

Building Space in the Machine:

Digital Tool Kits for Mirror Worlds

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Recent advances in technology have moved the construction of virtual cities and Mirror Worlds out of the research lab and into the hands of the general user. In this paper we explore tools to create digital cities providing examples from Google Earth through to Second Life and into Crysis. Finally we explore the merging of worlds such as Second Life and Google Earth into Second Earth and look into the potential of these emerging ParaVerses.

The ideology behind digital tool kits, virtual worlds and machine space 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 1992 science fiction novel *Snow Crash* in which life Neal Stephenson 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 virtual city, the rise of the digital earth, advances in computer graphics cards and the free availability of modeling software has made it easier than ever to virtually build urban form.

Through systems such as Google Earth, Microsofts' Virtual Earth and NASA's WorldWind virtual cities can be seen as the foundations for something all together more powerful, a virtual city that mimics the real world - 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 visualize are providing a digital sandpit for decision makers, architects, urban designers and the public at large.

The starting point is the move away from high end, often expensive tools for the construction of virtual environments towards freely available tools aimed at the general user. Typical of these are Google SketchUp and trueSpace from Microsoft, both aimed at adding user generated content into their respective digital earths and both available free of charge. The market place is changing with tools that were once running into thousands of Euros being refined and released free of charge to tap into the Web 2.0 world of social networks and volunteered geographical information.

Web 2.0 technologies and these new toolsets have combined to create a renaissance in geography, one that is becoming known as ‘Neogeography’. This is the geography for the everyday person using Web 2.0 techniques to create and overlay their own geo-tagged information on and into systems that mirror the real world. Essentially, Neogeography is about people using their own maps, creating their own cities and combining elements from other sources on their own terms. It is a new world of information whereby digital cities can be built, manipulated and indeed inhabited anywhere, anytime.

These emerging digital cities act as layers of information, a rich canvas onto and into which information can be inserted and extracted at will over the network. In essence they act as the ‘space inside the machine’, a space that can be iconic, photo realistic or multifaceted depending on a users preference. Hiller, (1996) defined ‘space as the machine’, in a Web 2.0 world we would argue that the ‘machine is space’ and with sprawling worlds such as Second Life, Active Worlds and Google’s Lively the space is growing by the second into a digital suburbia.

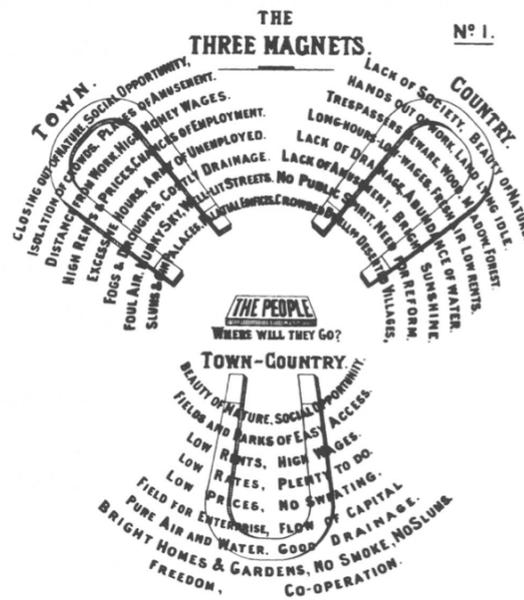


Figure 1: The Three Magnets ‘Where will People Go?’

Indeed it is timely to look back at the classic ‘Three Magnets’ from Garden Cities of To-morrow published in 1902 where the concept of suburbia was crystallized. The three magnets pull people between Town and the Country. Virtual Worlds and the digital cities contained within them are adding a new magnet to the equation – that of Town and Virtual Country. It is this new magnet that is key to the development of the digital world and its impact on the policies and design of the real world and its occupants ‘first life’.

Turning to the actual tools, in terms of pure visualization the production of photorealistic models of the built environment used to be a time consuming process. Indeed it was limited to the realm of professional photogrammetry, street surveys and

aerial calibration points. In today's Google-led world based on releasing free software with high levels of functionality combined with low levels of required expertise, it is now possible to produce a photorealistic model in under 30 minutes.

We don't have the space here to go into detail on how to use SketchUp but if you go to <http://www.sketchup.com> you can download the software and a series of simple start up tutorials. Figure 2 illustrates our 'Quadangle at University College London' a grade two listed building of complex architecture. Using SketchUp it was possible to build the model in a few hours and then simply 'save as' to add it into Google Earth and share it with the rest of the world via the 3D Warehouse.

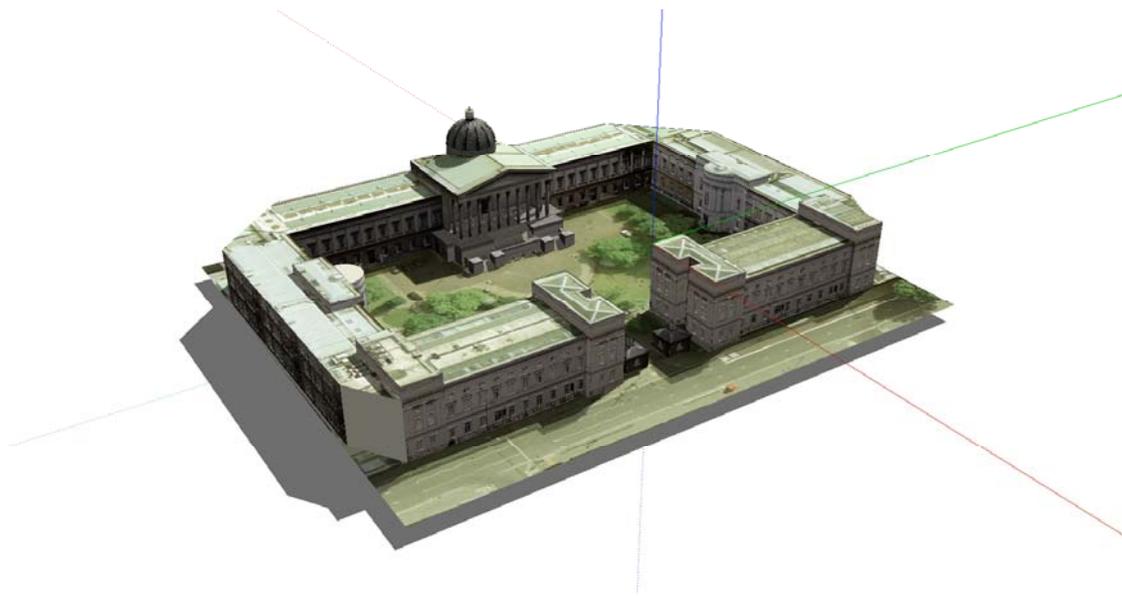


Figure 2: Modelling in SketchUp

Sketchup both in content and concept links direct to the 3D Warehouse (<http://sketchup.google.com/3dwarehouse/>), Googles' user created repository of 3D models. The 3D Warehouse is crowd sourcing for the digital city in its purest sense. Creating and populating Google Earth is expensive and time consuming, especially in terms of 3D models, the 3D Warehouse allows the public at large to build the city at the level of individual buildings, slowly but surely contributing to complete coverage of a digital earth. To date there are over 200,000 models in the warehouse, each one available to download, modify or convert as one sees fit.

Side by side the development of accurate geography and location of digital earth based cities is the arguably more powerful world of the game engine and fantasy architecture. The availability of powerful gaming engines is partly driving this emergence 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 'mod' community. Game Engines in many ways represent the cutting edge in desktop graphics technology and the ability to import models into 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 cityscapes. Figure 3 illustrates our Virtual

London model running in the Crysis Engine allowing real-time lighting, shadow and object manipulation.



Figure 3: Virtual London Model in the Crysis Game Engine

Sitting side by side yet somehow abstracted from both the 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 city building 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 kilometers of simulated computer space, it now covers more than 750 square kilometers. 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 4 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.



Figure 4: Editing the digital streetscape in Second Life

Second Life is but the tip of an iceberg. It represents a glimpse into the future of digital cities, visualization 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 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 machine space where the real and virtual are populated and vis-versa.

The availability of free tools to build the digital environment takes away the previous restriction of many developers, that of cost. It is now possible to build, view and inhabit mirror worlds with a level of realism to increasingly blur the real from the virtual. Such worlds open up a cornucopia of possibilities for policy makers, designers, academics, students and interested parties alike.

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