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

Task 2: Preparing and analysing road centre line models

Description

This exercise explains the workflow of space syntax analysis using road centre line (RCL) maps as the starting point. It includes different types of RCL maps to understand the different issues they raise. The task involves the preparation of the map (cleaning and simplification), followed by segment angular analysis. The results of different network measures can be displayed following the same steps from Task 1.

Stage 1 – Explore RCL maps

1) **Prepare the project**
   a) In the 'Layers Panel' in your QGIS project expand the 'road centre lines' group.
   b) Explore the differences in between OS Meridian 2, OS Open Roads and OSM (geometry representation of the street network, street segments included, and attributes)
   c) Create a new group of layers, selecting 'Add Group' in the Layers Panel context menu.
   d) Rename the group to "Task2 RCL".

Stage 2 – Clean RCL maps

2) **OS Open Roads**
   a) Start 'RCL Cleaner' from the SST toolbar
   b) Select "road_os_openroads" as the input layer to clean
   c) Do not select to snap endpoints
   d) Specify output type as memory layer
   e) Change the name of the cleaned memory layer to "road_os_openroads_cleaned"
   f) Select to load errors and unlinks and press OK
   g) Rename errors memory layer to "road_os_openroads_errors"
   h) Rename unlinks memory layer to "road_os_openroads_unlinks"

3) **OS Meridian2**
   a) Start 'RCL Cleaner' from the SST toolbar
   b) Select "road_os_meridian2" as the input layer to clean

c) Specify snapping threshold to 3 decimals
d) Specify output type as PostGIS (or memory if you don't have PostGIS)
e) Click '…' and select the database and schema (ignore if you don't have PostGIS)
f) Specify output name as "road_ os_meridian2_cleaned" and press OK
g) Select to load errors and unlinks and press OK
h) Rename errors memory layer to "road_os_meridian2_errors"
i) Rename unlinks memory layer to "road_os_meridian2_unlinks"

4) **OpenStreetMap**
   a) Start 'RCL Cleaner' from the SST toolbar
   b) Select "road_openstreetmap" as the input layer to clean
   c) Specify snapping threshold to 3 decimals
   d) Specify output type as shapefile
   e) Click '…' and select the file output location
   f) Specify output name as "road_openstreetmap_cleaned" and press OK
   g) Select to load errors and press OK
   h) Rename errors memory layer to "road_openstreetmap_errors"
   i) Rename unlinks memory layer to "road_openstreetmap_unlinks"

Stage 3 – Compare clean RCL maps

5) **Explore results**
   a) Compare the maps in group 'road centre lines' > 'clean' if you haven't completed the previous stage
   b) Compare errors layers of the three cleaned RCL layers, both the geometry and the type of error
   c) Compare unlinks layers of the three cleaned RCL layers
   d) Delete the 'road_openstreetmap_unlinks' layer you created: these are wrong and are not needed for analysis of OpenStreetMap.

Stage 4 – Simplify RCL maps

6) **OS Open Roads**
   a) Go to 'Processing' > 'Toolbox' to open the toolbox panel
   b) Type 'simplify' in the search and select the 'Simplify geometries' tool
   c) Select "road_os_openroads_cleaned" as input
   d) Set the tolerance value to 10
   e) Specify output file location and name "road_os_openroads_simp10"
   f) Repeat with tolerance 20

g) Compare the results with the clean Meridian2 map.

7) **OpenStreetMap**

a) Go to ‘Processing’ > ‘Toolbox’ to open the toolbox panel
b) Type ‘simplify’ in the search and select the ‘Simplify geometries’ tool
c) Select “road_os_openroads_cleaned” as input
d) Set the tolerance value to 10
e) Specify output file location and name “road_os_openstreetmap_simp10”
f) Repeat with tolerance 20
g) Compare the results with the simplified OS Open Roads and clean Meridian2 maps.

Stage 5 – Prepare RCL maps for analysis

8) **OS Open Roads**

a) Start the ‘Graph Analysis’ tool from the SST toolbar
b) In the map tab select the “road_os_openroads_simp10” layer
c) In the unlinks tab load the “road_os_openroads_unlinks” layer
d) Open the ‘Verify Layer’ tab and click ‘Verify’
e) Zoom to the unlink errors, notice the intersection with 4 segments
f) Make the road layer editable (set ‘Settings’ > Snapping options…’ if needed)
g) Modify the segments so that only two segments cross at the unlink location
h) Save the changes
i) Click ‘Update IDs’ and then click ‘Verify’ again

9) **OpenStreetMap / OS Meridian2**

a) Load the ‘Graph Analysis’ tool from the SST toolbar
b) In the map tab select the “road_os_openstreetmap_simp10” or the “road_ os_meridian2_cleaned” layer
c) In the unlinks tab load the “road_os_meridian2_unlinks” layer
d) Open the ‘Verify Layer’ tab
e) Click ‘Update IDs’ and then click ‘Verify’
f) No errors to correct, the map data has the standard RCL representation with two segments crossing at the unlink location.
g) In the unlinks tab deselect the unlinks layer (‘------‘)

Stage 6 – Analyse RCL maps

10) **OS Open Roads / OS Meridian2 / OpenStreetMap**

a) Load the ‘Graph Analysis’ tool from the SST toolbar

b) In the ‘Map’ tab select the input layer you want to analyse
c) Tick “Segment map or road centre line map”
d) In the ‘DepthmapX Remote’ tab select ‘Segment’, specify the radius of analysis as ‘n,400, 800, 1200, 2000’
e) Mofdify the output table name if necessary
f) Make sure that you have depthmapXNet running in the background.
g) Click ‘Calculate’ and wait

Task 3: Preparing other urban data layers – Urban Data Input Tool

Description

This exercise offers the experience of a complete workflow of mapping urban data (frontages, entrances and land uses) using the Space Syntax standards for QGIS.

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 – Frontages data input

1) **Prepare the project**
    a) Open the sample data project (sample_data.qgs)
    b) Make sure the 'Building' layer is present in the layers panel
    c) Start the UrbanDataInput tool from the Space Syntax Toolkit menu or toolbar
    d) Select the 'Frontage' tab

2) **Create frontage layer**
    a) Click the 'Create New' button
    b) There are several ways to get started with a new frontage layer, we try one
    c) Memory layer from existing building layer:
        i) Don't set the save location
        ii) Select the 'Use building layer' check box.
        iii) Select the 'buildings' layers from the drop-down menu.
        iv) Click OK
    d) The memory layer is a temporary layer that disappears after closing QGIS. You need to save it as a shape file to keep the data.

3) **Draw frontages**
    a) Choose one of the following options:
        i) Building
        ii) Fences
    b) If you choose 'Building', you can choose the following sub categories-
        i) Transparent (e.g. shop fronts with large windows)

   ii) Semi-transparent (e.g. wall with some windows)
   iii) Blank (e.g. blank wall with no windows)
c) If you choose 'Fences', you can further choose from the following sub categories -
   i) High Opaque Fence (or wall)
   ii) High See Through Fence
   iii) Low Fence (e.g. below waist level)
d) Select the 'Add Feature' from the Digitizing QGIS toolbar.
e) Draw lines along the respective building.

4) **Update frontages**
   a) Select the Frontage (line) to update
   b) Observe the attribute values in the data table
   c) Choose one of the following options:
      i) Building
      ii) Fences
   d) If you choose 'Building', you can set one of the sub categories (see above)
   e) If you choose 'Fences', you can further set from the sub category (see above)
   f) Click 'Update Type' at the bottom left on the Urban Data Input tool panel

5) **View attributes of selected features of the frontage layer**
   a) Use the 'Select features' QGIS tool to select the required frontages.
   b) The attributes related to the selected frontages will now be displayed in the Urban Data Input tool

6) **Update Frontages ID**
   a) If you have a Frontage layer loaded on the map canvas press 'Update IDs' to update the 'F-ID' attribute of the Frontage layer

7) **Update Frontages Length**
   a) If you have a Frontage layer loaded on the map canvas press 'Update Length' to update the 'Length' attribute of the Frontage layer

8) **Hide frontages**
   a) To hide the lines with no value for Frontage type press the 'Hide' button at the bottom right of the tool.
   b) To make the lines with no value for Frontage type reappear press the 'Hide' button again at the bottom right of the tool

Stage 2 – Entrances data input

9) **Create entrance layer**
   a) Shapefile:
      i) Click the 'Create New' button
      ii) Click the '…' button and select location to save the Shapefile.
      iii) Click OK

10) **Draw entrances**
   a) Choose one of the following options:
      i) Controlled
      ii) Uncontrolled
   b) If you choose 'Controlled', you can choose the following sub categories-
      i) Default
      ii) Fire Exit
      iii) Service Entrance
      iv) Unused
   c) If you choose 'Uncontrolled', you can further choose from the following sub categories -
      i) Default
   d) Select the 'Add Feature' from the Digitizing QGIS toolbar.
   e) Draw points at appropriate locations along the respective building.

11) **Update entrances**
   a) Select the Entrance (point) to update
   b) Observe the attribute values in the data table
   c) Choose one of the following options:
      i) Controlled
      ii) Uncontrolled
   d) If you choose 'Controlled' you can set one of the sub categories (see above)
   e) If you choose 'Uncontrolled' you can further set from the sub category (see above)
   f) Click 'Update Type' at the bottom left on the Urban Data Input tool panel

12) **View attributes of selected features of the entrances layer**
   a) Use the 'Select features' QGIS tool to select the required entrances.
   b) The attributes related to the selected entrances will now be displayed in the Urban Data Input tool

13) **Update Frontages ID**
    a) If you have a Entrances layer loaded on the map canvas press ‘Update IDs’ to update the ‘E-ID’ attribute of the Entrances layer

Stage 3 – Land use data input

14) **Create frontage layer**
    a) Select the ‘Land Use’ tab
    b) Click the ‘Create New’ button
    c) Shapefile from existing building layer:
        i) Click the ‘…’ button and select location to save the Shapefile.
        ii) Select the ‘Use building layer’ check box.
        iii) Select the ‘buildings’ layers from the drop-down menu.
        iv) Select the appropriate ID column from the drop-down menu.
        v) Click OK

15) **Draw Land Use blocks**
    a) Choose one of the 21 available land use categories.
    b) Choose one of the Sub Category options if available. Some land use categories also have Sub Categories, e.g. Catering has 3 Sub Categories:
        i) Restaurants and cafes
        ii) Drinking Establishments
        iii) Hot Food Takeaways
    c) Add an integer for ‘Total number of floors:’ if required. Leave 0 if no data available.
    d) Add ‘Description’ if required. Leave blank if no description needed.
    e) Select the ‘Add Feature’ from the Digitizing QGIS toolbar.
    f) Draw polygons to represent the buildings as required.

16) **Update Land Use blocks**
    a) Select the Land Use blocks (polygon) to update
    b) Choose one of the 21 available land use categories.
    c) Choose one of the Sub Category options if available.
    d) Add an integer for ‘Total number of floors:’ if required. Leave 0 if no data available.
    e) Add ‘Description’ if required. Leave blank if no description needed.
    f) Click ‘Update Type’ at the bottom left on the tool

17) **View attributes of selected features of the Land Use layer**
    a) Use the ‘Select features’ QGIS tool to select the required land use blocks.

b) The attributes related to the selected land use blocks will now be displayed in the Urban Data Input tool.

18) **Update Land Use ID**

a) If you have a Land Use layer loaded on the map canvas press ‘Update IDs’ to update the ‘LU-ID’ attribute of the Frontage layer

Task 3: Preparing other urban data layers – Catchment Analyser

Description

This exercise introduces the Catchment Analyser tool to produce a single station or multiple stations metric catchment analysis (service area). This exercise requires the Public transport stations dataset and the OS Meridian2 road centre line dataset.

1) **Prepare the project**
   a) Make the public transport layer visible
   b) Make the OS Meridian2 road centre line visible
   c) Start the Catchment Analyser tool from the Space Syntax Toolkit menu or toolbar

2) **Run the catchment analysis for individual origins and all**
   a) The aim of this step is to run the catchment analysis for individual stations and for all stations combined (the minimum distance to any station)
   b) For the network layer, select the OS Meridian2 line layer
   c) For the origin layer, select the Public transport point layer
   d) Leave the custom origin names empty, or check and select 'name_of_st'
   e) For the cost bands, type the following distances: 400,800,1200,1600,2000
   f) Ensure the catchment network is ticked
   g) Click on the "..." button to save the catchment network output as a new shapefile.
   h) Ensure the catchment polygon is ticked
   i) Click on the "..." button to save the catchment polygon output as a new shapefile.
   j) If you leave these blank no files are created, only temporary layers that later need to be saved.
   k) Press run
   l) Two layers are created that show these network catchment bands and polygon bands

3) **Run the catchment analysis for individual lines**
   a) The aim of this step is to run the catchment analysis for individual underground (tube) lines rather than for individual stations
   b) For the network layer, select the OS Meridian2 line layer

c) For the origin layer, select the Public transport point layer
d) Click on the custom origin names
e) Select "lines" in the custom origin name menu
f) This will do the catchment for groups of stations based on the tube line.
g) For the cost bands, type the following distances: 400,800,1200,1600,2000
h) Ensure the catchment network is ticked
i) Click on the "..." button to save the catchment network output as a new shapefile.
j) Ensure the catchment polygon is ticked
k) Click on the "..." button to save the catchment polygon output as a new shapefile.
l) If you leave these blank no files are created, only temporary layers that later need to be saved.
m) Press run
n) Two layers are created that show these network catchment bands and polygon bands

4) **Visualise catchment analysis along network**
   a) To visualise the catchment analysis for individual stations, double click on the "catchment_network_meridian2" in the layers panel
      i) Go to 'Style'
      ii) Under columns, select the "station" you would like to visualise
      iii) Click ok
      iv) The map shows the catchment for the selected station as colour gradient.
   b) If you want to visualise the catchment analysis for all the stations, double click again on the "catchment_network_meridian2" under the layers panel
      i) Go to 'Style'
      ii) Under columns, select the "min_dist"
      iii) Click ok
      iv) The map now shows the catchment from all stations, with the value on each segment being the distance to the nearest station (minimum distance)
   c) If you want to visualise the catchment analysis for individual tube lines, double click again on the "catchment_network" from the line results (step 3) under the layers panel
      i) Go to 'Style'
      ii) Under columns, select the "line" you want to visualise (e.g. northern line)
      iii) Click ok
      iv) The map shows the catchment analysis from the stations on the specific tube line

5) **Visualise catchment analysis polygons**

a) The catchment polygons are not styled and all overlap. To view polygons from specific stations we must filter the layer.
b) Right click the layer "catchment_areas_meridian2"
c) Select the ‘Filter…’ tool
d) Select the “origin” field in the “Fields” box
e) To see available Values click the Sample or the All button
f) Add the ‘origin’ Field to the Filter expression box at the bottom, by clicking or typing “origin”
g) Type “=” or use the operator button
h) Type the station name or double click the name in the Values box
i) Click OK
j) The map now shows the polygons from the selected station
k) Filter for more than one station using the expression: “origin” IN (‘station1’,’station2’)
l) Filter for specific distances adding the distance condition: AND “distance” < 1200

Task 4: Connecting and analysing the various results – Gate Transformer and Space-movement correlation analysis

Description

This exercise introduces the Gate Transformer tool and the QGIS spatial join functions to produce a simple space-movement correlation analysis. This exercise requires the pedestrian count dataset, the OS Meridian2 line analysed dataset and the catchment network dataset from the previous exercise.

1) **Prepare the project**
   a) Make the Pedestrian counts layer visible
   b) Make the OS Meridian2 analysed road centre line visible
   c) Make the Catchment network layer visible

2) **Run Gate Transformer – Resize**
   a) The aim of this step is to resize the movement gates so it has a constant length for visualisation
   b) Start the "Gate transformer" tool by clicking on the gate transformer button or go to "SSToolkit" -> "Gate Transformer"
   c) Select the “Pedestrian count” layer
   d) Click on the "resize" radio button
   e) Set the length to "25" metres
   f) Click ‘Transform’
   g) This resizes the movement gates to the same length of "25" metres

3) **Visualise the Pedestrian counts layer**
   a) Start the "Attributes Explorer" SST tool
   b) Select the newly created join layer
   c) Select "Symbology" tab
   d) Select the "Pedmov" attribute
   e) Set colour range as "Classic"
   f) Increase the line width to 0.5
   g) Set Intervals to "Equal Intervals"

h) Click the "Apply Symbology" button
i) This is the standard display for the pedestrian movement data
j) You can add arrows by going to the ‘Style’ panel of the layer
k) Save an image of the map window

4) **Run Gate Transformer - Rotate**
   a) The aim of this step is to rotate the movement gates so it intersects with the segment layer
   b) Start the "Gate transformer" tool by clicking on the gate transformer button or go to "SSToolkit" -> "Gate Transformer"
   c) Select the “pedestrian count layer”
   d) Click on the "rotate" radio button
   e) Set the angle at "90" degrees
   f) Click ‘Transform’
   g) The gates are now rotated by "90" degrees.
   h) If the gates do not intersect with the segment layer, rotate again with a different angle until it intersects.
   i) Make sure the gates intersect the correct corresponding segment.

5) **Pedestrian count gate and space syntax measures spatial join**
   a) The aim of this step is to join the pedestrian count gate data layer and the OS Meridian2 analysed map
   b) Go to the "vector" menu at the top - "data management tools" - "join attributes by location"
   c) Select the “pedestrian count” layer as target layer
   d) Select the “OS Meridian2 analysed” layer as join vector layer
   e) Check the intersect button
   f) Leave the other parameters as default
   g) Press run to create a temporary join layer
   h) The temporary layer contains both the movement data and the space syntax measures where the two intersect

6) **Pedestrian count gate and catchment analysis spatial join**
   a) The aim of this step is to join the pedestrian counts gate data layer and the catchment analysis map
   b) Go to the "vector" menu at the top - "data management tools" - "join attributes by location"

c) Select the “pedestrian count layer” as target layer
d) Select the “catchment network layer” as join vector layer
e) Check the intersect button
f) Leave the other parameters as default
g) Press run to create a temporary join layer
h) The temporary layer shows both the movement data and the distance to tube stations where the two intersect

7) **Statistical scatterplot analysis of two variables**
a) Start the "Attributes Explorer" SST tool
b) Select one of the newly created join layer
c) Select "Charts" tab
d) Select "Scatter plot" button
e) Under numeric attributes or X-axis, select "INT" (or the name of a tube station)
f) Under Y-axis, select "Pedmov"
g) The scatterplot shows the regression line, the equation of the line and the r2 (goodness of fit)