Second Life in higher education: Assessing the potential for and the barriers to deploying virtual worlds in learning and teaching

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Abstract

Second Life (SL) is currently the most mature and popular multi-user virtual world platform being used in education. Through an in-depth examination of SL, this article explores its potential and the barriers that multi-user virtual environments present to educators wanting to use immersive 3-D spaces in their teaching. The context is set by tracing the history of virtual worlds back to early multi-user online computer gaming environments and describing the current trends in the development of 3-D immersive spaces. A typology for virtual worlds is developed and the key features that have made unstructured 3-D spaces so attractive to educators are described. The popularity in use of SL is examined through three critical components of the virtual environment experience: technical, immersive and social. From here, the paper discusses the affordances that SL offers for educational activities and the types of teaching approaches that are being explored by institutions. The work concludes with a critical analysis of the barriers to successful implementation of SL as an educational tool and maps a number of developments that are underway to address these issues across virtual worlds more broadly.

Introduction

The story of virtual worlds is one that cannot be separated from technological change. As we witness increasing maturity and convergence in broadband, wireless computing,

video and audio technologies, we see virtual immersive environments becoming more practical and useable. In this article, I review the present socio-technical environment of virtual worlds, and draw on an analysis of *Second Life* (SL) to outline the potential for and the barriers to successful implementation of 3-D immersive spaces in education.

Virtual worlds have existed in some form since the early 1980s, but their absolute definition remains contested. This reflects the general nature of a term that draws on multiple writings of the virtual and the difficulties in attempting to fix descriptions in an area that is undergoing persistent technological development. The numerous contextual descriptions that have appeared, from the perspectives of writers, academics, industry professionals and the media, have further complicated agreement on a common understanding of virtual worlds. Bell (2008) has approached this problem by suggesting a combined definition based on the work of Bartle (2004), Castronova (2004) and Koster (2004), drawing the work together using key terms that relate to: synchronicity, persistence, network of people, avatar representation and facilitation of the experience by networked computers. But perhaps the most satisfying and simplest insight comes from Schroeder (1996, 2008) who has consistently argued that virtual environments and virtual reality technologies should be defined as:

A computer-generated display that allows or compels the user (or users) to have a sense of being present in an environment other than the one they are actually in, and to interact with that environment (Schroeder, 1996, p. 25)

In other words, a virtual world provides an experience set within a technological environment that gives the user a strong sense of being there.

The multi-user virtual environments (MUVEs) of today share common features that reflect their roots in the gaming worlds of multi-user dungeons and massively multi-player online games (MMOs), made more popular in recent times through titles such as *NeverWinter Nights* and *World of Warcraft*, both based on the *Dungeons and Dragons* genre of role-playing game. Virtual worlds may appear in different forms yet they possess a number of recurrent features that include:

- persistence of the in-world environment
- a shared space allowing multiple users to participate simultaneously
- virtual embodiment in the form of an avatar (a personisable 3-D representation of the self)
- interactions that occur between users and objects in a 3-D environment
- an immediacy of action such that interactions occur in real time
- similarities to the real world such as topography, movement and physics that provide the illusion of being there.

(Smart, Cascio & Paffendof, 2007)

These are features compelling enough to attract more than 300 million registered users to spend part of their time within commercial social and gaming virtual worlds (Hays, 2008).

From MMOs and MUVEs to SL

What marks a significant difference between MUVEs and MMOs is the lack of a predetermined narrative or plot-driven storyline. In the worlds exemplified by SL, there is no natural purpose unless one is created or built. Here, social interaction exists not as a precursor to goal-oriented action but rather, it occurs within an open-ended system that offers a number of freedoms to the player, such as: the creation and ownership of objects; the creation of interpersonal networks; and monetary transactions that occur within a tangible economic structure (Castronova, 2004; Ludlow & Wallace, 2007). It is primarily this open-endedness, combined with the ability to create content and shape the virtual environment in an almost infinite number of ways, which has attracted educators to the possibilities afforded by immersive 3-D spaces.

A typology of virtual worlds

Within the broad panorama of virtual environments, we can find offerings from both open source projects and proprietary vendors. These include the worlds of *OpenSim*, *Croquet Consortium*, *ActiveWorlds*, *Project Wonderland*, *There*, *Olive* and *Twinity*. We can identify a number of approaches to platform development and delivery each defined by their perceived target audience. For example, *Olive* specifically markets itself towards large institutions and enterprise-level productivity. MUVEs, therefore, can be categorised in a number of ways. In the typology shown in Table 1, a number of extant 3-D virtual worlds are grouped by their narrative approach and 3-D representational system.

There are several alternative categorisations that have been suggested. Messinger, Stroulia and Lyons (2008) builds their typology on Porter's (2004) original typology of virtual communities where the five key elements of purpose, place, platform, population and profit models are identified. Messenger uses this alternative typology productively to help identify the historic antecedents of virtual worlds, their future applications and topics for future research. What both these typologies demonstrate is that there is a range of virtual worlds, which offer distinctly different settings in which to site educational interventions. Within the typology outlined in Table 1, concrete educational activity can be identified in all four of the virtual world categories listed. The boundaries between these categories are soft and reflect the flexibility of some virtual worlds to provide more than one form of use. This is particularly true of SL, and has contributed to this platform's high profile in comparison to other contemporary MUVEs. Although often defined as a 3-D social networking space, SL also supports role-playing game communities and some degree of cooperative workflow through the in-world tools and devices that have been built by residents.

SL as the platform of choice for education

SL represents the most mature of the social virtual world platforms, and the high usage figures compared with other competing platforms reflects this dominance within the educational world. The regular Eduserv virtual worlds survey conducted among UK tertiary educators has identified SL as the most popular educational MUVE:

Table 1: A typology of 3-D virtual worlds (adapted from McKeown, 2007)

Flexible narrative	Social world	Simulation	Workspace
Games (MMPORGs) and serious games	Social platforms, 3-D chat rooms and virtual world generators	Simulations or reflections of the 'real'	3-D realisation of CSCWs
World of Warcraft *NeverWinter Nights* *Ardcalloch* *Rivercity project*	*Second Life* *Metaplace* *Habbo Hotel* *Sims Online* *vSide*	*Distributed Observer Network* *Google Earth*	*Project Wonderland* *Olive* *Open Croquet*
The world is a setting in which your story or narrative unfolds within the constraints of the rules and goals set by the designers.	The world may have elements of both a fictional and physical world and exists primarily as a place for social interactions to occur.	The world is a close representation of the physical world and governed by the same rules.	The world provides a virtual workplace setting for collaborative activity and often includes the necessary tools.
You are a character in a role with a defined purpose.	You are an extension of yourself.	You are yourself.	You are yourself.

CSCW, computer-supported collaborative workspace; MMPORG, massively multi-player online role-playing game.

Taking into account institutions who haven't responded but where there is reasonable evidence of SL activity, and institutions who are developing in SL but not in a public way, then a figure of roughly three quarters of UK universities are estimated to be actively developing or using Second Life (Kirriemuir, 2008, p. 58).

This represents a substantial increase when compared with the figures reported for July 2007 where around 40 plus UK universities and colleges (less that a quarter of the total) were listed as having a building, land or island on the grid (Kirriemuir, 2007). The report does acknowledge that other environments such as *OpenSim* are being investigated. But it is the relatively low cost of entry, the ability to create complex objects and environments, combined with the sophistication of its graphics and the rich immersive experience, that are identified as establishing SL as the most attractive proposition for educators.

Components of the SL experience
Three components of SL are explored in more detail: the technical infrastructure, immersion and socialisation. These comprise major elements of the type and quality of experience that SL offers. They also represent dimensions that are essential in understanding its potential and the barriers to using virtual worlds in educational settings.

Technical infrastructure
The underlying architecture of SL is built on a client-server model. The graphical user interface runs locally while the 3-D virtualisation is provided partly by the Havok physics code running on servers owned by Linden Lab. The visual experience is rendered in real time, unlike other gaming engines where objects such as monsters and weapons are stored locally. This working approach is one that facilitates an unprecedented openness in terms of user-content creation. On the downside, it places undue stress on the graphic capabilities and bandwidth at the user end. Often, this compromises critical components of the end-user experience, particularly the frame rate, the key to creating the illusion of smooth and uninterrupted interaction. This can lead to one of the most negative in-world effects, that of 'lag'—where heavy loads caused by too many objects in a single location slow the experience to one which can feel jerky, unstable and frustrating. In addition, the evolutionary process of system updates and patches often compounds frailties that stem from scalability and resilience issues across the platform in general, such that down time and the burden of installing new client releases at regular intervals. As educators, often working with limited resources, these are issues that form a major barrier to more widespread use and are discussed later in this paper.

These technical issues do raise questions as to the viability of using virtual worlds for large-scale educational projects, yet we can identify emerging technical developments aimed at increasing the porous nature of what were once relatively closed systems. We are now witnessing the opening up of application programming interfaces, allowing interactions between third-party developers and proprietary systems. The multimedia capabilities of these are now increasing and include the ability to stream video, sound

and web content to specific in-world parcels or locations. With the introduction of audio, avatars can now benefit from spatialised sound that responds by changing in volume as the distance from the source increases or deceases. These advances have been matched by more simplified methods for importing external content and offer attractive incentives to educators seeking to build rich learning and teaching activities inside virtual worlds.

The tools and processes available in SL for creating artefacts are sophisticated and do not differ substantially when compared with the processes for creating electronic objects in computer-based application development. A basic vocabulary of shapes, from cubes to cylinders, forms the simple building blocks that can be moulded and interconnected into more complex 3-D objects. Interaction between elements can be achieved through the use of embedded scripts, and in this sense, the design and development processes resonate more with games design than traditional computer programming. To work collaboratively and effectively, any major build requires techniques to standardise naming procedures, ownership and version control, and semi-formal development methods are essential to achieving useable outputs, helping to rationalise what can be a significant investment in time and labour (Salt, Atkins & Blackall, 2008).

Immersion and co-presence
The presence layers elaborated in Figure 1 and the visual and physical realism that SL adds to the virtual space combine to produce a profoundly immersive experience—one that conveys a feeling of being there and a strong sense of co-presence when other avatars are present. Yee, Bailenson, Urbanek, Chang and Merget (2007) have studied the social norms and behaviours of avatars inside SL, focusing on the persistence of non-verbal elements and their relevance in establishing virtual worlds as a place for research in the social sciences and clinical behaviour. They reported a strong correlation to real-world findings of fluctuations in interpersonal distance and mutual gaze, suggesting that avatars behaved very much like their real-world counterparts. When repositioned in an educational context, co-presence can be related to the concept of student and teacher presence, central elements in Garrison and Anderson's (2003) community of inquiry model (COI). In the COI model, the abilities of both student and teacher to project themselves into the learning space are key elements to successful learning transactions. These findings suggest that the immersive nature of the virtual world, crossing physical, social and cultural dimensions, can provide a compelling educational experience, particularly in relation to simulation and role-playing activities.

Socialisation and social objects
Social acts and socialisation drive the use of SL and are supported by multiple communication channels, viewable avatar profiles and the intricately built architecture and objects. In-world sociality is visible in the bonds that form within virtual communities and the subcultures that develop in-world. When viewed through Engeström's (2005) conceptualisation of an 'object-driven sociality', the rich landscape of objects and people can explain why virtual spaces such as SL are so successful. It is the relationship between people and objects, and the importance of shared interest through social

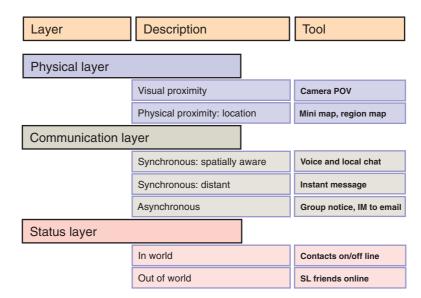| Layer	Description	Tool
Physical layer		
	Visual proximity	**Camera POV**
	Physical proximity: location	**Mini map, region map**
Communication layer		
	Synchronous: spatially aware	**Voice and local chat**
	Synchronous: distant	**Instant message**
	Asynchronous	**Group notice, IM to email**
Status layer		
	In world	**Contacts on/off line**
	Out of world	**SL friends online**

Figure 1: Presence* layers in Second Life (SL). *Presence, according to Yee et al (2007), measures how real one believes a mediated environment is, in terms of non-verbal behaviours (Garau, Slater, Bee & Sasse, 2001), physiological responses (Slater, Usoh & Steed, 1994) and other measures. In the diagram, three separate presence layers are identified for SL. The physical presence layer is composed of a visual element, where avatars can see each other through the default camera point of view (POV)—the main window on the 3-D setting—and a geographic element, where the location of other avatars in-world can be tracked using the in-world 2-D maps. Physical proximity also allows avatars in-world to see physical gestures, poses and animations. The communication layer offers several channels for interaction from synchronous voice and instant messaging (IM) to asynchronous mechanisms, such as an in-world group notification system and the connection of IM to an email account. The status layer provides minimal information about in-world presence indicating when avatars are logged into SL

objects, that create the conditions under which these social spaces work. Without these objects, there would be little conversation with which to sustain life in the virtual world.

Stutzman (2007, p. 1), in a development of Engeström's ideas, makes a distinction between object-centric and egocentric networks:

An egocentric social network places the individual as the core of the network experience (Orkut, Facebook, LinkedIn, Friendster) while the object-centric network places a non-ego element at the center of the network. Examples of object-centric networks include Flickr (social object: photograph), Dopplr (social object: travel instance), del.icio.us (social object: hyperlink) and Digg (social object: news item).

SL combines both aspects to some degree. Ultimately, what the residents of SL and other virtual worlds do so well is provide a reason (we can call them social objects) around which people can connect together and want to continue those connections.

Affordances of SL for education

Peachey (2007) has remarked that as computer games have become more visually dynamic, stimulating and collaborative, they have become of increasing interest to educators. And now, studies from the research community have started to explore the particular affordances (Norman, 1988) of the established environments such as SL and *World of Warcraft*. A review of work carried out on MUVEs and in particular SL (Warburton and Perez-Garcia, 2009) identifies where components of the SL experience can facilitate innovations in pedagogy, through:

- **Extended or rich interactions:** opportunities for social interaction between individuals and communities, human–object interaction and also intelligent interaction between artefacts
- **Visualisation** and **contextualisation:** the production and reproduction of inaccessible content that may be historically lost, too distant, too costly, imaginary, futuristic or impossible to see by the human eye
- Exposure to **authentic content and culture**
- Individual and collective **identity play**
- **Immersion** in a 3-D environment where the augmented sense of presence, through virtual embodiment in the form of an avatar and extensive modes of communication, can impact on the affective, empathic and motivational aspects of the experience
- **Simulation:** reproduction of contexts that can be too costly to reproduce in real life with the advantages that some physical constraints can be overcome
- **Community presence:** promoting a sense of belonging and purpose that coheres around groups, subcultures and geography
- **Content production:** opportunities for creation and ownership of the learning environment and objects within it that are both individual and owned.

In a complementary list, Kay and Fitzgerald (2008) have developed a set of categories that they believe represent the current educational activities of SL:

- self-paced tutorials;
- displays and exhibits;
- immersive exhibits;
- role plays and simulations;
- data visualisations and simulations;
- historical recreations and re-enactments;
- living and immersive archaeology;
- machinima construction;
- treasure hunts and quests;
- language and cultural immersion;
- creative writing.

These can be mapped against the affordances to provide a rich picture of support for both distance and flexible education. In concrete terms, these have been deployed within a number of disciplines to create educational opportunities that have explored both formal and informal learning approaches that include: role play and performative learning; experiential learning; cooperative learning; and game-based learning

(Warburton, 2008b). The PREVIEW project has used problem-based learning to address key issues in teaching clinical management (Savin-Baden, 2008). By taking advantage of the creative role-playing opportunities that SL affords, the project has produced a number of collaborative problem-based scenarios for students to learn how to deal with paramedic emergencies.

Barriers versus potential in the use of SL

The complexity of immersive environments spans a range of technical and social intricacies, and presents a particular set of problems to educators and developers seeking to situate educational activities in a virtual space. The affordances identified have been exploited in a number of ways as noted in the list from Kay and Fitzgerald (2008). Yet creating effective learning scenarios within SL is not without problems. These can be as basic as the competencies required by students to engage with the tutor—as one exasperated tutor comments on the popular *Second Life* Educators (SLED) list when trying to use audio in-world:

> ... teaching with voice can be such a pain. There's always someone who has a problem. Used to be that the problem was related to SL, but more and more, it's just that they [students] don't know how to adjust their settings. I finally sat down and made up a class handout with screenshots that I hope will make my teaching easier in the future.

A survey of newsgroups, blog posts and the extant literature reveals eight broad categories under which reported issues in relation to the use of SL can be grouped (Warburton, 2008a, c; Warburton & Perez-Garcia, 2009):

1. **Technical:** These span machine-related client-side issues of bandwidth, hardware and firewalls to the server-side issues of down time and lag to human or use-related issues that include managing the client interface and developing basic in-world competences such as navigation, creating objects, manipulating one's avatar and developing a visual 3-D grammar. These issues can act in combination and impact differently on different users such that the in-world experience is not consistent for all participants.
2. **Identity:** The fluidity and playfulness inherent in SL identity construction can be disconcerting and confusing. Building social relations can be problematic and fraught when identities are never fixed and the freedom to play with identity and manage reputation can become an issue of concern, and accountability for actions becomes displaced.
3. **Culture:** SL can be an isolating experience. Communities are not always easy to find and can be demanding to participate in, and the lack of in-world persistence (see 8 below) deters casual use. SL has its own set of codes, norms and etiquette (Meadows, 2008), and reading these is not straightforward. SL can feel destabilising and—outside the 'safety zone'—a place of no limits, no boundaries and no restrictions on behaviour.
4. **Collaboration:** Cooperation and co-construction need to be scaffolded, and building trust and authenticity are critical factors for successful group activities. Enabling effective dialogue requires considered use of the available in-world presence layers,

and the minimal social networking tools mean that external services such as wikis, blogs or a virtual learning environment (VLE) are often needed to support the interactions between avatars.

5. **Time:** Even simple things can take a long time. Designing, validating and running teaching activities requires time to address issues such as intellectual property rights, object permissions and accessibility. The design, implementation and practice overheads in SL often require educators to develop multiple skills to deal with them.

6. **Economic:** The economic models differ across platforms depending on whether they are hosted locally or outsourced, whether the code base is open or proprietary, and whether they use a subscription, owned or similar business model. For SL, the game engine is hosted by Linden Labs on their servers, while the client used to access the world is open source and freely downloadable. A basic account is free but anything beyond simply being present in-world costs money: buying land to create teaching spaces; uploading images and textures; and purchasing useful in-world tools, employing building and scripting expertise.

7. **Standards:** The current lack of open standards and interoperability between virtual world platforms potentially locks any investment, both time and economic, inside a single non-transferable setting. Standardisation remains a major problem for developers who want to integrate other technologies and resources into their creations to enhance the in-world experience.

8. **Scaffolding persistence and social discovery:** The in-world profiles associated with each avatar provide a limited mechanism for the social discovery of others, unlike egocentric social networking services such as Facebook and LinkedIn. Various details describing 'First Life' and 'Second Life' activities can be entered but the visibility of a friend's social network is hidden—each avatar remains trapped at the centre of its own community. The virtual world itself is persistent, but persistence for avatars only exists when they are in-world. A number of web-based services have now appeared to bridge the connection between in- and out-of-world and augment the possibilities for social discovery and scaffold avatar persistence. In particular, Flickr photo sharing groups are used to support avatar constructions and flesh out identity. These external websites and social services form an important dimension in the mediated process of relationship formation and sustain synchronous in-world activities beyond the virtual world.

Discussion

The technical, immersive and social affordances of MUVEs like SL offer many new potentialities for educators, yet these must be weighed against the barriers to managing a new technological environment. Despite the high level of activity in the area (the SLED list has a membership figure of over 5000), clear guidelines for practice remain difficult to find. In terms of education, SL dominates the virtual world landscape, and the healthy subscription figures suggest that its use will continue into the future. The likelihood that other virtual worlds will eventually come to challenge the dominance of SL seems high. Figures from KZero (KZero 2008a, b), a group analysing market trends in virtual world usage, already identify over 90 virtual environments as either live or in development.

Judging the best approach to deploying virtual worlds in an educational context is not straightforward and is further complicated by a recurring trend of rapid prototyping towards stable platform releases. Surveying the development themes across MUVEs reveals a range of initiatives that are starting to address perceived weaknesses and promise advances in usability and applicability that will strengthen their use within mainstream education:

- Experimentation with open-source viewers has led to a proliferation of new SL browsers such as *OnRez* and *AjaxLife*. These new clients, some providing a web-based interface, offer new possibilities for personalisation and portability at the user end.
- Consensus is being reached over the need for open standards, open specifications and a drive towards interoperability that will allow bridging between 2-D and 3-D domains (Livingstone, Kemp & Edgar, 2008; Sun Services White Paper, 2008).
- New initiatives are appearing in the area of portable identities. These efforts would effectively free avatars to roam from virtual world to virtual world maintaining their identity and assets across multiple platforms.
- Increasing levels of granularity in the types of virtual worlds being described are apparent. The acronym MMOLE (massively multi-user online learning environment) is being used to describe the 3-D equivalent of a VLE such as *Blackboard*, and *Intraverse* (Kish, 2007) represents a closed internal 3-D workspace that is conceptually derived from web-based intranets. MUVE developers are becoming more user-aware and establishing niche markets based on perceived needs, and virtual world creation tools such as *Metaplace* are marking a new trend. These offer the potential of targeted worlds for specific educational requirements, for example, where physically accurate simulations may be required for experiments that are too costly or dangerous to run in the real world.
- New peer-to-peer architectures are being developed that allow devolved ownership and connection to a wider mesh or grid to link personal virtual spaces, for example, the *OpenLife* project based on the reverse-engineered SL clone *OpenSim*.
- A number of projects are also exploring the use of haptic devices to mediate interactions with virtual worlds. These devices, sensitive to force feedback, aim to provide a richer immersive experience.

Conclusions

The current state of play in MUVEs is one that is dynamic and volatile, and the future development roadmap cuts across technical, cultural and business considerations. This is set against a backdrop of large-scale changes in the audience profile, marked by increasing levels of connectivity, bandwidth and disposable personal time (Smart *et al*, 2007). The assessment of SL affordances and barriers demonstrates that virtual worlds are attractive spaces for education, yet they present particular design challenges to educators. As Herbert Simon succinctly said:

Everyone designs who devises courses of action aimed at changing existing situations into desired ones. (Simon, 1969, p. 129)

Each of the identified barriers to the use of SL represents a challenge that requires the careful consideration of a number of design possibilities. Only by constructively approaching each one is it possible to make design decisions that encourage the positive and rewarding use of virtual worlds for learning and teaching. Despite the excited predictions of some commentators, it is not inevitable that education will rapidly transfer to the virtual. To achieve a move on this scale still requires us to address how to manage best our virtual identities, improve our digital and cultural literacies, understand more fully the links between immersion, empathy and learning, and develop design skills that can be used productively to exploit virtual spaces.

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