STRUCTURE, MEMORY, AND VISIBILITY

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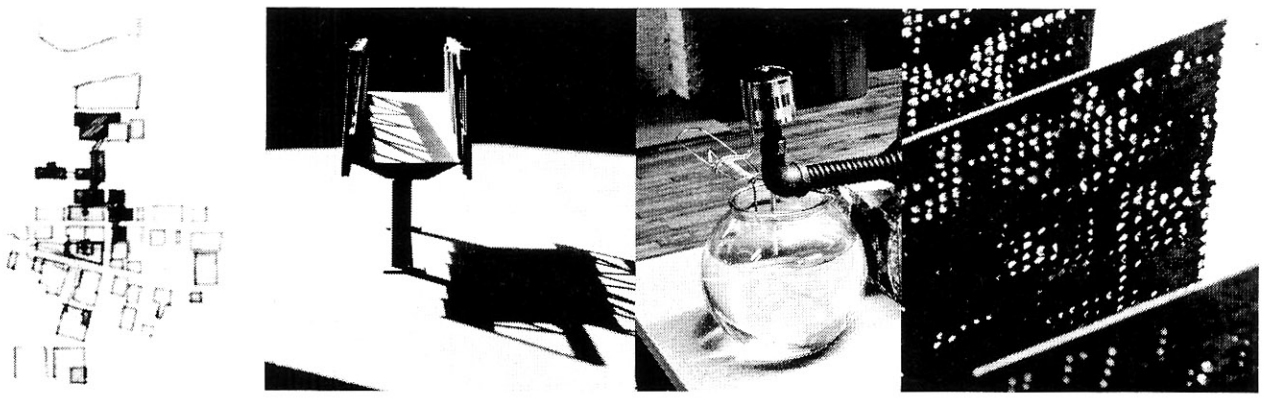

Fig. 1. Students: R. Smith, K. Halling, M. Honzay, B. Nelson

Introduction

As instructors at a North American university, we recently confronted the need to define curricular content for a third-year architectural design studio intersecting two primary objectives: to comprehensively address steel structure and detailing in architecture, and to introduce students to questions about architecture's relationships to an urban context. We determined to integrate these objectives through exploration of a less well-bounded question: could a studio be structured to productively blur distinctions between *architectural research* and *design innovation,* developing those cognitive skills common to each set of tasks, through a specific pedagogical focus on the production of representational artifacts such as models and drawings? Stated differently, we wished to test how a pedagogical focus on the production of representational artifacts could initiate and sustain a continuous process of observing and making-in-response, whether we termed this process *research* or *design*.

From the outset, our position acknowledged that a successful studio would depend on students developing an ability to proceed through research and design phases with confidence, despite their being surrounded by conflicting information and an ever-expanding array of media and tools. We recognized that the progression in architectural education from a "historic" dependence on analog media into a contemporary dependence on analog, digital, and hybrid media has made students' choices more complex even as their options expand in scope. To develop this ability of effective media

selection over the course of a semester became an early issue in our curricular development.

Effective media selection could be defined as the ability for a student to develop productive inquiry through the testing of sensibilities concerning media, or as the ability to decide whether one medium or another, or a combination of media, is better-suited to the asking of a particular set of questions. As a consequence of their inherent properties, specific physical media are well-suited to particular lines of architectural inquiry. Digital media also possess inherent properties, limitations, and capabilities, meaning that effective digital media selection demands knowledge as specific and sensibilities as well-developed as those required for effective analog media selection. In the sense that digital media are consequences of programmers' explicit decisions, their capabilities are perhaps even more strongly inherent than those of analog media: a pencil or a wet rag may be used to push paint around on a canvas, but there is no obvious way to use Photoshop to build a three-dimensional digital model.[1]

We set the studio's primary learning objective as a test of the relevance of graphics skills to the understanding of site as precedent, and to the development and understanding of formal ordering systems. We repeatedly returned to the question: *How do the things we make to make our ideas visible affect the character and outcomes of our design processes?*

The criticality of mediating artifacts

Studio education depends on establishing pedagogical conditions for the production of mediating artifacts such as drawings and models as means of stimulating collaborative discussion of existing and proposed architectural projects. The success of a studio depends on establishing a shared language centered around the design, production, and collaborative criticism of mediating artifacts. David Leatherbarrow, in a 1998 essay,[2] names three practices as being specific to the architectural discipline:

(1) Mediating artifacts are constructed to disclose things which cannot, nor ever will be, seen (e. g., a floor plan makes a building "visible" in a way which cannot be achieved by someone inhabiting the building);
(2) Architects engage in a process of *reciprocal questioning,* which requires that understanding proceed through dialogue (implying that architectural ideas take form through the iterated production of mediating artifacts);
(3) Architects rely on knowledge of building technology as a combination of techniques of mass-production and of manual craft.

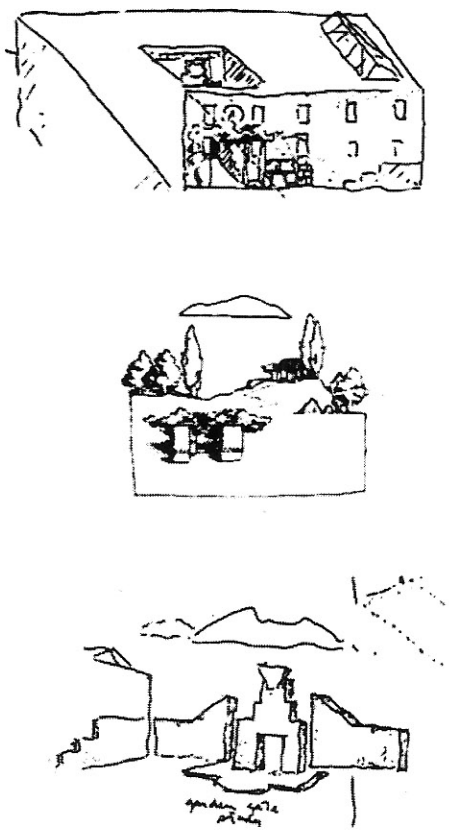

Fig. 2. Michael Graves's "tangible speculation."

Michael Graves in a widely-referenced 1977 article supports Leatherbarrow's identification of the criticality of media and drawing to the architectural discipline. Graves identifies a specific property of mediating artifacts as *tangible speculation:* that is, that an artifact such as a sketch simultaneously makes a

proposal specific and opens new possibilities for interpretation (Fig. 2).[3]

The criticality of media as ground for self-reflection is further emphasized by William Porter, who writes that "objects may be created [in the process of architectural production] that are not integral to the production of the building, yet are integral to the cultivation of ideas that relate to the building."[4] Stated differently, artifacts produced during *research* or *design* phases have the potential to cultivate architectural ideas, the ultimate implications of which upon a finished architectural product may not be immediately clear. In short, the selection of a particular medium necessarily restricts the possible material as well as conceptual outcomes in architecture: as Julio Bermudez and Kevin King have noted, media directly and essentially impact the way architecture is "conceived, developed, and communicated."[5]

Defining the project

As is often true of cold-climate downtown or institutional sites, Fargo, North Dakota, contains a system of elevated walkways or *skyways* which connect a disparate collection of buildings to each other. Fargo's skyway system consists of steel-and-glass bridges spanning downtown streets, and interior hallways at the second floors of buildings connecting one bridge to the next. The bridges rely on modular structural frames, possess strong visual transparency, and exhibit consistent articulations of assemblies and components over multiple scales. The system responds to a programmatic need to connect to varying types of existing structures, and to the desirability of standardizing system construction to minimize construction costs. The skyway system represents a deliberate attempt to structure memory through visibility and thus to aid navigation within the city; in other words, as a system, it relies on carefully structured visibility in order to function.[6]

American cities in general (and Fargo's downtown is no exception) are characterized by apparently accidental relationships in urban form and patterns of use (Fig. 3) – for example, as seen in the insertion of new skyways within and between existing buildings.[7] While we acknowledged that the difficulty of urban analysis is due in part to a multiplicity of observable systems as well as to apparent complexity of interrelationship, we also recognized that a principal pedagogical issue in urban analysis is *effective media selection*. We felt that the studio project would need to be defined in such a way that students could test the effectiveness of media (drawings, photography, model-making) as means of productively discerning and describing significant attributes in both existing urban landscapes and in their own developing design work.

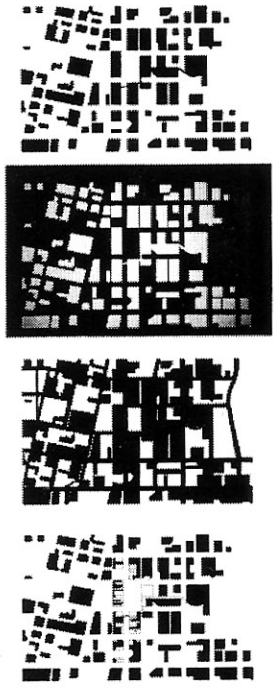

Fig. 3. Maps of downtown Fargo, North Dakota (student: T. Zelazny)

In attempting to define a semester-long studio project fitting within our stated objectives, we recognized that effective media selection as a pedagogical issue could be highlighted through our choice of a specific urban site. Thus, we

formulated a studio syllabus which had as its primary design project the extension to the Fargo skyway system. We designed a series of exercises for the first half of the semester, requiring each student to define a specific *field of action* for a proposed extension, and provoking each of them to consider how this question is made operational through the production of representational artifacts. We opened the second half of the semester as a means of testing the students' abilities to apply their conceptual understandings of media and site to the specific problem of articulating, in architectural terms, extensions to the system.

Structuring the studio assignments

We divided the operational aspect of the studio into three phases: a field selection phase, the proposal itself, and a period of reflection. Students completed the field selection phase with a presentation arguing in favor of a specific field of action within which the Fargo Skyway System could be extended. This phase included six interrelated assignments which we designed to engage the students in discussion about the iterative nature of the design process and its corollary in urban development. These six assignments are discussed in detail below.

Assignment 1: Huge Joined Model

In the first investigation, which we came to call the "Huge Joined Model," students worked in groups of increasing size to design and build material connections between found objects.
To begin the assignment, we asked each student to find an object which was "heavy and somewhat inconvenient" and which fit within a 12" cube. Each student documented the material and conceptual properties of their object most amenable to sustaining physical connections with the found objects of other students. Students then worked in pairs to join their two objects and to document the result. This process was repeated in larger groups – from groups of two students to groups of four, then eight – until at the end, sections of sixteen students collaboratively completed the Huge Joined Model by joining large assemblies of previously-joined objects (Fig. 4). Each student was required to document the whole, the part they contributed, and the character of the joints immediately around it.

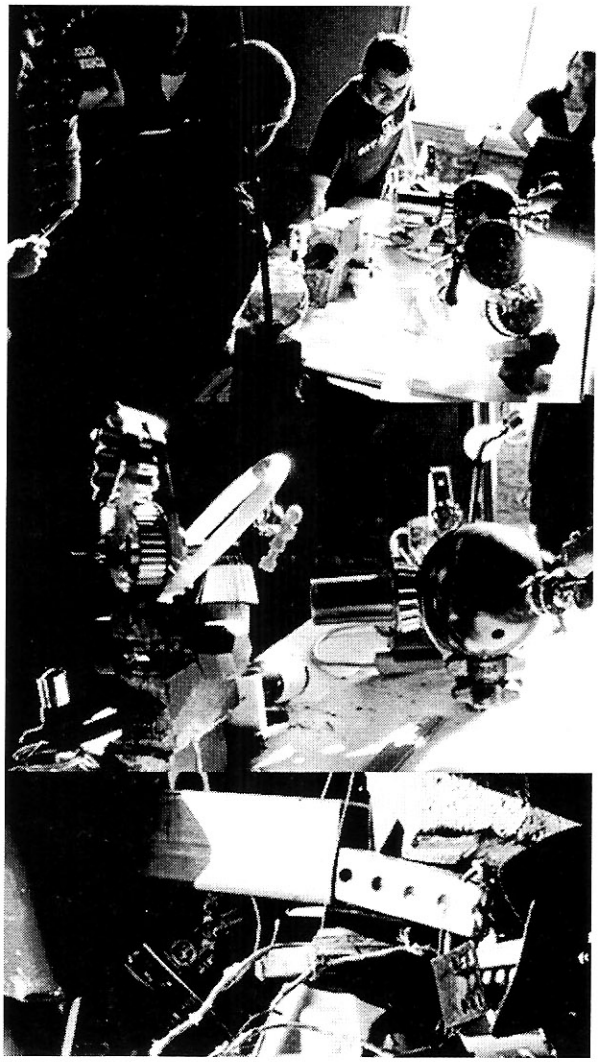

Fig. 4. Construction of the Huge Joined Model.

The exercise raised the issue of restrictions imposed by a series of free but disassociated decisions in the making of a system. In this way, it served as a simulation of the larger forces – social, economic, and political – that drive urban development. The students came to understand that while architects are granted some

professional freedom, that freedom is at the same time restricted by the choices others make in the same arena, and particularly by the material result of those choices, which in contemporary urban environments often appear random and "somewhat inconvenient." This understanding informed subsequent possibilities for designing new skyways within the existing field of downtown buildings.

Assignment 2: Objects and Seeing

The next assignment required the students respond to the Huge Joined Model and their memories of its production. We asked them to consider three questions:
(1) In what way can the system as a whole be made visible (re-presented) so as to emphasize memorable aspects of its entirety, its totality as a system, its completeness?
(2) In what way can a fragment of the system (consisting of at least three objects and their joining artifacts) be made visible so as to emphasize memorable aspects which the objects and their joining artifacts have in common with each other?
(3) In what way can a selected pair of objects and their joining artifact be made visible so as to emphasize the primacy of the joint over the objects?
We asked the students to produce three artifacts in response to each question, using a range of media and techniques. This not only provided a range of possibilities for re-presenting memories of making while enlarging the speculative tools available to the students, but it also reinforced the students' developing conviction that observations and the memories derived from them are critically important in developing design concepts. The exercise offered an opportunity for students to test how underlying conceptual meanings in architecture can be substantiated and revealed through an accretion of details and the joining actions that perpetuate them.

Assignment 3: Skyway and Seeing

The third assignment required the students to visit the Fargo skyways and record their observations through *orthographic drawings, structured photography* (360-degree panoramas and frame-by-frame summaries of movement), and *image fields* composed through sequencing of space. We asked the students two sets of questions. The first set of questions dealt with apprehending the structural systems employed in the skyway system and their visibility (or lack thereof), and whether the presence was memorable in the sense that it could assist navigation through the system. *Did the system's materials operate to reveal or obscure the structural system, and did their joining provide points of memory during navigation?*
The second set of questions dealt with the system's facility to provide memories and navigational characteristics to users. Did the system in its parts, and in its whole, make the city visible and memorable? *Did the physical layout buttress memories of the passage of time? Did it encourage a pace that would allow memories to accumulate to the threshold of navigation?*
We designed this assignment to assist the students in moving their newly acquired skills in the re-presentation of memory out of the laboratory environment of the studio and into the larger environment of the living city. As a consequence of their deliberate close examination of the existing skyway system, several students reached a critical threshold, as they encountered the existing system's failure to structure a specifically memorable set of experiences. At the close of this assignment the students understood that durable building materials and proper construction techniques mean that architectural decisions reified in the larger world possess long lives. Lack of content becomes frozen in time. The sense of melancholy experienced by numerous students was anticipated by us and would prove a useful viewpoint during the design of their proposal.

Assignment 4: Skyway and Constructing

Assignment 4 required the students to reassess their visit to, and the conclusions they drew about, the existing skyways. Specifically, we re-asked questions from Assignment 2, except that we asked the students to consider "spaces and surfaces" instead of "objects." In this assignment we were interested in providing the students with a conduit to move from a strictly critical viewpoint, one of disappointment at the lack of memorable experiences within the existing system, to a more flexible critical stance that would allow them to discover the potentialities present in the disassociated and often expedient free-for-all of urban development. In the making of their re-presentation materials they exhibited an increasing interest not only in the joints, large and small, but also in the design and construction techniques employed in the construction of the skyway that sometimes revealed joints and sometimes did not. Through this assignment, the students developed an understanding that the act of assembling and joining materials could, under the right set of circumstances, establish a memorable event in space and time. Further, they became convinced that the act of making communicative artifacts such as drawings, models, and photographs of joints at various scales is a deliberative process rich in potential for making memorable experience visible.

Assignment 4.5: Sticks

We designed the Sticks exercise to heighten awareness of relationships between the assembly of structural frames and the ability of frames (in combination with planes both opaque and translucent) to modulate light. The exercise required students to use a strictly limited set of materials – bamboo skewers and rubber bands – over a strictly limited duration to construct simple scale models of skyways. First, we divided the students into teams of four or five people, and we asked each team to construct an assembly using the smallest number of units possible, such that the assembly spanned four feet without intermediate support or end-fastening. No volumetric enclosure was initially permitted.

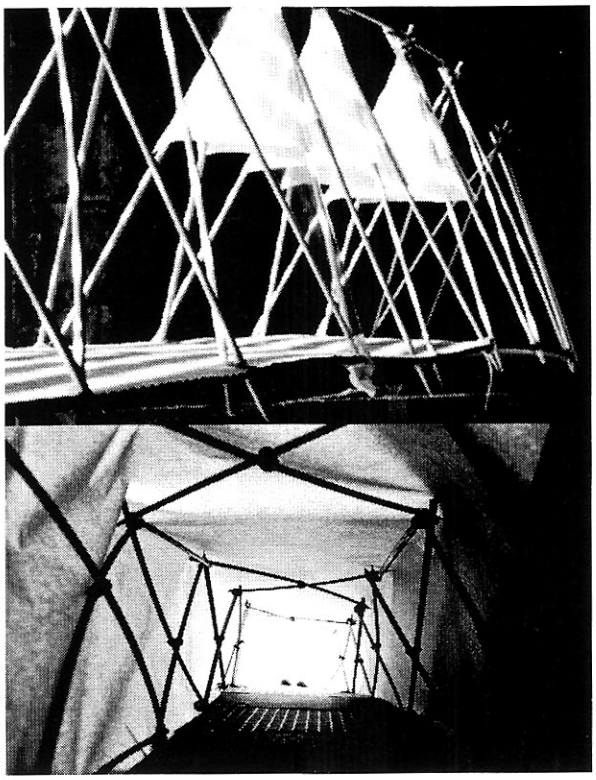

Fig. 5. Results of the Sticks exercise (Students: C. Downing, B. Nelson, T. Peterson, J. Strom, J. Stanz, M. Tarr, D. Tranby)

Next, we asked the students to consider the assembly as a scale model of a pedestrian bridge, and to include a walking surface composed of rigid planes. Finally, we asked them to modify their assembly to include enclosure, either by using rigid planes or nonrigid translucent material or a combination of both (Fig. 5). Students realized on their own initiative that lines drawn on nonrigid translucent paper could help them visualize the force distribution of the structures under load.

The most pronounced factor spurring creativity in this exercise was limited time. Because the students did not have the ability to plan ahead, they focused their efforts on fundamental means

of joining small objects into a cohesive structure. While certainly grounding their explorations in the strictly possible, the time limit also highlighted the need to collaborate efficiently as a team. Students revisited this exercise many times as they developed the design of their extension.

Assignment 5: Field Selection

In this assignment, each student selected a field of action for an extension of the existing skyway system. We required their presentation to address three questions. First, in what way did the entire system operate to make the city visible and how could the artifacts made to that point contribute to answer that question? Secondly, how or whether does the city make the system visible from within and again, how did the artifacts made to that point contribute to the answer of that question? And thirdly, what specific field of action would be best to propose an extension of the system?

This assignment was much more than a reprise of students' past documentation. It also challenged the students to find *memories of making* in their artifacts; to ask how and whether these memories made the city and the skyway system visible; and in making use of their past documentation materials, to confidently propose a field of action in which to design.

Structure and Program

The students developed their individual designs subject to specific issues, such as *structural responsibilities* (e. g., the need to span streets, the need to resist forces, and the need to impose loads on existing structures); *responsibilities regulated by common agreement* (e. g., accessibility and building codes); *responsibilities to the commercial function of the system; responsibilities to climate; and responsibilities to memory, visibility, and navigation* (e. g., provisions for directional devices, or signs that establish place, such as murals and windows). These responsibilities informed students about how their interventions could operate to make the city memorable, visible, and navigable.

Reflection: Comprehensive Document

At the end of the semester, each student compiled and reflected upon their work through essays discussing the issues and learning experiences of the studio. We established a minimum resolution of 300 DPI for all images, and we required at least one CD to be bound into the document.

Conclusions and speculations

Because we formulated the studio in response to two primary curricular objectives it is difficult to define an unambiguous means of evaluating its success. Considered first as a means of comprehensively addressing issues of steel structure and detailing, the studio clearly provided substantive analytical opportunities and significant design challenges for the students – which, for the most part, they met. Indeed, with our full support, several students chose to enter their studio work either individually or as teams in the 2007 ACSA Steel Competition. Considered secondly as an introduction to questions about architecture's relationships to an urban context, the studio provided ample opportunities for students to engage issues of a larger scale than those to which they were previously accustomed – or in other words, it served as a transition between smaller sites of earlier studios and a comprehensive urban design studio to follow in the succeeding semester.

The Huge Joined Model assignment seems, in hindsight, to have been both too brief in scope and too *initial* in that we did not actively query it throughout the semester. We gained insight into this question through the subsequent Sticks exercise. But why did the Sticks exercise have more purchase on the student's imaginations than the Huge Model? One of the weaknesses of the Huge Model is that it did not carry loads in an illustrative way. Being made of found objects

(e. g., a frying pan, a brick, a fan blade, a gear, a bearing race, a fish bowl and a fish), its joints, while showing great ingenuity on the part of the students, did not revealingly transmit forces but were instead simply *expedient*. The bamboo bridges, by contrast, contained *realism* in model form. Fundamentally, *the Huge Model lacked an ability to test reactions to force*. This became increasingly true as the model grew in size: while pairs of students could design their joints in specifically revealing ways, a mechanism for collaborating was not obvious. An analogy to the skyway system emerged: individual joints or connections might be carefully designed, but the system as a whole is fundamentally "disjointed." *How could we focus the design and jointing of our next Huge Model to amalgam the successful aspects of its making with the successful aspects of the bamboo bridge designs?* Could we restrict its materials to heighten their importance in structural behavior? Could we restrict the joint-making to draw more attention to load-carrying aspects? Could we extend the exercise, allowing students more time to design their joints, and to have these critiqued as they evolve? How might we more actively draw parallels between the act of collaboration on the Huge Model and the act of operating as an individual designer in a complex urban context? Could we emphasize documentation of the Huge Model, and then relate the documentation/design process to the documentation/design of fragments of the city? These questions were implicit in our thought before the semester started; the end-of-semester results suggest possible refinements.

Whether the studio productively blurred distinctions between research and design is answered best by students who invested time in the construction of analytical models of their sites, only to find that the exclusions and prioritizations necessary to make their analyses specific raised questions leading to new trajectories for design. Thus, a reframing of the studio focused on the production of research and analytical work *throughout the semester* could lead to exactly the kind of "productive blurring" we were hoping to achieve.

Notes

1. Mike Christenson. "Confidence in the presence of conflict: digital and analog media in architectural representation," in *Proceedings of the Design Communication Association Biannual Conference, 2005,* ed. Steven Juroszek (Bozeman, Montana: Design Communication Association, 2006): 55-64.
2. David Leatherbarrow. "Showing what otherwise hides itself." *Harvard Design Magazine* 6 (1998): 51-52.
3. Michael Graves. "The necessity of drawing: tangible speculation." *Architectural Design* 47 (1977): 388.
4. William L. Porter. "Designers' Objects," in *Design Representation,* ed. Gabriela Goldschmidt and William L. Porter (London: Springer, 2004): 63-79.
5. Julio Bermudez and Kevin King. "Media interaction and design process: establishing a knowledge base," *Automation in Construction* 9, no. 1 (2000): 37-56.
6. Mike Christenson. "Re-representation of urban imagery: Strategies for constructing knowledge," in *Proceedings of the 27th Annual Conference of the Association for Computer Aided Design in Architecture,* ed. Brian Lilley and Philip Beesley (Cambridge, Ontario: Riverside Architectural Press, 2007): 212-221.
7. Mike Christenson. "Accident and predictability: an analytical methodology for persistent forces in the American city," in *Proceedings of the Architectural Research Centers Consortium National Conference on Architectural Research, 2005,* ed. James L. West, David J. Perkes, and Anne H. Howell (Mississippi State, Mississippi: Mississippi State University College of Architecture, Art & Design, 2005).