

SHARED ARCHITECTURE: RAPID-MODELING TECHNIQUES FOR DISTRIBUTION VIA ON-LINE MULTI USER ENVIRONMENTS

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Abstract

This paper explores techniques for the rapid modeling of local scale urban environments. Multi user avatar based systems are utilized to enable the import of traditional CAD models into a collaborative on-line environment.

The rise of Internet based technology is changing the way we distribute and communicate information. The move towards mass distribution and rapid data publishing is impacting the communication of the built form on-line. From the simple application of World Wide Web sites, providing information relating to architectural practices to the placement of Computer Aided Design (CAD) models on-line for mass viewing, the Internet is reaching a new audience for information based on urban form and structure. However, with this rise in distribution comes the problem of how to effectively communicate three-dimensional CAD like models over the Internet, which for the majority of users is a low bandwidth environment. The use of CAD in architecture is traditionally limited to high power workstations running proprietary architectural or modeling based software. Such packages provide high quality animations or single frame renderings of proposed changes or additions to the built environment but they are not designed to communicate effectively over distance. The problem of distance arises when a model needs to be shown interactively to a client or user base, CAD is not a low bandwidth real time rendering tool. If models are to be distributed and indeed interactively changed over distance they need to run over both a network and within an interface which operates effectively on an average home or office based machine. This paper explores and demonstrates how such models can be rapidly prototyped and distributed within an on-line multi user environment operating in real time. The models explored are all aimed at local scale, i.e. streetscape, and are therefore applicable for the communication of singular buildings or aspect of urban design. They are as such aimed at gaining a sense of location and place on-line.

Problems of placing models of built form on-line are two fold, firstly one of file size and available bandwidth. The majority of users logging into the Internet from home or the office have a maximum connection rate of 56K per second and this varies according to the load on the network. As such the file size of models placed on a server for on-line distribution need to be kept to a minimum, the recommended maximum file size is 500K. Secondly, is the need for an acceptable frame rate when exploring or digitally manipulating the model. While advances in graphic card technologies over recent years have overcome a lot of earlier problems, frame rate can still vary considerably between users machines. For real-time interaction a rate of 8 frames per second or above is preferable, although acceptable levels of interaction can still take place at 4 frames per second.

The placement of models on the Internet is not a new phenomenon, it dates back to the introduction of Virtual Reality Modeling Language (VRML) in 1993. VRML provided a standard for the distribution of three-dimensional information on the World Wide Web and has since been widely used to communicate information relating to the built environment. Bell et al, 1993, described VRML as a language for describing interactive simulations – virtual worlds networked via the global Internet and hyper-linked with the World Wide Web. The format was widely viewed as being the answer to the distribution of three-dimensional models on-line, indeed a number of high profile CAD and three-dimensional modeling packages export to the VRML format. However, the format's future is doubtful, problems arise with VRML in relation to both file size and frame rate with models representing even basic urban form becoming un-viewable in standard machines. While impressive models in VRML have been created, the example of Bath in the United Kingdom is the most commonly sited VRML model of urban form, they were often limited to high end workstations and thus could not compete with traditional CAD output. Moores Law stated in 1965 that there would be a doubling of the capacity of computer chips every 18 months (Intel, 2000), this has born true and has gone some way to stave off criticism of low framerates and un-viewable models on standard home or office based machines since the introduction of VRML in 1983. However, even with ever increasing processor power and frame rates VRML is no longer widely supported or indeed viewed as the standard platform to distribute three-dimensional models on-line. The original promise of three-dimensional models communicated via the Internet has failed to materialize, at least in any usable form. Models of urban form currently available on-line, for example Virtual Helsinki, New York and Ottawa, to name but a few, are limited to basic block form models with limited texturing. With this in mind 'Shared Architecture' at the Centre for Advanced Spatial Analysis, University College London, was set up as a research project to explore how the built environment can be conceivably communicated on-line. Shared Architecture has focused on two concepts, firstly, on how to construct rapidly, urban models to convey a sense of location and place on standard home or office computers and secondly, the placement of the models in a multi user real time environment.

Figure 1 illustrates the modeling package Canoma, from Metacreations, used for rapid modeling from multiple photographs. Canoma was chosen for its ability to quickly construct the existing environment using a range of pre-defined polygons. As figure 1 illustrates, images are imported into the software and 'pinned' with a range of polygons to overlay the architectural features. The utilization of photographs ensured that details traditionally difficult to model rapidly, often due to lack of data, such as roofing structure were included. The use of photographs also allowed a high level of detail to be obtained using texture mapped surfaces. These textures were subsequently modified in a standard image processing package to represent changes in lighting, shadowing etc. The ability to quickly model urban form using photographic software is an emerging field. In the projects

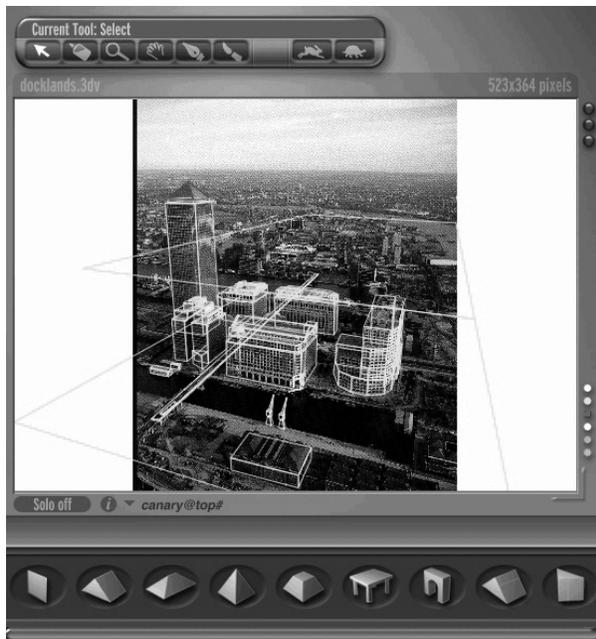


Figure 1, Title: Rapid Urban Modeling using Canoma

time span Canoma was utilized although a number of new software packages have since emerged. Notable of the emerging packages is Geometra from AEA Technology p/c, which offers a free functional version to be downloaded from the Internet. Such packages are allowing the layman to construct realistic architectural models of existing buildings and distribute them on-line.

A range of models were constructed and placed on-line selected from buildings local to the research centre. These models included a range of London tourist attractions, including Buckingham Palace to illustrate how simple new build constructions as well as buildings of rich architectural heritage can be distributed on-line. Each model was initially placed on-line in Metastream format (.mts), available for viewing as singular structures. Metastream was selected due to its ability to both compress the overall file size and stream texture data to the end user. Streaming results in a wire frame version of the model displaying on the user computer within approximately 5K followed by the texture mapping. File size varied accordingly to a number of factors such as texture resolution and the number of photographs used for modeling. On average models on the Shared Architecture site are 180k, a considerable decrease in the equivalent VRML file size.

In order to construct a street scene, and gain a sense of location and place on-line, each building was imported in an ActiveWorlds World Server. Figure 2 illustrates an avatar in the constructed street scene. ActiveWorlds is a multi user 'chat and build' system for Windows 95/NT. The ability to load each building into a multi user environment allows various levels of collaboration in the design process. For example, each section of the scene can be manipulated and interchanged in real time, i.e. if a house is taken out of the scene and replaced with a modeled retail unit all users logged in as



Figure 2, Title: Avatar in Urban Scene.

avatars observe the changes at the same time regardless of physical location. The models are imported into ActiveWorlds as Renderware format (.rwx), a number of modeling packages export file formats that can be easily converted into Renderware. The ability to convert into Renderware format allows traditional CAD output in .DXF to be imported to ActiveWorlds. The import of traditional CAD models combined with rapid scene construction using Canoma allows developments to be viewed and manipulated in context. The ability to interact with CAD output and small scale urban form models on-line presents the opportunity to aid the design and decision making process. From allowing clients to walk through a range of design options on-line, regardless of location, to the ability to place options on-line for public consultation, the Internet represents an opportunity to enhance the communication of design information.

Models, both singular and multi user, maybe viewed on-line at the Shared Architecture Site:

<http://www.casa.ucl.ac.uk/public/meta.htm>

ActiveWorlds, <http://www.activeworlds.com>

Bell, G., Parsis, A. & Pesce, M. (1995), VRML : The Virtual Reality Modeling Language Version 1.0 Specification, *in* VR for the People: A Brief History of VRML, (<http://www.gnn.com/gnn/wr/sept29/features/vrml/history.html>)

Canoma, <http://www.canoma.com>

Geometra, <http://www.geometra-3d.com/>

Intel, 2000, Processor Hall of Fame: What is Moores Law? <http://www.intel.com/intel/museum/25anniv/Hof/moore.htm>

Virtual Bath, <http://www.bath.ac.uk/Centres/CASA/>

Virtual Helsinki, <http://www.helsinkiarena2000.fi/>

Virtual New York, <http://www.planet9.com/earth/newyork/index.htm>

Virtual Ottawa, <http://www.intoronto.com/inottawa.html>

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