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Proposing A Generative Model Developed By Ecologic Approaches In Architectural Design Education

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Abstract

In recent years, due to global warming and rapid consumption of natural resources and inevitable effect of construction sector in producing all this transformation, ecologic data has been one of the most important factors in formation of architectural design. However, especially in architectural design process dominated by intuitive thinking, students often ignore this data. Therefore, being inspired by sustainable/ecologic approaches, this study aimed to develop a model for the use of generative architecture understanding that can benefit from natural energy sources at maximum level, in architectural design education. We envisaged using generative approaches that remodel the design process and support the designer in this process, rather than the results. In this context, a case study was carried out. The case study aimed to produce formative alternatives and new designs by the generative system. The presence of algorithmic approach the students develop considering ecologic data in design process was tested; theoretical information about ecology-effective design was expected to be applied on concrete architectural projects.

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1. Introduction

Since Architectural design education is a period in which students are given forms of understanding and perceiving the surrounding they are in and abilities to reproduce and organize it with their own elements. Every data that define the design process effect the architectural shaping. In the recent years, due to both global warming and

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exhaustion of natural resources and the inevitable effect of construction industry in this transformation, ecological data are among the most important factors that effect architectural design. However, in architectural design period in which especially common sense is dominant, students disregard this data.

Ecological buildings are buildings that are constructed with natural and economical materials non-harmful to environment, consisting of resources that can sustain its presence, having high energy preservation and using energy of its own production [1]. Ecological design concept involves five basic principles: a healthy artificial environment, sufficient and generative energy systems, environment-sensitive form, nature friendly construction materials and recycling activities [2]. Ecological design is an approach that takes protection of natural energy resources and passive utilization in buildings as well as interaction with nature and constructing buildings that are harmonious with the natural surroundings in to consideration [3]. In the recent studies it is determined that architecture transformed from a static structure that exploits nature and its surrounding into a system that takes its inspiration from nature and changes according to the environmental conditions [4]. One of these creative methods in which the design is shaped via forming a similarity with the nature itself is generative method.

Millions of years old design experience of the natural environment that we destroy fast today has been an inspiration to many architects. And the generative approach is a system that develops new rules via examining the development of and the changes in the natural environment and that produces new stylistic alternatives from them. "Nature's power of adaptation, its selection and variation abilities" [5] were taken as examples in the development of generative approaches, and these were defined as parameters in the shaping, improvement and transformation of new stylistic pursuits beginning from an abstract geometrical form generally [6]. Generative systems must have 3 basic qualities - associationism (visualization, analogy, abstraction), adaptation (implementation, automation) and improvability (similar production) - and their sub-qualities [7].

Thus, in this study, whether designing housing spaces -the natural environment of its users- is possible or not using ecological and generative approaches that are developed after the example of natural environment in architecture. In this respect, it was aimed to develop a model in which a generative architectural understanding that will benefit from natural energy resources in maximum taking sustainable/ecological approaches as inspiration is intended for architectural design education.

2. Case study and findings

While shaping their designs in architectural education, students have to form a connection to the environment they are in. Using the physical environment (nature) as an inspiration by human beings begins with the design history. Inspiration via formal analogies headed for the discovery of the process after perceiving the perfection in ecosystems. Both ecological and generative approaches are design perceptions that were developed in this sense. These models have been guiding students not only during the practice but also the education process. In this respect, a case study with 10 post graduate students of Gazi University was conducted which aims producing formed alternatives and new designs by taking ecological approaches -in which producing its own energy and reusing of natural resources are possible- as inspirations. The case study was realized in three stages.

At the first stage, the students were informed about general design decisions, organizational decisions and the systems used (Fig. 1). During the ecological design process, it is the basic parameter in the shaping of mass; other systems used together with supports sustainable approaches. For this reason, students have to think the organization of the mass at first whilst shaping their designs.



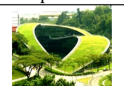
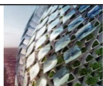



general design decisions			ecological systems that used			
mass organisation			Façade organisation	sun	wind	water
Horizontal discharge	Vertical discharge	grand transportation	façade design	PV	wind tunnel wind turbine	green garden
 floor gardens	 atrium	 green roof				

Fig. 1. Ecological design parameters

At the second stage, first information on how to develop the generative approach was provided. According to this, generative design system has to inspire the user in inference, carry ideas to new contexts, produce and express alternatives of similar contexts [8]. A generative system should allow studies that are conducted by users with different contexts and experiences, and should be able to adapt itself. A generative design system inherently has the ability to produce different alternatives because it is an evocative and an adapting system. This ability to produce is determined via accumulation of knowledge and preservation of experience [9] (Fig. 2).

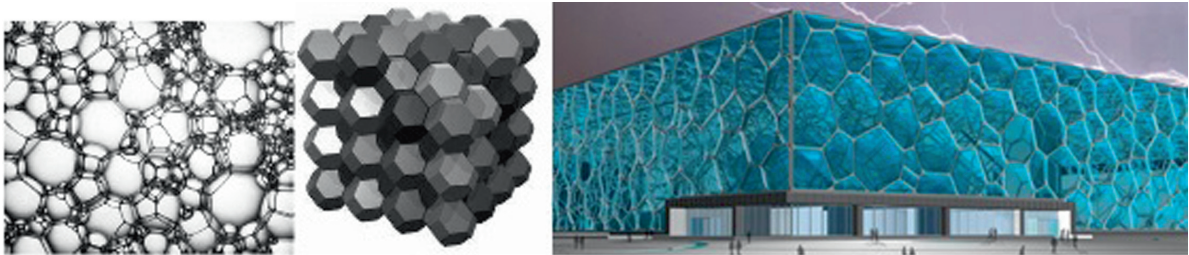


Fig. 2. Developing the basic unit with generative approach

After transferring these two information, the students were asked to choose the unit in which they were going to organize the mass. The students choose the cube because it allows for formal operation in general. At this second stage, they were expected to organize the mass on the basis of full-empty relationship in order to shape the total form of the house. To be able to do this, they determined alignment rules of the cubes which they had chosen as the basic unit. In determining these rules, besides the full-empty relationship, they were also asked to take the wearing of the ground, the position and of the building and the climate it is in into consideration, and take the natural developments and growth of the nature as an example (Fig. 3).

Basic unit	Derived from unit	Addition Rules	Mass Organization	Basic unit	Derived from unit	Addition Rules	Mass Organization

Fig. 3. Developing the basic unit with generative approach

At the last stage, every student designed his/her own high-built housing in line with the growth and development rules. During the design process of the houses, not only generative approach was effective but also ecological data were used. Especially, floor gardens and atriums are effective in the shaping of volumetric organization with regard to full-empty relationship. Likewise, ecological elements were taken into consideration in the organization of the

relationship between the building and the entrance floor. Especially in designing the façades ecological systems were taken into consideration (Fig. 4).

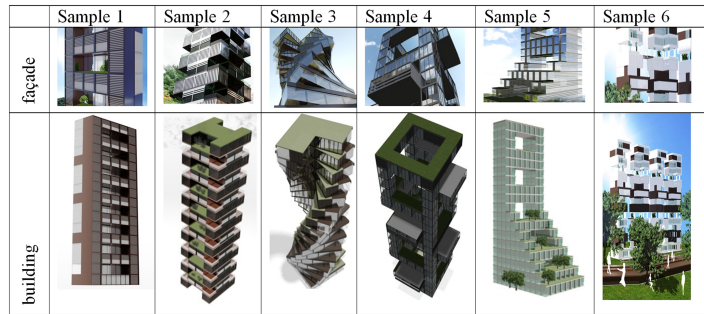


Fig. 4. Samples of students projects

Lastly, an observation form was developed in order to determine the way the students use these ecological data and generative approaches as well as the variety of them, and all the evaluations were made via this observation form.

With this study, whether a new form of generative model in education will be able to be produced or not by using generative and ecological approaches together was tried. Most of the students approached with ecological angle at the start and took the organization of the mass into consideration. Then with the generative approach they shaped the whole form of the house in line with it. This full-empty relationship determined both the relocation of the green areas to top floors and more daylight with different shading opportunities. Besides this, the mass is emptied in the examples where the wind energy will be benefited. At the second stage, more façade organization and the adaptation of additional units for the façade into the design were provided. According to this, every student reached different stylistic alternatives by transforming and changing high-rise housing units -which they formed with regard to unit development rules that they determined via functional relationships- in line with ecological approaches.

3. Conclusion

With this study, awareness tried to be generated in students who have little knowledge of both creating a stylistic model in the process of architectural education and sustainable/ecological architecture. Within the scope of this study, the generative and ecological model that was developed was evaluated as a creative educational model as it improves and transforms the design process and provides opportunities for different stylistic explorations.

As a result, it was determined that the belief that architectural design process and energy-ecology efficient architecture are totally different concepts should be diminished, and that these two processes should be integrated with each other at the first stage of design. It is thought that this educational model will, in the future, diminish the ideas that energy-ecology efficient architecture has a certain architectural form and that it puts aside architectural productivity/originality/aesthetics.

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