Virtual Studio of Design and Technology on Internet (I)

Educator’s approach

Prof. Gianfranco Carrara, Ing. Gabriele Novembri
Dipartimento di Architettura Tecnica e Tecnica Urbanistica
Università degli Studi “La Sapienza” - Roma - Italy

Prof. Anna Maria Zorgno, Prof. Pio Luigi Brusasco, Arch. Luca Caneparo
Dipartimento di Progettazione architettonica
Politecnico di Torino - Torino - Italy

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1. Introduction

This paper presents a teaching experience involving students and professors from various universities, in Italy and abroad, which began in 1996 and is still on going. The Virtual Studios on the Internet (VSI) have some features in common with the Teaching Studios planned for the new programme of the faculties of Architecture in Italian universities. These are the definition of a common design theme, and the participation of disciplinary teachers. The greatest difference is in the modes of collaboration, which is achieved through information and communication technologies. The chief result of this is that the various work groups in different places can work and collaborate at the same time: the computer networks provide the means to express, communicate and share the design project.

Apart from giving the first results of this experience, the paper intends to examine certain theoretical aspects of the teaching of architectural design in relation to the innovations produced by information and communication technologies. It is a response, firstly, to our need to organise systematically these on-going experiences, and, secondly, to the theoretical content of the teaching programmes. It will also deal with the methods of information storage and retrieval determined by the computer, the media for communication offered by telematics, and the spatial configurations adopted. It is the need to think up a working method, and a teaching method, that can correspond to innovation. What is required is, if not a systematisation, then at least an organisation capable of comparison with the cultural reference points in each individual’s design and teaching method.

2. Teaching method and design

Architectural design is half (this is the half expressed by the noun) a highly technical task, requiring skill, organisational and managerial ability, and method. The other half, contained in the adjective, is the expression of a deeply-felt social need to present the community with the idea that their own human and social reality is worth living (Lukács 1970). To obtain the second result, we need a civilised environment, an intimate understanding of the language of constructed forms, and, finally, working conditions that do not strangle the original gifts of the individual at birth, without which any intellectual knowledge can ever produce valid works of art.

There is a generalised tendency to penalise this factor: for example some of the leading exponents of a school of architecture, much inclined to a rhetorical emphasising of form (High Tech), say, that in order to satisfy technical requirements and the needs of their clients, aesthetics slip into the background (Jencks 1990 p. 94).

This dualism emerges in the teaching of design, and the same problems which arise even in courses teaching technical or historical subjects, are greater in courses aimed at training students to design. Here the difficult and complex task of solving problems of organisation, construction, and environment, becomes the theme, i.e. the topic to be developed, in a discourse which is other to the discourse of architecture proper. Quite rightly, Lukács speaks of double mimesis in the case of architecture: the technical solution is already an intellectual interpretation of the physical and social reality of the construction, in the neutral forms of applied science; the artistic development that follows is a further development into a humanising form.

The concept of form is extremely important from the didactic point of view: the student must be closely involved in the technical and social problems dealt with, in order to give them an aesthetic, that is a humanising, interpretation. The fact that synthesis is a characteristic feature of architecture, (as has been noted by many, from Vitruvio to the present day) may result, to a large extent, from the architect’s having to consider all aspects of a project (technical, social, organisational, historical) on the same level, and with a view to being understood by the community, rather than remaining strictly within the limits of one discipline, like an engineer. And this is due to the need for reinterpretation that Lukács calls second mimesis.

2.1 Teaching design and simulation

The only way design can be taught is, either by allowing students to participate in a design project, or by having them elaborate the design. The first of the methods is apprenticeship; the second is that used by architecture schools. It may perhaps be possible to include the first method in the schools, but this would run counter to a two hundred-year tradition, originating with the eighteenth century Academies.

An exercise in project design is a simulation, that is, it implies imagining a virtual transformation of an area, in the city or country, and is relatively free from any need to actually realise it. The VSIs, in their experiment, chose a real theme, that is an urban transformation that will actually be realised, though not perhaps by the present students. This theme is also inextricably bound up with an urban context rich in historical features that cannot be neglected, with a complex system of city functions and connections that cannot be simplified, and finally, with a large number of controlling bodies, who will have a decisive role in determining future usages.

The subject of the design project is a railway station in Turin-Porta Susa- to be incorporated in a reorganised rail transport system (the infrastructures are already under construction) as an intermodal junction between high speed trains, regional trains, city underground etc. (Figure 1). The fact that this area touches the old city centre will have considerable impact on the organisation of administrative and commercial activities at a regional level, and on real estate values. In particular, the laying and covering (partly completed) of the railway tracks, that split the city in two close to its centre, will bring together areas which have developed in separate ways, so creating both potential benefits and rising problems.

Turin City Council, in accordance with the State Railways Company, intends to set up an international competition for a design for the station and the public spaces around it. Through computer networks, the teaching studio in continual contact and collaboration with both the City Council and the Railways, and is offering to help define the terms of the competition.
2.2 Design Method

We believe that, at the first stage of design, a synthetic view is needed. This means that the design process must be seen as a whole, considering all the aspects that influence it. In other words, the railway plans for tracks, levels, and tunnels (which of course cannot be changed in any way), the studies of the impact on real estate in the urban context, and the effects of radical transformations to the city which have happened or are planned (the analogous city as it is called) in the area have been considered from two clear and distinct points of view:

- the exclusively technical aspects, and what remains as a record of the past are to be seen as given, so not to be called into question, only interpreted.
- the social, economic, and building areas, where some possible choices are still open, are to be examined thoroughly, to discover the results that could follow different decisions taken. They must, of course, also be interpreted architecturally, depending on the choices made. The students are taught a method to arrive at an understanding of their own actions, of how their designs may be interpreted in reference to the past, and to recent developments in architecture, and to comprehend the ideological attitudes underlying their design choices.

So the synthetic view of the contributions made by specialists is not limited to the initial stages which lay the bases of the design project, but follows on to the stage of evaluation and analysis. There is an effort to involve the specialists (constructors, economists, railway engineers) even in the evaluation of the effects of one or the other of the design choices.

It is clear from this that this synthesis of specialist involvement is not simply an end in itself, and that it is not proposed merely as the most realistic way of using simulation to learn about the difficulties of architecture. Rather it is the premise, essential though not sufficient in itself, from which we may arrive at that true architectural interpretation, that can be fostered but not produced artificially.

With this in mind, we should comment briefly on the methods of acquiring the linguistic competence, which enable one to manipulate forms to be constructed in reference to their social, cultural, and artistic significance.

Linguistic competence, the ability to dig deep into, or even revolutionise, a shared language, is what is commonly called a poet’s imagination, a painter or sculptor’s hand or a musician’s ear.

Today there are formal theories aimed at helping the architect to acquire this artistic technique, which is a necessary part, though not all, of his professional skill. Typological studies, on one hand, and semiotic and rhetorical studies, on the other, produce a deep understanding of the shaping of architectural forms with their meanings throughout history, and the possibilities of transforming the language, with its thousand years of tradition.

When we apply typological research to a building type, like the new station, the links to be created between various kinds of transport, and the reuniting of areas of the city separated for years, the typological research must be understood in a wider sense, as operative awareness (Muratori 1967). It must not be considered as an extrapolation or development of existing types. This leaves an ample margin for architectural interpretation.

It is our intention to explore in depth, from a semiotic and rhetorical point of view, the impact made by the phenomena of memory, awareness, and collective intelligence linked to the process of designing on the Internet. The questions we will ask are these. Will this new virtual organism affect, and if so to what extent, architectural language and its transformation by means of rhetorical devices? Will it produce group idiolects? Will it foster or destroy individual creativity?

3. Teaching method and information technology

In the Studios students are taught a design procedure and by means of the "design exercise” will be given them the opportunity to practice it. The teacher’s role is to reproduce real project conditions, to provide a method of working which will cover everything the students need to work on and learn during the design. Finally, throughout the "guided design” s/he must help students to follow all the stages of a real experience of design. A key element of the teaching method is continuous teacher / student interaction, direct communication between teacher and the individual student or, at the most, small group of students.

The aim of experimenting with information technologies applied to education is to produce new teaching methods. The first aspects to be changed by these innovations are the time and place of education. For example, distance learning means that teachers and students do not need to share the same physical space, or even the same timetable (Mitchell 1995). There is a prior stage to the decision to adopt technological instruments, which is the growth of an awareness of the real needs of modern society, and thus the attempt to meet them with teaching aids. Information is now communicated with means, and on a scale,
unknown in the past. At the same time, the background of knowledge available to the architect is increasingly complex, and the architect is expected not only to be aware of their own work, but also to "contain" in himself all the elements he will use to shape his design. We believe that this concept of "containing in himself" is one of the keys to the interpretation of the innovations of the near future, or rather, in the changeover from individual intelligence to organisations which are intelligent as a whole (Lévy 1996) (de Kerckhove 1996).

Even prior to McLuhan (1964) innovations in telecommunications were thought of in organic terms: information is the link between individuals that, by creating a whole, forms "organisms". These organisms act on their own intelligence, which is superior that of its single members, since they enhance and are in turn nourished by each individual’s measure of intelligence (Lévy 1996).

To the eye of a foreigner, Tokyo seems to live in synchrony, as if each person knows and takes into account what every other person is doing. The degree of co-ordination and unspoken agreement that I found in Tokyo reminds me of my experience at another conference, the International Symposium of electronic arts, at Helsinki in 1994. Almost everyone was already "on line". They considered themselves a complete new kind of people. There was also the impression of a new kind of space. I realised that the Internet space was "alive" with a presence that was collective, vibrant, active and human. Yes, there was something in common between the people on the streets of Tokyo every day, and the four hundred artist-engineers who met together at Helsinki. Searching for the mot juste I said it was a kind of "collective intelligence" (de Kerckhove 1996 p. 191).

4. Collective Intelligence

**Collective intelligence** is the intelligence of groups who, pragmatically, have the common aim of collaboration. An intelligent organisation is a set of individuals carrying out a task together, as if the group were a biological organism which acts coherently, guided by a unifying intelligent principle. According to this concept, collaboration is a particular kind of information processing system (IPS). IPS models can be formalised, have their components articulated, be studied and, therefore, improved. Newell and Simon (1972) hold that the aim of IPS is to bring into being an autonomous computer system that simulates human behaviour, while the aim of collective intelligence is to realise computer systems that facilitate collaborative work (CSGW) (Garlegher 1990) (Greenbaum 1991). The purpose is not to create an artificial intelligence, but rather to extend human cognitive and intellectual capacities.

4.1. Collective Memory

In order for a group to act as an intelligent system it must possess a long-term memory of information and of the context in which it was developed. This memory consists of, both the knowledge and know-how of the individual members, and the information stored in computers. The functioning of the collective memory depends on the tools used to communicate between individuals and with the computer systems.

In the past the written word, the printing press and technical drawing enabled knowledge to be copied, reproduced, and so passed on. Today computers and networks can create change in the function and interaction of the collective memory. McLuhan says that electric technology extends the instantaneous process of knowledge, through the relationship between its components, analogous to that which has always existed in our central nervous systems (McLuhan 1964 p.372).

The unique features of the collective memory are that it is simultaneous and interactive; innovations made through networks and computers result from these features. One example is the Internet, which is, in any case, merely the first, rudimentary version of this rapidly evolving system. It would be a mistake to think of the present networks and programmes as demonstrating mature and aware implementation of the collective memory. Internet may be that, but it is also many other things. It is up to the collective awareness of its users, in this case teachers and students, to turn this potential into real capacity.

4.2. Collective Process

By process we mean the processing of information. In architectural design, information processing creates a constant relationship with the problem and reality. The procedure involves processing historical, morphological and typological information, identifying relations, drawing imaginary structures, make changes to these structures, and compare them. In all cases we have observed that design includes an aesthetic dimension, within the essentially synthetic procedure. Each student is taught a method, and it is his/her responsibility to develop in his/her own personal design process: an individual process which is experimented during the design theme.

Collective process means enabling individuals to share the experience and the work they are planning to do, or have already finished. It is a collective body of knowledge that the students of the same studio have in common because they share a method and a "context". In the current studios this collaboration is achieved through the sharing of a common time and place: viz. the studio. In VSIs, unity of time and place can be transcended using programmes for information processing which include means of communication. Programmes of information processing are the tools we use for reflecting on, documenting, imagining and representing the knowledge, activities which are necessary at various stages of the process of architectural design. The basic processes of information are writing, drawing, modelling and simulating.

The collective process requires the existence of continual communication between individual information processes. For the student the communication must be transparent: that means s/he must be able to move from one tool to another, exchanging data from one application with that of another without breaking continuity, as needed at any stage in the design process. The computer and operating systems must be able to handle large numbers of concurrent processes, while the individual applications should be equipped with common protocols for data exchange.

Beyond the personal dimension, the flow of information must be extended to the group. This is the level of the LAN and WAN, of Intranet and Internet. On this level communication between individual processes must be guaranteed, so two or more students can work together at the same time on the same object. They must be able to access the collective memory and activate the flow of information, using the multimedia the design process requires.

4.3. Collective awareness

Every architectural work represents, to some extent, the memory, not only the becoming of the applied technical processes, but also of previous works. It "contains in itself" as much a record of the past, as its reworking in the present. The web of relations between present and past is ill-defined because it involves this level communication between individual processes must be guaranteed, so two or more students can work together at the same time on the same object. They must be able to access the collective memory and activate the flow of information, using the multimedia the design process requires.

5. Activation of Virtual Studios on Internet
Collective intelligence is a concept that several authors (cf. Reference) share to underline how information science has produced changes in human relations. Many of these changes are being seen in embryonic form, for they are the result of very recent innovations in the field of telematics. It would be wrong today to look for single programmes able to implement the concept of collective intelligence into a working system. What do exist are, rather, different programmes that integrate some of the elements needed to allow human groups to be collectively more intelligent, and to make better use of the skills and knowledge of their individual members.

5.1. Collective Memory

In VSI's the collective memory consists of the combination of the knowledge held by teachers and students, and of the information about the design project stored by the computer. The World Wide Web is at present the closest thing we have to the idea of a collective memory, since it is extensive, multimedia, simultaneous and interactive.

**Extensive**: the Web links enable any teacher or student, from school or from home, to have access to a comprehensive body of information in a transparent manner (Figure 2). They have no need to know if a document resides on a local or remote server. They can, for example, view a design or document made up of parts residing on different servers (Figure 3).

**Multimedia**: the HTTP and MIME protocols ensure that different applications can share data under different formats - so not only as HTML documents, but also drawings, photographs, videos, animations etc. (Figure 4).
Simultaneous: this is the result of instantaneous electric speed, as McLuhan (1964) terms it. Being simultaneous, the Web allows students to work on their own design project to share information about it, not later, after their work is completed, but while they are working on it. In actual fact, links at a hundred bits per second, as we are now used to getting on the Internet, on a practical level are a fairly poor implementation of the idea of simultaneity. Fortunately, besides these very slow links, VSIs also make use of ADSL and ATM whose performance is closer to the idea of instant speed.

Interactive: a growing number of programmes are equipped for direct or indirect interaction with the Web. These programmes integrate tools for surfing the WWW, for saving directly in HTML format, or in formats compatible with the HTTP. In any case, the more this collective memory grows, and the greater the number of heterogeneous documents it holds, the greater the need for structuring criteria. We need keys for interpretation, and tools that can supply information about the context in which it was activated and processed, in analogy with the operation of the human memory. Many of the current programmes are poor precisely in organisation of, and structured access to, the memory (Carrara 1994) (Caneparo 1997 p. 43), in so far as they are too dependent on the hyper-link.

5.2. Collective Process

In the VSIs the basic processes of information are writing, drawing, modelling and simulation. With today’s multitasking operative systems with graphic interface, all the single processes can be carried out using different programmes. The collective process is the result of interaction between different programmes on the same computer, and with other computers hooked up on the net. The degree of overall integration can be measured by three fundamental parameters: common task, shared environment and time/space.

Common task measures the degree of sharing of the same task among members of a group. A growing number of applications integrate tools for sharing data, not only between different programmes on the same computer, but also with other computers across networks. For example, in the package Office97, Word includes tools to share easily a document at the level of LAN and of Internet/Intranet by means of e-mail and HTML. In a similar way, AutoCAD version 14 has analogue capacities, at the level of both LAN and Internet. It supports FTP and HTTP protocols and the proprietary format “Whip” for inserting two-dimensional vectorial drawings into HTML documents. In the meantime many solid modellers are beginning to support the VRML format to export 3D models directly onto the Internet.

A shared environment does not share only the later stages of a project, but also what other people are doing, as they do it, plus individual approaches and the overall “atmosphere” in the group. For example, electronic mail that simply relays messages between various participants has a low impact on the scale of the shared environment, while an integrated system of videoconferences has a greater impact (Figure 5).

Time/space refers to modes of interaction, which can be synchronous or asynchronous: if synchronous the interaction requires simultaneous participation, if asynchronous it is not tied to a shared time.

The mere sharing of data is a condition which is necessary, though not sufficient to obtain an effective collective process.

Turning our attention to the applications useful for creating a shared environment of students, teachers and information systems, we feel, that in the present situation of rapid evolution of systems, the two most interesting ones are videoconferences and shared virtual reality.

5.2.1. Videoconference

Videoconference allows communication and interaction among people in different places. Besides better video and audio links, the quality of the interaction is improved by integrating several applications in the desktop. The digital whiteboard allows several users to share drafts, drawings, sketches or photographs and interact with them by means of drawing tools (Figure 5).
Applications can also be shared in a window across several desktops. For example, a student can open a window with a C.A.D. or a lighting simulation program and share it with the other participants in the videoconference.

5.2.2. Shared Virtual Reality

Virtual reality allows exploring and visiting a 3D model according to the user's defined viewpoint and paths. By means of shared virtual reality it becomes possible to meet and communicate with people who are simultaneously connected to the virtual model in Internet.

Real time visualisation of form and space allows the student to know the design from visual experience. At the same time, virtual reality lets the student interact immediately with forms in the third dimension, that is, to rethink and modify the model of the building directly. Sharing the same virtual space among several students and professors offers an innovative educational medium: it is a kind of visit to a virtual building yard, to visualise and experience the on-going stages of the conception and representation of the design. The student's design can be discussed, reviewed and modified with both local and remote participation of professors and students (Figure 6).

5.3. Collective awareness

The current experience of VSIs involves working groups in Italy and abroad. At the moment the participants are Prof. Alan Constans of the University of...
This experience is too recent, still evolving, for definitive evaluations to be made; for us to judge whether the individual student has achieved a particular degree of awareness of the activities of the other participants, and of the overall project as a whole.

Others taking part in the VSIs, in different qualifications, were those "commissioning" the project, and the decision-makers: the Turin City Council, the National Railways, and the local Transport Authorities. Their participation turned an exercise in design into an authentic design project, where the student is able to follow and experience the various stages. As well as being open to institutional interlocutors, through the Internet the project is also open to its ultimate users - the citizens of Turin. The question that arises is whether the continuous, immediate availability of information concerning a project for a central, nerve centre of a city could influence the decision-making process, at least at a city level. And it is a question that certainly goes well beyond the realm of teaching practice. At any rate, at the end of the experience it may be interesting to find out whether the group has developed an awareness of the interactions between design processes and social processes.

Design forms emerge during, and derive from the long process of communication. If the architect can assume control of this process, s/he can continue the evolution of forms inherited from previous generations. The architect perceives changes and mutations in society and these are made evident in his designs. A design is not just a passive reflection; it transmutes the signs and forms of a society. The architect gives shape, renders concrete the progressive development of a society’s signs. In any case, the mutation of language is always a collective process. Computer networks involve the design project in a creative cycle: from project to project in a continuous development. Potentially, what may change is the actual role of the architect - creator of spaces and forms in which an era and a culture can find its reflection. The Web changes the future development, the acquisition and the diffusion of these forms in so far as it proposes signing machines which enable us to invent our own languages (Lévy, 1996, p. 131).

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References

Further information on the VSI is available on-line at:
http://www.comune.torino.it/~spina2
http://sat00103.comune.torino.it/