BIM AND INTEGRATED PRACTICE AS PROVOCATEURS OF DESIGN EDUCATION

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Abstract. Building Information Modeling (BIM) obfuscates the role of composition, scale and abstraction by displacing the primacy of abstract conventions of representation with a methodology based on simulation. BIM subverts, while simultaneously clarifying, the holistic relationships of the parts to the whole in the architectural design of form and space. Architectural design education has great opportunity and risk in how it comes to terms with re-conceptualizing design education pedagogy as the profession struggles to redefine the media and methods of architectural deliverables in the age of BIM. The paper examines the foundation issues proposed by *Integrated Practice.* The paper questions how BIM and modeled simulation of architectural assemblage might transcend current definitions of convention in design and construction representation. This paper explores how the academy might prepare students of architecture for a digital practice that focuses on the virtual building model and database management. BIM and *Integrated Practice* viewed as provocateurs of design education provide great potential for critical analysis of how architectural design is taught. The associated pedagogies are transforming the way in which architectural education engages issues of design and representation and creates opportunities to question the roles and rules of traditional conventions. The paper seeks to engage issues of design specificity and ambiguity related to the assets and liabilities of digital modeling as the primary means of design and representation that BIM represents.

1. Introduction

"How can teaching proceed within a framework that demands its own subversion?."
-Marc Angélil, Inchoate (2004)

Building Information Modeling (BIM) and the emerging vision for *Integrated Practice* (Strong, 2006) provide potential to fundamentally transform the way in which architectural education engages issues of design and representation and suggest opportunities to question the roles and rules of traditional architectural conventions of visual communication. The conceptual and practical advantages and consequences of BIM provide a unique catalyst for a critical analysis of architectural design and design

process and how they are fundamentally conceived and taught. Focused on the virtual building model simulation as the primary means of communication and representation in the emerging concept of *Integrated Practice*, architectural educators must take pause to critically engage and conceive outcome driven educational models. Pedagogical positions must be evaluated relative to the conceptual shift away from abstraction as the *modus operandi* embedded in current models of education revealed in the primacy of the traditional projected conventions of plan, section, and elevation. The foundation issues, conventions and fundamental pedagogies of architectural education all need to be reconceived.

The consequences of digitally driven processes and thinking on architectural education will be profound. The underlying premise for design processes, fabrication and construction will increasingly challenge the historic relationships between architecture and its means of production (Kolarevic, 2003) leading to new demands of the profession on education to adapt and prepare students for digitally enabled *Integrated Practice*. Academia must completely revisit the curricula and imagine a system that acknowledges the obsolescence of the how and what of that which is taught in today's schools of architecture. BIM represents a shift in thinking that calls large segments (Clayton, 2006) of contemporary architectural education into question.

Educators must explore and develop new methods to develop three-dimensional and four-dimensional, data driven, thinking and skills. These methods will contribute to, and expand upon, the learning objectives of modern curricula. Simply applying new tools and processes to old pedagogical and educational paradigms will not be sufficient. The careless introduction of BIM could be detrimental to design thinking and its central role (Cheng, 2006) in architectural education. Integrating BIM into the way students are educated will necessitate innovative thinking about the generation and definition of new forms of representational conventions. New conventions will develop, not based on the abstract biases of the past, but instead on emergent ones based in simulation and information management. As the conventions of communication and representation of the past were determinant factors in the architecture the new conventions will propose new architectures. The design studio project that embraces these new conventions in the age of BIM will transform the architectural design product as much as the architectural design process.

2. Beyond Tools – Approaching Ways of Thinking

"A Tool directs your attention. Its function becomes your focus: as the saying goes, when you hold a hammer, all the world looks like nails."
-Malcom McCullough, Abstracting Craft (1996)

The challenge is to understand the opportunities presented when digitally driven design, process and production technologies are envisaged more comprehensively than as mere tools (Kolarevic, 2006) to fully embrace them as ways of thinking in and of themselves. One of the dilemmas of *tool* thinking is that it undermines the additive value of skills and intentions

working together when conceptualized as a working methodology with its own rules and boundaries to be played against. A tool, like a chisel, is one way to remove material. As a *tool of removal,* a chisel is limiting. BIM is not a tool, but a way of thinking, a conceptual position. BIM is not the chisel, but, more precisely, it is the *concept of removal* that the chisel represents. Understanding and positioning BIM as a way of thinking is far more powerful than limiting it as a tool. As a methodology it can be developed and dissected into and throughout a curricular structure. It is a way of thinking that seeks to simulate the construction of a building. The method by which the model is constructed must be considered as a design decision. Students must understand not only the model geometry but the implications of the ways the model is constructed (Cheng, 2006) to develop a rigorous process of critical evaluation to understand the elements not only through building convention but also design intent.

The primary question is; does architectural education still require representational abstraction in the age of BIM? What are the issues and what is the knowledge that academia should now address to enable the digital design process? What current issues and knowledge gets displaced? Many academics and scholars favor a reductionist approach (Guidera, 2006) that seeks to mediate the complexities and simultaneities that BIM brings to bear. What might happen if, as Daniel Friedman posits, "...schools acknowledged design as an epistemology more than a skill; reoriented the development of individual expertise to the ethos of team; expanded studio as the laboratory for all academic activity in architecture..." Perhaps academia might hybridize existing educational models with the goals of *Integrated Practice* and reformulate the underlying value of technology and process and the comprehensive nature of architectural design.

Perhaps a design studio in this new era might not end with the design of a building but might begin with a model of one already designed. The lessons might have to do with 4D logistical planning for construction and staged building processes. Perhaps detailed investigations or analyses of structural, electrical or mechanical systems in consultation with allied disciplines or consultants would set the agenda for a design studio. Fabrication of steel frame and composite wall systems at 1:1 scale from CNC processes would be the conceptual vehicle for the pedagogical lessons instead of drawing or modeling design ideas. The promise of BIM applications is that simulated and actual construction might be the products derived from the design studio. The possibility of starting with *building* rather than ending with *building* might radically reposition curricular goals, concepts and knowledge in the design studio.

As architects move beyond drawing-centric practice into a dynamic process/component oriented *integrated practice,* a new conceptual foundation for architectural thought and production that focuses on a fluid relationship between design, construction and maintenance in which *information,* not drawing, as the medium will emerge. Students must be taught that architecture is more than simply applied knowledge and skills. Architecture is a way of seeing and thinking that requires understanding of BIM beyond the idea of tool to one of process, even methodology. It is in this spirit that BIM is discussed here. This presumes a convergence of best-

of-class technologies that leverage data management and knowledge production as the value of the architect and the true goal of the design process. The greatest potential BIM promises is the opportunity to re-invigorate and re-center contemporary practice and education simultaneously on ways of exploring architecture by developing and exposing design processes and methodologies that reprioritize ways of seeing, thinking and making.

Abstraction and its role in architectural representation has traditionally been about fragmentation and isolation of the parts from the whole. Contemporary educational models presume this relationship of the *parts to the whole*. BIM as a concept or process is much more of a context driven anti-fragmentation, anti-isolation design process that is dependant on contextual relationships in the modeling environment and data to fundamentally re-conceive the relationship of the *whole through the* parts. Speculation about this shift should at least provoke a critical debate about the possibilities and pitfalls of the new trajectory suggested by BIM and Integrated Practice.

3. Finding Ways Forward

"Anything you can imagine is possible."
-*Thom Mayne, Change or Perish (2006)*

Contemporary architectural education assumes a traditional set of communicative visual conventions, orthographic projections, at varied scales and levels of detail, that when taken in concert signifies a whole, complete idea of a building. Contemporary architectural practice assumes a simple one-to-one correspondence between design intent and interpretation, between the representation of ideas and the interpretation of the design of buildings. Contemporary construction documents reveal this assumption, these abstract, fragmented representations of the building and its components rely on reductive syntactic connections (Lonna, 1997) where by each abstraction is part of a dissected whole and when taken as a summation these fragments exceed their individual abstraction and constitute a literal description of the complete building. BIM conversely begins with the virtual construction (simulation) of the whole, which is then viewed as a series of synthetic assemblies of constituent components. BIM represents a design process that does not prioritize abstract representation or fragmented conventions of communication but instead privileges the contextual construction of a formal/spatial systemic *intelligent* simulation.

When avant-guard practioners such as Thom Mayne proclaim “I haven’t drawn a plan in five years.” they expose a significant issue of BIM’s effect on education. BIM fundamentally subverts plan thinking by prioritizing a three-dimensional view of the world. While seasoned practioniers my not need to work in plan does their education in that form of abstract thinking still serve them well? And if so does it bear continuing its prolific dissemination even at the chagrin of today’s avant-guard? When anything is possible how can academia educate students to know good from bad, right from wrong? To find a way forward academics might be well served to expose debate or hybridized transition in the projects themselves. The

pedagogical discourse around a design projects conception might very well accelerate design thinking and embracing simulation and its emergent conventions over the conventions of the past.

The academy must seek out new methodologies for exploring architecture that reflect the pedagogical shift represented in BIM by developing teaching methods that reprioritize ways of seeing, thinking and making in the design process. This technology is outpacing the discipline's ability to respond. It is this gap between design theory and digital practice that exposes a possible path for engaging digital design media in education that explores how fundamentally BIM might reshape the design process and conceptually shift to production of architectural ideas and objects like nothing has since orthographic and perspective projection (White, 1958) in the fifteenth and sixteenth centuries. Focused on the virtual building model simulation as the primary means of communication and representation in the emerging concept of *Integrated Practice*, architectural educators must take pause to critically engage and conceive outcome driven educational models.

4. Conclusion

Academia must seek out new educational models that expose methodologies for exploring architecture that embrace a pedagogical shift through BIM as process by developing teaching methods that reprioritize ways to reconcile the traditions of abstraction and the opportunities of synthetic simulation. The design studio project must now reflect new ways of teaching and addressing BIM methods and processes, and critically evaluating their effects and possibilities on architectural production.

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