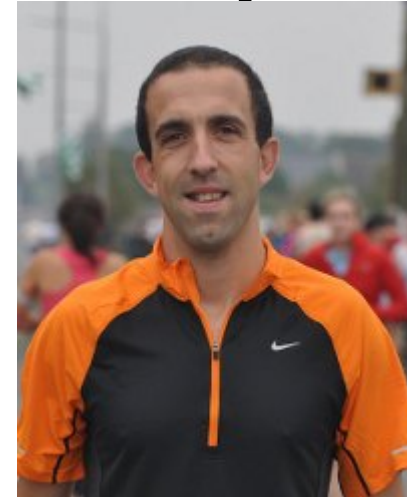


Volatile Volunteered Geographic Information (VVGI) The OpenStreetMap Example



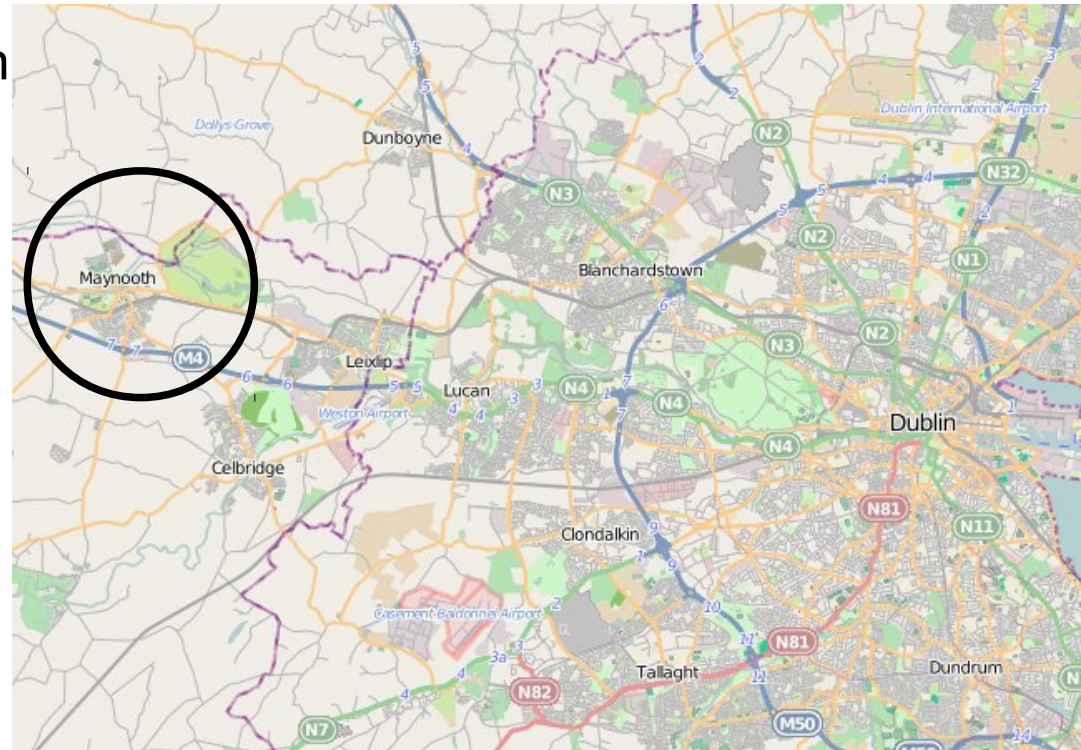
Peter Mooney

Department of Computer Science
National University of Ireland Maynooth
(NUIM),
Co. Kildare, Ireland

Email: peter.mooney@nuim.ie

Web: www.cs.nuim.ie/~pmooney

Padraig Corcoran,
School of Informatics,
University College Dublin,
Ireland.



You wouldn't buy a car without knowing it's history.....



Lois (looking at a used car Peter wants): Peter, this car has dents in it, and it's got a cardboard steering wheel.

Peter: Just a second honey.

Lois: And look, there's no engine! It just has a drawing of an engine!

Car salesman: But it only had one previous owner....James Bond!

Peter: I'll take it!

Using the History of Objects in OSM for analysis of users, contributions, and shape evolution - Overview

“Those who cannot learn from history are doomed to repeat it”. - George Santayana, Life of Reason 1905

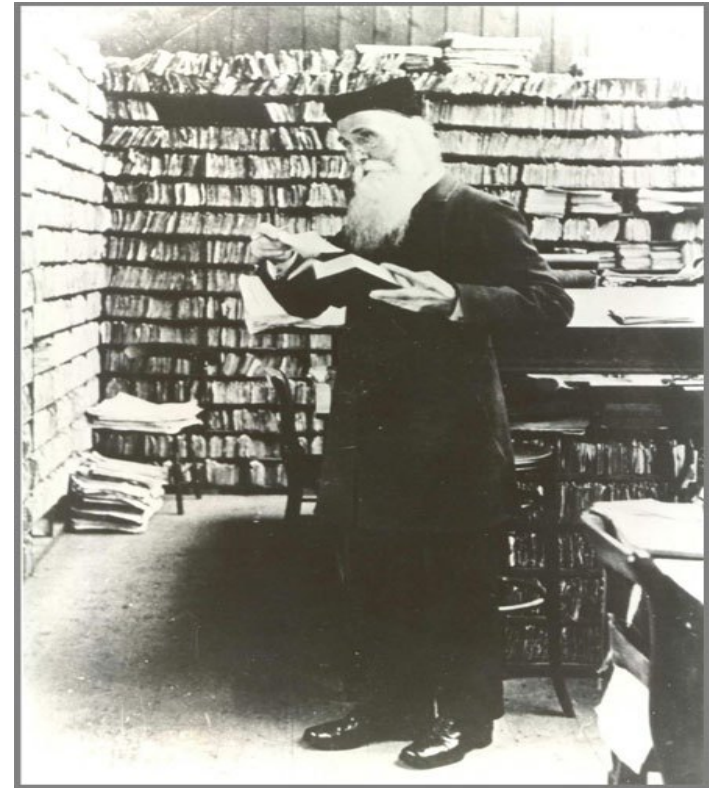
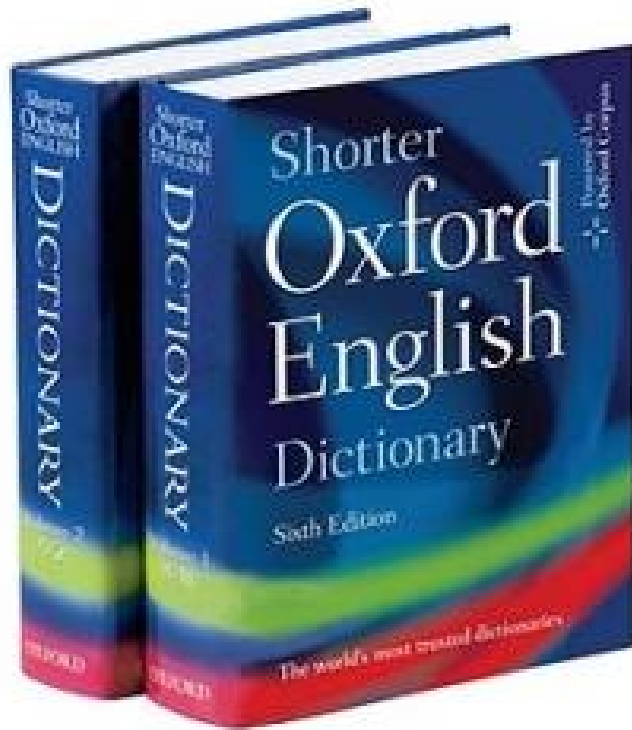
- Why should we look at the history of objects?
- What types of patterns of evolution does the history reveal?
- Lessons learned – next steps
-
- **Overall:** To develop quality indicators for OSM data – by looking at OSM in isolation and understanding the dynamic nature of contributions.

Let's start..



[Flickr.com/peterm7](https://www.flickr.com/photos/peterm7/)

During its beginnings the OED used teams of Volunteers to collect words



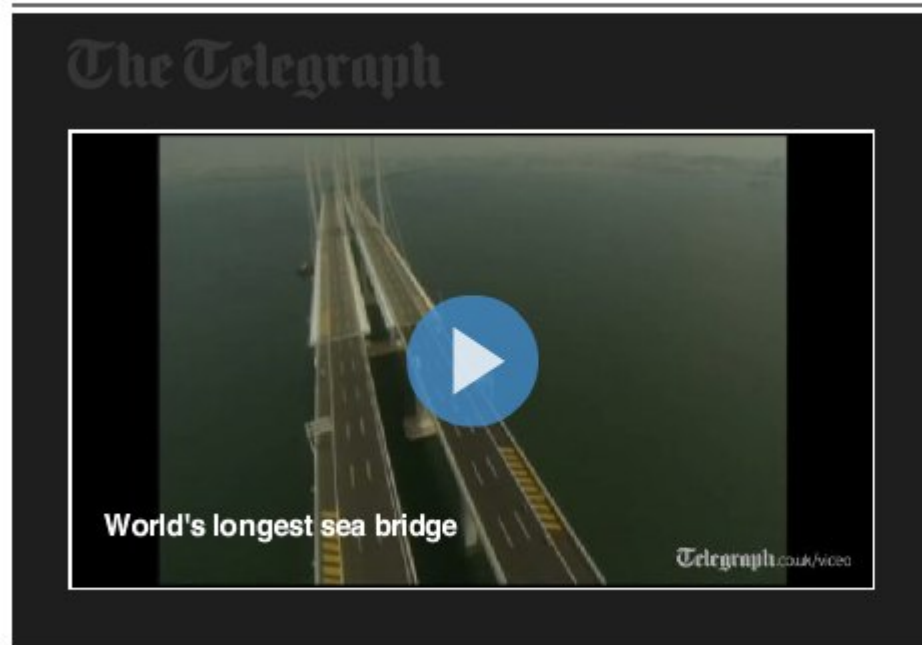
1879: James Murray – appealed to volunteers to “report as many quotations as you can for ordinary words” and for words that were “rare, obsolete, old-fashioned, new, peculiar or used in a peculiar way.”

Winchester, Simon (2003). *The Meaning of Everything: The Story of the Oxford English Dictionary*. Oxford University Press.

From Qingdao 青岛 To Huangdao District 黄岛区

China opens world's longest sea bridge

China has opened the world's longest sea bridge, a 26.4 mile-long structure that could easily span the English Channel.



[Link to this video](#)

By Malcolm Moore, Shanghai

1:57PM BST 30 Jun 2011

30th June 2011

4 years of construction..

View Edit History Export GPS Traces log in | sign up

User Diaries

Way: 119903682

« 119903681 | 119903683 »

Edited at: Fri, 01 Jul 2011 18:14:35 +0000

Edited by: [homeslice60148](#)

Version: 2

In changeset: [8601729](#)

Comment: qingdao bridge & city name

Tags: [bridge = yes](#)
[highway = motorway](#)
[layer = 1](#)
[oneway = yes](#)

Nodes: [1345656403](#)
(also part of way [— 95345478](#))
[1345656752](#)

A map showing a blue line representing the sea bridge crossing a body of water. The bridge connects a landmass on the left to a larger landmass on the right. The map includes roads, water bodies, and some buildings. Below the map, there are two links: "View area on larger map" and "View way on larger map".

OSM evolution is dynamic and keeps pace with societal development

http://tools.geofabrik.de/mc/

Map Compare

Choose map type: Google (Hybrid)

Choose map type: OSM Tiles@Home

July 5th 2011

The image shows a side-by-side comparison of two maps of the same geographic area, Qingdao, China. The left map is a Google Hybrid satellite-style map, showing terrain, buildings, and water bodies. The right map is an OpenStreetMap (OSM) Tiles@Home map, showing a vector-style map with roads, buildings, and water bodies. The OSM map is dated July 5th 2011. The interface includes a browser address bar, navigation controls, and a 'Map Compare' title. The OSM map shows a dense network of roads and buildings, with the date 'July 5th 2011' overlaid in the center. The Google map shows a similar view but with a different style and more detail.

A Historical Comparison of OpenStreetMap's Completeness in Britain

comparing road lengths with respect to Ordnance Survey's Meridian 2 Data (why?)

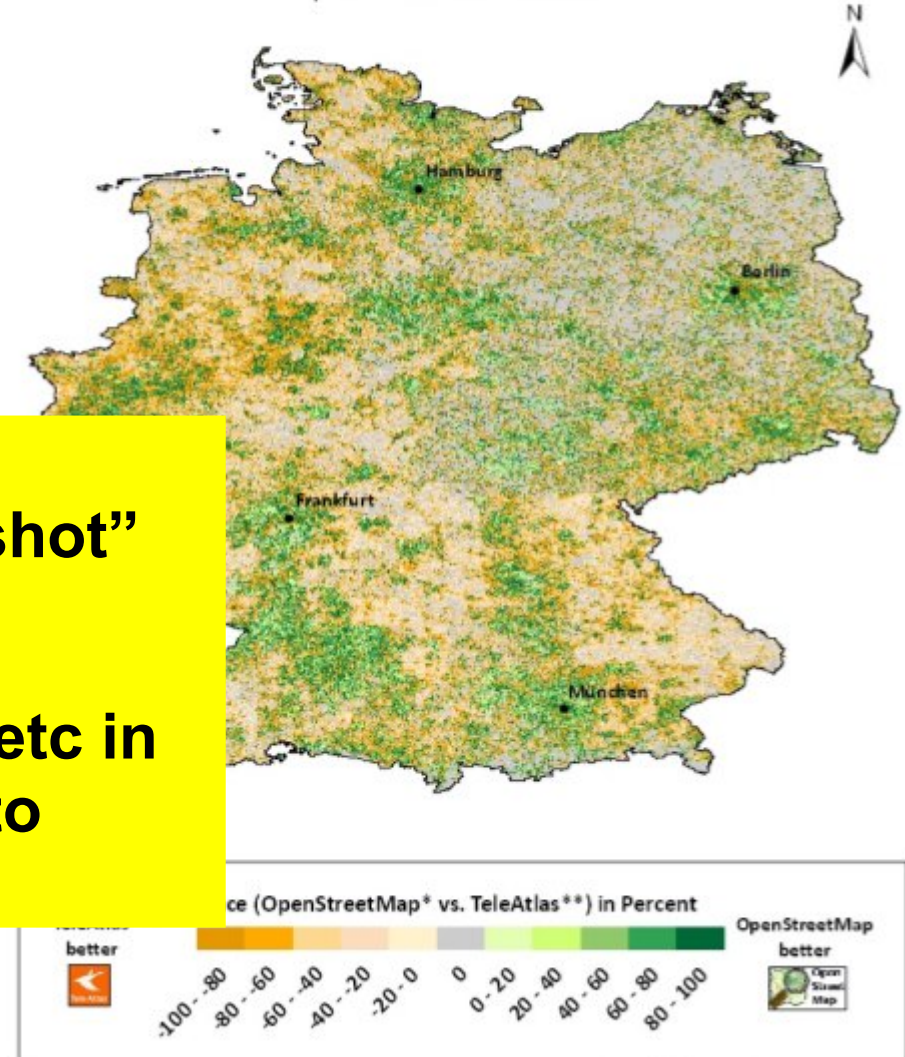
Data Analysis: *Dr Muki Haklay, UCL CEGE. Website: [Oliver O'Brien, UCL CAS](http://www.olivero'brien.com)*



Most analysis of VGI (and OSM) is performed on only a current “snapshot” of the data

The history of contributions, edits, etc in OSM is rather difficult and tedious to access at present

Total Length Differences of Pedestrian Navigation Related Data between OpenStreetMap and Tele Atlas per km² in Percent



<http://orca.casa.ucl.ac.uk/~ollie/osmcompare/>

Zielstra, D. and Zipf, A. (2010):
A Comparative Study of Proprietary Geodata and Volunteered Geographic Information for Germany.
AGILE 2010. The 13th AGILE Guimarães, Portugal.

Accessing the History of Things in OpenStreetMap

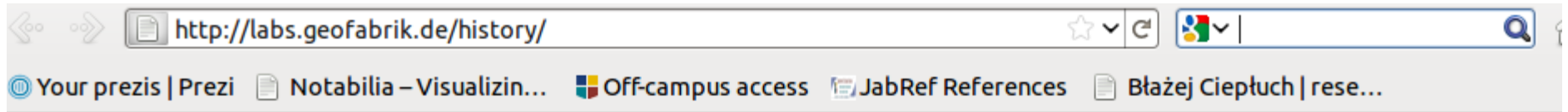
- Not just a simple task of making an API call...
- You really need: some time, some processing power, and no shortage of inspiration (or stubbornness....)
- Full Planet.OSM history is *one* option
-
- In this research we have looked at a specific subset of OSM - “**High Edit**” features – those with approximately 15 or more edits (versions)...

Martijn van Excel

slideshare.net/mvexel/dealing-with-historical-data-in-openstreetmap

- Full history dump is ~ 451 GB of XML
- 1.7 Billion node versions... 170 million way versions... etc...
- We need:
 - A schema
 - Ideally ... a History API

History Coverage - Frederik Ramm



OSM History



Displaying Historic OpenStreetMap Coverage

The history service creates an image of the map over time. It does so by painting a dot on a segment and ways, which means that the history service has to take into account aspects of image generation, like the way the map is rendered.

Computation is too time-consuming to view or download them once they are generated and also how long other users are waiting and also how long other users are waiting.

You can browse past results below. This service is mainly intended for people who are interested in the history of the map. I will probably delete old images from the server.



d over time. The history service creates an image of the map over time. It does so by painting a dot on a segment and ways, which means that the history service has to take into account aspects of image generation, like the way the map is rendered.

ted and then s are

e. This ions. I will

Fill out this form to request

Identification

Your Name:

Image Name:

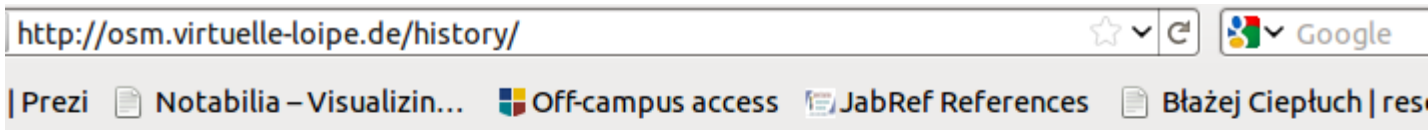
This is just so that you (and others) can recognize the image later. You can put any user name, it is not checked against a list.

Bounding Box

min. lat min. lon

max. lat max. lon

History Browser by Langläufer



OSM History Browser 0.4 (beta) by [Langläufer](#)

way

Revision history of way #14928586

merge sequent edits of a user

(prev)	<input checked="" type="radio"/>	<input type="radio"/>	2011-06-22T00:12:06Z	NE3	
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2011-04-02T09:43:34Z	NE2
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2010-03-14T02:26:24Z	NE2
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2009-02-06T03:46:24Z	dufekin
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2009-02-04T19:37:39Z	dufekin
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2009-02-04T19:37:05Z	dufekin
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2009-02-04T19:36:34Z	dufekin
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2009-02-04T19:36:21Z	dufekin
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2009-02-04T19:35:49Z	dufekin
(cur)	(prev)	<input type="radio"/>	<input type="radio"/>	2009-02-04T19:32:42Z	dufekin

way 14928586

- merge sequent edits of a user
- show only the differences

[<< prev](#) [next >>](#)

[version #178](#)

[dufekin](#) at 2009-02-04T19:37:39Z

14

created_by=Potlatch 0.10f

highway=motorway

key=I-240

name_1=State Highway 3

oneway=yes

tiger:cfcc=A15

tiger:county=Oklahoma, OK

tiger:name_base=I-240

tiger:name_base_1=State Highway 3

[<< prev](#) [next >>](#)

[version #179](#)

[dufekin](#) at 2009-02-06T03:46:24Z

11

created_by=Potlatch 0.10f

highway=motorway

oneway=yes

ref=I-240

tiger:cfcc=A15

tiger:county=Oklahoma, OK

OSM History Viewer: Changeset 446785

- [Back to home page](#)
- [Browse on OpenStreetMap](#)

This analysis was created on 2011-07-06T09:10:32Z.

Everything green on this page will show the status after the changeset was committed in blue haven't changed.

Tags

Details

Creation time: Wed May 14 21:30:46 CEST 2008

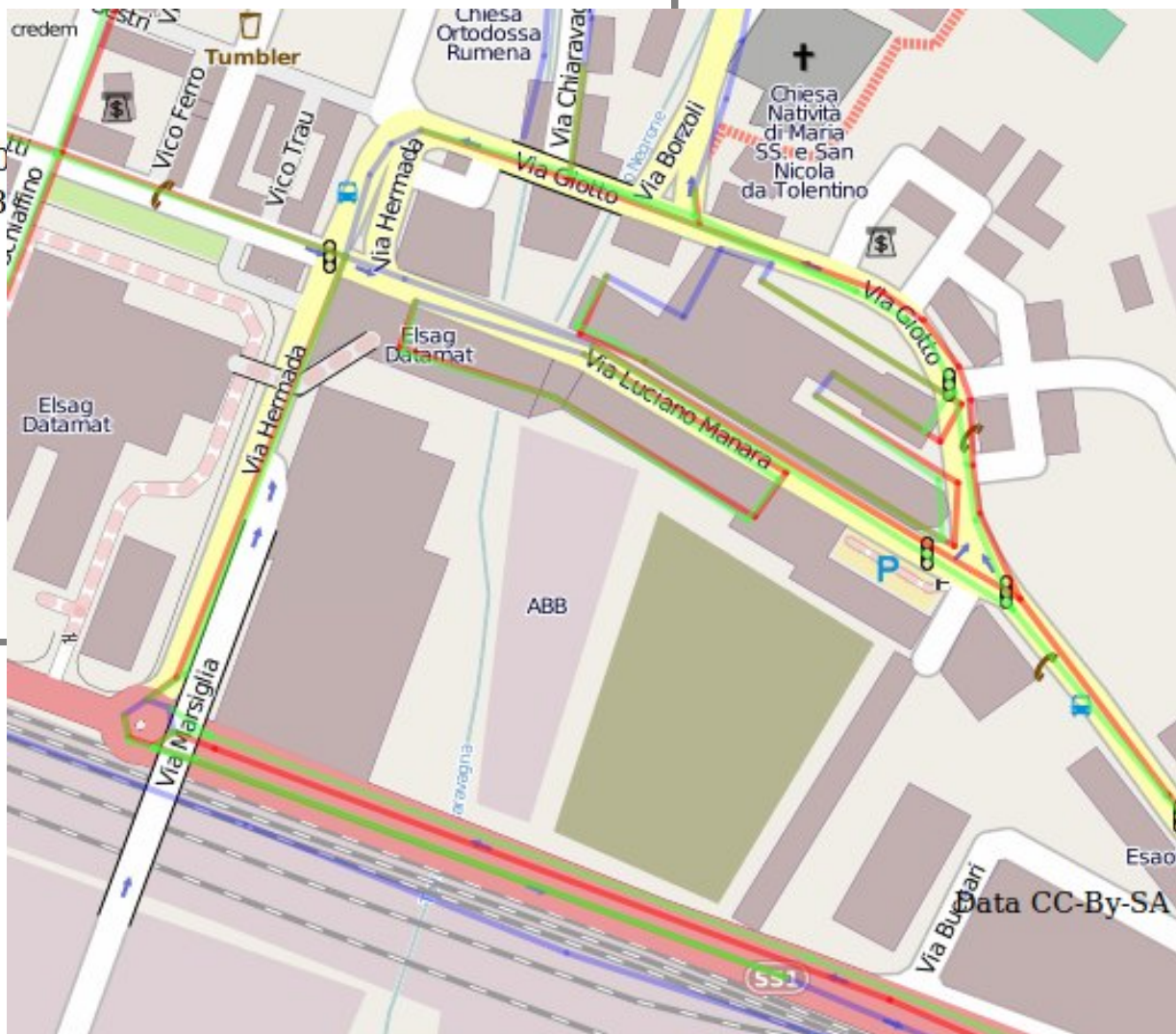
Closing time: Thu May 15 00:55:25 CEST 2008

User: [mikelima](#)

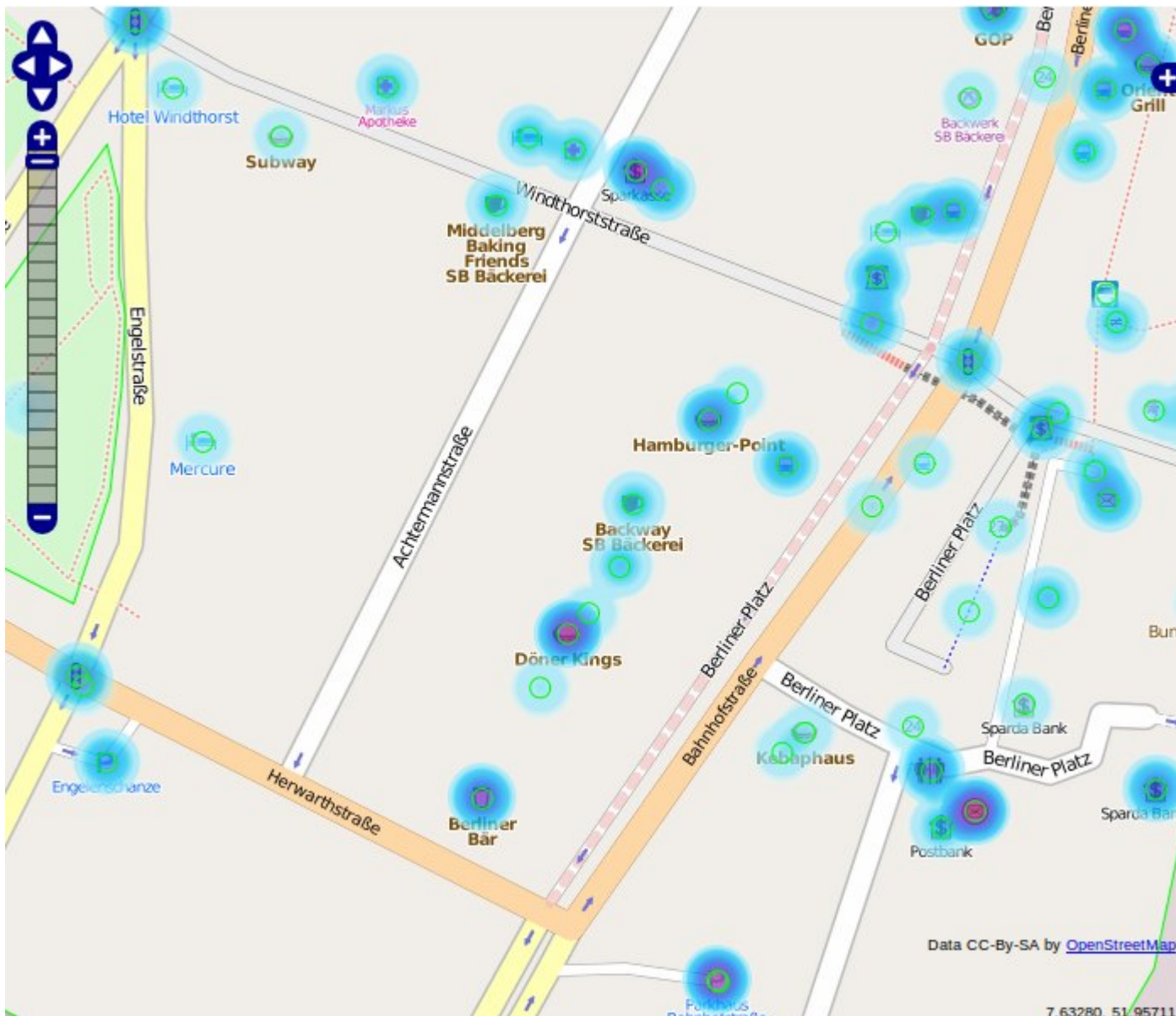
Changed object tags

Hover the elements to view the changed tags.

- Way 23516292 ([browse](#))
- Way 20668000 ([browse](#))
- Way 24280182 ([browse](#))
- Way 23245813 ([browse](#))



Trame and Keßler (2010)

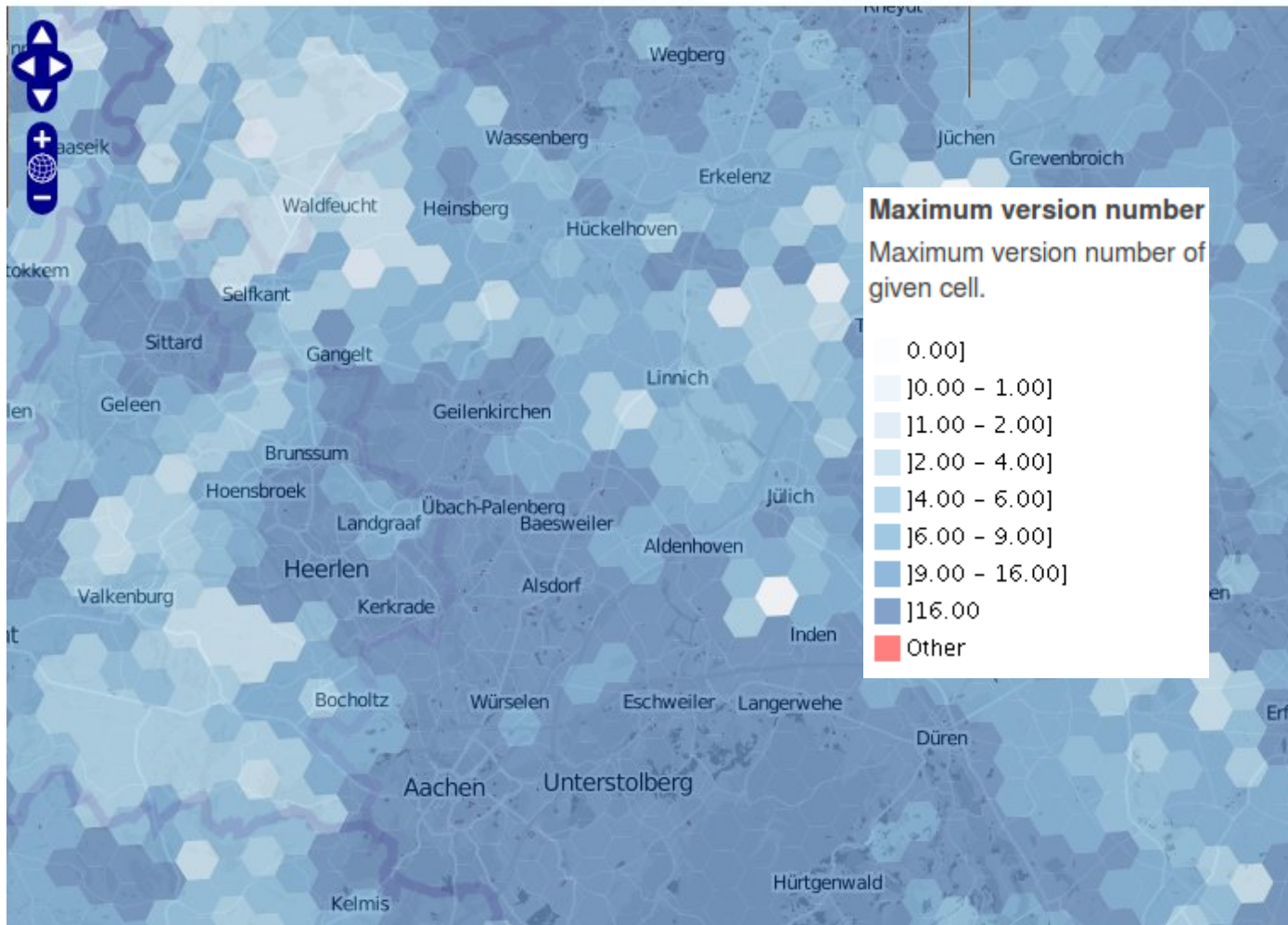


Heat Maps of
OSM Activity

- potential for pattern
analysis of tagging
and contributions

Roick and Zipf (2011)

OSMatrix



WMS for Germany

Hexagonal Tiles

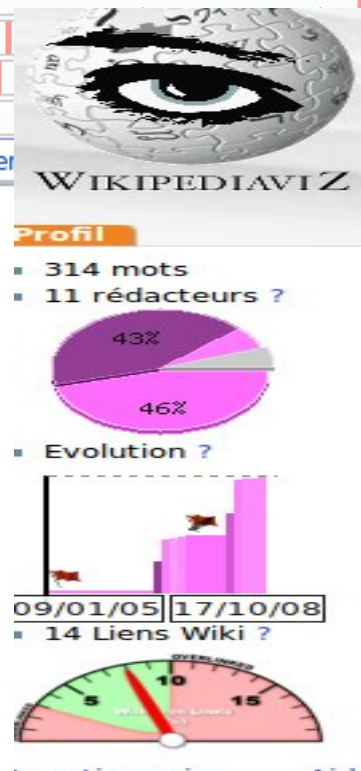
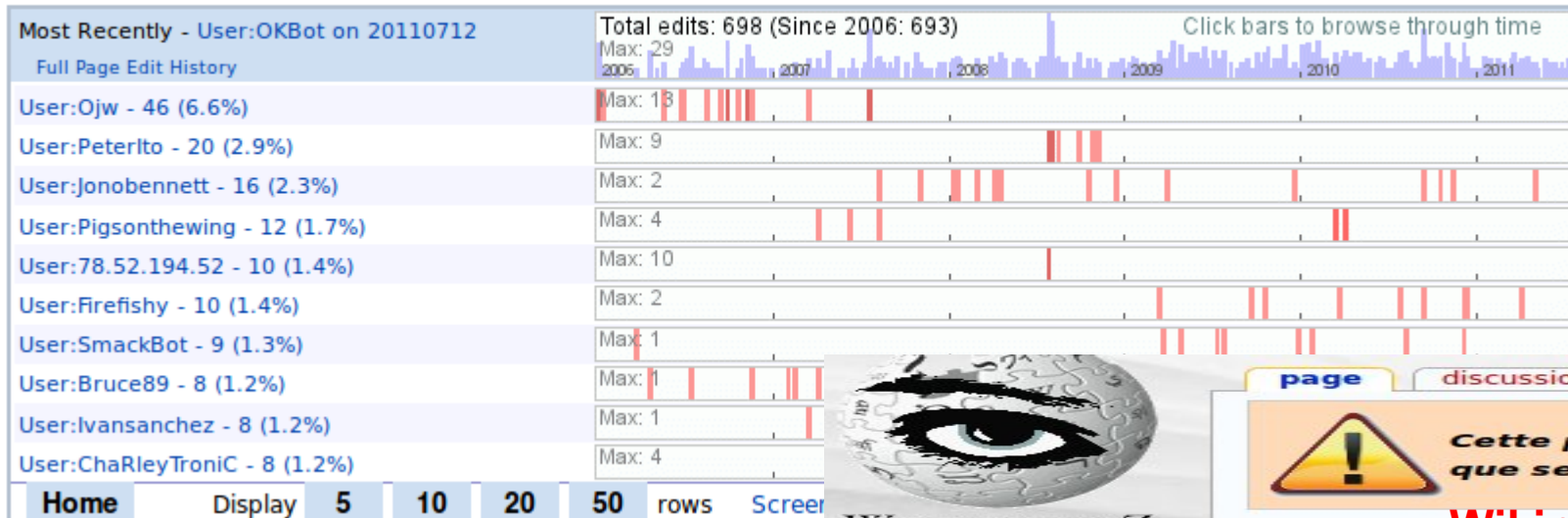
Simple statistical
Features of OSM
in hexagonal cells

Some visualisations of edit history of Wikipedia are appearing

OpenStreetMap

From Wikipedia, the free encyclopedia

- **WikiDashBoard**



page discussion modifier his

! Cette page est une version que ses auteurs. Le LRI, l'U

WikipediaVIZ

Insectivore

À ne pas confondre avec les *Insectivore*

Les **insectivores** sont des animaux se no

Sommaire [masquer]

- 1 Insectivores
- 2 L'Homme
- 3 Une source alimentaire très vaste
- 4 Lutte contre les nuisibles
- 5 Classification

[modifier] Insectivores

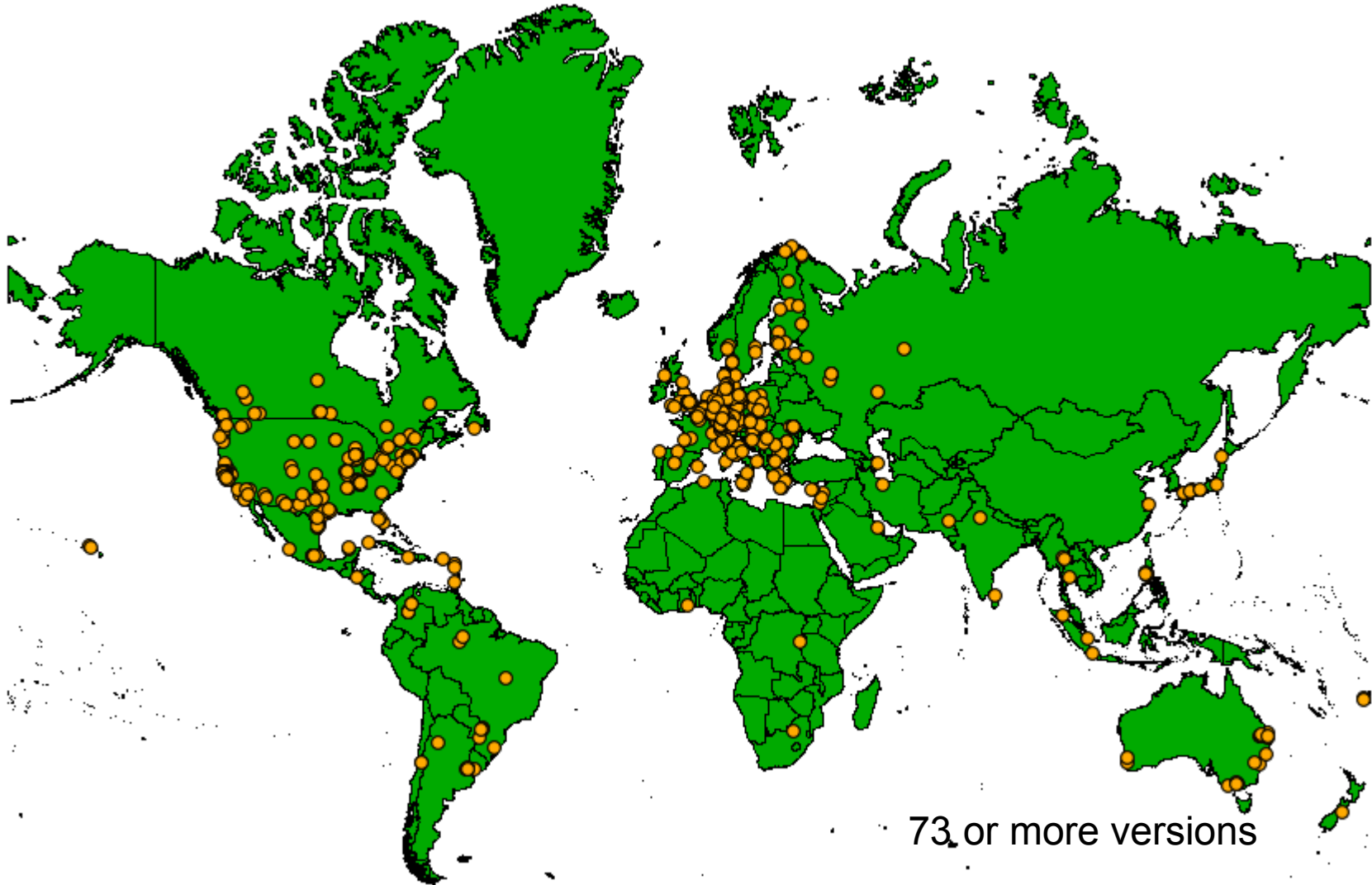
De très nombreux animaux sont insectivore
On peut citer les **hérissons**, de nombreux
On peut dire que certains insectes aussi si

Literature on collaborative project is now appearing in many domains

- **Doan et al (2011)** “What are the encouragement schemes E&R for contributors?”
- **Prasarnphanich and Wagner (2011)** “Wikipedia articles are *cumulative integrated products of co-authored contributions*”
- **Antin (2011)** “people like the idea that Joe Schmo can edit Wikipedia but most are sceptical of Joe himself”
- **Neilsen (2006), Heipke (2009)** - “90% of users consume, 9% contribute sometimes, 1% constantly contributing”
- **Foster-Smith & Evans (2003), Nerbonne and Nelson (2008)** - “number of training hours, in-task support, education, profession are not predictors of data quality”

Analysis

World Top 1000 Edited Features Centroids (Most Recent Version)

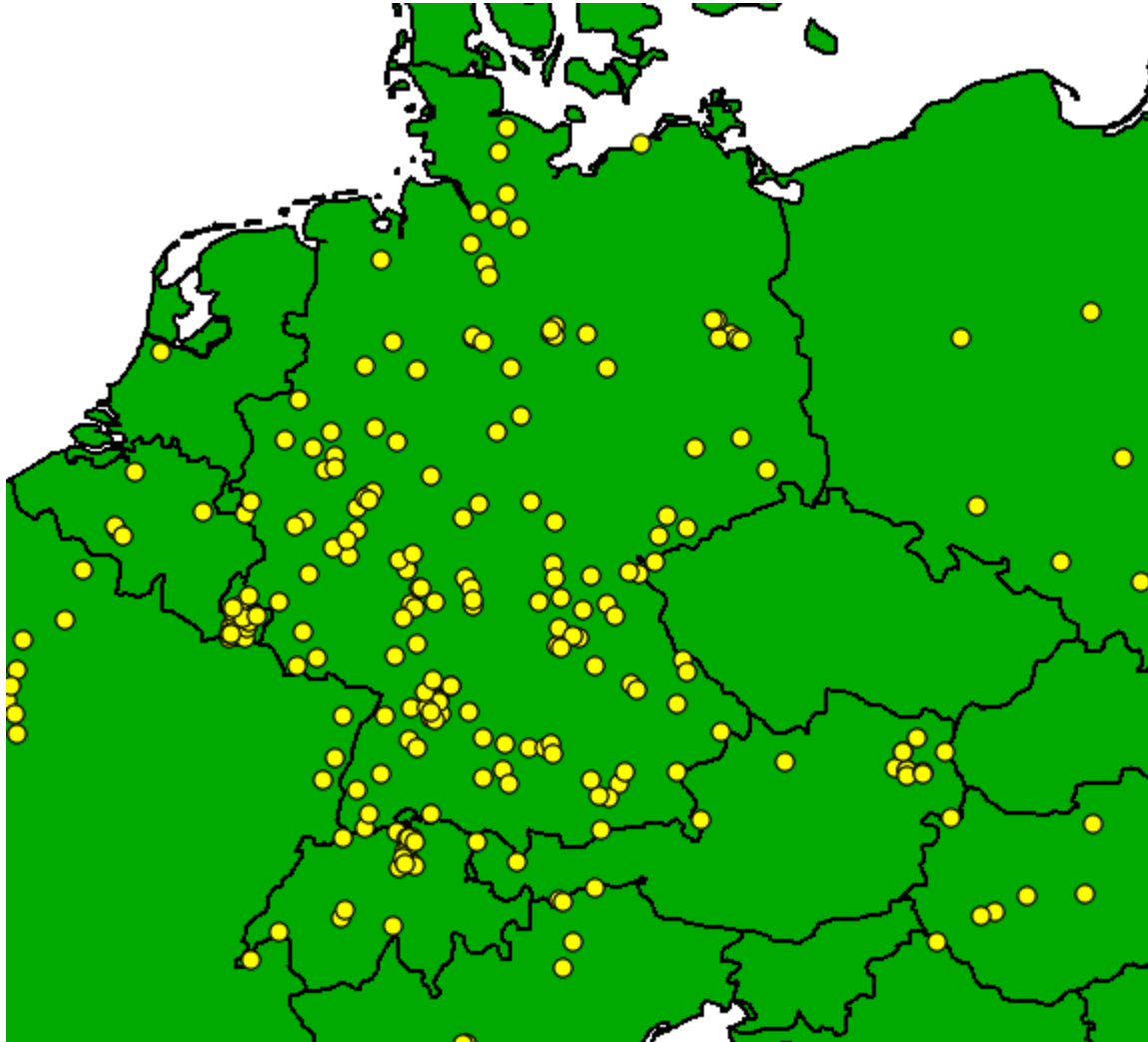


```
wget --no-proxy http://www.openstreetmap.org/api/0.6/way/5045432/full  
-O ./xml/full/top500-5045432.xml
```

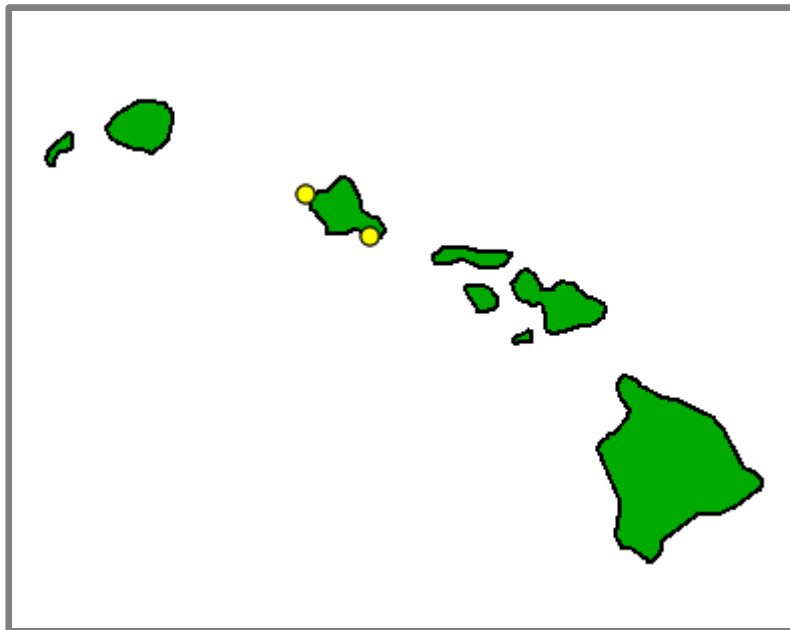
Europe is the continent with highest concentration of high edit features



Within Europe – Germany OSM is dominant for high edit features



Honolulu



Way: 12204628

Edited at: Sat, 25 Dec 2010 05:00:23 +0000

Edited by: [MojaveNC](#)

Version: 82

In changeset: [6758822](#)

Tags: [highway = track](#)
[tracktype = grade4](#)

Nodes: [110640990](#) (also part of way [— State Highway 930](#))
[666665676](#)

Bujumbura, Burundi



Way: Boulevard du Port (8111815)

Edited at: Sun, 03 Jul 2011 15:56:52 +0000

Edited by: [Matana](#)

Version: 87

In changeset: [8620447](#)

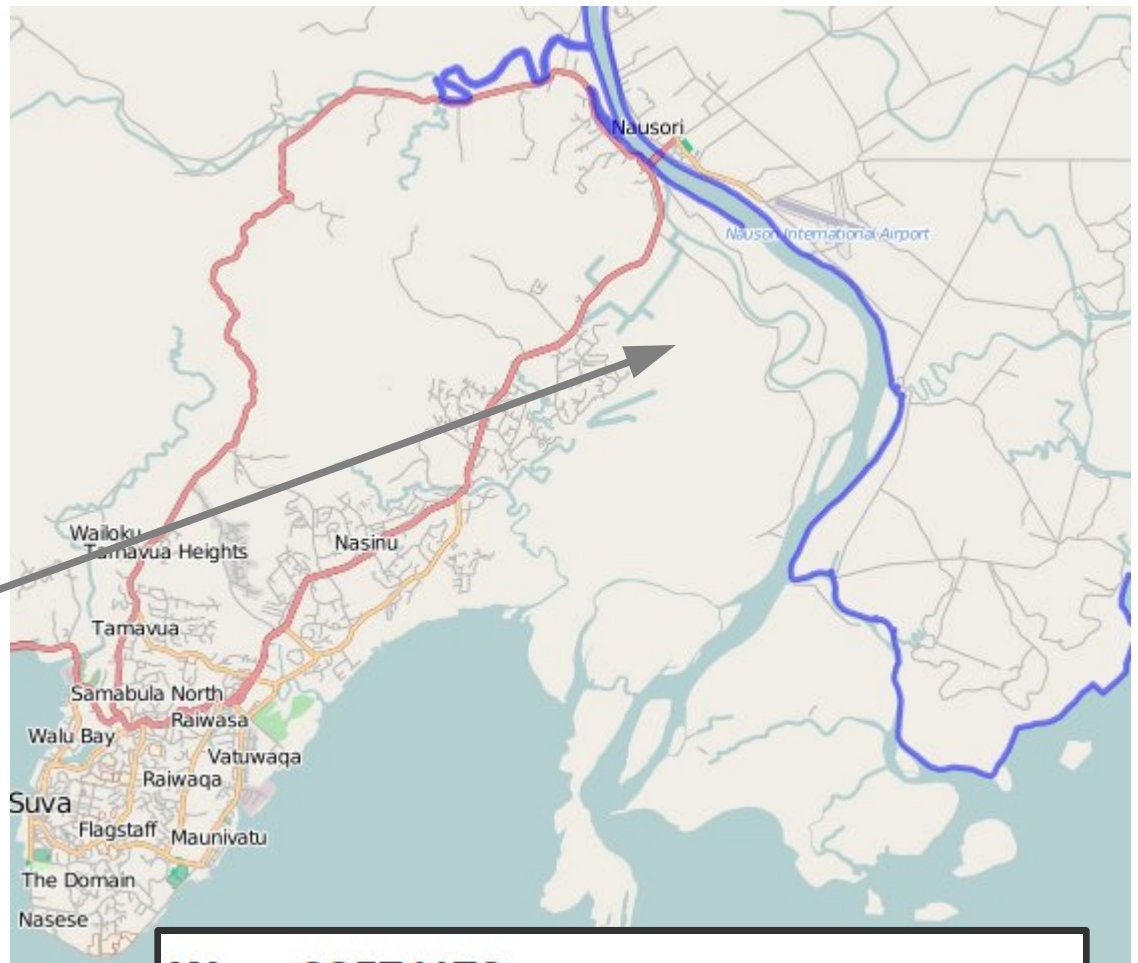
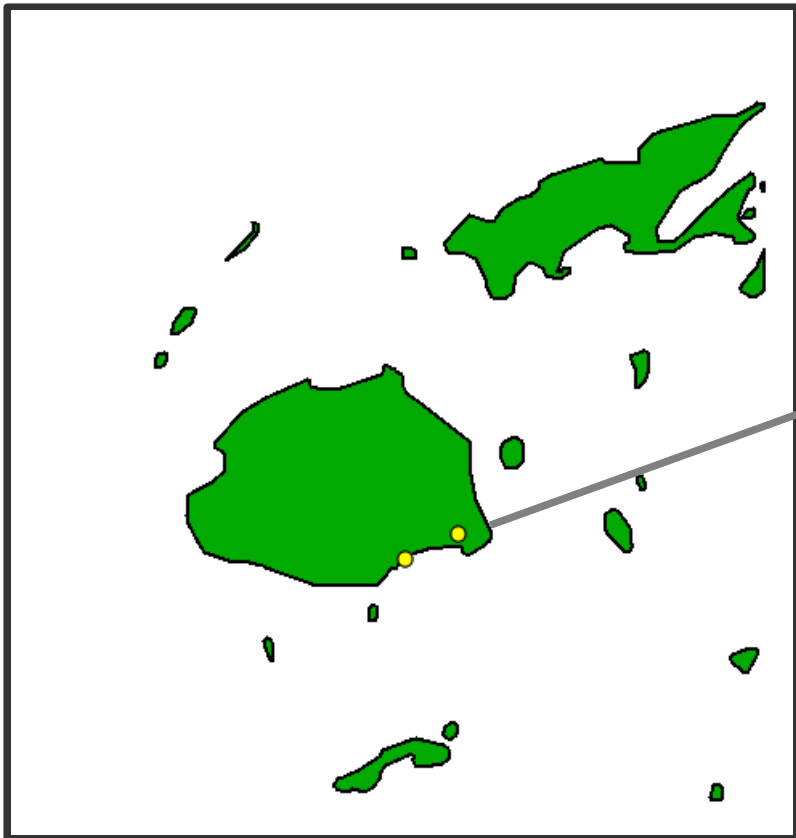
Comment: Bujumbura Update

Tags: [highway = tertiary](#)
[name = Boulevard du Port](#)

Nodes: [435994551](#)
[435428521](#) (also part of way [Avenue de la P](#))
[327198516](#) (also part of way [29705002](#))
[327182177](#) (also part of way [29704657](#))
[327182766](#) (also part of way [Av. du Marais](#))
[72685740](#) (also part of ways [Boulevard de l](#)
[du 1 Novembre \(120115053\)](#))



Fiji



Way: 22571178

Edited at: Tue, 02 Nov 2010 17:38:48 +0000

Edited by: [PA94](#)

Version: 115

In changeset: [6269716](#)

Comment: created relation for riverbank with islands

Tags: history = Retrieved from v43

natural = coastline

source = PGS

Nodes: [268075945](#) (also part of way [24749202](#))
[241987969](#)

Norway – Barents Sea

Way: 5961724

Edited at: Fri, 10 Oct 2008 14:59:08 +0000

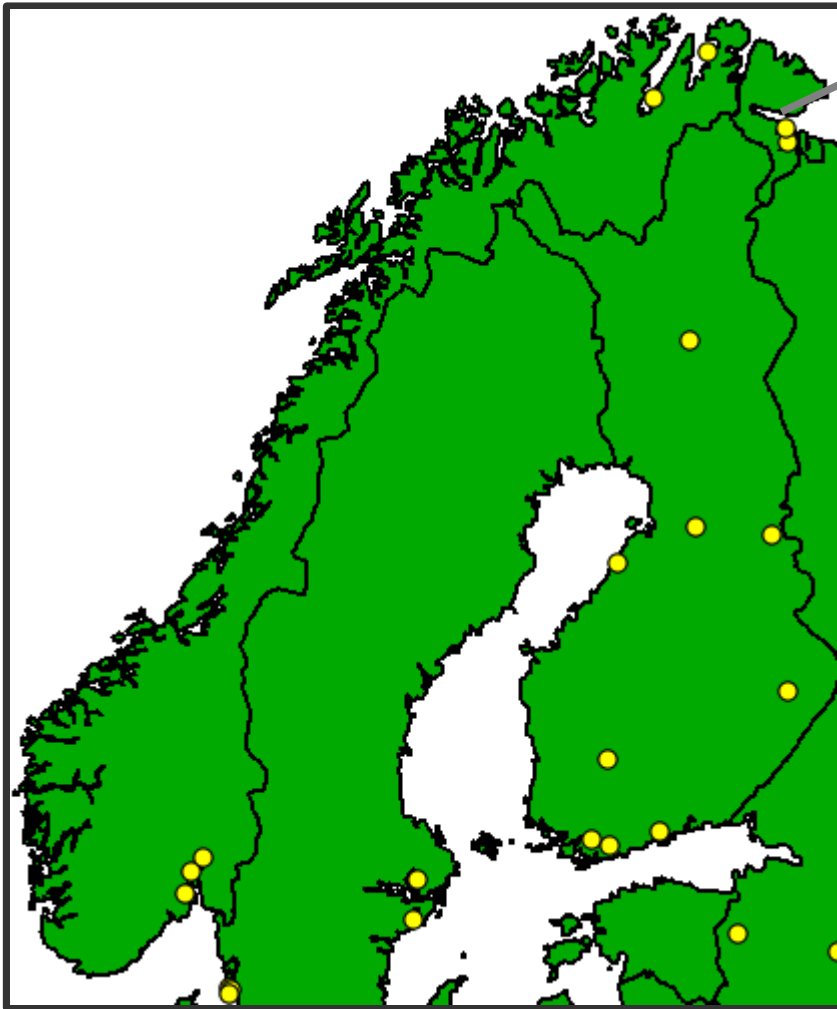
Edited by: [olf](#)

Version: 84

In changeset: [214511](#)

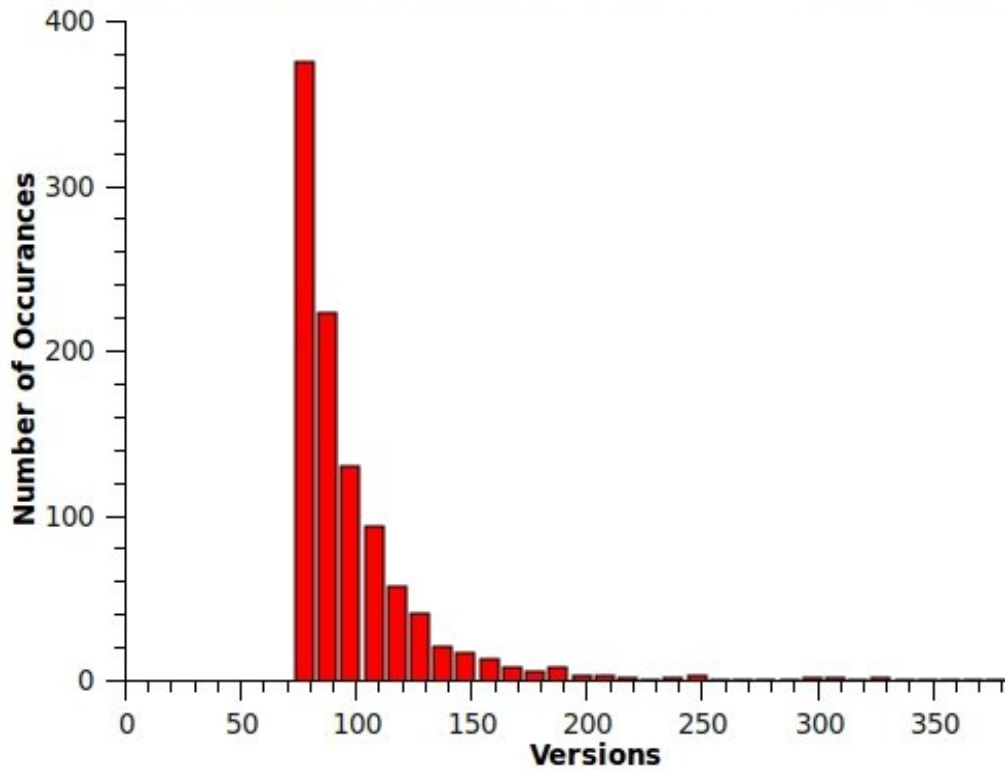
Tags: [created_by = Potlatch 0.10d](#)
[natural = coastline](#)

Nodes: [49021132](#)
[49020987](#)
[303559562](#)
[303559563](#)

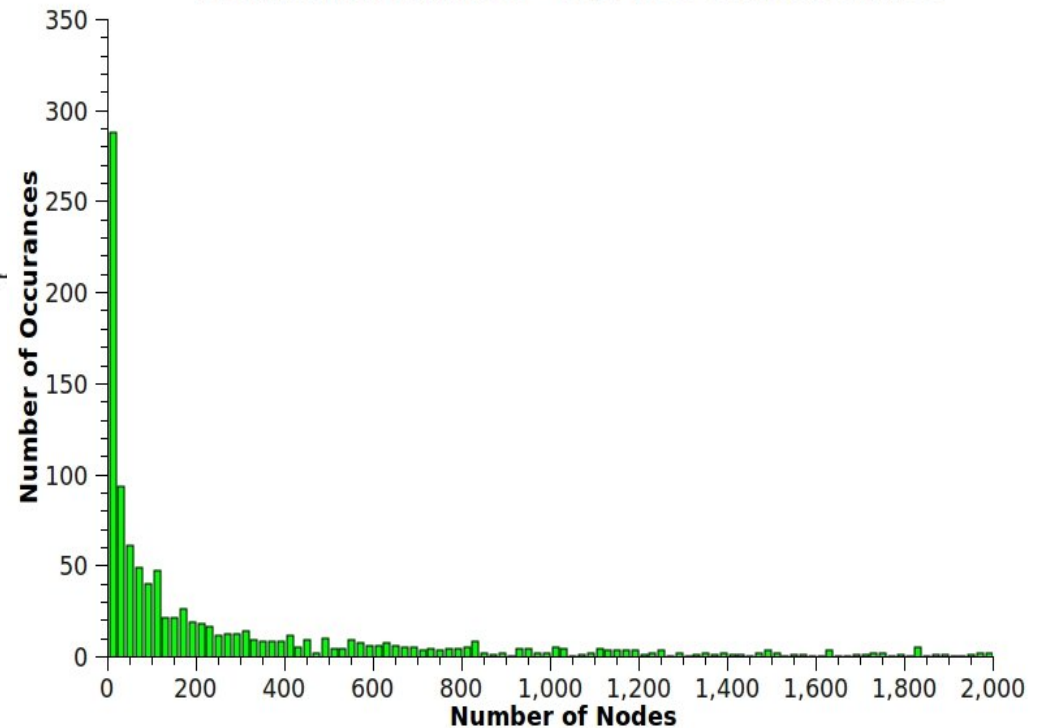


What do the top 1000 look like?

Distribution of Versions - Top 1000 edited features



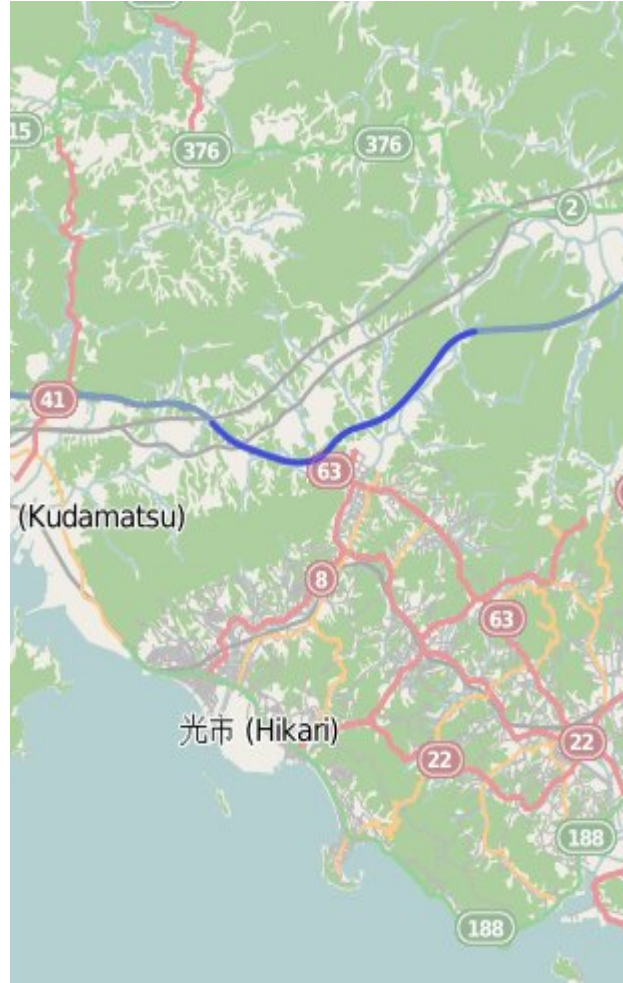
Distribution of Nodes - Top 1000 edited features



The OSM Editing World Champions From Recent Planet.OSM



South W - JAPAN
24770043 V400

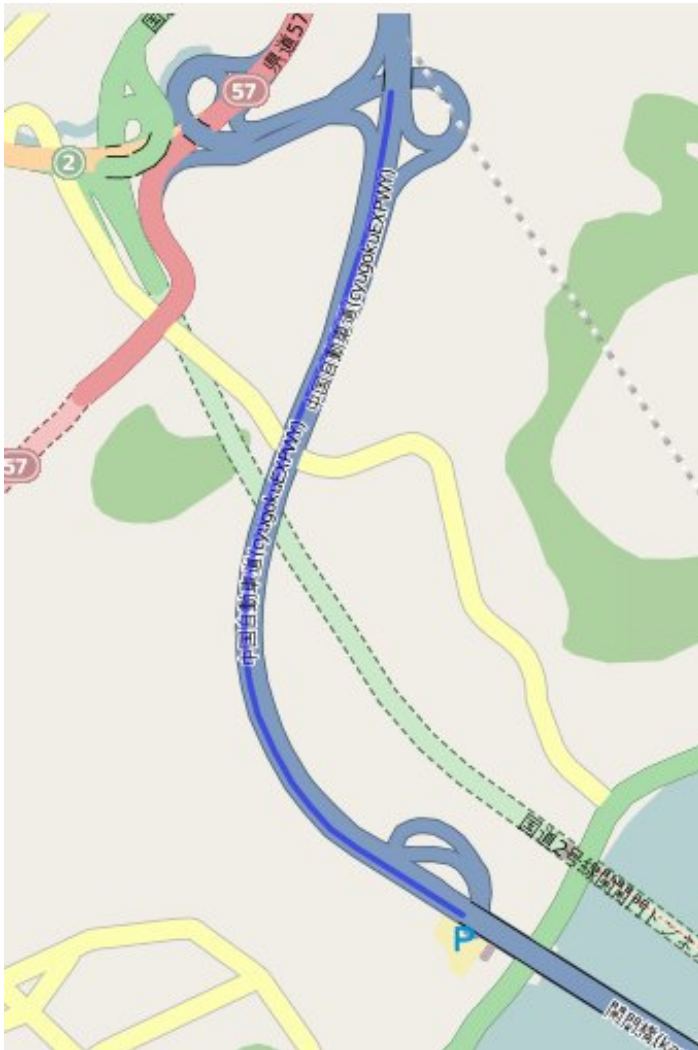


South W - Japan
24761888 , V399



Lausanne,
Switzerland
23381485, V323

The Champion



- 3 editors
- Start: 8-6-2008
- End: 5-1-2011
- One editor exclusively for first 398 versions!
- 10 Changesets
- Nodes: (278, 629,26)

24770043

Silver Medalist



- 1 editor
- Start: 08-06-2008
- End: 12-10-2009
- One editor for all 399 versions
- 7 Changesets
- Nodes: (444, 652,204)

24761888

Bronze medalist, but maybe actually gold medalist?



- 37 editors
- Start: 21-03-2008
- End: 19-10-2010
- One editor created 153 versions
- 149 Changesets
- Nodes: (444, 652,204)

24770043

Example 1:



28493686
Reckenerwald,
Luxembourg

Version 1:

"2008-11-18 18:15:01"

Nodes = 384

1 User

"created_by->Potlatch
0.10fXXlanduse-
>forest"



Version 2:

"2008-11-18 18:17:20"

Nodes = 504

1 User

"created_by->Potlatch
0.10fXXlanduse-
>forest"

(2 minutes later)



Version 33:

"2008-11-30 17:58:51"

Nodes = 980

2 Users

"created_by->Potlatch
0.10fXXlanduse-
>forest"

(12 days later)



Version 37:

"2008-11-30 18:07:42"

Nodes = 1057

2 Users

"created_by->Potlatch
0.10fXXlanduse-
>forest"

(9 minutes later)



Version 121:

"2009-02-09 19:46:51"

Nodes = 1830

2 Users

"created_by->Potlatch
0.10fXXlanduse->forest"

(~ 6 weeks later)



Version 122:

"2009-02-14 17:28:40"

Nodes = 1664 (-)

3 Users

"created_by->Potlatch
0.10fXXlanduse->forest"

(~ 5 days later)



Version 130:

"2009-09-27 07:58:53"

Nodes = 1616 (-)

6 Users

""certification->FSC
created_by>Potlatch0.10f
landuse>forest
name->Reckenerwald""

(~ 7 months later)



Version 156:

"2011-02-02 07:50:16"

Nodes = 1571 (-)

7 Users

"certification->FSC
landuse>forest
name->Reckenerwald"

(~ 18 months later)



CURRENT!
Version 178

"2011-04-07 20:33:36"

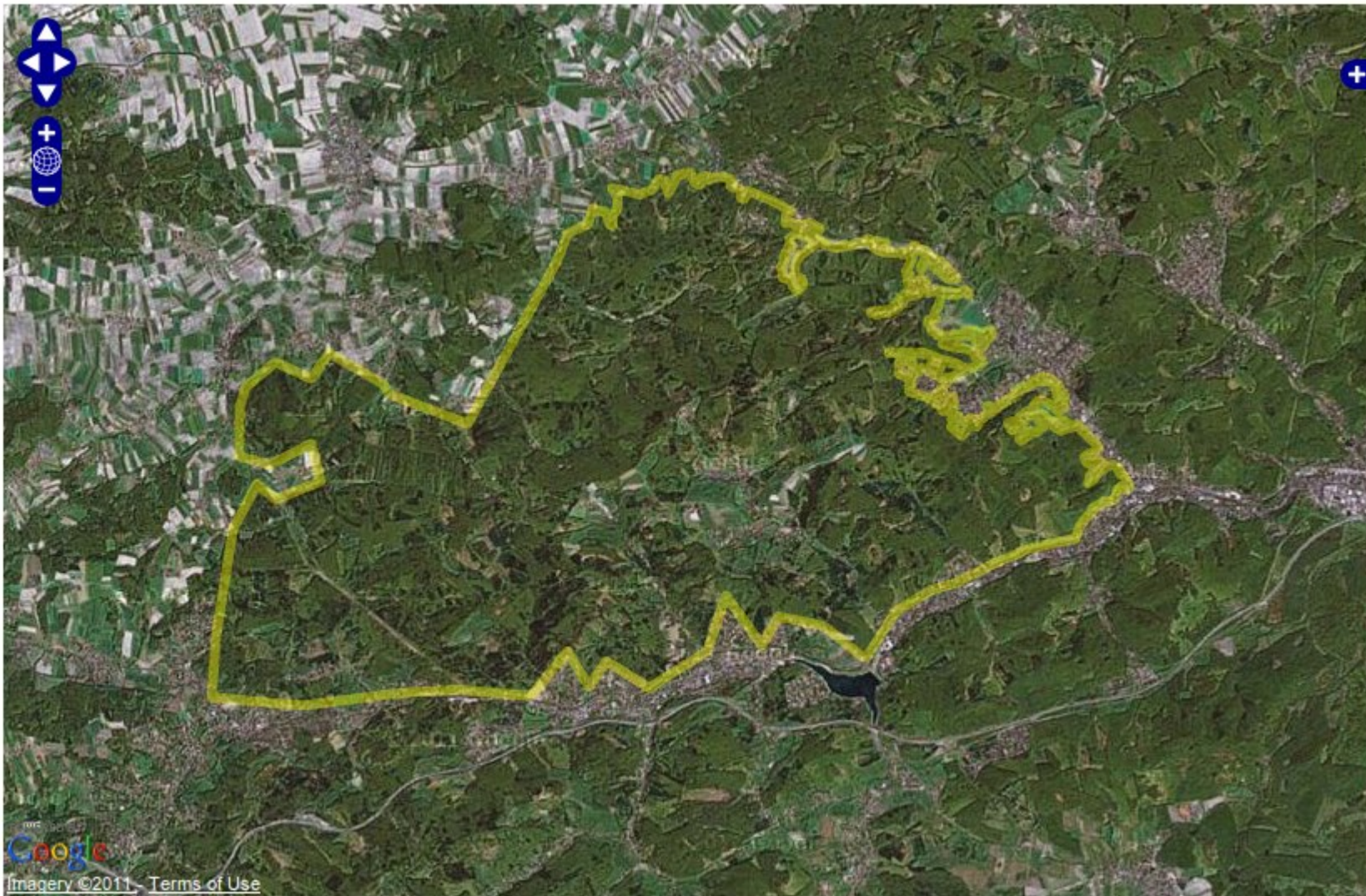
Nodes = 1559 (-)

7 Users

"certification->FSC
landuse>forest
name->Reckenerwald"

(~ 2 months later)

Example 2:



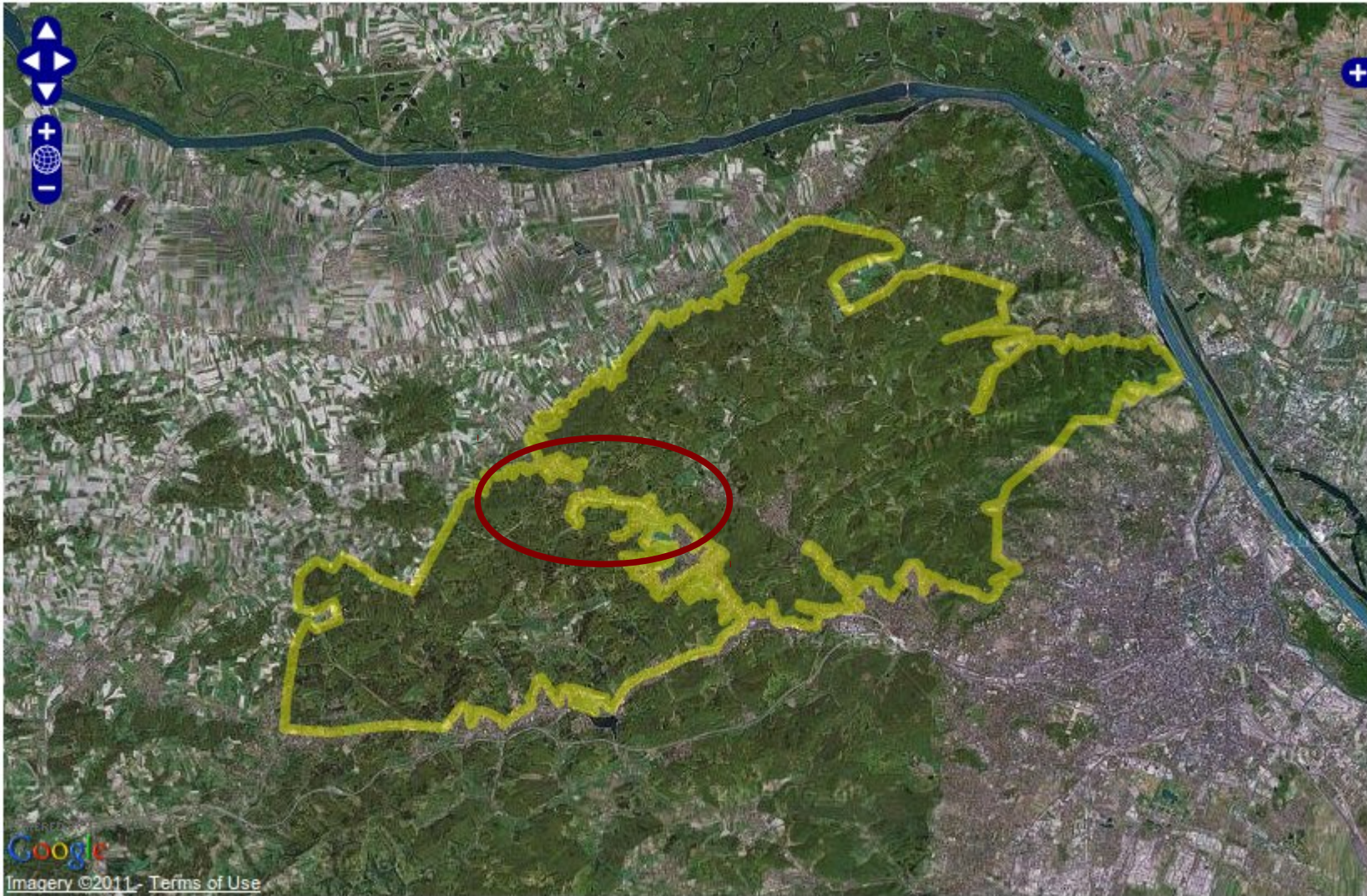
Version 5 "2008-01-22 18:35:26"

Nodes =1153

Users = 1

"created_by->Potlatch 0.6aXXname->WienerwaldXXnatural->woodXXtodo->This needs to be retraced. I just did a quick sketch using Landsat."

**OSM_ID = 22569777
near Pressbaum,
Wien-Umgebung,
Lower Austria**

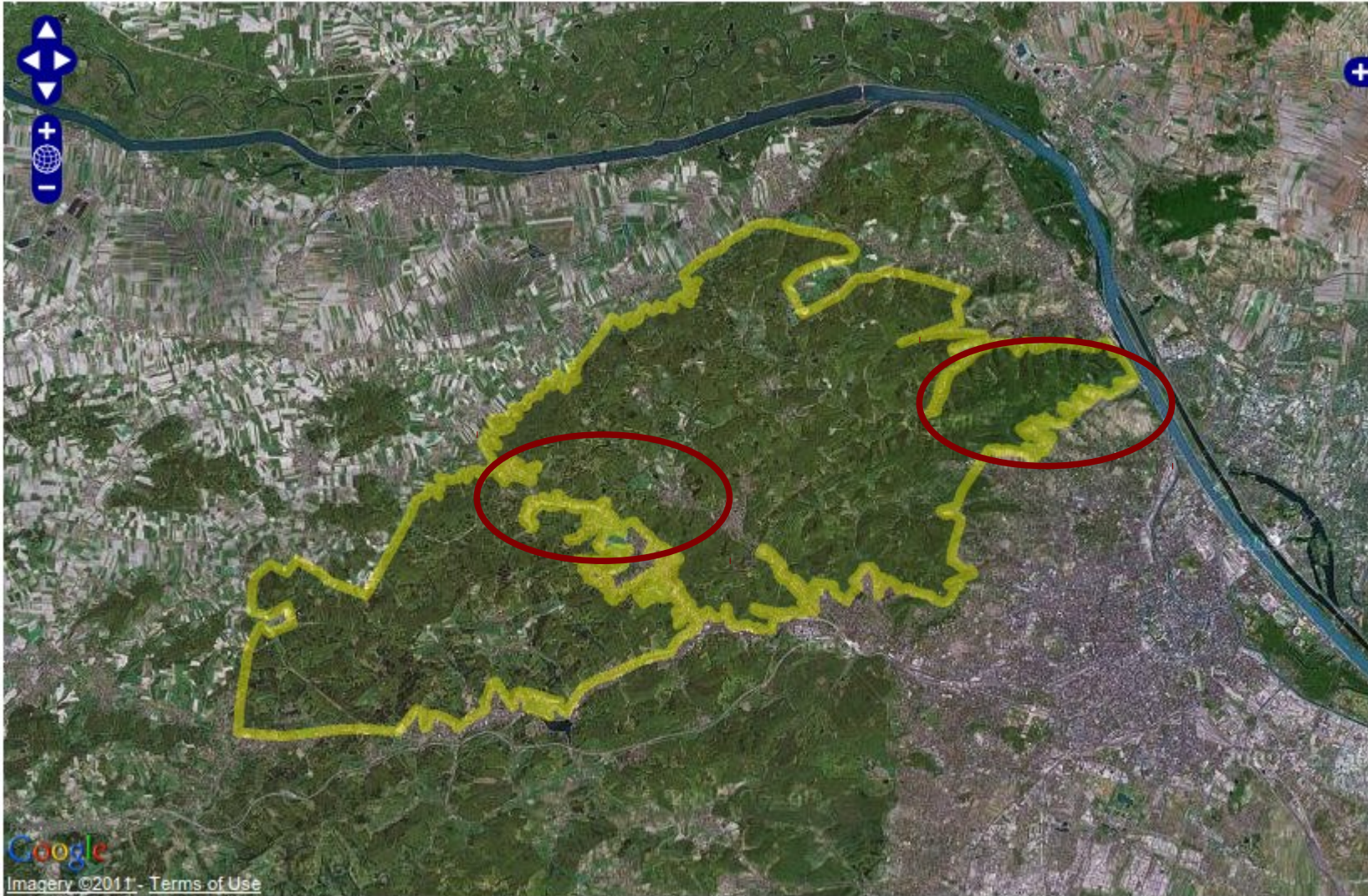


Version 21 "2008-09-05 09:19:57" (+ 8 months)

Nodes =2254

Users = 6

**"created_by->Potlatch 0.10bXXlanduse->forestXXlayer->-
2XXname->WienerwaldXXnatural->woodXXtodo->This needs to
be retraced. I just did a quick sketch using Landsat."**



Version 89 "2008-09-26 11:38:58" (+ 3 weeks)

Nodes =2663

Users = 10

"created_by->Potlatch 0.10bXXfixme->This needs to be retraced. I just did a quick sketch using Landsat.XXlayer->-2XXname->WienerwaldXXnatural->wood"



Version 90 "2008-09-26 17:19:51" (+ 5 hours)

Nodes =1175 (-) - valid geometry now

Users = 10

"created_by->Potlatch 0.10cXXfixme->This needs to be retraced. I just did a quick sketch using Landsat.XXlayer->-2XXname->WienerwaldXXnatural->wood"



Version 90 "2008-09-26 17:19:51" (+ 5 hours)

Nodes =1175 (-) - valid geometry now

Users = 10

"created_by->Potlatch 0.10cXXfixme->This needs to be retraced. I just did a quick sketch using Landsat.XXlayer->-2XXname->WienerwaldXXnatural->wood"

In the next sequence of versions...

- **Version 110;**
"2009-06-17 21:47:00";
Users: 14;
Nodes: 1324;
Tags: "created_by->Potlatch 0.10fXXfixme->This
needs to be retraced I just did a quick sketch using
Landsat.XXlanduse->forestXXlayer->-2XXname-
>Wienerwald"
- **Version 120;**
"2010-04-27 14:03:14";
Users: 19;
Nodes: 679;
Tags 0;"NONE"



Version 122 CURRENT "2010-05-30 12:07:10"

Nodes =317 (-)

Users = 20

NO TAGS

Example 3:



Version 1 "2007-08-31 21:02:54"

Nodes = 88

Users = 1

**"created_by->JOSM name->Rhein natural->water
waterway->riverbank"**

OSM_ID = 4394710
The River Rhine
Düsseldorf
North Rhine-Westphalia



Version 81 "2009-08-19 07:22:04"

Nodes = 496

Users = 23

name->Rhein

natural->water

waterway->riverbank



Version 154 "2011-05-26 21:27:17"

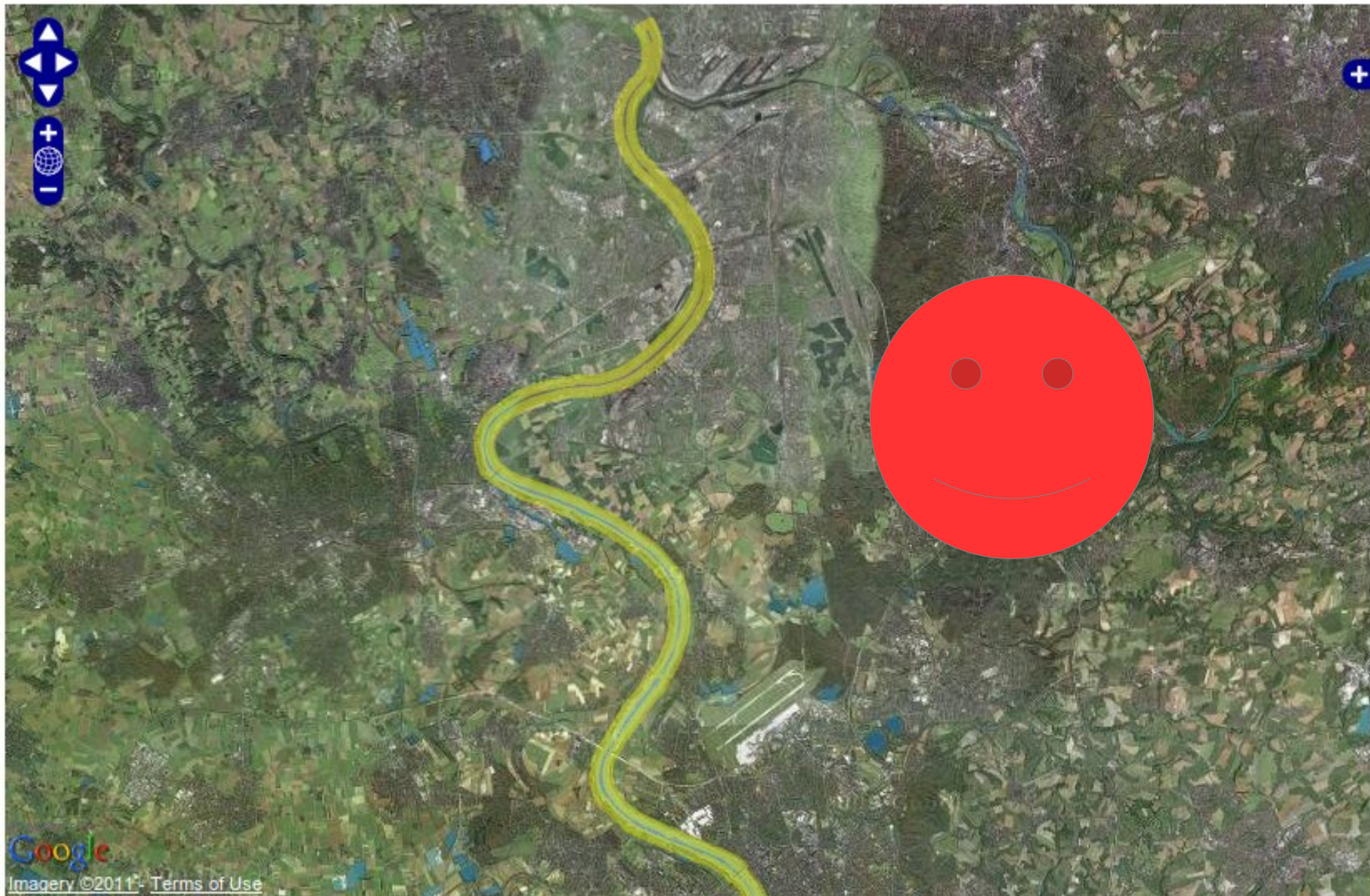
Nodes = 895

Users = 38

natural->water

source->bing

waterway->riverbank



Version 159 (Current) "2011-05-27 19:32:47"

Nodes = 958

Users = 38

natural->water

source->bing

waterway->riverbank

Additional Examples Online

- At my homepage
- [Http://www.cs.nuim.ie/~pmooney/osm](http://www.cs.nuim.ie/~pmooney/osm)
- Or
- <http://bit.ly/qVtY9H>

How names change over versions of history....

Austria (4771112, 3 contributors)

5 changes

"Raststätte Kapellerfeld"

"Autobahnraststätte Kapellerfeld (in Bau)"

"Autobahnraststätte Deutsch-Wagram (in Bau)"

"Raststation Deutsch-Wagram (in Bau)"

"Raststation Deutsch-Wagram"

England (24276789, 2 contributors)

7 Changes

"Oakthorp Drive"

"Over Green Drive"

"Oak Thorp Cr"

"Oak Thorp Dr"

"Oak Thorp Dr; Broomcroft Rd"

"Oak Thorp Drive"

"Oak Thorpe Drive"

Scotland (4755815, 12 contributors)

5 changes . .

"A199"

"Edinburgh Road"

"Milton Road East"

Scotland (23602699, 2 contributors)

5 changes . .

"phenox cres"

"Phenoix cres"

"Phenoix crescent"

"Phenoix Crescent"

"Phoennoix Crescent"

"Phoenix Crescent"

Name tag for highway in USA

Version	Edit Date	#Users	UserID	KEY: name	#Tags	#Nodes	Changeset
1 (First)	14-09-2008 (14:57)	1	30521	Will Rogers Expwy; I-44	23	3	631460
16	14-09-2008 (15:19)	1	30521	Will Rogers Expwy; I-44; I-44	23	193	631460
32	26-09-2008 (05:59)	1	30521	Will Rogers Expwy	23	195	698784
116	06-02-2009 (03:32)	1	30521	Will Rogers Expressway	17	274	199845
120	02-08-2009 (08:44)	2	37392	Will Rogers Expressway; Interstate Highway 44; United States Highway 62; United States Highway 277	17	274	2010509
121	02-08-2009 (08:48)	2	37392	Will Rogers Expressway; Interstate Highway 44; United States Highway 62	17	274	2010509
124	05-02-2010 (07:40)	3	207745	Will Rogers Expressway	16	15	3796064
126 (Final)	11-02-2011 (16:35)	5	5286	Will Rogers Expressway	16	15	7256802

http://en.wikipedia.org/wiki/Interstate_44_in_Oklahoma

Street in Bordeaux, France

Version	Edit Date	#Users	UserID	KEY: name	#Tags	#Nodes	Changeset
1 (First)	30-01-2008 (10:07)	1	20814	No name tag specified	2	34	709744
66	09-04-2008 (21:29)	3	25762	Boulevard Alfred Daney	5	77	97429
81	24-04-2008 (08:30)	3	29316	Boulevard Pierre 1er	5	50	241232
83	24-04-2008 (08:30)	3	29316	Boulevard du PrÃ©sident Wilson	5	45	241232
90	29-04-2008 (22:32)	3	29316	Boulevard du PrÃ©sident Wilson	5	18	290025
91	01-05-2008 (10:59)	3	29316	Boulevard du PrÃ©sident Roosevelt	5	17	298606
112	02-11-2008 (17:39)	6	24664	Boulevard Jean Jacques Bosc	5	13	659699
116 (Final)	22-09-2010 (15:31)	8	53048	Boulevard Jean Jacques Bosc	4	17	5846448

Checking on the ground required with local mappers to understand these changes

Highway Naming: I-25 and US-59

Version	Edit Date	#Users	UserID	KEY: name	#Tags	#Nodes	Changeset
1 (First)	21-09-2007 (05:22)	1	7168	I-25	14	266	480633
3	25-03-2008 (18:41)	3	32090	N Cascade Ave	19	266	391628
6	04-04-2008 (19:29)	4	19219	I 25	19	266	44616
64	24-10-2008 (22:36)	7	34124	Interstate 25 Northbound	22	197	553491
124	25-10-2009 (11:05)	13	131218	I-25 N	21	14	2944508
129	18-03-2010 (22:57)	14	207745	No name tag specified	12	14	4166310
130 (Final)	03-06-2010 (01:27)	14	207745	No name tag specified	13	14	4888931

Version	Edit Date	#Users	UserID	KEY: name	#Tags	#Nodes	Changeset
1 (First)	06-12-2007 (20:00)	1	7168	Eastex Fwy	13	363	111244
36	31-12-2008 (11:12)	3	37392	Eastex Fwy;United States Highway 59	13	331	690448
132	10-07-2009 (06:03)	3	37392	Eastex Fwy;US 59 HOV	12	229	1785711
147	10-07-2009 (07:56)	3	37392	Eastex Fwy;United States Highway 59	12	120	1786311
152	13-03-2011 (06:37)	5	207745	Eastex Freeway	13	10	7540941

24912668 Landuse tags

Version	Edit Date	#Users	UserID	KEY: natural	KEY: landuse	Changeset
1 (First)	16-06-2008 (13:27)	1	8732	No natural tag specified	No landuse tag specified	182100
2	16-06-2008 (13:32)	1	8732	wood	forest	182100
4	16-06-2008 (18:39)	1	8732	No natural tag specified	No landuse tag specified	185088
5	16-06-2008 (18:44)	1	8732	wood	forest	185088
44	30-09-2008 (13:46)	10	62296	NO natural TAG	forest	723854
45	01-10-2008 (09:29)	11	31231	No natural tag specified	forest	8143
68	23-10-2008 (20:31)	14	51927	wood	forest	537880
70	29-10-2008 (19:52)	14	8732	No natural tag specified	forest	623394
113	06-06-2011 (17:21)	23	206037	No natural tag specified	meadow	8362193

Schwarzwald-Baar in Baden-Württemberg in Germany.

Landuse Tags or Natural Feature Tags:

These bring a beautiful but complex semantics problem to the surface

What is a wood? What is the forest? What is a meadow or a field?

Why do people tag the “same” features differently?

25934442: Landuse Example 2

Version	Edit Date	#Users	UserID	KEY: natural	KEY: landuse	Changeset
1 (First)	02-08-2008 (17:20)	1	8226	wood	No landuse tag specified	25198
10	12-09-2008 (18:51)	5	26299	No natural tag specified	forest	612983
11	14-09-2008 (20:37)	5	57276	wood	forest	635751
13	25-09-2008 (11:08)	5	57276	wood	No landuse tag specified	693985
17	25-10-2008 (13:36)	7	57645	No natural tag specified	forest	561927
19	13-12-2008 (18:49)	7	18407	wood	forest	354539
22	14-01-2009 (17:21)	8	26299	No natural tag specified	forest	787684
26	20-02-2009 (19:44)	9	57276	wood	forest	580431
27	08-03-2009 (12:06)	9	18407	No natural tag specified	forest	756107
63	01-05-2010 (19:16)	22	21220	wood	landfill	4578445
64	01-05-2010 (19:18)	22	21220	No natural tag specified	forest	4578445
116 (Final)	10-04-2011 (19:41)	27	21220	No natural tag specified	forest	7826738

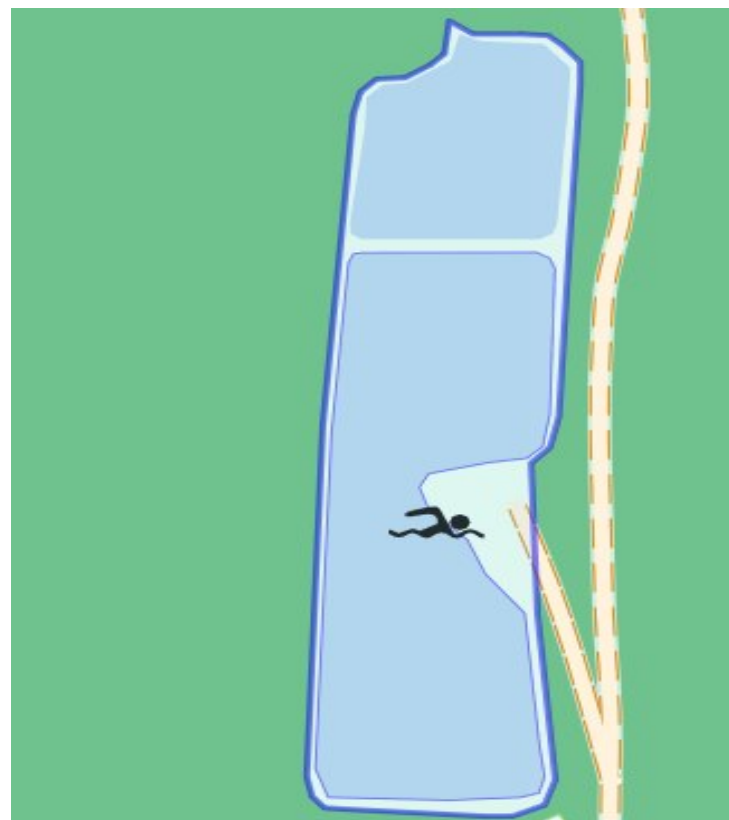
Changing Landuse - Austria

Version	Edit Date	#Users	UserID	KEY: natural	KEY: landuse
1 (First)	17-10-2007 (02:11)	1	16464	water	No landuse tag specified
4	17-07-2008 (13:49)	3	42253	wood	forest
7	21-07-2008 (15:51)	3	42253	No natural tag specified	forest
8	11-02-2009 (07:50)	4	16330	No natural tag specified	farmland
9	11-02-2009 (07:51)	4	16330	No natural tag specified	meadow
10 (Final)	18-08-2009 (07:05)	4	42253	No natural tag specified	meadow

Strange Rendering...

Meadow is the only tag...

<http://www.openstreetmap.org/?way=9682620>



Summary of Analysis

Overall summary of our study of OpenStreetMap Ireland and UK

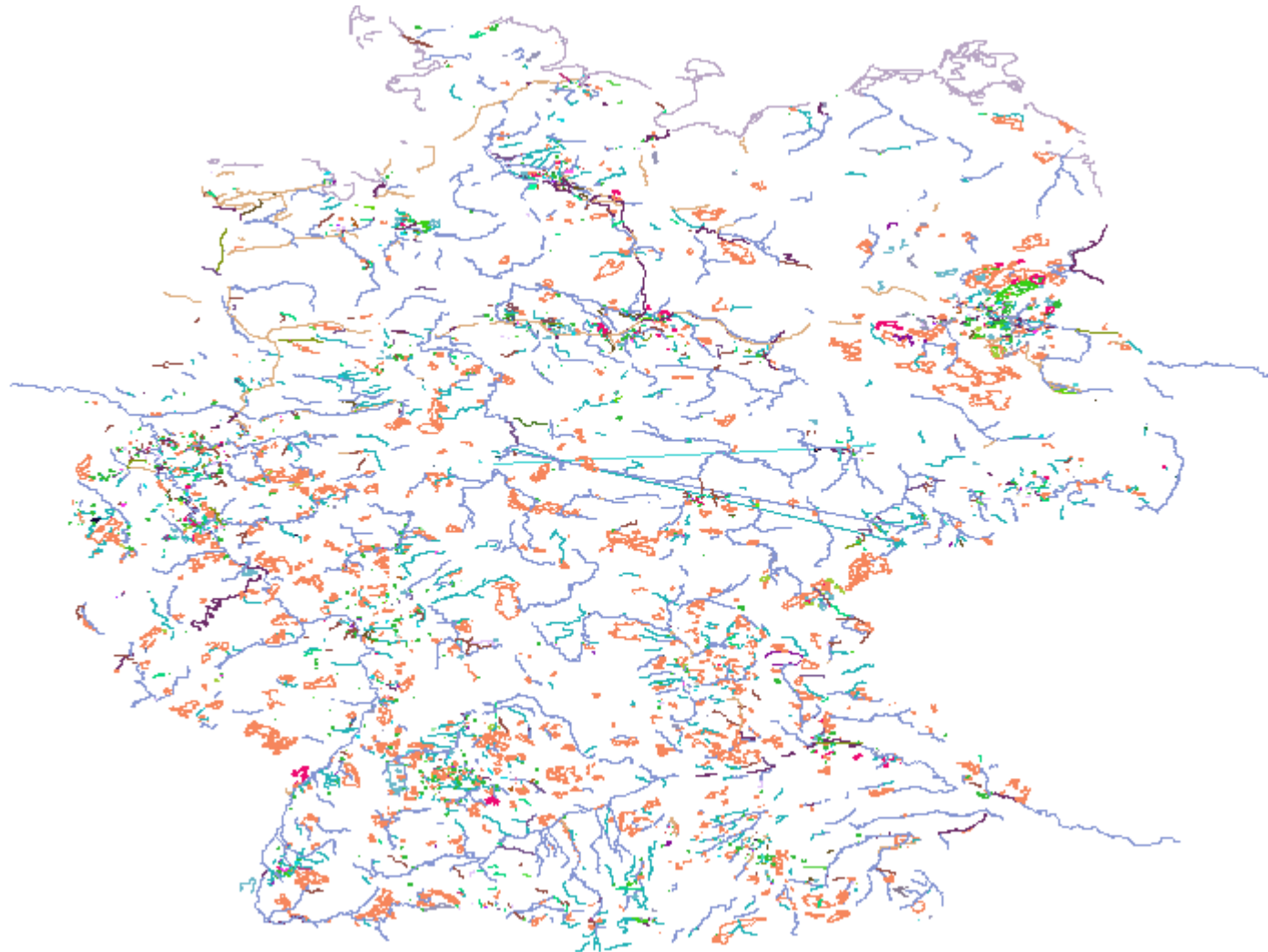
- Total of **220,779** edits
- England – **171,907**
- Scotland – **21,931**
- Wales – **13,825**
- Ireland – **13,116**
- There are **3084** unique contributors
- **25 users** edited in all 4 countries
- **56 users** edited all 5 chosen feature types
- Earliest contributions begin in **May 2007**



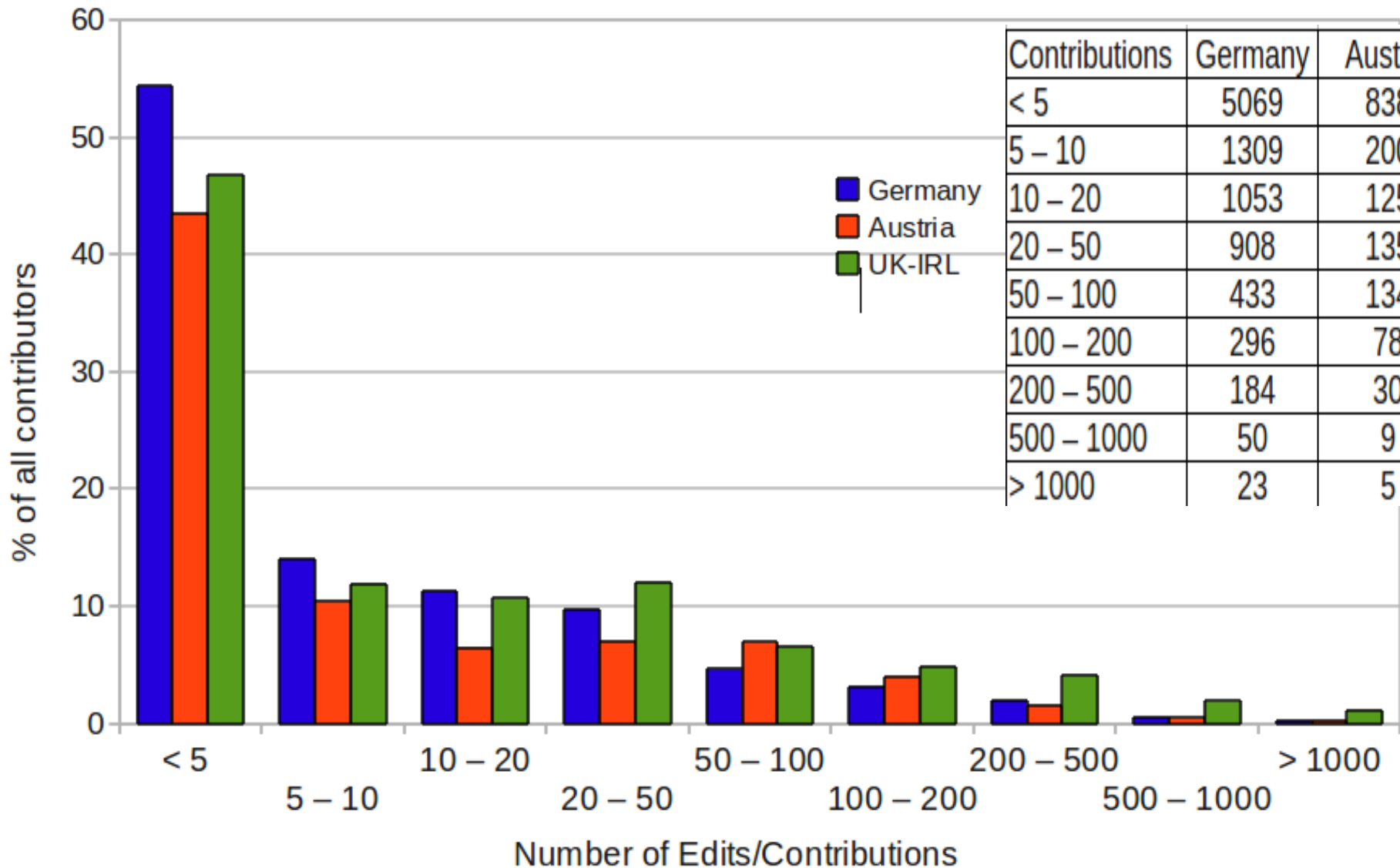
Germany (1) – OSM Database

- We biased our selection of features toward LANDUSE Total **10603** features
- Amenity **510**, Highway **684**, Landuse **6998**, Natural **590**, and Waterways **1821**
- Total Objects = 259,049, Consecutive Versions = 248,426
- Unique Contributors = **9325**
- **234 (2.5%)** Contributors edited ALL feature types
- **Germany (2) July 2011 – 16,681 contributors, 67422 features**

Visualisation of OSM sample of high edit features in Germany



Contributor effort



AUSTRIA (1926 unique editors)

UK & Irl (3084 unique contributors)

Germany1 (9325 unique contributors)

One time “test the water” contributors are significant

- Contributors who performed **ONE EDIT**
- **Ireland** (30% - from 355)
- **England** (27% from 2505)
- **Scotland** (25% from 379)
- **Wales** (28% from 316)
- **Austria** (22% from 1926)
- **Germany¹** (27% from 9325)



Contributions are mostly restricted to very low volume edits

- Contributors who performed **10 or Less EDITS**
- **Ireland** (66% - from 355)
- **England** (58% from 2505)
- **Scotland** (61% from 379)
- **Wales** (68% from 316)
- **Austria** (74% from 1926)
- **Germany¹** (70% from 9325)

Analysis of the time between consecutive edits to objects

Time Between Versions	Austria (%)	UK/Irl (%)	Germany (%)
<= 5 minutes	22.80	41.25	25.98
5 mins to 30 mins	7.03	8.25	9.42
30 mins to 1 hour	2.01	1.81	2.48
1 hour to 2 hours	1.42	1.47	1.88
2 hours to 12 hours	3.47	2.94	4.28
12 hours to 24 hours	3.05	2.62	3.93
24 hours to 1 week	10.57	8.67	13.26
1 week to month	13.42	9.30	13.94
> 1 month	36.00	23.63	24.84

Austria (3367 Objects – 45,369 consecutive versions)

UK + Ireland (10693 Objects – 206,843 consecutive versions)

Germany¹ (10603 Objects – 248,426 consecutive versions)

Changesets could help reveal more accurate patterns of contribution

- **England:** 171,907 versions – top 5 changesets had (127, 267*, 34, 86, 103) **ways**
- **Austria:** 135,010 versions – (89, 16, 76, 86, 75)
- **Ireland:** 13,116 versions – (17, 10, 15, 35, 40)
- **Scotland:** 21,931 versions – (56, 14, 24, 45, 28)
- **Wales:** 13,825 versions – (23, 264*, 3, 10, 12)
- **Germany(2):** 1,059,348 versions (2068**, 2010, 1200, 147, 730)
- Notes: * = user_id 91657, ** user_id = 5164

One time “test the water” contributors for changesets

- Contributors who created **ONE CHANGESSET**
- **Ireland** (30% - from 355)
- **England** (26% from 2505)
- **Scotland** (25% from 379)
- **Wales** (28% from 316)
- **Austria** (27% from 1926)
- **Germany2** (21% from 16,681)



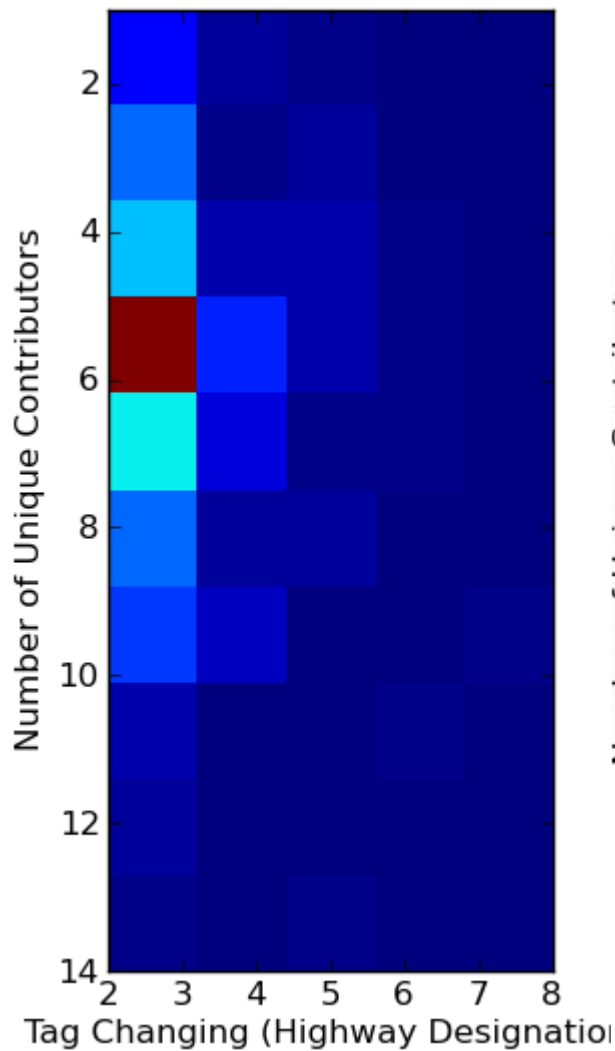
CONSISTENT WITH THE PERCENTAGES FOR 1 EDIT. ...

Patterns of higher contribution are similar at changeset resolution

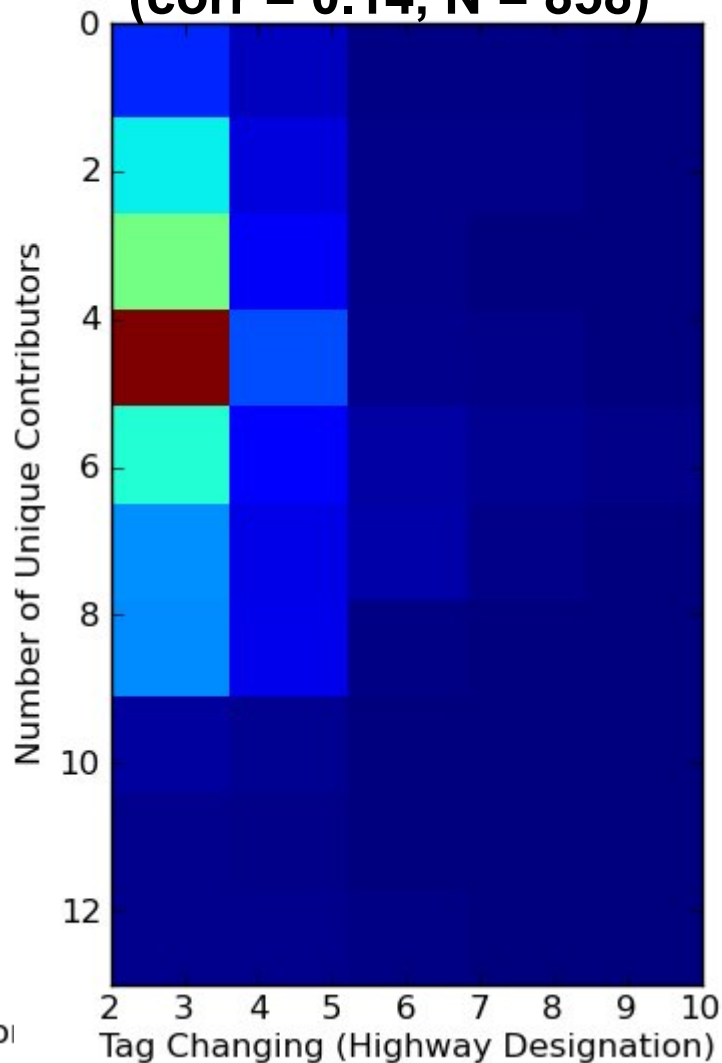
- **Ireland:** 10% (from 356) \geq **100 changesets**
- **England:** 12% (from 2505)
- **Scotland:** 9% (from 379)
- **Wales:** 7% (from 316)
- **Austria:** 8.3% (from 1926)
- **Germany2:** 10% (from 16,681)
- **World:** 4% (from 661)

Tag “flip flopping” - highways

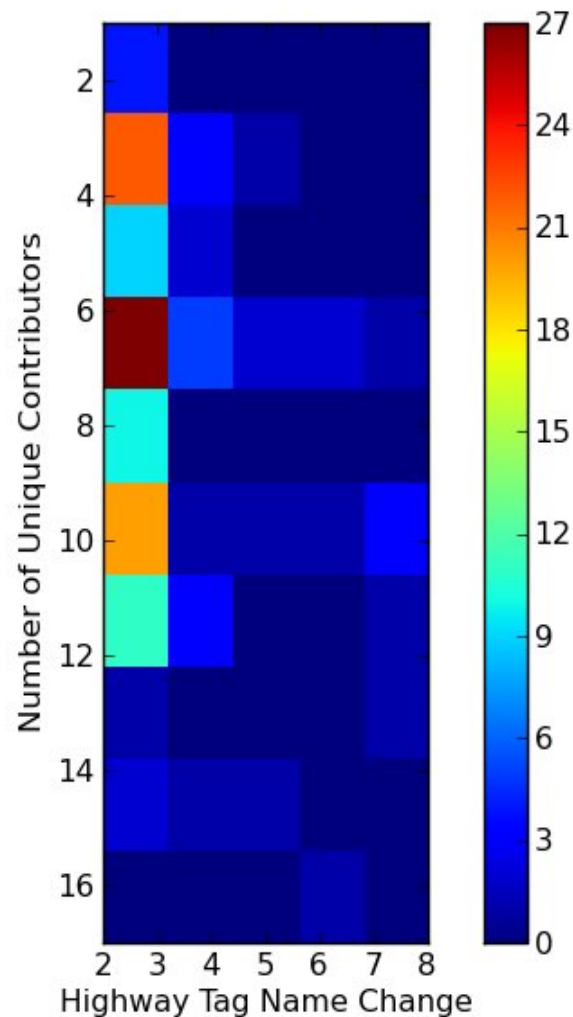
Austria (corr = 0.018, n = 395)



UK and Ireland (corr = 0.14, N = 858)



Germany1 (corr = 0.29, N = 148)



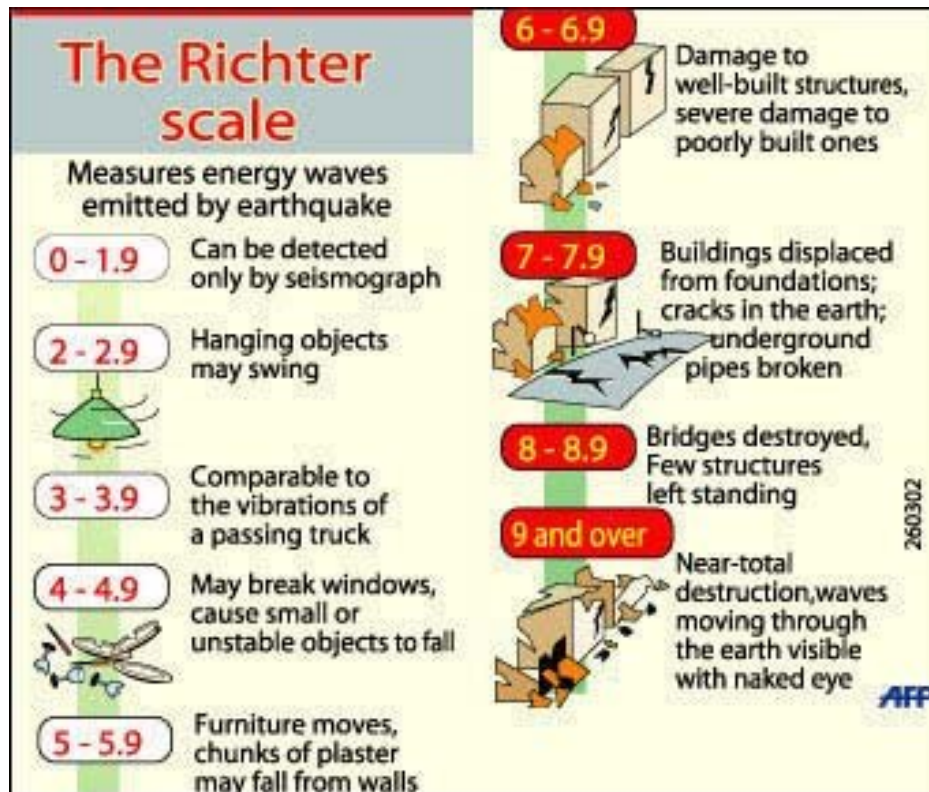
Future Work and Outlook



Some future work

- Formalise the change description and detection model outlined here
- Writing some journal papers
- Web Application: for selected areas/features
- Application of Wikipedia quality models
- Collaboration with the OSM community

Development of a “Stability” metric for OSM features



- #users, #versions
- #changesets
- #tags
- Tag changes, node changes, etc
- Geometry validity
- Overall lifespan

OSM data is volatile ... So is History!

- Need history API/schema/something!
- OSM is a very different collection/update model – need alternative quality measures
- Geometric accuracy of roads/streets largely “solved” - landcover, polygons, etc are not!
- Shapes and tags change unexpectedly
- Who to blame? editors or editor software (Weber 2011)
- Our research supports the “Neis 35%” and the “Nielsen 90:9:1”
- Is there enough “work” to retain the *mega*-contributors?

THANKS!



Photo: David Slater
<http://bit.ly/IGd3Ea>