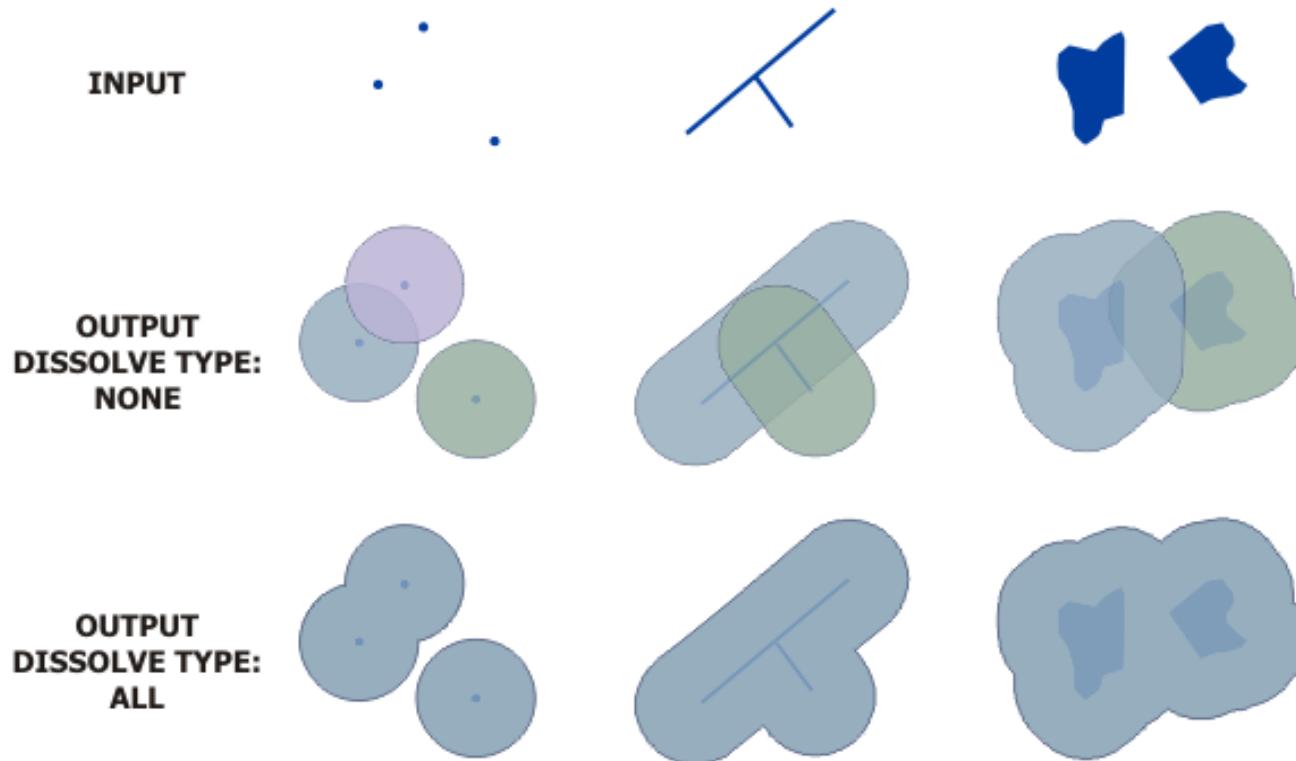


ESRI. 2021. Simplify line. [online]
<https://desktop.arcgis.com/en/arcmap/10.3/tools/cartography-toolbox/simplify-line.htm>

Vector operations - Simplify

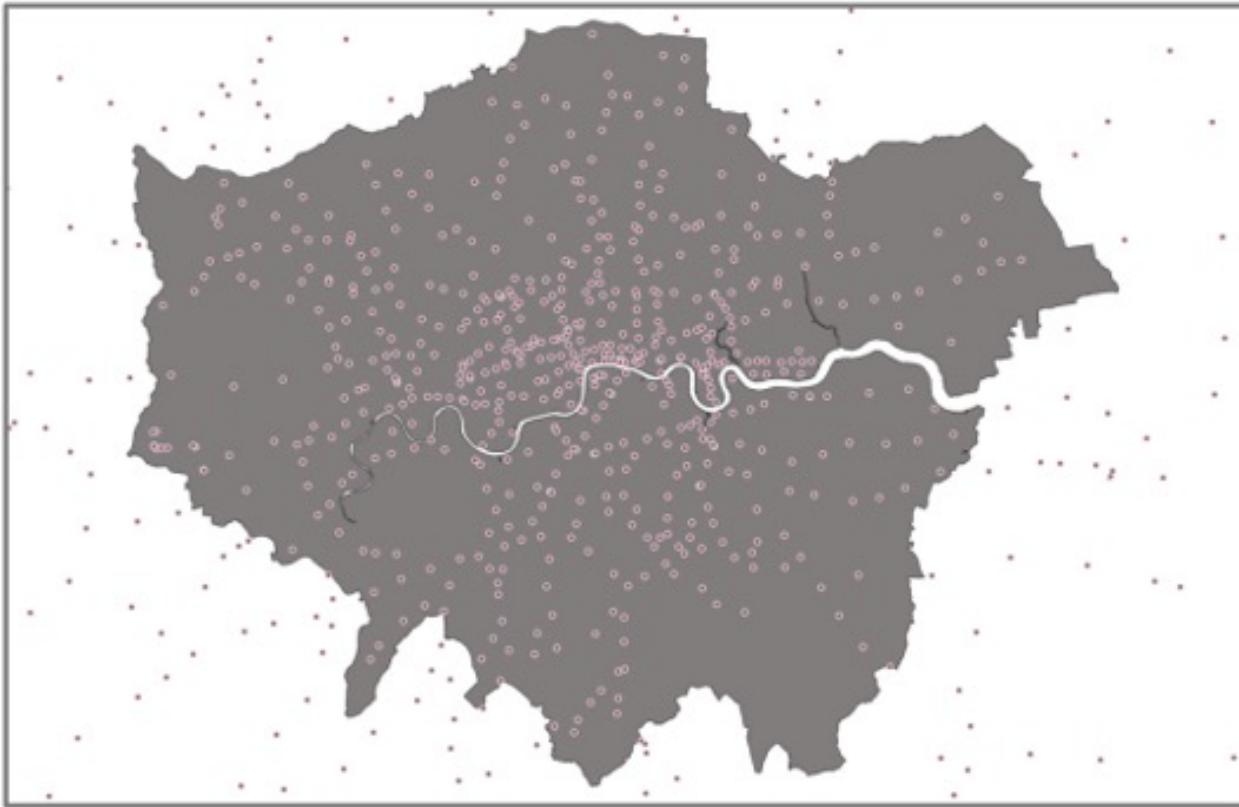


Vector operations - Buffer

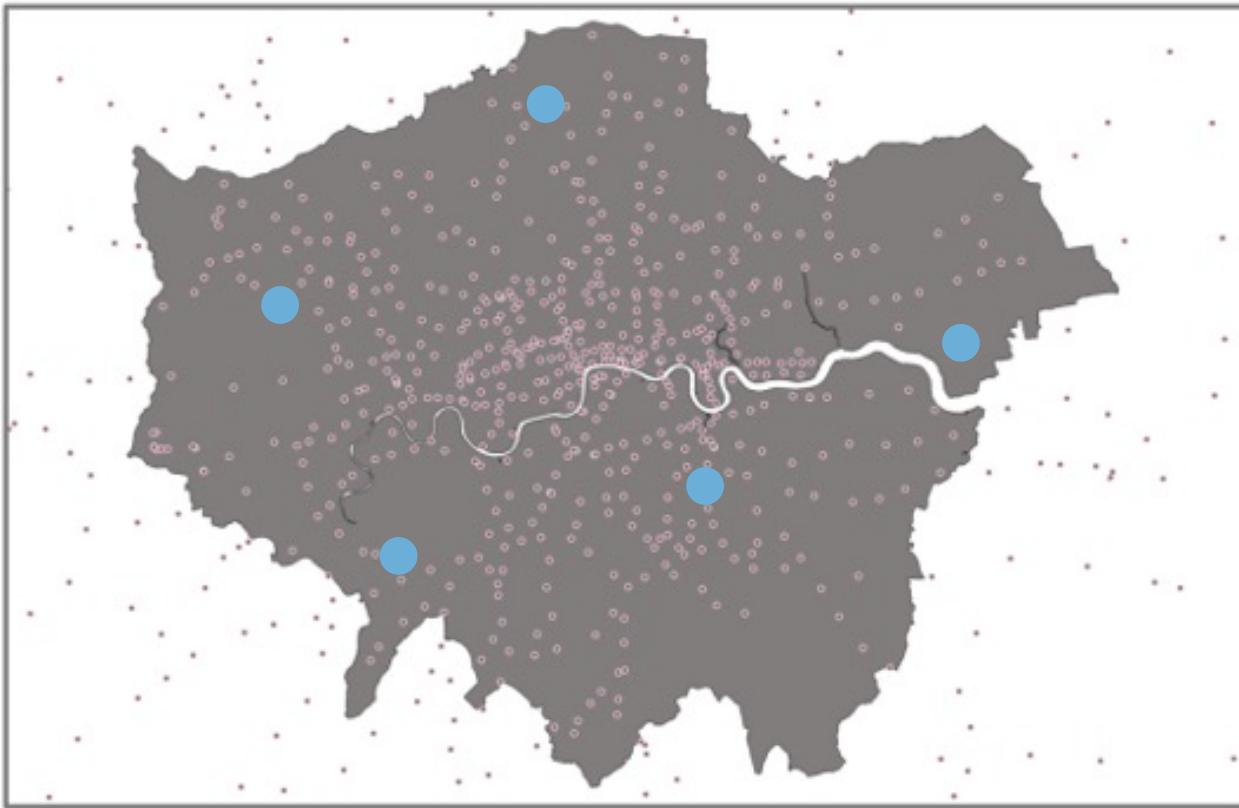


ESRI. 2021. Buffer. [online]
<https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm>

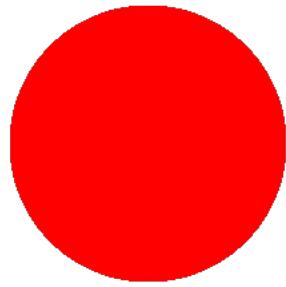
Vector operations – Spatial query



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 22 2024.
- On Moodle: guidance as well as examples.

Assessment

- You should create a minimum of 6 maps - and a maximum of 8 - and not exceed 1,500 words.
- You can choose a specific theme, e.g. "Healthy Living", "Cost of Living in 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.
- Greater London cannot be used as a case study.

Assessment

The screenshot shows a Moodle course page for 'Topic: Assessment | GEOG00'. The page title is 'moodle.ucl.ac.uk/course/view.php?id=38486§ion=3#tabs-tree-start'. The header includes the UCL logo, navigation links for 'Home' and 'My courses', and a user icon for 'JV'. The main content area is titled 'Module assessment details' and contains the following information:

Geocomputation is assessed through two separate assignments:

- 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.
- Exam Assessment (40%).** The second assessment will take the form of a written two-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

Two PDF documents are listed for download:

- GEOG0030 Assessment: Social Atlas (105.1 KB PDF document)
- GEOG0030 Assessment: Data Descriptor Table (72.2 KB PDF document)

A blue 'Back to top' button is located in the bottom right corner of the content area.

Assessment

The screenshot shows a web browser window with the title bar "GEOG0030" and the URL "jtvdijk.github.io/GEOG0030/11-data.html". The left sidebar contains a "Module overview" menu with sections: Welcome, 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: Geometric Operations and Spatial Queries, 7 Analysing Spatial Patterns II: Point Pattern Analysis, 8 Analysing Spatial Patterns III: Spatial Autocorrelation), Advanced Spatial Analysis (9 Rasters, Zonal Statistics, and Interpolation, 10 Transport Network Analysis), and Additional Resources (11 Data Sources). The main content area features a large heading "11 Data Sources". Below it, a text block 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 callout box contains the note: "You are **not limited** to using these datasets for your coursework assignment or your dissertation, but these are merely some suggestions." The right sidebar has a "On this page" section with links to "11 Data Sources", "11.1 Open Data", and "11.2 Safeguarded Data". There is also a "Report an issue" link.

11 Data Sources

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.

ⓘ You are **not limited** to using these datasets for your coursework assignment or your dissertation, but these are merely some suggestions.

11.1 Open Data

The following websites contain Open Data or link to Open Data from several respectable data providers:

- [AfricanUrbanNetwork](#)
- [AirBnB Data](#)
- [Bike Docking Data \(ready for R\)](#)
- [Bing Maps worldwide road detections](#)
- [Camden Air Action](#)
- [Consumer Data Research Centre](#)
- [Department for Environment, Food & Rural Affairs](#)
- [Edina \(e.g. OS mastermap\)](#)
- [EU Tourism Data](#)
- [Eurostat](#)

Assessment

TL;DR story of at most 1,500 words tied together by 6-8 related maps.

Questions

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