This will change everything.
Virtual Worlds in Education

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This paper explores the potential for supplementing or even replacing bricks-and-mortar spaces with virtual spaces for teaching and learning. Global population changes are creating an ever-widening gap of access to higher education, and current building strategies are simply not sufficient to cope. There exists the potential to utilise 3D virtual worlds to provide space for lecturing, student projects and simulations, while at the same time reducing costs to a fraction of the costs for campus-based buildings. Additionally, these spaces can be used to give students safe experiences that might otherwise be completely impossible. The paper presents work at the University of Auckland toward these ends.

Keywords: virtual worlds, second life, simulation, avatar

Introduction

> *...although some insightful research has claimed that online culture heralds the arrival of the "posthuman", I show that Second Life culture is profoundly human. It is not only that virtual worlds borrow assumptions from real life; virtual worlds show us how, under our very noses, our "real" lives have been "virtual" all along. It is in being virtual that we are human: since it is human "nature" to experience life through the prism of culture, human being has always been virtual being. Culture is our "killer app": we are virtually human. (Boellstorff, 2008, p. 5)*

In the spring of 1993 I downloaded a new application to my computer. When I saw it for the first time, shivers ran across my body and a thought bounced wildly through my head..."*this will change everything*".   That application was NCSA Mosaic, the first widely accessible browser that transformed the internet into the *World Wide Web*. And indeed, one could argue that it has changed the world.

In the middle of 2006 I downloaded a software application called Second Life, and began a journey that would again send my mind reeling with the thought, "*this will change everything*". After three years of involvement with building, scripting, researching and socially engaging in this virtual environment, I am becoming convinced that it could transform higher education around the globe.

In this paper I will briefly trace three themes that lead me to conclude that significant change is both needed and is rapidly coming, and I then offer a fairly radical possibility for meeting such change. My challenge is to do so without sounding fanatical.

Crumbling Foundations

Throughout most of my academic career I have seen educational reform movements that were heralded as transformations to our way of teaching, yet as I look around I see that we continue to use the *lecture* as the primary mode of engagement in higher education today*.* This often-seen painting by Laurentius de Voltolina, painted in the second half of the 14th century, comes strikingly close to depicting our institutions of higher education in this first half of the 21st century. You will note in the painting the similarities to today's classrooms, with some students attending to the lecturer, others sleeping, and still others engaging in private – and probably disruptive - conversations. Seven centuries, and we are apparently not much different.

Universities have always been *places* where students go to gain access to *scarce* repositories of knowledge and to interact with those that profess deep understanding of those repositories. I emphasize the words *places* and *scarce* here for a reason; they arguably form the basis for the organisational structures of higher education that guard knowledge.

It was of course practical, and often political, to guard knowledge. Even a quite modest stack of books could represent the life's work of several scribes, so to lose or damage a volume would have been potentially catastrophic. Early hand-crafted books were so precious they were kept in locked chests inside of locked rooms, and were made available on loan only to selected scholars (Crawford, 2003).

It seems logical that scholars who had access to those volumes would be called upon to *transmit* their knowledge of them to students. In an all-too-familiar scenario, students would diligently scribe their notes during lectures in an attempt to recapture the essence of what was in the guarded texts, thereby creating their own versions. In fact, much of our understanding about early education environments comes strictly from such student notes, and the works we have today of early thinkers like Aristotle may very well be compilations taken from student notes. (Blair, 2004)

But what if scarcity was no longer the driving force behind educational organisations? What would happen if instead of locking knowledge behind gates, everyone in the world had unfettered access to the bank of knowledge of the human species? It is not farfetched. The Google Books Library project has the goal "to create a comprehensive, searchable, virtual card catalogue of all books in all languages" (Google, 2009).   All books, all languages. The scale and impact of such a project could be remarkable. We may indeed be near the tipping point that will give us global access to global knowledge. It may be that, in this new journey, students and scholars will no longer differentiate university repositories from other global repositories, and that the necessity to lecture *as a means of information transmittal* will become nearly obsolete.

Along the way I fear our strategies for building viable institutions for the future are not keeping pace, and that we are not paying attention to the rapidly crumbling foundations of our educational institutions – *place* and *scarce* may no longer sustain us.

Invented Here

Year in and year out we continue to hire scholars and divert them from their research to develop institution-specific teaching resources that are already widely available. Just how many Math 101 courses do we really need to develop? Do locally-developed courses in basic studies actually provide sufficient scholarly or business differentiation to merit the expense? I think not.

In the spring of 1993 when I downloaded that first browser, I designed a collection of pages – what we now call a website – that contained the lecture notes and graphs I used to teach my undergraduate course in Statistics.   I was quite proud and excited about having developed this resource for the university.

One of the graphs I commonly used in my teaching explained the concept of normal distributions in populations – the Normal Curve.   My web version of this graph was simply a scanned copy of the paper version I handed out in class, but I recall at the time proudly thinking that perhaps other teachers would now use it for their classes as well. I don't know what happened to that first site of mine, but as I was reflecting on the experience I thought it might be interesting to conduct a web search to see if it

still existed somewhere.   I used the search phrase *normal curve,* and was presented with 11,400,000 discrete sites that explained the concept.

This seems shocking to me. How many staff hours were spent, and how much ongoing storage does it require to provide 11,400,000 pages of material that explain a simple concept.   Expanding my search to cover the phrase *Introduction to Statistics,* I was presented with over sixty million discrete sites. What an unimaginable waste of time and money.

It appears to me that the advantages of wide collaboration and sharing of resources far outweigh any gained through competitive business differentiation. With the emergence of groups like the Open Education Resource Foundation (http://wikieducator.org/OERF:Home) I believe we can begin to redirect monies from wasteful duplication into increased funding for research and teaching innovation.

Expanding Pie

Figure (1) shows the projected world population up to 2050, and in my mind presents compelling evidence for us to change our foundation strategies for higher education.

If we assume that every human being deserves the right to a full education, we will need to build over 2500 large universities (of 40,000 students) *this year*...and next year...and so on.   Overall, by 2030 we would need over 200,000 large universities to be in operation worldwide, staffed by over 400,000,000 teachers (presuming only 2,000 teaching staff at each university). If we assume that we will assemble large classes of, say, 300 per course, we would need approximately 40 million large lecture theatres in which to deliver 3 lectures per week.

Source: U.S. Census Bureau, International Data Base, June 2009 Update.

Naturally, I am overstating the case here. Demand will not likely approach overall population levels, but nonetheless the potential exists to have it quickly outstrip even our most ambitious long-term staffing and building strategies. It would seem impossible to build the bricks-n-mortar campuses required for even a fraction of this increasing population, and given our wasteful institution-driven resource duplication, it would not seem we can possibly staff them anyway. If we are to truly meet the responsibility of the future, we must engage radically different strategies.
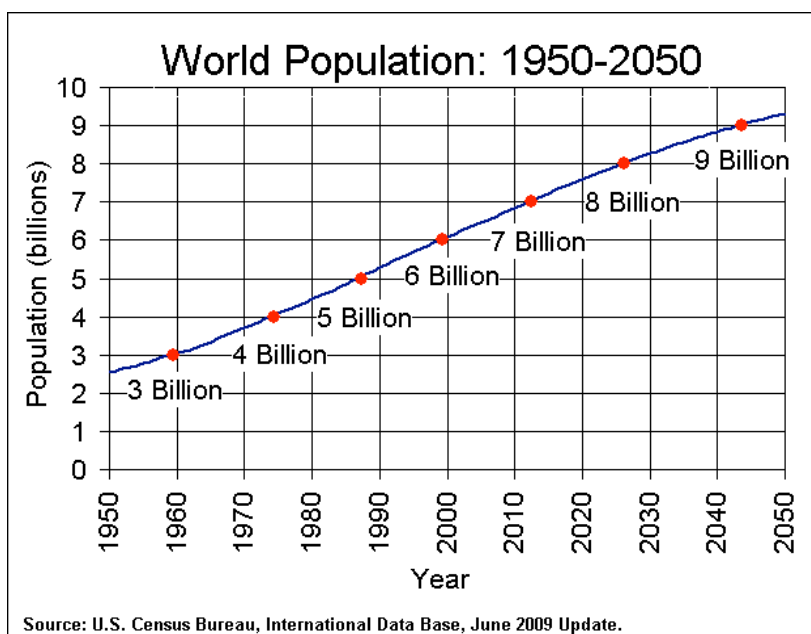
Meeting the Challenge

In 2006 I began to explore the use of virtual worlds as viable alternatives to physical spaces, with most of my emphasis placed on the commercial platform Second Life. Operated by Linden Labs in the United States this online environment is now host to over 16 million users worldwide. Although it is difficult to define the extent to which higher education institutions actually use Second Life for teaching purposes, there is a growing list that of universities that maintain a presence in the environment (Kay, 2009). These 'campuses' quite commonly include things like buildings, classrooms, large lecture theatres, interactive whiteboards, video displays, furniture and sundry 'entertainment' features.

Figure (2) University of Auckland outdoor lecture theatre in Second Life

In Second Life, each user is represented by a malleable 3D character, called an *avatar*. Using this avatar, people are able to move around in the 3D environment interacting with each other and with the objects that have been created there. Second Life is not a pre-designed world with fixed parameters like many virtual world games. In fact, all content in this environment is created by users. Second Life is not a game, and it has no prescribed rules, goals or outcomes; it is entirely user-generated. Using simple 3D modelling tools, users can create objects and combine them to form complex environments with quite realistic effects.

It is notable that many of these objects are developed by entrepreneurs specifically to sell to other users, and form the foundation for a rapidly growing economy. In fact, the user-to-user sales of objects created in Second Life exceeded $400,000,000.00 USD in the first three quarters of 2009. Figure (3) shows an impressive increase in

user transactions over four years (Linden Research, 2009), and many companies now operate solely within this virtual world.
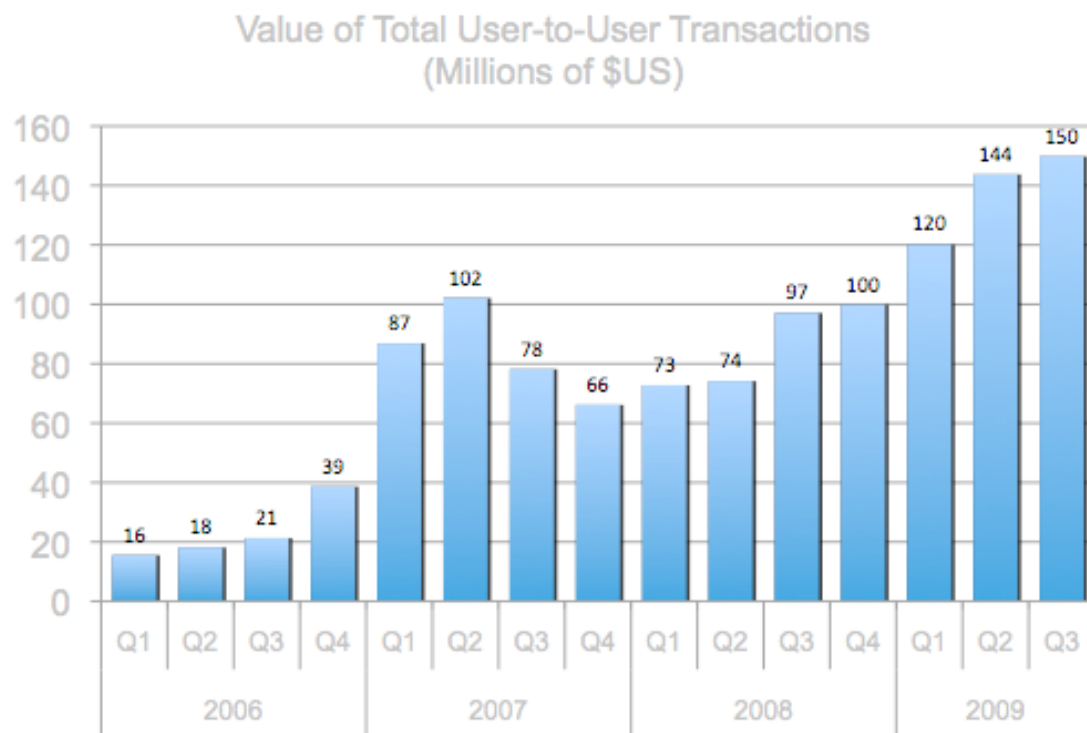

Figure (3)

What makes Second Life different?

While most educational institutions today utilise various technologies to support a range of distance learning offerings, the developments and experiences within virtual worlds are significantly different.   Douglas Thomas and John Seely Brown's recent study of Second Life and massively multiplayer games like *World of Warcraft* led them to conclude:

> *The kinds of deep engagement that players have not only with the game, but with the social life around the game, suggest that the relationship players may have with these new learning environments may be much deeper and much richer than current learning theories that rely on a notion of transfer may be able to explain.* (Thomas & Brown, 2009, p.47)

Borrowing from Kapp & O'Driscoll (2008), there are three dimensions of Second Life that in my opinion differentiate it from other technology-mediated forms of teaching and learning.

Sense of Self

One of my earliest recognitions that my avatar was 'real' came when I was demonstrating for a group of other avatars - all colleagues - how to change

outfits. I was instructing them on how to drag-n-drop a folder containing the outfit onto the avatar, thereby effecting a complete change of outfit in one move. Unfortunately I had forgotten that the only item in that particular folder was a pair of boots. I ended up standing in front of the entire group dressed in only those boots!

At that point, two important things happened that signalled to me this was not simply a toy environment. First, I became embarrassed in real life. I *felt* embarrassed, and my skin blushed. What would they think of a man who behaved in such a manner?   Second, the group in unison *turned their avatars around* just as they might turn their heads in real life. They were uncomfortable with my avatar's nakedness, but had such a sense of self in their own avatars that they turned *them* rather than simply looking away from their computer screen.

This sense of self that exists in Second Life cannot be underestimated. Users spend countless hours and millions of real dollars creating and modifying avatars. There is even emerging evidence that these representations can influence actual world self-image. (RTI International, 2009; University of Texas at Austin, 2009).

Sense of Place

In Second Life there is a built in Instant Message (IM) capability that allows for users to communicate privately regardless of where they might be located in the virtual world. I was recently on the Univeristy of Auckland's Second Life island, having an IM conversation with a colleague who was on a different island. During the conversation he said to me, "why don't you come over here so we can discuss this in person?"   It was not enough that we were able to chat in real-time; the experience of being 'together' to discuss the issues formed a crucial component in our communication.

Anyone who has experienced Second Life will relate similar stories. Even the language we use in Second Life reflects the nature of this sense of place. In normal video conferences people often say "oh, there you are". In Second Life they instead say "oh, here you are". The sense of co-location, of being in the same time and space, is a fundamental part of the experience of Second Life that offers the potential to design new and powerful collaboration spaces.

Sense of Emotions

I recently asked a large group how many had ever cried or become emotional over a movie they were watching. Most raised their hands. This human ability to 'suspend disbelief', to accept the improbable as probable for a short time, opens people up to a wide range of emotions inside of virtual worlds.

Observably, people get angry, sad, happy, fall in love, have sex, dance, sing, and generally engage in the full range of human emotion.

> *Perhaps the most important is that the student becomes emotionally involved, which implies a level of engagement that might not be present otherwise. Given that things can be brought about in Second Life that are not possible in real life, the potential exists for creating a learning environment where the student can be engaged in experiences not possible in other environments (Kelton, 2007).*

This emotional involvement seems odd to those that have not experienced virtual worlds, but it is real, significant and human. The avatar plays a significant and irreplaceable role in mediating the deep social interactions that occur in Second Life, and I think there are plausible reasons that help explain it.

Recent work on the activities of mirror neurons in the prefrontal cortex has suggested that when we watch other people in action, we 'behave' that action within the brain ourselves (Ramachandran, 2000; Iacoboni, 2005; Umilta, 2001). Early work by Rizzolatti (1996) clearly showed that a specific cluster of neurons activated when a monkey watched another monkey eating a peanut, as if the watching monkey was also eating, and Iacoboni (2005) showed that these cells not only take part in recognizing the actions of others, that in fact they play a role in our *ability to grasp* the goals and *intentions* of the actions. Moreover, he showed that these cells help us grasp the different intentions of the same actions done in different contexts. This body of research suggests that these mirror cells play a crucial role in empathy, and in fact the lack of functioning in these cells may be the basis for disorders like autism.

This body of research also strongly supports the contention that 'doing' (even by watching) is a significantly more powerful learning mode than simply listening, and I am convinced that the animations and avatar movements available in Second Life and other virtual worlds activate this mirroring system in the prefrontal cortex.

As a last example, anyone who has ever watched a person on a computer game has seen the player bobbing and weaving in real life, apparently acting as if they were actually inside the game dodging bullets, weaving through a slalom course, or leaning into a banked curve on a race course. It seems

reasonable to suggest that the avatars and objects in the virtual world impacts upon our mirror neurons in the same manner as do real world people, giving us the experience of real actions, real emotions and real understanding of intention based upon context.   With this in mind (and I do apologise for the obviousness of the reference), the experiences cannot be thought of as simulations, but as real. Ongoing research in this area is exciting, and I think efforts from groups like the Interacting Minds Project (http://www.interacting-minds.net/Sted/PROJECT.html) show great promise for laying the groundwork for research into virtual social worlds.

> *It's not just that an avatar is a prosthetic that we can occasionally mistake for our own body, nor that it is a version of ourselves that we can view and empathize with, nor that avatars flip on the sprinkler systems of our endocrine systems, nor even that we can use the avatar as a narcissistic pool of pixels and see ourselves in a magic and phosphorescent portrait. No, it's that avatars are becoming increasingly human. (Meadows, 2008, p.112)*

In our work at the University of Auckland, we have created several medical simulations that range from a general Emergency Room (figure 4) to a specific simulation for nursing education (figure 5), along with a host of private meeting areas and meeting rooms (figure 6). In each case the developments attempted to incorporate key elements necessary for students and staff to engage in realistic ways, and our early pilot studies indicate that we get comparable outcomes when gauged against real-world simulation outcomes.

Figure 4. The Emergency Room

Figure 5. The Nursing Simulation

Figure 6. The Executive Meeting Room

I have reported on these developments in earlier papers (Diener et al, 2009), and there are a wide range of similar developments around the world (Beard et al, 2009; Hansen, 2008). Although there are already a fair number of duplications within many of these efforts, they nonetheless present us with the opportunity to address the issues raised earlier.

First, these virtual worlds allow us to design interactive environments that go far beyond the normal lecture form of teaching.   We can explore, share and collaborate in ways that have not been available to us before. We can take student for a walk through a functioning human heart, or place them inside of an active volcano.   We

can create simulations that allow students to safely explore, construct and share learning experiences with each other.

Second, we can easily make our work openly accessible to the world. If a school or university is in need of an emergency simulation environment, we can give them access to ours, or easily provide them with copies of the entire simulation *at no cost*. During my graduate school years I recall a talk I heard by Leo Buscaglia where he said, and I paraphrase; "I can share with you everything I know, and I will still know everything I know. I will not be diminished by having shared it". Contrarily, our current institutional focus on profit from intellectual property is largely unreasonable. In most cases, there is little to be gained from such protectionist practice. It is incumbent upon us to review our competitive strategies with a goal to remove the barriers to open education resourcing in this new environment.

Being a virtual world by no means guarantees this will take place, of course. Sadly, there are already many higher education developments that are completely locked down, available only to specific groups, and there are even more that have wastefully duplicated resources that have already been developed elsewhere. Fortunately in our work at the University of Auckland, and in other universities around the world, we have been successful in gaining full cooperation with colleagues to create all resources under a Creative Commons license, freely available to the world. This has allowed us to begin to work around the world in open, non-competitive and creative ways.

Thirdly, in virtual worlds we can rapidly develop and deploy learning spaces that keep pace with the growing population of the world. A copy of an entire 'university campus' can be implemented within a virtual world in a matter of seconds. Specialty simulations can be copied in entirety and made available without cost to those wanting to install them in their own spaces. Virtual collaboration environments can bring together educationalists from around the globe to interact in real time, producing real outcomes. Figure (6) is a snapshot taken of a recent meeting between academic staff of the University of Auckland and academic staff from Umea University to discuss the potential for a collaborative development around health care. This two hour meeting required no travel costs, housing costs, videoconference costs, or even clean up! The savings represented here are substantial. More importantly, the meeting would possibly never have taken place at all if the virtual world had not been available.

In her book, Learning Spaces, Diana Oblinger (2006,p.3.9) states that the key to learning spaces "... is to provide a physical space that supports multidisciplinary, team-taught, highly interactive learning unbound by traditional time constraints within a social setting that engages students and faculty and enables rich learning experiences".

If we substitute the word *virtual* for the word *physical* in the above passage, we are presented with the real potential for virtual worlds to provide ultra-low-cost educational infrastructure that can supplement, and perhaps even replace parts of our current physical learning environments. In fact, these virtual environments allow

us to construct learning opportunities that may be impossible in the real world, and importantly to bring students into the very design process itself.

We do have barriers to making all this happen, of course. Foremost among those is the issue of access to technology. These virtual world environments require a high level of graphics capability, and at present such systems are at the higher end of the cost scale. Along with that, these virtual worlds require broadband access that is simply not available in most parts of the world. Within New Zealand, broadband is not generally available except in dense urban areas, and even there the metered service caps are set so low that students cannot afford to access bandwidth-intensive applications like Second Life.

These are not minor barriers, and will require close collaboration between schools, business, higher educational institutions and government agencies to ensure that education remains at the top of all long-term technology strategies.

Conclusion

That we mostly continue to rely upon 14th century teaching methods will of course come as no news to most of you here at this ASCILITE 2009 conference. But it does raise an important and fundamental question: *Why are we still doing it?*

That is the question I challenge all of us to consider during this conference. The ASCILITE 2009 conference is titled *Same Spaces, Different Places*, and as part of my challenge I would ask that we *not* simply focus on the theme of emerging new spaces for our teaching and learning. I ask that we carefully guard against falling into the trap of thinking we can simply do the same old thing in new spaces. I ask us to consider how we can finally realize the emergence of constructivist pedagogies into the *mainstream* of teaching; pedagogies that immerse students and ourselves in collaborative activities that focus not on content delivery, but instead on how one acquires, evaluates, acts upon, and adds value to the knowledge of the world. If we can do this, *it will change everything*.

"Virtual worlds require us to think about knowing rather than knowledge..." (Thomas & Brown, 2009, p. 44)

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