Cognitive Consumers

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1.0

Background and Process

1.1 Introduction

The conception of Cognitive Consumers was born from contemplation of impact. One of my primary objectives was to have the potential to extend value outwardly from my project conducted with Honors. By narrowing the idea down to a platform that serves to cut through the weeds of salesmen, chaos and bias in media, the power behind the work could then be funneled into development.

Cognitive Consumers is a platform specifically designed to cover topics related to the fashion industry and spread information to contribute to a greater understanding of the industry's performance in sustainability, as well as potential directions forward. The intended audience is anybody that possesses interest in the subjects but likely, the articles will appeal to educated adults asking specific questions about fashion. Beyond this, I also believe that fashion has been weak as an industry in the context of sustainability. Many fashion products are produced, worn, washed and thrown away without due scrutiny on their impacts on the environment. A $2.5 trillion industry that employs 300 million people worldwide, with an annual use of more than 97 million tons of nonrenewable resources (Gazzola et al., 2020 & Maloney, 2019) deserves attention and objectivity. Websites like https://goodonyou.eco/ & https://www.thegoodtrade.com/ reflect an appetite and yearning for information of this nature. The versatility afforded by

an online-based project opens up further opportunity for value and impact in the future. With no limit to how many eyes may fall upon the site; the web was the clear route. This also meant that the work (largely in research, writing) was pandemic-proof. This proved to be crucial as many other projects may have necessitated changes with the arrival of COVID-19.

1.2 Sustainability Certifications and Self-Study

The preparations for this project began in the late spring of 2020. Through self-study and on-line coursework, I acquired two certifications that exposed me to sustainability in the business and professional world. The first credential that I completed was the Certificate in Sustainable Management offered by Duke University Continuing Studies (https://learnmore.duke.edu/certificates/sustainable-management). This certification consisted of 5 self-paced courses (~25 hours of online instruction) with assessments after each one with minimum required scores gauging comprehension. The subjects of the courses were:

- An Overview of Sustainable Management
- Corporate Social Responsibility
- Measuring Sustainable Management Performance
- Sustainable Management: Leadership Ethics
- Triple Bottom Line Accounting

These courses were designed for current business professionals and highlight best practices in sustainability and Corporate Social Responsibility. The topics, especially the section on triple bottom line accounting, gave me useful background to

comprehend the role of frameworks such as the Global Reporting Initiative (GRI) when I came across them in research. The real-world examples and professional anecdotes furthered my understanding of business ethics. Businesses have incentives in the form of economic performance (reduced costs, tax credits, savings on operations), appeal to potential customers, moral responsibility and greater profit margins to pursue sustainability. By way of this certification, I deepened my sustainability vocabulary and ability to analyze the fashion industry.

For a further piece of my background work, I obtained a Sustainability Associate certification from the International Society for Sustainability Professionals (formerly ISSP-SA; now ISSP-SEA). For six weeks, I studied the ISSP-SA's study guide (~35 hours) leading up to passing an exam designed for professionals in the field of sustainability. The material covered in the 300-page ISSP-SA study guide extended the topics covered throughout the Duke Modules in addition to new information. Background about events, trends and practices in environmental topics were included in the material. Organizational tools and frameworks for Triple Bottom Line (TBL) accounting and sustainability management added colors to my picture of corporate sustainability: how to measure, achieve and maintain performance. Vocabulary such as Benefit Corporation, Comprehensive Assessment System for Built Environment Efficiency (CASBEE), embodied energy, operational boundary and product environmental footprint (PEF) among many others added tools to my kit in understanding how businesses measure, track and adhere to various organizational and governmental regulations in pursuit of sustainability. This information was critical for understanding Life Cycle Assessments (LCA) of fashion products because I gained

further insight into the how and why behind the cradle-to-grave production analyses. The LCA technique involves compiling inventories of inputs and outputs, evaluating potential impacts, and interpretation of the flows of resources. The deep background and history of major environmental happenings and legislation served to strengthen my knowledge of the broader field of sustainability over the past decades, illuminating context for crafting articles for the platform.

ECON 287: Economics and the Environment furthered my foundation of literacy in economic dynamics related to the field of sustainability. This course provided insight into the dynamics of supply and demand in markets, the ways in which governments regulate businesses (ex. Cap and trade pollution permit systems), public vs. private goods, how emissions and effluents are measured and analyzed, along with techniques employed to measure passive-use values (ex. contingent valuation), to mention a few. Coupled with the certifications, I am constantly working to strengthen my understanding of the business, professional and economic side of sustainability.

1.3 Analysis of the Fashion Industry

During the fall semester of 2020, I completed an independent study and produced a 20-page paper compiling my research investigating the link between the fashion industry and the environment. This research allowed me to build my comfort and library of exposure to the industry. I traveled through typical stages of fashion products all the way from natural resource extraction to disposal and recycling. At all stages of the supply chain, I spent hours reading through scholarly sources and books to familiarize myself with the jargon, dynamics, and flows of the industry's materials,

methods, labor, markets, techniques, etc. I was exposed to every stage of a product's journey along the fashion supply chain, similar to the stages emphasized in the Life Cycle Assessment (LCA) technique. Highlights of my research included: industry challenges and shortcomings in reporting metrics, its massive footprint, wide use of petrochemicals in manufacturing & processing, geographic location in areas of loose regulation, and massive proportions of wasted resources.

1.4 Drafting and Synthesis

Armed with tools from the accreditations, I spent the fall semester drafting, researching subjects and compiling topics for the Cognitive Consumers website. Coupled with active field research of platforms or brands already engaged with this sort of work, I systematically began drafting articles for Cognitive Consumers. Simultaneous to this work as well as during the summer, I prepared and brainstormed lists of topics informed by my research that I felt valuable to focus on.

I let my own curiosities and knowledge gaps guide much of the direction of the pieces. I asked myself questions like: How does a typical supply chain work? What are major materials used in fashion and how big are markets? Where and how does production and consumption of fashion happen? What resources are used? Where is the industry in terms of sustainability action and initiatives?

1.5 Communication and Website

Once a topic had been brainstormed and felt valuable to address, I began drafting. Drafting occurred simultaneous to research and reading into the subject

concerned. If a post took one hour to write, I likely spent 5/6 hours on research. The short format of the article posts forced me to be concise, objective and sharp with my ideas and writing. This aspect of the challenge sharpened my writing and ability to convey ideas. I constantly thought about audience: Was I being clear enough? Did the words work with me or against the ideas I sought to convey? Was the writing accessible to a wide range of levels? Was the topic intriguing and did it capture interest? I also reached out to contacts like Mimi Miller, a fashion designer and business owner in the industry that could give me insight from different perspectives.

Once a first draft was written, I sat with the content. I would re-read and edit articles multiple times, revising and refining all the way. The editing phase of this writing process was dense but benefitted from meticulous planning—so it was executed efficiently in practice. After the articles had been drafted, a focus group involving first-year undergraduate students produced feedback that will be employed to strengthen both my communication and the effectiveness of the platform.

Following the research and writing came website development. This stage of the process presented a steep learning curve but honed skills I did not know I had. The abstract approach of how to display information in a stimulating, effective manner on a patch of imaginary real-estate required work and attention. The platform is not where I envisioned it to be, but the excitement of further evolution is encouraging, and I love the challenge.

2.0

Investigating the Link Between the Fashion Industry and the Environment[1]

Author: Benjamin Nelson

Introduction

Humans express themselves in many ways—through language, writing, music, art. One of the most visible of these expressions is through fashion. Whether it be cultural attire, dressing for the weather, team uniforms or a favorite brand; we all wear clothes. Fashion has aided historians and archeologists in identifying cultural trends, evolution and deeper understanding of synchronic context. Clothes worn by warriors both ancient and modern carry symbolism deeper than physical threads. Tradition sees judges adorn themselves in black robes in some western civilizations, fashionably symbolizing a position of authority. The colors (or lack thereof) of uniforms helped colonists and the British discern each other on a chaotic battlefront of independence. Fashion has protected, guided, connected, cooled us down when the desert sun proved

[1] **Fall 2020 Sociology Independent Study Research – Dr. Sarabia**

too brutal, warmed us as the winter frosted over, signaled status and even driven trade routes and conquest. Humans have long been impacted by fashion however, in the modern era that impact has transcended unsustainably into our environment.

The impact of humans on the natural environment all over the world has been well documented, researched and studied for decades now. This macro impact of climate change is not the subject of this research, but it is important for context. Since as early as 1958, humans have been measuring the amount of carbon dioxide in the atmosphere at Mauna Loa Observatory in Hawaii and have been tracking increasing CO_2 over 60 decades (“Global...”, 2020). When tasked with the question, many scientists and intellects of today argue the angle of air pollution as well as toxins (such as POPs) found as far away as the Arctic point towards the fact that there may be nowhere left on the planet left undisturbed (“Arctic…”). Further contributing to these trends of environmental degradation is a dark horse; the fashion industry.

Fashion is defined as “a popular or latest style of clothing, hair, decoration, or behavior” by the Oxford Dictionary (Anon, 2020). For these research purposes, this definition of fashion is used. When concerning sustainability, the Brundtland Report definition is used. "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). The purpose of this paper is to contribute to the discussion and organize evidence of the fashion industry’s relationship to the environment and sustainability. Before delving into the specific major stages clothing goes through, some background may be valuable to ponder.

Fashion is iconic. The threads humans don tell stories beyond practical purpose. Different materials, colors, patterns; all reveal deeper expressions of self. From a symbolic interactionist perspective, fashion can be a massive iconic representation of oneself, heritage, or even country. What humans wear can drive behavior and dictate subconscious judgements, both of which are forms of communicative information from one to another. Previous research has found evidence of one consciously using professional attire to evoke more status and respect while business casual clothing used for developing connections (Karl et al., 2013). The effects of fashion and its implications seem to transcend into other spheres of influence and interfacing with the world as well as others. Furthermore, a study analyzed in the same paper looked at flight attendant's subjective perception and found an association with perceived performance and the presence of professional attire (Karl et al. 2013).

In the realm of social interaction, clothes can influence how we think and act. Research has been done to attempt to document the extent to which nuances in fashion impact subjective measures as well as psychological cues (Johnson et al., 2014). Reflecting on the crucial role that fashion may occupy in the social and psychological sphere can serve to place the industry in context. How humans dress is critical to much of everyday life. "… in my workplace I make progress only when I am dressed in the code of my profession—that means wearing a tie" (Niinimäki, 2010). This quote perfectly captures the utility side of fashion in human culture.

The necessity of clothing is an enduring market. Trends in the global $2.5 trillion industry (Maloney, 2019) over the past decades give analysts insight into the direction of fashion. The industry has a wide reach over many different countries through

complex supply chains. The large reach and swath of resources dedicated to the industry employs 300 million people (Gazzola et al., 2020). Nearly 4% of the world's population works in businesses or jobs that contribute to global fashion.

All of this production, extraction, distribution, transportation, etc., of fashion commodities sees the industry accumulate a massive footprint. 98 million tons of non-renewable resources including oil, pesticides, fertilizers and chemicals used for treatment and dying are used annually by the fashion industry (Gazzola et al., 2020). Much of these compounds are used in the growing of cotton, production of synthetic fibers (petrol-based), or treatment of clothes. 20% of wastewater worldwide can be traced back directly to fabric dying and treatment ("How…", 2019). Underlying all of these facts is the amount of carbon pumped into the environment as a product of processes. The fashion industry accounts for more carbon emissions than maritime shipping and international flights combined, making up 10% of global greenhouse gas emissions ("How…", 2019).

Out of all of these statistics, one stands out in terms of environmental pollution; microplastics. Half a million tons of microplastics every year are dumped into the oceans (Gazzola et al., 2020). These plastics *cannot* be extracted from the environment and consequently, spread through food chains ("How…", 2019). These side effects have muddied the record of the fashion industry's relationship to the environment. The bulk of the remainder of this work will focus on the various stages of the fashion industry operating model. Each juncture will be visited; raw material extraction, material processing, product manufacture, distribution, use, and finally, disposal and recycling.

Raw Material Extraction

Nothing comes from nowhere. Through millions of years, Earth has assembled some amazing complex systems, exchanges of energy and transformation of matter. The industry of fashion must start at these launch points. Just as food must be produced to stock shelves in supermarkets, the threads fed into looms and stitched into shirts, pants, jackets, socks and the like must come from somewhere. The raw materials extracted come from two major sources: natural fiber and man-made fiber (Muthu, 2014). In respect to assessing environmental impacts the amount of land, amount of pesticides/fertilizers used, amount of energy needed and from what source, as well as amounts of water and its source are among some of the most important considerations (Muthu, 2014).

Land is a precious resource on a planet with an expanding population. The growing demands of future generations and the rising consumption of populations has the potential to strain ecosystems even further. This idea is crucial especially when circumvented with the projection that 20% of the planet's surface is declining in productivity (Oliveira Duarte, 2019). Global apparel consumption is projected to rise from 62 million tons to 102 million tons by the year 2030, a 63% increase ("Fixing…", 2019). The demand for textile raw materials has driven large swaths of the Southern United States' farmland to be farmed for cotton. The United States is a huge portion of

global cotton production and has been for centuries, with the evolution of technology from the cotton gin to the combine playing a role in increasing yields per acre as well as efficiencies (Daystar et al., 2016). This fact sees over 8,000,000 acres of farmland dedicated to cotton in the U.S. alone (Daystar et al., 2016). According to a study conducted by the Environmental Justice Foundation (EJF), cotton growing occupies 2.5% of the world's cultivated land (Muthu, 2014). Furthermore, the agriculture foundation of raw materials for the fashion industry affects a wide range of ecological variables. Biological diversity, human health, food security, water quality, greenhouse gas emissions, soil erosion, pollination cycles, carbon sequestration and communities of all kinds are affected by how we use the land (Oliveira Duarte, 2019). These facts transition smoothly into employed methods to maintain all of this land for raw materials.

Crop yields across the world have science and technology to thank for increased efficiencies and returns. However, the use of fertilizers and pesticides is key to analyzing this equation within the context of the environment. Returning to cotton as an example; "Expansion of conventional cotton farming, for instance, is considered as one of the most polluting forms of agriculture, driving major land use change and loss of biodiversity" (Oliveira Duarte, 2019). Statements such as these are supported by research and studies conducted around the world. A startling 16% of the world's insecticides (substances used for killing insects) are used to help cotton grow (Muthu, 2014). The picture becomes much more ominous when the toxicology of these chemicals are delved into. 7 of the 15 most commonly employed pesticides in growing conventional cotton (acephate, dichloropropene, fluometuron, diuron, trifluralin, pendimethalin and tribufos) are classified by the Environmental Protection Agency

(EPA) as ‘likely’, ‘probable’ or ‘known’ human carcinogens (Muthu, 2014). These facts harp to a disconnect in methods and results; especially externalities. The massive use of nitrogen-based synthetic fertilizers is also an area of concern. The USDA report stated that 78% of cotton farms used nitrogen fertilizers (“USDA…”, 2020). The potential for adverse environmental ramifications should be considered given that N_2O emissions are 300 times more potent than carbon dioxide in respect to greenhouse gases (Muthu, 2014). These stark statistics paint a picture of embedded impacts on local, regional, and global environments in relation to the utilization of compounds and chemicals to produce textiles.

The next piece of the nexus in question is energy. Energy is necessary for numerous operations in the raw material extraction phase. While the latter phases of the fashion industry operating model contain most of the energy-intensive processes, the raw material extraction phase is valuable to visit. This is supported by the vast amounts of energy the textile industry uses in its production hotspots. For example, about 4% of total energy is used for the textile industry in China (Hasanbeigi & Price, 2012). The energy required for raw material extraction is difficult to measure because of the large-scale of the industry’s operations as well as the nature of agriculture for sourcing natural fibers. However, with respect to man-made fibers, the raw material phase is easier to track. Polyester requires 125 MJ per kg of fiber versus 55 MJ/kg for conventional cotton and 14 MJ/kg for US organic cotton (Nrdc.org, 2011; Muthu, 2014). Polyesters’ sourcing from petroleum means that it can be produced without the intense land necessities. This, however, does not make up for its energy intensive demands in terms of

sustainability as well as the intrinsic nonrenewable nature that the source materials are derived from.

Additionally, the demands placed on global water supplies is of utmost concern in analyzing the impact of the fashion industry on the environment during this stage. Although it only makes up 33% of fibers found in textiles, cotton is the most common natural fiber (Drew & Yehounme, 2017). The cotton crop is extremely water intensive and demands much from the environment. This is reflected in the 2,700 liters required to make one cotton shirt, enough for one human to drink for 2½ years (Drew & Yehounme, 2017). This case is most famously made by the disappearance of the Aral Sea from excessive water use for growing cotton through water drawn from the Amu Darya and Syr Darya rivers (Drew & Yehounme, 2017). With an estimated one-third of the global population living in moderate to severe water stress in 1997 and increasing trends of water use as well as scarcity (Wada et al., 2011), the textile industry is a hotspot for sustainability reform. The growing demand on water sources impacts the environment at all levels. These trends could explain the growing proportion of man-made fiber prevalence given natural fibers' intense demands on land, chemicals, and arguably most paramount—water.

The physical space that the fashion industry's operations take up, the compounds and chemicals used to aid in growing natural fibers, the necessary energy, and the use of water are all crucial facets in the context of the industry's larger footprint. These systems and interrelated variables of the raw material extraction phase begin to sketch the foundations of a dark horse of pollution, resource use and general impact on

the environment we all depend upon. Following raw material extraction is the material processing stage.

Material Processing

Material processing includes the spinning, weaving, processing, and other techniques that turn raw materials into fibers and fabric for use in product manufacture. Over the decades, the industry has improved techniques and production processes to increase the value of the final product. This manufacturing includes chemical finishing, dyeing, pre-treatment processes, coating, printing and drying that can release carcinogens, toxic emissions, chemical waste and harmful vapors into the environment (Uddin, 2019). For material processing, the impacts can be broken down into natural and manmade fibers.

Natural fibers are fibers derived from plant and animal sources (Muthu, 2014). Common examples of natural fibers are bamboo, cotton, wool, rayon, hemp, jute, silk, mohair, cashmere, alpaca and sisal (Muthu, 2014). Natural fibers are often heralded for their sustainability performance for a number of reasons. Their biodegradability (due to being made of cellulose/other natural material), non-abrasiveness, renewability, and eco-friendly properties mean that natural fibers are commonly considered more environmentally friendly than their synthetic counterparts (Muthu, 2014). However, fibers such as cotton still require material processing in the form of blending, mixing, cleaning, drawing, roving, carding and spinning (Uddin, 2019). Beyond the carbon sequestration that occurs while the plant is growing or the animals' natural impact in the

ecological sphere, natural fiber production generally consumes less energy and resources than synthetic fibers (Muthu, 2014).

As for semisynthetic and synthetic fibers, the material processing stage is much more involved. Synthetic and semisynthetic fiber material processing is diversified through the use of chemical agent, monomer, catalyst, precursor and auxiliary chemicals yielding the yarn or fiber product (Uddin, 2019). As indicative of the classification, man-made fibers are typically derived from nonrenewable sources such as petroleum and carry significantly more emissions with them from the processing phase (Muthu, 2014). Impacts become more apparent as focus is placed on specific materials. Polyester for example, emits acetaldehyde and dioxins (volatile organic compounds) which can damage human health and ozone, employs the use of carcinogens as catalysts such as antimony and discharges volatile monomers as wastewater byproducts (Muthu, 2014).

Viscose-rayon is a further semisynthetic fiber. Due to being derived from cellulose (found in plant cell walls), viscose's sustainability is a complex subject (Muthu, 2014). The greatest concerns amongst viscose-rayon production are the compounds and chemicals used in processing the material. Viscose processing employs carbon disulphide as a solvent and 50% of unused CS_2 is released into the atmosphere, endangering humans and environments that come in contact with the toxic molecule (Muthu, 2014). Given the processing-heavy pipeline that viscose requires, the fiber is also energy intensive. Compared to the 14 MJ/kg for organic cotton, viscose-rayon demands as much as 100 MJ/kg (Nrdc.org, 2011; Muthu, 2014).

The material processing of fibers for textile and fashion products requires a plethora of water, land and frequently further compounds to reap desired textures, properties and qualities. These demands are not isolated from the global system and effect ecological spheres all over the world. Following a thread's journey further is the phase of product manufacturing.

Product Manufacturing

Between the material processing and product manufacture stage, yarns made from raw materials are weaved and knitted into finished textiles (Niinimäki et al., 2020). These textiles are then transported to garment manufacturers for further processing into products (Niinimäki et al., 2020). The product manufacturing stage impacts the environment on many degrees, but the most blatant impact hits close to home; impacts on people. For this research's purpose, the primary focus of this section will be the environmental impact of product manufacturing on humans.

The fashion industry has gained global notoriety for its treatment of humans across the communities of the Earth. The quick turnaround approach behind 'fast fashion' has rewarded companies that source their materials and products through the most cost-efficient, quickest means possible. This fact drives business in the fashion industry to source labor for the work-intensive phase of product manufacture from the cheapest possible source (Niinimäki et al., 2020). This can be captured through

research aimed at observing trends in fashion consumption. Despite increases in number of clothing items owned, the average expenses on fashion has decreased from ~30% in the 1950s to about 5% in 2020 (Niinimäki et al., 2020). These low prices driven by a combination of consumer demand and quick turnaround operating models have paved the way for the market to exploit those that find themselves in loose regulating, developing economies.

One of the most tragic, concrete examples of the fashion industry's crimes against the environment is the Rana Plaza disaster in Dhaka, Bangladesh. Operating within the supply chain of dozens of fashion brands, the factory at Rana Plaza produced cost efficient materials and garments at budget labor prices (Chowdhury, 2017). The factory and its heavy machinery were located on the upper floors of the building while shops and other businesses occupied the lower stories—the day before the disaster, cracks were noticed in the structure driving the lower businesses to discontinue operations (Chowdhury, 2017). The following day, workers in the garment factory upstairs were forced under threat of a month's pay being withheld to return to work (Chowdhury, 2017). At 8:57am BST, the building collapsed with 3,122 workers inside the structure; the search ended with a death toll of 1,134 (Chowdhury, 2017). Over half of the victims were women, along with many of their children whom were held in the nursery on site (Chowdhury, 2017).

The Rana Plaza disaster tragically exposed (further) many of the shortcomings that are side-effects of the global fashion industry. As the worst structural disaster in modern-human history, the event can be used as a microcosm perspective on the labor, human rights, and ethical concerns surrounding fashion (Chowdhury, 2017). Garment

factories and labor conditions such as those found in Dhaka paint a piece of the picture on how people have been increasing their wardrobe sizes while spending less of their income. Social irresponsibility as well as accountability in labor have catalyzed intense backlash and criticism of the fashion industry in recent decades (A. van Ree, 2016).

On the one hand, globalization has spurred incredible innovation, increased wealth and lowered prices—on the other, developed countries have taken advantage of no/weak regulations and fellow humans in the outsourcing of cheap labor. This can be reflected in the fact that greater than 60% of the world's clothing is manufactured in developing countries like Vietnam, Bangladesh, Pakistan, the Philippines, etc. (A. van Ree, 2016). The lack of human rights legislature and regulations often found in these geographical areas allow supply chains to exploit cheap labor in work-intensive stages of production. Furthermore, this market structure perpetuates inequality. In developing countries, women makeup 85% of garment workers according to the Clean Clothes Campaign (A. van Ree, 2016).

These facts beg the question, for an industry as large as fashion, how do labor conditions such as those mentioned above exist? The fashion industry is reported to be the third largest manufacturing industry, only following automotive and technology industries ("Fixing…", 2019). The fact could be supported by the inequality of consumption. Through the regulatory loopholes discussed above, high-income countries feed a growing demand for cheaper, plentiful and trendy fashion products. 81% of global products were consumed by 20% of the world's population (A. van Ree, 2016).

Perhaps the most personal aspect of the environmental impact of the fashion industry is its effect on our brothers and sisters across the globe. Cascading impacts

upon human communities catalyzes impacts to the broader ecosystem. As long as loopholes exist in the global supply chain, sustainability goals are far out of reach. Human rights violations are unsustainable.

Distribution

Following a product's manufacturing stage comes the distribution of goods to potential markets. Within fast fashion, quick response times and the ability to respond promptly to consumer trends has been a crucial facet of success. To accomplish this, fashion companies employ vast distribution networks. These are the same connections that see a shirt made in Bangladesh hit the storefront in the United States with incredible pace.

This drives the fact that the global dimensions of the fashion industry include carbon-emitting transportation that seek to transport goods from product manufacturing to demanding markets (Shen, 2014). It seems cognitive that, the further distance a product has to travel along its supply chain, the greater potential impact the product may impose upon the environment both locally and globally. According to internal sustainability reports, an estimated more than half of H&M's carbon emissions are a product of transportation from factories to stores (Shen, 2014).

H&M is a great example of the slow pendulum swinging towards sustainability in the fashion industry. Within their supply chain, the company has employed cleaner transportation methods (such as trains and boats) for over 80% of their products paired

with an energy and resource management software for use in data collection and analyses (Shen, 2014). Based upon the vast size and reach of the industry, H&M's actions highlight a cognitive approach towards more trackability and transparency within their entire supply chain but especially distribution. However, in the case that a company ships product via air to save time (often seen in fast fashion), carbon emissions can be increased 35% (Niinimäki, 2010). Part of the equation as to why the fashion industry has silently accumulated such broad environmental impacts could be found in the massive scale of the industry supply chain. Tracking impacts at every level can be a daunting (and expensive) task for a company, so a large company such as H&M's movement towards these goals is a step in the sustainable direction.

Use

Once a t-shirt makes it into a market and then into the hands of a consumer; the use phase begins. At this point, the product is out of the hands and responsibility of the company. The consumer then has autonomy over what to do with the fashion product. This could include using and washing hundreds of times or simply tossing the product out after one use. Due to the vast variability within the use phase of fashion products, these impacts have been expanded upon in a less substantial manner in the literature. Also, many impact assessments may omit in part or entirety the use phase of the product in question. Water, energy and leeching toxins are all relevant to the discussion

of the use phase's impact on the environment; but one topic is important enough to emphasize in this section.

Extensive work in recent years has shown; one of the primary concerns surrounding environmental impacts associated with the use phase of textiles is that of microplastics. Microplastics are bits of plastic that have broken down to 5 millimeters or less in size (Maes et al., 2017). When plastic pollution enters the ecosystem, weathering, impacts, frictions and other processes break down the material into smaller pieces. Microplastics threaten the most fragile of ecosystems and carries impacts across wide varieties of habitats.

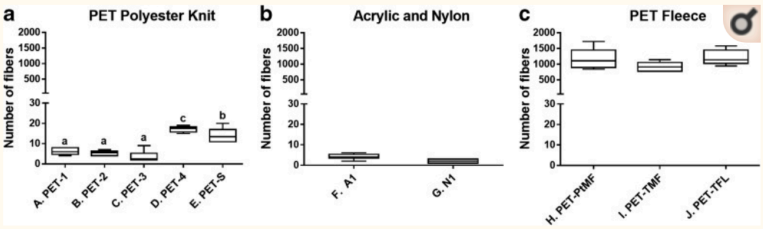

Fig. 1

Total number of fibers released from 100 cm^2 of fabric per wash. Results are presented in box plots showing median, 25th, and 75th percentiles, max and min. Different types of fabrics are divided into separate figures; note that *y*-axis scale is identical in all figures, to emphasize differences. **a** Five polyester (PET) fabrics of differing structure. **b** Acrylic (A1) and nylon (N1). **c** Three different polyester (PET) fleece (FL) or microfleece (MF) fabrics, commercially produced by Polar Tech (Pt) or Tenson (T). Statistically significant differences are indicated by letters ($p < 0.05$). See Table 1 for more detailed descriptions of fabrics. $n = 6$

(Almroth et al., 2018)

Where does the fashion industry fit in? The laundering of synthetic textiles and synthetic textile blends are a large source of microplastic pollution into the environment (Laitala et al., 2018). Over the course of a garment's life, potentially hundreds of washes shake loose these materials—microplastics that are now ubiquitous in terrestrial and aquatic environments across the globe (Laitala et al., 2018). Recent research has sought to quantify the shedding of these microplastics from textiles. Fig. 1 from one of the aforementioned studies includes a visual on the amount of fibers released by a variety of synthetic textile materials (Almroth et al., 2018). While the quantitative breakdown of the amount of fibers shed per wash can look few, it is the accumulation of

shedding of multiple pieces over long periods of time from millions of homes that is responsible for global microplastic pollution.

Environmental impacts associated with microplastic have sparked a surge in attention and research into the subject. Microplastics are found in soil, water columns, and even the deep ocean; furthermore, indigestion of the material can interrupt all parts of the trophic level and harm humans further down the food chain (Maes et al., 2017). Plastics also have the potential to accumulate persistent organic pollutants (POPs) as well as leech toxins into the environment; some which have been demonstrated to catalyze endocrine disruption and carcinogenic impacts (Maes et al., 2017).

Laundering technology and the comforts of developed life have provided immense conveniences to many. Microplastics are a silent side effect that the global fashion industry has accepted in exchange for cheap, versatile and cost-efficient synthetic materials.

Disposal

A garment's journey ends with disposal. This can be done through a number of different avenues. Our clothes may be tossed into landfills, recycled into new products, repurposed, handed down, given away, and increasingly popular; second-hand marketed through thrift or consignment stores—a market that is expected to balloon from $28B to $64B by 2024 ("2020 Fashion…", 2020). The reality of it is; the vast majority of fashion products are thrown away. Data from 2017 indicated that over 66% of textiles produced were landfilled in the United States, with just 15% recycled ("Advancing…", 2019). The statistics for other global communities are telling.

In Europe, the rates are similar to those in the U.S.; 15-20% of textiles are reused (50% downcycled 50% recycled) while the rest are incinerated or find their resting place in landfills (Gustav & Peters, 2018). It is worth noting this data about Europe is over a decade old. Further East, the landscape of material efficiency is far less. In China, the world's leading producer *and* consumer of textiles, the reuse and recycling rates are <1% ("Chinese Textile…", 2019).

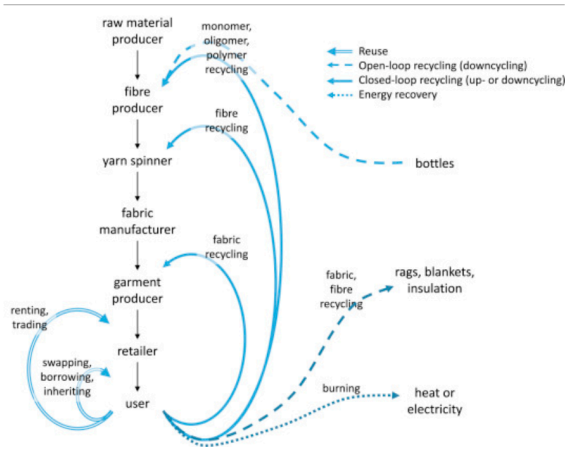

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Fig. 1. A classification of textile reuse and recycling routes.

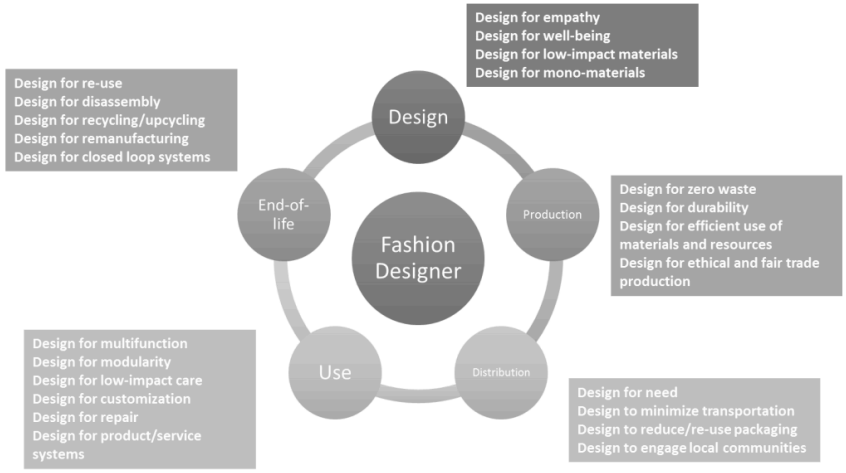
(Sandin & Peters, 2018)

However, the pendulum can be seen slowly swinging towards more circular, sustainable disposal practices. Fig. 1 from Sandin and Peters (2018) provides a visual of the potential routes for textile recycling at various points in the existing supply chain. Many countries have begun to employ systems that encourage more reuse and recycling. Take Germany for example, the recycling rate is a staggering 70% (Gustav & Peters, 2018). This case could be a piece of the argument for policy, community intervention, and education impacts in the pursuit of sustainability. The successes and failures of global consumers disposal of fashion products can teach valuable lessons.

Conclusion and Future Directions

The fashion industry has much ground to recover in the effort to become a sustainable industry. However, widespread growing environmental awareness and education could be contributing to increasing emphasis on transparent supply chains, sustainably sourced materials, and ethical labor. Zara-Inditex, the largest fashion company on the globe, has committed to using 100% sustainable materials for their products by 2025 (“More…”, 2016). This example from Zara and the H&M trends mentioned in the distribution phase section of this work highlight a market shift towards more sustainable action, initiatives and messaging.

In seeking new ways to operate and run the global fashion model, two other approaches are worth mentioning. The first noteworthy development is the concept of dematerialization. This idea aims to deliver the same functionality to the user through the use of less, or no, physical material (Whitson-Smith, 2016). The figure from Whitson-Smith (2016) depicts potential points of strategy from the perspective of fashion design.



Dematerialization strategies from Whitson-Smith, 2016.

The second concept worth mentioning in relation to future directions of the industry is the topic of digitization. This idea encompasses the digital transformation of fashion design and production (Roberts-Islam, 2020). This could take many different

forms in the context of the fashion industry; digital innovation behind design could see more connectivity between consumer and designer as well as interdepartmentally, digitization of the consumption end could see things like on demand personalized production and exact- number orders, as well as within the interface to vetting styles; digital platforms can plug augmented visual reality to move away from the necessity of a physical stock (Roberts-Islam, 2020). Furthermore, 3D design and data analytics may be implemented already in the complex supply chains of fashion companies. These tools drive the market towards more practical, data-based, pragmatic solutions in the face of the challenges towards a sustainable future.

Throughout the fashion supply chain from the extraction of raw materials to the grave of disposal, immense impacts follow. The segmented and wide reach of the industry drives a piece of the challenging puzzle behind sustainable fashion, but I also see this as its strength. This massive global conglomeration of producers, manufacturers, consumers, distribution networks and retailers have the potential to weaponize connectivity and supply communication, as well as optimize its deliverance of value to consumers. Big data and modern tools allow us to view large problems through thousands of lenses and possibilities; analyzing inputs, outputs, risk and benefits.

The same innovation that drove the fashion industry to its status as a global titan is the innovation that will solve its biggest challenges. As the approaching generations hold their breath, it falls into the hands of governments, producers and consumers alike to drive the zeitgeist in a manner that leaves this planet in a better place than we found it.

3.0

Communicating Environmental Subjects

The values we hold matter. These values inform decisions and are central determinants of environmental risk perceptions (Corner et al., 2014). A limitation of this work and many others that discuss environmental issues is the attached rhetoric and stigma surrounding the subject. With only 18% of the public regularly reading science news (*Communicating Science Effectively,* 2017), communicating the topics surrounding the link between fashion and sustainability is a delicate matter. This means much of the potential audience may not have foundational understanding of concepts discussed—a driving factor behind the emphasis on objectivity throughout Cognitive Consumers. The literature on communicating science supports this approach as people dislike uncertainty and ambiguity (*Communicating Science Effectively,* 2017). People are complex. Many factors such as context, socioeconomic capabilities, social influences, cost-benefit analysis, goals, and value-systems play a role in decision-making and interfacing with information related to the environment (Steg & Vlek, 2009).

Background, research and writing are essential steps of this project. Equally important is the ability for the work to communicate the subjects effectively. If an audience cannot absorb the information, hours of research and legwork are futile. When attempting to communicate about environmental topics such as climate change or chemical pollution released by a fabric processing plant, values play a major role.

Moreover, the concept of a ‘frame’ is crucial to reaching audiences. The way information is packaged or framed impacts its delivery. To this end, the writing on Cognitive Consumers is framed to elicit hope and optimism, while other articles take more serious, matter-of-fact tones. This variation of styles increases the potential bandwidth of interaction from audiences of different backgrounds (Corner et al., 2018). However, most non-science audiences make sense of the world through stories (Corner et al., 2018), so this can be seen as a limitation of the platform in its mission to inform a wide spectrum of audiences. A further dimension of communication is the two-way street that exists. Information can be transmitted, broadcast or published and go unnoticed if there is a vacuum of interest.

This facet of the challenge—communicating science and environmental ideas—serves as one of the biggest obstacles for bottom-up change. This is illustrated in studies that observes that self-transcendent values are often linked to greater acceptance of climate-mitigation policy change (Corner et al., 2014). The role that individual perception plays muddy the waters of communicating environmental science and sustainability. Coming full circle, the complexity of this communication explains my motivation for undergoing this project. Education is a building block of better futures. Thus, responsibility and awareness about the consequences of actions is a crucial desired outcome of environmental communication (Liobikienė & Juknys, 2016).

I chose the topics of the articles based off of my own questions, gaps in knowledge of the industry and flows of material throughout the water-energy-land nexus. I delved into several widely-used fiber materials, broad impacts of the industry on resources and labor, shares of the market, performance in sustainability,

perspectives from sustainable designers with boots on the ground, impacts of COVID-19 on the industry, and directions forward for the future of the industry—all examined through a lens of sustainability. The goal behind this was for the audience to be able to takeaway knowledge about the industry and products that they could be wearing every day, so as to be able to make more cognitive decisions when facing future consumption choices. While engaging with this material, I simultaneously improved my own knowledge as a consumer in the market, my ability to critically assess sustainability in the context of business operations, as well as my ability to synthesize subjects into engaging, objective communication.

Finally, in order to assess the effectiveness of my own communication, I sought out feedback. Upon a visit to an interdisciplinary class of first year undergraduate students, eight articles were read and analyzed over breakout rooms via Zoom. Students responded to questions related to delivery, content and interest through an anonymous file share. The raw feedback and unaltered responses from the small mock focus group may be found in the appendix. Themes that emerged from this feedback included questions about the short format, inquiries that sought deeper information and recommendations for website layout. Positive responses from the focus group emphasized the science and data included, sources cited, concise information, novel information and objective tone. These brief comments and takeaways fall in line with my own predictions about the perceived strengths and weaknesses of Cognitive Consumers and shed light on important considerations. My next steps would be to tighten up the interface and web layout of the site, making sure that my communication of topics was done as effectively as possible.

Conclusion

This project allowed me to integrate skills learned throughout my education at Roanoke in order to conceptualize, plan, and execute the multifaceted work. Research, reading, exploring others' perspectives, talking to insiders in the industry, and drafting short yet purposeful articles required utmost focus. Due to the nature of my motivations behind selecting the fashion industry, I was coming at the literature and subjects with fresh eyes.

Through finding my voice and publishing content on the internet, I grew my assertion and strength in my writing. I reviewed over and over again to make sure I was comfortable with the message and information on the website and made my peace with disagreements in execution. Writing in this short and objective style improved not only my penmanship, but my skills as a communicator of information overall. The execution of this project and pitfalls, adaptations, obstacles, and opportunities taught me resilience in the face of goals.

Moving forward, I aim to continue to build and improve the site. I still approach Cognitive Consumers with passion and wish to extend value beyond the scope of Roanoke College. Being my own web developer was made easier by way of online templates and programs, but still presented a learning curve. The technical website side of Cognitive Consumers will be the greatest challenge as I continue the site in the future. In summation, the lessons learned through conducting this work have improved me as a student, writer, and human.

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Appendix A

- **Culmination of work in a deliverable website:** CognitiveConsumers.com

Appendix B

A. Small Focus Group Feedback: Tuesday, April 27th 2021 @ 3:00pm

Breakout room #1: Digitization in the Fashion Industry

- What level of interest do you have in this information?
  - I am fairly interested in sustainable fashion, but had not considered digitization.
- What would draw you to a site like this?
  - A site like this would draw in interest because a consumer would want to make a conscious choice to support a company that has a common goal of sustainable economic development. Additionally, by adhering to the goals of sustainability, a company can find innovative and beneficial ways to manufacture and produce the goods.
- Did you feel like you gained anything from reading the article?
  - The explanation of what digitization is and how it could be applied was clear and concise, allowing the reader to easily grasp the concept.
- What features or types of information would you find useful?
  - Information such as carbon emissions or modes of transport (with the emissions calculated) would be important in the eyes of a consumer.
- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
  - When looking for information about consumer products, it is important to see how it is produced and the effects of such items. But, on many websites, it is difficult to find this information as it is embedded within the hidden areas in the consumer region. Therefore, a lot of times, this topic is disregarded.
- Other comments?
  -

Breakout room #2: Secondhand Shopping and the Resale Market in Fashion

- What level of interest do you have in this information?

    - Medium, definitely heard about before
- What would draw you to a site like this?
    - It would likely be a lot cheaper than buying new clothes.
- Did you feel like you gained anything from reading the article?
    - Yes, insight into thrift shopping, more into the statistics (it goes further than just hearing rumors about how secondhand is better)
- What features or types of information would you find useful?
    - Numbers to back up the claims, the more specific and data driven it can be the better.
- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
    - The specific data and numbers aren't widespread on the benefits of second hand shopping. The ideas around the benefits are very popular right now but the specific data is not as commonplace.
- Other comments?
    - Right now it's really strong! Any more sources would make it even stronger. I know Remake the World has a clothing campaign surrounding sustainable clothing. You could also discuss some thrift/ second hand shopping etiquette in terms of if you don't need to buy winter coats second hand, don't so that those who really need them have access, that sort of thing. But what you have is strong.

Breakout room #3: Recycling Challenges in Fashion: A Piece of the Circular Economy Puzzle

- What level of interest do you have in this information?
    - We are fairly interested in the topic, especially learning new ways goods can be produced.
- What would draw you to a site like this?
    - If we are looking for more information about sustainable clothing processes/sustainable production.
- Did you feel like you gained anything from reading the article?
    - We learned the basic overviews of the potential of recycling clothing and the potential of saving energy.
- What features or types of information would you find useful?
    - Some real life examples of this process or research projects would be nice.
- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
    - I do not commonly look for information about consumer products.
- Other comments?
    - For the website structure, maybe you can make tabs by category and have a drop down box so it's a little more convenient to navigate

Breakout room #4: Global Manmade Cellulosic Fiber Production

- What level of interest do you have in this information?
    - I think that it's nice to know that there are alternatives, or even straight up better options to what we are currently using, and that those might be on the rise.
- What would draw you to a site like this?
    - What would draw me to a site like this is perhaps if I was trying to buy clothes that were environmentally and economically sustainable.
- Did you feel like you gained anything from reading the article?
    - I gained some information on where the clothing industry might be shifting and moving towards in the coming years as well as materials to look out for when I am trying to be more environmentally conscious.
- What features or types of information would you find useful?
    - More statistics about those who are using this material, companies by name, or even explaining actual differences in the material being used in clothes. Does it feel different? Is it comfier?
- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
    - In full honesty, I don't really look for information about consumer products because I rarely shop for clothes or anything that isn't food. When I do buy things that could be harmful to the environment based on the materials or product, I do my best to pick an alternative item.
- Other comments?

Breakout room #5: How Sustainable is Bamboo Fiber?

- What level of interest do you have in this information?
    - It's good to know especially when looking at more sustainable options
- What would draw you to a site like this?
    - Knowing why types of clothing to buy rather than others
- Did you feel like you gained anything from reading the article?
    - I did, i did not know that about bamboo
- What features or types of information would you find useful?
    - Examples of what companies might use this
- Do you look for information about consumer products? What challenges have you
  faced in obtaining this type of information in the past?
    Yes and no. When I'm curious I do, but for the most part I don't. You n have no idea if it's true or not
- Other comments?

Breakout room #1: Mask off: The Potential for Environmental Impacts from the COVID-19 Pandemic

- What level of interest do you have in this information?

    - High, daily issue so think about often
- What would draw you to a site like this?
    - Daily issue, ongoing pandemic so still need to use masks
- Did you feel like you gained anything from reading the article?
    - The article didn't really introduce anything new to the audience that they didn't already know. Maybe more expansion on how to address this problem would help
- What features or types of information would you find useful?
    - More ways that production can be changed, less consumer based and more towards production. Any research towards ethical production would be nice.
- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
    - The exact chemicals that are in the masks are helpful, and the most recent research is the most helpful. Usually it is a little difficult to find the most recent research.
- Other comments?
    - A little more on the solutions paragraph maybe, besides the pandemic ending. Could endorse disposable masks that are compostable or fast decomposing?

Breakout room #2: The State of Transparency in Fashion

- What level of interest do you have in this information?
    - Medium
- What would draw you to a site like this?
    - A scandal caused by a companies lack of transparency might prompt me to do further research
- Did you feel like you gained anything from reading the article?
    - It's good to see a positive trend of transparency
- What features or types of information would you find useful?
    - Maybe individual stats or companies that aren't necessarily transparent
- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
    - I normally don't look very extensively into a products history, but when I do, the information can be difficult to find since companies often want to hide their shady practices.
- Other comments?
    - Maybe you can throw in a chart or graph, or a picture relating to the topic.

Breakout room #4: How Has the COVID-19 Pandemic Impacted Fashion in America?

- What level of interest do you have in this information?
    - Honestly, I do not have much interest in this information. While I know it about the economy as a whole, I am not that invested in

predicting trends or analyzing how people are responding to the changing economy.

- What would draw you to a site like this?
    - Probably the only thing that would really draw me to this site is if I was writing something like a perspective paper or application paper and it was based on the economy as a result of Covid, and I was analyzing different economic sectors.
- Did you feel like you gained anything from reading the article?
    - I gained some information about the opinions of what is happening with the fashion and economics of that in America, but not necessarily enough to form a strong and information based opinion myself.
- What features or types of information would you find useful?
    - Predictive analytics or trying to anticipate future market ramifications/adaptations. I would be interested if companies will adapt to creating clothing for a more sedentary or isolationist lifestyle in response to shifting interests or anticipation of future events like this pandemic. This could be juxtaposed with a motivation to be on the cutting edge of fashion for when COVID is finally over and there will be a massive influx of people going to social events.
- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
    - I am not entirely sure what this is asking, but I definitely look at fit, customization options, durability, storage, etc… but in the spirit of the article, when I do look at material, it is never to make an informed decision about the environment.
- Other comments?
    - Interesting read. Maybe I missed this, but is there a reason why the article is so short? Is it just to provoke questions?

Breakout room #5: How Much Clothes are Really Recycled?

- What level of interest do you have in this information?
    - It is important that clothes are recycled or reused to increase the lifespan of such items and to also reduce landfill volume. So, our group is very interested in it
- What would draw you to a site like this?
    -
- Did you feel like you gained anything from reading the article?
    - I gained a better understanding of the recycling rates, and how much better the US can do in terms of preserving and reusing clothing items.
- What features or types of information would you find useful?
    - More information on what to look for where to buy new or secondhand clothes would be helpful, along with updates on recycling rates every few years.

- Do you look for information about consumer products? What challenges have you faced in obtaining this type of information in the past?
    - Yes it is important to look at the information about consumer products. To find information about clothing recycling, one must look at overall statistics of that article of clothing, because some groups of people will donate their clothes after use, discard of it, or recycle it.
- Other comments?