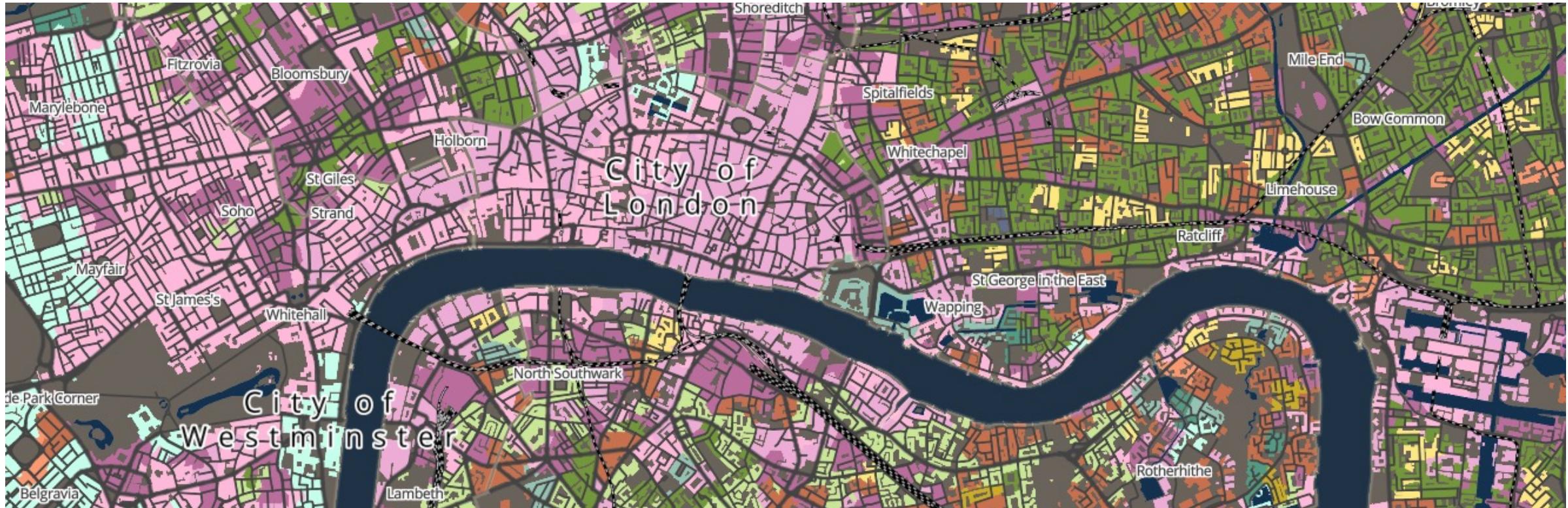


Geocomputation

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 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: XXXX XXXX

This week

- Spatial properties
- Spatial operations
- Spatial relationships

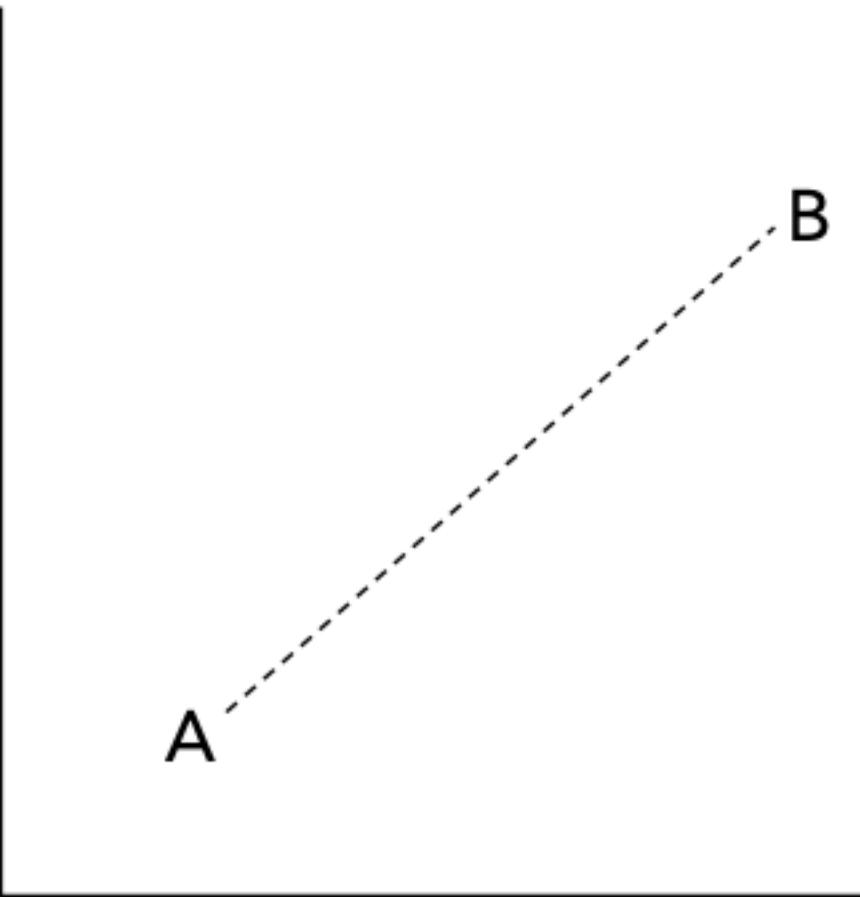
This week



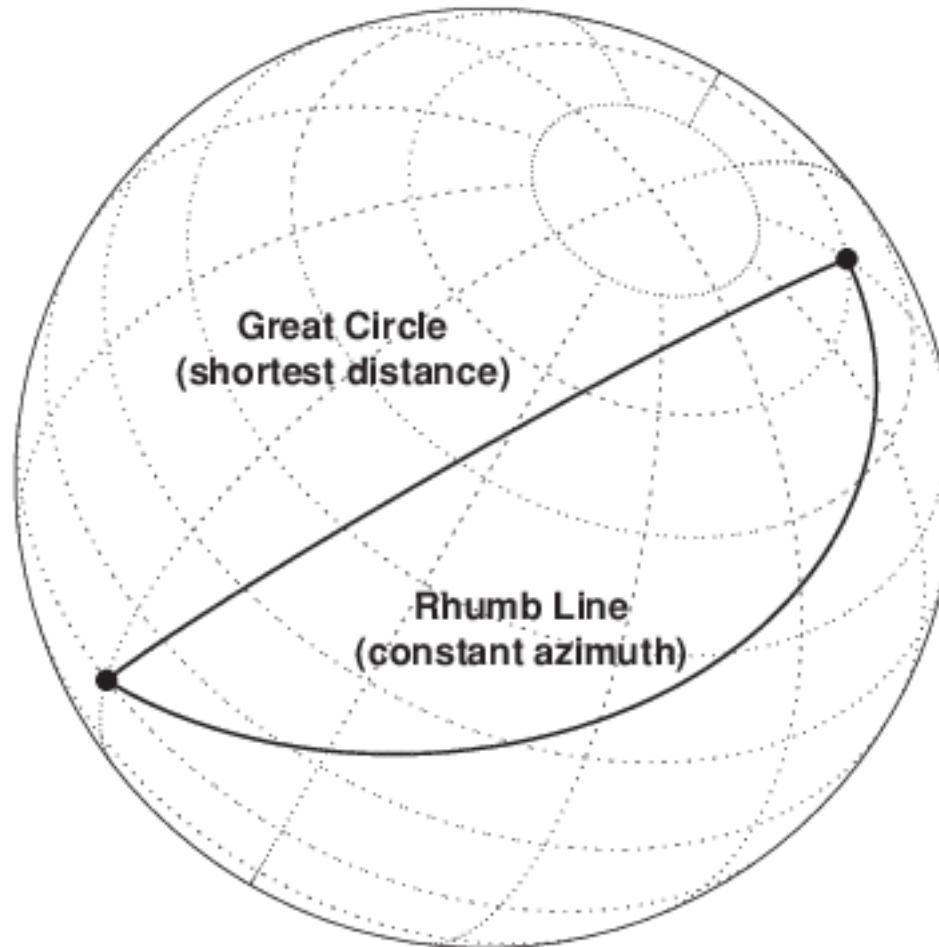
Spatial properties

- 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.

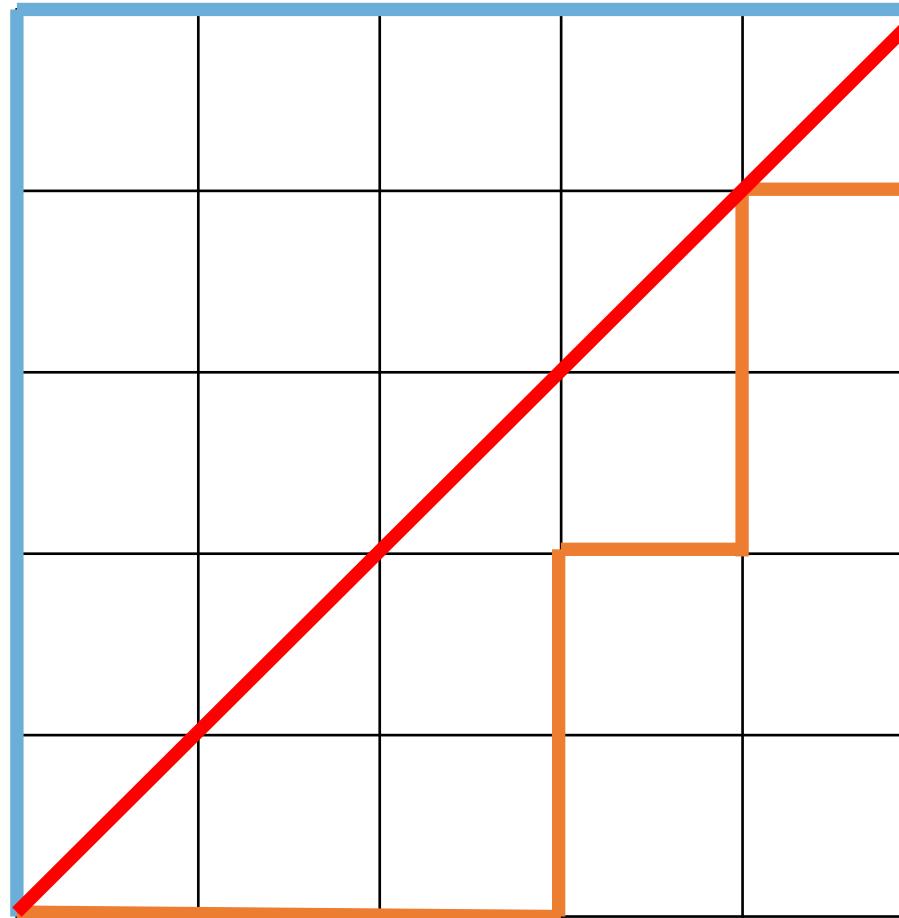
Distance



Distance



Distance



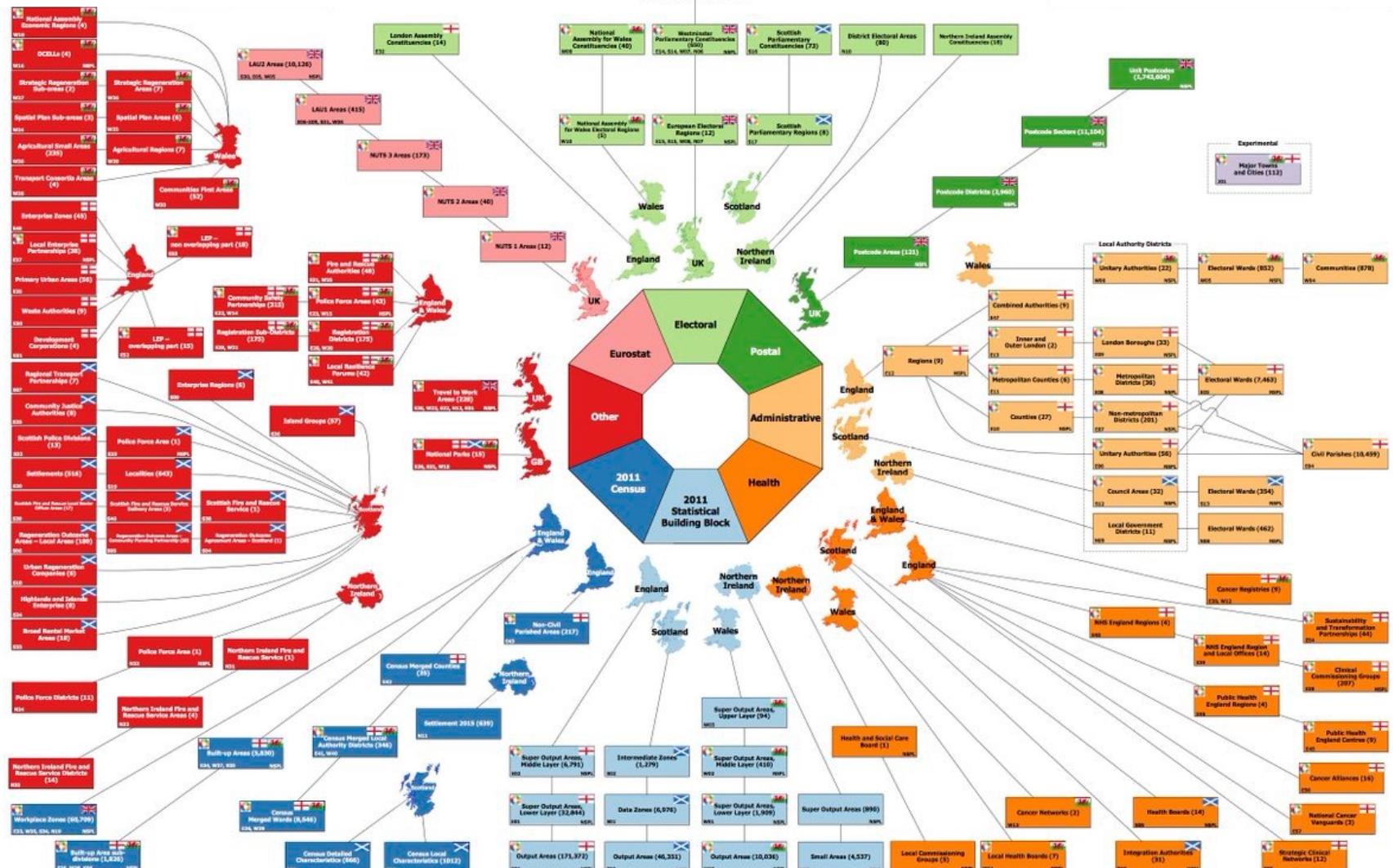
Area



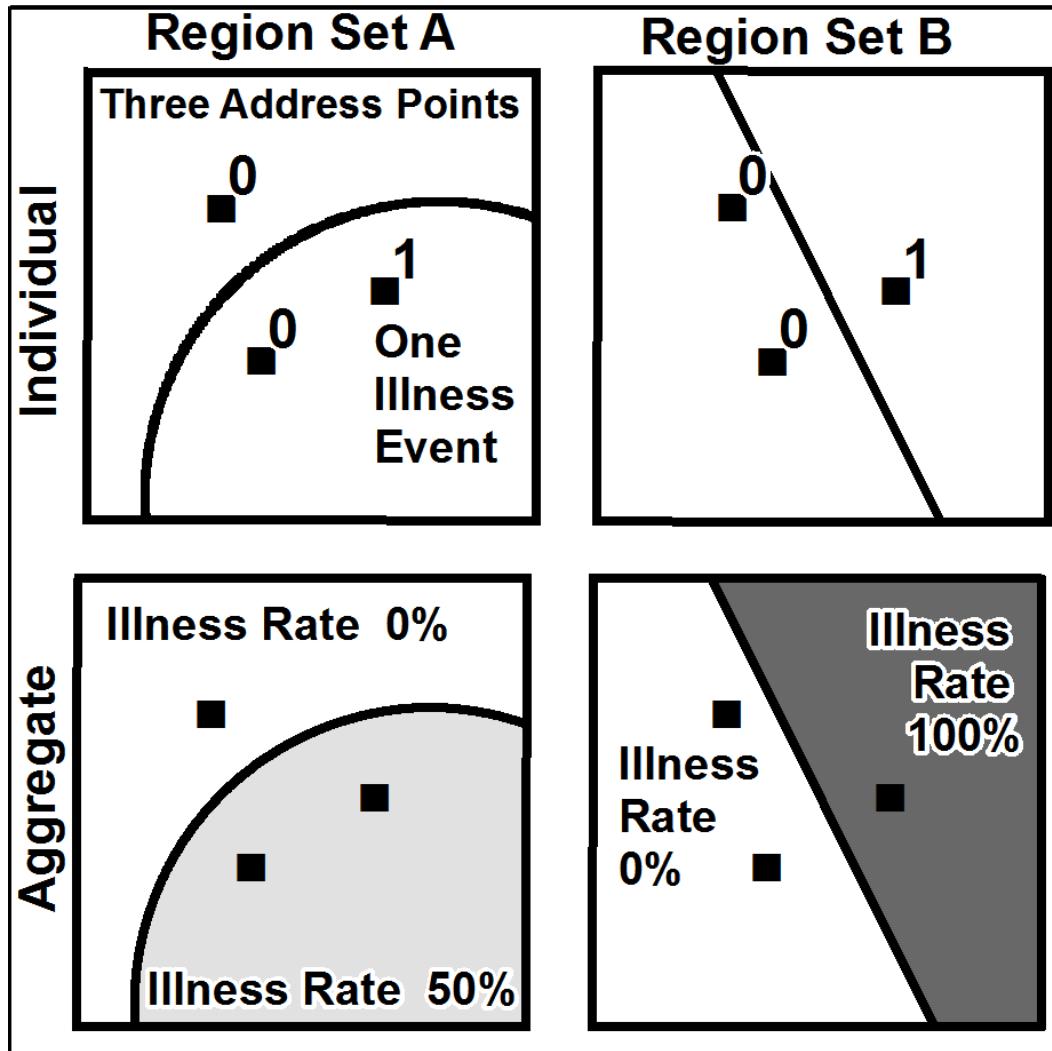
Area

- 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.

Administrative Geographies



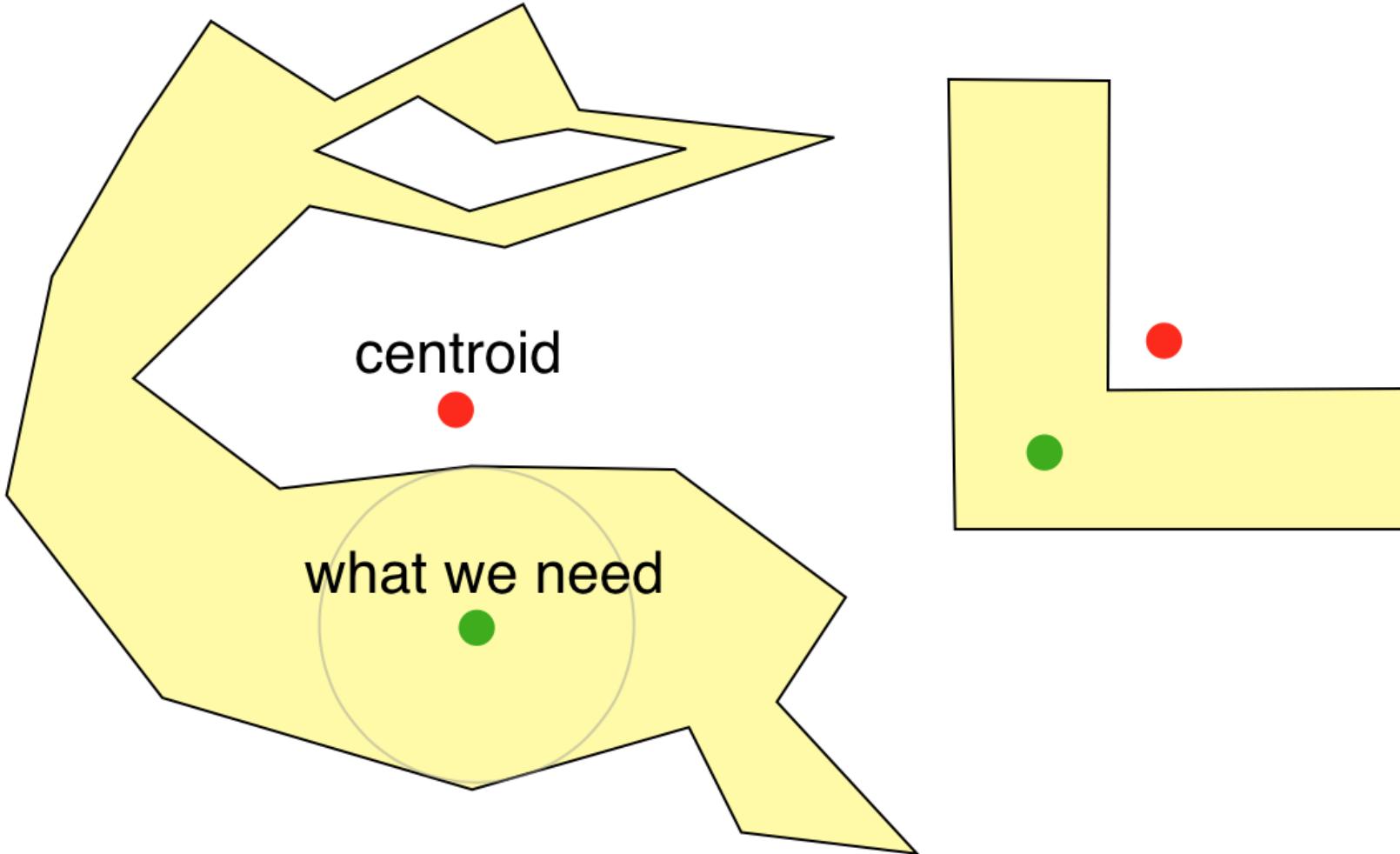
Modifiable Areal Unit Problem



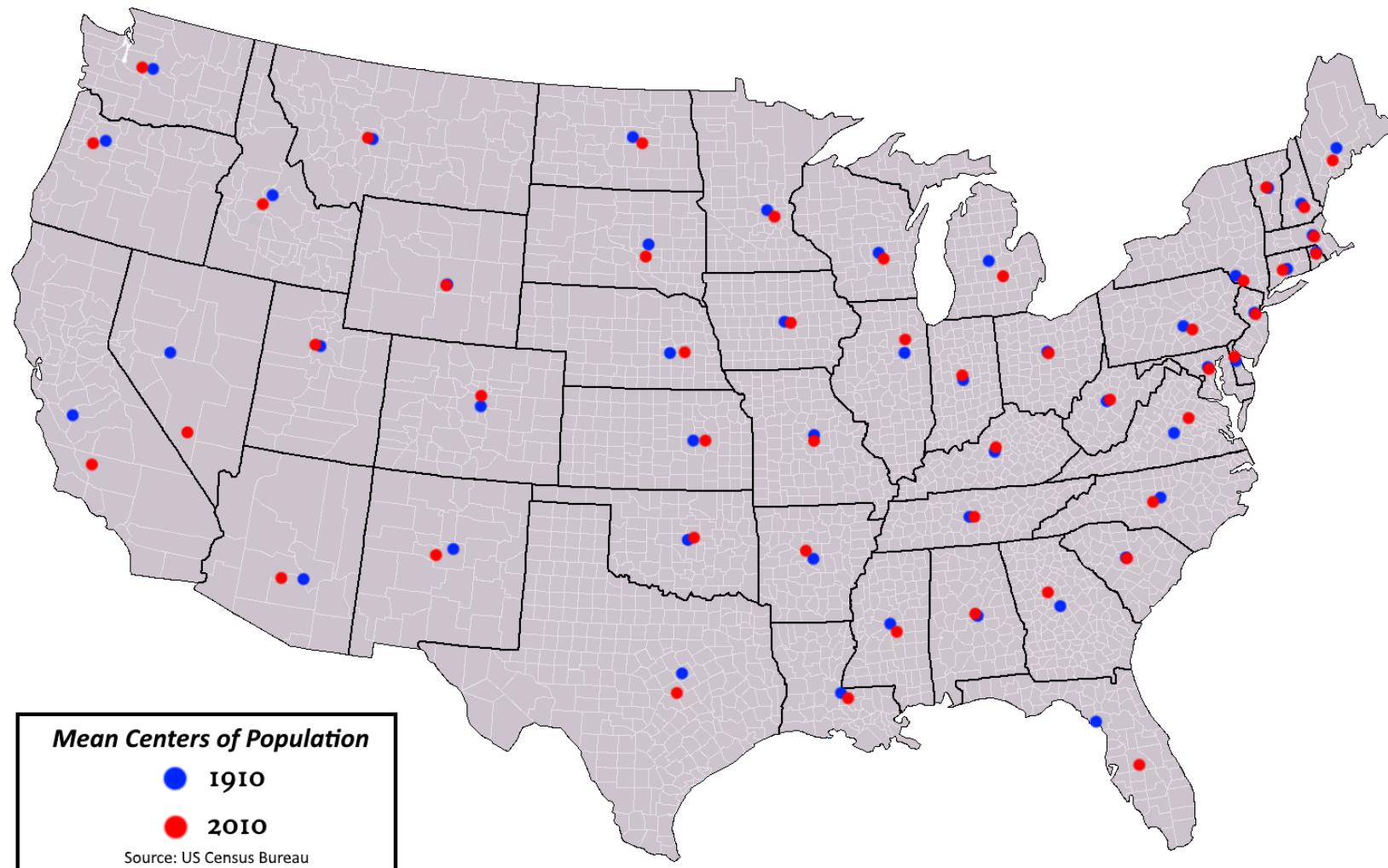
Shape

- 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



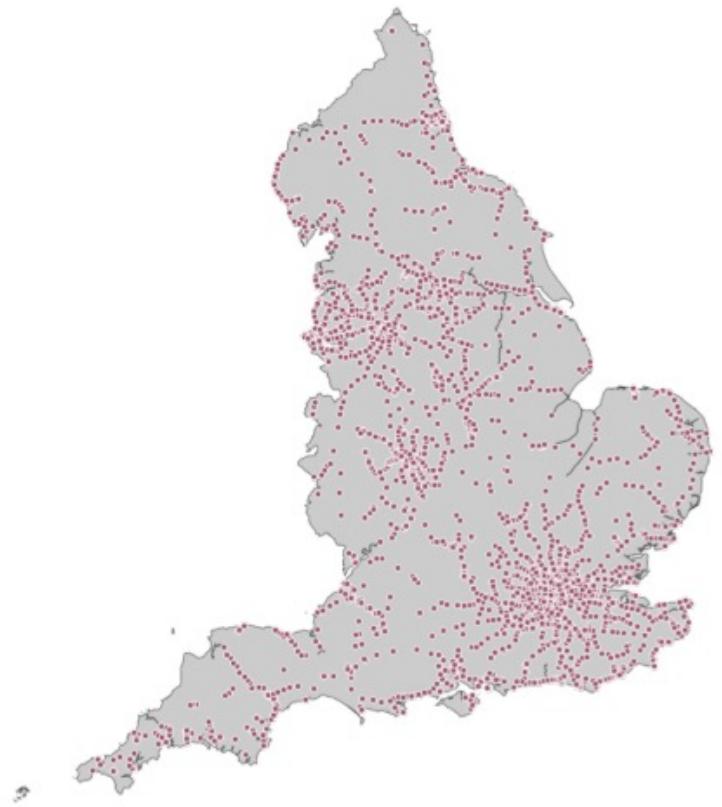
Shape



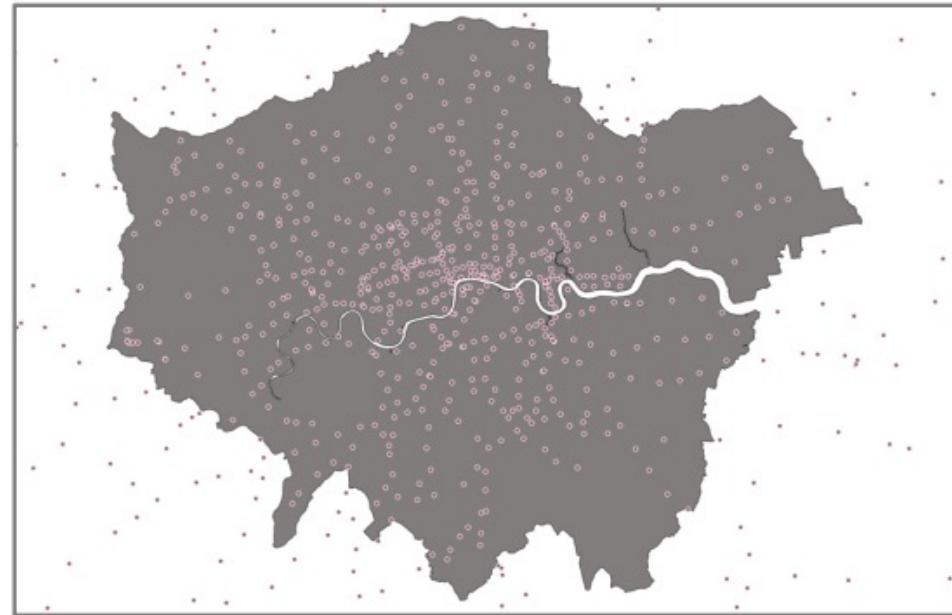
Spatial operations

- 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

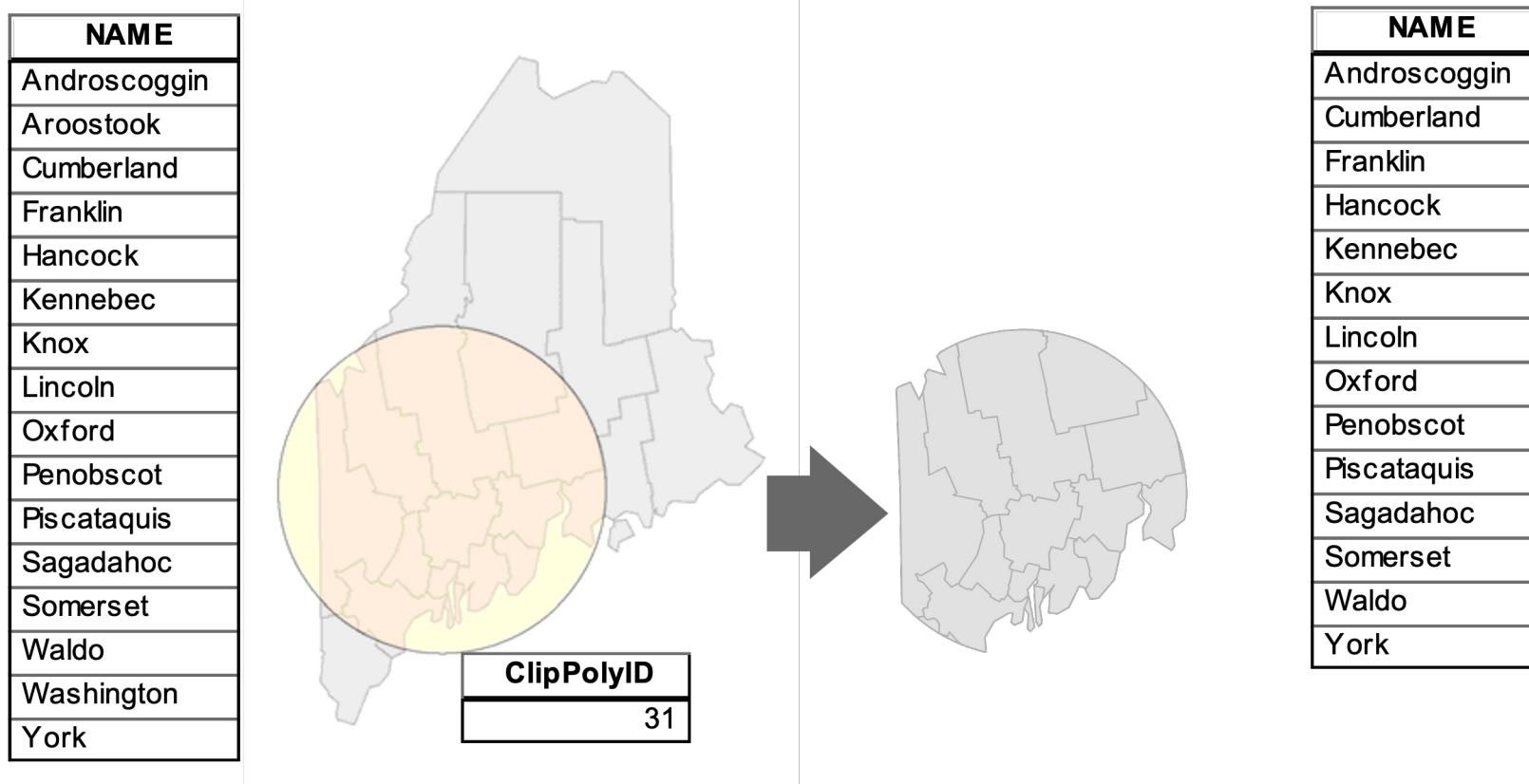
Spatial properties + Spatial Relationships =
Spatial Analysis

Spatial analysis

Spatial analysis =

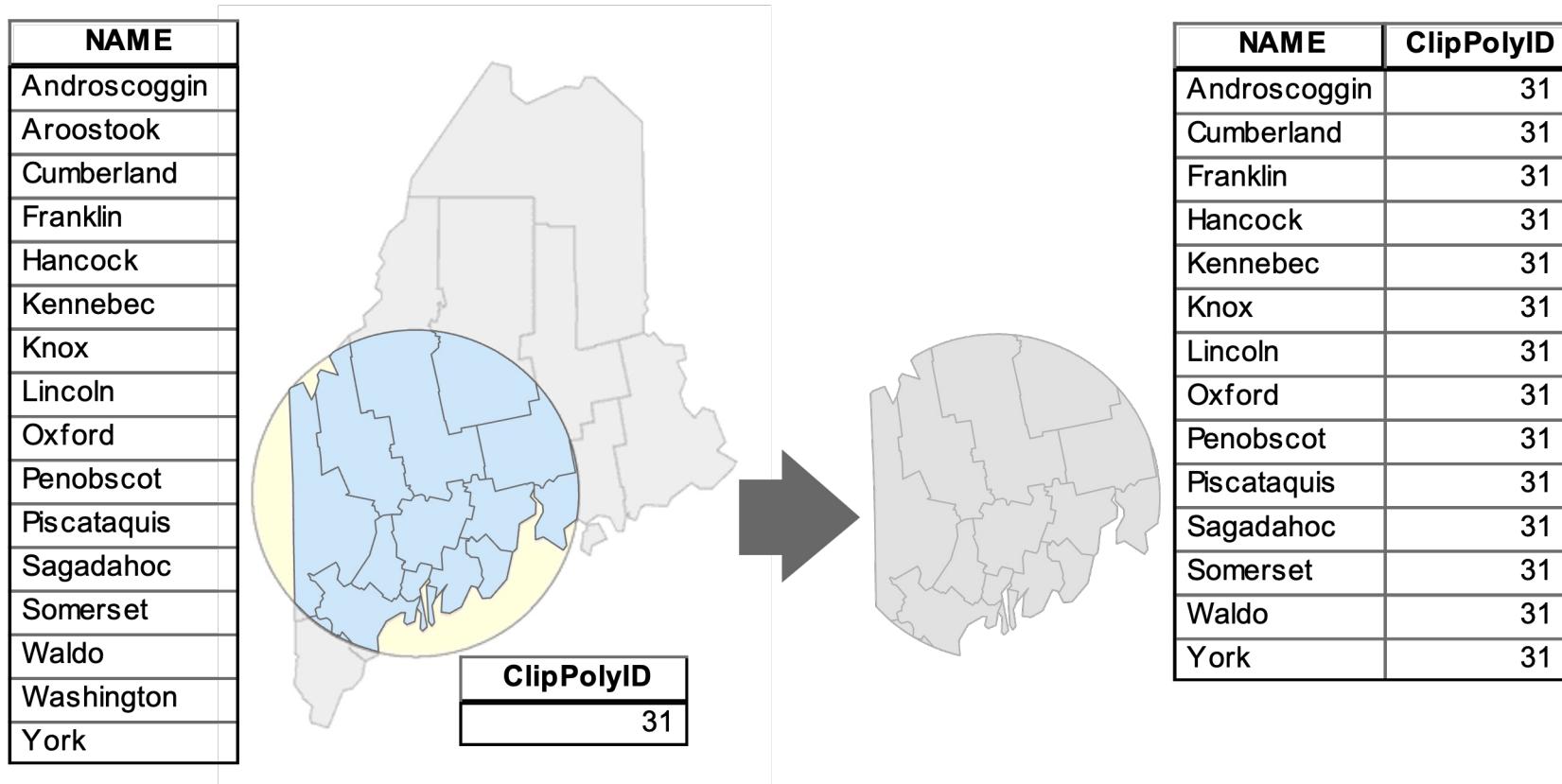
Geometric Operations + Spatial Queries

Vector operations



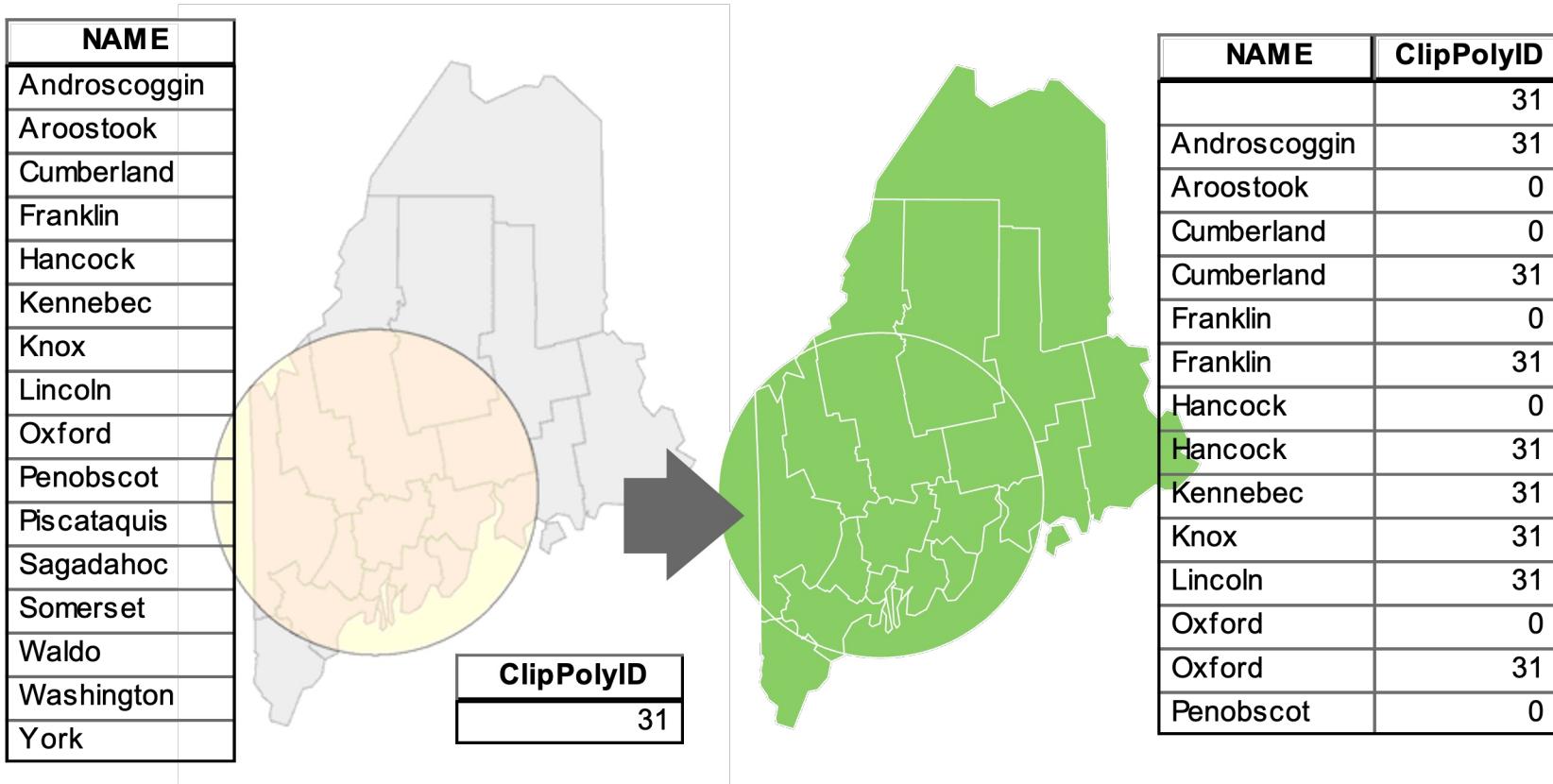
Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations



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

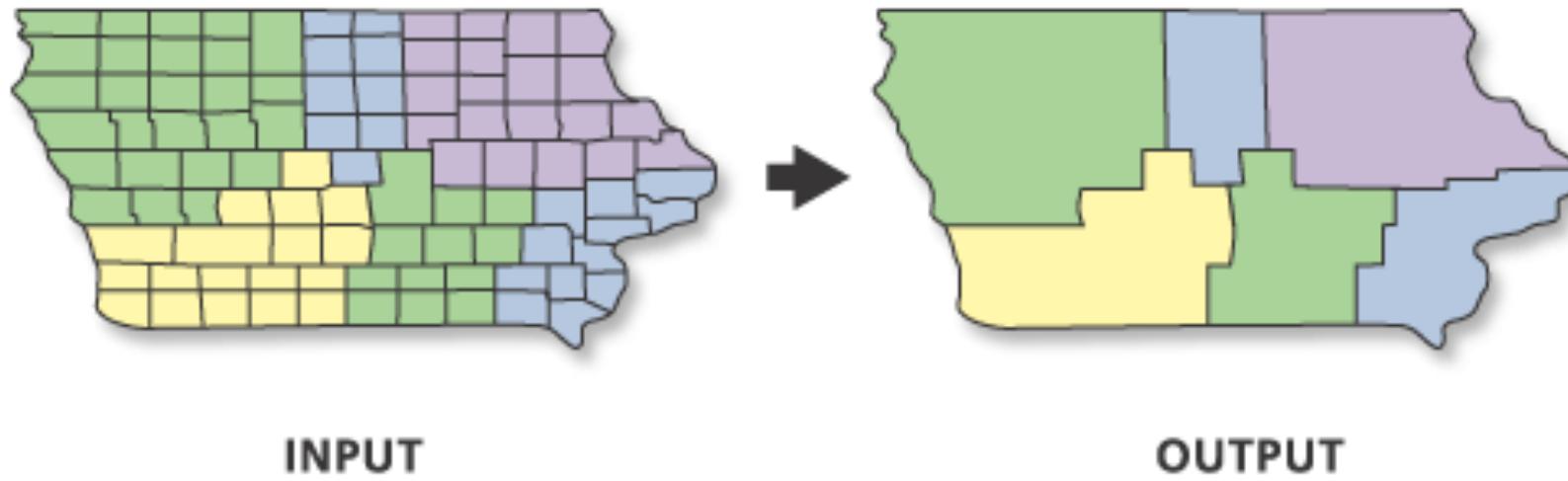
Vector operations



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

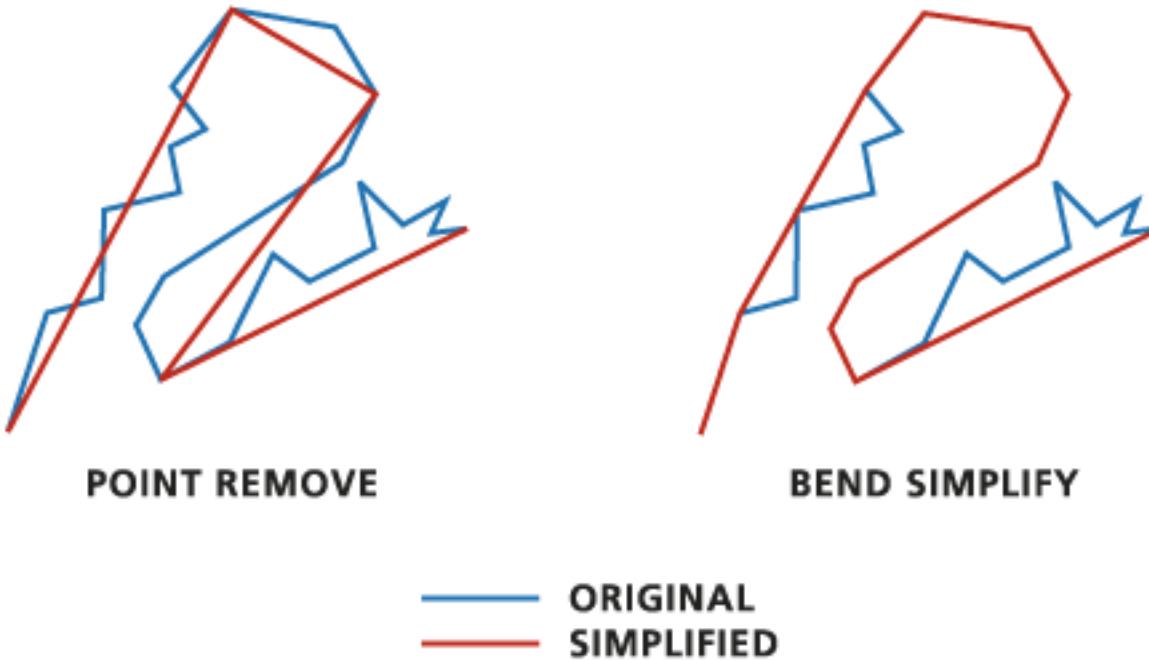
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations - Dissolve



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

Vector operations - Simplify

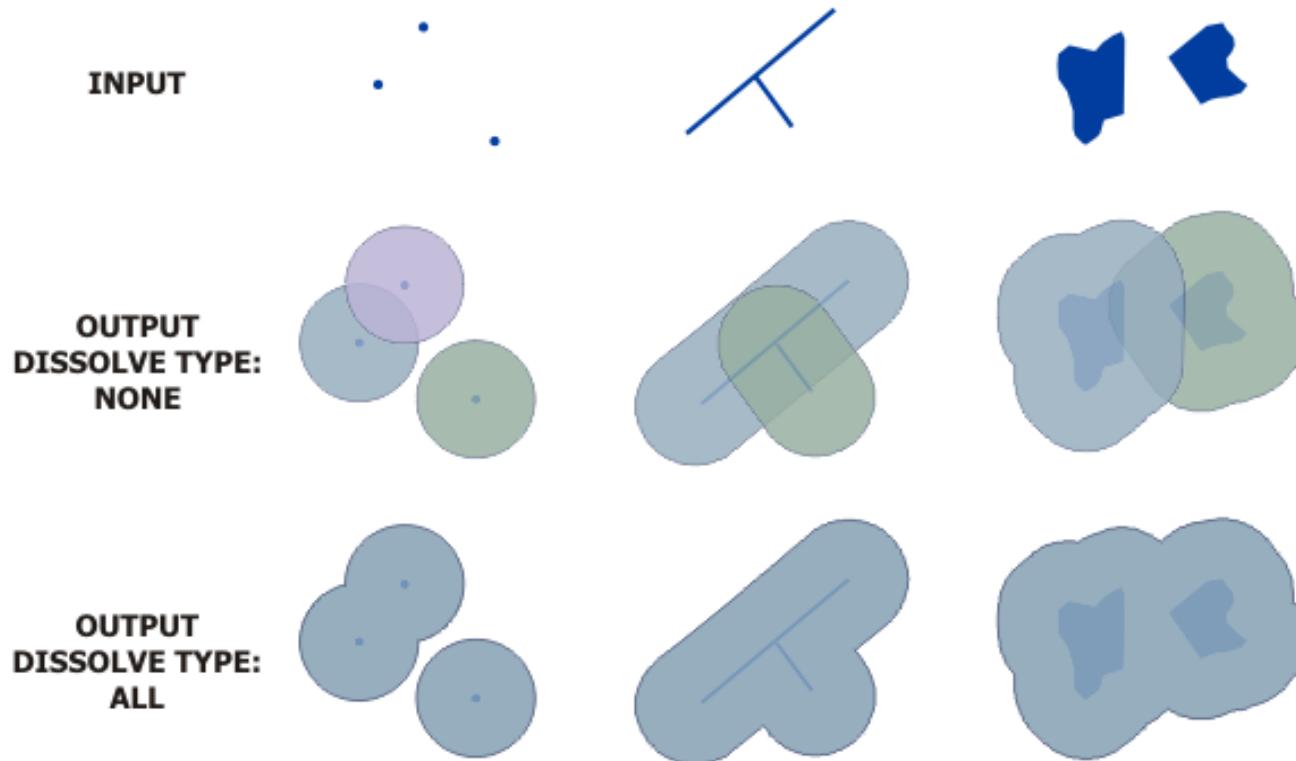


ESRI. 2021. Simplify line. [online]
<https://desktop.arcgis.com/en/arcmap/10.3/tools/cartography-toolbox/simplify-line.htm>

Vector operations - Simplify

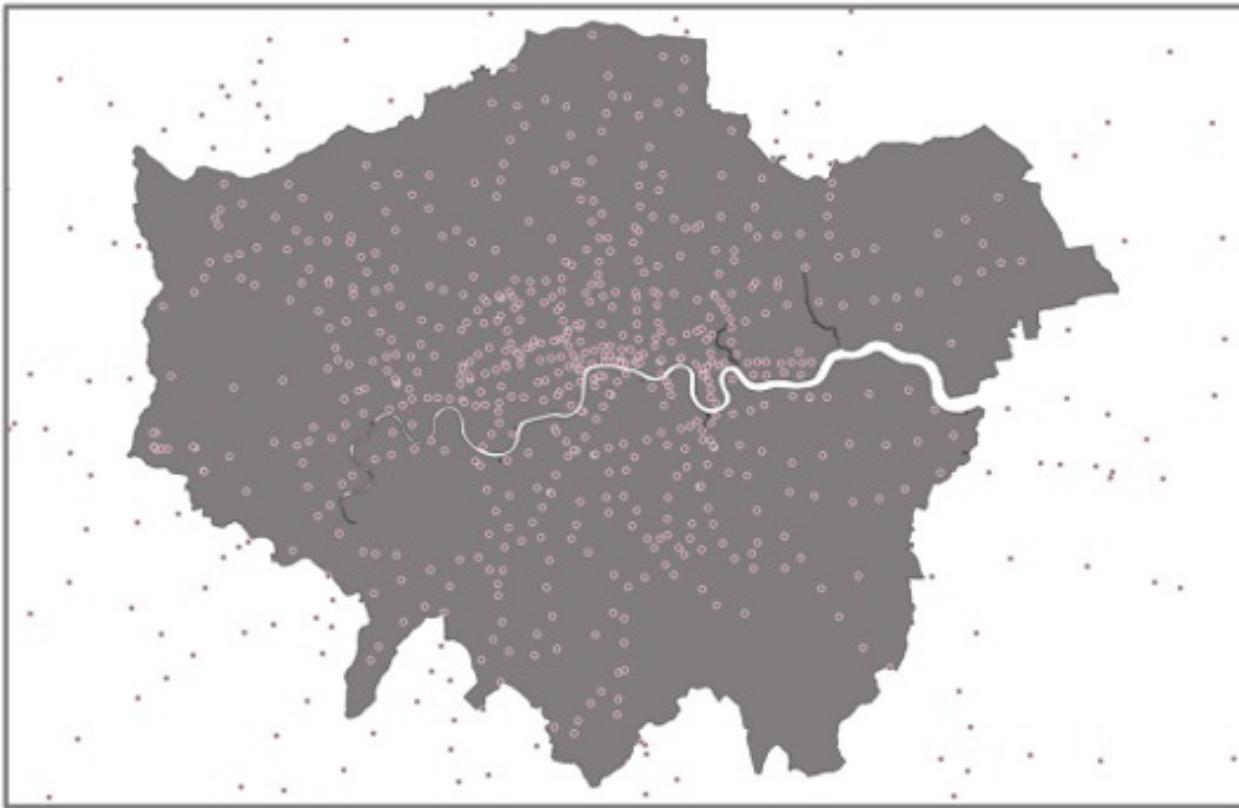


Vector operations - Buffer

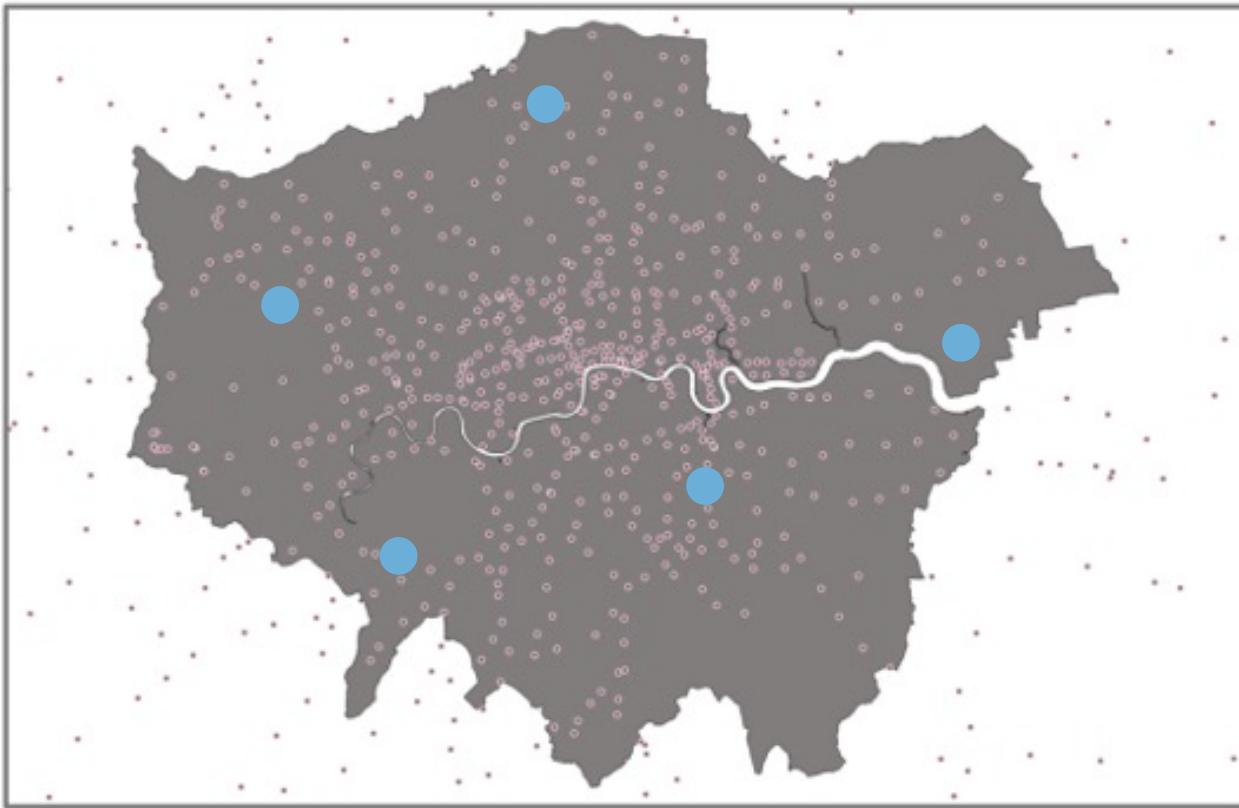


ESRI. 2021. Buffer. [online]
<https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm>

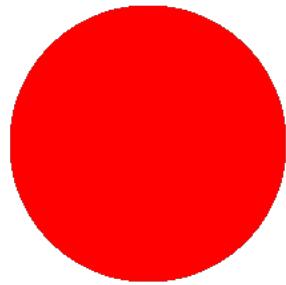
Vector operations – Spatial query



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 8 maps - and a maximum of 10 - 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 titled "Topic: Assessment | GEOG0030". The page includes the UCL logo and navigation links for "Home" and "My courses". It features a dark header with "Edit mode" and user initials "JV".

Module assessment details

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:

- 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.

Assessment

The screenshot shows a web browser window with the title 'GEOG0030' at the top. The URL in the address bar is jtvdijk.github.io/GEOG0030/11-data.html. The page content is organized into several sections:

- Module overview** (dropdown menu):
 - 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
 - Additional Resources
 - 11 Data Sources
- 11 Data Sources**: The main heading for the current page.
- Text**: A paragraph explaining that the list of resources is not exhaustive but contains suggestions of websites that may want to use.
- Info box**: A callout box containing the text: "You are **not limited** to using these datasets for your coursework assignment or your dissertation, but these are merely some suggestions."
- Section 11.1 Open Data**: A heading for the first section of data sources.
- Text**: A paragraph stating that the following websites contain Open Data or link to Open Data from several respectable data providers.
- List**: A bulleted list of 14 data sources:
 - [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 8-10 related maps.

Questions

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