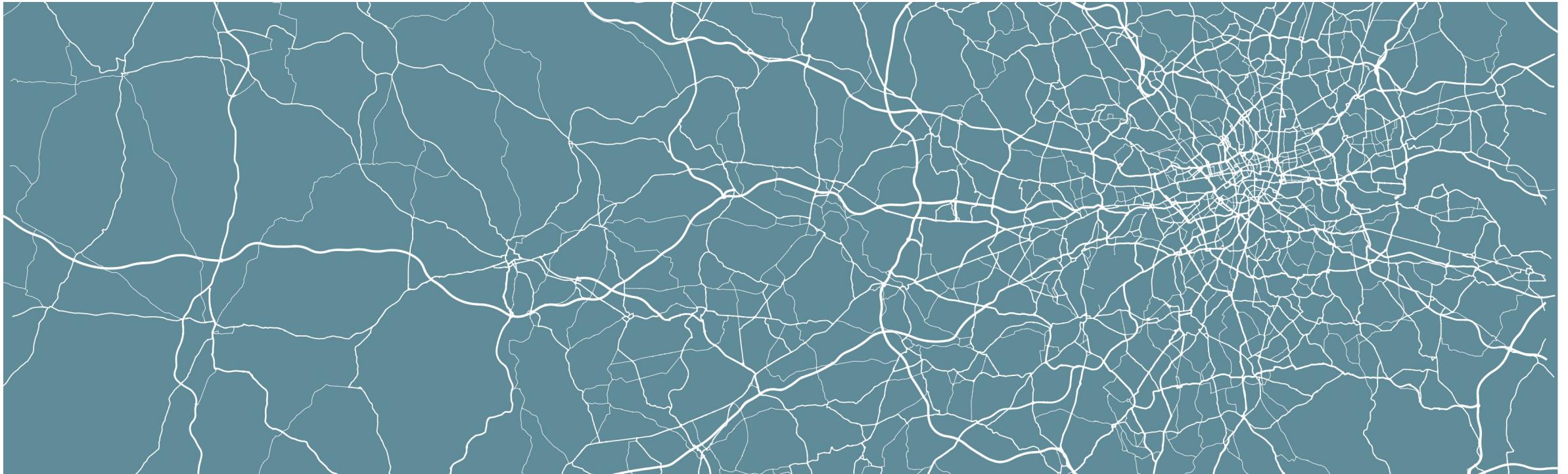


# Geocomputation

## 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



# This week

- Spatial properties
- Spatial operations
- Spatial relationships
- Example: Querying large spatial data

# Before we start

- Go to [www.menti.com](http://www.menti.com)
- Use code: 1334 8681



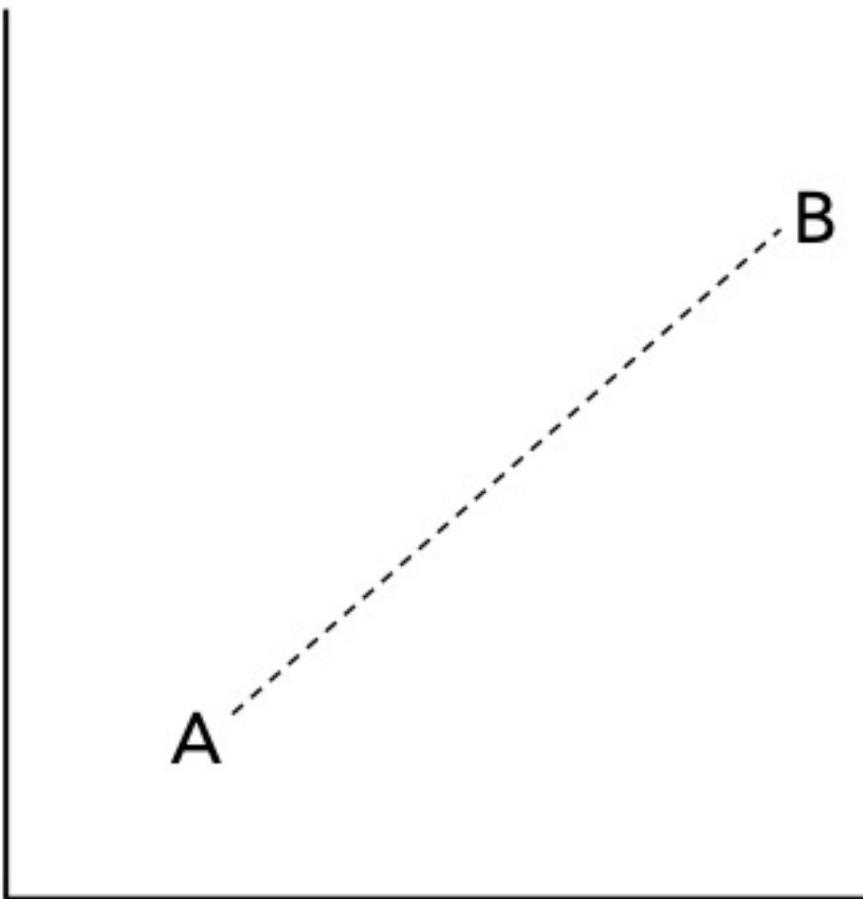
# This week

- Spatial properties
- Spatial operations
- Spatial relationships
- Example: Querying large spatial data

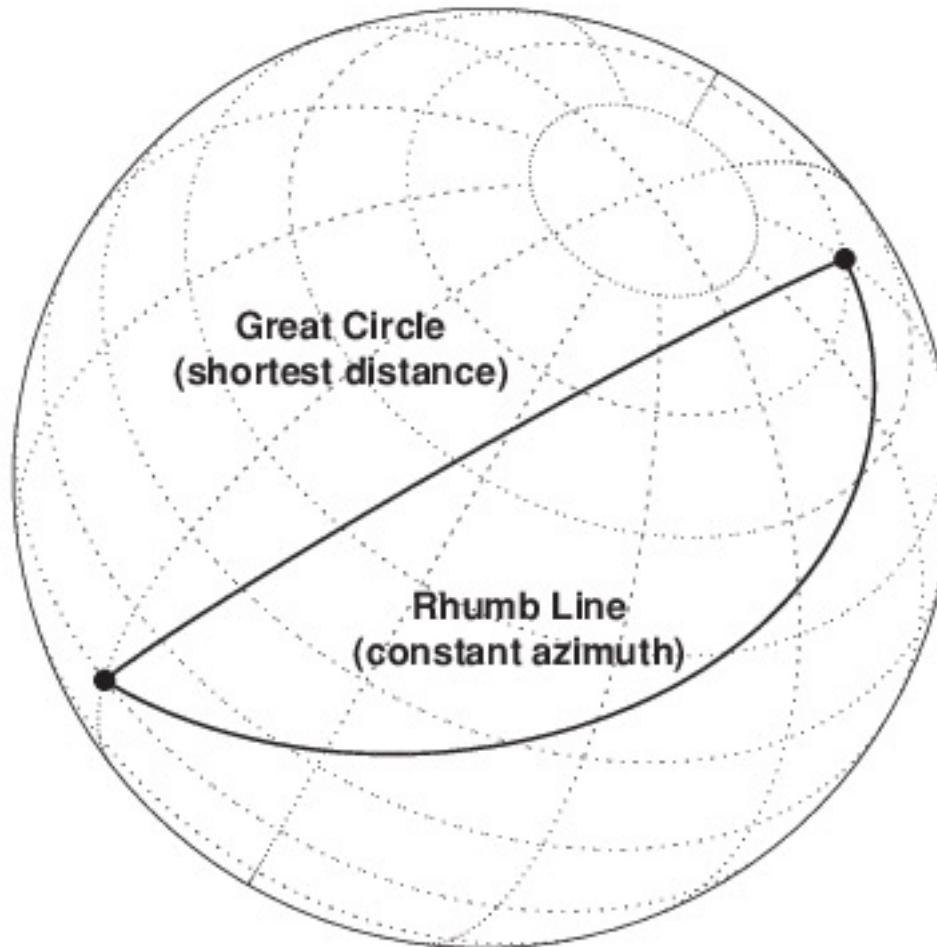
# Spatial properties

- 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.

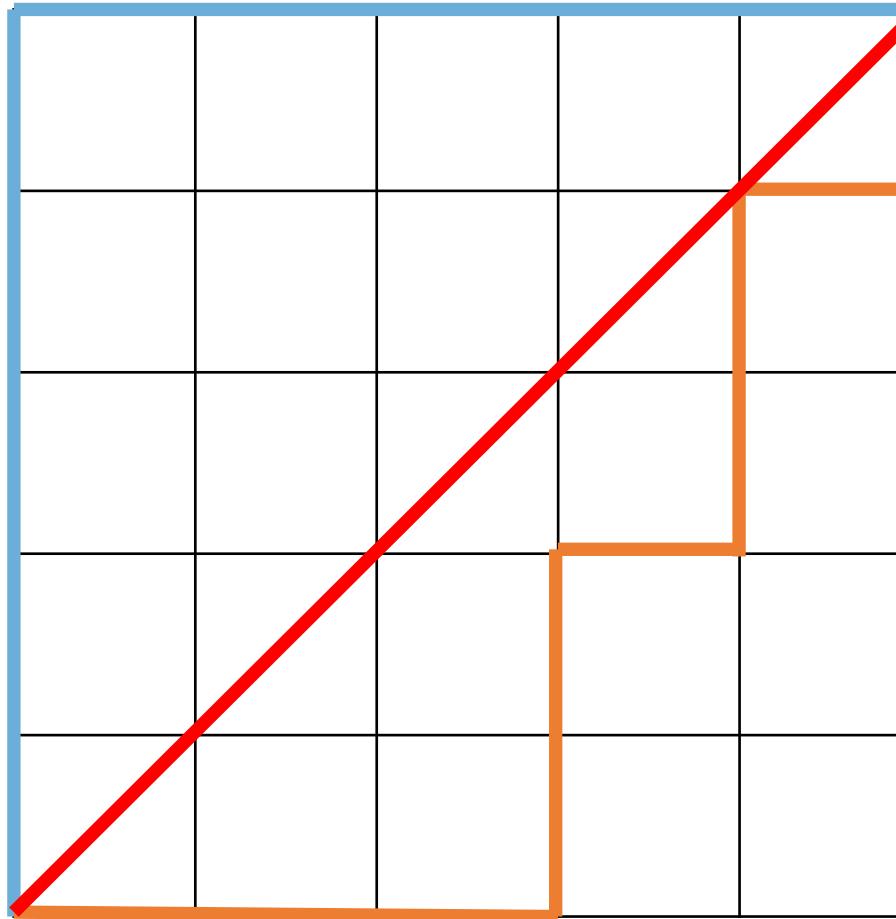
Distance I



# Distance II



# Distance III



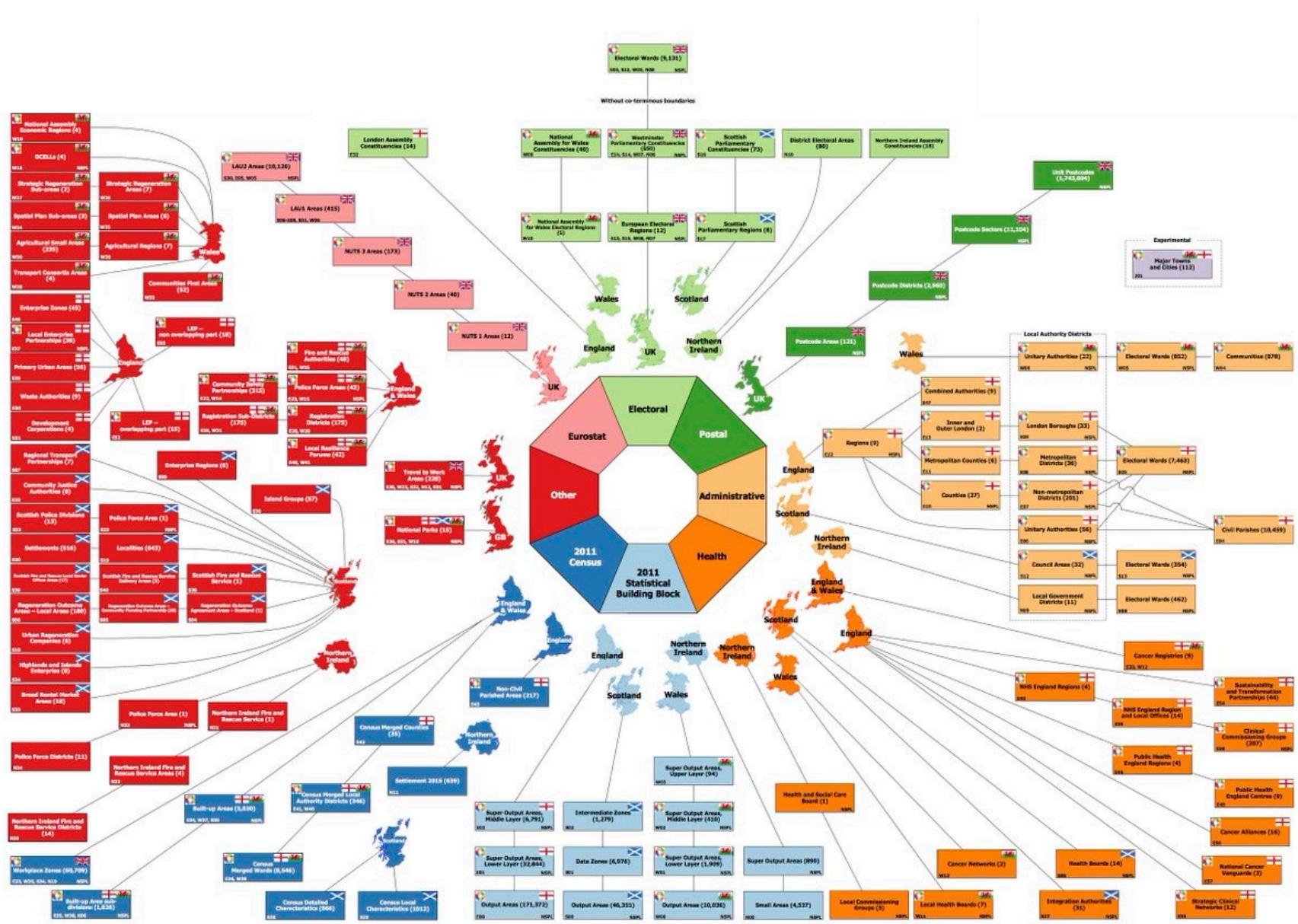
Area I



## 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.

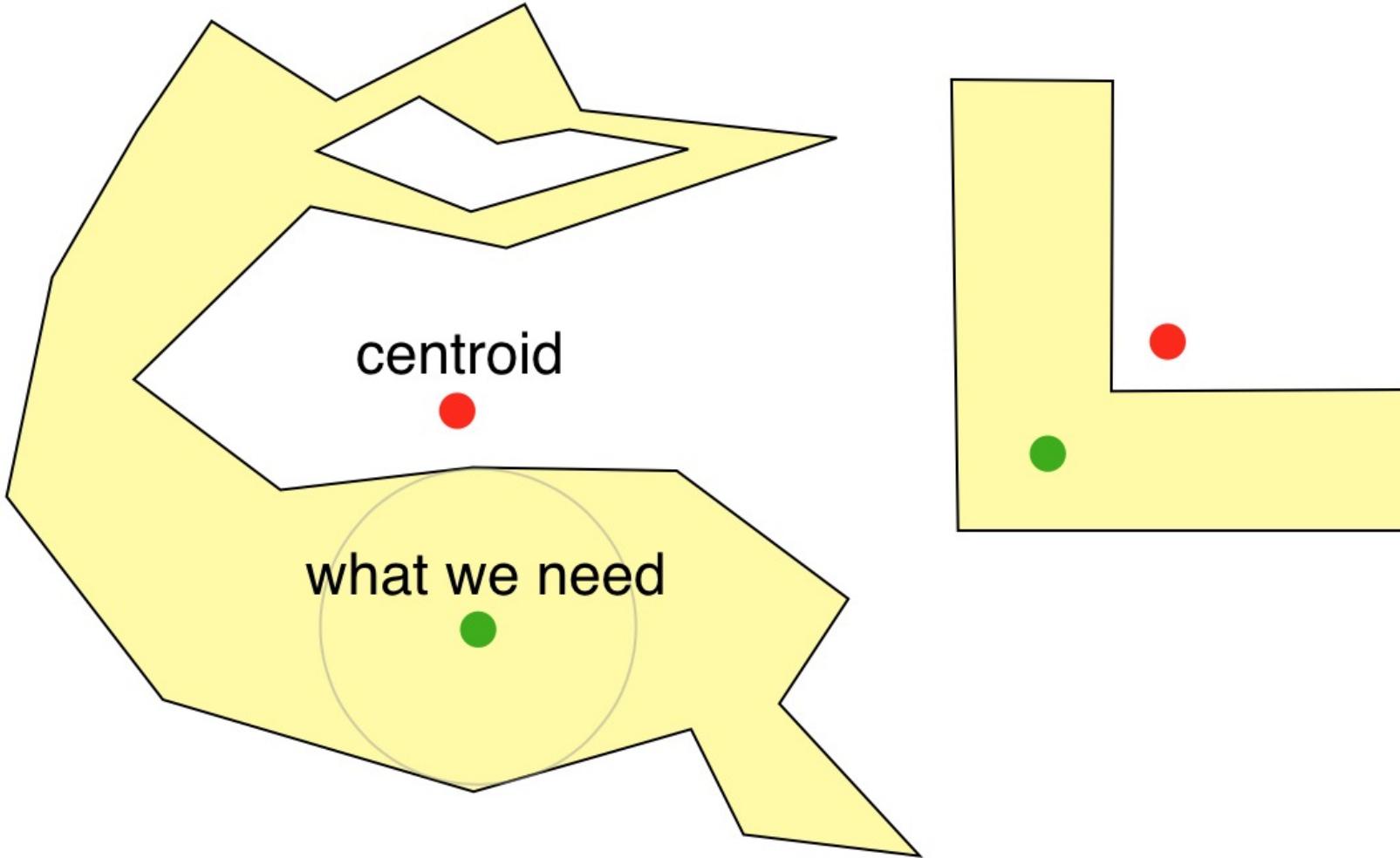
# Area III



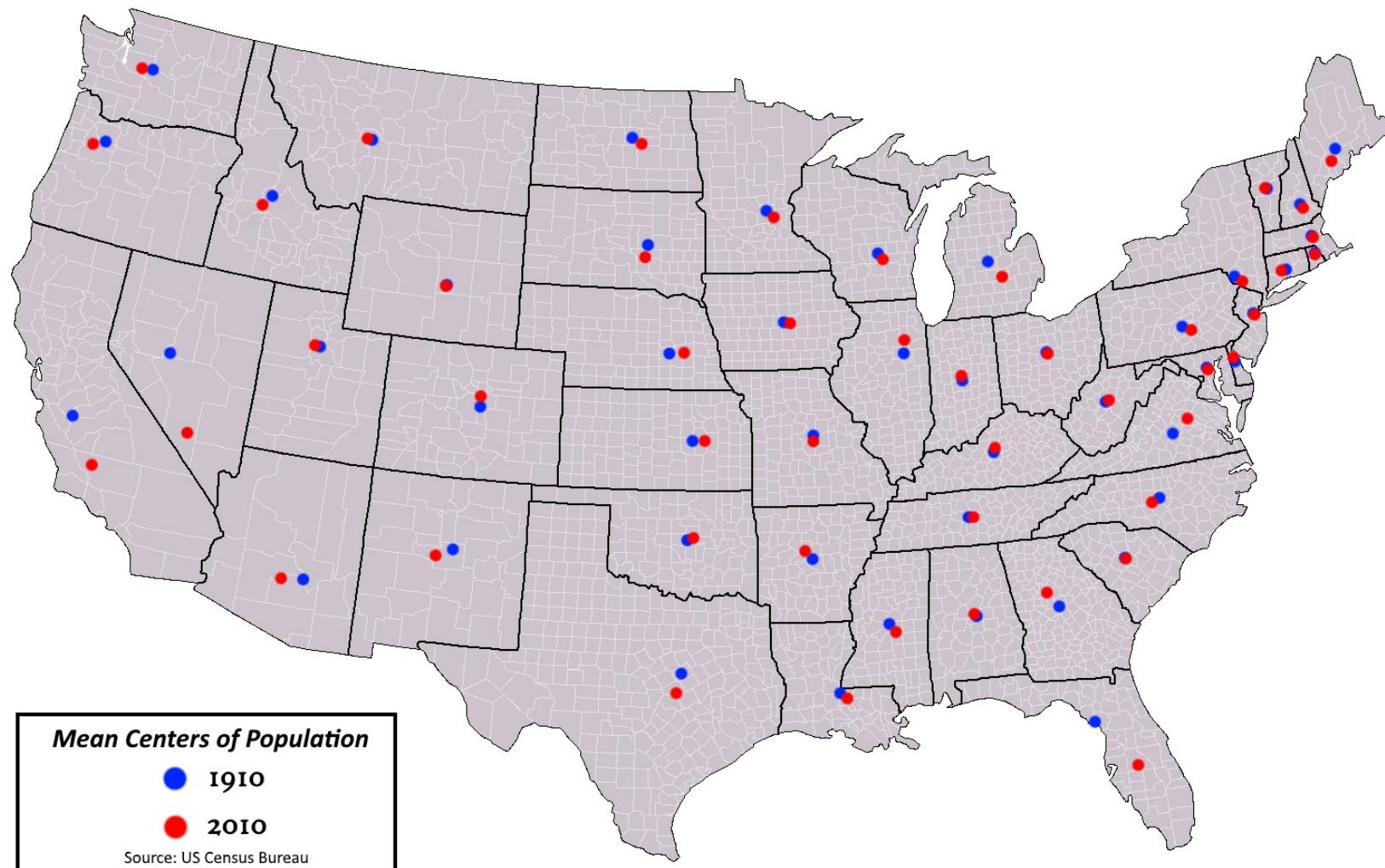
# Shape I

- 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



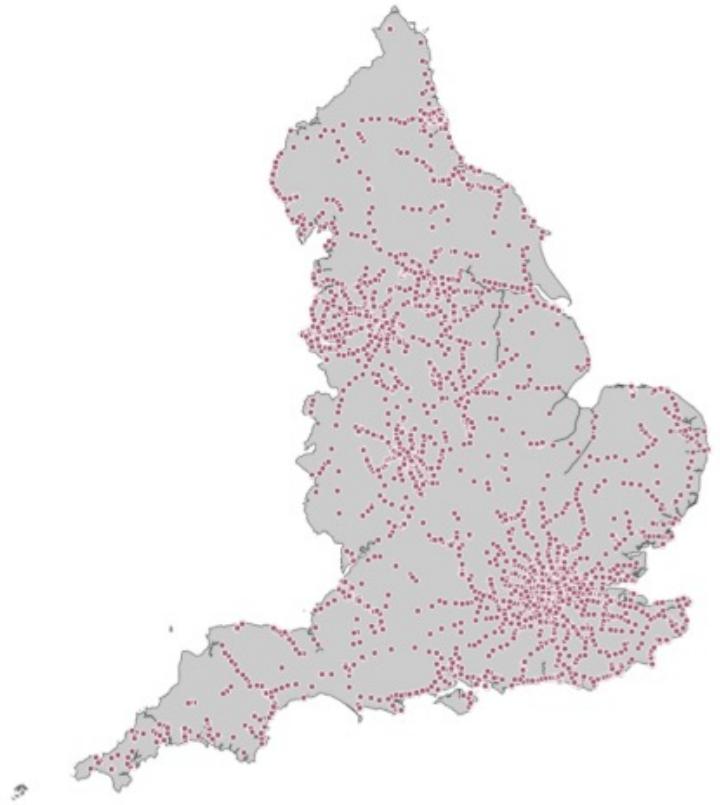
# Shape II



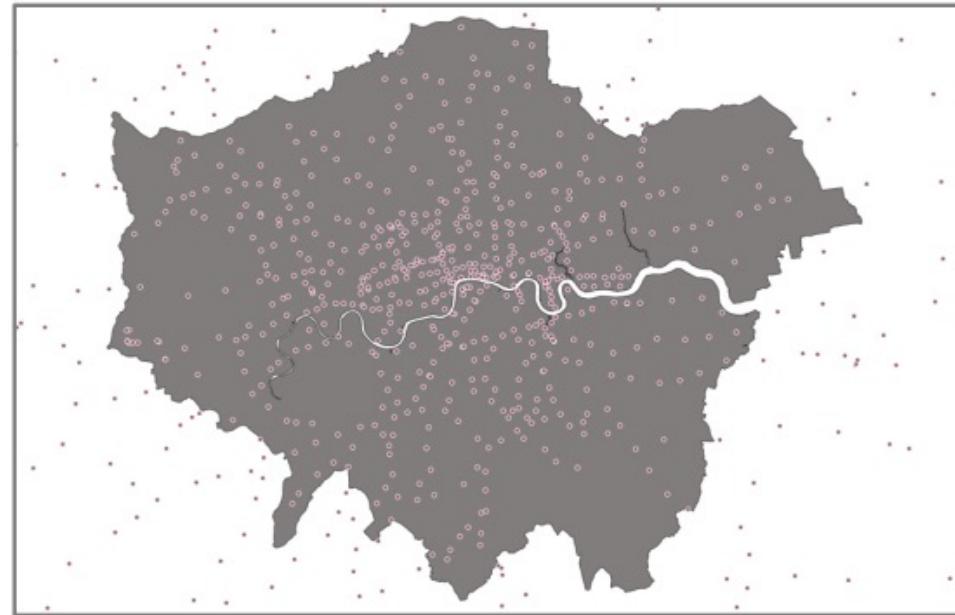
# Spatial operations I

- 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

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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

<b>Equals</b> A is the same as B	
<b>Touches</b> A touches B	
<b>Overlaps</b> A and B have multiple points in common	
<b>Contains</b> A contains B	
<b>Disjoint</b> A shares nothing with B	
<b>Covers</b> A covers B (or vice versa)	
<b>Crosses</b> 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

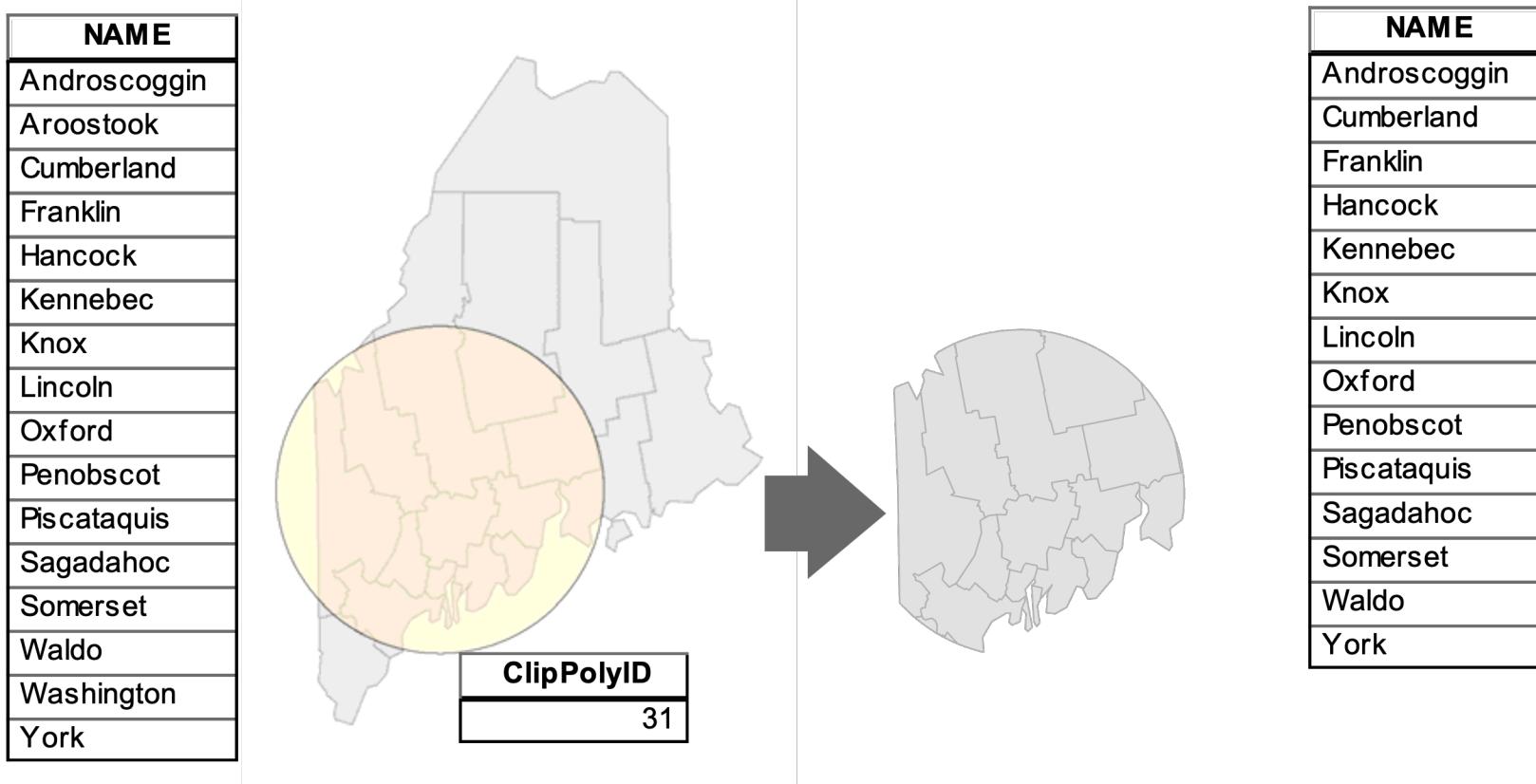
Spatial properties + Spatial Relationships =  
Spatial Analysis

# Spatial analysis

Spatial analysis =

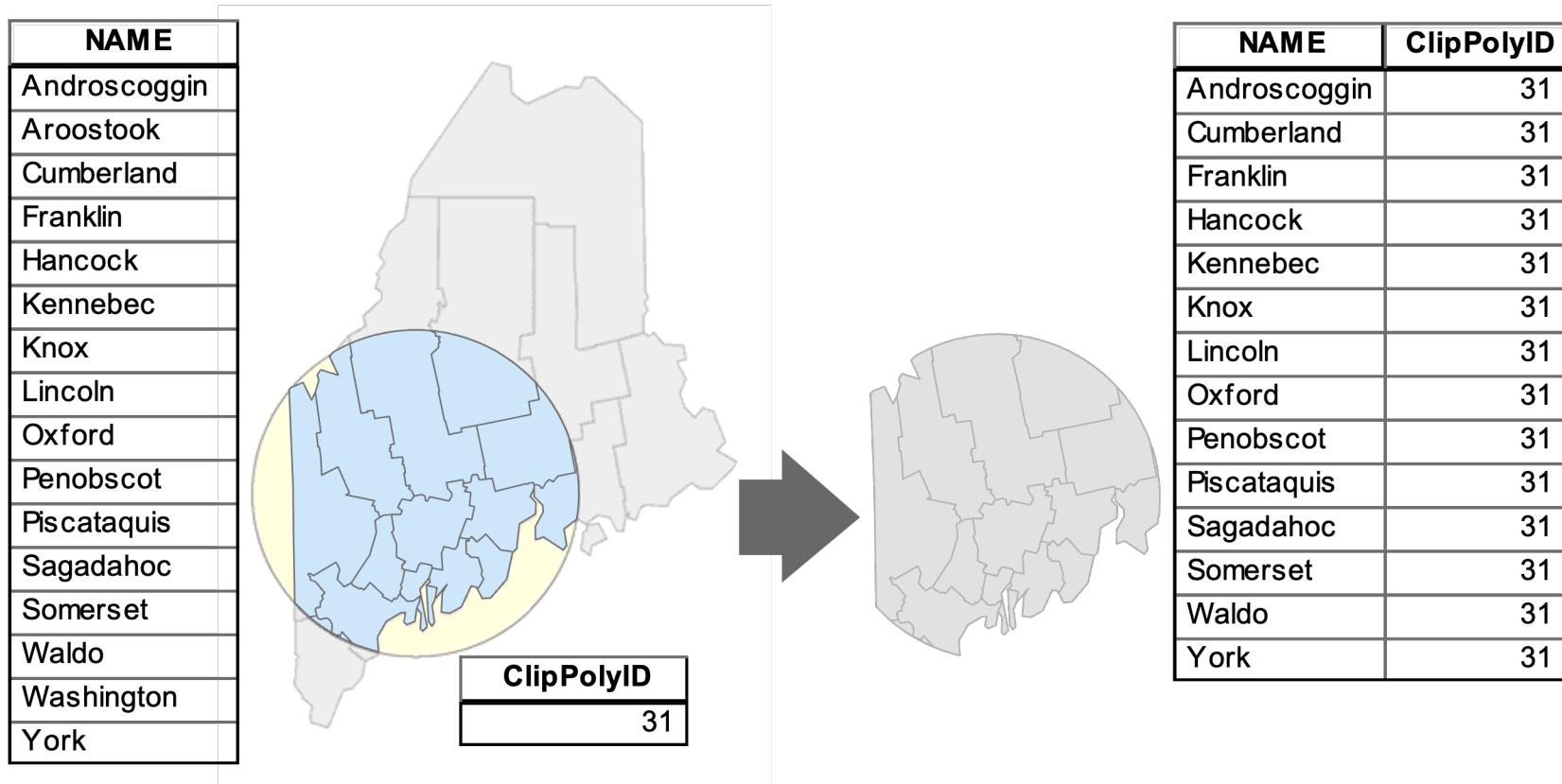
Geometric Operations + Spatial Queries

# Vector operations I - Clip



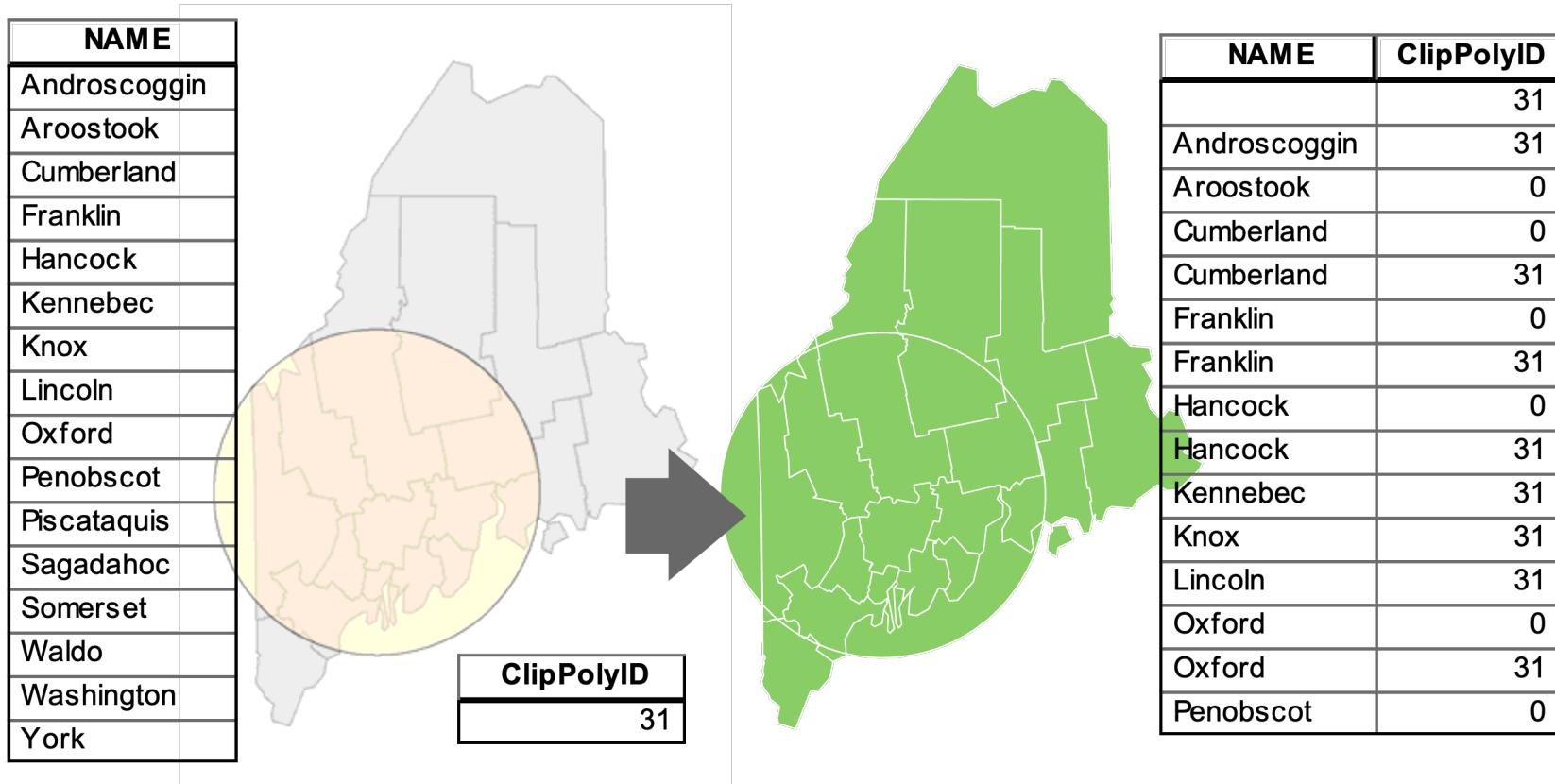
Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]  
<https://mgimond.github.io/Spatial/introGIS.html>

# Vector operations II - Intersect



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

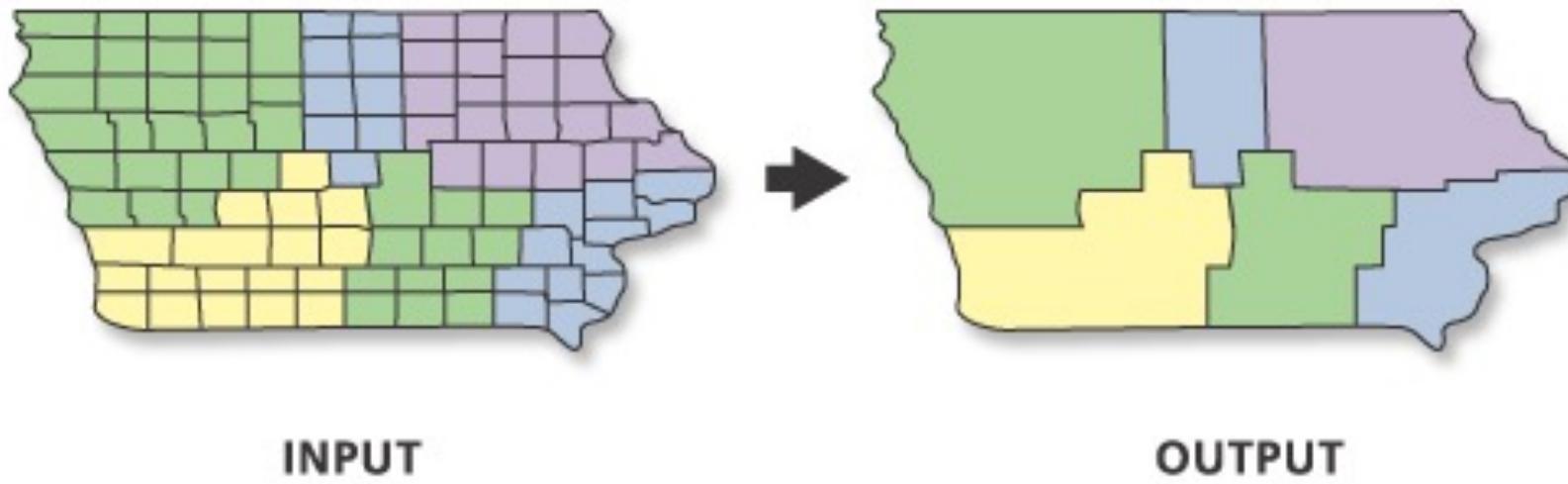
# Vector operations III - Union



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

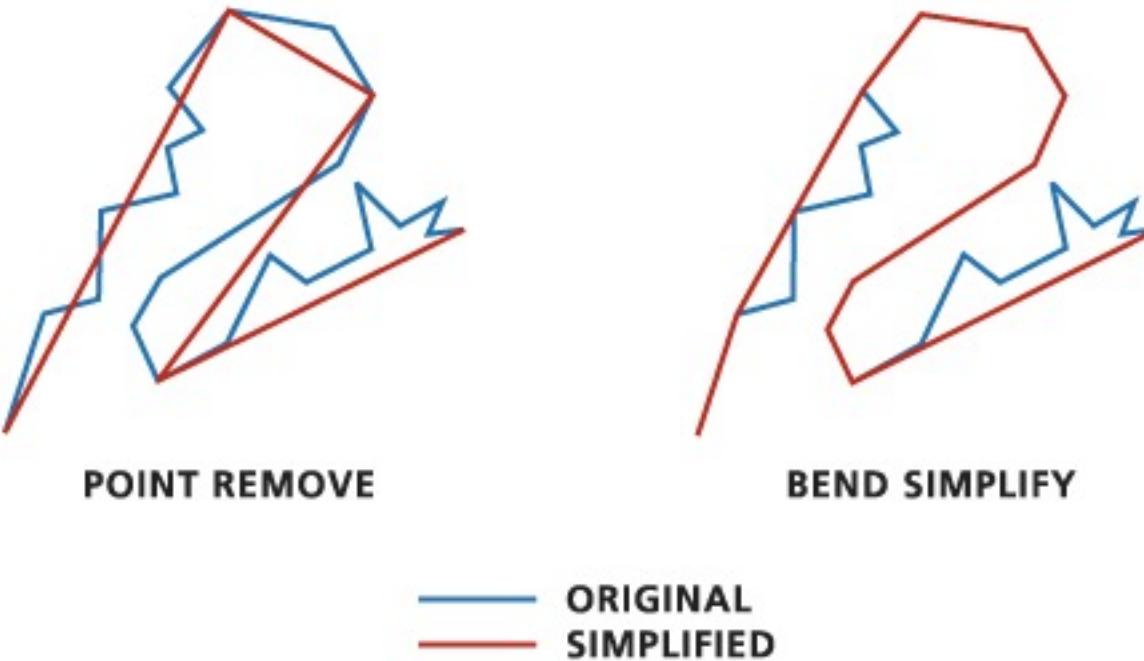
<https://mgimond.github.io/Spatial/introGIS.html>

# 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

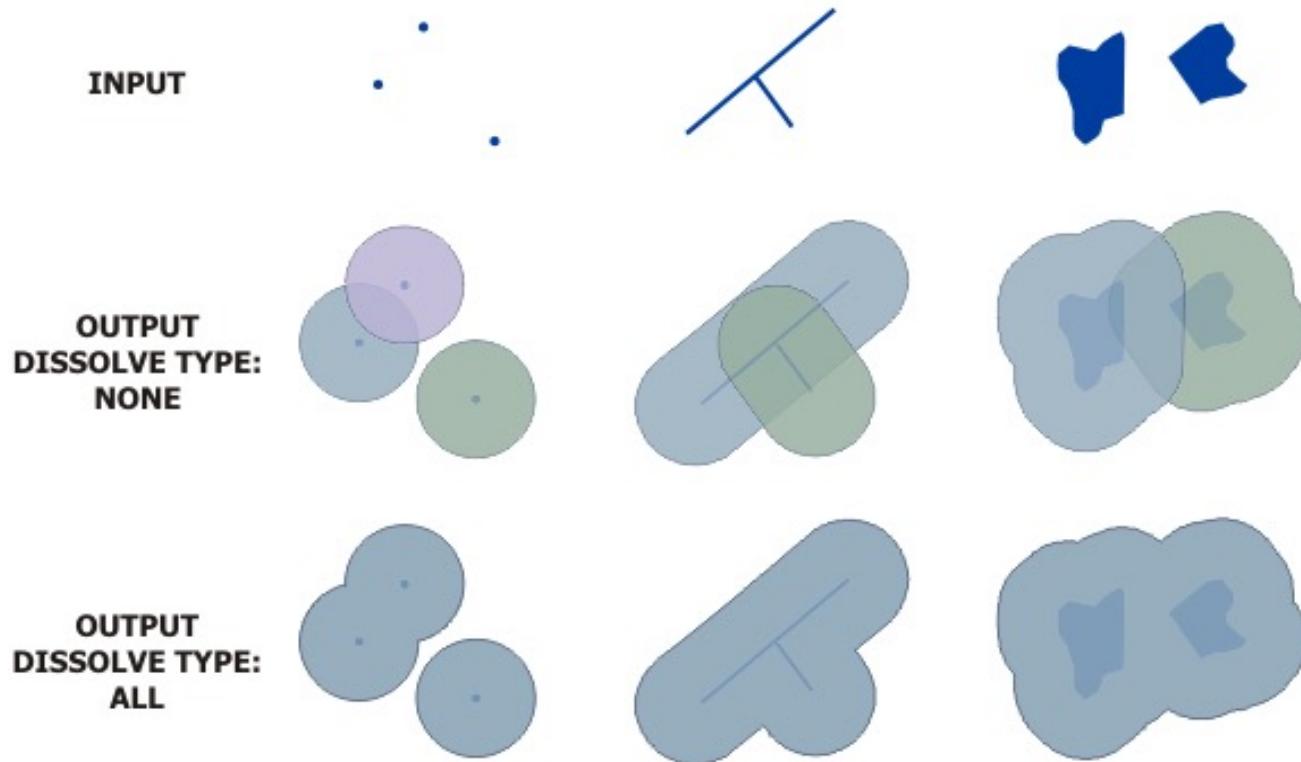


ESRI. 2021. Simplify line. [online]  
<https://desktop.arcgis.com/en/arcmap/10.3/tools/cartography-toolbox/simplify-line.htm>

# Vector operations V - Simplify

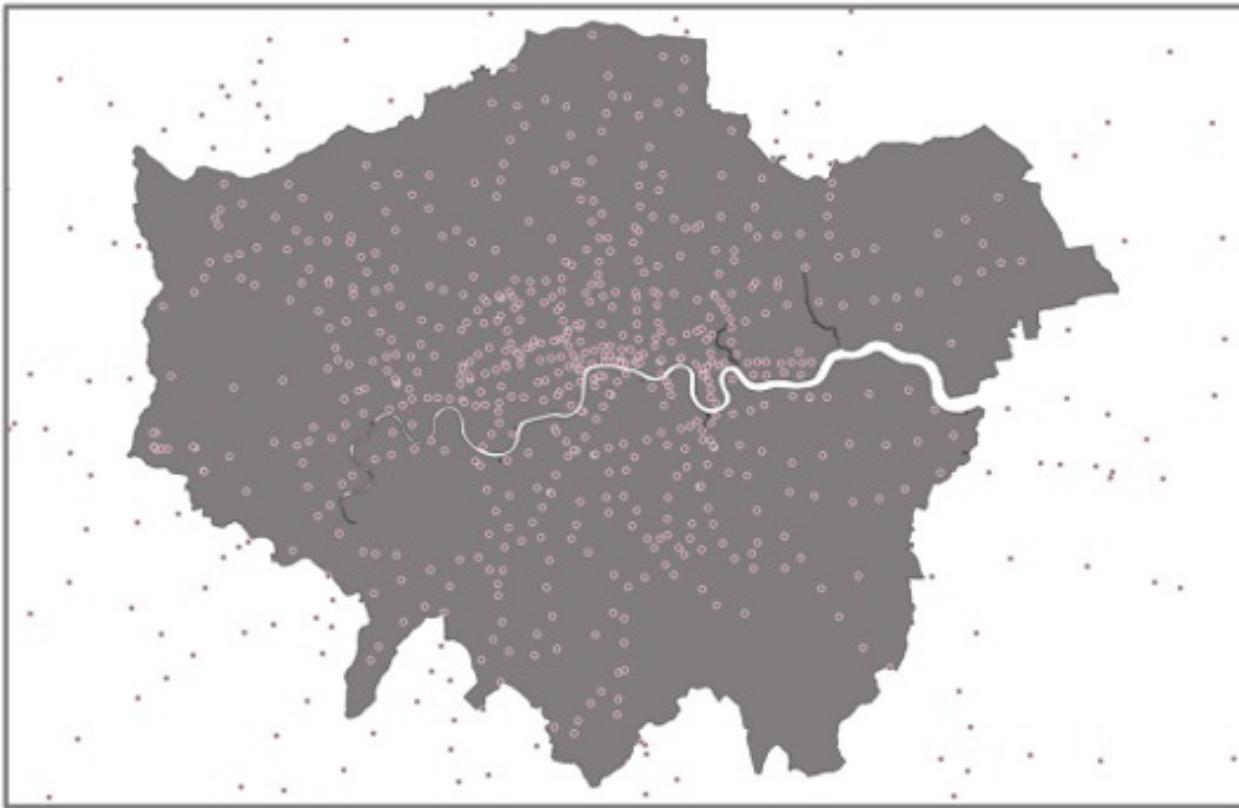


# Vector operations VI - Buffer

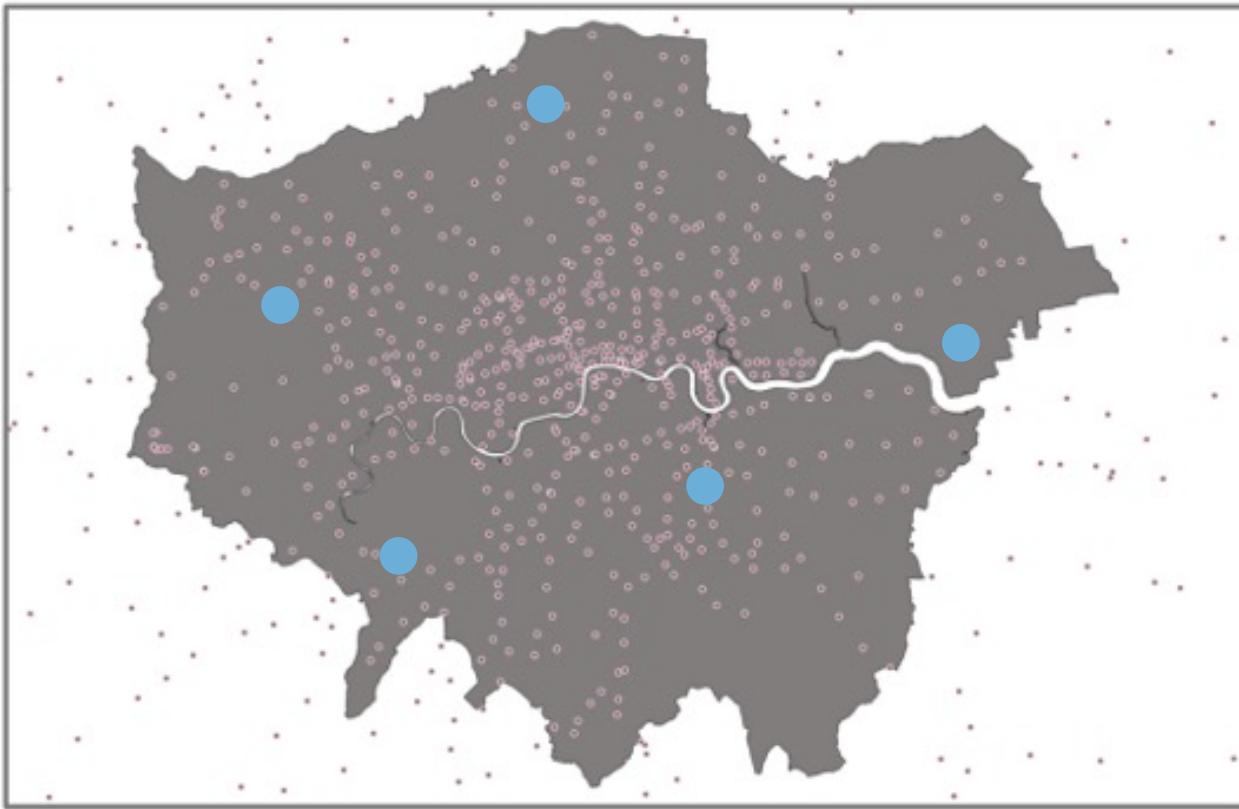


ESRI. 2021. Buffer. [online]  
<https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm>

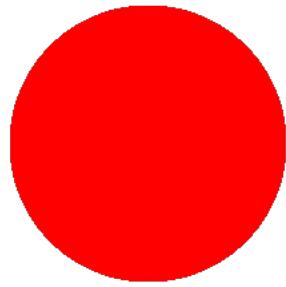
# Vector operations VII – Spatial query



# Vector operations VIII – Attribute query



RStudio



LIVE

# 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. To the right of the main content are several sidebar boxes: '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); and 'Administration' (Course administration, Edit settings, Turn editing on, Course completion, Users, Unenrol me from GEOG0030 Geocomputation). A sidebar on the left contains 'Coursework guidance' with links to PDFs for the Social Atlas and Data Descriptor Table, and 'Social Atlas Examples'. It also includes 'Assessment support' with a link to 'Plagiarism and Academic Writing for Students'.

Course: GEOG0030: Geocomputation

moodle.ucl.ac.uk/course/view.php?id=23850&section=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
<b>11 Data Sources</b>
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

