An Intuitive CAAD

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This paper presents the educational experiment, which emerged from the junction of different inspirations and needs. It joins the experiences from an individual research on intuitive 3d computer modelling, courses of traditional architectural composition and the idea of individualisation of the computer use in architectural design education. It shows how computers were used in part of architectural education in a non-computer-oriented course. The experiment was included to and further developed within the frame of AVOCAAD project.

Introduction

The issue of how to employ intuition in the field of Computer Aided Design is not a new one, however, there is no general methodological pattern of 'intuitive computing' in architecture. It seems, that it is not possible to elaborate such a pattern, because itself it contains the insoluble paradox: it is the call for objectivisation of completely subjective and individually conditioned sphere. It also seems, that such objectivisation, if any, could be possible only on the ground of psychology. The work presented here does not try to give a full, and objective solution of the problem of intuition in CAAD. It shows, how three independently developed and existing sources, produced a very simple, but valuable educational method.

These sources are:

- experience with traditional, conventional course of architectural composition
- research on abstract computer modelling
- research on individualised approaches to architectural education

The course of conventional architectural composition.

The course is concentrated on exploration of formal and spatial qualities, resulting from the play with simplest 3d primitives: mainly cubes, but also spheres, cylinders, cones, ets. There are four compositional exercises to be done by students:

- low relief
- solid composition
- transformation from a given cube to cuboid of imposed dimensions
- passage – transition

Low relief composition can be compared to the simple design of abstract elevation of the building. There are initial conditions given:

- the basic background, which consists of the two planes vertical and horizontal, 30x30 cm each (in the scale 1:100 it ranges the space of 30x30x30 meters);
- the relief must suit to the area of natural perception (60 degrees in horizontal plane, 30 degrees in vertical)

The task is to explore relationships between basic

3d forms in a semi-spatial environment. The outcome should be one monochrome, physical model of the form, made in the scale of 1:100.

Solid composition concentrates on exploration of specific emotional values, which shall be represented in a 3 dimensional form. The task is to design a form which shall be:

- monumental or
- dynamic
- massive
- static
- light

Each student designs one of the above types of form.

The resulting form shall be composed of cubes, cuboids, or forms derived from them. The initial condition is horizontal plane 30x30 cm (in the scale 1:100 it represents the space of 30x30x30 metres).

The task in the next exercise is to design a form, which shall represent the **transformation** of the cube 6x6x6 cm into a cuboid of the imposed size (e.g. 2x4x12, or 12x6x2, etc.). This exercise involves the notion and process of rhythm. In order to achieve a deeper complexity, the applied rhythm shall be distorted. It is required, that the transformation, as a whole, is to show both: a process, designed by the student, as well as a valuable, architectural form. There is an initial, horizontal plane 30x60 cm given. This exercise do not intend to have any reference to the 'real' world, therefore it is scaleless.

The exercise of **passage – transition** is similar to the previous one, but its aim is not to design a form which 'goes from a to b', but to define a space of 'passing through'. In the scale 1:100, on a plane of 30x60 cm students are asked to design their own interpretation of such a space. For this purpose they have to find themselves a metaphor, a formal or literal reference of the passage – transition space, which should serve as an inspiration. They are allowed to use any kind of 3-dimensional forms, and the colour application is widened to the shades of grey.

The general aim of this course of architectural composition is to help students understand the implications and possibilities given by basic transformations of simplest solids in a three dimensional space. Through discussions, they are encouraged to express their own, personal interpretations of the subjects. The exercises serve only as formal shelves for increasing individual creativity in the processes of learning how to express intuition in a physical form.

At the same time, this course has a very serious limitation. The amount of time (too small for discussion and experimentation, on the other hand – physical model making takes a lot of it) does not let both the students and teachers, develop the issues more deeply.

Abstract computer modelling

Abstract modelling is an idea of intuitive computer modelling of abstract, 3-dimensional forms. It is generally opposed to the whole sphere of computer simulations of real world, but rather it is aimed at individual interpretation of the neutral space, which given by computers. On the other hand, it uses the concept of abstract art in a sense, which was developed in first decades of 20th century by K. Malevich, W. Kandinsky, L. Moholy Nagy and others. Especially the suprematist approach to painting *('... under Suprematism I understand the supremacy of pure feeling in creative art...')* by Malevich is, by analogy, of a special use in computer abstract modelling.

Computer, or rather 3d modelling software, as no other medium, enables us to visualise what is not rationalised yet, or even mentally ordered, to produce certain forms, electronic realities, with very simple, basic, primitive input data (i.e. geometric primitives), as a material for formal and spatial exploration. Therefore, it occurs possible to improvise, intuitively compose and design architectural occurrences, with the use of computer in real time. There is no material limitations, no efforts to force physical substance for this kind of architectural sculpturing. This idea opens a chance for unlimited exploration of various aspects of 3-dimensional forming of geometrical structures, and to model or create forms and spaces, which are impossible to create otherwise, or somewhere else. It is a purely generative approach to computer based modelling, which is opposed to the simulative one.

There are two main types of computer abstract modelling:

- form making with the use of many simple solids, where the special value is sought in establishing certain relationships between elements
- geometrical transformation of a single solid, aiming at achieving the inspiring form resulting from the internal complexity of transformed geometry;

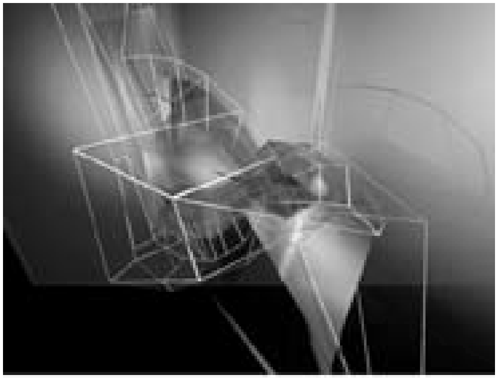
Having no external limitations or special requirements, it is possible to play with geometry and space and the only limit is personal intentions and creativity of the user – player. It is not important what kind of software it is used, because it is the specific, affective approach is important here.

There is another analogy to Malevich and his concept of additional element in painting, which indicates all over-rational, intuitive and emotional approaches to the creative activities: *"this eliminated element is the one which I call the 'additional element'; this is which develops and produces new form either by causing the existing norm to evolve or by overthrowing it"*

Such understanding of doing things - compared to a purely rational use of computers indicates that also here the 'additional element' as a state of mind, innovative and individualised approach, should not be eliminated (as it is) as destructive. Computer abstract modelling provides one of possibly many examples of introducing such additional elements to CAAD. Comparing it to all rational, effective computer applications in architectural design, abstract modelling was called an affective approach to architectural computing. Affective approach to computing is the additional element, the missing link in the whole sphere of creative activities in the space between computer and architecture,

Individualised approaches to architectural education

The third thread, concerning our educational experiment concerns the general approach to education. The main assumption here is that gaining knowledge cannot be separated from the general, full development of the person. Abraham Maslow explains it quite clearly: *'education can no longer be considered essentially or only a learning process; it is now also a*



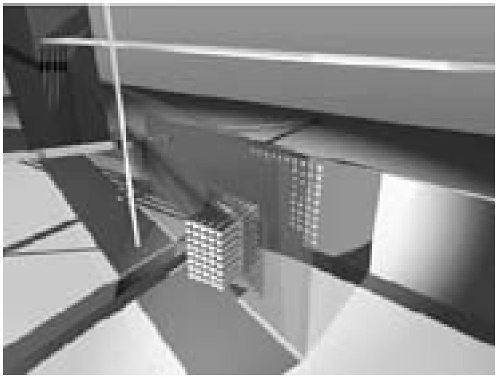


Figure 1 (left). Abstract modelling examples, A. Jakimowicz *character training, a person-training process'*, therefore: *'what I am really interested in is the new kind of education which we must develop which moves toward fostering the new kind of human being that we need, the process person, the creative person, the improvising person, the self trusting, courageous person, the autonomous person'*. (A Maslow, 1971). The problem of today is not the problem of practical skills or the amount of information to be acquired.

Architecture nowadays is deeply changing by the electronic technology, which mainly concerns introduction of computer technology into the domain of architectural design. Computer technology (including networking), offers the new and still not completely known sphere (environment) to work in. This is still the sphere, which can be called the sphere of possibilities, the adaptive sphere, which can be used, adapted for different purposes and in various ways. Therefore we still face a pursuit of inventing new needs and so - new uses FOR this new environment. Environment, which causes new communicational (cultural?) paradigm.

Thus there still is the problem of how to find a place for computers in architectural education. In the context of what was written before (problem of the 'between', the person in education, inconsistency within the understanding of architecture) finding the solution seems to be impossible. When we ask the question of education in CAAD for practice, first we face the real problem of unavoidability and must to reconfigure both: education and understanding of practice. It cannot be solved now.

However, we believe that the key for this reconfiguration lies in appreciation of full personal development as a general aim of education - architectural one too. Keeping this in mind we can model two actually possible approaches to the problem of professional education (Jakimowicz, 1996):

Development of the individual is a secondary (and accidental) outcome of education.

Education should linearly serve the actual practice of the profession.

In such case the word 'education' should be replaced with 'training', which is to get the efficient 'amount' of information, or manual skills with procedures how to use it in order to fulfil the pragmatic requirements of the market of the profession.

Learning CAAD in this situation is getting possibly a highest level of manual skills in operating the design oriented software. CAAD education here is just software (probably the most popular on the architectural design market) usage courses. Generally the concrete curriculums of such courses are not very essential for architecture itself or the student.

The full development of the individual, as a primary goal of education, leads to a full evolvement of the subjective, personal features of the educated person in order to enrich, strengthen and support the objective practical problems solving i.e. practical experience.

Here, via professional education and later - profession, the full development of individual performs. Individual features, talents, interpretation (analysing, synthesising) abilities, skills to act creatively in various situations are appreciated and developed in the context of a given profession.

In architecture, this would be based on developing an active, creative and individual attitude to various aspects of the field of architecture, not just profession.

In this pattern, CAAD is the sphere of exploration, development of new possibilities for architecture and various aspects of design.

This could be done by possibly free access to computers also as experiment devices for design, formal exercises, structural analyses, etc., where the student opens himself for the new possibilities he/she discovers, appreciating creative surprises as a result an active dialogue with this specific device;

The first model of education presented here uses computer as a tool, second - as a medium. A medium approach to computing, where computing is participating in the process of development can be a wide and general indication in searching for architectural CAD education models for the present and for the future.

An intuitive CAAD

The above described experiences, research and thoughts have led us to prepare a simple and specific educational experiment, which concerns the regular course of architectural composition. It is the course for first year students, and the idea to introduce computers appeared not for computers themselves, but to try improve the efficiency in teaching – learning process of a very intuitive design tasks.

We assumed that for this kind of formal experiments no special preparation, even for students, who do not have computer literacy, is required. Therefore, after the short introduction of how to build solids using a 3d modelling software, and how to move, rotate and scale them, students begin their own work. The more advanced computer skills are developed during the work.

First students were asked to explore symmetry and dynamism. They had no initial conditions to fit in. Some of the results were very impressive.

Next semester, we tried to impose the spatial limitations (planes 30x30 and 30x60 units) and the conditions taken from the course of conventional composition. Students were doing low relief, solid composition, cube transformation and passage – transition.

The students are allowed to ‘go wrong’ and have a maximum freedom in modelling. If the task is properly and clearly defined, most of the time with teacher students spent discussing the design problem, not the computer problems. In this specific case of compositional exercises, computers proved a very helpful medium. During the time, which is normally used for designing one physical model of the required composition, each student was able to produce at least two valuable compositions. But the final outcome, i.e. computer model, is not the most important thing here. Thanks to the computer use (modelling software), they could much more easily explore the implications of the 3d solids transformations. They could easily play with them, seeing immediately the results of their decisions and try much more possibilities, than doing physical models. It is interesting to see, how computers can be successfully used in a non-computer-oriented course.

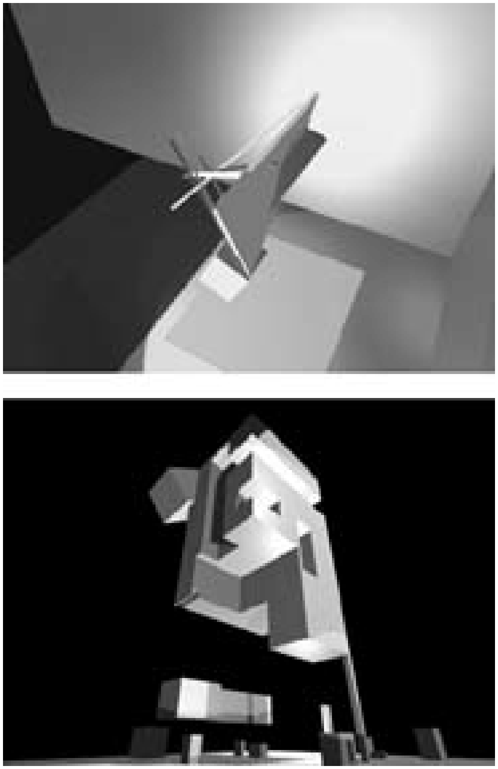


Figure 2 (left). Top: Dynamism exploration, student A. Dybacki. Bottom: Massive form exploration, student R. Konert

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