Sophia Roces
12 December 2016
Prof. Chris Jensen
Ecology

Term Project Proposal

The fashion industry has recently gained widespread notoriety for its abysmal environmental impacts. The discussion around this issue has primarily highlighted the unsustainable practices of the industry itself, which are collectively branded as “fast fashion”. This term connotes the dominant system in place wherein large retailers mass produce cheaply made clothing in vast quantities overseas where manufacturing regulations in factories are minimal. This means policies such as minimum wage for employees and proper disposal of waste chemicals can be evaded, which cuts costs, so the retailers can afford to churn out an increasing number of collections per year. People mindlessly buy these cheap clothes and get rid of them after a short time, resulting in tons of clothing waste that are sent to landfills or third world countries.

Efforts within the fashion industry to solve the problem of fast fashion have been largely superficial. The arguable beginning was the eco-fashion movement dating back to around the 1980s, wherein the “ecology look” that featured ostensibly natural or “unprocessed” looking materials and ecological motifs was in vogue, but had little actual environmental benefits beyond a statement. Modern designers concerned with sustainability have practiced upcycling, using recycled or natural materials, zero waste patterns, natural dyeing, sourcing fabrics and producing locally, creating innovative textiles, and so on. These are extremely compelling creative solutions, but they are small-scale, generally more expensive, and often cater to only niche markets. Even large retailer H&M has recently marketed sustainable initiatives, including a clothing recycling program and recycled fabric clothing line, however, this does not nearly compensate for the millions of garments they produce yearly.

Initially, my project was going to focus on the abovementioned efforts towards sustainability. I was interested to find which one of them was quantitatively sustainable; in other words, not merely sustainable by name or intention but scientifically sustainable, with proof in the calculations. In my research, I explored a multitude of Life Cycle Assessments and related carbon footprint studies of textiles and garments, both standard ones and those marketed as sustainable, such as recycled fabric and organic natural textiles. I was expecting to find some sort of silver bullet, perhaps a certain dye or material that was either an exceptional pollutant to avoid, or a surefire environmentally friendly alternative that I could use to design “The Ideal Garment”. The truth that my research revealed, however, was that the bulk of the problem was not in the production stage of the garment’s life cycle at all, but in the “use” stage.

In 1995, the American Fiber Manufacturers Association conducted a life cycle inventory study on a standard women’s 100% polyester blouse. A life cycle inventory is a study that analyzes the total environmental impact of a product during the different processes of its life

span, from the extraction of raw materials, to the processing, manufacturing, transport, use, and disposal. The study measured energy consumption, greenhouse gas emissions, and the production of solid and liquid waste. Their findings reported that a whopping 82% of energy use and 66% of solid waste production in the garment's life cycle was from consumer use. [1] Laundering, bleaching, and ironing are among the processes during the use phase of the garment that consume energy and resources and produce waste. [2]

Firstly, there is the water temperature in which the garment is washed. In the United States, as seen from a 2005 survey, 55% of washing machine-owning households washed most frequently using warm water (40˚ C) and 34% used cold water (30˚C). [3] A 2011 study that compared the quality of cleanliness in various fabrics that had been washed in different water temperatures concluded that there was a very minute (about 1.9%) difference between the fabrics that had been washed in 30˚ and 40˚ water. The study also tested for changes in textile quality, namely tensile strength, dimensional change, and color change after multiple washes in 30˚ C, 40˚C, and 60˚C water. Results were somewhat ambiguous, but results did show that the hottest washing temperature caused modifications to practically all the textile colors, including color bleeding. Tensile strength for acetate decreased slowest in the cold wash. [4] Statistics point to the fact that a decrease in average washing temperature would result in significant corresponding energy consumption reductions. A 2012 study by the Waste and Resources Action Programme speculated that a change in average washing temperature from 46˚C to 32.9˚C reduced the total carbon footprint by 2.7%. [5]

Laundry detergent, fabric softeners, bleaches, and other solvents of this ilk usually contain toxic substances that enable the scents, textures, and colors that consumers desire. Fortunately, alternatives have been developed that are biodegradable and/or organic, without sacrificing the efficiency. This includes an option for environmentally friendly cold water-efficient detergent, which allows for a quality wash in cold water where other detergents would not perform as well. [6]

Drying garments ends up being an incredibly energy-heavy process when machine dryers are used; 60% of the energy use of a garment in its use stage is attributed to tumble drying. This is more of a logistical problem that, if resolved, allows for the conservation of 0.9 terawatt hours, a considerable amount of energy. [7]

Studies show an increase in the frequency in which people do laundry nowadays, but they also point to the fact that the socially accepted perspective of what is considered clean and dirty has little to no scientific basis. The "Dirty Linen" study features a survey in which people were asked the primary reason for their decision to put a certain type of "linen" into the wash. For underwear, sports clothing, and day-to-day clothing, in decreasing order, people answered that the fact that it had been worn once was the deciding factor. For household items, they were more apt to say that it smelled bad or looked visibly dirty. However, for clothing, the consensus was overwhelmingly that whether or not there was perceptible grime, just the fact that it had been worn was enough, because people simply had the instinct to routinely wash clothes that were worn for no concrete reason. [8]

Consumers are informed on how to care for their clothing by the small fabric tags attached to the inside of garments, known as care labels. These labels indicate the best methods to clean, dry, treat, and press the specific garment that will best preserve the fabric and additional trimmings or hardware. There is a universally recognized set of symbols that denote certain conditions such as water or iron temperature, drying method, dry cleaning or bleaching method, etc. The right combination of these symbols on the label, with the creation of new symbols where needed, coupled with some supplementary instructions in words should ideally urge people onto the right track of sustainable consumer care. I am interested in taking it a step further by giving the care labels some personality. On perhaps the backside of the label with the technical care information, I'd like to input some prose that will speak to clothing consumers in a familiar tone and get them to realize that it is incredibly counterproductive to wash clothes that are not dirty, to own washing machines and dryers that are not energy efficient, and to constantly seek that artificial "clean laundry scent" as proof of cleanliness. There is literally not a whole lot of room for novelty on a little tag that is designed to be as unobstrusive as possible, but at the same time I believe there are certain messages that cannot be communicated as effectively through symbols.

Annotated Bibliography:

[1] Smith, G.g., and R.h. Barker. "Life Cycle Analysis of a Polyester Garment." *Resources, Conservation and Recycling* 14.3-4 (1995): 233-49.

This source is a study by the American Fiber Manufacturers Association of the life cycle inventory of a standard 100% polyester women's blouse. Beginning with the resin manufacturing process, the study encapsulates the fiber, fabric, dye, and apparel manufacturing processes, followed by the consumer use and disposal phases. The study then quantifies the energy use and emissions of each phase, ultimately revealing that the "use" phase of the life cycle has the greatest quantitative impact on the environment. Consequently, the study declares that changing consumer care habits would have the most significant effect in mitigating the environmental impact of clothing.

[2] Moon, Karen Ka-Leung, Chorong Youn, Jimmy M.t. Chang, and Alex Wai-Hon Yeung. "Product Design Scenarios for Energy Saving: A Case Study of Fashion Apparel." *International Journal of Production Economics* 146.2 (2013): 392-401. *ScienceDirect*. Web.

This study explores different possibilities for sustainable product design in fashion. It places emphasis on the energy saving aspect, asserting that the fashion industry's energy consumption is the worst culprit. Simultaneously, it is the area with the greatest possibility to improve on because reducing energy consumption will typically cut costs. Part of the methodology of this study promoted design of clothing using materials that require less care (quick dry, wrinkle free, etc.)

[3] Dombek-Keith, Kathleen, and Loker, Suzanne. 101-114 Sustainable Clothing Care by Design in *Shaping Sustainable Fashion: Changing the Way We Make and Use Clothes*. London: Earthscan, 2011. Print.

This chapter of the book, containing a myriad of different methods of fashion sustainability, is specifically about clothing care. It provides facts and figures describing the current practices in place for laundering and garments, and their impacts on the environment. Many alternative solutions are discussed, as well as their pros and cons. Furthermore, it offers viable suggestions on sustainable clothing design that enables low-impact clothing care without sacrificing aesthetic and affordability.

[4] Laitala, Kirsi, Casper Boks, and Ingun Grimstad Klepp. "Potential for Environmental Improvements in Laundering." *International Journal of Consumer Studies* 35.2 (2011): 254-64. *Wiley Online LIbrary*. Web.

This study features data from laboratory experiments that tested the difference in effectiveness of laundering clothes under different circumstances, in order to determine where change to more sustainable practices without sacrificing cleanliness and convenience was possible. The study concludes that due to the availability of higher efficiency consumer care

technologies, it is definitely possible to wash clothing in lower temperatures, use less detergent, and still achieve the same level of cleanliness. Furthermore, the garments wear and tear and propensity to shrink is generally reduced with these conditions, and line drying.

[5] Thomas, Bernie, Matt Fishwick, James Joyce, and Anton VanSanten. *A Carbon Footprint for UK Clothing and Opportunities for Savings*. Tech. WRAP, 2012. Web. <http://www.wrap.org.uk/sites/files/wrap/Appendix%20IV%20-%20Carbon%20footprint%20report.pdf>.

This report details the findings of an extensive experiment to quantify the carbon footprint of new and existing clothing of various fabric types in the UK. The section on the use phase in this specific study demonstrates that consumer care comes second to the fabric production phase in environmental impact, 26% as opposed to 33%. It also shows that cotton has by far the greatest washing and drying carbon footprint, considering it is the most consumed material. The report presents scenarios wherein less frequent washing, low wash temperatures, larger wash loads, and less dryer use are implemented, and concludes that a reduction of up to 6.5% of the carbon footprint would be possible.

[6] (Dombek-Keith, Loker, 2011)

[7] Fletcher, Kate. 91-109 *Sustainable Fashion and Textiles Design Journeys.* London: Routledge, 2014. Print.

This book, which also addresses the design of sustainable products and systems within the fashion industry, discusses the use phase in depth in this chapter. It summarizes past studies of LCAs for garments that reveal the comparatively large environmental impact of the use phase. It details the problems and sustainable solutions to the consumer care process, emphasizing that the problem at hand is as much a sociocultural one as it is an environmental one, and that an intersectionality of habitual changes is required to produce significant results.

[8] Yates, L., and Evans, D. (2016) Dirtying Linen: Re-evaluating the sustainability of domestic laundry. Env. Pol. Gov., 26: 101–115. doi: 10.1002/eet.1704.

This study analyzes laundry practices in the UK in depth, with attention to the reason behind consumers' behavior. It investigates the consumer's rationalization of "dirty" and "clean" and examines the differences and changes of clothing care habits from household to household. Ultimately the study emphasizes consumer care as a multifaceted problem, requiring a variety of solutions and efforts instead of just one to make a quantitative environmental change for the better.