QGIS: a local application

Summer School on Digital Humanities

Web site: https://bit.ly/dt4h-gis

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QGIS: a local application

- The user installs a GIS application on the PC

User

- In this scenario, the Web is a tool for exchanging data
  - but it's not a requirement
- QuantumGIS (QGIS) is an open-source GIS application
- Runs on Windows, Linux, and macOS

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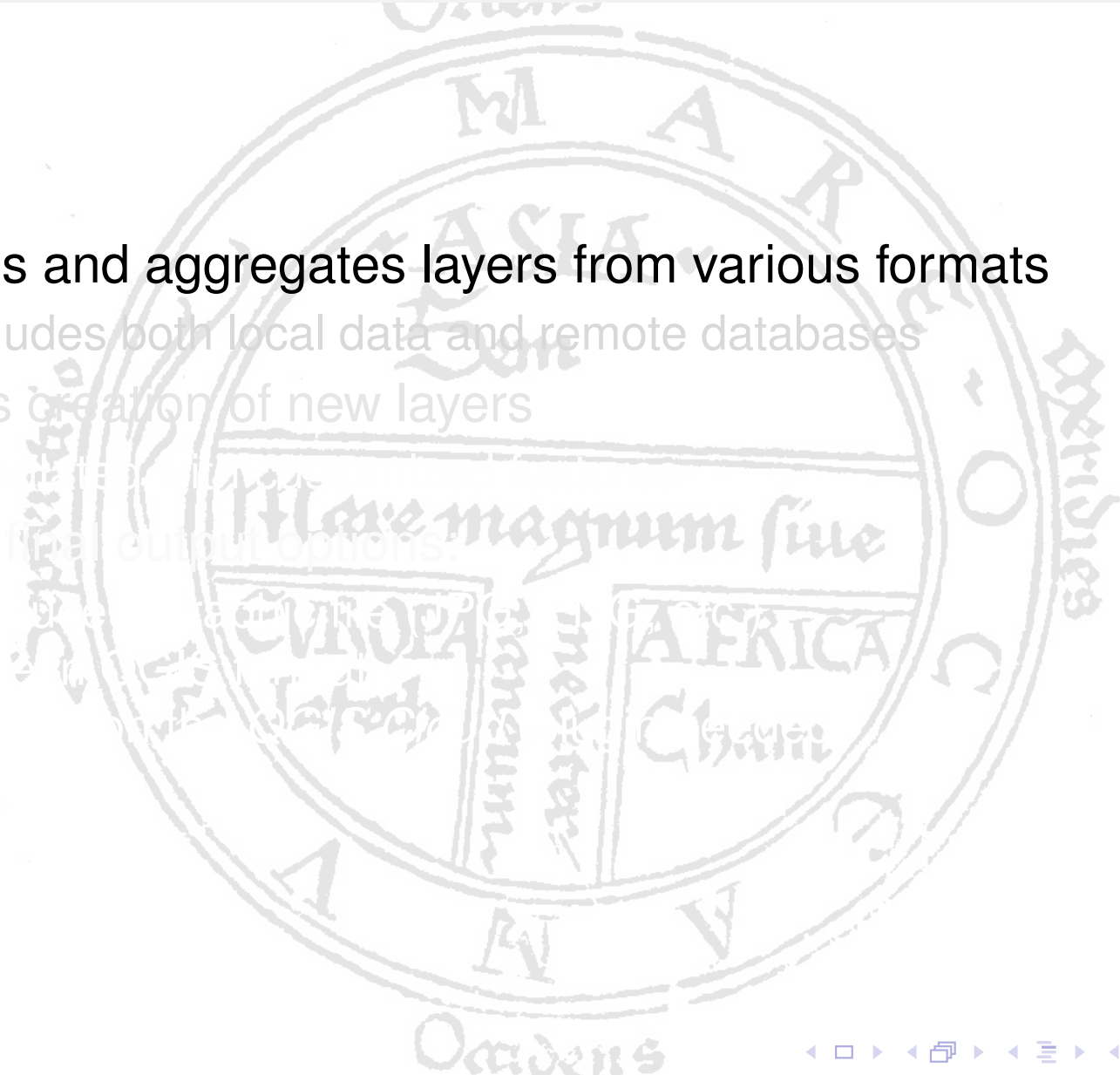
QGIS Operation

- Acquires and aggregates layers from various formats
  - Includes both local data and remote databases
- Enables creation of new layers
  - Points, lines, polygons
- Among final output options:



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- Among final output options:
  - Produce a graphical map
  - Save to a shapefile
  - Publish to a web server

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  - Produce a graphic file (JPG, PNG, etc.)
  - Save in OGR format
  - Publish online (GeoServer) (plugin needed)

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Step-by-Step QGIS Tutorial - Load a raster

Create a New Project

- Open QGIS and select Project -> New

Add a Raster Background Layer

- Layer -> Data Source Manager -> XYZ Tiles
- Double-click on OpenStreetMap
- Use the control pad to zoom in on a specific region

Understanding the Raster Layer

- The map is now displayed as a raster layer
- Various providers offer raster layers

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Understanding the Raster Layer

- The map is now displayed as a raster layer
  - Composed of multiple tiles similar to an image
  - Cannot be modified like vectors
- Various providers offer raster layers

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  - e.g. OpenStreetMap, Google Maps, Bing Maps

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Define a Vector Layer

- Layer -> Create Layer -> New Shapefile Layer
  - Or use the *New Shapefile* icon in the toolbar (third icon in the second row)
- Choose:
  - Add new fields for the attributes of the layer
  - The new layer appears in the *Layers Panel*
  - Two layers shown, Demo and OpenStreetMap
  - We can edit the Demo vector layer

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  - Or use the *New Shapefile* icon in the toolbar (third icon in the second row)
- Choose:
  - A file name (and save the layer in e.g. Demo)
  - The geometry type (e.g. Point, Line, Polygon)
  - The coordinate reference system (CRS)
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- Choose:
  - A filename to save the layer (e.g., Demo)
  - The feature type: *Point, Multipoint, Line, Polygon*
  - A coordinate system (EPSG:4326 - WGS84)
- Add new fields for the layer attributes
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  - The feature type: *Point, Multipoint, Line, Polygon*
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  - e.g. *Layer -> Add Field*, Define a name, click *Add to Field List*
  - When finished, click *OK*
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Further Configuration of a Layer

- Double-click on the Demo layer to set its properties
  - In *Symbology* choose the graphic symbol and adjust its properties
  - In *Fields* update feature attributes

Further Configuration of a Layer

- Double-click on the Demo layer to set its properties
  - In *Symbology*, choose the graphic symbol and adjust its properties
  - In *Fields*, update feature attributes
  - In *Labels*, select *Single label* and choose the field for labeling the points (e.g., select the *name* field)

Step-by-Step QGIS Tutorial - Refine the layer definition

Further Configuration of a Layer

- Double-click on the Demo layer to set its properties
  - In *Symbology*, choose the graphic symbol and adjust its properties
  - In *Fields*, update feature attributes
    - [illegible] new field
    - [illegible] field
  - In *Labels*, select [illegible] and choose the field for labeling the points (e.g. [illegible])

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Further Configuration of a Layer

- Double-click on the Demo layer to set its properties
  - In *Symbology*, choose the graphic symbol and adjust its properties
  - In *Fields*, update feature attributes
    - you may want to add a new (as virtual) field
    - for this enable editing with the pencil and add (or delete) a field
  - In *Labels*, select *Single Labels* and choose the field for labeling the points (e.g., select the name field)

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Step-by-Step QGIS Tutorial - Working with points

Populate a Vector Layer (with Points)

- Select the Demo layer and Layer -> Toggle editing
  - Or the pencil on the second toolbar
- Then select Edit -> Add Point feature
- Click on the map to create a new point
- Repeat as you like
- To move a point, select the Move feature tool
- To exit edit mode, right-click on the Demo layer and select Layer -> Toggle Editing

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Populate a Vector Layer (with Points)

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  - Or the pencil in the second toolbar
- Then select Edit -> Add Point feature
  - or the equivalent button in the second toolbar
- Click on the map area to add a new point
- Repeat as you like
- To move a point around
- To exit edit mode, right-click on the Demo layer and select Layer -> Toggle Editing

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  - Or the pencil in the second toolbar
- Then select Edit -> Add Point feature
  - or the Ctrl+. shortcut
  - The mouse pointer changes to a crosshair
- Click on the map to add a new point
- Repeat as you like
- To move a point, enable
- To exit edit mode, right-click on the Demo layer and select Layer -> Toggle Editing

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  - A [illegible]
- Repeat as you like
- To move a point, [illegible]
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  - The mouse pointer changes to a crosshair
- Click on the map to add a new point
  - A box appears to enter the data fields
- Repeat as you like
- To move a point, activate the Move Feature tool
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  - A box appears to set feature fields
- Repeat as you like
- To move a point feature,
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  - The mouse pointer changes to a crosshair
- Click on the map to add a new point
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- To move a point feature,
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Step-by-Step QGIS Tutorial - Working with points

Populate a Vector Layer (with Points)

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Step-by-Step QGIS Tutorial - Edit fields

Update Feature Attributes

- Right-click on the Demo layer and select Open Attribute Table
  - Use the bottom-right icons to adjust the view style
- Press `Ctrl+E` to enable table editing (or click the *Pencil* icon)
- Modify attribute values as needed
- Press `Ctrl+S` to save

Add an Attribute ("description") to the Features

- Right-click on the Demo layer and select Open Attribute Table

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Add an Attribute ("desc") to the Features

- Right-click on the Demo layer and select Open Attribute Table
  - Enable editing
  - Press `Ctrl+I` to add a new field (or click the "New Field" button in the toolbar)
  - Set the name to "desc" and type to Text
  - Click OK

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- Right-click on the Demo layer and select Open Attribute Table
  - Enable editing
  - Press `Ctrl+W` to add a new field (or find the "New Field" button in the toolbar)
  - Set the name and type (e.g., "desc" of type Text)
  - Click OK

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Step-by-Step QGIS Tutorial - Process fields

For each point compute a new field with distance from Rome in degrees

- Select a layer and click the Open Attribute Table button in the toolbar
- Click CTRL+I or the abacus icon in the attribute table window
- Input a name for the new field (e.g., *Lat*)
- Choose a type for the field (e.g., *Decimal Number*)
- Enter the following formula in the *Expression* box

```
distance(@geometry, make_point(12.5, 41.9))
```

- The `distance` function takes two points
- Note: to see meters conversion is needed, from `EPSG:4326` to `EPSG:3857`, using the `transform` function

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Step-by-Step QGIS Tutorial - Save or export

Save Your Work

- Save the project in QGIS native format (Ctrl+S or Project -> Save)
- Export as an image (Project -> Import/Export -> Export Map to Image)
- Export in a portable vector format (Project -> Export DXF)

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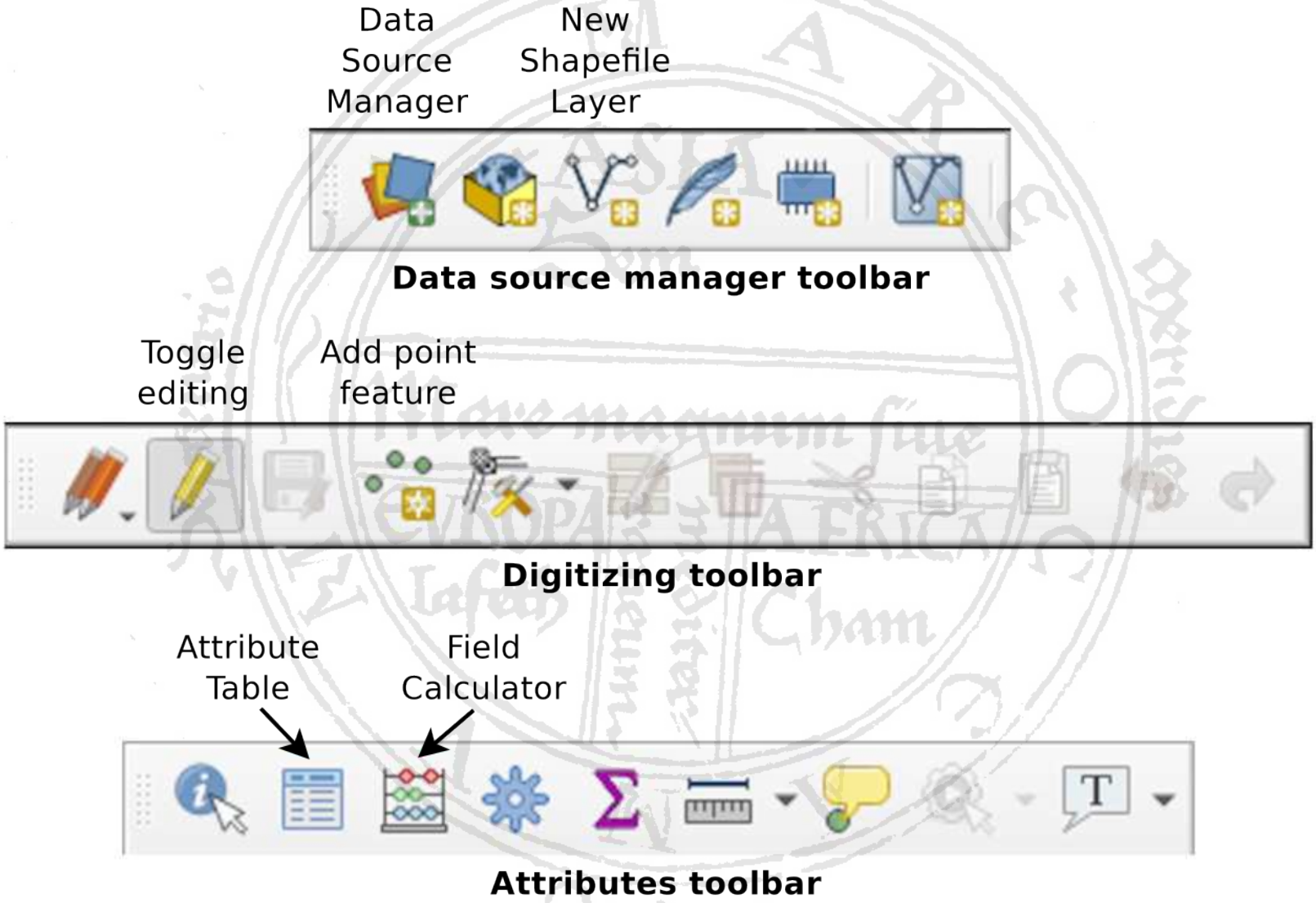
GUI Toolbar Icons (Quick Reference)



Lab Activity

- (Basic) North of La Spezia, there is a region called "Cinque Terre". The name comes from five fishing villages: Corniglia, Manarola, Vernazza, Monterosso, and Riomaggiore. Set a Point for each village and display a label with its name on the map.
- (Intermediate) Draw a sea route visiting all the villages, starting from Levanto (another small town to the north). For this create a new LineString vector, enable editing, select `Add Linear Element` and mark waypoints with the left button. Right button to close the LineString.
- (Intermediate) Convert the line to a new layer of vertices using Vector -> Geometry Tools -> Extract Vertices
- (Advanced) Compute the longitude and latitude of these points, and label each one with a string "(long, lat)" using the concat function in the calculator.