Virtual Design Studio 1998 - a Place2Wait

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This article reports on the recent, geographically and temporally distributed, intercollegiate Virtual Design Studio based on the 1998 implementation Phase(x) environment. Students participating in this workshop had to create a place to wait in the form of a folly. This design task was cut in five logical parts, called phases. Every phase had to be finished within a specific timeframe (one day), after which the results would be stored in a common data repository, an online MSQL database environment which holds besides the presentations, consisting of text, 3D models and rendered images, basic project information like the descriptions of the phases and design process visualization tools. This approach to collaborative work is better known as memetic engineering and has successfully been used in several educational programs and past Virtual Design Studios.

During the workshop, students made use of a variety of tools, including modeling tools (specifically Sculptor), video-conferencing software and rendering programs. The project distinguishes itself from previous Virtual Design Studios in leaving the design task more open, thereby focusing on the design process itself. From this perspective, this paper represents both a continuation of existing reports about previous Virtual Design Studios and a specific extension by the offered focus. Specific attention will be given at how the different collaborating parties dealt with the data flow and modification, the crux within a successful effort to cooperate on a common design task.

Keywords*: Collaborative design, design process, new media usage, global networks*

Introduction

With the growing global awareness and specialization in the architectural design and construction industry, the need for collaborative work at remote locations supported by computational and telecommunication technology is rising. The industry is moving towards a state in which the emphasis is increasingly on networked computing, interwoven with the attention for social and interpersonal aspects. The need for competitive advantage between companies creates an awareness for coupling expertise at a scale never seen before - the continuing revolution in the technology enabling cooperative design work is changing the way architectural practice is perceived. Occupying the largest part of the architectural design process, communication demands the development of environments which accommodate asynchronous and synchronous data streams, and the coupling of information repositories. Expected is the continuation of networked computing, hand in hand with the thriving development of simulation and visualization tools to support digital information exchange. Blending the edges between technology and social aspects in the architectural design process, GroupWare applications supporting collaborative work have to keep the same pace as networked computing itself. A very important focal point in these developments is enabling the shared understanding between the multiple professions in the process. There is a need for consistent and non multiple-interpretable data exchange between the participants of the process, requiring extensive experiments with state-of-the-art technology. This need can be partially addressed through the focussed deployment of VRAD. The Virtual Reality Aided Design can be best described as Computer Aided Design using virtual reality methods. Virtual Reality Aided Design systems can have a radical influence on the way architects design and communicate their ideas at distance.

Since 1992, several universities around the world have been experimenting with a new architectural design method involving the temporally and geographically distributed collaboration, known today as Virtual Design Studio (VDS) paradigm. Perfectly fitting in the latest wave of developments, this paradigm focuses at the dynamic control of social aspects in the design process by the exploitation of technological possibilities. The electronic media used in the experiments should create a new culture, a *global village*, in which the distance between people is radically reduced. Although the computer mediated collaborative design is not longer uncommon in the contemporary design practice [Wojtowicz et al 1998], the spiral movement of analyses, synthesis and evaluation of design development requires more work on development of the new design and communication methods. The VDS experiments are at the core of achieving this, although the paradigm only represents one approach. We believe that usage of Virtual Reality Aided Design Systems can have a positive impact on the development of new design and communication methods. This article will also report on the usage of these kind of system within the 1998 VDS.

Phase(x)

Continuing the line of the VDS'97 workshop called "Multiplying Time", students and teachers at Hong Kong University, ETH Zürich, University of Washington (Seattle), University of British Columbia (Vancouver) and Bauhaus - University Weimar joined in a collaborative design week called "VDS'98, a Place2Wait". As the participants were located approximately 8 hours apart in three different time zones, the work on the common design tasks continued around the clock. A global think-tank was created, in which one used computer-aided design systems, a central database, World Wide Web, and video-conferencing. At Bauhaus-University Weimar, the Virtual Reality Aided Modeler (VRAM), which is currently under development, was additionally used for viewing and modifying designs.

To coordinate the continuous, collaborative work on the common design task, one made use of the Phase(x) approach. This approach has been developed at ETH Zürich and is successfully used in several courses there. The approach makes use of phases to cut the design task in several parts. Every phase, a student has to finish this subtask and submit it to a digital pinup board, a MSQL database environment which holds text, 3D models and rendered images. In the next phase, the student has to choose a design created by another student in the previous phase to develop it further. This approach forces the sharing of design ideas and the forming of design teams - one can hardly speak of individual authorship of ideas anymore, but rather of individual contributions to a shared design model. To support a level of shared understanding between the participants, students have to explain their ideas and contributions, using the implemented presentation template in the web based pinup board. After finishing all the phases, genetic trees can be created showing the influence, the contributions of students on the shared design models.

A great advantage of using the Phase(X) database is that participants can view the design process at any place, at any time. However, to allow interpersonal contact and communication, the workshops also make use if email and videoconference sessions: because of the time-differences, participants can share design ideas in the same phase after an 8 hour work session. For example, Hong Kong starts and develops design ideas and models which they can communicate to Weimar after 8 hours, approximately the time when Weimar starts working with the phase requirements. The total project can be best seen as a spiral movement, in which design ideas get to a higher level each phase.

The Task

> *As the viewer's mind works with the provocative image, unconscious associations are liberated, and the creative imagination asserts itself*. From Phase One: Parti, place2wait, VDS98.

The main task of Place2Wait was to design a place to wait as a folly, placed on a nondescript, generic site. Traditionally, a folly can be seen as an exotic structure, often in the form of a small pavilion placed in a park or garden. Famous follies are Parc de la Villette (Bernard Tschumi) and the Osaka Follies, built in the eighties for the Expo. The experimental character of the design task allowed the potentially strong connection with surrealism: to support the participants in their creative idea-finding process, several phase descriptions inhabited a background description on surrealistic art(ists) or ideas.

The design process, from tabula rasa to a structured design, was cut into five phases. In phase 1, called parti, participants had to create a conceptual, rather abstract model of a folly, which had to be refined in phase 2, called *form*. In phase 3 (*detail*), the participants had to further detail this model, after which they had to apply material on it in phase 4 (*material*). In phase 5 (*place*), the participants were completely free in choosing a building site.

The real-time solid modeling system called Sculptor was used by all of the participants. This conceptual design tool has been developed by David Kurmann at ETH Zürich and successfully used in several, previously held Virtual Design Studios.

Results

As could be expected from the previously held Virtual Design Studios using the Phase(x) approach, one can clearly speak of a *collaborative* design week. A look at the VDS website shows a wide variety of models, in which via threads and genetic trees the contributions to the shared models can be viewed. Questionable, however, is in how far ideas were really shared: the communication streams between the universities were unfortunately insufficient to allow a high level of idea sharing on a direct, possibly face-to-face level. Email was seldom used for personal communication, presentations were often visually oriented and therefor multi-interpretable, and desktop videoconferences were limited by the bandwidth, unless audio-feedback was provided via a telephone connection. In the case of videoconferencing, people often feel unpleasant or insecure using it, caused by both language differences and bad audio connections. On the other hand, reviewing the visual structure of a model, supported by the VRML browser on the VDS website, was more successful.

The strength and success of the workshop, being relatively *independent* of long range communication media, certainly lies in the power of Phase(X) of specifically supporting asynchronous collaboration. In the past, there were several other VDS projects were this aspect was addressed successfully through use of dedicated ISDN lines, or casual student to student desktop video connections. Phase(x) by its very nature is very structured and asynchronously oriented. This can certainly be marked as both its strength and its limit.

Additionally, very interesting observations can be obtained from students using Sculptor. It can clearly be seen that students first have to get through experiencing the new program itself, getting used to modeling with the solids and voids in a very approximate way. Some students tended to see Sculptor as a simplified CA(A)D program, which should function like a construction technical program and get frustrated when they try to use it in such way.

Among the new tools introduced in the Place2Wait project was the evaluation system allowing tutors and potentially students to offer quick critical feedback on the published designs. This certainly deserves further study and should be encouraged in any collaborative environment. The ability to query the collective database and display the results in the graphic, and genetic format is the unique strength of the Phase(x) environment. Its creative use should be further encouraged during the design process in the future.

From Bauhaus-University Weimar perspective - VRAD systems

Since the introduction of the paradigm, the VDS workshops have been a place to test new design media in a collaborative design process. For several years now, the non-immersive, desktop virtual reality modeler Sculptor has been used for modeling the conceptual designs during the workshop. This year, at Bauhaus University Weimar (BUW), a complementary tool was used for design and review, called Virtual Reality Aided Modeler (VRAM). This tool, which has recently been developed at BUW, allows fully immersive navigation, editing and construction of designs. BUW has a strong tradition with VRAD systems - in the past years, two conceptual design tools have been developed, called voxDesign and planeDesign. The voxDesign software environment specifically focuses at sketch oriented creation of spaces with voxels, whereas planeDesign is space oriented making use of planes [Regenbrecht et al 1997] [Donath et al 1995]. All systems make use of a Virtual research VR4 HMD, a stylus, a Polhemus Fastrak magnetic tracking device and the at the university developed “platform” construction. To allow the user to interact with the virtual environment without ergonomical restrictions (like the many cables) the wooden platform construction enables movement in an almost unconstrained 4x4x2.5 meter space.

During the last phase of VDS’98, the participants used the VRAM software environment to review their designs, by simply exporting VRML models from Sculptor which could be loaded in VRAM. Next to the platform construction, a large 2x3 meter projection screen was setup. The combination of the user immersed at the platform and the participating colleagues watching the screen showing the same image as could be seen by the user wearing the HMD, supplied us with informal, but very usable information. Users preferred being fully immersed above viewing the designs at the projection wall or at the desktop, but did not perform large adaptations on the model, as was done with Sculptor. The power of using an immersive design review and creation tool can be explained by focussing on the spatial knowledge acquisition implications. The designs which were viewed were rather abstract and it is relatively hard to get a good view on the spatial qualities of these designs using a desktop system, even though one can easily obtain multiple viewpoints within the VRML browser. First, consider the different kinds of spatial knowledge, namely configurational knowledge (the cognitive map which holds object locations and inter-object distances from a geocentric perspective), procedural knowledge (the depiction of sequences of actions) and landmark knowledge (the storage of visual detail) [Goerger et al 1996]. The obtainment of spatial knowledge is closely related to the egocentric (human point of view) and exocentric (bird’s view) frames of reference. With all manual and desktop based design tools, the focus largely is on using exocentric viewpoints on designs. This is ideal for getting configurational knowledge, but it is far more recommendable to obtain spatial knowledge via both exocentric and egocentric viewpoints for a more complete mental model of the design. The mental transformation of an exocentric viewpoint to an egocentric viewpoint is very hard due to the limited human spatial abilities, which is were a VRAD system comes to aid. In a VRAD system, one can easily obtain both egocentric and exocentric viewpoints by viewing graphical output which can also match the real scale of he design. The user wearing the HMD has a rather limited field-of-view, but a 360º field of regard, resulting in an environment which completely surrounds the user, who is able to view around. During the process of viewing and walking through the designed environment, users obtain several very important cues with respect to the egocentric frame of reference. Namely, position, motion and orientation of objects are determined receiving headcentric and bodycentric cues received from head and body motion, and both proprioceptive and vestibular cue, caused by movement in real space and interaction with the designed environment [Howard 1991]. Students using the VRAM software environment reported positively on the usage of a VRAD system to obtain a more clear view on the designs of both themselves and others during VDS'98. The VRAD system made it a lot easier for the students to quickly evaluate a design, which was often hard with the limited text and visual information available on the website, after which modifications could be made in Sculptor.

Summarizing, the usage of a VRAD system during VDS workshop can certainly be seen as an added advantage on top of the already used design support systems. The quick obtainment of spatial knowledge is very important, since during the VDS workshops students often need to evaluate ambiguous models. Though, there is still a need for better interaction techniques to take the full potential of a VRAD system for modeling in virtual space too. Furthermore, there is also a great potential in developing support for distributed, multi-user design environments, which may well take future VDS workshops to a new level.

From the UBC Perspective

At UBC five only architecture students participated in the Place2Wait exercise using the facilities of MAGIC Lab at Computer Science. They were not thoroughly familiar with the UNIX environment and Sculptor solid modeling software after the few hours introduction prior to start of the project. Additional instruction or more comprehensive help menu could facilitate the first days with the Phase(x). Implementation of the server at ETH was delayed by the few hours and reduced the time of the Phase One for the students in Pacific Standard Time zone. However, by the second day everything started to fall in place, as the familiarity with the new environment was established. During the first few days students lost some time attempted in vain to move geometry out of the Sculptor to the more familiar modeling tools or to import it back. As this proved impossible designers returned to continue work within the limits of the new conventions and tools.

Students utilized chat and participated in several informal point to point video conferencing sessions using Inperson. For the final review of the project the multicast session the video session over the Internet was made possible by moving voice to POT based conference call with speaker phone at each site.

In retrospect the direct synchronous exchanges and communication with other participants were not central to the project success and the majority of time was devoted to development and asynchronous publishing of the basic design projects. Well structured database and excellent tools like map and evaluation were largely underused due to limited time devoted to the project. At the end of this exciting studio all at UBC agreed that more time should be devoted to evaluation and discussion of the project at the end of each stage and at the end of the exercise. Students propose to devote more time to the design development and tectonic design in the future studios.

Conclusion

We are still far from a truly collaborative, geographically distributed and synchronous design environment. The current state of the art is limited by the bandwidth and it remains largely asynchronous.

The structured nature of the phase(X) can be seen as restrictive, However the limits resulting from its structure and from the decision to use common software (Sculptor) was also seminal and important factor helping in recording, organizing and ultimately exploring the complexity and history of the creative, but guided design exchanges.

This rendition of VDS can be seen as innovative as it introduced the online evaluation and the immersive environment to the geographically distributed design studio. While VR was attempted only at one of the projects four sites, namely at Bauhaus Weimar University it is potentially very interesting. In the future the implementation of asynchronous immersive environments utilizing immersive environments in asynchronous mode can extend the VDS environment into the new realm.

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