

Exploring Transformable Design for Development of More Sustainable Fantasy Costumes

by

Kajsa B. A. Hallberg

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Program of Study Committee:

Dr. Rachel Eike, Major Professor

Dr. Ling Zhang

Dr. Brianna Burke

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Abstract

Textile waste is a major source of pollution in the apparel industry with over 17 million tons recorded by the Environmental Protection Agency (*Textiles: Material-specific*, 2021). This large amount of waste is an environmental issue that requires altered design approaches across the industry to increase clothing sustainability (Claxton & Kent, 2020). One area of clothing designed and produced that is largely under-researched is the genre of fantasy costume. Fantasy costumes have previously only been briefly studied through the lens of fantasy cosplay.

This observation was made following over 15 years of attendance to multiple renaissance festivals and five years of research into sustainable apparel design. The fairy costumes at these festivals change often and require multiple components. Thus, this category of fantasy costumes is a good fit for inspiration to explore sustainable design approaches, modular and transformable design, to propose design and construction alternatives to make these costumes more versatile and long-lasting, therefore, helping cut down on textile waste entering landfills. With this research and inspiration in mind, a ‘research through practice’ study inspired by the works of Bye (2010) and Chen and Lapolla (2021) was created to explore how transformable and modular design can improve the sustainability of these costumes, from a textile waste sustainability perspective. Data gathered through photo analysis guided the design creation of a costume of this specific aesthetic and genre (i.e., fantasy fairy). The resulting costume is completely reversible and features modular elements that make it versatile in styling to generate multiple ‘new’ looks for the performer. Future research is recommended to look into expanding both the sustainability applications for this genre and expanding modular and/or transformable design approaches into other fields of costume design.

Introduction

Sustainable Design Opportunity – Fantasy Performers' Costumes

Renaissance festivals are often host to a wide variety of fashion styles and costume genres, often leading to a similar variety of wardrobe building and sustainability habits regarding those costumes. This can be seen for both attendees and performers. However, a large variance of wardrobe-building behavior has been observed after years of attending various festivals in the American Midwest. For example, stage performers may only have one or two costumes, main actors such as the Royal Family may have around four distinct costumes, and street performers will often have anywhere from two main costumes to having something new almost every weekend of the festival season. When focusing on the latter, an opportunity to look at increasing sustainable wardrobe habits arises among the street performers. This wide variety of costuming and new outfit changes tends to occur most in the fantasy genre of costumes such as the fairies, elves, and similar magical creatures.

Attendance of many renaissance festivals has led to a few observations by the researcher regarding fantasy costumes for these street performers. First, they often rely on bright colors and at least one shiny component – often the wings for fairies, jewelry for elves, etc. – to be able to easily catch the eye of attendees who will enjoy their act. Second, the costumes seem to change regularly to continue keeping up audience interest in the character, and also for photography reasons. New outfits allow for more photo opportunities (such as formal photoshoots) to happen, which can lead to prints being sold from those photoshoots. This type of merchandise needs to stay fresh, so new photography needs to occur which often leads to a necessity for new outfits. Overall, clothing consumption appears to be quite high for performers of this genre. This

approach to costuming raises questions around how it can be made more sustainable without preventing the performers from providing their audiences with new content.

One route many costume designers can take to approach this issue is incorporating transformable techniques through modular design in the costume creation. This is when a garment is specifically designed to be restyled or modified through different facets of the garment, allowing for a large variety of looks without requiring different clothing every time (Schaefer & Navarro, 2013). Modular variations of garments increase their sustainability by increasing the creative usage of those garments, therefore giving them a longer-than-average lifespan and cutting down on clothing consumption by the wearer (Chen & Lapolla, 2021). This design approach has potential for helping fantasy performers increase the sustainability of their costumes due to the multiple restyling options that will help keep their wardrobe versatile without need for excess consumption.

Research Objective

This study aimed to examine the sustainability issue posed by these costuming decisions in fantasy apparel. Through research of existing literature and photo analyses of leading performers in this field, the goal of this study was to find a way to use a transformable and modular design approach to provide performers with costume items that can be used multiple times over five years or more. Additionally, these costuming pieces can be used in a large variety of ways so that the overall look continues to remain fresh and new to the eyes of their audience.

Purpose and Research Questions

The purpose of this research was to investigate how transformable and modular design can be used to make fantasy costumes more sustainable, cut down on consumption by street performers who play characters in that genre, and design and create an example of transformable

and modular design in this costuming genre. Use of the transformable and modular design approaches has the potential to allow performers to maintain their diversity of wardrobe without continuously needing to purchase or make new items. This lower consumption can decrease textile waste, making this side of costuming more sustainable.

The developed research question explored current costumes worn by fantasy performers at festivals and fairs, and the ability to use transformable and modular design in fantasy costume creation:

How can fantasy costumes for renaissance festivals be realized through the sustainable design lens of transformable design and modular design?

Significance of Study

Users

When doing a personal perusal of renaissance festivals' websites, the average number of performers hired for each event is around 200 people, with about one third of them in the fantasy and magic genre. That would make for about 66 fantasy performers per festival, and an estimated 50 of them are likely unique to each festival. There are 333 registered renaissance festivals across the United States (*List of Fairs, 2022*), resulting in an estimated possible 16,650 fantasy performers across the country. Finding of this study can provide these performers, as well as any other people interested in fantasy costumes, with a wardrobe-building approach that is more sustainable and versatile than the traditional method of constantly acquiring new pieces. Additionally, the average person only wears a garment seven to ten times before throwing it away (Greenwood, 2018). By embodying sustainable design priorities, garments will be able to last longer in rotations of outfits, which will also be more cost-effective for the wearers.

Industry

Following the Covid-19 pandemic and subsequent building public awareness surrounding sustainability, many apparel brands are making decisions on that promote sustainability (Cernansky, 2020). Consumers have made it clear in their increased calls for more environmentally friendly clothing that sustainable policies are becoming a necessity for the apparel industry. Brands that fail to include these measures have seen an increase in consumer backlash and demands for their products to be made more eco-friendly (Cernansky, 2021; Rinaldi, 2019). Recent surveys show that consumers are more willing to seek out new brands that are more sustainable than their current options. They are also more aware of marketing manipulation and are scrutinous with how they research policies, so brands that make substantial sustainable policy will be more favorable in their eyes (Cernansky, 2021). Transformable and modular design research could serve as a potential guideline for apparel designers, both costume and mass market, to include sustainability in their design processes to meet shifting consumer demands and evolve their design approaches.

Academia

Modular versions of transformable design have become a popular area of research as sustainability grows in importance to both designers and consumers. Recent articles exploring modular design in apparel can be found through a variety of databases, however most of these focus on sportswear and formal wear (e.g., Cao et al., 2014; Chen & Lapolla, 2021; Koo et al., 2014). While research has explored transformable design in ready-to-wear categories, there is a distinct gap in research to improve the sustainability of costume design through this design lens, both in fantasy genres and more general areas. This study will contribute to filling that gap and assisting further research and development of using transformable and modular design in apparel creation.

Assumptions and Limitations

Inspiration for this study stemmed from more than 15 years of attendance to multiple renaissance festivals and observations made over the course of those visits. Those years of learning about renaissance festival life and culture, as well as following many fantasy performers from those locations, have led to a few assumptions regarding fantasy costume design. These assumptions are listed below.

1. It is assumed that renaissance festival performers create and maintain a unique look that allows them to be recognized among performing peers.
2. It is assumed that the performing community could benefit from sustainable design as realized through their costumes.
3. It is assumed that fantasy costumes can be realized through transformable modular design through subtle changes in pattern style, such as different sleeves, color, or length of the garment (Chen & Lapolla, 2021).

Through the research already conducted, limitations were speculated. There is very little literature available that studies sustainable costume design, and there is almost none for fantasy costume design. Further details are provided in the literature review. This lack of literature impacts the need to clearly define and describe this particular genre of costume design. Lack of previous research also means that there is not a steady foundation of study into sustainable costume design to build upon. The feasibility of producing sustainable costumes for fantasy performers has not been determined, making the design challenge significant.

Operational Definitions

Modular Design Design approach that allows for garments to be transformed through the manipulation of smaller units (Chen & Lapolla, 2021)

Practice-based Research	Research framework that encourages development of the research through practice and application of the concepts; Research process that often includes a creative component output both as part of the research and as a result of the process (Candy & Edmonds, 2018)
Sustainability	Ability to last for a long time and fulfil present needs without completely using up or destroying resources (<i>Sustainability</i> , 2022)
Transformable Design	The ability for one garment to change into one or more different garments that share similar characteristics (Wei, 2016)

Literature Review

Sustainability in Apparel

The United Nations defines sustainability as the ability to meet present needs in a way that lasts a long time and does not use resources in a way that completely depletes them (*Sustainability*, 2022). In apparel, this can take on many forms and the term is often defined by the end goal of each individual designer or apparel company. Some activists care more about sustainability regarding people and labor, while others focus on the environmental effects of clothing (Henniger et al., 2016; Rinaldi, 2019). For the purpose of this study, the sustainable focus was on the environmental side as the focus was on reducing textile waste in costuming, which has direct effects on the environment.

Environmental Sustainability and Apparel: Textile Waste

The apparel industry has a major impact on the environment due to textile waste caused from large material consumption seen in manufacturing, consumer purchases, and thrown away clothing and fabric scraps. In 2018, the Environmental Protection Agency recorded 17 million tons of municipal solid waste generated through discarded textiles in the United States, making

up 5.8% of waste generated that year. On the recycling side, only 2.5 million tons of textiles were recycled that same year (*Textiles: Material-specific*, 2021). There have been many proposed solutions to the environmental issues caused by this large amount of waste such as slow fashion, eco-friendly textiles and materials, increased push in shopping vintage and second-hand, and encouraging increasing quality of garments being made so they last longer (Henniger et al., 2016; Jung & Jin, 2014; Rinaldi, 2019; Ruppert-Stroescu et al., 2015). Designers specifically have been pushed in recent years to include more sustainable measures in their design practices such as eco-friendly and biodegradable textiles (Henniger et al., 2016), moving production to be more local/domestic instead of globalized (Claxton & Kent, 2020), ethically-sourcing materials (Henniger et al., 2016), circular design (Claxton & Kent, 2020), and transformable design (Henniger et al., 2016). Reducing textile waste by apparel companies through sustainable design practices and clothing consumption by consumers are the biggest ways that fashion's impact on the environment can be reduced. Focusing on the sustainable design approach of transformable/modular clothing shows great potential for reduced textile waste, reduced consumer consumption of wearable goods, and shows the greatest potential for the costume genre.

Sustainability in Costume Design

Incorporating more environmentally friendly practices has grown in importance to many who make and/or wear costumes for a variety of reasons. Both designers and consumers have been following the broader sustainability trends and have explored ways to decrease waste in the costume creation and consumption (Lamerichs, 2021; West & Smith, 2017). One of the major places that sustainability in costuming has been pushed is through social media posts and communities. Costumes made in a more environmentally friendly manner are often posted with

the hashtag “#ecocosplay” on Instagram, joining a large community in planet-conscious wearers who are demanding more from their costumes (Lamerichs, 2021). Both designers and consumers are pushing the idea of “circular fandom,” a play on the concept of circular fashion. Costumes are encouraged to be able to be shared, reused, and renewed so the lifespan can be increased, and the material waste decreased (Lamerichs, 2021). This has led to trends of upcycling and sourcing secondhand materials for costume development (Lamerichs, 2021; Parsons, 2020; West & Smith, 2017).

Upcycling has been very popular for environmentally friendly costume design amongst smaller creators. The practice has proven to be a fun way for many designers to challenge their creativity and show off what they can do with scrap and unconventional materials (Lamerichs, 2021; West & Smith, 2017). Upcycling allows materials to be given a new life in a new creation, which cuts down on the consumption of materials and reduces manufacturing impact on the environment (West & Smith, 2017). This design approach also increases collaboration amongst creators. For example, why buy new material for a costume when fabric from a friend’s old costume that is no longer worn can be repurposed? This increases the lifespan of the materials and makes the use of the costumes more sustainable and waste conscious (Lamerichs, 2021; West & Smith, 2017).

Additionally, sourcing materials secondhand, outside of the concept of upcycling, is an environmentally friendly method of manufacturing that is growing in popularity in larger scaled production measures. Working with secondhand and other sustainable materials helps decrease the textile and material waste experienced in costume design (Parsons, 2020). Because the outfits are often only worn a few times total before returning to storage, reducing the number of new materials going into them decreases material consumption overall. Hollywood costume designer

Sinéad Kidao is fond of using this approach to manufacturing and has introduced this method of sustainability to many of her projects (Parsons, 2020). Work like Kidao's and other efforts by designers to incorporate more sustainable practices in costume design are slowly increasing in popularity and becoming more prevalent in how the costumes are created (Parsons, 2020).

Transformable and Modular Design in Apparel

Modular design is defined as a transformable design approach that features small units that are able to be combined and worn in a variety of ways, providing a lot of diversity in style and appearance for the wearer of the items (Chen & Lapolla, 2021; Schaefer & Navarro, 2013). Transformable design is defined as one garment's ability to be "transferred into at least one or more garments or related items that share certain characteristics and functions with the original garment" (Wei, 2016, p. 8). This design approach helps increase the lifespan of clothing by providing the wearer with more options in styling. The idea is that the different modules, or units, of a garment or full outfit can be organized and integrated in any combination desired by the wearer, providing nearly endless style opportunities, thus making clothing more sustainable (Li et al., 2018). A detailed example of this design approach can be seen in Figure 1.

Figure 1

Detailed Example of Modular Design in an Apparel Collection (Rahman & Gong, 2016)



Note: For the design of this collection, 39 separate pieces were used totaling in the ability to create at least 21 ensembles. Reprinted from “Sustainable practices and transformable fashion design – Chinese professional and consumer perspectives” by O. Rahman and M. Gong, 2016, *International Journal of Fashion Design, Technology, and Education*, 9(3), p. 241, Copyright 2016 by The Textile Institute and Informa UK Ltd.

The concept for modular design in apparel comes from similar concepts found in architecture, engineering, and similarly related science and design fields. These influences can be seen in past approaches taken by designers such as manipulating style lines so that the garments are easily translated from one style of wearing to another (Chen & Lapolla, 2021). Little research has been done in how to apply this design process to more fitted garments. However, recent studies by Li et al. (2018), Moretz (2018), and Wei (2016) have explored how modular and more general transformable design can be used in more form-fitting styles, further increasing design possibilities through the process. An example of Moretz’s design can be seen in Figure 2.

Figure 2

Transformable Design in a Form-Fitting Gown (Moretz, 2018)

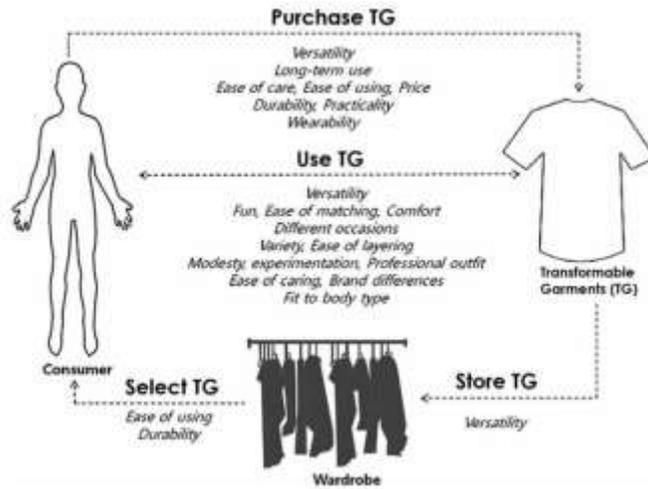


Note: Adapted from “Transformative innovative pattern cutting and draping” by C. Moretz, 2018, *International Textile and Apparel Association (ITAA) Annual Conference Proceedings*, p. 2, Copyright 2018 by International Textile and Apparel Association, Inc.

Clothing designed using a modular approach has also shown to be popular with consumers in market research (Cao et al., 2014; Rahman & Gong, 2016). Focus group testing and discussion has shown that consumers would be willing to purchase this type of adaptable clothing and use them for longer in their wardrobes. In fact, many participants in a focus group from one study indicated that they would wear clothing designed using modular processes for ten years or longer, if possible (Cao et al., 2014). The versatility of this adaptable clothing has been marked as a big selling point for many consumers. Additionally, market researchers identified three main expectations consumers have for modular design: fun and experimental, comfort and usability, and context aptness (Koo et al., 2014). Figure 3 illustrates consumer attitudes towards garments with modular design (Koo et al., 2014).

Figure 3

Consumer Attitudes Towards and Expectations for Transformable Design (Koo et al., 2014)



Note: Reprinted from “Design functions in transformable garments for sustainability” by Koo et al., 2014, *International Journal of Fashion Design, Technology, and Education*, 7(1), p. 12, Copyright 2013 by Taylor & Francis

Expectations of such as experimentation, comfort, wearability, and versatility for different occasions can be met with ease using the modular design approach thanks to its customizability. This willingness by consumers to adapt transformable and modular fashion is a great indicator towards the feasibility of introducing it into fashion markets (Koo et al., 2014).

As reviewed in this sub-section, research and design scholarship employing transformable and modular design approaches has been conducted for ready-to-wear and formal wear garments, primarily showcasing its potential to grow into the larger fashion market. While this research has not yet been applied to areas of costume design or the performance community, opportunities exist for adaption of the design techniques into costume wardrobes thus reducing the textile waste generated from costume creation.

Methods

Rationale for Research Approach

The focus of this qualitative study was to explore clothing trends in select fantasy costumes to present a design solution that embodies the sustainable transformable and modular design approaches to engage the role-playing community in sustainable behaviors connected to their clothing and textiles. A photo analysis of current leaders in performing spaces and their costumes provided the necessary data to show what textiles, silhouettes, shapes, and other costume design components are utilized in fantasy costume creation and where transformable/modular design can be included. The research framework also included the design and construction of a physical costume prototype to demonstrate how transformable/modular design can be realized after photo analysis. Collection and use of the photo data allows for creative interaction and interpretation, which is necessary for design scholarship (Maher et al., 2018). This design followed the ‘research through practice’ framework developed by Bye (2010) and refined by Chen and Lapolla (2021).

Research Design

‘Research through practice’ is a form of design scholarship within apparel and the creative arts that has existed for around 40 years. The scholarship itself is still largely undefined regarding a settled status (Candy & Edmonds, 2018). However, a version for apparel design was recently developed by Bye (2010) and further refined by Chen and Lapolla (2021). The framework used for the proposed research is centered around “problems derived from practice, initiated from an inquiry directed by an aim or goal” (Bye, 2010, p. 211). In this style of study, researchers approach the design challenge as an inquiry into practices currently used. Data analysis leads to creation of experimental designs that are tested, analyzed, and further developed

until a finalized solution is created (Bye, 2010). This process creates a circular research and development process that encourages inquiry and discovery and pushes creative design solutions (Chen & Lapolla, 2021). A visual depiction of this framework can be seen in Figure 4.

Figure 4

Research Through Practice Design Framework (Chen & Lapolla, 2021)



Note: Reprinted from “The exploration of the modular system in textile and apparel design” by C. Chen and K. Lapolla, 2021, *Clothing and Textiles Research Journal*, 39(1), p. 52, Copyright 2020 by ITAA

Experimental designs, in this framework, served as part of the research process instead of solely being an application of the research findings. Chen and Lapolla’s (2021) research into modular design featured four experimental designs each feeding into further development and refinement of research questions, more review of previous research and work, and resulted in a mini collection through which the study could be visually followed. However, the framework is flexible in how it can be applied. The circular process can be lengthened or shortened as needed and the layers of the spiral can be individually examined for their own findings and application (Chen & Lapolla, 2021).

This study used the ‘research through practice’ framework where one experimental design was produced as the outcome of photo data analysis. The decision to focus on one circular

phase of the research design, where the outcome would be one experimental design prototype, was selected based on two considerations: 1) the niche area of costume design for fantasy performers and 2) the novel approach of sustainable transformable and modular design for fantasy costume application. These two points, along with belief that sufficient data could be gathered and analyzed to inform the transformable and modular design processes, informed this decision. Suggestions for additional experimental design iterations will be outlined to consider for future design research opportunities.

Data Collection and Analysis

Coded themes are reported as a table in the results section of the research and compared to the final creative component design to ensure consistency of the research question, data, and results.

Data was collected by accumulating photos of Twig the Fairy, the creator of the largest brand of fairy performers for festivals and fairs, to analyze the costumes and their components that make up her brand's wardrobe. Public forums, such as social media and the performer's website, were used to gather the photos. Any images gathered had to include at least a shot of the torso (including head), with full body shots being preferable, so that details of the costumes could be seen. *Note:* Copyright has been respected by ensuring that shared photos have been cited properly and no financial gain was achieved through use for this study.

Collected photos were loaded into the NVivo software and themes were coded for analysis. The use of NVivo software was selected as it has been previously used in other qualitative design scholarship research studies by demonstrating the program's usefulness for coding visual themes found in apparel and other creative arts pursuits (Maher et al., 2018). Themes such as silhouette, color scheme, and performer-identifying individual components, like

arm warmers, neck pieces, and shawls/capes, were analyzed through the software to create a guide for wardrobe analysis and the experimental transformable and modular design. This type of analysis provided the ability to prioritize components of the costumes while noting where transformable and modular design considerations could be included.

Following data analysis, an experimental fantasy design was constructed for further analysis of transformable and modular design within this style of costuming. The garment was evaluated for success of including transformable/modular elements. Records of the entire design process were collected to provide future guidance on exploring this method of environmental sustainability in costume design.

Summary of Methods

The proposed qualitative study collected data through the use of photo analysis of fantasy performer, Twig the Fairy, who has interacted with fantasy costumes in renaissance festivals, fairs, and similar venues for 19 years. Photos were gathered from the performer's social media and coded for themes in the costumes. The design scholarship framework of research through practice developed by Bye (2010) and explored by Chen and Lapolla (2021) was then followed by using the results to guide the design process for the creative component garment. The resulting creation was a fantasy costume using transformable and modular design techniques which was subsequently analyzed for success of application and further exploration of the technique in costuming.

Results

Photo Analysis Data

Over the course of data collection, 82 photos of Twig the Fairy were gathered and analyzed in the NVivo software. Initial observations of the photos led to the establishment of four main

themes where different sub-codes were identified. These themes informed 1) base garment structure, 2) silhouette shape, 3) color scheme, and 4) accessorizing elements to build the costume so that when transformed, each style was unique yet identifiable to Twig the Fairy.

When coding in NVivo, various parts of the images were selected to identify the section of the costume where the coding could be best observed. For example, if Twig was wearing a neckpiece with a costume, the area on the photo where it could be seen would be selected, then the code was applied to that section. Highlighted sections could overlap, so the garment shape identifying the overall silhouette could take up the whole area where Twig's costume could be seen, but that would not hinder the ability to still highlight smaller areas of the garments that then could inform other themes, such as accessorizing elements. Figure 5 depicts an example of how different themes were identified throughout each photograph.

Figure 5

Example of Identifying Themes in Photo Analysis



Note: Photo used in creation of example figure is reprinted from *Tumblr*, by M. Masala, 2011, <https://mousiemasala.tumblr.com/post/7745849606>. Copyright 2011 by Mousie Masala. Reprinted with permission.

Theme descriptions

Analysis of the photos identified 15 different costuming elements, or codes, across four main themes. For the **base garment** theme, sub-themes of corsets, dresses, tank tops, and tunics were identified. Of these, tunics and tank tops were coded the most with 46.3% and 26.8% frequencies, respectfully. Two different **silhouette shape** themes – bell and sheath – were identified with bell silhouettes being the most common at 59.8% frequency. To further explain, this coding structure communicates the most common costume in Twig’s brand consists of a bell-shaped silhouette shape made from a tunic base and then built up with a variety of different accessorizing elements.

Four distinct **color** themes were identified throughout analysis of the photos. There were two versions of a cool-toned color scheme and two versions of a warm scheme. The first cool-toned scheme, dubbed “Cool – Natural,” was created from an amalgamation of colors found in nature that had blue undertones. This was made of mostly blues, cool browns, and cool greens in deep gem tones. The second cooler color scheme, “Cool – Water,” was made up of brighter colors and pastels that involved all blues, purples, and pinks. The first warm-toned color scheme labeled as “Warm – Natural” was similar to its cooler companion but was comprised of colors with yellow undertones such as oranges, yellow browns, warm greens, and a few reds. This color palette also was mostly gem tones or muted colors. The final color scheme, “Warm – Fire,” was completely bright reds, oranges, and yellows with the occasional inclusion of warm-toned pinks and greens. Analysis of these color palettes showed that warmer colors were much more common and made up the majority of Twig’s costumes. The most common overall was the warm, natural colors featured at a frequency of 46.3% and also aligning best with the brand Twig built for herself and her other actors.

The final main theme identified in the analysis were the **accessorizing elements**. Twig's costumes were full of many different scarves, sparkly appliqué, knit shawls, and different headpieces.

For a more detailed view of the photo analysis, Table 1 shows the full overview of how often (frequency) each theme appeared in Twig's collection of costumes.

Table 1

Overview of Themes Observed in Photo Analysis

Photo Analysis of Twig the Fairy's Costumes			
Theme Areas	Specific Codes	Frequency (Count)	Frequency (Percentage)
Base Garment	Corset	11	13.4%
	Dress	11	13.4%
	Tank Top	22	26.8%
	Tunic	38	46.3%
Silhouette	Bell	33	40.2%
	Sheath	49	59.8%
Color Scheme	Cool – Natural	27	32.9%
	Cool – Water	16	19.5%
	Warm – Fire	33	40.2%
	Warm – Natural	38	46.3%
Accessorizing Elements	Arm Warmers	27	32.9%
	Corset	22	26.8%
	Neckpiece	55	67.1%
	Shawl/Cape	11	13.4%
	Sparkle Appliqué	5	6.1%
	Sweater	11	13.4%

Note: Costumes often had multiple accessorizing elements, and sometimes the top half of the garment would have a slightly different color scheme than the bottom half. Because of that, the counts for those will not add up to 82.

Costume Design Process

This photo analysis of Twig's costumes was followed by the design and construction of a costume using transformable and modular design techniques to increase sustainability through design of the performance fantasy costumes genre.

Initial design inspiration came from identifying key element of the style of costumes found in and inspired by Twig's brand, as outlined from the photo analysis phase of this study. These costumes often involved scoop-neck base garment, most often a tunic or tank top, accompanied

by a skirt made of different layers of fabric and scarves, plus other accessorizing elements. The resulting experimentally designed, transformable costume features a scoop-neck tunic with the ability to attach side pieces onto it lengthen the base while adding texturizing layers. The skirt was made by overlapping and layering triangles. These pieces were easy to create with virtually no fabric waste and were then similar in shape to the pieces of Twig's skirts. This process meant that the only textile waste leftover came from initial creation of the tank top and everything else was zero-waste in its construction. A visual of this minimal waste can be found in the Appendix.

When choosing colors for the garment, the analysis revealed both warm and cool color schemes, so both schemes were incorporated into the new costume design through reversibility. One side of the costume features warm colors, and one side utilizes fabrics of cool colors. Twig also sometimes mixed color palettes, so reversible garments allowed for the possibility to have a warm top paired with a cooler skirt, and vice versa.

The final part of the design process was looking to include different ways to add more elements (i.e., accessories) to the garment since Twig's garments never included only the base garment and skirt. Some of the skirt pieces were then made detachable so it could be either a short skirt or have longer pieces on the side. These pieces could also double as sleeves, both on and off-the-shoulder, making them versatile in use. The reversible nature of these pieces also allow for a wide variety of color styling and creating unique schemes and palettes for the wearer.

To aid in building the reversible garment, both sides feature lace-up closures. Use of lace-up closures made the garment easy to flip and also adjustable in size, allowing the wearer to adjust as desired for a tight or loose fit. Bodies are often more fluid in size, so having something with some size adjustability allows the garment to remain longer in the wardrobe. For the same reasons of ease in reversibility and accessibility, the skirt was made with an elastic waistband.

When making the garment, the base top was draped, and a sample was made to check fit and ensure that it could be reversible. Size of the triangles used for the skirt and tunic attachment was chosen from what could be cut from fabric quarters and create as little textile waste as possible. After ensuring fit and functionality, the garment was able to cut and constructed from the final fashion fabrics. This was when final colors were chosen for each pattern piece. It was decided that both sides would feature green colors so that the same ribbon could be used for lacing up the sides and attaching the side tunic pieces. Additionally, colors for the skirt had to work with both sides of the top so that the skirt could be flexible in styling. Figure 6 displays the final costume with select styling options. Documentation of the creation process can be found in the Appendix.

Figure 6*Costume Collage Showing Style Options*

Note: These 16 stylings are only a few options. Further exploration of different combinations of attachments could increase the variety of ways this costume can be styled.

The resulting garment had 16 different styling options with the possibility to explore other styles as well as more experimentation with mixing the colors and prints. Additionally, asymmetrical inclusion of the detachable elements may result in more style variations/combinations. Three different ways to create cape and off-the shoulder sleeves were identified. Two lengths of the skirt were created. Four different color palettes were generated through mixing and matching of the top and skirt. This all combined to create a versatile,

transformable, and modular garment that followed many of the themes found in Twig's costumes and has the potential to work in the costume lineup for her brand of characters.

Discussion and Future Directions

The goal of this research study was to investigate how transformable and modular design could be used to improve the environmental sustainability of fantasy costumes in the renaissance fairy styling. The final garment showed how transformable and modular elements can be used to create a fantasy costume design that is both sustainable and brand/performer specific. Over 16 different style options could be created from one top, skirt, and six attachments that were all reversible in nature. This garment was still able to fit with the overall theme of the fantasy genre of inspiration, showing that including more sustainable design practices is possible while still following an established brand image, keeping the product marketable.

Costume Analysis

Analysis of the garment through Koo et al.'s (2014) standards showed a costume that is very user-friendly. The costume was adjustable for fit because of the elastic waistband in the skirt and the lace-up closure on the sides of the bodice. Both of these features do not require the wearer to perfectly fit the garment and instead allowed the garment to mold to fit the wearer. The same closure features that made the garments more adjustable in fit also made it easy to wear. There are no zippers or buttons in awkward locations for the wearer, and the modular pieces can be attached prior to dressing. Because of this, one person could easily dress themselves in the costume and not require the assistance of another. The costume showed ability to be adaptable with layering options. A thermal shirt, thin sweater, or leggings could easily be worn underneath the costume during cold days. There are also no components that would get in the way of a scarf or shawl. These different accessibility aspects made the costume to be a

practical choice for the performer since it can be so easily altered to best fit their needs and comfort. Finally, the transformable and modular elements made this a costume designed for experimentation in styling. The costume can be worn over 16 different ways without the addition of additional accessories, providing the performer with a creative outlet to find new ways to wear the costume for multiple renaissance festivals. All of these analysis features were deemed important for feasibility in previous transformable design research (Koo et al., 2014). These features also help make the garment have a longer wardrobe potential, which will help the wearer reduce their clothing consumption and therefore reduce textile waste, showing the sustainability of the garment.

Future Research

Future research can delve deeper into applying additional transformable and modular design features and explore different elements of the garment beyond the base. For example, other designs could approach creative solutions through development of different detachable collars or cowls to include more of the neckpiece elements unique to Twig the Fairy. Additionally, designers can consider different ways to add more tiers to the skirt and explore alternative attachment components (beyond hooks and eyes). Other textile fabrics can also be explored beyond the cotton fabrics that were used for this study and creative product, but other textiles may also be beneficial to explore for longevity and recyclability. A stiffer fabric or the inclusion of boning could provide more of a supportive fit for the bodice, adding another layer of comfort for the wearer. Alternative lightweight fabrics that feature more drape could be used as different sleeve and collar attachments.

This study explored the first layer in Chen and Lapolla's 'research through practice' framework (2021). Future researchers and designer can build from the creative output of this

study to continue through revisions of the framework to produce additional transformable design solutions. Building upon this research can help increase awareness and usage of these sustainable design techniques. This can then help other designers improve the environmental sustainability of their costume pieces and help the industry reduce their textile waste.

Future design research could expand beyond this one genre of costume design. There are many other fantasy costumes, historically inspired designs, stage and theatre costumes, and other genres that could benefit from transformable and modular design renewal to improve their sustainability stance as a product or product category.

Conclusion

This study was inspired by observations of fantasy fairy performers at renaissance festivals leading to the idea that there was opportunity to investigate how to make their costumes more environmentally sustainable. Textile waste has shown to be a large environmental problem for the fashion industry (EPA, *Textiles: Material-specific*, 2021) so finding a design approach that would help reduce waste generated was given importance. Background research showed that the versatility of transformable design techniques, such as modular design, helped lead to a reduction in overall waste generated. Transformable and modular design techniques were chosen to experiment with through a costume design based on the fantasy fairy costumes so beloved by many renaissance festival actors. A photo analysis using NVivo was done on 82 photos of Twig the Fairy, a leader and brand creator in the fantasy acting realm for nearly 20 years, to gather the data that guided the design of this experimental costume. A transformable costume that featured both reversible and modular elements was then made as part of the ‘research through practice’ approach designed by Bye (2010) and Chen and Lapolla (2021). The resulting garment explored how sustainability elements can be incorporated into this specific style of costume while also

providing future questions on how the research can be both continued in its current genre and expanded into others.

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Appendix

Figure 7

Draping the Tank Top Base Garment



Figure 8

Analyzing the Sample to Check for Fit



Figure 9

Tank Top Patterns

**Figure 10**

Planning the Cool Color Scheme Fabrics

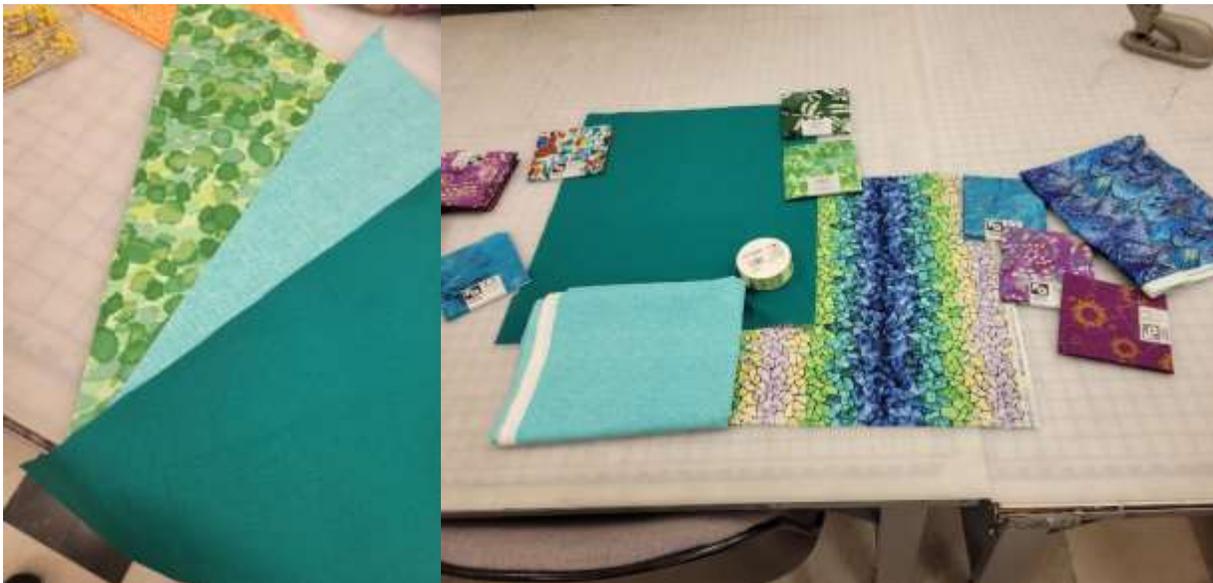


Figure 11

Both Sides for the Reversible Tank Top



Figure 12

Topstitching the Tank Top sides



Figure 13

Adding the Grommets to the Tank Top

**Figure 14**

Planning the Skirt Layers



Figure 15

Stitching the Skirt Layers Together

**Figure 16**

Total Waste from Construction

