Integrative Training for Integrated Practice

BIM in Academia 2011

PaoloTombesi and Peggy Deamer

You can teach a man to draw a straight line ... and to copy any number of given lines or forms with admirable speed and perfect precision… but if you ask him to think about any of those forms… he stops; his execution becomes hesitating…; he makes a mistake in the first touch he gives to his work as a thinking being. But you have made a man of him for all that. He was only a machine before, an animated tool…

And observe, you are put to stern choice in this matter. You must either make a tool of the creature, or a man of him. You cannot make both. Men were not intended to work with the accuracy of tools, to be precise and perfect in all their actions. If you will have that precision out of them, and make their fingers measure degrees like cog-wheels, and their arms strike curves like compasses, you must unhumanize them…

John Ruskin, The Stones of Venice II, 1853

The crisis consists precisely in the fact that the old is dying and the new cannot be born; in this interregnum a great variety of morbid symptoms appear.

Antonio Gramsci, Prison Notebooks, 1929

All the improvements in machinery, however, have by no means been the inventions of those who had occasion to use the machines. Many improvements have been made by the ingenuity of the makers of the machines, when to make them became the business of a peculiar trade; and some by that of those who are called philosophers or men of speculation, whose trade it is not to do anything, but observe everything; and who, upon that account, are often capable of combining together the powers of the most distant and dissimilar objects.

Adam Smith, An Inquiry into the Nature and Causes
of the Wealth of Nations, Book 1, Chapter 1, 1776

Building Information Modeling is being widely adopted in the practice of architecture/engineering/construction and will change the nature of the design process and production. But how and where is or should BIM be taught? In academia or the profession? As a fundamental or optional skill? Within its own boundaries or in conjunction with schools/departments of related building professions? Across all professions or within disciplinary silos? Through the initiatives of employers or employees?

In the current situation, the teaching and training of BIM is mired by three levels of difficulty:

Between Disciplines -- BIM is only a technical scaffold and its instrumental advantages change depending on the actors using it. Conceptualized differently by each profession and market, it is taught differently in each area.

Within Disciplines -- The place of BIM training in any of the disciplines falls under current definitions of technology, thereby overlooking its potential for more radical conceptual shifts affecting the nature of design expertise/collaboration.

Between Academies and Professions -- BIM, particularly in architecture schools, has ambiguous academic status. Seen as a technical tool and undeserving of academic credits and/or of design-affecting merit, it is taught in Schools of Architecture less because BIM's value is understood than because schools fear sending out unhirable graduates.

WE want to all for an analysis of teaching and training BIM such that these obstacles are overcome and replaced with a holistic approach to design ad BIM training/teaching in it.

A. Background

Architectural practice is increasingly marginalized. The percentage of buildings originating in architectural offices in the US has been declining steadily as the profession has struggled to establish its commitment to owners' and or/users' needs. Moreover, traditional clients are increasingly being displaced by private equity firms, hedge funds, real estate investment trusts and other financial institutions. These entities are driven by sophisticated analyses and their investment strategies are centered around yield, safety and liquidity.[1] In the face of this, the introduction of digital modeling capabilities allowing building actors to see the effects of decisions in terms of cost, energy efficiency, material availability and other project expenditures, is not only of interest to this new kind of client but can offer the tools to put architecture in the center, not the periphery, of the AECO industries.

Yet the introduction of integrated digital platforms also produces socio-technical challenges. If BIM has the ability to analyze and simulate the consequences of any decision brought to bear over the building project, decisions will have to be made as to which design or work planning dimensions can be developed autonomously, which ones should be dependent on others, and which ones ought to be considered together. For example, what is the relationship between architectural form and ease of building maintenance, technological innovation and construction safety, building flexibility and environmental performance, site organization and built quality, materials selection and labor resources? At the moment, most of these relationships are not structured explicitly and instead happen by default. In a mature BIM environment, they could all be envisioned and prescribed as design goals.

But given that the stakes and risks in building are vast and socially specific (i.e., different participants have naturally different interests in the development of building products and the built environment), tendencies to model information from particular perspectives are natural. BIM advantages are conceptualized very differently by each profession and market, and taught differently in each area.

The moment we consider operating in a technologically integrated framework we need to be mindful of the myriad of possible inputs and causal connections between project issues, and the cultural and strategic differences between information-producing agencies. In order to be able to do this, however, one has to have the intellectual capacity and horizon to reflect, incorporate and govern concerns that are still design-based but of an increasingly multidisciplinary nature.

Under this light, the task and the role of the 'architect' of the building information model is socially important but professionally cumbersome, because decisions can and therefore ought to be made on a plethora of design platforms that straddle across professional canons and cultures. This condition places emphasis on the type of preparation required to operate effectively in BIM-based environments, suggesting the need to focus on the structures of training and academic teaching.

With regard to the latter, BIM is the unfortunate step-child with no positive identity. As a technology, it is taught as an add-on to systems integration

[1] Urs Gauchat, "The $300,000/Year Architect," AD, September, 2009, pg. 34.

courses already overloaded with difficult information. As a professional tool, it is added to courses that suggest that BIM will be part of a professional future, not a form of design practice. As a program that allows for the integration of environmental information, it is shoved into courses already filled with essential but often marginalized information. If introduced into the studio at all, it is at the elective, advanced level, indicating that it is neither necessary learning nor integral to the concept of design.

Not surprisingly, BIM education therefore is most consistently found in programs sitting outside of architecture proper. Auburn University's Master of Design Building Program, Penn State's IPD/BIM Capstone Project Course, IIT's Master of Integrated Building Delivery are examples of programs that have taken the lead in teaching BIM. While this might be the path of least resistance for providing BIM training, it makes a strong statement that architecture is NOT where one gains this knowledge. Either 1 to 2 more years will need to be added to an architecture student's education or she will opt out of architecture altogether.

Significantly, the emphasis on the mastery of BIM technology in these programs is essentially procedural and coordination-based rather than architecturally investigative, thus suggesting a possible distinction between the training of skilled technical operators able to manage data and the preparation of BIM world-inhabiting cultural operators open to designing the integration of complex sets of data. But what would it take to train future architects in the integrative design issues BIM raises rather than (just) the processes it entails? Can it be done in architectural schools or does it require a rethinking of professional education and training paths?

B. What Needs to Happen

A study of how BIM might properly be taught would rest on understanding and establishing: a) the extent to which knowledge relevant to digitally integrated building design practices is currently supplied; and b) the consideration of educational models or training configurations that may respond to the professional formations in demand but could underpin drastic changes to specialized professional programs as we know them. One must investigate how professional access to workable data may have modified building design content and how the import of these changes affects traditional descriptions of professional practice and the structures of work. These investigations have embedded in them a number of implicit questions: Does the proper modeling of building information require a rethinking of building actors' roles? Is there a difference between producing information and designing? Is managing information equal to integrating design? Is it possible for future architectural design to come to imply not only the design of built form and space but also the design of the process itself?

This Ruskinian attitude would test a multidimensional notion of design in building that welcomes disciplinary contamination, recognizes existing or possible socio-technical networks, and can be used to steer and structure policy efforts in the digitally-supported integration of building activities. Its assumption is that building can be made a branch of architecture, as opposed to architecture remaining a privileged but inward-looking sub-set of building. In this approach, design is understood not merely as the aesthetic design of an object but as a "problem-defining, problem-solving, information-structuring activity that, on the basis of understood conditions and rules defines a specific course of action." Sketched in these terms,

design activity enters all the dimensions of the building procurement process.

Work is understood as the creative manipulation of specialized design developed by a socially diverse panoply of contributors. In other words, building design can be thought of as composed of a host of different tasks, spread across official *project inception and management*, *professional design*, *manufacturing* and *building production* operations, which involve principals, fabricators, component suppliers and tradesmen as well as architectural professionals. In comparison with conventional 'professional' descriptions of design, this assumes an important *horizontal* dimension to the design development and design production process, which opens up a host of issues in relation to the social division of knowledge and responsibilities in the building industry as well as the role architects may play in this environment. Because all actors are designers with different specializations, all are equally worth interrogating with the same set of questions.

In turn, this re-conceptualization of design and work comes with a rejection of the traditional *architect-owner-contractor triangle*. The emerging structure(s) should be seen as groups of separate specialized units, each contributing to one aspect of the product, engaged in intense direct communication, and embedded in a dense social network. Although coming together on a project basis, these units have strong ties grown out of the complementarity of their functions and the market advantages that productive cooperation brings. This approach envisions architecture not as a siloed profession distinct from other AECO industries but as one amongst other fields - engineering, building construction, building management, environmental engineering - sharing the power of BIM modeling. In this, the field of architecture is broadened and along with it, the scope of training/education investigation.

After this, the assumption will be that architectural curricula can no longer be organized around the singular aim of design sophistication. Rather, it will be organized around the process of putting a building together, in which design and aesthetics have a specific place. In lieu of the barely-modified beaux-arts model of design education that exists today, a new model might teach - in addition to aesthetics - judgment, teamwork, technical skills, building procurement/delivery processes, and the ability to collect information and move from information to design.[2] The growing addition of programs outside of architecture that take this challenge on and combine architecture with building construction is an indication of curricular impingements that need to be addressed and/or embraced but that current architecture curricula do not know how to handle. History/theory, structures, environmentalism, and fabrication would embrace the speculative as well as practical thinking that accompanies each of these environments. Design in this construct would in theory not be sacrificed; it would, rather, spread into another dimensional context. It would, in any case, revive classic discussions on collaborative practice and socio-technical systems developed in the 1960s, at a time of intense theoretical architectural and building elaboration. Emphasis would move from the 'design of the building' to the 'design of the project', and the nature of design will be steered away from single authorship to collaboration, and from object-production to scaffold-production and the ability to imagine analytical frameworks capable of decoding the value of particular patterns of work, technical coalitions or transactional strategies.

[2] Ibid, pp. 36-37.

The moment education is directed toward the ability to order and manage (e.g., to architect) the design/construction process, new areas of innovation are tapped into. Architecture acquires an altogether new connotation as a complex governance tool that implies/requires creative decisions, ones that are not only generated by the profession, but by the academy as well.