International Journal of Virtual and Personal Learning Environments

April-June 2013, Vol. 4, No. 2

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The *International Journal of Virtual and Personal Learning Environments* is currently listed or indexed in: ACM Digital Library; Bacon's Media Directory; Cabell's Directories; DBLP; Google Scholar; INSPEC; JournalTOCs; Library & Information Science Abstracts (LISA); MediaFinder; SCOPUS; The Standard Periodical Directory; Ulrich's Periodicals Directory

The Tree of Knowledge Project:
Organic Designs as Virtual Learning Spaces

Dean A. F. Gui, English Language Centre, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China

Gigi AuYeung, English Language Centre, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China

ABSTRACT

The virtual Department of English at the Hong Kong Polytechnic University, also known as the Tree of Knowledge, is a project premised upon using ecology and organic forms to promote language learning in Second Life (SL). Inspired by Salmon's (2010) Tree of Learning concept this study examines how an interactive ecological environment – in this case, a tree – might offer numerous learning possibilities via every segment of the structure. Third-party billboard and sculpt modeling techniques, SL building tools and mega prim applications (which are more effective for organic shapes) were used to develop a three dimensional textured trunk, two-faced layered leaves and size-locked branches, crown, and roots. Preliminary student survey responses to the various elements of the virtual department architecture included an appreciation for creativity, innovation, and attractiveness in the design; challenges included a sense of dizziness when maneuvering around, difficulty in controlling the avatar, slow computer system responses, and lack of instruction in how to navigate through the structure.

Keywords: *Ecology, English, Language Learning, Second Life (SL), Texturing, Tree Of Knowledge*

INTRODUCTION

The Tree of Knowledge Project: Organic Designs as Virtual Learning Spaces

Since the recording of humankind, the image of the tree has appeared in one form or another, amongst a diversity of cultures, histories, and imaginations: from the kumquat trees of happiness and prosperity that adorn homes during Chinese New Year, to the tree from which Adam and Eve ate forbidden fruit. Trees in virtual worlds take on yet additional functions and forms of meaning which are sometimes prohibitive for their physical counterparts – namely, issues of accessibility and complexity (Ramasundaram, Grunwald, Mangeot, Comerford, & Bliss, 2005) – whereby the simulated landscape acts as a three-dimensional, interactive interface providing open access, transparent ecosystems, and allowing synchronous and asynchronous experimentation. Second Life (SL), more specifically, is an immersive virtual environment with landscapes blanketed in lush and fantasy-orientated cyber-greenery,

DOI: 10.4018/jvple.2013040105

attracting users from a wide range of spheres such as automobile companies and poets, and with diverse avatar representations including celebrity-impersonators, Japanimation characters, vampires, and elves. Both virtual residents and virtual real estate engage in a symbiotic relationship, where one tentatively depends on the other in order for successful immersion to occur. Here, trees serve in various functions – as part of an avatar's home garden, as background to a scene, as part of a nature preserve, or as a store front – possibly more so than any other organic form. While the context in which these organisms are used differs, the general premise tends to run parallel across the frontiers: trees are the guardians and providers of knowledge and opportunity.

However, educators and researchers also preside over the SL universe, creating simulations ("sims") for collaboration, social interaction, and building upon practical, constructivist knowledge to bring back into the physical world (or "first life"). Over 700 global educational institutes are represented in SL (Linden Lab, 2011), and the virtual communities evolving from this space often reflect the particular principles of that institution. The University of California, Santa Barbara's Department of English, for instance, boasts a SL "Transcriptions Project" which negotiates the medium between different eras of literature and literature's relationship with information culture. However, these deliverables also need a platform from which to be disseminated. Some virtual departments reflect their respective physical departments; some come in the shape of space stations; while others expand across an entire forest or park. Consequently, users of fantasy-oriented communities expect that in exchange for their time, the environment will be interesting (Spaulding, 2010). Yet, despite the vast studies conducted on tree designs – their complexity and potential for interacting with and enhancing the virtual environment (Huang, Kahai, & Jestice, 2010; Nebiker, Bleisch, & Christen, 2010), and the effects trees have on the human psyche (De Kort, Meijnders, Sponselee, & IJsselsteijn, 2006; Lin, 2008) – and research observing ecology as an organism metaphor for learning (Stevens, 2007) – the idea that learning builds upon previous learner knowledge, and extends infinitely – reports on how organic structures could aid in virtual education are lacking.

Virtual environments allow for self-navigation and interaction with the environment and other virtual residents as well as creating objects (Yasar & Adiguzel, 2010). Within social media, virtual worlds tend to differ from other applications in three ways: i) virtual worlds allow others to interact in real time (whereas there are potential time delays in such tools as Facebook); ii) virtual worlds allow users to create fully customized self-representations (avatars) (perhaps more flexible than images created in online communities like YouTube); and iii) the basic rules of physics makes SL three dimensional and navigationally comparable (unlike the two dimensions of blogs) (Kaplan & Haenlein, 2009). These other social media, however, have evolved and adapted over time to incorporate more interactive and customizable user tools. Facebook, for example, has incorporated live chat, interactive gaming components, and marketplace functions to provide a more immersive user experience (Bicen & Cavus, 2011). Yet, the concept and application of virtual worlds has dated as far back as 1968 to the virtual reality simulators of Sutherland and Sproull (Sutherland, 1968), and virtual world definitions extend beyond social platforms to those with off-line components such as the children's chore-tracking device used in MMORPGs (massive multiplayer online role playing games) like Handipoints, and those used to help hospitalized children by organizations such as Starlight Children's Foundation. One advantage which virtual worlds seemingly have over other social media is the ability for users to engage with the environment in synchronous and asynchronous fashion.

The tree is one of the most complex designs used in research projects for nature studies (Sen & Day, 2005) since it is one of the most intricate elements of nature with multifaceted geometric properties, due to its branching structure,

leaves, and many different forms. The authors of this study also understand that trees are one of the most difficult elements to animate and to interact with in a virtual environment, since accurate depiction of the design desired would require knowledge in both botany and the target theory or methodology. A successful virtual tree platform, therefore, potentially conducts itself as a distributed learning network where knowledge is dispersed to all learners, and a peer-to-peer network where learning becomes self-regulating. Thus, collaboration online is sometimes characterized in terms of how ecology becomes a pedagogy, both complementing and transcending conventional classroom structures and practices, benefitting learners (Dieu, Campbell, & Ammann, 2006). In the biological world, the field of ecology concerns itself with the study of the patterns of interrelationships between organisms and the environment in which they live. Relationships in ecology are never fixed like in rigidly structured courses, but rather self-organizing and fluid, shifting in response to ever changing environmental factors. Here, the idea of a "learning ecology" invites students to learn through discovery and experimentation, creating and sharing their own content – in a setting where English is a second or foreign language a peer-centered approach guides learners in a situation where they can use and improve their language skills in self-directed ways while conversing with peers; it gives them access to a distributed network, and familiarizes them with the available tools; and it also requires teachers to provide technical, educational, and moral guidance (Ibid.).

For language-based courses, SL allows users to visualize three-dimensional data and multimodal representations of images or text, and in an age of peer production where composition should include a variety of non-traditional genres to ensure relevancy, English departments are undergoing an even greater impetus to change. In response to this, peer-reviewed pedagogies become subject to immediate revision, collaboration, and even deletion, challenging traditional assumptions about authorship, authority, collaboration, and power (Moxley, 2008). While the HK PolyU's Department of English does not have an embedded virtual pedagogy per se, as the small handful of faculty involved with this project only joined the virtual campus community in 2010, continuous collaboration has taken place between the Department and external entities in virtual world learning, infusing subject matter directly into the virtual classroom (Fox, Arena, & Bailenson, 2009). Until such pedagogy has been defined, students will continue to engage in virtual language learning which reflects the Department's current mission: providing applied English language skills and developing critical understanding and awareness of English communication in a multicultural professional context.

The Hong Kong Polytechnic University's (HK PolyU) virtual Department of English, also known as the Tree of Knowledge[1], is a project attempting to explore ecology as a language learning device in SL. Inspired by Salmon's (2010) Tree of Learning concept, the Tree of Knowledge represents an interactive ecological community offering numerous learning possibilities and socializing opportunities (Lin, 2008). Yet, when transformed into a space where formal education is to transpire, the online world can sometimes become a contentious stomping ground for both praise and criticism – from both students and teachers – where the learning environment may become neglected or rejected due to the perpetuation of unmet needs (Rovai, Ponton, Derrick, & Davis, 2006). By contrast, the impetus for the Tree of Knowledge was to create a type of "virtual face" (Meyer, 2008) for the physical Department of English, serving as a metaphor or a manifestation of the visions and objectives pursuant to the physical department. Additionally, the virtual department attempts to exemplify its own "virtual world pedagogy" (Lim, 2009), a safe space welcoming a diverse range of cultures, inviting students and visitors to reflect upon the affordances implicit in the design of the learning space (Turnley, 2005), and to engage in learner autonomy. And lastly, virtual worlds provide a place for creation and international exhibition of new forms of digi-

tal arts, architecture, and other digital content (Messinger et al., 2009) allowing both students and teachers of this project to become collaborators in the virtual production, display and discussion of student language-based products.

The Tree of Knowledge project is a work in progress that addresses several issues: 1) to build a virtual sim that is ecologically practical by using the roots, trunk, crown, and branches of a tree-shaped platform; 2) to craft a space that allows for blended, informal, and autonomous language learning; and 3) to develop interactive, creative, and collaborative tools for students to negotiate knowledge-building within virtual spaces, and applying that knowledge back in the physical realm. This paper further considers the pre-developmental, developmental, and post-developmental stages of building a virtual organic infrastructure for the purposes of English language learning; and how students interact with the various elements of design – namely space, proximity, gravity, balance and movement. It is hoped that the introduction of an organic layered design used as a space-efficient learning platform will interest other educational practitioners to consider the merits and challenges of such an application in their own classroom practices.

PRINCIPLES OF DESIGN

Before moving on to a discussion of the construction and application of the virtual Department of English, the theories and rhetoric sustaining organic designs and ecology should be reviewed and considered. Four areas surface in this regard which are relevant to this study: pedagogy / distribution, emotional state/senses, spatial movement/exploration, and technical/modeling.

Pedagogy/Distribution

Highly flexible virtual worlds are starting to allow content created by one user to be experienced immediately by other users. In this regard, Stevens (2007) explores online collaboration as a pedagogical ecology, complementing and transcending conventional classroom structures and practices; distributed amongst numerous residents and repositories; and where collaborators contribute unique skills and resources towards their pedagogical goals. In this study, the Tree of Knowledge not only moves away from traditional learning spaces in the physical world, but also maximizes the affordances of virtual worlds to emulate an organic, evolving structure different from other virtual learning spaces which may be creative in appearance but remain static, and contain unused (or unusable) segments. Besides content developed for immediate use, alternative user-created tools also allow for immersive and collaborative user experiences: Babbler, for example, is a translation device developed by Linden Labs (see Stevens, 2008). Additionally, such free downloadable third-party add-ons as Ventrilo and Teamspeak (voice over IP devices) are easily adaptable to SL, although the asynchronous objects there have a much greater potential for transformative impact on education than synchronous interaction. It is necessary, therefore, for proponents of social networking sites to gain enough experience through experimentation and critical reflection to mount principled appeals to policy-makers who may not have grasped the transformative benefits of these distributed learning networks, and unrestricted access to the Internet.

It is clear that many who are drawn to SL are intrinsically motivated to be there – including owners of educational sims such as the New Media Consortium (NMC) and avatar-educators like Peter Twining and the Open University project, Schome. Stevens (2008) further introduces additional SL avatar-educators and educational sims: Dudeney Ge and Consultants-E, founders of the islands of Edunation, a safe-space for students to learn short grammar lessons and then interview and engage in role-play with other external SL residents – once on the now defunct SL Teengrid; now on the main grid with three islands. Other language-specific sims include Second Life English (now known as VIRTLANTIS) and Languagelab. These educational environments tend to be island or park

oriented learning spaces with buildings reflecting the physical environment. It is hoped that the Tree of Knowledge will not only become an inspiration for the general and language learning communities but also become an example of a learning space whose structure is an integral part of the learning process itself.

Perhaps the only evaluation of SL in the context of an English subject (*Composition and Reading in World Literature*) is Traphagan's (2007) report which observed that there is no limit on how to use SL spaces, and accommodations can be made for the learning preferences of Net Generation students. With an island as a platform and using building skills to execute course tasks, students demonstrated that the ability to collectively construct the virtual environment heightened users' sense of social community, even though some considerations prior to SL engagement included limiting access to the sim to only those who are registered in a course – in case, for example, any minors were enrolled. In this present study, students had access to the virtual department, but did not have rights to "terraform" (modify the landscape) or edit student work already uploaded. The question of security was raised at one point, and whether or not restricted access would be placed to protect students from "griefers" (virtual bullies), but in light of wanting access available to visitors and collaborators, this consideration was forfeited. Additionally, Open Sim was considered as a supplementary platform for the bulk of student interactive work, but an initial consideration for using SL was for students to traverse the vast virtual landscape outside of the department boundaries.

Some post-observations in Traphagan's report noted that most students did not use SL for purposes beyond their assigned tasks or did not find any additional uses for their course sim. Some students, however, did indicate that SL could be beneficial for courses requiring immersive experiences (such as anthropology and literature), and courses which could create scenes (such as literary criticism). The Tree of Knowledge was designed in such a way that each quadrant of the tree would be deeded a specific function. This is discussed in detail in the Pre-production sub-section that follows; however, one area which was considered for scene creation included the roots where the Drama Lab would be located, and in the branches where students could create products using their SL builder tools, and tools that the project manager would install.

Emotional State/Senses

In our world of rapidly developing media, information and computer technology, physical models are gradually being replaced by computer simulations and other mediated environments. De Kort, Meijnders, Sponselee, & IJsselsteijn (2006) underscore the importance for people to reduce stress and improve health in an otherwise relentless world, but also recognize that the availability of natural restorative environments to support this end is sometimes non-viable. While de Kort, Meijnders, Sponselee, & IJsselsteijn's study did not consider virtual environments as a replacement for physical resources, it did evince that immersion enhances restorative potential of a mediated natural environment. Subsequently, the focus of this paper does not rest on psychological restoration of an individual via mediated spaces, but it is nevertheless interested in the effects of ecological systems on its inhabitants (students, teachers and visitors).

A virtual community is like a social community, giving members opportunities for interaction, including chat. However, virtual communities are characterized by anonymity, addictive behavior, and voluntary behavior. Lin (2008) uses a model derived from DeLone and Mclean's IS success model to determine the impact of system characteristics (e.g. information and system quality) and social factors (e.g. trust and social usefulness) in determining success in virtual communities. A virtual community-based approach is an effective way of sharing knowledge, since it facilitates informal sharing of knowledge available from users with previous experience. Participants in Lin's study indicated that virtual communities meet their

needs when they are reliable, convenient, and user-friendly, providing accurate, complete, constantly updated, and customized information. Mutual trust plays an important role in reducing uncertainty and increasing confidence in virtual worlds without physical face-to-face interaction. Students from this study were surveyed, and indicated that while it was unclear whether or not an organic design would be useful to their learning, the environment was at least creative and attractive enough to gain their initial interest.

Additionally, Meyer (2008) conducted a study discussing the "virtual face" of various community college and tertiary institutions, and in particular, their websites. This window into the institution provides visitors clues to its priorities, and evidence of how it wishes to be seen. Yet, there is a remarkable absence of accountability mechanisms to ensure colleges succeed in educating students. While many home pages are well designed, others are messy, requiring users to hunt for important information, or are only friendly to internal members already familiar with the environment. Eighty-eight percent of surveyed participants in Meyer's study indicated they had difficulty identifying and contacting faculty. The seemingly three-dimensional nature of SL allows departments to present their "faces" in a metaphoric sense – visitors do not necessarily have to initially scroll through numerous pages, click on links or hit tabs in order to discover a mission or motto; and in the case of a tree design representing an English department, the meaning could be immediately clear or subtly evident: knowledge, guidance, protection, and growth.

Spatial Movement/Exploration

Places usually relate to several directions by a system of paths and these paths express a subject's possibilities for movement and divide the environment into relatively well defined areas called "domains." Huang, Kahai, and Jestice (2010) observe that the "inside" and "outside" of a place should be clearly defined if the designer wants the experience of being in this place to come across as meaningful and convincing for the user since activities are only meaningful in relation to these places. Objects which function more like points of reference or as landmarks generally communicate some meaning to and structure experiences for the operator, involving the learner as an active participant. The cognitive thinking implied is reflected in the four domains of knowledge-building considered for the Tree of Knowledge (discussed in the Pre-production sub-section) as well as in Ramasundaram, Grunwald, Mangeot, Comerford, and Bliss' (2005) study on computer-aided instruction in exploration-based learning. Here, students gained a better understanding of spatial distribution by physically exploring and experiencing the soil, terrain, and land use of an environmental system.

Interactivity between the users, as well as between users and the virtual objects, allow for rich collaboration opportunities. Kohler, Matzler, and Fuller (2009) indicate that innovations are seldom the result of lonesome individuals, but rather originate from the collaboration of diverse groups. One example that is representative of the numerous opportunities is the case of Aloft, a new hotel concept from Starwood Hotels showcasing loft style guest rooms, customizable room packages, and minimalist hotel features. Staffers observed how avatar-guests move through the space, what areas and types of furniture they gravitate towards, and what they ignore. The project was also an effort to tap consumers for ideas, and since the publication of Kohler, Matzler, and Fuller's study these hotels have been established worldwide. The Tree of Knowledge study recognizes that simply building an organic form with ecology-of-learning precepts may not guarantee that learning will take place there – as discussed later in the Post-production sub-section a preliminary tool used to gauge if learning was suitable or took place in such an environment was a survey distributed to study participants, and teacher observation, as well as interaction during workshop sessions.

Technical/Modeling

Various modeling systems exist which attempt to perfect or explain the organic form as a virtual representation. Sen and Day (2005) consider the use of L-Systems, a string rewriting tool and formalism of Chomsky Grammar which replaces automata and fractal theories for the overall framework for plant development. L-Systems try to capture the biological development of multi-cellular organisms where many cell divisions may occur concurrently, and as a modeling language can encompass a multitude of model types. On the other hand, Nebiker, Bleisch, and Christen (2010) propose a three-dimensional city modeling paradigm based on rich point clouds which are acquired by using ground-based mobile laser scanners. Such point clouds are able to capture the micro- to meso-scale environment in detail from a first-person perspective, allowing walk-through or drive-through application scenarios while generating semantically rich models such as terrain and vegetation. In this study, in addition to using SL-embedded tools, including mega prims (explained later in the Construction subsection) a third modeling system is examined: texture mapping, which demonstrates complex forms by using images as opposed to geometry. Modern graphics cards, according to a study by Bourke (2009), can handle texture maps and avoid the potential consumption of graphics systems which systems entertaining geometric prims are threatened with.

The nature of virtual environments is generative, by allowing self-navigation and interaction with the environment and other virtual residents, as well as object creation. Learning Management Systems (LMS) such as Moodle, when merged with three-dimensional virtual environments potentially become student-centered and -managed spaces which also deliver traditional learning outcomes such as course deliverance, collaboration, and assessment. Yasar and Adiguzel (2010) note that for language-based courses SL permits users to visualize three-dimensional data and multimodal representations of images or text. SLOODLE (Simulation Linked Object Oriented Dynamic Learning Environment) links an open-source LMS like MOODLE together with SL, allowing archived password-protected chat-room discussions; registration which integrates both avatar names and MOODLE accounts, and tracks student activity; an assignment drop box; using a range of classroom gestures (like hand-raising) and automatically writing in MOODLE blogs from SL; presenting slides or web pages in SL without conversion or uploading processes; and the Quiz Chair, offering multiple-choice questions and an option to record answers. The HK PolyU recently switched its LMS from Moodle to Blackboard although there are still sectors of the university that utilize some element of Moodle. Nevertheless, transference of knowledge occurs from the virtual realm back into the physical classroom where students can apply this knowledge into everyday situations. While a full implementation of SLOODLE was not available during this study, certain similar designs were incorporated such as voting bars for favorite student work, and password protected "mailboxes" which students could access to view note card comments left by other students about each other's work.

CONSTRUCTING THE VIRTUAL DEPARTMENT OF ENGLISH

The impetus for the project was a reaction to the 2012 Hong Kong-wide university adoption of a four-year degree curriculum (from a three-year program) for in-coming freshmen, and thus the perceived need for an alternative delivery of learning in order to better prepare our students for a more international and comprehensive academic and professional life. As discussed earlier in this paper, one of the major contributions of SL lies in education: it can support learning activities by creating innovative environments for distance education (a potential consideration for the new university curriculum). Students can, in the virtual world, enjoy simulations of lectures, enhance experiential learning, practice skills, try new ideas,

and learn from their mistakes. This project initially started out in a borrowed space in the HK PolyU's virtual campus' Convention Centre near the closing of the 2009 fiscal year, then developed into a more comprehensive, creative, and official venue for interactive learning – the current Tree of Knowledge.

Throughout the infancy and development of the undertaking, three English teachers and a project associate were actively engaged with the Tree of Knowledge. Two courses, English for Technical and Web-based Writing (ETWW) and English for the Media (EM) were incorporated into the initial Convention Centre platform – both courses are electives for full-time students and compulsory for part-time students; and while certain student products from both courses – a book cover and a news report video – were uploaded to the temporary space, the learning objectives of ETWW, however, made it a preferable course to initiate the preliminary project. ETWW is designed to help students to understand the genre of technical writing; to develop linguistic skills to write clearly, correctly, and concisely; to work creatively with basic technical skills in desktop publishing and web design; and to develop competence and confidence in basic human-computer interaction.

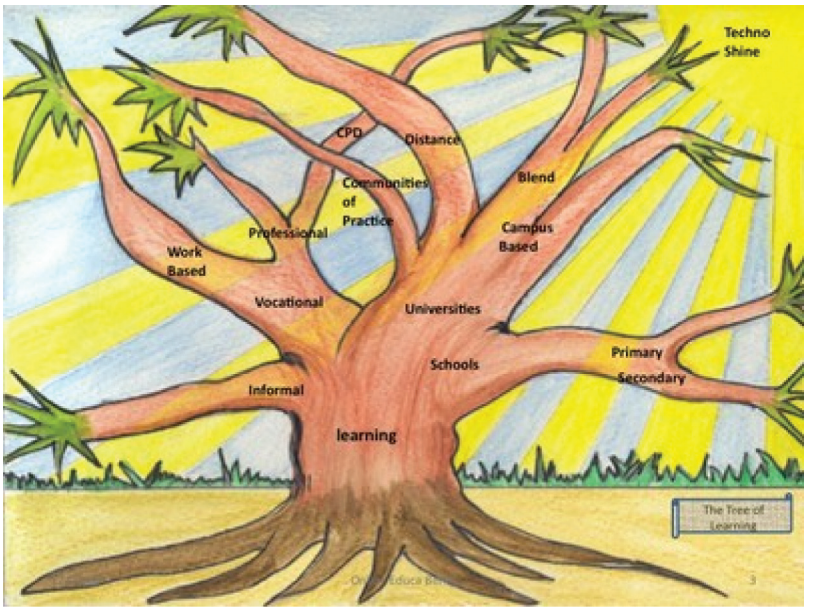
An additional task, the poster design, was added to ETWW as a non-graded, easily transportable (to the virtual world), in-class assignment specifically for the project and designated as such in the hope that students would feel less pressure to perform for a grade, and focus instead on task criteria, creativity in design, and being open to collaboration and assessment in a new learning environment (most – if not all – students were either unfamiliar with SL or had little experience navigating through virtual environments). Since the Department of English is the newest member of the HK PolyU virtual campus, no embedded pedagogical or technical support is currently available to Department students. However, several other departments have had an extended presence in the virtual campus – such as the School of Design and the Department of Computing – and so students coming from these faculties and departments have further opportunities to engage with the virtual environment. Additionally, besides the workshops provided before students interact with the Tree, in-house materials on SL – covering topics from account creation to computer hardware requirements – produced by the Department of Applied Social Sciences are available to the PolyU community.

After posters were uploaded to SL, students engaged in collaboration through the voting of their favorite posters; peer feedback via virtual notecards; in-world discussion of particular posters; and, finally, review of the experience back in the physical classroom. In addition, the task was a way to introduce and ease ETWW students into an unfamiliar learning environment. Certain design criteria also needed to be considered, namely contrast, proximity, balance, and alignment. Students were given one week to complete the task, and upload their products to WebCT (a second LMS formerly supported by the HK PolyU), after which the project manager for the course (who is also one of this study's authors) uploaded them to a display gallery. It was shortly afterwards, in 2010, that Gilly Salmon attended the Innovation Symposium hosted by the HK PolyU as its main guest speaker.

Pre-Production

Design considerations. Biblical references aside, the Tree of Knowledge was, in part, inspired by the Tree of Learning model proposed by Salmon (2010) (see Figure 1) which considered the idea that learning (the "root" of Education) could be divided into four regions (various parts of a tree) – informal, vocational, universities, and schools – whereby unique components of learning (such as blended learning and communities of practice) could be cultivated and built upon, all the while being influenced and molded by the technological advancements in learning ("techno shine"). Each part of the Tree of Knowledge– roots, trunk, crown, and branches – would function as an area for learning and knowledge-building (the grass area,

Figure 1. The Tree of Learning (© 2012, Rod Angood. Creative commons licensed but used with permission)



which was also part of the design, would serve as a learning area later on). The four regions of Salmon's Tree also have some relevance to the potential behind the virtual Department of English: 1) Informal – the process of avatar creation, tree navigation, and general exploration become tools the student brings back into the physical world for practical application; 2) Vocational – students become participants in a technologically advanced form of distance education; 3) University – the Tree becomes the virtual face of the physical department, offering a chance for sister universities from afar a cost- and time-effective alternative for collaborative opportunities; and 4) Schools – students can outreach to outlying schools and the general community, and design virtual knowledge products for communities with English language needs.

Four domains of knowledge-building were proposed for the virtual Department of English (see Figure 2): information services, ecological construction, peer collaboration, and innovative production. Each domain is interconnected through the central theme of "knowledge" allowing deliverables to be 1) passed on from product to user; 2) stored and archived by users for later use; 3) created and adapted by users; and 4) passed on between users and extended communities. The knowledge domains were then interspersed amongst four quadrants of the Tree of Knowledge which served as the infrastructure for the virtual Department of English (see Figure 3).

Space and utility were considered in relation to the courses taught by the project's teachers, with the possibility of using or extending branches and root tendrils to accommodate materials from other courses taught by teachers who would (hopefully) later join the project. It should be noted here that while the initial project began in a borrowed space at the HK PolyU virtual campus, all student products were eventually moved to the current Tree of Knowledge. The exhibition area would serve as the project's main language learning domain, implemented with interactive learning tools designed to negotiate students' collaborative, constructivist,

Figure 2. Domains of knowledge for virtual Department of English

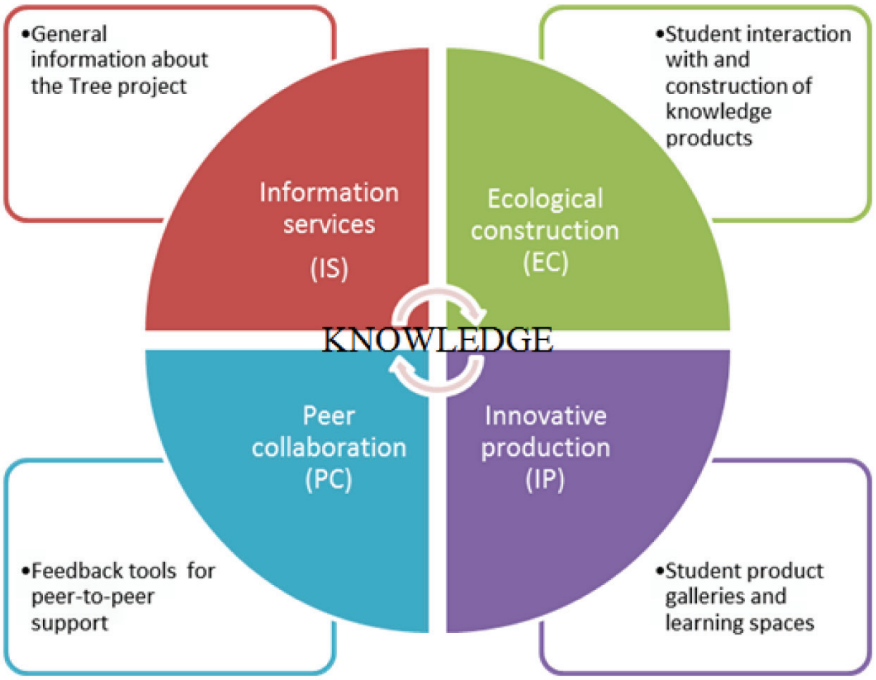
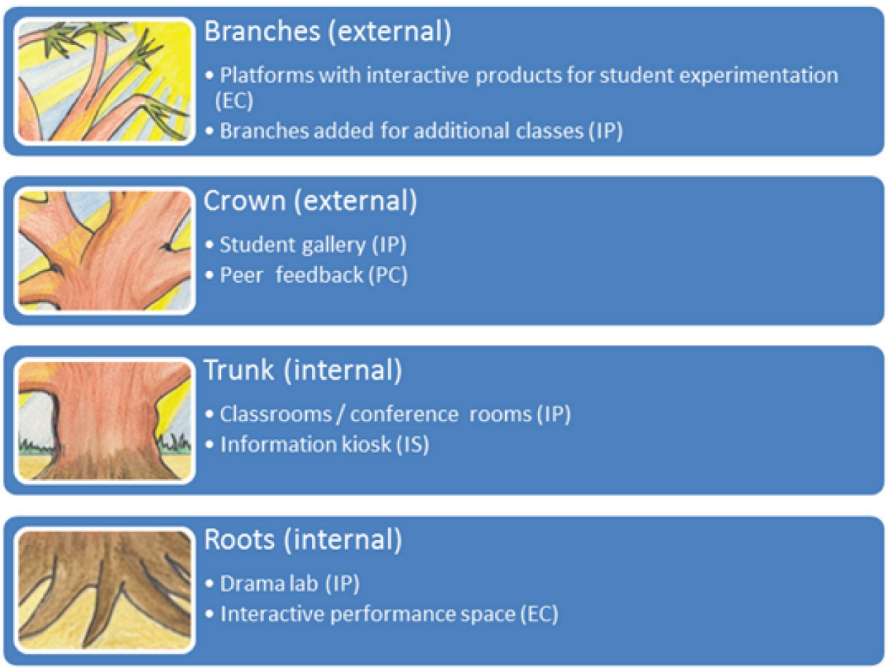


Figure 3. Infrastructure for Tree of Knowledge. (Adapted from Rod Angood's The Tree of Learning)



and communication abilities. The main platform at the tree crown would be divided into three areas devoted to assignments from ETWW and EM: User Guides, Movie Posters, and News Videos. Student avatars would fly, walk, or teleport over the respective branches to a platform. Each platform would have an interactive tool relevant to that particular student product, allowing students to manipulate its various parts in a three-dimensional setting. A SLOODLE (Second Life Moodle) chat or blogging component would allow students to share their opinions and findings with each other, as well as respond to each other's feedback. This would also act as a constructivist element for future students who might visit the archived chats. Specifically, visitors interested in Movie Poster features could walk into a three-dimensional version of a student-designed movie poster (much like the now-defunct SL sim of Van Gogh's Starry Night) to get a better feel for how design elements are implemented, and to manipulate text, image, and symbols for their own design concepts.

The quadrants of the Tree would contain the following:

- **Roots:** This space would be reserved for an English-in-Drama course in the form of a Drama Lab; performance space would allow students the ability to not only enact works of drama with the aid of bit-part robots, but also learn about various types of stages and performance methods through changeable and interactive stage sets.
- **Trunk:** Visitors would be greeted by a robot on the ground level (the landmark) of the three levels in this area – this level would also include a vending machine with Department of English t-shirts, introductory videos, and virtual notecards about both the physical and virtual departments, additional resources for language learning, as well as opportunities to participate in research; the other levels would include more traditionally structured classrooms and conference areas.
- **Crown:** Student work would be displayed here allowing students to interact with each other's products in a gallery style setting; students vote on each other's work through the use of a voting system in front of each work; private comments could also be left regarding student work on virtual notecards found in individual account inventories.
- **Branches:** Acting like work spaces, students would engage in basic building tasks; sample products would be created to produce a three-dimensional, interactive environment where students walk inside of and visualize the various elements of design; additional language learning products allow students to collaborate in task-oriented activities.

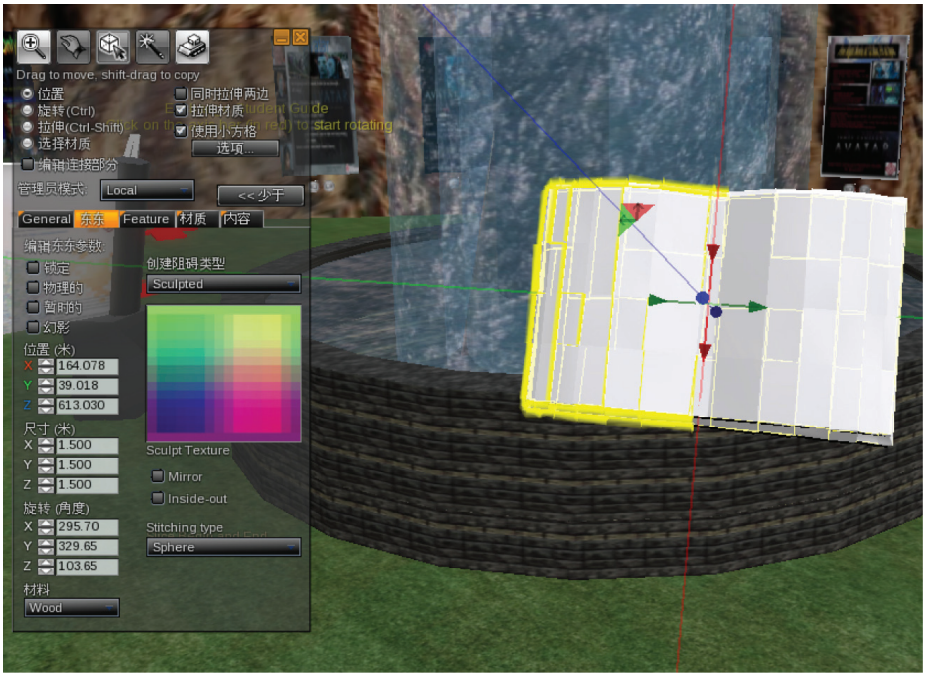
Technical Considerations

Modeling in SL requires understanding the affordances and limitations of such elements as primitive (prim) size, count, and shape. Each prim is limited in size to 10 x 10 x 10m and there cannot be more than 13,824 prims on one island. One method for building requires the use of SL's own in-world model-building tool (see Figure 4) which uses three-dimensional geometric modeling (or prim modeling) and provides a limited range of prim shapes. This is a constructive method producing models that use geometric prims (or blocks) like spheres, cubes, and cylinders to form complex designs. A relatively precise and effective method for simple construction, it is however better suited for non-organic shape modeling.

A second method is sculpting, popular in modeling technology and more appropriate for building organic forms. A third party tool is used to create an image map (or sculpt map) by recording the displacement between each vertex on subdivision surfaces of a polygon control mesh of an object and its centre point on a 32-bit image map. The uploaded sculpt map helps calculate the location of each vertex on the object and displays the organic model in-world (the virtual environment) (see Figure 5).

Figure 4. Second Life model-building task panel

Figure 5. Sculpt map and mesh object



Production

- **Sculpt Map Modeling:** In order to create an effective three-dimensional tree model, a third-party software such as 3D MAX or PloppSL was used to generate a sculpt map exporting function. Prim count restrictions on a three-dimensional model required building of a three-dimensional tree trunk model rather than an entire tree. The trunk sculpt map was exported and then uploaded to SL. The sculpt map was applied in SL by first creating a prim and then editing the prim: In the *Object* tab of the editing panel (see Figure 6), *Sculpted* was selected in the *Building Block Type* drop-down menu and the relevant texture was uploaded from a personal inventory. The resulting sculpt model (texture) was applied to the prim (see Figure 7).
- **Billboard Modeling:** Due to the excessive quantity of leaves necessary to simulate a real tree, sculpt mapping was not an effective option for this simulation as this would have caused heavy loading on the rendering speed, affecting performance and user experience. To compensate for the rendering load, Billboard modeling was considered (see Figure 8), which made use of three prim boards crossing over each other with two-face leaf texturing to give a three-dimensional illusion (see Figure 9).
- **Use of Mega Prims in Second Life:** Another issue for consideration was the size of the tree and leaves which required a scope exceeding the maximum 10 x 10 x 10m dimensions. Mega prims permit unlimited prim sizing, but become a burden on server load. Mega prims allow users to build, can be stocked in personal inventories, and are found by searching around SL or purchasing them from the SL Marketplace website. One drawback of mega prims is that no adjustments can be made to their dimensions; therefore, different mega prims are needed to build an organic struc-

Figure 6. Object tab in SL editing panel

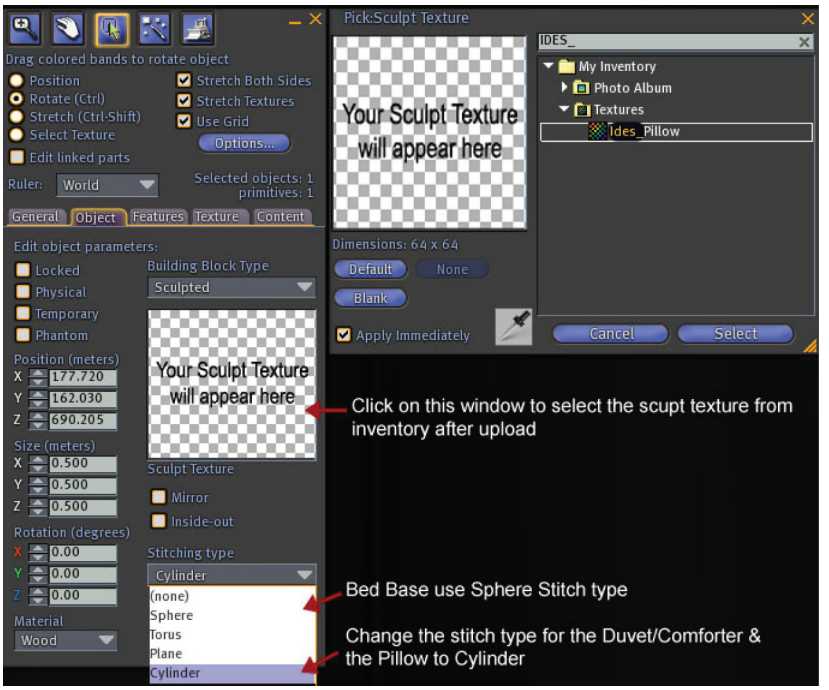


Figure 7. Sculpt modeling onto tree prim

ture like a tree. For this project, sculpt maps were exported separately and applied to the various mega prim sizes: a 32 x 40 x 50m sphere was applied to the trunk; a 25 x 25 x 32m sphere to the top of the trunk; a 50 x 50 x 50m and a 50 x 50 x 25m cylinder to the root and branches; and a 25 x 30 x 0.25m cube to the leaves. Additional texturing was applied both on the inside and on the outside of the Tree, using an "inside-out" texturing technique to apply the same two-face effect that was used on the leaves.

- **Data Logging:** To protect student data, a separate server logging system was developed using Apache, PHP and MySQL. This allowed for monitoring of student conduct and peer interaction in the virtual department.

Post-Production

The virtual Department of English was officially launched in 2010 in the HK PolyU's virtual campus, six hundred meters in the sky. Since then, the Tree has been adapted and has evolved to include resources suggested by students during informal feedback, focus groups, internal feedback systems, virtual notecards, and surveys geared towards autonomous student learning,

Figure 8. Example of billboard modeling

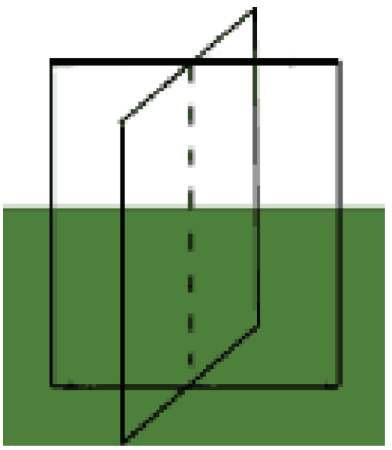
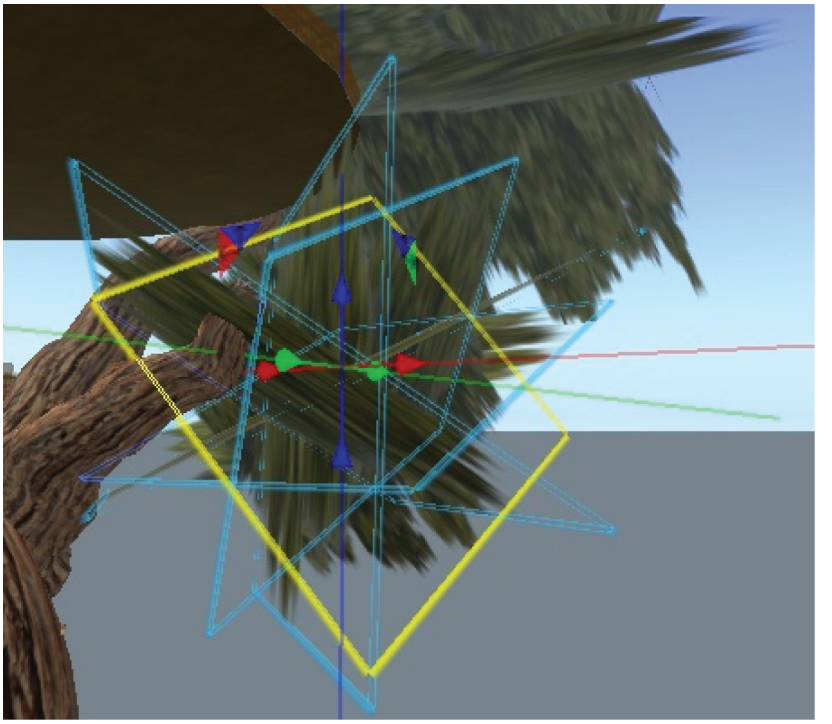


Figure 9. Example of two-face leaf texturing



protection of student work and personal information (Giles, 2007), and improvement of interactive tools (see Figure 10).

- **Student Responses to Design and Space:** While the focus of this study is to describe the development of a virtual learning platform, an additional survey component was added to the research for a more vigorous investigation into the practicality of using organic designs in virtual learning. This is a reinforcement of the discussion regarding the spatial exploration section of the literature reviewed (see in particular Huang, Kahai, & Jestice, 2010; Ramasundaram, Grunwald, Mangeot, Comerford, & Bliss, 2005; Kohler, Matzler, & Fuller, 2009) where participants were observed as to which spaces and objects they tend to gravitate towards, and how that negotiated exploration-based learning. Building a space for learning does not necessarily induce the impetus to learn, and so, during Semester One of the 2011 to 2012 academic year, a different cohort of students engaging with the Tree of Knowledge were asked to participate in an online survey (see Appendix: Virtual Department of English "Tree of Knowledge" survey) created with Google Docs, showing their satisfaction level and attitude towards the tree design and its implication towards their learning. The authors wanted to observe how and whether students move through space, what areas they gravitate towards, what they ignore, and what alternate collaborative platforms they might also find useful for learning and knowledge-building (Kohler, Matzler, & Fuller, 2009). Thirty-six student responses by local Chinese students were recorded in class years ranging from first year to Masters in disciplines including English, Computing, and Finance. Two cohorts of students were surveyed who had been exposed to the Tree of Knowledge during two, two-hour workshops each,

Figure 10. Post-production virtual Department of English (Tree of Knowledge)

from both the ETWW and (this time) Popular Culture and English (PCE) courses. In addition to the book covers and user guides already on display for ETWW, billboards were added for PCE. Table 1 shows Likert scale responses to two of the survey questions regarding how students felt about the virtual Department of English.

The quantitative data evinced that

- While most of the students were appreciative to neutral regarding their liking the design of the department, many were also neutral to dissatisfied as to whether it served as a practical learning environment.

Additional quantitative data from the survey indicated that

- The majority of students were visiting SL for the first time (90%).

Table 1. Student feelings towards the HK PolyU virtual Department of English design (N = number of student responses)

How much do you like the tree design that is used for the virtual department?	*Very much* 5	11	13	6	*Not at all*
How useful do you feel the design is for your learning?	*Very useful* 6	3	16	10	*Not at all* 1

- Students tended to visit all areas of the tree, but only one student specifically visited the roots quadrant.
- Most students would return to the tree again (40%) or where neutral in their feelings (40%).

Qualitative data from the open-ended questions further expressed that

- Students found the design and graphics creative, innovative, and attractive. However, they also felt dizzy when maneuvering around, manifesting cybersickness (Nelson, Sadler, & Surtees, 2005); found it hard to control the avatar (some even falling off the edge); indicated the system was slow; and felt the design elements were too difficult to use and understand.
- Suggestions for improvement included using simpler and clearer menus and directional signposts – many initial visitors to virtual worlds never return because it is too complicated (Newitz, 2007).
- While some students wanted to keep the Tree as a representation of the department, other suggestions included a map, a natural park, a playground, and even more "familiar" designs such as a classroom or a building.
- Finally, learning in the virtual organic environment was more interesting than attending a lecture or a seminar in the physical environment.

The results reflect findings from other studies where primary drawbacks of the SL platform included hardware requirements, scalability, disorientation, functionality familiarization, and limited interaction; and assets included novelty of approach, distance learning support, multiple communication channels, and graphical representation (Andreas, Tsiatsos, Terzidou, & Pomportsis, 2010). Here, students also evince characteristics of the two domains reflected in Bloom's taxonomy for learning (plus the additional third psychomotor domain) (Anderson & Krathwohl, 2001) (Table 2).

While it can be argued that the preceding data does not necessarily suggest any unique findings with regards to the vast pool of work being conducted in this field in other parts of the world and for other academic subjects, it is unique in a contextual sense, adding to the limited data available for English courses used in virtual worlds, and student responses to virtual learning environments in Asia.

CONCLUDING REMARKS

This study investigated the reproduction of an organic structure in Second Life representing a Department of English for the purposes of English language-learning and knowledge-building in a Hong Kong university. Several modeling techniques as well as student engagement with design elements of the learning platform were addressed to determine platform efficiency and effectiveness. The investigation also determined the challenges with constructing a tree for these purposes: in order to overcome prim count and size restrictions, and rendering overload, a blending of sculpt mapping, billboard mapping, and mega prim methods were applied to the design execution. While there are numerous organizations and individual practitioners that support language learning in Second Life, very few studies have been conducted in support for the English subject, and even less – if any at all – on language learning in organically-shaped environments. The data and findings from this study are important as they add to language learning areas in an Asian context where limited data is harvested.

While it is not possible to include touch, smell, or taste to create a more immersive virtual learning environment, the addition of audio effects and music may be considered. More opportunities to interact with and perhaps manipulate the environment may also give a sense of kinesthetic immersion. It is generally believed that the greater the number of human senses is involved, the more presence a partici-

Table 2. Bloom's learning domains evident in student responses to Tree of Knowledge survey

Domain	Description	Example from Tree of Knowledge study
Cognitive	Evaluating: making judgments about the value of ideas or materials	"The places where students' work is uploaded is convenient to distribute teaching materials and for us to flip through each other's work"
		"Some objects have no relation to the real English Department – why is there a native American teepee tent in the middle of the platform?"
Affective	Receiving phenomena: awareness, willingness to hear, selected attention	Teacher observations during workshops and interaction with students in SL: engaging in text chat as students attempt learning activities
	Responding to phenomena: active learner participation	Teacher observations during workshops and interaction with students in SL: engaging in text chat as students attempt learning activities
	Valuing: the worth or value a person attaches to a particular object	Wanting something more familiar to students' everyday surroundings in place of current platform design such as a traditional classroom or a building
Psychomotor	Perception: the ability to use sensory cues to guide motor activity	"A clear sign to show where we will go after clicking on a certain object"
	Guided response: early stages in learning a complex skill that includes imitation and trial and error	"A bit lost and dizzy when walking around"
		"I cannot control my avatar to land on the platform safely – I always fall in the water"

pant experiences (Ch'ng, 2009). Background music does stream throughout the sim which houses the virtual Department of English (just as it does with many SL sims); however, this was not taken into consideration during the study and can be an area for future research. Additionally, "mesh," although not new per se as it was being used in other virtual worlds prior to its release in SL, is a more advanced generation of content-creation technology (transported into SL from a third party building tool) which has the capability of rendering more complex and detailed organic forms (amongst other items and objects).

The intention behind the tree design is to provide a space for learning where all segments of the tree are negotiated, although more efficient navigational and transportation methods should be considered, especially in a no-fly zone where avatars sometimes fall off the learning platform and free fall to the land six hundred meters below. Improvement of system speed may also alleviate the challenges of avatar control. It is worth noting here that these technical considerations may also prove beneficial for educators with non-programming backgrounds (Huang, Kahai, & Jestice, 2010). In terms of the survey generated for student response, questions specifically directed towards active learning were lacking. It is not clear as to whether learning actually took place within the organically-shaped learning platform – or rather, it is not clear as to exactly what kind learning took place.

Since the writing of this paper, further plans have been developed to turn the virtual learning platform into a more integrated and interactive space, although traffic has subsided since the university's decision to suspend virtual campus efforts temporarily while it prepares for the upcoming Hong Kong tertiary-education wide changes in curriculum structure. Nevertheless, plans include outreaching to other local entities engaged with Second Life in collaborative

projects, and incorporating creative tasks which extend beyond student projects: currently, a multimodal task is in place, requiring students to match images of human facial expressions with the appropriate text description by clicking on the correct pairings – avatars participating in this activity can use voice or text chat to discuss task strategies and their experiences.

A Second Life Department of English serves as a multi-functioning learning environment, which allows for both synchronous and asynchronous activities otherwise impossible or not easily duplicated in first life or within other internet-based applications. The availability for students to voice chat, text chat, discuss, and create multimodal technical products, and seek feedback from the overall virtual community renders Second Life a potentially apt environment for language learning. Just like a tree, the virtual Department of English continues to evolve and grow, adapting to and changing with the learning needs of its students and visitors.

ACKNOWLEDGMENT

The authors would like to thank Dr. David Herold and his team at the Applied Social Sciences Department (APSS) at the Hong Kong Polytechnic University for their invaluable assistance with the Tree of Knowledge project.

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ENDNOTES

1. The following Second Life URL (or SURL) will transport the visitor to the virtual Department of English (The Tree of Knowledge): http://maps.secondlife.com/secondlife/HKPolyU%20Resort/160/42/611. However, an active Second Life account is required in order to access the landmark.

Dean A. F. Gui is an Instructor in the English Language Centre at the Hong Kong Polytechnic University (HK PolyU). He has also served as a Visiting Lecturer for the HK PolyU's Department of English, as a high school teacher for the Chicago Public Schools, and as a Lecturer for the California Community Colleges. With a Bachelor's degree in English Literature from Western Illinois University and a Master's degree in Creative Writing from the University of Illinois, his research interests include virtual world education, creative literature in Asia, and multi-ethnicity. In addition to his academic pursuits, Dean is also an avid poet, having had his work published in such magazines as Maverick Press, Mascara Literary Review, Fleeting, Transnational Literature*, and* Blackmail Press*. In his spare time he enjoys challenging himself by taking courses such as the online Introduction to Artificial Intelligence course delivered by Stanford University.*

Gigi AuYeung is an education technologist specializing in multimedia application. She was the Project Manager of the Virtual Hong Kong Polytechnic University (HK PolyU) in Second Life. Besides multimedia design for educational uses in virtual worlds, she is also involved in the development of web-based applications and games. Her interests lie in the areas of online and game-based learning. Gigi is currently working on a joint project between HK PolyU's English Language Centre and Chinese Language Centre to develop an online interactive platform and learning management system supporting English and Chinese reading and writing requirements across the University.

APPENDIX

Table 3. Virtual Department of English "Tree of Knowledge" survey

This survey focuses on the tree-structure of the HK PolyU virtual Department of English (in Second Life). Your participation is voluntary, and your responses will remain anonymous. Data collected from this survey will be used for research purposes only and will not be sold to the public. The questions you are about to answer target mainly your experience and thoughts on the usefulness / practicality of the tree design which is used as the shape of the virtual English department. The research follows the Code of Ethics for Research Involving Human Subjects mandated by the Hong Kong Polytechnic University and underpinned by the Declaration of Helsinki; further information can be obtained by contacting the Research Office at roro@inet.polyu.edu.hk. Please contact me if you have any questions or concerns about this survey or my research pertaining to it: Dean A. F. Gui, Language Instructor, ELC (HK PolyU), ecdafgui@inet.polyu.edu.hk. Thank you for your participation.
1. What is your degree major?
2. What year student are you?
3. What course are you taking / did you take that required use of the virtual English Department?
4. On a scale of 1 to 5, how much to you like the tree design that is used for the virtual department? Like it very much 1 2 3 4 5 Don't like it at all
5. On a scale of 1 to 5, how useful do you feel the tree design is for your learning? Very useful 1 2 3 4 5 Not useful at all
6. How much of the tree did you visit (whether for learning or just out of interest)? * All of it * Some of it * None of it
7. Where did most of your learning take place? * The roots * The outside ground / grass area * Inside the tree * The top of the tree * The tree branches * All areas * None of the areas
8. On a scale of 1 to 5, how likely are you to visit the virtual English Department again because of the tree design? Very likely 1 2 3 4 5 Not likely at all
9. List no more than five (5) things you like about the tree design
10. List no more than five (5) things you disliked about the tree design
11. How would you change the current design to make it more useful for your learning (list no more than 5 items)?
12. If you were to create a design for the virtual English Department, what would it be and why?
13. Any additional comments?
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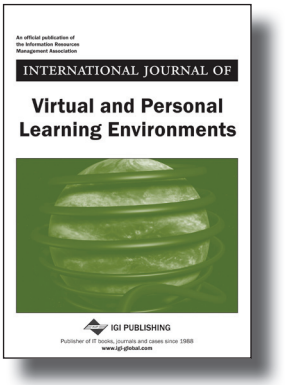

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