

A COMMENT ON DIGITAL TECHNOLOGY IN ARCHITECTURE -FROM DESIGNING TO USING PHASE

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ABSTRACT

By the accession of computer to the process of design and production and use in searching for qualified solutions aiming rational practices within the architecture, the architect has gained more facilities and time for production of design ideas and for the visualization of its sketches. Computer technologies are also important for analyzing the problems and for determining the conformation of data obtained to the architectural solutions and for creating possibilities of testing the ability of the ideas. The aim of the architecture is the designing of ecological, economical, safe and healthy spaces necessary for the life comfort of the user. During the rapid development of the technology and social life and the changes caused by them, the designer has to add new ones to the disciplines which he has to be in interaction with.

By creating new forms and spaces the designer can visualize and discuss them more easily and quickly. The forms designed by the agency of virtual reality can be analyzed in three-dimensional aspects and the architectural places can be lived in visually beforehand. This kind of studying also accelerates the creation process of the architect. Biomorph, complicated, curvilinear, free and fluid shapes which are difficult to design and realize within the traditional technologies can be applied easily by the advanced technology of production and material. The characteristic design studio creates a kind of scenario and presents sculptural expressions of architectural spaces. The dynamic, emphasizing, communicative values of shapes become the important elements of architectural space design.

This study is discussing the process of the architectural design and the production of space by contributions of the digital technologies.

Key Words: Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Digital Architecture, Virtual Reality.

INTRODUCTION

The first use form of computer on architecture was not on the purpose of design, but of drawing and submitting the pre-made designs. The beginning of the 21st century, the applications of computer had already changed the design method, especially the technology like the virtual reality, CAD (Computer Aided Design) /CAM (Computer Aided Manufacture) technology, and internet. Through the computer, many famous architects, had designed various amazing spaces. Many of the architectural elements had been redefined, such as

function, form, volume and space. This new type of architecture produced by the combination of new architectural efforts and digital technology is generally called digital architecture [1]. Digital Technologies offer new advantages generally in the process of design research and performance tests and formal research, and analysis processes, and the development of design strategy. New architectural morphologies are also created by the digital design techniques on the search so as to be genuine and to take over by becoming different during our age at the cutting edge of entertainment culture. Additionally, advances in computing based on the study of natural processes such as biology, genetic evolution and emergence, now suggest that the elusive nature of creative architectural thought can be articulated and further applied in a technologically mediated environment. The future of digital processes rests on the ability of computer-mediated environments to facilitate the creation of architectural designs created so that digital thinking becomes indeed architectural thinking [2]. All these approaches are also necessary for the benefit from the scientific and technological developments by interrelating with the other disciplines. In this process architect takes his place in a position where he manages information organisation between the different disciplines.

MATERIALS AND METHODS

The rapid change in computer and digital communication technology leads to some changes also in the formation of architectural space, and of which architectural flake covers those spaces as in every sphere of our daily life. For that reason, within the context of study, analysed by the constant developing technological innovations, computer aided design (CAD) and manufacturing (CAM) technologies brought by the changes in the environment of architecture. In our article taken under the main titles of “digital space” and “digital form” in architecture, it is discussed on design technologies and their use, such as “design based on animation and performance analysis”, “evolutionary design”, “smart space”, “virtual space” which are always the most spoken areas of today.

DIGITAL SPACES IN ARCHITECTURE

Recently the fact that digital software programs enter into space designs, and that new design aptitudes take over brings new arrangement constructs to spaces. Spaces offer more “sculptural” formations through their curvilinear and fluid features also as in building flake (Fig.1-2).

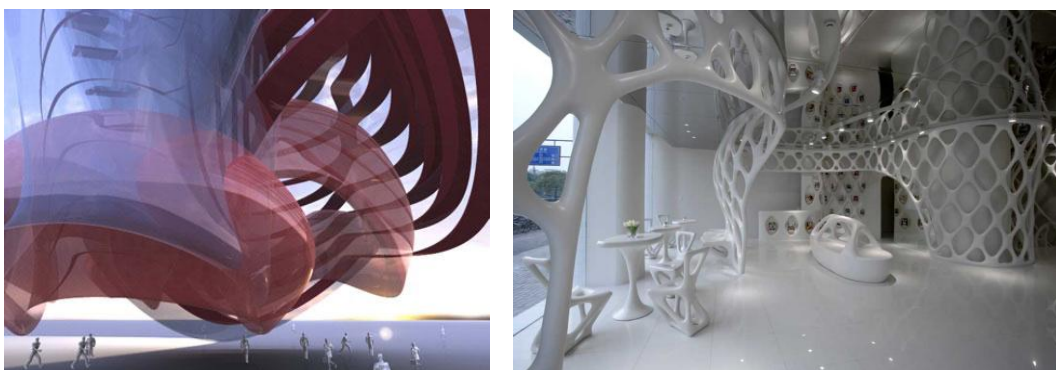


Figure 1. Tectonic-space, George Katodrytis / Studionova Architects [3]

Figure 2. Hangzhou Store, China, SAKO Architects [4]

Spaces with the new definitions such as “virtual space” and “smart space” gradually become more complicated. Now the aim is to create spaces which are on the mind liquidity, and

change, and move instantly, and interact with human. Spaces are programmed by architects so as to be able to comply with the changed conditions such as virtual space, life and perception conditions in space change. Someone who uses virtual reality systems, by means of computer interface and internet, depending on mouse and keyboard movement, can surf on a place wherever he wants in the world, and turn on the space where he is, and look up-down, and get close or far to the image, or within the three-dimensional models formed, visitor can percept the space both visually and over the movement [6]. Also smart spaces are the supply of surface automations on the advanced level by supporting with computer-information technologies added user faces, and soft wares which enable spaces to be equipped with buried sensors, and those to be programmed according to the wishes of the user. In this sense, studies of human on space-computer interaction take out architectural space to be aerospace surrounded by some elements, and change it into a robotic system which talks and hears and percepts, and recognize mimics [7]. Besides there are also existing some spaces which give reactions such as the change of light and sound and digital image in space, and the movement of the surface by perceiving different data coming from the environment. The building skin can show a dynamic structure with its features that building skin is able to open, close, change its color and mutate, like the living organisms. Also, the skin behaves like a membrane which serves as a connection between the exterior and interior of the habitat (Fig.3). With these developed systems it is aimed to use up minimum energy and maximum “adaptability” in the ecological medium which is shared by the man-made objects and the nature, which is called “ecological sustainability” [8].

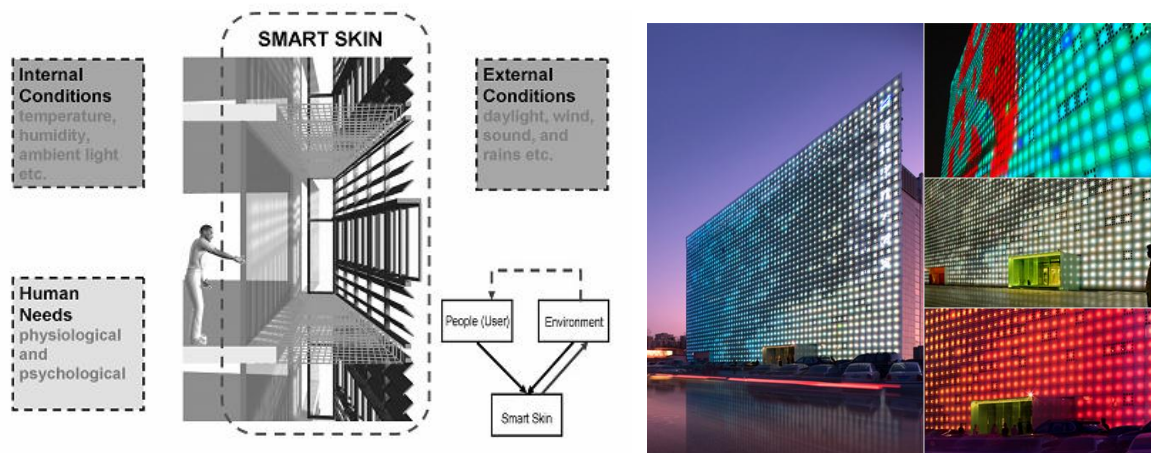


Figure 3. Building Skin in Respond to External and Internal Conditions [9].

Figure 4. GreenPIX - The Zero Energy Media Wall [10].

With the use of digital media as architectural construction element by moving out from the traditional computer environment, the building facades commanded by computers can also be turned into a giant computer screen where film and animation can also be shown (Fig.4). Thus, interior space and facade gain a dynamic feature. Now with the rise of similar applications, our living spaces also become interfaces which make life easy and colorful, and store information belonged to us in their memory, and present where necessary beyond being closed shelters we only survive in and work or entertain [11].

DIGITAL FORMS IN ARCHITECTURE

New digital techniques have emerged that attempt to exploit the powerful means provided by computers as a direct tool to generate novel architectural forms. With the fact that the geometries of Euclid it is now possible and very easy for the design and manufacturing of

biomorphic, complex, curvilinear, free, and liquid formations. By the use of computer, many famous architects, for instance Frank Gehry, Peter Eisenman, Zaha Hadid, Marcos Novak, NOX, UN Studio, Greg Lynn, John Frazer etc. had designed various amazing spaces and sculptural forms. In several recent iconic architectural examples, close relation to the actual building production, has had a remarkable effect on architectural expression and final building appearance. These buildings on the other hand have been regarded as more unique and uncommon architectural examples, such as Guggenheim Museum in Bilbao (Fig.5-8).



Figure 5. Guggenheim Museum in Bilbao, Frank O. Gehry [12]
 Figure 6. Abu Dhabi Performing Arts Centre, Zaha Hadid [13]

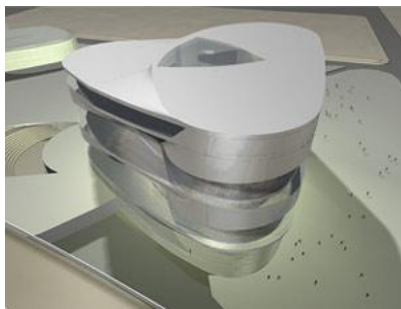


Figure 7. Son-O-House, Holland, NOX, [14]
 Figure 8. New Mercedes-Benz Museum, Germany, UN Studio, [14]

In some of the most enhanced examples of the architectural free form modelling, the used CAD-tools are the same as the tools in automobile and aeroplane industries, which have obviously guided the development of some of these high-end tools, such as Catia. Other examples of similar kinds of 3D modelling tools are available in Maya, Rhino and Autodesk's 3ds Max and VIZ [15]. CAD has also given the designer the opportunity to emulate free form geometrical surfaces and curved structure using NURBS (Non-Uniform Rational Bezier Splines) [16]. The application of the complex architectural formations with computer added manufacturing (CAM) techniques also becomes easier and more economical.

On the search of creating and manufacturing the form by architects with the developments held in biology and genetics, it is seen that nature is the most important source on the purpose of developing a new architectural language. The studies of Greg Lynn accepted as a pioneer in this field consist of rich references related to biological theories and concepts and models, and he bases on dynamism in his designs. Lynn establishes a metaphoric relation between the construction process of a an organic form and of an architectural form [17]. The embryologic houses project of Lynn is one of the important projects which represent transition from modernist and mechanic forms of recent date to the biological models of our present day which are alive and living and developing. An Evolutionary Architecture of John

Frazer "investigates fundamental form-generating processes in architecture, paralleling a wider scientific search for a theory of morphogenesis in the natural world" [18]. He proposes the model of nature as a generating force for architecture, considering form, space and structure as the outward expression of architecture. By applying some generative rules, he then accelerates and tests his process of evolution. Also Dennis Dollens continues his form and design research through a soft ware called XFrog. Dollens creates different structure and space and surface formations by making architectural relations with the similarity of growing rules within seed or plant in the digital environment (Fig.10) [19]. The models developed and the techniques used in the digital environment through the encryption system by using genetic algorithms can accelerate the evolution process and developments, and can be tested.

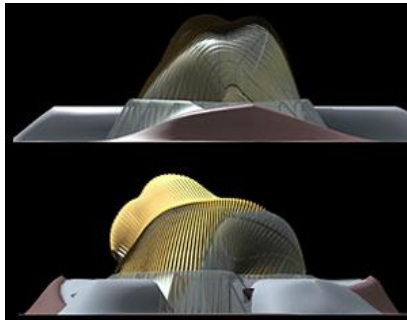


Figure 9. Embryological House, Greg Lynn FORM [20]

Figure 10. Digitally-Grown Architecture, Surface (leaves), Dennis Dollens [19]

In the animation techniques used for form construction, it is possible to select a particular image of space through pausing the animation in a moment when preferred, and to develop form changes according to the parameters determined in a period of time [21]. The simulation environments in which the effects of environmental factors such as sun and wind on space and flake can be observed are established also on the purpose of analysis use. The building simulation programs also provide great benefits in terms of optimizing in every aspect including cost, energy, material, and analysing the performance of the building.

RESULTS AND DISCUSSION

Architectural objects of our present day, which are defined as "unusual", and offer surprising visuality with their features as "unidentification", "nonlinearity", "complexity", and take over since they carry different qualities compared to the buildings where we live, become applicable in a very easy way by means of digital technologies. Architectural space and form concepts with digital technologies, and also aesthetic concepts and value systems have changed.

Accessing information quickly and where necessary through globalization removes distances and borders. Virtual space concept developed in this process prevents space to be lived by being experienced. This situation brings the person in a position that he is the subject of a space which he is not in. The blank definition of space determined with physical borders should be considered once again today. Smart space and smart building conceptions developed as a result of information and computer technologies will be matters in a discussion more and more in the near future. In the process of creating a new language in architecture, architectural formations also have great changes with digital technologies and new materials. Form, with its being one-time, and originality, and its image placed in the mind, and dynamism, and its reflected philosophy to be told essentially as wished, gains a sculpture quality at the architectural scale.

If the changes lived are considered as they are held very quickly, the only way to cope with it is to equip the future architects with highly strong science and technology knowledge. Since especially several concepts related to biological processes become the subject of research in architecture, architect should also be perfect on interaction between disciplines. In this sense, the future of architecture discipline must be questioned once again starting from the level of architecture training.

The aim at living all those technological changes and transformations are not to create only a different kind of form language by transforming architecture to a consumption object. The aim must be in the way that a sustainable environment in its each aspect is created, and that technology, and cultural and social values are also put in the forefront.

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