



The Future of Virtual Worlds

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Introduction

Back in 2007 we wrote two white papers: Virtual Worlds – A New Medium and Virtual Worlds – A Road Map. Between them they tried to set out why we believed virtual worlds were important, how we thought they would be used, and how they would develop.

It's now 3 years on. A short time in some industries, but a very long time in virtual worlds. So we thought it about time we revisited those two papers – and this new white paper is the result.

Just as before the aim of this white paper is to give our views on:

- why virtual worlds are important
- how they are being used, and will be used
- and how they will develop.

The paper takes a medium to long term perspective – we are already almost past the short term perspective of the first paper! It is focused on the impact of Virtual Worlds over the next 5 - 50 years, maybe more. To some it may talk the language of science fiction; to us, though, it is the language of science, engineering and ultimately of society itself.

This paper is divided into four main sections:

- Virtual Worlds 101
- What Virtual Worlds Really Are
- Standards
- Future Roadmap

It is not a short, or simple, document. It is intended to collect the best of our past and current thoughts about what virtual worlds really are, where we think they are going, and why they will be so important. It is also intended to be provocative!

VIRTUAL WORLDS 101

What Is A Virtual World?

"Virtual Worlds" tends to be a fairly generic term, and is often used alongside other terms such as MMOs (Massively Multiplayer On-Line games), Serious Games, and Synthetic Environments. There is no commonly accepted definition of what a virtual world actually is. A good working definition is:

"A shared multi-media electronically generated environment in which users, represented by avatars, can act, create and communicate at will, retain ownership of what they create and can exchange assets, information and currency with each other (and ideally the outside world), whilst subject to no more onerous restrictions than they could expect in the real world."

We use the term "synthetic environment" to define the broader class of computer generated experiences that also includes 3D chat, 3D visualisation and simulation tools and on-line games.

The diagram below gives you some idea of what segments are in this larger synthetic environment space and how they compare - by potential audience size and openness of the environment (i.e. the

Virtual Worlds

Virtual Worlds are worlds realised by computer. They differ from games in that they have no plots, quests or objectives, and no more rules than you might find in real life. In a virtual world you just do what you want to do, for as long as you want to do it. That may range from simply chatting to someone, or doing some sightseeing, through to playing games or going to a concert, or running a business.

The first virtual worlds were text based, ran on mainframes, and were typically offshoots of so-called Multi-User Dungeons (MUDs). The coming of the Internet enabled such worlds to be accessed more easily. They also became more graphic. Users were represented as Avatars, computer generated human or non-human characters which users could design and dress as they liked.

Since early 2006 Virtual Worlds have grown significantly in use and awareness. Second Life (the most complete and visible virtual world) has grown from 100,000 users to over 20 million (mid 2010).

If you need a primer on virtual worlds then please download our introductory White Paper "Virtual Worlds and Serious Business".

extent to which you can create and act as you like, and exchange money and information with the outside world). Our main focus in this paper is on the true Virtual Worlds in the top right hand quadrant - targeting very large audiences and being totally open, and their more constrained community and organisational counterparts in the bottom right.

Uses of Virtual Worlds

Whilst a lot of the initial interest in virtual worlds was around marketing and selling we are currently seeing 4 areas where virtual worlds are proving a productive tool:

- learning, training and education
- built environment visualisation and exploration
- data visualisation and collaboration
- remote meetings and virtual conferencing

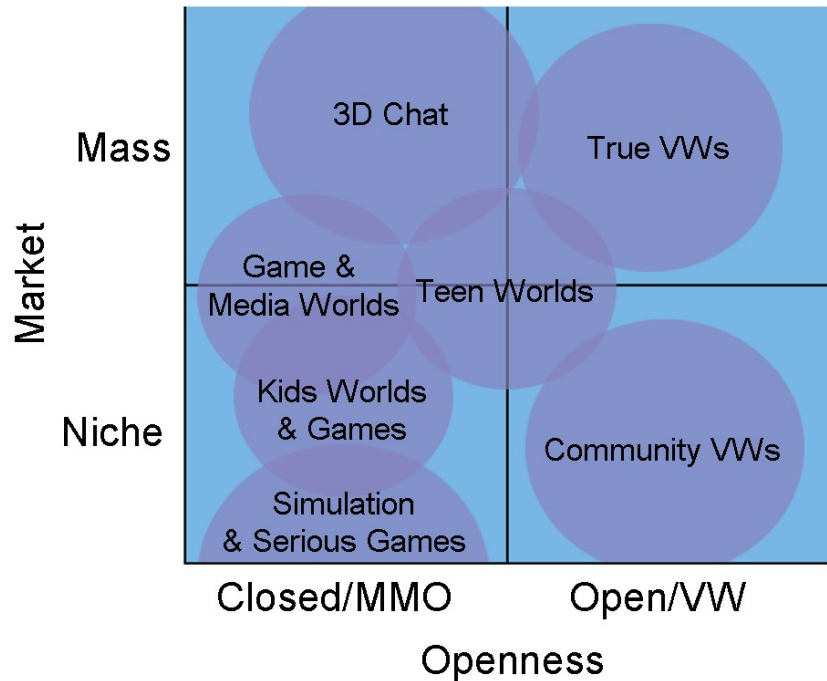
In due course we may also see them being used more extensively for:

- product/service development & modelling
- sales and marketing
- customer support
- mass entertainment

These are in addition to the consumer-to-consumer uses for socialising, entertainment and v-commerce.

For more about the educational use of Virtual Worlds please see our white paper "Virtual Worlds for Education and Training".

US virtual worlds consultancy ThinkBlam also has a good paper on the practical uses of virtual worlds [THINKBALM2009].



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This chart includes both 3D, 2.5D (isometric – eg Habbo Hotel) and even 2D spaces (eg Club Penguin), MMORPGs (eg World of Warcraft), dedicated training simulators (eg World of Warcraft), and could at a push even include text based virtual MUDS and MOOs.

Two points are important and are explored as this paper develops:

- What characterises all these is that they are about engagement and immersion, not about transactions
- All can be seen as variations of a single generic “virtual world” - differing only in audience scope, breadth of functionality, level graphics and range of goals

What are the Benefits of Virtual Worlds?

We have been using virtual worlds for serious business for only 5 years or so. However we also have some 2 decades of work into simulation and other synthetic environments to draw on. The experience, and evidence, suggests that virtual worlds can deliver the following generic benefits, one or more being realised by each successful use case and application:

- Saving costs and time through reduced travel and environment set-up costs

Training in Virtual Worlds

There is significant use of virtual worlds in education and training. This varies from a lecturer simply gathering social studies students around a virtual camp-fire to complex simulations of paramedic, first-responder and disaster management and emergency planning scenarios. A few examples are shown below:



Paramedic training at St George's, University of London



Customer Service NVQ training at the University for Industry/LearnDirect



Youth education at South Lanarkshire Connex.

- Creating experiences which are just not practical in real-life to create new learning and understanding
- Supporting remote collaboration and develop greater levels of trust than video and audio conferencing
- Growing a sense of community through shared experiences
- Increasing motivation through greater immersion
- Changing team dynamics through different communication models
- Using the sense of space and context to enhance learning and recall – even of more routine meetings
- Enabling high levels of repetition to increase learning and retention
- Creating subjective/experiential views of data and/or processes to help make better decisions and create a deeper understanding

For more information see our other white papers such as *Virtual Worlds for Real Business* and *Virtual Worlds for Education and Training*.

We remain sceptical about the current use of virtual worlds for both marketing and e-commerce (sometimes called v-commerce in this instance). In the former case there are just not the numbers (or mechanisms) to make it a viable marketing platform (and as we'll see it's a meta-medium not a mass medium anyway), and the latter is primarily a transactional activity (until we can leverage the "social shopping" dimension). But the time will come for both of these – just not yet.

Current Virtual World Platforms

The table at Annex A summarises the platforms typically presented as virtual worlds, and which we believe are suitable for enterprise use. Note that there is a distinction between the technical platform which creates a virtual world environment, and how a virtual world experience is presented to users. For instance the Second Life platform can be used to create as diverse experiences as a paramedic trainer, an air-traffic control visualisation tool, a building consultation tool and a shared social entertainment and leisure experience.

WHAT VIRTUAL WORLDS REALLY ARE

Not the 3D Web

One thing that we are quite clear on is that Virtual Worlds ARE NOT the 3D Web, and the future of the Web is not Virtual Worlds. A web page full of text and graphical imagery is an incredibly information rich environment. The Web will remain, for the short to medium, and maybe all but very long term, the most efficient way to view, assess and interact with most *transactional* information and services. Virtual worlds are about *immersion* and *community*. The two are quite fundamentally different. Virtual Worlds convey experience, the Web conveys information.

The web is an ideal medium for textually rich, asynchronous information exchange and transactions. Virtual worlds are currently pretty useless for that. Likewise, a social discussion in a virtual living room with virtual

avatars is a far richer and memorable experience than exchanging lines of chat on a web forum.

To us, the most distinguishing feature of Virtual Worlds is social interaction. Along with word-of-mouth it is the only medium analysed at Annex B which is synchronous - people need to be there at the same time.

The most immediate result of this is that for Virtual Worlds we should look to applications which need and exploit this synchronicity and choose those to move into this medium. Applications which do not require or exploit this synchronicity are unlikely to do well in Virtual Worlds and should be avoided. In fact, this is why we are very wary about statements that Virtual Worlds are the "3D web".

So *social interaction* is the "killer app" of Virtual Worlds.

This is ironic given their association with young reclusive men lacking in social skills. It is, however, born out by the data with female users matching male users, female users spending almost twice as much time in-world as male users, and the large numbers of women running successful businesses in virtual worlds.

We also believe that lying in the shadow of social interaction is social inclusion. Whilst many may struggle with comprehending what virtual worlds are all about (and are lucky enough to have a choice as to their engagement in a rich virtual or real social life), we think that there are many currently disadvantaged (for social, medical or emotional reasons, or even just location) who may find that virtual worlds offer them the opportunity to engage with society on an equal basis - perhaps for the first time.

Finally, Virtual Worlds (perhaps ironically) may re-humanise the Internet. Before the Internet those with niche interests (an obscure hobby, a cult TV programme) might often know of very few people who shared their interests, or be part of a very slow, postal based fan network. The Internet (even before the web) changed all that. Fans could connect to fans, discovering hundreds of others who shared their interest and with whom they could have almost instantaneous communication. The problem is that for social purposes the Internet (and particularly email and the Web) worked too well. Soon it was thousands, or tens of thousands of fans and many were so deluged by the amount of content and traffic generated that they had no choice but to withdraw back into semi-isolation.

By re-introducing the physical metaphor Virtual Worlds bring things back down to a manageable size. Yes you might have several hundred, even a thousand users on a topic group in a world, but when it comes to an event the room or forum will only have a few dozen people, maybe not even that. We are back to the scale of the dinner party, salon or tutorial, or that chat down the pub. We can all participate again, we can all handle the bandwidth. Things have returned to a human scale.

Of course this same change might represent a challenge to the commercial exploitation of virtual worlds. Many of the Web's great successes have been founded upon the aggregation of thin thin demand (e.g. eBay, niche e-tailers). Does this same model still work in a Virtual World, or has the market re-fragmented?

Virtual World Generations

We consider that systems such as Second Life represent the third generation of Virtual Worlds.

First Generation

The first generation where those early VRML and other systems of the late 1990s where avatars were often 2D and virtual spaces often stretched to infinity and were filled with solid polygons, but little architecture.

Second Generation

Active Worlds probably represents the top end of the Second Generation, or Early Third, where avatars were more developed, as were building tools, but scripting and certainly web interfacing, were limited.

Third Generation

Second Life, OLIVE and Vastpark are typical of Third Generation systems.

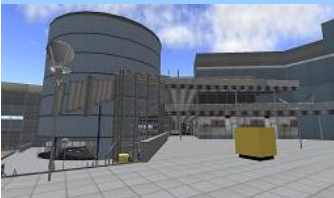
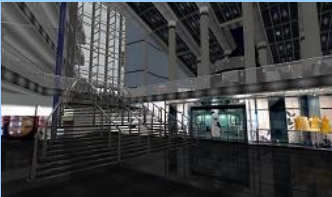
Fourth Generation?

Further generations can probably be expected at around 5 yearly intervals. Blue Mars is probably a continuation of Third Generation, but something like Croquet/Cobalt, and maybe even Vastpark, if fully developed, could represent a 4th Generation.

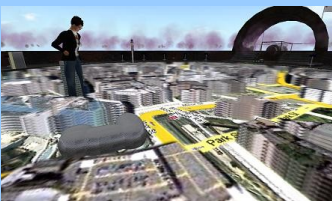
The Built Environment in Virtual Worlds

Whilst we have had high quality 3D renderings of new (and old) buildings for some time in the form of architects fly-throughs, virtual worlds appear to be well placed to explore the social dimensions of the built environment, by not only allowing groups of stakeholders to explore the building together and independently, and on their own terms, but also to use the building as a living/working/performing space, and to plan the use, management and changes to the building or space over time.

A few examples are shown below:



Millennium Point in Birmingham modelled at 1:1 scale



Birmingham city centre modelled at about 1:500 and over-layed with real-time data.

Virtual Worlds as a Meta-Medium

At Annex B we present an analysis of virtual worlds against the characteristics of different media, and at Annex C we present a further analysis in terms of Marshall McLuhan's Media Tetrads. Our conclusion is that virtual worlds have more in common with person-to-person physical-world communications, than with the web.

We believe that this analysis of Virtual Worlds against other media also highlights one very important difference. Unlike all the other media described, Virtual Worlds are able to act as a wrapper for all other types of media - you can watch TV, listen to the radio, read a web site (just), have a chat, all within the Virtual World. Whilst the web can act as a portal to some or all of these the metaphor of interaction is always that of a web page (no matter how graphically fancy). But in a virtual world a radio can look and act like a radio, a newspaper can look and act like a newspaper (or even a newspaper as we'd like to re-invent it if not hindered by atoms).

Our conclusion, Virtual Worlds are a meta-media. The only other meta-media we have is the real world of atoms that we were born into. If we are happy with Nicholas Negroponte's distinction between atoms and bits [NEGROPONTE1985] then we have two types of world - that of atoms (the singular physical world), and those of bits (a variety of electronic worlds), and a meta-media for each - the physical world and Virtual Worlds.

Note also that this to us is the correct dichotomy - physical world and virtual world. Like many others we often lazily use the terms "Real Life" and "Virtual World" (or even "Second Life"). But activities in a virtual world are just as real (or even false) as those in the physical world. We work with real clients, with real money, with real people, real reputation, real risks and real experiences. There is nothing unreal about our use of virtual worlds.

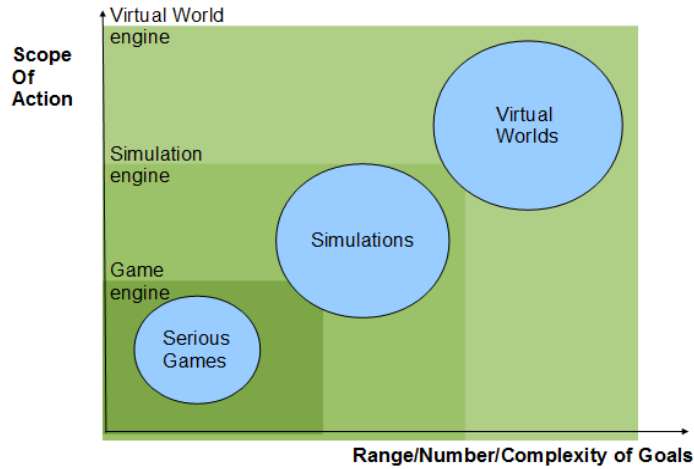
Virtual Worlds, Simulation and Serious Games

One issue that many people struggle with, particularly in a learning and training context is where do virtual worlds sit alongside simulation applications, and games ("serious" or otherwise).

One useful method of analysis is to think in terms of what scope of action does the user have in each system, and how varied, numerous or complex are their goals. In a serious game - typically a part trainer focussed on one task - the scope of action is very limited, and the goals simple and often singular. With simulations the scope of action increases - but is limited usually to what is being simulated - but the goals may be broader and more complex, and may even be contradictory. With a true virtual world the range of actions is almost limitless, and there actually are no explicit goals - every user brings their own goals. On this analysis Second Life is probably the only true (or at least most complete) virtual world as it offers the widest scope of action (including in-world building), and the most goal free (and hence ironically goal rich) environment.

A second approach is to analyse not the games, simulations or worlds themselves, but the platforms or engines on which they are built. Not surprisingly each environment is supported by platforms with the capability (and probably optimised) to develop and deploy that type of environment. However since the virtual world platform is designed to deliver the most complex environment is actually possible to use the

same platform to create simulations (by introducing limits to actions and introducing more specific goals), and even games (by further constraining actions and goals, and by providing more game type feedback).

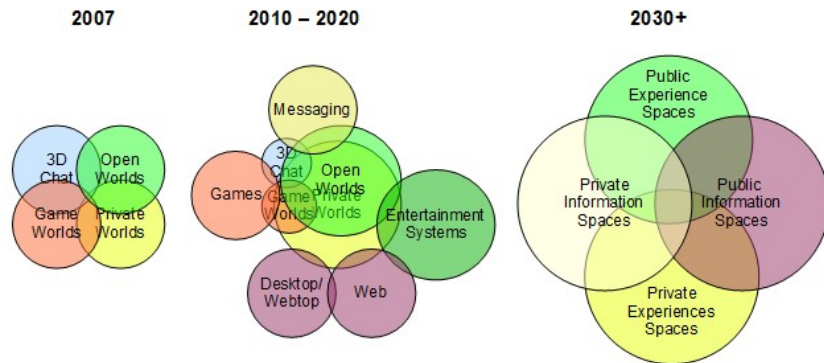


So on this analysis virtual worlds represent a superset of simulations, and simulations represent a superset of games.

Whilst at the moment there are technical reasons (chiefly in terms of fidelity of rendering and scalability) why you use a game engine for games and a simulation engine for simulations, rather than a virtual world engine for both, we expect that as the power of computing devices and the speed of networks increases we will reach the point in the next 5 – 10 years where it *does* make sense, and is technically feasible, to use virtual worlds for most simulation tasks, and in the next 10 – 20 years to use virtual worlds for most game tasks.

Convergence

This convergence is possibly not even limited to games, simulations and virtual worlds. At present we see four main areas of synthetic environment: 3D chat, public worlds, private worlds, simulations and games.



Over the next two decades the boundaries between these will become blurred, and related systems such as messaging, entertainment, on-line

Collaboration in Virtual Worlds

As described virtual worlds are at heart social spaces – so collaboration is a natural application of the environment. Moving from simple gatherings around a virtual camp-fire, to a sophisticated collaboration environment such as Datascape which bring in web pages, white boards, Powerpoint and even video virtual worlds can support a variety of collaboration activities.



A simple project meeting in a virtual world.



Datascape showing a variety of web media streams and the plotting of geographic data.

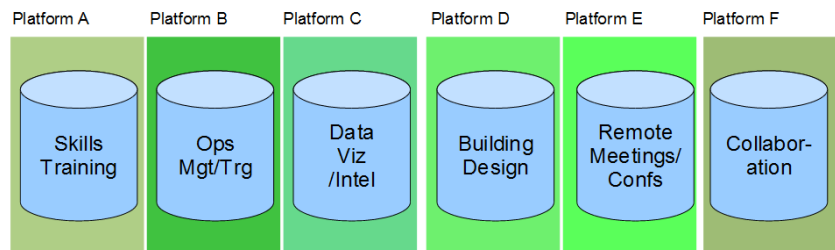


A conference panel session underway in Second Life.

games and even the web and desktop will be drawn into the maelstrom. The eventual model may be one where the “systems” will largely coalesce around a new 2 x 2 matrix defined by private and public access, and information and experience spaces – not by technology or even applications – although the Information axis is likely to be dominated by “web” like systems, and the Experience axis by virtual world like systems.

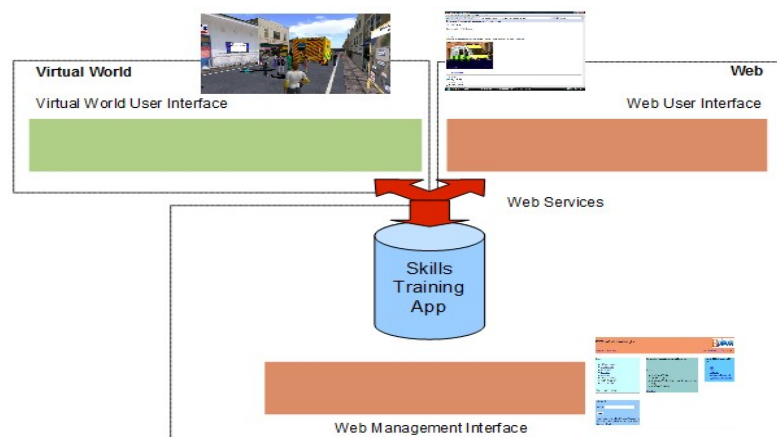
Virtual Worlds as a 3D User Interface

The “traditional” way to create immersive applications is to build them within the immersive environment or platform. This results in an organisation wishing to exploit several different businesses uses of social/spatial applications having a whole variety of different platforms, for instance for CAD/CAM, virtual meetings, virtual conferences, data visualisation, training etc



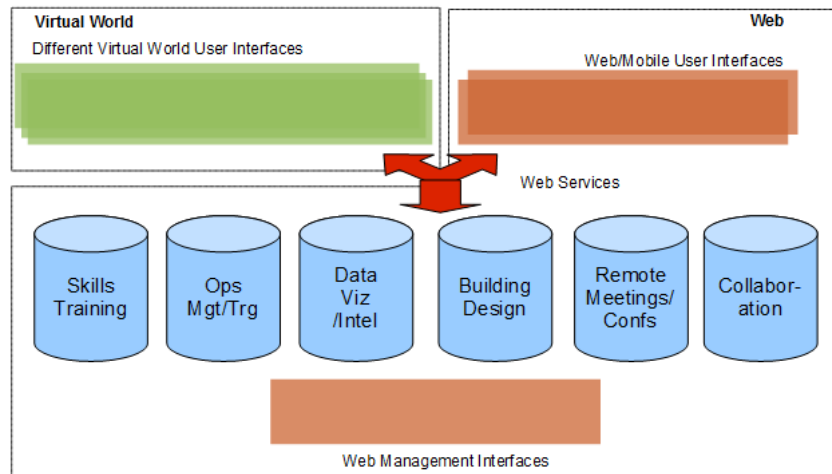
When we develop applications for virtual worlds we are increasingly finding that we develop the core of the application on the web – and effectively are only using the virtual world as a user interface (e.g. with PIVOTE and Discourse). The reasons for this approach are many:

- By developing on the web we can use powerful and familiar application development environments, rather than be limited to the scripting languages of most virtual worlds
- We have limitless data storage
- It is easier for non-techies to maintain content
- We can deploy the same application in multiple virtual worlds, and even into 2D and 1D environments such as the web and SMS,
- If our chosen virtual world disappears we have not lost our application, we just deploy it into another virtual world



We think this approach makes a lot of sense. We minimise risk and maximise productivity only bringing information into the world at the last moment – when we want to show it to the user, and bring information out of the world as soon as possible, doing the bare minimum of processing beforehand.

Since most virtual worlds support web-services this model becomes easy to implement, and the virtual world becomes the user interface for our user community to our applications.



The Application Layer

Whilst we continue to have a situation where there are multiple virtual worlds, and where large organisations (eg US Federal Government with vGov) may have multiple virtual worlds (at least 4 in the vGov case), then this model of virtual-world as user interface should be essential. If each virtual world requires a training capability or a data visualisation capability then why on earth develop a separate application for (and even in) each virtual world? Instead why not develop an application layer of predominantly web (service) based applications which can be managed in one place and deployed into multiple virtual worlds. With PIVOTE (Daden's open-source training system), Discourse (our chatbot/AI system) and Blue Phosphor's Data Glasshouse (for data visualisation) this is already a reality,

Virtual Worlds as a Geo-Social Operating System

At the other end of the application model we can also see the virtual world as the equivalent of the operating system. We still don't, in this case, actually write the application code in the virtual world (that is still best on the web as described above), but the virtual world becomes the enabler of the application, and the common substrate for networked communication and user presentation across a wide variety of applications – from nurse training to factory ERP systems.

Of course the most similar “operating system” is the web, a common substrate for networked communication and user presentation, but in 2D not 3D.

Where the virtual world differs, apart from the extra dimension, is that it is about people and space in a way that the web is not. The web, as described above, is about information and transaction. Yes of course

Data Visualisation in Virtual Worlds

A virtual world places almost no limitations on how we plot and view data. We can use abstract, literal or metaphoric approaches, and by combining the three spatial dimensions with an additional 3 or orientation, plus size, colour and shape we can soon be plotting up to 9 dimensions worth of data. And most of all we can step inside this data – viewing it from within, and even holding meetings about the data from in or on the data – improving not only understanding but also recall. Here are some examples:



Real-time radar data of aircraft approaching Los Angeles airport.



Galactic distribution data for the 100 galaxies closest to the Milky Way.

with Web 2.0 there is far more that is personal, and even social, about the web, but (again as mentioned earlier), the web is asynchronous whereas the virtual world is synchronous – and as such a far more sociable media.

In addition the sense of space, and the related sense of presence makes the virtual world a far more visceral (and hence immersive) space than the web could ever be. Yes we may have our home page on Facebook or Linked-In, but it will not be our “home” or our “avatar” in the way that a home and avatar in a virtual world would be.

The existence of this virtual self in a virtual place is incredibly powerful. Through it our experiences whether for learning or analysis, consultation or collaboration become far more vivid and memorable, and extend from one application to another running within this one environment.

So just as the web has become the *de facto* development/deployment environment and operating system for almost any new informational/transactional application so to do we see the virtual world becoming the *de facto* development/deployment environment and operating system for any application which is more about social interaction and spatial information than about transactions and non-spatial information.

The logic is, to us, very clear. By having this common “operating system” for a wide variety of applications:

- You only need to train users on one user interface style
- Your IT people need maintain only one set of servers
- Your developers need only understand one application model (and can in fact share most of this with web development)
- You can have instant, global, deployment

In fact, just like the web.

STANDARDS

Where are The Standards?

It is often said that virtual worlds are at the same stage of development now as the web was in 1996/7. In fact the better analogy is that we are in the days just before the web, the early 90s, the days of AOL, Prodigy, MSN etc. At that time we had several competing information and communications network, each using its own protocols, and any interoperability being limited to things like e-mail. With virtual worlds in 2010 the situation is pretty much the same, each vendor is pretty much using its own proprietary or (different) open source technology, and web services provide limited (but rare) communications between each,

It is our view that virtual worlds will not achieve mass adoption until they work on a common platform. Virtual Worlds are waiting for a new Tim Berners-Lee to create HTML and HTTP.

The Role of Standards

There *have been* numerous attempts to create standards for virtual worlds. Right back in 1997 a standard was created called Virtual Reality

Open Standards

The problem with standards is that often there are just too many of them. Here are the “open” standards which are informing the virtual worlds standards debate:

Collada – a standard for 3D objects, developed by Sony, popularised by Google Earth (through SketchUp), and with its roots in VRML. (see www.collada.org)

HTML5 – the new HTML standard which incorporates 3D graphical elements (see <http://dev.w3.org/html5/spec/>)

IMML – the “layout/environment” standard used by VastPark which references 3D models defined by Collada etc (see www.vastpark.com)

MXP - a second generation virtual environment protocol specification defining a minimal and easy to implement open protocol for networked virtual environments (see <http://www.bubblecloud.org/>)

VRML – Virtual Reality Markup Language – the original 3D model and environment standard defined in 1997 for use alongside the web (see www.w3.org/MarkUp/VRML/)

X3D – a similar standard to Collada with a similar VRML heritage, but intended to be used at run-time and also defines object behaviours. Maintained by the Web3D consortium (see www.web3d.org)

Mark-up Language to create virtual worlds, I built my first virtual worlds using it. But the technology of the day was not really up to it, few people installed the browser plug-in and VRML did not cover all the areas that a standard needed to cover. The ideas of VRML linger on though in the open X3D standard, and in the IMML standard of Vastpark – but both have currently a limited community of users.

In the boom days of 2006/7 several vendors and solution providers started talking about standards, particularly for avatar interoperability, and the Virtual World Roadmap projected was started (see sidebar on page 14) – and died.

Now (July 2010) the IEEE is starting its own thread of standards development (see www.metaversestandards.org) – to which Daden is a contributor.

In our mind there are three different types of standard that are possible for virtual worlds.

- Interoperability Standards

A standard which makes different systems work with each other. This appears to be where most of the (failed) virtual worlds standards work has been in the last few years, and possibly the “default” path for the IEEE work. This would include ways to move assets and avatars between worlds for instance, but let each world define its own internal standards

- Infrastructure Standards

This isn't about integration. It's about having common standards which each “world” (integrated or not) uses to build itself. So there are common data representations and even logic algorithms within the world. This is the equivalent of HTML/HTTP. Note that we didn't move forward from AOL/Prodigy/MSN by more closely integrating the worlds through interoperability standards, instead Tim Berners-Lee created HTML and HTTP and *everybody* moved to these common infrastructure standards. Of course we still have different browsers (IE, Firefox, Chrome, Safari etc), and different servers (Apache, IIS etc) from different vendors, and the implementation of the standards is not as consistent as we'd like, but they have enabled the explosive growth of the web far more than any interoperability standards could have done.

- Outer-operability Standards

First coined, we think, by Nic Mitham at virtual world consultants K-Zero [MITHAM2007] – the aim here is to define standards for how things are stored outside of the virtual world, and how they can be brought in – rather than have them embedded in each world. A (possibly poor) example are things like Collada and even 3DS, where objects are defined outside of the world and then brought into it. A better, to us, example is what we are trying to do with PIVOTE where the structure and non-3D content of a training exercise is stored on the web in an ANSI XML standard called MVP, but the virtual world (or even a web or phone application) is really only used as a user interface to this data. Green Phosphor's CIGP/Glasshouse system takes a similar approach for data visualisation. The advantage of this approach is that by developing the interfaces for each world to the outer-operability standard it can instantly draw on an existing body of material – and that material can be created and managed in a more appropriate environment. It also gives the users an independence from each virtual

world's technology, so they can move worlds if one fails, or run multiple worlds sharing common assets and applications.

There are though two significant differences between the MVP and Collada examples though:

- with Collada/3DS we actually take the objects into the environment (so that any change to the out of world representation is not reflected automatically in the virtual world), whereas with MVP the virtual world accesses the external information “live”, so any changes are reflected immediately
- Because of the live access the virtual world accessing MVP needs live access to the web based logic and repository and can't work in stand-alone mode
- with Collada/3DS we are representing the objects in terms of how they will actually be presented, whereas with MVP we are defining the items in more semantic terms (eg chair, table, wrist touched, rez thermometer) and we leave the presentation to the virtual world. This is again analagous to the web, the Collada/3DS model is what we got with the presentation focussed HTML, whereas MVP is far closer to the semantic web that Tim Berners-Lee is desperately trying to get us back to.

Of course an issue with the Outer-operability model is who “owns” the information hub, or is this something that could be done on a federated or P2P basis?

Conclusions

To re-iterate, for us the ONLY way that virtual worlds will reach mass market is when we have common infrastructure standards like HTML and HTTP (hey we could even call it VRML 2!).

But creating those standards and getting them adopted is a HUGE task (and far harder than creating interoperability standards which aren't adopted). And if we have infrastructure standards as a long term goal (which by all means we should be starting now), then perhaps we should also look for some quicker wins out of outer-operability standards – particularly in terms of avatar information, inventory data, application services (such as PIVOTE and Glasshouse) and maybe even world layout.

FUTURE ROADMAP

What is a Roadmap?

So where are virtual worlds going? In futurology terms a roadmap is an attempt to map out the technological, environmental, social and political forces and changes around a particular development. The map tries to identify the most likely and/or important milestones in the future progress of that development, and some of the most likely alternative paths between those milestones.

Three Key Technologies

Along with many commentators, we identify Virtual Worlds – or at least the “digitisation” of the atom based world – as one of the 3 key technologies that will change human culture during this century. For reference the 3 are:

- Genetics
- Nanotechnology
- Digitisation

Genetics is primarily concerned with how we use biology to change our own bodies, and the life around us.

Nanotechnology looks at using mechanical methods (at a microscopic level) to achieve the same ends.

With Digitisation our focus is on the new domain of digital existence, our surroundings, and perhaps even ourselves, are digitally mediated.

Scope

The scope of this roadmap is the future development of virtual worlds. Within this roadmap we are not so much concerned with the segmentation of virtual worlds (eg into Massive Multiplayer On-Line Games (MMOs), 3D chat etc), or their application to specific markets, but rather the bigger picture of their long term evolution. The roadmap principally concerns itself with the technological options and milestones in this evolution, at a later date we might also identify the social, economic and political issues where they may significantly affect development.

Assumptions

In developing this roadmap we have made a few basic assumptions:

- There are no military, political, social, economic or environmental issues which will block or otherwise significantly delay or deflect the roadmap
- Virtual Worlds remain primarily a private sector endeavour, and not under public or monopoly control
- There is a continuing will to develop Virtual Worlds
- Infrastructure standards (as described above) are established and are adopted across all virtual worlds – making a hypergrid of virtual worlds

We have also assumed that the development of Virtual Worlds along this roadmap is now something that can be accomplished by the private sector, and that it is not dependent on governmental (or even private sector) mega-projects – although Government funding may help speed the process, and government involvement as a major user/participant is almost inevitable.

PEST Analysis

PEST stands for Political-Economic-Social-Technical and is a standard approach for futures management. The table below identifies the main PEST issues which are likely to impact the future development of virtual worlds – and hence drive the roadmap.

A PEST analysis for virtual worlds is shown below:

The MetaVerse Roadmap

If you are interested in the future of Virtual Worlds you may also wish to look at the Metaverse Roadmap which was developed in the US during 2006/7. It can be found at:

<http://metaverseroadmap.org/>

Unfortunately development of the roadmap came to something of a grinding halt as many of the contributors fell foul of the crash in virtual world service companies once the marketing dollars left, but the core of the roadmap is still a nice way to look at the virtual world (and related augmented reality) space.

Political	Economic
Increasing legislation on reducing carbon/energy use	Increased cost of travel/commuting
Increasing need for co-ordinated response to natural and man-made disasters	Possible taxation of virtual world transactions
Continuing importance of the “war on terror” and the need to curb extremism	Increasingly global and collaborative nature of business
	Short(medium) term focus on cost reduction and increased efficiency
Social	Technological
Increasing stigma of travel/commuting	Continual improvement in the power of computers and in their graphics capability
Increased diaspora and need to connect distributed families/communities/friends	Continual improvement in the bandwidth for fixed and mobile connections
Increasingly house/hospital bound elderly generation	Increased use of mobile and hand-held devices
Kids brought up on virtual worlds enter University/work	Emergence of new interface technologies
A continuing preference for unobtrusive and “natural” interfaces	Continued concerns about network, data, identity and information security

We believe that the impact of these on the future development of virtual worlds are:

- A growing need for virtual-worlds, not just to address remote working/learning, but also to help with social changes such as an aging population and distributed communities, and a need for greater co-operation and collaboration in business and government
- Certain technology “needs” of virtual worlds (good PCs and bandwidth, and even mobile operation) will just happen as a result of general technological progress
- The “regulation” and oversight of virtual worlds is likely to increase not decrease – reducing their “fantasy” element and embedding them more fully in the real world
- More interface options are developed, and users become more familiar with using virtual worlds – but they are still resistant to “artificial” user interfaces

Technology Strands

For the roadmap we have identified 8 major strands of technological development for virtual worlds:

- Physics: how objects interact and behave in the world
- Functionality: what you can do in the world
- Rendering: how the world and the objects in it appear to users
- Avatar Appearance: how the avatar looks
- Avatar Interaction: how the avatars interact
- Virtual Agents: how avatars can act apart from human control
- User Interface: how the user controls the avatar and senses the world
- Access: how the user accesses the virtual world
- Architecture: how the virtual world is built

The table below summarises what we see as the main developments in each of these, and there is more detail in Annex D.

Strand	Short Term	Medium Term	Long Term
	Timescale 2010 – 2015	2015 – 2025	2025 - 2040
Physics	Earth “physical” physics(*)	Other values of gravity Radio propagation. Other scales Soil mechanics Hydrodynamics	Chemistry Biology
Functionality	Web access * Mirrors (*) Applications (*)	Any app	Any app
Rendering	2000s game good(*)	2010s game good HD	Window good Eye good
Avatar Appearance	Dynamic expressions Extensive motion-capture(*)	Muscle features Fully realistic movement and gestures	Internal organs
Avatar Interaction	Text* Speech*	Speech translation Touch	
AI & Virtual Agents	Task bots* Chatbots(*) Basic emotion/motivation Text to speech (*)	Speech recognition Advanced emotion /motivation Virtual world Turing passed True virtual assistants	Individual and personal Turing passed Personal programmatic “copies”
User Interface	WIMP* Joystick*	3D webcam Tactile gloves Head mounted displays Augmented reality	Neural/brain wave interfaces?
Access	Bespoke thick clients* Browser plug-ins (*)	Common thick client Native in-browser (full and part immersion)	
Architecture	Stand-alone proprietary and OS grids	Move to common open standard hyper-grid	Open standard hyper-grid

Items marked * are available now in some(*)/most* virtual worlds

Bots in Virtual Worlds

Bots can be used in a wide variety of ways in virtual worlds – and can exist at varying levels of sophistication. Our main interest is in avatar-based bots – ones which look and act like other users. Uses can include virtual receptionists, sales staff and tour guides, mentors, and characters in simulation and training exercises, or even in virtual dramas.



Two virtual actor bots acting out a scene from a video – each bot knows only its own lines, and the cue words from the other actor.



Abi, Daden's virtual receptionist. She can answer questions about Daden and will soon be able to give tours of the island. A 2D version runs on Daden's web site driven by the same “brain”.



Bots can be given emotional responses so they react instinctively when they see things they do or do not like.

The Role of Bots and AI

To me *the* most interesting aspect of the future development of virtual worlds is the parallel development in artificial intelligence. As the quotes at right suggest we believe that virtual worlds provide the environment necessary in which to develop an AI (or within which an AI can develop. An environment built for humans not laboratory AIs, but one in which the AI can participate on a level playing field. If you look at an avatar in a virtual world you cannot tell just by looking whether it is a human or an AI. It is only by the way it acts, speaks and behaves that you can tell. And in most virtual worlds your normal working assumption is that every avatar is a human, not a bot – the game has changed.

– A Virtual Turing Test

For us a virtual world is a far more natural place to hold a Turing Test than on the web or in a command line interface. The Turing Test [TURING1950] was proposed by British mathematician and code-breaker Alan Turing to identify whether a machine was “intelligent” by seeing whether a human “judge” could tell the difference between chatting (by text) with the computer AI and chatting with a human “confederate” through two unidentified terminals. The problem for us with this is that the judge *knows* they are taking part in the test and so does the confederate human (and if it’s clever the computer!). By putting the AI into the wild in a virtual world and asking people *after* they’ve talked to it (and other humans) whether it’s human or not we have a far fairer test. In fact our bots take part in such virtual Turing tests every day as they are logged in 24/7, and some days they do actually pass it for a few minutes or so – and we know that other bot developers such as MASA Group have reported the same thing.

“part of the essential component of human-equivalent AI is to be intimately connected to an environment”

- Mitch Kapor, ex-Chairman Linden Lab, Founder of Lotus and Designer of Lotus 123.

- Main Chatbot Milestones

We see eight main milestones in bot development:

“a computer-modelled world .. puts both ‘artificial’ and ‘real’ people on more of an equal footing. Indeed, this is a requirement of the Turing Test; .. An avatar controlled by a person you cannot see (or is the avatar under the control of AI?) is more in keeping with the conditions of the test.”

- Extropia DaSilva, SL Resident and Blogger

Milestone	Description
Task bots	Bots which perform particular tasks and can respond to limited commands – such as greeters or simple characters in training and learning scenarios
Chatbots	Bots with a fuller natural language capability to carry out basic conversations but at a sub-Turing level, and with a moderate degree of agency in the world (eg navigate, rez, give, gesture etc)
Emotional/Motivated bots	Bots which have emotional and motivational models, and reflect these in their behaviours. In some ways many game AIs already implement these – but in a far more constrained environment than a virtual world
Virtual Turing passed	The virtual Turing test – as defined above - is passed. The bot cannot be recognised as a bot by the majority of people after 5 – 10 minutes engagement with it in a virtual world
True virtual assistants	Bots with the ability to be practical and effective virtual assistants become available. They can stay in world when you are gone and meet others and go to events on your behalf and report back. Think of the 1980s videos of what mobile phones would do!
Individual Turing passed	Like the Virtual Turing, and again in the virtual world, but now the bot rather than being a generic character represents a “known” person – such as a historic figure or VIP.

What We Got Wrong

As mentioned at the beginning this white paper is a follow-up to 2 papers we wrote in 2007. Forecasting the future is a notoriously risky business – so where was our crystal ball the most off in trying to forecast what would happen in the last 3 years?

- We hoped that simultaneous co-located avatar numbers would reach 1000 by 2010, but most virtual worlds are still stuck at the 50 – 100 level with no real change in the last 3 years

- We thought that entertainment would lead business, but scaling issues have still kept serious entertainment usage out

- We thought that transactions (including v-commerce) would be an important part of the early virtual world scene – they aren't and won't.

But we did get some things right:

- it's still going to be 5 – 10 years yet before virtual worlds hit mainstream

- the “virtual” landmass is still at country not continent level

And one you can debate – we'd forecast 500m users in virtual worlds. That seems over the top now, but leading VW analysts KZero [MITHAM2010] currently estimate that there are around 600m registered account in virtual worlds at end 3Q09, BUT only 20m of those are aged 25+ (which would make that figure almost 100% Second Life, so something is wrong somewhere!).

Milestone	Description
Personal Turing passed	Like the Individual Turing, but the person the bot is emulating is you, and your colleagues and family cannot tell the difference!
Personal programmatic copies	<p>With the passing of the personal Turing it becomes feasible to create personal programmatic copies of yourself which can operate in world 24/7. They are not perfect, and they are programmed and developed from monitoring, teaching and learnt behaviour but they can fool the majority of people for most of the time., They are not the result of any science-fiction type brain scanning or “upload” process – just sheer hard and smart work and engineering.</p> <p>Amongst the whole host of ethical issues that are raised at this point is what happens to your copy(ies) when you die?</p> <p>For an interesting primer on this whole area of artificial immortality read Linda Geddes article “Immortal Avatars: Back up your brain, never die” in the 7 Jun 2010 issue of New Scientist [GEDDES2010].</p>

For more information see David's paper presented to the 2008 British Computer Society Special Interest Group on AI annual conference [BURDEN2008].

Metrics

We have also tried to estimate the metrics that might be associated with the growth of virtual worlds over the coming decades. This is harder to estimate than the qualitative changes (and indeed the part we – and other analysts – have got the most wrong), but it might give some idea as to the rates and extent of growth that could be expected. Please pay attention to orders of magnitude, not specific values. A possible scenario is:

Metric	2007	2010	2015	2020	2030	2050
Global Internet Population		1Bn	1.5Bn	2Bn	3Bn	6Bn
VW Users	50m	100m	200m	500m	2Bn	6Bn
Simultaneous Users (all grids)	20k	100k	250k*	5m**	100m**	500m**
Max co-located, co-visible users in one place	50	100	1000	5000	10000	50000
Built area	NYC	NY state	Whole countries	Earth	Solar System	Solar systems
Deployment Model	S/alone Grids	S/alone Grids	Both	Hyper-grid	Hyper-grid	Hyper-grid

* across the hypergrid

** across the hypergrid and including personal bots

So where does all this lead us?

Bringing together our assessment of what virtual worlds really are, growth in adoption and changes in capability, standards activity and the convergence activity we identify four potential major phases in the development of the technical infrastructure which provides Virtual Worlds:

- **Startup Phase (2000 – 2010)** – A growing number of isolated virtual worlds, many the products of start-up companies, or the result of special projects within major media organisations
- **Growth Phase (2010 – 2020)** – A big surge in numbers as the B2B usage goes mainstream. The effect of this is likely to be that the model of isolated virtual worlds becomes unsustainable
- **Consolidation Phase (2015 - 2030)** - Initially Virtual Worlds combine, and then we start to migrate to (hopefully) open standards that allow all worlds to inter-link. The integration and inter-action extends to other related platforms, and this helps to support the adoption for B2C and C2C use.
- **Universal Phase (2030 – 2050)** - The final major change is when Virtual World usage becomes just a “standard” part of the Internet in the way that the Web is now – and every Internet user also has their Virtual World existence.

Our development and analysis of this roadmap has also led us to identify 6 spaces which Virtual Worlds are likely to occupy in our lives. The spaces do to an extent overlap, and indeed we already see some signs of the first 3 in the current virtual worlds. It is, though, important to bear in mind that for each space there may be fundamentally different audiences, business models, dominant virtual worlds and methods of interaction.

‘We think a lot about the nature of the brain, and whether computational substrates can be dense enough to enable thinking within them. I know exactly how that’s going down, I think ... SL is dreaming. It could be looked at as one collective dream.’

- Philip Rosedale, Founder & twice CEO Linden Lab

- **Social Space** ... where people can meet and socialise
- **Experience Space** ... where we are happy to have social, emotional, learning and business experiences, which have real-world impacts, including training, learning, experiencing past, present and future built environments, and collaborating for work and play
- **Entertainment Space** ... which rivals, and maybe then surpasses, many games, films and even TV as a source of compelling, “realistic” entertainment, both user and commercially generated
- **Agent Space** ... where we can leave software agents to conduct transactions for us, drawing on our own knowledge and experiences, access the web for raw information needs, and engaging other agents to fulfil or facilitate transactional needs
- **Dream Space** ... in which our virtual experiences are as real to us as our dreams
- **Post Human Space** ... a space in which we, or our synthetic agents or analogs, can live a complete existence, independent of the real, physical, world

CONCLUSIONS

Virtual Worlds are still in their early years. However we believe that they have now started an almost unstoppable march towards becoming a dominant factor, if not THE dominant factor, in our lives.

Within this paper we have identified a number of key messages about virtual worlds and their future:

- The current serious use of virtual worlds is around training and learning, building visualisation and data visualisation and collaboration
- Virtual worlds can deliver real savings in cost, time and CO₂, and deliver increased involvement
- Virtual worlds are all about social interaction
- Virtual worlds are not the future of the web, or the 3D web
- Virtual worlds can provide a common 3D/collaborative interface across a wide range of application types – they can provide a geo-social operating system to compliment the 2D/transactional web
- We need common infrastructure standards if virtual worlds are going to achieve mass adoption, but in the short-term interoperability standards may be more use than interoperability standards
- Bots and artificial intelligences will be a key component of virtual worlds

In Geoffrey Moore's technology adoptions terms Virtual Worlds have yet to "cross the chasm". They are still the domain of the early market, but we judge that they are now well beyond the "visionary" stage and into the realms of the early adopter.

In hype terms (see Gartner's Hype Cycle) we consider that Virtual Worlds are now nicely beyond the "slough of despond". For Virtual Worlds the real hype was over 10 years ago with Virtuality headsets and immersive VR. That technology may come again, but a teenager (or business man or woman) playing or working in a virtual world is every bit as immersed as their visor-wearing 1990s counterpart. That is not to say though that it will all be plain sailing as we move further along the hype-cycle curve towards the "plateau of productivity". The main curve is, we are sure, a fractal. Focus in on any one part and you will see micro-cycles of different technologies and different platforms. The hype around Second Life came and went, and may come again, and its growing pains may not yet be over – but overall the trend is upwards.

For us, though, the factor that chimes the loudest is the fact that the first fully productive "spaces" may yet be 5 - 10 years away. The Web took just over 10 years to go from nothing to the nearly all pervasive system it is now. It seems reasonable to allow these latest generations of usable Virtual Worlds a similar time to establish themselves. And just as with the web organisations that engage now will have a chance to learn and establish mind-share in their sectors before the real competition is joined.

But that time-frame is important for another reason. Today's 12 – 15 year olds grew up with Club Penguin, Runescape and Disney's Toontown (yes they are in the past already). They have grown up in Virtual Worlds. In 5 - 10 years time they will be going to college, and starting work. And Virtual Worlds will be ready for them. Will we?

About the Author

David Burden is a Chartered Engineer by training but also spent 10 years in the British Army (where he claims to have been one of the first true cyberpunks - going to work in the 1980s dressed in black and with a laptop, wireless modem and 9mm pistol), as well as having been Marketing Director for a £60m turnover IT company.

During the dot-com boom David founded a wireless start-up, and also set-up First Tuesday Midlands, a regional chapter of the First Tuesday organisation. He founded Daden in 2004.

David's interest in Virtual Worlds pre-dates the web - his first Virtual World was the vast pen and ink Science Fiction role playing game that was Traveller, and for which we wrote several gaming supplements. Once the web arrived David realised how even simple tools such as Javascript and VRML could be used to create synthetic personalities, and Virtual Worlds.

David takes a keen interest in regional and national issues within the IT sector (having sat on and chaired committees at both levels), and has also spent time focussing on issues of accessibility and the digital divide.

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Further Information

If you would like to talk through some of the issues raised in this white paper, or think that we can help you understand Virtual Worlds a little bit better or use them in your organisation, then please contact us:

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By email: info@daden.co.uk

In Second Life at: Daden Prime sim or IM Corro Moseley, our virtual representative in Second Life.

About Us

Daden Limited is a Virtual Worlds and AI solution provider based in Birmingham, UK and Second Life. We have been working with avatar and Virtual World technology for almost 10 years. We have built environments in several Virtual Worlds, and also developed interfaces between virtual and real environments. We have a deep understanding of the possibilities offered by new technologies, but combined with good understanding of the marketing and usability issues to know what might work, and what won't.

We have worked on virtual world and virtual character projects for a wide variety of public and private sector organisations, in the UK and abroad, and principally within the areas of learning and training, built environment visualisation, and collaboration and data visualisation.

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Current Virtual World Platforms

World/Owner	URL	Description
Alpha World <i>Active Worlds Inc</i>	www.activeworlds.com	Pre-dates all the other so simpler graphics, but has good user interface (UI) and programmability, and relatively low bandwidth/graphics requirements
Blue Mars <i>Avatar Inc</i>	www.bluemars.com	Consumer focussed world, like There.com on steroids, but beginning to offer white label development opportunities. High spec and gloss.
Olive <i>SAIC</i>	www.saic.com http://www.forterrainc.com/	An "enterprise" solution with many Global 500/Government users, recently acquired by SAIC in their takeover of Forterra Inc. *
OpenSim <i>Opensource</i>	www.opensim.com	An open-source version of Second Life, still in beta, but growing in adoption
Protosphere <i>Proton Media</i>	www.protosphere.com	A relatively new entrant aimed at the Enterprise space
Second Life <i>Linden Lab Inc</i>	www.secondlife.com	Both a consumer and enterprise world
Teleplace <i>Qwaq Inc</i>	www.teleplace.com	A meetings orientated virtual world (or virtual meeting room to be precise)*
Vastpark <i>Vastpark Inc</i>	www.vastpark.com	A relatively new entrant, recently placed its core code in open source.*
Web.alive <i>Avaya</i>	www.projectchainsaw.com/WaStore/	A browser based solution from Nortel, more an engine than a virtual world. Recently sold to Avaya.*
Open Wonderland <i>Open source</i>	http://openwonderland.org/	An open source virtual world written in Java. Was supported and promoted by Sun, but Sun support was discontinued after their takeover by Oracle. Now a community project.

Platforms marked * have been chosen for the US Government's vGov prototype programme.

Virtual Worlds – A New Medium or Meta-Medium?

What is a Medium?

Before answering the question as to whether Virtual Worlds represent a new medium we have to make sure we know what a medium is. The OED defines a medium (in its communications sense) as "an intermediate agency, means, instrument or channel", also "the 'element' in which an organism lives, one's environment, conditions of life." To us a medium is a method of communicating information (including emotional information) from one person to another.

Note that a medium here is separate from a communication channel. This is more specific in how the information is moved across space, and is independent of the content of the information.

TV, radio, newspapers, word of mouth, email, the Web are all forms of media. The Internet, wireless, broadband, paper are communications channels.

That virtual worlds are a means of "communicating information (including emotional information) from one person to another" seems to us to be self-evident.

If virtual worlds are a new medium then they are likely to bring with them a new language, their own advantages and disadvantages, their own formats and their own stars, and turkeys.

Whether a virtual world is, of itself, a mass-medium is another question entirely. We don't think that it is. In fact, the problems that many retailers and marketeers may face in exploiting virtual worlds may be through the mistaken assumption that these worlds are just another mass medium.

The issue is not so much whether Virtual Worlds are a medium, but whether they are significantly different from related media such as the Web.

Characteristics of Media

We see media as being defined by 4 characteristics.

Type	Is the medium one of atoms (e.g. paper, sound) or bits (i.e. electronic signals)
Senses	Which senses does the medium invoke (sight, sound etc.)
Synchronous/ Asynchronous	Must the sender and receiver be 'present' or 'connected' at the same time?
Interactivity	Is the communication one-way or two-way

Here we use "bits" and "atoms" in the sense developed by Nicholas Negroponte of MIT [NEGROPONTE1985], and accept that analogue TV would be classified as bits (even though it is an analogue signal).

We can use this to try and characterise the common types of media in existence today:

Medium	Type	Senses	Sync/ ASync	Interactivity
Newspapers	Atoms	Sight/Text	ASync	V Low
Books	Atoms	Sight/Text	ASync	No
TV	Bits	Sight/Sound Images	ASync	Low->Medium
Radio	Bits	Sound	ASync	Low->Medium
Billboards	Atoms	Sight/Image/Text	ASync	No
Word of Mouth	Atoms	Sound/Sight	Sync	V High
Web	Bits	Sight/Text/ Sound	ASync	Low->High (2.0)
eMail	Bits	Sight/Text	ASync	Low

On this basis we would characterise Virtual Worlds as:

Medium	Type	Senses	Sync/ ASync	Interactivity
Virtual Worlds	Bits	Sight/Sound (Rich 3D)	Sync	V High

It is interesting to compare this with Web - the medium with which most people would associate Virtual Worlds:

- Both are bits based
- Both are primarily sight based, but Virtual Worlds are more image orientated (and pseudo-3D at that), and increasingly sound orientated. On the Web, despite YouTube, text and still image continue to dominate.
- The Web is fundamentally an asynchronous medium - something is posted and it may be hours, days even years before it is read. Virtual Worlds are far more synchronous, people typically need to be on-line at the same time to exchange information.
- Interactivity levels on the Web are increasing (Web 2.0), but fall far short of the interactivity inherent in Virtual Worlds.

Hence, Virtual Worlds are distinctly different from the Web in two areas - synchronicity and interactivity.

Interestingly the medium with which Virtual Worlds have the greatest affinity is with the real world of person to person, and person to object interaction. This should be their comparison base - not the Web.

If we are going to treat virtual worlds as a new, social, medium then there are further observations that we can make.

First; experience has shown that users typically invest a lot of time and emotional capital in Virtual Worlds. The average Second Life usage is 19 hours a month (25 hours a month for women). Users are unlikely to be seriously active in more than one world.

Second; Virtual Worlds are an immersive, all-consuming synchronous environment. They require a user's almost complete attention, and they need users to be in the world at the same time to have the full social experience. Whilst browsing the Web, or using a chat system, users may also be watching TV, listening to the radio, popping in and out doing other things. With Virtual Worlds the user is far more likely to be entirely focussed on the world - to the exclusion of other media, and even other social activity. They exist, to all intents and purposes, only in the Virtual World.

Third; the introduction of any new medium often results in existing media having to adjust or adapt. Just look at how print and TV media have adjusted to the Internet. How will they, and the Web, have to adjust again to Virtual Worlds?

Precession of Simulacra

Another perspective which could be applied to this evolution (although at the risk of getting just a little pretentious!) is Jean Baudrillard's Precession of Simulacra from his book Simulations (fittingly both an inspiration for and prop within The Matrix). Baudrillard identifies 5 successive phases of the image:

- basic reality
- the reflection of a basic reality
- masking and perverting a basic reality
- masking the absence of a basic reality
- bearing no relation to any reality whatever: it is its own pure simulacrum

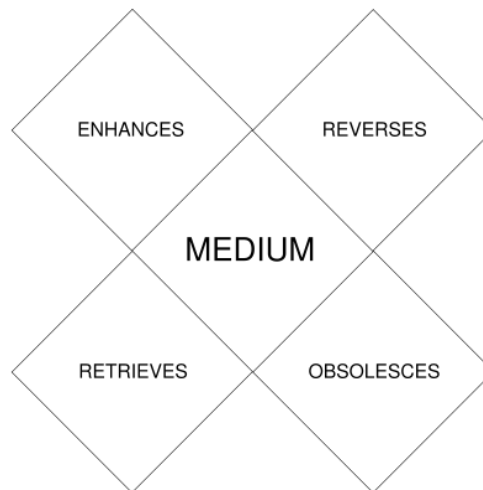
It may be too literal an interpretation, but in this we see:

- reality and the real world,
- word of mouth
- books, literature and text reporting
- radio, TV and the web
- virtual worlds

Media Tetrads

Another useful model for analysing media is Marshall McLuhan's Tetrad. This pulls together his 4 laws of media and seeks to analyse each medium (or indeed any change agent) in terms of:

- What it enhances
- What it obsolesces
- What it retrieves from the past, and
- What it might become if its impact is the reverse of that initially envisaged.



The Tetrads for the Web and for Virtual Worlds could be:

Medium	Enhances	Obsolesces	Retrieves	Reverses
Web	time and distance	tv libraries retail shops	knowledge	porn link farms abandoned sites malware
Virtual Worlds	synchronicity imagination	real world meetings travel?	socialising shared experience camp-fires geography	cyber-sex griefing (virtual vandalism) ghost towns

Virtual Worlds and the Web show marked differences. The Web enhances communications across time, Virtual Worlds almost demand synchronicity. The Virtual World really enhances imagination, the web (and TV) delivers a complete, pre-packaged experience. The Web obsolesces information and product "shops" (which necessarily will have to re-invent themselves), whereas Virtual Worlds may obsolesces real world travel and gathering (which some find a frightening thought, possibly rightly if not treated in a balanced way or re-invented and re-assessed) Likewise the Web retrieves knowledge whereas virtual spaces retrieve social interaction and shared experience (even if in virtual space).