

UNREAL STUDIO

Game Engine Software in the Architectural Design Studio

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Abstract. This paper investigates the relationships between conventional modes of architectural design, those represented through and mediated by Cartesian schema, and the radical organization of spatial experience available through the use of NURBS modelling. This is examined particularly through a study of how game engine software and the appropriate editors are able to accommodate the properties of both. Within this software the first-person view attempts to provide a normalised experience of the VR environment (usually a game), yet there is significant scope for experiencing radically ‘other’ spatial and topological presences. Whilst considerable work has been done in the use of participatory digital spaces, there is the opportunity for examining the manner in which a highly stylised medium such as Unreal Tournament can productively assist the architectural design process.

1. Introduction

By using a number of experimental maps created in the Unreal Tournament 2004 Editor, modified to remove the aggressive elements in the HUD (Heads Up Display), this paper will present an analysis of the emergent ontological qualities of working and thinking in a game-space, Figure 1, as distinct from those spaces currently typified as the technical domain of avant-garde architectural practice – complex geometry and NURBS modelling. The ability to create and script an environment that is present and interactive fundamentally transforms the manner in which architectural design may be approached. Beyond the fascination with complex geometries for their own sake, the manner in which the use of game-engine software is a performative medium gives it a temporality and indeterminacy absent from more controlled representations. Further, functional gaps in the available

technology – BSB holes (problems with reading form caused by ambiguous rendering priorities), video card properties - may be exploited to get a glimpse of aesthetic qualia that digital theory is still attempting to articulate, the experimental nature of this work permits an immersive optical activity and, through scripting, encourages new kinds of haptic practices (Wardrip-Fruin and Mountfort 2003). This paper will summarise the analysis of studio work by referring to interests in flow, surface and indeterminacy - interests that are typical of architectural work influenced by readings of philosophers of presence (Massumi, de Landa) who have attempted to clarify how the experience of the digital is a unique event.

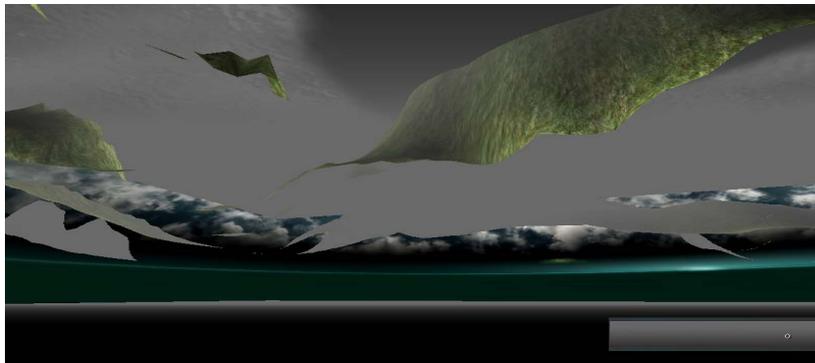


Figure 1. Unterwasser, Unreal Game Space

Until recently there have been clear extant, though under-discussed, conventions in the understanding of the role of representation in architecture. Up to the onset of digital practices, these conventions preserved a dilemma regarding the manner in which architecture represented itself. Given that, essentially, the media of representation had not changed since the Renaissance, the issue turned often on the similarities of the explorations of graphic architectural practice to similar ideas in the visual and graphic arts. The strength of this debate was the recognition and celebration of the fact that the graphic practice of architectural representation had developed autonomous critical discourses that looked past the media of its presentation in order to concentrate on the referent of the work. This is not always the case. Daniel Libeskind's Gnostic/Kabbalistic constructions: *Three Lessons in Architecture*, or alternatively the datascares of MvRdV present clear critiques of conventional architectural representation. In many respects the strength of this critical practice on the nature of architectural language – the vicissitudes of the referent – reaches a self-reflexive apogee in the work of Peter Eisenman in the seventies. Alberto Pérez-Gómez's *Architectural Representation and the Perspective Hinge* is a liminal study in this respect - giving a damning assessment of the properties of the digital before the

medium had established a body of critical practice worthy of discussion (Pérez-Gómez and Pelletier 1997). Key to Pérez-Gómez's book was the ineluctable relationship between the medium of representation (drawing in its many forms) and the architectural work's role as a general indicator of trends towards, for example, precision, instrumentality and categorisation. Indeed in a previous book, *Architecture and the Crisis of Modern Science*, Pérez-Gómez explicitly identifies the relationship between drawing practices in the work of Soufflot, Guarini, Durand and others and the development of categorisation and functionalism in architecture.

2. Applying the Applications – NURBS Modelling and Beyond

The advent of digital mediums, from the precision of 2D applications such as AutoCad and the collagistic opportunities of Photoshop to the use of NURBS modelling has significantly changed the manner in which these questions have been addressed in studio work within schools of architecture. The use of CATIA, 3DSMax, Rhino, Solidworks and Maya has unleashed an array of complex geometries within speculative architectural design work without a proportionate examination of why these geometries might be appropriate or otherwise. The questions for theorists of architecture are whether the same semantic relationship between form and meaning holds in this new, more complex environment. The formal complexity of this work, from the para-organic forms of Greg Lynn, Hani Rashid and Lars Spuybroek to the myriad fluid-form children of this practice now emerging in architecture schools around the world, is only partially understood.

What is clear is that the process of theorizing the work follows the same paradigm as that of the Modern distinction between objects, method and meaning. As with the example from Pérez-Gómez, the work is often explained as a consequence of its method of production, with a number of metaphorical similarities exploited to present its theoretical depth. The flow of a surface is compared with the phenomenological flow of the eye over it; the liquidity of a plan is compared with the patterns of programmatic use by persons over a period of time; the indeterminacy of where vertical and horizontal planes might meet is compared with ideas on how multi-centred the post-renaissance individual is; the complexity of the structural geometry required is connected to the fusion of form and meaning extant in the Gothic – ensuring an impression of historical continuity as well. In addition, the ability of NURBS surfaces to precisely accommodate the complex algorithms necessary for the determination of double curvatures, folds, and other motile surfaces which can then be incorporated into CAM procedures allows the architectural work to sit credibly in a materialist economy. In this sense the perennial question, 'But, can it be built?' is also answered.

This being the case, work such as Gehry's is explained as being 'sculptural' in a populist sense, or 'spatially and phenomenally provocative' in the language of architectural criticism touched on above. The relationship between means of production and meaning is clear – the use of 3d applications is focussed on allowing the architect to unleash some sort of mystical *Kunstwollen*, literally a 'will-to-form' that attempts to describe the (somewhat Nietzschean) movement by which appropriate form is chosen by the artist/designer. The most important early digital example of this was Bernard Cache's *Earthmoves: The Furnishing of Territories*, in which the subtle argument for folding and replication eventuated in a number of projects whose final form was determined, ultimately, by a form of post-critical 'choice'. Choosing a single iteration of his designs for CNC milling from an infinite number of variants was a trivial precipitate in comparison with the realisation that the process of coming-to-form was inherently chaotic and performed no representational or semantic function (Cache 1995). To be cynical about this however risks forgetting the very legitimate arguments that the process of identifying patterns of use that in themselves are enlightening. Just as the minimalism of Mies differs subtly from that of Ludwig Hilberseimer or Ernst May, so too the florid emendations of Preston Scott Cohen or Lise-Ann Couture may contain subtle, but revealing differences as yet unarticulated.

When this relationship is resisted and the expressive fallacy of concentrating on the designer and their supposed intentions is put aside, there are two options. Either one reads the work *sui generis*, assuming that it appears as some effect of 'the digital' as a natural event, or one looks to processes that might provide form without selections of choice, *Kunstwollen* again, being made. The use of viral algorithms in architectural design to theoretically remove the selectivity and stylisations of the design process remains a method that tends towards the same theoretical ground as Serialism in art and music. Highly structural, it resists the transactional relations of meaning that Structuralism generally sought to uncover, but without the same type of reflexivity central to a discipline such as anthropology. The hypersurfaces of Stephen Perella and Marcus Novak attempt to circumvent a simple transaction between form, process and meaning as an issue of sequential apperception. Mark Jackson writes perceptively on this process, identifying the undeveloped reliance on mind/body split that remains resolutely Cartesian – and hence a form of fetishization of the reader rather than the author with all the transferred anthropomorphism that that may entail. Better, for Jackson, are the analyses of Greg Lynn who identifies the exact, anexact and inexact as iterations of the possibilities of complex digital modelling undertaken over time – introducing the opportunity for recognising architectural form as a dynamic

system (Jackson 2002). Whilst Jackson's essay concentrates on the issue of the 'diagram' that emerges from this study and the commentary on this provide by Zizek and Massumi, there is also, I argue, opportunity to read the environment of digital production created within Game environments.

3. Gaming

The parallel development that has occurred within digital media, specifically the enormous rise of game environments in which players participate as first or third person avatars performing actions is as varied as the entertainment media industry can devise. Significantly too the code for these environments, the manner in which they organise uv mapping, field of vision rendering, frame rates is allied to the representational 3D modelling media identified above, Figure 2.



Figure 2. Suspiria

Gaming of course continues to be regarded as a threat to social cohesion and democratic experience because of the violent and anti-social theme of most its products, the particularly disembodied nature of community it embraces, and a residual 'parental' chauvinism towards the idea of games. Of course the critical community of gaming has not addressed these issues to a broader audience for a number of reasons. Principal of which is the sheer economic force of the current product, it needs no explanation or attempt to reinterpret it as part of positive, reflective artistic culture because it is part of a significant 21st century economy for which these questions are no longer crucial. Secondly there is an internal ongoing debate within the gaming community regarding the narrational and/or ludic aspect of games. Are games representative of fictional production generally and open to the body of critical commentary developed within literary studies, or are they simply a form of dissociative experience that temporarily and innocently disengages the player from everyday experience and places them in a contained,

speculative space of pre-determined operations (Frasca, 2003)? Significantly the understanding of how this discussion should evolve is not considered to lie outside of the gaming itself - it is a function of the qualities of contemporary gaming practice and not literary studies or neuroscience. Gonzalo Frasca looks towards an emergent critical practice that is unique to the structural properties of the game experience.

Yet this is difficult to achieve in the short term because of the rapidity with which generational change is occurring within the commercial games marketplace. For example the narrational simplicity of *Doom 3* is presented as evidence, along with its technical sophistication and economic power, that ludic aspects are paramount. The rejoinder to this does not come from a meta-discourse on the nature of fictional engagement, but from the fact that the successor blockbuster, *Half Life 2*, contained considerably more storyline (*and* a better physics engine and particle shader).

It is a matter of historical record now that along with the gaming industry, digital architectural culture has developed enormously. And while Pérez-Gómez had had considered suspicions regarding a practice that so clearly presented the textural qualities of the medium as limited in their aesthetic-critical effect, the very thin-ness of this effect coincided with the emergence of discussions of surface (Perella 1998).

So it is worthwhile investigating aspects of the representational practice of computer games to see the manner in which theoretical crossovers between it and architecture take place. For not only do most 3D games take place in environments that attempt to imitate aspects of the 'real' world, they also invoke ideas relative to the temporal moment of architecture either as historical fragments, future utopian/dystopic places, or the current world. They involve the presence of the gaming subject as either a first-person, third person or omnipresent figure; they create simulations of physics recognisable as being terrestrial, ambient sound and weather effects; and they also include complex animation sequences that either figure as part of the dynamic qualities of the environment, or are used as filmic cut-scenes within game-play.

I take the position that architecture, as a discipline, enjoys a culture of enquiry directed not only at the built environment and those projects that specifically are directed at construction in a traditional sense, but more generally in the practice of using architectural design as a mode for representing and exploring an embodied form of thinking. For this reason, the infinite expanse of the digital game environment represents a land beyond the looking glass whose architectural culture is yet to be recognised.

4. Applying the Applications – Game Modelling

Central to these environments is the creative process of 3D modelling packages such as 3D Studio Max, Maya, Lightwave, Solidworks, etc, the game engines used to paint 3D space within gameplay, pc videocards that assist the CPU's in this process, and the editing suites (often associated with the game engine) within which these environments are created. A typical example is the game *Unreal Tournament 2004* that utilises its own game engine and editing suite (UnrealEd) in which the complex environments of the commercial game are made. Whilst this software is specifically created, or adapted from previous incarnations, for the use of the game developers it is also supplied to general public as part of the software game package. This is to encourage the development of brand loyalty to the game by supporting the Mod community attached to it. An extremely large and well-organised Internet community uses these resources to create modified versions of the game, releasing them as freeware to the community for peer appraisal – the most active of the fan sites is <http://www.beyondunreal.com>.

So there are a number of coincident parameters between the discussions of the philosophical aspects of digital culture in architecture, the software associated with the creation of game environments and the emerging theoretical culture on the nature of game-play. Architectural practices and schools regularly use 3DStudio Max for example to produce speculative work as part of their critical practice. These works tend to remain within that package, utilising the rendering capabilities of the package to produce sophisticated still images or animated fly-throughs of the building(s). These renderings currently tend to be very resource intensive, requiring specialist skill and dedicated hardware to be produced.

5. Our Work

At the Louis Laybourne Smith School of Architecture and Design and at the Spatial Information Architecture Laboratory at RMIT, we have currently been investigating the use of the Unreal Tournament game editor and engine in the exploration of architectural projects. At the most basic level, the level editor UnrealEd provides an environment within which designers can carve out a negotiable space, skin it in an appropriate texture, place digital objects within the space and tour around this environment in real time. The editor is extremely adept at reproducing texture and light effects in an internalised environment. With a little more experience, the designer can begin to create quite complex architectonic spaces with a variety of lighting and textural effects and even 'exterior' terrains that imitate the complex geometries of land-forms, vegetation and animated skies. However there are governing aspects of the game environment that tends to emphasise an economy of

polygons. The frame-rate at which the processor is able to render scenes is directly proportional to the amount of complex polygonal faces it needs to surface and the lighting effects associated with them. For this reason, geometries that are composed of simple triangulations are more efficient than complex 3D surfaces. A square face has only 2 triangular polygons, whereas complex curves can have exponentially more.

This situation is somewhat alleviated by the creation of a category of pre-rendered objects (Static Meshes) that are skinned in an alternative program. This skin is then imported as a single texture. This situation, combined with the fact that game designers have traditionally not had an architectural background, tends to produce environments that have none of the spatial exploration or structural complexity, Figure 3, seen in contemporary architecture.



Figure 3. Terror-ain

Yet the opportunity exists for a creative use of this material. Not only for the immediate idea that it would be interesting to see how persons trained in the creation of architectural environments would utilise the medium, but also to see how more complex ideas on the nature of immersiveness within a digital medium might reflect a developing emergent identity for architecture. If we begin to develop these ideas in concert with thinking on the nature of digital and virtual experience, then the issue of how spaces, objects and surfaces are engaged with is significant.

In many respects there is an emerging public competency in negotiating digital space because of the ubiquity of PC games. Whether they are educational environments, adventure games, tactical games or first-person shooters, the relation between the tasks of the game and the manner in which environments are engaged with are structurally conjoined. The convention for exploring these spaces is often linear, or hub related. The player will be encouraged to follow an intuitive path, tightly scripted by the game designer, leading to the set pieces of game play. Generally speaking meandering is

discouraged as it tends to affect the suspension of disbelief, the telepresence, critical to the immersive experience (Taylor, 2003). Yet anecdotal discussion of some games is full of just these forms of delinquent behaviour. The Cyan games *Myst* and *Riven* were noted for their (contemporarily) sophisticated landscapes and players would enjoy the effect of 'being' in the environment as much as the ludic aspects of the game play (mostly the solving of complex puzzles). This delinquency is crucial to the philosophical freedom of the medium as it grants the player the opportunity for rational action and free choice.

So the game engine is already coded as a performative environment in that it contains texture sets, static meshes, ambient sounds, sprites that are made up from the palette of the original game attributes. It is already, in the minds of many students, a place where you make game-like spaces as opposed to architectural spaces. It is arguable whether there is a necessary priority for either type of space or indeed whether they are as different a type of space as might be first assumed. But if contemporary architectural discourse on digital presence and the flow of information is engaged then fundamental questions regarding the architectural process are informative. These questions concern a number of issues that I can only briefly point to. The primal act of creation involves the separation of matter to make a void space that will become the theatre of actions; the first/third person perspective involves an ecology of care for the avatar in the created space; the practice of texturing is infinitely thin, even despite the illusionistic opportunities of bump-mapping on textures; the spectacle of events may be didactically controlled to point to something (or nothing); the scene may be triggered to invoke cut-scene segments that are fundamentally prophetic and/or textural; there is a gravitational physics for both player and objects that may be controlled; and finally, there is a normative component that de-emphasises the immanence of the fantastic.

6. From The Void

When making a game space the first condition that must be recognised is that the creation of a negative space must always precede the creation of an object. This is in direct contrast to most 3D modelling applications in which the object is the primary focus of construction, an exteriority that must be cored out to form the spaces of occupation, or must be part of an aggregation of objects that incidentally make a space. In this respect the game-space is already architectural in a fundamental fashion inasmuch as it proposes an interior without a meaningful exteriority. It is already a space of propinquities between objects, actions and events, quite coincidentally like the *khora* of classical antiquity. It is already the first part of the labyrinth, for every subsequent space is an interiorised connectivity. Even when creating

significant external environments the idea of the infinite, Figure 4, is adumbrated by the limitations of the medium. In a traditional reading of the meaning of these spaces there is an immanent experience of the sublime as a vast interior – more Piranesi than Casper David Friedrich.



Figure 4. Two Towers

7. The First Person Perspective

Without even considering the issues surrounding the nature of vision and the manner in which perspective appropriates and constructs our experience, the first person perspective possible within the game-engine environment is significant. It allows the viewer to move across any horizontal plane. It also allows the viewer to move in the vertical axis via the use of stairs and ramps. Immediately issues arise regarding the manner in which the phenomenology of sensate bodily experience occurs. Whilst we may be skeptical regarding the manner in which suspension of disbelief may occur in the immersive context of a game narrative, it is clear, in my belief that a desire to preserve the avatar presence occurs when confronted with places that may involve a dangerous fall, agoraphobic or claustrophobic situations. But as death is not the end in game-play, an ambivalent relationship develops between the self and the environment.

Further, if we examine recent architectural discourse on the nature of post-Cartesian space, such as that famously of Henri Poincarre or latterly of Gilles Deleuze or Bernard Cache, the artificiality of the first-person perspective is immediately present – not simply as a defective representation of ontological presence – but as an artifice that is already outmoded. If architecture has relied on perspectival representation to simultaneously be a mode of representation and a vehicle for further critical scrutiny, the realisation that vision is a far more fragmentary and collagistic experience has significantly influenced the ‘de-centering’ of architectural theory. Much more can be said about the relationship between the desire for spectacle and the textuality of the medium in game culture, what is important is the nostalgia for outmoded forms of game-play. *Tetris*, *Space Invaders*, indeed

any scroller game that de-ontologises presence in favour of the pleasures of geometry represents this.

This is a radically new set of questions for architectural theory: the illusion of freedom created through the *démodé* of camera perspective.

8. The Texture

Texturing, and the associated task of lighting, is again a fundamentally architectural practice for it attempts to approximate the haptic qualities of material whilst acknowledging the highly mediated manner in which this occurs. A textured object has the material applied equally across its designated polygons; it may then be adjusted in location and scale to create a more 'realistic' effect. The process of bumpmapping, creating a stereometric or Blinn effect in a texture to give the illusion of depth is not as sophisticated in UnrealEd as it is in 3d modelling packages, but there is alternatively a number of ways in which composite and animated textures can achieve the same effects.

Yet the process remains infinitely thin. Inasmuch as the interest in the fold of the surface (Rajchmann 1992), again a Deleuzian influence, represents an implicated spatiality - it is a spatiality of the surface that presents the material texturing as a simulacra of some Real texture from either empirical sources, or from work done in Photoshop. Yet though it is, in part, the ability of the texture to approximate 'reality' that helps to affirm the telepresence of the scene, the more effective textures tend to be robustly haptic in their visual effect. Flat, or subtle, textures tend to disappear under most simple lighting effects.

9. Movers

Within environments, it is possible to key-frame the movement of items to respond to any number of triggers - from player proximity to the effects of other components of the level. Using the Matinee function there are the further possibilities of creating complex camera movements associated with both animate and inanimate objects. Scripting this is a fundamentally cinematic process.



Figure 5. Home

So the environment is never fully created until the opportunity to present simple functional operations is taken up – from an opening door or window to more complex ballets of ghostly operations driven by the unseen hand of the architect/programmer. The idea of a *Deus ex Machina* is implicit in these events, presenting a logic for the transformation of the repetitive functional parameters of a map without this logic being necessarily explicit. Why does one door return to its original state whilst another stays open? Each movement seems to act as a didactic sign for the player, like the analogical universe of medieval culture in which there is an assumption that actions occur for reasons that may eventually be theologically explicable. The process of deriving and representing architectural experience, Figure 5, through the tools of animation questions the very idea of how time and temporality function within the architectural project.

For architecture this is a new level of control, for it may no longer be assumed that elements of the functionality of a building, its inherent repetitiveness, are a matter of simple alterity (Benjamin 2000). If an environment is animated, or one can suggest - has *anima*, then its definition as a functional presence, a place that will always work in a certain fashion, is significantly more complex.

10. The Cinematic Pause

Game play has instinctively modelled part of its narrational structure on the insertion of cinematic segments that aid the ongoing storyline, give the player a moment of respite, or summarise events to date (including resolving the arcs of the major protagonists - as with conventional cinema structure). What might be made of this for the specifically architectural environment remains to be seen, for it allows the insertion of different modalities of experience for the first/third person agent. It is unusual to be able to transform the phenomenologically attentive ‘player’ into the passive spectator of a spectacle and then re-place them in the environment with a possibly different ecology of risk, trust, care and danger. In essence it can act as a critical voice, a parallel text on the nature of exploration, or habitation, or the melancholy of the ruin, etc.

11. Physics

Of course part of the process of verisimilitude between the real world and the virtual turns on the manner in which random acts of physical expression are translated into events. The current leader in this area is *Half-Life 2* whose physics engine allows for incredibly real responses to force by objects – barrels fall, roll and float, mattresses slump, timber splinters and breaks. In all of these applications there is the possibility for amending the properties

of objects. The degree of friction between an object and a surface may be modified, the buoyancy or pattern of action and reaction may be adjusted to make objects bounce in a counter-intuitive fashion, their pitch and yaw can be adjusted to make the laws of the entropy of energy seem unreal.

Obviously, in a fashion similar to that of the movers, this is an interesting challenge to architectural theory. It is as if a narcotic element may be introduced to dissociate the player from another aspect of their contact with real-world expectations.

12. The Normal

Fundamentally though, for all of the opportunities for creating wildly nomadic, transitive and surreal worlds, the medium works most effectively at the moment when it is merely showing the inflection of this change. The tension between an environment whose abstraction is immanent but never explicitly rendered and our experience of the everyday world is crucial. In some fashion we borrow this pattern from our understanding of fictional or counter-factual worlds. They are sensible (that is, seems to refer to something explicable) when they are at some measure real. Any of the visionary city/social-scapes of recent film science-fiction from *Solaris* to *Gattaca* to *Existenz* rely as heavily on the normalcy of the place as the desire to fetishize the differences.

13. Parting Thoughts – God Mode

The architectural opportunities of the 3d game engine are quite profound - for the structural opportunities they offer for re-presenting the world are massive. Principally though, these opportunities are meaningless without a coeval process of thinking-through of the implications of the medium. Architecture has a long, critical history of reflexive study of its mode of presentation. This is no different a circumstance. It is only the emergent breadth of events that are now part of digital worlds that makes one think that a fundamental shift is occurring in the spectrum of architectural knowledge. Whilst there is a long history of visionary thinking in architecture from, Alberti's *Hypnerotomachia* onwards, the ability to script morphologies that are utterly novel is unique to the medium.

The paper has attempted to open a number of questions: Why has architectural theory in relation to digital culture struggled to describe the manner in which the highly idiosyncratic forms have come about? And, in fact, are their differences only cosmetic? In this circumstance, if we look at the use of game-engine software, the questions about how it might be architectural are very interesting. First it provides a first-person perspective that seems to privilege a renaissance world-view. Yet this optical mastery is

undermined by the freedom with which the ‘world’ under the gaze may be manipulated/coded to achieve remarkable experiences. And in fact the tools by which a recognisable world might be made: form, light, texture, movement are the same medium for making a profound and unsettling estrangement. Surely this is a core task of architecture.

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