The Hong Kong Polytechnic University
Faculty of Construction and Land Use
24 October 2006

Virtual London

3D GIS, Multimedia and Public Participation In a World City

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University College London

Outline of the Lecture

- Beginning with Models. What are Models?
- A Little Bit of History: What is a Virtual City?
- How We Build Virtual London: GIS and CAD
- What Is It For? Design of Many Kinds
- The Model as It Is Now: *Google* and Beyond
- Models inside Models: Avatars, Games and Virtual Worlds
- Back to Reality: Fabricating the Material World
- Next Steps: Questions?

Beginning with Models. What are Models?

Let me begin by telling you a little about ‘models’.

A model is a simplification of reality: we work with them all the time but in the last 50 years they have become central to our vocabulary.

Models are abstractions – whatever we do, we abstract and simplify and thus we can define a model of anything. We learn from such simplifications, as we learn from ‘toys’.

The models in this lecture are iconic models.

One of the key issues about city models is the media in which we can represent them. 50 years ago, when we build models of cities, they were made of traditional materials.

The transitions is now to digital media. And once we build the model digitally – in data and software – we can manipulate it over and over again. We can change it at will and much of what I say will be about the power to manipulate such models.

We can second guess the future. We can experiment on the city without changing it for real. We could not do this with traditional models.

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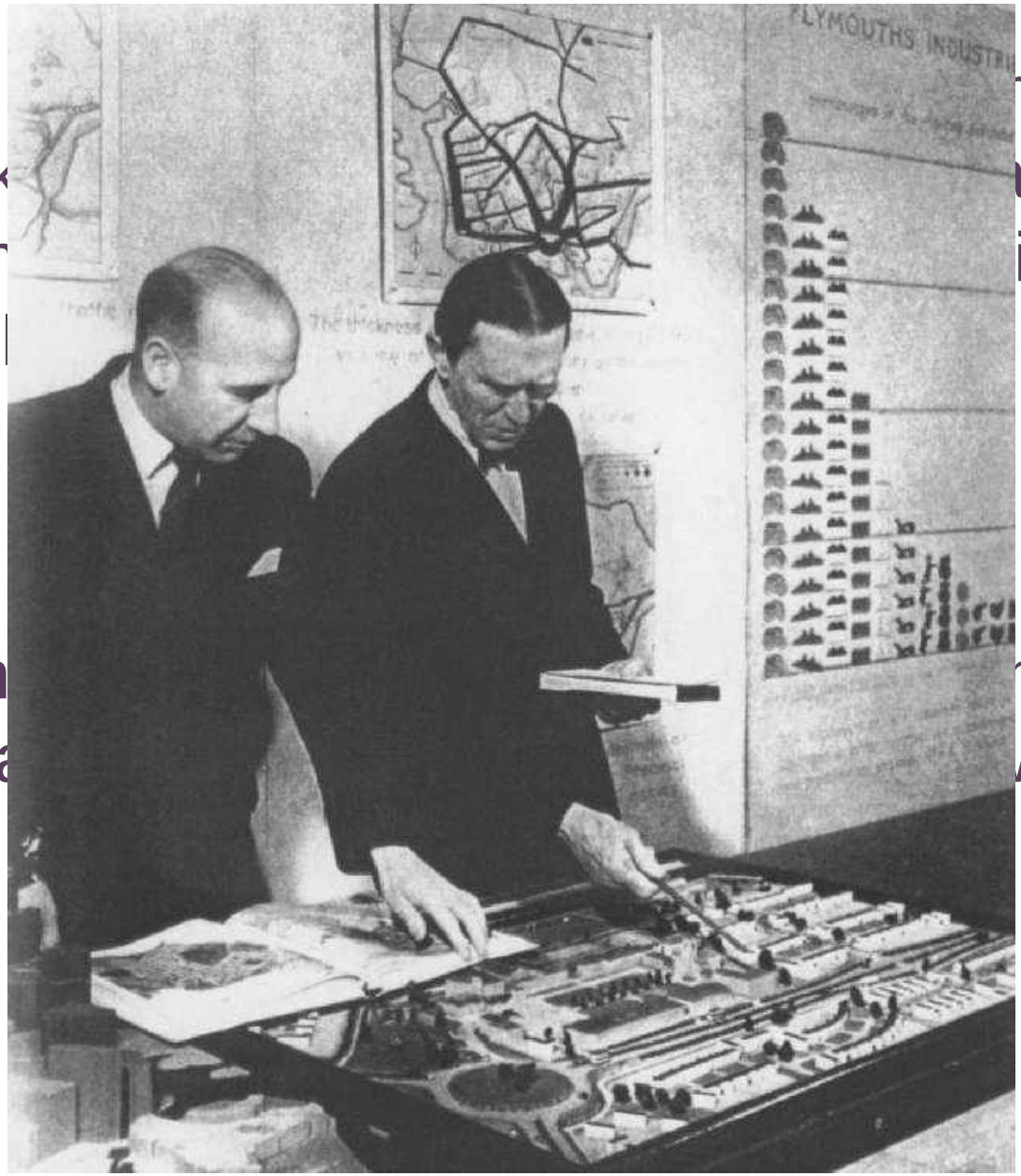

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Traditional models are beginning to scale up:
here are some of those being used to visualise and discuss what is going on in Central London and Docklands.

But here is what computers can now do …

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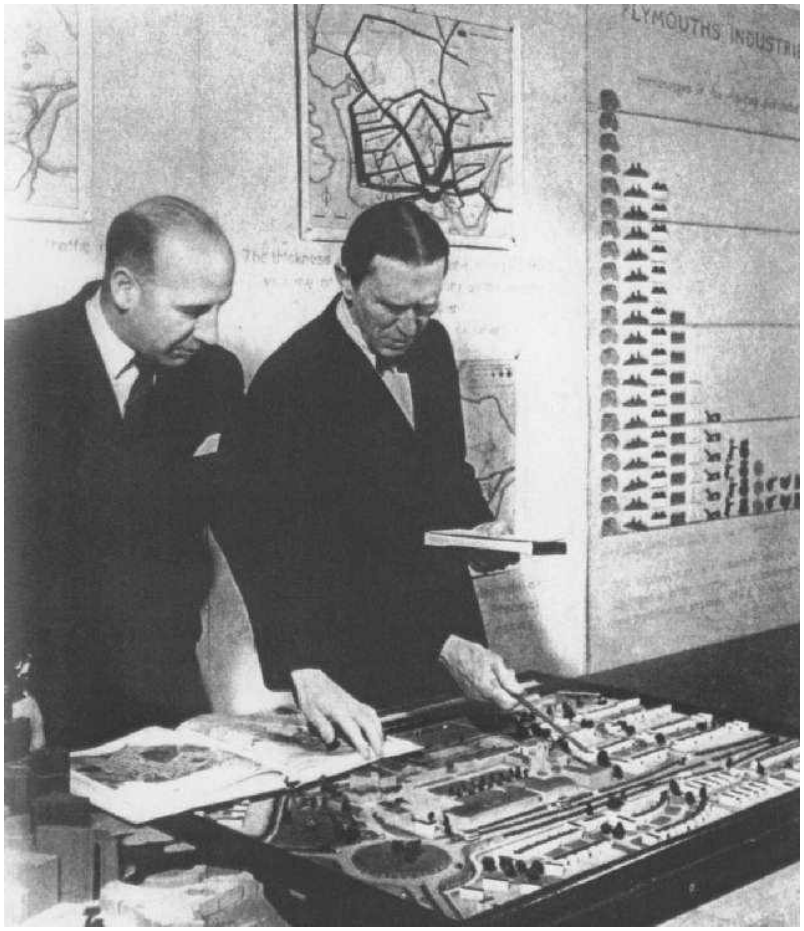
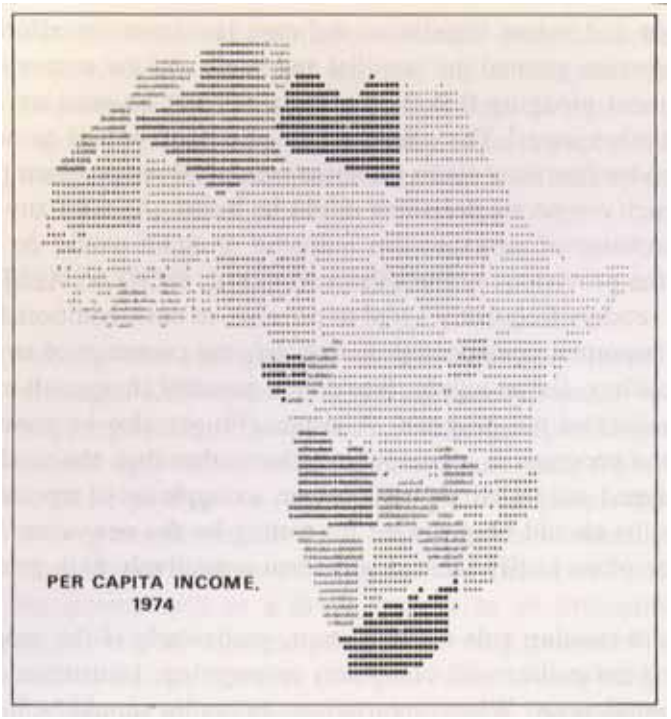


How do we get from here to there?

A Little Bit of History: What Is a Virtual City?

Almost as soon as computers were invented, people began to experiment with using them for graphics. Maps were printed using line printers for example. Here are some examples.



Program 1.1 'Mickey Mouse' line printer program-plot
© 1987 The Walt Disney Company

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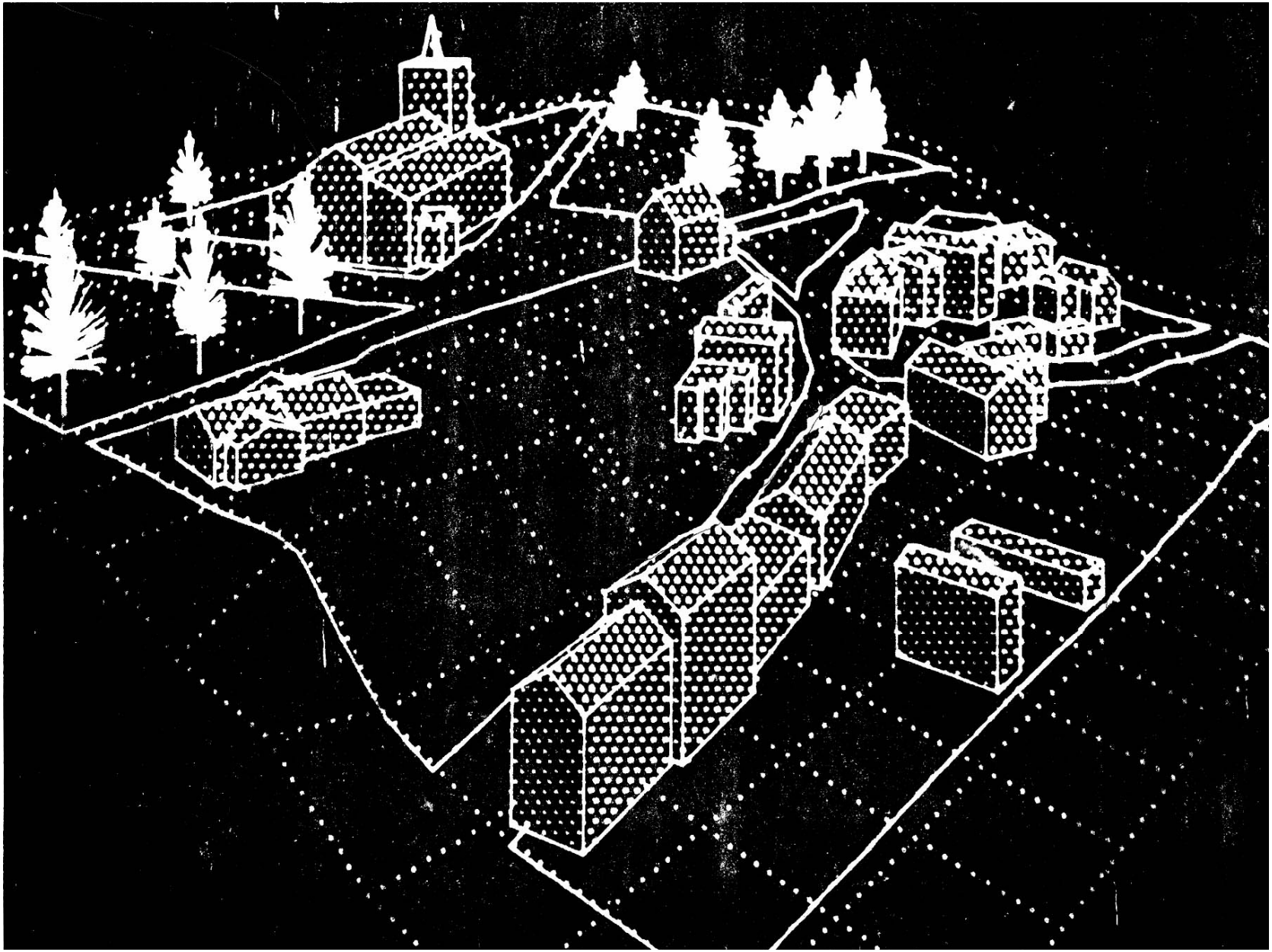


What are Virtual Cities? Digital representations of some aspects of the city – and they can range from web pages that advertise the services of cities to CAD models that represent the city geometry

A key feature is how they are delivered to the user – either on the ‘desktop’ or the ‘web’. Here we will mainly assume we will deliver these models to many people across the internet, rather than to single users on the desktop

How they are designed depends on purpose, use and who the users are.

We will come to the issues about users soon but first let us sketch some ideas about what such a virtual city is. Virtual cities:

- represent data about a city (which can include plans for the future)
- view that data in literal visual fashion, as 3D, a various kinds of media, and even as abstract conceptions
- provide a means of communication which is as wide as possible, and currently implies the internet as well as the desktop, but could in time comprise hand-held devices all the way to grid computing

How We Build Virtual London: GIS and CAD

Let me suggests some generic issues related to building virtual cities, and then I will show you a few of the key elements we have been using.

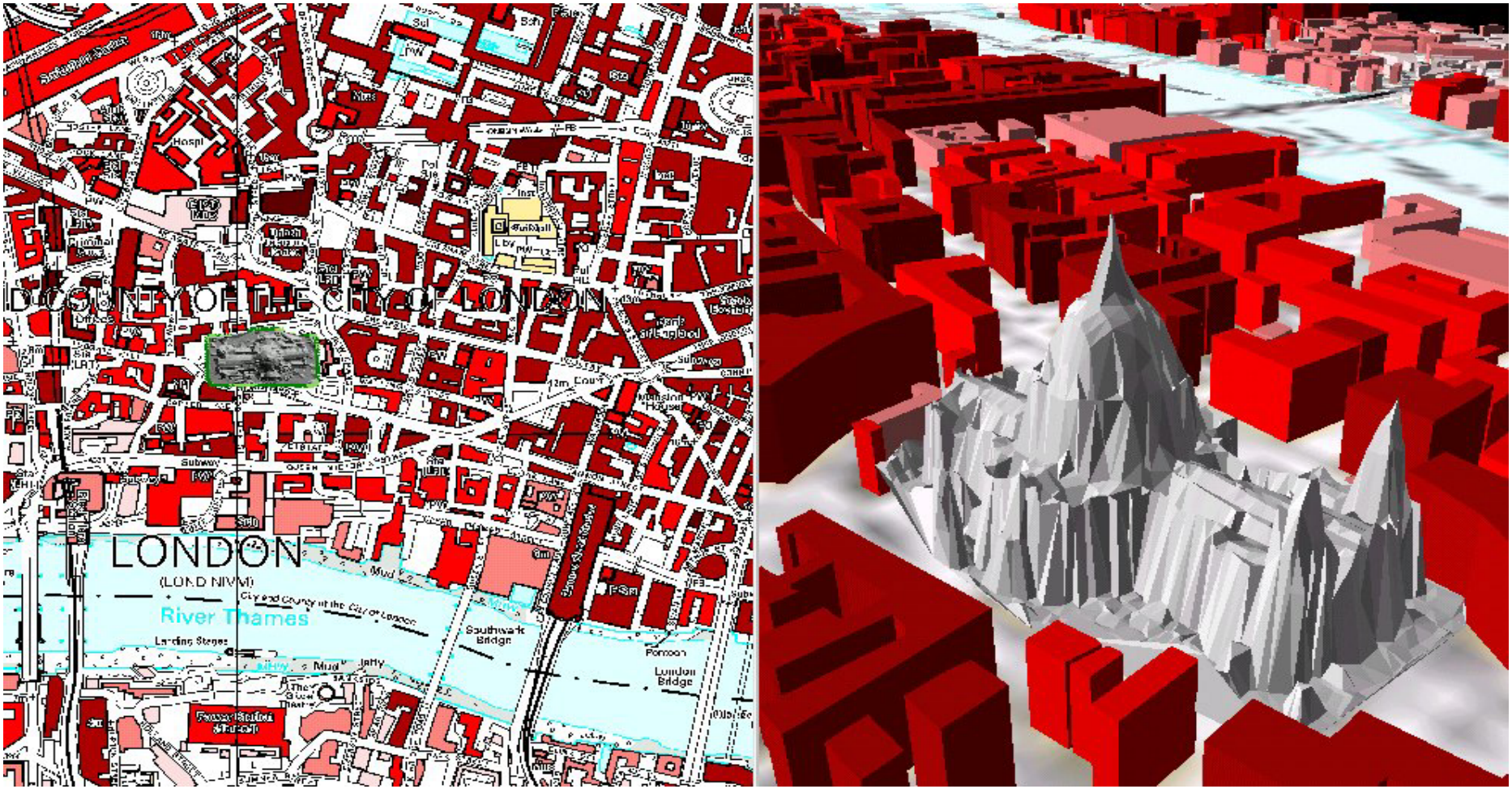
Then I will show you the model, circa 2003, which is our model of ‘central’ London.

In terms of our framework, we have a basic digital model where the surface representation of the city – its geometry – is the ‘filing cabinet’ or ‘container’ for its geography

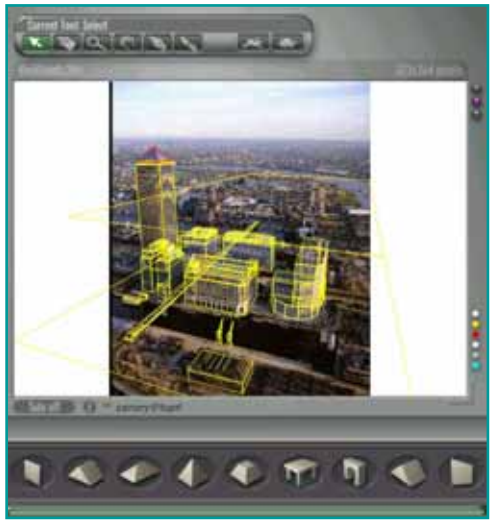
From this data base, we can visualise the city in many different ways – which we refer to as products for example

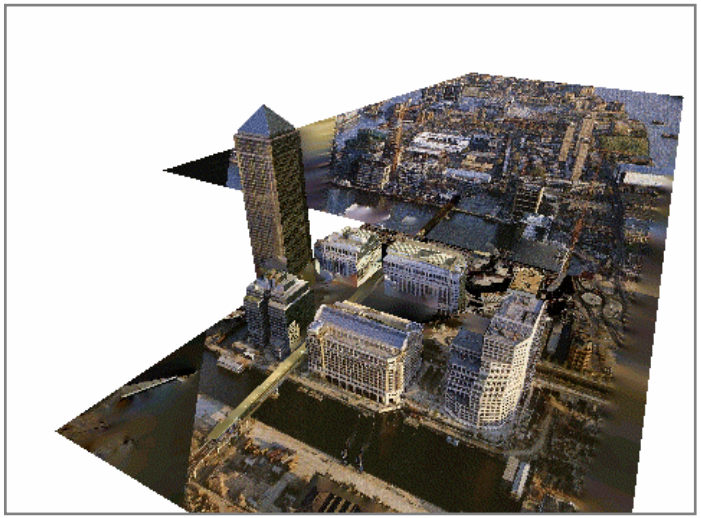
- As a full blown 3D GIS, and/or as a CAD model
- As various kinds of multimedia which are combined with the 3D model – such as photorealistic panoramas, zoomable maps and so on
- As hard copy products – as maps and printed 3D copy

Once we have a digital model, we can replicate it in different environments – on the net, on the desktop, as movies, and as hard copy.


LONDON
(LOND NIVM)
River Thames
Southwark Bridge
London Bridge

We use a lot of photorealistic rendering to detail the buildings – these are photogrammetrically correct, and we use rapid wire frame software to sketch such media into the block model e.g.





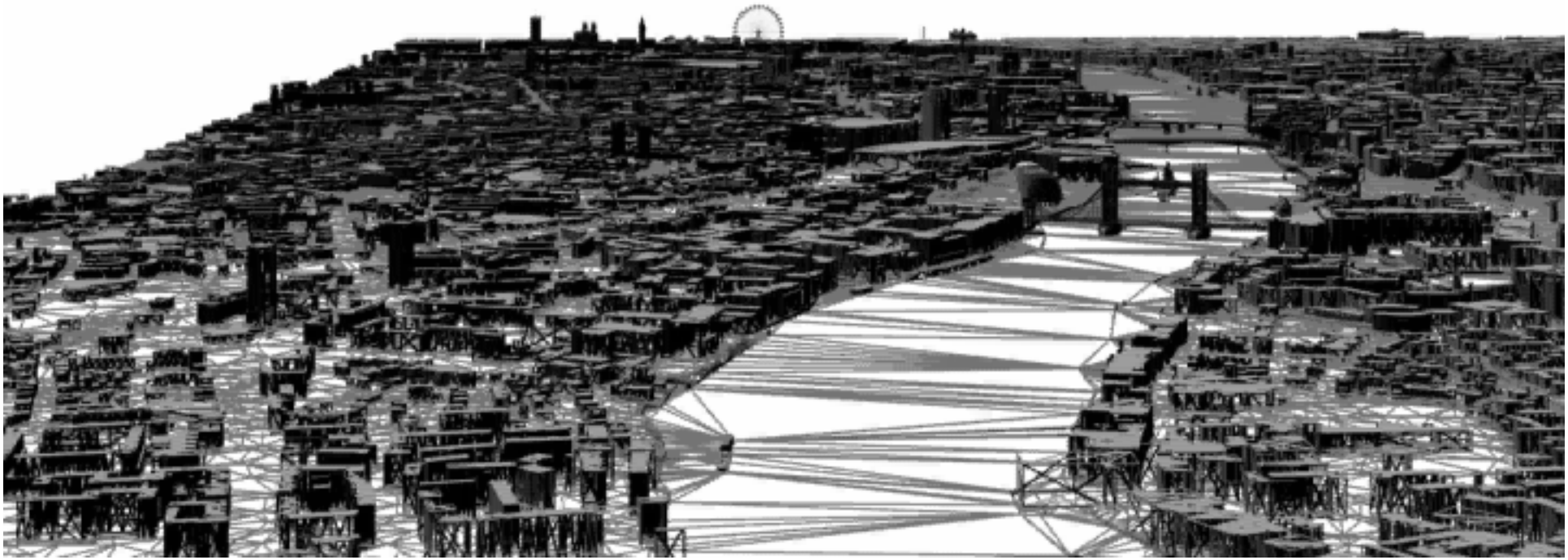
We use digital panoramas to embed in the GIS

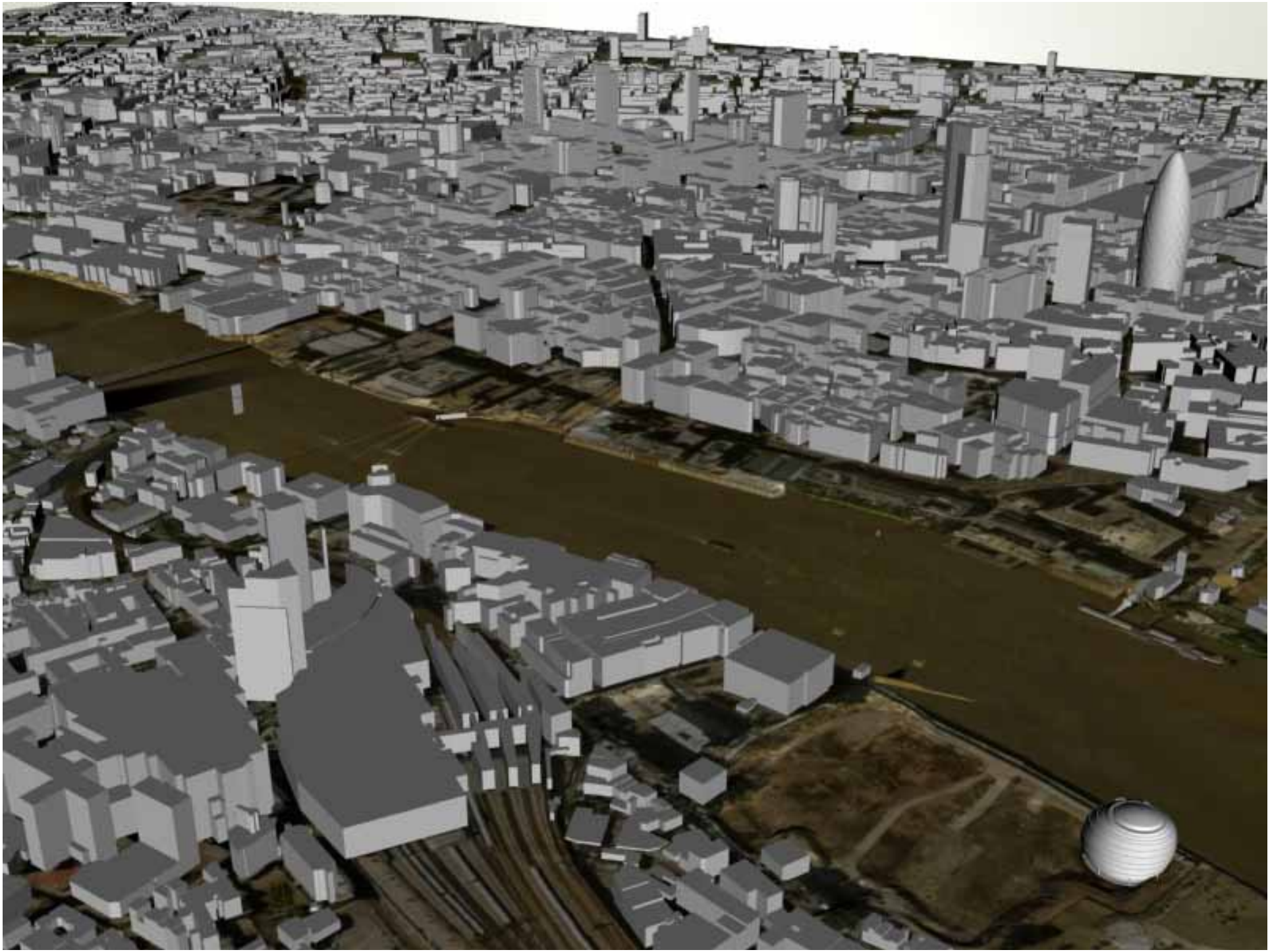
and we use these virtual world technologies to deliver the model in virtual exhibition spaces, virtual art galleries and so on.

I will now tell you how we built in layers.

First we develop a DEM – DTM digital terrain model from InfoTerra LIDAR, then we drape the Cities Revealed aerial photo of London. Then on top of this, we layer Ordnance Survey MasterMap vector parcel data on this and we extrude the parcel and street data to the heights from the InfoTerra LIDAR data.

This gives us the skeleton and we color the frame as blocks. We have ~50000 buildings over 20 square kilometers modelled. We then slot in the 30 or so detailed rendered buildings from CAD.



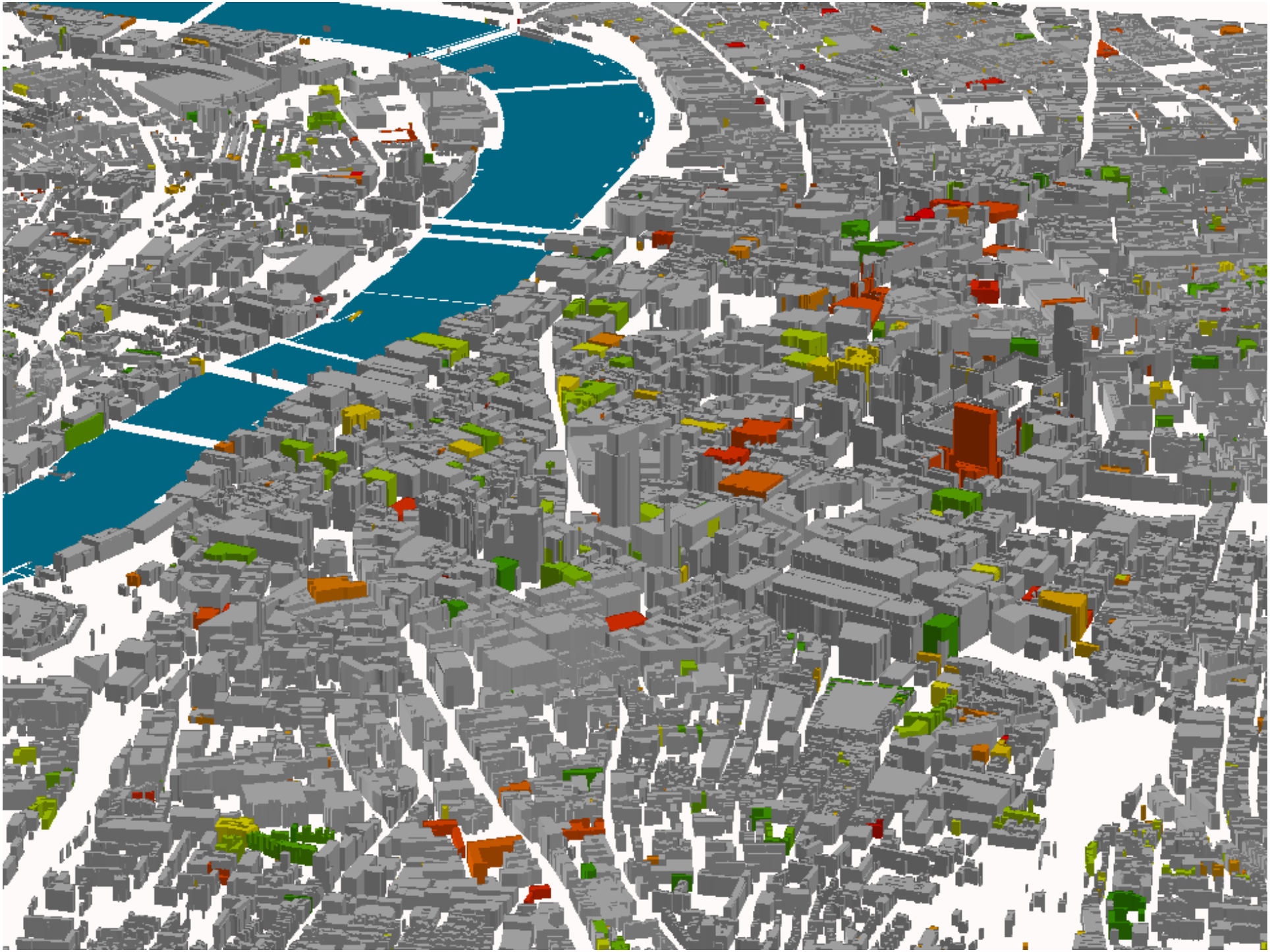


What Is It For? Planning of Many Kinds

Our model can be used for almost anything you wish to do in cities that involve understanding it or planning it.

First Complex Queries – this is a data base.

How about: “Show me all the buildings owned by Japanese Banks within 10 minutes walk of Bank Station which have view of Tower Bridge?”

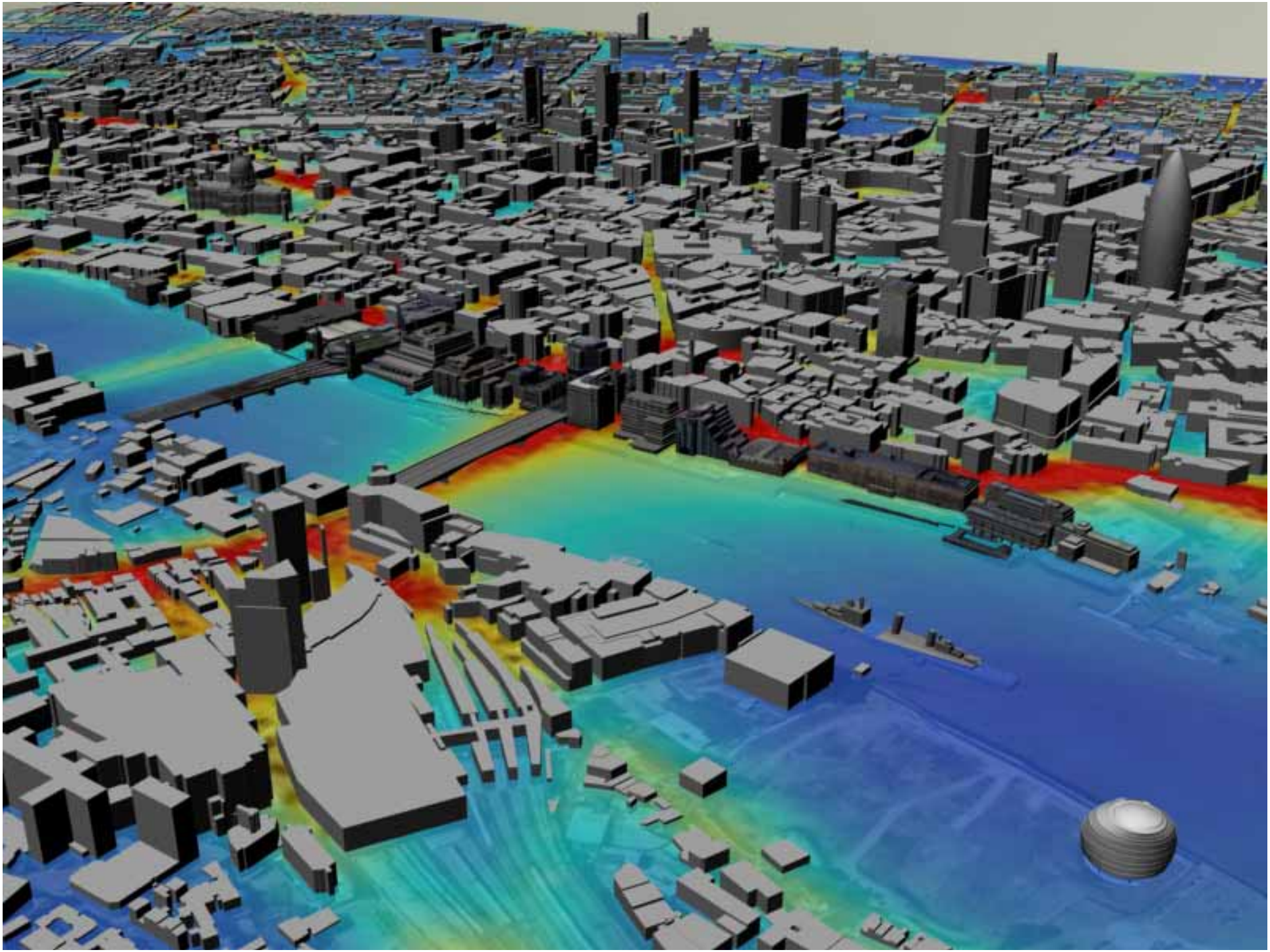


Second New Layers:

Flooding: what happens if the Greenland Ice cap Melts and the North Atlantic rises by 10 meters?

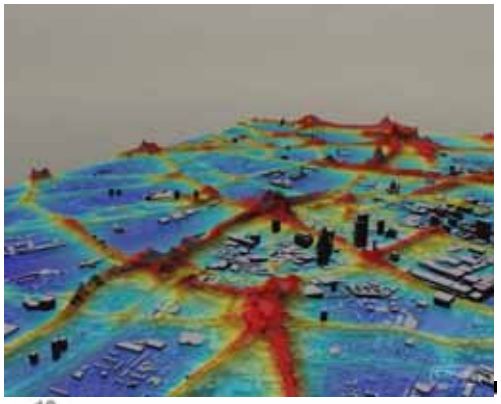
Air Pollution: can we show air pollution in the model?

What can we see if we put a new high building into Central London and break the 50 year old policy that St. Pauls cathedral should not be overshadowed?

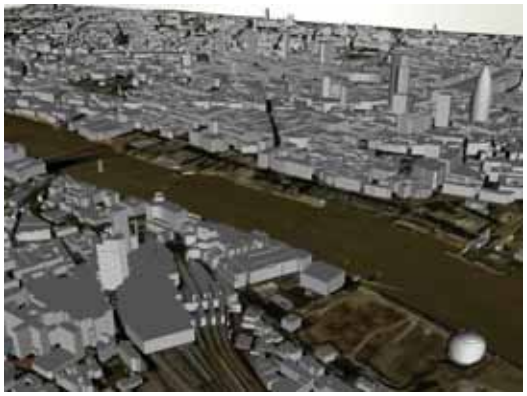


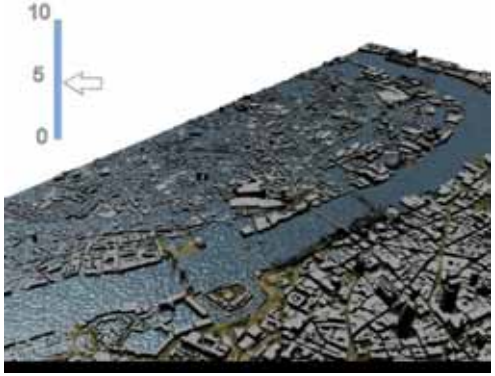
Let us see some applications – air pollution flooding and the impact of high building

Pollution



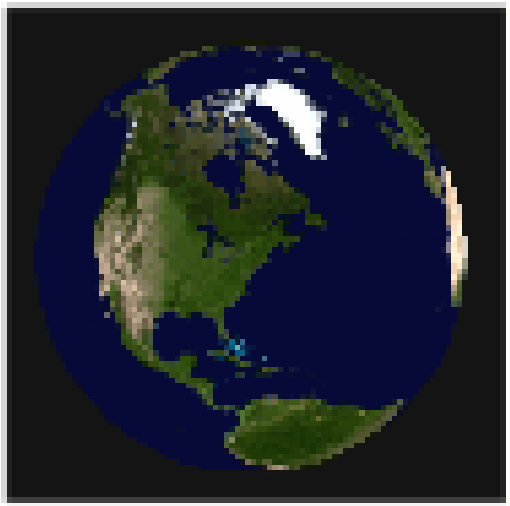
High Buildings Swiss Re





Flooding

And in Virtual Earths



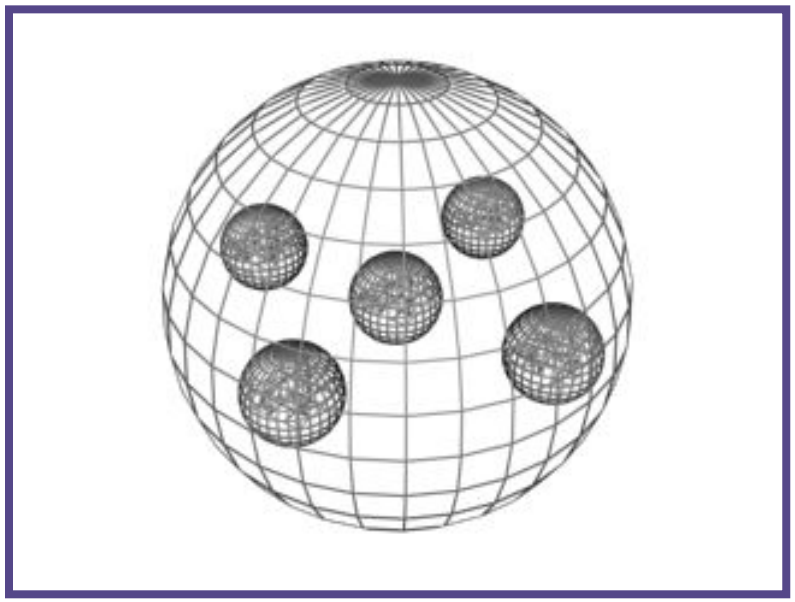
which we show below

Into this 3D GIS, we add other kinds of media – mainly panoramas and zoomable maps which enable us to add greater realism – seamlessly – as well as greater abstraction.

My purpose is not to detail what this model is but to simply make the point that once we have different media, we can embed it into other.

Here are some pictures of how we embed panoramas into each other. If you go to one of our web sites, there are some movies:

http://digitalurban.blogspot.com/



Panoramas

The Model as It Is Now: Google and Beyond

These kinds of virtualities are not mere speculations for the few for new spatial infrastructures are emerging which might make these notions accessible to a much wider audience.

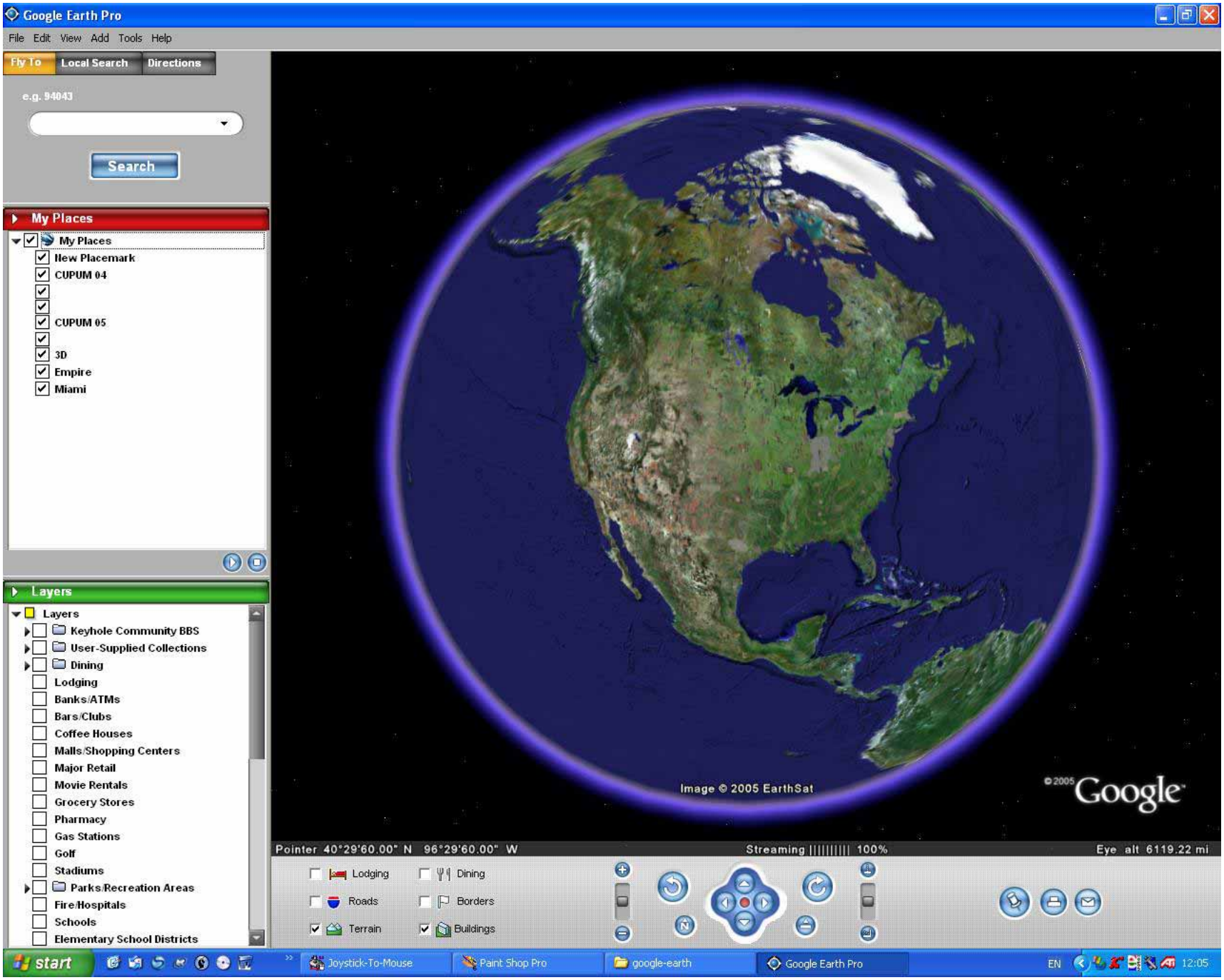
Already there are many thousands of users of virtual worlds and these technologies appear to be posed to enter all kinds of more conventional forums such as e-commerce and e-government.

The most recent is ***Google's*** Earth

We have a very neat use of the model using this ‘free software’. We now have the model out to the m25 orbital road with 3.1 million building blocks.

The 33 London Boroughs generally do not have the software to run this model but they do have the copyrighted OS data. London Connects have bought the LIDAR data.

So using Google Earth we can deliver the model ‘free’ to all local authorities in London: they currently have it. Can they use it? That is an educational issue. But here is what they have.


Google Earth Pro
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Miami
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User-Supplied Collections
Dining
Lodging
Banks/ATMs
Bars/Clubs
Coffee Houses
Malls/Shopping Centers
Major Retail
Movie Rentals
Grocery Stores
Pharmacy
Gas Stations
Golf
Stadiums
Parks/Recreation Areas
Fire/Hospitals
Schools
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Models inside Models: Avatars, Games and Virtual Worlds

My last foray into virtual cities is to embed different media into other media which can only occur when digital objects are placed in different environments from the one in which they were created.

The best examples of such environments constitute virtual worlds and games in which various media can be added and in which the users appear as avatars.

We can take our digital model – our virtual city and place it in such a world. This is a little like taking the model and placing it within itself as a scaled down version.

In short, we can take our virtual city and place it as an object within another digital space, for examples fashioned as an exhibition space. The model can this be viewed as it were a tangible object – which it is not – but in a space that appears tangible – which it is not and so on …….

This gives those using the model a different sense of how it might be used.

It may appear in more familiar ways, one might engage in dialog with others through the virtual world in which it sits, and one might treat the world as a virtual design studio.

Here are some pictures of what is possible with the first shots simply of creating such a world of avatars and populating it with the simplest of digital objects

index.gif - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://www.casa.ucl.ac.uk/atmos/ Go Links

Google Search Web 86 blocked AutoFill Options

LONDON

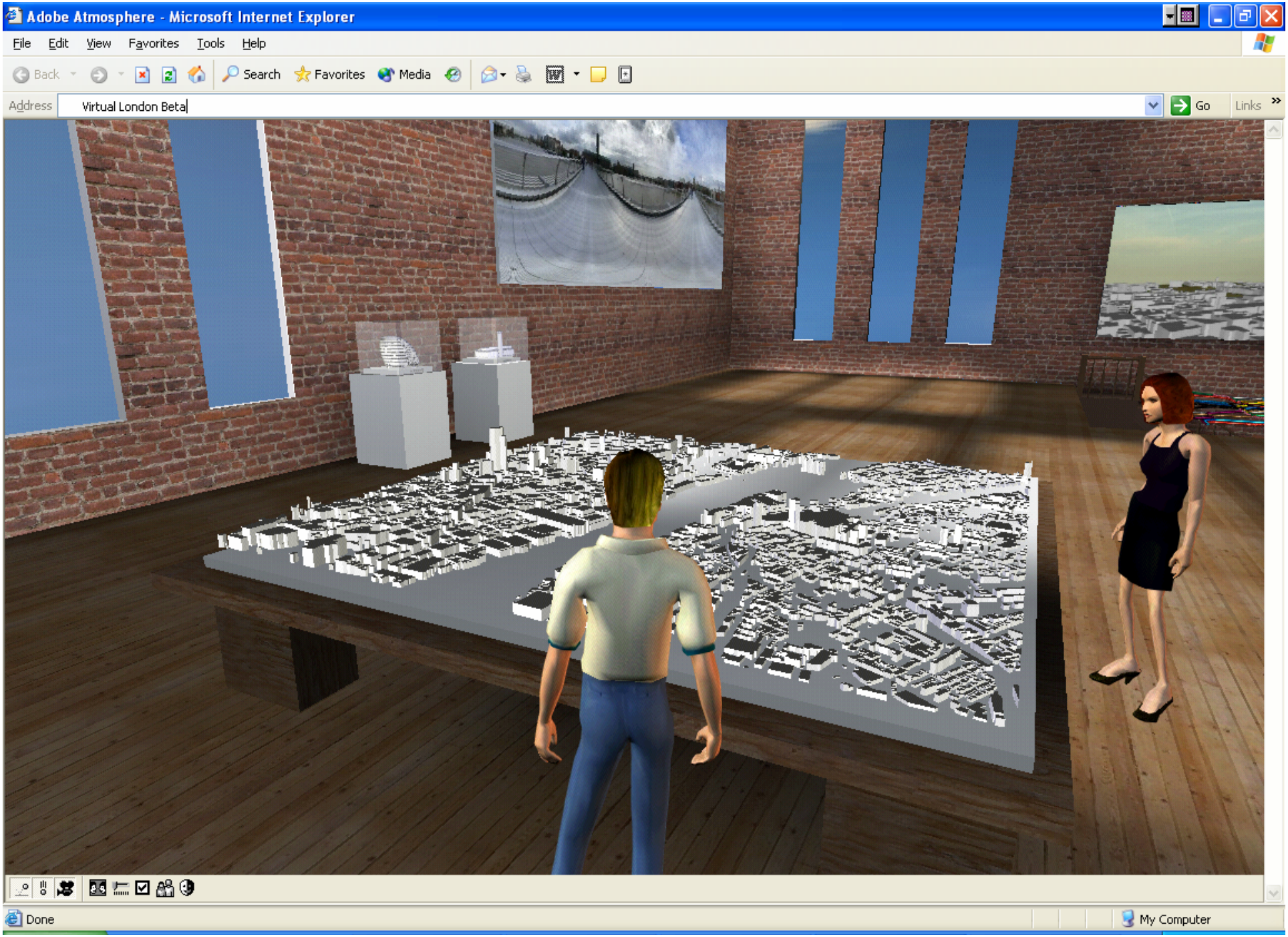
Use your arrow keys or mouse to move in the Virtual World.

To tilt your view, hold down the Ctrl key, and use the arrow keys or mouse.

Welcome to the Virtual London 'multi-user' gallery. If its your first visit the software will automatically install on your machine. Its simple to use and provides and insight into the development of Virtual London at the Greater London Authority.

Virtual London was developed at the Centre for Advanced Spatial Analysis, University College London. Please contact asmith@geog.ucl.ac.uk for help or further information.

We can show a movie of this


Adobe Atmosphere - Microsoft Internet Explorer
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Go Links
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My Computer

Real and Virtual Design Studios

And then there are games:

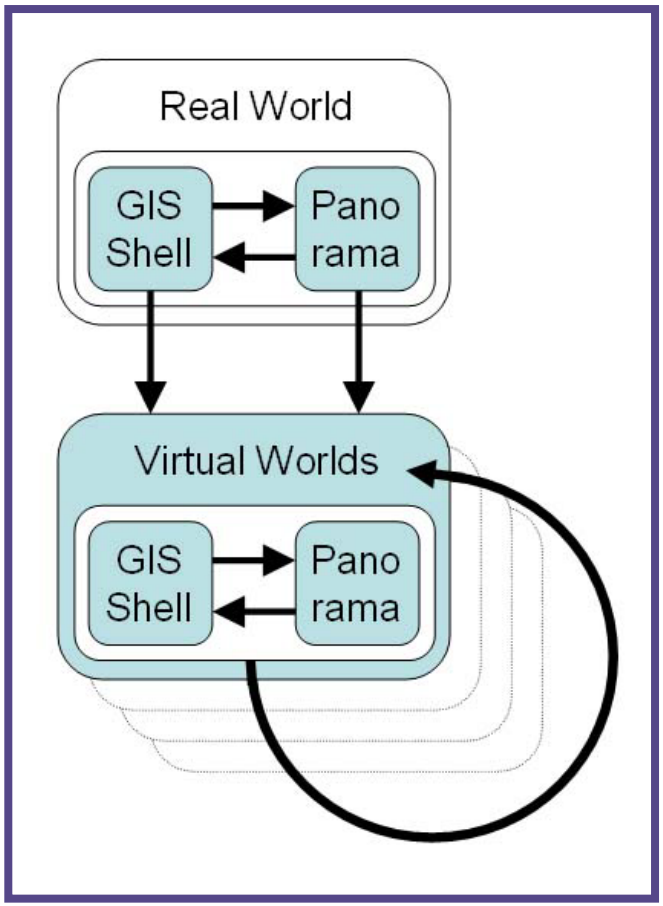
We are putting CAD and GIS media into Game Engines and recently we have put various CAD files into ***Oblivion*** – realising the power of the animation. Our Virtual UCL model which is a bit of Virtual London but very highly rendered is of this form.

Let me do one last thing before we change tack completely

We have moved from the real to the virtual but with these physical models, we can move from the real to the ideal. We can use our GIS-CAD models to explore future forms quite easily by cut and paste, just as the great modernists like Le Corbusier did in his Plan for Paris and as Frank Lloyd Wright did in Broadacre City.

Here are is a musing from my colleague Andy Hudson-Smith

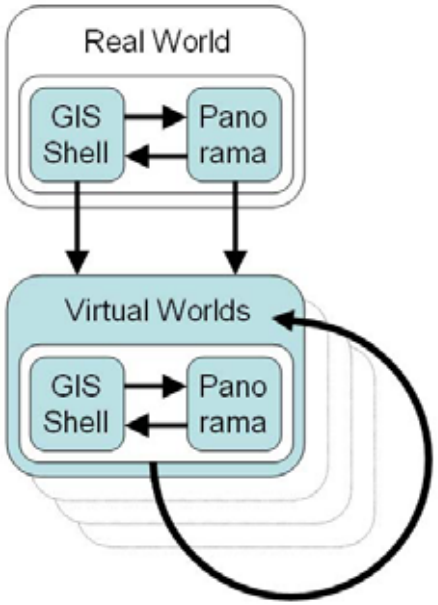
What are we doing here? We are putting our media into different worlds and in principle we can embed anything into anything else once we have it digitally.



To summarize …

We build a virtual city as a GIS Shell, populate it, and add different realistic digital media.

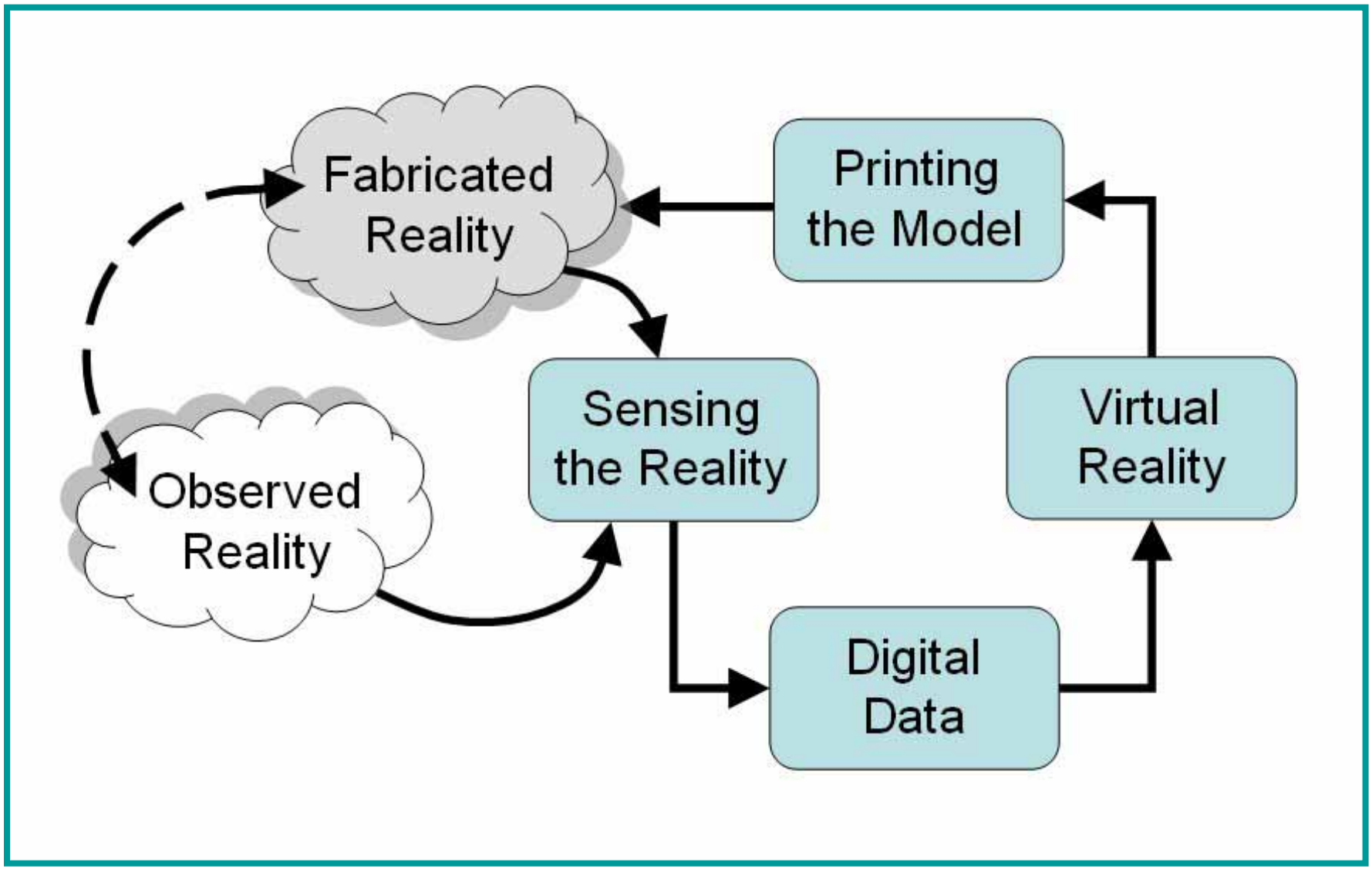
We can then embed this Shell and media into a virtual world, which in turn we can embed within another world, with each interaction enabling an explosion of possible realities or virtualities.


Real World
GIS Shell
Pano rama
Virtual Worlds
GIS Shell
Pano rama

Back to Reality: Fabricating the Material World

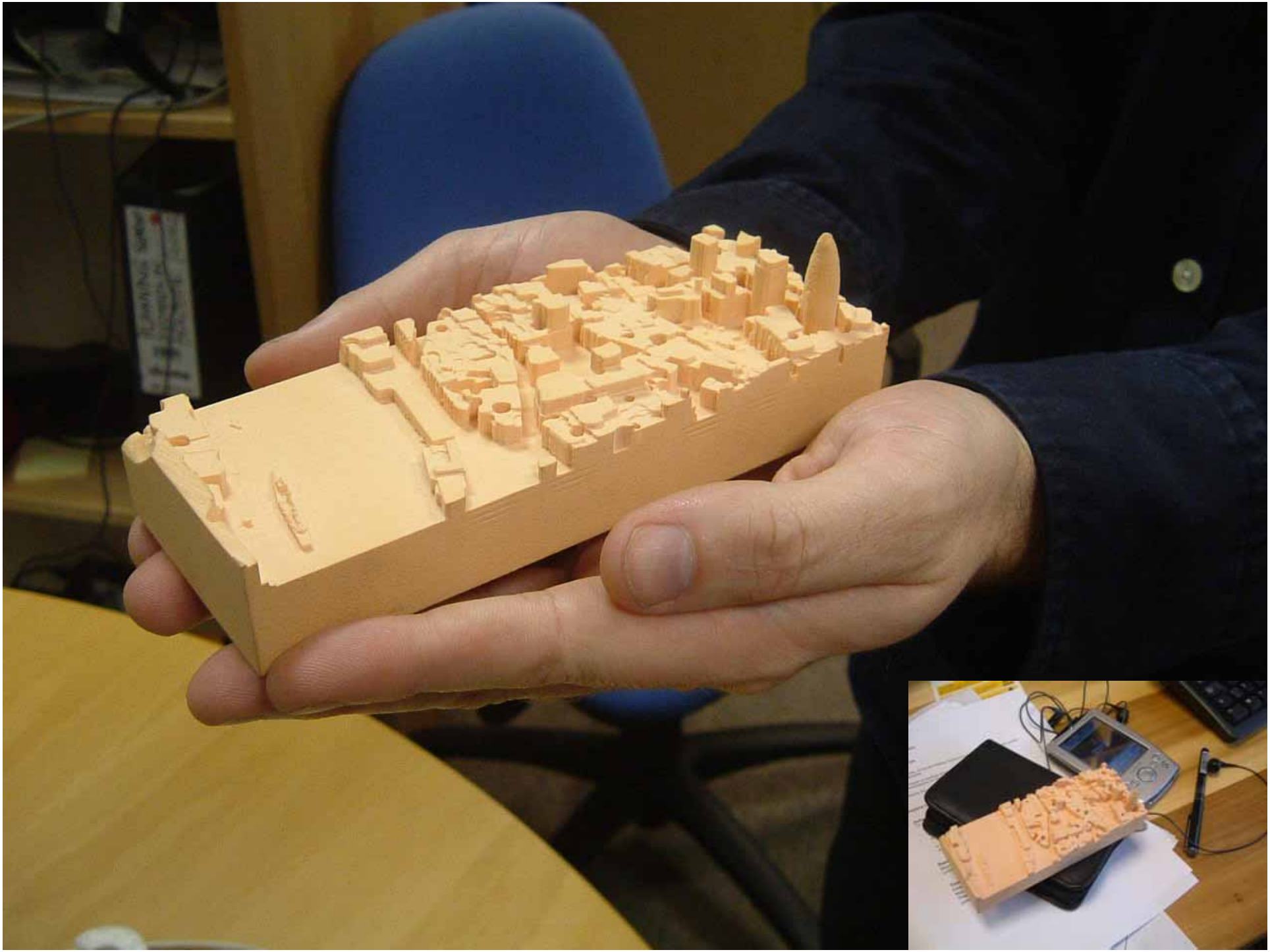
So far, we have moved only one way – ever deeper into digital worlds, but we can move the other way. We can use the digital world we have created to fabricate or manufacture a world in material terms.

This may be closer to the world from which the digital objects and their environment were created in the first place but it is not the original world and in this sense, diverges in a different way from it.

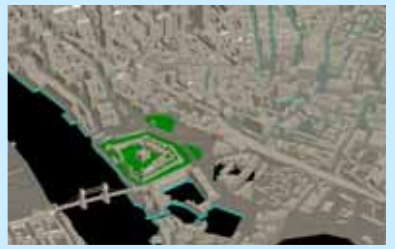


Moreover we can the take this manufactured world and create other digital worlds from it, and so on ….

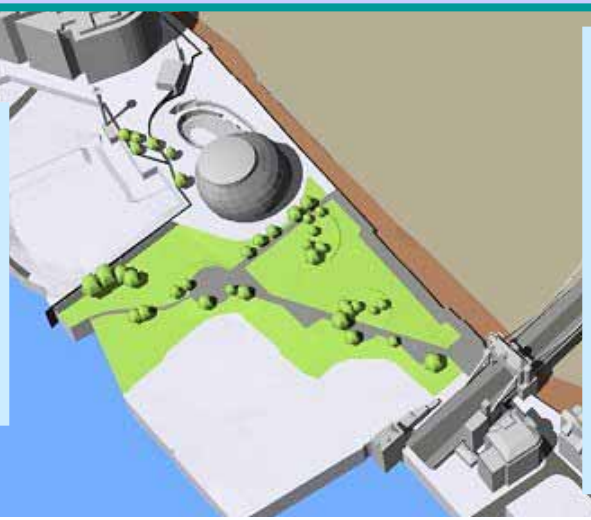
Hard Copy from Soft Copy: Printing Bits of Virtual London

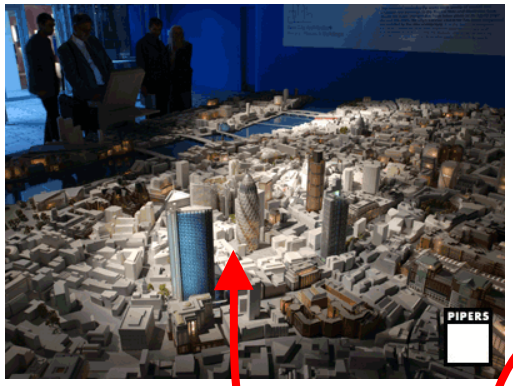


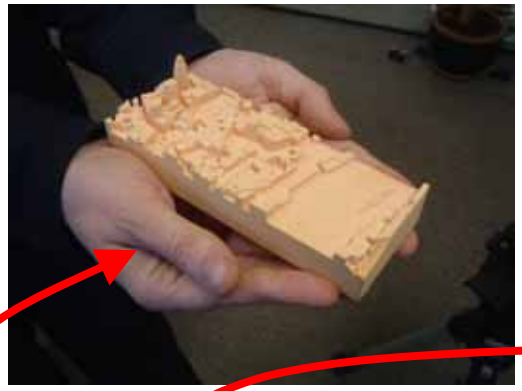
Other Virtual London's

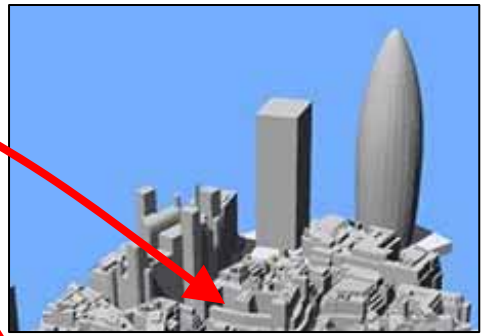


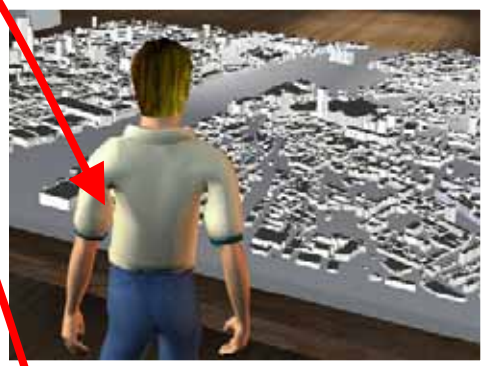
Delivering the Simulacra: Desktop, Web, CAVE, Theatre, Hand-held, Touch Table, Holograph and so on …. Over the net or wirelessly … Many other plays on this theme of recursion that we don't have time to develop here but they are relevant ……..











Fabricated
~~Reality~~
Realities

Sensing
the Reality

Observed
Reality

Multiple Fabricated Realities

Next Steps

Phases 1 & 2 – the digital model is complete and has been delivered to the Boroughs, but we need to figure out how it can be used professionally

Phase 3 – delivering products to web and desktop as movies, bits of the model in VRML – through a Virtual London Portal

Putting in the Overground and Underground, inside buildings

Populating the model with socio economic data

Providing a skeletal framework for individual populating of the blocks with detailed rendered buildings

Adding new functionality to the 3D GIS – accessibility analysis in 3D – viewshed analysis

Building user interfaces for sketch planning and urban design

Adapting the portal to different types of users with different expertise…. And so on, and so on. A million things to do to make it more realistic and usable…

CREDITS

Centre for Advanced Spatial Analysis

The Architects of Virtual London: *Dr. Andy Hudson-Smith & Steve Evans*

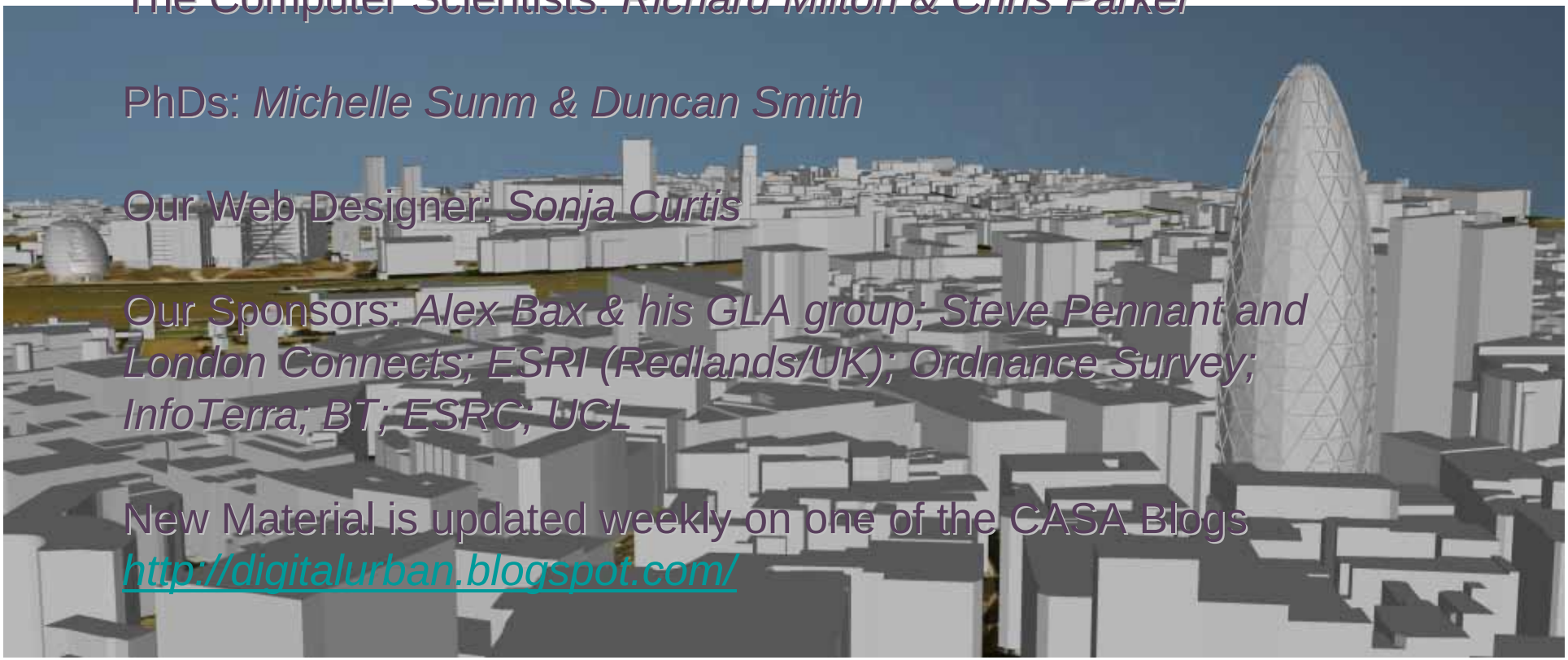
The Computer Scientists: *Richard Milton & Chris Parker*

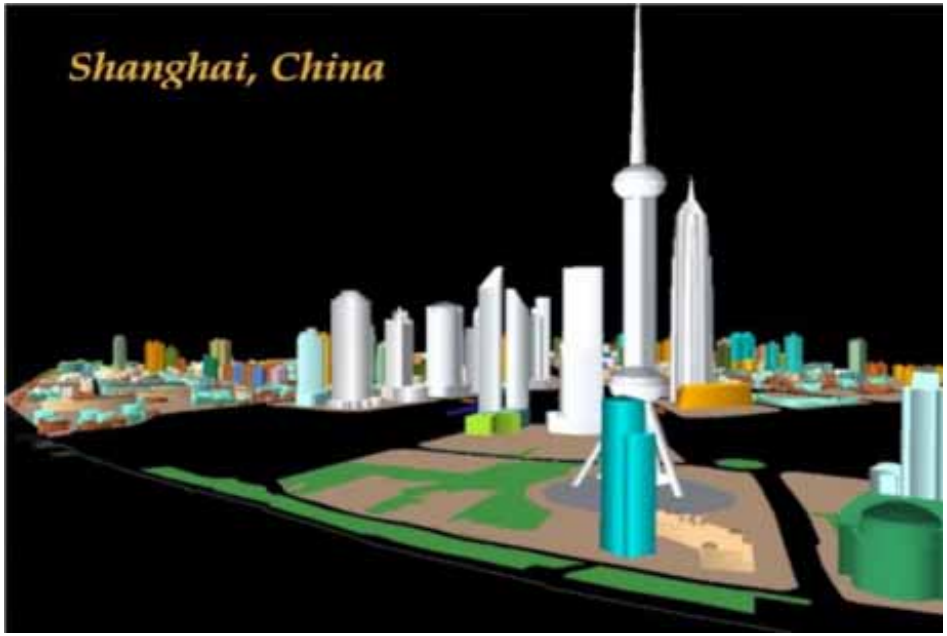
PhDs: *Michelle Sunm & Duncan Smith*

Our Web Designer: *Sonja Curtis*

Our Sponsors: *Alex Bax & his GLA group; Steve Pennant and London Connects; ESRI (Redlands/UK); Ordnance Survey; InfoTerra; BT; ESRC; UCL*

New Material is updated weekly on one of the CASA Blogs
http://digitalurban.blogspot.com/

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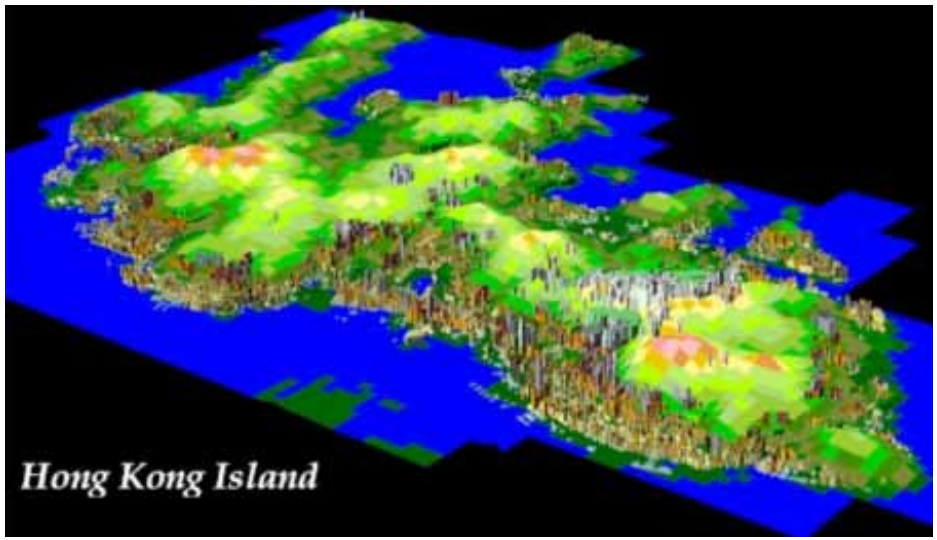
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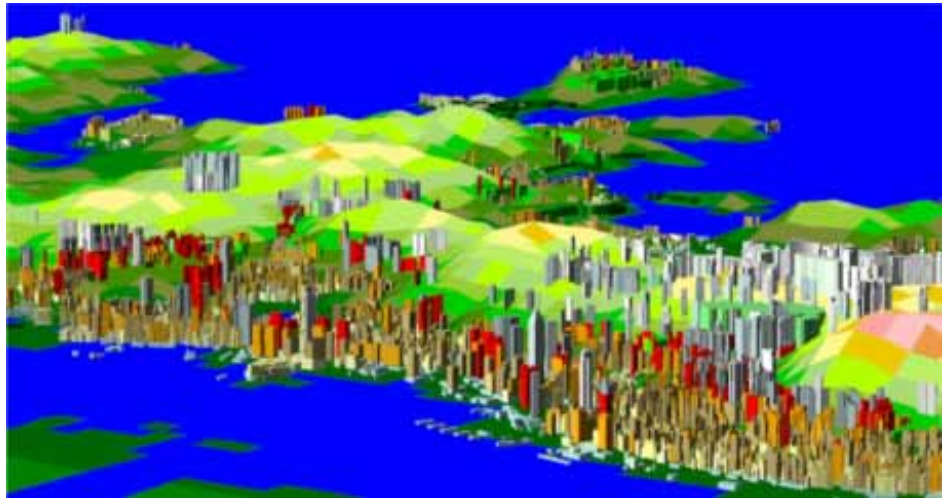

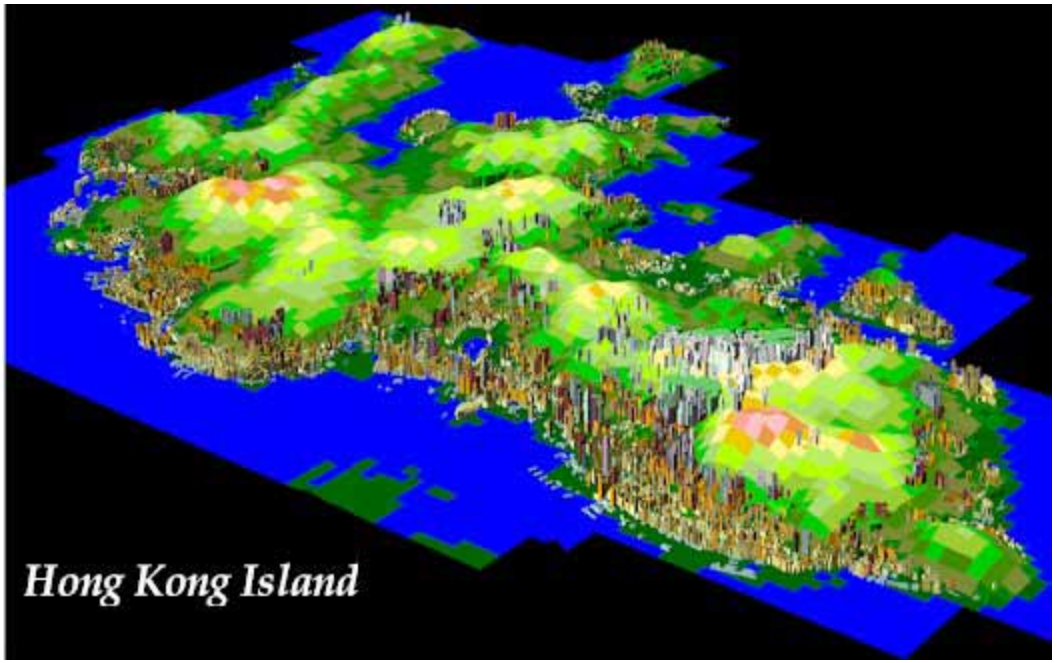
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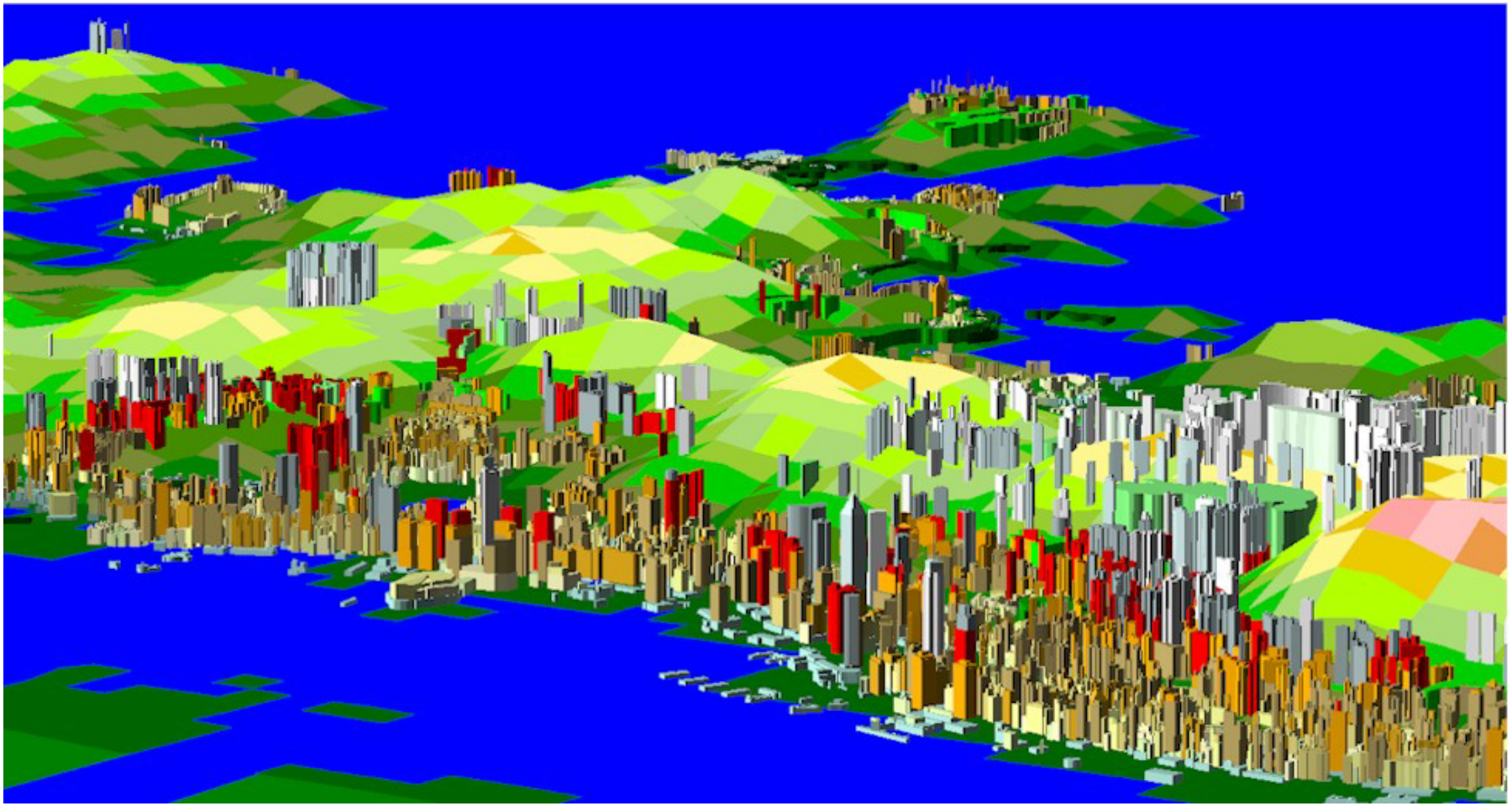

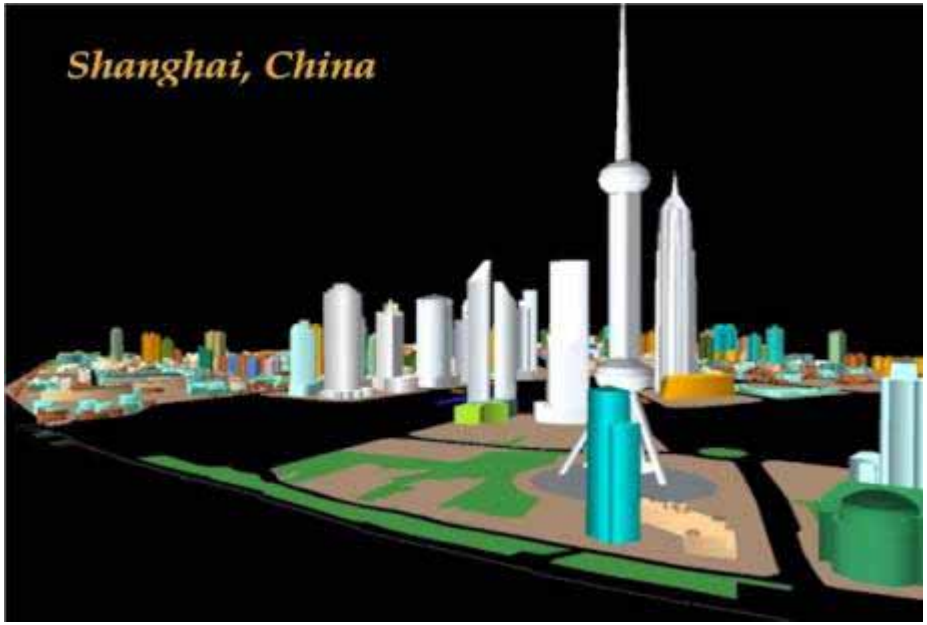
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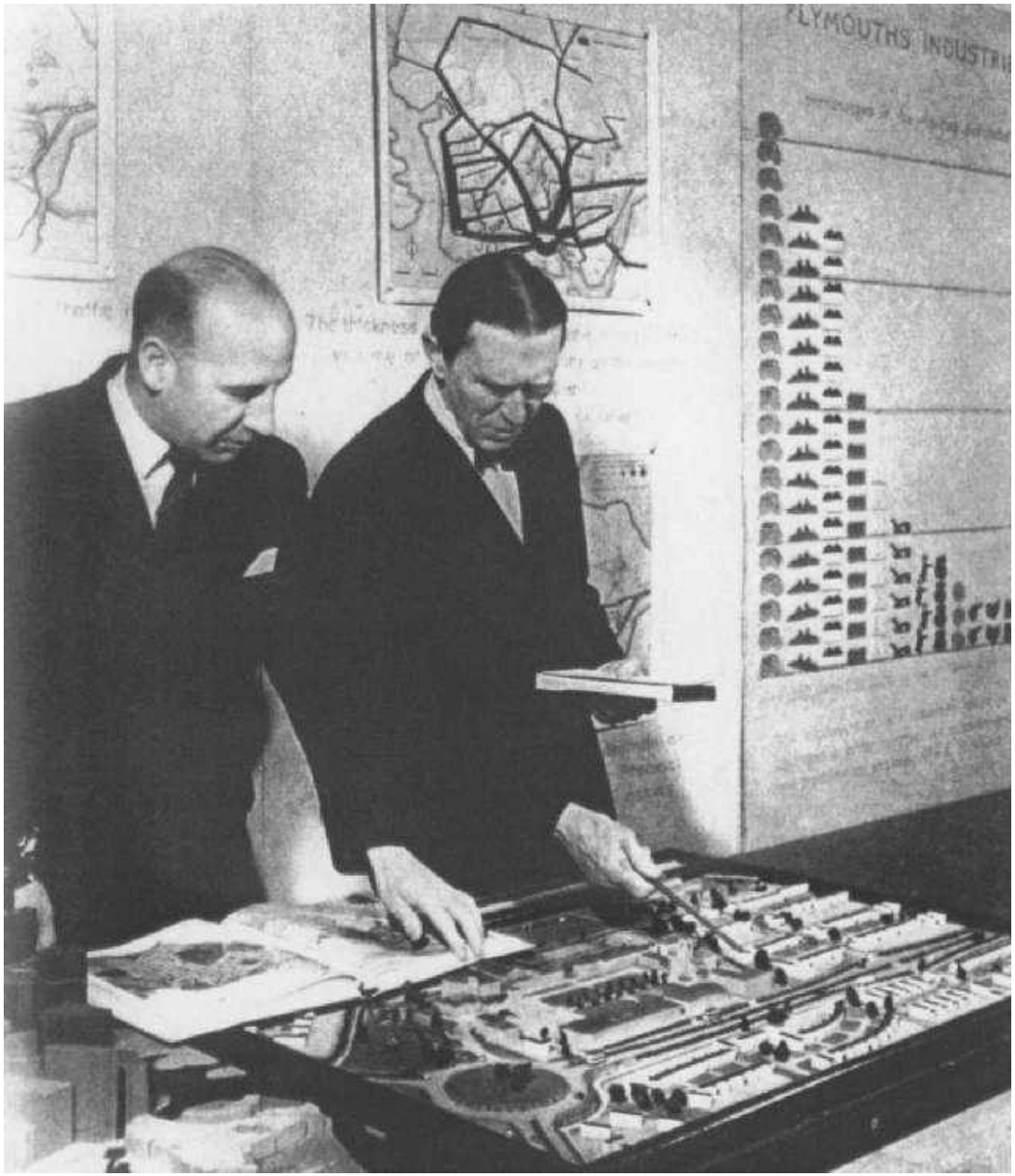
PLYMOUTHS INDUSTRI

LONDON

We also use zoomable maps within the interface with rapid delivery over low band width lines

Let me now show you an example of some of this within virtual London before I then tell you how we built it, what is in it and who it is for