Let's Build Bigger: Foundation Projects at Full-Scale

In introductory studios, projects are often simplified to achieve specific pedagogical outcomes. By artificially separating issues of mass, structure, composition and spatial organization, individual exercises can be developed to focus on each. This simplification results in a teaching model that does not reflect the practice of architecture.

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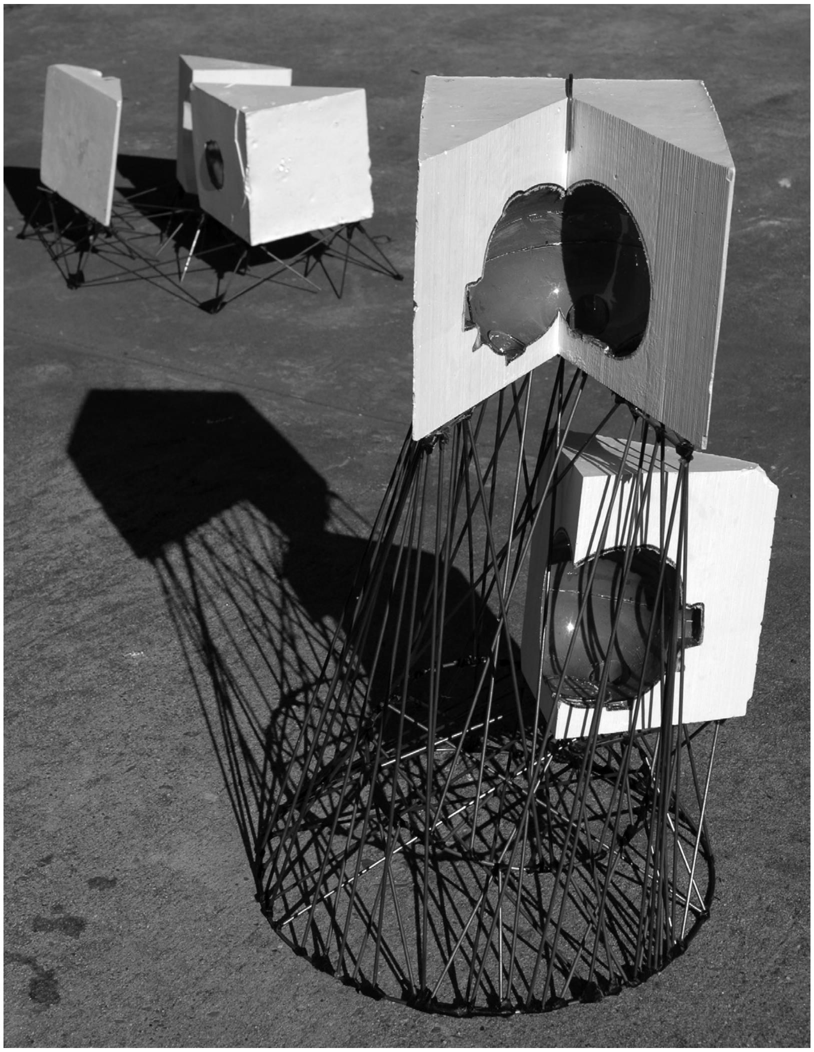
In addition, freshman level projects often rely on reduction in scale to contain project outcomes. However, these limitations make it difficult for freshmen to understand implications of their designs, and in particular, what it would be like to construct and inhabit their designs at full-scale.

This paper presents introductory exercises which teach students the implications of materiality, weight, and spatial character through design at full-scale. These exercises are rooted in exploring composition and capitalizing upon inventiveness. They introduce the multivalent character of design, allowing students to quickly learn to work with numerous design issues at the same time in order to come to a single solution.

The first example is both a structural and compositional exercise. In the first phase of the exercise, students begin by casting plaster to understand its intrinsic character as a volumetric mass: first by pouring plaster into socks to create topologically complex, organically shaped solids that investigate gravity and weight; and second, as cubes, with a void cast inside. The void is created by inserting a found object, supplied by the student. The casts were then cut multiple times on the band saw to reveal sectional character. During the second phase of the exercise, students support a collection of the plaster sections with insulation rods. They choose whether to position the masses as a "tower" or as a "bridge," adopting a horizontal or vertical morphology. Using black masking tape, the students join the insulation rods.

Developing a connective logic between the rods and an intuitive understanding of compression and tension, the students react to the weight of the plaster masses to create complex and unexpected structures. A sort of dance occurs, as the weight of the masses, in conjunction with the ephemeral character of the taped connections causes the constructions to shift and decompose – in response, the students physically interact with the constructions during design, holding pieces, adding density based upon how they see their design yield under its own weight. Because we do not



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allow the students to glue the plaster to the structure, they fabricate ways to grasp and support the plaster with the insulation rods. On the whole, this exercise requires that students develop a creative synthesis of structure and geometry in service of gravity. As a result, an empirical method of design develops, where students have to alter their ideas as they build, with outcomes rarely following their initial design intentions. The downside of this process, in particular the method of using the tape as a way to accomplish rapid prototyping, is that the projects were ephemeral, with most self- destructing within a relatively short frame of time.

A second exercise is the construction of an inhabitable composition. This project asks students to operate between maquette and full-scale in order to reveal the implications of their design decisions. Students begin by designing a composition of linear members that encloses space, working at ¼" scale using an array of different thicknesses of wire. Working in groups, students develop designs in a scale model of the exhibit space. One design is voted on by the students, and then the group translates their design to full-scale. A kit of materials includes dowel rods, string, and bailing wire. The dowel rods are intentionally shorter than the wires used in the maquette scale. As a result the students must develop a detail to connect the rods together. The instructors also encourage the students to change the design in response to the actual scale of the exhibit space. This methodology facilitates

Figure 1: Tori Smith and Madeleine Greer, *Tower and Bridge*

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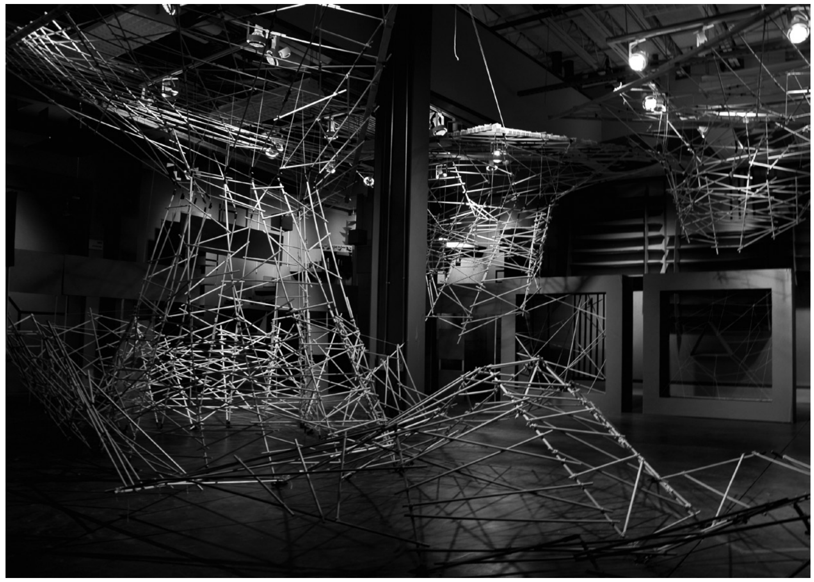
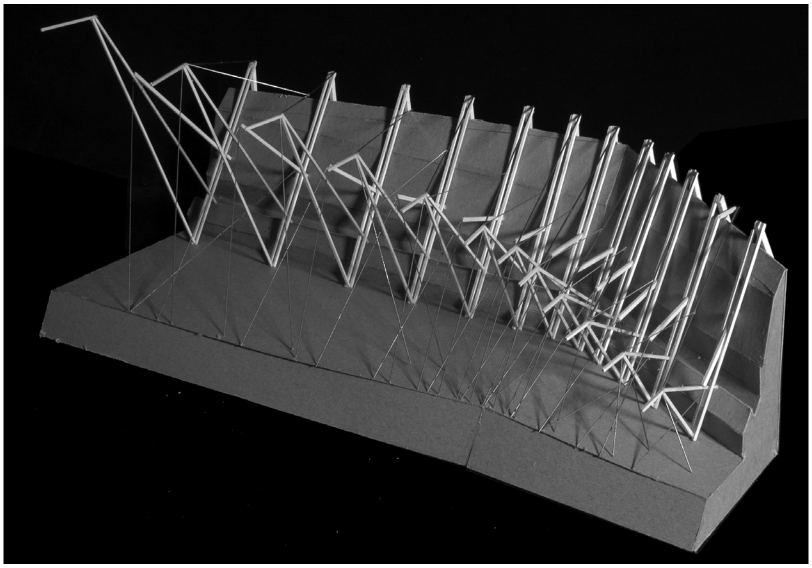


inclusion of all students in the design process, as a sly way to circumvent lack of participation by students who are disillusioned when their individual design is not selected. In this first full-scale installation, completed fall of 2013, we emphasized compositional principles of movement, density and scale. As students constructed the spaces they used their own bodies, and sense of enclosure, to shape and size the three volumes. Discussions on density and form resulted in the students deciding how many units needed to be added, what their sizes needed to be, the specific details of tying those units together, and how the different materials performed structurally. Just as with the previous structural exercise, encouraging students to respond to critique and modifying the design in real time builds a fluid and interactive environment where the students are considering a multitude of variables. Observation of how the elements of design react to constraints encourages students to evaluate the interaction of those variables during the installation process to create new design opportunities.

The final exercise, which spans the duration of a quarter, is a tectonic and structural construction at full-scale. The project begins by generating closed 2-d shapes informed by a verb from Richard Serra's "Verb List Compilation: Actions to Relate to Oneself," abstracting a closed shape from images expressing the verb: people or objects engaging in the verb; alterations of the landscape; and experientially through abstract art. The project serves as a precursor to digital lofting techniques introduced in the sophomore year. Students select three of the resulting close shapes generated from the verbs, and those shapes then serve as sections for volumetric exploration through lofting – a beginning, end, and mid-section. This exploration is achieved by aligning the sections and constructing an axonometric. A second iteration, constructed in chipboard, encourages students to angle and preposition the sections to create more dynamic constructions.

After the volumetric exercises, students are then asked to engage in a tectonic investigation of the project. Students simplify the volumetric studies while preserving their general character and reintroducing underlying lines of organization and meter. Students divide up the volume into a series of interconnected ribs. Framing ideas are discussed, including module and bay strategies, how hierarchy in member size might be explored, and the introduction of lateral bracing. Conversation builds

Figure 2: Freshmen Fall Quarter, *Vornado*



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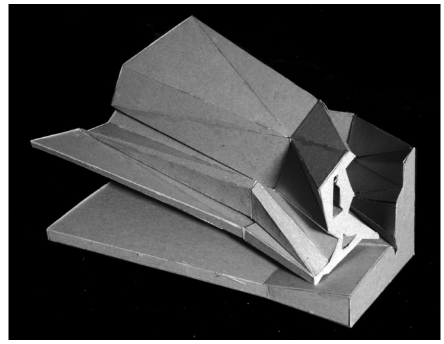

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upon previous quarters' discussions of structure, focusing upon how ribs might act in compression, tension, and cantilever. We remind the students to work with their original verbs, and give students precedents for their investigation into detailing and tectonic resolution. Additionally, students are asked to develop a site strategy that is sympathetic with their verb and which accentuates their design. Every section is envisioned as a structural rib, which when considered together enclose the space described by the original volume. As students move from scale models to full-scale construction, they develop tectonic resolution between members through detailing. In particular, students must consider the limitations of their own ability to work with tools, the stock lengths of materials, and use their ingenuity to invent ways to build their ideas at full-scale.

This past year was the first time students built this project at full size. Previously the "rib project" served as a vehicle to inform the design of a first building design effort (for example a greenhouse) in the sophomore year. Moving the project down to freshmen year is a way to intensify the architectural character of our first year design coursework, and make room for more thorough introduction of digital tools in the sophomore year. By building at full-scale, the project creates a resonance within the curriculum, serving as a precursor to a Design-Build quarter in the spring of junior year, which typically is a structurally poetic pavilion. The benefits of the project are that students can see the scale of their decision making, the effort it takes to build, and gain a more full understanding of how materials react when constructing at full size. One of the students commented "I now understand just how tall 22 feet is, and that it is hard to drill steel plate, and that types of wood behave differently." This awareness is difficult to develop when working in model, and an understanding of the scale of enclosure seems invaluable. At the same time, the process exposed a number of downsides. While the instructors scheduled in time for designing detailing, the shortness of the duration of construction (three weeks out of a ten week quarter) meant those details could not be constructed. Instead, less refined

Figure 3: Emily Greene, *Chipboard Construction*

Figure 4: Emily Greene, *Tectonic Study*

5 

connections were implemented. A second issue was that only one project could be built. While the team that worked on the design of that project was fully involved, other students, whose projects were not selected, showed a lack of engagement. Unlike the previous installation described earlier in this paper, the design could not withstand significant input from the entire group during construction, as the scope required substantial planning. Finding ways to engage all the students equally is a goal for this next year's project.

In all three of the projects discussed in the paper, the students gain a direct physical and haptic knowledge of the materials they use. They acquire an understanding of the relationship of abstraction and modeling to construction in reality. They translate between designing in maquette form, when a project appears as an object, to full-scale installation, where they must consider its spatial implications. They learn to solve many problems with a single solution. Finally, they become confident in their own ingenuity to problem solve and to invent, rather than to seek out predetermined answers.

Figure 5: Freshman Studio Winter Quarter, Photo courtesy of © Miguel Lasala, *Final Construction*