

BIKEABILITY.DK
cities for zero-emission travel and public health THURSDAY, DECEMBER 2ND, 2010, COPENHAGEN


HOME ABOUT SUMMARY WORK PACKAGES



Visualising & Modelling Local Movement What We Are Doing in CASA


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

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Outline

- What We Do in CASA
- Modelling Cities: Morphologies, Movement, Location: Social Physics, Microsimulation, ABM, etc
- Four Broad Areas: Modelling, Visualising, Mapping, and Sensing
- Our Projects: From Blue Skies to Fairly Applied
- Recent Examples: Sensing, Spreading, Visualising
- A Focus on ABM, Pedestrian Modelling and BIKEABILITY: The London Bikes Project

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What We Do in CASA

We are a fairly eclectic group focussed on using formal methods, models, computation in relation to cities – we tend more to the cities side being architects and planners and engineers than to math/computation per se

But we have a lot of programmers and applied maths people as RAs and Co-investigators in our projects

We work to a strong sub-theme of the complexity sciences

We started 15 years ago are interdisciplinary, cross disciplinary but we are embedded as one of the 7 units that comprise the Faculty of the Built Environment – i.e. the Bartlett School



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Modelling Cities:

Our models draw from several traditions – primarily social physics which involve things like nonlinear dynamics, scaling, reaction-diffusion and so on, and we operationalise our models using ABM, microsimulation, aggregate econometrics and so on

Our focus tends to be at the district level up – i.e. neighbourhoods in cities up to metro regions like Greater London, but with recent extensions to global dynamics

There are also pressures in our work to extend down-scale because of our interests in sensing and new data sources



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Three Broad Areas: Modelling, Visualising, Mapping, and Sensing

We have projects in all these areas and I will catalogue these in a minute before I describe a few of them

Our core technologies used to be GIS and still are but we extend to all sorts of applications such as CAD, multimedia, Web 2.0 applications and so on

I have not mentioned data but we are immersed in large spatial data sets – and have strong interests in open data, public data and so on; obviously in map data, and increasingly in sensing data



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Our Projects: From Blue Skies to Fairly Applied

Modelling:

ARCADIA (EPSRC) Climate change in Greater London (Tyndall)

SCALE (EPSRC) – the impact of rapid changes in energy costs on movement dynamics in cities (with CS and Transport)

Enfolding: Modelling and Visualising Global Dynamics – in trade, migration, development aid, etc (with)

Mechanicity (ERC) – modelling cities and their morphology using allometry and network science, with a focus on energy

Mapping:

GENeSIS (ESRC) – generative spatial modelling and mapping (with Leeds) using web 2 style mapping – building new kinds



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of GIS infrastructure for social scientists. This work is extending into sensing and into fine scale pedestrian modelling

NeISS – an add-on to GENeSIS from JISC involving mapping

Visualising:

To an extent, all our projects involve visualisation as this is a major way of reaching out to stakeholders as well as embracing the complexity of our simulations and delivering our science to others

Sensing:

TOTEM (EPSRC) – tagging objects with codes – building memory into the built environment (with

COSMIC (ERA-Complexity-Net) – a pilot network on spatial dynamics in cities at the fine scale involving sensing



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Examples: a focus on Sensing & Visualising

I am going to pick five modest projects from our set and look at these – they all involve the four areas we are working in modelling, mapping, visualising and sensing but they are more geared to the latter two areas; and they are quite current and represent our way forward: I will look at

- Network Data in the COSMIC project
- MapTube – web mapping and crowd-sourcing
- Spatial Analysis of Urban Activity using Twitter data
- Early and Current Projects on ABM & Pedestrian Modelling
- Measuring Online Demand and Supply for Transport (the London Bikes Project)



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Network Data in the COSMIC project

CASA Telecoms



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CASA Subway Data – London Tube, and London data generally

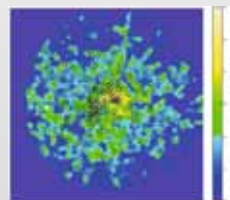
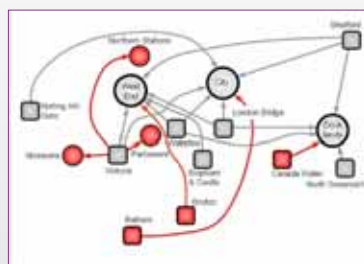
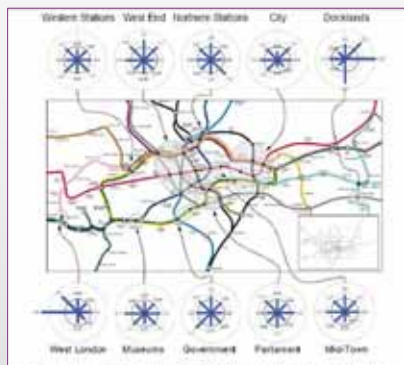


Figure 4. The London subway (tube) system, polynorms and factor of attraction. In the inset, we show the station tube network while in the main figure, we focus on the central part of London. We represent the top-most important polynorms defined in the description of Figure 3, and show the corresponding propensity to attract (comparing actual flows with the null model defined in the text). A propensity of 1 means that there is no difference in a given direction with respect to the null model. Values correspond to varying levels of statistical propensity ratios. The darker colors in the middle corresponds to 1, lower values correspond to a propensity of 0.2 and 0.5, and even darker to 2 and 3. The assignment is essentially in opposite directions from the center, thus obtaining a strong bias towards the suburbs for peripheral centers essentially, rather than for central centers. Stations, next, distance toward their own regions and seem to have their own distinctive factor of attraction.



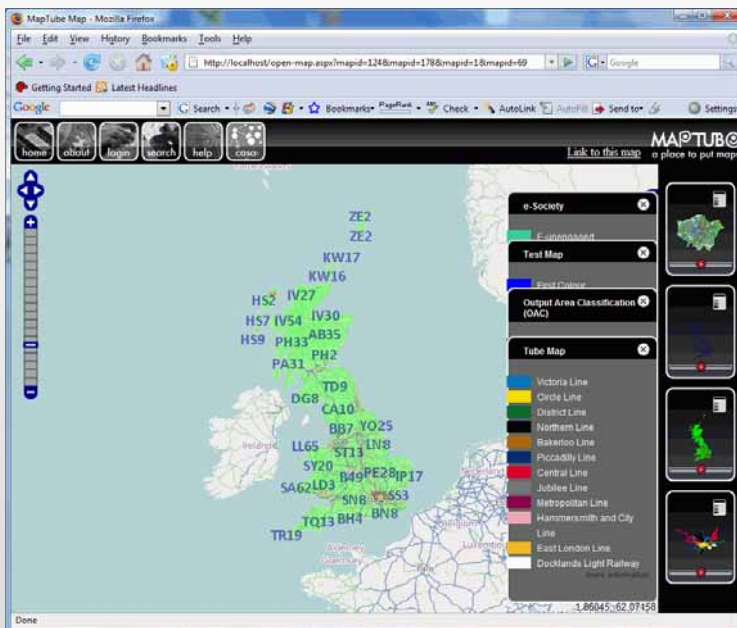
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MapTube – web mapping and crowd-sourcing



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Tooth courtesy of
Johan Lundin
Biomedical Informatics Research Group
Department of Oncology
University of Helsinki
<http://www.webmicroscope.net/>



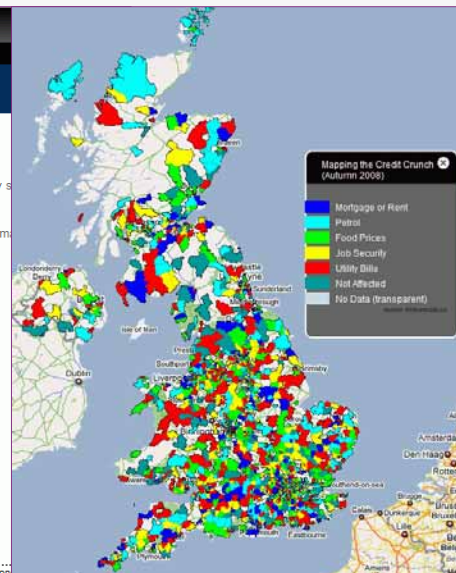
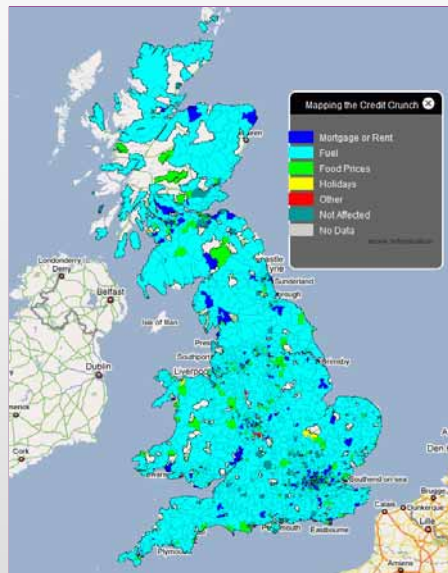
The Kremer Collection
<http://www.thekremercollection.com/>



<http://chs75.harvard.edu/manuscripts/>



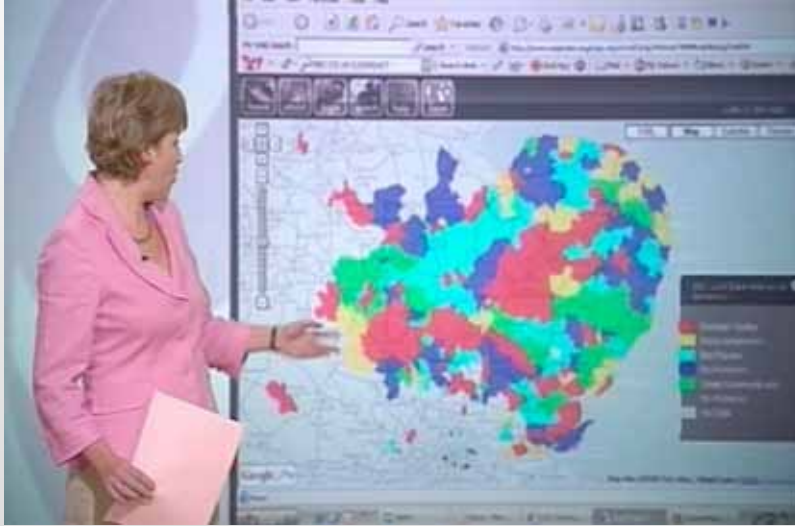
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<http://www.maptools.org/creditcrunch/>



BBC Look East: Anti-Social Behaviour



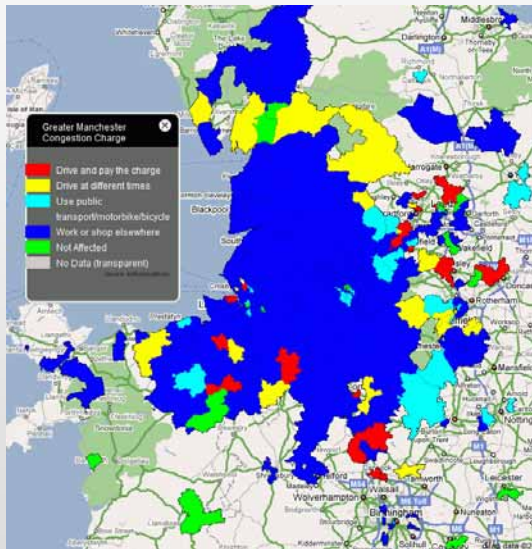
<http://www.maptube.org/lookeast>



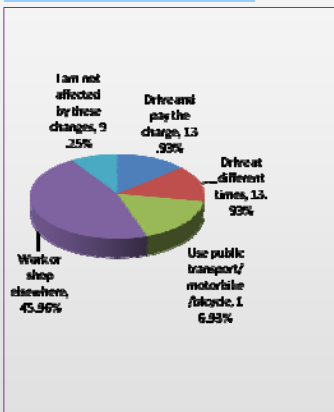
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Manchester Congestion Charge



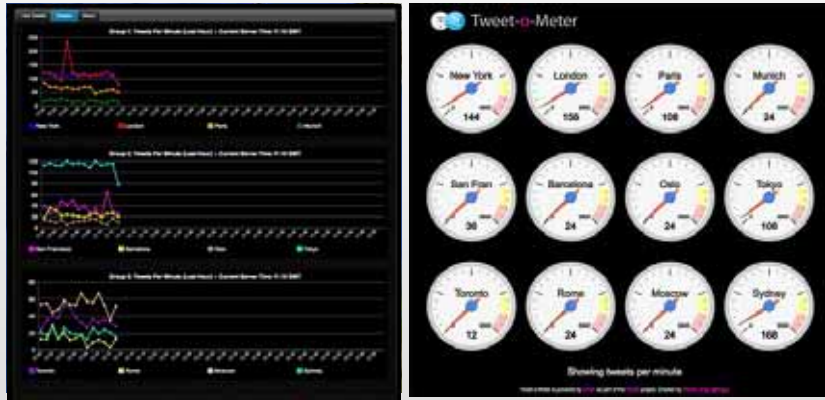
15,902 responses
October to December 2008



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Spatial Analysis of Urban Activity using Twitter data



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The screenshot shows a web browser window displaying a blog post from digitalurban.org. The page title is 'Suprageography: A Personalized Web'. The main content includes a video player showing a man in a blue shirt, a map of a city, and a 'Biko-o-Meter' visualization. The text discusses urban activity and the use of digital tools for spatial analysis.



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Tweets as Background Radiation about Dynamics in the City **UCL**

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' 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.



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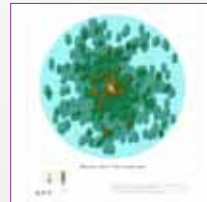
New York



London



Paris

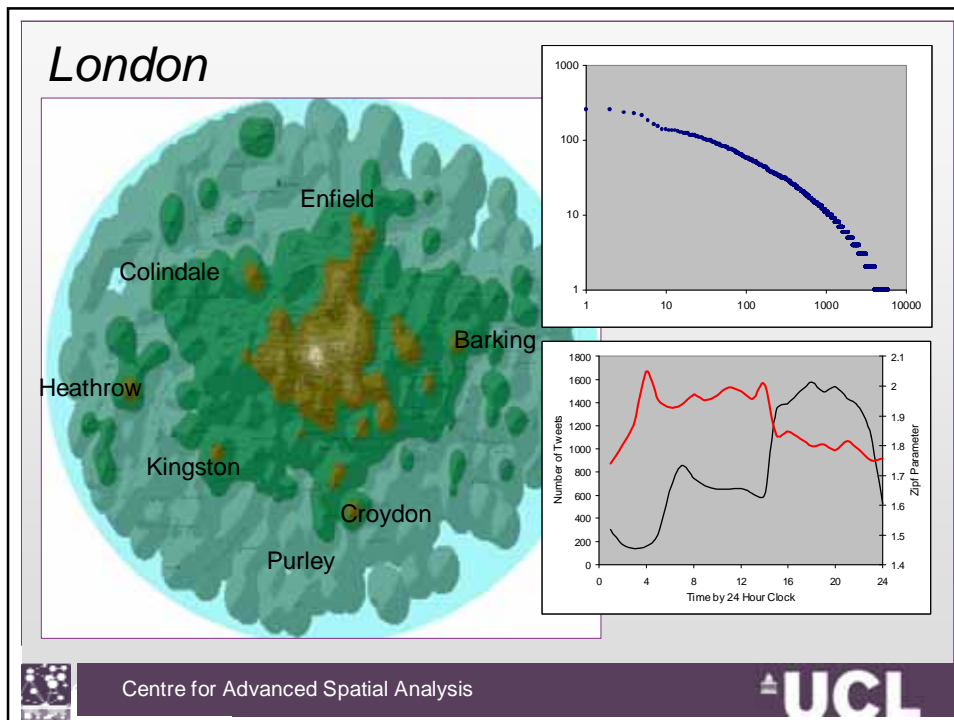


Moscow



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Developing Agent-Based Models for Simulating Movement – Pedestrian Modelling

We have looked at three projects: two in CASA on the Notting Hill Carnival and the Covent Garden Entertainment Hub and one from Anders Johansson now in CASA from his time in Dresden and ETHZ with Dirk Helbing

Anders is now working on GPS tracing of movements in central London and we are planning some work on building an epidemics model of spreading diseases like the common cold in enclosed transport environments like the Tube system.

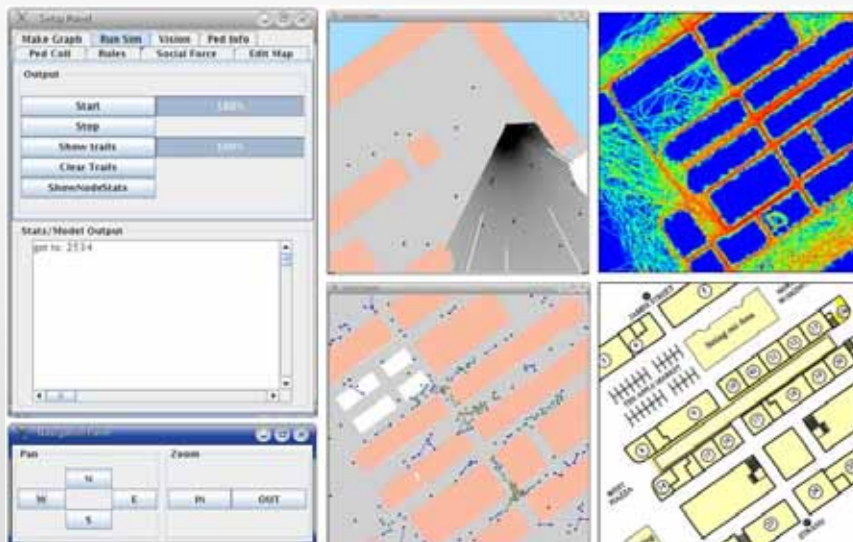
Here are some of these examples



Above: Crowd Scenes and Emergency Vehicles at Hajj and in Notting Hill: Below: Our ABM of the Notting Hill Carnival



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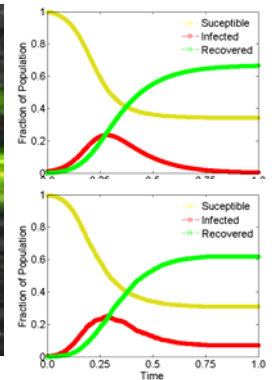


John Ward's ABM of Tourists & Shoppers in Covent Garden



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Ander's Johansson's Epidemic Model of Central London based on GPS tracks from Courier Data
 There is a very nice visualisation of this – animation – at http://www.ajohansson.com/london_epidemics.avi



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Measuring Online Demand and Supply for Transport (the London Bikes Project)

Scraping Data: The London Bikes Experiment

Locally called Boris's Bikes



4200 bikes, 340 stations, access via online registration or by paying on a credit card at the local bike station – so all online data



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- **Docks** – The things which hold onto the bikes and release them
- **Stations** – groups of docks
- **Spaces** – docks which are empty

City	Official Name	Installed	System	# of Bikes
London	Barclays Cycle Hire	July 2010	Bixi	4,300
Barcelona	Bicing	March 2007	Bikemi	4,200
Milan	Bikemi	December 2008	Bicing	1,100
Saragossa	Bizi	May 2008	Bicing	800
Girona	Girocleta	September 2009	TNT	100
Washington DC and Arlington	Capital Bikeshare	September 2010	Bixi	650
Montreal	Bixi	May 2009	Bixi	4,200
Minneapolis	Nice Ride	June 2010	Bixi	600
Denver	B-cycle	April 2010	B-cycle	350
Melbourne	Bike Share	June 2010	Bixi	400



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Let's Visualise Them!

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<pre>
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- Obtain the data from the operators' websites
 - Some provide XML/JSON/KML
 - Lots of Regex parsing
 - Velib-based systems require two stages
- Store it for analysis
- Stick it on a map
 - OpenLayers has some nice vector styling for points
 - OpenStreetMap-based background
 - Charts of historical trends via the Google Chart API

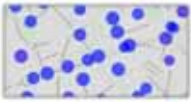
Bike-o-Meter
casa.ucl.ac.uk/bom

- Tweet-o-Meter for bikes
 - Steven Gray (@Progo)
 - 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 ☺



Bike/Dock Ratio

- No of bikes per 100 docks
 - Based on max availability at around 5pm ("no" usage)
 - Averaged over a few weeks

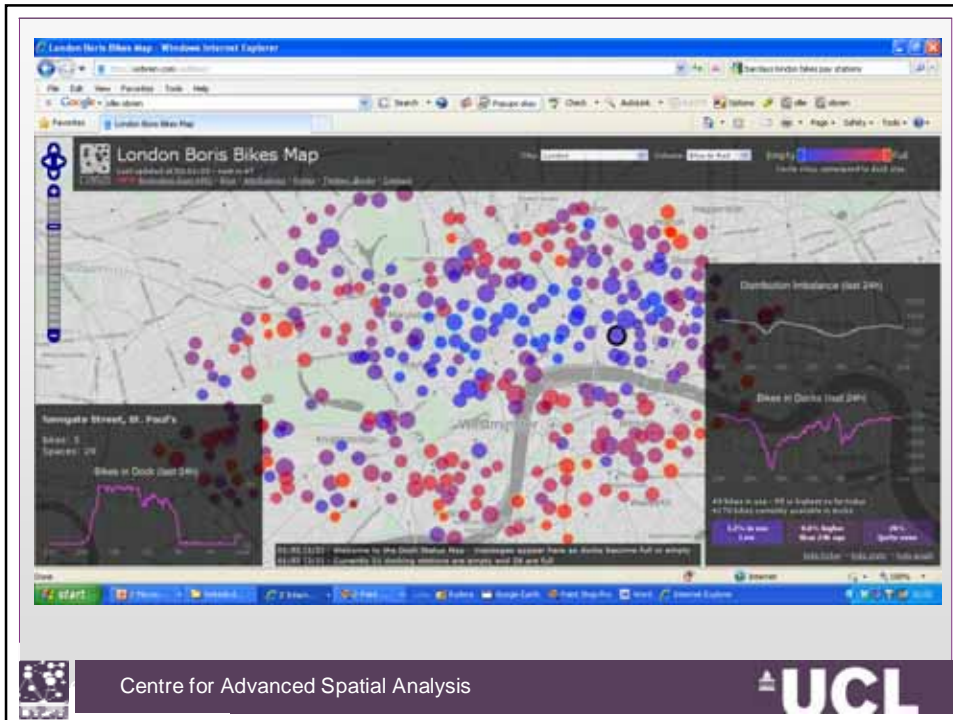


City	Ratio 100
Melbourne	33
London	34
Denver	34
Milan	35
Statis	37
Washington DC	38
Saragosa	38
Barcelona	39
Washington DC	40
Statis	40
Paris	41
Statis	41
London	42
Statis	42
Statis	42
Average	42

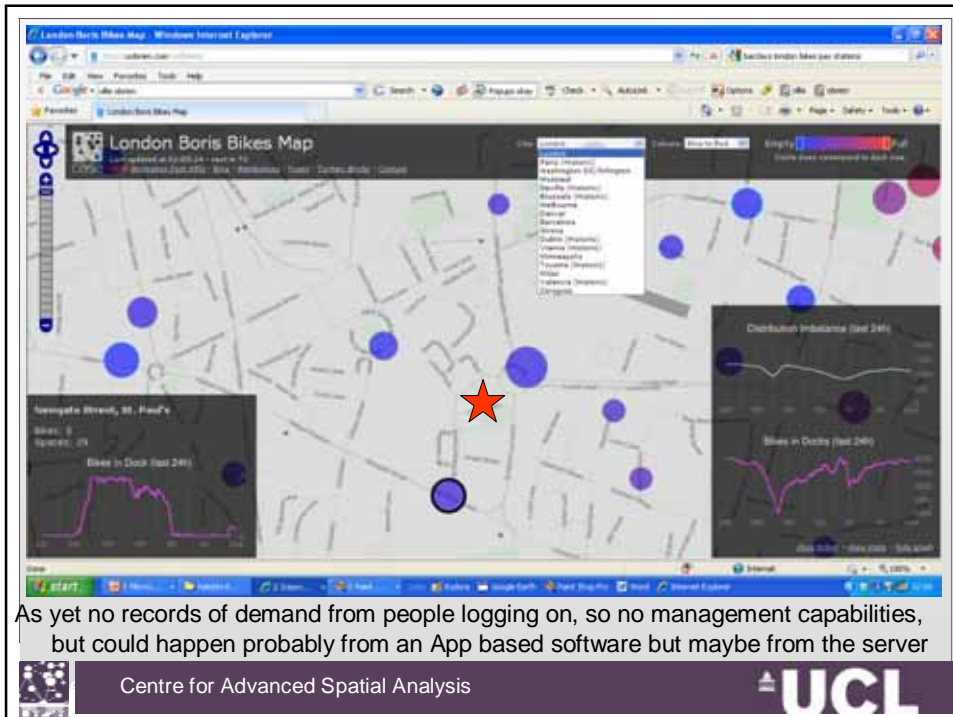


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As yet no records of demand from people logging on, so no management capabilities, but could happen probably from an App based software but maybe from the server

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Weekday Use – 1. Europe ex-Spain

Simultaneous Bike Usage (Weekdays)
empty docks available (equivalent to bike usage) scaled to 200 at 1am

More Analysis

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

Redistribution Effectiveness

Distribution of bikes (Weekdays)
Average % bikes needed to move to balance

Bike-o-Meter

casa.ucl.ac.uk/bom

- Tweet-o-Meter for bikes
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iPhone Screenshots

Nearest Bikes

- Hyde Park Corner
0m W, 28 docks, 21 bikes/7 free.
- Knightsbridge
133m W, 43 docks, 31 bikes/12 free.
- Grosvenor Crescent
189m S, 18 docks, 7 bikes/11 free.
- Wellington Arch
277m E, 36 docks, 10 bikes/26 free.
- Albert Gate
342m W, 29 docks, 25 bikes/3 free.
- Belgrave Square
420m S, 21 docks, 18 bikes/3 free.
- Seville Street
420m W, 18 docks, 18 bikes/0 free.
- Curzon Street
616m NE, 16 docks, 2 bikes/14 free.
- South Audley Street

Trip Summary

Started at 09:08
Elapsed 45m 12s
Cost £1.00
Next price increase 15m

[Stop](#)

Cost is based on the published TFL schedule, and may be less accurate at the end of a time period.
Some bike stations may not be open or built yet.

<http://oobrien.com/vis/bikes/>

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