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Heterogeneous, Distributed, Collaborative: The Li-Long Virtual Design Studio

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This paper describes the Li-Long Virtual Design Studio, which involved six universities in three countries, collaborating in a distributed asynchronous manner on a two-week design exercise. We give an account of the technical, methodological and design aspects of the exercise, concentrating on the perspective of the Barcelona node, and evaluating some of the technical tools used in the studio.

Introduction

During the first weeks of March, 1994, we represented the Escola Tècnica Superior d'Arquitectura de Barcelona (ETSAB) in a virtual design studio spanning three continents and several time zones. The studio project consisted in elaborating a new typology of medium density residential buildings for Shanghai, based on the traditional Li-Long housing type. Participating universities were Hong Kong University, the ETSAB, the University of British Columbia, The Massachusetts Institute of Technology, Cornell University and the University of Washington at St. Louis.

In this paper will give an account of the Li-Long Virtual Design Studio, seen from the point of view of the Barcelona node, concentrating on methodological, technical and design aspects of the experience.

The virtual hybrid studio

When we qualify a design studio as "virtual", we mean that its participants do not work at the same place, at the same time. To the extent that the word "studio" does not only refer to a room, but also to a group of collaborators, a strictly asynchronous collaboration, where members of the group leave work-in-progress for each-other in a shared physical space without actually meeting face to face, can be considered a virtual design studio. A design studio can also be virtual even though participants work synchronously, if they are distributed in different physical locations. Each row in

the diagram in Figure 1 illustrates one mode of collaboration in a design studio, the first row stands for the traditional mode, while the other three are virtual. Each small square represents the studio, the left half being in one location, and the right half in another, while the black and white circles correspond to different collaborating designers. The left-to-right axis stands for the progress of time. Thus in the first row, we can see the idealized traditional studio where designers work in the same location simultaneously throughout the duration of the studio. In the second row the collaboration is synchronous, but the designers are always in different locations. In the third row, the physical studio is again a single physical space, but the collaborators never actually meet. And finally, the fourth row, where the distributed asynchronous nature of the studio results in the collaborators always working in different locations at different times (Wojtowicz et al. 1993).

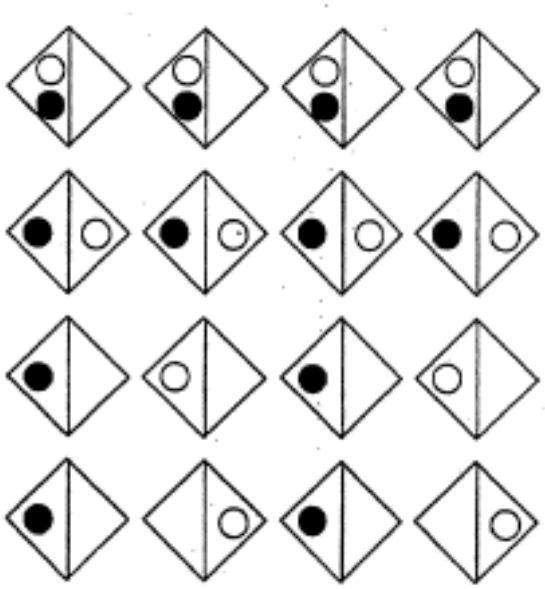

Figure 1

Of course any of these modes of collaboration are rarely found in the idealized state represented in the diagram (Casaus et al. 1993). And all of them are often present in any collaborative effort. Thus a more flexible scenario would be a hybrid one, represented by a diagonal reading of the diagram, say from the top left to the bottom right. A pair of designers might start working in one location, then one of them could contact a colleague in another location and collaborate synchronously, only to continue working alone for a while before leaving work in progress for the distant colleague to work on later.

If we combine this hybrid model of design collaboration based on communications media, with a heterogeneous model of production media where traditional means are mixed with digital technology on different software and hardware platforms, we get a very general and realistic model of a virtual design studio (see Figure 2). This is precisely the kind of collaboration tested in the experimental design studio which we will describe below.

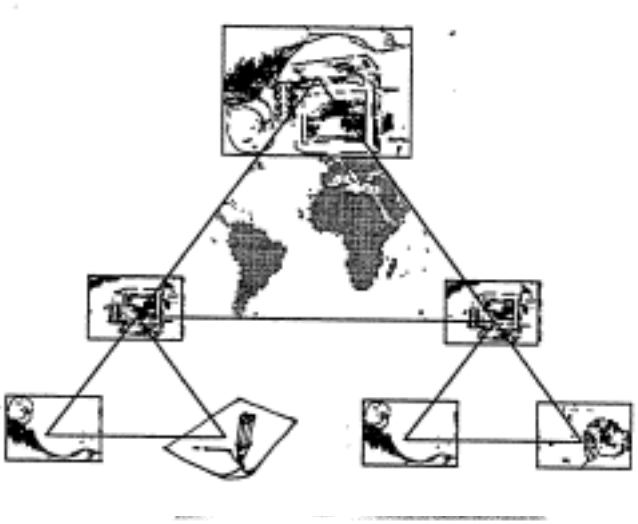

Figure 2

The Li-long VDS

The two-week Li-Long Virtual Design Studio relied on heterogeneous communications mediums —including the Internet, ISDN lines, conventional telephone lines and face-to-face communication— as well as hybrid production modes, ranging from asynchronous, distributed collaboration to synchronous sessions involving interactive whiteboards and video-conferencing. The studio project ended with a review session in the form of a multi-conference, using live video and audio, for the interactive transmission and critiquing of final project proposals.

The design exercise chosen for the studio was the redefinition of the traditional Li-Long residential building type which is the predominant typology for housing in Shanghai. The dynamics of collaboration was relatively flexible, relying on a few basic naming conventions, the sharing of a common "pinup" account at the University of British Columbia (UBC), and the division into a first week for "sketching" and a second one for "production". The hardware and software platforms used during the studio varied greatly. At the Barcelona node we used a Silicon Graphics Indy and Indigoes, Macintosh AV's, and IBM compatible PC's. The main CAD software was AutoCAD, complemented by the Silicon Graphics generic rendering and editing software and a host of other draw and paint programs. For communications over the internet, we relied on e-mail and the ftp protocol, for asynchronous information exchange, and we used Collage and Vat software for real-time and video and audio. This allowed us to conduct several node-to-node synchronous design sessions with other nodes over the internet, in anticipation of the final videoconferencing review, involving all six nodes simultaneously, conducted over ISDN telephone lines.

Although there was a certain level of interaction between all participants throughout the project, the limited duration of the studio and the novelty of the media, only allowed for concentrated and sporadic design influences across sites. This led to the emergence of a diversity of design proposals, with clear instances of cross-fertilization, without any real co-authorship of projects. In the following section we will present our design proposal, concentrating on the influence of the computational and communications technology on it.

Density and diversity

The initial idea of our project emerged when we discovered a sketch from the Hong Kong team in the UBC computer. We were interested in the fluency of the space between the streets, but we realized that it would be interesting to consider a proposal similar to the one from Hong Kong but turned 90 degrees so that the resulting scheme seemed more based on the traditional Li-Long patios. The Hong Kong team's plan thus became our longitudinal section (see Figure 3).

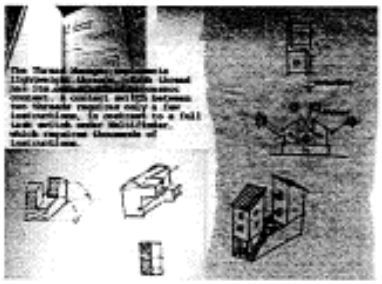

Figure 3

From that initial scheme we began to develop two basic typologies, the "T" and the "L" which we could be inverted (see Figure 4). These typologies always had the core in the middle and the bedrooms facing the streets. The living room was in the patio space and the access stairs to the different dwellings rose through this space. Some typologies had a terrace on the roof of the living room below. We were asked to raise the traditional density of the Li-Long housing, so we stacked the typologies in units of four generating a great urban variety. We thought that this quality was very important in a unit that had to be repeated many times in the narrow streets of Shanghai

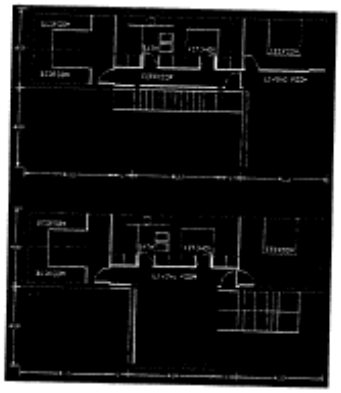

Figure 4

We realized that not all the combinations of typologies were possible, because the stairs could not give access to all the dwellings or because the terraces were too closed and could not have enough light and ventilation. We also wanted that the entrance to units be trough the south facade, as in the traditional Li-Long house. We then developed a program that enabled us to visualize all the possible combinations of L's and T's, automatically rejecting the undesired ones. This program was written in Common Lisp and it's output was an array of section views cutting the living rooms, where we could also see the outdoor stairs and the entrance to the dwellings. The result was the image in Figure 5, where the typologies with impossible stairs appear crossed out, and the ones with bad terraces have a gray background. The result was 21 acceptable combinations out of the 81 possible combinations generated.

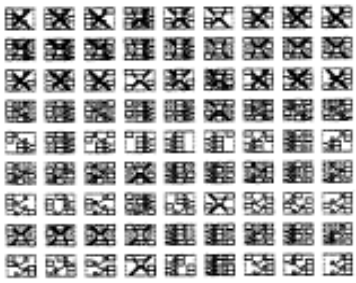

Figure 5

Once we had all these combinations which we could place side by side, we noticed that they could also be grouped one facing each other generating larger patios and giving rise to a wide range of solutions with differing impact at the urban level. Adding a new structural constraint (which eliminated combinations with cantilevered rooms) to our program, we obtained a new array of possible combinations of pairs of units seen from its street facade. The top group are the South facades, and the bottom group the corresponding North facades. In Figure 6, the white areas are the main facades, the light grays are the middle ground, and the dark grays the farthest volumes.

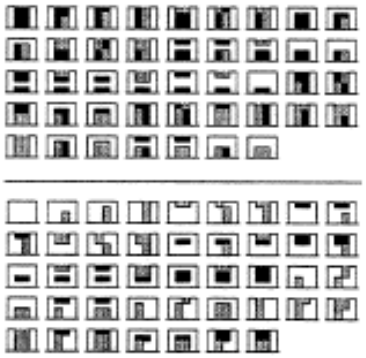

Figure 6

We went on designing all the elements that configured each unit, windows, terraces, bow windows, stairs in the CAD system. We were inspired by the images we were receiving trough the Internet, like the oriental street, the Shanghai "chiaroscuro" or the traditional bow windows of Li-Long housing (see Figures 7). All these different elements were combined trough different constrains that we introduced in our program, for example: dwellings without a terrace would have bow windows on the south facade. This program generated an AutoLisp file which, when run in Auto CAD, built each unit from all the different elements we had previously drawn as blocks. The result was a variable 3D model of one unit.

Figure 7

Then we generated all the possible combinations of units we had obtained, as shown in Figure 8. Using some of the possible combinations we got a street image were each unit had all its variety of elements (see Figure 9).

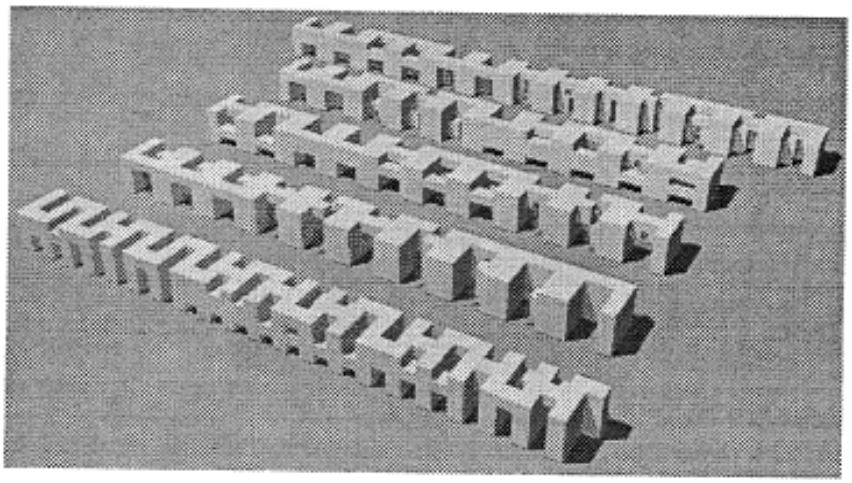

Figure 8

The computer was thus used not only as a luxury ink-pen but also as a tool that was able to combine, with the logic imposed by the architect, a series of different elements to produce variety and to avoid the uniformity which would have been produced in a 1920's proposal with similar characteristics. It is ineteresting to note the implicit potential of such a methodology for complementing urban regulations, by providing a systematic definition of a typology (Fargas 1991).

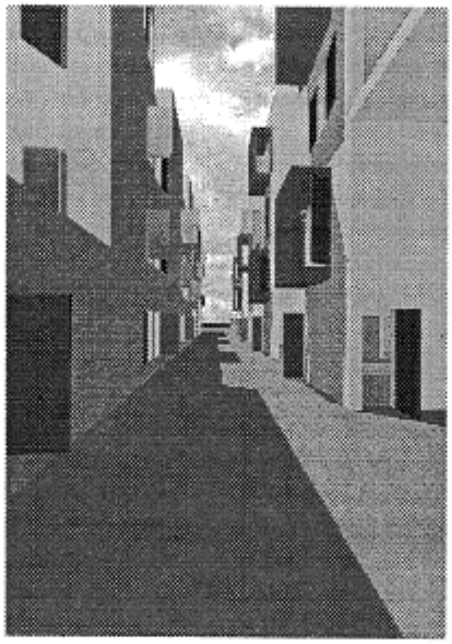

Figure 9

Collaboration dynamics

The Li-Long Virtual Design Studio exercise served as the platform for testing the similarities between the normal collaboration dynamics of the traditional design workshop, and the dynamics of the virtual studio, as well as the difficulties which could arise from the temporal and spatial distance of the participants. The technological resources available to us were varied enough so as to allow the adoption of any of the four modes of collaboration described above. The choice of tools at any given moment depended on factors ranging from the limitations of the tools themselves, to their availability to all the participants.

The four main technologies of communication which were used were suited for different purposes and had different characteristics. They are the following:

• e-mail: Fast, and easy to use for maintaining an ongoing dialog almost synchronously, to leave messages, and to document or comment design drawings.

• ftp: The basic means of transferring of images and models. Less synchronous and predictable than e-mail, but very effective. Used for following work initiated by other groups, modifying design proposals or combining solutions.

• Collage, Vat and CUseeMe: Real-time audio-visual interaction over the internet. Requires a coincidence in time between participants in a session (early morning in Hong Kong, after midnight in Barcelona), adequate hardware and software, and patience, but the feeling of "live" connection, the interaction between participants, and the simultaneous sketching on a whiteboard comes closest to a traditional working session.

• Videoconferencing: Simultaneous audio-visual conferenceing over ISDN lines. Most sophisticated and expensive technological option (but much more affordable than conferencing via satellite). Recommendable for large numbers of participants, and "rehearsed" performances. Only used for final critique session in the Li-Long VDS.

The continuous reliance on these technologies, and the imaginative use that different groups made of others' design proposals, seems to justify the variety of means of communication (Fish 1993 and Bly 1993). On the other hand, the daily need to summarize the design progress in a number of images, models, and textual comments, forced the participants to engage in an analytical effort as well as an effort of synthesis which noticeably improved the results. Similarly, the daily revision of updated files from other groups allowed an ongoing control of the development and evolution of the design process. Both these daily routines of the daily design session allowed participants to adapt their pace and rhythm of work, and to establish an objective distance with respect to their own work. Undoubtedly, these were the most striking influences of the application of the communications media on the creative process.

Conclusions

For the virtual design studio to become a common mode of collaboration in practice, or at least in education, the communications media will probably have to evolve in order to allow more bandwidth, for lower costs. Until then, there is a need and an opportunity for frequent experimentation, and careful assessment. It is very likely that the virtual design studio format will become more and more common in education, not only because students will need to be prepared for the inevitable popularity of distributed asynchronous collaboration in practice (Buday 1993), nor simply because it is an inexpensive way to collaborate with students of other cultures, but because of the pedagogic advantages it offers. Two main aspects of these advantages, both of which we experienced during the Li-Long VDS are worth highlighting. First, given the particular nature of collaboration at a distance, there is the challenge of communicating and absorbing ideas with intelligence and rigor, a discipline which rapidly translates into improved design quality and an effective learning environment. And second, the opportunity to harness computer technology beyond its usual use as an efficient production tool, in the effort of sending not just drawings, but intelligent design mechanism across the network.

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