Material Matters: Process of Intuitive Design
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MATERIAL MATTERS:
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Abstract:

Steady. Tighten. Splice. Bend. Fold. Weave. Elongate. Stiffen. Break: This is the vocabulary of
an undertaking of craft, designing-while-making, improvising, learning-while-doing.

This thesis is an exploration of design as craft. Woven plywood models are created in
improvisational moves, benefitting from the embodied knowing that comes with extended
material engagement. The making of these pieces is an experimental and playful process, where
methods are tested and discovered by hand. The body is the driver in this way of making, and
decisions are made based on the possibilities and limitations of the material.

The plywood pieces are held together with friction alone. With no boundary conditions and no
permanent fixatives, they are endlessly malleable, repeatedly remade into new forms, each time
producing new lessons for the maker.

Drawings are created after making, in order to map these undevelopable forms. The series of
drawings are not representative of form, but are instead a method to unravel the story of making.

The resultant family of structures advocate for designers to engage with material in order to
make discoveries of forms and methods that would not have arisen using the hylomorphic model
of design. Working by hand allows the material to assert its own logic, principles, and exciting
possibilities.

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“Machines reduce the boredom of repetition (of the maker), on the other hand they permit a play of the imagination only in the preliminary planning of the project.

Material is the field where authority blocks independent experimentation less than in many other fields, and for this reason it seems well fitted to become the training ground for invention and free speculation.”

-Anni Albers
Introduction

“It is quite possible to project whole forms in the mind without any recourse to the material, by designating and determining a fixed orientation and conjunction for the various lines and angles.”
- Leon Battista Alberti

Here Alberti describes the hylomorphic method of design. In this method, creative decisions are made entirely in drawing, and those drawings are projected upon a static material. Material itself plays no role in design. Architecture belongs in the realm of the mind.

This thesis is an argument against that vision of architecture, and against any architecture project that is designed only using CAD, models that were sent to the 3D printer, design that is distilled into a set of instructions for a digital machine. The intimate connection between architecture and the human body should not only be a part of the result of design, it should be a part of the process.

This thesis does not outline a problem and propose a way to solve it. It is an exploration of process, and a personal undertaking in a method of making. The goal is to create something—or as it turned out, a family of somethings—that could not have been designed with software, and could not have been digitally fabricated.

With this goal in mind, I chose the material, plywood, and I chose the method, weaving, because it is extremely difficult to simulate weaving and friction, and because a robot would have a very hard time weaving a material of this stiffness. Robots weave fabric, but this material has a breaking point that must be found and sensed by the maker.

I made myself an apprentice of weaving for a semester. A novice in the artform in every way, I began cutting 1/32 and 1/16 sheets of birch plywood with a table saw, building up piles of bendy sticks, and playing. Material play is the only way for the novice to gain embodied knowing.

Embodied knowing is an essential element of craft which is absolutely absent in the process of digital fabrication. It is knowledge in the maker’s hands of the elasticity and strength of the material, the extent to which it can bend and torque before breaking. Where to put one hand to support the pulling and pushing of the other. Every artist and craftsman in the world is equipped with her own specific domain of embodied knowing which she could not have learned by reading or by listening; she had to learn by making.
When splitting timber with an axe, the skilled woodsman brings the axe down so that the blade enters the grain and follows a line already incorporated in the tree. As Deleuze and Guattari put it, “it is a question of surrendering to the wood, and following where it leads.” I followed my strips of plywood, and they led me to strange geometries that I argue could only have been discovered through this method.

To achieve a process where the body is the driver and design decisions are made intuitively, I set up a system which relies entirely on what my body is independently capable of doing. There are no boundary conditions beyond the material itself, so the pieces are “floating”, relying only on their own friction to resolve themselves. In moments of making where the piece might fall apart, I, the maker, must find ways to create enough friction to hold it together. Without anchors or any other means of restraining the work, I can see my hands and arms and in some cases, toes and feet and teeth, in my memory of holding, grabbing, yanking, pushing, coaxing.

There are an infinite amount of decisions to make, but the material dictates when and where to make them. In moments of complete looseness, anything can happen. In moments of tension, only a few moves are possible. And in the middle space where the piece is in danger of collapse, the limitations of the material is tested the most. Designing while making is an improvisatory process with no preconceived outcome, and the set of constraints is simply what I can manipulate by hand. Nothing is instantaneous, and everything is malleable.

All this information of making is stored in me throughout my solitary apprenticeship in weaving wood. I can’t draw that embodied knowing. Drawings are made in this project after the making, as a way to recall the improvisational moves that were made. It can be quite difficult, even as the maker, to make sense of the pieces when the making process is over, or paused. Drawings are used to document the configuration step by step. Repetitious moves are shown to best reflect the process. They are most useful when used to deconstruct a piece with your mind, should the viewer wish to gain a better understanding of how the geometries were made. If the drawings were given as instructions to a new maker, I’m confident that the pieces that would be born from those drawings would be completely different from mine. This is because the drawings are not representative of what was pulled here, and loosened there, the radius of a curve or the flexibility of the weave. All of that comes from the maker while making.
Designers must engage directly with materials in order to make discoveries of forms and methods that would not have arisen using the hylomorphic model of design. The following pages show forms and relationships that were only discoverable by hand, and with extensive engagement and play with the material.

I believe this thesis shows that there are still geometries that are discoverable only by working by hand, and therefore there is an inherent value in the use of the human hand in making and designing. There is more to learn from material than could have been discovered in simulation. Playfulness is just as fruitful as rigor, and there is more to be built than can be distilled into a set of instructions for a machine to carry out.

There are many possible avenues for the future of this project. Perhaps this could be a design class to create new forms and teach design thinking, which could then be implemented at a medium scale for a space or shelter. These soft structures are held together with friction only, so they are infinitely reusable, recyclable, and therefore ideal for a process of making, unmaking, and making again with a different result every time.

My solitary apprenticeship is not reflective of the history of weaving: there is an essentially social, participatory tradition of weaving that could be the ethos of the next phase of this project. Instead of the limitations of one maker’s hands, we could see what structures arise from the collaboration of many.
From a pile of sticks to the sculptural pieces I’ve named *Klein, Beast, Bounty, Gourd, Serpent, Basket Ball*. I introduce them in the following six pages before their more in-depth imagery and drawings.
Klein

*Klein* is so named because of its resemblance to a Klein bottle. This is the only piece that uses glue to lengthen an element, before I ruled out all fixatives as a constraint. This is described in Klein’s drawings pages X-X.
Beast was born of an attempt to recreate Klein using strips twice as wide. My inability to recreate Klein speaks to the demands and specificity of material. Slight changes in material create enormous changes in making. Where Klein is lighter than air, Beast is robust, strong, and offers multitudes of opportunities to diverge and continue. Beast is a colony of sea barnacles. It grows.
Bounty began as a symmetrical shell, and remnants of that symmetry can be seen in the wider bowl. Two vessels share a wall. The curvature of two different spaces melt into each other.
Gourd

Gourd began with a rectilinear grid. Two elements that cross at 90 degrees meet again. To close this vessel I thickened the grid at its middle and then released the grid into a tangle of curves.
Serpent

*Serpent* is an exercise in lengthening. Its grid is a spine that can always accommodate another addition. However this was the least stable of all the pieces, because its looseness is only ever restricted at the ends of an element. Branching out into more directions than one would produce a sturdier and complex creature.
Basket Ball

This piece uses 1/16 ply, which is much more rigid than the 1/32, so to elongate I created woven joints that do not disrupt the curvature of the piece, and remains within my constraints of using no glue and fully recyclable materials.
Bounty
Serpent
Notes

Timelapse video

www.youtube.com/watch?v=C6y9GSvpjFM

Photography credits

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