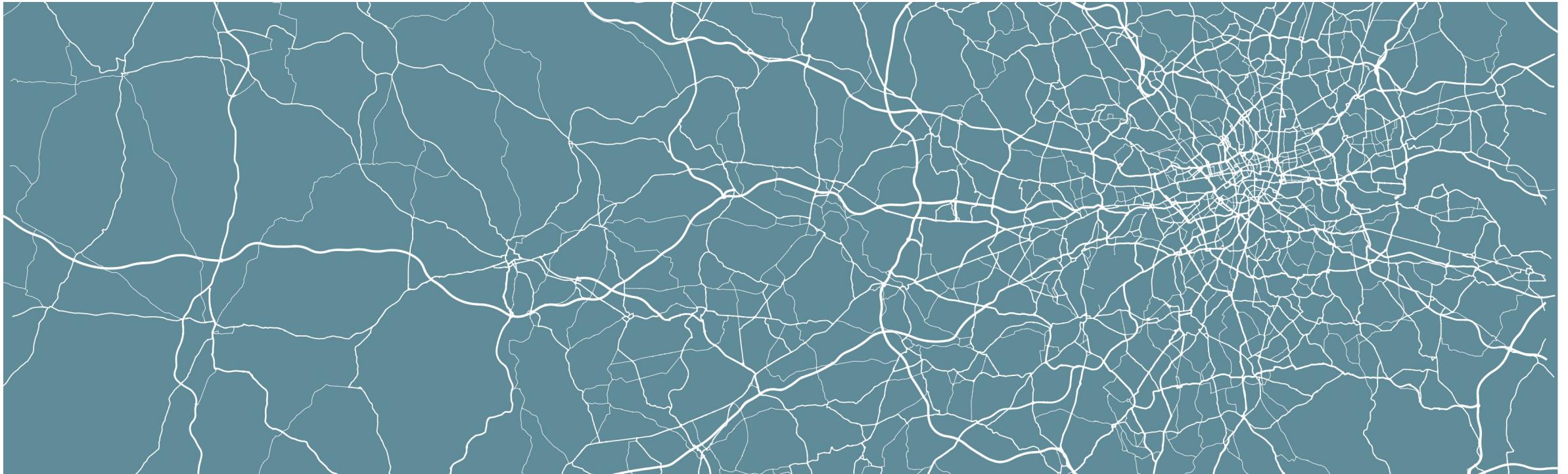


Geocomputation

W6 – 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

This week



Before we start

- Go to www.menti.com
- Use code: 1334 8681



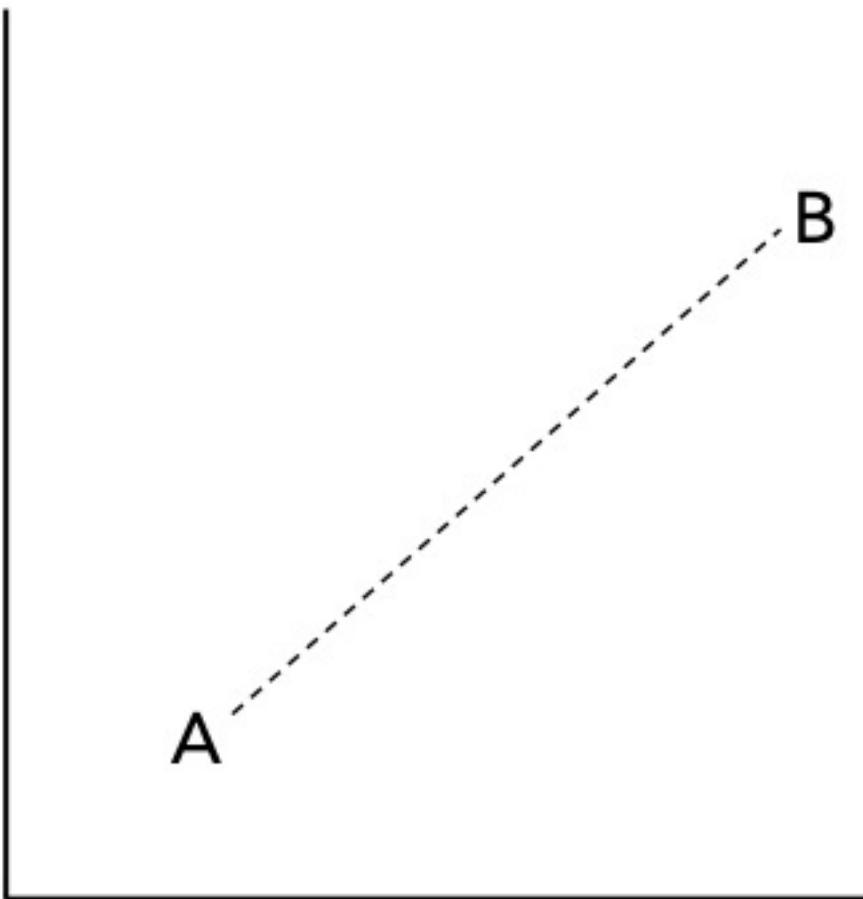
This week

- Spatial properties
- Spatial operations
- Spatial relationships

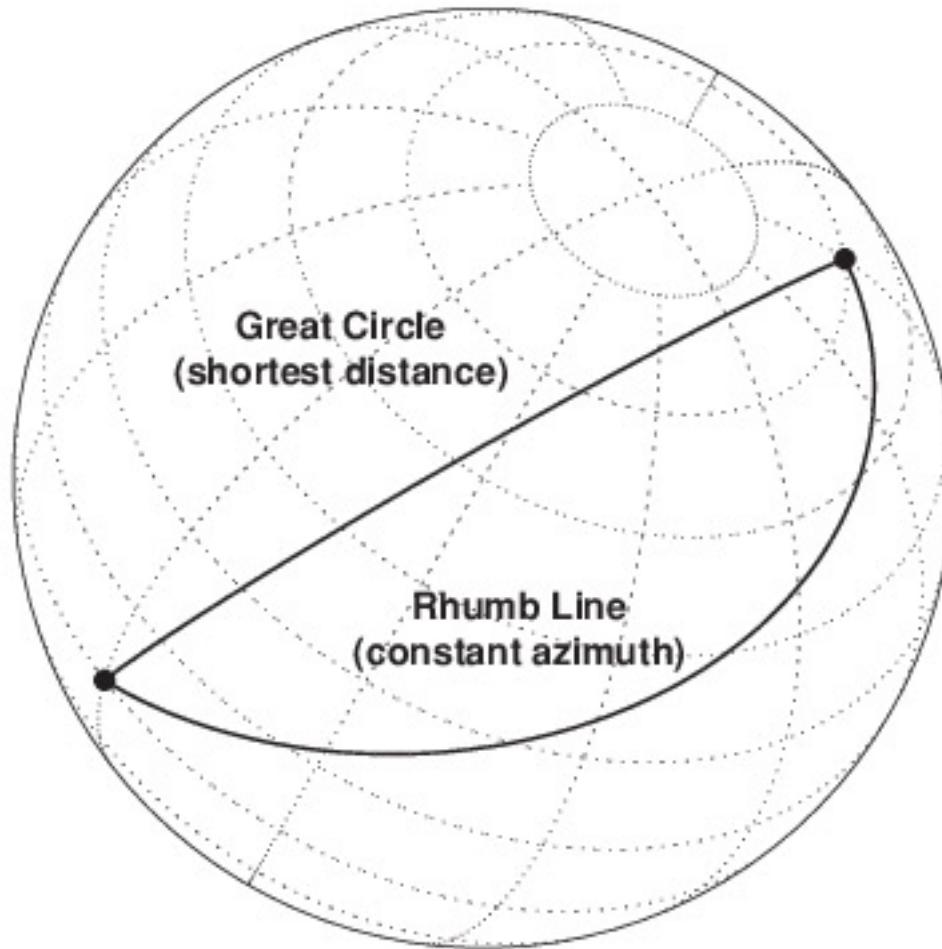
Spatial properties

- 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.

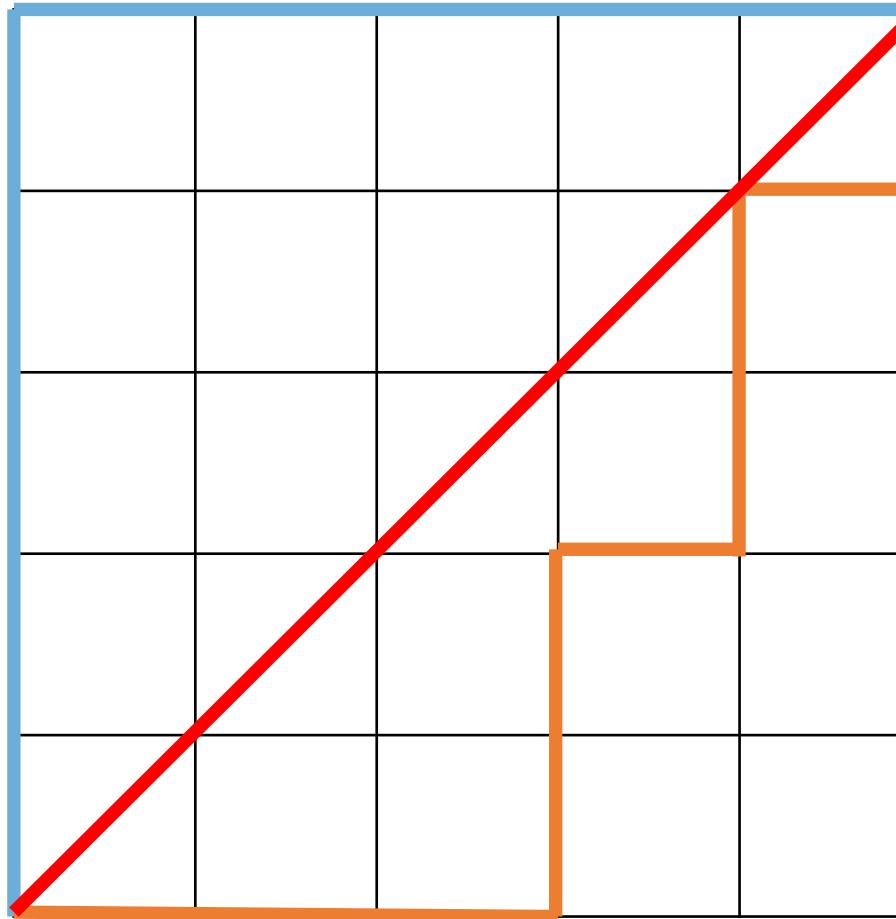
Distance I



Distance II



Distance III



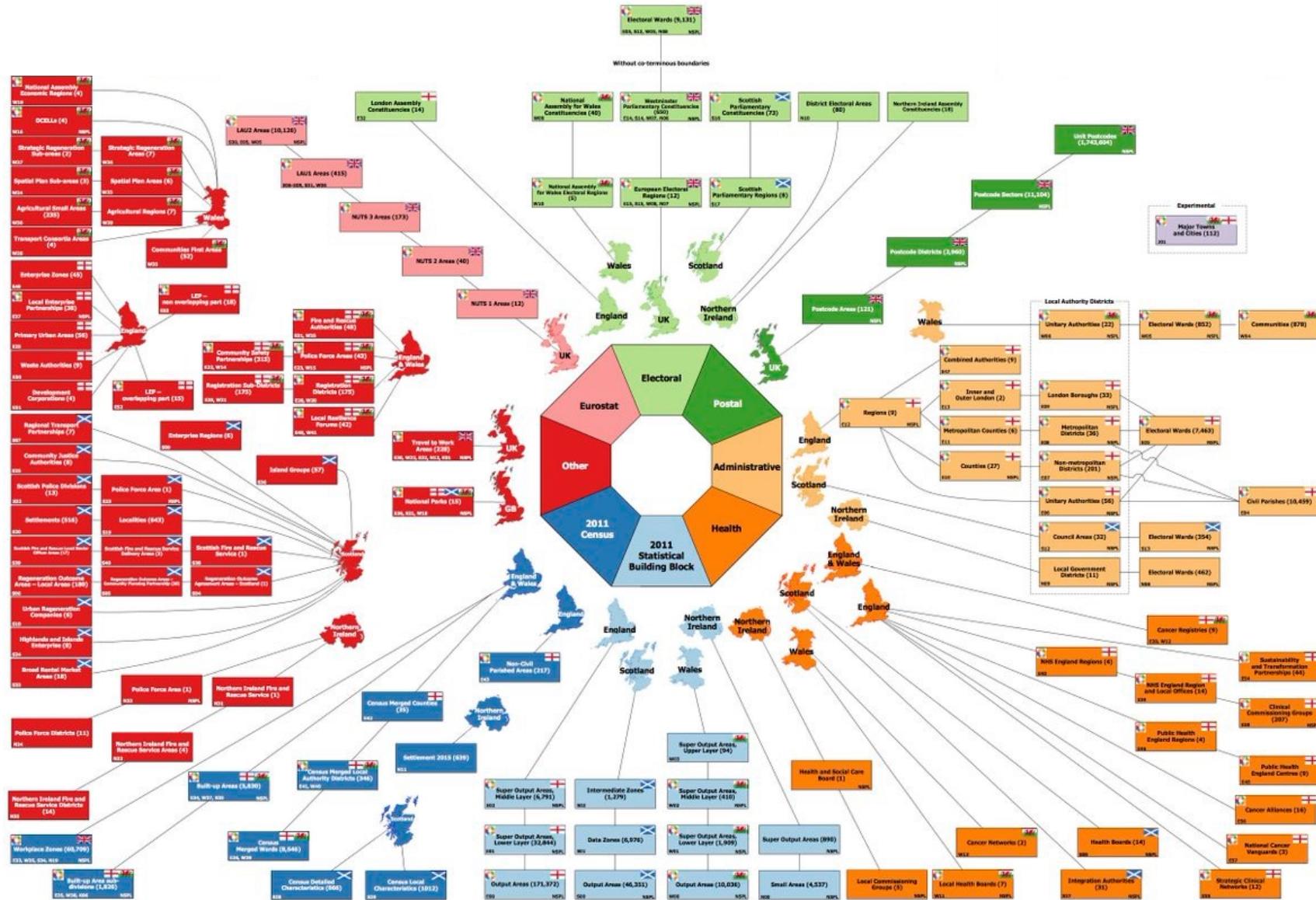
Area I



Area II

- 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.

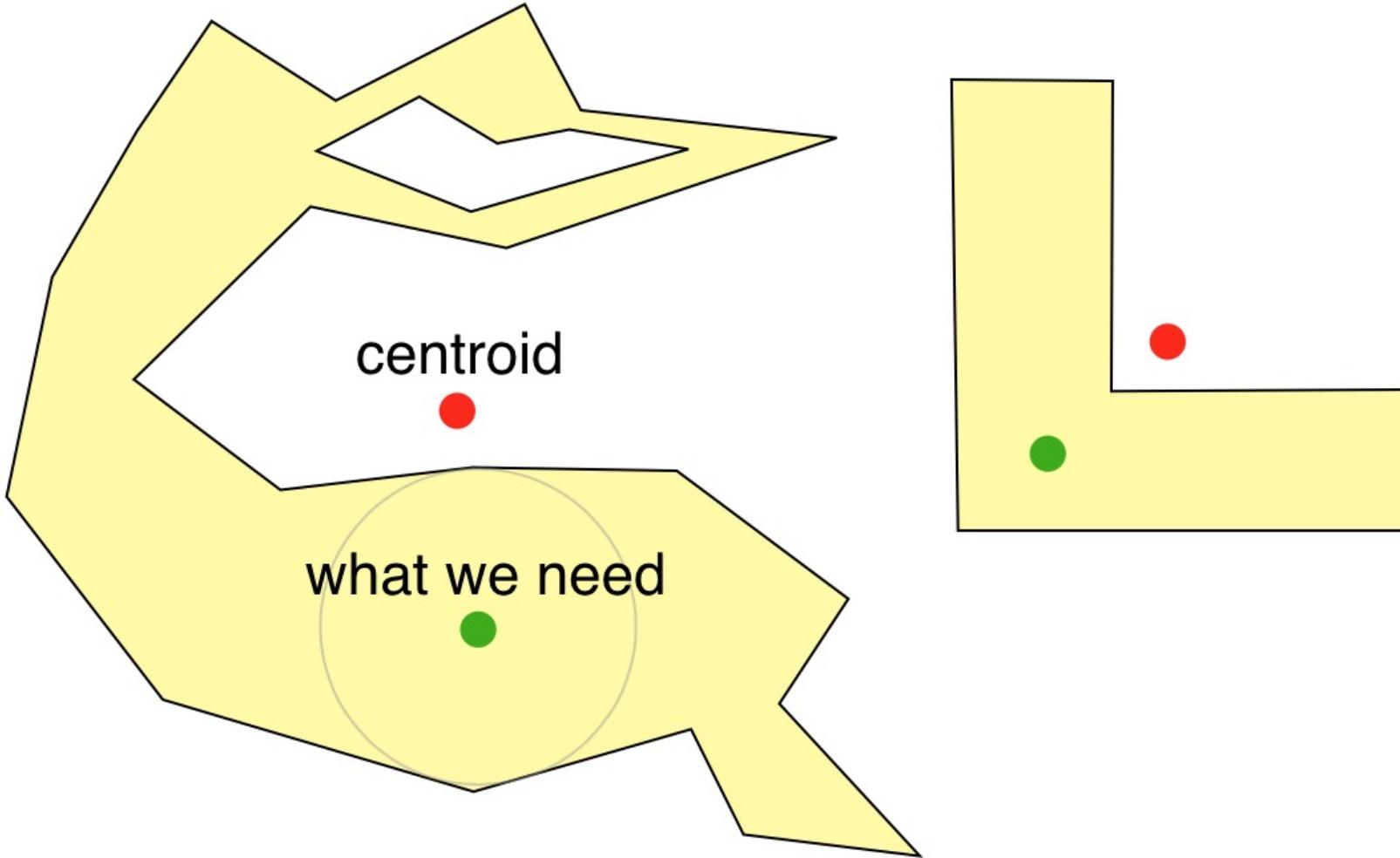
Area III



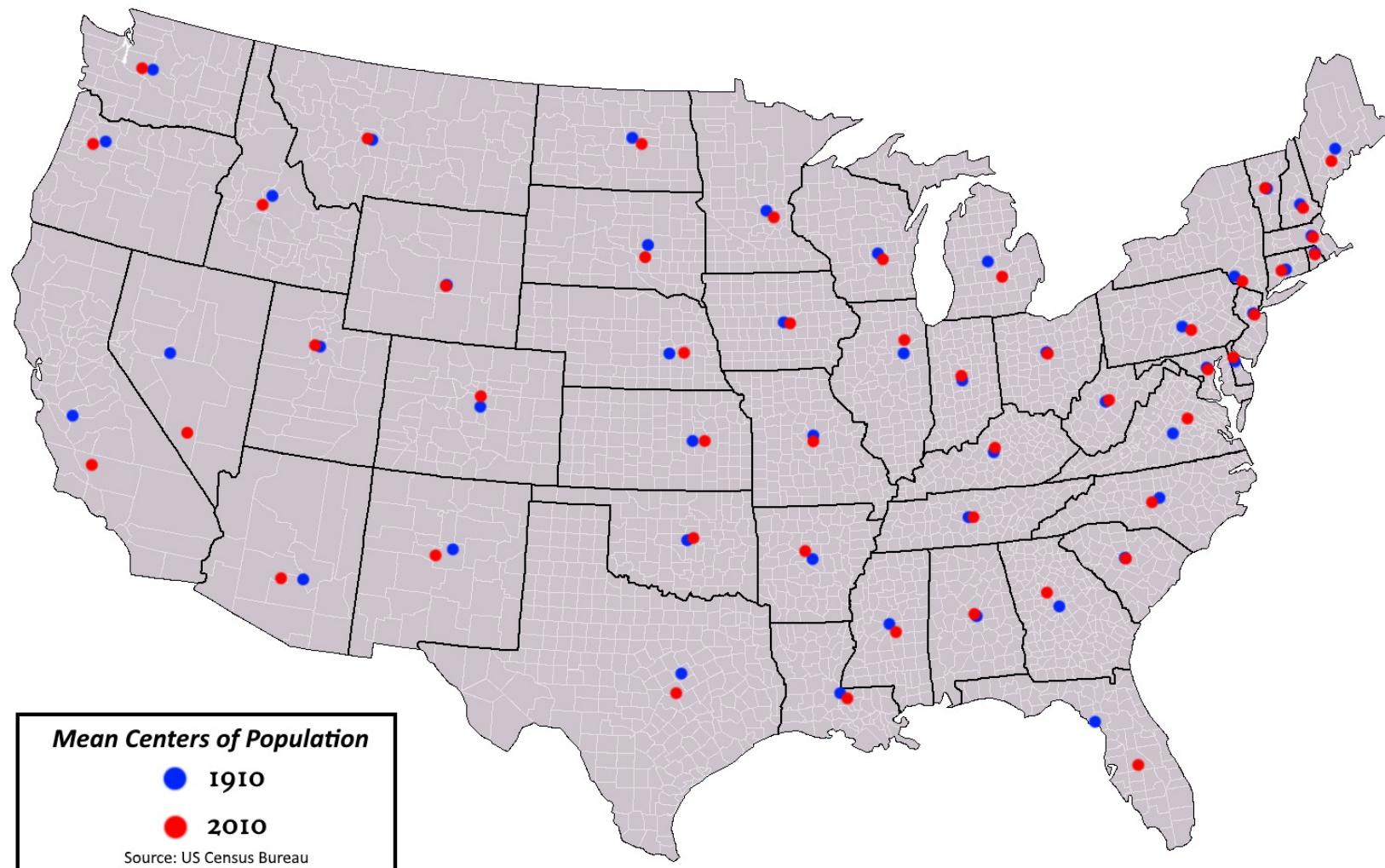
Shape I

- 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 II



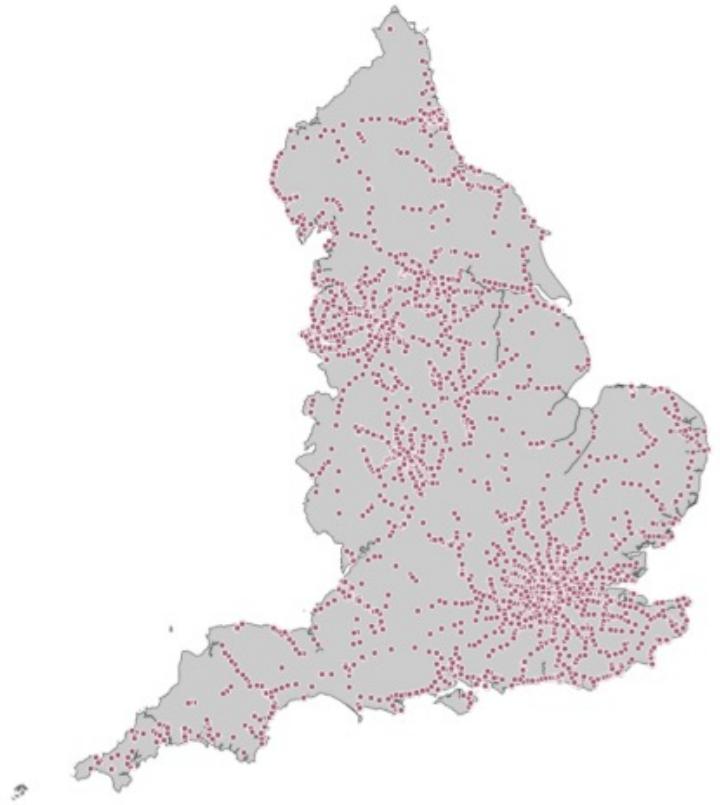
Shape II



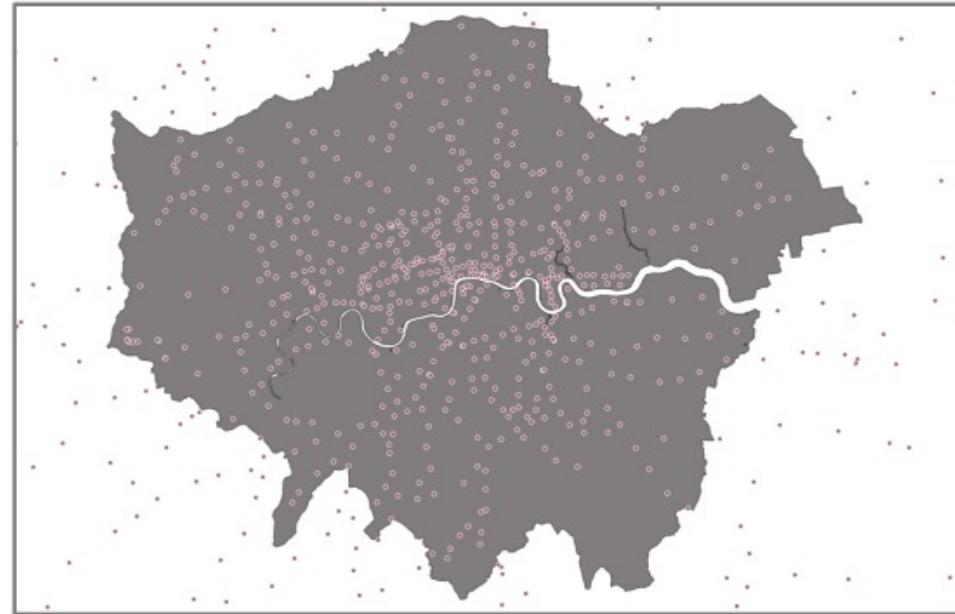
Spatial operations I

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

Spatial operations II



?



Spatial operations III

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 III

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 I

- 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 II

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 III

- There is some spatial maths 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

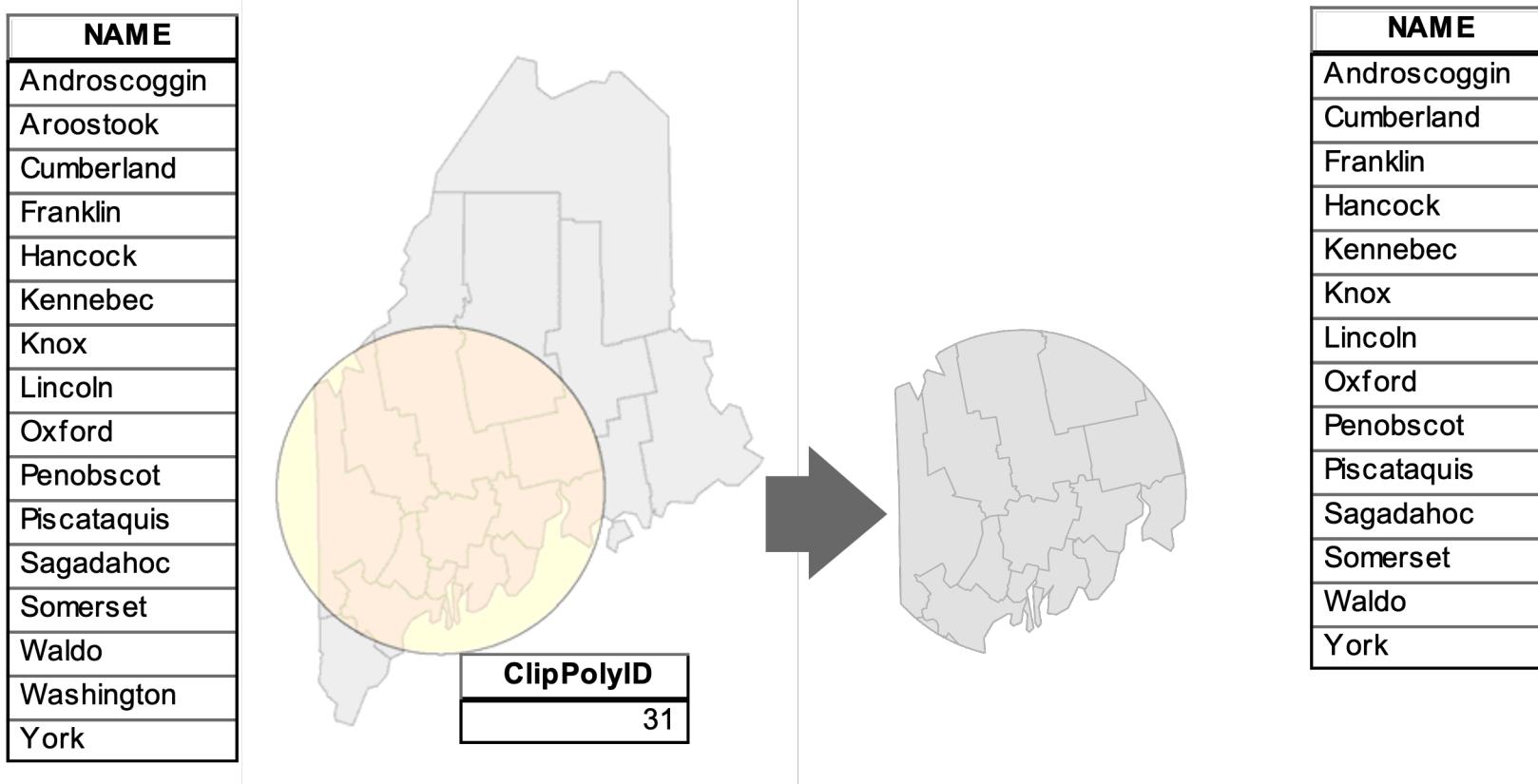
Spatial properties + Spatial Relationships =
Spatial Analysis

Spatial analysis

Spatial analysis =

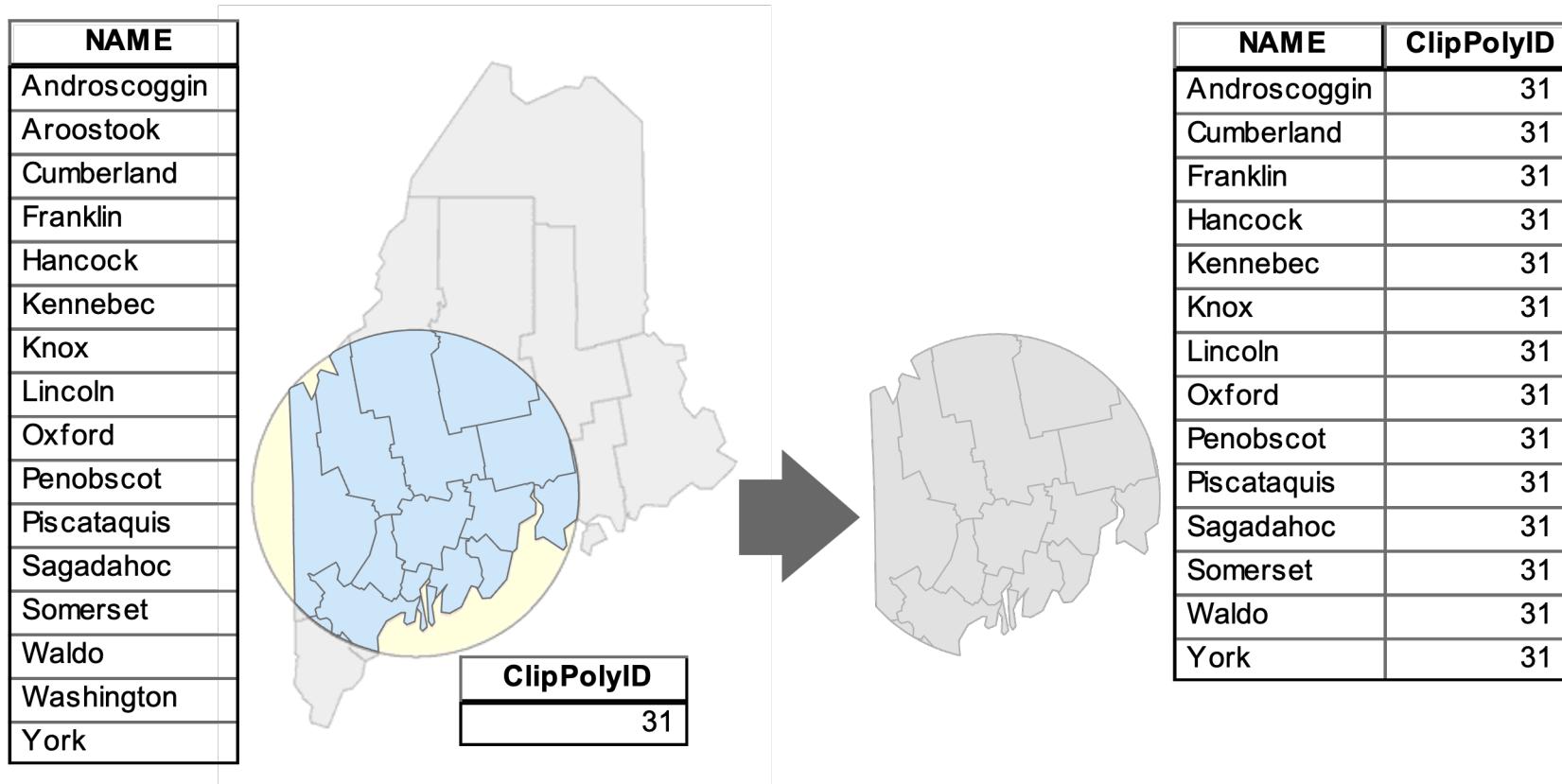
Geometric Operations + Spatial Queries

Vector operations I - Clip



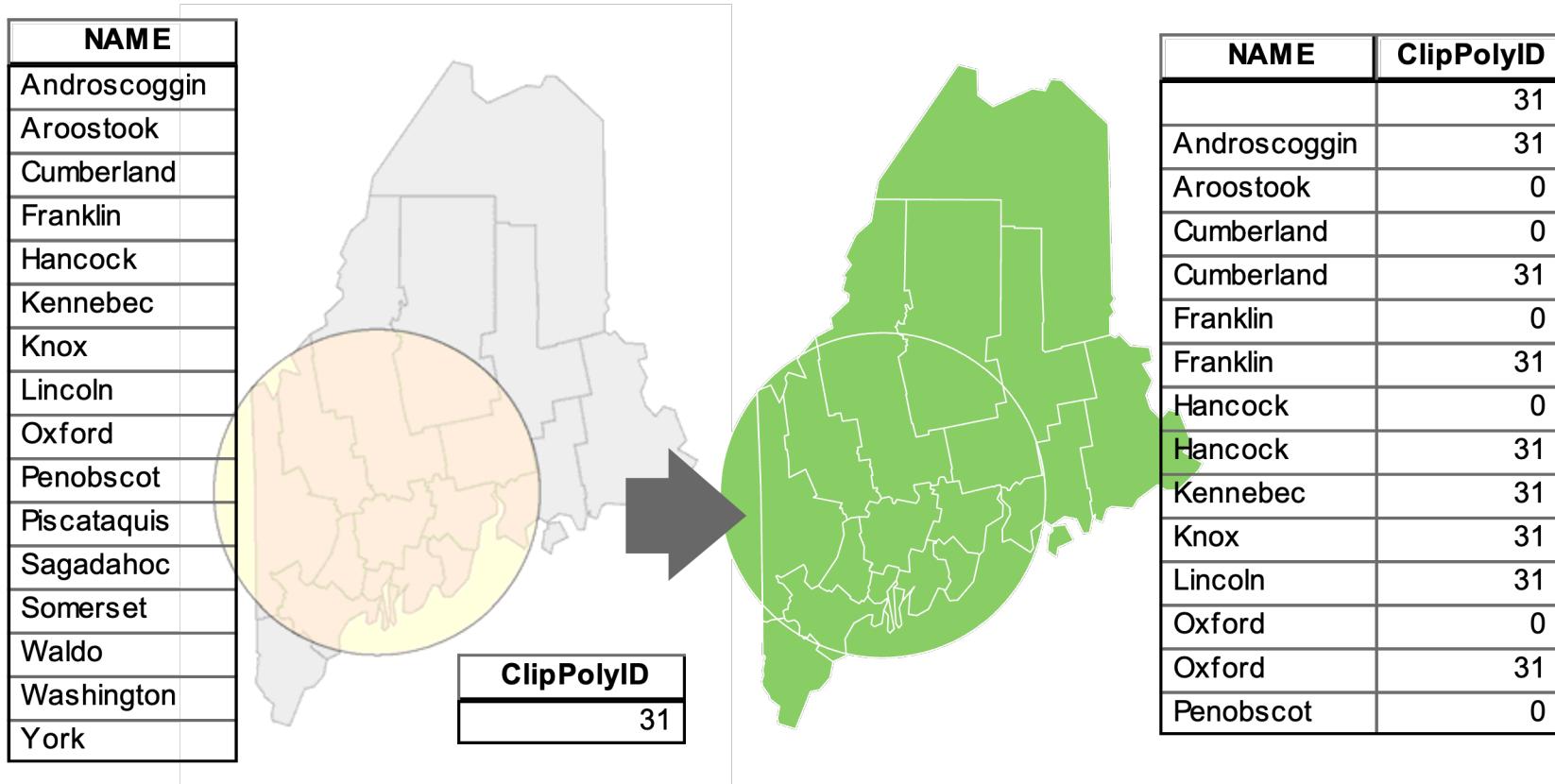
Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations II - Intersect



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

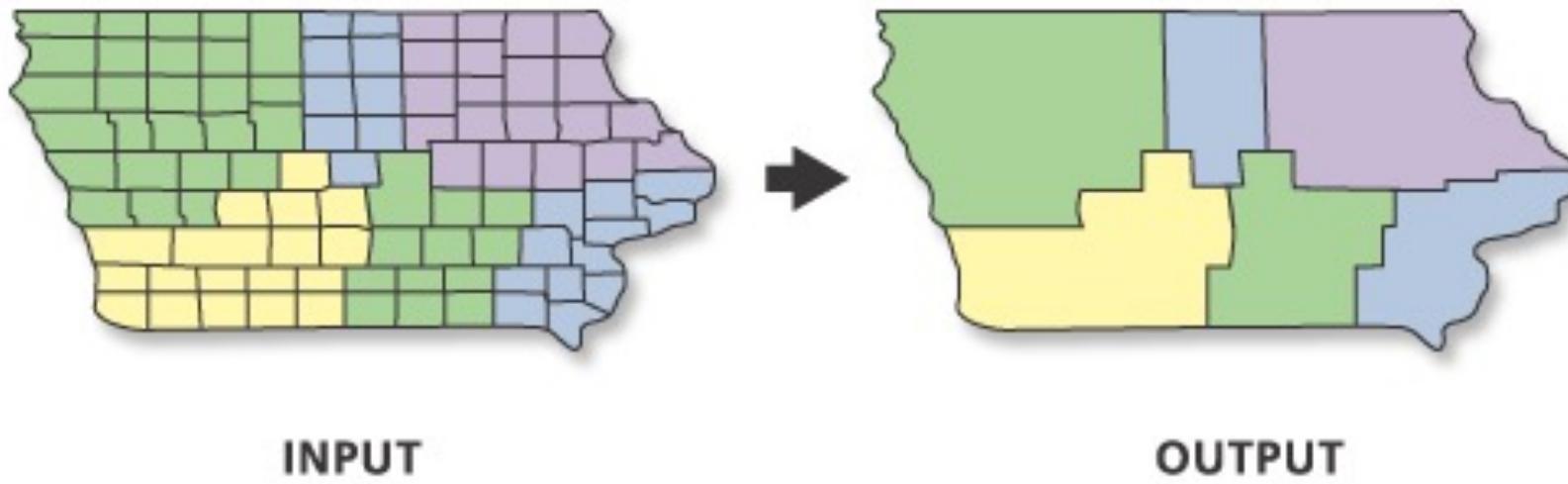
Vector operations III - Union



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

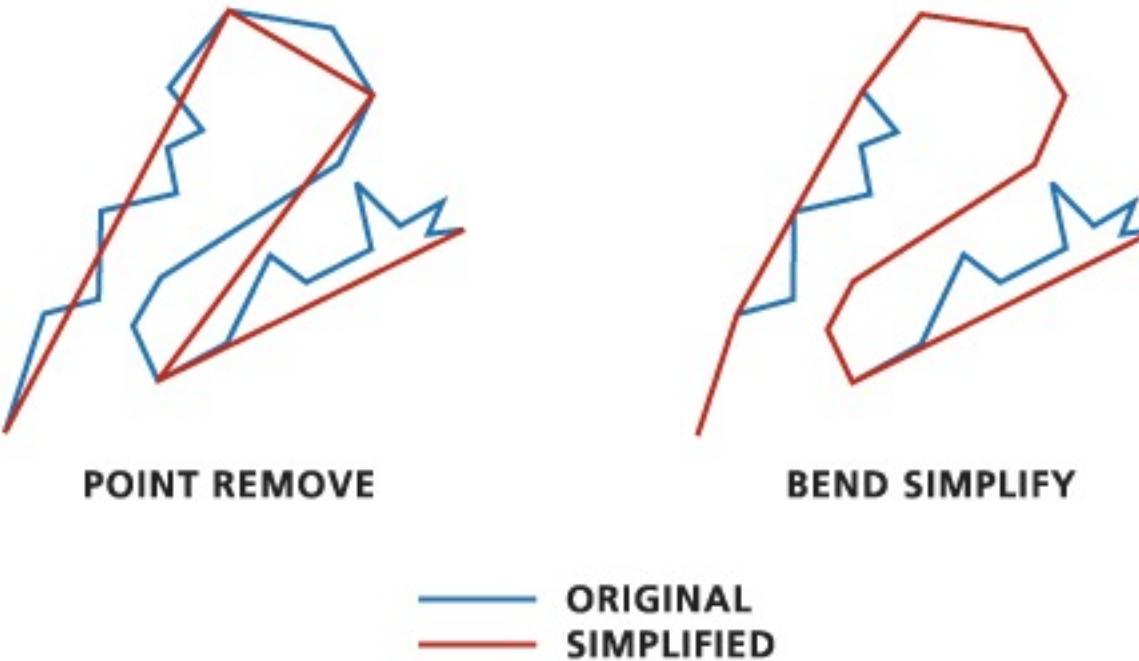
<https://mgimond.github.io/Spatial/introGIS.html>

Vector operations IV - Dissolve



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

Vector operations V - Simplify

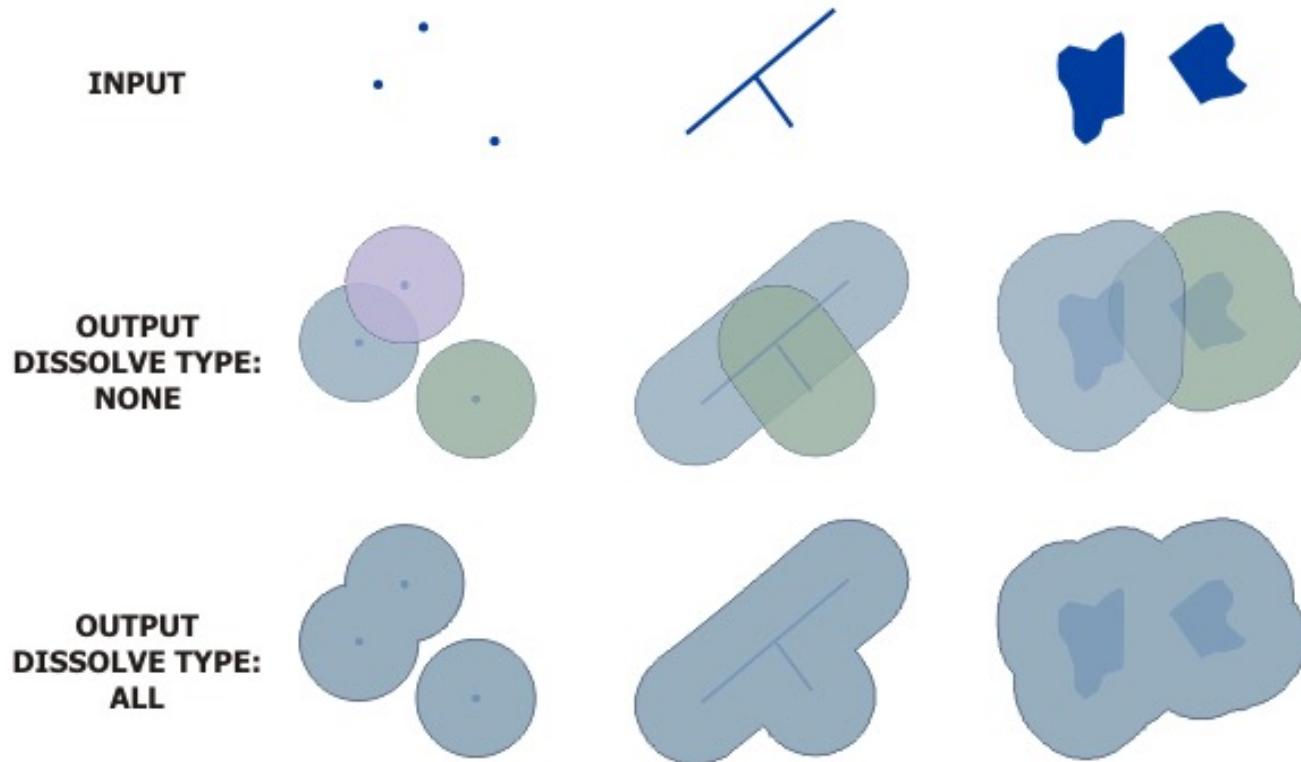


ESRI. 2021. Simplify line. [online]
<https://desktop.arcgis.com/en/arcmap/10.3/tools/cartography-toolbox/simplify-line.htm>

Vector operations V - Simplify

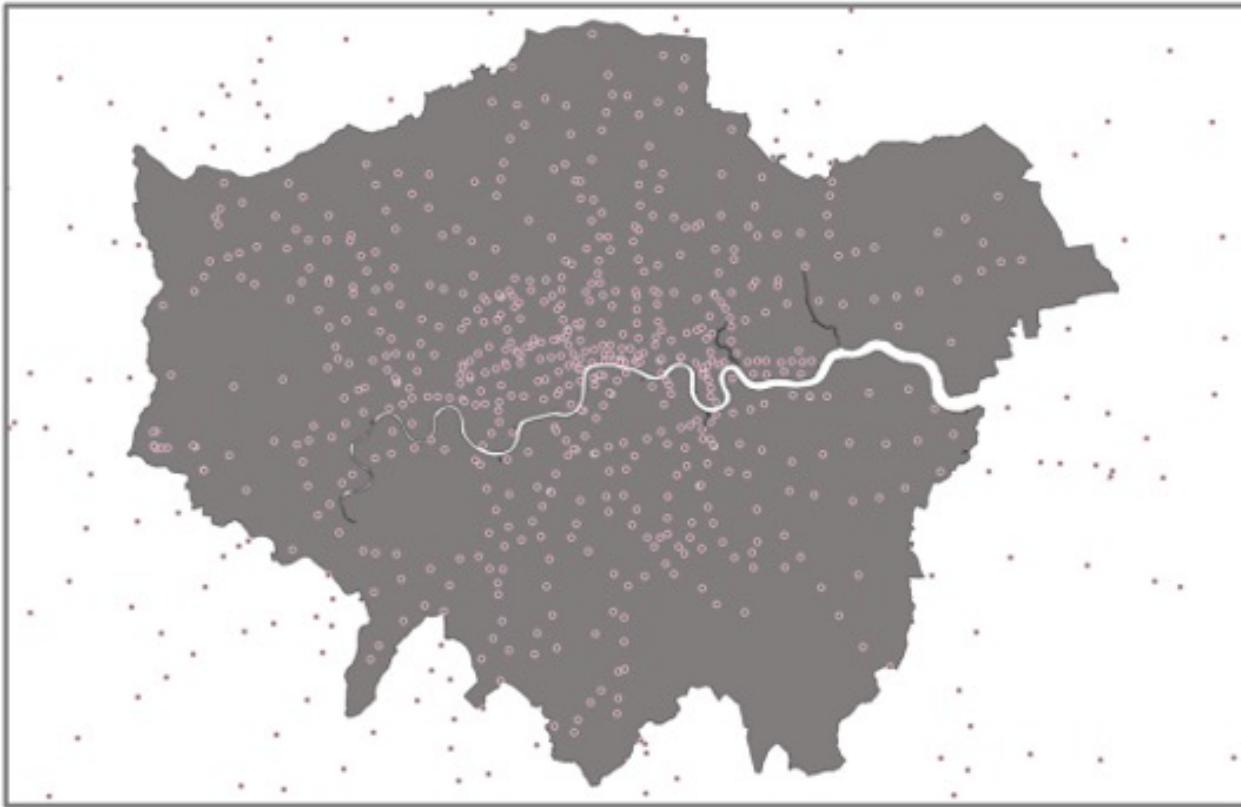


Vector operations VI - Buffer

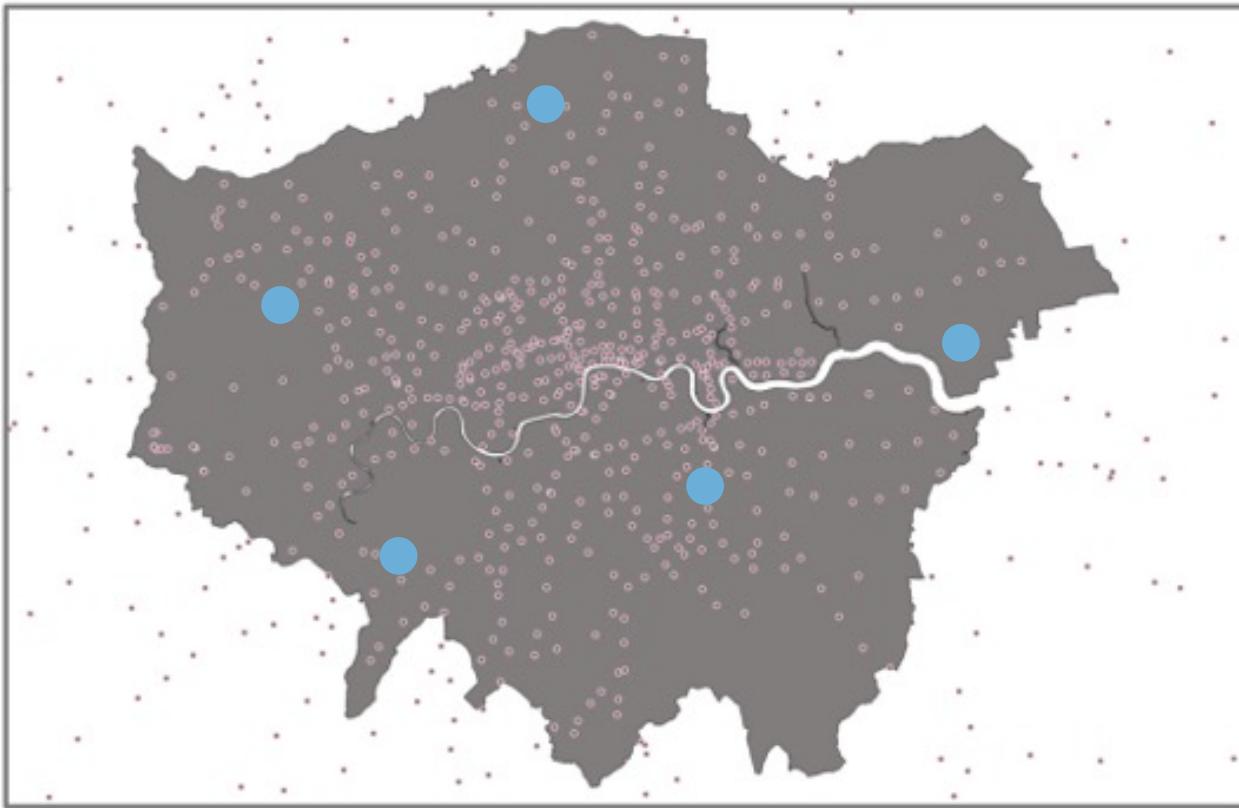


ESRI. 2021. Buffer. [online]
<https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm>

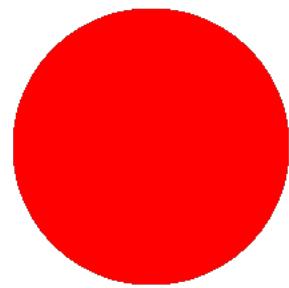
Vector operations VII – Spatial query



Vector operations VIII – Attribute query



RStudio



LIVE

The word "LIVE" is written in a bold, sans-serif font. It is enclosed within a rectangular frame that has a thick red border. The letters are white with a black outline.

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.

Computer tutorial

- Today: conducting geometric operations and spatial queries with yet another case study of London.
- Carefully read the instructions although there *may* be small deviations in the syntax.
- Assignment: no need to hand-in but if you want to leave before the end of the computer tutorial you should be able to show your results.

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 25 2022.
- 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" or "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.

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, Services, Turn editing on, and Hide blocks. The main content area features a tab navigation bar with Welcome, Learning Online, Keeping In Touch, Module Overview, Lecturecast - Video recordings of classes, and Assessment, where the Assessment tab is selected. Below this, a section titled 'Module assessment details' states: 'Geocomputation is assessed through two separate assessments:' followed by two numbered points: 1. Social Atlas Coursework Assessment (60%): Described as a spatial analysis project based on theory, concepts, and application. 2. Exam Assessment (40%): Described as a written 2-hour Exam. A sidebar on the right contains sections for Contact Details (Module Convenor: Dr Justin van Dijk), Common Timetable (Personal and Module Timetables), Library Resources (UCL Explore, LibrarySkills@UCL), and Administration (Course administration, Edit settings, Turn editing on, Course completion, Users, Unenrol me from GEOG0030 Geocomputation). A 'Coursework guidance' box lists three download links: 'GEOG0030 Assessment: Social Atlas' (78.4KB PDF document), 'GEOG0030 Assessment: Data Descriptor Table' (17.7KB Word 2007 document), and 'GEOG0030 Assessment: Social Atlas Examples'. An 'Assessment support' box contains a link to 'Plagiarism and Academic Writing for Students'.

Course: GEOG0030: Geocomputation

moodle.ucl.ac.uk/course/view.php?id=23850§ion=5#tabs-tree-start

Home Events My courses This course Staff Help Student Help Services

Turn editing on Hide blocks

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

Course Feedback

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 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.

Coursework guidance

- GEOG0030 Assessment: Social Atlas 78.4KB PDF document
- GEOG0030 Assessment: Data Descriptor Table 17.7KB Word 2007 document
- GEOG0030 Assessment: Social Atlas Examples

Assessment support

Plagiarism and Academic Writing for Students

This Moodle course is open to all UCL students and contains:

- Guidance on essay writing style;
- UCL's definition and guidelines around plagiarism;
- Advice to help you avoid plagiarism;

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
Edit settings
Turn editing on
Course completion
Users
Unenrol me from GEOG0030 Geocomputation

Assessment

The screenshot shows a web browser window with the title "11 Data Sources | GEOG0030: Geocomputation" at the top. The URL in the address bar is "jtvdijk.github.io/GEOG0030/data-sources.html". The left sidebar contains a table of contents for the module:

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: Geo...
7 Analysing Spatial Patterns II: Spat...
8 Analysing Spatial Patterns III: Poi...
Advanced Spatial Analysis
9 Rasters, Zonal Statistics and Inter...
10 Transport Network Analysis
Additional Resources
11 Data Sources
11.1 Open Data
11.2 CDRC Data
11.3 Other Data

The main content area starts with a section titled "11 Data Sources". Below it, a text block says:

Below you will find some online resources that you might want to explore when sourcing data for your coursework assignment and/or your dissertation. This is by no means an extensive data list, but summarises data used within some of the practicals alongside some additional data sources.

Note

You are **not limited** to using these datasets for your coursework assignment and/or your dissertation.

Below this note, there is a section titled "11.1 Open Data". A text block states:

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

- [Google Dataset Search](#)
- [Tesco Store Data \(London\)](#)
- [NHS Data \(ready for R\)](#)
- [US City Open Data Census](#)
- [nomis](#)
- [ONS Geoportal](#)
- [UK Data Service](#)
- [ONS](#)
- [Edina \(e.g. OS mastermap\)](#)

Assessment

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

Questions

Justin van Dijk

j.t.vandijk@ucl.ac.uk

