ARCHITECTURE OF DIGITAL IMAGINATION

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Abstract. Digital technologies extend, displace or substitute entirely new elements into what has been observed so far in the traditional modes of conception, representation and communication of design. This paper examines various characteristics of digital media and representations, their impacts-constraining and liberating- on modes of conception in design, and possible shifts in design expressions and ways of designing. While much effort invested in research to date has relied upon architecture as conceived, taught and communicated in traditional modes, the use of digital technologies changes those very premises. The import of such characterisation for design computation research is to highlight emerging agendas for future investigation.

1. Introduction

As evidenced in the recent literature on design computation, digital technologies continue to be appropriated in pedagogical contexts in many different ways. Some of those accounts of design activity also suggest subtle changes in the objectives, means, and outcomes that may be attributed to digital media. The changes arise from peculiar nature of digital representations and operations to manipulate those. Our experiences in teaching advanced modeling, interactive media, and design studios, lead us to characterise such changes as one or more of the following: *in ways of designing, that which is designed, and ways designs are communicated*. This paper discusses specific changes arising from the use of digital technologies in design process.

An underlying motivation for the paper is to render visible relationships between conception of design and their expression using digital technologies. Our work benefits from similar studies in traditional media and representations. Critical history of architectural representation has evolved into a distinct scholarship over the last four decades. This line of inquiry has resulted in many

early classics (Gombrich, 1960; Arnheim, 1970), continuing with the more recent ones (McCullough, 1996; Perez-Gomez and Pelletier, 1997). A common thread among many scholarly works is to investigate how representations and design conception are intimately tied together. Similar questions about other expressive disciplines and their transformations due to digital technologies have recently engaged commentators (Murray, 1997; Wertheim, 1999).

Digital technologies introduce a fresh set of concerns into investigations of design activity. Due to their special characteristics, digital representations extend, displace or substitute entirely new elements into what has been observed so far in the interplay between non-digital representations and modes of conception in design. This paper examines various characteristics of digital media and representations, their impacts- constraining and liberating- on modes of conception in design, and possible shifts in design expressions and theoretical discourses on designs and designing.

1.1 MEDIA, REPRESENTATIONS AND TOOLS

In this paper, the words such as media, representations and tools are used with specific connotations. We are interested here in design descriptions that act as surrogates for the real architecture. Those descriptions are traditionally marked or recorded on a *medium*, e.g. stone, paper, photograph. The structure of marks in various media follows certain conventions that, in turn, allow meaningful communication and additional inferences. Sketches, scaled projections, etc. thus constitute *representations* that may be generated using some procedures. To exercise such procedures and register representational marks on a medium, a wide variety of *tools* are employed, e.g. rule, compass, etc. It should also be clear that words such as media, representations and tools acquire specific meanings in the context of their use (and which gives rise to ambiguities).

2. Stepping into the Morphland

Architectural literature typically focuses on personalities, retrospective accounts of designs, or espoused ways of designing. Studies into particular ways of seeing, projecting design intentions and how they are intertwined are recent phenomena in literature. A curious gap in this discourse is scant reference to the material context of designing- how different media, representations and tools encourage particular design sensibilities. It can be explained partly by the fact that contemporary role of design descriptions as the prime vehicles for design development, documentation and communication came about some time during the Renaissance (Cable, 1983) in the western architectural tradition. However, the nature of different tools and media of design did not change as much as representations that enabled qualitatively different inferences (Panofsky, 1919)

and also supported the increasing coordination and communication among a professionalising community.

The introduction of digital technologies in design marks a fundamental shift in the nature of media, representations and tools of design. First, digital representations possess a computable structure, even if it is used only for 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. Third, different digital media types, e.g. static and dynamic graphic, text, and audio fuse into a synthetic form that is hard, if not impossible, to achieve using traditional media. Although these properties of digital technologies are well-discussed by now, the impacts they have on design process, products of design and how designs are communicated are only now being reflected upon and digested.

3. Architecture of Digital Imagination

In the contemporary climate, design educators stand on shifting grounds. Caught between design discourse, development of new digital tools, and cultivating design sensibilities among students, design educators need to devise pedagogical frameworks that incorporate digital media in design education while being conscious of the fact that such frameworks do not rest upon extended historical traditions. In our work, the focus of design curricula supported by digital media is to balance the need for imparting digital skills with sustaining an engagement with design issues. Based on our teaching experiments using digital media over the years, we notice substantive changes in design conception arising from the use of digital technologies as changes *in ways of designing, that which is designed, and ways designs are communicated*. Why do such changes come about? How can changes be recognised? How can they be articulated? The following is one attempt at characterising these changes if not responses to some of the questions raised.

Tactile and procedural dexterity: The tactile dexterity one develops while working in traditional media is replaced by a procedural one in digital media. The loss of tactility of media is accompanied by procedural abstractions of design operations. Different software programs inculcate such procedural abstractions through underlying digital representations, operations supported and ways of accessing both representations and operations. Similar in some ways to how architects in antiquity delineated their designs through words and not through drawings (Hewitt, 1985), contemporary designers use procedures to mediate between their imagination and externalised digital representations (Figure 1).
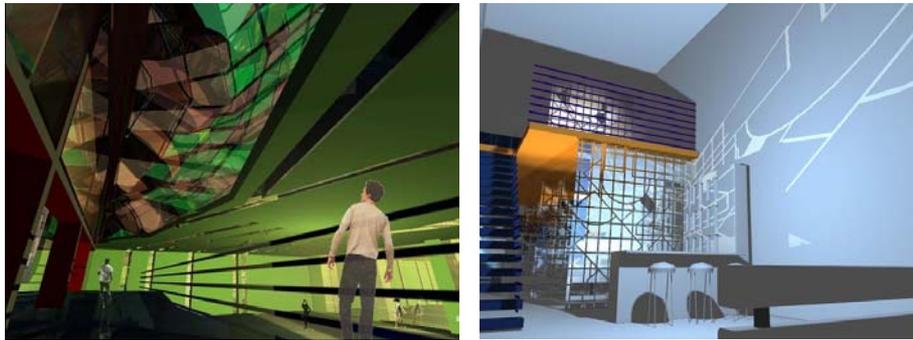
Figure 1. Procedural dexterity: use of light and transparency as design generators
(Student: Stephanie Phan).

The direct physicality of representations is subsumed by symbolic choices that bring representations into being. This additional layering between designers and design artifacts continues perhaps the tendencies noted by Alexander (1964) that design process continues to evolve from unselfconscious to conscious and formal traditions. The immediate effect on design students using digital media appears to be a slow, unintentional dissolution of materiality in their design projects.

Alternating between representations and procedures: A degree of fluidity one maintains between imagination and externalised representations while working in traditional media often becomes hesitant and broken in case of digital 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 (Figure 2). Sometimes it leads to accidental discoveries, at other
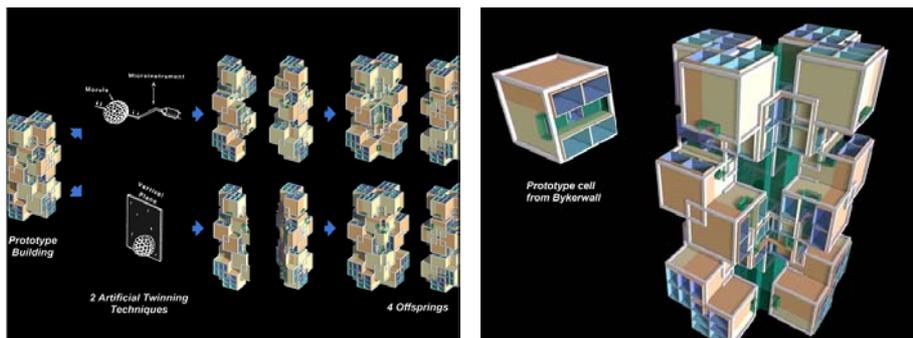

Figure 2. Procedures encapsulating generative possibilities
(Student: Danny Liong).

times to disastrous blind alleys in which design intentions are lost forever. Those students who are adept at composing and recomposing available procedures into innovative possibilities usually manage this oscillation between representations and procedures in a more productive fashion than others do.

Procedural directionality: Digital representations and their manipulations demand a certain ordering of actions. Every choice one makes circumscribes some other choices, and there usually is no escape into alternate worlds of choices. 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 (Figure 3). Such representational or procedural limitations if conceived or accepted intentionally can well be productive devices, e.g. shape grammars encapsulate these issues vividly to better understand families of choices in design and their underlying motivations be they formal, cultural, technological or others.
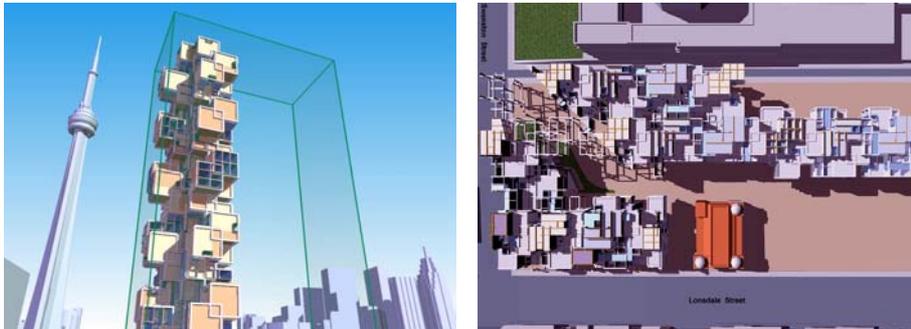

Figure 3. Procedural directionality: design reflects underlying generative procedures (Student: Danny Liong).

Articulation of forms: The underlying representational structure in digital media significantly affects how forms are explored and articulated in design. As geometric representations underlying many current software have become more sophisticated, we have witnessed parallel shifts in design expressions that moved 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 (Figure 4). At the same time, articulation of forms appears to a large extent as an articulation of choices about material surfaces and textures and not the substance of materials themselves. The procedural dexterity mentioned above has not yet extended to formal richness- whether it simply reflects current

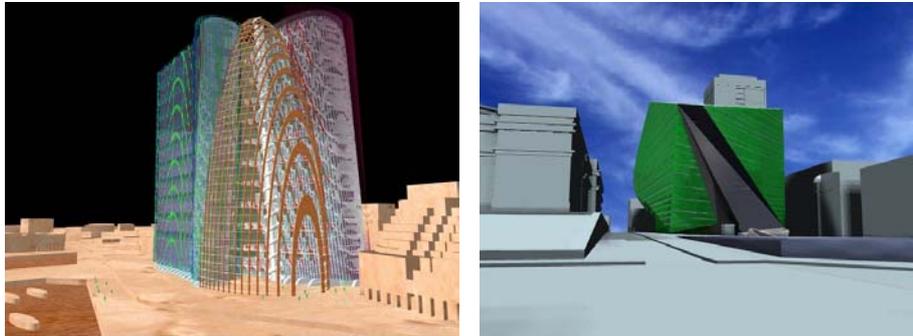architectural dilemmas or derives from the expressive poverty of digital media remains to be investigated.

Figure 4. New languages of forms:
articulation of skin for a high-rise apartment (left- Student: Dierijk Drent),
a non-planar volume that twists in space (right, student: Ray Marshall)

Procedural distancing: While digital technologies afford greater degrees of accuracy, realism and predictive power in design, they also foster a certain amount of distancing from the very act of a conscious and constructive design process. A remark of a colleague about how one not only draws a perspective but mentally constructs the whole edifice and thereby internalises both design and its realisation are lost by procedural distancing. The intentional, in-process design exploration turns into procedural trial and error that may fail to encourage a sense of engagement with designed artifacts.
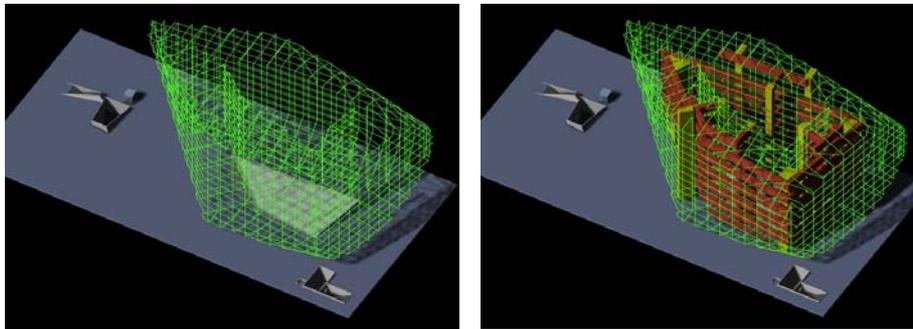

Figure 5. Procedural distancing: fabrication of a non-planar volume as geometry,
material considerations surfaced much later in design (Student: Ray Marshall)

Screen as frame: Traditionally communication of design takes place through a number of representations such as drawings, models, montages, etc. A distance exists between an observer and that which represents an architectural idea. In case of digital media, a computer screen or its projection both reveals and hides information; there is an implicit selectivity that is further accentuated by viewpoint transforms that are embedded in modeling software (Figure 6). These are mathematical constructs that may not have one-to-one correspondence with natural human vision. Further, the space contained within frame is different from space without. Many projects that are conceived using screen as frame translate poorly in media that do not have similar containment of space or gaze.
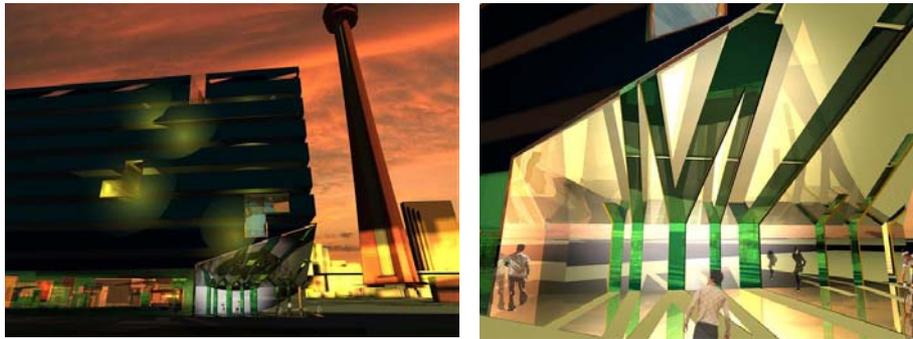

Figure 6. Framing insights: exaggerated views
(Student: Stephanie Phan).

Representational opacity: Digital representations comprise overlapping layers of information. The only way to access this complexity is to step through the screen into the digital landscape. From a distance, digital representations are as opaque as traditional media. And yet communication of digital products requires a special effort, distinct in form and content from traditional media. What is rendered visible and accessible is a function of communicative objectives, display surface and scale at which information is
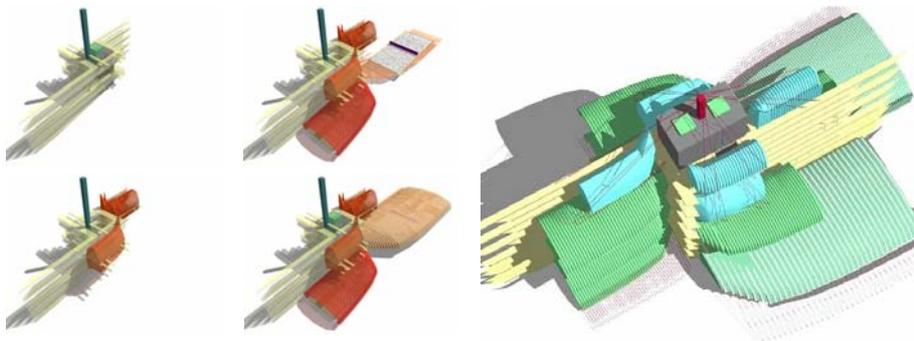

Figure 7. Representational opacity: design by accretion over time
(Student: Lucy Knox-Knight).

 understandable (Figure 7). Unlike traditional media in which multiple, interrelated representations are available simultaneously, digital media offer communication on demand at the cost of often not supporting simultaneity of experience.

Temporality: Unlike 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. Temporality used properly in design communication can reveal aspects of design that would be hard to represent in traditional media. At the same time, it may introduce an artificial pace of time that is truly disconnected from our routine experiences.

Experientiality: Similar to the benefits of a temporal dimension of digital media, one also obtains new possibilities for sensory experiences with digital technologies. Scaled representations are no longer limited to that which is visible or can be grasped with senses. Instead that which may not be normally accessible and cannot be directly experienced can be made accessible in digital media. Additionally, different media types can be combined to render a much richer experiential representation of designs.

Ideational representations: Rooted in procedural unfolding, digital representations do not exhibit the same suggestive qualities that arise from an absence of details one finds in traditional media (Figure 8). 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 also invites premature judgements about spatial qualities.
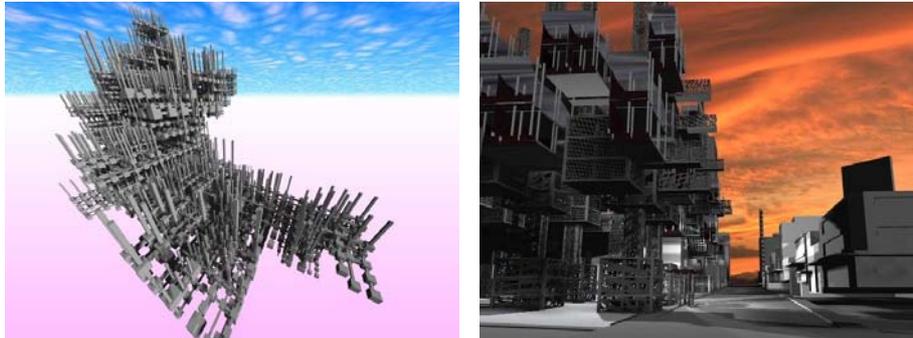

Figure 8. Ideational representations: schematic sketch, left, for a finished proposal, right (Student: Grant Cook).

4. Summary

The subtle changes in the design process informed and aided by digital technologies leave 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. The ephemerality of appearance is reinforced by virtual dust that even on the sharpest screens does not completely coalesce into opacity of traditional media. The luminous nature of computer screens lends a degree of transparency to even the densest materials and textures. The collapse of time and space permitted by digital media transform architecture from stable, relatively permanent artifacts into temporary figments that can be summoned to appear and disappear at will. 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. It is also an architecture of body moving through space but one that carries a frame through which architecture is appreciated. There is an emphasis on visual and aural dimensions that unfold in time. Traditional architectural representations as encoders of an unambiguous moment in time give way to architecture that can only be appreciated as succession of moments.

The extent to which digital technologies may be attributed a defining role in new design expressions has already been noted in literature. If new forms can only be represented using new geometries and they can only be realised as spatial configurations using computational means, the significance of digital media in fostering new languages of design needs little further substantiation. The preceding characterisation although sketchy and incomplete nevertheless serves to provide useful beginnings for critically recognising the changes in design education and discourse that accompany the use of digital technologies. Their recognition also opens up a possibility for consciously embracing those changes in purposeful and productive ways. The import of such characterisation for those engaged in design computation research may be to recognise emerging shifts and reassess research agendas. While much effort invested in research to date has relied upon architecture as conceived, taught, communicated and debated using traditional media and representations, the introduction of digital technologies in design calls into question many assumptions underlying such research and pedagogical premises.

Acknowledgments

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