Pixel Points

Bharat Dave
The University of Melbourne

1. Introduction

The increasing adoption of digital media in design education also leads to subtle changes in design objectives, means, and outcomes in that process. Such changes are due to the peculiar nature of digital representations and operations that allow us to manipulate representations. With only a few decades of collective developments and experiences in digitally supported design education, it is not surprising that we still frame and reflect on these changes in only a provisional fashion.

The rapid pace of developments in digital technologies and new experimentation they afford in design conception engender a context in which provisional explorations supplant sustained theoretical reflections. We are too intimately close to evolving digital technologies and that makes it difficult to select vantage points from which to better articulate development of a new expressive and communicative medium and to understand its ramifications. In such a climate, design educators stand on shifting grounds. Caught among design discourse, development of new digital tools, and cultivating design sensibilities among students, design educators have responded with multiple possibilities to incorporate digital media in design education.

In our work, focus of such programs has been to balance a need for imparting skills in digital media while sustaining an engagement with design issues. Based on our teaching experiments using digital media over the years, a new design sensibility appears to emerge in student work and can be characterized through *ways of designing, that which is designed,* and *ways designs are communicated.* In order to integrate such conceptual shifts in design education, we draw partially upon studies in traditional representations, media and architectural design that trace lineage of contemporary western architectural educational pedagogies to the earlier ones, to Bauhaus, Beaux-Arts and the master-apprentice systems in antiquity. However, we also recognize that digital media are fundamentally different from traditional ones and call for new pedagogical strategies that in various guises complement, substitute or completely displace traditional modes of design exploration, development, documentation and communication.

Digital media as mediators between imagination and its expression are fundamentally different in two regards. First, digital representations possess a computable structure, even if it is used only for information display. This is unlike traditional media in which the structure of representation is in the mind of the beholder. Second, the underlying structure of digital representations can only be manipulated using a repertoire of operations in a specific sequence. This too is unlike working in traditional media wherein order of design operations is largely free of such considerations. These two major characteristics of digital media, in turn, foster changes in both ways of designing and that which is designed. The added dimensionalities of representations in different media types and their temporality are quite unlike what we are used to with traditional media. The temporal dimension of new media changes how design ideas are explored and communicated.

2. Digital media in design education

How do we embrace these possibilities as part of broader curriculum framework in architectural design? For us, it is important not to privilege or castigate use of digital media at the expense of all the other cognate studies that students undertake. Neither should such studies become isolated and studied as an end in itself. These commitments have led us to evolve a series of subjects in which digital media play a central role with progressively expanding ambitions. Students progress from developing a facility for conceptualizing and working with three-dimensional representations, to incorporation of interactive digital media, to an intensive design development project using digital media. In the initial

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phases of this progression, skill acquisition in the use of digital media alternates with exploration of a set of design issues, and finally design conception dominates relying upon *any appropriate combination of media and representations* including traditional and digital ones. The structure and key exercises for three such subjects are described next.

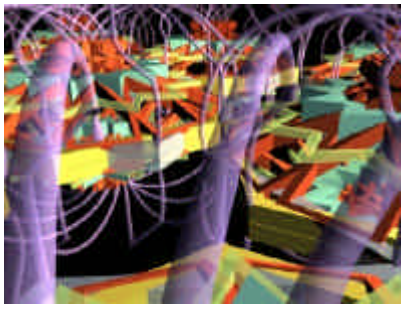
Digital Visualisation

The subject revolves around visualisation concepts including rendering, light, and motion to explore and communicate design intentions. The objectives of the subject are to go beyond acquisition of technical abilities alone to cultivate and situate visualisation as part of creative design operations. The sequence of design exercises is as follows.

- ***Geometric composition*** involves systematic application of geometric operations to develop three dimensional frieze comprising geometric primitives, and shape editing and transformation operations. This assignment provides an opportunity to explore different ways of creating and assembling geometric compositions that are difficult to explore using standard 2D projections.

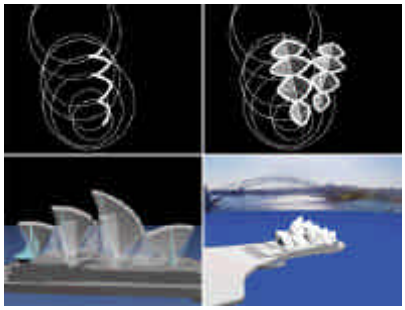
- ***Spatial composition and motion*** revolves around a given three dimensional context to study and assign cameras, lights and materials to develop two or more different spatial experiences without changing the scene geometry. The objective of exercise is to exploit light, materials and viewpoints as important parameters in spatial design.

- ***Compositional analysis*** requires analysis and communication of exemplar design projects to explicate underlying generative or organisational principles, e.g., configurations of planes or volumes, proportioning systems, structural elements and systems, use of light, materials, colors, etc. On the one hand, this final project reinforces the notion that visualisation techniques are valuable for exploring design as a purposeful process and not only for presentation at the end of that process. On the other hand, the project affords an opportunity to synthesize studies in visualisation, history and theory of architecture.



Geometric composition
(Sze Yee Evelyn Chin)

Spatial motion animation
(Yu-Sheng Chiu)



Compositional analysis
animation (Matthew Soulsby)

Figure 1. Digital Visualisation – student projects

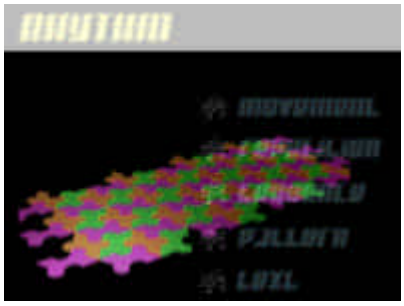
Digital Speculations

The subject is aimed at developing a critical understanding of interactive digital media and their potential for imaginative design explorations. The subject revolves around thematic discussions that become more concrete in the form of three speculative assignments. The speculations are structured so that students, on the one hand, get exposed to new possibilities for design exploration and learn to develop a critical and reflective attitude. On the other hand, students also learn to explore and use new media authoring tools. The content of speculations is consciously designed not to faithfully build or rely upon traditional architectural or spatial expressions. In fact, students are encouraged to reassess their pre-conceived notions by way of being critical and reflective in all the speculations.

- ***Critical analysis*** requires students to critically analyse and review an interactive project from a number of external sources. The student reviews focus on both the content and form of the original interactive project. The reviews analyse and reflect the efficacy of media types, their structure and presentation in the interactive project. In a sense, this speculation exposes students to a palette of interactive media from which they can draw upon in subsequent speculations.

- ***Experimental project*** is concerned with exercising the vocabulary of interactive media elements through a selected theme. Over the years, some of the themes explored in this project have ranged from representation of tangible and ephemeral places (e.g. war memorial, train station) to abstract concepts like rhythm, contrast, pattern, proportion, symmetry, etc. The emphasis of the speculation is on evocation of a selected context or abstract concept and not literal replication of traditional representations. In other words, students are encouraged to express a selected place or concept using interactive media in ways that cannot be done or may be difficult to do using traditional media and representations.

- ***Creative expression*** offers an opportunity for students to bring their creative imagination and technical competence together in the form of a major interactive project. Students are asked to select a 'text' as a reference (e.g. Walled City by Gibson, color music) and render it as an interactive multimedia project. The emphasis of speculation is on interpretive dimensions of the project and not on simply reconstructing or reproducing the original text into another form.



Rhythm: experimental project
(Andrew Hayne)

Illustrated Man: final project
(Cameron Lacy)

Desert Swamp: final project
(Gemma Cooke)

Figure 2. Digital Speculations – student projects

Design Investigation Studio

In the final year of architecture, a thematic studio is offered for those interested in design and digital media issues. The first semester is dedicated to research investigation into nominated theme, followed by detailed design development in the second semester. The contents and quality of student projects are expected to emphasise design competence, proficiency in the use of digital media alone is not considered sufficient. Over the last few years, this studio has explored the following themes.

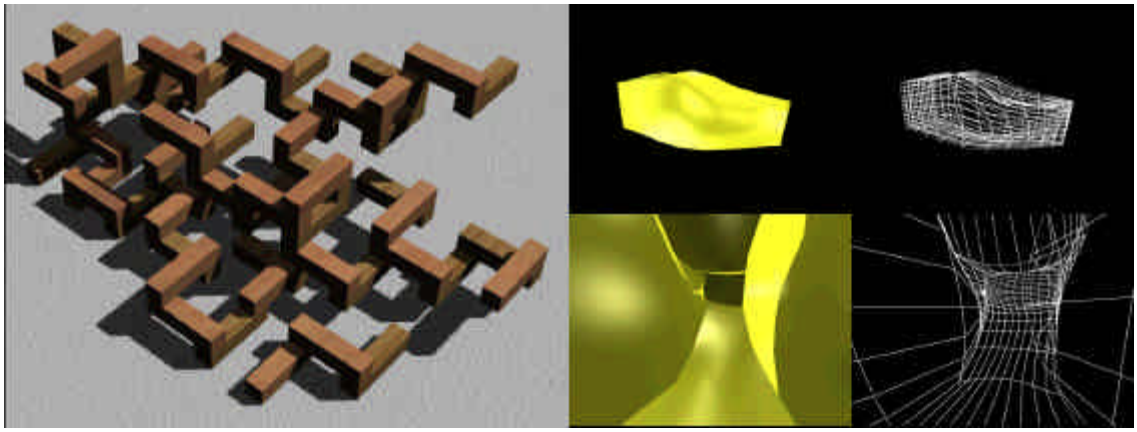
- **Highrise design / Delirious Melbourne-Toronto** revolved around exploration of relationship between digital representations and production of architectural form, and to bring these explorations to bear on the problem of making architecture in the contemporary context of globalization through an online digital charrette with the University of Toronto.

- **Parametric design and rule-base systems** involved systematic and disciplined exploration of design propositions based on a selected topic in design computation including shape grammars, fractals, cellular automata and evolutionary systems, rule based systems, typological and parametric variations.

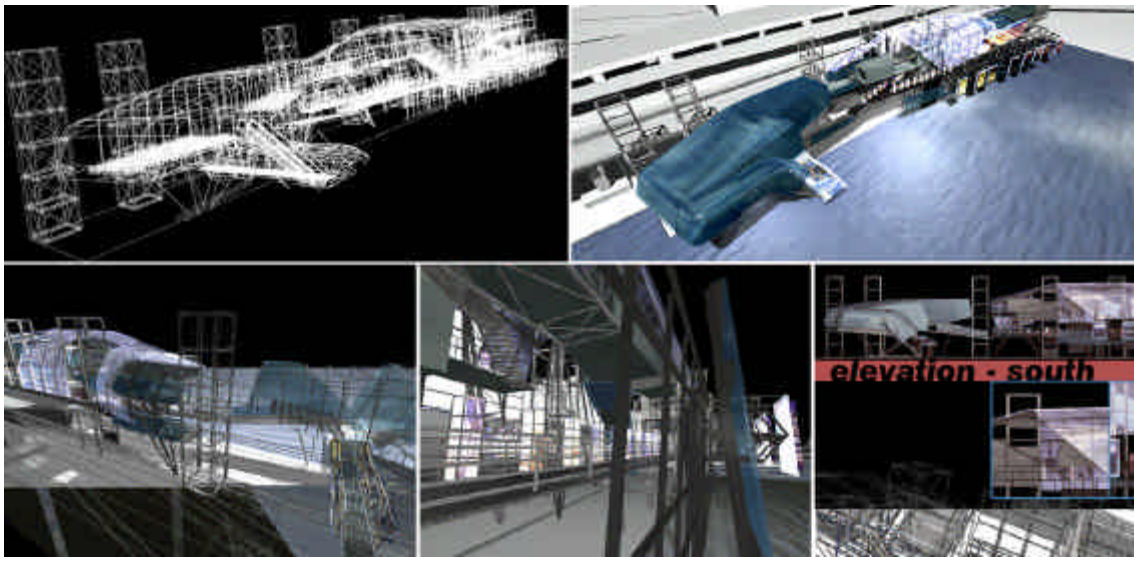
- **Between Stasis and Morphosis** explored notions of materiality and spatial reconfiguration in architectural compositions through the following issues. Stasis, *firmitas*, accretion of collective memories and significance attached to them in one form of another are considered inevitable consequences of materiality in architecture. What if those conditions were not inevitable? What becomes of the very role of architecture?

- **Marking Space** involved readings and projects to gain insight into the power of representations and the way they shape and, in turn, are shaped by discourses that develop around them. The objective was to critically devise and use appropriate representations for descriptive, analytical, predictive, generative or conceptual explorations in design.

- **Light :: Architecture** explored natural and artificial light in architecture. The emphasis was on understanding and experimenting with the use of light as generator of ever changing spatial experiences. The studio required use of mixed (traditional and digital) media and representations.



Syntactic compositions (Andrew Hayne) – Investigation project



Melbourne mediathek (Eugene Cheah) – final year design project

Figure 3. Design Investigation Studio projects

3. Discussion

The above examples illustrate just one set of possibilities for integrating digital media and design issues in teaching, many other possibilities are documented in the literature (e.g. many papers that have appeared in CAADRIA, ACADIA, ECAADE and other similar conferences). The following remarks draw upon our experiences and encapsulate how digital media tend to impact upon pedagogical issues in design education.

Tactile and procedural dexterity: The tactile dexterity one develops while working in traditional media is replaced by a procedural one while using digital media. The loss of tactility of media is accompanied by increase in the use of procedural abstractions of design operations. The immediate effect on design students using digital media appear to be a slow, unintentional dissolution of materiality that occasionally filters through in their design projects.

Alternating between representations and procedures: A degree of fluidity between imagination and externalised representations while working in traditional media often becomes hesitant and broken in case of digital media environments. The necessity of conceptualising intentions into procedural actions prior to generating representations in digital media gives rise to design process that continually alternates between representations and procedures.

Procedural directionality: Digital representations and their manipulations demand a certain ordering of actions. The enforced directionality of procedures is hard to break through unless one is equipped with very privileged knowledge (i.e. access to internal representations and programming expertise and even then it may not be possible). For these reasons, many student projects harbor a linear unfolding of design ideas unbeknown to them.

Articulation of forms: The underlying representational structure in digital media significantly affects how forms are explored and articulated in design. As geometric representations underlying current software become more sophisticated, we witness parallel shifts in design expressions that range from flat planes, to punctuated solids, to skins that act as surfaces at one time and as containers of solid materials at another time. The formal complexity of design compositions has increased in student projects over the years.

Procedural distancing: Although digital media afford greater degrees of accuracy, realism and predictive power in design, they also foster a certain amount of distancing from the very act of conscious and constructive design process. The intentional, in-process design exploration turns into procedural trial and error that may fail to encourage a sense of engagement with designed artifacts similar to what are claimed while working in traditional media.

Design outcomes*:* The subtle changes in ways of designing introduced by digital media make an imprint on the final design outcomes. The architecture of digital imagination is enigmatic as it harbors many dichotomies. Although it exhibits a degree of immateriality and impermanence it also appears too definitive. In the hands of some design students, architecture that emerges is not one of careful, crafting of forms but one that originates from mediation through procedures. In such cases, the genesis of an idea is inscrutably concealed in the procedures; one in which visible forms are only fragments through which one grasps the underlying computational procedures.

Screen as frame: Traditionally communication of design takes place through a number of representations such as drawings, models, montages, etc. A distance exists between the observer and that which represents an architectural idea. A frame, if one exists, is porous. In case of digital media, a computer screen or its projection almost always frames representations. A frame both reveals and hides information; there is an implicit selectivity that is further accentuated by viewpoint transforms in modeling software.

Representational opacity: Digital representations comprise overlapping layers of information. What is rendered visible and accessible is a function of communicative objectives, display surface and scale at which information is still understandable. Unlike traditional media in which multiple, interrelated representations are made available simultaneously, digital media support communication on demand at the cost of often not supporting simultaneity of experience.

Temporality: Unlike discrete slices of time encoded in traditional representations, digital media make it possible to communicate information as a succession of moments. Communication of design information can occur in a temporal dimension that is elastic. While temporal dimension of digital media is quite often celebrated it may also happen that the observer's gaze has little freedom in choosing where and when it can focus or linger on.

Ideational representations: Rooted in procedural unfolding, digital representations do not exhibit the same suggestive qualities that arise from a lack of details one finds in traditional media. A sense of finality pervades in which communication is definitive, leaving little room for inviting an observer to fill in the missing bits. The lack of ideational representations especially in communication of design information may invite premature judgments about spatial qualities.

4. Summary

The changes introduced by digital media in architectural design point towards a fundamental shift in not only design processes but also the products of design and their communication. The preceding discussion described our ongoing experiments in developing an appropriate role for digital media in design education as part of a broader framework of architectural education. Based on our teaching experiences, the discussion also offered salient attributes of what we consider as both promising and problematic aspects of digital media in design education. The changes resulting from the use of digital media in design put educators, researchers and theoreticians at a critical juncture in that these changes can be recognised only by engaging with digital media and then standing at a reflective distance from resulting products in a continuous process of reassessment and re-engagement with digital media in architectural design education.

Subject websites

- Digital Visualisation (http://webraft.its.unimelb.edu.au/702347/pub/)
- Digital Speculations (http://webraft.its.unimelb.edu.au/702402/pub/)
- Design Studio 5
    - Light (http://webraft.its.unimelb.edu.au/702574/pub/light.htm)
    - Marking Space (http://www.arbld.unimelb.edu.au/~bdave/ABP/di02/)
    - Stasis and Morphosis (http://www.arbld.unimelb.edu.au/~bdave/ABP/di01/1-cont.shtml)
    - Intersections (http://www.arbld.unimelb.edu.au/~bdave/ABP/di00/index.shtml)
    - Melbourne/Toronto (http://www.arbld.unimelb.edu.au/~bdave/ABP/design5-98/)