The Mock-Up as a Living Tool in Design Pedagogy

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Introduction

Mock-ups make the transition from design to construction and serve both instructional and experimental purposes. They are precise and evanescent—contrived as well as improvised. In design and design/build pedagogy, the family of mock-ups—one-to-one material studies, sketch models, maquettes, full-scale drawings—recalibrate drawings’ dimensions, reveal material conflicts, show disconnections of joints, and expose flaws in fastening schedules. Mock-ups help us critique previous phases of the design process, while they provide a model and template for what we will do next. As a set of explorations, mock-ups speak to each other—and to us—about materiality, connections, strength, aesthetics, and local resources. They become an important part of the editing process, often serving as three-dimensional Ockham’s razors, hewing toward the simplest solutions. Mock-ups are also tools of visualization. To build a test case at full scale is to see problems, pitfalls, and possibilities. This paper explores the mock-up as a living tool that is equally didactic and experimental—teaching as well as speculating, answering some questions, while probing previously unconsidered conditions and raising other lines of inquiry. Mock-ups link tool and process in the course of learning how to build. This paper seeks to understand how this link works.

Mock-up as Dummy

Mock-ups are dummies. Early applications of this technique quite literally mocked what they were imitating. Since the 12th century, French moquer has meant to satirize or tease, extending at times to the point of deception. Mock-ups are also tools of visualization. To build a test case at full scale is to see problems, pitfalls, and possibilities. This paper explores the mock-up as a living tool that is equally didactic and experimental—teaching as well as speculating, answering some questions, while probing previously unconsidered conditions and raising other lines of inquiry. Mock-ups link tool and process in the course of learning how to build. This paper seeks to understand how this link works.

Though not always included in the mock-up family, sketch models are invaluable tools for moving the design process into the realm of the built. Like maquettes used by sculptors as scaled-down versions of their artwork, physical scale models are working drafts, rough but precise. They do not merely document results of the design process but instead prepare students to construct the project—a process of designing to build. With carefully-made basswood models, a student’s desk becomes a builder’s yard of materials—stick lumber, joists, beams, rafters, studs, and purlins. Pushing a finger against a half-inch scale model reveals the racking of an unbraced frame, the stiffening of moment connections, the resistance added by bracing, or the lateral strength of a shear wall’s sheathing.

And then mock-ups bring parts of the sketch model to full scale. In a design/build project for a bicycle trailer in the Spring 2013 semester, students first constructed a scale model at one inch equals one foot. In this model, students gained an understanding of the overall systems, but the scaled-down construct allowed them to ignore or gloss over particular material choices and connections. The scale-model veered more to the side of dummy as mode of deception. Students could elide, even hide, unresolved design elements; but with the full-scale mock-up, they saw the challenges of details and joints and the implications of different materials, whether intended for sheathing or framing. This dummy was ugly—raw in the actual fastening of components—but effective in making a transition away from students’ preconceptions about scale, material, and joint to a situation that tied together the tools and process of making at full-scale.
Mock-up as Tool

With the full-scale mock-up of the bike trailer, we could walk around and through the actual construction. Instructors and reviewers could not only point to potential problem areas but also physically engage the construction itself—lifting, sitting, leaning, and sliding. But as an instructional tool, the mock-up was already speaking, and many of the challenges were by this time evident to students without our prompting. Among an array of insights, the gearing ratio of the folding canopies required additional armatures, the frame required additional bracing for stiffness and performance, and its overall physical weight showed a need to change framing materials from wood to steel.

Lessons learned, the mock-up also provided a foundation for students to experiment. In all its full-scale awkwardness—even grotesquerie, as some students compared it to a medieval torture mechanism, the mock-up became a tool for speculation, a vehicle for further joint refinements, material studies, and overall system integration. For these latter two, students tested sheathing materials for translucency, durability, and flexibility; and they discovered that a two hundred watt solar panel, with minor adjustments, fit each folding canopy and could establish the modularity of these so-called “wing” components.

When sketch models become full-scale, tectonic components themselves now take up actual space. Joints become architecture, and framing members like joists—previously understood nominally by their two-by-six dimensions—now concede to actual measurements in which the two is one-and-a-half inches and the six is five-and-a-half inches. In some cases, full-scale drawings also aid such transitions, clarifying dimensions and allowing construction details to come to life as a one-to-one kit of parts. But only construction mock-ups, with applied materials and systems, fully engage both tool and process in the design/build project.

Mock-up as Process

Mock-ups provide a pedagogically efficacious connection between tool and process. As tools, mock-ups can quantify forces, such as loads on building systems. But at the same time, in the educational context, they interact with the learning process itself. They are real-time, full-scale modes of making. During a 2010 studio in Siem Reap, Cambodia, Jim Adamson’s design/build studio mocked up masonry arches to determine the most efficient roof system for the project’s kitchen. After a series of explorations that did not call for formwork, students determined that bricks laid on formwork effectively provided the most direct technology for their budget and schedule (fig. 2).
At other times, the connection between tool and process is more direct, and mock-ups are less speculative and tied more closely to final outcomes of construction. To build a test case at full scale is to see problems, pitfalls, possibilities, and realities of budget. This way of seeing also prepares students for professional practice, where many firms first assemble full-scale building sections, particularly in collaboration with engineers, to test proposed systems and components. Such mock-ups also facilitate communication with clients who might then better understand a project’s material palette and scale. Even though mock-ups cost time, they often save money and help avoid misunderstandings as well as miscalculations (figs. 3 and 4).

Mock-up as Janusian Condition

The interrelation between tool and process in mock-ups creates a Janusian condition, in which communication occurs retrospectively as well as prospectively. At full scale, everyone can more easily see what the issues are, and mock-ups facilitate group decision-making—a key component in design/build studios. Such visualization leads to conversation. And mock-ups allow the studio to look backward and forward simultaneously—back in order to critique previous design decisions and forward to offer a plan, a model, or a template for the next step.

In this sense, jigs are a part of the mock-up family, which bring the process full-circle. Jigs return to the drawing board, bringing the studio into the workshop and linking shop to construction site. Like mock-ups, jigs are full-scale templates for what will be made. Once set up, they allow repetitive, precise production of components, whether by cutting, fitting, or fastening. When Jim Adamson sets up a jig for braced frame bents at Yestermorrow Design/Build School, he introduces the process as a form of drawing where one inch equals one inch (fig. 5). Edges, center lines, overlapping pieces, cut lines, and fastener locations are inscribed on plywood.
surfaces raised on a work bench. Blocks and drill holes further register the assembly process and make the jig a reference tool for construction. This mock-up becomes a dance floor—one reason we call it a “jig”—that choreographs students’ movement as they put each frame together.

Fig. 5. Jig setup at Yestermorrow’s Public Interest Design/Build Studio, August 2013 (photograph by Jim Adamson)

Mock-ups are dynamic tools that link designing and building, thinking and making. Though not mobile per se, they circulate among those building and reviewing them and allow real-time and full-scale discussions about successes and failures and refinement and revision. In a 2008 design/build project for an outdoor classroom and community garden at the Boys and Girls Club, we built mock-ups not only to test materials and systems but also to engage the project stakeholders and local community. Unexpectedly but fortuitously, these full-scale constructions became ersatz adventure playgrounds where the children at the club had fun and where we learned how our clients would likely use the project (fig.6).

Fig. 6. Mock-ups during the project for outdoor classroom and community garden at Boys and Girls Club, Gainesville, Florida, Spring 2008 (photographs by author)

Mock-ups’ dynamism parallels what Michel Serres has called the “quasi-object.” Tokens—or, as Serres says, “constructors”—of intersubjectivity, quasi-objects link subject and object across the temporal field of process.” They do not merely tell, they actually show. Our mock-ups for the layout of the Boys and Girls Club project became full-scale demonstrations for the network of material, technical, and social interactions that might
occur on the site—what we called “sketches with wood” (fig. 7). These mock-ups summarize a link between tool and process that can remain open-ended—essential for pedagogies of design/build—while also finding degrees of resolution in an actual context—also necessary for projects out of the studio in the community. And in that sense mock-ups are thresholds for a professional life of design.

Fig. 7. “Sketching with wood,” Boys and Girls Club community garden and outdoor classroom project, Spring 2008, (photographs by author)

References


The Weight of Things
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Design curricula are frequently organized to preference the poetic, assuring that students are adept with an a priori approach that allows them to move incrementally towards the characteristics of materiality without being burdened by the full breadth of technical concerns of materials, and more so stripped from the direct interaction with these materials in any meaningful way. In this regard, the recollections of Kahn’s story of holding the brick might offer insight, assuming that the awareness of the brick is universal. What has become increasing apparent to us is the physical separation of students from the material world that surrounds them, making the quotations of Kahn largely detached and adrift in a theoretical sea of discarded architectural aphorisms. These observations are drawn from a direct interaction with students competing as part of the Project Re:Focus entry in the 2010 Solar Decathlon Europe competition. Through a careful examination of the design and construction process for the Re: House, this paper will explore the students’ collective aspirations for the project, the limitations and realities that they confronted, and the realization that many of their struggles were the resultant of a pedagogical model that precluded the measuring of material as a thing by favoring it as an idea.