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Second Life and Other Virtual Worlds: A Roadmap for Research

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Abstract

Virtual worlds like Second Life are becoming important tools for, among other activities, socialization, social networking, entertainment, collaboration, and business development. These environments offer information systems researchers a unique opportunity to study how these environments are built and managed by operators, how they are used and misused by users, and the impact that they have on users, communities, organizations, and societies at large. This paper summarizes the discussion of this topic that was presented at the ICIS 2007 panel entitled “Second Life and other Virtual Worlds: A Roadmap for Research.” The paper provides an introduction to this topic and offers a roadmap for research on virtual worlds based on insights offered by several academics and practitioners who are actively involved in building, managing, and using virtual worlds.

Keywords

virtual worlds, synthetic worlds, multi-user virtual environments, online games, virtual reality, human computer interaction, Second Life, research frameworks

Disciplines

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Comments

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I. INTRODUCTION

Virtual worlds like *World of Warcraft*, *Second Life*, *Kaneva*, and similar environments have the potential to dramatically change how people interact, navigate Web sites, and conduct business. As these environments become more pervasive, research examining this phenomenon will be needed to better understand these 3D spaces. Information systems (IS) researchers are uniquely positioned to offer valuable insights about designing, building, managing, and using complex multi-user environments and, because virtual worlds have been and will continue to merge with existing corporate and consumer-focused applications, there is an imperative for IS scholars to engage in research in this domain. This paper offers several perspectives on the future and potential of virtual worlds and offers insights that present the starting point for developing a coherent roadmap for a research agenda.

The remarks and comments are derivative of the discussion that took place at the 28th International Conference on Information Systems (ICIS) in December 2007; however, the panelists have also added additional comments and perspectives beyond those presented at the panel discussion. The concept of a panel on virtual worlds arose during a set of discussions that took place during the spring of 2007 among several of the participants involved in organizing the Columbia Institute for Tele-Information and the conference board's summer meeting on virtual worlds. The Columbia Institute meeting occurred in June 2007 within *Second Life* and was designed to discuss and define a research agenda for virtual worlds. During these initial discussions, several of the panel participants agreed that the topic of virtual worlds is not only timely but that a need existed for IS scholars and professionals to begin to conduct systematic research examining this phenomenon. The decision to present a panel of experts at the ICIS conference was made because it represented the most efficacious way to spark interest in virtual worlds and to begin the process of defining a research agenda.

The panel was designed to discuss the nature of virtual worlds like *Second Life* and to discuss research issues that are relevant to IS scholars and practitioners. The panel session was well attended and included panelists who appeared not only on the dais but also via a live connection within *Second Life*. We have included commentary from the panelists below in the order in which they presented their remarks during the panel session. The following issues were discussed at the panel by the distinguished group of speakers:

1. Introduction to the Panel and Overview of Virtual Worlds (Brian Mennecke, Iowa State University)
2. The Corporate Perspective: Commercial and Business Opportunities and Problems of Virtual Worlds (David McNeill and Matthew Ganis, IBM Corporation)
3. The Academic Research Agenda: An Overview of the Research Roadmap developed at the Columbia Institute summer meeting (Edward M. Roche, Columbia Institute for Tele-Information)
4. The Network Operator's Perspective: The Nature of Virtual Worlds and *Second Life* Residents (John Lester, Linden Lab)
5. Perspectives on the Structure and Organization of Virtual Worlds (David Bray and Benn Konsynski, Emory University)
6. Closing Comments and Observations (Anthony Townsend and Brian Mennecke, Iowa State University)

II. BACKGROUND

Virtual worlds are increasing in popularity and have garnered significant attention from the public at large, from businesses and other organizations, and from scholars in disciplines as diverse as law, sociology, psychology, math, and, more recently, information systems. Virtual worlds are growing not only in popularity but also in numbers. While no reliable statistics are yet compiled on the industry, hundreds of publicly accessible virtual worlds exist (e.g., visit www.virtualworldreview.com for a list of only a few such environments) and firms like Forterra Systems (www.forterrainc.com/) build and manage countless numbers of private virtual worlds used for corporate or military applications. These environments have been designed for a variety of functions as well as a diverse set of target markets. Environments such as *Second Life*, *There*, and *Active Worlds* are general purpose and targeted to adults, while other environments such as Disney's Virtual Magic Kingdom (VMK.com), General Mill's Millsberry, and Sulake Labs' Habbo Hotel are focused on specific ages, demographics, and functional applications.

As a genre, virtual world environments are classified within the broad domain of massively multiplayer online games (i.e., MMOG). Unstructured 3D virtual worlds such as *Second Life*, Kaneva, There, and Active Worlds, as sub-types of MMOGs, have been tagged with the label multi-user virtual environments (MUVEs). MMOGs have grown dramatically in popularity within the last three years. As of early 2008, *Second Life* supported almost 12 million unique avatar accounts, and World of Warcraft had more than 11 million subscribers. This growth is due in part to the engaging, 3D environments that provide users with stunning visuals, animations, role playing opportunities, and social communities. Much like Facebook and MySpace, part of the popularity of virtual environments come from the interaction that users experience with peers, friends, acquaintances, and, in many cases, strangers. While structured (i.e., closed) MMOGs like *World of Warcraft*, *EverQuest*, *Final Fantasy*, and *Star Wars Universe* are designed around socialization, fantasy, and role playing, unstructured (i.e., open) MUVEs like *Second Life* offer these same opportunities, plus an active economy that is designed around the ownership of virtual property and other forms of intellectual property.

Thus, a unique feature of virtual environments like *Second Life* is that they are designed to function as realistic economic zones that enable users to exchange services as well as virtual objects that are created and maintained exclusively within the virtual environment. Many MUVEs support commercial activity, such as the buying and selling of "virtual" property, either within the game or through external brokers (e.g., ige.com). For example, Linden Lab designed *Second Life* to enable members to build their own environments, generate social networks, and engage in a virtual economy using a synthetic but convertible currency, the "Linden Dollar." The economic and social activity in these environments create unique opportunities for users to pursue economic, social, fantasy, and real activities. While these environments might be thought of as "games," because there are real-world consequences to activities undertaken in MUVEs (e.g., generating an income), these environments are much more than games.

Virtual worlds have several common features and functions that make them attractive for users and of interest to scholars. In general, they are immersive "game-like" environments where participants use an "in-world" representation, an avatar, to engage in a variety of activities in a shared space. The shared environment is a fundamental feature of virtual worlds and provides the basis for understanding why they create an engaging environment for users. As creatures that inhabit a 3D physical world, our brains are designed to expect and accept input that resembles the real world. In other words, we respond to the spatial nature of virtual environments favorably because they resemble the real world [Durlach et al. 2000; Turner and Turner 2006]. In fact, research examining spatial issues, tele-presence, and haptic interfaces associated with virtual environments has been conducted for almost two decades; however, much of this research has focused on issues related to the user interface, user perceptions, and a variety of issues related to collaboration. For example, a significant amount of research on virtual worlds and virtual environments has focused on issues related to social presence, embodiment, and similar issues that center on the user experience [Knoll 2007].

With the recent advent of MUVEs like *Second Life* that enable not only a rich experience for the user but also create broader, network-based infrastructures, the opportunity now exists to examine a variety of economic, organizational, and social issues that extend beyond the domain of the individual user. For example, a number of researchers in the area of law, public policy, and economics have begun to publish research on questions addressing important legal, ethical, taxation, and economic issues that these virtual worlds create or engender [e.g., Castronova 2001, 2002, 2004; MacInnes 2006; Malaby 2006; Mennecke et al. 2007]. Castronova has noted that large, multiplayer games such as *Second Life* offer numerous opportunities for researchers to examine important questions in the social sciences [Castronova 2006]. In fact, he goes so far as to suggest that large multiplayer games are "social science research tools on the scale of the supercolliders used by physicists" [Castronova 2006, p.1]. It is the breadth and scope of these environments combined with the accessibility and transparency they offer that make them attractive venues for research on individual behavior, social dynamics, economics, government, legal issues, and a host of other research areas of interest to social scientists. Furthermore, as they evolve to new forms that are embedded in other systems (e.g., similar to Flash plug-ins), their influence will extend far beyond the realm of the currently bounded spaces.

III. THE PERSPECTIVES

The following includes remarks summarizing the presentations made by the panelists. The majority of the panelists included comments about their individual presentations as well as about questions that were addressed to them by the audience.

Matthew Ganis and David McNeill:

Commercial and Business Opportunities and Problems of Virtual Worlds

In this paper, we explore some of the barriers to Internet commerce in a virtual world. Barriers include such issues as the lack of tactile feedback and the problem of attempting to experience a higher level of fidelity than the current infrastructure provides. However, before considering these problems, we need to address the security and trust models that are in place today. Are they adequate? We believe not, and, until they are addressed, we do not believe that commerce within virtual worlds can truly thrive. However, once established, the solution to the difficult problems of tactile feedback and “real world” simulation could cause commerce in the virtual worlds to take a similar path as web-based solutions, leading us to an exciting and new frontier for e-commerce.

Advances in e-commerce technology have continued to transform—at an almost overwhelming pace—our personal lives as well as our business landscapes. According to a Global Online Survey on Internet Shopping Habits (conducted between October and November 2007), the Neilson Group Reported that more 40 percent of the world’s Internet population made an online purchase within the month, up from 10 percent a mere two years previously [Nielsen 2008]. Of the online population, over 85 percent of the 875 million Internet users claimed they had purchased something online at some point in time [eMarketer 2008; Nielsen 2008]. Estimates suggest that by 2009 some 47 percent of all business-to-business (B2B) commerce will be conducted online.

It is hard to pinpoint exactly when the e-commerce revolution began. According to NetMarket in Nashua, New Hampshire, the first item purchased via a Web site protected by commercially available data encryption technology was the CD *Ten Summoner’s Tales* by Sting in August of 1994 [Gilbert 2004]. However, the “tipping point” for e-commerce could probably be traced back to end of 1994, when Netscape released its Web browser version that incorporated the Secure Sockets Layer (SSL) security protocol, creating a connection between a client and a server over which data could be sent securely. Secure data transmission supports the general social expectations of privacy and security at the time of an actual business transaction. The ability to keep the most critical elements of the business transaction confidential hence enabled the possibility of trust in the very open environment of the Internet. Once transactions could be conducted in a secure manner, there was no turning back.

One might ask how this situation relates to virtual worlds. Let’s look at some of the many parallels between virtual worlds and the Web world (or two-dimensional and three-dimensional Internet). The 3D clients we see, such as *Second Life* or *Active Worlds*, are analogous to the original browsers we saw in the early days of the Internet. Granted, the visual elements and interaction models that these 3D browsers support are far more complex than what the early Web browsers were capable of, but current-day 3D browsers still lack the 3D equivalents for SSL or any other security/privacy-enabling protocols. Now, as businesses want to begin to expand into e-commerce markets, the question becomes: What can the 3D experience do to participate in or, better yet, add to the two-dimensional e-commerce experience, fueling commerce in the way the way the SSL did?

Security versus Trust

The sense of security experienced by a user of an interactive system is determined by the user’s feeling of control of the interactive system [D’Hertefelt 2000], along with the technical attributes that actually contribute to supporting security and privacy in the information interchange during the business transaction. Trust and security are key enablers for Internet commerce. For users to participate and feel comfortable with e-commerce services, they must have confidence that their online services are both trustworthy and secure, and they particularly must feel confidence in the security of their online transactions. Clearly, one area that is in need of improvement within virtual worlds is the implementation of a secure transport between the user’s client system and the supporting e-commerce servers. One area of research that needs investigation is the integration of security protocols such as SSL and privacy models in the virtual world clients and the experiences that they render. For example, a physical manifestation (in the virtual world) to indicate that secure communications are underway, such as perhaps a universally recognized “secure zone,” will be necessary. (Such a manifestation would be analogous to the “https” prefix on the URLs for secure Web sites—this indicator is now relatively ubiquitous in Web experiences in standing for “secure transaction found here.”) This sort of manifestation would need to be present for secure transactions in the 3D experience so as to win the confidence that their critical transaction data was being handled in a secure manner for the vast majority of end users.

Assuming that security concerns have been alleviated adequately, the next e-commerce hurdle to be mounted in virtual worlds is most likely that of establishing systemic trust concerning transactions done in them. It is reasonable to assume that a level of system trustworthiness at least equal to Web e-commerce today will be the necessary and sufficient condition for the “unwashed masses” to be comfortable in adopting the 3D variant of e-commerce.

The difficulty of establishing trust lies in the salient characteristics of trustworthiness:

Establishment of trust is largely experiential and due to past performance.

Trustworthiness of an entity is established through consistent positive experience with the entity, meaning that the entity develops a reputation through time. While it is common knowledge that trustworthiness is established through time, it is equally common knowledge that one or a few negative (trust-breaking) experiences with an entity lead to widespread and usually devastating communications and consequences concerning the entity. Such trust-breakings in a virtual world will lead to word-of-mouth denigration of the failed system, at Internet speeds. Opportunities for *in situ* testing of any trust-related theories from virtual world transactions are few indeed, especially where there is any linkage to real-world goods or services. Hence, this area of research—how to most efficaciously establish and maintain trust in the linkage between virtual and real worlds—is one with very high return on investment.

Trust-deserving entities operate within a larger support system that sets a context for trustworthiness.

Trustworthiness of an entity is enabled and sustained by the organizational policies of the entity as well as the laws and legal framework within which that entity operates. There will almost always be an operational codicil and/or environment for a trusted entity that will either: (a) reinforce the behaviors that are positive and demonstrate trustworthiness, or (b) offer corrective or punitive measures to the entity for behaviors that are negative and detract from the entity's trustworthiness.

Research applied in this area of study would yield policy frameworks (for commercial entities) and help establish legal (legislative) baselines for how virtual worlds must behave when they are linked to the commerce of real-world goods and services. In large measure, the kinds of issues that would need to be overcome are: (a) in establishing legally acceptable linkages between virtual world agents (avatars) and real-world identities, and (b) in establishing the legal jurisdiction whose laws apply to the transaction.

To use an illustrative and recent example, in the virtual world of *Second Life*, trust was broken with a number of *Second Life* residents when a virtual "bank" where residents had deposited monies changed its policy to restrict withdrawals and eventually vanished from the virtual world. The result was a "scam" of those *Second Life* residents out of a substantial amount of Linden dollars, producing aggregate losses of some \$700,000 in real money to those affected. Most of those residents no doubt viewed the sudden departure of this bank with their funds as a breach of trust. Moreover, because the Linden currency is viewed as an attribute of the service provided by Linden Research, the legal consequences of this "meltdown" are uncertain, whereas, were this same meltdown to occur in the real world, it would be viewed as subject to legal action by real-world individuals (or as a class action) for recovery of damages [Talbot 2008].

Making the Experience Personal

Searching for and buying a product on e-commerce Web sites can often be a frustrating task for consumers. According to Silverman and Bachann, more than 80 percent of Web shoppers have at some point left an e-commerce Web site without finding what they wanted, resulting in a poor user experience [Silverman and Bachann 2001]. Within the Web, a richer e-commerce system that can connect a marketer to their customers could enhance customers' decision-making and the merchant's bottom line [O'Keefe and Mceachem 1998]. Within *Second Life* or any other virtual world, the poignant question becomes: "What makes the e-commerce experience personal?" The IBM Virtual Business Center in *Second Life* provides a presence staffed with "live" concierges to assist customers and prospects, not so much with enabling commerce transactions (at this point) but more with finding the information they may be searching for. This approach is one way for helping personalize the experience. Many *Second Life* islands have been found to be empty, causing users to abandon the experience. Some popular regions are never crowded, not for lack of intriguing content, but because of an inherent limitation of the *Second Life* grid, where each server on the grid can only handle a small number of avatars at a time [Rose 2007]. Clearly there is an opportunity for research into the scaling of these virtual worlds, especially where the virtual experience is directed toward or linked with real-world goods and services. This research is needed to allow the interaction that 3D worlds promise, allowing the end users to establish a sense of trust, thus increasing the propensity for e-commerce transactions.

The idea that scaling of virtual worlds is important is supported by Sinha and Swearingen [Sinha and Swearingen 2001] who found that consumers are far more likely to believe recommendations from people they know and trust rather than from an automated system. Social network sites such as MySpace and FaceBook are driving an increasing volume of traffic to retail sites [Clemons, Barnett, and Appadurai 2007]. These sites are beginning to become a starting point for Web users who are interested in e-commerce; having those social interactions occurring within the virtual world should only increase e-commerce transactions in the future. These social interactions could be reasonably taken as the technologically enabled modern-day equivalent of word-of-mouth advertising. It has been estimated that the presence of these virtual avatars in an e-commerce transaction can increase profits by up to three times [Wallace 2000].

Tactile Clients

Assuming that the security and trust elements of the virtual world clients can be overcome, the next question to ask is: "How can the three-dimensional aspects of these worlds be exploited to further e-commerce?" In a two-dimensional Internet experience, users are limited in their abilities to simply viewing a two-dimensional image (notwithstanding the ability to listen to music or audio recordings or to view dynamic 2D content like videos or animations). So, in a three-dimensional world, if shopping is limited to a three-dimensional representation of the object (as opposed to a simple picture), what are the benefits to the consumer of participating in a commerce transaction? What additional stimuli would help the user make a purchase decision?

When immersed in a virtual world, a user expects to interact in a realistic manner. For example, gravity causes objects to "fall," and sound appears to diminish based on distance or proximity. Studies have shown that being able to physically touch virtual objects can make the virtual objects and the virtual environment much more realistic [Hoffman 1998]. According to Hoffman, when mixed reality memories become more similar to real memories, people are more likely to confuse real and virtual objects, adding to the realism.

As an example, consider a user approaching a camera store in a virtual world with the aim of purchasing an item for themselves (to be used in the real world—a "true" e-commerce transaction as opposed to a commerce transaction within the economy of the virtual world). Because it is in a 3D world, the camera would be represented in three dimensions. The prospective buyer would therefore expect to spin the product around and readily observe it from all sides. Missing from this scenario, though, as contrasted to walking into a real "brick-and-mortar" store, is the "feel" of the camera and its controls, the weight (and weight distribution) of the camera, and, maybe even more important, the view through the viewfinder. How can these evaluation experiences be simulated in a virtual world? Clearly, we can simulate the view through the viewfinder using a HUD or some such mechanism; however, lacking the presence with and tactile connection to the physical product (meaning the eye is not actually being held up to the camera), the simulation falls short of the real-world experience.

Consider the case of a laptop or a computer keyboard. How do we simulate the "touch" or "feel" of the keyboard in these virtual worlds? Audio devices (speakers and microphones) take the same path. If my computer is not equipped for stereo sound, how can it render the "sense" of a computer that possesses such capability in a purchasing decision?

Consider also the evaluation of objects larger than one could reasonably "touch" with respect to the physical constraints of technology that is rendering the virtual world. Were the tactile experience somehow included as part of the product evaluation process, physical evaluation of large objects such as cars, refrigerators, subwoofers, and so on would also need to be possible.

IBM Redbooks in *Second Life*

While IBM is not actively "selling" anything within its Support Library in the IBM Business Center, it is offering access to a selection of our IBM Redbooks [IBM 2008]. Offered there is a simplistic rendering of a variety of Redbooks, but access to those books is considerably hindered by the medium of the virtual world (*Second Life*). Consider the brick-and-mortar bookstore scenario: if a particular book catches your eye, you reach out and pick up the book. You have an immediate impression of the product by the "feel" of its cover and its overall "solidity." The "build quality" of the book is reflected by a fair handful of tangible physical attributes that are generally enhanced (for "good quality" books, at least) by the bookbinders' arts that have been developed over the course of several centuries of experience. In evaluating the book, you might look at the spine of the book and take a quick look at the back of the book. While these motions are possible in the virtual world experiences we have today, they are definitely not convenient experiences in the physical sense, and their difficulties tend to dissuade users and push them back to a traditional web and/or real-world evaluation experience.

Back to the example of the brick-and-mortar store: In browsing through a book, we quickly look over the index or table of contents, potentially flipping back and forth and skimming or reading the actual text. While these browsing actions can be achieved with the movement of simple objects covered by graphical textures (e.g., *Second Life*) the speed of the browsing actions and quality of rendering make this approach less than optimal. So while not a tactile function, the mere action of "flipping a page" can by itself be problematic, yet this action is trivial and absolutely a requirement for anyone who has ever evaluated a book in the real world.

Concluding Remarks

While we do see a tremendous opportunity to enhance the e-commerce experience using virtual worlds, we highlight some of the challenges that need to be addressed. Clearly commerce cannot flourish until clients and servers can operate in a secure environment. The sense of trust that most of us feel today with a traditional Web model for

commerce needs to be established (or re-established) for the consumer to feel comfortable in conducting transactions, and much research is needed to find acceptable models for enabling, establishing, and securing trust in virtual worlds. Once trust is re-established, the next set of unmet commerce needs is the exploration of more and better ways to exploit the 3D experience in ways that are relevant to the user. Seeing a three dimensional rendering of an object or an experience is fine and even compelling in many ways, but we need to explore ways to include the other senses as well as we drive to a truly immersive, low-cost e-commerce experience.

Edward M. Roche and John Lester: An Overview of the Summer Meeting's Research Roadmap

Virtual worlds offer a broad range of research opportunity. On one hand, there are many issues that are IT related. These concern the underlying technology infrastructure and how it is designed and managed. But the research does not stop here. There also are legal, psychological, sociological, media and business strategy issues on the horizon. Even national security might be involved (Roche, 2008). Recent press reports have warned about possible international criminal and terrorism issues that may arise from virtual worlds. So there is a broad range of concern and thus an ample field from which to pick a research topic. The following is a synopsis of the research issues discussed at ICIS.

Technology Performance of Virtual Worlds.

The evidence thus far indicates that virtual worlds do not scale very well. When too many avatars attempt to participate at once, responsiveness lags, and rendering of the environment becomes more problematical. In our meeting at Columbia University, even with an Internet bandwidth of 100Mbps+, we were experiencing up to a 20-second delay in audio between our live audience and the avatars who were joining the meeting. This may indicate that a variety of technical issues have not been solved in the design of the application. What are the methods of optimizing performance? How can required network capacity be defined as a function of virtual world loading of avatars? What is the optimum partitioning of server space? How is response time determined, and what is its psychological optimum? What are variations in design that yield different performance levels? How much is cached on the local end-user device? What is the most efficient graphics rendering system? What algorithms can be discovered to help a virtual world adjust to rapid and dramatic changes in the number of participants at any one time? Finally, there is an important research discussion around technical standards for virtual worlds. Will Open Source gain ground? How will standards emerge and what should they be? There is, of course, a theory that explains emergence of standards, but no one yet has applied it to virtual worlds.

Defining the Entry Strategy.

If a firm (or any organization) decides to take the plunge into virtual worlds, what paradigm do they use to make the decision (Roche 2007)? Expending whatever resources will be required must be justified to management, but how? Several paradigms fit. First Mover Advantage theory might be used. A firm may wish to move into virtual worlds to preclude any advantage that its competitor might obtain by getting there first. But does the first mover advantage really exist for virtual worlds? Professor Clemmons' Competitive Necessity Theory [Clemmons 1991] also may be applicable. If a firm's competitors move into a space, and gain an advantage, then this forces the firm to follow, or lose the advantage. This is even more compelling if the competitor is picking up new customers. But have we seen real competitive advantage yet in virtual worlds? If not, why? If not yet, then when? Another perspective is simply R&D experimentation. Most firms have an experimental arm, and several are experimenting with virtual worlds. The majority of firms have an entry strategy that is exploratory in nature. They can test new products and ideas. An important research question would be to examine and address the entry strategy problem.

Defining the Corporate Purpose.

Closely related to strategy is the question of purpose, or application. Already researchers have identified a range of possibilities. Some firms are using virtual worlds simply as a "showcase." They build a presence to show off, even if it is for the time being merely a cost write-off. Others are focusing on advertising. Panasonic constantly runs video commercials inside *Second Life*. But where are the advertising metrics? What type of consumer lurks behind the avatars? Are they middle-aged, living in suburbs with two kids, driving an SUV, watching a DVD player, and earning an income of \$65,000 to \$150,000 per year? No one really knows, and until researchers find ways to understand this, it is difficult to predict how well advertising will work, at least advertising as we know it now.

Another application is "v-commerce" or "v-customer service", including "v-CRM" (Virtual Customer Relationship Management). The idea is to service your customers in a virtual world, or enable them to establish "customer communities." But there are a host of problems researchers need to solve. One issue is how to verify if the avatar really is your customer, and thus entitled to see private or sensitive information on their account. There is also the accompanying slew of issues around cost and efficiency; that is, can a virtual world be as efficient as a call center?

Globalization of operations is a fact of life. Some firms view virtual worlds as a new way to improve their global operations by serving as a new collaboration platform to help coordination. Here, the theory is simply the old story of using a new technology to improve operations. But does anyone yet have evidence on this?

Who Is in Charge?

For those interested in the organizational theory of the firm, virtual worlds raise many issues. How does one manage a virtual world? Is it done with a corporate committee? If so, who is on it? Does the Internet portal team already in place take the lead? Is it a sales and marketing issue? Does the corporate strategy group get involved? Perhaps different groups are involved at different stages of the process; first strategy, then an IT or customer service operations group after the virtual world is set up and running? Who will manage and underwrite the budget? What does Legal need to review and approve? Perhaps by using a series of case studies, researchers could get a sense of how this is done, and how it best can be done. For the time being, however, most firms are flying blind and need research to point the way.

Selecting the Right Virtual World.

One team of IBM employees has been quoted as saying that they were researching "more than 1,000" virtual worlds. Others are reporting a smaller number of environments. We may not know the exact number, but there is agreement that virtual worlds are highly differentiable. Some like *Second Life* and *World of Warcraft* have broad appeal, at least for now. Others are being developed for the military. Some appeal to children from the ages of 8-13. Some are being rolled out for the elderly or for veterans with serious injuries. At the ICIS meeting, John Lester from Linden Lab demonstrated how severely handicapped people are using *Second Life* to "live a life they really want."

The research question centers around how to make the choice. Does one use a psycho-graphic approach and attempt to match your customer profile against a particular virtual world? Is a portfolio approach best; i.e., where bets are made on several virtual worlds, perhaps for different customer segments? Is it better to choose a virtual world that is completely private, operating as a closed community under your control, or one open to the public? What are the pros and cons of each alternative?

Certainly research needs to apply what we know about decision theory to these questions. Essentially, there is a need to match two sets of factors: those describing the adopter, and those describing the virtual world. But what factors? Here is where the inherent "social encoding" of virtual worlds comes into play. Virtual worlds are 100-percent engineered environments, and nothing is random. The researcher must understand how the virtual world is programmed to work, e.g., what avatars can do and not do and why. A general model is needed that maps virtual world characteristics against adopter needs.

Economics of Virtual Worlds.

The world's most dismal science is everywhere, even in virtual worlds. The economics of virtual worlds present at least three major areas of inquiry. First, there are questions concerning the economics of building a virtual world. How much does it cost to do the requirements determination, the design, the programming, the hosting, and the ongoing maintenance needed to keep it running? Another important factor is systems integration, which is one of the least-understood and most costly considerations. Companies will need to link their virtual world presence with their back-end production information systems to implement customer-centric applications. Is there a learning curve effect? At this time, there are no published reliable data on what a firm needs to spend to implement a virtual world systems strategy and keep it running. As there are no reliable published cost data, there can be no cost/benefit analysis.

Second, there is a rapidly emerging line of research examining financial and trading markets within virtual worlds. How do these markets operate? A small number of "players" are becoming very wealthy running businesses completely within virtual worlds. How are they doing it, and what, if any, are the rules of economics that apply?

Third, there is a more fundamental question concerning the sustainable ecology of virtual worlds. Some of these worlds seem to grow rapidly, others grow then falter and fade away, and others never seem to get out of the starting gate. There are data demonstrating the existence this phenomenon, but no one has managed to explain why it occurs. Research is needed to develop a theory that explains virtual world evolution.

Defining a Revenue Model.

An adopter also needs to understand the "economics" of how to make the virtual world pay for itself. Several models are being studied including: (1) the advertising model—invest in virtual worlds and get paid back in sales; (2) sales and marketing—establish a presence in virtual worlds (the virtual "showroom"), build a new channel to your customers, and increase sales; (3) market research—use virtual worlds to conduct research either about customers

or with customers either in a less-expensive or more inclusive way; (4) product development—use virtual worlds to launch entirely new products that can be delivered in no other way, thus getting a new stream of revenues; (5) R&D—use virtual worlds as a “laboratory” to conduct a variety of experiments that otherwise would be impossible or cost-prohibitive. Each of these models needs further research, including identification of yet other revenue models that are not yet obvious.

IT Management and Computer Science.

The number of IT issues presented by virtual worlds is staggering. Lack of trained personnel, ever-present security concerns, questions of how to link virtual worlds to production databases, protection of customer information, as well as the technical design issues mentioned above, all are key problems that need resolution. One problem in particular needs highlighting. There is no 4GL or other set of tools today that will interlink virtual worlds with the external information environment. For example, if an avatar chooses some virtual object, how can this drive an SQL call to a back-end system and serve something to the customer or track their behavior? None of this works very well at the moment. All of these issues present significant challenges for the hackers that actually build the underlying technology. This work is only beginning, and there is a long road ahead and much opportunity for start-ups and innovation.

All in all, there are ample challenges for MIS research. Other areas are emerging as well. Legal issues are emerging in areas such as jurisdiction, enforceability of virtual contracts, evidentiary viability, and computer crime. Psychologists are studying addiction problems. Indeed, virtual worlds present a broad range of research opportunities that span a number of research areas in the behavioral sciences.

David Bray and Benn Konsynski: Structure and Organization of Virtual Worlds

Who's Running the Show? Governance of Virtual Worlds

More than 15 million people now inhabit virtual worlds. In this section, we consider the question of who really is “in control” in virtual worlds: real-world organizations or virtual citizens?

Since most virtual worlds are operated by a single real-world firm, to date the answer to who is in control has been the private, real-world firm hosting the virtual world. Dotsoul.com and other open-source efforts provide intriguing virtual worlds attempting to empower the virtual participants themselves to help define property rights and rules. Other virtual worlds clearly are focused on corporate ownership and profit. Free and unregulated virtual worlds can be problematic, as the chief virtue of *Second Life* is also its most glaring flaw: Everyone is free to create anything they like, which can result in ugly sprawl and ugly developments. A potential parallel “Tragedy of the Commons” could arise in virtual worlds [Dawes et al. 1986; Ostrom 1991; Hof 2006a].

Yet recent activities have shown a maturing in virtual worlds, as virtual designers like Anshe Chung and Aimee Weber begin to realize that their virtual customers want some order and regulation. Real-world corporations are asking *Second Life* to consider more regulation to ensure the stability of the Linden dollar before they invest further in a virtual world. It could be that a combination of virtual citizens and businesses in virtual worlds may endogenously produce additional laws and hybrid, inter-world social institutions designed to stabilize virtual worlds [Kharif 2006].

We posit that virtual worlds represent an interesting intersection of three parties wrestling for power, influence, and authority in these relatively new spaces (Figure 1). Specifically, these parties are: (1) corporations, representing virtual businesses (V-BIZ) to include economic and business interests; (2) governments, representing virtual governments (V-GOV) to include political and legal interests; and (3) *vox populi*, representing a heterogeneous third party, distinct in its dissociation from either corporate or government interests, and instead attempting to speak on behalf of “digital citizens” in virtual worlds.

We also posit that these three parties—as they wrestle for power, influence, and authority in virtual worlds—embody similar (though less pronounced) struggles for power, influence, and authority as in the real world. Virtual worlds, due to their newness and digitally liberating features, including anonymity and dissociation with physical form, present relatively less pronounced consequences for actors (versus the real world). Yet the power-based outcomes obtained in virtual worlds represent salient economic and legal influences; to wit, *Second Life* sees an average of \$70 million real U.S. dollars spent monthly.

Given fewer adverse consequences for losers (i.e., reduced risk to both individuals and institutions), combined with salient rewards for obtaining power, virtual worlds provide more attractive areas for power and influence struggles

than the real world. In the real world, losers might lose life or property, whereas in a virtual world, the losers can always either terminate or erase their accounts.

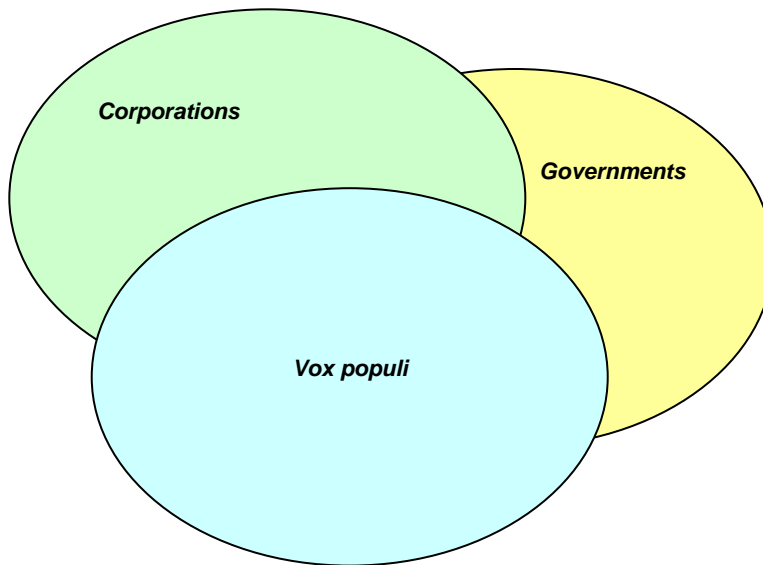


Figure 1. Three Parties Wrestling for Power, Influence, and Authority in Virtual Worlds

It could also be that virtual citizens and real-world businesses begin to take offense at each other. Radical, anti-corporate activism has begun to appear in virtual worlds, to include the *Second Life* Liberation Army (SLLA, slla.blogspot.com), which claims to be a “national liberation movement working towards establishing citizens’ rights within *Second Life*.” Concerned that big businesses increasingly will take over the direction and focus of *Second Life*, the SLLA has performed acts of vandalism in the virtual world on corporate storefronts, such as American Apparel and Reebok, in an effort to promote its cause. The SLLA has petitioned Linden Lab, the private firm that operates *Second Life*, with a demand for individual participants to each receive real-world stock in the company. The radical activists have also posted bounties between L\$500-L\$1,000 for any virtual avatar recording attacks on specific corporate targets. Real-world journalists have also had opportunities to be embedded with and interview members of the SLLA virtually [U.S. National Intelligence Council 2001; Hof 2006b].

If a mass exodus of virtual individuals occurs in any virtual world, the company hosting the virtual world will suffer. It is in the best interest of Linden Lab to keep a majority of its virtual citizens happy—so the question remains unanswered, who really is in control in virtual worlds?

Who Governs the Show? Jurisdiction of Virtual Worlds

Continuing our inquiry into virtual business (V-BIZ) and virtual governments (V-GOV), we now consider in this section a few of the tricky jurisdictional questions associated with virtual worlds. “Where” are virtual worlds? Which legal system applies? If a business wanted to press charges against an individual or group in *Second Life*, would the legal charges fall under the U.S. legal system (since that is the location of Linden Lab, hosting the world)?

When the “copybot” incident allowed malicious individuals to make copies of all virtual items belonging to other virtual participants, Linden Lab publicly said it would not resort to virtual world “law enforcement” of such malicious activity, but rather would refer any complaints to real-world law enforcement under the U.S. Digital Millennium Copyright Act (DMCA). If the malicious individuals existed in a country outside of the U.S., could they realistically be charged and brought to court for an offense in a virtual world

The involvement of the U.S. Department of Homeland Security in *Second Life* also begs a few interesting questions. If an aberrant activity is detected, do they have any authority to stop an individual in a virtual world? Presumably they would defer to Linden Lab to identify and remove a virtual avatar, though such questions have (as of yet) been unanswered. If terrorist groups began to distribute propaganda in *Second Life*, would the U.S. government intervene? How much free speech is allowed in virtual worlds?

Of note, *Second Life* will soon release a Chinese-language version of its software client, which begs the question as to how much free speech will be allowed in a Chinese version of *Second life*. The influence of Chinese politics over previous Internet technologies is worth considering, as users of the Chinese version of Google (www.google.cn) may

receive dramatically different search results than users of the U.S. version (www.google.com). The search for “Tiananmen Square” on the U.S. version reveals historical articles discussing the 1989 uprising by students and subsequent massacre; whereas the same search on the Chinese version results in travel guide and photos of tourists visiting Tiananmen Square, absent of any historical discussion of an uprising. Thus, will the Chinese version of *Second Life* include similar government-encouraged censorship on behalf of Linden Lab in *Second Life*?

Fast-forward another 10 years, with the continued adoption and growth of multiple virtual worlds, and a serious research question can be posed: Do virtual worlds exist within or do they transcend national boundaries? Noting an existing trend for global off-shoring of work, 10 years from now individuals may work and play increasingly with individuals who transcend their immediate local environments. As of 2006, this is already the case for thousands of individuals. By 2016, this could be the case for millions of individuals who begin to identify their citizenship not with their real-world location, but with the companies they work for electronically, through computer-mediated experiences, and the friends they play with through virtual worlds [Craig 2006].

As virtual worlds grow, will they present social forces that challenge the dominant power of national governments? Could individuals even begin to have multiple citizenships, with both a real-world nation and several virtual worlds of their own, elective choice?

To help academic researchers, we suggest and review the topic of cooperation in virtual worlds. Since this topic represents a relatively new thematic element in the information systems (IS) literature, we incorporate articles informing this theme by highlighting the interplay between human users and information systems (IS) enabled environments, some of which were published in the 1980s and 1990s but remain quite relevant to researchers studying virtual worlds today.

First, Castronova [2005] discusses the growing popularity and use of virtual worlds, moving beyond multiplayer online games to include digital environments complete with “conversations, battles... sex... [and] home to commerce as well” (p. 20). Castronova then briefly highlights the opportunities for trade, product placement, and risks presented by virtual worlds.

Second, much earlier than Castronova, Winograd and Flores [1987] discuss the opportunities posed by computers and human cognition. Their book centers on how best to design computers to complement and extend human cognitive abilities, discussing the rationalistic orientation toward language, decision-making, and problem solving while also recognizing cognition as a biological phenomenon.

Third, even earlier than Winograd and Flores, Leavitt and Whisler [1958] consider how computers would influence management in the 1980s, postulating that information technology would prompt far-reaching impacts on organizations. Leavitt and Whisler correctly predict that new information flows would transform the possibilities for organizations and human interactions.

Fourth, Barrett and Konsynski [1982] provide more concrete details on how inter-organization IS would transform organizations and human interactions, recognizing one of the significant impacts of computers would be the ability to form large networks within and across organizations.

Fifth, Galbraith [1982] suggests organizations should combine their structure, information and decision processes, rewards, and people in a unique way to help create an innovating organization. Of greater note, Galbraith argues that organizational design tries to match the complexity of an organization’s structure with the complexity of its environment and technology.

Sixth, Konsynski and McFarlan [1990] extend discussion of computers as physical machines and networks to the realm of shared data and information partnerships. Konsynski and McFarlan recognize that information partnerships allow for virtual organizations or virtual alliances to occur. While their article focuses on business-to-business partnerships, Konsynski and McFarlan’s article also holds true regarding to company-customer partnerships, modern-day interactive possibilities now offered by the immersive nature of virtual worlds.

Seventh, Anderson [1999] discusses the applicability of complexity theory to organization science, defining a complex system as a large number of interdependent parts with many interactions. Anderson reminds researchers that it may be premature for organization studies to settle into a normal science mind set. Anderson suggests that organizations (as complex systems) feature surprising non-linear events, since components interact with one another via a web of feedback loops.

Eighth, Messick [1999] discusses concepts similar to Anderson's reminder of feedback loops within complex systems. Messick argues that traditional, consequentialist models of decision-making represent inadequate models to account for human decision-making. Instead, Messick suggests that decision processes involve perceptions of appropriateness, identity, and rule-based choice. Messick also recognizes that decisions made (or not) also reshape human perceptions, influencing further decision-making efforts.

For additional literature surrounding virtual worlds, we could cite several articles from *Businessweek* or CNet.com regarding current events and headlines, but such information would become out-dated quickly and does little to inform a theory of cooperation in virtual worlds. Thus, we close our recommended reading for researchers studying virtual worlds with four references representing pioneering research that can inform virtual worlds.

First, we recommend Dawkins' [1976] *The Selfish Gene*, as we believe this work helps all researchers, not just biologists, understand the influence of an environment in exerting selection pressures for different genetic (or memetic) qualities in organisms that later present themselves in the behaviors of said organisms, including self-interested behaviors. For virtual worlds, what behaviors do these environments exert pressures for and consequentially select for in users?

Second, Hodgson and Knudsen [2006] highlight the need for incorporating a generalized Darwinism into economics research. The authors note how Adam Smith's original "invisible hand" of free markets mirrors several of Darwin's principles, yet modern economics currently fails to recognize some of the significant tenets behind evolution, most notably that organisms and institutions constantly evolve, never reaching a global maximum or minimum but instead iteratively responding to selection pressures. The authors also present reasons for why Darwinism alone cannot explain all of human or institutional behavior, and they optimistically look towards a future when economics can apply research findings obtained by biological and social science researchers. For virtual worlds, the interaction between humans and their IS-enabled environment clearly allows for exploratory research with regard to how the two reciprocally influence the other.

Third, Lamb and Kling [2003] remind IS researchers that users represent social creatures, influenced by what others do, what others think of them, and what demands or incentives are presented to them. The researchers suggest a shift to the concept of a user as a social actor will sharpen perceptions of how organizational contexts shape IS-related practices and at the same time will help researchers more accurately portray the roles that people fulfill while adopting, adapting, and using info systems.

Fourth, and perhaps most importantly for any researchers studying human participants, we suggest Simon's [1955] article concerning bounded rationality. We would like to remind researchers studying virtual worlds specifically that:

1. Humans pursue self-interests but often do not know what those interests are.
2. Humans are aware only of some possible alternatives.
3. Humans are often willing to settle for an adequate solution, instead of continuing to search for an optimal one.

Where's the Show Going? 10 Questions Worth Considering

Having reviewed the literature discussed earlier, we now suggest ten future research questions for researchers to consider in virtual worlds. This clearly is not an exhaustive list but is representative of some interesting questions to hopefully inspire future queries:

1. For virtual worlds, what behaviors do these environments select for in users?
2. For virtual worlds, how are fads, memetic cues, ideas, or knowledge passed along among participants?
3. How can organizations use virtual worlds to help better deliver necessary information to their employees?
4. How do virtual world environments influence the development (or non-formation) of trust?
5. How do individuals in virtual worlds employ sense making to organize flux?
6. How do individuals in virtual worlds go about labeling elements of their environments?
7. How do individuals both recall and predict actions in virtual worlds?
8. How do individuals in virtual worlds form social relationships, and what type of online relationships do they value the most?

9. How do virtual worlds help (or hinder) organizing through communication?
10. How do virtual worlds help (or hinder) individuals and groups to take action?

Anthony Townsend and Brian Mennecke: Closing Comments and Observations

The ICIS Virtual Worlds panel was designed to bring together a distinguished group of scholars and practitioners for the purpose of exploring practical and theoretical questions raised by virtual worlds like *Second Life*. The panelists offered a variety of perspectives about virtual worlds; however, several common themes emerged from this discussion. Specifically, we identified three broad themes: 1) psychological, 2) sociological, and 3) technological. We close our discussion of the ICIS panel by looking at the future of virtual worlds and, at the broad thematic level, a set of appropriate research questions that are derivative of the various perspectives offered by the panelists. We present these questions within each of the three themes.

Psychological Themes

All phenomena within a virtual world involve individual human actors, and hence, the psychological factors that affect individual experience and motivation are a critical component of a virtual world research program. Individual factors such as personality, attitudes toward technology, self-image, and cognitive ability will all associate with different experiences of virtual worlds. As had been the case with numerous other technological innovations that we have seen in the past, understanding what is happening inside the head of each user will need to be at the center of research examining virtual worlds. Literature and methodologies derivative of work done in areas dealing with collaborative technologies (e.g., group support systems), end-user computing, and human-computer interaction will all be relevant to examining virtual worlds. In addition, much of the work addressing immersive virtual environments such as that done at Stanford's Virtual Human Interaction Laboratory, the Virtual Reality Application Center at Iowa State University, and numerous other virtual reality centers and programs will be relevant to studying psychological themes associated with multi-user virtual worlds. Questions at this level include:

P1: Do users with different personality types experience virtual worlds in different ways, and if they do, can a personality type to virtual world fit be identified?

P2: Do personal dispositions such as need for affiliation, affection, aggression/aggression avoidance affect users' experiences of virtual worlds?

P3: Do personal traits, such as self-efficacy, cognitive ability, spatial ability, and motor coordination affect users' experience of virtual worlds?

Sociological Questions

Clearly, although it is possible to interact with a virtual world in a completely solitary manner, many of the most interesting phenomena of virtual worlds involve the complex sociology of multiple users. As such, methods and questions that have been used to examine the sociology of multi-user information systems provide a starting point for the examination of the sociology of virtual worlds. Multi-user systems have historically affected a metaphorical space that encouraged the development of community and social identity, but with virtual worlds, this space is reified in an explicit relationship with participants. Thus, concepts related to social presence and co-presence take on new meaning as the spatial proximity among avatars creates a rich experience that evokes the spatial references of subjects' physical selves. Furthermore, because virtual worlds bring together people who are physically located in venues from around the world, new organizational, cultural, and governmental structures have emerged that often transcend the boundaries defined by the physical and jurisdictional structures that exist outside of the virtual realm. So, while extant multi-user systems have engendered a significant number of socially oriented studies, the intensity and explicit sociology of virtual worlds demands a research program that accounts for the "physicality" of the space, and draws upon theories that pertain to physically proximate interactions, psycho/social behaviors, and cultural and organizational development. This suggests a set of research questions that will focus on sense of space, the role of virtual proximity, perceptions of presence and co-presence, and cultural and organizational development. Specific questions will include:

S1: Is a sense of co-presence/physicality/geography truly enhanced in virtual worlds and does this have an effect on decision-making, interpersonal behaviors, and individual perceptions of belongingness and group affiliation?

S2: Does the explicit presence of others (as avatars) augment creativity, communication, and decision quality compared to non-avatar based systems?

S3: Does the society created in virtual worlds represent a new form of community or organization, does it require unique government and organizational structures, and how do these (new) structures interact with and relate to the world that lies outside the virtual realm?

Technological Issues

While the sociological and psychological phenomena of virtual worlds are fascinating, it is important to acknowledge that they exist in an evolving technical space, and the development of that space exists in a critical partnership with the behavioral capacities of virtual worlds. The current status quo of virtual worlds (proprietary environments, owner controlled, non-interoperable, etc.) will inevitably yield to a variety of new forms, and these new forms will engender vastly different user experiences and uses for virtual world technologies. Some specific questions that will need to be addressed in the technological realm include:

T1: Is cross-world interoperability possible, and is it desirable?

T2: How can virtual worlds be aligned with other information systems in ways that will facilitate decision making, negotiation, and other collective and individual processes?

T3: How can the virtual world interface be improved to facilitate participation among more users, and to improve the quality of interaction when using the virtual world?

Concluding Comments

While virtual worlds have been on the developmental radar for some time, it is only recently that the critical convergence of technical capacity and developer interest have enabled the creation of virtual worlds capable of attracting participants from the broader population. The current models of virtual worlds, in both the social networking and gaming domains, offer relatively attractive and easy to use platforms that have created a demonstrable public interest in the virtual world phenomenon. As participation continues to increase, and as technologies make these worlds ever more accessible, the scale and scope of research opportunity and market exploitation grow exponentially. The research questions articulated here, hopefully, anticipate the emerging importance of the phenomenon and provide a rough schematic for its exploration.

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EDITOR'S NOTE: The following reference list contains the address of World Wide Web pages. Readers, who have the ability to access the Web directly from their computer or are reading the paper on the Web, can gain direct access to these references. Readers are warned, however, that:

1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. The authors of the Web pages, not CAIS, are responsible for the accuracy of their content.
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David McNeill (AKA – DBMc Smalls) is a certified executive program manager in the ibm.com User Engineering group at IBM. With 25+ years of experience with IBM and having served in several IBM divisions in various technical and management roles, he is currently the executive program manager responsible for ibm.com's Virtual Business Center in Second Life. David's career experiences include key roles in: developing and marketing IBM's first-to-market object-oriented visual construction application development products; marketing, sales, and delivery of very large services contracts; establishing IBM's application management services initiatives; and program managing initiatives associated with ibm.com's strategies to make itself into a world-class Web-based route to market. David is certified as a project management professional and in IBM's Project Management profession program, and he holds BS and MS degrees in Computer Science from North Carolina State University. He can be reached at dbmc@us.ibm.com.

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David A. Bray (AKA - Secure Courier; Center for V-BIZ and V-GOV in SL) is currently a Ph.D candidate researching Information Systems at the Goizueta Business School, Emory University. Prior to academia, David served for five years as IT Chief for the Bioterrorism Preparedness and Response Program at the Centers for Disease Control and Prevention (CDC). Prior to CDC, David worked as a senior developer and project manager for Microsoft, Yahoo!, the Institute for Defense Analyses, and the National Institutes of Health. His research focuses on knowledge ecosystems and emerging governance structures within virtual worlds. David is also researching the convergence between virtual worlds and knowledge ecosystems, particularly for large, inter-organizational collaboration efforts. More information on David's research papers is at <http://ssrn.com/author=745562>

Benn R. Konsynski (AKA - Rejin Tenjin; Center for V-BIZ and V-GOV in SL) is the George S. Craft Professor of Decision and Information Analysis at the Goizueta Business School at Emory University. His research interests included electronic commerce, delegation technologies, model management, decision processes, and virtual reality and world-making. He is interested in a number of research topics in Second Life, including innovative models of



exchange and commerce practice in VW buyer and seller communities, patterns of barter and exchange, alignment of forms of learning and practice, infrastructure and tools for learning, models of service provision for governments and welfare institutions, information and services provision for institutions like CDC, Halle International, etc., and visualization and new tools for collaboration and knowledge sharing.

John Lester (AKA - Pathfinder Linden) is Linden Lab's Boston Operations Director, coordinating the growth of Linden Lab's Boston-based office. He is also the academic program manager, acting as a general resource and evangelist for educators using Second Life for teaching, academic research, and scientific visualization. John joined Linden Labs in 2005, bringing experience in online community development as well as a background in the fields of healthcare and education. Previously he was the information technology director in the Neurology Service at Massachusetts General Hospital, where he pioneered the use of the Web in 1993 to create online communities for supporting patients dealing with neurological disorders. He has also held an academic appointment at Harvard Medical School, where he created online collaborative environments for professors and students to advance the case-based teaching method in medical education

Anthony Townsend (AKA – TwinTheaters Janus) is an associate professor of Information Systems at Iowa State University. Dr. Townsend became interested in networked and online collaboration with the advent of the first Ventana products, and has continued to pursue research in collaborative environments. He has a Ph.D in Organizational Behavior and Industrial Relations from Virginia Tech and has conducted research in virtual collaboration and technology and team process. He is currently involved in research into technology and personality, gender and technology, and the role of cognitive style and online decision making.

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