Remote Pedagogical Framework for Design Studio

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Abstract:
This paper introduces a Remote Pedagogical Framework for Virtual Architecture Design Studio. Two combined aspects contribute to make that pedagogical experience an original one: its virtual architecture design topic and its 3D real time open source remote setting. The studio topic is based on previous works on virtual studio namely the design of a 3D virtual space that support both specific architectural design tasks and synchronous remote design by collaboration. That framework is also an opportunity to introduce and expose students to various aspects of “virtuality”, such as: virtual reality, augmented reality, digital architecture, virtual architecture, 3D virtual spaces (i.e. 3D chat). For that purpose, a Virtual Documentation Center has to be designed first by students. That Virtual Center serving as a source of reference for the next phase, where they have to tackle their virtual studio propositions only through a process of synchronous and asynchronous remote design by collaboration. The virtual studio deployment allows for real-time design collaboration between remote student pairs. Support for real-time graphical communications was provided using available open-source technologies for both Mac and PC platforms. Finally, the academic context and pedagogical objectives are documented and discussed as well as the knowledge and experience gained from this unique academic opportunity. The paper concludes with specific and practical recommendations and improvements for future virtual studios in order to take advantage of this Multicultural, Collaborative and Synchronous Context (MCSC).

1 INTRODUCTION

Both Schools of Architecture of Toulouse (France) and Laval University (Québec, Canada) have a long teaching tradition with the integration of ICT\(^1\) in the architectural project and its design process.

In Québec, things started as early as 1972, with the arrival of Professor Takashi Nakajima and his researches on the topological representation of floor plans using the Graph Theory which he integrates in his teaching of undergraduate and graduate classes. At the beginning of Eighties, the need for representations evolves to one for tools to manipulate them. Indeed, back then, we were dreaming of 3D environments as equivalent to text editors that appeared with PC. The beginning of Nineties marks the commercial availability of those 3D modelers, and the School of Architecture of Laval University (EAUL) give its first paperless studio at the winter semester of 1991. Until today, this experiment was pursued in a continuous way at a rate of 2 studios per year.\(^2\) Based on that experience, and following the developments in computer and networking technologies, the new challenge and opportunity to teach the architectural project remotely found naturally its niche at EAUL.

The School of Architecture of Toulouse (EAT) created a teaching of computer science, as a discipline, with its concepts and methods at about the same time, in 1972, and made several of its experiments on didactic frameworks. The team of research of Li2a,\(^3\) started in 1982, to launch bridges between teaching of architecture and computer science, being interested in the use of 3D models as well as representations. At the present time, this team supports part of the major axis
of "Spaces and representation" of EAT, and develops as well a certain number of didactic frameworks integrating uses, sometimes in a none conventional way, of computers. If drafting assisted packages are obviously present as tools in class, they are in a way less present than at EAUL. The expertise at EAT in the field is due more to massive uses of ICT in teaching, as a culture, in a critical way to handle a whole set of appropriable software at given moments of the design process, authorizing operations with both digital and analogical models.

Both schools, from their history, evolved and moved "naturally" with the development of networking, and are perfectly equipped for that purpose.

2 THE MAKING OF FINC-AV

The two institutions are interested in the topic of Virtual Architecture, and have each one a course on the subject. Those courses were conducted in a rather different way at the end of the academic year of 2002. Form, Information, Novation and Conception (FINC) in Toulouse was a seminar of fifth year (equivalent to a second year of master). Its goal was the production of a report ("mémoire") following an initiation to research on a topic connected to a general subject. As for the Computerized Design Studio ("Atelier Virtual", AV) in Québec, it was about an architectural design project conducted mainly through 3D modeling, during the third and last year of the undergraduate studies. Its goal was the production of a project of virtual architecture, designed, modelled and represented by computer.

This disparity of objectives, levels, and forms in the final work were a source of enrichment by the constraints imposed. Indeed, collaborative work was, as we will see it, enriched.

About the technical frameworks, many experiments through out the world make it possible now to count several forms of collaborative works with more or less sophisticated means and tools. The first experiments in "real time" (now said synchronous), as the "Virtual Design Studio", between Hongkong, Zürich and Seattle, are first described in Kolarevic et al.. As for the professional work, the principle is established at the beginning of the Nineties, for example in Wojtowicz et al.. These experiments continue in many schools of architecture and universities with increasingly sophisticated tools using now the Web capacities for audio and video transmissions. As example, it is enough to consult the recent communications in eCAADe, and ACADIA conferences.

The significant aspect for us is not the performance of the tools, but rather their adaptation to our teaching objectives. This is why we invest more on a series of frameworks that we contribute to found, and which are known by what we currently name Multicultural, Collaborative and Synchronous Context - MCSC. Our goal is to focus here on the following topics: multi-cultural aspects, diversity of the actors, situations of collaborative work, synchronous and asynchronous situations, places of dissemination, teaching approaches, etc. As we can note the qualitative aspect is placed before the performance.

3 PEDAGOGICAL FRAMEWORK PRINCIPLE

The experimental and multinational FINC-AV module has the authors for this article as persons in charge of the didactical and technical frameworks. However, other teachers were involved in that module on both sides of the Atlantic: architects, plastics technicians, sociologists, computer scientists.
3.1 Object

The activities and subjects of pedagogical exercises of this semi-annual teaching are partially shared by the students of both schools of architecture, and in practice, in the form of a remotely collaborative, synchronous and asynchronous work.

The experimental but formal protocol which binds EAT and EAUL implies:

- two teachings having their own autonomy within EAT and EAUL, with their administrative and teaching constituent;
- a common exercise of virtual architecture design to be carried out by collaboration, associating one student of EAT with one of EAUL (pairs); this exercise is done in part in synchronous mode, on a two one half-day weekly basis, that lasts ten weeks, with joint jury and evaluations;
- a distribution of material and human resources, allowing the two groups of students to fully benefit from a local and a distant supervising, reflecting perhaps two types of cultural teaching of architecture and computer science.
- an interrelationship from:
  - each individual student background placed in company of another student from another country with a different background;
  - the difference of pedagogical objectives from none common part of both teachings (teaching of project at EAUL, and seminar at EAT)
  - the diversity of teachers brought into play, (disciplines: architecture, computer science, visual arts, social sciences; formations: architects, engineers, sociologists, academics, artists; country of formation: France, Canada, Brazil) that have to co-supervise from each side of the Atlantic.

3.2 Framework Description and objectives

Both teachings registered in their respective program in Québec and Toulouse remained independents. Their teaching objectives and didactical contents were not modified for the purpose of the framework but adapted according to logistical considerations, namely: the synchronization of activities, country time shift, and also shift in the academic year.

The Information and Communication Sciences (ICS) impact not only on the professional practice of designers, but also, and more generally, on our way of apprehending space and its representation. The consequences of this new point of view are not easily appraisable as a whole. They can however be studied through critical analysis of tools, principles, and new territories immersed from ICS. It is the case in particular of virtual architecture productions, which, looked like a new space and social field for human actions and interactions, requisitioning architectural competences that imply a new look on teaching and practicing architecture. Indeed, these "architectures" challenge designers in two ways: according to particular modes of design and aesthetics of the communication, and the short live of this type of productions. For future architects, it is then a question of recognising the divergences, but also established bonds and reciprocal contaminations between physical and virtual configurations of architecture.
The various registers through which form and information are declined in the ICS are also the occasion for re-questioning frameworks and finalities of design operations, while making it possible for students to consolidate their control over contemporary environments of design and communication, and that through:

- exploration of new territories of digital (or virtual) space,
- practice of synchronous and asynchronous collaborative work.

FINC-AV has thus to provide to Toulouse and Québec students the favourable context and environment for training at the same time for design of virtual architecture and for the process of design by collaboration, starting with a forward step with the architectural project as a process to conceive and carry out a virtual 3D space.

Virtual architecture, as a new practice and curricular area, implies new questioning and new stakes.

The teaching content lends itself to two topics: "Freedoms and Constraints of Virtual Space" and "Architecture, Information and Cyberspace", and more specifically directing them towards trainings and contributing to knowledge by the following:

1. Space, the virtual place, the cyberspace: to know virtual spaces on the one hand like a new applicability of competences of the architect and on the other hand that of master and development of new architectural concepts.

2. Virtual representations and 3D models (techniques): that is to say the training of techniques of current modeling and representation allowing to interact with a virtual 3D space.

3. The virtual studio: design by collaboration through networking support and as a source of inspiration for designing and realizing virtual architecture.

4. Interfaces for virtual 3D collaboration: to know technologies supporting multi-users virtual 3D spaces (e.g. 3D chat).

Moreover, the concepts related to virtual architecture, numerical architecture and cyberspace are the subject of studies and explorations within the double frameworks to project and initiation to research in seminar.

3.3 Teaching opportunities: organization and modes of collaboration

The whole activity rests on a double complements:

- the expertise of both groups of students with different type of formation at this stage of their trainings, due to the difference in formation provide by their institution;
- the different objectives of the two institutions, visible partly by differences in positioning their courses and also by practice differences to be carried out from those trainings.

In other words, of a heterogeneous constraints of heterogeneous populations having to collaborate, and having different formations and objectives (a seminar report, and a modeled project), one intends to enrich each population by reciprocal contributions which will appear naturally by contact between the “cultures” (architectural, computer science, technical) having to implement different means. Thus, that brought us to a program which takes account of these differences, but also exploits them, in an opportunistic way to reach that goal. The experiment
showed that this operation of mixing plays as envisioned, making it possible to better apprehend the tools and to better reflect on the bottom of nature, freedoms and constraints of virtual space. The experiment has showed that productive conflicts could be generating, but also deviations, sometimes involving a degradation of collaboration by dividing labour, simpler and more effective to work with when urging times occur, but more frustrating too.

To ensure a good process for the teaching framework, the following logistic was adopted.

Collaboration teams (pairs) are made by drawing of lots. Each pairs works from a common proposal, collaborating for the design and realization of a 3D space, which receives an evaluation for the team work. A ten weeks intensive period, with two common meetings of evaluation (intermediary and final jury) of the virtual projects, completes the work in Quebec in mid-December, and initiates the phase of report drafting for the Toulouse students who start one month later, and will finish one month later.\(^{13}\)

Apart from the project, each time possible, there is transposition of exercises or supports. Thus, for example, not fixed at same time, the Web Diary of Québec and the Système d’Information du Mémoire (SIM) of Toulouse can correspond. The first is a daily numerical account of reflections, sketches, comments, and conclusions of a student or the team. It is a question of constituting a daily trace, a numerical collection of the work carried out in studio. At the end of each phase, this working diary is evaluated. The contents are completely free but must be presented in HTML format.

The second is an individual SIM. This one will have to represent a structured memory of references, interpretations, comments, etc. developed to prepare the drafting of the report (mémoire). Here too, it is a question of constituting a "trace", a numerical collection and documentation of the research task realized. This kind of information system is periodically followed remotely by two monitors which send by email their comments to the students concerned.

Lastly, the intermediary and final jury put in presence for common defence, the student pairs from Toulouse and Québec who present their common work in front of a jury made up of teachers physically present at the same time in Quebec and Toulouse.

### 3.4 Technical opportunities to serve pedagogy

If the comfort currently brought by the technology of transmission audio/video on the Web is undeniable, the collaborative space formed does become rapidly expensive and inaccessible as soon as our students want to continue together in a private context (e.g. at home). Here, the tele-presence could be exploited for oneself and the others with which is worked out the collaboration and communication. This tele-presence could take the form of an avatar, which will well fit in a class of virtual architecture...

However, those sophisticated modes of communication do not make enough place to what we would name "reflection of and by writing". Thus, we made the teaching choice to do all go through by writing, including "oral". We use for that email and "chat" communication on IRC.

Concurrent and synchronous 3D modeling is done with VRML encoder (White_Dune\(^{14}\)) resulting from the world of Open Source\(^{15}\) and with VNC.\(^{16}\)

The oral examination with two students separated by the Atlantic is done through a visit of the virtual space designed, log book and SIM, unrolled by one and written notes, copied and pasted...
in a chat window by the other. That requires meticulous preparation, precise synchronization, repetitions and many developments. Thus, even the final presentation results from a collaborative work, which is itself a collaborative presentation.

The jury must also coordinate itself in real time. To write the questions requires a high degree of accuracy, the attention increased by the already put questions, a very precise schedule of the whole meeting, argued adjustments in writing also, about the appreciations and notes.

Lastly, a system of "monitoring" of team work and their progress was set up. Work placed on a server are checked, and alarms are sent by email to the interested parties, bearing comments on the work progress, about its form (and not on the content). This monitoring could be crossed, that is to say a Toulouse monitor and a Québécois carrying out in tandem (and dialogue) that training supervision.

3.5 A first experiment of design: a "Virtual Studio"

The choice of the design topic has been inspired by pioneers work of Mary Lou Maher (which still continues\textsuperscript{17}). The project of virtual architecture proposed, in 2003, relates to the design of a virtual studio having to be used as a place of convergence, exchange and support to the architectural design process. A virtual space allowing and supporting the communication between our two groups of students. This "place" must be conceived in line and in a synchronous way. The programming of the virtual studio provides a list of functions having to be supported by the virtual environment allowing collaboration; these functions being translated in virtual spaces to define the virtual studio.

The place is missing here to give a better description of produced spaces, as well as teaching expectations. These gaps will be filled in an other article to come, but for now, three screenshots of as many projects are reported here.

Fig. 1. Virtual Studio of David Lavoie (Québec) and Raphaël Betillon (Toulouse) –
Fig. 2. Virtual Studio of Stéphane Vaillancourt Lapointe (Québec) and Angello Géraud
4 Conclusion and perspectives

This teaching took place in the Fall of 2003 and was renewed in 2004\textsuperscript{18}.

The results were particularly encouraging (after investigation made as well from teachers and students). The total cohort was of twenty students, 10 on each side of the Atlantic, thus working in 10 pairs.

We think, we have developed an operational way which gives to "integrated class" principle, a form with is somewhat different from what it is already known. VNC seem to allow that, at little cost. Collaborative work, even at the price of some clashes, was of quality, without physical displacement of one or others (although the EAUL allowed, at the third of the semester, a very short voyage of its students in Toulouse, which had great virtues: common classes and discovered, for each one, of its pair).

About communication issue, we could measure on that occasion that the use of a whiteboard to correct the gap between classes not taken jointly, would be relevant; making it possible to
teachers to intervene according to their competences, to answer request occurring sometimes in a rather unforeseen way.

If software training of students from EAUL seems to function well, mainly due to classes beginning earlier in Quebec, that of students of Toulouse was more painful and source of difficulties, resulting in mutual frustrations for students of both groups (lack of harmony between roles adopted by each group). In this respect, a real-time audio-video communication system would be certainly useful, to make it possible to fill in differences more quickly in levels or point of views.

One difficulty encountered was that of system time reaction in IP communication which did not allow for desirable fluidity of communication at time of interactive walkthrough in VRML models.

In short, with rustic but reasoned modes of communication, the total result is satisfactory, and the written recordings of chats, that we filed, certainly will allow us a finer analysis of the relationship (including apart from any teaching presence) between students of each pairs. Making it possible to better apprehends the nature of collaborative work and the worthiness of this type of teaching for each student.

Teaching evaluation is indeed a paramount data which makes it possible to judge of their interest. Another point is their capacity to be transferred, on two levels: transferable to other teachers, and transferable to other teaching. The first point seems assured, the expertise of teachers being only that of their material taught with a taste for multidisciplinary and international work.

As for the transfer to other teachings, it seems that pedagogical activities around the project of architecture, whatever they are, can be eligible for this type of framework. The best means of ensuring it is always the same, to try it out. In EAT-EAUL co-operation, another project of this type, concerning another level of the studies with real architecture, is being analysed for feasibility.

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5 WORKS CITED


The pedagogical work reported in that paper was made possible in part by founding and support from both School of Toulouse and Laval University, Québec.

ICT : Information and Communication Technologies.

Li2a, Laboratoire d'informatique appliquée à l'architecture; Jean-Pierre Goulette, Scientific Leader; École d'Architecture de Toulouse; <li2a@toulouse.archi.fr>.


Chupin and Léglise 1997, 23-44.

Bonnal et al. 2003.

Kolarevic et al. 1998.


eCAADe (Education and research in Computer Aided Architectural Design in Europe) is a non-profit making association of institutions and individuals with a common interest in promoting good practice and sharing information in relation to the use of computers in research and education in architecture and related professions.

ACADIA, the Association for Computer-Aided Design in Architecture, was formed for the purpose of facilitating communication and information exchange regarding the use of computers in architecture, planning and building science. A particular focus is education and the software, hardware and pedagogy involved in education.


In this context, one can see besides this teaching [ FINC-AV, in its EAT-EAUL relation ], like itself a exercise of collaborative design of a teaching framework, exercise that the teachers concerned of the two establishments were given.

The question of university beginning shift is interesting, it also forced design of a joint teaching.

White_Dune Web site: http://www.csv.ica.uni-stuttgart.de/vrml/dune/index_white_dune.html

All software used have to take into account the machine heterogeneity. In Québec, PC under Windows are used, in Toulouse, Macintosh with OS X. However, open source software make a great job with those heterogeneous environments.

VNC (Virtual Network Computing) software makes it possible to view and fully-interact with one computer from any other computer or mobile device anywhere on the Internet. VNC software is cross-platform, allowing remote control between different types of computer. To consult: http://www.realvnc.com/

The sites corresponding to this term are respectively accessible at:
http://www.toulouse.archi.fr/ensweb/pic/finc_av/index.html ; and http://www.limableu1.arc.ulaval.ca/atelier_virtuel/