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Adaptive Fashion: A New Design Methodology for People with Disabilities

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ABSTRACT

With 54 million US adults with disabilities and two adaptive fashion brands currently in the US, there is a huge gap in niche market that has been untapped. This is due to the systemic failures that contribute to a lack of visibility for people with disabilities(PWDs), a lack of centralized research on adaptive clothing, and a lack of will from the fashion industry. These systemic failures have far reaching consequences for PWDs and the fashion industry. This thesis proposes a methodology that will help fashion designers, efficiently design fashion for PWDs, without requiring the use of new and expensive equipment as well as be a grounds for researching new and testing old design solutions for PWDs, until a design system is created.

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GLOSSARY, LIST OF SYMBOLS AND ABBREVIATIONS

Abled Body	A body who's environment doesn't impede their ability to engage in certain tasks, actions, or participate in typical daily activities and interactions.
Adaptive Wear	Any item of clothing that can be adapted for a person with any form of disability
Adaptive Fashion	Any item of clothing that follows current social and cultural trends, that can be adapted for a person with any form of disability
AFD	Adaptive Fashion Design
Apparel	Clothing
Apparel Brand	Brand that creates clothing
Clothing	Items worn to cover the body
Disability	A disability is a physical, mental, cognitive, or developmental condition that impairs, interferes with, or limits a person's ability due to their enviornment to engage in certain tasks or actions or participate in typical daily activities and interactions.

Dress	An assemblage of modifications of the body, and/or supplements to the body
Dress Form	Three-dimensional model of the torso that is used for fitting clothing that is being designed or sewed
Fashion	Clothing that follows current social and cultural trends
Fashion Brand	Brand that creates clothing that follows current social and cultural trends
Home EC	Home Economics
Mobility Disability	A disability that is physical, mental, cognitive, or developmental condition that impairs, interferes with, or limits a person's ability to move in a typical way
PWD	Person With Disability
PWDs	People With Disability
Sloper	Clothing Blueprints

CHAPTER 1. INTRODUCTION

There is a distinct lack of functional fashion for people with disabilities (PWDs). Of the 24 brands (see Figure 1) surveyed in the US. Only 2, Target and Tommy Hilfiger, could be considered fashion brands, while the rest are simply apparel. Considering that there are 54 million people with disabilities in the US alone with the Baby Boomer population expected to expand that number in the next 10 to 15 years this is a large untapped market. This distinct lack of access to functional and socially and culturally relevant clothing, also known as fashion, can be traced back to three main systemic failures: the lack of visibility of PWDs stemming from a historical lack of governmental protections; a lack of centralized research from academia around clothing and disability due to the dismemberment of Home Economics programs; and a lack of will from the fashion industry to address this issue.

These systemic failures have led to a lack of access to functional and fashionable clothing, and it has barred people's access to various social and professional situations where they might already be stigmatized against due to their condition. In a study done around people with mobility disabilities and apparel, 53% said they had declined to participate in at least one occasion due to a lack of proper clothing, and 36% said it was a regular occurrence (Kabel, Dimka, & McBee-Black, 2017).

This thesis aims to design a methodology that would allow designers to create fashion for people with disabilities, that doesn't rely on creating new versions of tools that already exist such as the dress form.

CHAPTER 2. LITERATURE REVIEW

There is a lack of functional fashion for PWDs and it can be traced back to three main systemic failures: the lack of visibility of PWDs stemming from a lack of governmental protections, a lack of centralized research, and a lack of will from the fashion industry to address this issue due to the lack of visibility and centralized research. In this portion of the paper, which is set firmly in the United States of America, I will lay out the ground work for the lack of fashion for PWDs and for the systemic failures that led to it. Due to the nature of disability being a vast array of issues ranging from the sensorial to the physical to the mental, each with their respective needs, I am choosing to focus on people with mobility disabilities, specifically those who use wheelchairs as their main form of mobility, in part due to the fact that a person in a wheelchair is universally associated with disability.

2.1 Lack of Fashion for People with Disabilities

There is a stark lack of clothing, also known as adaptive wear, options for PWDs, with one critic making note that there are more clothing lines for pets than there are for those with disabilities (Ryan, 2018), which isn't an exaggeration. Petco alone sells pet clothing from 30 different brands of dog clothing and the survey I conducted could only come up with 20 adaptive wear brands (Figure 1). Only two companies on the list that could be considered fashion: Tommy Hilfiger and Target. And both of those are lines

made to accompany much larger fashion brands. Unlike in Canada and the UK, in the US there is currently no fashion brand created for people with disability.

Adaptive Brand List				
#	Brand Name	Location	Apparel/Fashion	Offers
1	Tommy Hilfiger	USA	Fashion	A Little of Everything
2	Target Adaptive	USA	Apparel/Fashion	A Little of Everything
3	Independent You	USA	Apparel	A Little of Everything
4	Silvert's	USA	Apparel	A Little of Everything
5	Wardrobe Wagon	USA	Apparel	Nursing Home Apparel
6	Wheelchair Jeans	USA	Apparel	Jeans
7	Clothes for Seniors	USA	Apparel	Senior Apparel
8	Adaptations by Adrian	USA	Apparel	Wheelchair Apparel
9	EZ Care Clothing	USA	Apparel	A Little of Everything
10	Adaptive Colthes Showroom	USA	Apparel	A Little of Everything
11	Buck and Buck	USA	Apparel	Senior Apparel
12	Care Apparel Industries	USA	Apparel	A Little of Everything
13	Personal Touch	USA	Apparel	Nursing Home Apparel
14	Rolling Wear	USA	Apparel	Post-Surgery/Hospital Clothing
15	Koolway Sports	USA	Apparel	Wheelchair Outerwear
16	Independence Day Clothing	USA	Apparel	Chidren's Adaptive Wear
17	Magna Ready	USA	Apparel	Magntic Button Up Shirts
18	4Ward Clothing	USA	Apparel	Reversible Clothing
19	NBZ	USA	Apparel	Jeans
20	Care+Wear	USA	Apparel	Clinically Accessibble Clothing
21	IZ Collection	Canada	Fashion	Mobility Disability Fashion
22	The Able Label	UK	Fashion	Ada
23	Able 2 Wear	UK	Apparel	Wheelchair Apparel
24	Adaptawear	UK	Apparel	A Little of Everything
25	Rackety's	UK	Apparel	A Little of Everything
26	Rollitex Berlin	Germany	Fashion	Wheelchair Fashion
27	Rolli Modern	Germany	Apparel	Wheelchair Jeans
28	Lydda Wear	Italy	Apparel	A Little of Everything
29	Lado B Moda Inclusiva	Brazil	Apparel	A Little of Everything

Figure 1 Adaptive Wear Brand List

2.1.1 Adaptive Wear is Apparel Not Fashion

Apparel is defined as clothing whereas fashion is defined as clothing that follows current and social trends. All fashion is apparel, but not all apparel is fashion. The same distinction has not been made with Adaptive Wear. Adaptive wear is defined as any item of clothing that can be adapted for a person with any form of disability(Matchar, n.d.).

While the person or group that coined the term couldn't be located, it's clear it came to prominence around the early 2000s with a short burst of renewed interest in the topic, in part due to online marketing campaigns by adaptive wear apparel brands at the time.

Some of the Adaptive Wear companies, such as (find name) boast that they sell fashionable clothing for people with disabilities, however the only changes they make to their lines are the prints used, and possibly the colors, but not the cut, or the styling, thus making it apparent that they are clearly an apparel brand. So for this paper I propose the term Adaptive Fashion, be the term used to describe fashionable clothing for people with disabilities, to make the clear distinction.

2.2 Systemic Failures

In this section I will discuss how the lack of access to Adaptive Fashion for people with disabilities, can be traced back to three main systemic failures: the lack of visibility of PWDs stemming from a historical and current lack of governmental protections; a lack of research from academia around clothing and disability due to the dismemberment of Home Economics programs; and a severe lack of will from the fashion industry to address this issue due to the lack of visibility and research.

2.2.1 Lack of Visibility

Systemic failures within the US government have lowered the physical visibility of PWDs. This lack of visibility has been perpetuated through both a lack of rights protection for PWDs and sometimes out-right hostility towards them. The USA is a representative democracy, which means that the hostilities and/or apathy of the government are a

reflection of those who had the ability to vote at any given time. In this section I will discuss the hostilities of the US government towards PWDs, the lack of protections that sparked the civil rights movement and what are the modern issues that still persist.

2.2.1.1 Outright Hostility

In 1867 the first Ugly Law in the US was passed in San Francisco. Ugly Laws were implemented across the United States and elsewhere making it illegal for “any person, who is diseased, maimed, mutilated or deformed in any way so as to be an unsightly or disgusting object, to expose himself to public view” (Coco, 2010). During this time begging was often one of the few ways PWDs could generate an income due to there being no state or federal protections for job discrimination at the time, and this law was often directly targeted at beggars in highly trafficked shopping areas. Portland, Oregon; Chicago; Omaha, Nebraska; Denver Colorado; Columbus, Ohio; and the entire state of Pennsylvania enacted their own Ugly Laws over the course of the next two decades (Schweik, 2009).

Many of these laws came into effect at a time when cities were expanding rapidly due to the first industrial revolution (or in San Francisco’s case the Gold Rush) and many people were forced to share public space with strangers, many of whom were impoverished(Coco, 2010). The last time an ugly law was enforced was in 1974 in Chicago, where the law was held unconstitutional and struck down(Greiwe, 2016). However 40% of the US homeless population has at least one disability (Diament, 2009) and with the growing housing crisis, there has been a new slew of laws known as anti-vagrancy laws that attempt to ban them from public view, are very much echoing the

intentions of the old ugly laws(Rankin & Mead, 2018). These ugly laws literally limited the visibility of PWDs to the public, previously by making it illegal to be seen publicly with a disability or simply being poor and now making a portion of them invisible by criminalizing their existence.

2.2.1.2 Lack of Protections

In this portion of the paper I will demonstrate how the lack of protections and enforced regulations have historically and currently led to the lack of visibility of PWDs. I will focus on accessibility, education, transportation, and voting because these are the major ways PWDs were and are kept from the public.

2.2.1.2.1 Accessibility to Public Spaces

Historically the lack of accessibility to public spaces has kept PWDs sequestered in their homes and unable to access governmental assistance, education, and social events. In 1961 the American National Standard Institute codified the first measurements, features, and graphic elements for accessibility in architecture and planning with the publication of ANSI 117.1–1961: *American National Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped* (United States of America Standards Institute, 1961). In 1968, President Lyndon B Johnson signed into law the Architectural Barriers Act of 1968 which required all facilities designed, built, altered, or leased with funds supplied by the United States Federal Government be accessible to the public based on ANSI 117.1(Architectural Barriers Act, 1968). This was ground breaking legislation for PWDs however it only applied to new buildings or ones that were being renovated. On top of that after four years, it was found that only ten

percent of all buildings that this law applied to had implemented these standards(Williamson, 2019c).

Then in 1973 with the signing of The American Rehabilitation Act, Section 504 stated that “No otherwise qualified handicapped individual in the United States…shall, solely by reason of his handicap be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance” (Brademas, 1973). This provided Civil Rights language to disability similar to those of the African American Civil Rights Movement a decade earlier. Because section 504 was added last minute, with no context on how the law should be applied, few were aware of the reaching consequences and backlash this section would unleash, in both the educational sectors as well as in transportation, which will be discussed in their respective chapters (Williamson, 2019a).

Then in 1990 the Americans with Disabilities Act became law and it provided comprehensive civil rights protection for PWDs. It mandated that local, state, and federal governments and programs be accessible, and that public accommodations and commercial facilities make “reasonable modifications” to ensure access for disabled members of the public, and not discriminate against them. It also mandated provision of disabled-access toilet facilities in private buildings, since public buildings had been required to have these from the Architectural Barriers Act of 1968(Burgdorf Jr., 1990).

All of these laws were great steps towards a more accessible United States, however, much like the Architectural Barriers Act, it only applies to new construction buildings, or those that are being renovated. This means that as of right now less than

1% of housing is wheelchair accessible(Chan & Ellen, 2017), churches are ADA exempt (Rigley, 2019), and the judiciary branch of the government has become the ultimate enforcer of these laws rather than the executive, as will be seen in the following sections of education, transportation, voting, and employment(Vu, Launey, & Ryan, 2019). This lack of accessibility keeps PWDs from public life, which further reduces their visibility to the majority of the public, which in turn downplays to the public the issues that they face while trying to access everyday places and services.

2.2.1.2.2 Education for Children with Disabilities

Education for children with disabilities is an important issue for the Disability community, especially from an access standpoint. The Education for All Handicapped Children was passed in 1975 and it declared that handicapped children could not be excluded from public school because of their disability, and that school districts were required to provide services to meet their needs, in a setting that resembles as closely as possible a regular school program (Education for All Handicapped Children Act, 1975). This came at the heels of the American Rehabilitation Act of 1973, and this passage along with the published draft regulations of the Department of Health, Education, and Welfare (HEW) that would require architectural changes to schools and college campuses. Administrators raised objections not to the principle of rights protection, but to the requirement of sweeping facilities changes. However civil rights protests of the time helped make sure that concessions were not made for these schools and college campuses(Williamson, 2019a).

The Education for All Handicapped Children Act of 1975 (later named the Individuals with Disabilities Education Act of 1990), and the many court rulings (used by civil rights activists as a way to help enforce protection of PWDs' rights) like the *Board of Education vs. Rowley* in 1982, *Roncker vs. Walter* in 1983, and *Oberti vs. Board of Education of the Borough of Clementon School District* in 1993 all agreed that public education not only was a right, but should be integrated and not excluded from the rest of public education when at all possible(Switzer, 2003). However an estimated 40% of students with disabilities are segregated into separate schools or to a separate class or section of the public school further isolating them from their peers and reinforcing their otherness(Krings, 2015). On top of that, the segregated sections are often shown to have worse results and are not tailored to each child's individual disability needs, and therefore setting them up to be less prepared for college or the workforce(Pratt, 2017).

Additionally despite the earlier rulings college campuses are rife with mobility accessibility issues that leave students who use wheelchairs facing multiple physical obstacles to work through, just to access the same education as their abled body peers, further isolating them, and barring some from continuing their education(Piro, 2017). Many colleges get away with this by working with students on a case by case basis, but often it's the student that has to bring the issues to the attention of the staff(Wang, 2015), and the colleges are not responsible for social events that the student might be unintentionally barred from due to their disability, such as Greek life (Pokorney, 2018) further isolating them from their peers. Studies show that only 34% of students with disabilities that attend college graduate from a 4 year degree (Bialka, 2018). Isolating abled children from their peers with disabilities during their formative years gives them a

false perception of how many of their peers have disabilities, deprives both from the opportunity to interact with each other making it more difficult for them to do so as adults, and all around lowers the visibility of people with disability and the problems they face.

2.2.1.2.3 Accessibility to Transportation

In 1972 the Paralyzed Veterans of American, the National Paraplegia Foundation, and Richard Heddinger filed suit against the Washington Metropolitan Area Transit Authority, demanding them to incorporate accessibility into their design for a new, multibillion-dollar system in Washington DC, siting the Architectural Barriers Act of 1968 as precedence 4/2/19 12:59:00 PM. That win was a landmark victory for PWDs with regards to accessible transit. Then the American Rehabilitation Act of 1973 with Section 504 gave legal precedence for public transit being more accessible, with the ADA extending those rights. However as we've seen in the past, once one of these laws is passed the argument isn't about whether the laws should exist, it's to what extent they should be enforced(Williamson, 2019d). Recently it was found that 31 percent of PWDs had insufficient transportation compared to the 13 percent of the general population(Heasley, 2012). Uber has also come under scrutiny by Disability Rights Activists who sued Uber, the Ride Share Giant, in San Francisco, for discrimination against people in wheelchairs. Uber offers Uber WAV, their wheelchair accessible app, however plaintiffs claim that 80% of the time the app is unavailable and waits can be upwards of 14 times longer that a normal wait (Reiss, 2018). This lack of sufficient transportation for PWDs severely limits their ability to interact in public, hold down a job, and have a normal social life, which once again limits the visibility of PWDs.

2.2.1.2.4 Accessibility to Voting

The main way PWDs have been denied the ability to vote is through the lack of accessible polling places. Then the Voting Right Act of 1965 became law and laid down protections for minority voting rights, and it granted PWDs to receive support “by a person of the voter’s choice” so long as they were not the person’s boss or union agent(Voting Rights Act of 1965, 1965). Then in 1984 The Voting Accessibility for the Elderly and Handicapped Act was signed into law and it demanded “handicapped and elderly" access to polling places, and provided for the creation of permanent disabled access voter registration sites (Voting Accessibility for the Elderly and Handicapped Act of 1984, 1984).

However 35 years later the voter turnout for PWDs is lower than that of the abled bodied population, in some places as low as 40% and many polling places are not up to regulation for accessibility (Vasilogambros, 2018). Nearly two-thirds of the 137 polling places inspected on the 2016 Election Day had at least one impediment to people with disabilities (United States Government Accountability Office, 2017). Some of that is due to untrained volunteers not knowing how to help PWDs, many polling places are in churches which are exempt from accessibility laws, and electronic accessibility machines often not working or untrained volunteers leaving them unplugged, or unsure of who is allowed to use it(Schur, Ameri, & Adya, 2017). This has led many PWDs questioning their place within the US’s democracy. “It’s surprising how many people don’t think they have the right to vote,” said Gina Desmond, an advocate for Disability Rights of West Virginia (Vasilogambros, 2018). Through governmental negligence PWDs are often barred from

voting, despite their constitutional right to do so, which limits their public visibility and their belief that they have a right to said visibility.

All of these governmental systemic failures have limited the visibility of PWDs to the public eye, which further alienates them from mainstream markets that would cater to them like the Fashion Industry.

2.2.2 Lack of Research

The lack of centralized modern research on the subject of clothing for PWDs is a contributing factor to why the Fashion Industry doesn't want to tackle this issue. A lack of modern research coming out of Academia can be placed on the shoulders of the disbursed Home Economics Programs, the research being scattered across academia. In this section I will give a brief introduction to Home Economics, why it was tied to Rehabilitation and Clothing for People with Disabilities, its dismemberment, and where the research came from after it fell.

2.2.2.1 Rise of Home Economics

Home Economics can trace its origins back to the early 1800s starting with its founder Catherine Beecher (sister to Harriet Beecher Stowe) , who was an advocate for domestics sciences and women's education and founded Hartford Female Seminary in 1823. During this time the suffragette movement was gaining ground and Beecher envisioned a domestic science course where women would receive an education in domestic chemistry, housing, and economical arrangement of storage in the home(Elias, 2008a). The Morrill Act of 1862 propelled domestic science further ahead as land grant

colleges sought to educate farm wives in running their households as their husbands were being educated in agricultural methods and many Midwestern states, such as Missouri and Iowa, were early leaders offering programs for women(Morrill Land-Grant Acts, 1862). There were women graduates of these institutions several years before the Lake Placid Conferences which gave birth to the Home Economics movement.

The first Home Economics program came out of MIT and was founded by Ellen Sallow Richards, who was the first woman to attend MIT. Her and other contemporaries of the field met for conferences at Placid Lake, the first being in 1899, which was where Home Economics was finally voted on as the official name. Home Economics has had the unfortunate inability to clearly define what it's goals were as an academic discipline, but at the time of its founding, the agreed upon consensus was that it was to bring the new scientific findings of the times and bring it into the homes(Stage, 1997).

Home Economics throughout the early 20th century played a huge part in both creating new career opportunities for women (such as hospital nutritionists(Babbitt, 1997), teaching positions at universities, and rural outreach coordinators for the government(Kline, 1997)) by giving them access to the science fields of higher education and promoting new scientific developments, such as germ theory(Tomes, 1997). It also ran counter-culture to the Social Darwinism of the time and its survival of the fittest dogma, by championing behavioral sciences and child psychology with its emphasis on nurture over nature often having great faith in science as a "cure all" (Stage, 1997). And their emphasis on human development, child behavior, nutrition, and the domestic sciences such as sewing, made Home EC the natural home for clothing for people with disabilities.

2.2.2.2 Home EC, Rehabilitation, and Clothing for PWDs

Adeline M. Hoffman a prominent Home Economist says in her book titled Clothing for the Handicapped, the Aged, and Other People with Special Needs that “Rehabilitation of the physically handicapped and the development of special clothing to facilitate the activities of daily living were two of the great pioneering efforts and achievements of Howard A. Rusk. (Hoffman, 1979)” Howard Rusk, known as the “father of modern rehabilitation” and a proponent for dignity and holistic rehabilitation for people with disability was a natural academic ally for Home Economics. During and after World War 2, Howard Rusk saw a great need to take care of disabled soldiers coming back from the war. He started the first rehabilitation hospital the Institute of Rehabilitation and Medicine in the US, that focused not just on the physical wellbeing of the patient, but on the mental and spiritual as well. He was a proponent that the body is a technology, and you just have to figure out how to use it to interreact with the environment while also a proponent for changing the environment to help the person(Williamson, 2019b). Throughout the 50s and 60s he supported efforts for clothing of the disabled, such as the book Functional Fashions for the Physically Handicapped by Helen Cookman, a prominent clothing designer for PWDs clothing from the 60s(Cookman & Zimmerman, 1961).

However even with the work of Howard Rusk, Helen Cookman, Muriel Zimmerman, and Adeline Hoffman, this subject never had much prominence in either the fashion world or the Home EC world, but was worked on by a few dedicated groups. However as Home EC fell out of prominence throughout the 70s and 80s (Elias, 2008b), the dismemberment of the Home EC programs meant that the mix of departments that allowed for research on clothing for people with disabilities were no longer interacting,

thanks to the silo-ing effect of academia (Craig, 2017). Research is still continuing, however it's scattered across academia, and buried in old Home EC journals, which gives the impression that there isn't an issue, or there is but there is no significant force in academia putting resources behind it. Ironically enough, some of the recent studies, that have come out in the past few years illustrating the need for Adaptive Fashion such as Kabel's study, have come out of the land grant colleges that gave rise to the Home EC programs.

2.2.3 Lack of Will

The Lack of Will from the Fashion Design Industry stems from a lack of visibility for PWDs, and a lack of research. In this section I will discuss how the lack of visibility for PWDs and other minorities means the fashion industry is less likely to market to them and why a lack of research from academia places the research into the industry's hands whose traditional and new technological tools as well as methodologies are not equipped to handle creating Adaptive Fashion.

2.2.3.1 Fashion Design Is a Reflection of Culture

Fashion is an industry like any other and as such, is only a reflection of cultural times, and not a driver of them. It can get clothing from concept to production to design in as little as a week(Hanbury, 2017), however it is far slower to reacting to changes that could be perceived to hurt the bottom line. Nowhere is this more apparent than with the slow progress on environmentally friendly clothing(Kell, 2018). While we are starting to see women of color (Bates, 2017), plus sized women (Kelly, 2017), transgender women (Peoples, 2018), and women with disabilities (Nolan, 2018) on the runway, in bill boards,

and even within the designer ranks themselves, there is still a lack of fashionable clothing marketed at and for PWDs.

This lack of Adaptive Fashion due to a lack of visibility is three-fold. One there is a great deal of ableism in an industry that is responsible for the Western World's idea of beauty, of tall ethereal men and women, and PWDs don't fit that mold(Ellington & Lim, 2017a). The second is the lack of visibility for PWDs which this paper previously attributed to a lack of protections that keep PWDs from participating fully as members of society. Even though there are 54 million adults in the US alone with a disability, putting them at 1 in every 7 people, which any brand would be happy to have following them, the optics keep many brands from taking on this task, as they see it as not financially solvent. However with the aid of social media and Millennials and Gen Z consumers demanding more social responsibility from their companies may help to change this (Sweet, 2018). And three, people don't dress in public. Unlike the issues of accessibility and transportation can easily be observed by an onlooker, unless you've watched a PWD dress themselves, it's not an issue one might consider even existing, let alone something that needs to be solved.

A possible fourth issue could be the optics of disability. And as an industry fashion often labels itself as art, and anything related to disability often invokes words like science and medical, labels the industry tries to avoid, unless it's in reference to science fiction, and not boring everyday medical(Fraser, 2018).

2.2.3.2 Methodology and Tools

There are two reasons for fashion brands balk at creating Adaptive Fashion. One, the lack of research coming out of academia on how to create clothing for PWDs puts the onus on the brands in the industry to research it themselves individually, which is time consuming and can be overwhelming when first started. The second issue is that Fashion Design Methodologies and tools don't lend themselves well to researching the issues PWDs face with regards to clothing. In this section I will talk about how patterning systems, tools, and methodologies don't lend themselves well to disability.

Most fashion methodologies are primarily aesthetic driven, whether it's a patterning methodology using the negative space of patterns to create a new and interesting look or just a student following the methodology often taught in school (research – illustrate – pattern/drape – test – final piece)(Martin & Krell, 2009). Fashion is always running after the new look, students are encouraged to experiment with textiles and form, to create unique drawing styles, and

With run times getting shorter and profit margins shrinking, the industry is turning to virtual design and patternmaking software to reduce prototype time. The new programs like Optitex and CLO3D allow designers to drape virtual fabric on avatars, with patterns and creates tech-packs dramatically cutting down the need for prototyping. However at most you can make the avatars sit, but none mimic the way a person with a disability would move, nor do they mime putting on the clothing. This further reduces visibility for PWDs and the issues they face as the industry becomes more reliant on such technologies, and will further isolate the fashion industry from this large target market.

CHAPTER 3. THEORETICAL FRAMEWORK

3.1 Ethics of Calling it Fashion

Fashion has a long track record of trampling the earth in pursuit of the latest and greatest trend. Even in it's much slower days, hats at the turn of the twentieth century alone were responsible for quite a few bird species going extinct due to over poaching for their feathers (Carroll & Kincade, 2007). And with even your basic fashion brands producing six seasons a year (something that has been historically two seasons), and a new report from the MacArthur Foundation stating that the fashion industry waists one garbage truck of textiles every second (Ellen MacArthur Foundation & Circular FIbers Initiative, 2017), there are real ethical concerns for calling for a new niche market in the fashion industry. Even with all of this I am choosing to call it Adaptive Fashion for a few reasons.

First, I have defined fashion as clothing that is socially and culturally relevant at a period in time. This could mean something as basic as professional wear, something PWDs have a hard time finding (Nittle, 2018), which can have a negative impact on their ability to secure employment. The negative aspects of being denied participation in something as socially and culturally relevant as defining your role in the world through clothing will be discussed later in Section 3.2.2, but the point is whether the fashion industry's practices are ethical or environmentally friendly at this moment in time or not, doesn't negate the fact that how one presents oneself to the world through clothing is a

relevant part of how one participates in society, and minimizing one's ability to do so minimizes their opportunities.

Second, the product and how the industry chooses to create the product are separate conversations, and while important, is not the issue within the industry that this paper is trying to address. And third, the fashion industry of today looks significantly different than it did 100 (Rowan, 2016) or even 200 years ago, and it was still called fashion, and I imagine, the industry will look very different 50, possibly even 20 years from now and will still be called fashion.

3.2 The Consequences for a Lack of Adaptive Fashion

A lack of Adaptive Fashion has many consequences for both the Fashion Industry and for people with disabilities. In this section I will lay out how the fashion industry's lack of will is costing them money, and how the lack of Adaptive Fashion has negative social and psychological consequences for people with disabilities.

3.2.1 Consequences For the Fashion Industry

There are 54 million adults in the US alone with a disability, and two fashion brands (Figure 1) that cater to them. This is a huge business opportunity lost. As designers fight tooth and nail for a tiny fraction of market share, there are whole markets they are all collectively ignoring.

The fashion industry's obsession with youth and under 18 models has some far reaching consequences for their pocket books(Singer, 2018). Women 50 years or older no longer feel that the fashion industry markets to them, even when they put older models

on the runway(Jefferson, 2018). Age tends to change the body, and women are having a harder time finding clothing that is flattering to their body shapes, further entrenching the notion that fashion isn't for them. This is a mistake. Generation Jones is entering their mid 50s to late 60s, and they have spending power, with people over 50 making up half the US's purchases (Best, 2015), and have always been fashion conscious. They will also start to have limited mobility, just due to the natural aging process. And it's not just the US: China(Rapoza, 2017), Europe(Desjardins, 2017) and Japan(Reynolds, 2017) all have aging populations, and they are all known for buying fashion, and have a lot of money, it's in the current fashion industry's best interest to start catering to them.

3.2.2 Consequences For People With Disabilities

3.2.2.1 Social Consequences for a Lack of Adaptive Fashion

In this section I will discuss the social consequences for a lack of Adaptive fashion in how clothing is perceived by others and how this has consequences for social acceptance and employment for PWDs.

3.2.2.1.1 How Clothing is Perceived by Ones Peers

There are a plethora of studies showing how ones clothing influences those around us. High school students' clothing styles influence the perceptions of their academic abilities among their peers and teachers (Behling & Williams, 1991); teaching assistants who wear formal clothes are perceived as more intelligent, but also less interesting(Morris & Gorham, 1996); women who dress in a masculine fashion during a recruitment interview are more likely to be hired(Forsythe, 1990), and when they dress sexily, they are

perceived as less competent (Glick, Larsen, Johnson, & Branstiter, 2005); clients are more likely to return to formally dressed therapists (Dacy & Brodsky, 1993); and appropriately dressed customer service agents elicit stronger purchase intentions (Shao, Baker, & Wagner, 2004). In all of these instances, it's clear that the right outfit for the right occasion can significantly alter the way one is perceived by one's peers, colleagues and professional superiors. However, the right outfit for any occasion is something PWDs lack due to a shortage of Adaptive Fashion Brands.

3.2.2.1.2 Consequences for Social Acceptance and Employment

This lack of Adaptive Fashion bars PWDs' access to various social and professional situations where they might already be stigmatized against due to their condition. In a study done around people with mobility disabilities and apparel, 53% said they had declined to participate in at least one occasion due to a lack of proper clothing, and 36% said it was a regular occurrence. One excerpt from the study was from a young woman who was unable to go to her best friend's wedding due to not being able to find anything to wear and that she knew he friend never forgave her for it (Kabel et al., 2017). Women with disabilities in particular deal with the stigma of not having proper business attire and have a difficult time finding clothing to meet their needs (Carroll & Kincade, 2007).

3.2.2.2 Psychological Consequences for a Lack of Adaptive Clothing

Dress is also the way in which individuals learn to live in their bodies and feel at home in them. Conversely having the wrong clothes or the clothing not existing for your body shape and/or it's abilities can keep a person form feeling at home in their bodies

and their environment (Entwistle, 2011). In this section I will discuss the phycological consequences for a lack of Adaptive Fashion by how we perceive ourselves through clothing and how we manage wellbeing.

3.2.2.2.1 Consequences for How We Perceive Ourselves Through Clothing

Lack of access to Adaptive Fashion can have a negative effect on self-esteem and identity. Recently sociologists and psychologists have been studying the effects of one's clothing, not just to those around oneself, but the effects it has on oneself as well. Enclothed cognition is the term that has been introduced to describe the systematic influence that clothes have on the wearer's psychological processes. Students who wore lab coats had higher selective attention than their peers who didn't wear a coat, and further, a doctor's coat increased their selective attention further than wearing a lab coat(Adam & Galinsky, 2012). People given a tunic they dubbed nursing scrubs made people have higher empathetic concern (López-Pérez, Ambrona, Wilson, & Khalil, 2016). Also students wearing police uniforms were found to have racial biases (Civile & Obhi, 2017). A lack of Adaptive Fashion such as professional wear, or constantly wearing sweat pants could have negative effects on how the person perceives themselves and how it affects their abilities.

3.2.2.2.2 Consequences for Managing Wellbeing

Fashion can have many positive effects on the wearer, and it is often used as a form of managing wellbeing. This processes has been framed into 3 separate categories of negotiating selfhood, managing mood, and befriending the body. Current apparel

options deny people who use wheelchairs this ability to manage their wellbeing (Masuch & Hefferon, 2014).

Within the context of negotiating self, there are two categories: expressing aspects of self and creating sameness. Lack of access to clothing that is both fashionable and adaptive to their disability forces people who use wheelchairs to choose between clothing that works for them but doesn't express who they are as a person, or clothing that expresses their personal identity, but is constraining, doesn't meet their particular needs, or fits badly causing them to spend more time and resources towards navigating an everyday need. The lack of fashionable options (or even uniforms for various occasions such as work or school) also denies people who use wheelchairs the ability to create a sense of sameness with those around them. Sameness for the sitting form is already sorely tested by said wheelchair. There is no disguising it and it is a constant reminder of their disability to themselves and others, compound that with clothing that either relays disability, or is poorly fitting due to the sitting position and there is nothing to garner a sense of sameness with one's peers.

Within the contexts of managing mood there are two categories: catalyzing cheerfulness and camouflaging on a bad day. The right outfit can make one already feeling good about oneself feel even better, and conversely on a bad day, this is another way of camouflaging oneself, or not drawing attention, as a way to limit social interaction when one is feeling down. And within the context of befriending the body, this could be most beneficial to people with disabilities. Every message from society and the fashion industry says that their body is about as far from the ideal as possible. By gaining access

to clothing that fits appropriately, reflects the fashion of the time, as well as their own personal style, they have the opportunity to like their body more.

3.3 Solutions

The lack of Adaptive Fashion is the result of a systemic failures, which require systemic changes. While most of them are out of the scope of this thesis, in this section I will give suggested solutions to fix the governmental systemic failures, and the research and industry systemic failures.

3.3.1 Addressing Governmental Systemic Failures

In this section I will address what needs to be done to address the Governmental Systemic Failures and what is being done.

3.3.1.1 What Needs to Be Done

To address the lack of accessibility that PWDs have to deal with, one possible solution would be creating grants for research on an affordable wheelchair that can quickly and easily go up and down stairs. While this won't solve all of the problems that PWDs face in an effort to get places, it would go a long way to helping them navigate cities, older subway systems, and college campuses. To address the education gap for people with disabilities, a National Standardization of Education in the US that sets appropriate standards for both abled students and those with various disabilities based in solid research on how they should be integrated into schools would help guarantee that students were getting an appropriate education. It would also allow parents to track

progress against the national standards and have accountability for their children with disabilities that are often lost in or left behind by the system.

Upgrading the US's mass transit infrastructure to be both environmentally friendly and wheelchair accessible would be a good for the country at large, but also give PWD's more independence and access to the outside world, which would allow them to participate in the economy more as both consumers and workers. For the lack of access to voting, creating a national holiday for voting, or placing on a Saturday like they have in Australia (Rychter, 2019), would have the benefit of higher voter turnout, and would cut down on reliance of churches for voting places, which are accessibility exempt, by placing them at schools, universities, and government buildings, that are now available thanks to the national holiday, and by law required to be accessible.

3.3.2 Addressing Research and Industry Systemic Failures

In this section I will address what needs to be done to address the Research and Industry Systemic Failures, what is being done, and what this thesis will address.

3.3.2.1 What Needs to Be Done

To address the lack of research with regards to fashion there are a few approaches that can be taken. One would be for research grants to be made available for the sole purpose of researching clothing with regards to disability that helps find overlap in solutions and gives a comprehensive understanding about how it could be applied to Adaptive Fashion and Inclusive Fashion Design. Another solution would be a Master's program for Adaptive Fashion, making it its own academic specialization would guarantee

more research coming out of universities for the industry to pull from. It should also be made available as an elective to a junior or senior undergraduate in Fashion Design to get them familiar with the discipline, should they want to pursue it further.

To address the lack of will with regards to the industry, you could go with either the stick and/or the carrot approach. The US government could tax companies for not making designs more inclusive, or not having a certain number or outfits that are created for PWDs. On the flip side providing a tax break for companies that have adaptive fashion lines to accompany their existing one, or tax breaks for brands that specialize in Adaptive Fashion.

3.3.2.2 What Is Currently Being Done

To address the industry systemic issues there is Runway of Dreams a not-for-profit that is trying to bring disability in focus for fashion, it was started by Mindy Scheier, a long time fashion industry worker, and mother to a son with muscular dystrophy. She started Runway of Dreams after her son begged her to wear a pair of jeans rather than sweatpants to school. She jerry-rigged a pair of jeans for her son to wear to school and according to her:

“Those jeans transformed him. He was able to get dressed on his own, he was able to go to the bathroom on his own; those jeans gave him confidence.” (Scheier, 2017)

They sponsor models with disabilities, bring awareness to new developments in Adaptive Wear, such as Zappos.com, an online department store, creating a section for adaptive wear brands, and support brands such as Tommy Hilfiger when they created an Adaptive Fashion line.

To address the research systemic failures there is the Open Style Lab, a non-for-profit run by Grace Jun every semester in conjunction with Parsons School of Design. It aims to bring designers, engineers, and occupational therapists together with various clients with disabilities to create solutions for them. Their mission is for all people to have access to style, regardless of cognitive & physical ability. They go to trade events, as well as do public outreach and education.

3.3.2.3 What This Thesis Will Address

Until there is standardized, centralized body of research on ease of use design solutions for adaptive fashion, the industry needs a methodology that addresses ease of use and fit for PWDs. This methodology should be able to accompany the methods already in use by designers, who are well trained in the aesthetic aspects of design. This methodology would be considered a stop gap until a such research exists and a tool to help evaluate said research.

This issue should fall within fashion design due to the technical skillset needed to achieve this. They are aware of current market trends, are capable of patterning, sewing and designing clothing. Due to lacking in traditional tools such as a sitting dressing form or the modern ones of digital avatars that can mimic putting clothing on or taking them off, the methodology will need to work with PWDs instead.

CHAPTER 4. RESEARCH METHODOLOGY

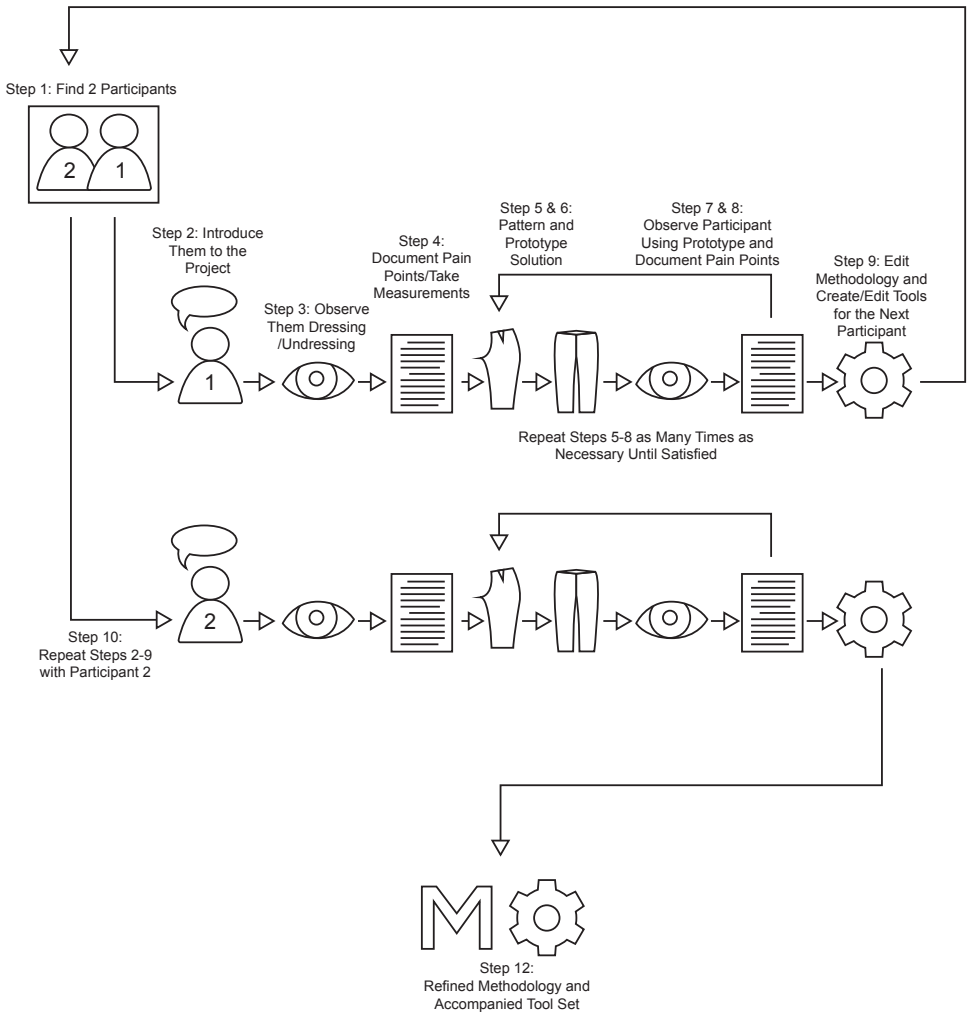
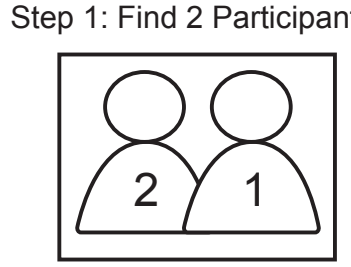


Figure 2 Research Methodology

The Research Methodology that will be implemented to create the Adaptive Fashion Design (AFD) Methodology, and it requires four basic sections: Finding Participants, Introduction and Initial Observations, Prototyping and Documentation, and Editing Tools and the AFD Methodology. This Research Methodology is created to be circular with the last three sections repeating themselves, as a way to keep improving

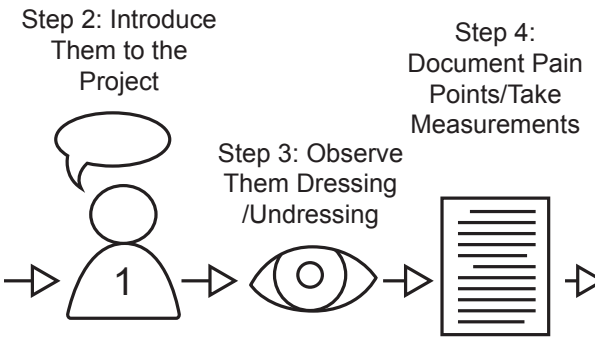
upon the AFD Methodology and any tools adapted or created for said Methodology. This will culminate in the final fully refined AFD Methodology and accompanying tools.

4.1 Step 1: Find Two Participants



The first step in the Research Methodology is to find two participants with mobility disabilities who primarily use a wheelchair as their main form of mobility to test with the AFD methodology. Ideally they would be of different ages and have varying degrees of limited mobility. Staggering the participants within the research methodology, rather than go through the process with them both at once, gives the opportunity to edit the design methodology, develop accompanying tools along the way, and be able to test them with the other participant. The participants will be ordered by their degree of mobility with the participant with the least limited mobility going first. This allows the first round's focus to be on editing the methodology and tools, so the more complex design problems with the following participant aren't as bogged down by editing the methodology and tools, assuming the edited methodology is an improvement on the original.

Figure 3 Methodology Steps 2-4



4.2 Steps 2-4: Introduction and Initial Observations

The research methodology then proceeds to Step 2 by introducing the first participant to the study in an informal first meeting. This meeting is to evaluate the

participant, make them fully aware what is being asked of them, get them to start thinking about how they interact with clothing, and what they might need help with. Should they wish to continue participating in the study, a meeting is then set up in a location of their choosing. At the meeting (Step 3) the participant is observed in how they interact with different pieces of their wardrobe, such as pants, shirts, dresses, and skirts, etc. They are observed in how they dress, undress, and partially undress for activities such as using the restroom. It's important at this stage that the participants are made as comfortable as possible because they are being asked to dress and undress in front of a stranger. If they would like to take their clothing off or put it on over a thin layer of under clothing such as leggings and a tank top that is acceptable. Then Step 4 is to document the dressing and undressing process for each piece using a User Journey Map that was provided by Professor Munoz-Islas, and to acquire patterning measurements from the participant. While they are dressing and undressing, a discussion will take place with the participant about possible solutions for each piece, and which ones they would like to focus on.

4.2.1 User Journey Map

Figure 4 User Journey Map

The User Journey Map sheet (Figure 4) maps how a participant interacts with an object. This is an industrial design tool so certain aspects of it will most likely be rethought. The first sheet asks to describe the who, how, where and when of a user's journey (hence the name) with an object before, during, and after its use. Then the second sheet, is where the subject is observed with the object, before, during, and after, and rated with both a numbering system 1-10 with 1 being the most frustrating activity, and emoticons of a frowning face, a neutral face, and a smiling face, with the frowning face used to express frustration. While documenting items of clothing, the before section will be used for dressing, the after for undressing, and the during section for the partial undressing for restroom use. A full picture of Figure 4 can be found in Appendix A.

4.3 Steps 5-8: Prototyping and Documenting

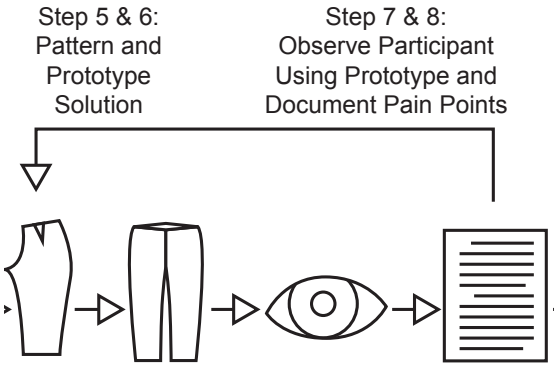


Figure 5 Methodology Steps 5-8

Step 5 is picking the design solutions considered to be most viable and patternmaking the prototype with the measurements gained from Step 4. Step 6 is Creating the Prototype. Once the Prototype is complete, a new meeting is set up with the participant, where they will try

on the garment and give feedback. Step 7 and 8 are similar to steps 3 and 4 in that the participant will be observed dressing and undressing from the prototype, and the proceeding will be documented with the User Journey Maps. If the results are unsatisfactory, the Steps 5-8 will be repeated until the prototype is satisfactory.

4.4 Steps 9: Editing Tools and the Methodology

Figure 6 Methodology Step 9

Step 9 is editing the AFD Methodology for better efficiency and to remove the pain points within the methodology. It also requires the creation of any tools or editing existing ones to better serve the methodology. This step is important because it allows time for reflection before moving on to the next participant and allows for the preparation of tools, to help work with the next participant.

4.5 Repeating the Process with Participants 2

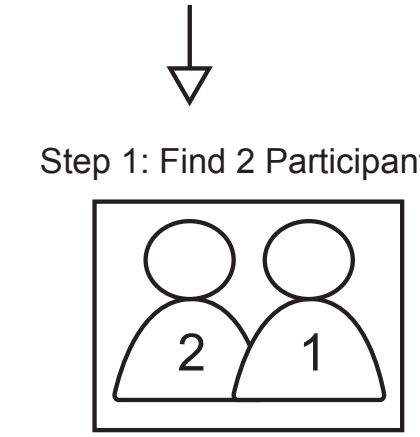
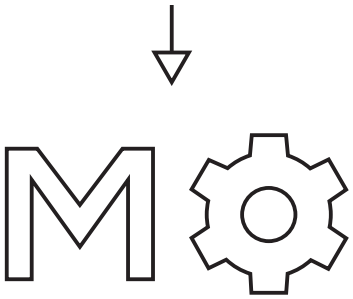


Figure 7 Methodology Repeat

Once the re-designing of the AFD Methodology is completed and the tools have been reworked to satisfaction, participant 2 is ready to begin the methodology. Repeat Steps 2-9 for participant 2, who will be more challenging due to their mobility ability being less than participant 1's. This will offer a new set of edits and reworking of the methodology and it's tools.

4.6 Refined Methodology and Accompanied Tool Set



Step 12:
Refined Methodology and
Accompanied Tool Set

Once participant 2 has been put through the reworked methodology and it has been refined, now we have a final proof of concept: a refined Methodology and set of tools to accompany it.

CHAPTER 5. RESULTS

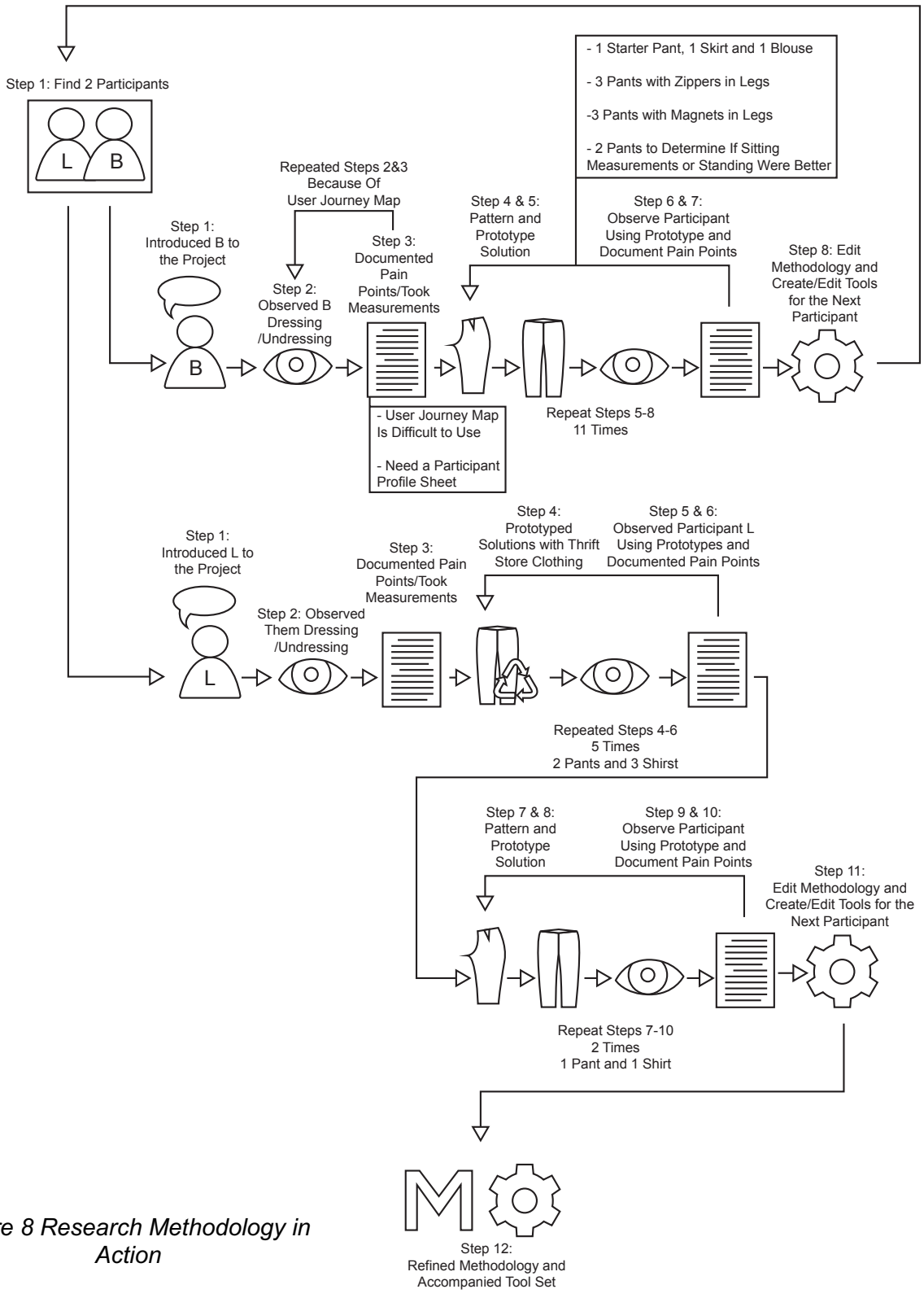


Figure 8 Research Methodology in Action

5.1 Finding the Participants

Finding participants B and L required a few different strategies. Strategy one was relying on personal networks, and discreetly asking friends, mentors and classmates if they knew anyone who would be interested in the study and that produced Participant B. Strategy two meant contacting Occupational Therapists at the UC school and asking them to pass along my contact information and a quick brief of the study to people they think would be a good fit and that got me in contact with Participant L.

5.2 Participant B

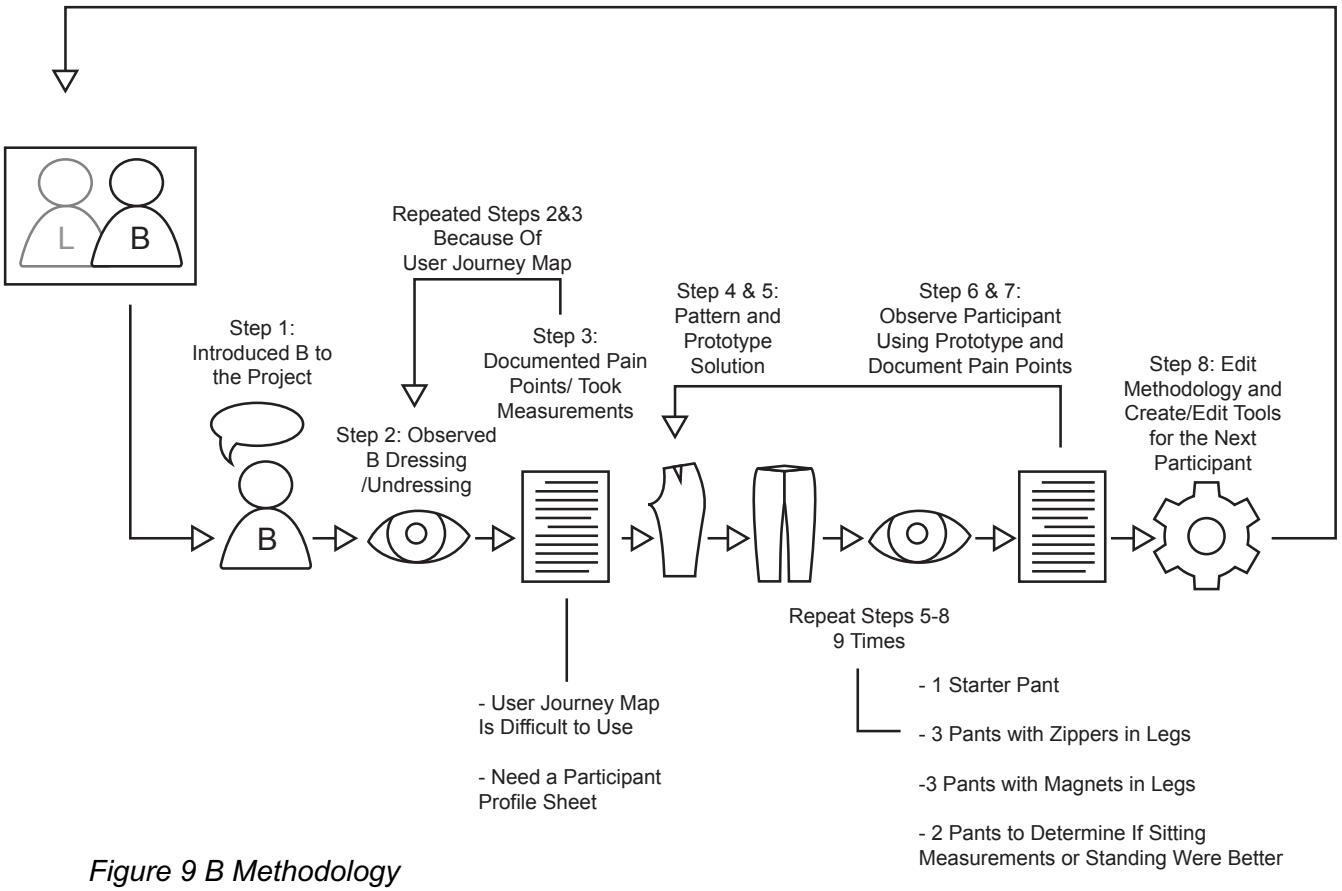


Figure 9 B Methodology

5.2.1 Meet Participant B

Participant B is a young woman in her early 20s with hemiplegic spastic cerebral palsy in a mild form on her right side. And what this means the brain signals to the right side of her body are slower than the signals to the left. While she has almost full range of function, it causes one side to be out of sync with the other, greatly affecting her balance, gait, and dexterity on her right side. Her right leg is also difficult to maneuver, which make dressing difficult. She can walk, with the aid of a walker, however the size of the school makes it impractical for her to get from one class to the other effectively so she uses a motorized wheelchair. Of the two participants she has the least restrictive mobility disabilities so the research methodology started with her.

5.2.2 Initial Meeting and First Observations

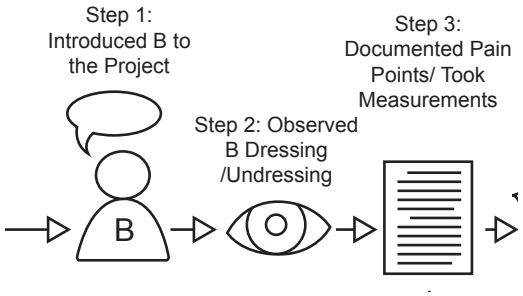


Figure 10
B Methodology Steps 1-3

The first meeting with B was in a cafeteria. She was very excited about the opportunity to be a part of the study. She mentioned the various issues she had with pants, and closures. She also said that she often avoided certain social situations due to the need to change into new clothing, which she often deemed too much of a hassle. However she did mentioned that if it wasn't so difficult she would be willing to go to more events. She agreed to continue helping with the project and an appointment was made to meet so that I could observe her trying on clothing, and take measurements.

B tried on various pieces of clothing from her wardrobe such as shirts, pants, skirts, and dresses and the dressing and undressing process was recorded on the user journey

maps (see appendix A). Pants and dresses were the hardest thing for her to get on and off, shirts and skirts were least difficult. Pants were difficult due to the fit, most fashionable pants for women currently are tight fitting throughout the entire pant, whereas dresses were difficult due to the placement of the zipper being in the back.

This first meeting was very enlightening, for three reasons. For one it made it clear that ease of use was a higher priority than fit, because she needed to be able to get in and out of clothing more efficiently. Two it was very apparent that the User Journey Map required a re-design, because it wasn't very efficient, and there were large sections of the map that could have been utilized better. And three was that a Participant Profile Sheet to record measurements and answers to vital questions was needed, because it was discovered shortly after the meeting that a few measurements had been forgotten to be taken and the prototypes couldn't be created without them. The User Journey Map edits and the Participant Profile Sheet will be discussed further down in Sections 0 and 5.2.7 respectively.

5.2.3 First Prototypes

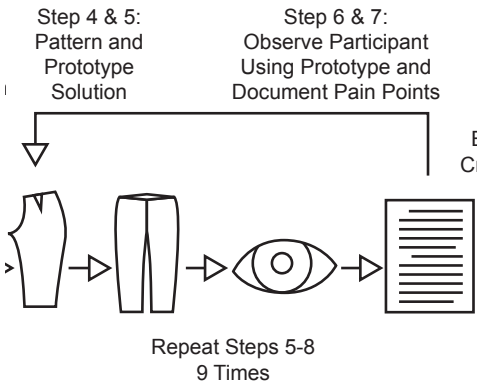


Figure 11 B Methodology Steps 5-8

The bodice, pant, and shirt slopers were chosen for alteration due to the fact that all other pieces of clothing (barring shoes, socks, accessories etc.) is a combination of these slopers.

For instance a dress is a skirt and a bodice sloper, a jacket is a shirt sloper with more ease, and a jumpsuit is a bodice and a pant combined.

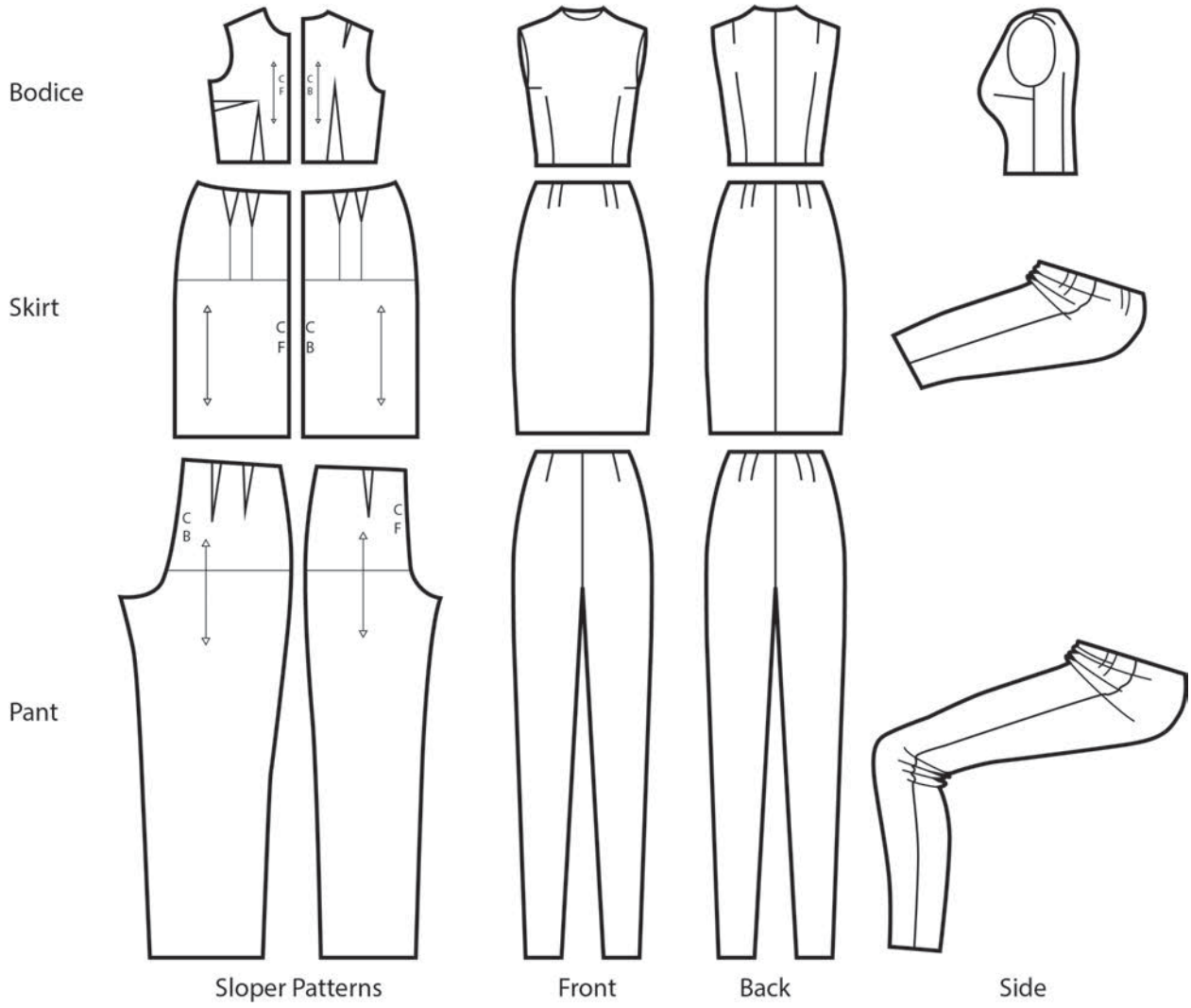


Figure 12 B Bodice, Skirt, and Pant Slopers

The first bodice, skirt, and pant slopers, for B were patterned and sewn up in cheap muslin. Once the fit was worked out for each of the slopers, the first prototypes in muslin were created.

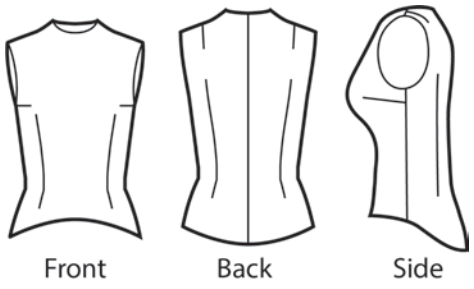


Figure 13 B Bodice Muslin Prototype

The bodice was shortened in the front and lengthened in the back to accommodate the seated position.

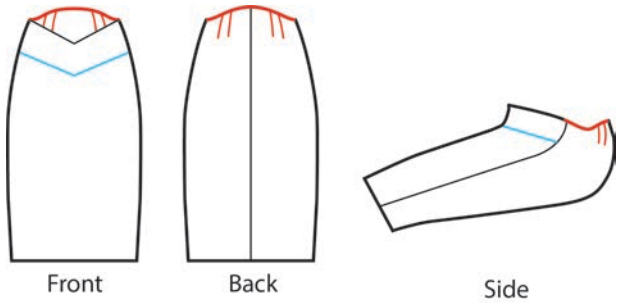


Figure 14 B Skirt Muslin Prototype

The skirt (see Figure 14) had the (red) center back seam lengthened (see Figure 15) and the (blue) center front seam shortened (see Figure 16) by a dart which was then turned into a seam, with the top piece being turned into a yoke (see Figure 20), with a long zipper on the side for ease of use.

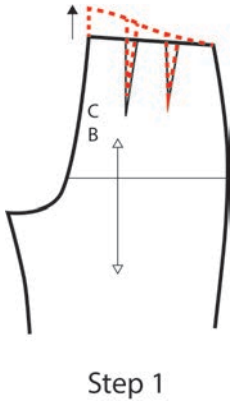


Figure 15 Center Back Seam Lengthene

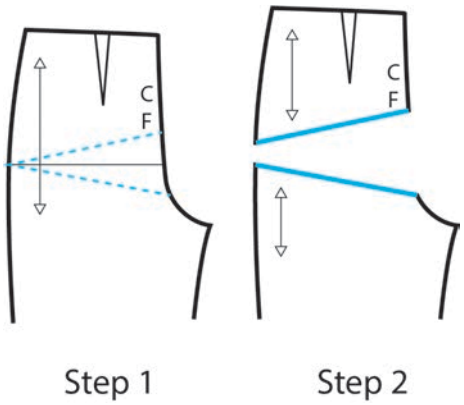


Figure 16 Dart-Turned-Seam

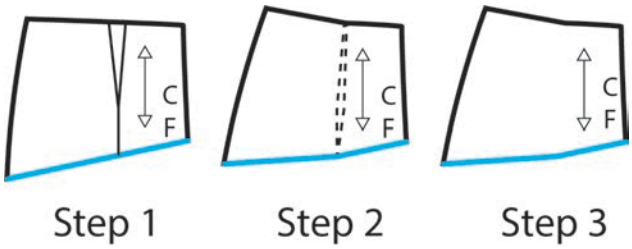


Figure 20 Yoke Creation

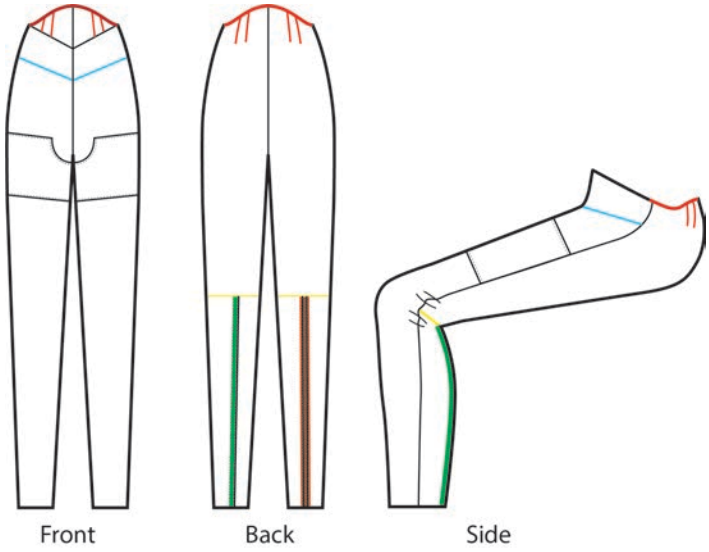


Figure 19 B Pant Muslin Prototype

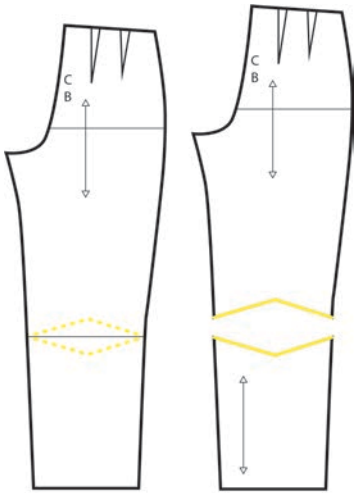


Figure 17 Partial Knee Dart-Turned-Seam

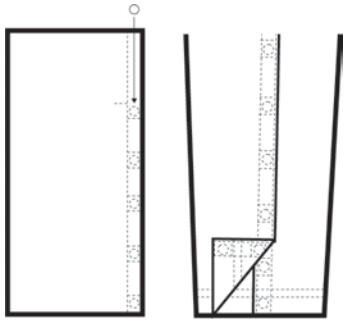


Figure 18 Magnets Sewn Individually

And the pant with the (red) center back seam lengthened (see Figure 15) and the (blue) center front seam shortened with a dart-turned-seam (see Figure 16), with the top piece being turned into a yoke (see Figure 20), and a (yellow) dart-turned-seam at the back of the knee (see Figure 17). A (green) magnetic closure on the back of the lower leg on the right, with the 7mm diameter and 1mm thick magnets sewn into both sides of the back seam to create the closure (see Figure 18), and a (orange) zipper closure on the back of the lower leg on the left were added to test which made it easier for her get her legs through the lower portion of skinny pants.

Once B tried all of them on, she was most interested in the pants, both with the zipper and

Figure 21 B Wearing the Pant Muslin Prototype

the magnetic calve closure options, however she preferred that the zipper be moved to the inside of the leg for easier access. She was also excited about the prospect of the magnets, because they snapped together behind her leg without much guidance from her. For her pants were the most frustrating piece of clothing she wore, because she wore them all of the time. While dresses were difficult, she had very few opportunities to wear them and the added time it took to dress in them wasn't considered as big of an issue. She also hardly wore skirts, and while the prototype was an improvement from a fit perspective, from an ease of use perspective, there wasn't much to improve upon to begin with, skirts are pretty ease of use friendly for her. So it was decided to move forward with the two types of pants.

5.2.4 Next Three Rounds of Prototypes

The next three rounds of prototyping of the two pants was an exercise in fit, ease of use, waistband placement, pocket placement, and magnet experimentation. It was decided to use a light stretch woven fabric to make it as accurate to what pants are normally made with. Pants 1, 3, and 5 were dedicated to working with the magnets in the back of calves. Pants 2, 4, and 6 were dedicated to working with zippers, which were moved to the side calves for easier access.

5.2.4.1 Round 1: Pants 1 & 2

In this section I will detail the construction of the first two non-muslin prototypes and B's reaction to both.

5.2.4.1.1 Pant 1 Prototype: Magnet Closures

Pant 1 (see Figure 22) had magnets sewn into strips which were then sewn into the seams on the center back seams of the calves rather than sewn individually (see Figure 23). The (red) center back seam was lengthened by adding inches to the top (see Figure 15), and the (blue) center front seam was shortened by taking 4 inches out with a dart that was then turned into a seam (see Figure 16), with the top piece being turned into a yoke (see Figure 20)and given a waistband with a front fly zipper. The front knee was straight through with no darting, but the (yellow) back knee was darted (see Figure 17) and then turned into a seam to account for the bend of the knee while sitting.

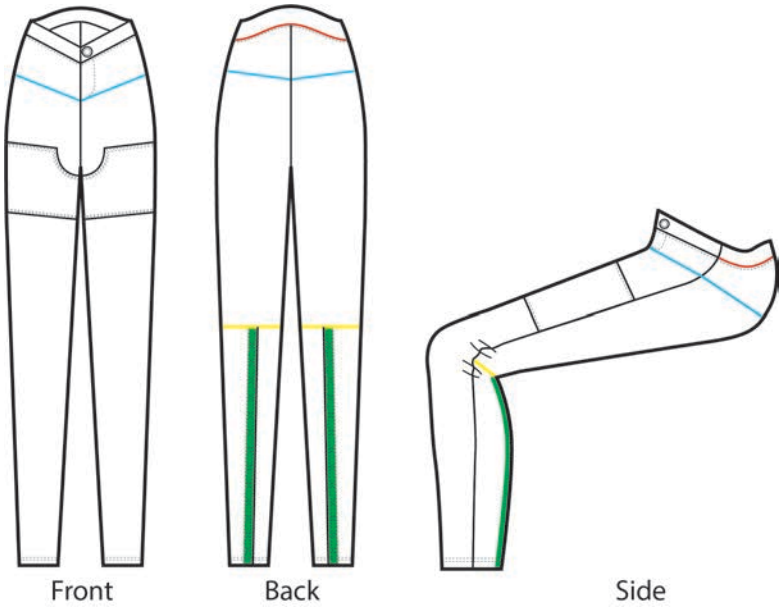


Figure 22 B Pant 1 Prototype

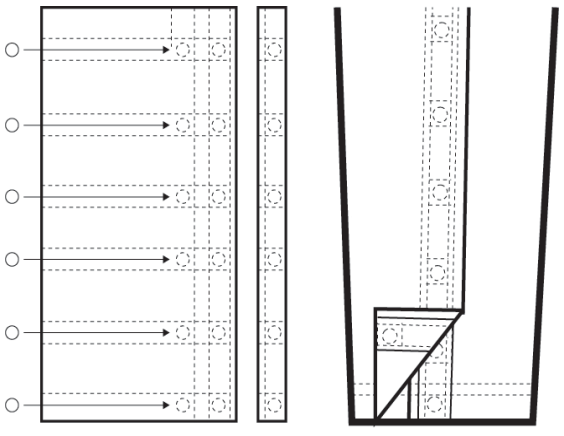


Figure 23 Magnets Sewn Into Strips

Pant pockets were added lower in the front to lay comfortably on the thigh so someone sitting could easily put their phone in and grab it out without having to shift their whole body to get it out.

Figure 26 B Pant 1 Prototype Front

Figure 25 B Pant 1 Prototype Back

Figure 24 B Pant 1 Prototype Full Front

5.2.4.1.2 Pant 2 Prototype: Zipper Closures

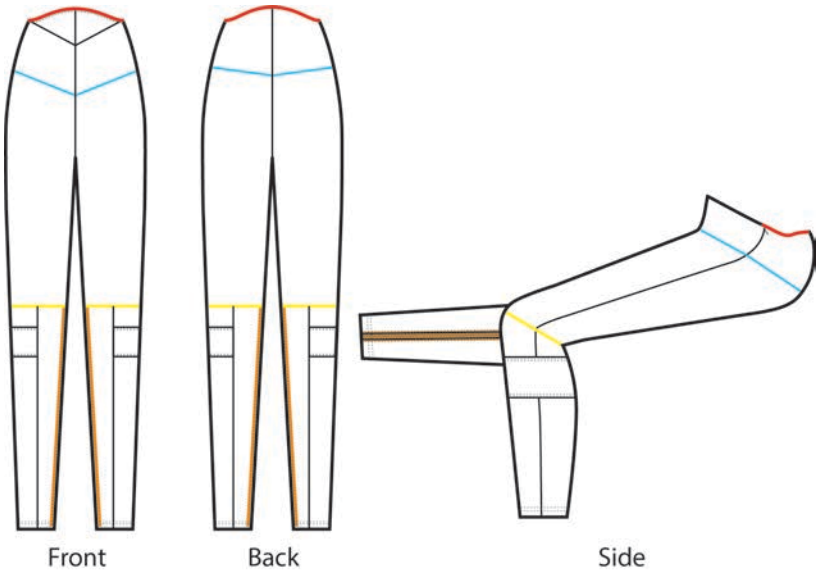


Figure 29 B Pant 2 Prototype

Figure 27 B Prototype 2 Full Front

Pant 2 (see Figure 29) had (orange) zippers sewn into the inner side of the calve, which allows B to get her feet more easily into pants. The (yellow) front and the back knee were darted and then turned into a seam to account for the bend of the knee while sitting (see Figure 28). The calve part of the pant was divided into 4 pieces with seams on the inner calve for the (orange) zipper, back and front seam to sew a pocket into those seams at B's suggestion, and an outer side seam because combining the two would throw off the fabric grain on one side.

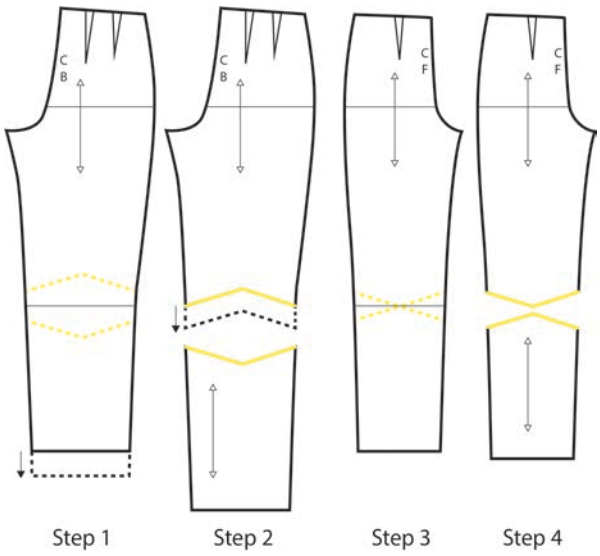


Figure 28 Full Knee Dart-Turned-Seam

The (red) center back seam was lengthened by adding inches to the top (see Figure 15), and the center front seam was shortened by taking four inches out with a dart-turned-seam (see Figure 16), with the top piece being turned into a yoke (see Figure 20) and given a facing with a left side invisible zipper.

Figure 31 B Prototype 2 Side Zipper

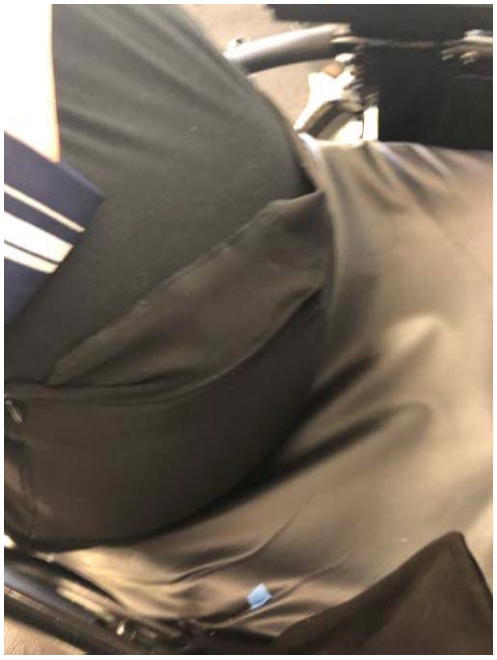


Figure 30 B Prototype 2 Back with Facing Out

Figure 33 B Prototype 2 Inner Leg Zipper

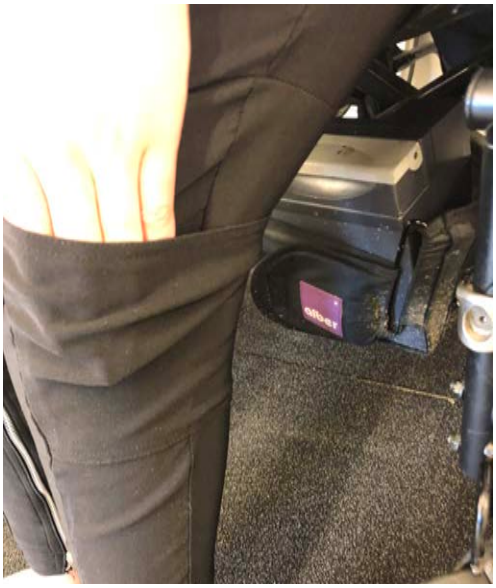


Figure 32 B Prototype 2 Outer Side Leg Pocket

5.2.4.1.3 B's Reaction

From a fit perspective, B believed that the dart-turned-seam throughout the whole knee on Pant 2 lay better than the dart-turned-seam only in the back of the knee on Pant 1 and I agreed with her. She claimed the waistband on Pant 1 was more comfortable than the facing on Pant 2, but would like to see more length in the back to better cover her backside. The dart in the front was appreciated for getting rid of some of the bunching and wondered if more could be gotten rid of.

From an ease of use perspective the biggest issue was the magnets. Unfortunately sewing the strips in had added extra fabric which weighed down the magnets so they didn't snap together as easily. This was attempted due to how much easier it was to sew magnets in premade strips rather than one at a time, but the extra fabric proved counterproductive. The thigh pockets on Pant 1 were well received, as was the calve pocked on Pant 2, however she suggested making it connect only to the outer side seam and the center back seam, which would be just big enough for a phone, and wouldn't put seam down the center front. The zippers worked as expected. All around she was happy with the progress, and looked forward to the next round of pants.

5.2.4.2 Round 2: Pants 3 & 4

In this section I will detail the construction of the second two non-muslin prototypes and B's reaction to both.

5.2.4.2.1 Pant 3 Prototype: Magnet Closures

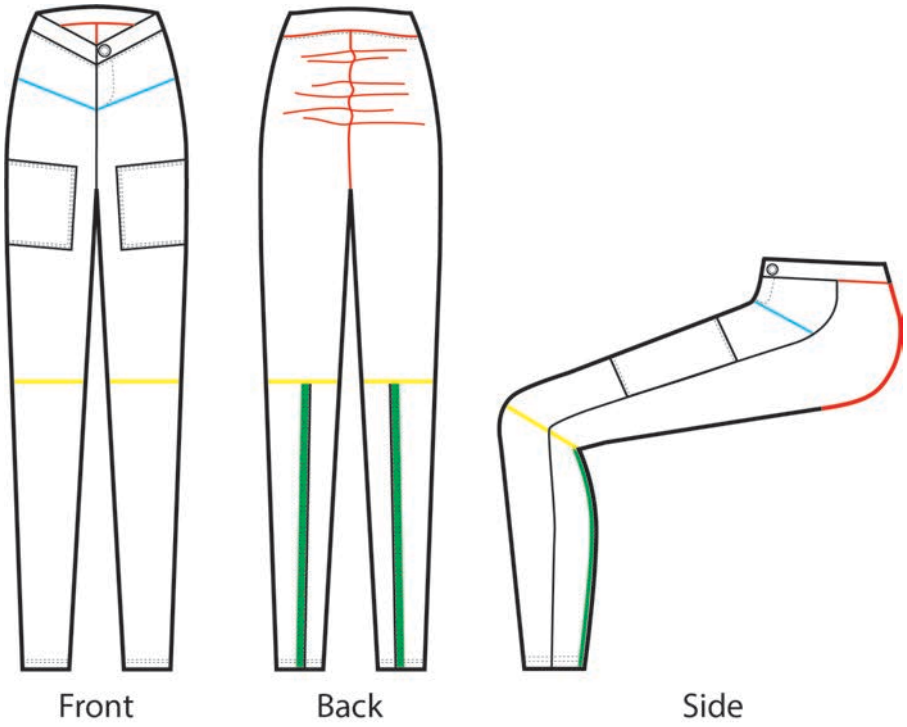


Figure 35 B Pant 3 Prototype

Pant 3 (see Figure 35) had magnets sewn into the seams on the center back seams of the calves one at a time to keep down the fabric bulk (see Figure 18). The front and the back knee had a dart-turned-seam to account for the bend of the knee while sitting. The part of the leg below the knee was divided into three pieces with seams on the inner and outer calves and one in the back seam for the magnets.

Figure 34 B Prototype 3 Front

After B asked for a longer center back seam (red), I went searching through some of the recent books I had found on and Adeline Hoffman's suggested that I lengthen by slashing and spreading (see Figure 36) the center back seam which I did (Hoffman, 1979). And the

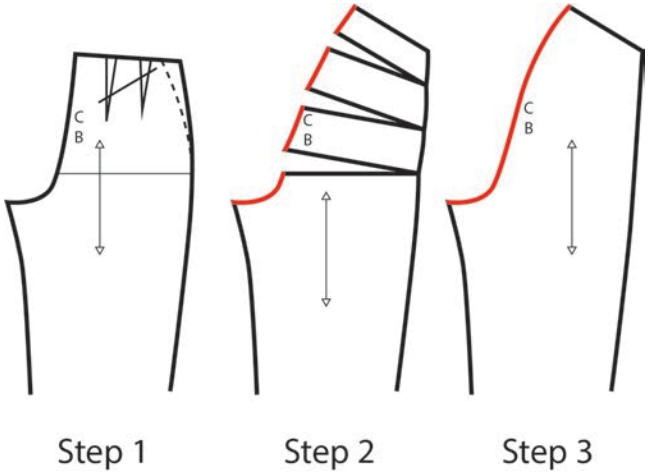


Figure 36 Slash and Spread Center Back Seam

(blue) center front seam was shortened by taking five inches out with a dart-turned-seam (see Figure 17), with the top piece being turned into a yoke (see Figure 20), and given a waistband with a front fly zipper.

Pant pockets were added again lower in the front to lay comfortably on the thigh so someone sitting could easily put their phone in and grab it out without having to shift their whole body to get it out.

Figure 37 B Prototype 3 Back

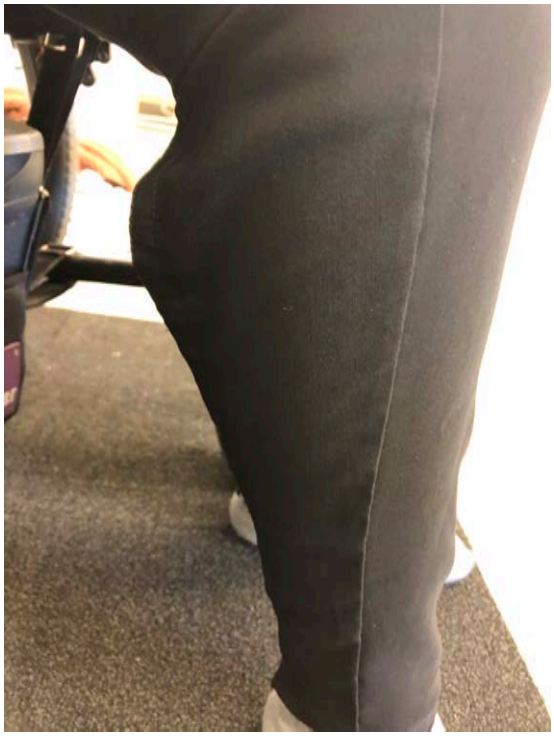


Figure 38 B Prototype 3 Back Leg Magnets

5.2.4.2.2 Pant 4 Prototype: Zipper Closures

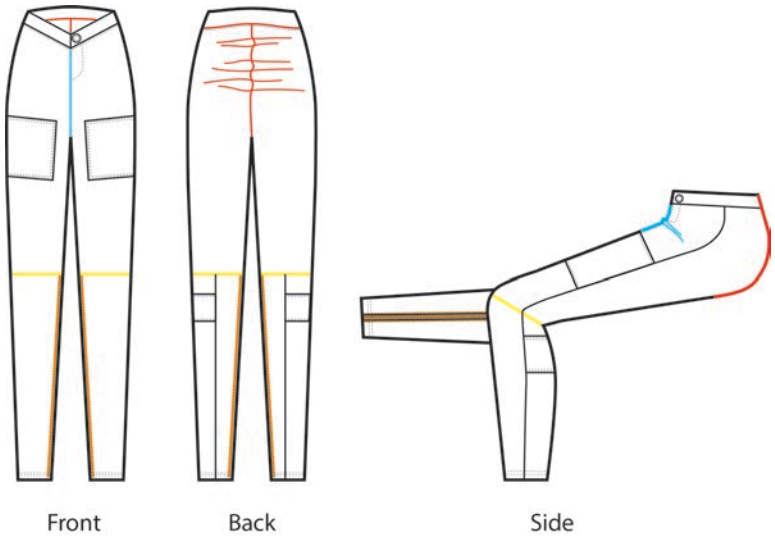


Figure 39 B Pant 4 Prototype

Pant 4 (see Figure 39) once again had (orange) zippers sewn into the inner side of the calve, which allows B to get her feet more easily into pants. The (yellow) front and the back knee have a dart-turned-seam to account for the bend of the knee while sitting (see Figure 28). The calve part of the pant was divided into three pieces with seams on the inner calve for the zipper, and back and outer calve seams to sew a pocket into those seams at B's suggestion.

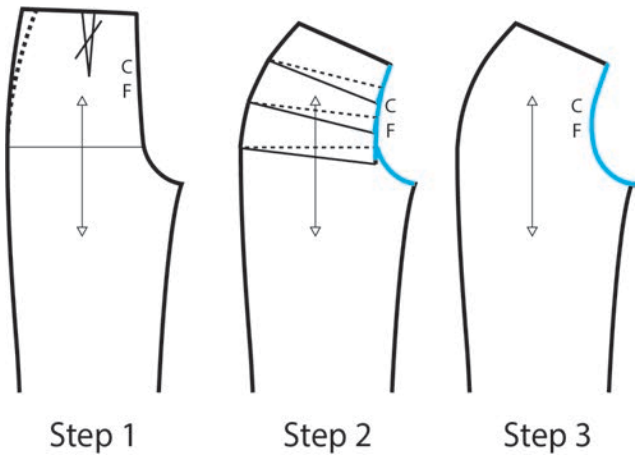


Figure 40 Slash and Compress

I lengthened by slashing and spreading the (red) center back seam, same as Pant 3 (see Figure 35), and the (blue) center front seam was shortened by taking four inches out by slashing and compressing it to see if this method laid better (see Figure 40) and was then given a waistband with a front fly zipper.

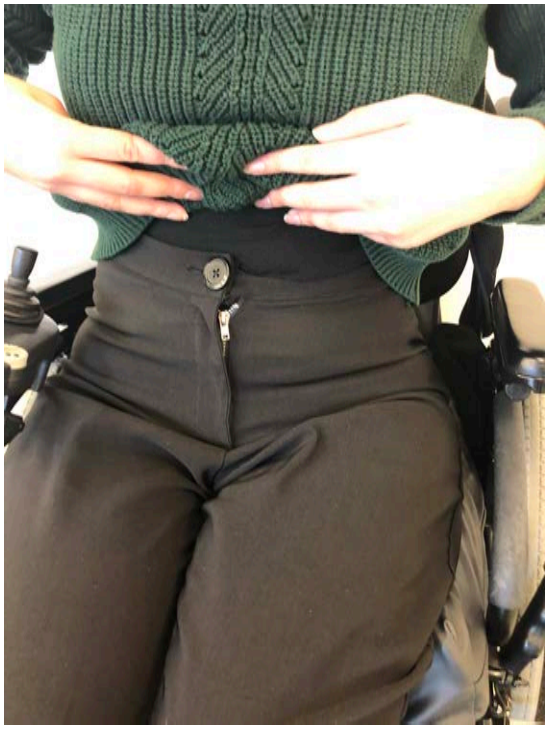


Figure 42 B Prototype 4 Front

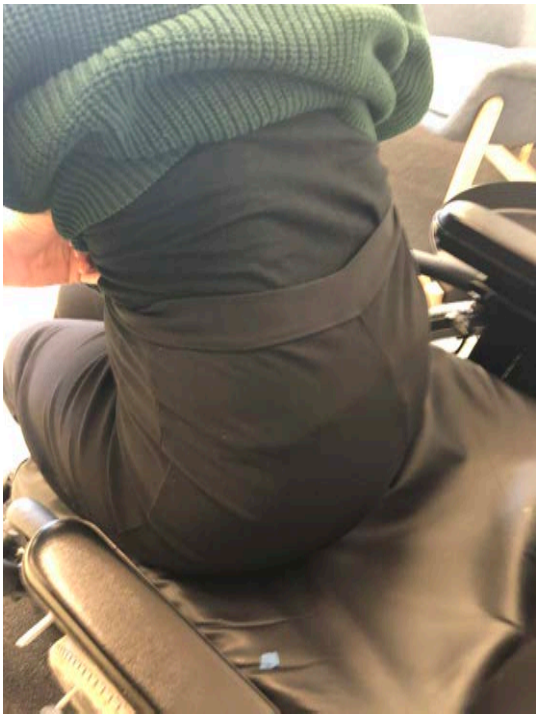


Figure 41 B Prototype 4 Back

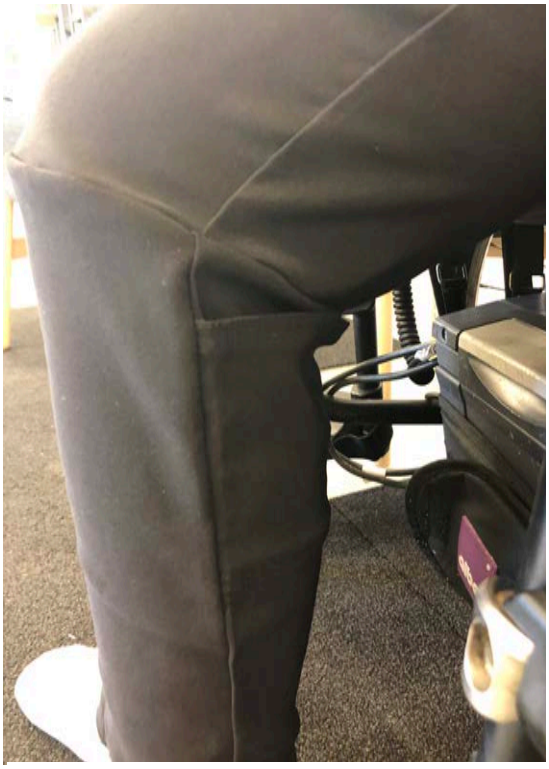


Figure 43 B Prototype Outer Leg Pocket

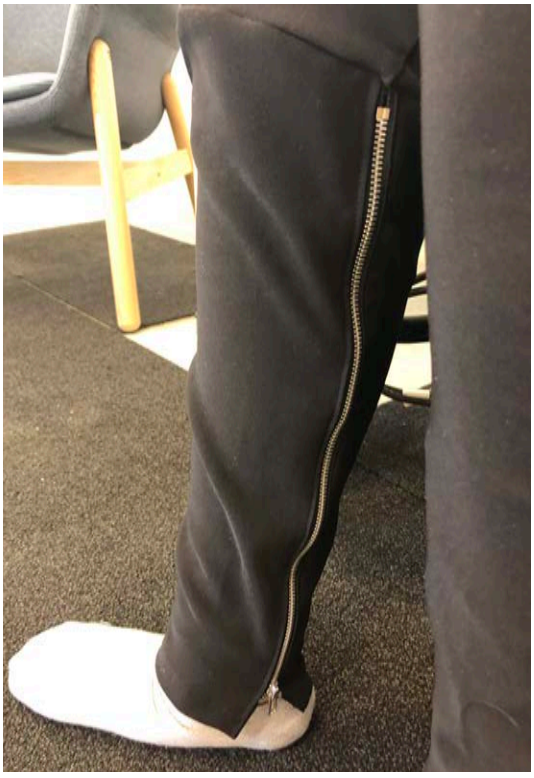


Figure 44 B Prototype 4 Inner Leg Zipper

5.2.4.2.3 B's Reaction

From a fit perspective, B believed that the dart-turned-seam yoke in the front laid better than the one without even though the same amount of fabric was taken out and I agreed. She was super excited that the waistband on both pants lay comfortably on her waist both in the front and in the back.

From an ease of use perspective the biggest issue was the magnets. Now they would connect at the back of the ankle but wouldn't connect all the way up the back of the calve. I thought maybe sewing the seam in the back down about 3 inches so that it was already over the thickest part of the calve. The calve pocket on Pant 2 was the right size and good on the back outer side but it needed to be moved down the leg an inch and a half for a more comfortable fit for a phone. The zippers worked as expected. All around she was happy with the progress, and looked forward to the next round of pants, which we were pretty sure they would be the last round.

5.2.4.3 Round 3: Pants 5 & 6

In this section I will detail the construction of the third and final two non-muslin prototypes and B's reaction to both.

5.2.4.3.1 Pant 5 Prototype : Magnet Closures

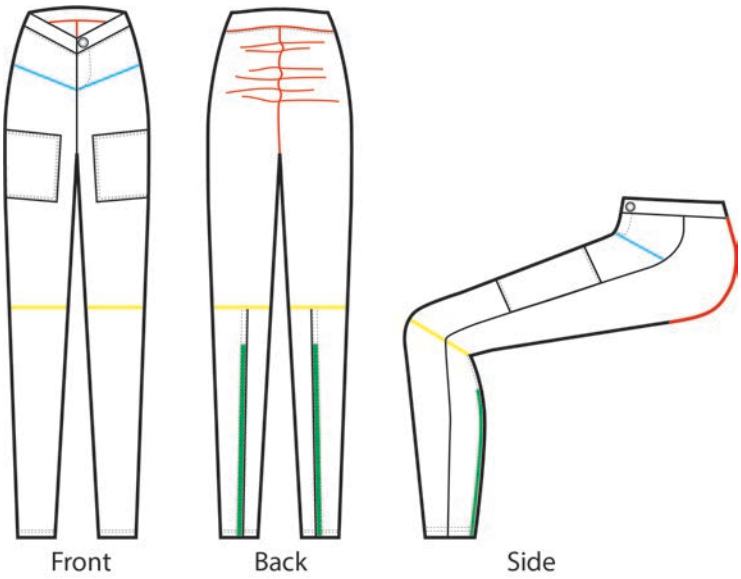


Figure 46 B Pant 5 Prototype

Pant 5 (see Figure 46) had (green) magnets sewn into the seams on the center back seams of the calves one at a time to keep down the fabric bulk and seamed and the magnets started three inches down the back of the calve. Once again the (yellow) front and the back knee have a dart-turned-seam (see Figure 28) to account for the bend of the knee while sitting. The part of the leg below the knee was divided into three pieces with seams on the inner and outer calves and one in the back seam for the magnets.

Figure 45 B Prototype 5 Full Front

Like pants 3 and 4, I lengthened the (red) center back seam by slashing and spreading the center back seam (see Figure 36), and the center

Figure 47 B Prototype Front

front seam was shortened by taking five inches out and giving it a dart-turned-seam (see Figure 16) with the top piece turning into a yoke (see Figure 16), and was then given a waistband with a front fly zipper.

Pant pockets were added again lower in the front to lay comfortably on the thigh so someone sitting could easily put their phone in and grab it out without having to shift their whole body to get it out.

Figure 49 B Prototype Back

Figure 48 B Prototype Leg with Magnets

5.2.4.3.2 Pant 6 Prototype : Zipper Closures

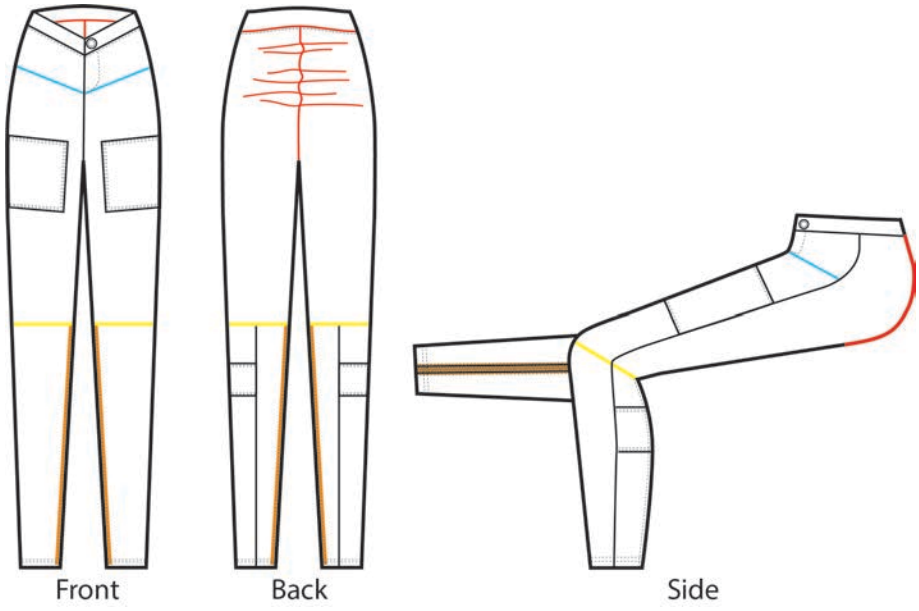


Figure 50 B Pant 6 Prototype

Pant 6 (see Figure 50) once again had (orange) zippers sewn into the inner side of the calve. The (yellow) front and the back knee had a dart-turned-seam (see Figure 28) to account for the bend of the knee while sitting. The part of the leg below the knee was divided into three pieces with seams on the inner calve for the zipper, and back and outer calve seams to sew a pocket into those seams which was lowered on the leg for more room.

Figure 51 B Prototype 6 Full Front

Once again I lengthened the (red) center back seam by slashing and spreading the center back seam (see Figure 36), and the (blue) center front seam was shortened by taking five inches out giving it a dart-turned-seam (see Figure 16) with the top piece being made a yoke (see Figure 20) and was then given a waistband with a front fly zipper.

Figure 52 B Prototype 6 Inner Side Zipper

Figure 53 B Prototype 6 Back

5.2.4.3.3 B's Reaction

From a fit perspective, B was really pleased with both pants. They both fit well and hit very comfortably at her waist in both the front and the back. The zippers worked as expected and the magnets with the lowered back leg seam now connect all the way through with little to no help from B. All around she was happy with the prototypes and despite the fact that they were purely functional and intended to be the basis for which to design aesthetically over, said she would wear them as is.

5.2.5 Bonus Prototypes: Pants Sitting vs Standing Measurement

With the knowledge that while in my sample of people I didn't have anyone without the ability to stand, it is likely that someone who uses this method would have to get measurements with a participant sitting down. So I created two prototypes: (based off of the final zipper prototype because the zipper is the easiest to sew) one created with B's sitting measurements (see Figure 54), and one with B's standing measurements (see Figure 55). This was done to test the difference in fit and try and decide on some patterning rules for how to pattern based off those measurements. When put on the Sitting Measurements fit better in the waist, but were baggier in the hips and thighs, whereas the Standing Measurements fit better in the lower hips and thighs.

Figure 55 Standing Measurement Pants

Figure 54 Sitting Measurement Pants

5.2.6 Initial Edits to The User Journey Map

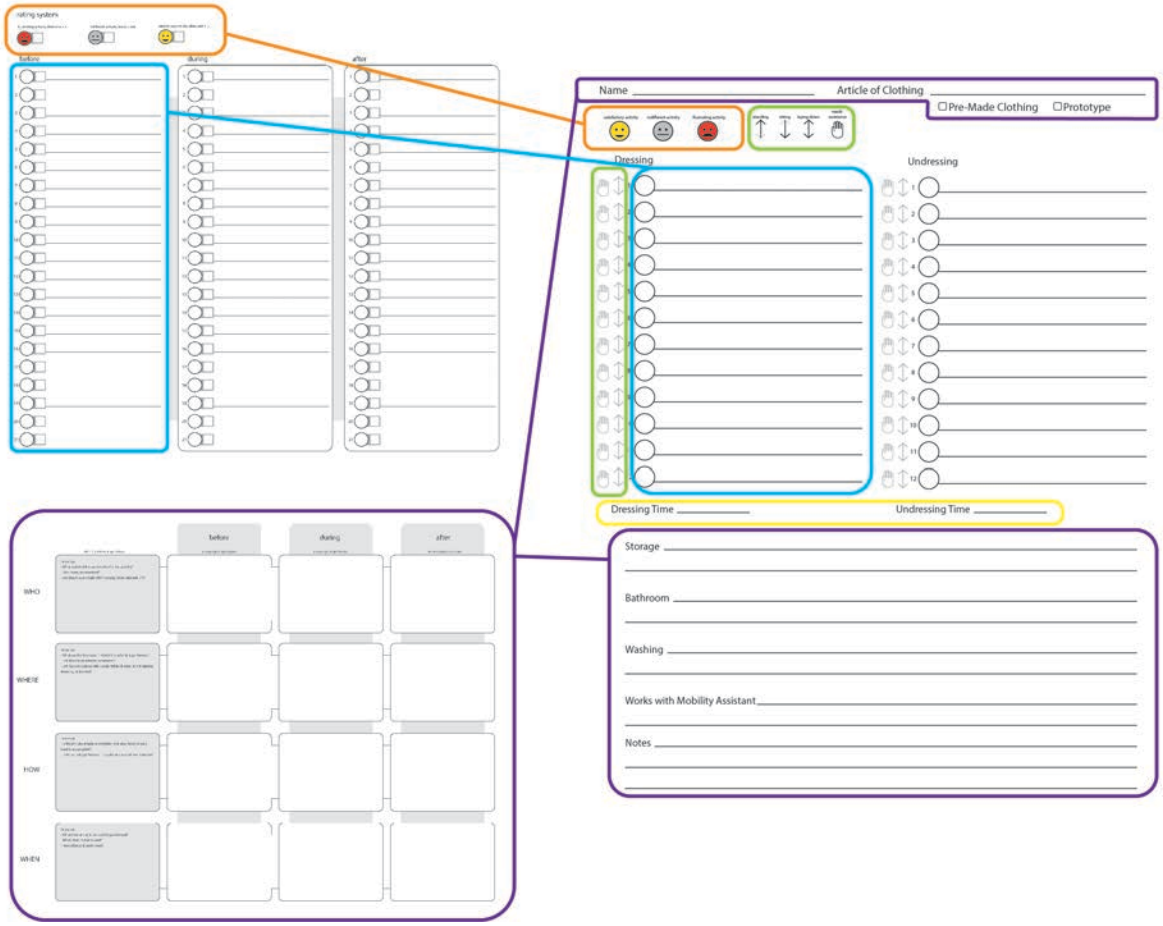


Figure 56 1st User Journey Map Edits

Figure 57 Original User Journey Map

The user journey map almost immediately needed some edits (see of documentation. Notes had to be taken outside of the margins (see Figure 57), there was nowhere to define what the object was or for whom, the page on who, where, when and how wasn't needed for each piece, and during the

Figure 58 1st Edited Version of the User Journey Map

dressing process B stood up and sat down constantly and making note of it every time was time consuming.

So I edited the User Journey Map to better suit the purposes of the methodology (see Figure 58). The (orange) emoji ranking were kept but the documentation was moved to two columns for dressing and undressing. New (green) indicators next to the emojis were added to quickly indicate whether the participant was sitting, standing, laying down or needed assistance during any point in the dressing period. I added (yellow) time to the bottom of the dressing and undressing task notation to better record whether the ease of use design solutions were making progress in comparison to their fashion counterparts. And (purple) certain relevant questions to clothing and the methodology were kept, while others were discarded or placed in the participant profile.

5.2.7 Participant Profile

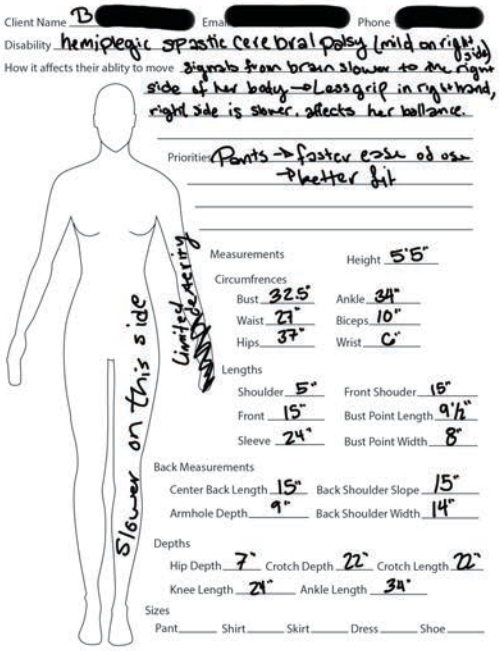


Figure 59 B Participant Profile

The need for a participant profile (see) came about due to realizing that I hadn't taken as many necessary measurements as I needed the first time, having not written them down thoroughly before hand and having to schedule a quick meeting to gain said measurements. It also seemed prudent to make the profile as an overview of the participant, rather than just gaining the measurements. So I placed a quick outline of a person to draw on to indicate what parts of the body the disability affects, measurements, naming the disability and any priorities the person had.

5.2.8 Rethinking Prototyping

Once B was finally finished, it became clear that there needed to be a change in how the methodology was implemented. The constant patternmaking and prototyping was time consuming and expensive, and while ultimately helpful, particularly from a fit perspective, the ease of use and fit ended up competing for attention, which required more prototypes, and it wasn't always clear if certain issues were ease of use elements or fit ones, so separating the two will be most helpful. For the next round it was decided to prototype for ease of use first and then for fit. To accomplish this, instead of

patternmaking and prototyping, ease of use design elements would be added to premade clothing, most likely from a thrift store, and tested from a dressing and undressing standpoint and once those are figured out, pattern for fit and sew the prototype. This significantly reduced the time spent on each prototype, and allow for more testing of different ease of use design elements.

5.3 Participant L

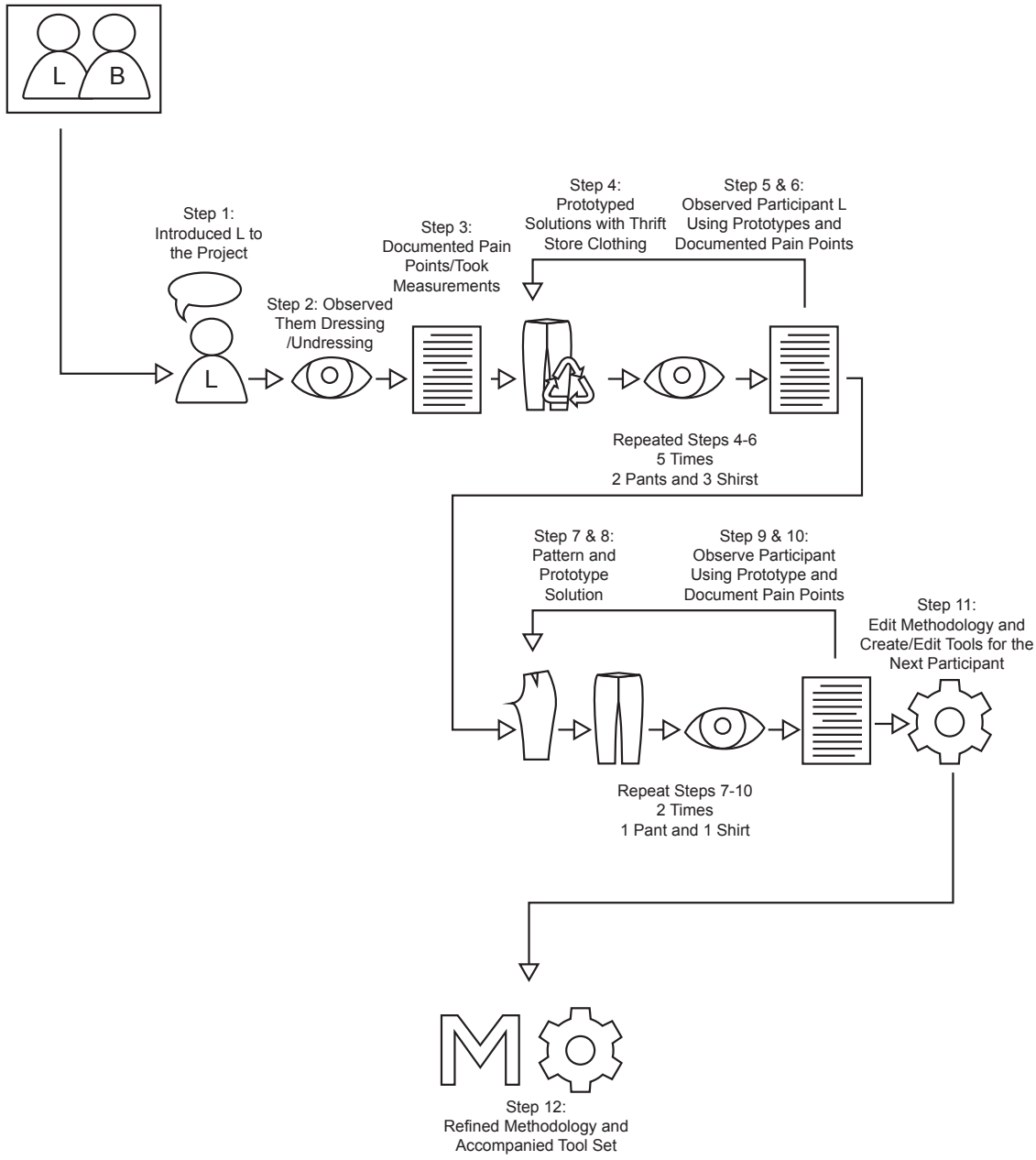


Figure 60 L Methodology

5.3.1 Meet Participant L

I met with Participant L and his wife who has been my point of contact. L is a man in his late 50s and he suffered from a stroke a few years ago that took away the use of his left arm, and his ankle doesn't roll as well. This throws his balance off, which makes walking, and dressing difficult. He can uses a cane, but only for short distances, so he gets around by electric wheelchair. His limited mobility is worse than Participant B who still had control of her limbs so he was slotted to be the second participant in the study.

5.3.2 Initial Meeting and First Observations

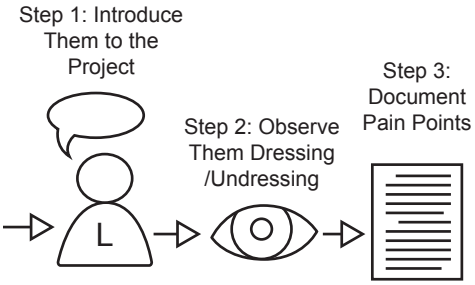


Figure 61 L Methodology Step 1-3

Once again I met with my participant in a cafeteria. Both L and his wife were very interested in the project, and getting some pieces made that will help him gain more independence, so they agreed to meet with me to discuss the process. He has a good sense of humor about his disability, but he does admit to getting frustrated about his inability to do simple things, that he used to be able to do, having only had to deal with this for the last few years. It doesn't help that the stroke affected his memory as well. They agreed to be a part of the process and we agreed to meet up to get measurements, and have him try on clothing to find where he was having trouble getting in and out.

We then met at their house and during the meeting I discovered that button up shirts, or jackets were the most difficult, and pants were a close second. Both required help from his wife, which he found both funny and frustrating.

5.3.3 First Prototypes

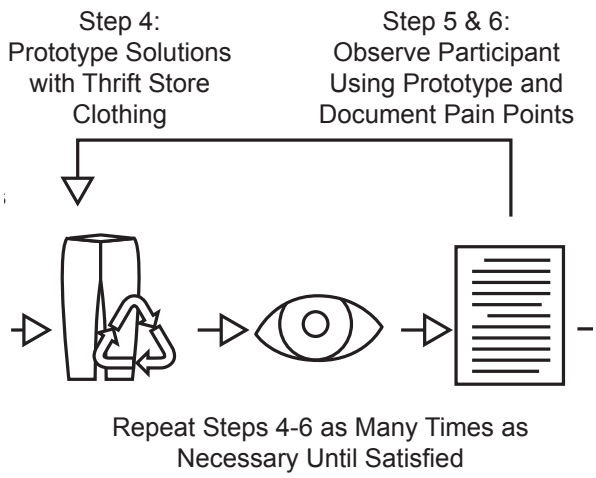


Figure 62 L Methodology 4-6

Since it had been decided that instead of patternmaking and prototyping, I would add ease of use design elements to thrift store clothing for the first round of prototypes that's what I set out to do. For L he needed pants, often longingly wishing for jeans, and button up shirts.

5.3.3.1 The Shirts

Button ups were difficult for L due to the left arm not working at all. He would have to put the shirt on the left arm, which he has no movement in, throw the shirt around the back and try to shimmy into the shirt, due to having no rotation in his left shoulder. So my strategy was that he wouldn't button it up the front, which required him to get it around his back.

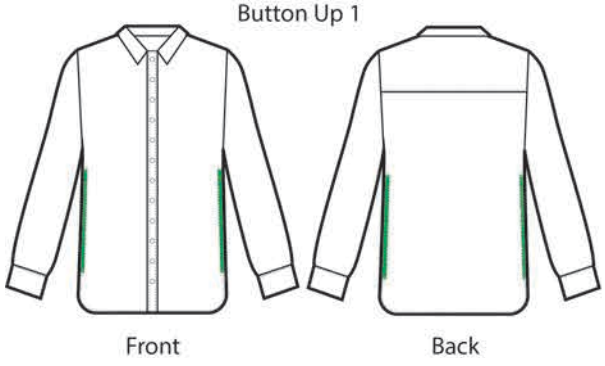


Figure 63 L Button Up 1 PM Prototype

I created 3 different button up shirts for L to try. Button Up 1 (see) had the 7mm diameter x 1mm thick magnets up the side seams to widen the shirt, possibly making it so that he could put it on the same way he

puts on his t-shirts. The same strategy was applied to Button Up 2 (see) which had a line of magnets up the back that ended at the yoke. Button Up 3 (see) had a line of magnets up the left side seam and under the arm. The idea was that he would put his right arm and head through and the magnets would snap into place around his left arm.

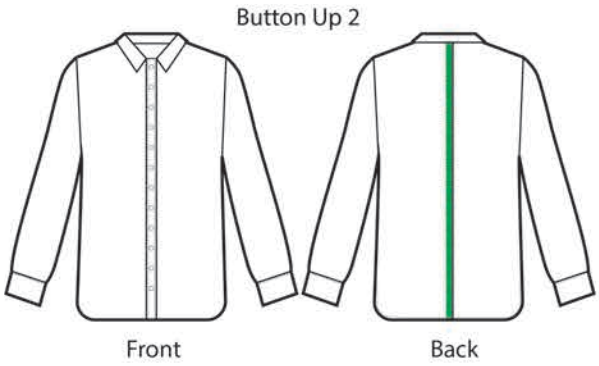


Figure 65 L Button Up 2 PM Prototype

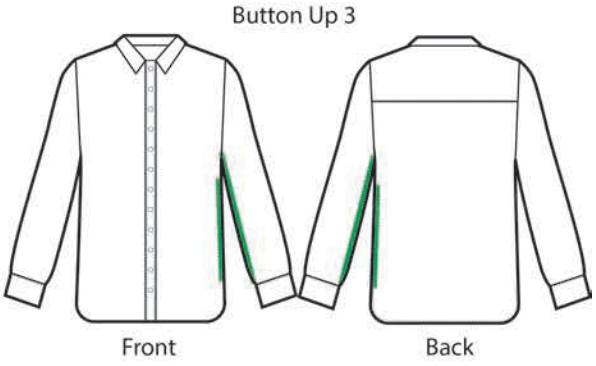


Figure 64 L Button Up 3 PM Prototype

Figure 68 L Button Up 1 Side Seam Magnets

Figure 67 L Button Up 2 Back Seam Magnets

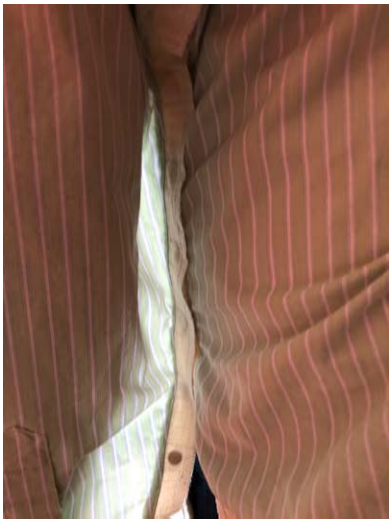


Figure 66 L Button Up 3 Side and Sleeve Seam Magnets

5.3.3.2 The Pants

Pants were difficult for L in the opposite way they were difficult for B. Where she needed help getting her legs through the end of the pants, men's jeans being much wider that after he easily got his legs through, however they would fall down when he stood up. This is a problem for a person with balance issue, because he had to bend over precariously trying to pick them back up. The other issue is that he one couldn't zip up or button the jeans once he did manage to pull them up, due to needing two hands to perform such a task.

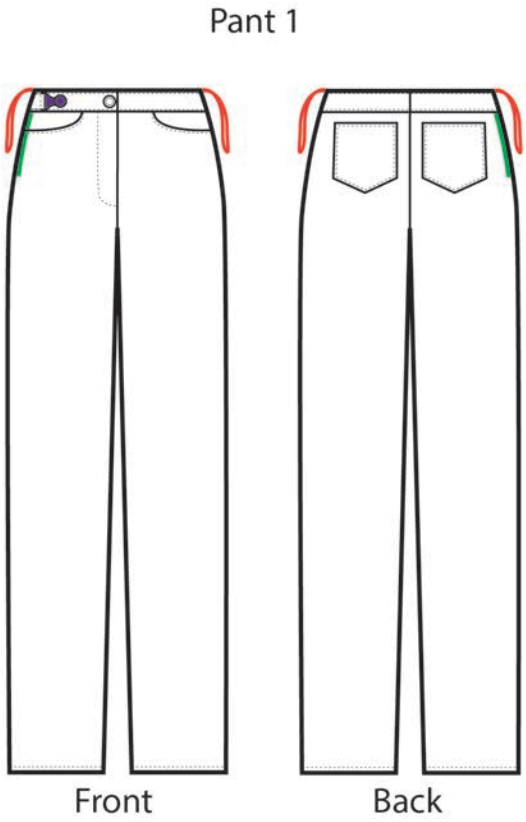


Figure 69 L Pant 1 PM Prototype

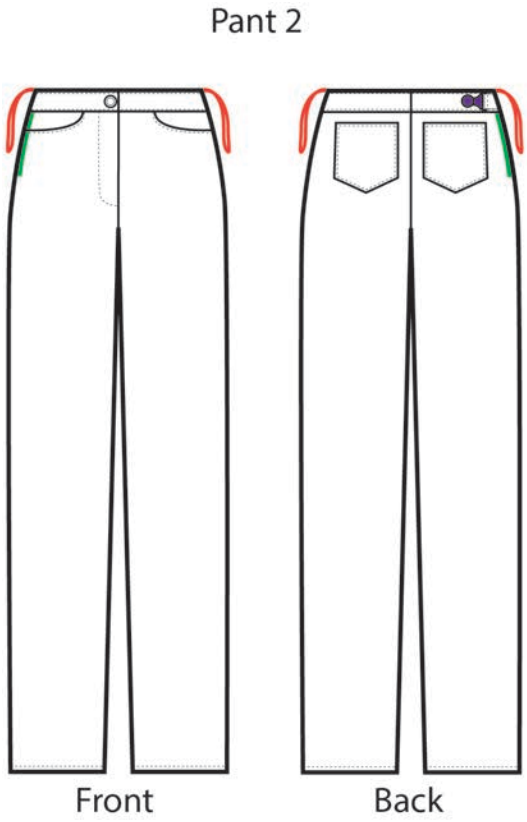


Figure 70 L Pant 2 PM Prototype

So I created two pairs of pants, with both pants having (red) ties that he could put around his wrists so that he would have a grip on them as he stood, with Pant 1 (see Figure 69) having elastic ties and Pant 2 (see Figure 70) having basic ribbons. The main fastening element for both pants was placed on the right side where his good arm is. Instead of a zipper I used the same (green) 7mm diameter x 1mm thick

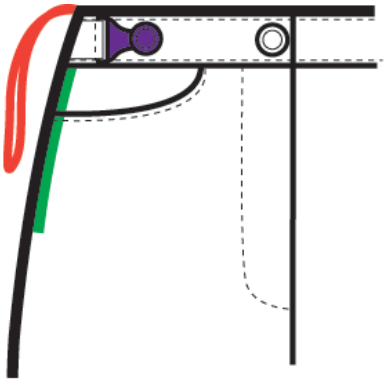


Figure 71 L Elastic and Overall Hook Close Up

magnets up the side seam with one large magnet at the top to secure it (see Figure 72) and then I added an (purple) overall suspender hook and eye with elastic to the waistband (see Figure 71), as the fastener, to make it easier for him to fasten his pants, rather than having him button his pants and try to zipper them. I had the hooks of Pant 1 facing the front, and Pant 2 hooks facing the back to see which one would be more comfortable for him.

Figure 72 L Magnetic Side Fly

Figure 73 L Overall Hook Toward the Front

Figure 74 L Overall Hook Toward the Back

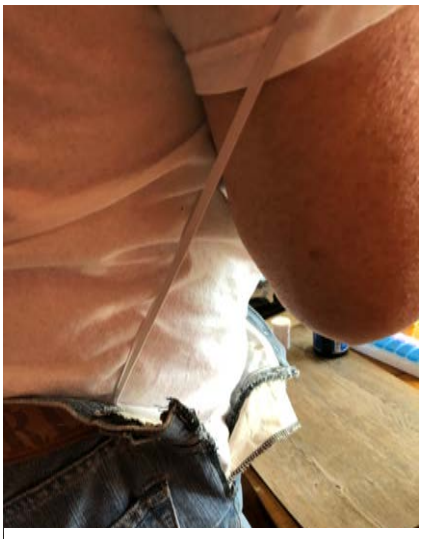


Figure 75 L Inside Elastic Hold

5.3.3.3 L's Reaction

Of the three button up shirts, L disliked Button Up 3. The issue with Button Up 3 was that due to the buttons being placed all along the side seam and the sleeve seam, which brought them into contact with each other and magnets are not picky about who they snap with (see Figure 66). This made it clear that any magnets used in the future could only be used with straight lines and h ad to have an easily guided direction or they will stick to whichever is closest.

Button Up shirts 1 and 2 were well received, both allowed him to get the shirt on over his head with little effort and then adjust. Button Up 2 however was too small and wouldn't close in the back (see Figure 67). Conversely it became apparent that with the magnets in the back, they could create sores due to the pressure they would place on his skin as he sat back in his chair. So instead of recreating Button Up 2 we decided that Button Up 1 was the better option to move forward with (see Figure 68). He also suggested replacing the cuff buttons with magnets, since he couldn't button one side and the other was difficult.

For the pants, Pant 1 was the clear favorite. The elastic ties inside the waistband were the easiest for him to hold onto, and he unexpectedly put them over his shoulders like suspenders which freed his hands to adjust the pants and then fasten them (see Figure 75), which I made note of for the next round of prototypes to place on both sides. He also liked the overall suspender hook and eye facing the front (see Figure 73), and liked the hook in general, especially with the elastic. He felt it was far easier to fasten his pants, and felt really secure.

5.3.4 Second Prototypes

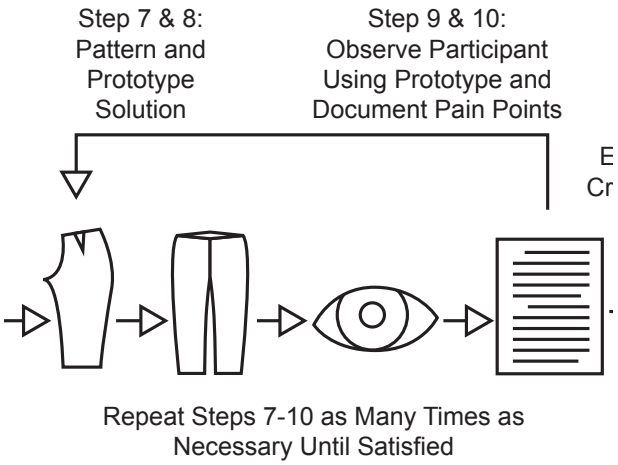


Figure 76 L Methodology Steps 7-10

Once the measurements had been taken and the functional design elements had been figured out I could create the prototypes with fit elements. So I created patterns for the prototypes, and decided to start the prototypes out of non-muslin material and skipping the muslin step, as a way to push the time saving that this improved methodology offered, I also felt more confident in my patterning skills with regards to fit, after creating 9 pants for B.

5.3.4.1 The Button Up

Figure 77 L Final Button Up Prototype

For the Button Up Prototype (see Figure 77), I lengthened the back to add coverage, and shortening the front so that it would lay nicely on his lap (see Figure 79) instead of bunching. I added the (green) magnets to the side seams for the ease of use design solution (see Figure 78), and placed magnets where the cuff buttons would be for another ease of use feature.

Figure 79 L Button Up Prototype Front

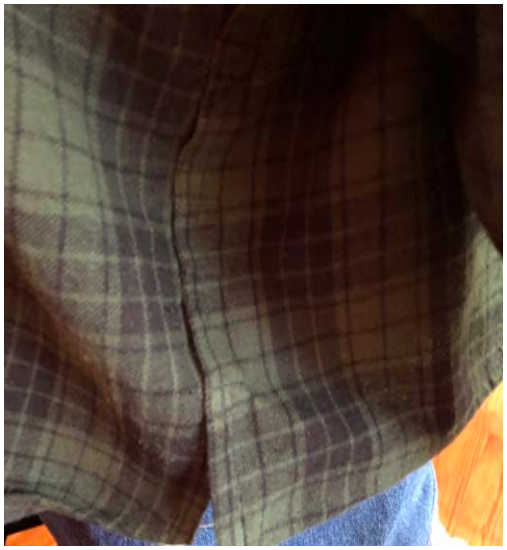


Figure 78 L Button Up Prototype Side

5.3.4.2 The Jeans

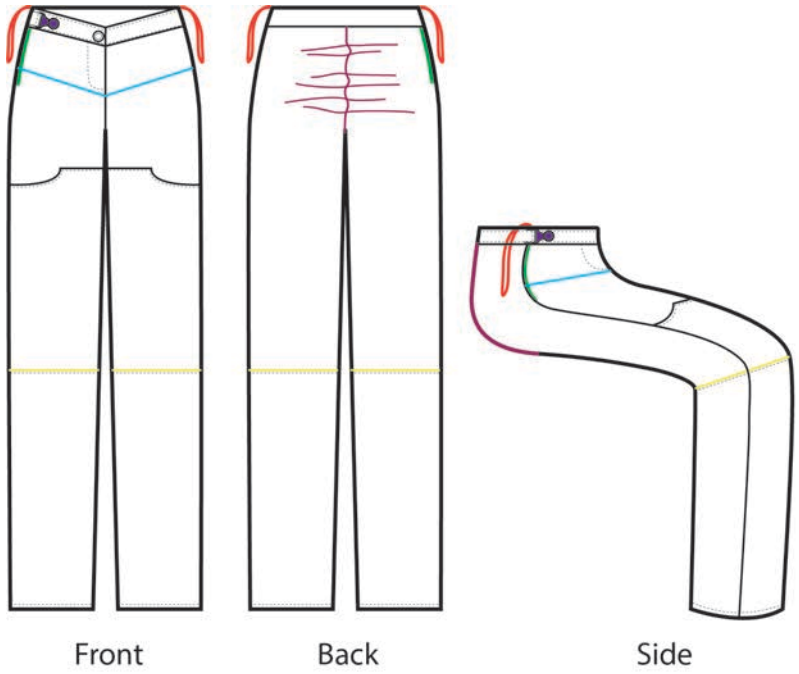


Figure 81 L Final Pant Prototype

For the Pant Prototype (see Figure 81) I lengthened the (magenta) center back seam by slashing and spreading the center back seam (see Figure 36), and (blue) the center front seam was shortened by taking five inches out giving it a dart-turned-seam (see Figure 16) with the top piece being made a yoke (see Figure 20) and was then given a waistband with an (purple) overall suspender hook and eye (see Figure 82) with a (green) magnetic side fly on the right side (see Figure 83) and with a faux front fly zipper in the front. There were pockets placed further down the leg to allow for easier access to them while sitting. The (yellow) front and the back knee have a dart-turned-seam to account for the bend of the knee while sitting. And I tacked (red) elastic loops on the inside on both sides of the

Figure 80 L Final Pant Prototype Full Front

waistband (see Figure 84) as an ease of use feature, to help him keep the pants from falling as he stood up while putting them on.

Figure 83 Side Magnetic Fly

Figure 84 Inner Elastic Suspenders

Figure 82 Overall Hook and Eye Closure

5.3.4.3 L's Reaction

He tried on the Pant Prototype first, and really enjoyed how easy they were to put on, from the elastic loops (see Figure 84) that kept his pants in place as he got oriented standing up. He also appreciated that they came up nicely in the back, providing coverage, and that he could use his pockets again. The fit was also something he appreciated, with the lack of bulk in the front, and the seam at the knee reducing fabric at the back of his leg. He said it felt good to wear a pair of jeans again.

Then he tried on the Button Up Prototype and was happy with both the fit, which definitely reduced the fabric in front, and gave more coverage in the back, and the ease of use features of the magnets on the side seams and at the cuff buttons. He also enjoyed the fabric choices for both, which, while again unimportant because technically the next

step would be to create the aesthetic version, it was nice to hear that he enjoyed the pieces as much as he did.

5.3.5 Edits to the User Journey Map

Figure 85 2nd Edits to the User Journey Maps

The second round of edits (see) to the User Journey Map weren't as extreme as the first round. Many of the (purple) questions taken out of the bottom to make room for drawn notes, were moved to the Participant Profile, due to them being only needing to be asked once, rather than with every piece of clothing. I also decided to switch to a (green) numerical system from one to five with one being a very satisfactory activity and five being a very frustrating activity. The reason for the switch was that in looking back on my notes it became clear that when taking quick notes on someone dressing, it's easy to make the neutral emoji look like its frowning or smiling without meaning to, and then having to go back over the recording to rewrite the documentation. Numbers are harder to mistake for

each other, and the five numbers allows for a little more variation of satisfaction versus frustration than the three emojis allow. With these edits the User Journey Map shall be renamed the AFD Journey Map, to mark its specific use within the AFD Methodology.

Figure 87 L User Journey Map

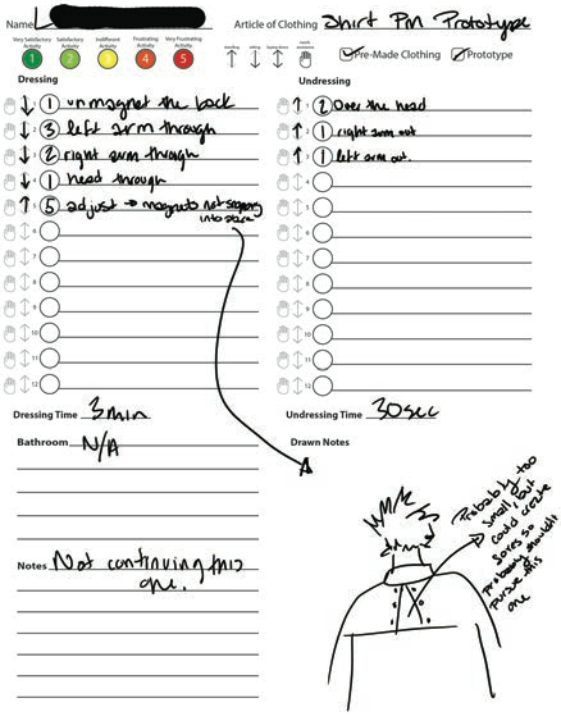


Figure 86 L ADF Journey Map

5.3.6 Edits to the Participant Profile

The edits to the Participant Profile (see) came in tandem to the final edits to the AFD

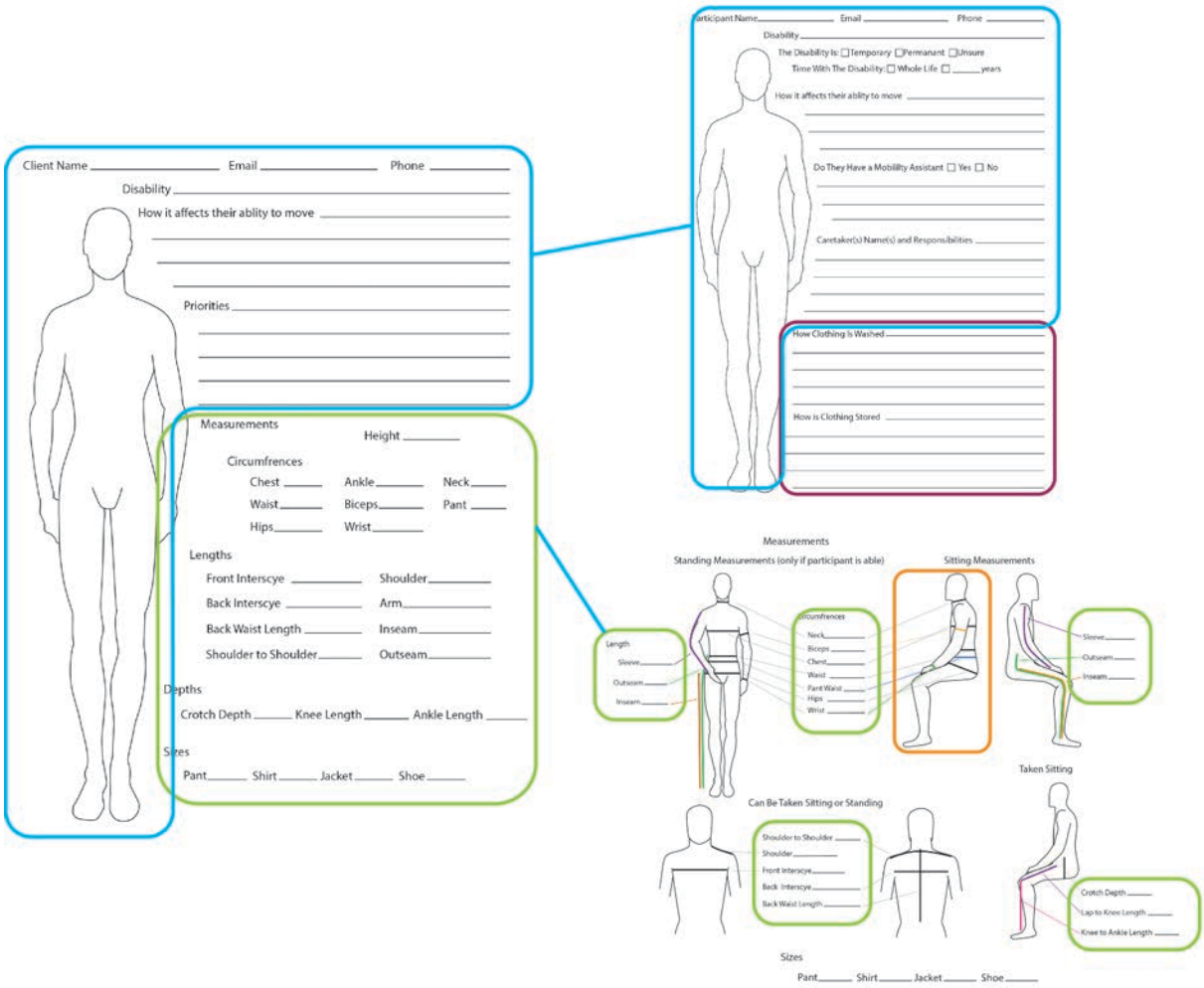


Figure 88 Edits to the Participant Profile

Journey Map. I decided to mover the (purple) questions about clothing storage and care to the Participant Profile since the procedure only needed to be asked about once. I also split up the Participant Profile into two sheets rather than one, with the (blue) front side focusing on the person and how they live with their disability, and the second on (green) measurements, and how to acquire them should the (orange) person not be able to stand.

With these edits the Participant Profile shall be renamed the AFD Participant Profile, to mark its specific use within the AFD Methodology.

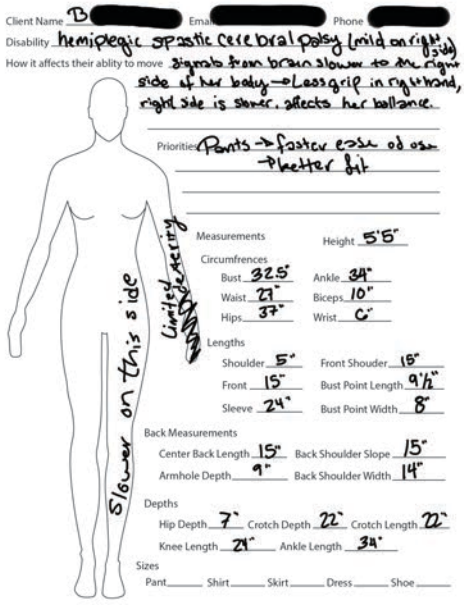


Figure 89 B Original Participant Profile

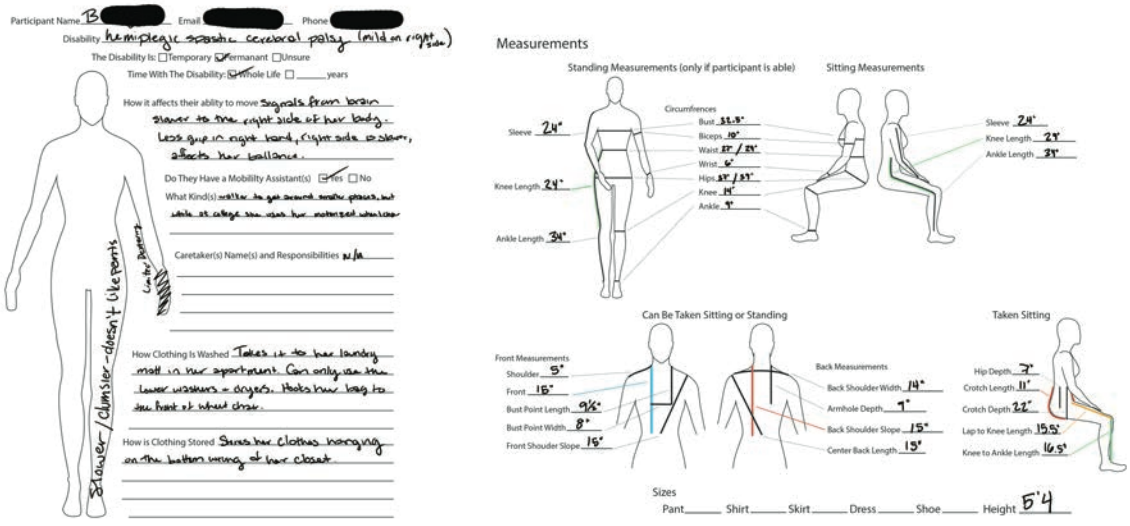


Figure 90 B ADF Participant Profile

5.4 Final Methodology Created and Accompanying Tools

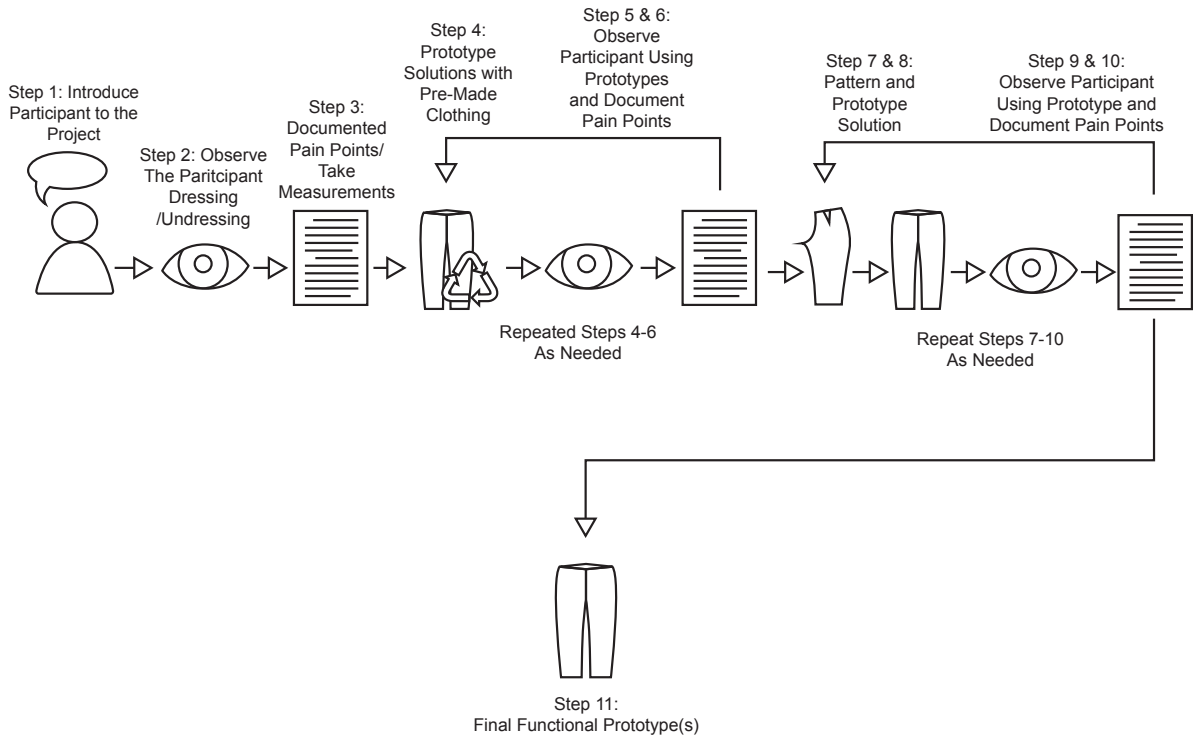


Figure 91 Final AFD Methodology

The final AFD methodology is a tool for fashion designers so that they can create ease of use design solutions and fit aspects for Adaptive Fashion. It requires the beginning portion of interviewing and documentation using the ADF Journey Map and the AFD Participant Profile, and then two sets of prototyping, one for ease of use, and the second for fit, with the end result being that there is a prototype that encompasses both elements that a designer can then design off of for the final look.

CHAPTER 6. DISCUSSION

Throughout this process I discovered that prototyping for ease of use with pre-made clothing and then prototyping for fit was more efficient than prototyping from scratch both ease of use and fit for designing for Adaptive Fashion for people who use wheelchairs. The AFD methodology can be placed at the beginning of the fashion design process for designers who want to do adaptive wear exclusively or it can be put at the end of a process for fashion brands that want to extend their lines into Adaptive Fashion. It could also be broken up to suit the designer's needs, with the caveat that ease of use design solutions prototyping needs to come before fit.

If the AFD Methodology would be taught at university it could be taught to senior or junior undergraduates as an elective. However it is my opinion that the methodology and Adaptive Fashion in general, should be a Master's level program. Since that is where the research is taking place for academia and Adaptive Fashion will probably always need new research as new textiles and technologies come on the scene. It would be beneficial to Fashion Design Programs to have a small track for Master Students to specialize in Adaptive Fashion, which would give the industry more experts to consult with and possibly more brands that are exclusively Adaptive Fashion.

As of right now the methodology is limited to mobility disabilities and specifically those who use wheelchairs, however I believe it would work for all if not most mobility disabilities, such as those with paraplegia or quadriplegia. It could also be effective for those with mobility disabilities that don't require the use of a wheel chair, such as amputees.

However it would need new tools to better understand dressing issues for other disabilities. For instance those who are blind, might need more sensorial help finding clothes rather than dressing help, but both fall under ease of use. I feel the aspect of using thrift store clothing for rapid ease of use prototyping could work for any or most disability issues, but the fit aspects I learned were only for someone who spends the majority of their time sitting in a wheelchair. It might be beneficial in the future to create an app that encompasses all of the tools needed with the various disabilities for this methodology to better store the information, and make it easier to collect.

I consider this methodology only a stop-gap, and probably best for research, until we have a system in place for ease of use design solutions for Adaptive Fashion. Fashion has systemized fit which is as individual as disability. The fit systems aren't perfect, and there is work being done to try and widen the system, but I believe if we could systemize design solutions for disability, it would make it much easier for the Fashion Industry to take up the cause. Also finding those things, such as the tag being printed on clothes for people with sensorial sensitivities, or placing pockets further down the leg, that could benefit everyone, would allow brands to become more inclusive without creating new lines entirely.

CHAPTER 7. CONCLUSION

In my research, the conclusions I have come across are that ease of use is the first priority, followed by fit, and I discovered that prototyping for ease of use with pre-made clothing and then prototyping for fit was more efficient than prototyping from scratch both ease of use and fit for designing for Adaptive Fashion for people who use wheelchairs, and doing so cut the prototyping time by two-thirds.

As of right now the tools created are limited to mobility disabilities, so it would need new tools to better understand dressing issues for other disabilities such as those who are blind. An app that encompasses these tools and code the data in an effective way so that it can be mined when it's all collected would be useful for this purpose.

The next steps in my research are to create a database of design solutions that currently exist for all of the disabilities, by collecting as much of it as I can find across the various academic disciplines and use this methodology as a way to test their effectiveness, creating tools as needed to document and move the process along. This will allow me to create an ease of use design solutions system for disability, and let me give clear numbers about what ease of use design solutions can help what demographics, and which ones could be inclusive to the larger population or exclusive to certain PWDs.

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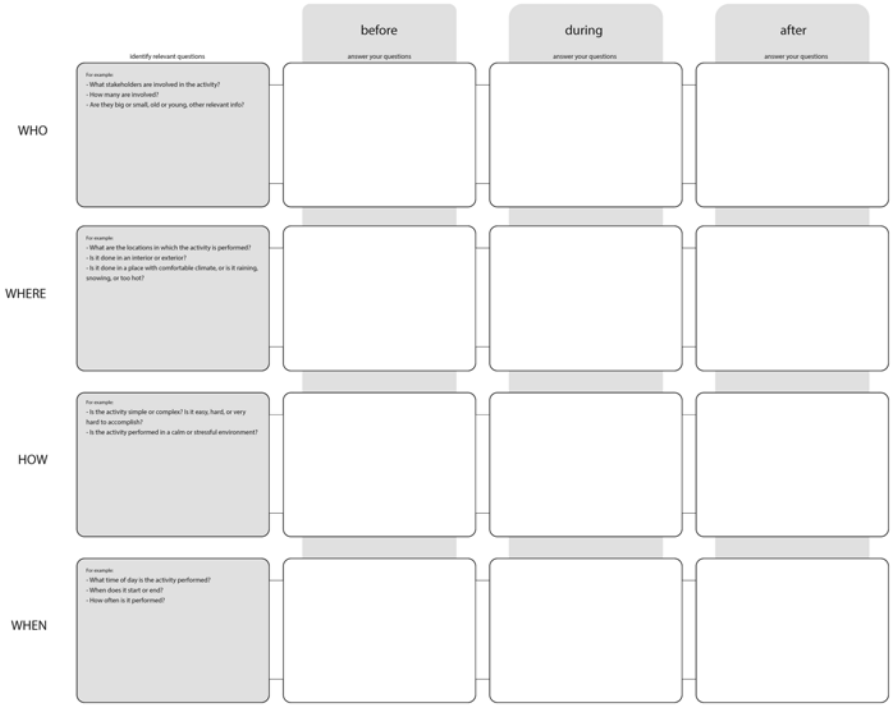
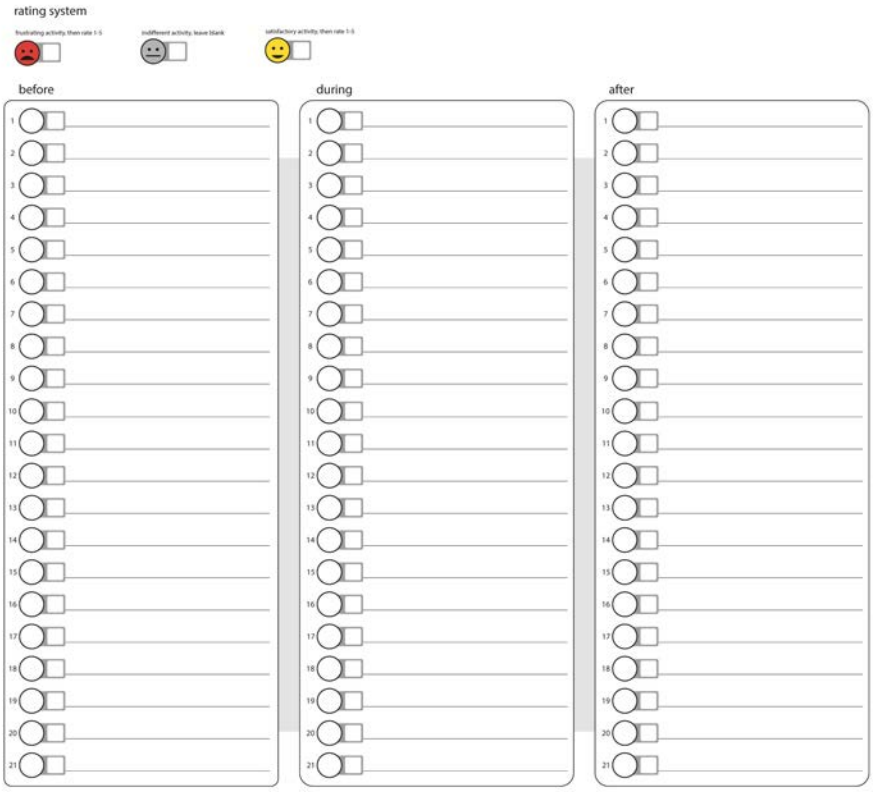
APPENDIX A – USER JOURNEY MAPS





Name _____ Article of Clothing _____

☐Pre-Made Clothing ☐Prototype

Dressing

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____
11 _____
12 _____

Undressing

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____
11 _____
12 _____

Dressing Time _____ Undressing Time _____

Storage _____

_____

Bathroom _____

_____

Washing _____

_____

Works with Mobility Assistant _____

_____

Notes _____

_____

_____

Name _____ Article of Clothing _____

☐ Pre-Made Clothing ☐ Prototype

Dressing

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____
11 _____
12 _____

Undressing

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____
11 _____
12 _____

Dressing Time _____

Undressing Time _____

Bathroom _____

Drawn Notes

_____

_____

_____

_____

Notes _____

_____

_____

_____

_____

_____

_____

APPENDIX B – PARTICIPANT PROFILE SHEETS

Client Name _____ Email _____ Phone _____

Disability _____

How it affects their ablity to move _____

_____

_____

_____

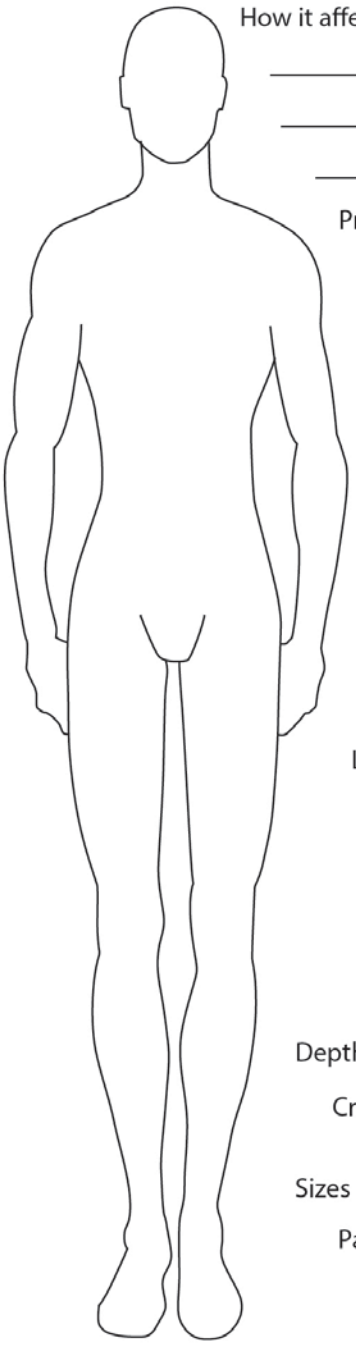
Priorities _____

_____

_____

_____

_____



Measurements

Height _____

Circumfrences

Chest _____ Ankle _____ Neck _____

Waist _____ Biceps _____ Pant _____

Hips _____ Wrist _____

Lengths

Front Interscye _____ Shoulder _____

Back Interscye _____ Arm _____

Back Waist Length _____ Inseam _____

Shoulder to Shoulder _____ Outseam _____

Depths

Crotch Depth _____ Knee Length _____ Ankle Length _____

Sizes

Pant _____ Shirt _____ Jacket _____ Shoe _____

Client Name _____ Email _____ Phone _____

Disability _____

How it affects their ablity to move _____

_____

_____

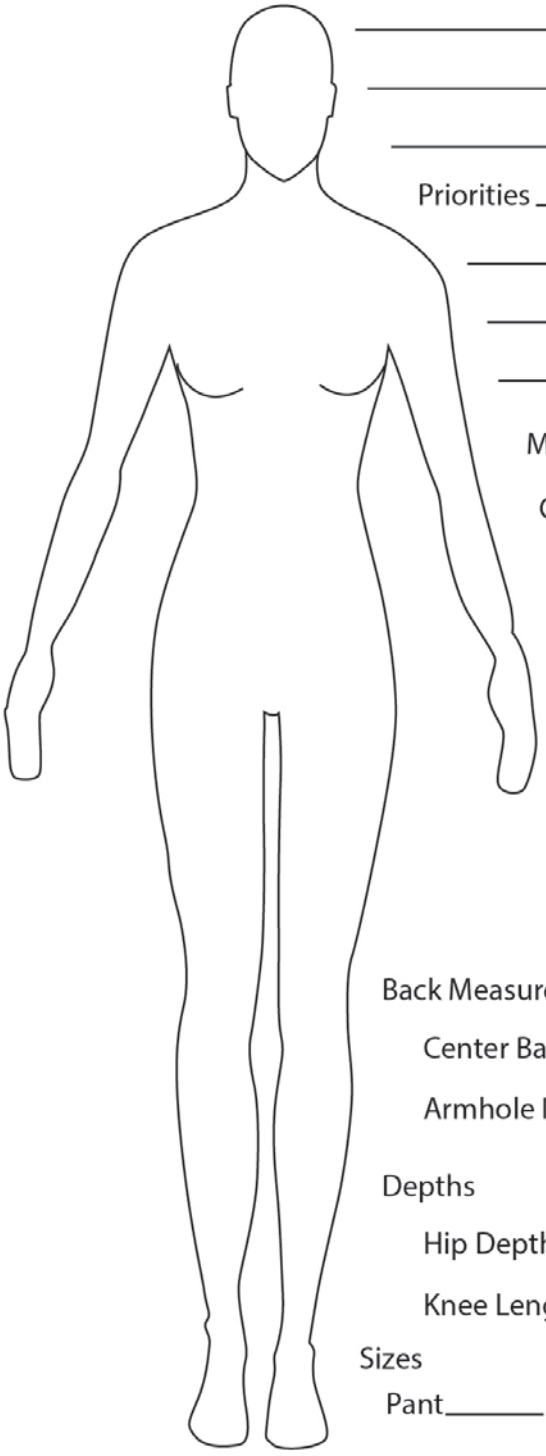
_____

Priorities _____

_____

_____

_____



Measurements

Height _____

Circumfrences

Bust _____ Ankle _____

Waist _____ Biceps _____

Hips _____ Wrist _____

Lengths

Shoulder _____ Front Shouder _____

Front _____ Bust Point Length _____

Sleeve _____ Bust Point Width _____

Back Measurements

Center Back Length _____ Back Shoulder Slope _____

Armhole Depth _____ Back Shoulder Width _____

Depths

Hip Depth _____ Crotch Depth _____ Crotch Length _____

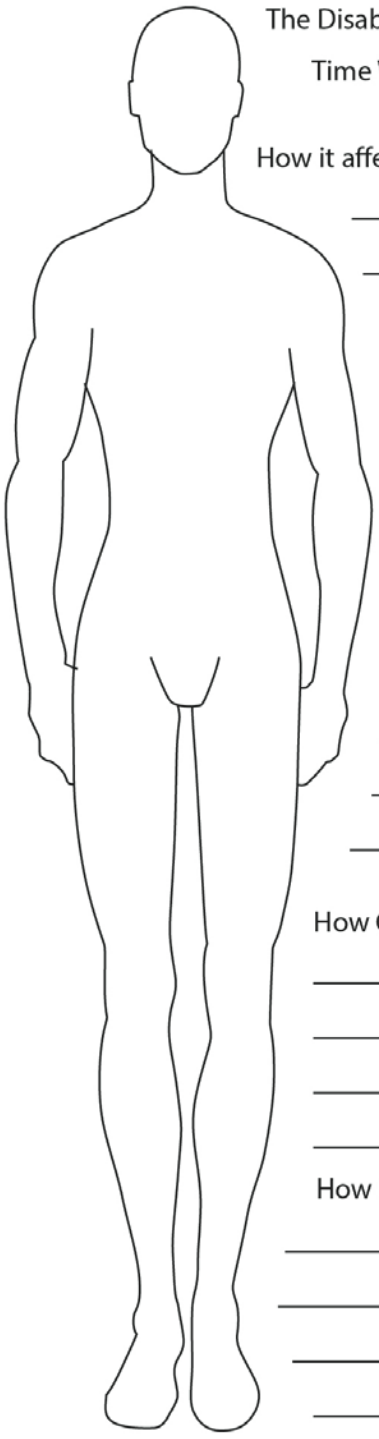
Knee Length _____ Ankle Length _____

Sizes

Pant _____ Shirt _____ Skirt _____ Dress _____ Shoe _____

Participant Name_____ Email _____ Phone _____

Disability _____



The Disability Is: ☐Temporary ☐Permanant ☐Unsure

Time With The Disability: ☐ Whole Life ☐ _____ years

How it affects their ablity to move _____

_____

_____

_____

Do They Have a Mobililty Assistant ☐ Yes ☐ No

_____

_____

_____

Caretaker(s) Name(s) and Responsibilities _____

_____

_____

_____

_____

How Clothing Is Washed _____

_____

_____

_____

_____

How is Clothing Stored _____

_____

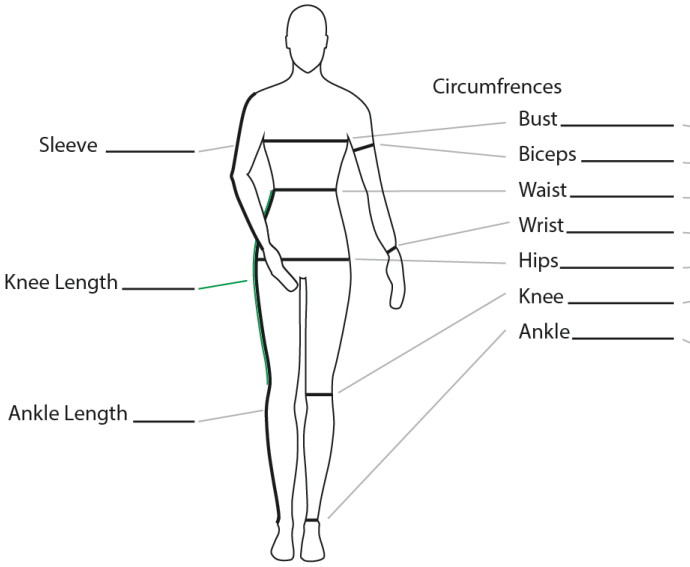
_____

_____

_____

Measurements

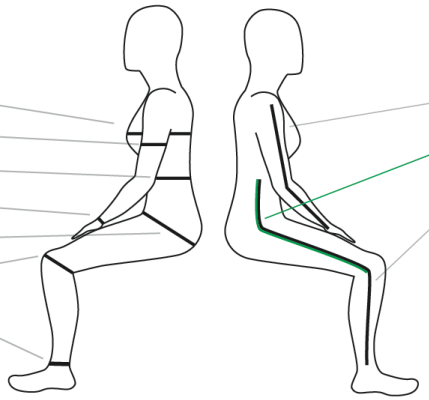
Standing Measurements (only if participant is able)



Circumfrences

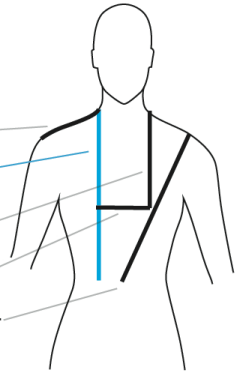
- Bust
- Biceps
- Waist
- Wrist
- Hips
- Knee
- Ankle

Sitting Measurements



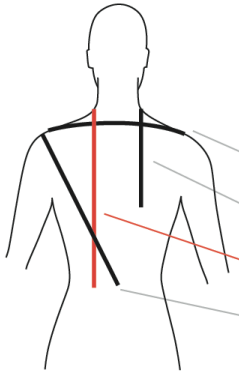
- Sleeve
- Knee Length
- Ankle Length

Can Be Taken Sitting or Standing



Front Measurements

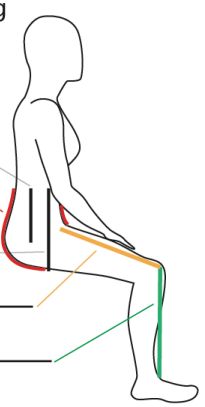
- Shoulder
- Front
- Bust Point Length
- Bust Point Width
- Front Shouder Slope



Back Measurements

- Back Shoulder Width
- Armhole Depth
- Back Shoulder Slope
- Center Back Length

Taken Sitting



- Hip Depth
- Crotch Length
- Crotch Depth
- Lap to Knee Length
- Knee to Ankle Length

Sizes

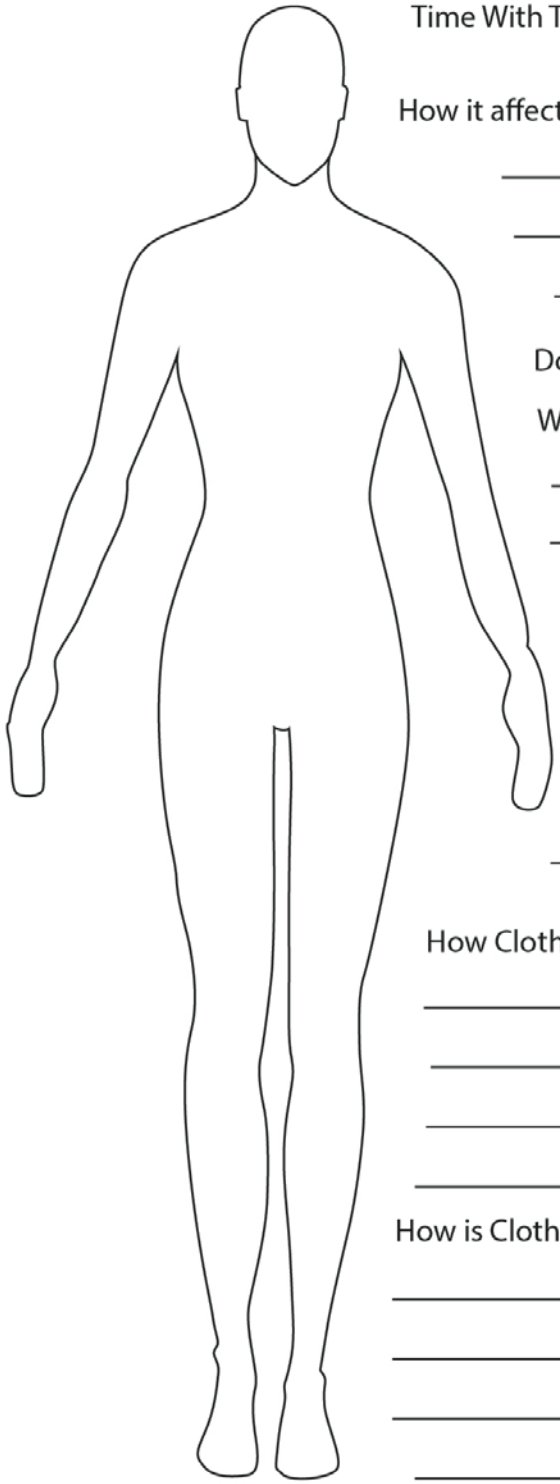
Pant _____ Shirt _____ Skirt _____ Dress _____ Shoe _____ Height _____

Participant Name_____ Email _____ Phone _____

Disability _____

The Disability Is: ☐Temporary ☐Permanant ☐Unsure

Time With The Disability: ☐ Whole Life ☐ _____years



How it affects their ablity to move _____

_____

_____

_____

Do They Have a Mobililty Assistant(s) ☐ Yes ☐ No

What Kind(s)_____

_____

_____

Caretaker(s) Name(s) and Responsibilities _____

_____

_____

_____

_____

How Clothing Is Washed _____

_____

_____

_____

_____

How is Clothing Stored _____

_____

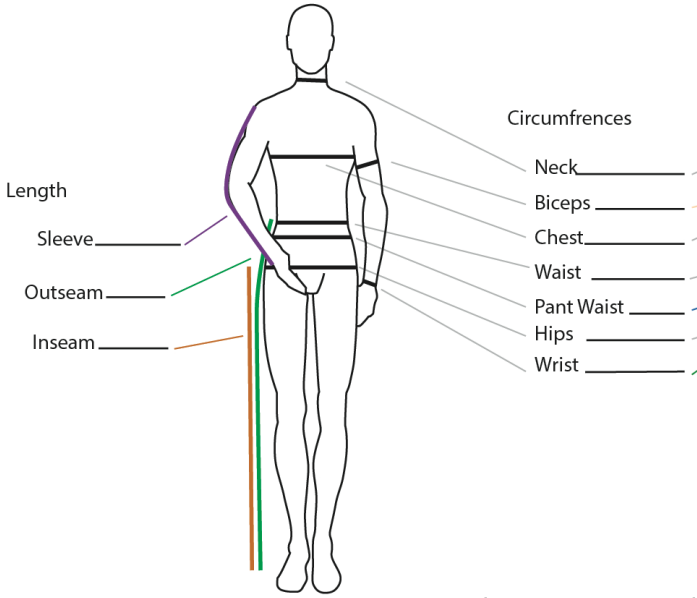
_____

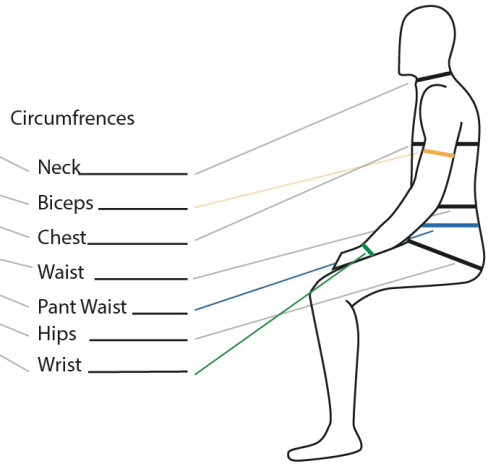
_____

_____

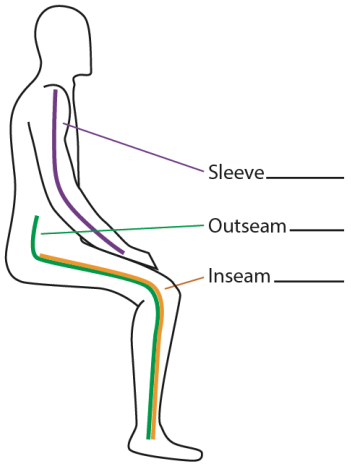
Measurements

Standing Measurements (only if participant is able)

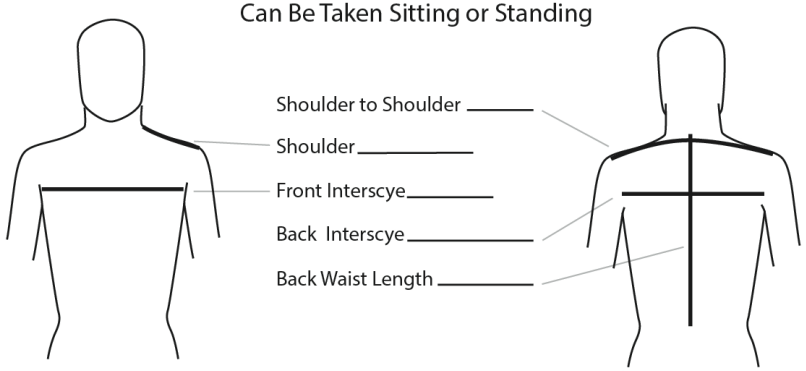




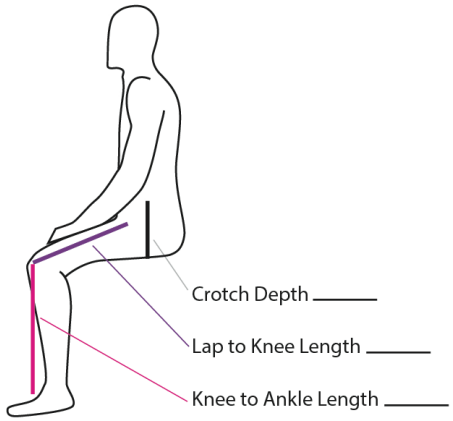
Sitting Measurements



Can Be Taken Sitting or Standing



Taken Sitting



Sizes

Pant_____ Shirt_____ Jacket_____ Shoe_____

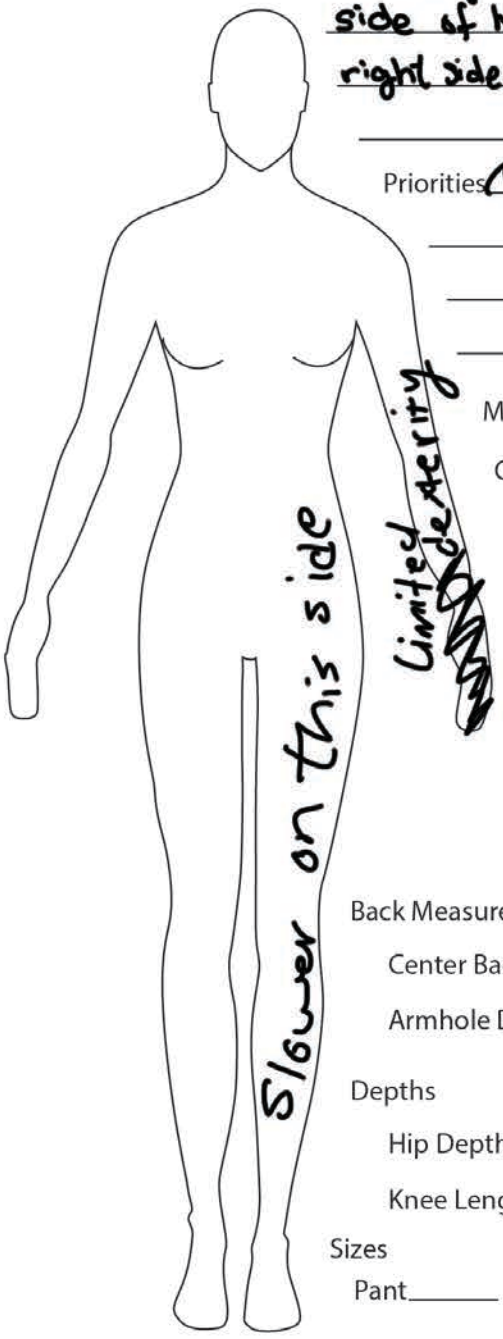
APPENDIX C – B DOCUMENTATION

Client Name B[redacted] Email [redacted] Phone [redacted]

Disability hemiplegic spastic cerebral palsy (mild on right side)

How it affects their ablity to move signals from brain slower to the right side of her body → Less grip in right hand, right side is slower, affects her ballance.

Priorities Pants → faster ease of use → better fit



Measurements

Height 5'5"

Circumfrences

Bust 32.5" Ankle 34"

Waist 27" Biceps 10"

Hips 37" Wrist 6"

Lengths

Shoulder 5" Front Shouder 15"

Front 15" Bust Point Length 9½"

Sleeve 24" Bust Point Width 8"

Back Measurements

Center Back Length 15" Back Shoulder Slope 15"

Armhole Depth 9" Back Shoulder Width 14"

Depths

Hip Depth 7" Crotch Depth 22" Crotch Length 22"

Knee Length 24" Ankle Length 34"

Sizes

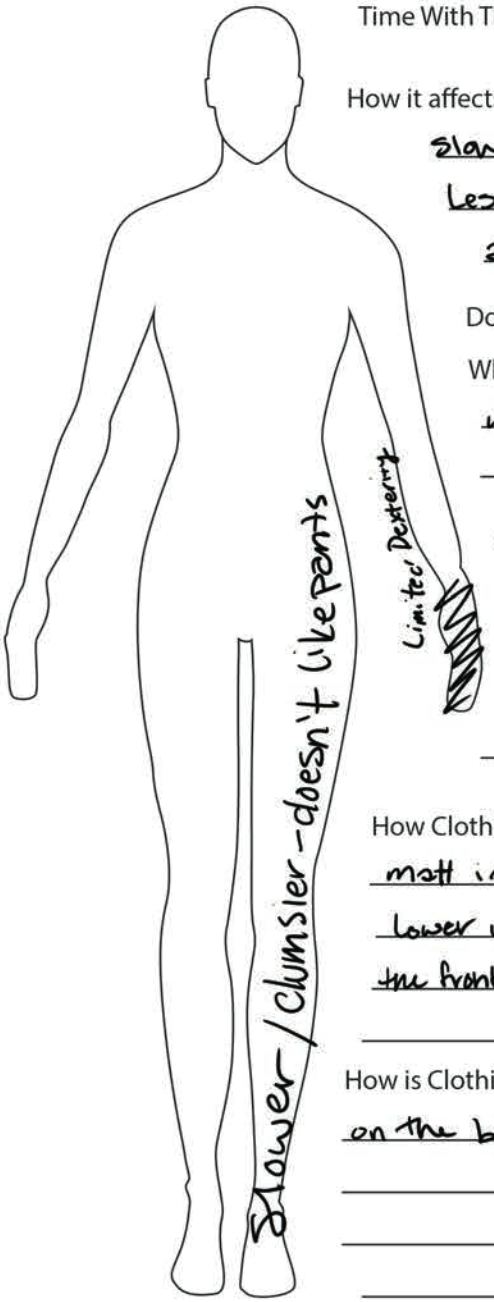
Pant____ Shirt____ Skirt____ Dress____ Shoe____

Participant Name B[redacted] Email [redacted] Phone [redacted]

Disability hemiplegic spastic cerebral palsy (mild on right side)

The Disability Is: ☐ Temporary ☑ Permanant ☐ Unsure

Time With The Disability: ☑ Whole Life ☐ _____ years



How it affects their ablity to move Signals from brain slower to the right side of her body. Less grip in right hand, right side is slower, affects her ballance.

Do They Have a Mobililty Assistant(s) ☑ Yes ☐ No

What Kind(s) walker to get around smaller places, but while at college she uses her motorized wheelchair

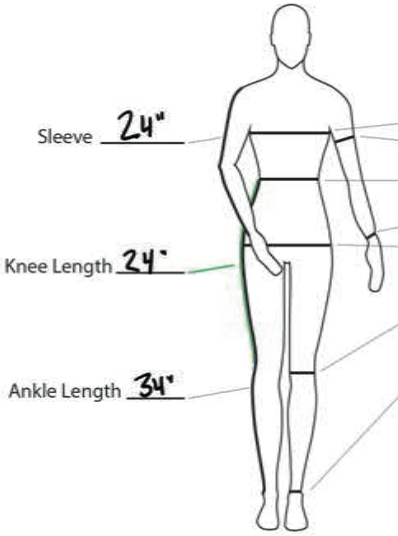
Caretaker(s) Name(s) and Responsibilities N/A

How Clothing Is Washed Takes it to her laundry matt in her apartment. Can only use the lower washers + dryers. Hooks her bag to the front of wheel chair.

How is Clothing Stored Stores her clothes hanging on the bottom wrung of her closet.

Measurements

Standing Measurements (only if participant is able)



Sleeve 24"

Knee Length 24"

Ankle Length 34"

Circumfrences

Bust 32.5"

Biceps 10"

Waist 27" / 29"

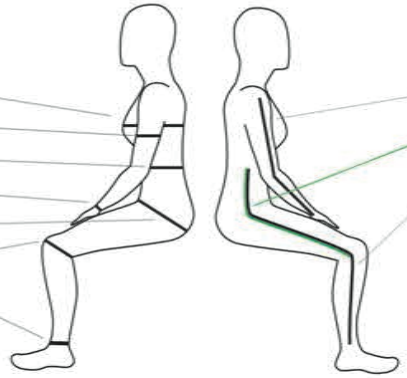
Wrist 6"

Hips 37" / 39"

Knee 14"

Ankle 9"

Sitting Measurements

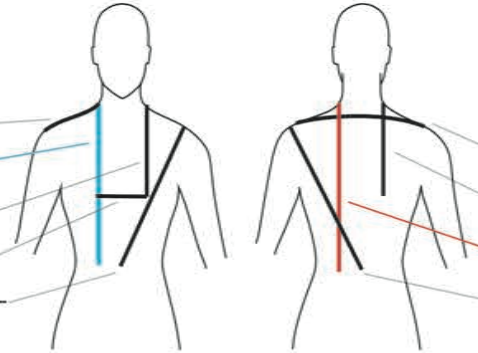


Sleeve 24"

Knee Length 29"

Ankle Length 34"

Can Be Taken Sitting or Standing



Front Measurements

Shoulder 5"

Front 15"

Bust Point Length 9½"

Bust Point Width 8"

Front Shouder Slope 15"

Back Measurements

Back Shoulder Width 14"

Armhole Depth 7"

Back Shoulder Slope 15"

Center Back Length 15"

Taken Sitting

Hip Depth 7"

Crotch Length 11"

Crotch Depth 22"

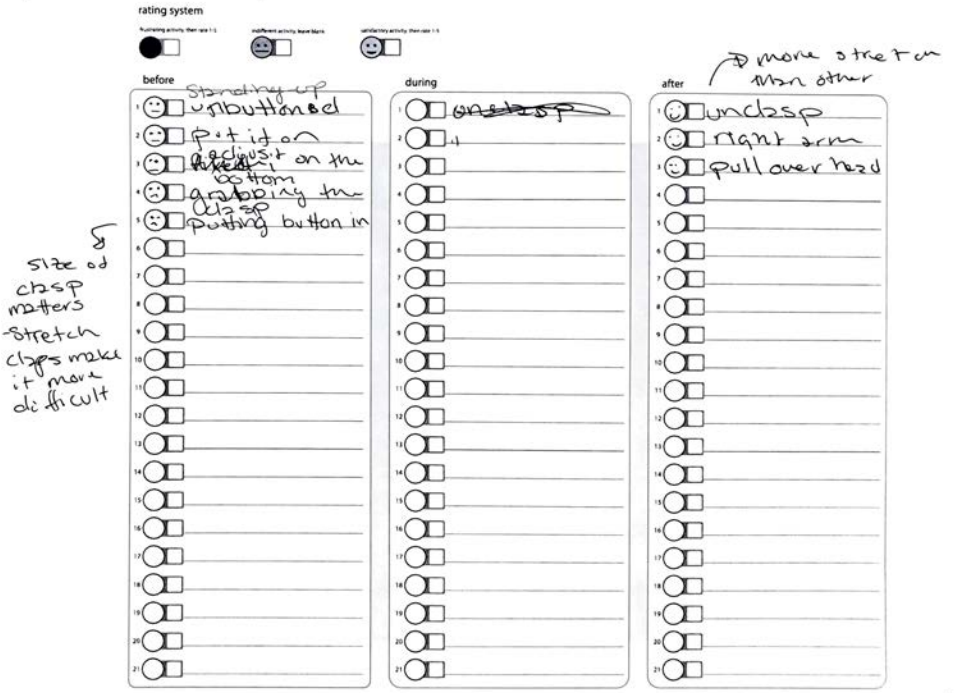
Lap to Knee Length 15.5"

Knee to Ankle Length 16.5"

Sizes

Pant_____ Shirt_____ Skirt_____ Dress_____ Shoe_____ Height 5'4

Black shirts Clasp on back → likes



Clothing Testing 1 for Subject B

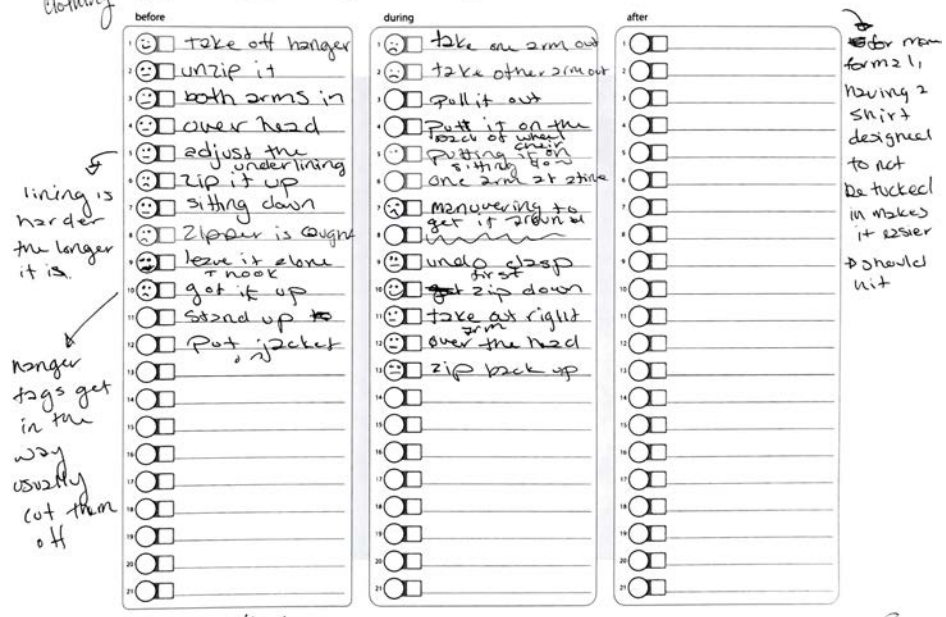
	identify relevant questions	before answer your questions	during answer your questions	after answer your questions
WHO	For example: - What stakeholders are involved in the activity? - How many are involved? - Are they big or small, old or young, other relevant info?	- subject 1 - ~~Young~~ 20 something female w/ spastic hemiplegic cerebral palsey/mild effects on the right side		
WHERE	For example: - What are the locations in which the activity is performed? - Is it done in an interior or exterior? - Is it done in a place with comfortable climate, or is it raining, snowing, or too hot?	subject#1's apartment, inside - comfortable climate		
HOW	For example: - Is the activity simple or complex? Is it easy, hard, or very hard to accomplish? - Is the activity performed in a calm or stressful environment?	- depending on the item it varies in difficulty, but is performed in a calm environment		
WHEN	For example: - What time of day is the activity performed? - When does it start or end? - How often is it performed?	Beginning of day or end of Sometimes performed		

Shirt w/ side zipper on left side + clasp at top of zipper

one of most difficult item of clothing

rating system

w/ jacket → hits mid thigh →



for men formal, having a shirt designed to not be tucked in makes it easier

should hit

lining is harder the longer it is.

hanger tags get in the way usually cut them off

more effort to zip up than down

B

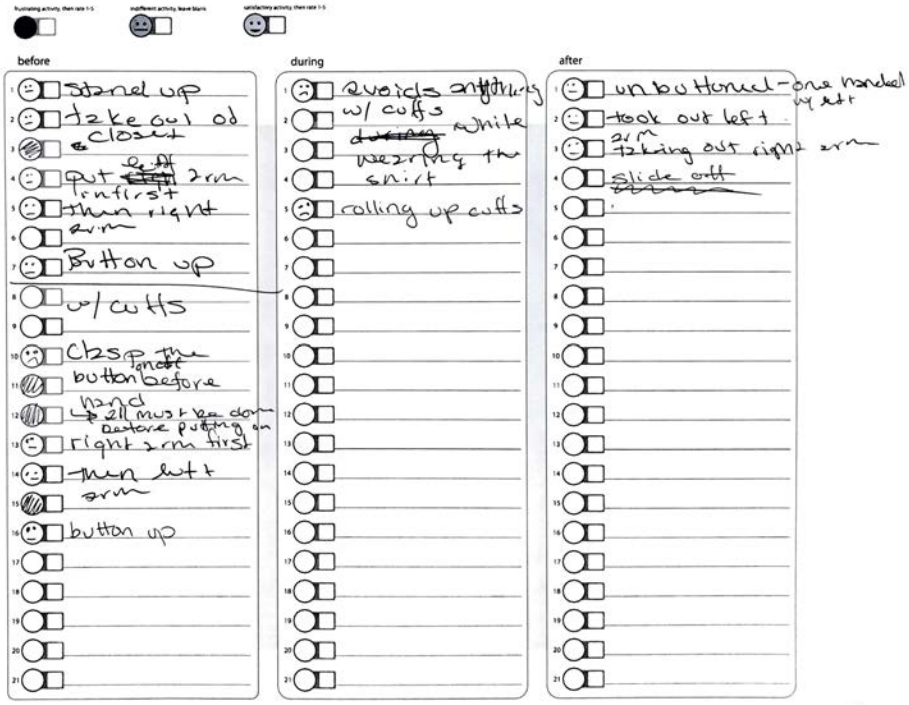
Jacket - Black w/ Gold belt buckle
- hits mid-thigh.

rating system

B

$ Purple Button up shirts / Black button up

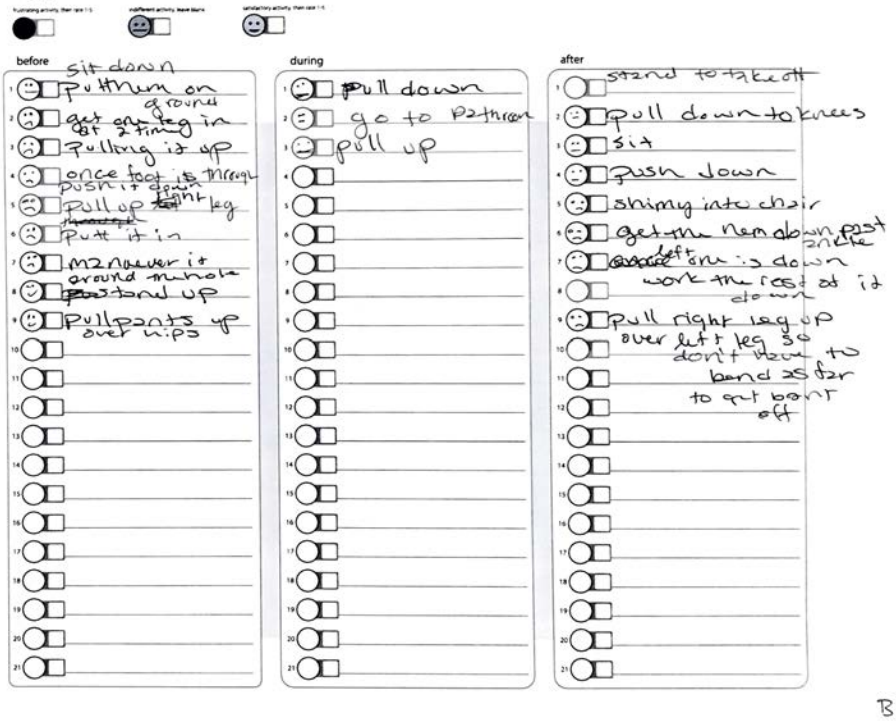
rating system



B

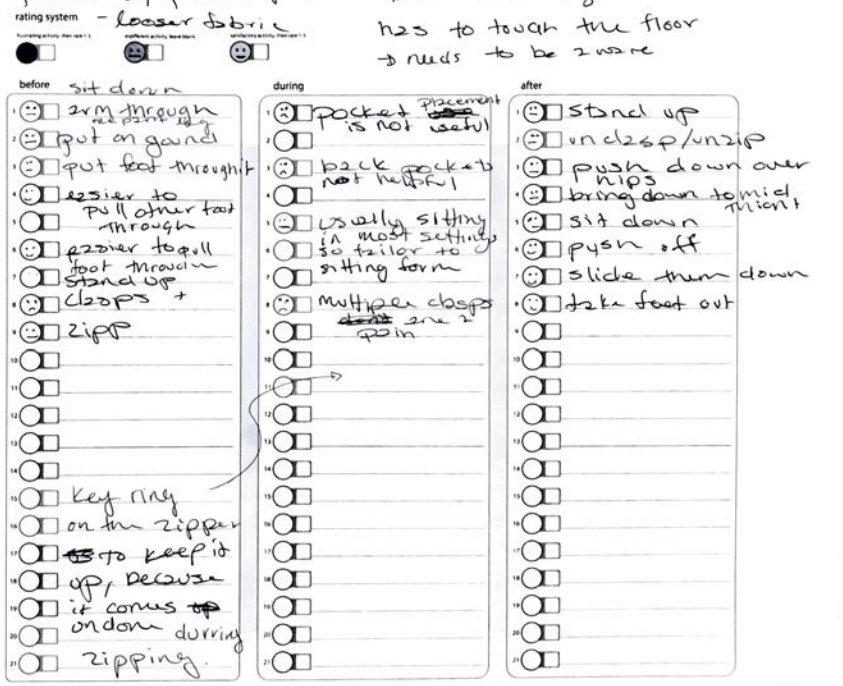
Black skinny pants with holes in knees.

rating system



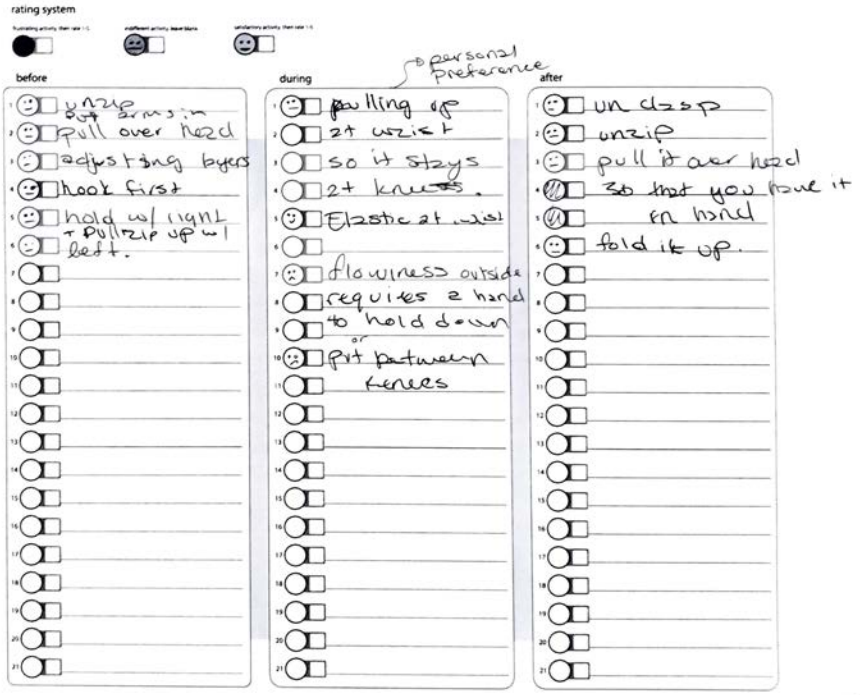
B

Press pants w/ pin stripes → because sitting down clothing has to touch the floor → needs to be 2 wore



B

Skirts → white



3

Black maxi dress w/ lining halway through
-cut on sides mid ~~[illegible]~~ calf.

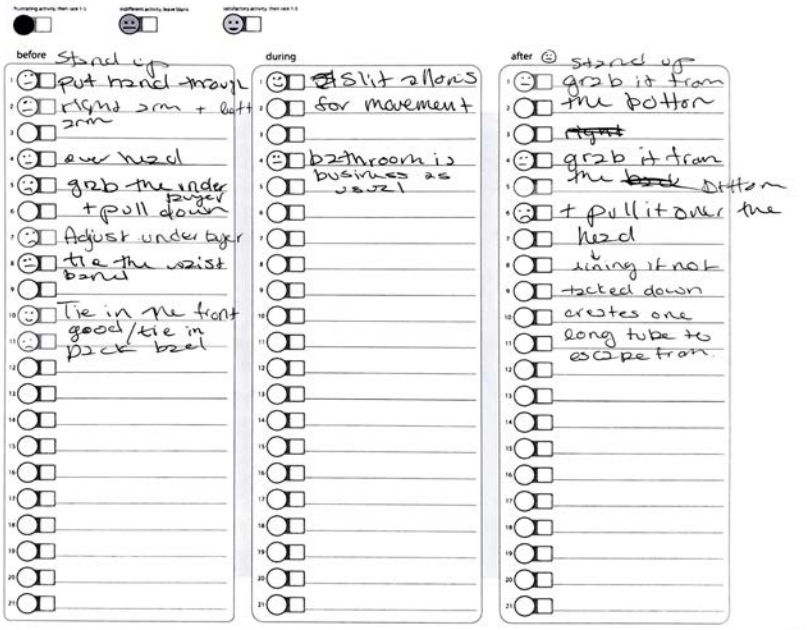
rating system

before	during	after
Stand up		Stand up
put hand through	slit allows	grab it from
right arm + left arm	for movement	the bottom
		~~right~~
over head	bathroom is	grab it from
grab the under layer	business as	the ~~back~~ bottom
+ pull down	usual	+ pull it over the
Adjust under layer		head
tie the waist		lining if not
band		tacked down
Tie in the front		creates one
good/tie in		long tube to
back bad		escape from.

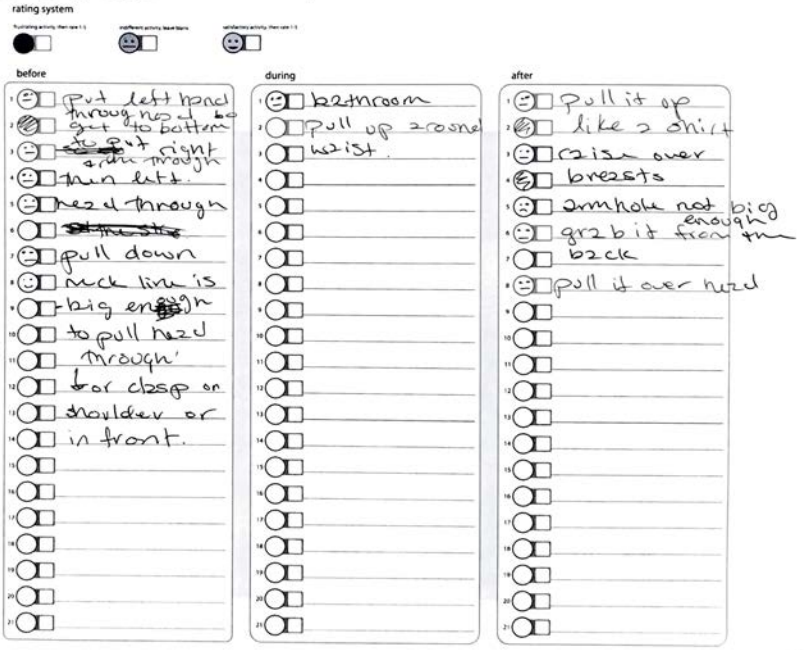
B

Black stretch sheath dress

rating system



before	during	after
put left hand	bathroom	pull it up
through head to	pull up around	like a shirt
get to bottom	waist.	raise over
to put right		breasts
arm through		armhole not big enough
then left.		grab it from the
head through		back
~~[illegible]~~		pull it over head
pull down		
neck line is		
big enough		
to pull head		
through		
or clasp on		
shoulder or		
in front.		

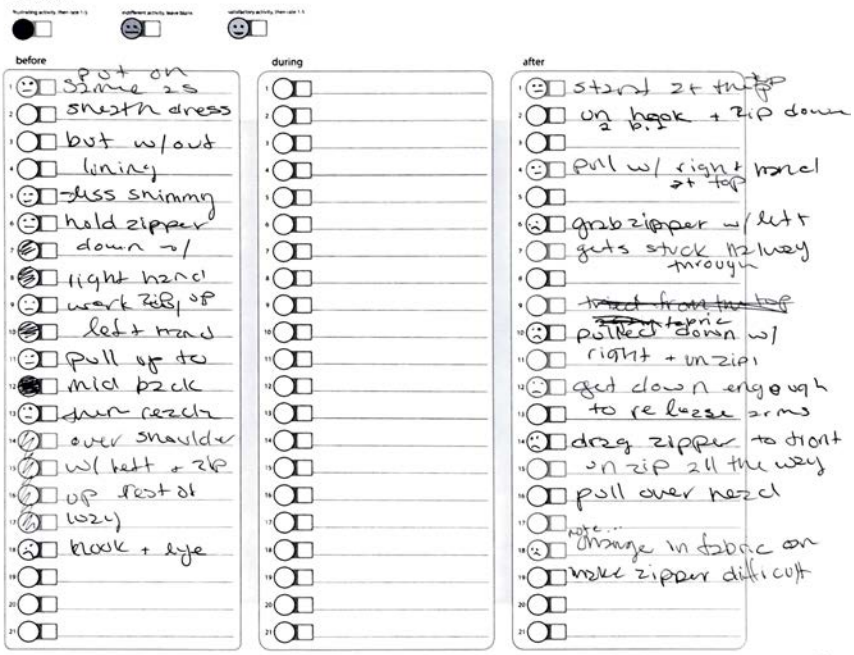


lining the same length can pull it down

B

Black dress w/ zipper

rating system

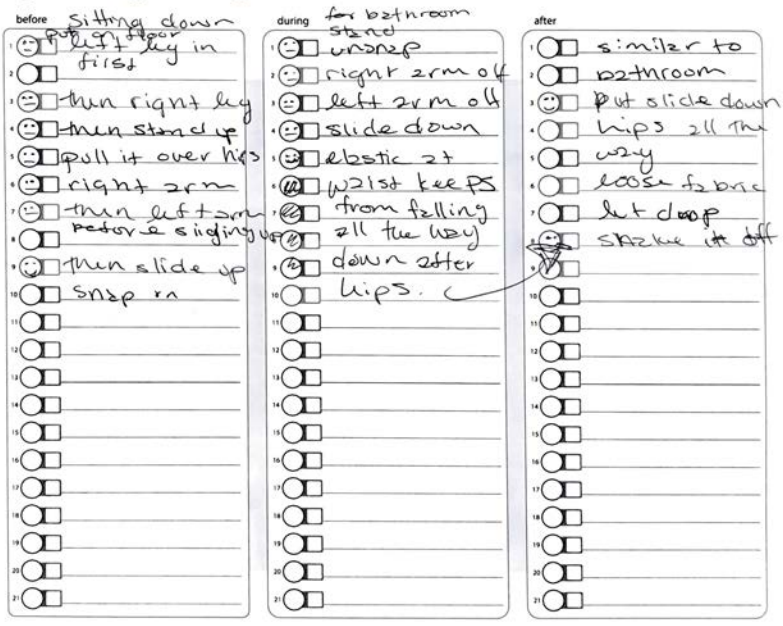


B

Black Romper → doesn't wear in public

rating system

→ 3 inch longer



B

Name [redacted] Article of Clothing Pant Prototype 1

☐ Pre-Made Clothing ☑ Prototype

Dressing

1. Open front zipper
2. Put right leg through
3. put left leg through
4. pull pants up rest of way
5. zipper + button
6. magnets aren't snapping together
7.
8.
9.
10.
11.
12.

Undressing

1. unzip + unbutton
2. pull pants down
3. let fall
4. toss off legs
5.
6.
7.
8.
9.
10.
11.
12.

Dressing Time 2:30 min

Undressing Time 1:02 min

Storage

Bathroom N/A

Washing

Works with Mobility Assistant

Notes → magnets should be sewn directly in pants
→ pocket at good height
→ waist isn't great need to reinforce center back seam

Name B[redacted] Article of Clothing Pant Prototype 2

☐ Pre-Made Clothing ☑ Prototype

Dressing

1. Unzip side zipper
2. unzip leg zippers
3. put right foot in pant leg
4. put left foot in pant leg
5. pull pants up
6. zip up side zipper
7. zip up leg sides
8.
9.
10.
11.
12.

Undressing

1. unzip the legs
2. unzip the side zipper
3. Push pants down 'til they fall
4. Toss pants off
5.
6.
7.
8.
9.
10.
11.
12.

Dressing Time 2min

Undressing Time 1:30

Storage

Bathroom N/A

Washing

Works with Mobility Assistant

Notes → likes the lower leg pocket but not front seam (they to keep it to turn out)
→ likes the seam at the knee better than the solid through.
→ likes 2 waist band better
→ still need to figure out the center back seam

Name B Article of Clothing Pant Prototype 3

☐ Pre-Made Clothing ☐ Prototype

Dressing

1. Unbutton *unzip Pant front zipper
2. put right foot in
3. Put left foot in
4. Pull pants up rest of the way
5. zip pants + button
6. magnets only going up half way.
7.
8.
9.
10.
11.
12.

Dressing Time 2:05

Undressing

1. unsnap magnets
2. un zip + un button front
3. Push pants down
4. Toss pants off
5.
6.
7.
8.
9.
10.
11.
12.

Undressing Time 1:31

Storage _____

Bathroom _____

Washing _____

Works with Mobility Assistant _____

Notes Center back was great! She loves it! Maybe for the magnets I should start them lower.

Name B

Article of Clothing Pant Prototype 4

☐ Pre-Made Clothing ☒ Prototype

Dressing

1. unzipps legs + fly
2. puts right leg in
3. puts left leg in
4. pulls up pants
5. zips + buttons waistband
6. zips legs
7.
8.
9.
10.
11.
12.

Undressing

1. unzips legs
2. unzips waistband
3. pulls pants down
4. tosses pants off
5.
6.
7.
8.
9.
10.
11.
12.

Dressing Time 2:30 min

Undressing Time 1 min

Storage

Bathroom

Washing

Works with Mobility Assistant

Notes The pocket needs to be moved down about 2 inches. The fit of the front is not better than the seam, but the center back is awesome!

Name B

Article of Clothing Pant Prototype 5

☐ Pre-Made Clothing ☒ Prototype

Dressing

1. unmagnet the legs
2. unzip + unbutton the waistband
3. put right leg in
4. put left leg in
5. pull pants up
6. button + zip waistband
7. adjust magnets
8.
9.
10.
11.
12.

Dressing Time 2:15min

Undressing

1. pull magnets in legs apart
2. unzips + unbuttons waistband
3. pushes pants down
4. tosses pants off
5.
6.
7.
8.
9.
10.
11.
12.

Undressing Time 45 sec

Storage

Bathroom

Washing

Works with Mobility Assistant

Notes It fits perfectly and the magnets worked great! Yay!

Name B

Article of Clothing Pant Prototype 6

☐ Pre-Made Clothing ☒ Prototype

Dressing

1. unzipps legs + fly
2. puts right leg in
3. puts left leg in
4. pulls up pants
5. zips + buttons waistband
6. zips legs
7.
8.
9.
10.
11.
12.

Undressing

1. unzips legs
2. unzips waistband
3. pulls pants down
4. tosses pants off
5.
6.
7.
8.
9.
10.
11.
12.

Dressing Time 2:25min

Undressing Time 1:15 min

Storage

Bathroom

Washing

Works with Mobility Assistant

Notes Fit is perfect! Also the valve pocket is perfectly placed

APPENDIX D – L DOCUMENTATION

Client Name [redacted] Email _____ Phone _____

Disability Stroke,

How it affects their ablity to move _____

Very little/no use of left arm move shoulder a little

Right Arm fine for most

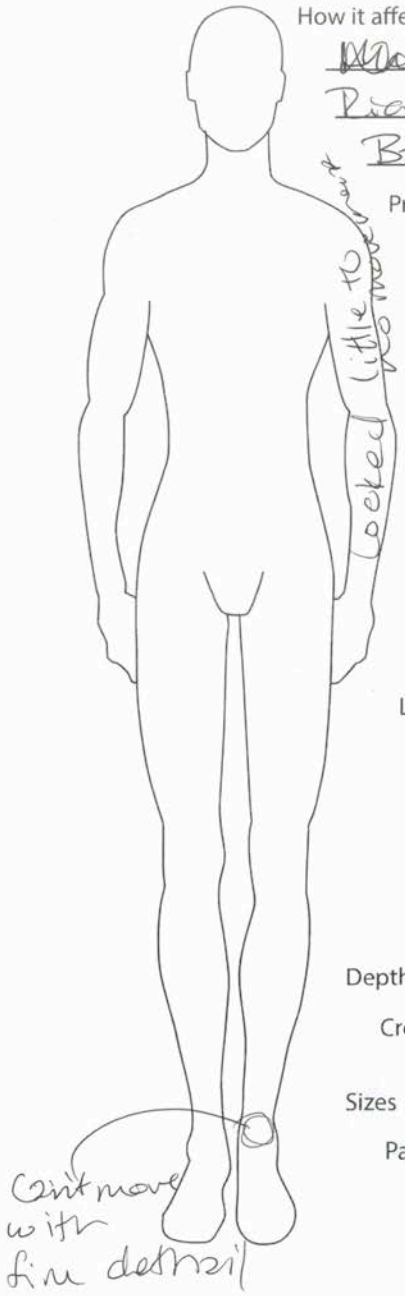
Balance, can walk w/ cane just under 2 min if need be

Priorities Independence, Comfort

Pants, knowing he can get dressed

Eliminating plumbers butt

Socks → Ankle are easier



Measurements

Height 5'11"

Circumfrences

Chest 46	Ankle 10	Neck 17
Waist 43	Biceps 13½	Pant 46
Hips 42	Wrist 7½	

Lengths

Front Interscye 15½	Shoulder ~~20~~ 7
Back Interscye 18½	Arm 26
Back Waist Length 66	Inseam 35
Shoulder to Shoulder 20	Outseam 43

Depths

Crotch Depth 0 Knee Length 29 Ankle Length 43

Sizes

Pant 40 or 42 Shirt XX 16½ or 17 Jacket 48R 42R Shoe 10 W EE

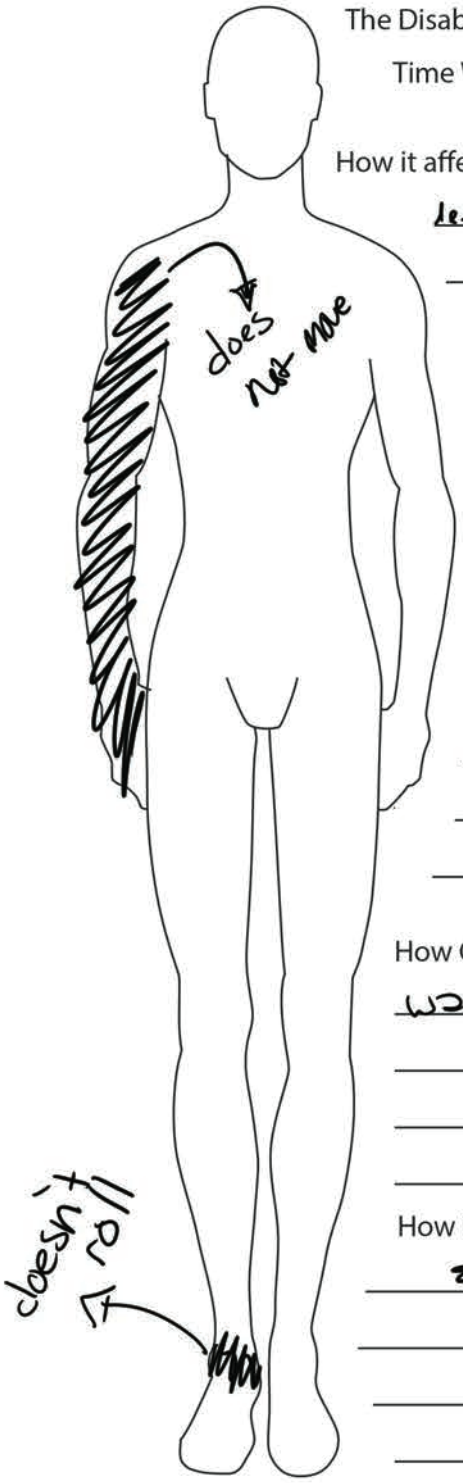
Participant Name [redacted] Email [redacted] Phone [redacted]

Disability Suffered a Stroke

The Disability Is: ☐ Temporary ☑ Permanant ☐ Unsure

Time With The Disability: ☐ Whole Life ☑ 2-3 years

How it affects their ablity to move Can't Move left arm at all, left ankle doesn't roll which is bad for balance.



Do They Have a Mobililty Assistant ☑ Yes ☐ No

He can walk + uses a cane for short periods of time but to go out he uses his motorized wheelchair

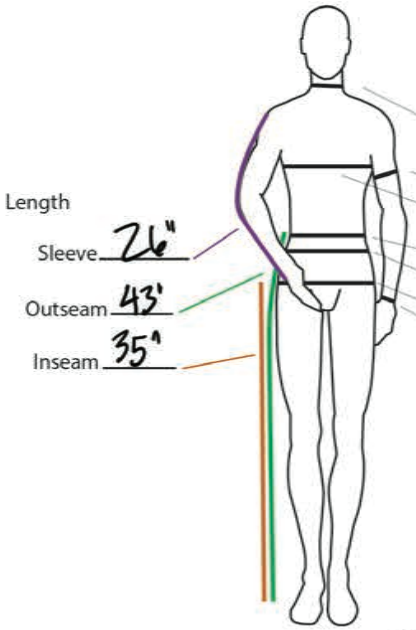
Caretaker(s) Name(s) and Responsibilities Jennifer - wife she is his care taker + helps him get dressed

How Clothing Is Washed Jennifer does all of the washing

How is Clothing Stored Jennifer does all of the storing of clothing

Measurements

Standing Measurements (only if participant is able)



Length

Sleeve 26"

Outseam 43"

Inseam 35"

Circumfrences

Neck 17"

Biceps 13½"

Chest 46"

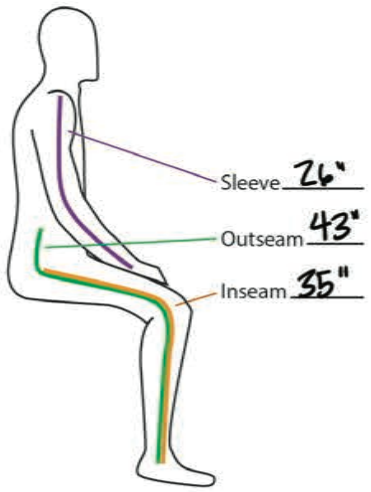
Waist 44"

Pant Waist 48"

Hips 42"

Wrist 7½"

Sitting Measurements

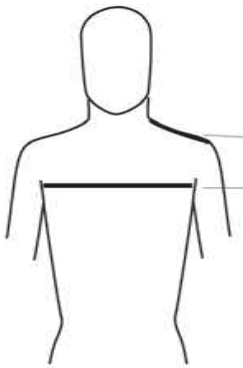


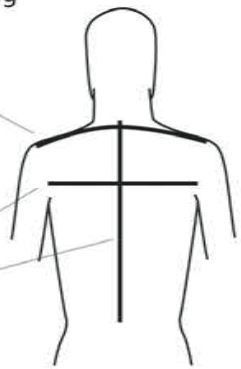
Sleeve 26"

Outseam 43"

Inseam 35"

Can Be Taken Sitting or Standing





Shoulder to Shoulder 20"

Shoulder 7"

Front Interscye 15½"

Back Interscye 18½"

Back Waist Length 17"

Taken Sitting

Crotch Depth 8"

Lap to Knee Length _____

Knee to Ankle Length _____

Sizes

Pant 40 or 42 Shirt XX or 16½ or L Jacket 48R Shoe 10

Name [redacted] Article of Clothing Coat

☒ Pre-Made Clothing ☐ Prototype

frustrating activity | indifferent activity | satisfactory activity | standing | sitting | leaning forward | needs assistance

Dressing	Undressing
1 Try to guide right hand in	1 Stand up
2 Stuff right hand in	2 Shrug out of right hand
3 Pull left through right	3 Shrug out of left hand
4 Arm hole + pull right through	4
5 Toss around head	5
6 Moves jacket around body	6
7 Straighten out	7
8	8
9	9
10	10
11	11
12	12

Dressing Time _____ Undressing Time _____

Storage _____

Bathroom _____

Washing _____

Works with Mobility Assistant _____

Notes Some stroke patients have their arms lock mummy style.

Name [redacted] Article of Clothing Dress Pants

☒ Pre-Made Clothing ☐ Prototype

frustrating activity | indifferent activity | satisfactory activity | standing | sitting | leaning down | needs assistance

Dressing

1. Left leg in
2. let drop
3. Put right leg in
4. holds chair
5. bends to grab pants
6. pulling pants up
7. Put clasp & zipper
8.
9.
10.
11.
12.

Undressing

1. unbuckle
2. unzip
3. let pants fall
4. right leg out
5. left leg out
6.
7.
8.
9.
10.
11.
12.

2 Not holding on to something

Dressing Time _____ Undressing Time _____

Storage _____

Bathroom toss pants off

Washing _____

Works with Mobility Assistant _____

Notes 2 buttons / 1 inside / 1 outside

Nam[redacted] Article of Clothing Dress Socks

☒Pre-Made Clothing ☐Prototype

frustrating activity | indifferent activity | satisfactory activity | standing | sitting | laying down | needs assistance

Dressing	Undressing
1 grab w/ teeth	1 pull shoe off
2 put left foot in	2 thumb in, pull off
3 Pull up flap	3 pull shoe off
4 right food on knee	4 thumbs in pull off
5 use teeth to place opening on hand	5
6 Place on foot	6
7 Pull up sock	7
8 Put foot down	8
9 foot up/ shoe on	9
10 foot up/ shoe on	10
11 use right hand to try + metatarsal	11
12	12

Dressing Time _____ Undressing Time _____

Storage _____

Bathroom _____

Washing _____

Works with Mobility Assistant _____

Notes use bungie cord for shoe laces

Name [redacted] Article of Clothing Jeans

☒ Pre-Made Clothing ☐ Prototype

Dressing	Undressing
1 Button Unbutton	1 Unbutton
2 Unzip w/ teeth	2 Unzip
3 Left leg first	3 drop jeans
4 Right leg in	4 right leg out
5 Grab jeans	5 left leg out
6 Pull up	6
7 Pull up the rest of the way	7
8 button + zip	8
9	9
10	10
11	11
12	12

Dressing Time _____ Undressing Time _____

Storage _____

Bathroom _____

Washing _____

Works with Mobility Assistant _____

Notes _____

Name [redacted] Article of Clothing Plaid Button Up

☒ Pre-Made Clothing ☐ Prototype

frustrating activity | indifferent activity | satisfactory activity | standing | sitting | bending down | needs assistance

Dressing	Undressing
1 Put collar in mouth	1 unbuttoning left handed
2 Try putting left arm in	2 right arm shrug off
3 But Right arm in	3 toss behind
4 Toss over head	4 peel off left arm
5 Straightens the shirt	5
6 Button up w/ right hand	6
7	7
8	8
9	9
10	10
11	11
12	12

Dressing Time _____ Undressing Time _____

Storage _____

Bathroom _____

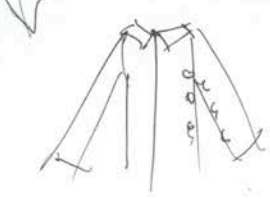
Washing _____

Works with Mobility Assistant _____

Notes Maybe, hanger that open cuffs are an issue

~~Pants~~ → inside ~~bottoms~~ ribbon / halve one color

shirt pockets are useful



Name [redacted] Article of Clothing T-Shirt.

☒ Pre-Made Clothing ☐ Prototype

frustrating activity | indifferent activity | satisfactory activity | standing | sitting | laying down | needs assistance

Dressing	Undressing
1 Put one side in ~~mouth~~	1 Pulling over head
2 Move left hand in	2 Pull off left arm
3 Move shirt up arm	3
4 Over head	4
5 Right arm through	5
6 ~~Get the~~ Adjust shirt	6
7 ~~Put~~ Get rid of bunching	7
8	8
9	9
10	10
11	11
12	12

Dressing Time _____ Undressing Time _____

Storage Wife picks out, but can go into drawers bottom shelf is difficult

Bathroom N/A

Washing ~~N/A~~

Works with Mobility Assistant

Notes

Name L

Article of Clothing PM Shirt 1

☑ Pre-Made Clothing ☑ Prototype

Dressing	Undressing
1 puts left arm in sleeve	1 pulls over his head
2 puts right arm in sleeve	2 pulls off left arm
3 pulls shirt over his head	3 pulls off right arm
4 straightens out the shirt	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12

Dressing Time 2 min

Undressing Time 45 sec

Storage

Bathroom

Washing

Works with Mobility Assistant

Notes Worked well, the fit prototype will need the front shortened. The magnets worked as intended!

Name [redacted] Article of Clothing Shirt PM Prototype

Very Satisfactory Activity 1 | Satisfactory Activity 2 | Indifferent Activity 3 | Frustrating Activity 4 | Very Frustrating Activity 5

standing | sitting | laying down | needs assistance

☑ Pre-Made Clothing ☑ Prototype

Dressing

1. (1) un magnet the back
2. (3) left arm through
3. (2) right arm through
4. (1) head through
5. (5) adjust → magnets not snapping into place
6.
7.
8.
9.
10.
11.
12.

Undressing

1. (2) Over the head
2. (1) right arm out
3. (1) left arm out.
4.
5.
6.
7.
8.
9.
10.
11.
12.

Dressing Time 3 min

Undressing Time 30 sec

Bathroom N/A

Notes Not continuing this one.

Drawn Notes

Name L Article of Clothing PM Shirt 3

☑ Pre-Made Clothing ☑ Prototype

Dressing	Undressing
1 puts right arm in sleeve	1 pulls over his head
2 pulls shirt over his head	2 pulls off left arm
3 straightens out the shirt	3 pulls off right arm
4 Magnets not	4
5 falling into place	5
6 They are sticking	6
7 to whatever magnet	7
8 is closest.	8
9	9
10	10
11	11
12	12

Dressing Time 5 min

Undressing Time 30 sec

Storage

Bathroom

Washing

Works with Mobility Assistant

Notes No go on this one. Magnets apparently need guidance and putting them along the whole seam won't give it enough.

Name [redacted] Article of Clothing Jeans PM Prototype 1

☐ Pre-Made Clothing ☑ Prototype

frustrating activity | indifferent activity | satisfactory activity | standing | sitting | laying down | needs assistance

Dressing

1	unbuckle overall buckle
2	left leg in
3	right leg in
4	places elastic over shoulders
5	pulls pants up rest of way
6	buttons overall button
7	tuck elastic away
8	
9	
10	
11	
12	

Undressing

1	unbuckle overall buckle
2	drop pants
3	shake pants off
4	
5	
6	
7	
8	
9	
10	
11	
12	

Dressing Time 2:30 min

Undressing Time 35 sec

Storage

Bathroom

Washing

Works with Mobility Assistant

Notes → don't need 2 rows of magnets, it just sticks to itself.
→ time to make the real deal w/ fit aspects.

Name L

Article of Clothing Jean PM Prototype 2

☑ Pre-Made Clothing ☑ Prototype

Dressing		Undressing	
1	unbuckle overall buckle	1	unbuckle overall buckle
2	left leg in	2	drop pants
3	right leg in	3	shake pants off
4	places ribbon over hands	4	
5	pulls pants up rest of way	5	
6	buttons overall button	6	
7	tuck ribbon away	7	
8		8	
9		9	
10		10	
11		11	
12		12	

Dressing Time 4 min

Undressing Time 30 sec

Storage

Bathroom

Washing

Works with Mobility Assistant

Notes Ribbon wasn't enough to hold up the pants, doesn't like the overall buckle facing the back.

Name L

Article of Clothing Shirt Prototype 1

Very Satisfactory Activity 1 | Satisfactory Activity 2 | Indifferent Activity 3 | Frustrating Activity 4 | Very Frustrating Activity 5

standing | sitting | laying down | needs assistance

☐ Pre-Made Clothing ☑ Prototype

Dressing

1. (2) put left arm in
2. (2) put right arm in
3. (1) pull over the head
4. (1) straighten out
5. ( )
6. ( )
7. ( )
8. ( )
9. ( )
10. ( )
11. ( )
12. ( )

Undressing

1. (1) Pull over head
2. (1) pull off left arm
3. (1) pull off right arm
4. ( )
5. ( )
6. ( )
7. ( )
8. ( )
9. ( )
10. ( )
11. ( )
12. ( )

Dressing Time 2min

Undressing Time 30 sec

Bathroom

N/A

Drawn Notes

Notes It looks great!

Name L

Article of Clothing Jean Prototype 1

Very Satisfactory Activity (1) | Satisfactory Activity (2) | Indifferent Activity (3) | Frustrating Activity (4) | Very Frustrating Activity (5)

standing | sitting | laying down | needs assistance

☐ Pre-Made Clothing ☑ Prototype

Dressing

1	2	Unbuckle overall buckle
2	3	left foot in
3	3	right foot in
4	2	place elastic over the shoulders
5	1	adjust pants at hips
6	1	buckle overall buckle
7		
8		
9		
10		
11		
12		

Undressing

1	1	unbuckle overall buckle
2	1	let pants drop
3	1	kick pants off
4		
5		
6		
7		
8		
9		
10		
11		
12		

Dressing Time 2:13 min

Undressing Time 30 sec

Bathroom

Drawn Notes

Notes Fit looks great!
"Happy to be wearing jeans again!" ~L
→ Also super stoked about the pocket placement!
No help needed!