Designing the Virtual Campus as a Virtual World

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Abstract. Virtual Worlds are networked environments that look like the physical world, and create a sense of place for the person communicating, navigating, and doing things in the virtual world. Virtual worlds have traditionally been developed as games, in fact, most virtual worlds today are games. A virtual campus has been developed in the Architecture Faculty at the University of Sydney that is based on some of the concepts of virtual worlds. The virtual campus is a place on the internet where students can go to take courses, meet with academic staff, and communicate with other students. The development of the virtual campus has been influenced by research in design science and is based on the conceptual metaphor of architectural design. The design of the virtual campus is considered at three levels: the implementation level, the representation level, and the interface level. Identifying these levels provides a basis for the design of virtual worlds for professional and educational environments. The consideration of the representation level results in a consistent use of a conceptual metaphor so that a person in the virtual campus can make use of the facilities in an intuitive manner.

Keywords: virtual campus, design, virtual worlds, architecture, design computing

1. Overview of The Virtual Campus

The Virtual Campus in the Faculty of Architecture at the University of Sydney was established in 1997 (Maher, Skow, and Cicognani, 1999). The Virtual Campus provides a comprehensive facility for internet learning for professional students, and local and overseas students. In some of the courses taught in The Virtual Campus, the students do not need to travel to the physical campus to attend lectures, seminars, or access learning materials. The Virtual Campus is used to:
1. augment traditional lecture-based teaching with online learning materials and communication
2. support project work that follows an intensive face-to-face learning program
3. provide distance learning with all interactivity and materials available online

These functions can be provided by a combination of Web-based learning materials with email and an electronic bulletin board. We have decided to provide an environment for a learning community rather than to limit the Virtual Campus to multimedia presentations of learning materials. In order to do that we have designed and constructed a Virtual Campus that has a similar function to the physical campus in providing a place to meet people, talk about projects, and bump into people unexpectedly.

In addition to the online materials giving access to materials at any time, lectures and seminars can take place in the Virtual Campus. At first, it looks as if the computer-mediated teaching is equivalent to traditional teaching. Our experience in the Virtual Campus shows that teaching and learning in a computer- mediated environment is sufficiently different, that the selection of face-to-face or computer-mediation need not be made on the basis of distance and location only. In some cases, we choose to hold a seminar in the Virtual Campus even when all the students are present in the physical campus.

We have experience in two types of online learning scenarios and their equivalent in traditional teaching: the virtual lecture and the virtual seminar. Experts in education methodologies have mixed views towards the efficiency of the lecture as an educational medium. However, an excellent lecture can be inspiring and it remains one of the most emulated models in online learning. The virtual seminar, in contrast to a lecture, is an online meeting to discuss a specific topic where the discussion is moderated. The major difference in the lecture and the seminar is the expected roles of the lecturer/moderator and the students. In a lecture, students are expected to listen, take notes, and occasionally ask questions. In a seminar, students are expected to come prepared to discuss a particular topic and may contribute to the discussion as much as the moderator.

The usual expectation is that virtual lectures in online learning are delivered either through the means of videoconferencing technologies or as recorded video materials. Due to the requirement for high bandwidth and specialised equipment we do not provide video taped lectures in the Virtual Campus. We focussed our

efforts on developing a virtual lecture model that does not require expensive hardware and software environments. The development of an effective lecture under such limitations is a challenging task. For the Virtual Campus, we audio tape a lecture to the students in the physical lecture theatre. After the lecture we split the audio recording into segments, in a way that the content of each segment is related to a corresponding slide. We link the audio content to each slide and make this visual/audio material available as individual slides online. The virtual lecture is available to students that actually attended the physical lecture and to distance students that did not attend the lecture. We have found that this online material is visited as much by the local students as it is by the distance students. This indicates that the virtual lecture serves as a resource that is different and complementary to other online materials.

A virtual seminar can be held both in synchronous and asynchronous mode. Asynchronous seminars are realised through computer-mediated bulletin boards. Synchronous seminars occur at a specific time in a classroom in the Virtual Campus. The classroom is equipped with a slide projector so the moderator can show slides to guide the discussion. There is also a shared whiteboard that the moderator and the students can write on. All discussion is "typed" in a chat-like environment. These online seminars show a remarkable difference to their physical counterpart. Usually discussions have an initial "cold" period, when participants are arriving, looking at the slides on the screen, and having social conversations. However, once started, discussions can break into several simultaneous streams and can move off the central topic. The role of the moderator is to prevent distractions and keep the focus of the discussion. Moderators make sure that all students have equal opportunities to participate in the discussion. Students also act as moderators in some circumstances by calling on other students to comment. In general, we have found that more students participate in virtual seminars than in face-to-face seminars and the focus on the instructor as moderator is not as pronounced.

The Virtual Campus makes extensive use of online learning materials, schedules, student tracking, online assessment, etc. What makes the Virtual Campus special is that it also provides a place, integrated with access to the online materials, in which students can attend lectures or seminars, or meet casually.

2. Designing The Virtual Campus

The design of The Virtual Campus is originally based on the virtual world concept. Virtual Worlds are networked environments that look like the physical world, and create a sense of place for the person navigating and doing things in the virtual world. Virtual worlds have traditionally been developed as games, in fact, most virtual worlds today are games. Our experience so far is that people are familiar with the idea of virtual worlds if they play computer games, otherwise, they are not familiar with the approach we have taken to design our Virtual Campus.

The design of The Virtual Campus is also influenced by the similarity between the physical world and the possibilities for leveraging this similarity in the virtual campus. The experiences of others using text-based virtual worlds for education highlights the benefits of the consistent use of the conceptual metaphor of building design. We were influenced by Diversity University[1] where the analogy with the physical campus not only provides a basis for the design of a physical campus, but also opens up possibilities. In addition to the provision of places to access teachers, students, and learning materials, the physical campus as buildings and rooms provides ideas about social environments, access to personal office space, the intended function and use of furniture and equipment, etc.

Finally, the design of The Virtual Campus is influenced by recent research in design science on the representation of designs according to their function, behaviour, and structure. The concept of a design prototype, as introduced in Gero (1990) has been used extensively in the development of knowledge-based design systems. These developments have led to an explicit representation of the functions and behaviours of buildings and their components. Some of these functions can translate into the Virtual Campus and new functions can emerge.

We present the design of the Virtual Campus at three levels: the implementation level, the representation level, and the interface level. At the implementation level we look at the decisions made to select an implementation environment and technology. At the representation level we look at the basis for identifying the virtual components of the Virtual Campus that have a physical counterpart. At the interface

level we look at how we structured the way in which the student interacts with the places, materials, and other people in the Virtual Campus.

2.1 The implementation level

The Virtual Campus is implemented as an object-oriented database, based on the LambdaMOO core (see Benedikt and Ciskowski, 1995). The database is accessed visually through dynamically created Web pages as well as through a telnet connection for simple interaction and advanced programming. External tools are maintained as stand alone tools, loosely integrated with the Virtual Campus. The major external tool in the current implementation of The Virtual Campus is WebCT[2] courseware.

The object-oriented database provides the basis for all aspects of the Virtual Campus:
÷   the implementation of the infrastructure of the places such as classrooms and offices,
÷   the implementation of the things in the place such as slide projectors, seminar recorders and people, and
÷   the implementation of the administration of the place such as the objects for information about registration of people and programming changes,
÷   the implementation of the interaction with other environments such as the web browser and WebCT.
Figure 1 illustrates the basic hierarchy of the database.[3] The root object defines the basic characteristics of all objects in the Virtual Campus. The first level of object types includes: person, room, exit, thing, and administration. A generic person is the basis for creating students and academic staff in the Virtual Campus. By creating a reactive object for each person, a student can customise his object representation to personalise himself and to have it behave as the individual wants. A generic room is the basis for the representation of classrooms, offices, elevators, etc. The exit is an object for connecting rooms that allow people and things to leave and enter. A generic thing is the object from which the object instances of furniture, whiteboards, slide projectors, notes, etc. derive their basic properties and verbs. The actions that can be performed on a thing include take, get, put, erase, etc. The administrative objects are there for programming purposes and generally are not relevant to the students.
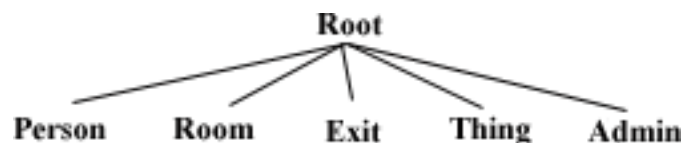

Figure 1. Object hierarchy in the Virtual Campus database

The object-oriented implementation environment is available to the people in the Virtual Campus for basic navigation and creation of new objects. It is also available as a programming environment if the person wants to customise the tools available to himself in the Virtual Campus.

2.2 The representation level

The representation of the Virtual Campus is based on the conceptual metaphor of architectural, or more specifically, building design. The infrastructure of the Virtual Campus is comprised of rooms and things. The room is a generic term for any kind of self contained space, so a room could also be interpreted as a hallway or an elevator, as well as a classroom. The initial development of the Virtual Campus as a text-based virtual world was based on the study of the use of language in design (Cicognani, 1998a and b). The continued development of the representation of the Virtual Campus is based on the extension of the conceptual metaphor of virtual architecture.

In developing a representation of the virtual room, we start with a prototype representation of physical room and adapt it. A design prototype, according to Gero (1990), includes a categorisation of parameters and knowledge about a class of design objects according to function, behaviour, and structure. A design prototype in the Virtual Campus includes the properties that characterise the features of a specific room and the verbs that describe what can be with the room. The features of the virtual room are defined by comparing the similarities between the function and structure of a physical room with the counterpart in a virtual room. This idea is illustrated in Figure 2 for a simplified prototype of a room. The two representations comprise several similar functional properties, but differ in the amount, type content and detail of structure properties. The behaviour of a room in the Virtual Campus can be quite different from

what is assumed in the building design metaphor. The virtual room exhibits not only the usual passive behavior of information container, but can interact with its inhabitants, for example, by responding to questions or automatically removing items that do not belong in the room.

	Physical Room	**Virtual Room**
Function	security privacy meeting environment storage	security privacy communication storage
Structure	floor shape and size wall height door location window size and location	properties: - description - owner - location verbs: - enter - lock - clean

Figure 2. A simplified prototype representation of physical and virtual rooms

The object representation of a room in the Virtual Campus is modeled after a generic container. Thinking about a room as a container, the list of contents is an important aspect for the functions of a room. The contents of a room may include people, furniture, and equipment. The following basic functions of a room are described according to their effect on the contents.

÷ Communication – all contents of a room that are people receive communication from other people in the room (similar to physical proximity and auditory privacy in a physical room).

÷ Security – all contents of a room can be locked to the room so that others cannot take them (similar to the equivalent security possible in a physical room).

÷ Storage – the contents of a room that are not people effectively allow a person to store objects in the room.

÷ Visual privacy – the people in the room can only see the activities in that room, activities in other rooms are not shown.

The elaboration of the representation of the object and places in the Virtual Campus are based on the features of their counterpart in the physical world. The following concepts are used in the Virtual Campus:

÷ Classroom – a place for lectures, seminars, and access to slides, notes, and bulletin boards.

÷ Conference room – a place for larger groups to attend and discuss presentations.

÷ Office – a personal working place for individuals.

÷ Meeting room - a place for small meetings and discussions with presentation and recording equipment.

÷ Studio - a place for designing and working on projects.

÷ Whiteboard – a surface for brainstorming and saving important comments in meetings.

÷ Slide projector – a piece of equipment that holds a slide carousel and presents slides to everyone in the room.

2.3 The interface level

The interface to the Virtual Campus is based on a combination of icons and hyperlinks in a web window and commands in a telnet window. These two types of clients, the web browser and the telnet window, are standard and therefore accessible to anyone. The interface is shown in Figure 3 for the classroom for the Hypermedia course. The components of the interface are marked as red numbers.

1. The display area. This a multifunction window used to display the point-and-click interface to the room. In this window you can navigate between rooms, inspect objects, read notes, etc, by clicking on

the links. Different rooms have different objects, depending on their function, for example you usually find whiteboards and bookshelves in classrooms. This window is also used to display some of the tools, for example the slide projector screen, or as a display for other tools, for example, the who tool.

2. The icon area. This window contains icons that allow you to access a number of tools in the Virtual Campus. If you click on one of the icons, the display area will switch to display that tool. The icons shown, from top to bottom are: the room view, the slide projector, the whiteboard, the book, the who tool, the mail tool, and the help manual.

3. The text area. This is basically a telnet client providing a chat-like window with a command driven interface to the object-oriented database of the Virtual Campus. Here you see text feedback from your actions, text descriptions of the behaviour of other people and objects, and the conversation taking place in this room.

4. The text entry area. This is where you can enter commands, and talk to other people.
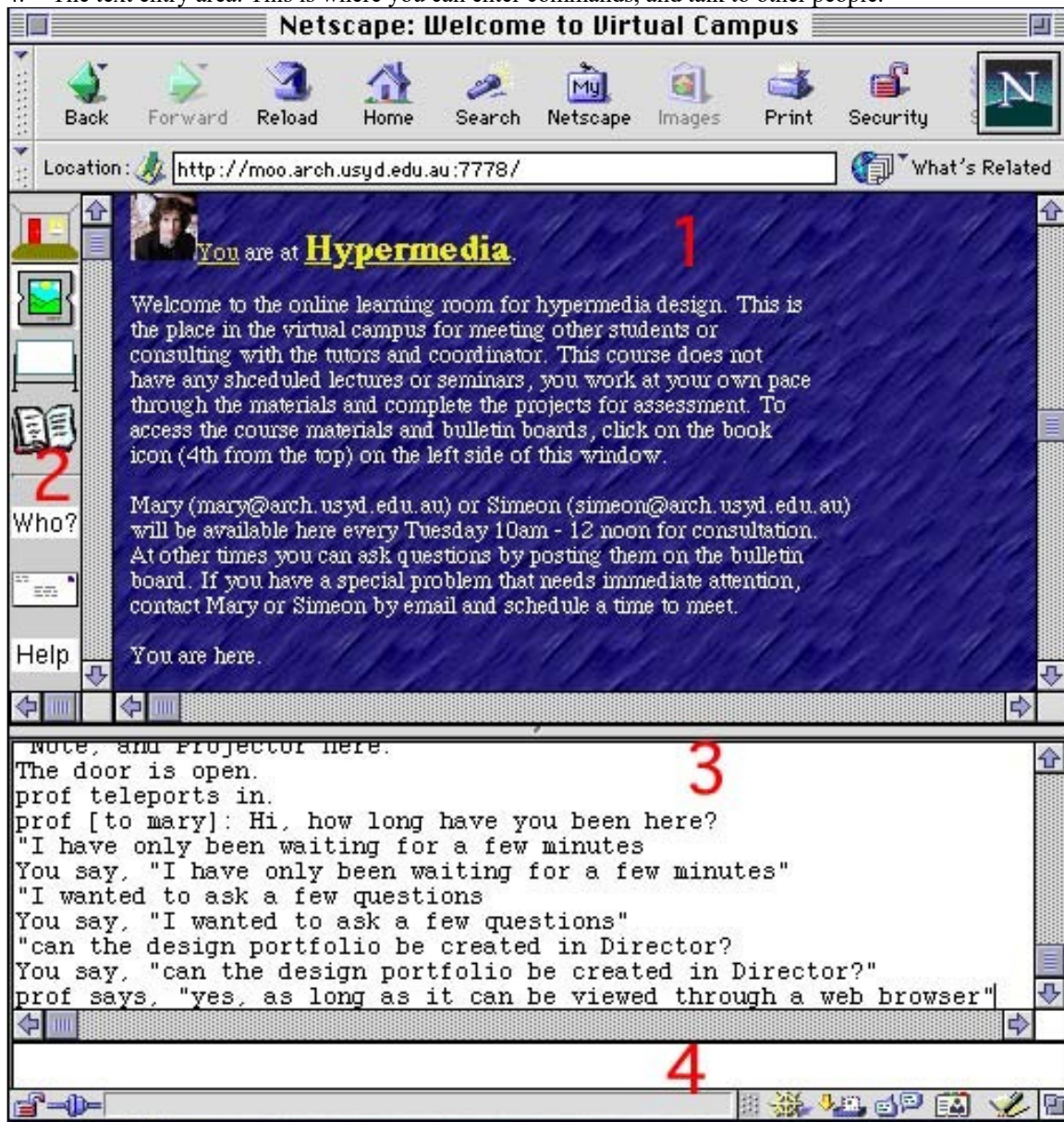

Figure 3. The interface to the Virtual Campus

Each room in the Virtual Campus is linked to a broad range of course materials and tools in the WebCT environment. The course materials can be accessed through the "book" icon. Though WebCT is a stand-alone tool, implemented separately to the Virtual Campus, information about the student and the course are passed between the applications. This link preserves the continuity between the virtual learning space and the online learning materials. Figure 4 shows the corresponding course materials interface for the Hypermedia course. The various components of the course materials and tools shown are:

÷   Information pages: these are web pages which provide information about the use of the campus and the objectives, unit value, and assessment.
÷   Calendar: the calendar is used to post public notices about lectures, seminars, meetings, and for individuals to post private notices for organising their own time. Notices can have links to reading material.
÷   Bulletin Board: a tool for carrying on discussions and questions about the course material.
÷   Course Content: a nested graph of course notes and reading material.
÷   Submissions: a tool for uploading student files for assessment.
÷   Online Quizzes: a tools for completing and grading quizzes
÷   Student Tools: a separate page of tools to assist the student in tracking their own performance and keeping track of where they are in the course content.

Other tools include glossaries, an index, a search tool, etc. The use of consistent icons style for all courses simplifies navigation within course materials.
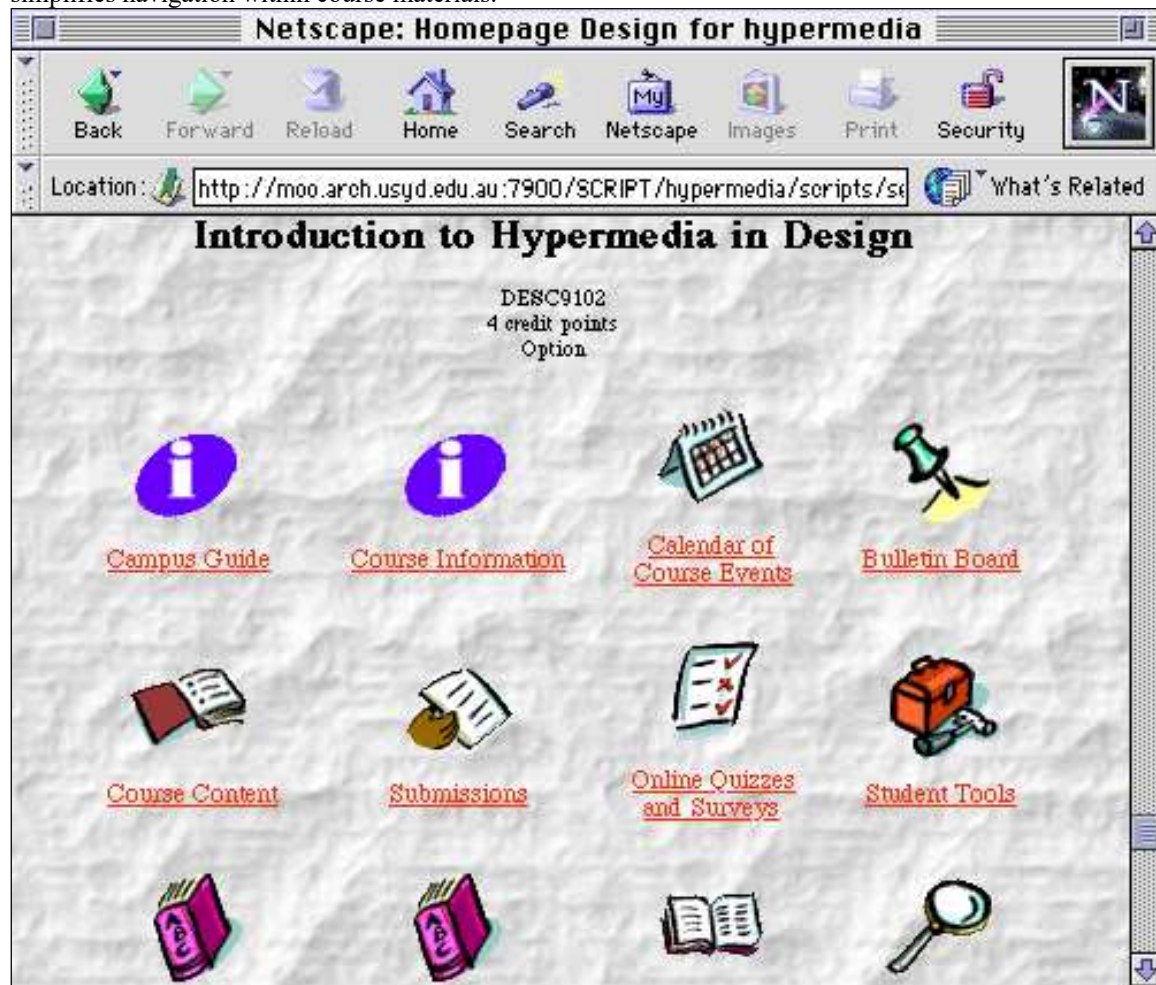

Figure 4. The interface to the course materials in WebCT

The interface for the Virtual Campus is changed as new tools are added, but the access to the Campus is through the standard Web browser. There is a capability to view the room as a VRML file, where the 3D model is stored in the object-oriented database. This aspect of the interface has not been fully developed.

3. Conclusions

The Virtual Campus described in this paper focuses on providing a place for students to learn and develop as part of a learning community. The design of the Virtual Campus combines aspects of virtual worlds and the sense of place they create with the flexible learning tools available to present and manage learning materials. The design of the virtual campus is presented in three levels: the implementation level, the representation level, and the interface level. The use of an underlying object oriented database for the implementation level has facilitated the incremental growth of the Virtual Campus. The consideration of the representation level and the conceptual metaphor of building design, provides an intuitive environment with the ability to expand to aspects of the physical campus not usually found in a virtual campus. The interface level directly addresses the functionality of the Virtual Campus to its users, the students and teachers.

Acknowledgements

Notes

1. http://www.du.org
2. http://www.webct.com
3. The hierarchy in Figure 1 is not accurate but it is illustrative of the different types of objects.

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