



# **DIGITAL GEOGRAPHY**

Geographic Visualisation for  
Urban Environments

Andrew Hudson-Smith

# **Digital Geography:** **Geographic Visualisation** **for Urban Environments**

**Andrew Hudson-Smith**



Published by:  
Centre for Advanced Spatial Analysis  
University College London  
1-19 Torrington Place  
London WC1E 7HB

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ISBN 978-0-9550581-1-0



## About CASA

The Centre for Advanced Spatial Analysis (CASA) is an initiative within University College London (UCL) to develop emerging computer technologies in several disciplines which deal with geography, space, location, and the built environment. It is affiliated with the Bartlett School of Architecture and Planning, and it provides a forum for interdisciplinary research focused on cities and their environments.

## About UCL

University College London is one of the constituent colleges which make up the University of London. Founded in 1826 by the philosopher Jeremy Bentham, it is one of the world's top universities in terms of the impact of its research and teaching.

## About NCeSS and ESRC

The National Centre for e-Social Science (NCeSS) is funded by the Economic and Social Research Council (ESRC) to investigate how innovative and powerful computer-based infrastructure and tools developed over the past five years under the UK e-Science programme can benefit the social science research community. This infrastructure is commonly known as the 'Grid'. CASA is funded as a node within NCeSS and the technologies presented in this booklet represent one of the research foci of the Centre.





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**The world of geographic analysis and visualisation has changed. New task specific software packages and services have emerged that have fundamentally changed the way we share, communicate and distribute information. These changes have steadily emerged since the mid 1990's and it is now quite clear that the connectivity produced through the internet lets us interact across time and space in ways that our ancestors could only dream about.**

This booklet is testament to such change. It has been produced through a Web 2.0 typical self-publishing service such as 'Blurb' that breaks the traditional publishing model allowing rapid print on demand documents to be produced. The booklet is aimed as the start of a 'recipe' book for Geographic Virtual Urban Environments (GeoVUE) which we will update frequently through both Blurb and other rapid printing methods.

Much of the work reproduced here is based on applications at the Centre for Advanced Spatial Analysis (CASA) at University College London and particularly its GeoVUE project. GeoVUE is one of seven nodes in the National Centre for e-Social Science (NCeSS) whose mission it is to develop grid and web-based technologies for the social sciences. Our project at CASA is to develop new applications of GIS and related technologies which are focused on 2D and 3D mapping and CAD. The express aim is to develop new kinds of virtual urban environments (VUEs) through which users can participate in furthering their understanding of cities as well as engaging in other forms of participation.

The mapping hacks and techniques that we have developed enable users to take any data in an appropriate mapping file and convert this to a form where it can be immediately visualised in a web page, in the spirit of Web 2.0. The key to all this is location, geography. We argue here that location and space now represents a third force in information technology besides computers and communications. Tagging not only the type of information but where such information is produced, who uses it and at what time, is fast becoming



## Introduction

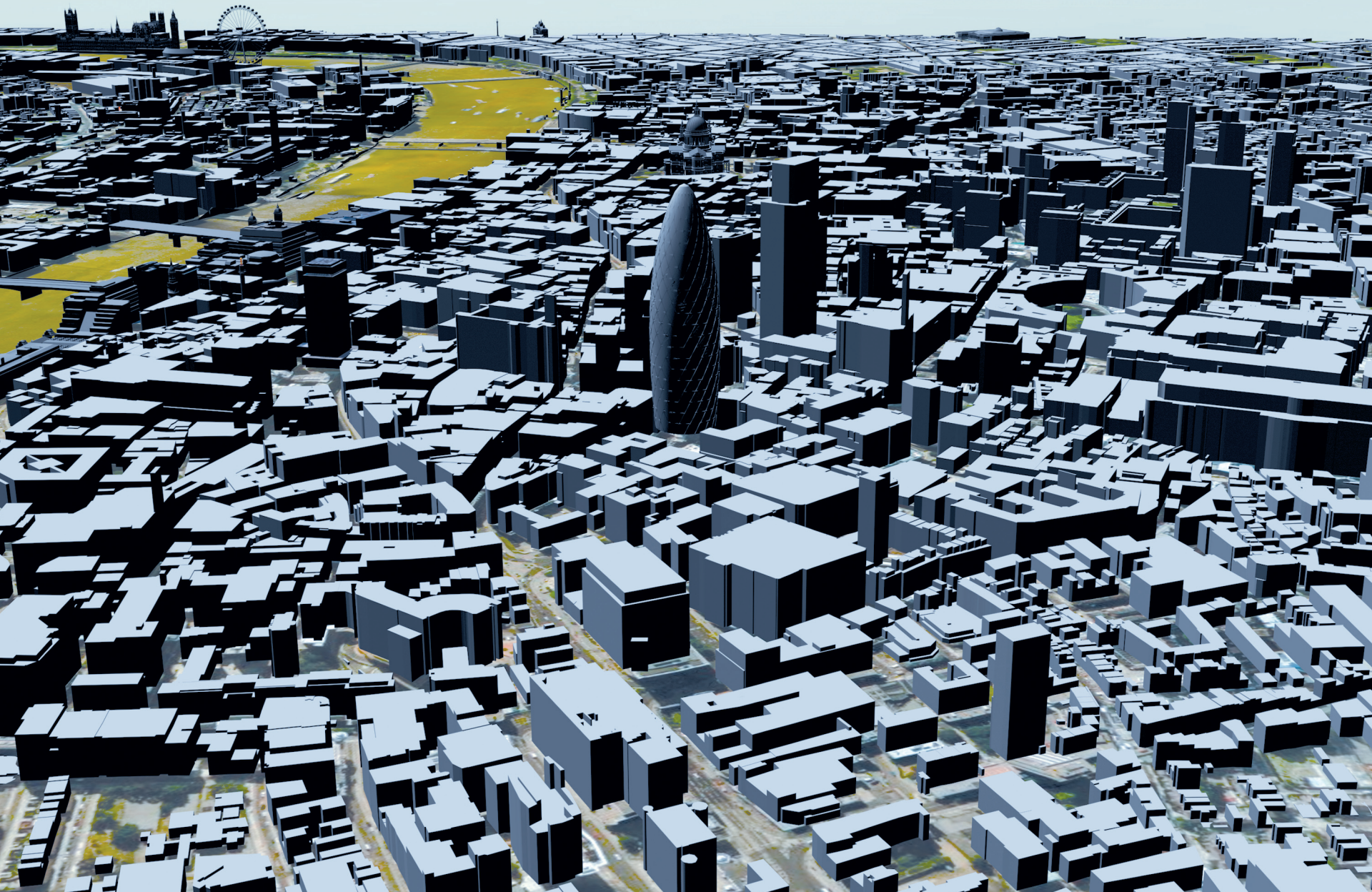
the killer application that roots information about interactivity generated across the web to systems that users can easily access and use in their own communication with others.

Already much is being accomplished and mapping systems such as Google Maps are simply in the vanguard of a whole series of software systems and virtual worlds that promise to bring geo-location to the fore. This is at the heart of this booklet. The re-emergence of the importance of geography in the Web 2.0 world is becoming known as 'Neogeography'. This is a geography for the everyday person using Web 2.0 techniques to create and overlay their own locational and related information on and into systems that mirror the real world. The term derives from Eisnor (2006), one of the founders of **www.platial.com**, where she defines Neogeography as: "...a diverse set of practices that operate outside, or alongside, or in the manner of, the practices of professional geographers".

Rather than making claims about scientific standards, methodologies of Neogeography tend towards the intuitive, expressive, personal, absurd and/or artistic, but may be idiosyncratic applications of 'real' geographic techniques. Turner (2006) expands the definition considerably in his pamphlet on the various techniques which non-professional users now have at their disposal. He says: "...a Neogeographer uses a mapping API like Google Maps, talks about GPX versus KML and geotags his photos to make a map of his summer vacation".

Essentially, Neogeography is about people using their own maps, on their own terms and combining elements of an existing toolset. As part of GeoVUE we have built and distributed our own 'toolset' for geographic visualisation.

**Welcome to a new world of rich geographic information available anywhere, anyplace, anytime.**



# Visualising the City



## Visualising the City

The city has become the focal point of visualisation in the last 18 months, mainly due to the rise of the Digital Earth, advances in computer graphics cards and the launch of free place-based and 3D modeling software. It is also down to location and the density of population. As the majority of users of web-based geographic information and visualisation systems currently live in cities or a least urban areas, it is not surprising that the city is one of the key metaphors of Web 2.0.

The ways locational information can be added to these applications where a website or application combines content from more than one source into an integrated experience, is known collectively as a ‘mashup’. In many ways, Neogeography and mashups go hand in hand. Our 3D Virtual London model is a mashup as such, a mix of information and data from many sources, changing and morphing according to the viewing platform and end user’s requirements. The primary aim of our model has been to inform

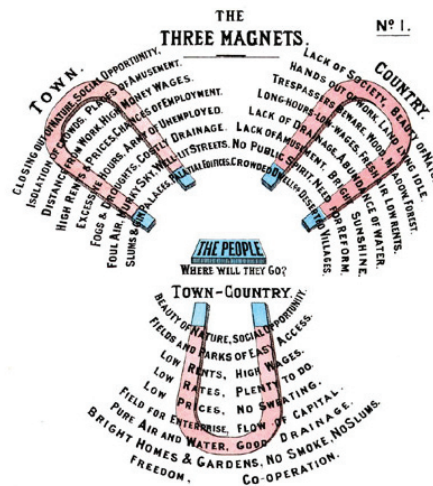
the public and professionals alike about the future of the city.

One of the prospects of Web 2.0 for virtual cities is that as these cities develop over time, new software, new data sources and new ways of digital building will become available. The fluidity that Web 2.0 enables with its focus on individualized updating of information in the location sense, augurs well for highly responsive and timely interventions in real cities. Indeed it is the fluidity of the city that is key to Neogeography as a whole.

Without question, the most important innovation in the development of the digital city, Neogeography, and the mashups that accompany it, is the concept of the Digital Earth. Google Earth and to an increasing extent Microsoft’s Virtual Earth and NASA’s World Wind have produced 3D cities at a speed and resolution that was unimaginable only a few years ago.

These cities act as layers for information, a rich canvas onto and into which information can be inserted and extracted at will over the network. In essence they act as 'space inside the machine', a space that can be iconic, photorealistic or multifaceted depending on a user's preference. It is into this space that spatial analysis, digital geography and geographic information systems (GIS) operate as software for analysing space.

Indeed Hillier (1996) actually defines 'space as the machine'. In a Web 2.0 world of increasing software and infinite capacity for information, we can import the city into the machine, digitally, in a recursive fashion whereby the machine actually becomes the 'space'.



Ebenezer Howard's Three Magnets

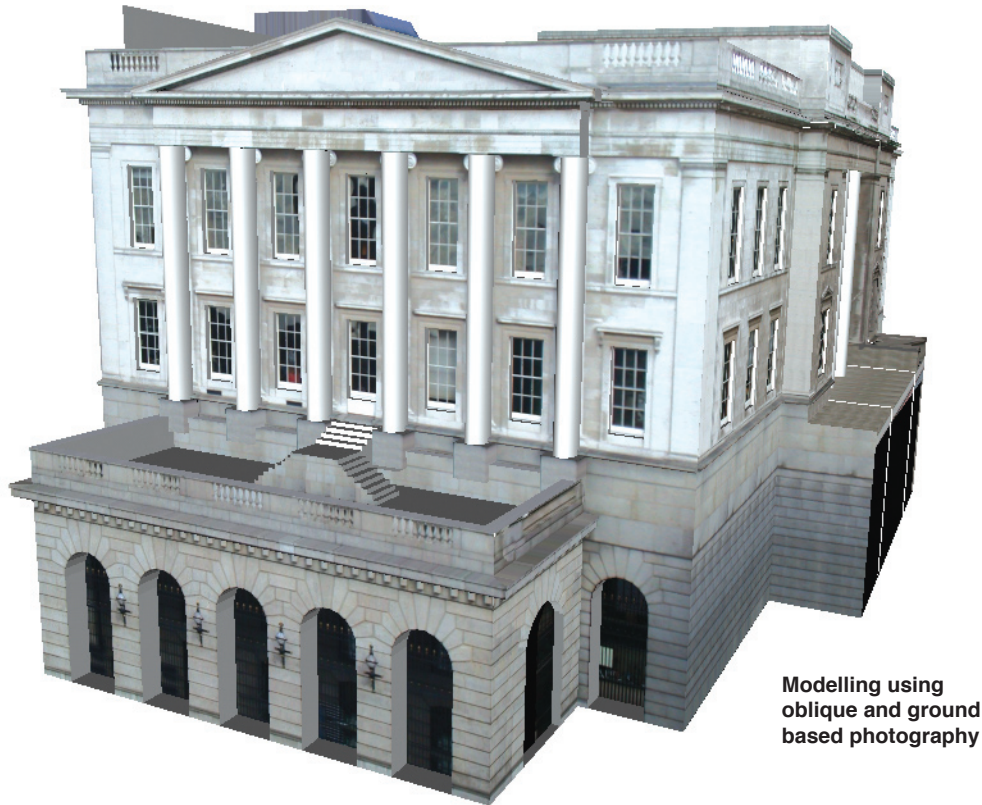
It is in these virtual and network spaces that people are building, creating and indeed occupying digital cities.

We will explore the concept of the Digital Earth and virtual environments such as Second Life later, but for now it is worth looking at the graphic 'Where will the people go?' adapted from the garden city movement, an approach to urban planning that was presented in 1898 by Sir Ebenezer Howard.

The three magnets pull people between the Town and the Country. In today's Web 2.0 world we have digital cities which are becoming increasingly populated and perhaps it is time for a new magnet - that of the Virtual Town-Country?



## Visualising the City



In terms of pure visualisation, the production of photorealistic models of the built environment is key to the creation of visual space. Yet it is a time consuming, manual process and one that up until recently was in the domain of professional photogrammetry.

The standard approach to producing a photogrammetric reconstruction of the city

has been through the use of calibrated images and matching control points.

The image illustrates the development of one of the key buildings along the north bank of the River Thames which is modelled using a combination of oblique photography from helicopter capture and ground based imagery.

The model took approximately two days to produce.

In today's Google-led world which is based on releasing free software with high levels of functionality combined with low levels of required expertise, it is now possible to considerably reduce the time taken to produce such models. Google SketchUp is a unique program that is available in both professional and freeware versions.

The differences between the free and professional versions are negligible and are only significant in terms of importing and exporting data.

This now means that the public-at-large are able to photo model through SketchUp and produce their own sections of the city - aka Web 2.0. Google SketchUp is linked directly with Google Earth which we examine further a little later, and it is linked to this for a good reason - so that users can develop free content.



**Rapid Streetscape modelling in Google SketchUp**

Creating a Digital City, one that reflects the actual built form, is a huge task and therefore time consuming.

So far, the only groups that have been able to get close to representing the city visually are Games companies such as Sony and more recently Microsoft.

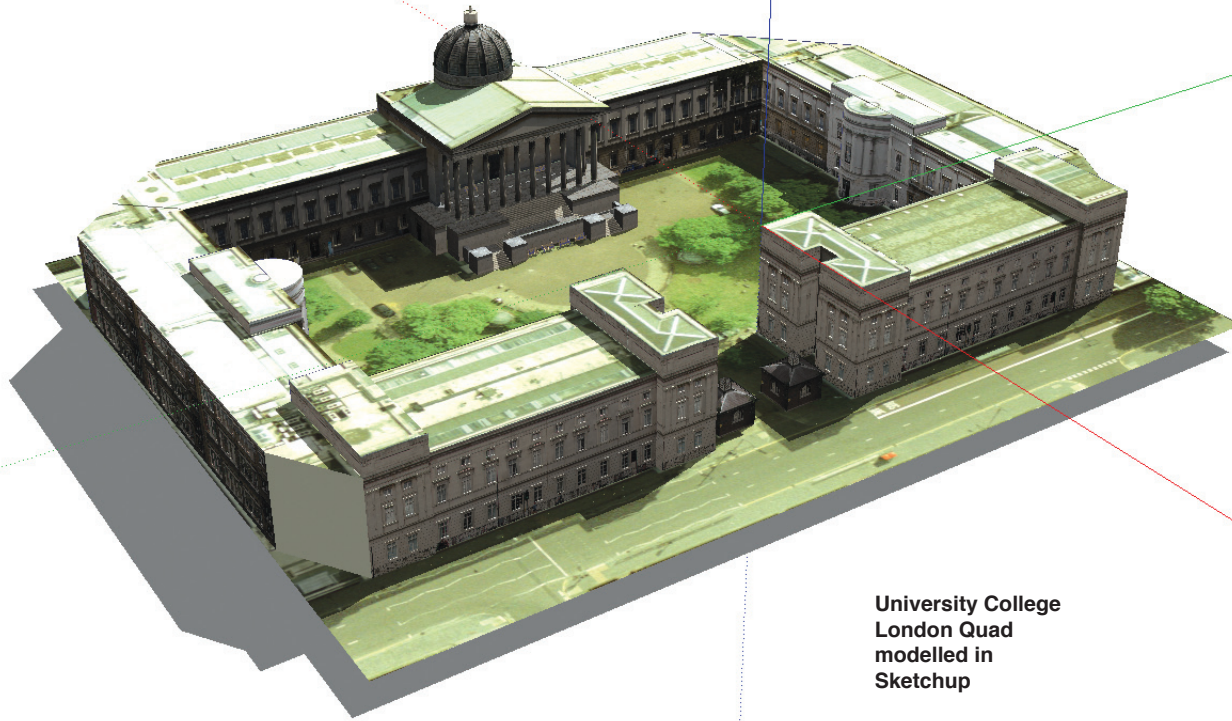
The results of such developments are impressive but the costs are typically in the order of millions of dollars to produce, while the models are also only of use for gaming.

They cannot be easily ported into contexts either where geographical analysis is required or where the public at large can interact with them,

largely due to the nature of their construction. Therefore to reduce cost, Google have released their SketchUp software so the users-at-large can produce the city themselves, block by block, building by building.

Of note is the latest version of SketchUp which, at the time of writing, allows users to import and calibrate their own photography, directly modelling over the imagery.

## Visualising the City



University College  
London Quad  
modelled in  
Sketchup

Although not as accurate as traditional photogrammetry, it does allow rapid modelling and the widespread adoption of photorealistic content.

The image illustrates output using the 'Camera Match' component in SketchUp. Camera Match allows models to be rapidly created using standard images from a digital camera or camera phone. It is easy to use and opens up the possibility for the rapid capture of anything from individual buildings to entire streetscapes.

We will look closer at SketchUp and more particularly the 3D Warehouse and its impact on the Digital Earth later...





New companies offering city based visualisations are emerging at an ever increasing rate. One company is [www.edushi.com](http://www.edushi.com) who have produced some of the best 2.5D city maps we have seen to date. Of note is Edushi's (short for e-City in Chinese) concentration on 'sim-city' style graphics and despite the models being produced in a 3D modeling package,

their distribution, as 2.5D perspective viewpoint graphics, is convincing.

The interface to Edushi is similar to Google Maps with the ability to search for local restaurants and businesses according to location. Placemarks are loaded accordingly over the map creating the opportunity to

overlay data exported from a similar viewpoint.

There are currently over 250 maps in the Edushi collection with a series of western cities promised in the next year. For simple access to information and a sense of location and place, it is sometimes difficult to beat this perspective viewpoint.



## Visualising the City

Real-time visualisation of cities or any large geographic/architectural scene is computer intensive and thus dedicated software is often required.

Game engines are generally overlooked in terms of visualisation yet they are without question the most powerful and cheapest way to visualise entire cityscapes.

The majority of new games come with a 'sandbox' mode that allow the user to essentially strip out the game and import one's own models – this gives a longer life to the game as users create and share their own content.

Our examples pictured here are running in the Crysis Sandbox (top image), produced by Electronic Arts, and Oblivion (bottom image) from Bethesda.





Visualising the city is often linked to real world cities as in all our examples explored so far. However to explore geography and architecture, it is sometimes beneficial to use ‘fantasy cities’ or ‘fantasy architecture’ as a base for exploration and learning.

Fantasy cities get around any issues of data copyright and can open up exploration of issues relating to space, place, architecture and planning to a wide audience. We organised an outreach activity with Noel Jenkins, a geography teacher from Court Fields Community School in Dorset to explore how his class of 11 year olds would design a future skyline.

Here are some examples of what the children produced...

**Fantasy Architecture in  
3D Studio Max**



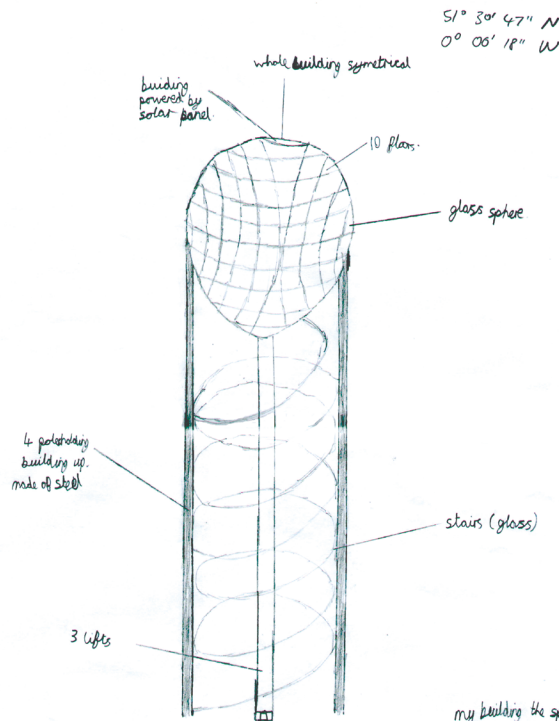
## Visualising the City

Noel's class of 11 year olds had been learning about Urban Land Use and Digital Geography, a subject that is perfect for fantasy architecture. The pupils sent in drawings of their chosen building and the best submissions were rendered in 3D for visualisation in both Studio Max and Google Earth.

At the end of the project a prize was awarded, in the form of a gift voucher, and the pupils made a short movie of their experiences.



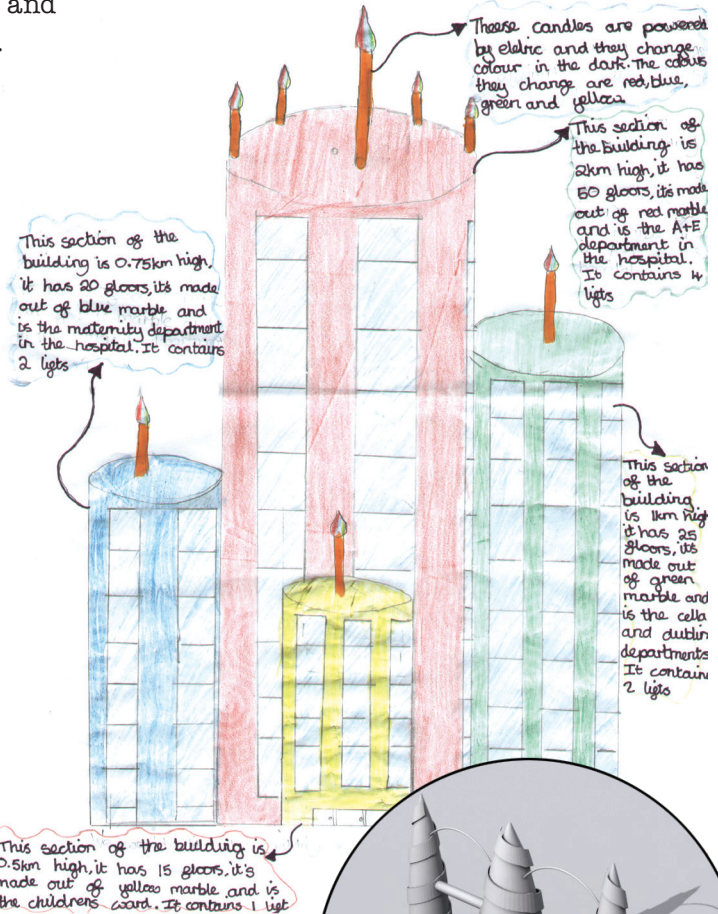
James Burston



my building the spiral tower is used for a modern art museum being made of glass it will be a truly beautiful building it will not be the tallest building in the world as I am aiming for it to be the most beautiful building ever built

Jenny. P  
Hamish. C  
Jess. P

## Candle Light Hospital !



This section of the building is 0.5km high, it has 15 floors, its made out of yellow marble and is the childrens ward. It contains 1 lift





# The Panoramic City



## The Panoramic City

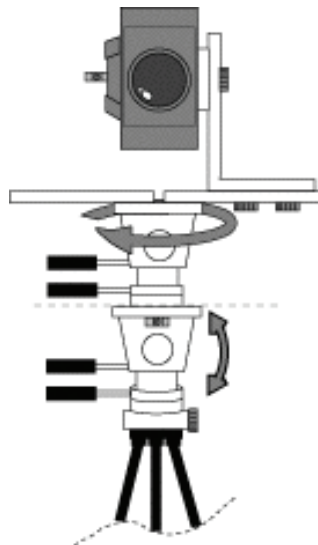
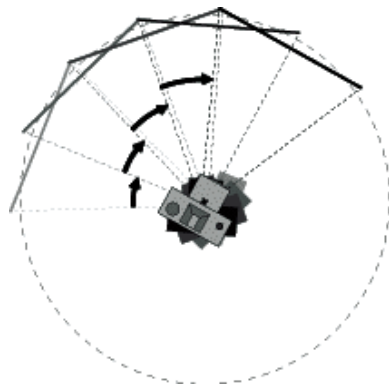
Panoramic images have not been brought about by the rise of the digital age; indeed they have been in existence since the 1840's with the introduction of the first dedicated panoramic cameras. However, it was not until 1994 with the introduction of a subset of Apple's QuickTime, known as QuickTime Virtual Reality that panoramic production, based on the stitching together in sequence of a number of photographs, became available for the first time.

Capturing panoramas used to be a fine art of manipulating each image. Blending layers in Adobe

Photoshop took time and the results were notoriously poor. Our first digital panoramas were captured using a Casio digital camera running at 640x480 resolution and a battery life that resulted in a single capture between charges.

Thankfully things have changed. Consumer level digital cameras are now approaching the 10+ megapixel range and stitching software has become so advanced that panoramas can be captured using a standard mobile phone, such as the Nokia N95.

In fact the Nokia N95 with its built in GPS, 5 megapixel camera and Wifi has become the current ultimate Neogeography device.





## Creating Panoramas with a Camera Phone

Software: [www.cs.ubc.ca/~mbrown/autostitch/autostitch.html](http://www.cs.ubc.ca/~mbrown/autostitch/autostitch.html)

### You will need:

- 1 x Mobile Phone (we used the Nokia N95)
- 1 x Copy of AutoStitch

Time Required:  
15 to 30 minutes

Taking panoramas used to be an art form that took considerable knowledge, a lot of heavy hardware and the semi-manual placement of control points in complicated software.

Things have changed and in our first tutorial on panoramas we show how it is possible to create a high resolution panorama using a simple camera phone and freely available software. This allows one to capture a scene at anytime creating spontaneous panoramas which, as we will see later, can then be embedded into either Google Maps or Google Earth.

We have used the Nokia N95 for our first example as it features a 5 megapixel camera, although the general rule is the higher the resolution the better. Taking note of the techniques, any camera phone or indeed standard digital camera can be used to create a panorama.





Completed Panorama

## Taking the Photographs

- 1) Set up your camera phone to capture images at the highest resolution, in our case 5 megapixels.
- 2) If possible choose a mode in which to photograph; in our case we used 'Landscape' as this ensures a constant focus throughout the capture process.
- 3) Stand in your location with the camera roughly at arms length and take your first image.

- 4) The secret to a good panorama is trying to firstly make sure the nodal point (lens) is kept central for each of the images and secondly that there is a 20% overlap with each shot. As such the aim is to make the camera the point of rotation and move around taking your second image so it overlaps the first one - as our first four images on the previous page illustrate.
- 5) Carry on working your way around the scene until you are

back where you started. You should take approximately 14 images for a complete circle.

- 6) To increase the field of view of your panorama - i.e. to include more of the ground or the sky - simply tilt your phone upwards or downwards accordingly and go around again.

That's it. The image capturing process should take approximately 5 minutes.

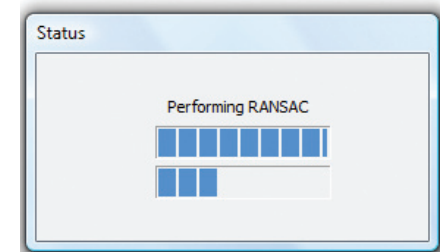
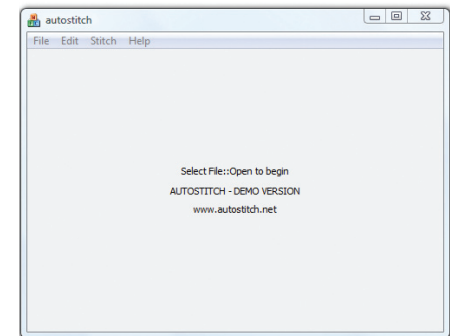
## Stitching the Images

We have used the freely available 'AutoStitch' software to merge the images into a panorama, although other stitching software is available, notably PTGui which we will be looking into in the next tutorial. PTGui provides a better blend of colours, but AutoStitch is free, quick and simple.

- 1) Download AutoStitch and install it on your machine.
- 2) Run AutoStitch and choose File > Open - then select all of your images. This will run a quick low resolution test stitch to ensure the images align. Once you are happy that the panorama has worked, go to Edit > Options and set the scale to 100%. Reopen your images and sit back and wait. A typical stitch will take approximately an hour on a recent specification computer.

You should now have a completed panorama taken using your N95 - our scene resulted in a 40Mb JPEG at 18100 x 3766 pixels.

Once captured, your panorama can be used in numerous ways from uploading to Flickr to embedding in Google Maps, viewed in full resolution using our Image Cutter software or placed inside of Google Earth. More on this a little later.



**AutoStitch**



## The Panoramic City

To take panoramas a step further, you need a tripod and a professional camera rig. We use a Nikon D80 camera with a 10.5mm fisheye lens for our 100+ panoramas which are online at [www.digitalurban.blogspot.com](http://www.digitalurban.blogspot.com).



Capturing the City

With such a set up, a complete 180 x 360 degree panorama can be captured in just 9 images. This makes it easier to blend out moving objects while

maintaining high resolution for print or visualisation in systems such as Second Life or Google Earth. Panoramas are one of the most versatile but rapid ways

to geographically capture the city. In some ways they present a better representation of space than any three dimensional model as they capture a complete moment in time.



Millennium Park, Chicago



## The Panoramic City

Just as in the real world, panoramas can also be created in any virtual world or game such as Second Life, Oblivion or Half Life to name but three.

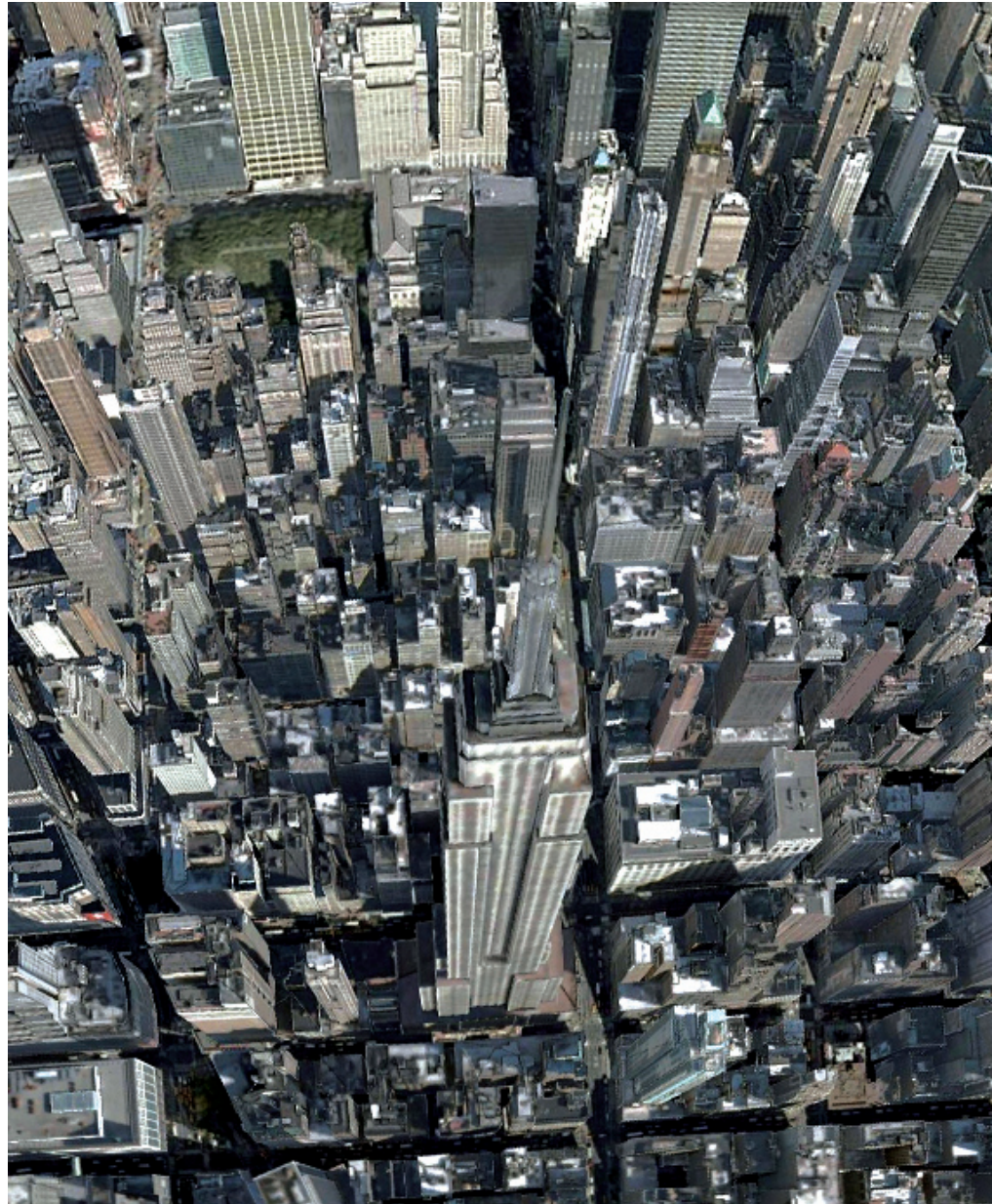
All that is required is the ability to grab screen shots from the player's point of view and to rotate around the all important nodal point.

Most games and Digital Earth systems have such a 'viewpoint' option, often known as 'first person', or 'mouse' mode.

Capturing such images allows the creation of a unique point of view. This, combined with Microsoft's roll out of photorealistic cities in their Virtual Earth, allows for the creation of stunning high resolution images in just a few simple steps.

Over the next couple of pages we provide examples and detail about how to easily create such images.

**New York Panorama captured from Microsoft's Virtual Earth**





## Creating Panoramas from Microsoft's Virtual Earth

### You will need:

- 1 x Virtual Earth
- 1 x Screen capture program
- 1 x Image Stitcher

### Time required:

30 minutes to one hour

### Step 1:

Load Virtual Earth by going to [www.maps.live.com](http://www.maps.live.com) and selecting 3D - type in your desired location and fly approximately 100 metres above the ground. For our example, we choose New York due to the inclusion of 3D buildings.

### Step 2:

Place Virtual Earth into 'First Person' mode - Press the CTRL+Q keys on your keyboard. Moving the mouse will now allow you to rotate around a single point. Scroll the mouse wheel forward to decrease your altitude, and scroll the mouse wheel backward to increase your altitude.

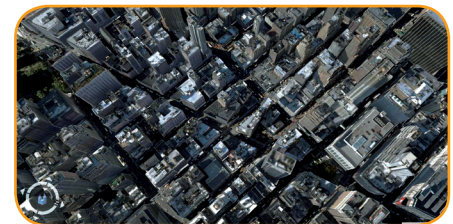
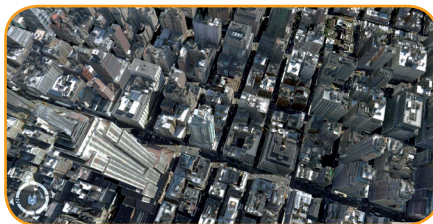
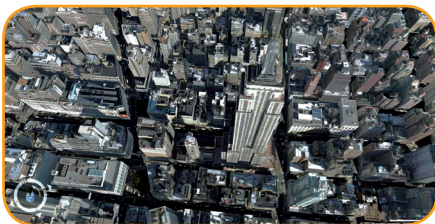
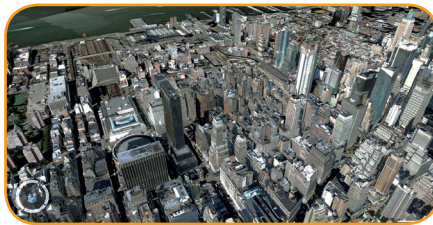
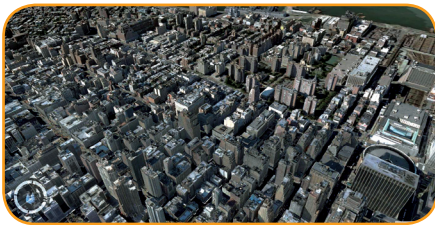
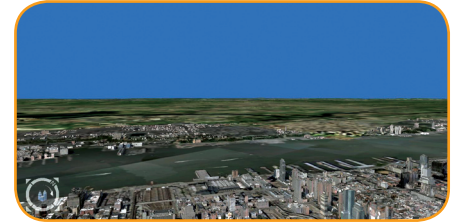
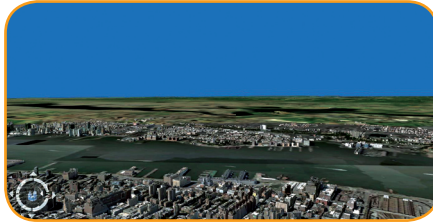
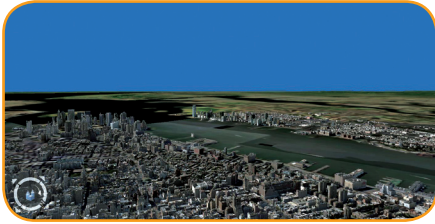
### Step 3:

Grab screen shots of the view to ensure you have full coverage of the area. We used FRAPS ([www.fraps.com](http://www.fraps.com)) to grab the screen images but any method of screen capture will work.

New York



# The Panoramic City





Depending on your screen's aspect ratio, it will take between 24 and 36 images. Each image should allow 25% overlap to the previous capture. On a Dell 21 inch monitor at 1680 x 1050 pixels, a complete panorama requires two rows of 12 images and a single final image looking down to complete the coverage.

### Step 4:

The images can be stitched in any stitching software. Our tutorial uses PTGui which is available as a 30 day trial download from [www.ptgui.com](http://www.ptgui.com).

Open PTGui. Click 'Select Source Images', navigate to where you saved your screenshots and select them all.

### Step 5:

Once the images are loaded, a Camera Lens Dialogue will appear. Simply click 'Cancel' and your images will now be loaded ready to stitch.

### Step 6:

Click 'Align Images'. PTGui will now analyse each image and automatically extract

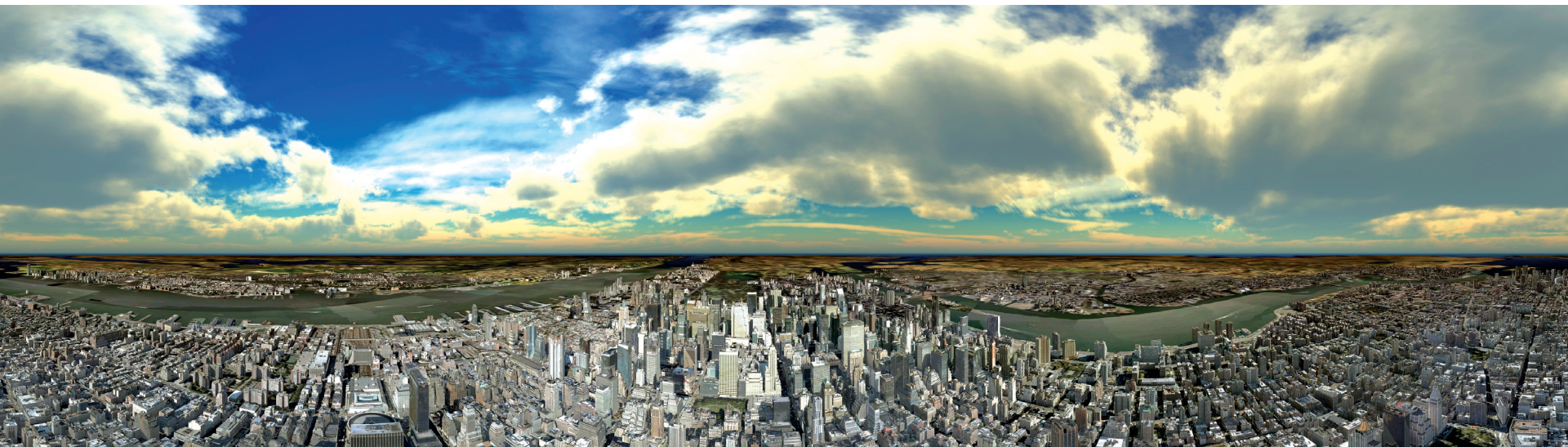
overlapping points, creating your final panorama.

Once stitched simply click 'Create Panorama' and save.

The first thing you notice is the lack of clouds. Microsoft's Virtual Earth does not include any weather effect. The sky is simply an even coloured blue.

As such it allows a false sky to be simply pasted and blended in.

**A complete 360 degree panorama of New York City**









### Creating a Photographic ‘Planet’

The ‘round’ image on the previous page is known as a ‘planet’. Take a look on Flickr and you will find whole ‘pools’ dedicated to panoramas that have been transformed with this projection.

They are easy to make. Once you have done the hard part and created your panorama, it is only a few simple steps to creating images that really stand out.

Subjects that are suitable for making planets are photographs that have a clear sky and ground area as these are the parts of the image that are most noticeable.

As such they are perfect for use on urban panoramas as they provide a unique way of viewing the urban architecture.

#### You will need:

- 1 x Panorama
- 1 x Photoshop, Paintshop Pro or Similar

**Time required:**  
5 minutes



# The Panoramic City

## Step 1

Open the original panorama in Photoshop or similar.



## Step 2

The images need to be square, so resize accordingly. Ours is 3000 x 3000 pixels.



## Step 3

Chose Filter > Distort > Polar Coordinates. Select 'Rectangular to Polar' and you're done.







The Navy Pier  
in Chicago



Main Street Chicago

If you would like to create more advanced planet type images, it is well worth downloading a Photoshop plugin known as 'Flexify'.

Flexify provides a 30 day free trial of its plugin allowing any number of projections and views to be created from panoramas.

[www.flamingpear.com/flexify.html](http://www.flamingpear.com/flexify.html)



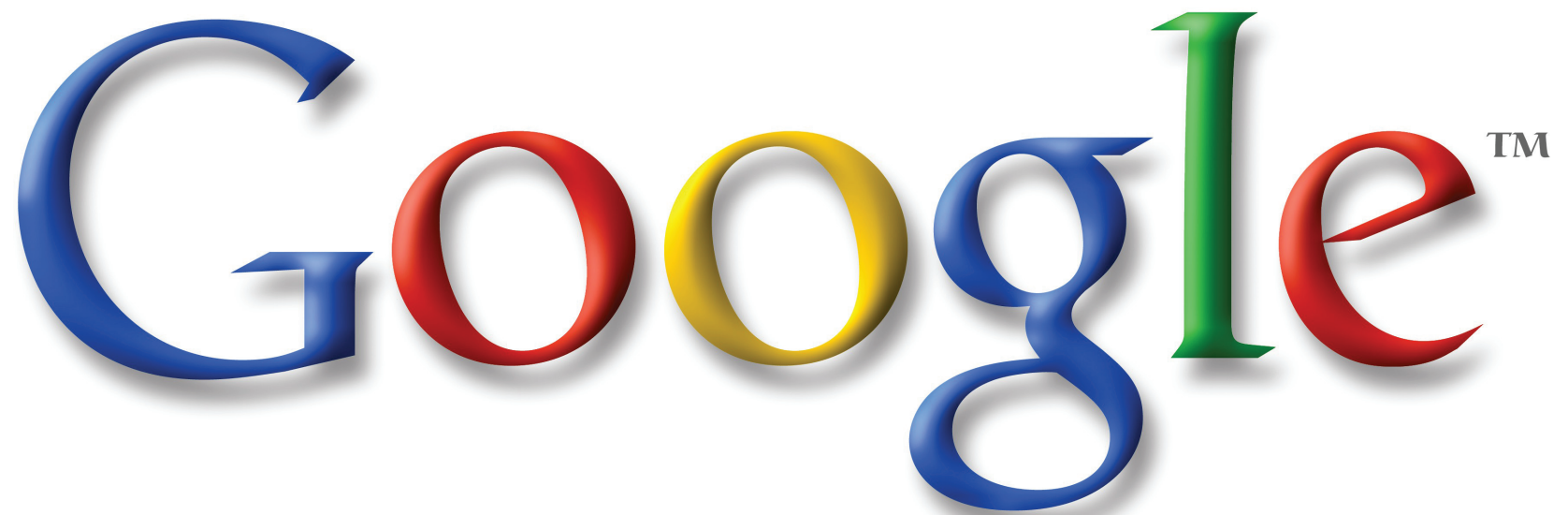


Panoramas are unique starting points into visualising space and as we will see in the coming pages, they can be visualised directly online, embedded into Google Earth and used to create ‘step inside’ urban spheres in Second Life.

With the addition of high dynamic range techniques of capture, they provide a source of dynamic lighting for 3D city models. Any scene can now be captured and mapped with a simple mobile phone or standard digital camera.

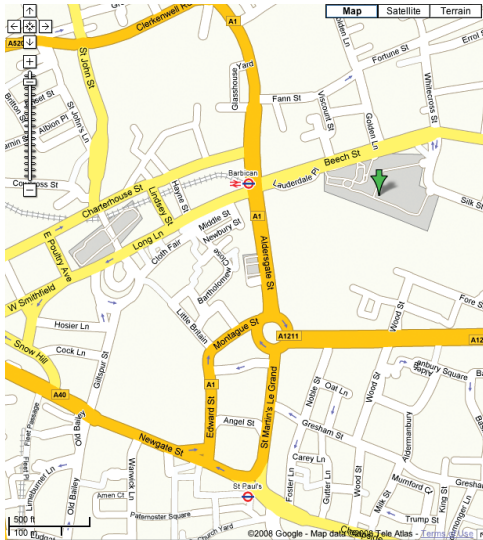
**High Dynamic  
Range Panorama**



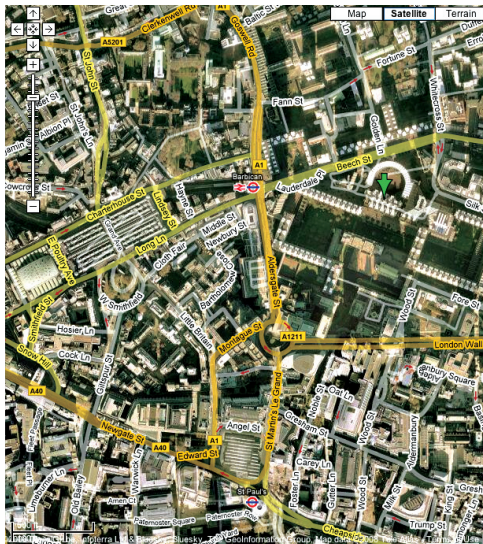


## The Mapping Revolution

# The Mapping Revolution



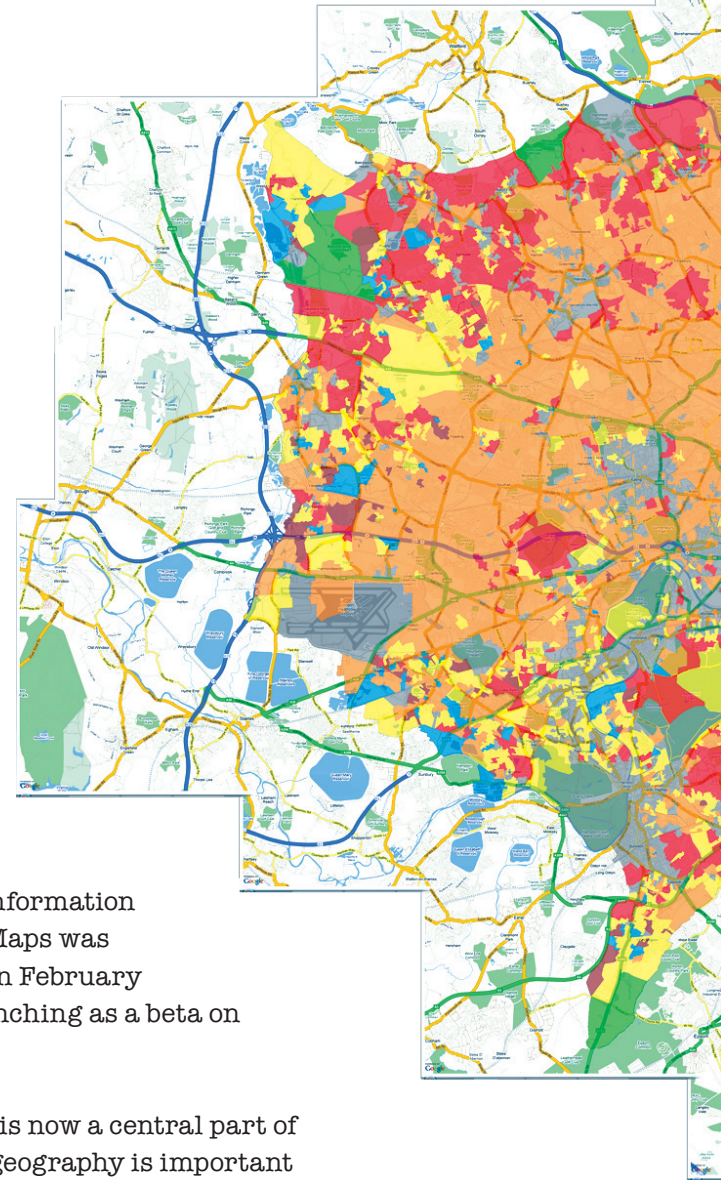
Street and Aerial View of the Barbican via Google Maps



Google Maps has changed everything in the online geographic world. Where once data was restricted to slow and cumbersome servers from the large GIS software companies, Google came along and made it easy. They provided a base layer on which to overlay information whereby users can pan (by dragging the mouse) and zoom (by using the mouse wheel) onto mapping information from almost anywhere in the world.

In short, Google has made mapping easy, opening up geographic information to the masses and leading the way to Neogeography, Crowd Sourcing, Volunteered Geographic Information and Collective Intelligence. Google Maps was first announced on the Google Blog on February 8th, 2005 with the main service launching as a beta on October 6th of the same year.

In little under three years, mapping is now a central part of the internet experience and indeed geography is important again. With this rise in mapping has come a demand for data, issues of copyright, questions over accuracy, but above all there has been an explosion in the amount of geographic information available. The coming pages



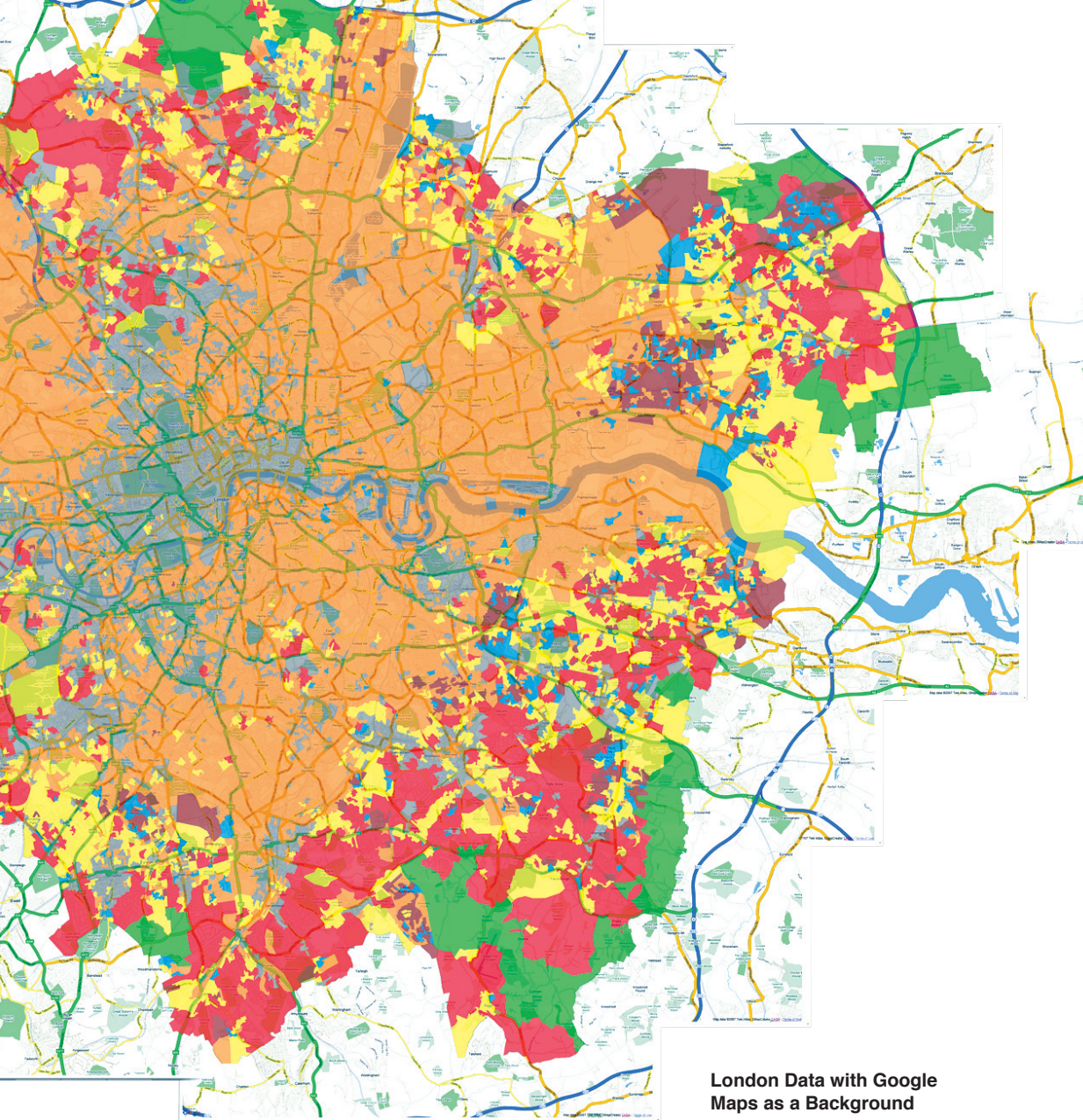


## The Mapping Revolution

provide a walk through of some of our software launched under GeoVUE, and we introduce MapTube 'A Place to Put Maps' which is our own Web 2.0 application.

To aid social scientists who have map and other picture data but are not interested in acquiring the detailed and often arcane skills for manipulating such data within a proprietary GIS, we have developed as part of GeoVUE software to take in such data and display it directly within a Google Map.

In short, our software GMap Creator enables a user to take a map which consists of vector data describing the physical configuration of objects and features that make up the map together with attributes that relate to these geometric features, and then to generate a layer that can be displayed/overlaid in a Google Map.



London Data with Google Maps as a Background

# The Mapping Revolution

## Creating a Google Map Overlay using GMap Creator

Software: [www.casa.ucl.ac.uk/software/googlemapcreator.asp](http://www.casa.ucl.ac.uk/software/googlemapcreator.asp)

### You will need:

- 1 x GMap Creator
- 1 x Shape File
- 1 x Webpace

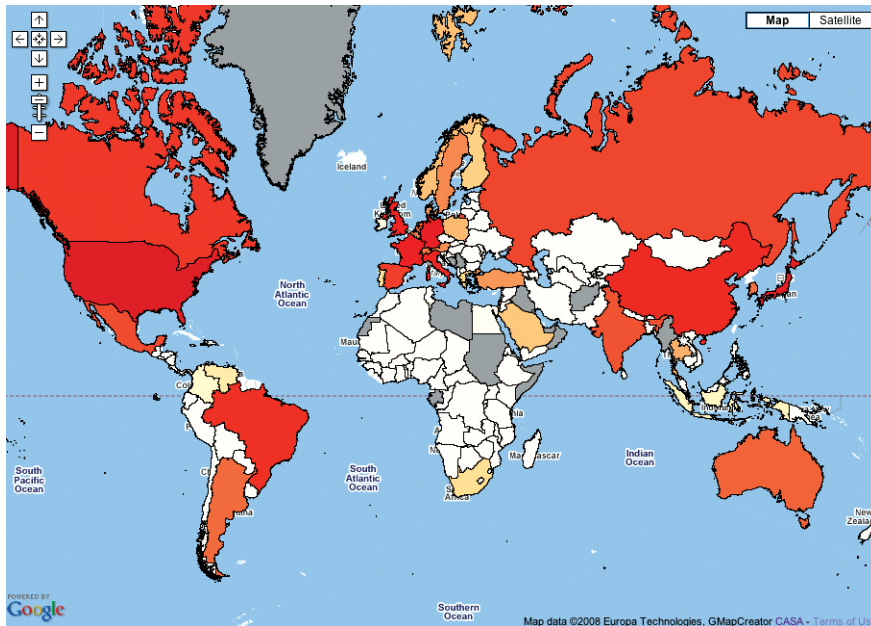
Time required:  
5 to 10 minutes

Google Map Creator has been created to publish .shp files in a simple 'point and click' manner. The .shp or Shapefile is a popular geospatial vector data format for geographic information systems software.

The format is developed and regulated by ESRI as a (mostly) open specification for data interoperability amongst ESRI and other software products. As such, the majority of geographic data can be converted to .shp files.

A search of the web for 'free .shp' files will produce numerous examples of data sets that can be shared online. We also provide a free example to download and use on our website from the URL above.

Although the main use of Google Map Creator will be by data providers and local councils, all the visualisations produced can be shared and 'mashed' using MapTube which we explore later.





## Step 1 Launching and Loading Google Map Creator

Download the software from our website and unzip into a folder. Note the software requires Java to be installed on your system which, if required, can be downloaded from [www.java.com](http://www.java.com).

To start Google Map Creator double click on 'gmapcreator1.1.jar' which can be found in your install folder. Or, if you are a Windows user you can simply select the software from your Start > Programs option.

Once the software is running, Select File > Open File and choose the .shp file you wish to display in Google Maps. For our example we are using a world map ranking by Gross Domestic Product (GDP) by country.

Once loaded, the Shapefile will be automatically re-projected into Mercator, which is the projection format used by Google Maps. All that we need to do now is to set the colours and save into a web directory.

### Google Map Creator



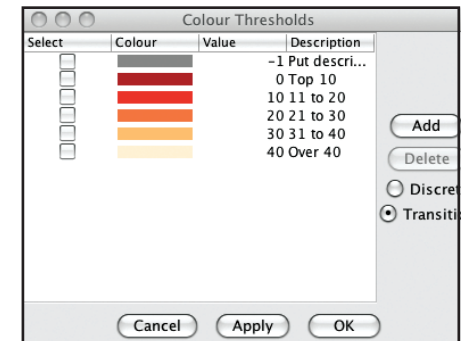
## Step 2 Setting the Colours

The map will load in a single colour surrounded by a pinky/ purple background. The background is simply to indicate where there is no data, it will not be visible in the final output.

You can choose to display any attribute that is attached to the data, according to your .shp file.

Select your required data from the drop down - in our case 'Rank'

To set the colours, select the 'Cols' button and this will bring up a dialogue box where the colour scale, according to your output range, can be chosen.



# The Mapping Revolution

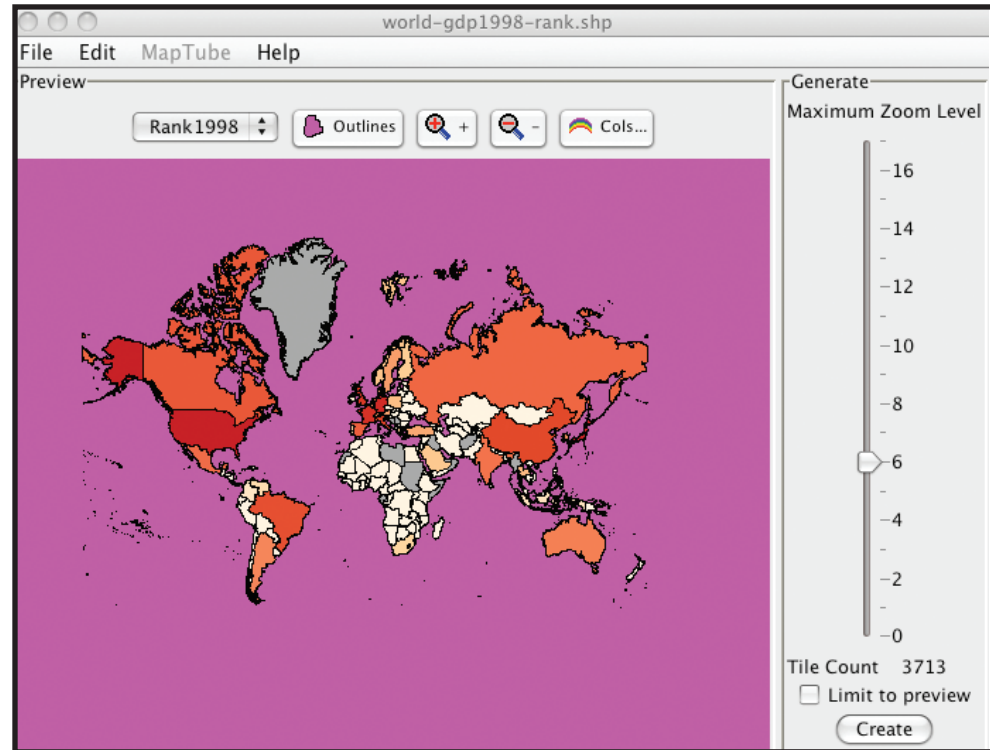
For our scale of ranked GDP, we have selected 6 categories and selected colours accordingly. This should only take a couple of minutes. Once you are done, click 'Apply' and the map will be coloured in relation to your scale.

With a coloured map you are now ready to set the level of zoom and select the area of the map to create. Most of the time you will want to publish your entire map, but if you would like to only export certain areas, you can use the + and - buttons to zoom in.

The area of the map you see in the window is what will finally get published.

On the right hand side of Google Map Creator is the level of zoom. This relates directly to the zoom level in Google Maps.

Moving the slider bar up and down will recalculate the 'tile count' which is the number of tiles that will be created when you click 'create'.



## Setting the Colours

For street level data, you will want to choose the maximum level of zoom, whereas for global data a medium level is fine.

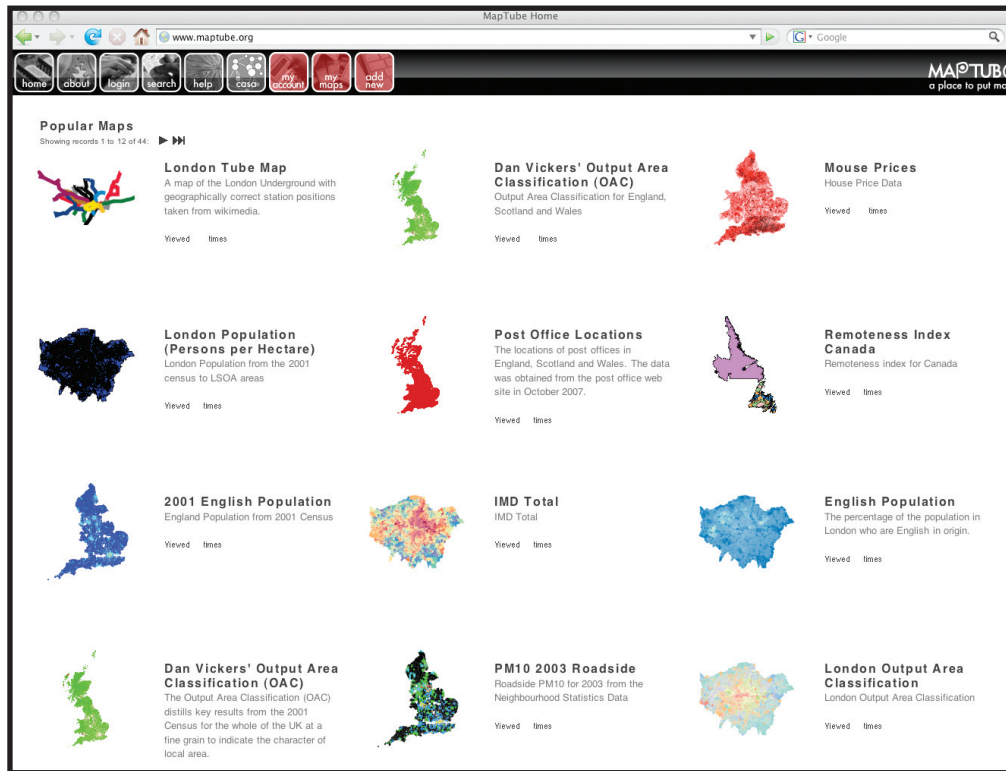
Now that the map is ready to create, there are a couple of options that can be added. Once you are happy with your colours and tile count, simply click 'Create'. Google Maps Creator will now create a folder containing all of the tiles, an XML file and a HTML page ready to publish.



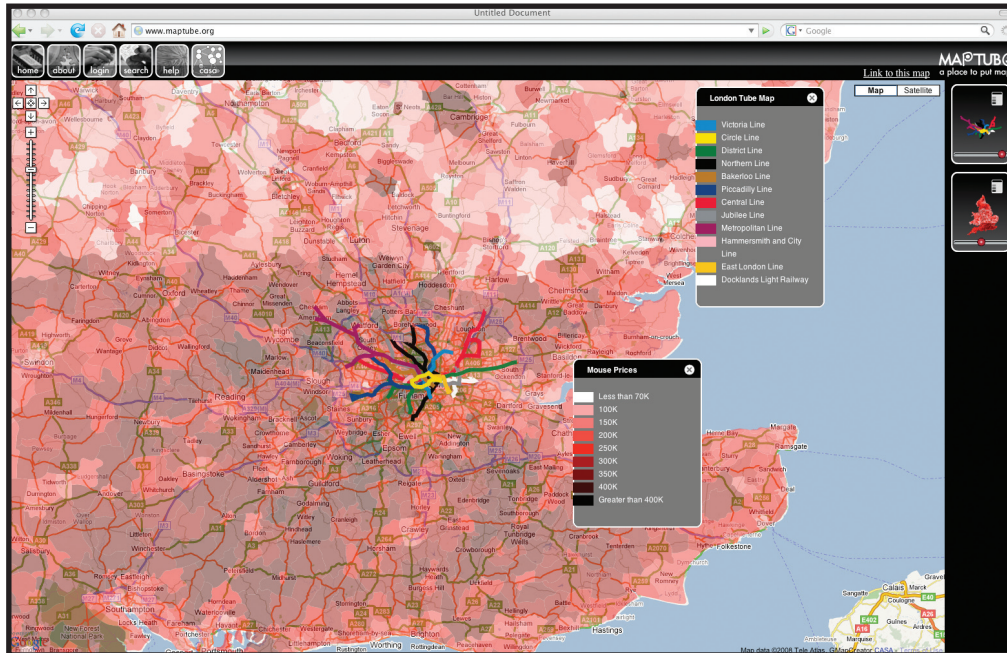
# The Mapping Revolution

Our latest release - MapTube - combines the generic idea of YouTube with the ability of Google Map Creator to create thematic maps. MapTube provides a 'place to put maps' where any map that is placed can be mixed and matched with any other map.

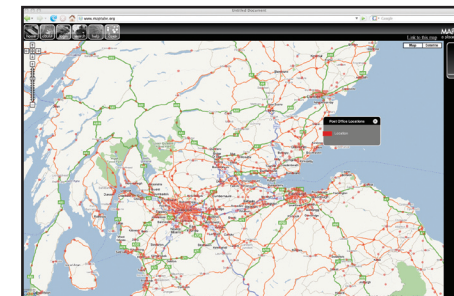
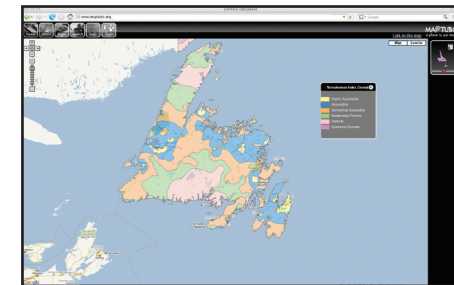
## Popular Maps in MapTube



# The Mapping Revolution



In a Web 2.0 world, data is everything. It is the key to knowledge and understanding. Spatial laboratories, such as ours at CASA, cannot survive without it. We consume data at an ever increasing rate, process it, analyse it, manipulate and merge it to visualise and ultimately aid our understanding of the city and its geography.



Creating and Viewing Maps in MapTub



Data is a valuable asset and without it spatial analysis would simply not exist. Google has been the analysts' friend of late with its acquisition of high-resolution aerial photography providing a base for other datasets and that all important sense of location. As such, aerial imagery is one dataset that we no longer have to worry about, unless of course it is needed for visualisation outside of a Google product.

The use of Google's license for aerial imagery is however just one dataset. Research labs generally obtain data by linking up with other partners or providers and piggy backing on other license agreements, and it is here where the danger lies. The need to consume and apply data often brings with it complications about copyright, intellectual property rights and licensing.

This is where MapTube steps in. Every map hosted on MapTube is held on an outside server and pulled in using the XML file which is automatically created

when using Google Map Creator. As Google Map Creator effectively creates 'image tiles' from the data, the raw information is not placed online, only the data visualisation. As such, issues of copyright are lessened as all the data is held outside of MapTube on servers around the world and the raw data is never shared. MapTube acts as a portal for geographic data, pulling it in whenever someone publishes a data set using our software and agrees to the map being shared.

Running as a portal, MapTube is unique in its ability to mix and match datasets. It allows virtually any geographically located data to be overlaid with any other. This allows an almost infinite number-of-combinations to be compared and visualised using the easy to use Google Map interface.

Using MapTube is simplicity itself, as a general user you can choose any number of maps to 'mashup' on the fly. Each layer can be mixed and matched to create the required visualisation which can then be saved and shared via a unique URL.

As a registered user, organizations or individuals can share their own data by typing in the location of their XML file. By adding a series of tags and general information, we ensure that the background to the data is kept intact and then MapTube does the rest.

You can take MapTube for a spin at [www.maptube.org](http://www.maptube.org).

# The Mapping Revolution

Google Map Creator requires a basic knowledge of data and, while it does a great job of converting existing maps that without such a tool may be destined to remain in local councils or research labs, it is not aimed at creating maps per se.

Placing you own data onto Google Maps used to mean getting your hands dirty via the Google Maps Application Programming Interface (API) and a request to Google for a license key. This restricted map making to those determined to visualise data or

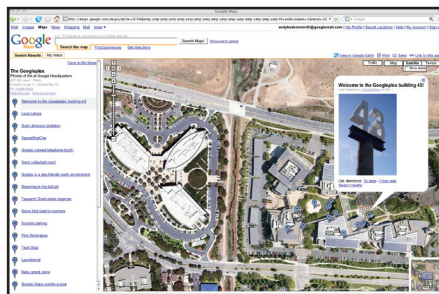
those already at ease with basic code editing. Google changed this with the introduction of 'MyMaps' in May 2007. MyMaps is a simple point and click interface to create and edit your own maps and possibly the most important innovation in mapping since the development of Geographic Information Systems.

To create your own map you simply need a Google Account and to be able to point and click on a map; it is that simple. As the Official Google Blog states, you can add placemarks, draw lines

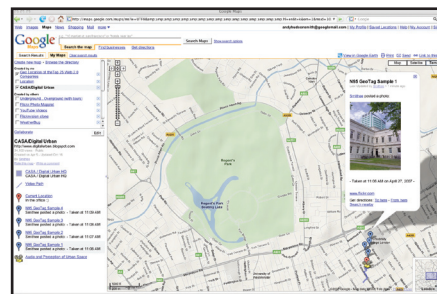
and shapes, and embed text, photos and videos -- all using a simple drag and drop interface. Your map automatically gets a public URL that you can share with your friends and family, or you can publish your map for inclusion in Google Maps search results.

To get started go to [maps.google.com](http://maps.google.com) click MyMaps > Create New Map. You will see a series of icons on your map allowing you to create a Placemark, Line or Shape. Making maps has never been so simple.

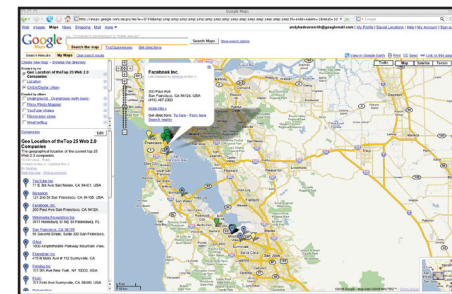
Tour of the GooglePlex



Adding Flickr to MyMaps



MyMaps of the Geo-location of the Top 25 Web 2.0 Companies







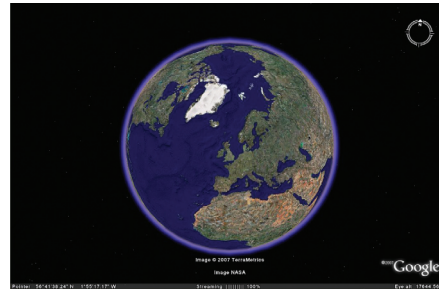
# The Digital Earth

# The Digital Earth

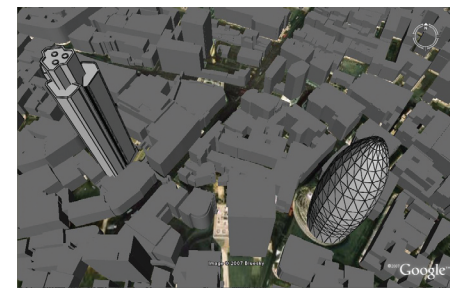
The Digital Earth is a recent phenomenon. It is barely 36 months since the original Keyhole Earth Browser was re-branded and launched as Google Earth, yet it could be argued that we already take for granted the ability to zoom into any location on the globe and view various levels of information and visual data in a three dimensional environment.

Google Earth was born out of Keyhole, a company founded by John Hawke with the aim of creating a 3D program called Earth. Of note is Hawke's inspiration from Neal Stephenson's (1992) science fiction novel Snow Crash which describes a virtual earth created by the Central Intelligence Corporation (CIC).

In this context, it is worth noting Stephenson's description:



“There is something new: A globe about the size of a grapefruit, a perfectly detailed rendition of Planet Earth, hanging in space at arm's length in front of his eyes. Hiro has heard about this but never seen it. It is a piece of CIC software called, simply, Earth. It is the user interface that CIC uses to keep track of every bit of spatial information that it owns, all the maps, weather data, architectural plans, and satellite surveillance stuff. Hiro has been thinking that in a few years, if he does really well in the intel biz, maybe he will make enough money to subscribe to Earth and get this thing in his office. Now it is suddenly here, free of charge”.



**Zooming into the Virtual London Model in Google Earth**

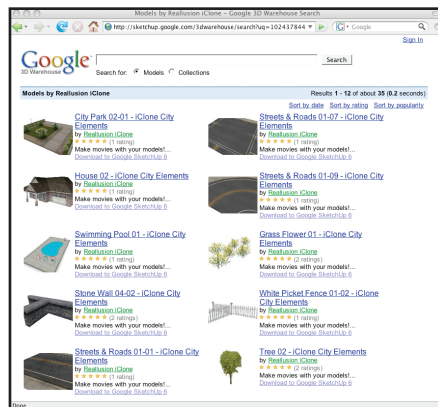


Central to Google Earth is the ability to view three dimensional cities on top of the high resolution imagery, streamed in from numerous sources,

either direct from the Google server, the 3D Warehouse which is a repository of user created models, or direct from a user's machine or server.

modeling tool in 2006, opening up the ability (and indeed requests from Google) for users to model their versions of the real world.

## 3D City Elements



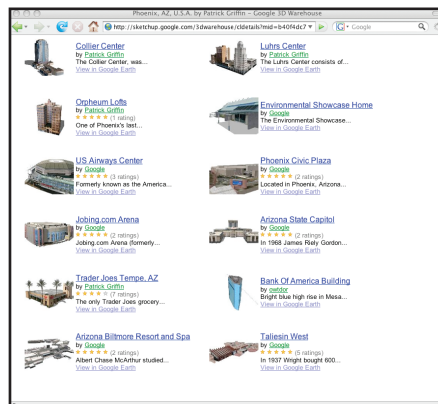
User created content, also known as Crowd Sourcing, is central to the Digital Earth as no software company has either the money or the man-power to build a complete digital representation of all the structures on earth.

Pictured below left are three collections from the 3D Warehouse. The warehouse currently holds over 200,000 models with the number rising by the day as users submit new content.

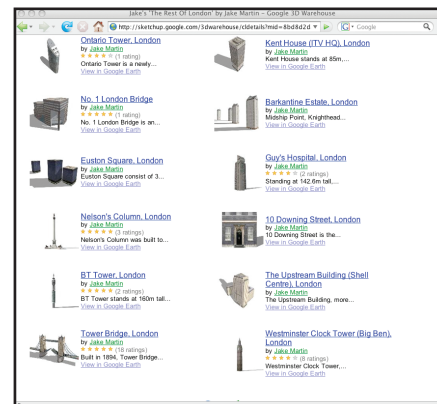
The power of Web 2.0 is that it provides users with the tools and access to create content and as such, Google released a free version of their SketchUp 3D

The best of these models become part of the Google Earth collection that are automatically streamed in when a user goes to the relevant section of a city - it is these models that are creating Google's Digital Earth.

## Phoenix



## The London Collection



# The Digital Earth

Google's 3D Warehouse route is classic Web 2.0 and opens up the use of 3D models for other applications such as CAD, 3D Studio Max or games software such as Crysis and Oblivion to name but a few packages.

The user creates the content, Google gets to populate their earth and with content comes new users to SketchUp. The cycle completes. It is Wikinomics in action.

Of note in the images of Boston in Google Earth is the mix of user created content and generic

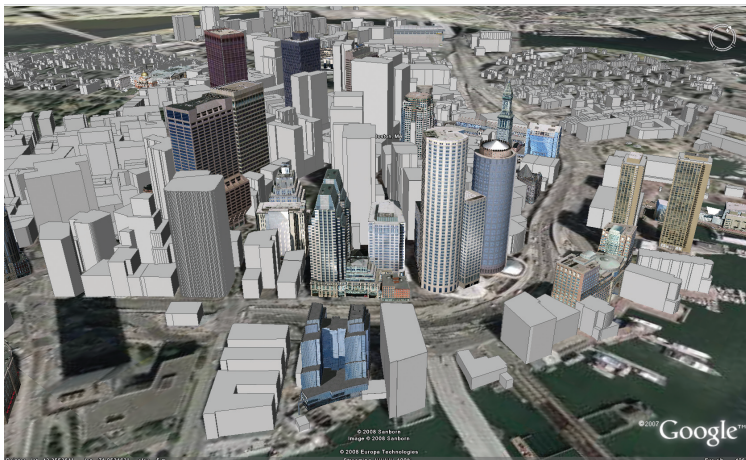
3D grey outlines of buildings that were typical of Google Earth before texture mapping of geometry was introduced.

User created content allows local details to be mapped, creating realistic streetscapes. The coverage is patchy, but it is still early days for the 3D Warehouse and its integration with Google Earth.

Microsoft have taken a different approach from Google with their Virtual Earth, currently in beta. While they understand the need for users to add basic 3D

models by way of their '3DVIA' application (see [www.3dvia.com](http://www.3dvia.com)), they are modeling the world cities themselves, building by building. Microsoft has invested in technologies to automatically recreate cities from a combination of aerial based Light Imaging and Detection Data (LiDAR) and oblique imagery. The results are impressive with fully texture mapped geometrically accurate models being produced and loaded into Virtual Earth as and when complete. With in excess of 500 new cities planned for inclusion

Boston in Google Earth



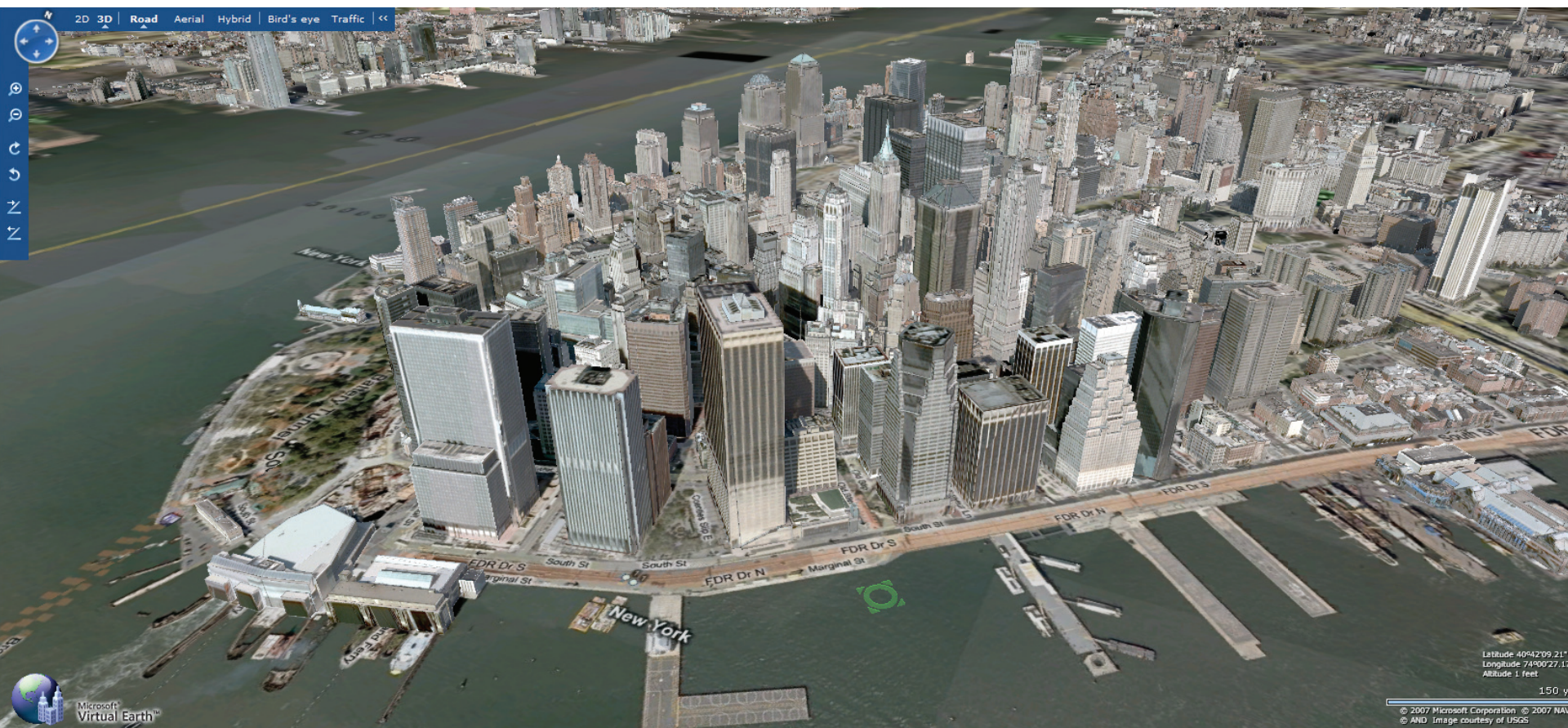


in Virtual Earth, this year the battle between Microsoft and Google for users has commenced in earnest.

Commentators have compared it to the battle between the Netscape Browser and Internet

Explorer. Time will tell but with investment levels considerable for providing the most up to date aerial imagery, it is doubtful if there is room for 2 Digital Earths, let alone the 30 plus that currently exist.

New York in  
Microsoft's Virtual Earth



# The Digital Earth

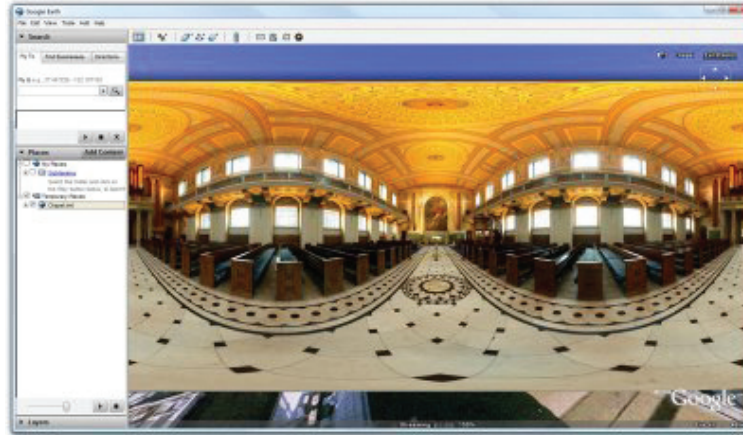
## Creating PhotoOverlays in Google Earth

Software: [www.casa.ucl.ac.uk/software/photooverlaycreator.asp](http://www.casa.ucl.ac.uk/software/photooverlaycreator.asp)

You will need:

- 1 x Google Earth
- 1 x Photograph or preferably a panorama
- 1 x Copy of PhotoOverlay Creator from the url above

Time Required:  
15 to 30 minutes



PhotoOverlay Creator has been made specifically to place high-resolution imagery into Google Earth. The tool supports full 360 x 180 degree panoramas, partial cylindrical panoramas and standard photographs or images, all within a simple point and click interface.

Working in a similar manner to our Google Map Creator software, the program tiles your data, in this case images, and creates a KML file ready to put on your server. KML is simply a file based on the XML language for three-dimensional geospatial data in Google Earth. Just as web browsers display HTML files, Digital Earth browsers such as Google Earth display KML files.

PhotoOverlay Creator essentially allows you to place any imagery into Google Earth on a three-dimensional surface and in its correct geo-location.



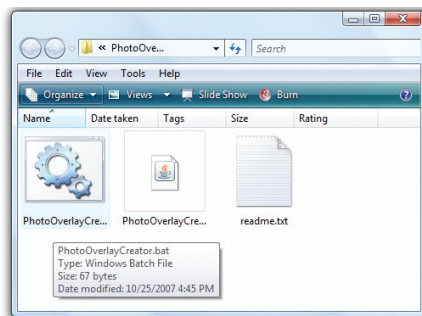
## Step 1: Launching and Loading an Image

Download the software from our website and unzip it into a folder. Note the software requires Java to be installed on your system which, if required, can be downloaded from [www.java.com](http://www.java.com).

To start PhotoOverlay, double click on PhotoOverlay.bat as pictured.

Loading the .bat file will open the interface which users of our other software tools, Image Cutter and Google Map Creator, will be familiar with.

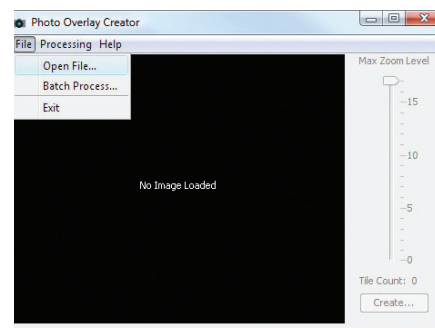
### PhotoOverlay Creator



Select File > Open File and choose the image you wish to display in Google Earth.

For this tutorial we are using a 360 x 180 spherical panoramic image of the Chapel of St Peter and St Paul in Greenwich, London.

The image loads and a level of zoom is automatically set according to the image's resolution, in our case level 6.

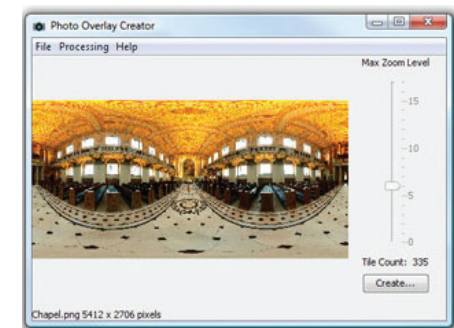


## Step 2: Geo-Locating and Setting Field of View

Once your photograph or image is loaded, click 'Create' to be presented with options on Image Shape, Location and Description. Enter a description of your image - in our case information on the Chapel in Greenwich. This text will be viewable in Google Earth.

Image Shape has 3 options:

- 1) Rectangle - for all images apart from panoramas. The set Field of View (FOV) button provides options relating to the camera settings but for the most part, these can be



# The Digital Earth

ignored as the software will automatically set the correct sizes and aspect ratio.

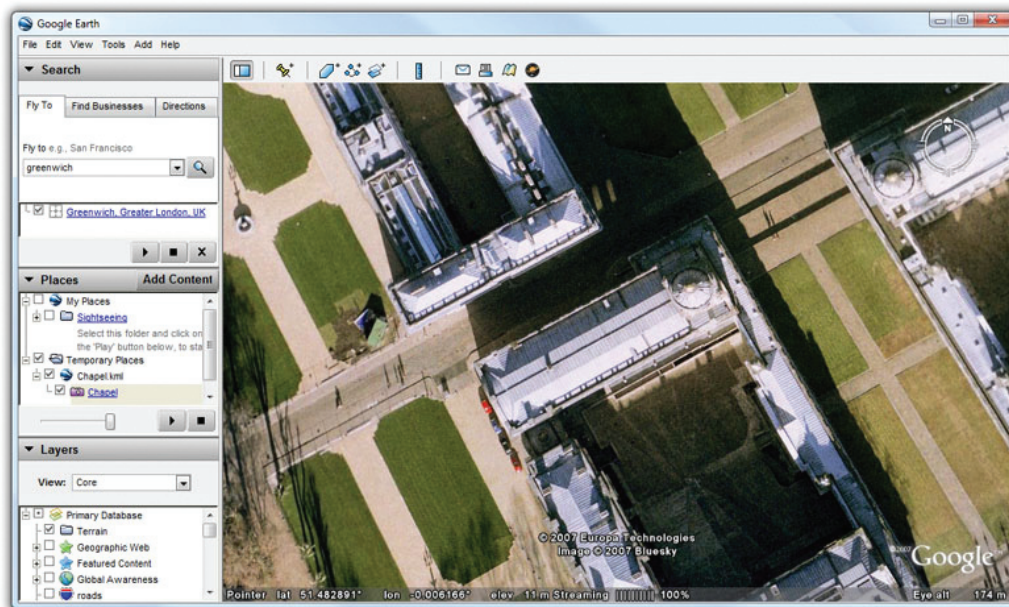
- 2) Cylinder - for partial panoramic images or images that do not cover a full 360 x 180 field of view. The FOV settings are important for cylindrical images. These should be noted down via your stitching software and input accordingly.

- 3) Panoramic Sphere - for use with 360 x 180 degree panorama images.

Select the Image Shape required as per the settings above, in our case Panoramic Sphere with the default FOV settings. As the images are located in geographic space, it is important to load them at the correct locations. This can either be done accurately by noting the latitude and longitude of your

image, or roughly by choosing a city location from the 'Look Up' option and later moved in Google Earth.

We are going to use the preferred method of looking up latitude and longitude using Google Earth. PhotoOverlay Creator uses latitude and longitude in degrees and decimals so we need to set our options in Google Earth to display these units.



Geo-locating in Google Earth



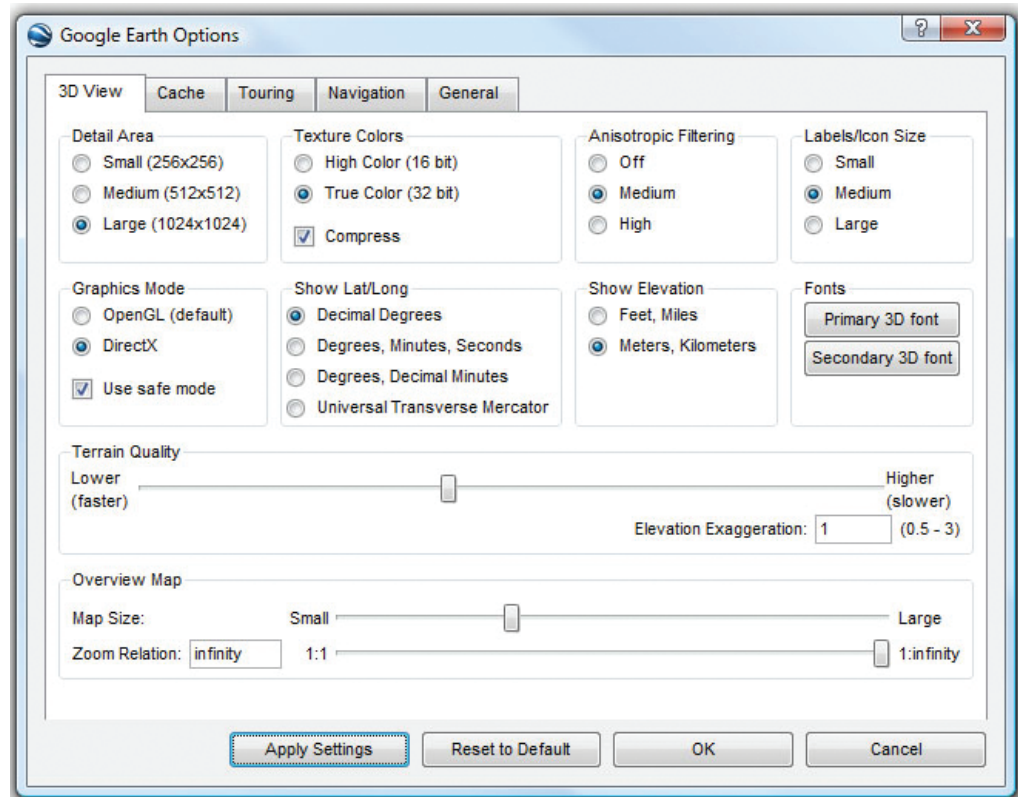
In Google Earth select Tools > Options and select the relevant check box under 'Show Lat/Long' - as illustrated.

The Chapel of St Peter and St Paul is located in Greenwich, London. To get the relevant latitude and longitude we simply fly into the location in Google Earth and subsequently run the mouse over where the photo overlay is to be displayed.

The latitude and longitude are displayed in the bottom left hand corner of Google Earth. Make a note of the co-ordinates and enter them into PhotoOverlay Creator.

Now simply click 'Create' and your KML will be created ready to view in Google Earth.

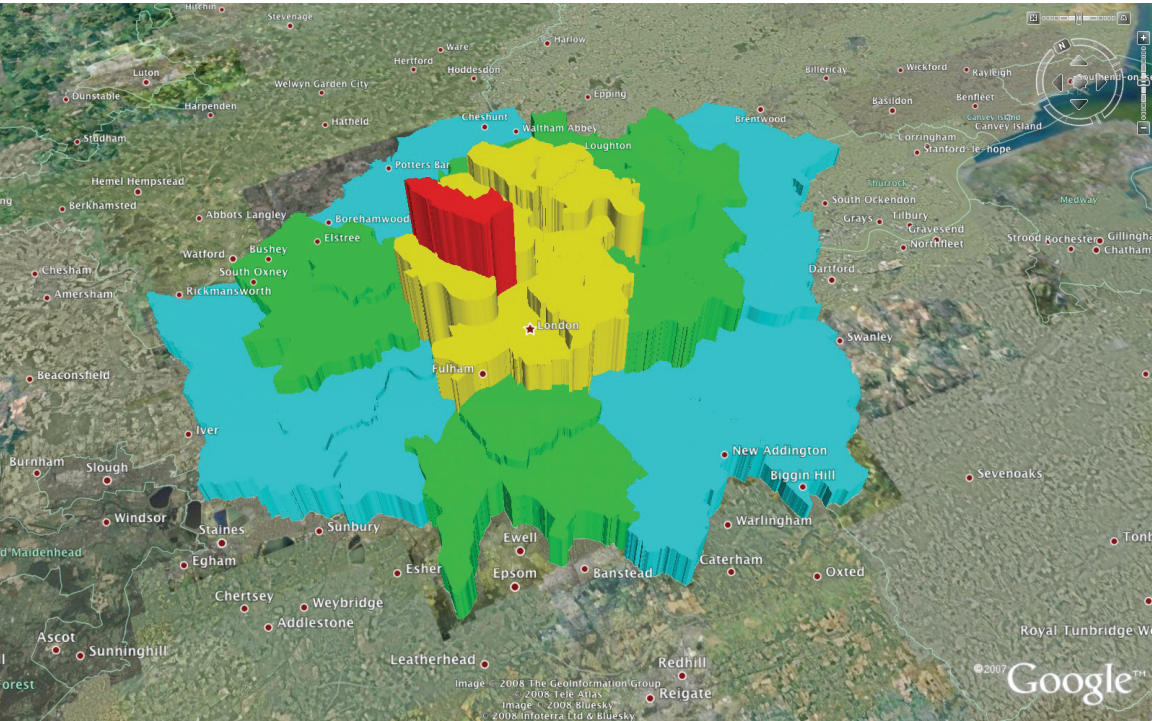
If you want to share your image with the world via a webserver, the KML needs to know the path to the image. Open up your KML file in a text editor such as notepad and locate the .jpg reference - ours is here:



**Setting Latitude and Longitude to Decimal Units in Google Earth**

```
<icon>
<href>Chapel-tiles/Chapel_$_[level]_$_[x]_$_[y].jpg</href>
</icon>
```

# The Digital Earth



## Three-Dimensional Data via Google Earth Creator

Simply copy your newly created tiles folder to your webspace and note down the path. Type this path after the <href>in your KML file

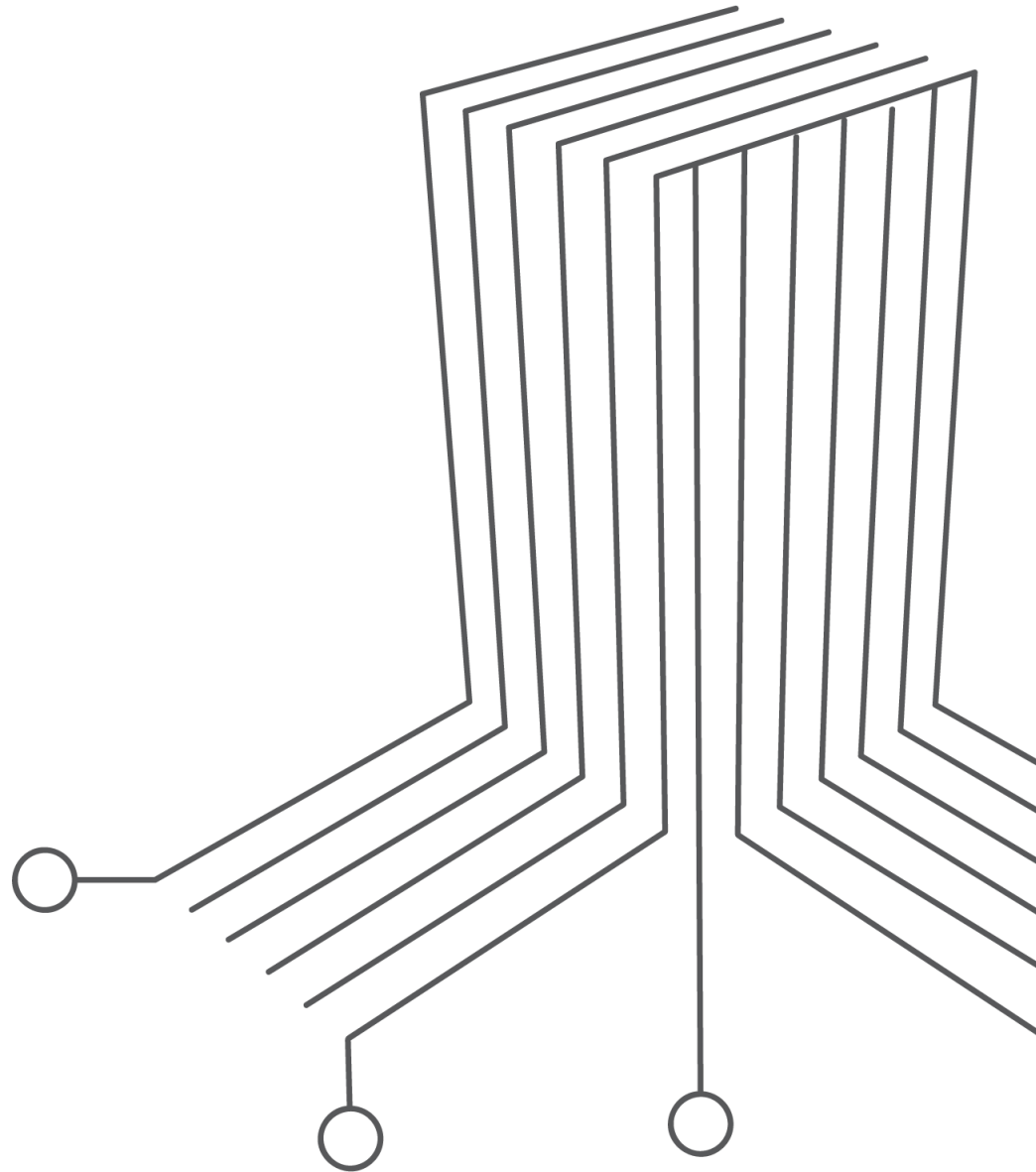
```
<icon>  
<href>http://www.yourwebaddress/Chapel-tiles/Chapel_$_[level]_$_[x]_$_[y].  
jpg</href>  
</icon>
```

Representing geographic data in three-dimensions is a step on from our Google Map Creator and towards Google Earth Creator. Google Earth Creator is due for release in the third quarter of 2008 allowing you to take any .shp file and share it in three-dimensions in Google Earth.

As ever, updates and information can be found on our website [www.casa.ucl.ac.uk](http://www.casa.ucl.ac.uk) and our blog [www.digitalurban.blogspot.com](http://www.digitalurban.blogspot.com).

Talking of blogs...





# The Blogs



According to Blogger, one the main providers of blogging software, a blog is “a personal diary... A daily pulpit. A collaborative space. A political soapbox. A breaking-news outlet. A collection of links. Your own private thoughts. Memos to the world”. In its purest sense and according to Wikipedia - blog, a portmanteau of web log - is a website where entries are commonly displayed in reverse chronological order. “Blog” can also be used as a verb, meaning to maintain or add content to a blog.

Blogger is a blog publishing system that is owned and operated by Google. It was launched by Pyra Labs in 1999 and introduced in its current form in 2004, after being acquired by Google for an undisclosed fee.

The key to blogs is they are easy to make. Little or no technical

knowledge is required allowing thoughts to be posted quickly with audio, images and video embedded by linking to other services such as Flickr or YouTube.

In short, blogs are a place to post thoughts and information, on whatever subject matter you choose, using a service such as Blogger which is free and characteristically easy to setup.

Blogger has provided an outlet for our work over the last couple of years through our blog known as Digital Urban. Located at [www.digitalurban.blogspot.com](http://www.digitalurban.blogspot.com), it has provided a focus for our thoughts and a way of sharing the information we have collated on urban and geographic visualisation.

Within this area, there are a number of core blogs, which we highlight over the next couple of pages.





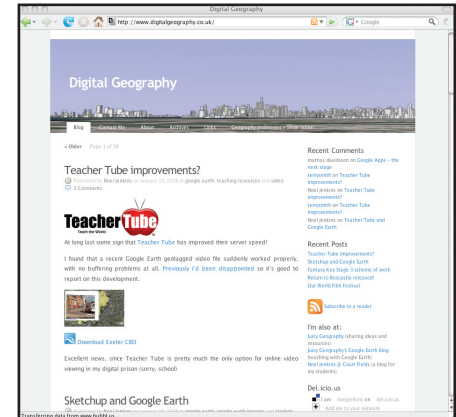
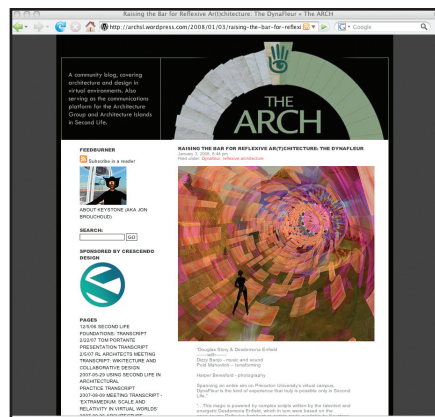
[www.gearthblog.com](http://www.gearthblog.com)

[www.spatiallyadjusted.com](http://www.spatiallyadjusted.com)



[www.edparsons.com](http://www.edparsons.com)

[www.archsl.wordpress.com](http://www.archsl.wordpress.com)

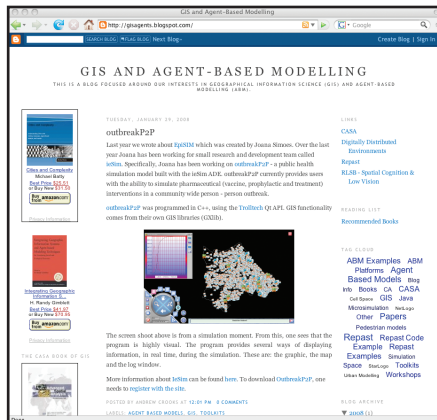


[www.digitalgeography.co.uk](http://www.digitalgeography.co.uk)

[www.cgarchitect.com](http://www.cgarchitect.com)



# The Blogs



www.gisagents.blogspot.com



www.cityofsound.com/blog



www.ogleearth.com





## Second Lives

Second Life and other similar virtual environments are easy to dismiss as pure distraction and entertainment. Yet look under Second Life's lid and it has the potential to combine all the aspects of Web 2.0, visualisation and Neogeography in one multi-user, three-dimensional collaborative environment.

Second Life is but the tip of an iceberg. It represents a glimpse into the future of collaboration and visualisation. Overlapping with systems such as Google Earth and toying with the concept of populated space, within the next few years the predictions are for a 'Second Earth': a merger of Google Earth and Second Life. Second Earth is, in short, an occupied version of the Digital Earth.

Perhaps a Second Earth is Web 3.0 or 4.0, a long way off in terms of the short run cycles of current technology, but the indications are there and companies are already working on prototypes. Chasing the future is typical of digital geography. The next



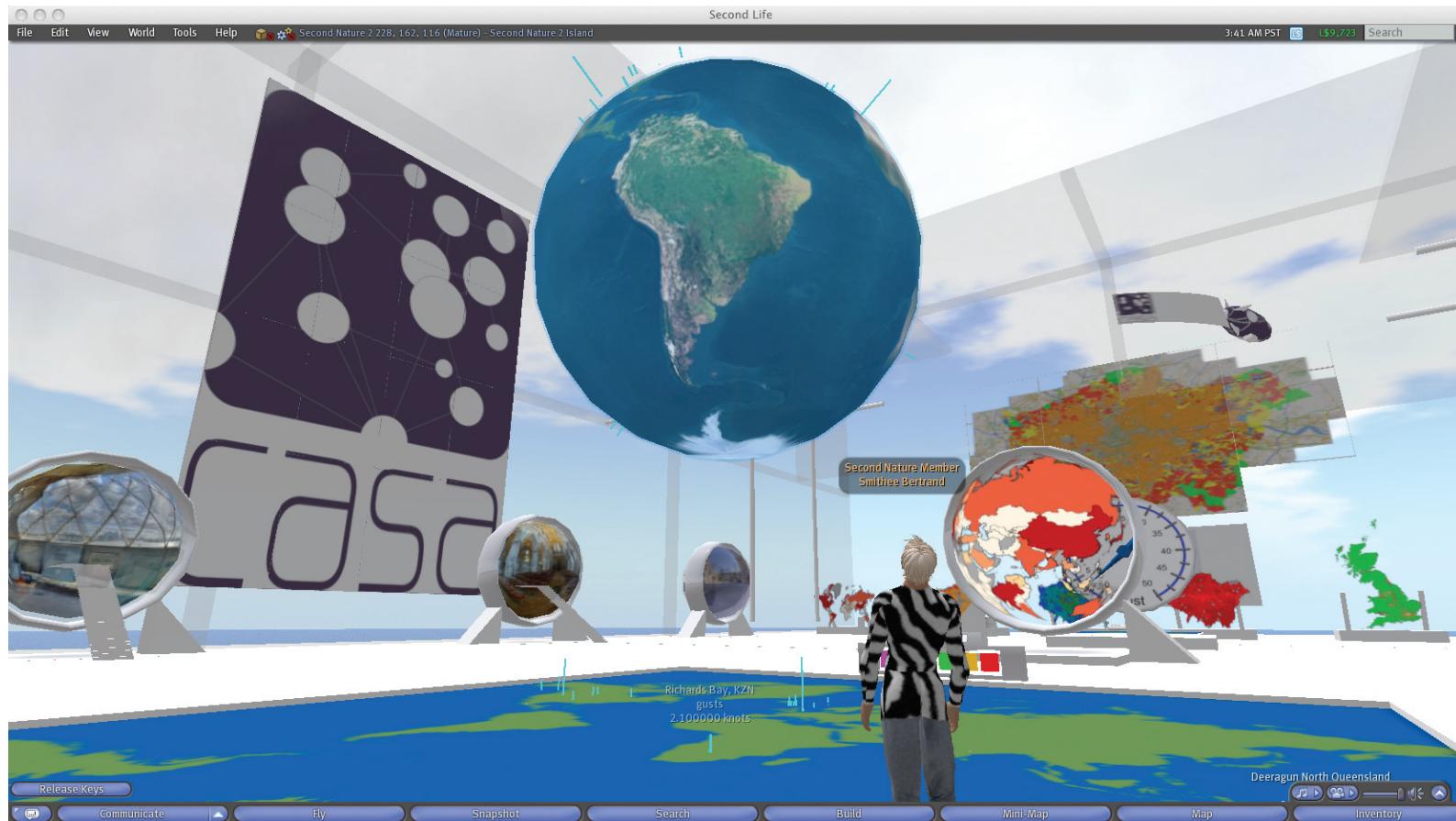
Avatars in Second Life

big thing in visualisation or communication is always around the corner. Back to the current state of the art and at the present time of writing (February 11th 2008, 14:20 hours), there are 34,954 people logged into

Second Life, living their virtual lives. These lives and the environments in which they exist are worth exploring.

Second Life currently represents the most successful social/visual





### CASA's Lab in Second Life as part of NATURE Island

environment on the Internet. Launched in 2003 with little more than a few kilometres of simulated computer space, it now covers more than 750 square kilometres. Created by Linden

Labs, based on Linden Street in San Francisco, the world of Second Life has been created almost in its entirety by its users. The users have created digital geography in its purest geographic sense. The rolling fields, river valleys, mountains,

hamlets and towns that occupy the ever growing 750 square kilometres have been created piece by piece by the millions of users.

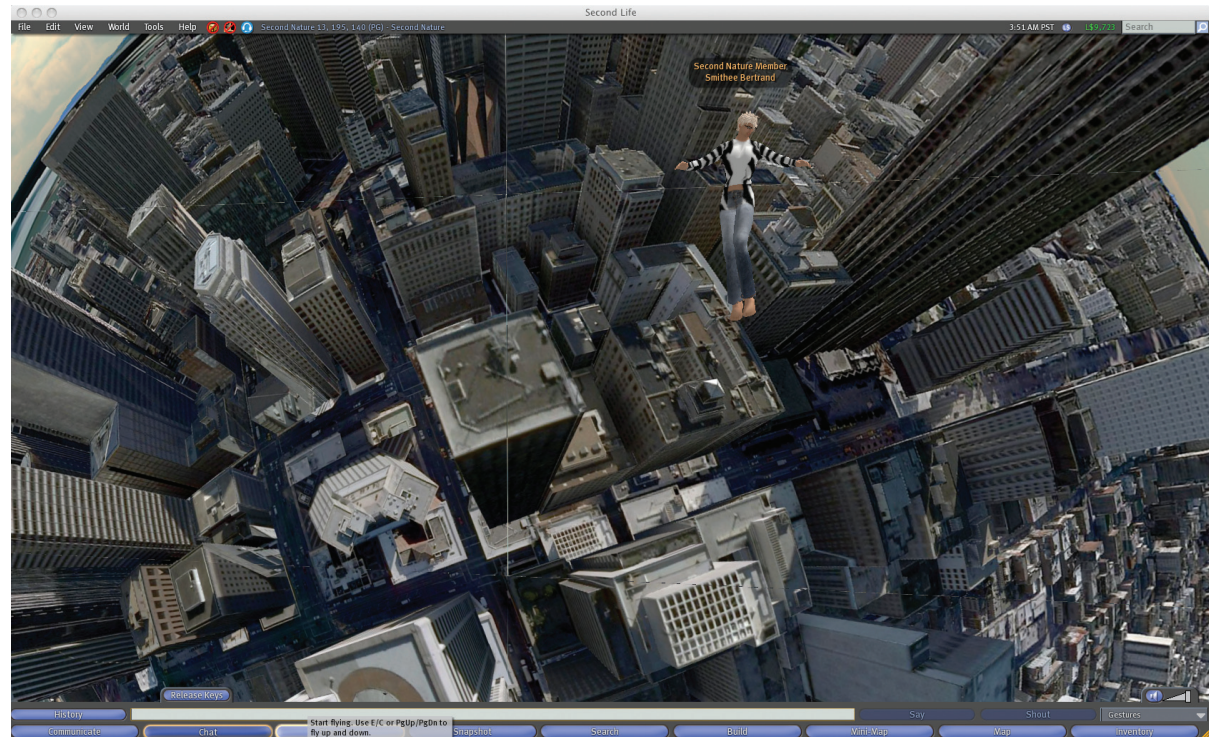
Neal Stephenson's influence can again be felt in environments

## Second Lives

such as Second Life that mirror his vision of the Metaverse. Stephenson's novel *Snow Crash* depicts life in the Metaverse as the following:

“As Hiro approaches the Street, he sees two young couples, probably using their parents' computer for a double date in the Metaverse, climbing down out of Port Zero, which is the local port of entry and monorail stop. He is not seeing real people of course. This is all part of the moving illustration drawn by his computer according to the specifications coming down the fiber-optic cable. The people are pieces of software called avatars”. Neal Stephenson, *Snow Crash* (1992, p.35).

Users can ‘jack in’ and ‘jack out’, to adopt the terminology of *Snow Crash*, creating a flux in population levels. During August 2007, 23 million man-hours were spent in Second Life by over 974,000 users, that's an average of 23.6 hours per user. Hof (2006), in an article in *Business Week*, indicating Second Life's



Visualising Cities in Second Life

spreading influence, estimated that residents spent a total of 23,000 hours a day creating things, something that would take a 4,100 strong software team to do.

This is pure Web 2.0 in action. A cumulative workforce operating inside a virtual world creating digital geography. It is quite simply staggering.

To start using Second Life all you need do is download the viewer, available for Windows, Mac and Linux from [www.secondlife.com](http://www.secondlife.com) downloads.

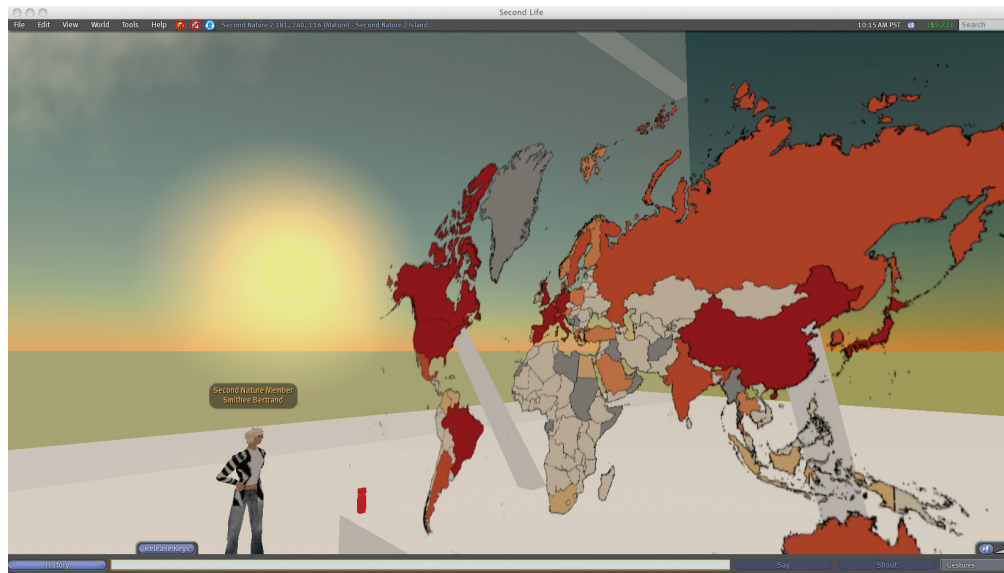
It is free to enter Second Life, chat and begin exploring. If you want to start ‘building’, then you need to register and purchase



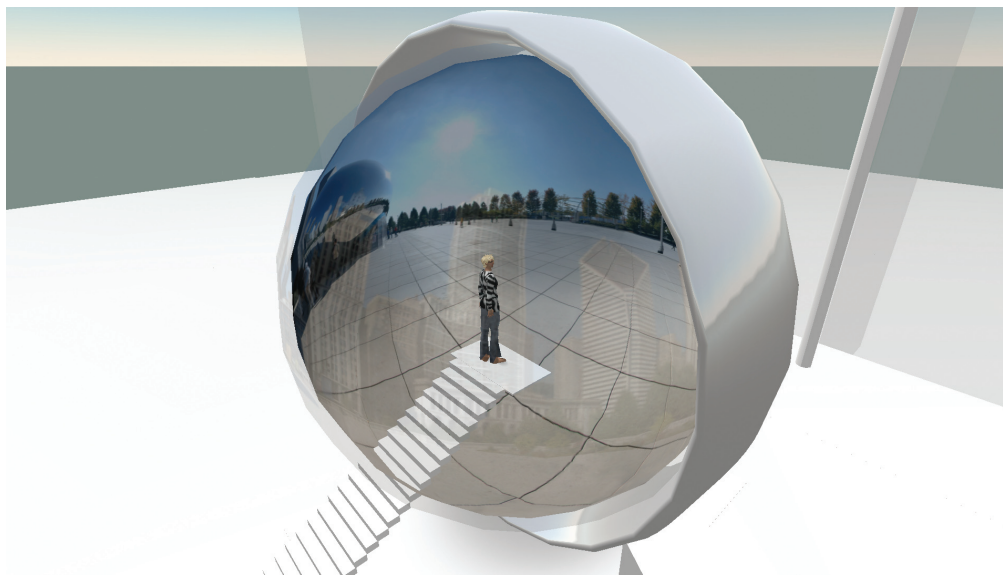
land using the currency of Second Life – Linden Dollars.

A Premium Second Life account starts at \$9.95 a month and allows you to claim a plot of land on which you can build. The registration fee includes a complementary 512 x 512 metre allocation of real estate. Any amount of land can be ‘rented’ from Linden Labs with a number of companies, universities and institutions occupying their own Islands in Second Life.

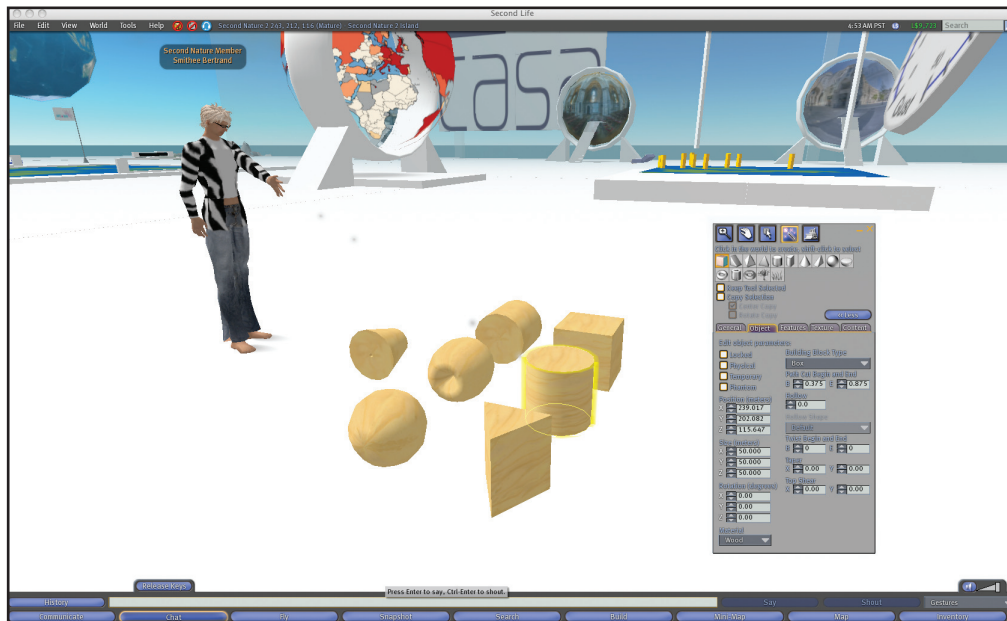
Our section of land in Second Life can be found on NATURE Island, a plot of land set up by the NATURE publishing group to encourage scientific research and outreach. We have set up a number of examples of geographic visualisation including maps directly linked to MapTube, real-time display of weather data from ‘Neometeorologists’ and ‘Step Inside’ urban spheres.



From MapTube to Second Life



Chicago Panorama as an 'Urban Sphere'



A Selection of 'Prims' in Second Life

Building in Second Life is simplified by a powerful and highly flexible tool set built into the Second Life browser. All objects in Second Life are created from a series of geometric primitives known as prims. These are the basic building blocks and each prim can be hollowed, flexed and shaped as required to create any required geometry.

It is worth going to a 'sandbox' area to practice building. These are areas that allow anyone to try out building techniques and are often supported by a number of nearby tutorials.

The best way to start out and learn Second Life is not from the printed word but either inside Second Life itself or by running a search for 'Second Life Tutorial' on YouTube. With resources such as YouTube, and various blogs at your fingertips, all that

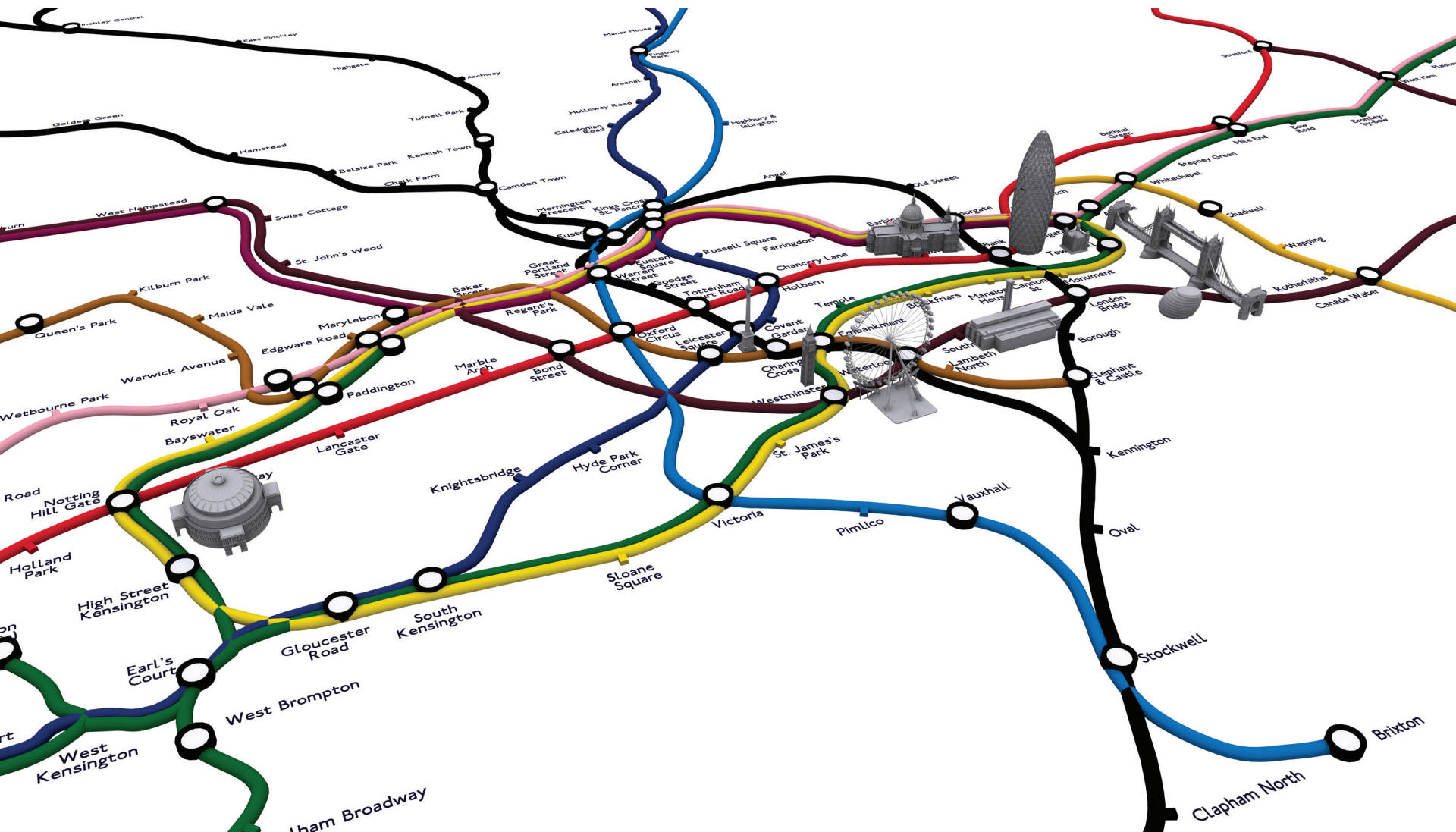
is required is an hour of time and you will be part of the collective that are creating the digital geographies and digital cities that are Second Life.

In essence, we are but at the beginning of what will be a revolution in social, visual and informational data plotted geographically by general users – Neogeographers. New tools are emerging on ever shortening software cycles and hardware is emerging that integrates geo-positioning as a matter of course. Mapping and visualisation is getting easier. Geography is important again and data is opening up to the masses. In short, these are interesting times in the world of digital geography.

A booklet is only as timely as its print date. As ever you can find out the latest innovations, news and techniques on our blog [www.digitalurban.blogspot.com](http://www.digitalurban.blogspot.com).

**Welcome again to the new world of rich geographic information – Digital Geography – in its new form Neogeography.**





Iconic Geography: London Tube Map

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*Digital Geography: Geographic Visualisation for Urban Environments*

Editorial Management and Graphic Design by Sonja Curtis

Material and Research by The CASA GeoVUE Team

MapTube and GMap Creator by Richard Milton

[www.casa.ucl.ac.uk](http://www.casa.ucl.ac.uk)



Web 2.0 is a collection of computer technologies that are changing the way we represent digital media. Location and place are fast becoming a third force in the IT revolution, central to the way we interact with one another and search for information. This booklet describes the mapping revolution that is upon us, illustrating how the development of digital earth and virtual worlds are creating a Neogeography in which we can all share.

Dr Andrew Hudson-Smith is a Senior Research Fellow in the Centre for Advanced Spatial Analysis (CASA) at University College London (UCL).



ISBN 978-0-9550581-1-0



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