

A Perspective on Smart Cities

Representing, Modelling, and Tracking Urban Futures

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www.casa.ucl.ac.uk & www.complexCity.info

Our View (in CASA) of Smart Cities

To an extent, everything we do in our Centre is about Smart Cities,

And in a sense, everything happening today and in the future in the City will be about Smart Cities

It is thus impossible to provide a complete overview so I will provide a sample of projects that we are involved in to give you some flavour of what we do and what we think the potential is

Our focus is on modelling and visualising what goes in in cities and their design & we outline seven streams



My Seven Themes: Exemplars

1. Modelling Land Use Transportation, Energy, etc
2. Modelling the Geometry of Cities: Virtual Cities
3. Representing Networks: Telecoms, Subways and Rail
4. Simulating Crowds:
5. Eliciting Data: Online Mapping and Crowdsourcing
6. Extracting and Mapping Social Media
7. A Framework for All of This: The Complexity Sciences

But first a note about what is the Smart City



The Smart City goes back a long way – certainly before the web – all about the wired city – installing fibre



After the initial period of installing networks, the focus moved in smart cities (read intelligent cities, virtual cities, digital cities, ...) to the provision of services and this still represents a main focus.

But the development of new data sets from sensing is now one of the key foci and linking our various technologies to understanding the city is providing a new momentum for modelling and prediction

The evolution of the smart city idea is following the same line as computation:

First hardware, then software, then data and orgware

In fact, the smart city idea is joining with data capture and data mining and visualisation to generate a new momentum in our understanding and modelling of cities; in short

BIG DATA + SMART CITY = New Models

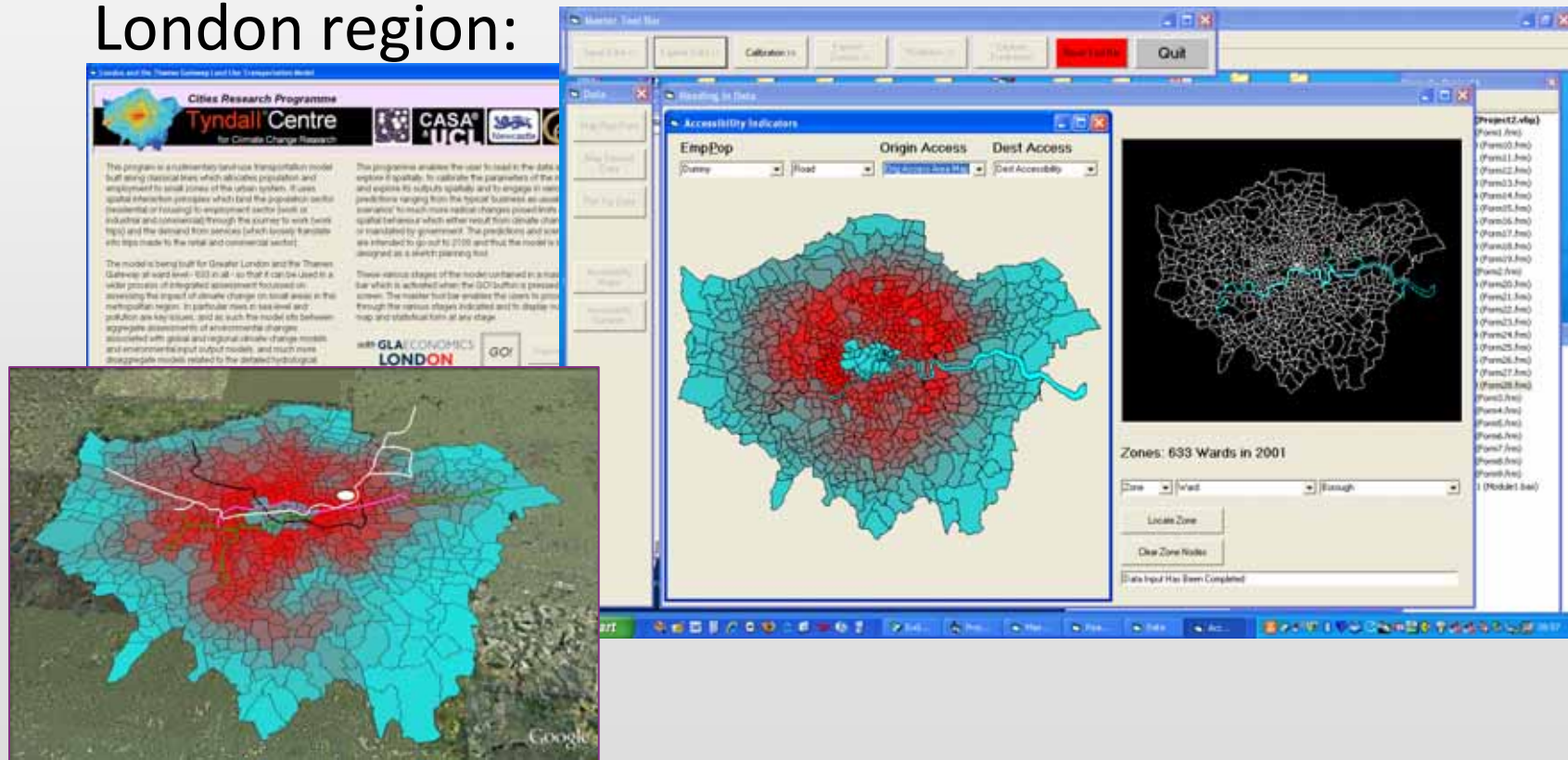
This is our focus really today. As a research group, we are not really into applications that are robust enough to be implementable *en masse* in large cities but we have many proofs of concept, some of which we feel have the potential for wider applications

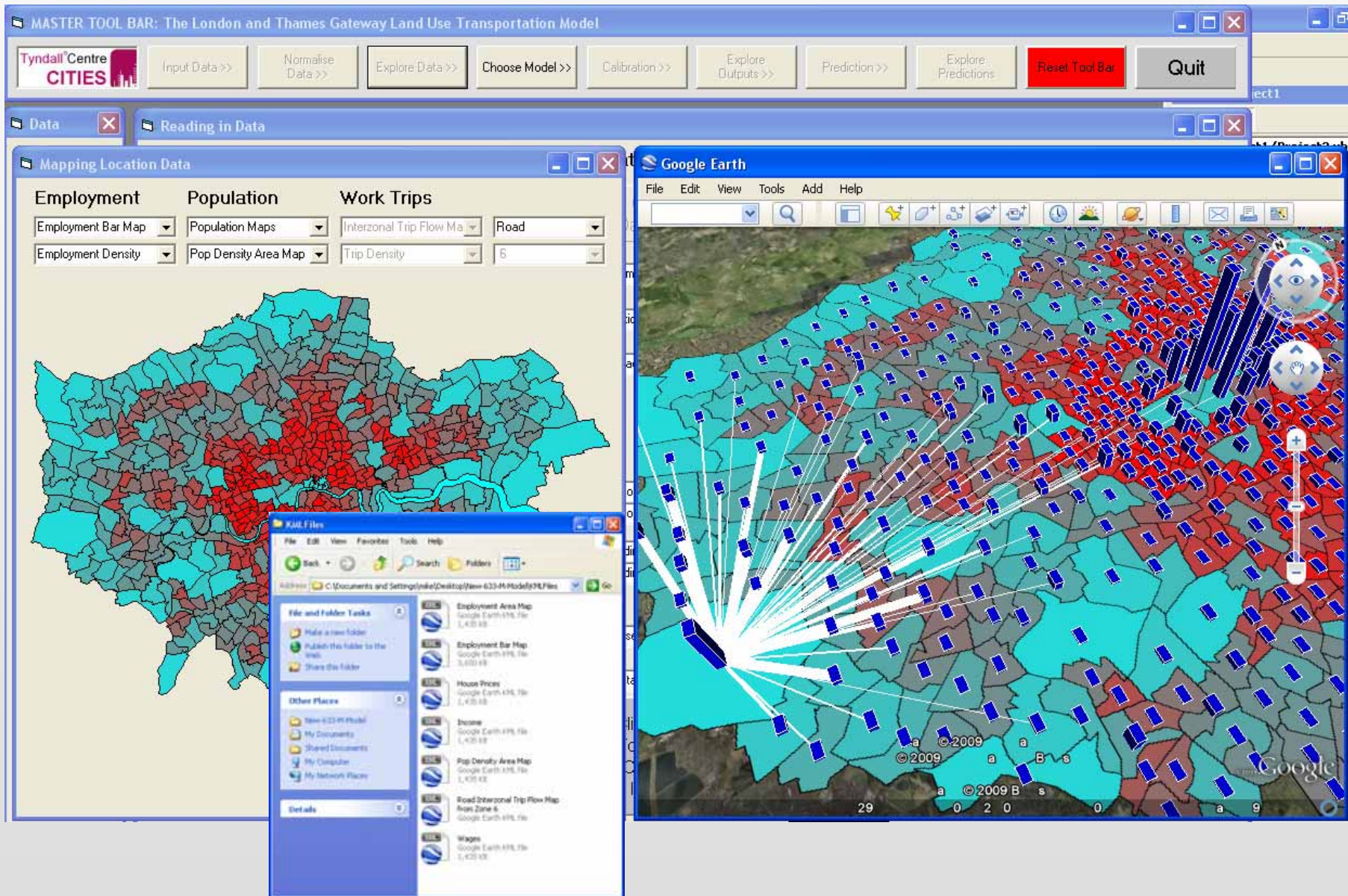
The longer term science of cities that we are concerned with involves computation to provide services

- initially in terms of our understanding and long term planning
- and now complemented by providing more routine services across networks
- all of this involves online data, networks, simulations, optimisations and participation
- it involves treating the city as an online system, an integrated set of databases whose origins lie in the way we are able to sense what is happening

Modelling Land Use Transportation, Energy, etc

Our core expertise is in land use transportation modelling and we have several such models for the London region:



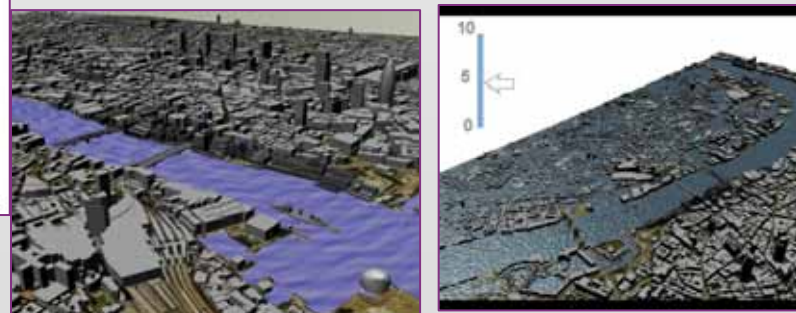
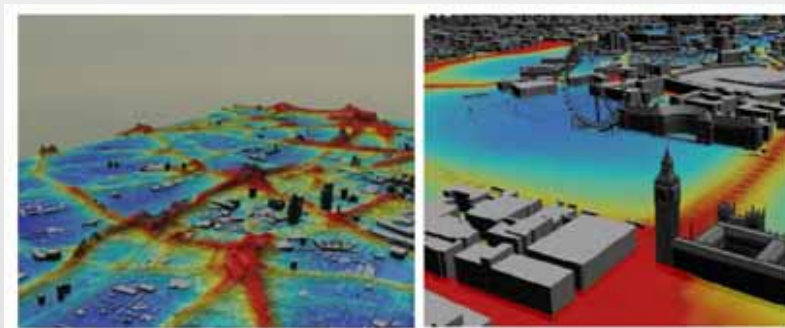
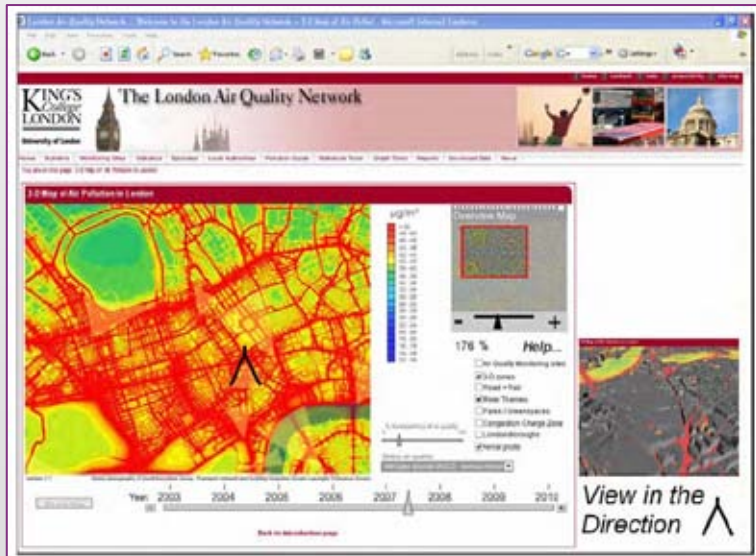
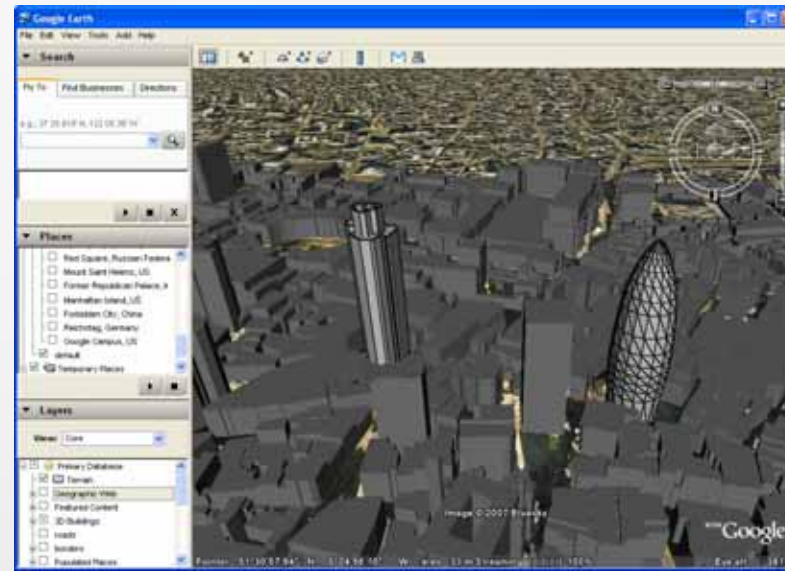
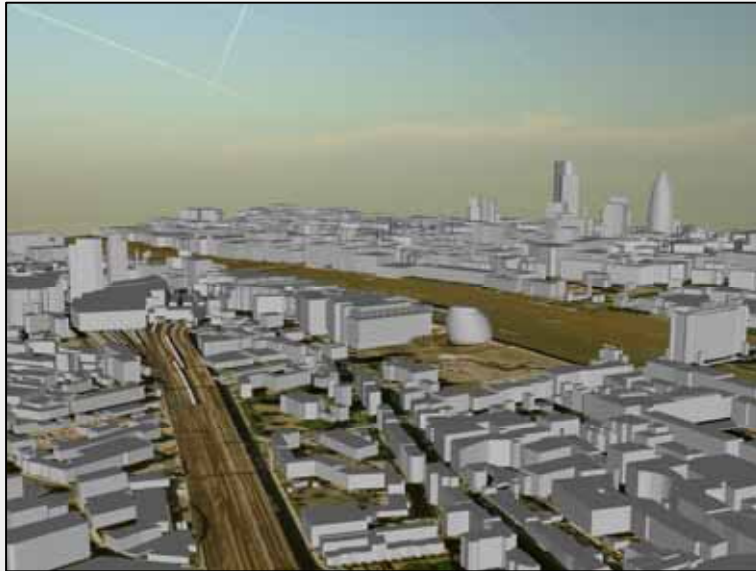


Modelling the Geometry of Cities: Virtual Cities

We have built a large scale 3-D model for London based on RS data at parcel levels. The model is different from our LUT models – requiring different skills

The models is being tagged with socio-economic data. We have used it for flooding, visualising air pollution, we have looked at the morphology of building form, and used it to visualise 2D to 3D design proposals.

What is intriguing is the way iconic and symbolic models are beginning to merge – land use transport models with virtual city models



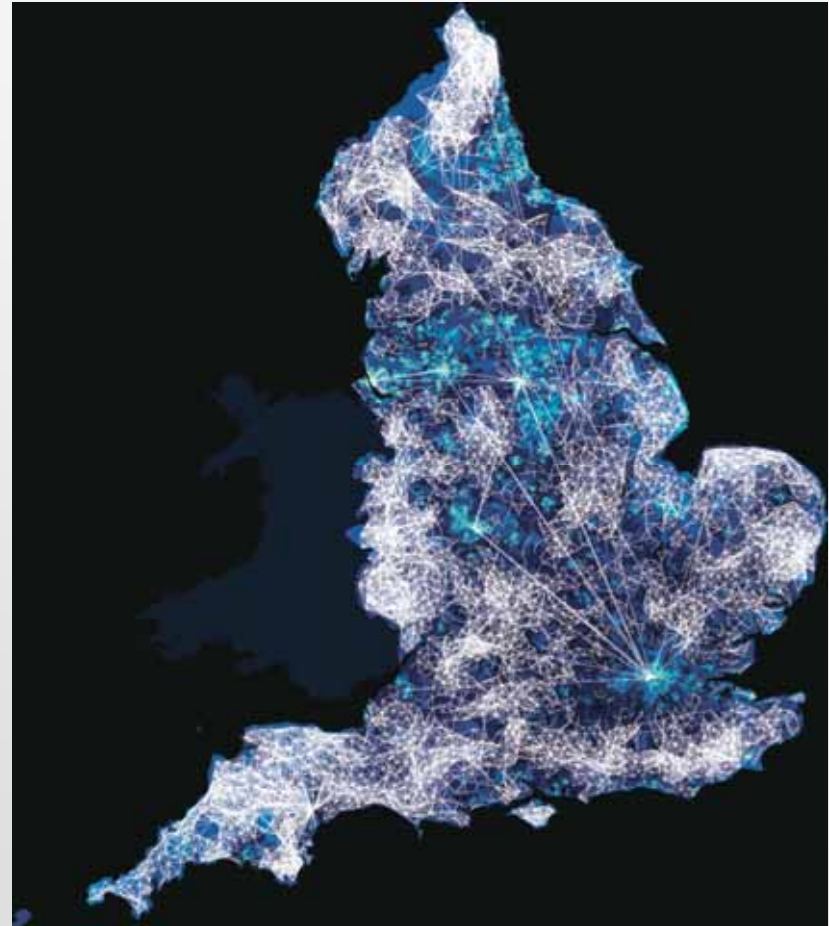
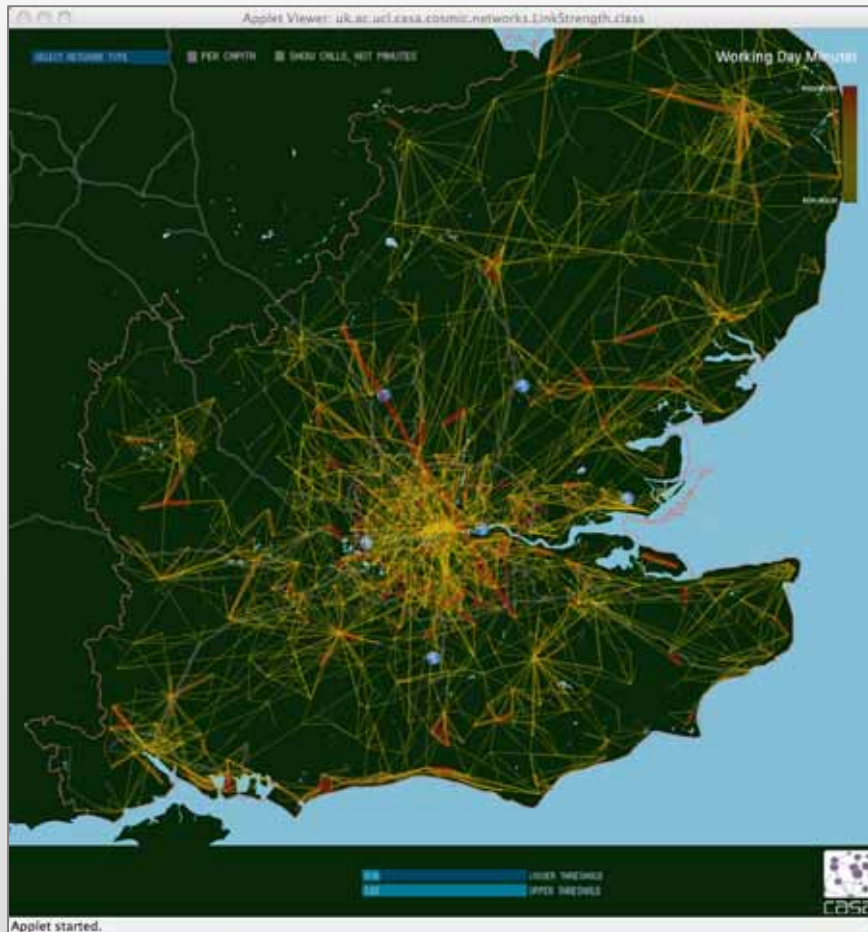
<http://www.londonair.org.uk/>

Representing Networks: Telecoms, Subways & Rail

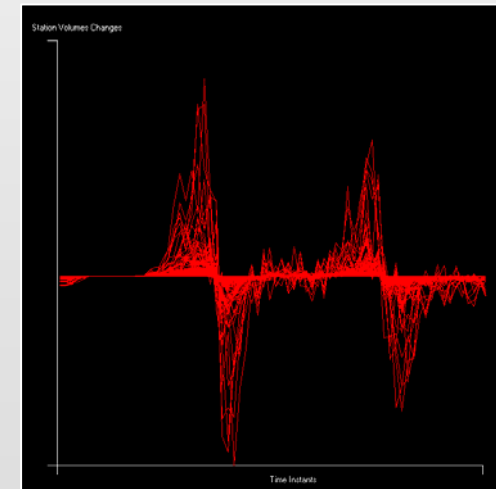
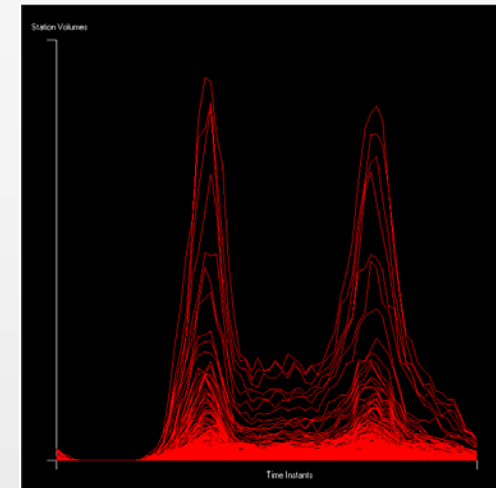
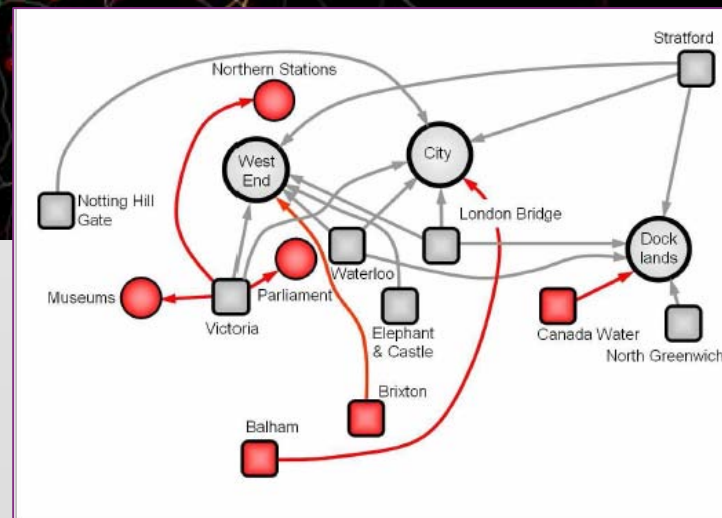
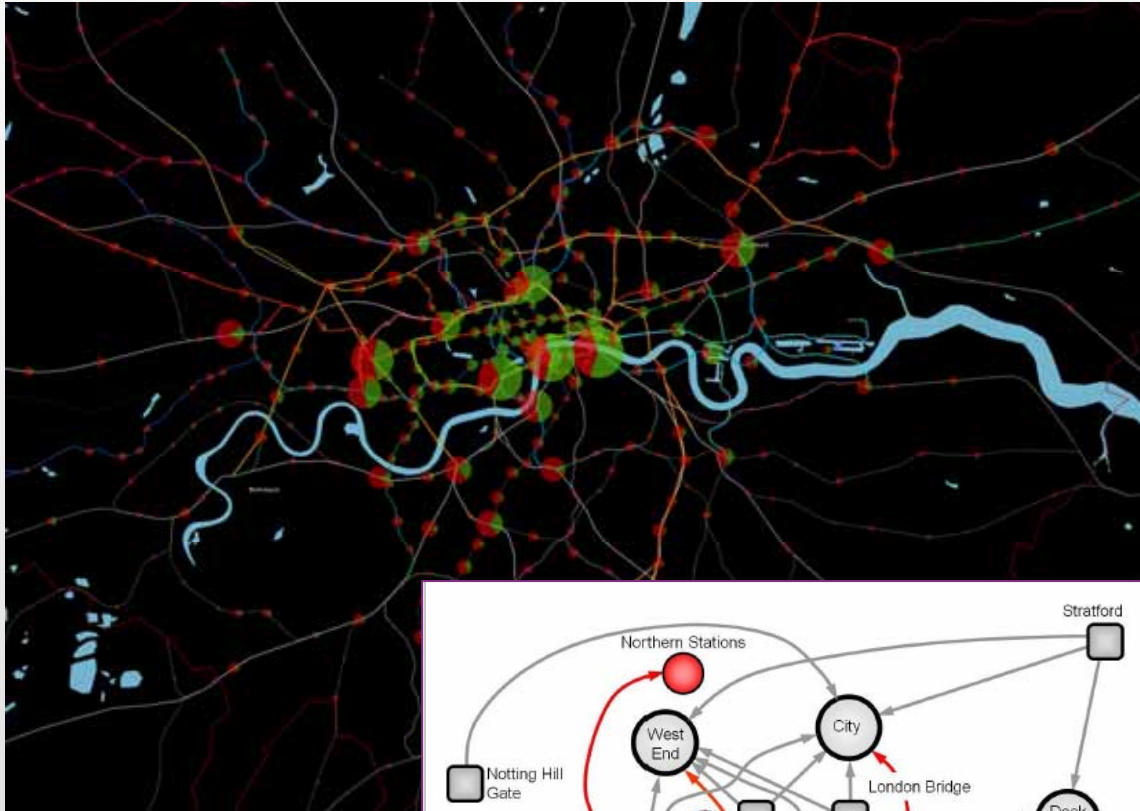
Many new sources of network data now exist, much of coming from digital sources and we are working with mining this data and extracting functionality from it

Our key data sets are telecoms data (landline) for the UK, the online travel card data (Oyster) for public transport schemes in London, and the online bike movement data for the London bikes scheme. These are big data sets that record every phone call, trip etc over a period of days with each object time stamped. Let me show three shots of this data.

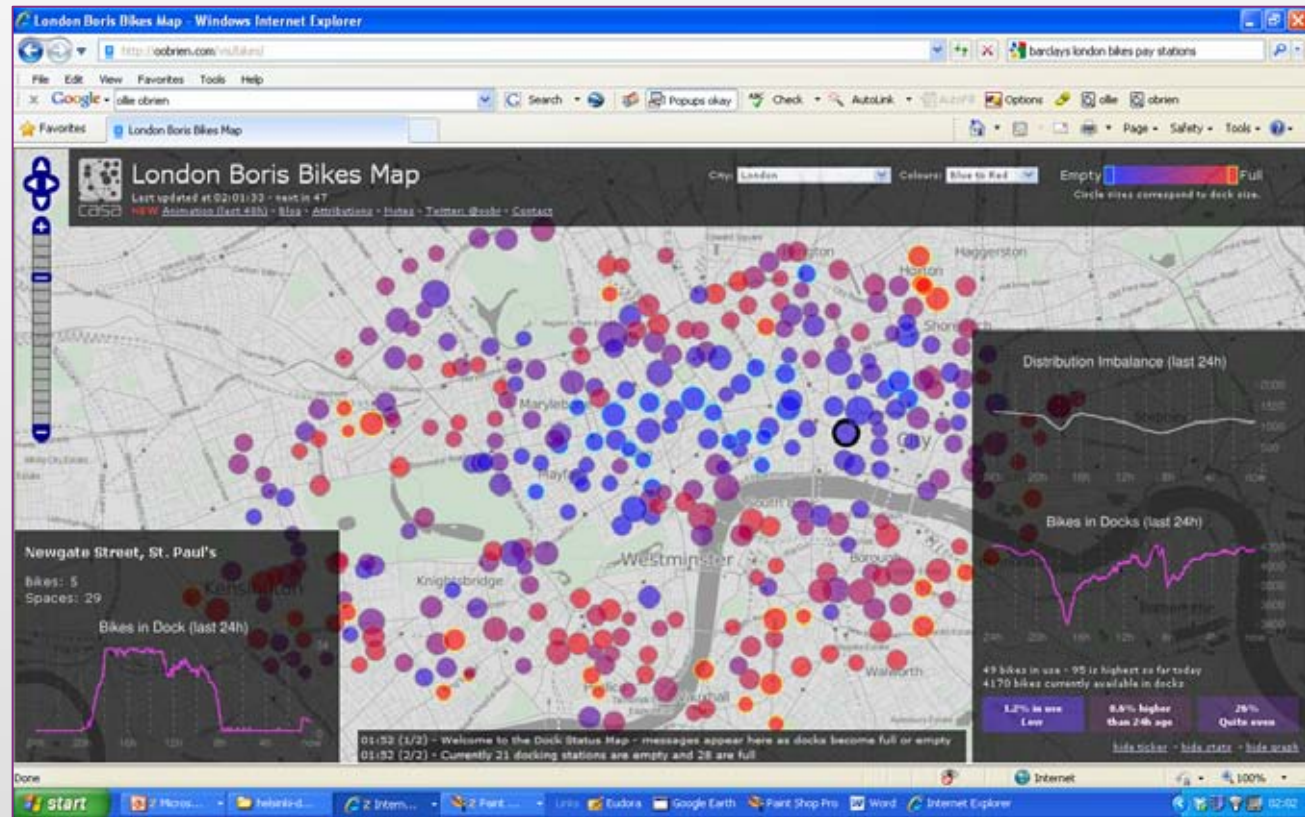
Telecoms – Jon Reades' work with a large UK telecoms provider and with Sensable City Lab at MIT



Oyster Card Data – interpreting urban structure, multitrips, etc.



Bikes Data – 4200 bikes, started November 2010, a years data – everything – all trips, at all times and between all stations





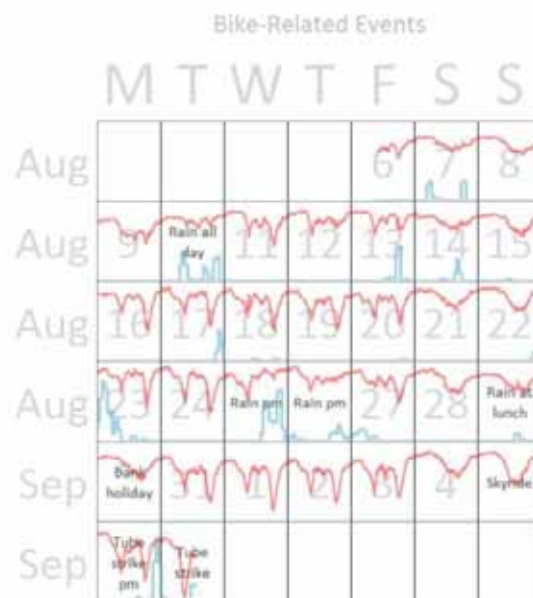
Animations of Public Bike Movements



Animations of Changes in the Bike Nodes: Docking

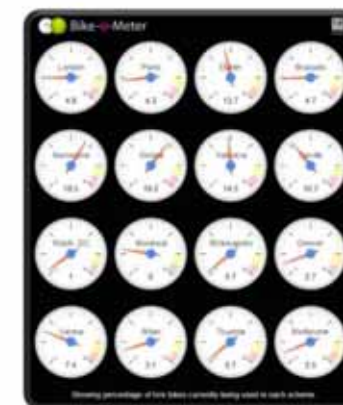
More Analysis

- **London**
- Graph shows number of bikes available to hire
- Effect of rain
 - Using the CASA weather station
- Effect of the tube strikes



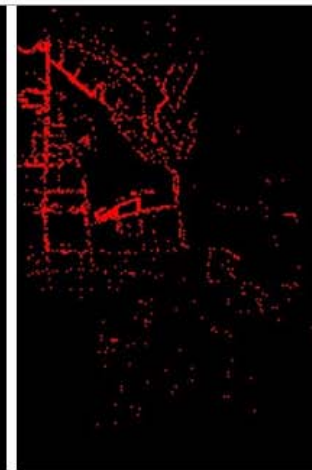
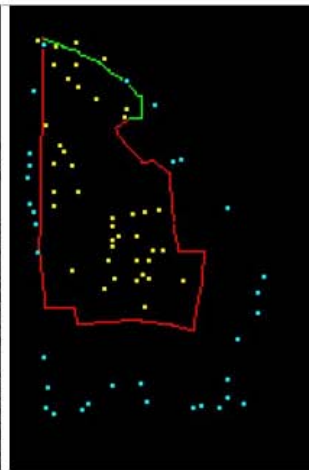
Bike-o-Meter casa.ucl.ac.uk/bom

- Tweet-o-Meter for bikes
 - Steven Gray (@frogo)
 - Using Google Gauges
- See the real life Tweet-o-Meters at the new British Library "Growing Knowledge" exhibition
 - Should be easy to hack to show the Bike-o-Meters instead ☺



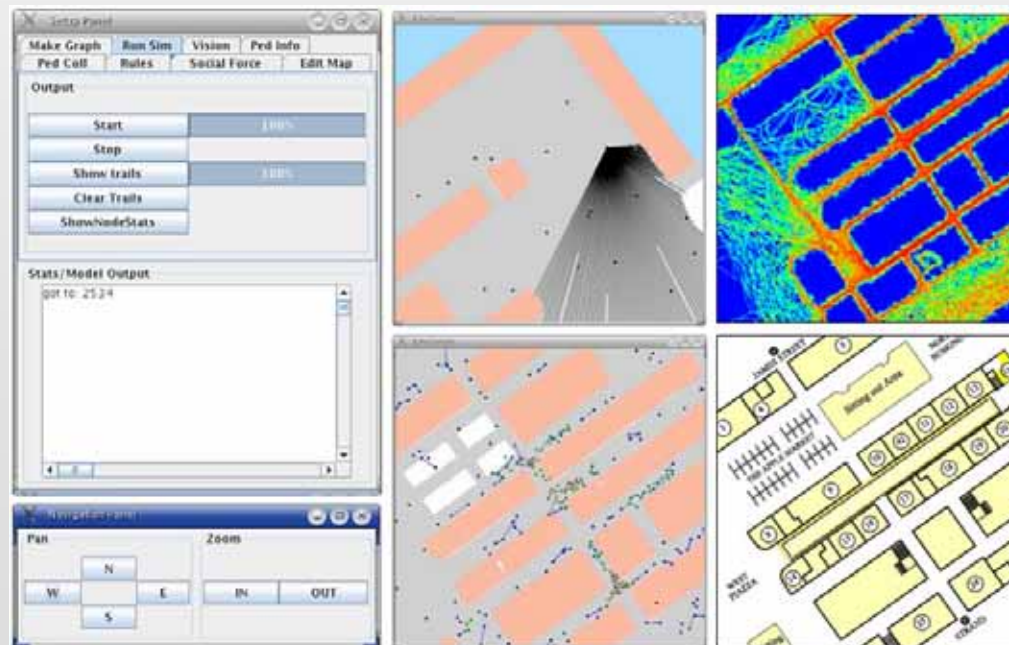
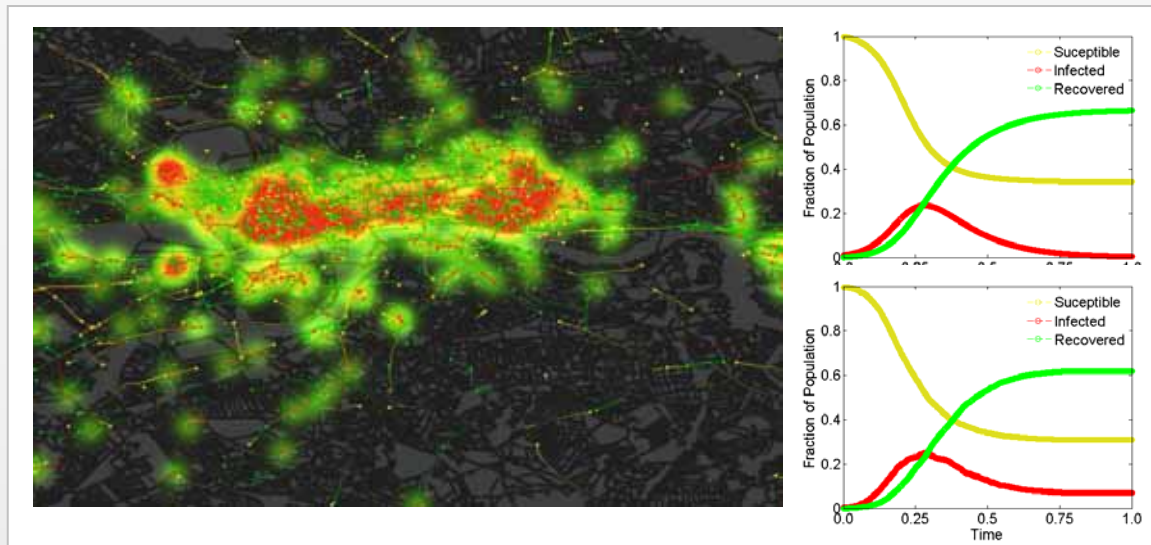
Simulating Crowds: Fine Scale Modelling and Sensing

In a different tradition but one which is rapidly converging with our interests in sensing and networks, we have developed a number of pedestrian models, first for the Notting Hill Carnival, and then for many town centres



We are now working on fine scale models which are mirror diffusion and spread in situations ranging from epidemics to evacuation and shopping.

We have a simple model of epidemics on networks in London and we are looking at evacuations of major shopping centres such as Covent Garden (right)



Eliciting Data: Online Mapping & Crowdsourcing

We have a number of mapping projects using Web 2 and these involve using these online mapping systems to elicit simple data from the crowd – but data that is geotagged, hence the production of online maps of the crowdsourced data in real time

We have looked at Manchester congestion charge, anti social behaviour and credit crunch where in all cases we have used the BBC to broadcast the questions and provide the forum for response while our servers and software have produced the maps. Here are some examples.



MAPTUBE
a place to put maps

BBC
RADIO



Radio 4: Mapping the Credit Crunch

Welcome to Radio 4 Listeners, below is the Credit Crunch question, simply select an option and then input the first part of your postcode - for example RG11

MapTube will then take your answer and every hour automatically create a map of the nation's mood.

What single factor is hurting you most about the credit crunch?

- ☐ Mortgage or Rent
- ☐ Petrol
- ☐ Food Prices
- ☐ Job Security
- ☐ Utility Bills
- ☐ Not Affected

Enter the first part of your postcode:

Submit

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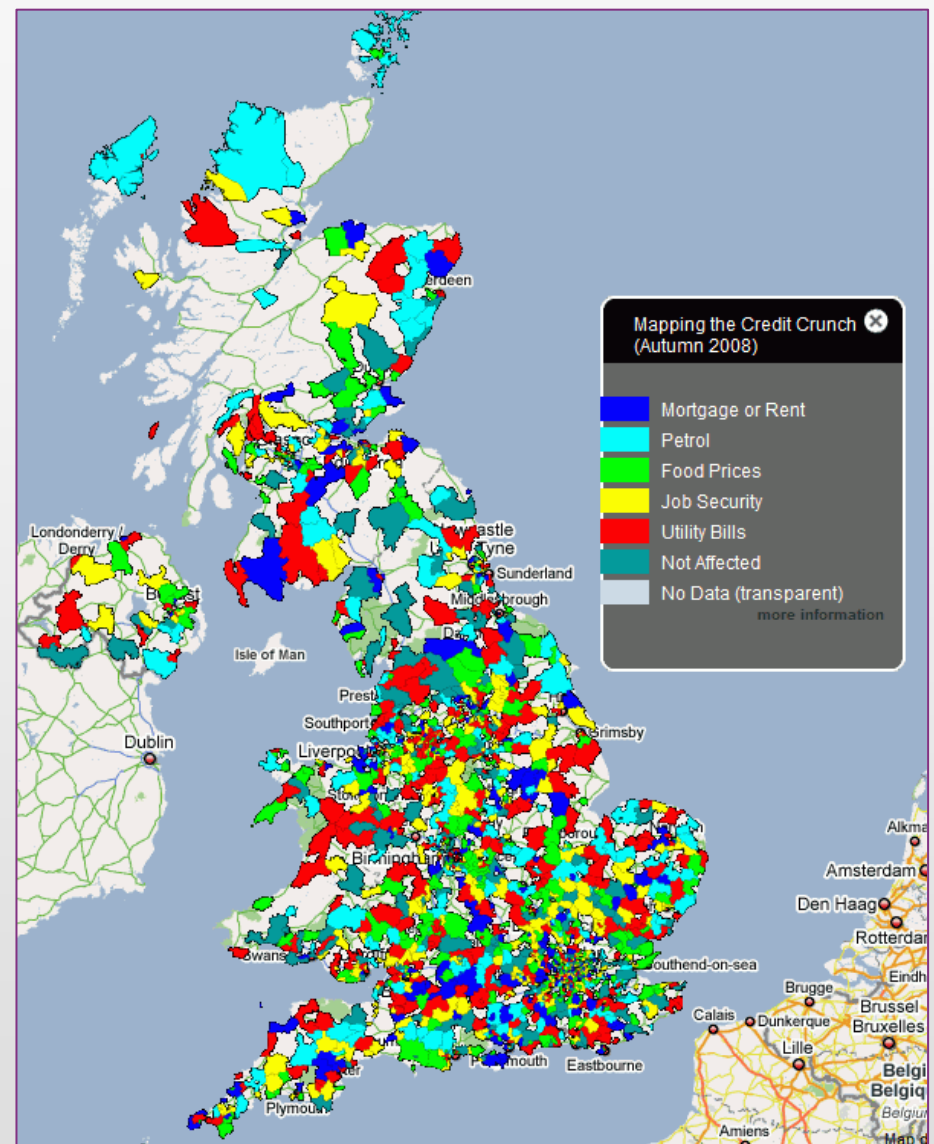
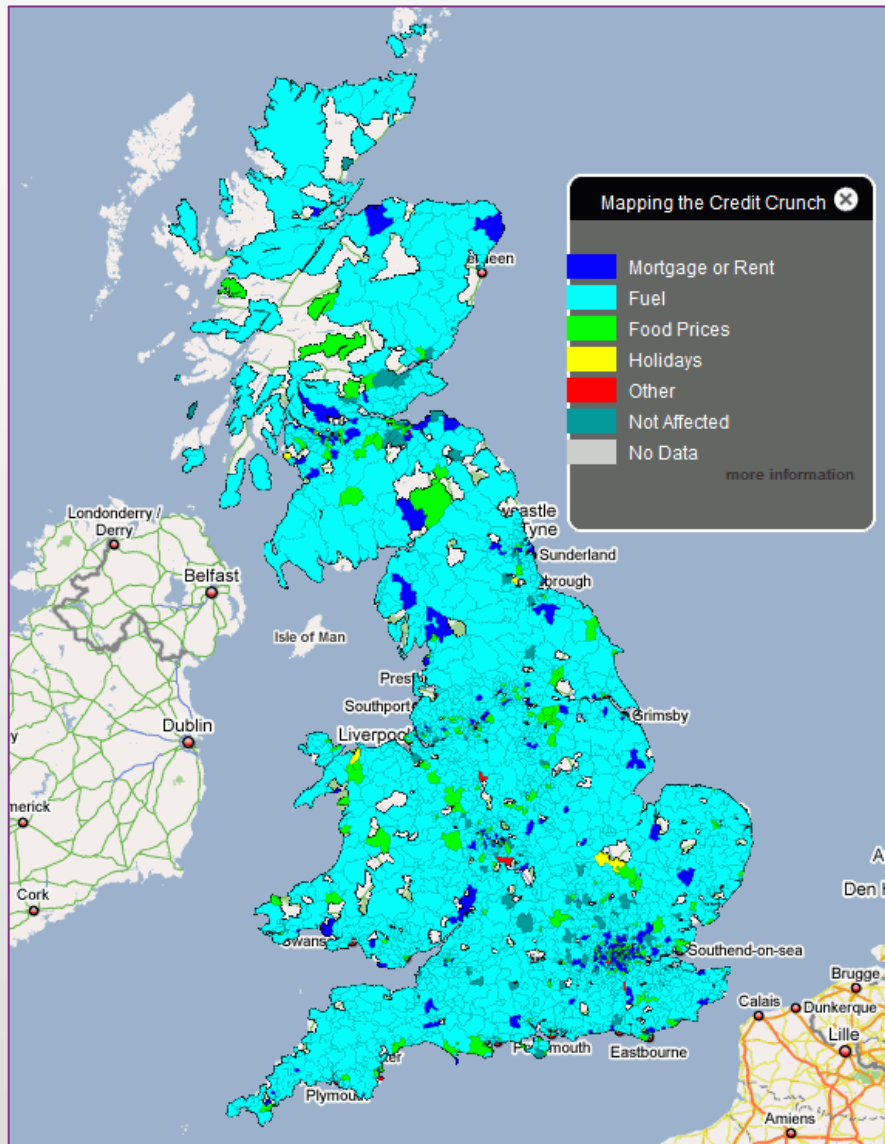
23,475 responses
April, May, June 2008

A new credit crunch
survey started in
October and currently
has 3,802 responses.



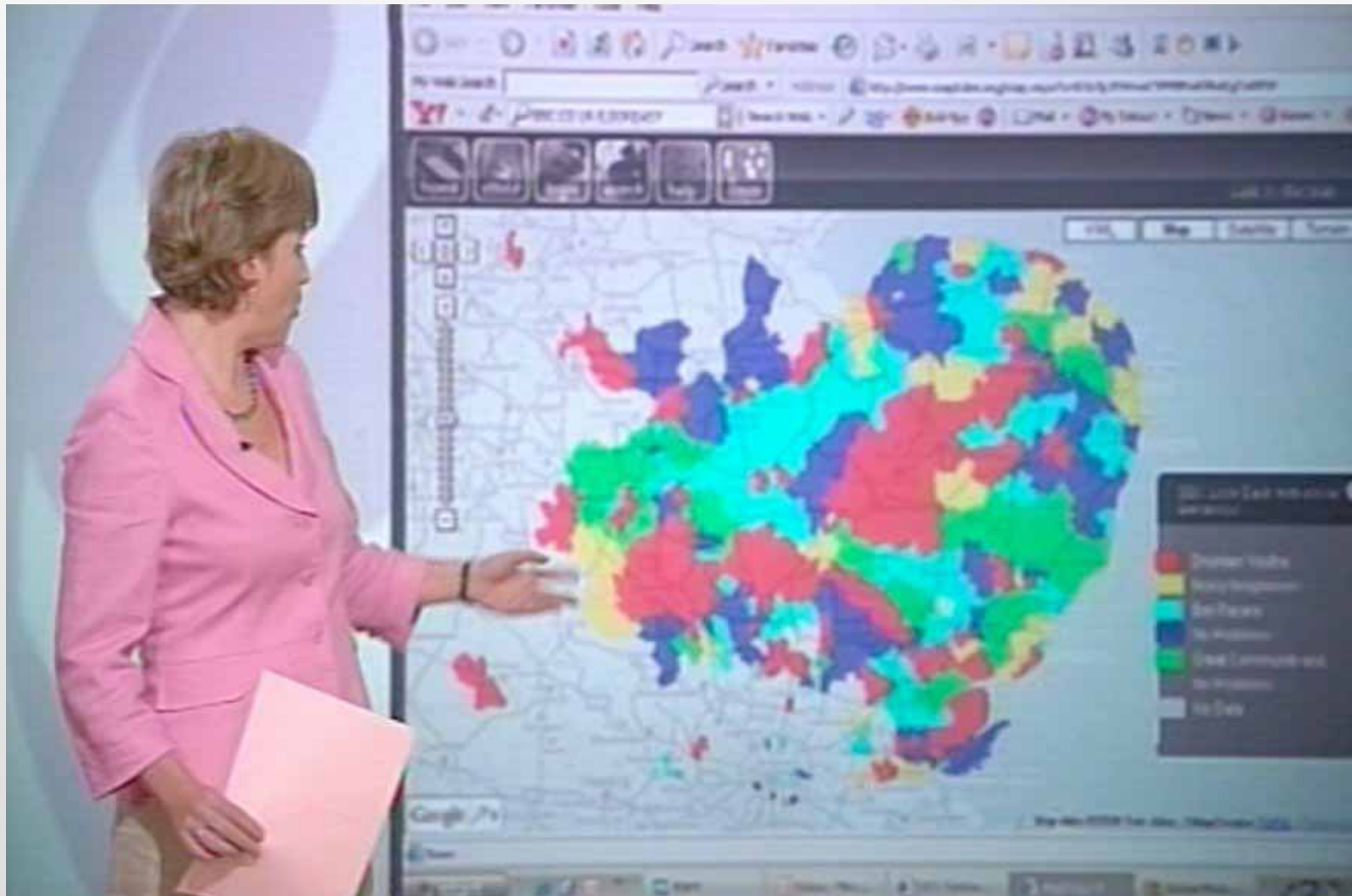
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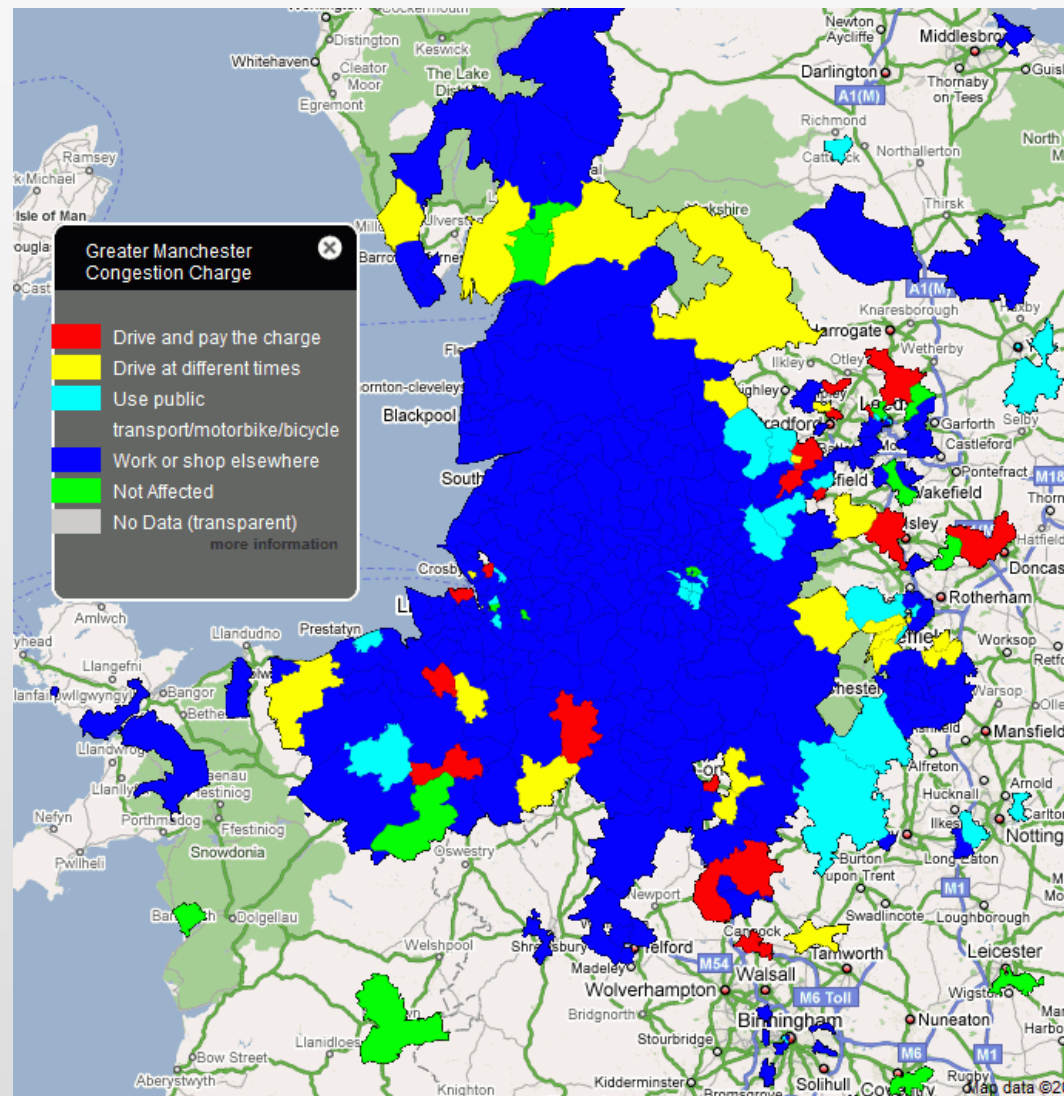
<http://www.maptube.org/creditcrunch/>

BBC Look East: Anti-Social Behaviour

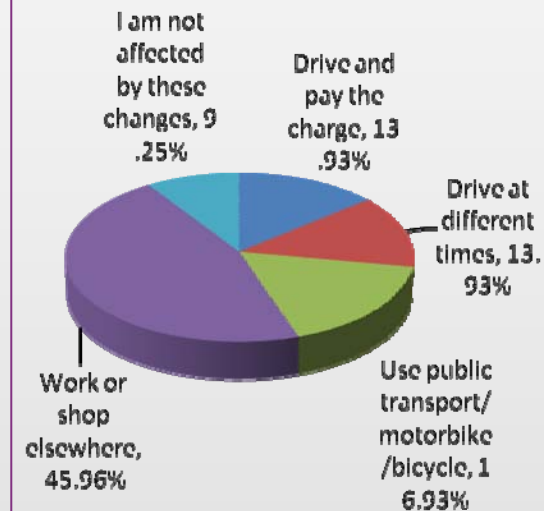


<http://www.maptube.org/lookeast>

Manchester Congestion Charge

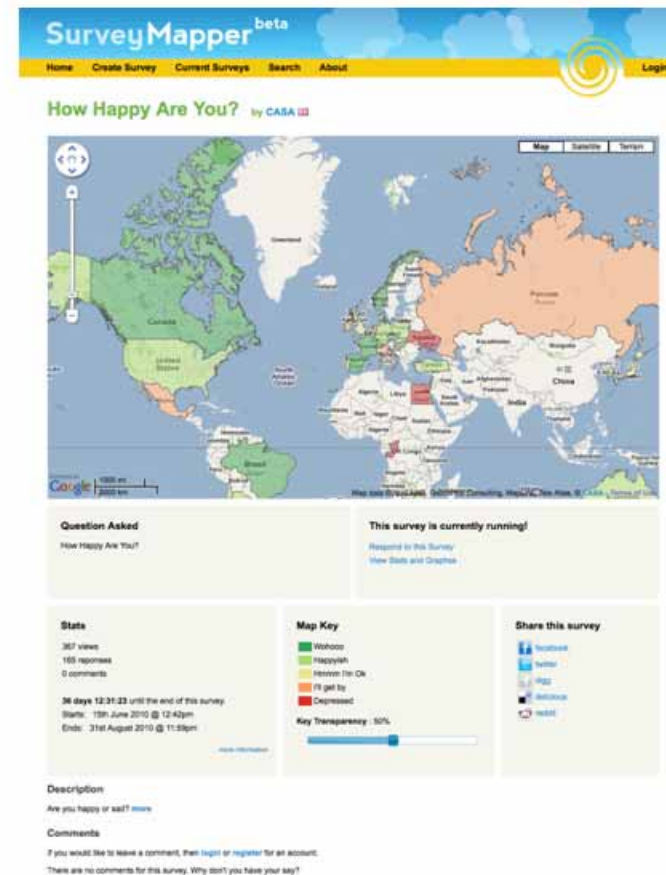


15,902 responses
October to December 2008

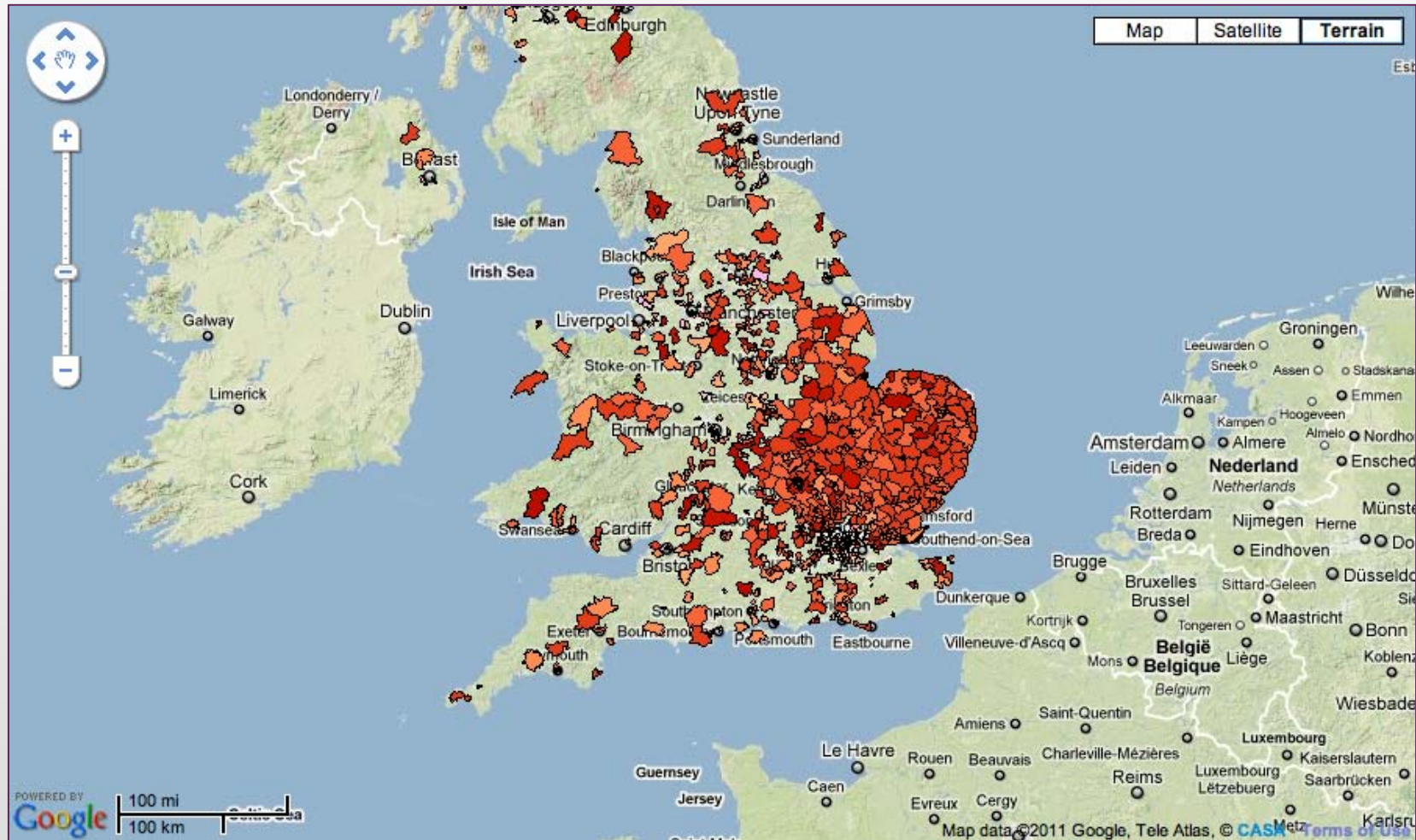


SurveyMapper

- Real-time Geographic survey tool.
- Up to 50 questions per survey
- Up to 50 answers per question
- Live stats and graphs
- Geographic Regions:
 - Worldwide Countries
 - European Countries
 - UK Counties
 - UK Postcode
 - Adding more soon
- Frequently updating regions



BBC Look East Survey - Broadband Speed Test

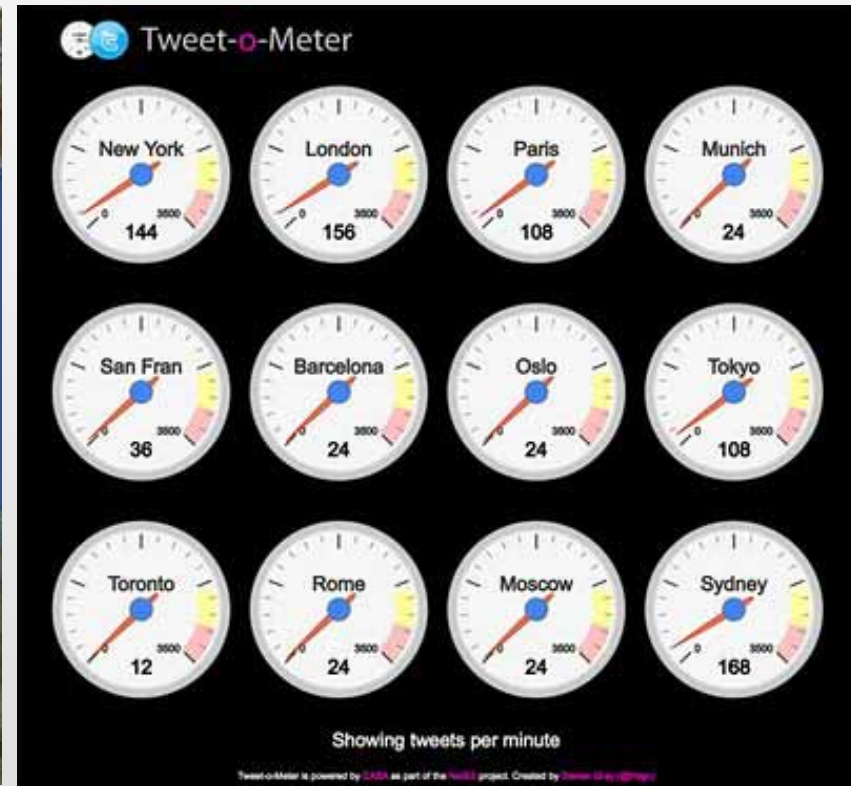
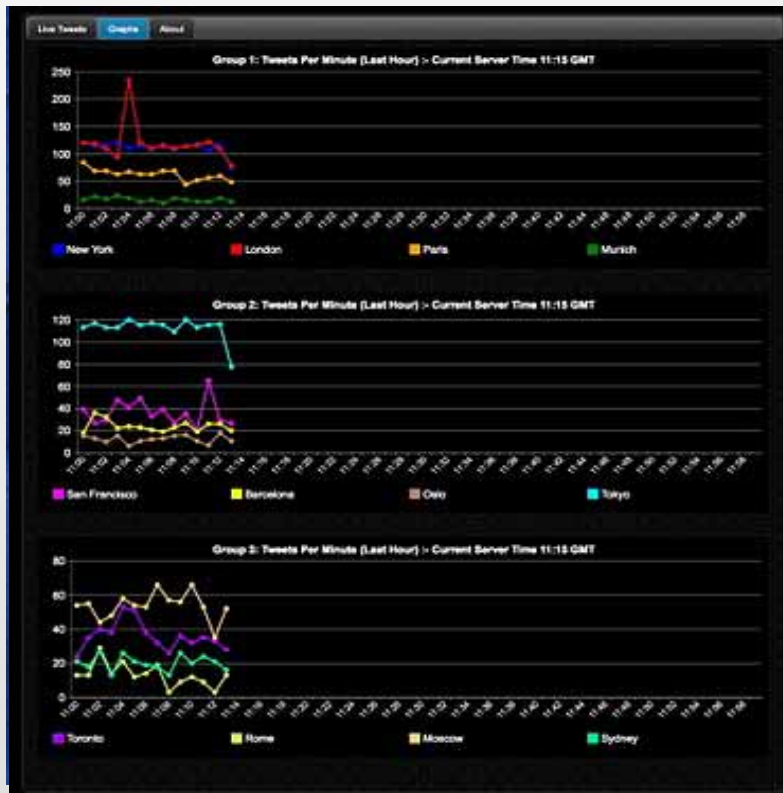


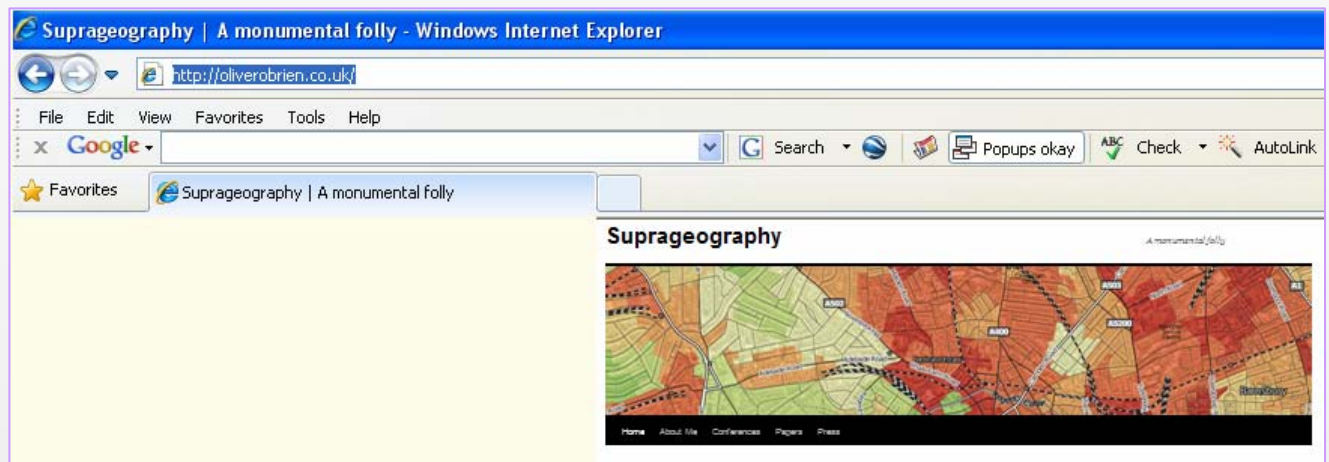
Extracting and Mapping Social Media

We have started to mine, map, interpret much social media because of the ease of its availability – and we have started looking at Short Text Messaging – Twitter data.

We have also begun to look at phone tracking data – from the iPhone for example but many of our data sets such as the bikes data, the Oyster card and such like data are really part of the same domain of new bottom up data. We have no control over this but some of the social media data we are mining we have greater control over. Here are some examples.

Spatial Analysis of Urban Activity using Twitter data





digitalurban.org
modelling, visualising and communicating urban environments

home masters course publications tutorials talesofthings surveynapper maptube about contact

2010-10-18

Bike-o-Meter Now Without Paris/Dublin/Brussels/Valencia/Seville/Vienna and Toyama

The world of data is changing, vast amounts of free and open data are enabling innovative visualisations. Our new Bike-o-Meter could be seen as a case in point, it provides at a glance a view of how bicycle rental schemes in cities around the world are performing. It even allows you to view the percentage of hire bikes that would need to be redistributed to balance each scheme and here may lie the problem - it allows under performing cities to be clearly identified using their own data.

3
Tweet

4689 readers
BY FAYEDUNHER

follow digital urban on
Twitter Facebook RSS

Subscribe

LATEST NEWS
Data Mash-Ups and the Future of Mapping: JISC Report Published

TalesofThings in the New York Times

TalesofThings features in Mashable's Spark of Genius Series, sponsored by Microsoft's BizSpark

Our Digital Urban Booklet is now available as a Free PDF

Bike-o-Meter

London Paris Dublin Brussels

6.3 NaN NaN NaN

01:22 PM 02:22 PM 01:22 PM 02:22 PM

Sadly a number of cities, run by a common provider, have requested that we no longer use their data, stating use protection under the harmonised sui generis database right, as provided under Directive 96/9/EC: Chapter III Article 7 (1) and (2).

Real Life Tweet-o-Meters

Posted on 2010-09-18 by Stuart



I was at the [British Library](#) yesterday for the launch of the [Growing Knowledge](#) exhibition of innovative research techniques. One installation has been built by Steve and Ben at CASA and is a real-life version of the [Tweet-o-Meters](#) (which were also the inspiration and technology for the [Bike-o-Meters](#) I mentioned yesterday.)

The installation has dials for nine cities around the world, showing the current level of Twitter activity (i.e. geo-located tweets) in these locations.

I love the "spoon retro" design of the installation. It is notable that all the other installations in the exhibition involve computer screens, in several cases these are used to display old maps (e.g. the New York Public Library rectification service) or historical paintings (using a Microsoft Surface screen.) I love the irony that the exhibition that is showing the data right now, i.e. coming live off Twitter from around the world, is the one which doesn't involve any computer screens at all - although they are of course computer-controlled

Archives

Search Month

Search

October 2010

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25	26	27	28	29	30	31

Blogroll

- Bike Share Interactive Map
- Bike-o-Meter
- CASA Weather
- CASA Weather (Mobile)
- My academic page
- My main website
- My Open Learning Blog
- Open Open Learning Blog
- UCL Geography Blogs

Recent Comments

- Paul Martin on [Bike Mile Around the World](#)
- Ernie Saglam on [Bike Mile Around the World](#)
- Cliveron on [Bike Mile Around the World](#)
- Ernie Saglam on [Bike Mile Around the World](#)
- Stam on [Bike Mile Around the World](#)

Meta

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- Comments
- WordPress.org



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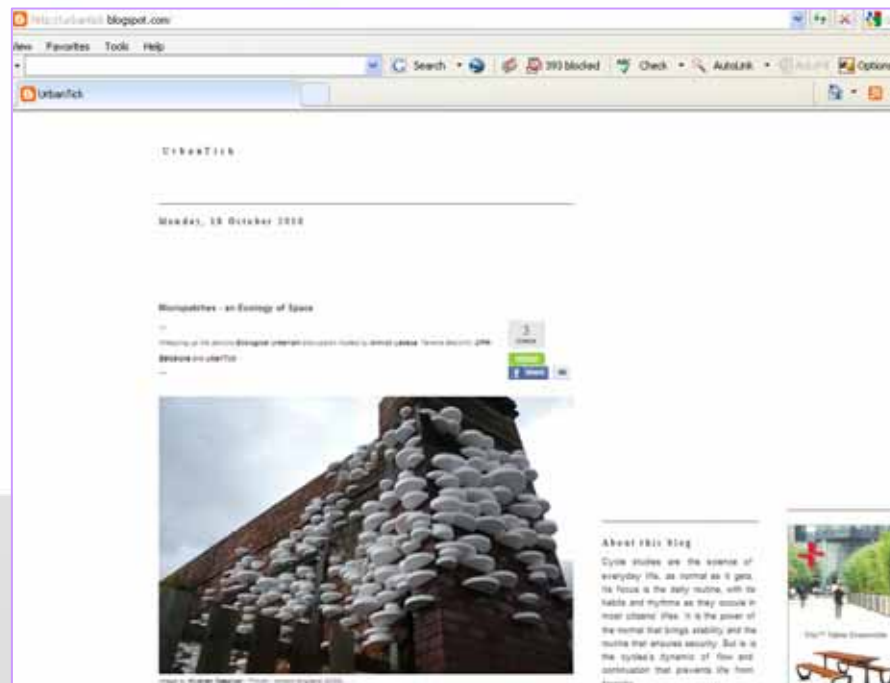




Urban Tick

Urban Tick is a new blog which is written by Fabian Neuhaus who is studying rhythms and cycles in the city for his doctoral work. An important way of looking at cities is through the fast processes that define the functions of the urban environment of which local movement is key. Tracking individuals and relating their space time trajectories to their behaviours and the activities that they frequent and use is basic to the way cities are organised. We can begin to define spatial structures in terms of such movement and tracking individuals is fast becoming one of the ways in which such structures can be defined. Contemporary IT with embedded GPS is central to all of this and Urban Tick seeks to record what is moving and shaking this fast developing field.

<http://urbantick.blogspot.com>

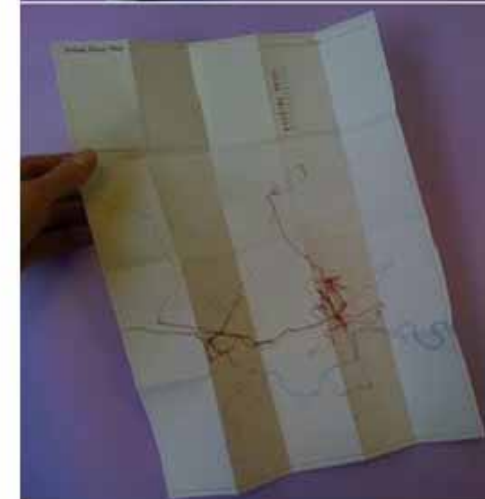


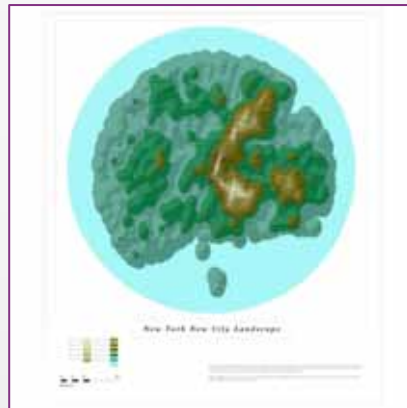
About this blog

Cycle studies are the science of everyday life, as normal as it gets. Its focus is the daily routine, with its habits and rhythms as they occur in most citizens' lives. It is the power of the normal that brings stability and the routine that ensures security. But it is the cycles's dynamic of flow and continuation that prevents life from freezing.

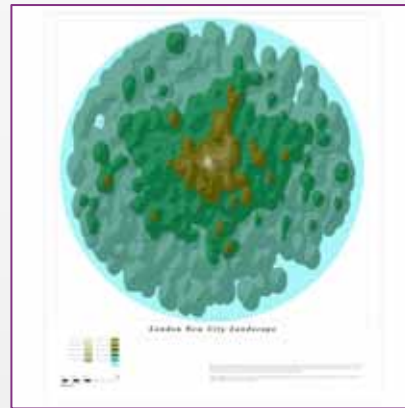
Cycles therefore stand for stability but are at the same time the engine of change.

With this blog the research on cycles and rhythms will be embedded in the most recent developments in technology, covering a range of areas with a focus on space-time related technologies.

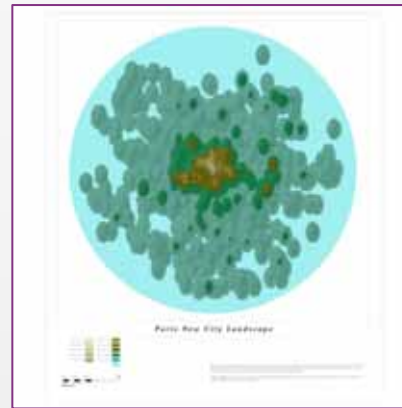




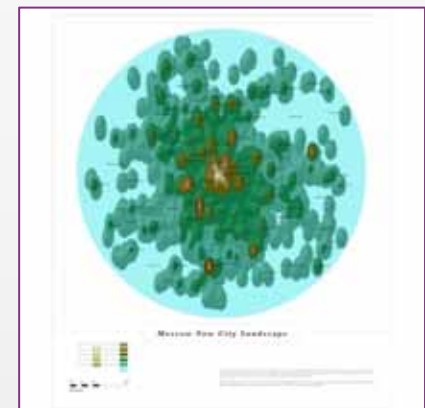
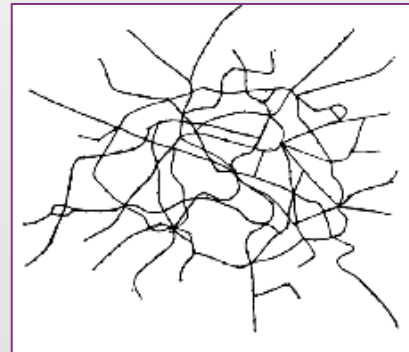
New York



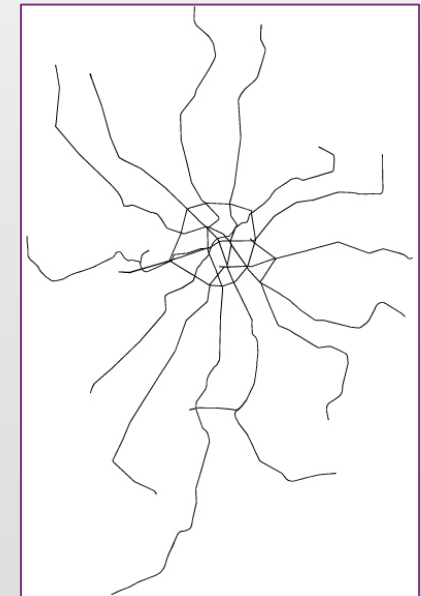
London



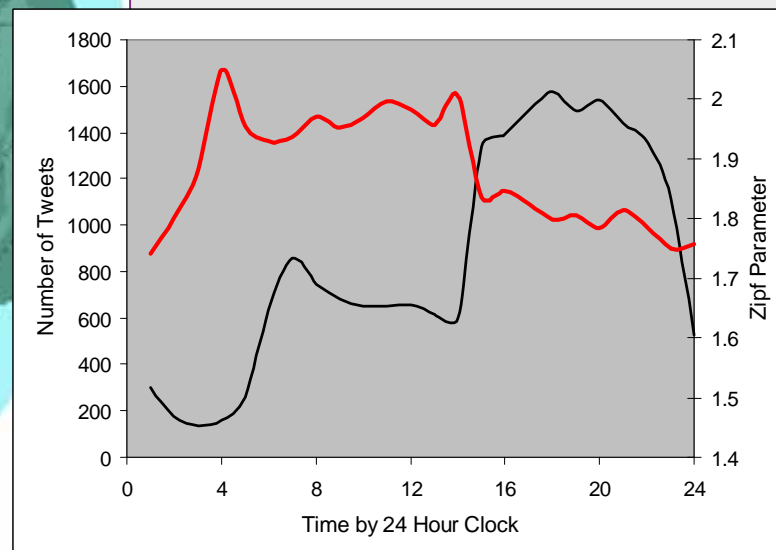
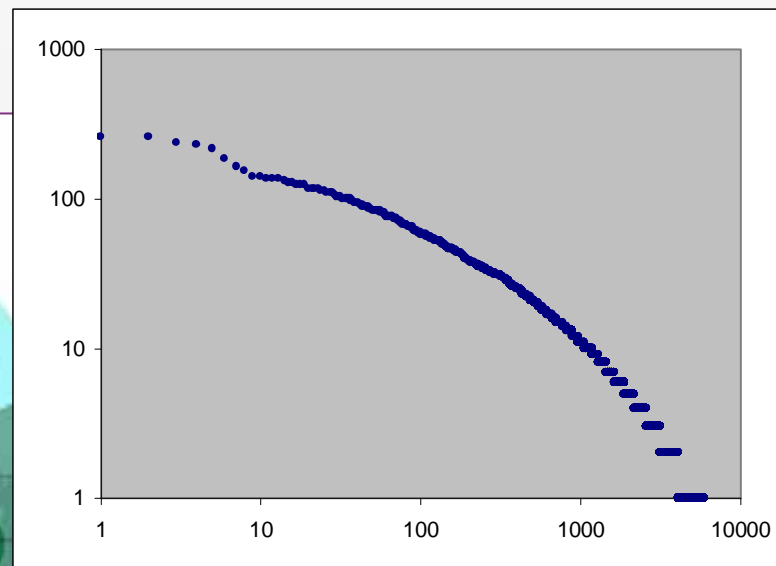
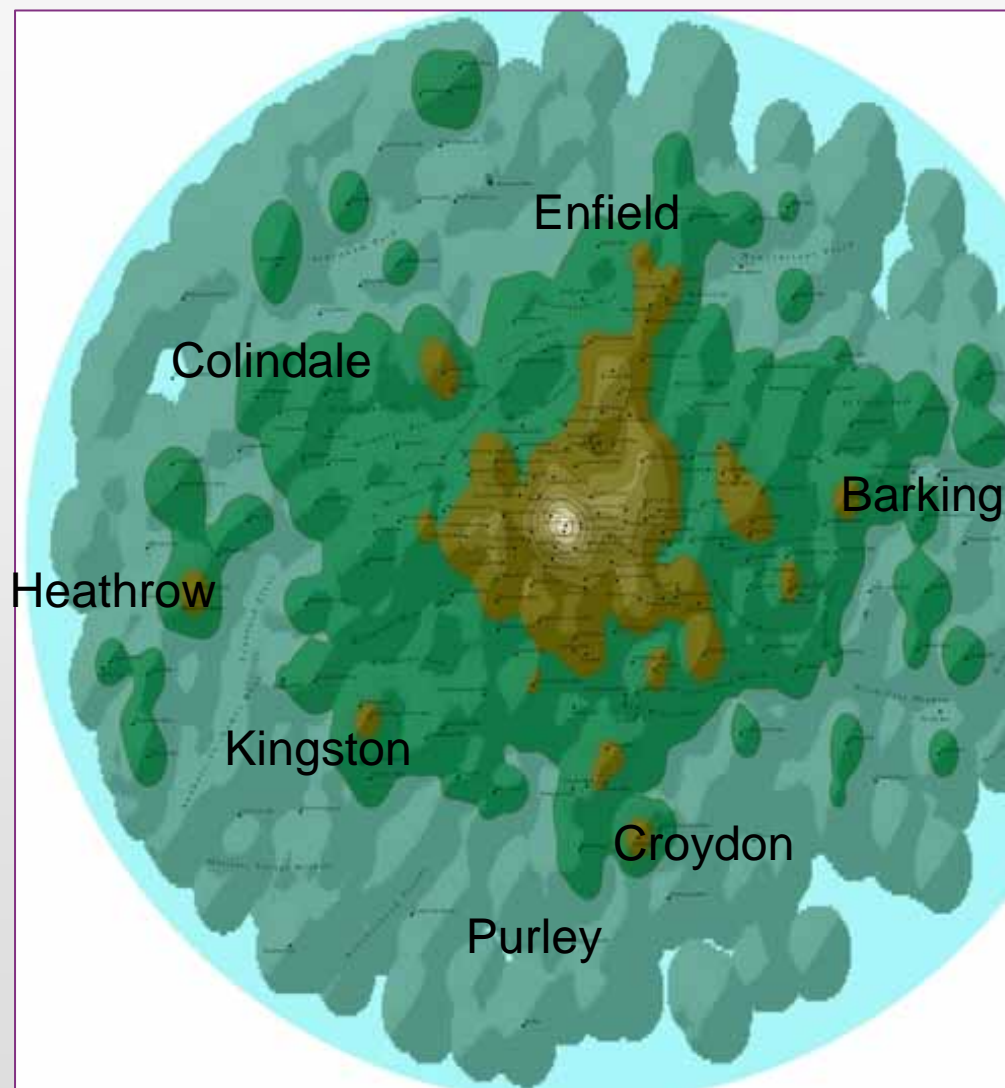
Paris



Moscow



London



A Framework for All of This: The Complexity Sciences

I will not labour this much longer but much of our work is informed by our general interest in understanding cities using the complexity sciences.

We are thus interested in understanding the social physics of the city, networks, flows morphology, dynamics, resilience, emergence and so on

I refer you to my own weblog – www.complexCity.info

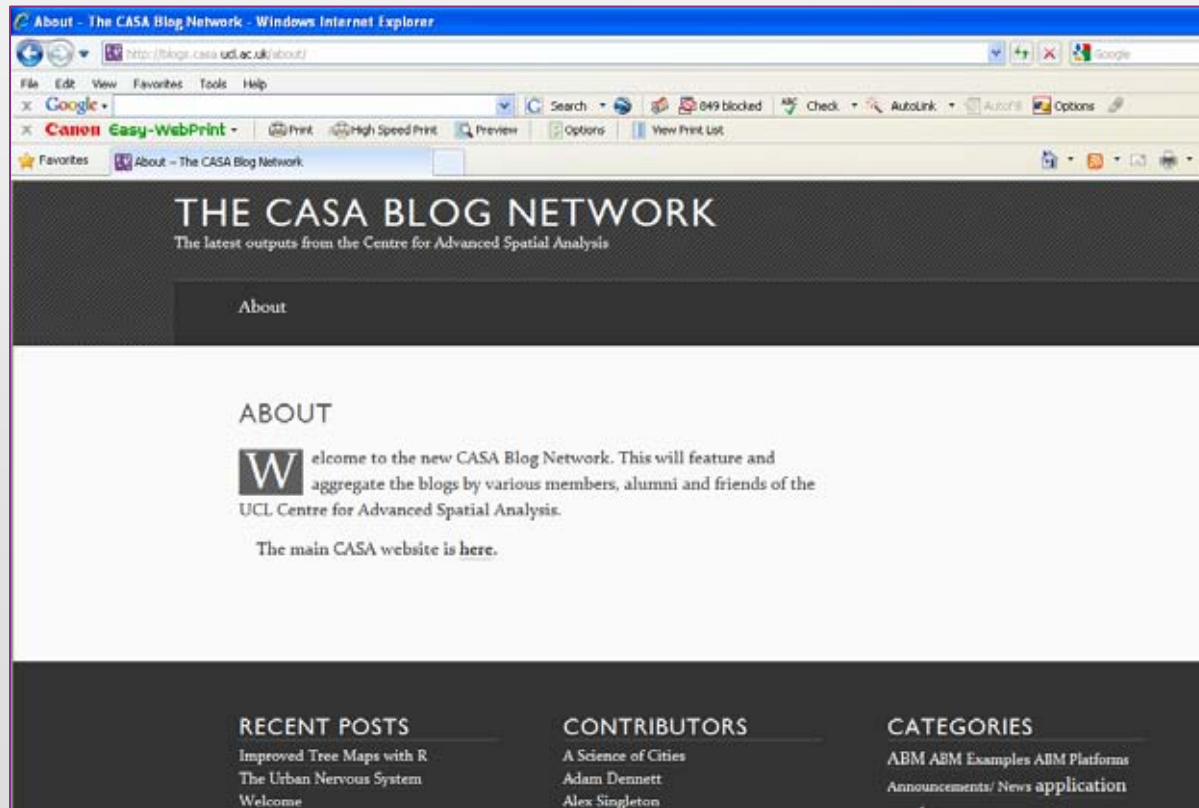
Which I call **A Science of Cities** (because I believe there is more than one science – there are many)



Let me finish by listing some resources:

Our blog aggregator

<http://blogs.casa.ucl.ac.uk/>



Centre for Advanced Spatial Analysis



And some of our blogs

A Science of Cities <http://www.complexcity.info/>

Big Data ToolKit <http://bigdatatoolkit.org/>

Digital Urban <http://www.digitalurban.org/>

GIS and Agent-Based Modelling <http://gisagents.blogspot.com/>

Simulacra <http://simulacra.blogs.casa.ucl.ac.uk/>

Sociable Physics <http://sociablephysics.wordpress.com/>

Spatial Analysis <http://spatialanalysis.co.uk/>

Suprageography <http://oliverobrien.co.uk/>

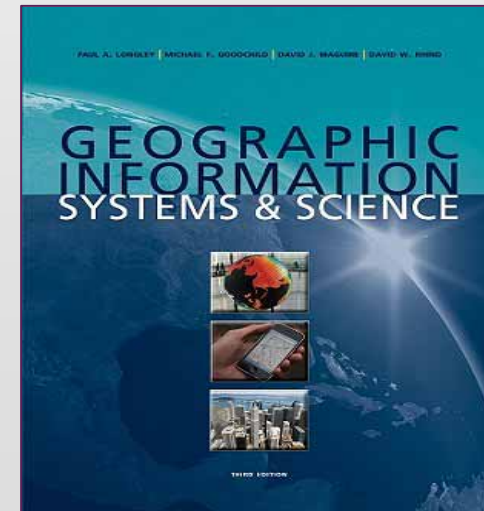
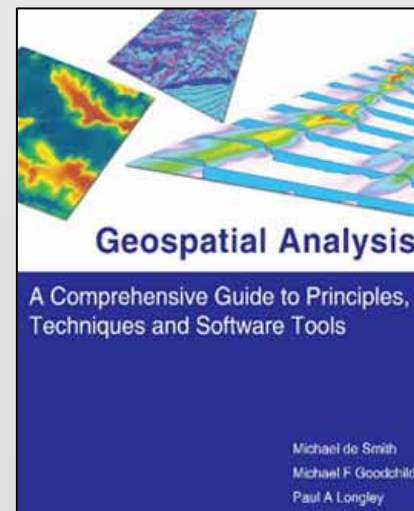
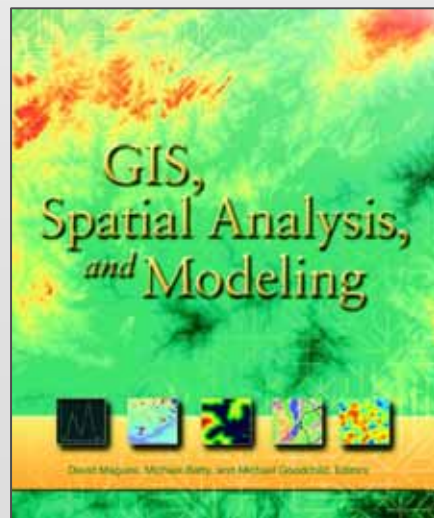
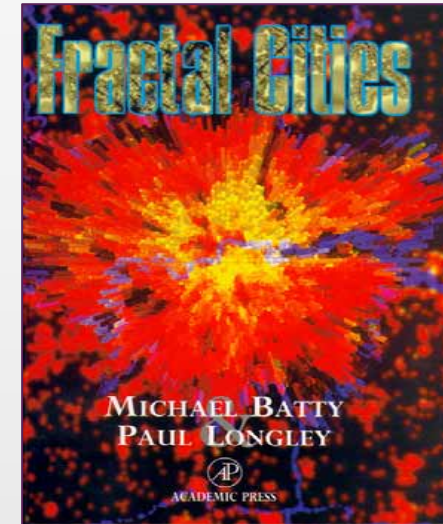
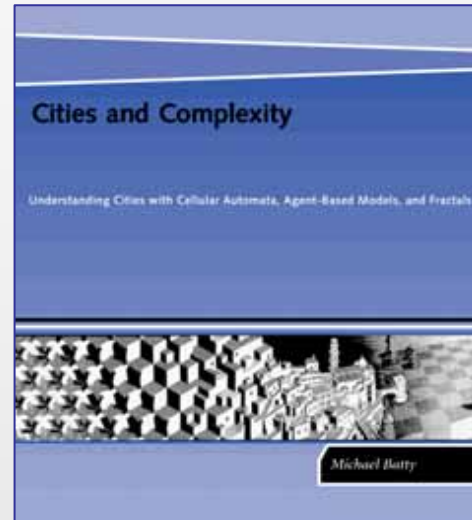
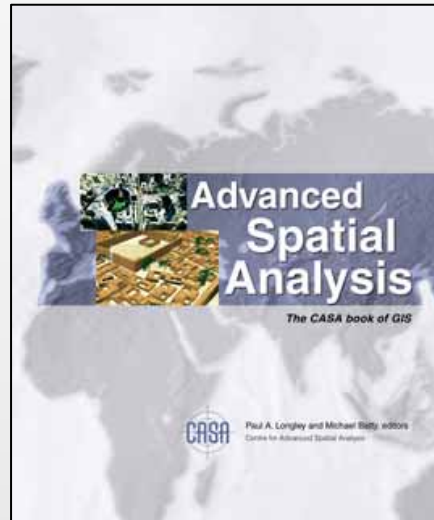
The Mapping London Blog <http://mappinglondon.co.uk/>

Urbagram <http://www.urbagram.net/>

Urban Tick <http://urbantick.blogspot.com/>



And some of our books



And last but not least, as part of a major initiative in Europe led by Dirk Helbing at ETH Zurich and Steve Bishop at UCL, we are bidding to the EU for an initiative for a large Europe-wide project called *FuturICT*

This will mobilise complexity science to explore the future human problems and as part of this there will be a significant focus on “Smart Cities”. We invite you to be involved; The web site is at

<http://www.futurict.eu/>

And the proposal will be submitted March-April 2012

