COMPARATIVE ANALYSIS OF ARCHITECTURAL AESTHETIC IN FAÇADE VERSES INTERIOR SPACE IN PARAMETRIC DESIGNED BUILDING

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Abstract - The advent of the computer in architectural design process not only has improved precision and increased speed of architectural drawings, but has also had a substantial effect on the design process. Consequently, it has weakened the role of architects to be merely rule setters who do not depend on their visual knowledge to innovate aesthetically pleasing forms. Therefore, the new generation of architects just define the geometrical rules and mathematical connections between them; then, the computer software generates a complex final version form, which can be edited simply by changing a specific variable. This complexity, which is provided by parametric computerized design, has been mostly applied on exteriors of buildings, so at first glance the building exteriors looks like a pleasing sculpture which catches the eye of the viewer. However, indoor space design, which is one of the most important parts of any architectural project, has received less attention due to the over emphasis on exterior aesthetic requirements. This computerize way of architectural design leads to superficial aesthetics where the indoor space quality is not compatible with the outer building envelope. As case studies, architectural competitions and proposals will be examined due to the lack of precedents in this design area. This paper seeks to highlight the coherency between the indoor quality and exterior façade which is designed through parametric design process. To do this, a set of different views of indoor and outdoor spaces of some parametric buildings will presented to architecture students and they will be asked to match them, which means they are tasked with finding both outdoor and indoor views of each building.

Keywords - Parametric Design, Coherency, Formal Quality, Space Quality, Aesthetic.

INTRODUCTION

Design process has been changed during the twenty century. Before the Avant of the computer applications in design process, architects used pencils and tracing paper which make the form finding process so time-taking and demanding job for them. Due to these design limitations, precedents with complex curve forms cannot be found in previous decades as they are predominant recently. Nowadays explosive growth of digital technology has affected the core of architectural design. Certainly, digital tools offer new possibilities that were inconceivable only a few years ago (Picon, 2010). This paper is separated into 3 sections. In the first section the parametric way of design and its impact on formal qualities of computerized building are investigated. In the second part we briefly highlight the formal aesthetic of the building. It helps us the define the factors and parameters in which we can evaluate each building on specific criteria. In the third part we present the results of a survey, which required architect students examine each building based on the varying formal and spatial qualities. As major criteria, the architectural students were required to have a high interest in computerized design. We present these results whether they exterior and interior are match or not matched by students.

II. PARAMETRIC DESIGN

During the past fifteen years digital media in architecture was used in different ways and influenced the whole field of design. At the beginning digital media was applied only as a representational tool. With emerging digital technology architecture has found a new tool for conceptual design in digital media (Schnabel, 2007). This process leads to new style of design which called parametricism. It is a style rooted in digital animation techniques, its latest refinements based on advanced parametric design systems and scripting methods (Schumacher, 2009). These scripting and parameters make it possible to tackle the challenge of modifying models built by designers to visualize their ideas interactively and also in 3D (Jabi, 2013).

These variable data not only are the input data which establish mathematical relations, but also include geometric information(Steinø& Veirum, 2010). In comparison to conventional design methods, rule sets are the basic and major part of the parametric design which generate architectural and urban models (Abdelsalam, 2009). The advantage of this is that it enables the exploration of a wide range of alternative solutions by changing the parameters of the logical relationship (Karle & Kelly, 2011), whereas for

traditional methods, designers usually only consider a relatively limited number of alternative solutions(robert F. Woodbury & Burrow, 2006). Another advantage is that designers can change and modify their own rule-based models at any stage of the design process so that the design process can be kept open and flexible, because all procedures, activities, and relations in parametric design are clearly defined (Oxman & Gu, 2015).

III. FORM CREATING THROUGH PARAMETRIC TOOLS

Parametric design implies the use of parameters to define a form when what is actually in play is the use of relations (Monedero, 2000). Woodbury (2010) explain that parametric design has been defined as an exploration process of associative relationships of geometric concepts. in a parametric design environment designers need a different kind of knowledge that can "predict persistent effects to understand the diversity and structure of the mathematical toolbox, and to shuttle between the intended effect and mathematical invention that models it" (R. Woodbury, 2010).

Mathematical knowledge of architects and computer parametric tools lead to complex architectural forms. This complexity in architecture is not only due to external stimuli such as increasing building performance requirements, new building functions, user requirements, urban settings, spatial configurations, integrated design processes etc., but also due to new formal interest in free-form geometry and the underlying mathematical and geometric concepts. (Dino, 2012) Design computation has the claim to be able to help the designer take complex and complicated decisions with greater confidence compared to the conventional case (Bittermann, 2009). Computational tools are falsely characterized by this tendency, and are believed to only generate form that is sculptural at its best.(Dino, 2012)

IV. ARCHITECTURAL AESTHETIC DEFINITION

Although some people may view aesthetic as qualitative and idiosyncratic, researchers have continued in their search for general principles.Psychologists define aesthetic response as favorable emotional appraisals or evaluations. (Ulrich, 1983; Wohlwill, 1974)However, the pursuit of enjoyable surrounding does not imply uniform design criteria to make all building and place pleasant. Evaluative response has been found to consist of three components: pleasantness, excitement and calmness calmness (Nasar, 1989; J. Russell, 1988; J. A. Russell, Ward, & Pratt, 1981).

V. OBSERVERS' APPRAISALS OF ARCHITECTURAL AESTHETIC

Presumably, observers make them in part on the basis of a building's physical features. This is an ancient and obvious truth. Pythagoras, for example, believed that the beauty of buildings could be ordered in mathematical terms (Murphy & Kovach, 1972), and the concept of the golden section pro-poses a precise geometrical specification of architectural beauty. However, aesthetic appraisals are not based solely on geometric or physical features of buildings. Among many personal and contextual factors that influence appraisals of the environment in general and of architectural beauty in particular are the observer's emotional responses to buildings (Mehrabian&Russell, 1974).

DISCUSSION

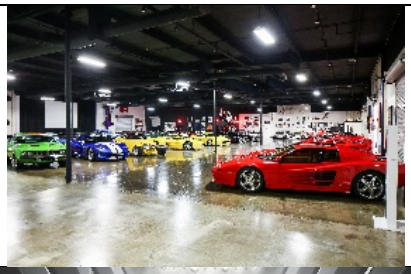
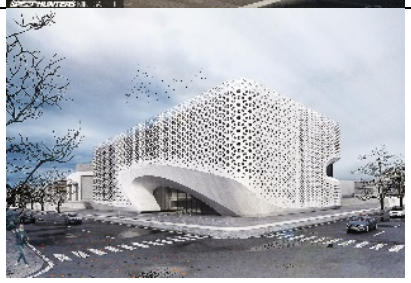
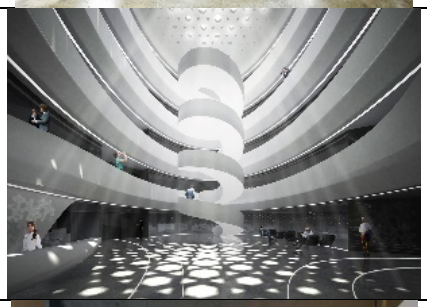
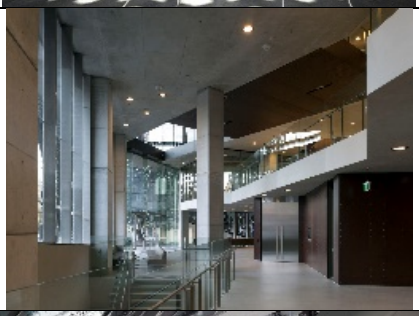
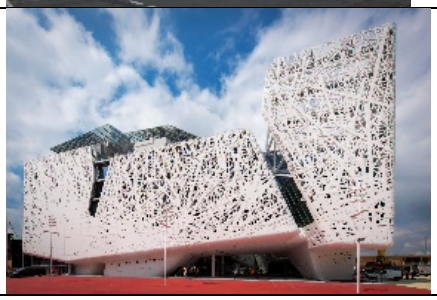
"Parametric design" can be applied to solve different kinds of problems of design questions. There are four application of the parametric tools. First, the thinking process of a designer or specifically an architect can be parametrized. In this way an architect tries to define a set of problems, and then by changing the variables different forms and alternatives are produced. This process takes place in architects' mind not in computer. For example, Gaudi's designs are considered parametric because he used parametric thinking through design process (Burry, 1993). Secondly, when architects use computer as the aided through design process. These software help architects to create not only complex or appealing from, but also help them to have clear plans with construction details, which hand drawing of these detail were tough and time taking process. Thirdly, architects use parametric tools to creates the whole forms of building through computer design. The case studies which have been used in this paper are selected in this approach of using parametric tools. Finally, and most recently, regarding to the designing building has different parts, for instance structure, optimization, energy, mechanical design. these different criteria lead to multi-objective design. It is the final stage of parametric design, which this way of design is applied to address different and not related aims.

In this paper we use the third approach because it just focuses on the creating forms which is the main objective of this paper. In term of the function of the buildings, parametric way of design generally used

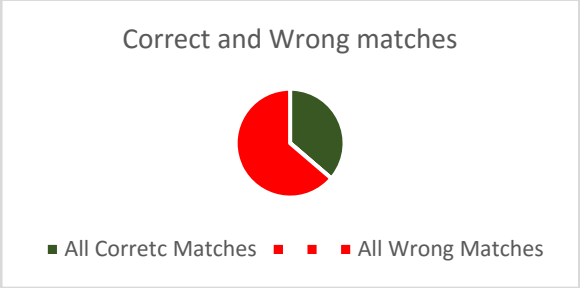
for the monumental buildings or big scale buildings rather than house design. Due to this fact, cultural centers, air ports, church, mosque, commercial center, and related function have been chosen for evaluation.

Table 1- the comparison between the interior view and the exterior viewSource: Authors

Name of the project	Exterior view	Interior view
Dance Palace by Architect: Unstudio Location: St. Petersburg, Russia		
Broad Museum Architect: Diller Scofidio + Renfro Location: Los Angles		
CIB Architect: Vaíllo&Irigaray Location: Pamplona, Spain		
Zahner Factory Expansion Architect: Crawford Kansas City, MO, USA 2011		
King Fahad National Library Gerber Architekten Riyadh Saudi Arabia		
Dear Jingumae Building amano design office Tokyo, Japan, 2014		

CHARLES STREET CAR PARK Location: Sheffield, 2009		
The Bad Café Architect: Nudes Mumbai, India, 2015		
The Petersen Automotive Museum Los Angeles		
Contemporary Office Space by Studio Symbiosis India		
Faculty of Engineering Architect: Denton Corker Marshall,Australia,2014		
Italy Pavilion – Milan Expo 2015 Architect: Nemesi Location: Milano, Italy, 2015		

There are 20 design studentsparticipated in the survey, they were asked to match exterior views to interior views. The survey results show that in the most cases student couldn't match both views. Most of them mentioned that they tried to find the clue to match two views such as their colors, specific details, or even the form of windows which might be related to the exterior. Since the aim of study is to investigate that do the formal features of the interior and exterior parts of the buildings are coherent, neither the quality of the space, nor the form of the interior was the factor which students used as recognizable signs. The graph below shows the accumulated wrong and correct matches which have been done by design students.



CONCLUSION

Design process has been changed significantly since the advent of computerized form generating tools. This transition not only occurs in the process of design, but heralds of a new age that complex and curved forms which have never been imagined before are easily created by parametric software. Although this transition from hand-drawing architecture to computerized one brings a lot of abilities to architects that never conceived before, it has some drawbacks which can be easily recognized in most recent buildings. In term of formal features, incoherence can be considered as an obvious predominant problem. Due to overuse of parametric tools on façade of the buildings in order to make seductive forms, the inner space quality which is one important goal of architectural design has been neglected. The survey in which 20 architecture students participated shows that it is really challenging for them to match interior view with the exterior of the buildings. This incoherency in the most cases indicates that the formal concentration was on the exterior of the building rather than the interior which is the most important part of the architectural design. The further research could use aesthetic classification which Nasar (1994) discussed as the main feature of the formal quality. In order to examine each view based on specific criteria such as complexity, order, atypical, and readability.

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