Task 1: Preparing and analysing axial models

Description

This exercise offers the experience of a complete workflow of space syntax axial and segment analysis using the Space Syntax Toolkit for QGIS. It involves the preparation of the axial model, correcting the axial and unlinks maps, followed by the analysis of the model using axial topological and segment angular analysis. The results of different network measures are displayed in the end.

Note: It is a set of minimal instructions, assuming basic familiarity with the QGIS environment and the space syntax (depthmapX) terminology. Participants can work through the various steps in groups.

Stage 1 – Project preparation

1) **Prepare the QGIS environment**
   a) Install the OpenLayers QGIS plugin. This plugin adds layers based on popular on-line maps such as OpenStreetMap, Google, Bing, etc. The plugin appears in the Web menu.
   b) Modify some QGIS settings 'Settings > Options…' (useful to know this dialog):
      i) 'Digitizing > Feature Creation' check 'Suppress attribute form pop-up…'
      ii) 'General > Icon size > 16' to reduce the size of toolbar icons and increase screen space
      iii) If the GUI is not English you can change it in 'Locale' tab, check 'Override system locale' and select 'U.S. English'. This requires a restart of QGIS.
2) **Prepare the sample data**
   a) Download the sample data from the repository: https://github.com/SpaceGroupUCL/qgisSpaceSyntaxToolkit/releases/download/v0.2.0/sample_data_v0.2.0.zip
   b) Unzip this into a folder in a location of your choice
   c) Open the sample data project (sample_data.qgs) by double clicking the file, dragging it onto the QGIS window, or going to 'Project > Open…'
   d) Activate the Google Maps background layer in the Layers Panel

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Stage 2 – Model preparation

3) **Create an axial map layer**
   a) Create a new shape file layer, 'Layer' > 'Create Layer' > 'New Shapefile Layer…'
   b) Select 'Line' type
   c) Click the Globe button to select the CRS (Coordinate Reference System)
   d) Type '27700' in the Filter box at the top, select 'OSGB 1936/British National Grid EPSG:27700', and click OK
   e) Do not add any new fields, leaving the default 'id' field
   f) Click OK and save the new layer 'axial_map_new.shp' (location of your choice)

4) **Draw axial lines**
   a) Select the 'axial_map_new' layer in the Layers Panel
   b) Toggle the pencil toolbar button in the Digitizing toolbar, or go to 'Layer > Toggle Editing'
   c) Toggle the 'Add Feature' toolbar button
   d) Zoom into the Barnsbury area
   e) Draw some axial lines: left click to start, left click for second point, right click to finish line.
   f) This is just to get some practice, the map does not have to be large. Do not draw polylines, and make sure the axial lines cross clearly.
   g) To modify a line use the 'Node tool' button in the Digitizing toolbar
   h) Click the 'Save Layer Edits' button when you're done, and un-toggle the 'Toggle Editing' (yellow pencil) button

5) **Create an unlinks layer**
   a) Create a new shape file layer as in 3.
   b) Select 'Point' type
   c) Set the CRS to EPSG: 27700 as before. Now it should be in the CRS drop-down menu.
   d) Click 'OK' and save the new layer 'unlinks_new.shp' (location of your choice)

6) **Draw unlinks**
   a) Select the 'unlinks_new' layer and make it editable (Toggle Edit)
   b) Draw some unlinks points using the 'Add Feature' tool in the Digitizing toolbar
   c) Place them near locations where lines cross, but there's no level.
   d) This is just an exercise and the unlinks don't have to be real locations. Look at the 'Unlinks (real)' to see the single unlink on the site.

7) **Update axial "id" colum**
   a) Select the 'axial_map_new' layer
   b) Choose the 'Field Calculator' tool in the QGIS toolbar (Aabacus icon) or in the Attribute Table window.
   c) Check 'Update existing field' and select the 'id' column
   d) Find the expression "$id" or "$rownum" in the Record group on the right
   e) Double click and it is added to the Expression window
   f) You can also type any of the above directly in the Expression window (without quotes)
   g) Click OK
   h) This populates the id column with unique ids for every line created
   i) Save layer edits and un-toggle Editing

Stage 3 – Model verification

8) **Verify the axial map**
   a) Hide the "_new" layers you just created (these are just for practicing digitising layers)
   b) Display the "axial_errors" and "unlinks_errors" layers
   c) Start the "Graph analysis" tool from SST
   d) Choose the 'Map' tab
   e) Select the "axial_map_errors" layer
   f) Click the 'Verify' button in the 'Verify layer' tab
   g) This results in a list of errors

9) **Correct the axial erros**
   a) Make the "axial_map_errors" layer editable (yellow pencil)
   b) Select each error in the report to zooms to the location
   c) Edit the axial line (delete, extend, move) depending on the problem, using the digitizing toolbar buttons
   d) Save Layer Edits of "axial_map_errors"

10) **Verify the unlinks**
   a) Choose the 'Unlinks' tab
   b) Select the "unlinks_errors" layer
   c) Click 'Verify' in the 'Verify layer' tab
   d) Notice the error message about IDs
   e) Click 'Update IDs'

f) Click the ‘Verify’ button again
g) Now it analyses he unlinks in conjunction with the axial layer and reports errors.

11) **Correct the unlinks errors**
a) Make the “unlinks_errors” layer editable
b) Select each error in the report list to zoom to the problem
c) Edit the unlink point accordingly (delete, move), using the digitizing toolbar buttons
d) Save Layer Edits of the “unlinks_errors” layer
e) Update the IDs again if the unlinks have moved

12) **Iterate the verification process**
a) Choose the Map tab
b) Verify the axial map again
c) Correct errors if necessary
d) Return to the unlinks tab and verify unlinks, updating ids and moving them
e) The verification process is only complete when there are **no errors** on **both** layers

Stage 4 – Model analysis

13) **Run axial analysis**
a) In the “Map” tab select the “axial_map” layer (no errors)
b) In the “Unlinks” tab select the “unlinks” layer (no errors)
c) Select the “depthmapX remote” tab
d) Type values in the Radius field: “2, 4,n”
e) Type new name for the Output table (optional)
f) Click Calculate
g) Notice the warning message
h) Start the depthmapX software
i) Click Calculate
j) Open the Attribute Table of the axial layer or the newly created layer

14) **Run segment analysis**
a) Still in the “depthmapX remote” tab...
b) Select the segment option
c) Type values in the Radius field: “400, 800” (n can be slow)
d) Check the “Weight” box and select “Segment Length”
e) Click the Settings button
f) Check the “Calculate full set of measures” (optional)

g) Click “Ok” to close the “Advance Settings” dialog
h) Type new name for the Output table (optional)
i) Click “Calculate”
j) Wait...
k) Open the Attribute Table of the newly created layer
l) Switch off all “axial” map layers, leaving only the segment layer
m) Notice the difference in the model: trimmed line ends
n) Select individual axial segments (Select Features tool)
o) Activate the ‘Map Tips’ tool to see the values of the selected attribute (defined in the ‘Layer Properties’ > ‘Display’ tab)

Stage 5 – Results visualisation

15) **Visualise axial analysis results**

a) Close the “Graph Analysis” SST tool
b) Open the “Attributes Explorer” SST tool
c) Select the “axial_map” layer to explore
d) Select the “INT” attribute
e) This shows the measure using the default space syntax style
f) Select other measures in the list

16) **Visualise segment analysis results for choice**

a) Select the “axial_map_segment” to explore
b) Select the “CHr400m” attribute
c) Increase the line width to 0.75
d) Set intervals to “Custom (Equal)”
e) Change the Top value to 20
f) Click the “Apply Symbology” button
g) This is the standard depthmapX display for the Choice measure
h) Save an image of the map window
i) Set intervals to “Natural breaks”
j) Click the “Apply Symbology” button
k) Set intervals to “Quantiles”
l) Click the “Apply Symbology” button
m) Save an image of the map window