Leveraging 2nd Life as a Communications Media: An Effective Tool for Security Awareness Training

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Abstract - Virtual worlds bleed into the physical world in increasingly interesting ways. This paper examines developing an in world island designed to prepare avatars for responsible global citizenship. It examines the unconstrained nature of these types of citizens; how trust and rights are beginning to evolve and be enforced in this environment; and how we might begin to prepare avatars to become good citizens.

The latter is explored in the context of a new program on virtual worlds at the University of Washington in which students immerse themselves, by both learning and working in the Second Life environment for an entire academic year. An end-of-term student project, creating Cybersecurity Island, is described as a place created for avatars to learn lessons in online security that can lead to good citizenship behavior and practices.

This educational program is conceived as a first step toward helping to guide the way that avatar citizenship develops. As the virtual and physical worlds blend, it is important to be aware of the kinds of virtual communities we are creating and to be certain we create foundations for civility in this new space.

Avatar, the movie, is "playing' now on your laptop presenting interesting challenges! Our work begins to address how we can ensure security and trust in virtual environments.

Index Terms: Avatar, citizenship, virtual worlds.

INTRODUCTION AND BACKGROUND

Developing the appropriate behaviors and competencies to integrate into society is a crucial test for any concept of citizenship [1]. Virtual society today is a connected community of global citizens thriving across multiple platforms and social networks. People are dispersed geographically, culturally and politically and are unconstrained by whom they interact with and why they interact. How can we ensure the development of good citizenship in this new environment?

In virtual worlds, the borders are fluid and physically unconstrained. The personal surrogate encoded as an avatar can move about freely and participate in dynamic, multiple states at the same time. The avatar is valued more for performance, skill and abilities in the context of the virtual world, rather than by race, pay grade or political affiliation. The avatar is empowered with self-prescribed roles and responsibilities and is emerging into a new kind of sovereign world, bursting out as the first manifestation of a geo-politically unconstrained global citizen. The question becomes, "What are the appropriate behaviors and competencies for citizens of a virtual society?"

Research finds significant correlation between virtual world behavior and physical behavior. Stanford's Bailenson found that avatars "felt" they needed more personal space when standing next to each other in virtual worlds [2]. Suggesting that people sense proximity to one another, irrespective of being physically present, has many correlates in the neuroscience literature. Sharer and colleagues at the University of Washington (2008) have seen a decrease in the pain and anxiety experienced among post-burn victims undergoing physical treatment while immersed in a virtual snowy world of winter [3] suggesting that the blending of environments produces a psycho-physiological effect. Castranova demonstrated that the price of a single good in two separate virtual worlds, with one being 50% less than the other, drove demand down by 43.1 percent [4] hinting that economics in virtual worlds work similarly as they do in the physical world.

Today, avatars interact with each other in virtual worlds in innovative diverse applications such as 1) weight loss programs, 2) education and outreach in post-traumatic stress disorder, 3) discerning what constitutes the development of green building technology, and 4) teaching cybersecurity, which is discussed in this paper. What is different in virtual worlds is the avatar's ability to interact with each other across borders, unfettered by physical location, using 3D communication software, and building strong, enduring trust relationships across boundaries. Trust is the glue keeping together any community. Building trust in virtual worlds is tied closely to ensuring that the environment is secure. The authors

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determined that engaging in-world participants in cybersecurity education will improve in world security practices and contribute to enhancing trust.

BUILDING TRUST IN VIRTUAL WORLDS

Building trust in virtual worlds is the cornerstone to building good citizenship behaviors. Stephen Covey in his book entitled The Speed of Trust [5] writes that we need to build a global sense of trust in our organizations so things progress fluidly without having to negotiate each transaction. This also equally applies to global communities in virtual worlds. The need to build trusted relationships in fluid communities is occurring in social networks. Virtual worlds add a 3D image, or a face to those relationships; and, software vendors have helped build that trust by creating avatars with expressions and gestures that help to convey human empathy. The advancing avatar-based applications provide first person views to help users concentrate on the tasks at hand, and third person views to develop a sense of self, so avatars can see themselves in the scene that represents their place of work, their learning environment, a geopolitical neutral environment, and their home. When that trust takes place over the Internet in meaningful exercises of activity that motivate and interest the learner, a heightened sense of participation occurs and the value of the experience is augmented. Avatars benefit from the combined efforts of "seeing" each other as they work together in 3D spaces and observing the quality of theirs and others performance and contributions generated in the 3D space as they engage in the act of "doing." To create and be, unfettered in virtual worlds, requires trust in the environment in which avatars are operating. This is closely tied to having a secure cyber environment.

Co-located environments bring people together in meaningful ways that occur easily in the physical realm. When a designer coordinates sociological features in a 3D environment such as building chatting spaces around the common community element such as a fireside, or a community center, the circle of trust expands. Avatars view each other's interactions in this powerful medium as community, giving importance to each individual in the community, and feeling the accountability of their contributions as a part of the sense of belonging, engendered by showing up and mingling together over long periods of time. Couple camaraderie with the ability to bring in mentors or top experts in a field to a virtual worksite and a healthy environment is produced with distributed organization, ready to take on a client with a distributed, qualified set of supporters on the spot.

Reaction times are enhanced and users do business seamlessly without the constraints of physical location. With no physical constraints, it may seem that the political and legal constraints imposed by physical restrictions melt away. There are no building codes, no onsite worker safety rules, no parking permits--less energy consumption and more focus on accelerating effectiveness and efficiency, flexibility and communication. From a business perspective, the benefits are pronounced as real time business can occur from the home office without a single physical visit to a corporate building, a bank or a law firm. There is a continuity of business operations that could survive almost any disruption. But with lacking legal constraints, business would have a difficult time flourishing.

A. *Building trust through legal supports*

To help out on the legal side of trust building, in some virtual worlds, digital rights management and the ability to transact real money enhances ownership, so when avatars co-create intellectual property they mutually define creator, subcontractor and owner IP--without lawyers! These digital rights stay with the objects at the pleasure of the virtual world creator and can be deeded, transferred, copied or made free in order to suit the needs of the inhabitant. Avatars are free to start businesses and transact instantly as though they were large organizations, because they create the environment that simulates the acceptable standards of doing business and use the Internet to connect to the same services enjoyed by most companies. This is a significant change from the investment that they could not have afforded previously, especially since the labor force can be a combination of people from all over the world. The sense of citizenship in a virtual world is enhanced by such legal underpinnings.

Original ownership of objects and real estate management add to the mix of the unconstrained worker's tools and motivates job creation in virtual worlds. Some virtual worlds are building virtual cities like Singapore and Tokyo to establish a sense of global positioning which benefits existing businesses setting up in virtual worlds, but, new citizens are unbridled by current location and are motivated by ownership and originality. They seek a sort of political anonymity or even cultural anonymity, so they are allowed to grow the social and economic outcomes in unconstrained ways. A large experiment of an emerging cultural entity is taking place, and paying attention to its proper use and function is becoming a serious subject of research.

Avatars buy or build and brand their own real estate, increasing motivation to participate independently. Avatars create property and make it available for trade to increase their value in working in-world. And here, they change it up instantly, retaining ownership rights and accommodating for any difference in doing business instantly. If something isn't working, they get rid of it at little cost, and put in a new one, after all they own it. If it's a parameter their customer does not like, they teleport to another location and bring together the elements of the world, the partners who are experts and the services

which are abundant and they try a new location to keep their business moving forward. The possibilities seem boundless since the new citizen works for several people at the same time, not just one corporation for a long period of time.

B. The reach of government in virtual worlds

Avatars do experience the reach of government in virtual worlds, so they are not completely unbridled in their activities as citizens. Governments can exercise regulatory control. For example, the US Federal government curtailed virtual banking, gambling and pornography as it began to threaten citizen protection, and with regulation can come innovation as governments adapt to virtual worlds. For example, the Swedish Financial Supervisory Authority (Finansinspektionen) granted a license to Mind Ark so they could function as a central bank for all virtual worlds within the Entropia Universe, offering selected bank services to customers on the conventional market [6]. Although some government precedents are being set, and the law is acting upon citizens' virtual lives, this area is not quite defined and citizenry in virtual worlds remain more or less self-governed.

In the current state of virtual worlds, avatars create what they want, go where they want, and self-govern in absentia until the authorities show up. They are not bound by physical restrictions, and morph their appearance or teleport from place to place engaging in any kind of identity tourism. This model represents freedom to many in the public. Freedom to innovate, to set up business, to compete on the Internet no matter the size of the organization, to engage in a world of creativity and individuality. It is unlikely that early adopters are going to give up so much freedom easily. They will comply, instead, where needed and will continue to innovate on the fringe, until the fringe becomes the norm. It is becoming increasingly important to study what is appropriate behavior of avatar citizens, and understanding their rights and responsibilities.

C. *The rights of avatars as citizens*

Rights of avatar citizens derive, and are guided by, constitutional government. Most avatar citizens today believe they have the right to express themselves freely and create worlds that represent their needs. They believe they have the right to own and transfer their intellectual property no matter where they made it. They have the right to build their own property, assemble in groups and move between virtual borders to transact as they desire. They believe there should be limits to search and seizure of digital content in their virtual spaces and when rules are broken across intra-constitutional communities, they believe they must be assured of their right to due process. We are still the same people, interested in integrating ourselves with our technology into a virtual society that uses as much of our political structure as possible. As a global virtual society, we are connected by technology across political boundaries. Thus, it must be clear that norms for defining virtual worlds apply across all work environments created by avatars, and across all social environments visited by avatars. In doing so, we evolve the concept of citizenship for the coming generations of geopolitically, unconstrained global avatars. Their numbers are growing!

Driven by this understanding, the authors have embarked on educational activities that prepare avatar citizens to engage in behavior online that is conducive to creating trust and good citizenship.

CREATING GOOD AVATAR CITIZENSHIP

In the physical world, good citizenship is shaped by community institutions such as our schools. Likewise, it is the authors' belief that good avatar citizenship can be shaped through an online virtual education process. That was a major motivation behind creating a certificate program in virtual worlds, at the University of Washington, which provides a certified environment for educating and building virtual citizenry. This year-long program is taught exclusively in virtual worlds. The objective of the program is to create a learning community in which avatars work together, play together and learn together. The program consists of three courses. The first requires students to visit, present and perform live in multiple virtual worlds. The second examines what it takes to design and build in a virtual environment—at the same time learning related virtual world architecture, psychology, law, cybersecurity, media responsibility, and information management. Students are visited in-world by renowned experts from around the globe who create an academy of learning that is unparalleled. Finally, the third quarter focuses on students building a virtual world together, usually with an external client, while being immersed in the programming and project management side of virtual world development. To grow the sense of belonging, the University also developed UW Avalumni island, a place designed and built by the avatar alumni community, to showcase best of breed development, provide access to mentors and experts in virtual worlds, to teach interested visitors, house responsible and performance-minded university citizenry who have a profound knowledge of virtual worlds.

During one of capstone experiences, an educational project was devised with the goal of raising awareness of security/privacy issues in virtual worlds. It was deemed that this knowledge was a necessary condition of good citizenship in virtual worlds. The authors argue that if we wish to create a civil society with strong trust relationships among citizen avatars, then standards of

behavior must be agreed upon and accepted by the community of avatars. To be trusted, at a minimum, the virtual environment must be secure and safe. That means that the avatar citizen must know how to behave safely and securely online.

D. Security awareness training

Security awareness training has long been recognized as an important pillar in any effective cybersecurity program. What constitutes an effective program is outlined in NIST Special Publication 800-50, which provides guidelines for the development and implementation of cybersecurity awareness training [7]. Recognizing that the "people factor" is the weakest link, NIST recommends that all users of any information system be made aware of their roles and responsibilities in maintaining security. To be effective, they further recommend that any awareness event be 1) designed to specifically address the intended audience, 2) built around a message and desired outcomes and, most importantly, 3) gain the attention of the target audience in such a way as to engage their commitment to change behaviors. Toward that end, the authors conceived of "Cybersecurity Island," an immersive, in-world, learning environment that makes security fun to learn.

Using NIST 800-50 as guidance, the authors guided a student-led project to develop Cybersecurity Island—a place in Second Life where avatar citizens can learn the basics of good cybersecurity and be shown the benefits of adopting these practices. The "clients" for the project were the Laboratory and the NSA/DHS Center of Academic Excellence in Information Assurance Education and Research at the University of Washington. Together they provided the requirements for the project which are described in the following sections. One of the authors provided the requirements script, another the subject matter expertise to develop security learning objects.

E. Setting the scene

Following the requirements script, students developed a site designed to engage avatar visitors in a rich narrative that explores all of the elements of cybersecurity in a manner that may be experienced as more mundane in lecture form. Some of the script/requirements narrative are given in Figure 1.

Zaapft! A curious traveler appears in the middle of a bustling center, filled with kiosks, interspersed with trees, flowers, and strange looking animals. All throughout the center there are fountains, deep and blue, with bubbling water that splashes passers-by. The traveler is bumped by a limping avatar with a sad expression, who staggers into him. Her clothes are tattered, her hair a dull gray. She careens off the traveler and into the water. Splash! An amazing transformation takes place. Her hair flashes bright red! Her face and clothing brightens and her limp is gone – she sprouts wings, and takes flight! Marveling at the change, the traveler also notices an especially dirty fairy avatar crawl exhaustedly into the fountain and emerge shining like the sun, all golden and energetic. Something is definitely odd about the water….

A persistent honking drags the visitor's attention back to his immediate surroundings. The honking is from a signpost with five arrows. As he looks, the honking stops. The arrows point in five different directions, labeled thus: True Security Found Here, Insider Mansion, Malware Safari Land, Stego Country, and The House of Illusion. The top arrow is blue; the second arrow seems to change color as he reads; the third one is striped, like a tiger; the fourth is yellow like a legal pad (and has some very tiny small print underneath – not readable), and the last glitters – gold, or maybe fools' gold. What strange names! What do they mean? Where to go first?

FIGURE 1. EXCERPTS FROM THE CYBERSECURITY ISLAND SCRIPT

F. Cybersecurity Island

FIGURE 2. ENTERING CYBERSECURITY ISLAND

Upon entering Cybersecurity Island, avatar visitors are immediately presented with a pre-test that examines their knowledge of cybersecurity. They can repeat the exam again upon exit to determine what they have learned during their visit. Throughout the island, there are built-in lessons of many kinds, from basic to advanced, that allow students to become familiar with good security practices in cyberspace that lead to good avatar citizenship.

FIGURE 3. MAP OF CYBERSECURITY ISLAND

The map of Cybersecurity Island is given in Figure 3. One of the destinations on the map, True Security Found Here, is described in detail to provide a sense of the lessons embedded in the site.

G. True Security Found Here

From the moment visitors arrive on the Island, avatars are confronted with the dangers of trusting the wrong avatar. They are potentially infected with a virus by clicking on the wrong object without looking for authentication. They are waylaid by other avatars role-playing in-world to convince them to participate in dubious activities. As their quest begins, they must figure out, how to get "disinfected" before advancing through the various stages of learning on the island.

In this area of the Island, they learn about common security issues, such as how to define security, and how security differs from individual to individual. This is where general cybersecurity education takes place and most visitors will benefit by starting here. Still, human nature, being what it is, many will be drawn to the dangerous-sounding theme parks like Malware Safari land, Insider Mansion, Stego Country or the House of Illusion. Since not everything is secure in this space, the avatar learns experiential lessons in security by becoming 'infected,' requiring them to search out mitigations in order to return to 'health.'

At the entrance to True Security, there is the Shiny Unicorn and the Oily Snake that seem to shift back and forth between each other to represent the dual nature of attempts to achieve true security.

The Unicorn symbolizes purity, security systems which are built to be secure from the ground up. The Unicorn also directs visitors to pools in the center of the Island where avatars can "recover" from any malicious or deceptive actions that are practiced upon them. By immersing in a pool, the avatar's color changes and a speeding-up effect occurs—in this way the avatar can experience the ravages of infection caused by poor security practice and the feeling of redemption gained from implementing appropriate security measures.

The Oily Snake is a play on "snake oil salesman" and represents purported security measures which do not really work. For example, Oily Snake might offer a visitor five factor authentication—where three of the elements are really the same. And so on.

FIGURE 4. TRUE SECURITY FOUND HERE

Inside *True Security Found Here* land there is an education center, set up as a series of classrooms, with the goal being to teach security basics. One class explains what a password is and how to use it. Another, held in a pool, shows how to operate in social networks, safely. A third looks a bit like a child's wildest fantasy about Lego's. This is where students learn how to combine various elements of security (and also learn that combining two secure systems does not necessarily yield a secure result).

A few of the other destinations on Cybersecurity Island are described subsequently and give some insight into the kinds of educational lessons offered throughout the island.

H. Stego Country

FIGURE 5. ENTERING THE MOUTH OF THE STEGOSAURUS

Stego Country provides the visiting avatar an opportunity to learn about steganography—hidden messages in digital files. It is represented by a Stegosaurus, munching on greenery, which can be entered through his mouth to reveal a hallway of lessons on steganography, the process of hiding messages in objects to obscure viewer perception of the hidden intent that are both fun and educational.

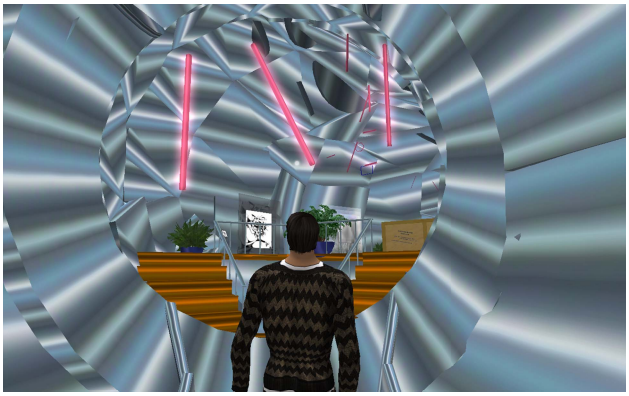

FIGURE 6. INSIDE THE BODY OF THE STEGOSAURUS

I. House of Illusion and Deception

Entering the *House of Illusion and Deception*, the visitor is confronted with floors of lessons and traps that force exploration and learning. The focus is on the idea that what may seem secure cannot be assumed to be secure.

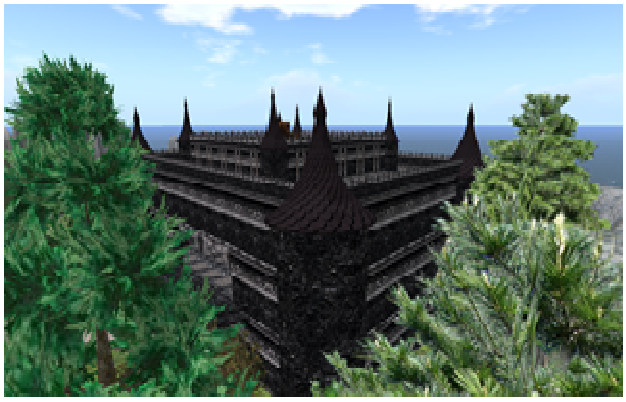

FIGURE 7. APPROACHING THE HOUSE OF ILLUSION AND DECEPTION

Here avatar visitors learn how both offense and defense in cybersecurity use illusion/deception to gain their objectives. Examples include: HoneyNets, HoneyPots, Mimicry, Shifting Ports.

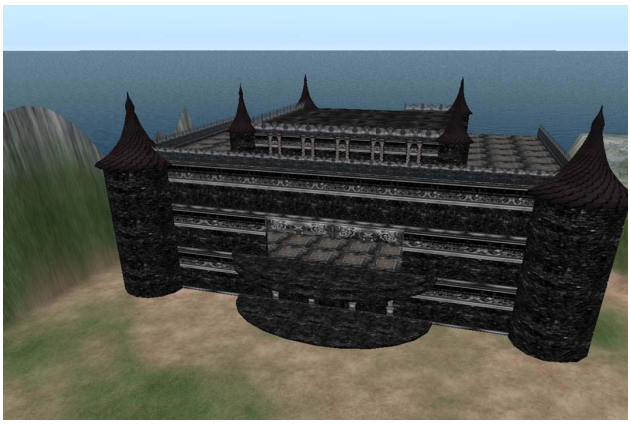

FIGURE 8. HOUSE OF ILLUSION AND DECEPTION AERIAL VIEW

The House is built like a carnival Fun House, complete with towers, moat, and draw bridges. Not everything in the house is "real," and not everything in the house should be touched. The visitor's goal is to find all of the items that deliver cybersecurity lessons without getting trapped! The Traveler enters across a draw bridge with signs "Cross At Your Own Risk!"

FIGURE 9. INSIDE THE HOUSE OF ILLUSION AND DECEPTION

RESULTS OF THE PROJECT

Those building Cybersecurity Island brought a strong sense of commitment to the development of the island and the concepts it teaches. The result was a persistent, live-learning environment, with a game-based engagement model, that is readily available to anyone wishing to teach the complex subject of cybersecurity. While the goal of the project was to create a learning environment that would raise visitor awareness of cybersecurity issues related to the digital world, it had a similar effect on the students building it. A byproduct is expected to be the creation of the kind of avatar citizens that can uphold a civil virtual community by being good practitioners of cybersecurity.

Engaging avatars as citizens requires an environment that establishes a deep immersion in the virtual world, a solid understanding of the community experience in virtual worlds, as well as deep knowledge of development that precipitates activity-based learning, assesses performance that is real-time and relevant to the purpose, and provides access to individuals with expert knowledge of the potential of virtual worlds. As the students in the course interpreted the content and translated it into meaning, they had to learn to work together, trust each other and follow a course of action that would achieve successful results. They also had to immerse themselves in a new subject for many, cybersecurity, and engage in conversations about what does indeed constitute responsible avatar behavior in world.

The class filmed a machinima, a video episode taken in a virtual world with avatars as the actors, and the virtual environment being the setting. The producers then overlaid sound effects to tell a story. The end product can be viewed at:

http://www.youtube.com/watch?v=EJkYzhaf6y4

FUTURE WORK

Being able to 1) meet in-world with avatars from across the nation, 2) interact with others for a long period of time, 3) record the experience for posterity, and 4) develop content that has relevance to the client as well as to the students, themselves, as avatar citizens, is the kind of experience that enables students to learn in a new, immersive way.

Future work includes refining and enhancing the Island, using the Island for scheduled cybersecurity meetings and collecting data about the value of the experience through the entry and exit exams mentioned earlier.

Cybersecurity Island was opened to the public for a period of time. It was hoped that it would shape and guide in-world behaviors of avatars, contributing to their good citizenship. Results are being assessed.

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