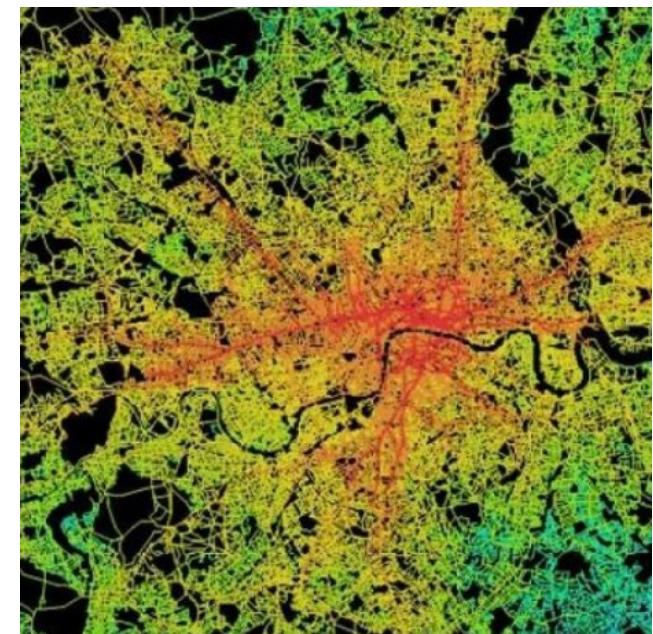


Space Syntax Toolkit for QGIS

Open source GIS and network analysis for space syntax research and practice

Jorge Gil

Space Syntax Laboratory
The Bartlett, UCL



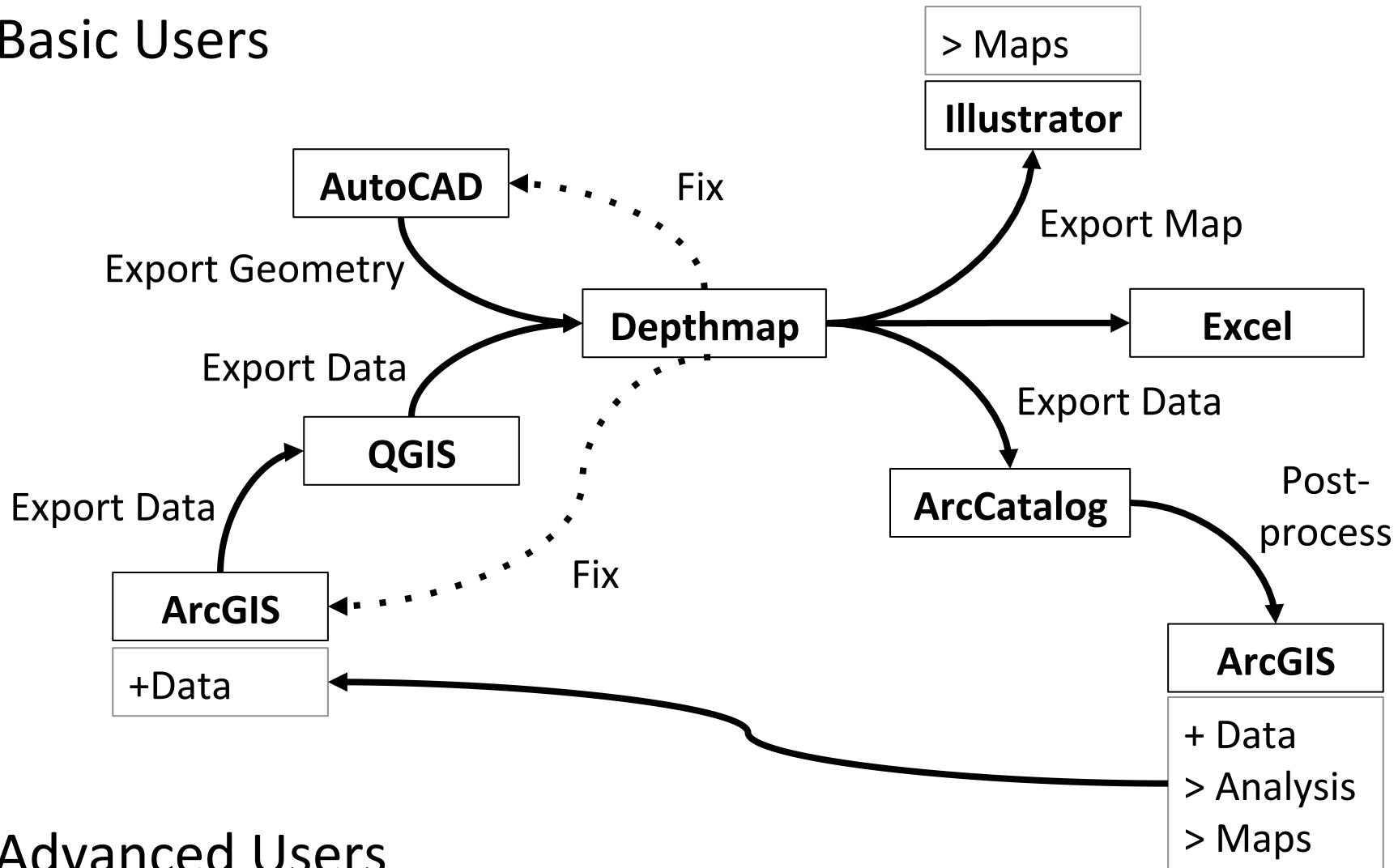
- Introduction to the Space Syntax Toolkit
- Installation
- Demonstration
- Feedback
- Break
- QGIS for space syntax research
- Exercise
- Additional resources
- Q&A

Space Syntax Toolkit for QGIS

An open source project for the space syntax community,
led by the Space Syntax Laboratory, The Bartlett, UCL

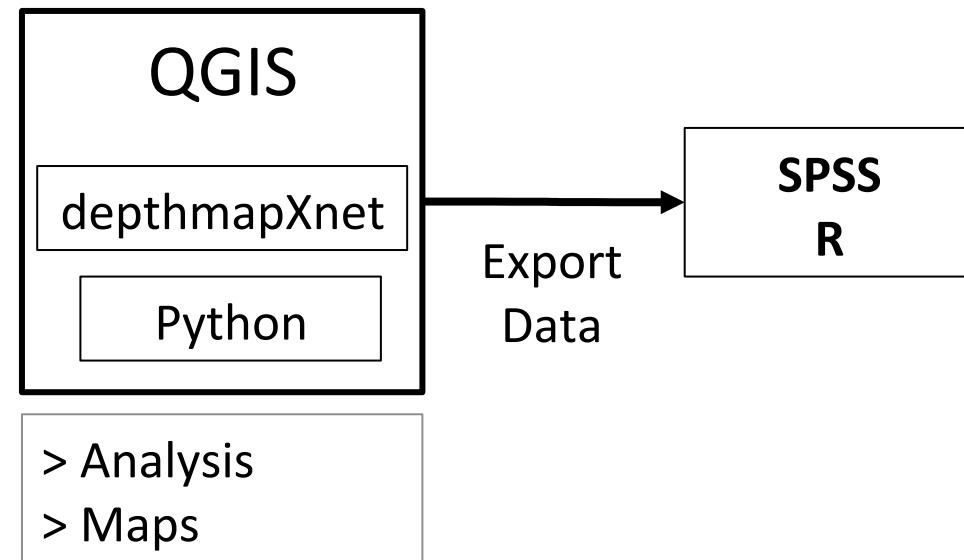
- **Integrate** space syntax spatial analysis (depthmapX) **with QGIS** for teaching and research
- **Expand** exploratory spatial and quantitative analysis features of **QGIS**
- **User friendly** tool for students: clear and linear workflows
- **Flexible** tool for researchers: analytic options and exploratory depth
- **Operational** tool for practice: robust, fast and optimised workflows

Basic Users



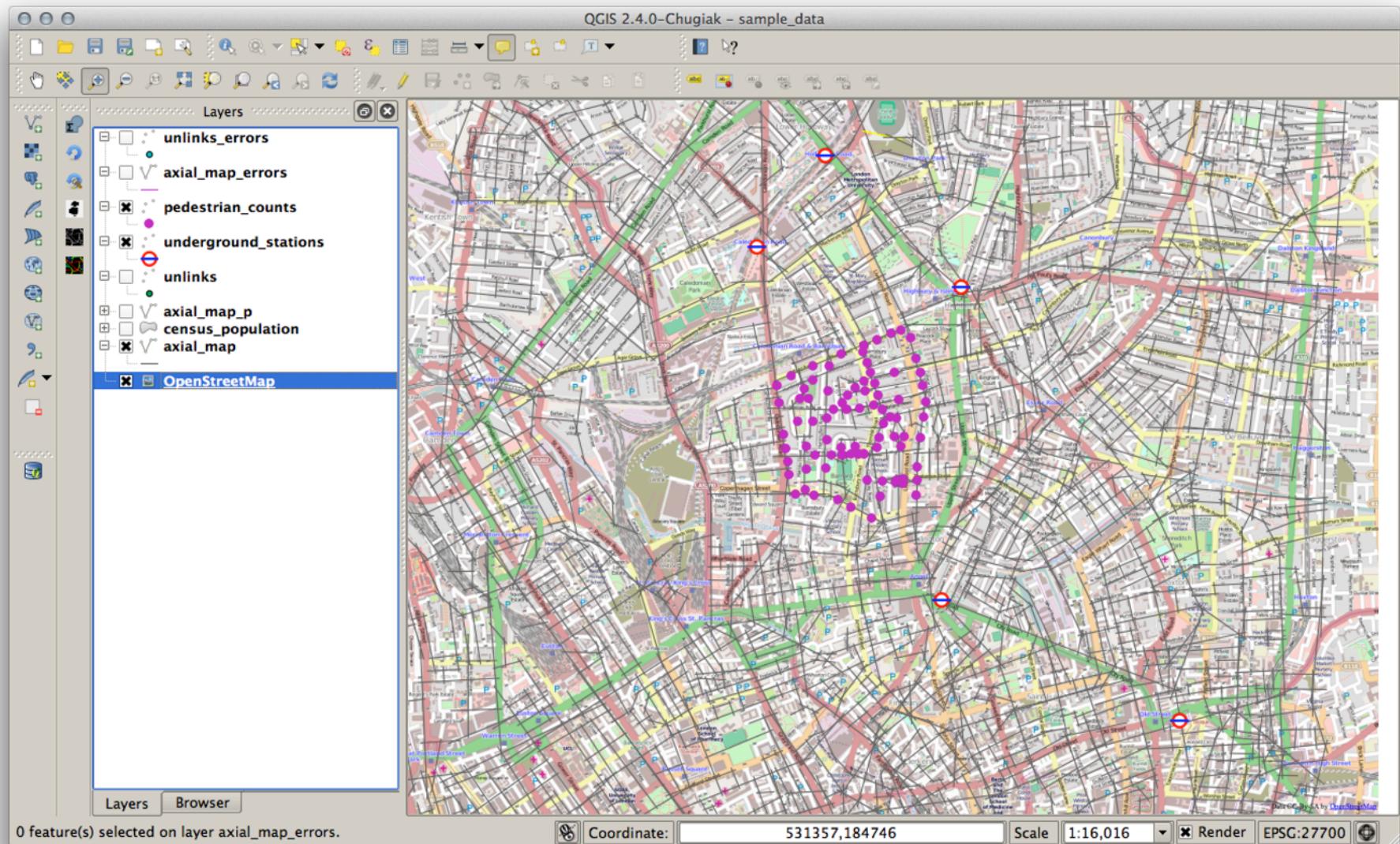
Advanced Users

Basic Users



Advanced Users

Why choose QGIS?



- Free and open source
- Cross-platform (Windows, Linux, Mac OSX, Android)
- Well documented (in English and other languages)
- User friendly interface
- Extensive input/output data format support
- Managed maintenance of plugins
- Flexible automation and customisation with Python

Space Syntax Toolkit (beta)

Graph Analysis

Data store SF: sst_sample_files ...

Map Unlinks Links Origins

Layer axial_map_errors

Verify layer depthmapX remote

Verify 100% Cancel

Update IDs All problems (11) Settings

ID	Problem
1	871 short line
2	400 island
3	401 island
4	402 island
5	403 island
6	1430 duplicate geometry
7	503 orphan
8	1435 short line
9	1916 polyline, coinciding points, small line, or...
10	1917 polyline
11	1918 duplicate geometry

Attributes Explorer

census_population

Numeric attributes:

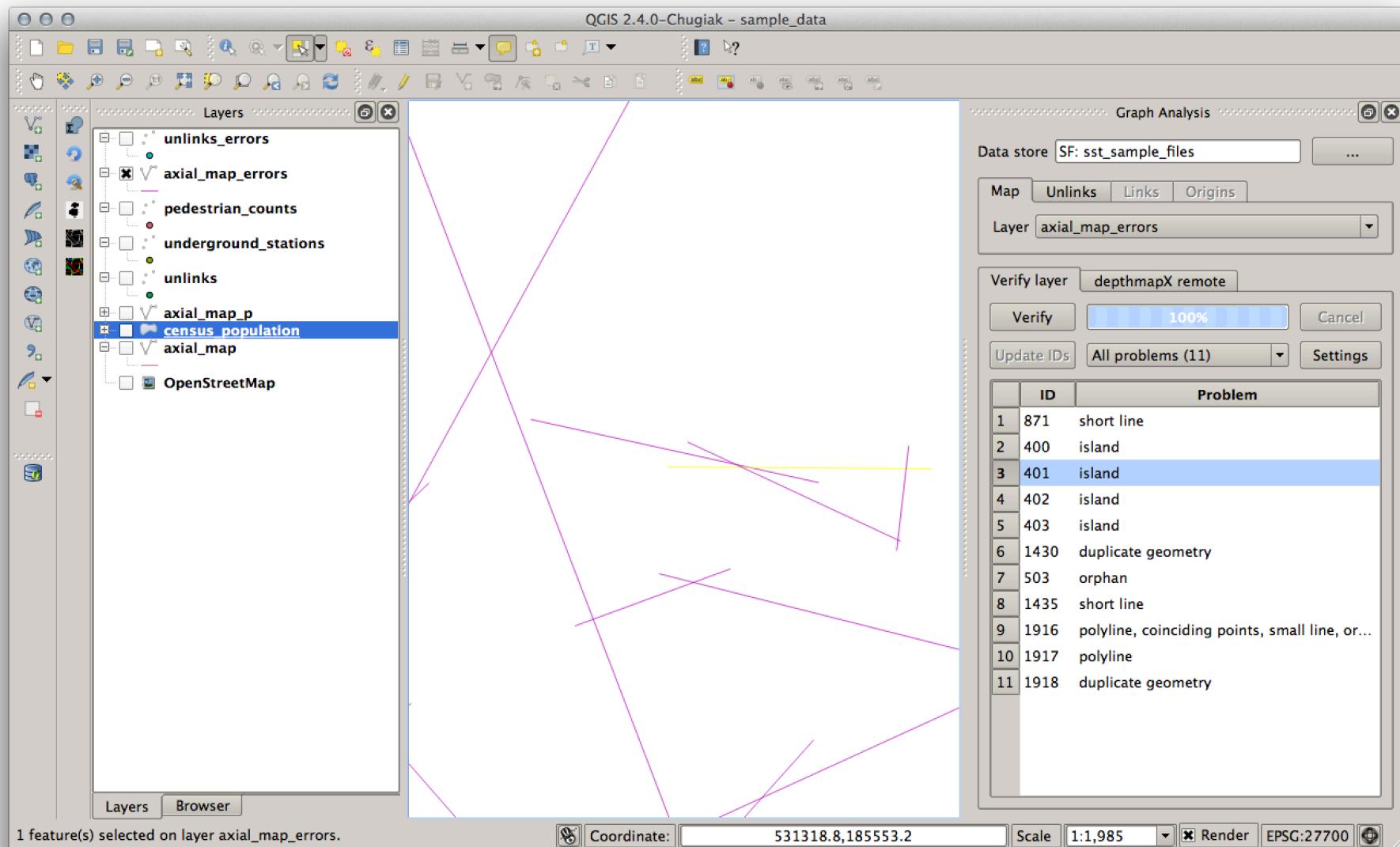
All_People
0_to_15
16_to_59
60_to_over
COUNT

Symbology Stats Charts

Statistic	Value	Selection
Mean	267.826530612	237.6
Std Dev	68.989503122	49.7155911159
Median	266.0	224.5
Minimum	83.0	152.0
Maximum	469.0	320.0
Range	386.0	386.0
1st Quart	219.25	207.5
3rd Quart	310.25	272.0
IQR	91.0	64.5
Gini	0.143140557172	0.114478114478

- Integrated tasks workflow:
 - Input data verification
 - Simple analysis, hidden advanced settings
- Analysis results post-processing and import
- Data input format agnostic
- Support native QGIS formats for output
- Alternative algorithms depending on:
 - installed python packages
 - data format used
- Optimised for geodatabase formats
- Multi-threaded analysis

Graph Analysis features



Graph Analysis features

Graph Analysis

Data store SF: sst_sample_files ...

Map Unlinks Links Origins

Layer axial_map

Verify layer depthmapX remote

● Axial ○ Segment Settings

Radius: 4,8,12,n

Weight: Line Length

Output table: axial_map

Calculate 0% Cancel

Running analysis...
Start: 02/09/2014 20:26:49
Finish: 02/09/2014 20:26:50
Post-processing: 02/09/2014 20:26:51
Total running time: 0:00:01.746986

Download depthmapXnet...

Advanced Settings

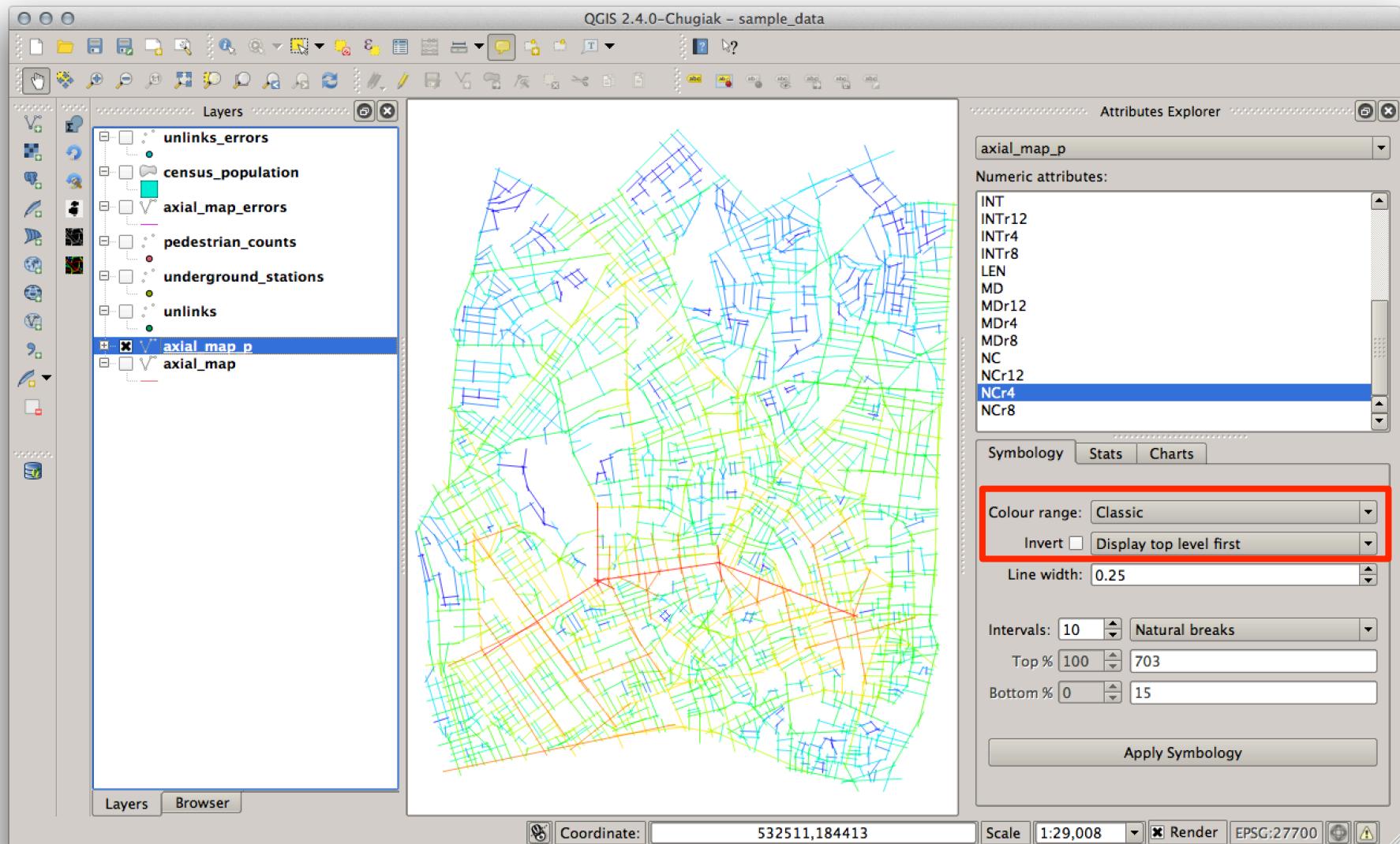
Calculate full set of measures
 Calculate choice
 Calculate NACH and NAIN
Radius type: Metric

Features total: 1915, filtered: 1915, selected: 0

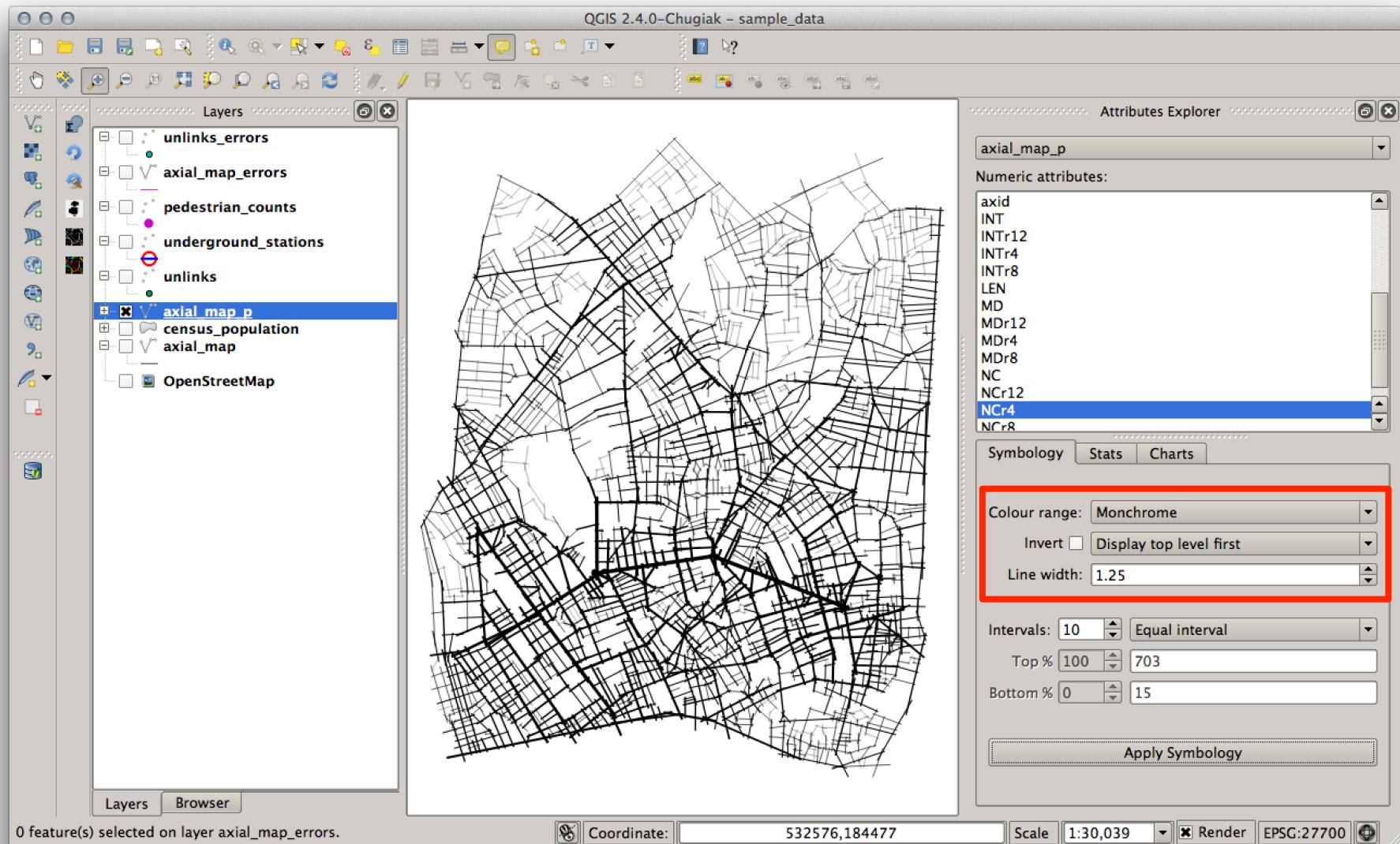
	y2	CH	Chr12	Chr4	Chr8	CO
0	198...	183833.197...	364211	301119	4825	100261
1	017...	184560.769...	92123	80610	996	29640
2	768...	184575.864...	126271	114312	3539	49059
3	483...	184123.694...	47928	46662	2220	22884
4	073...	184187.766...	49513	48837	2240	26287
5	531089.471...	184464.526...	531226.306...	184061.362...	20368	19838
6	531031.467...	184257.346...	531780.910...	184436.714...	27126	26372
7	531122.426...	183822.730...	531223.057...	184099.851...	34334	33470
8	530576.859...	184869.061...	530726.870...	183672.793...	354436	315941
9	531563.793...	183445.898...	531724.506...	183932.179...	127944	110472
10	531306.267...	184332.834...	531918.883...	184454.209...	38165	37076
11	531033.627...	185185.660...	531349.677...	184530.178...	54109	53461
12	531633.348...	184819.855...	531633.950...	184384.999...	310952	239764
13	531383.209...	183821.620...	531437.536...	184233.153...	22129	21805
14	530901.211...	183663.266...	530924.669...	184441.493...	69788	63677
15	530641.047...	183876.735...	531201.826...	183883.863...	38368	37330
16	531382.698...	183429.263...	531393.508...	184007.487...	32200	31823
17	531692.243...	183866.078...	532132.356...	183618.718...	239685	194478
18	531068.182...	183322.213...	531142.800...	183907.266...	60929	59885
19	531008.562...	183873.516...	531403.748...	183914.254...	25145	24881
20	531594.580...	184553.651...	531671.292...	184586.521...	558	556
21	531020.031...	184111.957...	531447.348...	184212.728...	14357	13882
22	531441.172...	183195.510...	531655.297...	183682.760...	192167	158036
23	530648.278...	184202.231...	531124.982...	184399.105...	6685	6639
24	531373.785...	183767.196...	531688.161...	183775.144...	29384	28929
25	530664.471...	183267.489...	530720.018...	183826.639...	96274	84438
26	531677.129...	184018.074...	531966.012...	183895.049...	22219	21860
27	530299.916...	183681.231...	530913.934...	183681.231...	252789	223532
28	530745.388...	184782.795...	530941.662...	184374.412...	19285	18733
29	531560.849...	183498.553...	531822.333...	183713.841...	62554	52812
30	531660.606...	184198.403...	532015.507...	184274.311...	27500	26964
31	531534.292...	183689.188...	531758.962...	183634.194...	49040	40824
					196	10961

- Intuitive and iterative exploration of attributes
- Simpler symbology settings
- Symbology for typical academic usage
- Store attributes symbol settings with project
- Allow interaction between tool and main window
- Synchronised presence of statistics and charts
- Keep data loaded for reuse across tabs

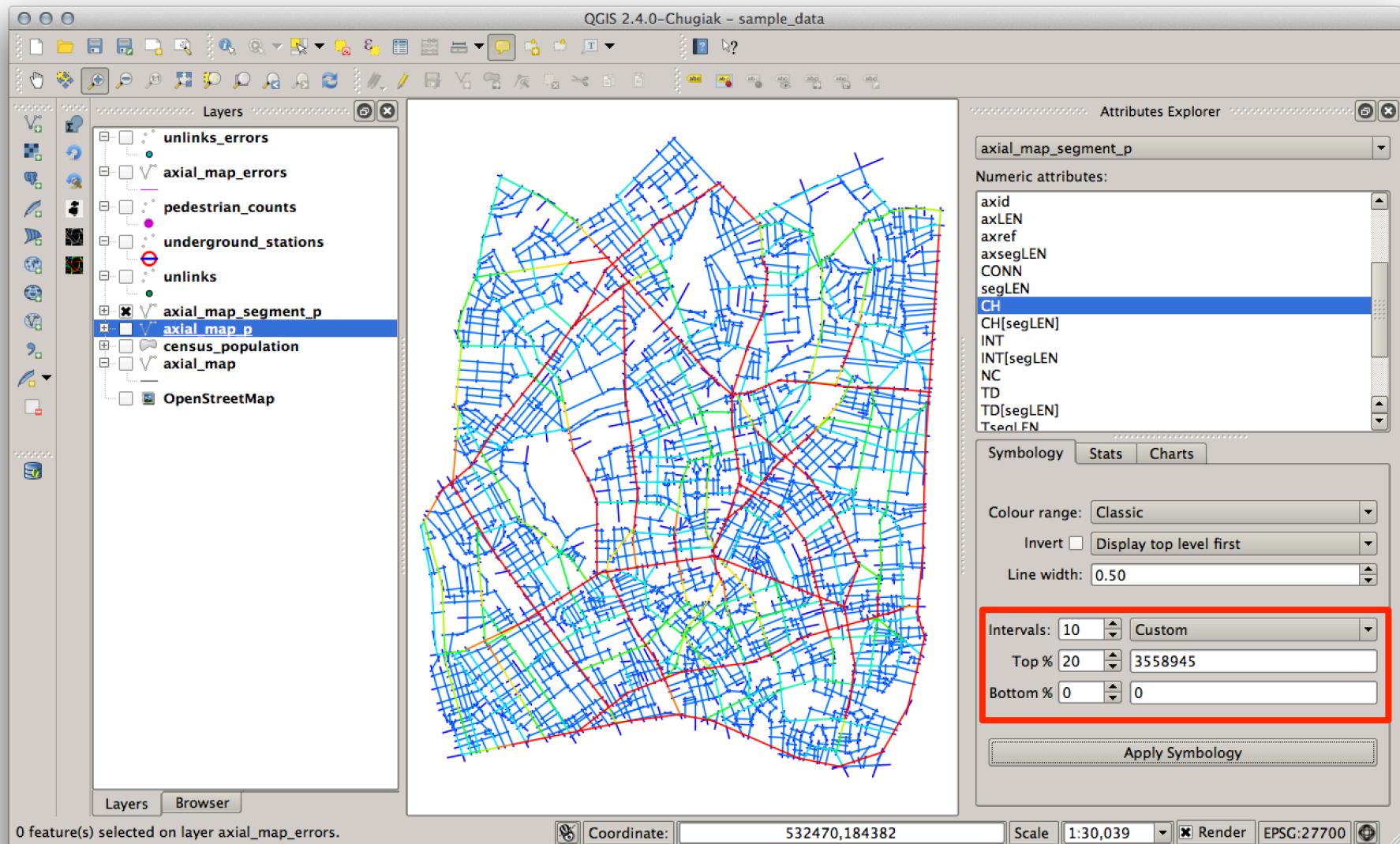
Attributes Explorer



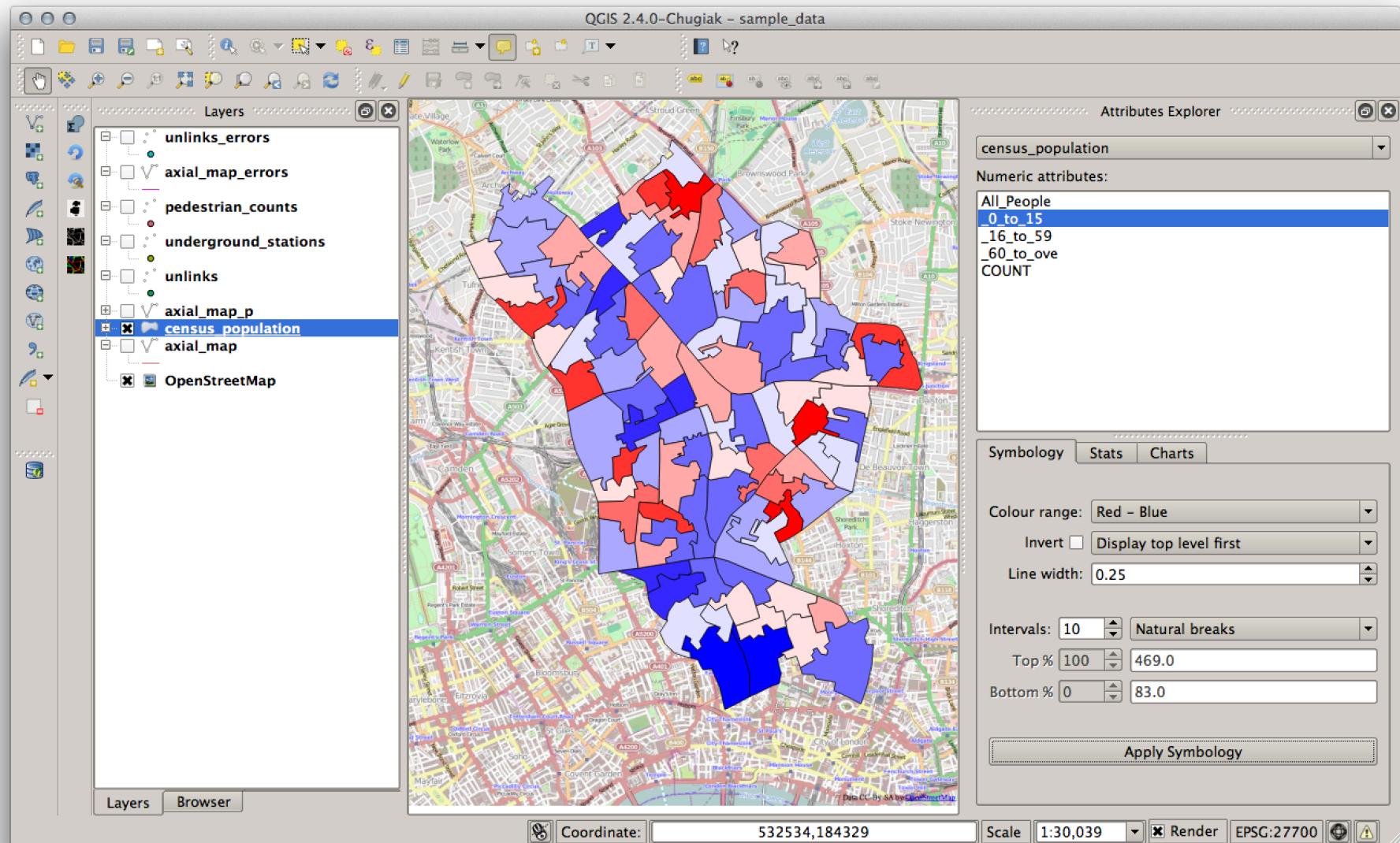
Attributes Explorer features



Attributes Explorer features

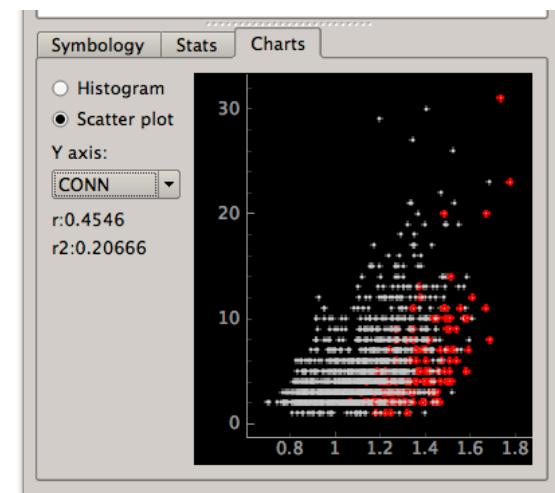
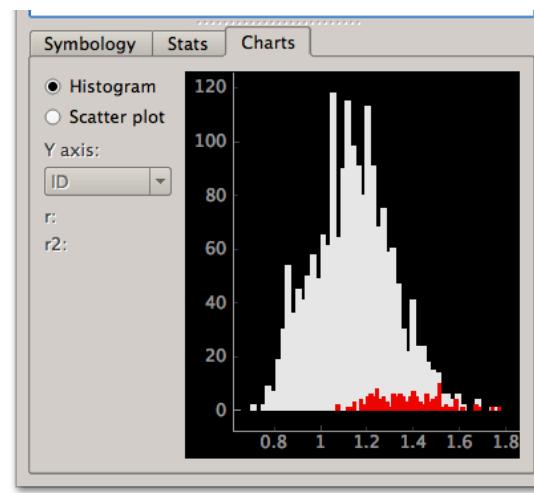


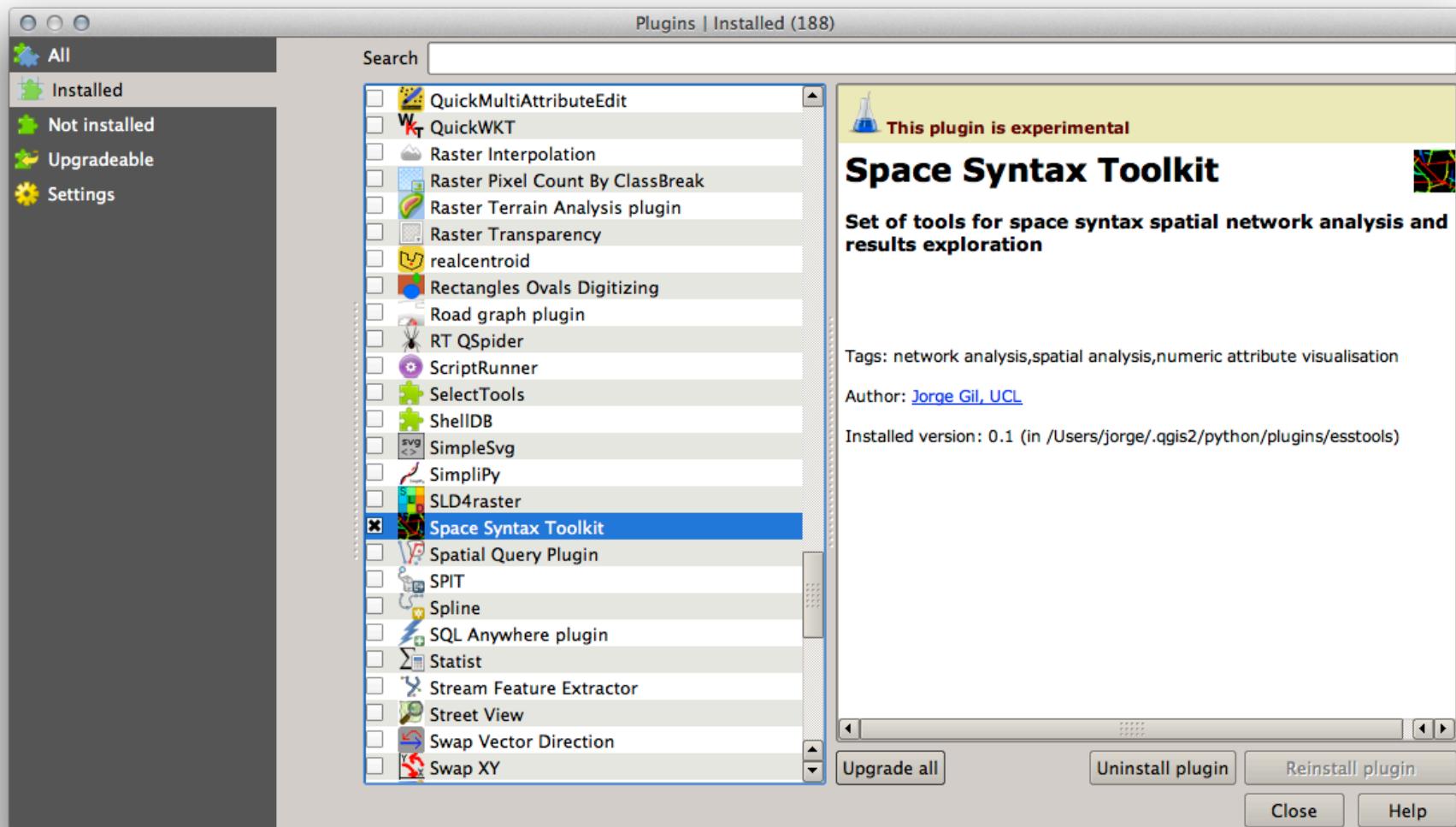
Attributes Explorer



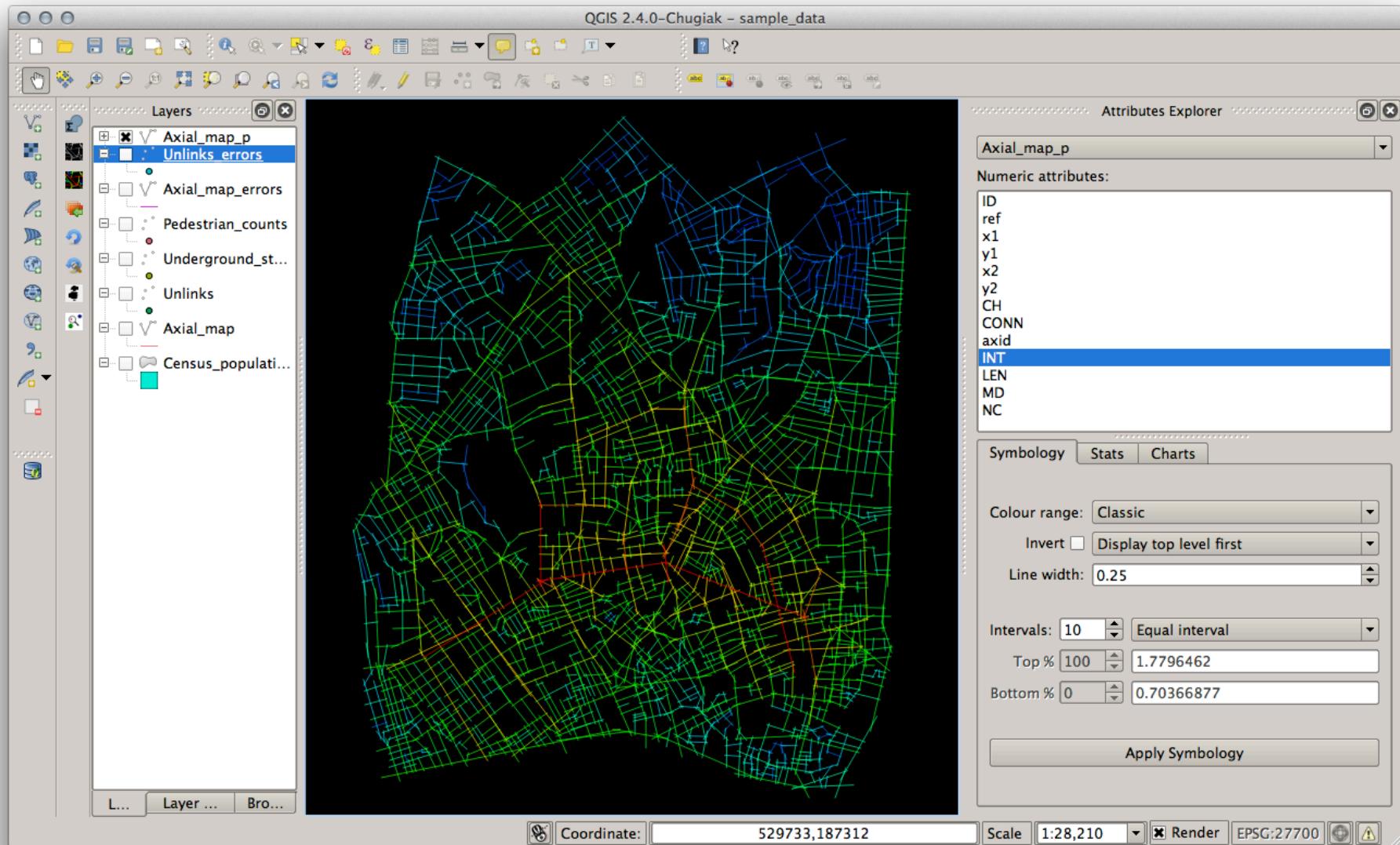
Attributes Explorer

Statistic	Value	Selection
Mean	1.14595585342	1.37035642571
Std Dev	0.170433853558	0.140481728418
Median	1.1428182	1.36595425
Minimum	0.70366877	1.071714
Maximum	1.7796462	1.7796462
Range	1.07597743	1.07597743
1st Quart	1.0310065	1.250248925
3rd Quart	1.25660885	1.4731474
IQR	0.22560235	0.222898475
Gini	0.0841057505602	0.0580875112952





Demonstration



- Testing and debugging
- Performance enhancements
- New features
- Distribution to the wider Space Syntax and QGIS communities (July 2015)

Space Syntax Toolkit wish and issues list in Github:

[https://github.com/SpaceGroupUCL/
qgisSpaceSyntaxToolkit/issues](https://github.com/SpaceGroupUCL/qgisSpaceSyntaxToolkit/issues)

Email:

jorge.gil@ucl.ac.uk



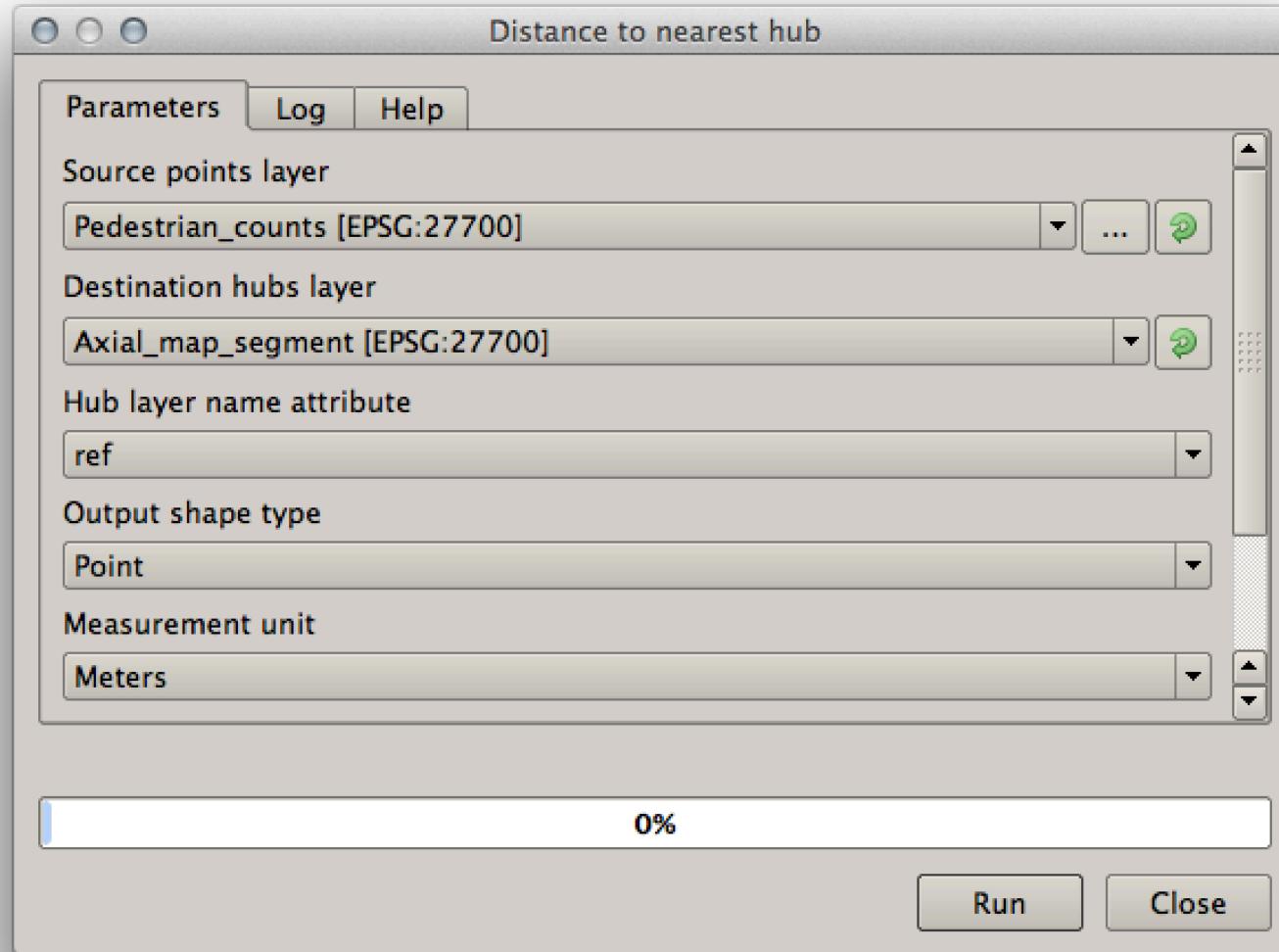
Stage	Operations
Data acquisition	Collect base map data Convert data formats Georeference vector and raster data User behaviour data entry Location survey data entry
Geo-processing	Filter, aggregate and join data based on attributes and spatial relations Find nearest feature Transform geometries Attributes update and calculation
Network model preparation	Draw map Extract map from larger data set Prepare plans Generalise road network Map verification Manage unlinks and links
Network analysis	Analyse network models (space syntax) Post process analysis results (attribute naming, selection, new calculations) Calculate shortest route and catchment areas Street and block morphology

Stage	Operations
Exploratory spatial data analysis	<p>Interactive visual exploration of results</p> <p>Inquiry of individual feature values</p> <p>Identify the core of the network</p> <p>Spatial analysis (interpolation, hotspots, clustering)</p> <p>Terrain analysis</p>
Statistical analysis	<p>Descriptive statistics</p> <p>Transform columns</p> <p>Interactive charts (histogram, scatter plot)</p> <p>Linear regression</p> <p>Multivariate regression</p> <p>Statistical clustering (PCA, k-means, hierarchical)</p> <p>Export data to statistics packages</p>
Reporting and visualisation	<p>Create base map compositions for print</p> <p>Set output format and resolution</p> <p>Standard visualisation (colour ranges) for screen and print</p> <p>Store named views</p> <p>Produce map series based on attributes</p>

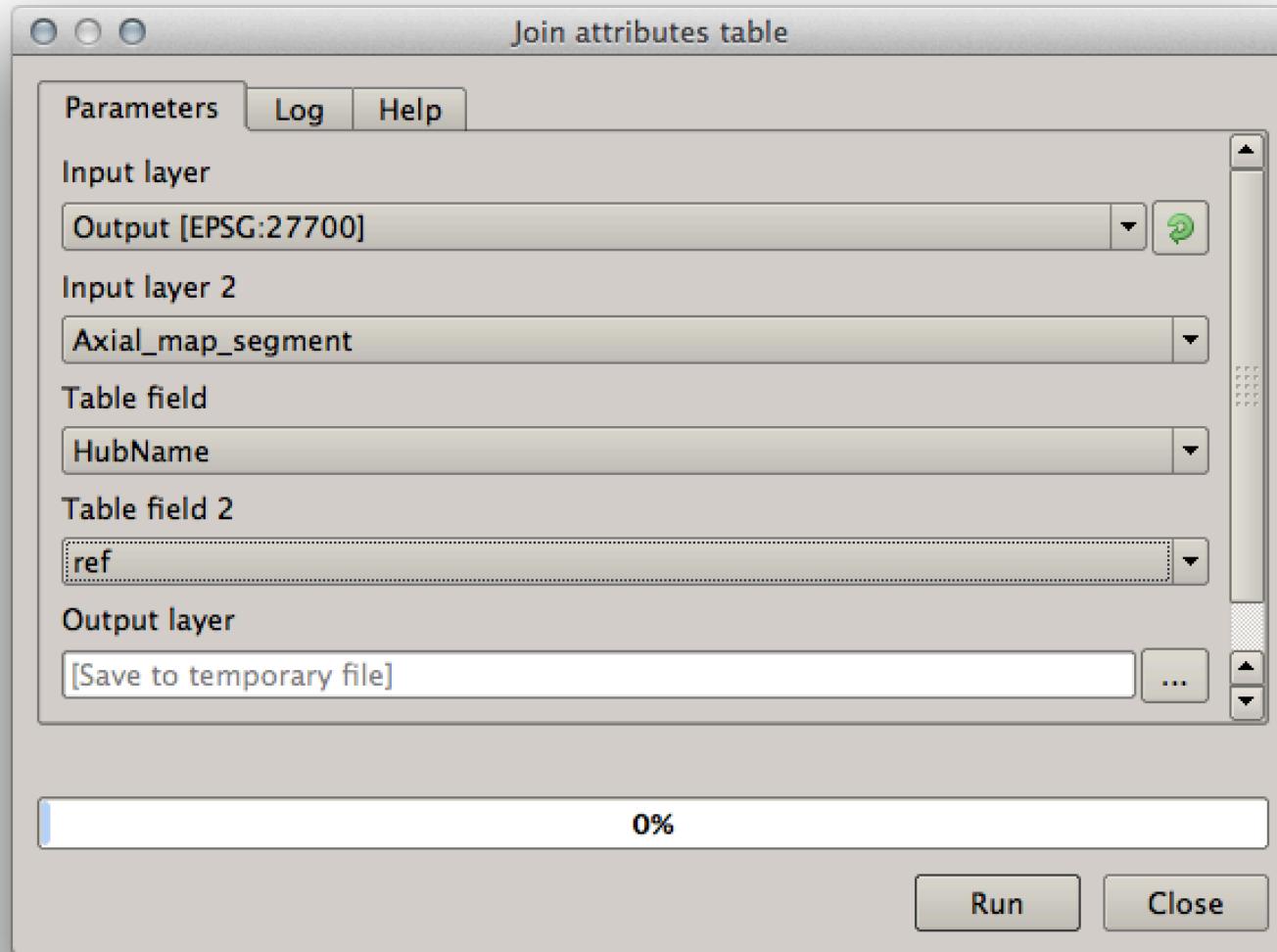
- Processing
- OpenLayers plugin
- Mmqgis
- NNJoin
- Dissolve with stats
- Table manager
- XyTools
- Contour plugin

1. Load base map
2. Create axial map and unlinks
3. Verify, analyse and visualise the results
4. Query the results
5. Link pedestrian counts to results and correlate
6. Aggregate centrality values on census polygons
7. Contour maps of distance to tube

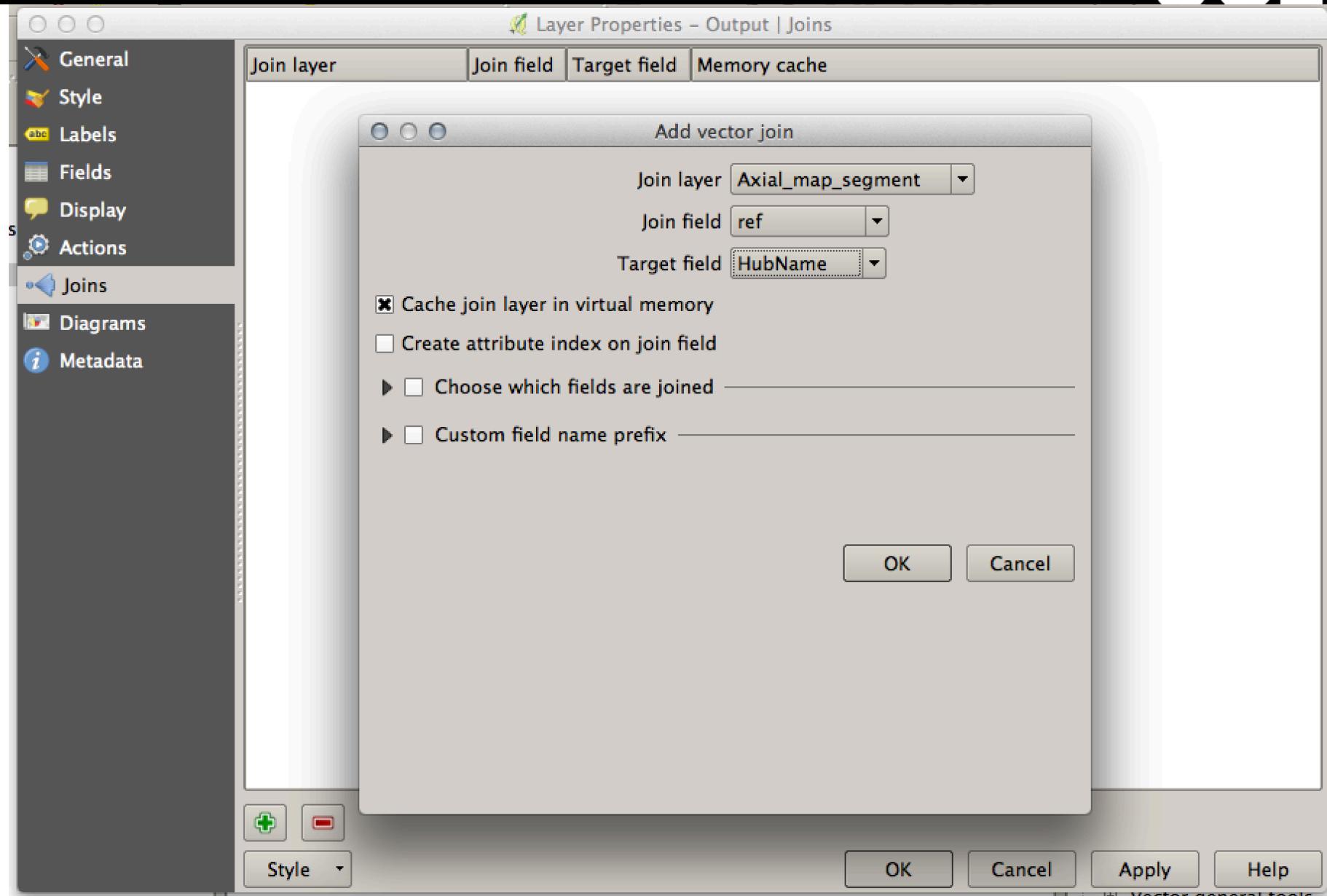
Exercise – step 5.1



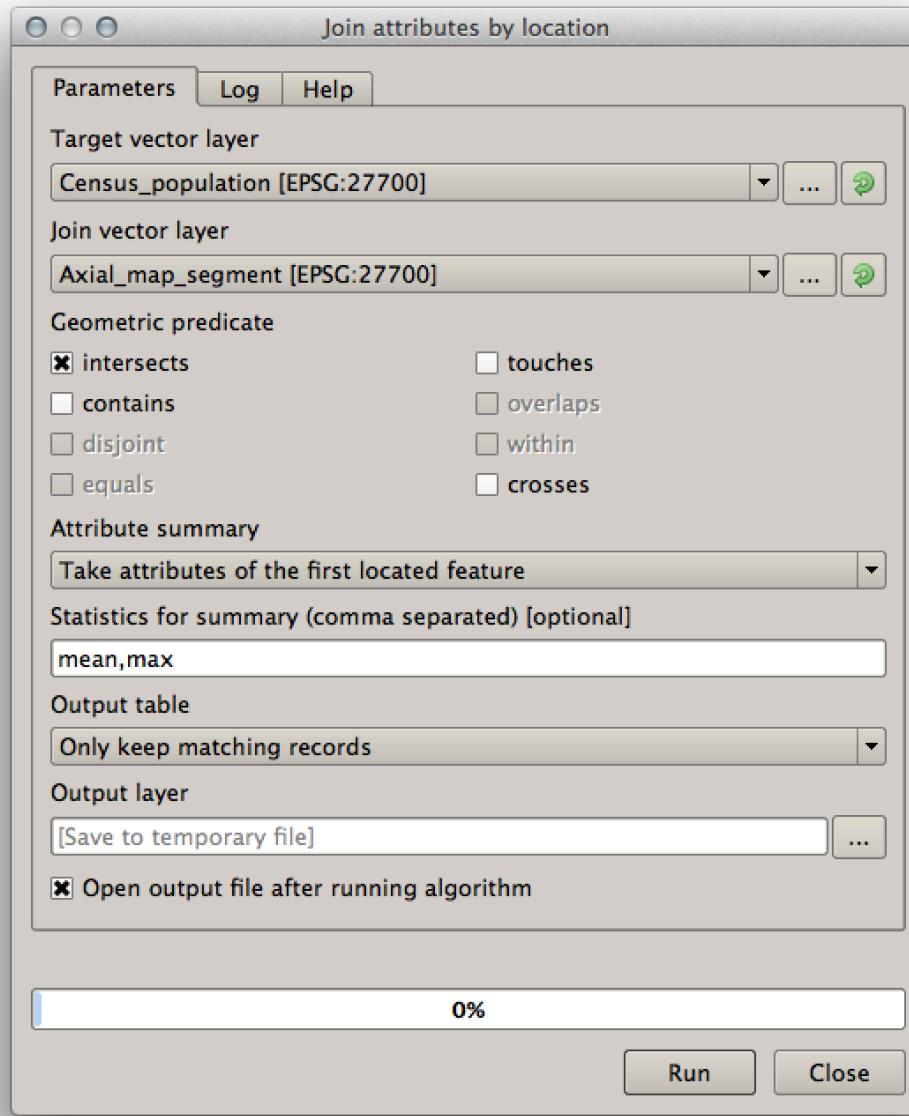
Exercise – step 5.2



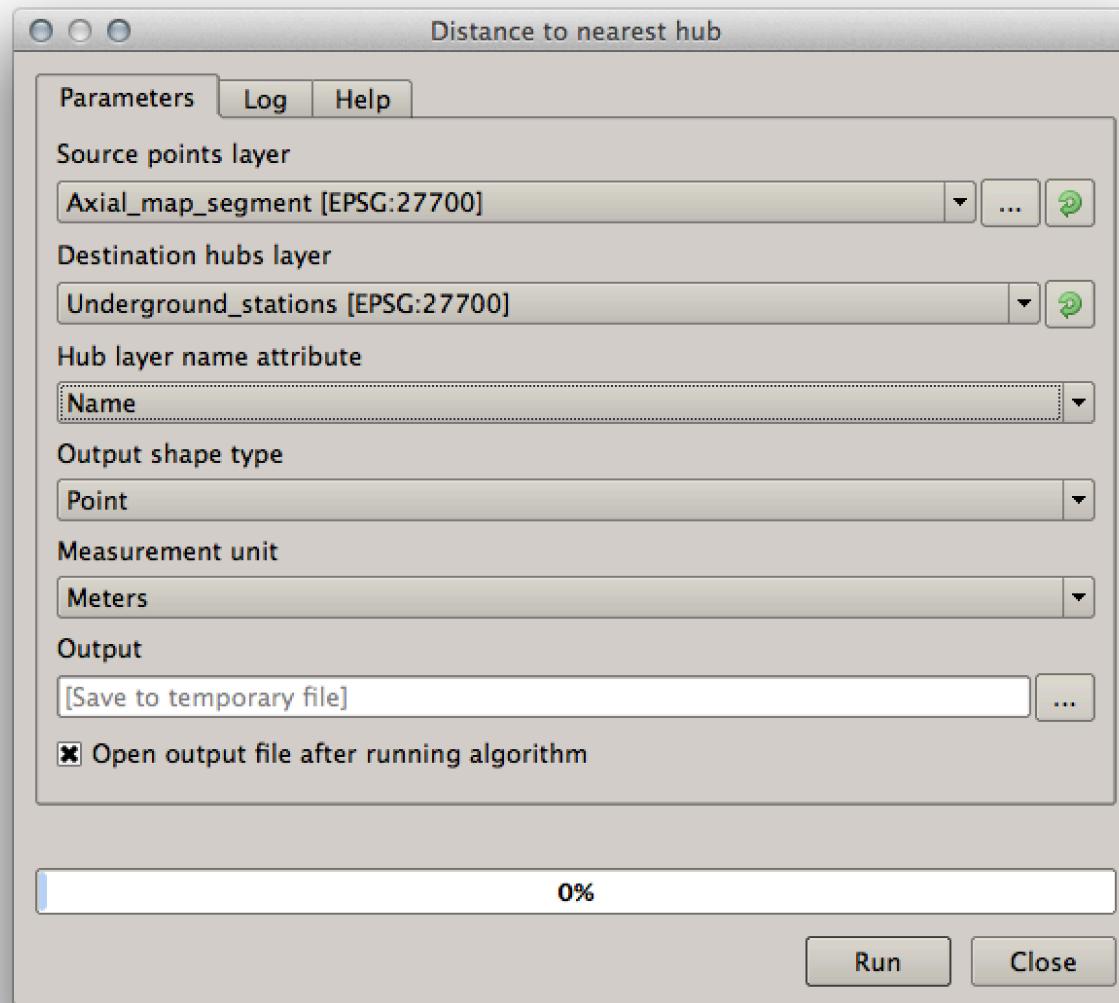
Exercise – step 5.2



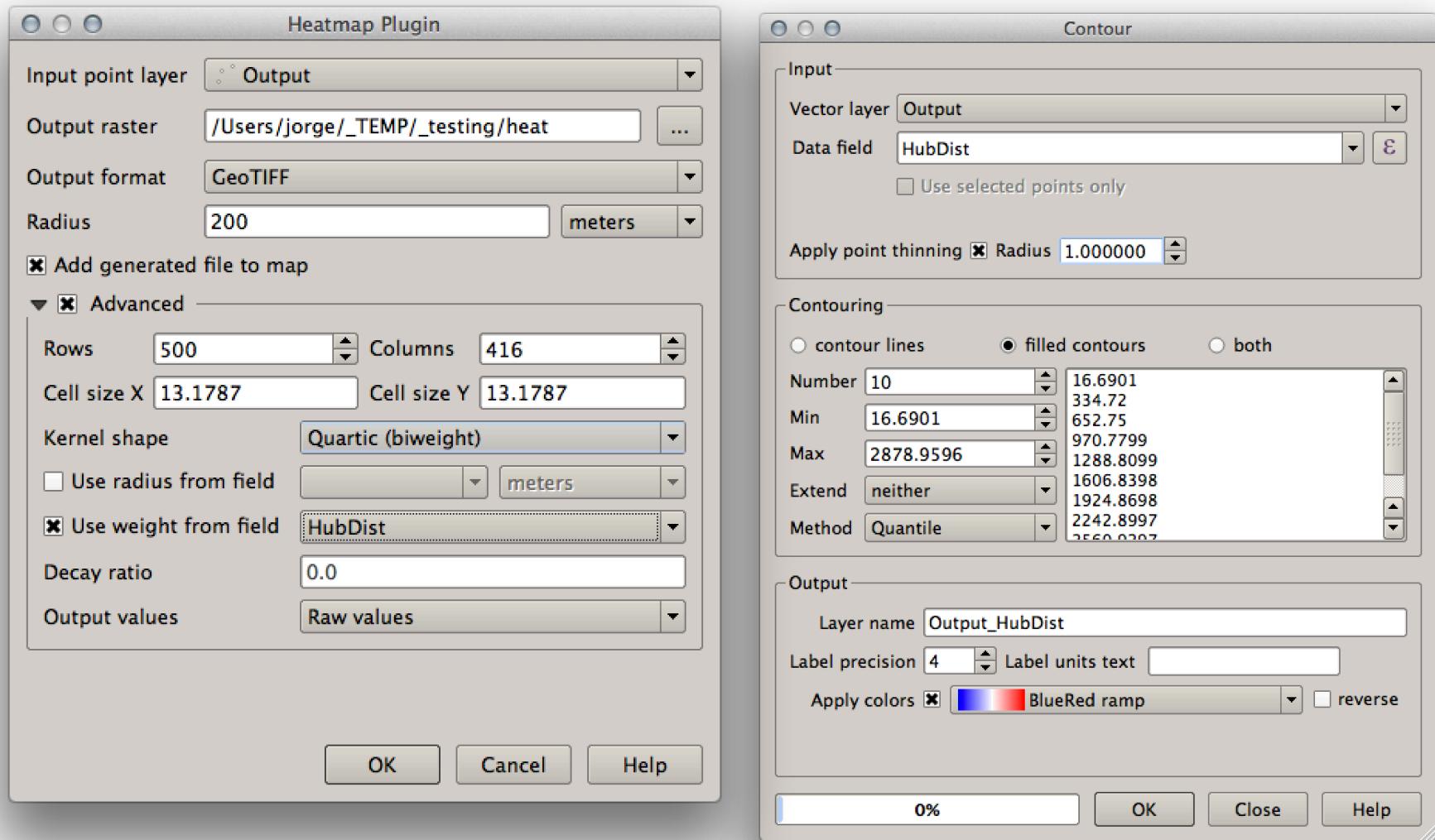
Exercise – step 6



Exercise – step 7.1



Exercise – step 7.2



The image shows two QGIS dialog boxes side-by-side:

Heatmap Plugin (Left Dialog):

- Input point layer: Output
- Output raster: /Users/jorge/_TEMP/_testing/heat
- Output format: GeoTIFF
- Radius: 200 meters
- Add generated file to map
- Advanced** (Collapsible Group):
 - Rows: 500
 - Columns: 416
 - Cell size X: 13.1787
 - Cell size Y: 13.1787
 - Kernel shape: Quartic (biweight)
 - Use radius from field
 - Use weight from field: HubDist
 - Decay ratio: 0.0
 - Output values: Raw values

Contour (Right Dialog):

- Input**:
 - Vector layer: Output
 - Data field: HubDist
 - Use selected points only
- Apply point thinning**: Radius: 1.000000
- Contouring**:
 - contour lines
 - filled contours
 - both

Number	10	16.6901
Min	16.6901	334.72
Max	2878.9596	652.75
Extend	neither	970.7799
Method	Quantile	1288.8099
		1606.8398
		1924.8698
		2242.8997
		2560.9297
- Output**:
 - Layer name: Output_HubDist
 - Label precision: 4
 - Label units text:
 - Apply colors: BlueRed ramp
 - reverse

- QGIS

<http://www2.qgis.org/en/site/index.html>

http://docs.qgis.org/2.6/en/docs/training_manual/

http://docs.qgis.org/2.6/en/docs/gentle_gis_introduction/

- Other GIS and Statistics software

<http://www.postgresql.org/> and <http://postgis.net/>

<http://pgrouting.org/>

<http://www.r-project.org/> and <http://www.rstudio.com/>

General research workflow or software specific issues (e.g. QGIS / GIS / depthmapX)

- What is your biggest frustration?

(Not again! I hate this...)

- What is your dream tool/feature?

(If only it could...)

Thank you!

jorge.gil@ucl.ac.uk

Project part of Platform Grant Extension: Space, Time and Interaction
EPSRC GR/S645561/01