THE 24 HOUR DESIGN CYCLE

An Experiment in Design Collaboration Over the Internet

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Abstract. This paper describes a Virtual Design Studio exercise involving three academic institutions – University of Hong Kong (China), ETH Zurich (Switzerland), and University of Washington, Seattle (USA) – whereby teachers and students, obviously on three different continents and in three different time zones, roughly eight hours apart, were working on a common design project using computer-aided design systems, video-conferencing and a web-based central database that managed and displayed all works throughout the process. The 24 hour design cycle is a metaphor for a more open and international approach to design, facilitated through computer networks. It implies a new form of collective authorship and distributed credits and thus deals with some of the essential challenges and opportunities the internet poses to creative disciplines.

1. Introduction

International collaboration via computer networks is increasingly important in the design and building industry. For large projects on an international scale, it has already become an absolute necessity. Time lags involved in sending physical plans, as well as project meetings that involve travelling can be avoided very effectively through the use of the various synchronous and asynchronous collaboration methods that the internet offers. With the advent of the world wide web, the accessibility of these communication means has become almost ubiquitous. This has created a strong trend that is changing the working

environment and infrastructure in large architecture, engineering and construction (AEC) firms quite dramatically.

While becoming ever more widespread, these new collaboration means are still being used according to traditional paradigms. So there is a strong need for new design and communication methods (Wojtowicz 1994, Schmitt 1996).

As we can tell from the development of the internet, an environment where individual ideas are basically everybody's freeware can generate an unparalleled pace of innovation. So there is obviously a strong potential in such open networks for creative work, though these processes run counter to established notions of authorship. By recording the exchange of model data between the participants, the Virtual Design Studio (VDS) we're describing in this paper created a new type of collective authorship. It was an experiment in design collaboration that thus tried to unlock the creative power of open networked environments to architectural design.

2. The 24 Hour Design Cycle

The term “Virtual Design Studio” was used for the first time and defined by William Mitchell in his talk at MIT’s Media Lab in early 1993, as reported by Wojtowicz (1994). The first Virtual Design Studio experiments date back to the early 1990’s, when typical applications were the collaborative work on design problems and the presentation and critique of a project through the network (Wojtowicz 1994, Lee 1998).

Three academic institutions were involved in the VDS described here: Hong Kong University, ETH Zürich and University of Washington, Seattle. The very particular geographic and temporal constellation of these partners – obviously on three different continents and in three different time zones, roughly eight hours apart – made it possible to “multiply time” by working continuously around the clock at one common design task.

The 24 hour design cycle thus established was not the main difference to other VDS projects in the past. It could actually be misinterpreted as merely an exercise in speeding up a design process. Despite the confinement of only five days available for the project, speed and efficiency were not the prevalent goals. The 24 hour design cycle mainly stands for the successful establishing of an international think tank. As we will explain in this paper, a central database managed, displayed and made available the works of all participants at all times. Rather than being limited to certain conferencing or critique times, it was open and active 24 hours a day. Our hypothesis was that this continuous, intense and open exchange of ideas would also result in better designs.

3. Preparation

The preparation of a collaborative project naturally must be a collaborative effort in itself. In the case of our VDS, the preparation tasks were distributed such that Hong Kong provided the detailed design brief, Seattle the information and documentation about the site, and Zurich the primary tools: the modeling software Sculptor and the common database. Of course these contributions were also the subject of numerous emails between all partners, necessary for fine-tuning.

3.1. THE DESIGN BRIEF

Students at each school were asked to design a house for a young couple, a Chinese painter and a Swiss writer, on a small island in Puget Sound near Seattle. This way an element from each environment (China, Switzerland, USA) was present in the design brief, bringing into design the cultural similarities and differences present in the given geographic and temporal triangle.

The schedule of accommodation describing both living and working quarters was given with an additional requirement that the volume of the house must be recognizable as a cube of 12 x 12 x 12 meters (40 x 40 x 40 feet). The project brief required that all spaces and openings be "carved" out from the basic cubic volume.

The project was divided into *five* different phases each focused on different *dualities* associated with the given design problem. First, they investigated two principal dualities that permeate the clients' lives: one is cultural—she is Chinese, he is Swiss, and they live in the United States; the second one is vocational—she deals with images and he deals with words. Next, students explored dualities associated with the building itself: solid and void, light and shadow, and material and immaterial. Finally, students investigated the relationship of the space and the place, that is, the relationship of the building and the site.

3.2. THE SITE

The island in Puget Sound, off the coast of Seattle, was documented in plans and pictures. While there were only few plans, the most detailed ones giving merely a rough outline of the topography of the little island, the site was very well documented with a large collection of photographs. Showing views of the island as well as from the island, they gave a very good idea of the particularities of the site and also very well portrayed the vegetation, the weather and the climate that most of the participants from China respectively Switzerland had not been familiar with.

3.3. THE TOOLS

Two tools provided by the ETH group were essential to our goal of enabling a free flow of ideas among all participants: the modeling software Sculptor and the so-called Phase(x) database setup, named after a course at ETH for which it was originally developed. While we also used many established means for synchronous as well as asynchronous communication (nv, vat, email, ftp, talk, netscape, etc.) those two were unprecedented in their application to a VDS and therefore shall be described in more detail here.

3.3.1. Sculptor

Sculptor is a program developed by David Kurmann at ETH Zürich to support the early conceptual phase of object and architectural design (Kurmann 1997). It allows intuitive interaction with a virtual model and is based on known concepts and mechanisms of spatial composition and recognition. Sculptor offers the opportunity to model with spatial elements, or voids. Such negative volumes that create a void when intersected with a solid, can be manipulated and moved in the same manner as solids. Solids and voids have the same data structure. The interactive real time intersection of positive and negative volumes supports the direct composition of spaces.

Using the same modeling program on all sides greatly facilitates the exchange of model data as it eliminates the translation into some exchange format which leads to loss of information between most CAD programs. Given the need for a common modeling platform on all sides, one reason to use Sculptor for this was that it is really easy to learn. Thus the levels of expertise among the groups were not too different, although most students had to learn it from scratch.

The second reason for using Sculptor is that the very visual and immersive working with geometric form the program enables is very well suited for the expression of formal ideas in a universal language of 3D geometry. In fact, one of the main feed backs from students we got after the week was that by exchanging Sculptor models they had felt they could actually communicate in their native architectural languages.

3.3.2 Phase(x)

As mentioned above, a central database was used to both manage and display the works of all participants. The core of this database environment had been developed for a CAAD course at ETH Zürich, called Phase(x) (Wenz and Hirschberg 1997). The system is entirely web-based and allows the submission

or download of project data from any internet client. It is also a showcase: all submitted works can be viewed in a www-browser immediately upon submission and different viewing modes are available to have an appropriate collection of works displayed (Figure 1).

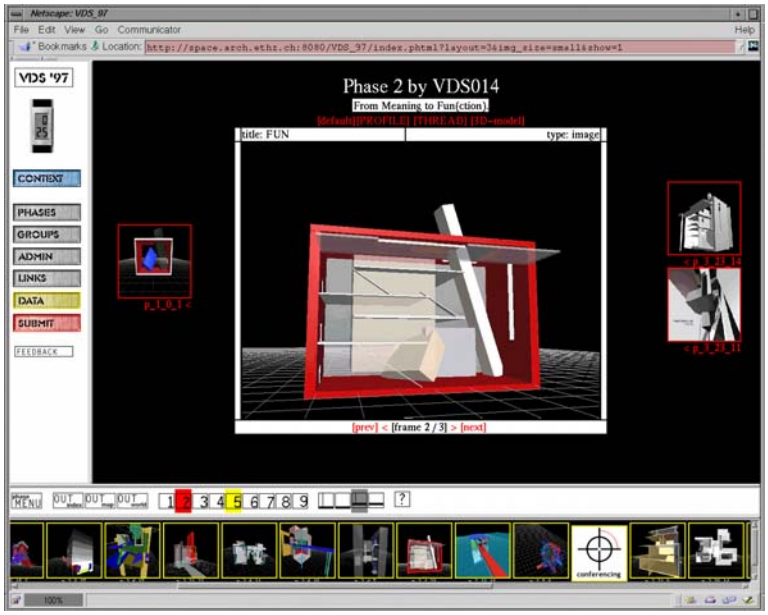

Figure 1. Web interface of the database showing a design from phase two with parent and descendants. In the bottom frame all works from phase two are displayed

In Phase(x) the design process is split up into phases with clearly defined design tasks. In every phase all works by all authors are placed in the database. In the following phase these results can be developed further by different authors. As students are free to choose which model they want to work on with (except that they're not allowed to pick their own designs…), the whole body of student works can be viewed as an organism where, as in an evolutionary system, only the fittest works survive.

In the original Phase(x) course, the system is used to browse through and exchange abstract formal exercises in geometric modeling. For this VDS the system was extended to allow the presentation of design content in a more flexible way. In addition to submitting the models of their designs, students could also use an unlimited number of template pages to make a presentation of design goals using text, sketches, and additional images, as they felt appropriate.

The basic idea behind this *phase(x) setup* (as we've come to call it) was to shift attention from the authors to the individual projects. British Scientist Richard Dawkins first suggested in his 1976 book "The Selfish Gene" (Dawkins

1976) that cultural evolution is based on similar mechanisms as biological evolution. In analogy to genes allowing the replication of life he introduced the term "meme" to signify the basic unit of cultural replication processes. The Phase(x) setup tries to apply this theory to architectural content. By splitting a rather complex design process into clearly defined units (the phases), compatible memes are generated. The memes are stripped from their authors by being placed into the public realm of the database and can then be copied as digital files by the next author without loss of substance. The attention is focused on how ideas develop under the hands of changing authors, rather than by any single author. Single authorship is thus replaced through collective authorship because all relations between works, authors and timeline are recorded in the database and can be rendered and evaluated.

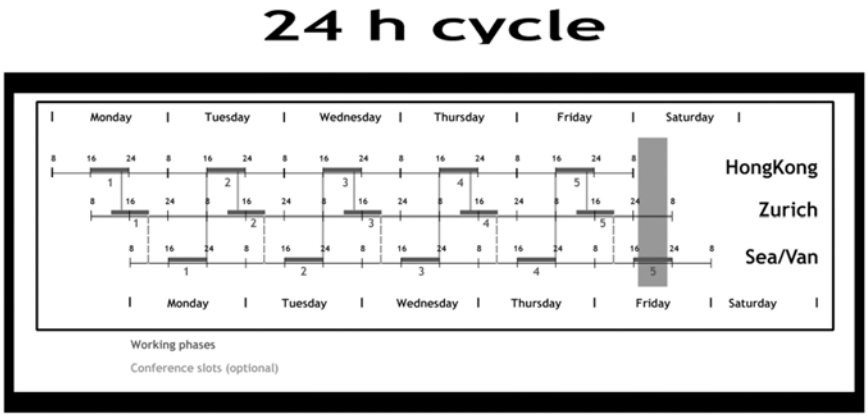

Figure 2. The schedule of the week with working phases and video conferencing sessions. While only two parties had conferences during the week, a video conference between all sides as a final review took place at the end of the week.

4. Process

With all preparations agreed on and completed and the schedule for the five days mapped out (Figure 2), the VDS itself could begin. On the morning of the first day, students in Hong Kong started with the design. At the end of their 8-hour working day, they placed the results in the common database that could be seen by all partners through the browser interface. Students from Zürich began 8 hours later and could thus base their decisions on the results achieved by their Hong Kong partners. After 8 hours, they also placed their designs in the common database, so that the participants from Seattle were able to explore the designs from Zürich and Hong Kong by the time they started to work. In addition, video conferences took place about every 8 hours, during which students could share and explain their ideas. The setup thus created an intense

global think-tank, operating 24 hours a day. Every day a new phase was introduced along with a new design issue.

Phase ONE
In Phase ONE of this project, we asked students to explore dualities evident in the design brief, and translate one or more of those dualities into an abstract 3D model, which did not have to resemble an architectural form.

Phase TWO
In Phase TWO, titled "Solid and Void", students had to actually design a house as an expression of the chosen duality (or dualities). They used Sculptor to create a 3D model of the house based on solids and voids that correspond to the programmatic requirements of the design brief (Figure 1).

Phase THREE
In Phase THREE, "Light and Shadow", we asked each student to illuminate a 3D model of the selected house, and consider the effects of color, light intensity, transparency, translucency, and reflectivity. We asked students to explore dualities such as light and dark (shadow), transparent and opaque, reflective and matte, curved and flat, open and closed, wide and narrow, short and long, deep and shallow, and how they relate to our perception of space.

Phase FOUR
In Phase FOUR, "Material and Immaterial", students explored how various materials interact with light and affect our perception (the immaterial) to create environments conducive for acts such as painting, writing, reading, exhibiting, meditating, etc

Phase FIVE
In the last phase, titled "Space and Place", students reexamined the links between the design and the site: vistas, sun angles, access. They produced photomontages to explore and illustrate the location and orientation of the house.

5. Collective Authorship

The design process was intentionally discontinuous. After each phase, every author had to put their design into the public realm of the database where it could be picked up and developed further by anyone of their colleagues, while they were not allowed to continue exploring it and had to select one of their colleagues, too. Considering the pride and close identification most architects develop for their creations, this might seem like a very cruel measure. Surprisingly, though, most students picked up on this procedure very quickly

and actually found it rewarding rather than frustrating. Students enjoyed observing how the VDS community reacted to their input, whether their designs were taken up, what the next authors turned them into. In some cases, authors of early phases selected one of the descendants of their work again. Others were glad that they didn't have to continue with their model because they saw more potential in someone else's proposal.

The database environment made this selection process very transparent. The line of development could be traced back, the profiles (the collected works) of the authors were linked with all designs. Lists could be queried, ordering the works according to number of children or relevance to the overall development, but could also single out the numerous unsuccessful dead-end designs.

The selection of designs hardly ever happened according to personal reasons. This can easily be seen in the fact that so many intercontinental selections were made (Figure 3). Due to the tight time schedule and the time difference, it was very difficult to establish any kind of personal relation between the students outside of the rather short video conferencing sessions. Some students complained about this. On the other hand this lack of communication on a personal level was compensated through a more intense reading of the designs in the database.

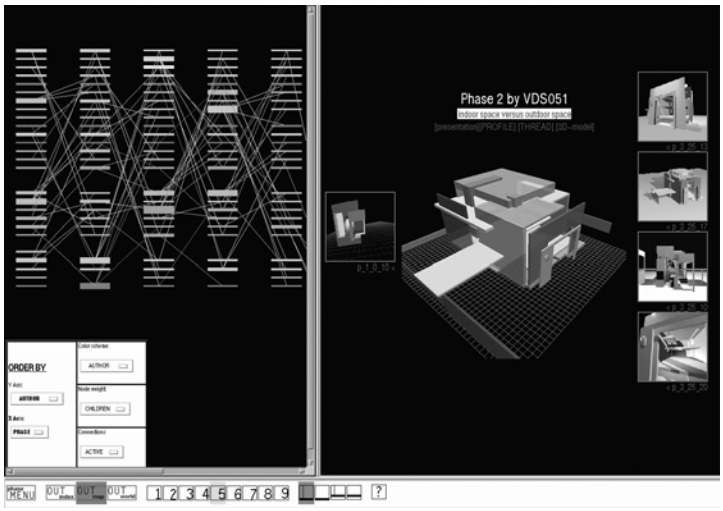

Figure 3. A graphic representation of the database on the left side shows the exchange of model data between authors. These charts also provide access to the works themselves, shown on the right side.

In the end the database could display virtual design teams for all works produced in the VDS – unintentional design teams, one might say, as most were

not aware of the different team constellations they had lent their creative powers to. The important thing about this collective authorship, however, is that every individual contribution is recorded in the database and thus can be traced and evaluated (Figure 4).

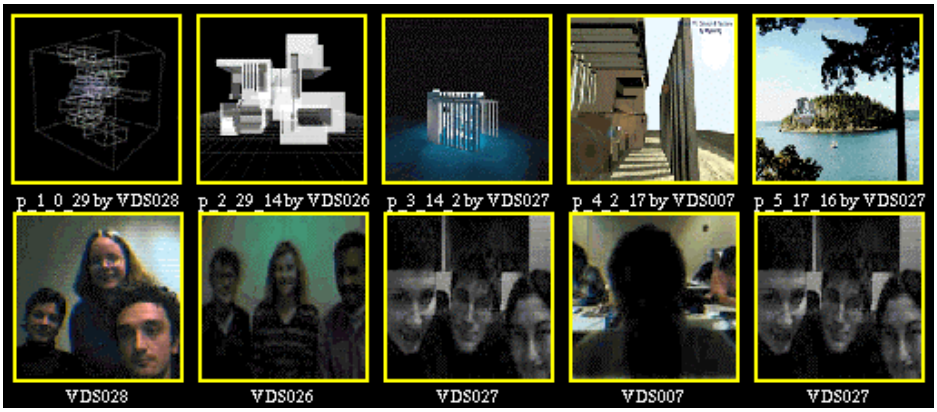

Figure 4. Collective authorship: a virtual team involved the five stages of a design process. The contribution of all authors are recorded in the database.

6. Conclusions

The assumption at the outset of the week was that the designs produced within the framework of this 24 hour design cycle would be better than they could have gotten without this intercontinental exchange of ideas. Of course this is very difficult to measure. The general feeling of most participants was that indeed they had not expected to get this far in just five days. This was particularly true in the Zurich group, where this exercise was carried out in a study week and the larger part of the group of students happened to be absolute beginners, joining this course with five weeks of architectural training and no CAAD experience in their first semester. They could of course profit very much from their more experienced colleagues on the other parts of the globe.

While a longer time for each phase of about one week would have been more appropriate to the complexity of the design task, we do feel that the rapid and intense exchange of ideas that happened in the project was indeed very productive. One of the bases for this exchange, the new model of distributed authorship and copyrights implicit in this VDS warrants further exploration. In the networked society currently taking shape, such models will become essential for architecture, just as for all creative disciplines.

Notes

The site of this VDS can be visited at http://space.arch.ethz.ch/VDS_97. Beyond what is described here, the project was later continued with a group of students at TU Delft, The Netherlands. Their work has also become part of the site.

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The Virtual Design Studio project described in this paper was a true collaborative effort, which couldn't have succeeded without the help of many dedicated individuals. At ETH, Fabio Gramazio managed the website and the database and Eric van der Mark made sure that video-conferencing sessions worked. At the University of Hong Kong, Marc Aurel Schnabel and Tim Yeung helped students in various phases of the project and insured that we could see our partners.

References

Dawkins R., 1976, *The Selfish Gene*, New York: Oxford University Press.

Garcia R., 1994, "Critical Reflections II," in J. Wojtowicz (ed.), *Virtual Design Studio*, Hong Kong: Hong Kong University Press.

Kurmann D, N. Elte, and M. Engeli, 1997, "Real-Time Modelling with Architectural Space," in R. Junge (ed.), *CAAD Futures 1997*, Dordrecht, Netherlands: Kluwer Academic Publishers.

Lee, S., W.J. Mitchell, R. Naka, M. Morozumi, and S. Yamaguchi, 1998, "The Kumamoto-Kyoto-MIT Collaborative Project: A Case Study of the Design Studio of the Future," in Proceedings of *Collaborative Buildings 1998*, Darmstadt, Germany.

Schmitt, G., 1996, *Architektur mit dem Computer*, Wiesbaden, Germany: Vieweg Verlag.

Wenz F. and U. Hirschberg, 1997, "Phase(x) Memetic Engineering for Architecture," in B. Martens, H. Linzer, and A. Voigt (eds), *Challenges of the Future (Proceedings of the 15th ECAADE Conference*, Vienna, Austria.

Wojtowicz, J., 1994, (ed.) *Virtual Design Studio*, Hong Kong: Hong Kong University Press.