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GIS in Archaeology

02 - Working with QGIS

Martin Hinz

Institut für Archäologische Wissenschaften, Universität Bern

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based on Datapolitan-Training/qgis-training.

You can download a pdf of this presentation.



Let's Get Started

- 1. Click this link and download the file to your desktop
- 2. Unzip the file
- 3. Click this link and download the other file also to your desktop
- 4. Open QGIS



Image Source: http://www.geocontrolling.com/co-je-gis.htm



Layer Ordering

- Layers on top are drawn on top
- Just drag and drop within the Layers Panel to change order
- Try it now

- Basic file for storing map elements
- Stores spatial data, like points, lines, and polygons
- Multiple files comprise a "shapefile"

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- .shp—The main file that stores the feature geometry
- .dbf—The dBASE table that stores the attribute information of features

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- .prj—The file that stores the coordinate system information
- .shx—The index file that stores the index of the feature geometry

You might also see

- .cpg—Identifies the character set to be used
- .sbn and .sbx—The files that store the spatial index of the features

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- Have a few limitations
- One geometry type (Point, Line, Polygon) per shapefile
- So sometimes you end up with this:

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osm_line.shp		1.5 MB	Unknown	Feb 4
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Overview of GeoPackage

- What is GeoPackage?
 - A data format for geographic information systems (GIS).
 - Platform-independent, open, and standards-based.
 - Uses an SQLite database to store both raster and vector data.
- Key Features:
 - Single file for easy data sharing and use.
 - Efficient, especially for mobile and offline environments.
 - Supports extensions for flexibility (OGC-approved and custom extensions).
- Why Use GeoPackage?
 - Lightweight and portable.
 - Facilitates easy data management and spatial queries.



GeoPackage vs. Shapefiles

1. File Structure:

- **GeoPackage:** Single file (SQLite-based).
- **Shapefile:** Requires multiple files (.shp, .shx, .dbf, etc.).
- 2. Data Handling:
 - GeoPackage: Stores both vector and raster data (multiple geometry type per file possible)

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- Shapefile: Vector data only.
- 3. Efficiency:
 - **GeoPackage:** Compact, better suited for mobile/offline use.
 - Shapefile: Larger, more fragmented.
- 4. Attributes:
 - GeoPackage: Supports larger field names and Unicode.
 - Shapefile: Limited field length and ASCII-only.



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Attribute Table (Right click on layer)



Attribute Table

Table View



Form View



Shapefiles and Attribute Tables

- Column names can only be letters, numbers, and underscores "_"
- Column names can only be ten characters long



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Let's add another layer

Going out in Bern

- Download the data to your desktop
- Unzip the file
- Open in QGIS



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Going out in Bern

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Filter and Query

• We can filter the points based on the values in the attribute table

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Filter and Query

• Right-click on the layer and select "Filter" to open the Query Builder





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We can also filter by multiple conditions



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Filter and Query - Multiple Conditions





Filter and Query - Multiple Conditions





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Zoom to Layer





Zoom Selection

• Select the zoom on the toolbar



- Draw a box around the area you want to zoom into
- Click the icon to return to the previous map extent



Pan Map

• Select the hand tool to pan around the map

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Exporting Data



Your Turn

- Filter according to your own criteria
- Try and find something interesting
- Change the style of the point, either to a different shape, color, or icon

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• Export your selection as a new shapefile

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CSV-Files

- General (textbased) spreadsheat format
- simple and robust
- human readable (kind of)



CSV-Files

• Perfect for data exchange between Spreadsheet (Excel) and GIS

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Load Text Layer



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Set coordinate columns

and Coordinate Reference System <- We will explain this in a bit!

You can also access more detailed Coordinate Reference settings.



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So what is a Coordinate Reference System?

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Projections

- No one's favorite part of GIS
- But a necessary part of it nonetheless
- Convert points on the 3-dimensional Earth (**latitude** and **longitude**) to x and y coordinates on a 2-dimensional map



Digital Coast Geozone

Projections

• Every projection distorts some part of your map

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FlowingData



Mercator Projections

- A common map projection
- Makes geometries near poles look bigger than geometries near the equator



• These circles are all the same size on the globe:

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• Conformal map projection (Winkeltreu)

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• As are these:



• Equal-area projection (Flächentreu)



• And these:









Projections

- For the most part we will work in WGS 84 (latitude and longitude)
- In Switzerland, we use a more accurate projection CHTRS95: Swiss Terrestrial Reference System 1995 that is identical with the european system ETRS89.
- You might also find 'Schweizer Landeskoordinaten' (CH1903) or Landesvermessung 1903 (LV03)



Source: https://www.swisstopo.admin.ch/de/wissen-fakten/geodaesie-vermessung/bezugsrahmen/lokal/lv95.html



Projections

- Identified by unique IDs (EPSG) that make it easier to talk about them
- EPSG: European Petroleum Survey Group Geodesy (it was introduced, because Oil companies were annoyed by the incredible number of different systems)
- WGS 84 is referred to as EPSG:4326
- Google Maps and other online sources often uses WGS 84 / Pseudo-Mercator (EPSG:3857)
- CHTRS95 is referred to as EPSG:2056

Remember these three and you should be set



Back to Adding CSV Data



Adding CSV Data

Coordinate Reference System Selection	tor						
Specify CRS for layer Parking_Facilities							
Filter 4326	(2)						
Recently used coordinate reference	systems						
Coordinate Reference System	Authority ID						
WGS 84	EPSG:4326						
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😑 Geographic Coordinate Systems							
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Selected CRS: WGS 84							
+proj=longlat +datum=WGS84 +no_defs							
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BERN

CSV Import - Bicycle Rental

Bicycles added.





What We've Covered

- Adding, styling, and labeling data in QGIS
- Projections
- Querying features



Homework

- Add the files you can download from the homework page to QGIS (note: the projection epsg is in the filename)
 - background_4326.tif
 - cities_2056.csv
 - lakes_3857.gpkg
- Style as you like
- Send me a screenshot



Any questions?



Source: https://www.instagram.com/sadtopographies

You might find the course material (including the presentations) at

https://github.com/BernCoDALab/gia

You can see the rendered presentations at

https://berncodalab.github.io/gia

You can contact me at

martin.hinz@unibe.ch