CELEBRATING THE SPECTACULAR

DISCOVERING THE NEW ENABLED THROUGH PERFORMANCE ART

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Celebrating the Spectacular: Discovering the New Enabled Through Performance Art

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Figure 1.1 - I Can Can: Colour

Figure 1.2 - I Can Can: Prosthesis

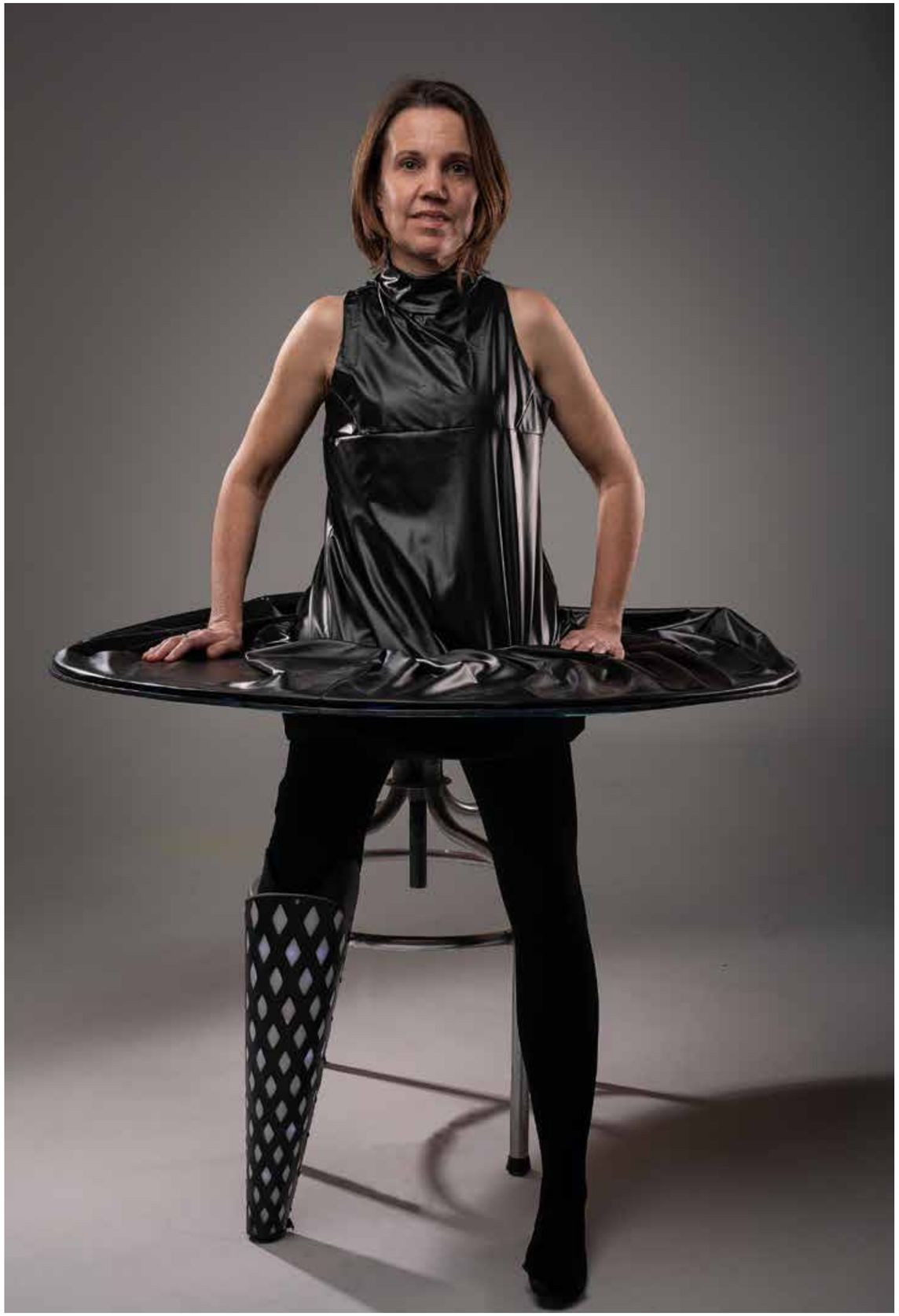

Figure 1.3 - I Can Can: Performer

Abstract

Social exclusion is a common problem facing amputees, however, there has been a development in the sporting context that has begun to change how amputees are perceived with the help of new technologically advanced and designed prosthetics. Unfortunately, the availability and promotion of these prosthetics is limited to athletes and a selected few contexts. To build momentum around the development and diversification of social inclusion, this thesis focuses on extending the area of immersion to the public by targeting the discipline of performance art. Through the use of an iterative design process, the work produced is a physical reflection of the research that was explored and defined to be important factors that improve the visibility and acceptance of amputees and their devices. This research benefits designers who are entering this field of design by introducing a new method specifically targeting artistic performance prostheses and providing a physical example of the output that was formed using this method.

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1 INTRO-DUCTION

The face of prosthetics in New Zealand has recently had a shift within the sporting context due to the athletic achievement of Paralympian, Liam Malone. It is this change that has created 'mana' and inspired this project to promote change in the broader public, via design and an performance art. Through an event that aims to re-define society's social and cultural perceptions, the promotion of prosthetics in the context of spectacular artistic performance for film or stage has the potential to generate and encourage discussion. As identified by Shapiro & Hunt (2003), the spectacle of theatre provides both the performers and community with recognition and understanding of issues, which is essential for social change. And the greater the satisfaction of performance, the greater response by the audience (Van Winkle & Backman, 2008). From such an event, can flow a range of opportunities that can continue to build momentum around the change of societal perceptions and attitudes. The enhancement of an artistic performance is hypothesised to produce a positive and evoking experience for the audience which may influence change in the socialisation process and address the issue of social inclusion.

In combination with the artistic performance enhancement, the relationship of technology and design also has a significant impact on the industry and the change of perception. Using new technology, such as additive manufacturing, we can question how people associate, understand and recognise the "new disabled" (Tamari, 2017). While technology provides a significant opportunity in the industry, if unsupported by design, it will not embody the full potential and cultural sensitivity of body image (Tamari, 2017). We can then move away from just focusing on functional purposes and now consider the effects of design on social inclusion that are related to a product or device (Vaes, 2014). Furthermore, this research has developed a tool that may assist designers in the creation of performative designs. The aim of this tool is to inspire a new generation of prosthetics that celebrate artistic expression through performance and extraordinary pieces, allowing the design to become a symbol that transforms disability into ability. The more the designed performances of the prosthetics are promoted and seen in different contexts and environments, the more accepted they become within a community (Bronston, n.d.).

What is social exclusion and how can it be addressed?

Social exclusion is something that people with disabilities know all too much about, from brief interactions with people on the street, to exclusion in places or events. The root of these incidents is caused by the lack of empathy surrounding the concepts of stigma. There have been many studies analysing stigma and the effects it can cause. Simply put, stigma is an attribute of a person, that may or may not be able to change, and is perceived negatively consequently devaluing that person. Many factors are said to contribute to the forming of stigma, but in the end, its pure form is discrimination. When someone is excluded or discriminated, not only can it lead to a decrease in mental stability for the individual but also a decrease in his or her social acceptance. This research looks at social rejection caused by stigma and how design can influence change in the socialisation process and address the issue of social inclusion. My theory is that to influence change in discrimination it needs to be targeted a lot like advertising. By immersing society in a specific subject, the more 'normal' and accepted it would become. As stated by Tellis (1950)

> "ads greatly impinge on consumers' awareness and have the potential of significantly affecting their thoughts, attitudes, feelings, and decisions"(p.3).

By leaving an impression on the viewers, whether it is through a positive experience or repetition, it can lead to an increase of social inclusion.

How will the output reflect the research?

The following background research guides the final design and will set the tone for how designers can contribute on an emotional and social level. The output of this research will demonstrate how the tools and methods used will establish an outcome that appropriately reflects the goals of this research. It will consist of a fully refined garment and prosthesis that captures and celebrates the qualities of amputees, as well as leave an impression on the audience that hopefully inspires social change.

Situating the Research

World of Wearable Art (WOW) is well-known throughout New Zealand with 13 shows that span over a 3-week period. The show is popular among locals and has a presence internationally for its unusual and creative output. The show's theme changes each year and is filled with garments that are fashioned by artists, designers, inventors and creators that reflect the wildest imagination.

However, this project will not be restricted to just the one performance /competition. The ideas and designs are inspired by the WOW show in terms of its values on pushing the boundaries of wearable design. This means that this design/s could also be promoted and published through blogs, magazines and other international competitions. Opportunities such as working with Attitude Pictures, a television production company, may also be an option.

Aims and Objectives

1. Investigate the relationship between stigma/social inclusion and prosthesis users.

a. Examine the relationship between new technologies and stigma on prosthetic devices.
b. Explore the representation of amputees in the media with reference to social inclusion.
c. Identify different categories of stigma interventions as a strategy for artistic performance enhancement.

2. Explore new narratives through an artistic performance that creates an experience.

a. Design printed prosthesis concepts to enhance aesthetics and social inclusion.
b. Understand how areas of performance affect the interpretation of a design.
c. Submit garment at WOW and/or other forms of publication.

3. Conclude by reflection on potential scenarios for future application.

2 LITERA-TURE REVIEW

The literature review introduces the collected works that have shaped my knowledge and inspired the research through design. Prostheses are a part of an amputee's life and are fundamental for them to achieve basic tasks. Other than their purpose to restore the functions of the lost limb, prostheses can also provide an aesthetic element that helps to target stigma associated with the devices. These areas help us to understand the technical factors and considerations around stigma in the physiological sense. However, what the literature often neglects is how all this is can be used to remove stigma and generate social acceptance. The literature I have gathered explores a different perspective, addressing this issue through the promotion of the 'new enabled' by way of a spectacular artistic performance. The idea being that the more the devices are promoted and seen in different contexts and environments, the more accepted they become (Bronston, n.d.). The literature review is organised into five central Themes. Each theme provides insight into new perspective and influences around social inclusion, stigma, prosthetics, media and technology that will help to guide the design process and the understanding of the issue at hand.

Stigma in Prosthetics

- "Prosthetics: Prosthetics refers to the technical and medical process of creating artificial limbs and fitting them on individuals who underwent an amputation surgery. The term "prosthetic" is also used as an adjective to describe items. For instance, the sock used to cover the limb is called a prosthetic sock.
- Prosthesis: While prosthetics refers to the science of creating artificial body parts, the artificial parts themselves are called prosthesis. One piece is called a prosthesis, but multiple pieces are called prostheses. This term applies to any artificial limb regardless of whether it is an upper or lower limb." ("Advantage Prosthetics and Orthotics," n.d., para. 2)

Social inclusion is an integral part of personal well-being; it is the act of making all groups of people within a society feel valued and important. However, many prostheses do not reflect the importance of design relating to stigma and the effects it can have on social inclusion. The review begins by exploring stigma experienced by amputees. I then discuss the findings and relate them to the concepts of normalisation and design.

There are two themes that emerge when dealing with stigma faced by amputees, one being the stigma of the device and the other, stigma around the disability or missing limb. Joan Susman (1994) raises an interesting point where the disability itself or the concept of a missing limb can gain a higher status than that of the person. Often referred to as a "master status" it suggests the idea that the impairment overshadows the amputee's individuality and capability. Because of this overshadowing effect on the amputees, even when efforts are made to look "normal", the stigma caused by society restricts equality in social domains. Similarly, Craig Vick, an amputee and one of the interviewees of Gelya Frank (1988), stated that "my disability is how people respond to my disability"(p.111). Gelya Frank's (1988, p.96) definition of stigma is the "negative characteristics imputed to an individual because of membership in a social group or category held to be inferior". Often amputees experience social discomfort from members of the public due to their lack of understanding around the disability and device. As discovered in Gelya's research, amputees are found to address this issue of stigma by changing the device's appearance to help them "look" normal or hide the device to avoid looking different. Goffman (1963) claims that this reaction is caused by the rejection of "normals". While Gelya agreed partly with Erving Goffman's research, she holds the view that, while some amputees do choose to hide their disability caused by rejection, some amputees avoid hiding the fact they are disabled. Even though there is no one way that stigma is formed and implemented, the literature cited point back to how amputees tend to either hide their disability or be proud of it by showing it off. This notion corresponds with the concept that design and aesthetics are an important element towards social inclusion. When no effort is put into the looks of the prostheses it can prompt preconceived ideas about the social role of that particular individual (Bispo & Branco, 2011). The effects of not considering the design or overall aesthetics of a prosthesis on an amputee could also lead to more serious issues such as rejection of socialisation and even rejection of the limb. Taken together, these results support Erving Goffman's, (1963) research that disability is a social, therefore changeable, construction.

Even though the disability of a missing limb cannot be changed, the association of stigma can be changed through the aesthetics of the prosthesis itself. The device could be seen as no more than an object formed to assist those that have lost a limb. However, because of society's relationship with objects, and how a person is often judged, it is unmistakable that objects hold an important role in the construction of identity (Campbell, 1995). Objects are often connected to a certain social status, which is evident in the way that a prosthesis may trigger stigma associated with impairment and vulnerability (Vaes, 2014). Because of this big concept of social identity, a way to address the design and the consequential stigma around the device would be to make it suitably represent that person in an aesthetically pleasing way. Bispo and Branco's (2011) argument was that:

> The stigma that is associated to disability cannot be solved by hiding it; hiding is based on the preconceived idea that a stigmatized person cannot be integrated in any way, thereby forever prolonging the stigma. (p. 3)

One major drawback of Bispo and Branco's approach is that their argument relies too heavily on the automatic acceptance by both the amputee and the public, and has little consideration into the idea of normalisation. (Because the theory of normalisation is an expansive topic, I will not go into detail). While some amputees may like having a limb that stands out, others may prefer a cosmetic cover that looks like a regular limb. You could consider a fairing (prosthetic cover) that replicates the shape of a leg a form of "hiding". However, Bispo and Branco's idea to show off the device is an opportunity where designers can offer a new way via a creative product rather than just a medical device. Not only will the device provoke a reaction by the public but it will help to increase the persons sense of self. "The aim in the end is about noticing an appealing product, rather than a missing limb" (Sansoni, Wodehouse, McFadyen, & Buis, 2015). Additionally, to confirm the theories, the idea of a creative product needs to be researched in the extremes and very little research has been done that covers this. Vaes' (2014) method of understanding, measuring and managing stigma using the Product Intervention Model for stigma (PIMS) could be used to help future studies on the current topic. By designing prostheses for specific contexts and publication, it could be hypothesised that the concept of designed prostheses will become accepted, reducing stigma and increasing social inclusion.

Disabled in the Media

Society's understanding of disabilities often relies on publication and media to generate positive outlooks. A theory to reduce stigma around disability and prosthetics is by looking at how the disabled are represented, whether it is through social media or performances and events like the Paralympics. Murray and Forshaw (2014) suggest that the representations of the disabled in the media can interfere with individuals' lived experience. Therefore, it becomes vital to consider society's impact on the structure of these experiences. It is argued by Lyons (2000) that people obtain "their beliefs regarding health and illness from the discourses and constructions available to them" (p.349). This approach can also be expected to represent the perception formed around people with a disability. Because of the media's impact on the public, it provides the perfect opportunity for the new image of disabled to be promoted.

An example of promoting disability, specifically amputees, is illustrated in Saner's (2014) article where he discusses Viktoria Modesta's fame. Viktoria is a pop singer from the UK who is known for her unique style and appearance. According to Saner (2014), a television channel in the UK had been looking for opportunities to promote people with disabilities in areas away from sport and asked her to perform at the Paralympics. Although the Paralympics is entirely sporting based, it comes as an opportunity to showcase the talent and capabilities of those who are disabled in all fields of entertainment. After observing the closing ceremony of the 2012 Paralympics, Saner (2014) described Viktorias' image and performance as an extension of the entertainment industry and challenged what should be considered a normal part of pop culture. In addition to this performance, Viktoria's own exposure via her singing, videos and social media has also helped to popularise "extreme" forms of prostheses. She explains that she wanted to use the limb as a medium to express herself rather than something that is trying to replace what is not there. She emphasises the missing limb has not limited her choice but instead has the opposite effect (Saner, 2014). We also see this positive influence on a slightly smaller scale, with the attention and impact created through social media platforms such as Facebook or Instagram. Jessica Quinn has become a Child Cancer Foundation ambassador and has gained over 60k followers by talking about and exposing her disability (Wadey, 2016). By Quinn displaying her disability and struggles, through these platforms, she is exposing people to the raw image of disability which can help to change the audience's perception and stigmatisation. This then translates the depictions of prosthesis users and impacts their experiences with the use of their prosthesis (Farnall & Smith, 1999). These examples support the idea of the research that extending the media and promotional coverage in all fields of disciplines and entertainment can change the image of the disabled and in time improve social inclusion.

While there are many positive examples of disability portrayal in the media, there are also many instances of publications and media that have caused adverse effects on amputees' wellbeing and public perception. It can sometimes be a fine line between the two. We see the negative image illustrated in movies, television shows and advertising. However, more often than not, especially in advertising,

disabled people are not even included and ignored in the mainstream media. Moreover, the most apparent finding by Paul Hunt (1991) was that disabled persons were presented as a particularly distorted image by some advertisers, notably charities. This inaccurate portrayal is explained appropriately by Shakespeare (1999):

> The use of disability as a character trait, plot device, or as the atmosphere is a lazy short-cut. These representations are not accurate or fair reflections of the experience of disabled people. Such stereotypes reinforce negative attitudes towards disabled people and ignorance about the nature of disability. (p. 165)

Until recently characters with a disability were given the image that formed perceptions of discrimination, promoting specific adverse emotional reactions (Farnall and Smith, 1999). While some movies, television shows or magazines may have the best interest at heart, it can sometimes be misunderstood or has not correctly portrayed the person or their identity. The idea that the portrayal of the disabled has a significant impact on the stigmatisation seem to be consistent with my findings and the research of Farnall & Smith (1999). Their research suggested that increasing the visibility of disabled people within society's day-to-day lives and through the media, may influence how people would react to them. Despite the negative findings of the stigma via media, this should not be a deterrent when aiming to publicise people with disabilities. If the different issues of interpretation are carefully considered, the result could end up positively impacting individuals and communities. In particular, this initiative would also help shift the attention away from the impairment of amputees and towards the identity of the individuals. This would be supported by good design in the prosthesis, all the while creating an inclusive environment.

Figure 2.1 - Viktoria Modesta
(Saam Farahmand, 2014)

3D Printing and Digital Aesthetics

3D printing, otherwise known as additive manufacturing (AM), is fast becoming a significant instrument in a new style of manufacturing and plays an essential role in addressing complex, customisable and less expensive bespoke products. It is believed by Lipson & Kurman (2013) that AM offers designers freedom in form and function. However, with new technology comes issues that have not been understood, or concepts that are not developed enough to create viable products. In light of this, this segment assesses the significance of 3D printing and explores the different applications, methods, digital aesthetics and difficulties that are associated with it.

What differentiates 3D printing from any other fabricating method is the element of additive rather than subtractive manufacturing. Being additive means that complex parts, that are usually made of separate components, can be produced in one print through the layering of one or more materials. Gershenfeld (2012) states that it is not just the additive factor that makes 3D printing so valuable, it is the ability to turn data into things and things into data. This process of data control introduces features such as fill density, style, materiality and digital form design that can be controlled. There are two processes in 3D printing that utilise data control through different applications, one being rapid prototyping (RP) which is where models of the products are made before producing a finished product; and the other is rapid manufacturing which is the creation of a product that can range in quality depending on the technology (Gershenfeld, 2012). Similarly, Terry Wohlers who writes the Wohlers Report (2003) has defined the term rapid manufacturing (RM) as the process of rapid prototypes that are developed into a direct production of finished goods. This description implies that for a model to be considered a true representation of the RM process it must use AM to create a finished product directly from digital data.

Regarding the applications of 3D printing, it has its fair share of disadvantages. As pointed out by Gershenfeld, (2012) the most significant current deficiency in AM is the speed of the production. One piece may take hours in a 3D printer, yet only take a couple of seconds in an injection mould. Furthermore, the products made through other manufacturing methods can create parts or features that are larger, lighter, or stronger. While AM may not be perfect, the key is to find the right context for this new technology to be used and embraced. The most significant problem causing the lack of utilisation is the application of materials and methods not being thought out. To recognise how 3D printing can be used, the process of data creation leading to the final design must be understood as it affects the assembly, aesthetics and materiality of the final product, as well as determining the most appropriate method of manufacturing.

Digital aesthetics is the result of data generated in a certain style or process and is a feature that makes AM so unique. Digital aesthetics can come in many variations, and influences how a designer may incorporate AM into their design. However, there are two main methods that are the foundation for specific digital aesthetics: generative design and parametric design.

Generative design: Has no one definition, and a conclusive definition is often avoided. The best way to explain generative design is stated by Agkathidis, (2016) where "it can be described as a design method where generation of form is based on rules or algorithms often deriving from computational tools" (p.14). Autodesk (n.d.) also suggest that generative design "mimics nature's evolutionary approach to design" (para. 2). This method allows a design to be edited by "rules" to create different generations or iterations of a single design. Nervous System is a design studio that takes advantage of the qualities that generative design can produce. The work they fabricate is a mixture of science, art and technology and is largely influenced by natural forms. Their process is illustrated using computer simulations to generate the designs.

Parametric design: Is similar to generative in some aspects of aesthetics but is primarily a prerequisite that produces the generative design method. The term parametric comes from the mathematics and computer science context of being a parameter. It is defined as a variable within a function that determines a form, while also using parameters to create a designed output. The unique characteristic of this process is that it can interlink features automatically, meaning that if one feature is altered the parameters adapt and change the rest of the three-dimensional form. This makes the process of modelling the focus, rather than the output.

Taking the CAD processes and digital aesthetics into account when designing specifically for 3D printing will allow for the manufacturing qualities to be fully capitalised. It will give designers the opportunity to produce anything to a high level of complexity, as well as the freedom to ideate and customise. Ultimately, it will aid designers in identifying new contexts that embrace the methods and aesthetics of this new technology.

Figure 2.2 - Pollen Lamp (Nervous System, n.d)

3D printing in prosthetics

The growth in technology, especially in the area of 3D printing, has had a significant influence on the aesthetics and manufacturing of prosthetics. The ability to customise, individualise and print virtually any shape and form, with extreme detail and with a wide range of choices of materials is why it is chosen for this particular branch in the health sector. Prosthetic products are becoming more apparent in the market due to the increasing accessibility and combined with the decreasing cost of technology and manufacturing.

This process design and manufacturing can be seen in a product that is becoming popular among the lower limb amputee, the fairing. A fairing is a product that is attached to the pylon (metal pole) of the prosthesis and is used purely for aesthetics, as well as replicating the form of a leg. UNYQ is a company that has benefitted from 3D printing to create these "fashion" accessories. The concept of a fairing targets the idea of expressing a person's identity to improve personal acceptance and social inclusion. To have something that can be changed day in and day out depending on the mood of the person, fills a purpose like any other piece of clothing and becomes a part of their identity. However, unlike other examples of 3D printed prosthetics, these covers come with a large price tag and have no functional purpose. While having a product purely for aesthetics is a significant step, it still lacks the full advantages that come with 3D printing where customisation and functionality can be utilised to its fullest. A great example of functionality and cheap 3D printing is explored in the article done by Zuniga, et al (2015), where they observe the effects of a product specifically designed for upper limb child amputees. 3D printing has been used effectively in this instance where it has become a quick fix for problems such as the small size of the children's limbs, constant growth, and psychological development. Prostheses for upper limbs are extremely complicated because the amputees rely on its functionality so much. Having a product such as this is a large step in the right direction to give people in need access to prostheses. Expanding on this article, Zuniga et al (2015) concluded that this product has significant potential to positively impact the quality of life and improve the daily usage. While the study focused on producing availability to children long distance in developing countries, this same product is now accessible as an open source for anyone with a 3D printer. Creating a product that is open-source means that the 3D printed prosthetics can now replace the commonly used hooks which are frequently rejected, partly due to their displeasing cosmetic appearance. The difference in having a hook compared to a 3D printed hand is something so simple, yet is revolutionary. While it does not replicate their exact hand, these examples prove that appearance and basic functionality alone can remove the stigma. While the open-source 3D printed hand is a good example of how it can be mass produced, 3D printing also provides an opportunity for highly crafted and individualised models. This is illustrated in the article written by Hobson (2016). The project created a 3D printed bicycle prosthesis, specially designed with aerodynamics in mind. Denise Schindler is the Paralympic cyclist who worked with Autodesk to create the first 3D printed prosthesis used at the Paralympics. The overall goal for Schindler, the designer of the prosthesis, was not just pushing the boundaries of

3D printing technology. Schindler explained that "The new technology is great for me, but my big goal is really to open up the sports world for the average amputated person," (Hobson, 2016, para. 12).

This goal of providing an opportunity for any amputee addresses the issue of stigma by allowing not only amputees to have the same ability than those with "normal" limbs, but possibly even more, due to the specialised design considerations. However, when researching 3D printed prosthetics, a large percentage of all results showed only options related to sports or basic solutions like sockets or fairings. To further address stigma, the accessibility of prostheses and technology needs to broaden so that 3D printed prostheses can be promoted in a variety of different contexts.

Figure 2.3 - 3D Printed Prosthetic (Sohi, 2016)

Conclusion

The present research of examining media platforms, stigma, new technology and manufacturing has helped to understand how the design process needs to be approached and developed into a final product and an artistic performance. The findings significantly influence the understanding of how technology, such as 3D printing, can be used to target stigma by creating a meaningful design that can be captured effectively through a media outlet and how that outlet will affect a selected population. The challenge now is to create a design that contains these different disciplines using the Product Intervention Model for Stigma (PIMS) (Vaes, 2014), as a way of developing the design to target the main issue of stigma and social exclusion.

ELEMENTS OF PERFORMANCE

This section explores the literature of Duggan's: The Greatest Show on Earth (2001) that informed the design methodology and the artistic performance. The first step of the research is to understand how performance elements can be used to target social exclusion and how they can influence a design. Duggan's research includes the performance elements: spectacle, substance, science, structure and statement, to explore how the blurring of different elements in art, design and performance influence the concept of a 'designed performance'. This literature contributed vital insights into factors of performance, as well as ways of illustrating specific ideas that help to influence social inclusion and stigma-free design.

Introduction

The concept of performance has changed dramatically throughout the decades, more so recently, due to the introduction of new technology and modern media. Although new disciplines have been introduced into performing arts, its fundamental association with a spectacle remains the same. As early as the 18th century, a visually striking performance was associated with a 'spectacle' which became a model of communication and meaning (Weigert, 2012). Nowadays we see it commonly used as a method to provide both the performers and community with recognition and understanding of current issues (Shapiro & Hunt, 2003). Using a combination of disciplines, it generates a better understanding of the portrayal of ideas within a performance. Each discipline contributing to the overall performance, that "simultaneously inspires, encourages and competes with the other" (Duggan, 2001). The relationship of fashion and art is one collaboration that, although new, shares this symbiotic relationship to create a 'spectacle' where the output consists of a garment, or range of garments, as well as a spectacular artistic performance. This relationship is otherwise known as 'performance art' or a fashion show. As stated by Duggan (2001)

> "the late 1990s mark a significant point in this development of a heightened art/fashion phenomenon that is more extensive in its effect, as it results in fashion show productions that communicate through the medium of performance art" (p. 244).

It moved away from the traditional fashion shows we often see, to a spectacle that shows off the medium of art through performance. The World of Wearable Art held in Wellington New Zealand is the modern example of the hybrid, where it rebels against the norm, and the most artistic and extraordinary pieces are celebrated. The show combines technology, dance, theatre, music, stage production, art and design to create a performance that exhibits artists' work from around the world. The aim of this show is for artists and designers to use the body as a "blank canvas" ("WOW - World of Wearable Art," n.d.) and encourage freedom of expression in innovative and challenging ways. Pushing these boundaries within the design and process is where the two worlds of art and performance are creatively blurred (Duggan, 2001).

Theme 1: Spectacle

Using Duggan's (2001) definition, a spectacle is a production that combines on-stage elements such as the set, sound, light or symbolism to enhance the performance on stage. Similarly, to create a design that is to perform, the elements that create the spectacle need to be carefully considered. Three essential components can be manipulated on stage within the performance to highlight the intention of the design. This includes lighting, theme, and movement.

Lighting- While the designers have no idea what the set will look like leading up to the show, considering factors like lighting can help strengthen the garment's connection with the set design as well as the relationship between performance and art to create a successful composition. Having a garment that actively reveals different perspectives just by using the stage lighting attracts the audience's attention through its onset of motion (Abrams & Christ, 2003).

Theme- Choosing to have a theme as the foundation for a design, makes it easier to decide the direction for the process and presentation. While the stage already exhibits the theme, the design of the garment could look to challenge the theme or create new innovative approaches to set it apart.

> "Themes can be specific or very abstract. Because these themes are used for many purposes, including the show's invitation, the production and the clothing line itself, they must be easily identifiable and memorable" (Duggan, 2001, p.248).

Movement- There are many ways that movement can be incorporated into a design whether it is through the movement of the performer or the movement of the design. The consideration of this aspect can create depth in any garment design, like using the action of 'surprise' to capture the attention.

Theme 2: Substance

Substance is a concept within design that is important in the production of a spectacle; however, it is often overlooked throughout the conceptualisation process. The substance in this instance does not refer to the materiality of a design, but the ideas and the meaning of those ideas being visualised through an abstract form or style. In the case of a performance, spectacle and substance form a symbiotic relationship. When a show is produced, it is transformed into a spectacle where it can be promoted and sold to its target audience, but for this product to have value and create an impact, the spectacle must be meaningful.

Duggan (2001) explained that designers are what create the substance in the performance not due to their designs being a product that is sold, but rather as something that expresses their idea. The product, which in this case is the performance, is secondary to the design process. Substance as a part of this project means that the design is considered in every stage of the project's development, down to the smallest detail, giving the performance enough substance to transform into a spectacle. The concept behind each design or design feature is essential to the understanding of the performance or the garment itself. The more substance within a design and/or the artistic performance, the more the audience will understand and be satisfied.

Theme 3: Science

Science is self-explanatory, where the concept is all about how new technology and materiality separate a design from the norm.

Theme 4: Structure

Structure refers to the form of a design and is approached in a form over function manner. Typically there are two approaches in design, *design for satisfaction*, where the focus is put on function and ergonomics, or *design for delight,* where form and aesthetics take priority (Rupinder P. Jindal, Kumar R. Sarangee, Raj Echambadi, & Sangwon Lee, 2016). Having structure as the focus in a performance puts emphasis on how a design's form conveys a message, rather than relying on abstracted symbolism like in substance design. Often in structure design, garments exist purely as an expression or an experimentation and take little account of comfort and wear-ability.

Theme 5: Statement

The creation of a 'designed object' often starts with an idea, message or purpose. For the message to be successfully transmitted, the designer must find ways that effectively convey the ideas through a physical object or artistic performance. This concept is called a "statement".

Duggan (2001) explains a statement designer to be someone who "creates environments and presentations that reflect confrontational ideas and messages". Instead of a design focusing on pure aesthetics and construction, it instead focuses on how others perceive it. Conveying a message can be fraught because of how individuals view a design in the context of their personal experiences, but this can sometimes be an advantage in extending the reach of the message. To convey the issue, spectacle designers can choose to communicate their message through the garment, the performance or the combination of both (Duggan, 2001).

METHOD-OLOGY 3

The purpose of this chapter is to use the knowledge learned in the background research to determine a method that guides the design research phase. The research output is simple: design a performance enhanced through a garment and prosthesis, but the process to get to that point can be complicated. Because the design output is a combination of two different disciplines, performance art and design, there was no real outline for how the design phase should be approached. When researching methods, the most popular means consisted of human-based design or product design, or on the other end of the spectrum, a fashion collection. None covered the topic of designing a performance. To guide the project's design phase, a methodology was formed that not only targets the artistic performance, but the issue of stigma that was inspired by Vaes' (2014) research on product stigmaticity.

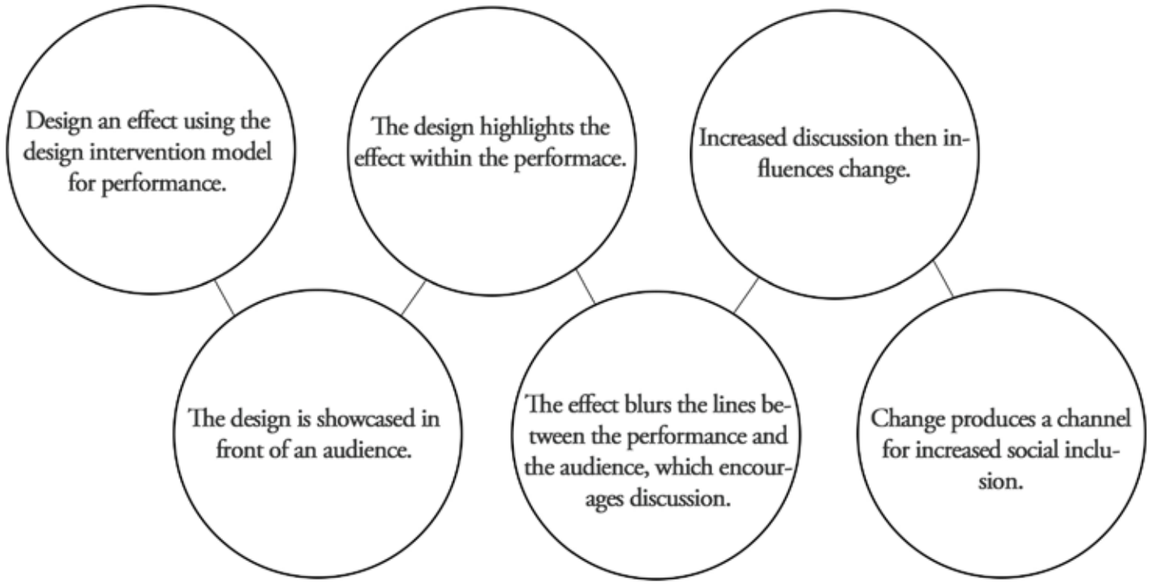


Figure 3.1 - Direction of research.

Research through Design

Research Through Design is a method that explores the tools and processes of design thinking and making, and applies the knowledge that is found through an action reflection approach into a developed design (Frankel & Racine, n.d.). For this method emphasis is put onto the process rather than the outcome.

> Research through design is constituted by the design process itself, including materials research, development work, and the critical act of recording and communicating the steps, experiments, and iterations of design. - Research Through Design (Burdick, 2003, p.82; Martin & Hanington, 2012, p. 146)

The visual representation of the research method used throughout this paper is based on Keyson and Bruns Alonso's (2009) diagram of "Empirical Research through Design". The diagram illustrates a new method that is different from traditional approaches to *research through design* where they developed it to focus on a priori knowledge through pilot studies. However, this papers research through design targets an artistic performance where both a priori and a posteriori knowledge is required. To show this, the process has been changed and illustrated as seen in figure 3.2.

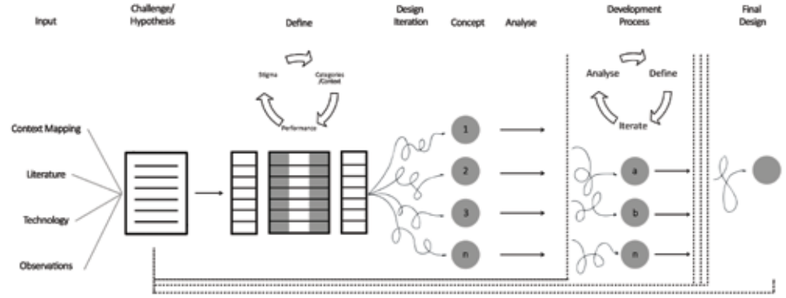
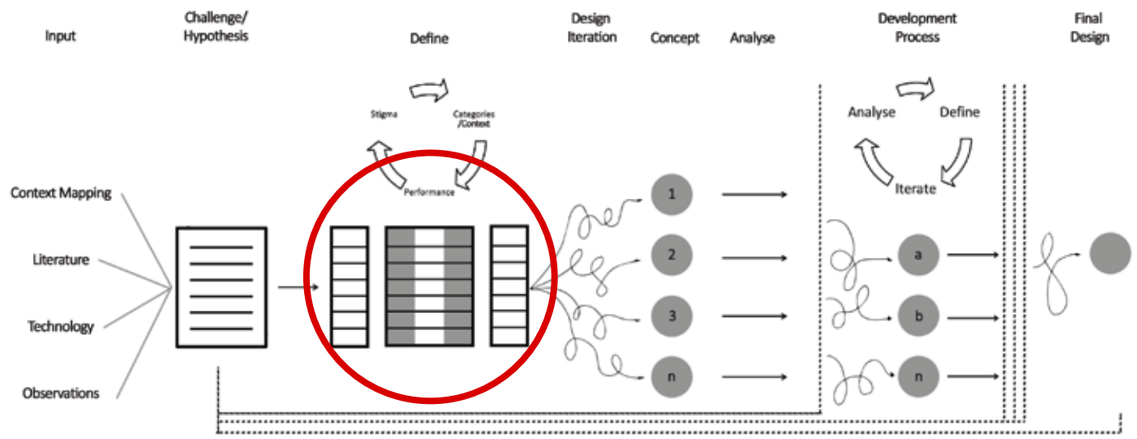


Figure 3.2 - Process Diagram

Design Intervention Model for Performance Prosthesis



This section introduces the Design Intervention Model for Performance Prosthesis (DIMPP) which is based off and includes Vaes (2014) Product Intervention Model for Stigma (PIMS). This model is comprising 3 different templates that are used to assist performance designers in the development of items incorporating features aimed at reducing stigma and enhancing the spectacle. Using this model, designers can aim to address the issue of social exclusion in a creative and positive atmosphere and create diversity in the applications that prostheses and amputees are seen. Not only will this help the public to become accustomed to seeing different variations of prostheses, but it will build self-confidence, increase user-product attachment and collective well-being (Vaes, 2014). The DIMPP chart is specifically for the iterative phase of the design process but can be referenced back in the final stages to validate the end product. This chart is only a small part of the design process and should only be used as a tool that guides a general direction.

Figure 3.3 - DIMPP Chart Process

What are the different templates of DIMPP?

The model has been separated into three parts to have the most cover the relevant subjects, these are: PIMS (stigma), Performance Elements (performance) and Categories/Themes (context). Each of these parts are interlinked with each other to form a design process, as seen in fig.___.

1. **PIMS -** The PIMS intervention model specifically "enables designers to take on their semantic responsibility and alleviate products of their stigma eliciting properties" (Vaes, 2014, p. 173). It is made up of 17 interventions that address:
Product:
- User-product de-identification
- User-product identification
- Product use
- Product materialisation & technology
- Product interaction

2. **Performance Elements –** This template references back to the research done through Duggan's: The Greatest Show on Earth (2001). Based on my interpretation of this research I have expanded the elements into more detailed categories that would help even novice designers understand the thought process needed to create a well-defined design. This template was frequently edited until all elements were substantiated.

3. **Categories/Themes –** Is an area that is to be filled in by the prospective designer. The chart is comprised of a list that identifies what themes or categories designers want their product to represent, which is helpful if the design and performance are to be a part of a bigger context, such as a fashion show or a brief.

The model is presented as a compact chart, allowing designers to compare, evaluate and intertwine them accordingly (Vaes, 2014). To make the most of this model, it is recommended to explore the elements within each of the categories to create more purposeful design decisions. The elements that are chosen are up to the designer, but to make the most of the DIMPP the importance of each category concerning their objective needs to be determined. Neglecting a category will reduce the overall impact that the 'product' has on stigma and the design.

PIMS	Performance Elements	Visual Design Elements	Themes	Categories/ Context
De-Identify	Spectacle	Colour	3D Printing	Avant-Garde
Identity	Statement	Line	Reflection	Reflective -
Product Use	Structure	Shape	-and/or-	Surfaces
Material and	Science	Texture	Refraction	Under the -
Technology	Substance	Space	Movement	Microscope
		Form	Symbioses	Open
		Balance	Asymmetry	Aotearoa
		Hierarchy	Negative Space	
		Harmony	Power of -	
			Numbers	
			Transparency	
			Magnification	

Figure 3.4 - DIMPP Chart

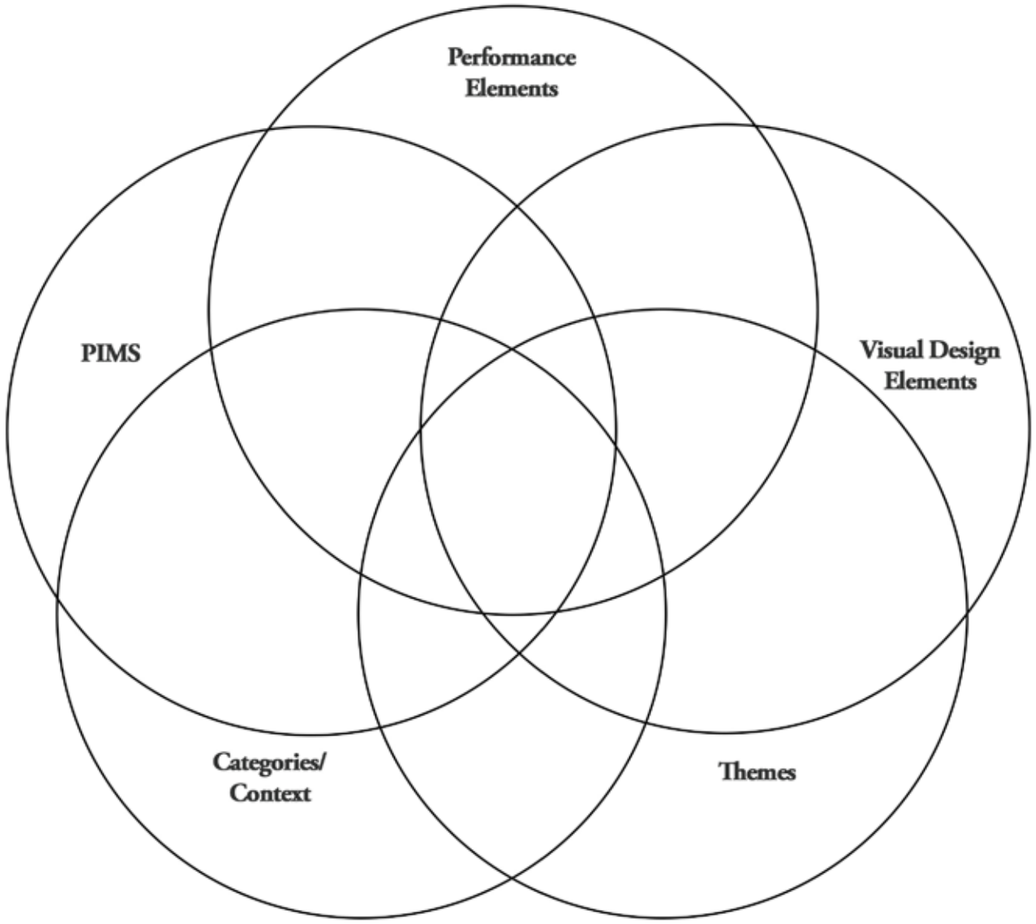


Figure 3.5 - Chart Relationships

Performance Elements	Visual Design Elements	Themes
Spectacle- The spectacle is al about the on-stage performance which is influenced or changed through aspects such as sound, light and action.	**Colour-** Colour can be used in any form, from harmonies to contrasting.	**3D Printing-** How this technology can be used in unique ways to create unique forms.
Statement- Is a specific message aimed at an audience.	**Line-** Line is an element of art defined by a point moving in space.	**Reflection/Refraction-** The experimentation of light on objects to emphasise certain elements.
Structure- All about the form and how it can portray different ideas, themes or representations.	**Shape-** Shape is a a 2D (or more) area that stands out from space.	**Movement-** Using movement to form visual cues and attract the line of sight.
Science- Based around new technologies and materials to create a new pathway of design.	**Texture-** The way a surface feels of is perceived to feel.	**Symbioses-** Making aspects of the design form a mutual and advantageous relationship.
Substance- Is all about the ideas behind the design and giving it depth. It has an emphasis on the process rather than the final output.	**Space-** The area around an object.	**Asymmetry-** Creating balance in an unbalanced design.
	Form- The look of a shape: Geometric (man made) Natural (organic)	**Negative Space/Void-** Emphasising something that isn't there.
	Balance- Is a state of equalised tension and equilibrium.	**Power of Numbers-** Creating multiple designs that can either create harmony or contrast of an idea.
	Hierarchy- Elements that lead the audience through each element in order of its significance.	**Transparency-** Experimenting with materials to create an aspect of hiding and revealing.
	Harmony- When all elements are in agreement.	**Magnification-** Making an element the overarching feature.

Figure 3.6 - DIMPP Chart: Performance Aspects

De-Identify	Identify	Product Use	Material and Technology
Camouflage or disguise.	Strengthen the products individual identity.	Eliminate physically or mentally confronting moments in product use.	Reshape product meaning through advances in technology.
Diversion of attention.	Strengthen the products insitutional identity.	Integrate additional benefits and experiences.	Reshape product meaning through advances in material technology.
	Strengthen the products group identity.	Manage the frequency and intensity of product use.	Reacts on meaningful interaction with other products.
	Strengthen the products brand identity.	Focus on the ultimate product goal.	

Figure 3.7 - DIMPP Chart: PIMS

Categories/ Context

Avant-garde-
Collision between art and fashion.

Reflective Surfaces-
Catch our eye, makes us catch our breath.

Under the Microscope-
Defying the limits of our vision.

Open-
Explore without boundaries.

Aotearoa-
Expressing our way of life.

Figure 3.8 - DIMPP Chart: Context

Tools

3D scanning: Unlike previous and some current methods of moulding to capture the form of the limb, a 3D scanner will be used. The advantage of using this technology is its ability for the form to be edited digitally as well as being less invasive for the patient. The scans recorded have the ability to be revisited at later times and changes made, no matter how major or minor, and can be stored as a file on a hard drive or computer, unlike the physical models. The data captured by the scanner provides the relevant information needed to create a fitted prosthetic without the need for multiple fittings which often mean a patient will need to travel to make the appointments.

3D Modelling: 3D Modelling, also known as Computer Aided Design (CAD) is a digital way to form 3D objects within a 2D environment. Many programs can be used to achieve different goals, for example, Autodesk Fusion 360 has the ability to freeform objects like clay which is suitable for organic models, whereas Rhinoceros 5 allows for detailed, editable and patterned designs through the plug-in Grasshopper. The CAD models can be used to create rendered images that take on specific materiality to accurately visualise the model. This process of 3D modelling is formed into a digital file and applied directly into the next phase of prototyping where it can be turned into a physical model, whether it is through rapid prototyping or other forms of manufacturing.

3D Printing: The digital file made in the 3D modelling process, is transformed into a physical model using the method of additive manufacturing. There are many types of additive manufacturing, each with their advantages and disadvantages, but most use methods of layering to form a 3D object slowly. Using this method of layering accommodates complex structures that normally could be extremely difficult or impossible to create through other means. Because it is easy to use and gives the opportunity for models to be quickly edited and printed it is efficient for the process of rapid prototyping. For this research, 3D printing will be a significant tool for the development of the physical design and creation of a fitted prosthetic.

Research Restrictions

Before starting the Methodology phase of this research, we had already experienced social exclusion when our expression of interest to apply for the entry of a design into WOW was denied. Not only does this demonstrate the frequent disregard for inclusion but it emphasises the importance of this project for improving social acceptance and equality for amputees.

4

Design Stage 1

Introduction

The first phase is to explore 2D processes for rapid ideation which include sketching, CAD modelling and rendering. Because the output was purely 2D, this allowed for the focus to be on the basic idea and form without the interference of scale, structure and details. The chapter also explores all areas of performance elements and begin to form themes that will guide the design. It illustrates how I analysed my work referenced off the DIMPP chart and documents selected parts of the process. Because it was such a back and forth process of analysing, developing and refining, not all my work is pictured.
Once my designs reached a level of refinement, it became difficult to visualise the artistic performance and three-dimensional qualities due to the broadness of the brief. The problem was quickly resolved in the next design phase.

Initially, this phase of the research was to have a co-design incorporated into it; this is because the research outcome of entering WOW was undecided. However, because the outcome changed, it was decided that it not need to be as individualised as what was initially intended, therefore chose not to have the participant involved at this point.

The following is the definition of 'garment' to help understand what I am designing:

- Garment- An item of clothing, item of dress, costume, outfit, robe, cover, dress attire. (Garment, n.d.)

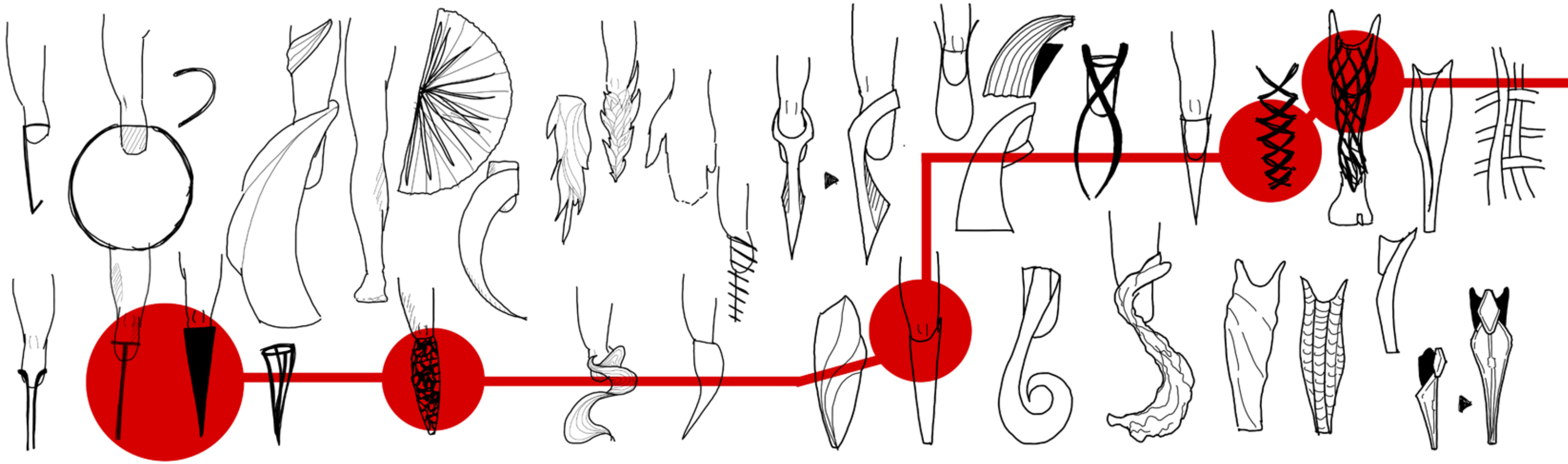
I have also defined a design statement that the research will work toward showing through its aesthetics and performance:

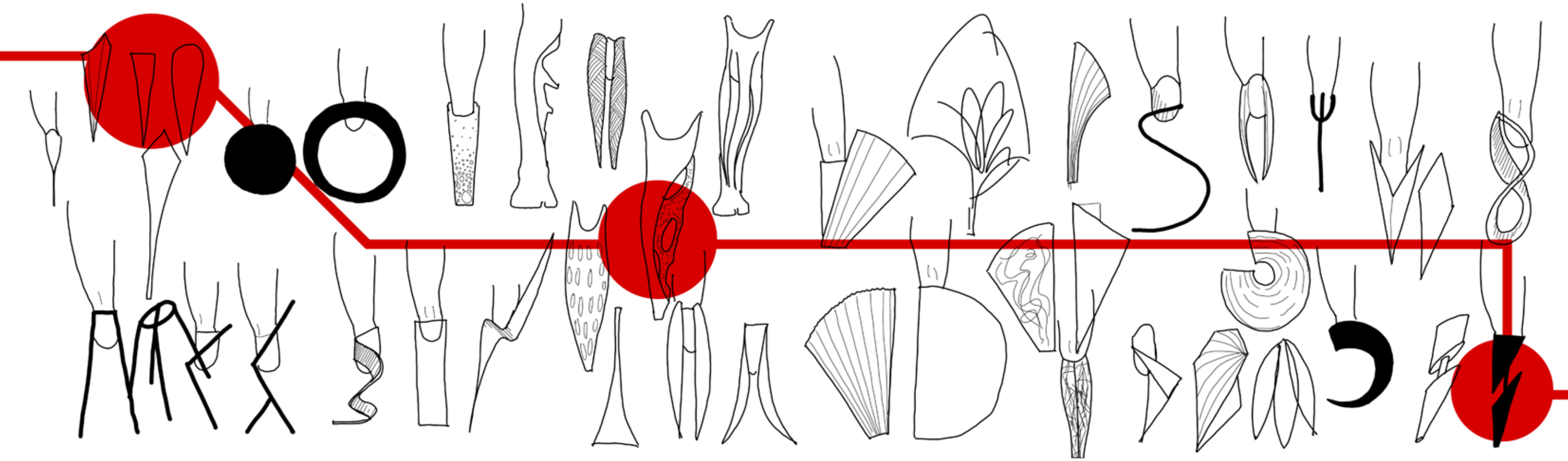
Celebrate amputees by not blending in, but standing out.

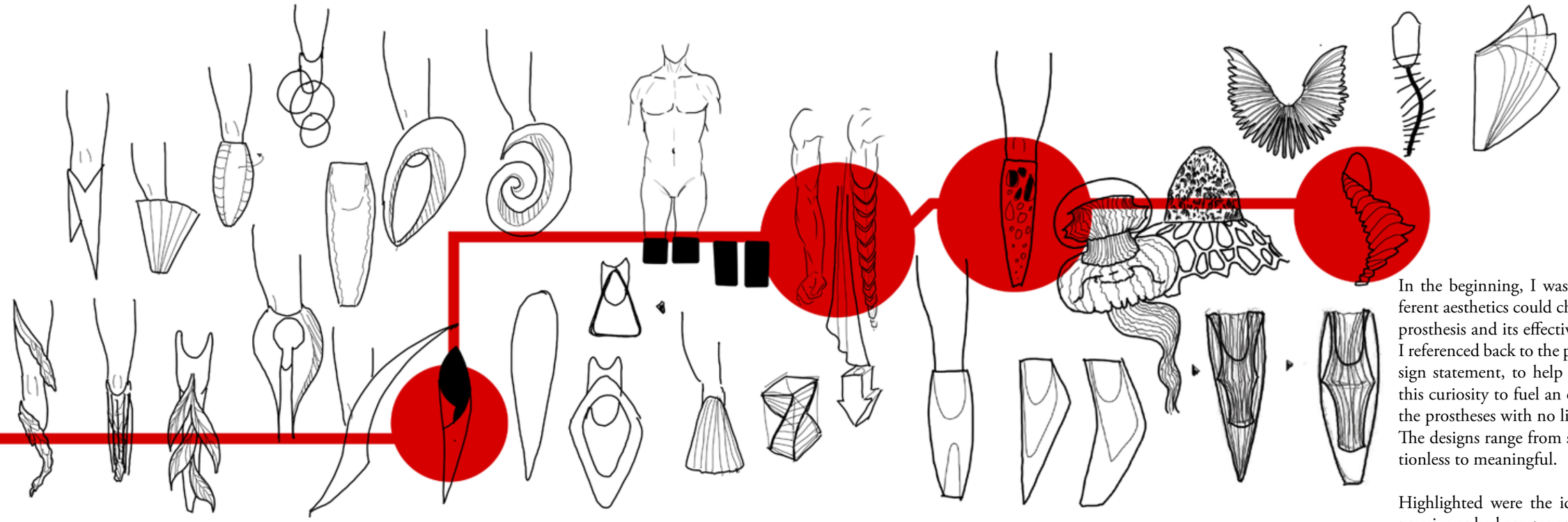
To help begin this phase, I began with the analysis of reference photos and mood boards to inspire the sketching and ideation of the garment and prosthesis. It gave an idea of what other designers have considered in their design process to make a successful or unsuccessful design that is relevant to my research.

The images are a set of prosthetics and costumes made for the performer Viktoria and her song covers and videos.

Left to Right
Figure 4.1 & 4.2 - Crystal Leg (Kander & Kotedia, n.d.), figure 4.3 - Light Leg (Stechnij & Suchorab, n.d), figure 4.4 - Stereo Leg (Williams & Enoch, n.d.), figure 4.5 - Spike Leg (Stechnij & Suchorab, n.d), figure 4.6 - Light (Viktoria Modesta, n.d.)



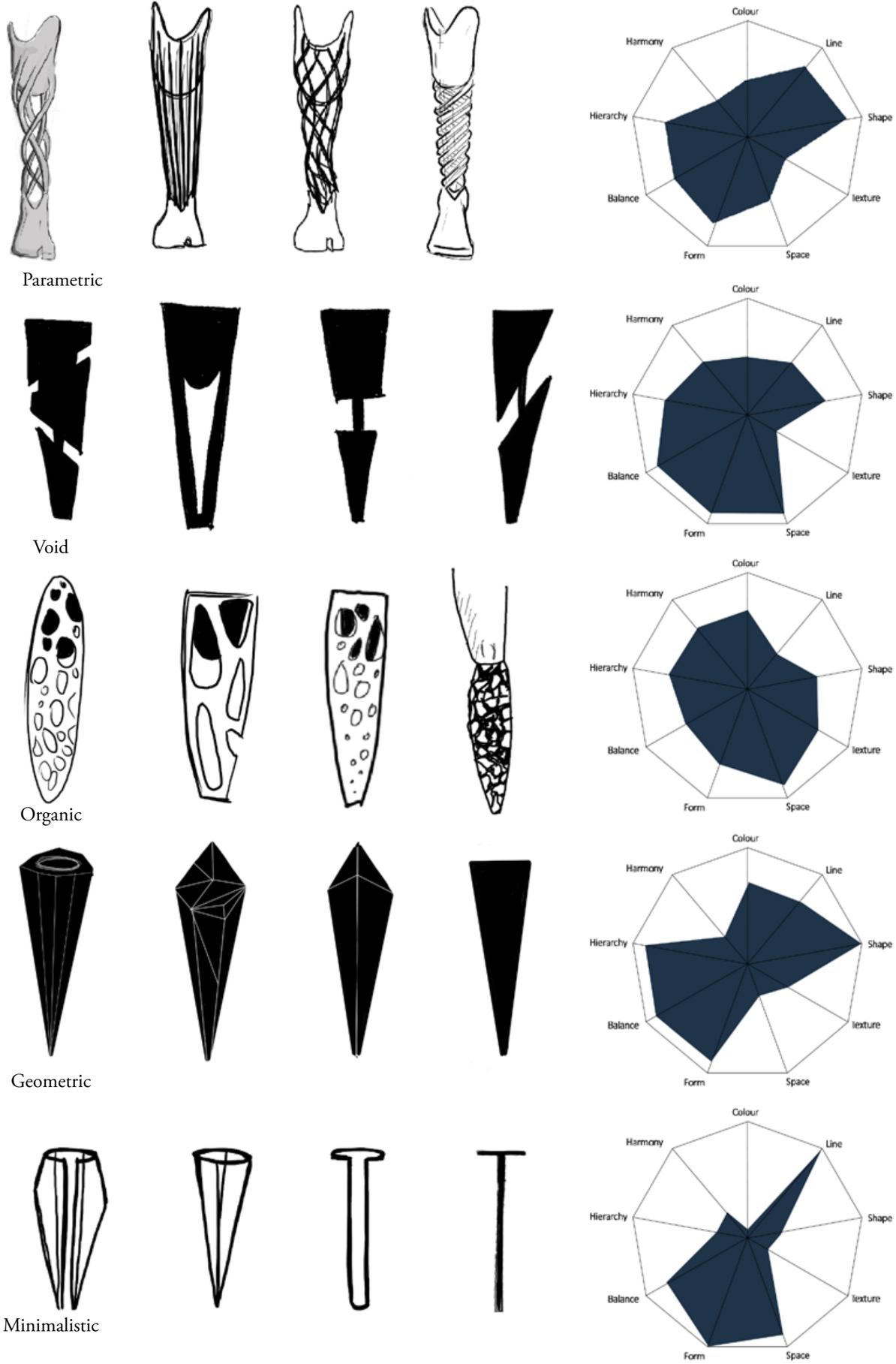




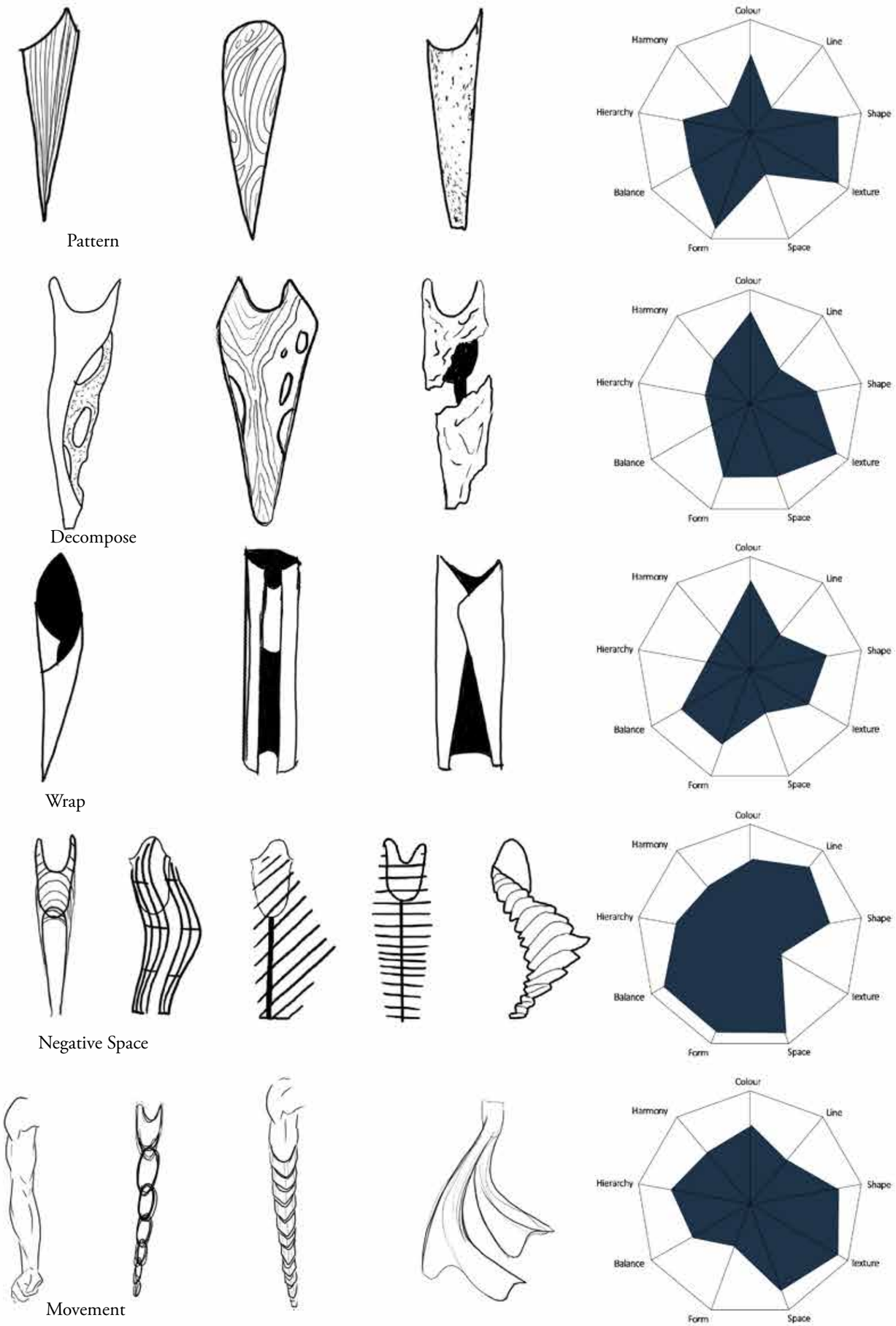
In the beginning, I was curious about how different aesthetics could change the perception of a prosthesis and its effectiveness to convey an idea. I referenced back to the performance element: design statement, to help guide this phase. I used this curiosity to fuel an expansive set of ideas for the prostheses with no limitations or parameters. The designs range from simple to complex, emotionless to meaningful.

Highlighted were the ideas that were more expressive or had greater opportunities to be further developed.

Figure 4.7 - Initial sketches.



Left Page
Figure 4.8 - Sketch analysis of visual design elements.
Right Page
Figure 4.9 - Geometric prosthesis



Left Page
Figure 4.10 - Sketch analysis of visual design elements 2.
Right Page
Figure 4.11 - Arm prosthesis.

Analysis

Using the initial sketches from the ideation stage, a few were selected and organised into themes that corresponded with specific aesthetics. The designs were expanded into collections within these themes to allow for the generating of analytic diagrams. As a starting point for the design development, I used one of the criteria's taken from the DIMPP chart and used it to illustrate the visual qualities and characteristics within each of the themes. The results of the charts were then analysed to decipher what themes had the most extreme visual qualities, as well as the most potential for 3D and performance development.

Each chart is based on my own opinion on the elements and to what extent these elements are seen.

One realisation while analysing the themes, was that the simpler the design, the more extreme the qualities of the designs seemed. These formed the basis for the ideation of the garment prototypes. To explore and extend the extreme qualities, several sets of garments were designed that either harmonised or contrasted against the prosthetic designs, so that I could understand what worked and what didn't. Using the DIMPP chart, the design elements were continually being critiqued, to understand how they will work together to strengthen the statement I intended to make.

A central theme that kept arising when developing the designs was the concept of surprise, where the garment or prosthesis would reveal an element that was hidden or would do something that was unexpected. The effect of surprise being used in different ways throughout the performance could have the potential to create a range of emotions such as suspense, amusement, joy and so on.

In the next step of the process I used the theme to expand on some previous garments and prosthesis designs and developed the overall form and performance. To get a better picture of how it would look on a person in 360°, as well as the materiality, I created CAD models and rendered the results. While rendering can come close to the desired effect, some results were not as I was expecting. Because light is an integral part of each of the designs, it was important to understand how it performs in different environments and with different materials. Although the rendering programs provided correct materiality, the way the lights react within the environment were not successful. However, to properly explore the materiality and effects more in-depth physical models and experiments are more effective. This is explored in the next design phase.

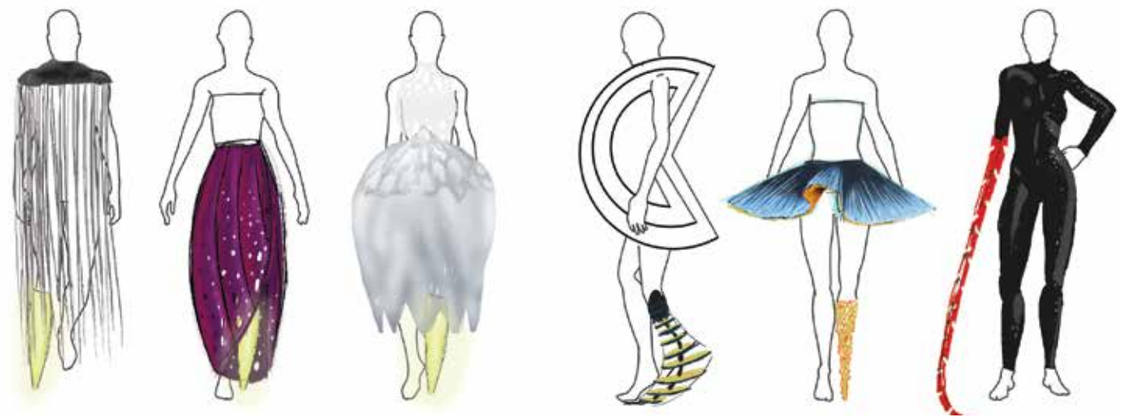


Figure 4.12 - Garment designs.

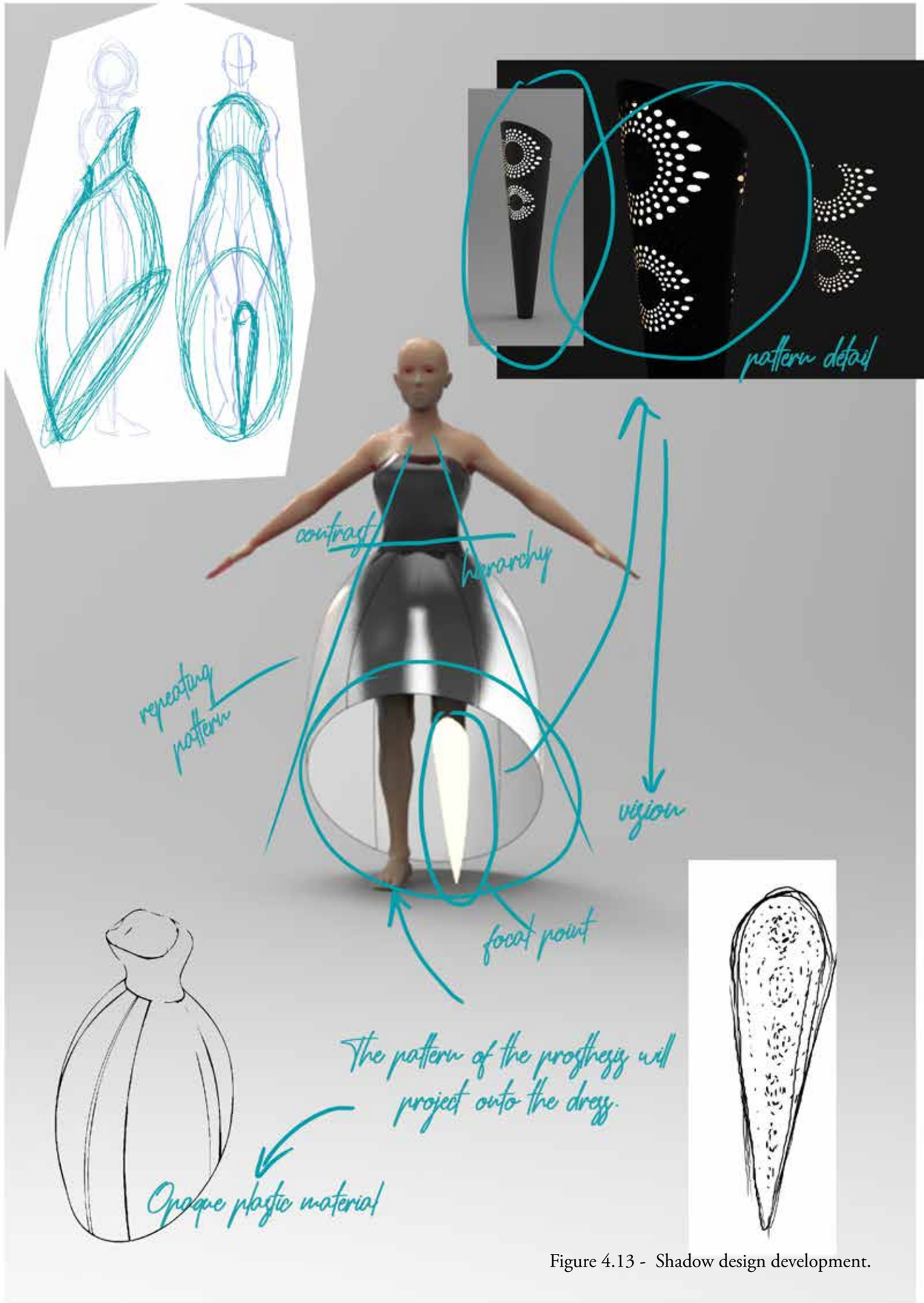
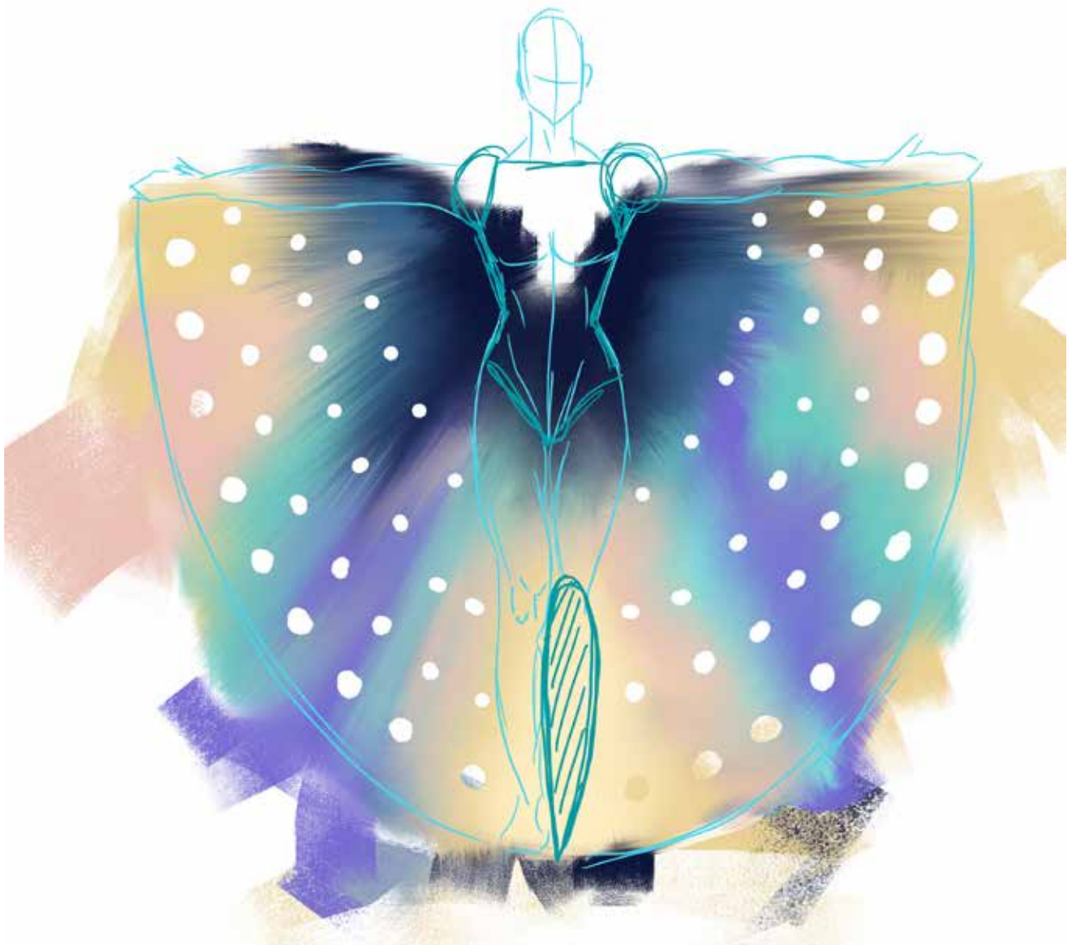


Figure 4.13 - Shadow design development.



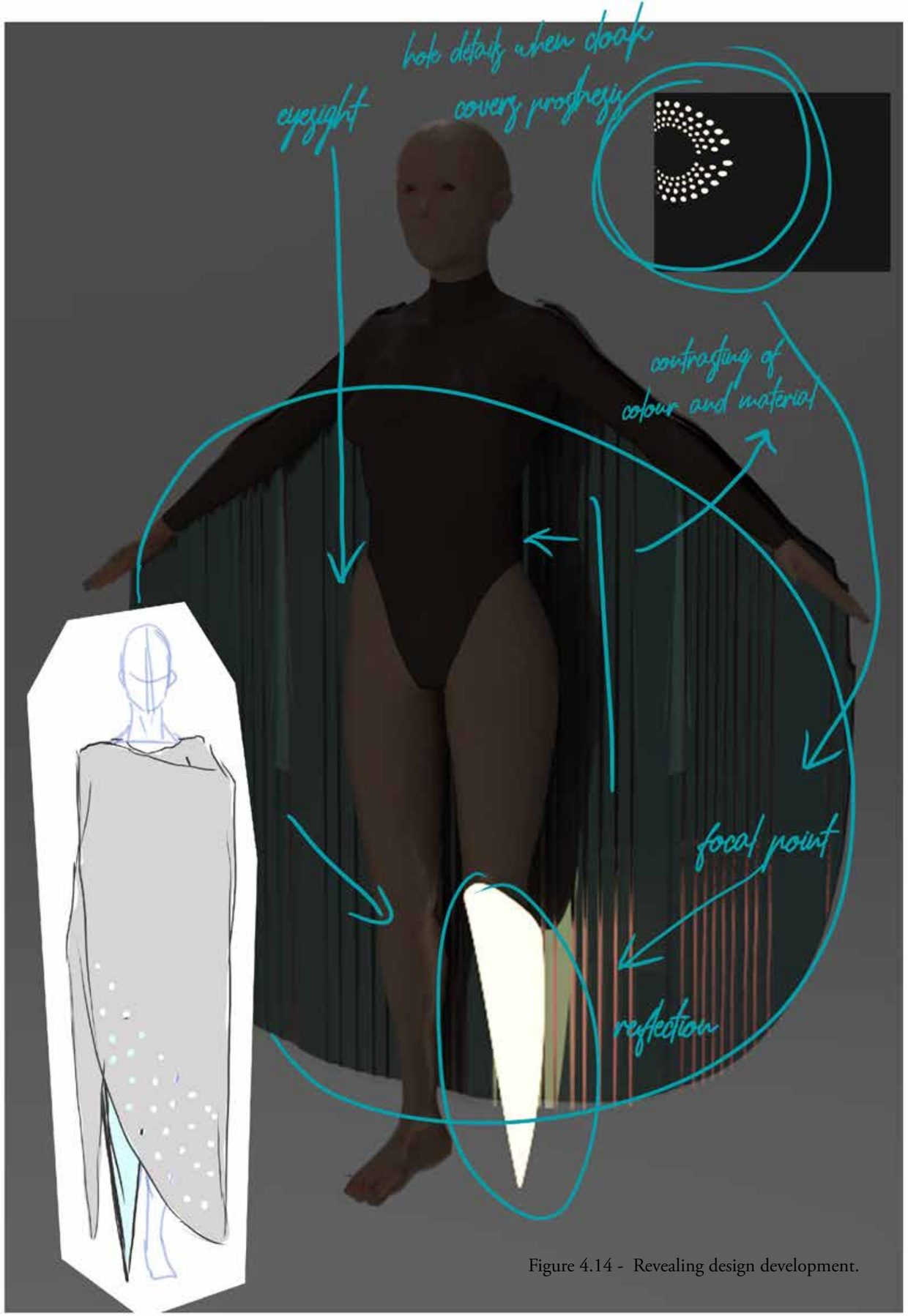


Figure 4.14 - Revealing design development.

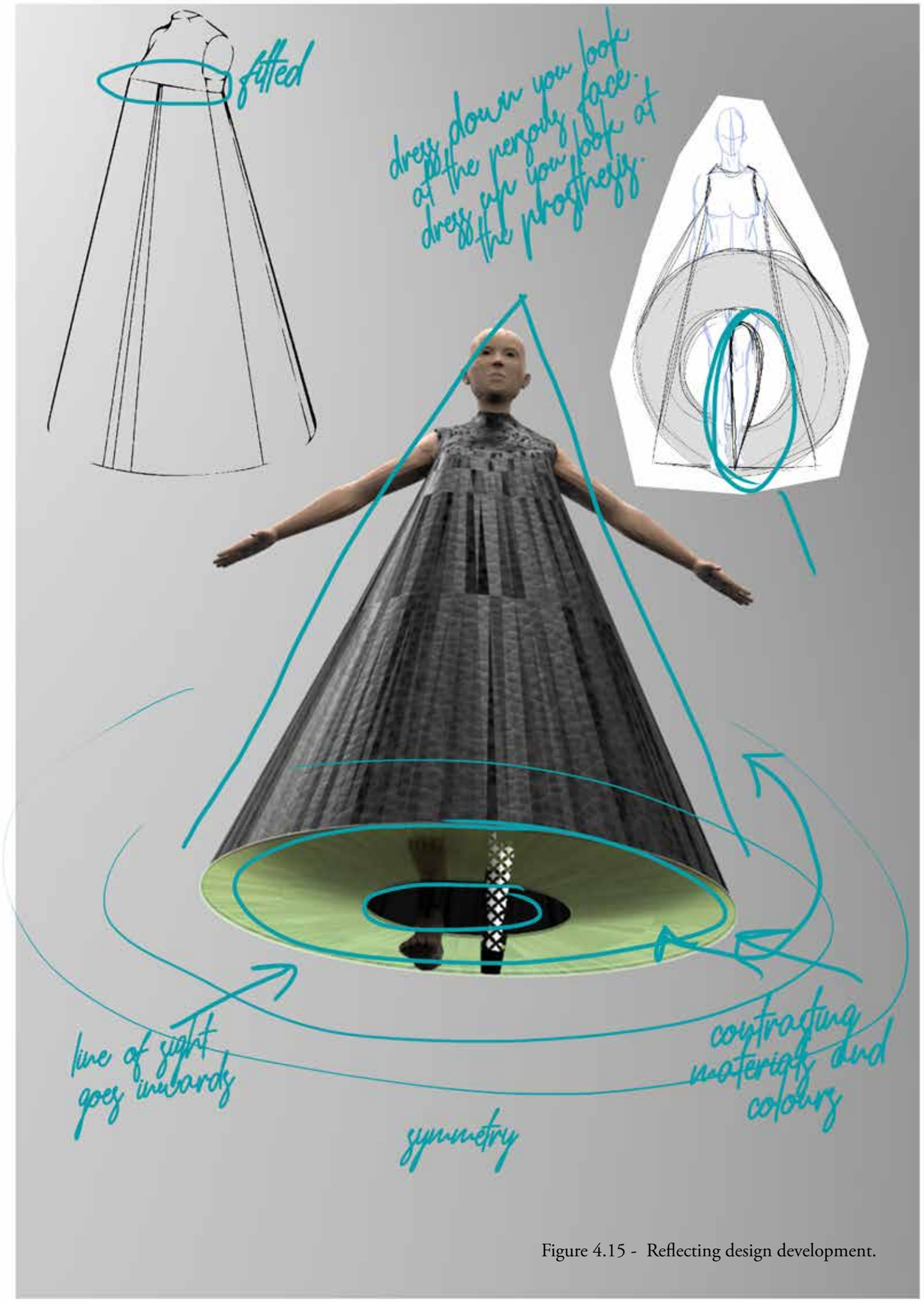


Figure 4.15 - Reflecting design development.

Design Stage 2

Material Study

The beginning of this phase was about understanding the qualities of the different materials and seeing if they have the desired effect. I became interested in the different types of reflectively and how it can be manipulated.

To begin this research, a variety of materials were selected with different characteristics to visualise its reaction to light. By positioning the materials under lights, different qualities were revealed. I began to understand how each material reacted to the manipulation, as well as the variations of colour and reflections in different angles and light.

- Rows 1 and 2 explored how the darker colours either absorbed or reflected the light.
- Row 3 looks at opaque and highly reflective materials.
- Row 4 and 5 is the exploration of iridescent and dichroic materials.

Figure 5.1 - Material exploration

Lighting and Model Study

After studying the qualities of each material, they were then tested on a scale model mannequin. The understanding of how the material would fall and what shapes it would form around the body became easier to visualise. The difficulties of working with particular materials also became apparent.

What was successful throughout these experiments was how the intended performance elements worked with the LED leg. Shadows were successfully cast upon the inside of the dress in row 3 of figure 5.3 , as well as its reflection in row 4.

During this process, I became interested in the dichroic vinyl used in row 4. The ability for it to transform its colour at every angle changed what could be a “plain” design into something with the wow factor.

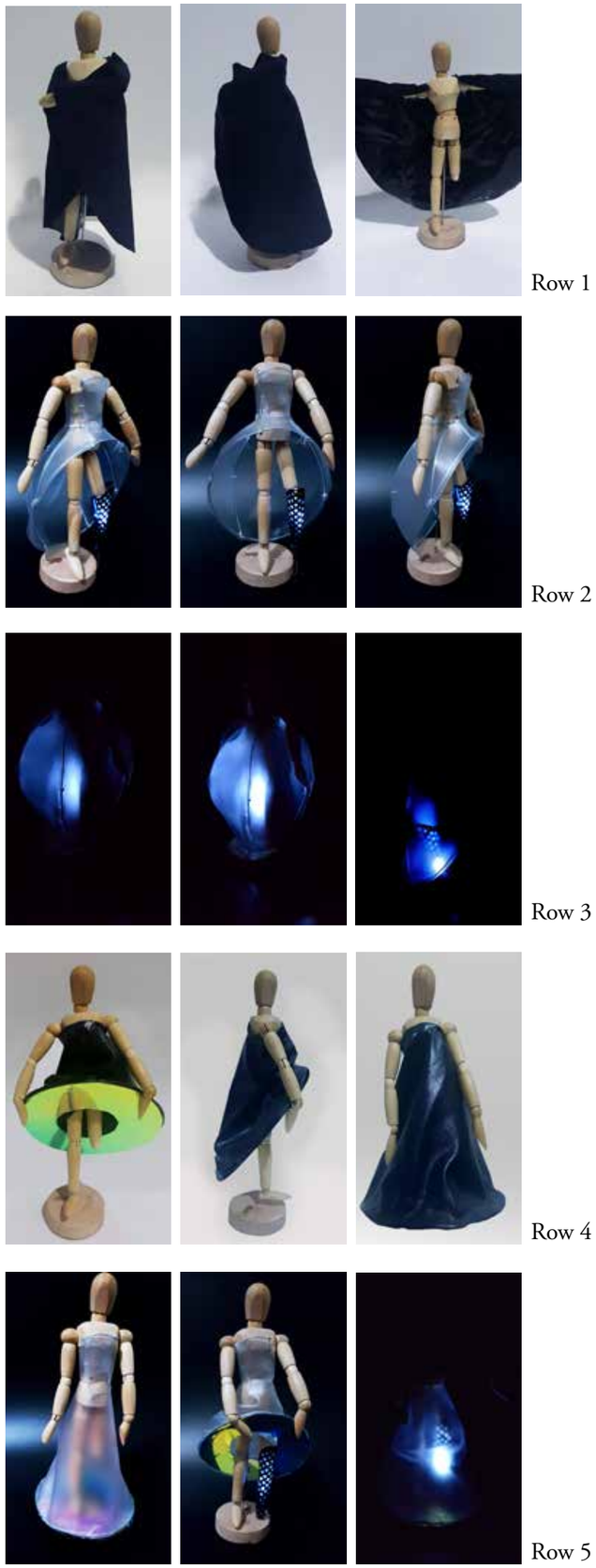
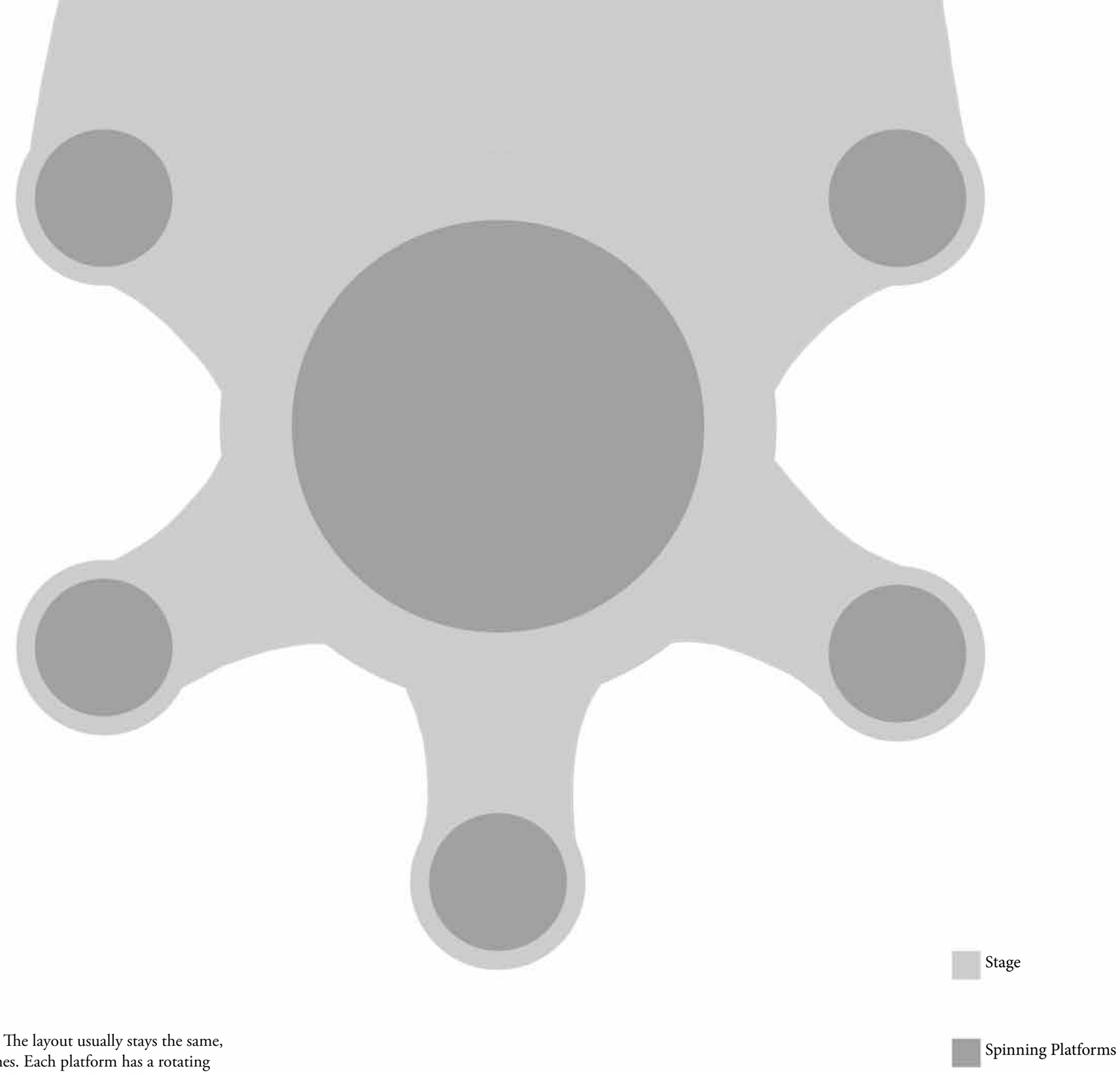


Figure 5.2 - Model study

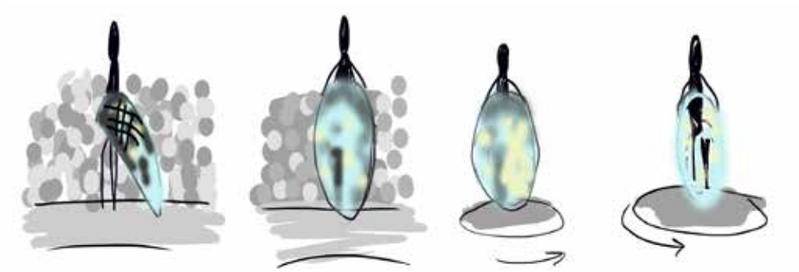


Shown is the stage used in the WOW shows. The layout usually stays the same, but stage props and set are added for the scenes. Each platform has a rotating disk where the garment displayed with a full 360° view in front of a section of the audience. The performer makes their way around the stage, stopping at each of the platforms and performing.

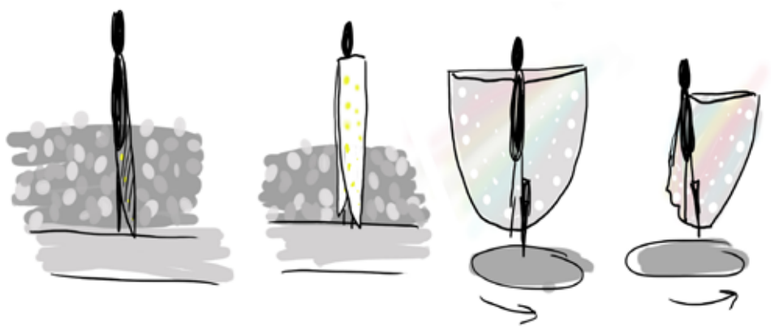
Figure 5.3 - WOW stage

Performance Study

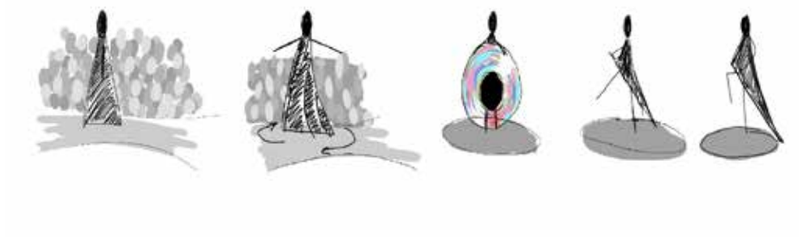
The storyboard method is a simple yet effective process to draft a series of events in a performance. By visualising the sequence of events in chronological order, it ensures the success by identifying potential problems in a scene or performance. Each garment's artistic performance was analysed to identify which formed a spectacular artistic performance.



The performance given by this garment is subtle yet compelling. Using the LED prosthesis as the main prop, it prompts and manipulates how the entire garment looks and feels. The idea would be for the lights within the prosthesis to be off as the performer walks around the stage, with only external stage lights affecting the qualities of the dress. As the performers stand onto the rotating platform, that is when the lights from the prosthesis light up and begin to perform.



Unlike the previous designs, this garment felt to have the weakest stage presence. The surprise effect was dampened by the predictability of what was going to happen and as a result, would have less of an impact on the audience. While the movement it creates may be more dramatic than the other designs, overall it does not make up for its originality of it being just a cloak opening and closing.



Reflecting on the first two design concepts gave clues to configuring the performance. While the first concept frames and focuses attention on the legs in a compelling way, it remains somewhat static. By contrast, the second concept introduces a dynamic notion of 'revealing' as a performative concept. Combining these two concepts introduces a cultural context through the performative values of the Can-can dance and establishes unexpected parallels with amputees. Originally the dance was considered "scandalous" because of the controversial actions within the performance resulting in attempts to repress it ("Can-can," 2018). This is not unlike the stigma associated with amputees and the resulting inclination to conceal the missing limb. It offers an opportunity to make a thought-provoking and ironic statement whereby the amputee not only reveals the prosthesis but celebrates it with the extravagant movements of the Can-can.

Similar to the Can-can dress, this design can be twisted or pulled, catching the different angles of the stage lights. Being made from a dense black floor-length material, the dress effectively conceals the prosthesis and gives no hint as to its hidden purpose until the performer reaches for the base of the dress. As the disc is lifted, the character of the dress transforms from an inconspicuous black cone into a technologically enhanced show of light and colour. It frames and reflects, and ultimately celebrates the illuminated prosthesis with a contemporary interpretation of a traditional Can-can dress. To further enhance this spectacle, the performer would start to imitate the can-can dance.

This led to the creation of the garments name: I Can Can, capturing the idea that amputees have the ability to do or achieve whatever they want. They become the "new enabled".

The result of the material and stage experimentation produced a refined garment concept that represents the initial design statement. Reflecting on the first two design phases, using the DIMPP chart was a helpful tool to use as a guide when making even the smallest details purposeful when considering the line of sight or main design elements. What was difficult, however, was the ability of not being overwhelmed with ideas, then developing those ideas into one single but strong theme. Too much substance within a theme would overpower the design and make it too busy and hard to concentrate on what the design is trying to show, not enough substance within the theme would make the design too weak and not get the message across to the audience. Once this obstacle was overcome, it then made it easier to visualise the spectacle that would be produced.

Figure 5.4-5.6 - Performance study

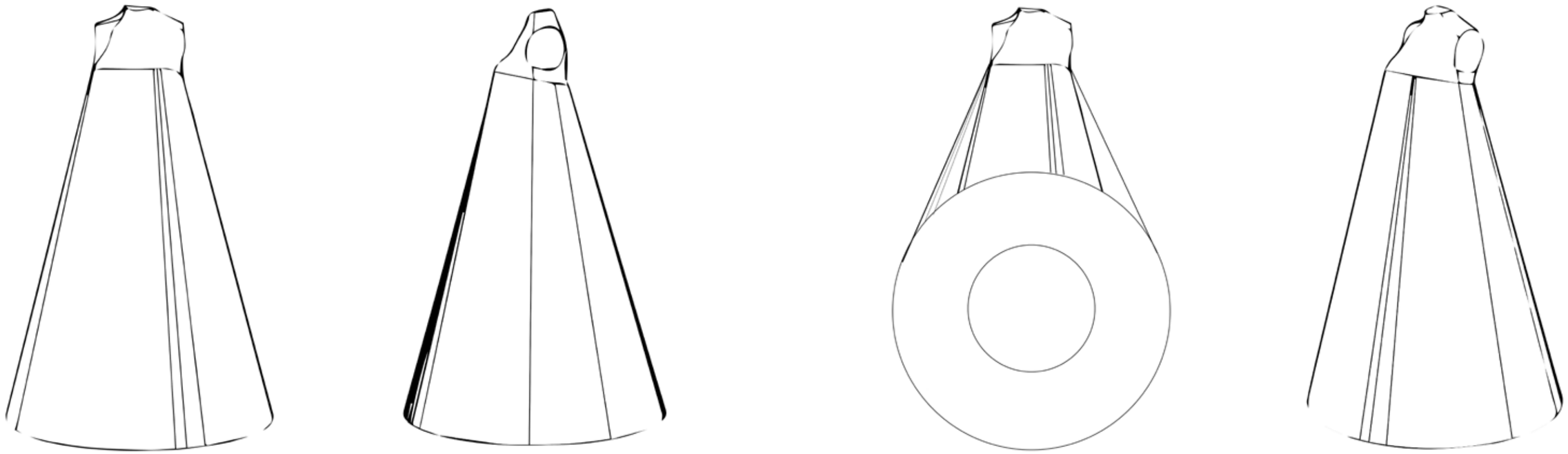


Figure 5.7 - Final design

Design Stage 3

Introduction

The third phase of the research takes what I have developed in 2D and small-scale 3D models and starts to refine details with higher definition, as well as edit and form the garment on a full-scale mannequin, taking into account specific measurements and ergonomics that affect how the garment would be made. This required manufacturing methods, dress templates and structural compositions to be explored in three main areas: garment design, performance design and prosthesis design.

Garment Design- The garment design takes the material exploration and expands that knowledge into the full-scale model. It tests the different methods of sewing needed to accurately form the shapes and desired effects needed for a polished garment.

Performance Design- Looks at how the main feature of the garment can be enhanced through form manipulation or manufacturing to increase the overall performance. All the characteristics of this design will aim to highlight the design statement and make the prosthesis a feature that cannot be missed.

Prosthesis Design- Is developed to match the overall theme selected for the garment, so all the parts of the design are in harmony with each other. The construction of the prosthesis will need to be considered for the safety and comfort of the performer and to successfully install the LEDs within the design.

To keep the design from going off track, the DIMPP chart was constantly referenced to critique the choices made in the process in relation to the design statement.

Garment Design

A handful of materials that were successful in the initial experimental stages were used for the garment design, they included two base materials for the main part of the garment, see figure 6.2. Unlike most fabric, these were covered in a thin layer of rubber. The matte black softened the light it was exposed to, and contrasted against the highly reflective and dichroic vinyl intended for the disc. This effect made the two features (dress and disc) somewhat independent of themselves, yet worked together in emphasising the main feature, the prosthesis. Unfortunately, the downside to this material was its need for perfection in the sewing. The elasticity of the material required the stitching to be set at a particular setting. If the stitches were too close together, there was too much tension in the material and pulled in different directions. If it was too loose, there wasn't enough strength to hold the material in place. A way around this was to have a supporting material underneath that helped to keep the stitching and material in place. One thing that became apparent in the design was the shape the dress formed around the body. Because there was no structure, it looked sloppy and unconsidered. To fix this, darts were placed either side of the chest to pull the material inward and bring back the organic shape of the body.

The reflective black fabric had similar characteristics when sewing. However, the aesthetics were completely different. Unlike the matte black, this fabric reflects the lights to create an edgy feel to the garment. Rather than contrasting against the dichroic material, they form a harmonising relationship. The similarity in the finish of the materiality takes the emphasis off the prosthesis. By using the matte black, the audience can look at the garment (when it is down) as its own identity, with the folds and form. When the disc and prosthesis are revealed, rather than capturing the attention of the audience, it becomes a background feature that still supports the prosthesis, but does not take the attention away.

Figure 6.1 - Sewing study

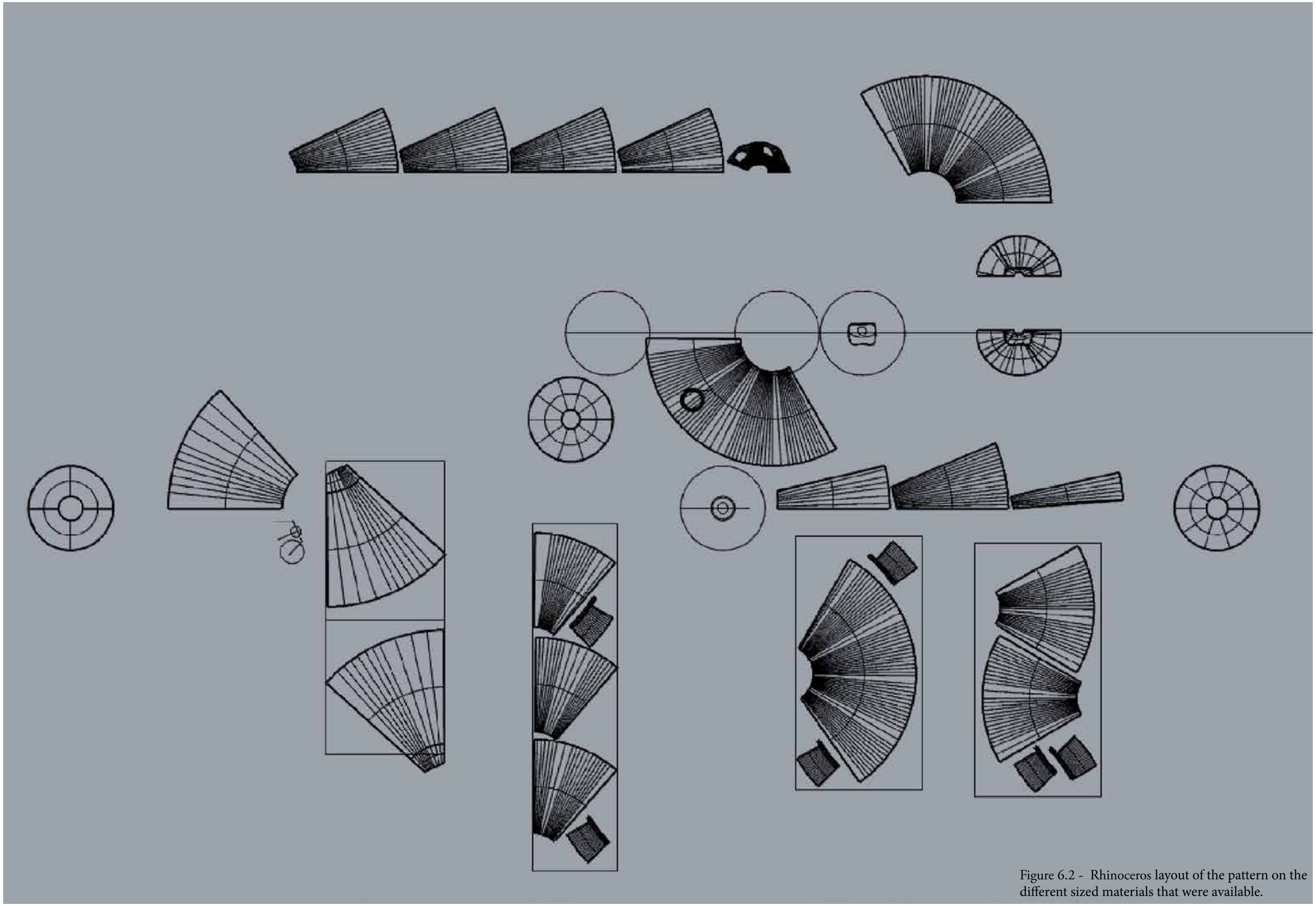


Figure 6.2 - Rhinoceros layout of the pattern on the different sized materials that were available.

Performance Design

To enhance the performance design, it was discovered that the disc could do more to emphasise the prosthesis. The material chosen was a dichroic vinyl film that, from every angle, generated a new colour. Another quality that this material possessed, was its ability to reflect images directly in front of it, while still experiencing the colour shifting appearance. I became curious as to what angles were best to create the drastic shifts in colour and how to use the reflection to magnify the prosthetic device. Through a series of small-scale models, I began to experiment with different forms in a disc shape using vacuum forming over a 3D printed model. I found that the discs with the steeper angles created greater contrast in the film's colours with the most effective being a wave pattern. Using these forms, we could change how the reflection of the prosthesis would be seen. The concave shapes brought the image of the prosthesis towards the middle of the disc, whereas the convex exploded the image outward. The wave-shaped disc also formed multiple fragmented images of the reflected prosthesis from different angles and had an interesting effect in how it scattered the light.

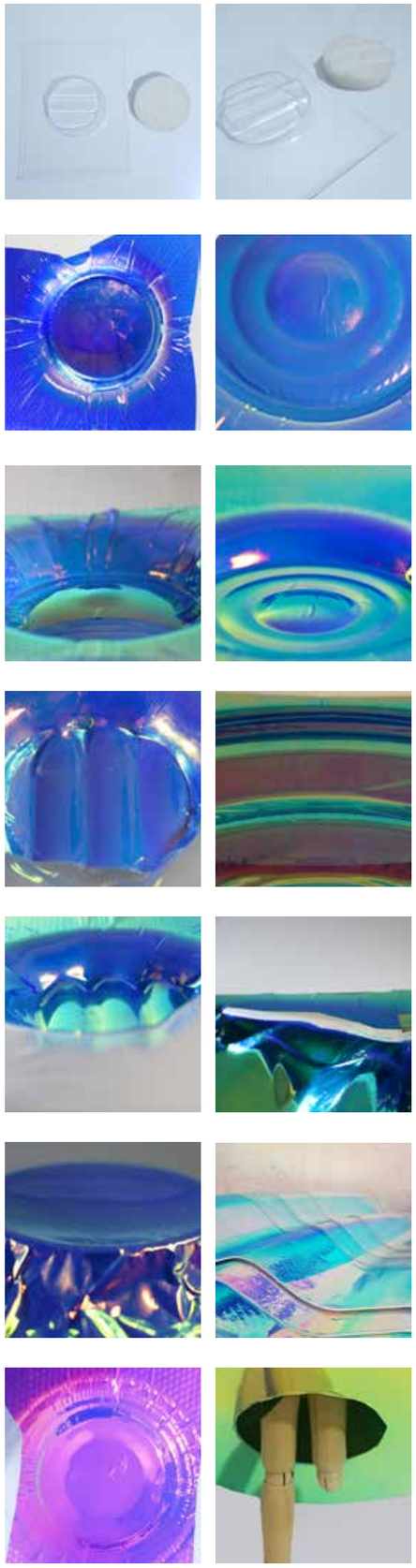


Figure 6.3 - Colour exploration with vinyl.

Once the final form was chosen, the process to create a full-scale model began:

Step 1- Create a 3D model with correct dimensions. This model is then sent to a Computer Numerical Controlled (CNC) Router where pieces of timber are carved into the 3D form. It is then sanded until smooth.

Step 2- ABS and PETG plastic is then vacuum formed over the mould to create the desired shape. For the vinyl, because the material came pre-glued, it needed to be stuck onto the sheet plastic before it was moulded. As the material is heated, so is the vinyl and it is sandwiched between the plastic and mould when the air is suctioned.

Step 3- The pieces are then cut out using a hand saw and the edges are sanded until smooth.

To attach the disc to the garment, I created two layers of the disc, interior and exterior. This allows for the fabric to go between the two pieces and have a sharp, clean edge.

A common problem that occurred was finding the correct temperature to set the vacuum former. I noticed when it was too hot, the glue on the vinyl would begin to melt and create bubbles underneath the material, making an uneven texture on the surface.

One of the major limitations throughout this phase was the availability of specific materials similar to that of the vinyl. The dichroic vinyl is a statement feature in the design, and it was purposely chosen for its unique qualities. The unmoulded finish of the vinyl is the effect wanted in the design, but in many unsuccessful attempts, we were unable to create that smooth finish on the vacuum formed moulds due to the adhesive that the material used. In this case, we had to find alternative materials as close to the original as possible. All had a smoother finish, but none had the spectacular dichroic properties.

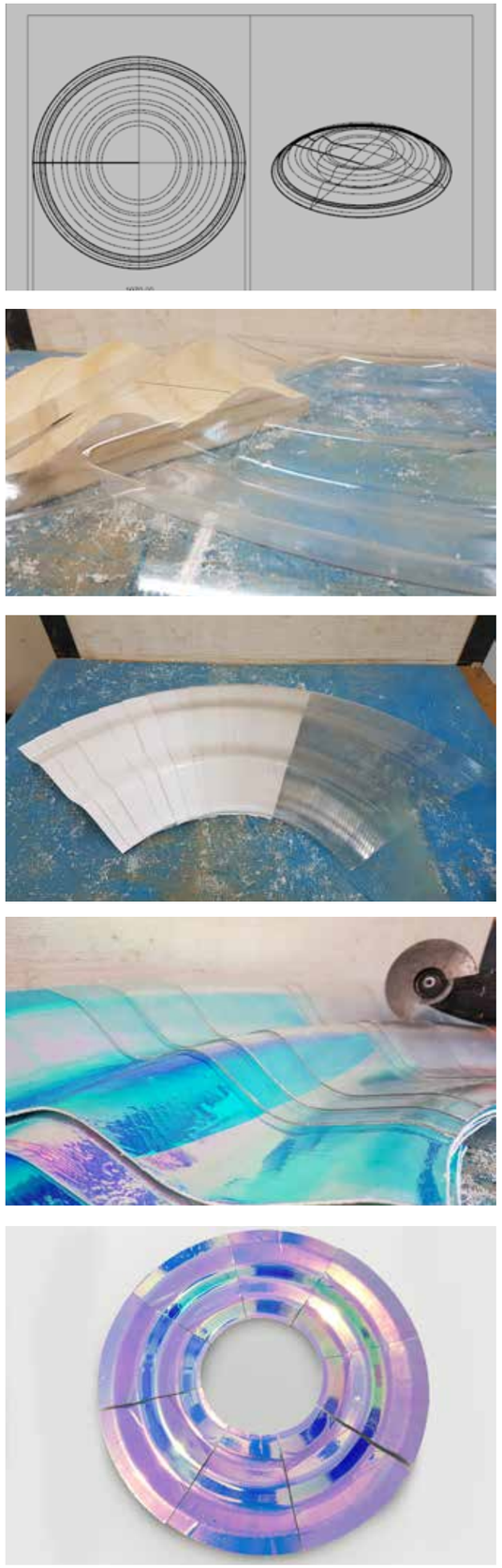


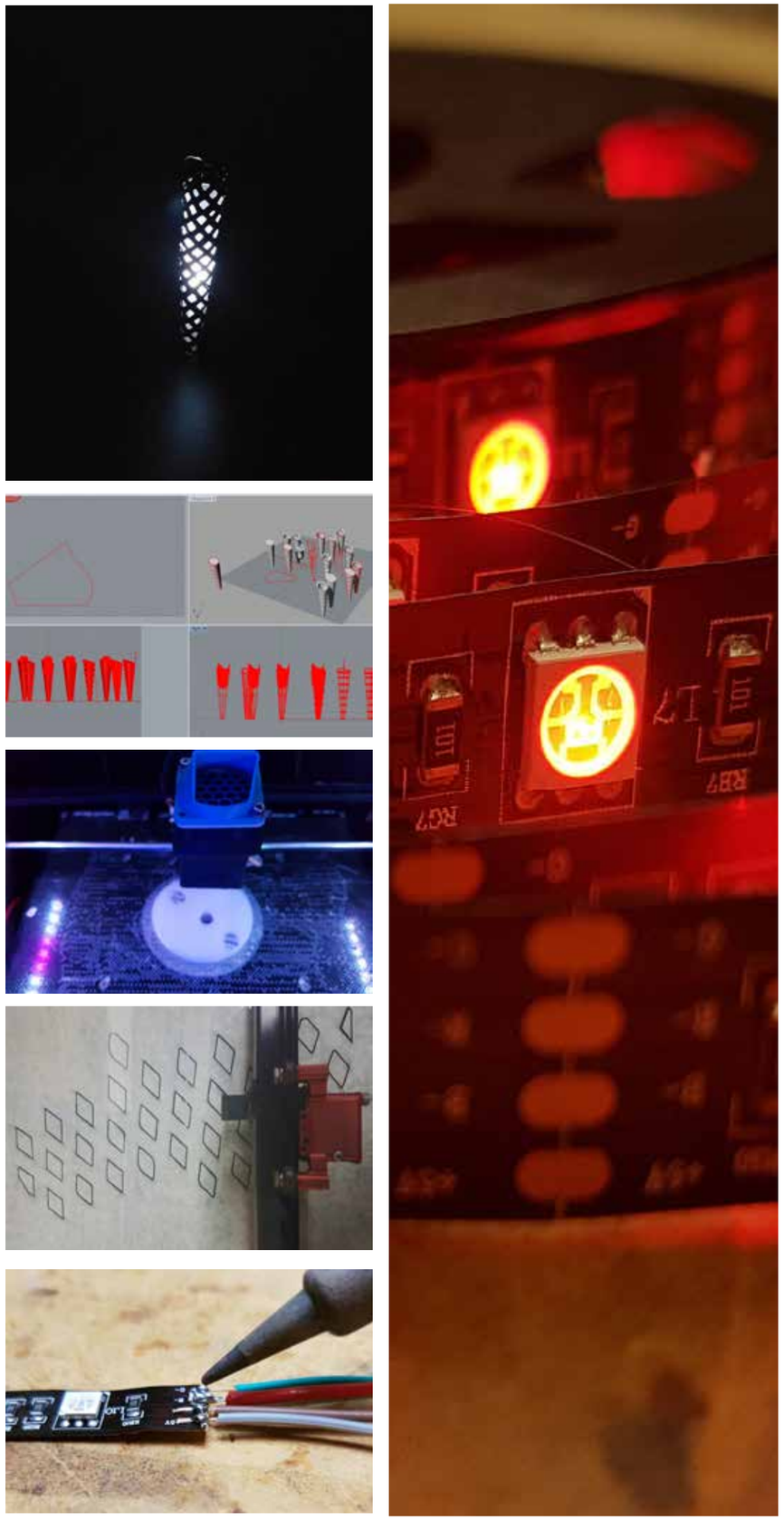
Figure 6.4 - Making process, chronological order from top to bottom .

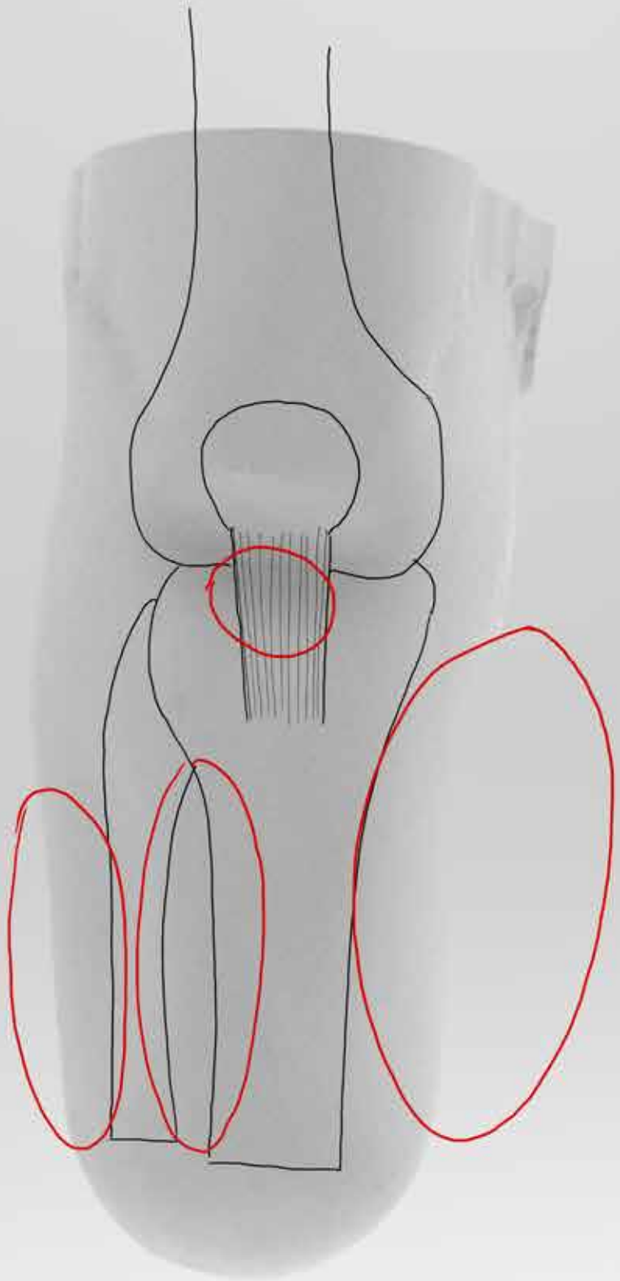
Prosthesis Design

The prosthesis consists of two parts; the first is the interior structural support and socket, and the second is the exterior shell and details. The pattern chosen reflects the style of fishnet stockings. The reasoning for this choice is so it relates back to the overall theme identified in the earlier design development, the can-can dance. Not only is this pattern harmonising the elements of the garment, but the concept of fishnet stocking takes it one step further where it is often referenced as sexy. Integrating a symbol with that connotation into the prosthesis, takes the design back to the notion of constructing identity and social inclusiveness discussed in the literature review. Figure 6.7 is an image of the scans taken of the selected performer for the final fitting. Illustrated in these renders are the pressure tolerant areas of the residual limb. This is where the socket is formed into the leg, so the weight is distributed across those areas, the main area being just below the knee. For the performance of the prosthetic, it was important not to remove that area to provide the most comfort when wearing and walking around. An issue that rose during the scanning process was the implication of the performer being a relatively new amputee. This meant that the residual limb was shrinking drastically each week. To overcome this problem, it was decided to use special socks as the attachment from the prosthesis to the limb, meaning space could be filled with layers rather than the need to reprint the entire prosthesis or a complicated system put in place. Taking this scan into the Rhinoceros CAD program and using parametric modelling, a variety of different forms were created, some exploring the form without the use of the side supports and some with, as well as determining the appropriate measurements and alignment on the body. The goal of these experiments was to create a design with the most aesthetic appeal, that was still safe and comfortable for the amputee. The iterations also determined how the LEDs were going to be incorporated into the design. An important detail needed in the design was the fact that when the LEDs are placed onto the prosthesis, for the light to disperse evenly, it needs approximately 10mm at the least between the LEDs and the light diffusing material. By creating crevasses within the prosthesis fixture, it allows for the light to expand out.

The lights used in this design were programmed RGB LEDs. This gives them the ability to change to nearly any colour in the spectrum, as well as be programmed to do lighting displays.

Next page
Figure 6.5 - Prosthetic process.





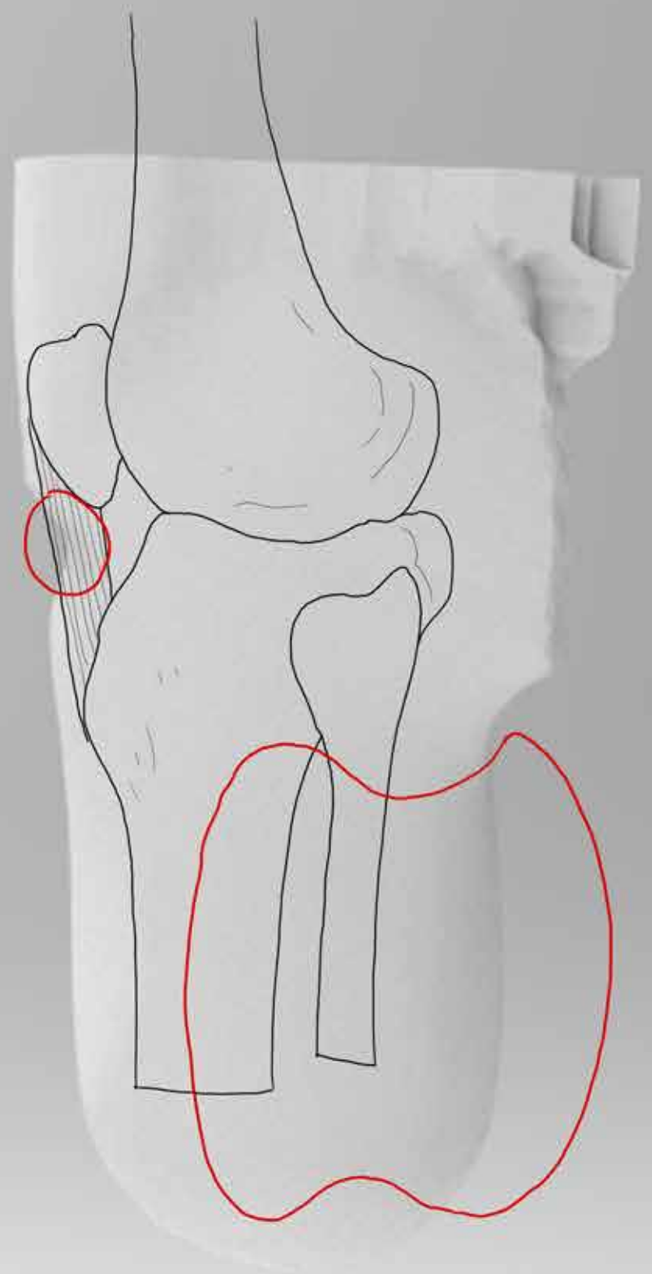
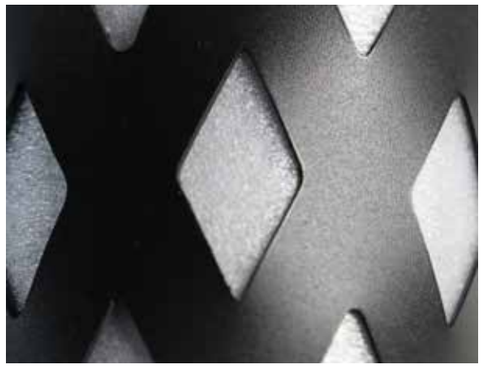
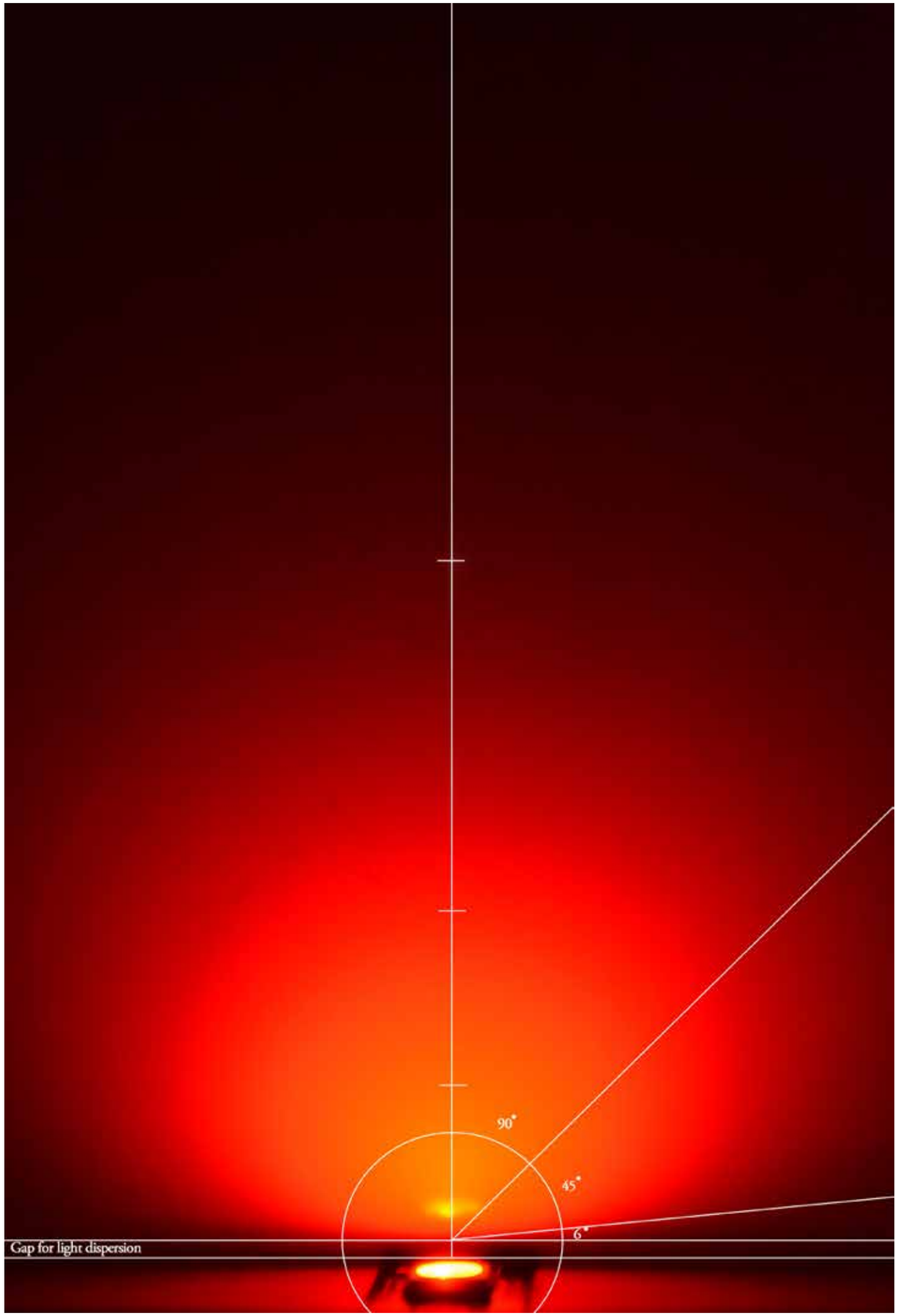


Figure 6.6 - Models scan of limb with pressure tolerant diagram.

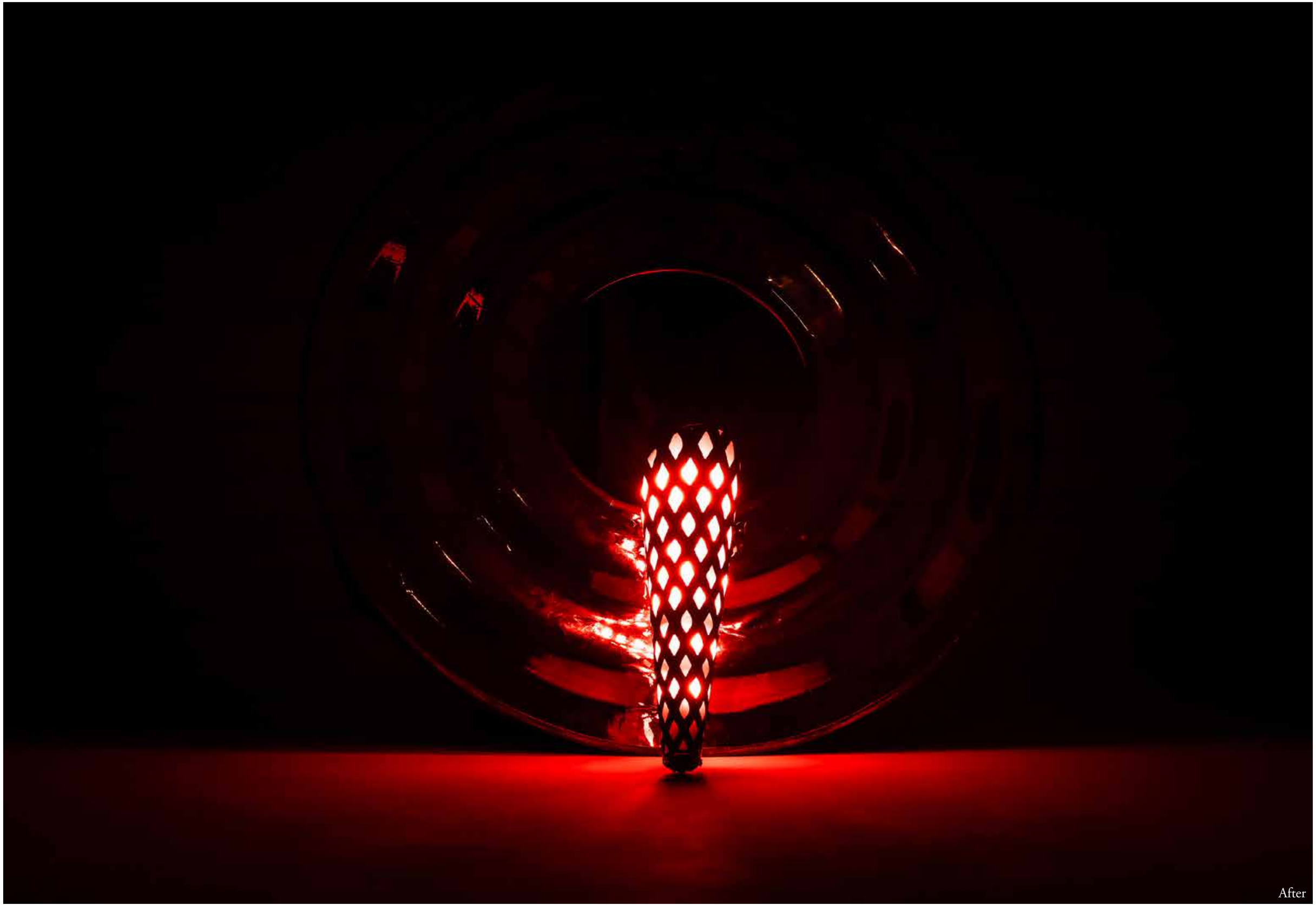
The EVA foam was a successful material to disperse the LEDs. However, a mistake made in the structure of the prosthesis meant that the light was not correctly spread. By not chamfering the crevasses out at a wider angle, it created an inconsistent and striped transition between each layer of LEDs, forming an undesired look. To change this, I needed to consider the beam angle of the LED lights. By measuring the lights against a chart, I was able to determine the angle that these specific LEDs spread, see figure 6.9. This experiment resulted in a successful LED prosthesis.

An issue with the fitting of the prosthetic was the amputee's ability to walk. Unlike a standard prosthesis, this design tapers to a point making it harder for the amputee to balance and walk with. Amputees told me that it takes time and practice to get used to being on something similar to a peg leg, but for the performance, it was discussed that background dancers could be used either side of the performer to help with extra stability if needed.





Left page
Figure 6.7 - LED prosthesis test
Right page
Figure 6.8 - Light study.



After

Final Design

Previous Spread: Figure 6.9 - Red LED Leg, Left page: Figure 6.10 - Garment design down, Right page: Figure 6.11 - Garment design up

Performance

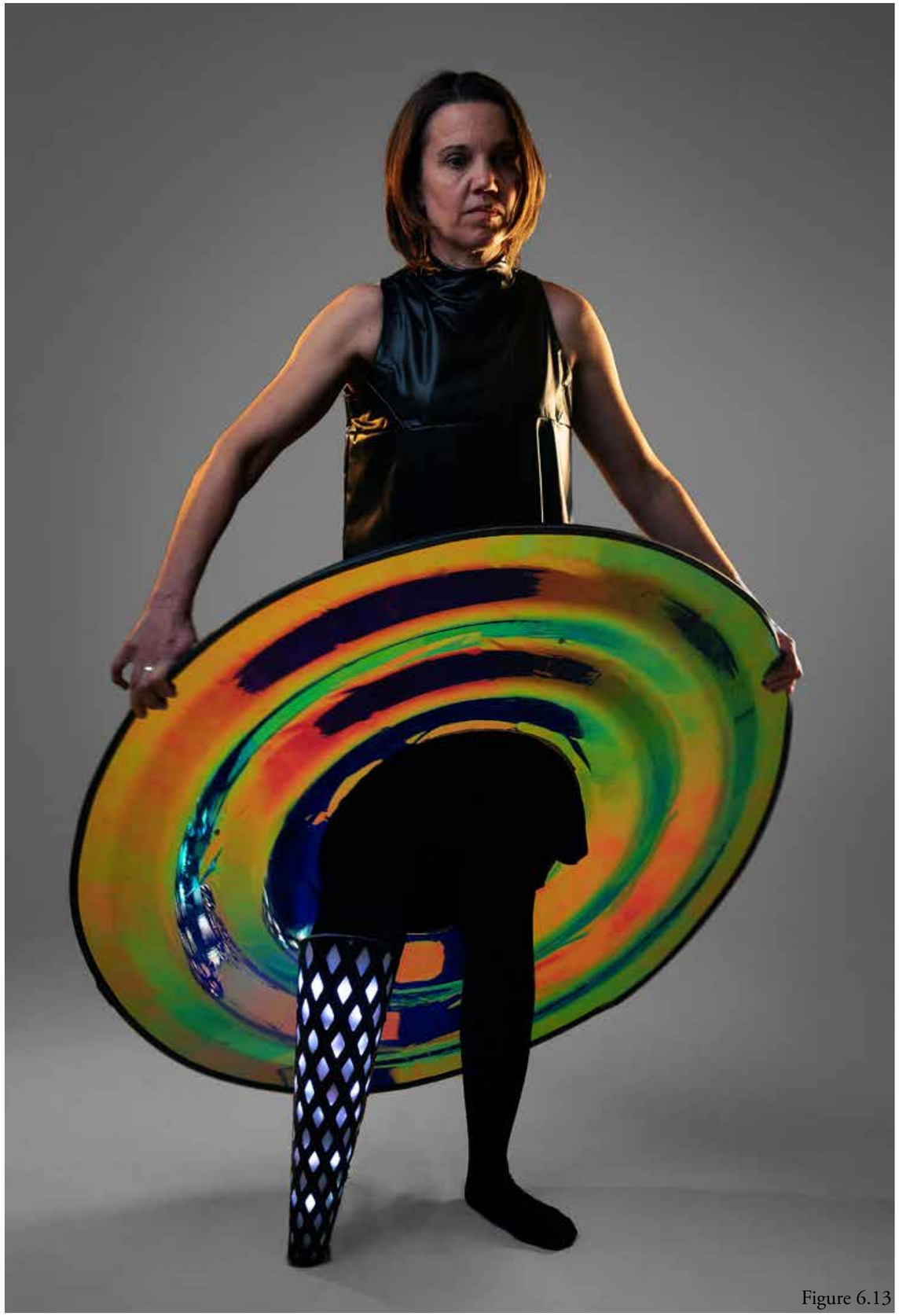


Figure 6.13

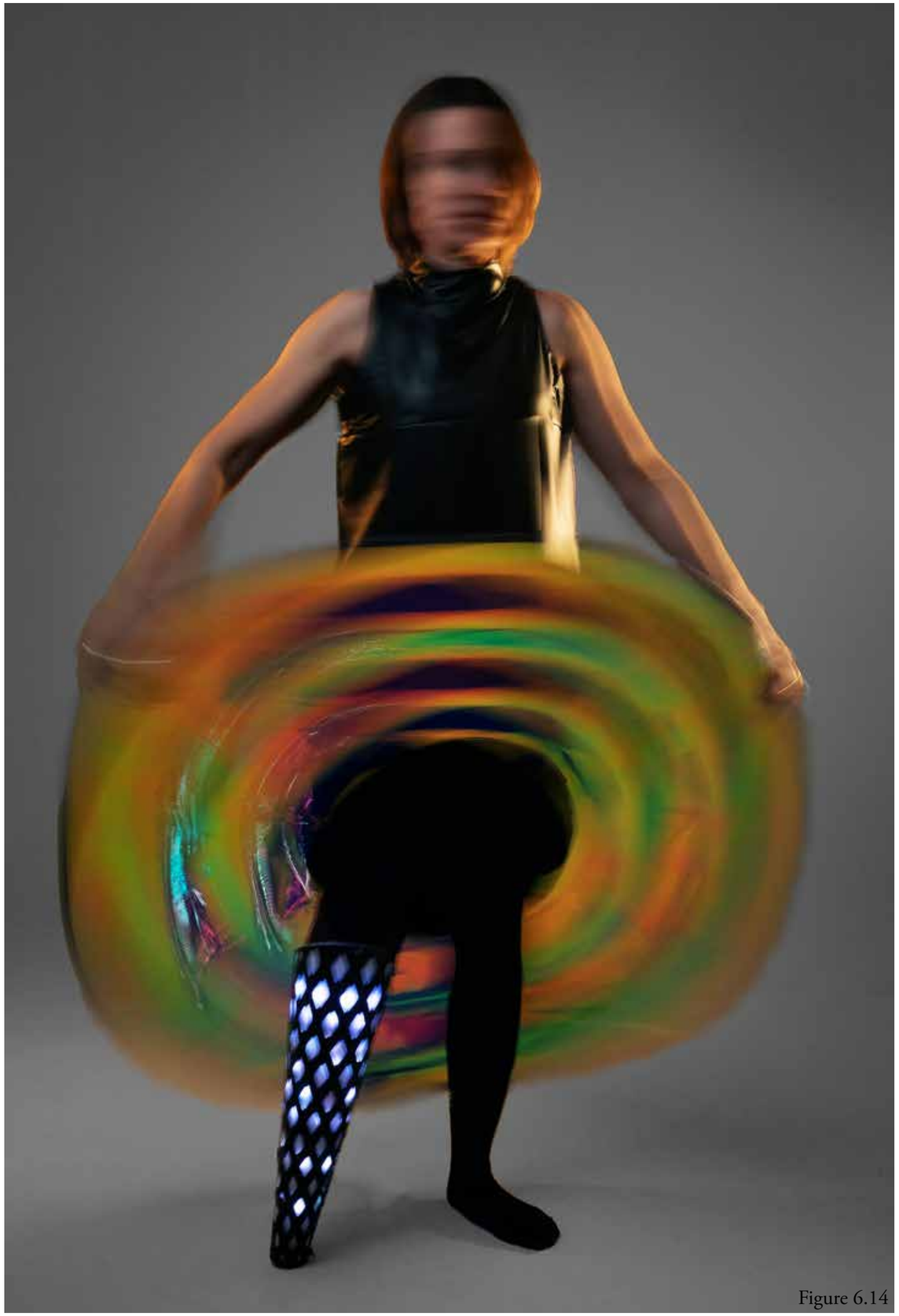


Figure 6.14

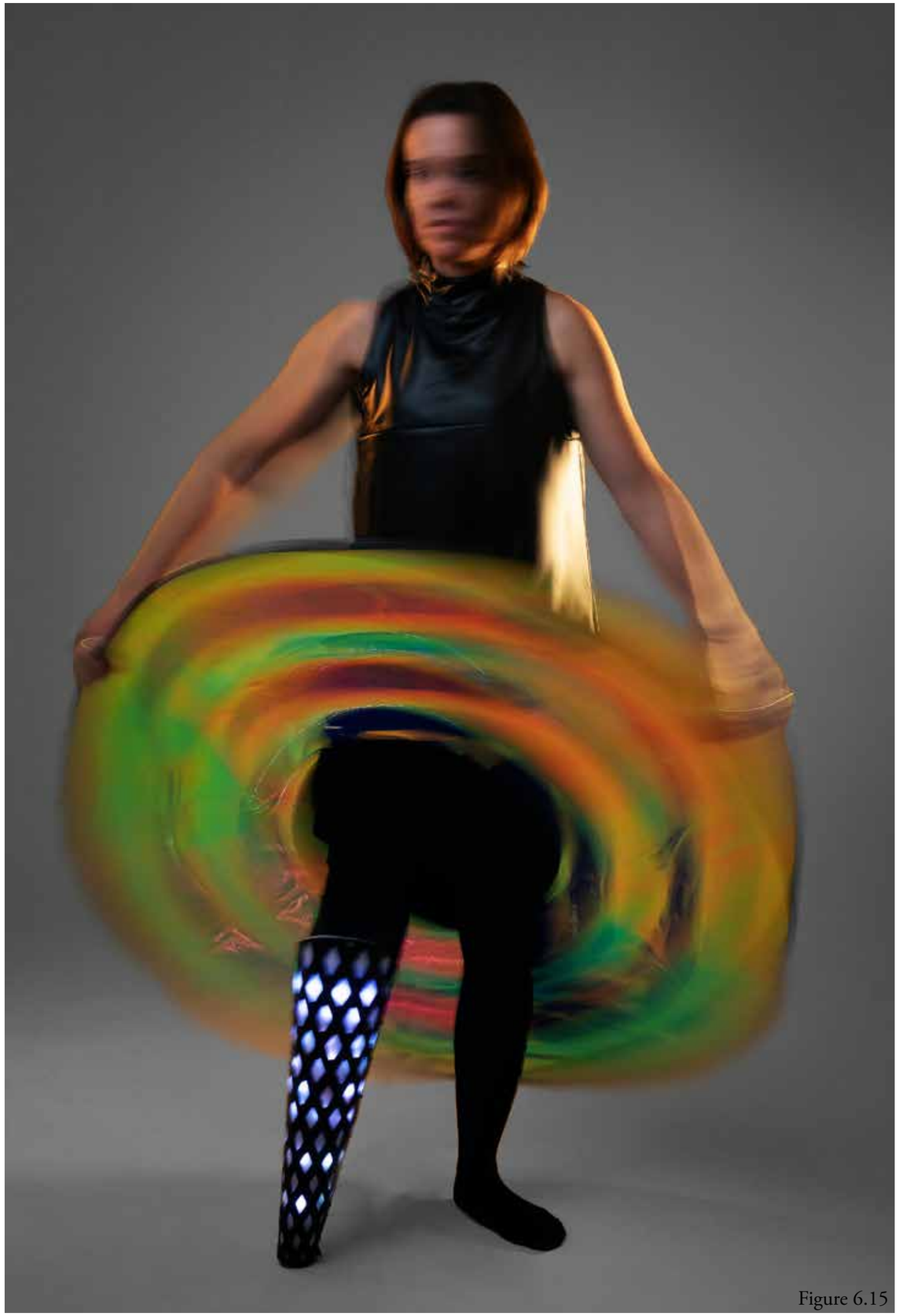


Figure 6.15

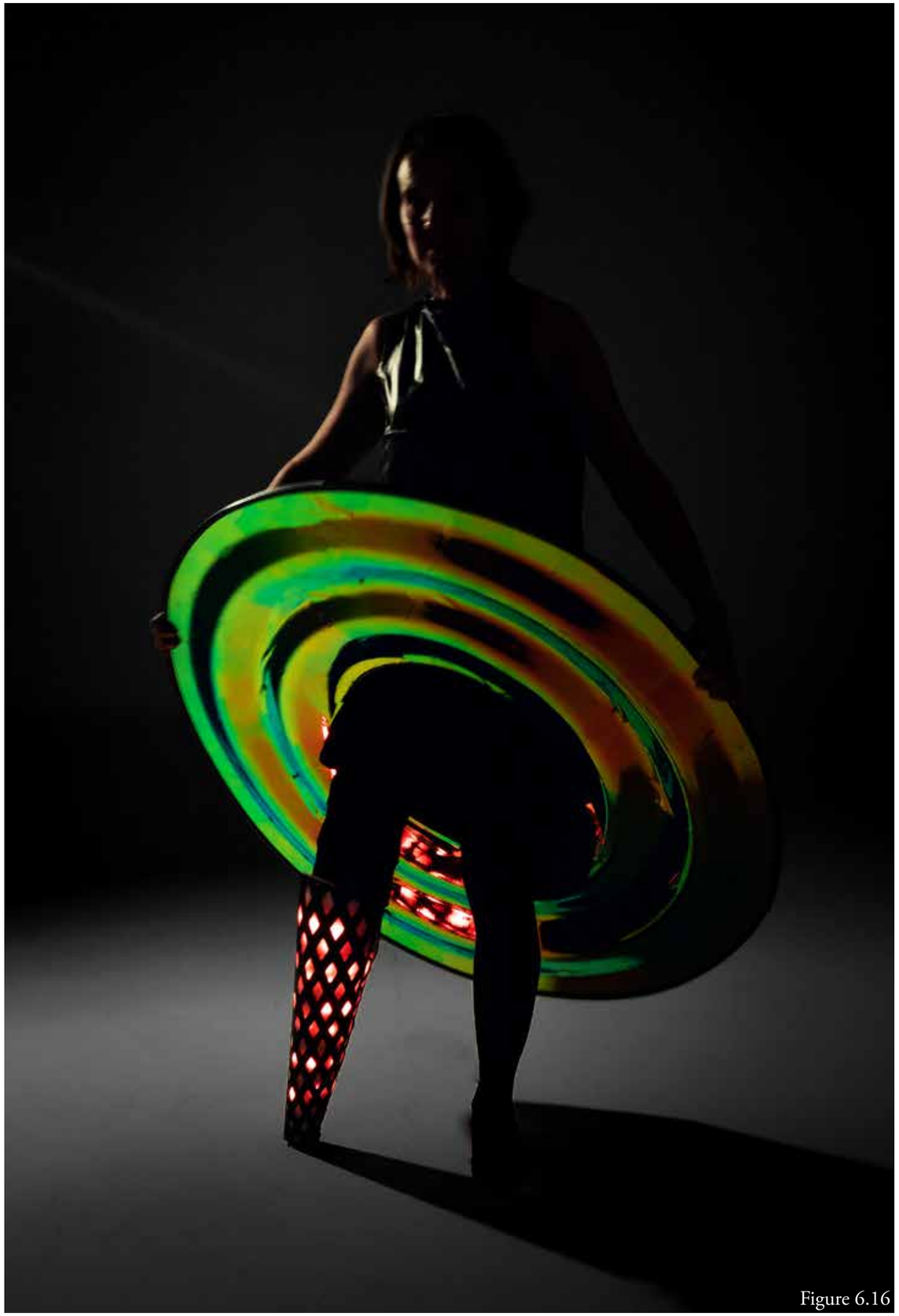


Figure 6.16

Figure 6.17

Figure 6.18

Figure 6.19

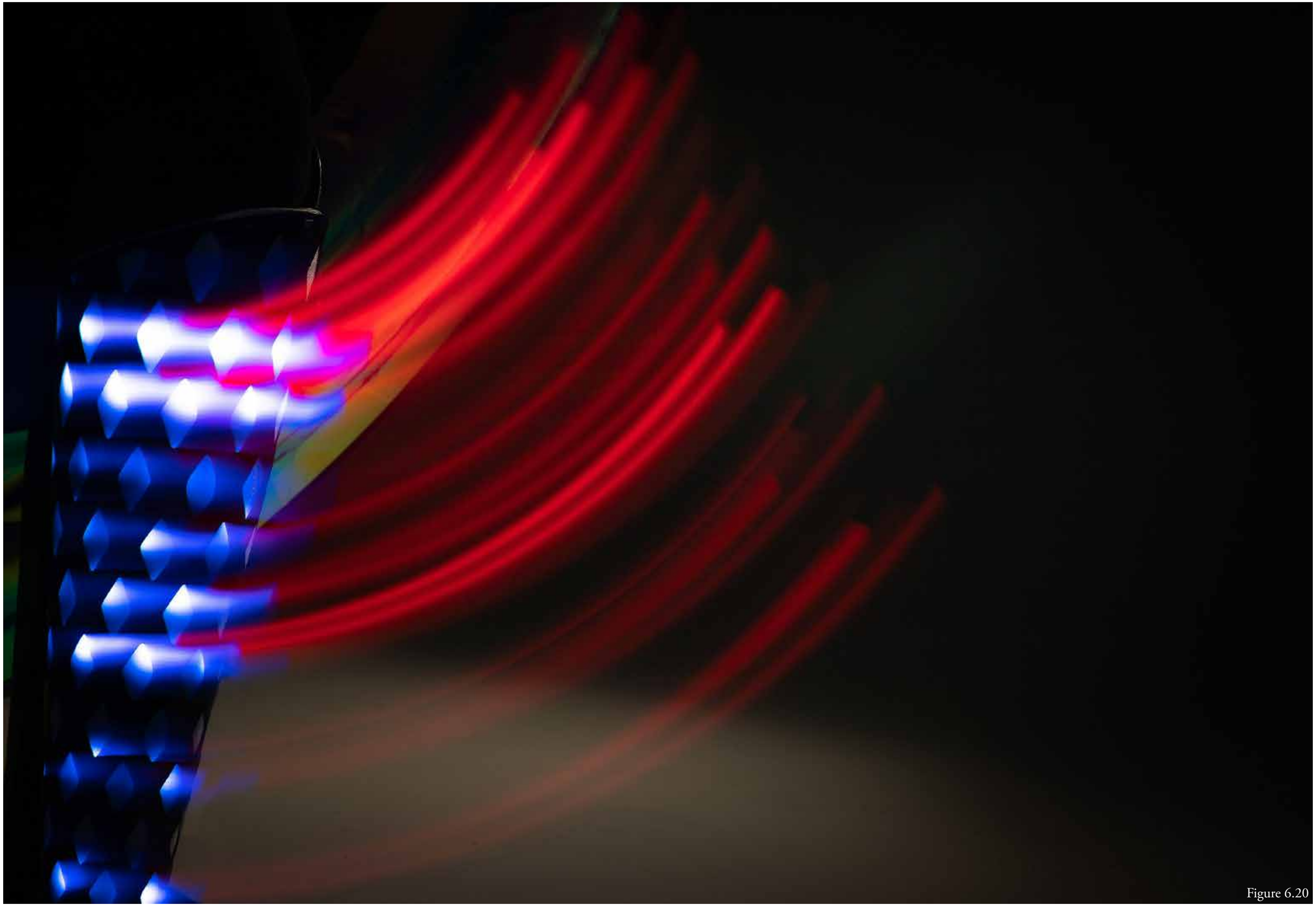


Figure 6.20

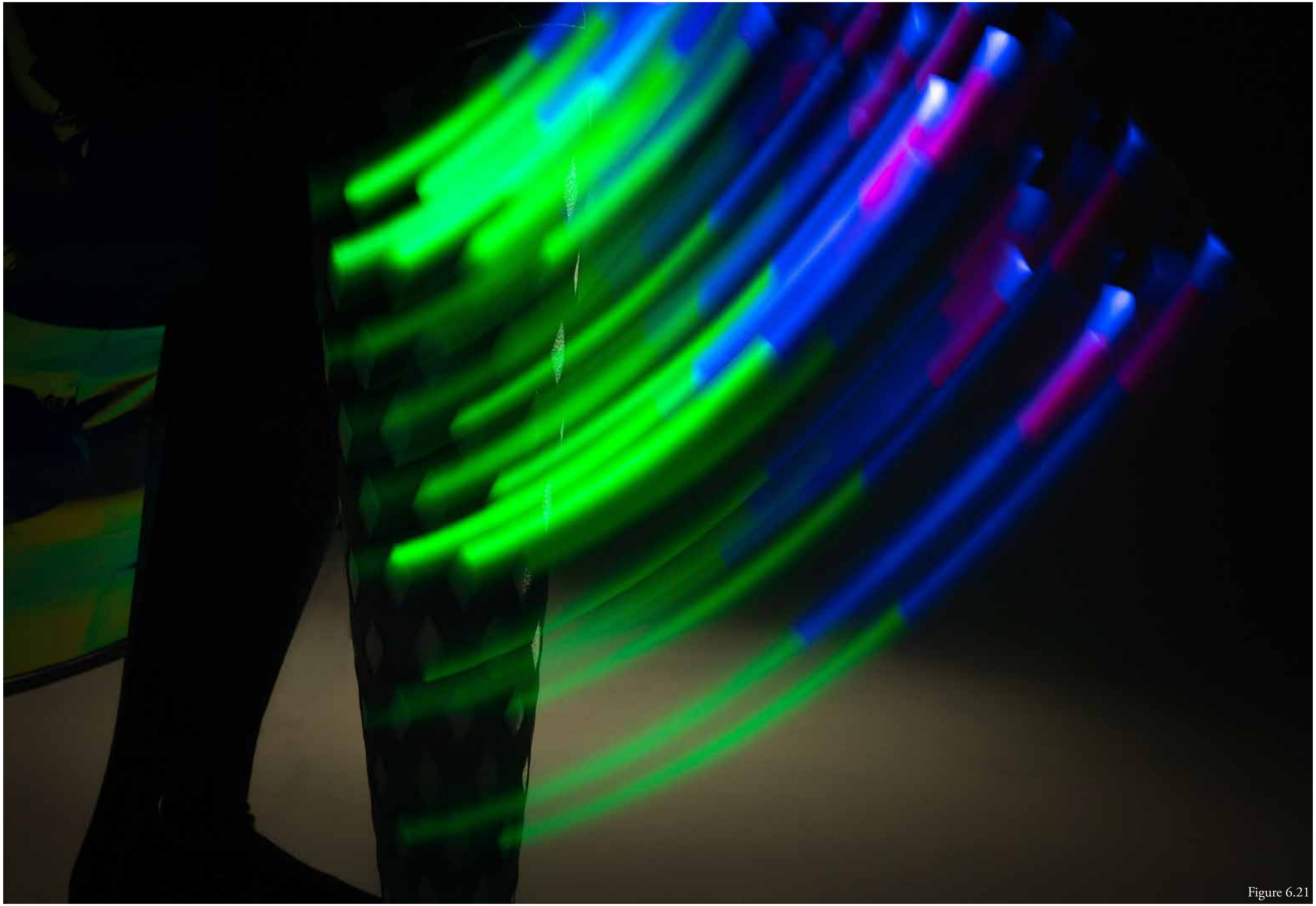


Figure 6.21

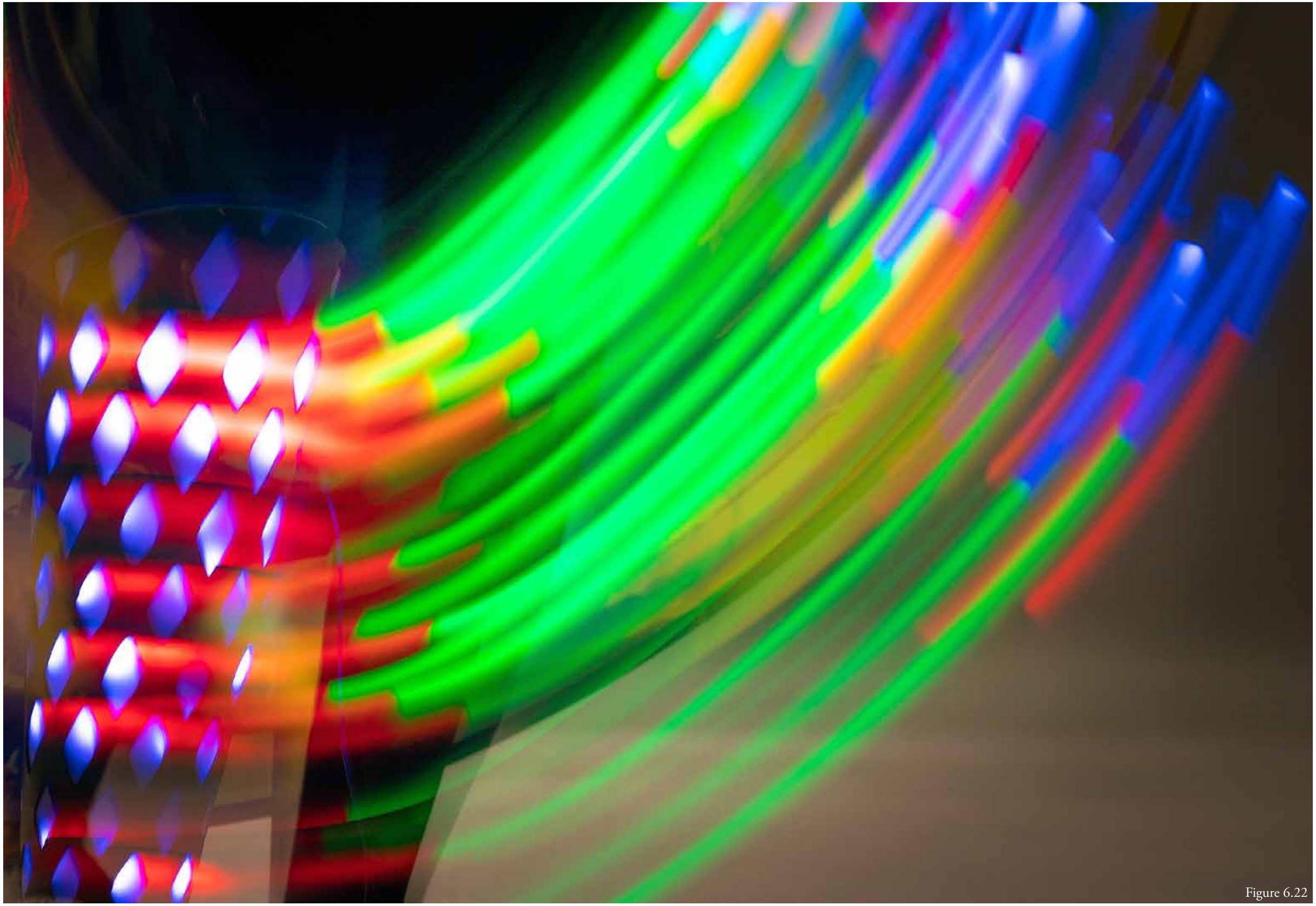


Figure 6.22

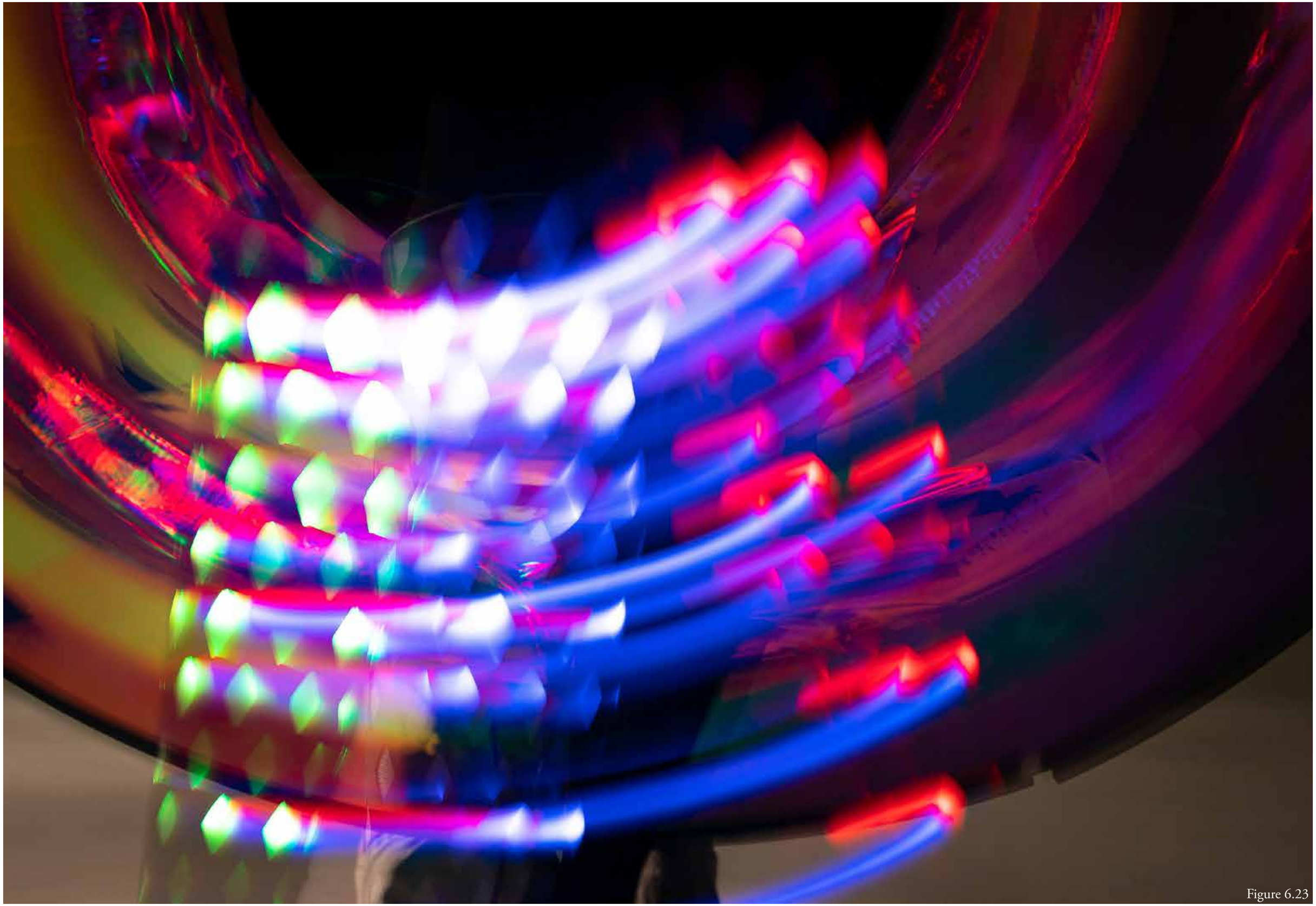


Figure 6.23

Figure 6.24

7

Discussion & Conclusion

The work presented in this written thesis is the exploration and development of an artistic performance through a garment and prosthetic design, challenging the issue of social exclusion of amputees. Initially the topic was difficult to confront, especially when experiencing exclusion first hand. A number of potential venues were identified at the beginning of the research with the intention to participate in the multiple contexts, however, the project was excluded in one of these contexts because of the logistic difficulty of dealing with disabled people. This ultimately reinforces the project's goal to support and help change the social exclusion issue. For the design intention to then be accepted in other contexts and in the process of being a part of a larger spectacle, means that people are open to this change, and that it is possible to do this through the chosen disciplines. Furthermore, the design process was a learning experience that created a more profound understanding of social inclusion, performing arts and design, which is discussed in this chapter

Background Research

Understanding the issue at hand was difficult to comprehend, but the literature review provided insight to identify the basis of the project. The theories and research surrounding the issue of social exclusion influenced the design decisions made further on in the iterative process. Another part of the background research that is excluded in the thesis is the discussions and information gained through interactive tasks completed by several amputees. These conversations provided a wide range of information and insight, while also helping me as a designer have empathy towards the individuals and its inclusion in my designs. All of this background research led to the analysing and reflection of public, individuals and designer's perceptions and understandings to begin a new approach.

Design Phases

Performance art and prosthetic design were topics that never overlapped with the same objectives. The beginning of the design phases started with the classic product design approach where the focus was on finding a simple solution. It was not until later in the process when I struggled to formulate successful concepts that I combined the different disciplines and formed a performance design tool. It was Duggan's (2001) philosophy of blurring lines between the disciplines that inspired the new approach and understanding of how the two subjects could relate and intertwine. The result of the new method allowed a new way of thinking within the context of performative prosthetics without restricting the creative and empirical flow.

This project had endless possibilities at each stage of the research, meaning that it was easy for the process to go off topic or get too in depth in unnecessary details. The efficiency of the research came down to the design statement. It provided direction and guidelines for the process to follow and could be assessed against the DIMPP chart.

The physical development of the designs came with many highs and lows. It was the phase three of the research that had the most complications as the research began to work with manufacturing, full-scale models and materials. When analysing my way of designing I understood that the process became reliant on my ability to "learn on the job" and use common sense to overcome the obstacles. To become better at understanding why things are happening, the designer must

learn to critique their work and observe it from different perspectives, which was extremely important for this particular project. This process of developing design concepts for the garment informed and complemented the development of the performance, which slowly made connections to the cultural context of dance. From this emerged an integrated design concept for both the garment and the performance that manifests itself in the final outcome of I Can Can.

Situating the research

The output of the research was initially intended for the 2018 World of Wearable Art. However, when it came to the final stage of entering the competition, it was decided to wait until 2019. This decision was due to not being entirely satisfied with the garment at the point of entry and wanting to refine the design to a higher standard. However, an opportunity with the television production company, Attitude Pictures, was also an influencing factor that still needed additional consideration. On further investigation, it was noted that using a TV production company could potentially have more benefits. This is because the design will be exposed to a broader variety of audiences, as well as the opportunity to involve social media influencers (who are amputees) to be a part of this project. To participate in WOW, I would be limiting myself because of the ownership and publicity restrictions, while I would have the freedom to continue the publicity through other avenues even after the initial performance is aired with Attitude Pictures.

Because the direction of the research worked towards a particular output that was dependent on an audience's perspective, it was not necessary to have amputees' input on the overall design. To get a new perspective within the performing arts and prosthesis design, a more personalised approach could be taken. This would allow for the understanding and promoting of the amputee's statement and identity. This identified gap could uncover understanding surrounding confidence in social exclusion and how it can be influenced through performing arts and a designed prosthesis. It may also be valuable to consider exploring other behavioural or emotional responses.

Moving Forward

To take the project to the next stage, there needs to be further refinement in both areas of the performance and the garment.

For the garment:

- Complete a disc that is made in one solid form with a smooth finish.
- Have the prosthesis properly fitted and strengthened so the performer can move freely.

For the performance:

- Have movements choreographed that enhance the idea.
- Adapt the performance to a selected output.

Depending on the direction that the design is situated, will depend on how the performance and final adjustments need to be enhanced for the final output.

Conclusion

While this study was aimed at a specific context, future studies can use this research to inspire designed prostheses in all areas of creative or performance design. By promoting diverse and designed prostheses in different contexts and environments, the more they will be seen by the public, and the more accepted they will become. I hope this study has helped the reader to form an understanding of empathy towards amputees through the learning of new methods and outlooks of thinking. And that this will inspire and assist designers who wish to support social inclusion and the "new disabled" (Tamari, 2017) and take it even further by promoting the "new **en**abled".

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Figure List

Figure	Title	Source
1.1 & 1.2	I Can Can	Images taken by Author
1.3	I Can Can	Andrew Matautia (2018). I Can Can. Wellington, New Zealand: Victoria University
2.1	Viktoria Modesta	Saam Farahmand. (2014) *Viktoria Modesta.* Retrieved from: http://www.viktoriamodesta.com/media/
2.2	Pollen Lamp	Nervous System. (n.d). Pollen Lamp. Retrieved from: https://n-e-r-v-o-u-s.com/shop/product.php?code=67
2.3	3D Printed Prosthetic	Sohi, P. (2016). 3D Printed Prosthetic. Retrieved from: https://www.sohididthis.com/denise/
3.1 - 3.8		All images, tables and figures made by author.
4.1 & 4.2	Crystal Leg	Kander, N & Kotedia, O. (n.d.) Crystal Leg. Retreived from: http://www.thealternativelimbproject.com/project/crystal-leg/
4.3	Light Leg	Stechnij, E & Suchorab, L. (n.d). Light Leg. Retrieved from: http://www.thealternativelimbproject.com/project/light-leg/
4.4	Stereo Leg	Williams, R & Enoch, J. (n.d.) Stereo Leg. Retreived from: http://www.thealternativelimbproject.com/project/stereo-leg/
4.5	Spike Leg	Stechnij, E & Suchorab, L. (n.d). Spike Leg. Retrieved from: http://www.thealternativelimbproject.com/project/spike-leg/
4.6	Light	Viktoria Modesta. (n.d.) Light. Retreived from: http://brainprick.com/viktoria-modesta-the-bionic-model-of-the-future-redefines-disability/
4.7 - 4.15		All images, tables and figures made by author.
5.1 - 5.8		All images, tables and figures made by author.
6.1 - 6.12 & 6.17 - 6.18		All images, tables and figures made by author.
6.9, 6.13 - 6.16, 6.19 - 6.24 & video.	Performance	Andrew Matautia (2018). I Can Can. Wellington, New Zealand: Victoria University