Introduction to QGIS: Week 1

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Different options

- ArcGIS
- QGIS
- R
- Python
- (Stata)

Simplest type of data

ID	Urban Area	Population
2046	Paris	9'711'652
2314	Lausanne	256'647
3027	Wien	1'856'676
....	....	....

Simplest type of geographical data

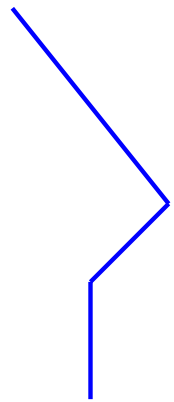
ID	Urban Area	Population	Coordinates
2046	Paris	9'711'652	(48.8567, 2.351462)
2314	Lausanne	256'647	(46.52183, 6.632702)
3027	Wien	1'856'676	(48.20835, 16.3725)
....	....	....	....

Two main types of data

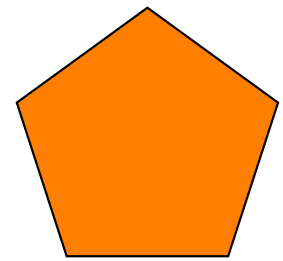
- Vector
  - $\Rightarrow$ Points
  - $\Rightarrow$ Polylines
  - $\Rightarrow$ Polygons

Vector data

(a) Point



(b) Polyline



(c) Polygon

Two main types of data

- Vector
  - ⇒ Points
  - ⇒ Polylines
  - ⇒ Polygons
- Raster
  - ⇒ Grid of cells

Coordinate Reference Systems (CRS)

Problem:

- Earth: round (more or less)
- Map: flat
- Display: flat

Not straight forward how to represent a 3D object on a 2D plain

Coordinate Reference Systems (CRS)

- Different projections
- None of them perfectly preserves all of the following
  a) Distances
  b) Areas
  c) Angles
- Best CRS also depends on the location and size of the area of interest

Coordinate Reference Systems (CRS)

- Important to have the same CRS for different layers
- QGIS does on the fly projection
- Default is WGS84 (EPSG 4326)

Please open QGIS

Have a look at

1. Main Menu
2. Toolbars
3. Browser Panel
4. Layer Panel
5. Map View
6. Status Bar

Shapefiles

- Most common format to store vector data
- Shapefiles for many different locations can be found and downloaded online
- Not enough to copy the .shp file. In the example below, the download included the following files: .cpg .dbf .prj .sbn .sbx .shp .xml .shx

Country borders by the Worldbank

- The folder `WB_countries_Admin0_10m` on moodle contains a shapefile with countries worldwide
- It can be found in the data catalog of the Worldbank `https://datacatalog.worldbank.org/search/dataset/0038272/World-Bank-Official-Boundaries` (accessed: 11.10.2022)

Opening a shapefile

1. Create a folder dedicated to QGIS
2. Download the folder `WB_countries_Admin0_10m` and move it to your QGIS folder
3. Use the browser panel in QGIS and navigate to the shapefile
4. Drag the file to the layer panel

Inspecting a shapefile

- Right-click on the layer name and choose `Open Attribute Table`
- Click on `Identify Features` in the toolbar and click on a country you are interested in
- `Select Features by Area or Single Click` allows you to select all countries in an area that you define
- Click on `Select Features by Value` in the toolbar. Try to select a) all countries in Africa b) all countries with a population of at least 100 million

Exporting a shapefile

1. In the browser panel, create a new folder "Upper Middle Income" by right-click $->$ `New` $->$ `Directory`
2. Select all *Upper Middle Income* countries
3. Right-click on the name of the layer, choose `Export` and `Save Feature As`
4. Keep the format as *ESRI Shapefile* and the CRS as *EPSG:4326 - WGS 84*
5. Tick `Save only selected features`
6. Click on ... next to `File Name`. Navigate to the folder you created. Give it a name, hit `Save` and `Ok`

Using additional data to create a map

- The shapefile gives you the geography of the objects of interest and usually some other information
- However, you might want to map something else
- Today, we are interested in the change of life expectancy between 2010 and 2020 by country
- Eventually, we want to create a map depicting this change

Life expectancy

- On moodle, you can find the file `Life_Expectancy.xlsx`
- It is based on data of the *World Development Indicators*, that can be downloaded at `https://databank.worldbank.org/source/world-development-indicators` (last accessed: 11.10.2022)
- I worked on that file a bit, deleting entries that are groups of countries, rather than individual countries and computing the 2020-2010 difference we are interested in
- Crucially, I made sure that the country codes are compatible with our shapefile. This can potentially be tedious

Importing the information

1. Move the file to your QGIS folder
2. In QGIS, drag it to the layer panel
3. By right-clicking it and choosing `Open Attribute Table` you can see the information it contains

Linking the information

1. Open the `Toolbox`
2. Search for the tool `Join Attributes by Field Value`
3. Choose:
    - Input layer: Country shapefile
    - Table field: Country ID (`WB_A3`)
    - Input layer 2: Table with additional information
    - Table field 2: Country ID (`Country Code`)
4. `Run`

Symbology

- Crucial to understand your map
- Right-click on layer $->$ `Properties...` $->$ `Symbology`
- A categorized symbology allows you to depict classes
- In our case, choose a graduated symbology with *difference* as the value
- Choose pretty breaks and define the classes ourselves

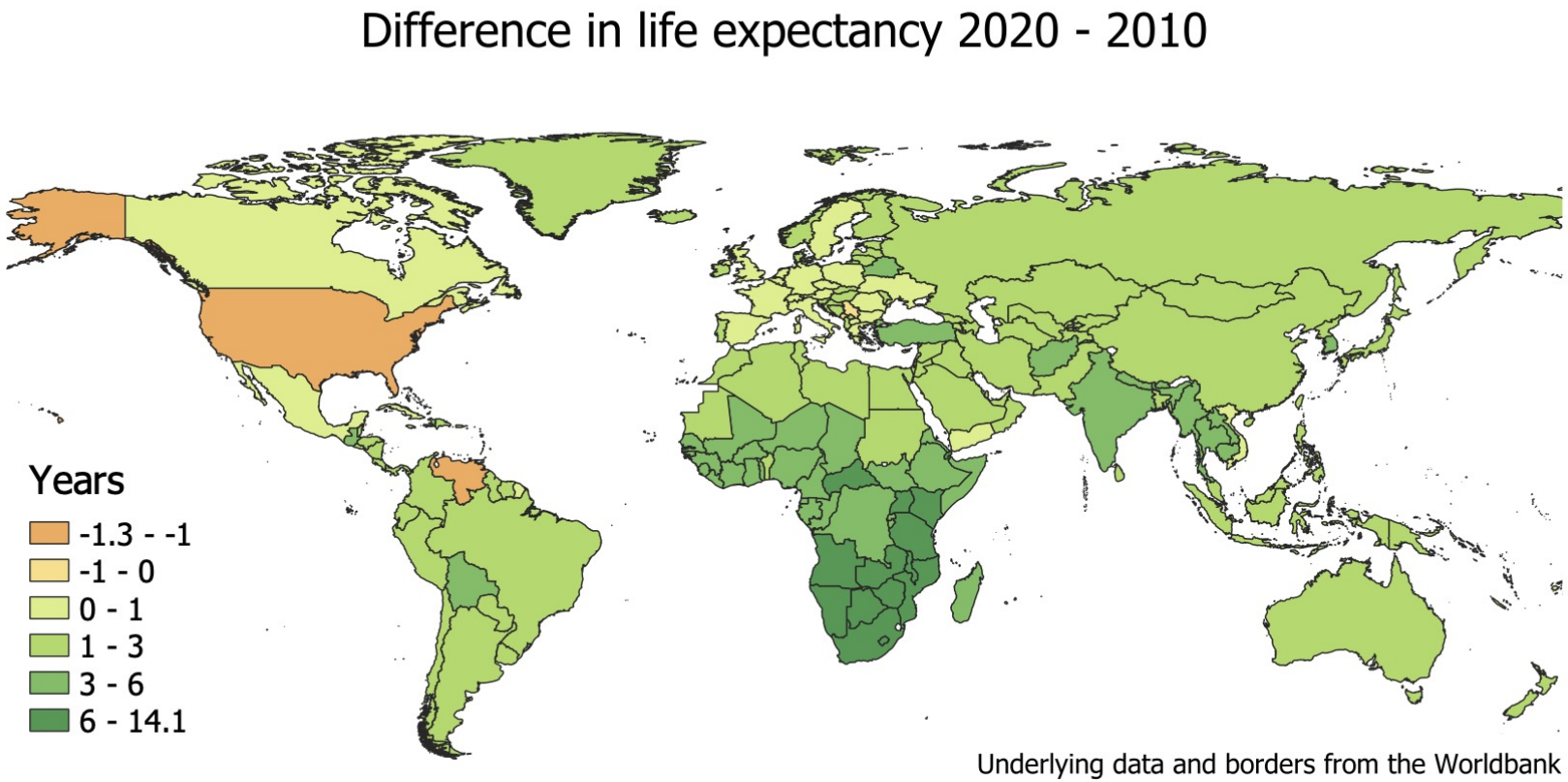
Choosing colors for your map

https://colorbrewer2.org

Creating a map

1. `Show layout manager`
2. Create an empty layout and give it a name
3. `Add Item` $->$ `Add Map` and draw a map window
4. `Move item content` lets you move your map and zoom to the desired size
5. `Add Item` $->$ `Add Legend` / `Add Label` for legend and title
6. Style
7. `Layout` $->$ `Export as PDF` to save your map

Our first map



Final remarks

There are many useful online resources that help you to understand the basics of QGIS

Two examples that helped me write these slides:

- *A Gentle Introduction to GIS*, provided by QGIS: `https://docs.qgis.org/3.22/en/docs/gentle_gis_introduction/index.html` (last accessed: 11.10.2022)
- *Introduction to QGIS*, provided by Stephanie Saephan of the open.gis.lab: `https://static1.squarespace.com/static/56f6ee5f8a65e2431330aac8/t/626b336f5722f31057280b5b/1651192692582/IntroQGIS_GISDAY_111820.pdf` (last accessed: 11.10.2022)