Neogeography, Gaming and Virtual Environments: Web 2.0, Mapping for the Masses and the Renaissance of Geographic Information

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Abstract

Web 2.0, specifically The Cloud, GeoWeb and Wikitecture are revolutionising the way in which we present, share and analyse geographic data. In this paper we outline and provide working examples a suite of tools which are detailed below, aimed at developing new applications of GIS and related technologies. GeoVUE is one of seven nodes in the National Centre for e-Social Science whose mission it is to develop web-based technologies for the social and geographical sciences. The Node, based at the Centre for Advanced Spatial Analysis, University College London has developed a suite of free software allowing quick and easy visualisation of geographic data in systems such as Google Maps, Google Earth, Crysis and Second Life.

These tools address two issues, firstly that spatial data is still inherently difficult to share and visualise for the non-GIS trained academic or professional and secondly that a geographic data social network has the potential to dramatically open up data sources for both the public and professional geographer. With our applications of GMap Creator, and MapTube to name but two, we detail ways to intelligently visualise and share spatial data. This paper concludes with detailing usage and outreach as well as an insight into how such tools are already providing a significant impact to the outreach of geographic information.

The world of Geographic Information (GI) Science has changed. It has experienced expeditious growth over the last few years leading to fundamental changes to the field. Open up Google Trends and a simple search comparison between GIS, Google Maps and Google Earth highlights the point: on April 23rd 2005 the number of searches for Google Maps overtook those for GIS as we illustrate in Figure 1. Using Google Trends is by no means a scientific analysis, for it simply means that Google Maps and Google Earth are higher in search terms, but it does point to one thing – the increased awareness of GI by the public at large. With this increased awareness has come the rise of volunteered geographic information, crowd sourcing, Neogeography and citizen science, amongst many other newly emerging terms linked to the geographic profession. On that basis, April 23rd, 2005 can be pin-pointed as the day

the world of GI Science changed, a change that we explore throughout this paper in terms of outreach, communication, visualisation and analysis.

Hand in hand with this change is the rise of Web 2.0 from an underground movement to the driving force behind many Internet communications and data collection of the present day. The term is adapted from O'Reilly Media in 2004 to summarise the rise of services from web-based communities focusing on technologies of social networking, social bookmarking, blogging, Wiki's and RSS/XML feeds (Graham, 2007.)
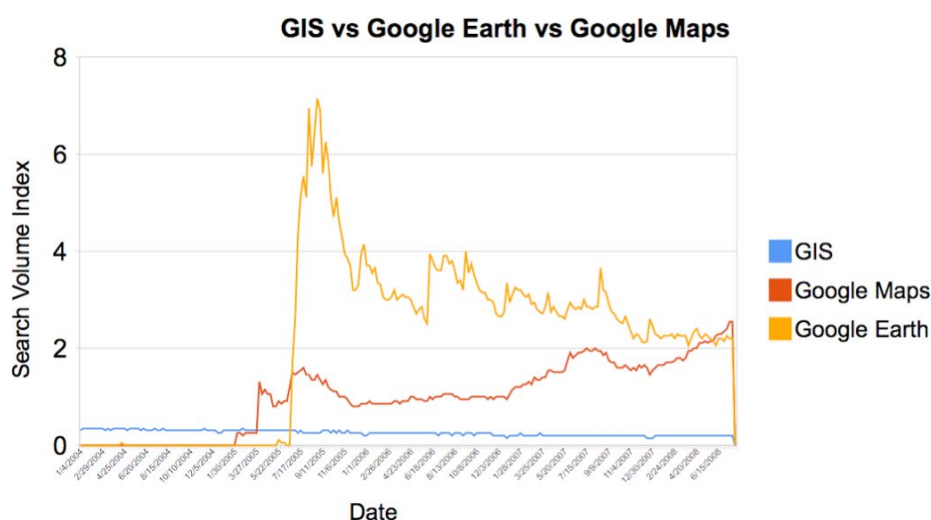
Figure 1: Google Trends, Google Maps vs. Google Earth vs. GIS.

An increasing amount of the information we now consume digitally is user created as is evidenced by sites such as YouTube, Facebook, Blogger, Flickr etc. Central to all of these applications is ease of use and the ability to communicate via freely available tools. They can be learnt quickly and effectively without immersion in professional activities (Hudson-Smith et al., 2008) this has also been viewed as the cult of the amateur (Keen, 2007). In short professional tools are entering the realm of the masses via Web 2.0 technologies and from this the professions' themselves are changing. This is happening across the board from economics in the form of Wikinomics (Tapscott and Williams, 2006) through to the 3D modelling world with the Google Warehouse and Wikitecture and perhaps more notably in the world of GI via a plethora of tools, techniques and services.

One company stands out amongst all in the creation and deployment of such services and we would argue that it has done more for the field of Geographic Information Systems (GIS) and outreach of geography in general than any other. That company is Google. We realise that in professional GIS circles this is controversial and indeed threatening to long-term practice but the simple fact is that companies that are not geographic specialists are simply doing digital geography more effectively than the big GI players. However, it needs to be stressed that the majority of the features developed are tools for the visualisation of GI. They do not provide any complex spatial analysis per se, merely a spatial database and under-pinned by generating income through advertising. This is symptomatic of Web 2.0 whereby tagging not only the type of information but where such information is produced, who uses it and at what time is fast becoming the killer application (Hudson-Smith, 2008).

As such geography is undergoing somewhat of a renaissance and one that is becoming known as 'Neogeography'. The term derives from Eisnor (2006) one of the founders of www.platial.com where she defines it (Neogeography) as '… a diverse set of practices that operate outside, or alongside, or in a manner of, the practices of professional geographers. Rather than making claims on scientific standards, methodologies of Neogeography tend towards the intuitive, expressive, personal, absurd, and/or/ artistic, but may just be idiosyncratic applications of 'real' geographic techniques. This is not to say that these practices are of no use to the cartographic/geographic sciences, but that they just usually do not conform to the protocols of professional practice'.

Perhaps one of the most widely known terms in recent geographical discussions is the 'MashUp'. Originally used to describe the mixing together of musical tracks on DJ Danger Mouse's The Grey Album, the term now refers to websites that weave data from different sources into a new integrated user service (Hof, 2005). In many ways Neogeography and MashUps go hand in hand (Hudson-Smith et al., 2008) which brings us to our work and software tools we have developed in our group (CASA) at University College London as part of the National Centre for e-Social Science's node on Geographical Information of Urban Environments (GeoVUE). Both the software and techniques developed have been built and released on a short development cycle

to meet the demand for new easy-to-use geographic tools in light of the rise of the 'Google'esk' geographic environment.

In a short period of time we have created a notable base of both professional and non-professional users allowing the creation of new data sets and new ways of sharing geographic information. We detail these tools in the following sections in relation to Web 2.0 and their inevitable impacts on GI Science.
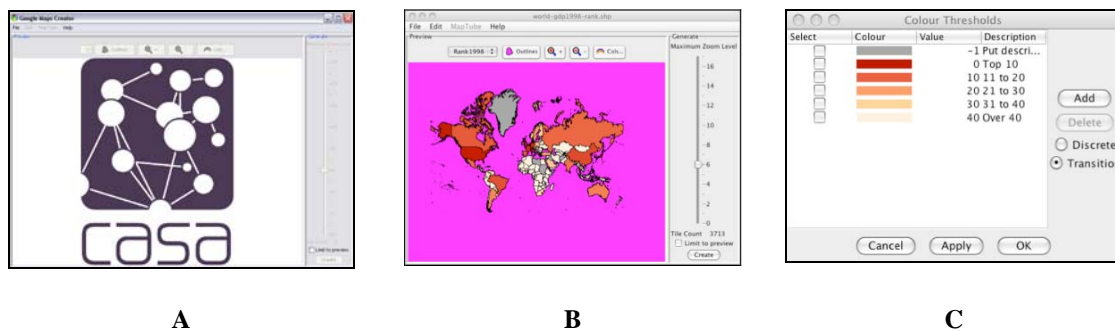

| A | B | C |

Figure 2: Google Map Creator.

A: Initial Screen when GMapCreator is First Opened. B: Uploading a Shapefile and Selection the Required Level of Zoom. C: Selecting the Scales for the Thematic Data.

Central to our digital tool kit is 'Google Map Creator (GMapCreator)' which we illustrate in Figure 2. GMapCreator was developed partly as a result of frustration behind how difficult it was to rasterise, share and view maps on top of the standard Google Map interface. Google Maps allows two levels of basic integration with geographic data, firstly through the 'Application Programming Interface (API)' meaning getting ones hands dirty with code and secondly the more user friendly 'My Maps' system. Google released 'My Maps' in 2007, essentially building on the same product as Google Maps but allowing users to create their own maps via a simple point and click interface. One can draw lines and shapes, embed text photos and videos – all using a simple drag and drop interface. My Maps is viewed as possibly one of the most important innovations in mapping since the development of GIS (Hudson-Smith, 2008). My Maps is typical Neogeography, it has opened up mapping to the masses but it is of little use to the more professional geo-community. As such

our GMapCreator takes the tile structure and concept of Google Maps and applies it directly to GIS datasets.

Using a tile based approach gets around the simple 'KML" export path which is restricted to a 1Mb file size (see Gibin et al., 2008 for more information). GMapCreator allows users to take a vector data map, in the form of either a .shp or formatted .csv and export it in the correct projection as a series of raster tiles for display over Google Maps. This is a notable move away from the points, lines and polygons approach of KML towards a 256 x 256 pixel tile approach with the number of tiles relative to the required level of zoom. The use of the tile-based approach has the added benefit of avoiding infringement of many intellectual property rights as the raw information is never shared or placed online, it is pure data visualisation.

Data visualisation is the key where the aim is not to create an online GIS, but simply to find a way to view and share geographic data for the masses. GMapCreator has to date been downloaded over 9000 times and is under continuous development, most notably in our MapTube application to which we turn next.
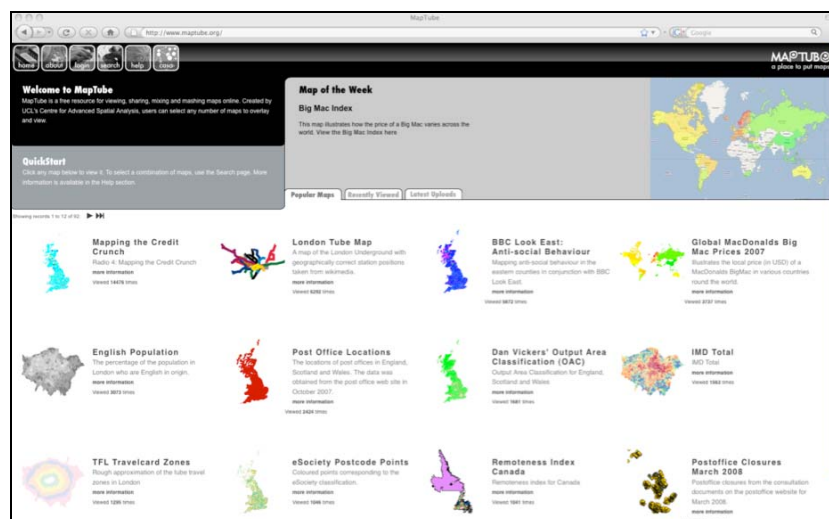

Figure 3: The Home Page of MapTube (http://www.maptube.org).

MapTubes' tag line is 'a place to put maps'. It combines the generic idea of YouTube providing a portal for geographic data produced using the GMapCreator software. Maps are pulled into MapTube via an XML file which is automatically created

whenever GMapCreator is run. Pulling data in from outside servers rather than holding them internally allows data creators to maintain ownership of data tiles and ultimately their distribution, which is seen as a nod back to data providers who are perhaps wary of the Web 2.0 environment. We illustrate the front page of MapTube in Figure 3. Maps can be arranged by popularity, recently viewed and by the latest uploads. Once a user registers with the site they are given free access to the GMapCreator software and the ability to upload map data.

Typical of Web 2.0 and the rise of the Neogeographer is user content, something we return to in Mapping the Credit Crunch for BBC Radio 4 later. MapTube is typically reliant on this user generated content. Users can submit their own maps to MapTube via a simple user interface which we illustrate in Figure 4. Users are asked for several pieces of information to ensure as much information about the data and collection techniques used, which are subsequently documented and viewable on the site within the information tag attached to each map.
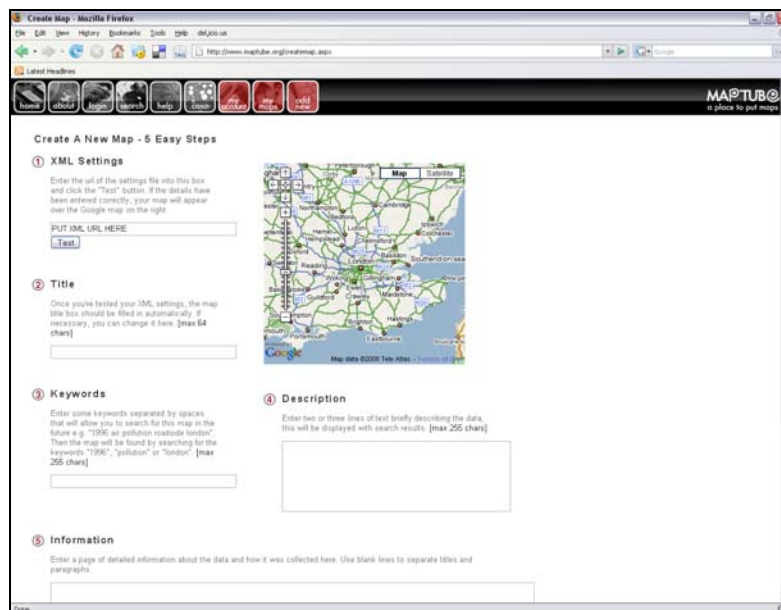

Figure 4: MapTube Interface where Members can add their Own Maps.

Once the information is submitted, an 'icon' of the map is automatically created and the map is available to view, mix and 'mash' on the site. Any map on MapTube can be viewed on top of or in combination with any other map. This is of note as it is to date the only system online that allows such a simple integration of rasterised

datasets. The ability to mix and match maps is illustrated in Figure 5. We have overlaid regeneration areas in London with the Index of Multiple Deprivation (IMD) and the percentage of Bangladeshi population. The ability to quickly and easily upload, view and compare datasets makes MapTube of particular interest to local councils, government based organisations, academics and those requiring the ability for end users to view maps in a simple intuitive manner. Standard Keyhole Markup Language (KML) can also be overlaid on these maps, allowing any polygon output via either My Maps or a professional GIS package to be viewed via MapTube. In addition to this KML files can be uploaded and saved in the same way as the standard datasets, providing a unique 'place to put maps'.
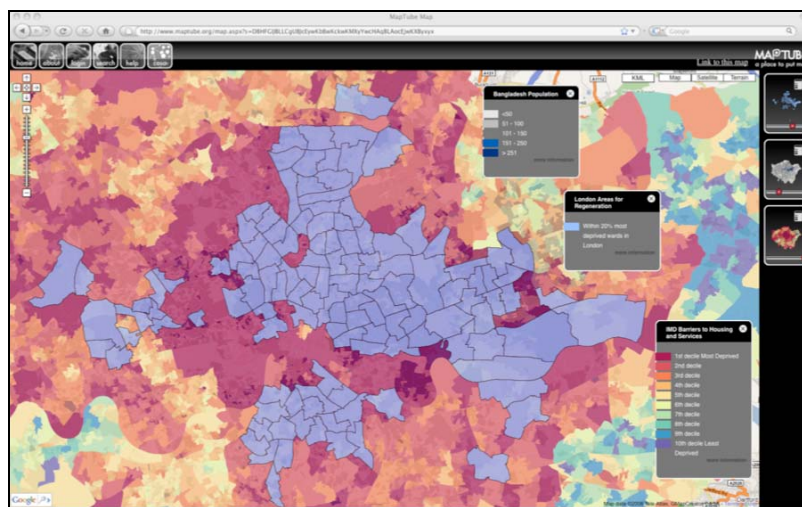

Figure 5: Viewing Maps in MapTube: Bangladesh Population, Regeneration and IMD.

Not only does MapTube allow people to share and view other peoples' maps but it can also be used in more innovative ways. For example, as web surveys are often aspatial (e.g. surveymonkey.com), the ability to use GMapCreator and MapTube offers a simple solution to build spatial surveys for large areas. A pilot study was carried out as an experiment to create a mood map of the credit crunch within the United Kingdom in conjunction with BBC Radio 4 iPM show and News Night as illustrated in Figure 6A. Based on what is the singly most significant factor hurting the person the most about the credit crunch, participants were asked to enter the first part of their postcode (postcode sector) so their responses could be geotagged choosing one of six options from: mortgage or rent, fuel, food prices, holidays, other, or the credit crunch is not affecting me, as shown in Figure 6B.
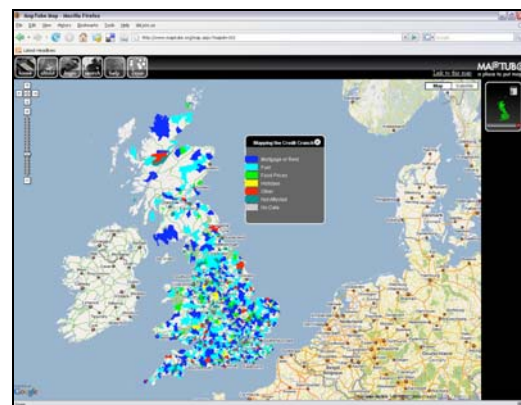
A
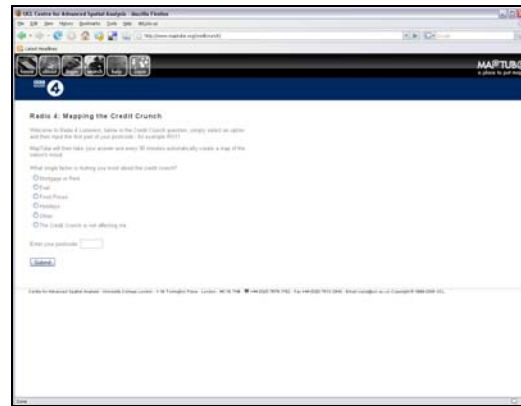
B
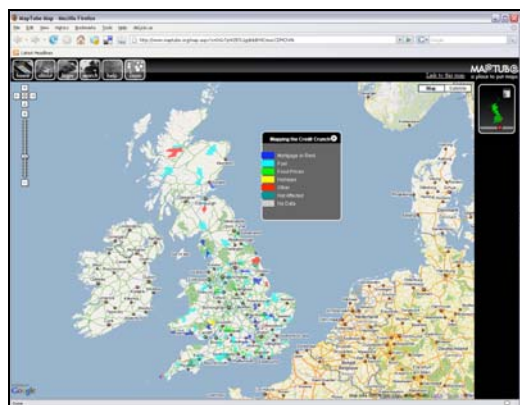
C

D

Figure 6: Mapping the Credit Crunch.

A: Link from the BBC Radio 4 iPM Show, B: Choosing the Single Factor Hurting the Person the most about the Credit Crunch and Entering their Postcode, C: Maps of the Mood, D: Map of the Mood as more People enter their Information.

No personal information was collected and participants were reassured that their actual locations could not be identified. This was ensured through the use of postcode sector rather than the postcode unit or building address therefore preserving data confidentiality. Each response updated the database element of the underlying shapefile with GMapCreator running in the background every 30 minutes to create a new map which was subsequently updated on MapTube as shown in Figure 6C. Over time, as more participants entered information, the map went from blank to varying shades depending on what people were worried the most about in the postcode sector as demonstrated in Figure 6D. Used in conjunction with MapTube, it allows participants and other users to take other information and lay the maps on top of one

other. The potential of this approach for gathering spatial information is enormous. For example, it could easily be used to gather other information such as fear of household burglary, the quality of primary school education, access to local health facilities and so on.

Mapping the Credit Crunch represents one of the first near real-time geographic surveys of a nation's mood. As such the time element is also of importance as each response includes a time stamp allowing the nations mood to be visualised in both time and space. In excess of 40,000 people took part in the survey over a three-week period creating a unique and interesting dataset which is very much of its time. The Credit Crunch Map has since led to BBC Look East, the nightly news programme for East Anglia in association with BBC local radio, using the system to create a mood map of anti-social behaviour. Using a similar data entry technique, viewers of BBC Look East were asked to answer a series of questions on their views on anti-social behaviour at a postcode district level. The survey at the time of writing is on-going with 5000 plus respondents to date, Figure 7 illustrates its use as part of a news segment on BBC Look East.
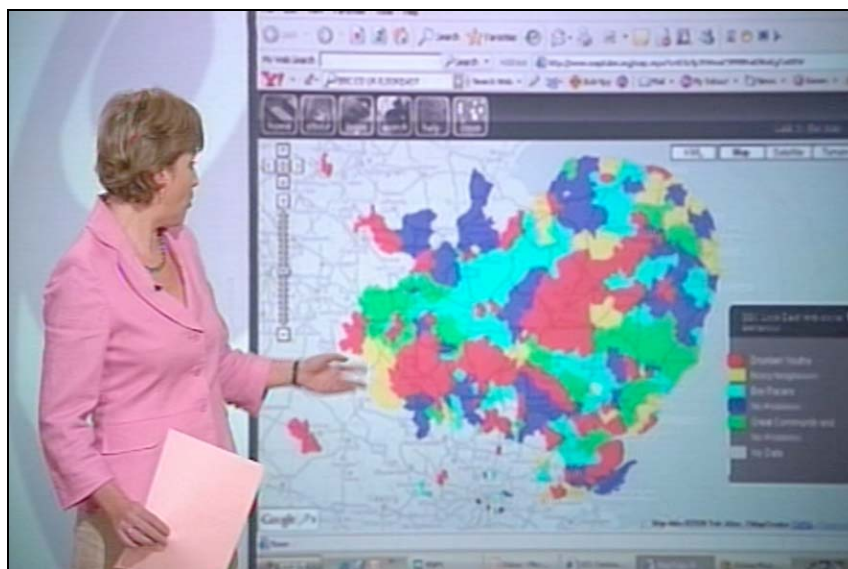

Figure 7: BBC Look East using MapTube

In a 'pre-Google' world none of this would have been possible for the license to use the base map and aerial imagery would have been prohibitively costly and the behind-

the-scenes GIS would have been undoubtedly slow and cumbersome. We consider this in many senses to be Web 2.0 and Neogeography in action: free, easy to use and yet potentially very powerful in terms of GI Science.

Returning to Figure 1 and the Google Trends search, of particular note is the rise of the digital earth with Google Earth perhaps being the most influential single release of geographic based software to date in this current wave of new geographic software. Google Earth, Microsoft's Virtual Earth and NASA's WorldWind to name but three are indicative of a new trend in geography, one where digital points lines and polygons are moving into the third dimension. The ideology behind such developments can be linked back to David Gelernter (1991) in his seminal book Mirror Worlds: or the Day Software *Puts the Universe in a Shoebox*. Gelernter (1991) defines 'Mirror Worlds' as software models of some chunk of reality, some piece of the real world going on 'outside your window' which can be represented digitally.

Gelernter predicted that a 'software model' of your city, once setup, will be available (like a public park) … it will sustain a million different views... each visitor will zoom in and pan around and roam through the model as he chooses' (Roush, 2007). Back in 1991 Mirror Worlds and the concept of the universe in a shoebox were fantasy leaning closer to the science fiction novel Snow Crash in which Neal Stephenson (1992) defines life online as a 'Metaverse':

'As Hiro approaches the Street, he sees two young couples 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 monorails top. 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. These people are pieces of software called avatars'.

Fast forward to the present day where swathes of the universe can be viewed via Google Sky and the Metaverse is close in definition to emerging virtual world systems such as ActiveWorlds and Second Life. Indeed the last year has in many ways been the year of the digital geography, the rise of the digital earth, advances in computer graphics cards and the free availability of modelling software has made it

easier than ever to virtually build, tag and navigate three dimensional geographical space.

Through digital earth systems, the GeoWeb can be seen as the foundation for something all together more powerful, a digital earth that mimics the real world, created by users at large via Web 2.0 - Gelernter's vision of a Mirror World. Indeed although technology is moving at an ever increasing pace we are but at the beginning of a revolution in place and space. These new tools and techniques to communicate and visualise are providing a digital sandpit for geographers, GI specialists and the Neogeographer.

Side by side the development of geographic visualisation using digital earths is a field often overlooked by the geographic profession – that of utilising game engines for geo-visualisation. Partly driving this emergence are games such as 'Crysis' from Crytek. The game comes packaged with an editable 'sandbox mode' allowing the main game to be stripped away and new models to be inserted and shared via the gaming 'modification' community. Game engines in many ways represent the cutting edge in desktop graphics technology and the ability to import models into game such as Crysis should not be underestimated. The learning curve is slightly higher than importing a model into Google Earth but the results are much more realistic allowing flythroughs of large cities, land and datascapes. Figure 8 illustrates our Virtual London model running in the Crysis engine allowing real-time lighting, shadow and object manipulation.

Figure 8: Virtual London Model in the Crysis Game Engine

Our Virtual London model extends to every building inside the M25 and it is available free of charge to local authorities throughout the Greater London Authority boundaries. In essence Virtual London is a professional 3D GIS model yet to run it in real-time with graphic details such as shadows and the ability to add in/replace buildings within the cityscape. It is necessary to take it out of a 3D GIS and into a much lower priced game engine. Only then can the model be freely navigated, manipulated, queried and indeed populated. Crysis at the time of writing retails for £24.99.

Sitting side by side yet somehow abstracted from mapping, gaming and digital earths is Second Life and other similar virtual environments. Second Life and their like are easy to dismiss as pure distraction and entertainment. Yet look under the lid of Second Life and it contains one of the most powerful geographical data visualisation kits available. Second Life represents one of the most successful social/visual environments 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 entirely by its users. The users have created a digital landscape primitive by primitive, with simple objects such as spheres, cubes and pyramids becoming the digital equivalent of bricks and mortar. In Figure 9 we illustrate our avatar manipulating the digital streetscape. Each section of the building is based on a simple rectified image aligned as to create a high-resolution representation of the entire building. Adding objects is as simple as dragging shapes into the environment and aligning and texturing accordingly.

We have been developing a series of geographical visualisation examples in Second Life on land kindly donated to us by the Nature Publishing Group. Our examples range from the 'global' view down to 'local' with an emphasis on real-time data feeds and data query techniques. Figure 10 illustrates a small section of our work.
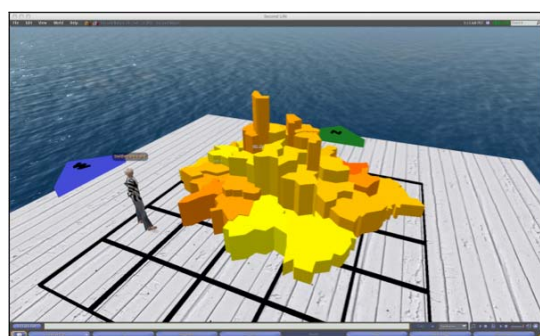
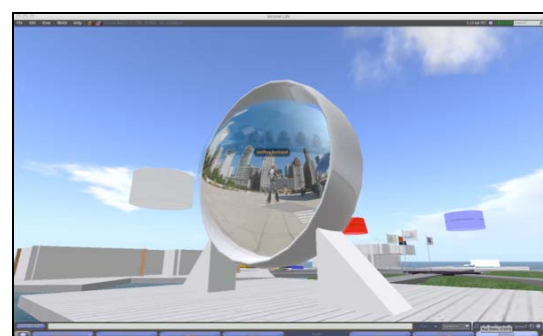**Figure 9:** Editing the Digital Streetscape in Second Life

A
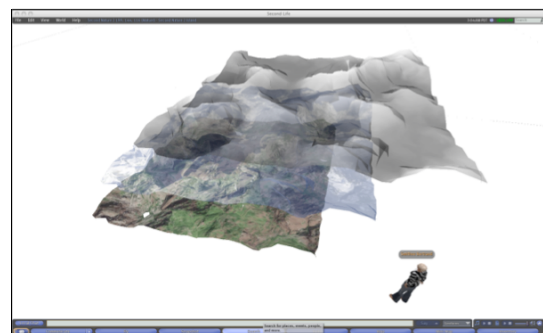
B

C

D

Figure 10: GeoVisualisation in Second Life

*A: Digital Earth with Real-Time Weather Data, **B**: Multiple Layer Geographic Surfaces **C**: Geographic Data Visualisation, Imported Direct from ESRI ArcScene **D**: Urban Sphere Panoramic Visualisation.*

Second Life is but the tip of an iceberg. It represents a glimpse into the future of digital geography, visualisation and collaboration in virtual space. 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 sorts of Google Earth and Second Life. These in turn move the digital toolkits we have today for constructing Mirror Worlds into a ParaVerse – a parallel virtual world geographically linked to the planet earth or other bodies in the physical universe. A working ParaVerse may seem some way off but a number of notable companies are working on the software as we type and a merging of the virtual earth combined with populated virtual space maybe closer than we think. This will be a true geographic machine space where the real and virtual are populated and vice-versa.

So where does this leave the world of GI Science? It leaves us with a wealth of new data, new ways to visualise it, tag it and query it in both two and three-dimensional space. April 23rd 2005 can be seen as the first wave of a new age of geographic innovation. Coming waves include the 'GeoCloud' whereby data, software and tools are held on remote servers accessible regardless of machine or location. In many ways this wave is already upon us with 'My Maps' existing in The Cloud. On site Geotagging is also of the moment and gaining in popularity via the iPhone 3G, Nokia N95 and alike with built in GPS and mapping tool kits. Combine The Cloud with location based services and Web 2.0 Crowd Sourcing and you enter the phenomenon of OpenStreetMap, OpenAerialMap. Day by day new services and tools are emerging. The list is becoming endless.

Such tools open up a cornucopia of possibilities for the world of GI Science, especially for geovisualisation and it is high time to embrace the Neogeographer, the data and perhaps more importantly the services they are creating. Welcome to the new world of geographic information.

Acknowledgments

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