Generative Making: Devising New Uses for Making in the Architectural Studio

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Introduction

In his essay The Tell-the-Tale Detail, Marco Frascari discusses the potential role of the detail as a generator of design. For him, within the architectural detail are both the "techne of logos" (the making of understanding) and the "logos of techne" (the understanding of making); here the construing and the construction of architecture coalesce.[1] If so, how can architectural details, building materiality, and processes of assembly inspire students as meaningful initiators of conceptual design? Detail and materiality both command prominent roles in our understanding of the essence and substance of the architecture we inhabit. Yet these elements have a tendency to escape significant investigation by architecture students due to the typical studio construct of macro-scale to micro-scale progression. In addition, although processes of making are used on a regular basis in the design studio, these processes are typically used to depict, demonstrate, develop, test, or convey design ideas. Rarely are acts of making charged with the task of generating ideas.

In a pair of recent courses, third year architecture students explored these topics by engaging with building materials through critical making. Matt Ratto, in his article "Critical Making," defines this process as a theoretical and pragmatic connection between two modes of engagement that are traditionally held apart: the conceptually based practice of critical thinking and the traditionally goal-based material work of making.[2] The exploration of materiality and detail can force students to engage a problem in ways outside of their comfort zone, sparking new ideas and habits of thinking that can be used to conceive future projects; it is a process of alternate perspectives. This paper compares two projects focused on the critical making of conceptual generators and postulates the potential this way of making holds for the training of future architects.

Critical Making

> While I was studying, I developed a particular way of thinking through making. Instead of always starting with a drawing or a discussion, I used the making of test pieces in the workshop to find ideas.... Although giving myself permission to experiment, I remained open and receptive to the possibilities that the materials in my hands were offering, ready to convert them into something useful. Making them, I was wondering how each one might translate to the scale of a building or piece of furniture...[3]

This process, illustrated by designer Thomas Heatherwick, can be described as one of critical making. Within this process, there are embedded two essential thinking strategies: critical thinking and lateral thinking. Critical thinking is an act of reasoning; when an individual critically thinks, he or she "actively links thoughts together in a way that allows [him or her] to believe one thought provides support for another thought."[4] Conversely, lateral thinking is a process by which the thinker poses different

approaches, concepts, or points of entry into a given problem. It is a process of exploration that is closely related to perception and asks the thinker to suspend judgment of 'correctness' or 'validity' in favor of opening up possibilities for 'what might be.' Critical thinking is a logical, step-by-step process; it is constantly attempting to move forward. Lateral thinking, on the contrary, steps sideways with the goal of revealing a series of ways to engage the problem from widely divergent perspectives. Where critical thinking is analytical in nature, lateral thinking is provocative.[5]

In critical making, these thinking skills are paired with processes of making. For making to occur, the maker must have a "systematic encounter with the material world."[6] This encounter is an embodied practice, one requiring the maker to use his or her body to generate a set of movements (known or unknown) in order to achieve the desired form or result of the made object. If the movements are known, the process likely has a logical structure; this type of making frequently strives for efficiency and a vertical step-by-step approach to making a pre-conceived product (i.e. an assembly line). Conversely, unknown movements liken the process of making to that of lateral and critical thinking. This process explores avenues for manipulating the material at hand (lateral thinking) and determines the best ways to use the material to achieve desired results (critical thinking).

Often, it is difficult for novice students to engage in making without prior knowledge of what they are going to make. There is a significant difference between making a model of a design and designing a project by making models. Tentative to make a leap without a plan in place, these students sit and ponder, frequently very unproductively. Critical making is one way of initiating a project. Utilizing the complementary tools of making and thinking, this construct has the ability to act as a generative device for sparking the design process.

In *Thinking Architecture*, Peter Zumthor positioned: "We know them all [architectural materials]. And yet we do not know them. In order to design, to invent architecture, we must learn to handle them with awareness. This is research; this is the work of remembering."[7] For Matthew Crawford, this notion centers on the need for experiential knowledge or "knowing how" instead of simply applying the universal knowledge of "knowing that."[8] Critical making not only has the potential to generate ideas, but also to deliver to students experiential knowledge of material. Juhani Pallasmaa would refer to this as learning the movements of the "architect's surrogate hands"[9] in reference to the craftsmen and laborers that execute the work that architects design. All refer to a need for architects, especially those in training, to have tangible knowledge of the elements of architecture. Critical making has the ability to provide those intimate connections.

Generation I: Cubes

This first generation of critical making exercises was inspired by David Morrow Guthrie's building exercises outlined in his book *Cube*. Guthrie sought to reinvigorate architectural education through the introduction of the tangible consequences of scale and materiality as primary components of assigned exercises.[10] Like Guthrie's, these design exercises sought to directly engage the students with hands-on design; here, however, the larger goal was the establishment of conceptual ideas through the critical making process.

The studio was setup as two concurrent tracks running the full length of the semester. The first track followed a typical studio trajectory, while the second pushed the students through a series of critical making exercises involving full-scale building materials that complemented the first. The two tracks informed each other, bridging critical making with traditional research and design and vice versa. Along with the ideas of critical making, this structure fostered student

engagement with the project through multiple mediums and different thought processes in an attempt to maximize the potential learning experience.

The first phase of the critical making track asked the students to develop 16"x16"x16" full scale cube constructs out of given materials while establishing a design concept about the relationships of the individual elements, the parts to the whole, and the space created within the cube. The designs were not models, but full scale constructions; they were not representations of anything larger or more "real." Although abstraction was not completely removed from the process, this fundamental shift from creating a representation of something to creating the object itself forced the students to fully resolve each component. The design of each element was generated through sketching and making. Drawings and other digitally produced elements were used solely for documentation and analysis of the finished constructions. These limits, along with an accelerated timeframe, forced the students to jump directly into the making process; sitting and pondering could not occur. Each student had to quickly begin to engage with the materials and the process of making and learn to generate ideas through exploration and experimentation.[11]

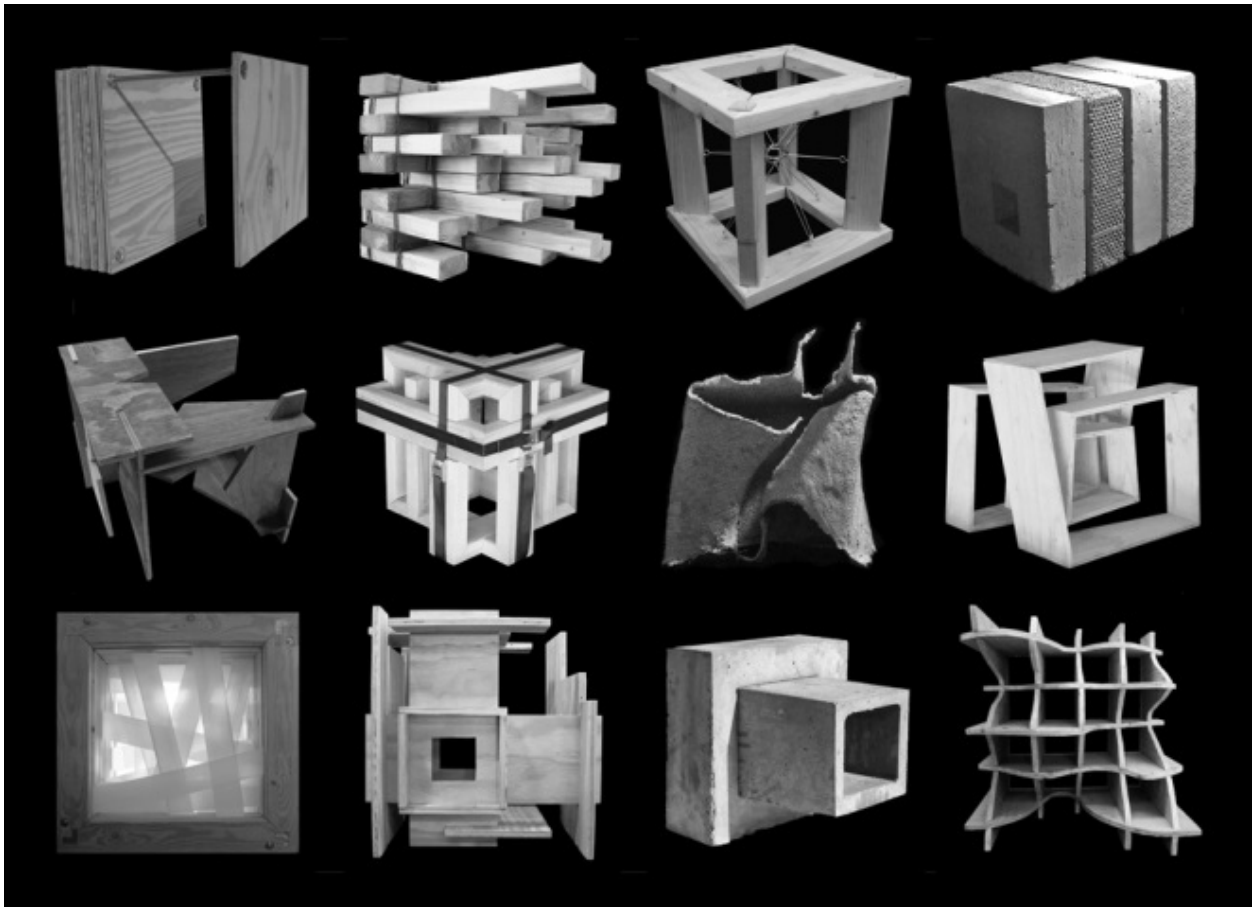

Fig. 1. Cube constructions - 2x4s, 1/2" plywood, concrete, fabric (M. Bartschi, J. Brookbank, D. Edwards, K. Griggs, P. Khatanifar, B. Lucke, R. Mays, D. Yu) (photographs by students), spring 2010

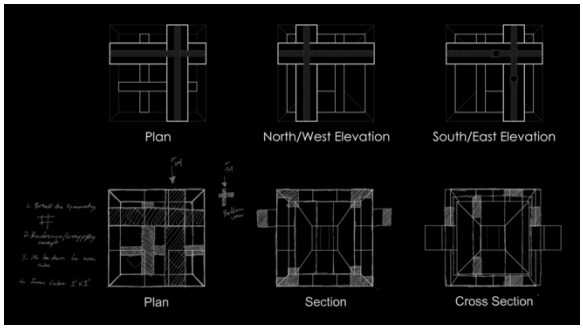

Fig. 2. As-built drawings and redlines (P. Khatanifar), spring 2010

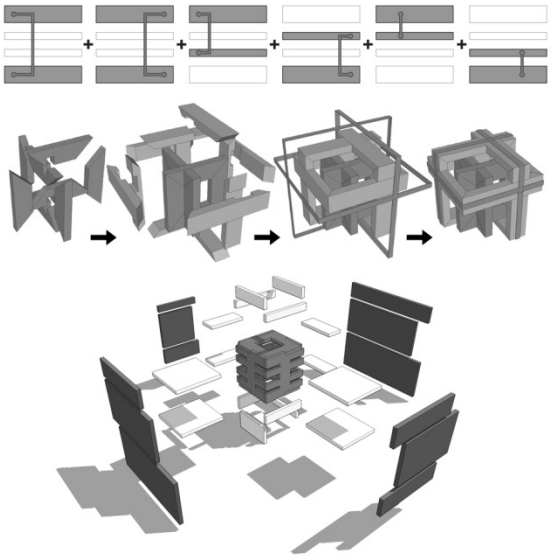

Fig. 3. Cube analysis diagrams (D. Edwards, P. Khatanifar, R. Mays), spring 2010

There were four pairs of cubes built by the students in this studio, each from a different primary material (2x4s, 1/2" plywood, concrete, and fabric). The process of maintaining student engagement in each pair of constructions required alternating between sketching, fabricating (Figure 1), documenting (Figure 2), critical thinking via studio critique and drawing markups (Figure 2), and analysis (Figure 3) in an iterative cycle. Each finished construction was required to demonstrate an understanding of the medium, the detailing, and the design thesis. At the conclusion of each exercise, the students were asked to excavate ideas out of the assemblies and transfer them over to the next material construct. This analysis was crucial to the experience as it required the students to critically think beyond form (much like a case study), to the ideas or lessons generated through the process of making. This transfer of medium was also essential as the unique qualities of concrete, wood, and fabric provided the students with a wide palate for exploring their ideas. At the end of the critical making exercises, the ideas were drawn out for a final time and used to inspire the final studio project: an arts center (Figure 4).

There were three primary goals for the critical making exercises in this course. First, the baseline goal was to generate ideas through the making of constructions. This goal was met with distinction throughout the course. Each student in the class was able to quarry architectural ideas from their constructions. The translation of these ideas, however, proved to be more challenging. Although most of the students were able to carry their ideas from construct to construct fairly effectively, the final translation to the primary

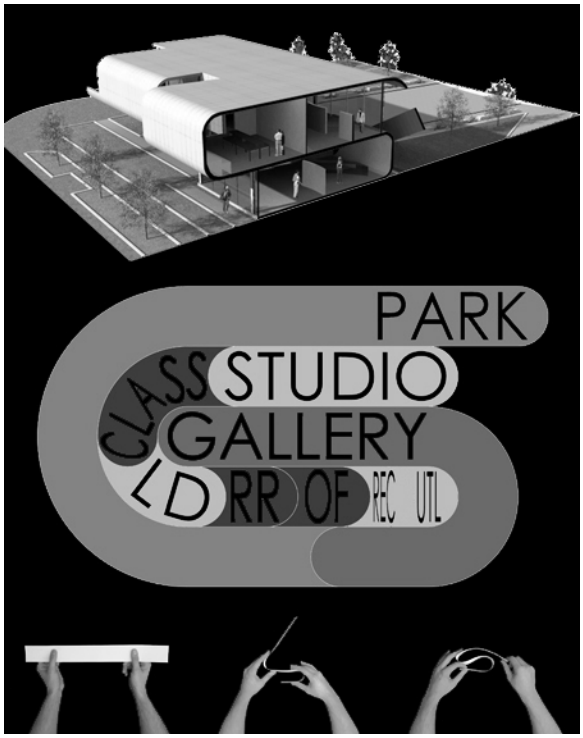

Fig. 4. Final Arts Center project (P. Khatanifar), spring 2010

project was a significant challenge for a majority of the class.

The second goal was to use this process to broaden student perspectives regarding architectural design. The process of critical making opened up a new approach to design that most of the students had never experienced, exposing them to alternate ways of thinking and expanding their skill set.

And finally, the third goal was the creation of intimacy. The notion of critical making centers on a more intimate connection with a tangible subject. It is about touching material, feeling its form, and reshaping it into an idea. It is about developing an intimate relationship with the physical world and using that relationship to inspire design. As Martin Heidegger has stated: "the way we come to know a hammer is not by staring at it, but by grabbing hold of it and using it."[12] The experience of critical making for an architecture student can, therefore, help him or her understand the actual processes involved in creating architecture. Students engaging in this work never find that their conceived constructions are easier to build than they originally thought; it is always the opposite. As students explore their ideas about architecture with an interaction that reaches beyond the visual, they nurture their ability to understand the ramifications of their design decisions more clearly.[13]

Generation II: Panels

The second generation of the critical making exercises sought to build on the successes of the first while also addressing its shortfalls. The general construct of the assignments stayed intact in this course. Each student built pairs of constructions out of the same types of materials and followed a similar process to that of the first generation; they iteratively alternated between sketching, fabricating (Figure 5), documenting, critical thinking via studio critique and drawing markups, and analysis. Again, each finished construction was required to demonstrate an understanding of the medium, the assembly, and the design thesis. The ideas within each construction were developed and carried from one construct to the next. At the end of the critical making exercises, the ideas were, once again, drawn out and used to inspire the final studio project: a cemetery (Figures 6 and 7).

Despite the similarity in the process, this generation of exercises included several significant modifications from the first. In this studio, the generic configuration for the constructions was a 32"x16"x4" panel instead of a cube. This transition was made to align with the program of the primary studio project, but also, more importantly, to assist in the translation of ideas. The plane-like nature of the panel offered the potential to provide a clearer transition into a variety of architectural situations than the object-like nature of the cube.

In addition to this change, the analysis phase of the exercise integrated tasks focused on translation directly into the process. For each panel, the students were required to create simple renderings that, in an abstract way, turned photographs of their constructions into architectural environments at different scales - that of the detail, the room, the building, and the site (Figure 8). These translation exercises proved to be very useful as this class demonstrated more clarity in reinterpreting the ideas nurtured in the panel constructions during their work on the cemetery project.

The introduction to the critical making project was also modified in generation II. In this class, each student was required to select an object/scene/image to serve as an inspiration for the design of the first panel. This inspiration was found during a field trip to several local cemeteries (including our final project site) during the first week of class. The elements - the sinuous roots of an old tree, the stained glass on the door of a mausoleum, the patterning of gravestones in a remote corner of the cemetery - were

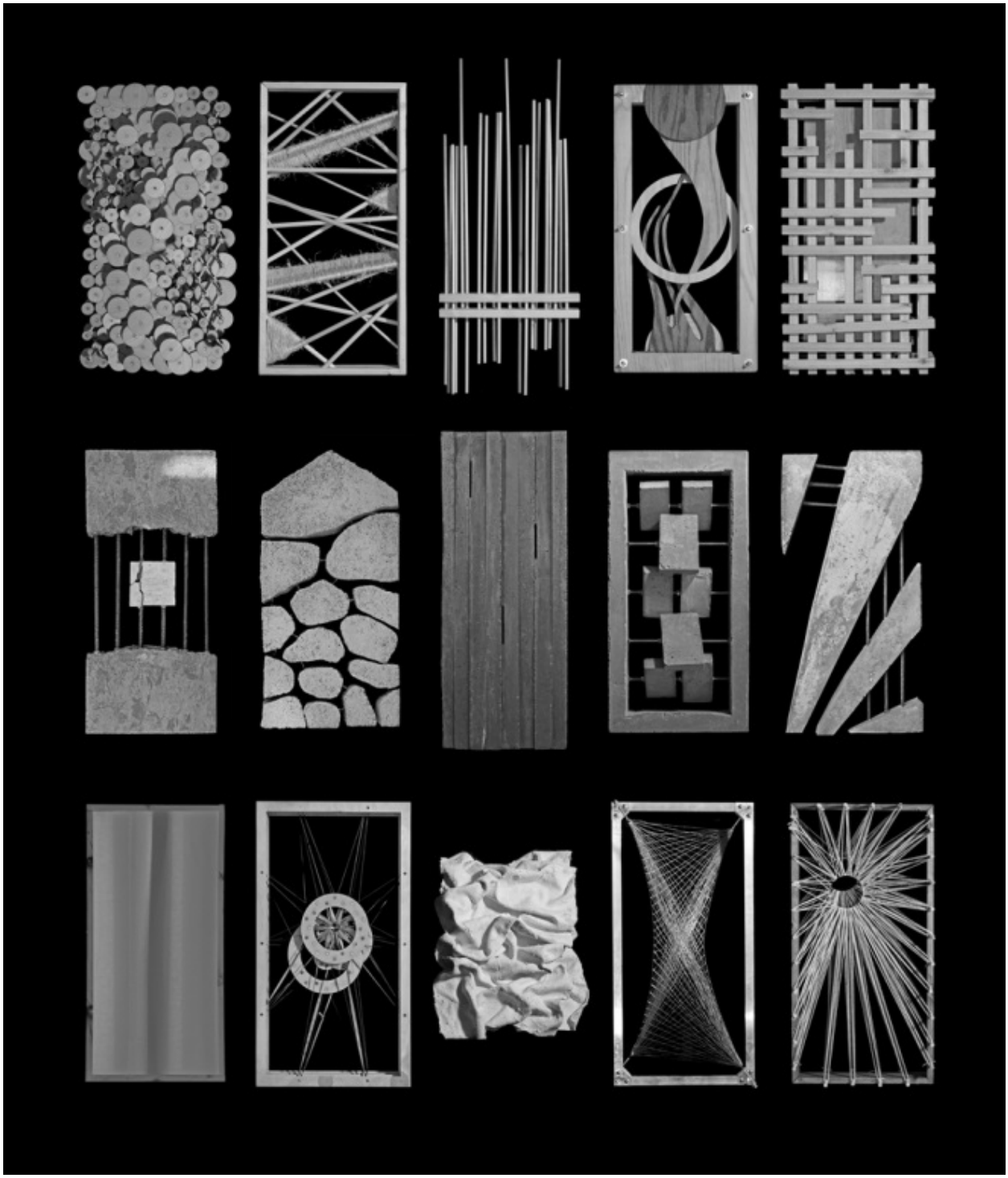

Fig. 5. Panel constructions, wood, concrete, fabric (M. Ollmann, A. Steiskal, K. Patrick, D. Thomason, S. Dale, A. Michael, R. Musial, B. Mount, R. Northcutt) (photographs by author), fall 2012

photographed and the images were analyzed and mined for useful lessons. These inspirations made the initiation of the making process easier for the students as the proverbial "blank canvas" never existed; there were always existing ideas to draw from. This addition also helped root the

problems in "place," even though they did not have an actual site or context.

Despite the modifications, the project goals remained the same as in the first generation: the production of ideas through the making of constructions, the broadening of student perspectives, and the opportunity for intimacy. Once again, all three goals were met relatively well. The modifications to this studio allowed for better transition into and through the series and the work produced by the students demonstrated an absorption in the process.

Conclusion

> It is symptomatic of the priority given to sight that we find it necessary to remind ourselves that the tactile is an important dimension in the perception of built form. One has in mind a whole range of complementary sensory perceptions which are registered by the labile body: the intensity of light, darkness, heat and cold; the feeling of humidity; the aroma of material; the almost palpable presence of masonry as the body senses its own confinement; the momentum of an induced gait and the relative inertia of the body as it traverses the floor; the echoing resonance of our own footfall.[14]

This quote by Kenneth Frampton is as true for the education of the architecture student as it is for the practicing architect. In these two courses, third year students were introduced to a new strategy of engagement. The results revealed a strong reception by both student groups (an average of 4.95 out of 5.0 from both groups on course quality and educational experience), but also revealed that there is room to grow and build on these initial attempts. Moving forward, new impetuses include the introduction of a strong literature review (a key to Ratto's construct), the increased use of recycled materials, and new strategies to transfer ideas between constructs. Nevertheless, critical making would appear to have a place in an architectural curriculum that strives for connectivity between design and construction.

Architects Stephen Kieran and James Timberlake have claimed in *Refabricating Architecture* that the next generations of architecture will not be about style, but instead will focus on substance and the methods and processes of making.[15]

Fig. 6 (top). Cemetery Section, Fig. 7 (bottom). Cemetery Element Diagrams (R. Northcutt), fall 2012

Projects undertaken through the lens of critical making in the context of full-scale constructions provide architectural students the opportunity to become more engaged in architectural assembly. This process driven strategy is about substance and style and has the potential to be a significant contributor in the development of the next generation of architects.

Fig. 8. Panel inhabitation, monument (K. Odle), fall 2012.

Notes:

[1] Marco Frascari, "The Tell-the-Tale Detail," in *Theorizing a New Agenda for Architecture:* An *Anthology of Architectural Theory 1965-1995*, ed. Kate Nesbitt (New York: Princeton Architectural Press, 1996), 500.

[2] Matt Ratto, "Critical Making: Conceptual and Material Studies in Technology and Social Life," *The Information Society* 27 (2011): 253.

[3] Thomas Heatherwick, *Thomas Heatherwick: Making* (New York: The Monacelli Press, 2012), 22.

[4] William Hughes, Jonathan Lavery, and Katheryn Doran, *Critical thinking: An Introduction to the Basic Skills*, *6th ed.* (New York: Broadview Press, 2010), 19.

[5] Edward de Bono, *Serious Creativity: Using the Power of Lateral Thinking to Create New Ideas* (New York: HarperCollins, 1992); Edward de Bono, *Lateral Thinking: Creativity Step by Step* (New York: Harper & Row Publishers, 1970)

[6] Matthew Crawford, *Shop Class as Soulcraft: An Inquiry into the Value of Work* (New York: Penguin Books, 2010), 21.

[7] Peter Zumthor, *Thinking Architecture*, *2nd ed.* (Boston: Birkhauser, 2006), 66.

[8] Crawford, *Shop Class as Soulcraft*, 161.

[9] Juhani Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture* (West Sussex: John Wiley & Sons Ltd., 2009), 63.

[10] David Morrow Guthrie, *Cube* (New York: Princeton Architectural Press, 2005).

[11] Paragraph adapted from: Chad Schwartz, "Crafting intimacy: Sculpting the Design Process of the Architecture Student," *The International Journal of Design Education*, 6 (3), 68.

[12] Matthew Crawford, *Shop Class as Soulcraft*, 163-164.

[13] Paragraph adapted from: Chad Schwartz, "Crafting intimacy," 67-68.

[14] Kenneth Frampton, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance," in *The Anti-Aesthetic: Essays on Postmodern Culture*, ed. Hal Foster (Seattle: Bay Press, 1983), 28.

[15] Stephen Kieran and James Timberlake, *Refabricating Architecture: How Manufacturing Methodologies* are *Poised to Transform Building Construction* (New York: McGraw-Hill, 2004).