Unreal Editor as a Virtual Design Instrument in Landscape Architecture Studio

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1 Introduction

The design studio case study discussed in this paper explores how off-the-shelf gaming software can be utilized as a central design prototyping and representation instrument in landscape architecture education. The Unreal game engine was used to create and interact with virtual landscapes, individually and in groups, which students created in response to a challenging design brief based on a real-world site and scenario.

It was found that through experiencing their designs in the first-person and within the constraints of a 'physical' system students were able to gain a much-enhanced understanding of the landform, spaces and structures and seize time-based design opportunities not present when working in other media. Four major benefits of using real-time modeling over physical scale modeling identified by the students were; comprehension of scale, engagement of other senses with sound, understanding space and time, and the ability to interact with others in a virtual landscape.

2 User-Centered Digital Visualisation

Traditionally much of the visual media used to communicate landscape architecture proposals in design studio is framed in two-dimensional representations of plan, section and elevation. Habitually when three dimensions are used it is in the form of perspective sketches or scale models, each of which has severe representational shortcomings when it comes to understanding the scale and sequential nature of moving through the landscape. The production of such perspectives and models is a time consuming process in which a high degree of judgement and interpretation must be exercised in order to communicate constructively.

The last decade has witnessed increasing use of digital models to represent landscape proposals in three dimensions, in addition to, or instead of traditional models and perspective sketches. Such virtual models allow the fourth dimension (time) to be engaged, usually by means of animated 'fly-throughs'. Despite the strengths of digital models and animations as a form of representation they very rarely allow the landscape to be experienced in more than one predetermined sequence, that is, to be navigated at will in real-time, approximating a more accurate experience of the spatial experience of landscape architecture.

3 Real-Time First-Person Visualisation

Walking is possibly the most primary way to experience the landscape. ERVIN & HASBROUCK (2001) talk of the difficulties of generating an egocentric viewing perspective when animating a digital landscape model for a 'walkthrough', noting camera paths simulate, "*the motion of a professional movie camera…….but not usually the way people really walk"*. Game engines have a biped walk built into them so animation is unnecessary – the 'camera' is fixed to the head of a character and thus has movement patterns associated with it, for example running and walking have distinctive gaits with the horizon bobbing up and down in response. The unevenness of this movement seems to offer, at every step, the possibility to change direction, to re-evaluate the path taken, to engage and relate to the landscape spontaneously.

In addition to the visual illusion of walking, the sound of footfalls gives an extra sense of attachment to the ground plane and is an aural cue for change of materials underfoot. When steep terrain is encountered the walking motion slows down as gravity kicks in - forward motion comes to a complete halt at a very steep gradients reinforcing the illusion that the camera is attached to a person. However, in the games engine it is possible to experience the landscape in ways other than walking by either flying your avatar over the landscape, or jumping into vehicles and driving, flying or hovering. As we take advantage of the benefits of first-person experience of landscape it is likely that real-time exploring will replace the animation process (KRETZLER 2003).

4 Studio Project

Second year students of Landscape Architecture at the School of Design, Victoria University of Wellington, New Zealand, took part in an experimental studio over half a trimester. The six week intensive project centred on a design brief which challenged students to consider how 1.1 million cubic metres of waste from the World Trade Centre site in Manhattan could be used to create a memorial landscape at the Fresh Kills landfill on Staten Island, to where it was taken by barge. The first three weeks of the project required students to develop design concepts for their memorial landscapes, through two-dimensional narrative, graphic and topographic representations. During this time they evolved design ideas to generate a topography for the landform intervention. They drew up existing and proposed contour plans in Nemetschek's VectorWorks and overlaid their design intentions on these.

The second three weeks involved building the proposed landform in virtual space and then modifying and composing other 3D design elements. Students were introduced to Unreal Tournament 2003 Editor, which allowed them to model their designs in three dimensions, at one-to-one scale. Within the Editor students first created digital terrain with a heightmap based on an Adobe Photoshop rendered greyscale image of their contour plan. Once the base terrain was generated, students then used the terrain editing brushes to cut, fill and smooth the terrain then apply texture and vegetation layers. At any point in the design process they were able to experience their landscapes in the first person through the gaming interface (with the heads up display (HUD) and weapons graphics turned off for critiques).

Students modelled 3D objects with the Editor to a limited extent, but primarily used Discreet's 3d max and SolidWorks to create or source models which were then imported and composed in Unreal Editor. Textures and materials were wrapped and assigned to model surfaces in 3d max and then automatically placed within the Editor. Extra perceptions were engaged by students through the use of particle systems to simulate weather, and sound (with proximity sensing) to add atmosphere and sensory experience to students designs.

WHYTE (2002) writes that, "*virtual reality is of most use as a prototype that can be discussed, challenged and recreated*" and it was as an evolving prototypical landscape that students engaged with this project, constantly and quickly testing concepts of scale, proportion, materiality, and composition in the game editor. In this way the instrument of the gaming software was utilised as a design generator and testing device not simply a representational technique.

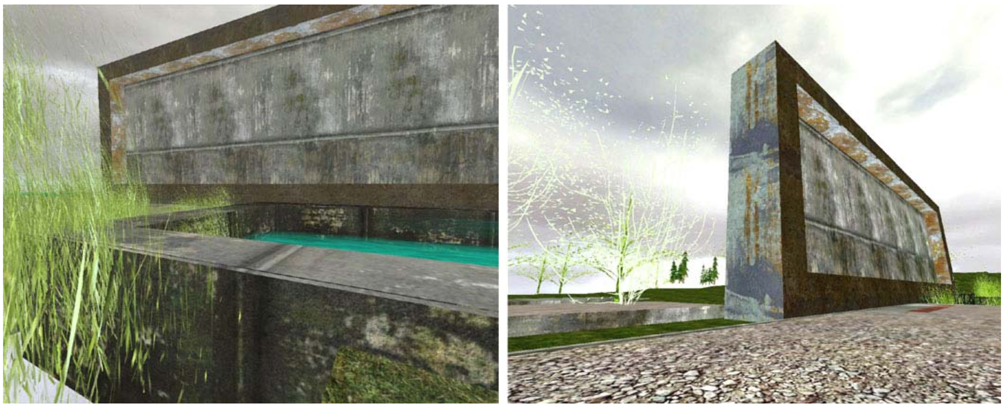

Fig. 1: Kara Berube's landscape included a contemplative water garden enclosed by the forms of upturned garbage barges at the point of entry to the memorial from the river.

5 Results

Previously the same studio brief had been given to students to work on over the same time frame but had required students to model a physical representation of their memorial landscape instead of demanding virtual models. While this enabled the exploration of narrative design expressed primarily in landform, from a bird's eye viewpoint, it did little to assist students in developing a sense of the scale and sequential experience of their memorial landscape. Students found it difficult to take into account the much more grounded viewpoint of the pedestrian and the scale and time-based nature of their interventions from this perspective. Students in the digital studio noted four distinct advantages of virtual models over the physical ones they had made in an earlier project.

Firstly the use of the game engine gave students "*a new way of seeing a project and identifying problems of scale*". Overall students found their landscapes were designed and experienced with a much greater understanding of height, distance, proportion and composition than is possible to comprehend from physical models. They were able to get to grips with the "*massive*" scale of the design challenge issued in the brief by being able to wander through their designs from a human perspective, being "*virtually present in the digital landscape*". In contrast, at the conventional landscape architecture scale of 1:1000 adopted for last years models a human figure and its associated viewing height would be approximately 1.6mm from the surface of the model. When we consider that at the same scale a medium/large object such as a tree or street lamp is only 5-8mm tall it becomes clear that there are enormous barriers to design development in addition to effective representation.

A second benefit was the ability to heighten sensory awareness of the landscape through the use of sound – landscape surfaces were able to be 'felt' through sounds associated with materials and spaces. For example footfalls sounded like crunching snow, or clanking steel, which together with the rendering did a very good job of connecting with two senses. Some students designed with ambient sounds associated with specific spaces, such as birdsong in a meadow or the sound of flowing water at a memorial wall. The use of proximity sensing whereby the volume is linked to distance from the object helped achieve a tangible and at times poetic sense of atmosphere around student's memorial landscapes; "*sound helped me communicate the experience of walking through my landscape*".

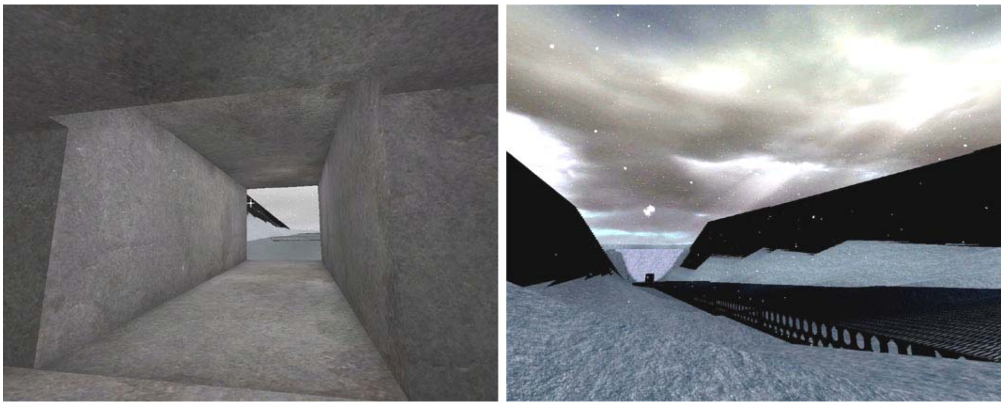

Fig. 2: Denise Adair's landscape intervention involved tunnelling below the new landform to generate an arrival sequence which confronted visitors with solid and void.

The third advantage was time/animation. In addition to the time-based experience of walking through the landscape students noted that animated surfaces, atmospheres or objects helped "*bring the landscape to life*". Students achieved this in varied ways, from the poetic use of weather, for example, snow slowly drifting down onto the landform, fluid surfaces such as rippling water, wind making flags wave, and fire. For landscape students it is fundamental that they understand and become passionate about designing with dynamic systems rather than with static objects. 'Bringing a design to life' is a metaphor that is employed across the design disciplines, it is however a unique quality in landscape architecture that this metaphor transcends from representation to a literal reality.

The final major benefit of designing with real-time models over physical ones was noted to be **interaction** - students were able to experience each others designs in the first person; in fact the whole class was able to simultaneously experience the memorial landscapes. During critique / presentation sessions the whole class were able to enter each others virtual landscapes simultaneously via their avatars using the softwares multiplayer capacity. This allow both individual and collective participation and interaction with the landform, spaces and objects within the students work and generated a great deal more involvement interest and excitement in the work of classmates while promoting discussion on the design merits of the various schemes in terms of experiencing the space in the first person and socially. The level of collegial participation in these final designs was far greater than in the past when the same studio had been run using 1:1000 scale physical models.

For second year students with no previous experience of the range of software this project was challenging; "*information overload*" and "*a very steep learning curve*" for some was exacerbated by the irregularities of the Unreal software which had an unfortunate habit of crashing. On reflection, the six week timeframe in which students had to both develop a design proposal and get to grips with all the software to create the Unreal model was probably a little tight. Students felt "*confused*" and "*overwhelmed*" at the earlier stages of the project and would have appreciated "*more time to learn the software without having to think about the design*". Some were frustrated that their design development did not get as far as they thought it might due to "*learning to use Unreal and deal with all the bugs that went with it*".

6 Conclusions

The project was a short and focussed 6-week introduction to the potential of gaming software for use in landscape architecture education and demanded the use of a sophisticated suite of software. When compared to the manual design development from the previous years studio it is clear that the exposure to this new medium/instrument raised the student's goals and expectations regarding the possibilities of their designed outputs. While some felt they fell short of achievable design development targets their outputs still exceeded those from the previous years. Despite the sweat and tears, every student that took part in the studio has since either used Unreal on other projects or is planning to use it again, one enthusiastically declaring that, "*I really see it as the key software program for the future of landscape representation*"

The results of this studio challenge the assertion that using 3D game engines for landscape visualization requires a working knowledge of games engines and level design (HERWIG & PAAR 2002). None of the students engaged in the studio had any previous experience but were able to create very convincing virtual landscapes within a short time. Surely it won't be long until we start to see the integration of more traditional design and construction softwares (such as 3D CAD & GIS) with first person real time rendering engines. For example, international architecture and building consultancy Arup has recently developed its own real-time visualisation tool, called Realtime, which is based on gaming technology and has been used as an integral part of the design process on several projects (ARUP 2004).

In addition to the development of bespoke hybrid software, the advanced rendering capabilities and sophisticated physics engines of the next generation of games such as HALF-LIFE 2 (2005) and UNREAL ENGINE 3 (2004) point to greatly enhanced time-based opportunities for landscape architecture design and representation. The new engines include physical properties such as friction, dynamic shadowing and complex interaction of objects. The Half-Life 2 mod, GARRY'S MOD v7a (2005), was created "*just to mess around with the physics"* of the new engine and is a compelling glimpse of the future (or the present) of real-time gaming technologies. Massively complex mechanical and physical interactions between objects and materials are animated and interacted with such intricacy that older gaming technologies suddenly feel very rigid. In Garry's Mod it is possible, in game, to spawn, place and pose (ragdoll) characters and objects at will and to weld, rope and connect objects together. Cameras can be placed on moving objects and watched on the HUD, props interact dynamically with water and air (spray, float, bob about, sink). In the past it has been very difficult to generate or change the space and form of a map from within the game; this mod illustrates the huge potential for design and interaction with virtual landscapes without needing complex editing software.

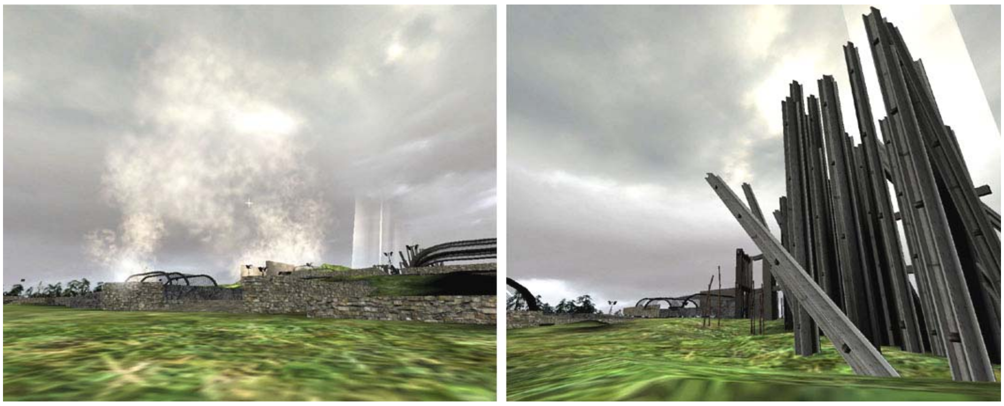

Fig. 3: Katherine Skurr's memorial landscape was designed as a field of rooms created from exposed material remnants from ground zero.

7 Future Directions

In response to these new technologies and as a result of successful experimental design studios such as the case study presented in this paper we are making real time interaction with virtual landscapes an integral part of our common first year introduction to computers syllabus at the School of Design. In the recent past the conventional teaching philosophy has been to build up students understanding of digital media through two dimensional representations (where the students use PhotoShop and Freehand, for example) before tackling three dimensional modeling and only then approaching animation and now real-time interactivity. In an extensive revision of the first year digital syllabus students are now introduced to game editing software from the very first day. In fact by the end of their first lesson the landscape architecture, interior architecture and industrial design students are able to occupy a space, move over and around objects and across textured surfaces. In addition to the new UT2004 editor more conventional design software, such as 3d max and SolidWorks, complete the emphasis on developing ideas in three dimensions. It is important to point out however that the final outputs of each design 'experiment' are reviewed and graded from within the real time UT2004 environment and that developments of textures in two dimensions and digital models in three are always seen as components within a more immersive world.

The rapid development of these mass-market technologies has presented the opportunity to use affordable software as a virtual reality platform in the core digital design curriculum, which will help to open the door to widespread use of real-time interactive visualisation in landscape architecture education. The enhanced ability to immerse oneself in a fully responsive three dimensional world and the ease with which these results are made possible by the latest game editors (and even in-game editing) will drive a new understanding of the 'basics' or 'fundamentals' of new media use in landscape architecture.

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