AVOCAAD, TEACHING CAAD ON THE INTERNET

R.H.M. VAN ZUTPHEN, A. TURKSMA, H.H. ACHTEN, and J. AF KLERCKER*
Eindhoven University of Technology
Faculty of Architecture, Building, and Planning
P.O.Box 513, NL-5600 MB Eindhoven, The Netherlands
**Technical University Lund*
Faculty of Architecture
Box 118, SE-22100 Lund, Sweden

Abstract. The Leonardo da Vinci pilot project AVOCAAD (Added Value of Computer Aided Architectural Design), aims to innovate the use of computers in architecture. It tries to achieve this through the development of new course material, which will be used in the education of architectural students as well as for post-graduate education, continuous education and training-on-the-job of architects working in a practice. Besides the development of new course materials, a new framework was developed to give structure to the huge amount of different topics within the CAAD-curriculum and to improve dissemination and learning facilities using the Internet. In this paper, we describe the AVOCAAD project in general, give some examples of concrete course materials, and focus on the general framework, which we called the Vienna Scheme. The paper also focuses on the implementation, and use of the Vienna Scheme on the Internet is also discussed. The project is funded by the European Community under grant B/96/2/0539/PI/II.1.1.c/CONT.

1. Introduction

CAAD offers a lot of new possibilities and there is an increasing number of examples showing us how new technologies support and change the design process in a positive way. Nevertheless, we see an important part of the design offices is not using these new possibilities. Often, they are using CAAD only for producing plans and simple visualisations. Acting in this way, these offices do not gain any added value of CAAD. Although the new technologies offer a lot of new techniques and can have a positive impact on the design process, we see a lot of architects who get confronted with these new media, react in a negative way. In most cases this is due to lack of proper information and lack of time or efficient training material to get acquainted with new and innovative CAAD technologies. So, it is clear that new impulses are needed in order to develop the added value of CAAD to the design process and to make this positive impact clear to the architects.

CAAD is an aspect of Information and Communication Technology (ICT). ICT is not only a catalyst for new methods and techniques in design but also in education (Achten, 1996). In this era of continuous and distance learning, we

will see many changes in academic institutions in general as well as in the design studios that deal with CAAD and ICT implications. Some of the trends that are coming into focus include implications for a learning centered environment, rather than a focus on the traditional 'access to information, campus-based' one, meaning that information goes to the people rather than the other way around. Another trend is moving toward more consumers oriented courses and programs that are self paced, with different methods for different students. This will provide equitable access in a more active learning and not lecture-based environment, resulting in a need for different kinds of student assessments. Other changes may include such things as creating a master databank of courses so each institution does not have to re-create the same basic courses or a master databank of student learning as each person adds to a lifetime of skill development.

We like to see the Leonardo da Vinci pilot project AVOCAAD (Added Value of Computer Aided Architectural Design) as a new impulse to innovate the use of computers in architecture. For this purpose, new course materials and structures are developed and stored in a master databank of courses and exercises. The internet is used to make this material accessible.
Focus is on new unusual ways to use software in Architecture. The projects wants to benefit from the experiences in universities as well as in architectural design offices. The course materials developed will be used in the normal education of architects as well as for post-graduate education, continuous education and training-on-the-job of architects working in an office. As this last category graduated some years ago and there is now much more experience in the ‘upstream’ use of computers, especially for them, an incentive towards stimulating more creative use of computers is necessary (Verbeke, 1997).

2. CAAD-curriculum, a new approach

During the last one or two decades CAAD-systems have evolved from simple 2D drafting tools to complex 3D design tools. The latest CAAD-systems are based on product modeling concepts using the advantages of object oriented techniques. They offer a much better interface to various building performance calculation and evaluation tools in a more collaborative way. Also computer visualizations and presentations have been dramatically improved. Wireframes and flat shaded images are replaced by very realistic interactive Virtual Reality models giving both clients as well as architects a much better understanding of the consequences of design decisions. Computer-hardware and infrastructures have improved even faster than the software tools.

Because of all these new developments, teaching CAAD means that one has to address a constantly growing number of diverse topics. Unfortunately, this

makes it very hard for teachers and lecturers to keep up with their training material.

We believe that in order to assure that education is always up to date, a CAAD-curriculum should be an ongoing process of re-evaluation and improvement of goals, contents and means.

One of the initial steps of this project was the exploration by the AVOCAAD-team of several CAAD-courses given at their and other universities. During the analyses of the results, the team was confronted with the problem how to classify all these different courses and topics. The basic understanding of a curriculum is that it should be a set of more or less coherent courses. So the question is what criteria to use to classify the different modules in such a way that a coherent set can be defined.

During the evaluation two general observations could be made. The first observation was that a part of the courses were concentrating on technical computer issues. They address CAD-software fundamentals, multimedia techniques and computer hardware. In general these courses aim to achieve practical skills and technological insight, the 'Computer Aided' aspects of CAAD. The remaining other part focuses on architectural design. Here, issues like basic design concepts and design theories or methods are lectured, the 'Architectural Design' aspects of CAAD.

The second observation was that a group of courses is dealing with engineering issues and procedural and formal knowledge while on the other side a group of courses is addressing items like creativity, intuition and esthetics. This observation represents the well-known duality within architecture: the tension between art and science.

Both observations are translated to two perpendicular axes. The horizontal axis goes from Computer Aided topics (left) to Architectural Design topics (right). On the vertical axis we see at the bottom the engineering aspects and at the top aspects like creativity, intuition and esthetics. The resulting diagram (figure1) is called the Vienna Scheme because its birth was during the eCAADe conference in Vienna (Verbeke, 1998).

Both axes have a scale, which is used to position each CAAD-topic or -exercise. The 'smallest' educational unit within our CAAD-curriculum is either an *exercise* or a *topic*. These are represented on the Vienna Scheme as a colored dot. An exercise is used to get some practical experience about a certain CAAD-issue. All exercises are formulated following a predefined structure: description (giving some background and context information), goals, required skills, required software, exercise (the detailed exercise description) and results (the format in which the answer is requested).

For a better understanding, we give an example:

Exercise Space-Geometry

Description: This exercise enables to explore spatial and geometric relationships between elements, parts, volumes of the designed abstract composition. The aim is to achieve a form, which represents certain architectural space quality. The forms are composed with the set of primitives - cubes, spheres, ... They are juxtaposed, moved, rotated, scaled in order to achieve the acceptable or desired spatial, aesthetic expression. In a common sense it a game with simplest 3 dimensional geometrical forms.

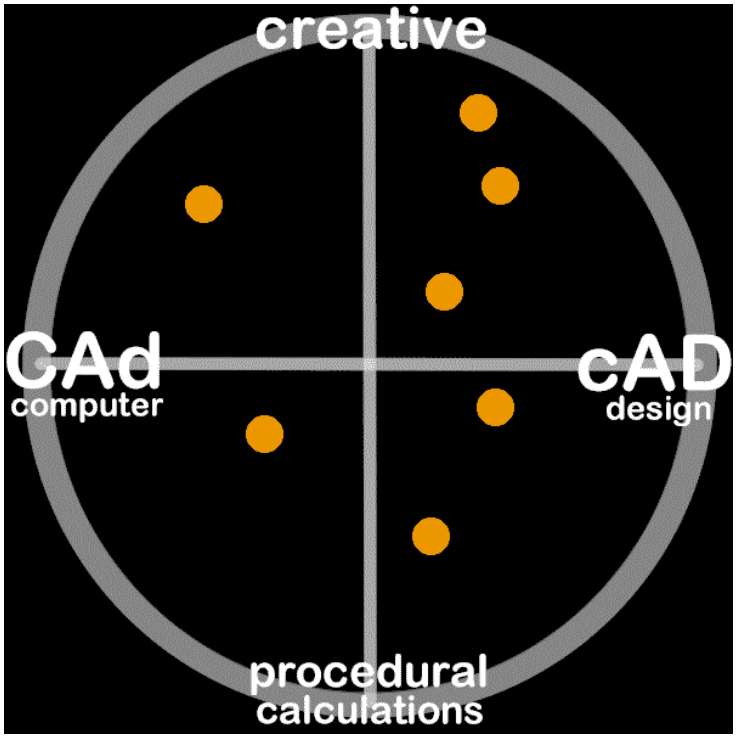

Figure 1. The Vienna Schema.

Goal: To create an environment, which enables possibly easiest formal and spatial exploration of 3-dimensional forms interrelations; to enable students get an easy and effective modelling possibility; to overcome the time and material limitations of typical models making; to explore the abstract computer modelling as a useful activity in the conceptual stage of architectural design.

Required skills: Creation and basic operations with 3 dimensional forms. Additionally, options enabling simple renderings, as lights definition, are useful. However, they can be learned as one of the steps following the basic modelling.

Required software: Autodesk 3D Studio release 4 - mainly its module 3D Editor.

However, every 3D modelling package can be used to proceed this exercise. It is recommended that the software enables as much intuitive as possible way of using its routines.

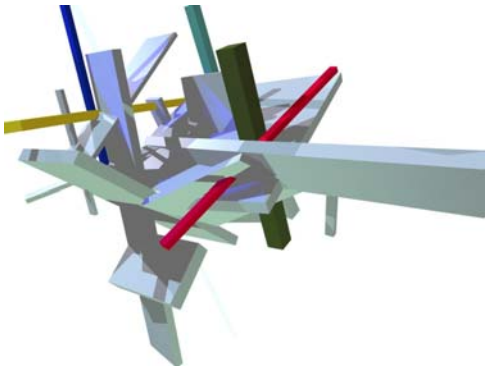

Figure 2. Space-Geometry

Result: The result of the exercise is a set of models made by each student as well as rendered images presenting them. When the students become more aware of the software possibilities, the more advanced modelling is possible, for example in exploring colour and texture relations. The most important result is the students' experience of form awareness achieved after making a number of different models in a relatively short time.

As a next step it is possible to prepare a more advanced exercises, where students are to do forms of required quality - dynamic, static, massive, monumental, etc.

A *topic* is a concentrated amount of structured information needed to fully understand a related exercise. All topics together form the so called *foreground information - database* as opposite to *background information* which is not stored in a database and per definition unstructured. Both exercises and topics have keywords which makes it easy to browse and search specific information. Hyperlinks or other references within the foreground information database are guaranteed to be valid.

A set of related topics and exercises is called a *module*. A module could be interpreted as a course. For example, a module 3D-Modelling could have topics and exercises about Boolean operations, 3D-entities, texture mapping, etc.

A sequence of modules constitutes a so-called curriculum. The AVOCAAD-system is design to support different types of users and different curricula.

3. Different users of AVOCAAD

As mentioned before, the AVOCAAD-system will be used in the normal education of architects as well as for post-graduate education, continuous education and training-on-the-job of architects working in an office.
Users should be able to interact with the database in a variety of ways, for which reason a number of user profiles have been defined (see Table):

TABLE 1. Users.

User	**Interaction with database**
Guest	General information, no interaction with course material
Student	Follows predefined curricula by teacher
Professional	Can select his own modules and exercise
Teacher	Selects and creates exercise, topic, modules and curricula
Editor	Local manager, selects for central server
System manager	Overall technical overview

For each user, the website offers different functionality's, in order to best accommodate their wishes.

A guest is any visitor on the web who wishes to be informed on the AVOCAAD site. This option features a run-through of the site.

The student follows curricula defined by a teacher. There is the option to keep track of the required sequence or to 'jump' exercises and work ahead. Students have to upload their results and can receive credits from their peers and teachers.

The professional is the architect in the office who wishes to do some exercises from the database. From his or her stated interest, it is possible to select appropriate exercises and topics, and to create user-specific modules.

The teacher has full access to the database and can create new exercises and topics, define or alter modules, and define or alter curricula. Also, submitted material of students has to be worked through, and the system should aid in the management of the courses.

The editor selects for the local server of the AVOCAAD server the exercises, topics, modules, and curricula. The central server holds all material, but local servers can choose to have a subset or a particularized set of materials.
The system manager has the technical responsibility for the system and needs to maintain the server.

It is important to note that any real user can access the database in different user profiles: a student can access as a professional, or a teacher can access the database as a student. Therefore, once a user has accessed the AVOCAAD site,

he is not bounded by only user profile. People who can alter or change the content of material (rather than uploading) have more freedom in changing user profiles than for example students. Should a professional or student want to change something in this matter, then he or she should contact a teacher.

The AVOCAAD site departs from the general idea that a website has a generic set-up for every visitor, and that the site is based mainly on the content. Here, the required actions of different users form the basis for shaping the site. The site can therefore be characterised by the term 'action-driven' rather than 'content-driven'.

Layout and structure of the site are determined by:

- Content of material
- Database structure of material
- Flowchart of actions

For each type of user, flowcharts have been made to track possible (inter)actions with the database. In each user profile some general interface features are always present (such as 'search', 'status information', and 'log out'). These have been given a consistent layout and always appear in the same manner in any place of the flowcharts. To keep matters clear, these items have been left out of the flowcharts. Since each user has quite specific characteristics it is possible to predetermine any possible path a user would want to take (see Figure 3).

In the current status of the work, the flow charts are transferred to the design of the web interface. From the flowcharts it is possible to determine require functionality of the website, and to see what new programming has to be done. After implementation and initial tests, it will follow if any adaptations need to be made.

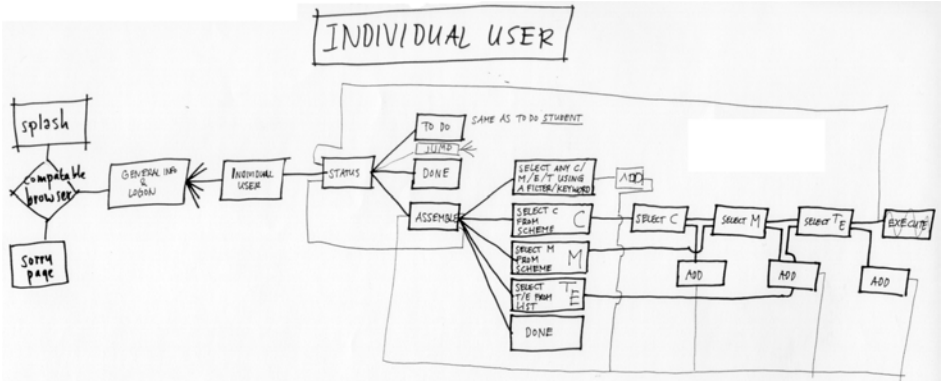

Figure 3. Flowchart of processes and interactions

4. The AVOCAAD implementation

The realization of the AVOCAAD-system is done using Internet technology.

The exercises, AVOCAAD topics and external links are visualized as colored dots on different layers on the AVOCAAD Scheme. The dot's position on the scheme represents the kind of information it contains. When moving over a specific dot, the title of the exercise, topic or link appears. Clicking it displays the underlying information.

The AVOCAAD Scheme is currently the main entrance to the topics and exercises, but in the future, the material will be available through different interfaces, which will be presented in a next paper.

When you choose to make an exercise and you hit its dot on the scheme, you will arrive at the main exercise page. This contains the description (explaining the general context), the goal, the required skills, the required software (always the kind of software, rather than a specific package), the explanation of the exercise itself and what kind of result you should reach at the end. This main page has also some links that may be useful for anyone who makes the exercise: to related topics (AVOCAAD topics as well as external hyperlinks), to exercises that have the same interest or that are somehow related and to the results of other people that made the same exercise. In addition, four indicator bars give an impression on the time load, the required computer skills, the required design skills and the difficulty level of the exercise.

After finishing the exercise, the result has to be submitted to the web-site, as well as some explanation on the basic idea of your result and the path followed to come to it, where it will be included in 'other peoples results'.

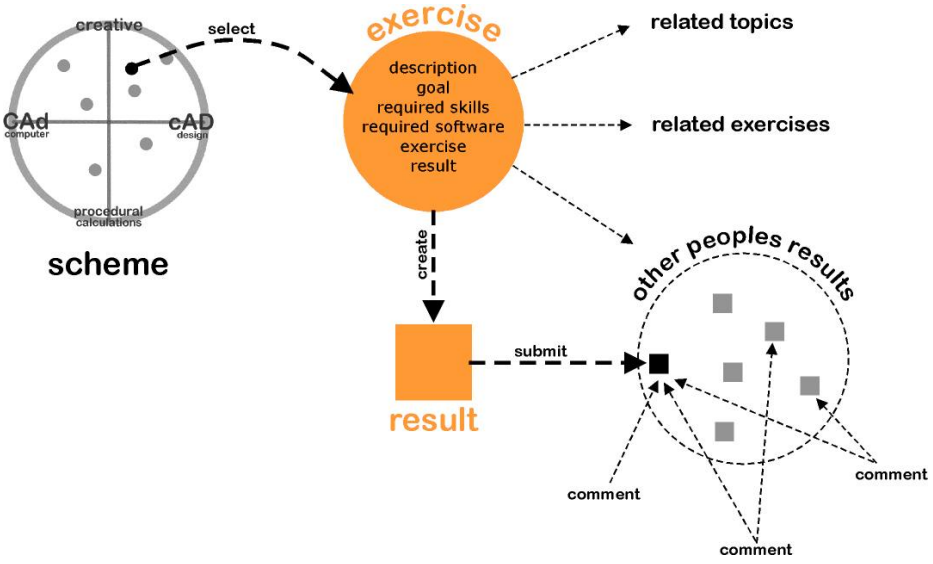

Figure 4. The web-structure of an exercise.

Now other 'users' who have finished the same exercise can provide comments on your result and you can discuss other's results. This provides a lot of reflection on the exercise you made and the path you followed through the exercise.

In this way, the AVOCAAD web-site will become a discussion forum to exchange experiences and ideas in the field of the creative use of computers in Architecture, useful both for architectural students and architects in practice.

5. Discussion

In this era of continuous and distance learning, we will see many changes in academic institutions in general as well as in the design studios that deal with CAAD and ICT studies. These changes are often related to the effort to make courses more independent in space and time, to improve and innovate the communication between students and teachers and to stimulate the interactive group learning process by displaying students' work and starting discussions on the web (Leeuwen, 1998).

The AVOCAAD project is incorporating these new methods and techniques. But it goes one step further, namely by using the web to support the collaboration of developing new CAAD training material. The general understanding is that most academic institutions face the same problems. Exchanging of training material and discussions about a new CAAD curriculum will be profitable for every partner. The project benefits from the experiences in universities as well as in architectural design offices. The course materials developed will be used in the normal education of architects as well as for post-graduate education, continuous education and training-on-the-job of architects working in an office.

Although the introduction of distance learning facilities will not replace the need for lectures, demonstrations, and tutorials, they will absolutely improve education and will be of great help for practitioners to keep up their knowledge about innovations in CAAD (continuous learning).

In the next coming months the AVOCAAD system will be tested during workshops on the AVOCAAD-conference in April and on the eCAADe conference in Liverpool later this year.

Acknowledgements

This paper is not only the result of he above mentioned authors but based on the effort of the whole AVOCAAD project team. The other members are J. Verbeke, T. Provoost, J. Verleye and Koenraad Nys from the Institute for Architecture Sint-Lucas - Brussel, G. Pittioni from Ingenieurbüro Pittioni - München, A. Asanowicz and A. Jakimowic from the Technical University Bialystok, Faculty of Architecture - Bialystok.
AVOCAAD is a Leonardo da Vinci pilot project of the European Commission. Grant B/96/2/0539/PI/II.1.1.c/CONT.
The AVOCAAD website can be visited at: http://www.avocaad.org/

References

Achten, H.H.: 1996, Teaching Advanced Architectural Issues through Principles of CAAD, *in*: Ekholm, A. and Fridqvist, S. and af Klercker, J. (eds*.), Education for Practice. Proceedings of the 14th European Conference on Education in Computer Aided Architectural Design*, Lund, Sweden.

Verbeke, J. and Verleye, J. and Nys, K. and Provoost, T.: 1997 (ed.), *AVOCAAD*, Proceedings of the 1st AVOCAAD Conference, Brussels, Belgium.

Leeuwen, J.v.,Dubbelman, T., Achten, H.H.: 1998, ICT as a means of education, *in* Proceedings of the 16th European Conference on Education in Computer Aided Architectural Design, Paris, France.

Verbeke, J., Provoost, T.:1998 AVOCAAD, the scheme, *in* Proceedings of the 16th European Conference on Education in Computer Aided Architectural Design, Paris, France.