

## Formative Material Studies: Developing Tectonic Awareness in Beginning Design Students

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### Introduction

One of the more challenging aspects of beginning design is the integration of technical subjects into foundation design studios. In upper division studios, design-build projects or comprehensive design projects address this, but projects in lower divisions have traditionally focused on design principles at the expense of materials and fabrication processes. How can these issues be addressed in the early years of a student's architectural development? How can we instill a sense of materiality and craft in an environment where digital processes are so nuanced and invisible? How can we develop student awareness of formal, spatial, tactile and experiential aspects of architecture as products of material and fabrication processes?

At Cal Poly we've begun to address these questions by introducing Form and Material Studies into second-year design studios. Related to larger design projects, these studies are conducted parallel to lectures, presentations and readings meant to frame conversations about the conceptual, theoretical, aesthetic, philosophical, performative and technical issues affecting architecture. The studies are designed to promote a fundamental understanding of materiality, tactility and fabrication processes. The focus is placed on traditional materials and processes (joining and binding wood, folding paper, weaving reed, casting plaster, etc.) with the understanding that these studies will lead to greater speculation in subsequent projects or design courses.

Two principles underpin this approach. First, we believe that although advanced materials and digital tools allow great freedom in architectural form, it is also necessary for designers to understand parameters that can and should delimit most architectural projects. Second, we believe that it is crucial to make the relationships between material and fabrication, and also between form and process apparent before students move to more complex digital studies and fabrication methods where these relationships become less visible.

This paper presents ten total projects executed by second year students at Cal Poly between 2007-09. Seven of the projects are Form and Material Studies, i.e. short projects that may be evaluated on their own merit but which also inform more comprehensive studio projects. Three of the comprehensive projects informed by the studies are also included here to illustrate their larger context. In addition to linking materials with processes and processes with form, the studies are intended to reinforce larger themes intro-

duced in second-year studios such as lessons from everyday life, topography and site, single-space form, multi-space form and the changing role of technology in contemporary society.



Fig. 1: Examples of Studies 1, 2 and 3.

### Form and Material Study 1: Casting the Everyday Object

Students, even those in their first or second year of college, are adept at finding and following the flashpoints of design and culture. This project challenged students to observe the world beyond the fantastic surface that fascinates the world-at-large in an effort to learn lessons from everyday life that are less obvious but often more poignant. Underpinned by a reading of Giuseppe Zambonini's essay "Notes for a Theory of Making in a Time of Necessity", this project encouraged students to engage the inner life of ordinary things while developing tactics for better understanding them.

Casting the Everyday Object (see fig. 1, top) asked students to select three thematically linked objects that could not be fully understood from looking at their exteriors. Using the

objects themselves as molds, students prepared and cast them thereby capturing the negative space with plaster and making the invisible visible.

The first learning objective was to hone students' ability to look more closely at the everyday world. Students had to demonstrate curiosity and a facility for looking beyond surfaces into the substance of things. The second learning objective was to explore a new tactic for studying space: casting with plaster. Students had to demonstrate a grasp of the physical properties of the material, as well as the process used to give it form, namely mold preparation and release agents.

### Form and Material Study 2: Marking a Plaster Field

Extending student understanding of plaster casting learned in Casting the Everyday Object, this project focused less on casting as an analytical tactic applied to an existing object and more on design methods for generating a new object. As a starting point, students read and discussed Nicholas Serota and David Sylvester's interview with Richard Serra in *Weight and Measure* 1992.

Marking a Plaster Field (see fig. 1, middle) entailed two stages. The first was the composition and casting of a plaster relief 16"x24"x1-3". Students used the cast "objects" from their previous project to mark the surface of wet plaster cast in formwork of plywood and masonite. The emphasis in this stage was the successful composition of the markings in light of the surrounding white space, as well as an understanding of how to compose negative space without being able to see it in advance.

The second stage asked students to think of their compositions as a 1/8 scale representation of a plot of land measuring 128'x192' in San Luis Obispo County. With this scale shift in mind, students located a 25' wide road and added 200' total length of walls, composing these linear elements against the voids they created in the first stage. The walls were built from re-purposed masonite previously used as formwork to cast the plaster field in stage one.

### Form and Material Study 3: Wrapping and Incising

Students executed this project, Wrapping and Incising (see fig. 1, bottom), as a prelude to the design of a retreat for a poet. Since the retreat was to be the first building design attempted by most students in the class, this project was introduced to help them sidestep the feverish form making that often characterizes this situation.

At its core, this project is less about materials and more about processes that can be used to activate a simple volume using unexpected tactics to lend surprisingly three-dimensional results. For inspiration, students read Donald Wall's "Gordon Matta-Clark's Building Dissections".

For the first stage of this project, students chose a poet and a poem by that poet (or vice versa). Parallel to this activity,



Fig. 2: Examples of three scales of comprehensive project 1.

students used chipboard to build a 2.5"x5"x1.5" rectangular volume as an unfolded single surface. Students explored relationships between the chipboard shape and the printed poem so as to capture the text on as many faces of the volume as possible. The second stage of this project entailed incising a series of five openings in the volume with the stipulations that each opening must activate more than one face of the volume and that each opening could eliminate no more than one word of their poem.

#### **Comprehensive Project 1: Retreat for a Poet on a Rural Site**

This project, an 800 sf retreat for a poet sited on a half-acre plot of land in rural San Luis Obispo County, drew directly from the results of the previous three Form and Material Studies. Student designs for their plaster reliefs with walls (Marking a Plaster Field) were used as the landscape for the project, and their wrapped rectangular volumes with five openings (Wrapping and Incising) were used as the starting point for this project: Retreat for a Poet on a Rural Site.

The program called for interior spaces for writing, relaxing, sleeping, cooking, hygiene and storage. In addition, the site had to provide an outdoor poetry reading space for 40 persons, a shaded space for outdoor activities and a covered parking space.

Like the projects preceding it, this project began with a palette of materials. Students were asked to design the retreat using heavy timber construction using engineered lumber, clad with standing seam metal on structural insulated panels. Although this palette took a range of tectonic decisions out of student hands, it helped to rationalize the rectangular volume, gave the studio the chance to discuss construction issues common to all student projects, and helped to relate the studio to parallel courses in materials and methods of construction.

This project (see fig. 2) drew much of its inspiration from the house and studio designs of Le Corbusier as students were asked to incorporate four of the Five Points of Architecture. To ground their work, students read and discussed the essay "Houses and Villas" by William Curtis.

#### **Form and Material Study 4: Cutting, Layering and Binding**

The first objective of this project, Cutting, Layering and Binding (see fig. 2, top), was to introduce students to strategies that would help them in the project to follow, a printing press/book bindery for a narrow urban infill site. In preparation, students were asked to volume by re-configuring its solid and spatial layers. Rather than using 2-D or digital means of exploration, students were asked to build the simple volume using mdf for solid layers (floors) and all-thread for spacers/binders (columns). This approach enabled the second objective: to hone students' basic shop skills with various saws and drilling techniques.

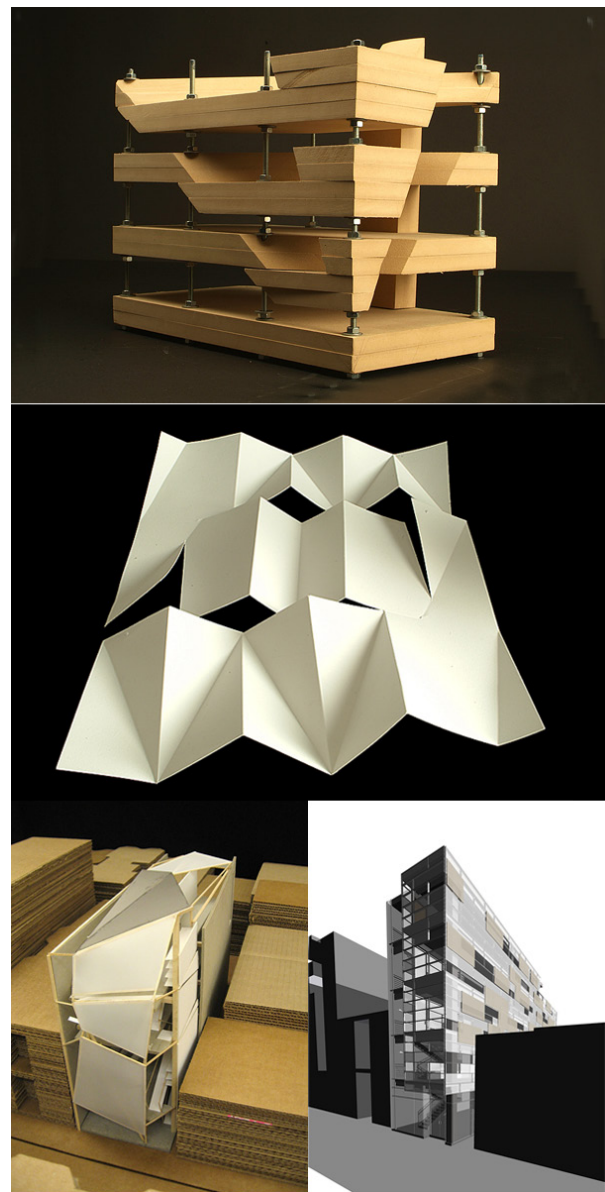
The project began with the reading and discussion of Steven Holl's essay "Anchoring" from the book of the same

name. Students then moved their efforts to the shop where they built simple, stacked volumes then worked to internally transform them by re-configuring their solid and spatial layers. The final stage was to add a vertical element in such a way that each "level" would be engaged.

This project addressed design issues such as solids vs. voids as well as their activation through subtraction. At the same time, it addressed tectonic tactics such as cutting, stacking, layering and binding.

#### **Form and Material Study 5: Transforming a Paper Field**

By way of Stan Allen's essay "Field Conditions," students were introduced to the concept of field as a way to envision form and tectonics as a response to a specific set of physical and/



*Fig. 3: Examples of studies 4 and 5, and comprehensive project 2.*



or metaphysical conditions at times embodying site, activity, space, energy and human relationships. Embedded in this statement is the issue of scale: both the conditions and the response may range from the scale of a building element to the scale of a city sector.

Beginning with 11"x17" sheets of Strathmore paper, Transforming a Paper Field (see fig. 3, middle) asked students to explore multiple studies of continuous fields using operations such as folding, pleating, scoring, bending, slotting and cutting. Regardless of the operation (no more than two could be used per sheet), no paper could be added or subtracted from the 11"x17" field. Along the way, students were encouraged to focus on economy when making their manipulations: how could the paper be transformed with just the slightest intervention?

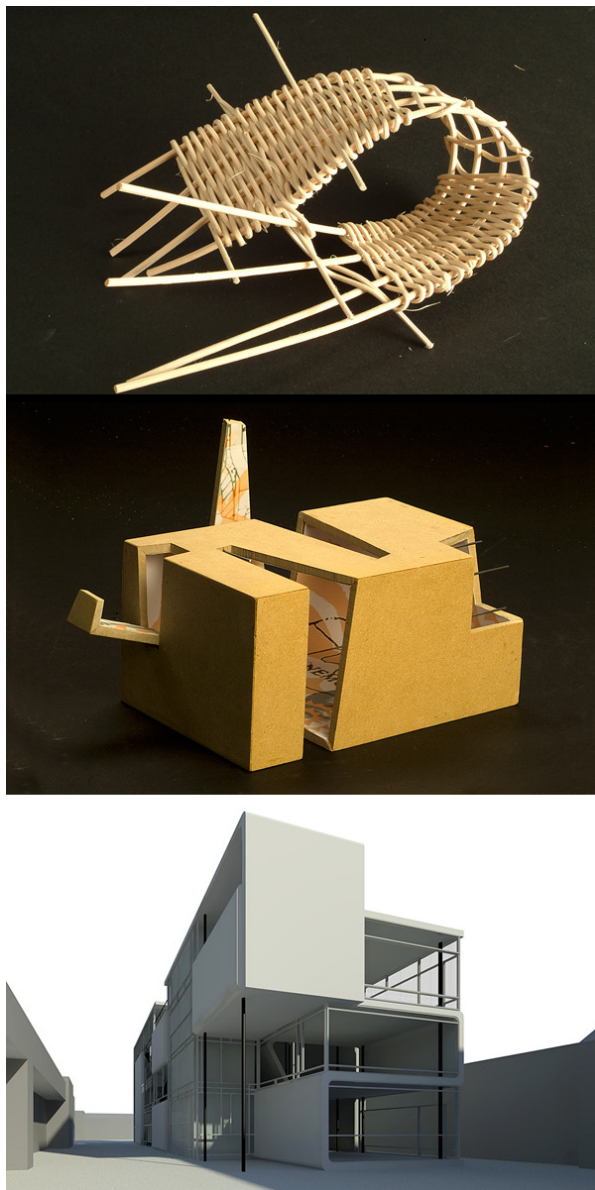


Fig. 4: Examples of studies 6 and 7, and comprehensive project 3.

## Comprehensive Project 2: Urban Strategies for a Printing Press

This project, Urban Strategies for a Printing Press (see fig. 3, bottom), was for many students their first attempt at a multi-story, mixed-use building type involving a complex urban site.

The San Francisco Bay area was selected for the project due to its long association with alternative presses. The presence of the Beats and the counter-culture surrounding Berkeley's campus generated a tradition of small, determined publishers dedicated to publishing works that were too controversial for larger publishing houses. Students began by researching this tradition and analyzing the SOMA district that had been selected for the project. A point of much discussion in the studio was the delicate balancing act necessary to address both the deference of architecture to the urban realm, i.e. the legibility of shared space, with the fresh paradigms of space and place necessary to engage the contemporary mind. Underpinning this discussion was the reading and discussion of "Afterimage" by Ben van Berkel and Caroline Bos.

The main components of the program were a 4500 sf printing press/book bindery, a 1500 sf cafe and exhibit space and a 1500 sf residence. The 25'x85' site required a 5' setback along the southwest side. This presented some unusual daylighting potential but also necessitated shading strategies. Students developed their projects using a combination of physical and digital models, moving back and forth between the two as the design process required. Like the projects preceding it, this project began with a somewhat prescribed palette of materials: students were asked to design with a heavy timber frame in combination with CMU masonry where fire separations and shear walls were required.

## Form and Material Study 6: Weaving Surface and Form

As a prelude to a museum of Chumash culture, this project (see fig. 4, top) positioned itself as a form of research into the material lives of the Chumash Indians, the indigenous people of the Central Coast of California.

The Chumash were a culture that lived very lightly on the land and most of what it produced (including architecture) was made of natural plant fiber that was knotted, plaited, wrapped, coiled or woven. Although much of its cultural production has been lost due to the short lifespan of plant-based artifacts, the Chumash baskets which remain are widely considered to be the most exquisitely crafted of all US Indian tribes.

Using a reading and discussion of "Wood, Earth and Fiber" by Peter Nabokov and Robert Easton and research into basket weaving technique as starting points, students explored form as the result of unique material processes such as plaiting, knotting and weaving.

Project objectives for Weaving Surface and Form were to

create a woven form using reed that closed on itself (although not entirely). Projects were required to have both an interior and exterior and fit within, but not necessarily fill, an 8"x8" volume; students were asked to avoid forms that resembled baskets.

### **Form and Material Study 7: Revealing and Framing**

Using images culled from their research on Chumash Indian culture, students created a 2-D collage using digital tools. This project, Revealing and Framing (see fig. 4, middle), subsequently asked students to completely rethink their collage by using it to line the interior faces of a wood box measuring 6"x8"x12". Whereas the original collage was meant to be viewed frontally and in its entirety, this project presented the collage in a 3-D frame that in turn provided select views of the collage within. To provide visual access to the box's interior, each student crafted four reversible openings or viewing frames which each had to activate at least two sides of the rectangular volume.

This project was framed by a reading and discussion of "Tactics for Opportunistic Architecture" by Paul Lewis, Marc Tsurumaki and David Lewis. Its learning objectives were three-fold. Certainly, the development of shop skills and knowledge of wood and wood tools was a consideration. Also, the exploration of simple form that is mutable and kinetic. Lastly, the investigation of the potential of framing devices and their role in modulating the relationship between interior and exterior spaces, with an eye towards the translation of these strategies into openings in more comprehensive works of architecture.

### **Comprehensive Project 3: Santa Barbara Museum of Chumash Culture**

This project asked students to apply what they learned about transformation via weaving, hinging and revealing in their proposals for an 8500 sf museum both inspired by and intended to serve the culture of the Chumash Indians. Alongside research on museums, the Chumash and the city of Santa Barbara, students read and discussed essays by Alison Smithson, Timothy Hyde and Stan Allen from Case: Le Corbusier's Venice Hospital and the Mat Building Revival. Santa Barbara, now known mainly for its mission-style architecture, its shopping districts and its spas, was once the geographic center of the Chumash world that existed before the Franciscan and European invasion. Although siting this quarter's project in Santa Barbara is not without irony, the city's downtown has an alluring mix of civic, cultural and commercial uses and offered the opportunity to introduce a wide-range of tourists and locals to the rich indigenous culture that existed until the 19th century.

The Santa Barbara Museum of Chumash Culture (see fig. 4, bottom) asked students to weave together site, program and materials in a way that addressed both the world of the Chumash and the world of modern Santa Barbara. Students developed their projects using a combination of physical and digital model, moving back and forth between the two

as the design process required.

Successful projects were able to project dual aspirations for art and history in compelling proposals that contributed to the vibrant, pedestrian-oriented community of downtown Santa Barbara.

### **Conclusion**

In general, the seven Form and Material Studies presented here may be characterized as tactics for looking, thinking and making. Since the focus of this paper was the integration of materials and material processes into studio projects, i.e. making, it should be emphasized that making is both a reflective and prospective activity and is therefore inextricably linked to looking and thinking. These tactics are not meant as ends unto themselves, but rather are intended to be employed in the synthesis of the three critical aspects of architecture: site, program and technology. Hopefully the three comprehensive projects presented here are evidence of that synthesis.

Architects must ultimately possess an effective way of working towards solutions to complex situations. This paper makes an argument that we must help our students, even those at the foundation level, to develop a design process that effectively and simultaneously addresses conceptual, environmental, programmatic, spatial and tectonic considerations. Of course, this statement assumes that effectively is appropriately prescribed by each level of a student's development such that expectations are graduated from first through fifth years of an undergraduate curriculum.

To help younger students get a feel for a multi-dimensional design process, these projects took a procedural approach that required students to work in a disciplined and creative manner. In part, this is done to demonstrate to students that discipline and creativity are not at odds with one another. On the contrary, the design courses from which these projects are excerpted take a layered approach to design intended to help students think more deeply and holistically about the world and speculate how to effectively intervene in it. Hopefully they impress upon students the need for their projects to be well formed not just on conceptually and spatially levels, but also in material and technical terms.

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