Unknown Wonders:
The hidden potential of materials

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Abstract

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This thesis explores the relationship of material, idea, and the realization of that idea through modelmaking. It looks at material properties as an impetus and place to start design. It looks at the translation of a pure idea into physical form and pays attention to the design moments that occur during that translation. It examines the work of architects and artists who have developed practices from a similar theory of working closely with material. The thesis examines how personal experience dictates, informs, and changes design. The primary concern that runs through the whole thesis is how architects have become divorced from materiality and how materials intimately inform the work of any designer.

Figure 1. Graphite rubbing.

TABLE OF CONTENTS

Chapter 1 Introduction:

I am dyslexic, so it took me longer to learn to read and write than the other students in my grade-school class. I still wanted to engage in school, so my teachers allowed me to participate in class by making objects that investigated the subject being taught. For example, during our quarter on the Middle Ages, I made a working catapult; during Egyptian studies, I made a working reed vessel, and so on. From then on making, and synthesizing information through making, has been intrinsically woven into my learning process.

This thesis is about making: that making is learning and learning leads to discovery. Making through learning can lead to insight about material process and new ways to consider material and the relation to materials. This thesis asks how a process that involves making can inform the design of a building. Within this inquiry regarding making, the thesis will question what models mean, how scale relates to learning, and how the role of making is incorporated within other processes such as drawing and writing. Ultimately, the thesis seeks to inform the development of my own personal design process as I prepare for the practice of architecture.

Making or building as a way of learning isn't new to architecture. The etymology of Architect (arkhitekton) comes from the root words ἀρχι- "chief" and τέκτων "builder". During the Middle Ages architects used something called a tracing-house. "The tracing-house floor was covered in plaster on which the architect drew in life size part of a vault or some other feature of the church, indicating every possible aspect of it."[1] In the 13th century an architect lived and worked onsite overseeing the building of the cathedral which took several generations to build, necessarily spanning the lifetimes of multiple architects. These massive stone buildings were experiments in making and sometimes fell down. The rubble was used as foundation and the building was started again. The position of architect now is on a shorter time scale and far less involved with the physical act building.

[1] Gimpel, J. (1983). The cathedral builders. Salisbury: Michael Russell. p. 94

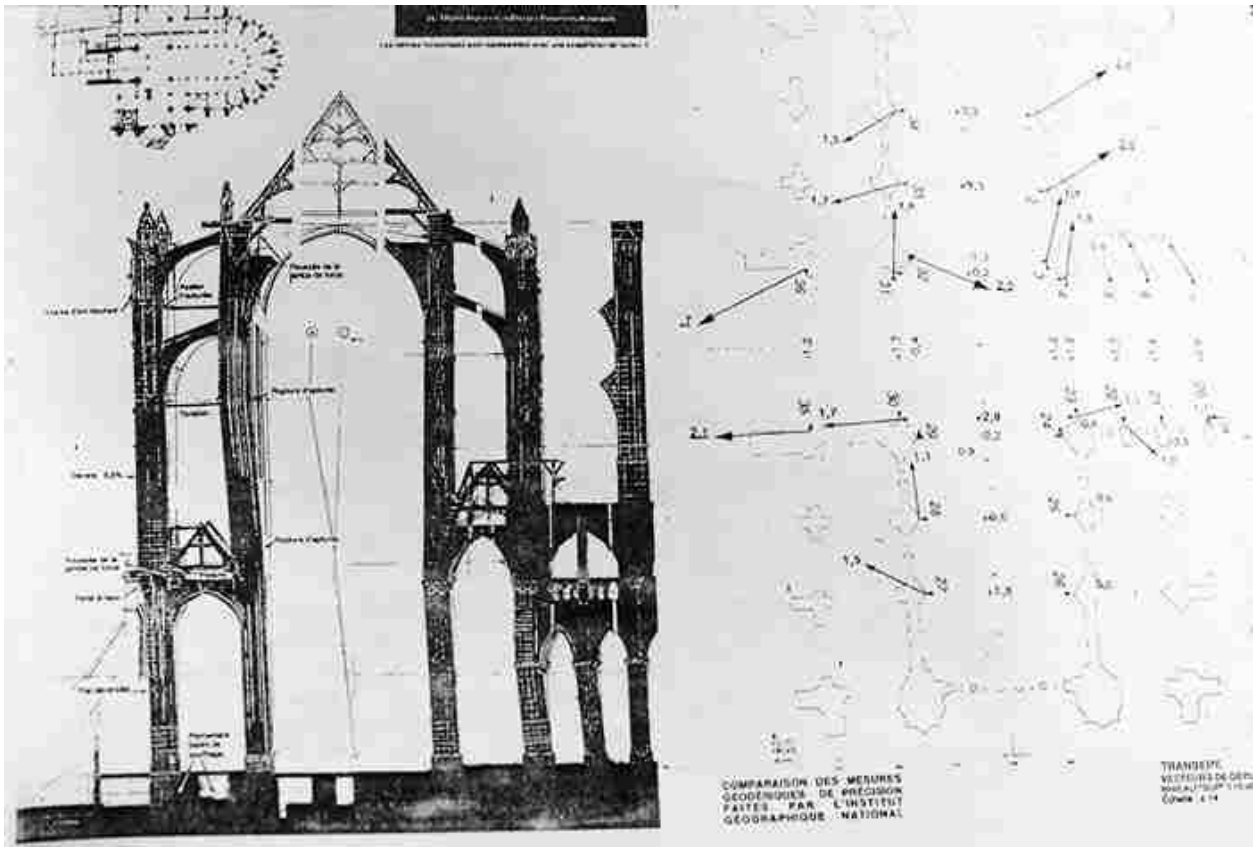

Figure 2. Diagram showing displacement of building components causing collapse of France, Beauvais, Cathedral of Saint-Pierre.

Making by hand is a form of knowing. To touch something is to know it. In German the word “Greifen” is usually used to describe the act of grabbing or gripping. It also means to “grasp” in both senses of the word. We use it the same way in English to describe physically grasping something and to “grasp” as in to understand. This is an etymological idea about making and knowing. German is the root language of approximately a quarter of the English language, providing us with other commonly used words such as “haus” becoming “house.” Words are the clear evidence of thought and show how our ideas change, adapt, and become real. In the same way that words serve to reveal thought, so too does making serve to reveal the physical qualities of the materials we work with. This shows how the idea of making as learning is already part of our lives. The German word “Greifen” reveals a linguistic understanding of this process and the way in which we practice architecture should mimic this.

Buildings are not just fully rendered drawings but are made of materials and each of those materials has its own meaning. We can learn about those individual meanings through touching, smelling, looking, and listening and we do this by working with the material as part of the modeling and building process. If we only draw our models, then we are only thinking and experiencing a quarter of what the materials have to offer to the practice of architecture. By designing and making at the same time we are able to discover the untapped richness of the material that is waiting to be used, accentuated, and leveraged in process of building. The act of making reveals structures and patterns in the material that would never be seen through a conventional architecture model.

Each architectural project offers a unique opportunity to combine and resolve site, culture, material, weather, and client difference into a single project, but the architect also brings in conditions that need to be incorporated into that solution. One of these conditions is where the architect was raised, lives, and practices. The environments that surround the architect influence their choices in building style and material choice and so where we come from contributes an important portion of how we determine the outcome of our design. I was born, raised, and lived in Anchorage, Alaska, a city that sits slightly north of the 61st parallel. Anchorage is at the same latitude as Oslo, Stockholm, and St. Petersburg, with the same landscapes and climate, as well as unique lighting conditions during the winter months. It has become clear to me that the design of buildings in these northern environments is a reflection of the landscape.

Theory

In Steven Parcell's paper "Architect since Birth: A Creation Myth Borrowed from the Phenomenology of Music," he uses parallels between the structure of Western architecture theory and the structure of Western music theory to ask question of architecture. He asks questions about materiality, composition without a designer, and questions about dividing architecture into ideas of tecture. Parcell writes that "one

consequence of this belief in musical mathematics is that Western music has relied primarily on pitch intervals—not absolute pitches that are high or low, but proportional relations between pitches. In theory, a C-major triad in a low register is equivalent to a C-major triad in a high register. This proportional relationship has been the basis of harmony in Western music."[2]

This sort of idea, that a musical geometry can not just control, but inform relationships between notes and pitches, then informs Parcell's understanding of the development of Western architecture and the internal relationships found in architecture. In particular, Parcell thinks that "Western architecture theory has been based primarily on form, starting from the ratio between the lengths of adjacent sides of a rectangle, constructed with Euclidean geometry. This proportional relationship has been the basis of harmony in Western architecture."[3] Parcell continues to discuss more complicated ideas, including the theory of timbre: "Timbre is difficult to conceive but easy to perceive. All creatures recognize timbre intuitively from experience and memory."[4] He summarizes a complex idea into a statement that specifically notes that timbre has to be experienced to recognize, that it is not something we are born with, but an idea we develop through age and experience until it because an intuition. Like timbre, Parcell recognizes that "materiality is difficult to conceive but easy to perceive. All creatures recognize materiality intuitively from experience and memory."[5] Parcell is examining ideas that discuss what it would be like to design only with materiality, informed by one's body's relationship with material and the discoveries that a designer can make by working directly with what they can build.

There is a quality inherent in materials that one, as a person, can respond to, but can't necessarily describe or quantify in the design process. This is the issue that this thesis is exploring. Designing

[2]Parcell, Stephen. "Architects Since Birth: A Creation Myth Borrowed from the Phenomenology of Music." July 16, 2007.p. 2
[3]Parcell, Stephen. "Architects Since Birth: A Creation Myth Borrowed from the Phenomenology of Music." July 16, 2007.p. 2
[4]Parcell, Stephen. "Architects Since Birth: A Creation Myth Borrowed from the Phenomenology of Music." July 16, 2007.p. 3
[5]Parcell, Stephen. "Architects Since Birth: A Creation Myth Borrowed from the Phenomenology of Music." July 16, 2007.p. 3

through the constraints of the body and materiality might lead to a richer design process and discovering ways to build that might not have been previously possible. Parcell again discusses an immaterial concept: “This description of "tecture" portrays a first moment of a discipline that is more basic than architecture. As a creation myth associated with early human experience, it is not part of recorded history but a separate, prehistoric origin.”[6]

“A "tecturan" might proceed gradually with an equivalent series of challenges that starts with observing and performing, rather than by jumping immediately to composing or designing”[7]

Norberg-Shulz has something to say about this process. He says that “the architect does not work in a vacuum. His products are solutions to problems coming from the environment, and the solutions also have a retroactive effect.”[8] This thesis gives form to the ideas I have developed during my master’s program and those I hope to incorporate from my research into other architects and designers who explore and solve these same problems. It gives me the tools and the system to approach and solve design problems while exploring material properties and the site conditions. Essentially, the system is learning by making and this process will help guide me in my exploration in solutions to problems.

Literature review

By studying other architects and artists who use forms and materials and have practiced in the manner I am interested in exploring, I hope to see how they integrated making and material into their workflow and what was successful and not successful in that process. The following architects use materials as an integral part of the design process prove my point.

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[6] Parcell, Stephen. "Architects Since Birth: A Creation Myth Borrowed from the Phenomenology of Music." July 16, 2007.p. 7

[7]Parcell, Stephen. "Architects Since Birth: A Creation Myth Borrowed from the Phenomenology of Music." July 16, 2007.p. 7

[8] Norberg-Schulz, Christian. Intentions in Architecture. Cambridge, Mass.: M.I.T. Press, 1968. p. 21

Peter Zumthor's work speaks clearly about the importance of human interaction with materiality and expands the idea of making as learning by incorporating sculptural and close work with craftsmen in his design process. Mike Cadwell gained fame in the late 1990's as an innovator of design build in its most esoteric form. He is a professor of architecture at Ohio State University who did a series of small self-built projects in New England farm country. Finally, Kengo Kuma has a conventional world-class practice that specifically targets material study and making as the genesis of his work.

Christiana Feser's body of work entitled *Partitions* deals with a small aspect of what interests me in architecture and making. Looking critically at her photographic series highlights the importance of making by hand and how that can inform the artist and the viewer. Her works bridge the gap between two-dimensional images and three-dimensional objects. They critique and flip the relationship between object and photograph. The inspiration for this manipulation through cutting and layering photos comes from her observations of how people interact with photography.

Her work entitled *Partition 3,* 2013 is a photograph of many paper tubes that she folded and then stacked in a grid and photographed head on. That photograph was then carefully cut and folded to create a three-dimensional object from a photograph of a three-dimensional object. The periphery of the images reveals the careful cutting and folding and it becomes apparent that Feser has developed a unique object through a hand-building process of working with the material. An object that was once seen as flat is now richer from the cutting and folding that the artist utilized. This simple process of cutting the photograph allows Feser to explore her material in new ways by adding physical volume to a medium that is almost always presented as two-dimensional.

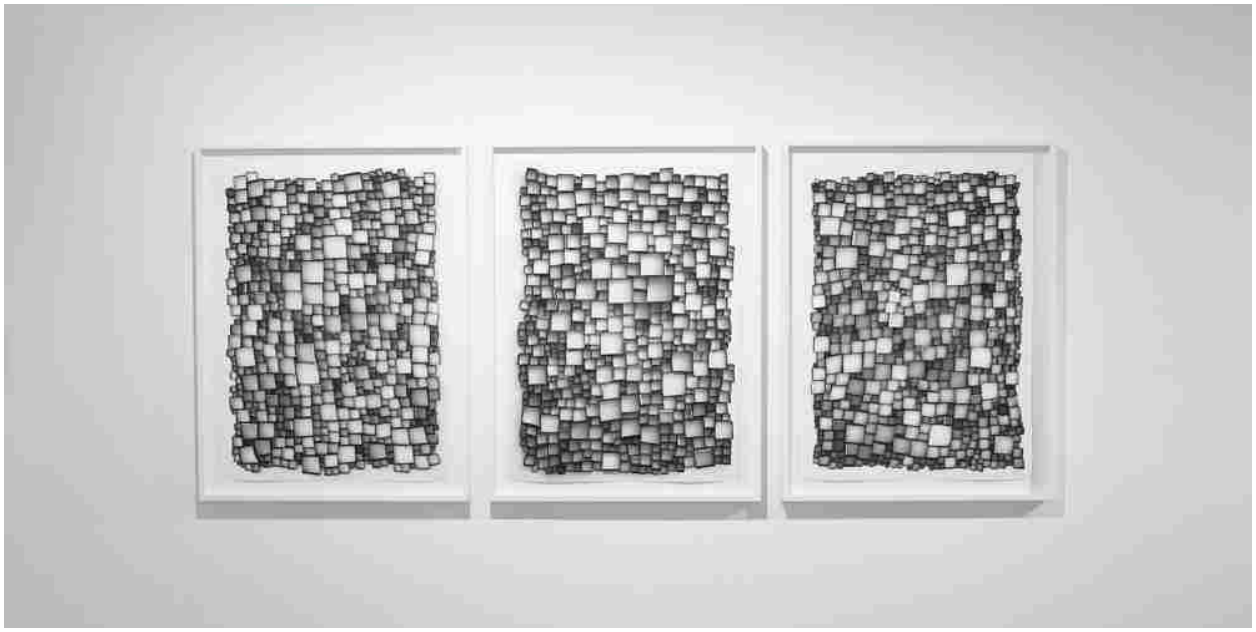

Figure 3. Partition 3 front view.

This piece, and the rest of her work in the *Partitions* series is a subtle critique of the way we consume information. These sculptures are physical objects which she makes, then photographs, then alters again. This process is a richer way of working without a direction connection to materials. The photograph becomes a material to be used to create art. It also offers a different perspective on how to approach design problems, in contrast to the way problem solving is taught in school. We are supposed to research a topic, look at pictures, and then draw concepts on flat portions of paper. The flatness of the images results in flat designs which may be visually stimulating, but give no other information about the project beyond the arrangement of lines. Feser's work moves beyond the idea of information being presented as a photo or drawing as its final form.

ZUMTHOR

Zumthor's Harjukulma Apartment Building in Jyväskylä Finland is an interesting example of designing and making going hand in hand. Zumthor and his office pair the concept or idea of the gathering space a pond makes in winter. "We saw the birch tree branches drifted with snow and the water of the pond in the courtyard turn to ice in the Finnish winter…We envisioned this courtyard as a secluded interior space for the whole residential community"[9] with the need for the building to be cost effective, a demand from the developers.

Zumthor explores the form of the building with a series of foam models. Each model has the exact same perimeter and various holes were cut out to accomplish the open Finnish courtyard to fulfill the other part of the concept. Why does he use foam to model the building? Foam has several advantages compared to wood or cardboard for model making purposes. Foam has volume and is quick to work with as it only requires a hot wire to cut it. Secondly, foam does not read as any particular material. It has an amorphous homogenous (foamy) structure which does not have a scale or an analogous material. Scale models in wood are fraught with concerns about the grain reading much too large for the size of the project.

With these foam models Zumthor is able to explore the relationship between form and concept. Each model has a different void, but all the voids are similar in that each has undulating walls. This "natural" form reflects the concept of a pond. The thinness relates to the structure of the rooms within. Each model in essence offers a solution to the proposal. Materiality is not explored in this form of making, but it might serve a way to clarify the concept of a gathering point without imposing too much information. By using foam to explore the form of the void, Zumthor cleverly avoided exploring any other aspects of the project. From these models he selected a form that he found desirable. Using the form as a guide of sorts he started to develop the building in terms of the practicalities of an apartment building. This next model tests

[9] Durisch, Thomas. Peter Zumthor: Buildings and Projects 1985-2013. Vol. 3. 5 vols. Zurich: Scheidegger & Spiess, 2014.

how the form works as a conventional apartment building. Here we see cardboard covered with black paper. By marrying cardboard with black paper, he leverages the utility of cardboard while minimizing its utilitarian appearance.

Next Zumthor makes sectional models with a more expressive internal structure. It is of note that all of these models appear to be a similar scale. Each model is a physical object that tracks design process and thought as the idea develops from concept to hard line drawings. Sadly, this project never reached the construction phase. I admire this project as it retained the same poetic properties, the same curves and adherence to the initial concept.

Figure 4. Foam concept models for Harjukulma Apartment Building in Jyväskylä Finland

Zumthor's Bruder Klaus Field Chapel, Wanchendorf, Germany is also an interesting project to discuss as it relates to making and exploring material by hand as a rich way to explore a concept and idea. I love the idea of making a site by hand, one that is not made from stacked up cardboard, but sculpted in a loving manner. Zumthor's site model makes me think of the site in a more subjective manner. The work is more about material and feeling than an "accurate" depiction of the site's contours.

Metric scales remain a mystery to me, but looking at an image of the site model, the project itself is a small tower in the middle of a vast landscape. This site model helps set the scene and establish how the building will fit within the landscape. The poetics of the landscape influenced the material of the project by bringing it into the project at an early stage.

It appears that the site and the model are made from the same material and larger scale models explore the texture of the interior of the project. These models serve to test the idea of how the impressions of tree trunks might transfer to a hard surface. Models of this study shows plasticine clay pressed against cylinders and then pulled away to project a space between the two. The chapel was conceived as a progression of trees leaning against each other with rammed earth compressed around the trees, forming walls and a solid mass. He spent six years working on this project starting with drawing, then model making, mock ups, and site dioramas to fully explore the material and landscape.

Figure 5. Bruder Klaus Field Chapel, Wanchendorf, Germany during construction.

In this work, Peter Zumthor fully explores the problem, landscape, and materials that he chose to work with. The final chapel was made by ramming concrete in 50 centimeter tall steps, around the trees, creating a tall rectangular block. When the trees were removed, they left the impression of the trunks, something Zumthor had explored in his models, and a hole in the roof. This opening in the top of the chapel is an expression of the direct link to God. The trees were both scaffolding and form, leaving the impressions of bark and the volume of their trunks in the triangular walls of the chapel. Though the building appears to be simply made and composed, it is a highly nuanced project with each step carefully considered.

Concrete takes the form of its mold. All the carpentry goes into mold-making for this project. The energy and hand-making of the building is eventually removed after the concrete has set. Rem Koolhaas

compares concrete sites to Noah's Arc, saying "Modern architecture needs a flood."[10] In concrete projects, all the energy is put into making the form. Once the liquid concrete has hardened, the forms are removed, leaving only the concrete behind. The energy and hand-crafted materials are washed away. Zumthor deals with concrete differently. He understands its material properties and ability to take impressions and he masterfully harnesses its potential for physical memory in this project. The chapel project is a perfect example of exploring material potential and learning by making.

Figure 6. Bruder Klaus Field Chapel, Wanchendorf, Germany complete.

CADWELL

Mike Cadwell's work seems like an obvious source material and inspiration for me, but it fails to take into account material studies. He draws his only inspiration from the act of making. Cadwell's *Small Buildings* are part of a "pastoral quartette, located on various sites in secluded parts of New England."[11] They are crude timber structures that are both sculpture and architecture at the same time. The reader is encouraged to visit the buildings if they are able to find them. They are simple and small enough that a single person could construct them and they invite the viewer to interact with the smaller, more intimate

[10] pg. 249, Koolhaas, Rem. Delirious New York : a Retroactive Manifesto for Manhattan. New York :Monacelli Press, 1994.
[11] Cadwell, Mike. Small Buildings. 1st ed. Pamphlet Architecture ; No. 17. New York, N.Y.: Princeton Architectural Press, 1996. p 3

space. The four buildings are *Bridge-Box*, *Drum-Barge*, *Ark-Tower*, and *House-Tunnel.* Each project uses untreated timber that will “fold back in the earth” with time and decay.

Figure 6. House-Tunnel, Ark-Tower, Bridge-Box and Drum-Barge

Drum-Barge is the third in the series of four projects. In essence it is a pontoon boat made from a platform, a barrel, and cloth fashioned into a roof. The concept that inspired *Drum-Barge* are summer swim stands and the prompt that Cadwell used is literally “*Drum-Barge* = summer Drum-Barge. swim-stand. in water.”[12] Cadwell’s project does just this. A large man-sized barrel sits on pontoon floats on a lake in Starksboro, VT. A four-sided roof tent structure shades and protects the inside of the barrel. *The Drum-Barge* takes advantage of water as its means of entry. The user dives below the deck of the water to emerge by rope up into the interior of the volume. The required submerging of the project leverages a natural element as a point of entry.

The user enters the barrel from below by swimming under the pontoon. Water is used as an entrance and the person progresses up a wooden ladder inside the barrel to the roof portion.

[12] Cadwell, Mike. Small Buildings. 1st ed. Pamphlet Architecture ; No. 17. New York, N.Y.: Princeton Architectural Press, 1996. p 3

This is an interesting material study as it takes advantage of that fact that wood expands when wet across the grain. Barrel makers use this property too. Wine barrels, when dry, are loose and have gaps between the staves. When soaked in wine, the staves swell and expand enough to become watertight. His use of this material property is apt, but fails to look deeply into what else could be done beyond the conventional use of wood in a barrel.

“The reason I chose to work this way is simple: the abstractions of modeling, drawing, and writing about architecture become meaningless to me when I no longer knew to what these abstractions referred. It was as if I were a painter composing a painting without a true sense of what it felt like to put pigment to canvas.”[13]

I agree with this quote insofar that we work in abstractions. While his *Small Buildings* project is interesting, it lacks a richness. I think the failure here is that he made up his own prompt so he did not need to do any problem solving to find a solution to a new idea. I fail to see a relationship between the stated concept and the handling of material. It’s more the use of simple woodworking techniques to make a form somehow related to the four words that prompt the design. To me it is as if he had idea and a concept, but failed to fully explore what the process of making means. His work here seems very conventional in its construction and response to environmental conditions. The work matches the landscape of New England worn down from glaciation from the last Ice-Age and lacking anything interesting or worthy of secondary consideration.

There is no point in looking twice at the work. The work seems fairly obvious, but at the same time is so personal that it is cryptic and self referential. The architect himself offers up a vague invitation to find the worlds in the countryside. Thus nothing is revealed about the world, offering no entry point. In effect I see no point in the work other than the fact it may have inspired future works which are more accessible.

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[13] Cadwell, Mike. Small Buildings. 1st ed. Pamphlet Architecture ; No. 17. New York, N.Y.: Princeton Architectural Press, 1996. p 5

What would this project have been like if he had chosen words at random instead of designing a prompt around a design idea he already had?

His work relates to my thesis goal of learning by making because each piece was designed and made by the same person. Cadwell clearly learned from making the work, but did not address the material properties in his final projects beyond their structural value and form. He stays true to his statement by using materials to compose an idea, but there is no dialogue between his capacity to design and ability to build.

KUMA

I had an opportunity to visit Tokyo during March, 2018 which coincided with the opening of an exhibit at the Tokyo Train Station of Kengo Kuma's models and materials lab. Kengo Kuma is famous for his material studies and has made a career from learning by making. I was able to walk through both floors of the exhibit and observe the models and physical artifacts of his design process and then look at how they informed the final projects. I then went on a tour of his finished buildings in Tokyo to see the realized projects that were sketched out from the material samples and models in his exhibits and to see how he had addressed design problems from the site.

Figure 7. Variety of Models displayed in Tokyo central train station from the office of Kengo Kuma.

The lab for materials exhibit breaks each project into material categories rather than a timeline. The buildings are then organized in a chart by lines that loop and relate projects to the actions that inspired them such as “loop,” “weave,” and “stack” as well as by material type. Earth, steel, bamboo, and wood are all listed as well as the actions are those which building with them are accomplished. Making and traditional techniques are obviously celebrated by Kengo Kuma. The materials he chooses to use and explore are not sheetrock, fiberglass or composite, but rather materials that are considered traditional or experimental. He balances very new materials and ideas with traditional craft and design and informs his practice through rigorous material studies.

Kengo Kuma explains how he perfected his craft:“I didn’t have a job in Tokyo for 10 years. I was designing small buildings in the countryside. I worked with a craftsman and studied how to use natural materials in those 10 years. From this experience, I learned the great aspects of Japanese traditional architecture. I started to design traditional Japanese architecture and foreign people took notice of the design.”

The relationship between the architect and client is very apparent in viewing Kuma’s work. On projects that seemed more personal or self-funded, such as the Teahouse and the Pavilions, his interest in material experimentation was clear in the final design. The smaller and more personal works had a successful relationship between the material program and concept which interwoven into a single cohesive object closer to a piece of art. In a comparable project in size, such as the Starbucks Dazaifutenmangu Omotesando, a wood lattice structure is applied to the interior of the building which shapes space, but does not provide structure which is a less cohesive solution to Kengo Kuma’s design problems. It seems that the clients were more interested in interior decoration than a complete building. Finally, the Sunny Hills Japan building is an excellent example of making to learn as well as being informed by concept, program, and client. In this specific case, it is easy to imagine from viewing the building that the client said “We do pineapple cakes.” and the response from Kengo Kuma was “Great,

let’s just do a pineapple.” From the perspective of design thinking through making, the buildings I saw were successful in different ways.

Figure 7. Pineapple sketch found in The Sunny Hills Japan building.

It is apparent that Kuma has an affinity for wood and he expresses his adoration in various interviews. In the Tokyo Train Station exhibit, the Teahouse from 2015 is the only project in its entirety and I believe represents a tight project that balances material inventiveness, local culture, and program. Three distinct parts make up the Teahouse. A large, clear vinyl balloon filled with helium, translucent polymer fabric, and tamari mats once assembled becomes a tent held aloft by the balloon. The program is very simple, only providing an entry where one bows and a place to sit within a space defined by the loose folds of the polymer fabric. It is worth noting that the entire project fits in a suitcase. Here Kuma has fully explored and applied materials to a program while also incorporating the bare essentials of what makes a teahouse as a nod to the cultural requirements. I believe that because of the small scale of the project the architect experimented directly with the materials to learn how to best apply them to the problem. This project verges on an art installation because he didn’t model it during the design process and the final project reads that way.

The Starbucks Dazaifutenmangu Omotesando sits in between the scale of the Teahouse and the next work, the Sunny Hills Japan building. This project is comprised of sixty-millimeter square sticks notched together at oblique angles, lining and wrapping the inside of the building to form a network of wood that acts more to shape space than to provide structure. The wood structure is in between a facade and furniture and I initially did not care for his solution to this problem because there was no relationship with the structure of the building and the shape of the wood. Looking more deeply into the project I see that it is more of an expression of wood as an inviting and friendly element that helps to invite people into the store.

A portion of that wood structure is displayed in the Tokyo Train Station Exhibit. Seeing it in the setting makes it more akin to artwork than architecture. He is not building anything with the wood lattice, but is instead decorating the inside of the building and shaping the volume of the room. Historically, buildings in Japan were made from wood spliced together from multiple pieces and this work is a clever nod to that practice. The wood in the exhibit and the building is an exciting highlight to what would otherwise be an ubiquitous Starbucks.

This project chronologically follows the first latticework he did at the GC Prostho Museum Research Center. In that work the lattice is rectilinear where all the joints are at ninety degrees. Kuma plays with the abilities of the craftsperson and plays with how the lattice can interlock, changing the joints to be oblique for the Starbucks. This is an example where he tested out an idea on one project and altered it for the next specifically by working with the materials, but also in dialogue with the craftsperson. He explores a craft and cultural dialogue by using jigoku-gumi or “hell joints” in his design.

The Sunny Hills Japan building sits on a corner of a residential neighborhood block. The building houses a company that sells pineapple cakes from Taiwan. The building first appears as a tangled mass of wood stretching skyward with thin fingers when first approached from the street. Its form does not respond at all to the site, but instead arose directly from Kengo Kuma’s practice of learning by making. The profusion of

wood on this project is not only an interesting facade but is also a structural element. The exterior walls are two diamond lattice works held apart by a tertiary lattice much in the same way that two layers of paper are held apart by a hollow core to make corrugated cardboard. The floors interlock with the wooden wall to fully interface the lattice with the building.

It is apparent here that Kengo Kuma started with a simple concept. On the third floor there is a drawing of a pineapple left behind almost as if to show exactly what he meant. There is no question that the he thoroughly explored what a pineapple means and how he could apply it to a building problem. A pineapple has a diamond-shaped pattern on the skin with texture that gives it a three-dimensional pattern as well. This tough lattice-like exterior of the pineapple gives the fruit its structure and shape. Building on his earlier experiments in lattice wood work, Kuma uses the same structure again but this time more effectively than in the Starbucks project.

By learning from his past wooden works, Kengo Kuma settled on a three-layered wooden system. Despite its size, this project, like the Teahouse, looks like a model made full-size. Much of the material learning happened in model form as he explored texture, pattern, volume, and rhythm. Comparing the model and the building there is no difference between the two. Even the angle of the wooden sticks surrounding the service entrance is exactly scaled up from the model. For such a dynamic facade and structure, the building feels a little static. That during the construction there was no making while learning, but instead just a strict adherence to detail as dictated by the model. Instead of simply scaling up the model, the building could have been made more interesting if there had been a dialogue between the craftsperson and the architect. If this had been the case, would the building integrate more gently into the site and context of the surrounding Tokyo cityscape? Tokyo is a city resplendent with iconic buildings that astonish the viewer. Intentionally not responding to the site seems to be a point of pride for the architects that designed many of Tokyo’s most famous and incongruous buildings, but it results in a jarring array of buildings.

Figure 8. Sunny Hills in Site, Structure, Size of beam in Relation to Hand and Scale Model.

The idea of a pineapple is simplistic. Kengo Kuma didn't just make a building that looked like a pineapple but leveraged that pineapple as a rule for design. These rules were in turn leveraged to have a relationship to core principles. The whole project was then explored in wood. Why wood? Wood seems like a natural choice for exploring the zeitgeist of the pineapple as they share many qualities including texture, color, warmth, organic genesis, and fibrous structure. It's worth mentioning that this building could have been rendered from expanded metal just as easily. It would have had the same structure and interactions with the site. Wood breaks down the facade into human-scaled components that invites an inquisitive hand. Metal would be cold or hot to the touch, but wood is warm and comforting.

The pattern and the size of the wood are related in the building and Kuma's desire to explore the elements of material. As the lattice shrinks, the lines get finer and the original drawing comes through more clearly, but you lose the strength of the larger timbers. The hand-sized wood pieces used in the lattice must be important. The hand-sized lattice serves to reinforce that the building was made by hand and that Kuma was intimately involved in the design process by making models and learning from the material. However, some of the details in this project do fall short. In particular the steel footings for the exterior facade cap the wooden foot. This acts as a pan to collect rainwater, causing obvious wear and

decay which is interesting because the same foot-steel connection on the inside of the building is without a pan.

Kengo Kuma tries to dissolve the lines that define architecture. Some of his more intimate projects feel like furniture for living. His emphasis on bringing the body into the design process produces buildings that are human-centric and delightful to be in. He focuses on traditional building materials and craftsmanship, but does not hold himself to it and is open to exploring new materials and new ways of building. Kuma explores his buildings through deep material studies and intimate work with craftspeople to solve the problem of how to incorporate and display the elemental essence of the materials used.

Rather than leading with the material study, Peter Zumthor tends to start with sketched drawings that he can interpret with the help of a craftsmen. This is a third approach. Rather than directly making the thing yourself, a la Cadwell, or rigidly adhering to architectural models like Kuma, Zumthor relies heavily on the expertise of a craftsperson who can help him understand the materials and how that will inform his design. His models tend to be more sculptural and open to interpretation, allowing for them to be built in more conventional, but also more esoteric means.

Kengo Kuma explores materials as their structural quality and weaves them with the poetics of culture and program. Zumthor is interested in the material qualities of texture, touch, and warmth then relates them to concept. His work appears to be more tactical and he learns by making models that focus on the feeling of a building rather than the structure. This contrasts with Cadwell who takes material qualities at face value and uses them for their structural properties rather than necessarily their elemental values. Sverre Fehn plays with cultural identity as his focus and then finds appropriate means to express that through material. These architects approach their work differently. They share a common interest in making and the craftsperson as the way to explore design, but diverge in how they explore materials and how they are integrated into the design workflow.

Kengo Kuma, as a renowned Japanese architect and professor, instructs architecture students: To use “Hands”. Much like in his designs, this statement is sparse, to the point, but allows room for interpretation within its confines. He wants his students, and also those who view his work, to understand where his ideas come from and how they were developed. Kengo Kuma’s working method always starts with a site model which allows him to physically manipulate the materials which is a vital path for him to learn about the project. The German artist Christiana Feser approaches these ideas on a smaller scale by examining how we interact with photographs. She changes the physical form of the photo to force us to spend more time with the image and to consider it more deeply than we would after being conditioned to quickly flip through images on screens.

Christiana Feser’s work identifies a problem that became very apparent during my trip to Tokyo. Each building or site I visited I had seen countless times already on my iPhone or computer screen. These digital images are flat and the product of colored pixels on my screens. Each image in effect is the same, each one is made from glass and light. Digital images remain unchanged as the code that creates them is copied and displayed countless times. Feser approaches this problem in an interesting way and says that “the image from the iPhone is flat and ageless. I watch as my photographs were consumed in the same manner. I started to cut my photographs to make people stop and realize there is something more.” Her manipulation of the physical form of the photograph is partly a study in the material, but also turns it into a different type of object that elicits a new response from the viewer.

I see the same issues that the visual image is preferred over the physical, partly due to its accessibility. Flashing screens have rendered full realized objects into pancake versions that can be flicked through with a finger. Something is lost in the transformation or compression that is inherent in the photograph and Feser’s exploration of how she can physically manipulate the object is a method of learning from the material and reinstalling it with meaning, albeit not the same meaning that the subject of the photograph had.

Referencial Material

Cabinet makers have to know how to use tools in the best way for the job. I learned the difference between the right way and wrong way to use a tool when I worked in a cabinet shop during high school and one summer during college at Alaska Wood Molding, Alaska's largest cabinet shop. While watching the cabinet makers and carpenters work in the shop I was always impressed by the deliberate and precise way that each tool was handled. Each task in the production of the work had a right and wrong way to do it. I see a connection between this ethic of making and the work of Peter Zumthor. It is an easy connection to make in part because Zumthor worked in his father's cabinet shop in the early part of his life before moving into architecture study and practice. I also noticed that the craftsmen at Alaska Wood Mold would also improvise and change tool uses based on the project. There was a sense of learning while doing. I suspect that Peter Zumthor does the same thing in his work.[14]

Looking at his drawings, I see that same wood working precision. For example, the way he uses the hard edge of the conté crayon to define the inner courtyard of the Harjunkulma Apartment Building, Jyvä, Finland 2001-20014 exemplifies the same mastery of tools as a fine woodworker. Using the crayon on its edge he presses harder on the inside edge leaving a greater concentration of pigment and a hard edge. This stroke communicates how light will diffuse through the interior of the building. His strong and emotive drawings are all done by hand. Through drawing by hand he learns about his project, its qualities and how it might look or feel. From a close reading of Zumthor's interviews and written work it seems that he starts with a concept or idea that he hand draws.

"I made a drawing of the Therme Vals were all the huge blocks of ice were six meters and they would be asking: how are you going to do this? What are those big blocks? And I always said: I have no idea, we'll

[14] Zumthor, Peter, Nicolás Alvarado, and Alejandro Hernández Gálvez. Peter Zumthor En México: Arquitectos Suizos En México = Peter Zumthor in México: Swiss Architects in Mexico. Ciudad De México: Arquine, 2017. p. 66

find out. And later, I told the carver: show me the biggest blocks you can make and every block was way too small. So I asked him: what are you really good at? and he said: I have these long stripes and that's how we managed to make the building. That's exactly how it works."[15]

In this quote he talks about have a concept, drawing it and then when it is still in its infancy, working with a craftsman to find a solution for the concept. Bringing in the realities of building in the workflow from the very start of the project insures that Zumthor is able to manipulate the poetics of the real building. Material and feeling are just as important to him as the structure of the building. Looking at the Therme Vals baths the concept of the building and stones used to assemble it are one and the same.

Zumthor brings the hand and making into his projects in three ways, first by his hand drawings, which allow him to express ideas, second he makes models by hand that express the "feeling" of the project and finally he makes models a large scale the actually describe the construction of the projects. He is willing to admit that his ideas don't come from anywhere. " I go there and I'm not afraid. Some people say. " how can you have an idea?" And I don't know, I just go there and I have one. But I look around…"[16] If in fact ideas don't come from anywhere then they paradoxically come from everywhere,which he goes not to say " movies, literature, we all have a lot of knowledge inside of use we are not aware of."[17] His ideas might not come from somewhere but because they are developed in materials or in the manner they will be made that express the idea of the project clearly " The projects are volumes"

It appears that the first loose sketches begin to define a concept, then models are made at a large scale with many variations and finally some mock ups are made. This is all supposition of course because I

[15] Zumthor, Peter, Nicolás Alvarado, and Alejandro Hernández Gálvez. Peter Zumthor En México: Arquitectos Suizos En México = Peter Zumthor in México: Swiss Architects in Mexico. Ciudad De México: Arquine, 2017. p. 76
[16] Zumthor, Peter, Nicolás Alvarado, and Alejandro Hernández Gálvez. Peter Zumthor En México: Arquitectos Suizos En México = Peter Zumthor in México: Swiss Architects in Mexico. Ciudad De México: Arquine, 2017. p. 83
[17] Zumthor, Peter, Nicolás Alvarado, and Alejandro Hernández Gálvez. Peter Zumthor En México: Arquitectos Suizos En México = Peter Zumthor in México: Swiss Architects in Mexico. Ciudad De México: Arquine, 2017. p. 83

have not visited his studio or found work that backs up this claim. However, I see evidence of model variations in the exhibits and works published both on the web and in books.

Materials

Rather than using materials as a surface treatment or assemblage of parts, these architects manage to have architectural practices that leverage the properties of materials. Through careful investigation, they highlight the relationship between material property and the design of the project. Mark West clearly stated this concept in his 2018 lecture at the University of Washington. He said “It took me three years to unlearn the excellent education I got, that buildings weren’t just assemblies of components, but each material meant something and had a certain smell and a certain touch.” Peter Zumthor uses drawing materials the same way, to highlight the qualities of the material and to express the concept. He uses a material to relate to the concept, even in the drawings that he does. This material exploration is an example of learning and designing by making. It allows the architect to learn and apply material concepts even before work begins on the final design.

Theory is just a way to look at the world. The word stems from the ancient Greek “theōréō” which means to look at, view, consider or examine. It is related to the word “theáomai,” or theater, meaning to observe. The theory that I will develop here will guide my design practices by establishing goals and procedures for making that gives me flexibility in site design and material choices, and builds in room to learn from my materials and apply those lessons to my design. Some of the most important guiding principles of my thesis are as follows:

Modeling(Verb)

Mark West, an architecture professor, has developed a theory of design where modeling is used as a verb rather than a noun. Models are created by using analogous materials. Steel, for example, is modeled with stiff paper because it mirrors its properties at a small-scale. Plaster is used for concrete, etc. This is a hyper-realistic way of modeling because it allows one to build in constraints almost immediately. These constraints are based on the reality of the site.

Conti Crayon Drawings

Another theory that Mark West uses to guide his practice is inspired by 15th-century conti crayons. He states that every site you come to is not a blank slate, that there is the “cosmos over it and flora and fauna that live in it.” The conti crayon drawings use toned paper and white and black is then applied to build up the background and foreground. There is no neutral background in this technique and it is the artist’s responsibility to respond to the paper appropriately with white and black. This theory relates to architecture because West thinks all sites have information, like the toned paper, rather than being empty. That site information just needs to be discovered so it can be worked with, like building the drawing using black and white.

Translation Theory

Paradoxically, the Ise Jingu Grand Shrine in Mie Prefecture, Japan is 1,300 years old, but is also less than 20 years old because each of the two temples that face each other is rebuilt on a 20-year cycle. The one standing serves as a full-size template for the temple that is being built. The temples have been constantly rebuilt, but the essence of the design is the same because of the dialogue between temple and construction. This theory illustrates that there is nothing new in architecture, that everything is a translation, repetition, or reproduction of existing ideas. Once we can accept that, then we are freed from the modernist thinking that everything must progress linearly and that new design cannot exist with old design.

Right Tools for the Job

This is less a design theory, and more of a theory of realistically realizing buildings through material-lead design. This theory encompasses ideas about handling materials, including looking at materials and understanding which tools are used in their treatment. This design theory relies on work being as simple as possible. The designer and craftspeople need to work together so that the best work practices can be established. Ideally, by working as simply as possible, the material properties will come through in the design and the whole process will be more economical by excluding overly complicated processes.

Goals

This thesis does not cover and finish the work I designed and built in my master's program, but rather it serves as a guided exploration to inform my professional practice. Rather than being the umbrella that caps everything off, it is the vessel that gives form to my future work. I will show this through the design of my thesis project. The process will start with a series of models that bring material studies immediately into the design process, demonstrating the production of ideas by building physical objects. They will also show how my design process changes as I learn by making.

Creating physical objects allows for outside critique and internal reflection, resulting in tighter designs and a more thoughtful finished product because there is less translation in scale with a made rather than imagined object. Christian Norberg-Schulz accurately summarizes the need for physical objects as part of the design process.

> "We do not, in the first place, think of the technical difficulties which have to be surmounted in connection with any building task, but we rather have in mind the problem of defining the task, and of deciding whether a planned or completed solution is satisfactory. In both

> cases we have to take into consideration 'practical' and 'artistic' needs which concern the architect as well as society and the individual client."[18]

The hands-on building process incorporates the technical process of working with the materials. By making objects, I will be forced to deal with any problems that will arise from my material choice, leading me to solve them before building the final piece, and to adapt my design process to incorporate the material properties. The series of models will ensure that learning occurs, that I adapt to the material, that I learn by making, and that I can look back and see the progression of ideas through the whole process.

This system is designed to challenge me and force me to confront and overcome obstacles throughout the design process. This is Cadwell's weakness in his *Small Buildings* series. His design exists entirely in his head and he is not forced to overcome difficulties supplied by a prompt or problem. Essentially, he eliminates all difficulties that would force him to adapt and overcome, instead relying on the same procedures to create objects which he then installs in the landscape rather than utilizing the landscape and materials to inform his work.

Zumthor's *Field Chapel* best expresses the ideas that I want to put into practice. He explores his materials at the beginning of the design process so that as his design could evolve as he learned. He responded to the landscape through the outside and inside design of the chapel, his choice of materials, and his use of concrete as a medium to capture texture. The simplicity of his final design belies the complexity and depth of the process that went into it. The external structure appears to be a simple concrete rectangle standing on end, a simple geometric shape that contrasts with the low hills and forest of the site. The internal structure is the opposite. The void left by the trees is shaped by the pattern of the trunks used both as scaffolding and concrete mold, and includes the shapes of the surrounding forest and the texture of the trees. The triangular chapel space brings the eye up to the oculus that lets in the sun, wind, and weather.

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[18]Norberg-Schulz, Christian. Intentions in Architecture. Cambridge, Mass.: M.I.T. Press, 1968. p. 7

He has brought the material of the forest into his building and inextricably linked it to his construction. Stepping into the chapel is like stepping into the woods, albeit woods that have been shaped by a designer's hand and cast in concrete to bring your eye to source of light that serves as metaphor for God's presence. The final product is a design that plays with space, shape, and texture. It is an intersection of volume and education from careful site observation leveraged to solve the problem present of building a chapel in the woods.

The Bunkhouse Mark West built for his island property off the eastern coast of Canada represents a prime example of how personal influence, direct work with materials, a relationship between site, constraint, and client can give rise to a rich project that offers moments of magic (or ghosts) that wouldn't otherwise be present. This project is a great case study for the work explored in this thesis is because Mark West is working within strict constraints. He needs a bunkhouse that has room to sleep and live for him and guests, but also room for a workshop. He is constrained by his island location, which supplies not only the site the work will be informed by, but also inhibits his available materials because he can only bring supplies to the island by small boat.

Mark West worked directly with a carpenter to build at full scale the model truss system he developed for the bunkhouse as well as the basic floor plan. Moving from the scale of a model to a full size beam created issues of translation where a beam which could be glued together at model sized needed to be bolted at full scale. The difficulties in moving the beams created additional difficulties. The benefit of using a model was that he had an object he could intuitively inhabit and work on with his hands. There is a relationship between the intuitive building of the model and the translation of that intuition to the work Mark West did with the carpenter when creating the full scale truss system.

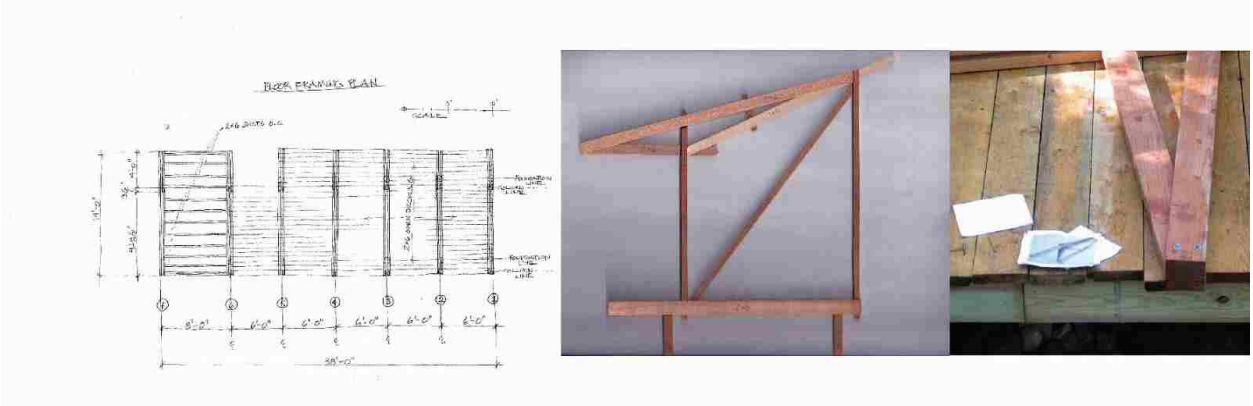

Figure. 9 Floor plan, Truss Model and Construction Photo of Bunk House.

The project is also a reflection of its site, the island. There are the constraints on the size of material that can fit on small boats as well as the need to utilize what is readily available. In Figure 10. Mark West utilizes sailboat sails and cleats typically used to hold line on boats. In this use of sails and lines, he develops a building cladding system that can be “tuned” in the same way a boat can. This small scale bunkhouse is a primary example of building within one’s personal influences and seeing how the development and complex interplay of even limited ideas creates a rich, thoughtful building.

Figure 10. Surplus Sails, Small boats, Cleats, Workshop detail.

In Figure 11 we see these rich ideas and moments of magic. For example, the trees surrounding the bunkhouse cast beautiful shadows on the canvas that creates a more visceral inside-outside relationship than glass could. The shadows additionally enhance the texture of the canvas and how it shapes itself as it is pulled taut. In Figure 12., you see the usage of tension from a bow and the boat cleats to make a door that automatically slides shut. These moments that represent the spirit, or ghost, of the building could only

arise from a constrained design process. The constraints ultimately enrich the project rather than diminish it.

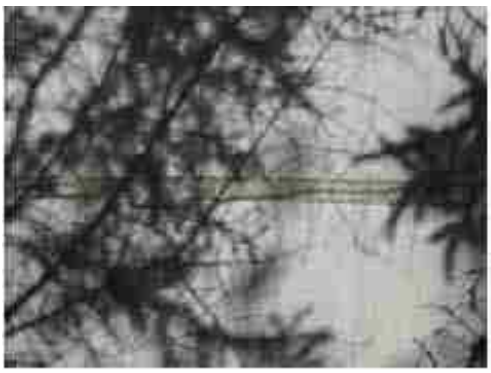

Figure 11. The magic.

Figure 12. Bow and Cleat

Mark West's Bunkhouse represents the process and kind of architecture that this process-based thesis seeks to explore. His direct use of materials, an intimate relationship to site, and his intuitive way of working make room for his personal experiences and his influences to affect the design. As a result, the design has these moments of magic, or what I am calling "ghosts", which represent the very spirit of the project. These ghost moments are the evidence of who Mark West is while he works: his direct influence on the work. This concept of spirit of place is also discussed by Christian Norber-Schulz as the a concept called "genius loci."

Figure 13. Bunk House.

Aesthetic Bank

The idea of Genius loci is a concept that Christian Norberg-Schulz proposes and discusses. A place has a character or spirit. “According to ancient Roman belief every “ independent” being has its *genius*, its guardian spirit. This spirit gives life to people and places, accompanies them from birth to death, and determines their character or essence.”[19] Goethe says: “it is evident, that the eye is educated by the things it sees from childhood on, and therefore Venetian painters must see everything clearer and with more joy than other people.”[20] In another work entitled Nightlands: Nordic Building, Norberg-Schulz attempts to define the relationship between the place and Nordic architecture. He puts forth the idea that Nordic light defines Nordic lands and what I particularly take from his ideas is that “Nordic form embodies tension rather than character”[21]

[19] Norberg-Schulz, Christian. Genius Loci : Towards a Phenomenology of Architecture. New York: Rizzoli, 1980. p. 18

[20] Norberg-Schulz, Christian. Genius Loci : Towards a Phenomenology of Architecture. New York: Rizzoli, 1980. p. 18

[21] Norberg-Schulz, C. (1996). Nightlands : Nordic building. Cambridge, Mass.: MIT Press. p. 15

Alaska in the winter is when the state is most beautiful. Trees lose their leaves reducing their form to pure structure and the landscape becomes covered in snow, turning it white. Black trees read as a positive on the white, snowy background which reads as a negative. The forms do not have depth in the morning as we have a low, grey light that illuminates but does not cast shadow. Place has deeply affected my sense of design. The writings of Christian Norbert-Schulz delve into the " spirit of the place" and he speaks about nature conditions such as the forest and the snowy weather. Norberg-Schulz asks the question "What, then, does this tell us about the nature of man-made things? Are they only reflections of natural meanings…" [22] In the way that Norbert-Schultz talks about site, so too can we think about architecture as a layering of conditions. By looking at the final product, the resolution of those conditions, we can infer how those conditions were used. The architecture gives an insight into how the architect solved the problems of the site.

If you follow the global latitude line that runs through Anchorage, Alaska at 61 degrees North, that line will run through European capitals known for their design work. To begin the discussion of my Alaska aesthetic bank, it is important to start with this polar view of the globe. The low light of winter produces a twilight that only northern latitudes receive creating a gray, flat light that does not cast a shadow, but rather softly accumulates on objects, producing form without depth. The white sky and white land blend together to show off the contrasting greys and blacks of objects washed by this flat light.

[22] Norberg-Schulz, Christian. Genius Loci : Towards a Phenomenology of Architecture. New York: Rizzoli, 1980. p. 18

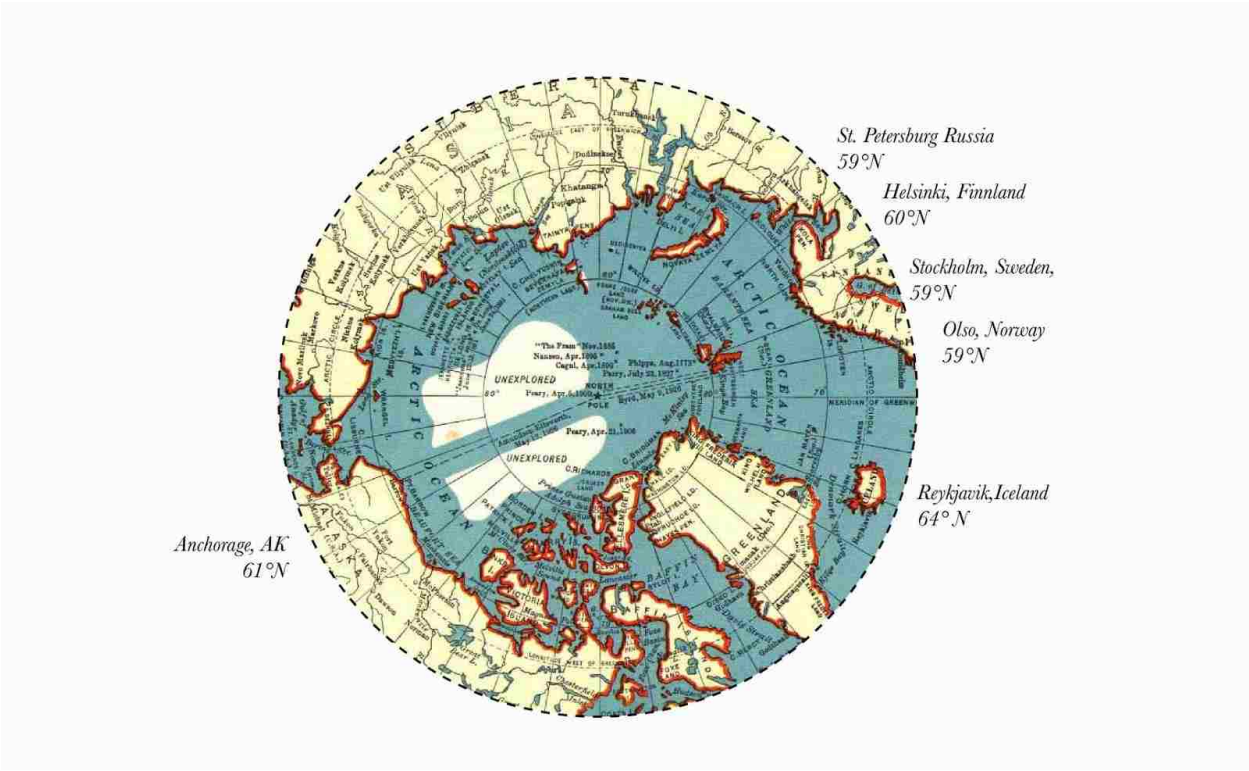

Figure 14. Anchorage Alaska in Relation to other Northern Cities.

I peeled away a ring of birch bark as one of the first exercises of this thesis. By using a scanner, I was able to scan and flatten the birch bark into an image. The scanner served as a tool that intruded its presence on the birch bark and revealed something new to me about that material. The flat image of the birch bark eliminated all of the texture of the real object, reducing it to its base colors with no depth or tactile elements. Then as a second experiment to understand the nature of the birch bark, I reduced it further by dragging it over the scanner as it was operating. This movement completely distorted the image, drawing out only lines of the color from one section of the bark. The scanner, again used to distort the birch bark, reduced it further a color palette of vertical streaks of brown, orange, tan, white, and black. This new, distorted image shares many of the same colors as an undistorted snowy, coastal landscape. The blacks and tans and whites were all there, just reduced to bare elements in the former, and speckled through the landscape in the latter case.

Figure. 15 Birch Bark

Figure. 16 Distorted Birch Bark

My interest in the Alaskan landscape and color palette stretches to the forms seen in the Alaskan landscape. Of particular interest are the sinuous windings of the rivers that cut through tundra, permafrost, and gravel bars. Flying over the countryside reveals a landscape filled with melting snow, birch forests, and these rivers bending and swooping, forming elegant shapes in the land. While these shapes alone are beautiful, what is more interesting is the basic processes that created them. These forms are the result of the ancient, elemental process of water moving over a soft, glacially formed landscape. These forms are simply material forms as they are a direct result of time and materials working together. By using a camera, we can record and compare similar forms we see at different scales. The sinuous curves of the river are repeated throughout nature, from the closed sutures of skull plates, to the webbing in reindeer antlers before their velvet is shed.

Figure 17. Ox bows forming in Bristol Bay.

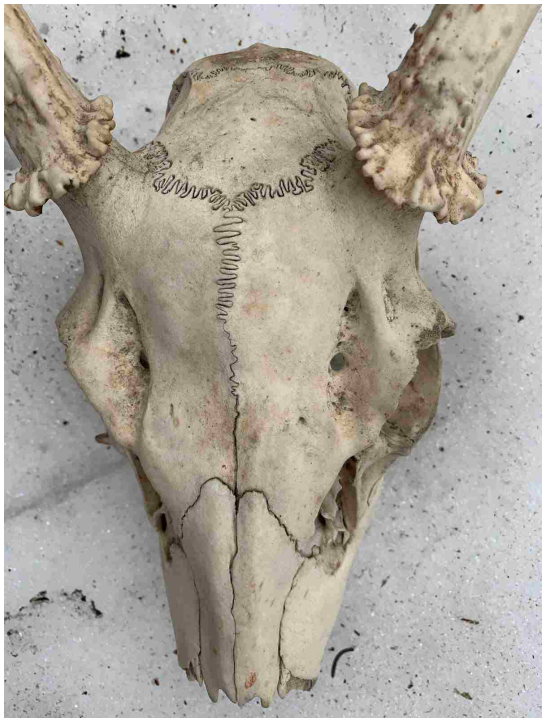

Figure 18. Deer Skull found on Admiralty Island in 1992

The Alaskan landscape color palette, unique light, and elemental shapes have had a distinct influence on this thesis by providing me with design cues and source material that have impacted my choices of material, color, and design process. All of the work produced during this thesis directly relates through form, color, or material to the landscape that shaped my childhood and has proven to be an indelible mark on my brain.

Figure 19. Winter landscape on the Coastal trail. Anchorage, Alaska.

Alaska has had a second effect on my design process beyond the development of color palettes and the formality of form. I funded my graduate school education by working during the last four summers as a wildland firefighter in remote parts of Alaska. There is something very exciting about the juxtaposition of my work as a firefighter and my work as a graduate student in design and architecture. Though seemingly

dissimilar, I found that there was a nexus between the two that ultimately informed my design ideas and interest in architectural practice.

Figure 20. Loading up Helicopter.

Most of the wildfire fought in Alaska is far off the road system. More often than not, crews are loaded in a small, eighteen-seater plane and flown to the airstrip closest to the fire. From there, the firefighters are loaded into even smaller helicopters that ferry the firefighters by twos and threes to a landing zone close to the fire. The very nature of this transport system highly constrains the work we do by limiting the tools and resources to those that can fit in packs and be carried by humans many miles through tundra, dense brush, and forest. Resources that are brought in after the team has landed are again constrained by what

can be fitted into nets, the weight that can be lifted by a helicopter, and also the availability of limited helicopters that need to serve the demands of other crews and remote communities.

Figure 21. Calling in a sling load.

The structures that are designed and erected to serve as ‘home’ in the field are composed only of the materials we can bring with us on the helicopters to the final landing zone. Figure XX shows what is referred to as a “yellow,” which is a twenty by forty foot nylon tarp stretched between trees using multi-purpose cord carried in the line packs. The clearing for the “yellow” was created with chainsaws, the same saws that are used to create fuel breaks and down trees while fighting fire. The same axes used for trenching are also used to dig the hearth for a fire and the “refrigerator,” a hole that reaches down to the permafrost in the earth to keep the food from spoiling. A place that is the very essence of architecture- a

hearth and roof- is created only with tools repurposed for firefighting and lightweight materials packed in on the backs of men. This “yellow” is architecture boiled down to serve the essential human needs and is considered home for many weeks.

Figure 22. The Yellow on Fire 181 July 2019

Often fighting fires in Alaska also involves creating the tools used to fight that fire. In the case of tundra fires, a few strokes of an axe or saw will remove the needled limbs of a black spruce tree which are then used as “beaters,” literally a branch used to beat out the fire. The irony of using a tree limb to fight fire is inescapable, but does serve to show how a tool can be a simple, elemental form, but still fulfill a useful purpose.

Figure 23. Selmer beating out a Tundra fire near Whitefish, Alaska.

The final point to make about the relationship between my design process and firefighting is aimed at resolving questions about materiality and the elemental nature of fire. I initially saw fire as a primary, elemental force that had the power to shape the landscape. But fire, even at the same scale, burning through tundra is very different from the same fire burning through sagebrush. Though fire as an

elemental, primordial symbol is eternal, its very nature changes in response to the landscape in which it burns. The sagebrush fires in Utah move at an incredible rate and intensity that cannot be fought with the tundra-fire spruce branch “beaters.” Instead, we have to stand back and cut line, hoping to deprive the fire of fuel and allowing it to burn out without spreading. These fires bear almost no resemblance to the small, soft tundra fires of the north. They are instead roaring infernos that shape the weather around them with powerful updrafts, creating storms and even tornadoes. Fire as a material is fascinating because it retains the same basic properties, but changes in response to the landscape, much in the same way that this thesis sets out to explore how materiality changes in response to the varying constraints of each design project.

Figure 24. Fire in Northern Utah

Figure 25. Tundra fire near Adak, Alaska

The concern with building exclusively through materiality sparks the question of what it would be like to build and design without materiality. Designing without materiality is akin to the idea of a ghost: a presence without material form. The benefit of a ghost is that the idea and spirit of the project is expressed without concern for materiality. By developing a ghost for each project, the design can then respond deeply and personally within the idea of site and land without the concerns for materially that normally inform and often dominate a project. The beauty of working with a ghost as the driving force rather than materials is that once you begin to translate the ghost into physical form there are moments of unexpected beauty.

Figure. 25 Ghost Dress.

Take for example, the form developed from the union of a circle and triangle. It is an object that uses elemental geometry, translated by the machines and programs that made them, as a test case for the idea of a ghost. I developed the triangle-circle form as simply as possible using two separate programs. First, I set the constraints of a circle inscribed in a triangle, but held apart at a particular distance. Next, I asked the program to join the two using a command designed to produce a “developable surface.” That form was then exported from its native software and translated to be understood by the 3D printer.

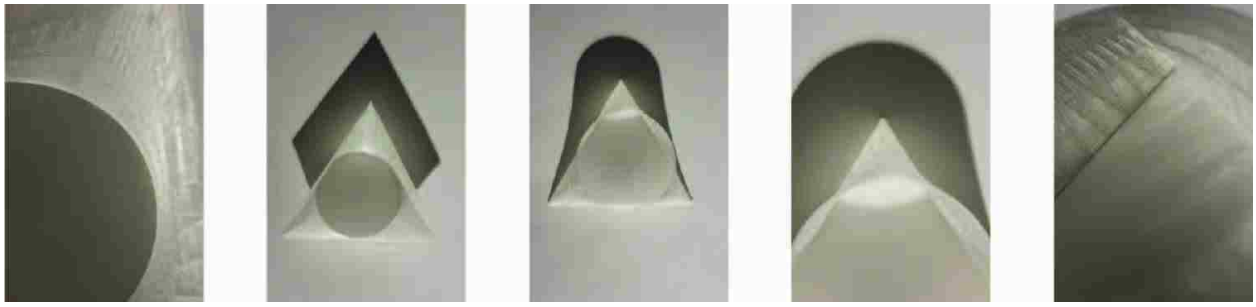

Figure. 26 Test Ghost photographed by A digital single-lens reflex camera

The object produced by the 3D printer was something totally unexpected. In order for the 3D printer to understand what was inside and what was outside, it took each surface and broke them into triangular facets with their own particular vector. While this makes sense on a logical basis, it produced a result that I could never have designed or imagined.

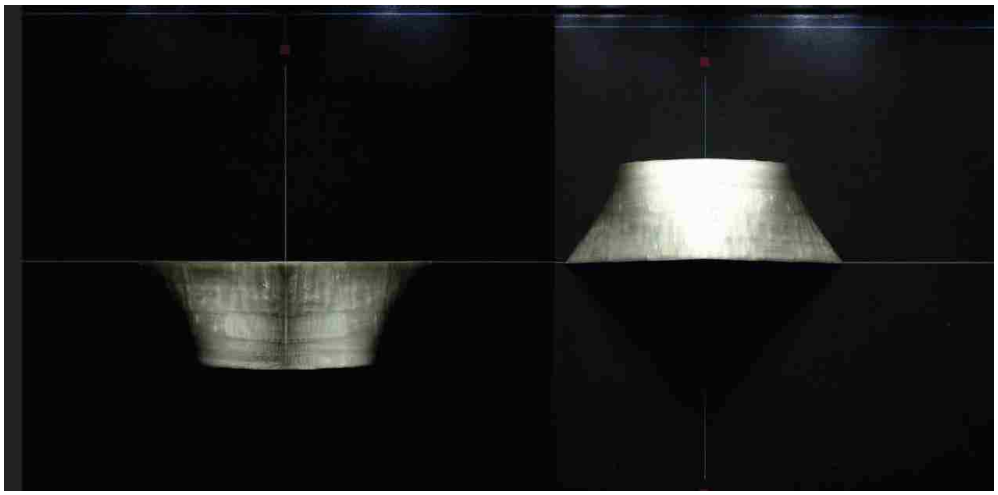

Figure 27. Test Ghost compared by Digital Scanner.

Now that the initial ghost had been realized, I then used the same tools that analyzed my aesthetic bank in order to analyze the unexpected wonders that were the result of the 3D print. In figure XX, simply shining a light at an oblique angle and taking a direct photograph yielded a shadow line and shape that I would have been unable to consciously design or predict. Here the camera imposed itself and yielded more unexpected forms. Using the scanner and changing lights, I was able to understand more forms of 3D prints and their resulting plaster casts. This first test ghost was successful and gave me a new approach to my intuitive, material way of making. It was the antithesis to my old approach for designing and it sparked ideas about how a ghost could inform the development of ideas and design by no longer relying on material elements to supply the dominant feature.

I initiated each of these projects by conceiving a design using materials that I did not know how to work with, which would allow me to more freely explore the idea of the ghost, and also forced me to work with

people who knew how to use that material, much in the same way an architect needs to work with craftsmen. I was unencumbered by material choices, leaving that instead to the people who had agreed to help me, and thus was allowed to focus solely on the design.

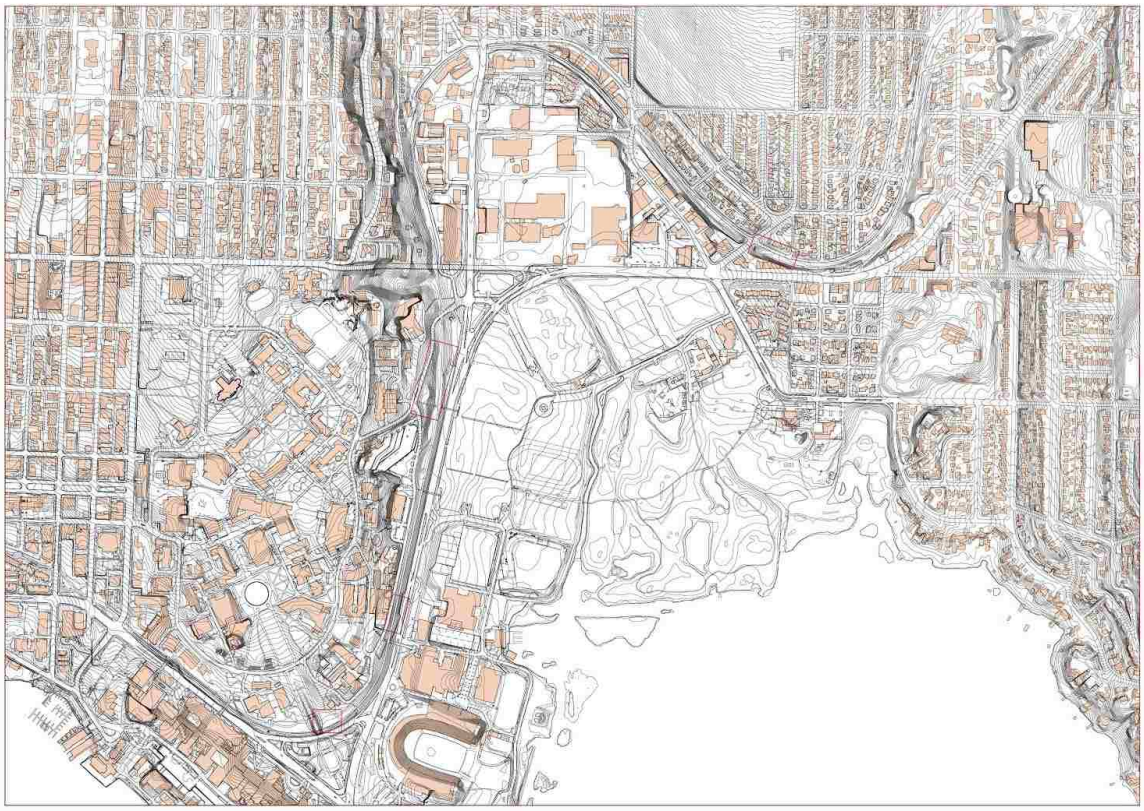

Figure 28. Test sites in Red Rectangles along the Burke Gilman Trail, Seattle Washington.

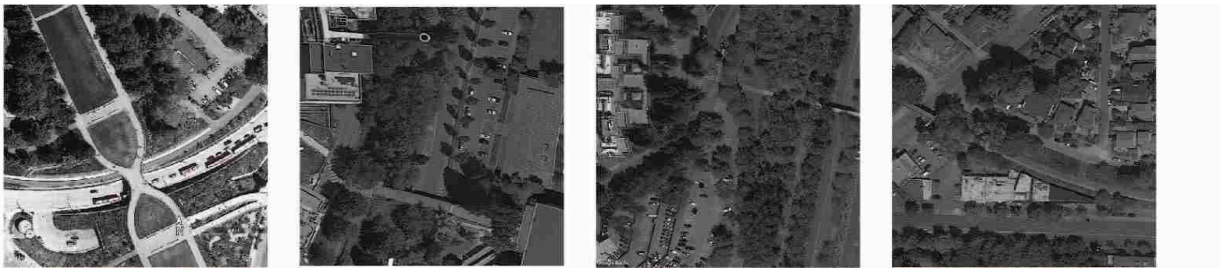

Figure 29. From left to right sites, 1,2,3 and 4

To test out this idea about design, I selected four different sites on the Burke Gilman Trail. I chose sites that I could access personally and respond to physically. Each site allowed for a comparison of approaches. See Fig 29 for the sites chosen for this project along the Burke Gilman Trail in Seattle, Washington.

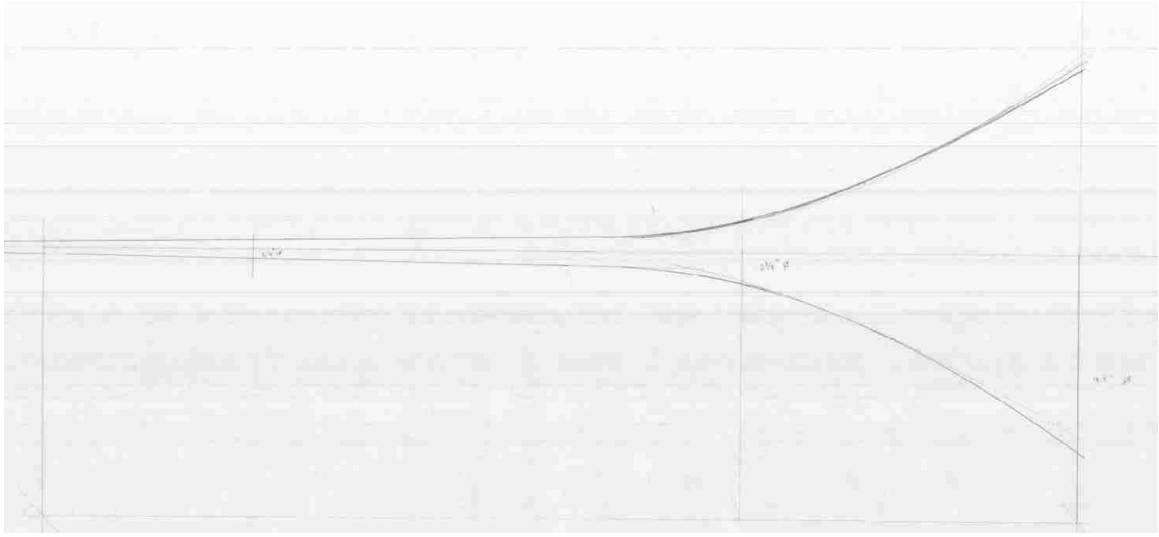

Figure 30. Sketch for Ghost 1.

My initial reaction to Site 1, adjacent to the University light rail station, was to design a project that faced towards the sky and whose building form reached to the very core of the Earth and to the edge of the breathable air. I reacted to the ghost and drafted a drawing of a funnel. As a builder, I saw the idea of a funnel as an object that was both closed off and open at the same time, and most resembled a piece of glass. Glass is a material in which I have no experience working. It is also a material governed by physical properties of viscosity, heat, and tension developed through unequal cooling. I went to the University of Washington glass studio and worked with Professor Mark Zirpel and lab technician Sean O'Neill to translate the initial sketch into a physical object. Here in Fig 31, you can see me in a workshop unable to participate in the production of the object. What was produced was not a direct translation of the form that I had drawn, but rather a translation of it through the tools and material available in this particular workshop. The object itself is architectural in the way it was made as an architect no longer works directly with their tools, rather relying on the skills of craftsmen and builders. It's both an object that

illustrates the idea of a ghost, but still replicates the process of architecture. It is an object with architectural presence. It is not a direct representation of an actual building, but rather a facsimile of the process of designing and translating that might produce a building.

Figure 31. In the Glass hot shop.

Figure 32. Completed Ghost 1 in stand.

Site 2 sits between the Burke Gilman Trail and a service road on the University of Washington campus. My initial reaction to this site was that it was a long linear form and I reduced it to the idea of a long, thin line that curved to react to the site. A single two-dimensional line is not an inhabitable architectural presence so there needed to be a shape that allowed for inhabitable space that then diminished back into that single line that referenced both the road and the trail. In order to develop a translation process for this work, I presented an initial ghost sketch to a colleague, Thorey Munro and worked with her to develop the final form. This was another exercise in allowing another person to develop the project and dictate the work produced from the initial ghost that I had created. The final steel structure was developed in an iterative manner until it reached a point where it satisfied my initial ghost concept. We jointly utilized rawhide as a way to merge the three-dimensional form with the two-dimensional form, but also because we did not know how the material would interpret the ghost, in the same way that I allowed the 3D printer to interpret my initial concept of the circle-triangle form. As the wet rawhide dried around the steel armature a number of unexpected things happened: The texture of the rawhide as it pulled and resisted the steel was revealed. The hide showed the history of the animal and the markings from how the hide had been removed from the carcass. The free edge of the rawhide which was held by twine dried unevenly based on its proximity to the tie down point and the twine which wicked away moisture. Lastly,

and most dramatically, the drying rawhide warped the underlying structure, bending the steel plate, breaking welds, and warping the steel rod that served as the single line from my original ghost. We had predicted that the rawhide would draw down on the single steel rod, making a concave shape, but it instead pulled up from the bottom and twisted the steel plate into a new form. This proved to be a material study that illustrated how the concept of a ghost is radically changed by the material chosen to realize it.

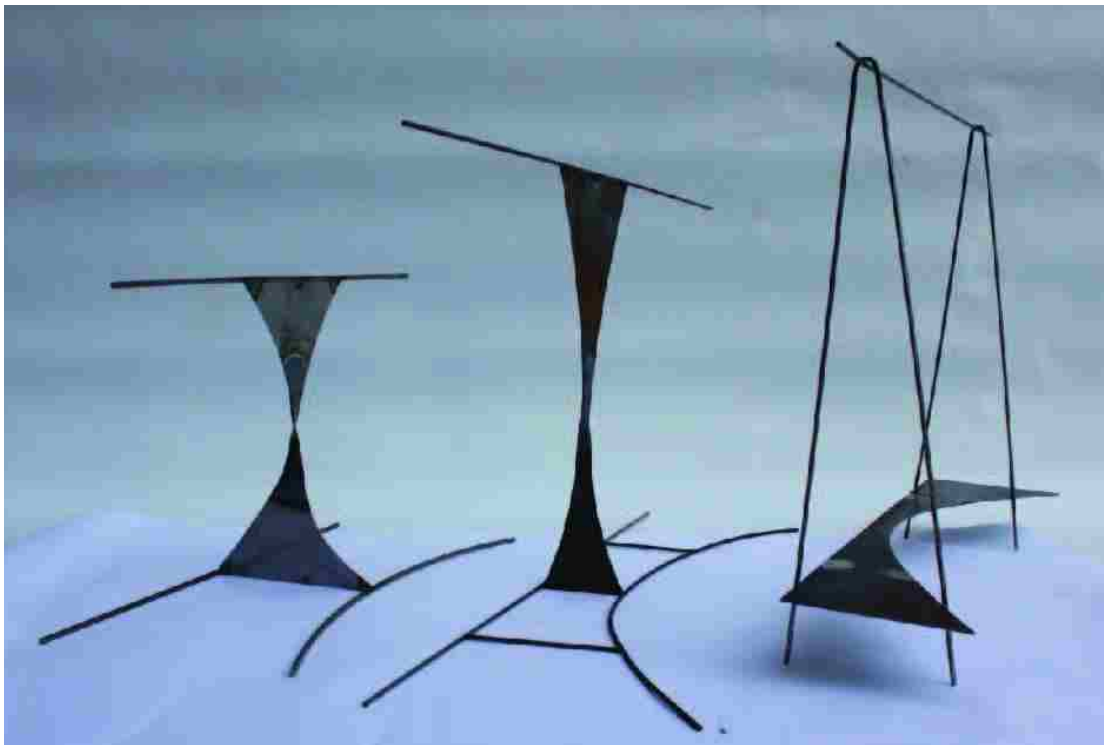

Figure 33. Steel iterations for Site 2

Figure 34. Moments of discovery for Site 2 Ghost.

Figure 35. Ghost 2

Site 3, located along the Burke Gilman and eastern edge of the University of Washington campus, offered a dramatic slope and enclosed tree space. I developed a simple, translucent tower ghost form in response to the vertical nature of the elms and poplars on the site and the steep topography. The ideas of a tower and the movement and flexibility of the trees inspired me to design a ghost form that was both a tower and a translucent dress, a shape that reference the vertical and flexible elements present on the site while incorporating some of the soft textures of the trees and dappled sunlight. In the same way that I had no idea how to create the last two designs alone, I went to the Theatre Department because the ghost I designed for Site 3 was somewhere between a set piece and a costume. Thankfully, Deborah Skorstad, a lead costume designer in the costume shop, was able to help. She translated my initial drawing, see Figure 35, into a series of pleats that were sewn and structured so that they were gathered together at the top and allowed to open and flow towards the base. Once it was determined the piece

could be created from fabric, I realized that Seattle's boat culture already had the material I needed: fiberglass, a material between fabric and a base building block of modern architecture. The fiberglass was sewn in the manner described by Deborah, impregnated with a two-part epoxy, placed on a form, and allowed to harden. This initial test yielded a ghostly structure that was translucent enough to transmit light while still resembling both a dress and tower.

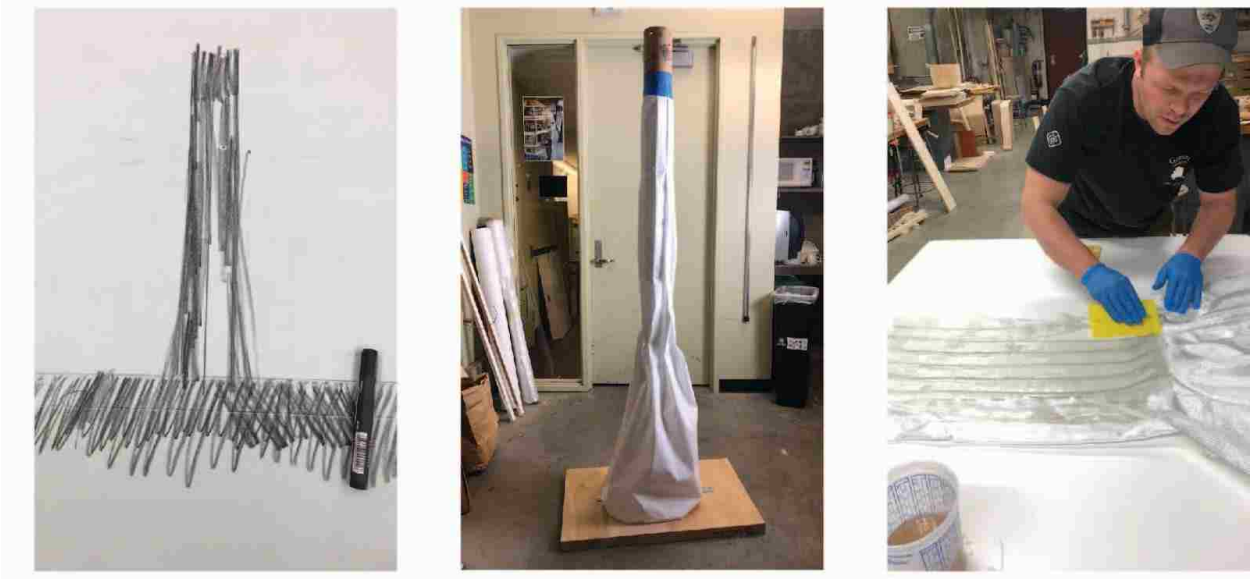

Figure 36. Process images for Ghost 3

Figure 37. Ghost 3 details

Site 4 is the only site that was outside the University of Washington campus. This site was located on a crossroads near a railroad bridge in a neighborhood. I was inspired by the wooden structure of the existing bridge and considered the idea of a ghost as a congealed form around a structure no longer used for its intended purpose. The ghost, while congealing around the form, also needed to serve as part of the form, permanently altering its structure and presence. I looked at the slats and structure of the bridge and translated those ideas into an interlocking wooden scaffolding. This scaffolding, held together only with friction and tension was transferred through the additive process of dipping it in molten wax. Each layer

accumulated on the surface, incrementally changing its form and locking its structure together while the ghost design emerged. Again, I had a craftsperson make this for me and only checked in to stop the dipping process once the ghost had been fully revealed by the wax and met my original design. There was no way to predict how the wax would accumulate and so the material in this design more powerfully dictated the end result.

Figure 38. Dipping and Congealing

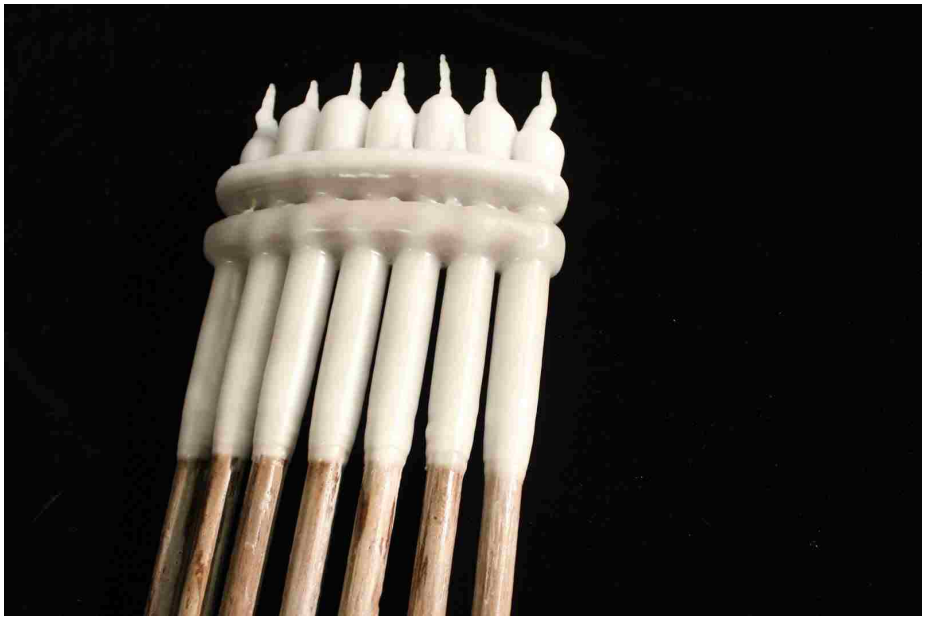

Figure 39. Final Ghost 4

It was the intention of this thesis study not to put a capstone on my time at the University of Washington, but to treat it like a cup that would inform a process of design for my future work. I wanted this to be the start of, and set the intention for, my practice as an architect and designer. My goal was to make whole objects that were architectural and because I did not have the budget to make whole buildings, I decided to pursue this idea of ghosts in design. These projects are architectural in nature, but also complete. They are not models or facsimiles, they are complete objects as they are. By necessity, these objects were smaller in scale than more conventional architectural pursuits, but they relate to architecture in the same way that art and design do: these objects exist on a sliding scale somewhere between pure art and pure architecture and are informed by both disciplines. Figure 40 details a simplified version of this relationship. These objects also served as a test case for a way to work with the people who will actually realize the designs and projects that I put forth.

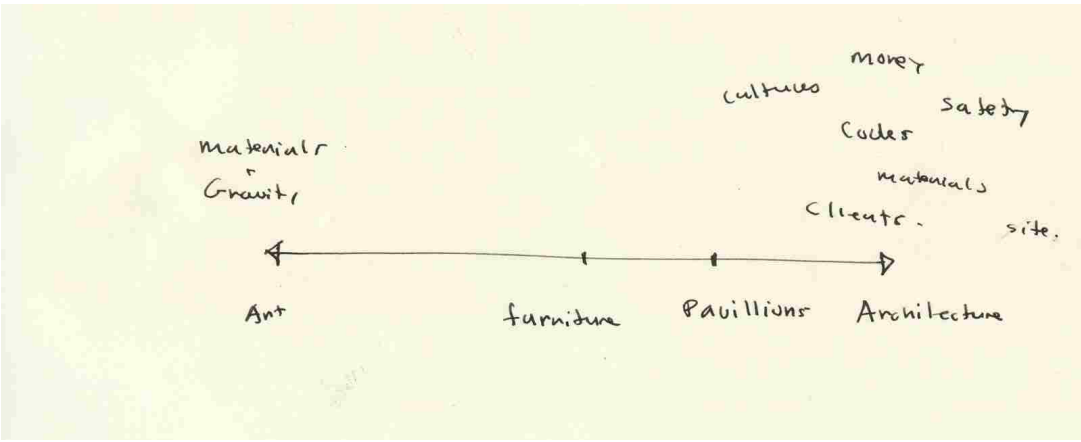

Figure 40. Scale from Art to Architecture

This project revealed the power of repetition. I watched a design develop and change from the pattern of a tool being used over and over again. This process happened every step of the way, from building the site models to creating the ghosts. One example of this is how a simple material like twine, used in a variety of ways, became a powerful material that shaped the interactions I had with the site models and ghosts. For example, I used twine to bind twigs to form model trees, much as a fisherman ties flies, to

attach the rawhide to the steel form, and by utilizing its waxy adhesive properties, to suspend the steel funnel above a steel plate. By using the same material over and over again, but exploring its different properties, the twine took on a life of its own and informed how my ghosts developed in response.

As this thesis' underlying goals were to develop a process as a way to work in the future in an architectural practice, it seems reasonable to question how this process might develop into pavilions and buildings. The ghost designed for Site 2 shows how these ideas might be used at a larger scale. For example, in order to make a traditional teepee, one needs around 37 buffalo hides. Which then begs the question of how and where they would be stitched together, how strong they would be, and what kind of light they would transmit. In this way, the Site 2 ghost is just one piece of a larger whole. The ghost and material choices were the first step in a design process that I allowed to develop organically. The materials and tool choices revealed magic moments as the ghost was realized, moments where the tool left an indelible pattern or the material showed a series of marks that were previously hidden. This process, again translated from a design to a form by a craftsman, was marked by many of these magic moments that occurred during the entire crafting and development process. By using tools like a camera or scanner I was able to amplify these magic moments. The tool used to perceive these moments imposes itself on the object and changes our perception of it.

Acknowledgements

First, thank you Kimo Griggs, my advisor, and Dr. Vikramāditya Prakāsh for his patience and valuable guidance, suggestions and most of all, listening to me talk through the concepts in this thesis. Thanks also to Thorey Munro for her ability to make clean edits. I would also like to thank Rob Hutchison for suggestions, comments and encouragement.

I am most grateful to my family who listened thoughtfully to my arguments of the importance of building by hand. Thanks Kathywatts for the chollo for ghost structure.Thanks most of all to my brother Mark without whose help this thesis would remain incomplete.

Finally, for the original stimulus of the idea, thank you Jon Stewart for the following thought:
….heres why its not journalism and and I will explain this and this really is true. we don't fact check and we don't look at context because of any journalistic criterion that we feel has to be met. we do that because jokes don't work when they are lies. People don't laugh when people know you're full of shit about what your saying. So we fact check so that when tell a joke it hits you at sort of a guttural level. It's not because we have a journalist integrity hopefully it's because we have a cometic integrity….

List of Figures

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