VIRTUALITY IN ARCHITECTURE: A Desisgn Metaphor

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Abstract: Traditionally, architecture in its design process employs physical matter, requires physical presence and relies on real world environment using conventional methods of 2D depictions such as paper and pen or 3D representations such as physical models and communicates design ideas in verbal or text-based form. The conventional design process, for example an interior design, a residential house, a commercial complex or even urban design projects, follows the same hierarchy of activities. Efforts are made to the satisfaction of both parties to give the ideas of a physical shape through sketches, drafts and models which may take weeks, even months. Finally the project gets its final shape in a working drawing, 3D visualisation or model making. This process is time consuming and somewhat redundant.

In recent years technology has offered architects a new tool—the virtual environment. Architects use virtual environment increasingly as device of communication and presentation of design intensions. Virtual environment enables users to interact in real-time with design but unfortunately has not been used widely in the process of architectural design. The aim of this paper is to investigate the relationship between present design process and the emerging technology of virtual reality, establish a relationship between the two and its influence on architecture to form a new translated design process and communication, an interface between architect and client.

Information technology, in its process of evolution, is influencing all creative art defining new tools and environments. The process of architectural design is also

facing the challenge of the new technology resulting in tremendous collaboration with different disciplines that mediate between technology and the humanities, between science and arts.

Also the requirement of interaction becomes expensive and troublesome for both client and architect if they are located geographically in different parts of the world.

Various issues have been reported on successful implementation of virtual environment in architectural design such as technology overhead, quality of design and communication and collaboration. It has been noted that the quality of design and their outcomes are directly linked to the communication and collaboration between designers and between designer and clients (Kruijff, 1998; Kvan, 2000). Therefore, an emergence is felt for a happy marriage between the evolving technology and architecture.

Enable the client to describe the space in terms of a set of parameters and the architect to translate the space into virtual world utilizing digital data. These digital data are descriptions of space in the virtual environment. This is the challenge of the time where we need to define whether virtuality is a new design metaphor for architecture and other creative arts.

1. Introduction

Architecture was one of the primitive professions in history, driven by the power of creativity and sense of aesthetics. With the influence of new evolving technologies [i.e: computer, information and communication technology] in present times, every element of our life and society was being shaken. Architecture was being influenced as well, but the design process has not changed much under the influence of these applications. As with the introduction of other new technologies, (such as electricity) it takes quite some time to find the proper application. The first step in this process usually is to apply a new technology in a conventional way (Vries et al., 1997). It happened similarly in computer applications in architectural design and yet a 'natural' use of it has to be found.

Following our previous idea of 'WWW based architectural design service' (Al Masum et al., 2003), we realized the necessity of concentrating more on the core of the industry—'virtuality in architecture'. We were keen to focus on developing a study in this area to determine the scopes and limitations of emerging information and communication technology in design process. This is a preliminary phase of an on-going research and this paper will be illustrating the initial part of the study. Here, we will try to define the virtuality, virtual reality and conventional design process. We will discuss, 'how the design process being influenced by computer technology', the scope of virtuality in design process (development, evaluation and communication with client), the constraints in

present applications and scopes towards an integral application suitable for virtual design studio.

2. Virtuality : digital and virtual architecture

Virtual architecture has different meanings in different contexts, for example, as information architecture (Schmidt, 1999) or virtual place (Novak, 1990). Three types of architecture were defined for the purpose of the paper mentioned as 'digital architecture', 'physical architecture' and 'virtual architecture' (Mary, Ning, Fei, 2001). Here, the term 'virtuality' was considered as ' the computer applications in different phases of design development process and representation techniques'. In a sense, we are really combining digital architecture and virtual architecture together and terming it as 'virtuality'. Though we will consider both the digital and virtual design process, we will focus more on the phase of virtual reality application in the design process. There will be an overview of design process being facilitated with these applications as well as the limitations and the scopes. There are a few questions and a potential scope of this technology:

- 'Is this technology leaving us on fabulous visual quality towards the presentation of a project?'
- 'Does this technology enable architects to visualize the important parts of the projects for better understanding of space?

If it does, then this process definitely helps architects in development phase of design and understanding of space and has a very important role to play.

The aim of this paper is to investigate the relationship between present design process and the emerging technology of virtual reality, establish a relationship between the two and its influence on architecture to form a new translated design process and communication, an interface between architect and client, enable the client to describe the space in terms of a set of parameters and the architect to translate the space into virtual world utilizing digital data. These digital data are descriptions of space in the virtual environment. This is the challenge of the time where we need to define whether virtuality is a new design metaphor for architecture and other creative arts.

3. Design process in architecture

There is a very long tradition in architectural design process of solving problems. Even before the introduction of computer system in architectural design, much research was spent on systematically describing the design process (Vries et al.,

1997). The creative part of the design process is very hard to grasp in a formal way, but can be identified with a process of different stages. We can identify five stages in the total architectural consultation process (Maheshwari and Warsi, 2003), in which three stages (1,2,3) are really our concern. Even in those three stages, the second stage is the area of focus in this study. The five stages are:

1. Introductory stage (client's brief, codes and standards, climate and other studies, data, literature studies, planning consideration, design concept).
2. Sketch design stage (conceptual sketch, functional diagram, form and space, approval, plans, elevations, model study, 3D views, space lustrations).
3. Working drawing stage (detail design in scale and working sheet, structural designs, mechanical, electrical and other drawings).
4. Construction and supervision stage (on site execution, supplying the contractor, supervision and overall observation on the progress).
5. Post occupancy evaluation (modifications, alterations, renovations, problem identification, analysis and solution).

4. Design Development stage

The sketch design stage is a design development stage but closely related to and very much influenced by the previous stage. In Stage One, we have several application to assist. Even sometime we can take help from different DTP softwares [Adobe Photoshop, Image ready, Quark Xpress, Adobe Premiere] to produce photographic, video graphic and analytical data. Though adobe Photoshop and other similar types of graphic software and associated programs are already in a vast use in preliminary study and research phase. Area survey and study of the site and surrounding through photographic illustration is a common and most conventional practice in architectural design. This phase is being facilitated most with computer applications. Multimedia applications are also being used for an interactive presentation of this phase to present the analysis for an initial review from the client. In Stage Two, we have whole the design development process to describe. In brief, sketching, drawing, simulation and managing, these are the activities of this stage (Vries et al., 1997).

4.1. SKETCHING

Architects usually start with sketching do generate and develop ideas about the form, articulation of space and even diagrams for different interrelation of different aspects of design. The use of computers in this phase is very limited as there is no user-friendly software for freehand sketch. But, there is such scope as if the sketchpad is having a facility to activate digitisation that will generate the drawings in a vector based 2D drawing manipulation and an eraser which can erase. Similar sort of pen

activation is possible for notepad in Toshiba Tablet PC. Parallel to the hardware we definitely need the compatible software to run such interactivity.

But, there are some scopes to use Flash, Adobe illustrator and other drawing software for different types of drawing to explore the idea. The limitation in this method doesn't help much in the involvement of digital technology in design development process. It rather helps to create interactive presentation for the client to have a sequential browsing towards the total design process. Clients can have the clear interactive multimedia presentation describing every phase of design development. At the same time, if we prefer to design the 2D sketches in Flash, we can transfer the drawings in 2D vector interface in other software such as AutoCAD, 3DStudio Max and Maya. Then these 2D lines can help as a reference for 3D manipulation in the relevant 3D modelling software. We can extrude the 2D lines created in Flash, as it is vector based and can generate 3D forms in software as AutoCAD, 3DStudio Max and Maya.

4.2. DRAWING

The next is to study form and space and the articulation between them. The form and space should integrate with functional and other requirements of the project. To progress in this phase, the conventional way was to make models. Those were termed as mass models or rough models to study the form and the integration of the form with the surroundings and the activities. Parallel to all the study in this phase, we analyse the function and the space integration as an integral part of the function.

In this phase, the projects can be blessed with virtual reality. It is characterized by the illusion of participation in a synthetic environment rather than external observation of such an environment. It relies on three-dimensional (3D), stereoscopic, head-tracked displays, hand/body tracking and binaural sound. VR is an immersive, multisensory experience (Ear shaw et al., 1993). In VR, the architect designs the building as if he is creating a full-scale model and can be in any place [in any room, in front of any façade of any height] in the creation process. It helps the designer to have a detailed design perception and close look into every detail designs. Using 3D softwares such as 3dStudio Max and Maya can maintain this process. But, the application of VR until now is mainly being used in render, texture mapping, lighting and other effects. It could however, be used for a greater understanding of form and relevant other parameters.

4.3. SIMULATION

It is a detailed design phase. In this phase, designs are developed in scaled, proportioned and accurate form. Traditionally, we draw with the help of drafting boards and scales and try to produce the detailed model. And while we do that, we

have less chance of changing any major design decisions. In this phase, we definitely produce the finished design and wait for the final manipulation. We start doing visuals such as perspectives in different spots of the design as per client's requirements.

This phase can be described as a detailed drawing in Autocad and detailed modelling using 3D parameters of the same software. The usual way is to draw 2D design in every detail, such as wall, column, floors, windows, steels, glasses, etc. in different layers in one drawing. Then to get the 3D articulation of the design, the architect uses the extrude parameter and makes it 3D and it's hard to manipulate further in the later phase. To get the detailed texture and colour effects of the design, the detail drawings made in 3D form in Autocad need to be transferred to 3Dstudio Max. It can be rendered with the effect of the colours and textures of all the materials. After this phase, it is almost impossible to manipulate the changes in basic design diagram. That is the limitation in this type of process being in practice in architectural design process.

4.4. MANAGING

In this final phase of design development process, it is very hard to manipulate the designs and details. In conventional method and in the computer application, both process is complex to deal with such manipulation, but in VR studio we have a scope to create a user-friendly manipulator interface with the existing platform of 3D programs.

5. Architects and clients in virtuality

In this format, architects and designers can easily perceive the spaces, though on a computer screen, but with a feeling of the constructed space. In the conventional method, architects were left with a power of imagination. They had to wait for the project to be built, to perceive if the real imagination was a potential solution for the incident. The architects should rely on their own experience and perception of what they have achieved through the years of their practice. But, this technology is providing professionals with the scope to evaluate their design in advance and they can analyse before they really approve the design to be built. There is scope for correcting the major or minor visual errors and aesthetical correction. They can walk through the spaces and with the application of different environmental parameters, they can even study the light effects and other relevant parameters. If we use the technology extensively, it is also possible to have a real experience of the traffic flow and public mobility of different urban spaces. Following this discussion, it is likely that architects' perception is being promoted with the help of virtuality.

We have different modelling softwares such as [rhino, 3d studio max, maya, etc.] which can help us to better study of the mass and space articulation. It is complex to manipulate the modelling in these softwares, but still it can provide with real life perception of the spaces. This technique can supplement the mass model phase of design development. Even, we can study mass models in AutoCAD as well. But, it is better to use AutoCAD for scaled drawing rather than study phase of a 3d form and space.

As we can realize, we were having mass model study and sketch going on parallel. Finalising to the form and function and specific detail features, we were moving into detail solution of the design. Eventually we move to scaled drawing based on the decision of the final form, function and specific features. In the process of the scaled drawing, we can identify some errors and corrections that need to be manipulated. We investigate the correction of the similar way we did the whole design process. And we finalise and produce the final model. It is unlikely that we are having major changes after the final design detail and final model is done. The reason is, we have plenty of consultation meetings with clients in every development phase of the designs. The client is involved in the whole process as a integral part to make sure that the right thing of his aspiration is going to be built.

We can now discuss it from the client's side. Previously, clients had to believe and trust the architect's power of innovation. Sometimes, clients couldn't realize what was going to be built. Most of the clients were not really imaginative enough to visualize the 2D drawings in 3D forms and space. As a result, architects had to produce perspectives of different important spaces to help the client visualize the space when it would be built. This was really time-consuming and static. But, virtual reality and virtual representation of the spaces is much more dynamic and we can show the virtual walkthrough and visual quality of the spaces from any point. It is less time consuming, much more communicative and apparently real-time experience. In this way, we can even get the most effective feedback from the client. The client can really interact with the design and can do any sort of major and minor changes with his aspiration. It enhances the scope of negotiation with the architects before the project is being built. The clients is being better facilitated than ever.

The technique of virtual reality was being used specifically to produce the presentation for the clients. It doesn't have much influence in design development phase, the reason is the limitation to modify in this phase of presentation. But, if we concentrate, we can find a interlinked way of different applications in design development process.

Traditionally architecture employs physical matter, requires physical presence and relies on real world environment using conventional methods of 2D depictions such as paper and pen or 3D representations such as physical models and communicates design ideas in verbal or text-based form. [2]

In recent years technology has offered architects a new tool - the virtual environment. Architects use virtual environment increasingly as device of communication and presentation of design intensions (Bertol, 1997).

It has been noted that the quality of design and their outcomes are directly linked to the communication and collaboration between designers and between designer and clients (Kruijff, 1998; Kvan, 2000).

The paper will analyse the limitation of convensional design process and the scope of the application of these technologies. We will analyse the scope of computer application in different phase of the design process and the idea of the new.

6. Conclusion

The discussion here is just finding a way towards the better understanding of 'virtuality in architecture'—its constraints and scope. It is understandable that this new genre of design process is likely to come up with a new design metaphor. We are trying to identify the nature of the metaphor and to generate a positive discussion towards the further research possibilities. *All the visuals related to this discussion will be produced in the presentation.* This is an initial phase of an in-depth research and understanding on 'virtuality in architecture'. We are trying to identify and produce an integral system of comfortable and user-friendly virtual design studio. This short paper is symbols of the journey towards that mission and hopefully have enlighten us towards the virtual understanding of virtual reality as a part of 'virtuality in architecture'.

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