Natural Dye Use in the United States by Individuals, Communities, and Industries

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The purpose of this dissertation was to better understand how and why individuals, communities, and industries use natural dyes in the United States. My overarching questions were:

1. Who currently uses natural dyes and why?

2. How are natural dyes currently used?

3. What are the challenges and possibilities of production?

To examine these questions I incorporated interviews, participant observation fieldwork, and film production into my data collection methods. Over the course of three years, I gathered 40 interviews with 33 different individuals involved in the use of natural dyes.

My research first looked at the challenges and innovations that surround the use of natural dyes in the U.S. fashion supply chain. I found that fashion labels must deal with color inconsistencies from natural dyes due to variable growing conditions for plants, water quality, and manufacturing setups. This has led to scientific and agricultural innovations by companies to mitigate variabilities in processed natural dye stuff. Furthermore, fashion labels find it a challenge to communicate and market information about natural dyes. Production dyers would find ways to educate their clients about the realities of using natural colorants.

Next, I explored how and why people use natural dyes. I found that individuals use natural dyes because of their own perceived environmental and health concerns, to create a sense

of personal fulfillment, and to have autonomy over the production process. I then argued that my participants tied personal identity and meaning to natural dyes.

Finally, I used my work in the natural dye community and the internet as sources of information to explore textile-centric epistemologies that fuel dual purposes of commodification and community building. I argue that individuals build a community interested in buying their knowledge. Many times, physical and virtual knowledge sharing is communal. Knowledge can be shared for free at events such as knitting circles, quilt retreats, and weaving guilds. Knowledge can also be sold through in-person and online classes or workshops. However, this connects back to the identities of individuals who can financially afford to take workshops or feel included in physical and virtual spaces. This can lead to underrepresented communities being left out of textile craft communities.

Biographical Sketch

Kelsie Doty was born and raised in Kansas where she grew up in a small rural community on the edge of the Tallgrass Prairie. Doty began her academic research journey as an undergraduate student at Kansas State University where she conducted her first project as part of the McNair Scholars program. Guided by her undergraduate mentor, Professor Sherry Haar, she learned the basics of research and found her passion for creative inquiry, community, and teaching. For her Master of Science degree at Kansas State University, Doty continued working with Professor Haar and compared the colorfastness of mordanted and nonmordanted wool dyed with sawdust from Kansas native black walnut, eastern redcedar, and Osage orange. She also completed research and teaching assistantships within her department and created her first solo exhibition of naturally dyed garments titled *Arboretum*. After she graduated with her master's degree, she taught upper level fashion design courses at Kansas State University for a year. In 2016, Doty was accepted to the PhD program in Apparel Design at Cornell University where she researched the intersections of sustainability, fashion supply chains, and communities from a multidisciplinary perspective with Professor Denise Green. During her time at Cornell, Doty produced the solo exhibition, *What We're Made Of*, which featured a fully biodegradable collection of garments dyed with food waste from Cornell Dining. Doty also worked as a research assistant and was the instructor of record for two years for a 3-week summer college course on fashion portfolio development at Cornell. After completing her doctorate in May of 2020, Doty returned to Kansas State University as a faculty member in the department of Interior Design and Fashion Studies.

For my family

For plants

For the earth under my feet

For the light shining on my face

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I would like to acknowledge that the occupied land that I currently live on belongs to the Očeti Šakówin (Souix), Kaw (Kansa), Osage, and Kiikaapoi (Kickapoo). Natural dye knowledge is Indigenous knowledge.

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Chapter 1

Introduction

Organic sources like leaves, flowers, lichen, roots, and insects create natural dyes that can be used to color certain fibers and textiles. The purpose of this dissertation is to better understand how and why individuals, communities, and industries use natural dyes in the United States. While the environmental sustainability of natural dyes is complicated because of their origins and use (Bechtold & Mussak, 2009; Bechtold, Turcanu, Ganglberger, & Geissler, 2003; Fletcher & Grose, 2012), fashion companies often cite natural dyes as a more sustainable option to synthetic man-made dyes. Natural dyes could be important as a source of benign color for textiles, as well as a point of cultural and personal articulation (Bechtold & Mussak, 2009; Bechtold et al., 2003; Fletcher & Grose, 2012). However, more research is needed to increase a holistic understanding of the impacts created by natural dyes. My research is important because it not only looks at how natural dyes are currently used but I also ask why it is important for individuals to use natural dye color and what ideas are produced through their use. The overarching questions that guided me through the research process were: (a) who uses natural dyes and why? (b) how are natural dyes presently used? and (c) what are the challenges and possibilities of production? Through case studies, ethnographic engagement with different dyers, and documentary film practice I explore how natural dyes are used in the United States' fashion supply chain. I examine why individuals are motivated to use natural dyes, and how natural dye knowledge is produced and shared in the communities formed around textiles, crafts, and design industries.

Natural dyes intersect with numerous academic subfields such as botany, chemistry, history, color theory, horticulture, design, and many more. The many intersections make it a rich subject to explore through qualitative research. For my dissertation I have employed qualitative ethnographic methods, alongside documentary filmmaking, to gain a deeper understanding of the use of natural dyes. My research has brought me across the United States to uncover how and why the fashion supply chain and hand craft industries engages with natural dyes. In the following section I have provided an overview of my dissertation and explain how I have organized the subsequent chapters.

Dissertation Overview and Organization

I separated my work into three research-style papers situated in Chapters Two, Three, and Four, bookended by introduction and conclusion chapters. Due to the nature of this dissertation format, the reader will find redundancies in information throughout. The introduction chapter covers the overall use and definition of natural dyes, synthetic dyes, and the apparel supply chain. The introduction also covers the wide variety of methods used to complete my dissertation research. I wrote Chapters Two, Three and Chapter Four with specific target journals in mind and each may differ in tone, length, and content based on the journal to which I intend to submit. Chapter Two looks at the use of natural dyes in the present day fashion supply chain by means of the circuit of style-fashion-dress to organize my findings. I explored the challenges fashion companies face and innovations required when they employ natural dyes in the current system. For Chapter Three, I looked at individual's motivations to use natural dyes. I found that motivations center around perceived environmental and health concerns, personal fulfillment, and autonomy over the production process. In Chapter Four I stepped back and looked at the commodification and knowledge sharing by those in the craft industry. I used natural dyers as an

example to better understand the phenomenon. In Chapter Five, I conclude my dissertation by summarizing Chapters Two through Four and sharing some key observations that emerged during my research project.

Review of Literature

Natural Dyes

Natural dyes come from natural sources. Most are typically found in plants, insects, or minerals but natural dyes are also harvested from mollusks, lichens, and mushrooms (Boutrup & Ellis, 2018; Cardon, 2007). There are a variety of methods for natural dye color extraction. These may include direct contact between the dye stuff and the fabric, known has contact dyeing (Kadolph & Casselman, 2004, p.16). Colors also may be extracted for immersion dyeing with solvents (Baliarsingh et al., 2012), ultrasound (Sivakumar et al., 2011), microwaves (Sinha et al., 2012), or chemical reduction methods referred to as vat dyeing. One of the most common extraction methods for natural dyers is to use hot water. The dyer will place the natural dye source into a pot of hot water and extract chromospheres of color from the flowers, leaves, or insects. This creates a soluble dye. Researchers will often test a dye's ability to adhere to a textile by subjecting it to a variety of conditions, such as exposure to light and laundering. These tests determine the colorfastness of a dye. Some natural dyes readily attach themselves to textiles, these are known as direct dyes. Other natural dyes, known as indirect dyes, require the assistance of an insoluble chemical fixative known as a mordant[1]. A mordant is a metallic salt that provides an extra link to fix the dye color to the textile (Bechtold & Mussak, 2009; Boutrup & Ellis, 2018; Cardon, 2007; Chakraborty, 2015). Mordants allow a large array of colors to be achieved with mixed colorfastness results (Boutrup & Ellis, 2018; Burgess, 2011; Cardon, 2007; Doty et al.,

[1] According to Chakraborty (2015), "A mordant is a simple chemical which possesses affinity for both fibre as well as dye." (p. 187)

2016). These metallic mordants are one of the factors that can complicate the use of natural dyes. If used improperly, they can be dangerous to the user (Cardon, 2007). In the past, dyers used hazardous heavy metal mordants such as copper, tin, and chromium to fix colors (Cardon, 2007; Glover, 1995). Today aluminum, a metallic salt used in paper making, pickling, and water filtration, is the mordant most often used with natural dyes (Cardon, 2007). However, recent research has shown aluminum to have poor absorption into a textile, with which a majority of the mordant remain in the dye bath (Saha et al., 2018). While aluminum mordants are widely considered benign, the amount of metal ions that remain in a dye bath may not meet effluent standards in some countries (Chavan, 1995; Erdem İşmal et al., 2014; Saha et al., 2018).

As briefly mentioned before, direct natural dyes do not require the use of a mordant. Bio-mordants can occur naturally in plants, such as tannins (Cardon, 2007). Tannin or tannic acid is the same natural substance that makes coffee and wine bitter and leave a dry feeling in your mouth (Cardon, 2007). Practitioners can still enhance the performance of these with a metallic mordant, which increase the colorfastness of the dye and decrease the amount of dyestuff needed to produce comparable depths of shade (Doty, Haar, & Kim, 2016). Some natural dye artists abandon metallic mordants and opt instead for a soymilk binder to fix dye color (Desnos, n.d.).

Companies and individuals who produce natural dyed textiles need to consider textiles, dyes, mordants and many more factors before the use any natural colorant. While interest in natural dyes continues to grow, widescale industrial adoption is yet to occur. Synthetic dyes account for a clear majority of textile production. Long standing research has shown several categories of synthetic dyes, such as azo and cationic synthetic dyes, to be toxic to the environment and humans (Brigden et al., 2012; Gregory, 2007, p. 52-62; Puvaneswari et al., 2006; Singh & Chadha, 2016). Research links synthetic dyes to cancer in individuals who work

in textile factories (Singh & Chadha, 2016, p. 2). They also prevent photosynthesis for plants once released into the environment (Kant, 2011, p. 26). Natural dyes may present an alternative that is less toxic and fully biodegradable.

Contemporary Use of Natural Dyes

Spurred by consumer interest in sustainable products in 2016, larger companies have started to explore natural dyes. The most notable of these include Patagonia, Eileen Fisher, Nike, Allbirds, and TOMS (Breyer, 2019; Leighton, 2018; DuFault, 2017; Gibran, 2016). On April 22, 2017 (Earth Day), Eileen Fisher released a line of botanically dyed women's linen tops that they produced with the natural dye company Botanical Colors of Seattle, Washington (DuFault, 2017).[2] Botanical Colors dyed the garments with indigo, madder root, and pomegranate peels, which provided an array of colors that the brand labeled as "non-toxic" (DuFault, 2017). As part of Nike's 2019 summer capsule titled the "Nike Plant Color Collection" the company released a limited run of Air Max 95 and Blazer Low sneakers that they colored with plant-based dyes (Breyer, 2019). Billed as a sustainable product, an article on Nike's webpage described the collection with:

> While plant-based dyes do not solve every challenge in sustainable design, they are an exciting alternative that are already inspiring further experimentation. Plant-based dyes reduce the amount of particles in wastewater. Additionally, plant-based dyes don't have to be heated to high temperatures, and don't require as much processing time as some synthetic dyes, which saves energy and helps reduce emissions (*Plant Color Collection*, n.d., para. 5).

[2] Ironically, some plants are toxic. Consider the Oleander plan, a beautiful bush that grows along the southern coastlines of the U.S., that can be fatally poisonous if consumed.

However, Nike's claims are contradictory to what researchers have found about the sustainability of natural dyes, specifically, the time spent in the heating and processing phases of production. Researchers have pointed out that natural dyes require longer and slower dyeing treatments than synthetic dyes and that heating dye baths is often part of the process (Fletcher, 2008). Experts have also cited the production of dyestuff, multiple wet processing steps, color consistency and fastness, and scalability as natural dye issues (Fletcher & Grose, 2012; Bechtold et al., 2003). While some larger companies focus on limited releases of natural dyed garments, there are smaller U.S. based apparel companies that create most of their apparel assortment with only naturally dyed color. Fashion brands such as Older Brother, Jamala Dyes, Miranda Bennett Studio, and Colorant all use natural colorants for most of their garments with a few exceptions. The use of natural dyes by large and small apparel companies has helped to grow a niche natural production dyeing industry in the United States. Independent dyers such as Kathy Hatori of Botanical Colors, Liz Spencer of The Dogwood Dyer, Audrey Louise Renolds, and Winona Quigley of Green Matters Natural Dye Company work with apparel, textiles, and yarn manufactures to dye products with only natural dyes. Besides production dyeing, they also host public workshops and sell their own lines of natural dyes online and in stores. In this dissertation, I focus on smaller apparel companies and independent dyers based in the United States for several reasons: first, most of these smaller U.S. brands produce naturally dyed garments domestically as opposed to dyehouses overseas. This allowed me to see the production process up close and to better understand how they use natural dyes. Second, U.S. based companies gave me a better vantage point to understand independent natural dyers when it came to their motivations and knowledge sharing. I was able to speak to dyers face to face as well as visit dye studios and factories across the U.S.

To better understand how and why natural dyes are used in the contemporary context, it is important to revisit the past. Dyes from nature are the oldest form of coloration and examples can be found around the world with the earliest examples of human-made textiles (Davies, 2018; Kramell et al., 2014). Throughout history, hegemonic classes have monopolized specific colors due to limits in natural resources. The use of natural colorants led to the overharvest of and the exploitation of human labor (Balfour-Paul, 2011; Cardon, 2007; Clark et al., 1993; Jensen, 1963). There are two colors that can help illustrate this history: deep violet purple and sapphire blue.

Natural Dyes and Their Exploitation Throughout History

Tyrian Purple. One of the most desired and expensive colors in Roman, Byzantine, and European history was purple, sometimes referred to as Tyrian Purple (Cardon, 2007, p. 570). Sumptuary laws or exorbitant pricing prohibited lower classes from purple cloth (Cardon, 2007, p.553; Jensen, 1963, p. 115). The exclusivity of purple dye was due to its singular source: a small, white saltwater mollusk. Specifically, the Murex snail which is found in the Mediterranean, the Atlantic coasts of Europe, and along the coasts of South and Central America (Cardon, 2007, p. 566). The historical methods for the collection the Murex snails was to either dive for them or to set traps filled with fish scraps to ensnare the carnivorous mollusks (Jensen, 1963, p. 108). Workers would crush the sea snails to release dye from the hypobranchial glands and demanded 8,000lbs of raw material to produce 500lbs of dyestuff (Jensen, 1963, p. 108). Mollusks were harvested extensively along the Mediterranean and Middle East until the 15th century and nearly resulted in their extinction (Clark et al., 1993; Jensen, 1963). Mounds of discarded shells can still be seen up and down the coastline of Lebanon where Phoenician dyers found plentiful murex beds (Cardon, 2007, p. 566; Jensen, 1963). After the fall of the Roman

Empire, Tyrian Purple fell out of favor and the knowledge required to produce it was lost (Jensen, 1963, p. 117).

Nearly 400 years later, 19th century European dyers were eager to discover ways to emulate the rich dark purple from the Roman era. Around 1835, German colorists developed a purple from uric acid extracted from Peruvian bird guano and created a dye called Murexide or Roman Purple (Travis, 1993). Dyehouses frequently disguised the origins from public knowledge (Travis, 1993). At one point in 1855, a single dyehouse used around 12 tons of bird guano to produce purple dye (Travis, 1993). However, with bird guano dye it was hard to create a deep purple on wool and silk fibers and was not colorfast on most other textiles (Travis, 1993). In the early 1800s, another purple was developed by French dyers from several species of lichens found across Europe (Travis, 1993). "French Purple" as it was deemed, was bright and color fast on silk, wool, and cotton and trended between 1857-58 (Travis, 1993).

Be it Tyrian, Roman, or French, this story of exclusivity and exploitation is not unique to purple. Due to finite natural resources and the hard labor needed to harvest and use natural dyes, many colors were unattainable to parts of the population. Another good example is the ubiquitous blue commonly find in denim jeans: indigo.

Indigo Blue. Indigo is one of the oldest recorded dyes used by humans and has a deep history throughout many parts of the world (Balfour-Paul, 2011; Cardon, 2007 p. 335). However, since this dissertation focuses primarily on the U.S., it would be valuable to review the colonization, labor, and trauma that indigo created while it was produced in the 17th and 18th centuries in what is now the Southern United States (Bonynge, 1852; Coon, 1976; Rembert, 1979; Sharrer, 1971a, 1971b; Winberry, 1979).

In the 17th century, producers began to grow indigo in the southeastern regions of North America (what is today Florida, South Carolina, and Louisiana) due to the warm and humid climate needed to cultivate tropical species of indigo producing plants. French, Spanish, and English colonies grew indigo dye plants for the textile industry (Rembert, 1979). However, the history of indigo in the Americas is deeply enmeshed in slavery and plantations (Balfour-Paul, 2011; Rembert, 1979; Sharrer, 1971b). Enslaved peoples cultivated, harvested, and refined indigo the America's in 1655 when the British colonized what is today known as Jamaica (Sharrer, 1971a). The brutal colonization of North and South America meant the death and displacement of Native Americans and the use of enslaved people to cultivate crops and serve colonizers (Feeser, 2013; Handler, 2002). Indigo production is arduous and plantation owners forced both enslaved African and Native American people to create the blue dye. Indigo seeds were often sowed in early March and could be harvested up to five times in a season by the removal plants tops, which then allowed them to regrow (Beeson, 1964, p. 216). The plants were harvested by hand, bundled, and carried to indigo vats for processing (Beeson, 1964). The first vat, called the "steeper", is where the bundles of indigo plants would be placed in water to ferment and extract the indican, the precursor to indigo, from the plants (Feeser, 2013, p. 79). To expedite the fermentation process, the plants in the steeper vat would be pounded by hand with heavy wooden mallets (Beeson, 1964, p. 216). The fermentation process produced an unbearable stench, which is why the vats were located at least a quarter mile away from residential households (Beeson, 1964, 215). The odor and glucose released in fermentation also attracted flies and mosquitos and cause illness amongst the people forced to work with the dyestuff (Beeson, 1964, 215). When the liquid in the steeper turned a bright violet or green blue it would be drawn off into a second vat called the "beating" vat (Beeson, 1964, p. 216). Workers would

often stand in the basin and to churn or "beat" the liquid until the dye particles separated and began to congeal (Beeson, 1964). The vat would then rest and the indigo would settle to the bottom, the clear liquid on top would be drawn off and disposed, and the watery residue on the bottom would be drawn into the third vat (Beeson, 1964, p. 217; Siebert, 1931). The third vat allowed a majority of the remaining liquid to evaporate and the indigo sludge would be strained and placed in cloth bags to dry (Beeson, 1964). The final step was to dry the indigo in shallow containers and cut them into cakes of indigo that were suitable for transport (Balfour-Paul, 2011, p.). Indigo production in the United States continued to exploit enslaved peoples until the late 18th century. Most plantations abandoned the crop around 1786, when the East India Trading Company flooded the market with an excess of indigo and dropped prices too low for U.S. growers to continue their work (Beeson, 1964; Winberry, 1979, p. 218).

Indigo cultivation continued to be prominent in other parts of the world, like China and India. However, the production of plant-based indigo dramatically changed with the invention of synthetic indigo in 1897 by the German company Badische Anilin und Sodafabrik (BASF). In an 1901, London Times article titled *The Downfall of Natural Indigo*, a columnist penned that Dr. Brunck of BASF celebrated the release of synthetic indigo and that, "the results they have hitherto achieved so fully correspond to their expectations that they hope to be victorious in the long and arduous struggle that is before them; in fact they think it is merely a question of time when the entire consumption of indigo will be provided for artificially" (Armstrong, 1901, para. 4). This prediction came true. Today the fashion industry almost exclusively uses synthetic petroleum-based dyes to produce apparel and textiles.

The Genesis of Synthetic Dyes. The first person to produce a synthetic dye was Frederick Calvert, a professor at Royal Institution Manchester (Travis, 1993). He discovered

synthetic aniline dyes a little over 50 years before BASF tested synthetic indigo. Calvert could produce a yellow dye synthesized from coal tar in 1845, but the high production costs prohibited him from creating a successful business from his discovery (Travis, 1993). However, the inventor most often credited with the discovery and development of synthetic dyes is William Henry Perkin. Perkin was from London and began to study at the Royal College of Chemistry at a young age (Travis, 1993). In 1856, the 18-year-old Perkin was home for Easter. He began to practice oxidative condensation and tried to synthesize quinine from coal tar to use for an anti-malarial drug (Blaszczyk, 2012; Travis, 1993). The experiment went wrong. Instead of a clear quinine liquid, a black precipitate appeared at the bottom of the beaker (Blaszczyk, 2012; Travis 1993). Perkin discovered that he could dissolve this black sludge in denature ethanol, which could be used to produce an intense deep purple that was colorfast to light (Travis 1993). Unfortunately for Perkin, the production of such a dye at manufacturing scale was financially untenable (Garfield, 2002).

Convinced his creation held promise, Perkin quit the Royal College of Chemistry in the fall of 1856 and began to travel to Scotland to test his dye with calico printers (Travis 1993). Perkin was met with resistance along the way from textile dyers who were secretive about their natural dye processes and resistant to new approaches in textile manufacturing. In 1857, Perkin took out a patent for his purple dye and built a dyehouse in the north-west section of London to produce what they called Tyrian Purple, a synthetic version of the historic dye created by the murex snail (Blaszczyk, 2012; Travis 1993; Garfield, 2002). His timing could not have been better. In the summer of 1857, one of the most influential fashion figures in the world, Empress Eugenie, declared that mauve (a light lilac purple) was her new favorite color as she thought that it matched her eyes (Blaszczyk, 2012, p. 21). In 1858, Queen Victoria wore a lilac-colored gown

trimmed in silver moiré to her oldest daughter's wedding, which sealed the conception of what fashion critics of the time would deem "the mauve measles" (Blaszczyk, 2012, p. 22).

Mauve purple became a craze in the spring of 1859 in England and France. The color was so popular in clothing and accessories that intermediaries of the time referred to it as "a virulent outbreak of measles" and that it was "spreading to so serious an extent that it is high time to consider by what means it may be checked" (David, 2015; Travis 1993; "The Mauve Measles", 1859). However, Perkin's did not invent the purple worn by the fashion elite. Instead, it was created from lichen and was known as French Purple (Garfield, 2002). Perkin was busy at this time as he visited dyehouses across Europe and perfected the new technological process (Garfield, 2002). Eventually, he won over the masses to his vibrant dye and by 1860 Perkin and Sons filled large orders. The inventor quickly became rich, but competition soon arose from chemists who followed in Perkin's footsteps (Garfield, 2002). Fellow chemists soon started the production of colorfast yellows, blues, greens, and violets (David, 2015; Garfield, 2002). Numerous dye shades followed from coal tar and scientists of the industrial revolution worked quickly to make further dye discoveries (Garfield, 2002). Guided by the markets, Perkin and other color innovators constantly sought out the next trending shades and hues (David, 2015).

Dangers of Early Synthetic Dyes. In the late 19th century, garment workers suffered from the chemicals used in these dyes (David, 2015; Garfield, 2002). Dyehouse workers in direct contact with synthetic dyes became ill with "acute and chronic aniline poisoning" and suffered from illnesses like skin irritation, anemia, bronchitis, bladder cancer, testicular cancer, and a sickness called cyanosis which turned extremities blue due to a lack of oxygen (David, 2015, p.103-115). In 1860, Perkin's factory discontinued the use of mercuric nitrate to create the synthetic color magenta due to workers who became sick from exposure to the solution (David,

2015, p. 115). When synthetic dyes became popular, garment wearers were afflicted with skin burns and rashes due to moister from the body bodily sweat that came into contact with the dyed textiles. The reaction, which caused the dye to rub off on the skin (David, 2015, p. 100). In the 1870s, brightly colored socks were of particular concern (David, 2015, p. 102). Corrosive synthetic dyes would interact with the PH of an individuals' sweat and, in some cases, fatally poison the wearer (David, 2015, p.102). These instances of poisoning and illness were not enough to deter Europeans and Americans who demanded the brightest and gaudiest colors available and in the late 19th century new synthetic dyes continued to flood the market with cheap and toxic color (David, 2015, p.).

The End of Perkin and Sons. In 1868, red colorants derived from madder root was still prevalent, when Europe imported 17,500 tons of the dyestuff (Garfield, 2002). By 1876, however, imports of madder fell to 4,400 tons annually and the global suppliers of natural dye producers began to feel the decline of their once lucrative business (Garfield, 2002). Competition with natural dyes declined over the years as synthetic dye development advanced in German dyehouses, which generated newer and cheaper products (Travis 1993). Perkin made a fortunate by the age of 35, when he sold his business in 1874. The Queen of England later knighted Perkin for his accomplishments in the field of chemistry and industry ("Chemists Here Honor Sir William H. Perkin", 1906). Not long after he sold his business, a large majority of the worlds' dye production moved to Germany. By 1900, Germany produced 90 percent of the world's synthetic dyes (Blaszczyk, 2012, p. 29).

Adoption of Synthetic Dyes. Over the past 160 years, chemists refined synthetic dyes and developed them for optimal use in large-scale manufacturing. Due to the lower cost, excellent colorfastness, and high reliability, synthetic manmade dyes are now the industry

standard (Gregory, 2007). In the synthetic dye industry, scientists studied commercial products over long periods of time and have gained a strong understanding of the toxicology of synthetic dyes (Gregory, 2007, p. 46). However, research has shown synthetic textile dyeing to contaminate air, soil, and water with effluents and associated the dyes with a heightened risk for disease (Gregory, 2007; Pronczuk-Garbino, 2005; WHO, 2018). The World Health Organization (2018) points to manufacturing from textiles and pigments as sources of arsenic and formaldehyde. If an individual has exposure over a long period of time, this can lead to skin, bladder, and lung cancer and death in extreme cases (Gregory, 2007; Pronczuk-Garbino, 2005; WHO, 2018).

The Fashion Supply Chain

The current global fashion supply chain is a massive player in the world economy. It directly impacts the global community an individual level in complex and subtle ways. Globally, textiles and apparel account for nearly $505 billion in trade for 2018 (Lu, 2019, para. 1). In a 2017 report by the United States International Trade Commission, U.S. textiles and apparel exports totaled $22.1 billion and imports totaled $121.4 billion (Roop, n.d.).

The process of garment creation starts with fibers, which can be natural or manmade. Natural fibers are classified as either cellulosic or protein, and are typically harvested from plants, and animals (Kadolph, 2010). Cellulosic fibers come from plants (e.g., cotton, linen, hemp), whereas protein fibers are harvested from animals (e.g., sheep, alpaca, or silkworms). Synthetic manmade fibers, on the other hand, are produced from chemical compounds in a controlled manufacturing setting (Kadolph, 2010). Polyester, acrylic, and nylon are some of the most well-known synthetic fibers used in garment production (Kadolph, 2010). Some manmade fibers, like viscose, rayon, lyocell, and Tencel™, are manufactured from cellulose (most often

wood pulp) that is processed with a solvent (Fletcher & Grose, 2012; Kadolph, 2010). These fibers are considered manufactured, regenerated cellulosic fibers. Manmade, synthetic, and natural fibers are the building blocks for all fabrics and are sometimes blended to achieve different fabric properties and performance requirements. To produce a garment, manufactures spin fibers into yarns, yarns are knitted or woven into textiles, and textiles used to create garments. The dye process, natural or synthetic, can occur at any point along the supply chain, from fiber to finished garment. It is this process of dyeing in the fiber, yarn, fabric, or garment stage that my dissertation focuses on. In the next section I will introduce the methods I used for my research and explain my research journey.

Methods

Overview

For my dissertation I have used a multi-method approach that incorporates interviews, participant observation fieldwork, creative design work, and film production as modes of data collection. I completed a total of 40 interviews (19 in person) with 33 different individuals who use natural dyes. Most interviews lasted between 30-90 minutes and were either filmed or audio recorded. I conducted participant observation research at locations in 6 different states across the U.S.: New York, Vermont, Tennessee, Kansas, Oregon, and California. I formed a rich dataset for this dissertation through by collecting 1085 photographs, and 360 hours of video footage across multiple field site. Exemptions (see Appendix A) were granted for my research by the Institutional Review Board for Human Participants at Cornell University. All of the interviews were transcribed with Trint and coded with NVivo software. The theories used to inform data collection and interpretation vary for each of the subsequent chapters and will be discussed in more depth in each chapter.

Background of the Researcher

It is necessary in this instance to review my own background as it relates to the research topic. The wooden bookshelves in my office are lined with craft books on natural dyes and my weekends are spent dyeing with plants grown in the garden behind my house. My work started over eight years ago as an undergraduate, when I conducted my first research project as part of the McNair Scholars program. Paired with a mentor, Professor Sherry Haar, I learned the basics of colorfastness research with natural dyes from black walnut and eastern redcedar tree bark, my own choice of dyestuff. Colorfastness testing is when a researcher dyes small samples of fabric or yarn and then subjects it to washes, direct light, or other physical abuse to see how well the color will stay on the textile. For my Master of Science degree, I researched the comparative colorfastness of mordanted and nonmordanted wool dyed with sawdust from Kansas native black walnut, eastern redcedar, and Osage orange. When I applied to PhD programs, I was ready to explore natural dyes in a different way, eager to foster human connections outside of the scientific lab setting. This motivation is why I applied to Cornell University to work with Professor Denise Green, a researcher trained in anthropology and ethnographic studies. Over the past four years, I have begun to understand the qualitative research process and the work has been immensely gratifying.

Data Collection Timeline and Methods

Throughout my data collection I relied on qualitative methods to better understand the phenomena of natural dye use by individuals, communities, and industries. According to Creswell (2014) qualitative research "is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem" (p. 4). Qualitative research involves an inductive approach to data collection and analysis, requiring constant reflection from

the researcher (Creswell, 2014; Strauss & Corbin, 1994). Using qualitative methods such as interviews, documentary filmmaking, audio recordings, photography, field work, participant observations, and field notes I was able to better understand why my participants used natural dyes and the context in which they used them. My theoretical approach was to use Grounded Theory, which recognizes that reality comes from an interactive process that the researcher and subjects form and agree upon its meaning (Charmaz, 2014; Strauss & Corbin, 1994). In the following section, I outline how my research journey developed from the beginning of my doctoral program until the end of my data collection.

My research began the first semester of my doctoral degree in the fall of 2016. My own experiences as a dyer and designer piqued my curiosity and I wanted to know what motivated people to use natural dyes. As a practitioner, I understood the difficulty and frustration of the natural dye process which can frequently end in inconsistent colors and unexpected results. However, there is also joy in actualizing color from underappreciated sources, such as sawdust and invasive species. I began with interviews with and observations of a handful of natural dyers in and around the Ithaca, NY area. I visited their dye studios, kitchens, and gardens. I interviewed each dyer to see if physical location and community influenced their artistic practice. These initial interviews made me question how dyers shared knowledge. The following semester I examined the use of social media, specifically Instagram, within natural dye communities and furthermore how natural dyers were discussed and knowledge shared. I took this opportunity to conduct interviews via phone and reach out to dyers across North America. Around this time, I began my work in documentary filmmaking and followed in the footsteps of my Committee Chair, Professor Denise Green. Professor Green taught me the basics of videography and lent her film camera for interviews. I started to film my research subjects and brought back the footage to

Professor Green for critiques and suggestions on my filming techniques. I employed participant observation research methods, which mean that I was not only an observer, but I also completed natural dyeing myself.

In the summer of 2017, I worked with the menswear label Wool & Prince to naturally dye a run of 80 men's t-shirts with four different natural dyes (chestnut, myrobalan, madder, and organic indigo) that produced brown, dark grey, orange, and blue. In collaboration with my Cornell advisor, Professor Denise Green, and my MSc advisor, Professor Sherry Haar from Kansas State University, we produced naturally dyed garments and conducted an online survey with customers who purchased the t-shirts from Wool & Prince. The first survey focused on basic demographics and online purchasing behavior. The second survey, sent four months later, asked about their satisfaction with the garment, their laundering practices, perceived changes in garment color, comments they had received about their shirt, and if they would purchase another naturally dyed t-shirt from Wool & Prince. Each participant received a total of $20 for completion of both surveys.

Throughout these other endeavors, my work with natural dyes has also included "creative design inquiry", which is an "experiential" form of research (Bye, 2010; Gray & Malins, 2004). As Gray and Malins (2004) articulated in their book *Visualizing Research*, "We learn most effectively by doing … by active experience, and reflection on that experience" (p. 3). In fashion design, that can mean the exploration of ideas through a creative process of making, unmaking, remaking, reflecting, and sharing garments and textiles. Funded by a grant from the Cornell Council of the Arts, I created a solo exhibition titled *What We're Made Of*, exhibited in the Jill Stuart Gallery, College of Human Ecology, Cornell University April 3rd-22nd, 2018. The exhibition consisted of textile and apparel designs that used only 100% biodegradable natural

fibers, dyes, and findings (see Figure 1.1). I used post-consumer waste from discarded clothing and natural dyes from food scraps as a critique of consumers' disposable relationship with garments and the prevalence of synthetic fibers in the fashion industry. My personal outcomes from this project included a fresh perspective of my own history, present, and future as well as consideration of the cyclical nature of existence.

Figure 1.1

What We're Made of Design Exhibition

In the fall of 2018, I took a documentary film course at Cornell University with Professor Dehanza Rogers and I produced a film about natural dyers' use of Instagram. I was also a part of a qualitative methods class taught by Professor Sofia Villenas, where I learned many of my interview and qualitative data collection skills. It was through these two courses that I developed

the short documentary film #NATURALDYE, which I submitted to the Fashion Studies Journal and has been accepted for publication.

My personal work with natural dyes also extended to teaching. I taught several workshops on the basics of natural dyes use to color textiles throughout this period. A workshop generally consists of between four to twenty students who come together for a short time to learn a concentrated amount of knowledge. In October 2018, I gave a two-day natural dye workshop in Vermont as part of my site visit to Wing and a Prayer farm. In June 2018, I gave a one-day natural dye workshop at the Cornell Botanic Gardens in Ithaca, NY (See Figure 1.2). Over the course of my dissertation I also assisted and prepped dye bath for several teaching and outreach sessions with Professor Green. My approach to these relatively short learning sessions is to introduce students to natural dye process basics and have them experience various types of natural dyes. We often dye silk and cotton scarves as a way for individuals to walk away with a wearable textile after the class is over.

Figure 1.2

Teaching a Natural Dye Workshop at the Cornell Botanic Gardens.

While I taught others the natural dye process and used these processes in my creative design work, in my personal notes from the time, I longed to explore their use on a larger scale. I wondered: Do natural dyes disrupt a capitalist system built on speed and profits? Could natural dyes replace synthetic dyes on a larger scale within a system built for the immediate use and disposal of fashion? In November 2018, I passed my dissertation proposal and began in earnest to recruit natural dyers who were participated in the fashion supply chain. My connection to natural dye communities had deepened by this point due to my research projects from the

previous two years. In February 2019, I began to travel to collect interviews. My first trip was to Gap, Pennsylvania with a carload of film equipment to visit one of the only large-scale industrial natural dyehouses in the United States. Then I traveled to New York City to visit several small fashion designers who ran their own labels and naturally dyed garments. In late March/ early April, I received travel funding from the Cornell Graduate School to fly to the west coast, where I visited dyers in the Portland, Oregon; the San Francisco-Bay Area, CA; Los Angeles, CA; and San Clementi, CA.

In the summer of 2019, I received a grant from Engaged Cornell to complete a community-based research project with the only large-scale indigo growing operation in North America, Stony Creek Colors based out of Springfield, TN. My fieldwork included a two-and-half-week stay, from June 10th to 26th and a follow up visit October 3rd-5th. That summer I also helped Stony Creek Colors' (SCC) founder, Sarah Bellos, produce four open-access "how-to" style videos for natural dyers. In exchange, she granted me access to interview SCC employees about their various roles at the startup company. My follow up visit in October was my last in person source of data collection, although I have continued to communicate with various participants over the phone and through Instagram up until the submission of this manuscript.

Theoretical Background

The Circuit of Style-Fashion-Dress

The circuit of style-fashion-dress (CSFD) has guided the theoretical framework throughout my research because it captures the fluid and intersectional aspects of how identities, materials, economies, and cultures are produced. It is divided into five sections: production, distribution, regulation, consumption, and subject formation (Kaiser, 2012). Fashion theorist Susan Kaiser revised this model from Stuart Hall and Paul du Gay's "Circuit of Culture" (du

Gay, 1997). Kaiser was also informed by other fashion theorists, cultural theorists, symbolic interactionist theory, and anthropologists who looked at the social importance of the garments and how change is promulgated through fashion (Kaiser, 1997). Early theorists such as Veblen, Sapir, Simmel, and Kroeber were mostly concerned with the consumption and class of the fashioned body (Kroeber, 1963; Sapir, 1937; Simmel, 1957; Veblen, 1912). They studied the conspicuous consumption of the leisure class, which caused the lower classes to imitate their styles and manners of dress (Simmel, 1957; Veblen, 1912). In the 1970's, sociologist Pierre Bourdieu continued to build on ideas of class to better understand how and why individuals wear clothing (Bourdieu, 1977). Bourdieu (1977) stated that taste (and consumption) are the inherited cultural capital of the hegemonic upper classes and built ideas around why and how people wear clothing (p. 141). To Bourdieu, actions are predetermined by the social world and that an individuals habitus (deeply ingrained habits or embodied cultural capital) form how that person wears clothing (Bourdieu, 1977). Anthropologist Terence Turner (2012) also focused on subject formation and identity expression, focused on dress and body adornment as a cultural medium. To Turner (2012) dress is the interface between a person and their social world (p. 493).

Class, dress, and the body were important themes throughout fashion studies. However, it was the work of Elizabeth Wilson, Fred Davis, and Susan Kaiser brought ideas of ambivalence and ambiguity to academic vernacular. In the book *Adorned in Dreams: Fashion and Modernity* first published in 1985, Elizabeth Wilson critiqued Veblen's early notions of either/or and gendered thought. Wilson complicated ideas of identity through descriptions of the use of ambivalence and contradictions (conflicting truth claims) to understand the fluid nature of subject formation (Wilson, 2003). Davis and Kaiser built from this thinking to prescribe ideas of ambivalence (mixed emotions) and ambiguity (mixed messages) as the drivers of style and

change. Another concept is articulation, which is the point of connection that pulls together two contradictory ideas. In cultural studies, articulation presented the double meaning as a process of both expression and connection (Grossberg, 2010, p. 222; Hall, 1997, Kaiser, 2012, p. 4). Articulation can be a method by which researchers break down what appears to be whole and rearticulate new frameworks or interpretations (Grossberg, 2010, p.22).

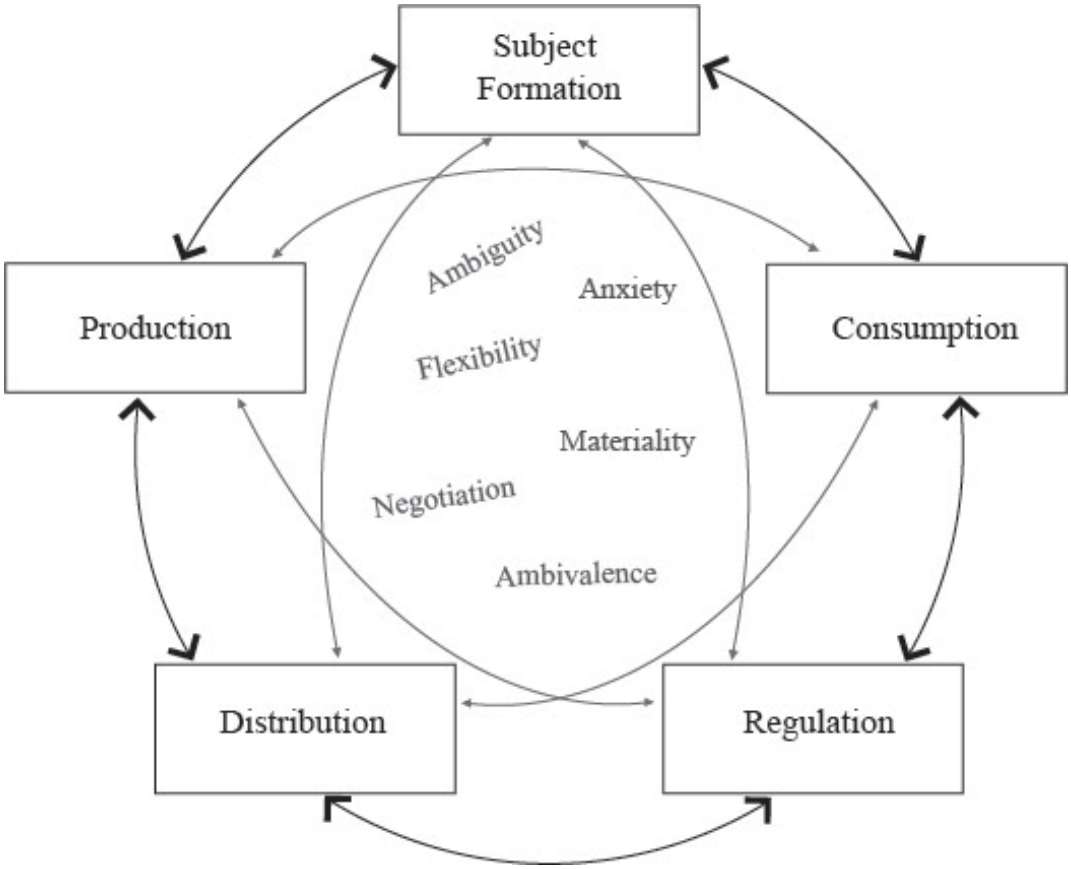
The CSFD is due in large part to Carol Tulloch's (2010) theory of style-fashion-dress. Style-fashion-dress articulated a system of concepts and is hyphenated to show a whole and part relationship in the way individuals display their subject positions (Tulloch, 2010, p. 274-275). Style is defined as agency and can be seen through "Style Narratives" or the constructed narratives that individuals produce for the larger social world (Tulloch, 2010, p. 276). Fashion is defined as the larger cultural context and dress is defined as body modifications and supplements (Tulloch, 2010, p. 275).

The CSFD breaks down into five distinct concepts with each element in the circuit itself a process (see Figure 1.3). The elements (production, distribution, regulation, consumption, and subject formation) are set in a circle with crisscrossing lines which connected each concept (Kaiser, 2012, p. 13). *Production:* Production is creation (Kaiser, 2012, p. 14). Production could be the growth of natural dye plants through agriculture or the coloration of a garment in a natural dyehouse. *Distribution:* How products are distributed and marketed (Kaiser, 2012, p. 19). Since the mass globalization of production, distribution has become a huge part of the fashion supply chain with cargo ships and freight that crisscrosses the globe. Before the mid-1800s, natural dyes were a significant part of the global supply chain with purple from mollusks shipped from the Greek isle to Northern Europe or indigo seeds shipped from India to North American colonizers (Clark et al., 1993; Jensen, 1963). Natural dyes are still a small part of the global supply chain

but issues that surround how and where dyes are grown affect the dyehouses that use natural colorants. *Regulation:* The regulation or limitations placed on production, distribution, consumption, and subject formation is both formal and informal (Kaiser, 2012, p. 23). For example, formal regulations on the distribution of naturally dyed garments could come in the form of import tariffs. Informal regulation could be the cultural discourse around natural dyes as "environmentally friendly" that regulate someone's subject formation and consumption of a naturally dyed garment. *Consumption:* The consumption or use of a product (Kaiser, 2012, p.18). Most times individuals concern themselves with the how, when, why, and at what rate people consume goods and services. The buying and wearing of a naturally dyed garment can be studied by fashion researchers interested in consumption patterns. *Subject Formation:* Is the act of being or becoming (Kaiser, 2012, p.20). Kaiser points out that subject formation is a continuously fluid process that involves many different factors including identity intersections, identity politics, and style-fashion-dress (Kaiser, 2012, p.20). Kaiser uses identity intersections (class, age, gender, ethnicity/race, sexuality, place, and nation) to describe the differing factors that contribute to our sense of being (Kaiser, 2012, p.30). For example, there are cisgender white women who can use their class position to use natural dyes as part of an environmentally sustainable identity. There are also natural dyers who are part of Indigenous communities and use natural dyes as part of long-standing traditions within their nations. For each group their class, age, gender, race, etc. contribute to their emergent identities and why/how they use natural dyes.

Figure 1.3

The Circuit of Style-Fashion-Dress



Note. This figure has been adapted from Kaiser, 2012, p. 41

The Grey Area Within the Circuit. Conflicting emotions and open possibilities float in the middle of the CSFD model. Kaiser (2012) says that, "a circuit connotes the idea of multiple sites connected by routes with potential detours (p. 40-41). The routes are not linear and movements flow in multiple directions. Circuits of culture and circuits of style-fashion-dress recognize that time and space intertwine through cultural practices that are themselves interconnected". It is this complex non-linear path through which I can better explore the

politics, production, and presence of natural dyes in the contemporary North American supply chain.

Conclusion

My research began as a small local sample of 4 individuals and gradually grew to over 33 participants in 6 states. Much like the growth of a single indigo plant from two small green leaves into many, the way I view this research process has become increasingly expansive. The following chapters outline only a small part of the knowledge there is to learn about this subject, and each chapter expresses one direction of potential growth.

This dissertation is only the beginning of a more expansive body of work that explores why we dye.

References

Armstrong, H. E. (1901, April 15). The downfall of natural indigo. *The Times*, 13. The Times Digital Archive.

Balfour-Paul, J. (2011). *Indigo: Egyptian mummies to blue jeans*. Firefly Books.

Baliarsingh, S., Panda, A. K., Jena, J., Das, T., & Das, N. B. (2012). Exploring sustainable technique on natural dye extraction from native plants for textile: Identification of colourants, colourimetric analysis of dyed yarns and their antimicrobial evaluation. *Journal of Cleaner Production*, *37*, 257–264. https://doi.org/10.1016/j.jclepro.2012.07.022

Bechtold, T., Turcanu, A., Ganglberger, E., & Geissler, S. (2003). Natural dyes in modern textile dyehouses: How to combine experiences of two centuries to meet the demands of the future? *Journal of Cleaner Production*, *11*(5), 499–509.

Bechtold, T., & Mussak, R. (2009). *Handbook of natural colorants*. John Wiley & Sons.

Beeson, K. H. (1964). Indigo production in the eighteenth century. *The Hispanic American Historical Review*, *44*(2), 214–218. https://doi.org/10.2307/2511598

Blaszczyk, R. L. (2012). The color revolution. MIT Press.

Bonynge, F. (1852). *The future wealth of America: Being a glance at the resources of the United States and the commercial and agricultural advantages of cultivating tea, coffee, and indigo, the date, mango, jack, leechee, guava, and orange trees, etc*. Francis Bonynge.

Bourdieu, P. (1977). *Outline of a theory of practice*. Cambridge University Press.

Boutrup, J., & Ellis, C. (2018). *The art and science of natural dyes: Principles, experiments, and results*. Schiffer Publishing.

Breyer, M. (2019, March 14). *Sneaker peak: Nike announces plant-based dye collection*. TreeHugger. https://www.treehugger.com/sustainable-fashion/nike-plant-color-collection.html

Brigden, K., Casper, K., Cobbing, M., Crawford, T., Dawe, A., Erwood, S., Haiama, N., Harjono, M., Hojsik, M., & Kai, Z. (2012). *Toxic threads: Putting pollution on parade*. Greenpeace International.

Burgess, R. (2011). *Harvesting color: How to find plants and make natural dyes*. Artisan Books.

Bye, E. (2010). A direction for clothing and textile design research. *Clothing and Textiles Research Journal*, *28*(3), 205–217. https://doi.org/10.1177/0887302X10371505

Cardon, D. (2007). *Natural dyes: Sources, tradition, technology and science*. Archetype Publications.

Chakraborty, J. N. (Ed.). (2015). *Fundamentals and practices in colouration of textiles*. CRC Press.

Charmaz, K. (2014). Grounded theory: Objectivist and constructivist methods. In W. Luttrell, (Ed.), *Qualitative educational research: Readings in reflexive methodology and transformative practice*. Routledge.

Chavan, R. B. (1995). Revival of natural dyes: A word of caution to environmentalists. *Colourage*, *42*, 27. https://colourpublications.in/product/colourage/

Clark, R. J. H., Cooksey, C. J., Daniels, M. A. M., & Withnall, R. (1993). Indigo, woad, and Tyrian purple: Important vat dyes from antiquity to the present. *Endeavour*, *17*(4), 191–199. https://doi.org/10.1016/0160-9327(93)90062-8

Coon, D. L. (1976). Eliza Lucas Pinckney and the reintroduction of indigo culture in South Carolina. *The Journal of Southern History*, *42*(1), 61–76. http://doi.org/ 10.2307/2205661

David, A. M. (2015). *Fashion victims: The dangers of dress past and present*. Bloomsbury Publishing.

Davies, C. (2018, October 4). Imaging tool unravels secrets of child's sock from ancient Egypt. *The Guardian*. https://www.theguardian.com/culture/2018/oct/04/imaging-tool-unravels-secrets-of-childs-sock-from-ancient-egypt

Desnos, R. (n.d.). *Natural dyeing*. Retrieved January 20, 2020, from https://rebeccadesnos.com/natural-dyeing/

Doty, K., Haar, S., & Kim, J. (2016). Black walnut, Osage orange and eastern redcedar sawmill waste as natural dyes: Effect of aluminum mordant on color parameters. *Fashion and Textiles*, *3*(22), 1-16. https://doi.org/10.1186/s40691-016-0074-9

du Gay, P. (1997). *Production of culture/cultures of production*. SAGE.

Erdem İşmal, Ö., Yıldırım, L., & Özdoğan, E. (2014). Use of almond shell extracts plus biomordants as effective textile dye. *Journal of Cleaner Production*, *70*, 61–67. https://doi.org/10.1016/j.jclepro.2014.01.055

Feeser, A. (2013). *Red, white, and black make blue: Indigo in the fabric of colonial South Carolina life*. University of Georgia Press.

Fletcher, K. (2008). *Sustainable fashion and textiles: Design journeys*. Earthscan.

Fletcher, K., & Grose, L. (2012). *Fashion and sustainability: Design for change*. Laurence King Publishing.

Garfield, S. (2002). *Mauve: How one man invented a color that changed the world*. W.W. Norton & Company.

Gray, C., & Malins, J. (2004). *Visualizing research: A guide to the research process in art and design*. Ashgate.

Gregory, P. (2007). Toxicology of textile dyes. In R. M. Christie (Ed.), *Environmental aspects of textile dyeing* (pp. 44–73). Elsevier.

Grossberg, L. (2010). *Cultural studies in the future tense*. Duke University Press.

Hall, S. (1997). *Representation: Cultural representations and signifying practices* (Vol. 2). Sage.

Handler, J. S. (2002). Survivors of the middle passage: Life histories of enslaved Africans in British America. *Slavery and Abolition*, *23*(1), 25–56. https://doi.org/10.1080/714005224

Jensen, L. B. (1963). Royal purple of Tyre. *Journal of Near Eastern Studies*, *22*(2), 104–118. https://doi.org/10.1086/371717

Kadolph, S. J. (2010). *Textiles*. Pearson.

Kadolph, S. J., & Casselman, K. D. (2004). In the bag: Contact natural dyes. *Clothing and Textiles Research Journal*, *22*(1–2), 15–21. https://doi.org/10.1177/0887302X0402200103

Kaiser, S. B. (1997). *The social psychology of clothing: Symbolic appearances in context*. Fairchild Books.

Kaiser, S. B. (2012). *Fashion and cultural studies*. Bloomsbury.

Kant, R. (2011). Textile dyeing industry an environmental hazard. *Natural Science,* 4(1), 22-26. https://doi.org/10.4236/ns.2012.41004

Kramell, A., Li, X., Csuk, R., Wagner, M., Goslar, T., Tarasov, P. E., Kreusel, N., Kluge, R., & Wunderlich, C.H. (2014). Dyes of late Bronze Age textile clothes and accessories from the Yanghai archaeological site, Turfan, China: Determination of the fibers, color analysis and dating. *Quaternary International*, *348*, 214–223. https://doi.org/10.1016/j.quaint.2014.05.012

Kroeber, A. L. (1963). *Style and civilizations* (Vol. 76). University of California Press.

Lu, S. (2019, August 16). WTO reports world textile and apparel trade in 2018. *Global Apparel & Textile Trade and Sourcing*. https://shenglufashion.com/2019/08/16/wto-reports-world-textile-and-apparel-trade-in-2018/

Plant Color Collection. (n.d.). Nike sustainability. Retrieved October 15, 2019, from https://purpose.nike.com/plant-color-collection

Puvaneswari, N., Muthukrishnan, J., & Gunasekaran, P. (2006). Toxicity assessment and microbial degradation of azo dyes. *Indian Journal of Experimental Biology*, 44(8), 618-626. http://nopr.niscair.res.in/handle/123456789/6554

Rembert, D. H. (1979). The Indigo of commerce in colonial North America. *Economic Botany*, *33*(2), 128–134. https://doi.org/10.1007/BF02858281

Roop, M. (n.d.). *Textiles and apparel*. United States International Trade Commission. Retrieved January 13, 2020, from https://www.usitc.gov/research_and_analysis/trade_shifts_2017/textiles.htm

Saha, K., Patwary, S. U., & Haar, S. (2018). Investigating the effluent of aluminum acetate as a pre-mordant on cotton print cloth. *International Textile and Apparel Association Annual Conference Proceedings.* 114. https://lib.dr.iastate.edu/itaa_proceedings/2018/presentations/114

Sapir, E. (1937). *Fashion*. Bobbs-Merrill Company Incorporated.

Sharrer, G. T. (1971a). Indigo in Carolina, 1671-1796. *The South Carolina Historical Magazine*, *72*(2), 94–103. https://www.jstor.org/stable/27567037

Sharrer, G. T. (1971b). The indigo bonanza in South Carolina, 1740-90. *Technology and Culture*, *12*(3), 447–455. https://doi.org/10.2307/3102998

Siebert, W. H. (1931). Slavery and white servitude in east Florida: 1726 to 1776. *The Florida Historical Society Quarterly*, *10*(1), 3–23. https://www.jstor.org/stable/30150116

Simmel, G. (1957). Fashion. *American Journal of Sociology*, *62*(6), 541–558. https://doi.org/10.1086/222102

Singh, Z., & Chadha, P. (2016). Textile industry and occupational cancer. *Journal of Occupational Medicine and Toxicology*, 11(36), 1-6. https://doi.org/10.1186/s12995-016-0128-3

Sinha, K., Saha, P. D., & Datta, S. (2012). Response surface optimization and artificial neural network modeling of microwave assisted natural dye extraction from pomegranate rind. *Industrial Crops and Products*, *37*(1), 408–414. https://doi.org/10.1016/j.indcrop.2011.12.032

Sivakumar, V., Vijaeeswarri, J., & Anna, J. L. (2011). Effective natural dye extraction from different plant materials using ultrasound. *Industrial Crops and Products*, *33*(1), 116–122. https://doi.org/10.1016/j.indcrop.2010.09.007

Travis, A. S. (1993). *The rainbow makers: The origins of the synthetic dyestuffs industry in Western Europe*. Lehigh University Press Bethlehem.

Tulloch, C. (2010). Style—fashion—dress: From Black to Post-Black. *Fashion Theory*, *14*(3), 273–303. https://doi.org/10.2752/175174110X12712411520179

Turner, T. S. (2012). The social skin. *HAU: Journal of Ethnographic Theory*, *2*(2), 486–504. https://doi.org/10.14318/hau2.2.026

Veblen, T. (1912). *The theory of the leisure class: An economic study of institutions*. B. W. Huebsch.

Wilson, E. (2003). *Adorned in dreams: Fashion and modernity*. I.B.Tauris.

Winberry, J. J. (1979). Indigo in South Carolina: A historical geography. *Southeastern Geographer*, *19*(2), 91–102. https://doi.org/10.1353/sgo.1979.0005

Chapter 2

Natural Dyes in the United States Apparel Supply Chain: An Exploration of Natural Dye Use Through the Lens of the Circuit of Style-Fashion-Dress

> It's not a plug and play, it's not like here's natural dyes, plug them into the existing consumption model. No. No, no, no, no. The existing consumption model needs a whole bunch of new technologies, new thought patterns, new behaviors, new leaders, new businesses … It needs a complete transformation of how we're consuming, what we're consuming, and when we're consuming … when you become more intimate with the process, you stop having to look at this monstrosity of the industry and saying, "how do I serve that?" Stop asking that question, stop asking natural dyes to answer that question. (Rebecca Burgess, personal communication, March 31, 2019)

Introduction

While natural dyes were at one point the only source of color for textiles, over the past 160 years, apparel and textile manufacturers have made synthetic dyes the norm. However, the fashion industry is once again adopting natural dyes, citing them as a more sustainable and renewable option to synthetics. Many people see natural dyes as a more environmentally friendly option because they are renewable, biodegradable, (Cardon, 2007; Fletcher & Grose, 2012) and reduce the impact of the fashion industry on waterways and soil (Bechtold et al., 2003, p. 502). Since 2016, Nike, Elieen Fisher, Allbirds, and Patagonia released small, limited runs of garments and shoes dyed with naturally derived colorants (Leighton, 2018; DuFault, 2017; Gibran, 2016). TOMS is one of the most recent companies to use natural dyes as an environmentally friendly alternative. In February of 2020 TOMS released a line of naturally dyed espadrilles as part of

their Earthwise™ collection (Earthwise™, n.d.). On the company website, the Earthwise™ collection framed its focus on sustainability:

> We like to think of Earthwise™ as both a challenge and an opportunity to create products rooted in earth-friendly materials and processes. As we continue to improve–whether that means more zero-chemical processes or new and innovative materials–so too will Earthwise™. Because the need for conscious creation is urgent, and progress has always been our purpose. (Earthwise™, n.d., "About Earthwise" section)

More examples of the fashion industry using natural dyes comes from Allbirds and Patagonia. In April 2018, Allbirds released a surprise, limited collection of naturally dyed wool runners right before Earth Day (Leighton, 2018). They created three colors dyed with indigo, madder root, and Japanese Pagoda flowers (Schneider-Levy, 2018). Allbirds released each color on a different day to increase publicity (Leighton, 2018). Patagonia launched the “Clean Color Collection” of men’s and women’s garments in the summer of 2017, which they dyed with agricultural bio-waste. In an interview with the fashion industry news site Fashionista, Patagonia's Senior Material Research & Innovation Manager, Sarah Hayes, said that natural dyes "were used for thousands of years and they come from renewable resources, but they also come with their complications, and we want to make sure we're being responsible and making the most responsible decision about what resources are being used" (Brannigan, 2017, para. 16). Patagonia worked with the dye house Archroma to produce dyes from agricultural and herbal waste and use extracts from almond shells, saw palmetto residue, and pomegranate skins leftover from food and herbal industries (Laughlin, 2017). Allbirds, Nike, and Elieen Fisher have also promoted naturally dyed products as a more sustainable alternate to conventional synthetic dyes.

However, natural dye use is a complex subject when it comes to sustainability. Experts have voiced concerns related to many facets of natural dye production and use (Bechtold et al., 2003; Fletcher & Grose, 2012). These concerns include natural dyestuff production, multiple wet processing steps, color consistency and fastness, and scalability (Bechtold et al., 2003; Doty et al., 2016; Fletcher & Grose, 2012; Saha et al., 2018). The industry requires more research on the use of natural dyes in the apparel supply chain before brands can claim sustainability with confidence. As previously mentioned, natural dyes lag nearly 160 years behind synthetic dyes when it comes to research and development for the scale of many major fashion brands. While natural dyes may not be explicitly more sustainable for the environment, it is also important to explore the challenges and innovations both small- and large-scale companies experience.

Purpose

The purpose of this chapter is to explore the challenges and innovations that surround the use of natural dyes through the theoretical lens of the circuit of style-fashion-dress (CSFD) (Kaiser, 2012, p. 13). For this chapter, I use the CSFD to help organize and analyze the information gathered in this study. Specifically, I examine the production, distribution, consumption, regulation, and subject formation associated with natural dyes. I concentrate on the fashion supply chain in the United States to narrow the scope of my research. This study is significant for several reasons. The first is that it broadly reviews the natural dye supply chain in the United States and provides readers with a snapshot of an industry that has found a seemingly renewed interest in natural colorants. My research also enhances awareness of those interested in the use of natural dyes for apparel production. I follow the process from plant to garment to individual with the hope to thoroughly convey the challenges and benefits of natural dyes.

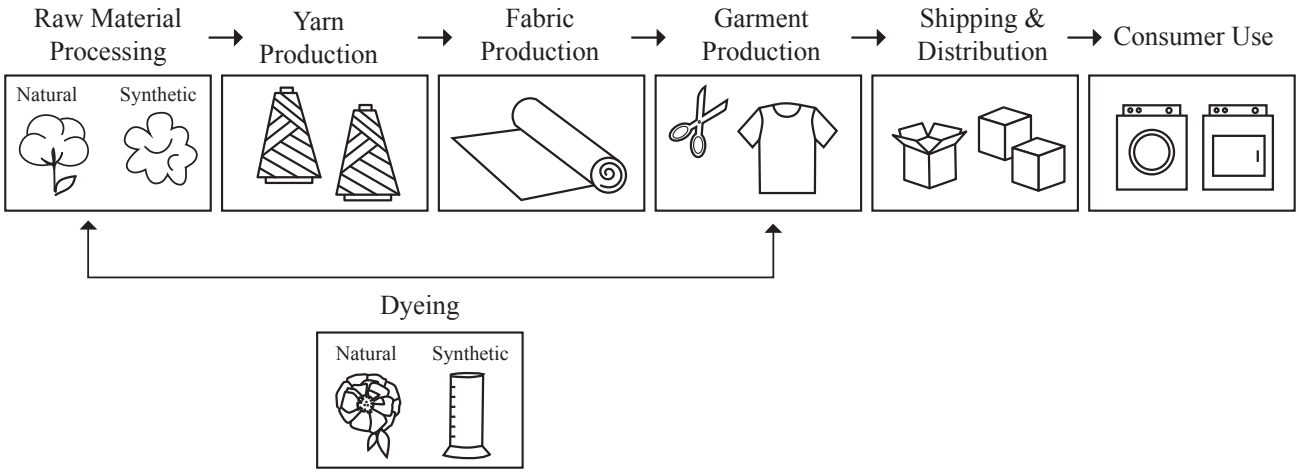
Literature Review

Global Fashion Supply Chain

The fashion industry is highly complex and one of the largest and most pollution intensive systems of production in the world (Boström & Micheletti, 2016; Curwen et al., 2013; Forman & Jørgensen, 2004; Shen et al., 2017). Globally, textiles and apparel account for nearly $820 billion USD in trade for 2018 (Lu, 2019). In 2017, the United States International Trade Commission reported that the U.S. textiles and apparel exports were $22.1 billion USD and imports totaled $121.4 billion USD (Roop, n.d.). Behind these large-scale numbers, the stages of the supply chain can be broken into these broad steps: fibers are produced, fibers are made into yarn, yarns are woven or knit into fabric, fabric is sewn into a garment, the garments are then shipped to retailers and sold online or in brick and mortar stores. Dyeing (natural or synthetic) can happen at the fiber, yarn, fabric, or garment stage of the supply chain (See Figure 2.1). Since the 1990s, enhanced public scrutiny into the ethical labor practices and environmental standards of the fashion supply chain pushed companies into the exploration of sustainable means of production (Fletcher & Grose, 2012) and resulted in some of the current corporate interest into natural dyes.

Figure 2.1

The Fashion Supply Chain



Natural Dyes

In the field of apparel manufacturing, there are two broad categories for dyes: natural and synthetic. Petroleum forms the base for synthetic dyes while plants, animals, minerals, or fungus create natural dyes. In manufacturing, synthetic dyes have become a reliable source of cheap, consistent, and high-performing color (Gregory, 2007). Scientists and environmentalist scrutinize synthetic dyes for the ways in which they pollute water and soil by the dye facilities (Brigden et al., 2012; Gregory, 2007). This has increased interest in natural dyes for an array of uses that include food coloring (Downham & Collins, 2000), beauty products (Daniel et al., 2006; Wang et al., 2015), pharmaceuticals (Chigurupati et al., 2002), and in textile dyeing (Bechtold et al., 2003; Cardon, 2007; Doty et al., 2016).

One challenge that faces widespread adoption of natural dyes is color consistency. The chemical coloring components that make up a natural dye vary based on the source. Organic chemical compounds such as quinones, benzoquinones, anthraquinones, naphthoquinones,

flavonoids, and indican can occur in differing amounts that are dependent on the conditions in which the dyestuff grew (Cardon, 2007). It is often necessary for dyers to pretreat fabric with a metallic salt, mordant, to fix these organic compounds to a textile. A mordant is not always necessary due to naturally occurring chemical compounds in the dye such as tannic acid. However, research has shown the use of one can improve dye absorption and colorfastness for dyes that do not require a mordant (Doty et al., 2016). Mordanting can occur before dyeing (pre-mordanting), throughout the dyeing process (simultaneous mordanting), or after the dyeing process (post-mordanting) (Cardon, 2007, pp. 11-15). Artisans most commonly use pre-mordanting, but to reduce water use and increase efficiencies, researchers have explored the usefulness of simultaneous mordanting (Bechtold et al., 2003). Another barrier is that natural dyes work best on natural fibers such as protein fibers (e.g., wool and silk) and cellulosic fibers (e.g., cotton and linen) (Bechtold et al., 2003; Bechtold & Mussak, 2009; Boutrup & Ellis, 2018; Cardon, 2007). Natural dyes are ineffective on some synthetic fibers, such as polyester and spandex. Nylon, a manmade fiber similar in chemistry to silk, is the exception. Still, this limitation drastically impedes the use of natural dyes on activewear and swimwear garments (Kadolph, 2010), so many fashion companies choose to use synthetic dyes.

As such, larger-scale companies that can use natural dyes need to consider how to improve their sustainability and longevity within modern textile dye houses. Bechtold et al. (2003) examined the use of 50 different types of natural dyes for use in a modern textile dye house. In this study, the researchers laid out a list of requirements that natural dyes needed to meet for adoption. Their research suggested improvements such as the development of a broad range of shades formed by a basic set of dyes and the creation of corrective measures to deviations in color depth and acceptable fastness properties (Bechtold et al., 2003). In terms of

sustainability, one of the most important improvements is the use of a one-step or simultaneous mordanting process to reduce water and energy use (Bechtold et al., 2003, p. 503). Lastly, the researchers calculated the chemical load of natural and synthetic dyes in wastewater left over from the dye process (Bechtold et al., 2003, p. 507). For cellulosic fibers, there was a distinct lowering of the chemical load in the wastewater but for wool the use of natural dyes did not improve the chemical load (Bechtold et al., 2003, p. 507). The researchers were quick to point out that regardless of the improvements to wastewater, all synthetic dyes are from non-regenerable sources while natural dyes are biodegradable and regenerable (Bechtold et al., 2003, p. 507). This motivation to create renewable and safe dyes is why companies such as Nike and Patagonia have developed natural dye products (*Clean Color*, n.d.; *Plant Color Collection*, n.d.). Yet, with a lack of research in the use of natural dyes, it leads me to ask: what are the current challenges natural dyes face in the apparel supply chain and how do the current innovations improve the process?

Methods and Theoretical Framework

Data Collection

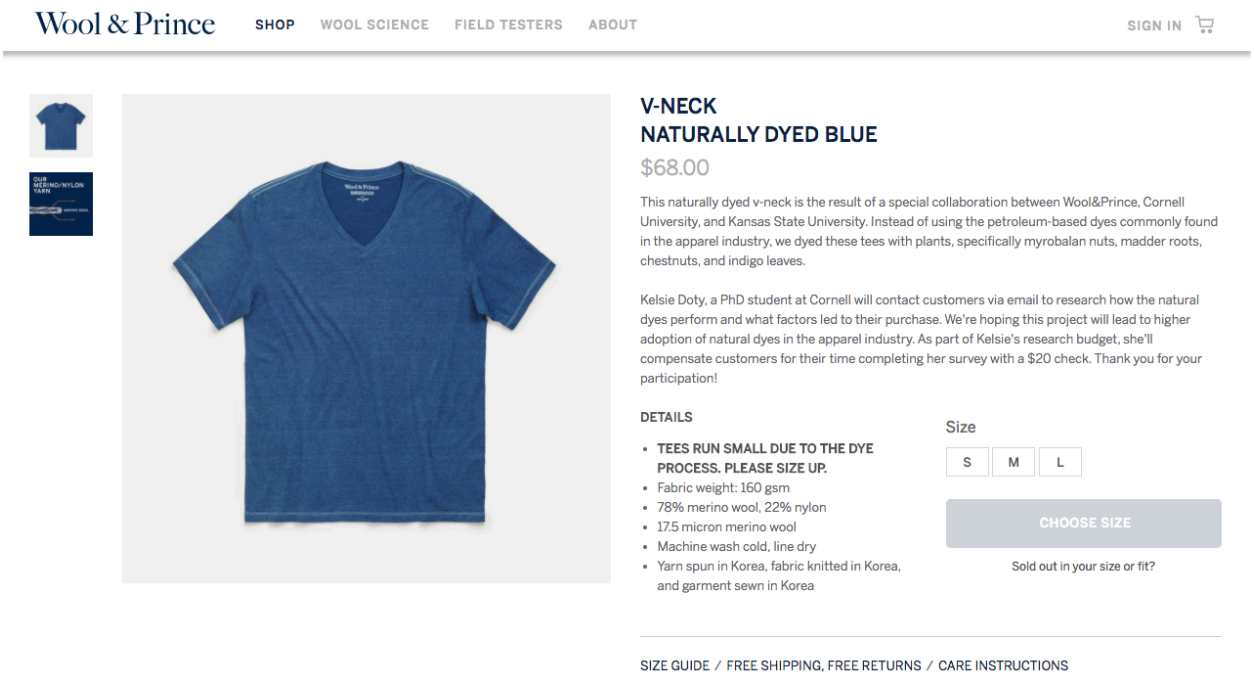
To document the use of natural dyes in the U.S. fashion supply chain, I integrated a variety of qualitative collection methods (e.g., interviews, participant observation, field notes and sketches, documentary filmmaking, and surveys). Over a three-year period (2016-2019), I conducted 15 in-depth interviews with people who work with natural dyes. These included fashion and textile designers who used natural dyes, natural dye growers, production dyers, and apparel companies that sold naturally dyed garments. I recorded many of the interviews via video camera for data analysis and for use in a documentary film. My fieldwork occurred in 12 different locations across the United States and included New York, NY, multiple locations in

Brooklyn, NY, Gap, PA, Springfield, TN, Portland, OR, multiple locations in the San Francisco Bay Area, CA, Los Angeles, CA, and San Clementi, CA. Over the course of my research, I took approximately 130 hours of film and over 700 photos. I also assisted participants with their work as a form of participant observation.

In the summer of 2017, I, along with Professor Denise Green and Professor Sherry Haar, took part in a research project with the menswear company Wool & Prince. As part of the project, we dyed 80 wool t-shirts in four different natural colorants. After dyeing, Wool & Prince sold the t-shirts through their online website and included a description of the study alongside the naturally dyed product (See Figure 2.2). We sent an e-mail to individuals who purchased a naturally dyed t-shirt and solicited their participation in two online surveys (see Appendix B for online surveys). We sent the first survey immediately after their purchase and then sent a follow-up survey four months later.

Figure 2.2

Screenshot from Wool & Prince Website Taken on October 10, 2017



Analysis

To analyze the interviews, I used a Grounded Theory approach and included in-depth first and second-round coding. I used NVivo[3] software for all analytics. For first-round coding, I used an In Vivo approach as outlined by Saldaña (2015) where the participants own words as a code. This is particularly useful when conducting research with members of a particular culture or subculture (Saldaña, 2015). Also, in first-round coding, I wrote analytical memos which guided the synthesis of broader categories for the second round of theoretical coding. For second-round coding, I included themes of production, distribution, and regulation as described in the theory of the CSFD. To increase the validity of my study, I used "rich and thick" descriptions for the results (Creswell, 2014; Geertz, 1973). A thick description, according to Creswell (2014) "may transport the readers to the setting and give the discussion an element of shared experiences" (p. 202). These descriptions include details of many perspectives around a theme that emerge from firsthand, experiential fieldwork and my fieldnotes (Creswell, 2014).

Theoretical Framework

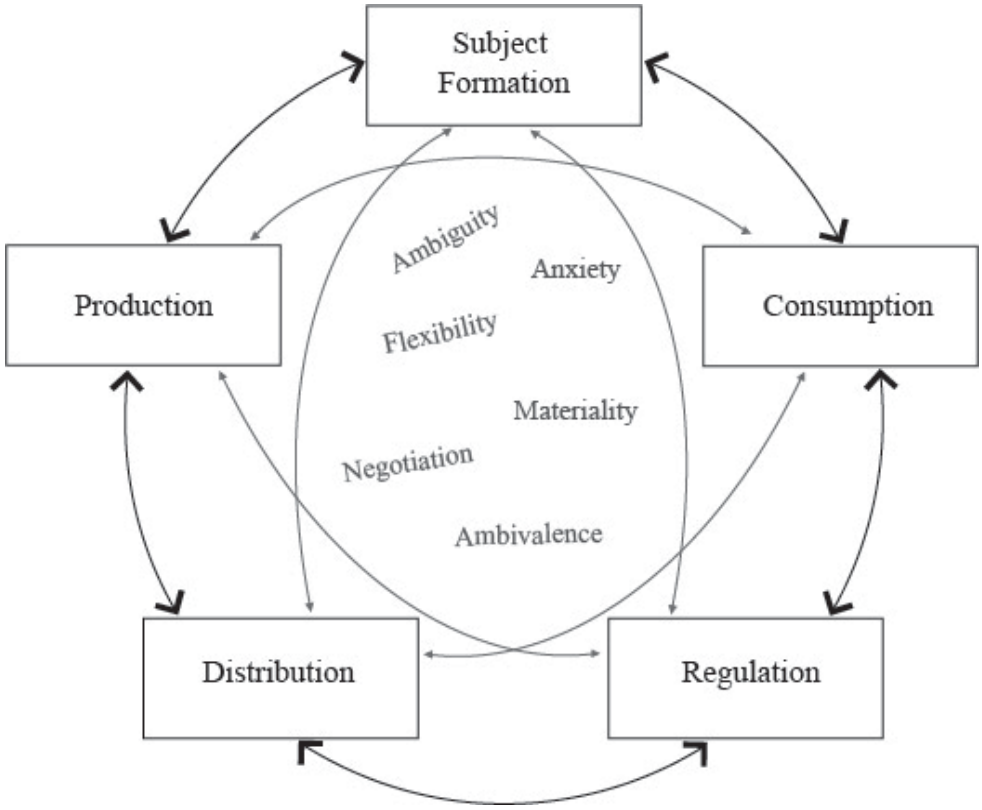
To analyze and organize my study, I used the CSFD model as laid out by Susan Kaiser (2012) in the book *Fashion and Culture Studies*. The CSFD was developed from du Gay's "circuit of culture" (1997) and from Carol Tulloch's fashion theory of style-fashion-dress to think about the global flows of fashions and ideas (du Gay, 1997; Kaiser, 2012; Tulloch, 2010). Applied concepts from fashion studies is particularly useful in the examination of complex issues such as the global fashion supply chain. The CSFD model includes production, distribution, regulation, consumption, and subject formation, which are placed within a circuit (see Figure 2.1), opposed to a linear path, to denote the multiple complex routes ideas can travel (Kaiser,

[3] NVivo software is not to be confused with the coding methods known as In Vivo.

2012). The definition for each delineation along the circuit is as follows: (a) Production, refers to the ideas of "making and doing" and is meant to conceptualize the production of apparel, ideas, or cultural practices (Kaiser, 2012, p. 14). (b) Distribution is the physical movement and marketing of goods (i.e. natural dyestuff, mordants, naturally dyed garments) and considered an inherently ambivalent concept, both dividing and dispersing (Kaiser, 2012, p. 19). (c) Regulation refers to the formal and informal regulation of subject formation, regulation also represents policies and restrictions placed on companies producing and distributing goods (Kaiser, 2012, p. 23). (d) Consumption is the utilization of a product or service (Kaiser, 2012, p. 18). (e) Subject formation is the act of "being or becoming" and is an iterative process of identity development (Kaiser, 2012, pp. 20-21). In the middle of the circuit lies a grey area, comprised of conflicting emotions and open possibilities, such as ambiguity (mixed emotions) and ambivalence (mixed messages), that continue the non-linear connection of the aforementioned delineations (Kaiser, 2012, pp. 14-41).

Figure 2.3

The Circuit of Style-Fashion-Dress



Note. This figure has been adapted from Kaiser, 2012, p. 41

Results and Discussion

Production: Growing Pains in Production and Scalability

To decrease production costs, fashion labels have developed ways to produce more naturally dyed garments at one time. This has led to the emergence of dedicated natural dye houses and large-scale natural dye growing operations in the United States. The following describes some of the current challenges and innovations I found in efforts to scale-up the use of natural dyes.

Textiles. Wool & Prince is based out of Portland, OR and focuses on the production of men's wool and wool blend t-shirts, button-up shirts, pants, and accessories. Due to the structure of the fibers, which are made from a series of overlapping scales, wool has a great affinity for natural dyes (Boutrup & Ellis, 2018). This made a collaboration with Wool & Prince an exciting prospect for a small line of naturally dyed garments.[4]

We dyed 80 wool t-shirts in four different natural dye colors (chestnut, myrobalan, madder, and organic indigo) that used a Global Organic Textile Standard (GOTS) certified mixture of mordant and dye that was created for volume dyeing in a mass manufacturing setting. For the indigo, we used dyestuff from Botanical Colors in a fructose sugar vat. One of the challenges we discovered in the project was that the top-stitching thread — likely made of polyester rather than nylon — remained white while the rest of the shirt developed a rich color from the dye (see Figure 2.2). We had expected the t-shirts to dye with a heathered effect since the fiber content for the t-shirts was 78% wool and 22% nylon, and the wool and nylon fibers the dye slightly differently. We did not anticipate the bright white stitching that remained after the dye process.[5] Wool & Prince was able to take our feedback after the project and changed their thread to a natural fiber when they later created their next collection of naturally dyed t-shirts. Our project was a reminder of the challenges natural dyes present when it comes to textiles. Companies should carefully consider the fiber content for the textiles, threads, and findings used to create a naturally dyed garment.

[4] If Wool & Prince made garments from polyester, we would have been unable to use natural dyes since they are ineffective on most synthetic fibers.
[5] Since the thread used to construct and finish the garment was likely 100% polyester, it absorbed little to no dye.

Figure 2.4

Madder and Myrobalan Dyed Wool & Prince T-shirts.

Color Consistency. Modern dye houses favor synthetic dyes for their consistency in targeted colors and exceptional colorfastness (Bechtold et al., 2003). Natural dyes have not received the same attention from researchers and current dyers acknowledge issues with reproducibility and color variance (Bechtold et al., 2003; Bechtold & Mussak, 2009; Doty et al., 2016). Many different variables affect the growth of a dye plant can include amount of sunlight, water, soil, predation, and temperatures, all of which can change the final color a plant will dye (S. Bellos, personal communication, June 2019). Other variables beyond dyestuff, such as water quality and manufacturing setup, also contribute to greater color variance. These inconsistencies in color were discussed as a limitation of natural dyes in informal conversations and formal

interviews with research participants. Production natural dyers such as Wynonna Quigley with Green Matters Dye Company discussed frustration such as "it might take six months to figure out like … that batch of matter root had iron in the soil. And so it was contributing to a certain amount of discoloration" (W. Quigley, personal communication, February 7, 2019). Even slight alterations in color can require a dye house to re-dye or discard a batch of garments or textiles. For this reason, it may be best to develop methods for whole garment dyeing, since thread color depends on each natural dye bath.

An important insight into this challenge and the subsequent innovations came from Sarah Bellos, founder of the Tennessee-based natural dye production company, Stony Creek Colors (SCC). SCC is one of the only fully commercialized producers of natural dyes in the United States and focuses on manufacturing natural plant-based indigo (S. Bellos, personal communication, June 24, 2019). The objective for SCC has been to offer a transparent supply of natural dyes that is tracible back to the farm that grew them. Today SCC produces roughly 120,000 pounds of indigo per day in the harvest season from late June through early November (S. Bellos, personal communication, June 24, 2019). Most of the yearly harvest is sold to denim mills to dye cotton fabric for blue jeans, while the rest of the indigo is sold to independent artisans or small-scale production dyers. SCC starts indigo plants from seeds (*Indigofera tinctoria, Indigofera suffruticosa, and Persicaria tinctoria*) and then transplants them in fields owned by local farmers contracted to work with SCC. Contract farmers are responsible for the cultivation of the indigo crop to maturation. Then SCC harvests the plants and processes the indigo in their factory in Springfield, TN. Most of the yearly harvest is sold to denim mills to dye cotton fabric for blue jeans, while the rest of the indigo is sold to independent artisans or small-scale production dyers.

Before she began SCC, Bellos owned a company, Artisan Natural Dye Work, where she naturally dyed textiles with her sister. They found that one of the largest issues with the scalable production of natural dyes is a consistent source of color. I spent three weeks at SCC in Springfield, TN in June of 2019, with a follow-up visit in October 2019 to better understand how SCC produces large volumes of indigo for consistent color. Bellos described the genesis of her idea to start SCC while she and her sister ran Artisan Natural Dye Works:

> My sister and I found ourselves … struggling at this like OK you know we're maybe dying a couple of hundred yards a week of fabric or pounds of t-shirts but it's very labor intensive and very unpredictable still even with great note taking and so that led me to leave that business Artisan Natural Dye works and start Stoney Creek Colors to be focused on … a pure play company that is going to try to scale and commercialize natural colors from plants … I realized was that there were certainly garment dye houses out there quipped who could potentially process and dye clothing with natural dyes but the supply of the extracts that was available was just really not consistent enough to get great results so we did a couple of trials with those types of garment houses and just found the challenges were really significant and really could be traced back to the inconsistency of the raw material ultimately that was going into the equipment. And so sometimes that can be a beautiful thing, right? One of the awesome parts about natural dyes is that they do have lots of chemical constituents in them it can really allow the colors to harmonize very well but it also does present some really significant challenges when you go to make that step change kind of beyond the artisan and craft level into industrial processing

> where you can't afford the time to go back and re-dye something if it doesn't meet … the color standards that the customer set (S. Bellos, personal communication, June 24, 2019).

Bellos was not able to achieve consistent results from the raw natural dyestuff and extracts, which led her to seek consistency through science and engineering at SCC. Before and throughout the indigo harvest an agricultural (ag) team visited alternating fields to take samples of indigo plants. I went along for one of these sampling runs with two members of the ag team to visit a field of perfectly cultivated *Persicaria tinctoria* (Japanese Indigo). Recent rains meant I waded through mud up to my ankles, but the indigo appeared healthy and robust (see Figure 2.2). On a map, SCC plots each indigo field into a grid. The ag team collected samples from various regions of the field, recorded the location on a sample from, and then took the samples back to the SCC chemistry lab. Lab technicians then analyzed the Indican level in each sample. Indican is the chemical precursor to indigo and levels can vary based on the maturity of the plants and growing conditions. SCC tracked indican levels and evaluated the best time to harvest and process the indigo plants into pigment (S. Bellos, personal communication, June 24, 2019). This type of chemical analysis allowed SCC to produce a more consistent pigment for use in large-scale manufacturing.

Figure 2.5

Field of Persicaria Tinctoria Near the SCC Factory

Beyond color consistency between batches of pigment, there are inherent difficulties in the use of natural dyes in a system optimized for synthetic dye manufacturing. Several individuals described uneven natural dye results while collaborating with traditional synthetic dye houses. Ellie Rivkin, head designer for Wool & Prince, discussed challenges with their overseas producer after our initial experiment dyeing 80 t-shirts:

> Ideally, we want to work with our … mass production overseas partners to really have them educated … and be able to produce the natural dyes together. So … there's definitely some companies that are working towards it. What our obstacles have been, kind of education ... they just haven't worked with natural dyes before so it's a different process, it's a different preparation method. You

> know, when they did sort of an indigo test it kind of came out all splotchy and, you know, we kind of learned that maybe there's a different scouring method involved or, you know, things … like that where they just haven't had experience doing it and that's only a matter of time. We just kind of communicate together and work together to get the right professionals in to teach each other and learn from other companies (E. Rivkin, personal communication, March 4, 2019).

Conventional dye houses are unlikely to know the extra steps required to use natural dyes since they mostly focus on synthetic dyes. For Wool & Prince's latest line of naturally dyed t-shirts, released in September of 2019, they worked with Green Matters Dye Company. Winona Quigley owns and operates Green Matters Dye Company based in Lancaster County, Pennsylvania. I first met Quigley in early February 2019 when I went for a four-day visit to Green Matters' production facility. The dye house is in a large steel building on the outskirts of town which houses other small-scale manufactures and businesses such as a woodworking studio and an RV rental business. Green Matters Dye Company is one of the few dedicated natural dye houses in the United States (W. Quigley, personal communication, February 7, 2019). Quigley described Green Matters as an all-natural dye service. Fashion labels often present Winona with a description of the color they need. The team at Green Matters then samples variations of the color and works with the fashion label to produce a desirable shade. Once they decide on a color, the fashion label will then ship either fabric or whole garments to be dyed at their factory in Pennsylvania. Green Matters naturally dyes the fabric or garments in their facility in Lancaster and then ships the product back to the fashion label. The shipping and disbursement of a natural dyed product brings me to the next step in the CSFD, distribution.

Distribution and Consumption: Connections Between Cloth and the Individual.

In the CSFD model, distribution is the process of either physical, visual, or conceptual movement of a fashion (Kaiser, 2012). Consumption is the acquisition and use of a product or service (Kaiser, 2012). Distribution and consumption form a nexus for discussion around how ways in which producers communicate with their clients and how clients perceive and use naturally dyed garments. In this next section, I will explain how individuals communicate and consume naturally dyed garments.

The Distribution of Natural Dyed Products. I found two major points of distribution for natural dyes: first, distribution occurs from growers to dyers. A company such as SCC is a good example of distribution from a producer to dye houses. However, a majority of large-scale natural dye production happens outside of the United States, thus outside the purview of my study. Another form of distribution is between natural dyers and their clients. This type of distribution comes with its challenges for how to communicate and market information about natural dyes. Since natural colorants are relatively unknown to much of the fashion industry, production dyers have found they need to educate their clients about the realities of natural colorant use. Liz Spencer is a production dyer based in southern California and operates The Dogwood Dyer. An experienced dyer, Spencer has collaborated with independent brands such as Colorant, KES NYC, and Svilu to color batches of garments with natural dyes (*Collaborations*, n.d.). In our interview, Spencer explained the necessity of communication this way:

> I communicate with my clients at the outset that natural dyes are not synthetic dyes. They're not meant to be forever. And even if you mordant well and scour well, and do your due diligence to do everything … and choose the right dyes that are known to be historically lightfast or even done lightfast tests yourself that it is not synthetic petroleum

based colorant that is going to, you know, outlast you. And so that's just that's what you have to understand about natural dyes, is that they will fade. And change. Sometimes they'll even darken with light exposure (L. Spencer, personal communication, April 11, 2019).

Quigley from Green Matters Dye Company also explained the challenges of managing expectations with clients who order products to be natural dyed for the first time:

> Something that we struggle with is managing expectations when a client is coming from like having a synthetically dyed product because there are they're just different, they're vastly different, especially cellulosic fibers have a like little bit of a smaller like color pool that we can create and, you know, like especially after working at like a large fashion brand. I do know that, like sales are driven by black … every season companies develop like really like a lot of money in developing color palettes. And then they're top selling product is always black. And I wear black all the time. And so I'm a part of that. But we don't offer black right now. There are dyers who have created a true black, but we have found that in production with cost and the, you know, not compromising handful of fiber or things like that is just not something we're offering yet. And that has been something that like with clients who are selling, you know, with right now, like if they're top selling products or black, that's not something that we can meet. We can't meet them there yet. And we want to be but we're just not there. It's going to take a lot of development, but that there has been a challenge when clients come to us and they really want to push to develop that. And we can't get it there, like a true black require, it can be up to five dyes. And that really drives the cost up and makes it unfeasible for production. So that's been a challenge (W. Quigley, personal communication, February 7, 2019).

Both Spencer and Quigley discussed difficulties they have found in the distribution of their products to client, most of whom have expectations based on their experience with synthetic dyes only. As natural dyer and print artist Graham Keegan put it “I think it's more about the consumer expectation of perfection. Or, you know, the consumer expectation of continuity that is possible...that synthetic dyes made possible (G. Keegan, personal communication, March 8, 2019).

Another concern voiced by Quigley was difficulty in the successful creation of black from natural dyes. The achievement of black is a simple one-step process with synthetic dyes, whereas it requires many steps with natural dyes. When I met Spencer for the first time in person, I complimented her on the pair of rich dark black pants she wore. “Naturally dyed!” she exclaimed but qualified that it required numerous dye baths to achieve (L. Spencer, personal communication, April 11, 2019). For production dyeing, every time they need to add a separate dye bath to the process it comes at a cost the dyer and the environment. In other words, a color that requires two separate dye baths usually doubles the cost; three separate dye baths triple the cost and so on. More water is used, which is not good for the environment. Fashion labels pass higher costs onto consumers through an increase in the final price of a garment. The question is, do consumers have the will to purchase naturally dyed garments?

The Consumption of Naturally Dyed Products. As previously mentioned in this chapter, I had the opportunity to survey customers who purchased and used naturally dyed t-shirts from the brand Wool & Prince. In the next section I will describe and discuss the result of the surveys. The first survey focused on basic demographics, online purchasing behavior, and on their perceptions of the naturally dyed product. The survey also asked about their initial thoughts about their satisfaction with the garment, satisfaction with the garment description, and if they

would purchase another naturally dyed t-shirt from Wool & Prince. The second survey, sent four months later, inquired about their satisfaction with the garment and its color, their laundering practices, any perceived changes in color to the garment, comments they had received about their shirt, and if they would purchase another naturally dyed t-shirt from Wool & Prince. For both surveys, questions were open-ended.

Wool & Prince sold the naturally dyed t-shirts online from October 8th, 2017 through December 31st, 2017 for $68. The first survey finished with a sample size of 24 participants (21 male, 3 female). Half of the participants had shopped online for clothing 10 or more times over the past year and nearly three-quarters of those surveyed had purchased clothing from the Wool & Prince website one to three times. When asked about what contributed to their decision to purchase, three people noted that they supported more environmentally friendly apparel production. One participant said, "[I] love the idea of high quality and environmentally friendly products, and also thought the t-shirt looked fantastic, great color," and another participant expressed an "Aversion to humanity's reliance on petroleum products; interest in sustainable manufacturing processes; damn good aesthetics". One participant found the product because they, "Googled indigo wool t-shirt and found Wool & Prince". Because of the polyester thread used for construction, the visible stitching on each t-shirt remained white. Three separate individuals mention this defect. When asked about their initial thoughts one person said, "Very positive. The only possible negative is the white stitching".

Approximately four months later, I sent a follow-up survey to participants who had completed the first survey and finished with a sample size of 18 participants (14 Male, 2 Female, 2 Non-reporting). When asked if they were satisfied with their naturally dyed t-shirt, all 18 replied positively. Some went further and explained they enjoyed the textile's hand and drape

and were pleased with the comfort and fit of the garment. Others mentioned the heathered look of the dye and said, “The color is deep, rich and natural looking burnt orange with very pleasant subtle variations in color that seem to add texture and depth to the fabric,” while another said “the colour has held fast despite weekly use, regular sun exposure, and multiple washings. The variations in colour of the garment are somewhat harsher than I prefer”. I also asked survey participants about how they laundered their naturally dyed t-shirt since washing can alter the color of some naturally dyed textiles. Three had not washed their garments, four had washed them 1-3 times, six had washed them 4-7 times, and four participants had washed them 8-11 times. Two individuals reported that they saw a difference in color and said the color had lightened. When asked if they would purchase another naturally dyed garment from Wool & Prince, all 18 participants answered “yes” and two individuals mentioned the need for a reasonable price point. While a small number of survey respondents mentioned their reluctance to pay more for naturally dyed products, it could represent a difficulty for fashion labels that want to use natural dyes. Currently, the natural dye process is much more labor and knowledge-intensive, which increases and that es the overall price of production.

Of course, a limitation to this series of surveys is the relatively small sample size. I did deliver these results to Wool & Prince, which helped to guide the subsequent production of anther collection of naturally dyed Wool & Prince garments. All companies should consider natural dyes’ effects on dye uptake and should consider the thread used to construct garments and fiber blends for textiles or consider dyeing fiber or fabric first and the completion of garment construction second. Consumers perceived natural dyes as an environmentally friendly alternative to conventional colorants. However, companies need to communicate the reason for an increased price point with naturally dyed garments.

Regulation: The Fight to Control Intellectual Property

Regulation may be formal (i.e. laws and codes) or informal (e.g. social pressure, self-regulation, and cultural discourses), but each shape the way we create knowledge, share ideas, and circulate materials and images. In natural dye communities, intellectual property concerns around natural dye processes are the main subject of regulation. A quick search through U.S. patents shows that individuals have copyrights for mordants and dyes (Echeverry et al., 2011; Goswami et al., 2004; Gurley, 1995, 1997; Ortalano & Vissing, 2003), which produces a formal regulation of information. However, in my discussions with participants, it was evident that informal regulation of natural dye information was common. In other words, natural dyers choose, through a process of self-regulation, whether to share information with other individuals. Most often natural dyers described the need to share information to enhance awareness of natural dyes. One of these was Graham Keegan, who is a textile print designer based in Los Angeles, CA. While there are natural dyers who prefer to maintain information such as dye recipes and methods as proprietary information, there are others who willingly share information as part of their business. Keegan explained his philosophy as:

> I'm of the camp of like, you know, share the knowledge. I think it's such a challenging, diverse, and huge landscape that there's plenty of room for everybody. I think … if you are a person who only kind of does one thing and that's your product, that can be- it can be dangerous to share your knowledge there, because then you could hypothetically be in direct competition with people. But in my case, if I just sharing how to do this stuff, you know, the people also have to have a want to figure out how to do it and then figure out what their setup is gonna be. There's a very high bar in terms of like competency (G. Keegan, personal communication, March 8, 2019).

Figure 2.6

Textiles Created by Graham Keegan

In a separate interview with Lydia Wendt, we discussed a lack of information sharing in the fashion industry and possible solutions for future dialogue (L. Wendt, personal communication, March 2, 2019). Wendt is the founder of California Cloth Foundry, a naturally dyed casual knitwear clothing brand based out of California. Besides apparel, Wendt has also taken part in projects that promote the discussion of climate change. In 2018, Wendt's company dyed tablecloths for the Global Climate Action Summit where chef Alice Waters served only ingredients that could survive rising global temperatures (Neubauer, 2018). I met Wendt in a coffee shop in San Francisco and had a conversation about current experts in the natural dye industry and innovations that have occurred with their expanded use. Eventually, our discussion moved towards informal regulation within natural dye communities. Wendt suggested I hold a symposium or a virtual round table of my participants to help connect them. I expressed my

reluctancy at this request, both because of my limited time and because of the regulation I had witnessed with several natural dyers outside of my study. Dyers had at times expressed an unwillingness to fully describe a process or dye recipe. To this Wendt suggested:

> Maybe you could put together a five bullet or six bullet code of ethics that we could all kind of feel very safe under the umbrella of sharing kind of resources. And recipes, are recipes … I mean, everybody was surprised that we put our Alice Waters recipe on our website. And people were asking us, hey, can I ask you, what colors did you use? Weld and indigo! You know, it's like...it was pretty easy. It's a given. But the more transparent you are...it's only gonna help each other (L. Wendt, personal communication, March 2, 2019).

Individuals who agreed to participate in my study, for the most part, readily provided me with information. The interest to grow natural dye communities and promote the environmental sustainability movement was central to the identity of many people that I talked to. The one exception was a company that is beholden to investors. To gain access to interviews at this company I had to sign a non-disclosure agreement. As businesses invest money into the development of natural dyes, it is increasingly likely researchers will see more information become proprietary. However, this is in opposition to the subject formation of many dyers who choose to use natural dyes because of sustainability reasons. They see promotion and the share of environmentally friendly methods as the way forward for fashion production. In the next section, I will further discuss how natural dyes shape identities through the process of subject formation.

Subject Formation: Identities Produced Through Natural Dyes

Subject formation is the process of being and becoming (Kaiser, 2012). It is not a static concept but instead represents everchanging identities. This can be related to how and why

individuals choose to use natural dyes. As mentioned in the Wool & Prince surveys, environmental concerns were a key theme that emerged from consumers of natural dye products. Moreover, many of the participants I interviewed made the connection between natural dyes and environmental sustainability. For Rebecca Burgess, natural dyes are central to ideas of ecological sustainability in the fashion industry. Burgess is the founder and executive director of Fibershed, a sustainability-focused nonprofit organization. Fibershed "develops regional and regenerative fiber systems on behalf of independent working producers" (*About – Fibershed*, n.d.). A regional fibershed connects different segments of the fashion supply chain in a specific area to produce a locally made yarn or garment. It is like the purchase of farmer's market cider that was produced from local orchards, a local fibershed provides an avenue for purchasing locally grown and produced fiber goods. Burgess has also authored books on fashion sustainability and natural dyes. Most notably *Fibershed: Growing a Movement of Farmers, Fashion Activists, and Makers for a New Textile Economy* (Burgess & White, 2019) and *Harvesting Color: How to Find Plants and Make Natural Dyes* (Burgess, 2011). Burgess champions the use of natural dyes that are beneficial to the regional fibershed, explained "my practice was always about how to work with plants that are indigenous to my area that could grow with the existing rainfall patterns" (R. Burgess, personal communication, March 30, 2019). As Burgess mentioned at the beginning of this chapter, natural dyes are not a sustainable solution in the current fashion supply chain as we know it.

It was in our interview that the use of natural dyes in the current fashion supply chain started to make sense to me. In the current fashion supply chain, natural dyes are counter-intuitive in many ways. The effort to scale natural dyes to fit the current consumption model will not work unless the entire fashion supply chain changes. Fashion companies must holistically

address their volume of garment production, the health of their workers, and the cost of production while considering the utilization of sustainable supply chain methods such as natural dyes. The largest challenge to natural dyes lies within a supply chain that is based on the cheap large volume production of clothing colored with synthetic dyes. If the fashion industry does not alter the entire supply chain, improvements to the natural dye process will only bring the industry so far.

Conclusion

In this chapter, I have reviewed the current challenges and innovations within the United States' fashion supply chain with regard to the use of natural dyes. Companies try to scale up production of naturally dyed garments in the U.S., but there are problems such as the use of natural textiles and uneven dye results. However, companies such as Stony Creek Colors are the innovation of new methods in natural dye production through scientific testing and enhanced agricultural sampling. Another innovation is the use of dedicated natural dye houses such as Green Matters Dye Company, which specializes in the use of natural dyes. Individuals who distribute naturally dyed products have had to communicate and educate others about the differences between natural dyes and synthetic dyes. This includes communicating why there is an increase in the cost of a naturally dyed garment. As for regulation, the industry needs to be aware of informal and formal codes of knowledge sharing when it comes to proprietary information on the use of natural dyes. One of my participants even suggested a code of ethics for the share of resources and information. Finally, participants in my study communicated a belief that natural dyes are an environmentally sustainable alternative to synthetics; however natural dyes currently do not meet the demands of the fashion supply chain and cannot be a

reasonable replacement for synthetic dyes. It is only through a complete disruption of the manufacturing system that natural dyes will make sense in the future of fashion.

Limitations and Future Research. To address the limitations of my research, I want to first identify my own biases related to natural dyeing. As I outlined at the beginning of my dissertation, I am an active participant and promote the use of natural colorants. These biases affected how I viewed their potential use in the fashion supply chain. There was also bias from my research participants. Most of them are making a living selling naturally dyed goods, so they want to promote them in the best possible light. In future research, I would like to find ways to limit my personal biases towards natural dyes. This may include more conversations with individuals opposed to their use or research methods that require less of my input. For example, researching via online surveys instead of in person interviews. A major limitation of the surveys I conducted with Wool & Prince was the relatively small sample size. Moreover, individuals were self-reporting and there was no way to verify their responses. Another limitation was my relative lack of knowledge on consumer survey instruments. Consumer research is a relatively large branch of inquiry in fashion studies and any future surveys will involve feedback from fashion consumer scholars in my field.

Ideas for future research include a broad survey on how much of the industry synthetic dyes or natural dyes. It would also be helpful to know the percentage of those factories using wastewater treatment procedures after dyeing. However, due to the global and often secretive nature of the fashion supply chain, it would be extremely difficult to complete this type of survey. An example of this approach could be working with an environmental scientist to test the amount of water used by natural dyehouses and the condition of the wastewater. By building a

better understanding of how natural dyes affect the environment, we can create processes that are best for the environment and the people using natural dyes.

References

About Fibershed. (n.d.). Retrieved February 16, 2020, from https://www.fibershed.com/about/

Bechtold, T., Turcanu, A., Ganglberger, E., & Geissler, S. (2003). Natural dyes in modern textile dyehouses: How to combine experiences of two centuries to meet the demands of the future? *Journal of Cleaner Production*, *11*(5), 499–509.

Bechtold, T., & Mussak, R. (2009). *Handbook of natural colorants*. John Wiley & Sons.

Boström, M., & Micheletti, M. (2016). Introducing the sustainability challenge of textiles and clothing. *Journal of Consumer Policy*, *39*(4), 367–375.

Boutrup, J., & Ellis, C. (2018). *The art and science of natural dyes: Principles, experiments, and results*. Schiffer Publishing.

Brannigan, M. (n.d.). *Why is fashion still sleeping on all-natural dyes?* Fashionista. Retrieved September 21, 2019, from https://fashionista.com/2017/04/all-natural-dyes-for-fabric

Brigden, K., Casper, K., Cobbing, M., Crawford, T., Dawe, A., Erwood, S., Haiama, N., Harjono, M., Hojsik, M., & Kai, Z. (2012). Toxic threads: Putting pollution on parade how textile hiding their toxic trail. Amsterdam e NL.

Burgess, R. (2011). *Harvesting color: How to find plants and make natural dyes*. Artisan Books.

Burgess, R., & White, C. (2019). *Fibershed: Growing a movement of farmers, fashion activists, and makers for a new textile economy*. Chelsea Green Publishing.

Cardon, D. (2007). *Natural dyes: Sources, tradition, technology and science*. Archetype Publications.

Chigurupati, N., Saiki, L., Gayser, C., & Dash, A. K. (2002). Evaluation of red cabbage dye as a potential natural color for pharmaceutical use. *International Journal of Pharmaceutics*, *241*(2), 293–299.

Clean Color: Natural & Plant Based Dyes. (n.d.). Retrieved February 18, 2020, from https://www.patagonia.com/clean-color.html

Collaborations. (n.d.). The dogwood dyer. Retrieved February 16, 2020, from http://www.thedogwooddyer.com/collaborations

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE.

Curwen, L. G., Park, J., & Sarkar, A. K. (2013). Challenges and solutions of sustainable apparel product development: A case study of Eileen Fisher. *Clothing and Textiles Research Journal*, *31*(1), 32–47. https://doi.org/10.1177/0887302X12472724

Daniel, M., Bhattacharya, S. D., Arya, A., & Raole, V. M. (2006). *Natural dyes: Scope and challenges*. Scientific Publishers.

Doty, K., Haar, S., & Kim, J. (2016). Black walnut, Osage orange and eastern redcedar sawmill waste as natural dyes: Effect of aluminum mordant on color parameters. *Fashion and Textiles*, *3*(1), 22. https://doi.org/10.1186/s40691-016-0074-9

Downham, A., & Collins, P. (2000). Colouring our foods in the last and next millennium. *International Journal of Food Science & Technology*, *35*(1), 5–22.

du Gay, P. (1997). *Production of culture/cultures of production*. SAGE.

Earthwise^{TM}. (n.d.). Retrieved February 15, 2020, from https://www.toms.com/earthwise

Echeverry, L. F., Zapata, S. P., Torres, L. F. (2011). *United States patent: 7927637 - Blue colorant derived from Genipa americana fruit* (Patent No. 7927637). http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-

bool.html&r=20&f=G&l=50&co1=AND&d=PTXT&s1=%22natural+dye%22&s2=textil e&OS=%22natural+dye%22+AND+textile&RS=%22natural+dye%22+AND+textile

Fletcher, K., & Grose, L. (2012). *Fashion and sustainability: Design for change*. Laurence King Publishing.

Forman, M., & Jørgensen, M. S. (2004). Organizing environmental supply chain management: Experience from a sector with frequent product shifts and complex product chains: The case of the Danish textile sector. *Greener Management International*, *45*, 43–62.

Geertz, C. (1973). Thick description: Toward an interpretive theory of culture. In *Interpretation of cultures* (pp. 3–30). Basic Books.

Goswami, U., & Ganguly, A. (2004). *United States patent: 6689391 - Natural non-polar fluorescent dye from a non-bioluminescent marine invertebrate, compositions containing the said dye and its uses* (Patent No. 6689391). http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=32&f=G&l=50&co1=AND&d=PTXT&s1=%22natural+dye%22&s2=textil e&OS=%22natural+dye%22+AND+textile&RS=%22natural+dye%22+AND+textile

Gregory, P. (2007). Toxicology of textile dyes. In *Environmental aspects of textile dyeing* (pp. 44–73). Elsevier.

Gurley, S. (1995). *United States patent: 5403362 - Mordant and method of dyeing fibers* (Patent No. 5403362). http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=46&f=G&l=50&co1=AND&d=PTXT&s1=%22natural+dye%22&s2=textil e&OS=%22natural+dye%22+AND+textile&RS=%22natural+dye%22+AND+textile

Gurley, S. (1997). *United States patent: 5651795 - Mordant composition containing citric acid for dye processes* (Patent No. 5651795). http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=43&f=G&l=50&co1=AND&d=PTXT&s1=%22natural+dye%22&s2=textile&OS=%22natural+dye%22+AND+textile&RS=%22natural+dye%22+AND+textile

Kadolph, S. J. (2010). *Textiles*. Pearson.

Kaiser, S. B. (2012). *Fashion and cultural studies*. Bloomsbury.

Laughlin, J. (2017). Experimenting with naturally dyed clothing. Patagonia. https://www.patagonia.com/blog/2017/06/experimenting-with-naturally-dyed-clothing/

Leighton, M. (2018, April 17). *You can buy Allbirds – Silicon Valley's favorite shoes – in 3 exclusive colors for Earth Day this week only*. Business Insider. https://www.businessinsider.com/allbirds-limited-edition-earth-day-wool-runners-2018-4

Lu, S. (2019, August 16). WTO reports world textile and apparel trade in 2018. *FASH455 Global Apparel & Textile Trade and Sourcing*. https://shenglufashion.com/2019/08/16/wto-reports-world-textile-and-apparel-trade-in-2018/

Neubauer, M. (2018, October 11). *To teach people about climate change, feed them journalism*. Columbia Journalism Review. https://www.cjr.org/brown_institute/climate-change-food-journalism.php

Ortalano, D. M., & Vissing, C. J. (2003). *United States patent: 6503317 - Dye based aqueous pigment dispersions* (Patent No. 6503317). http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=34&f=G&l=50&co1=AND&d=PTXT&s1=%22natural+dye%22&s2=textile&OS=%22natural+dye%22+AND+textile&RS=%22natural+dye%22+AND+textile

Plant Color Collection. (n.d.). Nike sustainability. Retrieved October 15, 2019, from https://purpose.nike.com/plant-color-collection

Roop, M. (n.d.). *Textiles and apparel | USITC*. United States International Trade Commission. Retrieved January 13, 2020, from https://www.usitc.gov/research_and_analysis/trade_shifts_2017/textiles.htm

Saha, K., Patwary, S. U., & Haar, S. (2018). Investigating the effluent of aluminum acetate as a pre-mordant on cotton print cloth. *International Textile and Apparel Association Annual Conference Proceedings.* 114.

Saldaña, J. (2015). *The coding manual for qualitative researchers*. SAGE.

Schneider-Levy, B. (2018, April 17). *Allbirds launches earth day collection of naturally dyed styles.* Footwear News. https://footwearnews.com/2018/shop/shoes/allbirds-earth-day-dyed-wool-limited-edition-series-1202550327/

Shen, B., Li, Q., Dong, C., & Perry, P. (2017). Sustainability issues in textile and apparel supply chains. *Sustainability*, *9*(9), 1-6. https://doi.org/10.3390/su9091592

Tulloch, C. (2010). Style—fashion—dress: From Black to Post-Black. *Fashion Theory*, *14*(3), 273–303. https://doi.org/10.2752/175174110X12712411520179

Wang, H. M. D., Chen, C. C., Huynh, P., & Chang, J. S. (2015). Exploring the potential of using algae in cosmetics. *Bioresource Technology*, *184*, 355–362. https://doi.org/10.1016/j.biortech.2014.12.001

Ybema, S., Yanow, D., Wels, H., & Kamsteeg, F. H. (2009). *Organizational ethnography: Studying the complexity of everyday life*. SAGE.

Chapter 3

Meaning Infused into Fiber: Exploring Motivations of Natural Dyers

This chapter explores the underlying motivations of individuals who use natural dyes as part of their apparel and textile design practice. I argue that natural dyers infuse meaning into a cloth and produce identities through their work. For a dyer, the process of natural dye color creation typically requires many steps. Physical labor is required and might include the need to lift heavy buckets, strain dye plants from hot murky water, and continuously stir textiles to achieve the color they desire. While natural dyes have been studied for their colorfastness (Haar et al., 2018; Hossain et al., 2017; Sarkar & Seal, 2003), for their use in historical artifacts (Coon, 1976; McGovern et al., 1990; Puchalska et al., 2004), and as part of Indigenous knowledge (Modesto & Niessen, 2005; Richards, 1994), little research exists about for-profit, informal, and non-Indigenous communities of dyers and the contemporary use of natural dyes within the fashion industry. I explore the motivations of modern natural dye artists or craftspersons who use them in the United States. The intensive physical and mental labor involved in producing naturally dyed textiles is something that I had personally experienced, and this urged me to ask: why do we dye?

What is a Natural Dye?

A natural dye is often used to color textiles and is extracted from plants, minerals, or insects (Choudhury, 2017; Patel, 2011). For a list of common dyes grown and/or used in North America, please see Figure 3.1. Natural dyes can color food or cosmetics but, for this study, I focus on their use to color yarn, cloth, and garments. Natural dyes work best on natural textiles made from protein fibers (wool, mohair, alpaca) or cellulose fibers (cotton, linen, hemp) (Boutrup & Ellis, 2018; Cardon, 2007). However, due to their chemical structure, natural dyes

often require the aid of a metallic salt known as a mordant (Boutrup & Ellis, 2018; İşmal & Yıldırım, 2019; Purwar, 2019). In the past, dyers used toxic metallic mordants, such as copper, chrome, and tin. The most common mordant today is alum and it is widely considered to be benign (Boutrup & Ellis, 2018; Cardon, 2007). In interviews for this study, natural dyes were often compared to synthetic dyes, which are manufactured petroleum-based colorants. After synthetic dyes were discovered and adopted by the industry in the mid-late 1800s, they have risen to be the majority textile color source (Travis, 1993).

Figure 3.1

Sources of Common Natural Dyes Used in North America.

Common Names	Scientific Names	Colors Produced	Source
Madder	*Rubia tinctorum*	red, orange red	roots
Marigold	*Tagetes*	gold, yellow, green-yellow	flower
Cochineal	*Nopalea cochenillifera*	fuchsia pink, red, purple	insect
Indigo	*Indigofera tinctoria* *Indigofera suffruticosa* *Persicaria tinctoria*	blue, blue purple, blue teal	leaves
Chestnut	*Castanea dentata*	brown, silver, black	fruit, trunk
Cutch	*Acacia catechu*	cinnamon browns, deep browns	heartwood
Walnut	*Juglans nigra* L.	brown, dark grey brown	fruit, trunk
Weld	*Reseda luteola*	bright yellow, olive green	leaves, flower heads, small stems
Myrobalan	*Terminalia chebula*	light yellow, dark grays	fruit
Pomegranate	*Punica granatum*	gold yellows, grays, greens	rind from the fruit
Avocado	*Persea americana*	light pinks, tans	rind and stone from the fruit

Note. Informaiton is taken from Boutrup & Ellis (2018) and Cardon (2007).

The Natural Dye Process

Compared to synthetic dyes, natural dyes often require more steps to achieve a successful color (Boutrup & Ellis, 2018). Natural dye chromophores do not readily attach themselves to

fiber and require fabric and yarns to be free of impurities, oils, wax, or sizing (Boutrup & Ellis, 2018; Cardon, 2007). For consistent dye results, the material requires a thorough scouring (i.e. washing) with hot water and a detergent (Boutrup & Ellis, 2018; Cardon, 2007). After scouring, textiles are often mordanted, which is the application of a metallic salt to the textile. To mordant, natural dyers will most often dissolve an aluminum (alum) salt into warm-hot water and then add the textiles to this bath. The alum mordant is transparent when dissolved in water and only the acidic smell indicates that something is happening to the soaking textile.

After the dyer prepares the textile, the next step is to extract the dye from the dyestuff. To do this, a dyer will often use water and possibly a solvent (i.e. ammonia, ethanol, or denatured alcohol) depending on the dyestuff (Bechtold et al., 2003; Bechtold & Mussak, 2009; Cardon, 2007). Say a natural dyer wanted to use marigold flowers. They would place the fresh or dried flowers in a pot filled with water and bring it to a low simmer. It will not take long before a bright yellow color starts to seep from the floating flower heads. This is much like if one brews a cup of tea and can see the color from the tea leaves change in the hot water. After a couple of hours, the dyer strains the marigolds from the dye bath. Sometimes, natural dyers will instead use what is called an “extract”, which are created through a distillation process and can be purchased from several suppliers (Boutrup & Ellis, 2018). A dyer can add the concentrated natural dye extract to water and skip the extraction process altogether. After the dyer prepares the natural dye, they add the scoured and mordanted textile to the dye bath and gently heat so the dye takes to the fibers. When a dyer uses a synthetic dye, it is not always necessary to do steps such as scouring, mordanting, extraction, or heating the dye bath. This means that synthetic dyes have a much shorter and less labor-intensive process.

The Complicated Environmental and Sociological Impacts of Natural Dyes

In research, one can often find natural dyes touted as a sustainable alternative to synthetic dyes (Bechtold & Mussak, 2009; Doty et al., 2016; Erdem İşmal et al., 2014; Khatri & White, 2015). In some cases, natural dyes may be more sustainable when it is considered that natural dyes easily biodegrade due to their organic origins (Bhatti et al., 2010; Fletcher, 2008; Mirjalili & Karimi, 2013). However, as mentioned in previous chapters, there are factors that complicate the use of natural dyes and more research is needed to better understand the implications of their use. Little is known about the impacts natural dyes have on land and water use, post dye effluents, the biodegradation of dyes, and their overall long-term effects on people and the environment. One of the greatest areas of concern I encountered in my fieldwork was the use of water use in standard natural dye practices. The multiple-step process, explained earlier, requires a large amount of water. This can be particularly painful in states such as California, which recorded "exceptional drought" conditions from 2014 to 2017 ("Drought in California", n.d.).

Fletcher and Gross (2012) pointed out that the sustainability critics of natural dyes often miss the point. They explained that individuals are motivated to use natural colorants to work within the limits of nature and to connect more deeply to the land and community (Fletcher & Grose, 2012). However, in Fletcher and Gross's (2012) book, *Fashion and Sustainability: Design for Change*, they only briefly discussed these motivations and did not cover how natural dyes may be a source of personal articulation for the individuals using them. When it comes to natural dyes, little is known about the implications of their use and an individual's self-identity or motivations. There is a research gap on how and why individuals choose to use them in the context of craft, art, and design. This chapter is important because I ask what motivates an individual to use natural dyes.

Methods and Analysis

For this chapter, I utilized qualitative methods including interviews (over the phone and in person), documentary filmmaking, audio recordings, photography, field work, participant observation research, and field notes to explore the use of natural dyes by textile artists and production dyers. After I gained approval from the Cornell Institutional Review Board, I interviewed a total of 20 dyers based in the United States from November 2016 to June 2019. Each interview was informal, but my guiding questions[6] were:

1. How long have you been using natural dyes?
2. Why did you begin using natural dyes?
3. How did you educate yourself about natural dyes?
4. Why do you continue to use natural dyes?

Interviewees had a range of experience and use of natural dyes. Six of the dyers could be considered production dyers which meant they naturally dyed bulk orders of fabric, garments, and/ or yarn for other companies and individuals. Two of the individuals used natural dyes to color wool yarn, which they sold online and in person. Four owned their individual small fashion labels and use naturally dyed fabric and garments for their fashion collections. The remainder were individuals used natural dyes as part of their creative practices and some created conceptual art for gallery exhibits and sale. Each interview was 45-90 minutes long and all the participants agreed to allow their names and likeness for use as part of this research. I conducted site visits and participant observation in 15 different locations across the United States. I conducted many of the formal interviews in person and recorded via video camera. Through participant

[6] For a complete list of interview questions, please see Appendix C.

observation, I had the opportunity to experience the physical labor involved in the production of natural dyes or naturally dyed products. Participants gave permission for field notes, audio recordings, and photographs.

I transcribed my interviews and coded them with NVivo computer software with a Grounded Theory approach. A Grounded Theory approach enabled me to identify emergent themes, concepts, ideas, or elements through a coding process (Strauss & Corbin, 1994). First round coding used an In Vivo coding method to find "participant-generated words from members of a particular culture" (Saldaña, 2015, p. 91) and aided in the production of a codebook utilized for second round thematic coding. To help illustrate my findings, I will use thick descriptions and direct quotes to improve the validity of my results (Lincoln & Guba, 1985). As my results attest, the use of natural dyes is complex and nuanced, with intersecting ideas of identity, knowledge, and sustainability. Throughout my time with natural dyers, I have found three main sources of motivation: (a) perceived environmental and health concerns, (b) personal fulfillment and identity, and (c) the opportunity for autonomy over production, which I will discuss in the following section.

Results and Discussion

Environmental and Health Concerns.

Concern for the environment and human health were two major motivations for the pursuit of natural dyes. Natural dyes are a biodegradable colorant, even if their wider impacts are not fully known. Natural dyers often rejected the use of synthetic dyes and cited their concern for the impact of synthetic dyes and associated chemicals on the environment and their health. These fears are not unfounded, as research has linked the use of synthetic textile dyes and solvents to

the increased occurrence of colon cancer and bladder cancers in the textile industry (Singh & Chadha, 2016).

Jenna Baucke is the founder of Jalama Dyes, a clothing label that Baucke owns and operates by herself. I sat down for an interview with Baucke in her studio in Oakland, CA. Dyed garments and leather bags lined the wall behind us and Baucke pulled out pieces to show me (see Figure 3.2). Baucke has each garment cut and sewn in California before she naturally dyes them by hand (J. Baucke, personal communication, April 1st, 2019). Baucke explained the reasons she uses natural dyes as:

> A few things motivate me to do that. Primarily the regenerative aspect of it, where, even though water has been used through that process, you can still put it in your garden and it's safe going back into the ground, which is huge. That sort of... all of the elements are minerals or plants that have already come from the earth, almost directly. Whereas, opposed to lab made dyes are just so far from anything, just wanting to not use anything synthetic for my own health, as well as for the health of the planet and the health of the customer.
>
> I got really fatigued dumping toxic chemicals down the drain all the time … And because I was working for a clothing company that did synthetic dyes and just actually felt the physical effect on my own body, and I just wanted to see what other alternatives were around, for my own health (J. Baucke, personal communication, April 1st, 2019).

Figure 3.2

Jenna Baucke in Her Oakland, CA Studio

Other natural dyers echoed this sentiment. Not only did they want to find a source of color that was better for the environment but one that was also healthier for themselves and others. For Kenya Miles and Ramya Naidu, founders of the small independent label Ke/Ra Cloth, sustainable practices are at the center of their design ethos. I met Miles and Naidu at a trunk show for their naturally dyed jackets in Oakland, CA. We sat down for an interview in a lush backyard garden in early April (see Figure 3.3). A light rain threatened to end our interview early but our conversation on plants, cultural appropriation, and sources of natural dye knowledge kept us in our chairs. Naidu is the designer behind the label while Miles does the screen printing and natural dyeing. Naidu explained her journey to use natural dyes for Ke/Ra Cloth as:

> It started with low impact dyes, because that I thought was environmentally friendly because I had heard all these things about natural dye not being, there's no longevity to

natural dyes, and how in clothing it can be very tricky and it fades and people don't like that and I just there was all this negative information that I'd heard about natural dye. So I stayed away from it. But when I met Kenya I realized that … there's a different way of looking at that work, right? … We're attached to this idea of something being permanent and but then there's also something to be said for the … transient nature of things. And I think that's what drew me to natural dyes and I started looking at clothing design from that perspective (R. Naidu, personal communication, April 1, 2019).

Figure 3.3

Kenya Miles (right) and Ramya Nadu (left) from Ke/Ra Cloth

Beyond health reasons, natural dyes and sustainability are connected to personal values for Naidu. She needed to feel a connection to the garments she wore and produced. Naidu also discussed her ambivalent feelings she experienced related to the perceived impermanence of natural colorants. However, some natural dyes can hold their color for a very long time. For example, a pair of Egyptian wool socks from over 1,700 years ago at the British Museum in London are still brightly colored with dyes sourced from weld, indigo, and madder (Davies, 2018). However, synthetic dyes do have better overall colorfastness for the wide range of colors they provide (Chequer et al., 2013). After Naidu explained her motivations, the three of us continued to talk about the expectations and impacts of synthetic and natural dyes. We explored the connection to permeance that synthetic dyes represent. Miles said:

> I think that that concept of just like needing things to last forever and you're not actually using them in a forever way. You might wear that for 40 days of all the years of your life. Right. But you still need it somehow. And so I think that that concept is also something that really needs to be explored.
>
> And so I also feel like things do fade and … even if they're chemically dyed things fade and things shift and you know. Whether it's extreme exposure to the sun or light exposure it just happens. But it's also there's a very like strong hold that. Things just must be a certain way and I feel like it's a really imperialist way of connecting to the extension of the things in your life (K. Miles, personal communication, April 1, 2019).

Miles argued that while natural dyes may not be as durable, they also do not necessarily need to be permanent. She believed that to honor the process of garment construction involves more than a permanent dye color. Liz Spencer, from the Dogwood Dyer, explained “Color doesn't have to last forever. We don't last forever” (L. Spencer, personal communication, March

11, 2019). While sustainability was mentioned throughout my conversations, the deeper need for personal fulfillment and meaning-making proved more important to the individuals with whom I spoke.

Personal Fulfillment

Gaining Knowledge. Natural dyes occupy a multidisciplinary space that include subjects such as botany, chemistry, history, color theory, horticulture, design, and many more. Natural dyes are a site of a large variety of known and unknown information. Dyers expressed joy when they learned of the natural dye knowledge that currently exists as well as when they discovered new aspects about the processes. Liz Spencer is a production dyer and teacher from the San Clementi, CA area and founder of her own small company called the Dogwood Dyer. I spoke with Spencer on multiple occasions over the phone and in person. In the spring of 2019, I visited her dye studio in San Clementi. We met on her front porch where translucent jars lined open shelves and each vessel contained colorful dried dye plants. Small indigo seedlings sat about our feet in large trays. Spencer explained that one of her first connections to natural dyes was when she helped to organize a community natural dye garden at the London College of the Arts. She then continued to train herself in the use of natural dyes through books and mentors. Spencer is now a natural dye instructor and teaches various workshops and classes across the United States including the Fashion Institute of Technology. She is also a production dyer and dyes small batches of garments and accessories for various companies. When I asked Spencer what motivated her to continued use of natural dyes, she replied:

> Natural dyes for [me] ..., I think, will be a lifelong commitment. Hopefully! That's what it feels like at least. Like in the throes of the passion of the art and then the craft and the challenge of working with natural dye because it's definitely not easy. It is, like you said,

there's a long learning curve … there's a lot to learn and a lot to it working with so many different plants and so many variables. So. Maybe that's another reason why … there's so much to learn that I feel like I'll never be to the end of the depth of understanding (L. Spencer, personal communication, March 11, 2019).

Spencer articulated difficulties she experienced when she navigated how to use natural dyes; however, she continues to use them because they provide a source of learning and exploration. Other dyers also expressed this sentiment included Kenya Miles from Baltimore, MD. Miles, who I mentioned earlier, is a natural dye artist, teacher, and one half of the duo behind Ke/Ra Cloth. When the discussion turned to motivations to use natural dyes Miles said:

> What motivates me to keep doing it is that there are so many facets of it that I cannot know everything. And that is exceptional. I mean it's exceptional to be in an area of information where like you know the pinnacle is like just the tip. And so … that makes me feel confident and excited to have that as like a long-term practice (K. Miles, personal communication, April 1, 2019).

Both Miles and Spencer discussed the multiple variables that increase the complexity of using natural dyes. Each natural dye requires a different way to grow and/or use the dye. For example, to use madder plants, they first need to grow for at least two years before digging up the deep red roots for dyeing. It is important to use hard mineral rich water and to slowly heat the dye bath to then extract the color. When each separate dye has these types of considerations and multiple variables, it can mean years of trial and error to achieve a desired color. Graham Keegan is a print designer and natural dye artist based out of Los Angeles who explained that:

> The main motivator for me has been the … as of yet endless realm of exploration. Like it's … I haven't reached the end of like what is knowable nor what is explorable. It feels

> like sort of a still a wide-open country in terms of discovering options or opportunities or ways of transferring color to cloth. That is also … it's like a historically rich, it's rich in a process and materials way, like just the logistics of figuring out how to physically do the thing. And it's definitely rich in terms of the combination of understanding that comes through having some sense of working knowledge of the chemistry (G. Keegan, personal communication, March 8, 2019).

For Keegan, much of their exploration came from the printing and dye processes. He specializes in traditional block-printing and hand cut stencil techniques for natural dyes (see Figure 3.4). His original interest in natural dyes came from a desire to understand the historical aspect of how to create color on cloth. The challenges presented by historic processes have kept him motivated over time. I came to this research as someone who uses natural dyes, so I understand the curiosity and exploration that motivated individuals. The “what ifs” of a changed a component or an aspect of the application process continues to drive my own exploration. What I did not expect to learn was the path many dyers had taken to become a full-time natural dyer. Many came to a turning point in their lives and then made a conscientious decision to change their jobs and lifestyles to focus on natural colorants.

Figure 3.4

Graham Keegan Dipping Screen Printed Silk into an Indigo Bath

Life Change. Throughout my interviews, numerous stories began with a pivotal life change. Participants often had a natural dye practice while they worked another job before they eventually left their steady full-time work to focus on natural dyes and develop their businesses. Mari Pombo is a natural dyer based in Brooklyn, NY and she is an example of someone who decided to quit a job in the fashion industry to start their own natural dye business. I met Pombo in her sunny studio in February 2019. Stacks of pink avocado dyed fabric laid on surfaces around the room (see Figure 3.5). Pombo creates fashion and conceptual art under the label

Fragmentario. Before she started her label, she worked in the fashion industry for a large company. Pombo described her transition from an industry fashion designer and natural dyer to focusing on her natural dye label, Fragmentario:

> I was thinking … I cannot do this and have my job at the same time. So, I made a decision that I was gonna quit my job as a fashion designer and then to try this out for like three months. Which is not enough time at all but I said that the time that I was going to give myself so I save some money and then I gave myself those three months. But then in those three months things started happening like more people were approaching me for workshops and then I started organizing workshops here and then like more commission work started happening just through Instagram (M. Pombo, personal communication, February 17, 2019).

Figure 3.5

Mari Pombo in Her Brooklyn Studio

Pombo also described how she built much of her following on Instagram. She used the social media platform to connect to other individuals and built a following before she decided to try being a natural dyer full time. Pombo shared her swatches and experiments on Instagram and answered questions from followers. The three-month period Pombo gave herself turned into six months and then a year and by the time we sat down for an interview she had worked as a full-time natural dyer for three years.

Autonomy Over Production

Another aspect of the motivation to use natural dyes comes from desired autonomy over the production process. Natural dyers appear to enjoy, in part or in whole, to have control over the process of growing and creating naturally dyed textiles. In this next section, I describe some of the specific processes that motivated natural dyers to continue in the craft.

Individuals described the personal satisfaction they had when they grew their dye plants. A single dye garden can produce a wide range of colors, yellow from marigold, orange from cosmos, and blue from indigo. Gardening and horticulture are areas described by some dyers as integral to their sense of being. For Rebecca Burgess, founder of the California Fiber Shed, the ability to garden is directly linked to her use of natural dyes. In our interview at the UC Berkeley Garden, Burgess confessed that “I really love gardening. I mean, that's where I would be if I weren't sitting here right now and I will be racing back soon if I could spend all my time gardening” (R. Burgess, personal communication, March 30, 2019). Although the process for natural dyes use is more labor intensive than conventional synthetic dyes, some individuals described a found sense of personal satisfaction from the process. Jessie McNaughton naturally dyes yarns for her self-run company Blue Sheep Yarn Co. and she sells yarn on Etsy and at a

local farmers market in the Upstate New York area. Jessie described enjoying the non-immediate process:

> You know, like, the process starts taking a walk in a field or in the woods and gathering different plants and nuts and flowers that I can use and then bringing that material back into my kitchen and like extracting the colors and prepping the fibers to be able to take the colors is just really satisfying and … I feel connected to the earth and like to processes that people have been using for thousands of years. Like, it just kind of connects me to history and nature and it's just really satisfying. And I love the slowness … it's just kind of … zen to have something not be instant (J. McNaughton, October 18, 2017).

Another part of production control is the ability of dyers to choose where their dyes come from. An individual can choose natural dyes that were grown from all over the world, but they can also intentionally use a dye grown from a specific place. This conscientious decision gives natural dyers the ability to infuse place and identity into cloth. For example, a dyer could choose to use black walnut hulls that grow near their home in upstate New York because they are part of the landscape where that dyer lives. That individual attaches meaning to the plant because of its geographical location. For Jenna Baucke from Jalama Dyes, the ability to use dyes from a specific area is integral to her design work. Baucke named her company after Jalama Ranch, which is located near her childhood home on the central coast of California. All the dyes that Baucke uses come from California (J. Baucke, personal communication, April 1st, 2019). Baucke explained her use of specific dye plants as:

> This is what the Bay area's color palette is … and I think that narrative of place and apparel or adornment is really interesting … because I think that's something in a time

> where we're all kind of disconnected in a big way. That's one way that we can feel like we're just a little more grounded in the world itself and in our way of interacting with it daily and participating in a good way (J. Baucke, personal communication, April 1st, 2019).

Baucke's work articulates place and bodily adornment with natural dyes she gathers from in and around the Bay Area. She also decidedly uses these dyes as a form of creative restraint. Baucke stated that "it feels right with the whole purpose of the brand to kind of wear the colors of your place" (J. Baucke, personal communication, April 1st, 2019).

Mari Pombo is another example of a natural dyer who ties place to dyes and the water used to dye to place as well. Part of Pombo's work focuses on the use of water from different locations around the world. The minerals, salts, pollutants, and pH of water can alter dye results, which Pombo discovered on a trip to Paris. Pombo conducted workshops with avocado seeds around Europe and noticed that the avocado dye looked a little different in each location (M. Pombo, personal communication, February 2, 2019). It was when she was in Paris that the most dramatic color change occurred and achieved much lighter shades than previous locations. She was also had a much harder time with her hair after a few days of washing it in the hard, Parisian water (M. Pombo, personal communication, February 2, 2019). It was then that she made the connection between water and the dye results. When Pombo returned home, she experimented with different chemical compositions of the water by adding calcium, lime juice, and baking soda (M. Pombo, personal communication, February 2, 2019). However, soon after that experience, she found she could not travel due to a change in her immigration status as she is a Venezuelan who resides in America (M. Pombo, personal communication, February 2, 2019).

Consequently, she asked friends to bring her water when they traveled. Now she has shelves filled with bottles of water from different locations around the world. She proudly showed me her extensive collection and explained that she tests each water sample with dye extracted from avocado seeds (M. Pombo, personal communication, February 2, 2019), saying that:

> It evolved into this idea that we could explore water quality with the avocado seed. Almost kind of similar to like you do like a blood test. And then they put something in your blood depending how it reacts they know if you have high cholesterol or low. So for me it's kind of like the avocado seed it was a good way to see how the water is acting (M. Pombo, personal communication, February 2, 2019).

Pombo's governmentally imposed travel restrictions and subsequent exploration of water from different global locations reveal a fascinating intersection between nation, immigration, ethnicity, place, and practice. Pombo, unable to travel, used her own community connections to provide small amounts of water from around the world. She then used the water to extract and dye with avocados and recorded the resulting color from each place. Pombo identified not only on the water she could use but what type of natural dye she used. Pombo specifically dyed with avocado but not necessarily because of the dye color, which is light dusty pink. For Pombo, avocados connect her back to Venezuela and gave her a sense of home, place, and comfort (M. Pombo, personal communication, February 2, 2019). She gathered the avocado pits and skins from local restaurants that would have discarded them otherwise. However, Pombo articulated her ambiguous feelings about the dye:

> It's like in a way coming from a nice place but also from kind of a more combative place, in a way, because people are thinking like 'oh yeah I'm gonna eat so many avocados I save the seeds and then I can dye … with them' and it's like no … maybe we shouldn't

> need four avocados every day. You know like we also need to think about, like this, what is this costing like in Mexico and in the world and everything that it's like these super high consumption of like avocados. And I feel that it was kind of like a good way to start this conversation without me even having to say it so explicitly but um it just organically happened. Like people were asking me and some people were thinking like oh it's so cute it's so sustainable it's pink it's pretty. But then some people were getting very upset like 'Oh but then you're eating all these avocados da da da like you're ruining the world' and I'm like 'No' I'm not eating them like I'm getting from the restaurants. So I'm actually kind of doing something nice with what they would have as trash anyways (M. Pombo, personal communication, February 2, 2019).

It was this conversation with Pombo that brought me to the realization that natural dyes are bigger than a resulting color on a cotton t-shirt or a wool scarf. Individuals infuse a message or meaning into a textile through a natural dye that connects them to a specific place and time. Pombo articulates complicated ideas about overconsumption, home, and waste reuse when she uses avocado dyes.

Infused Meanings

In conclusion, individuals used natural dyes to infuse meanings into cloth, whether their own perceived environmental and health concerns, a sense of personal fulfillment, or autonomy over the production process. First, the natural dyers interviewed articulated concerns for their ecological and personal health by the rejection of synthetic colorants. Natural dyes represent a process that is more respectful to the environment, safer for the human body, and to those who choose to wear or manufacture naturally dyed garments. Second, the natural dyers developed skills through research and study of natural dyes. When they create a complex color or print, a

natural dyer makes their own tacit knowledge visible through the finished textile. Lastly, natural dyes represent the ability for more autonomy over production. A dyer can focus on parts of the process they most enjoy, be it growing plants or dyeing fabrics, and make choices that represent that dyer. Natural dyes can represent ideas of time and place. A dyer can communicate a narrative of a specific location through a dye from that environment. They can also communicate broader philosophical ideas through their dye choices. Through all these motivations to use natural dyes, it appears natural dyers can share aspects of their personal identity in an object they have colored, infusing meaning into the very fiber of the cloth they dye.

Limitations and Future Research

My first limitation was the way in which I found my research participants, namely through Instagram. Social media is a place for extensive knowledge sharing and it led me to individuals who use natural dyes in a consistent and meaningful way. However, this also limited me to only individuals who use natural dyes on Instagram and left out many other populations that might not interact through the social media platform. This biased my data towards younger English-speaking individuals. Another limitation of my study was the lack of personal information gathered on research participants. For this study, I did not obscure the identities of my participants. This led to uneasiness when I asked for basic demographic information from my participants. In future research, I would like to focus more on who uses natural dyes and obscure the identities of my participants. This way I can comfortably gather demographic and background information.

For future research, I would also like to explore how individuals are linked to one another and how they share information. Sometimes my participants would know one another and discuss how they had shared information. However, in one case, two of my participants worked

in the same large industrial building in Brooklyn and yet had never met. I would also like to explore the unintended and intended meanings natural dyers infuse into their fibers. More information could be gathered on what types of dyes individuals use, why they use them, and what meanings are being produced by those choices.

References

Bechtold, T., Turcanu, A., Ganglberger, E., & Geissler, S. (2003). Natural dyes in modern textile dyehouses: How to combine experiences of two centuries to meet the demands of the future? *Journal of Cleaner Production*, *11*(5), 499–509. https://doi.org/10.1016/S0959-6526(02)00077-X

Bechtold, T., & Mussak, R. (2009). *Handbook of natural colorants*. John Wiley & Sons.

Bhatti, I. A., Adeel, S., Jamal, M. A., Safdar, M., & Abbas, M. (2010). Influence of gamma radiation on the colour strength and fastness properties of fabric using turmeric (Curcuma longa L.) as natural dye. *Radiation Physics and Chemistry*, *79*(5), 622–625. https://doi.org/10.1016/j.radphyschem.2009.12.006

Boutrup, J., & Ellis, C. (2018). *The art and science of natural dyes: Principles, experiments, and results*. Schiffer Publishing.

Cardon, D. (2007). *Natural dyes: Sources, tradition, technology and science*. Archetype Publications.

Chequer, F. D., de Oliveira, G. A. R., Ferraz, E. A., Cardoso, J. C., Zanoni, M. B., & de Oliveira, D. P. (2013). Textile dyes: Dyeing process and environmental impact. In *Eco-friendly Textile Dyeing and Finishing* (pp. 151–176). InTech.

Choudhury, A. K. R. (2017). Sustainable chemical technologies for textile production. In S. S. Muthu (Ed.), *Sustainable Fibres and Textiles* (pp. 267–322). Woodhead Publishing. https://doi.org/10.1016/B978-0-08-102041-8.00010-X

Coon, D. L. (1976). Eliza Lucas Pinckney and the reintroduction of indigo culture in South Carolina. *The Journal of Southern History*, *42*(1), 61–76. https://doi.org/10.2307/2205661

Doty, K., Haar, S., & Kim, J. (2016). Black walnut, Osage orange and eastern redcedar sawmill waste as natural dyes: Effect of aluminum mordant on color parameters. *Fashion and Textiles*, *3*(1), 22. https://doi.org/10.1186/s40691-016-0074-9

Erdem İşmal, Ö., Yıldırım, L., & Özdoğan, E. (2014). Use of almond shell extracts plus biomordants as effective textile dye. *Journal of Cleaner Production*, *70*, 61–67. https://doi.org/10.1016/j.jclepro.2014.01.055

Haar, S. J., Patwary, S., Doty, K., & Green, D. N. (2018). Natural dyes for volume dyeing: Colorfastness to laundering. *International Textile and Apparel Association Annual Conference Proceedings*. 75.

Hossain, Md. D., Khan, Md. M. R., & Uddin, Md. Z. (2017). Fastness properties and color analysis of natural indigo dye and compatibility study of different natural reducing agents. *Journal of Polymers and the Environment*, *25*(4), 1219–1230. https://doi.org/10.1007/s10924-016-0900-6

İşmal, Ö. E., & Yıldırım, L. (2019). Metal mordants and biomordants. In Shahid-ul-Islam & B. S. Butola (Eds.), *The impact and prospects of green chemistry for textile technology* (pp. 57–82). Woodhead Publishing.

Khatri, A., & White, M. (2015). Sustainable dyeing technologies. In R. Blackburn Editor, *Sustainable apparel: Production, processing and recycling* (pp. 135–160). Elsevier.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE.

McGovern, P. E., Lazar, J., & Michel, R. H. (1990). The analysis of indigoid dyes by mass spectrometry. *Journal of the Society of Dyers and Colourists*, *106*(1), 22–25. https://doi.org/10.1111/j.1478-4408.1990.tb01225.x

Mirjalili, M., & Karimi, L. (2013). Antibacterial dyeing of polyamide using turmeric as a natural dye. *Autex Research Journal*, *13*(2), 51–56. https://doi.org/10.2478/v10304-012-0023-7

Modesto, H. S., & Niessen, S. (2005). The revival of traditional practices as a response to outsiders' demands: The resurgence of natural dye use in San Juan La Laguna, Guatemala. *Ethnobotany Research and Applications*, *3*(0), 155–166.

Patel, B. H. (2011). Natural dyes. In M. Clark (Ed.), *Handbook of textile and industrial dyeing* (Vol. 1, pp. 395–424). Woodhead Publishing.

Puchalska, M., Połeć-Pawlak, K., Zadrożna, I., Hryszko, H., & Jarosz, M. (2004). Identification of indigoid dyes in natural organic pigments used in historical art objects by high-performance liquid chromatography coupled to electrospray ionization mass spectrometry. *Journal of Mass Spectrometry*, *39*(12), 1441–1449. https://doi.org/10.1002/jms.728

Purwar, R. (2019). Antimicrobial textiles. In Shahid-ul-Islam & B. S. Butola (Eds.), *The impact and prospects of green chemistry for textile technology* (pp. 281–306). Woodhead Publishing.

Richards, L. (1994). Folk dyeing with natural materials in Oklahoma's Indian territory. *Material Culture*, *26*(2), 29–47. https://www.jstor.org/stable/29763953

Saha, K. M., Islam, M., & Haar, S. (2018). Investigating marigolds as a dyestuff for a small business: Extraction, colorfastness to laundering, and care of silk and linen. *International Textile and Apparel Association (ITAA) Annual Conference Proceedings.* 145

Saldaña, J. (2015). *The coding manual for qualitative researchers*. SAGE.

Sarkar, A. K., & Seal, C. M. (2003). Color Strength and Colorfastness of Flax Fabrics Dyed with Natural Colorants. *Clothing and Textiles Research Journal*, *21*(4), 162–166. https://doi.org/10.1177/0887302X0402100402

Singh, Z., & Chadha, P. (2016). Textile industry and occupational cancer. *Journal of Occupational Medicine and Toxicology*, 11(39). https://doi.org/10.1186/s12995-016-0128-3

Strauss, A., Corbin, J. M., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. SAGE Publications.

Travis, A. S. (1993). *The rainbow makers: The origins of the synthetic dyestuffs industry in Western Europe*. Lehigh University Press Bethlehem.

Chapter 4

Craft and Social Media: Cites of Knowledge Production and Consumption

Interest in natural dyes is part of a much larger resurgence in the popularity of textile-centric craft. The crafting revival started in the early 2000s and has unfolded in both digital and physical spaces (Parkins, 2004; Robertson & Vinebaum, 2016; Stannard & Mullet, 2018; Winge & Stalp, 2013). Fiber-centric craft consists of techniques such as knitting, crochet, sewing, quilting, weaving, yarn spinning, and beading (Robertson & Vinebaum, 2016). A plethora of specialty stores, publications, websites, and social media groups have developed to meet the needs of the growing textile community and provide sources of knowledge to start and complete projects (Parkins, 2004; Robertson & Vinebaum, 2016; Stannard & Mullet, 2018). These are sites of information sharing and production where individuals can find community and exchange money for knowledge, services, and goods.

Textile crafts have become a space dominated by affluent white women who can afford the time and money to participate (Clark, 2019; Saxena, 2019; Stannard & Mullet, 2018). A recent outcry on social media has pointed out that craft communities often discriminates against lesbian, gay, bisexual, pansexual, transgender, genderqueer, queer, intersexed, agender, plus (LGBTQIA+) as well as Black, Indigenous, and people of color (BIPOC) (Saxena, 2019). On Instagram in 2019, knitters with brown and black skin shared stories about how yarn stores would ignore their presence or treat them as amateurs (Saxena, 2019). LGBTQIA+ individuals expressed discomfort with biological essentialism reflected through the use of pink Pussyhats to represent women's solidarity at marches in 2017 (Compton, 2017). These examples of discrimination led me to ask not only who produced knowledge for textile craft communities but how was it shared? It also led me to explore my own complicit role within natural dye and craft

communities. As a cisgender, heterosexual white woman, how was the information I shared both in person and online working to commodify knowledge and build community in a capitalist system rooted in racism and appropriation of labor? More importantly, who is explicitly and implicitly harmed by my actions or inaction?

Purpose

In this chapter, I explore fiber-centric epistemologies that fuel dual purposes of commodification and community building. To better understand this phenomenon, I use data gathered from 20 in-depth interviews with natural dyers from the United States. Natural dyes are an interesting subset of textile craft because of the way they intersect with aspects across textile communities. A natural dyer may color yarn to sell to knitters or dye their own fabric to sew into garments or quilts. To supplement the conversation further, I also used information gathered from social media and online websites relevant to fiber and textile craft communities. Researchers have pointed out that knitting, and I would argue all textile crafts, are simultaneously a form of production and consumption (Shin & Ha, 2011). My discussion first situates craft within the current capitalist system and gives an overview of terms used to describe how individuals participate in production and consumption. I then discuss how subject positions like gender, race, class, and sexual orientation intersect as identities (both individual and collective) that influence craft and knowledge production. With information and viewpoints gathered from my fieldwork, I explain epistemologies of commodification and community building in both physical and virtual spaces. Finally, I conclude this chapter by with a proposed an inclusive model for knowledge sharing within craft communities.

Craft in a Capitalist System

Prosumer, Prosumption, Craft Consumption, Craftivism, and Craftprosumptionivism?

Karl Marx (1867) famously wrote about the division of labor that occurs in a capitalist economy in his book *Capital*. He explained that, in a capitalist system, objects are mass produced by an unseen and alienated work force (Marx, 1867). In *The Theory of the Leisure Class*, Thorsten Veblen (1912) wrote about the idea of conspicuous consumption—that is, a consumer who buys items to display wealth rather than utility. Veblen described the alienation that an individual performs when they mindlessly purchase an item without care for where it came from or who made it (Veblen, 1912). In textile craft communities, individuals can purchase luxury yarns, expensive knitting needles, and high-end weaving looms as a form of conspicuous consumption. However, sociologist and craft scholar Collin Campbell (1995) critiqued Veblen's idea of conspicuous consumption. He suggested that it missed the intended mark because the theory excluded many of the other possibilities an individual may have to purchase and engage with an item other than a display of wealth (Campbell, 1995). The following will introduce terminology for consumption, production, and craft and explains some of the various reasons craftspeople might have to engage in consumption and production.

Prosumer, Prosumption and Craft Consumption. A person who is proactively engaged, as opposed to passively involved, with an object is considered a prosumer, a productive consumer (Knott, 2013; Toffler, 1980). Visionary theorist Alvin Toffler coined the terms "prosumer" and "prosumption" in the 1970s and saw the idea as a new and exciting way for individuals to become producers of their interactive media. To theorist Colin Campbell (2005), people who engage in a form of "consumption as ensemble activity" are participants in "craft consumption" (p. 33). He defined craft consumption as a "consumption activity in which the

product concerned is essentially both made and designed by the same person and to which the consumer typically brings skill, knowledge, judgement and passion while motivated by a desire for self-expression" (Campbell, 2005, p.23). Philosopher Stephen Knott built on ideas of prosumers and craft consumption to develop three levels of prosumption: following, rejecting, and adapting. The first level is following, which is defined as prosumers who follow the rules (Knott, 2013). An example of a following prosumer could be an individual who purchases a kit with the exact yarn, needles, and pattern required for them to knit a sweater. While it may be submissive for an individual to follow a company's instructions exactly, it does give the prosumer some production power while they increase their knowledge and skills (Knott, 2013). However, that individual also uses their economic position as someone who can afford to participate in textile crafts to dispossess someone else in the supply chain of a knitting job. The next level is rejecting, which is defined as those who reject rules and pursue self-sufficiency (Knott, 2013). This idea is seen as empowering prosumers with a sense of autonomy through the rejection of capitalism (Knott, 2013). Ironically, individuals feel that they need to purchase something in a capitalist system to reject said system. This is a particularly widespread idea in current circles of textile craft (Cardon, 2018; Chanin, 2012; Chia, 2009; Hisdal, 2010; Roach, 2012). Due to the fashion industry's exploitation of labor and fiber arts' place as a traditional handcraft, the fiber arts have been at the epicenter of the rejection of mass production and consumption (Fletcher & Grose, 2012; Ross, 2010; Smestad, 2009). Books on mending (Cardon, 2018; Roach, 2012; Rodabaugh, 2018), knitting (Herzog, 2015; Hisdal, 2010; Stoller, 2012), and sewing (Chanin, 2012; Chia, 2009; Mills, 2015) guide an individual to their own handmade wardrobe. The last of Knott's (2013) prosumer terms is adapting; defined as individuals who adapt and create items from a wide array of tools and materials. Adapting could be expressed

through the popularity of upcycling, where a typically unwanted garment's value is enhanced "through thoughtful reclamation" (Fletcher & Grose, 2012, p. 69). Examples could include a person who disassembles a pair of unwanted jeans and resews them into a travel bag. Another example is a beloved concert t-shirt, worn out by years of use, that is cut apart and refashioned. Through the adaptation of capitalist objects, Knott (2013) explained that individuals are productively interacting with the capitalist world they inhabit: "Demonstrating their craft prowess by making use of the resources to hand" (Knott, 2013, p.61). However, even this form of prosumerism relies on an object mass-produced by an unseen and alienated workforce.

Textile Craft. While the aforementioned terms apply to a broad array of craft activities, scholars have also looked at why individuals engage with fiber-centric crafts. Knitting and other forms of textile craft are a way for individuals to cope with what sociologist George Ritzer (2014) called the "McDonaldization" of society. The idea of McDonaldization is that of ultimate capitalist efficiency, calculability, predictability, and control over a product (Ritzer, 2014, p.). Ritzer specifically used the knitting as an example of crafters who rebuff consumer culture, but he inadvertently failed to see a much larger problem (Ritzer, 2014). Ritzer pointed out that knitters who create their products are engaging in a political stance against the woes of capitalism. However, his ideas failed to consider the fact that textile craftsmen required the mass production of yarn, needles, fabric, notions, and other supplies to complete projects. In a recent study of raw material consumption by knitters, it was found that among respondents the majority (a little over 12%) preferred Lion Brand yarn, followed by Red Heart yarn (Stannard & Mullet, 2018). These brands are two of the biggest yarn labels in the United States and are found at large-scale retailers such as Jo-Ann's, Michael's, Hobby Lobby, and Walmart (Stannard & Mullet, 2018). Theorist Mackenzie Wark (2013) addressed this type of hypocrisy and

described a maker culture divorced from the actual labor process but reliant on tools and supplies created by an unseen industry. This fetishizes the idea of "handmade" while it feeds a capitalist system (Wark, 2013).

Craftivism. Knott's ideas of rejecting and adapting play into the idea of what scholars call "craftivism". Craftivism is when practitioners use crafting techniques to express political ideas (Close, 2018; Corbett & Housley, 2011; Greer, 2011; Ratto & Boler, 2014; Tapper, 2011). Craftivism is a relatively new term for the ideas Ruskin and Marx once espoused for handcraft, as a radical departure from the capitalist machine. Today's political craftivism is generally led by women as a form of resistance to a patriarchal system (Close, 2018). In the United States, textile crafts have been considered historically female and have been downgraded to an unproductive pastime compared to capitalist production (Black, 2017; Bratich & Brush, 2011; Luckman, 2013). Craftivism in textile communities helped bring third-wave feminist work into a public space (Bratich & Brush, 2011). Craftivist Collective is one such group that engages in textile-based activism and represents themselves as a form of "gentle protest" ("Our Story", n.d.). This label could play into feminized tropes of women as gentle caretakers opposed to their more brutal and militarized male counterparts. The Craftivist Collective sells kits for projects such as "Stitchable Change-Makers" where you use embroidery floss to stitch the numbered outline of a current political activist. They also sell "a heart for your sleeve" where they send felt and floss to make a heart-shaped pin to "help remind us all to protect our beautiful world and secure a safer future for the next generation of crafters" ("A Heart For Your Sleeve #fortheloveof…," 2015; "Stitchable Change-makers," 2015). This type of "gentle protest" and the broader craftivist movement has proven to be an important source of feminist discourse. However, the craftivist conversation often leaves out LGBTQIA+ and BIPOC voices. While weaving, knitting, and

other forms of textile craft have long been thought of as a space for older cisgender heterosexual white women in North America, a large shift has started to occur within craft communities.

Gender, Race, Class, and Identity in Textile Craft

When Instagram Exposes an Underlying Problem. One early morning in January 2019, I woke to my usual ritual and checked Instagram while half asleep in bed. It was quickly apparent that a shift had taken place overnight in craft communities. The day before, influential white female knitwear designer, Karen Templer, had posted a racist entry on her blog about an upcoming excursion to India (Templer, 2019). The post was othering and equated a trip to India to the same as "a flight to Mars". In the same article, she later discussed an NPR story about "the inevitability and nearness of colonizing Mars" (Templer, 2019, para. 12). The author centered herself as someone who looked for "more color" and that India was the place to find what she had sought (Templer, 2019). This post appeared to be the breaking point for many in the knitting and larger craft community and a flood of responses went out on social media. Through Instagram, BIPOC individuals performed the emotional labor and pointed out the harmful language and inherent racism that was rampant in the craft industry, an industry that focused on the needs of white women. At the forefront of this work were women of color in textile crafts[7]. They placed themselves in front of many angry, white women who "just wanted to get back to knitting"[8]. The activists also pointed out specific knitting magazines that only featured white models as well as the knit designers who favored white women to be their test knitters. For an

[7] Missy Bimbamboum @nappyknitter, Franco-Maori @arohaknits, Sukrita Mohan @su.krita, Tina Tse @tina.say.knits, Ocean Rose @ocean_bythesea, Diane L. Ivey @ladydyeyarns, Grace Anna Farrow @astitchtowear, Korina Yoo @thecolormustard, Heidi Wang @booksandcables

[8] For an example see (Moore, 2019). Warning, some may find the content triggering due to tone policing and victim blaming.

example of magazine covers from Vogue Knitting's 2018 collection see Figure 4.1[9]. BIPOC knitters also shared stories on Instagram about how they were ignored in knitting stores and white knitters who assumed they were poor or amateurs (Saxena, 2019). Several BIPOC knitters expressed their frustration as it took so long to raise awareness of racism in knitting communities and, furthermore, that it took a white woman's racists words to facilitate change (Saxena, 2019).

Figure 4.1

Examples of Vogue Knitting Magazine Covers from 2018

[9] More recently, after the outcry on social media, Vogue Knitting released covers featuringthat featured people of color for 2019 Early Fall and 2019 Holiday.

Before social activists brought up race on Instagram, critiques of white-centric crafting were also leveled at the organizers of the Pussyhat Project (Black, 2017; Compton, 2017). A Pussyhat is a knitted pink rectangle joined at the sides to make a hat, the corners along the top fold line to look somewhat like cat ears. These pink hats adorned demonstrators at the 2017 Women's March on Washington, in support of women's rights and protest of the newly elected president of the United States, Donald Trump (Compton, 2017). Shortly thereafter, criticism was leveled at organizers for their lack of sensitivity towards trans people and people of color (Compton, 2017). Kristina Suh, a founder of the Pussyhat Project said that they used the term "pussy" to reclaim the word. She also explained that they chose pink because of its close association with women and femininity (Compton, 2017). LGBTQIA+ critics of the movement pointed out the word pussy was associated with cis-gendered women's anatomy (Compton, 2017); therefore, Pussyhats perpetuated biological essentialism and that transpeople were not welcome in the movement. The color pink was another point of contention as shades of pink are frequently associated with Caucasian skin tones (Compton, 2017).

As critiques continue within textile craft communities, it is important to recognize that textile craft knowledge has been, and continues to be, shaped by hegemonic power dynamics. Throughout my following discussion on knowledge commodification and community, it is critical to remember the constant struggle LGBTQIA+ and BIPOC have had in the present world of textile craft due to racist tactics. These tactics include whitewashing (when the focus on white bodies) and tone policing (when white individuals criticize others for when they communicate their discomfort). As knitter and activist Sukrita stated:

> The biggest challenge to a safe community comes from white people who see themselves as intrinsically good. Their ignorance causes great harm all the time, and most are

> oblivious to it. Many will defend themselves to the extent of claiming victimhood saying, 'I didn't intend to cause harm,' while never fully understanding why the actions were harmful, nor changing their behavior in the future (Mahon, 2019, para. 3)

This makes me question, when well-meaning white women are the individuals seen to be the dominant voices in producing craft knowledge, how can it be safe for anyone else? Before I can identify the barriers for BIPOC and LGBTQIA+ communities, I first need to address how individuals in textile craft communities produce knowledge for commodification and community building in the first place.

Methods

To explore ideas of commodification and community I employed a qualitative approach within natural dye communities. After IRB approval, I conducted fieldwork from November 2016 - October 2019 and gathered information through interviews (over the phone and in person), documentary filmmaking, audio recordings, photography, fieldwork, participant observation, and field notes. I interviewed a total of 20 individuals who naturally dye textiles, yarns, and fabric in 15 different locations across the United States, which included the states of New York, Vermont, California, Kansas, Tennessee, and Oregon. All interviews were recorded, either video or audio, and transcribed. From 2016 to 2019, I also taught several natural dye workshops to a range of individuals, from high school-aged students and older adults.

Due to the sensitive nature of commodification and exchanging knowledge for profit, I have omitted the identities of participants from this chapter. However, the term "commodification" and others like it are not meant to paint individuals as those who greedily take money from amateur crafters. Anthropologist Arjun Appadurai defined commodity as "anything intended for exchange" (Appadurai, 2005, p. 35). People with knowledge exchange

their time and effort to organize a workshop for monetary compensation. Sometimes these exchanges are free but more often students pay money to take part in the course, with organizations paying for the workshops. As I will explain later, this labor is generally part of an independent business run by a single person. In the following text, I will discuss the physical and digitals spaces where I have witnessed knowledge sharing within craft communities. I will then propose a new theoretical model for knowledge sharing based on my findings.

Communities and Commodity from Craft Knowledge

Physical Spaces

People share textile craft knowledge in both physical and virtual spaces. Information is distributed via books, blogs, social media, open access online videos, paid classes (online and in person), guild meetings, patterns, one-on-one tutoring, and informal conversations. Many textile crafts have a communal mentality built into the foundation of knowledge production and sharing. Traditions such as knitting circles, quilt retreats, and weaving guilds build a community around shared interests of members. These groups bring people together in a physical space and around shared physical materials. A knitting circle held at a local library can connect more experienced knitters with novices and provide a space for information to be shared freely (Prigoda & McKenzie, 2007). While this form of knowledge sharing is "free" to all involved, it is limited in depth and only provides short lessons or troubleshooting. For an introduction to a new subject or a deeper understanding of a subject, crafters will often turn to in person workshops.

A workshop is a method of knowledge sharing that helps to articulate ideas of communities and commodity within a physical space. A 'workshop' has several definitions in craft, first, it is a dedicated location where a master craftsman works at their trade alongside apprentices (Gamble, 2001; Sennett, 2008). For example, in a silversmithing workshop, a master

silversmith takes over the most complicated tasks and leaves projects that require lesser skills to apprentices. The master silversmith would simultaneously complete complex projects while also guiding an apprentice over the course of many years through the necessary skills required for them to become a master craftsman.

An alternative definition of a workshop is similar in that often a 'master' or advanced craftsman teaches others with lesser skills. Other similar terms are classes, retreats, and intensives. Instructors hold these workshops for a very short amount of time, from a few hours to a week. These temporal spaces of learning are meant to share information from one individual to another. Often workshops are held in informal locations, such as a back porch or community pavilion but sometimes the workshops take place in dedicated spaces. Places like the Textile Arts Center in Brooklyn, NY and Wildcraft in Portland, OR have dedicated space where individuals can casually enroll in a single course to learn skills such as leather craft, knitting, weaving, dyeing, marbling, and more.

Workshops are a part of how artisans make a living by selling or "commodifying" knowledge they have developed about a craft. For nearly every participant in my study, they discussed how they supplement other forms of work, such as production dyeing or designing, with teaching workshops. As one individual who owns a small weaving studio explained "I realized early on that the largest amount of profit is from local people and it's not necessarily … selling a product online [it] is like really about getting people in the space … from the local community to get interested in like the workshop that I'm offering". This person taught workshops and simultaneously created their conceptual textile art. As they connected with the local community and taught a variety of weaving and natural dyeing workshops, they found that selling their knowledge helped them to maintain their independent art practice. Another

participant who is a production natural dyer explained that teaching workshops offered them flexibility, saying that:

> I started a family and with young kids … I sort of discovered simultaneously that I was teaching small one-off workshops here and there [and] that I really love teaching … my business has become flexible … and I've been able to teach. Sometimes it's you know 80% teaching, 20% production work, or a 100% teaching, no production work.

Many of my interviewees mentioned this idea of a flexible source of income. As natural dyers explained their income stream, to teach for a profit was consistently part of the explanation. Another consistent theme was how natural dyers were interested in community building through their workshops and how individuals would build support through social media. This illustrated how the physical and virtual spaces are increasingly interdependent. However, this connects back to the identities of individuals who can finically afford to take workshops or feel included in physical spaces. In my personal experience, it is very often older white women who are affluent enough to engage in this type of knowledge sharing. In response to this inequity, some in the textile community offer scholarships for the LGBTQIA+ and BIPOC to access information. For example, Ash Alberg of Sunflower knits provides a scholarship to "trans/non-binary/gender non-conforming and/or BIPOC" to receive a free copy of her ebook *Natural Dye as Practice (Alberg, n.d.)*. Actions like these are important, as individuals from non-hegemonic identities have also expressed discomfort when participating in knitting circles and being the only non-white person in attendance (Yoo, n.d.).

Virtual Space

For textile craft communities, the internet has become a critical source of information. Social media, electronic books (e-books), online courses, blogs, podcasts, and more are sources

of knowledge that are available to anyone with the ability to access the internet on a smartphone or computer. In a study by Torrey, Churchill, and McDonald (2009) researchers conducted in-depth interviews with people engaged in various crafts (not limited to textile crafts) to better understand how online resources contributed to their craft practice. Of the 15 participants, two-thirds could identify forums, blogs, or mailing lists that they consistently engaged with to better understand how to complete projects (Torrey et al., 2009). In my research, I found that individuals who produced knowledge sought ways to directly connect to other textile craftspeople and generate a profit such as selling access to digital ebooks. Other participants worked to foster community and commerce in indirect ways. These indirect ways included open access "how-to" videos inhabit this space of digital knowledge sharing which fosters community through an indirect modus operandi. To better illustrate, let me describe one of my fieldwork experiences.

As part of a community engagement research grant, I spent three weeks in Tennessee filming a series of how-to videos with an indigo production company that sold powdered dye to textile artisans. The goal was to create open-access videos that could easily teach textile craft artists how to prepare indigo for dyeing. Indigo is more difficult to use than other natural dyes because it does not easily dissolve into water. It requires a reduction process to make the dye available. This indigo production company works with local farmers to help them replace no longer lucrative tobacco crops with indigo. Indigo is an alternative to tobacco that is far less labor intensive and can improve soil conditions. To help sell the indigo to craftspeople, it was necessary to create videos that were free to view online. This is opposed to some how-to videos that can only be accessed if an individual pays for the right to view the content. Through the distribution of information, such as a free "how-to" video, individuals and companies generate

more information for those interested in the subject, grow the community, and grow product demand. This, in turn, aids the indigo production company, which supports local farmers who wish to find alternative crops to tobacco. The dissemination of information is more than building brand awareness due to the craft's position of both free and for-profit knowledge sharing. Individuals are physically interacting, reinterpreting, and sharing information instead of passively consuming. These communities build around a physical act in both physical and digital spaces.

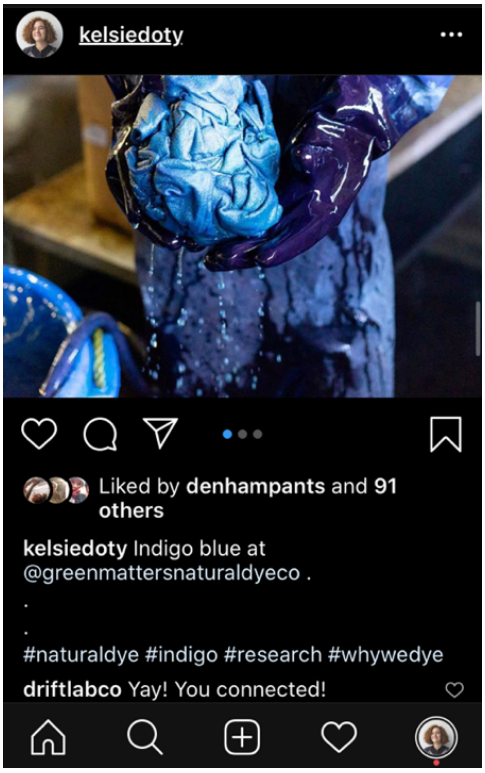
Online Community Formation. Connected by interests, communities of knowledge share information through social media. Ravelry, Facebook, and Instagram are common social media platforms for textile craft artists to connect. For example, individuals interested in the complex methods involved with indigo extraction and plant cultivation can join the Facebook group "Indigo Pigment Extraction Methods", which has over 3,000 members from around the world (*Indigo Pigment Extraction Methods*, n.d.). In this space, members are free to ask questions about what might ail sick indigo plants, post videos of dye extraction methods, or share pictures of indigo dyed textiles. Encouraged by the rise of the internet and social media, Ritzer and Jergenson (2010) believed that the boundary between producers and consumers is less and less evident, which is promulgated by the rise of prosumption. This includes information sharing platforms such as the Indigo Pigment Extraction Methods group on Facebook, where individuals create searchable information about a process that can be difficult to successfully accomplish.

Instagram is another example of an interactive social media site that encourages consumers to produce content. Image centric, Instagram focuses on photos and videos but also includes a field for text underneath. Separate information can be connected through "tagging" metadata using the hashtag symbol (#) followed by a descriptive word or words. For example, a

natural dyer who wishes to tag their post could use #naturaldye, #botanicaldyes, or #plantcolor to help other users find their post. Users can either create a post that will stay on their profile (unless deleted by the user or by Instagram) or add temporary visual information to the user's "stories", which automatically disappear after 24 hours. See Figure 4.2 for an example of an Instagram post from my personal Instagram account.

Figure 4.2

Instagram Post from My Personal Account



I argue that social media is the articulation of both commerce and community. A textile craft artist can both share information to connect with a broader community and promote the consumption of their knowledge. An individual in the textile arts can demonstrate their knowledge through short tutorials or process images to help promote individuals to join them for their next workshop or buy their e-book. One of my participants explained that social media:

> Has been wonderful in that I can connect with other dyers and other people interested, and do some teaching or just demonstration and … it's also a wonderful tool to get the word out about my physical workshops … if people want to learn from me in person.

When I visited the farm of one of my participants in Vermont, I already knew some of the farm animals' names and the basic layout of the barn even though I had never physically visited the space before. This farm owner is constantly connected with individuals who follow her on Instagram. She sees social media as an important part of her outreach to answer every comment or question posted to her account. She updates stories daily with many aspects of Vermont wool yarn production. The farmer expressed her articulation of knowledge, community, and commerce saying:

> As a farmer on Instagram it's been really important to answer questions, to be an educator, so my Instagram account is all about sharing … about what I do which is farming, tending flocks, all of the sides businesses that being a farmer requires, because you can't just do one thing you have to have a lot of products. Like my baking, and workshops and I enjoy sharing the process of dyeing because its … my way of being part of a world of creatives and Instagram is a beautiful place for inspiration if you're a maker, a dyer, an artist of any sort. So also what is important is when I share all these things. A person, a potential customer, a friend they get to learn about all that is involved in a skein of yarn that they might be knitting with or crocheting with and I think that I think that when we work as hard as we all do for people to learn about what goes into something is to everybody's advantage, I'm always hoping to make the world a better place so that I hope by teaching them about what, how we got the color in

> that skein were going to learn a lot of important lesson about the environment and how to be careful and how to make good choices and how to support their local farmers.

Social media has proved itself as a site of knowledge production and community interaction. In her words, there is the articulation of not only community and commerce but also transparency for the farmer who produces the product. To place it in the context of Stephen Knott's craft consumption, this individual is both rejecting (by rejecting rules and pursuing self-sufficiency) and adapting (creating items from a wide array of tools) how craft supplies are made. Through the share of experiences on Instagram this individual also helps others who wish to reject and adapt capitalism through craft consumption. However, social media has also been a source of whitewashing for BIPOC individuals (Saxena, 2019). Natural dyer and knitter Ocean Rose outlined her erasure as a woman of color in an article with Vox. She explained that "I just noticed the space was easier to navigate when I didn't show who I was, because then you wouldn't assume that I was a black person" (Saxena, 2019, para. 17). Knitters like Rose express how it can be easier to participate in commerce and community on social media when they do not expose their identity. This shows once again, the way knowledge is shared is directly linked to an individual's identity.

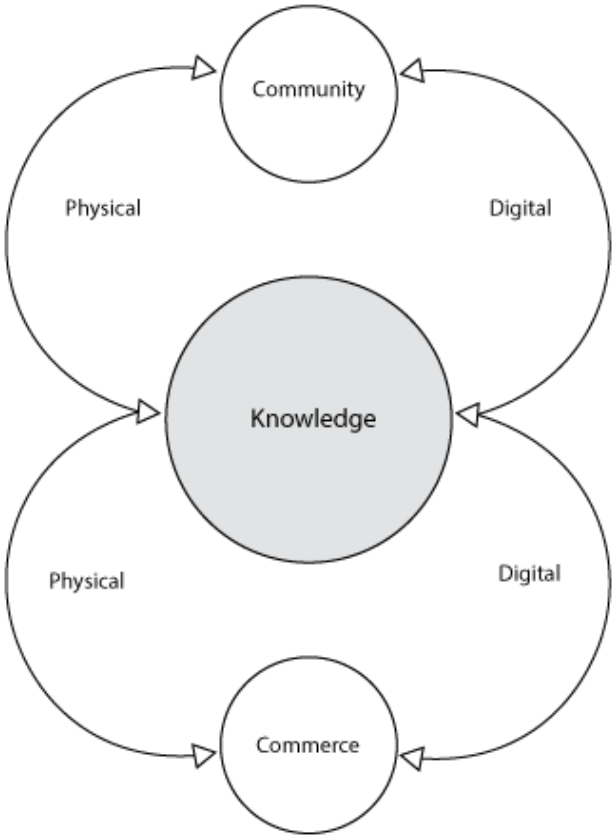
Proposed Theoretical Model

While I kept in mind hegemonic systems of knowledge production, I inductively developed a theoretical framework to represent the idea of knowledge commodification and community building in textile crafts. I framed my ideas around Susan Kaiser's (2012) circuit of style-fashion-dress but quickly understood the importance of the development of a new model. Kaiser's (2012) circuit of style-fashion-dress is the combination of Stuart Hall and Paul du Gay's

circuit of culture and Carol Tulloch's theory of style-fashion-dress. The circuit of style-fashion-dress is meant to represent a fluid process of identity production divided into five sections (production, distribution, regulation, consumption, and subject formation), which revolves around a circle. My epiphany occurred when themes of knowledge, found in the interview data, were situated within each of the five sections. Craftspeople produce knowledge through their exploration of the craft and then distribute and consume knowledge in digital and physical spaces. In my proposed model knowledge on how to create a textile-centric craft is the central idea that produces community and commerce (see Figure 4.3). However, it is critical to acknowledge that textile crafts have been and continues to be shaped by hegemonic power dynamics. From my observations within textile craft communities, cisgender white women still maintain a large majority of the control over knowledge production. These women often have the financial support and cultural capital to navigate knowledge production and this places them at the center of the diagram. Due to the lack of inclusivity for BIPOC and LGBTQIA+ individuals in textile craft, there remains a huge gap in knowledge in the circuit of knowledge production in textile centric craft.

Figure 4.3

Circuit of Knowledge Production in Textile Centric Craft



I argue that within a capitalistic society those who wish to make money from textile craft rely on the production of knowledge to help build community. They also benefit from their identities as white affluent individuals that can afford to be entrepreneurs in the textile craft industry. As the production of knowledge is critical in the production of community, there is also a reliance on commerce. In capitalism, community and commerce have become interdependently centered on the production of knowledge for hegemonic groups. This is not to say that a farmer can no longer sell goods without an online presence. There are many farmers who have no social media presence and I can buy their yarn at local farmers markets. However, for those who wish

to grow the community that buys their product, it appears that some type of knowledge production is necessary, be it in person learning experiences or online resource sharing.

I hope by through the creation of a theory around the way knowledge is created and shared in textile craft communities, individuals can better observe and dismantle how individuals are left out of communities. It requires a diverse array of voices at the center of the theory to produce knowledge that is inclusive for everyone. In the following and final chapter of my dissertation, I will summarize each chapter and continue to outline possible future research topics that stem from my research.

Limitations and Future Research. My first limitation for this chapter was my personal subject position as a white heterosexual cisgender female. My positionality has allowed me to bypass difficult conversations on identity compared to BIPOC and LGBTQIA+ individuals in textile craft communities. As I outlined in my literature review for Chapter Four, the voices of BIPOC and LGBTQIA+ craftspeople have been systematically ignored from much of the conversations regarding craft and knowledge. Researchers need to examine the barriers underrepresented, BIPOC, and LGBTQIA+ communities might have to participate in textile crafts and textile craft knowledge. Further research should also be conducted to understand the inclusion of people with different levels of ability (i.e. blindness, mobility, hearing loss, etc.) and what steps can be taken to create improved experiences.

As an able-bodied heterosexual cisgender white woman, I am not the correct researcher for this work. However, I will support others who better represent the communities in question. As for the proposed model of the circuit of knowledge production in craft, it is just the beginning of a much longer journey into how individuals are producing knowledge. The next step should be to more closely examine the identities of those producing textile craft information and survey the

most common ways individuals engage with textile craft information. There is a lifetime's amount of research to conduct alongside the textile craft and natural dye communities. As I conclude my dissertation, I am excited this is only the beginning of a much longer journey.

References

A Heart For Your Sleeve #fortheloveof…. (2015, September 18). Craftivist collective. Retrieved March 10, 2020 from https://craftivist-collective.com/A-Heart-For-Your-Sleeve-fortheloveof

Alberg, A. (n.d.). *Crush scholarship*. Sunflower Knit. Retrieved March 10, 2020, from https://www.ashalberg.com/crush-scholarship

Appadurai, A. (2005). Definitions: Commodity and commodification. In M. Ertman & J. C. Williams (Eds.), *Rethinking commodification: Cases and readings in law and culture*. NYU Press.

Black, S. (2017). Knit + resist: Placing the pussyhat project in the context of craft activism. *Gender, Place & Culture*, *24*(5), 696–710. https://doi.org/10.1080/0966369X.2017.1335292

Bratich, J. Z., & Brush, H. M. (2011). Fabricating activism: Craft-work, popular culture, gender. *Utopian Studies*, *22*(2), 233–260. https://muse.jhu.edu/article/451893

Campbell, C. (1995). Conspicuous confusion? A critique of Veblen's theory of conspicuous consumption. *Sociological Theory*, 13(1), 37–47. https://www.jstor.org/stable/202004

Campbell, C. (2005). The craft consumer: Culture, craft and consumption in a postmodern society. *Journal of Consumer Culture*, 5(1), 23–42. https://doi.org/10.1177/1469540505049843

Cardon, J. W. (2018). *Visible mending: Artful stitchery to repair and refresh your favorite things*. Martingale.

Chanin, N. (2012). *Alabama studio sewing + design: A guide to hand-sewing an Alabama Chanin wardrobe*. Harry N. Abrams.

Chia, W. (2009). *Twinkle sews: 25 handmade fashions from the runway to your wardrobe*. Potter Craft.

Clark, N. (2019, June 25). The real reason ravelry's ban on white supremacy is surprising. *Vice*. https://www.vice.com/en_us/article/xwnp4a/the-real-reason-ravelrys-ban-on-white-supremacy-is-surprising

Close, S. (2018). Knitting activism, knitting gender, knitting race. *International Journal of Communication*, *12*(23), 867-889. https://ijoc.org/index.php/ijoc/article/view/6122

Compton, J. (2017, February 7). Pink "pussyhat" creator addresses criticism over name. *NBC News*. https://www.nbcnews.com/feature/nbc-out/pink-pussyhat-creator-addresses-criticism-over-name-n717886

Corbett, S., & Housley, S. (2011). The craftivist collective guide to craftivism. *Utopian Studies*, *22*(2), 344–351. https://muse.jhu.edu/article/451899

Fletcher, K. (2008). *Sustainable fashion and textiles: Design journeys*. Earthscan.

Fletcher, K., & Grose, L. (2012). *Fashion and sustainability: Design for change*. Laurence King Publishing.

Gamble, J. (2001). Modelling the invisible: The pedagogy of craft apprenticeship. *Studies in Continuing Education*, *23*(2), 185–200. https://doi.org/10.1080/01580370120101957

Greer, B. (2011). Craftivist history. In M.E. Buszek (Ed.) *Extra/ordinary: Craft and contemporary art* (pp. 175–183). Duke University Press.

Herzog, A. (2015). *Knit wear love: Foolproof instructions for knitting your best-fitting sweaters ever in the styles you love to wear*. Abrams.

Hisdal, S. (2010). *Poetry in stitches: Clothes you can knit*. Unicorn Books & Crafts, Incorporated.

Indigo Pigment Extraction Methods. (n.d.). Retrieved February 8, 2020, from https://www.facebook.com/groups/2003754103201900/

Kaiser, S. B. (2012). *Fashion and cultural studies*. Bloomsbury.

Knott, S. (2013). Design in the age of prosumption: The craft of design after the object. *Design and Culture*, *5*(1), 45–67. https://doi.org/10.2752/175470813X13491105785587

Luckman, S. (2013). The aura of the analogue in a digital age: Women's crafts, creative markets and home-based labour after Etsy. *Cultural Studies Review*, *19*(1), 249–70. https://doi.org/10.5130/csr.v19i1.2585

Marx, K. (1867). *Capital: A critique of political economy* (Volume one). Progress Publishers.

Mahon, S. (2019, June 26). *On Ravelry's Trump ban*. Unfinished Object. From https://www.unfinishedobject.com/blog/on-ravelrys-trump-ban

Mills, M. (2015). *Merchant & Mills workbook: A collection of versatile sewing patterns for an elegant all season wardrobe*. Pavilion Books.

Moore, K. J. (2019, February 17). A witch-hunt on Instagram. *Quillette*. https://quillette.com/2019/02/17/a-witch-hunt-on-instagram/

Our Story. (n.d.). *Craftivist collective*. Retrieved February 7, 2020, from https://craftivist-collective.com/our-story/

Parkins, W. (2004). Celebrity knitting and the temporality of postmodernity. *Fashion Theory*, *8*(4), 425–441. https://doi.org/10.2752/136270404778051564

Prigoda, E., & McKenzie, P. J. (2007). Purls of wisdom: A collectivist study of human information behavior in a public library knitting group. *Journal of Documentation*, *1*(63), 90-114. https://doi.org/10.1108/00220410710723902

Ratto, M., & Boler, M. (2014). *DIY citizenship: Critical making and social media*. MIT Press.

Ritzer, G. (2014). *The McDonaldization of society*. SAGE Publications.

Roach, K. M. (2012). *Mend it better: Creative patching, darning, and stitching*. Storey Publishing.

Robertson, K., & Vinebaum, L. (2016). Crafting community. *Textile*, 14(1), 2–13. https://doi.org/10.1080/14759756.2016.1084794

Rodabaugh, K. (2018). *Mending matters: Stitch, patch, and repair your favorite denim & more*. Abrams.

Ross, R. J. (2010). *Slaves to fashion: Poverty and abuse in the new sweatshops*. University of Michigan Press.

Saxena, J. (2019, February 25). *The knitting community is reckoning with racism*. Vox. https://www.vox.com/the-goods/2019/2/25/18234950/knitting-racism-instagram-stories

Sennett, R. (2008). *The craftsman*. Yale University Press.

Smestad, L. (2009). The sweatshop, child labor, and exploitation issues in the garment industry. *Fashion Practice*, *1*(2), 147–162. https://doi.org/10.2752/175693809X469139

Stannard, C. R., & Mullet, K. (2018). Consumption of raw materials by crafters: Desired characteristics of yarn and retailers. *Clothing and Textiles Research Journal*, *36*(1), 17–32. https://doi.org/10.1177/0887302X17734644

Stitchable Change-Makers. (2015, May 12). *Craftivist collective*. https://craftivist-collective.com/project-stitchable-changemakers

Stoller, D. (2012). *Stitch 'n bitch: The knitter's handbook*. Workman Publishing.

Strauss, A., Corbin, J. M., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. SAGE.

Tapper, J. (2011). *Craft activism: People, ideas, and projects from the new community of handmade-and how you can join in*. Potter Craft.

Templer, K. (2019, January 7). *2019: My year of color*. Fringe Association. https://fringeassociation.com/2019/01/07/2019-my-year-of-color/

Yoo, K. *[@thecolormustard]*. (n.d.). Instagram. Retrieved March 10, 2020, from https://www.instagram.com/thecolormustard/

Toffler, A., & Alvin, T. (1980). *The third wave* (Vol. 484). Bantam Books.

Torrey, C., Churchill, E. F., & McDonald, D. W. (2009). Learning how: The search for craft knowledge on the internet. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM Digital Library. https://doi.org/10.1145/1518701.1518908

Travis, A. S. (1993). *The rainbow makers: The origins of the synthetic dyestuffs industry in Western Europe*. Lehigh University Press Bethlehem.

Veblen, T. (1912). *The theory of the leisure class: An economic study of institutions*. B. W. Huebsch.

Wark, M. (2013). A more lovingly made world. *Cultural Studies Review*, *19*(1), 296–304. https://doi.org/10.5130/csr.v19i1.3170

Winge, T. M., & Stalp, M. C. (2013). Nothing says love like a skull and crossbones tea cozy: Crafting contemporary subversive handcrafts. *Craft Research*, *4*(1), 73–86. https://doi.org/10.1386/crre.4.1.73_1

Chapter 5

Conclusion

The purpose of this dissertation was to better understand how and why individuals, communities, and industries use natural dyes in the United States. My overarching questions were:

1. Who currently uses natural dyes and why?

2. How are natural dyes currently used?

3. What are the challenges and possibilities of production?".

To examine these questions I incorporated interviews, participant observation fieldwork, and film production into my data collection methods. Over the course of three years, I gathered 40 interviews with 33 different individuals involved in the use of natural dyes. I also conducted location visits and participant observation research in 15 different states across the United States. In this final chapter, I will summarize and synthesize the information presented in Chapters Two, Three, and Four. After a summary of each chapter, I will discuss the overarching observations and themes found in my research.

Summary of Chapters

Chapter Two

In Chapter Two, I explored the challenges and innovations that surrounded the use of natural dyes in the U.S. fashion supply chain. I spoke with a variety of individuals who included fashion and textile designers using natural dyes, natural dye growers, production dyers, and apparel companies that sold naturally dyed garments for my data collection. I also worked with the menswear company Wool & Prince to naturally dye wool t-shirts and survey their customers after they purchased a naturally dyed shirt. To help analyze and organize my findings, I used

delineations (production, distribution, regulation, consumption, and subject formation) from the circuit of style-fashion-dress (CSFD) (Kaiser, 2012). The following is a summary formed around each delineation.

Production. To meet the growing interest in natural dyes, fashion labels have developed ways to produce more naturally dyed garments at one time. This led to the development of dedicated natural dye houses and large-scale natural dye growing operations in the United States. I discovered there are growing pains in natural dye production. These tension points are unsurprising, given that large scale natural dye production is just now in redevelopment after a nearly a 160-year hiatus.

Since natural dyes are ineffective on most synthetic fibers, companies encountered unexpected challenges when it came to fiber content for textiles and thread. Fashion labels have also discovered color inconsistencies from natural dyes due to variable growing conditions for plants, water quality, and manufacturing setups. This led to scientific and agricultural innovations by companies such as Stony Creek Colors (SCC). To mitigate variabilities in processed natural dye stuff, SCC analyzes the levels of dye chemicals available in plants to best assess when to harvest. Fashion companies that try to use natural dyes have also found that conventional synthetic dyehouses are unequipped for the use of natural dyes. Conventional dye houses are unlikely to know the extra steps required to use natural dyes, since they mostly focus on synthetic dyes. Natural dye houses, like Green Matters Dye Company, have developed processes to produce naturally dyed goods. They work with commercial clients to develop color pallets and bulk dye fabric or garments for the fashion and craft industries.

Distribution. I found two major points of distribution for natural dyes. The first was distribution from natural dye growers to dyers. The second form of distribution, and more

relevant to my study, was between natural dyers and their clients. My participants found it challenging to communicate and market information about natural dyes. Production dyers that I interviewed found they needed to educate their clients about the realities of natural colorants use. Dyers needed to communicate possible issues with fading and color limitations that include difficulties in the obtainment of a black color with natural dyes.

Consumption. To better understand why and how individuals consumed naturally dyed garments, I worked with the menswear company Wool & Prince. The first survey focused on basic demographics, online purchasing behavior, and on their perceptions of the naturally dyed product. The second survey inquired about their satisfaction with the garment and its color, their laundering practices, any perceived changes in color to the garment, comments they had received about their shirt, and if they would purchase another naturally dyed t-shirt from Wool & Prince.

The first survey (n=24), sent immediately after the garment was purchased, found that some individuals purchased a naturally dyed t-shirt to support environmentally friendly apparel production. Furthermore, while over-all perceptions of the t-shirts were positive some individuals expressed dissatisfaction with the white stitching that occurred due to the polyester thread used to construct the garment. The second survey (n=18), sent four months later, found that all respondents would purchase another naturally dyed garment from Wool & Prince. However, there was variance in the experience's individuals had when it came to colorfastness. Two individuals reported that the color had lightened on their garment after washing and wear. Another did not perceive color change after multiple laundering and sun exposure. A couple respondents also voiced concern for a reasonable price point. The key takeaways from the survey data were (a) all companies should consider natural dyes' effects on dye uptake and should consider the thread used to construct garments and fiber blends for textiles or consider dyeing

fiber or fabric first and the completion of garment construction second. (b) Consumers perceived natural dyes as an environmentally friendly alternative to conventional colorants. (c) Companies need to communicate the reason for an increased price point with naturally dyed garments.

Regulation. I found that the intellectual property of natural dye processes is the main subject of regulation for the natural dye community. In my discussions with participants, it was evident that informal regulation of natural dye information was common. Natural dyers chose whether or not to share information with the rest of the community. Sometimes individuals would keep dye recipes and process information proprietary for monetary and business reasons. More often natural dyers described the need to share information to enhance awareness of natural dyes. Furthermore, a code of ethics may help to increase information sharing within the natural dye community. While we discussed regulation, my participants were often very forthcoming with information and happy to share their knowledge with me.

Subject Formation. For the participants of my study, natural dyes correlate with ideas of ecological sustainability. They often cite natural dyes as being a sustainable alternative to synthetic dyes. Since natural dyes can biodegrade, unlike conventional synthetic dyes, this may be true. However, within the current fashion supply chain, natural dyes are yet to meet economic and sustainability demands. I argued that to try to scale natural dyes to fit the current consumption model will not work unless the entire fashion supply chain changes. Large fashion companies need to address the volume of production, the health of their workers, and the cost of production before the creation of ways to use sustainable supply chain methods. If the fashion industry does not alter the entire supply chain, natural dyes will not succeed as a sustainable alternative.

Chapter Three

In Chapter Three, I explored how and why people use natural dyes. I utilized ethnographic methods that included interviews, documentary film making, audio recordings, photography, fieldwork, participation observation, and field notes to explore the use of natural dyes by textile artists and production dyers. I found that individuals use natural dyes because of their own perceived environmental and health concerns, to create a sense of personal fulfillment, and to have autonomy over the production process. I then argued that my participants tied personal identity and meaning through natural dyes.

First, natural dyers articulated their concerns for their ecological and personal health by the rejection of the use of synthetic colorants. Natural dyes represented a process that is more respectful to the environment and safer for the human body. They can also be seen as less harmful to those who choose to wear or manufacture naturally dyed garments. Second, individuals are motivated to use natural dyes because they create a sense of personal fulfillment. Natural dyers are excited to learn and to continue to discover new ways to use their medium. Dyers discussed the multiple variables that increase the complexity of natural dye use and how that adds to the amount of knowledge there is to learn. My participants also described how natural dyes were part of a pivotal life change. Multiple individuals quit their jobs in the fashion industry to pursue less traditional careers to use natural colorants. Third, natural dyes represented the ability for more autonomy over production. Dyers tended focused on the processes they enjoyed most, such as growing plants or dyeing fabrics.

I concluded with the argument that natural dyers infuse meaning into cloth by the use of natural dyes. Natural dyes can communicate a narrative of a specific location with a dye from that environment. They can also communicate broader philosophical ideas through their dye

choices. Natural dyers can share aspects of their personal identity in an object they have colored and create meaning into the fiber of the cloth they dye.

Chapter Four

In Chapter Four, my focus shifted to the textile craft industry. I used my work in the natural dye community and the internet as sources of information. The purpose of this chapter was to explore textile-centric epistemologies that fuel dual purposes of commodification and community building. Interest in textile-centric craft has grown since the early 2000s and sites of information sharing (i.e. specialty stores, publications, websites, and social media) have developed to meet the needs of the community. However, BIPOC and LGBTQIA+ individuals have been left out or uncredited for knowledge production for the craft community.

As I acknowledged this bias, I examined the epistemologies of commodification and community building through both physical and virtual spaces. In physical spaces, people are sharing textile craft knowledge through books, blogs, classes, guild meetings, patterns, one-on-one tutoring, and informal conversations. I found that artisans earn an income through the commodification of knowledge they have developed about natural dyes. I also found that individuals build a community interested in buying their knowledge. Many times, physical knowledge sharing is communal. Knowledge can be shared for free at events such as knitting circles, quilt retreats, and weaving guilds. Knowledge can also be sold through classes or workshops, where an advanced craftsman teaches others with less skills. However, this connects back to the identities of individuals who can financially afford to take workshops or feel included in physical spaces. This can lead to underrepresented and/or impoverished communities being left out of the textile craft community.

Knowledge sharing also happens through virtual means for the textile craft community. The internet has become a critical source of information through social media, electronic books (e-books), online courses, blogs, podcasts, and more. I found that individuals who produce knowledge sought ways to directly and indirectly sell to customers. One example is someone who directly connects to a customer virtually to sell an e-book on how to weave. An example of an indirect method would be a free how-to video to show a potential customer how to use a product a company was selling. Besides digital products, social media is an important source of knowledge production and sharing. An artist can both share information to connect with a broader community and promote the consumption of their knowledge. However, for BIPOC and LGBTQIA+ individuals, it can be easier to participate in commerce and community on social media where they do not expose their racial or gender identities. This shows once again the way knowledge is shared is directly linked to an individual's identity

I concluded with a proposed a model for knowledge sharing within the craft community, called the circuit of knowledge production in textile centric craft. While I kept in mind hegemonic systems of knowledge production, I inductively developed the theoretical framework based on Kaiser's (2012) model of CSFD. In my model, knowledge on how to create a textile-centric craft is the central circle. Craftspeople produced knowledge through their exploration of textile craft and then distributed knowledge in digital and physical spaces to create community and commerce. I argue that within the current capitalist society mostly white affluent individuals benefit from the production of textile craft knowledge.

Observations from my Research

Now that I have outlined my findings from my dissertation, here are some of the overarching observations I found during my time with the natural dye community.

Instagram as a Connection Point

When I started my research on natural dyes in 2012, there was little natural dye information to be found on the internet. A couple of obscure blog posts were the only sources of non-academic information I could find on how to create color from nature. When I started using Instagram in 2015, I could use hashtags (specifically #naturaldye) to find others who shared my interests in natural dyes. I followed anyone who used the tag on one of their posts, determined to collect all the Instagram user names of individuals who experimented with natural dyes. Over time I found key individuals that centered their Instagram accounts around using natural dyes and consistently interacted with their followers. These individuals, such as Liz Spencer from the Dogwood Dyer and Mari Pombo from Fragmentario, are those whom I first reached out to for my research. Instagram's image-centric format has made it a popular social media site for not only natural dyes but for other forms of hand-craft. In retrospect, my research would have been very different if I had not been able to find so many of my participants through a single source.

Documentary Filmmaking as a Method

Videography and documentary filmmaking featured prominently in my data collection methods. The physical labor of traveling with camera gear or setting up film equipment for an interview impacted the time I had with my participants but also opened more opportunities for interviews. For example, setting up my camera and audio for an interview would take approximately 30-45 minutes. I then needed to monitor the equipment while I conducted the interviews. It was difficult to pay close attention to my interviewee while also adjusting focus and listening for audio interference. However, being able to introduce myself as someone who is creating a natural dye documentary led to more interviews as people were interested in being in my film. Long term, I hope to create a documentary film that is more accessible to a non-

academic audience than a typical journal article. I take pleasure knowing that a visual record of the faces, voices, and textiles of my research participants will live on in more than just my memory.

The Future of Natural Dyes

During my fieldwork I had the opportunity to give an informal consultation with a designer at Nike on the use of natural dyes. He asked for guidance on the sustainability of natural dyes and if I had any advice for their use. I did my best to give a holistic picture of the complicated position natural dyes hold as an ecologically sustainable colorant. My advice to him and to the rest of the fashion industry is to move forward slowly. As I stated in Chapter Three, it is better to not try to scale up natural dyes to fit the current consumption model. More research needs to be completed by chemists, social scientists, and apparel scholars to gain a better understanding on how to use natural dyes in the least destructive way towards the planet. Beyond the fashion industry, I would like to point out one of the key strengths natural dyes possess for anyone interested in using natural colorants the ability of natural dyes to be an establishment of place. When I walked through indigo fields in Tennessee, visited a container garden in California, or labored in the Cornell Natural Dye garden, I was reminded of that natural dyes represent a specific time and place. Natural dyes have the potential to be a connection point between a place, garments, and the human body.

References

Kaiser, S. B. (2012). *Fashion and cultural studies*. Bloomsbury.

Appendix A

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Institutional Review Board for Human Participants

Concurrence of Exemption

To: Kelsie Doty

From: Amita Verma, Director, ORIA

Approval Date: November 14, 2016

Protocol ID#: 1610006734

Protocol Title: Motivations of Natural Dye Artisans in Relation to Place and Community

Your above referenced request for **Exemption from IRB Review** has been approved according to Cornell IRB Policy #2 and under paragraph(s) 2 of the Department of Health and Human Services Code of Federal Regulations 45CFR 46.101(b).

• Paragraph 2 allows to be exempted from IRB review research activities in which the only involvement of human subjects will be in the following category: Surveys/Interviews/Standardized Educational Tests/Observation of Public Behavior – Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior if: i) information obtained is recorded in such a manner that human subjects cannot be identified, directly or through identifiers linked to the subjects; or ii) any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation.

Please note the following:

- Investigators are responsible for ensuring that the welfare of research subjects is protected and that methods used and information provided to gain participant consent are appropriate to the activity. Please familiarize yourself with and conduct the research in accordance with the ethical standards of the Belmont Report (http://www.hhs.gov/ohrp/policy/belmont.html).
- Investigators are responsible for notifying the IRB office of change or amendments to the protocol and acquiring approval or concurrence **BEFORE** their implementation.
- Progress reports, requests for personnel or other administrative changes, or requests for continuation of approval are not required for the study.

For questions related to this application or for IRB review procedures, please contact the IRB office at irbexemptions@cornell.edu or 254-5162. Visit the IRB website at www.irb.cornell.edu for policies, procedures, FAQs, forms, and other helpful information about Cornell's Human Participant Research Program.

Appendix A

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Institutional Review Board for Human Participants

Concurrence of Exemption

To: Kelsie Doty

From: Amita Verma, Director, ORIA

Approval Date: July 19, 2017

Protocol ID#: 1707007306

Protocol Title: Natural Dye Use In The Apparel Industry

Your above referenced request for **Exemption from IRB Review** has been approved according to Cornell IRB Policy #2 and under paragraph(s) 2 of the Department of Health and Human Services Code of Federal Regulations 45CFR 46.101(b).

• Paragraph 2 allows to be exempted from IRB review research activities in which the only involvement of human subjects will be in the following category: Surveys/Interviews/Standardized Educational Tests/Observation of Public Behavior – Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior if: i) information obtained is recorded in such a manner that human subjects cannot be identified, directly or through identifiers linked to the subjects; or ii) any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation.

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Appendix B

Wool and Prince Online Survey (first survey)

Demographic questions

Age:

Gender:

Current place of residence (city, state, country):

Ethnicity:

Questions regarding your buying behavior:

1. How often do you shop for clothing?

2. How often do you purchase clothing online?

3. How many times have you purchased clothing from Wool&Prince.com?

Questions regarding your purchase:

4. What contributed to your decision to buy a naturally dyed garment from Wool & Prince?

5. What are your initial thoughts about the naturally dyed garment from Wool & Prince?

6. Are you satisfied with the color of your naturally dyed garment from Wool & Prince? Please elaborate.

7. Are you satisfied with the quality of your naturally dyed garment from Wool & Prince?

8. Do you have any questions after reading the product description?

9. Would you purchase another naturally dyed garment from Wool & Prince in the future? Please explain.

Appendix B

Wool and Prince Online Survey (second survey)

Questions regarding your purchase:

1. Are you satisfied with your naturally dyed garment from Wool & Prince?

2. Are you satisfied with the color of your naturally dyed garment from Wool & Prince? Please elaborate.

3. How have you laundered your garment?

4. Would you consider purchasing another naturally dyed garment in the future? Please elaborate.