Design Values, Craft, and Futures

How do the values, skill, and thought processes embodied in craft translate to our future design paradigms?

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Abstract

This thesis project began as a study in traditional craft methodologies and ways of understanding design with the goal of learning how to better inform our often technologically focused futures. Over the course of the project it evolved into a study in the process itself and became an exploration of what it means to engage in material centered design research and learning. Through a process of material engagement, as well as learning through making with both analog and digital fabrication tools, I took on a series of studies to better understand for myself how to apply a craft and skills based learning mind set. As my work progressed I evaluated my studies based on different levels of perceived value. I was able to synthesize the learnings into a framework that could be used to explore how both the tangible and intangible qualities of craft might help us to inform our design exploration and research process methods.

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Introduction

As designers, in our work we often implement a user centered design research process that consists of phases such as finding a problem, researching and exploring, generating ideas, prototyping those ideas, evaluating them with stakeholders, refining them, and coming up with a solution. This thesis project was taken as an opportunity to explore a somewhat different type of working process that, though very much still human centered design, has been grounded and focused in materiality and making centered learning methods first. It seeks to understand what these methods might look like as alternative or additional ways of approaching the human centered design research process. As a designer who has had more exposure to research and digital design than actual physical making and craft, I was curious to explore this other way of thinking. I wanted to know what learnings from it might mean for the way that I, or someone with a similar background, approach the design process and design thinking methods.

In this project I have addressed the physical process of making as a means of exploration into another way of approaching design research processes. I have focused mainly on the area of physical making and craft and not on digital making and craft, though my learnings could be expanded upon in this area in the future. This project started as a study traditional craft methodologies and ways of understanding design with the goal of learning how to better inform our often technologically focused futures. It has since evolved into a study in the process itself and an exploration of what it means to engage in material centered design research and learning.

Significance

The way in which we design today is very fast paced. With advanced technologies we can design products, buildings, systems, and so many more things all within a digital world. We are not always required to take the time to stop and consider how they would impact our physical world and the systems within which they are situated. We also have many different types of methodologies and research processes that we can choose from when deciding how we want to explore a problem or challenge. The craft and making traditions of the past are not always the first to be considered or encouraged as a way of understanding how to approach a design problem. Taking the time to understand and immerse oneself in the physical making and craft process could allow for the ability to explore a different method of design thinking.

Design Approach

I approached this project with three main objectives that I wanted to explore. First I wanted to examine how we learn from more traditional craft based design models and how that evolves with the addition of new technology. Second, I wanted to engage in a materials based design exploration process as an approach to inform my design research methodologies. And third, I sought to establish a framework that would allow me to explore how I might take that knowledge forward as my design process and work changes over time.

In developing the process and methods that I would follow for my project, I started in way that might almost seem backwards. Since I wanted to learn principally through making and craft, in order to do that I needed to look beyond the process of, "find a problem, research, generate, prototype, evaluate, and define a solution" that is taught at Carnegie Mellon. I began by learning basic craft through a series of small studies. I then expanded upon each of these studies by varying intent, materials, technologies, and techniques involved. After evaluating my learnings, I began to also learn from outside craftspeople, and finally developed a framework to explain my learnings and process.

Part I

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Literature Review

Literature Review

Over the past year I have been researching and learning about the philosophy and methods behind traditional craft. In order to begin to understand craft and the physical making process, and to inform my subsequent studies, I read works that focused on understanding materiality, values, the mind, the body, and the artifact. Each author came to the subject with a slightly different approach and way of examining how these elements impact the way in which a craftsperson works as well as how they impact the society or context into which they are placed.

Craftsmen of Necessity

In *Craftsmen of Necessity*, Christopher Williams writes about the nature of craft from its' most basic state. In his writing he addresses the relationship between technology and craft and the evolution from handmade tools, and an economy where all things were custom made for both the craftsperson and the purpose, to tools and objects that are made on a replicable and mass produced scale. In his description of a craftsperson working with wood he writes that, "builders know that wood will warp, sag and lose some of its rigidity over a long period of time, so they build to accommodate these changes."¹ Traditional craft requires customization of the design not only to fit the object's intended purpose, but also to respect the materials that it is made from. He goes on to say that, "Each kind of material has its own form. Artisans come to know their materials and just which forms they assume comfortably"² and

¹ Christopher G. Williams and Charlotte E. Williams, *Craftsmen of Necessity* (New York: Random House, 1974), 53.

² Ibid., 161.

"they have developed an intimacy and an intuitive knowledge that goes beyond the spoken language."³ If the maker or craftsperson were to try and force fit a function to the wrong material or medium and didn't fully understand and respect the context in which they were working the outcome would not be as functional or desirable as possible. It is important to fully engage with the material to know it at a deeper level before working and designing with it.

Williams also addresses the idea of value in craft. He writes about the wear and weathering of an object over time and with repeated use. It may be something that could easily be replaced, but with the elements of time and the environment having left their imprint, the object has become highly valued by the owner because these marks cannot be replicated. Not only do time and the environment add value to a crafted object, but the maker or craftsperson also passes on a piece of themselves in the object or design. Williams writes, "Before the product reaches the hand of the user, it is something personal to both. There is a recognition that the maker is giving the user part of himself, his knowledge, his energies and a segment of his finite life."⁴ This passage hints at the deeper meaning of a creating something by hand that is not exactly replicable. There is a personalization and uniqueness of thought and intent and it creates a connection between the person making the object and whom they choose to give it to. This creates a value in that piece, which can be understood by both owner and craftsperson. This is a connection that is often lost in the mass production or standardization of objects over time.

³ Williams and Williams, *Craftsmen of Necessity*, 161.

⁴ Ibid., 176.

In relation to the idea of the craftsperson passing on a piece of themselves in the object or design, Williams also begins to look at how the knowledge of the body impacts craft. It is not only an intuitive knowledge but also a physical knowledge that the craftsperson must retain. He states that, "If the hand is considered the first part of the tool, the material moves through a transition from the softness of flesh to the harder structure of wood to the strength of iron."⁵ He considers the craftsperson or artisan an integral part of the tool in traditional craft and making methods. As making becomes more standardized this connection between the tools and the maker and their knowledge and skills becomes lost. It is a combination of both thought and physical knowledge and experience that create value in a crafted piece. Williams states, "The work of most artisans is a total involvement of mind and body."⁶ Without the integration of both physical knowledge and detailed thinking there is a gap in learning and understanding that is created and our connection with the process, materials, and outcomes becomes incomplete or lacking.

Thinking Through Making

When a designer or craftsperson makes an artifact it is important to think about the different methods of making and how various processes impact the ways in which our knowledge, ideas, and intentions are imparted on the object or artifact. The diversity in the processes used in making can contribute to the creation of knowledge and push us to think in new and more innovative ways. In his lecture Thinking Through Making, Tim Ingold states, "Thinking through making puts that in reverse – a way of knowing from the inside – knowledge not created through encounter of minds that already understand concepts and frameworks - rather knowledge grows from engagement with materials things beings around us, inside of being in an unfolding of life."⁷

⁵ Williams and Williams, *Craftsmen of Necessity*, 105.

⁶ Ibid., 169.

⁷Tim Ingold, "Thinking Through Making" (lecture), October 31, 2013, accessed October 24, 2016, https://www.youtube.com/watch?v=Ygne72-4zyo.

If one considers making beyond just an engineering sense, there are many new ideas that a craftsperson must be much more attuned to. Ingold states that, "To think through making is to participate in the weave of the meshwork of the world."⁸ Thinking through making is a way to interact more directly with our physical world and to help us recognize elements that we may not consider if we were not physically engaged with them in this way. By prioritizing processes that span beyond the technological development that is supposed to make our lives easier, we are compelled to slow down and stop to consider more of the factors that push and pull us in particular directions. With an increased awareness we can then design with a better understanding of challenges that we might face and also new approaches to confronting those challenges, which could reduce potential problems later on.

In his lecture Ingold states that, "We cut knowing off by wrapping it up in our predefined concepts and frameworks"⁹ and "the more knowledgeable we become the less we pay attention to what's happening in our environment."¹⁰ By following predefined methodologies and frameworks for design that are not always fluid enough, we limit our ability to learn through craft and making. By having an understanding of physical making and materiality, we can become more aware of alternative or additional possibilities of how we can approach the creation of objects and systems that impact the way we live and function in our society. Through learning to think more in this way, we are able to stop and consider the implications of what we create and how we are creating it, to better inform the design working and thinking processes that we are using.

If technology enables us to act and create with increasing efficiency and speed, then at a certain point we will inevitably have to confront the problem where we haven't thoroughly considered what we are creating and why we are creating it. If we allow making to run ahead of thought and do not give our mind the time necessary to process all the different factors involved, then we are losing out on the potential to realize new paradigms and solutions to design problems or challenges that we face. By taking the time to learn through craft and the making and not let our working

¹⁰ Ibid.

⁸ Ingold, Thinking Through Making (lecture).

⁹ Ibid.

process be overrun by technological constraints or demands, we will be giving ourselves a chance to create things that can have a more unique and thoroughly considered impact and outcome.

The Body in Pain: The Making and Unmaking of the World

As designers, we have the ability to greatly influence the way in which an artifact or object imparts knowledge upon its user or impacts the way in which they interact with or think about the world. In *The Body in Pain: The Making and Unmaking of the World*, Elaine Scarry states, "while there is no part of making that is empty of ethical content, this particular attribute carries within it a very special kind of moral pressure."¹¹ This statement supports the suggestion that the craftsperson has a great deal of responsibility in their position. The way in which they make things, both in the methods and material chosen as well as in the functionality designed into a piece, has the ability to impact and change the way people who interact with these objects perceive the world around them, putting the craftsperson into a very powerful position.

One of the most important factors in the craft and making to consider is also the material which something is made from. The different properties, associations, and affordances of a material not only reflect the society, resources, and values of the designer who chose them, but they can also have a great impact on shaping the thought structures of those societies. If technological constraints influence how we design our artifacts and make material choices, then will the morals and politics of the technologists and engineers be the only ones reflected through those objects? We need to be certain that there is room for a wider array of thought and inclusion in the artifacts that we make or we are risking a loss of diversity and many thought processes.

Technologies begin to become actors that add new variables and requirements to the selection of the materials and therefore add a new layer of value into that object, which the designer might have less control over than with previous methods. Scarry states that, "Through objects, human makers recreate themselves, and now

¹¹ Elaine Scarry, *The Body in Pain: The Making and Unmaking of the World* (New York, NY: Oxford University Press, 2006), 281.

this newly recreated self finds that it is no longer expressed in the existing object world, and thus goes on to project and objectify its new self in new objects. "¹² The use of new materials with changing technologies could also begin to signify the change in the human view of the self as Scarry has noted. The use of more technology based methods in craft could influence a change in the values of not only the craftsperson or designer, but also in the society in which that crafted piece will become an actor. An example of this might be in 3-D printing. If it is easy for the craftsperson to make a model on the computer and then print it before engaging with the material in a more tactile way, then they may begin to value the piece differently. If others know that the piece was made with a 3-D printer it they may possibly see the object as something more disposable or easily replicable, and not value the time and thought put into the design by the craftsperson in the same way as a piece that required more tactile engagement. A faster pace in the evolution of technologies potentially accelerates this shift in value and thought, but whether or not that is something that we should strive for remains a very important question.

In Scarry's writing she addresses questions of our own abilities to consider the artifacts around us and how they are impacting the way we think and choose to live based on how they are made. When referring to an artifact Scarry states that, "It will be found to contain within its interior a material record of the nature of human sentience out of which it in turn derives its power to action on sentience and recreate it."¹³ She looks at this idea of human sentience and our ability to think subjectively. If the thought process in creating the artifacts and systems that we live with and use on a daily basis is dictated by only one viewpoint or sequence of actions, in this case increasingly one that might be technologically driven, then will this impact our ability as humans to think subjectively about how we live? If we assimilate to this one line of thinking because it has become so pervasive amongst the objects that we use then how will we be able to break from it? It is important that we consider the language of the materiality of objects and if that really represents us and our goals in craft and the making of an object.

¹² Scarry, The Body in Pain: The Making and Unmaking of the World, 320.
¹³ Ibid., 280.

Opaque and Articulate Design

In Opaque and Articulate Design, Albert Borgmann takes on the ideas of traditional skills of artisans and artists and how they have translated to modern practice and design processes. There is a difference between aesthetic design skill of the artist and functional design skill of the artisan. The ability to blend the two puts the designer in a unique position think critically. The design engineering of a product and the aesthetic qualities are interesting elements to explore to learn exactly how and where the designer is, or perhaps should be, asserting their skills and thought process to afford the most transparency to the user.

Our lifestyles and the products and systems with which we interact are often transitioning to incorporate the digital technology that defines the solutions and interventions for how we live today. Is designing an exterior to hide the inner workings of our designs and thought processes allowing us to be as knowledgeable about the things that we use as we should be? We can begin to see how the artifacts and objects that we are using are creating a focus on the aesthetic and taking away our knowledge of the inner technology making things work. How can we as designers shift this focality to allow for new thought?

In his piece Borgmann begins to illustrate the shift towards the concealment of our technologies when he states, "The tools and implements that humans have forged to engage their world have, beginning with the industrial revolution, divided into an impenetrable machinery and an opaque and colorful surface that conceals the machinery."¹⁴ There is a split between the ideas of more aesthetic design and more functional design, an artist's design and an artisan's, which begins to reflect the rapid growth and advancement of technology in society. Look at a phone for example. Years ago one could take apart the phone, see the inside, and potentially be able to understand how it worked based on the design of the form. In comparison, when a smart phone of today is considered, the way in which the device is constructed does little to make us aware of how the element got there. We cannot understand the process of how the device works by looking at the product and we often don't have access to even take it apart without advanced technical skill or knowledge.

¹⁴ Albert Borgmann, "Opaque and Articulate Design," *International Journal of Technology and Design Education* 11, no. 1 (2001): 5, doi:10.1023/a:1011238324239.

Borgmann also begins to look at this problem more critically through the lens of what we are losing through the concealment of the mechanisms involved in the function of the artifacts that we are using. "There is nothing wrong with the current lusty play of colors and shapes except that it occludes the task of design that comes to giving the fundamental appropriation of reality a telling and engaging form."¹⁵ Good design can be used to inform through form and cause the user to think about the implications of their actions with an object as well as the larger system that it might be working within. This would allow the user to make more informed decisions about the way they are interacting with their world, forces impacting allocation of their time, and guiding the way in which they are being influenced to think. Borgmann further explores this paradigm of design when he looks at the logic behind much of our technological development.

Where a technological device has reached the height of convenience, engineers have taken over the construction of the underlying machinery, and designers are left with superficial if glamorous assignments. We must appreciate the logic of this development. Impenetrable and unintelligible surfaces are the inevitable consequence of the disburdenment promised by technology. Impenetrability means that skillful intervention and careful attention have been obviated and are in fact repelled.¹⁶

By trying to relieve some of the burden in our lives through the development of technology we have essentially limited our own skill base and are no longer pushed to think about detail in design. The skill and attention to detail involved in the craft and design process add a new layer of thought and understanding to the development of not only the exterior aesthetic qualities of a design, but can also contribute greatly to the ability for the inner workings of a piece to become more transparent and work better for the end user. If the role of the designer is overlooked in this space and part of the process then a valuable mode of thought and consideration will be lost, detracting from the overall effectiveness of a design.

¹⁵ Borgmann, "Opaque and Articulate Design," 5.

¹⁶ Ibid., 7.

Technology allows us access to a huge opportunity space in both the creation and functionality of our designs. Such a large range of options that come with this design space can sometimes be troublesome in that it may hide many different ideas and influences that we don't even realize are shaping the way we think. As designers we need to be more aware of the power of the form that we are tasked in creating, whether physical, digital, or both. We are shaping the ways people think and behave, as well as their ability to learn and function in the world. We need to be using design to start setting the boundaries for technological innovation and guide it in a productive direction that opens it up to a wider range of channels of thought. Borgmann goes on to state that, "Opaque design is confined to the texture and color of surfaces. Articulate design shapes objects and environments that are articulate in the sense that they are crafted to some depth and in the sense that they speak to us in an intelligible and inviting language."¹⁷ Design should be used in an articulate manner that allows for a more open field of access to everyone. Rather than confining it to the surface and using the skills of designers to hide difficult and advanced technology, it is important that we can harness the more thoughtful skills of craft in the sense of the artisan. Making artifacts and objects to represent the depth of thought that was intended in their creation and to articulately impart that on the user should be of the utmost importance in the designer's process.

¹⁷ Borgmann, "Opaque and Articulate Design," 9.

Part II

Research Exploration

Research Exploration

For the research exploration portion of this project, I worked over a span of ten weeks during the fall semester to immerse myself in the making process. In this time I undertook a series of five different micro studies in making and craft, so that I could better understand some of the concepts and themes that I had been reading about in the literature I was reviewing. I used the initial four studies to make small simple items such as spoons, a tea light holder with tray, and a bookshelf. These studies helped me to familiarize myself with both the tools and materials as well as to learn the proper way to work with them. For my fifth study I created a series of bookshelves of the same design, but with varied materials and making processes. I did this so that I might better understand how these variables impacted my working and craft process as well as how the introduction of different technologies changed the design process for the piece as a whole. Throughout all of these studies I was able to begin to understand some of the concepts that I had read about such as the craft of certainty and the craft of risk, and the additive and subtractive design processes. By physically engaging with the material and learning how to make, I could better understand the mindset of the craftsperson and the rationale behind their decision making and design processes.

A Study in Form I

In the first study in craft that I undertook for the project, I learned how to make a pair of wooden spoons. I began with this object because it was a fairly simple design, which allowed me to get comfortable using some of the more basic tools and gain confidence in my abilities. It was a good opportunity to be able to learn how to control my hand and become adjusted to the amount of resistance that I could expect from different materials as I used them in the machines before moving on to more complex projects.

I started out working with a piece of foam that was cut into the same shape as the wood that I would be using. This was done to allow me to practice with maneuvering the piece to make the cuts that I wanted before moving on to work on the actual wood. The band saw, which was the first tool that I learned for this project, was used to cut the pattern on the piece of foam, as shown in figure 1. I appreciated the use of a different material to prepare me for making the final piece as it gave me experience that I did not have, and an understanding of the form and machine. The practice piece also gave me the opportunity to think more about the idea of fit. As is shown in figure 1, each piece had to be taped back together before the next cut could be made in order to align the cuts on multiple axes and create the final form. By continually reassembling the piece I was able to better understand how the form





of the spoons would emerge, and how each decision I made and step that I took impacted the outcome of the next.

The creation of the final wooden spoons followed much the same process as the practice model. As can be seen in figure 2, the spoons did not come out completely identical and had certain parts of the handle that were thicker on one than the other. Those imperfections and varied qualities could be seen as a mark of quality and individuality making them unique. This is something that wouldn't happen with a more mechanized process, but did that make them more valuable? As the craftsperson, I needed to consider if this was something that I wanted to highlight and celebrate, or to just make do with and work out through sanding and other means later on. The fact that I was able to make that choice for each individual piece gave me more power in the design decisions related to the piece. This study also introduced me to the concepts of additive and subtractive processes, this being a subtractive one because I was cutting away material to allow a new form to emerge. It also made me more aware of how the craftsperson must plan their process around their final intentions for the piece and make decisions along the way accordingly. If I hadn't understood how each cut I made would impact the next, I would have ended up with a very different outcome.



Figure 2

A Study in Form II

For my second study I learned how to use a lathe to turn wood. The project was to create a tea light holder based off of an example inspiration image. I started by creating shop drawings with measurements and design intent for myself to follow. I also learned how cut the block of wood that I would be using to the correct size on the bandsaw and then to set it up on the lathe, as is shown in figure 3.

Throughout the process of turning the piece I learned that, when making something by hand it is important to pay attention to allowances because human error can sometimes be the most difficult if not impossible factor to control. It is a different level of precision that one needs to be aware of when making things by hand. I learned that this type of craft was considered to be the craft of risk. From my earlier reading I understood that this was the type of work that relied on the skill of the maker and could not be pre planned for in such a way that mistakes could be avoided during the making process. As I was in the process of creating the piece, there was no way to exactly measure out where all of the coves and curves would be to match the drawing exactly. I would have to rely on my intuition to make decisions on how the piece would look. It was not a precise process that could be replicated with exact certainty and it required a lot of in the moment decision making by the person crafting the piece.

My final piece, as seen in figure 3, came out in a similar shape to my inspiration, but in the process of turning it I began to understand much more about the nature of the materials. Though I would have liked to make the neck of the piece much thinner, as it appeared in the inspiration photo, I learned that as a novice wood turner that was going to be difficult for me. The thinner that a piece becomes at a particular point such as the neck piece the more "give" the wood will have. With the material rotating at such a high speed, I had to be careful not to go so far as to snap the neck of the piece when carving it to be very thin. Making a design vision match what one actually creates can be difficult if you don't yet have the skill set to get there and it takes time to build up that level of precision in your work.

Another important observation that I made, after a few days of thinking back about the entire process in this study, was in regards to my physical role in the making. When turning wood on the lathe the craftsperson must be entirely focused on what they are doing. The dexterity and control exhibited by my hands could literally make or break the way the piece came out. The muscle memory that I was developing was integral to the nature of the piece and I was not just a craftsperson using a tool, but I was in a sense also the actual tool. It was my hands guiding the blades across the wood, determining the angles and necessary pressure, and judging just how far was far enough by feeling the give from the material as I worked. This reflects a point made earlier in the literature review in *Craftsmen of Necessity* by Christopher Williams, but it was not a concept that I could fully grasp until I had physically experienced it for myself through making and learning a craft process.

A Study in Form III

For the third study, I started to apply what I've been learning about craft and materiality to a process that was not based around working with wood for the finished product. I created a tray to go with the tea light holder that I had turned on the lathe earlier. Instead of creating the final piece out of wood I learned how to create a mold and to use a vacuform machine to mold plastic to the final form that I wanted.

The process began with making a mold out of a sturdy particle board material that would be easy to cut as well as simple and without texture, so that it wouldn't leave any marks on the actual piece. In figure 3 the finished mold material is shown. When working on this I learned that I really needed to take into consideration the type of materials that I would be using to create the form. This exercise also highlighted how differences in material might dictate the way in which something is crafted. Each material can withstand varying levels of force from the tools. It takes a knowledge of the behaviors and properties of the materials to be able to anticipate how they will react to various types of manipulation.

The process of vacuum forming also made me particularly aware of understanding the piece in three dimensions as well. Sometimes the craftsperson must design through modeling or in the case of molds, reverse modeling. They have to be able to think three-dimensionally about the different attributes of the piece before actually starting to make it, so that they know how to approach the fabrication and can visualize the way everything will fit together in the end. This also allows him or her to better make adjustments and improvisations throughout the craft process. This can be seen in figure 3, showing the final vacuform piece.



Figure 3

A Study in Form IV

For my fourth study, I learned about the preparation of a material from raw wood through to final assembly and finishing. In the study I made a small desk bookshelf. I started out this process by getting my material, two linear feet of 4x4 poplar wood that still had the bark from the tree on it. I went through multiple phases learning about leveling the wood, cutting it to be square and even on all sides, creating channels for assembling the pieces, drilling and measuring the holes for assembly, and all of the finishing design elements. These steps can be seen in figure 4.

Throughout this construction process I began to understand that there are many different factors that can affect the way that a piece of wood behaves. Elements such as the species of wood, the age, the level of humidity the space where it is being stored, or just the way that it grew originally may all impact how easy or difficult the material is to work with. These things all impact how the wood will behave even after being cut into standard sized boards. I learned that I could cut a piece and it might allow the wood enough give to revert back to its natural tendencies of curvature and potentially warp again or split over time because of this. Every piece of wood is different and individual in its characteristics, so the craftsperson has to have a deep knowledge of materiality and strong intuition in regards to the tendencies of their medium, to be able to craft a piece in the way that they intend.

In the process of making this bookshelf I learned about the importance of a craftspersons' knowledge of the various quirks and traits of any element that they work with. A craftsperson has to have an innate sense of the medium they are working in and it is important to work with the material and use its natural tendencies to ones' advantage. I also learned about having the ability to adjust and reevaluate the plan and process along the way. In woodworking there is a lot of estimation and measuring involved, but there is no guarantee that a piece is exactly replicable each time. All pieces will behave differently and outcomes will change with regard to skill and level of detail taken by the craftsperson. In this exercise alone, my classmates and I were all following the same directions and using the same machines, but we all came out with slight variations in our pieces that were specific to the craft style of each of us individually.





A Study in Form V

Study A

In this study I began to look at how I could use different digital tools to create the same bookshelf that I had created with non digital tools. I first decided to experiment with a laser cutter. I wanted to know how my design process would change and how the material and machine limitations would affect it. I was also interested in how the final piece would physically hold up and look in comparison to the first one that I had made by hand.

I started with the exact same drawings that I had previously used and with the intent to make my piece as close to the original as possible in size and construction. I began by using wood, but it needed to be different than in study IV, as the laser cutter could only cut up to 1/4" thickness, so I had to use plywood and combine several pieces to get the right size. The process of cutting the pieces was actually made more simple by using an Adobe Illustrator file that took about 20 minutes to create and then run on the laser cutter, as is seen in figure 5.

Because I was laminating pieces together, there was a margin of error that I needed to account for and there had to be space for adjustment. This new part of the process required precision, as the pieces had to be perfectly aligned. It also created room for error because small imperfections in the sizing of the plywood were multiplied with each layer. Additionally, there was significantly more time needed to complete this phase because each layer of adhesive had to dry and set before the next could be added.

I finished the piece by sanding down all of the faces until they were smooth. This, I learned, was not as easy as it had been with the solid hardwood though because of the way that the plywood is manufactured. It was quite difficult to get it as perfectly smooth a finish as I desired. The edges were also burnt black from the laser cutter, a material characteristic that I had not foreseen, and so had to make a choice to either leave this as a design element of the process or to remove it. I opted to sand down the burnt edges so that they would look uniform with the rest of the piece. This also made more sense from a functionality standpoint because the burnt element rubbed off on anything that it came into contact with and would not have been good to have next to books or other pieces on the shelf later on when it was in use.



Figure 5

Study B

In the next exploration, I constructed the same shelf using the same method for form V, study A, except this time I used clear acrylic material. I wanted to learn how the different material would affect my process of making. The initial cutting process was similar to that of using the plywood. I was able to use the same Adobe Illustrator template and the same thickness of material to create my pieces. My process began to differ when I started looking at how to assemble the piece. The acrylic material made the process much more time consuming and I had to rethink and adapt my methods and assembly processes to accommodate the change and still be able to end up with, as similar a piece as possible in the end.

The final piece did not come out exactly as I had anticipated. Because I opted to use a clear acrylic, this meant that all of the adhesive used to assemble and laminate the pieces together could be seen when it dried. Also, air pockets and dust were easily trapped between layers, making the overall look of the piece much less aesthetically pleasing. Although there are some instances of craft where imperfections can be celebrated as an important part of the aesthetics of the design, in this particular scenario the imperfections were clearly not intentional and made the piece look more like a work in progress rather than an actual finished element.

When using the acrylic I also learned that it was much more difficult to manipulate than the previous materials that I had worked with. I had to use special tools for assembly since the acrylic was so strong. I then had to do hours of hand sanding to hide various imperfections. In this case the material, end goal, and processes didn't entirely align. The material was extremely rigid, making it difficult to work with by hand as I had learned to do. I forced different elements together that were not necessarily meant to be used in the way that I had decided to use them. I could have avoided the extra time and effort that went into making this piece by choosing a more forgiving material that was easier to manipulate and that responded better to the tools that I was working with. Instead, by selecting a material that was not easy to work with and manipulate, I learned about working with constraints in design and how they can influence and impact the process. Elements of the process and final piece are shown in figure 6.



Figure 6

Study C

For the last iteration of my study, I used 3-D printing technology to understand how this would change or impact my craft process. I used a plastic thread material which was one of my only options since the printer can only work with specific types of materials. I decided to experiment with the 3-D modeling software and create the bookshelf as one solid entity. Because I had never used this particular software it took me about 45 minutes to figure out how to make the shape of the shelf. I had been working off of a 2-D drawing set and now needed to translate those drawings into three dimensions. The software was very complex, and even though the simplicity of the design was maintained, it still took several detailed steps to create the same piece three dimensionally. After creating the model it was sent to the 3-D printer and several hours later the piece was finished as can be seen in figure 7.

Some of my biggest learnings from this study were that sometimes technology forces a craftsperson to adapt their designs. Interaction with craft, on the other hand, helps one to form and shape their designs. For this particular study I had to scale the shelf down slightly because the printer couldn't accommodate the size of the original. Also because of limitations with the printer and what it could do, the material that I had to use wasn't exactly the most aesthetically pleasing and took away from the overall perceived value of the piece. The nature of the plastic printing material left some areas of the piece thicker than others, and did not create perfect corners as I had built into my digital model, which took away from the aesthetic appeal. Even though the design was built a very specific way in the digital model, the actual translation to the physical was not identical to this due to the material choice.

Finally, there was a small mistake that I made in building the model, but because of the technology, once the model had been made and sent to the printer, there was nothing I could do to course correct before the print was finished. In 3-D printing the object is made in one continuous print and interruption could set it off course or misalign something in a way that the piece would be ruined. There are no breaks between each step or section of the piece and therefore the space for adjustments and course correction is eliminated because of the constraints of the technology. In this case, even though I realized the issue soon after I sent it to print there was nothing that could be done at that point other than to start again.



Figure 7

Part III

Prototype Development

Prototype Development

During the prototyping development phase of the project I began to step back and evaluate all of my learnings from my previous studies in the research exploration phase. I found that I had explored the elements of material and technology and their impact on the making process, but wanted to further understand the element of value in the craft process. With this intent I spent the next eight weeks completing two new studies in my series. The first being a continuation of the studies of the bookshelf form and the second being a study in bowl turning.

A study in Form VI

In this study I created three bookshelves. The intent was to keep one of these shelves for myself, gift one to someone else, and sell one. The purpose of this exercise was to identify the value that someone else, who was not involved in the making process, puts on the piece and to better understand the way in which this perception impacts the designers' thinking in their making process.

I began this exploration as a study into how others might perceive value in my craft, in the form of appreciation and respect for the process, material, and skill in execution. Where, previously I had focused more on my own perception of value based on materiality and making process. For this iteration of my bookshelf explorations, I also worked with wood as my material again. I began by sketching to work through different ideas and options in the planning of how I would modify the piece, and the working process can be seen in figure 8.

Although there are many different styles of joinery that look simple to create, it is actually quite difficult to learn the dexterity and skill to execute these.



Figure 8

I considered learning how to make dovetail joints and various forms of Japanese joinery, but as beautiful as these were, they were beyond my level of skill and ability to create. Often craftspeople will show tutorials that make intricate designs look easy to do, but for someone like myself who had never attempted this type of work before it would have been almost impossible. Even the more experienced woodworkers who had been helping me wouldn't be able to create the more intricate joinery. After taking some time to learn about the technique required to create each type of joint I decided on a simpler slot design for my first exploration into this type of woodworking.

I first cut and assembled the shelves somewhat similarly to the way that I had done the previous ones, except with a few design modifications at the joints. The process illustrated for me, the meaning of the craft of certainty vs. the craft of risk that David Pye describes in *The Nature and Art of Workmanship*²⁰. I was not skilled enough to properly employ the craft of risk for the design of this piece and made mistakes that I had to correct along the way. Although measuring, setting up guides, and testing cuts initially takes time, this method, craftsmanship of certainty was necessary in my case to ensure correct cuts in the piece, as seen in figure 8.

There were several issues that I had with fit in this process because I was still learning the joinery technique. For as simple as it was, it still required a slow and methodical process to execute accurately. The materials didn't necessarily behave the way that I had originally intended or expected. Moreover, cutting on the table saw caused damage to the softer wood, which I also hadn't anticipated. Even when materials were cut to the correct size they didn't always fit into the slot that I had created for them easily, I actually had to make them smaller to fit well. Later I had to figure out how to patch places where the wood chipped or broke away, which I was able to do with moderate, but not complete success. I was using a table saw to make many of my cuts for accuracy, but the small, somewhat delicate, cuts in combination with the large table saw blade left me with issues of fit and breakage that were unanticipated. If I were to experiment with this process again, I might consider changing my process to work with different material or to complete each bookshelf in full before starting the next, so that I would have more opportunity to learn from the mistakes of the previous object. The final results of this study are shown in figure 9.

²⁰ David Pye, The Nature and Art of Workmanship (Cambridge University Press, 1968).



Figure 9

A study in Form VII

In the final study of craft I chose to focus again on wood turning. For this study I took a class for women on bowl turning at the Society for Contemporary Craft in Pittsburgh. Going into this class I knew the basics of turning from my previous explorations with the method and technology, but this time I was able to get a bit of guidance from a local craftswoman who is a turner. This also gave me an opportunity to interview a few craftspeople to get a better understanding of their processes and thoughts on new and changing technologies within their field.

At the beginning of the workshop, I learned about the tools specific to bowl turning as well as the differences in the lathe, as I was using a smaller one than I had previously worked on. There were many new tools and techniques, some of which were more difficult than others to understand due to my own novice skill level and ability. As in all of the my previous studies, I came to realize that nothing was going to be completely as planned. There were a few unintended marks on the end grain and sides of the bowl where I had trouble gaining enough control and mastery in working with the tools. These unintentional elements differentiated my hand made piece from a machine made one, and can be viewed as more of a unique design element rather than a flaw or imperfection.

The final results of my two-week study in turning were three bowls, as seen in figure 10. None were completely perfect, but each was an improvement on the previous. I found that I value these personally much more than I do something similar that I would have purchased at a store, because I know the time and effort and skill that was required to make them. If someone else were to buy a piece such as this, understanding their perception of the value would be difficult to compare to that of my own. Value in the piece would be a difficult point to judge or understand because I will never meet the person who bought the piece and likewise they will never know anything about me as the maker, other than what they can understand from the detail and care given to the physical attributes of the work. I don't know or have any control over where it will end up in the world. This is something that the craftsperson must be able to accept, that they are putting a part of themselves and their skills out into the world with no control over whether they end up with someone who understands and values their craft or someone who has little knowledge of the time and skill that went into creating a piece.



Figure 10

Part IV

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Conceptual Framework

Conceptual Framework

The framework that I developed to reflect my learnings was based on three main concepts. The concepts were an understanding of the expression of values through craft of the physical object, gaining a new consciousness in one's actions in their work through the process of iteration and reflection, and the physical making and craft process as a catalyst for new ideas and ways of approaching design questions. In coming to these conclusions I went through a process where I evaluated all of my studies and looked at some of the main lessons that I had learned along the way. I devised a matrix comparing how the main idea of each different lesson or concept that I had learned about in my studies impacted the others. This matrix can be seen below in figure 11.

The important takeaways from the exploratory and development phases of my working process were as follows. First, were some of the ideas of leaving space for adjustment in the working process. It is important to leave allowances for human error as well as machine error and having the space in both one's' thought process and physical making process to allow for course correction and re-evaluation during the making and learning process. Second, was the concept of material and how it will impact the form and working process. Thinking and making processes often bend to the constraints of the material that one is working with. A craftsperson must develop an intuition in regards to the tendencies of their medium and be able to work within or around the bounds and constraints that it brings with it. The third important takeaway was the understanding of my physical role in the process. The tacit knowledge that is developed by a craftsperson enables them to look at design challenges and understand the process of making in a more precise way, giving them

a mindset that leads to different ways of approaching the design process. A final important takeaway from the studies was to think about value and perception of the design or object. Aesthetics, making process, and knowledge of the craftspersons' intent can all impact the overall perceived value of the piece or design by both the maker and potential audience. This influence and intent should be taken into consideration during the process. When transitioning the main ideas of these lessons into a matrix, I sorted them into several overarching themes of craft and making as consciousness, catalyst, material, value, skill, iteration, and tangibility.

Consciousness	Acknowledging how the physical world impacts the users perceptions					
Catalyst	Interacting with physical materials leads to new ways of looking at and solving problems	Awareness leads to action in how materials are engaged in an end product				
Material	Materials are physical and can be manipulated through touch	Understand and acknowledge how the material will impact usability	Varying mediums create opportunity for new and different design innovations and uses			
Value	Different types of value are given to physical objects that are not so easily replicable as digital ones	Being aware of why we value certain traits or mediums	Value can be a catalyst for design innovation and preservations of particular traits	Value is inherent in a material based on it's story and composition		
Skill	It takes a particular cultivated skill set to manipulate objects in tangible ways	Respecting the need to build a body of knowledge to meaningfully engage	Cultivated skill sets can be a catalyst for how to manipulate the physical making process	Refined skill sets are required to work with particular materials	In the physical making process skills required to create something add to its value and vice versa	
Iterate	Many versions of physical making are necessary to learn from the process of making	Knowing that continuous engagement and trial is necessary to develop the end solution or piece as well as the thought process leads to it	Different iterations of a design can be a catalyst for new ideas and solutions	Multiple iterations in the same or different materials can help to uncover new insights	Replication and proof of a model adds value, time and effort adds value	Repetition builds skills in making of all kinds, both digital and non digital
	Tangible	Consciousness	Catalyst	Material	Value	Skill

Figure 11

After mapping out the connections between each idea I further developed the conceptual model of my process to convey the most important and influential themes. This framework can be seen below in figure 12. The overarching areas of focus, built off of my previous learnings, were craft as a consciousness, craft as a catalyst for different ways of viewing a challenge or design, and craft as expression. These themes were further supported by the concepts of value, reflection, and skill, which were each explored in various ways throughout my working process. The framework is structured in a cyclical way, because the process of craft was not strictly linear. The supporting concepts were seen in the craft working process, at the beginning through to the end, and each helped contribute to the overarching themes throughout.



Part V

Reflection and Evaluation

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Reflection and Evaluation

My design process and final framework address the initial objectives that I wanted to explore in this project by allowing for the freedom of exploration and the ability to engage with materials. I was able to iterate on small studies throughout my project and learn about craft first, testing out different materials and types of technologies and techniques involved in making. I was then able to take the time to evaluate what I learned through making and tactile engagement. This approach gave me space to try different things more quickly and then to stop and reflect on the choices that I was making. It also provided the space to fail at what I was doing without major repercussions to the process and then to also be able to learn from that failure and iterate upon those learnings. This project was not designed to elicit outcomes that would be tested and evaluated as a success or failure. It was rather, a reflective making process that was an exploration into another way of thinking in order to open up other possibilities in the design working process.

Initially, this project was developed with the intent to be a personal project and wasn't necessarily meant to be something to translate for other designers to use in their practices. After evaluating my learnings from the project, however, there are aspects of it that could be valuable for other designers to engage with in their own way to realize their own personal learnings on process and methods. There were three main elements of my project that I felt would be applicable to the learnings of others. The first element is the ability to take a step back from the working mindset that we are usually in and to engage in a different way of thinking that could expand the way we see or approach design challenges and problems in our work, in my case this was thinking through craft and making. The second element to consider is the application of process that involved micro studies rather than one long linear research design process. By taking this approach I was able to build in time for course correction, and reflect on what I was learning during the design process rather than just evaluating everything that worked or didn't and how that might change in the future. The third important element to consider is the way in which the designer values certain aspects and elements of his or her personal design process and end result versus the way that others do, and how both sets of priorities can influence and impact the way that they choose to work and create a final outcome.

Part VI

Conclusion

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Conclusion

In this project I began to consider how we learn from our craft based design models of the past and take that knowledge with us as our design process changes through time. Craft and making requires experience and has a certain physicality to it that allows one to learn through really seeing and interacting with something, not just by thinking through it. There is also a certain material honesty that is necessary to consider and understand in the craft process, which will impact how a design is perceived and how it will interact with the existing systems in which it is placed. I carried out a process of various small studies in craft methodologies and techniques, reflection, and analysis. Through these I was able to learn that engaging in a different way of design thinking, such as craft, expands the ways in which we, as designers, might approach a challenge or problem that we are trying to understand. By working in small design sprints instead of a linear process I was able to reflect on my learnings and address them while I was still engaged in the making process. I was also able to explore the concept of value, from the side of the craftsperson or designer as well as from that of others who are interacting with their piece or design. This can influence the way that the designer engages in their working process and prioritizes end goals of a design. Over the past two years I have been immersed in the user centered design and research process. Although I have come to appreciate this approach, I felt that there were other methods and processes that are valuable as well and which could provide insight into a different way of viewing a problem or design challenge. I wanted to push myself as a designer and gain an understanding of a different type of process that I will be able to use along with my knowledge of other design methods and approaches in the future.

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