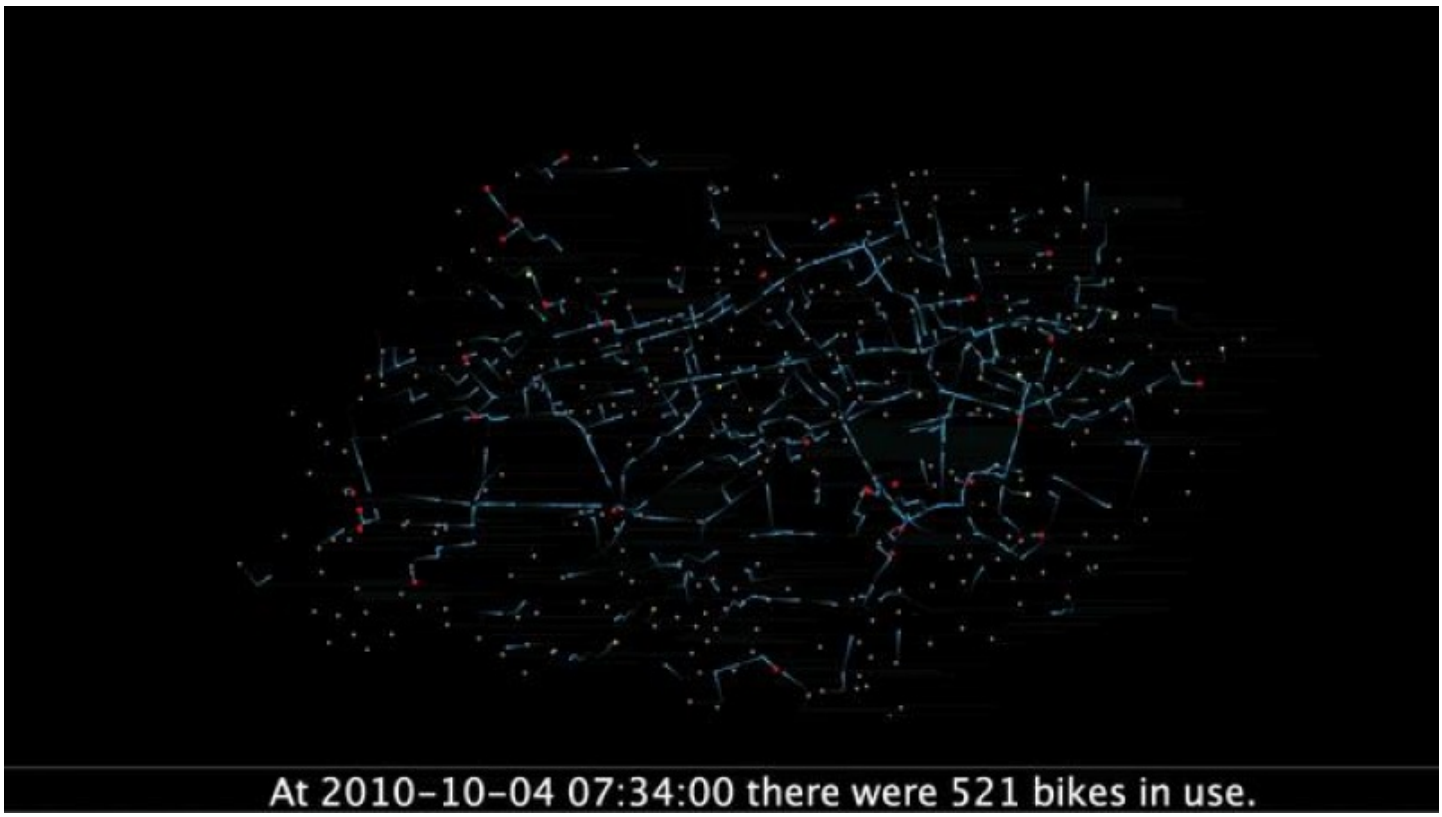
MOOVE INTERVIEWS

Michael Batty

The Science of Smart Cities



Ever wondered how your daily commute on the London tube would look as a data visualization? Ask Michael Batty. He is the Bartlett Professor of Planning who heads the Centre for Advanced Spatial Analysis (CASA) at University College London, a research unit of architects, geographers, physicists, archeologists and computer scientists that mines, models and visualizes the multiple data that is available from a city. Moreover Michael Batty is the author of *Cities and Complexity*, a book about urban dynamics and how complexity theory can be applied to complex systems such as cities. Recently he was host of the *Smart Cities Conference* in London, which aimed to 'bridge physical and digital'. Mooove wanted to know all about the science of smart cities:

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BY
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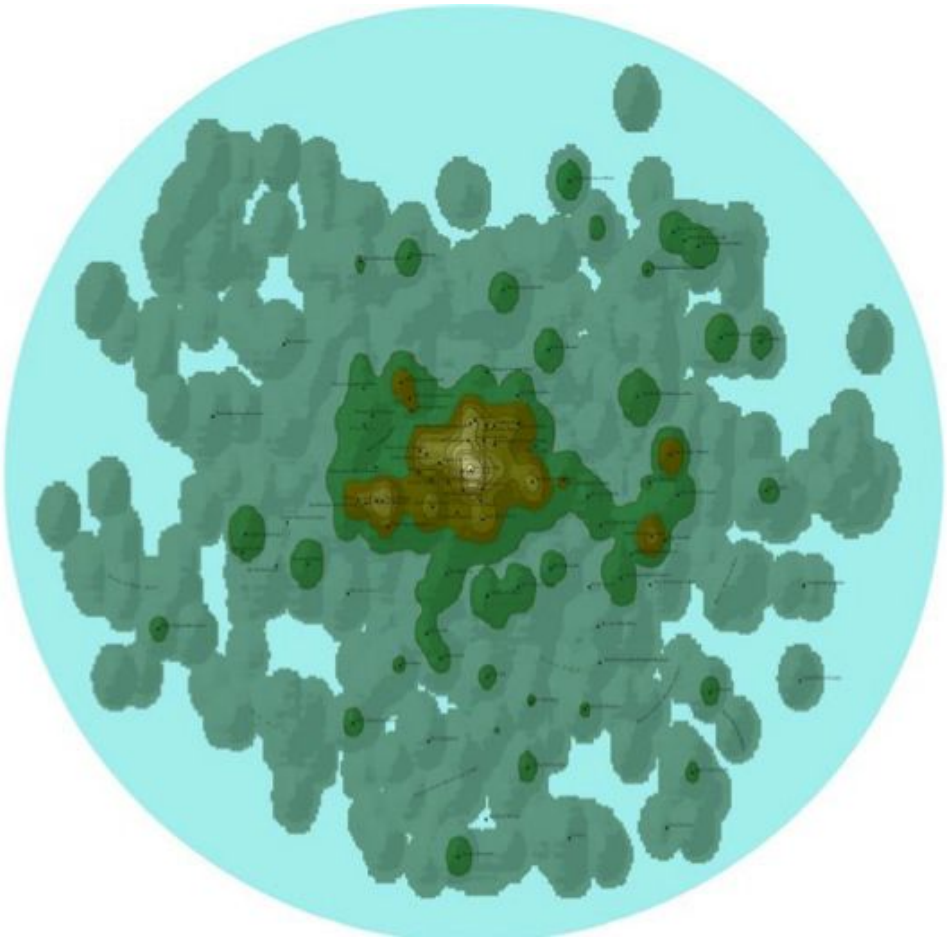
LOCATIONS
London

As a start, what is your main research at CASA, an interdisciplinary practice?
Our main research is in applying computers to cities at different scales, from the geographic scale to the local urban design and even building scale. This involves us in building computer models at these different scales that really show how cities function in terms of their flows of traffic, information, energy, the markets for housing and land, their population growth, migration and so on. We are also heavily involved in visualizing the data and outputs of these models and making predictions for urban planning.

How do you collect the data: What kind of software do you use for analysis and visualization? Is it an open source data viz program, such as Gephi, or did you build it from scratch?
We use a variety of proprietary software, such as a geographical information system (GIS) called ArcGIS for mapping and various CAD software, such as Autodesk 3ds Max for 3D. But we also do a lot of our own web programming for online maps. Many of our models are built in Java, C++ and other standard programming languages. In terms of new social media software like Gephi, we do use this but we are quite eclectic in our tastes in software—we use anything that we can.



A map of Twitter densities in Paris produced during 24 hours on 21 June 2010. From chapter *Real Time Sensing: Crowd-sourcing and Mapping Social Media*

From publication: *Smart Cities of the Future* By Michael Batty, Kay Axhausen, Giannotti Fosca, Alexei Pozdnoukhov, Armando Bazzani, Monica Wachowicz, Georgios Ouzounis, and Yuval Portugali (2012)

And how exactly do you 'bridge physical and digital', as was the motto of your recent *Smart Cities Conference*?
Most of work takes data which is already digital or it puts data into a digital form and then we model it. We use it in our simulation models and everything from then on is on the desktop or visualized and operated on the web. But our visualizations are pictures of cities either at what we call the thematic 2-d map scale or at the 3-d building scale.

Yet these are digital, and we find that people—although they can appreciate digital images—are much more comfortable with physical: tangible images and models. In other words, although it is nice to fly through a computer model of a city, it is nicer in some ways to see a physical 'wooden' model of the city.

So what we did was to take our digital media and project it back physically onto tangible, such as paper maps and various analogs and also digital displays like iPads that people could actually get hold of. The idea of getting hold of something is awfully important in the digital world. This was the message of bridging the physical.

The other issue is that once we have a digital model, we are able to then print the model using cad-cam printers. This is an interesting issue because we can use devices to sense real cities digitally, then produce digital displays and then print these digital displays in real terms. The first real is different from the second and we can go on and on doing this: capture the real city digitally, model it, display it, print the digital as a new kind of real, capture the new kind of real through the cycle over and over again.

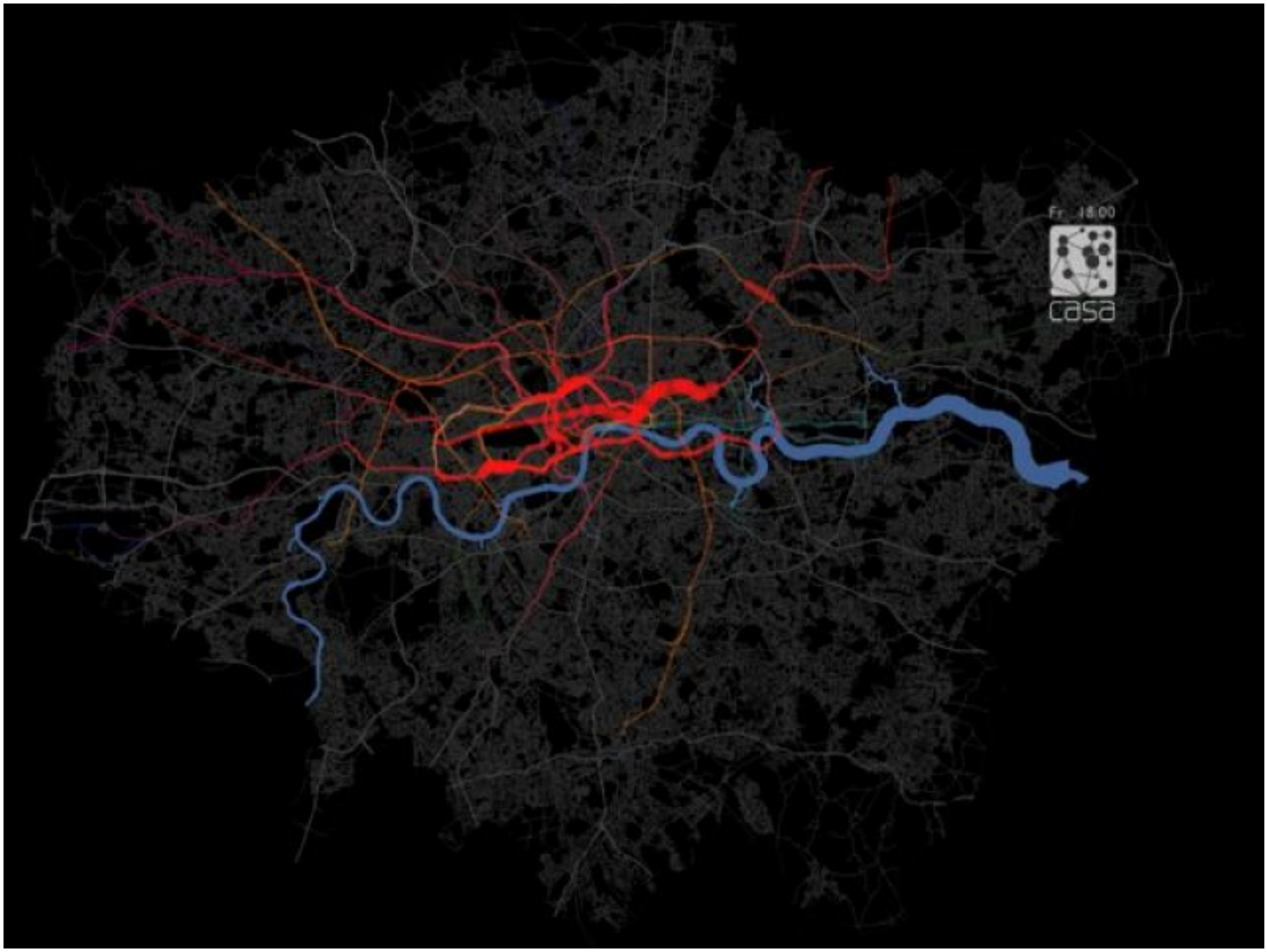
A 3D printed part of CASA's Virtual London project

A perpetual digital-physical cycle! Did you ever think of making sculptures using this data?
We do print them in 3D occasionally. For example, we have printed bits of our 3D virtual London model but we haven't really pursued this line in a major way. Of course the software is getting better, and the printers are better, so there is more possibility that we can do this now.

Regarding *Smart Cities*, in what ways can we get something meaningful out of the data that is collected around and about us every second?

The major issue is that we can learn how we behave from this massive data. And if we can learn how we can behave, we should be able to find all sort of ways in which we can improve our behavior.

This is planning of course. But also we can learn about problems from all this data. For example, with our Oyster card data from the London tube, we can search for points of real congestion and we can identity where we can improve these. This is essential for the Olympics. A little late, I know, but basically this is what it is all about.



A video made using the programming language Processing that visualizes the weekly passenger flows on the London Tube tracked through their Oyster Card usage.

 http://simulacra.blogs.casa.ucl.ac.uk/2011/08/pulse-of-the-city/

In that regard, please tell us about the concept of your *CityDashboard* web application that aggregates available live data from a city. How do you want to further expand it in terms of infrastructure and demographics?

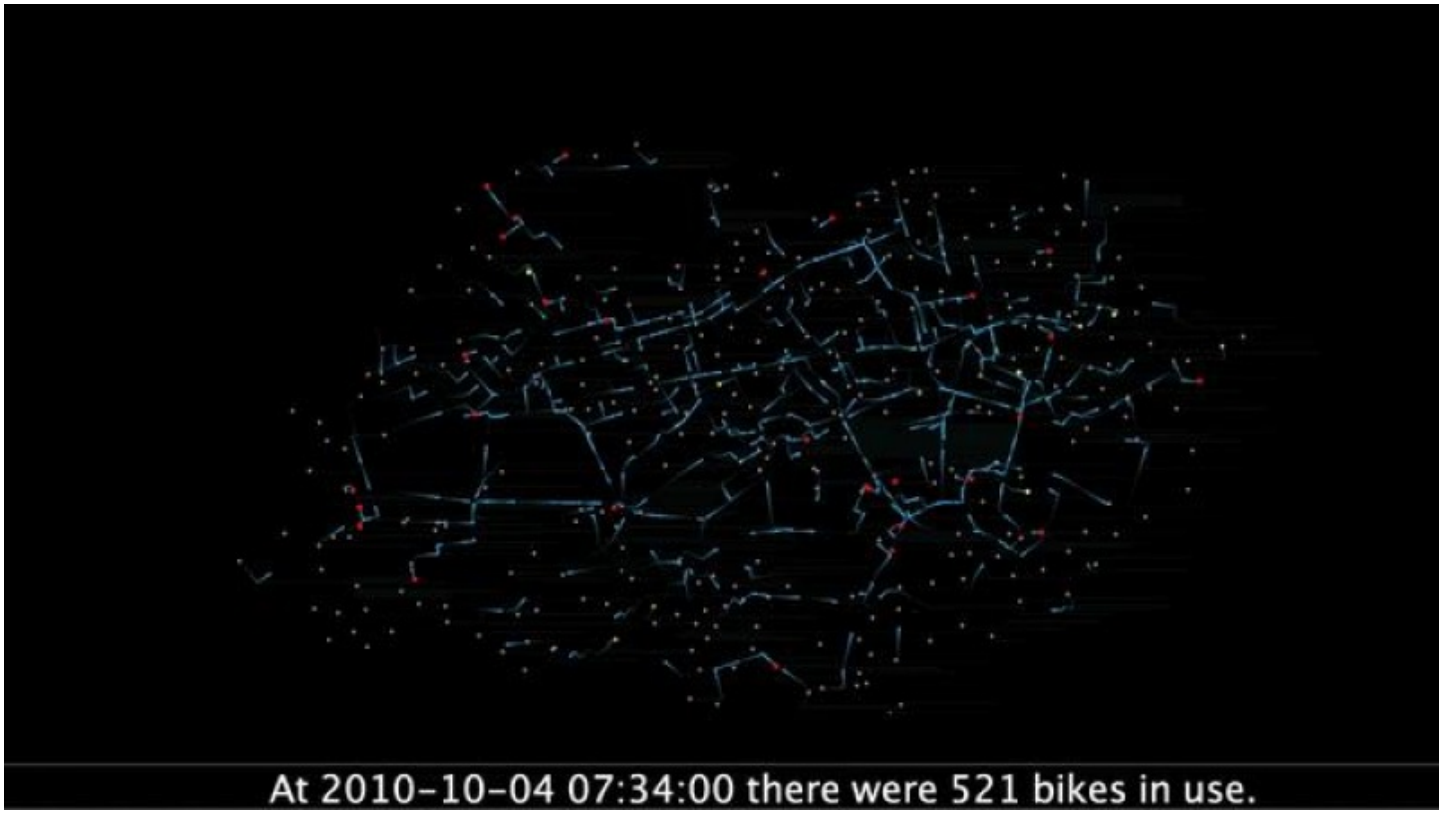
CityDashboard is assembling all the critical data about a city on one web page—this is real-time sensing. Related to this is the idea that we can display all this in 3D. We really hope to expand this beyond data that you get on news sites like the weather, data that provides a framework. But we are much more interested in things like

how many people are coming to the city, how house prices are changing and what are the levels of crime, and how these really big policy issues and problems are changing in real time. Of course, they change more slowly than the weather so a big challenge is to extend our dashboard to deal with all this on different timescales.

What we want to do eventually is produce the dashboard with much more serious data about migration, changes in ethnicity and also more on transport, so the dashboard would increase in size and scale.

The **CityDashboard** web application by CASA aggregates simple spatial data for cities and displays the data on a dashboard and a map.

Please tell us about projects from the conference you found the most visionary.
With the Hire Bikes data we have every record from the very beginning of the public bikes scheme—the so-called *Boris Bikes* after Boris Johnston, mayor of London. That means all the records of all bikes are taken out and then docked. From this we can begin to build up a real understanding of a manageable scheme. This is in contrast to our London transport smart card data which is massive. We are learning how to understand this, too, and this will lead to some really important policy issues about travel in London.



A flow animation of hire-bicycle behavior in real time in London during the major train strike on 4 October 2010. The data, taken from Barclays Cycle Hire a.k.a. Boris Bikes in London, was released by Transport for London (TfL).

What do you make of the recent ambient social networking trend? I'm thinking of location-based applications for your smartphone that show you nearby 'friends' from your social networks and likeminded people.

I think these are exciting. We have mined Twitter data and we have maps of where the intensity of tweets is and how they change over the day in a dozen large cities worldwide. We even have a *Twitter meter*, a web site with all this data being piped through in real time. Then, the big problem with all this data is its content: It is so variable but it is exciting as we are getting better at mining it and understanding how it all works. There are concerns in all this digital data about privacy, of course, which is basic and all the data we have is protected from us knowing who is responding.

On your own site, www.complexcity.info, you gather interesting data visualizations of urban areas. What makes a good visualization for you, and how to visualize complexity?

Now this is more abstract but for every visualization we do we have to simplify and extract from complexity. This means we need to get the essence of things. So it is the message that is all-important, and we need to simplify in such a way that we get the essence of things visualized. That means throwing a lot away but not the kernel of what we want to show. So in visualizing complexity we need, as I have been at pains to say, real focus and also identify who we are producing the visualization for. In fact in complex systems, often times we need to visualize so we can enhance our own scientific understanding.

Michael Batty, a Bartlett Professor of Planning who heads the Centre for Advanced Spatial Analysis (CASA) at University College London

What is your favorite data visualization?

My favorite is in fact not a computer one at all but those transformations of real objects by M. C. Escher who took real objects and distorted them to produce fictional images—things that could not actually happen in reality but seemed as though they could visually. This tests our minds and opens up the world to ideas that things might be different but the same. Of course we can now create these visualization on computers so much more easily, but Eschers work shows that it is all in the mind in the first instance.

Thank you for the interesting talk, Michael Batty!

FURTHER READING
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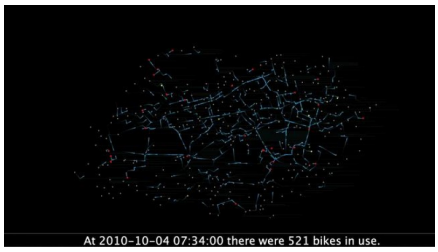

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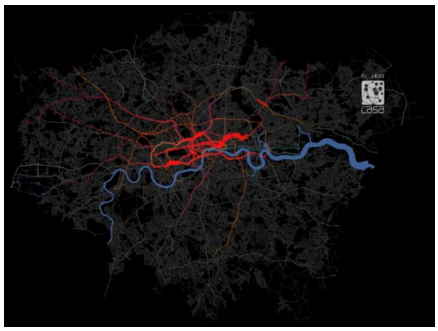
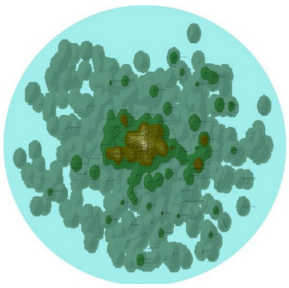


A video made using the programming language Processing that visualizes the weekly passenger flows on the London Tube tracked through their Oyster Card usage.

© Jon Reades at CASA-UCL http://simulacra.blogs.casa.ucl.ac.uk/2010/of-the-city/



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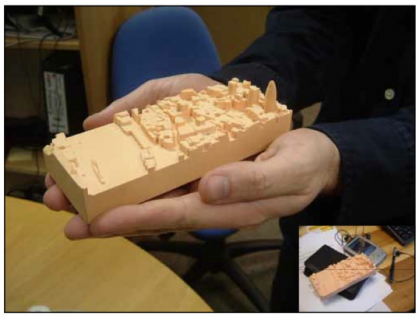

A 3D printed part of CASA's Virtual London project

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The CityDashboard web application by CASA aggregates simple spatial data for cities and displays the data on a dashboard and a map.

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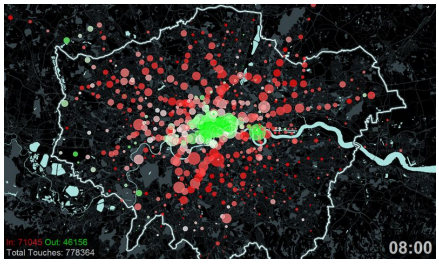
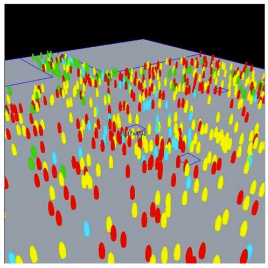


Oyster Card data visualization of passengers' tap-ins and tap-outs generated by Oliver O'Brien, a researcher at CASA

© Oliver O'Brien Contains data from OpenStreetMap (CC-By-SA) and Transport for London (TfL) http://mappinglondon.co.uk/files/2011/07



Pedestrian Movement Dynamics in 2D and 3D

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