JOSE MANUEL POZO MUNICIO
PROYECTS DEPARTAMENT
ARCHITECTURAL TECNICAL SCHOOL
UNIVERSITY OF NAVARRA. PAMPLONA. SPAIN

Developing One's Vision to Get the Notions Better

It can be easily observed, at least in Spain, that there are many members of the academe within the field of architecture who still confuse the use of the computer with the teaching of architecture. It as if the simple fact of having an access to a computer were a giant step in the development and dominion of architecture.

Let me explain.

At the sight of the indubitable representative capacity of computers in the field of architecture, a great number of professors confuse the adroit handling of computers with the dominion of one's capacity to make projects. They do not realize that the computer is not something with which one can express himself but, rather, it is only a bearer of language.

From the practical point of view, this confusion is brought to the point of absurdity -I am talking of the Spanish case- by fomenting the introduction of Computer-Aided Design in the new plan of studies for the first cycle in Architecture when students do not even know what architecture is nor for what reason can the computer *aid* them. This has its own place in a more advanced stage of the course.

Thus, it cannot be denied that the computer invasion in architecture is going to provoke a deep-seated change in project-making and designing giving place to other architectural languages and other perceptions [1]. We, however, cannot permit ourselves to be swayed by the vain thought that if a student is capable of performing a realistic computer simulation, we have succeeded in preparing him well for architecture. One must not forget that an advanced capacity of representation and perception can go in direct contradiction to the capacity of creation and objective description of architecture [2], since

_____

[1] LENTZ, Uffe; *MultiMedia in Architectural Education;* ECAADE '92 Conference; Barcelona, November 1992.

[2] SAINZ, Jorge & VALDERRAMA, Fernando; *Infografia y arquitectura;* Ed. Nerea. Madrid, 1992. p. 176.

we run the certain risk of guiding our students to a new beaux-arts with the concomitant aggravating effect of cultural poverty.

This portion cannot be established as if its objectives do not form part with the objectives of the rest of the course. What is really important and difficult is not to dominate technology but rather to use it well. The pursued end is more important than the means employed. The means will always remain as such. Moreover, we cannot consider the means as an end. If one considers the means as an end in itself, then what can happen to him, whose only contact with teaching architecture is precisely computer education, is that he may lack an adequate referential Point to situate the teaching of arquitecture in its proper place.

I think that, at this moment, we must not be influenced by the impressive capabilities of this or that program. The more pressing matter that must be addressed is to outline the manner of applying the computer not so much in depicting architecture but, rather, in using it as an instrument at the service of the project.

Now, neither can we limit one's influence in the process of the project to the fact that the computer can be useful in working on specific images in which an incipient project idea is manifested.

To work "for the project" is also to employ the computer in a stage which is even far from the final result. It is even more basic, namely: in its origin: contributing to the development of qualities and of the necessary mental categories in an architect in order that he may have better potency, capability and disposition for imagining the architecture. In other words, it is geared to developing his "spatial vision" and mental agility in order to capture the three-dimensionality of space.

And my communication refers to this, to wit: the use of the computer as a pedagogical aid in Descriptive Geometry, a subject entrusted to Spain's architectural schools in order to develop these abilities in the students.

What is arduous in order to form an arquitect, and not simply to form a "screen-designer", is precisely this: to teach him *how to see and how to imagine.*

This gathering seems to be the ideal forum to discuss this aspect of the pedagogical utility of computer graphics.

In the Barcelona congress, we have seen some developments which used the computer at the incipient or intermediate stage of a project. I specially would like to

mention the talk of Prof. Madrazo of the Polytechnic of Zurich entitled *Design as Formal Language* [3].

Madrazo expounded the computer method which he developed, basing it from the project composition schemes of Durand [4] for three-dimensional composition by juxtaposition, subtraction, partition, addition.... This method seeks to connect the computer to geometrical and linguistic needs proper to architecture. In this way, through the concepts of Composition, Construction, Space, Object, Type, System and Method (which he calls Key Words), it reaches to the Representation of simple structures which contain an incipient gestation process of basic "architectures" [5]. As such, it provides a good way to reach a certain control of geometrical depth of space and to try a process of form generation in which each step is an initial stage of the next elaboration until it reaches the final idea.

Clearly, it is only an example but, understood in this way, the computer can be a great didactic instrument which enjoys the quality proper to drawings, such as imaginary and expressive technique [6]. Thus, it is more than a simple means to *represent;* it is more like an instrument to *conceive* architecture.

The importance that Madrazo attributes to the association between language, geometry and architecture as a departure point for designing permits him to cherish the hope of being able to intervene in designing utilizing the computer as a means to improve this language-geometry-architecture relationship. And, for this reason, I think that to achieve the use of the computer at the service of Descriptive Geometry (the science of graphic languages) is an interesting path to intervene in the project at its initial stage: acting upon the imagination and correcting its perceptive deficiencies.

The results of some investigations which I have carried out in this area are encouraging.

Furthermore, the computer can be a most useful instrument not only for developing spatial vison and for enriching the formal baggage of students who begin their course but it is also a good means to detect and correct weaknesses in this field.

_____

[3] MADRAZO, Leandro, *Design as Formal Language;* ECAADE '92 Conference; Barcelona, November 1992.
[4] Vid. MADRAZO, L.; *Durand y la ciencia de la arquiteaura*; I Bienal of Architecture and Urbanism de Zaragoza; Zaragoza, 17.1.1992.
[5] MADRAZO, L., *Key Words: Notes on Form, Space and Arquitecture;* ETH Zürich, 1993.
[6] SEGUI, Javier; *Anotaciones acerca del dibuio en arquitectura;* Revist EGA, no. l, 1992. p. 14.

The majority of programs available in the market do not permit the direct resolution of many meeting points and of constructing many surfaces of those that usually appear upon representing detailed architectural elements. One can take good advantage of it, since it will force the student to work with his head and in the screen upon configurating them three-dimensionally. Moreover, it is of great benefit both for one's understanding of what he is representing, and for the development of a three-dimensional vision that the objects' two-dimensional projections encompass.

If Panofsky used to define perspective space in order to identify the spatial perception enclosed in a perspective drawing, I think that we can define computer space as an ambit of imagination and living experience of an "enclosed thing" in the computer screen in which we have to learn how to move ourselves.

The illustrative examples given in the exposition have been selected among those carried out by the second year students of Navarre's School of Architecture this year.

Each of them shows a distinct aspect of computer application to the objectives proper to Descriptive Geometry in the sense referred to above, namely: the preparation of the mind and the imagination for project exercise and of rigorous expression of geometrical configuration of architectural forms.

The treatment of texture or colour was not undertaken since the aim of the exercise was to achieve the construction as faithfully as possible. Moreover, emphasis was not placed in giving a realistic aspect.

The three-dimensional modelling of an architectural element that has a well-defined and rigorous geometry was proposed to the students in these exercises. It, however, posed some problems for the resolution of details such that a real construction of the element had to be realized on screen. AutoCad's versions 10 and 11, and Architrion II were employed. The majority of these exercises were done using Macintosh computers.

The difficulty of some of the questions posed, a rosette or a Gothic window, for example, as well as the different preparation of the students forced them to accept different degrees of fidelity of the models. Thus, this was the occasion to bring into light the perceptive defects of many students who were deemed as incapable of constructing the proposed volumes on the screen with due approximation.

The works that were shown correspond to the final exercises by three groups who have shown more interest and better performance. The experience was directed to the entire studentry (120 students).

It has to be noted that the students were using computer drawing programs for at least a year. It is only proper to mention the difficult teaching job undertaken in this area by Professors Bustinza and Fernández Villegas.

The first of these exercises that I am going to mention centers on the modelling of Olite's Castle located south of Navarre. It deals with a voluminous nineteenth century construction that has suffered several damages along the course of time; the last was a reconstruction of Violletian style realized during these past few years. It is a rocky mould that enjoys a very clear geometry due to its volume as well as to its ornamentation. It is preserved in its entirety thanks to the restoration which permits one to work well in the modelling of its volumes.

This work on the Castle was done in two levels: a group worked on the modelling of the entire Castle using Architrion II in Macintosh computers while a larger group meticolously modelled each one of the elements which comprised the balconies of the Tower of Homage using AutoCad 11 on a Tulip 386 computer.

The representative possibilities which the machines offered and the programs used in such machines were not sufficient to define many details and the moulds of the elements. This forced the students entrusted to do the work to exert a herculean imaginative effort with the end of obtaining its representation.

The geometrical structure of the elements were respected and made easily visible with the intention of comprehending clearly its volume, and not only its contours. In this manner, through graphic penetration in the Durandian geometry-language relationship, we can analyze and understand better the spatial reality of the architecture on which we are working.

The work realized with Architrion has been shown very useful in order to develop spatial imagination, even though one must undoubtedly be meticulous by force due to the difficulty of modelling the moulds and adornments by blocks. It is, however, pedagogically efficient for it obliges one to situate each element in space by using his imagination while it is defined in its projection above the floor. It is clear that the students with little spatial vision encounter great difficulty in the resolution of whatever question which is a bit more complicated.

The balconies of the Tower of the Four Winds, for example, require great dexterity not only for the definition of the moulds and profiles but also for the situation of the blocks that should configurate the general volume. To place it in its proper place was not

simple such that the student who worked on the element had to try the process several times in order to "fool" the machine.

As for the part that was developed with AutoCad, specific elements of the Castle were chosen with the view of modelling them as rigourously as possible. The most interesting examples are the elements which composed the balconies of the Tower of the Four Winds: the rosettes, the pillars and the gothic window lattices. It was intended that authentic computer sculptures might be done with them. As such, it required previous analysis and decomposition of its components with the end of reducing them into figures which could be modelled geometrically. The final appearance of the elements shows the dominion of its form and geometry that the authors had acquired while they were trying to find how to adjust these stone elements according to geometric rule.

The other work chosen as an example is the representation of the Water Deposit of Noáin's Aqueduct in Navarre. It was finished in 1782 by the Spanish architect Ventura Rodríguez. The Water Deposit used to form part of a group of structures destined to provide the water supply for Navarre's capital. Among the original structures of this Aqueduct, only the Water Deposit and another part still exist up to this date.

This work turns out to be interesting, above all, for the solution which was given for the representation of the Water Deposit's arches, whose forms do not adjust to the forms of any concrete geometrical surface. They are adjusted only to the elliptic arches in the lateral walls as well as in the center in such a way that they acquire an anarchic form that is difficult to represent, if not impossible using conventional methods.

The computer permits the joining of the various supporting arches as if it were dealing with a terrain. The Deposit's arches define the surface which "spreads out" among the supporting arches. The solution is brilliant and it is without doubt that its author had to "see it" in his head before seeing it on screen. It, however, cannot be denied that this is a case in which, if we truly understand what is represented, it is due to the computer which "creates" the (computer) space and that which defines the represented architecture.

The necessary ingenuity and mental capacity to resolve some of the spatial problems that appear in the modelling, if the themes are well chosen, amply justifies the employment of purely geometrical exercises in order to force the imaginative visualization of spatial realities; a quality that is at the root of the exercise of project-making and to which the deficiencies in this area are attributed.

It is also interesting to put into light that this type of exercises has two big practical advantages. On the one hand, it is not necessary to invent continually new exercises. Once the usefulness and the degree of difficulty of the proposed exercises are evaluated, they can be employed once again to other students since the aim is not the visual result as is the common goal in computer graphics. On the other hand, an excessive updating of the software used in the exercises is not necessary since the use of new program versions or other versions that may appear can even have a negative effect, to wit: it may provoke that a good part of the foreseen result may be obtained with less imaginative effort.

It is, however, neither contradictory to place oneself up-to-date in order to avoid that the student may be familiarized with out-dated programs.

Hardware: Macintosh SE 30/40 (8 megabytes RAM), 13” colour monitor.
Tulip compatible 386

Software: Architrion II. AutoCad 11.
Presentation: MacroMind Director 2.