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Virtual Design Studios

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Beginning in 1993, small groups of students of architectural design at different institutions around the world participated in collaborative design projects using a variety of tools, including CAD, Internet and teleconferencing. This programme, known as the "Virtual Design Studio" (VDS), allows students to work collectively with colleagues from different cultures and climates who are thousands of kilometres and in different time zones. Most recently, in February 1994, four institutions in N. America, one in Europe, and one in S E Asia participated in VDS'94. This paper explains the operation of the VDS and explores the future of the VDS as a potential tool for architectural design education. In particular, we review what we have learned in employing computer tools to extend the teaching in design studios into a 'virtual' experience.

Introduction

The Virtual Design Studio (VDS) completed in February 1994 at the University of Hong Kong was our second experience in participating is such a studio. The earlier experience, VDS'93, is comprehensively documented in *Virtual Design Studio* (Wojtowicz 1994*a*). The objective of VDS'94 was to continue to investigate the dynamics of designing across the barriers of space and time while exploring how design collaborations are affected by technology. We want here to review the process of running a virtual studio and how it might be improved. A broader discussion of the experiences of VDS'94 can be found in Cheng 1994 and Wojtowicz 1994*b*.

The project set this year was the redesign of traditional Li-Long courtyard housing in Shanghai. Basic data had been collected by students from the University of British Columbia (UBC) during a summer visit in 1993. Li-Long housing is a unique tenement form developed in the early 1930s, mixing traditional housing forms with occidental architectural techniques to produce a higher density solution.

Participating institutions in 1994 were (from East to West), the University of Hong Kong, ETSAB in Barcelona, MIT, Cornell, Washington University in St. Louis and UBC in Vancouver. Some students from Harvard participated under the auspices of MIT. We were unable to include students from a school of architecture in Shanghai, although this had been the original intention. Instead, a visiting lecturer from Tongji University (Shanghai) was present in Hong Kong during the studio and was able to give criticism and a local perspective. Languages in use were English, Spanish and Cantonese.

System Configuration

In common with earlier VDS exercises, we established a central server at UBC, known as the 'pinup' account. All users were given access to this account and were able to post and retrieve files using ftp. Participants exchanged scanned images in TIFF format, CAD models in DXF format and posted long text files in ASCII format. Thus, we started the studio by posting in pinup the brief (ASCII text), photographs of the site (TIFF images), and site models (CAD files). In addition to posted files, e-mail flowed directly between participants or was sent to distribution lists (which eventually became longer than the messages that followed).

Each institution had a subdirectory on Pinup into which they could post their own files. Anyone wanting to find information from other sites would therefore explore the listings under that sites subdirectory. Additional subdirectories were established to post the handouts (text, images and models each having their own branch under HANDOUTS), and a 'lost and found' subdirectory in which the system administrator could place stray items.

In order to make the information more accessible, the separate sites each created a local mirror of the pinup. In our case, we created hardcopy from some of the exchanged images in order to heighten awareness of the other designs, and to keep track of what was going on.

There were no restrictions placed on hardware or software configurations at each school. Most sites used Silicon Graphics machines and many used Macintoshes and PCs. CAD software tended to be Autocad but included others. We wanted to allow each site the freedom to do what they thought best and to use whatever systems they had at hand. In Hong Kong, we used PCs for scanning and initial CAD modelling. Students then moved up to SGI devices to complete the modelling and rendering, as well as using these devices for communications.

We had to agree upon file formats and naming conventions. We settled on using ASCII for text transfer rather than RTF, 24 bit TIFF formats for images and DXF or DWG formats for models. All files were compressed using UNIX *compress* before posting in order to save disk space and transfer times.

Students communicated primarily through asynchronous exchanges by posting files to pinup and e-mail messages. In order to explore real-time collaboration, we installed Collage (version 1.2.1), an interactive whiteboard and image sharing program (downloaded from ftp.ncsa.uiuc.edu), and VAT, LBL's Visual Audio Tool for audio conferencing over networks, using version 2.17beta (downloaded from ftp.ee.lbl.gov). These two latter systems were tried successfully by the participants within North America and also within individual sites (such as at HKU where the systems worked well within the campus) but we found that the intercontinental connections established were too slow for successful synchronous collaboration.

We concluded the studio with a six-way video conference call. In Hong Kong, we started before breakfast at 6am, joining Barcelona as they engaged in midnight revelry while Boston and Vancouver enjoyed wine and cheese.

Running the studio

From our point of view (and from others we suspect), the studio was a harrowing experience. Co-ordinating the teaching schedules of six institutions was bad enough. We eventually found a two week period in which we could all commit our attention. This was considered less time than desirable since the earlier experience had suggested that three or four weeks might be a more reasonable time frame in which to obtain substantial design solutions as well as handle the inevitable technological impediments. We in Hong Kong did manage to extend the two week period a little by starting our students a few days earlier, giving them research tasks to get on with before joining the studio.

We had the normal snail's-pace start that students exhibit when faced with any design problem. Slowly, the students came to focus on the topic and started to study Li-Long housing while learning the software skills they had failed to acquire during classes on the subjects. Networks failed and cables disconnected just when you needed them most. File transfers were slow over Internet, especially for files of the size we create using graphics systems. In Hong Kong, we suffer from a particular limitation of bandwidth at the satellite up-link, one which is being addressed and improved this summer.

Each site approached the studio in its own way. At HKU, we formed three teams, grouping some of our fourth year students into teams of three or four. Each team used whatever hardware or software they could, depending upon what they had at home or knew how to use in the department. Other schools allowed each student to develop their own designs individually. In part, this contributed to the proliferation of participants, making inter-site collaboration more

difficult to set up. Conversely, we found that our teams were so busy with local negotiations that the distanced exercises became less compelling.

We started to tackle the problem by sketching on paper, by gathering background information and reference materials on housing, Shanghai, climate, anything. Relevant information to be communicated was scanned in and converted to TIFF format. Other sites did the same. Postcards, maps, scraps of paper all went into the scanner. Being the only school in Asia participating, we felt a responsibility to find out as much as we could about Li-Long housing and the Shanghai context. This we channelled back through the Internet to Pinup for others to use.

A major sense of connection came when the students first received images from other schools. At first, bit-mapped images appeared without explanations, as cryptic as Rorschach tests, but much more colourful. Later, as we got in the habit of starting each day with time-consuming downloads, we would be delighted as new design images emerged. Because of time limitations, they provided food for thought rather than being incorporated into our design investigations.

Reviewing the results

Our students went off on their own tangents, as did other schools. We focused on functional needs, reflecting our social situation in Hong Kong where high densities and enormous economic pressures make the pragmatic desirable. Our students were fascinated by the ethereal fantasies of East Coast schools. They came to see some of the different approaches practised around the world but, with little interaction, they could only speculate why these differences existed.

Encouraging and guiding the design discussion over the network could make the exchange more productive. For example, early in the process our students viscerally responded to some of the posted "Chinese" images with questions about their validity, feeling a little mocked by occidental caricature; not the most delicate way to start an Internet relationship. In one case, a few students followed this up with a very negative e-mail design crit and were honestly surprised that they did not get any response. They were just echoing the architecture school culture most familiar to them in a context which denied the immediate feedback normally received.

Presentation skills are always an issue in schools of architecture. Our students are very proficient at producing splendidly composed boards with detailed and carefully assembled wood and plastic models. This proficiency is reflected in their ability to prepare detailed digital compositions. Although we start teaching computer skills in the first of the five years, we have found that the students are not that proficient at presenting using digital media, having not digested the differences of the media. Obviously we are not alone; in the course of the final crit for VDS'94, this was seen to be true of other schools. What was never explored in the brief time we had was the effect that digital interfaces were imposing on the communication process -- that is, we experienced the differences but did not get a chance to investigate them.

In order to get beyond the traditional constraints of the physical studio and to exploit the digital studio, we have to cultivate new ways of working. Most importantly we have to introduce better collaborative attitudes. Each site has a responsibility to encourage exchange. Diverted by local exigencies, it is inevitable that each site might 'go silent' for a while. Conventions can be developed to convey the temporary isolation. It was the consistent silence which was disturbing. We found that some sites participated some of the time as passive nodes from which little was heard, thus diluting the collaborative experience. The students found this most disconcerting and it visibly discouraged them from further attempts at interaction.   At the root of it lie asynchrony and synchrony and the best ways to exploit their presence.

Observations on synchrony

A fundamental issue in collaborative design is the difference between synchronous and asynchronous communication. Our VDS explorations have been in large part reviewing this question. Clearly, some design activities are asynchronous in their nature (such as privately exploring design solutions) while others, such as a crit, are synchronous. With constraints of time zones and band width, we cannot (nor wish to) make all the work synchronous. Thus, e-mail, pinup and ftp are adequate tools. We are looking to improve our asynchronous communication and expect to use Mosaic as the interface next time.

On the other hand, there are times when synchronous collaboration is desirable. Much has been written about the role of video in collaboration. We have begun to explore this, using SGI INDY platforms, but the work is not concluded and our conclusions are tentative. We have found that it is far more important to have the ability to collaboratively manipulate and edit a graphic image, supplementing this collaboration with audio exchanges, than to have a video link. Without video, we can utilise our narrow bandwidth channels and rely less on expensive high bandwidth. More exploration has to be done here and this probably will be the focus of the next VDS.

Conclusions

What would we do differently?

Certainly reduce the number of participants, in reality or virtually. Six institutions was too many, each with several teams or individuals. Students could not exchange ideas or interact well. Next time, we will establish a requirement for students in different institutions to pair up and design together. The metaphor which we have come to use is to treat this as a chess tournament, where each participant may only play one other at any one time but over the course of the tournament, each person plays (interacts with) a large number of others. Clearly we have to accommodate large numbers of participants (that is the reality of design often). We need to develop management strategies to comfortably handle them all.

Spend some time at the start of the studio allowing teams to establish identities for themselves on the network, by exchanging images or data which promotes an identity, such as Barcelona did with scanned candy and quotes. This was done during the prior virtual studio, VDS'93, and it helped establish rapport. In addition, the emerging personalities make the virtual atelier more vivid and define how group members are inclined to interact. This gives clues to the kind of role each of the participants can take in solving the design problem efficiently as a group.

Improve the sharing of information over congested bandwidth. We will be developing tools to allow different sites to query and manipulate shared models without the need for extensive transfer of large databases. Combined with a whiteboard and an audio link, this promises to be a useful platform for design collaborations.

We are establishing a design network within Hong Kong, connecting architecture students at the University of Hong Kong to the Department of Architecture at the Chinese University of Hong Kong and interior design students at the Hong Kong Polytechnic. These lessons will be applied as we move on to explore some of the broader issues of interaction and collaborative design. We have established our department as a discrete Internet address (arch.hku.hk) and will be setting up a World Wide Web server soon. Both of these moves are an attempt to reduce the network barriers for communications while giving our own department greater control over our own node.

Architecture in Hong Kong operates very much in an international context, both for practice and education. Our students already participate successfully each year in several international competitions. In addition, digital ways of working are well into all our design studios, from first year to fifth. Bringing these together, we are looking to expand the opportunities for international digital collaboration in design studios. We see it as an important professional future and, more pertinently, a necessary pedagogical technique.

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