



FLUX: Design Education in a Changing World

DEFSA International Design Education Conference 2007

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Architectural Knowledge and Iterative Mediating Artifacts

Abstract

This paper seeks to extend Donald Schön's often-referenced and widely-accepted observations that design, specifically architectural design, is a reflective "conversation with materials" consisting of a cyclical process of "reflection-in-action". Specifically, the paper argues for the extended applicability of these observations to the question of analysis of existing architecture.

Architectural analysis and architectural design both productively rely on iterative processes of observing and making-in-response (or "reflection-in-action") as means of constructing architectural knowledge. The mediating artifacts resulting from such iterative processes are fragmentary and selective; even in aggregate, they never constitute a totality. Indeed, a successful mediating artifact, whether made to support analysis or design, will always provoke iterative response due to its fragmentary nature. Michael Graves in a well-known 1977 article discussing the "Necessity of Drawing" described this property of artifacts as "tangible speculation": that a mediating artifact informs an iterative process of knowing architecture precisely because it simultaneously concretizes and inquires.

In short, whether mediating artifacts are constructed in an attempt to "reflect-in-action" about existing architecture, or to propose and develop as-yet-unformed architecture, these artifacts contain the same kinds of incompletenesses, omissions, highlights, abstractions, selections, and prioritizations.

Consequently, to initiate a cognitive shift from the act of analyzing through making to the act of designing through making does not imply a change in the kinds of things made but rather a shift in the kinds of questions asked about those things: i. e., a shift into "design" requires that questions become increasingly directed towards informing production of new architecture. To sustain this position demands that students develop an ability to recognize opportunities for productive response within fragmentary models whether those models are initiated as analytical or speculative constructs. The subject considered to illustrate and develop this argument is a selection of student architectural design work conducted under the author's supervision in two recent undergraduate architectural design studios, each of which deliberately foregrounds the relevance to design of an iterative analytical process.

Thus, the paper articulates and illustrates a specific relevance of architectural analytical work to architectural design work. It concludes with specific suggestions on strategies for wider application of this articulated relevance to architectural design studio education in general.

Key Words: *architecture, analysis, design knowledge, design process, reflection-in-action*

Architectural knowledge constructed through mediating artifacts

Whether a work of architecture physically exists or is projected, it enters into collective knowledge and discourse through the production and dissemination of *mediating artifacts* such as drawings, models, texts, or photographs. Not to deny the epistemological functioning of direct experience of a work of architecture, this observation is intended simply to foreground the dependence of architectural discourse on mediating artifacts, whether that architecture physically exists and is directly available, or is *not* directly available either because it is imagined (i. e., unbuilt) or simply distant.

All mediating artifacts contain incompletenesses, abstractions, selections, and prioritizations. They are fragmentary and selective, never constituting a totality. This property is what Michael Graves has described as “tangible speculation”: that is, that an artifact (such as a sketch) informs the construction of knowledge because it simultaneously concretizes and inquires (Graves, 1977). Moreover, constructing mediating artifacts as a means of *knowing* a work of architecture tests the ability of a particular way of making to inform the construction of a specific kind of knowledge. Julio Bermudez and Kevin King have written that media directly and essentially impact the way architecture is “conceived, developed, and communicated.” (Bermudez & King, 2000: 41.) Similarly, David Leatherbarrow defines mediating artifacts as “representations meant to direct the development of something conceived into something constructed.” (Leatherbarrow, 1998: 51.) Patricia Boge and Jim Sullivan add that “[a]rchitectural representation ... suggests a visible demonstration of the ‘architecture’ of a student’s thinking as well as the architecture about which a student thinks.” (Boge & Sullivan, 2006: 46.) And, Norman Crowe and Steven Hurtt acknowledge that the mediating artifacts which architects construct to make sense of existing architecture “are very much like the kinds of drawings that one makes in the design process itself.” (Crowe & Hurtt, 1986: 12.) Taken together, these writers imply that to move from the act of *analyzing existing architecture* to the act of *designing new architecture* need not imply a change in the kinds of things made but rather a shift in the kinds of questions asked about those things: i. e., that a shift into “design” implies only that questions will increasingly direct the production of new architecture. To sustain this position in an academic setting requires that students acquire and develop an ability to recognize opportunities for productive response within fragmentary artifacts *whether those artifacts are initiated as analytical or speculative constructs*. William Porter, in his 2004 article “Designers’ Objects,” discusses the possibility of constructing mediating artifacts as *reflections* on existing architecture. He writes that “objects may be created that are not integral to the production of the building, yet are integral to the cultivation of ideas that relate to the building.” (Porter, 2004: 64.) By extension – though he does not explicitly acknowledge this – those newly cultivated ideas may possibly serve a generative function with regard to the production of new architecture. The present paper seeks to explore this possibility within the context of Donald Schön’s writings on the functioning of the architectural studio.

Schön on the production of architectural knowledge

Donald Schön’s extensive writings on pedagogical modes specific to the architecture studio (e. g., Schön, 1983; Schön, 1984, Schön, 1985, Schön, 1987, Schön, 1988a, Schön & Wiggins, 1992, etc.) focus on a cognitive ability to *reflect-in-action* – an ability which he argues is central to design activity in general and also to activities in certain professional fields. However, as Broadbent, Martinez, Cardaci, and Zoilo (1998) have noted, Schön does not say enough about the *content* of the architecture studio. Indeed, apart from two brief exceptions, most of Schön’s discussions which directly address the architecture studio focus on a specific ability to re-see developing design work – that is, *architecture in a state of production*. In other words, his work does not focus on the pedagogical function of reflection-in-action as it might relate to observing and making sense of *existing* conditions of architecture or site. The two exceptions within Schön’s work – those in which he focuses on the functioning of reflection-in-action as it relates to existing conditions – are, first, his references to site contours in excerpts from dialogue between an architecture student, Petra, and her instructor, Quist, and second, his discussion of the “Library entrance exercise.”

Several of Schön’s writings make reference to the discussion between Petra and Quist (i. e, each of his writings referenced in the preceding paragraph). Petra and Quist are described as being engaged in an attempt to design a new elementary school on a site with gentle contours. The discussion describes how the student and teacher work together to understand latent possibilities within the student’s developing design, clarifying it, making it more specific, and opening new lines of exploration. That part of the dialogue which concerns *existing conditions* relates to the physical site, which is treated differently from other developing aspects of the work. Specifically, the site is always conceived of as *something to be imposed upon with new architecture or organizational schemes*.. Petra’s own earlier decisions are repeatedly questioned by Quist, but the site and its representation remain unquestioned to the same degree. Then, in the discussion of the library entrance exercise (an

exercise designed by William Porter, and described in Schön, 1988b, and in Schön & Wiggins, 1992), students are asked to interpret or mine an existing work of architecture through reference to a very specific mediating artifact: a “generic footprint,” or outline floor plan of a branch library design, in order to support an architectural analysis of various possibilities for entrance locations. After describing how the exercise was carried out, Schön and Wiggins offer a critical comment on the possibility of reflection-in-action related to existing architecture: “Not only is designing conducive to discoveries that prepare the student for further designing, but designing may be undertaken in order to build improved understandings of systems or structures. ... [T]he account of designing sketched above suggests a reinforcement of the architectural design studio’s traditional emphasis on drawing (or other forms of action in visual media) as *a means of coming to see things in new ways.*” (Emphasis added.) Apart from these examples, Schön hints at the possibilities of reflection-in-action as these might relate to existing architecture, as for example when he identifies (but does not elaborate on) the Design Domain of *precedent*, ascribing it no unique consequences; or, as in Schön (1988a), where he speculates on the value of architectural *types*. Broadbent *et al*, following Schön as observers of the functioning architecture studio, implicitly recognize this shortcoming in his work as they adapt Kuhn’s *paradigms* as a framework for observation – specifically as they survey the students’ dependence on *processes, representations, and exemplars*. (Broadbent *et al*, 1998.) However, Broadbent *et al* themselves do not go far enough, as they offer only a brief glimpse into how these dependencies actually function in the studio.

Clearly, there exist latent possibilities in Schön’s work with further applicability to analysis of existing architecture. Specifically, if the ability to “see things in new ways” is agreed to be an important component of “preparing the student for further designing” as well as of “building improved understandings” of existing structures and systems, how might ways of seeing *existing* architecture in new ways – indeed, *ways which fully allow the existing architecture to participate in a reflective-active cycle* – be established? To test this question, the author designed two architectural studios in which students would (a) rely on the production of mediating artifacts to analyze existing architecture and sites, and (b) formulate, with reference to these mediating artifacts, proposals for adding to the building.

The studios

Students in the first of these studios were asked to design an addition to an existing public museum in Ahmedabad, India, designed by the architect Le Corbusier and completed in 1954 (Figure 1). The museum, or *Sanskar Kendra*, is constructed on a concrete frame with brick infill. It is three stories tall, square in plan, with an internal open-air courtyard. This building is one of only three in the world (the other two are in Chandigarh, India, and Tokyo, Japan) built by Le Corbusier as illustrations of his concept of the *Musée de la Croissance Illimitée*, or Museum of Unlimited Extension. This concept proposed a square-spiral plan which in theory could be extended arbitrarily far to support museum expansion. In the studio, the students were provided with a hypothetical program for museum expansion, though they were not required to adhere to Corbusier’s projected spiral plan.



Figure 1. Sanskar Kendra, Ahmedabad, India.

Much of the design work in the studio was carried out in the form of physical models at a small scale. The conditions of the studio were defined to require of those small-scale models (1) that they must be fragmentary, not attempting to establish a totality; (2) that they should be *iterated*: i. e., that every new model was expected to respond to discoveries made in previous work (Graves, 1977); and (3) that they be carefully crafted, meaning that the choice of materials and selectivity of assembly were identified as necessary attributes of good models. Furthermore, students were asked to consider several questions when constructing models of the existing building, such as, What does a particular way of constructing the model reveal about the architecture? What does it reveal about construction? And How does a model, however fragmentary, suggest possibilities for extension?

Lindsay Beukhof, a student in the studio, made an early determination to analyze the construction of the existing building’s exterior wall. While exploring the question of creating an opening in the exterior wall, she constructed a model (Figure 2) which acknowledges the physical separation between the building’s exterior brick wall, which she modeled in chipboard, and its structural concrete columns,

modeled in wood. Simultaneously, the model speculates on the possibility of introducing a new glass layer behind the opening (modeled in tracing paper):

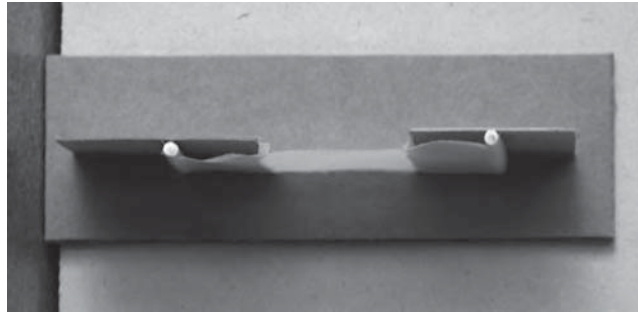


Figure 2. Initial model of wall.

This initial model embodied several of the ideas discussed in this paper's previous section. By constituting a fragmentary abstraction of something understood through media, it illustrates Graves's "tangible speculation." Moreover, it does so in a manner *specific to the architecture under consideration*, that is, it is as Porter suggests an object "integral to the cultivation of ideas that relate to the building." Beukhof produced a new model (Figure 3), a *re-iteration* exploring the possibility of inhabiting the space between brick wall and glass wall simply by increasing the space between them:

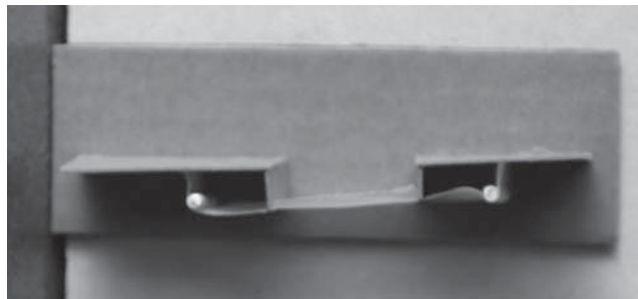


Figure 3. Re-iteration of wall model.

Beukhof's reaction to her initial model, and its re-casting with new emphases, specifically recalls Schön's discussion of "conversation with materials":

"[D]esigners put things together and make new artifacts. They juggle variables, reconcile conflicting values, and maneuver around constraints – a process in which, although some design products may be superior to others, there are no unique right answers and no moves that have only their intended consequences. With its webs of moves, discovered consequences, and implications, designing is a reflective conversation with the materials of a situation." (Schön, 1988a: 4.)

Importantly, Beukhof's initial models do not obviously categorize themselves as either purely analytical models, describing or interpreting a condition within the existing building, or purely speculative models, testing possibilities for new architecture. Rather, they are simultaneously analytical (reflective) and speculative (active); they construct architectural knowledge of what is there while they make possible new insight into what could be there; they at once crystallize and "barely initiate thought" (Piotrowski, 2001: 51). These initial models are successful as speculative artifacts because they are deliberately fragmentary and incomplete (Graves, 1977). By excluding the enclosed space of the entire existing building – that is, by limiting their extent to a fragment of the enclosure – the models made it possible for Beukhof to conceive of the existing exterior wall of the building as an opportunity for new architecture: specifically, as a site for creation of inhabitable volume. Beukhof proposed such an inhabitable volume as one which followed the perimeter of the existing building, expanding by degrees on each existing facade. Her subsequent models (Figures 4, 5) speculated on the degree to which the separation between the solid brick wall and the emerging glass one could become inhabitable:



Figure 4. One-bay (facade) model.

The iteration presented at the final review (Figures 4, 5) suggested that the separation could become sufficiently inhabitable so as to accommodate all required expansion space, but critically to the building's function as an urban museum, that the "inhabitable wall" could become a place through which knowledge of the city is constructed: as the exterior wall wraps around the building, it gradually expands in depth until it widens sufficiently on the right side of the building so as to constitute wholly new construction. Figure 5 shows the model; Figure 6 is an annotated plan of the model, indicating that the new construction is partially within and partially adjacent to the existing building.

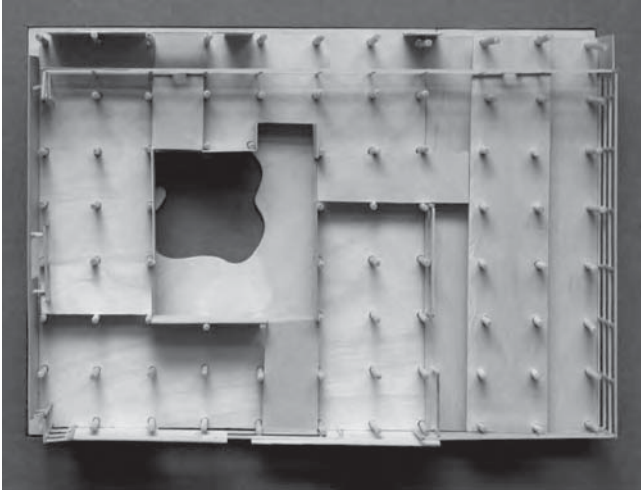


Figure 5. Final model.

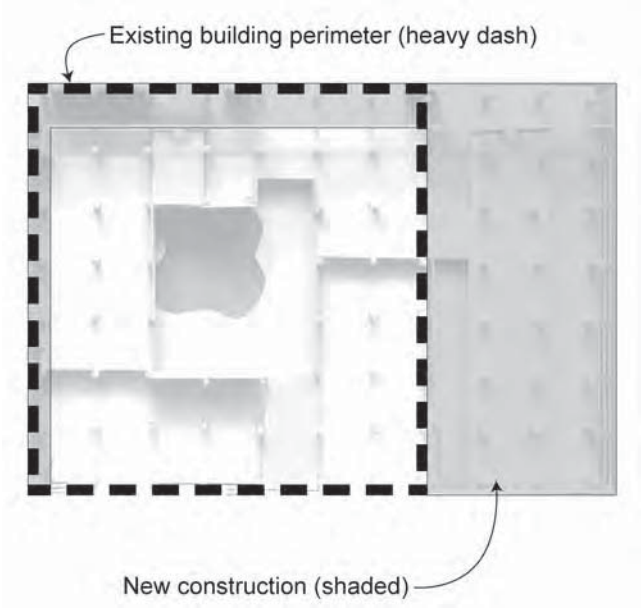


Figure 6. Annotated plan of final model.

Beukhof's work suggests that a process of knowing existing architecture through the production of mediating artifacts – a process of questioning its specificity as material assembly and structure, one of "seeing, moving, and seeing" (Schön & Wiggins, 1992) had the effect of making the latent conceptual possibilities of this architecture visible. Her process was not exclusively directed either to interpreting the existing work of architecture nor to the proposal of new construction: it does both simultaneously. A second student in the same studio, Meghan Gruber, began her process of reflecting on the architectural characteristics of the existing building with the model shown in Figure 7:

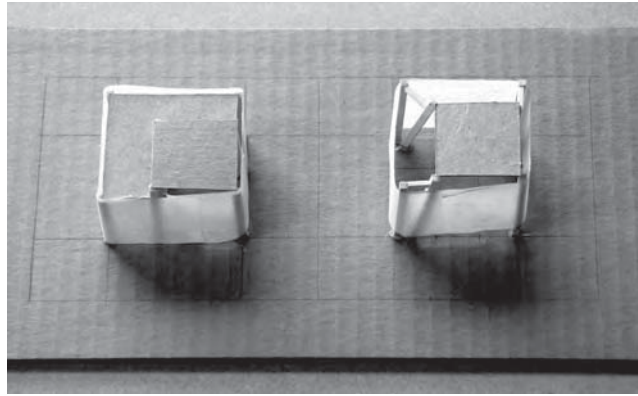


Figure 7. Initial courtyard model.

Her model constitutes a physical construction of the void – that is, a three-dimensional *trace* of the volume defined by the existing building’s empty central courtyard. By deliberately excluding the entire existing structure (a pencil trace of which is barely visible on the model base), Gruber caused the courtyard-volume to become visible and available to action. Critical to her subsequent work (though it did not become obvious until later in the process), her model includes a second courtyard-volume, apparently exterior to the existing building. Initially, this may have been done simply as a second iteration of the constructed void on a common base. But, once the volume created by the existing building was recognized and made explicit, a way of creating new volume exterior to the existing building was implicitly established. Clearly, Gruber’s initial model simultaneously makes the existing architecture visible in a particular way, crystallizing the interior court as a distinct volume, while establishing a position for making new architecture. Which of these two courtyard-volumes corresponds to the existing (“remembered”) building and which corresponds to the new (“imagined”) one? Ultimately this distinction is inconsequential: the value of the model is simultaneously reflective and speculative; analytical and provocative. Gruber’s subsequent models (Figures 8, 9) continued to embody a duality not fully resolvable into “either/or”, “new/old”, “analytical/speculative”, but in each case operating to construct architectural knowledge of the existing building while opening possibilities for new construction of architecture. In her next model, modeled columns are engaged against the courtyard facade, opening questions relating to degree of visual permeability of architecture (critical to conceptual functioning of a building which must operate to construct knowledge of the city outside):

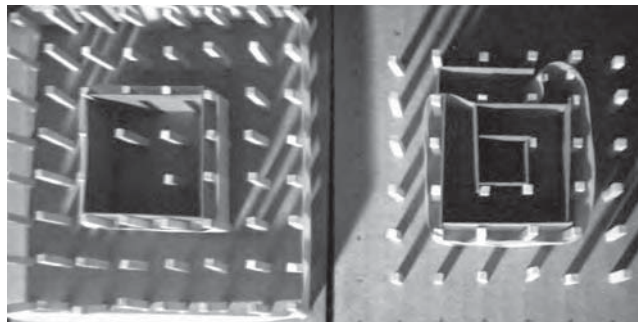


Figure 8. Column/courtyard models.

Specifically, the model in Figure 8 fulfills an analytical function with respect to the existing architecture, because it questions the degree to which the existing columns affect visibility through and from the existing courtyard; simultaneously, the model enabled Gruber to speculate about new architecture, initiating new questions such as What is the skin? How does it admit light? How does it structure possible movement of inhabitants through the space? In her next model, she resolved the hitherto unresolved duality between existing and new by including in the existing building the four existing mezzanines arranged in a “square spiral” (left half of Figure 9):

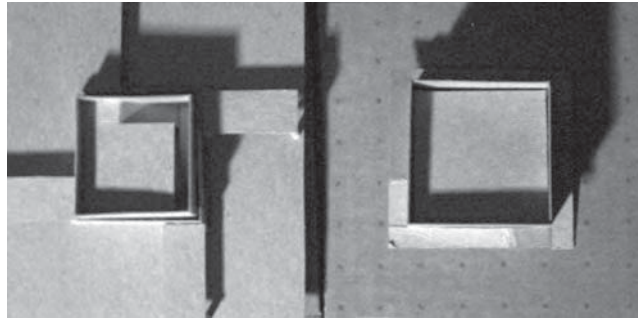


Figure 9. Dual building model.

Evidencing Schön's "conversation with materials" (Schön, 1988a) through a cycle of "seeing, moving, and seeing" (Schön & Wiggins, 1992), Gruber drew a host of new questions from the latest model: questions, for example, about the architectural definition of the existing building's edge as it faces new construction; about the possibilities for vertical movement within or adjacent to the new structure; about views from the existing courtyard, as they differ from a corresponding view from the new building. How is experience of the one (new) affected by memory of the other (existing)? How is the hidden court within the existing building made known or anticipated by the exposed exterior court? Critically, how is knowledge of the city constructed differently by seeing the city from within the existing court, mediated by the existing building, as compared to being seen from within the new exterior court, mediated by empty space? Gruber capitalized on these inherently open-ended questions in her final presentation, which paired hand-drawn perspective views of the existing and the new from comparable vantage points in each (Figure 10):

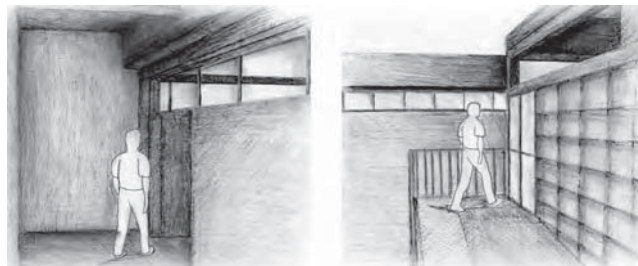


Figure 10. Drawings.

The iteration presented at the final review (Figures 11, 12) showed the two clearly separated buildings on the common base:

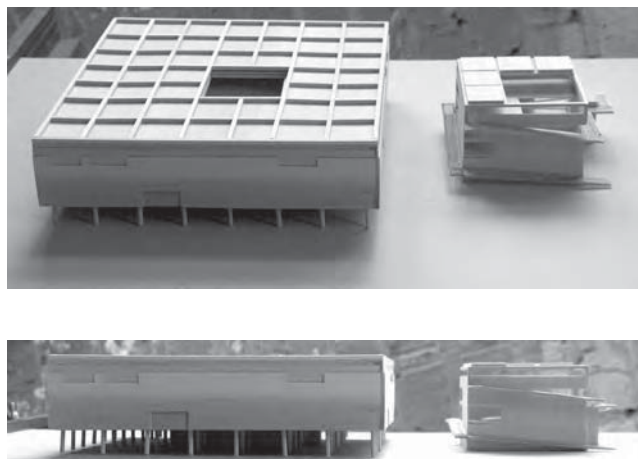


Figure 11. Final model.

The model contained both courtyards in their entirety, but a totalized view of both could only be obtained by removing the "shell" of the existing building from the model:

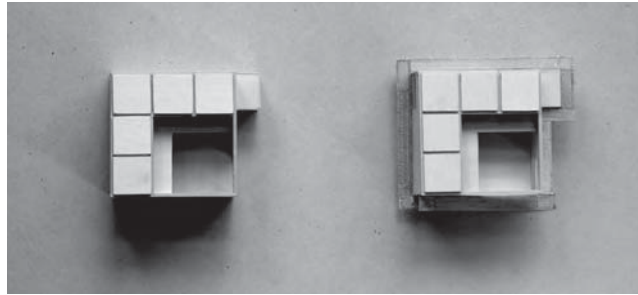


Figure 12. Final model.

In hindsight, by excluding the physical form of the entire existing building from inquiry, the initial models heightened the importance of the question “what will I see through” to constructing an understanding of the city. The process repeatedly engaged “reflection-in-action” as models simultaneously tested an understanding of existing (remote) work even as they deliberately and tangibly speculated (Graves, 1977) on new work.

A second studio, also instructed by this paper’s author, provides a final illustration. In this studio, architectural design students were asked to propose new architecture accomplishing an extension of an existing system of skyways (overhead pedestrian walkways) through downtown Fargo, North Dakota. The existing system connects and penetrates several downtown buildings, including the Black Building, an eight-story 1930s office building (Figure 13):



Figure 13. Black Building, Fargo, North Dakota, USA.

Brent Nelson, a student in this skyway studio, analyzed the Black Building in detail as part of his investigation in pursuit of opportunities for new architecture. While studying the structure and materiality of this building, he became interested in the possibility of cutting a series of sections through its entire height. He translated his direct observations into a series of computer-drawn sections (Figure 14):

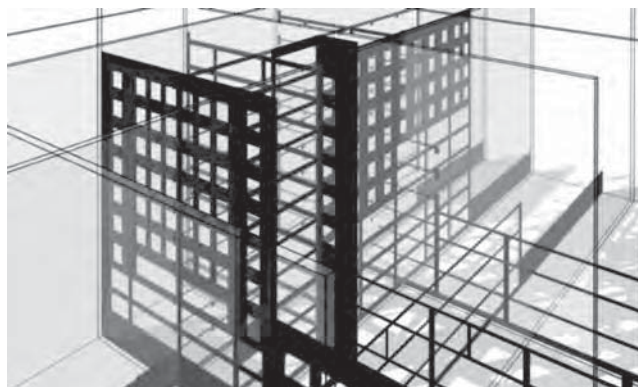


Figure 14. Computer-drawn sections of the Black Building.

These were further translated into physical planes using a computer-driven laser-cutter, and placed into a physical framework, registering a highly selective understanding of the existing building (Figure 15):



Figure 15. Laser-cut sections of the Black Building.

Nelson's construction of this initially *analytical* or reflective model highlighted physical and conceptual gaps which became opportunities for him to articulate the possibility of new architecture. His final model simultaneously reflects on commonalities among and between the building's frame structure and its bearing-wall neighbors as it proposes new architecture suspended on and within the existing (Figure 16):

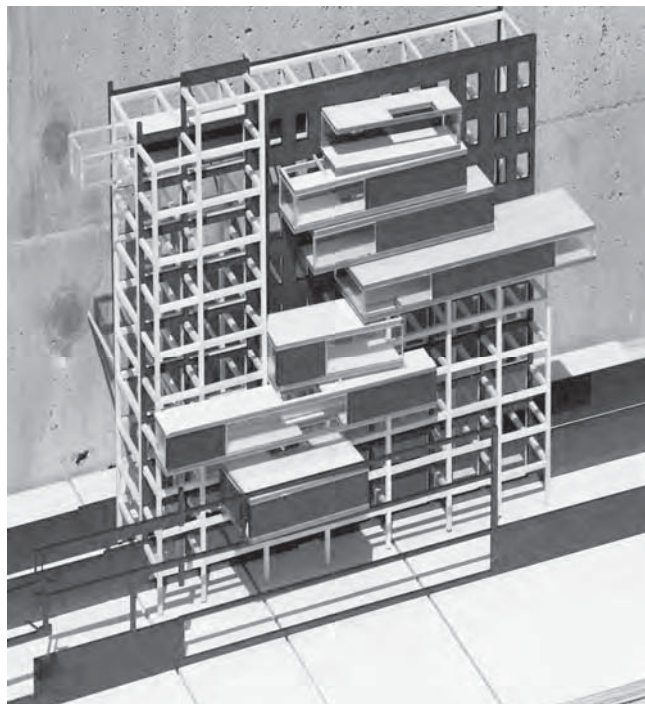


Figure 16. Final model of the Black Building with new proposal for architecture.

Clearly, constructing a deliberately fragmentary model analyzing an existing situation enabled *new ways of seeing things* (Schön & Wiggins, 1992). Considered as a “conversation with materials” (Schön, 1988a), Nelson's process critically engages digital and physical work to arrive at a position. In the end, Nelson's proposal represents neither a discrete proposal for extension nor a didactic stand-in

for the existing building. His proposal is, in short, not easily separable into parts labeled *existing* and *new*, but instead concretizes an unvoiced position between them, revealing each by degrees.

Conclusions

The work discussed here suggests that Schön's ideas about *reflection-in-action* and *conversation with materials* can productively apply to the analysis of existing architecture, at least within the context of an architectural studio ultimately focused on the production of new architecture. The application occurred as the following explicit pedagogical conditions were in place:

1. models constructed by the students to analyze existing architecture were expected to embody fragmentary and incomplete registrations of an existing building;
2. models were expected to be produced in an iterative fashion (i. e., that each new model was expected to constitute a physical response to ideas latent in prior models); and
3. even as the models were immediately directed to the purpose of analyzing existing architecture, they were expected to influence or direct the production of new architecture (though this process was not required to be linear or predictable).

The first two conditions are nothing more than specific formulations of widely-accepted ideas concerning the functioning of mediating artifacts in architectural design (e. g., Graves, Leatherbarrow, Porter, Crowe & Hurtt, etc.), and both conditions are compatible with Schön's assumptions regarding the functioning of reflection-in-action within the studio. The third condition is less obviously necessary to sustain a relationship between Schön's ideas and the processes involved in analyzing existing architecture. The question is whether artifacts engaging reflection-in-action must necessarily inform *the production of new architecture*. A test of this question would be to structure an architectural studio around the problem of analysis of an existing building, requiring the students to design and produce representations of it, but not resulting in any explicit production of new architecture. In contrast to the examples discussed by Schön (specifically, Petra's response to the contours, or the discussion of the library entrances), such a design studio would depend upon the construction of mediating artifacts directed to no *a priori* purpose. To what degree would a specific artifact made in this studio depend on the decisions made by an original designer? To what degree would it depend on a student's ability to reflect-in-action on an earlier artifact? How would this studio conclude, if not in the production of new architecture?

I argue that not only is it important to reflect-in-action on existing architecture when the question of producing an addition to that building arises, but generally when new architecture must take place within the context of existing architecture, which is always true in urban sites. As the analysis of existing work is shown to productively inform new, that is, as reflection-in-action becomes something more like "action enabled through reflection," the implications of Schön's decades-old work on architectural design pedagogy remain current and influential. A question with wider implications for architectural pedagogy seems to be whether an architecture studio could successfully engage Schön's reflection-in-action while deliberately avoiding explicit production of new architecture.

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Notes

1. All images are by the author, except Figure 13, downloaded from www.fargo-history.com; Figures 8, 9, and 10, provided by Meghan Gruber; and Figure 14, provided by Brent Nelson.