THE MEDIUM IS THE MESSAGE

The Results of the Early Immersion of Architectural Students into Computer Modeling

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Abstract. The biggest challenge to students of architecture is the development of the visualization skills necessary to facilitate design conceptualization. Our faculty has instituted programs that immerse students in computer modeling at the beginning of their study. The results from these programs raise questions regarding the position and influence of the computer medium in the process of design.

1. Introduction

A conventional approach to the computer medium in architecture is to equip students with basic representational skills before exposing them to sophisticated software. The traditional skills of drawing and model making remain the mainstay of early tuition in architecture. While these are important they require the students to be reasonably skilled before they can represent their ideas. The relationship between the medium of representation and design is such that unless a student can 'see' their design conception they cannot develop or improve the design. They cannot interact with the first notions of the design to transform it into the realm of the feasible. So if they cannot draw, they cannot see and cannot design. The presumption that first year architectural students have not yet to learn to draw carries with it presumption that the design potential will be held back until they can 'see'.

The interrelationship between the process of design and visualizing the concepts is implied in models of design methods. The models generally share a component of iteration to test solutions and to provide a visual feedback for the design process (Rowe: 1987, Lawson: 1980). Implicit in the acceptance of the importance of the iterative nature of design is the crucial role played by the visualization of these iterative stages. The methods of visualization have been drawing and model making. These traditional methods require the accumulation

of skills from simple to sophisticated techniques. This teaching model is reflected in texts on architectural communications (Cooper: 1990). The same model of skill accumulation has been followed in the teaching of CAD and computer graphics. This follows the intuitive wisdom that skills build upon each other and the preceding stage of skill development must be mastered prior to advancing.

The limitation of this linear model is that the development of design skills of the new student will be hampered by inadequate graphic skills. It was for this reason that we developed a program that would explore the introduction of sophisticated computer modeling to first year students. The pedagogical premise behind this approach is that architectural students are exposed to the potential of computer based modeling programs as an aid to the development of the skills of architectural composition.

2. Digital Design Studios

Within our faculty programs have been instituted to locate the digital medium as a mainstream tool of architectural design in the beginning of a student's education. The key is to create an environment that promotes the use of computer three-dimensional modeling as a part of the conceptual stages of the design process and not to see the use of computers as distinct from creative activity. Digital modeling was not to be perceived only as a tool of higher level research or sophisticated expertise.

Mainstreaming the computer into the conceptual stages of design was implemented through exercises that immersed students into modeling software in concert with the learning of formal composition. The building blocks of computer visualization are established in parallel with learning the grammar of design.

2.1. SPECIFIC OBJECTIVES

The specific aims of this program for first year students within the faculty are:
- To demonstrate the usage of the digital medium as a flexible tool at all stages of the design process. The intent is to change the perception that digital media is a tool of presentation and analysis, but rather it can be effectively used in the early conceptual stages of design.
- To foster a familiarity with three dimensional computer techniques early in a student's education and to reduce the impression that these imaging techniques are separate from other techniques of communication and the domain of later year students. This level of familiarity should ultimately place the digital medium on an equal footing within the grab bag of representation techniques.

- To encourage a critical attitude for students to assess the influence that representational media in general, and digital media in particular, has on design outcomes. The effect of the medium on design products had been understood in the matter of drawing and perspectival space (Perez-Gomez: 1997). The effects of digital object modeling are being perceived in emerging architectural expression (Davidson et al: 1997).

3. Pilot Programs

Over the past three years studio design programs were established that looked directly at the efficacy of students using computer modeling in the early phases of the design process. These pilot programs were for later year students and were aimed at testing the format of integration of computers into design. The lessons gleaned from these programs ultimately shaped the format for the first year student program.

The computer environment of the recent past was one in which CAD software was taught at an increasingly complex level as the students progressed. In the later years students could elect to extend their learning through the use of more sophisticated computer rendering, animation and modeling. While this process created specialists in the area and worked effectively at the top end of the computer imaging research, it limited the potential of the computer medium until later years. It was felt that students should be exposed to computer modeling as soon as they enter the course. Two preliminary programs were undertaken in later years to develop the strategies and content for digital integration in the first year. These were the 'Temporary Museum' and 'Delirious Melbourne/Toronto'.

### 3.1. 'TEMPORARY MUSEUM': THIRD AND FOURTH LEVEL DESIGN STUDIO

This design studio project was established for students from the third and fourth level of the five-year course. Students undertook a project in which half engaged in the design process using only wooden models and the other half using digital modeling. Students undertaking the computer component were selected because they had only limited CAD experience and no experience in three-dimensional software. The aims were to test the take-up rate for students unfamiliar with the software and to see how productive they could be become, and to compare iterative design results between the timber and computer sections of the studio. This would illustrate the effects each medium would have on the design product. The project was to design a small museum for Melbourne.

The interesting observations were as follow:
- Students were able to self-learn sophisticated software with a minimum of tuition to a level where it enabled them to be as productive (or more

productive) than fellow students. They worked and perceived their schemes in three dimensions from the beginning of the design process.

- The students in their design outcomes exploited the potential and limitations of the modeling medium. This was expressed in the interest generated by some students in aspects that would not have been a factor in traditional drawing and model media. These were a concentration on the articulation of interior space, the use of artificial and natural lighting effects and a tendency to greater formal complexity. The software allowed for easy expression and exploration of these effects that led to them being a major design feature. This paralleled with the other half of the studio whose designs were slanted towards the qualities of the timber materials which they were compelled to use for representation of the design process. This studio illuminated the issue that the medium of representation is not benign but can be an active ingredient in design outcomes.
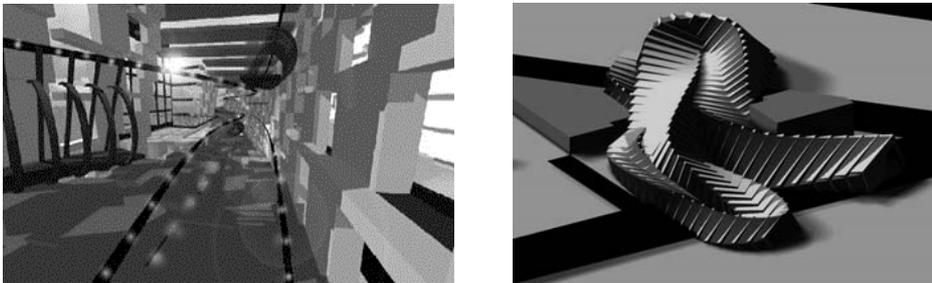
Figure 1. Examples of students work illustrating an interest in interior effects and formal complexity .

Following the quick responses by the test group of students to exploit the potential of the software, it was felt that lower year students could cope with a similar digital learning curve and be productive after a short period. It was proposed that a series of exercises be developed for first year students that would lead them into the area of abstract design composition using modeling software. This project would dovetail into the general pedagogical aim of early students developing skills in conceptualizing in three dimensions. The computer solid modeling ability is ideally suited for students to quickly explore composition as has been demonstrated in other instances. (Krawczyk, 1997). To help develop and test the material for the design program a project was established with fifth (final) year students in which they engaged with the software to produce digital design speculations. These speculations were based on conventional compositional techniques.

3.2. 'DELIRIOUS MELBOURNE / TORONTO': FIFTH YEAR LEVEL

This project was for multi level housing in the twin locations of Melbourne and Toronto. It was a digital studio relying on modeling software for the design concepts and presentations. It incorporated a research component that required compositional and analytical exercises to be undertaken using digital modeling. In this case FormZ software was used as the representational medium.

Students completed two design speculations on general techniques of architectural composition. The broad technique categories were subtraction, addition and supple. Within these students tackled speculations exploring operations that were not specific to any medium. These could be considered generic design techniques and were similar to the approaches offered in writings on architectural design processes and analyses (Ching, 1996; Baker, 1996; Clark, 1985; Lynn, 1993). These general speculations included basic subtraction, slicing, puncturing, additive stacking and intersecting, and supple folding and stretching. The second speculations were compositions based on operations that were closely related to modeling software. These were based on emerging operations becoming common to generic software such as texture mapping, Boolean operations, meshing/nurbs etc (Mitchell, 1995).

Figure 2. Example of a subtractive operation of piercing and a housing project using the compositional lessons of additive stacking and intersecting

Students with no previous experience quickly acquired the skills to use the software without specific tuition. This was a function of the necessity to understand the software to engage in the digital design speculations. The speculations based on the modeling operations also provided an insight into the directions the software could encourage design outcomes.

Consequently a program was developed for use by first year students that fed from the compositional material explored by the final year. The final year studio was a prototype for digital design composition that was offered to first year students.

4. First Year Program: Techniques of Architectural Composition

This program was created to be primarily self taught by the students. The content was an introduction to design composition techniques using three-dimensional modeling software. The format of the program was that students received a CD containing a tutorial for the software, in this case FormZ, and a step by step guide to the exercises. The exercises were accompanied by dialogue boxes that explained the steps and allowed the student to skip forward or backwards within the particular exercise or to previous exercises. The interface also allowed the student to return to the menu index and to toggle between the software running underneath so that the exercises could be followed as the students proceeded with their models. The students are required to replicate the exercises then to take the compositional bases of the exercises and to create a speculation that extends the design concept. This process would be kick started by a short introduction to the software interface after which students are expected to follow the processes.

Generally the students had no experience with CAD software and only limited experience with computer graphics. They are expected to learn sufficient skills to submit relatively complex computer models within four weeks. An expectation of competency is raised for each student to complete the program and the skills are to be developed through following the exercises, peer assistance and general experimentation.

The program specifically required the student to follow and complete eight composition exercises form the categories of subtractive additive and supple operations. These match the categories tested on the fifth year students. The categories contain numerous variations on these design themes. Following the exercises gave the students an introduction to the software interface and typical commands. Students are also required to take three of the various compositional operations and to provide speculations, which incorporates the characteristics of the operations. These are to be exploratory and push the understanding of the computer facility to accommodate the ideas of the student.

The basis of this format is similar to that tried in the fifth year studio with presumptions made as to the relative capacity of the first year students to cope with the program. The trial group was a small group of students with intensive tutorial attention. The first year format was for one hundred and fifty students with minimal tutorial introduction The aim was to produce similar results to the later year program but over a shorter period of time. To achieve this the project was specifically constructed so the first year students could follow and easily navigate through the tutorial and exercise explanations as provided on the CD.
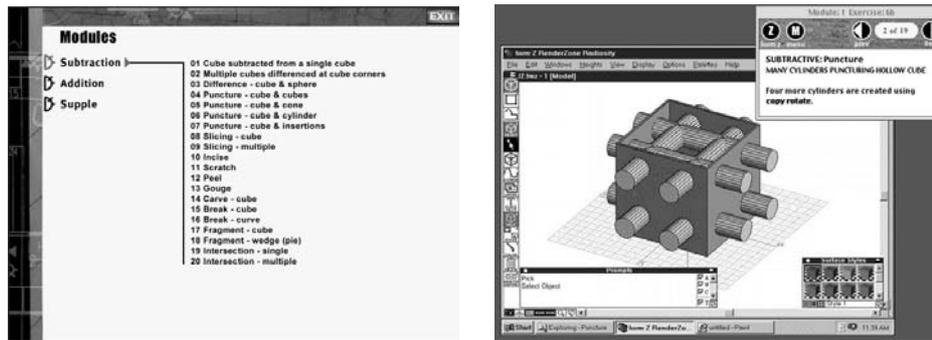
Figure 3. Interface showing index for exercises and the exercise interface with
dialogue box.

The project is described to the students in terms of the design issues behind
the exercises and the speculations and not as a training vehicle for the software.
This will provide a focus for the skill in the software that will take the students
as far as they need to be effective. The program is offered within a subject that
also deals with a suite of architectural communication techniques. These include
hand drawn perspective constructions and life drawing.

5. Early Results

The program for first year students was implemented in 1999. Responses
indicated that students were able to cope with the software and complete the
exercises. The students demonstrated a keen interest in the software and
obtaining their own versions. This would augment the good access they have to
parts of the computer resources within the faculty and encourage further entry
of the digital medium into the design studio.

The lessons from the implementation of the modeling project have indicated
that:

- Students will develop the digital skills as required to engage effectively in
  the design process.
- Students will mix software, 3D, graphics, rendering, etc to suit and will
  incorporate other media as required, through scanning etc. A cocktail of
  techniques is used because mastering a particular digital technique is not the
  aim but rather achieving a desired design outcome is the goal.
- Students will appreciate both the limitations and potential of the digital
  medium and will demonstrate an understanding of the effects the medium
  has on the design direction.
- Testing of conceptual design ideas can be accelerated.
- Studio environs allow for cross learning between students regarding the
  techniques and software expertise.

The early results confirm that we can become more ambitious in further developments and that computer modeling will be a mainstream component of the design studio culture from the beginning of a student's architectural learning. We were encouraged by the quality of speculations produced by students who until recently had not been exposed to computer modeling. Below are some examples.
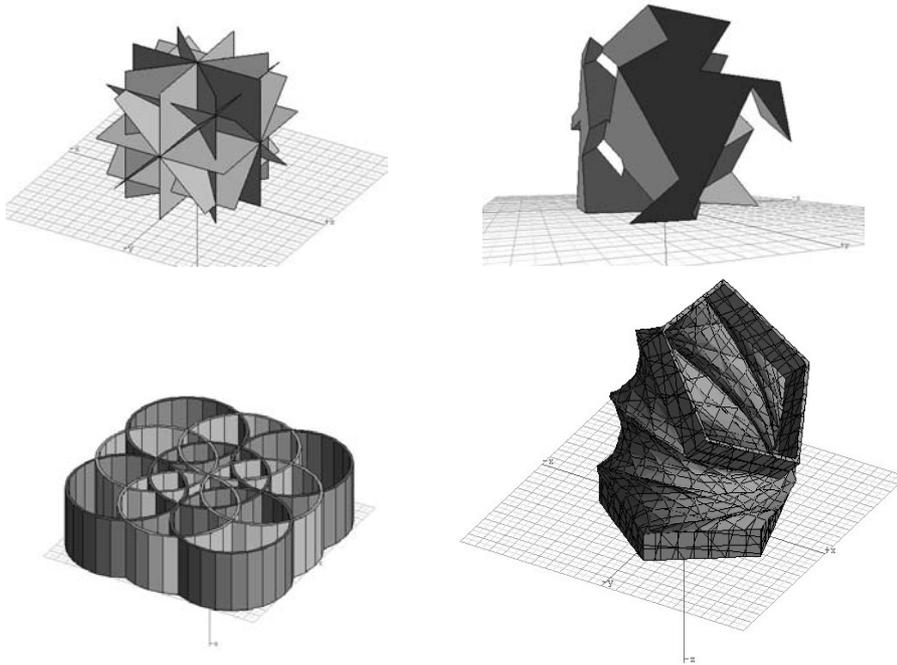
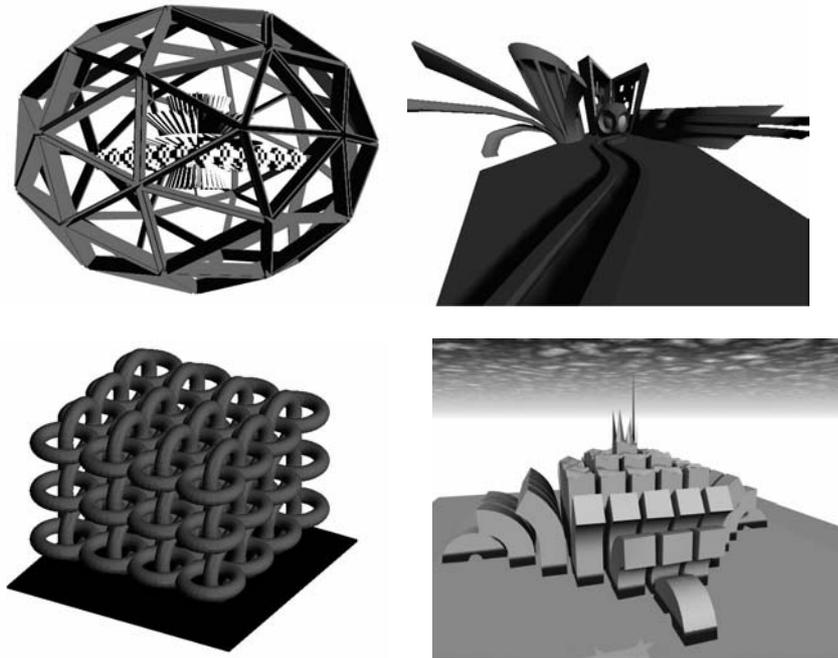*Figure 4*. Examples of compositional exercises for addition, subtraction and supple operations.

Figure 5. Examples of speculation exercises for addition, subtraction and supple operations.

6. Conclusion

The immersion program resulted in first year students having the means to explore three dimensional composition at a time of their learning when traditional methods of drawing would not have been adequate. The outcomes of the program demonstrated a degree of experimentation through design speculations that demonstrated understanding of both the issues of composition and the potential of the digital medium. This will form the basis for further learning in design and techniques of representation. The traditional skills of drawing will not be supplanted by the computer but rather they will develop in parallel with a better understanding of the three dimensional environment within which architecture occurs.

Another important issue was exposed by this program which will form the basis for further investigation. The first year students were able to assess the level of influence the modeling software had on their speculative designs. This recognition of the effects of the media was unearthed at the beginning of the students architectural education. This allows time for reflection research into the limitations and potential of the computer medium.

Acknowledgments

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