

EXPLORATORY MAKING:
SITE INSPIRED MAKING AS A TOOL FOR
SITE ANALYSIS AND DESIGN

by

WESLEY MOORE

A REPORT

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College of Architecture, Planning & Design

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Approved by:

Major Professor
Jon Hunt

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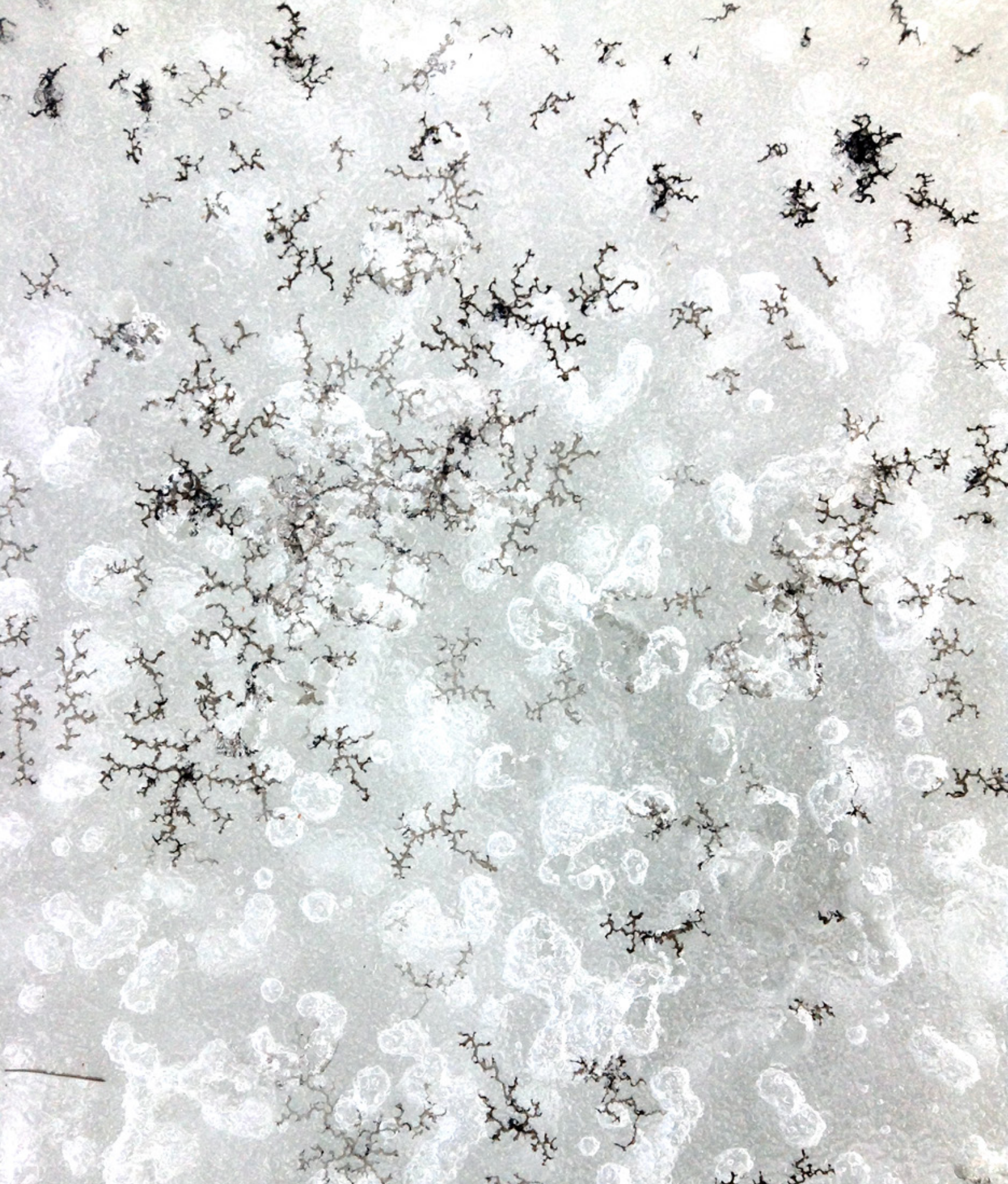
Abstract

Design tools (the method of making a designer uses to conceptualize or communicate the assembly of an object) are not simply secondary instruments to communicate designs through, but are the primary media through which designers contemplate and process design problems. Designers should utilize tools, whether digital or analog, with an awareness of each tool's limitations and advantages and the possibilities they provide to each step of the design process. The intent of this report is to study how site inspired making methods can be used to observe and reveal information about a site, and thus contribute to the site analysis phase of design. Site inspired making methods are developed in this report through an exploratory research process. Exploratory research is a qualitative method used to provide flexibility in developing knowledge about a topic. An exploratory process was chosen to allow my focuses to shift as I make and reflect so my findings arise as I conduct the studies, not just from an initial hypothesis. Through an exploratory research process of making and reflecting this report answers the question:

How do various methods of making develop and document my understanding of the site?

Exploratory methods of drawing and sculpting are used to observe and reveal site information, and develop site-inspired artistic works. The site is a small, wooded lot and cove of Tuttle Creek Lake located northwest of Manhattan, Kansas. The research process is divided into an investigation phase in which I explored initial drawing and sculpting methods and an application phase in which I created a sculpture and series of drawings inspired by the site.

I documented site conditions through observational drawing; revealed patterns and textures by drawing with and on site materials; developed parametric studies of balancing sculptures; discovered crystallization patterns by splattering ink on a frozen lake; designed a balancing sculpture inspired by the motion of ice sheets and driftwood on water; and created frost drawings by applying ink to soaked and frozen watercolor paper. Each method revealed different site qualities and informed my understanding of the site.



Exploratory Making : Site Inspired Making as a Tool for Site Analysis and Design

Wesley Moore, Master's Project and Report

Abstract

Design tools (the method of making a designer uses to conceptualize or communicate the assembly of an object) are not simply secondary instruments to communicate designs through, but are the primary media through which designers contemplate and process design problems. Designers should utilize tools, whether digital or analog, with an awareness of each tool's limitations and advantages and the possibilities they provide to each step of the design process. The intent of this report is to study how site inspired making methods can be used to observe and reveal information about a site, and thus contribute to the site analysis phase of design. Site inspired making methods are developed in this report through an exploratory research process. Exploratory research is a qualitative method used to provide flexibility in developing knowledge about a topic. An exploratory process was chosen to allow my focuses to shift as I make and reflect so my findings arise as I conduct the studies, not just from an initial hypothesis. Through an exploratory research process of making and reflecting this report answers the question:

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Major Professor:

Jon Hunt, Associate Professor, Landscape Architecture / Regional & Community Planning

Committee Members:

Dustin Headley, Assistant Professor, Interior Architecture & Product Design

Dukno Yoon, Assistant Professor, Metalsmithing & Jewelry

Department of Landscape Architecture / Regional and Community Planning

College of Architecture, Planning and Design

Kansas State University



**LANDSCAPE ARCHITECTURE
/ REGIONAL & COMMUNITY PLANNING**

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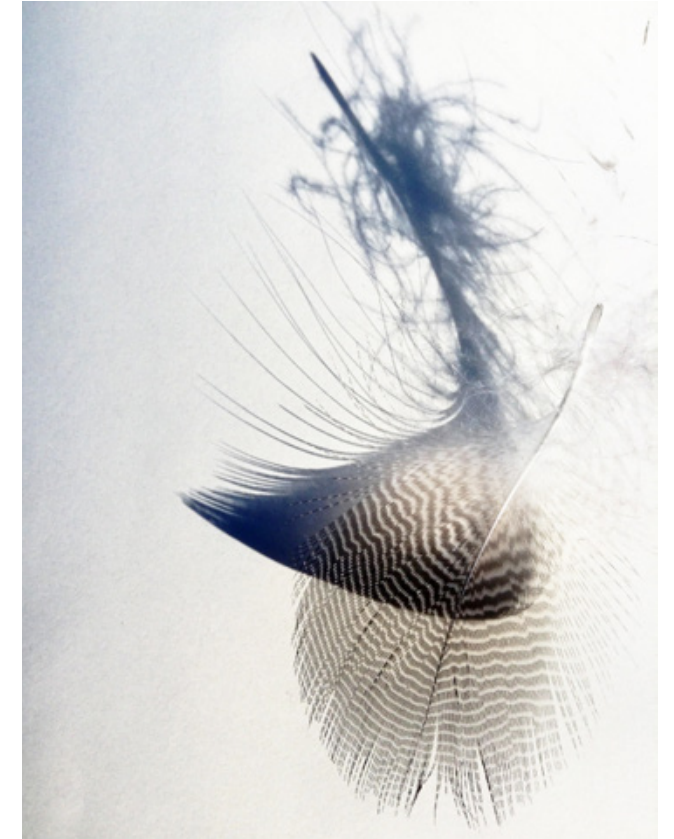
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Introduction



Designers use a variety of making methods to develop and communicate designs. The methods of making that designers use to conceptualize or communicate the assembly of an object or system play an important role in any design outcome. A designer should utilize a tool, whether digital or analog, with an awareness of its limitations and advantages and its effect on their process. Overall, tools should be used to unveil information and explore possibilities rather than prescribe solutions. A designer's work should ultimately be a reflection of their mind and the factors they are responding to, not a stylization of the tools used.

Intent

The intent of this master's report is to explore various ways of making and develop methods of experiential site engagement. In this study, I used an exploratory research method of making and reflecting to study a site and developed an artistic response with the knowledge gained from the site. Exploratory research is a qualitative method used to provide flexibility in developing knowledge about a topic. An exploratory method was chosen to allow my focuses to shift as I make and reflect so my findings arise amidst my studies, not just from an initial hypothesis. Through an exploratory research process of making and reflecting I answered the question:

How do various methods of making develop and document my understanding of the site?

Installation Art

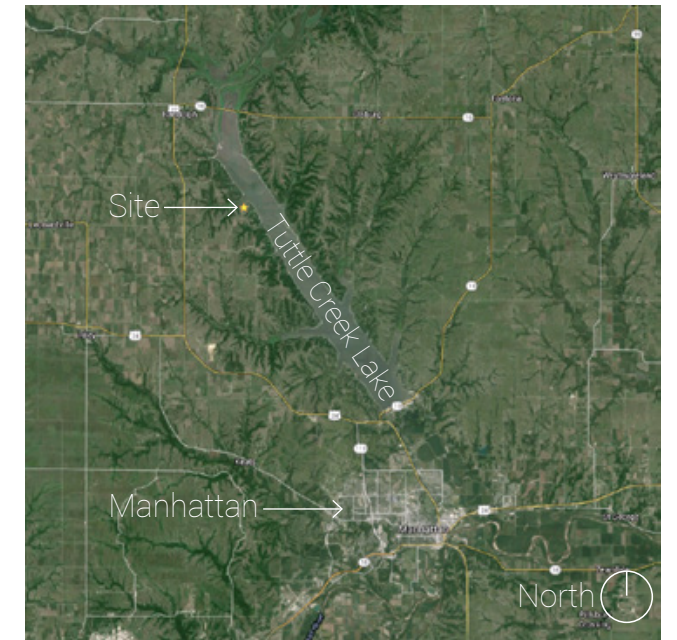
I explored this research question through site explorations and geometrical investigations that inform the design of an installation art piece. Installation art is a term that many different works fit into, but its core focus is on how a work is experienced spatially by the viewer. This value coincides with my intent for my art piece to evoke a spatial experience inspired by my process of learning and the impressions discovered about the project site.

Project Site

The site (0.28 acre) studied in this project is owned by Richard Thompson and is located at 7201 Hackberry Circle, northwest of Manhattan, Kansas along Tuttle Creek Lake (see Figures 1.3 and 1.4). The site has rough terrain and is densely wooded with primarily eastern cedars and oak trees. The site is at the end of a quiet cul-de-sac that is occupied by one permanent residence and one temporary residential summer house. The front perimeter of the property contains a thick buffer of low-growing Eastern Red Cedars. Upon entering the property from the cul-de-sac, the terrain slopes steeply down before it levels slightly fifteen feet away from the entrance. This terrace is low enough that the terrain blocks one's standing height view to and from the cul-de-sac. The terrace and the rest of the site contains a medium-density canopy of trees between ten and fifty years old. Another steep slope begins to the northeast of this terrace and continues until the site levels out near the back property line. From the property line the site slopes gradually to a valley. The valley has been filled with driftwood that had collected on the site from previous high waters (See Figure 1.5). Within the lake there are multiple dead trees, indicating significantly lower water that allowed trees to begin growing in this location several decades ago (See Figure 1.6).



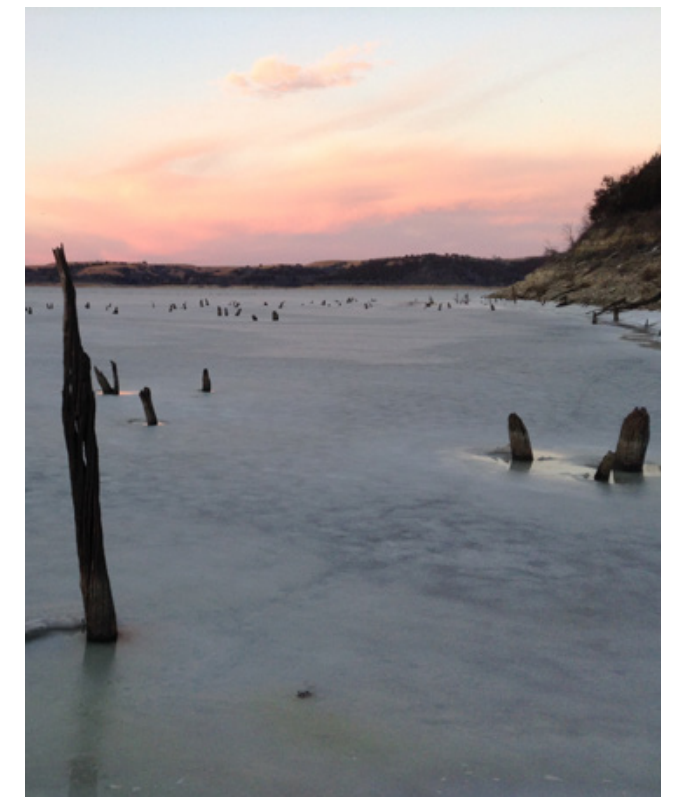
Site Aerial (Figure 1.3) The site is outlined in white and shows the cove where the study was conducted.



Regional Context (Figure 1.4) The site is located northwest of Manhattan along Tuttle Creek Lake.



Branches and Trees in the Cove (Figure 1.5) Branches deposited along the banks of the cove when previous high waters receded.



Dead Trees in the Frozen Lake (Figure 1.6) Dead trees signal the increase of water levels over previous decades.



Background & Literature Review



The literature review includes research on creativity and phenomenology and describes the role of imagination, hand drawing, digital design tools, and the overlap of creative and analytical studies in design. The research establishes an approach to designing through making and informs this report's methodology of exploratory making as a site analysis tool. This section also provides background information on installation art and Grasshopper parametric scripting.

Formal Imagination vs. Experiential Projection:

In his essay “Empathic Imagination,” Juhani Pallasmaa (2014, p. 82) establishes a distinction between two kinds of imagination: one of composing geometric forms, known as formal imagination, and the other of simulating a sensory experience of imagined entities, experiential projection. Pallasmaa, advocating the importance of experiential project, contends the true qualities of architecture are not formal or aesthetic, but are existential experiences: a result of individual encounters with the physical world. Pallasmaa references Henry Moore’s description of the power of artistic imagination to mentally encapsulate entire forms: to feel the volume of objects, not just see them. He encourages the designer then to work towards a sensory quality and richness by developing experiential projection in addition to formal imagination (Pallasmaa, 2014, p. 84). In developing experiential projection a designer focuses on how forms are experienced, not just what they look like. By developing this awareness, a designer may establish a keen sensibility for their future design decisions and better match the intended effect of their design to others’ actual experiences.

Developing Experiential Projection

Peter Zumthor, influenced by the work and words of Pallasmaa, describes a concept similar to experiential projection with the term “atmosphere”. Zumthor (2006a) describes atmosphere in his book *Atmospheres*, as a feeling that arises from a momentary impression of the physical world, based on sensory memory of prior experiences.

Zumthor (2006a) describes atmosphere as a compilation of our many memories. Multiple mental images, that together compose a specific and often ineffable feeling. He states we immediately have a sensation about the quality of a new place or object by comparing images of our previous experiences with past places or objects (Zumthor, 2006b). This use of the term images does not simply refer to the visual, but describes how we recall the smell, touch, taste, sight, and sound of previous places we have been when experiencing a new place whether real or imagined.

Zumthor’s term atmosphere helps to describe the immediate impression a person may feel upon entering a new place (Zumthor, 2006a). Our body feels the worn grain of an old chair before we have touched it, because our memory of chairs and their materials’ properties are stored as mental images. The immediate sensation is informed by our previous experiences, but does not necessarily require a conscious recollection of every detail composing those memories. However, for a designer, the challenge is to develop an experiential awareness of how details compose atmospheres, and to imagine the atmosphere that will occur when new forms are combined.

In my view, developing experiential projection skills begins with defining how individual mental images contribute to atmospheres. I believe an important characteristic of a mental image is that it is imprecise yet evocative. While a photograph pro-

vides all the visible details of a moment, a mental image begins to fade with time, but as the details of the visual fade, the memory begins to be filled in with information from the other senses. In this way the mental image acts as a link to the other senses; while the photograph only preserves the visual. The design of objects should be approached with this sensitivity to multiple senses, not just the visual. Designers can develop this sensitivity by being aware of the images and atmospheres they experience in their daily lives.

Hand Drawing as Experiential Projection Tool

The methods of making designers use play an important role in how their experiential projection develops. With many new design tools being introduced through digital technology, there has been much discussion within design professions over the importance of retaining the benefits of hand drawing. Specifically, learning to draw by hand requires attentiveness and focused observation that encourages the drawer to think and consider the relationship between part and whole, between detail and experience (Treib, 2008, p. 12). While drawing by hand does not necessarily lead to more thoughtful design than digital means or vice versa, the differences between the two media support different thought processes and lead to different benefits to the designer’s creative process. Therefore, by utilizing multiple methods of making in the observation and design process, designers may harness different benefits from each tool.

Tools have inherent capabilities and limitations and designers should select a tool based on how they fulfill the design goals. While a tool may be criticized for its inherent limitations it should also be considered how these constraints can help focus a design idea into a precise expression. “The essence and value of the thought undergoes a critical review in the transition between thought and expression: it must be decided over and over if the thought is even worth sharing” (Glynn, 2011, p. 32). When a designer decides what and how to draw something they are making decisions about what is valuable and what needs to be shown. When a designer decides how to digitally model a form they are also making value decisions about the design. Both analog and digital methods have inherent limitations, but working through these limitations a designer may more clearly define the qualities and composition of a design.

Developing Formal Imagination

The quality of a designer’s experiential projection is not completely independent but relies, to some degree, on a designer’s formal imagination capabilities. The development of the formal imagination involves understanding technical components of design and developing ways of imagining new objects (Pallasmaa, 2014, p. 82). Digital design tools, such as digital 3D modeling programs, and digital fabrication tools, such as 3D printers, provide new possibilities for a designer to view and interact with a design before it is completed, and thus impact how modern designers can develop their

formal imagination. An important consideration in the use of these tools is whether their use increases or decreases the designer's formal imagination and experiential projection.

I would compare the efficient modelling capability these tools provide to a poet who is capable of using large words he has heard but does not truly understand. Often times the large words disguise the actual emotive qualities of the poem, making the poem appear more powerful than it really is, without truly adding to the poem's meaning. Following my analogy, a more genuine design, or a design that speaks to various senses and not just the visual, will use forms based on their emotive meaning, not just their flashy power to impress. While good poetry is not about using big words, but about using the right words, there is still a better chance of finding the right words if a poet has a larger vocabulary. It is important to develop vocabulary (the designer's formal imagination), but it is equally important to remain aware of the syntax of words (the designer's experiential projection).

Analytical Investigation as Formal Imagination Tool

A way of developing formal imagination is through analytical investigation. The work of Ron Resch, a sculptor and designer, demonstrates how analytical investigations can lead to very creative compositions. Resch became interested in a seemingly mundane form, wadded paper, and began a lifetime of research. Resch recognized a very complex geometrical sequence was being thrown into

the waste bin every day and wanted to find a way to pull new ideas from it. He began by abstracting simple geometries and common patterns he observed in the folds and began diagramming the geometries. To develop the ideas further he introduced new media such as wood and cardboard to test the diagrams with three dimensional forms and complex folding. After many iterations, Resch had developed an entire oeuvre of intricate geometries and 3D sculptures by extrapolating one geometrical question (Resch, 1992).

Similarly, the design work of Santiago Calatrava, an engineer and architect renowned for his firm's sculptural architectural structures that employ creative uses of structural engineering, was grounded in very analytical studies of foldable geometries completed in his thesis dissertation (Tzonis, 2001, p. 10). The knowledge Calatrava gained from these analytical studies surely laid the foundation for the creative, groundbreaking work he has been able to complete. In this way, his work "... reveals how analytical construction can be a precondition and an instrument to creative composition and effective synthesis" (Tzonis, 2001, p. 17).

Digital Tools in Analytical Investigation

The work Resch was able to complete in his lifetime demonstrated a very thorough knowledge of geometrical principles. Though he began his work before computers were available for such research, Resch realized early in the development of computers how beneficial they could be in reducing the busy work involved in geometrical

investigations (Resch, 1992). Resch often found new geometries and possibilities after constructing a model based on a previous concept. By reducing the time it takes to create the geometry, which in his case was a tedious manual process, the designer can spend more time investigating further possibilities and practical applications. Today, digital tools offer ways of computing complexity that can make investigations more efficient.

Grasshopper Scripting

The digital tool chosen for this study is Grasshopper, a visual scripting tool for the 3D modeling program Rhino. Visual scripting tools, also known as visual programming editors, allow designers to create and edit algorithms through a graphic interface instead of a textual one (in a visual scripting tool the elements of code are displayed as graphic symbols that can be moved around and connected. As opposed to a textual interface in which elements of text are composed to establish a script). Visual scripts reduce the learning curve involved in algorithmic design. Algorithms, or scripts, are a series of procedures that perform an operation defined by the designer. Grasshopper scripting allows a designer to define a sequence of Rhino commands. Generally, a sequence consists transformations that arrange and combine various geometrical forms. Through a process enabled by Grasshopper, referred to as parametric design, the designer can then test how adjusting or changing individual commands will affect the final design. In Grasshopper, if an input parameter is changed, such as a dimension or angle, the rest of the mod-

el updates to reflect the change. In theory, a comprehensive script can be written so dimensional adjustments can be quickly applied late in the design process and the computation will output geometries based on the new input.

Parametric modeling tools were originally developed to increase flexibility of digital modelling software (Davis, 2013, p. 4). At the same time, the original use of parametric models to make digital design more responsive to change has proven to be difficult and has been limited by the rigid behavior of scripts (Davis, 2013, p. 6). Davis defines rigidity as the limitations of a script's reuse. Where dimensional changes in an existing design are easily adjusted through input parameters, critical changes in the design schema and changes that were not foreseen during the script's construction may result in an incompatibility that, on occasion, can only be solved by reconstructing the model, adding time, instead of saving it. Despite the loss of efficiency in some circumstances, many architectural firms and students continue to develop uses for parametric modelling tools because, unlike basic Computer Automated Drafting (CAD) softwares that are primarily used as efficient and accurate substitutes for hand drafting, parametric modelling tools are used to extend design possibilities by harnessing computational capability. Therefore the value of parametric tools should not simply be evaluated by the flexibility they provide to a design process but also by the design possibilities they can reveal.

Combining Formal Imagination and Experiential Projection

The exciting possibilities of digital tools lies in the new formal possibilities they unlock, but as Pallasmaa encourages, the true quality of the forms lie in their experiential qualities. Alexander Calder, a sculptor who created elegant, free-balancing sculptures, spoke about his efforts to evoke dynamic qualities with sculptural forms. Specifically, his aim was to focus on the way living things react and move through a method of abstraction, resulting in an object that does not resemble the living thing, but evokes its manner of reacting and moving (Gimenez, 2004, p. 47).

Pallasmaa (2014, p. 83) describes the architectural process as typically beginning with diffuse bodily feelings or atmospheres that are gradually concretised through successive sketches and models. "The design process is a vague and alternating process of internalization and projection, thinking and feeling, which becomes eventually increasingly precise and concrete" (Pallasmaa, 2014, p. 83). The designer must determine along each step of the process how the immaterial qualities and feelings intended for the design will be translated into the actual building and must also ask how it will be experienced by someone else. Because each method of making will impact how a designer approaches translating an idea into reality, I find it valuable to utilize a variety of making methods. Allowing each method to contribute different insights into the final solution.

Mark Rothko (2011, p. 46) describes this quality of experiential truthfulness in art as "plasticity". Plasticity can be described as the quality of a piece of art to evoke a universal feeling. But with any piece of art, poetry, or architecture, the final work is concrete and not ephemeral like a dream. Rothko uses the term plasticity to describe this positive attribute of art, specifically when a work of art convincingly imparts a feeling of existence to the viewer. While it may be helpful to hint at a meaning and leave vagueness to evoke other senses, the form must be communicated completely through its particular media. Rothko suggests that the artist's goal is to evoke qualities by focusing intently on his reality and medium. An important consideration with parametric tools is that a designer may become distracted by the possibilities of the tool and forget to focus on the experiential significance of the design. Therefore, to maintain truthfulness to the original inspiration, designer should create digital works with experiential projection in mind.

Installation Art

Artists in many styles and periods have developed ways of communicating truthfulness and plasticity through art. A style of art, installation art, aims to provide truthful experiences at a scale that surrounds the viewer. Archer (1996), Veikos (2006), and Molesworth (1998) all assert that there are different forms of installation art, however they provide various characteristics that are essential to the intended artistic effect of installation art to engage the artist in an experience.

Installation art incorporates a variety of visual and artistic media to convey an experience. "Part sculpture, part environment, part assemblage, installation art revels in its impurity of genres, mixing the traditions of stage sets, architectural models, happenings, dioramas, and other forms of three-dimensional presentation" (Molesworth, 2008, p. 45). The concept that ties this "impurity of genres" together is the effort to bring the viewer and environment into the composition of the piece. Installation art is about composing an experience.

The desire to trace the origins of installation art led Veikos (2006) to study qualities in Arte Povera (Poor Art) paintings, in which painters aimed to spatialize the picture plane. Through the paintings,

the painters asked and approached questions of spatial limits and architectural scale. These strategies were later employed by installation artists to "... emphasize the bodily, tactile, and visual participation of the spectator ..." (Veikos, 2006, p. 79-80). This focus on the experience of the design is a cohesive theme among installation artists and helps distinguish it from sculpture. Sculpture is viewed from the outside, whereas installation art sets up an environment the viewer is invited to enter and is a part of ("Installation Art," 2015). In this way, installation art differs from sculpture in that "the formalism of the composition remains of secondary importance - it is the effect on the spectator's spatial and cultural expectations that remains paramount" ("Installation Art," 2015).



Methodology



Site inspired making was used in this report as a qualitative approach to site analysis. The primary intent of site inspired making was to develop my site awareness through drawing and sculpting, on and off site. After several initial site studies, I focused on revealing ice crystal patterns with ink and replicating the movement of ice sheets on water with balancing sculptures. Through site inspired making, I not only developed my awareness of the landscape but also revealed its qualities in unexpected ways by adapting my process as new information was gained. The methodology is divided into two phases of drawing and sculptural exploration: *investigation* and *application*.

Investigation phase

I conducted investigative site analysis through a variety of drawing methods. I began with drawings that represented existing conditions, physical qualities, natural patterns and forms. I then used site materials to make drawings that revealed textures and patterns. Finally, I made marks directly on the landscape to reveal discreet site information.

I conducted investigative sculpture studies by replicating a mobile by Alexander Calder with parametric software. I then utilized the software to explore other possibilities for balancing forms and used wire and string to create and test sculptural ideas through analog making.

Investigation : Site Studies

The site studies began in late January by drawing trees, leaves, topography, and stones throughout the site to develop an awareness of the textures, patterns, plants, and overall character of the site.

After drawing on the site during my first two visits, I explored the public property between the site and Tuttle Creek Lake. To the northwest of the site is a cove filled with dead branches and trees that had collected in the cove when lake levels were higher in previous years. The tangled wood formed sinuous lines that spanned the banks of the cove. The lake had frozen over and birds rested on the ice, animal foot tracks crossed the snowy ice, and dead trees reached up from beneath the ice. I decided to make the cove with its branches, dead trees, ice, and stones the focus of my study.

During the next three site visits, I created drawings that showcased what I appreciated about the cove and lake. The drawings also represented existing conditions, physical qualities, patterns, and forms. I spent time making additional drawings to reveal textures and patterns of site materials. I focused my attention on detecting and responding to marks in the landscape and I used materials I found on the site to direct how I was making marks on paper with charcoal and ink.

I created charcoal rubbings on stones, bark, leaves, and branches. I followed deer tracks through the snow, noting the difference between my typical routes and the deer routes. I listened to the sound of stones, branches, leaves, and snow under my boots. I used chalk to camouflage dead trees against the white snow. I threw stones onto the ice to check its thickness before walking onto it. I felt the various texture of the ice by sliding across it in my boots. I used branches, cockle burrs, leaves, and snow to apply ink to paper. I spilled ink into a bank of snow and used the ink-filled snow to draw with. Seeing the ink in the snow made me aware of many more areas in the landscape that were black: holes in stones, shadows beneath twigs, and birds in the sky. I realized I had been observing the site by way of the paper, but by making marks directly on the landscape I could focus my attention on the site in a new way.

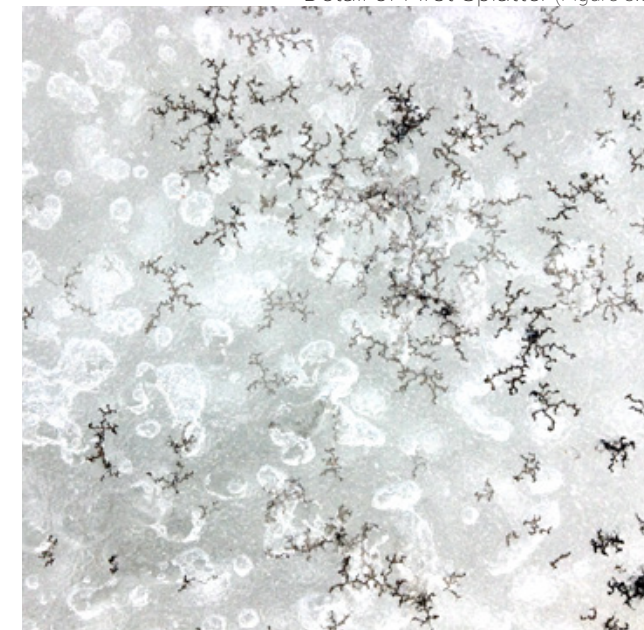
I then spilled ink on the ice, which left a typical splatter stain, but as smaller droplets splattered outward they flowed through the crevices formed

by the frozen water droplets, showing the beautiful patterns on the ice. One night it rained, covering the droplet-textured ice with a thin, smooth, and sheet of ice. Splattering, throwing, rubbing, and dropping ink across the fresh ice revealed new patterns based on how the crystals had frozen, whether the ice was in the sun or shade, and how much water was resting on the ice. I repeated the ink on ice studies twice a week until the ice had fully melted in late February. Each visit revealed new patterns formed in the freeze-thaw cycles.

Investigation : Digital Balance Studies

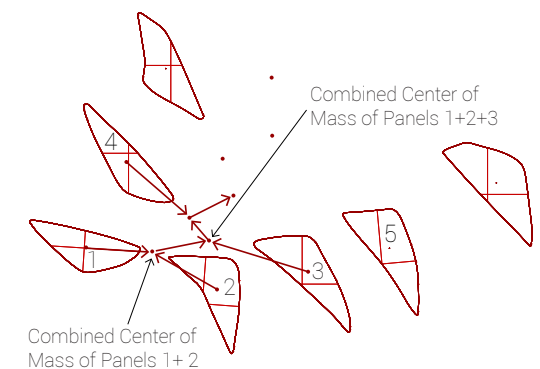
Digital studies of a mobile sculpture by Alexander Calder were conducted as the sculptural component in the investigation phase. The intent was to digitally replicate the forms he had designed through analog sculpting, to reveal his construction logic, and develop insight into his work. Calder's sculpture "Big Red" is a nine foot wide, steel wire and panel hanging mobile created in 1959. It was selected for study as an iconic representation of Calder's refined, later work.

Detail of First Splatter (Figure 3.3)

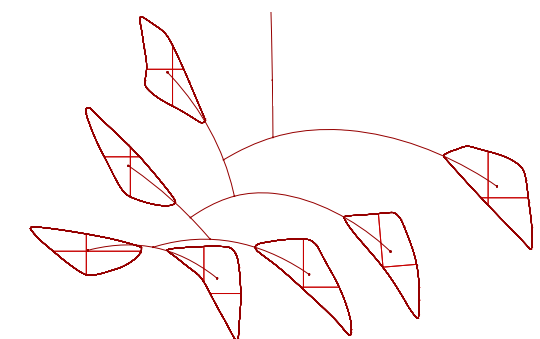


Rhino polysurfaces were used to trace over an image of the sculpture's fourteen panels. The volume of these panels was calculated in Grasshopper to find their individual centers of mass and their combined center of mass. An interpolated curve connects the first panel to the second panel through the two panels' combined center of mass (each combined center of mass is vertically adjusted to match the curve of Calder's wires, vertical adjustment changes the appearance and length of the wire but does not affect the balance). A second curve connects from the third panel to the first two panels' combined center of mass through the combined center of mass of all three panels (See Figures 3.4 and 3.5). Continuing in this manner the Grasshopper model calculates wires to connect and balance all fourteen panels.

Diagram of Panel & Mass Sorting (Figure 3.4)



Panels with Interpolated Curves (Figure 3.5)



Application phase

I furthered my drawing investigations by creating drawings to explore ice crystallization patterns. I created the drawings by soaking and freezing water color paper and applying ink to the crystals that formed on the paper.

I furthered my sculptural investigations by creating a balancing sculpture inspired by the motion of ice sheets on water. The sculpture uses a balancing mobile to support horizontal panels that react and move like ice sheets on water. I used the parametric model developed in the investigation phase to calculate supports for the horizontal panels and I made analog studies to test the motion of various mobile structures and materials.

Application : Frost Drawings

A series of ink drawings on soaked and frozen watercolor sheets were completed in the drawing component of the application phase. The idea for this making method arose when reflecting on the ways of making I had used when there was still ice on the lake. The last two days before the thaw, the ice that covered the lake had broken into chunks and melted down to thin, very smooth sheets that looked and sounded like panes of glass scraping across each other. I placed these ice sheets on blank paper to photograph them. After placing them on the paper the ink and melting ice caused the ink to run across the paper in a unique pattern. This made me wonder if it would be possible to have the ice form directly on the paper. I decided

to explore this by soaking watercolor paper and freezing it. When thin ice crystals formed on the paper, I used a brush to make marks with ink to test if the medium would reach the paper through the ice. Because of how thin the ice was it would immediately start melting when I pulled the paper from the freezer, which helped the ink spread across the ice crystals; however, if I left the paper out of the freezer a few seconds too long the crystals would completely melt and the ink would blotch out on the paper.

In the first frozen drawing studies, I used a calligraphy brush and ink to draw along the ice crystals that formed on the paper. But the marks of my brush strokes often distracted from how the ice crystallized on the paper. I used a rag to clean up areas where ink started to run or bleed on the paper. I noticed that rubbing the rag over the ice would push the ink into the paper around the crystals or through holes that had formed on the ice. Evenly rubbing the ink over the ice showed the form of the crystals without my own gesture overwhelming the drawing.

When the temperature went below freezing I took a 55 in. x 55 in. sheet of watercolor paper, a tub of water, and ink outside. I began by soaking the paper and splattering ink across the paper in increments of fifteen to twenty seconds to test how the ink reacted differently as the water froze. The thin water on the paper freezes much more quickly than water on a lake. Smaller crystals are a result from a quick freeze. The large drops of ink I had

thrown on the lake showed the large crystals well, but the large droplets of ink on the frozen paper bled across the crystals, thus hiding much of their form. To resolve this I used an air compressor to splatter ink across the drawing in finer droplets.

Working outside shifted how I was making the drawings in several ways. Unable to quickly melt the whole drawing (by pulling it out of the freezer as before), the sheet became coated with a layer of ice that prevented the ink from reaching the paper. I used the warmth of my hands to melt the ice down to the paper, but my hands became numb as I continued this method across the whole drawing. I considered how I might use my entire body to melt the ice and shape the drawing. I took my shirt off and laid down across the paper to melt the ice. My body tensed as it pushed against the cold ice but as my blood rushed in to warm my chest and arms the ice melted. Jumping to my feet, I used the air compressor to splatter the whole drawing with ink. The ink landed in the water left from the melted ice and crystallized across the paper as the water re-froze. But the ice was thick enough where my body had not made contact that I wiped the ink off. As I rubbed the ink off the ice, the bumps in the concrete caused the ice to crack, allowing the ink to spread to the paper through the ice cracks.

When the water and ink froze it revealed a sort of heat map of my body. For in the area where my chest and arms had been the water was still cold enough when the ink was applied that they

crystallized together on the paper, showing a dark pattern of the ice crystallization. Where my stomach had been, the water was warmer and took longer to freeze over so the ink began to move in the water before it froze; leaving a pattern of ink in water, void of crystallization (Figure 3.6).

The next series of drawings arose from my initial findings. These drawings are based on my findings that rubbing the ink over the ice crystals showed the forms more consistently than splattering or brushing the ink onto the ice. Inspired by the texture of the concrete beneath the paper, I was also interested in the forms created by cracking ice and rubbing the ink through the cracks onto the paper. I began by hanging a 24 in. x 36 in.

Crystal Formations on Frost Drawing 2 (Figure 3.6)
The different patterns above and below were caused by the different heat levels of my chest and abdomen respectively.



sheet from a clothesline; and, using a spray bottle, I applied water to the paper. Then by holding the bottom of the drawing and pushing into it with an inky rag I cracked the ice; simultaneously applying ink to the paper through the cracks.

After testing the clothesline I hung another 55 in. x 55 in. paper from the clothesline to wet it, this led the crystals to form evenly across the paper in spiralling rosette patterns. To preserve these crystals I used a smooth flat surface to rub the ink into the drawing. However, the surface material was still warm from the day causing the crystals to melt as I was working. As a result, adjacent patterns of intact and melted crystals were created, and crystals were interrupted to then freeze in new ways.

Application : Balancing Sculpture Studies

A series of wire, wood, string, and digital studies were completed in the sculptural component of the application phase to connect my experience on site to my sculptural investigation findings. The sculpture studies completed in the investigation phase are a series of tests for organizing the mobile arms and supporting panels to create a balancing sculpture that elegantly evokes the motion of ice sheets on water.

As the ice covering the lake began to fracture and melt, the motion of the water beneath began to activate the ice sheets. Observing this motion, I was reminded of the various movements made by the first mobile I had created. Wanting to reflect the beauty of these ice sheets in motion, I was led

to the idea of dropping wires down from the arms of a mobile to sheets along a horizontal plane. I pictured a flat surface that would respond to touch or wind; breaking up into individual sheets as it moved. Each sheet would respond to the motion of the mobile and the mobile would be designed to react with the fluid wave motion similar to the physics of water waves.

I wanted to utilize what I had learned from “Big Red” to support a series of flat panels that would imitate the ice sheets. I began by creating a series of randomly generated panels that form a square. I then used the Grasshopper file I had made for the “Big Red” sculpture to draw wires between the center of mass of each panel. The primary difference between this mobile and the Calder mobile is that a string would connect vertically between the wire end and the center of mass of the panel instead of the wire connecting directly to the panel.

Despite the accuracy of the digital tools to calculate the wire distances and the center of mass of each panel, I discovered two primary issues after fabricating the study piece. First, the single point of connection allowed each panel to freely rotate and spin in any direction; so even though the panels were balanced they were unstable individually. Second, the branching structure of the mobile was single stemmed instead of multi-stemmed, which reduced the overall flexibility of the mobile. These two issues initiated two additional studies: to create first, a mobile that would sustain layered motion when activated, and second, vertical con-

nections to the panels that would effectively convey the mobile’s motion to the panels.

Through an iterative process of digital and analog making I developed concepts for organizing a mobile to simulate wave movement of water. I formulated new ideas through analog making, digitally calculated balance structures for those ideas, tested the results with analog mock ups, and made further adjustments to the digital model to more accurately reflect reality. These studies allowed me to make decisions based on motion over form; thus, leading me to sculptural concepts that no longer reflected Calder’s mobile.

I developed a way to connect the mobile to the panels so the panels would mimic ice sheets on water. I began with a single connection at the center of each panel. But this allowed the panels to spin and rotate with little relation to the motion of the mobile and the other panels. I added more connection points to the sheet, ultimately finding each sheet needed a connection at each corner. I then tested various methods of connecting multiple sheets together. My first test caused the panels to react in parallel, which did not reflect the motion of the ice on water. Instead, the panels needed to mirror their adjacent panels. I found

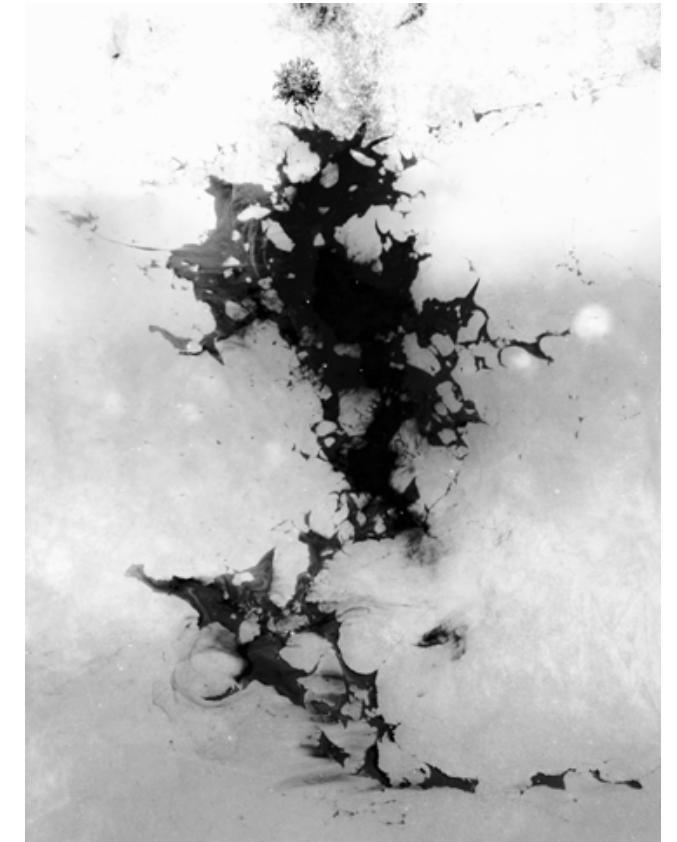
that I needed to connect the adjacent panel corners from one connection point in the mobile. Connected this way, as the corner of one panel rose, the three adjacent panel corners would also rise.

After these studies I better understood how to arrange the mobile and panels to evoke the motion of the ice sheets on water, but I had not been thinking about how to arrange the mobile and the sheets to reflect other aspects experienced on the site. I began to reflect on the transition from the winter to spring; the beauty of the ice versus the beauty of the tangled branches. I noticed in one of my first visits to the site a dead tree dangling from a small tree at the top of the ridge. It dawned on me that the branch’s position was due to high water levels. Looking up towards this tree, hanging twenty feet above the current water level, I pictured the high waters pushing all these branches upward and imagined them moving and swaying within the water current far above my head. This imagery inspired me to create the balancing sculpture with a seemingly random and overlapping dowel rods that connect to the hanging panels with thin string. When touched by wind or people, the two materials react as if they were on water. In this way, the mobile conjoins the two distinct phenomenon in one balancing sculpture.



Findings : Investigation

The sculpture and drawing studies in the investigation phase were approached with an openness to the unknown and responsiveness to discoveries along the way. In the site analysis process, the body acts as a sensor that detects, interacts with, and records its surroundings by drawing in and on the landscape. In the digital sculpture process, making is defined as a sustained performance of analog and digital sculpting through which I developed knowledge of balancing forms.



Together, the discoveries made in the investigation phase reflect the result of an exploratory process of making, through which I revealed and documented a variety of site and sculptural information.

The following pages contain an overall narrative of my findings (in black) and reflections on making (in gray). The reflections were written in a stream of consciousness method during, immediately after, and the day after each making session.

Investigation : Drawing : Site Landing

When moving through the site for the first time my mind naturally focused on determining what sounds and sights the landscape contained. I believe our bodies establish a baseline site awareness so we can detect aberrations in the landscape and determine if they pose a threat or not. But, soon this baseline information recedes to the back of our minds. We become comfortable in a landscape we are familiar with. Therefore, in my first visits I drew and wrote my raw first impressions before they faded to my subconscious awareness.

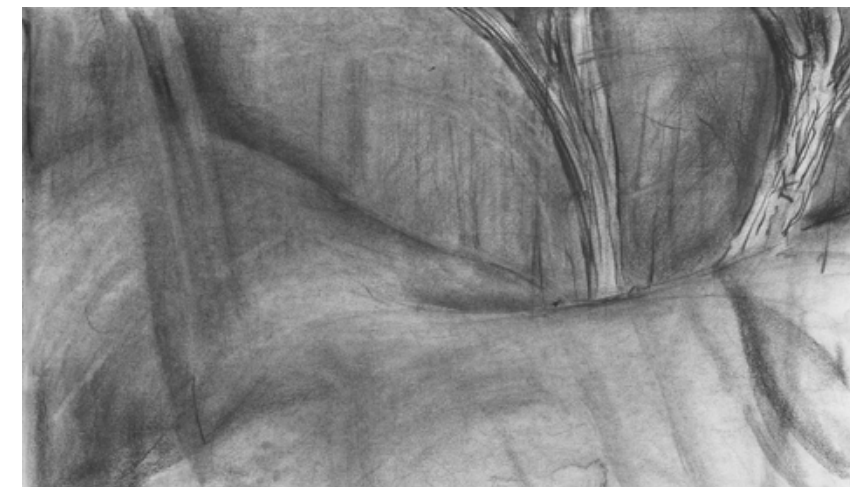
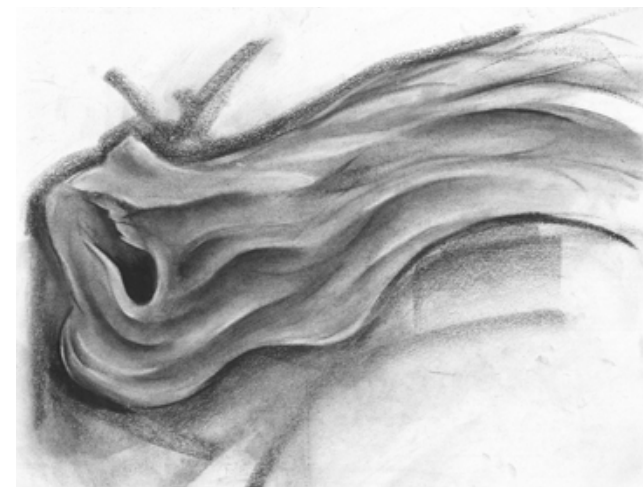
11.12.15 : Reflections

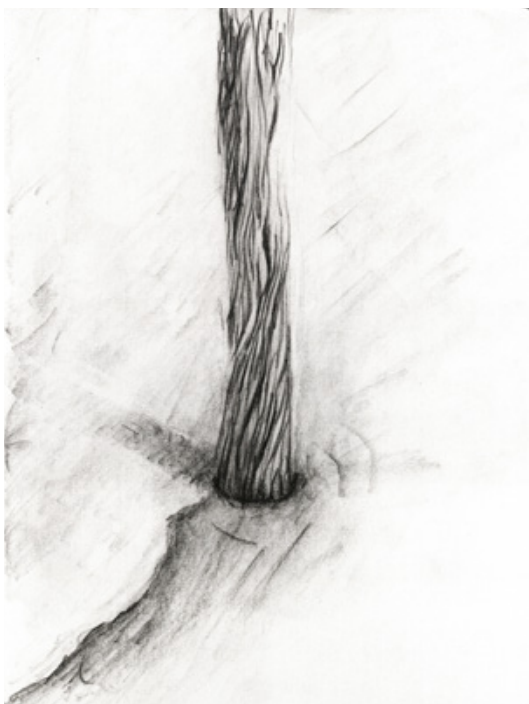
chirping dogs
whirring spindles
power tools
car doors
gravel dumptruck
reversing footsteps
crinkling atv
rumbling leaves
dumping timbers

Light refracting through the leaves casts a double shadow of suspended twigs. As the far branch sways, the shadow of the near branch tremors and shifts. The shadows merge into the horizon with the yawning sun.

Sitting to draw, my boots dig through leaves to scrape forward cold mud. The path leads to a bowl and mound, the lake is visible from the latter, but is cluttered with cedar saplings.

(Figures 4.3 – 4.6 Clockwise from top)
Charcoal site drawings of pathways, topography, stones, and wood on the site.





Investigation : Drawing : Observational

After documenting my first impressions, it was important to my study to continue discovering and reinterpreting the landscape's information through different media and modes of thinking. After a few visits I found myself taking the same path through the woods to the cove; when I realized this, I intentionally took different and more circuitous routes to the cove each time. Making me aware of new facets of the landscape I had not previously noticed. These explorations led me to realize that though the way I was drawing was important in developing my knowledge of the site, how I chose what to draw was perhaps more valuable in shaping the overall direction of my study.

01.28.16 : Reflections

I followed deer paths through the snow, a primary route traced the outer property line. it wraps back up through the pocket terraces and back to the access trail. Seeing the ice on the lake led me down there. I had been down there once in november, but today the remarkable patterns of driftwood was accentuated by the snow. I began noticing more litter than before, strangely beautiful, resting quietly in the snow. soda bottles and liquor jars, ten, twenty years old? A bright yellow spray can trapped beneath branches. A white cap atop a perfectly upright, bottle trapped in the ice, snow melting away from the dark oily substance in the container. I couldn't pull the bottle out of the ice, so I screwed off the cap to find the murky remains of some marinade that never made it to meat.

Left : (Clockwise from top left Figures 4.7 – 4.15)
Charcoal site drawings of wood and stones in the cove.

Right : (Figure 4.16)
Charcoal drawing of stone erosion pattern.





Investigation : Drawing : Texture and Pattern

I realized I had subconsciously interacted with the environment to learn about it. I threw rocks onto the frozen lake to test the ice's thickness and pushed gently against the tangled branches in the cove before putting my full weight on them. We interact with our surroundings to learn, especially as children, and the more we do this the more we are able to interpret the site visually and move through it deftly. After walking across the branches multiple times I became more trusting of my sight and could walk across them with a visual understanding of which branches were more likely to be sturdy and which might break or slip. I had gained a visual understanding by repeated physical interaction with my surroundings.

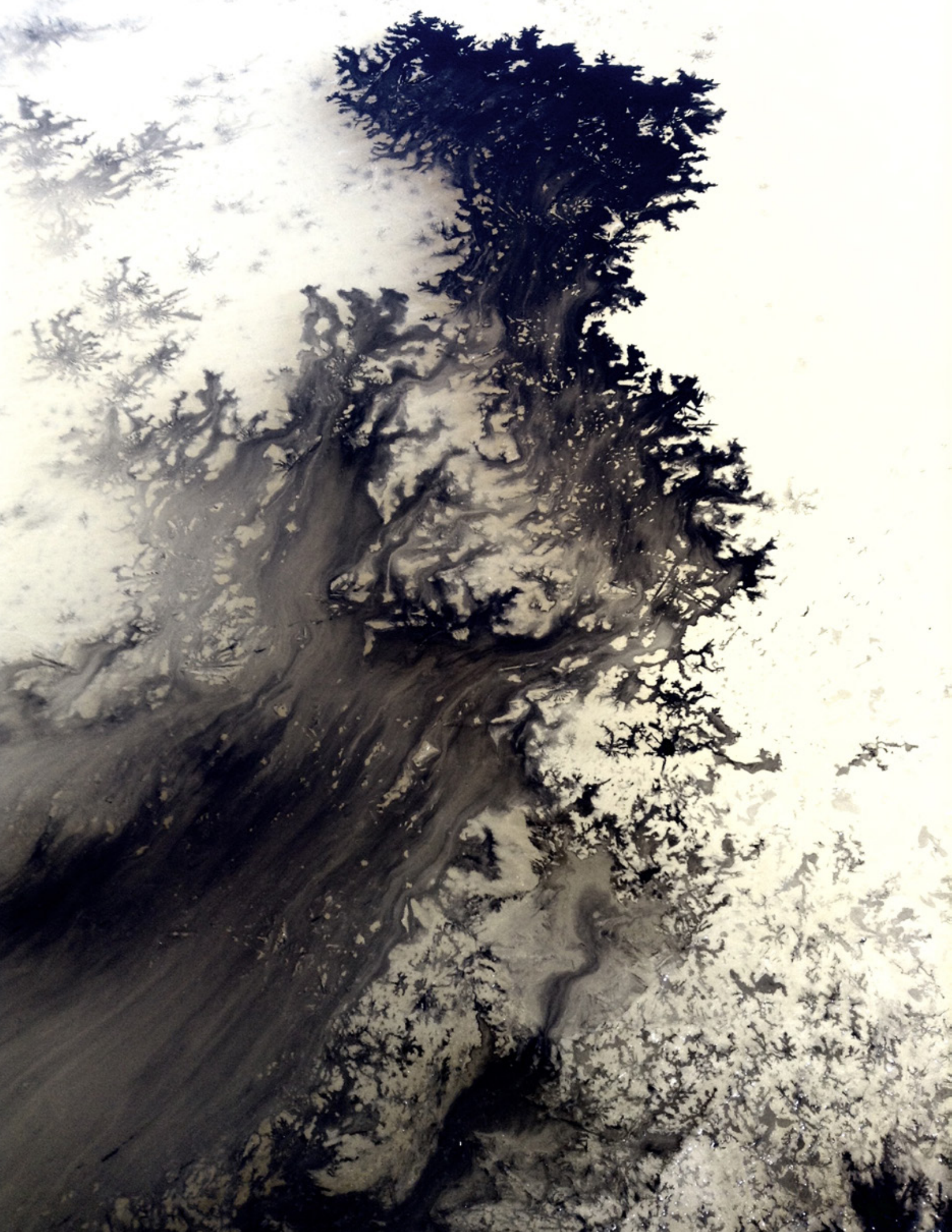
01.29.16 : Reflections

So many birds at sunset. Ice. Ink. The patterns of ink on the paper. Suddenly it looks like someone splattered ink on the rocks. Eyes recognizing pure blacks and whites amidst the tan environment. Crows call out the evening minutes. Silence resonates above me. Geese in the sky, crows on the lake, clouds on both. Focused attention. Toes soaking up the cold from the water that is covering the ice I'm standing upon. Carefully still, unsure how thick it is, but feeling solid. Crossing the drift field is a constant game of anticipation of falling two feet down. The ice is thawing fast, but still hold up the branches. Sliding on the ice, my eyes vaguely aware of my sense of balance. Charcoal smudging. Even pure snow has so many tones.

Left : (Figures 4.17 – 4.25): Ink drawings created with snow, stones, cockleburrs, sticks, ice, and splattering.

Right : (Figure 4.26): Charcoal Rubbing of Stones, sticks and leaves.





Investigation : Drawing : Ink on Ice

When drawing, our hand directs the medium to the paper through touch. In doing so, what we see and what we feel overlap in our mind, deepening our knowledge of what we draw. By making marks directly on the landscape around me, my whole body became involved in drawing. I focused on how my body was acting as a sensor of the site, detecting and responding to the landscape as I moved through it. I found I was developing mindful wandering, following my intuition through the site to reveal and discover what to study further. Over time this method led me to spending less time documenting what I could see and more energy revealing information I could not see.

02. 04. 16 : Reflections

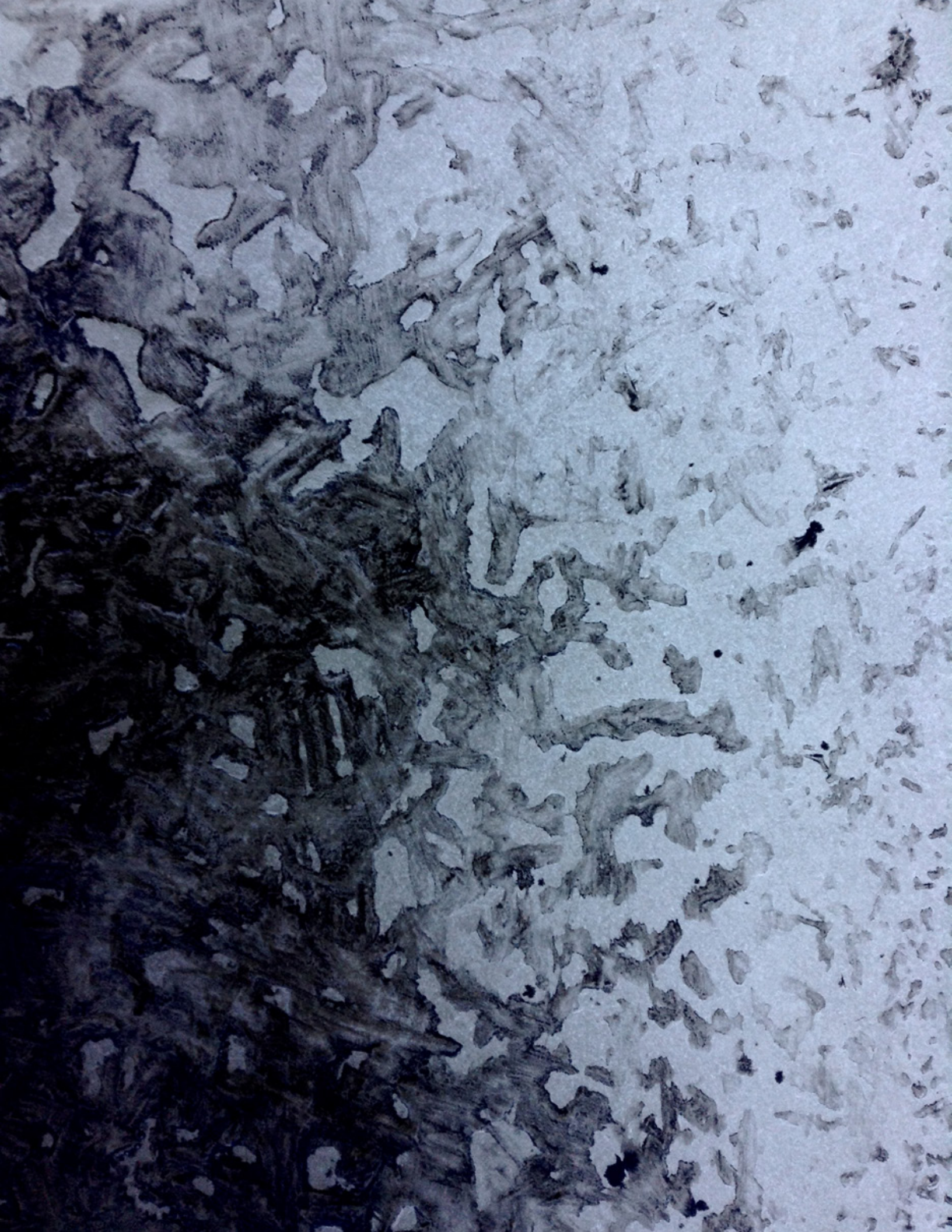
Cold days make me truly decide if it is worth it to be out there: and remind me to focus on what can't be photographed. Especially cold and windy by the water. Patient, controlled drawings are not an option. The cold slowly peeled me away from depending on the determining a drawing's worth by its visual beauty. Finding new ways of working and making. Ink on smooth ice after the rain. The ink would freeze and float in fractal chunks depending on the depth of the water that remained on the ice. If the water was very shallow, it would spread out in coral patterns as it froze. I started throwing rocks to break the thinner ice. The ice would shudder and crinkle upon impact, and small air bubbles would scurry along, trapped beneath the ice, collecting in large pockets of air.

Left : (Figures 4.29): Ink splattered on water and ice after rain.

Above Right: (Figure 4.30): Ink splattered on melting ice revealing the layers of melted and refrozen snow that had collected on the ice.

Below Right: (Figure 4.31): Ink splattered on refrozen melting ice.





Investigation : Drawing : Ink on Ice

Sitting and drawing helped me better understand what I saw in the landscape; but by pushing, pulling, throwing, jumping, running, crouching, hanging, and balancing through the landscape I developed a physical awareness of it. My making stopped being about showing what was there but about looking underneath what I thought was there. By interacting with the landscape, I became excited about the possibilities of what could be found. I focused on discovering why things are the way they are, and started to not just represent beauty but to investigate how it became beautiful.

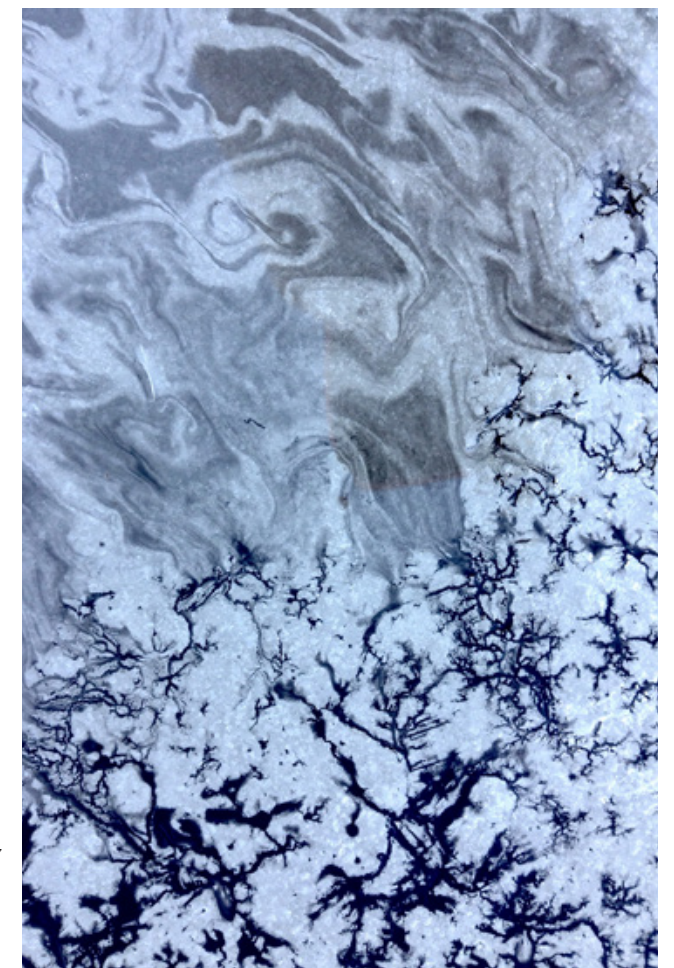
02.07.16 : Reflections

Windy. (!) Ice melting and shaking. Quivering. Moving in awkward geometries toward warmer waters. Driftwood looser than ever. Balancing and dancing across. Dark rumble of the wind in the trees. Birds being blown across the water. Wind is a violently clenched fist wanting to wrap around loose branches and rip them away. Ice in fractals shimmer, glinting on the moving surface. Sunward warmth held out and snatched away just as you decide to accept it. the water always offering its cold embrace, encroaching on the boots. Too windy and wet for ink. Pages collapse onto hand in the wind. Words yawning on the paper. Messiness. Ink spilling on the hand. Hands shaking. Eyes fading. Birds barrel roll in the wind. dancing like kites. kites without strings. wall of calm. behind cedar branches. clouds in perfect composure as the wind pushes them along. the wind trying to tame the earth revolts in hopeless frustration.

Left : (Figures 4.32): Ink rubbed on shaded ice.

Above Right: (Figure 4.33): Ink rubbed on shaded ice.

Below Right: (Figure 4.34): Ink splattered on ice and water.



Digital Replication of "Big Red" (Figure 4.35)



Investigation : Sculpture : Big Red Replication

I replicated Alexander Calder's sculpture "Big Red" with Grasshopper, a parametric modeling tool for Rhino. Through this I gained a better understanding of how to construct a balancing sculpture because a complete Grasshopper model requires an understanding of the construction logic, not just a visual replication of the forms. The study revealed minor discrepancies between the balance points of the digital and original models. At closer observation this discrepancy was due to the increased wire gage Calder used to support the top panels.

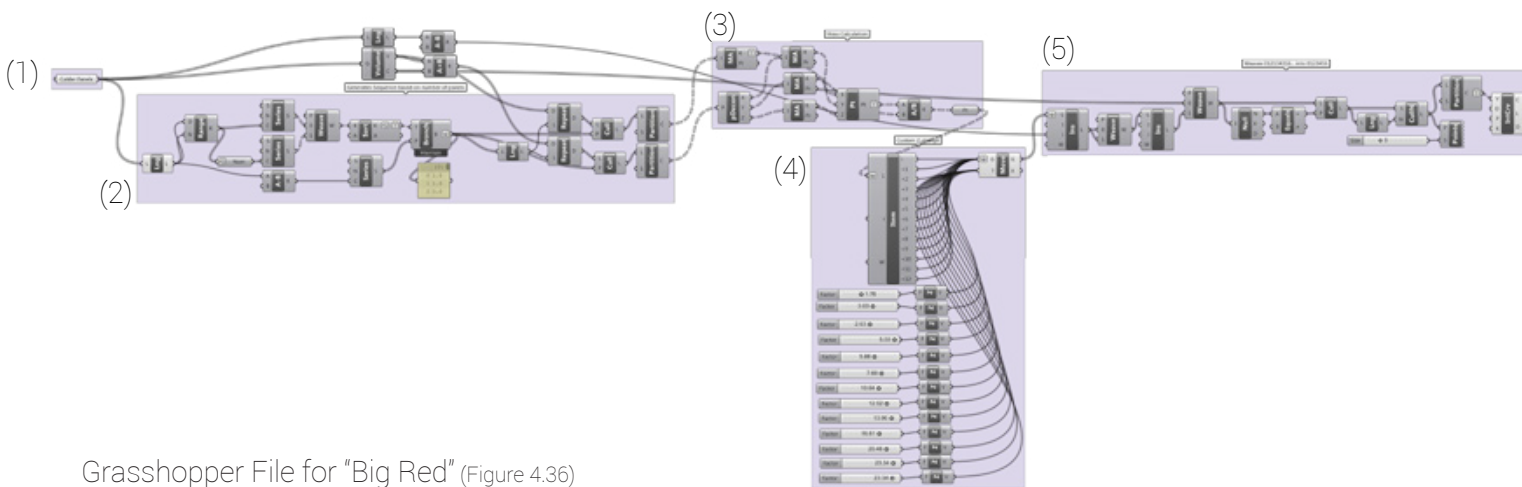
This study also helped me understand the branching pattern Calder used in his work (and later guided me to study new branching patterns). His mobiles consist of a single branching structure, not a multi-branching structure. Meaning panel four would counterbalance weights one, two, and three. In a multi branching tree, weights three and four would balance with weights one and two.

The digital study provided flexibility and consistent precision that is difficult to achieve with an analog method. Namely, that adjustments can be made anywhere in the model and the program will update the rest of the model to compensate. This allows design possibilities to be investigated and forms to be changed along the way, so the designer is not bound to an initial form but may explore new ideas as information is gained.

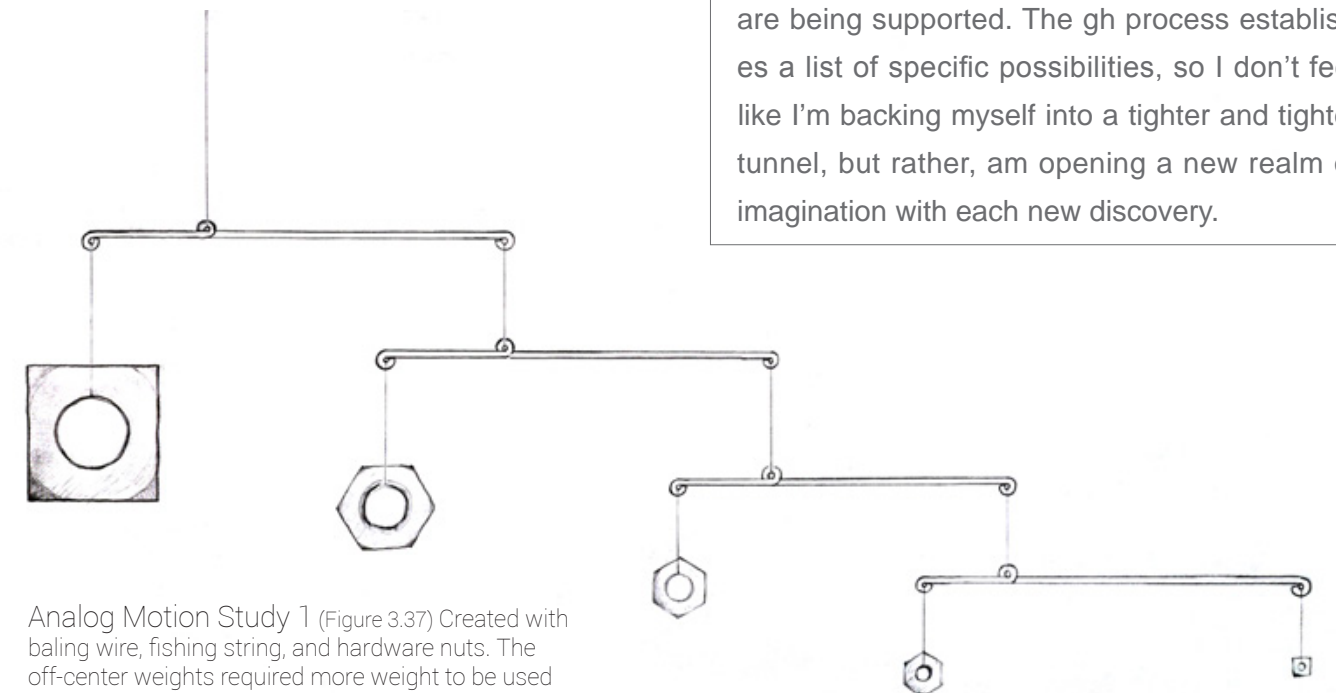
02.07.16 : Reflections

I used partition to split the list. Used original z code, but made a route to incorporate a fibonacci option. Generated sequence code by making and weaving 0's and 1's. Next step is to generate points within a 2D field, sort them by proximity, see what happens, start resolving overlapping intersections. Ultimately, since i was able to generate the sequence I can begin thinking about ways of overlapping data trees: so multiple points are being supported. The gh process establishes a list of specific possibilities, so I don't feel like I'm backing myself into a tighter and tighter tunnel, but rather, am opening a new realm of imagination with each new discovery.

- 1 : Panels drawn in Rhino
- 2 : Generate sorting sequence
- 3 : Calculate panel masses
- 4 : Vertically adjust combined masses
- 5 : Sort masses to interpolate curves



Grasshopper File for "Big Red" (Figure 4.36)



Analog Motion Study 1 (Figure 3.37) Created with baling wire, fishing string, and hardware nuts. The off-center weights required more weight to be used but resulted in more motion on the lighter end than if the balance points were centered between the weight and the next wire.

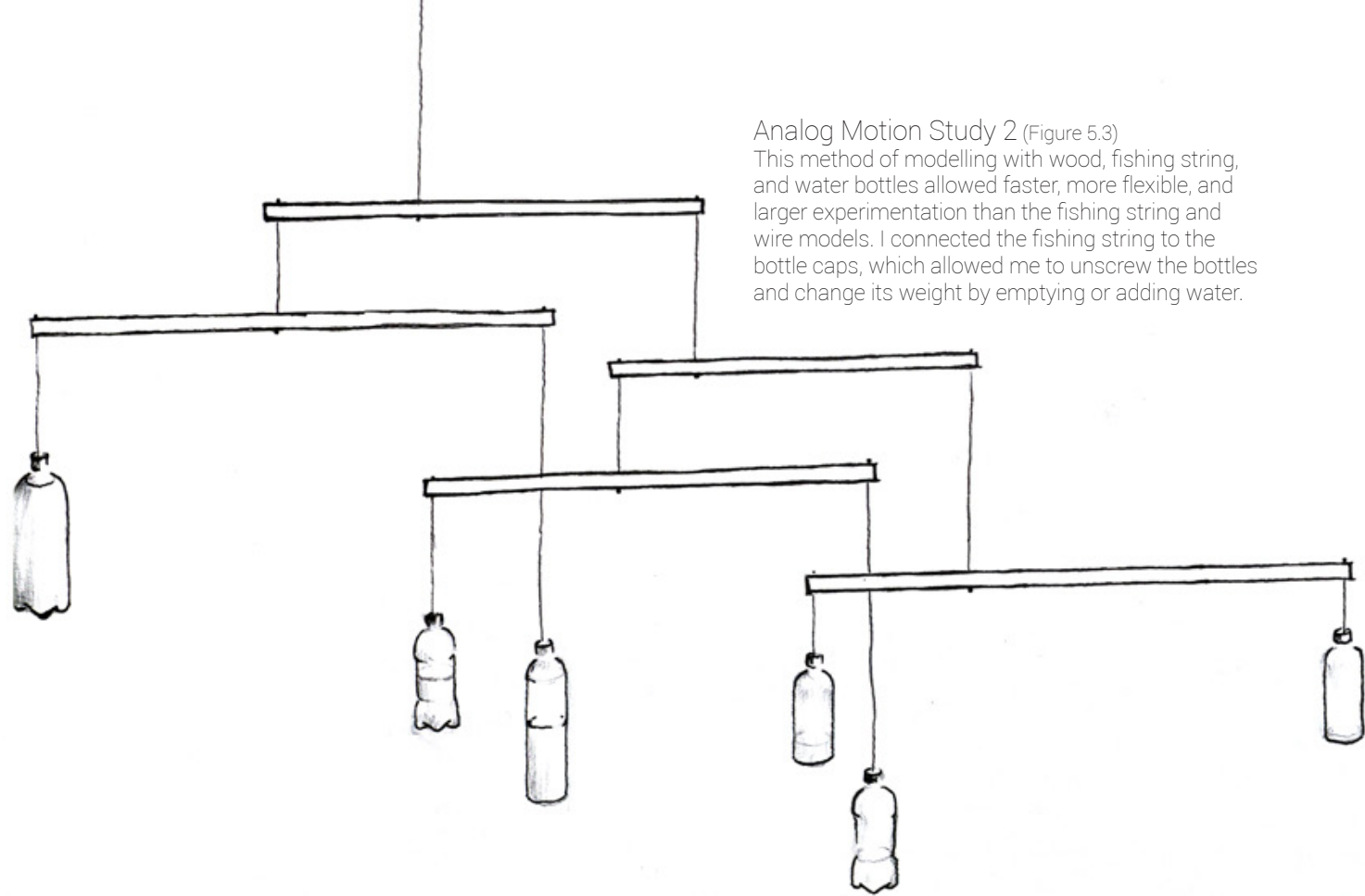


Findings : Application

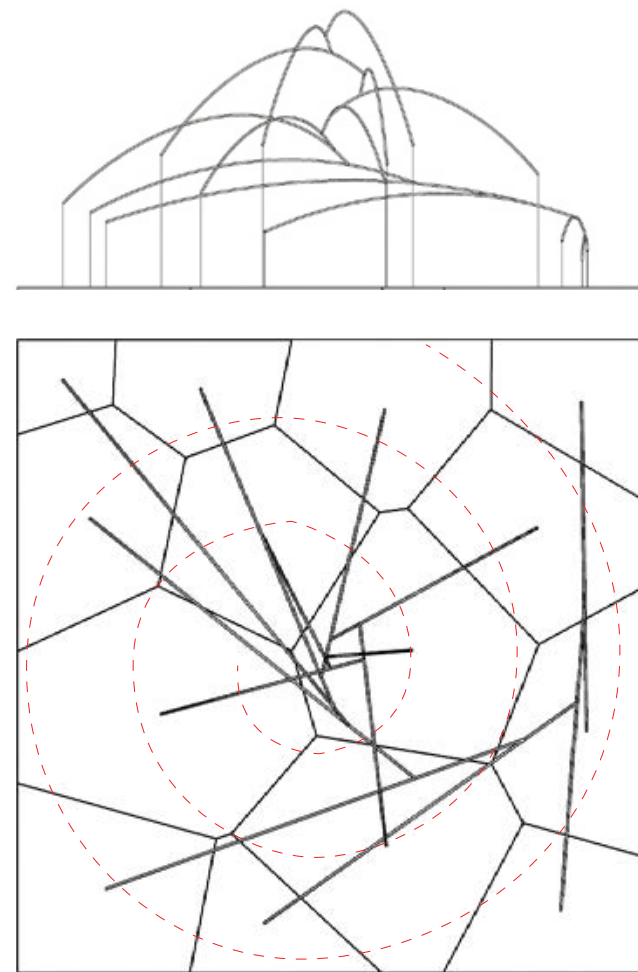


The sculpture and drawing studies in the application phase were developed separately but stand together as one body of work, typified by a site-inspired approach to making. The works are not created to exactly replicate site phenomenon but to evoke select qualities experienced on site.

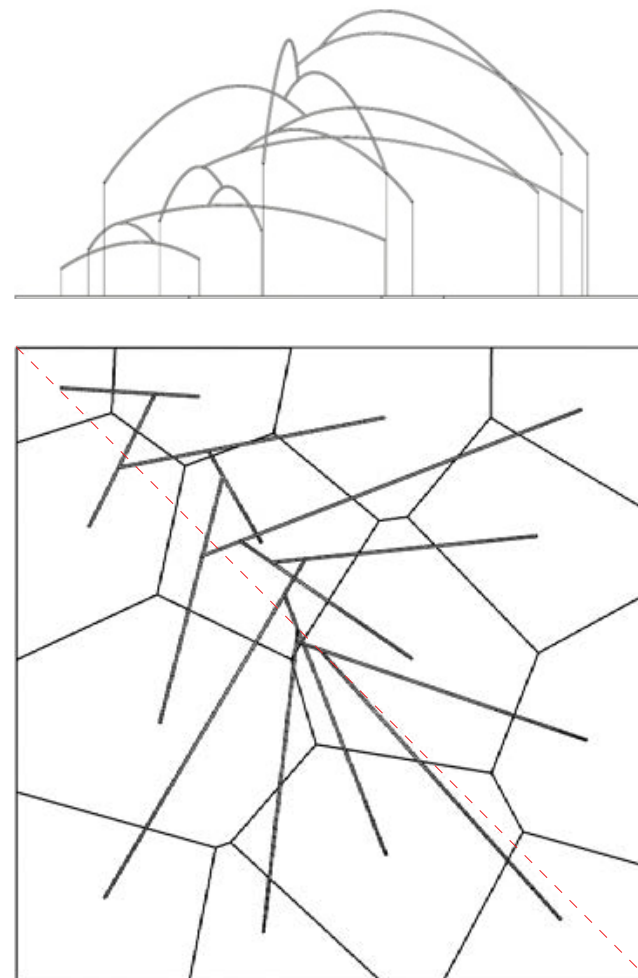
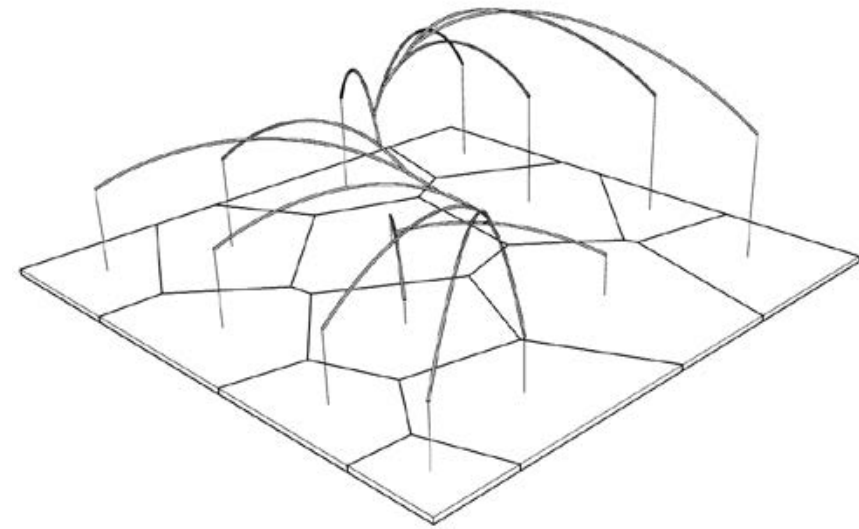
Together, the discoveries made in both studies reflect a personal development of improvisational making, in which final forms developed as they were made, rather than being predetermined. In this approach I embraced failure as an important actor in the process, not a deterrent to progress.



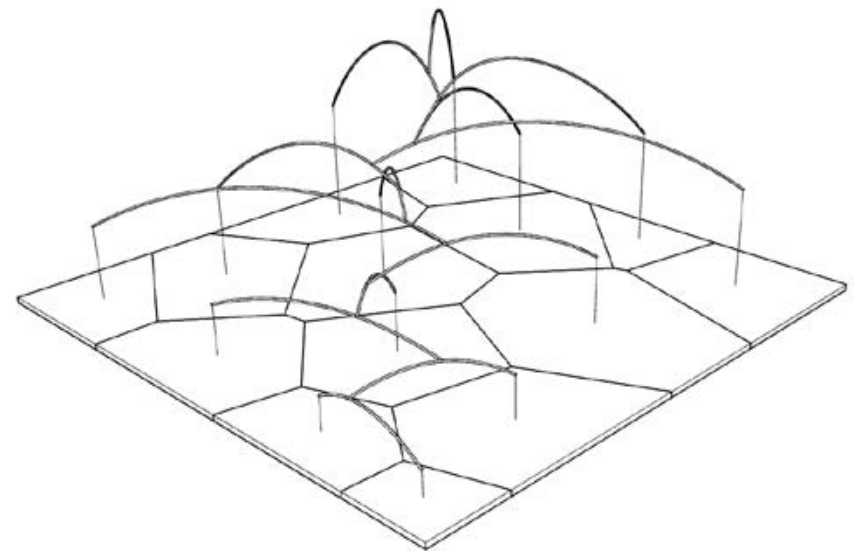
Analog Motion Study 2 (Figure 5.3)
 This method of modelling with wood, fishing string, and water bottles allowed faster, more flexible, and larger experimentation than the fishing string and wire models. I connected the fishing string to the bottle caps, which allowed me to unscrew the bottles and change its weight by emptying or adding water.



Panel Support Test 1 (Figures 5.4 – 5.6)
 Developed from the "Big Red" Grasshopper file, this design balances the weight of horizontal panels. A square was populated with random points and voronoi panels were created around those points. Strings drop from the end of each wire to the centers of mass of each panel. The difference between Test One and Test Two was created by changing how the panels were sorted. As indicated by the dashed red lines in plan view, Test one was sorted with a spiral and Test Two was sorted with a diagonal line.



Panel Support Test 2 (Figures 5.7 – 5.9)
 The digital model allows the designer to quickly adjust the number of panels, the form of the wires, and the vertical difference between the wires. Fabricating this model revealed the center connections were unstable and the single branching arms limited sustained movement in the mobile.



Application : Sculpture : Ice Sheet Motion
 Using digital and analog techniques was valuable to my process because one method often revealed an insight that had been missed in the other method. Analog tests were limited by the efficiency and flexibility of the modelling method. Indirectly, digital modelling compensated for this because I could change inputs into the model and see the visual outcome. As seen between the two Panel Support Tests (Figures 5.4 – 5.9), a single shift to the input (such as how the panels are sorted) resulted in different formal outcomes. Efficient and flexible as the digital tests were, they often contained goofy failures and impracticalities that were found when built. I found it to be most valuable to experiment in one medium and test the results in the other to account for the failures of one with the capabilities of the other.

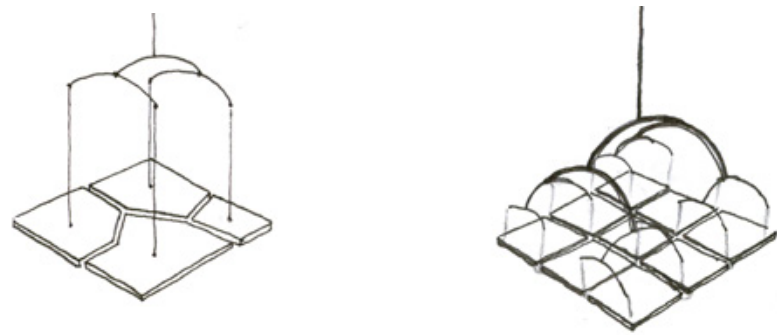
02.10.16 : Reflections
 Twisting wire, tying string. Focused. Mental breakthroughs feel like the first moments, when digging a tunnel, the earth falls away to reveal another tunnel. The earth loses its solidity and just before you break through it feels that the whole world is about to collapse. The sensation that if you leaned up against the earth it would cave in and reveal something wholly unexpected. These breakthroughs are mental images of a design or a feeling about what the design should evoke. They provide me a direction, but I want to be careful to set myself on a specific route that limits the realizations I make along the way. Sometimes the breakthrough also turn out to be a small idea of how to do one thing differently, and these are often more approachable solutions, but both are valuable and exciting.

Application : Sculpture : Ice and Driftwood

The fabrication of Panel Support Test Two revealed a need for improved connection methods between the wires and the panels. I tested various techniques with wire, fishing string, and chipboard. With each test, I increased the number of connection points to the chip board panels. Eventually I found that connecting adjacent panel corners from the same wire point would provide the best transfer of motion between the wires and the panels (as seen in the bottom right diagram below).

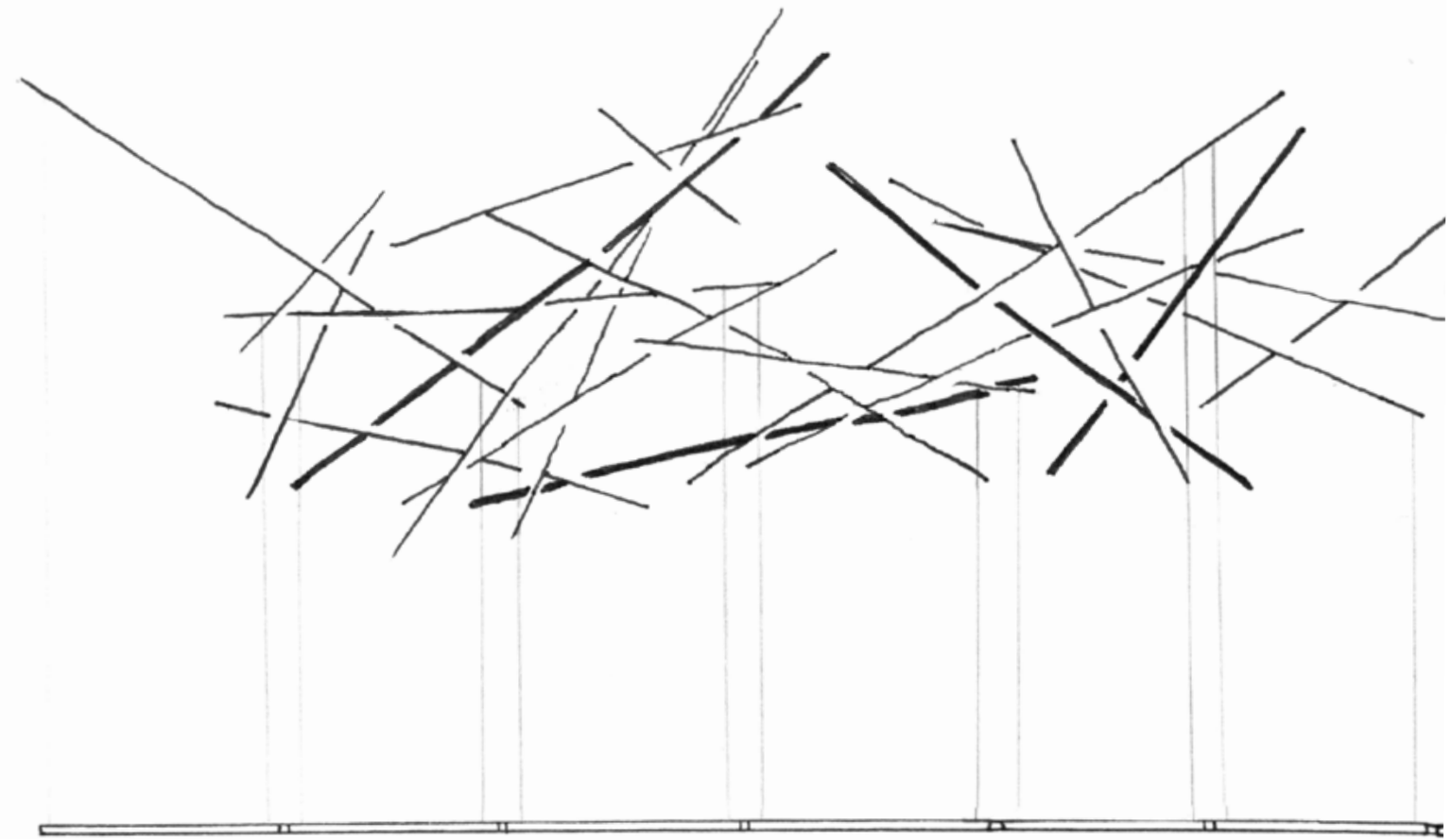
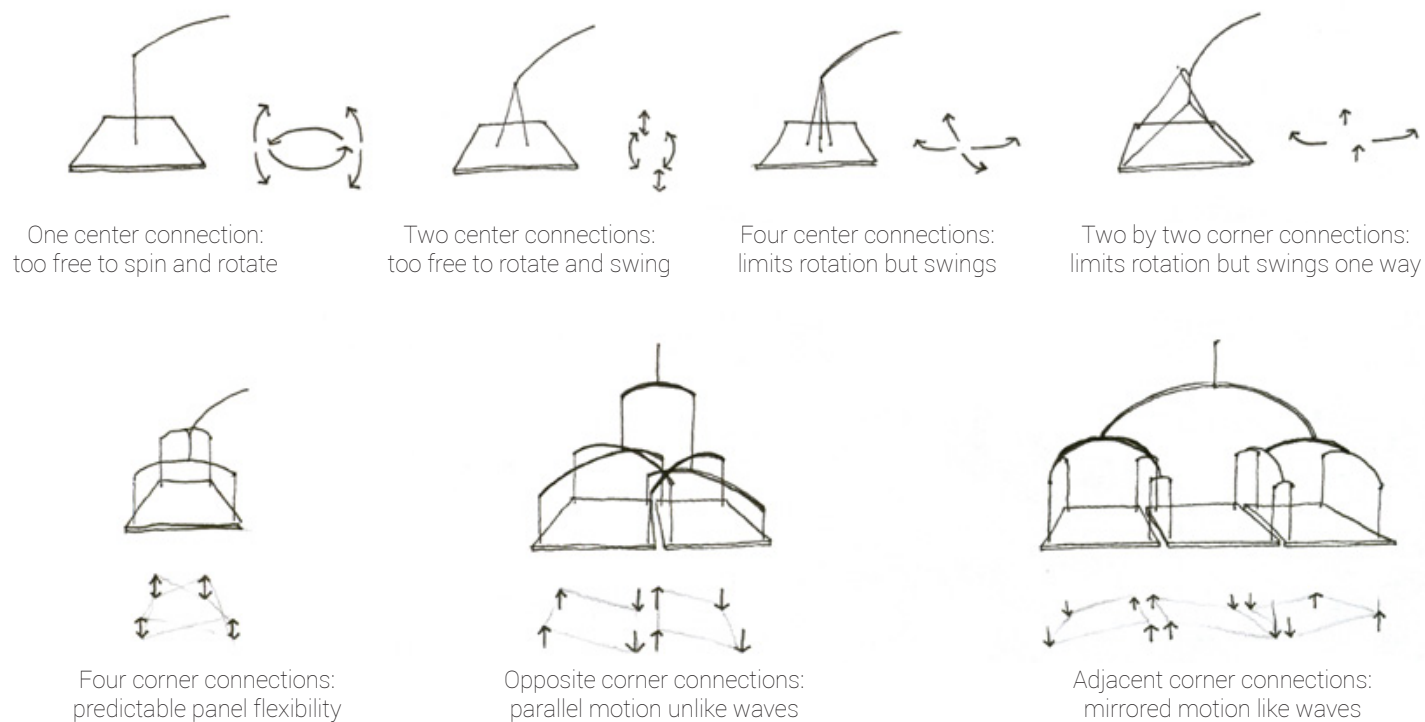
02.24.16 : Reflections

Frustration. Difficulty stepping back and imagining. I feel restricted to the methods I'm using to study balance. Creating a more efficient system helped but it's hard to jump ahead. I'm trying to make decisions too often. So i forget what my overall goal is. I had felt that the digital took away from the in-between, and now after working on the analog I am realizing it is really about thought, but I'm not sure what gets me to focus more on it. The analog is more of a feeling, and digital studies help me visualize it in my mind better, but I still don't have an overall sense of the physics of it from the digital.



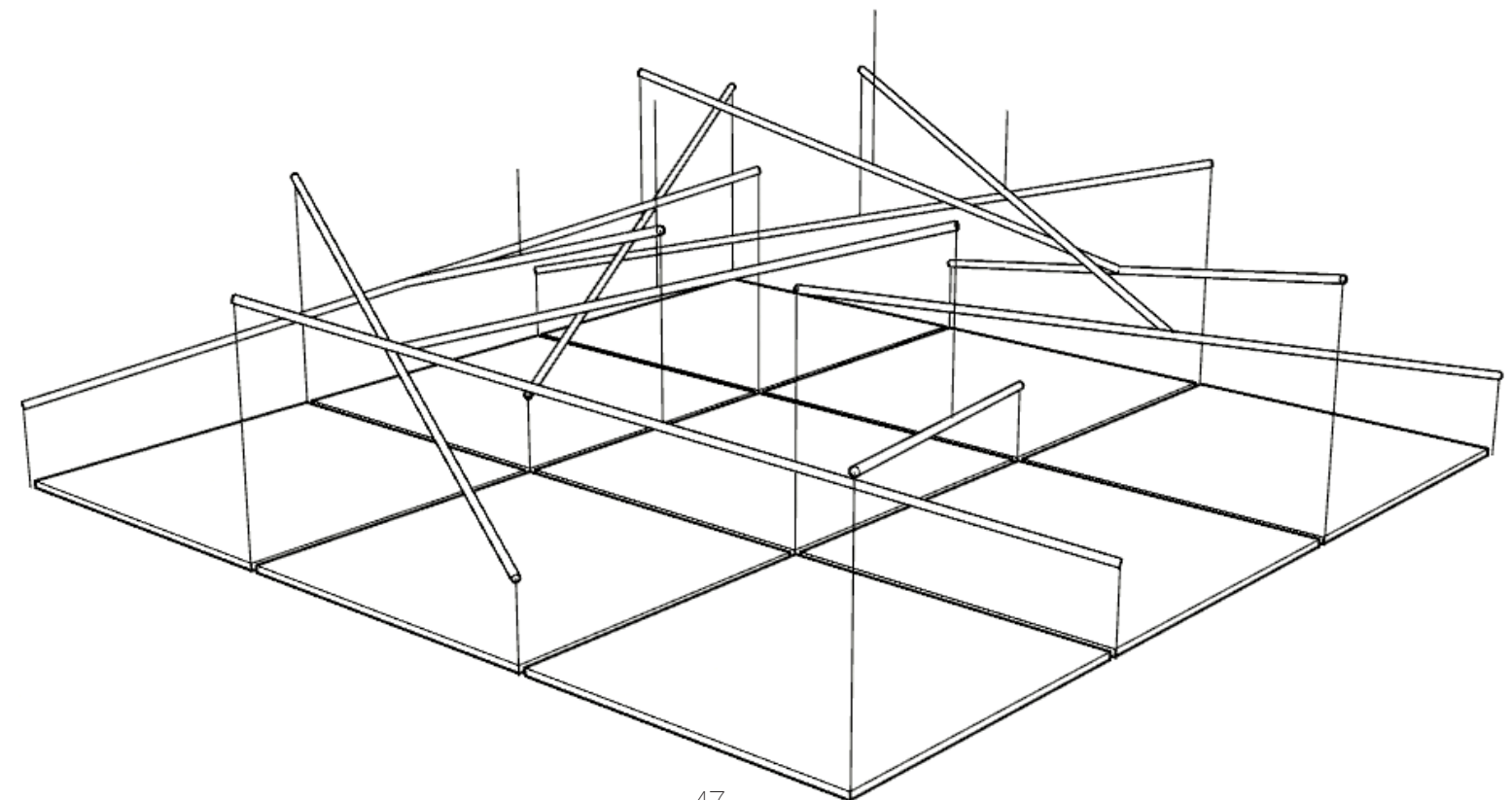
Left: Panel Connection Types (Figure 5.10)

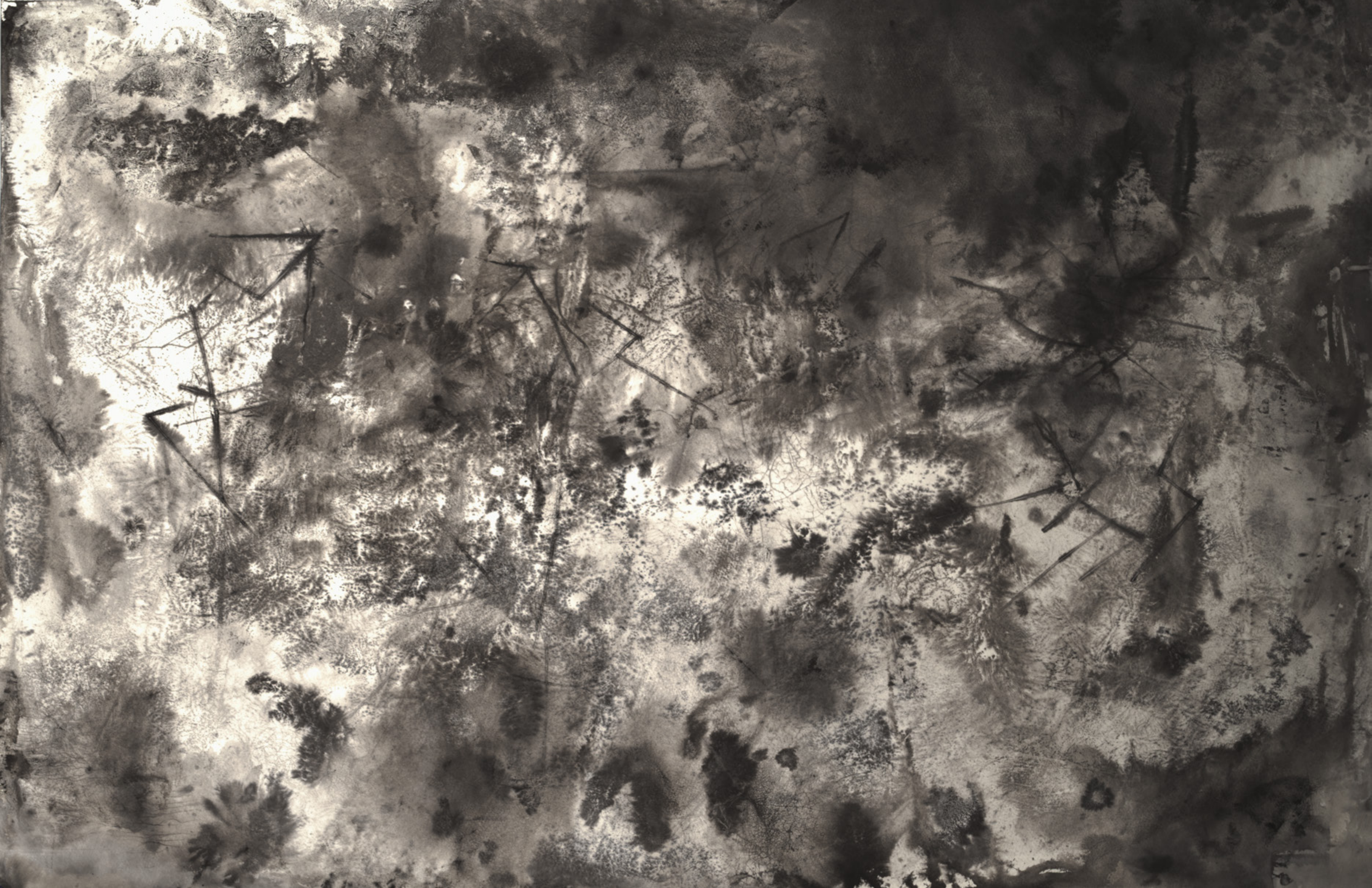
Below: Panel Connection Motion Tests (Figure 5.11)
Diagrams of the connection methods tested. The arrows indicate the general motion of the panel that resulted from the connection method.

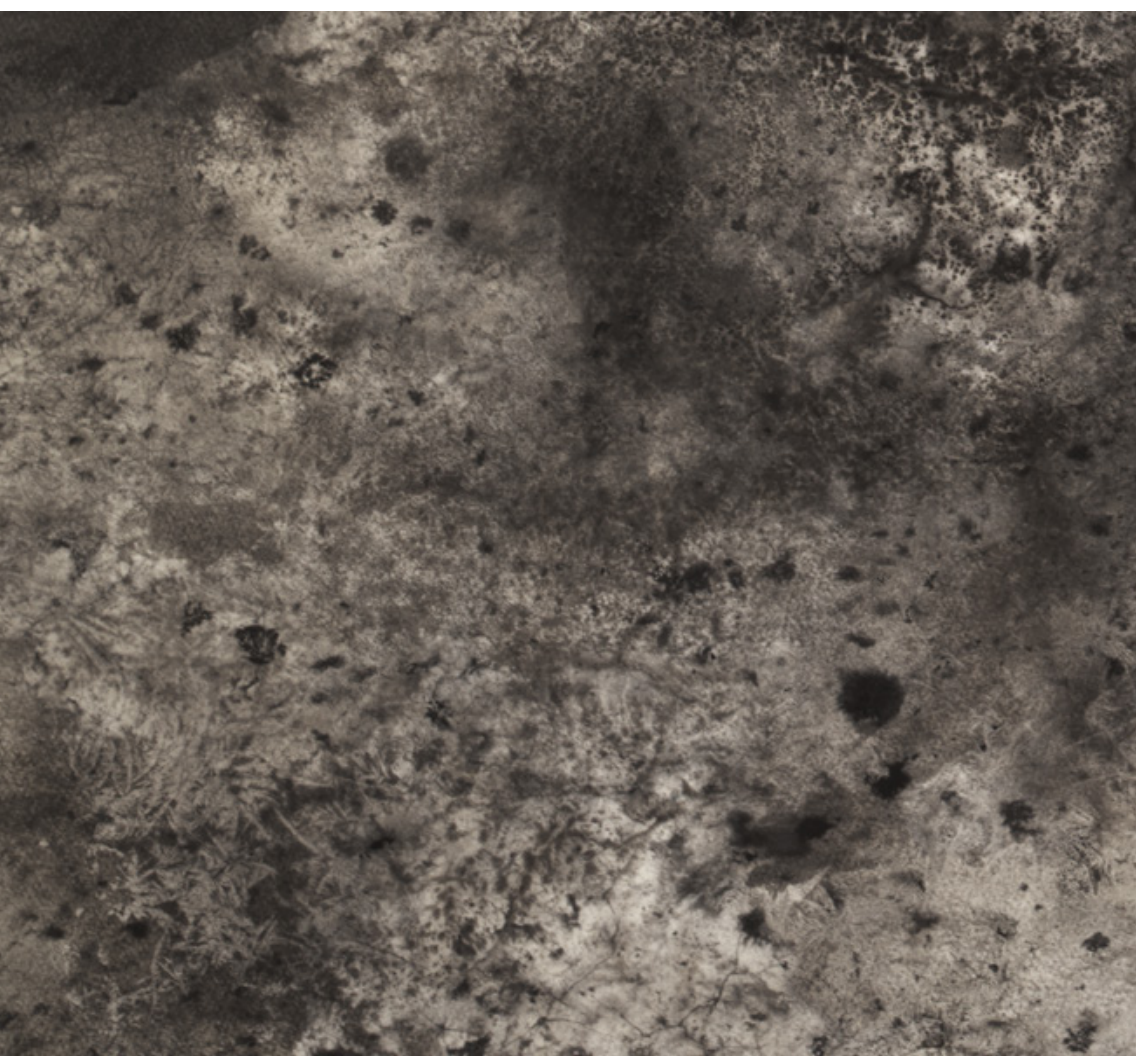
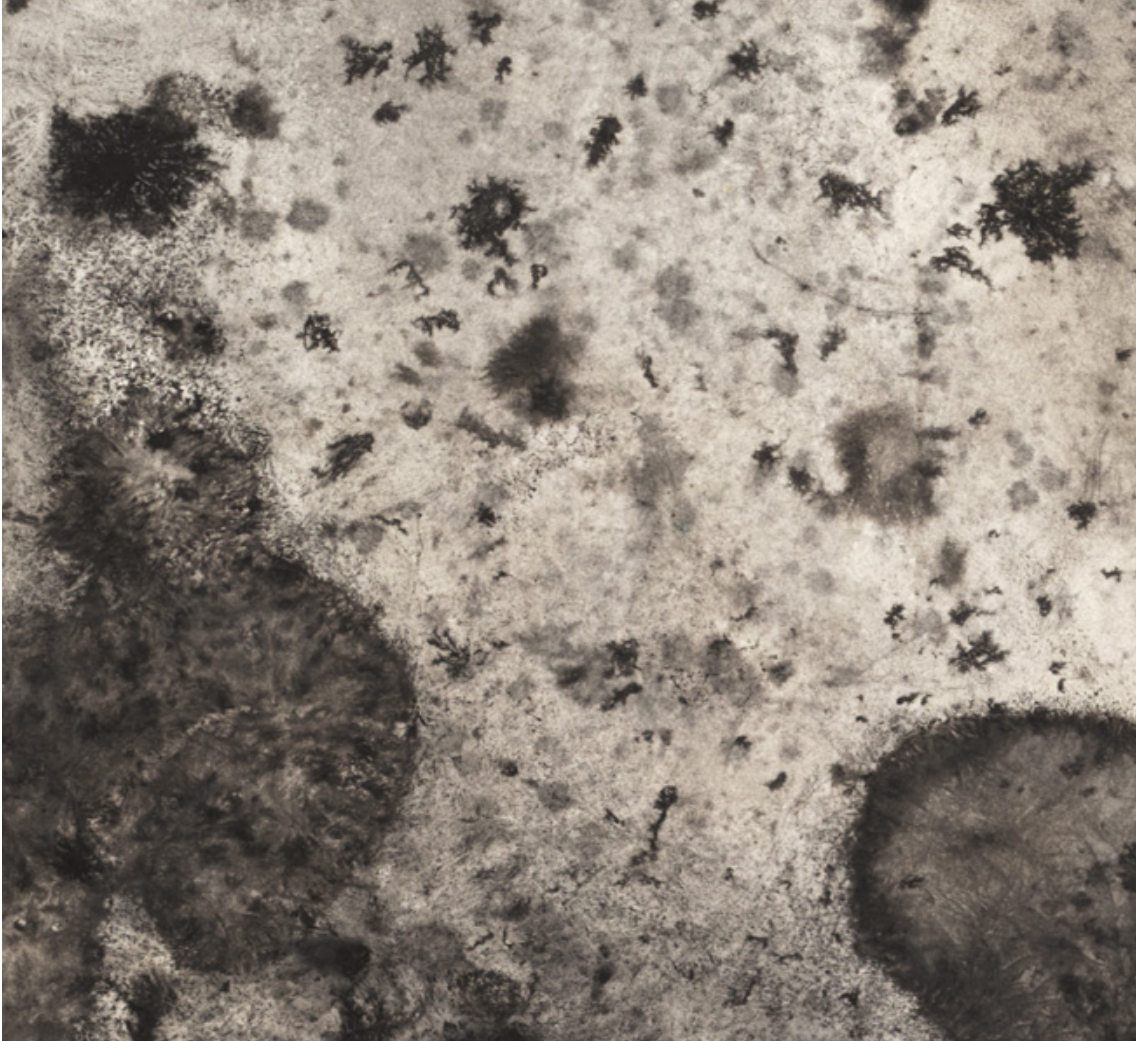


Above: Icesheet and Driftwood Sculpture Conceptual Section (Figure 5.12)

Overlapping Connection Test (Figure 5.13)
Digital model with proposed materials of dowel rods, fishing string, and wooden panels. Based on the Panel Connection Tests, the rods connect between panels to create mirrored motion between each panel.







Application : Drawing : Frost Drawings

Making the frost drawings was as much about how and when I applied water as how and when I applied ink. The drawings were not premeditated works but were the result of various disruptions and responses. By making the drawings, I gradually developed an intuitive knowledge of what patterns might form on the paper based on how much water I applied and how many seconds I waited before applying the ink. But with so many variables to how ice freezes and ink spreads, repeating the same process would still result in slightly or drastically different crystal patterns. I embraced this complexity and focused on disrupting the crystallization in various ways. By disrupting the natural phenomenon, I was causing new patterns to form that would not have occurred on their own.

I gradually developed ways of applying ink that revealed the crystals without revealing my hand gesture. Hiding my gesture was not a way of re-

ducing my role as the director of the drawing, but allowed me to focus on controlling and disrupting the conditions in which the ice formed. Pushing the drawing into grass created fractures in the ice that created patterns on the drawing like wrinkled skin. Pushing against concrete created speckled fracture patterns. The heat of my body disrupted the ice by melting it when I touched it. The heat of my body interrupted the natural phenomenon, leaving it to restructure the ice on the paper.

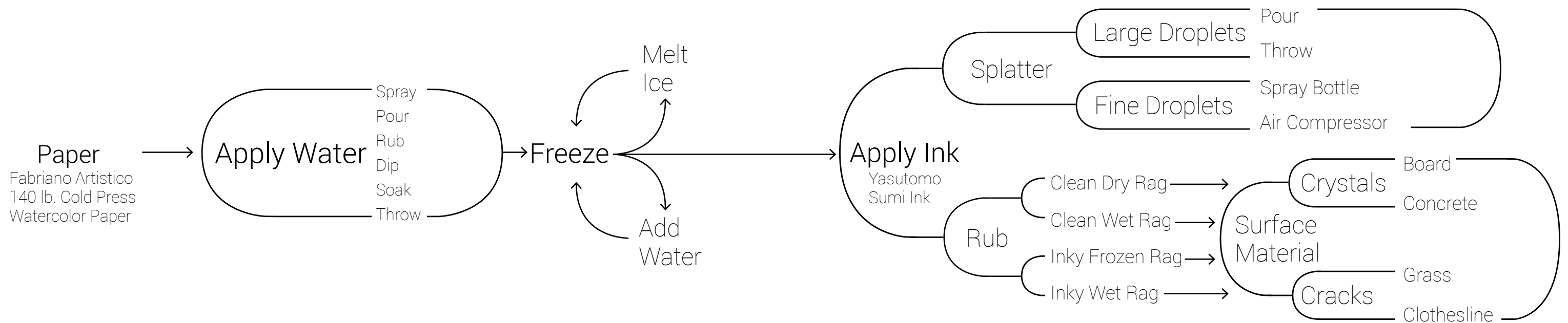
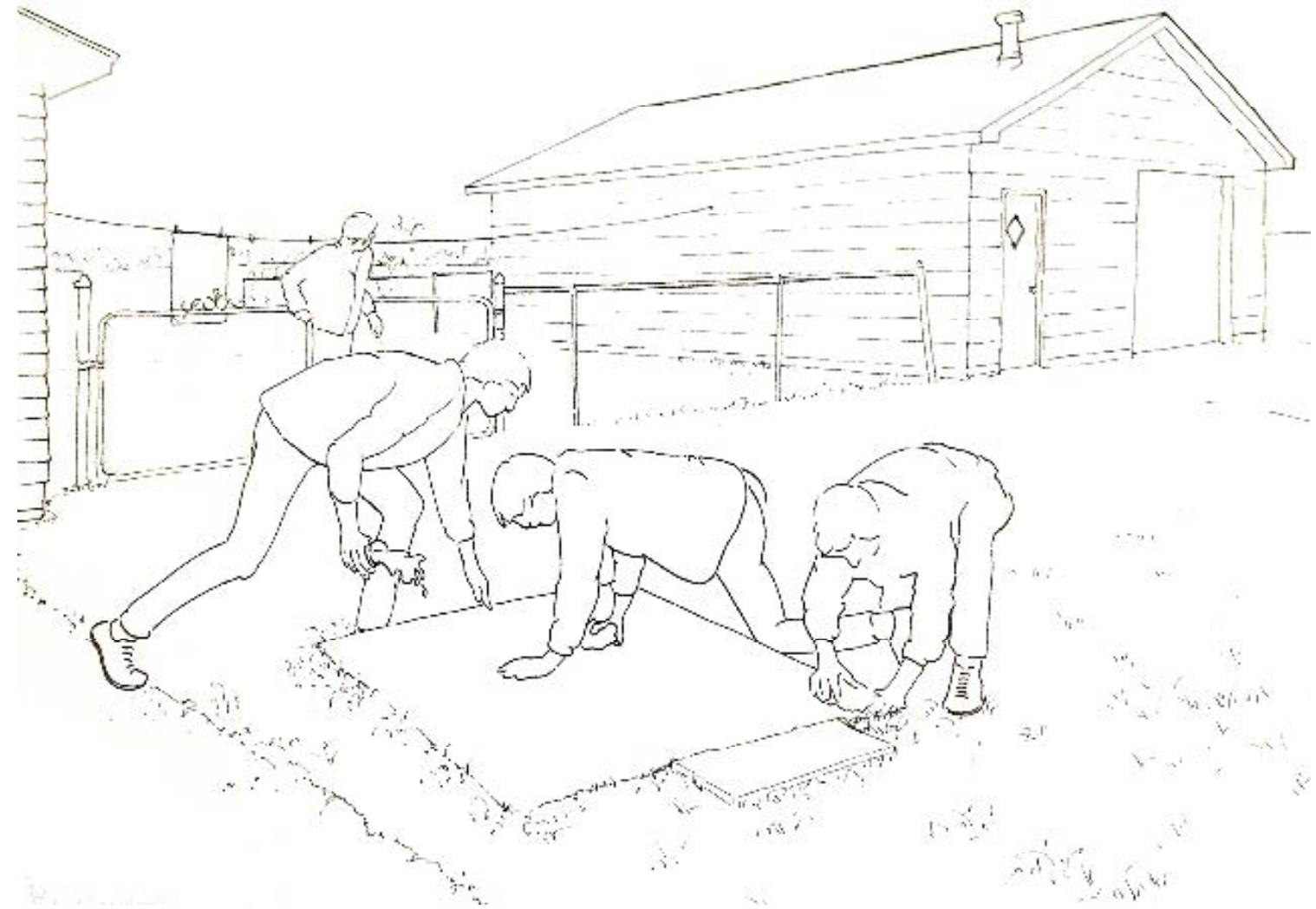
Two Spreads Previous: Frost Drawing 1
24 in. x 36 in. (Figure 5.14)
Created in a freezer with brush, bamboo, rag, water, and ink.

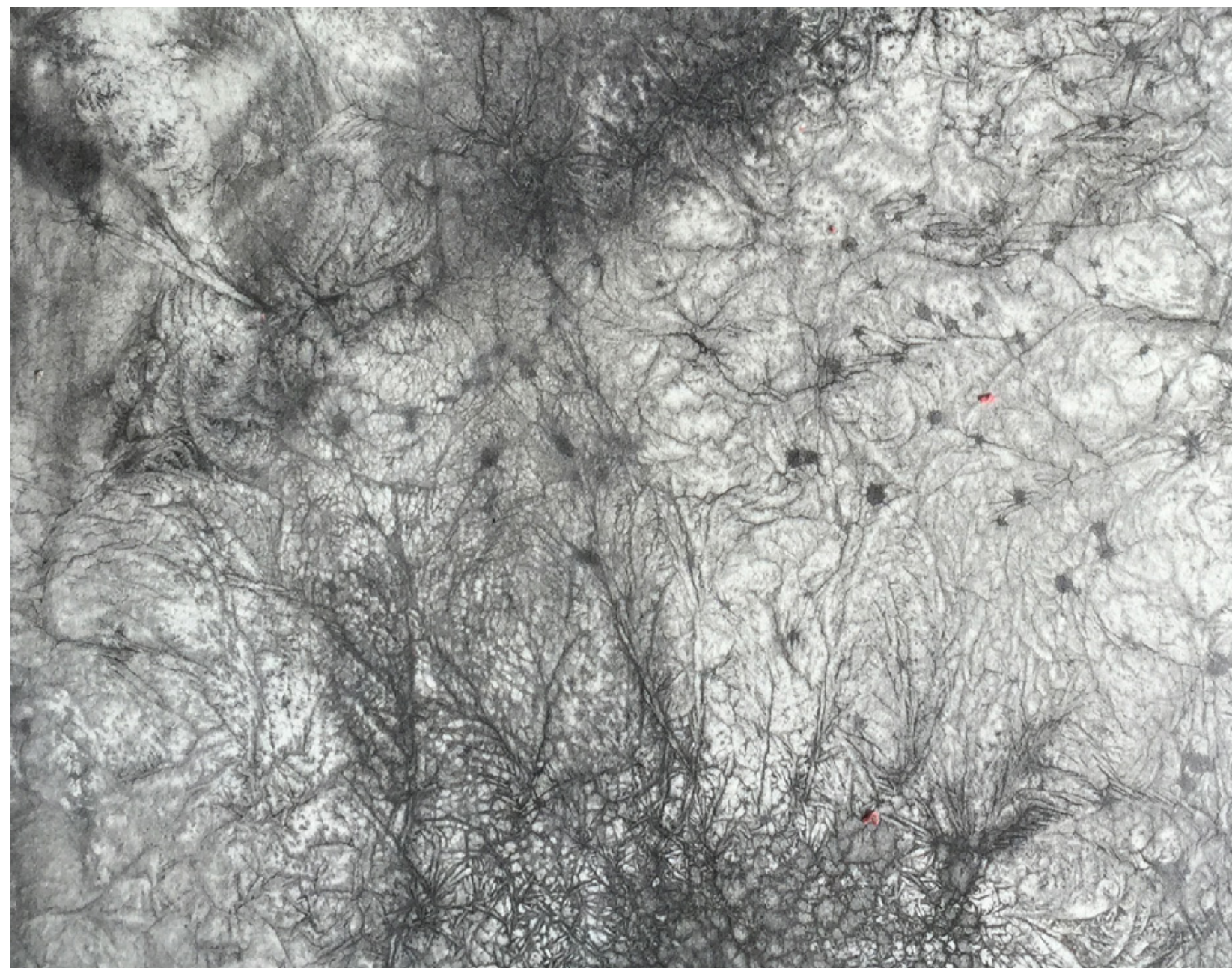
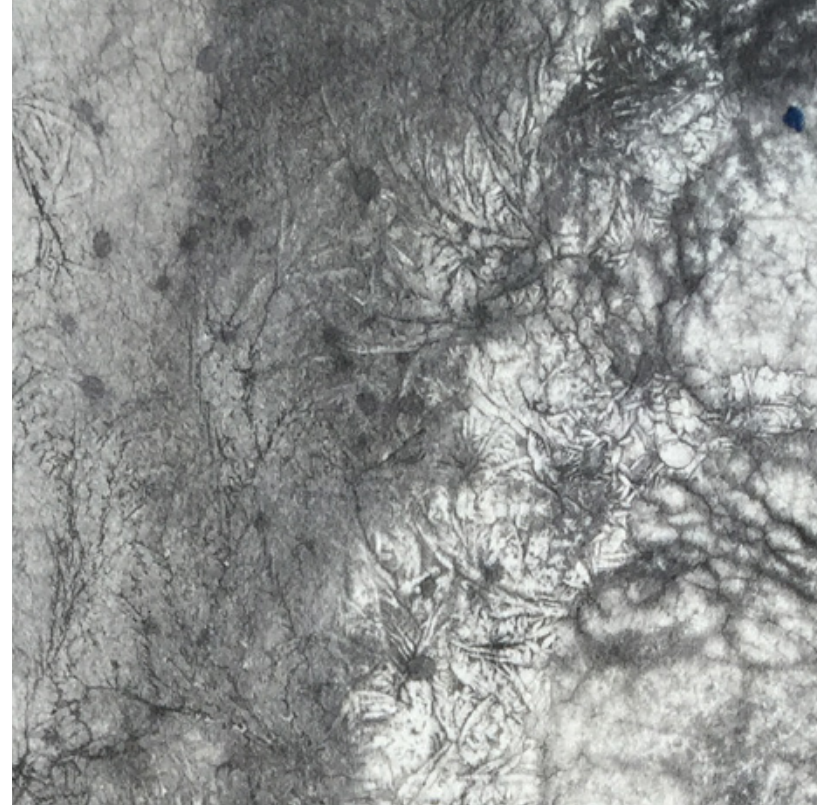
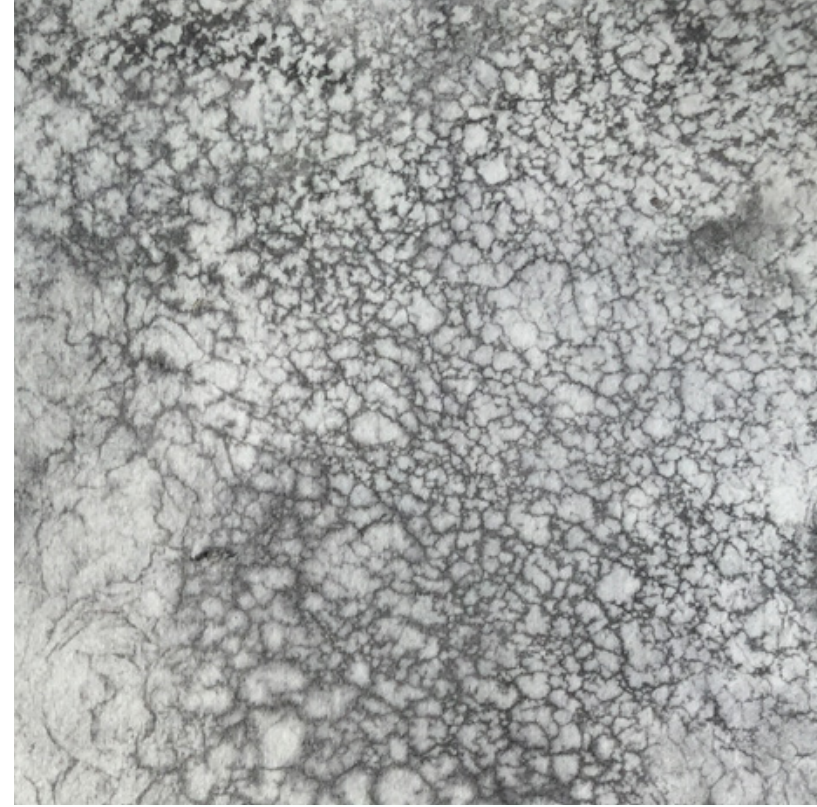
Previous Spread: Frost Drawing 2 and Details
55 in. x 55 in. (Figure 5.15 – 5.17)
Created outside with air compressor, rags, body, water, and ink.

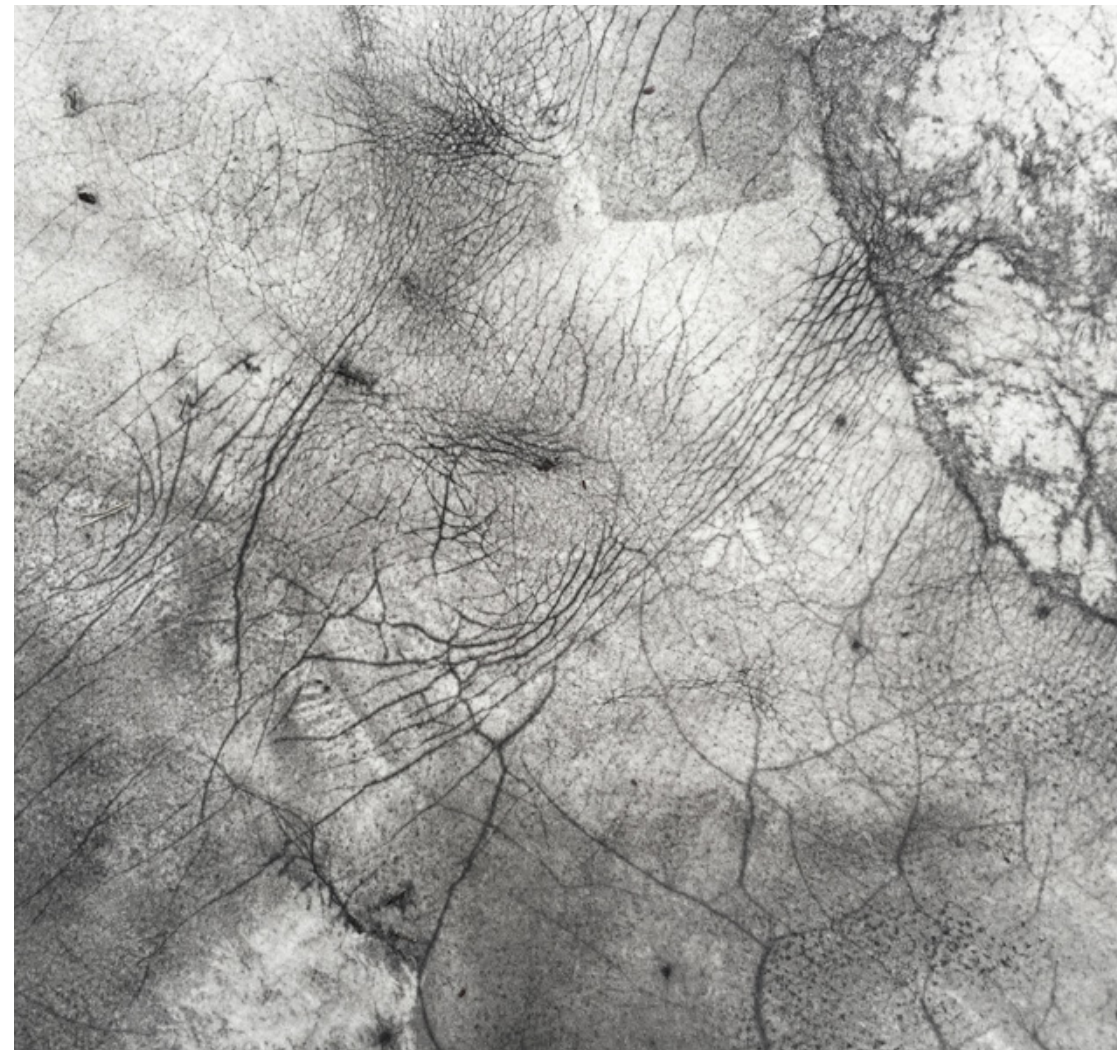
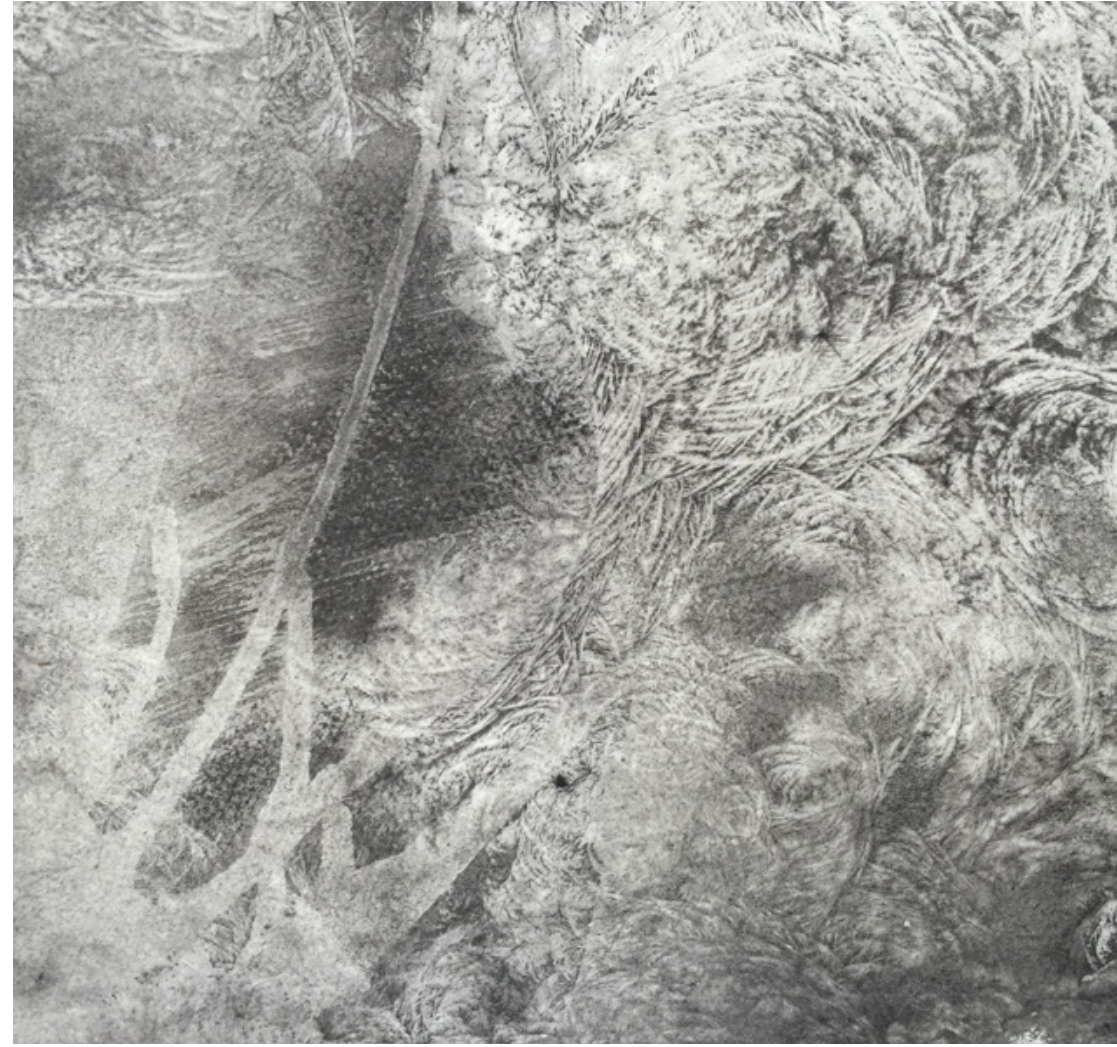
Below: Process Outline (Figure 5.18)
The order of materials and methods used to create the frost drawings.

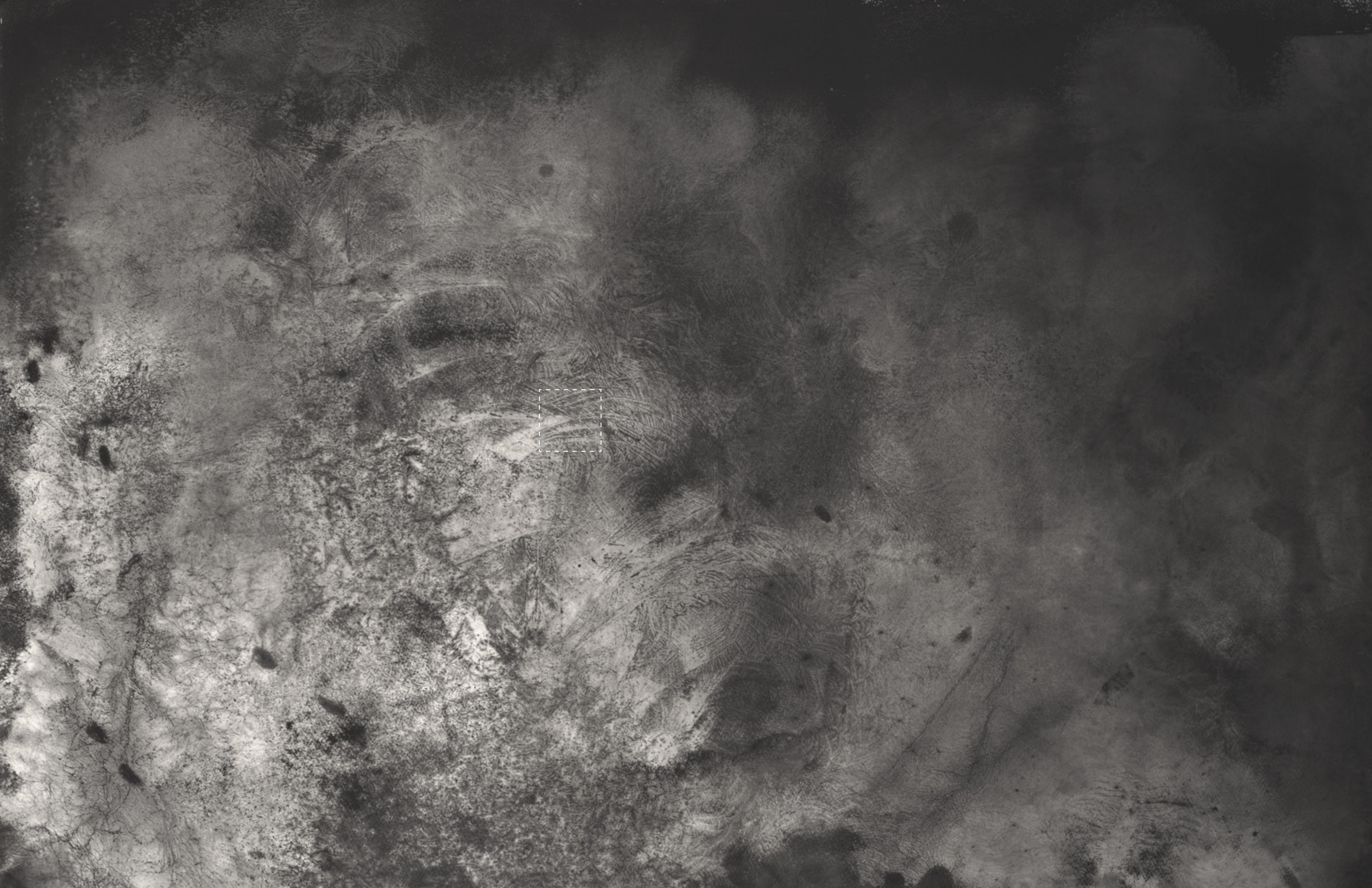
Right: Drawing Space (Figure 5.19)

Following Three Spreads: Frost Drawings 3 – 5 and Details
24 in. x 36 in.; 55 in. x 55 in.; 24 in. x 36 in. (Figures 5.20 – 5.26)
Created outside with spray bottle, hands, rags, water, and ink.



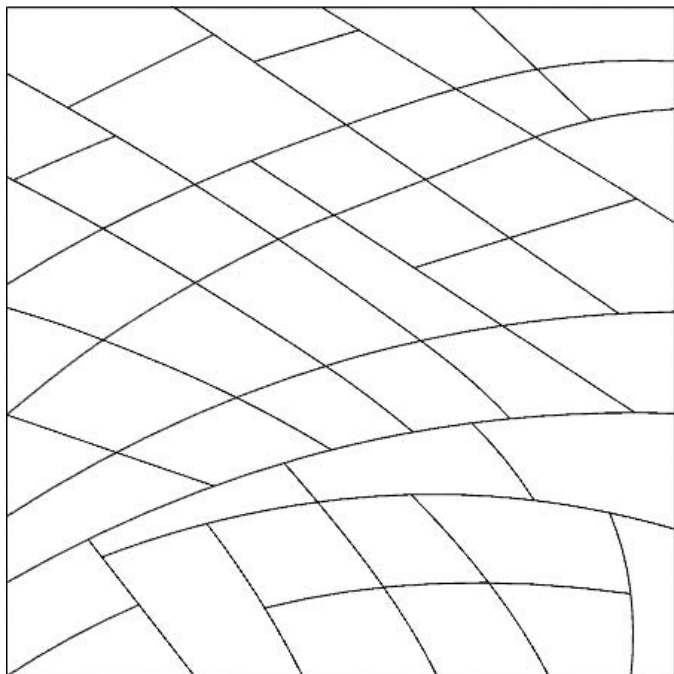
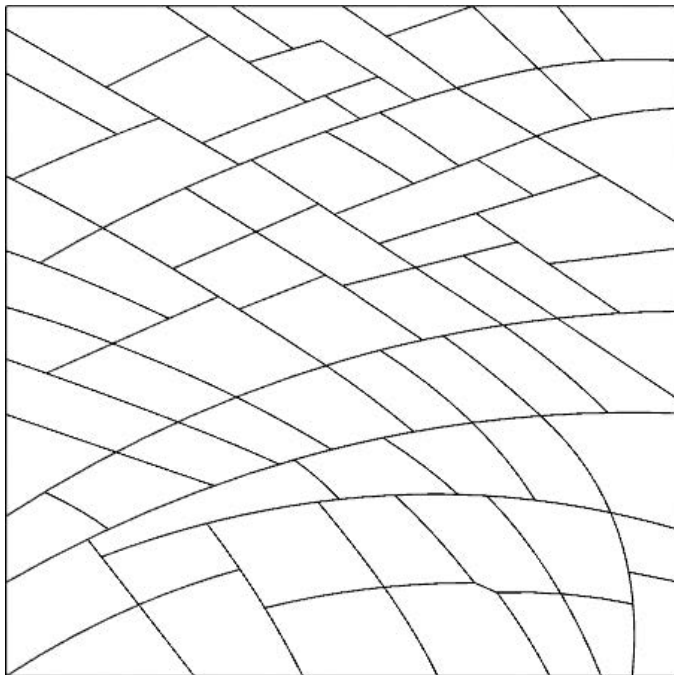








Ice Drawing Inspired Panels (Figure 5.27 – 5.30)
The selected area of Frost Drawing Five (indicated in the previous spread with a dashed white box) was used as inspiration for the panels of the installation art. Geometries were abstracted as a line drawing from the selected area and the line drawing was used as a reference to mill out panels from quarter inch birch plywood.



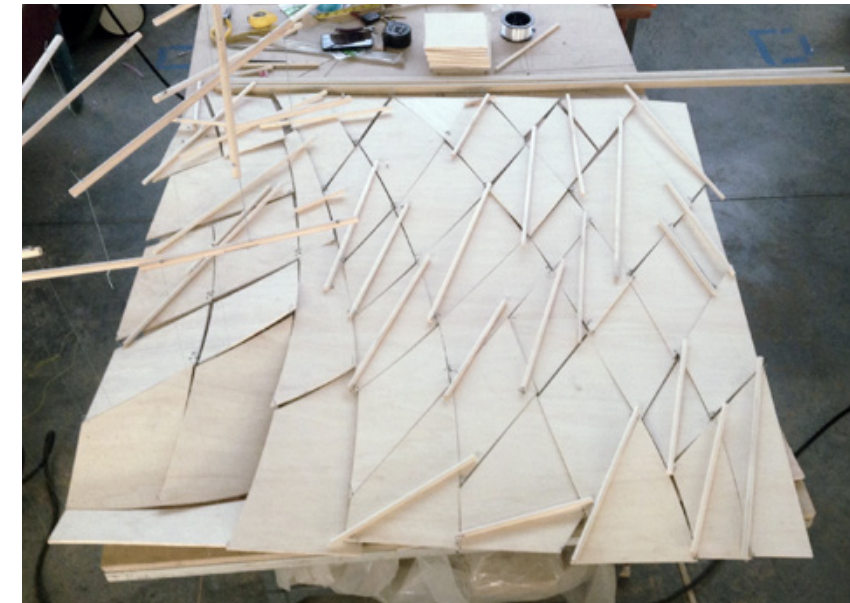
Application : Sculpture : Ice and Driftwood

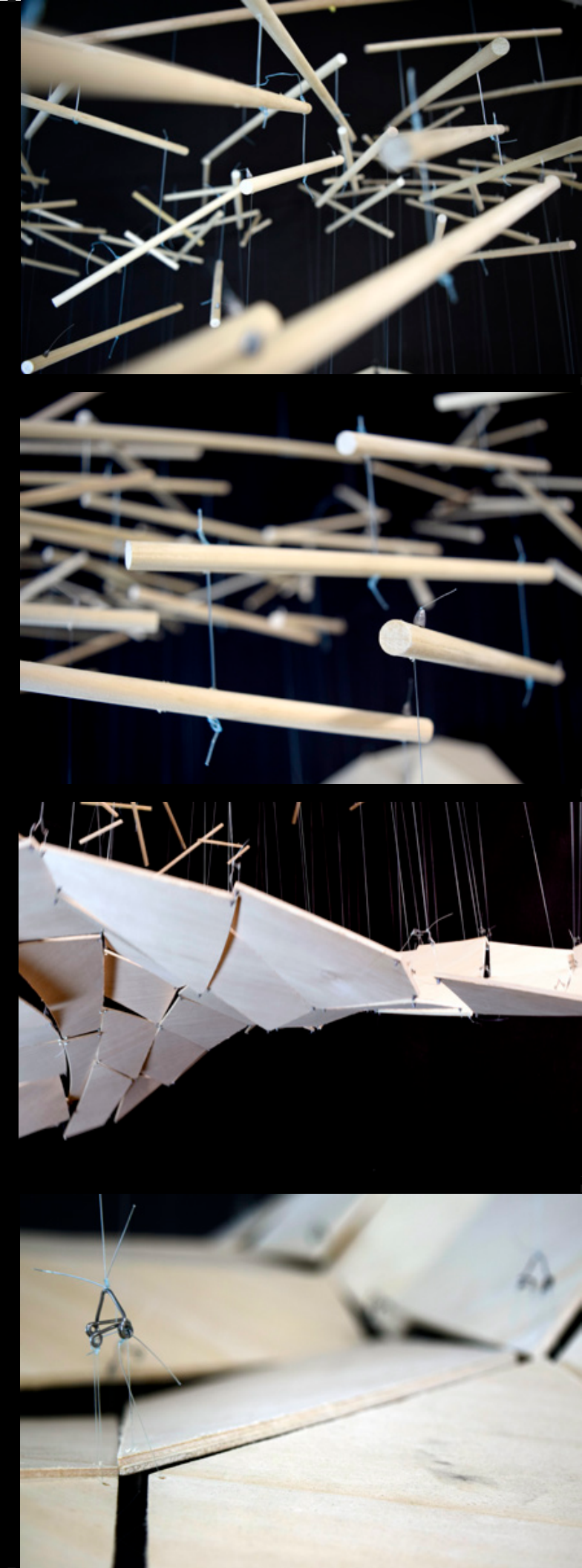
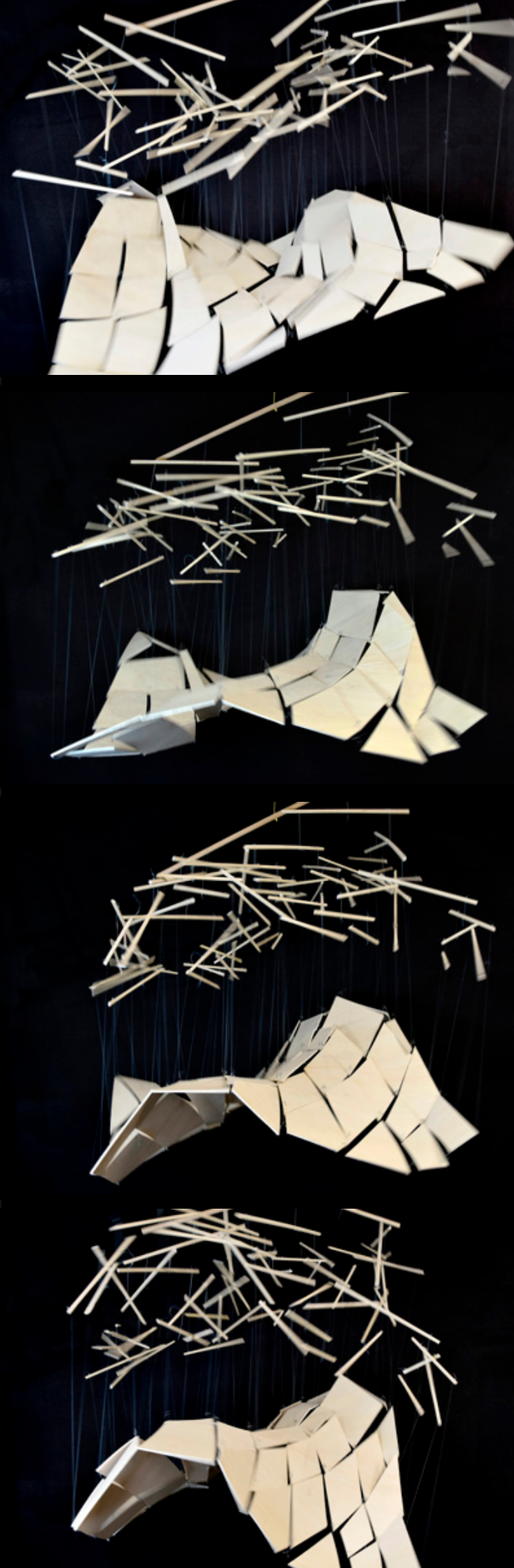
The final installation piece, inspired by the motion of ice sheets and driftwood on the lake, took its formal inspiration from a pattern created in the Fifth Frost Drawing. The pattern resulted from water being brushed off the paper as it was freezing. This motion disrupted the rosette crystallization and caused linear, but interrupted lines to form. The irregular and twisted grid provided enough consistency for the motion of the mobile to transfer to the panels, but enough irregularity to create a variety of motion across the form.

The form also allowed for the dowel rods to be sorted in a way that evoked the flowing yet overlapping pattern of branches that had collected in the cove on site. The individual corner connections required custom wire connections to be made to space out panels. Fishing string and fishing weights were used to connect the dowel rods to the panels.

Upon connecting all the panels, I raised the dowels up by a central string. The sculpture was out of balance because I had to guess at the center of mass due to the dowels being interconnected. After raising up the dowels, I was able to adjust the balance points to correct the major imbalances. But at rest the panels took on an unexpected, yet beautiful form. Depending on how the mobile is moved, the sculpture reacts as if on smooth or rough waves. As the panels collide they resonate with the sound of driftwood on moving water.

Right: (Figures 5.31 – 5.33) Process of arranging, connecting and raising the dowel rods to support the panels.





04.25.16 : Reflections

Hours of bending wire and tying string, the smallest parts taking the most time. Eight fishing knots for each four-corner connection. Drilling holes, guessing the balance, trying again. Dropping tools, tangling string, staring. Slowly building it up, but not able to test it all at once, holding parts in my teeth and balancing as many as I can, carefully placing them back down to not tangle. Patterns started to form, more knots, more string. subdividing the last sections, larger dowels to support it all. Pulling upward, dry bones bouncing to life, clattering, tangling, untangling in the air. Panels out of balance. Adjusting one shifts the rest, carefully planning which adjustments to make, crafting the

form of the resting panels. Interestingly, the imbalance typically manifests in one area at a time, many minor imbalances compile into one tectonic breakage. I can't help but feel a comparison to the complexity of balancing daily life, where we work to balance all the parts but all the minor failures compile into one area, but making a correction in that area won't solve the problem, if anything it will just shift the problem somewhere else. At first there is a sense of defeat attached to this sensation, but with each adjustment the imbalance is gradually shifts and a carefully sculpted form emerges. Every piece interconnected, pulling each other along, pushing each other out of control, searching for a balance between it all.

Left: (Figures 5.34 – 5.37) Images of the installation in motion.
Above: (Figure 5.38) Long exposure of installation in motion.
Right: (Figure 5.39 – 5.42) Details of the final installation.



Afterword



The exploratory process used in this report consisted of explorations of numerous site qualities and led to refined expression of those qualities. Ultimately the studies harnessed the pattern and motion of ice and driftwood into a body of art works evocative of a specific site experience. Overall, The findings represent my understanding of the project site and demonstrate the relevance of analytical and creative making methods in understanding and responding to a site.

Personal Development

Through analytical and creative studies I developed my experiential awareness of site and my ability to create site inspired design responses. I had begun by observing what I saw, but through this process learned ways of revealing information hidden beneath the surface. In this report I focused on the pattern and motion of ice and driftwood on the lake, but many other phenomenon could be studied as well. Some other studies from the site could include the geological pattern of stones and fossils, how plant and trash patterns indicate various flood levels, the material formations of driftwood in the cove, and the 3D crystal patterns formed in morning frost. An example of how a visual form reveals site history can be seen in figure 6.3, where a dead tree hangs from the branches of a younger tree. The trees were located on the ridge, twenty-five feet above the water levels at the time of my study. The dead tree created an intriguing and unexpected form in the sky, but its presence held even more significance by indicating that the water levels had reached higher than the driftwood on the ridgeline indicated. I realized the landscape contains many indicators of site processes that have occurred. Aware of this, I learned to investigate what processes have led to a site's current form, not just document the beauty of its forms.

Further development

Both the experimental process and the individual outcomes of this process (the drawings and installation art studies) hold rich potential to be

developed beyond the conclusion of this report. I am interested in finding seasonal equivalents to the frost drawings. These studies could be the patterns of worms crawling through the rain and mud of spring, the cracks formed in dried earth in summer, or the decay and pattern of fall foliage. With these possibilities in mind, I also recognize that I am more interested in directly experiencing the impacts the seasons have on the site than speculating on the differences.

During this study I was surprised at how many processes occur on the site each day, week, and season, even in winter. I was surprised by the rich information I found in winter because most of my studies of other sites have occurred in warmer seasons. The landscape is in constant flux. Each moment reveals information that would likely be missed in other seasons. I believe understanding site processes in other seasons would lead to a deeper understanding of occurrences that span the seasons and give the site its overall character. I see the drawings and installation art as snapshots of temporary qualities in temporal landscapes. But I also see that multiple snapshots throughout a year would reveal the overall breathe of the landscape in how the seasons and years blend together into the landscape.

The sculptural studies strengthened my commitment to developing analytical studies along with creative studies. While creative studies were important in the process, the sculpture could not

have been fully realized without analytical studies. Only after multiple digital and analog tests and failures was I able to create a sculpture that evoked a snapshot of my site experience. This physical expression was an important step in communicating an experience in ways drawing and writing cannot.

The outcome in this report could be furthered by considering the impact of mobile installations at different scales. Interior spaces could be transformed with mobile ceilings that move with the air currents of a building. At a fantastical scale, the shifting tension between panels could transform an urban space as people move through it.

The installation art in this report was an abstraction of site qualities. But the final piece contains a rich array of sounds and experiences itself that can be the source of further studies, abstractions, and refinements. The study would no longer be about directly evoking a site experience, but about responding to the experience of the installation art.

Professional Development

Budgets and time frames limit the energy designers and firms invest in investigating site information and design possibilities, but an exploratory process of site inspired making is valuable not only for the site information that is revealed, but for the design insights it may lead to. The processes of a landscape may be understood at an analytical level through soil samples, geological surveys, plant samples, and hydrological studies.

But this information, often delivered digitally, does not involve the designer's direct engagement with the site. When this data is collected and utilized only through other sources, the designer misses out on unexpected inspirations and a site understanding that exploratory site making provides.

Floating Tree (Figure 6.3) Dead tree left hanging in a younger tree by previously high water levels in the lake.





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Image Citations

Appendix : Extended Literature Review

Cultural Roadblocks in Creative Digital Exploration:

An important aspect of Resch's work is his demonstrated ability to draw inspiration from the surrounding world. Grasshopper software designers have made important steps in this direction by creating definitions that replicate natural growth patterns. A primary example is delaunay triangulation. The delaunay triangulation is a calculation that was written in Grasshopper script and publicly shared. Now, the use of this definition can be seen in many designer's works; whether in the facade of a tower or the detail of a lamp shade.

The capability of design tools has remarkable implications in allowing ideas to be immediately shared and implemented globally. But, on the negative side, when ideas are shared in this manner they can be used unsparingly by others who do not understand the functional purpose or the concepts that make the form possible. What results is a new aesthetic that becomes ubiquitous and overused, ultimately detracting from the original significance of the concepts. With new technology we are overwhelmed by immediate possibilities and visually interesting definitions such as these, but we should be careful to understand how and why a definition was created.

Resch spent a lot of time making "cool" objects, but he did not make them just for the visual appeal. He made them to explore ideas and unlock new concepts, each exploration lead to new questions and new explorations. It is easy to be

mesmerized by technical feats provided by digital techniques and forget the ideas that make the technical feats possible. But, by looking deeper into these concepts, a designer may unlock new possibilities for tools instead of replicating the obvious (Lynn, 2004, p. 11).

Digital Scripting as a Design Tool

Mark Burry (2011), an architect and programmer makes an argument for the importance for designers to understand and have control over the tools they are using to design and to use the tools to increase capabilities. Burry states "Programming is useful in handling information beyond our perceptual capabilities" (Burry 2011, p. 69). He proposes that algorithmic modeling is important in this regard because it allows the designer to structure the logic of the tool as well as the design.

Burry (2011) argues that by having control over the tool we are using, not to mention understanding how it works, we increase the range of capabilities we have with the tool. Grasshopper gives designers control over the 3D modeling program Rhino, by giving a visual interface for the 3D commands to be parametrically modeled in. Most important in Burry's argument is the implication that we by controlling how the tool functions it can become part of the solution. In addition to problem solving, scripting a sequence of commands can allow the designer to efficiently investigate design iterations without manually recalculating structural dimensions for each possible form (Burry, 2011).

The relevance of design scripting also comes with hesitations and criticisms. Some criticize the tools for the time it takes to write the script and that designers may focus more on the quality of the script than the quality of the actual design (Bell, 2015). I would compare this to a common criticism of Ian Mcharg's (Mcharg was a landscape architect and writer who wrote *Design With Nature*, describing a process of ecological site analysis) process: that designers may rely too heavily on the model to provide the answer, rather than focusing time on understanding elements that are not represented in the model. However, in my experience, this step-by-step scripting process can also be considered a benefit of the process, because the designer must be aware and should carefully decide how each element of the design impacts the whole. Every step of the algorithm is defined by the designer, meaning that the algorithm becomes a sort of diagram of the design logic. This is beneficial because I can look back on what tools are being used and why, without having to remember all the calculations within that process. To me, the completed definition is profound, not because it can be edited in real time, but because the designer can step back from the specifics and think about what tool or step could push the concept into new ground. The visualization of the algorithm and instant feedback of its output sets up a playground in which the mind can explore new possibilities without being bogged down in calculations.

Utilizing Analytical and Formal Capabilities to Respond to Complex Inputs

Zaha Hadid, well known for her geometrically complex architectural designs, began investigating her parametric design approach long before she had the tools to calculate or construct her designs. She used painting in her early career to investigate form and movement. From this perspective, her work seems to not be advocating the use of digital tools as much as confronting the implication of technical advancements (Lovell, 2015, p. 7). She began with the analogue development of imagery, investigating how to respond to the expansive cultural and physical context of a site. She viewed the context of a building as the input parameters, pulling in lines from landscape forms miles away from the site and colliding them in the building (Wilson, 2015, p. 40).

While her economic success has been greatly aided by the capabilities of the technologies she utilizes, her architectural success has been dependent on her ability to resolve the program, site, brief, and materials within the space instead of allowing the influences to be segmented and delegated to their individual roles (Bell, 2015, p. 48).

In my opinion, a fascination with a tool's capability may distract from a careful use of the tool. But it is important that any design tool be used as an aid for experiential and meaningful design that responds to its environment, rather than just being used to create spectacular forms.