Beyond Mere Representation: The Changing Perspective of Computer Use in American Architecture

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By surveying a total of 55 cutting-edge architectural design offices (mostly in the United States), this paper looks at the use of computational media to get an overall understanding of its current use for architectural design presentation. The intent of this paper is to highlight the changing direction of computer presentation through graphic examples, specifically three-dimensional modelling that goes beyond conventional representation. The paper also illustrates various types of uses of computer media by designers into specific categories, and extracts a summary of hardware and software preferences.

**Keywords:** Digital Media, Design Offices, Non-conventional Representation, 3D modelling

**Introduction**

Although technological changes have arrived within the architectural profession at a slower pace than other fields, the recent use of 3D modelling and multimedia applications portrays significant changes that are occurring currently in the field of architectural visualisation and design representation. Architects and designers have begun to experiment very recently with the digital media that reaches beyond the purpose of mere presentation or documentation in Auto CAD.

Compared to the invention of still photography and its elaboration into the motion picture, architectural drawing formats and conventions have lagged behind. Before the advent of electronic technology, there were no new drawing types since the invention of perspective theory in the Fifteenth Century. The theory of axonometric drawing or parallel projection, another convention of three-dimensional drawing, also dates back to the time period of the Italian Renaissance. If a new approach could be achieved that would bring together all known conventions (plan, elevation-section and 3-D views), architectural drawing would move into a new arena where the comprehensive overview of the design could be as important as its technological base. From the survey of 55 design offices it is apparent that the computer media for representation is being aimed at that direction, by a number of avant-garde design offices.

The selection of the offices in this paper were random and were varied in the size of establishment as well as type of projects. The total of 55 offices include: Architecture Research Office (New York, USA), Arquitectonica (Florida, USA), Office dA (Boston, USA), Ellerbe Becket (Minnesota, USA), Helmut Jahn of Murphy/Jahn (Illinois, USA), Kajima Corporation (Japan), Machado and Silvetti Associates (Massachusetts, USA), Morphosis (California, USA), Eric Owen Moss Architects (California, USA), NBBJ (worldwide), Cesar Pelli & Associates (New York, USA), Perkins & Will (New York, USA), Polshek and Partners Architects (New York, USA), Richard Rauh & Associates (Atlanta, USA), Resolution: 4 Architecture (New York, USA), Bernard Tschumi Architects (New York, USA), Venturi, Scott Brown and
Associates (Philadelphia, USA), and Ken Yeang (Malaysia).

Practice in Context of Education

For any professional field it is important that both the education and the practice complement each other in terms of knowledge dispersion and gaining feedback. At the beginning of computer use in architecture, it was the profession, who took the upperhand and demanded production drawings from new graduates using the new digital media. The feedback from education was subliminal. Practitioners in 1980’s have blamed architecture schools for not preparing new graduates for the new technology, especially CAD. This claim was also reinforced by the American Institute of Architects, the representative body of the profession. That trend has changed during 1990’s. Now fresh graduates bring more diverse and comprehensive computer knowledge than ever before. Many offices now look forward for new graduates to introduce new computer application, rather than using existing ones.

On the other hand the universities have always focused on total learning of computer environment, not just AutoCAD. Most curricula in the United States now emphasise 2D drawing, 3D modelling, desktop, and multimedia and their various use in conceptualisation, as well as representation of design ideas. Software training is not the goal, rather, it is the use, that extends beyond the limit of the design studios. It is not only to learn how to create images, but also how to use them for various purposes, like survey, reports, on-screen presentation, internet submissions and so forth. Between 1992 and 1996 a significant number of schools adopted Form•Z, a new 3D modelling and rendering application designed initially for architects, with the big question that the practising offices at that time were not using Form•Z. Many other schools were hesitant to adopt the application. Today that question does not exist since most avant-garde design offices create their models with Form•Z (including Peter Eisenman, Frank Gehry, Morphosis, and others). It seems that the missing link is disappearing slowly.

Hardware and Software

By reviewing (55 design offices) all the projects featured in the original published book Digital Architecture by McGraw-Hill (Uddin, 1999) by the author of this paper, it is clear that architects and designers are settling down on their choice of software. Although not intended to be a complete list, it can be summarised that the following application programs have become widely accepted for architectural use at present time.

- For production drawing: Auto CAD, (some use of Form•Z, Microstation, MiniCAD, ArchiCAD)
- For modelling and rendering: 3D StudioMax, and Form•Z (some use of Microstation, MiniCAD, ArchiCAD)
- For page layout: QuarkXpress and PageMaker.
- For image manipulation: Adobe Photoshop remains the invariable choice.
- For animation and video editing: Adobe Premiere
- For multimedia authoring and presentation: Adobe Premiere, PowerPoint, and Director have common use

When comes to platform, smaller offices with strong design commitment tend to prefer Macintosh platform, whereas the larger corporate offices are in Windows network. Midsize offices in few cases have both platforms in operation. Use of Zip (as well as Jaz) drives are common to all offices. CD writing capability is also becoming a common feature in most offices.

Primary Use beyond AutoCAD

Architects and designers have begun to experiment very recently with the digital media that reaches
The use of various modes include: conceptualisation, design synthesis, design presentation (2D drawing and 3D modelling and rendering), desktop publishing (brochures and reports), animation (movies, and videos), web-page authoring, multimedia and hypermedia authoring (slide show, interactive presentation, QuickTime VR movies).

According to the types of uses, the work submitted by the designers can be subdivided into:

a) Conceptual Studies
b) Dimensional Orthographics
c) 3D Modelling and Rendering
d) Desktop Publishing Formats
e) Digital Analysis
f) Digital Hybrids, and
g) Digital Multimedia

The examples shown in the next section under the heading Non-conventional Models illustrate a number of design projects that fall into these categories.

**Non-conventional Models**

It should be noted that the drawings in this section are drawn before the construction of a building, or in few cases for unrealised buildings. Such drawings beyond the purpose of mere AutoCAD presentation.
often play an important role in the development of architectural ideas and new movements, and are different from drawings that only document a building. Drawings in this segment of the paper illustrate examples that are non-conventional in nature and explore the digital media beyond typical representation through three-dimensional modelling.

a) Conceptual Studies
Matthew Baran’s (California, USA) conceptual schematic design studies for a School of Architecture was developed simultaneously as a digital presence in the internet and a model for the built environment. The program spaces were represented by various cubic nodes, which would dock in a logical relation to one another (figure 1).

The images by Architecture Research Office (New York, USA) for the Sunshine Messa House in Colorado take advantage of computer modelling to analyse the context of the vast site and the designed building. The relationship between long distance and near views specific to each room of the house was studied in 3D model environment to adjust window and mullion sizes and their appropriate location (figure 2).

Conceptual recording of random reality and imagination in 3D computer model by Morphosis (California, USA) represents embryonic grammar of form (figure 3).

b) Dimensional Orthographics
Richard Jensen’s (Syracuse, New York, USA) site and floor plans illustrate digital integration of technical line drawing and pictorial image of colourful landscape. The integration takes into account combining raster and vector imaging (figure 4).

c) 3D Modelling and Rendering
The 3D model by Scott Howe illustrates a multi-purpose commercial off-road vehicle conceived as a modular design consisting of a tractor or power plant and a plug-on special function module that can have various functions. Each element of the design moves and transforms to create a new function (figure 5).
The image for Oklahoma Civic Center Music Hall by Polshek and Partners (New York, USA) illustrates a powerful exploded cut-away perspective emphasising constituent components and floor plan footprint within a 3D modelling environment (figure 6).

Kiss + Cathcart’s (New York, USA) complex curving shape comprised of over 1200 glass and photovoltaic modules most of which are different sizes and shapes for the Hamburg’s Electrical Utility takes advantage of computer modelling and rendering for appropriate simulation (figure 7).

On the other hand ecology is the primary concern for Ken Yeang’s (Malaysia) modelled environment. The project for Continuous Vertical Park and Expo 2005 Tower by Ken Yeang explores and brings together ecological concerns and bioclimatic approach to the design of tall buildings (figure 8).

d) Desktop Publishing Formats

Resolution 4 Architecture’s professionally printed postcards for each project (after its completion) using desktop publishing application is intended for distribution to clients and Colleagues (figure 9).

NBBJ’s large format poster for the Mok Dong Entertainment Complex in Seoul, Korea was produced to market and showcase firm’s services as a travelling display (figure 10).

e) Digital Analysis

Zareen Rahman’s (Sheffield, UK) study of three-dimensional ‘sight-lines’ in a site plan represents a series of vertical layers of “force plane” rendered in progressive luminosity and translucency that intends to produce a lucid and cogent spatial analysis for an urban project. Through the mode of translucency hidden patterns could emerge and be read in parallel with the existing site fabric (figure 11).

Rogers Marvel Architects’ (New York, USA) 3D model for reconstruction of Pratt Institute School of Architecture combines abstraction and colour rendering in a schematic manner to emphasise certain aspects of renovation work (figure 12).
f) Digital Hybrids
Eric Owen Moss’s (California, USA) digitally stitched photo montage for Pittard Sullivan Office Building unfolds a space that is impossible to document or record in conventional photograph (figure 13).
This hybrid image by Voorsanger successfully integrates the exterior photographic environment and a 3D computer modelled interior environment to create a simulated combined environment that takes into account of building orientation, time of year and hour of day (figure 14).

g) Digital Multimedia
Capabilities of changing physical parameters in an animation is illustrated by author with the technique of separating the basic constituent components from the total mass of Le Corbusier’s Parliament Building in Chandigarh, India (left frames). The middle frames from an animation sequence produced by Arquitectonica (Miami, USA) incorporates the techniques of special effects including morph through video editing to illustrate the building growing out of a comet. The third strip by Arquitectonica illustrates digital “fly-over” sequence for Miami International Airport Terminal (figure 15).

Besides these examples, it is noticed that several architectural offices have taken the computational media beyond the traditional purpose as design and drawing tool, and expanded this media for physical construction, which is the final product of all design efforts.
For Office dA (Boston, USA), the digital media has permitted its designers an unquestionable fluidity between the process of conceiving, drawing, and manufacturing that was virtually unprecedented. For the “Fabrications” project at the Museum of Modern Art, Office dA has constructed a folded plate structure using a technology that had never been attempted at that scale or level of complexity with digital computation and laser cutting (figure 16).

Exploration with 3D technology at NBBJ (worldwide) is not just limited to 3D electronic data. For design studies, design team(s) extract 3D electronic data from the computer and use this data on various manufacturing tools to build 3D physical models that are more tactile and can physically relate the objects’ scale. Whether it is laser cutting Plexiglas and wood or the use of SLA (Stereo-Lithography) polymer resins to create a physical model, the design team(s) now have an increasing palette and resourceful tool combinations. Consequently, the two design methods (virtual and physical) complement and inform each other throughout the design process (figure 17).
Conclusions

There is no debate whether the computer technology is a positive or negative influence in the design process of architecture. That was an issue when AutoCAD was the only mode of adaptation of computers in architecture. By reviewing these examples it is clear that the computer use in profession now has expanded its boundaries to include various modes of operation beyond typical production drawings. The professionals views towards the media is no more as rigid as it used to be. The missing links are slowly filling-in. Education and Profession both are now receiving feedback from each other without being involved in blaming. These examples in this paper as well as in the extended version as a published book speak to the power of the digital media and its changing direction that is too significant to be ignored. Elaboration of the issues discussed in this paper and details of computational involvement by professionals can be found in the book “Digital Architecture” (Uddin, 1999) published by McGraw-Hill.

References

M. S. Uddin, Hybrid Drawing Techniques by Contemporary Architects and Designers (John Wiley, New York, 1999)

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