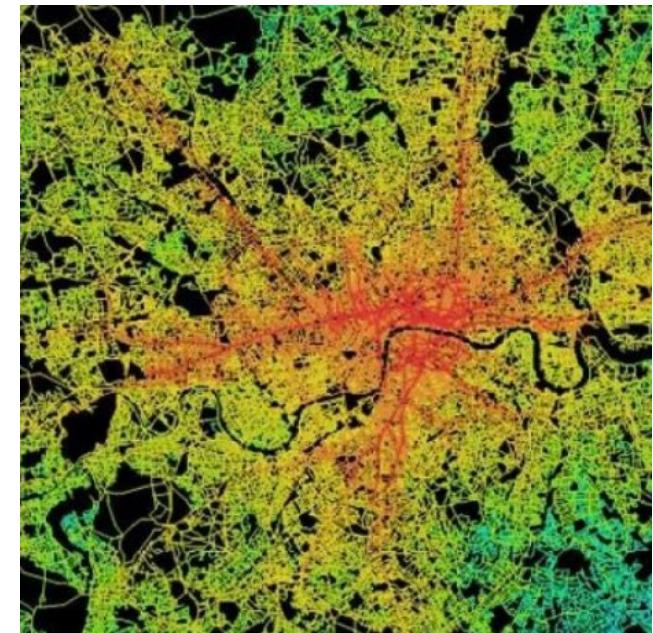


Space Syntax Toolkit: Extending QGIS with exploratory spatial analysis for urban design research and education

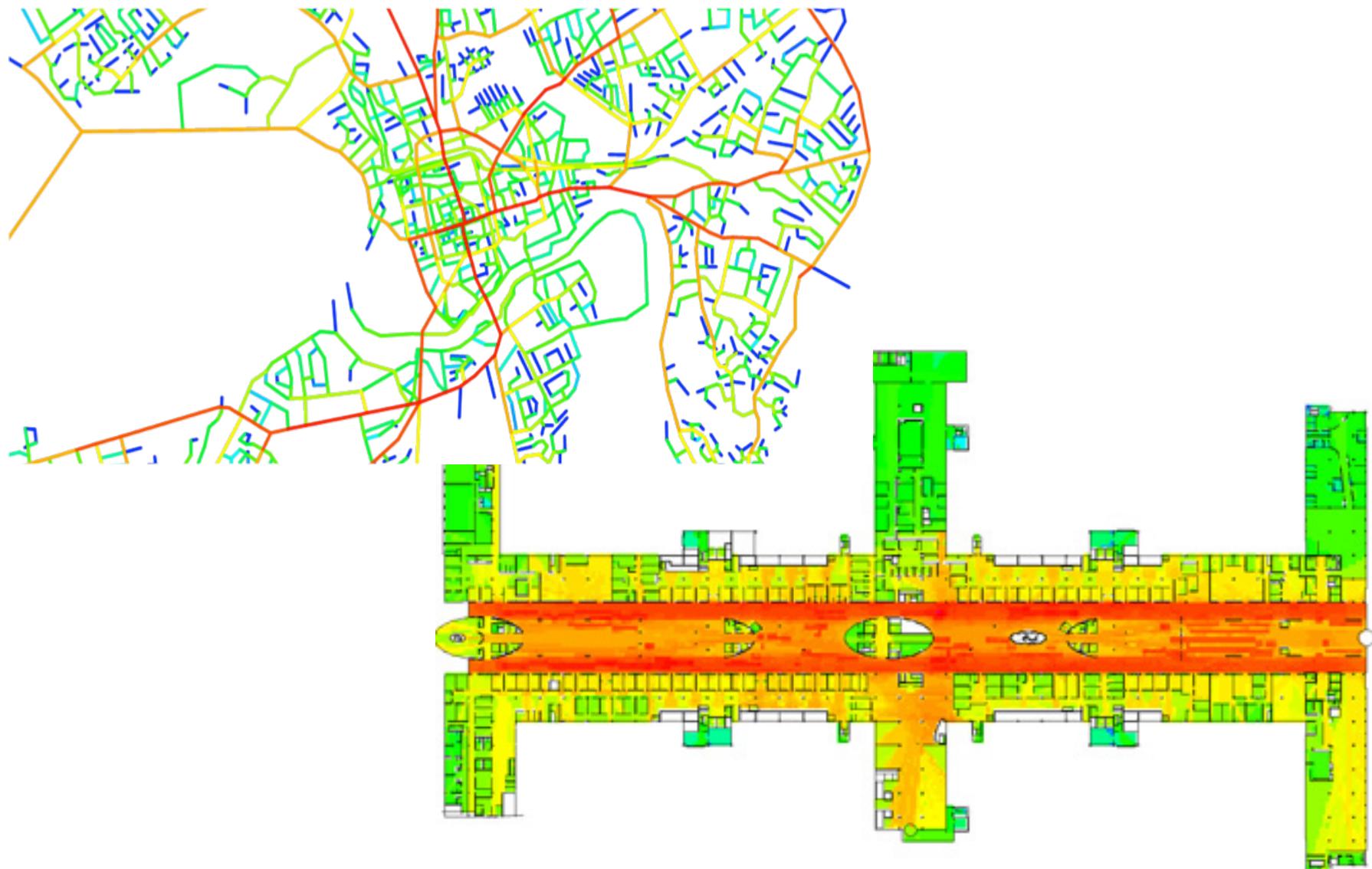
Jorge Gil, Tasos Varoudis,
Dr. Kayvan Karimi, Prof. Alan Penn

Space Syntax Laboratory
The Bartlett, UCL



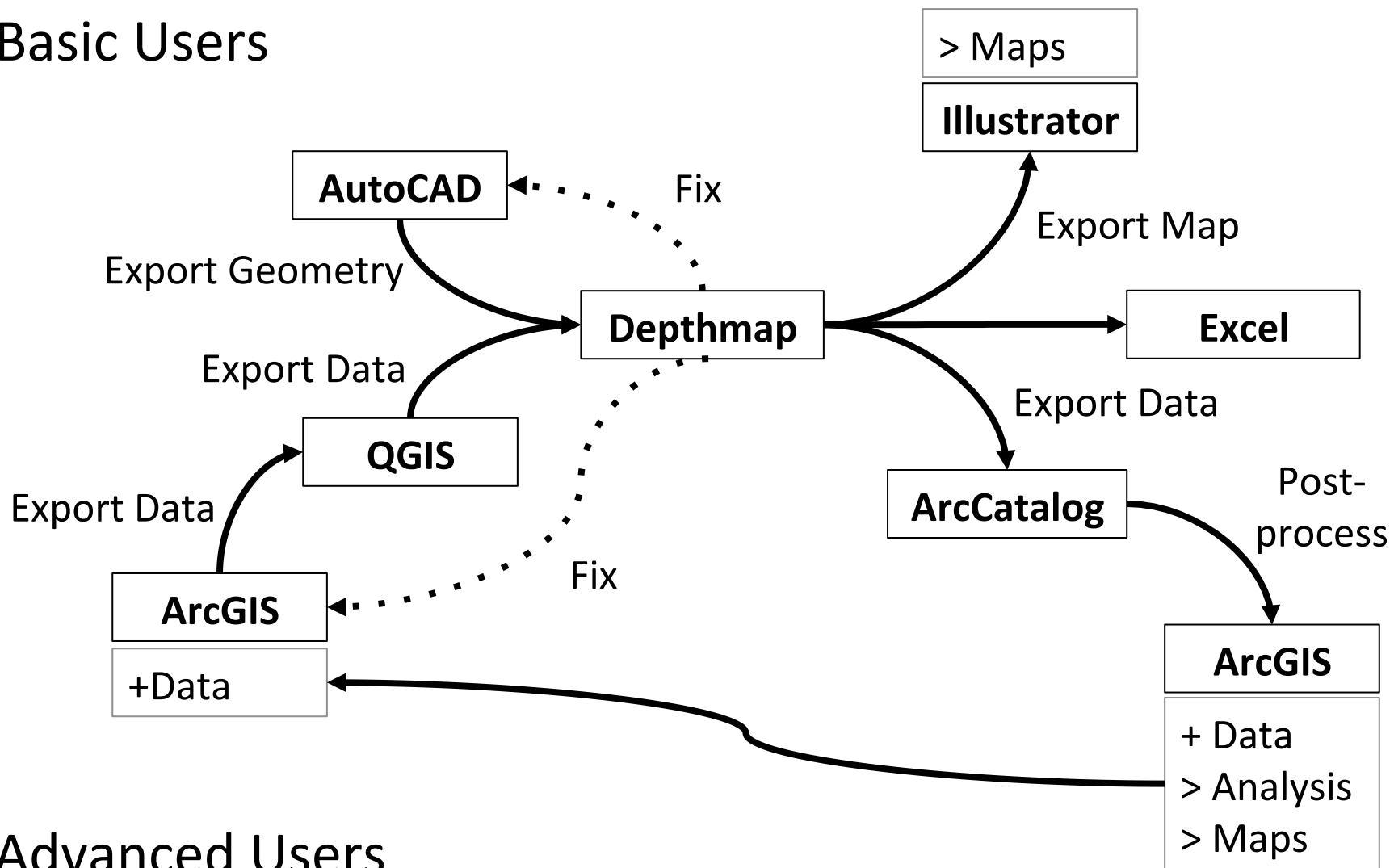
- Space Syntax Laboratory is part of The Bartlett, UCL, established in 1972
- Developed space syntax theory, methods and software (e.g. Depthmap) to represent and analyse space as networks, from buildings to cities and regions
- Studies relationship between spatial design and the use of space and longer-term social outcomes (i.e. movement flows, crime, land use, property value, social exclusion, health)
- Involved in education (MSc), research and practice

Background



- **Integrate** space syntax spatial analysis (Depthmap) **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

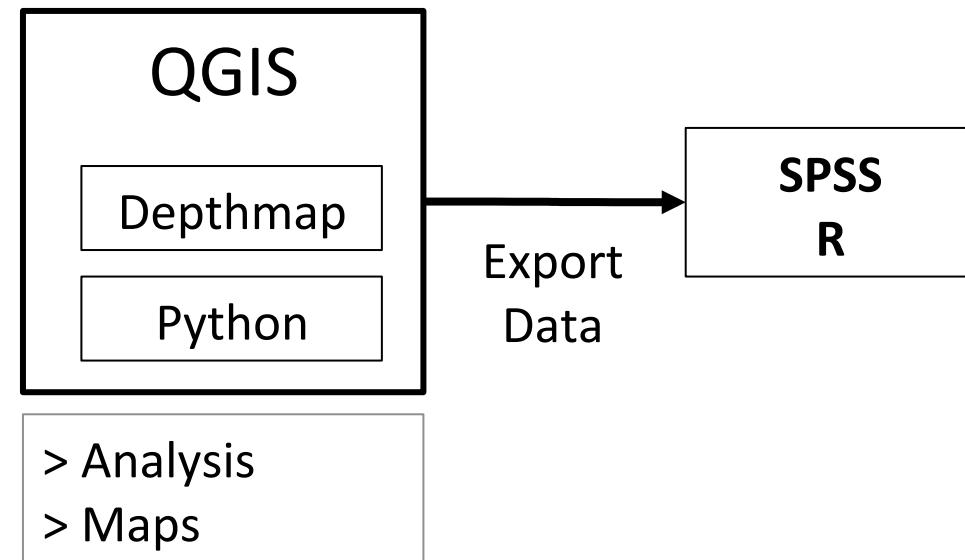
Basic Users



Advanced Users

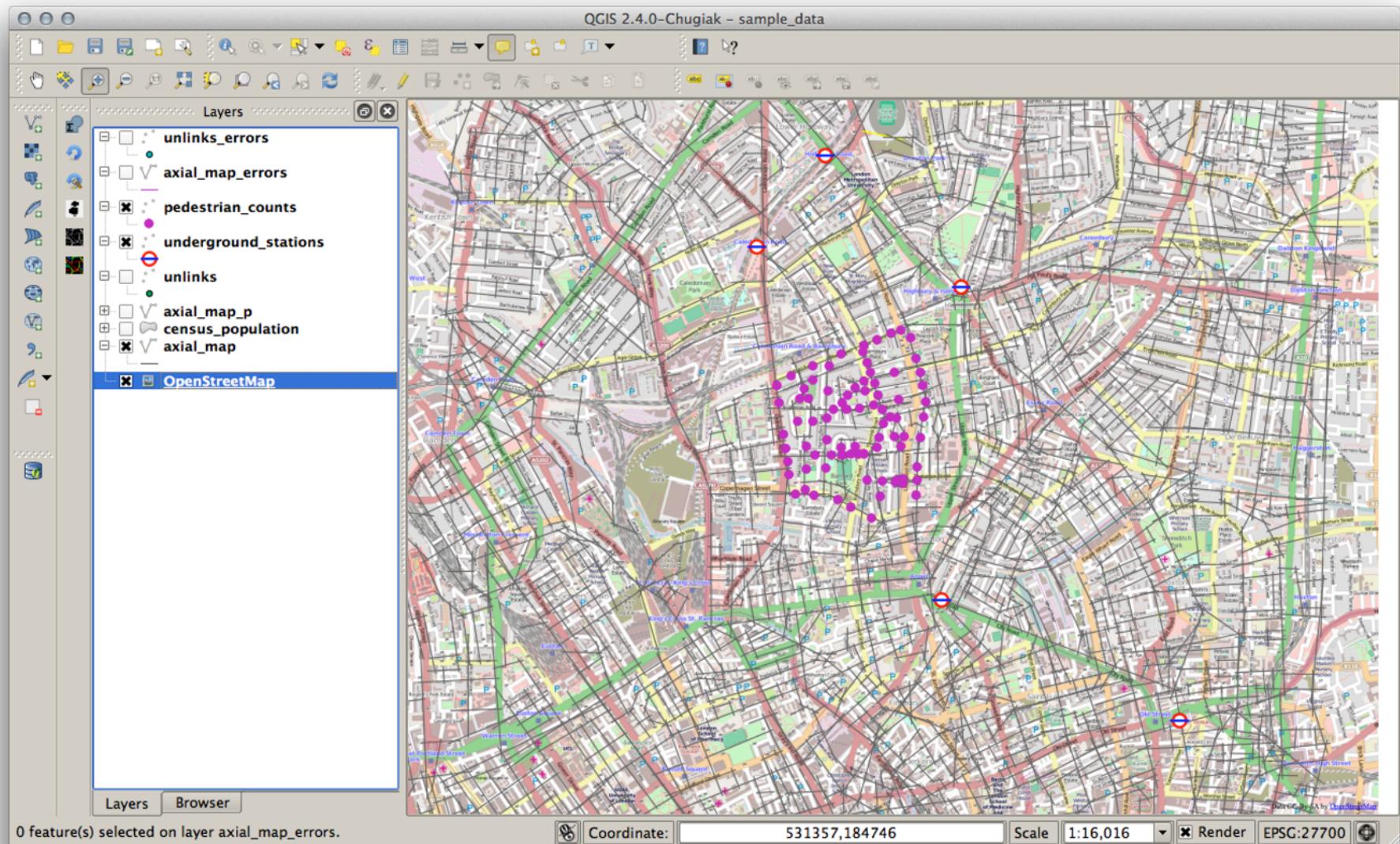
- Teaching urban design and analysis to **architectural students** using GIS
- **Engage** GIS beginners
- Avoid **frustration** with complicated workflows
- Avoid **rigid or limited** input / output options
- Provide **swift and intuitive** data exploration
- Avoid **lengthy non-responsive** operations

Basic Users



Advanced Users

Why choose QGIS?



- Free and open source
- Cross-platform (Windows, Linux, Mac)
- 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

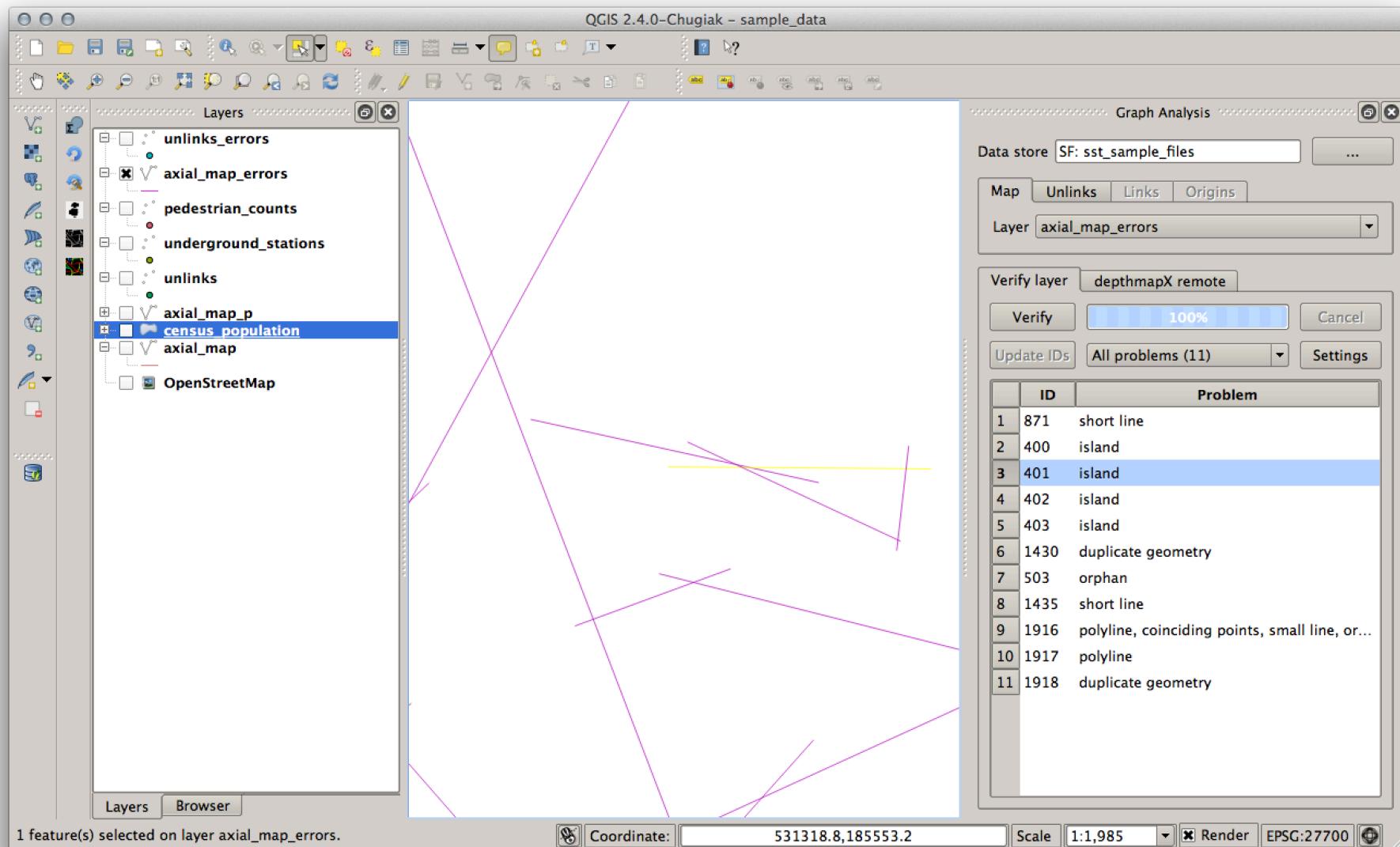
Numeric attributes:

All_People
0_to_15
16_to_59
60_to_ove
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

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

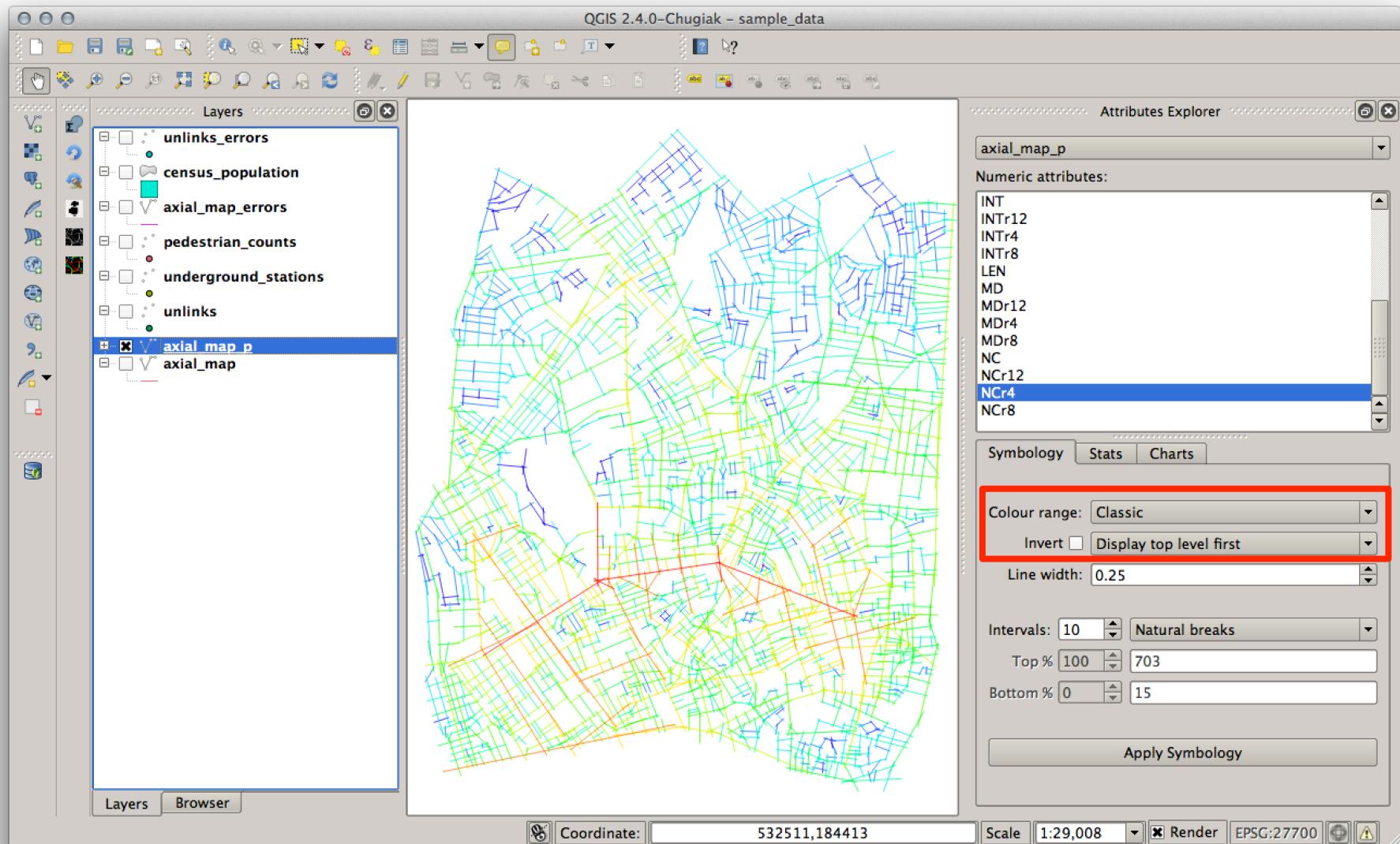
[Download depthmapXnet...](#)

Attribute table - axial_map_p :: Features total: 1915, filtered: 1915, selected: 0

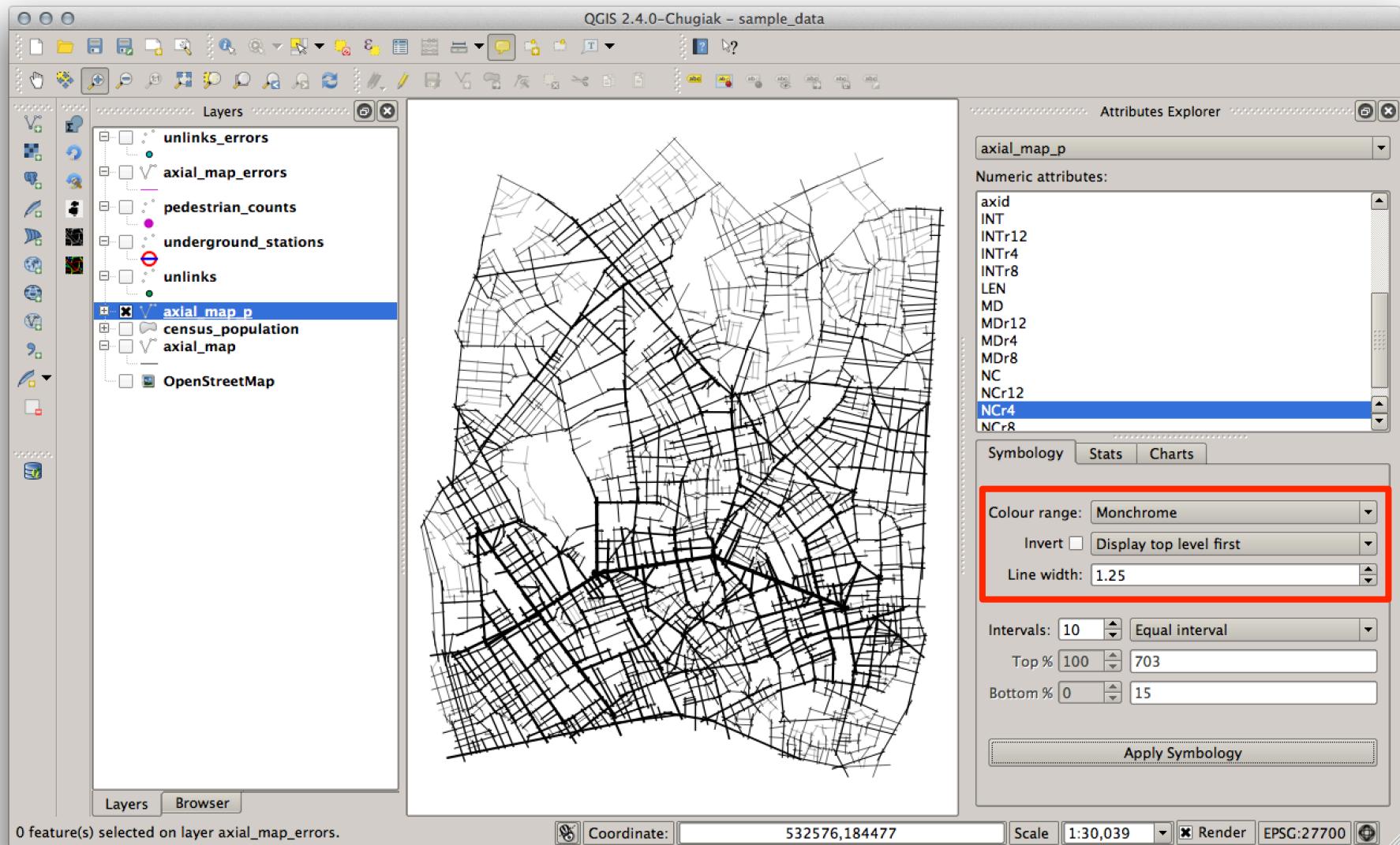
x1	y1	x2	y2	CH	Chr12	Chr4	Chr8	CO
531620.057...	184591.580...	531718.198...	183833.197...	364211	301119	4825	100261	
531317.562...	184563.168...	531644.017...	184560.769...	92123	80610	996	29640	
530641.467...	184265.063...	531391.768...	184575.864...	126271	114312	3539	49059	
531310.826...	184630.049...	531449.483...	184123.694...	47928	46662	2220	22884	
531197.894...	184076.078...	531687.073...	184187.766...	49513	48837	2240	26287	
531089.471...	184464.526...	531226.306...	184061.362...	20368	19838	1017	9081	
531031.467...	184257.346...	531780.910...	184436.714...	27126	26372	1223	12692	
531122.426...	183822.730...	531223.057...	184099.851...	34334	33470	1175	16711	
530576.859...	184869.061...	530726.870...	183672.793...	354436	315941	7252	124137	
531563.793...	183445.898...	531724.506...	183932.179...	127944	110472	2191	41594	
531306.267...	184332.834...	531918.883...	184454.209...	38165	37076	1339	18351	
531033.627...	185185.660...	531349.677...	184530.178...	54109	53461	2251	27426	
531633.348...	184819.855...	531633.950...	184384.999...	310952	239764	1910	58717	
531383.209...	183821.620...	531437.536...	184233.153...	22129	21805	1407	11383	
530901.211...	183663.266...	530924.669...	184441.493...	69788	63677	1711	28386	
530641.047...	183876.735...	531201.826...	183883.863...	38368	37330	1962	21813	
531382.698...	183429.263...	531393.508...	184007.487...	32200	31823	1744	17493	
531692.243...	183866.078...	532132.356...	183618.718...	239685	194478	2800	64880	
531068.182...	183322.213...	531142.800...	183907.266...	60929	59885	1534	33659	
531008.562...	183873.516...	531403.748...	183914.254...	25145	24881	1280	14291	
531594.580...	184553.651...	531671.292...	184586.521...	558	556	24	302	
531020.031...	184111.957...	531447.348...	184212.728...	14357	13882	729	6098	
531441.172...	183195.510...	531655.297...	183682.760...	192167	158036	1647	49493	
530648.278...	184202.231...	531124.982...	184399.105...	6685	6639	313	3460	
531373.785...	183767.196...	531688.161...	183775.144...	29384	28929	1010	14717	
530664.471...	183267.489...	530720.018...	183826.639...	96274	84438	1895	30898	
531677.129...	184018.074...	531966.012...	183895.049...	22219	21860	1051	11267	
530299.916...	183681.231...	530913.934...	183681.231...	252789	223532	2115	83576	
530745.388...	184782.795...	530941.662...	184374.412...	19285	18733	631	7701	
531560.849...	183498.553...	531822.333...	183713.841...	62554	52812	1014	18412	
531660.606...	184198.403...	532015.507...	184274.311...	27500	26964	939	14602	
531534.292...	183689.188...	531758.962...	183634.194...	49040	40824	196	10961	

- 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 format(s)
- Multi-threaded analysis

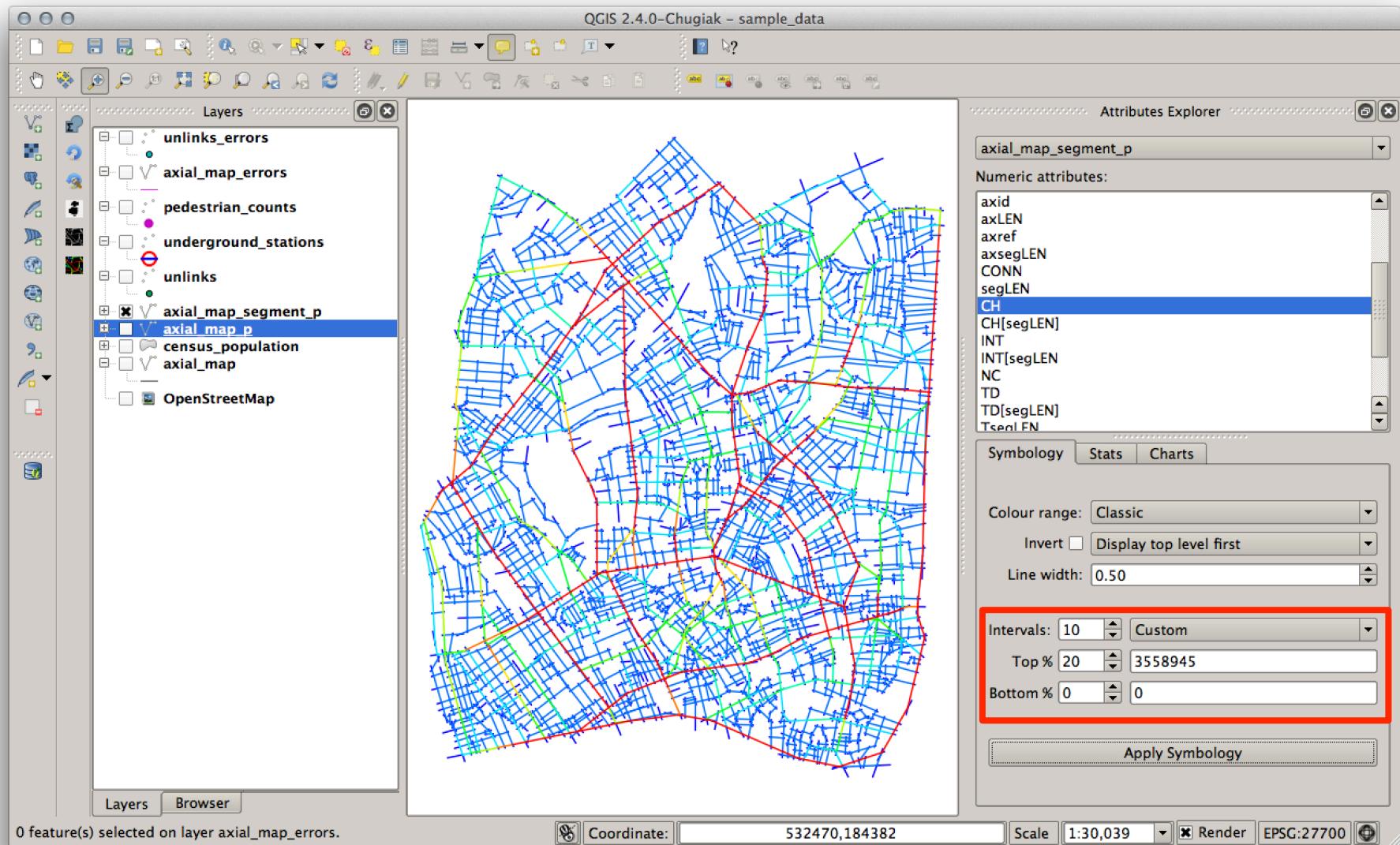
Attributes Explorer features



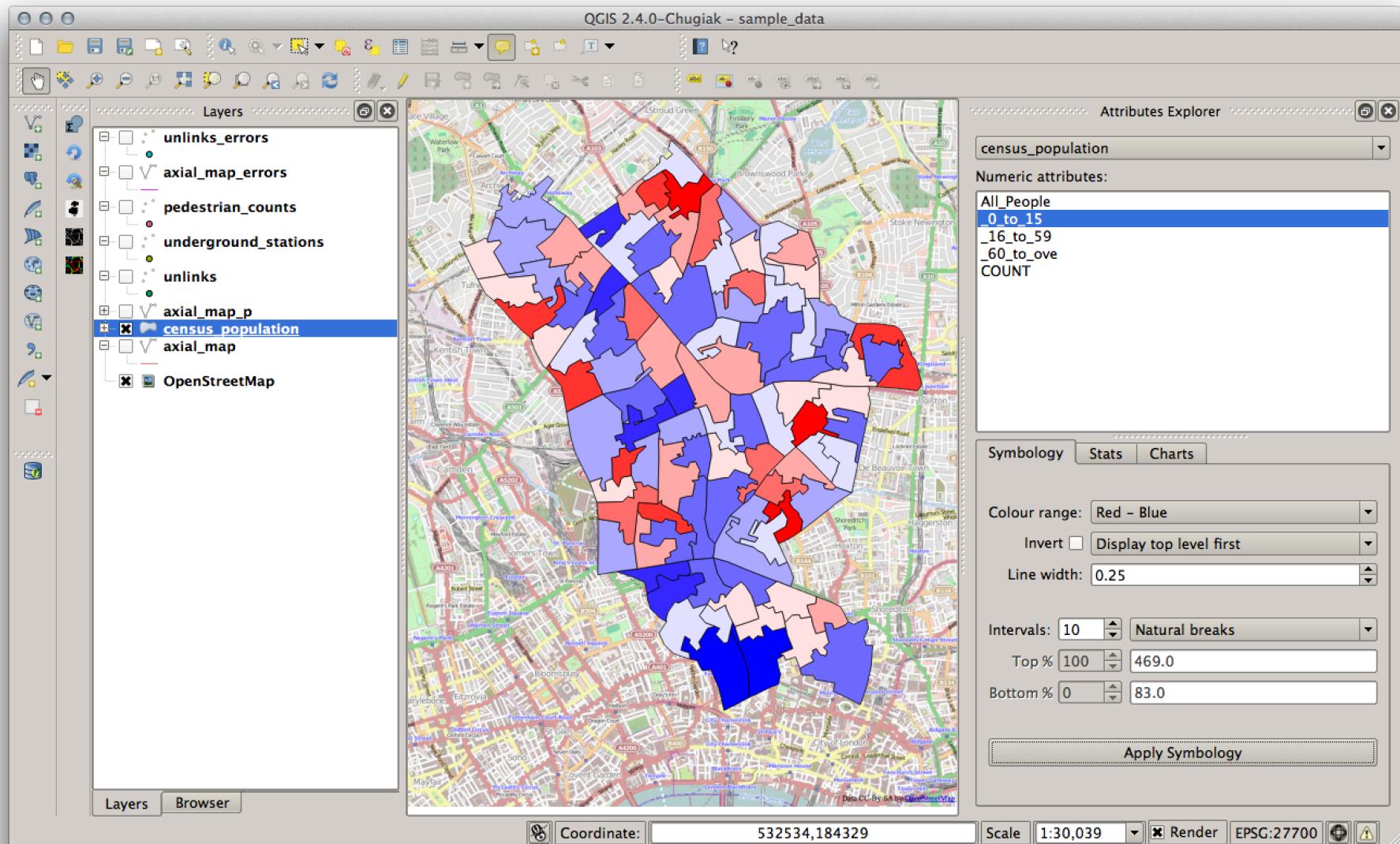
Attributes Explorer features



Attributes Explorer features

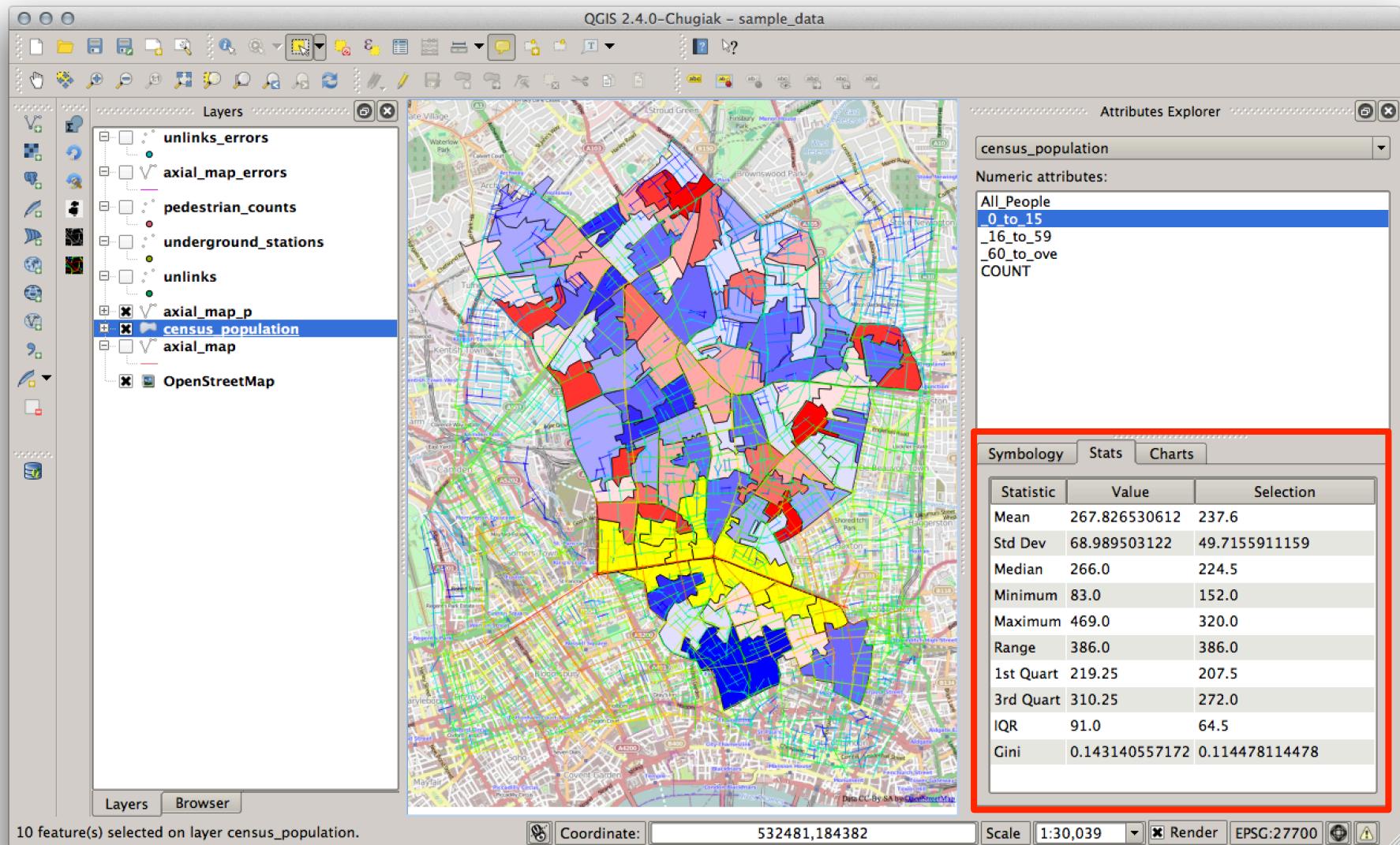


Attributes Explorer features

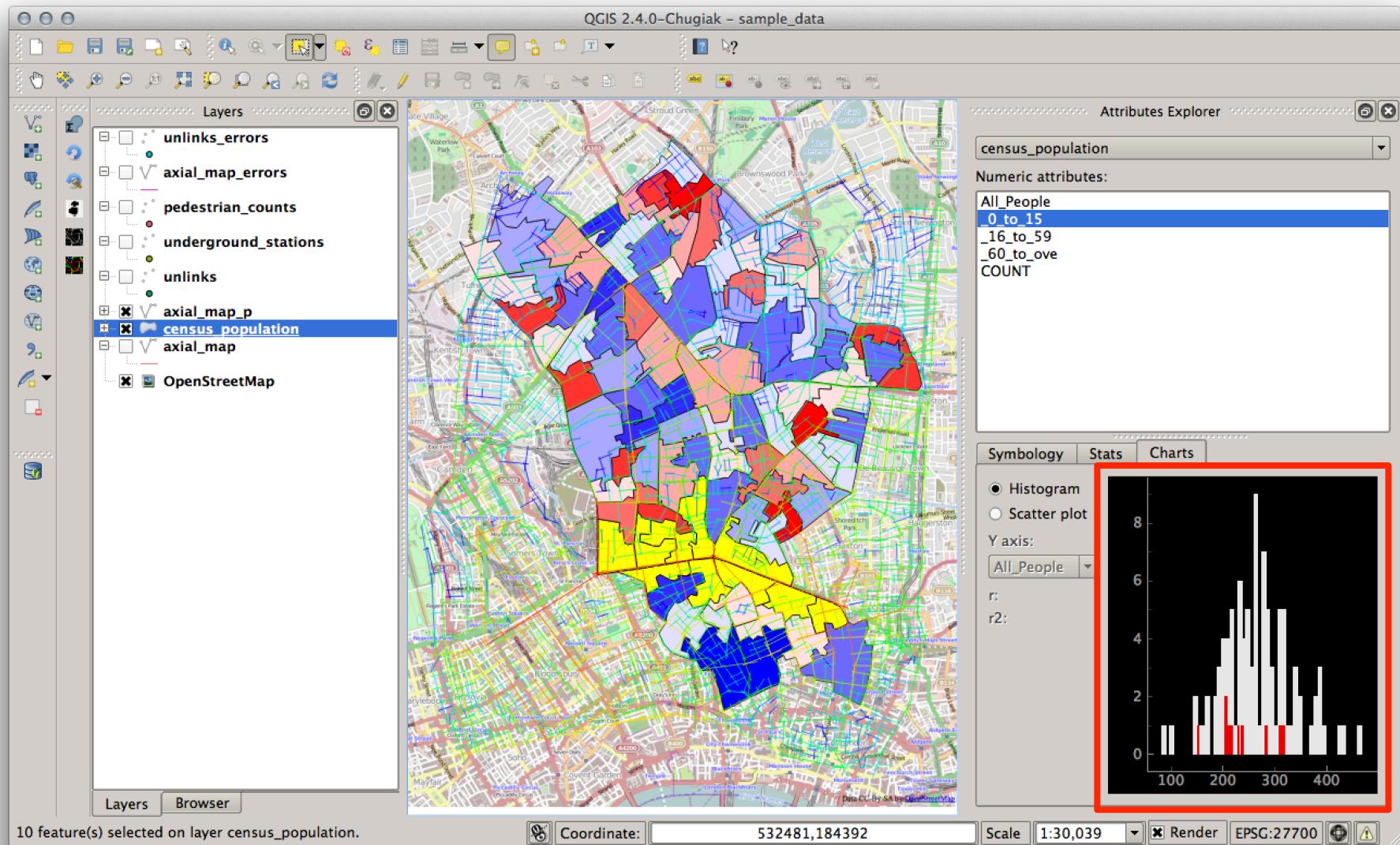


- Intuitive and iterative exploration of attributes
- Simpler symbology settings
- Symbology for typical academic usage
- Store attributes symbol settings with project

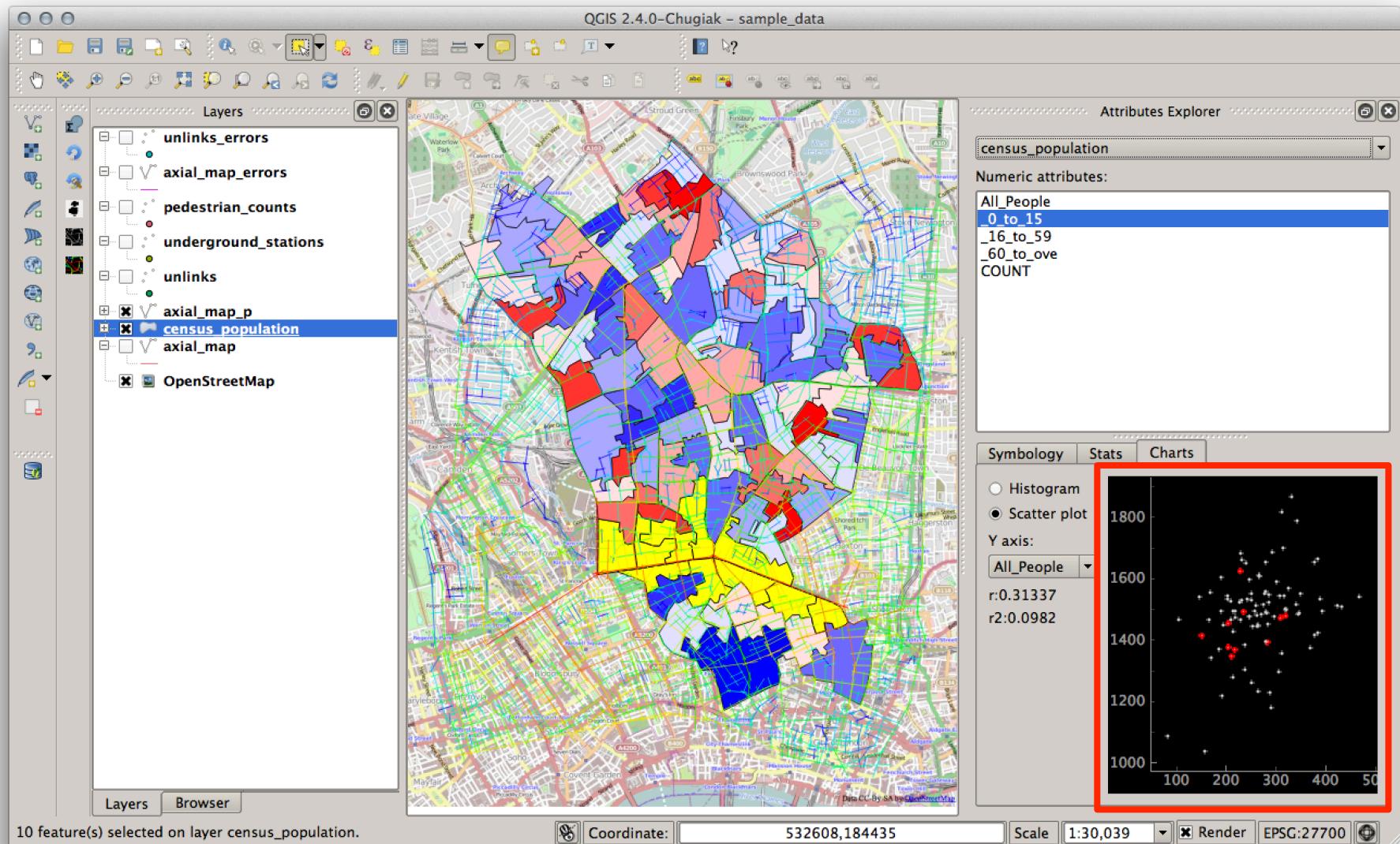
Attributes Explorer features



Attributes Explorer features



Attributes Explorer features



- Allow interaction between tool and main window
- Synchronised presence of statistics and charts
- Keep data as loaded for reuse across tabs
- Avoid replicating existing functionality, eventually making it more efficient

- Testing and debugging
- Distribution to the QGIS community
- **Add new features:**
 - Support PostGIS
 - Add chart interaction
 - Add graph analysis features
 - Improve plot performance
- **Address Python package dependency:**
 - Use QGIS network module
 - Implement Qt only based charts
- **Horizon 2020 proposal** (under review) – Planning Support System based on QGIS

Thank you!

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Project part of Platform Grant Extension: Space, Time and Interaction
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