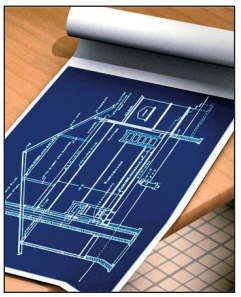

3D Social Virtual Worlds

Research Issues and Challenges

Adel Hendaoui • *University of Lausanne*
Moez Limayem and Craig W. Thompson • *University of Arkansas*

The advent and success of 3D social virtual worlds (SVWs) reveal challenges worth exploring for both researchers and managers. In his famous science-fiction novel *Snow Crash*, Neal Stephenson envisioned the Internet evolving into what he called a "metaverse," a 3D virtual reality (VR)-based space in which people interacted and communicated with each other through their avatars (graphical representations of themselves).

This is a far cry from the early text-based multi-user domains (MUDs) and MUD-object oriented (MOOs), in which a single character represents a user. Virtual worlds have since evolved into sophisticated 3D interactive systems, such as massively multiplayer online role-playing games (MMORPGs), through which millions of people chat, cooperate, and compete with each other through their avatars.

Beyond the entertainment and game-play features, virtual worlds are evolving toward Stephenson's concept of a metaverse in which social and economic interactions are the main drivers. Currently, one of the best examples of this evolution is Second Life (www.secondlife.com), an SVW in which people (called *residents*) can communicate, collaborate, and buy and sell not only virtual goods and services (such as clothes and real estate) but also real products through their customized virtual spaces and avatars.

Unlike most prior virtual worlds in which content was designed and managed by software specialists, Second Life developers have added an important feature: enabling users to build and personalize their avatars, private virtual spaces (lands), and objects (houses and clothes), through a powerful and easy-to-use interface. In addition to text-based chatting and instant messaging, developers also recently added voice communication capabilities that are opening interesting opportunities for learning and training applications.

Second Life's population has grown from 64 acres in 2003 to 65,000 acres today and from 2 million residents in December 2006 to more than 9 million today. Roughly half a million users visit Second Life regularly (www.informationweek.com/news/showArticle.jhtml?articleID=201500141). Interestingly, residents spend more than a million dollars every day — this world might be virtual, but the money is real. Current business transactions are performed in a virtual economy, letting users convert real money into a virtual currency, indexed by an exchange market managed by the developer's online platform. In other words, users can buy and sell virtual money at any time. Moreover, well-known companies and banks are going "in-world" (inside Second Life) to advertise and eventually sell real products and services, either by building virtual stores or putting a link inside Second Life to their traditional Web sites. Similarly, universities and educators are setting up lectures and classes in Second Life. Recently, the Swedish government opened an official representation in Second Life, and French politicians promoted their presidential campaigns in-world (www.washingtonpost.com/wp-dyn/content/article/2007/03/29/AR2007032902540_pf.html).

Key Research Issues

According to Gartner Group, "Eighty percent of active Internet users will have a 'second life' in the virtual world by the end of 2011" (www.gartner.com/it/page.jsp?id=503861). Similar to how the Internet expanded, we can expect SVWs to grow further, becoming a huge network of intercon-

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nected virtual worlds. The emerging metaverse market could reach billions of dollars in coming years (www.metaverseroadmap.org/inputs.html). Thus, we believe that researchers and managers will have to face several business, social, political, communication, educational, technical, ethical, and legal issues in the near future.

Business Issues

SVW business success stories already abound. For example, one famous Second Life baron, Anshe Chung, has made approximately one million real US dollars speculating on virtual real estate. Behind this avatar lies a real "out-world" company located in China, employing several dozen artists and engineers, who are now expanding their activities to other virtual worlds like Entropia (www.entropiauniverse.com).

SVW's growth is attracting established companies interested in advertisement, promotion, and communication. IBM, for instance, has acquired more than 20 Second Life "islands," and several thousand of its employees have created avatars in Second Life. According to IBM's CEO, his company will invest US$10 million to develop the 3D Internet, which he considers to be the "next phase of the Internet's revolution" (http://money.cnn.com/magazines/fortune/fortune_archive/2007/02/05/8399120/).

The presence of other companies in SVWs is more oriented to marketing. Leading brands (including Reebok, Lacoste, and Toyota) use SVWs to express and expand their image and products. Car companies provide (for free or a few US dollars) 3D models of their real cars to Second Life residents, drivable in-world and sometimes even customizable. Companies might build and test products or strategies in-world and then export them out-world. More than a supplementary marketing channel, an SVW leads toward a whole new paradigm: v-marketing.

Similar to their presence in Web-based social communities, companies are seeking candidates and even hiring people in-world. A nationwide job fair was organized, with major companies (including Microsoft and eBay) offering real-life traditional jobs as well as new in-world careers. Talking about Second Life, an executive director of a consumer research company stated that, "Competition on a global scale is forcing companies to look at innovative ways of both marketing and recruiting ... some industries will have a greater advantage or relevance in a virtual world like Second Life" (www.msnbc.msn.com/id/20588553).

The emerging metaverse market could reach billions of dollars in coming years so researchers will have to face business, social, political, communication, educational, technical, ethical, and legal issues.

Based on these observations, we believe that the following business issues are worth exploring:

- Why are companies investing time and money in SVWs?
- What are the business models for these companies?
- How might companies redesign their processes with the increasing convergence of real and virtual worlds? How might companies synchronize virtual and physical parts of their business processes?
- What is the impact of investments in Second Life on organizational performance in terms of sales, customer satisfaction, retention, and market share?
- How can companies establish an effective Second Life strategy in general and a customer relationship strategy in particular?
- How can an avatar that represents a real consumer's virtual self influence its creator's buying of real-world products? For example, does an avatar that buys a virtual Toyota influence its creator to buy a real Toyota?
- What factors motivate a consumer to purchase virtual and real goods in SVWs? Are consumers ready to buy virtual products in real-life settings?
- How do advertisements in 3D SVWs impact consumer behavior in the virtual world and in the real world?
- What is the most effective way to present and describe virtual and real products in the virtual world?
- How and why would recruiters prospect for talent inside SVWs? Will the appearance of a candidate's avatar have an impact on the hiring process?

Social and Political Issues

The number of Second Life users increases daily. Moreover, several communities are created in-world, such as cultural or interest groups. Charities, such as the American Cancer Society, are also burgeoning there and conducting fund-raising.

In addition to the political candidates mentioned earlier, governments are also moving in-world. The governments of the Maldives and Sweden have recently opened official

embassies in Second Life. According to a Swedish official, the country's virtual representation will be "primarily an information portal for Sweden" that, rather than deliver visas or passports, will provide information on how to get them (www.thelocal.se/6219/).

Given the growth of social and political activities in Second Life, researchers should explore the following questions:

- How are avatar-based communities different from Web-based communities?
- How do these avatar-based communities develop over time? Why do some of them prosper and attract a large number of people, while others fail to attract members?
- Can governments offer their real-world services to real-world citizens and businesses more efficiently in SVWs?
- Will e-government evolve to v-government?
- How will our virtual social interactions impact our real social behavior? If we interview avatars in an SVW, how should we interpret their responses?
- Will SVWs lead to negative or dysfunctional behaviors such as addiction and social isolation?

Communication and Collaborative Work Issues

Emerging SVWs involve users in creating and sharing unique content. The creation process in Second Life is iterative, interactive, and often collaborative, and users have the opportunity to share their experiences and knowledge. For example, Second Life contains numerous tutorials through which beginners can learn how to model 3D artifacts such as houses and buildings. Many companies such as Cisco and IBM encourage collaboration by gathering their employees, partners, and customers in their Second Life islands. Anshe Chung's company announced a strategic in-world alliance with a virtual marketing company, Rivers Run Red, aiming to develop content and services for SVW clients, constituting probably one of the first business-to-business collaborations in the SVW area (www.secretlair.com/index.php?/clickableculture/entry/virtual_world_business_alliance_blooms/).

These issues lead us to ask the following questions:

- Will e-collaboration evolve to v-collaboration?
- How will virtual teams adopt SVW technologies?
- How do SVWs change intra- and inter-company communication?
- How do meetings held in SVW compare to Web-based and face-to-face meetings?
- How do SVWs as a communication medium compare to other communication forms such as email, instant-messaging systems, video conferencing, telephone, and face-to-face?
- What's the impact of 3D SVWs on collaborative work processes and outcomes?
- How will multi-organizational collaboration develop in 3D SVWs compared to real-world settings?
- How and why will out-world companies collaborate with in-world companies?

Educational and Learning Issues

A growing number of universities and academic institutions are immersing themselves in SVWs, exploring the ways in which education and learning can be leveraged through virtual interactions. For example, Harvard Law School now has a virtual extension in Second Life in which virtual teachers teach the courses and students can interact with each other, approximating the regular sense of classroom interaction (www.cnn.com/2006/TECH/11/13/second.life.university/index.html).This new way of interacting and communicating within 3D spaces, in which components of a real-world classroom are realistically simulated and integrated (teachers' and students' physical presence, class room, and video and voice capabilities, among other things) leads us to posit the following research issues:

- Will e-learning evolve to v-learning?
- How does learning in SVW compare to e-learning and face-to-face learning?
- How can we design an SVW classroom to promote effective learning?
- How do lecturers' roles change in SVW classrooms?
- What are the effective ways to assess learning in an SVW?
- How does the instructor's avatar — its design and appearance — impact a student's attention and motivation?
- What factors motivate teachers to adopt and continue to use SVW as a teaching environment?

Technological Issues

Currently, SVWs are proprietary environments run on the owning companies' servers. However, free open source projects are multiplying: Libsecondlife (www.libsecondlife.org), the Metaverse Open Source Project (http://metaverse.sourceforge.net), and Croquet (www.opencroquet.org), among others, are working to extend and integrate the future metaverse by developing free servers, tools, and applications.

With the growing number of SVWs and the different technologies used to design and develop them, it's crucial that researchers investigate technological issues:

- Which technological infrastructures will support the future metaverse?

- Given that there are many standards (OpenGL, Direct 3D), what will be the main 3D protocols for SVWs?
- What's in the future for SVW software clients? How will clients evolve — for example, by integrating head-mounted displays for enhanced 3D experiences?
- How will other communication technologies, such as PDAs and mobile phones, connect to SVWs?
- How can software designers develop easy-to-use and powerful applications to build content for SVWs?
- How will Web sites connect with SVWs?
- How will heterogeneous SVWs be connected? What will be the communication protocols and standards?
- How will individuals run their own SVW servers and interact with other servers?
- How will financial, accounting, and human-resource systems connect with SVW environments?
- How will v-business applications be implemented in SVWs?
- What security problems might be related to SVWs technologies? How will programmers design and integrate security tools such as antispam, antivirus, and antispyware into SVWs?
- If we introduce a new capability into an SVW, such as the ability to shrink an avatar or object to become very small, how will that change the dynamics of the virtual world? Similarly, if avatars have augmented powers in an SVW, such as the ability to run very fast or see through walls, how will that affect SVW dynamics? Can we predict how hackers or terrorists might use new capabilities to wreak havoc?
- What new emergent behaviors will occur if we change the laws or economy in one enclave and avatars pass among enclaves? Will an emergent behavior cascade out of control? How do we measure the good and bad effects of such emergent behaviors?

Mapping between the Real World and the SVW

We can create extensions to Google Earth or similar maps to mirror the real world in an SVW (see www.metaverseroadmap.org/overview/02.html#mw). This could let us control our homes while traveling, shop in our neighborhoods without leaving home, or watch over our school children while we're at the office.

- Can we design a home in an SVW and export the design to the real world or vice versa? What import/export capabilities need to exist? Can we export other elements besides designs for smart facilities, roles, laws, processes, or economic systems? How can such artifacts be composed?
- If we develop global-scale mapping between the real world and SVWs, how will it change the way we travel, buy real estate, or respond to disasters?
- If we model common devices in an SVW so that each has identity, controls, and status, can we also develop device control management technology so a person or avatar can control hundreds to thousands of networked devices, even though people today have difficulty connecting a stereo to their HDTV or keeping their computer virus scans up to date?
- Can we develop next-generation smart devices in an SVW, model their use cases, and improve their functions, then map these objects back to the real world — an invention factory? For instance, we could model a warehouse in a supply chain or a hospital operating room to test whether and how new technologies such as radio frequency identification (RFID) would add value. This could lead to try-before-you-buy deployment.
- At present, avatars are anonymous, but links to other social virtual worlds such as Facebook or MySpace could connect real people to their circle of real friends and avatar friends. What happens when we merge real and virtual identities? How well can people manage multiple personalities?
- In future SVWs, not only people but objects will communicate with each other. People will need languages to talk to objects. Rules will tie compositions of objects together so that a blood pressure machine might tell an IV drip to increase during an operation. The smart devices in an SVW could map directly to smart devices in the real world so that an avatar could check that the real-world oven is turned off.
- Access-control mechanisms similar to digital rights management could limit the rights to use or control smart devices to the owner or others who have been granted that right.
- Can viruses spread in an SVW? How long would it take to infect a population? How could populations be quarantined?

Ethical and Legal Issues

Unlike previous virtual worlds, Second Life residents own the intellectual property rights on their creations (such as goods and businesses), and Second Life lets real-world laws reach into virtual settings.[1] However, how to apply theories of rights related to the physical world to the virtual world is still an important issue. Recently, a Texas court convicted a programmer for conducting professional activities virtually without a legal license.[2] A Second Life citizen is currently suing Linden Labs because they shut down his account, leading

him to lose tens of thousands of dollars worth of virtual land and other property (www.wired.com/gaming/virtualworlds/news/2006/05/70909). In the future, researchers will likely face several legal and ethical issues related to SVWs:

- How will real-life laws and rules apply to SVWs?
- Do we need to define special laws and rules for SVWs?
- What are users' legal responsibilities when committing crimes through their avatars?
- Will avatars be considered as virtual extensions of humans? Is a virtual self equal to a real self? Role-playing games let individuals look and act differently than they do in the real world in which their real reputation resides. In SVW, misrepresenting themselves is an accepted part of the game. At what point does misleading behavior become unethical or criminal?
- In the real world, many rules and laws insure safety and privacy. When should avatars be allowed to attack other avatars or their creations?
- How will v-business be regulated and transfer of ownership be guaranteed and protected in virtual transactions?
- What are the ethics related to mass virtual marketing? How will consumers be protected from some kinds of viral virtual marketing?
- What legal issues arise when SVW residents broadcast copyrighted music or video in their private virtual space?
- How about identity theft? What if a resident reproduces the appearance of another resident and acts on behalf of him or her?
- If we use an SVW to model portions of the real world, how do we ensure personal and corporate privacy?

Today's SVWs are beginning to realize Stephenson's vision of the metaverse: a future massive network of interconnected digital worlds. Tens of millions of people already use these kinds of environments to communicate, collaborate, and do business. Big companies are also moving into these digital realms. Thus, in a context in which the Web is becoming increasingly social, we believe that SVWs are beginning to shape the knowledge-based and globalized societies and economies of tomorrow. Obviously, an urgent need exists to further understand SVWs and their implications for theory and practice. This article constitutes a first attempt to bring researchers into some of the business, social, technical, legal, and ethical issues related to SVWs. We anticipate that researchers will need to build new theories and concepts for SVWs, to explore the frontiers between reality and virtuality.

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Adel Hendaoui is a PhD student and a teaching and research assistant in the Information Systems Institute at the University of Lausanne, Switzerland. His research interests cover virtual business and commerce, virtual consumer behavior in 3D social virtual worlds, and virtual collaboration. Contact him at adel.hendaoui@unil.ch.

Moez Limayem is the head of the information systems department in the Walton College of Business at the University of Arkansas and is an expert on information technology adoption and usage, customer relationship management, knowledge management, and electronic commerce. Contact him at mlimayem@walton.uark.edu.

Craig W. Thompson is a professor and the Charles Morgan Chair in the computer science and computer engineering department at the University of Arkansas, where he leads a research project called Everything Is Alive. Subprojects involve modeling virtual smart devices and RFID in Second Life in healthcare settings. Contact him at cwt@uark.edu or visit the University of Arkansas island in Second Life.