

THE MULTI-USER WORKSPACE FOR COLLABORATIVE DESIGN

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Abstract : The design process requires a collaboration between organizations and individuals. This paper considers recent research in collaborative design system, it is called the multi-user workspace. The group-oriented multi-user workspace is a design environment where the collaborative work progresses smoothly between individuals or organizations in architecture design process. This paper describes the recent research concerning the multi-user work space with inter-university collaboration. The design is processed in the multi-user work space where participants interact with each other. This paper aims to prove the availability of the Multi-user workspace and to understand its problems.

Keywords : collaborative design, multi-user workspace

1.Introduction

The architectural design requires collaborative work among various participants who are architects, clients, engineers and various agencies in stages of the design process. The Sasada laboratory has conducted the collaborative architectural design through various projects. We found some important points in the process of projects. The face-to-face meeting is periodically held in real space (for example, conferencing room) and the presentation of the project is carried

out in the design process. The participants fixed the date for presentation using e-mail, telephone and fax. It's very difficult for all participants to be present in the same place, so the projects were performed in a asynchronous fashion.

Sometimes the participants need to synchronously access the virtual space, what we call the multi-user work space, where they review the design for solving the problems quickly in the design process. In the multi-user work space, the presentation data exist in multi-media format, such as text files, images, movies and 3D objects. The participants access the multi-user work space, review the design while communicating with other participants, and they solve problems by collaborating with each other.

This paper will describe the recent research concerning multi-user work space with inter-university(Osaka University in Japan and KyungHee University in Korea) collaboration. The design is processed in the multi-user work space where participants interact with each other. This paper aims to prove the availability of the multi-user workspace and to understand its problems.

2. Multi-user work space

The Sasada laboratory has carried out various projects with collaboration. According to those projects, design system is composed uniquely to facilitate the collaboration. These projects recently carried out, let us to know the necessity of new media.

2.1 Some models of the collaborative work

The WWW mediated projects classify into 3 types as follows.

- _ Collaborative design between designers and public
- _ Collaborative design between designers
- _ Collaborative design between designers and clients

2.1.1 Collaborative design between designers and public (Maruyama Project)

On the Island of Awaji in Osaka Bay in Japan, the Maruyama fishery harbor is located. In accordance with the master plan, we designed facilities of harbor one by one. The design

process is opened to the public from the early stage using its home page. The home page for this project is composed of texts, 2D images(including sketches, CG generated still images and photos), and 3D objects. For the purpose of operating the 3D objects at high speed on Internet, the data is composed of the model of the plan without the environmental data.

The public could not review the design completely under these conditions. Communication between designers and public was only through e-mail, and the information flow was unidirectional.

2.1.2 Collaborative design between designers (Ayuyagawa Project)

The Sumoto City planned to throw the big bridge over the Ayuya river, and requested the design of it to the Sasada laboratory. This case is processed between designers who have various specialties, and the feedback among the participants is very quick. The BBS records the comments and questions with image automatically, so the bidirectional communication is accomplished.

2.1.3 Collaborative design between designers and clients (Mikata Project)

The Mikata-cho in Fukui Prefecture is famous for the vestiges of Jomon Age. The Mikata-cho planned to make Jomon Park including the museum, recreation facilities and research center. The clients could review the design through 2D images of project home page and operate the VRML of the plan from all viewpoints.

In this project the interactive bulletin board is used for bi-directional communication. The clients download the image of project home page, and write his or her opinion on it and attach the image with e-mail. The agent program automatically separate the text and the image, and upload it to project home page. All of attach file is 2D image.

2.1.4 Lessons from these projects

Through these projects we found the necessity of new media with some conditions for smooth design review, that is synchronous, real and interactive media. We begun to research new collaboration system in 3D virtual space like any place in reality. If this 3D virtual space is the

same as real space, the participants, who are clients, or specialists, or designers, can perceive the things as their own way.

2.2 Concept of multi-user work space

Like any place in reality, the street is subject to development in Multi-user work space. Users can build their own small streets feeding off of the main one. They can build buildings, parks, signs, as well as things that do not exist in reality, such as special neighborhoods where the rules of three dimensional space-time are ignored. The events happen in a virtual three-dimensional world in a computer-driven alternate universe where people assume avatars, converse, travel, plan, and build.

Multi-user work space consists of shared virtual space and private virtual space. Shared virtual space allows multi-users to interact on the Internet. On the other hand, private virtual space is not shared for private work. The shared virtual space allows many kinds of tools in Multi-user work space to be shared, and changes in Multi-user work space such as motion, data modifications and sound are transmitted to the users immediately. In this case, the problem of having a seamless environment in time and space is solved. The private virtual space has a function in a separate space (not shared). The design process needs to set limits to the public, and needs to progress in private space until the design is partially completed. Thereafter, the shared Multi-user work space accommodates changes. In addition, the people concerned in the design process are free from the restraints of being present at the same time and same place. This can be compared to using a bulletin board for communication. The asynchronous function improves the quality of communication or design.

The method to express the representation of multi-user in the virtual space is very important. An avatar is the embodiment or representation of a user's awareness and identity within a multi-user computing environment. For virtual worlds, an avatar is an audiovisual representation of a human user that facilitates communication with other users in cyberspace. The purpose of the avatar is to give other users in a multi-user distributed VR simulation a proxy or surrogate for the purposes of simplifying and facilitating multi-user interactions on a social level. Thus, the representation of many human traits are important in the avatar representation of the user. For example, emotion and gesture may be vital for creating optimal

virtual conversation interfaces for users.

Virtual space is built by Project server. Project Server consists of a property server, an avatar server and Web Server. The property server manages all the data related to the building and objects in the world. The avatar server communicates avatar traffic through the world. In addition, a web server is required for storing the art work for the world. This web server can be anywhere on the Internet. The client who has their own browsers can access the project server.

3. Inter-University Project (KyungHee Project)

KyungHee University in Korea will establish the graduate school of architecture engineering for training design professionals. The established education system was given too much of logical reasoning, so the curriculum of the graduate school of architecture engineering is made centered upon practical experience. The building is composed of CAD room, computer room and lecture room with slide, audio and video facility. For the design of the building, the Inter-University project between KyungHee University in Korea and Osaka University in Japan has begun.

In the early stage of the project both of universities set up the project home page and shared the data. KyungHee University presented a topographical map, the picture of the building around the site, and the drawings in their home page. Osaka University provided various tools such as groupware calendar, bulletin board and web robots database to support multi-user workspace.

3.1 Objects making with Data base

KyungHee University produced 3D models of the buildings around the site, and presented those images and dxf files in their home page. Osaka university downloaded the dxf files from KyungHee home page, converted it into VRML for design review at any time on the Internet, and represented it to Osaka University home page. The multi-user work space is made by arranging the 3D objects after the 3D model is produced. Moreover, we could review and refine the design in the multi-user workspace.

3.1.1 Standard format for sharing 3D model data

We have different modelers(ArchiCAD, formZ, AutoCAD), so the 3D model data is shared by using dxf and VRML format. In the early stage of the project, KyungHee University made 3D model while Osaka university made it into VRML. As time went by KyungHee University understood how to make VRML and QTVR, and finally they made 3D model and VRML. In this process, we communicated how to use internet technology.

3.1.2 Data arrangement with web robots database

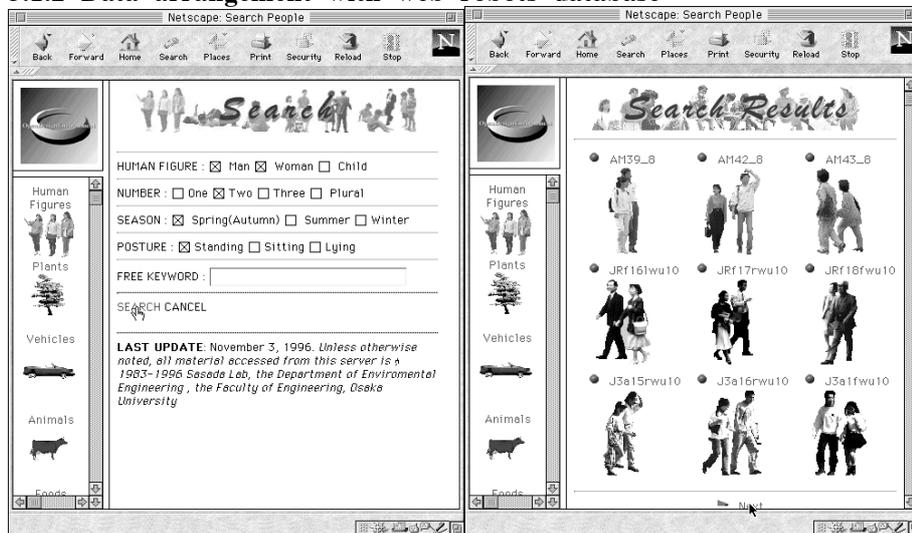


Figure 1 Web Robots

We used Web Robots Database for data arrangement on the virtual space. Web Robots Databases are used to manage and effectively search the distributed data on the internet. The List of Active Robots has been changed to a new format. This format allows more information to be stored, allows faster updates, and information to be more clearly presented.

The Web Robots Database is composed of robot, intelligent agent and a search engine. A robot is a program that automatically traverses the Web's hypertext structure by retrieving a document, and recursively retrieving all documents that are referenced. Intelligent agents are programs that help users with things, such as choosing a product, or guiding a user to fill forms, or even helping users find things. A search engine is a program that searches through databases of HTML documents gathered by a robot. (Figure 1).

3.1.3 communication with BBS

The BBS is used for communication between participants, and records the problems, questions and answers with multi-media data including text, image, VRML and movie. User post message with attached file, such as image, VRML and movie, BBS represent the contents user posted with inlined multi-media data (Figure 2).

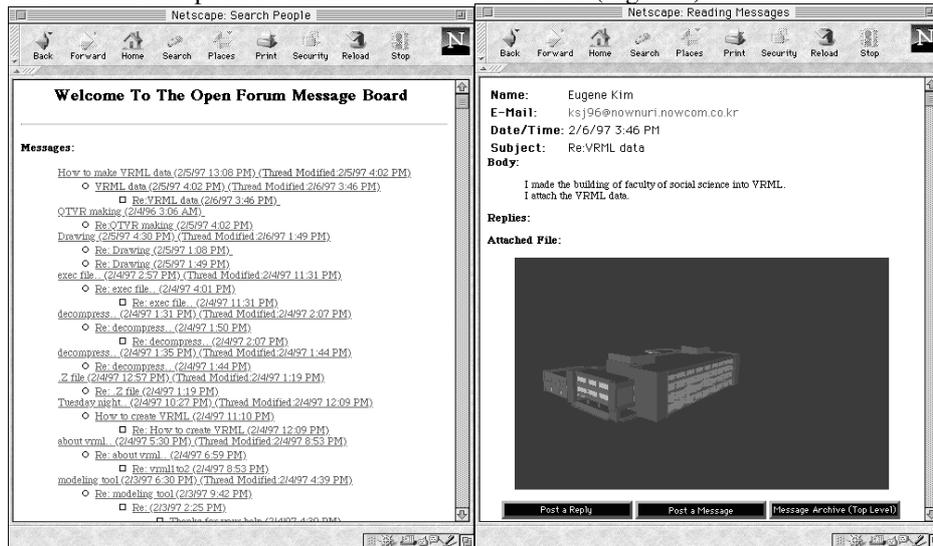


Figure 2 Bulletin Board System

The representative communication tools have its own advantages and disadvantages. The characteristics are as follows (Table 1). Comparing these communication tools, BBS is most useful in this project.

Table 1. Comparison of communication tools

	data format	records	comments
e-mail	text, image, movie, VRML	user's machine	record in participation time
BBS	text, image, movie, VRML	Project Server	record all history of project, whenever user reference the history, categorized by the questions

chat	text	not save, or user's machine	record in participation time
news group	text	News Server	once user read, never can't read, tree architecture

3.2 Design review in multi-user workspace

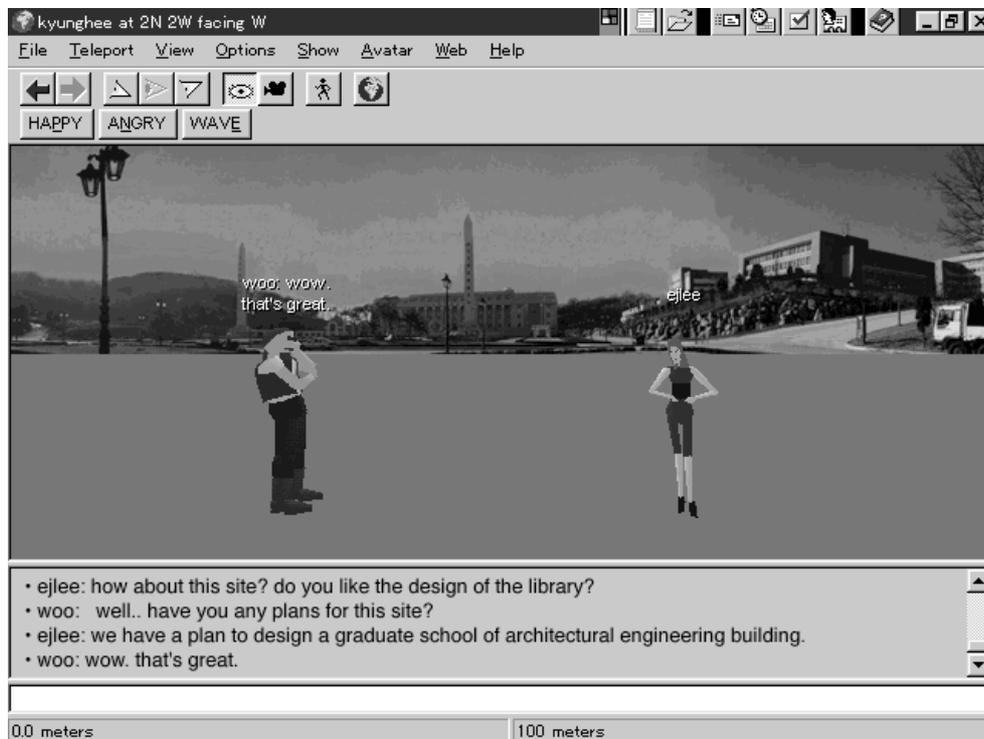


Figure 3 Multi-User Workspace

The server of multi-user workspace is setup after the background image of the site is completed. The server of multi-user workspace is composed of property server, avatar server and web server. Both universities made 3D models the buildings around the site, and placed it in multi-user workspace. The 3D model data produced by various modeler made into DXF or VRML format, and finally converted into RWX format(renderware format). These RWX data are saved in project server, and the participants can use it via their own browser. The available data are buildings, facilities, 2D images of human figures or trees, texture materials, 3D vehicles and street furniture.

The participants reviewed the design using their browsers whenever they wanted. They could simply arrange, move, and transform the objects in the multi-user workspace. The participants could recognize the avatar as a remote representation of human identity and existence, and express the emotion through the avatar. It's possible to communicate precisely through this synchronous communication.

After the environmental data is located in multi-user workspace, the participants reviewed each of the design alternatives while communicating with each other. The communication tool was BBS and chat, and the contents of the communication was recorded. As the result of the design review, 3 of the design alternatives were accepted (Figure 3).

4. Conclusion

Architecture design is the result of the teamwork of multi-disciplinary groups including designer, client and committee. The design process includes the exchange of information between individuals and organizations, and discussions among professionals of the team. In this study, professor and students enter into a shared virtual space which they made, and review the design interactively. This system is an available environment for participants to access data made by collaboration on the web at anytime. Each participant can see what he or she wants using the interactive function, such as walkthrough and examiners (review tool of rotating the object) and non-interactive functions, such as still images and animation, while he or she communicates with another participant.

Each student can review the design in the virtual space made by the professor and students. It is easy to use an authoring tool for making data, gathering opinions of participants on the bulletin board, VRML viewing and application analysis of the shadows from a distributed area. All of them are composed componently. This design environment makes design review possible at any stage of design in Multi-user work space on the web.

In this study, the Multi-user work space makes it clear that there is the possibility of open architecture with progressive communication between professor and students in various locations, with the Kyunghee project.

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