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Phygital Fash-

Phygital Fashion Emporium

A Loop'd remediation of the fashion narrative in an e-commerce interface.

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Abstract

The modern consumer is immersed in an experiential driven economy. Fashion has been rather slow at embracing emerging technologies, but the COV-19 pandemic has accelerated the digital transition online by forcing the industry to re-evaluate and adapt to new digital formats. Historically, luxury products have been presented in a manner that crafts a compelling narrative which appeals to the consumers' quest for self-actualization. The conspicuous reasons for consumer purchases are not the primary vehicle driving consumers' motives as they previously once were. Using Maslow's Hierarchy of Needs as a theoretical framework, the fashion market has shifted from satisfying basic priorities towards fulfilling personal growth and identity offered by experiential moments. It was the establishment of French Couture which enabled a desire for fashionable products. As it is commonly misunderstood, the emergence of luxury fashion brands led to the disappearance of diverse regional folk costumes and to the attenuation of heterogeneous class differences in dress. This was achieved by harnessing the power of storytelling through the act of runway presentation. Globalization and mass mediation has broadened the way contemporary fashion is perceived. This project seeks to remediate the experience of luxury fashion in the form of a new e-commerce interface designed for inclusivity.

Forward

Fast fashion has dominated the 21st century textile and apparel industry with each stage of its supply chain exerting a number of critical environmental and ethical impacts. This business model profits from selling large quantities of poorly constructed garments. These clothing items are marked with record low prices intended to entice the consumer to purchase more frequently. The combination of increased production speed and the changes in purchasing trends are contributing to a huge amount of textile waste while feeding a toxic consumer culture. Today, it is often cheaper to replace an item altogether rather than to mend or repair it. Inevitably, this has resulted in the devaluing of textiles and the art of clothing itself. The majority of society thinks of these items as disposable and are under the mindset that in order to remain in fashion, these clothing items need to constantly be replaced. As what we wear often reflects who we are and how we perceive ourselves, this represents an ironic predicament for our time.

For many companies that choose to go digital, they see an immediate benefit that will likely increase profit or production efficiency. It is no secret that the fashion industry has been slow at embracing new technologies in the 21st century. In reality, if a fashion brand were to embark on a digital revolution of its own, it would not only harness the potential for new profit channels, but could also begin to restructure the industry at large. By striving for better ethical and environmental solutions for industry workers and our planet, such brands could become top industry leaders within future fashion markets. The brighter side of a hopelessly long, global battle with COVD-19 is the fact that this unique situation could serve as an initiative for fashion brands to consider the integration of new media marketing techniques with hope of ultimately starting a fashion revolution.

The quest for this project began with speculating how new technology could improve upon sustainable fashion futures. The event of the global pandemic and the subsequent economic shutdown set the stage, so to speak, for this project. As a graduate student living primarily alone through this unprecedented event, my human relations, coursework, classes and all forms of entertainment became virtual within the blink of an eye. There is no question why, at times, it seemed unnecessarily difficult to arrive at the core of this project. Nevertheless, the following statement summarizes the project before it found its bearings. At my candidacy presentation, I had the following statement:

> In what ways can the design of a slow fashion clothing line utilize virtual reality to narrate abstract concepts of sustainability?

The project was presented as speculative virtual reality exploration. The intent was to re-imagine what a brick and mortar retail experience could look like if the customer experienced a virtual runway event while shopping. The goal of the project was to immerse the user in an environment that could educate them about the products virtually. Using a sustainable, digital fashion collection that I would design for this project, titled Loop'd, the remixing of an in-store experience with a runway show would breed a new format of

e-commerce shopping.

Rather than simply depicting a line of models walking a catwalk, I wanted to present the collection in a format that would highlight each look independently. By effectively utilizing the affordances of virtual reality, the role of the consumer would change. The user would become an active participate in lieu of a passive spectator. The concept was driven by the initiative to incorporate interactive runway performances into the e-commerce interface. The working draft of this project imagined a QR patch incorporated within each digital garment. The consumer would be given a tool to scan these patches in the virtual reality store. After scanning the QR patches located on each clothing piece, the surrounding world would transform and reveal the garment's sustainable message through animated text and audio. For example, one of the print designs for the Loop'd collection features tree rings. The message revealed after scanning the QR patch would announce the following:

"Each year trees form new cells which collect in the form of concentric circles called annual rings. What if our garments similarly grew rings? Good news, they do! Denim produces what is known as whiskers, and they record your day-to-day movement. The Japanese mending technique, Boro, is another form of textile record keeping. Take the challenge; What will your garment look like in five years?"

Another example included a message focused on cotton and the burning of land for new crops. The complementary virtual reality

environment would depict the burning of trees. The triggered particle effects, such as flames, would engulf both the user and the garment. The print designs, quirky messages and the virtual environment would work in tandem to educate
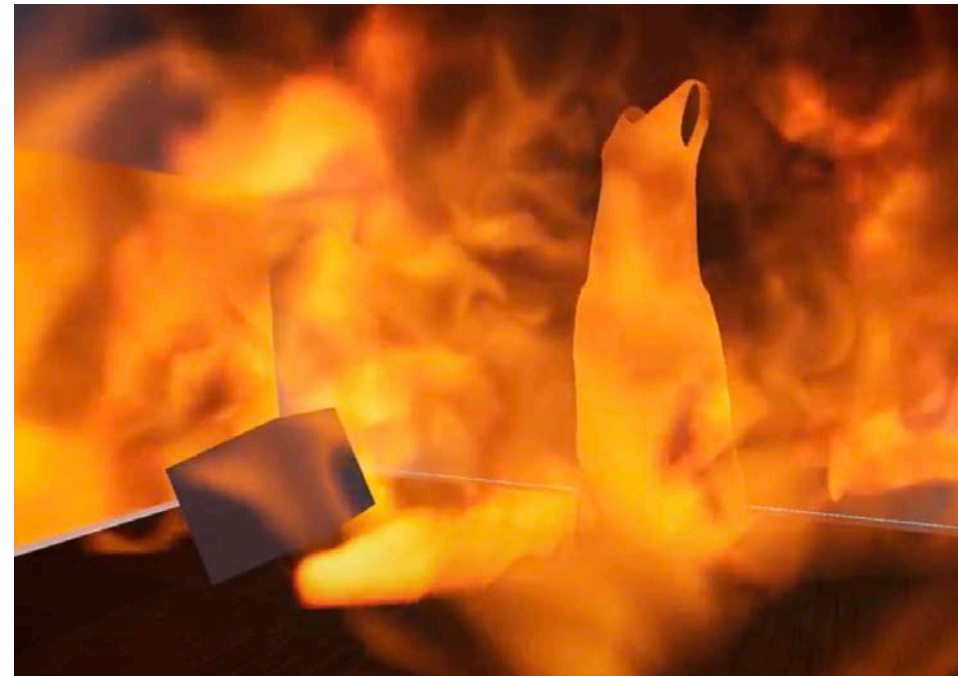

Fig 1. Early Prototype of Virtual Reality Fashion Inside the Heat of the Fire

the consumer about a variety of fashion production methods and environmental effects. The experience hoped to change
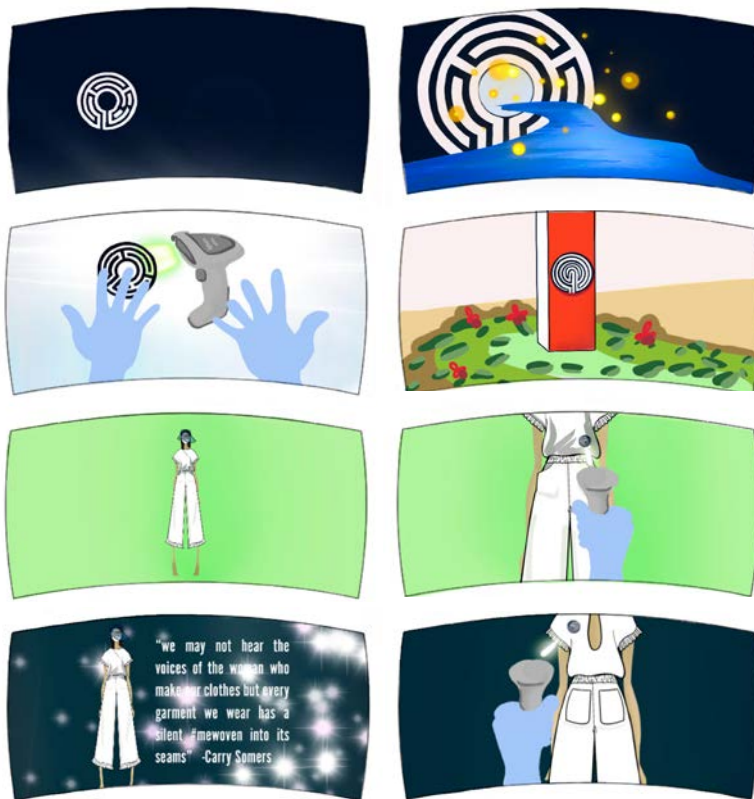

Fig 2. Storyboards for Virtual Reality Project Concept

how the consumer valued their clothing. Due to the pandemic, the semester calendar was adjusted by the extension of winter break. During this period, I spent the majority of my time working on learning *blueprints*, *Unreal's* visual scripting language, reverse engineering open source virtual reality projects, retopology, creating animations, rigging and *CLO3D*. All of these tools were important to explore in order to achieve the initial proof of concept for this project. Coming back from the extended winter break, I had some success and began to think about how the consumer would approach these experiences. At the same time, the project felt large and hard to manage due to the learning curve that I was also up against. Originally, I imagined a level where the consumer would discover wardrobe closets. Similar to *The Chronicles of Narnia: The Witch and the Wardrobe*, each closet would portray its own universe inspired by the sustainable message behind the fashion look. Based on my early experiments in virtual reality, I concluded that the concept of the wardrobe closet was too abstract. The project needed an element of something familiar and common in the everyday world. The wardrobe closet could have easily been misinterpreted if the surrounding environment was too surreal. Rather than the consumer wandering through a level in search of wardrobe portals, the revised version would use an elevator to transport the user between each fashion look. Each floor would debut a single Loop'd collection look, deliver its sustainability message, and depict its complementary environment. The elevator is a common, typically mundane experience, yet is easily recognizable by most individuals. The plainness in aesthetics choice of the elevator experience would serve as a visual break before entering into the various digital fashion worlds.

After returning from the extended break, I began meeting with my committee head weekly. Confusion about what the project was achieving began to surface. The more we discussed, the harder it began to justify the medium choice for this final project—virtual reality. While digital fashion is still in its infancy, there are clear graphical limitations that CG fashion entails. If we are talking about changing the way e-commerce is perceived and experienced, render quality matters. In the context of digital fashion, a CG production pipeline and available consumer headset technology, as of right now, can only be pursued so far. Accepting this reality, I replaced my "In what ways" statement with a research question. It was this moment that the pieces began to fall in place.

"Every new beginning comes from some other beginning's end."

- Seneca

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Project Introduction

"The Internet is the greatest known force of commoditization for goods as well as services," thus fueling an experiential driven economy in order to deliver differentiating value (Pine & Gilmore, 14). The modern consumer prefers experiences over material goods, where the memory itself becomes part of the product. The global lockdown brought on by the Covid-19 pandemic has challenged routines and behaviors for the majority of the population. While a sense of normalcy sluggishly follows in a post-vaccinated society, some of these disturbances have accelerated the existing trend of digitalization. Out of necessity, the customer segment who would have shopped in store prior to lockdown opted for e-commerce platforms. In fact, "Six in ten consumers have said that they intend to continue buying as much online once the pandemic has passed as they do now" (Kantar, 2020). Tracing back the lineage of luxury fashion products, staged performances were incorporated as a way to engage customers. Through the establishment of Haute Couture, fashion was democratized by the diffusion of image and story attached to the clothing. This project takes form in the design of an augmented reality e-commerce Interface that delivers opportunities for consumers to virtually try on, and shop memorable, experiential moments digitally. This paper begins with preliminary research gathered on the origin of luxury fashion and the state of the fashion sector today. Preceding historical context, project precedents will be evaluated and discussed in relevance to the qualities which informed The Phygital Fashion Emporium's concept. They will be presented in the following order: Alexander McQueen, The Fabricant, and The Museum of Other Realities. Subsequently, investigation into the following concepts will establish the theoretical framing for this project; Remediation, Maslow's Hierarchy of Needs and Fashion Diffusion. Through participating in the

Sweat Equality Challenge Program hosted by NSF I-Corps, this paper also contains market validation research that was conducted through video chat interviews with industry fashion brands (B2B), related discipline professionals, and fashion consumers (B2C) in order to evaluate market needs and consumer segments. The final section of this paper will detail the project processes, workflow and development, concluded by a final project reflection and relevant future application.

"I am always doing that which I cannot do, in order that I may learn how to do it." — Pablo Picasso

Research Question

Can a 3-dimensional e-commerce **interface democratize** the experience of **fashion storytelling** through an interactive, downloadable application?

Project Statement

There is a stark difference between fashion products designed for the average consumer and those designed for the luxury market. Luxury products are presented in a manner that crafts a compelling narrative. This project seeks to remediate the experience of luxury fashion in the form of a new e-commerce interface designed for inclusivity.

Historical Background
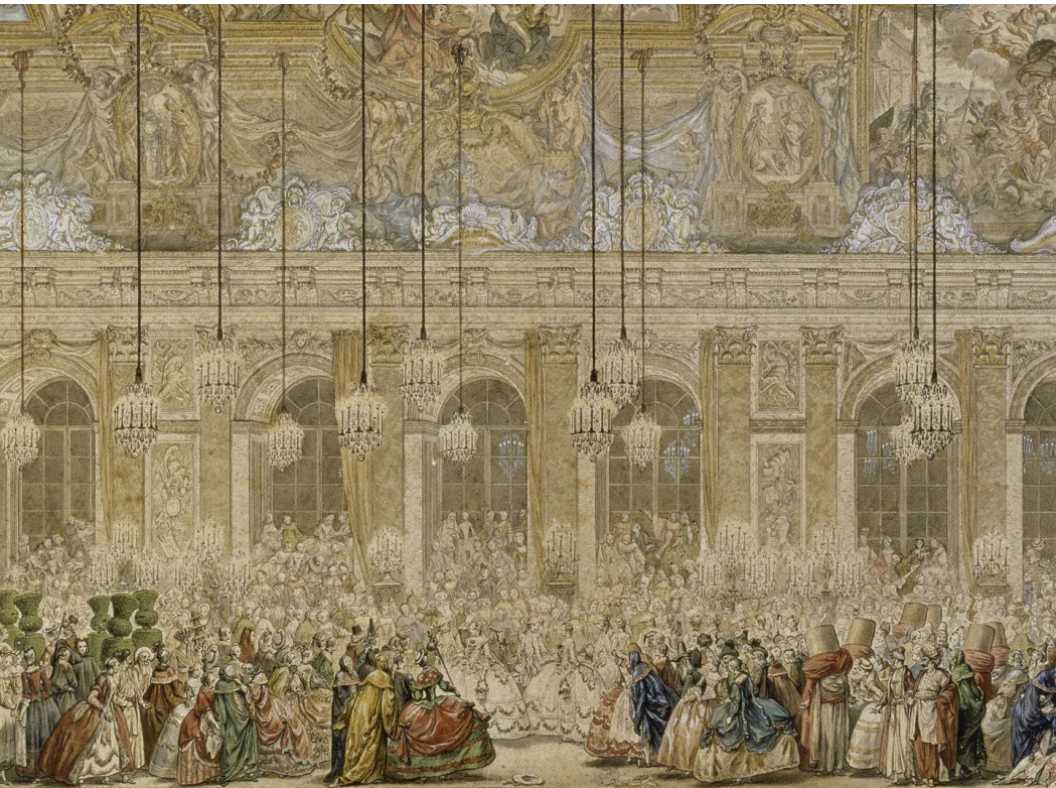
Fig 3. The Hall of Mirrors In Versailles, Built by King Louis XIV, Served as Validation for the Rest of the World of France's Artistic, Political and Financial Superiority; Source: Getty Images

Coined by Thorstein Veblen in his 1899 book titled *Leisure Class: An Economic Study in the Evolution of Institution*, conspicuous consumption is a nouveau riche (new rich) social class in which upper class participants advertise social power, prestige and sense of wealth through the ownership of luxury goods. The concept for what equates as luxury is not absolute, but rather relative to the political and social construct of an era. For example, from the Middle Ages onward, the sumptuary laws were enacted to regulate and distinguish economical class structures through consumption restriction. *The Black Law Dictionary* defines them as "laws made for the purpose of restraining luxury or extravagance, particularly against expenditures for apparel" (Black,1436). In other words, luxury was restricted from anyone outside of aristocracy.

Before France, the fashion capital was Madrid, Spain. Their global empire fueled a booming domestic economy, but once King Louis XIV of France came into power in 1643, this quickly changed. Establishing a luxury industry became Louis' top priority resulting in France's later title as the new fashion capital of the world. The Palace of Versailles caught Europe's attention as Louis secured power and prestige for France through his lavish expectations of court dress, professional textile guilds and foreign import restrictions. For Louis, the birth of the French luxury industry was not only for the health of the country's economic global standing, but for the reputation and survival of the monarchy. While the French

Revolution of 1789 dismantled old regime political standings, the luxury textile trade and commitment to highly crafted fashions of the day survived and became inseparable from French culture.

Before the 1800s, all clothing items were bespoke, either produced by the woman of a household or a seamstress/tailor, but just as exclusive as French fashion was, it was also progressive.

> "The rise of industrial dressmaking and the dynamics of modern lifestyles and values, led not only to the disappearance of diverse regional folk costumes but also to the attention of heterogeneous class differences in dress. Dressing in the fashion of the day became possible for an increasingly broad social spectrum. The most remarkable thing about this whole process is the contributions made by haute couture-a luxury industry par excellence to the democratization of fashion."

—Gilles LIpovetsky

Furthering France's notoriety, the father of Haute Couture, Charles Fredrick Worth, not only elevated the role of a seamstress to a designer/artisan, but also set the precedent for runway entertainment and established the infrastructure for a diversified fashion market. Worth was the first designer who made use of the connection between celebrity, fashion and the press. Capitalizing on elite presentation, his precursor methods towards
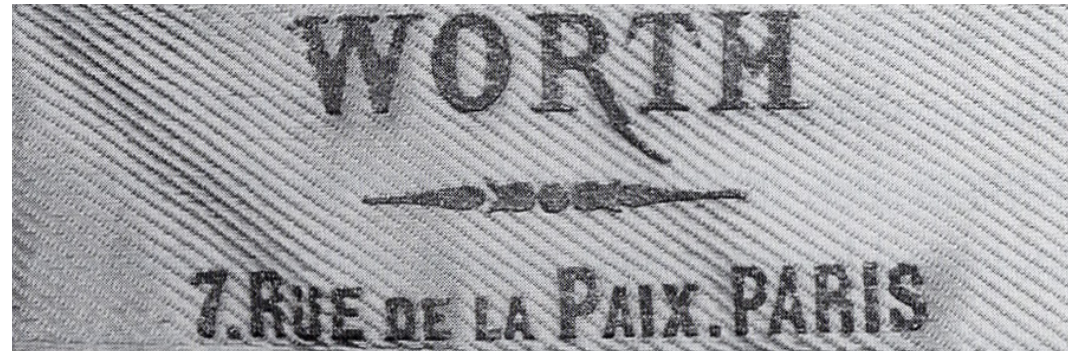
Fig 4. Worth's Label, Stamped Gold on White and Black and Woven Gold on White Petersham. First Designer to Sew a Label into a Garment; Source: Brooklyn Museum of Art, 1870-1885

mass production in concurrence with the arrival of department stores overseas and the release of Prêt-à-Porter (ready-to-wear) collections are the foundational frameworks of our modern fashion system today.

The problem with fashion discourse stems from the historical paradox of the industry. Worth designed and fitted garments for members of royal and aristocratic descent, stage performers, and department store shoppers because he recognized the financial opportunities, particularly within the American market segment. What started out

Fig 5. Nadar, Paul. Countess Élisabeth Greffulhe, Wearing a Charles Frederick Worth Gown. Palais Galliera, Musée de la Mode de la Ville de Paris; Source: Vogue, 1896

as a means for French couturiers to present collections to foreign buyers, turned into a full production event because it was "the défilé that makes the designer an artist, and not merely a dressmaker" (Skov et al, 3). Proceeding Worth's Influence, Paul Poiret and Lucile Lady Duff-Gordon continued to evolve the garment sector by orchestrating upper class fashion events and theatrical public performances. The production fashion show evolved by detaching its purpose from the selling of clothes to an event utilized as an image-creation catalyst. Couture ateliers, or houses, understood the importance of visual and performing arts in the promotion of a brand's reputation and admiration.

When the Wall Street market crashed in 1928, communication between France and America ceased. Home manufacturing took priority during this time as foreign import taxes reached 90 percent. It was this moment when American fashion evolved the ready-to-wear market, and "New York became a central production and distribution capital for the ready to wear rag trade" (English, 68). The garment designs were still driven by couture patterns but material choices were cheaper and patterns were adapted for a more casual lifestyle in response to the middle class needs and values.

Popular culture, cinema and art simultaneously became commercial vehicles for trends, ultimately diversifying the field of fashion globally. The emergence of graphic design posters made the public the new patrons of the arts, while

the rise of the middle class American sparked a new interest in goods and services.

> "The rise of modern marketing also forced a shift in economic theory away from production to consumption— away from the idea that the value of products resides in the cost of production and toward the idea that the value derived from subjective consumer demands or desires in relation to supply"
>
> — J.S. Allen

In Allen's text, the emergence of the autonomous consumer 'object' emerged when museum methods of curation trickled down to the department stores. This materialized a mediation between product and consumer through a new form of advertising.

The Bon Marché, the first department store to open in Paris by the Boucicaut family, revolutionized retail through its *luxury for the masses* aura. One of Boucicart's legacies was their continued support of the fine arts. The couple opened an art gallery within the department store which set a precedent for the entangled role art played in commerce. As art historian Jean-Paul Bouillon detailed in his essay, *The Shop Window*, the rise of the window display as a cultural phenomenon was a site for the consumerist spectacle. "Department stores encouraged customers to consume through the exploitation of visual pleasures" (Edward, 2010). They became the one stop shop where all customers could browse, dine, appreciate art and catch a fashion show. In other words, they were entertainment centers. The sophisticated

Fig 6. A New Theatrical Fad. Why Study to Be an Emotional Actress When You Can So Easily Be an Emotionless Mannikin; Vanity Fair, 1900-1929

Fig 7. Cover of Harper's Bazaar Displaying Names of French Fashion Designers Available in New York Stores; Source: Harper Bazaar, May 1915

Fig 8. Advertisement for Department Store Au Printemps Featuring Two Ready-Made Women's Outfits by Paul Poiret; Source: Collection Centre de documentation de la mode et du textile, Union Centrale des Arts Décoratifs, Paris, 1933

presentation of merchandise and the range of attractions available, secured the department store as a destination for middle-class leisure in America. This motion would ignite the high-consumption capitalism condition.

Manufacturers were king and the garment industry was thriving. Women in America admired French fashion and couture patterns were often reproduced in New York. According to the higher class, "American garment workers excelled at mass production, but lacked creativity" (Moore, 19). In any case, French shows mimicked elite social events and many foreign buyers traveled to Europe for the latest trends, some of which would appear back in America where the creations were presented in department store shows and window displays but were not available for direct purchase. Instead, adaptations were ordered that were inspired by the debut French collections and then manufactured by American factory workers.

WWII and Haute Couture's subsequent hiatus under occupation allowed American fashion and ready-to-wear to flourish. By the time couture returned, they responded immediately to the internal cultural and economical shift. In order to recover eminence in Couture manufacturing, houses released ready-to-wear collections and franchised accessory production as these channels became essential to France's recovery and survival of their craft. New York designers became successful rivals during their

absence, and for the first time, Couture and mass production were commercially competing. Through marketing, the brand logo was exploited masterfully by top Couture houses as the sole purpose of the

Fig 9. Paris Postcard of Métiers, translation: trades, Heliography; Source: Geneanet
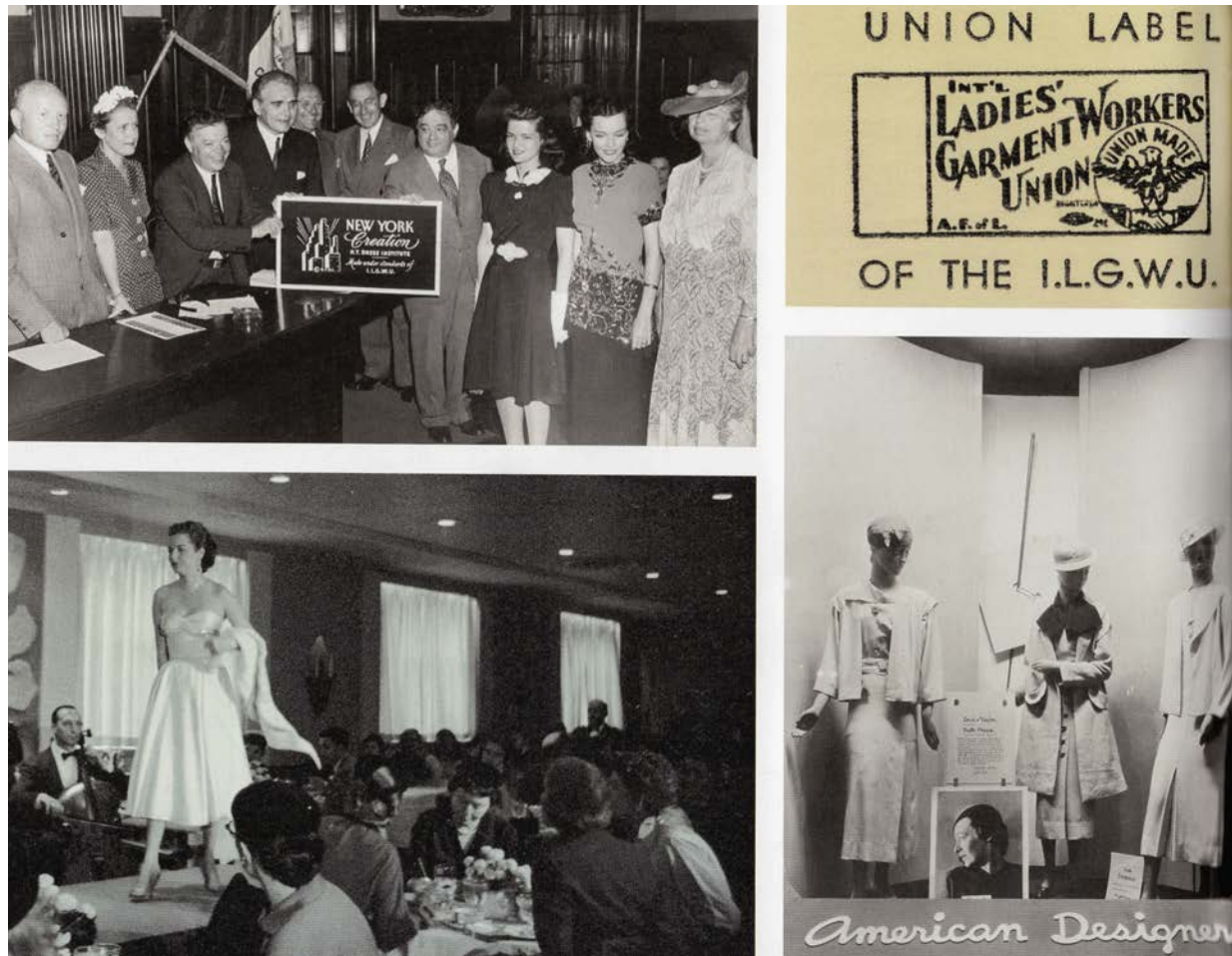
Fig 10. Top Left: Ceremony Introducing the *New York Creation* Label, 1941; Top Right: ILGWU Union Label Introduced in 1958; Bottom Left: Lord & Taylor Fashion Show, 1940; Bottom Right: Lord & Taylor Window Display, 1933; Source: Moore, Booth, and Von Diane Furstenberg. *American Runway: 75 Years of Fashion and the Front Row.* Abrams, 2018
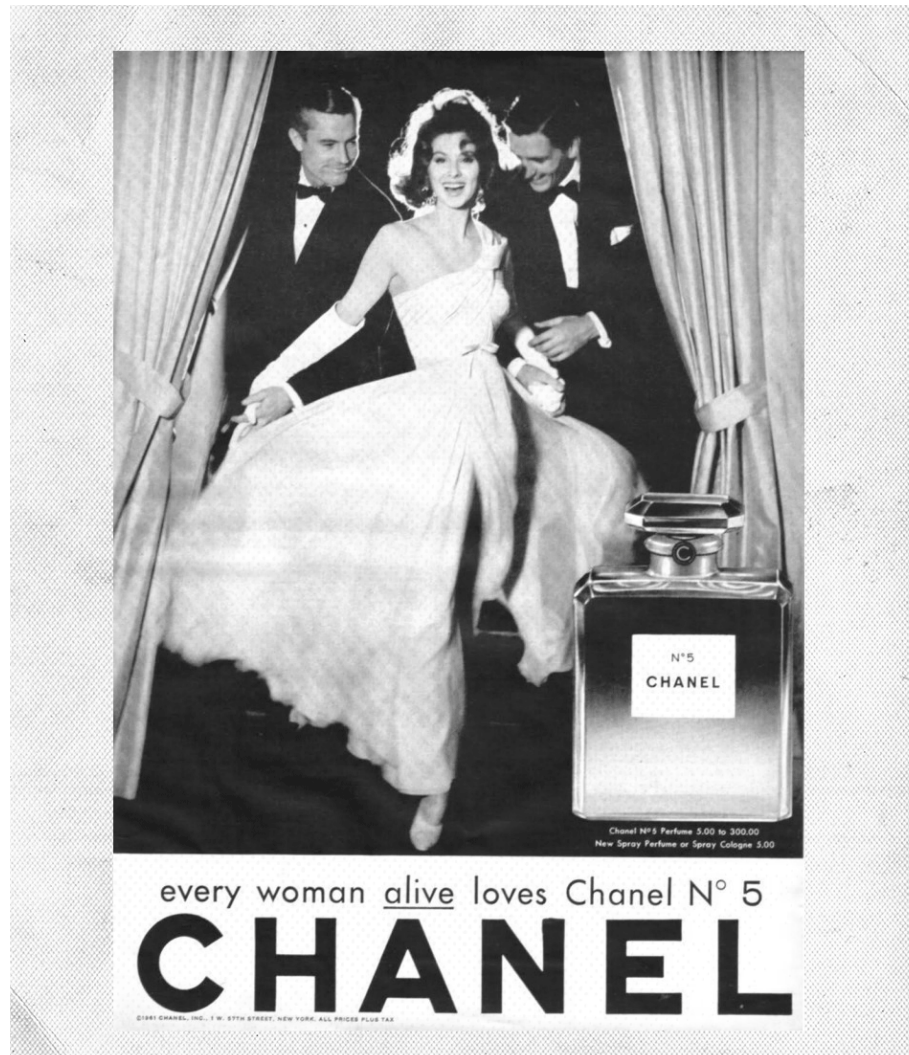
Fig 11. Signature Tag "Every woman alive…" Chanel No 5 became an Aspirational Purchase for Women of All Social Classes; Source: Harper's Bazaar, 1957

extravagant runway event was to glorify advertisement in a poetic manner. For example, the sportswear brand, Tommy Hilfiger was a competitor who unsuccessfully up-marketed the company's image to the same position of culture elitism of which couture houses already channeled.

Haute Couture had lost influential momentum in the early 1990's and the Prime Minister ordered the Chambre Syndicale, France's governing fashion authority, to overhaul accordingly. Louis Vuitton Moet Hennessy (LVMH) is a global fashion conglomerate which merges and maintains autonomy, personality and dynamism, through the centrality of the branding of luxury goods—in plainer terms, the financial backing of the Couture houses. It perceives itself as a patron to the arts committed to evaluating fresh talent, such as Alexander McQueen and Marc Jacobs. Haute Couture has high overhead costs, but at the same time, it has a superior influence on brand narrative and media publicity. Ironically, the original Haute Couture system was intimate, private and custom, remaining quiet in the public's eye, but brand image and experience interchangeably became the service and product. Houses recruited younger designers for their ability to attract media attention often through outrageously conceptual runway performances which, in turn, brought new life to traditional Couture Houses. Licensing became incredibly profitable because value inhabits the branding and experience of the product. Fashion marketing is a performance that communicates emotion and establishes

value that the customers can identify with. Commerce and fine art are one in the same for high fashion brands and their products.

The 21st century fashion industry is characterized by global price reductions, streamlined operations and a hearty rise in consumer spending trends. As mass-marketing strategies matured and new technologies advanced communication capabilities, the effects of globalization fabricated a new market segment—*fast fashion* is the design, manufacturing and marketing techniques formulated on selling apparel produced on a high volume scale. This business model encourages consumers to purchase more often because of the reduced prices and continual arrival of new merchandise. Couture brands have responded to the industry's new timeline by increasing the number of collections shown per year. The industry overall has evolved at a pace which cannot keep up with itself and has compensated by decreasing the quality of product while increasing ethical and environmental costs. "Clothing production doubled from 2000 to 2014 and the number of garments purchased per capita between 2000 and 2014 increased by 60 percent. Across nearly every apparel category, consumers also have kept clothing items about half as long as they did 15 years ago" (Remy).

Consumers have more disposable income than before, and fast fashion greatly entices consumers to adopt a disposable mentality. Fast Fashion production is a relatively

Fig 12. John Galliano Designs for Christian Dior, F/W Backstage; Source: Photographed by Roxanne Lowitt, 1997

low tech operation that embraces the spirit of brute force. By the same accord, emerging technologies have displayed tremendous potential for sustainable development, yet the fashion sector has largely remained hesitant to adapt. Fortunately, the most recent trajectories in fashion's digital integration and sustainability crisis are expected to reset the fashion industry.

INDEX 100 IN 2000

- - - - WORLD GDP

—— CLOTHING SALES

NUMBER OF TIMES AN ITEM IS WORN[1]

—— CLOTHING UTILISATION

>100bn units (2015)

2X

~50bn units (2000)
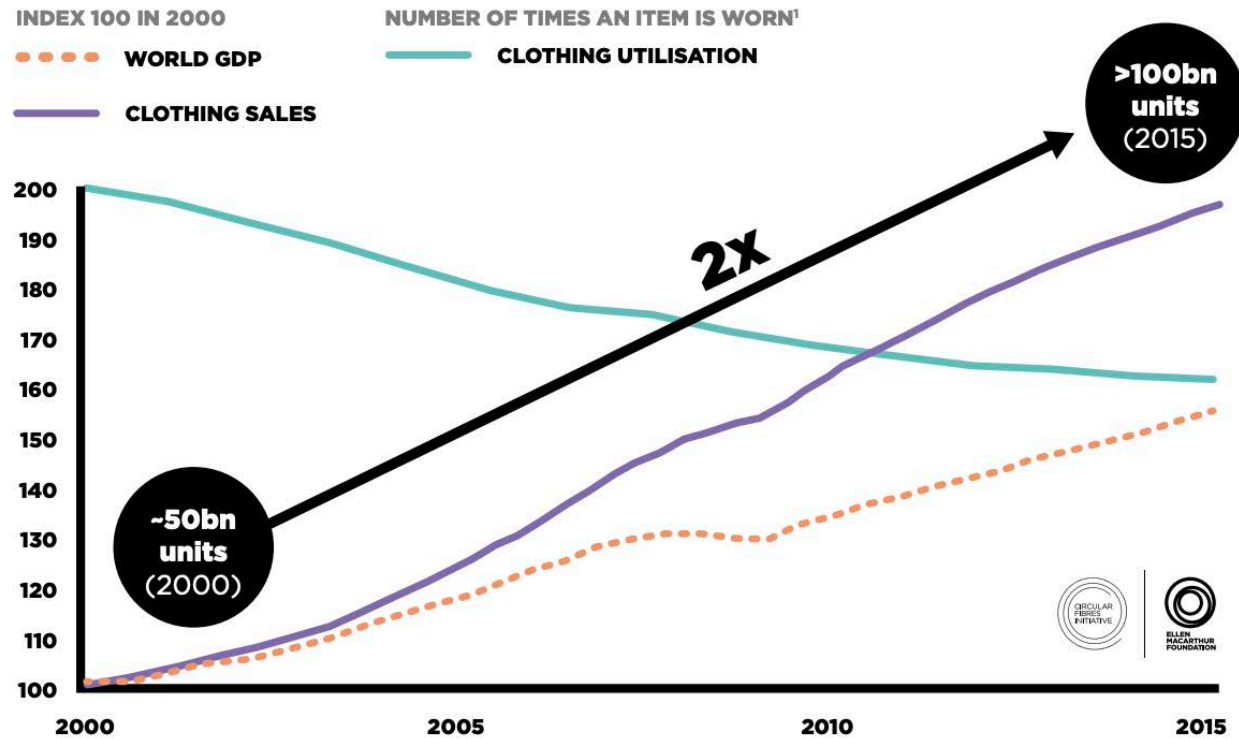
1   Average number of times a garment is worn before it ceases to be used

Source: Euromonitor International Apparel & Footwear 2016 Edition (volume sales trends 2005–2015); World Bank, *World development indicators – GD* (2017)

Fig 13. Growth of Clothing Sales and Decline in Clothing Utilization Since 2000; Source: A New Textiles Economy: Redesigning Fashion's Future, Ellen MacArthur Foundation

The Flux of Industry

The Effects of Fast Fashion

With the arrival of the 21st century, we have entered into the dawn of fast fashion. In 2018, the fashion industry was valued at more than 2.5 trillion dollars and employed over 75 million people worldwide (UN Alliance). Despite the increase in jobs this sector has provided, it has come with a significant cost. Fast fashion is a business model which rapidly produces inexpensive clothing focused on delivering consumers with an absurd amount of micro trends each year (Firth). By delivering increasingly lower prices, these companies have incentivized their customers to purchase more items per transaction. "It is estimated that more than half of fast fashion produced is disposed of in under a year" (McKinsey & Company, 19). On top of that, consumers are now conditioned to expect a constant stream of new merchandise. Michael Solomon, a consumer behavior expert and marketing professor at Saint Joseph's University states, "It's not just about clothing, it's about a disposable society." The problem with fashion's toxicity is its lack of immediate tangibility to consumers in the West. Many of fashion's environmental impacts remain in developing countries. The over consumption of apparel by the west is one of the ways the fashion industry is contributing to global pollution.

Donating old clothing or items no longer wanted is a common occurrence, especially within the United States. It is even publicly accepted as an act of good deed, which is imprinted in society through Consumption Philanthropy, or Cause Marketing. "Organizations that market with this angle, may not have ill intentions at heart, but collectively deliver a false message focused on individualized solutions towards the larger collective social problem, distracting our attention and resources away from the neediest causes, the most effective interventions, and the act of critical questioning itself" (Eikenberry). In other words, clothing donation centers have obscured and simplified the solution. This, in turn, implants a false depiction of the underlying cause by promoting the act of charity as a step towards a better planet. This discredits the seriousness and complexities involved. Donated clothing that is not otherwise sold through the organization goes into textile recycling. Textile recycling refers to the method of reprocessing and reusing old clothing, scraps, and fibrous waste materials that might have otherwise gone straight to a landfill. It is a substantial international business which also ships bales of clothing items each week for buyers around the world. Jackie King, the executive director of SMART, Secondary Materials and Recycling Textiles, the trade association for textile recyclers, says that 80 percent of the textiles given to donation centers end up in the hands of textile recyclers, of which about 45 percent is exported to what are considered as developing nations (Northam).

The fashion industry uses a high number of non-renewable resources. Textile recycling technology is still in its infancy and it is nearly impossible to separate individual fibers found within blended fabrics. The second hand clothing market has little transparency, and few understand what exactly happens to their clothing items that are not sold through donation or consignment doors. The Kantamanto Market in Accra is one of the largest second hand markets in West Africa. Unlike the donation centers in the West, this cast off market is a vital

Fig 14. Life Magazine Celebrates the Dawn of Throwaway Living Brought by Disposable Plastics; Source: Photographed by Peter Stackpoole. Life Picture Collection, Getty Images, 1955

sector for their local economy. Roughly 15 million garments flood the market on a weekly basis and the local businesses work tirelessly to recommodify these items.

> *"ThredUp's 2020 report states that they have recirculated 100 million items total and four million fast-fashion items since ThredUp began as a business in 2009. Kantamanto recirculates 100 million items—the overwhelming majority of them, fast-fashion—every 4 months"*
>
> *—The OR Foundation*

To put this into perspective, the items that ThredUp does not sell still have other destinations, such as with all Western donation centers, but for Kantamanto, whether those items are sold or not, they have reached their final destination. Over the course of a three year study, The OR Foundation, concluded that around 40 percent of clothing in Kantamanto still becomes waste.

Donating old clothing is not going to change the fashion industry's footprint because it is a system comprised of a number of networks and intricacies all dependent on one another. Edwin Kehy, CEO of the Hong Kong Research Institute of Textiles and Apparel states, "There is no silver bullet; rather, there will be a combination of a lot of small innovations and a few radical changes"(McKinsey & Company,

22). While I have chosen to focus on the second hand trade, there are a number of other factors that are also contributing to the unsustainable fashion industry narrative such as the toxic runoff produced by dye houses and tanneries, micro-plastics released into our waterways through washing, or the air pollution levels from garment factories in India. The list goes on, but as I have previously stated, fashion is a system which is highly dependent upon a number of pre and post consumer choices. With all of the ongoing examples that could be explored such as changes made to material sourcing, alternatives to harmful chemicals etc, the problem begins with simply too much clothing in circulation.

The Phygital Fashion Emporium demonstrates how a smaller, local brand could participate in the grander fashion narrative previously dominated by luxury fashion houses. Not only does this project acknowledge the need for fashion system education among consumers but also foreshadows a future business approach towards on-demand manufacturing. If you are already re-creating assets digitally with a program such as *CLO3D*, then you already have the base for a virtual production asset. With the more recent decline in brick and mortar spending, instead of stocking products in store, brands can craft interactive experiences virtually. As a result, this becomes an entirely new way to shop—changing the nature of the industry at large.

Fig. 15. A Worker Carries a Bale of Imported Second-Hand Clothing in Gikomba Market, Nairobi, Kenya; Source: REUTERS/ Thomas Mukaya, September 2020

Fig. 16. The Edges of the Korle Lagoon in Accra, About a 10 Minute Drive from Kantamanto Market, ITN's Penny Marshall and Liz Ricketts of the OR Foundation identify the Brand of the Piles of Clothes; Source: The Ghana Report, February 2020

Fig. 17. The India Gate War Memorial in New Delhi on October 17 2019 and on April 8 2020 After Air Pollution Levels Dropped During a Twenty-One Day Nationwide Lockdown to Slow the Spread of COVID-19 Virus; Source: Washington Post

Fig. 18. Dye Runoff in a Nearby Waterway, China; Source: CFP, 2011

Digital Integration

Moore's Law, established in 1965 as a means to rationalize the progression of computing, observes that a computer's processing power grows as the cost per component drops. To date, this has more or less been proven true. E-Commerce has had a significant impact on the fashion industry. The rise of the consumerization of enterprise technology has fueled the popularity and substantial growth of e-commerce giants like Amazon and Alibaba. The attraction for brands to reach otherwise foreign communities and clients on a global scale has triggered the escalating prominence of social media marketing campaigns and online shopping sites. However, whether a customer shopped online or ventured to a brick and mortar, never before in history has there been a collective economic shutdown in which e-commerce shopping was an option and only alternative. Like other global interruptions, the Covid-19 pandemic will likely have lasting effects on the fashion industry long term. According to Mckinsey's latest State Of Fashion Report 2021, "the primary driver of growth in the coming year will continue to be digital channels, reflecting the fact that people in many countries remain reluctant to gather in crowded environments" (BOF and McKinsey). To offset the damages from the widespread shut down, brands need to find new ways to excite consumers digitally. "History shows us that in a disrupted macro environment characterized by shifts in consumer behavior, excellent customer experience yields financial results as well as opportunities for companies to calibrate their propositions" (BOF and McKinsey, 38). Typically the return investment on brick and mortar locations has been measured by how much inventory was sold at that venue but those percentages have been interrupted by an upward tick in the number of online transactions. According to retail futurist Doug Stephens, "Retailers should think of physical store investments

as they have traditionally considered media investments—as a vehicle for customer acquisition, rather than purely as a distribution venue for products" (BOF and McKinsey).

The onset of the COVID-19 restrictions and lock down have reset reluctant e-commerce shoppers to try something new. With more consumers open to the possibility of shopping for clothing online, the window of opportunity opens for interactive, story driven experiences. The Phygital Fashion Emporium demonstrates a future vision for a new type of e-commerce experience.

Project Precedents

Fig 19. Is the Fashion Industry Breeding a Malignant Culture Around Illness? A Two-Way Mirrored Box Enclosed Models Who Wandered Eerily Inside, tightly Bandaged Around Their Heads and Unable to See the Audience, Collection VOSS S/S 01, Designs by Alexander Mcqueen; Source: MASIONJSC

Time dedicated to evaluating precedents is a crucial step in any designer's process. It is the moment in which the designer must observe and articulate what memorable qualities make past experiences or creative figures inspirational. The following reflections on Alexander McQueen, The Fabricant and The Museum of Other Realities inspired and informed the concept behind The Phygital Fashion Emporium.

Alexander Lee McQueen is one of the most visionary designers of his generation. A designer of his time, a rebel and pioneer, McQueen left an indelible impression on the fashion world. McQueen's work always embodied his own transgressive, challenging and hostile vision of the world in combination with his love for history, unlimited imagination, and Anglo-Scottish heritage. He was a visionary who took fashion into the twenty-first century through his continual effort to expose the complexities of women by demonstrating multi-layered, enchanted and visually compelling performances that fed his hunger for the subliminal experience. He not only was a skillful craftsman, but he also demonstrated a natural ability to embed potent concepts into his garments with experimental pattern cutting and technical tailoring techniques. In essence, he was an artist who perfected the craft of emotional persuasion.

"Love looks not with the eyes, but with the mind," a quotation from Shakespeare's *A Midsummer Night's Dream*. Helena, who has been abandoned by her beloved Demetrius because he

loved the more beautiful Hermia, describes love as an erratic, indefinable, powerful emotion. "Helena believes that love has the power to transform something ugly into something beautiful because love is propelled by subjective perceptions of the individual and not the objective assessments of appearance " (Bolten, 12). This quote, tattooed on McQueen himself, served as critical, creative inspiration expressed in all of his collections. Common themes of love and beauty always manifested through the political association of aesthetic appearance. McQueen drew inspiration from raw, personal journeys in his practice, and that inscribed a certain vulnerability amongst his pieces. The intensity of his runway performances fabricated provocative, visceral emotions to all spectators. His collections were journalistic in nature and conceptually always delivering a deeper message, "I'm making points about my time, about the times we live in. My work is a social document about the world today" (McQueen, 12).

McQueen always referenced historical themes. His collections drew inspiration from the nineteenth century, Victorian Gothic artists and writers. A period known for the combination of horror and romance, Victorian Gothic reflects a paradoxical relationship that his collections always embodied. His ability to juxtapose opposing themes in the form of highly crafted wearables created a dialogue between the past and present cultural and social expectations. The primary purpose of a runway show is to present the launch

of a collection. It is an extremely effective marketing tool intended to broadcast values of a house. McQueen, however, made his work personal. He believed the runway could deliver more engaging, influential experiences for the audience members watching. Through his presentation delivery, McQueen crafted performances that embodied a strong sense of narrative arc. He delivered raw, emotional, commentary about society's social fabric that previous runway designers had not demonstrated. The stories he crafted, along with the collection he designed, were never without consideration of the performance itself. These elaborate narratives were drenched in personal reflection and ancestral connection.

In the late 1990's, experiential and rebellious qualities were aspirations of many fashion houses. The collection titled "No. 13," was one of McQueen's most moving and beautiful performances that demonstrated his pivotal alternative perspective of the runway. The collection was inspired by the Victorian Arts and Crafts Movement. Designs featured materials such as wood, leather, lace and raffia. Balsa-wood skirts, natural in tones, sprung out mimicking blades of a fan. Hard, leather bodices with high necks purposely restrictive, altered models' posture. Another model wore a pair of wooden prosthetic legs hand-carved in Elm, which were reminiscent of the filigree qualities of Baroque carver Grinling Gibbons (Wilcox, 9). Surgical undertones were implied by the lacing that appeared as crude stitching. Leather buckles were also incorporated, loosely referencing straps and harnesses found in mental institutions. These were then paired with natural, organic materials like soft, tiered lace skirts and trousers. The skirts were flouncy and suggest an energy and lightness found in a flamenco
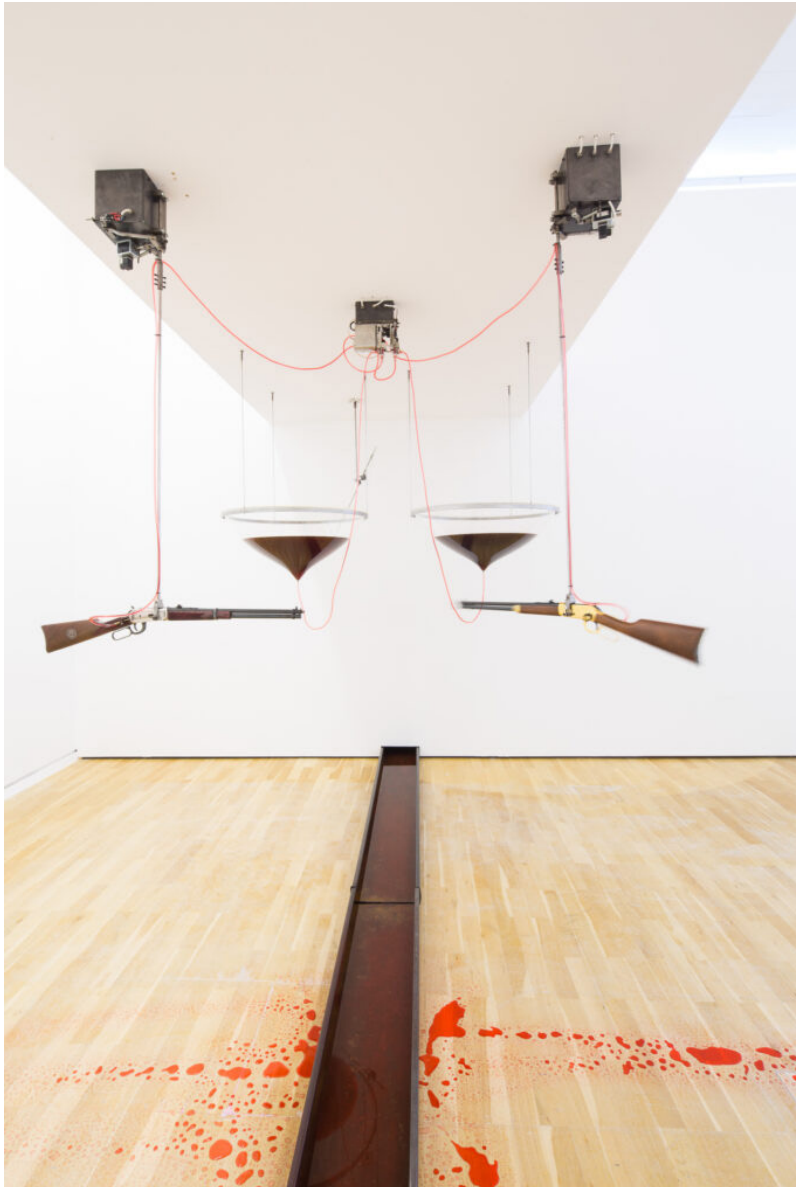
Fig 20. Installation *High Moon* by Marek Kruszewski at the Kunst Museum; Source: Kunst Museum, 2020

dancer. The emphasis on the natural and traditional elements are in stark contrast to a soundtrack by American hip hop artists, The Beastie Boys. The contrast between hard and soft aesthetic choices depicts a tension between the formal romantic ideals within a modern context. Following the ready to wear pieces of the collection, a group of models appeared on the main floor spinning around on turntables. The music switched to a classical track and there was strong suggested imagery of dancing jewelry box figurines. As if the collection was not conceptual enough, the finale was the most compelling and memorable look of them all. Former ballerina Shalom Harlow, wearing a virginal white dress held together by leather buckles and straps, made her way to the rotating turntable placed between two industrial robots. As she was spun around, she seemed to be interacting with the robots through gestural movement. Appearing submissive and at the mercy of the machines, they fired sprays of black and fluorescent paint on her trapeze silhouette dress. This sequence was inspired by Rebecca Horn's installation piece, titled *High Moon* (1991). It has also been suggested that it was demonstrating a counterpoint to William Morris's anti-industrial ethics. Morris, a textile designer, philosopher and social activist associated with the British Art and Craft Movement, rejected tawdry industrial manufacturing. The commentary McQueen provoked questioned the role of machine vs. humans within the twenty-first century.

The avant-garde, defined as a movement, group of work, person, or adjective, refers to the innovative, experimental concepts that lead to new social prospects. His shows offered both "reflection and expression of cultural, historical and subjective political imaginaries" (Moon, et al.
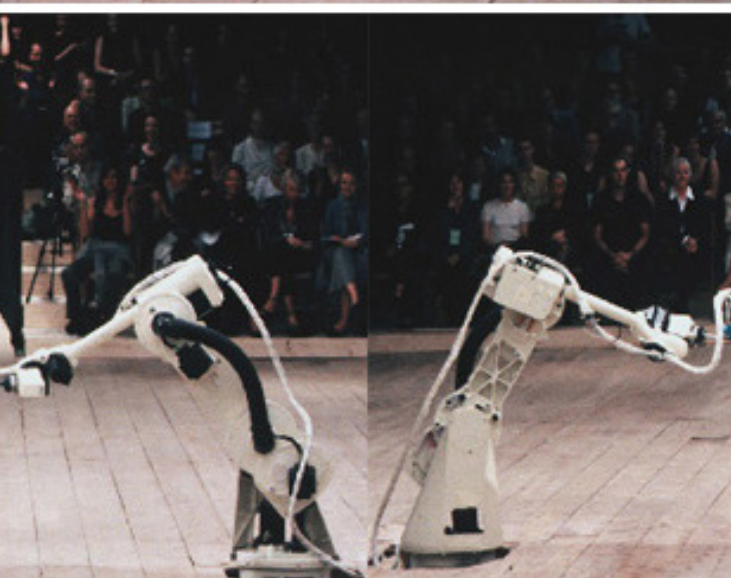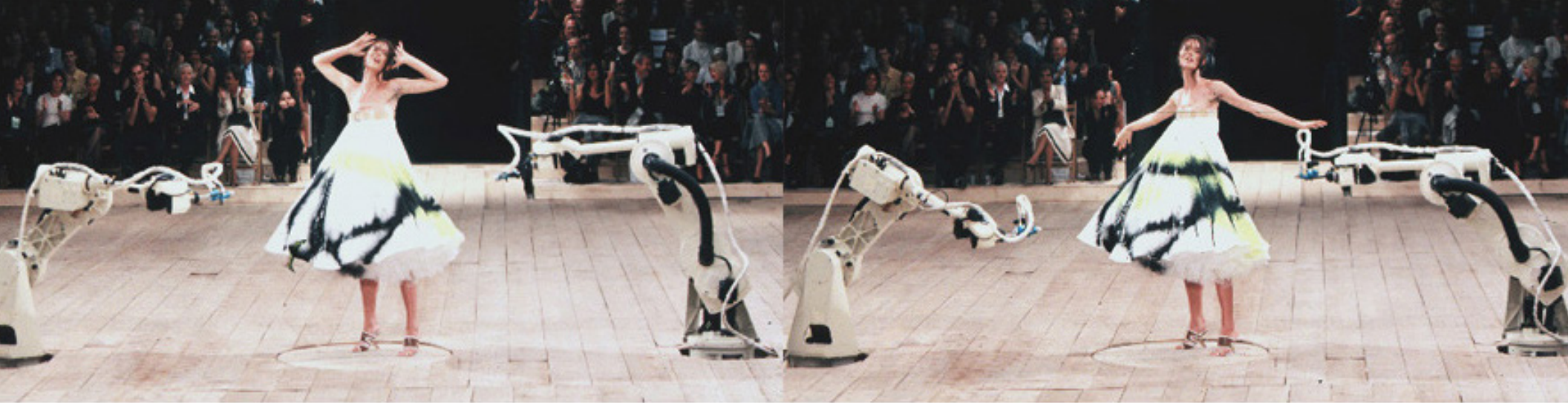
Fig 21. Shalom Harlow's finale; Collection No. 13 S/S, Designed by Alexander McQueen; Source: HauteKills Tumblr, 1999

Project Precedents

102). McQueen, both a technical artisan and a future visionary, had the ability to craft emotional, compelling stories that exposed fluctuating cultural etiquettes. McQueen's body of work attracted recognition from both in and outside of the fashion sphere because he defied industry standard norms. As a result, his methodology is the perfect testimonial for how fashion could provoke social change.

Social change seeks to reshape pre-existing rules of behavior and social structure over time. McQueen is an inspirational figure in the design of my final project because he aspired to challenge the role of the runway. Likewise, the design of my application will provoke another transformation for how the runway format could be experienced. Fast fashion is deeply ingrained in standard production methods today, but the role future technology will play in changing customer expectations and demands is forecasted to transform this industry standard. To clarify, McQueen's designs that I have covered above could never fall under this umbrella category. As a result, we can conclude that his performances were intended for those belonging to a higher economic class. It would be ideal but also naive, to assume that we can design a runway show for all economic social classes. Instead, increasing accessibility to runway performances could provoke a social movement in which appreciation and value for the clothing items owned could extend into other social class tiers. The flexibility of technology has led to a fluid, open dialogue between fashion and consumers. Emerging

social media platforms allow for the co-creation of brand story and value. Brands are no longer solely defined by just a product. In the digital world, the content these brands deliver will work in tandem with the product itself. As more consumers turn to e-commerce platforms, we will witness a change in consumer culture where the traditional brick and mortar destination isn't as necessary as it previously has been.

From marketing campaigns, to e-commerce experiences, to virtual tailoring, The Fabricant is manipulating and experimenting with it all. They are a digital fashion house questioning the role of clothing entirely by operating at the intersection of fashion and technology. The studio produces digital-only couture clothing and hyper-real fashion experiences. Their work challenges the current concept of the fashion industry by imagining an atelier that produces fashion stories free from the constraints of the material world. They are pioneers in the digital fashion revolution, but they are also promoting sustainable fashion solutions by shifting physical production to digital experiences without compromising the consumer's experience and emotional connection with the product.

The studio is defining a new place for fashion by challenging traditional conventions of a fragmented industry. While other industries embrace emerging technology, the fashion sector has been notoriously slow at adapting to the digital era. Amber Slooten, the co-founder and creative director of the fashion house was selected in October 2018 to participate in the De Toekomstbouwer, The Future Builders, a TV broadcast showcasing young creative talent designing a future

vision that could "change the future of humankind." A fashion designer who now only designs with digital pixels, encourages consumers to think about a future where they will try on clothing virtually via personal 3D avatars that match the consumers' personal measurements. I.T., the Hong Kong based luxury fashion retailer celebrated its 30th anniversary by commissioning The Fabricant to digitally recreate a collection designed to celebrate the three decades of fashion in China. The clothing included high end, couture labels such as Marques Almeida, Helmut Lang and Alexander McQueen. The collection pieces were only seen in digital renders, but were available for purchase in I.T.'s pop up stores. At these locations, a 60 second film played which highlighted the embodied aesthetic of the collection. There were also cubical-like, pop up digital displays containing images of 3D rendered stills. The images depict hyper-realistic garment creations. The pop up boutique featured no physical clothing in its exposition, and orders for the clothing were placed via an application. After an order is placed, the garment is produced and shipped to the consumer. "Digitization helps clients to promote and visualize ideas without wasting unnecessary resources. 3D visualization gives a multitude of possibilities on lighting, materials and background. With the virtual world yet unexplored, we have the visual means that will set apart brands from the overuse of film and photoshoot techniques" (The Fabricant). This will catapult fashion into the 21st century.

Fig. 22. MCQ Sweater Still From I.T. Hong Kong Pop Up Event, Collection VOSS S/S 01; Source: The Fabricant

Fig 23. I.T Hong Kong and the Fabricant Luxury Retail Pop Up Displaying Digital Renderings of Products, Collection VOSS S/S 01; Source: The Fabricant, 2020

Soorty is a Pakistani denim mill that supplies global retailers like Tommy Hilfiger and C&A. In collaboration with The Fabricant, the first digital denim garment was prepared as an expression of emotion to demonstrate the beauty of cradle to cradle principles and practices of Soorty. *Cradle to Cradle* is a "globally recognized measure of safer, more sustainable products made for the circular economy" (The Cradle to Cradle Products Innovation Institute). It is the process of designing a product that returns all materials back to the soil after their lifespan. While Soorty's C2C denim line has met certification requirements, "the motive in this collaboration layers within the approach itself" (Future Possibilities). Soorty has always been concerned with the environmental impacts of their products and saw how captivating The Fabricant's digital visualization could be." The Fabricant's ability to showcase the look, texture and movement of apparel which only exists in the digital realm, perfectly aligns with Soorty's mission of reducing fashion's environmental impacts via the use of sustainable practice" (The Fabricant). The digital denim garment was featured in a 60 second film that premiered at The Global Denim Industry conference at Kingpins, Amsterdam. The film depicts a futuristic environment composed of smeared, neutral toned textures that set the stage for the digital denim ensemble. The fabric wrinkles and folds as the garment struts forward in space. Shots alter between perspectives, while informative information tags overlay on top of the moving frames. This short demonstrates how 3D product visualization can

Fig 24. Collaboration between The Fabricant and Soorty World of Denim C2C Gold Certified Denim Ad; Source: Future Possibilities

promote and educate consumers through digital data methods without wasting materials. "What we are trying to tell is a story of fairness in combination with technology" (The Fabricant).

The Fabricant is an important precedent case study for my project because their work justifies an industry on the cusp of change. Their studio has influenced the way I am thinking about sustainable fashion collaborating with new technology.

The Museum of Other Realities, or MOR, is an immersive, interactive, virtual reality destination. The non-physical space offers participants a place to share, connect and experience digital art exhibitions together. The museum is hosting a growing collection of interactive experiences and experimental events, supporting and challenging how we utilize digital spaces. To enter the museum, a PC and VR headset are required. Although accessibility is limited to those who have the tools, MOR demonstrates a fantastic digital extension of our physical world.

By teleporting down one of the many winding, red carpet lined hallways inside MOR, you will stumble upon a collection of Cinema 360 experiences curated by the Tribeca Immersive team in collaboration with Marche du Film and Cannes XR. Numerous projects at this event addressed relevant cultural issues such as gun control, gentrification, pollution and more. These experiences are not a game or film but instead are an entirely new category of media. Loren Hammonds, senior programmer of film and immersive for Tribeca states, "At the heart of Tribeca Immersive, is our commitment to showcase new technology and social experiences, a dynamic vehicle for storytelling," (XR Must). One of those "social experiences" Hammond curated was titled, *The Book of Distance*, an immersive, narrative documentary. The director Randall Okita guides his audience through his grandfather's journey from Hiroshima, Japan to Canada in 1935 to begin a new life.

The experience is staged theatrically, using motion-captured actors. From traveling to establishing new roots by actively building a home and farming fresh produce, the user is eventually summoned into a Japanese internment camp during World War II. The heightened nuances captured of the state-sanctioned racism that follows are profoundly emotional and alluring. Through these moments of active, embodied participation, the story is incredibly immersive and engaging. It's a viscerally emotional journey packed with many moments of storytelling innovations.

MOR is designed for curation and this makes the future online world of digital experiences that much more exciting; It's always changing and evolving, reflecting a moment in time. For example, the fashion world during the emergence of the COV-19 pandemic has been under immense pressure. Once lock downs were globally implemented, fashion houses were faced with new challenges like how to stage a show that could no longer take place in person. The industry at large has been scrambling and searching for innovative solutions to tackle the necessary social distancing, temporary closures of brick and mortar locations and the cancellation of in person runway events. Some of the higher end fashion brands have turned towards virtual events.

"The Fabric of Reality" is the first of its kind produced by Verizon Media's Emmy Award winning immersive storytelling production house RYOT, and Fashion Innovation Agency

Fig 25. *The Book Of Distance*, A Virtual Reality Experience of Building A Home in Canada; Source: Sundance Institution

(FIA) at London College of Fashion, University of Arts London (UAL). The Fabric of Reality brought together three-cutting edge fashion designers and paired them with VR artists Stuart Campbell, Vladimir Ilic, Ana Duncan and John Young. The teams worked collaboratively to deliver fashion experiences that were never intended to reproduce the traditional runway show but to rather reveal a deeper understanding of the stories and narratives behind the featured collections. "An exhibition room with sculptural garments and three portals

representing each projects "story world" or self-contained universe, the event attempts a fresh expression of the emotional reality of the sculptural garment" (MOR). The exhibit overall attempts to re-imagine fashion as a broader category that expands beyond the garment and into the realms of virtual environments.

The Museum of Other Realities has served as a critical project influence because it has challenged my definition of destination. Experiencing The Museum of Other Realities during a global pandemic drove me to question what it means to deliver a product to a customer. Is it about the end product or is it about the experience of obtaining the product? I would argue that it is about both. The runway, for example, is supported by a narrative context set by factors such as lighting, location, music, and models. I have always admired when designers take a special sensitivity to runway presentation but until experiencing a place such as MOR, my imagination had not previously wandered into the possibilities for what this could mean for the future of virtual fashion events.

Fig 26. *The Fabric Of Reality*, A Collaboration with #FashionInnovationAgency, Verizon Media and Kaleidoscope; Source: Damara Inglês

Theoretical Framing

Remediation

The prefix *augment* means to enhance, make stronger, or extend and that is exactly what AR applications aspire to do. Augmented Reality, is the technology responsible for integrating digital content on top of or in juxtaposition with real world places or physical objects. This project illustrates a new way to experience and shop for fashion digitally. Framing a new media theory is important because AR applications lack a conventional UX design. This provides a unique opportunity for creative license, but it is best to evolve digital experiences by evaluating previous and current relationships between user, medium, and content.

Remediation, a term coined by Bolter and Grusin, is the evolution and recycling of content from one medium into another. This concept's elementary origin resides in Marshall McLuhan's reputable statement, "The content of any medium is always another medium" (McLuhan, 8). *Mediation* is the third party participant between the user and the content. In new media theory, it is the digital technology which acts as the bridge between the content and the users. Through the act of mediation, our culture strives to multiply and erase traces of the medium itself (Bolter and Grusin, 5). In plainer terms, new media strives to enrich or deliver a more authentic experience to its audience.

In *Remediation: Understanding New Media*, Bolter and Grusin establish three rationales in new media theory. The concept of *immediacy* is the idea that technology should echo the real world in order to effectively create a sense of presence. This could also be described as *transparent immediacy*, or the degree in which a computer interface registers as feeling "natural." It is important to note that immediacy is not limited to just digital technologies but also appears in older forms of media such as painting and photography. This also does not mean that all forms of visual media strive to achieve realism in a literal sense. If this was the case, how could we justify the range of emotions one can experience while watching an animated Pixar film? Instead, the important quality of immediacy is "the belief in some necessary contact point between the medium and what it represents" (Bolter and Grusin, 30). To make sense of this, "at no time or place has the logic of immediacy required that the viewer be completely fooled" (Bolter and Grusin, 30). It is the discrepancy of what the viewer instinctively knows and what they are viewing that is important. The sense of a believable reality can transmit the depiction of an image. For Pixar, believability is achieved through a keen sensitivity for humanity and the story/character development that persists beyond their ionic, stylized aesthetics. The audience is captivated by the universal message and reliability Pixar delivers on screen. "This naive view of immediacy is the expression of a historical desire"(Bolter and Grusin, 31). It is part of the human-nature experience to gravitate towards opportunities that provide a greater sense of immediacy.

To seek the sensation of presence implies a desire to remove the mediator. Greater degrees of transparency are achieved as erasure of the medium parallels technological evolution. Conceptually, if the medium is removed, the relationship between the content delivered and the

audience is intimate, without interference. Our technology is striving to achieve this. To experience the content feels effortless in the sense that it does not require learning significantly foreign concepts. For example, *Skeuomorphism* is a term used to describe a user interface design which mimics their real-world counterparts. By design, how the user can interact with the interface is partly instinctual because of conceptual familiarity. This is also closely related to the concept of *affordance*—"the relationship between the properties of an object and the capabilities of the agent that determines just how the object could possibly be used...a chair affords sitting...a flat plate mounted on a door affords pushing, knobs afford turning." (Norman, 11). Skeuomorphism is simply the digital accordances of a graphical user interface, and this effectively demonstrates how immediacy is propelled into the design of new media content. In contradiction to transparent immediacy, *Hypermediacy* "privileges fragmentations, indeterminacy, and heterogeneity" by "emphasizing process or performance rather than the finished art objects" (Bolter and Grusin, 31).

Hypermediacy is obvious on a desktop interface or an internet web page consisting of several tabs, sound, text, and video. Its goal is to remind the viewer of the medium where each window is its own visual point of view. Their multiplicities of windows foster a window within a window perspective that "expresses the tension regarding a visual space as mediated and as a "real" space that lies beyond mediation" (Bolter and
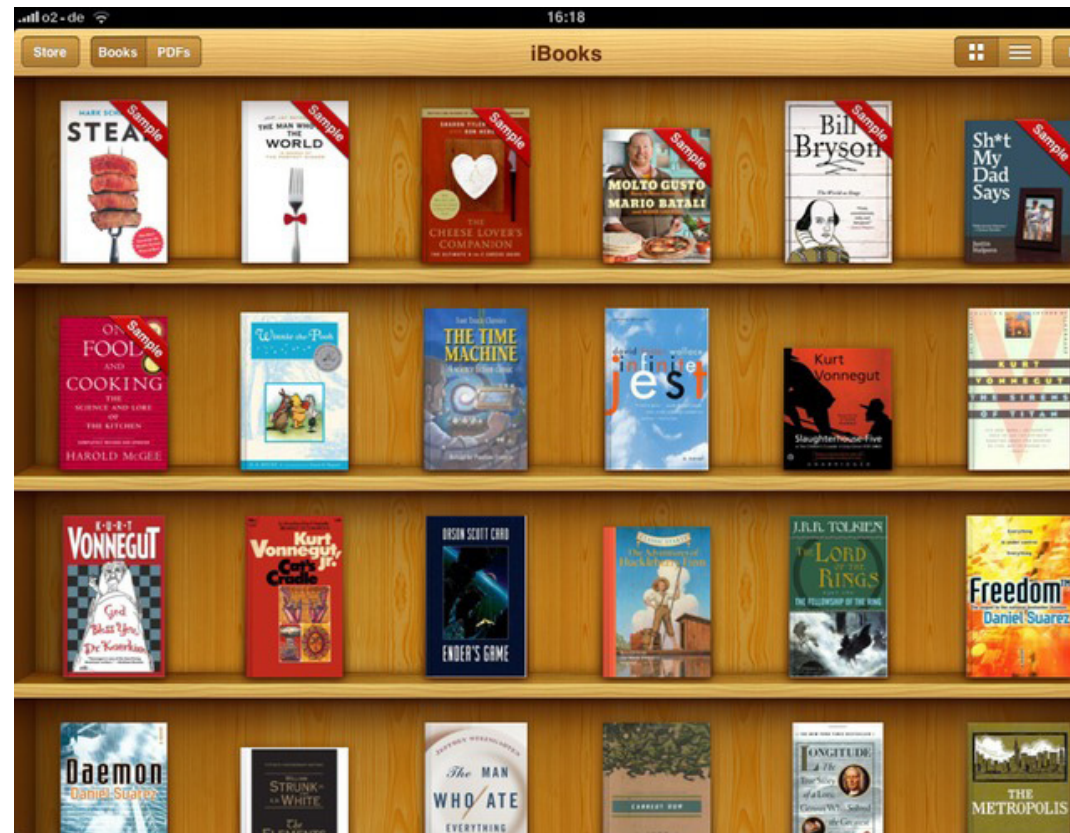
Fig. 27. An Example of Skeuomorphism. Apple uses a Physical Bookshelf Reference for the Interface Design of Their Digital E-Book Application; Source: Wired

Grusin, 41). Hypermedia is created by rearranging existing forms in which "they detach from their original context and then recombined" (Bolter and Grusin, 39). It is a *looking at* and ***looking through*** tension as Bolter and Grusin describe in any collage and photomontage art piece. The viewer is assimilating both the unified surface and fragments of imagery. As each medium is striving to deliver a more authentic experience than its predecessor, "each manifestation of hypermediacy makes us aware of the medium or media and (in sometimes subtle and sometimes obvious ways) reminds us of our desire for immediacy" (Bolter and Grusin, 34). It is this continual evolution of multiplication which is responsible for replacing one medium with another. "The representation of one medium into another is remediation" (Bolter and Grusin, 45) and this feature is a defining characteristic of all forms of digital media.

New media is created through the collaboration of both immediacy and hypermediacy. "Hypermediated productions strive for their own brand of immediacy," through the combination of muti-media and remixed analog predecessors (Bolter and Grusin, 9). Once a medium appears to have achieved a sense of immediacy, that medium becomes appropriated by another medium. Because we instinctively prefer a feeling of immediacy, media progressively borrows and refashions from previous forms of media. It is a continual cycle of progressive creation.

The Phygital Fashion Emporium seeks to democratize high fashion storytelling by remediating luxury market qualities and runway storytelling through the UX design of a 3rd party API. Because the

application challenges the expectation of the runway and e-commerce experience, careful consideration of UI elements that are familiar to the user and foster a sense of immediacy has been foundational to The Phygital Fashion Emporium's development.

Maslow's Hierarchy of Needs

Analysis of the human psyche and behavioral motives that drive our subconscious desires are fundamental towards human-centric design processes. Therefore, Maslow's Hierarchy of Needs is a foundational theory that supports the reasoning behind The Phygital Fashion Emporium. Under careful examination, the consumer's subconscious motives can best be understood and designed for accordingly. *Maslow's Hierarchy of Needs* (1943) seeks to categorize the needs of individuals from a primitive foundation which builds upwards towards a total achievement of an elevated, fulfilled sensation. This justifies the motivation behind human behavioral patterns. "Human needs arrange themselves in hierarchies of pre-potency. That is to say the appearance of one need usually rests on the prior satisfaction of another, more prepotent need" (Maslow).

According to Maslow, it is in our nature to perpetually desire. From having an initial physiological need for survival, to being motivated for safety, followed by love and acceptance, esteem and supreme self-actualization, all needs are built upon the fulfillment of a previous need. Physiological, safety, love, belonging, and esteem are considered as satisfying our basic needs. If one of our basic needs lacks a sense of total fulfillment, we experience anxiety, but when adequately met, we feel nothing. The quest for self-actualization is classified as a higher need. (Maslow, 375). This drives internal motives after basic needs are satisfied or, at the very least, partially satisfied. Maslow describes a cerebral sensation—

the feeling of a new discontent. He describes this feeling as internal restlessness. "What a man can be, he must be" (Maslow, 375). Achieving self-actualization is only resolved by becoming "actualized in what he is potentially" (Maslow, 383).

In response to Maslow, Manheim reviews the relationship between the artistic process and the achievement of self-actualization. He concludes that "the distinguishing mark of a self-actualizing person is that she/he has more frequent and more intense experiences of peak moments than the average person. Peak moments possess an absolute and infinite quality, even though they are momentary experiences" (Manheim, 1998). Peak experiences are the moments in which an individual feels as if they have been hit by a lightning bolt of ecstatic immersion, such as while reading an engaging novel, viewing an expressive painting, or any other creative, memorable act. Maslow believes creativity and all appreciation of creative endeavors, such as attending a fashion show or visiting the museum, are fundamental moments in time when we can achieve a total sense of self-actualization. The moments we feel a high level of engagement are peak experiences which grant us with a sensation of self-actualization. "The concept of creativeness and the concept of the healthy, self-actualizing, fully human person seem to be coming closer and closer together, and may perhaps turn out to be the same thing" (Maslow, 57).

When we think about apparel goods in relation to Maslow's hierarchy of needs, we notice that they satisfy a safety need, such as the need for protection and warmth; However, Maslow suggests that most developing countries sufficiently gratify the basic physiological and

Self-Actualization Needs
Self-fulfillment, personal growth, peak experiences, e.g. exposure to creativity, arts

Esteem Needs
Human ego, recognition from others; value

Love and Belonging
Human ego, recognition from others; value, e.g. positive relationships, receiving and giving affection, being part of a group.

Safety Needs
Physical safety, e.g. war, violence/abuse, racism, other harms, physical health and security, e.g. job, financial and emotional.

Physiological Needs
Universal, basic of human survival, e.g. food, drink, shelter, clothing, warmth, sex, sleep.

Fig 28. Maslow's Hierarchy of Needs Adopted Visual; Source: Maslow, 1943

safety tiers. It is interesting that Maslow's claims are based on this assumption in 1943. Today, as we are much more globally connected, it should be brought to our attention that this project is considering Maslow's hierarchy of needs from a Western perspective and does not claim the general assumption that Maslow's most basic physiological and safety needs are met in most developing countries. Today, we find our motivations driven by a need for love and acceptance, self-esteem and self-actualization.

Conspicuous consumption is the "ostentatious display of wealth for the purpose of acquiring or maintaining status or prestige" (Vablen). Emily Huggard describes fashion as a "vehicle for self-expression and alignment with social groups" (Huggard, 22). Because fashion can be used to signify aligned aesthetic preferences or more importantly, the intangible values and lifestyle of the individual, this makes sense why one would buy into a conspicuous good in the first place—to receive acceptance, recognition and praise by identifying their sense of worth through their material goods. Conspicuous motives for purchases are not the primary vehicle driving consumers' motives as they once were because we have shifted from a dated industrial market into a new era—the experience economy. With the rise of affluence and the integration of consumer technologies, Maslow's hierarchy of needs does not consider how new media is affecting our internal quest for self-actualization.

The experience driven market has emerged due to a general growth in prosperity and falling prices in manufacturing. The consumer of today seeks authenticity and this has become increasingly important because it "appeals to the senses and perception and is closely related to values and meaning" (Gilmore and Pine). Mirroring Maslow's hierarchy of needs, "many markets today—including fashion—have shifted from offering the basic priorities (i.e. availability, cost, and quality) to satisfying the desire for personal growth, by offering an experience and better yet, a transformation" (Gilmore and Pine). Within the model of consumer sensibilities, the levels of authenticity/experience and meaning are important and demonstrate what a brand today should strive to deliver. Basic level economical options remain detached, but experiences are inherently personal because they are unique to each consumer. Pines, the author of *The Experience Economy* states "People greatly desire them because the value of experiences lies within them, where it remains long afterwards." A study conducted by Cornell's psychology professor Travis Carter and Thomas Gilovich determined that buying experiences makes people happier, with a greater sense of well-being, than the purchasing of goods" (Carter & Gilovich).

The return to a romantic sensibility has been propounded as a key attribute of our era's philosophical and aesthetic movement. Providing an experience that nurtures the consumer's needs for self-actualization may seem decorative in the eye of a postmodernist, but we are in fact in the era of Pseudo Modernism or Metamodernism. Metamodernism stresses engagement, emotion, and storytelling. It is a structure of feeling. (Metamodernism). Through the analysis

Meaning
Transformation: charges for demonstrable outcomes and benefits consumers receive by using the economic offering.

Authenticity
Experience: charges for the feeling customers get by engaging with it.

Quality
Services: charges for activities you perform

Cost
Goods: charges for distinctive, tangible things

Availability
Commodities: charges for undifferentiated products
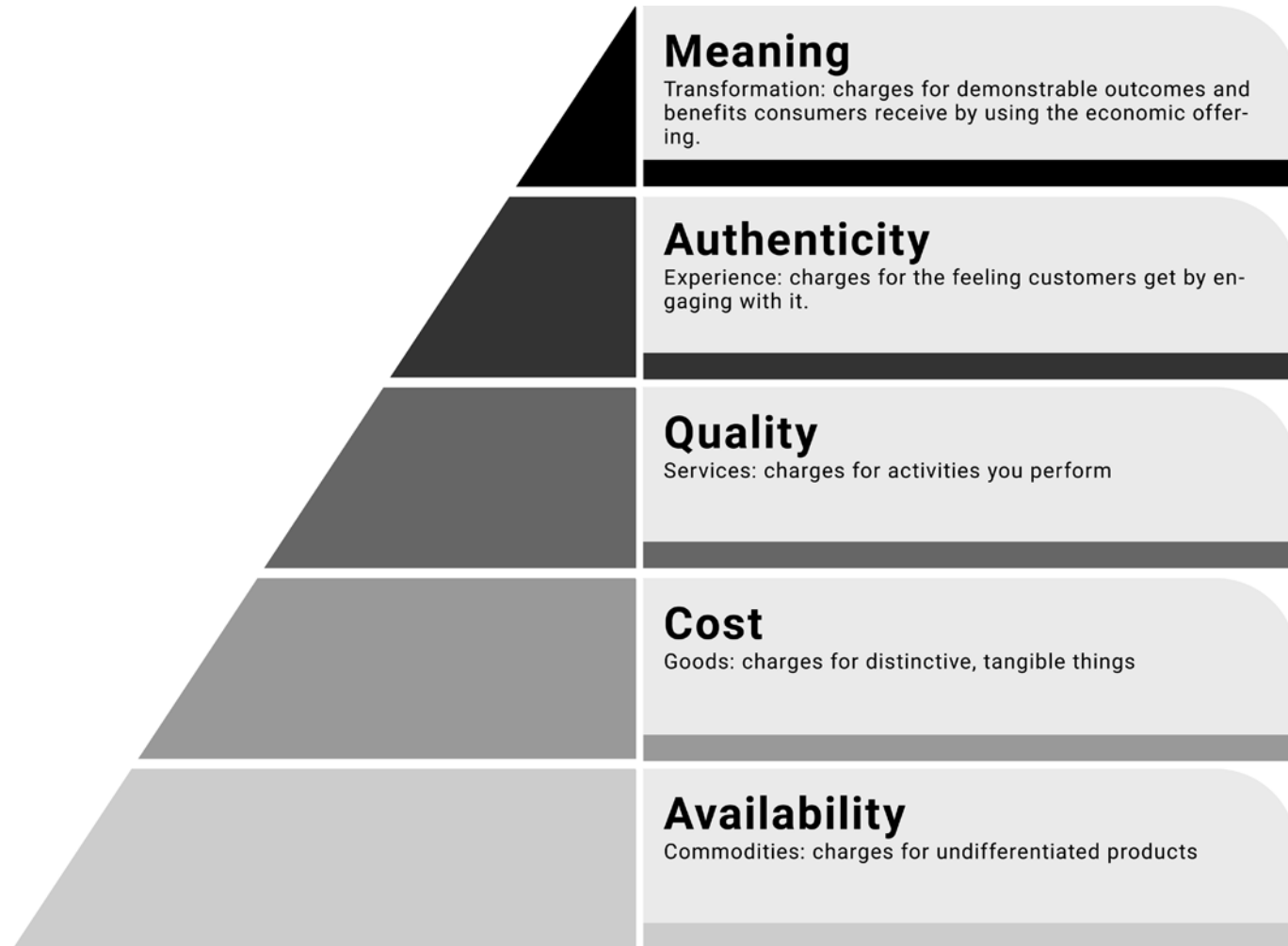
Fig 29. Hierarchy of Business Imperatives and Consumer Sensibilities; Source: Adapted from Gilmore and Pine, 2009

of Maslow's hierarchy of needs, we have concluded that our environment determines our configuration of desired human needs. We are internally driven by metamotives. Metamotivation steers and "impels an individual towards self-actualization and excellence" (Wikivisually). It is the distinguishable difference between basic needs and being needs.

Millennial's and Gen Z's have largely been supported by the transfer of wealth from their baby boomer parents. The majority fulfilled their basic level of needs, according to Maslow, from birth. Being needs are the pinnacle motivations defining consumer behavior choices. By considering e-commerce as a service which strives to deliver engaging and authentic, personalized experiences, The Phygital Fashion Emporium would appeal to the consumer's inner pursuit for identity and meaning.
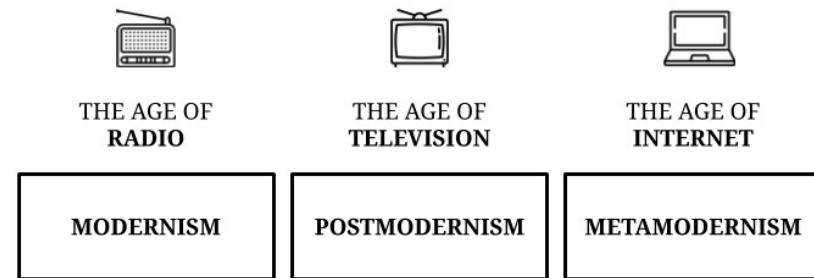
Fig 30. Metamodernism: The Cultural Philosophy of the Digital Age; Source: Ness Labs

Fashion Diffusion Theories

Diffusion theories seek to explain how trends are spread and adapted by the population. They were established through the works of classical sociological theorists who articulated how fashion was bound to social class hierarchies. It began with Dutch-English writer, Bernard Mandeville, in his well known book, *The Fable of The Bee*, published in 1705. His text became a pivotal document which changed the collective understanding of the relationship between social and economical structure found within society. Former social theories included "social institutions of divine intervention or by human will and plan" (Eveling). The moral of Mandeville's story suggests that flourishing societies only emerged from individuals who were self interested and driven to fulfill their own personal desires. At that moment in time, it was a provocative truth to claim given the shared belief in the act of self-sacrifice as an ethical code of conduct. It re-positioned the motivational influence defining the human condition.

The first fully articulated sociological theory of fashion is the *trickle-down theory* whose roots emerged from the influence of Mandeville. "Mandeville held a positive view of fashion and luxury in which he saw key drivers of prosperity" (Aspers et al.,179). Other processes used to articulate fashion included imitation as a dual motivational trait. Imitation was a tool used to express respect but also to assert oneself in a similar position of their superior. The sometimes contradictory nature of fashion driven motives and expression are found within these early sociological publications. Both theorists,

Simmel and Thorstein Veblen, are seen as the fathers of fashion's trickle down theory. Georg Simmel believed fashion was both the expression of individuality and class belonging while serving as a catalyst of imitation and differentiation. For Simmel, it was this push and pull effect of two competing elements, inclusion and exclusion. For Simmel, "fashion represents nothing more than one of the many forms of life by the aid of which we seek to combine in uniform spheres of activity the tendency towards social equalization with the desire for individual differentiation and change" (Simmel, 133). Simmel's perspective incorporated a new observation of social dynamics in the analysis of fashion adoption patterns. The *trickle down model* emphasizes social class distinction because those individuals who identify with a lower class will seek to align with the latter, while simultaneously, the top will seek distinction and distance from the rising tier class. The *trickle down theory* is the standard theory of fashion, but it has been challenged in subsequent years.

Trickle-across theory, also known as *mass market theory*, was an ideology based on a fashion behavioral marketing strategy established by Charles King in 1963. This market strategy ignores segment differences and rather aims to appeal to a larger market share. In King's early work titled *Trend Adoption: A Rebuttal to the Trickle-Down Theory*, he articulates his case for why the formal *trickle-down theory* isn't sufficient in contemporary culture. King was observing the effects new media channels had on communication. From King's perspective, *trickle-down theory* did not address how mass communication altered the economical social spectrum. Through his research, he identified fashion leaders in all economic classes. "Style can appear simultaneously in all class

strata, just at different price points"(Miller et al.,34). Advertising through television and radio allows for fashion trends to move horizontally between social class tiers. This created a new type of fashion forecasting in which multiple lines of product are designed for different market segments. "Retail giants offer similar trends at different price points in order to capture a larger market share"(Miller et al.,34).

Trickle-up theory was introduced by Paul Blumberg in the 1970's. It is "an upward flow of innovative influence from lower to higher status levels, a process which he calls the Status Float Phenomenon"(Field). It is when specific trends emerge from the lower income stratas and are adopted by higher social classes. The popularity of blue jeans and t-shirts are the perfect example of a trend that emerged from the blue-collar worker but later were featured on the catwalk of high end runway presentations. This theory recognizes another type of high class tastemaker, shaped by a time of which they did not hold such an influential position within society. As a tastemaker who climbed up the social ladder, Coco Channel is a perfect example because her influence brought a new type of casualty to womenswears. Prior to her popularity, women wore restricted clothing such as hoop skirts and corsets which greatly limited the ability to perform specific daily activities. Coco created a new fashion trend that promoted freedom in physical mobility through a simple sportswear aesthetic. She was influenced by the ease and comfort of men's attire. Coco's simpler life before marriage manifested within her work. This quality became quite the sensation throughout higher social classes and *Trickle-up theory* supports this accord.

Trickle-down, *trickle-across* and *trickle-up* are the foundational theories of fashion. Not one of these theories can support the diffusion of fashion alone. Maybe at one particular time they could, but we are communicating in vastly different ways today than at the time these theories were conceived. *Trickle-down* and *trickle-across* focus on the dichotomy of class distinctions. *Trickle-across*, what seems to be the closest model that describes how fashion is diffused today, considers the role new media plays within the process of fashion diffusion. Acknowledging the time period King developed his counter theory, the world wide web did not exist for the mass distribution of content. I argue that there must be a better explanation for the diffusion of fashion that takes into account the Internet's capacity to transcend time. The hyper-linked nature of the web connects all to a network of exchange at any given moment. Ubiquitous, digital connection increases the rate in which ideas cross pollinate and circulate amongst society. In addition, fashion diffusion theories are fabricated through a lens of social and economical segmentation, yet just because someone identifies as belonging to a lower economic class does not mean that they will not possess a luxury fashion item despite their inability to afford it. There is also a general lack of consideration for marketing and its effects on diffusion processes. The rise of the digital influencer is another modern phenomenon lacking proper placement within the scope of classic diffusion framing.

The Rhizome is a plant structure that grows underground and has both roots and shoots. These can simultaneously grow

under and above ground. Postmodern theorists, Gilles Deleuze and Felix Guattari, use the term to describe the process of growth which does not stem from a central point of origin. Instead, this root structure grows from a variety of directions making it hard to uproot or destroy. The complexity of fashion diffusion today has an overwhelming number of factors influencing the eb and flow of fashion adoption patterns. Our digital networks that connect everything and everyone simultaneously are influencing these patterns. The rhizomatic nature of cyberspace decentralized structures, which hold the capacity to democratize classic luxury based marketing techniques of fashion products through the use of real-time computing and digital production techniques.

As technology changes accessibility and the way we engage with fashion brands, The Phygital Fashion Emporium seeks to democratize the experience of fashion storytelling by providing a platform in which the smaller and or local designer can participate in the same type of fashion curation as the luxury fashion house.

Project Overview

Sweat Equity Challenge/I-Corps

Hosted by the Office of Research Commercialization at NC State, I participated in a guided market assessment through phase two of the SEC, Sweat Equality Challenge Program. It was a four week NSF I-Corps course designed to teach participants how to gather feedback and data to identify a target market for a software solution or a product idea. The National Science Foundation's (NSF) I-Corps program's ultimate goal is to quickly assess the translational potential of innovative solutions and connect its participants to funding opportunities and technical expertise in preparation to launch a startup.

Over the course of four weeks, I was assigned the task of conducting 20 interviews with potential customers, using the framework of the Business Model Canvas (BMC). A *business model* describes the rationale of how an organization creates, delivers and captures value. The canvas is a tool used to visualize the fundamental building blocks when pursuing the launch of a startup. There are nine basic building blocks, but the primary focus of the course was on understanding my software's customer segments and its value proposition.

The number one reason why startups fail comes down to ignoring the customer or simply building something that no one wants. Through the process of customer discovery, I was prompted to validate if my application had a market need. In other words, is my solution solving an existing problem?
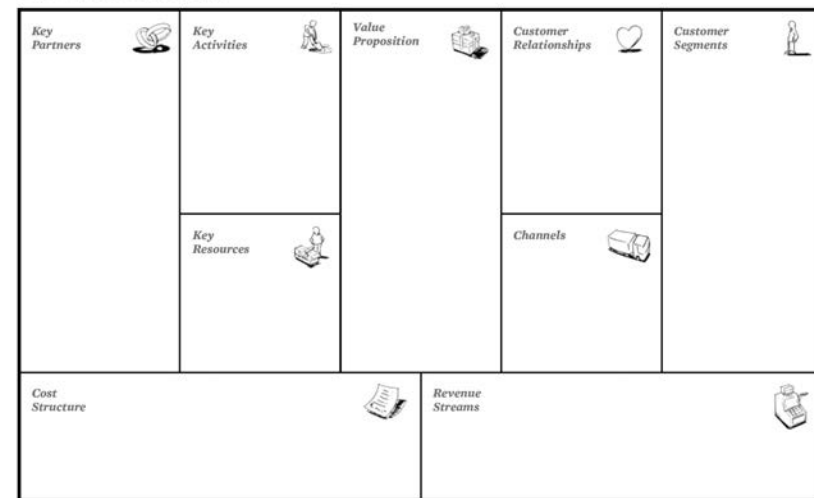
Fig 31. The Business Model Canvas; Source: Alexander Osterwalder, and Yves Pigneur, 2009

There are two forms of commercial transactions, *business to business (B2B)* and *business to consumer (B2C)*. In a B2B transaction, the business is selling their product or service to other businesses. In a B2C transaction, the business is selling a product directly to a consumer. I conducted interviews with both B2B and B2C customers. I discovered that my B2C customers did not verify the market but rather verified the habits of online shoppers. My B2B customers provided richer industry insight that helped verify if this application had a marketplace.

Based on the I-Corps formula, it was advised to begin the interviews with a draft of questions on hand that were broad and did not mention my end market solution. By excluding my product idea from the conversation, I could better observe what potential market gaps currently exist. While I was observing customer pain points, the goal was to also identify who the potential customer would be. This consisted of identifying the customer's age, occupation, lifestyle choices, as well as other competing needs that may affect whether they chose to engage with my product solution or not. Shopping habits such as frequency and time of day were also considered. I started by reaching out to businesses explaining that I was conducting research on fashion's e-commerce ecosystem.

My initial inclination thought it would be difficult to find fashion brands to interview, especially since I was conducting the interviews over Zoom as opposed to physically visiting retailer locations. So many individuals are now accustomed to working remotely that it was easier for me to conduct interviews with people that I may have never had the opportunity to speak with otherwise. I conducted a total of twenty interviews within the two week time period. Fifteen of these interviews took place over a zoom call while two took place via a phone call, one via email, and one via Instagram messages. I reached out to just over a hundred different brands. I thought I could use *Linkedin* Messenger to request interviews, but even with a *Linkedin* premium account, you can only send ten messages each month to anyone outside of your network. To get around this constraint, I used *Snovi.io API* in order to scrape and verify emails of potential contacts that I hand selected on *Linkedin*. This was extremely useful. The course leaders advised contacting individuals that held a lower level position within a company since they were more

likely to set aside time for an interview. In my experience, the brands I reached out to were small and as a result, I did end up speaking with several CEO's.

To summarize my inquiry, I was quite surprised by the size of the companies I interviewed. Across the board, all brands seemed to appear much larger online than they were. In reality, some of these brands were only run by one or a handful of individuals. While this was unexpected, it also verifies the importance of cultivating a strong web presence. To further support this, I had several interviewees confirm that increasing their web presence and social media engagement had become their top priority and will continue to be in the coming future. Participating In New York Fashion Week is expensive at 25,000 USD to debut ten looks pre COVID-19. Virtual Fashion Week 2020, cost 6,000 USD to debut ten looks but the designers had zero control over the models, shoes, setting or music. For Andra, owner of MOORE Goods, this was a huge disappointment as she felt powerless over her brand's image. According to Karina Tselnik, retail launch engineer at Garmentory, apparel sale transactions placed through a website primarily occur on a cell phone, as opposed to a desktop computer. The Instagram interface encourages endless scrolling, but a brand like DÔEN wants their customers to spend more time with their content. The B2B interviewees all stated that they would consider hiring a third party solution to build more interactive, media based experiences for their e-commerce audience. In fact, Cissy Huang, the brand

manager of Entireworld, mentioned such a solution could even replace the brick and mortar all together since the overhead to open a store front was quite high with hard to measure return value.

Participating in the SEC program was a crucial step in the development of The Phygital Fashion Emporium application. The qualitative research collected confirmed that fashion brands are in need of a new solution to engage with consumers moving forward. It verifies that brands are recognizing the future value of interactive e-commerce experiences and are dedicating more energy and resources towards e-commerce marketing. All brands interviewed seemed to express value towards a solution that better represented their product and connection to the consumer virtually.

Key Terms + Tools

Marvelous Designer, MD | Cloth simulation program used for digital garment creation in 3D art, film and 3D animation. Developed by *CLO Virtual Fashion, Inc*.

CLO3D | 3D fashion industry software used for the creation of virtual, true-to-life garment visualization and production. Developed by *CLO Virtual Fashion, Inc*.

Character Creator 3, CC3 | *Reallusion's* character creation software used for the production of realistic and stylized animation ready characters. Designed for use in *Reallusion's iClone* 7 or other external 3D packages.

iClone 7 | *Reallusion's* real-time 3D animation and rendering software.

Maya | *Autodesk's* 3D modeling and visual effects software with powerful rigging, animation and simulation features.

Adobe Substance 3D Painter, Formally Substance Painter | 3D photo realistic texturing and rendering solutions for digital assets.

Augmented Reality, AR | Technology driven enhancement of physical reality by the integration of superimposed digital elements, sound or other sensory stimuli.

Adobe After Effects | Visual effects, motion graphics, and

compositing software used in the post-production process of film making, video game and television production, developed by *Adobe, Inc*.

Adobe Illustrator | Vector graphics editor and design program developed by *Adobe, Inc*.

Adobe Photoshop | Raster graphics and photo manipulation editor developed by *Adobe, Inc*.

Adobe XD | Vector based user experience design tool used for web and mobile applications, developed by *Adobe, Inc*.

Unreal Engine (UE4) | Developed by *Epic Games*, an advanced real-time 3D creation platform used in the production of games, immersive experiences, simulation training and photo real visuals.

Virtual Reality, VR | Immersive, computer-generated simulation of a three-dimensional environment that can be explored or interacted with by a user.

DCC | Digital content creation applications.

Alembic File (.abc) | Interchangeable computer graphics file format that stores complex, animated scenes into a non-procedural set of baked geometric results.

Baked, Baking | Applied to a number of different processes in context of the 3D asset creation such as the case within texturing, animations,

simulation, etc. Typically related to the process of capturing pre-computed data by freezing or recording computational processes.

FBX (.fbx) | Developed by *Autodesk*, it is a file format originally created for the recording of motion capture data. FBX supports 3D models, scene hierarchy, materials lighting, animations, bones, skinning and blendshapes.

Compositing | The digital technique used for combining visual elements from separate sources into a single image or video.

Motion Capture | The process of recording movement of objects or people for later use within a digital ecosystem. Widely used within entertainment, gaming and film making.

UV Map | The 2D flat of a 3D model. It is used to project images or textures onto a 3D model's surface.

UDIMs | An automatic UV offset system that assigns an image onto a specific UV title. Allows the model to display multiple lower resolution texture maps from neighboring surfaces onto its form resulting in an overall higher resolution final product. UDIMs are better on performance than the use of a single, ultra high-resolution image or texture.

Warp, Portal, Teleportar | Video game elements that allow a player character to instantly travel between two locations or levels.

Six Degrees of Freedom | The six ways (independent parameters) that a rigid body can move in three-dimensional space—Dimensions: X, Y, Z and rotation: Pitch, Yaw, Roll.

Alpha Channel | Additional color channel that represents the degree of transparency or opacity of a color.

Shader | In computer graphics, it is the software's internal recipe which determines how each pixel is rendered onto the screen.

Workflow | A specific sequence of software processes used in the creation of digital assets and experiences.

FPS | FPS is the acronym for frames-per-second. Frame rate is the frequency of consecutive images that are recorded in an animation. The term is used in film, video cameras, computer graphics, animation and motion capture systems. Frame rate is sometimes referred to as frame frequency.

The Experience Comparison

The core of this project is about crafting a new type of e-commerce experience. My research question developed out of an early observation between luxury and consumer brands and their in-store and online experiences. Visiting a place like J.Crew is a completely different experience compared to visiting a place like The Gucci Garden.

To illustrate, mall storefronts seem to be under the general consensus that the customer is expected to "pop in" when they have arrived at the intended destination of choice—the mall. This means that the appeal of going to the mall is not one singular experience the consumer is seeking, but instead is the collection of options that are available within a centralized location. But what is it that draws the customer into one store over another? It is usually a window display that is crafted and curated to resonate or capture the mall goers attention that attracts them.

Let us imagine the customer with an upcoming beach trip. They are excited and ready for the much needed vacation time and feel they need something special to wear for the occasion. As this customer wanders around the mall's corridor, they happen to catch a glimpse of the orange and pink, beachy, picnic themed window display. Calm ocean waves light up in the form of an LED monitor backdrop. The loosely scattered mounds of sand and fishing line suspended hibiscus flowers are reminiscent of a late summer shower. These stage props complement the perfectly proportioned, grey

ceramic mannequins, dressed head to toe in topical inspired prints and silhouettes. Although this display belongs to a store the customer does not usually shop in, it has the ability to lure her in. That customer begins to feel a sense of joy when she realizes that she might be moments away from finding the perfect dress for her beach front, tiki lit dinner date next Friday.

If you compare this experience to going to a place such as the Gucci Garden in Florence Italy, you can easily see that they are strikingly different experiences. First, there are many who visit the Gucci Garden for the sake of the experience in itself. The storefront is not about alluring the customer into its chambers. In fact, the storefront appears even rudimentary amongst the typical Florentine facades. After purchasing a ticket for entrance, roughly 9 euros, you will quickly become captivated by its interior that pays homage to the original architecture featuring marble tile flooring, yellow Gucci printed wall paper and classical arched doorways. Gucci designs with the intent of delivering an experience and a product for the Gucci consumer and spectator alike. This may sound unusual, but let me further explain.

Referring back to the vacation inspired mall trip described above, we can expect to be greeted by abundantly overstocked racks once we cross the threshold beyond the flashy window display. As if on cue, we can also expect to be thrown into a progressively messier sales floor as we make our way towards the back of the store, approaching the ultimate depths of the lackluster clearance rack. This description seems to portray the typical brick and mortar experience the majority of clothing stores model. The Gucci Garden, on the other hand, is a three story experiential

destination which fuses together museum curation and luxury retail. Throughout the collection of rooms, glass encapsulated boxes house various historical garments which balance on top of ornamental bourgeois carved wood pedestals. "Objects and artifacts from the Gucci archive, dating back to 1921, sit next to memorabilia and contemporary art pieces. The "Guccification" room shows the transformation of the Gucci logo over time, while "Ephemera" describes Gucci's story from its inception to the present day" (Dorfer). A small cinema room, entrenched by grand fire engine red drapes, features an avant garde film with a central theme based on myth with twelve vignettes depicting the story of Hercules. The Gucci Osteria, an intimate and velvet green dining room serves elevated versions of classic Italian dishes. In many ways, the Gucci Garden delivers an experience similar to that of The Bon Marché or the early emergence of an American department store. Yet, this is on an even grander scale as the garden exclusively features only the Gucci brand.

The COV-19 Infleunce

During lock down, the fashion industry was inundated with disconcerting headlines. Topics ranged from which brands filed for bankruptcy, the end of fashion as we know it, the scamping chaos of hosting a fashion show online, the closures of brick and mortar stores and dressing rooms, etc. If brands did not already sell online, it was clear they were not going to survive. Struck by a spark of curiosity, I compared what the e-commerce interfaces of J. Crew and Gucci looked like when placed side by side. Ironically, by no longer having the option to shop at a retail location in person, I became much more aware of how influential the retail space itself was in my purchasing decisions. By observing my own e-commerce patterns when browsing online, I noticed that I do not always purchase items after placing them in my cart. From previous interviews conducted during my participation in the I-Corps program, I determined that this is not the case for all online shoppers. My personal reflection is what inspired the comparison between the two interfaces. I was taken back by how similar the interfaces appeared between everyday consumer brands and luxury retail. You could argue that these companies rely on transmedia marketing to distinguish and connect with their consumers, but the phrase "out of sight, out of mind" must surely influence the customer's decision as I had myself observed within my own e-commerce habits.
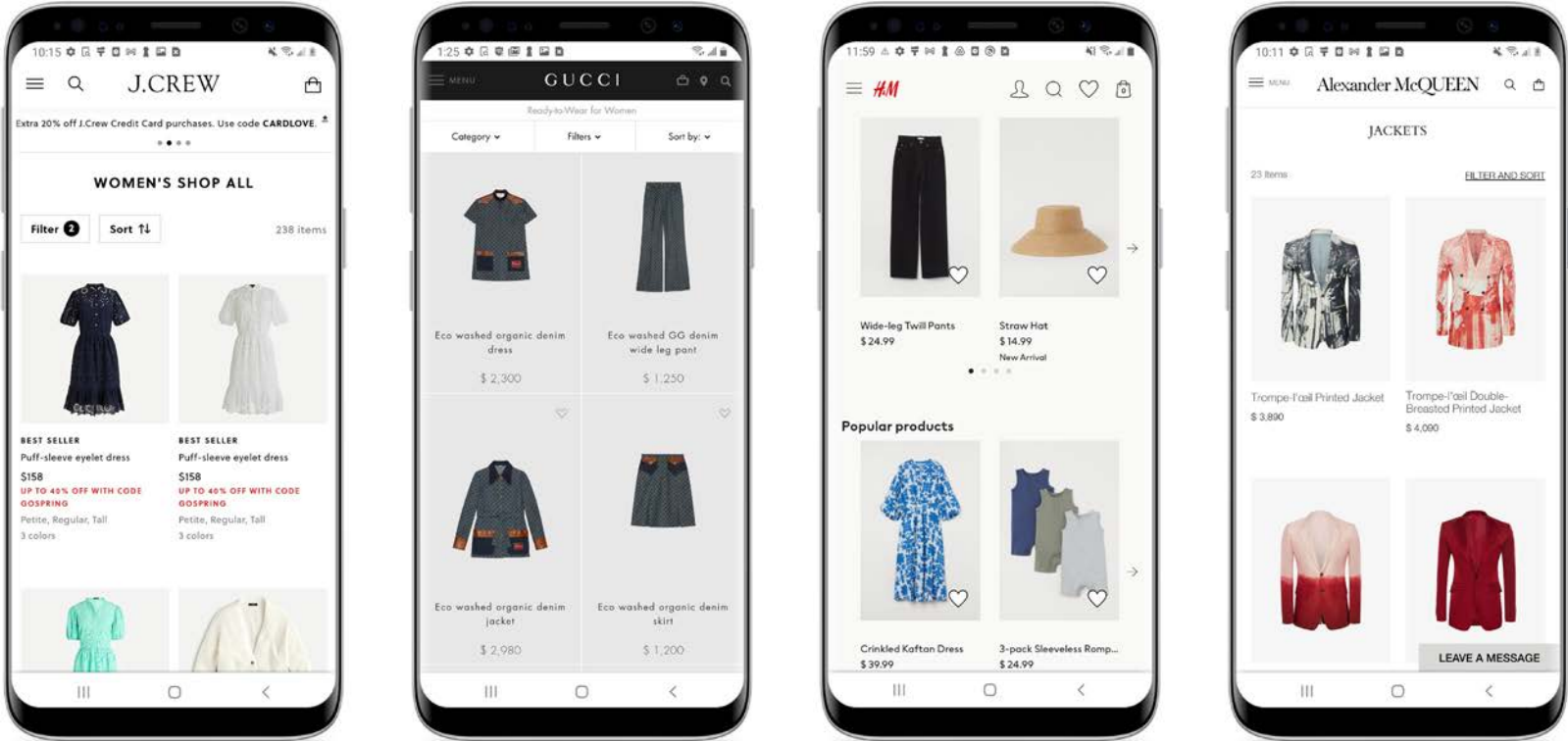
Fig. 32. Luxury vs. Consumer E-Commerce Interface Observation

CLO3D vs. Marvelous Designer

CLO Virtual Fashion Inc. specializes in the development of 3D garment simulation technology that is fundamental to their two CAD based software products. *Marvelous Designer (MD)* is used for the creation of cloth-based assets in CG, animation and gaming industries. *CLO3D*, which shares the same core technology as *Marvelous Designer*, is used for the creation of true-to-life garment visualization. *CLO3D* is a more robust solution comparatively due to distinct features which extend the software's capabilities into the design, development and manufacturing process of real world garment creation. To specify how the two programs differ requires general familiarity with fashion and apparel production standards.

Garment manufacturing differs from other manufacturing industries because it is a dynamic network of processes that vary between brands and manufacturers. The first step of garment production begins with design development and pattern making. There are a wide range of principles, rules and trade methods used in the process of pattern construction, such as tailoring, draping, slopers, and pattern drafting but the primary objective is the same—to finalize a pattern block. A *pattern block* is a 2D flat pattern used as a template for all apparel and soft good products. After the product sketch is finalized by the designer, a pattern maker will begin to draft the initial flat pattern, often by hand. Once this is completed, the seamstress will make a toile, a 3D mock up of the drafted pattern. Fit and style adjustments will be made accordingly and translated back to the 2D pattern. Designers will also review and suggest changes which can be as simple as a hardware change or an entire redraft of the garment's silhouette. All measurements and design specifics such as colorway, trimmings, type of stitching, and fabric

weight will be transferred to a tech pack document. A *tech pack* is the blueprint and assembly instructions for a product. It is an essential tool used for communication between the brand and manufacturer. After the manufacturer retrieves the tech pack, they will produce a series of samples. *Sampling* is the process of making a "finalized" prototype before bulk production begins. It ensures and eliminates the risk of miscommunications and product production flaws. The order of operations involved in pattern making, tech pack development and manufacturing entails much of the same processes across brands, but the tools for how they arrive at their end goal does vary. In some cases, manufacturers will even help determine what the essential POM's (point of measurements) are if this information is not included within the document. When this is the case, the manufacturer's samples will be shipped back to the brand, where fit and style adjustments will be made accordingly. Even if a brand completes the initial pattern draft and fitting before sending it off to the manufacturer, samples will be fitted once again and changes will be implemented where necessary.

Communication between designers, pattern makers and manufacturers cultivates continual evaluation of product, but slows down production time. It is often a repetitive process until the end product vision is achieved. It is also costly and lead times between shipping samples can take two to four weeks when working with factories overseas (AlleyWatch). Tech packs are highly detailed in specifications, but they are

Project Overview

CLO3D vs. Marvelous Designer

BRAND: THE BRAND NAME	DESIGNER: CLIENT NAME HERE	DESCRIPTION: WOMENS JACKET
SEASON: SS18	DATE: MM/DD/YYYY	MAIN FABRIC: FABRIC TYPE
STYLE NAME: STYLE NAME HERE	STYLE #: 11234	SIZE RANGE & [SAMPLE SIZE]: 4 6 8 [10] 12 14 16

FRONT

BACK

BRAND: THE BRAND NAME	DESIGNER: CLIENT NAME HERE	DESCRIPTION: WOMENS JACKET
BRAND: THE BRAND NAME	DESIGNER: CLIENT NAME HERE	DESCRIPTION: WOMENS JACKET
SEASON: SS18	DATE: MM/DD/YYYY	MAIN FABRIC: FABRIC TYPE
STYLE NAME: STYLE NAME HERE	STYLE #: 11234	SIZE RANGE & [SAMPLE SIZE]: 4 6 8 [10] 12 14 16

BODY & POCKET JETS: DEEP WELL
SLVS, CUFFS, COLLAR, PLACKETS, POCKET FLAPS & WBAND: BLACK BEAUTY
LINING: SHARKSKIN

BODY & POCKET JETS: DEEP FOREST
SLVS, CUFFS, COLLAR, PLACKETS, POCKET FLAPS & WBAND: SCARAB
LINING: SHARKSKIN

PANTONE 19-3911 TCX Black Beauty

PANTONE 19-3713 TCX Deep Well

PANTONE 17-3914 TCX Sharkskin

PANTONE 19-5350 TCX Scarab

PANTONE 19-6110 TCX Deep Forest

also constantly evolving documents responsible for recording cost, material and fit changes. Black and white garment *flats* are the 2D schematics included in the tech pack. Colorways and printed graphics are also incorporated into the schematics. All visuals are accompanied by detailed written descriptions and measurements.

CLO3D is marketed as a 3D visualization tool because this is currently where the software excels and is driving value for the fashion industry. *CLO3D* allows designers, pattern makers and manufacturers to communicate in real time, digitally. Silhouette evaluation by designers can be checked sooner in the development process. "On average, it takes about 1 hour and 6 minutes to create a 3D garment, and the output is more than 95 percent close to the real garment fit" (AlleyWatch). *CLO3D* is a subscription based software, offering several plans—student, individual, hobbyist or full business solution for multiple personal operations. *Vertical integration* describes when a company brings in previously outsourced operations in-house. As an enterprise client, *CLO3D* is not just software, but rather a business consultant that provides training, direct support and vertical integration services.

PDM, Product Data Management, emerged shortly after the adoption of CAD based software. They were originally designed as a system for managing, distributing and reusing large scale files within product development. At the time, computers could not easily store large files or share them.

Before the 1990's, PDM addressed this problem only. They later expanded and began to include things such as BOM (Bill Of Materials) and technical document changes. PLM 2.0 continued to introduce new layers to its system by including additional features useful for collaboration. PDM is the core of what PLM is today. PLM, Product Lifecycle Management, was introduced in the early 2000's, as a more inclusive system that contained the same PDM product development specifications, but also included additional data and necessary information related to the entire enterprise. It consolidates documents related to the design, manufacturing, commercialization and marketing of a business. *CLO3D* supports PLM integration. CLO-Vise, a PLM plugin, bridges the gap between *CLO3D* software and an enterprise's current PLM solution seamlessly. The differences between *CLO3D* and *Marvelous Designer* are commonly misunderstood, but the key difference boils down to *CLO3D's* ability to integrate with real world manufacturing systems. As advertised by the company, *CLO3D* supports both import and export of DXF-AAMA or DXF-AST files, which *Marvelous Designer* does not support.

DXF (Data Exchange Format) is an open source file type made by *Autodesk* which stores 2D and 3D drawing information that is compatible with most CAD based programs. It is also vector based meaning it can be opened and viewed with *Adobe Illustrator*. DXF files do not contain scale or unit information. The American Apparel Manufacturers Association created its own data exchange standard DXF-ASTM and its predecessor, DXF-AAMA. The additional standards that they include ranged from external cutting lines used to document seam allowance, grading marks and annotated text. They are specialized file types holding data specifically for pattern makers. There are many CAD systems available; Therefore,

they can be implemented into a garment manufacturing process in a variety of ways. CAD systems can commonly used for their precise calculation and grading capabilities. CAD based files, in other words, digital 2D pattern blocks, can also work alongside CAM software (Computer-Aid Manufacturing) which can further assest automation and manufacturing processes. CAD manufacturing examples include: laser cutting, machine embroidery applications, automated button holing, pattern cutting involving multiple fabric layers, fabric printing, and power driven jacquard looms. *CLO3D* and *Marvelous Designer* share the same interface and the files saved by either program are compatible with the adjacent software. Through research and exploration, I discovered that there is not a clear, articulated breakdown between the distinct differences in software capabilities. Yet, from my experience, I was able to uncover the unique functionalities native to each program.

CLO3D Includes an interior render solution that uses the technology of V-Ray SDK. *V-Ray* is a commercial plugin designed for a 3rd party 3D computer graphics application. It is known for accurately visualizing calculated distribution of light and physical material properties. V-Ray is used in a variety of industries such as in architecture, advertising and VFX in film. Because rendering is completed internally, *CLO3D* offers an extended print layout mode, which allows for better control of print placement. It also simulates print/pattern placement based upon fabric roll specifications
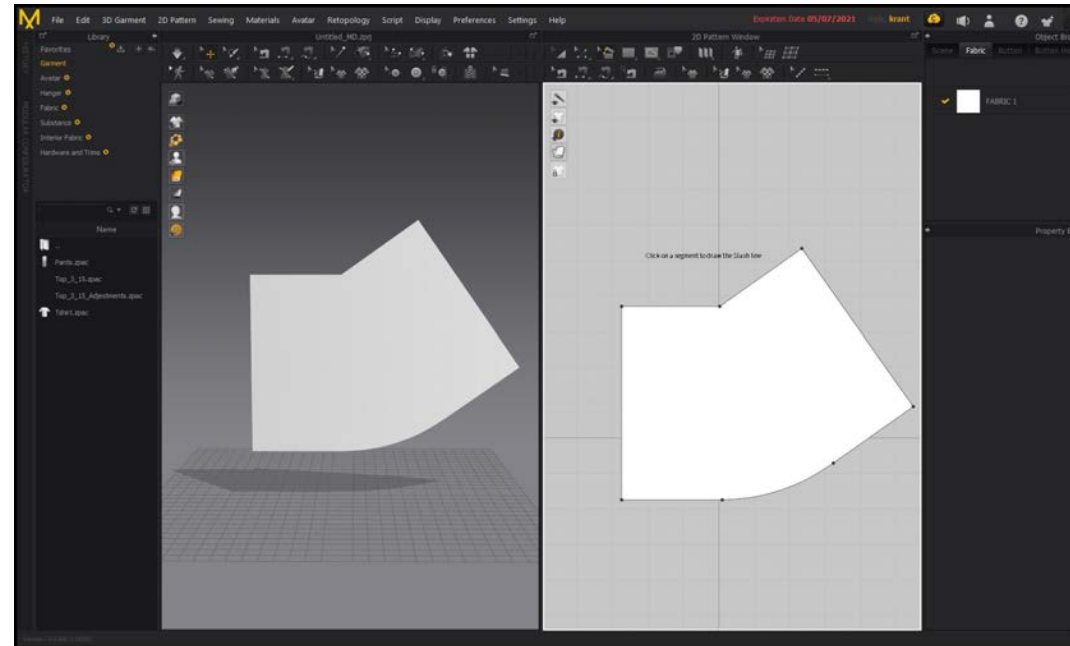
Fig 35. *Marvelous Designer* Slash and Spread Method Adds Points to the Line Without Reference Baselines

such as total yardage length and fabric bolt width. *CLO3D* includes a fabric emulator mode in which a CLO fabric kit can scan and digitize custom fabric properties used for accurate drape and simulation. This feature is only for enterprise clients. *CLO3D* offers a few tools that *MD* does not feature that help facilitate the process of pattern making.

CLO3D offers baselines, which can be used to mimic fabric grainline guides. Grainline guides are commonly used in the draping process of a real garment. These are the visual cues needed in order to tell if the fabric grain is perpendicular to the floor. Fabric grain orientation is an important factor in the garment making process because of its effect on fit. *CLO3D* offers greater control over fullness added to a pattern. *MD* offers a similar tool, *slash and spread*, which is used to add fullness to a 2D pattern while maintaining the length of a specific segment. It is achieved by cutting almost through the pattern and rotating one side. *CLO3D* supports this feature, but it is called *fullness* which has the additional option of smoothing the line that was slashed on the pattern. Smoothing vs. not smoothing in *CLO3D* does not change how the pattern is sewn digitally. That would be why this additional option is not included in *MD*. In real garment construction, you would always smooth this line. It would significantly ease the sewing process, resulting in a much cleaner physical presentation.

CLO3D also features a trace tool which allows you to trace whole patterns or sections of a pattern within the viewport. This can be used to trace patterns from a book without existing measurements or can be used to copy an angle from another pattern. While you can always just compare line segment length in both programs, *CLO3D* features a *walk pattern* tool which simulates the motion of how you would compare and adjust line segment length of a pattern manually. *CLO3D* allows you to add a notch to both pattern pieces in the process of walking a pattern. *Walking a pattern* is a technique used in the process of matching up patterns without having to physically measure. This is particularly useful when drafting a sleeve pattern for a woven garment. When constructing a real
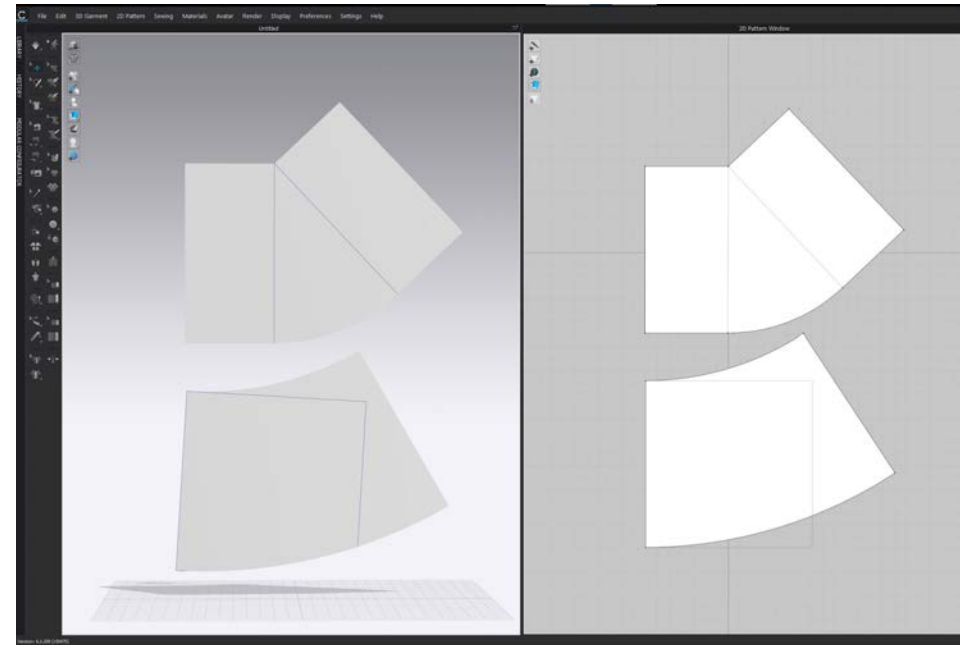
Fig 36. *CLO3D* Fullness Method Creates Pattern Baselines. Baselines Facilitate Greater Accuracy and Track Pattern Alterations. Top Skirt Pattern: Fullness Added by Point tool. Bottom Skirt Pattern: Fullness Added by Line Tool

garment, you always include notches on the sleeve and bodice pattern. When sewing two pieces of fabric together, it is not always necessary for these two pieces to be of equal length.

The Concept of Ease

Top fabric = 18 cm
Bottom fabric = 18 cm
No ease included

Top fabric = 23 cm
Bottom fabric = 18 cm
Excess fabric is eased between notches

Pin always placed on top of notches
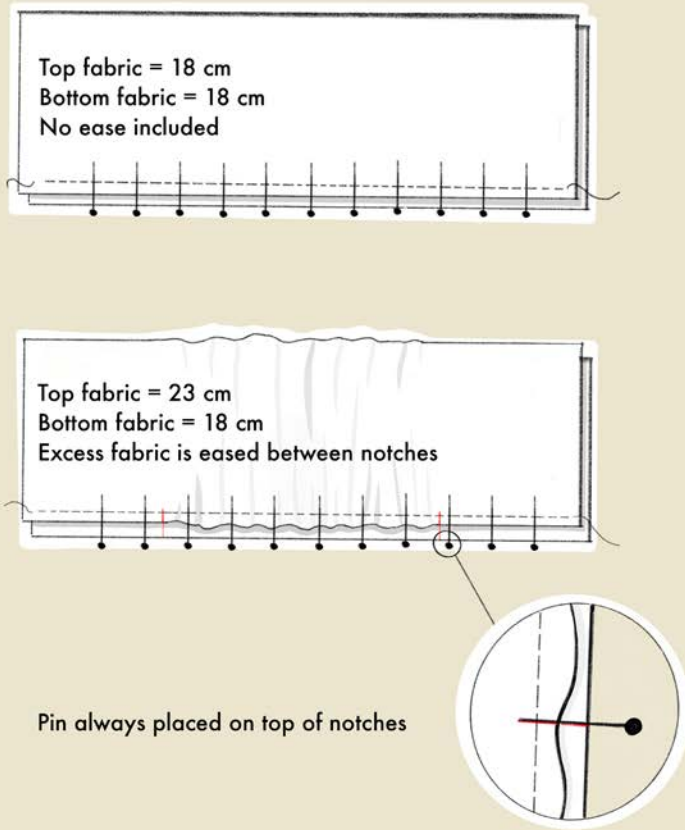
Fig 37. The Concept of Ease

In fact, manipulating this factor determines functionality and styles of a pattern. In some scenarios, you do want your pattern segment lengths to match, such as the case with side seams on a pair of pants. A *notch* is a mark or wedge that is cut into the seam allowance in order to facilitate matching and sewing corresponding seams together during construction. When making a physical garment, you would never leave out the notch because this determines where the ease needs to be distributed. Sometimes ease is concentrated in one particular location across the seam, such as across a back yoke pattern on a button down shirt. For a sleeve block, notches determine where the sleeve cap ease starts and stops. *Ease* is the extra segment length of your pattern that is "gathered" into the adjacent seam—Such as the case when "the sleeve cap was eased into the bodice." Without sleeve cap notches you could end up with an ill fitting sleeve because the segment length would be distributed across the entire armhole pattern rather than within a concentration area. Sleeve cap ease helps shape the pattern to the shoulder. Sleeve cap ease also compensates for the amount of excess fabric needed while raising your arms up in a woven garment. It provides necessary shaping to the pattern and can be further accentuated as a design element. *Notches* and *ease* are basic pattern-making concepts fundamental for pattern makers. If you are making a real garment, you would never leave out a notch because this determines where the ease of your sleeve cap falls.

Marvelous Designer overall has less features, but many of these would serve little, if any, need for individuals working within the CG, animation or the gaming industry. *MD* offers a sculpt mode, but currently is still in early development. Instead of including an interior render solution, *MD*

offers a UV editor mode which is essential for texturing 3D assets. The expectation is that the assets created in *MD* will travel to another software for further texturing and rendering. Even without V-Ray, *MD* still displays basic material and fabric characteristics within the simulation viewport. *MD* features a retopology mode which is useful for optimizing 3D assets. The need to retopologize a 3D asset could mean it will be exported to additional programs that will require careful consideration for runtime performance such as the case with game engines. Additional details can be sculpted in software like *ZBrush* and can be further processed into textured maps that are applied to lower poly meshes within a game engine. This greatly improves runtime performance without compromising details.

Since developing this project, software improvements and updates have continually followed. Both *MD* and *CLO3D* support *Substance* material integration. *CLO3D* now includes a UV editor mode in version 6.1. The original garment patterns for this project were drafted in *CLO3D* because I recognized the value in the additional pattern making tools that this software offers. I approached learning this software with a foundational understanding of the manual garment making process. *CLO3D* does support the full animation capabilities of *MD*, but I did come across a glitch while exporting alembic cache data from *CLO3D*. This was the reason I worked in both programs. When recording and exporting out the exact same files from *MD*, I no longer had the glitch. To conclude, *CLO3D* is designed
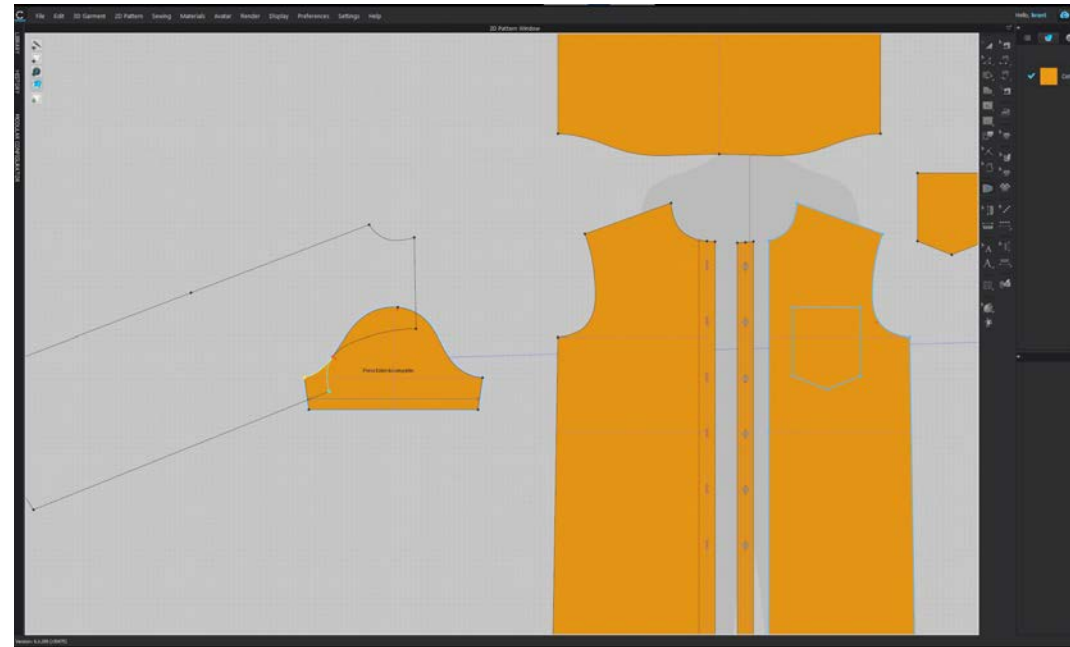
Fig 38. Adding Notches for Distributing Sleeve Cap Ease by Walking a Pattern in *CLO3D*

to be used as a one-stop digital clothing solution, housing everything one would need in the collaboration between software and real world garment production processes. *Marvelous Designer* is intended to be integrated into a larger CG production pipeline.

iClone 7 & Character Creator 3

I used *Reallusion's iClone 7* and *Character Creator 3* in the development of this project. *iClone 7* is a real-time animation software designed to help artists easily assemble animated content. This content can then be applied to their custom, fully rigged characters developed with *Character Creator 3*. The company offers a wide array of plug-ins designed to further enhance and automate some of the processes involved in the creation of game ready content. I took advantage of the *Unreal LiveLink + Auto Setup* plug-ins. These plug-ins automated the process of setting up a digital human shader for the *Unreal Engine*. The ability to generate LODs (Level Of Details) for game assets and other applications that require strict consideration of performance makes this software shine. While I did not use LODs in this project, by researching how to optimize characters for game engines, I discovered these tools. If this project was further developed into a functional application, I could imagine how it would fit into the larger production pipeline.

Fig 39. *Character Creator 3* Interface and Model Design

Alembic File Type Explained

Alembic or *Alembic cache (.abc)* is a universal file format designed for exchanging 3D animation data. 3D animation often includes rig systems to control animation of an asset or character. Alembic works by baking only the vertex location of the mesh during animation. This eliminates the need for a formal rig system. The rig is constructed of bones and joints. The bone and joint locations and rotation values are keyed on a timeline and this determines the changing shape of the mesh over a given period of time. The process of changing the shape of a mesh is known as *deformation* and can involve several other processes such as skinning, binding, and weight painting. Weight painting includes further fine tuning mesh distortion by the act of painting how much of the mesh is affected by the deformation. Since setting up a rig system for realistic cloth movement is a very complex and tedious process, all cloth animations were implemented as alembic files in this final project. Alembic cache animations are prerecorded, therefore, not running in real time. Because of this, physics properties within a game engine cannot interact with this type of animation. Alembic files tend to be large file sizes and should be used sparingly.
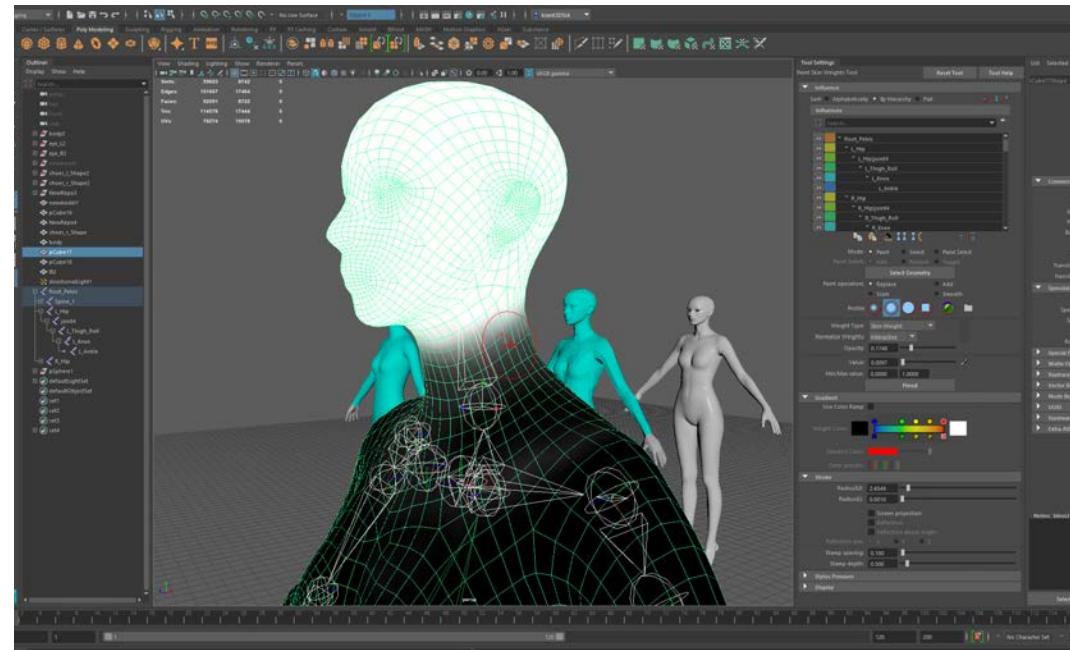
Fig 40. Example of Joints, Bones and Weight Painting in a Formal Rig System Set Up in *Maya*

The Unreal Engine

I used a game engine to build, compile, script and capture my final footage of The Phygital Fashion Emporium video walk through. The *Unreal Engine* (UE4) is a complete suite of creation tools used for game development, architectural & automotive visualization, linear film & television content creation, broadcast & live events, and training & simulation. *Unreal* is a popular choice amongst content creators because of its state-of-the-art, photo realistic rendering capabilities and dynamic physics and effects. *Unreal* is also free to download and use. According to their "End User License Agreement for Publishing, a 5 Percent royalty is due only when you monetize your game or interactive experience and the gross revenues exceed 1,000,000 USD" (Epic Games).
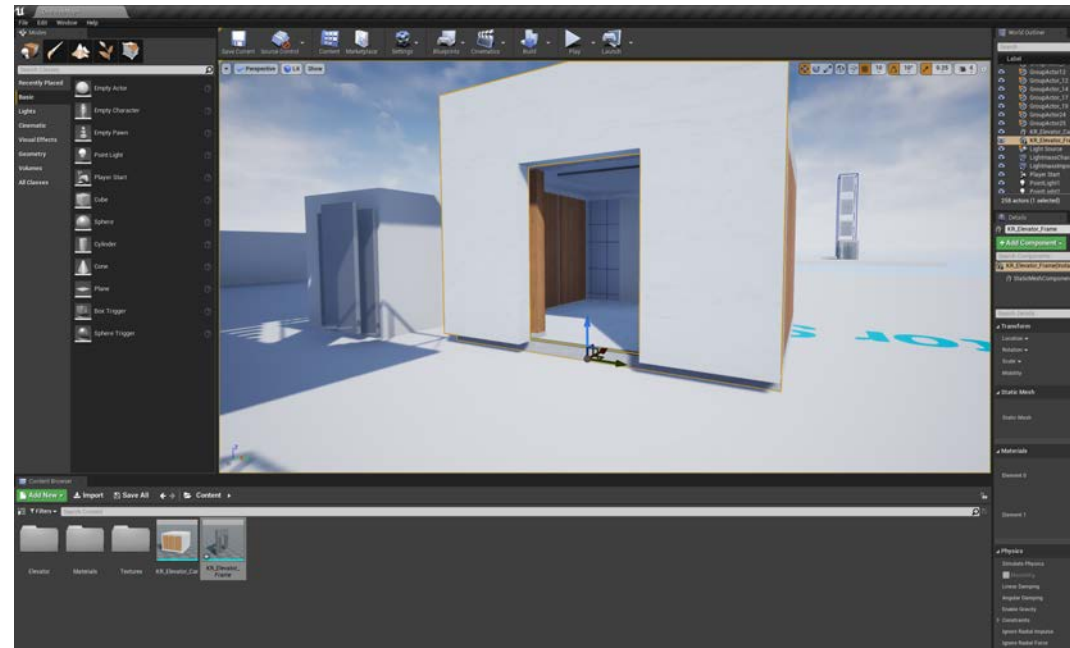
Fig 41. Working Elevator within the *Unreal Engine*

Substance Painter

Adobe Substance 3D painter is a photo realistic texturing application used for 3D Models. While completing this final project, *Adobe* acquired *Substance Painter*, but the core of the program remains the same. In 3D modeling, different combinations of textures and materials determine the final rendered surface of a 3D object. Any .jpg or .png file classifies as a *texture*, although it is common for an artist to combine several pictures into a single texture image. In my project, the print designs are textures. I combined several of my own illustrations within *Photoshop* in order to make a repeatable pattern. A *material* controls the appearance of the 3D object on the screen. Materials take textures as parameters. Materials also control how reflective or dull the rendered surface appears. A final material often uses several texture maps in combination. For example, one material could be made up of a diffused map, normal map and specular map. Even though I could have just used the texture maps created within *CLO3D*, I used *Substance Painter* to add additional details to both the texture maps and materials of my final garment designs.
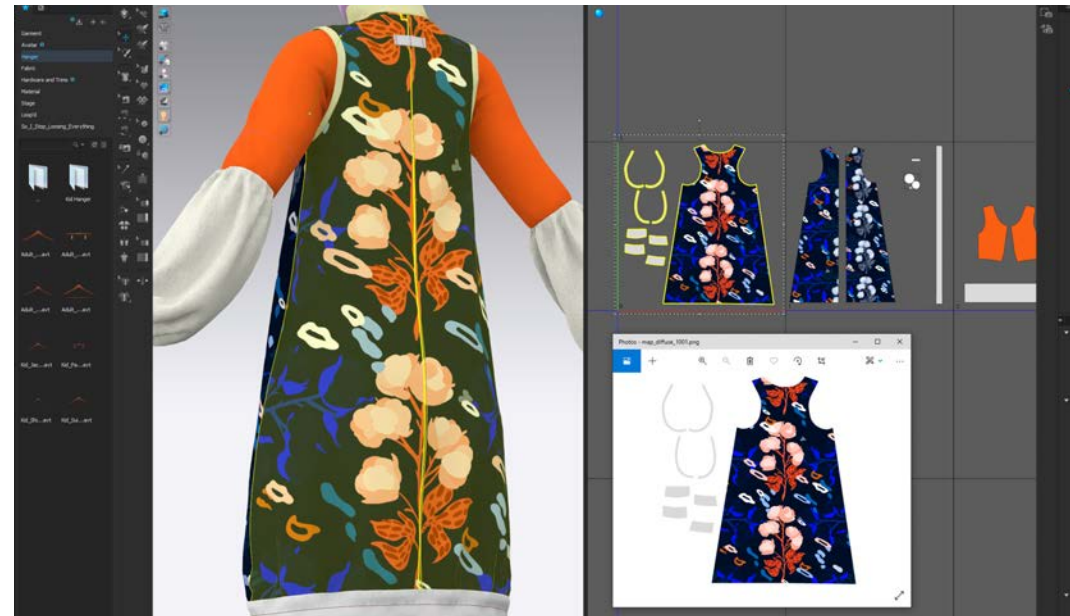
Fig 42. Baked Base Color Map from *CLO3D* for Correct Print Layout in *Substance Painter*

Project Description

For this project, I designed a digital fashion collection, titled Loop'd. The Loop'd collection features original mix and match print designs intended to promote fashion system education. Each print was designed with a quirky eco-centric backstory. The goal for this print collection was to express fashion transparency through the surface of the garment. Ideally, the hypothetical customer would be reminded long after the tags were removed what philosophy they "bought" into.

Augmented Reality is a superimposed computer-generated image onto a user's view of the real world. With the Loop'd collection, I explored the ways in which the design of an augmented reality interface could empower consumers to virtually try on, interact and shop through a 3D interface. By digitizing runway presentation and the in-store experience, this project proposes that we can democratize the industry of fashion because this space allows for smaller or local designers to compete on the same level as high end or corporate fashion brands. A remediation of runway storytelling through the implementation of augmented reality, The Phygital Fashion Emporium empowers consumers to become active participants in their e-commerce shopping experiences.

I explored setting up and implementing an augmented reality template built with the *Unreal Engine*, but I discovered that the *ARCore SDK* has not been supported like many of the other packages within the engine. Unity would be a better platform choice if I was to fully develop this application. For the scope of this project, a mock-up of The Phygital Fashion Emporium application featuring the collection, Loop'd, demonstrates a future e-commerce solution that will democratize the experience of fashion storytelling and marketing. It will showcase the applications interface design, feature 3D places, dancing models and virtual try-on sessions. By implementing augmented reality into the design of e-commerce, the consumer now has the opportunity to bring the dancing models into their own personal space along with the option to bring any asset placed within these worlds into their own for a more personalized, Instagrammable moment.
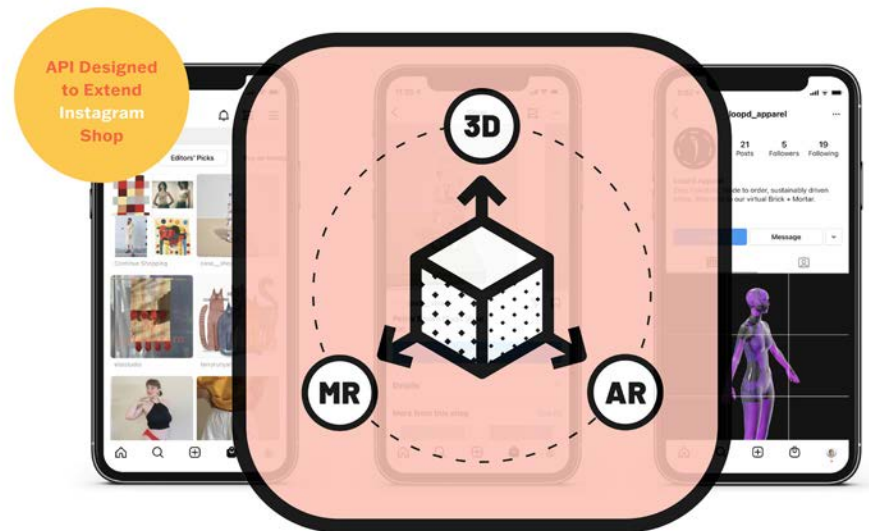
Fig 43. An API Designed to Extend Instagram Shop: 3D Place, Mixed Reality, Augmented Reality

Fig.44. The Loop'd Collection Sketches

RANT

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Project Overview
Project Description

Fig. 45. The Loop'd Print Collection

Navigational Mechanics

The sensor that powers the navigational mechanics of The Phygital Fashion Emporium is called the *Inertial Measurement Unit* (IMU). It is a specific type of sensor that measures angular rate, force and sometimes magnetic field. IMUs are always powered by a combination of data collected from several types of sensor inputs, such as the accelerometer, gyroscope, and magnetometer. These are found in many consumer products like cell phones, video game controllers and virtual reality headsets. The IMU can provide 2 to 6 DOF (degrees of freedom), which simply refers to the number of different ways that an object is able to move throughout a 3D space. The two most relevant sensors to The Phygital Fashion Emporium are the accelerometer and gyroscope. The *accelerometer* measures acceleration, or the change of velocity across a single axis. The accelerometer cannot measure rotational movement and this is why a combination of input is required to register 3D space. The *gyroscope* measures angular velocity of three axes: pitch (x axis), roll (y axis) and yaw (z axis).

The core physics behind navigating The Physical Fashion Emporium allows the consumer to oscillate between the virtual and real world. There are two modes of navigation, world orientation mode and stationary mode. In *world orientation mode*, the consumer's phone position is always locked into tracking a 180 degree field of view. By toggling between the front camera and back camera, the user can change whether they are looking in front or behind. *Stationary mode* is catered to those who might enter into The Emporium

on a subway, bus or in an office setting where space is limited. Instead of using the phone's 180 degree positional input, the consumer will orient their rotational view through the sliding bar that is fixed to the bottom of the screen. Stationary mode will still use the front camera and back camera toggles to change the consumer's view direction. To advance forward within the 3D spaces, the consumer will click on warp targets that are placed strategically on the floor of The Emporium. A *warp*, also known as a portal or teleporter, is an element used in video game design that allows a player character to instantly travel between two locations.

Fig 46. Navigating The Phygital Fashion Emporium, World Orientation Mode

Fig 47. Navigating The Phygital Fashion Emporium, Stationary Mode

Fig 48. Navigating The Phygital Fashion Emporium, Rotation Orientation of Camera View: Front Camera

Fig. 49. Navigating The Phygital Fashion Emporium, Rotation Orientation of Camera View: Back Camera

The Process of Simulation

Simulating dynamic deformation, such as cloth simulation, is well known for being difficult to work with. Compared to other CGI techniques, it has not advanced as quickly as other processes found amongst game and film studio work. For example, there are a lot of games that are critically acclaimed for their immersive worlds and storylines, including T*he Witcher: Wild Hunt and The Last of Us*, but the movement of the clothing is simple and limited (Harisova). This is the case because working within the parameters of simulation is considered a specialized skill within industry. CLO3D is a complete pipeline for real world garment creation, but trying to work with the assets it produces in other software packages is challenging and lacks formal documentation outside of industry kept secrets. Many studios have custom built tools that help facilitate the process, but still require years of accumulated knowledge and experience from the collaboration of their team in order to reach success. Since the fashion industry is starting to embrace software like CLO3D, I anticipate a great deal more research and development in optimization and procedural animation techniques available outside the film or game production studios to come.

To reiterate, those who are working with dynamic geometry in a game or film production pipeline have a specialized skill in the professional world and often hold mid-to-upper level position titles. I anticipate we will see a substantial call for individuals who have experience working with dynamic geometry and optimization techniques. Since brands are already generating their garment patterns digitally, this means they also have a 3D digital twin of that product—the garment asset. It is only logical to expect brands to want something more out of their digital patterns. CLO3D offers an internal render solution that produces highly detailed still images, but its future marketing applications are limited. Utilizing CLO3D assets in a game environment, like Unreal Engine, provides all of the tools one would need for a fully digital production stage which cannot compare to what CLO3D offers internally.

The broader term, soft body dynamics, is a procedural animation that generates a set number of frames in real time that could not otherwise be achieved through a predefined animation sequence. Physic engines approximate real world motion and energy. Physics engines include parameters like collision detection. Collision computes the overlap and intersection of various assets within a 3D scene.

If you draw a square in the CLO3D window and turn on a simulation, that square will fall exactly how it would in the real world if it was made of cloth. When collision parameters of a 3D object are defined and placed within the pathway of the simulated square, the digital cloth will interact accordingly. In my project, the digital cloth was draped to the virtual model, but you could use any 3D form, such as a digital hanger or a digital tent structure, etc. The possibilities are endless and it is all a matter of defining gravitational input for a given asset. In the scene, anything that remains stationary would receive zero gravitational input.

Establishing an Animation Workflow

Since we know digital cloth interacts with other assets in the viewport, it is easy to imagine how you would animate a digital garment. The first step involves assigning animation data to the model asset. CLO3D and Marvelous Designer come with a small selection of preloaded avatars, but they have limited customization options beyond basic size inputs. My final project's intention is to demonstrate a future virtual production workflow for the fashion industry. I expected to demonstrate total control over my model's aesthetics. From my interview with Andra, owner and designer of MOORE Custom Goods, I was informed that this was an important factor that was lacking in 2020's virtual New York Fashion Week experience. Character Creator 3 and iClone 7 provided my workflow with full control over my model sizes, facial and bone structures, make-up, accessories and animations with relative ease.
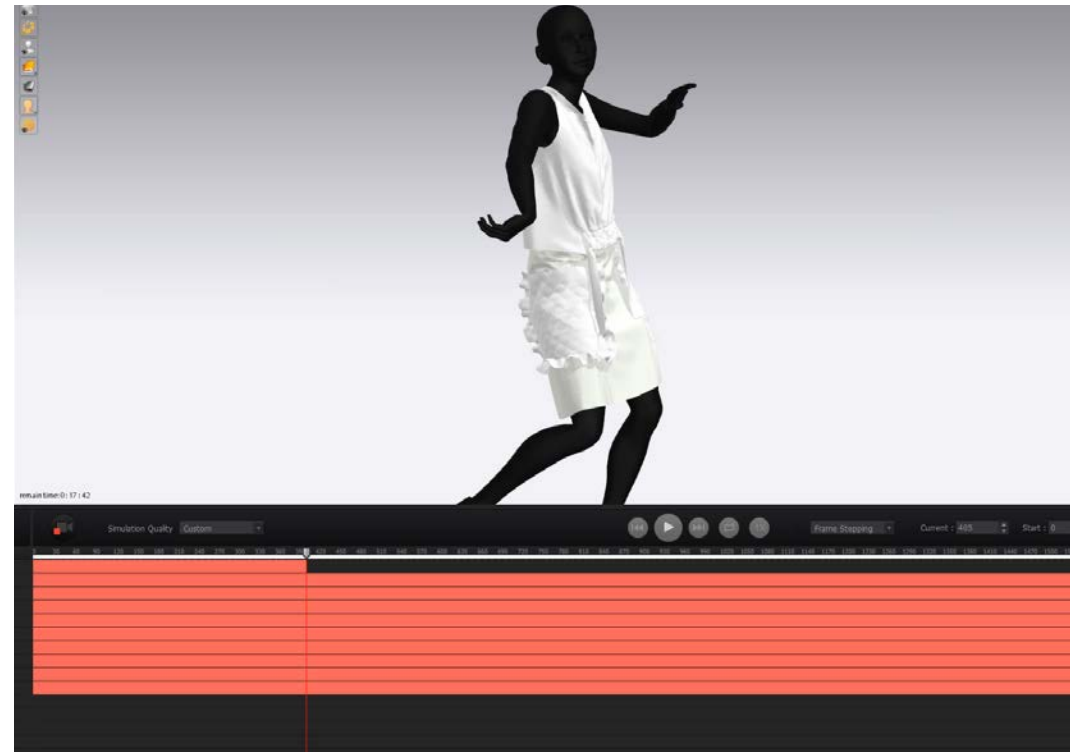
Fig. 50. Recording Cloth Animation in *Marvelous Designer*

All About Collisions

I anticipated running into difficulties while animating the garments and models. When digital cloth interacts with another digital asset in a 3D scene, it does so in the form of collision. Collision is a complex computational problem since all vertices of a 3D cloth surface have the potential to collide with one another during active simulation runtime. It is common for an avatar's limb, leg, etc to poke through the digital cloth surface during active runtime simulation or at various frames across a recorded animation sequence. It is important to understand that the animation of the model or avatar is independent from the cloth simulation animation. This means the cloth animation can break while recording if the avatar's animation is jerky, too quick, etc. Vice versa, the properties of the 3D cloth surface can break the recording since there are many different properties that affect how the surface interacts while colliding. Another potential problem that I discovered that one could run into while animating garments with avatars is this—it is incredibly easy to export recorded cloth animation data (and as in my case, alembic cache files) out of CLO3D at a different frame rate from the avatar's animation that it was recorded with. When imported into another software, the animation results will appear out of sync with one another.
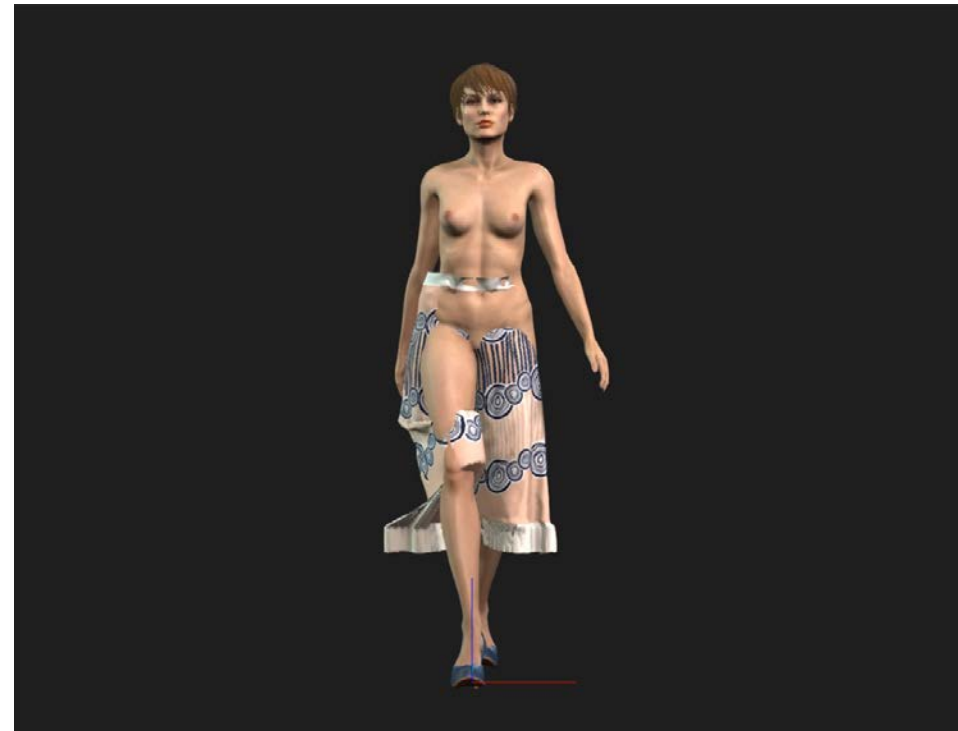
Fig. 51. Collision Problems from Frame Rate Mismatch in *iClone* 7

Workflow One

I first set out to achieve a simpler workflow for the production of The Phygital Fashion Emporium demo. *iClone 7* is a real-time 3D animation and rendering software package. *Character Creator 3 (CC3)* is a full character creation solution for generating optimized 3D characters ready for animation, games or intensive artistic design. Because both softwares are produced by *Reallusion*, the assets are easily transferable between programs. After designing my models in *CC3*, I sent them directly to *iClone 7*. Proceeding forward, I applied motion capture data that was purchased from *Reallusion's* marketplace. At this stage, I knew that if I could get the animated garments from *CLO3D* into *iClone 7*, that I could export out an image sequence with an alpha channel from *iClone 7*. An *alpha channel* is an additional color channel that represents the degree of transparency or opacity of a particular color.

Fig 52. Export with Alpha Channel From *iClone* 7

1 Procreate
- Draw Motifs

2 Illustrator
- Motif Clean Up
- Motif Manipulation

3 Photoshop
- Make Final Prints
- Repeatable

4 CLO3D
- Pattern Garments

5 Character Creator 3
- Design Models
- Send to iClone 7

6 iClone 7
- Apply Motion Capture
- Tweet Human IK
- Export FBX Model

3 Unreal
- Enable Composure Plugin
- Import Assets
- Build Scene

7 Adobe XD
- Interface Design Assets
- Transfer: AE to Animate

After Effects
- Compile
- Animate
- Render

1 Autodesk Maya
- Model Assets for Unreal Scene

2 Substance Painter
- Import Asset OBJ
- Texturing Unreal Scene Props Only

Workflow ONE

Animated Cloth Simulation

Scene + Assets

Mocking It Up

Compositing is a technique of combining visual elements from separate sources into a single render. It is used to create the illusion that all those elements are parts of the same scene. For the creation of The Phygital Fashion Emporium's demo, compositing is the technique that I used to demonstrate the application's augmented reality features. *CC3* and *iClone* 7 generate the materials and shaders for you. A *shader* determines how something looks when rendered within a software. Beyond the control of simple light effects in a 3D scene, they can also alter hue, saturation, brightness or contrast of an image, produce blur, light boom, volumetric lighting, normal maps, cell shading, bump map distortions, chroma keying, etc. The problem with shaders comes down to their translation between software packages. For example, *CLO3D* does not interpret shader information the same way as *CC3* and *iClone* 7. As a result of this, the model textures do not render the same within the *CLO3D* viewport as they do in iClone 7. For the purpose of making the animation, the material and shader information does not matter, but this emphasizes the importance of including *CLO3D* within a larger 3D production workflow.

After recording the animations, the garments were exported out of *CLO3D* in two file formats— an FBX and Alembic Cache (.abc). *Alembic Cache* files store non-procedural, baked geometry information. The FBX, in my case, did not include animation data, but instead included basic shader information. The garment materials transferred reasonably well, and I did
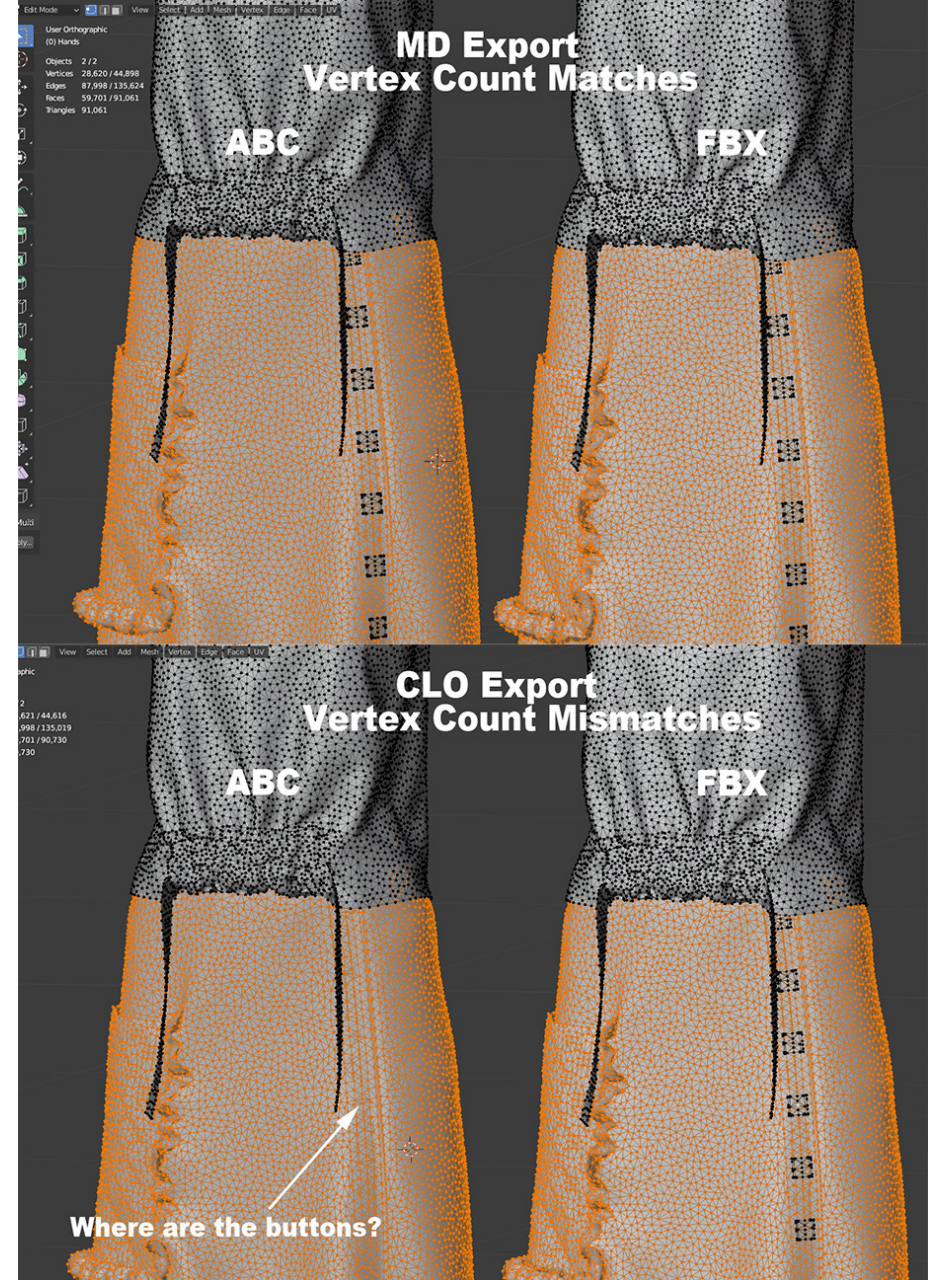
Fig 53. Troubleshooting *CLO3D* Export; Alembic Cache Vs. FBX Vertices Comparison; Source: Mr G, *Reallusion* Forum Discussion

not see a reason to further change it. After applying alembic cache data to the FBX, the geometry effectively transfers the list of stored vertex coordinates to the mesh. Although animation is supported in both *CLO3D* and *Marvelous Designer*, I came across a "bug" while exporting FBX files from *CLO3D*. The FBX exporter option from *CLO3D* added extra vertices to the graphic. A graphic in *CLO3D* is a type of texture added to a mesh. In this scenario, it was an image used for the button. In order to apply alembic cache data to an FBX, the vertex number must be the same.

Throughout my process, I relied heavily on forum pages. Particularly, I consulted the *Reallusion* forums, as I found a small group of individuals who were also working on animated garments with *CC3* characters. Many of these users were using *Marvelous Designer*, which inspired the thought to animate and export out of *Marvelous Designer* instead of *CLO3D*.
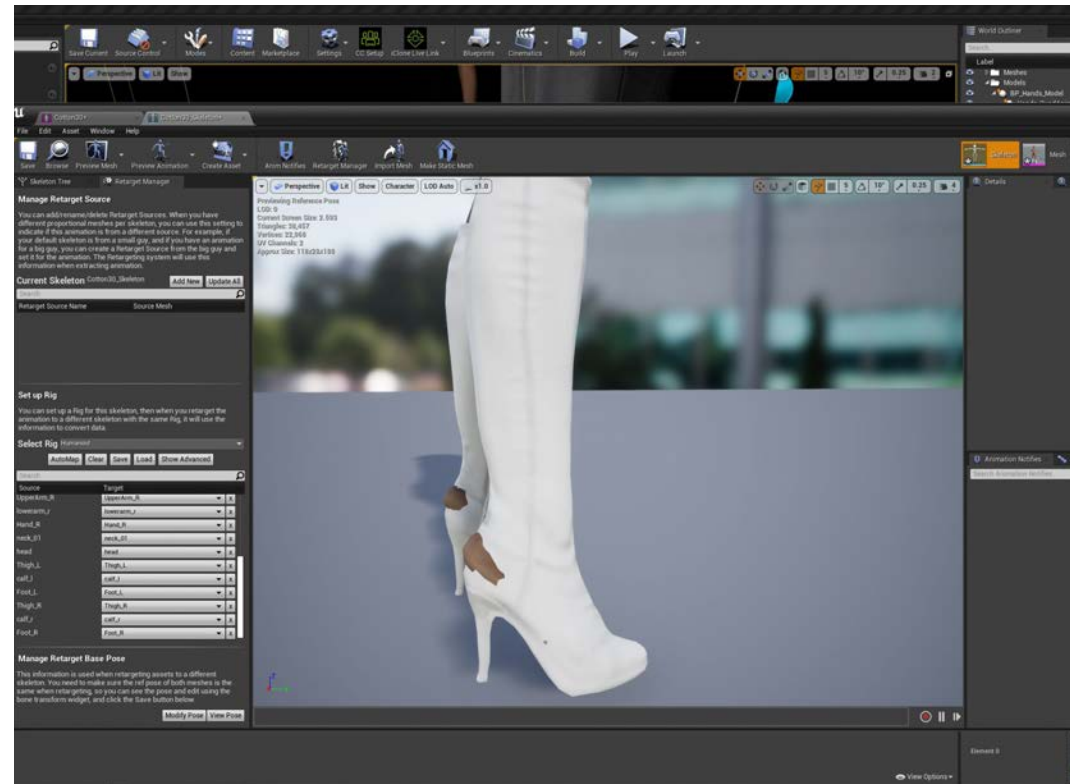
Fig 54. Pivot Difference From *iClone* 7 to the *Unreal Engine*; Re-targeting Rig Asset

Workflow Two

After switching to *Marvelous Designer* for the animation creation, it was time to import the garment into *iClone* 7. At the time, *iClone* 7 did not support the import of Alembic files, but after implementing a short Python script, I was able to successfully animate both the garments within the *iClone* 7 viewport. I applied materials and print layout in *CLO3D* while I was pattern-making. It was great for iterating print placement since *CLO3D* has an interface workspace designed for repeatable prints. Because the FBX file type, which was imported into *iClone* 7, supports basic shader information the print designs on the garments transferred fairly well to *iClone* 7.

In the beginning, I intended to render the animation of the garments and model within *iClone* 7. The results would be combined with additional footage of the applications 3D environment recorded within the *Unreal Engine*. The biggest drawback to this workflow was the fact that it would have been nearly impossible to synchronize the light and ambient occlusion between the assets if they were rendered with separate programs. The ideal solution would be to record and render all of the video content under the same environmental conditions. Much of the process for developing my end workflow involved troubleshooting a number of smaller steps of the process while progressively building towards the larger pipeline picture. At the same time I figured out the workflow for bringing in fully animated and textured garments into *iClone* 7, I was also exploring ways to translate the *Reallusion* character
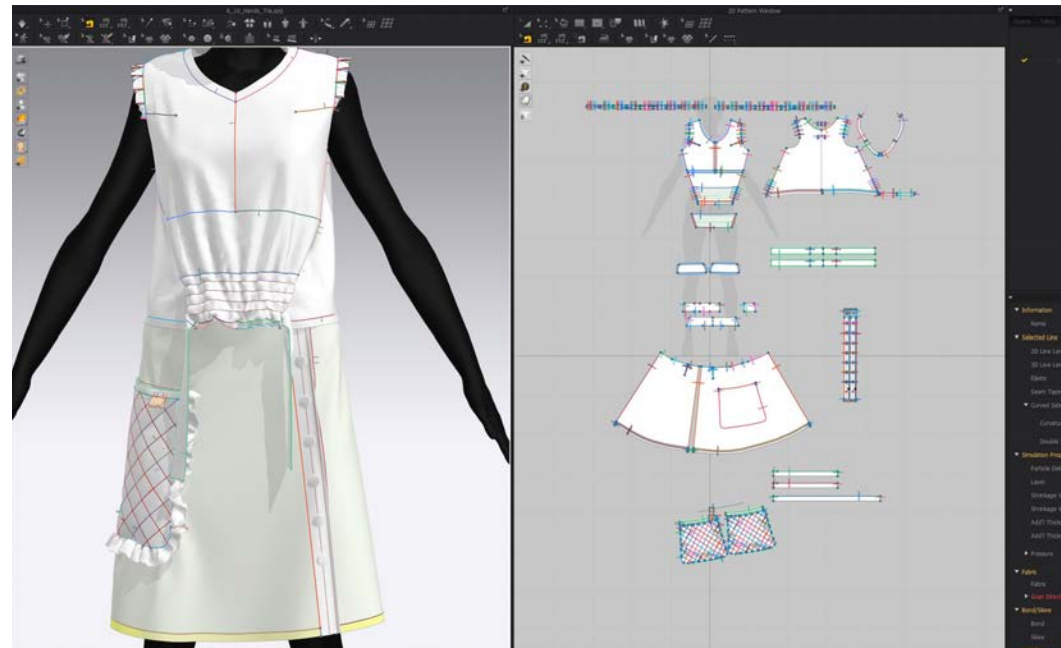
Fig 55. Pattern Making in *CLO3D*

shaders and materials to the *Unreal Engine*. I discovered that *Reallusion* offered an *UnrealLiveLink + Auto Shader + Skeleton Assignment plugin*. I justified the additional time needed to configure this set up as being worth it for two reasons:

- The overall quality of my final video would improve.

- If The Phygital Fashion Emporium was developed into a functional, working prototype, the final garment and model assets would need to be imported and correctly textured within a game engine environment.
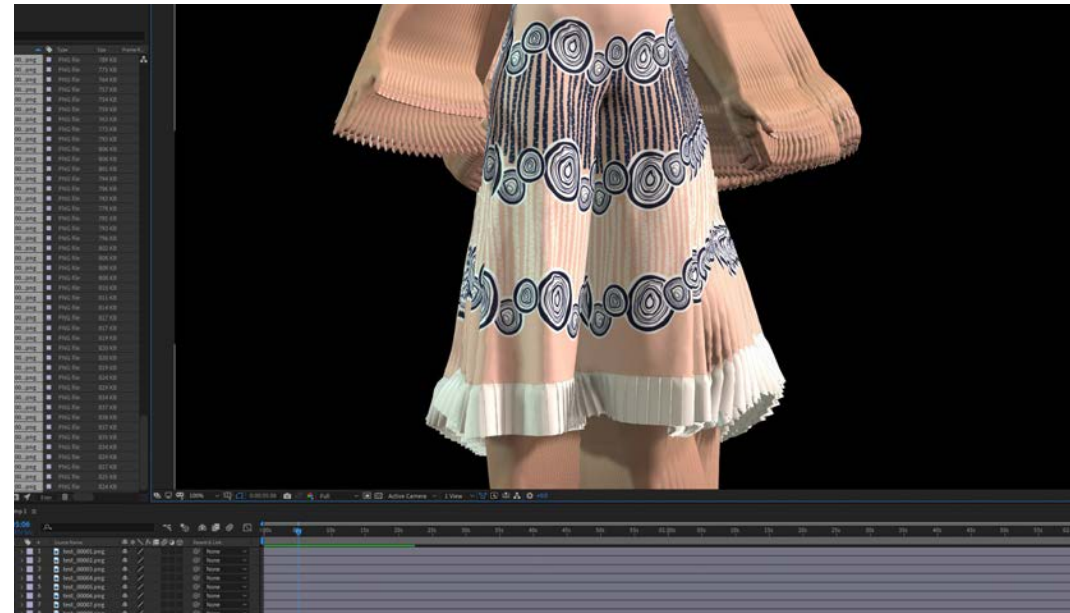
Fig 56. Alpha Layers Imported into *After Effects*

Procreate

1 **Procreate**
- Draw Motifs

Ai

2 **Illustrator**
- Motif Clean Up
- Motif Manipulation

Ps

3 **Photoshop**
- Make Final Prints
- Repeatable

CLO CLO Virtual Fashion

1 **CLO3D**
- Pattern Garments

4 **Print Placement**
- Pattern Garments

2 **Character Creator 3**
- Design Models
- Send to iClone 7

⬇ **Auto Setup**
- Download to Unreal Project

3 **iClone 7**
- Apply Motion Capture
- Tweak Human IK
- Export FBX Model

SUBSTANCE PAINTER

6 **Substance Painter**
- Import OBJ
- Settings:
  - Unreal Engine 4 (Starter Assets)
  - Preserve UV Tile Workflow
  - 2048 Map Sizes
- Texture Set List are Materials
- Face Sets = Texture Set List

Reallusion's Unreal Live Link And Auto Setup Plugin

MX

4 **Marvelous Designer**
- Import FBX Model
- Scene Warp : Set as Two
- Fit Garments
- Set Up UDIMs
- Simulate
- Record Animation
- Export Alembic OGAWA

M MAYA

5 **Autodesk Maya**
- Import Alembic Garments
- Enable UDIMs Layout
- Select Part of Garments via UV Shells
- Switch UV Selection to Faces
- Assign Materials = Face Sets
- Export OBJ for Substance
- Export Options:
  - Check *UV Write*
  - Check *Write Face Sets*
  - Check *World Space*
  - Check *Write UV Sets*

UNREAL ENGINE

7 **Unreal**
- Enable Live Link + Auto Set Up Plugin
- Enable Composure Plugin
- Import Additional Assets
- Set Up Virtual Texture Streaming
- ETC.

Xd

8 **Adobe XD**
- Interface Design Assets
- Transfer: AE to Animate

Ae

9 **After Effects**
- Compile
- Animate
- Render

Workflow TWO

Garment Print Design

Animated Cloth Simulation

Model/Character Shaders

Import Into The Unreal Engine

The *Unreal Engine* supports alembic file import. Getting the garments into *Unreal* was fairly straightforward as long as you are consistent with your FPS (frames per second) throughout your workflow. *iClone 7*, *Marvelous Designer* and *Unreal Engine* run at different internal frame rates, but within *Unreal*, this can be changed in the project settings. The *Unreal Engine* internally runs at 60 FPS. For the purpose of my demo, I specifically dropped the frame rate to 30 FPS since the demo is only a proof of concept. I wanted to retain the motion blur that you would encounter in films.

The trouble with bringing in alembic cache garments into the *Unreal Engine* is by default, they do not retain material information. Unlike my previous workflow, materials would not transfer like they had when rendering out of the *iClone 7* viewport. Alembic files imported into the *Unreal Engine* have one material slot. Alembic file types, according to *Google* and a number of unanswered forum pages, are known for being difficult to texture. Many users struggle to apply multiple materials to an alembic file within a game engine environment. After extensive trial and error, I used two techniques to conquer this problem, *UDIMs* and *face sets*.
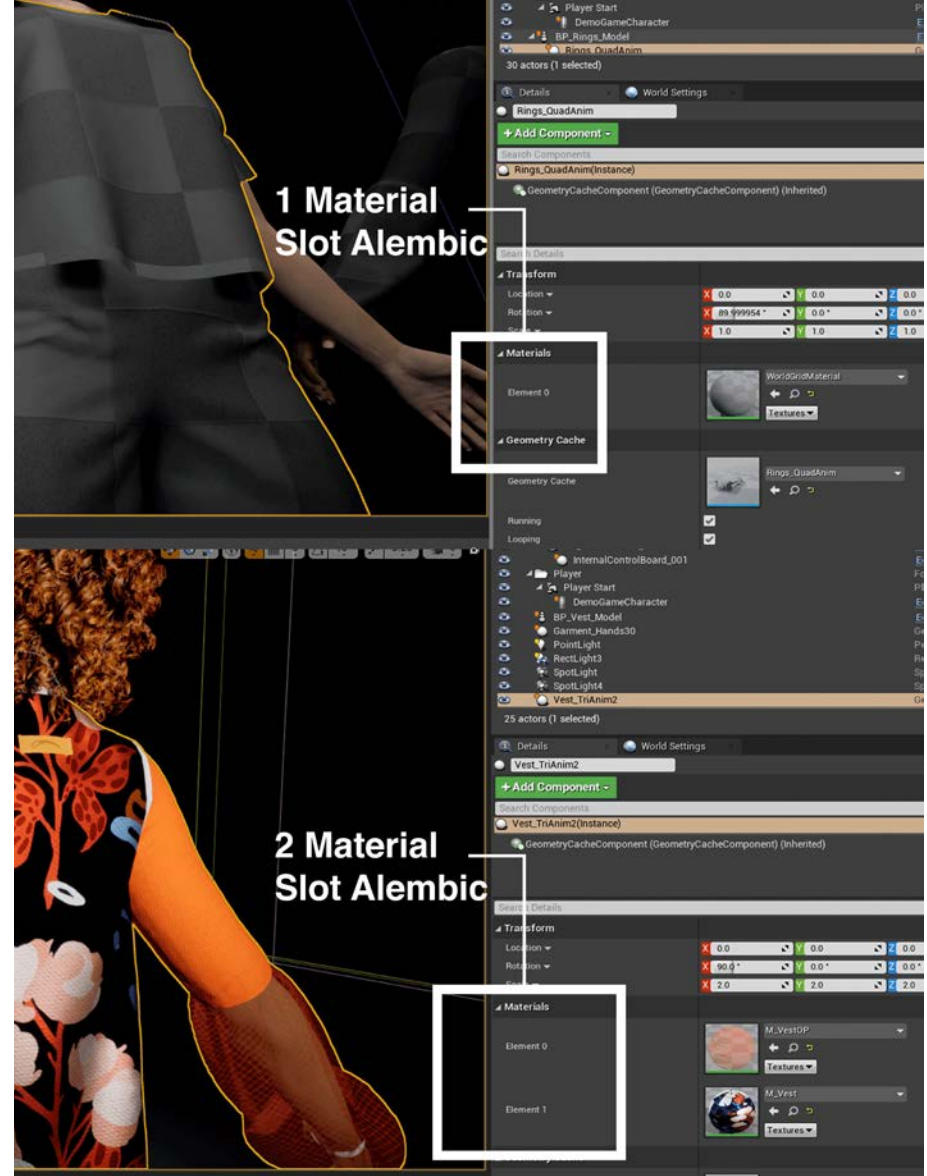
Fig 57. Alembic Material Slot With and Without *Face Sets* Applied in *Maya*

UDIMs Explained

Using a single UV tile does not provide enough overall resolution. This means that when you zoom in close to the garment, its texture would appear blurry. One way to combat this is to increase the UV map resolution since a UV map is essentially just an image. The problem with increasing the map size to 4K, or even 8K resolution, is that it becomes taxing to load, ultimately affecting overall performance within a game engine. *UDIMs* are an automatic UV offset system that splits a UV map into smaller maps of lower resolution. They are organized sequentially to provide overall higher quality resolution and are better for performance because they eliminate loading the entire map continually. Instead, it only renders the smaller maps that are in the scene view at that specific moment. This is quite simple to implement in *Marvelous Designer.* Using the UV editor workspace, it is simply a matter of scaling up the individual pattern pieces and offsetting them into their own UV quadrant. The final garment files were exported out of *Marvelous Designer* as an alembic OGAWA file after UDIMs were set up and all animation data was recorded. OGAWAs are smaller alembic files than the standard HDF5 format therefore making them quicker to load in other programs.
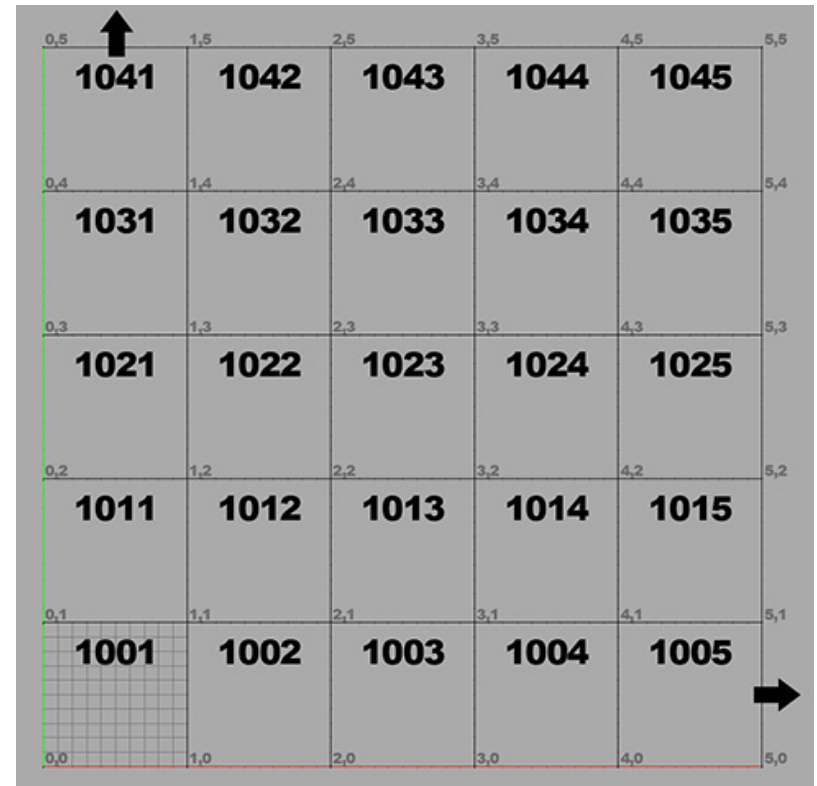
Fig 58. UDIM Offset, Each Quadrant Offsets a Map in Numerical Order; Source: Foundry

Face Sets

In *Maya*, a *set* is a collection of components. In this project, I used *face sets* to set up several material slots per garment in the *Unreal Engine*. By default, alembic files do not retain material information unless *face sets* are written in another program such as *Maya*. In *Maya*, by selecting parts of the garment via the UV shell and switching the selection to faces, when you apply a material, it will create a *face set*. When exporting the alembic file, the following needed to be checked in the options box:

• UV Write
• Write Face Sets
• World Space
• Write UV Sets

When importing the new alembic file into the *Unreal Engine*, as long as the "flatten tracks" box is checked, the alembic file will retain the correct number of material slots. This allowed me to create three materials for each garment.
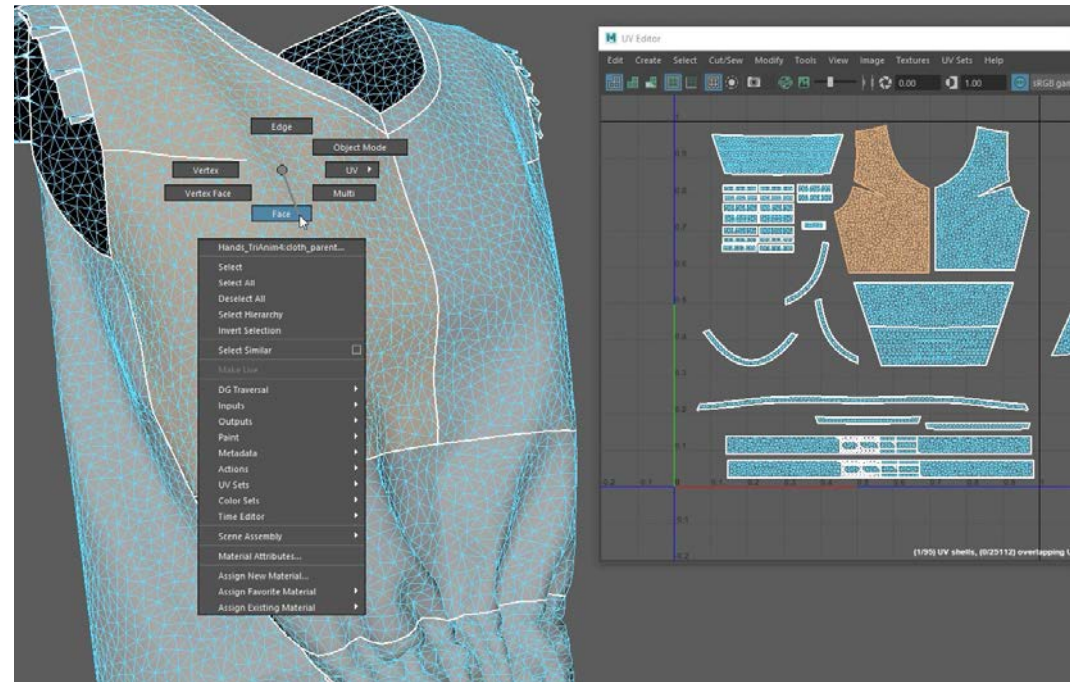
Fig 59. Applying *Face Sets* in *Maya* via UV Shell

Print Placement + Substance Painter

Substance Painter is a 3D painting software which allows you to texture across your 3D asset by directly painting on top of the model. I used this software to texture all the garments and assets. *Substance Painter* is great for texturing, but it is not ideal for garment print/pattern placement. Substance painter treats all imported texture as UV maps. This essentially means that it recognizes all images as having a square aspect ratio. If a rectangle imaged is imported into *Substance Painter*, the program will distort the image to fit it's predefined square aspect ratio. Because I did not consider this constraint when designing my prints, the repeatable sections of my final designs are not square. This meant that I needed to find an alternative way to apply the prints to the garments, weather in *Substance Painter* or another software.

CLO3D has a built in feature which allows you to drag any size or shape print design into the viewport. The work around for fixing the import of my print designs into *Substance Painter* required exporting the texture map of the final print design placement from *CLO3D* as a UV map. Essentially, CLO3D was used to determine print placement and scale on the digital garments. The final repeatable modular unit was not brought into *Substance Painter* as an image. Instead, I imported a specific snapshot of the print design's finalize placement onto the garment's pattern block. Because UV maps are always square, this eliminated the print distortion that happens when importing non- square texture images into *Substance Painter*. The final *Substance Painter* materials were exported with
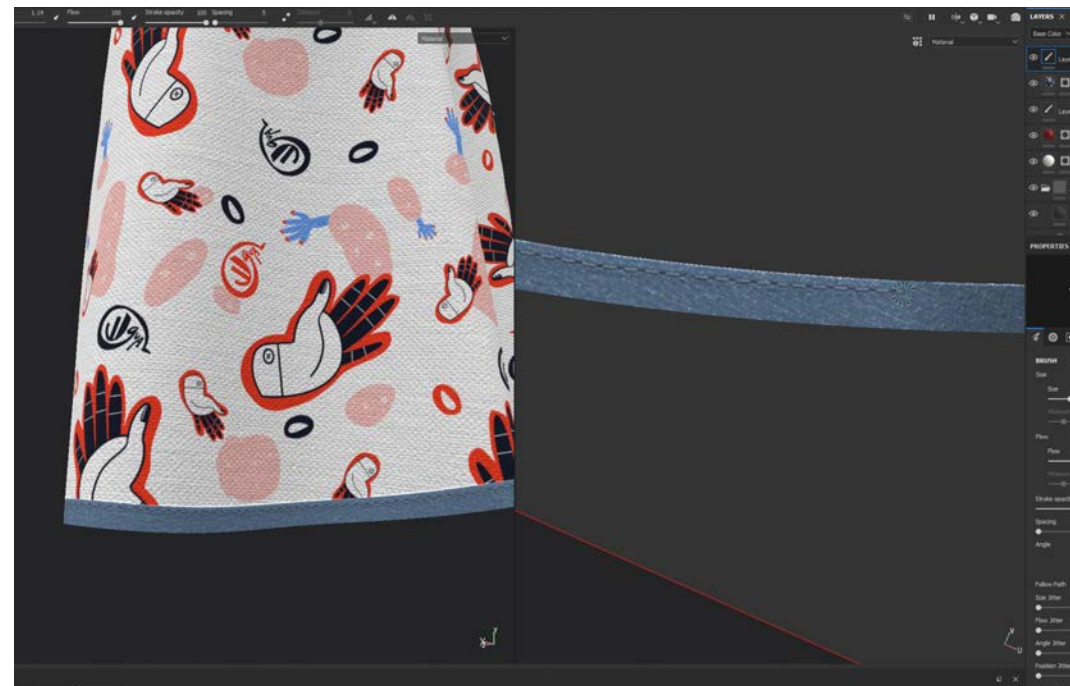
Fig 60. Texturing in *Adobe Substance Painter*

settings specific to *Unreal*. This saves out three texture maps that consolidate my working layers added within *Substance Painter*. Each material applied to the garment in the *Unreal Engine* is the combination of three UV maps in total—diffused (base color) map, normal map, and ambient occlusion map.

Project Overview
Substance Painter
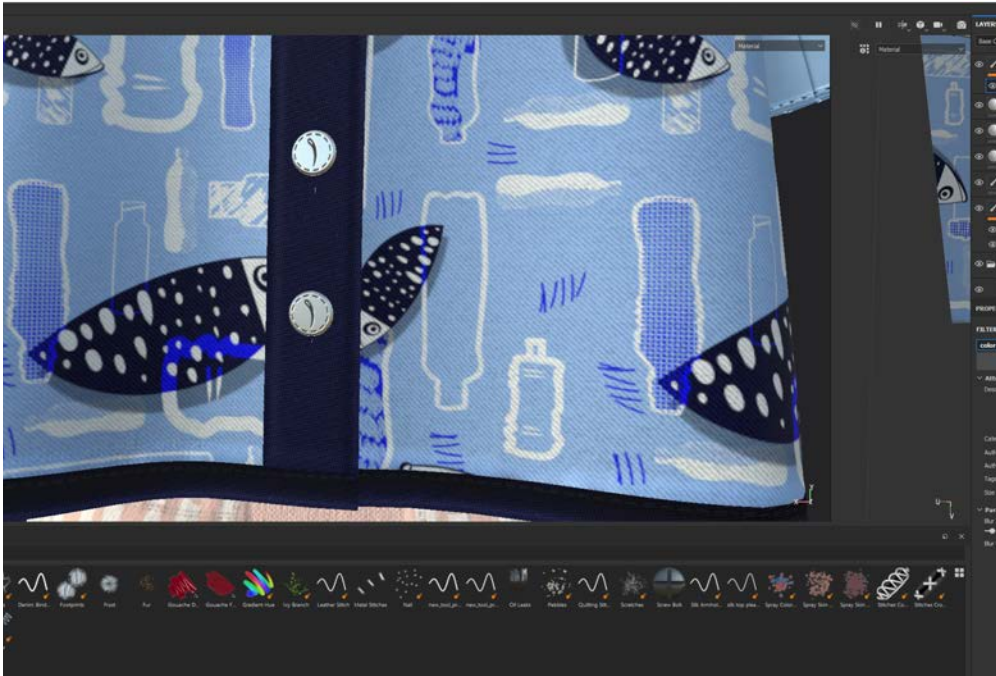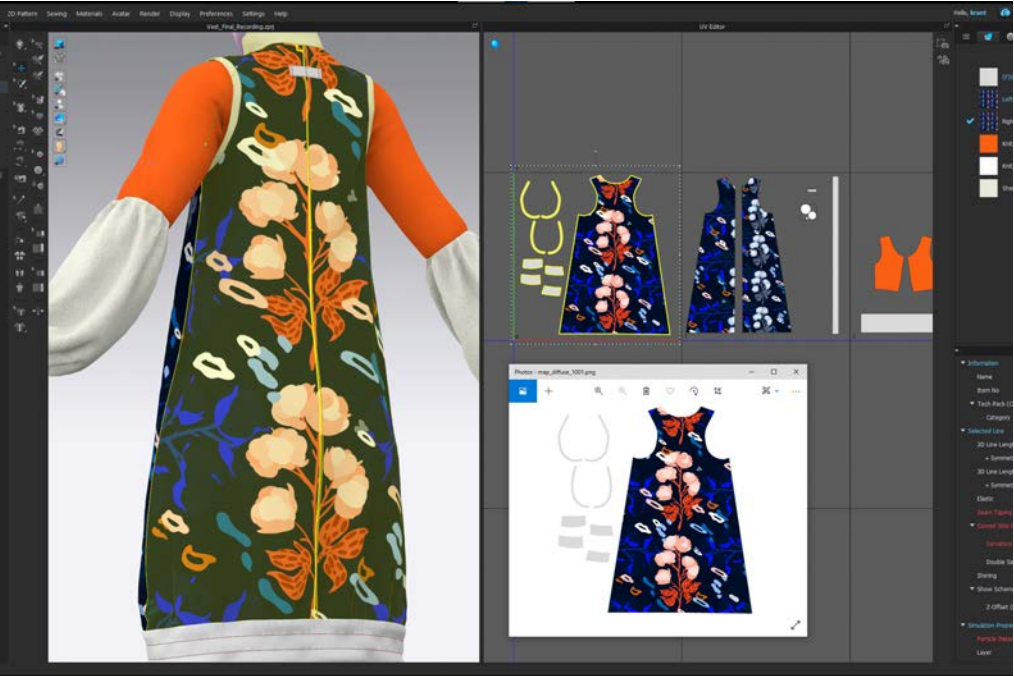
Fig 62. Additional Texturing in *Adobe Substance Painter*

Virtual Texturing

In order for the *Unreal Engine* to recognize the UDIMs set up on the garment assets, Streaming Virtual Texture (SVT) had to be enabled within the project settings. It was a straightforward setup process. Within the SVT system, only parts of the textures that are visibly rendered within the viewport are accessed. Because UDIMs utilized several maps at small resolutions, the GPU does not have to cache the entire texture that makes up the surface.
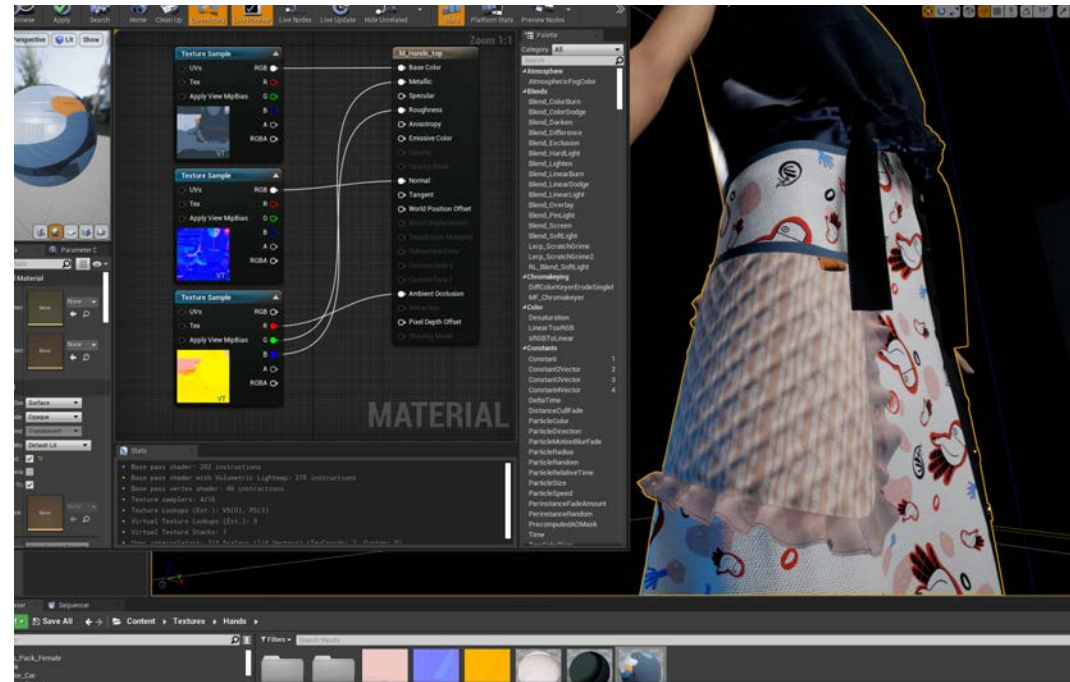
Fig 63. *Unreal Engine* Material Made up of Three VT (Virtual Streaming) Texture Maps

Model Movement

I chose to animate each model featured within the Loop'd collection with a dance. This decision was made primarily because of current AR display devices available to consumers. The cellphone is primarily how one would experience AR content. From early experiments deploying animated characters onto an android phone, I noticed that I needed to physically mirror the movement of the model/character with the cell phone. If the animation walked 20 feet left, my phone would need to follow in that general direction. It becomes incredibly easy to miss out on the AR experience unless your phone is pointed in the correct direction. This would assume that the consumer knows how the model/character is going to perform. To address this, I wanted the models to remain stationary yet in motion. Standard movements in which you can understand the garment material properties are not, by default, a mainstream feature e-commerce clothing stores utilizes today. While each model is featured within their own 3D digital environment, The Phygital Fashion Emporium also grants the user with the additional ability to place the model/character within their own environment. This was another reason why the stationary dancing movements were incorporated into the final demo. The consumer could now easily dance alongside the CG rendered models.

Fig 64. Render Proofs from *CLO3D*

Reflection + Future Work

Trending Forecast

At the core, this project demonstrates a new form of runway fashion storytelling inclusion to the independent fashion brand. It is a future vision for a sustainable fashion application that utilizes CG production assets and interactive environments in the redesign of an e-commerce experience. From my research and project development thus far, I have reached the conclusion that since the early onset of this project, it has always been about the concept of a 3D place and a digital fashion experience. Through the project's promotional demo, The Phygital Fashion Emporium speculates a future use case application of real time engines and digital fashion experiences.

The spirit of The Emporium's concept maintains significant similarities to the concept of the metaverse, which my previous research above did not examine. The *metaverse* is a term used to describe a non-physical world in which individuals can interact through the use of different types of technology. As of right now, the driving technologies for the metaverse are virtual and augmented realities. *Facebook* is a leading player in the metaverse race as Zuckerberg calls it *"the next generation of the internet."* He believes the metaverse will create *"entirely new experiences and economic opportunities." Google,* another big investor in the development of the metaverse, has been developing what is called the *Google Lens*. The *Google Lens* enables users to search via any camera by capturing an object in the real world. Through image recognition and *Google's* search engine, the user will receive object identification along with additional information about it. The expectation is to pair this with AR and VR applications. For example, in VR you could easily translate any text into your preferred choice of language. At the end of the day, the interruptions that COVID-19 have brought upon our lives

Fig 65. Ray-Ban Stories, £299 or $299, Come With Dual Integrated Five Megapixel Camera, a Three Microphone Array and Discreet Open-ear Speaker; Source: News So Times

have lasted much longer than anyone anticipated. Although society in the United States has partially returned to a new state of normalcy, our culture is still very reliant on video based platforms for remote work and certain social events. As a result, the digital realm is a space many are beginning

to feel comfortable in. It is only logical for developers to think about what comes after the era of the internet—that is, the metaverse. Excluding deeper discussion about the metaverse did not hinder the development of this final project, but rather it is an additional concept to further explore in a future research agenda. The metaverse is a concept we are just starting to see hit mainstream media. Because of this, it is a medium which lacks a standard UX expectation. Similar to the UI of augmented reality experiences today, both ventures are playgrounds ripe for research driven design speculation.

Steve Jobs presented the iPhone as the junction of a telephone, media player and remote internet device roughly fifteen years ago. This changed how society fundamentally operated on a day to day basis. There is a growing prediction that augmented reality could follow a simulator trajectory as the iPhone. Augmented Reality applications have the potential to revolutionize a number of different sectors and in the past two years specifically, we have seen tremendous promise for a consumer level wearable AR frame. Facebook launched their first pair of smart glasses, in collaboration with Ray-Ban maker EssilorLuxottica, that allows its user to listen to podcasts, answer calls and capture both photos and videos. This eye wear line, called Ray-Ban Stories, is expected to deliver *"a true AR experience in the next 5 to 10 years,"* according to Facebook's chief scientist (Culliford).

A Personal Accord

In the beginning, I wanted to create a virtual reality experience. When I started working on this project, the entire world had just shut down. Over the course of an eleven month period, I left my house only to go to the grocery store. I became increasingly determined to put digital fashion in VR and set about learning whatever I could to make that happen. Looking back, I believe that my desire to work in VR was a subconscious motive I was gravitating towards in order to escape the very real reality of the present. This was also a time of social and political unrest with reports of countrywide rioting flooding the news channels daily. When I started planning this final project, I thought about the medium first. In retrospect, this was a mistake because my concept was not about exploiting the medium or investigating the stimuli of a VR experience. I did not discuss the book, *Speculative Everything: Design Fiction, and Social Dreaming*, yet it greatly influenced how I approached conceptualizing my final project's topic. "To design speculation through a change in reality," left a lasting impression on me.

> *"The spectrum of conceptual design is broad. Each area of design has its own form and is used in different ways. At one end it is very close to conceptual art and is about pure ideas, often to do with the medium itself. Much applied art, ceramics, furniture, and device art, for example sit here. At the other end of the spectrum, conceptual design means a parallel space of speculation that uses hypothetical or, more accurately, fictional products to explore possible technological futures."*
>
> *– Dunne, Anthony, and Fiona Raby, 14*

Like many projects, original concepts start off grand but eventually simplify through the process of refinement. This can be an effective way to eliminate the parts that are not in service to the spirit of the project's core. The technical limitations of hardware and the time involved in the production of dynamic VR scenes that were riddled with heavy on performance cloth assets was not a realistic project scope to pull off given the time frame. I have come to realize that this project has become a personal journey about understanding where design fits in between research and practice. Ironically, one of the best decisions that I made was to "start over" on my final project. Once I accepted this truth, the pieces began to fall into place. This was not a defeat, but rather it was an unraveling transformation that happened organically processes guided by making, critiquing, deleting, collecting, analyzing and reworking.

In the end, The Phygital Fashion Emporium is a process, an experiment and a playground. This final project documentation is a future speculation guided by market research. This research is complemented by the additional documentation of a workflow for working with cloth simulation assets within game engines. While the larger picture of The Phygital Fashion Emporium is much granter than time allows, this project plants the seeds for a future 3D e-commerce interface.

Appendix

Prior Sweat Equality Assumptions

From the beginning of this endeavor, I had not considered exploring my project as a market solution to an existing problem. It was never considered simply because I wanted to jump straight into making. This is where my attention has always been. In my previous studies, I immersed myself in learning the necessary skills, qualities and craftsmanship required for the creation of garments. Over time, I started to search for ways in which I could continue my studio based practice more sustainably. Throughout my personal experiences and from what I have learned from others connected to the fashion industry, I have constructed my own mental picture of the fashion ecosystem. Initially, I was evaluating my final project based on historical insight and consumer patterns that I had identified. Even with a rich foundation of historical precedents, I came to realize that I was still drawing market based assumptions without verified insights with others.

Addressing the Following Prior to Interviews

Beginning the SEC (SWEAT Equity Challenge) program, I introduced my software solution to the course's cohort as an augmented reality fashion application that would challenge the experience of e-commerce shopping. Before the course, I addressed the following questions accordingly:

What is the market problem my software will address?

Because of the sheer cost, wastefulness, and inaccessibility of the traditional fashion show format, my application would address several market problems:

- The democratization of the runway. It would challenge the traditional fashion leaders who build customer following through the use of runway presentation and storytelling. Increasing accessibility for both the local fashion designer and the consumer, who otherwise may not be aware of local designers.

- Transition consumers to purchase local and value their material goods as more than just objects.

- Draw consumer attention away from fast fashion by providing them with more than just products.

- Currently, the interface of apparel websites are two-dimensional and lack visual diversity. The familiar white grid product selection page was a fantastic design for early widespread e-commerce adoption due to its efficiency purposes, but with more of our interactions

and day-to-day experiences taking place through an assortment of digital channels, the question to ask now is: "How do we foster better shopping experiences that mirror something similar to a brick and mortar shopping trip?" My application seeks to address how we can deliver consumers' unique digital experiences and foster a greater sense of presence through digital formats.

- The implementation of digital fitting solutions could shift apparel production methods towards an on-demand manufacturing model. This would eliminate unnecessary material waste, resources and labor cost by reducing excess product production.

What industry or consumer type is having this problem?

- The fashion industry

- All consumers of fashion apparel products including those who do not identify as fashion forward.

What is my solution?

- The augmented reality fashion application is a three-dimensional place designed for local fashion designers to deliver brand narratives more akin to those established by runway performances. Implementing a 3D interface

allows for consumers to view and explore clothing items in a 360 degree viewing format. Tracing back through the history of early runway couture, luxury houses established their brand identity through runway performance. Not all designers can afford to participate in New York Fashion Week. My solution attempts to democratize the very element which makes luxury fashion special— its marketing techniques. My application will oscillate between a fully immersed and enhanced real world overlay through the use of augmented reality.

How is it unique and why is it better than existing solutions?

- It is unique because it emphasizes the artistic expression of fashion branding. The concept stems from searching for sustainable apparel solutions. I believe the problem arises from overproduction within the industry and consumers' lack of investment in quality apparel products.

Who is your target customer/user?

- Millennials and Gen Zs. The intended audience is digitally fluent and ready for innovation.

Who are the target users for this software or app?

- Local fashion brands with small apparel operations. Fashion brands who would never show a collection at

New York Fashion Week, but are producing better quality products compared to other established, well known brands on the market.

Who are the buyers for this software, if not the end users directly? (For example a purchasing manager may be the buyer for enterprise software solutions)

- Fashion brands would purchase the interface solution.

Who are the buyers for this software, if not the end users directly? (For example a purchasing manager may be the buyer for enterprise software solutions)

- Fashion brands would purchase the interface solution.

Have I received feedback on your software/app idea from your target users or buyers?

- N/A

Questions + Approach

My email opener template: *"I am seeking to speak to industry experts to better observe and understand how e-commerce platforms are providing for fashion brands currently. I am looking into what makes a company like (____blank____) adopt innovative solutions to add towards their digital brand ecosystem."*

The Initial Interview Questions | Questions for B2B, fashion brands:

- What are the digital platforms you are using to sell your clothing?

- Which one of these platforms generates the most revenue for your brand?

- Has the pandemic brought new challenges for selling apparel online? If so, what are they and how have you adopted them?

- Have you thought of another solution for solving this problem if you might lack the resources for implementation?

- If any, what are the challenges you face with selling your clothing items online?

- If you could add anything to your e-commerce platform, what would this feature be?

- How does your brand differentiate itself digitally?

- What do you think fashion e-commerce is lacking in comparison when you think about comparing it to a brick and mortar experience?

- Have you ever considered incorporating additional digital tools into your e-commerce network in order to build brand value?

- Do you see any advantages in tools such as Augmented Reality? If so, how do you think they could add value to your brand currently?

- What is one thing that keeps you up at night with regards to your business and e-commerce channels?

- What are your feelings and thoughts about implementing 3D?

- What is the difference between your online presence and your brick and mortar experience?

- What are your customers missing or gaining from either?

- In general, what do you hope the fashion industry will embrace in the future?

The Initial Interview Questions | Questions for B2C, fashion customers:

- How often do you end up looking at clothing online? What time of day do you find yourself shopping online?

- How have your online apparel shopping habits changed since COVID-19?

- What do you feel is missing from online apparel shopping?

- If you could add any feature to your online shopping experience, what would this be and why?

- How do you discover new clothing brands?

- Do you buy from local brands? Do you seek them out or do you stumble upon them? Are they easy to find?

- What do you think brands need in order to differentiate themselves digitally?

- Have you noticed changes in your approach towards shopping for apparel items online vs. in store?

- What attracts you to the clothing process you pursue digitally?

- Why do you choose to purchase clothing items online?

- Why did you, before COVID-19, choose to buy clothing online?

- What is the most frustrating part of shopping online?

- What is the most frustrating part of shopping in a store?

List of Participants

B2B Interviewees

- Cissy Huang, Brand Manager of Entireworld

- Catherine McFarland, Wholesale Representative for Stine Goya

- Ashley Kick, Digital Marketing at DÔEN

- John Fijen, Managing Director at TC2 Labs

- Laura Siladke, Designer and Founder of LeeLanau Goods

- Rebekah Adems, Fashion Designer and Found of Poppyseed Clothing

- Karina Tselnik, Retail Launch Engineer at Garmentory

- Michaela Larosse, Creative Strategy & Communications at The Fabricant

- Frazi, Owner of Hip Replacements

- Andrea Moore Beaulieu, Owner and Designer of Moore Custom Goods

- Rebecca Karpus, FIT Professor who has taught a wide range of courses on fashion merchandising, advertising and visual merchandising.

B2C Interviewees

- Emma Wheeler

- Ben Johnson

- Katie Payne

- Brenda W

- Cameron Allison

- Georgia Van de Zande

- Rebecca Karpus

- Sam Reece

- Valentina Vedani

- Gretchen Biere

Week One Highlights

- People generally purchase clothing items online because of convenience.

- Participation in New York Fashion Week is expensive, yet fashion brands see value in the marketing opportunities that it offers.

- Some people have different hierarchical needs as demonstrated by sensitivity to cost. It will always be cheaper purchasing items in person than online, such as when seeking thrifted items.

- I need to focus on my B2C consumer interviewees because simply interviewing anyone who shops for clothing is too broad. This does not address and weed out the individuals who are driven by price of product alone.

- Sale transactions that take place on websites still primarily occur on a cell phone as opposed to a laptop or desktop.

- My target B2B customers are not small designers, but rather brands that do have an established e-commerce department.

Customer Profile Template

During the second week of the SEC course, after conducting my first initial set of interviews, I filled out a customer profile template. Its contents are the following:

End User:

- Anyone who shops for apparel fashion products online. Young, Gen Zs or Millennials who are comfortable using technology.

- My end user may shop online because of location restrictions. They are unable to access a brick and mortar boutique located in New York.

- My end user is shopping online because the pandemic has closed many brick and mortar locations.

- My end user shops online because they do not have the time to travel to a brick and mortar location.

Jobs to be done: (B2C)

- Try On + Garments = Virtually

- Experience + Clothing Brands = Virtually

- Learn About + Product = Digitally

- Context setting of *jobs to be done* could include: home locations, private office spaces, public office spaces, outdoor locations, living rooms, or even on public transit.

Decision maker: (B2B)

- Fashion brands

- Marketing and E-commerce departments

- Brand identity departments

Jobs to be done:

- Sell + Product = Virtually

- Gain + Consumer = Audience

- E-Commerce + Virtual Destination = Virtual Brand Experience

- Create brand marketing value by providing a more immersive digital shopping experiences.

- Differentiate between other fashion brands by curating a "virtual window display."

- Entice consumers to buy into a more sustainable fashion industry by providing them context. (Specific for fashion brands who are producing/sourcing sustainability.)

What are the current solutions addressing my problem:

- B2B customers | They understand brand value through transmedia storytelling produced by brands—engaging with Instagram posts, subscribing to email newsletters, ads in magazines, etc.

- B2B customers | They provide detailed product descriptions of each product.

- B2B customers | They share video content via Instagram Stories, Snapchat, etc.

What are the pain points and requirements for a solution to the problem?

- B2C customer | Lack of understanding of fit. How something looks on different body types.

- B2B customer | Keeping inventory well stocked.

- B2B customer | Keeping up with social media presence.

- B2B customer | Standing out amongst the sea of scrolling digital media needs.

Decision Criteria | What criteria do decision makers report when choosing a solution for this and similar problems? What are their highest priorities?

Fashion brand | They look for ways to grab consumer attention and highlight their products virtually. Cost of brick and mortar locations is traditionally high, but in general, brands that I

have spoken with who own brick and mortar locations feel that it is the best way to provide the customer with a true brand experience that centralizes and fosters a local following.

End user(B2C)| They care about how the product looks on them and how it fits. They ask questions such as, "Does this fit with my style?" Customers like it to be easy to purchase and prefer when they are provided with images of clothing viewed in real world context.

Ecosystem Hypothesis: A customer (specific person) performs (controls, makes influences) specific actions (decision, behavior).

- Millennial consumers purchase more products from fashion brands that have a distinguishable digital presence.

- Millennial consumers purchase more products from fashion brands when they feature products in specific contexts and environments.

- Millennials are more likely to purchase a product if they can visualize how the product looks specifically on them.

- Millennials are more likely to purchase from brands who make more wholesome decisions toward promoting sustainable fashion solutions.

Cumulative Notes + Observations: B2B Interviews

- Clothing sells better when it is viewed on the body as opposed to a flat image of just the garment.

- Clothing sells more when video is captured.

- Goya currently has a 75 percent return rate. This frequently is a result of fit.

- Goya is currently looking for ways to differentiate their digital shopping experience. The team is currently experimenting with a cut paper, mix and match website interaction.

- The stories of brands do not translate well online. In slightly higher end retail stores, the staff members are trained to communicate the companie's story on the sales floor.

- Many brands began selling online first and later open brick and mortar locations. Usually they are placed in populated areas where they have the most brand recognition. *This debunked one of my early assumptions.*

- For the brands that I spoke with, brick and mortars are extensions of their aesthetics and are used as a way to tell their story. Sometimes these spaces are also collaborative. Brands will curate their clothing alongside a number of different items from other companies.

- Brick and mortar locations are hard to open because they are costly. The return rate is not easily calculated.

- Some companies do not sell on Instagram. Instead, they use the platform as a bridge to direct customers to their website. From the brands interviewed, they all did not feel they were an impulse type of buy for the consumer. Brands believe that if the customer makes a purchase via the website, they have a much higher likelihood at increasing the number of items sold per transaction.

- DÔEN uses social media platforms to funnel the customer to their website. They currently do not sell merchandise on social media apps directly.

- DÔEN's brick and mortar functions as an extension of their website.

- DÔEN has always had an online presence, but after COV-19, their focus is to grow their online experience. Currently, they have not yet found the best solution to do this.

- Dôen believes they lack proper, distinguishable presentation of garment-related information. They are a sustainable fashion brand that hopes to educate the consumer on their item production methods and material composition. DÔEN wants the customer to understand that they are investing in an industry rather than just a garment."

"We haven't found the best way to tell that story, when it comes down to where the garment was even made." —Ashley Kick.

- DÔEN tells stories primarily through still images, but their website has a journal section which encompasses more about their products.

- When prompting DÔEN with the question, "What is one aspect of your brand that you wish you could virtualize?" DÔEN stated that, *"It would be cool, similar to something I saw somewhere, ...to have the clothing displayed and you could pull on parts of the garment and see hand details and descriptions appear."—Ashley Kick.*

- When DÔEN was prompted with the question, "Is there anything you think I am missing or I should have asked today?" DÔEN stated that in order to justify hiring a 3rd party solution, it needs to increase revenue. You need to consider the internal resources, age demographics and size of the company that you are targeting.

- TC Squared, a no touch body measurement scanner company, stated that companies in the fashion sector primarily utilize their scanners to generate measurement data. With this data, the company will draft their own grading scale tailored to the brand's customer segment. There are 10,000 TC Squared scanners across the United States today. When I asked specifically why fashion brands were not using their scanners for more than just generating data, I was told that it was because the industry has been traditionally reluctant to embrace technology. The company is excited to see dressing rooms close because it has forced businesses to think differently.

- LEELANAU opened up a brick and mortar location after establishing an online and wholesale business. LEELANAU opened up a store because they see it as a marketing opportunity.

- LEELANAU is located in San Monica, California. The brick and mortar location generated more sales than her online market before COVID-19. LEELANAU states that it was extremely expensive to open up a physical retail store. Since moving online entirely, her online sales have increased by 65 percent. Selling online will continue to remain her top priority after reopening.

- LEELANAU states that it is so much more affordable to sell clothing online because the brick and mortar location also requires overhead for employees, stocking inventory and paying rent.

- LEELANAU has started making Instagram stories from inside of the closed physical retail store in order to generate online sales.

- When asked what she wishes she could provide her customers with online, LEELANAU stated she wishes to provide her costumer's with a space in which they could explore and discover things like if they were shopping in her store. LEELANAU misses the ability to curate things

together, which are all part of the LEELANAU store experience. LEELANAU also wishes to provide the customer with a dressing room experience virtually.

- When prompted with the question, "What do you wish a 3rd party solution could solve for you?" LEELANAU stated that diving into Google analytics is confusing and incomplete. LEELANAU wishes to have more transparency about where online customers are coming from.

- MOORE, started selling clothing online and opened up a brick and mortar location in New York. When I asked MOORE, "What does the MOORE brick and mortar experience entail?" MOORE says it is interactive and engages customers by demonstrating the making process on the sale floor. The personal interaction and the ability to try things on is something she has not been able to provide her customers with online. She says that overall, moving to selling online during the lock down created a more "finicky customer." What she means is that she sees a lot of people put things in a cart but not necessarily checking out. She suspects this is the case because she is not interacting with the customer like she would have previously.

- When I asked MOORE, "Has the pandemic brought new challenges for you? If so, what are they and how have you adapted?" MOORE says that they now offer less by doing capsule collections instead. MOORE says they are more focused on styling details. MOORE is no longer doing sessions moving forward.

- MOORE participated in New York Fashion Week 2020. They were disappointed in how little input they had in the final digital experience. They had no input on the set design, shoes, models or music. MOORE says that New York Fashion Week typically costs $25,000 to display 10 looks. The 2020 Virtual New York Fashion Week cost was $6,000 to participate. Clearly, there is value in participating and MOORE confirmed that it was a big form of marketing for them.

- When I prompted MOORE with the question, "If you could add any feature to MOORE to better represent the brand digitally, what would it be and why? They responded that they would like to host a digital fashion show that was more approachable and available to a larger audience.

- When I asked MOORE to identify any current problem with e-commerce brand experiences and apparel offerings, they said that, "If you don't already have well established visibility online, brands can choose to pay for platform features and highlights." They feel that because of this, it is often harder for smaller brands to complete.

- When I asked MOORE, "If they were to theoretically hire a 3rd party solution, what problem or challenge do you see them solving for you? MOORE responded that they would be interested in having someone handle all of their website needs.

- Poppyseed Clothing only sells online because the CEO of the brand studied fashion marketing and is well aware of the tremendous up front expense of opening a brick and mortar location. The CEO of Poppyseed also likes not feeling tied down to a specific location because this is not her only job. Poppyseed is one of the businesses I interviewed who I was surprised to find out was only one person. The CEO also is a contract seamstress and pattern maker. Poppyseed Clothing sees Instagram as the number one platform for acquiring new customers. She is very active on Instagram, but recently finds it harder to stand out from the crowd. A solution to this problem has been sending out newsletters about product releases specifically to her established clients.

- Poppyseed Clothing is switching to only offering dead-stock material products. Each piece will be unique and she will only sell that product until materials run out.

- Before COVID-19, Poppyseed Clothing would host pop-up, try on events. These events provided an excellent source of revenue.

- When I prompted Poppyseed Clothing with the initial idea of including a virtual store that was directly linked to Instagram, she loved the idea because she would love to have her customers come into her studio space.

- Poppyseed Clothing believes the concept of a virtual 3D store front could re-educate consumers since so many of her clients have no

idea what goes into making a garment. Poppyseed Clothing does not like the made-to-order business model because they do not want to create a market in which requests for specific product changes become too accessible. They are concerned that too many opportunities for change can interfere with their brand's curated aesthetic. A request for a cat embroidery piece on a garment's shoulder, for example, could alter brand image.

- Garmentory is a website that is dedicated to providing their customers with access to the global world of smaller local designers. They operate entirely online. They are active on social media platforms including Instagram and Snapchat, but these channels are primarily used to direct their customers to their website.

- Garmentory has discovered that with minimal effort, they are able to generate several thousand dollars in sales by using SnapChat alone.

- When prompted with the question, "What challenges come with selling products online?" Garmentory stated that they were not aware of their customers' navigational paths on the website. Garmentory stated that many of the customers are not aware that they are a marketplace, despite detailed descriptions and boutique write-ups.

- When prompting DÔEN with the question, "What is one

aspect of your brand you wish you could digitize?" DÔEN stated that, "It would be cool, similar to something I saw somewhere, to have the clothing displayed and you could pull on parts of the garment and see hand details and descriptions appear."

- When prompted with the question, "If you were to theoretically hire a 3rd party solution, what problem or challenge do you wish they could solve for you?" DÔEN wishes to have an AI program in which they could photograph a garment, read its colors and write a product description based on this. DÔEN says writing product descriptions, colors, and general product categorizing is a tremendous amount of work.

- The Fabricant is a digital fashion house that believes that digitization of products like clothing can help clients promote and visualize ideas without wasting unnecessary resources.

- *"3D visualization gives a multitude of possibilities on lighting, materials and backgrounds. With virtual worlds not yet explored, we have the visual means that will set brands apart from the overused film and photo-shooting techniques." —Amber Jae Sloten, founder and creative director of The Fabricant.*

- Entireworld only sells clothing online because it is too hard to open a physical retail store. *"It takes a long time for the physical retail store to mature into something that is actually profitable." - Cissy Huang*

- When I asked Entireworld, "Would you hire a 3rd party solution

to create 3D environments to complement your web presence?," they responded with a definite "Yes." Entireworld responded as such because the CEO of Entireworld is very interested in using new technologies like VR and AR. They added that other brands may not be as interested just by the pure nature of that company's culture.

Cumulative Notes + Observations: B2C Interviews

- Generally, almost every B2C customer wants to feel the fabric. I was surprised to hear that this was more important to some of my interviewees than trying on the garment itself.

- Brenda W from Toronto (Late 20's, Her), states that she would use an AR filter to try on garments virtually because sometimes she feels pieces don't match her vibe, which she can't always distinguish on the hanger alone.

- Brenda believes that since the pandemic began, the choices of clothing she can purchase in stores seem more limited. While she prefers shopping in person, she has recently come to discover that she can find more options online. When shopping in person, she does not necessarily always try things on because she feels it can be inconvenient.

- Brenda uses Instagram shopping because she likes to purchase from local brands. She makes purchases based on what a particular brand stands for. In a store, she likes to feel the fabrics.

- Emma Wheeler (25, Her) prefers to shop online and hates lingering while shopping. When prompted with the question, "What makes a clothing brand stand out to you online?" She stated, *"Social presence is very important to her, along with colorful, catchy images."*

- Emma feels that shopping in person is time consuming. She never returns items and typically buys a size larger and shrinks her clothing.

- Gretchen Biere (Mid-Twenties, Her) uses Instagram to document her outfits. She primarily thrifts, but occasionally shops online because it is a way for her to relieve stress, even if she has tried to resist buying new clothes more recently.

- Valentina Vedani from Italy (Early 50s, Her), works in the fashion industry as a fashion buyer. Her number one frustration with online shopping is getting the wrong size. She prefers to shop in person because she believes assisted purchasing is an irreplaceable value.

- She loves when she goes shopping for one item, but walks out with a couple of other unexpected items. She feels most brands offer a comparable digital experience online, but Valentina spoke quite a bit about ordering a dress from Carel, based in Paris. This supports one of my initial hypotheses—*Couture brands harness powerful storytelling marketing techniques compared to smaller, local brands that lack internal resources to offer their customers.*

- Carel has been recruited by couture designers such has Karl Langefeld, Jean-Charles de Castelbajac, and Jean Paul Gaultier to design footwear specifically to complement runway events.

- When I asked Valentina if she would utilize a virtual try on app, she said she felt uneasy about it because she

said she would not trust the results. She did confirm that she much rather purchase clothing items through an app as opposed to a website. She mentioned H+M which I was quite surprised to hear her mention. I would have expected someone working in the industry to not purchase from H+M. She likes the discounts the H+M app features.

- Sam Reece (25, She) says since the lock down, she misses the tangibility factor of shopping in person and being able to try clothing on. She finds new clothing brands from watching Tik Tok clothing hauls. She misses the ability to go shopping with friends. The most disappointing aspect of online shopping for her is shipping. She does not like the waiting time and feels the process of shipping the product back is time consuming. She often forgets what she had ordered in the process, and this is frustrating to her.

Cumulative Notes + Observations: Another Interview

Not quite a B2B or B2C Perspective | Rebecca Karpus, a recently retired FIT professor who taught visual merchandising and fashion advertising, shared her perspective on the market. Her points are the following:

- *"Age is a huge factor when you are considering your market because younger generations don't remember the service industry. To build something that is easy enough for those who know how to use a computer, but only to a certain degree, would be big." —Rebecca Karpus*

- Rebecca thinks colors are not represented well online.

- Rebecca remembers a time when going to the department store was an event. *"You had lunch, watched a fashion show, and tried on clothing. It's also a source of entertainment for people."—Rebecca Karpus*

- Rebecca believes the more content you can offer, the better—particularly with regard to details and story. Rebecca asserts, *"Everyone loves a good story."*

- I shared with her my concept for including more immersive, online shopping environments. She mentioned that arranging window displays was one of her favorite jobs. I thought this was interesting because that is the reason behind why I would I would suggest the type of application I am purposing with this project. *"A lot of people have a hard time putting looks together, but when they see how something is arranged, they can see the creative possibilities. Creating your own look is something you also cannot do online." —Rebecca Karpus*. This was a point I had not previously thought about or had even planned on considering in my project—the ability to mix and match pieces digitally.

- Rebecca says that is essentially *"how to up-sell pieces, by being able to play with items in a way that gives buyers creative free range."*

- Another point she brought up was also being able to see the pieces on different body types and skin colors. *"Just because I see this one piece of clothing one skin color, does not mean that it will look good on my own skin color."—Rebecca Karpus*

- *"The more options, the more story, and the more service."—Rebecca Karpus*

- I brought up production-on-demand business models. She was aware of this concept working in other countries, and she believes that while it is not currently being implemented in the United States, it does hold promising potential. She was intrigued with the project's concept and idea overall.

Week Two Highlights

- The age demographic that this application might appeal to is much wider than I Initially anticipated. If the applications interface is approachable and already integrated into a platform that many users are familiar with, it could have a much broader audience than expected.

From my observations, fashion brands are either:

- Fast Fashion: Catering to the Gen Zs or 25 years old and younger.
- Fashion: Catering towards mid-to-late 20s up to early 50s.

This could be the case because it allows for more customers to potentially shop your brand. I do not observe hard and fast rules which can be applied to target age demographics. If I was to further pursue research on this topic, I would focus on income segmentation since as soon as cost becomes the customer's top priority, the information the interviewees provide me seemed no longer as applicable to my research questions.

Final Thoughts About Customer Interviews

- Speaking with brand owners and designers was informative, but I found when I was granted the opportunity to speak with those who worked as part of a brand's e-commerce marketing and outreach team, they generally had better insight to offer— usually in the form of a current stat or trend that they have tracked over time.

- Social media platforms seem to be where customers are remediating the brick and mortar experience. In many ways, it is as if these platforms have become large stores and all of the brands featured are individual products. Customers are starting to shop through social media platforms.

- To really draw conclusive results from qualitative data, you need either a larger pool of samples or a narrow market segment.

- My customer is a business. I started this project not considering if it was a tool that you could just provide the brand and they execute the rest or if it was a 3rd party solution that worked in collaboration with these fashion brands. Moving forward with the project, I am envisioning The Phygital Fashion Emporium as a service offered to businesses. From the interviews I conducted, I can strongly see this service as a future trend. Many brands voiced frustration trying to maintain and keep up with a virtual brand presence.

Revisiting The Original Questions After Collecting Interviews

What is the market problem my software will address?

Because of the sheer cost, wastefulness, and inaccessibility of the traditional fashion show format, my application would address several market problems:

- The democratization of the runway. It would challenge the traditional fashion leaders who build customer following through the use of runway presentation and storytelling. It would offer brands a service that would compete with traditional runway formats. Increasing accessibility for both the local fashion designer and the consumer, who otherwise may not be aware of the local designer. It would increase consumer access to runway presentations and stories.

- Transition consumers' to purchase local and value their material goods as more than just an object. It would allow consumers to explore and learn more about the products they are purchasing online.

- Draw consumer attention away from fast fashion by providing them with more than just a product. It would provide the customer with an experience—something unique that they can identify with.

- Currently, the interface of apparel websites are two-dimensional and lack visual diversity. The familiar white grid, product selection page was a fantastic design for early widespread e-commerce adoption due to its efficiency purposes, but with more of our interactions and day-to-day experiences taking place through an assortment of digital channels, the question to ask now is: "How do we foster better shopping experiences that mirror something similar to a brick and mortar shopping trip?" My application seeks to address how we can deliver consumers unique digital experiences and foster a greater sense of presence through digital formats.

- The implementation of digital fitting solutions could shift apparel production methods towards a produce-on-demand model. This would eliminate unnecessary material waste, resources and labor cost by reducing excess product production. My software enables customers to visualize how clothing items move. It would also provide the customer with an AR virtual fitting room found within the virtual spaces.

What industry or consumer type is having this problem?

- The fashion industry

- All consumers of fashion apparel products including those who don't identify as fashion forward.

What is my solution?

- The augmented reality fashion application is a three-dimensional place designed for local fashion designers fashion brands to deliver brand narratives more akin to those established by runway performances. Implementing a 3D interface allows for consumers to view and explore clothing items in a 360 viewing format with the additional ability to virtually try on clothing items via augmented reality virtual fitting rooms. Tracing back the history of early runway couture, luxury houses established their brand identity through runway performance. Not all

designers can afford to participate in New York Fashion Week. My solution attempts to democratize the very element which makes luxury fashion special: ~~its marketing techniques.~~ My application will oscillate between fully immersed, 3D curated environments and enhanced real world overlay through the use of augmented reality interaction.

How is it unique and why is it better than existing solutions?

- It is unique because it emphasizes the artistic expression of fashion ~~branding~~ marketing. The concept stems from searching for sustainable apparel solutions. I believe the problem rises from overproduction within the industry and consumers' lack of investment in quality apparel products.

Who is your target customer/user?

- ~~Millennials and Gen Z.~~ The intended audience is digitally fluent and ready for innovation. The intended customer has an income that allows for some discretionary purchases.

Who are the target users for this software or app?

- ~~Local fashion brands with small apparel operations. Fashion brands who would never show a collection at New York Fashion Week, but are producing better quality products compared to other established, well known brands on the market. Fashion brands and their customers.~~ Fashion brands that seek to work with a 3rd party solution in order to implement a new type of e-commerce experience.

Who are the buyers for this software, if not the end users directly? (For example a purchasing manager may be the buyer for enterprise software solutions)

- Fashion brands would purchase the interface solution.

Have I received feedback on your software/app idea from your target users or buyers?

- ~~N/A~~ Yes

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