Beyond the Remix: Clarifying Mastery In Virtual Environments

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Abstract

Virtual technologies are having a radical impact on university teaching and learning. A cursory survey of academic conferences on teaching and technology reveals an emphasis on sessions discussing the merits of digital dinosaurs such as learning management systems, e-chats, polling functions, and video-streamed lectures. Meanwhile, university students are remixing video and audio files, constructing 3D animations and multiple avatar-based identities, and playing high-end multiplayer video games in which they interact seamlessly with peers around the globe. More recently, we have seen the emergence of metamedia platforms. These are virtual environments which not only provide users with a dynamic, immersive experience, but also enable them to construct, embed, and archive multimedia resources, text, video, and 3D artifacts, and as well as web browsers and entire software applications. This paper focuses on the potential of metamedia in higher education to foster advanced knowledge production and transdisciplinary research in the construction and mediation of multiple complex lifeworlds. Using Second Life and Croquet as case studies for the engagement of the changing media environment in higher education contexts, we examine the potential and actual promise for tertiary education of 3D immersive technology to develop metamodal mastery – the ability to create, analyze, and synthesize data, artifacts, epistemologies, and vocabularies from a variety of fields in a variety of modes and media, within metamedia platforms. The problems and possibilities of metamodal mastery as a viable contribution also will be discussed.

Beyond the Remix: Clarifying Mastery in Virtual Environments

Although the abilities to access and to interact within virtually-mediated spaces are rapidly becoming basic life skills, our awareness and understanding of how this interaction differs from that with more traditional media is still in its infancy. The most advanced research in multimodal literacies is focused on schoolchildren; the implication being that the earlier technologically appropriate interventions are introduced, the greater their benefits. However, the most advanced usage of virtualized media is by our teenagers and young adults, so note scholars Henry Jenkins (2006) and James Paul Gee (2007) in their investigations into participatory culture and video game affinity groups. This has spawned an entire subfield of research hoping to translate the seemingly insatiable demand for gaming in virtual worlds into more compelling educational resources. All the while, the digital divide is growing between computer-savvy youth for whom the computer is a meta-medium - an interface through which they negotiate their identity and interact on a global level, and the adults around them who see computers largely as a pragmatic technology of convenience and efficiency.

This digital divide is particularly fore-grounded in universities where the range of computer use stretches from non-existent to deeply immersive virtual reality. The paper concentrates particularly on the North American university contexts where, for the most part, the bulk of computer use is still focused on text-based data processing within traditional disciplinary boundaries. Far from pushing the boundaries of computer-mediated research, in most cases, the level of computer literacy within universities has changed little since the introduction of the graphical user interface (GUI).

Many of the traditions and cultural practices that have solidified the university's position

as the bedrock of western intellectual culture for the past millennium are now impeding its ability to remain relevant in a digital and global economy.[1] For example, print-based scholarship continues to be privileged above all other forms. Nonetheless, a university education is still considered a necessary prerequisite to a career in the knowledge economy. Universities are under increasing pressure from governments, industries, and parents to provide its graduates with mastery of current and emergent technological literacies. While millions of dollars are being spent on university-based research studying the impact of new technologies on society, few of these findings are being employed to transform how university students and instructors can use advanced, computer-based technologies in higher-level knowledge production.

According to the Stanford Metaverse Roadmap Project <http://metaverseroadmap.org/MetaverseRoadmapOverview.pdf>, by 2016 students aged 13-30 will be spending over 40 hours a week using interactive, internet based, 3D visual environments for a wide range of purposes including education (Cascio, Paffendorf, & Smart, 2007). For the vanguard of these young people, most of the technical knowledge and skills they will be using in these activities will not be learned in an educational environment but rather through means similar to what we now see – social networking, entertainment technologies, and individual experimentation. Given the economic power of the entertainment, telecommunications, and computer industries, this raises serious concerns about the degree of agency that the next generation will have in negotiating their identities and activities in a virtually mediated world.

More recently, we have seen the emergence of metamedia platforms. These are virtual environments which not only provide users with a dynamic, immersive experience, but also enable them to construct, embed, and archive multimedia resources, text, video, and 3D artifacts, as well as web browsers and entire software applications. Metamedia are not therefore just

another media type, they are virtual portals for delivering a range of media and media applications to both producers and consumers of media.

The focus of this paper is the impact and potential of metamedia platforms to transform higher education into a learning metaverse – emerging 3D web of social spaces, technologies, and economies (Cascio et al., 2007) – that fosters many of the ideals of advanced knowledge production – transdisciplinary research, creative synthesis of ideas and perspectives, and individual agency in the construction and mediation of multiple and complex lifeworlds (Welshons, 2006). Using two contemporary virtual environments – Second Life (SL) <http://secondlife.com/> and Croquet <http://www.opencroquet.org/index.php/Main_Page> - we examine the potential and actual promise for tertiary education of metamedia environments to develop metamodal mastery (MM). We are suggesting metamodal mastery as an alternative and more appropriate approach to traditional notions of literacy in the context of metamedia learning environments that acknowledges the ability to work strategically and with a degree of personal agency across different media and disciplines (diSessa, 2000; Kahn & Kellner, 2005; Kress, 2003). Unlike discussions that prioritize individual ability, MM is presented as a level of expertise that is only fully realized when students and researchers with expertise in multiple fields come together to create something that would be beyond the ability of any one of them individually. In this sense, MM has a strong affinity with researchers who have focused on Web 2.0 usage, participatory culture, and remix culture (Gee, 2007; Lankshear & Knobel, 2003), however, MM is less connected to popular culture and more generalized in its border-crossing realizations. Within this inquiry, questions regarding the status of student participation in a virtual world are raised and potential directions for further inquiry are offered.

Shifting Boundaries between Academic Disciplines

Kress, Jewitt, and Isatsarelis (2000) describe the shift from modernism to postmodernism as one of destabilization in which the firm boundaries that structured the modern, industrialized systems and hierarchies become fluid and negotiable. This applies as much to the framings of the primary, secondary, and tertiary levels of education that they examine, as to the disciplinary categories by which the North American university traditionally has been structured and through which expertise within that institution has been recognized. Universities have responded to these changes with varying degrees of enthusiasm. On the external public level, the epistemological blurring of academic boundaries has been articulated in university marketing and recruitment literature that present universities as interdisciplinary environments that offer an opportunity to see the world through different lenses.[2] Privately, however, in the internal professional realms of the academy – dissertation defenses, academic journals, tenure reviews, and library holdings – traditional disciplinary divisions are still strongly maintained. Bodies of knowledge articulated as disciplines are more than discursively realized, they are concretely situated within sites of education (Kress, Jewitt, & Isatsarelis, 2000) such as academic departments, faculty offices, and classrooms. Even in the archiving of knowledge within library holdings, the separation between disciplines is spatially reinforced in academic journals situated on different bookshelves often on different floors of the library. In order to engage in transdisciplinary research, scholars must cross both conceptual and geographical boundaries into spaces where they are literally 'strangers in a strange land.'[3]

To clarify what we mean by the notion of transdisciplinary, a differentiation between the terms interdisciplinary, multidisciplinary, and transdisciplinary is needed. Here we draw on explorations of these differences occurring in two very different fields – science and visual

design. The work of Gibbons, Limoges, Nowotny, Schwartzmann, Scott, and Trow (1994) on Mode 2 theory of knowledge production focuses on context driven research that is embedded in the context of application and driven by problem-solving outside the traditional disciplinary distinctions. Within this dynamic, interdisciplinary teams collaborate on the development of approaches and concepts to problems that are a hybridization of their individual disciplinary affiliations. Gibbons et al. (1994) distinguish transdisciplinarity within this dynamic as different from multi or interdisciplinarity because the resulting solutions do not necessarily derive from traditional disciplinary frames, nor do they necessarily form new disciplines (Nowotny, Scott, & Gibbons, 2003). A further expansion of the notion of transdisciplinarity is situated on a common theoretical understanding now accompanied by mutual interpenetrations of differing disciplinary epistemologies, leading to a cluster of disciplinary-based problem solving creating a transdisciplinary homogenized theory or model (Gibbons et al., 1994).

Marshall and Pengelly (2006, 2007)[4] posit, in light of their studies in industrial design, architecture collaborations, and fine art practice, that various computer technologies have been used to navigate and transverse disciplinary boundaries. Further, they argue that an increasing number of practitioners are able and willing to work across designated discipline domains and they hypothesize that this has enabled a model of practice to emerge that engages cross-disciplinary discourse and yields convergence between distinct domains. Marshall and Pengelly (2006) employ transdisciplinarity in a way that ignores hierarchical distinctions, particularly of architecture, art, and design discourse and practice, and look to referencing from an expanded cultural field that can lead to new opportunities, often in the ‘terrain vague’ or conceptual space between disciplinary practices.

This transdisciplinary position effectively acknowledges creative approaches to knowledge production that synthesizes epistemologies and methodologies from inside disciplinary frames to spaces outside these frames, where innovative and unique ideas and solutions can emerge. We believe this conceptualization holds immense promise for describing diverse crossings of academic disciplines beyond solely artistically based domains; a fluid, to and fro, crossings of boundaries in a Heideggerian sense (Heidegger, 1971).

In essence, transdisciplinary practices explored from the realms of design and science are not just postmodernist manifestations of destabilization, they represent the transformation of actual disciplinary practices and artifacts to the virtual realm proposed by Pierre Levy in *Becoming Virtual* (1998). Levy describes the process of virtualization as one wherein objects and events become deterritorialized from physical space to a non-material realm; detached from their original contexts, easily shared among communities of interest, transforming individual users through a process of heterogenesis – shifts in both media and media users as each is increasingly shaped by digital media use.

From Multimodal Literacy to Metamodal Mastery

We see Levy's (1998) process of virtualization as particularly relevant to the digital dissemination of data, illustrations, text, and artifacts through which disciplinary boundaries are fluidly crossed. This kind of process was recently acknowledged in *Our Cultural Commonwealth: The Report of the American Council of Learned Societies Commission on Cyberinfrastructure for Humanities and Social Sciences* (Welshons, 2006), endorsing the potential of digital media to support the relatively seamless study of textual and non-textual objects and data in many fields.

We believe there is an inherent affinity between metamedia platforms and transdisciplinary education. Both are characterized by permeable boundaries that require a broad palate of technical, analytical, and critical knowledge and skills on the part of both novice and expert, variously conceptualized as technoliteracy, multiliteracy, critical media, visual, informational, and multimodal literacies (Kahn & Kellner, 2005; Kress & Jewitt, 2003; Kress & van Leeuwen, 1996). Given that the virtual world is a visually mediated space in which print objects are embedded rather than a print dominated environment where the visual takes a supporting role, it is not surprising that so many of these new literacies are focused on nonlinguistic semiotic modes. For this reason, in our articulation of metamodal mastery we reject the term literacy and its privileging of language in favour of the term 'mastery.' As diSessa (2000) claims, literacy "is about ideas that have their best expression in words" (p. 227) and as such is ill-suited to dynamic ideas such as symmetry or momentum. Mastery, thus, effectively defers the question of the representational mode in favour of level of competency, generating new ideas, products, or perspectives, but is more appropriate to metamedia which privileges the logic of visual over the linguistic (Anderson, Krathwohl, Airasian, Cruickshank, Mayer, Pintrich, Raths, & Wittrock, 2001). Unlike paradigms of literacy that focus on skills needed within a single media type, or in the case of multimedia literacy acquiring literacies in more than mode, MM focuses on the combinatory possibilities of multimedia – using many of the same abilities identified by Jenkins as typical within participatory culture (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006).

The notion of metamodality focuses more on a metalevel of disciplinarity that emphasizes the ability to see patterns and strategically select and combine[5] usually unconnected fields of knowledge and practice, than on the specific norms within a particular field. It

emphasizes semiotic effects and potentials of a myriad of objects, data, and ideas juxtaposed with those from different fields. Rather than positioning MM as a 'new' concept, we see it in its very formulation as emulating what it describes – an epistemological mash-up if you will.

Our preliminary definition of metamodal mastery then, is the ability to create, analyze, and synthesize data, artifacts, epistemologies, and vocabularies from a variety of fields in a variety of modes and media, within metamodia platforms. It is not intended to be a literacy around which curricula will be formed because it is inherently contingent and therefore evades the level of prescription and replication demanded by the term 'literacy' (diSessa, 2000). Instead, it emerges in the radical spaces between institutional and disciplinary norms where intuitive knowledge, innovation, and committed learning flourish (diSessa, 2000). It remains to be seen if this conceptualization holds up to closer scrutiny in practice; for now we see this term as emphasizing an aspect of transdisciplinarity that is underdeveloped in the literature and is critical if the potential of the metaverse is to be realized.

Virtualization in the University – Two Virtual Learning Environments

We have chosen to focus on the use of two metamedia platforms as sites of education because we see this evolution of computer technology as the first truly unique manifestation of the potential of digital media since the introduction of hypertext. Much of the focus on new media in education generally, and within the university specifically, has been on the degree of difference between face to face and full or partial technically mediated learning situations in terms of student satisfaction, grades, and quality of social interaction – peer-to-peer and student-to-teacher.[6] The bulk of these studies focus on technologies such as learning management systems (Blackboard, Web CT, Moodle, and Sakai), multifunctional conferencing software supporting video streaming, synchronized PowerPoint slides, chat and polling functions, and

podcasts (e.g. MediaSite Live and Breeze, the latter was initially developed to support business practices rather than for educational purposes).

These environments are typically used to develop what Peter Horsfield (2003) calls 'pseudo-reality' in that they mirror or imitate the traditional classroom dynamics, usually in the context of increasing access or flexibility in the time or site of learning rather than qualitatively transforming the educational site. In so doing, these virtual learning environments extend the reach of traditional practices much in the same way that personal computers have been used largely to facilitate and extend traditional representational and communication activities, e.g., e-mail, storing and displaying photographs, and editing video. Only recently has computer technology begun to realize new frontiers that are unique. The rise of immersive 3D environments is the first visually-based evolution of the qualities Horsfield identifies as moving beyond merely imitating reality to also being creative, having "not just an 'as if' but 'not quite' character, but also a 'what if' quality as well" (Horsfield, 2003, p. 5). This ability is very difficult, if not impossible, to render tangibly in other media.

Immersive 3D worlds are the mainstay of the multibillion dollar gaming industry, where the seemingly insatiable public demand for multiplayer, narrative-based games has financed the development of extremely realistic graphics and complex, unpredictable scenarios where players have a significant impact on the options available to them and subsequently the story lines that unfold. Public interest in these media has led to the recent introduction of professional leagues of video gamers, a development that promises to rival traditional sports venues for entertainment dollars.

Even the university has not remained unaffected by the interest in 3D worlds as the two following virtual environments illustrate. We examine their use in tertiary level education at

early stages in their implementation. Are they being used merely to replicate and extend traditional classrooms, or are virtual worlds beginning to morph into Horsfield's 'what if' scenarios? Is there any evidence of metamodal learning and mastery being supported in these environments? We are focusing our examination of virtual environments on those that are accessible without the use of head gear or other technology beyond a computer screen and the internet because many of the fully immersive virtual experiences are currently negotiated by individuals in non-curricular environments.

Second Life

A recently developed, virtual, open-source, 3D world that has gained much popular attention is Second Life (SL) <http://secondlife.com>. Developed by Linden Research, Inc (San Francisco) and often referred to as the Linden Lab, SL as a new virtual world inhabited and created by its users drew international attention in late 2006 and early 2007 (Harkin, 2006; Sege, 2006). A downloadable client program enables its users, who are referred to as Residents, to interact with each other through avatars, personas of their own creation. These interactions form an advanced level of social networking: meetings, exploration, socialization, participation in group and individual activities, and the creation and trading of virtual property and services with each other. The stated goal of Linden Lab is to create a world that is user-defined and in which people can interact, play, communicate, and transact business (Second Life, 2008). By September 2008, SL had over 15 million residents registered, although this includes both active and inactive accounts, according to the SL Economics site <http://secondlife.com/whatis/economy_stats.php>. In an April 2, 2009 article in *The Guardian*, Glyn Moody notes SL is now averaging 86,000 concurrent users with 640,000 active users who

are expected to cash out – trading Linden dollars for real currency – the equivalent of $450 million this year.

SL offers a contemporary 3D virtual learning environment and community, beyond historic brick-and-mortar buildings that comprise higher education physical campuses and learning spaces, opening up a world where an endless array of multimodal technologies can form new possibilities for the educative process and are welcomed beyond the normal print text emphasis in higher education. SL as a virtual classroom is embraced by major colleges and universities, including Harvard University, the Massachusetts Institute of Technology, and Stanford University, to name but a few (Second Life, 2008). This type of virtual environment for contemporary higher education students who have grown up in a wired world, illustrates the kind of learning space attuned to those Web 2.0 students who keep updated and informed about current cyber developments through, for example, social networking sites such as Facebook and grassroots information networks disseminated through wikis and blogs.

The York University Virtual Disaster and Emergency Lab in Second Life

A scene from a SL virtual disaster management exercise

At York University in Toronto, Canada, a 2008 Summer online course in Disaster Management used Second Life to recreate disaster simulations. The instructor, Professor Ali

Asgary, had been teaching this course using learning management systems such as WebCT and Moodle. Because of the dynamic nature of the subject matter, moving from a print-based to a 3D environment offers a more realistic visual sense of the temporal spatial dimensions of a disaster scene, which distinguishes it from the usual discussion-based simulations that occur 'in-class.' It would be prohibitatively expensive and logisitcally too complex to arrange real-life disaster simulations each time the course is offered, so the SL environment provides an opportunity for students normally outside the scope of what can be taught in a structured learning environment.

By utilizing the real-time audio function, students, who are assigned roles for the exercise such as mayor, fire chief, paramedic, etc., are able to coordinate their activities to manage the different aspects of a given disaster from their multiple perspectives by talking to each other in real time. The instructor is able to clearly see where everyone is and what they are doing throughout the execise because his own point of view is not restricted by location. He can easily, and non-invasively, move throughout the simulation to assess the choices and activities of his students.

The disaster simulation is set in the York University Virtual Disaster and Emergency (DEM) Lab in Second Life on a private island. The lab includes a Virtual Emergency Operations Centre (VEOC), a Media and Training Room, and a Virtual Disaster and Emergency Management Exhibition Hall, not yet completed, in which emergency management-related technology products will be showcased and tested. It is this virtual scenario that is used for the live table-top exercises.

Within SL environments, participants can share slides, audio and video, engaging in discussions, presentations, group projects, and explorations. In this way, SL can be understood as a metamedium which not only delivers multiple media but also provides contextual

environments in which students can develop MM regardless of their corporeal location or technical expertise. Although there were some technical glitches experienced during the simulation due to a lack of familiarity with the interface, the instructor finds SL no more difficult to use than other web based teaching systems.

In terms of fostering MM, SL provides some ability to embed applications such a PowerPoint and video into the immersive environment, but these features tend to be provided by the instructor for consumption by the students, similar to traditional learning environments. Likewise, much of the environment itself is either preconstructed or constructed within narrowly-predefined possibities by the SL development team working alongside techinicans from the host institution. Therefore, its effectiveness in forstering MM is limited, depending on the degree of administrative control the students are granted.

Croquet

Croquet < http://www.opencroquet.org/index.php/Main_Page> is based on the philosophy of Alan Kay and his mentor Seymour Papert, emphasizing constructivism and a repositioning of the learner as an active agent in the learning process (Papert & Harl, 1991). The Croquet Consortium is an international collaboration of volunteers from university and industry developing a freely downloadable, open-source, 3D environment that operates peer-to-peer so no servers (thus no regulatory control) are required beyond those needed to get on the internet. The Croquet architecture focuses on context based collaboration inside a 3D shared space, where users can see each other and what they are currently working on (Smith, Kay, Raab, & Reed, 2003). Artefacts of all modes (including 2D web applications and multimedia) can be imported into the Croquet space to be shared and manipulated among users in real time. Portals provide

visual, spatial links between Croquet spaces through which users fluidly move rather than hyperlink.

Unlike SL, the Croquet architecture is entirely built by users employing a developers' language called Squeak; there is no visual separation between development space and the user interface. This means that all maintenance and fixes happen in full view of users. It is a cross platform application that works equally well on Mac, PC, and Linux based computers and requires a bandwidth in only the tens of kilobytes range (Smith et al., 2003). Differing from most university offerings in SL, the Croquet projects developed during this preliminary iteration abandon the traditional classroom space in favour of more exploratory environments, exemplifying Horsfield's 'what if' possibilities of the virtual environment.

A particularly interesting example is the Arts Metaverse Project developed at the University of British Columbia <http://artsmetaverse.arts.ubc.ca/>. Leveraging the ability of

3D reconstruction of a Nisga'a village using both OGRE 3D and Croquet

Croquet to build unique environments, Arts Metaverse constructs educational sites in places normally inaccessible because of time and space limitations such as Machu Picchu in Peru. When combined with OGRE 3D, an open source graphics engine, the resulting Ancient Spaces environments are even more visually detailed <http://ancient.arts.ubc.ca/index.html> and include ancient Athens and Egypt as well as an ancient Nisga'a village, a First Nations settlement on the northwest coast of Canada.

The project is the brainchild of three undergraduate students at the University of British Columbia (UBC) who in 2003 wanted to develop a massive multiplayer world in which to explore ancient antiquity. A multidisciplinary team, including students from fields as diverse as classical studies and computer science along with staff from the Faculty of Art Instructional Support and Information Technology (Arts ISIT) unit at the university, launched the project in 2004. With initial funding of $80,000, the project exemplifies the principles laid out in *Our Cultural Commonwealth: The Report of the American Council of Learned Societies' Commission on Cyberinfrastrucutre for Humanities and Social Sciences* to enable students, scholars, and the general public "to explore connections within a cultural record that is now scattered across libraries, archives, museums, galleries and private collections around the world" by creating "an integrated, digital representation of the cultural record, connecting its disparate parts and making the resulting whole more available" (Welshons, 2006, p. 14).

The first course taught in this environment was UBC's Landscapes and Architecture of Pacific Northwest First Peoples offering, usually taught through lectures, quizzes, essays, and examinations. When the course was translated into a 3D environment, Nancy Mackin, the course instructor, shifted the grading scheme from essay to construction of a 3D presentation in which students were encouraged to cross disciplinary boundaries and to work in groups with students in

other fields. The software became a 'lingua franca' – a mode of communication across different discourse communities – among the students who were from archeology, architecture, landscape architecture, and First Nations Studies; or in Star and Griesemer's (1989) thinking, the virtual world is a boundary object or something that operates as a functional scaffold between people or frames from different communities of practice. By enabling students to construct buildings or to manage landscapes in this virtual world, Mackin observes that the space helped students "to understand that spaces are something with which people and other species interact, not aesthetic, abstract creations … history is something influenced by individuals creating and responding to change rather than as a series of events.… This in turn has implications for science, as the process of interweaving Traditional Knowledge (First Nations Knowledge) with Western Science has been verified by world agencies including the United Nations as vital to ecological and cultural diversity" (N. Mackin, pers. commun., 5 July 2007).

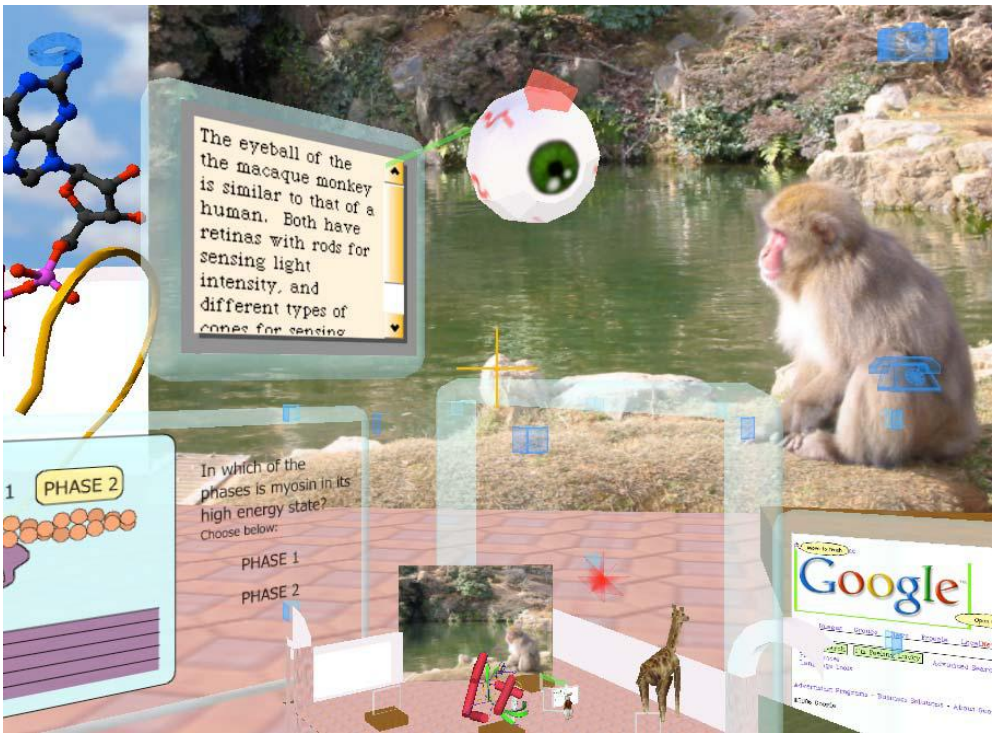
In effect, the Ancient Spaces environment 'de-literalized' the students' understanding of the Nisga'a village – re-contextualizing it from its linguistic representation in the regular face to face course where visuals supported the text description and discussion to a visual and spatially realized realm where the students' acts of construction were epistemologically integral to understanding historically what had impacted actual settlement. Here, the visual does not merely illustrate an authorative narrative retelling of the truth; it became an semiotically complex process of deconstructing and reconstructing the village with full realization of the effects and implications inherent in the modes and processes used – in other words, this course began to develop the students' metamodal mastery which opened up opportunities for a more complex and engaging site of learning. In the terminology of the New London School (1996), the Arts Metaverse Ancient Spaces Project essentially redesigns the ancient world by recombining

fragments of the cultural records separated in time and space in ways that not only make more accessible that which was lost, but reconfigures the lifeworlds of users relative to their cultural pasts in the process.

This is a different outcome and focus than that of the SL course and one that more strongly utilizes the unique potential of virtual worlds to cross disciplinary boundaries and foster higher level thinking. In this way, Croquet represents a significant movement towards being a true metamedia platform, and as such, a more effective environment for fostering MM than SL, although the complexity of the software still requires most students – and instructors – to negotiate their creativity with an advanced groups of technologists. While this is in keeping with the collaborative nature of MM, the inability of most students to independently construct satisfying artifacts, or to embed multiple applications within a reasonable learning curve, for instance, within the length of a university course, mitigates that ability of 'mastery' to be truly realized.

In 2006 the Croquet Consortium announced the development of a component based architecture that extends the accessibility of Croquet to lay people. Labeled Brie, it is intended to scaffold users to authors who can easily construct their own 3D environments, drawing directly on their expertise within their specializations or interests. Currently, attempts in higher education to develop sophisticated interfaces are impeded by exorbitant development costs and lack of access to appropriate expertise. By designing creative development specifically for 'technically naïve users,' Brie will effectively avoid both these barriers while empowering "end users to actively participate in the creation, assembly, and architecture of the applications they use" (Stearns, Gargus, Schuetze, & Lombardi, 2006, pp. 86-87). In Spring 2009 Brie will itself evolve as it is appropriated into yet another iteration of Croquet, OpenCobalt

<http://www.duke.edu/~julian/Cobalt/Home.html>. Perhaps, the developmental evolution of Croquet is itself an excellent example of MM in situ as experts from a variety of fields and knowledge bases work together, usually virtually, to define, develop, and distribute metamodal products that require transdisciplinary collaboration to even be conceived of in the first place.



A meta-medium application consisting of a 3D molecular model, 2D Flash, and a Web page, all annotated with text voice, video, and 3D portals constructed with Brie in Croquet

Conclusion

Croquet, Brie and to a lesser degree, Second Life, provide highly suggestive examples of the inherent compatibility of virtual environments and transdisciplinary metamedia modes of inquiry and representation. To function with agency in the twenty-first century, tertiary level educators and students need to develop metamodal mastery of the creative possibilities available in an extraordinary range of modes, both available and emergent. We agree with the belief of many of the writers referenced in the paper, that virtual environments hold tremendous potential

as an heir apparent to a world historically dominated by print as the medium most conducive to the challenges and possibilities facing it.

However, before virtual environments can take their place as a dominant media of representation, they must overcome several obstacles. First, in many cases, the benchmark of visual quality in the virtual world has been set by the entertainment industry at a level unmatched outside the economic power of the industry. In the Disaster Management course, the instructor found the interface style of SL too reminiscent of a video game which interfered with some students being able to take the simulation seriously. However, the production of more realistic graphics requires software and hardware far beyond the budgets and expertise of educational institutions. Research funding in universities is not adequate to meet the ongoing demands of this technology, and until this changes, virtual worlds in the educational sector will continue to be rendered in animation-style graphics that appear both simplistic, and often, childish. This is not just an aesthetic issue, it also prevents the degree of detailing that would be required to render details finely enough to support close examination. The funding issue in higher education needs to be addressed so that it possesses the research, development, and financial support to build convincing 3D immersive environments to metamodally develop appropriate learning mastery and knowledge shaping venues for students and educators. It remains to be seen if the Brie/OpenCobalt initiatives will be able to address these issues on a large-scale basis.

Second, as of yet, there exists a lack of understanding about how to create pedagogically appropriate materials and learning environments for the 3D virtual world. While the Arts Metaverse and York University Disaster Management courses provide strong models and directions for further development, we need more innovative approaches in other fields and domains in order to understand the learning potential of the media. We do not yet have a clear

understanding of the competencies that lead to metamodal mastery, nor do we have mechanisms and structures for recognizing and acknowledging this type of ability. Almost every system of recognition in our society is based on mastery within a single sphere of expertise.

In response to this dearth of understanding about how to use virtual platforms to reach pedagogical goals, the Immersive Education Initiative announced at the January 2008 Boston Digital Media Summit is a new collaboration of educational institutions and software developers, including Second Life, Sun Microsystems Laboratory's Project Wonderland, and the Croquet Project, working to develop best practices, platforms, and support communities for virtual reality and game-based learning systems <http://immersiveeducation.org/>. It remains to be seen if the Education Grid and Platform Ecosystem collaborations of the Immersive Education Initiative will address the pressing need in higher education for more transdisciplinary research and experimentation in technologically immersive environments.

Finally, there will need to be a cultural shift in universities where computer technicians tend to be viewed as 'service providers' rather than integral members of the teaching team. Until we have a generation of digital natives in technical leadership roles, this lack of genuine collaboration is a significant obstacle to both the degree to which immersive environments will be adopted as viable and the quality of the environments that are constructed.

The generation of tech-savvy students coming through the current educational systems and moving towards a future we can hardly imagine today, need the knowledge bases so strongly argued for in the research of Kress, Jenkins, Marshall, Pengelly, diSessa, the New London Group, and many others. The rise of complex metamedia platforms that seem so advanced today will become antiquated before today's toddlers reach university. Universities will be increasingly forced to respond, and hopefully, in time lead the rapidly paced transformations of the

hypermodern world. While our conception of metamodal mastery is still in the early unrefined stages of any mash-up, it addresses a level of human-computer interface that is yet underdeveloped but of potential importance in the coming years. To this end, we urge sustained, theoretically-based, systematic research to more clearly develop and scrutinize its contribution to the strategic and innovative possibilities of highly immersive metamedia platforms in higher education.

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Footnotes

[1]Exceptions here include Stanford University's Metaverse Roadmap Project: http://metaverseroadmap.org/ and the Humanities, Arts, Science, and Technology Advanced Collaboration: http://www.hastac.org/

[2]Toronto's York University's positioning as the Interdisciplinary University exemplifies this trend: http://www.yorku.ca/web/index.htm

[3]The reference here is made to science fiction writer Robert Heinlein's cult favorite, *Stranger in a Strange Land* of 1961, exploring themes of cultural change.

[4]Marshall and Pengelly derive much of their thinking about the semantic distinctions between transdisciplinary and interdisciplinary approaches from Century (1999).

[5]Borrowed from Lev Manovich's discussion (Manovich, 2001) of the cultural database in which elements are selected and compiled in unique and creative ways to construct new representations.

[6]Visit the No Significant Difference website at http://www.nosignificanctdifference.org/ for a thorough reference list of research going back to 1928.