DESIGNING AND LEARNING WITHIN THE DESIGN

A Case Study of Principles for Designing and Teaching 3D Virtual Worlds

N. GU
School of Architecture and Built Environment
University of Newcastle, Callaghan 2308, Australia
Email address: ning.gu@newcastle.edu.au

AND

L.F. GÜL, M.L. MAHER
Key Centre of Design Computing and Cognition
University of Sydney, Camperdown 2006, Australia
Email address: {lgul3679, mary}@arch.usyd.edu.au

Abstract. Within most architecture and design schools, 3D virtual worlds are traditionally perceived and used as a CAAD tool for modelling and collaboration. Building on the understanding of virtual worlds as the extension of our physical environments where people can inhabit and participate in a variety of activities, we teach designing virtual worlds as a design subject which considers 3D virtual worlds as a different kind of environment design other than a technical tool for supporting design simulation and collaboration. This paper reports on our teaching experience, as well as discusses the principles for designing and teaching in 3D virtual worlds.

1. Introduction

Supporting a wide variety of human activities online, virtual worlds are networked environments designed using the place metaphor. 3D virtual worlds (3DVW) distinguish themselves from other networked technologies by having place characteristics. It is not just another communication tool but the “ultimate destination” where we shop, are entertained and get educated (Kalay and Marx, 2001). Although virtual worlds have gradually become an important part of the holistic living environments we inhabit, most architecture and design schools often do not recognise designing virtual worlds as a design subject, rather focus on the technical aspects as a CAAD tool for design simulation and remote team collaboration. The most notable example of this focus is the concept and development of virtual design studios (Schnabel 2000; Kvan et al 2000; Maher 1999). From the 1990s, virtual design studios have been set up by architecture and design schools around the globe allowing remote collaboration on design projects.
Commercial 3DVW platforms such as Active Worlds (AW)\(^1\) and Second Life (SL)\(^2\) also set up 3D virtual campus platforms. Researchers meanwhile have taken an interest on the impacts of such environments on learning. Kvan (2001) argues that while design teaching has traditionally focused on the product, virtual design studios allow students to learn more about the design process. Dickey (2005) suggests 3DVW like AW can provide “experiential” and “situated” learning. Clark and Maher (2005) examine the role of place in virtual learning environments that encourage “collaboration and constructivism”. Prosolova-Forland (2004) assesses the use of 3D virtual learning environments for supporting social awareness among students. Wyeld et al (2006) focus on the cultural aspect in virtual learning environments where students from different cultural backgrounds learn collaboratively. 3DVW as an emerging technology for architectural design, team collaboration and learning have been indeed widely recognised and studied, however there is a general lack of research and practice in exploring and teaching designing 3DVW as a design discipline in its own right.

To recognise the significance of designing 3DVW as an emerging design discipline that crosses the fields of architecture and computing, we have been teaching a postgraduate course “Designing Virtual Worlds” since 2001. Structured as a design subject, our course explores (1) the relationship between virtual world design with traditional architectural design, and (2) its potentials beyond being a CAAD tool for architectural simulation and collaboration. This paper shares our teaching experience and discusses principles for designing and teaching 3DVW.

2. Designing 3D Virtual Worlds: Designing within the Design

Virtual World Design and Architectural Design: The early development of 3DVW has been closely related to architectural design due to its use of the place metaphor. Through this metaphor, virtual worlds can inherit many of the characteristics from architecture. Massively Multiplayer Online Real Life Games (MMORLGS) as well as those examples for sole simulation purposes such as virtual heritage worlds and military simulation worlds only aim to mimic the physical world. As a result, the focus of these designs has been placed on virtual reality and social aspects in order to make the virtual environments as close to their physical counterparts as possible.

Virtual World Design and Interaction Design: Designing 3DVW can go beyond imitating the physical world and still focus on accommodating human activities, in particular, interactions that are not readily available in the physical environments. The examples of virtual world design as interaction design can include the largely popular interactive online games and the recently emerging agent-based intelligent worlds. Situated in an environment, a software agent is capable of reasoning about the world and acting upon its beliefs and desires (Wooldridge 2000). Mediated with software agents, 3DVW become intelligent networked environments. Smith et al (2003) develop 3DVW that respond to their inhabitants in reflective, reactive and even proactive modes. This is achieved by applying a multi-

\(^1\) www.activeworlds.com
\(^2\) www.secondlife.com
agent model which enables each component in the virtual world to be an agent. Using a design agent model, Gu and Maher (2005) develop dynamic 3DVW that are designed and modified as needed during their use.

**Designing within the Design:** Maher and Simoff (2000) first characterise the design activities in 3DVW as “Designing within the Design”. Unlike in CAAD systems, virtual designers are represented as avatars that are immersed within the design. This idea has also been studied to enhance remote team collaboration in architectural practice (Rosenman et al., 2005). 3DVW provide an integral platform that utilises team collaboration, design representation, modelling and in the case of designing 3DVW, even design realisation.

3. The “Designing Virtual Worlds” Course

In 2006, “Designing Virtual Worlds” was taught as a full-semester (13 weeks) unit. The weekly format includes a 1-hour lecture and a 2-hours design studio. This course attracted 20 postgraduate students from the disciplines of architecture, engineering, design computing and digital media, to explore interesting ideas and new possibilities of 3DVW.

**Course Aim and Structure:** the aim of this course was for students (1) to develop an understanding of 3DVW as a new kind of environment design, and (2) to gain knowledge and hands-on experience in design and implementation. The course content was structured to have two major components: understanding and designing 3DVW. In order for students to develop the understanding of virtual worlds, firstly, relevant literature and design examples were introduced and discussed. Secondly, students were instructed to inhabit and critically assess a wide variety of virtual worlds and report in a short essay. In order for the students to gain adequate design knowledge and technical implementation skills, two design projects were scheduled as the major submissions for the course.

**Design Projects:** With structured design supervision and technical tutorials, the two design projects (one individual and one group project) provided opportunities for students (1) to develop and apply design principles of 3DVW, (2) to master the knowledge and techniques for virtual world implementation, and (3) to exercise individual design and group collaboration skills. In the individual project, each student designed and implemented a personal virtual gallery for displaying their digital design portfolios. The whole class was then divided into 4 groups. Each group designed and implemented a virtual place. Through interactions between the avatars and the designed place, the group’s understanding of virtual experience would need to be demonstrated. The virtual place and the virtual experience were documented in a digital video.

4. Principles for Designing and Teaching 3D Virtual Worlds

Based on our teaching experience and the course outcomes, we summarise the following principles for designing and teaching 3DVW.
**Design Metaphor:** The use of the place metaphor is important. Without the use of this metaphor, current design issues of 3DVW such as layout, virtual object design and navigation problem all become irrelevant, and if not for these place characteristics, 3DVW are simply computing entities. On the other hand, in order to explore the potentials of virtual worlds, designers need to think beyond principles of physical architecture. In our teaching, to prevent students from being too fixed on architectural design conventions, the course projected virtual worlds as a wide variety of experiential environments ranging from the familiar simulations of the physical world to interactive environments and to the vaguely “experience” design. In the final group project, we used “virtual experience” and “virtual story telling” as the design themes to encourage students to explore 3DVW from different perspectives. The 4 group submissions reflect on the diversity of virtual world designs. One group explored the virtual gaming experience, one group re-constructed a well-known fairy tale and the other two groups explored the ideas of “virtual living” and “virtual life”.

**Library-based Design vs. Parametric Design:** Over the years, a variety of 3DVW such as Adobe Atmosphere (AA), AW, Blaxxun, SL, Virtuols and Virtual Worlds (VW) have been tested and applied in our teaching. AW and SL were chosen for 2006 because they each support a distinctive design method for 3DVW. They also each possess an active online community which can provide useful resources for inhabiting, studying and designing virtual worlds. AW supports the so-called library-based design method and SL supports the parametric design method. Typically, a library-based design comprises a set of objects whose forms are pre-defined outside the world and provided by the object library of the design platform. To modify the forms require object library updates. A parametric design comprises a set of objects whose forms are determined inside the world by selecting geometric types and manipulating their parameters. They can also be freely adjusted within the world at a later stage. Design platforms that support the parametric design method are therefore modelling tools as well. We discovered that in library-based designs, students with less modelling experience rely heavily on the use of standard library objects provided by AW. As a result, library-based designs typically have a uniformed “AW look” due to the repetitive use of standard library objects.

**Metaphorical Approach vs. Virtual Approach:** Two approaches to designing 3DVW can be metaphorical and/or virtual. We define the metaphorical approach as having a strong influence from the physical environments, for example, designs that mimic physical forms and/or physical experience. We define the virtual approach as having a focus on the unique qualities of virtual worlds, for example, designs that explore interactions and experience that are not readily available in the physical world. Figure 1 shows two virtual gallery designs. The one on the left-hand side took the metaphorical approach aiming to create a familiar atmosphere similar to a physical gallery. The other design took the virtual approach to

---

3 AA was developed by Adobe Systems and was discontinued.
4 www.blaxxun.com
5 www.virtuols.com
6 VW was developed by Microsoft Research and was discontinued.
explore how the virtual gallery can actively “interact” with the visitors: the
gallery will self-modify its design according to the presence of the visitors.

Figure 1. Student designs: simulated gallery (L) and interactive gallery (R).

Figure 2 demonstrates two different experiences that can be provided by
3DVW. The one on the left-hand side mimics a physical event “Australian
Idol” contest and the other one aims to create a “Fantasy Land” that only
exists and makes sense in the virtual worlds.

Figure 2. Student designs: scenes from “Virtual Idol” (L) and “Fantasy Land”(R).

Skills and Assessment: Designing 3DVW can be for different purposes
with different foci. The design process in general can involve at least three
different sets of skills: architecture-related skills (place design), digital
design skills (modelling, imaging, video and audio production, scripting and
programming), and generic design skills (problem solving, team
collaboration). In our case, the individual project exercised all required skills
for designing 3DVW. In the group project, we grouped students with
different backgrounds and allowed them to work on their own interest and
expertise. For assessment, the design qualities of 3DVW are different from
those of the traditional environment designs and therefore require multi-
dimensional criteria that address the three different sets of skills needed for
designing 3DVW. Jury members are invited from the areas of architecture,
interaction and game design, and computer programming to provide students
with feedback from different perspectives.

Designing and Learning within the Design: the two virtual world
design platforms AW and SL used in the course not only provide virtual site
and technical tools for implementing student designs, they also provide
resources for teaching and learning. We constructed a common area in AW
where the whole class can participate in online lectures and discussions. This
common area also provides students with flexible access to online course
materials. Students use the in-world communication features for group
meetings and collaboration. The well populated online communities of AW
and SL provide students with a rich collection of design examples for
references and critiques.
5. Conclusion

This paper presents our experience in teaching 3DVW as a design subject and discusses the principles for designing and teaching 3DVW. Compared to other approaches where 3DVW are used as a technical tool for CAAD modelling or virtual learning, our approach that regards 3DVW as a design discipline adds new dimensions to 3DVW. These include the considerations of interaction design, metaphorical/virtual design and experience design other than mimicking the physical world. 3DVW as a design subject will prepare future generations of design students to develop an understanding of 3DVW as a new kind of environment design, which has become an important part of our holistic living environment. The emergence and further integration of this subject with the current teaching curriculum will suggest new opportunities and challenges for architecture and design education.

Acknowledgements

This paper was written while Mary Lou Maher is supported by the National Science Foundation in the USA. Any opinion, findings, conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the NSF.

References


