

ON RENDERING 3D ARCHAEOLOGICAL VISUALISATIONS

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ABSTRACT:

Realistically rendered and textured virtual spaces can be created in the UNREAL platform by importing high polygon models and scaled accurately reproduced textures. In addition Mellanium has successfully developed an application for utilizing all the archaeological virtual assets developed in 3D Studio Max over the past several years. It is possible therefore to create interactive environments of archaeological significance which can be accessed through the Internet and available to up to 40 participants. This paper will be accompanied by a live demonstration of networked PC's to illustrate the collaborative educational potential of this application

1. INTRODUCTION

Archaeology would be well served by a software application which would faithfully reproduce buildings, artefacts and photorealistic art and import them into a multi-participant environment. Published literature extols the potential value of creating virtual spaces containing archaeological experiences for educational and /or archival purposes and even the publishing of the results of novel future excavations. Indeed, it would have to be admitted that reading, studying maps and schematic drawings about such monumentally extensive cities as Rome in 130 AD could not be compared to being able to walk around the city in a virtual reproduction. In fact the entire city of Rome was modelled in plaster in minute detail during the years 1937 to 1972 which by any stretch of the imagination was a monumental task but still falls short of giving the feeling of "being there"

Now it is time to seriously consider the modern day possibility of using the existing 3D virtual platforms available to generate reproductions of the major constructs of the ancient civilizations. There have been papers published comparing the relative merits of these platforms and their capability of rendering with sufficient fidelity the architectural detail and photorealism necessary to produce an acceptable environment. These publications have indicated that the UNREAL gaming engine does have some attributes which could potentially fulfill some of the requirements of a platform worthy to create 3D virtual spaces within which up to 32 individuals could simultaneously experience high resolution objects and photorealistic art reproduction. In fact the UNREAL 2.5

variant has improved shading, light sourcing, high resolution pixel texturing and 2D graphics capability. Architectural applications have also been around for many years, finding in game editing a way to quickly visualize real estate developments and prospective designs with a low cost pre-construction interactive space. A number of projects have used the Unreal Engine for other architectural scenarios to: promote estate buildings^{1,2}; exhibit a protected natural park and help raise environmental awareness³ Researchers at the University of Auckland, New Zealand, use the Torque⁴ game engine to create a Collaborative Virtual Environment (CVE) to support architectural education. Through the CVE users can interact and share data in a common environment and concurrently explore shared architectural projects.



Fig 1 A view of the Coliseum imported into the UNREAL platform.

The AERIA project (2003) attempted to create archaeological reconstructions without the use of expensive CAD software. The authors⁵ used the Quake 2, HalfLife and Morrowind engines to reconstruct the palace of Nestor in Pylos and the throne of Apollo, respectively. They recognise that game engines have come 'of age' and offer a low cost but powerful tool for heritage visualisation

Jeffrey Jacobson⁷ has created a set of modifications for the Unreal engine which allows visualisation in a customised CAVE environment incorporating multi-screen displays. These customisations make the creation of a low-cost CAVE possible thus enabling VR applications that would require an immersive setting to also use the extensive features of a game engine.

Maria Sifniotis⁶ has compiled an excellent summary of the game engines and their strengths and weaknesses.

The key to effective virtual realism, especially for fields like archaeology, is the creation of an environment rendered so accurately that the user becomes emotionally involved in the content of the simulation. Users obviously desire to experience a design that has been created in terms of lighting effects, finishes, surface textures, layout and construction details which will lend itself to a complete suspension of disbelief⁸

2. THE UTILIZATION OF THE UNREAL 2.5 PLATFORM IN THE ARCHAEOLOGICAL FIELD

The Unreal engine has been promoted in the past as a complete solution for the accurate rendering of architectural and archaeological reconstructions. However until the advent of the UNREAL engine version 2.5 and the wide acceptance of hardware 3D graphical acceleration video cards and DIRECTX 8.0 it was highly impractical to produce virtual buildings and accessory items with high polygon static meshes and photo-realistic textures and 2D graphics which were not subject to debilitating pixellation on close inspection.

The UNREAL engine provides "a complete robust solution that has withstood the tough test of time of real-world game development". The UnrealEd level editor is integrated with the rendering engine and along with the extensible C++ core, its powerful UnrealScript high-level scripting interface, visual editing of avatars and surface textures with the virtual world. In combination with Mellanium's adaptation of a "bridge between CAD and Unreal" using high polygon modelling in addition to the use of the application of scaled high resolution textures the stage is now set for inclusive, world building package that matches the more expensive sophisticated CAD software.

As mentioned already one of the Unreal engine's most potent features is the integration with the UnrealEd level editor. UnrealEd is a realtime design tool, optimized for building real-time 3D environments. It is fully integrated with Unreal's rendering engine, offering a WYSIWYG camera view and immediate display of all lighting, texture placement and geometry operations. UnrealEd also offers single-click playability: even in the midst of the design process, the designer can launch the viewer and walk around their created environment in real-time.

After the creation of the 3D models photo-realistic textures up to 2048x2048 pixels in size can be applied to surfaces to enhance the perceived detail of the object. This capability combined with detailed textured mapping allows for detailed effects of decorated walls and objects such as trees.

In effect since Unreal can handle up to 60,000 polygons in one modelled item and there is an indefinite limit to the size of the assembled unit even with a fully textured and lit surface the engine can therefore handle enormous spaces suitable for generating immersive archaeological scenarios.

3. MELLANIUM

One of the obvious Mellanium applications is not only as an advanced presentational tool for archaeology in education, but also as a archival tool for any new excavations. The Unreal engine in combination with Mellanium offers several novel possibilities for interactive, collaborative presentations and conferencing. The huge volume of 3D modelled assets which presently exist comprising the cities of Rome, Athens and the temple complexes of Egypt could be readily rendered and installed on a LAN or viewed collaboratively over the Internet. Indeed by using VENTRILO or TEAMSPEAK, economical VOIP's, it is additionally possible for up to 32 participants from all over the world to enter the virtual archaeological space and chat together as they wander together investigating the recreated surroundings.

4. THE DENOUEMENT

Existing models of extensive high polygon models developed in 3D STUDIO MAX can be readily modified and imported into the UNREAL platform using the Mellanium application to generate dimensionally scaled and high resolution textured environments. These environments are interactive and up to 32 participants can enter the virtual archaeological spaces using a LAN or an Internet connection. By the kind permission of Kings College Visualisation Lab we were offered the opportunity to import the Theatre of Pompey into the UNREAL platform and we successfully completed this "proof of concept" project.



Fig 2. Screenshot of the KCL “Theatre of Pompey” showing a view of the Temple of Venus Victrix.

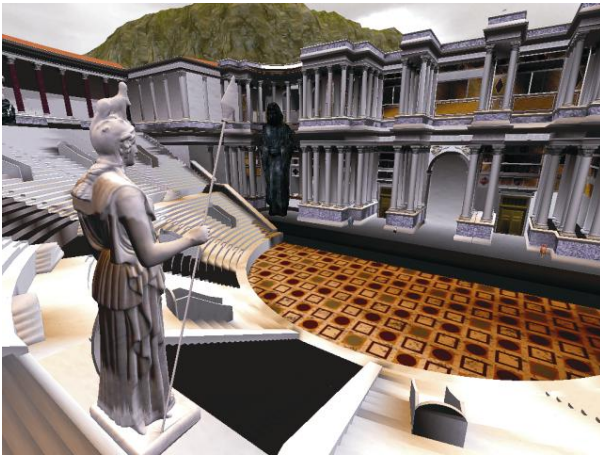


Fig 3. Screenshot of a view inside the KCL “Theatre of Pompey” looking down on the stage.

The ability to create immersive, interactive virtual environments coupled with the technology to present and collaborate from anywhere on the Internet affords the MellaniuM application significant potential as an educational and archival tool.

This paper will present the latest virtually reconstructed spaces including the Coliseum and the Theatre of Pompey showing avatars interacting realtime with the UNREAL environments.

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