Visual Design Thinking in the Design Process as Impacted by Digital Media

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Exploring design ideas, through two dimensional and three dimensional forms, is the basis of design exploration and visual design thinking during the design process. Imagining how drawings and models (be it manual or digital) will be presented in reality is the essence of visual design thinking.
By the beginning of the 20th Century, architecture has become more three dimensional in design exploration and in representation. This transition to three dimensions makes the processes of visual design thinking more related to digital media. The nature of media, utilized by architects, affects design-exploration processes.
The research investigates both the processes of visual design thinking and the interrelation between visual design thinking and digital media, in order to shed more light on how digital media should be introduced to students of architecture.

Keywords: *Visual design thinking: digital media; architectural education; design process.*

Introduction

There is a controversy in the architecture community in respect of what time is more suitable to address digital media to architecture students. On the one side, some researchers maintain that digital media are better to be taught to and applied by mature architecture students in a graduate level and professional architects, for example, Hebert (1995). On the other side, according to Cheng (1995) and Kellett (1996), it is better to be taught from the beginning of a designer's education in an organized guided manner. Furthermore, architecture schools are considered to be in need of elaborate pedagogy and theory to deal with digital media.
The study aims at answering the following questions: What are the processes of visual design thinking in design process? How does digital-media use affect visual design thinking? How should digital media be addressed to architecture students, the suitable time and the concentration of content outline?

Design process and design-exploration process

Designing is problem solving in a creative way. Creativity plays an important role in design thinking, as working in the three dimensional forms demands the architect to be more than just a problem solver. The design process has no ideal step-by-step technique; rather, "there are many different styles

of decision-making, each with individual quirks as well as manifestations of common characteristics" (Rowe, 1987). According to Goel (1995), design process has been recognized as involving complex cognitive tasks.

There are many characteristics in terms of the nature of design process to be described; however, three of them basically serve in investigating the research's objectives, namely: nonlinear nature of the design process, relationship with visual design thinking, and progression in representational environments (Abdelhameed, 2003).

Evaluation process reveals the first characteristic, the nonlinear nature of design process, where the back-forth movement between tentative solutions and a design-problem ambit is an ongoing process. The second characteristic is evidence, where visual design thinking is utilized against all tasks of design process; it is inextricably related to design development. The third characteristic comes from the fact that visual design thinking is performed throughout all design tasks (e.g. conceptualization, form-giving, decision-making, etc). In other words, architects cannot promote a design idea without using drawing in its germination or its evaluation.

There is an inevitable reciprocity between the act of drawing and the thinking associated with it. „The hand moves, the mind becomes engaged, and vice versa" (Graves, 1977). While defining, exploring, and redefining a design problem, architects construct, evaluate, and form their design ideas by utilizing different types of drawings.

Drawings (be it two-dimensional or three-dimensional) are a kind of external representation. Recent books on the functions of drawing in architecture, e.g. Fraser and Henmi (1994); Herbert (1993); Lawson (1994); Robbins (1994), indicates that drawing is still the medium for creative design and design development (Do and Gross, 1995). Drawing is a versatile language (Kasprinsin and Pettinari, 1995), which facilitates memory and thinking (Larkin and Simon, 1987).

Drawing not only connects various design activities, but is also utilized inside these activities. It is an integral part of visual design thinking where the designer conducts a dialogue in his mind during design. Thus, visual design thinking is the essence of design-exploration processes.

Visual design thinking and digital media

Architectural design process is comprised and linked series of visual design thinking cycles (Kellett, 1996, citing Zeisel, 1981; Abdellatif, 1985). In other words, visual design thinking is a cyclical process that is employed throughout the tasks of design process. These tasks that are involving complex cognitive tasks, have no ideal algorithmic pattern. In order to understand the logical structure of overt activities that appeared to take place, visual design thinking may be regarded as a series characterized by dominant forms of activity, such as perception, conception, analysis, synthesis, imagining, evaluation and so on.

Psychologists, while studying visual perception, give an evidence of that the image is not given to the mind, but it is formed by our mind, through past experiences and several other subjective aspects, which differ from one to another. The human eye never acts like a camera. Our mind actually takes selective focused data from the entirely exposed image created on the retina. „An art critic and psychologist, Prof. Margaret Hagen, states that there is a traditional and philosophical distinction between sight (seeing) and knowledge. Seeing is experience of sensation, and knowledge is construction of meaningful perceptions"
(http://www.artinarch.com/vp02.html: January 2004). With the same token, the research maintains that all processes of visual design thinking, such as conception, imagining, and evaluation, are formed and employed through the knowledge building and retrieving capability of each architect. It could be stated that the processes of visual design thinking are differently performed from one designer to another according to the individual style of design thinking. Rowe (1987) defines the personal style

of design thinking as the habitual way of solving problems, and illustrates the consistency that comes with it as the fluency in a particular way of designing.

It takes years of experience for an architect to imagine how depictions could be presented in reality. The issue of imagining how drawings and models (be it manual or digital) will be in reality is the essence of visual design thinking. For example, how to specify the dimensions of a corridor in a building, in order to accurately achieve its functional objective and fulfil the needs of users. Gaining this kind of knowledge and experience is a qualitative component of the personal style of visual design thinking in architecture. Moreover, design ideas need to be developed according to program requirements, construction practices, and field conditions, which represent another aspect of knowledge applied by visual design thinking.

On form level, manual media restrict design to what architects could reasonably draw or model by hand. The main characteristics of digital media introduced in representational tasks of visual design thinking are: 1) the higher levels of geometrical definition and abstraction, 2) the elaboration and coordination of complexity and details, and 3) the transformation and manipulation of both images and models in an easy way comparing to the manual-media use (Novitski, 1991; Kaiser and Maller, 1993; Barreneche, 1996; Groh, 1997; Delaura, 1997; Cheng, 1999). Three-dimensional depictions give the ability to perceive the designed space without the false assumptions that often accompany two-dimensional depictions. This difference is more evidence in using three-dimensional drawings of digital media.

While designing in a three-dimensional digital environment, new approaches are brought to visual design thinking, especially in areas of visual perception, conception, and creativeness. The nature of media, utilized by architects, affects design-exploration processes and visual design thinking; for certain ideas can be only derived from specific tools and from individual uses of media. The creation of form in space, through digital media, is available without any intermediation. Addition or subtraction can be utilized, allowing the modelling of virtual space similar to the creation of a sculpture. Floors and stairs can be added and subtracted according to the reaction and judgment provoked by the perception impact. The architect can raise walls, cut openings and adjust the slope of roofs. New formal paradigms, unthinkable in the manual design methodology, can arise from a direct experience of three-dimensional digital media. In this case, visual design thinking is performed through three-dimensional digital models. Designing in a three-dimensional digital environment might be described as sketching in space.

It could be stated that, for design-exploration process, three-dimensional modelling is the essence of computer media while sketching is the essence of manual media. The trend of digitalization in media use throughout the design process affects visual design thinking performed in design-exploration tasks. As what an architect can conceive and comprehend depends on what this architect can visually perceive through the media used. There is a difference in the process of visual design thinking used along with manual media, and of the one used along with digital media. The perception of paper-based drawings differs from the perception of computer-based models. Each kind of media needs different capabilities of imagining that are applied in the processes of visual design thinking.

Addressing digital media to architecture students

As previously mentioned, the essence of visual design thinking is the capability of imagining how depictions could be presented in reality. This capability can develop and improve through knowledge, and what may accumulate in architects' minds and hands during the study and practice of architectural design in digital media. To build this kind of knowledge is achieved through many years of experience and practice.

During the processes of visual design thinking and imagining, architectural education should direct students to form the capabilities of digital-media use, and to build up the consistency that comes with it, through having a fluency in a particular way of designing. Digital-media courses introduced to architecture students should achieve these objectives. In the same time, digital-media courses should concentrate on how architecture students construct the processes of visual design thinking, which are employed in designing in three-dimensional digital environments, i.e. perception, conception, design thinking, and imagining.

Time of addressing digital media

From the above investigation of both, the process of visual design thinking and the effect of digital media on this process, the research has the basis to judge on the suitable time of addressing digital media to architecture students.

Visual perception, conception, and creativeness, which architects use through depictions of digital media promote their visual design thinking, and in the same time, require different qualities than that of manual-media depictions.

Digital media, used as design tools, should be gradually introduced to architecture students in an early stage of the undergraduate level, in order for them to have enough time to gain the qualitative components of their visual design thinking performed in these digital environments. Digital-media courses should simultaneously progress with design courses, assisting the processes of visual design thinking to be formed and promoted at a same level.

Content and pedagogy of digital-media courses

Linking digital-media courses to design courses, from the first stage of learning and practicing specific techniques is an important aspect; however, it does not provide architects with what they need to compete with the challenging progress of digital-media use. Consequently, architects should have the ability to generate ideas in various ways and by different types of media, which leads to having the experience to effectively convey ideas.

The use of digital media varies according to the fluency and creativity of the architect in organizing the interaction of both media (digital and manual), or in utilizing the sole use of digital. Content and pedagogy of digital-media courses would have the use of different techniques that help in forming the processes of visual design thinking, allowing students to form their own techniques. Form-generating algorithms, however, are not seen to be among digital-media use that might be introduced to architecture students in the undergraduate level, as students would have shapes and forms without using their visual design thinking, which may have a negative impact on shaping their visual design thinking.

A well-informed architect will know exactly which medium to use for a particular kind of job. Architectural education, therefore, should constructively emphasize the three following implications:

- Forming the processes of visual design thinking, especially imagining, which architects perform in digital media.
- Equipping architecture students with: a curriculum based on multimedia, and the basics needed to face changing technology of digital media. What architects should learn and practice is the concepts behind the heterogeneous uses of digital media.
- Introducing broad knowledge of different uses of media to architect students, and deep experience of a few which fit their own styles of visual design thinking used in design process.

Future research avenues

The research opens future work in terms of proposing a detailed content and pedagogy of digital-media use in architectural education. Testing the proposed pedagogy will be an important part,

in order to measure how visual design thinking of students promotes in digital environments.

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