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Understanding Design Practice, A Case of Turkey How Really We Employ Digital Tools for Everyday Designing?

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ABSTRACT

With the proliferation of the use of information technologies in design activity, digital tools and techniques become determinant factors. The digital design processes and approaches that are always considered as complex activities are evolved. In this context, the role of the designer should be questioned. Thus, who is the designer today? What would be the impact of digital tools on design practice? How do the limits of the technology impact the ways designers think, understand and communicate the design ideas? How are different digital tools perceived in performing the complex design activity? In order to discuss the above issues, a comprehensive survey is conducted. In the paper, the result of the survey will be presented. We will also discuss the findings and give some insights of the use of digital tools in the design practice in Turkey. We conclude how the complexity levels of design activity have a considerable importance in the employment of the digital design tools. Different methods enable to reach higher or lower levels of complexities in design discipline are also discusses. Instead of representing a work of architecture in traditional ways, employing computing and digital tools in the design process might have a significant role in creating new kinds of built environments.

KEYWORDS: digital tools, design practice, design activity, complexity, design process.

1 INTRODUCTION

Architecture is always dependent on the technology and the representational techniques of its time. As William Mitchell noted that 'architects draw what they can build and build what they can draw'. In general, designing is a unique complex process which requires many different ways of communication and thinking. With the advancement in information and communication tools, designers have adapted digital tools and new ways of designing into their practices. The use of generative design approach and CAM technology in design discipline have been increased considerably in recent years. During the last decade, design related firms adapted CAD application and CAM procedures for different stages of the designing that leads to the evolution in the new design processes.

In addition, with the advent of digital tools and potentials of CNC (computer numerically controlled) construction architects can develop a provocative and innovative architectural and spatial vocabulary. With this new design paradigm, it seems to have raised an issue concerned with the creation of the complex form – complex artifact. From a general perspective, the concept of artificial might be described as anything that is man-made, which includes everything from skyscrapers to software they enable us to work with different complexity levels. At this point the boundaries of the criterion to

determine the complexity are also required. Our mind is usually tend to say that some forms or designs are more complex compared to others.

For instance, Esplanade building in Singapore (Figure 1) is likely to be more complex than Centro Colombo building in Portugal. We can argue about the criteria that make a design more complex than the other one, whether the facade is more complex to construct or the concept requires more cognitive processes to understand.

Figure 1: Cento Colombo Building in Portugal ,1997

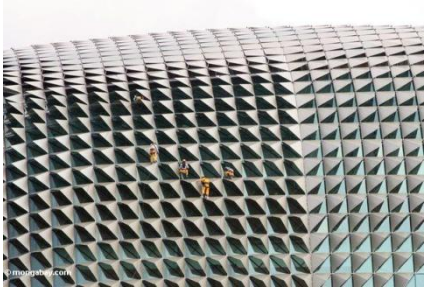

Figure 2: Esplanade Building in Singapore,2013

The aim of the paper is to discuss the concept of complexity in design in relation to the creation of the complex forms employing digital design processes. We discuss a particular digital design process, parametric design, and also present a survey result to determine the use of the digital tools in design practice and the perception of the architects of the digital processes in Turkey.

2 LITERATURE REVIEW

2.1 Level of Complexity and Current Situation

Complexity is a broad term which takes part in different disciplines. For design case, it is useful a broad definition of complexity by Simon's book The Architecture of Complexity: "Human beings, viewed as behaving systems, are quite simple. The apparent complexity of our behavior over time is largely a reflection of the complexity of the environment in which we find ourselves." (Simon, 1962) Actually, we usually tend to associate complexity with human brain, but it is actually born from simplicity in a complex, hierarchical environment.

A hierarchical system might be defined as a system which is made up of interrelated sub-hierarchical systems depending on certain relations in between. These relations define if the system will approach a lower or a higher level of complexity. The ways of systematization changes the level of complexities that could be reached. Simon also clarifies why we ought to be thinking in terms of hierarchical systems and design no matter we are economists, engineers or architects. The reason is basically, hierarchical systems enable us to understand quite complex systems. He gives a specific example on two watchmakers both working with ten pieces. The first one divides those pieces into subsystems and brings each of them together as a part of hierarchical systems. Then, his phone calls and

after the call he could resume without any time delay. However, the second one works with the same ten parts without using any hierarchical systems. Within the same time, the number of watches the second watchmaker completed was quite less than the first one. Since, systematic organizations and subsystem interactions are stronger relations in problem solving design than weak interactions like the second watchmaker. As a result, a system can reach different level of complexities with the same inputs but different sub-system organizations and relations.

2.1 Human Brain and Digital Tools

Both human brain and digital tools have a role in design process but the capacity of constructing hierarchical systems in terms of complexity is limited for human brain than artificial intelligence. Human brain has a limited capacity in storing information both in short and long term memories, which is the main limiting property of human brain. It is composed of seven chunks and two of them belongs the short term memory. There are several experiments related to the concept. In some of these experiments, when people are asked to read some letters or a string of digits and to repeat them back, the one can perform totally true up to mostly at seven or even ten words in length. In another task, but more simple, is interposed between the subject's hearing the things in the experiment and repeating them again, the correct number decreases to two. Miller proposes (1996), from their similarity in daily life we could call these numbers the "telephone directory constants." He clarifies that we can generally keep in mind seven numbers from a telephone directory if we are not interrupted by an external factor, even by our own thoughts. In other experiments it was proposed that the subject recodes the stimulus into a smaller number of chunks before keeping it in short-term memory. If ten items can be re-coded as two chunks, then ten items can be retained. In the other experiments where too much information appears to be kept in short-term memory, the times allowed the subjects permit them in fact to fixate the excess of items in long-term memory. For experts the information can be inserted to short term memory is quite limited in human brain. Thinking this situation for the design process, tools working with a lot more capacity than human brain might change design process significantly, as well as the end product.

2.2 Current Situation and Conventional Design

Based on the above framework, the role of the designer should be questioned. Thus, who is the designer today? What would be the impact of digital tools on design practice? How do the limits of the technology affect the way designers think, understand and communicate the design ideas? How are different digital tools perceived in performing design discipline?

Modern digital tools consist of various languages and components, which affect the ways of users' visualization and designing. Digital systems are substantial components in terms of storing and applying data. However, keeping and applying data is not enough to construct a design system itself. Almost all designers today use computers but how and why we use digital media changes. Design is usually represented by digital geometric modeling but it is not used to go beyond a geometric representation for design practice in Turkey. Computers still put into operation after a certain stage of design process, especially in the last stages to solve a problem related with a completed design. In architecture, computer aided design is used generally to represent a completely defined design in 2D or 3D in a digital environment. This tendency created a significant speed in representation compared to traditional representation methods, however; other stages of design process is hardly included in digital media. For instance, if design problem is a high-rise building, computer aided design tools have no contribution to search for other possibilities for designed products. In case the whole process is not included, computers become just some tools keeping data rather than being tools to search or create different architectural approaches. As a result, many different possibilities can be ignored and they are used as tools for physical representation instead of creating different design innovations and approaches.

2.3 Parametric Design and Basic Understanding

The concept of parametric design can provide for a powerful conception of architectural form by describing a range of possibilities, replacing in the process stable with variable, singularity with multiplicity. Using parametric concepts, designers could create an infinite number of similar objects, geometric manifestations of a previously articulated schema of variable dimensional, relational or operative dependencies. When those variables are assigned specific values, particular instances are created from a potentially infinite range of possibilities (Kolarevic, 2003).

"Parametric design can be defined as a series of questions to establish the variables of a design and a computational definition that can be utilized to facilitate a variety of solutions" (Karle and Kelly, 2011). Instead of modeling an external form, designers articulate an internal generative logic, which then produces, in an automatic fashion, a range of possibilities from which the designer could choose an appropriate formal proposition for further development (Kolarevic, 2003). Parametric thinking is a way of relating tangible and intangible systems into a design proposal removed from digital tool specificity and establishes relationships between properties within a system (Karle and Kelly, 2011).

It is clear that variation, flexibility and control of data are main aspects of computational design approach. In this context, it is usually difficult to categorize the implications between the process, the designer and the digital tools in computational design. The reason is mainly that parametric design process is almost impossible to imagine without an algorithmic sequencing tool of design.

3 METHOD

3.1. Survey, Aims and Objectives

In order to discuss design process of architects and the role of several design tools in Turkey, a comprehensive survey is conducted with architects who have different levels of experience and CAD knowledge. The survey questions included several open-ended questions to better understand different approaches on design practice and thinking. Also, several questions are included to understand designers' preferences on the employments of the digital tools and techniques. The aim was to evaluate architects' tendency in creating design solutions in working environment and the use of digital environments for design solutions as well as its reflections on their design thinking.

The survey included basically three parts. In the first part of the survey, project stages of different design offices were questioned and observed through the interviews of several experienced and inexperienced designers. In this first part, participant architects stated how they practice different stages of the projects they took part in. Their working process was asked based on their decision making systems in conceptual design stage, preliminary design development stages, the process after main design decisions, revision process preferences and data sharing with different bodies both in office environment and outside. Briefly, evaluating participants' design thinking in a complete design process was discussed in the initial stage of our survey.

In the second part of the survey, the goal was mainly to understand architect's preferences of the different design tools in relation to the efficiency and effectiveness of the design tools during the design process. First, we asked about the architects' skills to use different design tools. These tools included conventional design media such as sketching and physical model making as well as digital design tools like Photoshop, Autocad, 3D Studio Max and Revit, Indesign etc. Then, we asked about the parametric digital design tools. Lastly, the effects of all these tools on designers' thinking and how these digital design tools affect their design process were discussed.

Demographic questions took part in the last part of the survey such as the participants' age and design and CAD experience levels.

3.2. Survey Results

In order to analyze the answers, the voice recordings of the survey are transcripted. The utterances of the architects are then categorized and coded based on a custom coding scheme. The scheme is used to group the answers in order to understand the tendency.

The results show that the use of conventional and digital design tools in the current design practice in Turkey is similar among majority of designers. Though knowledge of diverse design tools is higher among inexperienced architects, main working processes to bring solutions to different design problems in various design offices are quite similar.

In early stages of design process, prevailing attitude in almost all participant offices is to use conventional methods like sketching and two dimensional working. When we asked one of the novice participant architects' opinion about the conventional working method of the office she works, she expressed that;

"We all aim to reach creative and innovative designs in the beginning but what we handle is just prototypes at the end."

When the use of different digital design tools asked, most of the participants stated that they use digital design tools to represent a completed design in 2-D or 3-D. Therefore, the use of digital design tools is limited to representing an end-product rather than being employed in the design process. For example, many architects in the research pointed out that they use computers after all the design decisions are made and many of them have no idea about how computers could be used except representing a work in 2D or 3D. In design stages, many participants claimed they work with sketching and physical model production to develop a conceptual project. After this process completed, prevailing attitude is to work in a digital environment. In spite of the fact that computer aided design tools are mostly parametric, designers usually prefer to use them for documentation or representing a completed project, rather than thinking parametrically.

The survey results show that, limited amount of novice designers (0-5 years experienced) stated they experienced these tools before, while more experienced participants only have misunderstandings or no idea. Limited amount of junior architects who experienced parametric digital design tools stated that these tools are not in use at their office, so their experience of these tools stayed limited to some elective courses and workshops they conducted at the university education. However, they also believe that parametric design tools have a mathematical base in which adaptive products affected by several parameters could be created if these tools are implemented into design process.

Nevertheless, many of designers, even juniors expressed that they have no idea about computational design. The ones having some ideas generally believes that computer aided design tools mostly used just to create difficult forms. Some of the participants explained their ideas about parametric design as:

"Parametric design means to create fluid forms like Zaha Hadid and I did not intend to learn because of this reason. "

When asked designers' ability to use digital tools, both expert and novice architects are capable of using digital tools such as CAD products and presentation software such as Photoshop and Illustrator. However, participants explained their goal in using digital design tools in working process is mainly to produce construction drawings or digital models as end-products of a complete design. Apart from misunderstandings about parametric digital tools, very limited amount of participants expressed their ideas in a way that they have capability and control of computational thinking and logic to apply in design process.

4 DISCUSSIONS

Based on the survey results, the design offices which we investigated use the digital tools in the presentation phase of the design practice. Simon argued in his book Architecture of Complexity (1996) that designers are not designing the specific form of an end-product. On the contrary, the process is

designed by a set of rules coded as a sequence of computational systems, in which specific instances of design can be created and changed as needed. This notion can be evaluated as a shift from conventional design activities into a more complex process of computational thinking and relational creation in design practice.

For instance, a very simple computational design approach could be drawn from Figure 2. In a conventional design approach, a designer would be able to sketch this free-form surface. Additionally, designers would be able to evaluate its performance with conventional software with fixed dimensional features. However, when computational logic is implemented into design process, designers would have to break down the fixed image of a complete design and try to find the logic that holds the geometries together (Figure 3). Using conventional software, a model can be built with constant dimensional attributes. However in this figure, this geometry is thought as two different sinus curves with different inputs like length, width and height as the parameters, which could be controlled and adapted based on necessary considerations or any other criteria such as shading, fabrication necessities and visual requirements. On the other hand, using a conventional tool, it might be possible or even easy to create such a model. However, any change in this model would be difficult and quite time consuming. Even changing a single dimension would require to adjust all other parts, which do not work together. This would restrict design exploration, design possibilities as well as design efficiency. Since the more possibilities a system can generate, the more complex systems could be approached. In design, both human brain and digital tools might have a role in the process but the capacity of constructing hierarchical systems in terms of complexity is limited for human brain. Therefore, the conventional methods would not generate as a complex system as parametric thinking enables. The fact that many designers attended our survey keen on using conventional CAD systems, their main focus is representing designed projects rather than reflecting algorithmic thinking into a whole design process. On the contrary, parametric thinking in the whole design process enables rapid adaptation of design dimensions or structure. Unlike conventional methods, it deals with multiple variables defining different sets of rules, smarter possibilities, better adapted designs to context, and most importantly possibility to explore higher level of complexities without the wasted time for the amendments.

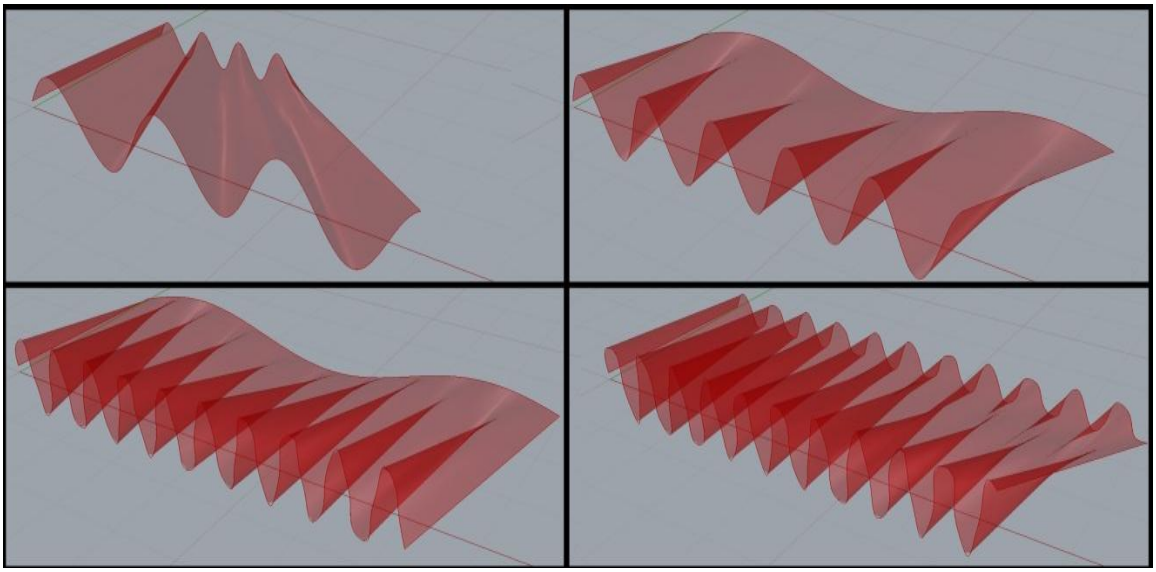

Figure 2: Variations of a basic geometric form with parametric modeling by the author

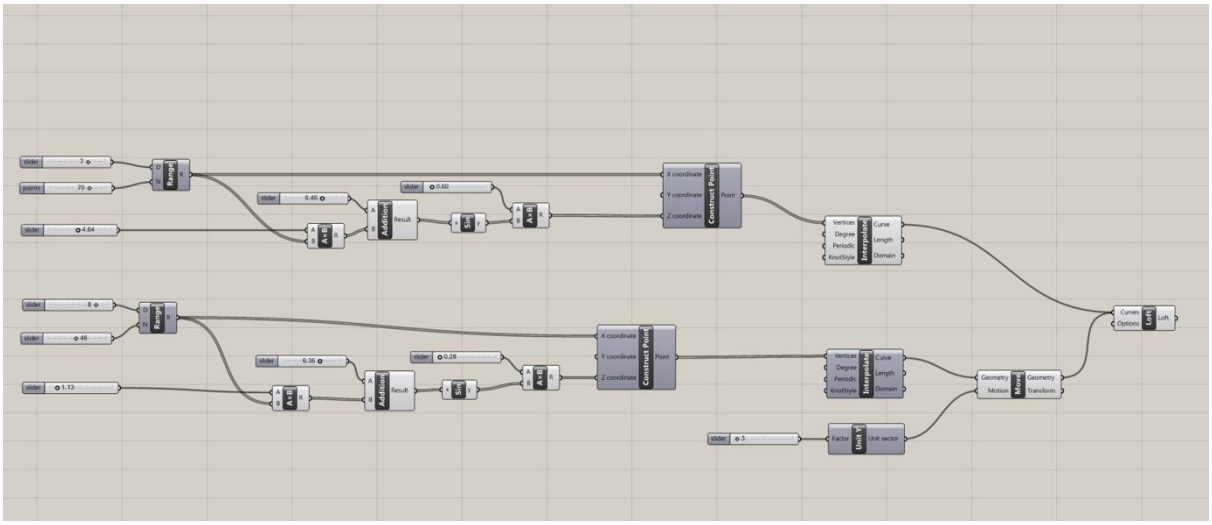

Figure 3: The system that generates different variations in Figure 2

5 CONCLUSIONS

We conclude that digital design tools have a considerable importance for architectural design stages and the final design product. Different design methods enable to reach higher or lower levels of complexities in design discipline. Instead of representing an architectural project in traditional ways, employing computing and digital tools in design process might have a significant role in creating new kinds of built environments. However, using the potential of digital tools in all stages of design process is not a common attitude for the case of Turkey. The main reason is that architects do not have enough knowledge of computational digital design tools to apply the whole design process stages. The result is in a conventional way of thinking rather than computational thinking. Therefore, digital technology is used for modeling a conventionally designed work instead of being the design itself. However, buildings might have more potential if computationally conceived and produced. In spite of having an enormous impact in other industries, adaptive features and production techniques of computational digital tools have not yet a wide impact in construction and building design in Turkey.

This investigation will be repeated with a larger data set including all of the geographical locations of Turkey to determine if the results are valid. That would be the future intention.

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