DIGITAL PERCEPTION, DEVELOPMENT AND PRESENTATION IN ARCHITECTURE: A Study of Bangladesh in the Global Context

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Abstract. *In the recent past the computer has become an important tool both in the design and presentation media/method in architecture. In this paper digitalization in architectural practice and architectural education in both the global and Bangladesh contexts have been studied. A survey questionnaire was carried out to find how and to what extent available software are being used in Bangladesh for this purpose. Opinion, views, expectations of architects from leading architectural firms of Bangladesh were studied to understand the future prospect of this field in Bangladesh.*

1. Digital Perception

Architecture, one of the oldest crossroads of arts and science, has been using information processing devices for centuries. These devices were sometimes in the form of measuring and drafting tools, sometimes in the form of wooden and paper models and, most recently, in the form of computers. The technology that has set the architects free to think extensively and broaden communication between themselves and the client community is not very old practice. Workstations (computer) are very recent equipment in architectural firms. Architecture has become a database containing information about the inhabitants, providing space quality according to the choice of the occupant. Michael Benedikt sees the distinctive achievement of the computer age as the marriage of digital design and physical presentation (Aaron, 1997).

But this emancipation is in the form of only a new fixture in architectural firms.

Computer has fundamentally changed the way of designing, allowing the architects to visualize what they build. Thom Mayne, architect of Morphosis, who is famous for his obscure, layered physical drawings and models, says, "The days of drawings are over. Designs are all digital now. It gives you so much more freedom…" (Aaron, 1997). Available software like AutoCAD (Computer Aided Design), ArchiCAD, 3D Studio Max, Form Z, Microstation, etc. allow greater possibilities in creating complex architectural forms and experiencing the spaces within. Frank O. Gehry's Disney Hall was really the breakthrough. Gehry proved that one could create highly fluid shapes on the computer and then model them directly (Aaron, 1997). These forms are not always the result of excessive expressionism but actually of precise optimization of materials. But European designers like Ben Van Berkel (UN Studio, Netherlands) and Wolf De Prix (Coop Himmelblau, Austria) argue that computer allows one to trace the forces of gravity with great accuracy and build them accordingly (Aaron, 1997).

2. Digitalization in Architectural Practice

At present, it is hard to find an architectural firm without any workstation. In all phases of planning and designing, computers are used in documenting, organising and storing information; to visualise design alternatives and to produce working drawings or 3D models for construction workers. Due to this fact, architectural firms require various types of drafting software like AutoCAD, MiniCAD, ArchiCAD; graphics software, like Adobe Illustrator, Corel Draw; image manipulation software like Adobe Photoshop, Corel Photopaint, Morph; video editing software like Adobe Premiere and 3D modelling and animation softwares like 3D Studio Max, Maya, Form Z, and Microstation. These softwares are being developed and appreciated both by users and clients. Moreover, analytical and simulation software like Spiel, Space syntax, Ansys, Shadow Pac, EZ Flow, Town scope, Daylight, etc. are also becoming popular among both professionals and academics.

According to Peter Zellner (1999), "Architecture need no longer be generated through the static conventions of plan, section and elevation. Instead, buildings can now be fully formed in three-dimensional modelling, profiling, prototyping and manufacturing software, interfaces and hardware, thus collapsing the stages between conceptualization and fabrication, production and construction".

2.1. GLOBAL CONTEXT

Most of the architects like to use the computer to streamline products, rather than explore its tentative abilities, the technology has given some architects to explore the out-of-sight potential in design process. The pioneers of this movement are:

2.1.1. Peter Eisenman

In Peter Eisenman's works architecture might appear to be purely formal research, but with everyday work the architectural project becomes more of a logical conclusion of a long speculative process leaving tracks with other feasible paths opened. In the design procedure computerized models are used with exceptional creativity in the office. These pliable models are used for more dynamic and immediate interaction. The real goal of Eisenman's digital models is not to establish a universal theory, but to produce a critical text. They are used to cover separate phases of the project bringing together different types of models like graphics, dynamic diagrams, etc. His designs are results of dialogues with all the different forms of representation used in order to develop an idea of architecture, which are not solely based on computer equipment (Luca G., Peter E., 2000).

2.1.2. Morphosis

Morphosis has been admired for a long time as an architectural practice dedicated to the intensive production of physical drawings and models. Thom Mayne, who is famous for intensive production of exquisite physical drawing and model, leads the firm. But for Morphosis today, the act of drawing and outlining a figure is less an exploratory process compared to building design directly within the digital medium. Rather than elaborate flat representations, computer-based manipulating, rescaling, stretching, amending, subtracting and prying apart a model until a design solution is reached, is more utilisable. As Thom Mayne adds, "building, unbuilding, building again … very direct, very physical… We just build, construct in one-to-one scale within the virtual space of the computer… no plan, no section, no elevation… its more like shaping clay" (Peter Z., 1999).

2.1.3. Marcos Novak

The abstract potential of the computer is the issue that has made Marcos Novak create fantastic structures. With these computers he has made in his terms 3 kinds of future-architecture, named, liquid spaces, transarchitecture and avatarchitecture. He exploits the spatial models with two concepts: (i) Delamination of passage from one set of data to another; and (ii) Arbitrary cross fades where using different from generating techniques like spline-based interpolation where 2 sets of curves were generated (Peter, 1999).

2.1.4. UN Studio

'Coproducing technician, organizer and planner in a highly structured, cooperative process in which clients, investors, users and technical consultants all take part' is taking shape as a new role for the architects. Since as a public scientist, according to Ben Van Berkel and Caroline Bos, "'No longer dependent on the subjective value of 'talent' or the rationality of design choices, the architect coordinates the

different parties who take up different places in the public field and uses specific tactics and techniques to once more take the radical step of offering vision" (Frederic and Marie, 2001). The design procedure of the firm involves through diagrams which are conceptual techniques of virtual organization before they become material technologies of concrete assemblage (Frederic and Marie, 2001). To him computer gives an ideology that is haphazard, intuitive, subjective and not associated with any linear logic; with options that are physical, structural, and probably, even technical.

2.2. BANGLADESH CONTEXT

In Bangladesh, the history of digital architecture is almost two decades old. Nowadays majority of the architectural firms of Bangladesh are inclining towards digital media for design development, digital visualization and presentation for architectural practice. The pioneers are:

2.2.1. CAD Limited
The first AutoCAD (version 1.7) was used in professional work and AutoCAD training by CAD Ltd. in 1986. More than 350 architects, engineers, diploma architects and diploma engineers were trained in AutoCAD from this organization. CAD Ltd. also started 3D modelling with 3D Studio in 1992 by doing the 3D model of SAARC fountain for sculptor Nitun Kundu. Regarding digitalization of architectural practice Architect B. K. S. Inan of CAD Ltd. asserted, "It is a very powerful tool and it is as good as its user." He also added, "Some do it because, others are doing it. Some have to, because everyone else including the client is becoming more and more digitally dependent. But for most, new generation architects prefer digitalization because the concept of 'architectural firm' has shifted from the large office to the 'SOHO' (small office, home office)".

2.2.2. Development Design Consultants Limited (DDC)
DDC started using digital softwares in professional work from 1988. They used CAD and GIS softwares extensively for 'Cyclone Shelter Project', a BUET-DDC joint collaboration project under the leadership of Professor Jamilur Reza Choudhury in 1990. Later this organization laid another milestone in digital architecture by providing all drawings for 'Bangladesh National Building Code (BNBC)' in AutoCAD which was published in 1993 (Bangladesh National Building Code, 1993). From 1992, they were also using ArcGIS and PC Arc/Info for accurate site information and StadPro for structural design. DDC also started using 3D softwares like 3D Studio, 3D Studio Max, graphic/DTP softwares like Corel Draw and image manipulation software like Adobe Photoshop for architectural practice in the early 1990s. According to Architect M. H. Shamim, "The digital perception skills for 3D

modelling, rendering and animations have improved the form-space visualization during design developments. The graphic communication skill through digital media also enhances the presentation techniques and processes in architectural practice" (Figure 1).

Figure 1. 3D Computer model of Extension of Pan Pacific Sonargaon Hotel, at Dhaka, Bangladesh, Consultant: DDC Ltd. 2002.

Figure 2. 3D Computer model of Basundhara City, Mixed use commercial development at Dhaka, Bangladesh, Consultant: Vistaara Architects (Pvt.) Ltd. 1998.

2.2.3. Decode and Latitude 23

Besides serving local clients some firms are doing CAD drafting, 3D modelling, rendering and animation works for international clients as well. 'Decode' started this type of work in 1994 and, in 2004 'Latitude 23' has achieved global reputation.

3. Digitalisation in Architectural Education

Architectural education is facing increasing globalization and specialisation in the design process.

3.1. GLOBAL CONTEXT

The following are some of the leading institutions using digital media in architecture education: Massachusetts Institute of Technology (MIT), Swiss Federal Institute of Technology Zurich (ETH), University of Seattle, University of Hong Kong, Delft University of Technology, University of Cornell, University of Toronto, Technical Research Centre of Finland (VTT).

Collaboration between different universities from remote locations has been established. This idea makes it possible to involve a number of architecture students to work on the same project simultaneously together or individually no matter how distant they physically are.

The 'multiplying time experiment' demonstrated that it is possible to work from a common database, taking advantage of different time zones and special capabilities of particular sites: Seattle provided the site, Hong Kong the first design models, Zurich the modelling program, and Delft special rendering techniques (Gerhard, 1999).

A similar type of practice named Computer Supported Collaborative Work (CSCW) offers the opportunity of working together in spite of being spatially separated. A special kind of CSCW is Computer Supported Collaborative Design where designers work together as an electrically linked team. This is a most attractive addition to working individually. It can foster synergies and lead towards a goal much faster, because the combined knowledge of the partners often leads to a breakthrough.

Based on the internet connectivity and information database, design teaching methodologies are being changed. Since its introdution in 1993, more than 600 students have been introduced with the first digital architecture design course at ETH Zurich named phase (X). It was an excellence in the series of network-based teaching experiments, which expanded the idea of 'paperless studio'. The 'fake.space' on the other hand is a system of nodes and containers of information. The students work in an asynchronous mode and then upload their results in the database, which are then immediately experienced by all other participants. As a sequel to phase (X) the phase (X) 2 was introduced with a different application interface. Replacing the modified AutoCAD, Microstation became the modelling program for phase (X)2, involving the similar designing procedure like composition in the plane, objects in the plane, positive and negative volumes, flow of space and movement, freeform surfaces, structure and cover, design vocabulary, parametric solids, self similar structures and fractals and light and space.

3.2. BANGLADESH CONTEXT

The use of computer-aided design in architectural education commenced in the mid 1990s. The following institutions have incorporated digital media in their curriculum:

3.2.1. Bangladesh University of Engineering & Technology

The undergraduate architecture students of Bangladesh University of Engineering and Technology (BUET) started using digital drafting, 3D modelling and animation in their academic projects from 1994. All these efforts were done in personal interest. In 1994 Architect Nurul Basir first started using digital softwares in his studio projects. Architect Ahmed Riad Momen first used animation with a computer 3D model of his design for an undergraduate thesis project in 1995 at BUET. In the

Figure 3. 3D Computer model of first prize-winning project of Student Design Competition 'Another living Architecture for Dhanmondi in 2020', joint project by Md. Emran Hossain (BUET), Md. Shabab Habib Khan (BUET) and Moniruzzaman Miah (KU), Organized by Alliance Frances, Dhaka, Bangladesh, 2003.

Figure 4. 3D Computer study model of design project 'Dream House' of Studio III, by Tajul Islam Akanda, Department of Architecture, BRAC University, 2003.

next year in 1996 Architect Shaheen Mahmud submitted his undergraduate thesis project's drawings in AutoCAD. Though the initiatives were being taken from 1994, the first CAD course in undergraduate architecture curriculum was introduced in BUET in 1998 with AutoCAD Release 12.

3.2.2. Khulna University (KU), Ahsanullah University of Science & Technology and University of Asia Pacific (UAP)

These universities with undergraduate architecture program have digital drafting and visualization course in curriculum since 1998. Their architecture students are taking the help of AutoCAD, 3D Studio Max, Maya and other graphics software for both design development and presentation purpose (Figure 3).

3.2.3. BRAC University (BU)

From the first intake in 2002, Department of Architecture, BRAC University has provided special attention to this issue by incorporating several digital architecture core courses in its undergraduate curriculum which is more than similar courses in any other school of architecture in the country. The student learns 'CAD: Computer Aided Design' followed by 'Computer Graphics' and finally 'Digital Visualization' (Figure 4).

4. Research Survey on Digitalization in Architectural Practice in Bangladesh

Random selections of architectural firms of Bangladesh were the case studies. These architectural firms use computers for design development and presentation as well as an office management tool. A similar questionnaire (Appendix) was distributed among the firms and necessary information was collected. The objective of this field survey was to get a glimpse of the current situation and prospect of digitalization of architectural firms in Bangladesh. On the basis of this, the information and the remarks made by the architects are compiled in the following diagrams.

It was found that the major reasons for the digitalization of architectural firms in Bangladesh are to provide more versatile design options to save time and to respond to the need of the present time (Figure 5).

Most useful modes of computer use in architectural firms in Bangladesh are key design development tool and key presentation tool (Figure 6). Reasons behind the digital divide in architecture in Bangladesh are lack of skilled manpower and lack of basic necessary trainings (Figure 7).

4.1. USER RESPONSE

At present, most architectural firms in Bangladesh are using AutoCAD, 3D Studio Max, Maya, Corel Draw, Adobe Photoshop, Adobe Illustrator, Adobe Premiere,
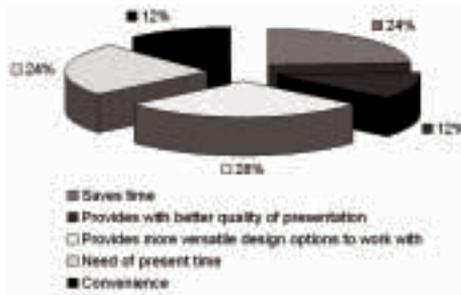
Figure 5. Reason behind the digitalization of architectural firms in Bangladesh.
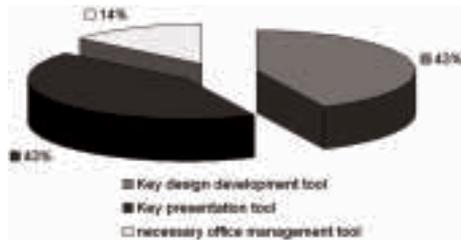

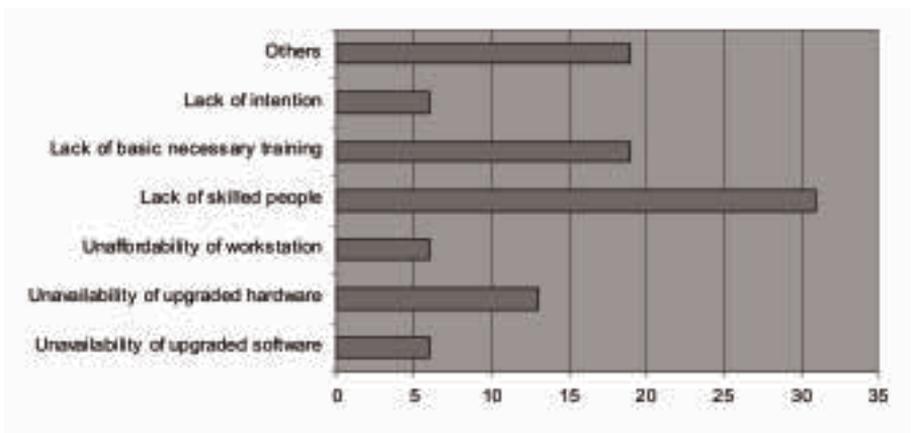*Figure 6.* Mode of computer use in architectural firms in Bangladesh.

Figure 7. Reason behind the digital divide in architecture in Bangladesh.

etc. for their drafting, graphics, image manipulation, 3D modelling, animation and presentation works. Architects' opinions regarding this issue are given below:

4.1.1. Vistaara Architects (Pvt.) Ltd.
Architect Foyez Ullah stated "We can see an intellectual giant leap in this IT age, all over the world, where architecture as a profession in Bangladesh has coped with this advancement of IT sector at an optimized level. The qualitative and quantitative changes in architecture profession in the last decade can be traced easily by analysing through causality inherent in this giant leap. Application of computer based techniques being the 'cause' has been impetus in bringing such change as an 'effect' in our country. Change being both qualitative and quantitative in the profession-facilitated architects to grow in the market exponentially. Computer has given them the efficiency, better productivity and reliability resulting in quantitative growth and virtual reality. Modelling, dynamic sculpting techniques, helping fidelity and stronger relationship between the client and finally result in a quality product of architecture" (Figure 2).

4.1.2. Tanya Karim, Nurur Rahman Khan & Associates
Architect N. R. Khan asserted, "The use of computers has contributed to drafting and presentation in most offices. Clients benefit from this as the offices are now able to make changes in short time or to provide proper visualization. However, I feel the obsession of the 3D Max perspective is in some way having a negative effect on design perception and understanding of form. We are yet to see a positive impact of computers in terms of design development and understanding of design. For example, I strongly believe models are a better way of understanding than simulated perspectives".

4.1.3. Vitti Sthapati Brinda Ltd.
For design development Ar. Ehsan Khan argued, "I don't feel using computer as a design development tool rather the computer is very useful only for drafting, documentation, presentation too".

4.1.4. Metaphor Architects
Architect Mamnoon Murshed Chowdhury emphasised, "It helps to study a wide range of design options before finalising the decisions and producing much more communicative drawings for clients, which obviously has a positive impact on practice of any architectural firm".

4.1.5. Institute of Architects Bangladesh (IAB)
Architect Jalal Ahmad, member professional of IAB mentioned that, "To limit building density and volume in urban growth centres and residential areas, IAB is

studying the concept of allowable Floor Area Ratio (FAR) through computers, a concept widely used all over the world has been proposed for all types and heights of buildings" (Mahtab-uz-Zaman et al., 2004).

5. Conclusion

Within a short span of time the computer has become a widely accepted tool of architectural practice in Bangladesh, both in the design and presentation processes and it is hoped that the computer's introduction into architecture will eventually have far-reaching consequences in the immediate future. After all, the current digital revolution is not just about the computer as a presentation tool but also about its role in the globalization of the design process.

Introduction of computers in architectural firms in Bangladesh presents a wide spectrum of approaches, for the architects who are now allowed to incorporate the techniques into their working methods in a more efficient and exploratory way. Digitalisation of architectural firms is not a movement but a concept that helps connect experts and laypersons on common ground for a better understanding of architecture. Nowadays, the majority of architects of Bangladesh are using contemporary technologies and software for design development, visualization and presentation matching global standards. But whether the quality of the architecture of Bangladesh has developed proportionately is yet to be established.

Digitalisation of architecture might organise and rationalise the gaps, pauses and intervals between pauses in a technologically accelerating world. We are aware of opportunities that exist between and behind design approaches. Instead of trying to take conventional architectural thinking in a different realm, the strategy today should be to connect architecture with different forms of digital media and other disciplines to produce a new hybrid.

Acknowledgements

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Appendix

Questionnaire:
Digitalization in Architectural Practice in Bangladesh

Sample no:
1. Name of the firm:
2. Date of establishment:
3. No. of architects:
4. No. of work stations:
5. No. of other peripherals:
   - ☐ Printer (s):
   - ☐ Plotter (s):
   - ☐ Scanner (s):
   - ☐ Fax modem (s):
6. Use of the workstations:
   - ☐ Architectural design
   - ☐ Urban design
   - ☐ Internet & e-mail
   - ☐ Account
   - ☐ All of them
   - ☐ Structural design
   - ☐ Presentation
   - ☐ Management
   - ☐ Documentation
7. Do you take any help from any graphic production house for presentation?
   - ☐ Yes
   - ☐ No
8. What is the reason behind the digitalization of your firm?
   - ☐ Saves time
   - ☐ Provides better quality of presentation
   - ☐ Provides more versatile design options to work with
   - ☐ Need of the present day
9. From your point of view when does the computer come first?
   - ☐ Key design development tool
   - ☐ Key presentation tool
   - ☐ Necessary office management tool

10. What defers our digital architecture from the Western world?
- ☐ Unavailability of upgraded softwares
- ☐ Unavailability of upgraded hardwares
- ☐ Unaffordability for a workstation
- ☐ Lack of skilled people
- ☐ Lack of basic necessary training
- ☐ Lack of intention

11. Remarks (if any) about digitalization of architectural firms in Bangladesh: