

USING THE COMPUTER AS A TEACHING AID FOR
ARCHITECTURE STUDENTS - SOME EXAMPLES

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1. INTRODUCTION

The use of computers has become part of the regular curriculum in many schools of Architecture in the last few years. In addition to specific courses related to basic computer knowledge (e.g.: programming), the computer's main application is in the design studio, for evaluating alternatives (e.g.: GOAL, GABLE), or as a drafting aid (e.g.: BIBLE, AUTOCAD, ARC+).

We believe that using the computer as a regular part of the teaching in all the courses, is of great importance. In this paper we present three examples in which the computer was used as a teaching aid in courses not related to the design studio. "Morphology" and "Introduction to interior Design".

The intention was to develop a tool to be used by the students in order to exercise and understand the material and terminology they had studied, and enable them to reach highly complex forms. without spending too many hours at the drawing board. At the same time, the students using the computer (mostly second year students), are to get used to treat the computer as part of their regular drafting equipment. In fact, it turned out that most of the students who experienced these exercises, chose in their advanced years, to study some of the non-compulsory courses in CAAD, offered by the faculty.

We took into consideration that most of our students come with no previous experience with computers (a situation which will probably change in the next few years, when today's teenagers will become our students). This implied that the computer programs had to be designed for the "ignorant user", by being completely interactive and very friendly (1,2). Part of the data is picked from a "menu" and part is put in numerically. The student has the possibility to see the graphical results of each decision he makes and change the input, when the results are not according to his expectations.

The exercises were developed on a microcomputer, attached to a simple dot-printers. The fact that the equipment is cheap and available in relatively large numbers, enable many students to use the computer during all the hours, without supervision.

2. EXERCISES IN MORPHOLOGY

In our faculty, the study of Geometrical Morphology, is an important part of the curriculum (3, 4, 5). These courses are intended to enlarge and deepen the students' understanding of geometrical manipulations in the two and three dimensional space.

A compulsory course, Morphology 1 (initiated by Prof. A. Wachman, is given to students of the second year, during one semester (14 weeks). There are two lecture hours and two exercise hours weekly. In the calss exercises the students practice the theoretical material taught in the lectures. Moreover, thee get home exercises in which they have to use the knowledge acquired, and their imagination, for the creation of patterns or models.

Two home exercises were chosen to be developed on the computer:

Exercise no. 1: The Strip Ornaments.

The first exercise was based on the topic of Strip Ornaments. By using a set of symmetry operations (translation, rotation, reflection or glide), one can create seven Strip Ornaments. Fart of the strips, may be reached by more than one set of symmetry operations.

For the manual home exercise on this topic, the student has to create an ornamented tile, and duplicate it by using any sat of symmetry operations. to generate the seven Strips.

Instead of this exercise, the students were requested to use the computer program, for doing two things: First, they had to generate the seven Strips; secondly they had to choose two strips and demonstrate how each of these can be reached in at least two different ways (two different sets of symmetry operations resulting in the same final strip).

When using the computer program, the following data has to be the input: The "Basic Element" (a shape made of straight lines, out of which the whole ornament will be made); The size M the translation vector; The "Basic Pattern" (the sequence of symmetry operations by which

the strip will be generated). The whole strip is then automatically generated, by the repetition of the "Basic Pattern".

Figure 1 shows some examples of the students results, demonstrating the graphical complexity which may be reached. Each of these strips is based on a different "Basic Element".

Exercise no. 2: The Wall Patterns.

The second exercise was based on the topic of the Wall-Pattern groups. Here, in addition to the different symmetry operations which may be applied to the "Basic Element", one has to choose also the Basic Lattice, defined by two vectors, and the angle between them. There are five different Basic Lattices. The combinations of the Basic Lattices, and the symmetry operations, yield 17 different Wall-Patterns.

In this case, the computer exercise, was different from the manual one, since the problem of the excessive work needed to draw the Wall-Patterns by hand, was overcome. The students using the computer program, were asked to generate seven different Wall-Patterns.

The data to be put in, is the following:

The "Basic Element"; The "Basic Pattern", which in this case includes, in addition to the sequence of symmetry operations, also the rotation angle, the angle between the reflection axes and the direction of the glide axis; and the Basic Lattice (the size of vectors A and B. and the angle between them). The whole Wall-Pattern is then drawn automatically, by the repetition of the "Basic Pattern", according to the chosen Basic Lattice.

Figure 2 shows some results of students exercises. Again, one may note the graphical complexity which was achieved by use of the computer.

3. EXERCISE IN INTERIOR DESIGN

"Optical illusions" is one of the subjects dealt with in the introductory course of interior design (initiated by Prof. A. Kashtan).

The purpose of the exercise we developed was to expose the students to the possible ways of creating optical illusions in interior spaces, by adding black and white patterns to the surfaces (walls, floor or ceiling).

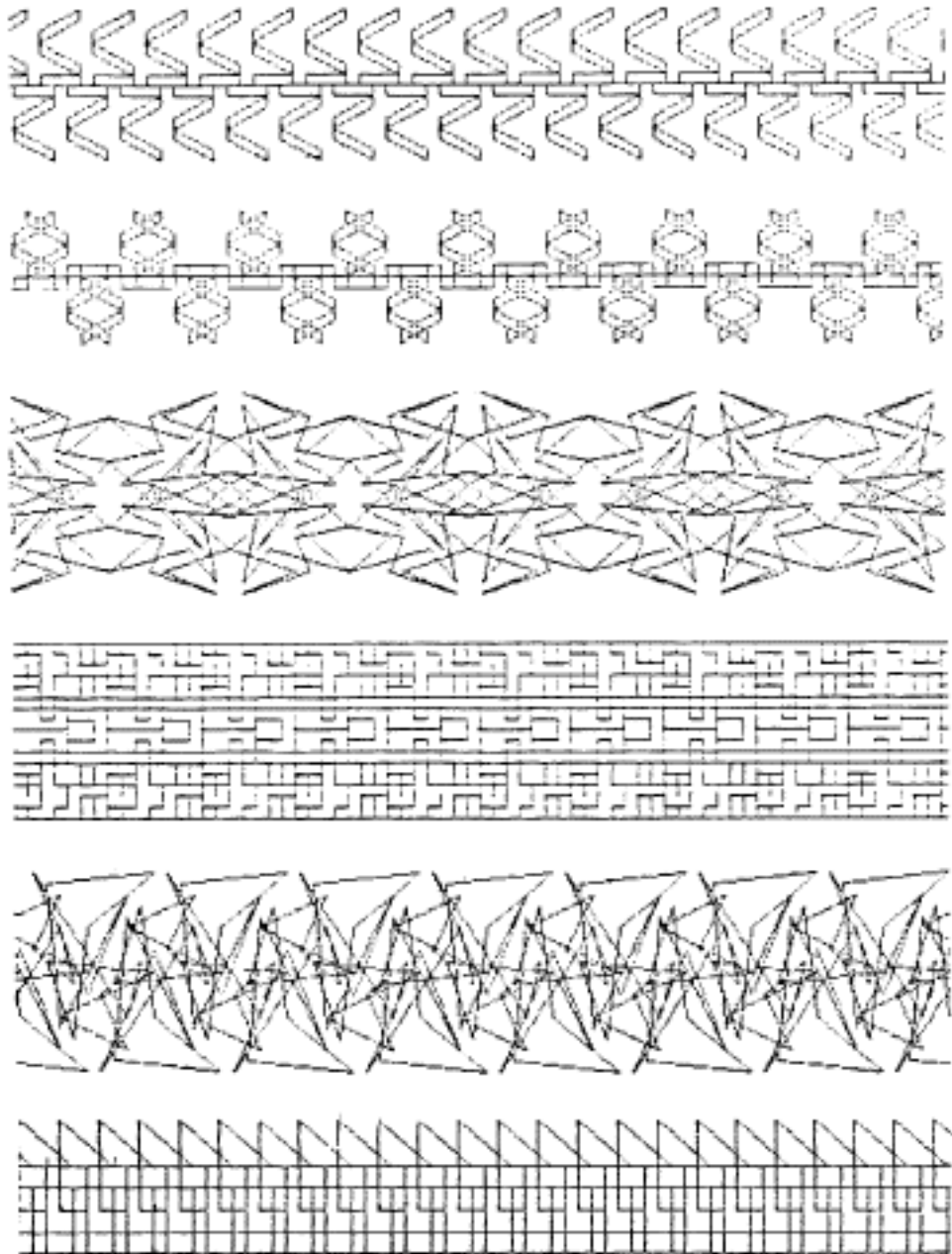


Figure 1: Strip Ornaments exercise: examples of students results

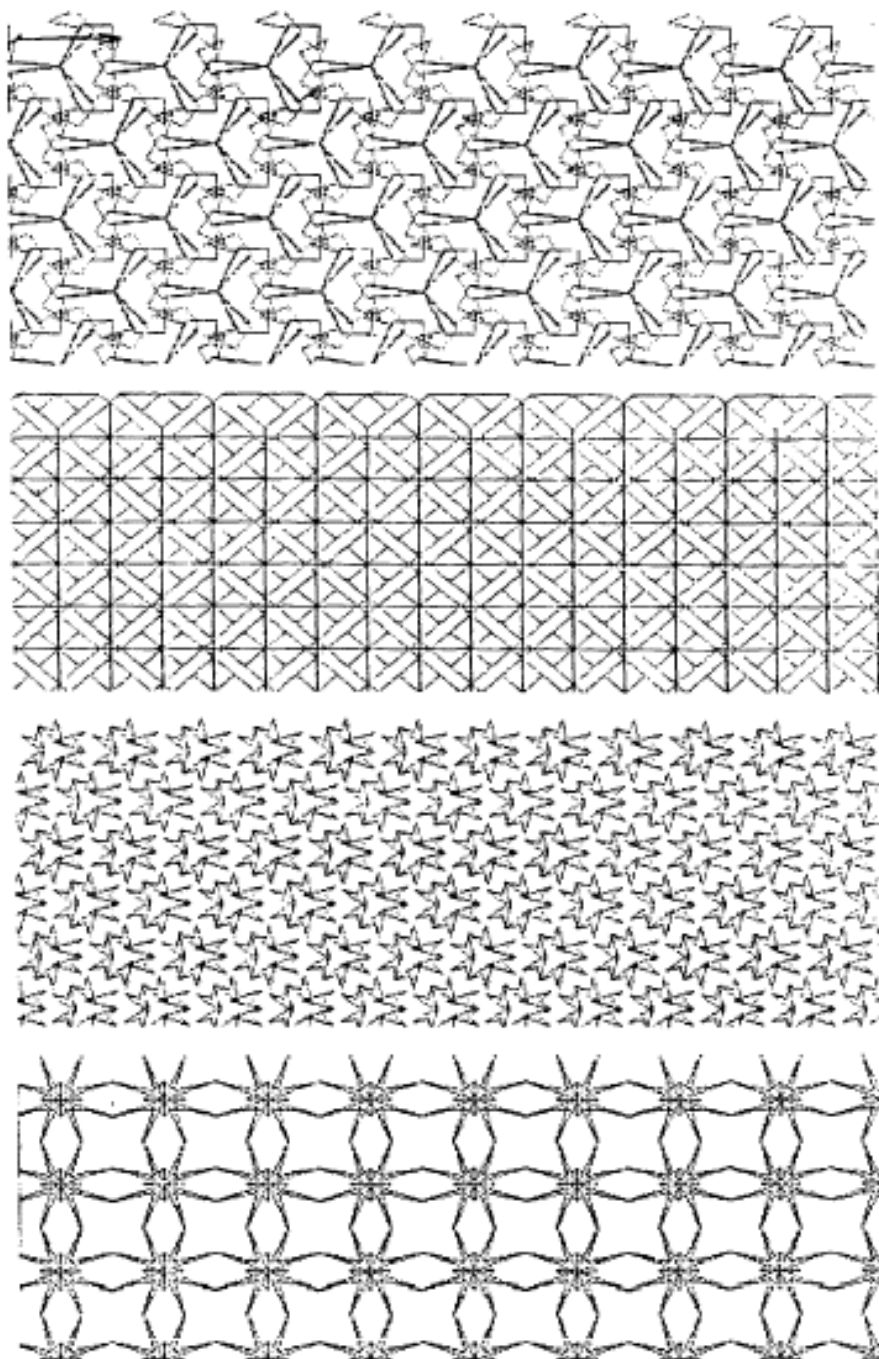
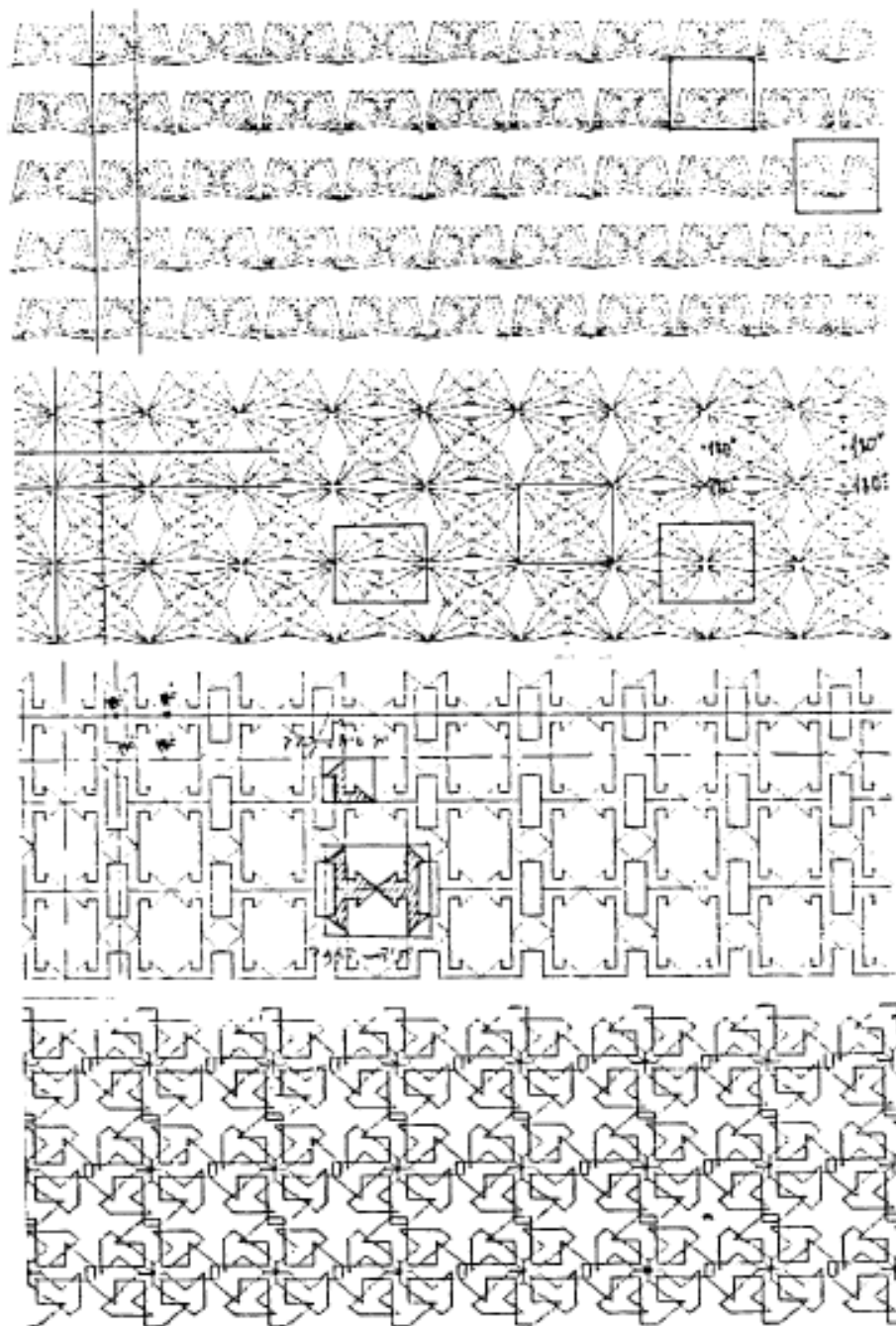


Figure 2: Wall Patterns exercise: examples of students results

(Figure 2: Cont.)



First, the student has to determine the parameters for the perspective-drawing. After reaching a satisfactory drawing, begins the procedure of adding patterns to the surfaces. The student chooses one pattern, out of a menu of 10 possible ones, and the surface he wants to add it to. He then may see the result of his choice, drawn on top of the initial perspective. After each step, the student may change his decisions, and a new drawing is presented to him.

The students had to check the influence of the different patterns on the followings: perception of the rooms dimensions (height, depth, width etc.): perception of geometrical shapes (as rounding of corners); How different patterns make spaces having different dimensions, look similar.

The fact that the students could check: the influence of their decisions without having to spend many hours to produce the drawings, encouraged them to try more and more possibilities, and in our opinion deepen their understanding of the possibilities they have, as architects, to influence the quality of the space. Some examples of students results, are presented in Fig. 3.

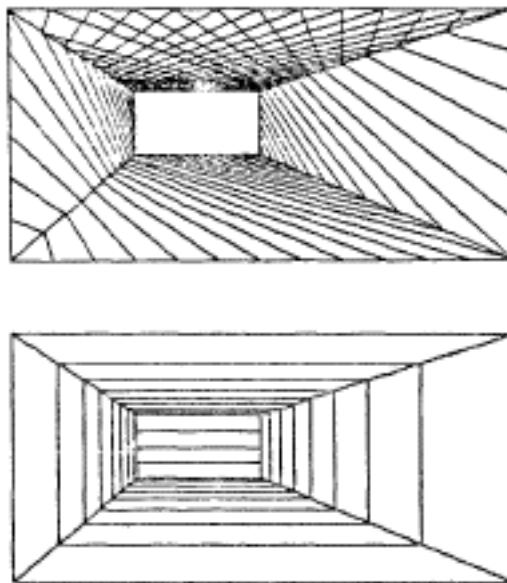


Figure 3: Interior design exercise: examples of students results.

4. SUMMARY AND CONCLUSIONS

After the exercises were first introduced, we checked the students' reactions to them. It turned out that none of them complained about having difficulties using the computer, though for most of them it was a new experience. They stated that the topics exercised, were made clear through the computer use, and easier to understand. Also, it turned out that they preferred the computer exercises to the manual ones. They all stated that they enjoyed working with the computer, and expressed their wish or more such exercises to be developed in the future.

Their enthusiasm and the results they reached, are the best indication of the importance of these exercises. The fact that most of their time was dedicated to thinking and learning the material, rather than exhaustive drafting work, is to us as teachers, the most important thing. It proves, that there is no need in heavy and complicated programs, which demand long training periods, to arouse the interest of the students in the potential and possible uses of computers.

We found that the development of such teaching software, encourages the collaboration between teachers of the various disciplines. We have been involved in teaching Morphology for many years, and the exercises were developed in collaboration with Prof. A. Wachman who is the senior teacher of the subject. The interior design exercise, was developed in collaboration with the teacher of the subject, who could define her needs, although she has no knowledge in the use computers. We are now working on similar exercises for the Basic Design course, again in collaboration with the teacher of the subject, who has no training in computers.

The main drawback of our approach lies in the fact that this software, may only serve the specific subjects for which it was developed, and is not widely applicable. However, as it does not require a long time and big teams to develop such programs, we feel that the efforts are worth while and profitable at the end.

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