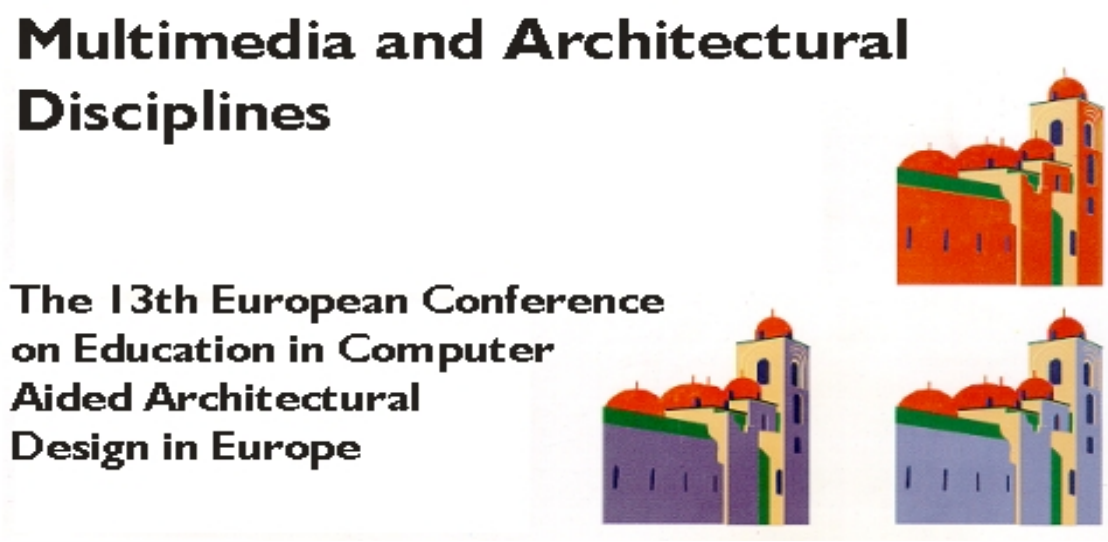
AN INSPIRING METHOD OF TEACHING CAAD PROGRAMS



Jaroslaw Kulinski

CAD Center, Electronic Computing Center (OETO)
Cracow University of Technology - Cracow, Poland

Abstract

This paper tries to describe the actual situation concerning computer use in architectural practice. It tries to trace the roots of the present situation as well as to find a possible alternative. The paper depicts the most common problems arising while getting started the concept work in computer environment. It tries to show how to find the links between human imagination and its expression by means of CAAD software. It outlines a proposal of teaching CAAD programs in the way which would stimulate the user's creativity in the electronic environment.

Introduction

The present paper is based on my own experience coming from several years of architectural practice as well as from the CAAD teaching at my university. A starting point for this paper was a conclusion on the actual place of a computer in a professional practice. The impressions on that matter come from my experience gained in several architectural offices.
My thesis says that, in most cases, computer serves only as a medium for storing and presenting graphical information concerning a specific project. The storage has a form of electronically drawn plans, sections, etc. and 3D models. From these data bases information is extracted in a form of printing plans or perspective views or fully coloured computer generated renderings. Well constructed graphic data bases can also furnish textual reports which complete project documentation.
This shows the actual place of a computer in the process of design which is reduced only to a communication medium between an architect and a client or an architect and a contractor.

Mastering the computer

The main problem is to gain control over the computer graphics environment which from the very beginning requires precise dimensioning. Insufficient knowledge of CAAD programs turns the

process of designing into the dull sequence of copying pre dimensioned objects from a paper into CAAD environment. As a matter of fact, a project drawn on paper is put into the machine. The role of CAAD program is actually reduced to a drafting tool. A computer seems to be almost absent at the stage of conceptual work.
A justified question might be asked about what is responsible for that situation. There are few possible answers. A computer is surely the newest tool which may help to express human spatial imagination. Classically this creative imagination finds its way of expression by means of skilful drawings. A computer as the newest tool seems to be least efficiently used in this field. One can even say that there are no adequate CAAD systems which might fulfil the architect's needs. But is that a fully true statement? In my opinion a human factor plays a predominant role. In terms of human factor, I understand the fact of being accustomed to a traditional way of visualisation based on the action of drawing.
Naturally, our first expressions of spatial imagination come by means of drawing, we learn its language intuitively. In a sense, this language seems common to all humans. In comparison, computer graphic environment is an artefact. Its language is theoretically conceived, and one must learn it to get full advantage of its use. It is specific to each application.
A common mistake in evaluating CAAD program comes from using the wrong criteria. Artificially created graphic environment should not be judged by the criteria of the traditional drawing. The means to conquer this misunderstanding could be other methods of CAAD teaching, These methods put stress on active use of a computer to solve problems at the level of concept, by means of learning and accepting specific CAAD language. They show the user how to convert a drafting tool into a designing tool.

Functional vs. chronological knowledge

One can imagine different ways of teaching CAAD. A quite comprehensive one, however useless from the functional point of view, is based on chronological presenting of available commands. In that way the user can get general knowledge about a CAAD system, (vocabulary learning) yet he has no guiding points for effective use of a program. Stress is laid on presenting the potential- abilities of the system. That method implicitly assumes that functional links (grammar) appear later as the user gets some more experience. In that way the user is free to discover them on his own. This might be time consuming.
The other way of teaching focuses on functional links rather than chronology. In that method a user gets a complete path leading to the solution of the problem. In some way the user's mode of thinking is cut accordingly to the functional logic of a specific CAAD system. In that sense different CAAD systems might be incomparable. If one were to look for a parallel to graphic techniques, possibilities offered by water-colour and pencil drawing cannot be compared.
Nowadays a computer is probably the last drawing tool one has to learn to use. In most (all?) cases somebody who starts using CAAD system is perfectly used to the environment of paper and pencil. It seems natural to transfer habits acquired earlier into electronic drawing. A direct transfer does not necessarily improve the creativity if one uses the most sophisticated tool which computer is. It rather gives the impression of insurmountable constraints.
The key which might help to master computer designing is good understanding of what an electronic drawing really is. The definition should put stress on the constructional aspect of electronically created drawings: the final effect is a result of cutting off unnecessary elements. This remark holds true either for two dimensional or three dimensional drawings.

Basic constraints

There are two basic problems the new user of a CAAD system faces: the dimensioning and the scale. Most commands in CAAD systems require precise dimensioning as a parameter. It almost paralyses free creativity of an inexperienced user. A fully conscious user easily manages the problem by the techniques of help lines or by picking a distance. Different systems offer different techniques, but

they have the same goal: to give a user a way to overcome a dimensioning constraint. This is a piece of knowledge which helps the user to regain "lost freedom" of drawing.
Another problem appears with a scale. Typically, the electronic drawings are constructed in real size. But all the time they are presented on screen in a certain scale. By means of zooming the scale dynamically changes. Most of us are used to a fixed scale of paper drawings. Thanks to their stable aspect one can learn a feeling of proportion. 1n a classic process of designing visual perception plays the role of the first aid in verifying the functional and aesthetic correctness of a design. In electronic drawing we are deprived of any fixed scale during work process. For the designer the object being drawn is rather a sum of his impressions got by snap shots in various scales. Under these conditions our judgements might fail. The only moment when the scale become fixed is the transfer of electronic drawing onto the paper by means of plotting. There is no evident solution to this problem. Perhaps only the time one spends on drawing in CAAD environment could give him more reliable view.

Functional CAAD teaching

One of methods oriented towards a functional use of CAAD system is based on solving drawing exercise by "copying" an existent paper drawing into electronic one. This method seems quite efficient, however it makes the user see a computer as a drafting table. It creates a habit of "inputting" data (drawings) into the machine. And this is certainly not an act of creativity. The effects of the above mentioned method are still easily seen in architectural practice in the offices, where a design is made on paper and then put on a computer. This method prepares the user for shaping the existing (already imagined) objects. It does not trace connections between conceptional process and its means of expression: an electronic drawing.

Inspiring CAAD teaching

A better adapted method which overcomes the above mentioned problems might be based on a free design of well defined (not yet drawn) objects. The aim of that method is to teach a user sequences of commands which lead him from imaginary objects into their graphical representation. My experience tells me that people who have problems in using CAAD programs have difficulties in describing the next steps they should perform during the drawing process to get the desired result. The method should teach possible sub sequences of operations which respond to the user needs while shaping the imagined objects on screen. In short, I will describe my idea of such a method.

1. The subject of an exercise should be formulated as a design problem. It should be well defined, restricted to easily understandable forms. The formulation of a subject should be textual. It should not suggest any graphical solutions, however it can contain an example of a possible solution.
2. A set of intermediate goals should be discussed with a student. This helps a student to find possible ways (appropriate sequences of commands) which might lead him to express his imaginary object .
3. A selected set of commands which might be helpful during the design process should be discussed.
4. There should be a time limit (set by the teacher) not to let a student make any preparations on paper, thus forcing him to exclusively use the computer. Here are two examples of exercises, I have put in practice on my courses of AutoCad.

These subjects were prepared for two levels of teaching: for the beginners and for advanced users. In both cases the subject was based on a similar idea of playing with well defined shapes such as Latin characters. The students were to design a logo based on their initials.
The beginner group prepared a two dimensional drawing while the advanced group were supposed to do it in three dimensions. The beginners resolved the problem on their fourth lesson being limited to just a few commands they knew, for example: line, arc, circle, trim, extend, erase, hatch. The

advanced group were encouraged to use AME module to shape their ideas. (In AutoCad AME module is a solid modeler extension).
It seems that these exercises fulfil points listed above: to be well defined, to be constructive, to have multiple solutions. They let the students do an interactive designing work in CAAD environment while approaching an imaginary object. It was not a process of inputting graphical data from paper. It was more a process of shaping an idea directly on screen. In both cases the exercises were realized during one and a half hour lesson. At the beginning some possible ways of solving the problem were discussed, as well as some aspects of commands which might be useful. The time for the exercise was short to force the student to work directly on a computer without any preparations done apart. The students' answers were quite satisfactory, however they showed different personal abilities to adapt to drawing in computer environment.

Conclusions

I have presented practical application of my points concerning an inspiring method of CAAD teaching on the basis of AutoCad. I have chosen different levels of skills to show that it might work in both cases. The actual level of development of existing CAAD software allows to see it as a creative tool in a designing process. A new approach to designing in computer environment should be developed. Well adapted methods of CAAD teaching might help the students and future users of CAAD programs to get the skills to use this technique efficiently.
Scientific research on the discussed matter still needs to be continued and I am interested in getting a more in-depth view of it.

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