CAAD: Education-Research and Practice
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Teaching Architectural Design and Caad

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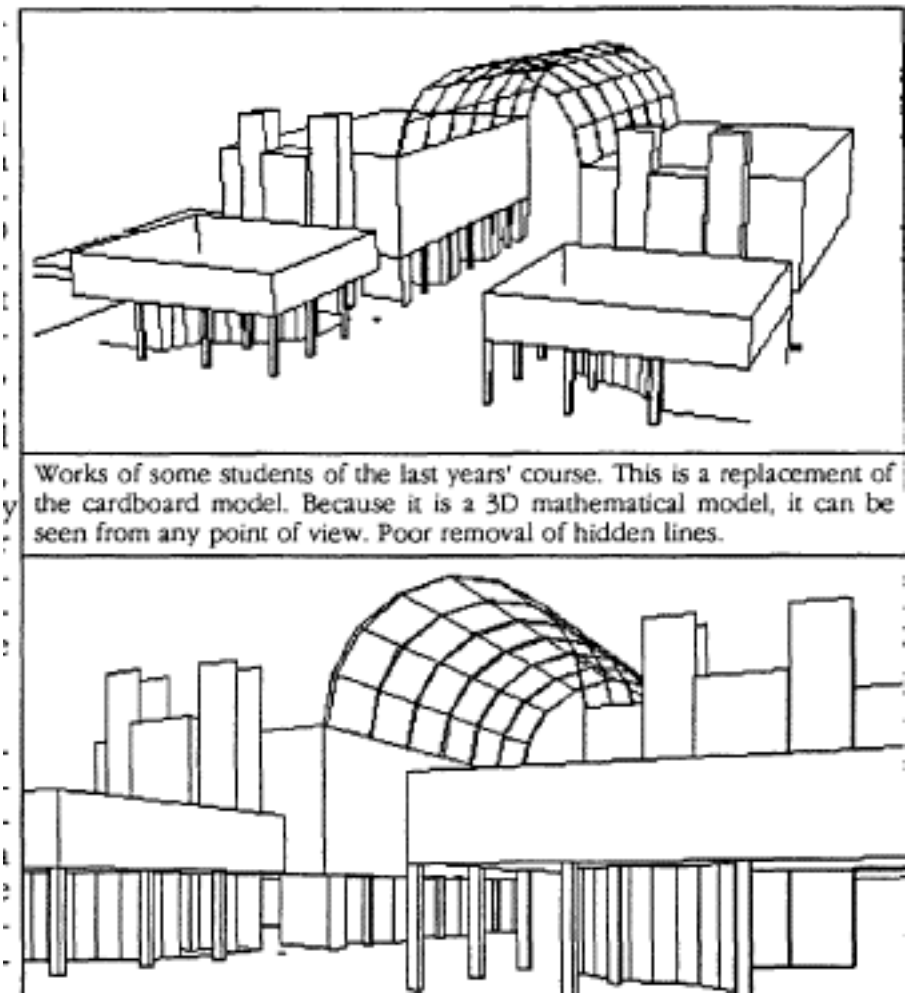
Abstract
In the following notes I explain the theoretical foundations on which I base our teaching work on Computer Aided Architectural Design in the course I held at Facoltà di Architettura di Genova, concerning Architectural Design (Composizione Architettonica) at second year and which are the future trends in the research field.

Computer Aided Architectural Design (CAAD) is the union between two complex subjects: design and computer science. Education and training for CAAD therefore involves some exposure to both of these subjects. The amount of exposure depends upon particular organisational environments and their staffing mix.

The lessons of my course concern the theory and practice of architectural design.
Being the course for 2nd and 3rd year students who attend a 5 year one we give a basic training in the architectural design by working on the essential elements and by giving a theoretical foundation of it. As we aim at a high quality standard we use and teach C.A.A.D. techniques.

In the conventional way of teaching architecture it is common to thinking design as a final synthesis of an analysis process ("Composizionell in Italian) comprehensive of different elements dealt with by different curicula subjects: History, Structural analysis, Technology, territorial and urban planning, etc. All together they build up the further step which, being comprehensive of their specific apports, become "project" .



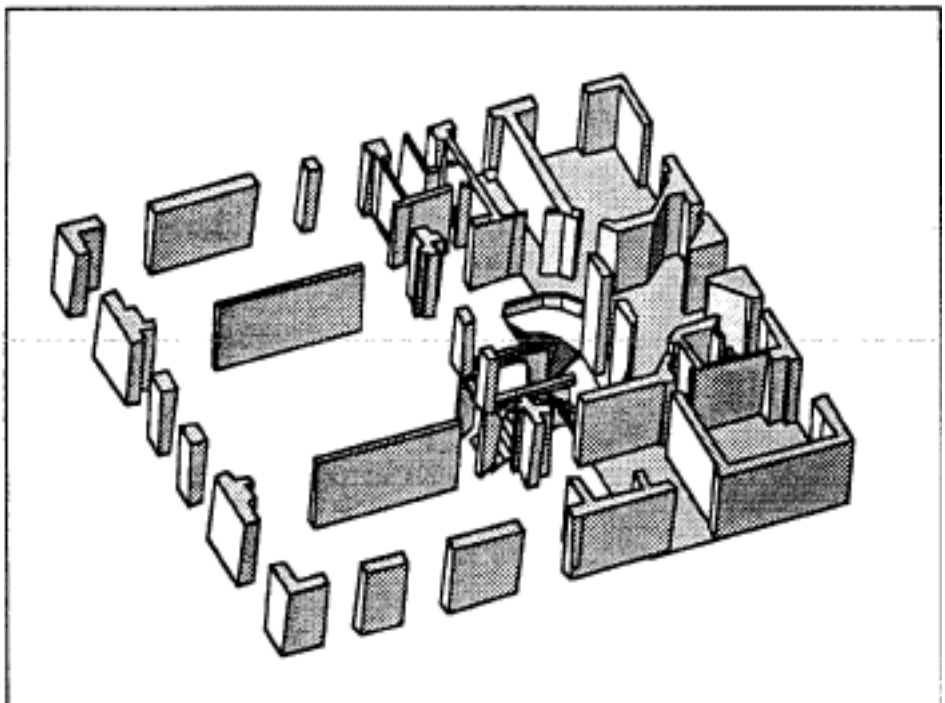
Works of some students of the last years' course. This is a replacement of the cardboard model. Because it is a 3D mathematical model, it can be seen from any point of view. Poor removal of hidden lines.

This idea is supported by a steady tradition (frorn the experience of the "Accadermia di Architettura" to the didactics of Ecoles Polytecniques) and it cannot be easily modified. However we must not consider it as the only one as Architectural Practising is, or should be, much rnore. The long and difficult road walked by the "Scuole di Architettura" in the last 20 - 30 years (with a significative widening of interest on social, political and economic sectors), the recurring attempts of epistemologic refounding emerging in some sectors, the claiming of design not as a starting point to a specific subject but as its assumptions, acknowledgement of the crisis typical of the contemporary town planning, the dinurling of several certitudes that had developed with the birth and growth of the modernist school, the weakening of the proniises which had given life to the strong discussion concerning town and territory planning, all of them require to reconsider the meaning and the

deeper suggestion that ihe project imply.

Therefore ihe project becomes the prompting point at the centre of the Human Sciences that the Architectural Practice involves.

The old scheme that assigned the synthesis as composition to the project is not more sufficient because related to a reductive reading of the epistemology which rules human sciences as if they could be thought as defined segments of the "physical" knowledge of the actual world. The contemporary refection on the difference between the understanding and the unfolding together with the attention given to the interpreting moment compared to the pure describing one give the project the task of enquiring instead of giving answer.



Spatial analisys of an ancient genuensis "villa". Axonometric view with ren-

To think Architectural in this way needs a particular attention from the teaching point of wiev: our didactic aim is therefore to teach how to build up a method allowing the architect to face correctly evaluation, definition, location, quality control problerns related to the design space qualities and to give the students the means to verify the project itself.

It is in this contest that we felt the necessity of inserting the teaching of C.A.A.D. (we train to C.A.A.D. and do not teach thought by it). In this way we lower the importance given to the graphic sign on the drawing paper forcing the students to think more to contents than to formal aspects of drafting and to consider the building they are working on as a 3 dimensional object an not to confuse it with its 2D drawings.

The usage of C.A.A.D. gives us other useful side effects related to didactics.

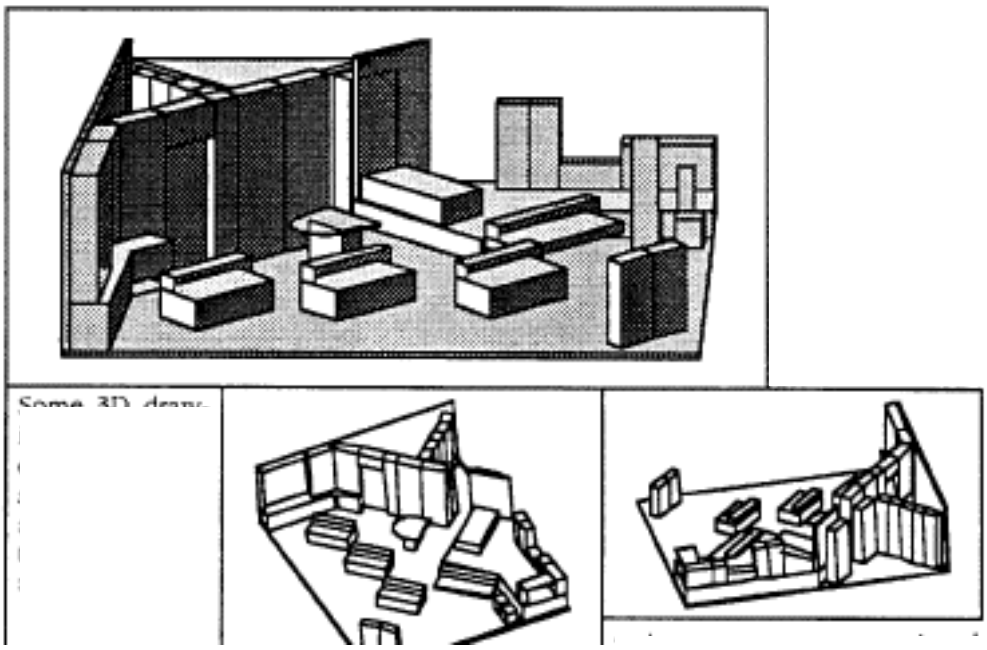
The action of producing a representation of a design on to paper is often, but incorrectly, considered to constitute C.A.A.D. in its entirety. A great deal of C.A.A.D. is undertaken, however, without any graphical involvement.

The absorption of these processes into a computer based design environrnent can be mentally demanding for both users and creators of computer aided design systems. Training and education problems can therefore arise outside of the popularity accepted bounds of C.A.A.D..

Of particular importance is the training of students at all levels on the social impli-

cations of C.A.A.D. and the effect of C.A.A.D. upon the structure of existing organisations.

The education and training of users



As the student population has a quite different study spread, it is fairly evident that the associated education and training task will require an equally wide spread. This is true specifically for the architectural design related training.

The students are encouraged to experiment from the earliest stage of training, to gain friendliness with the computer. It is at this stage that the concept is introduced, that the organisation of a parametric study using a program require the same techniques iised in the organisation of an actual experiment. As the term C.A.A.D. implies, it is a highly interactive process, many of the design calculations employed are of a relatively simple nature and do not require full scale computer facilities. In past times, the conunon tendency was to restrict the use of computer graphics and related equipment to small specialist teams. The only evidence for justifying this approach appears to be a justification of the economics of the equipement; today this assumption is not more true. So today is possible to use small but fully featured personal computers and made one available to every people involved in design. We expect that users will free from the day to day restriction imposed by the arduous task of getting drawing onto paper and managing all the informations related. This should then result in a more creative approach towards the design task.

A more detailed description of our training methods and experience can be find on proceedings of C.A.A.D. Futures '89 conference, held at Harvard University (Cambridge, MA) on july 1989. The proceedings will be published by MIT Press.

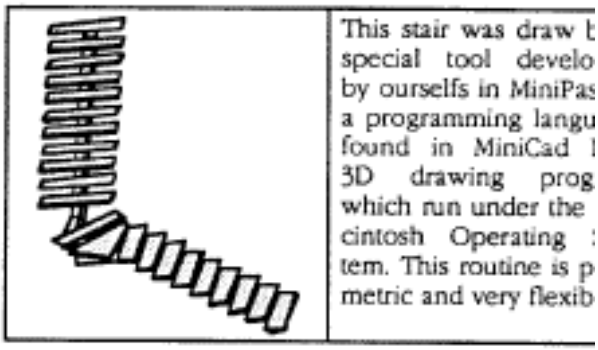
The research.

It is speculative as to whether the stage will ever be reached where the requirement for new C,A.A.D. systems will cease. It is thus foreseen that there will be, for many years, a requirement within practice, for people to create C.A.A.D. systenis or sub-systems, perdnent to each particular architectural need. These systems or sub-systems may eventually reach the stage where they are vehicles that enable particular groups of users to assemble sub-systems relevant to their own use.

The innovator of C.A.A.D. systems, which must find his natural place of work inside the University, is seen as requiring a triad of knowledge on three main and apparendy unrelated subjects.

The triad is:

1) A detailed knowledge of the architectural and operational aspects of the work is to be undertaken;
2) A broad knowledge of computer science with, perhaps, some specialist knowledge of particular aspects of computer science;
3) A reasonable degree of numeracy such that interfacing with the matematics aspects of design and computation does not cause difficulty.
The C.A.A.D. systems innovator, as well as being a creator and designer of C.A.A.D. systems, is also the hub of a communications and interpretations system. This function is as equally vital as the technological aspects, and if correcdy undertaken, will result in non-preferred systems and disquiet among prospective users. C.A.A.D. systems innovation is therefore one of the most demanding of the modern technological disciplines.



At present, the selection of personnel to work on various aspects of the application of computers to design and development problems, is based upon an individual approach, and is restricted to research aspect of our activity at University of Genoa. Because there are an insufficient number of suitable people with the necessary skill to do this job, actually we work to write a performance specifications system to which C.A.A.D. software must be related and to evaluate commercial available package in relations to such performance specifications.

We also do a litde job custoniizing to our need conunercial software, creating specialized macro instructions.
I will present in following some drafting examples obtained either from student training and from specialized routines already developed.

The way ahead

Our future work will be either on using craft and making craft.
Using craft, by teaching in more specialized and profitable way, due to present experience, to obtain the development of people, producing new attitudes towards design, and reconstructing practice to enable it to take full advantage of C.A.A.D..
Making craft, by exploring deeper the possibilty given by customizable software and by development of proprietary procedures finalized to resolve specific design problems. There is, however, no doubt that unless basic design standards are improved, the temptation will be to produce C.A.A.D. programs and systems where the first 'A' will cease to be *aided* and will become *automated*. I look with interest to research held in the field of artificial intelligence, and particulary at work of professor J. Gero; but at present I think it is only field for very advanced research only, not to be related to teaching and training of students.

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See also related paper presented at this conference by other people of my working group.