



# Open Government Data: A Case Study in Web Science

Professor Nigel Shadbolt

Twitter [Nigel\\_Shadbolt](#)

8th July 2010  
OII Summer School  
Oxford



# The Emergence of Web Science

## INFORMATION TECHNOLOGY

### Web Science EMERGES

Studying the Web will reveal better ways to exploit information, prevent identity theft, revolutionize industry and manage our ever growing online lives

By Nigel Shadbolt and Tim Berners-Lee

#### KEY CONCEPTS

The relentless rise in Web pages and links is creating emergent properties, from social networking to virtual identity theft, that are transforming society.

A new discipline, Web science, aims to discover how Web traits arise and how they can be harnessed or held in check to benefit society.

Important advances are beginning to be made; more work can solve major issues such as securing privacy and conveying trust.

—The Editors

Since the World Wide Web blossomed in the mid-1990s, it has exploded to more than 15 billion pages that touch almost all aspects of modern life. Today more and more people's jobs depend on the Web. Media, banking and health care are being revolutionized by it. And governments are even considering how to run their countries with it. Little appreciated, however, is the fact that the Web is more than the sum of its pages. Vast emergent properties have arisen that are transforming society. E-mail led to instant messaging, which has led to social networks such as Facebook. The transfer of documents led to file-sharing sites such as Napster, which have led to user-generated portals such as YouTube. And tagging content with labels is creating online communities that share everything from concert news to parenting tips.

But few investigators are studying how such emergent properties have actually blossomed, how we might harness them, what new phenomena may be coming or what any of this might mean for humankind. A new branch of science—Web science—aims to address such issues. The timing fits history: computers were built first, and computer science followed,

which subsequently improved computing significantly. Web science was launched as a formal discipline in November 2006, when the two of us and our colleagues at the Massachusetts Institute of Technology and the University of Southampton in

England announced the beginning of a Web Science Research Initiative. Leading researchers from 16 of the world's top universities have since expanded on that effort.

This new discipline will model the Web's structure, articulate the architectural principles that have fueled its phenomenal growth, and discover how online human interactions are driven by and can change social conventions. It will elucidate the principles that can ensure that the network continues to grow productively and settle complex issues such as privacy protection and intellectual-property rights. To achieve these ends, Web science will draw on mathematics, physics, computer science, psychology, ecology, sociology, law, political science, economics, and more.

Of course, we cannot predict what this nascent endeavor might reveal. Yet Web science has already generated crucial insights, some presented here. Ultimately, the pursuit aims to answer fundamental questions: What evolutionary patterns have driven the Web's growth? Could they burn out? How do tipping points arise, and can that be altered?

#### Insights Already

Although Web science as a discipline is new, earlier research has revealed the potential value of such work. As the 1990s progressed, searching for information by looking for key words among the mounting number of pages was returning more and more irrelevant content. The founders of Google, Larry Page and Sergey Brin, realized they needed to prioritize the results.

Their big insight was that the importance of a page—how relevant it is—was best understood in terms of the number and importance of the pages linking to it. The difficulty was that part of this definition is recursive: the importance of a page is determined by the importance of

## COMMUNICATIONS OF THE ACM

07/08 VOL 51 NO 7

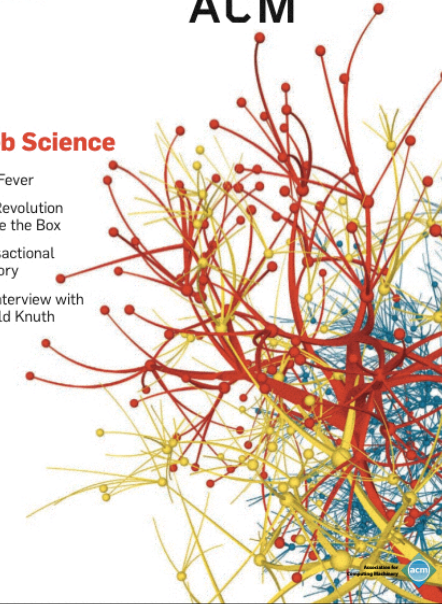
### Web Science

XML Fever

The Revolution  
Inside the Box

Transactional  
Memory

An Interview with  
Donald Knuth

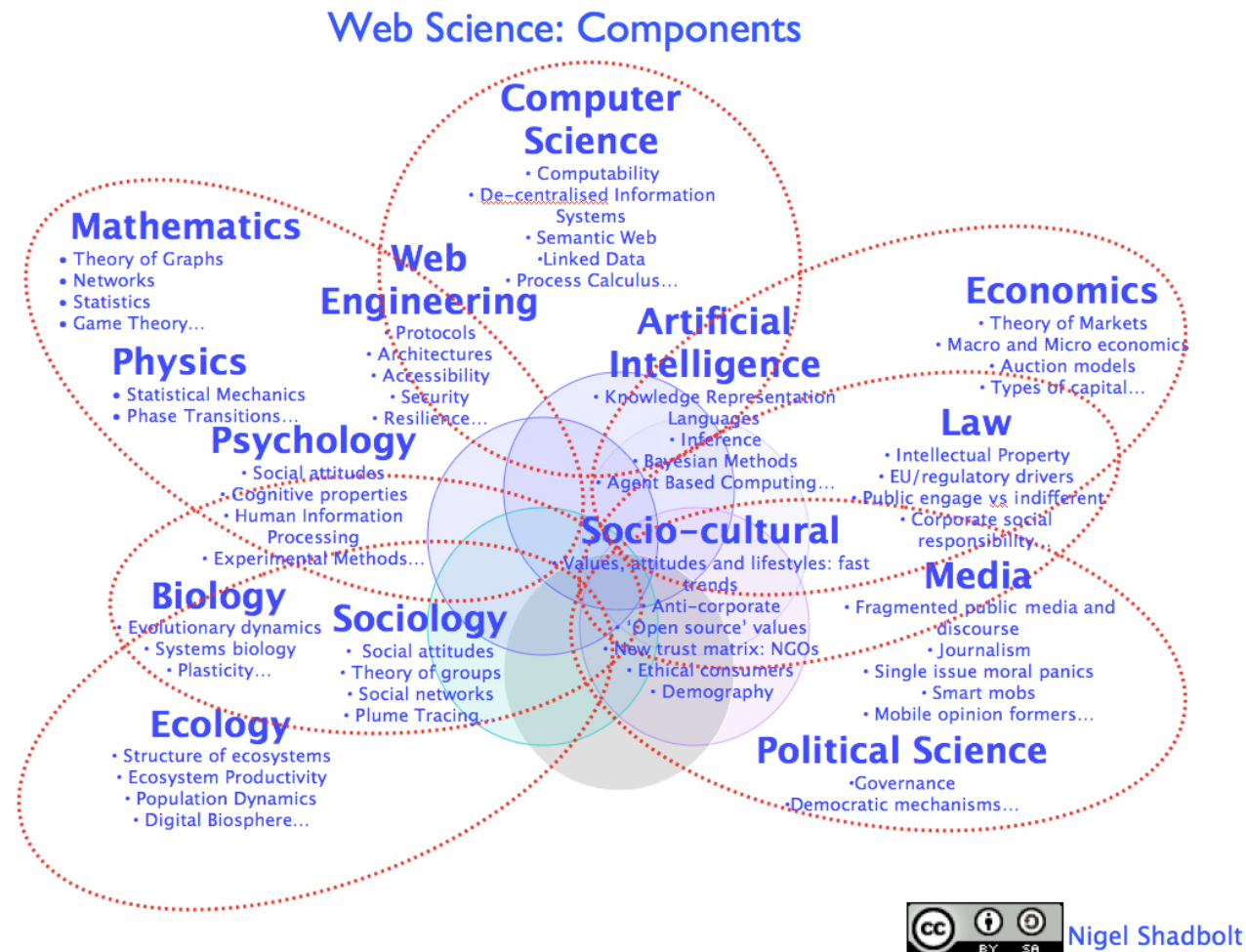


# Web Science

is about additionality

Not the union of the disciplines

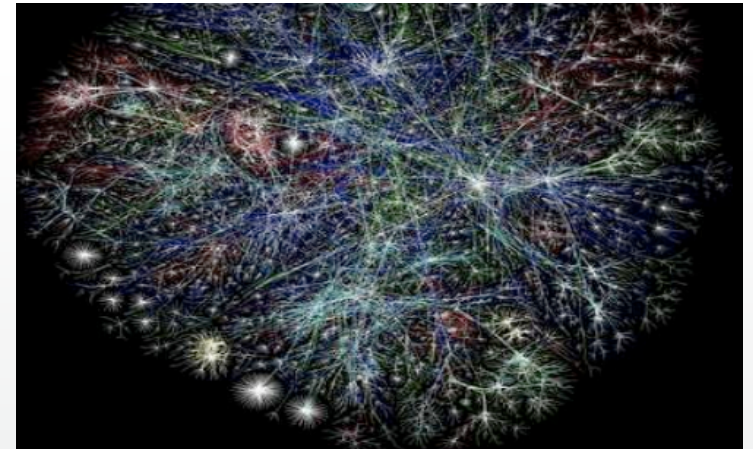
But more than their intersection



# Web Science

## essentials

- Web architecture is a set of simple principles that give rise to complexity
- Simple micro rules give rise to complex macro phenomena
- Many systems in nature are like this
- A need for a systems oriented view of the Web and its ecosystem
- A process that accounts for design/ engineering and analysis/science
- An approach that is focused on the social and technical

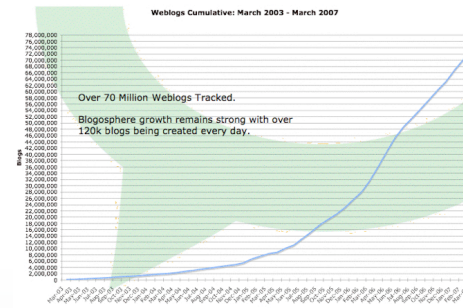




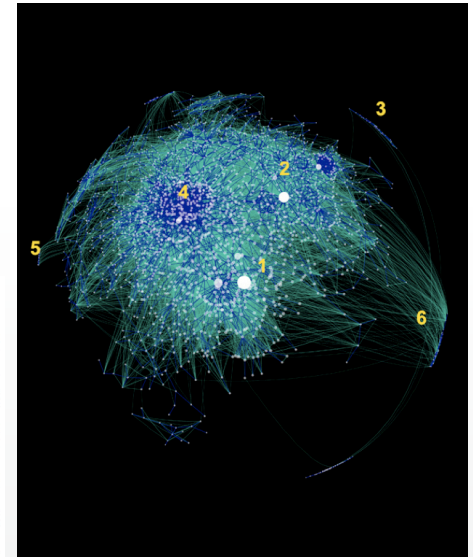
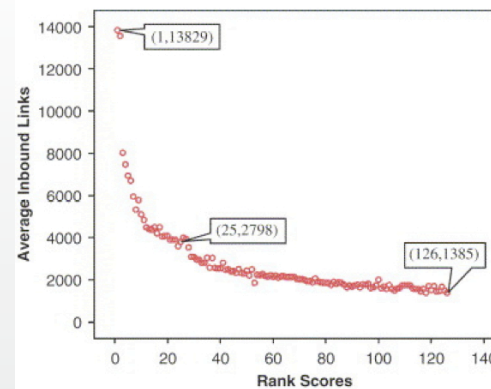
# Web Science

## an example

- When and why did the blogosphere take off?
- Who blogs and how much?
- Why do they blog?
- Is it the same everywhere?



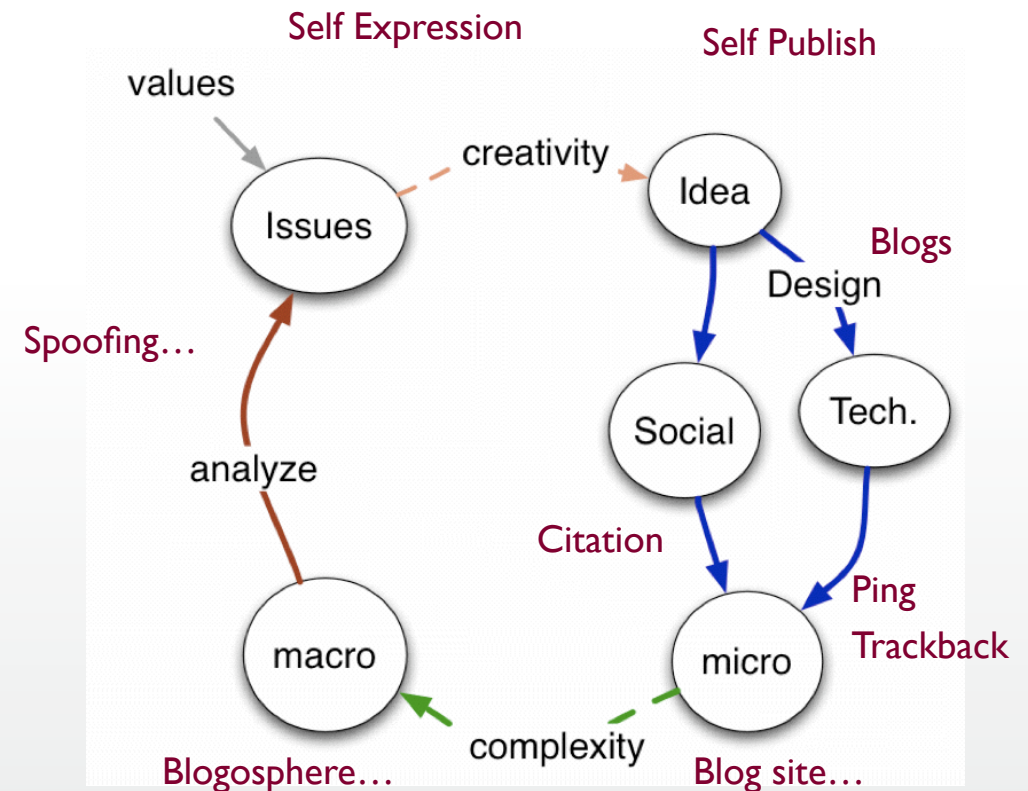
Top Blog sites



# Web Science

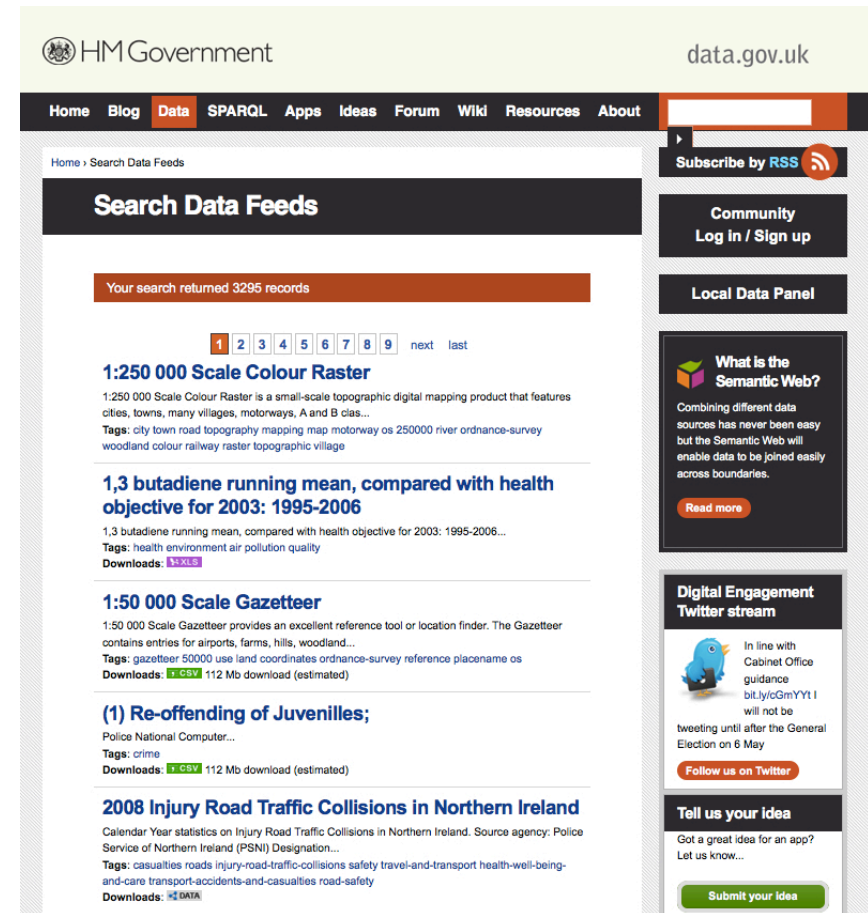
what we need to understand

- creative innovation
- design and engineering
- the social and the technical
- interpretation and analysis



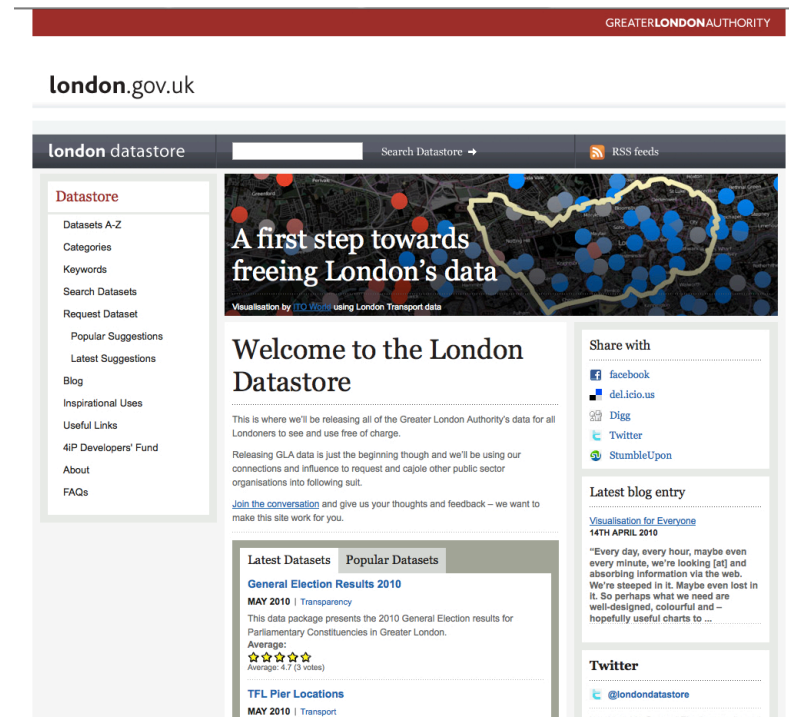
# Context

- Sometimes you can catch a wave
- Governments, cities, organizations, individuals - all releasing data
- Our emphasis was non-personal public data
- Wouldn't think that this would set your heart racing – but it does!



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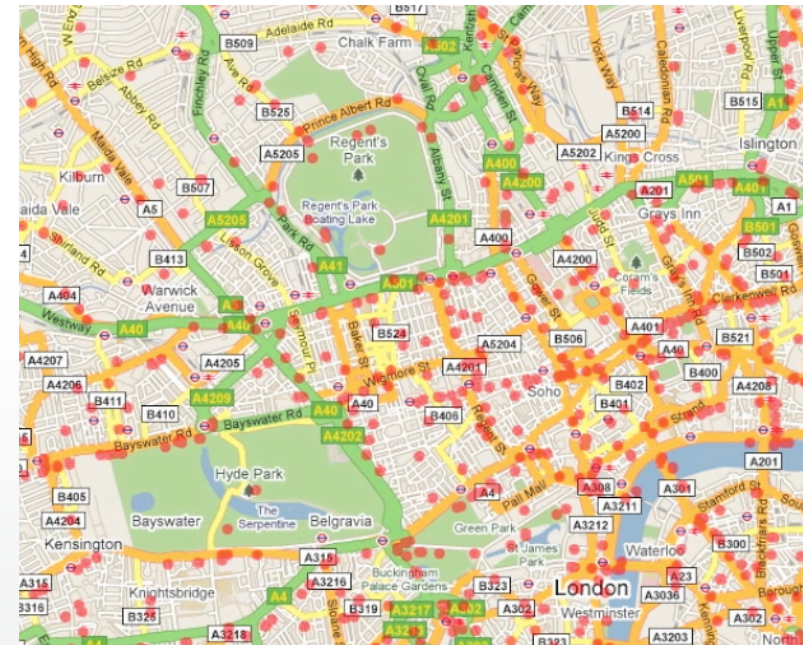




# The Power of Open Public Data



**Cholera  
cases**

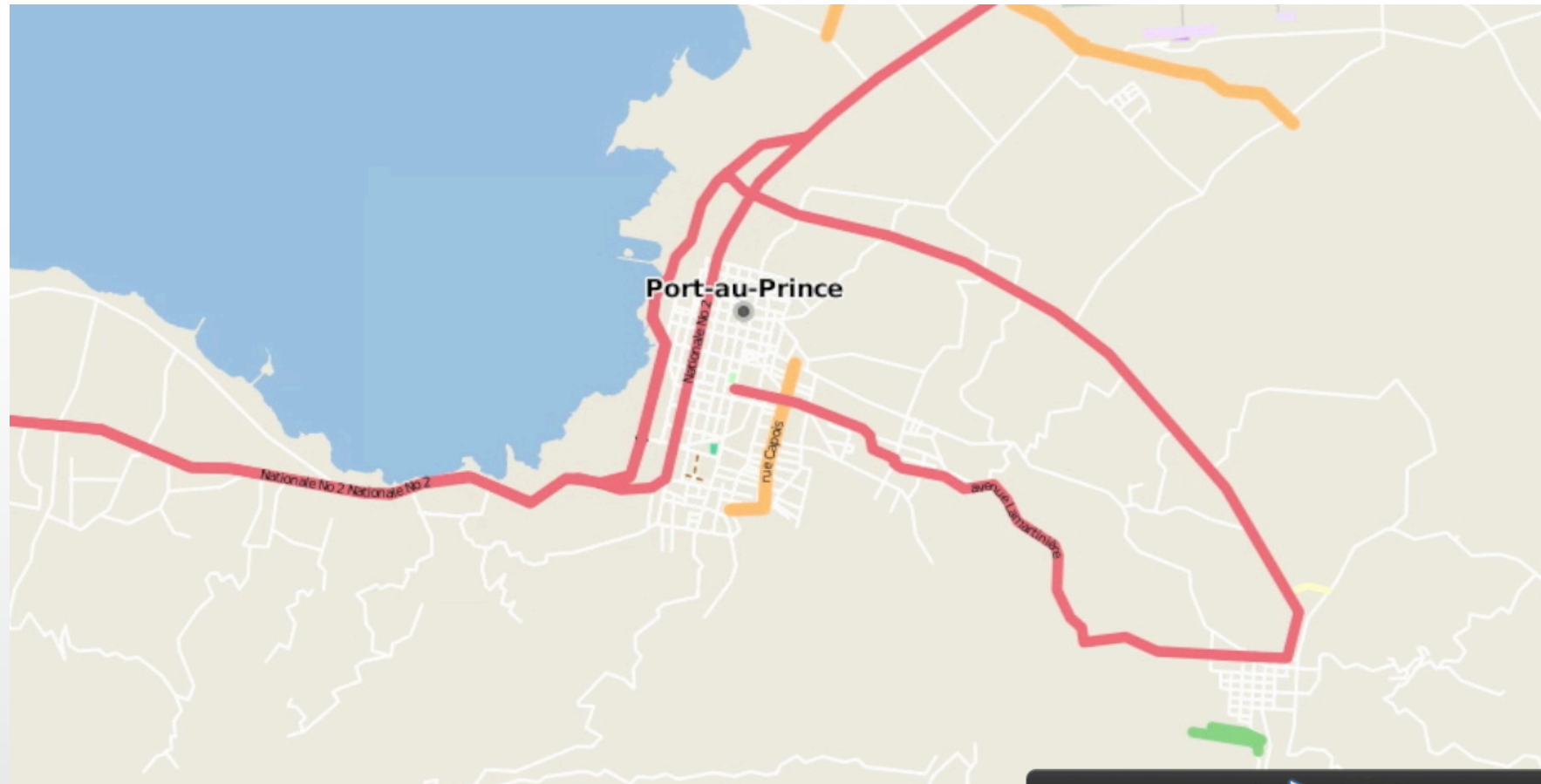


**Bicycling traffic  
accidents**



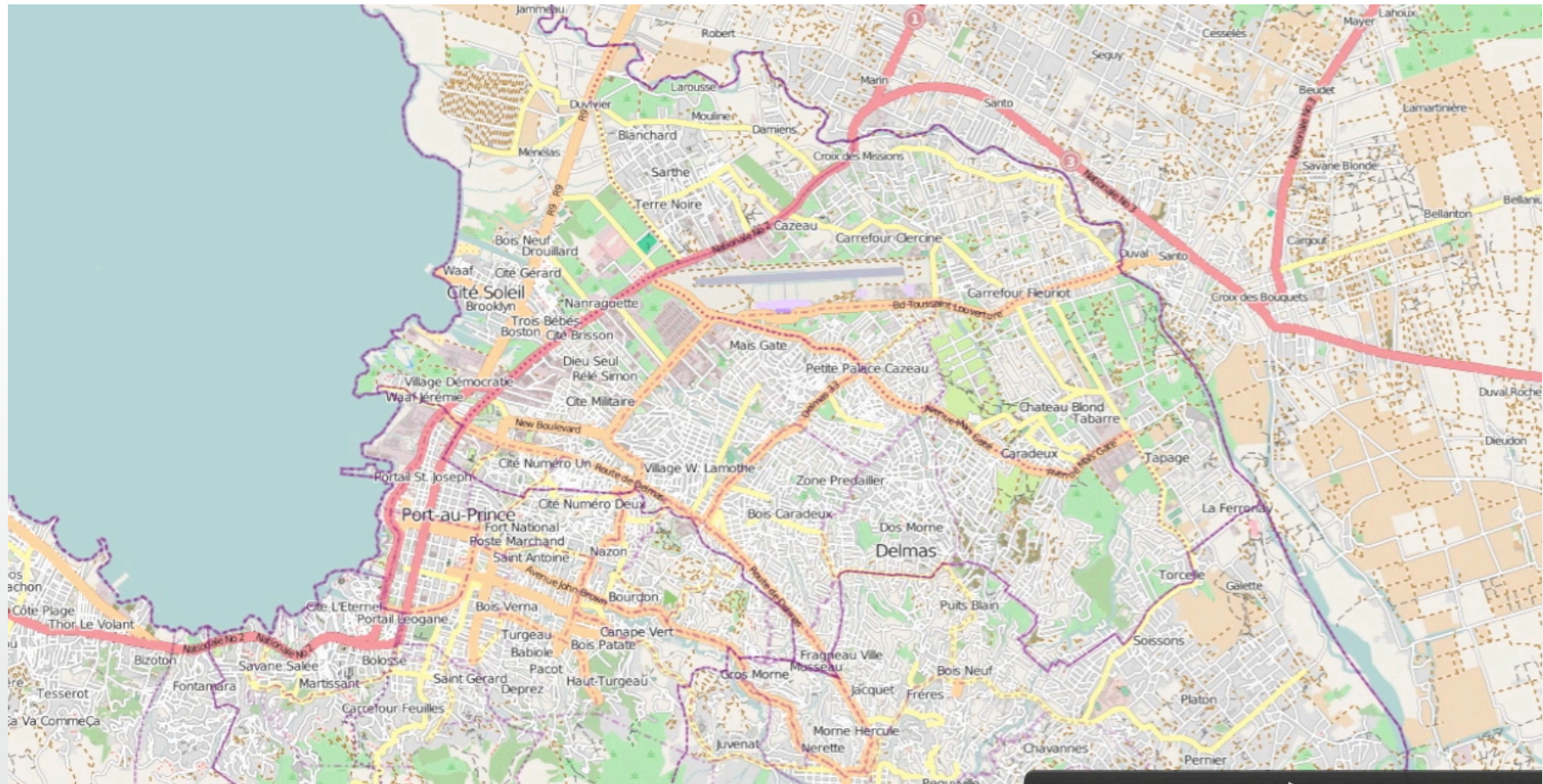
# The Power of Open Public Data

## Port-au-Prince < 12 Jan 2010



# The Power of Open Public Data

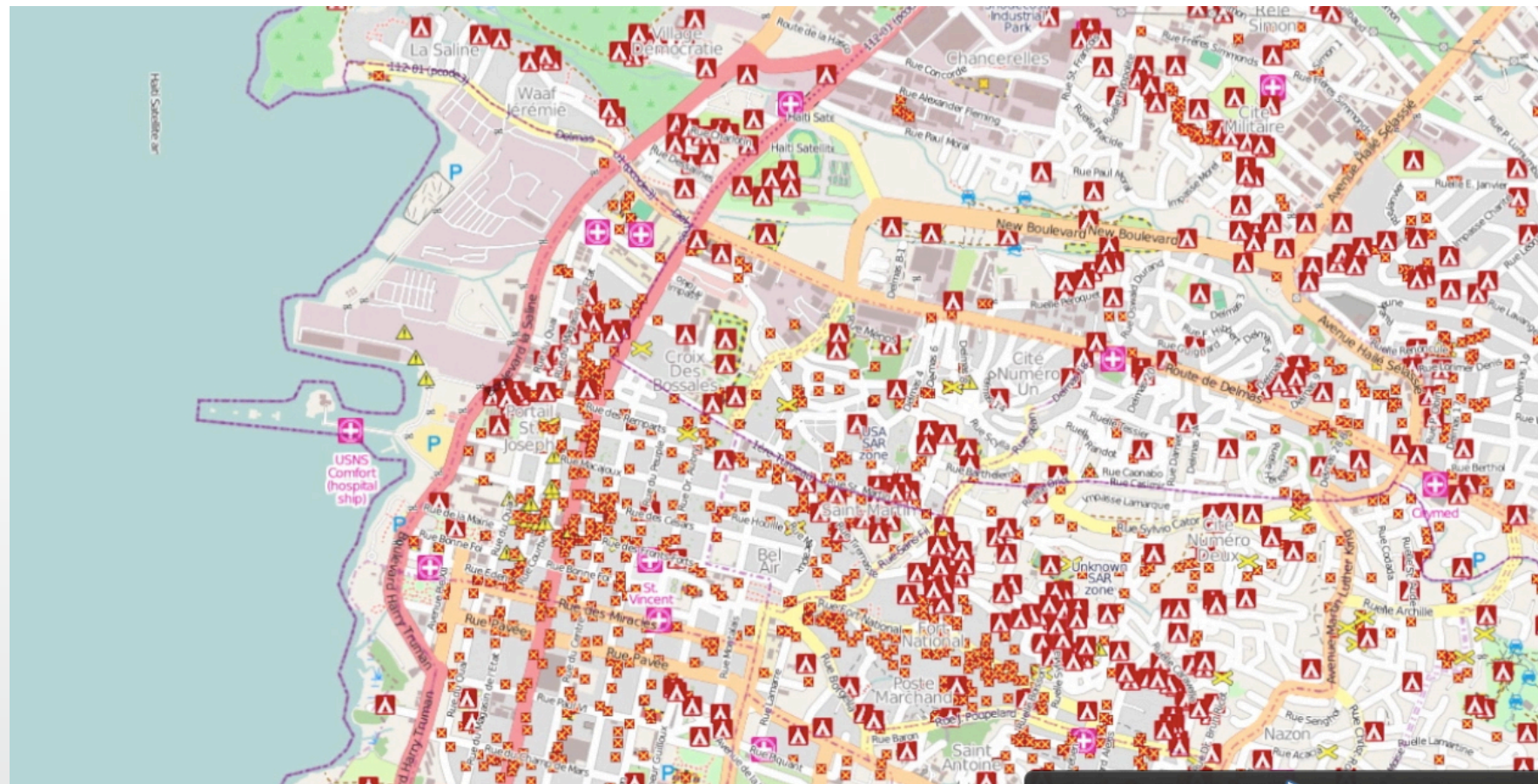
## Port-au-Prince ≈ 25 Jan 2010





# The Power of Open Public Data

## Port-au-Prince ≈ 25 Jan 2010





Using next generation Web technology to improve the delivery of policy and public services across Government (2005-06)



# The approach became embedded

## The United Kingdom Implementation of the European Directive on the Re-use of Public Sector Information

### - the first two years

#### **AKTive PSI: Leading by Example**

- 4.20 The UK public sector is a source of rich, high quality and sought after data. While much of this information is published and available for re-use by others, it is often trapped by poor data structures, locked up in legacy data formats or in fragmented databases.
- 4.21 To explore the issues more fully, in 2005-6, OPSI worked with Advanced Knowledge Technologies (AKT),<sup>36</sup> an inter-disciplinary research project led by the University of Southampton. OPSI's work with AKT, in a research project called AKTive PSI, had two aims:
- to raise awareness about and disseminate the capabilities of semantic web technologies amongst government departments, agencies and local authorities;
  - to show what is possible using this technology.
- 4.22 OPSI brought together a diverse collection of public sector information assets to experiment with. A number of public sector organisations were involved in the project, including Ordnance Survey, the Met Office, the Department for Communities and Local Government, the Office for National Statistics, the Department for Environment, Food and Rural Affairs, the Environment Agency and the London Boroughs of Camden and Lewisham. The project underlined the potential for the use of semantic web technology in large scale integration of public sector information and the benefits such aggregation would bring. Semantic Web technology provides the best model for a range of interoperability issues. If widely adopted it would do much to harness the re-use of public sector information.
- 4.23 AKTive PSI has spawned further work in government using Semantic Web technology<sup>37</sup>. OPSI is using this technology in the following ways:



# MPDP: Making Public Data Public

- Berners-Lee and Shadbolt – June 2009 Appointed HMG Information Advisors, 2010 Appointed to HMG Transparency Board
- Context – Power of Information Taskforce
- Previous work with OPSI
- We didn't know what we couldn't do!
- Strategic Drivers
  - Transparency and accountability
  - Economic and Social Value
  - Public Service Improvement
  - New Industries New Jobs



# What data?

"Public Data" is the objective, factual, non-personal data on which public services run and are assessed, and on which policy decisions are based, or which is collected or generated in the course of public service delivery.

The screenshot shows the data.gov.uk website. At the top is the HM Government logo and the URL data.gov.uk. A navigation bar includes links for Home, Blog, Data, SPARQL, Apps, Ideas, Forum, Wiki, Resources, and About. Below the navigation bar is a banner with the text "Unlocking innovation" and "Working with UK Public Sector information and data" next to a blue molecular structure graphic. The main content area is divided into several sections: "Latest datasets" with a list of recent updates (e.g., "25 June Costs and other data about central government websites"), "What we do" with a paragraph about the site's role in the Transparency programme, "Search Data" with a keyword search box and filters, "Browse for Data" with links to random datasets and lists, and "Most Recent Apps" featuring three app cards: "airTEXT", "Compare Care Homes UK Database", and "Best-care-home.co.uk". The right sidebar contains a "Subscribe by RSS" button, a "Community Log in / Sign up" button, a "Local Data Panel" button, a "What is the Semantic Web?" section, a "Digital Engagement Twitter stream" with a tweet from Nick Clegg, a "Tell us your idea" section, and a "Featured blogs" section with a list of recent blog posts.

# The Power of OGD - ASBOrometer



ASBOrometer is a mobile application that measures levels of anti-social behaviour at your current location (within England and Wales) and gives you access to key local ASB statistics.

ASBOrometer is available for iPhone and Android phones. Get it FREE from the iTunes App Store or Android Market now!

This app was created by [Jeff Gilfelt](#) and made possible by the [data.gov.uk](#) initiative, which is opening up UK government data for public reuse.



# The Power of OGD – Where's the dentist

- Home
- News
- Apps
  - Find GPs
  - Find Pharmacies
  - Find Postboxes
  - Find Pubs
  - Find Toilets
  - SF Trees
  - UK Dentists**
- Support
- Contact

follow us on  
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Available on the  
**App Store**

## UK Dentists

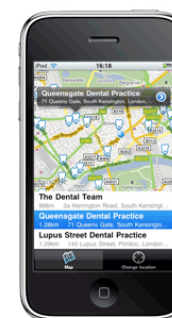


Find your nearest NHS dentist quickly and easily!

The National Health Service has over 7,500 dental surgeries across England but finding one can be a difficult and time consuming task. This app is based on data provided by the UK's Health and Social Care Information Centre (HSCIC)\* and covers 99.4% of all registered NHS dental surgeries in England.

Search for an NHS dentist around your current location, or look for one in another area (where you may be moving to, or for a friend) via a simple place name or postcode search. Distances can be displayed in metric or imperial units (configured in the application preferences).

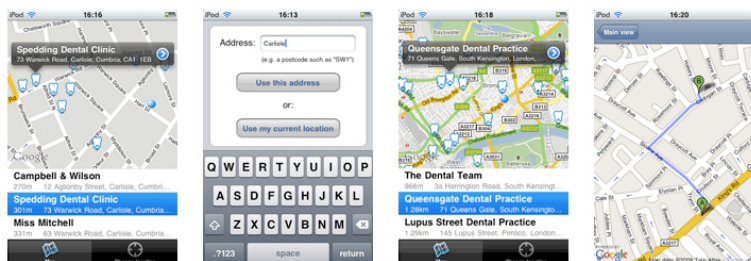
UK Dentists uses the built in GPS on the iPhone to get your current location, but can also locate an iPod Touch in built-up WiFi areas. If your location cannot be determined automatically then you can always enter your post code to get started. Please note that an internet connection is required to get location and map data.



\* Data reproduced under the terms of the Office of Public Sector Information (OPSI) Click-Use Licence.

## Application Screenshots

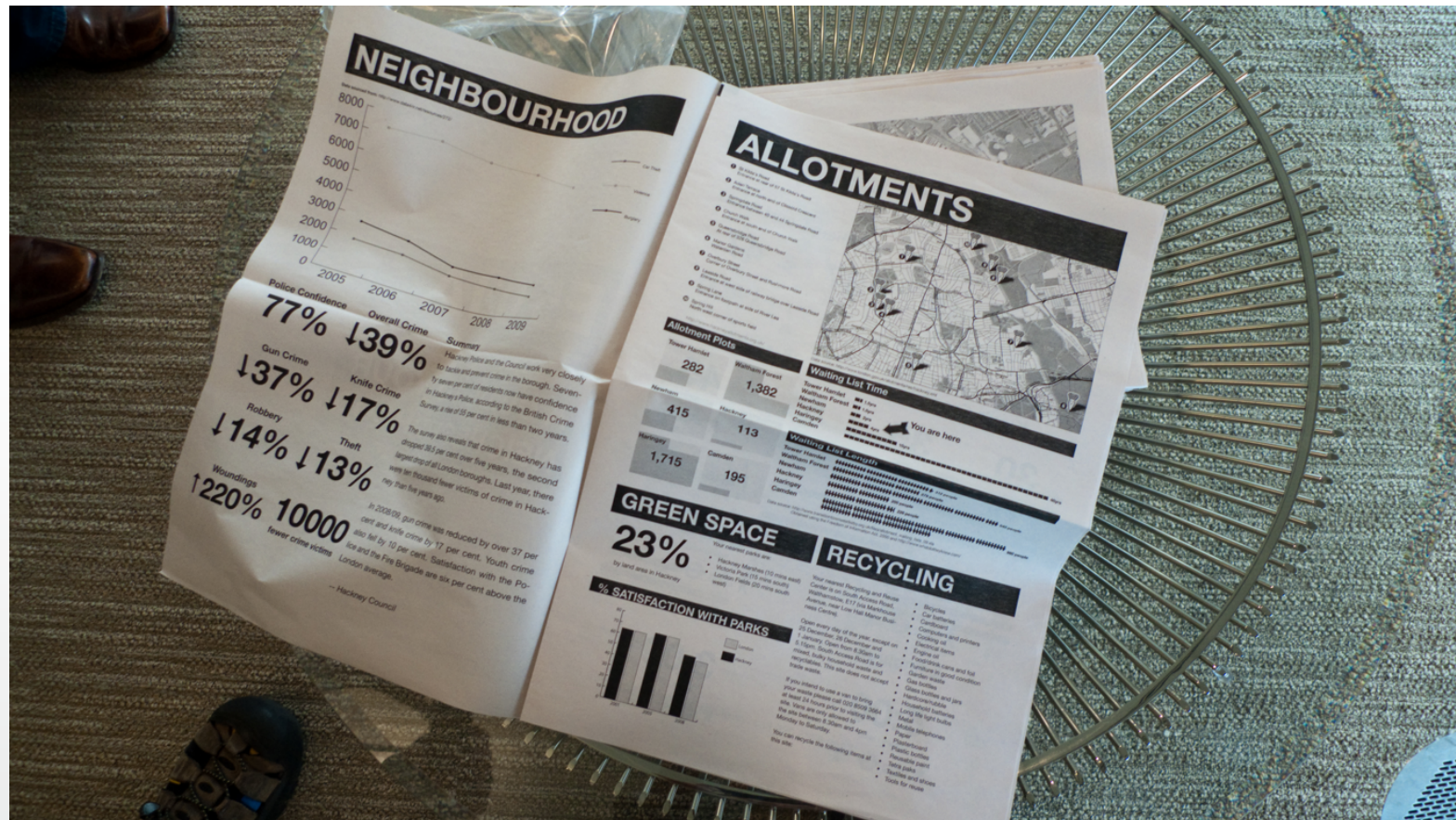
Click on any of the images to see a larger version



Buy on iTunes



# The Power of OGD – Post Code Paper





# The Power of OGD – Maps, Spending...

www.ordnancesurvey.co.uk/opendata

home view develop supply help

**OS OpenData**

Mapping data and geographic information from Ordnance Survey

Create and support innovative, exciting ideas and applications using Ordnance Survey mapping. With OS OpenData you can access a selection of the most detailed mapping datasets available for Great Britain.

Now available - OS VectorMap™ District - a new mid-scale vector and raster dataset (alpha version).

**view**

- Outline of Great Britain
- Overview of Great Britain
- MiniScale @
- 1:250 000 Scale Colour Raster
- OS Street View @
- Boundary-Line™
- OS VectorMap™ District - New

**develop**

- Create amazing web applications
- Enhance online projects
- Put Ordnance Survey maps on your website

Our API uses JavaScript to make web pages more interactive, anyone can create an application by following simple code and tutorials.

**supply**

Order OS OpenData on hard media or download direct to your PC, Mac or laptop (please note - you may need specialist GIS data software to view and use this data...)

**about**

View, download and order OS OpenData or use OS OpenSpace to enhance your own application.

You can also experiment with OS OpenData in RSC format.

If OS OpenData doesn't meet your needs, why not try:

- The Ordnance Survey Map Shop for paper maps.
- The Explore portal for routes, photos and blogs.
- Ordnance Survey mapping for business or education.

**help**

See our FAQ page to find answers questions you might have about OS OpenData, get more tech tips the map viewer or downloads.

Or you can email or call us on 0845 408 1895 (8.30am - 5.30pm Friday).

- OS OpenData Licence
- Privacy policy
- Website terms and conditions

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News Politics Coins data explorer

## Coins Data Explorer

This is our first attempt at producing a way to navigate around the 3.2m data items released by the UK government as part of Coins. Scroll down the page to choose which chunk of data you'd like to explore - and let us know what you find.

Find out what the acronyms mean with our glossary.

Send story ideas to coinsdata@guardian.co.uk

Help fill in the joint Guardian and Where Does My Money Go? google spreadsheet

Jump to results

Output all as CSV

Reset search

Search: go

All queries are filtered by what we believe to be the latest forecast of the amount spent in tax year 2009/10. This is only a forecast, the actual figures will only be known in September.

(Technically, filtered by data type "Forecast Outturn March" and data subtype "Forecast Outturn (Submitted)", removing zero values)

### Filter by department description

Armed Forces Retired Pay, Pensions etc (170)  
Cabinet Office (910)  
Cabinet Office: Civil superannuation (246)  
Charity Commission (58)  
Crown Estate Office (12)  
Department for Business Innovation and Skills (4985)  
Department for Business, Enterprise & Regulatory Reform: UKAEA pension schemes (51)  
Department for Children, Schools and Families (2641)  
Department for Communities and Local Government (6256)  
Department for Culture, Media and Sport (2707)  
Department for Environment, Food and Rural Affairs (4668)  
Department for International Development: Overseas Superannuation (72)  
Department for Transport (4004)  
Department for Work and Pensions (4073)  
Department of Energy and Climate Change (1041)  
Department of Health (1606)  
Electoral Commission (126)  
Export Credits Guarantee Department (185)  
Food Standards Agency (203)  
Foreign and Commonwealth Office (512)  
Government Actuary's Department (121)  
Government Equalities Office (139)

	B	C	D	E	F	G
	Job Title	Grade	Organisation	Annual pay rate - including tax	Notes	
	Chief Executive Officer		Asset Protection Agency	£150,000 - £154,999		
	Chief Risk Officer		Asset Protection Agency	£165,000 - £169,999	No pension	
	Chief Investment Officer		Asset Protection Agency	£165,000 - £169,999	No pension	
	Chief Credit Officer		Asset Protection Agency	£130,000 - £134,999	4 days per week	
	Special Advisor		Asset Protection Agency	£65,000 - £69,999	2 days per week	
	Chief Executive, Shareholder	Director General	BIS	£185,000 - £189,999		
	Director General, Business Gr	Director General	BIS	£180,000 - £184,999		
	Director General, Economics	Director General	BIS	£175,000 - £179,999		
	Government Chief Scientific	Permanent Secretary	BIS	£165,000 - £169,999		
	Director General, Science and	Director General	BIS	£160,000 - £164,999		
	Director General, Innovation	Director General	BIS	£160,000 - £164,999		
	Director General, Finance and	Director General	BIS	£160,000 - £164,999		
	BIS Permanent Secretary	Permanent Secretary	BIS	£160,000 - £164,999		
	Deputy Chief Executive, Share	Director	BIS	£155,000 - £159,999		
	Managing Director, Property	Director	BIS	£150,000 - £154,999		
	Managing Director, Royal Mail	Director	BIS	£150,000 - £154,999		
	Chief Executive	Director General	Buying Solutions	£150,000 - £154,999		
	Cabinet Secretary and Head	Permanent Secretary	Cabinet Office	£235,000 - £239,999		
	First Parliamentary Counsel	Permanent Secretary	Cabinet Office	£225,000 - £229,999		
				£210,000 - £214,999		
				£205,000 - £209,999		
				£195,000 - £199,999		
				£190,000 - £194,999		
				£180,000 - £184,999	No pension	

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## Coins publication is welcome – but not everyone will like results

There's a risk of tabloid-unfriendly projects being mauled, but it's still right for government spending to be transparent



Michael Cross  
guardian.co.uk, Friday 4 June 2010 13:38 BST  
Article history

A few years ago I helped the Department for International Development run a lavish international conference in Bangladesh, on the subject of migration. Its general conclusion was that migration is a good thing – remittances from migrant workers to their home countries far outstrip official aid, and, arguably, do more good.

I'm guessing that this is exactly the sort of jamboree the new government had in mind when, in opposition, it promised to open up the detailed ledgers of public spending. While I, and many real experts, might defend spending tens of thousands of taxpayer pounds promoting migration, it's not hard to see what the popular press would have made of it. Had they known about it.

In the new transparency age, ushered in today by the release of the first tranche of public data from the Treasury's jealously guarded Coins (Combined Online Information System), the migration conference would have had a very rough ride indeed.

In fact, in the current climate, the chances of funding it would be zero. Likewise, while swathes of public spending that doesn't immediately fall into the categories politicians like to boast about – bobbies on the beat, hospital beds, etc.

Despite this danger, I'm heartily in favour of the opening of Coins along with itemised government spending data. It's the latest stage in a revolution that was beyond our wildest dreams when Charles Arthur and I launched the Guardian's Free Our Data campaign, four years ago.

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Comments (33)  
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Coins (Combined Online Information System) - Freedom of information

Technology

Free our data

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More from Comment is free on

Politics

Coins (Combined Online Information System) - Freedom of information

Technology

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More on this story

Coins data release

release: release: 1. emisión; estreno; liberación; exarcelación; liberata; lanzamiento; disparo; alojamiento; descargo; absolución; disparador; b; novedad 2. emitir; exponer; largar; liberar; exarcelar; descargar

months free

FREE

guardian

**ACTIVATE 2010**

Judges include:  
Esther Dyson, angel investor  
Anil Hansjee, Google  
Julie Meyer, Ariadne

**Register now**

Latest from comment is free

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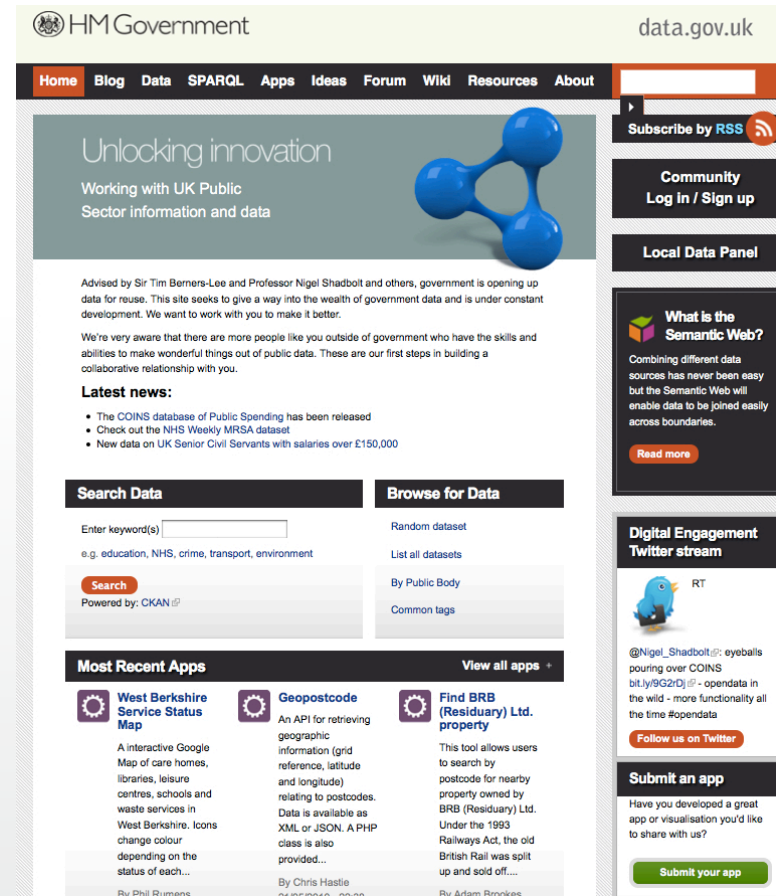
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- No, I don't believe in God | Aom Shaha

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# How data.gov.uk

- data.gov.uk > 4000 datasets on it
  - open source and open standards
  - key data sets released inc OS OpenData
- a new open licence for Crown Copyright information
- a network of 'guerrillas' within Whitehall
- a community of external data users and developers
- a group of experts on creating, transparent open and standardised formats for data



# How? Publish and Praise

<http://www.w3.org/DesignIssues/LinkedData.html>

- ★ Put your data on the Web (any format)
- ★★ Make it available as structured data (e.g. Excel, CSV, instead of PDF)
- ★★★ Use open, standard formats (e.g. XML, RDF)
- ★★★★ Use URLs to identify things (so people and machines can point at your data)
- ★★★★★ Link your data to other people's data

# How? Public Data Principles

1. Public data policy and practice will be clearly driven by the public and businesses who want and use the data, including what data is released when and in what form;
2. Public data will be published in reusable, machine-readable form;
3. Public data will be released under the same open licence which enables free reuse, including commercial reuse;
4. Public data will be available and easy to find through a single easy to use online access point (<http://www.data.gov.uk>)
5. :

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4. Public data will be available and easy to find through a single easy to use online access point (<http://www.data.gov.uk>)
5. Public data will be published using open standards and following the recommendations of the World Wide Web Consortium;
6. Public data underlying the Government's own websites will be published in reusable form for others to use;
7. Public data will be timely and fine grained;
8. Release data quickly, and then republish it in linked data form;
9. Public data will be freely available to use in any lawful way;
10. Public bodies should actively encourage the re-use of their public data; and
11. Public bodies should maintain and publish inventories of their data holdings.

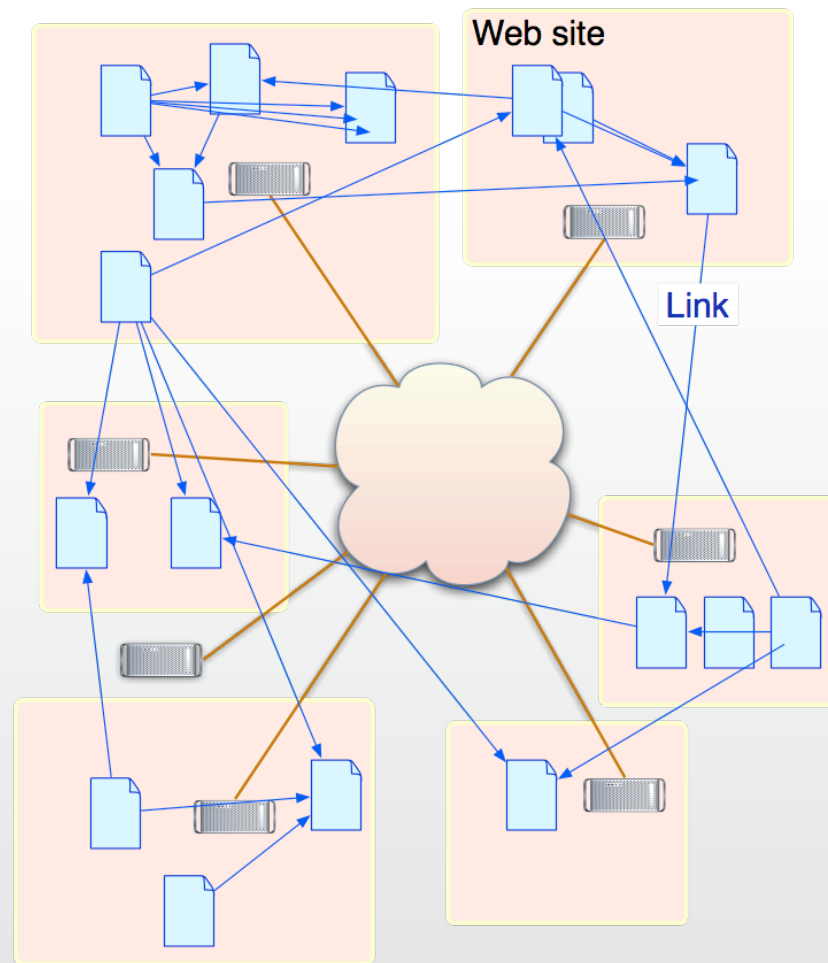


# Why Linked Data

- Light weight ontologies
- Lots of them - mix vocabs
- Four Micro Principles
  - URIs
  - That are dereferenceable
  - RDF/XML
  - Link
- Good for the hygiene of single datasets
- National digital infrastructure being built
- URIs for schools, roads, bus stops, post codes, admin boundaries...
- The link points will have a long tail
- Key data link points exist

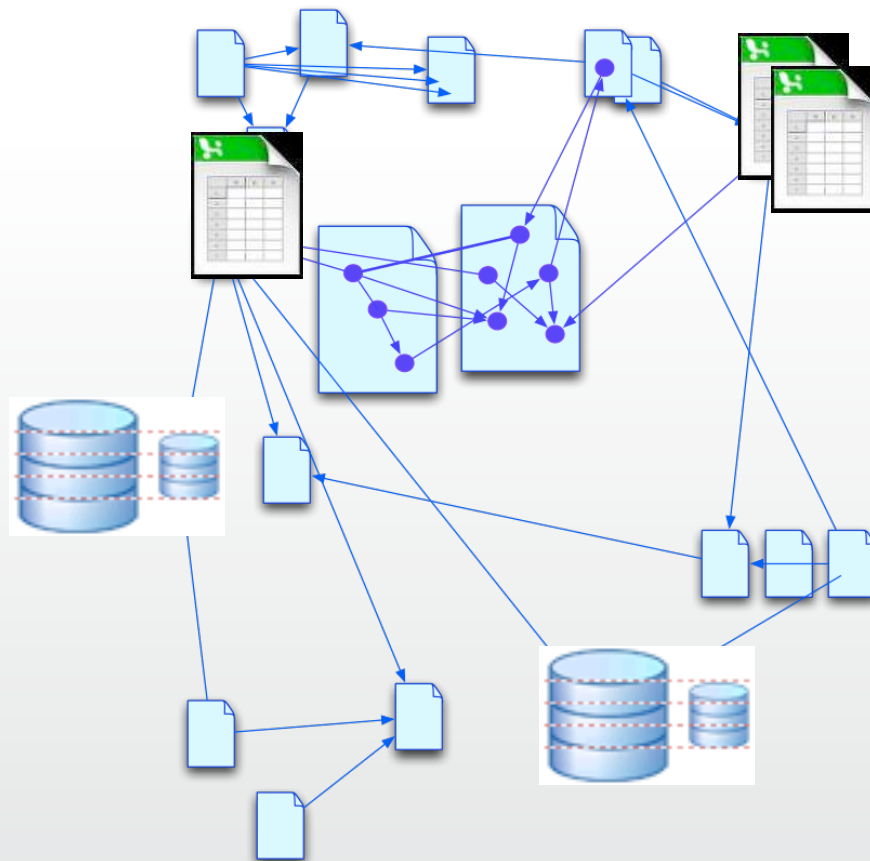
# Web Science

anticipation – from a Web of Documents



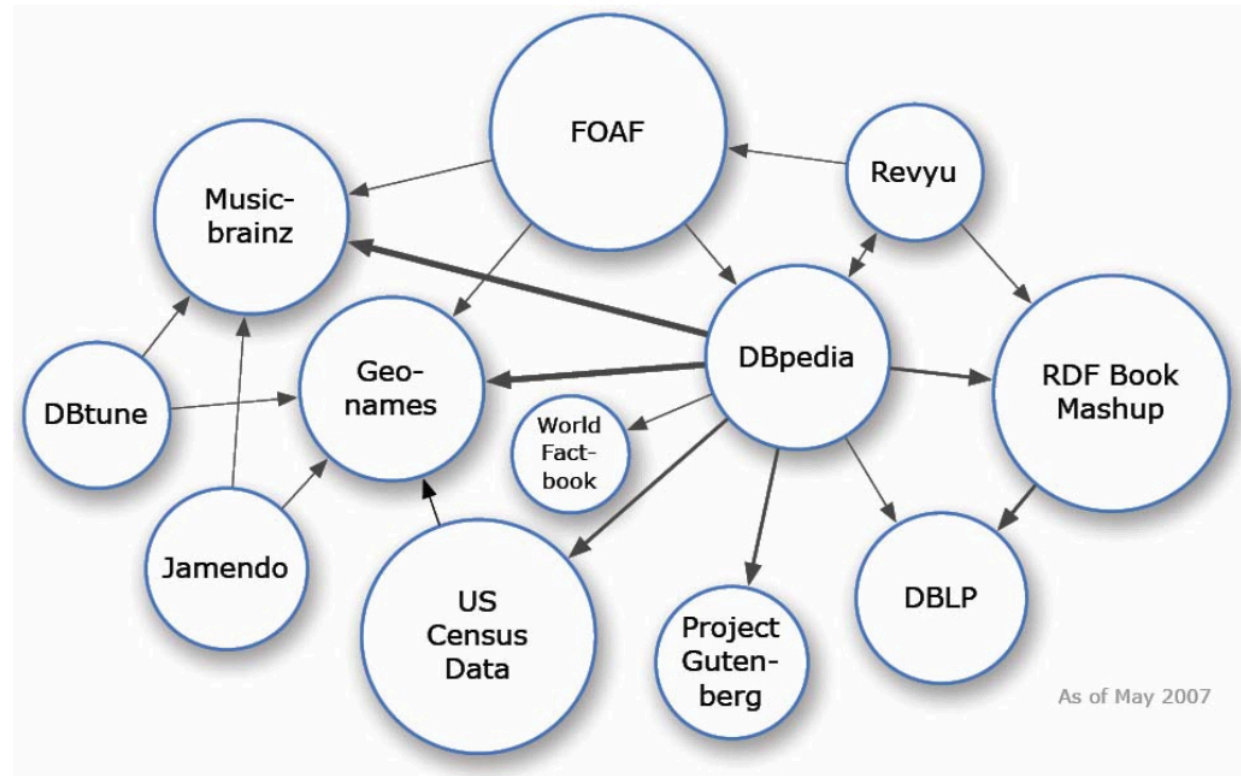
# Web Science

anticipation – to a Web of Linked Data



# Web Science

## anticipation – linked data

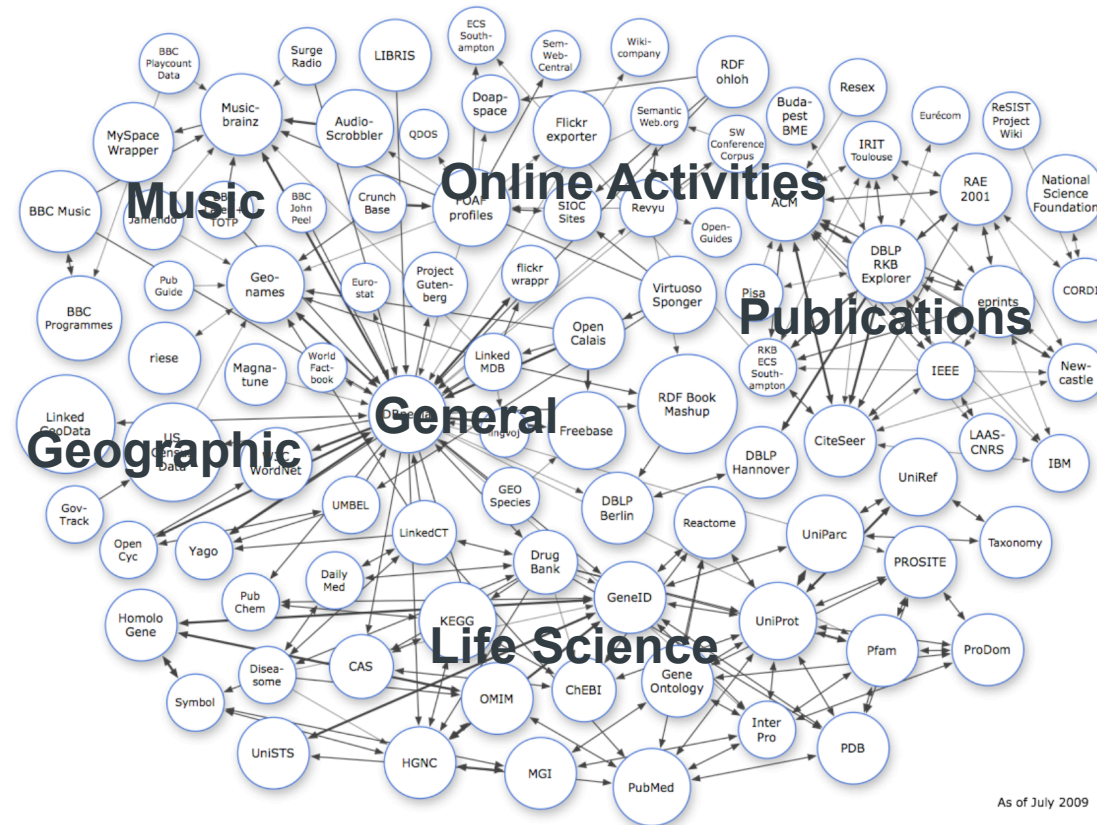


Open Linked Data on the Web:  
May 2007  
500 million triples  
120 million of links



# Web Science

## anticipation – linked data



Richard Cyganiak

Open Linked Data on the Web:  
July 2009  
Billions of triples and hundreds of  
millions of links

# OGD - UK Linked Data

## How good is my area ?

feedback ... please [email us](#)

Sources:

[statistics.data.gov.uk](#), [data.ordnancesurvey.co.uk](#),  
[IMD Database](#), [Boundary data from OS Open Data](#)

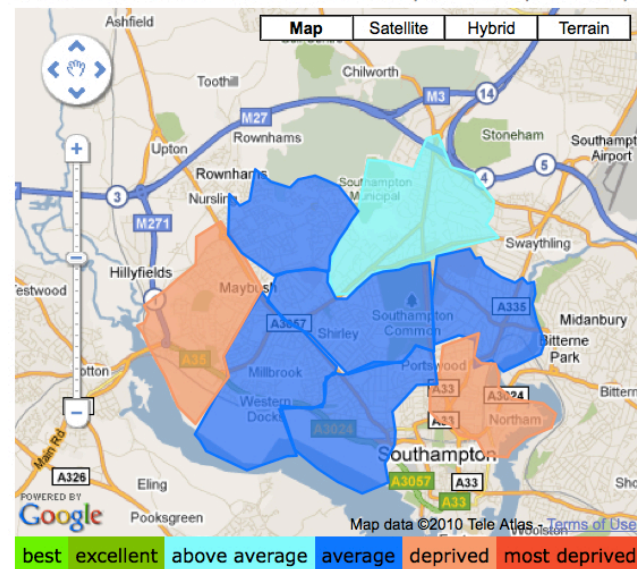
This is a **BETA** app developed in a [EnAKTing](#) hack day. It is built on top of Semantic Web technologies and Linked Data.

It displays a region and its surroundings showing how good are those areas based on the [IMD database ranking](#).

shirley

find

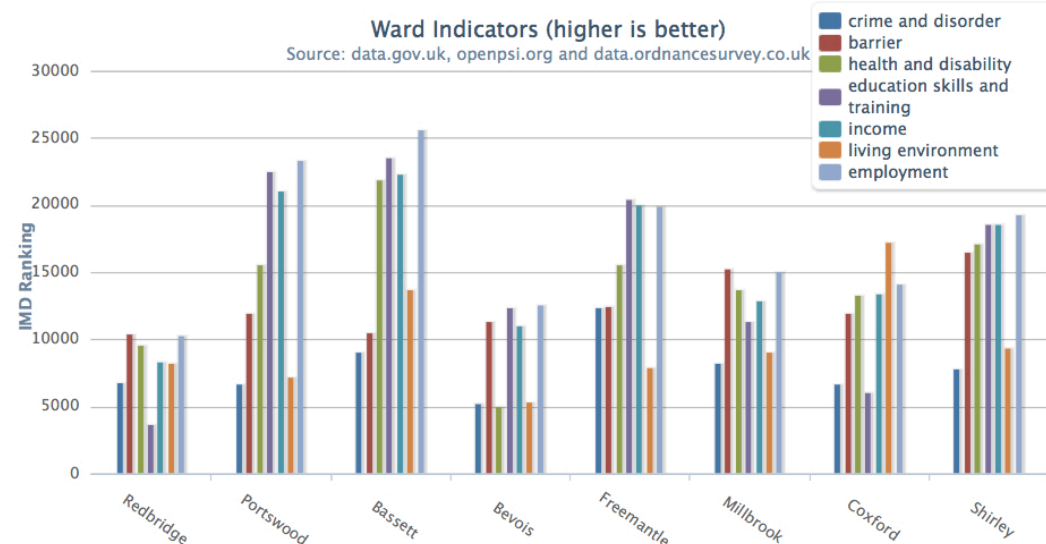
introduce an area name i.e: Portwood, Chilworth, Camden, ...



Area: Bevois

## Ward Indicators (higher is better)

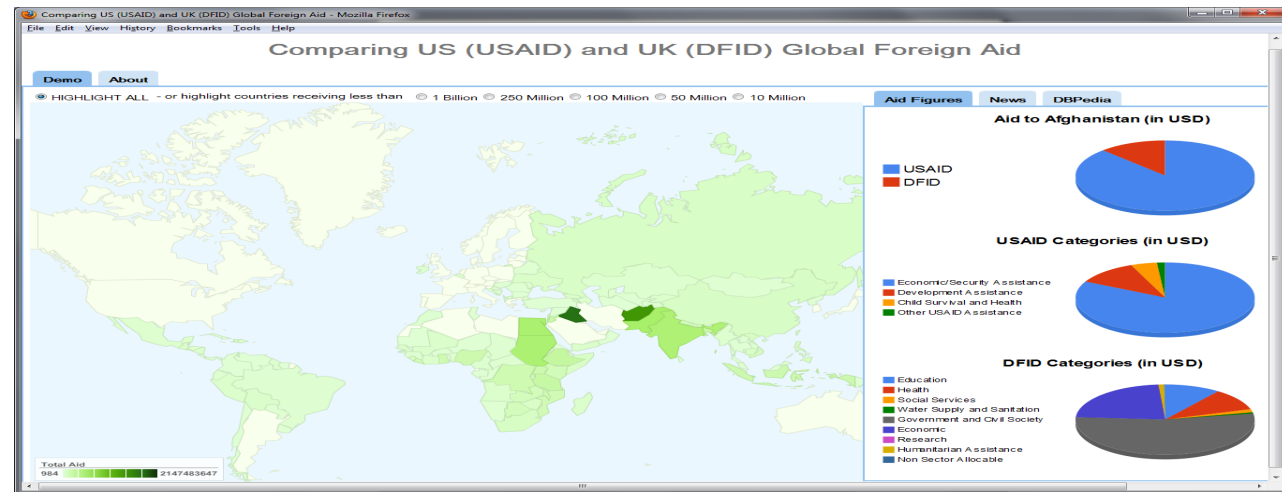
Source: [data.gov.uk](#), [openpsi.org](#) and [data.ordnancesurvey.co.uk](#)



[group by area](#)

# Linked OGD between Governments

This application presents a mashup of foreign aid data (represented in US Dollars) from the United States Agency for International Development (USAID) and UK Department for International Development (DFID) for the 2007 US Fiscal Year.



Users may retrieve foreign aid data for specific countries by clicking on a provided world map (shaded based on total combined contributions for USAID and DFID). Upon clicking on a desired country, three kinds of information are presented: Aid Figures, New York Times news, and wikipedia description.

<http://data-gov.tw.rpi.edu/demo/linked/aidviz-1554-10030.html>

**Aid Figures** **News** **DBpedia**

**Pakistani Refugees Pour Into Afghanistan**  
2008-09-30

**Bush Administration Reviews Its Afghanistan Policy, Exposing Points of Contention**  
2008-09-23

**In Afghanistan, British Leader Shows Support**  
2008-08-22

**Donors Press Afghanistan On Corruption**  
2008-06-13

**5 Dead in Attack on Mine-Clearing Team in Afghanistan**  
2008-03-25

**Kidnapping Prompts Rally By 500 Women In Afghanistan**  
2008-01-30

**4 Red Cross Workers Kidnapped in Afghanistan While Seeking Hostages' Release**  
2007-09-28

**WORLD BRIEFING | ASIA: Afghanistan: German Hostage In Tv Plea**  
2007-08-24

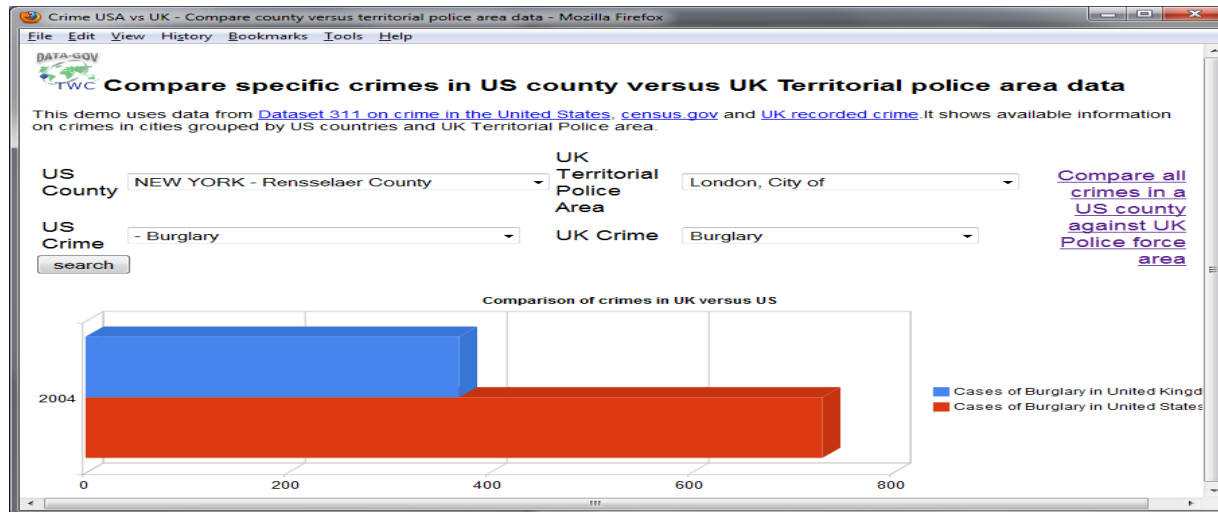
**WORLD BRIEFING | ASIA: Afghanistan: Kidnap Motive Was Ransom**  
2007-08-21

**Aid Figures** **News** **DBpedia**

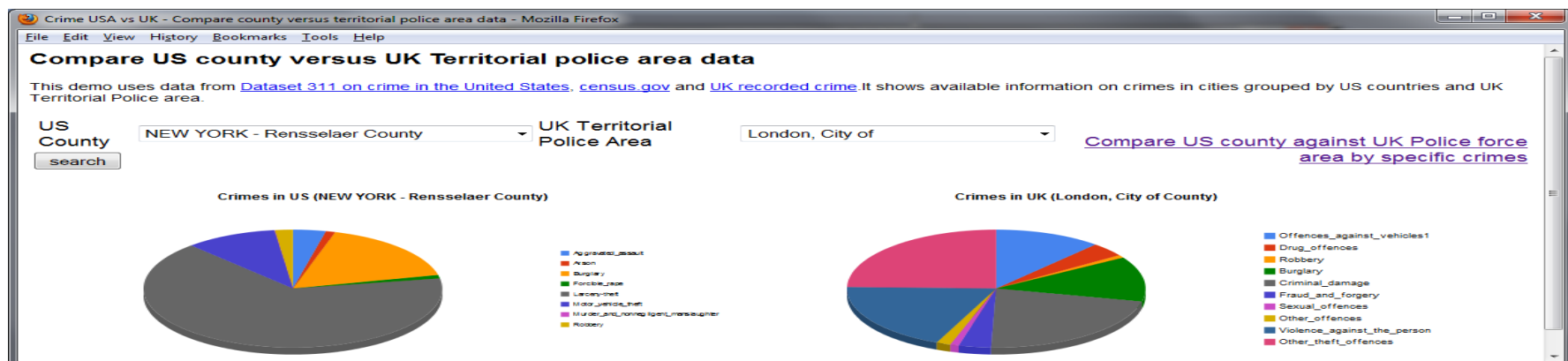


**About Afghanistan**  
The [[Islamic republic|Islamic Republic of Afghanistan is a [[landlock in south central Asia. It is variously described as being located withi Asia, [[South Asia, or the [[Middle East. It is bordered by [[Iran in the west, [[Pakistan in the south and east, [[Turkmenistan, [[Uzbekistan, [[Tajikistan in the north, and [[China in the far northeast. Afghanistan crossroads between the [[Eastern world|East and the [[Western world and was an ancient focal point of the [[Silk Road and [[Human migration|migration. It has an important [[geostrategy|geostrategic l connecting South and Central Asia and Middle East. Because of thi has been a target of various invaders and conquerors, as well as a from which local powers invaded surrounding regions to form their c empires. [[Ahmad Shah Durrani created the [[Durrani Empire in 174 considered the beginning of modern Afghanistan. Subsequently, the was shifted to [[Kabul and most of its territories ceded to former nei countries. In the late 19th century, Afghanistan became a [[buffer st "[[The Great Game" played between the [[British Indian Empire and Empire. On August 19, 1919, following the [[European influence in Afghanistan#Third Anglo-Afghan War and Independence|third Angl war, the country regained full independence from the United Kingdc [[foreign affairs. Since the late 1970s Afghanistan has suffered cont brutal [[Afghan Civil War|civil war in addition to foreign interventions of the 1979 [[Soviet war in Afghanistan|Soviet invasion and the 200 Afghanistan (2001–present)|U.S.-led invasion that toppled the [[Ta government. In late 2001 the [[United Nations Security Council auth creation of an [[International Security Assistance Force|International Assistance Force (ISAF) composed of [[NATO troops.

# Linked OGD between Governments



This demo uses data from [Dataset 311 on crime in the United States, census.gov](#) and [UK recorded crime](#). It shows available information on crimes in cities grouped by US countries and UK Territorial Police area.





# Why not

Loss of licensing revenue

Loss of control

Legal challenges

Unwelcomed exposure

Procedural changes

Privacy

National security

Complexity

Investment

Capacity building required

Authenticity, quality

Customer service

# Why

- More transparency – what is going on?
- More accountability – and is this acceptable?
- More localism – because it matters to me, my family, my locale
- More economic and social capital – which generates exploitation opportunities
- More engagement – and we can collect, contribute and improve Government's own data and information
- More argument –supporting evidenced based policy

# OGD - Web Science Perspective

