

Mockplay / From Vorkurs to Full-Scale Mockups

MOCKUP: noun; A usually full-sized scale model of a structure, used for demonstration, study, or testing.¹

TO MOCK: to treat with contempt or ridicule, to defy or challenge; serving as an imitation or substitute, especially for practice purposes.²

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MOCKPLAY

There are two important case studies of building which suggest alternative foundations for considering a contemporary discourse about design-build. The first, is Frank Lloyd Wright's full scale column failure test from the S.C. Johnson Wax Administration Building in Racine Wisconsin from 1937 and the second is the full scale fabric and wood mockup of Mies Van der Rohe's Kroller-Muller Villa from 1912. In both cases the effects of full scale are rehearsed in two complimentary ways. One tests entanglements with reality as the behavior of form as the performance of structural flows at full scale, while the other tests the effects of form at full scale. In both cases something is learned and gained from the process of building at full scale, not possible to be seen in small scale conventional representations. In short, the designs had to be enacted or built in some fundamental way to be understood, as preconceived notions weren't adequate to produce new thought and understanding.

The link between these historical case studies and a series of contemporary projects should be compared in relation to the Bauhaus foundation course, the Vorkurs. The Vorkurs class was the introduction to the curriculum of the Bauhaus in which "... students learned by doing , and experimentation for its own sake was encouraged while 'play' was considered key in imparting important theoretical discoveries."³

This paper highlights a range of Mocking-up and the progression of the Bauhaus foundation class, progressing from something preconceived to the intentional shedding of preconceptions in the pursuit of new insights into the new capacities and potentials, a relevant definition for 'mockups.' With the Vorkurs in mind we can situate these large scale mockups as examples of experimentation in which thinking is building, and building is play for the sake of experimentation. Shouldn't contemporary design-build incorporate more aspects of play, destabilizing the conventional methods of construction and assembly? When Josef Albers taught the 3rd installment of the Vorkurs class, students would visit workshops such as cabinet makers,



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wall paper factories, even breweries to criticize and rethink their manufacturing procedures.⁴

VORKURS

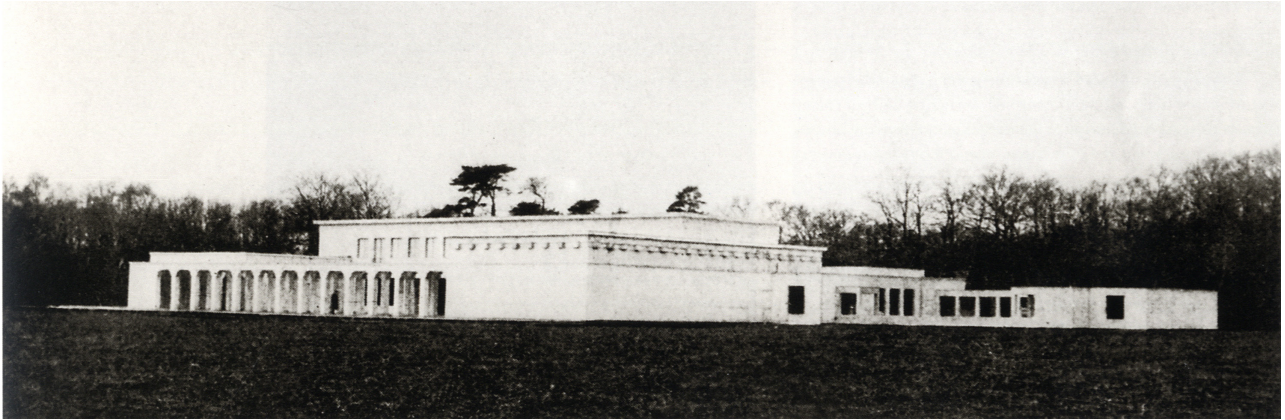
While the history and impact of the Bauhaus on modern design sensibilities are generally understood, a closer examination of the preliminary course, titled the Vorkurs is perhaps more useful for understanding contemporary tendencies of physical building and prototyping and even understanding contemporary pedagogical approaches towards collaboration with industry.

The well understood ambitions of the Bauhaus were to reunify the artistic disciplines, such as sculpture, painting and craft as found applied to the construction of medieval cathedrals, with a new comprehensive aesthetic which would ultimately produce a new architecture as a total work of art. The foundation of this model, was not the classroom or lecture hall, rather the workshop, even eliminating typical academic titles like “professor” in favor of titles like “master” from master-builder and students as “apprentices” implying their involvement in the real world trades.⁵ Looking forward we can begin to see alignments with traditional design-build curriculums which seek to place students and teachers into direct involvement with the construction industry, taking them out of the classroom and thrusting them into the field. What was a revolutionary idea about pedagogy at the time of the Bauhaus is something more comfortable and observable in architecture’s contemporary turn towards the physical prototype. When Walter Gropius conceived of the pedagogical model as being in direct relationship to the real world building trades, he devised a unique teaching solution for the courses for which there were no qualified instructor candidates. Each course was to be taught by two instructors, a master-craftsmen or workshop-master, and a master of form, typically a fine-artist who would try to stimulate creative thinking.⁶

During the first year of the program, the entering class was extremely varied in background and age. Johannes Itten was appointed to the Bauhaus as an acclaimed artist from Vienna, and Itten noting that the entering class lacked consistency proposed to Gropius that students be admitted to a provisional one semester class called the Vorkurs or basic foundation course. Itten crafted the first version of this class

Figure 1: Frank Lloyd Wright and building commission officials looking on as column mockup is loaded to failure. (1937)

in which students were to abandon all preconceptions and open their creativity to new ideas. Johannes Itten's approach to the course was laced with mysticism, in which classes began with a series of breathing and relaxation exercises, followed by common drawing exercises consisting of explorations of contrast. These exercises of contrasts produced tension through comparative analysis of qualities such as light and dark, color, material, soft and hard, which were then examined for the "sensual, intellectual and spiritual meanings which might emerge." (07) While Itten's approach to the course laid the groundwork for the preliminary class, his preference for expressive form and fanatical mysticism threatened the overall ambition of the Bauhaus, and he was ultimately forced out in 1923.



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Moholy-Nagy took over instruction of the Vorkurs class from Itten and instead focused on the rational considerations of materials and techniques, in a straight-forward manner. Moholy-Nagy's instructions emphasized the material through tactile perception of physical qualities such as strength, weight, density, three-dimensional volumes and qualities of light among others.⁹ These exercises shifted from the expressionistic tendencies of Itten to objective and utilitarian material investigations focused on the individual potentials of specific materials such as glass, stone, wood, clay, metal, textiles and color then incorporated aspects of form based on the study of material itself. When Moholy-Nagy left the Bauhaus in 1928, Josef Albers took over the Vorkurs, and it is his version of the preliminary course that had the longest duration and the most lasting influence on the pedagogical approaches of art departments throughout the world.⁹

Albers would again attempt to have students clear all preconceptions and experiment with materials to the point of exhaustion, first using glass, then paper, later followed by a material of their choosing, such as wire, corrugated cardboard, or newspaper. Students were asked to simply play around with these materials to see if they could make something or discover something specific about them.¹⁰ Students visited factories and workshops to engage and criticize their manufacturing processes and rethink their approaches to manufacturing and form. What is consistent about all three approaches is their abandoning of preconceived notions in service of producing new form and engaging the manufacturing trades as the end goal.

MOCKUPS

In design-build there is a moment where designs are constantly evaluated for their ability to be built, with a particular emphasis for the project to not only be designed well, but more so that it be buildable. There is a requisite partnering with construction trades often at the expense of playful design. In architecture, the task

Figure 2: Mies Van Der Rohe's Kroller Muller Villa
Mockup built of false materials, fabric and canvas to represent stone.(1912)

of translating design into building is tested through the process of Mocking-up. Two historical examples of Mock-ups are useful for understanding two distinct approaches toward testing the translation from design to building, or from representation to reality.

In 1912, Mies Van Der Rohe executed the construction of one of his first private commissions...a villa for the Kroller-Muller family in Wassenaar, Netherlands. But one could argue that Mies never actually built the Kroller-Muller Villa, rather he only mocked it up. To put it in other words, he faked it never actually building the villa, but building an imitation which looked every bit as real as the design for the building, which upon closer inspection relied on false materiality, imposter configurations of fabric and wood to represent stone and structure. Mies' Kroller Muller Villa was full scale, it was the same size as the plans for the original projects, but it wasn't a real building, it was a mockup...a false work, merely an imitation.

In 1936, Frank Lloyd Wright assembled a team of contractors in a public square in Racine Wisconsin to build at full scale, a mockup of his prototype for a dendriform shaped column to support the great work room in the Johnson Wax Administration Building. With eager building inspectors from the Wisconsin Industrial Commission, Wright himself, contractors, specialty suppliers, Wright's client, students from Taliesin and the press looking on, the column was constructed and top-loaded with sandbags, until it collapsed. This column prototype wasn't an imitation, it was constructed of exactly the same material specifications, with the same form and scale of what was designed in the building plans, but ultimately was built and destroyed over the course of one week in early June, 1936.

What exactly were these projects and how should we consider these two curious acts of building within a more recent history of architectural design research and experimentation enabled by large scale representations. These examples are difficult to pin down, because they're somewhat difficult to define questioning the very basic categories of building. What they have in common is that they are both physical and at full scale, but do we consider them Built or Unbuilt, Representations or Reality, Fake or Authentic, Visual or Performative, avant-garde experimentations or rote due diligence?

MOCKUPS + VORKURS = MOCKPLAY

The subtle effects of Mockups are most evident when considering their differences from the more traditional Architectural Model. Mockups are different from models, in scale but also in concept. Models are typically small scale and built to represent materiality, and mockups are typically large scale and constructed of the very material they represent. Models are a linear representation intended to suggest a future, by representing what's to come without consequence, and Mockups actually build that future in the present testing the process of translating representation into reality by translating the information in the drawing into the territory of material reality. Models assume reality as an inert receptacle of design while Mockups suggest entanglements with reality and push back on the design, highlighting the vitality of space and matter.

The Model is the architect's rhetorical device, ultimately a client presentation tool, typically built of small scale representational matter and hypothetical in its definition. These qualities are quite distinct from the characteristics of an architectural Mockup. While the model is small scale and insulated from the effects of reality, the Mockup is full scale and critically influenced by the effects of reality. While the model is a cloudy definition of some reality, able to be realized in a number of ways,

the Mockup is concrete and defined, absolute in its definition of material and scale, yet able to absorb the contingencies of process as a malleable definition of the future. While the model accepts the representational conventions of the present, a mockup often challenges and indicates the limits of representation.

While the model is a linear progression of scale, increasing from small to large scale in the process of design development, the Mockup represents a feedback, whereby full scale tests can have a significant effect on the small scale representations of form. Instead of functioning as a rhetorical device, Mockups function as the instrumental test, often testing architecture's entanglements with reality, not just structural capacities, but also the full scale effects of space. In many cases they are required as the process of translating representation into reality becomes uncertain, and unexpectedly difficult due to a number of factors encountered during the process of scaling up.

Ultimately while models rely on representing reality, Mockups are entangled with reality. Models are impartial to the effects of matter and scale, while mockups are critically endangered by those effects. Mockups don't represent reality they are reality, in that they are real and physical but their reality is slippery. They aren't real buildings, even though they look nearly identical to the buildings they imitate, rather they are real representations. These are the difference between the model as rhetorical device, ultimately the clients presentation tool, and the mockup as an instrumental test, the architects collaborative tool. Models are about a future yet to come and Mockups are about defining that representation in the present.

As Mockups are intended to test the process of translating form into material configurations, one could likewise identify a similar ambition in the Bauhaus and specifically the Vorkurs to just see what will happen. Often the utility of the Mockup is to test the unpredictability of translating small scale to full scale and suggests that the form must be built to be understood. There is an unpredictability and a discovery in the process of building and materializing. The vorkurs, similarly had this sense of discovery where students were encouraged to "...learn by doing, and experimentation for its own sake was encouraged while 'play' was considered key in imparting important theoretical discoveries."¹¹ Likewise there is a legible shift in the convention of mockups from recognizing what a form looks like to understanding how it will work, and will be physically built. There is a consistency here between the conventional practice of mocking up and the play associated with Alber's Vorkurs class, in which the manufacturing trades were closely examined for their insight into the nature of material qualities. Taken together both examples represent a type of Mocking and Playing, or Mockplay. These approaches to form and design, seek to re-contextualize architecture as a practice of collaborations between design and the appropriateness of these designs in the physical world, an appropriate definition of Design-build.

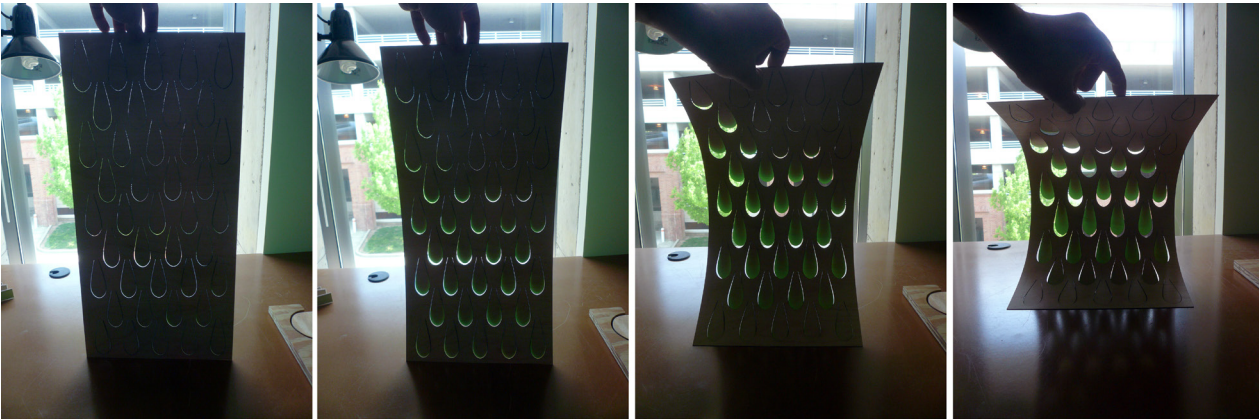
PLYWOOD MOCKUPS

The following few examples will document small scale experimentations with material, specifically laminate plywood and document the type of MockPlay as design research which further suggested methods of scaling up beyond the scale of the experiment. These small scale material mockups first tested how a form could be coaxed out of a specific material, as proofs of concept and then suggested how they may be applied to larger assemblies of frame and skin systems.

FLEX WALL

We began by treating a material like a specimen, looking for what it would do, not what it looked like, rather the ability for the material to behave in counter-intuitive ways. Beginning with an investigation into the potentials of a flexible membrane, a series of open patterns were cut into flat sheets of thin plywood before they were flexed into various shapes. The patterns did two things, first they acted as a type of strain relief allowing the material to be bent more once they were cut, and secondly they exaggerated the flexing action by protruding out at tangent angles to the surface curvature. A relationship was established where the patterns allowed the material to be bent, and the bending open the patterns up producing varying amounts of porosity through the membrane based on the material's specific ability to bend.

This phenomena was applied as a wall section panel in which an incremental flexing occurred from the edges of the wall to the center. This wall was titled "Flex Wall" and instead of arbitrarily cutting varying amounts of porosity through the cladding, a repetitive pattern was assigned to identical size pieces of material which were each bent varying amounts. The most bent or flexed pieces of wood exhibited the greatest degree of transparency as the pattern opened up behaviorally acting like apertures rooted to the physical properties of the material. This wall section specimen was much like any other relying on a simple frame wall and wood cladding system.



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LEANING

A second prototype was devised testing the potential of the cladding or skin to act structurally. A new structural frame was designed which was itself unstable, and without the corresponding skin would tip over. We titled this a leaning structure, and there is a stability produced through the interaction of the skin and the frame. The shape of the frame compels the skin to expand at precisely the right angle to meet the ground propping up the frame and contributing to its stability the way a structural buttress works.

FLOATING

A third series of prototypes tested the ability for skin to take over the primary structural duty of the assembly. Where typically a skin is hung on a structural frame, this mockup tested the ability to hang the structural frame from the skin. This represents a type of tectonic inversion where the frame no longer acts structurally, rather simply lends shape like a mold to the bending of the skin.

Figure 3: Bent Plywood study demonstrating relationship of flexing to transparency.

UNFLAT PAVILION

The Unflat-Pavilion is a large scale inhabitable pavilion designed and constructed based on the observation of the small scale mockups' behaviors. These small scale mockups demonstrated a range of positions for a thin plywood membrane to be digitally perforated and then flexed. This sketch of performance suggests a material property and the range of geometries this system is capable of producing. Great effort was taken to scale up this range of behaviors, first as small sized objects, and then again at the scale of building form. Careful observations and iterative studies led to a relative definition translated into digital form which was able to link the tangential strain relief pattern with the bent position of the membrane as something reactive. As the bent section was redefined the flaps would respond to different positions based on a relative tangent angle to the curvature of the section. As in the small scale mockups, when the plywood flexed the pattern would expand and allow greater transparency but at a much larger scale.

The physical flexing of material became the generator of the pavilions shape. Present from the beginning the ambition was to construct a pavilion utilizing the physical range of behaviors of a given material, privileging physics over optics. Careful study of flexing occurred at a small scale, after which the design development phase increased the scale of this behavior to the size of an inhabitable pavilion where it is merged with a building's form. Various advanced modeling and analytic software were utilized in support of the design, with an anticipation of material behavior present from the beginning. The design and fabrication of the pavilion combines characteristics of both personalized fabrication as well as an understanding of material potential energies and techniques for capturing these behaviors.

The design of the pavilion is a large scale generic house section mediated through the behavior of its materiality. The house section was revised several times based on the physical ability to bend plywood into its shape. What results is a mediated shape, a negotiated condition blended from the specific geometry, and the plywood's ability to define that shape based on the physical behavior of material. Several times the section needed to be redrawn based on the observed bending radius of materials at various scales, and then finally at full scale based on the specific wood-species of tree used.

SPECIFIC MATERIALITY

Materials were tested for their ability to simultaneously be flexible enough to bend yet be rigid enough to support load. Indeed multiple species of woods were tested, Marine Grad Merranti, Rotary Cut Lauan, Verticle Grain-Douglas Fir, Flat Sawn-Ash, Italian Poplar, Rotary Cut-Okoume, and finally settling on Baltic Birch. Different species demonstrated differing capabilities. Several of the discarded species were able to bend to the shape of the pavilion, but were too flimsy to prop it up. Several other species were too rigid to accommodate the bending radii of the sections, so they had to be revised. Baltic birch was the most resilient, able to be bent, although requiring greater force, but also able to support load on its edge condition. All of these wood specimens look approximately the same with slight variations in grain and tone, but while they look more or less the same, they perform with radical difference. Some buckled, some sagged, and some shattered into pieces, all symptoms of specific performance unrelated to the image of the building.

UNFLAT

As a result of preliminary mockups and prototypes, this pavilion project is different from many other design-build projects in that it doesn't go through the standard

Figure 4: Experiments in bent plywood mockups.

zooming in of scale, where typically one begins a project by looking at issues of site, then massing, then program, ending ultimately with details, rather this project begins with the details of material behavior which then are negotiated and tested for their appropriateness as architectural forms. As the details change so too does the massing, and if the massing were to change so too would the material necessarily adapt. The flexing of the skin produces feedback which redefines the shape of the frame and the configuration of the multiple apertures. There is a quality of inventiveness and playfulness whereby small scale effects large scale and vice-versa, a type of fabricated flux that Brennan Buck refers to as the state of “unstable interdependence.”¹²



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What is noteworthy here is the design process began by initially playing with material and then ultimately mocking-up by testing these playful moves for potential application to building. This type of Mockplay has roots in the history of translating representation into reality at full scale, the history of mockups, but also in the history of the Vorkurs, where preconceptions are shed in preference of observable material behaviors. The physicality of Josef Albers material investigations at small scale find new definition in the large scale translations of Mies and Frank Lloyd Wright’s full scale mockups. While Mockups acknowledge that the translation of representation into reality is full of pitfalls and unpredictabilities, the Vorkurs class sought to Play in that unpredictable indeterminate zone. Perhaps a contemporary discourse of Design-build can find equally compelling alternate histories in these examples. If so maybe any idea of design-build must take on a new ambition to not only engage the available tools and technologies available for the purposes of building, but simultaneously abandon those preconceptions and invent new approaches



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ENDNOTES

1. <http://www.thefreedictionary.com/mock-up>.
2. <http://www.thefreedictionary.com/mock>
3. Lerner, Fern; Foundations for Design Education: Continuing the Bauhaus Vorkurs Vision; from Studies in Art Education, A Journal of Issues and Research, 2005 46(3) p216.
4. Ibid, p 218.
5. Ibid, p 215.
6. Ibid, p 215.
7. Ibid, p 215.
8. Ibid, p 217.
9. Dearstyne, H. Inside the Bauhaus. New York: Rizzoli, 1986, p. 94.
10. Lerner, Fern; Foundations for Design Education: Continuing the Bauhaus Vorkurs Vision; from Studies in Art Education, A Journal of Issues and Research, 2005 46(3) p218.
11. Ibid, p 216.
12. Buck, Brennan. Who's Afraid of Fabrication?, ; Fresh Punches: Experimental Architecture Exhibition Catalogue, Lexington KY, CreateSpace Independent Publishing Platform 2013.

toward building rooted in playfulness of large scale testing and mocking. While Mockups represent types of built test-subjects, what becomes clear are the differences between the architectural model as a rhetorical device, and the model as an instrumental test subject. These test subjects suggest a new type of practice where the architect looks for evidence outside the normal conventions of practice abandoning preconceptions, producing new entanglements with reality both expected and even hopefully un-anticipated. Perhaps the value of any design-build effort is not in the commercial value of the built artifact rather in the insight produced by the process of building, mocking, and playing.

Figure 5: Bent Plywood pavilion.