

Education Unleashed: Participatory Culture, Education, and Innovation in *Second Life*

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Introduction

In the four decades since the start of the silicon revolution, the computational power of individual computers has increased by ten million times,¹ and computers have moved from prohibitively expensive scientific devices to an ubiquitous part of everyday life. During the same period, connections between computers have increased from the first packet-based transmissions of ARPANET to the saturation of the Internet and the World Wide Web.² These technological transitions drove two additional transformations: the rise of online computer games and the dominance of networked computers for information transfer and communication. These, in turn, have enabled a new media form: the virtual world. Like the computer games with which they share technology and terminology, virtual worlds take their participants to new places beyond the physical and geographic limitations of the real world. Yet virtual worlds go far beyond games in their leveraging of social connections and learning principles.³ This mix of fantastic possibilities and social educational opportunities has virtual worlds poised to transform basic approaches to learning and communication, as well as innovation and entrepreneurship.

In an increasingly technologically linked yet socially fragmented world,⁴ virtual worlds demonstrate the power to bring people together.⁵ They bypass the historic impacts of geographic,⁶ professional,⁷ and generational⁸ distance by allowing their residents to create knowledge⁹ and identity¹⁰ in collaborative spaces. Although a passionate minority of game players—those who play massively multiplayer online role-playing games (MMORPGs) like *World of Warcraft*, *Everquest*, and *Lineage*¹¹—has already experienced some of the impacts of virtual worlds, it is the transition away from traditional game forms that allow virtual worlds to address a far broader audience. Instead of playing through a fiction provided by the game creators, virtual world residents collaboratively learn how to solve problems in the creation of their own worlds. The resulting culture of participation infused with pervasive learning makes virtual worlds dynamic learning environments.¹²

Within the possibility space afforded by virtual worlds, residents become engines of creation themselves, working as the producers of content in the world, designing and reshaping the space around their own ideas and interests.¹³ Developers no longer produce all of the content; instead, this task is given over to the residents of the world. The virtual world *Second Life* was created based upon this premise, and has proven that, when given the correct tools, residents can create compelling and interesting content. Empowered by the ability to create, residents act with dedication and purpose, often overcoming tremendous obstacles

to acquire new skills and knowledge in order to make the world their own. In *Second Life*, interactive 3D content is created via the process of atomistic construction, described later in this chapter. Yet, the actual act of content creation is only a part of the overall process of building, particularly given the challenging nature of the tools. Access to the tools reinforces the culture of amateur-to-amateur education as residents move beyond content creation to take on peer-to-peer teaching roles. This network of knowledge and practice created not only encourages more building in the world, but also establishes *Second Life* as a robust learning space, powered through peer-to-peer pedagogy.

Starting with the section “Participatory Culture and Media Creation,” this chapter will focus on how features of *Second Life* align well with educational theory. These features both enable the emergence of different approaches to education and engage traditional, large-scale educational institutions.¹⁴ *Second Life*, beyond simply acting as a method of distance learning, has become a tool that extends the reach of both credentialed professors in classrooms and amateurs teaching for fun.¹⁵

The power of virtual worlds to convey information, and potentially to reduce the cost of learning within them due to pervasive connectivity and social networks, means the same technologies and techniques that apply to education also lead to changes in business process and entrepreneurship. Combined with the far lower capital expenses inherent in digital worlds, in *Second Life* hundreds of thousands of residents try out new roles, learn new skills, and approach learning with a passion and excitement they may not have possessed in school. This ecology is creating a new highly trained and flexible workforce not necessarily tied to national, ethnic, racial, or age boundaries. In the past year alone, sixty-five companies employing a total of over 220 people started within *Second Life* before moving into the real world.¹⁶ This group of innovators is leveraging education every day and building skills that also apply to the real world¹⁷ as they manage distributed employees from all over the world. What are the implications of this changing approach to work, where the most capable and effective people may not classify their activities as work at all? Instead, they may describe how they spend their time as “play” or “fun.”¹⁸

Virtual worlds like *Second Life* are on the leading edge of a new set of technological and experiential transformations that will impact how people communicate, play, and work. It is not surprising that this change is due to learning. Advances in educational theory, economics, and cognitive science mean more is understood about the process and impact of learning than ever before. So what are virtual worlds, and why do they educate so effectively?

Virtual Worlds, Not Games

The formal study of games is a young field,¹⁹ and the study of video games is even younger.²⁰ However, even as researchers and educators are creating workable frameworks for the study of video games,²¹ technology is enabling a new category of digital experience: virtual worlds.

It is easiest to begin by focusing on what virtual worlds are not. They are not massively multiplayer online role-playing games (MMORPGs). MMORPGs are currently the dominant form of online game, with at least fifteen million players worldwide.²² These games trace their heritage back to Bartle’s MUD, itself a descendent of *Dungeons & Dragons*.²³ This family tree results in recognizable signal characteristics, including strong game fictions and leveling. Strong game fictions mean the games take place within relatively cohesive settings that discourage intermingling with the real world. Fantasy motifs are common, but certainly not the only option. Leveling is the process of measuring progress via increases in experience

points. These experience points are gained by activities appropriate to the level, and each new level grants the player access to new abilities or game features. When judged against Salen and Zimmerman's definition that a game is "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome,"²⁴ MMORPGs clearly are games, with the conflict, rules, and quantifiable outcome all keyed to the leveling progression.

Virtual worlds are something different. While still massively multiplayer, meaning that thousands of players simultaneously experience the world in a shared space, they possess neither strong fictions nor leveling. Instead, their defining characteristic is the ability of residents to generate creations of value within a shared, simulated, 3D space. Strong, predefined fictions are not appropriate, as they limit the design space available to the residents. Instead, residents create their own fictions and communities, imbuing them with meaning through interaction.

For example, within *Second Life*, a group of stroke survivors have created a space dedicated to poststroke cognitive recovery, collaborating with other residents to generate the funding and expertise required for the project.²⁵ Just as strong fictions would interfere with the resident-driven design of this space, the limited features initially available via leveling would prevent new residents from being able to act fully within this space. By freeing themselves from the limitations of MMORPGs, virtual worlds enable a far broader design space to be shaped and transformed by residents.

An observer might view the entire World Wide Web as a virtual world. After all, users have certainly built a tremendous amount of content and there have been attempts at 3D Web pages. However, it is important to recognize the basic differences that exist. In particular, virtual worlds generate simultaneously shared spaces. The Web is built around sequential, solo access to content. While two, three, or hundreds of people can read a Weblog, or collaboratively participate in generating a definition for Wikipedia, posts are made sequentially. This is a very different experience than a real-world discussion. Instant messaging comes closer to capturing this, but—like phone and video conferencing—loses the physicality and place so critical to communication. Virtual worlds demand an environment where multiple participants can interact in real time to create collaboratively, sharing not only space, but time.²⁶ This feature of virtual worlds makes them especially suited for amateur-to-amateur learning, and is one reason many are already using virtual worlds to experiment with the future of education.

Virtual worlds are the newest offshoot from the game tree, and the least understood. While they are not games, they share game technology, vocabulary, and—in many cases—customers. They also have proven remarkably adaptable and useful in supporting most every aspect of human behavior. In order to see this potential, it is useful to view the history of several key developments shaping the state of virtual worlds today.

A History of Virtual Worlds

Four broad areas paved the way for virtual worlds: the World Wide Web, virtual reality, massively multiplayer online role-playing games, and avatar worlds. Each of these areas explored ideas key to virtual worlds and helped build solid technological and cultural foundations. Together, these technologies demonstrated that residents make significant time and economic commitments to online spaces. They proved communities can build large and complex digital creations, do not have to be modeled on fantasy motifs, and showcased the

power of shared spaces for creation. While the histories of all four technologies have been well documented elsewhere, a brief review of each helps explain how these histories formed the foundation for the conception of virtual worlds as robust learning spaces.

The Internet and the World Wide Web

From their beginnings as ARPANET in the late 1960s,²⁷ the Internet and Web have grown to connect people to a degree unprecedented in human history. Over one-and-a-half billion people worldwide now have the ability to communicate online. This communication often takes the form of networked peer production. Although Web sites are the most obvious example, Wikis and Weblogs form the core of an explosion of collaborative creation.²⁸

Collaboratively authored creations are special because, unlike much of the Web, they are maintained. Despite low marginal costs, decay impacts digital creations just like physical ones. Community and collaboration have proven to be effective preservation tools. Wikipedia has become the default exemplar of this kind of networked peer production.²⁹

Medium and technology both influence creation. In the case of the Web, most creations use text due to the ease of development, transmission, storage, and display. Unfortunately, the use of text compounds the Web's three significant flaws as a communications medium: it is generally asynchronous, it lacks place, and it is descriptive rather than experiential.

Contrast this with the real world, where communication is synchronous and interactive. This is true even when the conversation is largely one way (speeches) or nonlocal (telephone). Practiced speakers react to their audiences, adjusting their presentations on the fly, while telephone conversations allow speakers to react to each other. It is worth noting that telephone conversations share the Web's lack of place. Compare a conversation at a cocktail party to a phone conference with several people speaking at once. At the cocktail party, 3D audio and visual cues help to separate conversations, while overlapping phone conversations are often unintelligible. Place plays a part in providing the nonverbal cues critical to human communication. Relative location, movement, manipulation of objects, and body position are all lost when using text or voice media for communication.

Beyond the loss of place, Web sites are generally not experiential. A description of an airplane allows the reader to imagine flying it. Pictures, audio, or movies may cue the imagination, but the medium does not let the reader actually fly the plane. Physicality and simulation are not built into Web sites. So, while the Web supported peer production, it needed more. The next technology, virtual reality, attempted to fill this need by building on place.

Virtual Reality

Virtual reality has an extensive, albeit checkered, history.³⁰ Research into methods to allow interaction with virtual scenes has been going on for over forty years and has largely focused on head-mounted displays and haptic interfaces. The goal has been a natural viewing of virtual spaces and manipulation of objects within them. Overcoming tremendous technical and physiological challenges, virtual reality rapidly improved in the late 1980s. These improvements led to the idea that interaction with virtual models during construction would be a superior design and development tool. In particular, this would be the case when multiple users were in a shared space. Three-dimensional spaces—with creation, collaboration, and interaction between multiple users—would transform engineering and design.³¹

Unfortunately, research focused on the interface rather than on the collaboration. Head-mounted displays and haptic interfaces soaked up engineering effort and capital, with limited

successes. Concurrently, computer-aided design continued to improve, but with little attention paid to shared spaces.

Only recently have engineering organizations been able to share modeling and simulation tools and data fully. Not yet in widespread use, organizations have begun to recognize the benefits of collaborative creation, allowing both creators and managers to share, visualize, simulate, and freely manipulate data. Automobile companies, for example, are starting to explore new and creative ideas while using modeling and simulation to determine the performance and costs of development. Collaborative creation is helping organizations design and build superior products.

However, large-scale computer-aided design and fabrication technologies are still extremely expensive and generally quite challenging to use. Until recently, only a small number of people have had the opportunity to experience online collaboration. Massively multiplayer online role-playing games changed that.

Massively Multiplayer Online Role-Playing Games

MUD1 opened in 1979 and was the first major online world in which people played together. Inspired by both *Dungeons & Dragons* and *The Lord of the Rings*, *MUD1* created the online game standards that have been followed ever since, and spawned countless text-based online worlds with which a generation of developers grew up. When technology improved sufficiently, these developers converted their text worlds into graphical spaces, beginning with *Meridian 59* in 1996. *Meridian 59* was soon eclipsed by two hugely successful games, *Ultima Online* and *EverQuest*, heralding the birth of the MMORPG. Pulled by the novel combination of culture, economies, and game play, millions of players moved into MMORPGs.

True to the inspiration of *MUD1*, MMORPGs retain the signal characteristics of leveling, strongly themed worlds, social organizations, and player behaviors.³² MMORPGs have resulted in the growth of secondary markets for the value created within them, including virtual currencies, items, and characters. The global market for these virtual game items has been estimated at \$880 million per year, despite attempts by developers to eliminate it via end-user licensing agreements (EULAs) that unequivocally prohibit transfers and sales of virtual items.³³ Players, spurred by time pressure, the desire to play with higher-level friends, and perhaps even the need to consume conspicuously, generate sufficient demand to keep secondary markets in operation despite efforts to close them.

Leaving aside debates about wealth generation and ownership, the markets for digital goods in virtual worlds are large and growing. More importantly, these markets drive commoditization and, within MMORPGs, commoditization is a problem. MMORPGs are enormously expensive to build, due primarily to the enormous cost of creating hundreds of hours of content. In order to keep the experience engaging, developers carefully map out the consumption paths for this content. Unfortunately, if players can commoditize content and shortcut these paths, players may consume the content far too quickly, rendering valueless the millions of development dollars invested in content creation. As a result, although some games are testing newer economic and game play models, MMORPGs generally have not integrated real-world digital item markets.³⁴

MMORPGs brought millions of people online and taught them the power of real-time collaboration. Unfortunately, game play, design, and economic decisions limited their ability to move beyond the thematic and style roots of *MUD1*. One final experience was needed.

Distributed Avatar Worlds

The first broadly available, graphical virtual environment was *Lucasfilm's Habitat*. Launched in 1986 on the Commodore 64, *Habitat* introduced the avatar as the graphical representative of the player in a collaborative space. Users could interact with each other and customize the over 20,000 places within *Habitat's* world. Although *Habitat* drew from multiple sources, including text games and science fiction, it made the critical decision to move away from a fantasy motif. More importantly, *Habitat* demonstrated the failure of detailed central planning to create truly immense and complicated places.³⁵

While *Habitat* was successful, the avatar worlds that followed were commercial failures. Although many of them still operate due to the passion of their residents, most do not. Social interaction was clearly a necessary but not sufficient feature of digital worlds. Residents needed more things to do.

Active Worlds, introduced in 1995, attempted to provide building tools for users so that they could create additional content. Many users took advantage of these tools and demonstrated enormous creativity. Unfortunately, *Active Worlds* included neither the social nor the economic forces required to incentivize the creation and maintenance of large-scale and compelling content. Although still running, *Active Worlds'* population has waned.³⁶

The lineage of *Habitat* through *Active Worlds* proved that online worlds not based on the fantasy orientation of *Dungeons & Dragons* were viable. They reinforced the idea that users could be tapped as incredible sources of innovation and creativity. While users enjoyed creating 3D content, this content was not compelling enough to draw in new users. Insufficient motivations existed to generate sustaining behavior. Despite this, the pieces were now in place to change virtual worlds forever. *Second Life*, launched in 2003, combined these four basic technologies, and added the power of collaborative creation via atomistic creation. The result has been an explosion of creativity and learning still accelerating more than three years after it launched.

Moore in the Valley

The increase in a computer's abilities to store and process data has greatly impacted how games and virtual worlds are made.³⁷ Despite the fact that hit digital entertainment launches generate larger first-day revenues than movies,³⁸ the cost of development greatly limits options for creating virtual worlds,³⁹ especially worlds targeted at niche markets like education.

Most game and virtual world projects are commercial and practical failures. Even with the best funding and most talented developers, creating virtual worlds that solve the myriad technical and social challenges related to bringing thousands or millions of people together is an extremely difficult task. These challenges are compounded by the risks in developing projects that require tens of millions of dollars to complete.⁴⁰

In the early days of virtual worlds, the primary cost driver was the underlying technology, the computer code required to simulate and represent the world and its residents. Over the last ten years, newer and more powerful computers have allowed far more realistic depictions of environments and characters. In many cases, the display quality approximates computer-generated movies of only a couple of years ago. At the same time, the costs of creating those environments and characters also rival those of Hollywood.⁴¹

This should come as no surprise, since the tools and techniques for making art assets are fairly standardized, whether the artist is working on a movie or an online game. The only real difference is the extra difficulty of creating game assets, since—unlike movies—the content must be interactive. Imagine the difference between building a real town versus

the facade of a movie set. In the real world, all the buildings would have interiors. Plumbing and electricity would have to work, problems like traffic flow and garbage removal would need to be addressed, and the building materials would need to survive decades of use.

These are the problems faced by game artists and designers. Content built for games must be used and reused in experiences and quests compelling enough for hundreds or thousands of hours of play. Whenever possible, games take advantage of Hollywood tricks and build facades or limit the path of the player, but these tricks are less useful in online games or virtual worlds. Instead, more content must be created, even after the game is launched, in order to keep the players engaged. The cost of content creation now exceeds that of technology development for many online games, and will continue to grow as a percentage of overall development.⁴²

The long history of increased development costs has led to an increasingly risk-averse publishing model and fewer innovative games. Instead, more products are sequels and “me, too” titles. For the educator looking to use games or virtual world spaces as learning tools, this presents a real problem. Insufficient virtual world variety exists to provide enough choices for education and research. The problem becomes worse if educators want to build their own virtual worlds.

Virtual world development costs vary, but estimates range between \$12 and \$20 million.⁴³ While research projects of this magnitude certainly exist, this kind of spending exists outside the range of most researchers. Moreover, even if a school is able to marshal the resources required, it will face an even larger problem.

The Vast Majority of Games and Virtual Worlds Fail

Although in the commercial world, failure is defined economically, it is equally valid to examine it from the standpoint of use. Virtual worlds fail when they are insufficiently compelling for large numbers of residents to spend considerable time using them. If an educator or researcher spends millions of dollars building a virtual world and nobody shows up, that project is doomed to failure.

The problem continues to intensify as content costs soar. With the majority of development costs tied to content, traditional methods for building cheaper virtual worlds will not work. Middleware and full game engines are the most common approaches taken. Middleware is software designed to solve specific problems related to virtual world creation. Physical simulation⁴⁴ and foliage generation⁴⁵ are two classes of problems well-suited to middleware solutions. Similarly, full game engines have been built to reduce technical risk and cost.⁴⁶ Even if middleware and engines were able to reduce the technical development costs to zero, more than half of the development costs would remain, due to the cost of content creation. Of course, in the real world, middleware and engines still cost development time and budget, so in reality they create only an incremental change in development costs.

A natural response to this is to create markets for shared content resources. Success in this space has proved elusive. While numerous companies provide stock photography and sound effects, the specialized nature of real-time 3D rendering and the specific art needs of individual virtual worlds have combined to reduce the usefulness of shared 3D assets.⁴⁷ Worse, much content creation cost goes beyond the production of individual components. Complex creations, such as quests, scripted scenes, or even entire games, are particularly ill-suited for sale to multiple virtual worlds.

Fortunately, the World Wide Web has demonstrated the potential of user-created content. While participation levels still remain relatively small, with less than 25 percent of U.S.

Internet users adding content to the Web despite the emergence of easy-to-use tools like Flickr, the numbers are growing.⁴⁸ The challenges in applying the power of peer production to virtual worlds lie both in the tools provided to the residents and in the environment required to support high levels of exploration and use.

Atomistic Creation

While everything in the real world is built of atoms, they are generally not convenient tools for human construction. Nanotechnology, where products are built at the atomic scale, is expensive, difficult, and potentially risky. Construction at the macrolevel requires large expenditures of time, raw materials, and energy. Large-scale, real-world creation of artifacts like cities require economies of scale that generate undesirable outcomes like traffic and pollution. Unlike the real world, *Second Life* uses building blocks specifically designed for human-scale creation.

This is the principle the designers of *Second Life* call atomistic construction. Primitives are the atoms of *Second Life*. Simple primitives are combined to build interesting structures and behaviors, and are designed to support maximum creativity while still being simple enough for everyone to play with and use. To understand how atoms work, consider building a piano first in *Ultima Online* and then in *Second Life*.

In *Ultima Online*, a user can purchase a large number of objects, ranging from checkerboards to cloaks. With careful stacking and a lot of patience, it is possible to create something that looks like a piano. Of course, it is not really a piano and the user could not use it to compose music, although it might serve as decoration.

In *Second Life*, the resident would start building the piano in real time, simply creating primitives as needed. These primitives would be scaled, textured, colored, and combined to create a piano. Sound would be added to the keys, so it could be played. A symphony could be composed on it. Rather than simple decoration, this is a piano.

Of course, since it is built of primitives, the piano could also fly or follow the resident around like a pet. Copies of the piano could be given away or sold with practically no marginal cost of reproduction. When the piano was no longer needed, it could be removed from the world and stored for later use.

By endowing every primitive with physical and behavioral properties, primitives become the basic building blocks of everything from hats to houses, from cats to cars. Instead of the real world's hundred different atoms with complex interaction rules, *Second Life* is made up of several simple primitive types with the flexibility to generate a nearly limitless set of combinatorial possibilities.

These primitives exist in a physically simulated world, resulting in fairly predictable behaviors. Create a physical ball in the air, and it will fall. Build a square table with three legs, and it will fall over. Simulation allows residents to leverage their intuitive understanding of the real world. Although primitives are flexible enough to allow exceptions, the real world metaphor acts to orient new residents. Even more importantly, so much of this creation occurs in public that residents are constantly inspired. When a particularly spectacular motorcycle roars by, residents are able to ask immediately how they might build one, to explore and experiment on their own.

Primitives are manipulated and combined within *Second Life*, a construction process that does not rely on external programs. A resident does not have to build his model of a house in Maya, a complex 3D design program, before importing it into *Second Life* for use. Instead,

the building of the house occurs directly within the world, and other residents can be invited to help in the process. Thus, default creative methods are collaborative and synchronous, rather than individual and asynchronous. Collaboration can be as simple as asking someone for help or an opinion, or as complex as dozens of residents building a city from a set of master blueprints.⁴⁹ Feedback is instantaneous, and communication a natural back and forth, rather than following the asynchronous, sequential mode of a blog or e-mail. Collaboration, as a key mode of interaction, drives the way residents learn within *Second Life*.

Second Life residents from all over the real world have learned to create at every scale, designing clothing to full-scale games, including MMORPGs built within *Second Life*.⁵⁰ The creative power of the digital melting pot is astonishing. This power also drives the economic forces within *Second Life*.

Economics

Like the real world, creations built by the application of time, effort, and innovation are worth more than their constituent parts. In *Second Life*, primitives have almost no cost beyond the computing, memory, and bandwidth resources they consume. For individual, temporary primitives, these costs are effectively zero. As primitives are combined and left in the world, their costs increase. For residents to maintain permanent artifacts in world—their houses for example—they need to own virtual real estate within *Second Life*. This ownership allocates computing resources and balances the load generated by usage evenly across the computers simulating the world.

The vast design space available to creators using primitives means there are a myriad of ways to meet similar needs. Creators who apply more innovation, skill, or time to their creations generate more valuable artifacts. Markets within *Second Life* allow consumers to define value in different ways, from efficiency and effectiveness to scarcity and beauty.⁵¹ Some residents purchase space in order to create shopping malls while others create gardens and green spaces.

The flexibility and ease of collaborative creation drives tremendous variety and experimentation. For example, in November 2006,⁵² 500,000 distinct residents spent time in *Second Life*. Those residents exchanged over 500,000 items in ten million resident-to-resident transactions with a total value of US\$17 million. Although the transactions were made with the “Linden Dollar,” or L\$, it is possible to assign U.S. dollar values to these transactions because the L\$ is freely traded against the US\$. In November 2006, the value of those transactions exceeded US\$2.7 million and maintained an exchange rate of approximately L\$270 to US\$1. As with physical simulation, trade and economic activity provide an important context within digital worlds. Residents learn about the potential to make money from other residents, so some choose to explore this opportunity. The power of the economy should be expected, as *Second Life* leverages factors long associated with economic strength and growth: property rights, the cost of learning, and decentralization.

Property rights are a key enabler of innovation and therefore per capita economic growth. Without ownership, property is not fungible and retards economic growth.⁵³ This was one of the key ideas behind *Second Life's* decision to grant residents ownership of their creations. The growth of quality and quantity of user-created content in the three years since that decision is a significant proof point. However, precision here is important because digital artifacts are intellectual property (IP) rather than property.

The IP domain governs digital artifacts. This is important because although IP helps to steer innovation by creating excess value through temporary monopolies, it is the cost of learning that drives the rate of innovation.⁵⁴ Strong copyright, like the approach currently being applied in the United States, hampers innovation due to the increased learning costs. It also legislates areas of innovation rather than allowing less structured exploration, compounding the damage.⁵⁵

Fortunately, digital worlds and atomistic construction have several advantages over the real world with regard to the cost of learning. First, atomistic construction allows anyone to reverse-engineer or improve on the ideas of others, rather than limiting those options to large corporations. Copyright still holds, providing creators with legal protections, but the freedom to tinker increases the opportunities for useful knowledge to spread as new and competitive ideas enter the marketplace. Second, digital worlds have the opportunity to give their creators IP regimes that better support innovation by reducing learning costs.

Decentralization is the final important economic factor.⁵⁶ The steady reduction of communication and transportation costs in the real world has allowed many businesses to explore increasingly decentralized approaches. Many open-source and collaborative projects, such as Apache and Wikipedia, use these techniques.⁵⁷ In the real world, decentralization can run into limits when the time comes to production. Marginal costs and the need for specialized skills and materials limit the degree of decentralization.

Digital worlds with atomistic construction evade this limitation. Although personal skills will still vary, any resident with an idea or need has the tools to create a solution, and many do. During October 2006, residents in *Second Life* spent 240,000 user hours per day in-world and 25 percent of their time was spent actively creating. Thus, every day 60,000 user hours are spent creating, the equivalent of 30 user-years per day. That is the equivalent of an 11,000-person content development team. It would cost over \$1 billion per year to hire a team of that size! Even with Sturgeon's Law,⁵⁸ it is a team of 1,100, and this approach scales as the user base grows.

This decentralized creative team is closer to the community's needs and wants than any developer could ever be, allowing creation and innovation to be efficiently applied. For the same reasons that open-source users are often the best positioned to improve their products,⁵⁹ *Second Life* residents are constantly improving their world.

Participatory Culture and Media Creation

It is generally accepted that, for a given medium, rates of consumption will radically outweigh rates of creation. For example, far more people purchase music than play instruments, few television viewers create video podcasts, and only a small percentage of game players create mods of their favorite video games. Even when the technology and knowledge barriers to creation are low, creation is the exception while consumption is the norm. Despite the well-documented proliferation of Weblogs on the Internet, fewer than 7 percent of Web users have created Weblogs.⁶⁰ Wikipedia, often cited as the pinnacle of distributed user-created content on the Web, has contributions from less than 0.2 percent of its readers.⁶¹ So, conventional wisdom is upheld, with creators as members of an unusual, separate class from the masses of consumers.

Conventional wisdom fails to tell the whole story, however. History has repeatedly demonstrated that adopters of new technologies act to distinguish themselves from the

old, separating amateurs from experts by a gulf of jargon and certification.⁶² While human performance clearly varies across any measured parameter, educational theory provides no theoretical framework for the narrow segregation of a population into designers and non-designers, into expert and amateur.⁶³ Although current research around emerging uses of technology points to greater overlap between producers and consumers, a strong example was needed. The virtual world *Second Life* provides this example.

Using a diverse collection of built-in tools, residents create the objects, clothing, characters, script code, and experiences to fill the world. Despite the steep learning curve of many of these tools, *Second Life* has remarkable participation rates. Within any thirty-day period, over 66 percent of the residents who used *Second Life* created something from scratch. For example, a resident might create a 3D model, such as a car or a house, using the modeling tools. This is a task generally considered to be in the domain of professional 3D modelers. Another example would be creating behaviors, such as making the car fun to drive, by using the embedded scripting language. Far from drag-and-drop visual programming, *Second Life's* scripting language is as complicated as C, a programming language challenging to teach and to learn. Despite these hurdles, fully 15 percent of *Second Life's* residents experiment with scripting every week.

Second Life's demographics make these statistics all the more remarkable. Rather than the expected young male audience, *Second Life* has a nearly balanced usage by men and women, a median age in the early thirties, with women slightly more likely to continue using *Second Life* than men. Moreover, the older the residents are, the more likely they are to continue using *Second Life*.⁶⁴ Given that some of the previous examples, such as Wikipedia, almost certainly possess diverse audiences as well, heterogeneity of users is clearly insufficient to explain the observed rates of participation. What other mechanisms could be at work? While there is no certain answer to the question, in addition to the economic component discussed earlier, *Second Life* is a particularly good environment for learning. Though no hard data supporting this claim yet exists, the kinds of learning taking place within the world are worth examining. In much the same way that James Gee, Jane McGonigal, and Kurt Squire explore the learning strategies intrinsic to games elsewhere in this volume, *Second Life* may be viewed as an educational space.

The learning potential of *Second Life* becomes even more exciting when examining the next generation of content creators. Thirty-three percent of online teens share self-created media on the Web and nearly 20 percent maintain blogs.⁶⁵ Teens between the ages of thirteen and seventeen use *Teen Second Life*, a separate part of *Second Life*. During the preparation of this chapter, the author and fellow volume author Barry Joseph discussed the possibility of surveying residents of *Teen Second Life* about their participation and learning. A full analysis of the survey data is beyond the scope of this chapter, but after receiving 384 responses, a few data points jumped out:

- Seventy-five percent of the respondents were male;
- Sixty-seven percent had written at least one program using the scripting language;
- Eighty-seven percent had customized their appearance;
- Ninety-eight percent had created objects using the creation tools;
- For questions related to customizing appearance, designing clothing, and writing scripts, the most popular source of information was “friends”; and
- Twenty-three percent had created Web sites about *Teen Second Life*.

Finally, the survey itself was administered via an object created within *Teen Second Life*. The object—and the program to operate it—was created by a fourteen-year-old girl.⁶⁶

Amateur-to-Amateur Education

Residents spend a great deal of time in-world educating each other in both direct and indirect ways. Educational events, such as “Introduction to Scripting” or “Building 101,” are available nearly every day and provide new arrivals to *Second Life* with a fun and inviting way to learn about the tools and possibilities available to them.⁶⁷ Residents also spend a disproportionate amount of time in the “Welcome Area,” where new residents arrive. The “Welcome Area” is often full of residents displaying their newest and most impressive creations. While sometimes confusing to new arrivals, these displays provide a powerful demonstration of the power of *Second Life*, and often lead to the most critical of questions: “How did you do that?” This question is particularly important within *Second Life* because the answer can almost always be immediately demonstrated. Rather than redirecting the questioner to the solo experience of reading a Web site or learning a new piece of software, the demonstration is a social and collaborative experience, creating context and social bonds. More importantly, information is transferred “just in time,” or “on demand,” at a point when the learner wants the knowledge, rather than during an arbitrarily paced tutorial or lesson plan. This type of learning is one of the powerful features of games, and *Second Life* residents leverage it as well. This is one part of what learning specialists refer to as “situated learning,” a point discussed by Gee and others elsewhere in this series.

Second Life has proven so effective at displaying and communicating information that educators at all levels are choosing to expand their classrooms into the virtual world.⁶⁸ From drama departments and architecture to computer science and entrepreneurship, the ability to create exactly what is needed for a specific curriculum, class, or student is a revelation to many teachers.

Examining the lessons of *Second Life* in regard to the creation of an innovative, peer-to-peer learning environment is very important. Conventional wisdom about the rarity of content creators is clearly misleading in this context. Domain experts must recognize the potential of amateurs as teachers and learn to welcome their efforts. While collaborative learning has long been well understood as an important and effective component,⁶⁹ particularly in informal learning settings, *Second Life* provides an environment wherein such learning takes place on a daily basis. Residents have multiple ways of learning, including content creation, which casts many of them as teachers.

Everyone a Teacher

While this phenomenon is not limited to *Second Life*, the nature of the tools and lack of overt game goals within the world provide huge opportunities for residents to experiment with creation as a mode of engagement. Given that the actual mechanics of building are extremely challenging, the question that must be asked is: “How do people learn to use *Second Life*?”

While the answer to this question is complex, at least part of it lies in the ability for all residents to teach in, and more importantly to teach within, *Second Life*. Most creations in *Second Life* are built using the atomistic creation tools discussed previously—the avatar editing tools and the scripting language. For residents, because the building occurs in-world—in public—it is easy to show someone both what is being created and how the tools are being

used. This has led to a culture of educational events in which residents take time to teach others. Sometimes these teachers charge residents for their efforts, but in most cases residents hold classes because they perceive teaching to be a fun, social activity and a great way to meet new people.

Different communities within *Second Life* have taken on education as well. An excellent example is *Shock Proof*. This is the previously mentioned space for stroke survivors to work together toward cognitive recovery.⁷⁰ Several stroke survivors discovered *Second Life* independently, and together decided to build a space specifically designed to help their fellow survivors. In the aftermath of a stroke, a key indicator of long-term recovery is how engaged the survivor is in using the brain to communicate, solve problems, and practice fine motor skills.⁷¹ In the real world, especially if mobility-impaired, finding these opportunities can be very difficult. *Second Life* offers many different ways to approach these problems. *Shock Proof* is not only filled with activities, but also has areas for the older community members to teach and work with the new arrivals. Another is the *CyberOne* law class being taught at Harvard Law School. Taught simultaneously in the real world and in *Second Life*, *CyberOne* has provided both local and remote students an opportunity to study law in new ways.⁷² Or consider the virtual summer camp run by Global Kids, discussed elsewhere in this volume.

Examples like these abound, with communities using the tools of the world to educate newer members. Education has become a basic part of the culture. Perhaps more importantly, that education does not look like education in a classroom.

Virtual Vygotsky

The idea that education is strongly impacted by communities is certainly not new. Some of the earliest thinking on the topic was done by the psychologist Lev Vygotsky, who spent his brief adult years writing about play, internalization, and relationships between language and learning.⁷³ Vygotsky introduced generations of education researchers and instructional technologists to the basic concepts of learning by doing, arguing that education is best understood within the context of the surrounding culture and social interactions.⁷⁴ Designers, educators, and technologists like Seymour Papert⁷⁵ and Mitch Resnick⁷⁶ from MIT picked up on these theories in pursuit of developing constructivist tools for kids,⁷⁷ and the children's software movement discussed by Ito in this volume has its roots in Vygotskyian pedagogy.

A deep analysis of Vygotsky's theories is beyond the scope of this chapter, but understanding the breadth of influence of his ideas is helpful, because—unlike so many other technologies that have been applied to the classroom and education—virtual worlds strongly align with his basic theories. Rather than increasing the separation of surrounding social groups from education the way the computer often has, or decreasing the amount of time spent on actual hands-on activities as in the case of more passive media forms like television, virtual worlds both provide engaging playgrounds for experimentation and immerse these playgrounds within social networks.⁷⁸ This combination, enabled by the simultaneous collaboration model of virtual worlds, results in a striking alignment between play and authorship in virtual worlds, along with a variety of basic learning principles.

Legitimate Peripheral Participation

Legitimate peripheral participation (LPP) is an educational idea virtually unheard of outside education and literacy circles, yet it is arguably the most natural and effective learning

technique available.⁷⁹ LPP is the idea that people learn best when they spend time with people who have mastered the skills they wish to learn. Most commonly seen in apprenticeships, LPP provides the basis for learning and training in many fields today,⁸⁰ including medicine, military service, and journalism.

More specifically, LPP enables new learners to approach complex information in stages. For example, in journalism, a new employee may first work at final layout and proofreading, two tasks that require relatively small amounts of training. However, as the new employee masters these new jobs, he or she is also exposed to the particulars of journalistic writing style, content, story construction, and other elements which need to be mastered before moving on to copy editing or writing original stories. This immersive process ensures that when the new journalist does move on to more difficult tasks, he or she is already prepared.⁸¹

While not all tasks in virtual worlds are so neatly subdivided, new residents are first able to spend time watching how more experienced residents customize their appearances, acquire information, and manage their businesses. Much of the initial, experimental creation performed by residents in *Second Life* occurs in “sandbox” regions designed for free building. These explorations take place around more experienced builders, so the neophyte is able to observe the tips and tricks required to build successfully. Even more importantly, they are able to contextualize why they want to acquire these new building skills because they can see the results around them. This is situated learning.

Situated Learning

Situated learning is the idea that better learning occurs when the reasons and motivations for learning are clear. Rather than the “skill and drill” of assignments followed by testing, situated learning is more like on-the-job training, where the acquisition of skill is introduced in the context of use.⁸² Situated learning often provides an incentive to learn, an idea crucial to understanding the viability of virtual worlds as learning spaces.

In *Second Life*, residents constantly come into contact with people who may inspire them with their avatar design, possessions, businesses, or other skills. Although every resident is able to explore design space flexibly as they desire, these social interactions provide contexts and reasons for mastering skills they might not yet have. These incentives to learn make it clear, for example, why some mastery of the scripting language in *Second Life* is needed in order to make great jewelry. Or why practice with the avatar creation tools can lead to superior avatar design. Residents develop their skills as they build their knowledge around the possibilities the space provides. Residents not only model practical knowledge for each other, but provide opportunities for imagination to take hold and inspire new creation.

In addition, the desire to mold technology to individual needs can be further enforced within specific communities. Time spent visiting the International Spaceflight Museum in *Second Life* may inspire an educator to attempt a completely new approach to teaching about the history of spaceflight.⁸³ A habit of visiting jazz clubs may lead to an interest in music.⁸⁴ Because such flexible tools are available, the explorer has every opportunity for inspiration to lead to learning events.

This is reinforced by the on-demand nature of peer-to-peer learning in *Second Life*. When a potential student discovers a need to learn something new, the fact that nearly everything made within the world has been created collaboratively means residents are able to teach

each other. Unlike other mediums, the development platform of *Second Life* is both the distribution and experience platform. When a resident wants to see how to build a car, another resident can show how to do it right then or can refer the interested resident to one of the hundreds of classes a week being taught in-world.⁸⁵

Suddenly, residents are free to explore design space, to experiment, and to try, secure in the knowledge that bumps in the road caused by incomplete knowledge or skills can be overcome. With minimal delays between the desire to acquire knowledge and the opportunity, learners remain motivated and excited.

Heterogeneous Learning

These excited and motivated learners are also not all alike. For many students, classroom education can be an incredibly homogenous experience, with classrooms populated by students of the same age, nationality, and socioeconomic backgrounds. Such homogenous learning fails to take advantage of what a more heterogeneous environment offers⁸⁶—a place where irregularities in skills, knowledge, and experience create systems rich with differences.⁸⁷ In such systems, students must constantly make comparisons between elements, discovering strengths and weaknesses of each, and learning from the kinds of consensus and conflict that is created through the diversity of perspective.⁸⁸ Such a classroom is, in some sense, an ideal classroom. It becomes a place where people of different ages, experiences, and cultures come together to collaborate, share, and play. Virtual worlds can achieve such scenarios, bringing together learners of all ages into a single, shared space where each produces and shares knowledge.

This situation enables profoundly different learning and teaching opportunities than at any previous point in human history. For the first time, geography is not the primary determining factor in who can learn together or who can teach. Instead, affinity groups and communities of practice create the structures and methods needed to teach and to learn.

Schoolhouse Rock

Real-world educators are already taking the first steps to leverage the power of virtual worlds in education at every level. With over 150 universities and 1,500 educators already using *Second Life*,⁸⁹ a growing corpus of knowledge is being created around what it means to teach and learn in virtual worlds.⁹⁰ This knowledge is being shared, both within *Second Life* and via traditional Web structures like mailing lists and Wikis, so new educators can learn from each other.

For example, the 2006 *Second Life* Community Convention featured an educator's workshop and published proceedings that are now available online.⁹¹ These proceedings detail a tremendous array of experiences within *Second Life*, from reports from the students themselves all the way to the initial steps taken in leveraging virtual worlds across large, public universities.

The tremendous possibility space offered by virtual worlds continues to emerge as a powerful theme. Groups of universities have joined together to create visually impressive spaces within *Second Life*,⁹² with classrooms and lecture areas that are immediately recognizable for those new to virtual worlds. These spaces can act to extend the classroom by adding a holodeck to the blackboard or by allowing students to join the classroom from all over the world.

And this, of course, is just the beginning. Virtual worlds allow teaching to go beyond the classroom, extending learning beyond the limitations traditionally imposed by geography.⁹³ Musicians throughout the world have already begun to discover how virtual worlds provide new ways of engaging audiences. The ability for audience members to interact with each other, building communities that continue conversations after the performance, offers new opportunities for musicians, beyond the now traditional technologies of Webcasts and net radio. How long will it be before educators discover the same benefits?

In China, 1 percent of the population is urbanizing every year. This is the largest migration in human history, as thirteen million Chinese move to cities in search of jobs, education, and hope. In the midst of trying to build two New York Cities per year, China is facing an education crisis, as schools are overwhelmed and unable to keep up with growth and the demand of a generation of kids hungry for opportunity and knowledge. Given the power of virtual worlds, it is relevant to ask in what ways China's burgeoning interest in distance learning programs and online curriculum can be extended through the implementation of such programs within virtual worlds. It is clearly a smarter economic decision to deliver broadband to thirteen million people than to try to move them physically.

Small steps toward this virtual classroom model are being taken each day, with projects like Harvard Law School's *CyberOne* class, being taught jointly in the real world and in *Second Life*. The class is taught across worlds, with questions and information flowing freely between both, and is already offering up interesting lessons about teaching in virtual worlds. One unexpected discovery is that students have discussed how they are more comfortable asking questions when they attend class in *Second Life*.⁹⁴ While the full reasons are not yet known, the comfort and safety provided by pseudonymity and a virtual presence seems to play a part. With so much of education built around trying to reach students, are there ways for virtual worlds to remove some of the challenges of learning?

Group Learning

The ability for students to feel that they are part of an audience is important to facilitating a sense of shared learning as well. After all, in the real world, students can leave class and move off to study together. Traditional one-to-many communication channels like television or the Web do not allow receivers to build communities easily, or to find each other in order to continue the conversation. In virtual worlds, nearly every activity can occur within groups, so when the activity is education, participants already have a group of fellow students to lean on for additional discussion, learning, or study.⁹⁵

Membership in multiple, parallel groups also encourages students to act as knowledge conduits between groups. Absent geographic limitations, virtual worlds provide an important mixing opportunity for students to spend time teaching and learning with fellow students outside of their immediate disciplines.⁹⁶ Many educators have long sought structures to help in creating cross and interdisciplinary study, and virtual worlds are poised to create contexts for such programs. If the ability to gain literacy across subject areas and disciplines is a key to innovation in the twenty-first century, then discovering ways of delivering such experiences is crucial.

In education, like other forms of knowledge creation, innovation is tied to the cost of learning.⁹⁷ The more isolated various communities of practice become, the harder it is for the critical cross-pollination so necessary for innovation to take hold. Education, by leveraging virtual world technology to teach and to learn, is on the leading edge of making

more innovation possible. More than using technology to further education, the teachers mastering the space can build expertise that will flow far beyond the classroom.

Think Locally, Act Globally

The lessons and experiences of educators in virtual worlds will be invaluable as businesses⁹⁸ and governments⁹⁹ begin their own experiments. It will be critical for educators to keep the focus on learning—to avoid losing sight of the fact that, whether the goal is education or innovation, it is the lower cost of learning in virtual worlds that is transformative.

Any student of history can demonstrate that nations who educate their populations thrive.¹⁰⁰ Technology currently exists that allows research and development of education to benefit both education and business. After all, students are not just children aged five to eighteen, or those in college. *Second Life* shows that residents of all levels enjoy mastering new skills and are able to apply them in meaningful ways. As Schumpeter's "creative destruction" forces change on labor everywhere,¹⁰¹ virtual worlds are another tool to help those caught in the transformation.

Within the United States, as elsewhere in the world, there are enormous educational and economic inequalities between geographic areas.¹⁰² It should surprise no one that these same inequalities apply to innovation.¹⁰³ Spending money is likely to be a necessary, but not sufficient, solution to these problems. Virtual worlds, by allowing their participants to learn, to create, and to build communities across geographic and generational divides, are a critical tool in addressing these inequalities.

Projects like One Laptop Per Child and advances in cell phone technology mean that virtual worlds will soon have the same reach as the World Wide Web, but with the benefits over the Web already covered in this chapter. Even more importantly, virtual worlds bring markets with them. When examining the incredible impact of Grameen Bank on Bangladesh,¹⁰⁴ remember that this transformation was accomplished with microcredit loans of tens of dollars. As virtual worlds bring new markets, imagine the possibilities of marrying new ways of earning money with education goals. For example, if conducting immersion language training, why not hire local, virtual actors to supplement the educators? Normally, that sort of broad contact with a destination country is only found in exchange programs; virtual worlds could open the experience up to a much broader audience.

Suddenly, traditional media cultural imperialism is inverted. By allowing participants from around the globe to teach in their own ways, the value created for participants in virtual worlds is very different than traditional, one-to-many media. For many topics, the ability to learn from a local would be invaluable,¹⁰⁵ and virtual worlds provide both the markets to connect customers directly to providers and the platform for those interactions to be valuable in ways they never were before.

That value is created because the interactions take place between people. In the same way that online games rely on role playing as a core game mechanic, virtual worlds allow role playing to open opportunities that otherwise might not exist for participants. In the same way that students in virtual worlds are more comfortable asking questions of their law professors, role playing helps to reduce risk; to enable residents to cast themselves as learners, researchers, or experimenters; and to become more comfortable in those roles online before taking on those roles in the real world. This is a powerful idea, and it is fortunate that strong supporting evidence, such as the previously discussed *Second Life* development community, exists.

The Way Forward

The community and technology is here today for virtual worlds to become a basic building block of education for nearly every age group in most developed nations. Whether backed by established educators or not, this transformation is already happening as amateurs discover ways that virtual worlds can help them learn, communicate, and work. It is only a question of whether the mainstream will join them or get pushed aside.

That is not to say that this will be easy. Because virtual worlds have the potential to impact education in so many different ways, they will force the rethinking of curricula, of evaluation, and even of what it means to be a student. Schools that fail to embrace this change may find themselves increasingly on the outside of knowledge, increasingly outdated, and falling further behind as those who are mastering community and peer-to-peer education accelerate into the future.

And accelerate they will, for this is only the beginning. Nations and communities have no way to predict what it will mean to have education be—at every level—an international and multicultural process. What is known is that a general decrease in cost of learning between a more heterogeneous group of learners and educators will generate more innovation and change. The opportunity exists for teachers, schools, and universities to be driving that change, and they need to become part of the process today.

Businesses, communities, and nations that fall behind in a world accelerating along exponential curves may find it impossible to catch up.

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