VIRTUAL ARCHAEOLOGICAL ENVIRONMENTS GENERATED IN AVAYALIVE ENGAGE

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MellaniuM is leveraging AVAYALIVE ENGAGE to be capable of developing immersive virtual environments by importing all 3D file formats with photorealistic textures generated both by photogrammetry and laser scanned items and monuments for archaeological and educational use.

Archaeology would be well served by a software application that could faithfully render interpretations of reproductions of 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 interpretations 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 and educational research[1-4]; exhibit a protected natural park and help raise environmental awareness[5]. Researchers at the University of Auckland, New Zealand, use the Torque[6] 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.

The AERIA project (2003) attempted to create archaeological reconstructions without the use of expensive CAD software. The authors[7-9] used the Quake 2, HalfLife and Morrowind engines to reconstruct the palace of Nestor in Pylos and the throne of Apollo, respectively. They recognize that game engines have come 'of age' and offer a low cost but powerful tool for heritage visualisation

Jeffrey Jacobson[10] has created a set of modifications for the Unreal engine that 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 Sifniotis[11] 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 so well conceived interpretively 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 disbelief[12].

THE UTILIZATION OF THE AVAYALIVE ENGAGE IN THE ARCHEOLOGICAL 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 photorealistic textures and 2D graphics which were not subject to debilitating pixellation on close inspection.

Fig. 1 - Entrance to the Temple of Horus at Edfu.

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 and 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.

Fig. 2 - Inner Courtyard at the door to the Hypostyle Hall.

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.

AVAYALIVE ENGAGE VIRTUAL ENVIRONMENT PLATFORM

One of the obvious potential applications for AVAYALIVE ENGAGE [13] is not only as an advanced presentational tool for archaeology in education, but also as a archival tool for any new excavations. AVAYALIVE ENGAGE is an online, immersive collaboration environment that lets you communicate with others as though you were face to-face. AVAYALIVE ENGAGE runs on the UNREAL 2.5 gaming engine and is embedded as a browser plug-in that integrates with your local network, security and business software tools. Knowledge flows freely-from instructor to students, peer to peer, coach to team-all while presentations and materials display. MellaniuM is leveraging this 3D virtual environment platform to be capable of both importing all 3D file formats with photorealistic textures generated both by photogrammetry and laser scanned items and monuments for engineering, archaeological and educational use.

Jeffrey Jacobson has been working for several years on VR applications using the extensive features of the UNREAL game engine. His thesis and an UNREAL environment of the Temple of Horus, now being used in the Carnegie-Mellon museum, is available on the PublicVR website.

However it has to be accepted that the key to effective virtual realism, especially for fields like archaeology, is the creation of an environment so well conceived interpretively 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 disbelief. The MellaniuM application allows for the importation of high polygon models and rich textures that are being used now in the Temple of Horus complex to create the realism necessary for a true reduction of cognitive friction and the subtle transcendence to a believable immersion.

In addition comprehensive descriptive metadata relating to the original source, age, design and existing knowledge on associated artifacts can be connected effectively to any 3D item in the environment. By introducing small unobtrusive portal icons within the 3D models, which can be approached on the screen the participant will automatically be directed to URL or local links (web pages and movies) with pertinent information to the item. This type of semantic interactivity is vital to produce an environment that will encompass both a truly informative and a sensory experience resulting in an academically accurate and effective educational space.

It is entirely possible with one URL web link click to enter along with up to 50 others to explore and learn about the fascinating details of the Temple Complex. For a demonstration of the Temple of Horus go to http://wa692.avayalive.com

THE DENOUMENT

Existing models of extensive high polygon models developed in 3D STUDIO MAX or generated by photogrammetry or 3D laser scanning. can be readily modified and imported into the AVAYALIVE ENGAGE 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 by a simple click of one URL address. 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.

Fig. 3 - Inside the Throne Room of the Temple of Horus.

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Abstract

Realistically rendered and textured virtual spaces can be created in the AVAYALIVE ENGAGE 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 or generated over the past several years using photogrammetry and laser scanning. It is possible therefore to create interactive environments of archaeological significance that can be accessed through the Internet and available to up to 40 participants.

Keywords

Interactive; **AVAYALIVE ENGAGE**; virtual reconstruction; Temple of Horus; **CAD** modeling; game engine; photogrammetry; **3D** laser scanning

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