BitCity : 2011

Friday, November 4th, 2011, 9AM – 5PM
Wood Auditorium, Avery Hall, Columbia University

Smart Cities as Flow Systems:

How the Real Time World is Moving Online

Michael Batty

University College London
m.batty@ucl.ac.uk
twitter @jmichaelbatty

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

A Focus on Smart Cities, Intelligent Transport

I am going to look at three examples where we are able to use new online data sources – 'big data' – with new forms of model – 'big science' – to make predictions about the smooth running of traffic and the economy at three different scales

At the regional-metropolitan, at area-wide network infrastructure scales, and at the local street scale

These examples show how we can fuse the strategic with the tactical using new and immediate forms of new data and new data infrastructure.

A Quick Outline of my Themes & Exemplars

1. Cities as Flows, Flows as Networks: A New Paradigm
2. The Merging of the Routine and the Longer Term
3. Exemplar 1: Land Use Transportation Modelling in Exploring Fragmentation of Networks and Location
4. Exemplar 2: Automated Public Transport Rail Systems, with congested flows
5. Exemplar 3: Public Bike Schemes: Local Routing
6. Related Examples: What Else Are We Doing?

Cities as Flows, Flows as Networks: A New Paradigm

Ed Glaeser, now, and Jane Jacobs, a long time ago, articulated cities as being places that connect people

The network-flow paradigm is ever more important in a world where local reaches global and where activities are entangled in ways we can barely comprehend

New data sources particularly relating to material and ethereal – physical and informational – are being rapidly made available, and should lead us to much deeper insights into how cities function

The Merging of the Routine & the Longer Term

Besides making 'us' (maybe) and our cities 'smart', these new ways of looking at connections offer possibilities for using fast dynamics to inform slow dynamics and vice versa

That is, to use flows that we can monitor in real time to inform us about longer term issues of location, to merge and fuse tactics and strategy, short and long term.

What I mean by this is how we can use tools developed for the strategic for the short term and vice versa

I have three examples at very different spatial scales all relevant to both short and long terms issues. These are examples of network fracture and fragmentation

- *At the metropolitan regional scale*
- *At the local line segment scale*
- *At the finest street scale*

And to start I will take our land use transport model developed for a project looking at 50 to 100 years climate change assessment and show how we are using it for looking at short term issues. Let me give you a popular view of *these short term issues* before I look at the tools and the case studies.


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Rail passengers have been hit by delays caused by the wrong type of snow and within weeks leaves on the line will be back.
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Heathrow cancels bulk of flights as transport secretary Philip Hammond says he will ask IAAA for an explanation
Snow joke as winter grips UK
The Sun


Mail Online
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London Olympic planners work to avoid transport chaos at games, recalling Atlanta debacle
A third of Londoners must work from home during Olympics to avoid tube chaos
Service information
CENTRAL LINE

Exemplar 1: Land Use Transport Modelling in the Fragmentation of Networks & Location

Our land use transport model is a conventional one. It simulates trips between origins and destinations for largish zones in GLA area – 633 TAZ for 8 m. pop

Detailed networks underpin the model, four modes, and residential, retail, commercial sectors

It also has detailed flows of money – wages from where people work to where they live and then as expenditures on goods to where they shop. Travel costs are factored into this economy.

If we have 'leaves on the line', or 'snow', or 'freezing rails', or 'strikes', then we can figure out how much wages are lost if people cannot get to work. And thus in principle, we can get a sense of how the local economy gets distorted.

We can close off zones easily enough. Or street segments, lines and so on.

As the tube lines are privatised, one can get selective strikes on different lines that can really mess things up. In principle we can see how much longer it might take to get to work; as our networks are measured in terms of generalised cost which includes travel time.

How to beat the tube strike by bike

Don't let the tube strike defeat you. Our tips on on how to cycle past the queues

Commuters walk and cycle across Waterloo Bridge towards central London on Wednesday, 10 June. Photograph: Peter Macdiarmid/Getty Images

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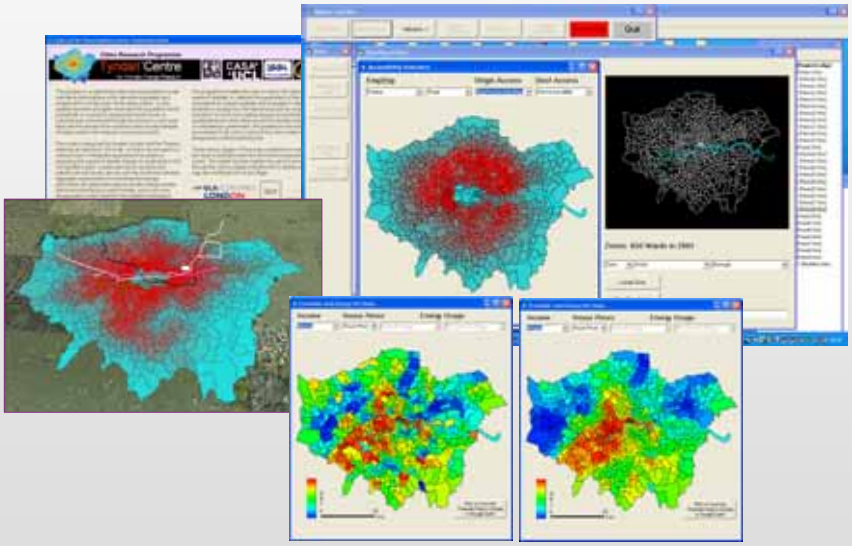
Here is some output from our LUTI model



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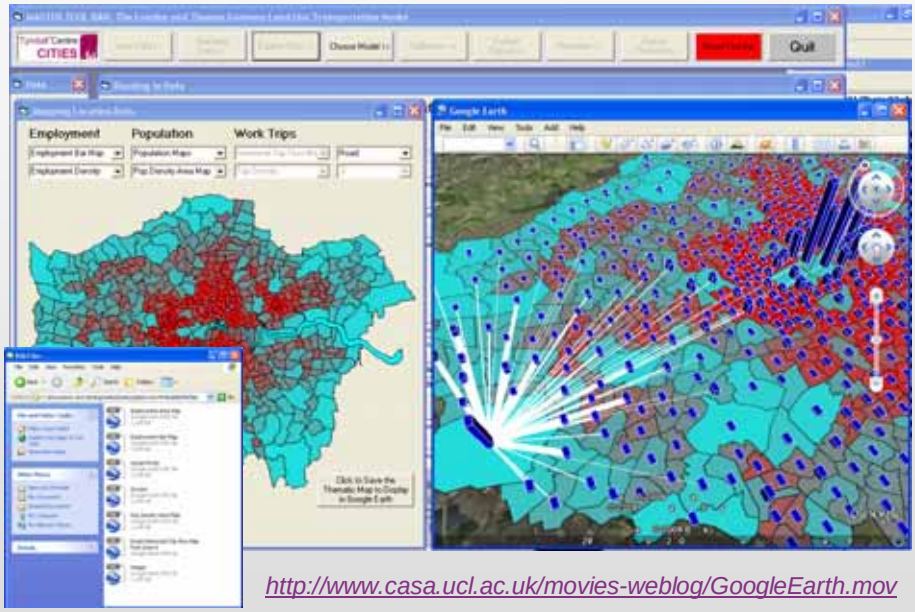


http://www.casa.ucl.ac.uk/movies-weblog/GoogleEarth.mov

Ok, in the model, the average income/wage in London is £18,953. And the total working population-employment is 4,560,795

The total income/wages of the city is thus £86,442 million or £86 billion (£23 million per day)

Of course we have all this info broken down by which mode the travellers take – clearly we could do with better data but we aren't allowed in UK to ask the income question in the Census – so this is from private geo-demographic companies data

So we can answer the following questions: how much money do we use if we close zone 6 – Heathrow?

How much if we close the city of London as happened on the day or 9/11, or close the entire CBD as on 7/7

But the implications are enormous for such closures – we have a nice way of doing all this for as the model reroutes trip-makers with capacity assignment, we can make many different kinds of prediction.

Here are some data about our Heathrow example.

The amount of lost income would be £ 2,195,050,000 (~£2.2 billion)(£6 million per day) or 2.54% if no one could get into or out of Heathrow. In fact in terms of the number of jobs affected this is about 3%. i.e. the disruption means 3% of jobs are no longer accessible.

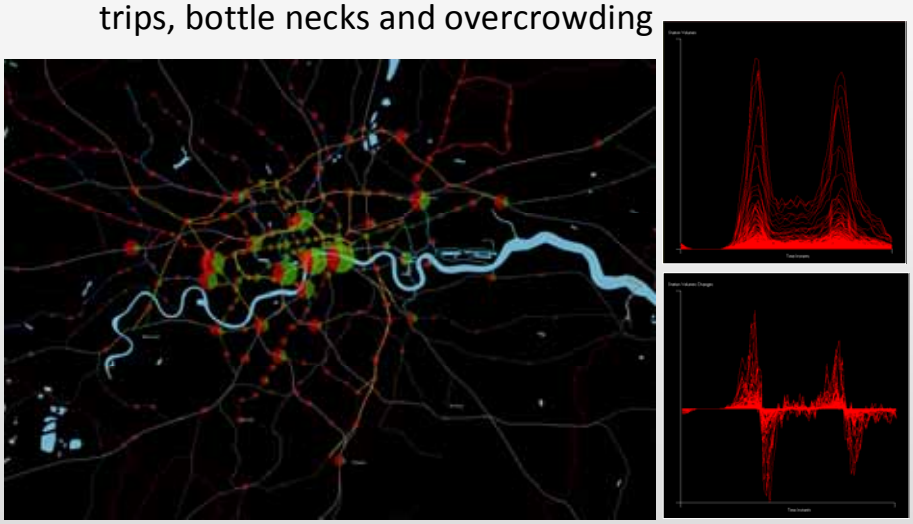
Exemplar 2: Automated Public Transport Rail Systems

Our second example is much more local – although it relates to the metro area. We have excellent data from all people travelling with Oyster cards – about 85% all travellers on pubic transport in London – for 2 months period – all swipe in and swipe outs

Nearly 700 m records over 2 months, something like that

We are looking at rail – overground and underground (tube) – local rail and have all flows.

Oyster Card Data – interpreting urban structure, multi-trips, bottle necks and overcrowding

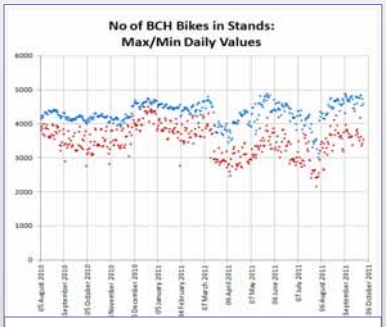


We hope to assess this problem by building new models of flows between key hubs/stations which will be somewhat different from the usual OD models. We can also use these models in our LUTI framework.

Exemplar 3: Public Bike Schemes: Local Routing

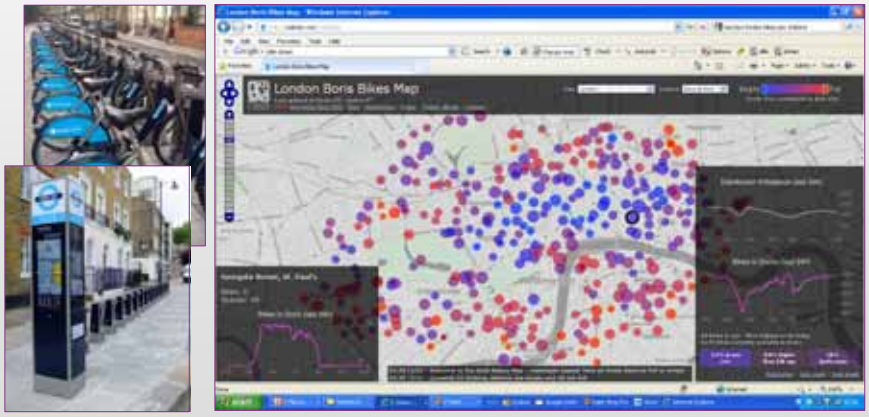
The really local scheme which we have excellent data on is the public bikes scheme called colloquially 'Boris Bikes' after the Mayor of London

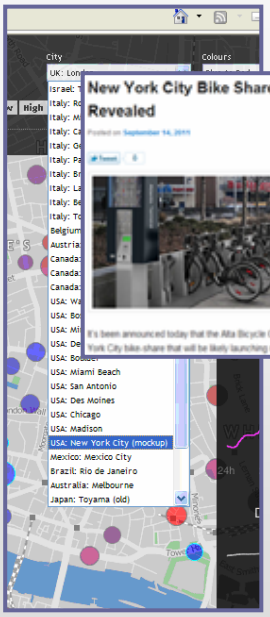
We have an entire record of all transactions and flows from the beginning in July 2010
There are about 5000 bikes and more that twice that number of docking spaces

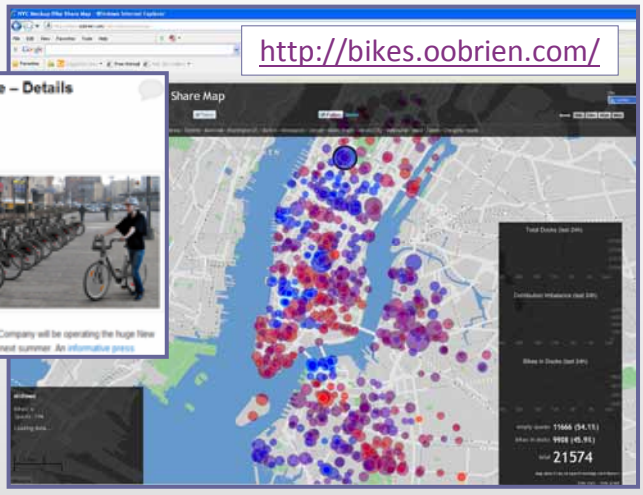


http://bikes.oobrien.com/

What can we do with all this – well this is a very different form of travel and we believe this will help us a lot in sorting out how we can model the bike-walk mode explicitly, much neglected







http://bikes.oobrien.com/

Ollie O'Brien who does this in our centre has all the schemes around the world

Another of our guys Martin Austwick is modelling bike flows and has some really nice videos on Vimeo

http://vimeo.com/19982736

And more from there ….

Related Examples: What Else Are We Doing?

Several other things: telecoms flows – with Sensable Cities Lab, public transport flows, tweets like everyone else – more vimeo – *http://vimeo.com/21351143*

And to finish some of our blogs

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

Spatial Complexity http://www.spatialcomplexity.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/

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

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Acknowledgements

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