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Utilization of digital-algorithmic design tools in architectural basic design education

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Abstract

Basic design education is the first step of architectural design education. Basic design principles based on Gestalt psychology and Bauhaus school are the body of rules which are necessary to establish the compositional organization. Students are not able to define the principles establishing the geometrical correlation. At this stage, teachers are expected to guide their students. For that purpose, user-participated “artificial intelligence” software is written solving the previously defined problems. Algorithms to produce two or three dimensional compositions with 3D Max Script are developed. As a result, during the basic design education, algorithmic rules set is regarded as beneficial materials for CAD softwares set in according to basic design principles, producing a new design, creating alternatives and visualization.

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1. Introduction

Architectural design education is a skill getting process related to how students understand, perceive and reproduce the environment by using their own elements. The basic design education in architecture is defined as “a thinking system whose visual dimension is heavy within the continuity of the education of design, embedded in the basics of the education of design to bring impetus to education.” (Denel 1981). The systematic and objectives of basic design education, based on Bauhaus School, is explained as follows: “Ensuring an manipulation to make students free from their biases, preparing an infrastructure for area selection with means-tools in an effective manner and giving the theoretical information with regards to the area for an objective perception” (Johannes Itten, 1967:9). Students are supposed to perceive the design problem that is given, establishing their design language for solution, forming their formal compositions by transforming with creativity and skills. Students try to constitute a meaningful design whole by gathering together the two and three dimensional basic geometrical forms in parallel with basic design principles such as repetition, rhythm, dominance, proportion, contrast, unity, coram, symmetry, asymmetry, figure-ground relationship and balance. However, students generally have difficulty in constituting the composition as they may use these principles singularly or not use them in a synchronized manner. In this face, students need to be oriented with one by one interactive communication by the teacher. However, this communication is not

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generally established because of the limited lesson hours, high number of students. Therefore, the student oriented approach granting the possibility of one by one interaction with students was required. It was targeted to develop a user-involved and designer-oriented computer based design tool which would generate different design alternatives by gathering together the basic geometrical elements whose type, dimension and number of items were defined previously within the scope of defined design principles. Algorithm for producing composition with 3d Max Script for both two and three dimensional were developed for that reason. This algorithmic software was tested with a case study.

2. Case study

The functionality of the computer based design tool which would generate different design alternatives by gathering together the basic geometrical forms within the scope of defined design principles was tested with the case study. The case study was conducted with first year students in basic design studio class for four weeks. The study was applied in two phases:

First, the students were asked to constitute a composition after selecting 5x5, 3x3 cubes, cylinders, prisms or spheres as the basic component and use in accordance with the “repetition”, “rhythm” and “unity” principles with traditional methods (Architectural two or three dimensional drawing, model).



Figure 1. Students works made by traditional methods

It was observed that students tried to associate either one basic geometrical component in line with one principle or more than one component in line with one principle in their works made traditionally. Components dimensions were chosen randomly, proportional relations were ignored. Relationship between geometrical components defining composition were not established, the meaningful design whole was not composed as because of the relationship between parts was not defined.

In the second phase of the study, students differentiated the same application and produced with the algorithm defined in the computer media. 5x5, 3x3 cubes, cylinders whose radius was 5, height was 20 cm and a sphere as geometrical components were given to students and asked to constitute a composition with these. With this Max Script, both benefit to computational calculation and storage skill, and could have been made arrangements by the user. At this stage, information regarding the use of design components and use of software was given. The developed software defines the relationship between cubes (the repetition interval, direction and number), makes the automatic array, sphere and cylinder could be added by the student as measurement and location to the composition. With each change, different alternatives can be generated and manipulated. Therefore, students were free to produce compositions. As a conclusion asked to present their alternatives to the teacher.

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