

ON-LINE REAL-TIME ARCHITECTURAL SPACES

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ABSTRACT

This paper presents a methodology for the development of VRML-based architectural spaces and a series of projects that speculate on how virtual environments may replace or complement architectural buildings.

KEYWORDS

VRML, virtual spaces, architectural spaces, hyper-media

INTRODUCTION

The last few years, the development of sophisticated modeling and realistic rendering techniques combined with the emergence of the World Wide Web (Internet) led to the development of virtual environments. These environments allow users from all over the world to access information on any subject, at anytime, about almost anything. Initially, information was provided in the form of two-dimensional multi-media layouts also referred to as *web pages*. Recently, through the development of faster networks and more capable client machines web pages can be extended into the third dimension. This technology is referred to as Virtual Reality Modeling Language ([VRML](#)). The effects of such technology may soon become apparent especially in the visual-based businesses: product design, advertising, motion pictures, electronic games, architecture and urban planning, etc.

THREE-DIMENSIONAL INTERNET

One of the main advantages of web-visited virtual reality is its availability over the network. At anytime and from almost anyplace, information can be viewed, criticized, evaluated, and exchanged. The same information can be viewed by different people and at the same time be criticized, modified, and re-distributed. In addition, because of the nature of graphics, information can be viewed from many different points in real-time providing a totally different experience to the user compared to a mere color picture.

Currently, the information provided over the Internet is presented mainly in two dimensions. The Hypertext Transfer Protocol (HTML) supports many forms of multimedia files but people who develop web pages prefer to present their information in the form of text, images, sounds, and movies. The reason for that was that these kinds of files were a) able to transfer faster and b) processed more efficiently by the end machines (clients). With the development of 3D protocols for transferring information of a geometric nature (VRML) and a significant increase in the processor power of the average personal computer, 3D models became available for viewing. Modelers and viewers were developed to support users with tool for experiencing 3D movement. Information can be presented in 3D either as abstract entities (i.e. bubble diagrams) or as 3D models that correspond to the physical world (maps, buildings, streets, etc.) Currently, when one looks for information in the Internet, searching is done on the basis of words and keywords. The search engines available today look for matching letters over large amounts of data and return the requested links. Information is not visualized within space and/or as a correspondence to the physical world but rather is viewed as long lists of text and images.

Many researchers have proposed or developed simulation models for architectural applications, few of which are implemented to run over the Internet. Fukai (Fukai, 1997) has developed a construction information system on the Internet but its main purpose is to link 3D models to construction documents. Since the World Wide Web is relatively new in the area of architecture only a few educational or

commercial applications are found. McCall and Johnson (McCall & Johnson, 1997) have developed a hypertext system, called PHIDIAS, that supports collaborative design. A few Internet based urban simulation companies, such as planet9¹ or construct² have attempted to address the issue of virtual cities, but the quality and detail of their representation is not quite realistic yet. Ligget and Jepson (Ligget & Jepson, 1995) have developed an urban simulation system based on flight-simulator technology but it does not run on the Internet. Instead it runs locally on a high-end SGI system and requires extremely large data files.

VIRTUAL SERVICES

Through the digitization of information and the popularization of the Internet new ways of accessing information have become possible. Mitchell (Mitchell, 1977) and Negro Ponte (Negro Ponte, 1995) have described extensively the concept of *digital*. They both refer to the concept of *place-less* and *ubiquitous* information. Especially, Mitchell proposes many uses of the Internet and speculates into the possibility of replacing architectural buildings. Novak (Novak, 1998) refers to that concept as *trans-architecture*.

There are many buildings that house information in the form of paper or film media. Public services, video stores, banks, etc. exist as buildings only because information is provided and stored on material media. If and when the Internet reaches the average household the same information can be provided through digital media. Therefore, the functions of some buildings as providers of material-based information may cease to exist. Instead, it may be replaced by a counter-function, that of providers of digital information. If and when that happens, the interest will be shifted from billboards and neon lights to web pages and Java programs.

Consider the following example: assume that it is possible to download a movie over the Internet. That means that you don't have to go physically to the video store, buy it, move it over to your TV, watch it, and then have to physically return it back to the store. Instead you can visit a web page, see what is available, buy it on-line, watch it, and then trash it. The prediction is that the companies will compete in how to provide a better and more attractive web page to their clients. Architectural space can be used to invite, entertain, and facilitate the purchase process. Three-dimensional space may be used to help the client explore the databases and enjoy the search.

Architectural spaces may not anymore house the body but rather the mind. In that world there is no need for protection from rain, heat, or a need to construct toilets. Instead, in those architectural worlds, important information may be bigger in size like important text is bigger than the rest in newspapers. Jumps from one part of the building to another may be done instantaneously in the same way that movies jump from one scene to another. Spaces can transform into other spaces according to the clients' interests. After all, they are just pixels on a screen. The term cognitive architectural space may be implemented sooner than what one may think.

In the following sections, a series of possible architectural spaces and functions will be presented that to a certain degree illustrate these concepts. Each project was developed as a master's thesis project at the School of Arts and Architecture at UCLA under the author's supervision. The address is <http://www.cda.ucla.edu/caad/theses/main.html>

VIRTUAL CINEMA THEATER

In this thesis project, the objective was to model a real cinema theater and to provide useful information to the client: location of the theater, movie previews, a lobby with movie posters to choose from, and the actual cinema room with different seat reservations and views. As the project was developed it became apparent

¹ See <http://www.planet9.com>

² See <http://www.construct.com>

that many of the functions of the real cinema theater were not applicable (such as toilets, emergency exits, etc.) and others became more important, such as size of spaces, flying movements, collision detection, etc.

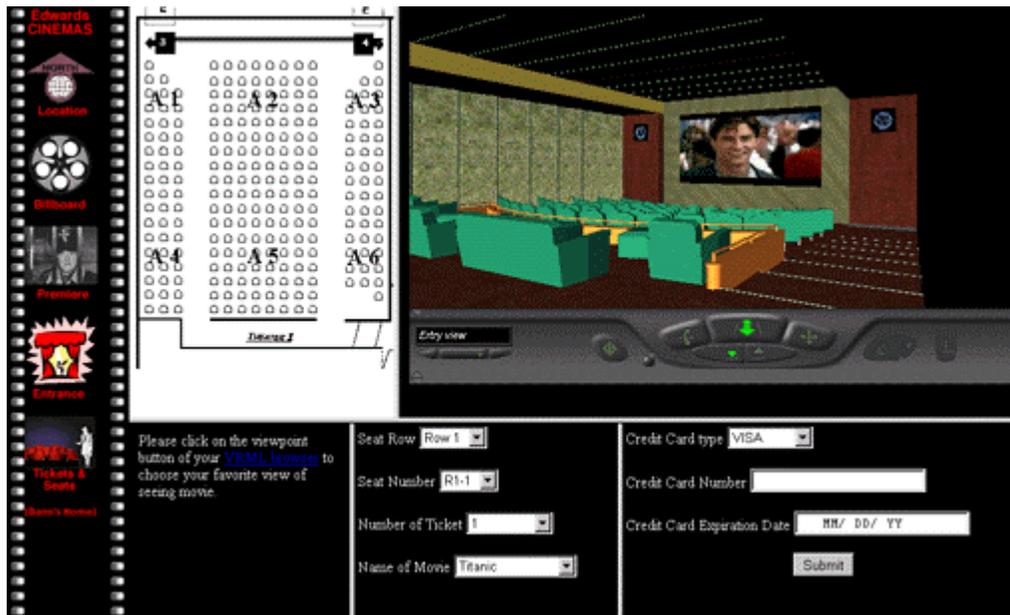


Figure 1. A virtual cinema theater by Dann Ru-Tsuen.

VIRTUAL VIDEO STORE

In this thesis project, it was assumed that a whole film could be downloaded through a high-speed connection. Therefore, an on-line video store would be possible. Compared to the previous project, a different view was taken. The video store was designed not to resemble reality but rather to emphasize to those elements that attract the eye and the mind. The whole store is enclosed in an implicit frame and it resembles more a living room than a video store. When entering the world, the camera is animated

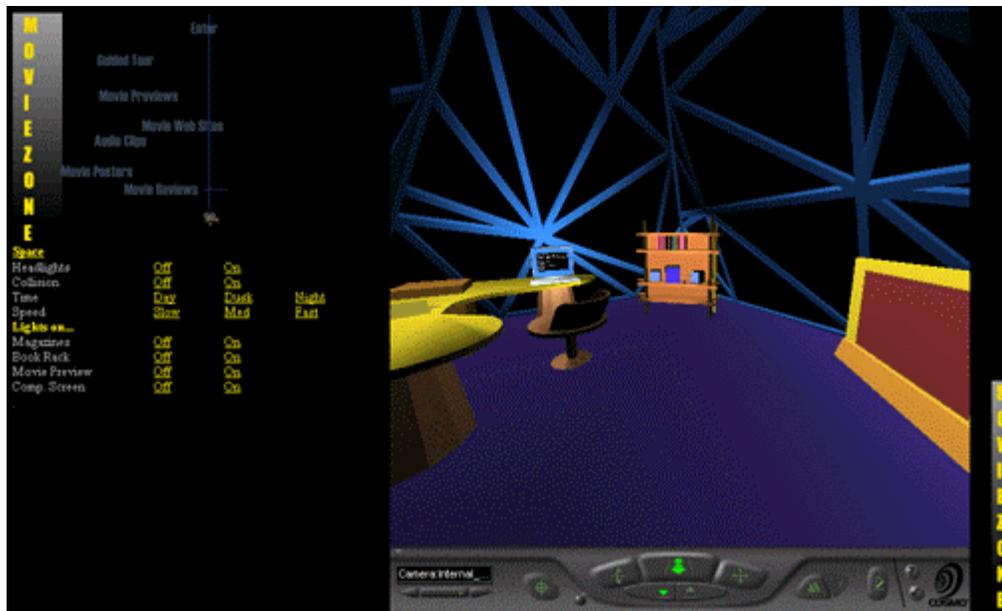


Figure 2. A virtual video store by Avantica Shahi

introducing the user to all the different functions of the store. There are different areas that perform different functions. There is a TV model that will play previews of films; a hi-fi stereo system that when clicked will play soundtracks; a magazine that shows information about the movies; posters of movies; and a video case where each video is a link to a motion picture company.

VIRTUAL GALLERY

In this thesis project, the objective was to sell an art object to a client. The student, who is now entering a business school, tried to design the thesis along these lines. The client is presented with a room where there are painting, photographs, and sculptures. By clicking on any object, the client gets a closer view of that object with many tools to examine it. There are different lighting condition, backgrounds, and colors.



Figure 3. A virtual gallery by Satish Ganesan

POTENTIAL AND FUTURE DIRECTIONS

The development of these projects may be regarded by many architectural theorists as offensive, threatening, or marginal. It may appear that none of these projects is *architectural* in the traditional sense of the word, since no physical construction is involved. Yet there are functions being served and forms being designed as if these are real buildings. Although these projects are directed more to the brain than to the body they still have a sense of architectural structure. As abstract entities they are related to their “inhabitants” in ways parallel to that of real buildings. The projects are experimental at this time but even the mere possibility that any of them may be applicable some time in the future makes them worth investigation.

The implications that these projects may have to architectural research and practice are tremendous. Imagine a world where people have the option of not having to physically move from point A to point B to get information in material form. A world where large archives of information can be accessed anytime anywhere and can be stored in a palm-sized diskette. After all information is not a material thing anyway. If that happens, then all these projects will become alternative solutions for those who prefer not to invest in unnecessary building construction.

The intention in these projects is to experiment, investigate, and complement the traditional architectural process and practice. Virtual does not necessarily mean something abstract or impractical. As the television significantly altered the need for building movie theaters, maybe the computer will also eliminate the need to build some types of buildings. This does not threaten the existence of architecture but rather shifts its practice towards new ways of expression. These projects try to complement the physical buildings and to avoid unnecessary construction. Some of the applications that this technology can offer are:

- Movie and cinema theaters
- Virtual shopping malls
- Banks and service providers
- Travel agencies and tour guides
- Educational institutions and remote learning
- Government services

Most of the future directions for these projects are aimed mostly towards efficient modeling and programming. Low speed connections and medium range personal computers require that data files are sufficiently small in size. Modeling has to be done so that the resulting models are not too complex and yet not too simple. Programming techniques can help towards that goal. Specifically, by developing the VRML models and by programming the interface between VRML and HTML it became apparent that improvements can be made in the following areas:

- a) Provide the 3D data in binary format to protect them from unauthorized copy and alter.
- b) Provide options of how to move between different levels of detail.
- c) Develop a Java navigator that will allow the user to view spaces without having to pre-download a commercial package. The VRML data could then be viewed directly without a plug-in.

It is the author's opinion that in order to address any of the above issues, it is necessary to develop a Java-based modeling system. By controlling the source code of the system, improvements can be made and new interfaces can be experimented. This is the main direction of current research and the results will be published soon.

REFERENCES

- Fukai, D.(1997) PCIS: A Piece-Based Construction Information System On The World Wide Web, Automation in Construction No. 6, (pp.287-298)
- Liggett, R. and W. Jepson (1995) An Integrated Environment for Urban Simulation. Environment and Planning b No. 22, (pp.291-305)
- McCall R. and E. Johnson (1997) Using argumentative agents to catalyze and support collaboration in design, Automation in Construction Vol. 6, (pp.299-309)
- Mitchell W. (1997) City of Bits: Space, Place, and the Infobahn, Cambridge: MIT Press.
- Negroponte N. (1995) Being Digital, Cambridge: MIT Press.
- Novak, M. (1997) Transarchitectures: Inhabiting Spacetime, in Space Design, Special Issue on Expanding Horizons of Digital Design No. 391 Tokyo: Kajima Institute Publishing Co. Ltd.