Color in Context: Utilizing natural dyestuffs of the Pacific Northwest to explore local and sustainable textile dyes

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Project Abstract

The synthetic dyes used to color our clothes and other textiles are highly toxic to ecosystems and the people who come in contact with them. Natural dyes may be an alternative to the synthetics currently used, however there are little to no natural dyes commercially available that have been sourced locally. I researched the availability of effective natural dyestuffs in the Pacific Northwest and how they may be used in local textile industries through a literature review. By taking samples of prospective dyestuffs from various bioregions and creating a dye bath out of each sample, I was able to catalogue the dyestuff, mordant, and methods used to make the dye bath, as well as the fabric dyes and dyeing method. I then used a few dyestuffs to create garments for seven models that were shown in the Associated Students of the University of Washington (ASUW) “Everybody, Every Body Fashion Show”. I found many different dyestuffs in the Pacific Northwest that can be used as effective and ethical dyes. This will be a significant project for the local textile industries that are working toward decreasing their environmental impact.

Introduction

Clothing has had an important role in human survival and culture since our genetic ancestors developed the need and desire to protect themselves from exposure, indicate social status, and express themselves through the decoration of their bodies. For most of this period, we were limited to clothing ourselves with natural resources locally available, textiles made from globally resourced goods were reserved for upper classes. Styles of clothing and garments varied greatly, not only between nations but also between micro-regions. It is possible to tell which valley or fjord in Norway a *bunad* (the folk costume of Norway) comes from based on the embroidery styles alone. In today's global economy we have nearly lost locally available resources and textile industries, while developing textile production chains that are extremely detrimental to environments, global social equity, and traditional cultural practices.

There is a great push towards local and sustainably produced food currently, and people are feeling the desire to have a connection with what they are consuming and where it comes from. Farmer Markets are common sights, where consumers can interact directly with the producers of the product and ask questions about its origin, how to use it, what's in season, etc. I was interested in exploring similar local and sustainable fashion movements, because some of the most prolific agricultural products are for the textile industry. Can we clothe ourselves by supporting the creation of local textile cultures that enhance ecological balance, and utilize regional agriculture while strengthening local economies and communities?

I came into this project with a background in fiber arts, and decided that instead of trying to encompass an entire textile industry I would focus on one aspect of textile production that I am very familiar with. I wanted to ask what natural dyes exist in the Pacific Northwest, and if could I use them as an alternative to synthetic dyes to create a wide range of colors. Originally I only had one product in mind, the creation of a dyestuff assessment catalogue that I could continue adding to as the seasons changed and different local dyestuffs became available. However it became clear that I would want another product that would show off what I had discovered, and I became involved in the ASUW 2015 Everybody Every Body Fashion Show as a student designer. I created outfits for seven models, all dyed with non-toxic methods using plants sustainably sourced from the Pacific Northwest, which showcased the range of colors I was able to achieve.

Context

The study of sustainable color is a significant part of creating a sustainable textile industry because color has been commodified since humans could produce it. Until synthetic colors were produced the trade of dyes was centralized to places with access to dyestuffs that produced remarkable colors. These colors were highly prized and closely guarded, with entire economies reliant on their production. Synthetic dyes freed textile manufacturers from those limitations as colors could now be produced in a much larger and vibrant range anywhere in the world (Grierson, 1989).

One of the most significant historical dyes was Tyrian purple. Tyrian purple is the reason purple is considered a royal or majestic color, as it was reserved for nobility and upper classes. This dye comes from an aquatic mollusk in the Murex family, and was highly prized as it was vibrant and lightfast, it was said to grow brighter instead of fading in the light. Accounts from this time describe the island where this dye was processed as being completely polluted with waste from the production process, and that you could smell the dye from miles away. This dye was so heavily produced that it nearly drove the Murex snail to extinction, and the use of it died off (Crabben, 2010).

In 1856 William Henry Perkin was attempting to synthesize quinine when he accidently created the first synthetic dye, mauveine. Mauveine was considered to be the synthetic replication of Tyrian purple and was hugely successful, sparking the creation of thousands of new synthetic dyes that largely replaced the traditional dye industry except in niche markets (Rzepa, 2006). Today synthetic dyes dominate the textile and fashion industries, and enable fashions to change quickly and wide ranges of colors to be accessible to everyone. However, due to poor waste management and water treatment practices at dye houses, toxic materials are regularly being dumped into water sources in countries like India and Bangladesh who have large textile industries. These chemicals are polluting ecosystems and harming local populations who come in contact with them (Flint, 2010).

Literature Review

History of Color

Today, most of the textiles made commercially are colored with synthetic dyes. These dyes are much more colorfast (resistant to fading or change of the color) than the natural dyes used previous to their invention, and can achieve a much larger range of colors than natural dyes (Green, 2000). On the other hand, Synthetic dyes are also much more toxic for both humans and ecosystems, and their effects are not limited to the factories and places they are made, as dye wastewater is one of the largest contributors to pollution. Synthetic dyes are devastating to ecosystems and water supplies, often making them unsuitable for human use and consumption (Zaharia, Suteu, 2012). The town of Tirupur in India is where most clothing that has a "Made in India" tag is sourced from. Wastewater from dye houses in Tirupur is dumped in the Noyyal River, which has made ground water in the area undrinkable and the land can no longer be used for farming, as it is too polluted. Officials have ordered that the practice be stopped, and many textile producers in Tirupur have closed down. Even with cleanup practices in place and zero toxins being dumped into the river, it will take at least 10 years for the river to cleanse itself and become toxin free (Subramanian, 2009).

Before the development of synthetic dyes, humans were limited to those that can be sourced naturally from plants and animals, but this does not mean all traditional dye practices were environmentally sustainable and local. Colors such as Tyrian Purple and Indigo were highly coveted, reserved for the elite, and their sources were over harvested due to demand. Before Indigo

Sustainability and Fashion

Sustainability is a big motivator for my project. The consumption encouraged by the fashion industry is entirely unsustainable, and is constantly moving more toward a "fast fashion" model. Creating Sustainable Apparel Value Chains (Martin, 2013) gives an interesting insight on the global textile and fashion industries, especially as they concern "fast fashion." It argues that the textile industries can raise efficiency and performance, while also raising the ecological and social sustainability of the industry. While I agree that current practices in fast fashion should become more sustainable, I am also going to argue in my senior project that we must move away from these global supply chains for our clothing. "Sustainable fashion" largely focuses on what materials are being used and disposed of, and often ignores the human factor into the

equation. This article has shortcomings when viewed for smaller apparel production methods, as it focuses entirely on large fast fashion chains. As my project focuses on more localized and smaller apparel production industries, I will hope to see if the practices I find might be translated into the practices recommended by the author for larger chains.

Fast fashion is a large contributor to the ecological damage caused to the environment by the fashion industry as the clothes produced are almost seen as disposable and contribute to huge amounts of waste. The clothing is extremely trendy and not intended to last long, often made out of textiles that wear out quickly and cannot be mended. In Overdressed (Cline, 2013), Cline exposes the wastefulness of huge retailers and their consumers. However, I think that she would argue that we cannot just make these retailers "sustainable," as they are too large to be able to equitable treatment to all of their workers and protect the environment. She argues that we should buy recycled, organic and locally produced clothing, along with putting to use the old mantra of "make, alter and mend" our clothing in order to reduce our ecological footprint. The clothing I will make for my senior project will be easily mended and reusable, ensuring that it will have a long life after it is finished being used for clothing. I also will make the garments (and dye them) with safe and biodegradable materials.

On a smaller level of sustainability, No Impact Man (Beavan, 2009)
is about one man trying to go one year with his family while having no impact on the environment. Through reducing his consumption of almost all products, his family gets as close to no impact over the course of the year as he can. He would argue that even making the fashion chains more sustainable is not enough to save the planet, we must stop consuming completely. While I agree with him on most parts, such as sourcing all of his food locally to support local farmers, he does not attempt or consider sourcing his family's clothing locally, and instead simply states that they will not buy any new clothes for the year. I do not think that this is looking at the whole picture of ethical consumption, as there are many problems with the used clothing industry. This method would deprive local artists and industries of revenue, making it impossible to create and support sustainable and locally sourced textiles and would continue our dependence on outside sources for clothing, unlike what Cline suggests.

Connection to Place

My project has a very strong component with connecting those who create and use locally produced textiles to a “Sense of Place”. To create a local industry that protects the environment, while supporting local economies and communities, those that participate in that industry must have a sense of place. I enjoyed the way in “What is Sense of Place?” (Cross, 2001) defines the concept in many ways and many types of relationships with local areas. The article touched on connections to place that are very present in my project, from physical connections to mental and emotional relationships. As Cross argues, “The relationship between people and environment is transactional: people take something (positive or negative) from and give or do things to the environment; these acts may alter the environment’s influence on the people.” I feel that if consumers develop a connection to the local area where the products they consume are sourced from, it will encourage ethical and sustainable consumption.

Along with a sense of place, bioregionalism is another aspect of locality to my project. I especially liked how “Dwellers in the Land” (Sale, 2000) defined of "querencia" as "a deep, quiet sense of inner well-being that comes from knowing a particular place of the earth, its diurnal and seasonal patterns, its fruits and scents, its history and its part in your history." Sale would have agreed in many ways with Cross’s many definitions and uses of “sense of place.” However, this book focuses on foodsheds and other natural resource use, without touching on local textile production. As local and sustainable food production has been a large topic of discussion and action, there are few sources on locality and sustainability that do not focus on it.

Method Informing

The book Eco Color (Flint, 2010) served as a large source of inspiration for me when starting this project. India Flint is a textile artist in South Australia who creates and sells printed fabrics using sustainably collected plants from her bioregion. Because she is from and focuses on plants available in Australia, a lot of the plant information will not be as useful for me, however I plan to use her methods of finding, experimenting with and using dyestuffs as a beginning point for my own methodology. However, I do have some differing opinions of her views on what plants should be collected and how. I think that the types plants that she recommends avoiding as they are not very common in her area could be much more common in the Pacific Northwest, and can be collected without fear of negatively impacting population counts, especially from windfalls. I will do research on the life cycle or each plant I experiment with to ensure that using it will not negatively impact its population in the area. She also lacks a lot of exact information, I think that her working style involves a lot of experimentation and repeatability isn’t a valuable

part of her process or end products. Because of this, I will use methods inspired by her working style, but by using more exacting measurements and quantifiable data, in order to ensure repeatability of my processes.

On the other side of instruction is the very precise article “Natural dyes in modern textile dye houses.” (Bechtold, 2003) While many of the concepts in this article refer to chemical processes that are somewhat above my level of comprehension, it had many interesting points to make about what practices can be effective in dye houses that can create effective textile dyes from plant matter, while lowering the chemical waste of dye houses. The article offered methods for dye extraction, mordant use and dye use that were very comprehensive and informative, with more data and information than offered in books such as Eco Colour which will inform my methods. However, unlike Eco Colour it does not offer ways to experiment with unknown dyestuffs, and relies solely on known natural dyes. I think the authors of this article and Flint would disagree on many aspects of what is valuable about natural dyes, and what ethical use of them entails.

Methodology

I began this project with previous experience in textile art, including dye practices. The first step of this project was to perform a literature review of existing texts, articles and writings about the textile industry, locality and bioregions, botany, sustainability, and texts that will inform my methodology. This literature review grounded and guided my project, and allowed me to use other's work as a jumping off point for this project. It also allowed me to identify methods that may be useful for the project. For example, I cross referenced lists of plants with known effective dyes with information about plants native to the Pacific Northwest, and compiling a list of plants that will be most likely useful in this project. I also experimented with native plants that are not yet identified as sources of natural dyes, and determined their effectiveness. Reaching out to connections in the fiber arts and the indigenous communities for knowledge and guidance was another source of support during this project.

The next step in my plan was to set up a dye lab and begin preliminary collections and dye samples. In order for this to inform the rest of my project accurately, I created a system of cataloguing the dyestuff, mordant, and methods used to make the dye bath, as well as the fabric dyes and dyeing method. I gathered different parts of plants that I could access without causing harm to the area ecosystem; such as gathering windfall, using invasive species, etc. There are a few markers for plants that may make good dyestuffs such as; sharp scent, visible color, or any immediate staining that can be achieved. Occasionally clues about the traditional use of a plant can be found in the plant's species name. Species with tinctoria or tinctorum (meaning used in dyeing) are an obvious one, but there are also clues in names that describe color or scent.

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After I collected samples of dyestuffs, I performed a preliminary “tea test,” where materials were cleaned and prepared, then a very small dyebath is created as a cup of loose leaf tea might be made. After pouring hot water over a cup of crumbled or cut up plant matter, a color might develop in the liquid after letting it sit for around ten minutes. This shows if the dyestuff has good potential as a useful dye.

When a dyestuff showed to have promise as an effective dye, I created a series of fabric samples to see what range of colors could be achieved with this dye. To create fabric samples, I pre-mordanted (mordants are substances that can change and fix dye to fibers, giving it a longer life and a wider range of colors) small pieces of white cotton (an easily obtainable natural fiber fabric, natural dyes have no effect on synthetic fabrics such as polyester) in mordants of potassium aluminum sulfate, ferrous sulfate, copper sulfate, and keep a control sample with no mordant. These mordants are non-toxic and safe to dispose of. They will also provided a level of consistency that allowed me to keep records of the colors, instead of making my own mordants that can be unpredictable and difficult to duplicate. I prepared a standard hot extraction dye bath with the sample, by chopping or tearing the dyestuff, covered it with water in a non-reactive pot, and left the dyestuff to simmer overnight. The dye baths were then strained and then returned to the pot. Then, while keeping the samples carefully labeled, I placed a sample from each mordant into the pot, and simmered until the color was as dark as possible or desired. Then the dyebath was taken off the heat source and the fabric samples were allowed to cool while still resting in the dyebath. When the liquid was cooled, the fabric samples were removed and allowed to dry completely before being washed with cool water and synthrapol, a soap commonly used in the dying process as it removes all excess dye from fabric. After being air-dried again, the samples were recorded and catalogued. This allowed me to quickly test many different types of dye and mordant combinations.

Each step was recorded in the same way for all dyestuffs, to ensure repeatability. At the end of my tests, I settled on a few dyestuffs that I would be using during the project as they were easily obtainable, created strong colors, and gathering them would have little negative impact on the local environment. These were: cedar leaves, red alder bark, locally grown red cabbage, and blackberry leaves.

After I created a working knowledge of dyestuffs local to the Pacific Northwest, I needed a platform to show that these colors could be used in textile and garment construction. For a short period of time I considered simply creating fiber art pieces using dye practices such as shibori and batik, and creating a small gallery show. However it was important to me that these colors would be shown as clothing, preferably with someone wearing them, as a huge focus of this project and my research questions were about creating sustainable fashion. That led me to the idea of planning my own fashion show, however due to time constraints I would not have been able to plan, market, and produce a fashion show while also creating the garments that would be shown.

A fellow CEP student informed me of the possibility of becoming a participating student designer in a large fashion show run by the Associated Students of the University of Washington (ASUW), called the Everybody Every Body Fashion Show (EBEB Fashion Show). The EBEB Fashion Show promotes body positivity on campus and celebrates the student volunteer models. This would be its seventh annual show, and while the majority of the clothes are provided by larger local retailers, they do often showcase smaller designers and students designers. I met with the director of the Student Health Consortium (the department of the ASUW that produces the EBEB Fashion Show), Daniel Masin, who agreed to let me become a student designer for the show. I was assigned seven models, four female and three male, and was given the responsibility to arrange model fittings and work within my model's preferences to create outfits for each one.

In the fall I had taken the first prerequisite class for Seattle Central College's Apparel Design program, which gave me some of the basic skills I would need for this project, such as pattern drafting, basic industrial sewing techniques and understanding of basic garment construction. I decided that it would be

easiest to tackle the garments for the female models first and applied these skills to create a basic pattern for a dress that could easily be adapted to each female model's preferences and measurements. After I had a basic pattern, I contacted each model and obtained their measurements and any information about what they would be uncomfortable wearing on the runway.

I created a basic dress for each female model according to their measurements and specifications out of a natural fiber woven fabric that was a 50/50 mix or linen and cotton, and then arranged model fittings to ensure the dresses fit properly. After I had the dresses tailored properly to each model, I began the dying process. Two of the dresses were dyed with cedar leaves, one using an aluminium sulfate mordant to create yellow, and one with an iron sulfate mordant to create a soft grey. The other two dresses were dyed using red cabbage, both with with aluminum sulfate to create a robin's egg blue. The dresses were fastened at the back by silk ribbons dyed with an iron sulfate mordant and red alder bark, which produced a golden color.

I had more trouble with the garments for the male models, and after a few days of trying to create a pattern for a shirt that I liked, I broke down and purchased pre-made 100% cotton white t-shirts to dye. For these I dyed one in cedar leaves to produce yellow, one in blackberry leaves to create a green, and one in red cabbage for blue (all using aluminum sulfate mordant). As these shirts have been processed more than the other materials I

was using, they did not hold onto the dye as well as I would have liked and faded to very pale colors. I also was unable to create a satisfactory pattern for the pants, as those are much more difficult garments to construct and I did not yet have that high of a skill level. I ended up purchasing a pattern for men's jeans and adapting it for my needs, using a 100% cotton canvas material. After performing similar model fittings as with the female models, I dyed one of the pairs in iron sulfate mordant and red alder to create the same gold as the silk ribbons on the dresses, one in aluminum sulfate mordant and blackberry leaves for green and one in aluminum sulfate and red cabbage for green.

With all of the clothes finished, I had final fittings with the models to ensure everything fit, and then gave the clothes to the EBEB Show staff, who held onto them until the models were ready to get ready for the show. On the day of the show I was availible to my models to assist with dressing and makeup, and to provide last minute alterations on the clothing.

Results and Reflection

I feel that my participation in the Everybody Every Body Fashion Show was a success. The show went well, even though two of my models managed to split their pants through exuberant runway walks and dancing. Even though I had to source these dyes in the winter when the least amount of locally sourced dyestuff are naturally available, I was able to create a range of colors that were beautiful and effective as clothing dyes. I am also pleased with the results of my garment construction, I was able to build lifelong skills and learn how to work around problems that I do not have the skills to solve. From now on, I will also double stitch the crotch of all pants, no matter how short of a time the wearer will be wearing them. Working on these dyes and garments outside of school provided dye labs and sewing rooms was a new challenge, and it forced me to accumulate a lot of supplies that I had previously taken for granted, and gave me a huge appreciation for what it means to be a private studio artist.

I also was able to involve myself in a communities that I previously had not encountered. I made connections with people in the local and sustainable fashion movements who were more than willing to hear about and give me advice on my project. This was a community that previously had intimidated me and seemed very insular, now I know that the members of this community are very welcoming and want the local fashion movement to gain momentum and succeed. The other community that I found myself unexpectedly involved with was the ASUW and other students who are involved in campus events. I have never been one to show a lot of school spirit, and haven't attended one school for longer than two years since the fourth grade. It was a very new experience to meet and work with people who pour their whole beings into creating events on campus, and into supporting the campus community. I got a new appreciation and respect for those who strongly identify with their school.

While my project did not yield many definitive results about the practicality of local dyes being used in local textile production and fashion industries, I feel that there are enough local plants and dyestuffs to make it a viable alternative to current industry dye practices for some niche markets and producers. The colors that can be created using dyestuffs local to the Pacific Northwest will always be limited and there are many colors that can only be achieved through the use of synthetic dyes. Because of this, it is not practical to work towards a complete replacement of the current global textile industry with local and locally sourced textile industries, however there are far more aspects of the textile and garment industry that can be sourced

locally and can be used to support resilient ecosystems, agricultural, economies, and cultural practices without sacrificing our love of decoration ourselves. I believe that if we are to make a large impact in the sustainability of the fashion and textile industries there needs to be great shifts made in the current consumer and fast fashion model of today. There must be greater shifts in how we, as a culture, view mass consumption and consumerism as a positive aspect of the industry and economy.

References

Bechtold, T. Turcanu, A. Ganglberger, E. and 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.

Crabben, J. (2010). Tyrian Purple, *Ancient History Encyclopedia*. http://www.ancient.eu/article/196/

Cross, J. (2001). What is Sense of Place?, Prepared for the 12th Headwaters Conference, Western State College, November 2-4, 2001.

Flint, I. (2010). Eco Colour: Botanical Dyes for Beautiful Textiles. Interweave.

Grierson, S. (1989) Dyeing and Dyestuffs. Aylesbury, Bucks: Shire Album 229, Shire Publications Ltd.

Green, F. (2000). Coming full circle: a brief history of the domestic synthetic dye and biological stain industries. Biotechnic & Histochemistry : *Official Publication of the Biological Stain Commission, 75*, 4, 167-75.

Martin, M. (2013). Creating Sustainable Apparel Value Chains: A Primer on Industry Transformation, *Impact Economy.*

Pemberton, R. (2012). The environmental impact of colonial activity in Belize, *Historia Ambiental* Latinoamericana y Caribeña, 1, 2, 180-92.

Rzepa, H. (2006). Mauveine: The First Industrial Organic Fine-Chemical. Imperial College. http://www.ch.ic.ac.uk/motm/perkin.html

Sale, K. (2000). *Dwellers in the Land: The Bioregional Vision*. University of Georgia Press.

Zaharia, C. and Suteu, D. (2012). Textile Organic Dyes – Characteristics, Polluting Effects and Separation/Elimination Procedures from Industrial Effluents – A Critical Overview, *Organic Pollutants Ten Years After the Stockholm Convention - Environmental and Analytical Update*, 55-86.