A PEDAGOGICAL MODEL FOR AN INTRODUCTORY CAAD COURSE

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Abstract. This paper presents a pedagogical model developed for an introductory CAAD course in the first year of architecture studies. The model is based on a set of exercises that emphasize the use of electronic media for the collection of information, its distribution, presentation, transformation, interpretation, and abstraction. The primary goal was to enable students to creatively apply digital media in their design work by simultaneously introducing them to a wide range of applications, and by enabling them to engage in abstract exploration of shapes, forms, and images.

1. Introduction

Computer technologies are extensively used in teaching and in the student-centred learning in the Department of Architecture at the University of Hong Kong. Students learn the basic principles of computing and computer-aided design in two required introductory courses (Computer Aided Architectural Design I and II) in the first two years of undergraduate study. These courses provide both a theoretical introduction and an opportunity to develop skills through intensive practical work, with the primary goal of nurturing and developing student's ability to use computer technology to express ideas, analyze data, explore and present design concepts, and to communicate and gather information electronically. Students who complete these courses have a basic knowledge of and sufficient practical skills in using various computer-based tools and techniques that are then immediately applied in design studios and other courses.

In the first required course, CAAD I, computer applications for drawing, drafting, image processing, 3D modeling and visualization, page layout and Internet publishing were traditionally introduced through lectures covering theoretical concepts and practical skill building exercises. In the second course, CAAD II, techniques for modeling, visualizing, documenting and presenting designs were studied in depth along with underlying principles. This year, as part of the University wide curriculum reform, both courses will

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be renamed to Visual Communication II and III, with the aim of linking them to current courses in Visual Studies, which will become Visual Communication I and IV. In Visual Communication I, students will be introduced to the fundamentals of visual inquiry through exercises in two- and three-dimensional composition, projections and basic graphic techniques using "traditional" design media. Visual Communication II (formerly CAAD I) will be an introduction to digital design media and its use for visual communication in architecture. Visual Communication III will be a further study in using digital media for architectural design and design communication, with a critical examination of the relationship between traditional and digital media in design. Visual Communication IV, likewise, will be a further study of the material introduced in the first course with some examination of the impact of the digital media. It is expected that further integration of what were formally separate areas of study will take place over the next few years.

This curricular change presented us with an opportunity to experiment with the course content. We tried to investigate the possibility of introducing concepts of transformation, interpretation, and abstraction to first year students through a series of carefully structured inter-related exercises. Our attempt is described in the rest of the paper, and the lessons learned are presented in the conclusion.

2. The Exercises

The course was based on a set of exercises that emphasize the use of electronic media for the collection of information, its distribution, presentation, transformation, interpretation, and abstraction. One of its main goals was to enable students to engage in abstract exploration of shapes, forms, and images.

At the beginning of the course, each student was asked to select an object of personal interest, and search the World Wide Web for related information, such as text and images. The range of objects that students chose was very wide (figure 1): comic and cartoon characters (Mickey Mouse, Calvin), sport stars, cars, music instruments, airplanes, popular music bands, etc. To our great surprise, none of the students selected anything related to architecture. The second exercise focused on the presentation of the gathered information. Students used word processing software to create a one-page layout with a short description of the selected object using the information collected in the first step.

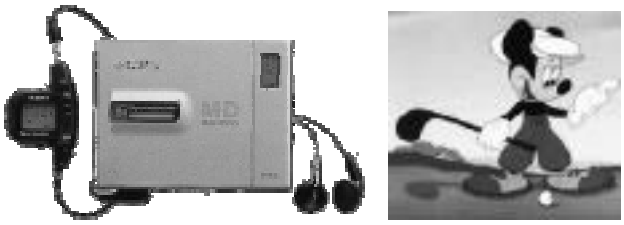

Figure 1. Images of the objects selected by students.

While the first two exercises focused on the collection of relevant information, and its presentation using electronic media, the exercises that followed focused on the transformation of the found information and extraction of new information through interpretation. Each student took one of the images found on the Web, and transformed it using filtering transformations in image processing software (figure 2). The exercise wasn't purely mechanical; the students had to apply various image transformations in order to extract the important features of the selected object. The transformations were used as a vehicle for interpretations.

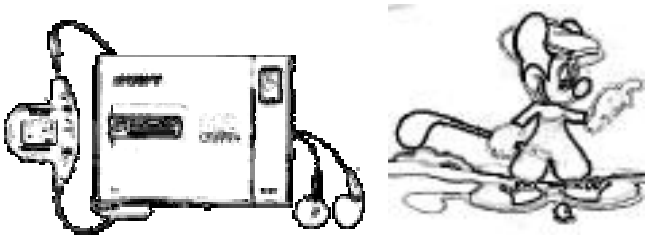

Figure 2. Transformed images of objects.

The transformed image was then used in drawing software as an underlay image for tracing the outlines of emergent shapes or objects (figure 3). The information extracted in this step was very similar to what was being extracted in the previous exercise, but its character, i.e., its encoding was very different this time. The shape outlines in the images were raster based, while the shape outlines in drawings were vector based; the implication was that the encoding of information often determines what can be done with it.

Figure 3. Shapes traced from the transformed image.

In the next exercise, students had to recompose the shapes and create different compositions using translation, rotation, scaling, reflection, and duplication transformations (figure 4). Again, new information was being created through transformation. We intentionally emphasized composition over content by encouraging students to experiment without seeking a special meaning in what they were doing.

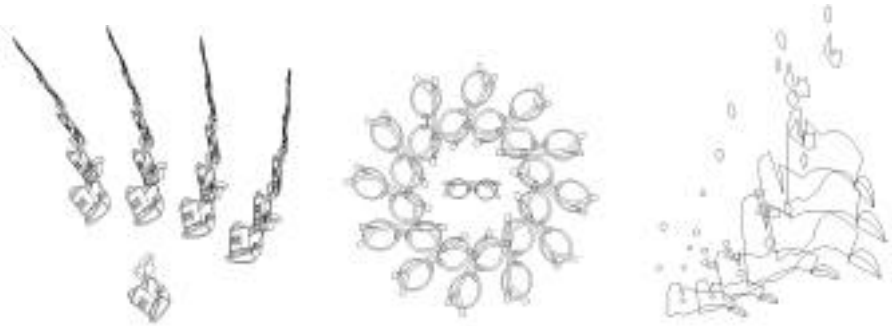

Figure 4. Recomposing the shapes.

The next set of exercises was more abstract. Each student was asked to select one of the previously created 2D compositions and used it as a base drawing to create two different 3D models, one by extruding (figure 5) and the other one by revolving the existing 2D shapes (figure 6). Using the same 2D data set, two very different 3D compositions were created, with very different forms and spatial characteristics. Students were asked to further explore thus created 3D compositions by applying the translation, rotation, scaling, reflection, and duplication transformations, in the same manner applied to 2D shapes in one of the previous exercises.

Figure 5. Creating a 3D object by extruding 2D shapes.

Figure 6. Creating a 3D object by revolving 2D shapes.

In the next exercise, students combined two 3D models into a single one, and were asked to create an abstract 3D object—a "spatial entity"—by selectively applying the Boolean operations of union, subtraction, and intersection to revolved and extruded forms (figure 7).

Figure 7. Creating a 'spatial entity' by applying Boolean operations to selected 3D objects.

In the next set of exercises, students moved from abstract to concrete. They had to "ground" the created 3D forms, and label the created "spatial entity" as an object with certain material properties; the created forms had to

become something, another identifiable object, a building, an urban complex, a bridge. etc. (but not a sculpture). Students used rendering software to assign various material definitions to surfaces and solids in the model, and had to create photo-realistic renderings (figure 8). In the next exercise, they had to place the created object within some context, by creating a composite image of the rendered object and a scanned, background image (figure 9).

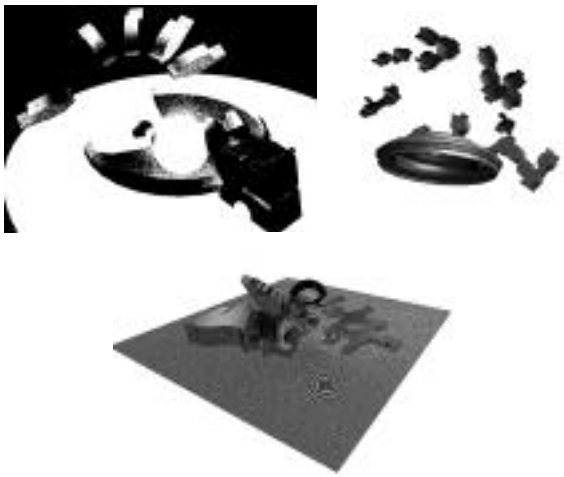

Figure 8. The 'spatial entity' is identified as an object with certain material properties.

Figure 9. The composite image of the object within some context.

Next, they used the spreadsheet software to compute some properties of the produced object (volumes, cost, surface area, etc.). In the final two exercises students used desktop and web publishing programs to present the process and the results of the semester's work.

3. Conclusions

Our intention was to suggest to students that digital media could be applied creatively in design through a fairly abstract exploration of shapes, forms, and images. Through a careful combination of playful interpretation and scripted transformation, we wanted to demonstrate to students the creative potential of the digital media. We carefully avoided describing the process as 'design'. We asked students to label the resulting "spatial entity" as "something" at the very end of process; we didn't want them to search for or to give a form to a specific object from the beginning. As it happened, an image of the sunglasses was transformed into a 'breaking plate', the minidisc player turned into a space station, etc (figures 1 and 9).

Students struggled to make sense of what they were doing, and we didn't tell them much why they were doing it. We hoped that they would discover in the process their own ways of "misusing" of "abusing" the digital media. We failed, however, to engage most of them in this abstract play. In light of that experience, this year we adopted a different approach. We decided to retain the early exercises, but to have students design a small pavilion within which images, drawings, and models of the selected object, both original and transformed, will be exhibited. This way, students felt that they were given a "design" task, and suddenly, all of the exercises had an obvious purpose.

Our other intention was to introduce them to a wider range of irregular shapes and forms. In other words we wanted to demonstrate to them that the design worlds do not need to be populated by rectangular shapes and prismatic forms, placed in rigid geometric compositions. We wanted to show to them that volumes could be not only added to each other, but also intersected and subtracted from each other, something that was not immediately obvious to most of them.

We hoped that they learned how to "play" with the media in a loose, indeterminate way, to seek the possible and unknown, instead of accepting the obvious. We showed them the value of transformation, two-dimensional and tri-dimensional, and how interesting shapes and forms can be generated in a simple methodical manner. We hoped that the course would enable them to engage with some confidence and skill in abstract exploration of shapes, forms, and images using digital media. Finally, we hoped that the course demonstrated the potential of digital media for creative exploration through transformation, interpretation, and abstraction.

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