Virtual Worlds and the Built Environment

A White Paper

March 2011
Introduction

Virtual worlds first came to public notice in 2006, when thousands, then millions flocked into the Second Life (SL) virtual world to see what all the fuss was about. The concept – open-ended, Internet delivered, 3D experiences – had been around since the dawn of the web (anyone remember VRML), but it was only in the mid 2000s that increasing PC power and broadband availability began to make the whole concept viable.

Whilst that early hype was all around virtual worlds for retail and marketing, many saw that this technology could actually be of far more use in other industries. Indeed one of the first success stories of virtual worlds was the Aloft Hotel – a model of a planned new physical world hotel planned by the Starwood Group and put into Second Life for comment by users (see sidebar).

Whilst the hype (and marketing interest) around virtual worlds has faded, the technology is increasingly being used in areas such as training & education, collaboration and data visualisation. This paper explores the on-going use, and future opportunity, of virtual worlds to help model the built environment, and as a result to use the virtual world to build a better physical world.

What are Virtual Worlds?

First, what is a virtual world? We would define a virtual world as a digital environment (usually graphical, usually 3D), which is completely delivered over the Internet or Intranet, where users:

- are represented by avatars
- can interact with each other
- can interact with and effect their environment in a persistent manner
- have no more restrictions placed on them than they can expect in the real world
- can decide from a wide range of actions, or even in-action
- can build and create within the world, without having to master additional tools
- can use the world for a wider variety of different purposes
There are a number of key differences here in comparison to more traditional Architecture-Engineering-Construction (AEC) visualisation tools. Principally that:

- the user is embodied in the world as an avatar, rather than having just a “camera” view
- the avatar/user can go where they like, and interact with the build
- the environment is multi-user, so users can interact with other users
- the environment is rendered in real-time, so although visual quality may not be as high, the environment can be far more dynamic and flexible, and renders instantly rather than needing an over-night render-farm.

Which Virtual World?

As the sidebar at left shows there are a number of “virtual worlds” around, and many are tuned to specific uses. However there is one criteria – which we think is vital to successful AEC (and other) use of virtual worlds which separates out the “true” virtual worlds from the others; can you build and change the world from inside it, or do you have to use a 3D design tool and import your models?

Whilst the external design & import is the most approach, for us it stops the virtual world from reaching its true potential. By putting the build tools into the hands of users inside the world you immediately make the space more dynamic and interesting, and foster creativity and community. This is why Second Life has been the most successful virtual world, and why it has kept going when others have fallen by the way-side.

Of all the virtual worlds listed in the sidebar only Second Life (and its open-source counterpart OpenSim) allow in-world building. This is not to say that you have to let users build, or that you can’t use a 3D design tool (such as Collada) and import models (a feature just arriving in SL/OpenSim), but that fact that the platform lets you take both approaches will make it far more flexible in both the short and long term.
Current Visualisation Approaches

Coming from outside of the AEC industry we need to be a bit cautious in what we say but our impression is that visualisation in AEC currently takes four main forms:

- The “glossy” high-end marketing/architecture led “fly-through”. This will give the best possible impression of the build, and make a lot of use of visual effects such as shadows, lighting, reflections and moving water. The upside is stunning visualisation of what the build could (but probably won’t) look like. The downsides are that the fly-through is a fixed track – you can’t look around the corners, and the high quality of the rendering means that you have to render the video over-night in server farms so it can only be updated on an occasional basis – and certainly can’t be dynamic.

- Mid-range graphics using game engines like Unity, which offer some interactivity but still major on look rather than functionality

- The more consumer orientated room-designer, with a bit of interactivity, flatter textures, but often fixed animations of walls and ceilings flying in and out

- The engineering and construction CAD style 3D model, with minimal texturing, no animation, but detail on the specification of every beam and panel

All of these approaches also tend to share the common “features” of:

- No representation of the user
- Being distributed as static files rather than being live-streamed from a central – and hence easily updateable – source

In terms of the technology used there also appears to be three different types:

- 3D Studio Max and similar for the high-end architectural visualisation
- Game engines, such as Unity
- Smaller, bespoke applications for room/interior design (although 3D Studio Max also used)
• CAD packages like AutoCAD for the engineering side.

What is interesting is that Autodesk appear to be dominating this whole space by buying up all the main tool providers – e.g. 3D Studio Max and Maya - to add to their original AutoCAD application – but model transfer between the tools is still far from easy or natural. Unity is probably the application which most effectively bridges these three use models at the moment.

To us where each of these tools comes up short is, naturally, where virtual worlds can fill the gap. We are not (yet) advocating the replacement of these tools wholesale by virtual worlds, but we believe that virtual worlds can achieve things that none of the these tools can currently achieve – principally to explore the human and social dimensions of a build. Virtual worlds can do this because they are all about putting one or more human-controlled avatars into a shared, real-time environment – something none of these existing tools do.

The Role of GIS

Although the distinction is becoming increasingly blurred AEC tools are primarily about visualising single buildings or developments, whereas Geographic Information Systems (GIS) are about visualising large areas – and being data-driven not image driven. A GIS will also typically consist of two sorts of information – the underlying maps, and overlaying datasets – both stored in a vector format that allows the user to zoom right out or right in. The big players in the GIS community are people like Bentley Microstation, MapInfo, Intergraph and ESRI, and common standards include the Open Geospatial Consortium/OpenGIS (including CityGML and GML), DLG and ISO 19115. The overlap between GIS and the AEC tools is increasing. Traditional GIS were 2D tools, but are now incorporating 3D components for terrain and buildings.

However as GIS systems reach out to the masses through Google Earth/Maps and OpenStreetmap (and even sat-navs) we are seeing them as becoming an even more important player in the built-environment.

Google Tools and Solutions

It is hard to over-estimate the impact that Google applications have had on the end-user use of geographic and spatial data. First Google Maps gave
everyone the ability to view recent satellite imagery of the whole earth at 1m – 10m resolution and to plot data against it. Then Google Earth made that experience 3D, and finally Google Streetview brought recent eye-level imagery of major conurbations to the desktop – you could walk a street before you visited it, check out parking and even choose your cafe seat based on it. With Google’s acquisition of Sketch Up they made 3D modelling accessible, with Google Warehouse they provided a central repository for 3D models, and with Building Maker they made the creation of simple 3D models for Google Earth from Google Maps imagery a 5 minute process.

The upside of all of this has been the emergence of new standards, Collada for 3D models and KML for spatial data. But the experience has remained resolutely non-immersive, although people have been talking for ages about having an avatar with which to walk out into Google Earth.

Collada is increasingly being seen as the de facto standard for 3D models (www.collada.org). Most virtual worlds support it, and even Second Life/OpenSim have Collada import in beta and as their preferred import standard. Data points from KML can be readily brought into virtual worlds such as Second Life and plotted – although polygons and lines can give problems.

As a result any future use of virtual worlds for built environment planning and visualisation will have to link into the Google tools and standards.

**Non-Virtual World Solutions**

Whilst we believe that virtual worlds offer the best long-term solution to the challenges of built environment visualisation it is worth looking at what other solutions have been tried.

Typically these try to bring the ease of use of games and gaming technology, but combine it with a locked-down approach to the experience – which contributes to the ease of use and maintenance, but ultimately limits flexibility.

Some example include:

- Gaming Engines – organisations like University College London's Centre for Advanced Spatial Analysis (http://www.casa.ucl.ac.uk) have used gaming engines such as Crysis to visualise large parts of central London. One downside
was that you had to tour the first version in an attack helicopter!

- The City of Philadelphia in the US has used a bespoke solution called GeoSimPHILLY (http://www.geosimphilly.com/) to not only visualise the city but also to integrate e-commerce for local shops
- Twinity (www.twinity.com), although more virtual world than not, offers 1:1 models of real cities, although without shopfronts and facias – apparently due to copyright and IP issues!

Pros and Cons of Virtual Worlds

Before looking at the specifics of virtual worlds, it is worth briefly summarising their pros and cons when used in support of AEC activity:

- Advantages

  - The ability to make changes instantly, in-world
  - The ability to support multiple users in the same space – typically 50-100 (but of course you can always clone spaces)
  - The ability to make things interactive – even linking computers to real computer applications, and signs to real signage systems
  - The ability to not only integrate building environmental and performance data, but also to visualise it in new and effective ways
  - The ability for users to peel-back layers of a building to see structural and service components
  - The ability for users to annotate the space, feeding back comments which can be automatically collated
  - The ability to track users through the building, and their interactions with its systems
  - The ability to let users choose between configurations and vote on them
  - The ability to support “live use” of the building, eg for entertainment or training
  - The ability to clone the building to create multiple copies to explore what-ifs
  - The ability to use the same platform to support virtual meetings, conferences, training, collaboration etc
  - Dynamic rendering which enables the instant changes and multi-user deployment
- Disadvantages

The disadvantages of such worlds are that:

- They still need a reasonably powerful PC (a £40 graphics card suffices)
- They need a dedicated downloadable client application - although in-browser access is being worked on
- They need reasonable bandwidth (ideally 1Mbps+, but can be used over 3G and Wifi)
- The user interface is not tuned to AEC and consultation use (but could be)
- The virtual world market is still in its infancy, and shake-outs are common (so back a winner or an open solution)
- Some users find it initially hard to control, or relate to, their avatar

Different Scales

Since most existing visualisation tools do not represent the user as an avatar there is no sense of comparative scale. One of the advantages of the virtual world is that we can build at different scales relative to the avatar based on the type of use, and experience of the interaction, that we want the user to have. Some examples are:

- 1:1 Scale

Library of Birmingham Virtual Model

The location is built at 1:1 scale to the avatar – the buildings are “life-size”. This gives the user not only a realistic view of building size and room spaces, but also of the distance between rooms and buildings, how
stairs, lifts, doors and escalators will work, and where
the “rat-runs” will be between spaces and buildings –
helping to identify pathways and signage opportunities.
This is the scale most familiar to AEC users.

- Table Top Scale Model

A Proposal For an Innovation Hub

Most AEC projects include a physical table top model –
which allows users to gather round and discuss the
build, and peer-in, maybe even removing roofs and
walls. In the virtual world we can do the same. We can
create the virtual meeting room, project or marketing
office, and build the table top model – although typically
the equivalent of 10m or so across since size is no
object in the virtual world. Not only can this model be
fully interactive, showing lighting and systems for
example, and feature slide-away sections, but the user
can also zoom in and into the model so that they
actually experience the model at what seems like 1:1
scale.

- Map Table/Floor Map

Birmingham City Centre in 3D on Google Maps
Taken one step further we can even turn the table into a map-table, projecting a fully interactive version of Google Maps (or Open Streetmap) onto it, with any associated data and with 3D scale models of a whole city or the key buildings of interest. And being Google Maps this map can zoomed in and out to any scale – just as with web based Google Maps, and panned to anywhere in the world. Unlike Google Maps you can share this visualisation with up to 100 other users anywhere in the world, and get up and walk over it! This gives the user what we call a “godzilla” view, striding over the area in a set of hundred-league boots (to mix metaphors). This ability to “walk-into-the-data” should not be underestimated. Not only can it bring new insights and understanding, but it's also a lot easier to remember a meeting and its contents when you actually stood on the area, or sat on the building, under discussion!

- Walkable Map

The UK as a 256m long map showing key cities

The final step in this range of visualisations is where we produce a scale map over a large area so there is a sense of walking between locations, and understanding their spatial relationship. Again such a map can be overlaid with scale-models and data, and by dynamic or fixed maps. Again the benefits are fresh insights into data and plans, and better recall of discussions.

- Large Area Modelling

Modelling large (>1-2 km square) areas at 1:1 with virtual worlds is possible, but needs careful management – hence a preference for scale maps/models at this level. The issues arise from the sheer amount of data that the virtual world needs to manage and send you, and your viewer to draw, when
you are trying to visualise a large area. Game type environments manage it by placing that data and imagery on a CD-ROM (or download) local to the PC, but a true virtual world is streamed "live" to your computer since any part might change at any time. With the right approach it is feasible to visualise the terrain of entire countries at 1:1 (as the US is understood to be doing with Afghanistan).

**Different Uses**

One of the biggest advantages of virtual worlds is that they allow an AEC model to be used in a wide variety of different ways, not just for visualisation.

- **The Planning Model**

At the very beginning of the AEC journey the virtual world model can support the planning process. A virtual city model, implemented at the table or walkable level, or even 1:1 can provide planners, clients and architects with an unparalleled way of understanding the opportunities and impacts of new developments. Such a model can even incorporate a time-slider, allowing planners and the public to see how the cityscape is likely to change over time as different projects come on stream – and even look back n the past to see how it has already changed.

One key consideration for the future – and discussed further below – is how that model can become populated and maintained as a by-product of the ongoing planning process, rather than as a separate undertaking.

- **The Consultation Model**

As a project progresses a 1:1 build model offers a unique and highly engaging way to support the consultation process. The best analogy is probably with the "planning for real" methodology, where a school hall is taken over, large paper maps and cardboard building laid out, and the community invited to come in, have a look, move things around and populate the model with post-it notes. We'd hate to stop having such tactile experiences, but the practical implications of running a planning-for-real exercise mean that it can usually only be run for a weekend.

With a virtual world the outputs of that exercise can be captured, represented on the virtual model, and a virtual planning-for-real exercise continued for weeks.
and months, embracing a far wider part of the community. Even if citizens don't have internet access or powerful enough PCs then terminals in libraries and community centres can be used. Being a virtual world all the data can be readily captured, users provided with virtual 3D post-it notes, and consultation and community meetings actually held on the model at any time of the day or night.

- The Project Model

Once the build process starts why not clone a copy of the model for use by the project team – secured away from public access. This model can be used as the venue for remote project meetings, allowing project staff to walk around problem areas and flag issues and snags – ideally automatically from any issue management system. Virtual worlds support most of the collaboration tools you are likely to use, including audio conferencing, PowerPoint, document sharing (and even desktop sharing), video (including on-site webcams), and potentially even video conferencing.

- The Social Model

As mentioned at the very beginning we see the virtual world as being about community and collaboration. They are about the social aspects of an activity, in the same way that the web is typically about the informational and transactional aspects. Faced with a video fly-through a potential resident or worker can do little more than go “ooh” and “aah”.

With a virtual world model they can begin to get an idea about what that building or space will be like to live or work in. How practical is the room layout? How easy is it to get from my desk to the toilets or café and back? What happens if we need to bring a large crate in? How should we lay out the rooms, where should we put the signs? Do the escalators go in sensible directions, and can I move easily from floor to floor? Do paths represent the most sensible route between buildings or will I cut across the grass? Are there areas that seem dark and dangerous, or spaces that are too small or inconvenient to use?

By creating a virtual model and letting users explore it under their own steam with their own avatars we can start to get answers to the very practical questions of how a building will be used, which appear to be missed by most current techniques. And we have a far better chance of catching problems early, which can not only result in happier (and hence cheaper/more effective) users, but also save the cost of rectifying mistakes.
- The Disabilities Model

A special case of the social model is where we explore the building from the point of view of disabled users, or with disabled users themselves. Whilst there are obvious challenges for visually impaired users in using a visual virtual world, for other disabilities the virtual world can provide an ideal way to have input at the consultation or design phase. Second Life already has a relatively high proportion of disabled users, and some are as concerned about disabled access to virtual builds in virtual wheelchairs as they are about physical access in physical wheelchairs. Not only can disabled users be brought in-world, but project staff can be forced to explore the build by wheelchair for a week to make sure that the build is fully accessible.

- The Services Model

Even once the build goes live the virtual model can play an important role. For instance in support of Facilities Management and E+M activity the model can incorporate wiring and piping systems, the ability to hide and show structural and service components, and even tag services with trouble-ticket and maintenance data. The model can also support maintenance training and remote maintenance, allowing users to learn and practice maintenance procedures in complete safety, and to have experts in the remote model talk them through what to do in the real build.

- The Environmental Model

With initiatives like BREEAM and LEED the environmental performance of a build is becoming increasingly important. A virtual world won't (yet) let you model the environmental performance, but it will let you visualise the outputs from such models, and from captured live data, in new and immersive ways. For instance every room of the build can be filled with colour representing temperature or energy use and changed time-lapse fashion to visualise a buildings diurnal cycle. Users can see how switching equipment off or changing air-conditioning settings will effect performance. The benefits should be more aware staff, and better management decisions, resulting in a more efficient building.

CityGML

CityGML is a markup language that has been designed for the built environment. As such it represents a link between the detailed 3D models of buildings generated by a system like 3D Studio Max, and the 2D large area layouts created within a Geographic Information System (GIS).

A standard such as CityGML could enable city planners to maintain a digital model of the whole city, slotting in 3D models of a particular builds as they are proposed. Provision of such models could even become a mandatory part of the planning process.

Crucially CityGML is to an extent a semantic language – it separates out the positional and meta data associated with a building from the 3D model itself. This means that in theory a CityGML model could be rendered in a variety of different environments, including virtual worlds, and what the user actually sees can be tuned to the power of their device and the bandwidth of their connectivity. We believe that such semantic markup languages will be vital as the development of virtual worlds move forwards.
- The Security Model

In these times of heightened terrorist threat there is more and more interest in how we design buildings and spaces that not only deter attackers (from both attack and reconnaissance), but also make visitors and employees feel safe. This is just one aspect of the concept termed “design with intent” (http://architectures.danlockton.co.uk/what-is-design-with-intent/). A virtual world can be a key part of this.

At the very least if you create a virtual model and open it up to the public you should be aware that it becomes a potential training and reconnaissance space for terrorists and criminals, so you need to take steps from the very beginning to deal with this. It might be that you only build the public space, or at the least ensure that private spaces are not accessible to members of the public (easily done by in-world permissions and virtual door-locks). You might want to also subtly change key areas of the virtual build to make them less attractive to potential attackers, or add in not just the CCTV you plan to have but additional cameras too.

In virtual worlds it's also easy to identify and track avatars – so just greeting every avatar by name, and having automated security guards repeat that greeting as they move around the build might do the trick! Even beyond the security considerations the virtual world can be an ideal environment in which to explore other more positive uses of the Design with Intent approach.

- The Navigation Model

We have already talked about how the virtual build lets user explore and designers design navigation routes around the building. But there is increasing interest in creating navigation systems for buildings – whether as kiosks in reception or in lifts, or even as in-building personal sat-nabs.

Whilst visitors could use the virtual model to familiarise themselves with the build and plan their route from home (see below) the virtual model will probably not have the immediacy in the building to answer questions like “how do I get to Ward B67”. However the virtual build does provide the assets which can help answer the question. Once the virtual build is complete it is relatively simple to video the various routes, or provide cut-aways with animated arrows and use these as the raw assets for an in-building navigation system.

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**Building Information Model (BIM)**

From Wikipedia: “Building Information Modelling (BIM) is the process of generating and managing building data during its life cycle, and typically uses three-dimensional, real-time, dynamic building modelling software to increase productivity in building design and construction. The BIM encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components. BIM is often associated with IFCs (Industry Foundation Classes) and aecXML [which uses IFCs], which are data structures for representing information used in BIM. Proponents claim that BIM offers improved visualization and productivity, increased coordination and collaboration, faster delivery and reduced costs.”

As virtual worlds mature we'll be able to take more and more of the BIM data into the virtual world for display, manipulation and experiencing, with potentially virtual worlds becoming the premier space in which to share and collaborate on BIM data.
Another area where building owners often employ dedicated systems and visualisation tools is in process simulation and modelling. Whilst a virtual world shouldn't replace a piece of dedicated numeric modelling or simulation software, it can be the ideal place the visualise the output of such a model. A manager can stand in their new space – before its finished – and see how it will perform once in live use. Whether its watching a production line in a factory, baggage or patient handling in an airport or hospital, or customer queueing in a bank or supermarket, being immersed in the build whilst watching the simulation helps to put the simulation into context, and brings the messages home.

- The Training Model

Finally as the build is ready to go live its virtual self can become the venue for staff and employee training. Customer service, health & safety, evacuation and employee familiarisation are all possible. The ability for staff, residents and visitors to familiarise themselves with layout and services (or through organised tours) will save considerable effort when the development finally opens. What we are trying to achieve is a sense of déjà-vu the first time they walk into the physical building – they know it from its virtual self, they know how it works, and they know how to find their way around it.

- The Live Services Delivery Model

Once the building goes live the 3D model should be used to support the building's users in their real-life, physical world work and delivery of products and services. For instance a virtual library can provide virtual meeting rooms and access to library booking systems, theatres can provide not only virtual spaces in which to stream live events (or host unique virtual events), but can also help with set and stage design, virtual offices can host virtual meetings and conferences from employees across the country or the globe.

- The Building Re-Design Model

Few buildings end their life as they started. Internal refits, external additions, changes in décor all take place. The virtual model enables employers, employees, developers and owners to explore options in a more immersive way than third-person building

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**The AEC Pipeline**

A while ago Daden ran a workshop for Birmingham City Council looking at the issues of digital standards in the built environment.

As a part of that workshop we asked representatives of different parts of the AEC community – and different stages in the AEC process – to put up a chart showing what digital and paper data they bring in, and what digital and paper output they create for the next link in the chain.

Whilst we often saw the same technology or standard in use it became apparent that even if common standards did exist they may not simplify the system since each part of the chain did not totally trust the data they were being given.

Other key issues identified were:

- The need for revalidation of data at each stage
- The need to scale across the industry
- How SMEs could participate if costs and requirements of 3D IT solutions are high
- Scepticism over the value for money of 3D modelling to the AEC community
- Lack of digital literacy within the AEC community
- The need to modify the procurement processes so that digital information is used (and actively encouraged), rather than mandating paper drawings
- The need for legislative and process changes within the planning and consultation framework to allow (and encourage) the use of digital systems and information

The lesson for us is that standards will only be of use and enable the true sharing of models and information if there is trust along the pipeline, and the whole AEC process and ecology is aligned to digital information.
tools, and just as with the initial build enable the social dimensions of any changes to be explored.

- The Whole Life Model

What this brings us to is the virtual world 3D model as a whole-life model of the building – not just a marketing showcase. From initial ideas to demolition, a 3D model of a building or development in a virtual world can support operations and management throughout its entire life. And if doing all these things with one model sounds a tall order remember that you can easily clone the building so that each user group has its own model to work with.

Standards

It would be nice if virtual worlds, and indeed the whole AEC industry were mature enough digitally that we could support these virtual buildings using common standards. However neither industry has a fully mature set of digital standards in place. Most virtual worlds are based around “media” standards such as 3D Studio Max and Collada, whereas AEC has traditionally made more use of CAD based standards such as AutoCad. Although the use of 3D Studio Max by architects is increasing that doesn't completely solve the virtual worlds issues as a) some virtual worlds do not yet support mesh import, and b) even where they do to achieve usable performance levels on average PCs and bandwidth requires far simpler models than those typically used by architects.

And it is not just building models we need to consider. There are E&M models and environmental models for a start. We also need to know how the buildings are laid out in space – something that standards such as City GML are trying to tackle (see sidebar). GIS systems (for both overground features and underground assets) bring another set of standards.

Whilst BIM (see sidebar) is making some progress in trying to bring these standards together, we are still a long way from a “build once use anywhere” digital AEC model.

Virtual People

One thing that rapidly becomes apparent in a virtual world is that without people (represented by avatars) it feels like a ghost town. Architects have long recognised this by placing images of people in the pictures and fly-
throughs of their builds. In a virtual world we can take a similar approach, and go one step further.

We find that there are three levels of “virtual people” we might need in a build. We can use the same technology for each, or if budget or performance is limited use different approaches at each level:

- **Background colour** – people in the distance, seen out the corner of the eye, going about their daily business
- **Non-player characters (NPCs)** – characters that the user may briefly interact with – perhaps asking the way somewhere, a character in a training exercise, or just a friendly “hello” as they pass
- **Feature NPCs** – characters with whom the user can have a lengthy conversation with and who can have free movement around the build – such as a virtual tour guide or receptionist.

Daden's Discourse chatbot engine enables us to deploy such virtual characters into a build, making it come alive, and engaging visitors in dialogue about the build 24/7. The characters can even access web services to answer questions (“what's the current rent for this...”), and alert human staff when questions or interest move beyond that which the bot can support.

**A Typical Project**

In creating a whole-life virtual model a typical project might flow as follows. Note that ideally the project will start before the architectural design is complete (or even commissioned) since the virtual space provides an ideal prototyping environment, but it is possible to start the process once the architectural design is complete.

- **Use Cases and Audiences**: First and most important think through who is going to use this, and what PC and bandwidth access they will have. Office users can often be more problematic than domestic users as they often have lower bandwidth, less powerful PCs, more stringent firewalls and locked-down desktops making it harder to deploy hosted or non-web solutions.

- **Choice of Virtual World Platform**: Guided by the use cases and audience choose the most suitable virtual world platform to meet your needs. This is likely to mean balancing accessibility against flexibility.
• **Create a Planning Model:** Create a scale model inside the virtual world of the intended build. This helps people to start thinking and using 3D from early on.

• **Source mapping and drawings:** Source the maps, drawings, photos and existing models that describe the build.

• **Terrain build/import:** Build the ground terrain that the build will occupy. Get important changes in slope and elevation correct.

• **3D model import or build:** For some virtual worlds you can import an existing 3D model (if available) from/through a tool such as 3D Studio Max or Collada. For others you may need to import the plans as raster images and scale to 1:1 and then build the model on top of them.

• **Texturing:** More time is typically spent creating and placing textures than in building the geometry. The detail you want here will be a major cost-driver. Image capture may require time on site, or with suppliers.

• **Create furniture, fixtures and fittings:** All the items in the build need to be bought or made. Again liaison may be required with the suppliers.

• **Train key staff:** Since many virtual worlds were designed as consumer tools it is feasible to train key client and project staff in how to create and edit objects within the environment – this can not only reduce longer term support costs but also make the whole build more responsive to changes and requests.

• **Interior fit-out:** With staff trained and interior items built (and often stored in a virtual warehouse), the project team and staff can start to fit out the build.

• **Script and deploy active systems:** The active parts of the building – lifts, escalators, access-controlled doors, digital signage etc need to be built and scripted. Some may even be hooked up to sensors in the physical world.

• **Deploy consultation and tracking tools:** The tools to support any consultation process (see sidebar) and tracking of users through the space are deployed.

• **Design User Avatars:** Users will often want to look something like themselves inside the environment, so avatars that match the demographics of the target audience are built.

• **Design and Script Virtual Characters:** As mentioned earlier a space without people seems
lifeless. Using the three-tier model described above primatars and automated avatars can be created and scripted to occupy the space and interact with users.

**Build Web Portal:** Whilst the virtual world may not operate within a browser, a web page is likely to be the users gateway into the virtual build. This will let them download any virtual world client, create an account (if needed), view videos of the orientation (see below) build and even access some of the consultation systems. It is important that the portal also supports those who cannot, for whatever reason, access the virtual world build.

**Create the User Interface:** The user needs to be able to interact simply, quickly and intuitively with the environment and the systems. This may mean augmenting the existing user interface for the virtual world with additional displays tuned to the needs of the build.

**Create Orientation Space:** Once the user leaves the web portal and enters the virtual world they may need some orientation – both to how the world works and about the build and consultation itself (the equivalent of a site marketing office).

**Video Capture:** Although not designed to replace a fly-through it is worth capturing some fly-through like video to help promote the virtual build and to put on the web portal.

**Test:** With everything in place its worth testing with other project staff and tame users, to make sure that everything not only looks right and works, but also that the whole experience is productive, informing and enjoyable.

**Snagging and Tuning:** As with any build there is likely to be some snagging and tuning after inspections and trials, so allow time (and budget) for this.

**Go Live:** With everything in place you can now go live, and open up to real users.

Of course since this is a whole-life build the whole project should not finish here. Absolutely key is embedding the model in the day-to-day work of the build and transition teams, and in the future working, planning and management practices of the client.

Done right the virtual build should be constantly changing and evolving as the real life use of the space changes.
Who are We?

Daden Limited (www.daden.co.uk) is a virtual worlds and virtual character solution provider. We have been working with these technologies for over 10 years, and our clients include Government departments and agencies, city and local councils, educators and health providers and private sector organisations in the UK and abroad. We are based in Birmingham, England.

What Next?

If you would like to see more of our work then visit our web site, where we have links to many client projects and videos. If you would like to discuss how we can help you and your clients with your next planning or build project then please contact us:

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- By post to:
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Glossary

AEC - Architecture-Engineering-Construction
AI – Artificial Intelligence
Avatar - A 2D or pseudo-3D representation of a person or character
BIM – Building Information Model
CityGML – and XML based mark-up for city data
GIS – Geographic Information System
KML – the XML based mark-up used by Google Earth
NPC – non-Player Character
Primatars – an avatar under computer control made from prims rather than the virtual worlds standard avatar system.
Prims – the 3D “lego bricks” from which some virtual worlds are built
RSS – Really Simple Syndication
SL - Second Life
XML - Extensible Markup Language – the emerging standard for representing data on computer systems