Translations From (Digital) Drawing to Building

KIEL MOE
Northeastern University

While architecture has enthusiastically deepened its technologically determined path with recent digital drawing, modeling and fabrication processes, critical lessons about the role of architecture drawings—specifically in regards to construction—evade even the most compelling forms of digital representation. Robin Evans:

> "We have witnessed, over the past fifteen years, what we think of as a rediscovery of the architectural drawing. This rediscovery has made drawings more consumable, but this consumability has most often been achieved by redefining their representational role as similar to that of early twentieth-century paintings, in the sense of being less concerned with their relation to what they represent than with their own constitution. And so the drawings themselves have become repositories of effects and the focus of attention, while the transmutation that occurs between drawing and building remains to a large extant an enigma."[1]

The consumability that Evans refers to has been enlarged considerably within digital production, even more acutely since the time of Evans wrote the above passage. In particular the tendency towards 'realistic' renderings and the ability to prematurely arrive at final-appearing results undermines the more nuanced exchanges that occurs both in slower media in which intelligence accrues through the design process and in the dynamic translations from drawing to building. Today there is disproportionate emphasis on the image quality of the building and less concentration on the intellectual content imbued in the building through the composition of the drawing. Yet all lines contain ethical implications and architecture remains mediated by the content of the architect's drawn lines. In my observations of student work, the condition today is characterized by a disconcerting emphasis on the drawing of a building as an object rather than the drawing as a set of implied actions, performances, and effects.

Ironically, this focus on the objecthood of projected buildings has been more prevalent in studios dominated by digital media. The untethered abstractions of computer modeling and the lack of scale and orientation as well as the propensity towards ultra realistic renderings often yields representations that lack some of the basic intellectual investments more frequently found in hand drawing. The inability to make certain intellectual decisions about architecture at appropriate scales in one's design process is a major intellectual change in the two design environments. In digital environments, there is always the temptation to add detail beyond the scope of what is appropriate as one zooms in and out of a drawing plane. This is notable, for instance, in the development of a section when disproportionate detail is added at a fine scale while larger issues remain unresolved.

However, I realize that this interest in hand drawings is rather subjective, perhaps even selfish. As Robin Evans stated: "to regard a drawing as a work of art as we usually understand it is to regard it as something to be consumed by a viewer, so that his rapacious appetite for formulated experience may be assuaged."[2] So, rather than bemoan the loss of the accrued intelligence of hand drawing and drafting out of my own proclivities, I feel impelled to find digital analogues that can impart the same transformative lessons and invest the drawing with the same level and kind of intensity and intelligence. It is incumbent upon those interested in the value of the architectural drawing to find pithy and productive transformations of drawing disciplines to include these digital media in order to fundamentally advance the role of

drawing in architecture. Further, it seems that the digital drawing and modeling mediums can, and must, be swerved to impart forms of knowledge that would have been too complex or too time-consuming in the hand mediums. In what follows, I describe both the hand and digital versions of an exercise and evaluate the relative merits of each.

DRAWING BUILDING ENVELOPE DURABILITY

The following text from Louis Kahn has been central to a series of drawing exercises that help teach building envelope durability, detailing, and their representation in my combined Integrated Building System and Comprehensive Design studio course:

"We should try more to devise structures which can harbor the mechanical needs of rooms and spaces and require no covering. Ceilings with the structure furred in tend to erase the scale. The feeling that our present-day architecture needs embellishment stems in part from our tendency to fair joints out of existence—in other words, to conceal how parts are put together. If we were to train ourselves to draw as we build, from the bottom up, stopping our pencils at the joints of pouring or erecting, ornament would evolve out of our love for the perfection of construction and we would develop new methods of construction. It would follow that the pasting on of lighting and acoustical material, the burying of tortured unwanted ducts, conduits, and pipelines would become intolerable. How it was done, how it works, should filter through the entire process of building, to architect, engineer, builder, and craftsman in the trades.[3]

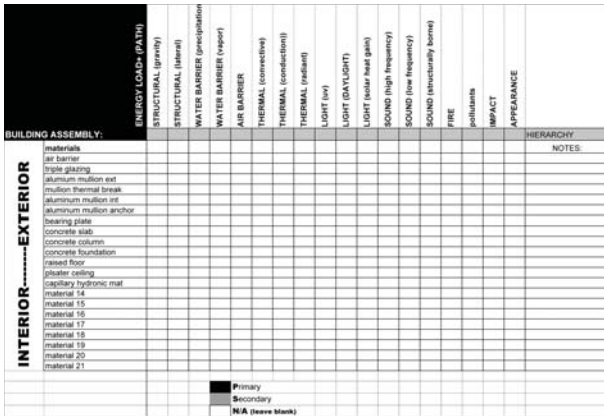
In this 1953 *Perspecta 2* text on "How to Develop New Methods of Construction," Kahn suggests that ornament and architecture evolves from the persistent evolution of the pragmatic and technical requirements of construction. A primary lesson from this passage is that the architectural drawing ought to rehearse construction. The process Kahn describes is productive for students who begin to see the drawing not as a representation of a static object but rather as a description of active processes and that this is one proper locus for design. In his case, the drawing rehearses the sequence of trades, their actions and activities on a construction site, and consequently their effect on the final construction. This transformation from the drawing as a projection of an object to the drawing as a projection of actions and procedures over time is a key intellectual process for architecture students to grasp. Departing from the text, the following exercises in both hand and digital mediums address this issue and lead toward a more integrated understanding of the translations from drawing to building.

MANUAL DRAWING EXERCISE

The hand drawn version of this exercise began with the development of a traditional wall and plan sections at increasingly large scales. In the iterative process of these drawing's development, a matrix of building envelope durability factors was introduced so that the students articulate and demonstrate the performance of each component in the envelope assembly. Eventually, a large scale section axonometric and analytique was produced that emphasizes the relationships between sectional thinking, facades effects and interior resolution. The final step was the fabrication of a building envelope model that rehearsed the construction sequence of the drawing.

DIGITAL DRAWING EXERCISE

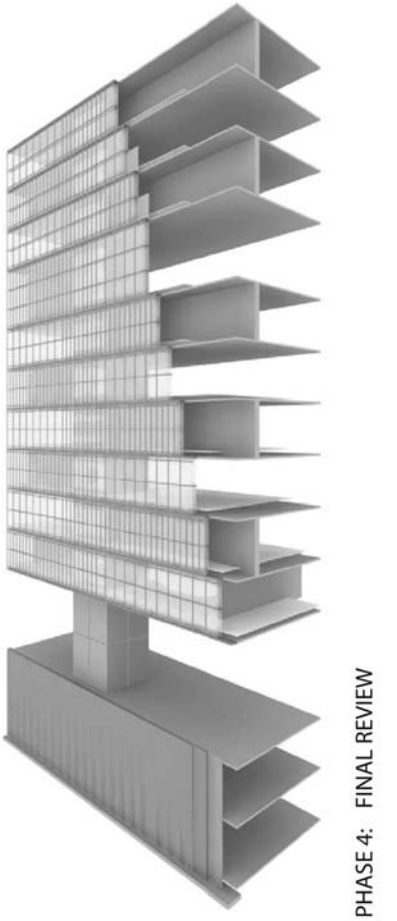
The initial sequence of the digital exercise is roughly the same as the hand exercise. Students draw large scale wall sections both for their tectonic content as well as the basis of thermal, air and vapor barrier diagrams. They also draw full scale plans and sections of major building component transitions and complete a building envelope durability matrix (figure 1). However, this is just the start of the digital exercise.



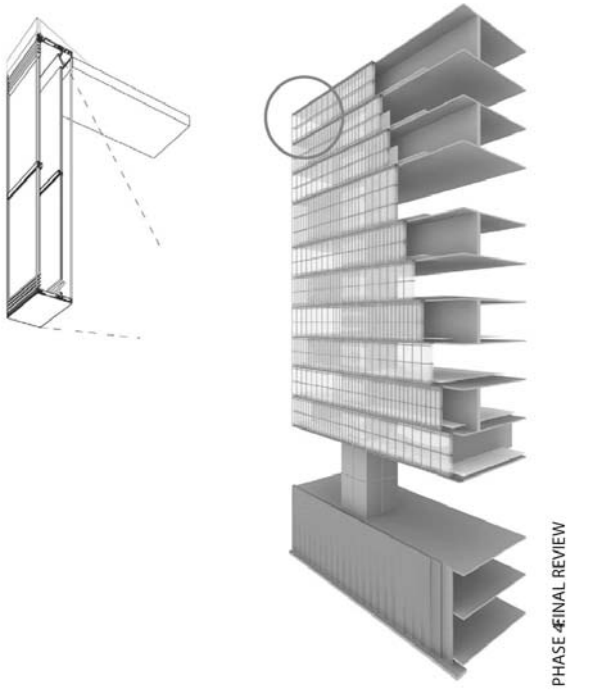
The core of the digital exercise consists of a very detailed digital building envelope model—typically including a few bays of the building—that starts from a basic wall section. The initial two-dimensional CAD section is extruded, pushed and pulled in the digital model to arrive at a building envelope model that is articulated in such a way that also describes the sequence of envelope assembly (figure 2).

It is here that students encounter the many subterfuges of the wall section: the impossibility of its contained implications as the assembly switches materials or transitions from wall to window or turns a corner. This building envelope model in turn serves as the basis of a large section perspective that is fabricated in such a way that the assembly of the building envelope and its completed façade effects are evident in the drawing (figure 3). Next, the unit components of the building envelope (for instance a metal cladding panel or a panelized curtain wall unit) are then pulled out in perspectival space and towards the viewer. This provides an enlarged perspectival view of this fundamental unit and its details. Next, large, often full scale, details of that assembly are composed on the same digital drawing to demonstrate the unit's relation to the whole construction. Finally, other orthographic details are composed on the sheet as necessary for unusual conditions (figure 4). The entire process proceeds though many iterations and through many types of software.

The centrality of an iterative process in this exercise is one of the drawing's most important and unchanging properties. In digital environments, however, students rarely engage a pithy iterative process. It is thus essential that students cycle through several software types as they proceed through the iterations. This imbues a sense of each software's utility but more importantly often reveals the ambiguities and falsehoods that each of the projections and softwares inherently contain. The cycling of three dimensional modeling of building envelopes and two dimensional wall sections forces students to imagine the three dimensional consequences of two dimensional projections. Similarly, the three dimensional modeling of the building envelope allows the students to study the non-standard conditions of the building



ENVELOPE SECTION PRINTING FACILITY



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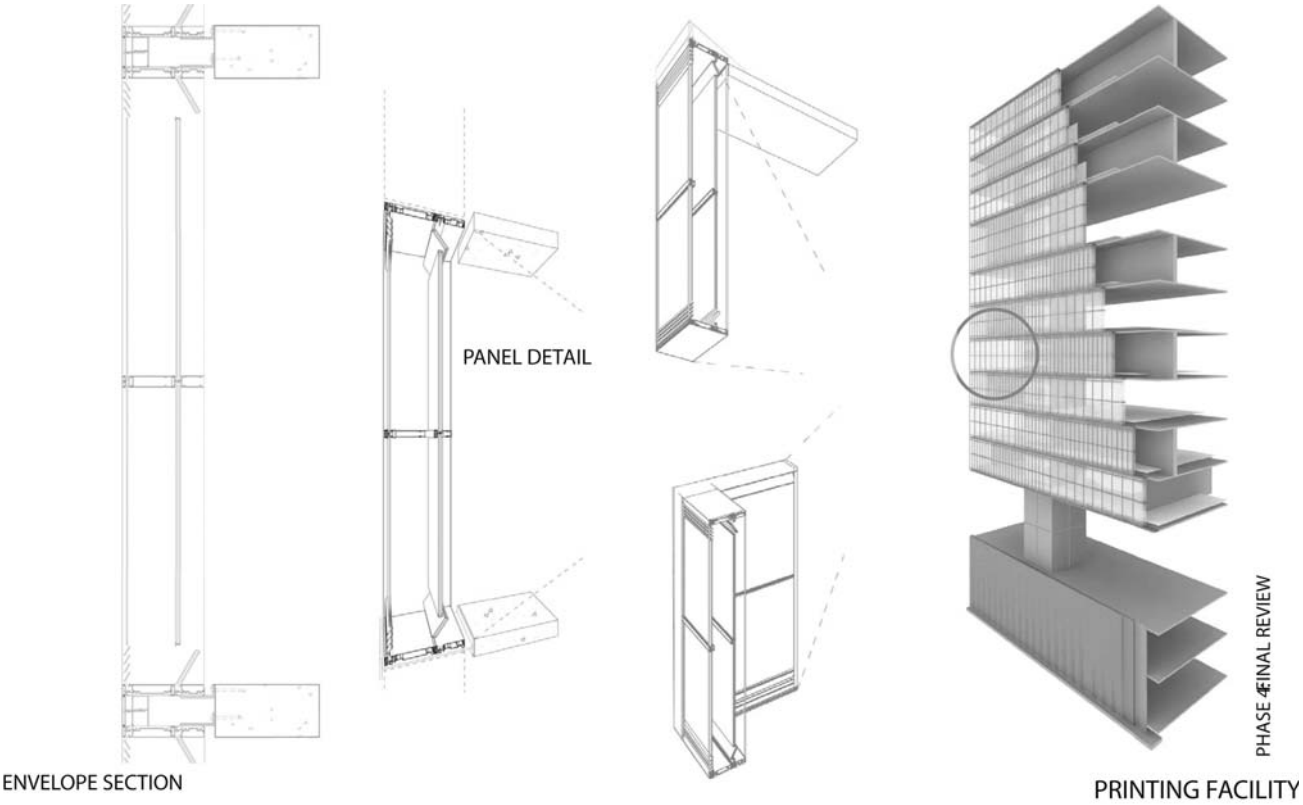
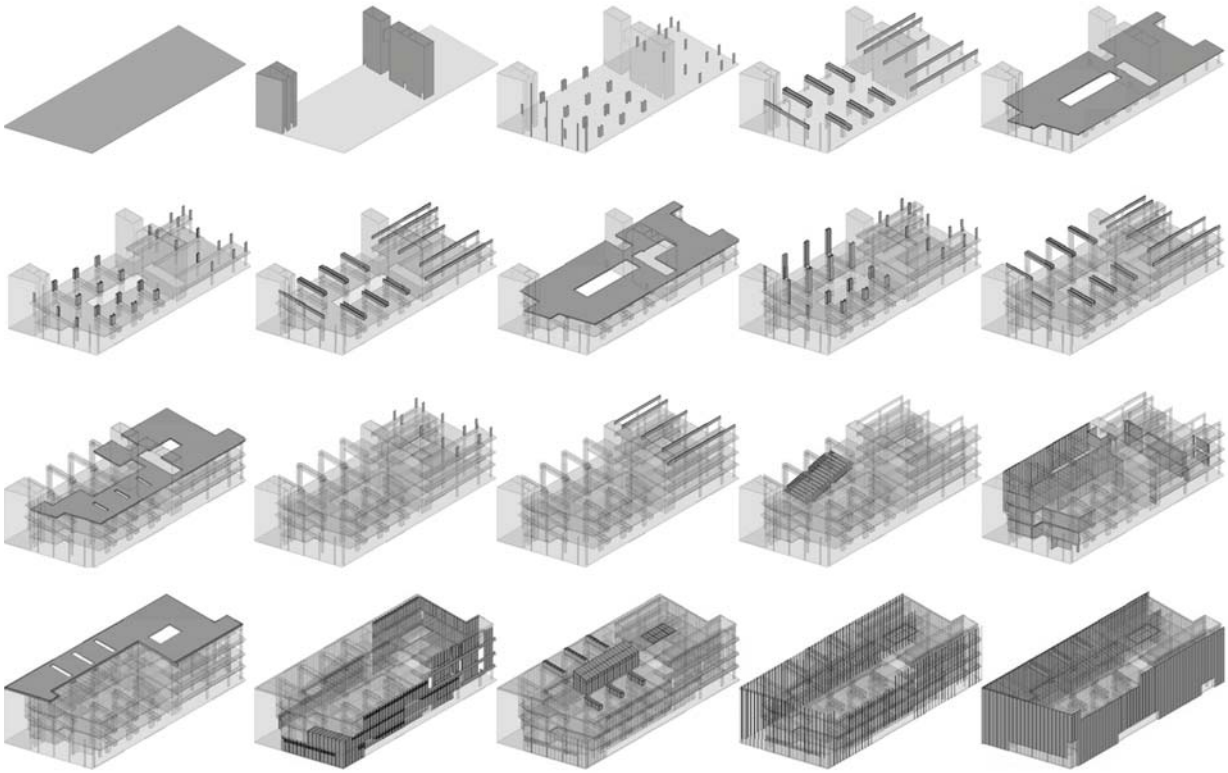


envelope such as windows, doors, and corners in a rapid and more thorough manner than two dimensional studies allow. This is a key benefit of this process rarely available to hand mediums. The result is effectively a *digital analytique* in which section and detail information appear together at a range of scales. As Marco Frascari noted on the analytique, "in this graphic representation of a designed or surveyed building the details play the predominant role. They are composed in different scales in the attempt to single out the dialogue among the parts in the making of the text of the building."[4] This digital approach to the analytique has begun to yield some of the coherency inherent in a hand drawn analytique for the students.

Once the digital building envelope model is complete, students then build a ½" or larger physical building envelope model, a final rehearsal of the construction. Like the digital building envelope model, the models are fabricated in such a way that the assembly sequence is overtly expressed. The primary instruction for this final model is that a contractor should be able to build the entire building envelope based solely upon this model. This becomes a design exercise in itself that teaches students to clearly articulate construction sequencing and assembly.

Students typically respond that they do not see buildings as they did before these building envelope exercises. They also comment that they fundamentally see the task of the architect in new ways as well after this series of exercises. The drawing is central to this transformation of the student's sensibility and students also respond that see the role of drawings quite differently as well. Other beneficial output engendered by the digital building envelope model included a series of sequence diagrams at both the building and building envelope scale that directly rehearse the sequence of construction, testing for constructability and serviceability (figure 5). This further advances their understanding of the building as a series coordinated and integrated processes rather than merely the physical description of an object.

Lisa Schoenbrunn + Michael DiMaggio



ASSEMBLY DIAGRAM

CONCLUSION

"The drawing would be considered not so much a work of art or a truck for pushing ideas form place to place, but as the locale of subterfuges and evasions that one way or another get round the enormous weight of convention that has always been architecture's greatest security and at the same time its greatest liability."[5]

While I feel that there are intellectual processes inherent in the corporeal process of hand drafting that will unfortunately atrophy in the coming years, I feel it is imperative that architectural educators find compelling ways to imbue digital architectural production with the same lessons and intelligence that its manual antecedents has developed over time.

A drawing will only communicate as much intelligence as is embedded in the drawing itself at the time it is drawn. It is thus essential that we work to find ways for students to imbue digital drawings with the intellectual processes inherent in traditional forms of integrated drawing such as the analytique.

ENDNOTES

1. Robin Evans, *Translations from drawing to Building and Other Essays*. The MIT Press, Cambridge, MA. 1997. p 160.

2. Evans, p 160.

3. Louis I Kahn, "How to Develop New Methods of Construction" *Architectural Forum* November 1954. p 157. reprinted in Louis I Kahn. *Louis I. Kahn, Writings, Lectures, and Interviews*. Edited by Alessandra Latour (New York: Rizzoli International Publications, Inc. 1991. p.57

4. Marco Frascari. "The Tell-Tale Detail." *Via 7* (1984), 22–37.

5. Evans, p. 186.