TEACHING CAAD AT PLYMOUTH POLYTECHNIC

Dr David S. Willey

& Mr Peter Bedford,

Senior Lecturers at:

Plymouth Polytechnic

School of Architecture

Hoe Centre

Notte Street

Plymouth PL1 2AR

Devon, England.

TEACHING CAAD AT PLYMOUTH POLYTECHNIC

Introduction

This paper will describe the policy and objectives for teaching CAAD in the Plymouth School of Architecture and outline the relationship between taught lecture courses in CAAD and the use of CADD in studio projects. It will also indicate the nature of the problems raised by this approach with respect to timetabling, assessment, staff and machine resources, training and program documentation.

Policy

In establishing a CAAD teaching programme in a school of Architecture it is necessary to clearly differentiate between using computers and learning about computers. When concerned with using computers the emphasis must be on hands-on experience in workshops and the design studio and the student gains insight and understanding as a by-product of this activity. The emphasis when attempting to learn about computers must be on the theoretical concepts which underlie computing and any computer use is seen as an illustration of those theoretical ideas. In the long term we will adopt the former approach although in the short term our teaching corresponds most closely to the latter model. We are not intent on producing computer experts but expert users. That is architects who understand the concepts involved in CAAD and who know how to make CAAD systems help them to enhance their own work. We also recognise that despite the increasing use of computers in architectural practice not all students

regard CAAD as a subject compelling their attention. Our intention therefore is to provide a hierarchy of opportunity.

CAAD Course

The CAAD course contains three elements. There are formal lecture courses, workshops for hands-on experience and studio projects. The pattern of the lecture courses is that students receive a ten lecture familiarization in their first year which outlines the principal concepts, methods and equipment employed in CAAD. In their second year all students are taught to solve problems through the medium of computer programming. This emphasis was chosen because of the insight which is provided into designing in general and into the organisation and presentation of the CAAD software which the students may use. Although students will employ BASIC as their programming language they will also be introduced to PASCAL, FORTRAN, and PROLOG. These are the only formal taught elements in the course. In the 1984/85 academic year, as part of our honours course, third year students will carry out a special study in which they may elect to pursue CAAD. This will entail either a written study, the development of a program or the evaluation of an existing software package.

CAAD workshops provide a situation of immediacy in which the student group must survive during a first contact with equipment. Whilst little of what is learned in such a challenging situation way be retained over a long period the first hurdles of unfamiliarity and hesitation are overcome. Workshops proceed at a fast pace allowing students to acquire a broad overview and do not allow them time to bring to bear their fear of the unfamiliar. There are workshops for all first year students in which they are introduced to a program or piece of equipment and spend time exploring it. This currently

averages out to about three one hour workshops each term for each student. In their second year students also receive workshop experience with the same programs but here the tasks involved are set to more closely match studio design needs. Thus in first year a student may digitize, site, and view a simple box with a monopitch roof. In second year the task may be a complex form of several blocks creating many complicated junctions at many levels. Second year students also spend at least one hour each week developing their programming skill.

Studio project work has during 1982/83 been focussed on siting and visualisation studies. In first year two sites were modelled for perspective viewing. One of these sites was a tutor's concoction and only existed in the computerised form. In second year an urban site for a small library was modelled. In third year a moorland reservoir site was described. In all these cases students were able, if they wished, to digitise their own proposals and view them on the landscape. Final year students were also able to describe their buildings and sites and about thirty per cent of those students did so. Thus CAAD techniques have been brought to bear on a traditional and major weakness in student's design project work, namely the lack of contextual sense. The site, most often 'left out' of student's design work is immediately available at the start of each design project. Preliminary design ideas be placed onto the site, views to and from the design examined and alternative schemes reviewed. The ability to encourage the student to explore his ideas through the capacity to accept change is one of CAAD's primary supports to the design process. Some modest use of the GOAL appraisal program was

also made by third and fifth year students. GOAL and other related programs being a more thoughtful and considered approach to a student's design strategy. However we still have to live with the inevitable retrospective, last minute, response situation when perspectives are required to illustrate a finalised design.

The use of CAAD in studio projects will become more integrated in the 1983/84 year because we are able now to clearly describe the benefits and limitations of our CAAD software and negotiate a sensible role within each design studio programme. CAAD options will be included in both the second and third year design courses. We envisage that specific issues such as energy usage or visual impact in a landscape will be directly addressed but by only a small group of students at any one time. Other students may be examining materials or semiotics using methods appropriate to those concerns. This allows a student to plan out a year's work and to include as much CAAD work within it as the student wants. It may be several projects or none at all.

Issues

Any attempt to teach CAAD in a School of Architecture requires at least four conditions to be satisfied before it becomes reasonably possible. First there must he an adequate provision of hardware which can support both graphics and design appraisal. The hardware must be available in sufficient quantity over a sufficient time period that student access to the hardware is not a major determinant of the teaching method and pattern. At Plymouth we have only three terminals available to our PRIME mainframe and one of these terminals does not

yet support graphics. This means we cannot seriously expect the involvement in CAAD of a complete year of students at any one time either in workshops or in studio design projects. Hardware provision will remain a serious limitation to our work for the foreseeable future. For example an investment of one hundred thousand pounds could produce a further sixteen graphic work stations but would still, with our existing three stations, only provide one workstation for every ten students. Our teaching is therefore bound by problems of access to hardware.

The second issue concerns the provision of suitable bug-free software. Students (not unlike practitioners) need to be able to see a clear advantage in using the computer. We believe that the GOAL, LAND and PERSPEC programs provide an effective introductory base on which to build our teaching programme. In the longer term we anticipate that more accurate (and probably more complex) programs will be necessary when some of our students become sophisticated users. This could be the 1985/86 academic year, or sooner if our teaching programme is especially effective.

The GOAL program, devised and written at ABACUS, has been implemented on Plymouth Polytechnic's PRIME mainframe. It allows a range of appraisals of environmental and cost performance to be carried out based on a simple description of the building's geometry plus files of data which provide the cost and environment context for the building. Individual students have generally found that the effort involved in creating the context files has been prohibitive for individual

projects. We have also been surprised at the slow rate with which we have appreciated the scope, complexity and accuracy of the program.

The PERSPEC program produces wire frame perspective drawings from previously created data files. It also allows a student to create an object by assembling groups of primitive shapes (box, pyramid, plane). The data files can be created by using the digitizing table. The programs were written by the Polytechnic's Computer Centre and have been developed and maintained by them during 1982/83. Also, as part of our research effort into visual impact we have developed hidden line perspective programs for landscape information, under the generic prefix LAND. Data files from this suite are interchangeable with PERSPEC files.

The third condition necessary for CAAD teaching is the provision of staff time to CAAD. We believe that the problems of program development and documentation, of timetabling and of effective integration into studio project work make it essential that the teaching load is spread over a number of staff. At Plymouth we have one member of the staff responsible full-time for teaching and program documentation; a studio teacher responsible for directing research; a part-time lecturer (six hours a week) who engages in program development and over the terminal support; and a research assistant (six hours a week) who provides knowledge of the PRIME system (for those of us who press the button less often than we intend) and over the terminal support. This means we can retain a diversity of interest within our group and also provide a supportive, but critical, environment for developing the course.

The fourth condition which needs to be fulfilled is the general support of all, (or at least a large majority of) the School's staff. This is essential, not only to allow CAAD to take place in studio project work, but also in releasing the resources to create the conditions outlined above. At Plymouth we enjoy both the natural scepticism of the creative for the mechanical and a genuine warmth of support which if not unique in Schools of Architecture is certainly exceptional, and very welcome.

Problems

We believe that three of the four pre-conditions for successful CAAD teaching are not acting against us at Plymouth. Our attention has become focussed on some of the more detailed problems which beset CAAD teaching. Some of these problems are simply related to the introduction of a new discipline into the (already overcrowded) syllabus. Other problems are features of the discipline itself. We can identify four problems which are critical and to some extent interrelated. These are timetabling, training, program user-guides and assessment. Timetabling is a problem because of the twin constraints of terminal and staff availability. In any teaching week an hour, or even two, can be acceptably released for CAAD but in an hour only a small group of students (which in our case is nine or ten), can use the three workstations. Each workstation has a different configuration and, in general, a different purpose so each workstation group is normally engaged on a separate activity. This generally means using two members of staff to maintain effective support and results in a large number of staff hours being devoted to only a small number of students. The Polytechnic bureaucracy regards teaching as

inefficient and even we have noticed that we seem to have no time to get anything else done. The net result is that we are putting in a large effort in terms of contact hours with students but each individual receives tuition only once every three weeks. In essence we believe each student should be working with a computer program for at least one hour each week. Too much time is consumed at the moment in remembering how to deal with the paraphernalia of computing (pressing RETURN or using BACKSPACE to correct mistakes) and we lose the essential purpose of the training which is to give each student sufficient confidence to independently employ CAAD techniques in studio work.

We believe a key to supporting student initiative is to improve the quality of the user guides which we provide for our programs. We are constantly looking to improve and develop our user guides and this has become a major and necessary preoccupation of the group. The user guides are designed to provoke an enthusiastic response from visual thinkers; in other words, the presentation of the information and supporting comment is specifically designed to function within the framework of a community of architects. The guides lead the student from one procedure to the next, but always relate each particular procedure within the context of the whole task. The aim of the user guides is to raise the level of debate between student and staff, where the rudimentary processes are essentially handled by the student alone. This allows design tutoring to take place at the computer terminal in exactly the same way as design tutoring which takes place over the drawing board. We naturally believe that the CAAD

situation provides particularly rich grounds for tutorial discussion. In 1983/84 the hands-on experience will be based on the most recent versions of our user guides. The students will be given the user guides and left to follow them. Staff will act as crisis managers only when the user guide cannot cope. Our intention is to promote the student's confidence that the user guide will support the student in any circumstance. Hopefully this focus will release staff for more effective roles, such as developing studio project based CAAD.

Assessment remains as the fourth problem. In first year students compile a workbook which records their skirmishes with CAAD. It is assessed as part of their studio project work along with their sketch books and design journals. Its assessment weight is small. In second year the programming course has its own assessment to rank alongside studio project work, structures, services, etc. We opted for assessment to be based on two termly submissions and to avoid any necessity for an examination. The assessment, like the course, has to deal with the wide range of skills present in a year group. Our assessment of programs will be based upon the spirit rather than the letter. Whilst successful running is the hallmark of a competent program we shall be careful to reward good intention. Our methodology is to set a pass mark to our termly assessments which will allow students who have no previous experience to base their response closely on their tutorial experience. More experienced students can set themselves more advanced problems and be assessed in the light of those intentions. The problems posed will generally contain a request for a simple program and a requirement to provide clear documentation for it.

Summary

We see the course as providing a hierarchy of opportunity for each student. In their first and second years students receive taught courses intended to provide a general background, and together with their workshop experience they should develop a reasonable sense of CAAD's potential. In their second and more so in their third year they can opt, if they wish, to follow studio design projects with a definite CAAD content. Or, more casually, they may on the spur of the moment decide to use CAAD techniques to, say, develop their visualisation of their design. The special study in the third Year will allow a student to pursue a CAAD topic in some depth. In the fourth and fifth year students can use the dissertation to develop an expertise in an aspect of CAAD whilst in studio project work they can, if they wish, develop CAAD work in the landscape design unit.

We anticipate that some students will ignore CAAD despite our efforts. Other students will seize the technology and leave us floundering in their wake. Our intention is to create the opportunity and to encourage the event.