3D GAME SOFTWARE AND ARCHITECTURAL EDUCATION

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Abstract

The use of computer technology to simulate architectural designs is well established in the profession and education. However most software interfaces in this field are intricate and require substantial time input, while the hardware requirements to produce quality animations are continually expanding. This software / hardware 'squeeze' can have a detrimental impact in the educational context of the architectural design studios. Students start with high expectations and rapidly become disillusioned at the time it takes to transfer ideas to digital reality. Those who persist often produce seductive computer graphics at the expense of design quality. This paper describes an innovative architectural design course at the University of Auckland in which computer game software was utilised as the design medium. The preliminary outcomes indicate that this relatively inexpensive software may address the above problems and in addition offer other learning opportunities.

Keywords

architecture, education, creativity, computer

Educational Context

Computers are used for a wide range of tasks in architectural education. These tend to relate to course differentiation between technology and design which occurs in the majority of degrees. Technology subjects use software to measure and test building performance - for example the deflection of a beam or the lighting levels generated by lamps. This use of building science software is relatively straightforward and is not the focus of this paper. By contrast the use of computers to support the main activity of architectural degrees - design projects undertaken in studios - is problematic. What follows is a description of the nature of the problem encountered at the Auckland School of Architecture.

Auckland has established itself among the top design schools in Australasia with our students frequently successful in prestigious international competitions. Reviews by accrediting agencies often make comment on the excellence and innovation students demonstrate in drawing and model making. In my view this is due to the emphasis placed by most design studios on the close relationship between representation and the development of design ideas. The "mark - interpret - mark cycle" articulated by Daniel Herbert in relation to sketching has been extended within our design studios to the production of innovative composite drawings and malleable physical models (Herbert, 1993). While not a certainty our experience has shown that innovative representation generally produces innovative and sophisticated architectural projects. These observations are reinforced by the work of theorist Robin Evans who in "*The Projective Cast*" traces the relationship between projective geometry and the generation of architectural form (Evans, 1995). In this work he proposes that the historical development of architecture has been limited by the ability to describe form on paper, and hence related to the drafting tools and techniques available at any given period.

Evans' historical perspective has been used by the author to propose alternate strategies facilitated or made possible by the use of digital technology (Moloney, 2000). These were categorised as *emergent form* (using generative techniques such as cellular automata, shape grammar or genetic algorithms), *immersive editing* (the editing of architecture within virtual environments) and *computer aided construction* (the automated construction of architecture using CNC machines). These three strategies are to my mind the advantages of computing for design. While the first involves computer programming beyond the curriculum of most schools and the later requires specialised and expensive machines, the facility to evaluate and alter architectural design - immersive editing - is within the resources of typical architecture schools.

As the principle lecturer responsible for computing my goal was to encourage the use of immersive editing to aid student design projects. The first step was to move the computers out of the computer lab and into the design studio. A relatively simple and logical move once nervous technicians and academic staff were persuaded of the need to integrate computers with other forms of representation in the design studios. A major hurdle however was the drawing culture which pervaded the school at the time. Freehand sketching is an activity that in the twentieth century has acquired mythical status for Architecture. After Le Corbusier the sketch is seen as a 'divine' moment of creation marking the spontaneous birth of the architecture, a mysterious ability that some have and some do not. Hence the 'table napkin' doodles (pre or post natal) which inevitably accompany the documentation of an architectural project. In this culture of drawing excellence the use of computers tended to attract students who were more interested in mastering every last software command than using the computer to develop their design projects. Three or four years ago the hunched figure of the 'computer geek' loomed large in both staff and student perception. Today the position is to some extent reversed. Our most talented students put in the long hours of interface pain and hardware time to generate work that has gained international recognition. However while computers are now associated with design excellence they still form a marginal percentage of student projects. Most students are discouraged by the time and effort required in the production of refined projects.

In discussion with students the most traumatic experience was the long anxious wait for hardware to produce renders only to find either design mistakes or technical errors such as lighting have ruined their work. The time lag between computer 'mark' and interpretation hindered the creative process and in the worst cases resulted in sub standard work. The obvious answer is to work in real time - so called virtual reality – rather than evaluate designs via rendered animations. Indeed the concept of immersive editing was proposed on the assumption of a real time editing environment. Unfortunately virtual reality software and the hardware requirements are still beyond the resources of most undergraduate degrees.

Game Software

Computer game developers have huge resources to bring to their research and development and as a consequence their products offer performance that rivals commercial virtual reality software - at a fraction of the price. Recently several games have offered 'level' editing - users can design their own scenes for the game play to unfold. It was now possible to design architecture using game software. After evaluating options we decided to use 'Worldcraft Toolkit' which is used to generate 3D scenes for the games 'Half Life' and 'Counter Strike'. A major advantage of 'Worldcraft' is that the modelling navigation is identical to the game navigation interface. Hence new design ideas can be instantly evaluated, edited and refined with fluency. It was anticipated that this would encourage experimentation and design modification throughout the design process. In order to test this proposition a design project was proposed for a summer design elective undertaken in January 2001.

The project was structured in two parts. A preliminary project required students to select an unbuilt work from a list of master architects and construct an accurate 3D model. The primary objective of this short project was to gain software fluency without the pressure of design. Another objective was to gain an insight into the work of their chosen architect and hence provide a precedent or referent for the next project. In this second design task students were required to produce an architectural proposal which referred to the previous model. The analogy of 'cousins' was presented for individual interpretation. Students were encouraged to exploit the game software to push the boundaries of architecture - the project did not necessarily have to be 'buildable' but should propose ideas and possibilities for architecture.

Outcomes

Design Iterations

In this first trial the anticipated benefits were achieved. Once students realised they could alter their projects and instantly examine the 3D consequences from any point of view, most produced a series of ideas which were discussed in tutorials. Students were encouraged to make file copies as they advanced these designs to provide a record of these iterations. The range and scope of iterations differed from student to student in a similar manner to non-computer based design projects. Research on creativity in architectural design has indicated a relationship between creative ability and the range and number of design permutations - the more creative solutions generally come from students who are prepared to critically examine a large number of iterations (Schoon, 1992). Hence the importance of using software which encourages immersive editing.

As well as these anticipated benefits the use of the software resulted in other outcomes of potential importance to the use of computers for architectural design education.

The Critique

Student projects culminate in a formal critique by invited critics who have not seen the work. In previous projects we have undertaken students would present with a combination of hardcopy prints and screen animations. The experience of the game critique was radically different. As 'Half Life' is a multi player game environment the critics manipulated avatars to follow the student around and engage *within* the architecture. Hence the critics were invited to experience the architectural proposal in a participatory manner as opposed to passive viewing and listening. This enlivened the whole process, relaxing the student and critic and encouraged conversations about aspects of the work to evolve. The process was one of mutual discovery, breaking down the normal power structure of architectural critiques - students standing in front of seated critics and endeavouring to 'sell' their project. This was of particular advantage to some 'English as a Second Language' students.

Design Emphasis

The tools available within the gaming environment affected the emphasis of the student designs. These included experimentation with surface qualities to produce in the best cases extremely seductive light and opacity effects. (Our visiting professional critic left inspired to seek out real world materials that would achieve these effects). Other students experimented with differential gravitational fields that challenged the position of the 'occupant'. Some inserted hidden triggers to animate walls dependent on proximity. 'Teleports' were embedded to transfer the occupant to other parts of the building, while others engendered a sense of danger via traps or breaking building parts. In one instance the student declared to the critics that her work could only be appreciated by continually running through the project as opposed to analysis from a fixed viewpoint. In summary, the above student experiments facilitated by the game software resulted in an emphasis on the *experiential* attributes of the architectural proposals. Students could simulate the sensual experience of design occupation as opposed to traditional evaluation through architectural codes of plan, elevation and section.

Further Work

This first experimentation indicates there are potential advantages in the use of game software. In particular the *immediacy* of the interface and the low hardware requirements address problems encountered with professional software typically used in architectural schools. Further work needs to be undertaken to explore the full potential of the software. In the next stage of this teaching experiment it is proposed to use the software to facilitate virtual design studios in which student and tutor can inhabit work in progress via the internet. We also see the possibility for collaboration with computer science departments to reprogram the game plot to provide a more educational focus to the game narrative.

References

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