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Cybergogy As A Framework for Teaching Design Students in Virtual Worlds

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Abstract. *In recent years, 3D virtual worlds have been explored for design teaching, yet it is unclear whether a specific pedagogy is used or adapted for such activities. Here we describe the pedagogical model of Cybergogy of Learning Archetypes and Learning Domains, developed specifically for teaching in 3D immersive virtual worlds, and its application to introductory building classes in the virtual world Second Life for architectural design students and teachers as part of the ARCHI21 project.*
Keywords. *Architectural education; Cybergogy; language learning; virtual worlds; Second Life.*

INTRODUCTION

The adoption of new technology often involves the use of that technology to replicate previous usage, e.g. the early automobile considered as 'horseless carriage' and the use of CAD in its infancy (and even by many today) for simply reproducing 2D paper drawings (Knight and Dokonal, 2009). Similarly, we often see online virtual learning environments (VLEs) initially used for teaching and learning in a manner that replicates face to face teaching but does not take full advantage of the affordances of these environments. Kapp and O'Driscoll (2010, p.27) state that the primary challenge for today's educators in the light of disruptive new technologies is to "think outside of the classroom". Further, they argue that trainers appear to be entrapped in the classroom paradigm, and thus rendered oblivious to the potential of what they term the 'webvolution' (the evolution of the World Wide Web from its 2D roots towards 3D media) and the kinds of teaching and learning realisable by 3D disruptive technologies. The immersive nature of 3D virtual worlds allows participants to engage at deeper levels than the standard 2D VLE embedded into most institutional strategies.

Virtual worlds such as Second Life [1], OpenSim and ActiveWorlds have been used in design teaching, both as an environment for modelling real world designs and as explorations into the creation of virtual architecture (e.g. Angulo et al., 2009; Mortice 2009; Gu et al., 2009; Brown et al., 2007). These of course need to adapt traditional design teaching methods for the online environment, and in general take advantages of the affordances of 3D virtual worlds (e.g. immersion, collaboration features), but none use teaching methods formulated specifically for virtual worlds.

This paper describes the use of a specialised pedagogical model—Cybergogy (Scopes, 2009)—for teaching design students in a 3D immersive virtual world (3DiVW) environment. As part of the EU project ARCHI21 [2], which investigates language learning integrated with design learning in immersive virtual environments (Hunter et al., 2011), we undertook a number of teaching activities with ar-

chitecture and design students. Some of these were held in the virtual world Second Life (SL). We use as a case study some of the teaching activities occurring between June and December 2011. The teaching of building skills in SL was necessary as a precursor for both students and teachers of design and architecture, to enable them to be sufficiently prepared to complete their local institutional collaborative design projects as required by the project consortium as a whole.

ARCHI21

The ARCHI21 project (Architectural and Design based Education and Practice through Content & Language Integrated Learning using Immersive Virtual Environments for 21st Century Skills) is a two-year project funded by the European Commission as a part of the Education and Culture DG Lifelong Learning Programme. One goal is to provide insight into a thematic focus on fragility in physical and virtual places. The primary participating institutions include schools of architecture and design at École Nationale Supérieure d'Architecture Paris-Malaquais, University of Ljubljana, Aalborg University and the Open University; language and education partners are from the University of Southampton and Centre International d'Études Pédagogiques (France).

ARCHI21 promotes awareness of the potential of immersive virtual environments in architectural and design education using a Content and Language Integrated Learning (CLIL) [3] approach to reach Higher Education students and educators, adult learners, language professionals, practising architects and the wider community. While a key aim of the project is investigation of language learning, the activities described here focus on the use of virtual environments for design education, in particular, the development of building skills within such an environment. To that end, two co-joined Second Life islands were purchased by the project for these activities (Fig. 1) [4].

In order to provide students with appropriate skills to operate in this environment, a number of introductory teaching activities were established. These included induction classes for SL that focused on the teaching of skills required to interface with the virtual world, followed by classes on how to build 3D objects in SL (for those interested). The first session of classes was for teachers of design, most of whom had no previous virtual world experience, with design students following in a second session of classes.

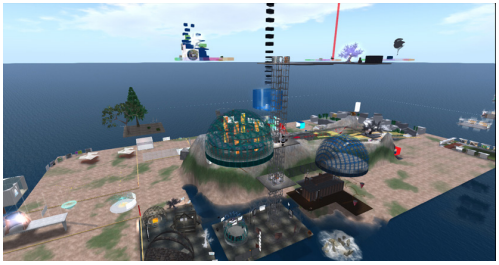
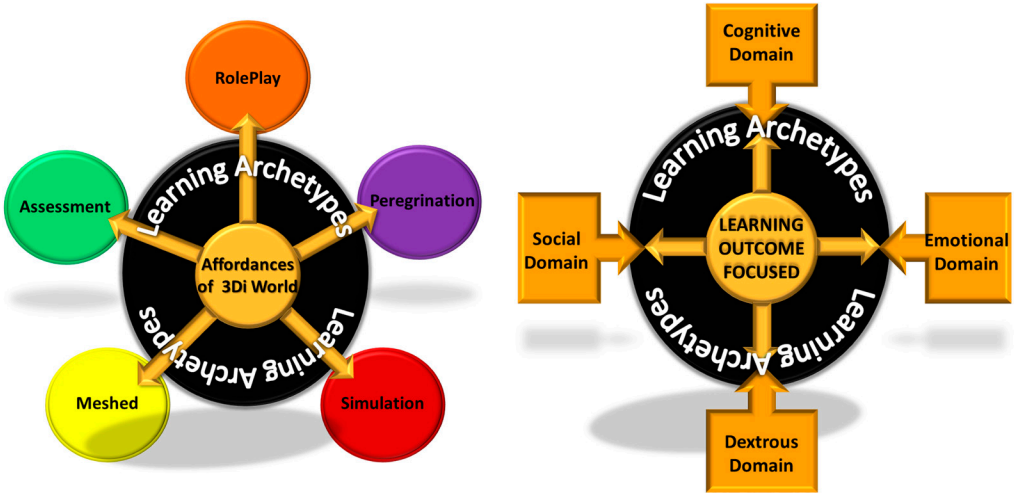


Figure 1
ARCHI21 Second Life islands.

CYBERGOGY OF LEARNING ARCHETYPES AND LEARNING DOMAINS

Unlike game-centric virtual worlds such as World of Warcraft, the virtual world of Second Life is primarily a social-centric environment. Although it can be seen to have some game-like qualities such as customisable avatars, the environment provides no game scenario and is open ended with no story narrative. Some degree of social interaction is almost inevitable, given that there are multiple channels for communication. These include public and private VoIP (voice) conversation, local public text chat, private and group instant messaging (IM), as well as features that provide an awareness of the presence of others, e.g. names of nearby avatars with viewable profiles and lists of friends online. As noted by Gu et al. (2009), Second Life supports collaboration in design learning by providing an obvious connection between a designer's avatar and the virtual object being manipulated as part of the design process. They found that co-designers benefited from the instantaneous nature of collaborative modelling, in that changes to objects could be seen by all present, with the ability to discuss them synchronously.

Figure 2
Cybergogy components.



The model of Cybergogy is underpinned by a Social Constructivist epistemology in which knowledge is constructed and internalised by the learner and is sustained by social processes. The notion, therefore, is that knowledge and social interaction are inseparable and—when the circumstances are optimal—can lead to collaboration. The model is composed of two interacting components: Learning Archetypes and Learning Domains (Fig. 2).

Learning Archetypes are categories of learning activities that capitalise on the affordances of the 3D environment, and are crafted at the instructional design stage to elicit learning outcomes that engage four Learning Domains. Originating from concepts first expressed by Kapp and O'Driscoll (2007) and later revised (2010), Learning Archetypes are the fundamental building blocks of educational activities whose locus is the plasticity of possibilities afforded by 3DiVWs. It is the game-like qualities that serve to enrich the virtual environment, setting it aside from the physical world by delimiting activities performed there.

The five categories of Learning Archetype are:

- *Role Play:* to assume a role in an alternative form (living or inanimate), with the objective of undertaking aspects of action, interaction or portrayal of emotions.
- *Simulation:* to represent real or virtual conditions for the purposes of enactment, exploration, rehearsal or evaluation.
- *Peregrination:* travel to locations, or the very action of journeying to destinations provides the circumstances under which learning can occur
- *Meshed:* creation of opportunities to combine and interconnect individuals and groups in various ways to achieve desired purposes and outcomes.
- *Assessment:* execution of appropriate methods of assessment, evaluation and feedback as part of the learning process.

Learning Archetypes are inherent to the instructional design process in providing a conceptual framework to support learning activities, thus serving as a vehicle toward attaining a condition of immersion of the learner. They are tools for the instructional designer and activities for the learner. The categories of Learning Archetype are further delineated into frames and sub-frames, which serve to steer activities toward specific Learning Domains (beyond the scope of this paper).

The second intrinsic component of the model of Cybergogy is comprised of four Learning Domains

that focus on learning outcomes: Cognitive, Emotional, Dextrous and Social. These domains represent strands drawn from the physical world and an understanding of pedagogy, assimilated to form a new taxonomy of established paradigms, and designed to draw forth all of a person's available sensibilities into the avatar mediated virtual environment. The Blended Taxonomy (Fig. 3) is based upon desired learning outcomes across all four learning domains at differing levels of implementation. For example, in a building class such as discussed here, the primary learning domain targeted is the Dextrous domain, in which the learner has to both operate the user interface with the 3DiVW and manipulate 3D virtual objects within this environment. The lowest level (1) of implementation of the Dextrous domain is the learning outcome 'Imitating'. The learner is required to imitate the actions of the instructor, supported by verbal, visual and/or text based cues. However, in order to attain this level 1 dextrous learning outcome, challenges in the Cognitive domain may need to be set much higher, i.e. levels 1, 2 and 3 (Remembering, Understanding and Applying). In essence, when all four Learning Domains are addressed, deeper learning and retention of information are expected to be attained.

This model of Cybergogy essentially acts as a structure for teachers using virtual worlds to conduct teaching and learning, enabling them to demonstrate stringent planning and benefit from the execution of imaginative, reflective practices that are felicitous for the 3DiVW, and not to simply create a virtual replication of face to face teaching methodologies or to be constrained by 2D e-learning techniques.

THE LEARNING ACTIVITIES

The classes were all held in Second Life (often referred to as being 'in-world'), facilitating distributed synchronous collaboration, with participants connecting from their individual computers at partner institutions. They included:

- a one hour induction class for SL itself;
- a ten hour class on building (modelling) in SL for ARCHI21 project teachers of architecture and design;

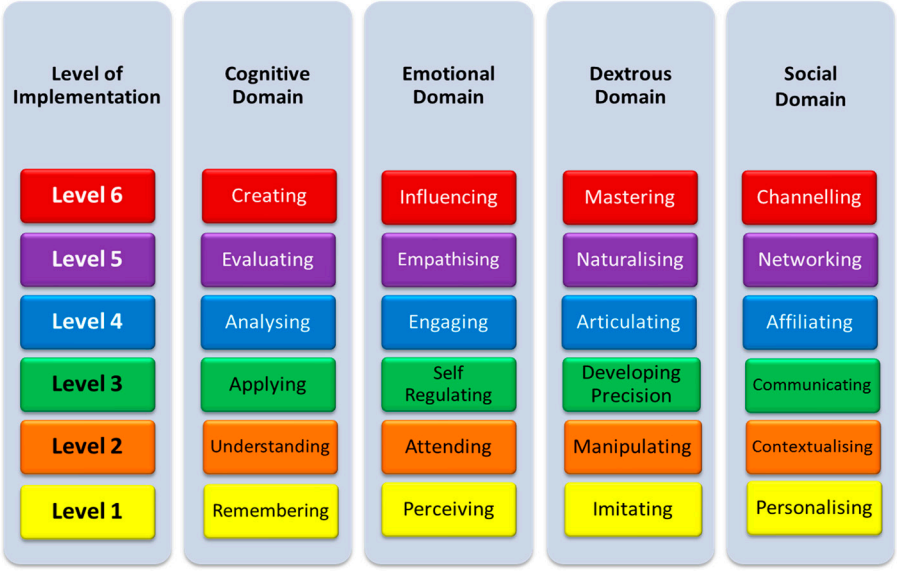


Figure 3
Blended taxonomy of Learning Domains, revised from Scopes (2009).

- a four hour class on building and presentation skills in SL for students from Slovenia participating in a traditional design studio with face to face instruction;
- a two hour class on lighting techniques in SL, in conjunction with a traditional lighting design course centred on the Slovenian design studio.

The class sessions (with the exception of the SL induction class) were taught by one of the co-authors, a project design teacher familiar with SL. The structuring of the sessions was informed by the model of Cybergogy, with the other co-author (a Cybergogy expert familiar with SL) acting as consultant.

For each class session, the instructor developed a rough session plan and passed this to the Cybergogy expert, who then developed a detailed lesson plan (Fig. 4), suggesting additional activities and strategies to incorporate more fully aspects of the model of Cybergogy, with a view to enhancing the learners experience and improving the transfer of skills from instructor to learner. This lesson plan was passed back to the instructor, who used it to further develop the teaching activities and content. The lesson plan consisted of

- aims and objectives, e.g. the session objectives for the lesson plan in Figure 4 were "Learners will acquire knowledge and skills regarding prim linking, object permissions, textures, scale and requirements that support presentations in Second Life";
- a list of activities, each with an allocated time;
- the category of Learning Archetype (with possible additional resources required);
- analysis of the Learning Domains addressed by the activity;
- the Assessment archetype (evaluation and feedback as part of the learning process); and
- associated real life activity (what the learner was actually required to be doing simultaneously in the physical world, e.g. reading a web page, discussing with other online learners, using SL building tools).

Figure 4
Extract from a lesson plan.

Time Allocated	Topic	SL Activity/Learning Archetype/ Additional Resources	Learning Domains Addressed	Learners RL Activity	Assessment Archetype
Introduce 10m+15m	*(details omitted)*				
Develop	**Building Techniques:**	**Simulation Archetype** ***Language Mediators support students during the following tasks***			
10m	• **Prim Linking**	Leader demonstrates linking/unlinking prims. Learners imitate tutor.	Cognitive Lv1&2	Attend to following 5 demonstrations	Formative Q&A to check for remembering and understanding (Cognitive) and Imitation (Dextrous)
10m	• **Permissions**	Leader demonstrates object permissions. Leader advises Learners how setting permissions over objects can limit or permit users interaction. Learners (in pairs) imitate leader.	Emotional Lv1 Social Lv3	Take notes for reference as required	Observation of practical output
25m	• **Textures**	Leader in-world presentation, demonstration. Learners imitate Leader.	Dextrous Lv1	Formulate questions in note form for summative Q&A	Based in the Emotional Domain, Learners are questioned regarding their feelings of the activity and perception of their abilities/satisfaction. Group forum is encouraged for peer feedback
10m	• **Building to Scale**	Leader presentation: Avatar size, camera issues, Mouselook	Cognitive Lv2		
25m	• **Presentations in SL**	Leader Presentation: 3D objects, slideshows, Uploading images, media on a prim, Chat, voice or text	Cognitive Lv2		Formative Q&A

A summary provided by the Cybergogy expert provided feedback on how well the lesson plan addressed all of the Learning Domains at required levels of implementation (as described in the Blended Taxonomy via the selected Learning Archetypes), and how both learning outcomes and learner immersion could be improved.

Language and subject expertise of the participants were varied. The teacher was a teacher of architecture and computing, with English as first language. The Cybergogy expert (also a native English speaker) had a background in computer based learning. The mediators were primarily native English speakers and had technical expertise. One of the class sessions, for students in Slovenia, also had a mediator in Slovenian language in attendance. The student cohorts were quite mixed: the first class series (June 2011) was for teachers of design. All were fluent in English, but as an additional language for most. The second class series (October-December 2011) was for students of architecture in Slovenia (all of whom had good skills in English, but as an additional language).

The sessions (conducted in SL) usually consisted of an instructor led presentation, incorporating some aspects of traditional pedagogy (e.g. still slides, written instructions) alongside adaptive Cybergogy strategies such as synchronous demonstrations, with students experientially imitating the instructor's activity, accompanied by real time verbal instruction and feedback (Simulation archetype / Dextrous domain, Level 1).

A site on the project island was established for the building classes (Fig. 5). Although this area was publicly accessible, only members of the building class group had permissions to build there. Features of the site included

- a presentation and demonstration area with boards for display of PowerPoint, web pages, video and an interactive whiteboard;
- building tips, tools for learners' personal use, and examples around the borders of the class area;
- an immersive lighting chamber, allowing live demonstrations and experimentation (Fig. 6);
- room for learners to practice (during lecture/demonstrations and afterwards). There was also a general public 'sandbox' area on the island, which allowed building (practice or otherwise) in an environment without risk of damaging existing built objects.

Toolkits were available for students to take at class sessions. These included a) links to online versions of the session content (class information, PowerPoint slides, links to resources including tutorials, places to visit in SL, building aids); b) modifiable sample objects and scripts, which demonstrated learning objectives for each session); and c) SL building tools for student use. Structured class sessions were usually followed by independent practice, where mentoring was available when required. On occasion, using the Peregrination archetype, there were planned expeditions to relevant sites in SL (e.g. virtual places of architectural interest).

As the technology can be tricky to learn and occasionally unreliable, we adopted a 'belt and braces' approach to dissemination and communication, i.e. multiple ways of viewing the lecture slides and be-

Figure 5
Building class, showing presentation boards, toolkit boxes, learners' experiments and immersive instructor texture demonstration.

Figure 6
Class demonstration in the lighting chamber.

ing present in the class (e.g. in-world, web based screen sharing, web streaming and whiteboard sharing). Several communication channels were available, including SL voice and text chat, with Skype as a voice fallback. A brief excerpt of a typical text chat discussion during a lighting tutorial is shown here:

Student: how can we put a light on a surface without glare something like a LED?

Tutor: If I understand correctly, you want the light source to appear sharp. To make the light source look like a light is coming from it, you can go into the texture setting for the PRIM itself, and set Full Bright on. Glow would also give it a varying glow, which is perhaps what you may or may not want.

Student: we want to use for illuminate the pavement.

Screen sharing proved very effective, as it allowed learners to view the instructor's screen from his point of view and follow as he performed a sequence of actions using the fairly complex SL interface. This also allowed those unable to sustain an in-world presence (due to technical issues) to follow the live class proceedings.

DISCUSSION

The strength of the model of Cybergogy is in its ability to engage the four major sensibilities of the learner by means of the Learning Domains. By catering to these major domains, the teacher can create compelling holistic experiences to transport the learner into an immersed condition of learning. As seen in the lesson plan (Fig. 4), the session objectives were to 'acquire knowledge' (in the Cognitive domain) and 'acquire skills' (in the Dextrous domain). The fundamental learning outcomes, in essence, precluded learning outcomes in the Emotional and Social domains. The Social Constructivist nature of Cybergogy provided an opportunity for the mediators to facilitate an atmosphere of collaboration to engage the Social domain at level 3 (communicating). The Meshed archetype has a direct relationship with the Social domain and should be utilised in order to establish group cohesion and foster collaboration.

The classes described here focused on an introduction to the 3DiVW and building within it. Had these sessions been design (as opposed to building) classes, the Emotional domain could have been more effectively engaged, at level 1 (perceiving emotion) and perhaps level 2 (attending to emotion), e.g. in discussing and reflecting upon design decisions. As it was, the sessions planned were weaker in both of these domains, simply because the implementation of Cybergogy became overshadowed by the essential learning outcomes, coupled with time restrictions and other problematic logistics. In order to strengthen the inclusion of the Emotional domain, learners were asked to reflect upon their experience along with their perception of the learning outcomes.

Language acquisition was not a major aspect of these classes (as was the case in other project activities), but it was supported by the provision of language and technical mediators. The English language skills of all participants were of a high enough level that there did not appear to be any comprehension problems. However, there were issues that arose, e.g. users' software with different language interfaces. This leads one to consider the need to map technical terms between languages in multi-lingual environments.

In early class sessions the mediators tended to take an observer's role, for use in analysis of the project activities. During the course of the sessions, mediators began to take on a more active role providing technical assistance, but the language aspect was addressed only through observation (as there appeared less need for active language mediation). Consequently, one should consider how language mediators might perform an active, facilitating role in alignment with the Cybergogy framework for such project activities.

Some class sessions were very busy, with many participants in different roles: instructor, students, mediators and observers. While an effort was made to make these roles easily distinguishable (e.g. titles

above an avatar's head, special headgear), in one session it was difficult to identify avatars in a crowded virtual space that lacked any structure to avatars' locations. One unresolved question is whether this had a detrimental effect on knowledge transfer and learning. This is an example where real world situations transposed into a 3DiVW might utilise solutions analogous to those in the physical world (e.g. breakout sessions, which were used on one occasion).

Body language is often a common way to obtain feedback from students, e.g. are they paying attention? In a virtual world this is not possible; one must often rely on more direct means. If there is not an ongoing dialogue between instructor and student, it is necessary to periodically stop and conduct an evaluation addressing each individual, which could be as simple as asking if there are any questions.

Although a stated prerequisite for the classes was some basic knowledge of SL (a few hours acclimatisation and exploration), this was not the case for many of the participants (both learners and mediators). As a result there were very mixed cohorts of learners and mediators, with many technical problems encountered by those with less SL experience. This contributed to delays in the class sessions: for example, presentations were often halted while learners' technical problems were being addressed, occasionally resulting in the discarding of part of the lesson plan.

CONCLUSIONS

We have reached a number of conclusions based on the outcomes of the teaching sessions.

We have learned which technologies work well and which don't (e.g. through steep learning curves, instability, high resource requirements, or inadequate outcomes).

The 'belt and braces' approach to teaching with technology served us well, with several occasions where participants needed to switch tools (e.g. voice to text chat, use of screen sharing for better learner comprehension, viewing of external web pages). A switch was often the result of a need to address either a technical problem or learner comprehension. This indicates that a broad, flexible approach is important, and that the instructor should be able to switch between multiple tools with ease.

The learning curve for SL and similar 3DiVWs tends to be considerably higher than a novice typically anticipates. We believe the amount of time required for both induction and building classes needs to be greater than that allocated for our activities; this includes time for students to explore independently, thus giving participants an adequate skill foundation to participate in the building classes and experience the social and cultural diversity of virtual worlds. The limited amount of contact time for the classes and many participants' lack of prior experience in-world were factors that led to insufficient accomplishment of some of the desired learning outcomes. The result was that the students' subsequent use of SL for their design projects was not as extensive as anticipated. The use of the 3DiVW environment should be tightly integrated into the curriculum (with tangible support and participation of the design teachers) and not considered as an optional 'add-on'.

The use of detailed lesson plans mapping Learning Archetypes and Learning Domains to the learning activities is paramount to the adoption of this model and should be prioritised when developing a curriculum. Given the likelihood of technical mishaps and the diversity of the learners' initial skill levels, these lesson plans should be highly flexible and adaptable, particularly with regard to activity timing.

We are using what we have learned to aid in the development of the learning activities for the project's final stages in mid-2012. These will also be incorporated into a number of project deliverables, including a) packaged content for delivery of these courses in Second Life and similar 3DiVWs; b) 'learning objects' for Cybergogy and architectural lighting design (focusing on the virtual world); and c) best practice guidelines for architecture and design students and practitioners in 3DiVWs. By being freely available to design educators, students and profes-

sionals, these resources add to the body of knowledge for teaching and learning in virtual worlds.

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