

# AVOCAAD, the experience

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*The Leonardo da Vinci project AVOCAAD (Added Value of Computer Aided Architectural Design) aims at stimulating creative and experimental use of computers in the field of Architecture and Construction by the use of new technologies. For this purpose, a large set of exercises and exercise materials was developed and is now available through an interactive web-site. This allows regular students as well as architects in practice to continuously seek for a more interesting and inspiring use of computers and IC-technology, adding value in their own field of interest and work. The interactive web-site generates a virtual forum for exchange of ideas.*

*The AVOCAAD partners as well as the newly joined partners are currently using and testing the available teaching materials (exercises, foreground and background information) with students. Moreover a small design exercise in the context of the project has been the theme of a workshop held at the AVOCAAD 1999 conference. Students and architects were asked to create a design in a predefined space based on experimental architectural music.*

*This paper intends to report on the experiences we gained in using the interactive web-site, the exercises and also doing the workshop. We will address the pedagogical implications of issues like learning environment, continuous and distance learning, and focus on their impact towards CAAD curricula. Examples and results will illustrate the general framework.*

**Keywords:** AVOCAAD, CAAD, Creativity, LLL, ODL

## Introduction

*The aim of the AVOCAAD project (Added Value of Computer Aided Architectural Design) is to stimulate the creative use of computers 'upstream' in the architectural design process.*

As computers became extremely affordable, they made their entrance in almost all architectural offices already many years ago. The software that

accompanied them was very appreciated because it took over lot of (drawing) tasks that were very time consuming. The CAAD packages contained a lot of advanced tools, simply unavailable on the architects' drawing table. Spreadsheet and word processor made the creation of bills of quantities, the specifications and the office management a lot easier.

Since then, in most architecture offices, little has changed. Computers (although their power and features grew exponentially) are still used as time

reducing tools in the construction-planning phase as well as in the actual construction phase of the architectural design process.

During the initial architectural design stages, where creativity, exploration and experimentation are indispensable, computers are anxiously ignored. But exactly during this phase, computers can play an extremely important role, though only if the architect deploys a creative and open attitude towards them, without losing a healthy amount of criticism.

The intention of the AVOCAAD project is to face the architects with the unexpected features of computers and to let them explore the added value this can have during the architectural design processes, especially in the early stages. We developed sets of specific exercises that force the architect to use computers and the software in a way he doesn't during his normal professional activities and thus opening his view. The exercises are clustered with topics in modules, to obtain educational entities. The underlying pedagogical background is outlined further in this paper.

### Spreading the news

AVOCAAD tries to infuse the architect's profession with these ideas in two ways. From one side, by spreading the ideas via the Universities teaching architecture, the future architects will be encouraged to at least explore the added value computers can

bring into the architectural design. The result is that they develop a personal attitude towards them, fitting it smoothly in their general architectural formation. From the other side, we hope to influence the architect who is in the professional world for years and in most cases already has some experiences with CAAD. This architect can't usually afford to invest a lot of time and money in post-graduate education and only wants to find answers to problems that appear during his professional activities.

The interactive AVOCAAD website, will contain the exercises and topics, grouped in modules and curricula as mentioned above. This will serve as a knowledge base with education material that focuses on the creative potential of CAAD. As distribution medium the Internet is chosen, because it reaches both groups of public: students as well as architects. While student access will be limited to modules and curricula predefined by their teacher, individual architects will query for topics and make exercises when it fits their needs and at the time and place they like. The advantage of submitting their results to the central AVOCAAD server is that they get response to their results from other users (including teachers) of the AVOCAAD system.

The results submitted to the website are stored on the server and then displayed for other users on a result page. From here, teachers and other users can comment these results. In this way, an interactive



Figure 1 (right). Screenshots of the interactive AVOCAAD web site

forum for discussion will grow out, giving both architectural student and individual architect a reflection of the achieved result.

## Pedagogical background

### *Pedagogical approach*

The pedagogical approach aims to realise the goal of the AVOCAAD project to move CAAD further upstream the design process. Through the teaching initiative and structuring of the AVOCAAD project we hope to achieve a basis for CAAD as a creative medium.

The AVOCAAD project has the following underlying pedagogical approach:

- **Lifelong learning.** Developments in CAAD research, education, and software are fast, which means there is a lifelong need to update knowledge, skills, and insights. Furthermore, given the wide variety of possible techniques, and the large community of practitioners, a steady input of new uses can be expected. In our opinion, practitioners and students alike need to acquire a discipline of lifelong learning in CAAD.
- **Learning through exercises.** Rather than through a standard course, or a design studio approach, we have chosen to illustrate new uses of CAAD through specific exercises. In our opinion this facilitates focused learning for both practitioners and students. Specific exercises help breaking through mental blocks of traditional CAAD usage. Also, learning through exercises enables a piecemeal build-up of a collection of exercise material, and makes it easier for other people to participate or to establish their own selection of exercises. Competence however, occurs not through the occasional single exercise, but through a cycle of exercises, in which a person learns more about the added value of CAAD.
- **Learning by exploration.** The AVOCAAD approach advocates in the nature of the exercises a degree of self-study, and supports browsing through the exercises to find topics and issues both in a structured but also a sometime haphazard way. The exercises are formulated in such a way that there is a degree of freedom in interpretation and a range of possibilities in exercise outcomes.
- **Learning through reflection.** Self-assessment of exercise results is stimulated through a reflection phase. This reflection aims at posing open-ended questions rather than fixed checklists of quantitative results. The aim is to entice the student to generate the learning experience by himself through answering the questions.
- **Learning through peer examples and critiques.** Distance learning has the disadvantage of isolation from a peer group in which one is learning. Feedback, asking questions, and personal contact are present in low degrees. In particular the often-informal nature of a group setting provides much additional information that helps in producing better results or getting better insight. Therefore, results from peers can be shown per exercise results page and these can be freely commented and reviewed.
- **Distance learning.** By using the Internet, the collection of exercise material becomes available to the architectural community and a platform of mutual information and influence is established. In particular for the case of the practitioner, the concept of distance learning facilitates the often very specific nature of learning goals free of time and place. However, also students that are working on a curriculum or module, are free to study other exercises they encounter on the web. Distance learning supports a large degree of freedom and exploration.
- **Impose or find new ways of using CAAD.**

Exercises can show new ways of using CAAD tools for solving a particular problem or question, or they can stimulate the student/practitioner to use existing tools in new ways.

- **Available body of knowledge.** Through the accumulation of exercises, topics, modules, and curricula, a body of knowledge is established that charts developments in the disciplines of architecture, CAAD, and design. Such a knowledge base is an inspiration for the community, and it can aid in showing underdeveloped areas. Furthermore, through the organisation of a conference (1997, 1999) it is possible to discuss on a peer level the concept of the AVOCAAD project and the results of the work.

## Pedagogical framework

The pedagogical approach outlined above results in a pedagogical framework of guidelines. This framework helps to impose a structure on the new and adaptation of existing exercises that make up the basis of the AVOCAAD system.

The concise formulation of the framework is:

*“The AVOCAAD project aims to improve the awareness of positive contributions of the use of CAAD to increase quality of architectural design in the formative early design stages through a body of exercises that is publicly available for practitioners and students alike, and which can be used in a free or (pre)structured manner.”*

In more detail, this is worked out in the following manner:

- The basic element in the AVOCAAD database is the *exercise*, which demonstrates one particular way of using CAAD. Each exercise is structured in the same way:
  - Title, which gives a brief indication of the aim of the exercise.

- Description, which gives some context.
  - Goal, which states the kind of outcome of the exercise.
  - Required skills, which summarises computer skills needed to make the exercise.
  - Required software, which summarises the kinds of software to make the exercise.
  - Exercise, which gives some more detailed information on the exercise.
  - Result, which states the factual output that has to be delivered to the AVOCAAD website.
- Reflection, which asks a number of questions to see whether the aim of the exercise has been fulfilled.
  - The companion to the exercise is the *topic*, which adds related information to an exercise. Skills can not always be taught through one exercise only, requiring a “cascade” of exercises that have to be done.
  - The *module* groups exercises and topics through which subjects like “conceptual rendering”, “solid modelling”, “mirroring” etc. are treated.
  - Should a teacher want to use a number of modules, then it is possible to establish a *curriculum*. In this way, a sequence of subjects can lead to a better understanding of some area of CAAD.

## Workshop during the second AVOCAAD Conference

### Introduction

The Second AVOCAAD Conference took place in Brussels from 8<sup>th</sup> - 10<sup>th</sup> of April 1999. During this conference an AVOCAAD workshop was organised. The workshop objective was to let participants create a result for an exercise, in order to get reflections about the AVOCAAD exercises developed.

Each conference participant received a CD-ROM

with the workshop files some weeks before the conference. These included the description of the exercise in the format used on the website, a VRML file with the 3D model to start with, a sound file in different formats and some photographs of the location the exercise is located at. This is about the same amount of information a student would get through the interactive website.

During the workshop, every participant presented the result (s)he created for the exercise and discussed the experiences of creating the result. The workshop evolved to a discussion about the exercise itself, but also about the pedagogic approach of AVOCAAD in general.

### **The exercise description**

This is the exercise description as it was distributed to all participants :

#### **Description**

Architectural spaces can evoke sound or music as well as sounds can evoke space. The perception of spaces is definitely coloured by sound or music.

Endoscopy is used to represent Architecture by pictures taken inside a model. In a similar way, 'Soundoscopy' could be the term for representing Architecture by sounds or music.

#### **Goal**

Creating spaces and images, by analysing music and extracting atmospheres and feelings out of it.

Stimulating space design by imagination and designing/modelling this spaces from scratch in a virtual computer environment.

#### **Required skills**

- Architectural design skills
- 3D modelling
- Rendering

#### **Required Software**

CAAD software, 3D modeller, Render software.

#### **Exercise**

Create an architectural sculpture in the given environment (see VRML file above and the photographs) that is a subjective reflection on the presented piece of music (find in /workshop files/sound/ directory) or on a fragment you select from it.

Make 5 (rendered) images to present your design. The 5 images together give an overview of the sculpture.

#### **Result**

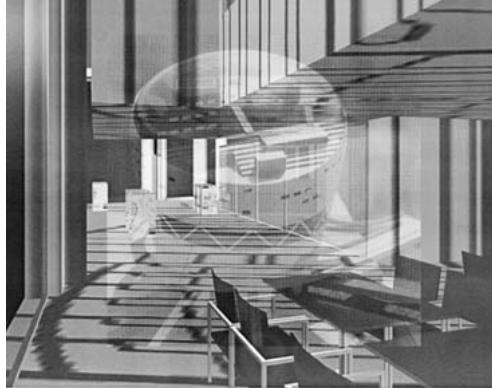
- A 3D model in VRML format that represents the given environment with the designed sculpture in it
- 5 images in GIF, JPG or PNG format that give a global image of the sculpture

### **Conclusions**

The discussion with the participants of the workshop showed that they found it very difficult to create a result for this exercise. Several reasons are responsible for this:

- The exercise is very difficult because of its abstract level. The combination of music and architecture is not very common and requires a deeper theoretical architectural knowledge and reasoning of the student. Although the concepts the exercise relies on are very abstract, in the end an actual 3D object has to be created and presented.
- The required computer skills to finish this exercise are quite numerous. Firstly, the student/architect has to handle different file formats. He has to transfer the given VRML file to a file format that his CAAD Package can manage. Besides this, he has to have knowledge of 3D modelling and preparing the model for transfer to VRML format. The exercise also asks for still images, these imply the knowledge of rendering software and image editing software. The result was that

Figure 2 (right). Result for the AVOCAAD Workshop created by student Philippe Plaghki



some students did not come to a VRML model at all, because they didn't keep this in mind during the design and that made their CAAD files nearly impossible to transfer to VRML.

- Most participants had a lot of difficulties with the description of the exercise. The assignment wasn't clearly enough defined. The exercise should have clearly defined objectives and evaluation criteria. It was not clear if the exercise focussed on technical skills or on a more conceptual level. This resembled in the wide diversity of the submitted results.

The conclusions of this AVOCAAD Workshop made clear that the underlying goals of an exercise should be expressed more explicit to the students. Otherwise, they easily get lost while creating the result, what has no added value at all for the student. We decided to add a new item to the exercise description that states the reflection criteria that are important when finishing an exercise.

## International Course Eindhoven<sup>[A]</sup>

### Overview

A second extensive but more technical oriented experience test session was organised during a 3-week course on CAAD for foreign architectural

students at the T.U. Eindhoven. Besides the normal staff members, teachers from the WENK, Sint-Lucas Brussels/Ghent were also invited to participate in the course: International teaching for international students. Simultaneously, the AVOCAAD web site could be tested in a kind of 'controlled' environment. A specific module was set up containing three of the exercises and the students were invited to use the AVOCAAD web-system.

The first results showed an obvious and very explicit enthusiasm of the students. During these tests, a series of technical problems and limitations were experienced, most of which were solved and adapted.

### Course

This course was organised for foreign students at the TU Eindhoven. Although some of them had some limited experience, most of the students could be considered as beginners concerning the application of computer technology or CAD in particular. On the other hand, it concerned mainly 4<sup>th</sup> or 5<sup>th</sup> year students, with interesting though different architectural backgrounds. The objective of this CAAD course was primarily oriented towards the training of technical skills (HOW), although other aspects were not necessary neglected.

The course itself was a mixture of class-teaching, exercises and the use of the distance learning technology (the AVOCAAD server). In this, it was not representative for the future use of the AVOCAAD web material.

After basic teaching in AUTOCAD and 3D STUDIO, the AVOCAAD exercises concentrated on some aspects of the virtual communication between the different partners in the building process. Exercises were defined as follows:

1. The making of a movie presentation. ( Based on 3D STUDIO )
2. The making of a 3D VRML model file. (Extracted from the 3D STUDIO model )
3. Optional: The making of panoramic presentation files.

## **Testing program**

Basically, this testing was a simulation of the normal activities of the teacher and the student profile within the AVOCAAD definition. The teacher prepared the course material by creating the exercises in a module. Students were supposed to follow the instruction of the exercises on-line, download the exercise material and upload the result files. For the first time, both teacher and students worked at distance with using a specific login name and password.

To ensure the normal program and the main objective of the course, these activities were totally organised in parallel. Students and teachers were provided with printouts and basic instruction sets to use in case of malfunctioning.

### **Test Results**

During the testing, the main technical problem seemed to be the stability and the capacity of the connection with the AVOCAAD Web Server. This hindered mainly the uploading of the result files by the students at the end of the course and caused some students to abandon the process.

The cause of this server's problem was mainly due to its actual 'temporal' (and too limited) configuration. Dispositions have been taken to adapt both stability and line-capacity in the near future to avoid this kind of problem.

On the other hand, the available functionality of both teacher and student profiles was generally functioning as it was supposed to. Small problems like the recognition of specific file formats and file size limitations were experienced and solved or modified. Teachers and students were satisfied as for time being.

As for the exercise material itself, the student's appreciation was divided, especially the moment they were invited to take a look at the rest of the exercise material. Mainly they were enthusiastic. But it was very clear that some of the exercises and topics needed more explanation. Some descriptions and goals were not so very explicit.

## **Interim Conclusions**

This kind of functional testing leads to fine tuning the actual AVOCAAD-working environment. It's inevitable to plan more similar experiments as to improve both the technical environment and the actual exercise material.

Another lesson to be taken of this experiment is the fact that in distance learning, things have to be more ( or in another way ) explicit than we are used to make them in our normal teaching. As we don't have any direct reaction from the 'reader', we don't know his or her perception. Even more, we cannot correct it as we use to do in our human-to-human communication. This is one of the main point's of attention for the future description's of exercise-material.

We have to state explicitly that an unstable and technical immature environment hinders the implementation of the AVOCAAD ideas and scares of potential users. Priority has to be given to the improvement of this environment.

## **Overall Conclusion**

The AVOCAAD Workshop during the second International Conference and the International Course at the Technical University Eindhoven served as an extremely useful test platform for AVOCAAD. Only during practical test sessions with students and architects, we get the valuable reflection to refine the educational material and technical implementation.

The further development of AVOCAAD will follow two different directions : the deepening into the concepts of AVOCAAD and the technical extension of the interactive website.

Conceptual work will happen on both the contents of the course material and the educational background. Now the technical infrastructure is ready for input, we urgently need to focus on curricula and modules with exercises and topics again.

Through the intensive testing of the website from different locations, of course some technical

incompleteness appeared that had to be fixed. Also a lot of functionality for individual architects and teachers using the system will be added.

The AVOCAAD has come in a stadium where a lot of testing has to be done. Therefore the group launches a call for beta-testers that can do dedicated testing of the course material and the AVOCAAD system.

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## Notes

The AVOCAAD web-site can be visited at:  
<http://www.avocaad.org>

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