

Comfort for Female Trekkers

by

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Abstract

This thesis proposal investigated the comfort, safety, and ergonomic requirements of female-specific trekking gear. Trekking is a popular and rewarding leisure activity enjoyed by both men and women, but current products are lacking in adequate female-specific solutions. Current female-specific products are often only size-adjusted male products, but neglect all of other aspects that make female needs different from male needs. This thesis proposed an in-depth study of user interaction and functionality of existing trekking products using various methods of data collection, including literature review, interviews, contextual inquiries, and surveys. Analysis of this data was aimed at the experiences of users and increasing the comfort, safety and enjoyment in relation to where these products are being used and where concerns are present, including but not limited to load carriage, sleep, temperature and injury.

Keywords: comfort, safety, trekking, ergonomic, female.

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Chapter 1

Problem Definition

1 Problem Definition

This chapter discusses the problem definition that is being addressed through this thesis project. It will investigate the approach taken, key information needed, questions to be answered and discuss the social context, background, and history related to females trekking.

1.1 Problem Definition

This thesis proposal investigates the comfort, safety, and ergonomic requirements of female-specific trekking gear. Trekking is a popular and rewarding leisure activity enjoyed by both men and women, but current products are lacking in adequate female-specific solutions. Current female-specific products are often only size-adjusted male products, but neglect all of the other aspects that make female needs different from male needs. There are various factors that can contribute to comfort for women that differ from men. There are physiological differences in body temperature, body shapes/sizes, periods, body composition (muscle mass, body fat %) etc. In other cases, the feeling of comfort can differ in terms of ways of thinking. Comfort for some may mean that the individual feels safe and confident. Unwanted attention can cause discomfort when alone or in groups, or the feeling of confidence can make all the difference in how comfort is perceived throughout the experience.

There are significant risks associated with the activity of camping and trekking for periods longer than 1 week in varying climates and times of year. These are very real and can in some cases prevent women from doing this activity to begin with, stop them earlier than intended from completing their goals, present problems and pressure from friends/family member which can be discouraging and cause doubt and fear. A significant percentage (22%) of women experience amenorrhea when on treks of extended periods of time, which can cause severe complications including fractures and loss of bone density which may be irreversible even after things return to normal. The challenges regarding temperature and sleep are important to address as well because sleep is important for recovery and preventing injury. There is need here for quality equipment

that allow women to feel safe and comfortable and help them to get outdoors in nature and accomplish rewarding outdoor experiences.

1.2 Investigative Approach Taken

Trekking is defined as “to go on a long arduous journey, typically on foot.” Information that will be gathered and analyzed during this thesis project will include the benefits and short comings of current products related to trekking, female specific gear and what that means within the industry, current trends within communities that participate in trekking for either recreational or professional purposes, as well as types of products that fit the users needs in these scenarios.

To develop a product solution to aid female trekkers, a variety of research methods were used. These included:

- Literature reviews
- Product benchmarking of existing products
- Interviews with experienced trekkers
- Survey about previous trekking experiences
- Experience mapping of current user experience with existing products

This investigative approach within the thesis project was aimed at answering the following questions:

- How might we increase comfort for female trekkers?
- How can the use of technology be combined within a physical product to address the user needs and improve the user’s trekking experience?
- What could the key features of this product be?
- How could this product encourage female participation with trekking?

1.3 Background/History/Social Context

Trekking is an outdoor activity that requires a physical exertion, and an extensive amount of walking. It can sometimes include climbing, hills, river crossings, and various weather conditions including rain, snow, storms, wind and heat. Typically, participants will sleep along their path of travel until they reach a destination. This can include sleeping bags, bivvy bags, tents or other means. All supplies need to be carried with the person, which is usually by means of a backpack. Trekking provides challenge, feeling of accomplishment, and allows people to explore and be physically active. There are proven benefits to humans to be in outside in nature, which increase the importance of accessible and comfortable trekking products.

Due to advancements in technology, there are increasing amounts of available products in the outdoor adventure industry with advanced materials and construction methods that allows for users to continue to have safer and more comfortable experiences with outdoor adventure trips. There is still large area for improvement to continue. A study of temperature limits on sleeping bags showed “traditional sleeping bags may be required to be re-designed to provide consumers both whole body comfort as well as local thermal comfort at feet/toes or users need to be made aware of the higher need for their insulation” (Lin et al., 2013). This is just one area among many, including weight carriage, weight distribution, injury prevention, weather protection etc. that show opportunity for advancement.

Among the technological advancements throughout history, there is also an obvious social change over time. A focus on equality is more prominent than ever, although there are areas that this still needs work and not everyone experiences this the same. Females statistically participate less in long trekking trips and “women are most likely to feel constrained--for instance, by personal safety concerns, inadequate facilities and information, insufficient funds, and outdoor pests” (Johnson, Bowker, & Cordell, 2001). This is an important issue that this thesis project will attempt to address by allowing and encouraging access to such outdoor adventures such as trekking.

The next chapter will discuss research methods used during this project and what research was found that was determined to be relevant to the thesis topic.

2 Research

This chapter will go into detail about what research methods were used during the design development stages and the findings of this research. This will give insight into what current products exist along with the features and benefits, as well as understanding user experiences. Some of the methods used will be user research, demographics, benchmarking and activity mapping.

2.1 User Research

2.1.1 User Profile

Demographics - Primary and Secondary Users

For this thesis project, there are primary users and secondary users. The primary users would be the females who are participating in the trekking activity for their own personal reasons and the secondary users could be professionals such as guides, researchers or rescuers who need the equipment.

Age: 20-60

Gender: Female

Income: Variable

Education level: 72% with bachelor's degree or higher

Geographic location: Continental climates to cold climate

User Persona

Name: Melissa

Age: 32

Job: Freelance artist and waitress

Education: Bachelor of arts

Location: Sweden

Hobbies: Trekking

Frequency: 1-2 months of the year

Duration: 1 week – 2 months

Social: Alone or in a group of 1-2 others

Other pursuits: Photography, working out

2.1.2 Current User Practice

Regular tasks

During the trek, regular tasks are those that are basic to survival and basic comfort functions. Right when the user wakes up, the tasks start. Depending on their eating habits they usually will need to wake up and eat. This involves getting water, and setting up the small portable gas burning stove. While waiting for the water to heat up, the tent and sleeping products can be packed during this time. Rolling of the sleeping bag, deflating of the inflatable sleeping pad and organizing clothing to be ready for packing in the bag. The bag can be repacked inside the tent. The tent can then be taken down, rolled up and attached or packed inside the backpack. When the food is ready, it can be eaten and then cleanup is required which involves either washing in a water source or rinsing with a bottle of water and the day can start.

Trekking begins after the take down of camp. Usually walking along the trail and following markers if the trail is marked. Walking and observing surrounding, while navigating and taking in the scenery. Stopping for a snack break or lunch break is part of the regular tasks. This involves taking of the backpack and getting out the food. Sometimes this can be cooked for or can just be cold in order to save time and cleanup.

After a solid day of trekking, the camp needs to be set up once again in order to sleep for the night. This involves unpacking the backpack and finding the tent. It is set up with pegs and set on even and flat ground. The rest is set up inside the tent, unrolling the sleeping bag, and inflating the sleeping pad by blowing into the valve. Other items can be unpacked from the bag in order to sleep or to use comfort items. Often the user will need to wash and cleanup. This can be done with products brought from home like wet wipes, or using an outside water source with soap and a towel.

Non-routine Tasks

Non routine tasks include things like taking photos, going off trail, encountering wildlife and emergency situations. Things for the users own comfort or enjoyment that is not critical to surviving on the trail would be considered for this section. Some of these tasking involves unpacking and repacking the backpack in order to access any gear needed, or involve leaving the bag behind all together and walking to explore other area unrestricted.

Emergencies and wildlife encounter require quick reaction and proper use of equipment in order to stay safe to help others stay safe. Emergencies such as personal injury is a large concern for many users. Staying aware of wildlife can prevent accidents and, in some cases, additional equipment may be needed in case of an attack.

2.1.3 Activity Mapping

Preliminary Video Scoping

Source: https://www.youtube.com/watch?v=b-QO_CDfb3Q

This video begins with a woman as she starts her 440 km journey through northern Sweden. This is a first-person video, and it follows her through each day. The first night she talks in her tent as it is very windy and she tries to sleep. The next day she continues to walk and stops to take a swim in a small lake. She gets very cold and gets dressed again. She stops at mountain huts along the way but stays in a tent every night. She is emotional on day four, where she describes her homesickness but is confused because she is meeting great people and seeing beautiful things. The toilets she passes are essentially just holes in a plank of wood which go into the ground. People that she has met walk with her for a bit, and they pick and eat berries. As she continues, she needs to cross a few rivers and uses a rowboat. The weather throughout is windy, rainy, cold, and foggy, as well as some clear days too. She gets cold and very wet for a few days. One night she struggles to find a camping spot and is stressed because it might get dark soon, and she wants to avoid setting up at night. At one point, she gets lost because there is a reindeer fence in the way, so she crawls underneath it. She can also be seen cooking and eating throughout the video and filling up water in the streams. On the final day, she reaches the end of the trail and celebrates.

Video Observation

Four key activities can be identified in the video. These are: hiking while carrying all gear, setting up/taking down camp, cooking/eating, and sleeping. Some challenges with this can be seen, such as the ergonomics of the gear she is wearing and how much she needs to walk each day as well as the way she needs to set up and take down the tent. A lot of this activity is done close to the ground and involves crouching, bending and pressure on knees. While cooking and eating, it involves waiting time and weather conditions. She speaks about sleeping and having trouble with that on some nights. She sleeps on a mat with a sleeping bag inside the tent. Some issues with this are that it can be uncomfortable and cold.

Direct User Observation

Chronology



Mikayla starts the packing process by gathering all the items she needs and packing the backpack with it laying face up on the ground. The pack is loaded from the front, and she stuffs the items inside in no specific order.



When she is done packing, she makes sure everything is pushed in and fitting properly and then zips up all the zippers.



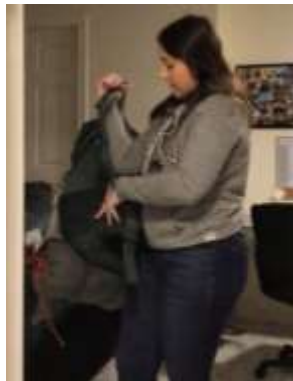
She still needs to add the tent, but it won't fit in the main pocket of the bag, so she brings it over to clip to the outside. There are two thin straps at the bottom of the bag with clips on the ends of the straps, which she loosens fully. She

positions the tent and then clips the straps in place.

She tries to tighten the straps, but it is difficult, and they are stiff. She struggles for a bit using her nails to try and loosen it up before she can tug it tight.



Once satisfied with the tent attached, she flips the bag up and clips in the top closure and pulls the straps tight. She performs all these actions while kneeling on the floor with her knees.



She stands up and pulls the bag with her by one of the straps. It looks slightly heavy as she uses momentum to bring the bag up off the ground.



She gets the one shoulder in the strap and then bends slightly to wiggle her arm on the other side. She uses her fingers to try and feel for the strap because she can't see where it is behind her.



She gets it on both shoulders and jumps up a little to make sure it is securely positioned on her as she gets ready to do up the additional straps.



She buckles up the hip straps first. She has to loosen them first to get them clipped together, and then she tightens them, so it pulls the bag securely against her back.



Then she moved to the chest strap. Bending her chin down to see where the buckles should clip together, she bends her arms and fastens them. She then pulls on the straps to tighten it properly against the body.



To remove the bag, she bends her one arms and slides it from the back through to the front of the bag and uses that to push the one side away from her body. She shifts the weight to the opposite shoulder and lets the bag fall onto that side.



She does the same with the other arm and lets the bag fall down the last arm. She grabs the other side with her first arm and the top strap with the last arm to lower it to the ground as she bends at the hips slightly until it touches the ground. She is now done\.

Organizing Data



- User is struggling with tightening straps
- A task that has to be done but is most challenging so far
- Has to kneel, hard on knees



- Picking up the bag is a large part of where ergonomics can be analyzed as it put the body in an awkward position.
- Puts stress on the arms and backpack

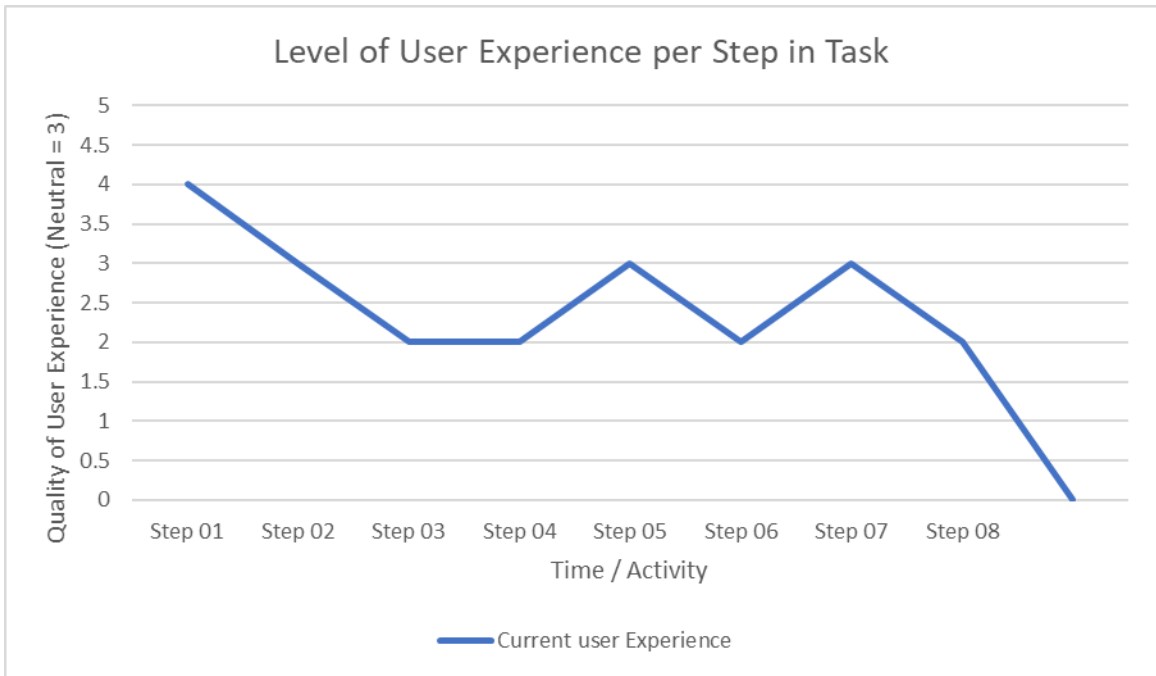


- Uncomfortable neck position
- Arms are in an unnatural position

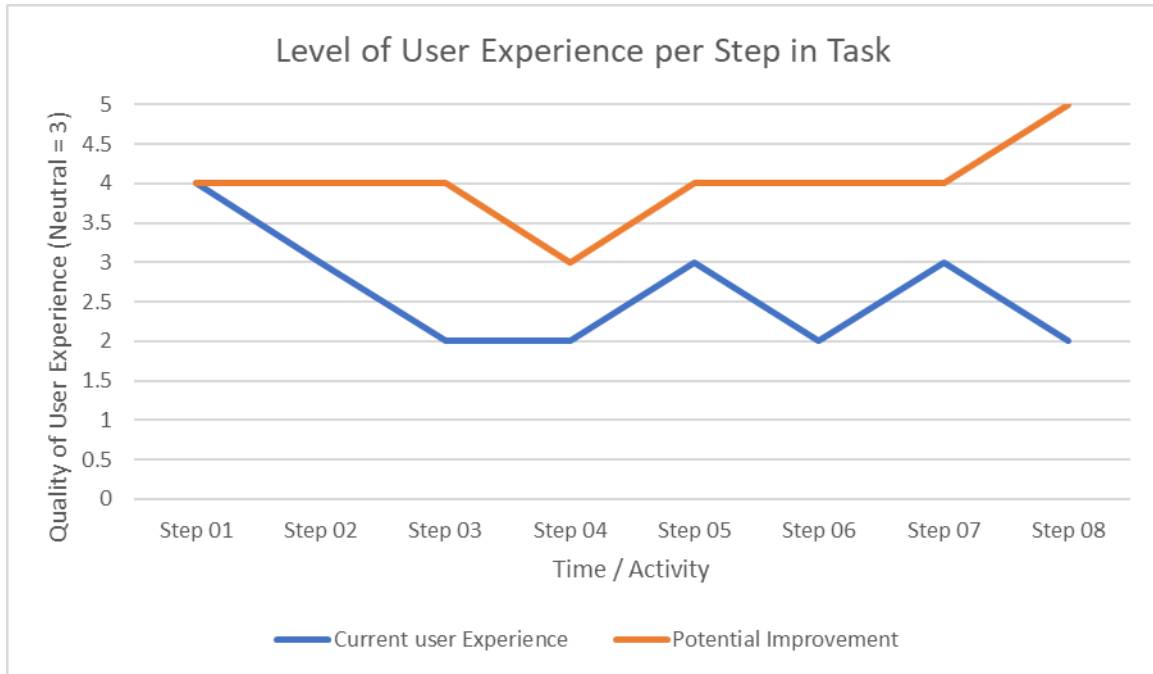
User Experience Map

Task: Packing backpack		
Step #	Description	Gradient Scale of Pain – Pleasure Points
		Negative = 1; Neutral = 3; Positive = 5
		1 2 3 4 5
01	Packing items	○ ○ ○ ○ ⊖
02	Zippering up bag	○ ○ ○ ○ ○
03	Buckling tent straps	○ ○ ○ ○ ○
04	Tightening tent straps	○ ○ ○ ○ ○
05	Securing bag top	○ ○ ○ ○ ○

06	Putting on bag	○ ○ ○ ○ ○
07	Fastening bag to person	○ ○ ○ ○ ○
08	Taking off bag	○ ○ ○ ○ ○



Potential Experience Improvement Chart



During this observation, some of the most notable things to discuss were as follows. The user was kneeling on her knees continuously when packing the bag and was kneeling until she was done and ready to put on the bag. After she was done packing when she adjusted the straps, they were very tight, and she had to pick at them with her fingers, this was extremely uncomfortable and not ideal for someone trying to pack effectively. She then has to pull up off the ground, cause some awkward and uncomfortable positions for her back and arms. The same happened when putting the bag onto the other arm as well as taking the bag off. The amount of weight in the bag would also affect what stress is put on the joints. These factors are important because of the ergonomic evaluations that can be made from this information. Human factors are extremely important to the comfort and usability of a product. These stresses to the body are things that can be changed and used to improve existing designs or to create new ones.

2.1.4 Ergonomic Research

Some of the main points for ergonomic research in this area will be focused around the carrying of items and the process and experience around sleeping. The products used for carrying gear is the backpack. The main items used for sleep are the sleeping bag, a form of sleeping pad (inflatable or closed cell foam) and some type of tent (tent, bivvy, hammock).

2.1.5 Safety and Health Research

There are various health and safety issues in regards to outdoor equipment. The environment of use is often harsh and unpredictable, thus needing products that are reliable in use. Some safety testing in current outdoor products can include but is not limited to weight bearing tests, cold testing, waterproof testing and infield use and testing with users. Often included features in outdoor garments for safety are insulation, waterproofing, breathable materials, and durable materials. In hard goods, there can be impact tests, connectivity features, waterproofing and GPS features.

2.1.6 Interview Results

Objectives

This section will summarize and analyze two different interviews with female participants (see Appendix C) in trekking activities and provide primary research and a basis to start making connection between user experience and secondary research.

Method

The method used to obtain information was through semi structured interviews. One was conducted in person and the other was over the phone. The reason this method was chosen was to be able to go in depth about each user's personal experience and to be able to go further in depth about the user experience. Semi structured format allows the conversation to flow freely but still get to the point of what needs to be addressed.

Discussion

There were some key take away from the first interview. To start, Hailey put a big emphasis on the weather conditions and how it affected her and her experience, saying that she ended up complaining a lot about the rain and being wet. She mentioned that everything ended up being wet at some point and it took while for things to completely dry. This provided a challenge in order to stay comfortable. There was also a physical challenge associated with the terrain as well as the weather conditions. The steep inclines she mentions were hard for her, although less hard for her partner. She states that her backpack took a bit to get used to and that she fell multiple times. These could all be related, the fit of the pack, the weather, the terrain, and the physical

requirements to walk the trail. All of this mentioned will have an impact on each other and the overall experience of the trekker. She mentions being scared with a wildlife encounter, which was with an unknown animal. This also can relate to the people she encountered and the element of the unknown. In both scenarios she doesn't know what animal is there and if it poses a threat, and doesn't know what type of person she is going to encounter and if they pose a threat. This needs some further thought and exploration to see if there can be a significant connection made between this and relating it to fear of the unknown.

There were some key takeaways from the second interview with Lisa. First being that she had experience purchasing women specific products within the last couple years as well as back as long as 30 years and 15 years ago. There were some notable differences in what is available and the seemingly lack of innovation in regards to backpacks specifically as mentioned by Lisa. She goes into detail about how the packs fit her in the past compared to now, with only changes noticed in the sizing as she described. She also discussed the effect that her gear would have on her trip and the experience you have while using a well-fitting pack compared to a poorly fitting one. She brought attention to the fact that having ill-fitting and uncomfortable gear can lead to pain and can limit what you are able to do such as freedom to move around and the need to rest body parts more often. This can hinder the trip and make things much more difficult.

She also talks about sleep and came up with a solution of having something between your knees to alleviate pressure on your hips. Having a user come up with solutions can lead you to their pain points, which is where she addresses the sleep issues and her main concern of hip pain and shoulder pain. She believes there is a solution to be found where you can change the sleeping positions to be comfortable and fitting to more positions than just your back, which also comes with problems. She brings up issues around safety and that could prevent her from going on a solo trip, which is something she sees as beneficial to wellbeing. Her main concern seems to be with regards to people and not trusting their intentions, as well as feeling not physically capable of defense if she was to find herself in a dangerous situation.

Conclusions

This can use some further research and possibly a follow up with more specifics on what would potentially change the perception of safety and what would actually be effective for the user. These issues are all things that could prevent Hailey and Lisa from enjoying their trekking trip to

the fullest or it could potentially prevent them from going at all. These are important factors to consider when creating a product that will allow access to such activities and promote a safe way to participate and enjoy. Both interviewees could see the benefits that trekking provides and both have fears and considerations that would potentially prevent them from enjoying these benefits. More interviews and surveys will provide further insights into the mind and experiences of female trekkers.

2.2 Product Research

2.2.1 Current Products Profile

Benchmarked Products – Benefits and Features

Multiple products were evaluated for comparison against each other in terms of features and benefits to the user (see Appendix E). The two critical values that were determined were comfort and durability. The products compared included sleeping bags, sleeping suits, sleeping mats, heated garments and a bivvy bag.

Feature Comparison Table								
								
Temperature	R-value 2	Unknown	Unknown	6 Degrees C	Low, Med, high	Low, med, high setting	20 degrees	44 F
Padding	6.4cm	850 fill down	low	750 fill down	Low	low	low	Med
Power source	none	none	none	none	Cordless battery	Cordless battery	Cordless 12v battery	none
Size	183cm long	Unknown	84 inches	200x80 cm	S.m.l	s-3xl	Unknown	5'11-6'4
Coverage	Low	Med	High	Med	low	Med	Med	High
Manufacturing	simple	Med	Med	Med	Med	Complex	Complex	Med
Seasonal usage (1-4)	2-3	4	3	3	2	2	2	2
Versatility	Med	Med	High	Med	High	High	Med	Low
Weight	250g	451g	18 oz	630g	Unknown	Unknown	Unknown	Unknown

The promotional material evaluated showed common features and benefits among the benchmarked products.

Features	Benefits
Temperature rating	Safety/Comfort
Padding	Comfort
Durable materials	Health and Safety
Size/weight	Convenience

2.2.2 Functionality

With most products used by trekkers, the comfort and durability of the product is a main concern as shown by the benchmarked products. Although some products have to sacrifice one for the other, there could be a solution that combines elements from both into a well-rounded product. The benchmarked sleeping bags that are high on the comfort scale, use soft and light materials, that lend themselves to tears throughout its lifespan. The sleeping mats fall somewhere in the middle, by using more durable materials than the sleeping bags but materials that are not always resistant to punctures when inflated. Durability is most seen in the bivy bag and heated work jacket. The materials are tough and designed to be used in rough environments, although they are not necessarily considered to be most comfortable.



2.2.3 Benchmarking – Aesthetics and Semantics

“Product semantics should be concerned not with material objects as such, but with how they participate in human affairs” (Krippendorf, 1989). How the product will fit into life and how it can be part of interaction with humans is important to execute well. The benchmarked products show a variety of aesthetic qualities. Some are bright and cold while others are muted and have a more practical feel to them. The sleeping bags for example, have bright primary colours which are interesting to look at and would stand out within the natural environment. The garments and bivvy bag are neutral tones which would blend into the natural environment. For safety reasons, it may be beneficial to have bright colours in order to be seen in case of emergency. Colours have an effect on humans as well, often triggering emotional responses and creating connections with the products they own and are close with.

2.2.4 Benchmarking – Materials and Manufacturing

Most of the current products are made from soft comfortable materials when in contact with the skin and insulating materials within the layers or on the inside of the product. These are geared towards providing comfort and maintaining durability in use. Materials used in sleeping bags include a nylon shell, either down or synthetic down as a filler and a synthetic inner liner (see Appendix E). Inflatable sleeping mats often use a durable outer material and a foam core that is easily compressed when not in use. All of these items are either stitched together or using radio frequency welding techniques to seal the edges.

When it comes to outdoor clothing, typically users wear a base layer, an insulation layer and something to keep the inside layers dry. Current materials for base layers can vary between silk, wool and different synthetic materials like polyester and synthetic fleece. The importance of these materials is that they wick moisture away from the body as you sweat, which keeps you warmer. Materials like cotton should be avoided in any type of outdoor wear, as it absorbs sweat and traps it close to your body. (Montana Fish, Wildlife and Parks, n.d.) In cold conditions this can be dangerous. Common insulating materials used in jackets can include down, synthetic down, or a combination of layers of fleece or polyester. Outdoor jackets use more durable and weather proof materials for the outer most layer to keep the user protected and to add longevity to the garment. Typical outer shell materials can be variations of nylon and polyester or blends of other synthetics (The North Face, 2020).

Most of the current products are made from soft comfortable materials when in contact with the skin and insulating materials within the layers or on the inside of the product. These are geared towards providing comfort and maintaining durability in use. Materials used in sleeping bags include a nylon shell, either down or synthetic down as a filler and a synthetic inner liner (see Appendix E). Inflatable sleeping mats often use a durable outer material and a foam core that is easily compressed when not in use. All of these items are either stitched together or using radio frequency welding techniques to seal the edges.

2.2.5 Benchmarking – Sustainability

There is a big push in recent years for companies to produce sustainable and environmentally conscious products. This can range from ethically sourcing materials like down and initiative that ensure workers are paid livable wages. Materials in various clothing items are now advertised as using recycled materials such as plastic bottle to make new fibers, or offering a repair service for products to ensure longevity and limit the need to buy new items to replace damaged ones.

Patagonia is a leading outdoor clothing brand that is a leader in sustainable practices, with their repair program, use of recycled and reclaimed materials, and work with BLUESIGN standards to manage the impact they have on the environment (Patagonia, 2020). “Because the value chain of the textile industry and similar industries must be increasingly accountable, BLUESIGN inspires and equips brands, manufacturers and chemical suppliers with comprehensive sustainability solutions, so that the industry continuously fosters safer work environments, increasing levels of environmental responsibility, enhanced business value and deeper consumer trust.”

(BLUESIGN, 2020)

3 Analysis

The following chapter will analyze the user research and product research from chapter two, considering user needs, needs not met by current products, latent needs and categorization of these needs. Through activity mapping exploration this chapter will also analyze the functionality of this thesis project and discuss aesthetics to come to an overall product solution.

3.1 User Needs Analysis

3.1.1 Needs/Benefits not met by current Products

Identifying and understanding the User Needs is central to designing a quality product. Design, manufacture, marketing and distribution are all critical in terms of product success, but if the product does not meet most of the user needs, then its market success will be short lived.

Identifying user needs is not straightforward. Humans are influenced by a multitude of inputs, and which of those inputs sway a decision, or an experience, is complex. In the short term, ‘the buy decision’ is influenced by the product benefits. How those benefits influence fundamental needs of the user is longer term, and has multiple inputs. As a result, the connection between benefits and needs is not easily determined.

There are two main steps used in this study to determining the connection between benefits and needs.

1. Determining the benefits of products that bracket key characteristics of the thesis topic, yet are not too closely related as to bias the design solution.
2. Linking those benefits to fundamental human needs
3. Generating a Needs Statement based on those fundamental human needs.

There are a variety of trekking products available on the market, but most of them don’t address female specific ergonomics and fail to deliver on female needs. This can be seen with sleep equipment, where the hips and back are lacking support and with backpacks where many females feel they can’t fit a backpack comfortably.

This thesis will explore a comfort device for female trekkers which affords:

- 1) Security for the user
- 2) Basic needs of pleasure
- 3) Higher order needs

Specific needs to be considered include:

- Safety for the user based on ergonomic requirements
- Stable and reliable for one or two people
- Control over environment, easy to use, comfortable
- Sleep quality

3.1.2 Latent Needs

Latent needs are needs that are not as obvious and may be overlooked by those needs that are easily visible and addressed by other products. Maslow's hierarchy of needs can be used to identify some of the latent needs of the user. Camping is a purposeful activity (user accomplishment, connection to environment, **mastery**) based on fun (**leisure, excitement, shared fun**), efficiency (**autonomy, self-esteem**) and comfort afforded the user (**comfort and security**). Camping can also be a **social** activity, since most camping can involve interaction within a group or new individuals along the way. **Esteem** can be afforded by good styling/quality cues of the device. **Control** and **mastery** of the device is related to the performance (**effectiveness, ease and comfort**). (See Appendix A)



	<i>Benefit</i>	<i>Possible Corresponding Fundamental Human Needs (FHN)</i>	<i>Relationship between Benefits and FHN</i>
1	Comfort	Control, security, self-esteem (mastery)	strong
2	Style	Esteem, belonging, aesthetically pleasing	moderate
3	Efficiency	Accomplishment, autonomy, self-esteem	strong
4	Ease	Accomplishment, autonomy, protection, security, control, self-esteem (mastery)	strong
5	Fun	Leisure (excitement), Participation, Belonging (shared fun)	strong

Comfort in this context is making the experience of camping more enjoyable by the feeling of being safe, connection with the outdoor environment and freedom to explore with sense of safety and confidence. It includes the ability to be in control of the situation and reduce amount of risk associated with the activity, increasing the sense of safety and security.

Security is the major fundamental human need met. Does the user feel safe and in control of the experience.

Style is an important expression of individuality. What is considered by the group as stylish increases **self esteem**. It can be aesthetically pleasing and increase the connection to the product.

Efficiency is defined as the effort required to perform at a particular level. This is related to **control** the user has during the activity (**autonomy**). Camping offers feeling of accomplishment and through the product usage could directly relate to self esteem.

Ease is in many ways related to efficiency in terms for fundamental human needs (i.e. **control, autonomy**). How does the product offer security and control to the environment and the user?

Fun related to **leisure** ('travel' to new interesting environments) and **belonging** (**shared fun, participation** between female camper and the environment). How does the product offer excitement and increase the opportunity for sharing and connection between individuals?

3.1.3 Categorization of Needs

The needs of primary and secondary users are listed and categorized below.

Latent: Self-esteem, mastery, control, autonomy

Immediate: ease of use, comfort, interaction between user and environment

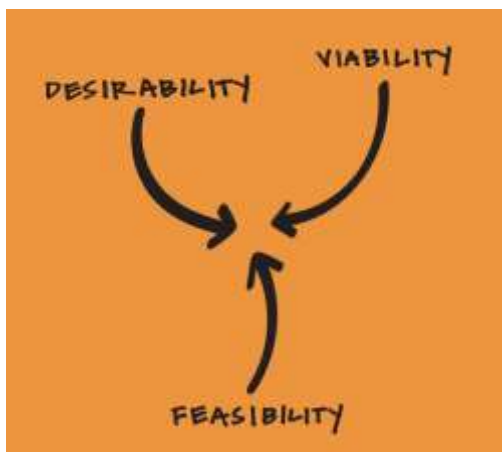
Wishes: to enjoy nature, to feel accomplished, to increase access to outdoor activities

Wants: to feel in control, to enjoy surroundings, to stay comfortable and safe

Categorizing these needs will allow for a strong direction to be established in this thesis project and create a solution that is essential for female trekkers.

3.1.4 Needs Analysis Diagram

Feasibility, viability and desirability must be covered by the design solution. Based on IDEO's human centered design innovation approach, the intersection of these elements is where innovation comes from.



1 Image IDEO Design Thinking <https://designthinking.ideo.com/>

Female specific trekking equipment is desirable because current products lack ergonomic consideration and don't address needs of comfort and the latent needs of female trekkers. Styling and aesthetics add desirability to the product and increase desirability to the user. Trekking is an activity for outdoor enthusiasts all over the world. The solution within this thesis could have the

potential to reach a global audience and increase its viability with this global reach. Technology and materials are constantly being improved and innovation in the textiles industry are changing. This increases the feasibility of the design solution and allows an opportunity for new technology to be used within the solution.

3.2 Functionality

3.2.1 Activity/Workflow Mapping

In section 2.1.3, the activity of packing, unpacking and putting on a backpack was performed by user Mikayla. Some key aspects of this observation were:

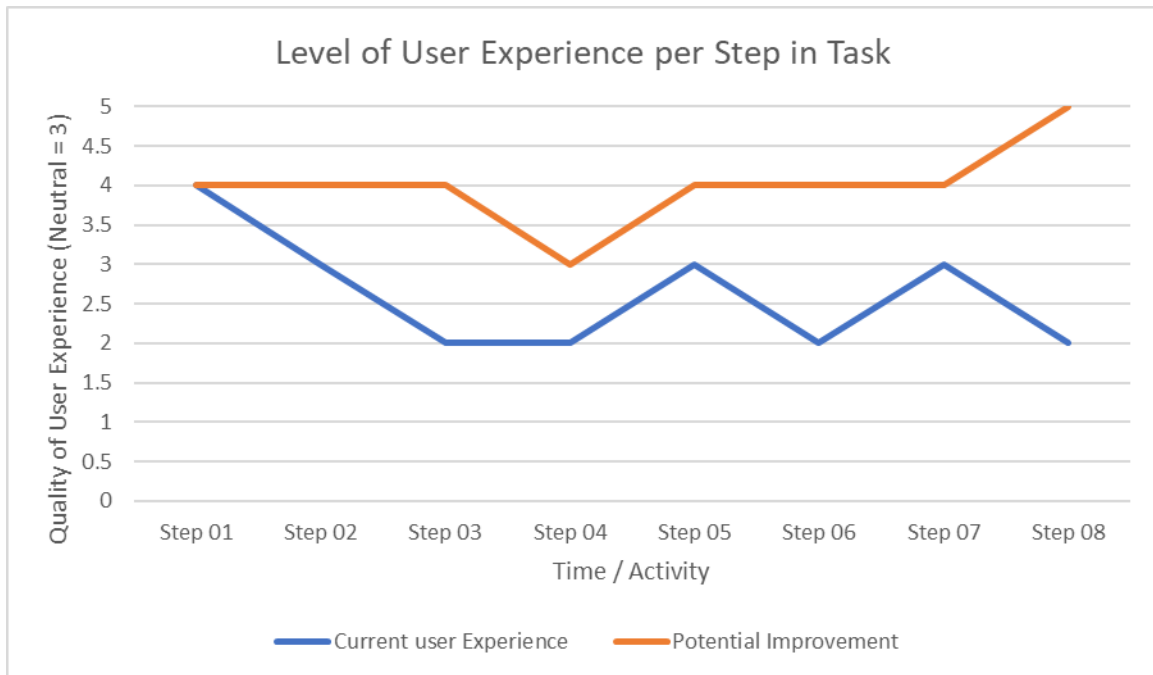
- Interaction with the backpack
 - Mikayla interacts with the straps to tighten and secure down compartments
 - Clips buckles into the corresponding male/female parts
 - Zippers close all open components

- Ergonomic pain points
 - Kneels on hard surface to pack and close bag
 - Has to pick at the buckles with finger nails to get enough length to tighten the straps
 - Lifting the bag from ground to shoulders is awkward and unnatural
 - Twists around in order to fit shoulder straps

- Ability to perform task
 - Completes the tasks
 - Uncomfortable and potentially cause strain with repeated use

- Time consuming with excessive straps and buckles to tighten
- Adjustability is awkward and time consuming

3.2.2 Activity Experience Mapping



To understand what the users experience is throughout the process in section 2.1.3, a user experience map is helpful. There is potential for improvement throughout the steps. Where it is uncomfortable to adjust all the straps and buckles during the packing phase, this can be remedied by creating a more specialized fit to the user and/or to the products being packed, eliminating the need for constant adjustments. As the activity continues, it is possible to improve where the backpack is lifted from the ground to the back, by either eliminating the need to use a backpack at all, reduce the weight that is carried in the backpack, or create a solution for picking the back up. At the end of the experience map, the potential for improvement is greatest. This is where the heavy pack is on the back and the user must continue to walk for an extended period of time. This can cause undue stress to the body. To improve this part of the experience, the need to carry the back at all can be removed or significantly reduce.

3.3 Usability

3.3.1 Introduction

This section explores ergonomic requirements of female trekking gear (a wearable garment with sleeping pads) through user interaction, use and functionality. Current options for female trekking gear are still limited and often doesn't suit all the needs that females require.

Ergonomics is important in an activity such as trekking, because of the major tole it takes on your body and the long days and weeks out on the trail. Current solutions include, tents, sleeping mats, sleeping bags, backpacks and outerwear. The goal of the evaluation process is to determine where stress to the body can be decreased during sleep outdoors, interaction with interface and overall wear ability and range of motion of the garment.

3.3.2 Literature Review

Dreyfuss uses his research on human factors in order to address “people’s needs for comfort and safety (which) are not being met” (Tilley & Henry Dreyfuss Associates., 2001) and this still needs to be considered when designing new products today. Many different sleep positions are used by different people, although most can be narrowed down to side, back and front sleepers. One study found that “participants spent 54.1% of TIB (time in bed) in the side position, 37.5% of TIB on the back, and 7.3% of TIB in the front position. Duration of nocturnal movements was 3.3% of TIB for the arm, 2.8% of TIB for the thigh, and 3.2% of TIB for the upper back. The average number of position shifts per hour was 1.6 during TIB” (Skarpsno, Mork, Nilsen, & Holtermann, 2017). There are current sleep diagnostic tools that are used to measure and record changes in sleep and sleep positions. One new proposition for sleep tracking suggests “a two-level classifier specialized for sleep motion based on Dynamic State Transition (DST)-framework. The DST-framework is designed to process the spatio-temporal sleep motion data collected via accelerometer/gyro sensing and classify twelve sleep position (SP) motions from four sleep positions” (Jeon, Park, Paul, Lee, & Son, 2019).

3.3.3 Methodology

The ergonomic evaluation and analysis of a current female trekkers was conducted with the following considerations:

Objective(s)

The objective was to evaluate and analyze the full-bodied human interaction design and ergonomics of a trekking garment and sleep wear. For this project, full bodied human interaction will include the torso, limbs and head/neck. This report goes through the methods of assessment for these areas.

Decision(s) to be made

The interactions between user and product with relevance to the three major body parts when using the garment were:

1. Sleeping positions in garment (Torso, limbs, head/neck)
2. Taking garment on/off (Limbs, head/neck)
3. Interaction with operation panel (hand and arms)

Description of Users Targeted by Product

The demographic for this project is females aged 20-65 who participate in overnight trekking trips. Individuals come from varying background, but are primarily able bodied and healthy enough to participate in the activity.

Evaluation process

The evaluation process consisted of designing a full scale (1:1) ergonomic buck of the garment layout that includes the sleeping function which allowed for critical observation of the following:

1. Observing how the user puts on and takes off the garment. (Ingress/Egress)
2. Observing how the user sleeps in different positions.
3. Observing how the user might interact with the operation panel.
4. Identifying critical areas where support is needed.

Description of User Observation Environment Used in this Study

For this study, the observation of the use of the garment was carried out indoors and on a flat hard surface to simulate the hard ground that may be slept on during a trekking trip. Key aspects were:

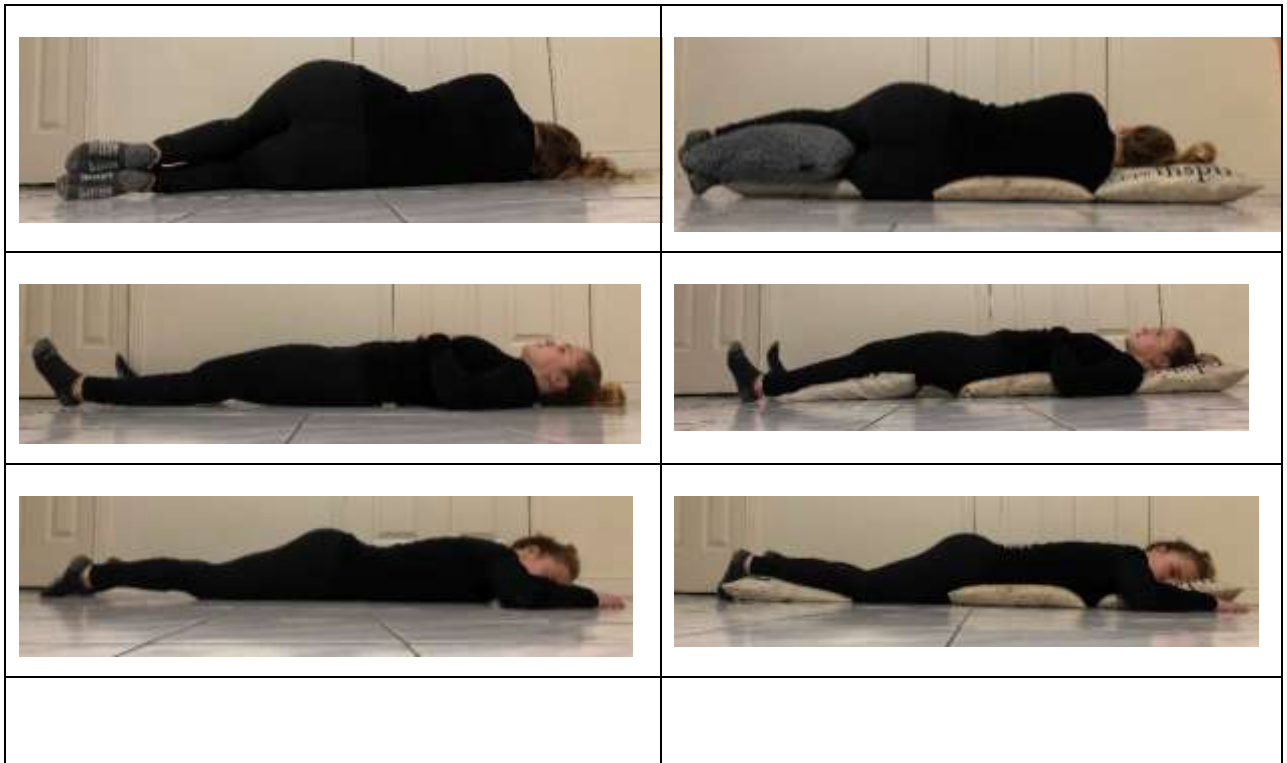
- Observing different sleep positions on hard surfaces
- Interaction with operation panel
- Putting on and removing garment

Location and Timeframe

Date of Observation(s): 01/02/20 (Observation 1)

Location of Observation(s): Home (Observation 1)

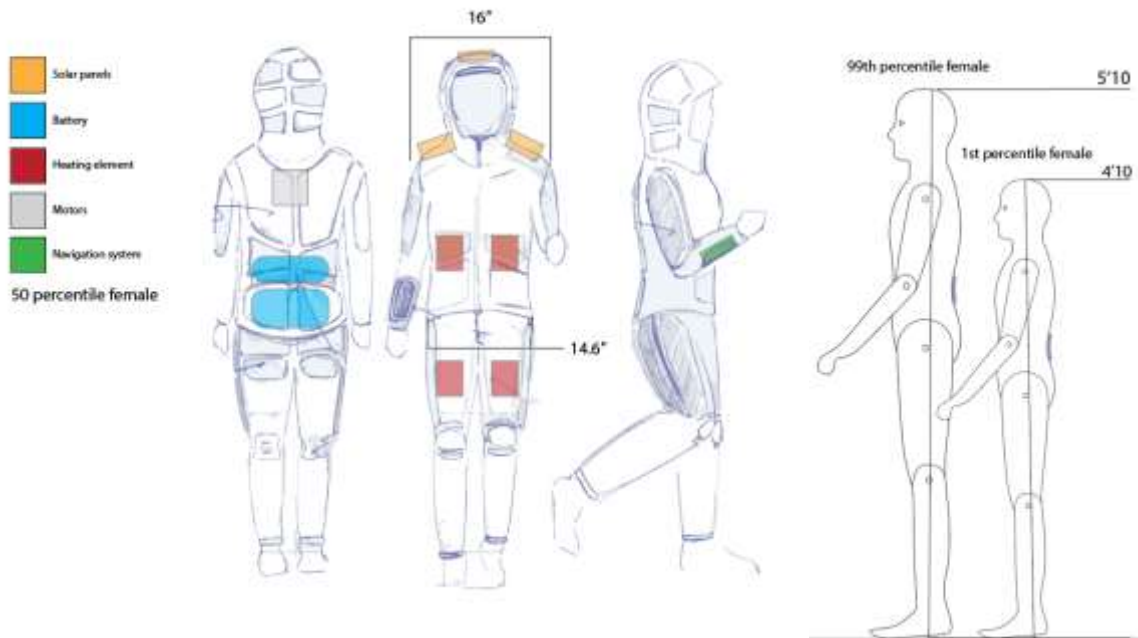
3.3.4 Results



The table illustrates the side back and front sleeping positions with and without additional support. All are on flat hard surfaces with a 50th percentile female.



The battery pack on the back is shaped to the back and flexible. The operation panel is placed on the arm in order to avoid unnecessary rotation to arms and comfortable neck position while looking at it.



3.3.5 Analysis

After completing the ergonomic assessment, it was clear that the sleeping positions without any support are not suitable and could be potentially dangerous for trekkers while out on a trip. The hips, shoulders and neck primarily take the most stress. Through experimentation, the best location for padding for side sleeping was determined to be under the head, mid back, under the legs, and between the legs. This elevates the hips from the ground and reduces stress on the spine and neck. For the back position, the best support was determined to be under the head/neck, lower back and under the clavicles. For the front sleepers, it is under the head and upper chest, hips and lower legs. The support will be provided by inflatable air pockets around the determined location on the body. There will need to be different sizes to accommodate all women. From xs-xl to cover a range of sizes from 1st to 99th percentile and with corresponding sizes of and location of inflatable sections.

As for the location and placement of the battery, it is placed on the lower back in order to be out of the way and prevent any restriction of movement. This would be the largest piece of required technology and can be concealed in that area successfully and inflatable section can be built around and on top of the area to prevent it from becoming uncomfortable to the user. The control

panel on the sleeve was tested and paced there to make viewing and interacting with it to be easiest on the eyes and hands.

3.3.6 Limitations and Conclusion

Identifying critical human dimensions affecting product use were as follows:

1. The user requires support for sleeping in the back, legs, arms and around the head and neck.
2. The user must be able to access the interface in any position.
3. the inflatable sections will need to be adjusted for different sized garments.

The study identified the major body areas that will be affected in different sleeping positions and placement of interactive touch points.

3.4 Aesthetics

Tom Kelley discusses the importance of connecting with the end user and creating an experience for them that is unique and personal. “There’s a value in maintaining human control and interaction, no matter the level of automation. Make sure that the people who use these new services have real, tangible interactions that enable them to fashion an experience or product they can call their own” (Kelley, 2005). After benchmarking and looking at the visual aesthetic of these existing products, there were some key elements that were observed.

Symbolism/Aesthetics

Outdoor and adventure gear has typically always been rugged and practical in appearance. With an importance of aesthetics being critical to the user’s self-esteem and feeling of mastery, can have the potential to change and be symbolic if the future. Lightness is a feeling that can be conveyed through style and form, as well as materials and manufacturing. To achieve a product that is attractive the female user and creates a connection in its everyday use is important to increase comfort for the female trekker.

Semantics (Style/Tech)

The technology that is available now and that will be available in the future is important to the development of this product and aids in what style directions can be pursued. Wearable technology and tracking is an element that is adaptable to many different configurations and styles. As seen in current products, the ability to place technology into different housings is vast and achievable.

Form Development

The form of this product will be largely based around the human body shape, as this needs to be close and formed to the body majority of the time during the trek. Female ergonomics will direct the form and basic measurements of the product which will ensure the most comfortable fit and optimal performance.

3.5 Sustainability- Safety, Health and Environment

The key differences in material choice for this thesis project versus what is readily available in today's outdoor equipment is the addition of smart textiles, displays, heat elements and renewable energy sources. Smart textiles are able to detect and relay information regarding the body's condition, allowing for the user to safely participate in what could potentially be a risky activity in certain conditions, as well as incorporating the added safety of keeping warm without the need to carry extra fuel or produce heat by body movements. The renewable energy from the sun is applied in this design as a safety feature to the user and as a sustainability element.

Harnessing the sun's power as the user walks for hours outside each day is used as a way for them to be self-sufficient for the entirety of their trip. The versatility of this design also encourages the purchase of only one garment to fit the needs of the user, rather than purchasing many different layers and garments that would be required for warmth otherwise.

3.6 Commercial Viability

The following section will address the material and manufacturing needs as well as costing to make this a commercially feasible design.

3.6.1 Materials and Manufacturing Selection

Materials used in current outdoor garment and gear are using existing technologies in new ways to make them more sustainable and/or more effective in outdoor use. Material using recycled

polymers are becoming more popular among mainstream brands, and things like biodegradable materials are also being seen to some extent. Materials and coating can be applied in ways to make garments waterproof, warmer, or more breathable. These are important to recognize as they all play a role in the comfort and effectiveness in the product.

The manufacturing methods used in this concept would be similar to current process. It would need to be sewn together for the main part, with the inflatable section using some kind of f welding to seal the edges and compartments. This is a common method used in manufacturing inflatable sleeping mats that could be applied easily to the process. The technological aspects (batteries, solar textiles, heat wiring, GPS) would need to be sourced from their unique suppliers, as they are quite innovative and in a unique niche.

3.6.2 Cost

Cost can be estimated by looking at existing products and what they cost to produce. These products would be outdoor jackets and pants, sleeping mats, battery packs, heating elements, GPS units and estimating the solar cell textile cost as it is not commercially available on a large scale.

3.7 Design Brief

A female specific trekking product solution that aids in comfort and safety in order to allow for enhanced outdoor trekking experiences is something that is lacking in the market. Some females feel they don't have the right products to allow them to participate in these activities. The solution will need to mitigate the ergonomic issue in current products. The criteria for the final product are as follows:

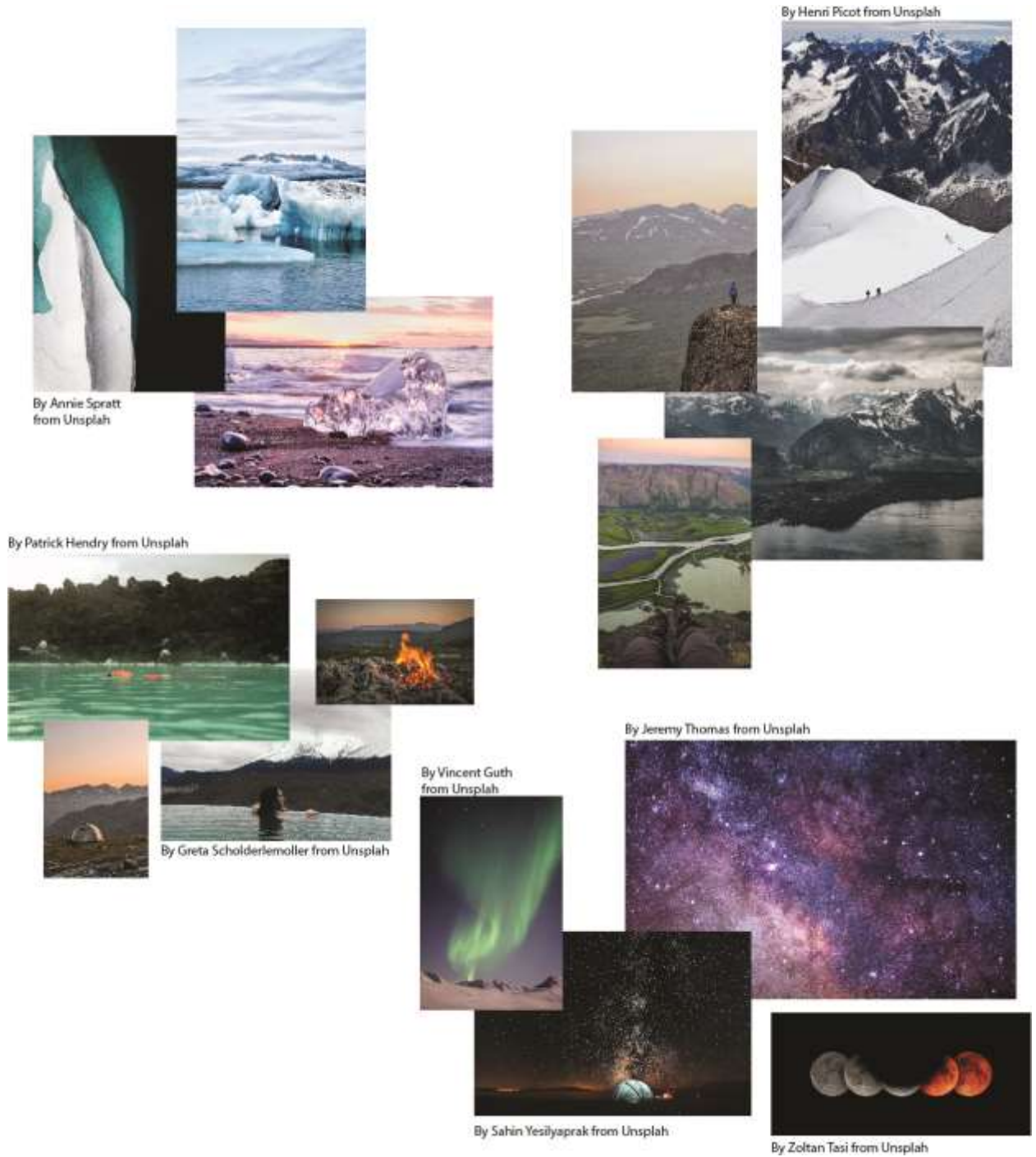
- Affords increased comfort to the user throughout entire trek
- Allows for connection with the surrounding environment
- Easier interaction between user and product
- Aesthetically pleasing for user
- Increases safety during trek

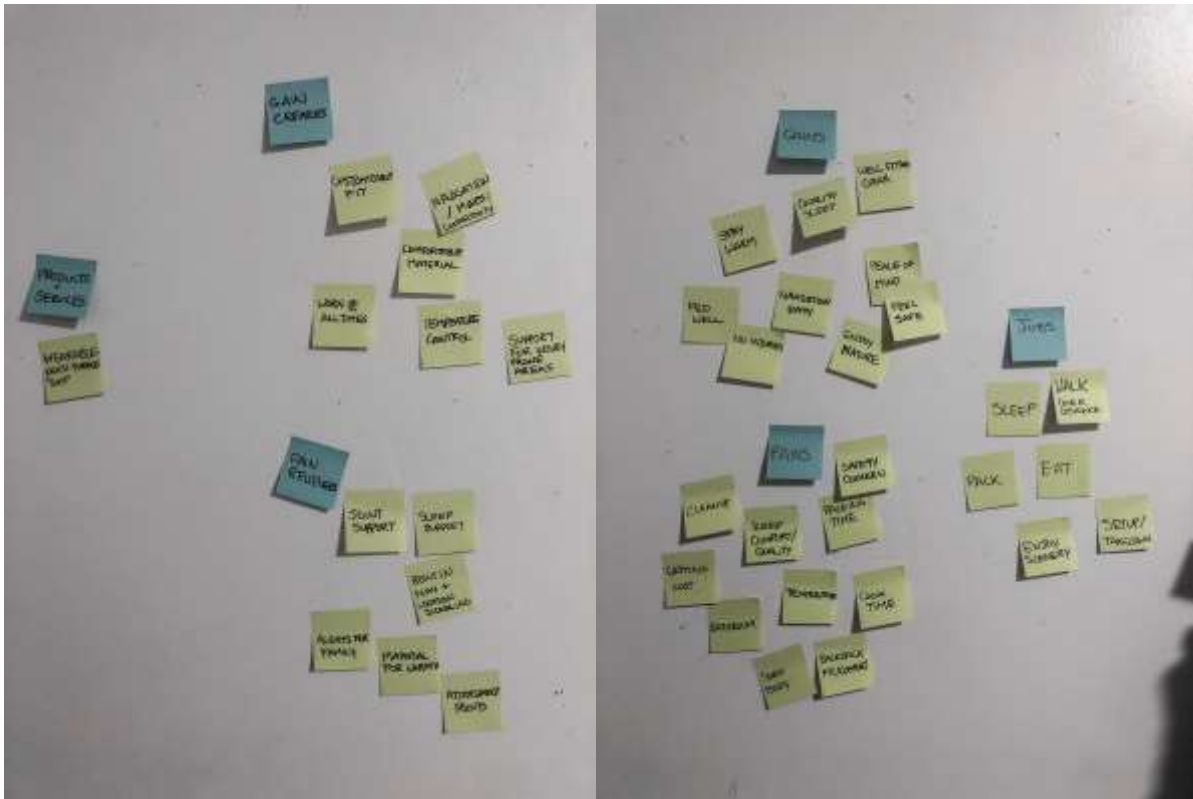
- Sustainable use of materials
- Improved ergonomics for female users
- Reduce the weight/need for load carriage using a traditional backpack
- Create a smoother journey from sleep to daily activities
- Reduce strain to body

4 Design Development

This Chapter will go over the design development process of the proposed concept that matches with the design brief and goes into detail about ideation, concept development, details and finalization of the design

4.1 Ideation



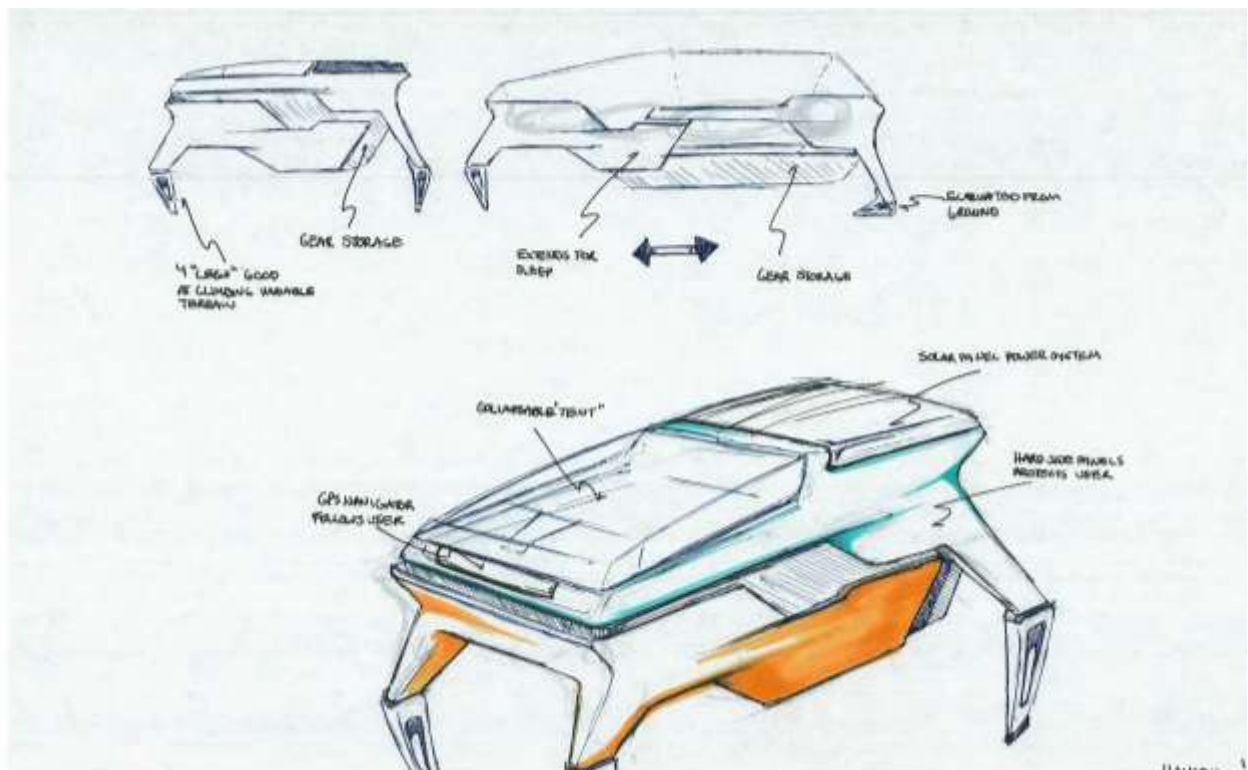


Ideation was inspired by the outdoors and what comfort might mean to someone. The mood board focuses on small warm oasis' in the form of hot springs as a metaphor for the goal of the garment which is to provide a safe and warm comfort solution in contrast to the harsh environment around it. The night sky also is inline with the goal of being able to sleep soundly with this product, and still be able to connect and experience the outdoors as closely as possible. The shape of glacial ice inspires shapes and forms that are organic and natural in essence.

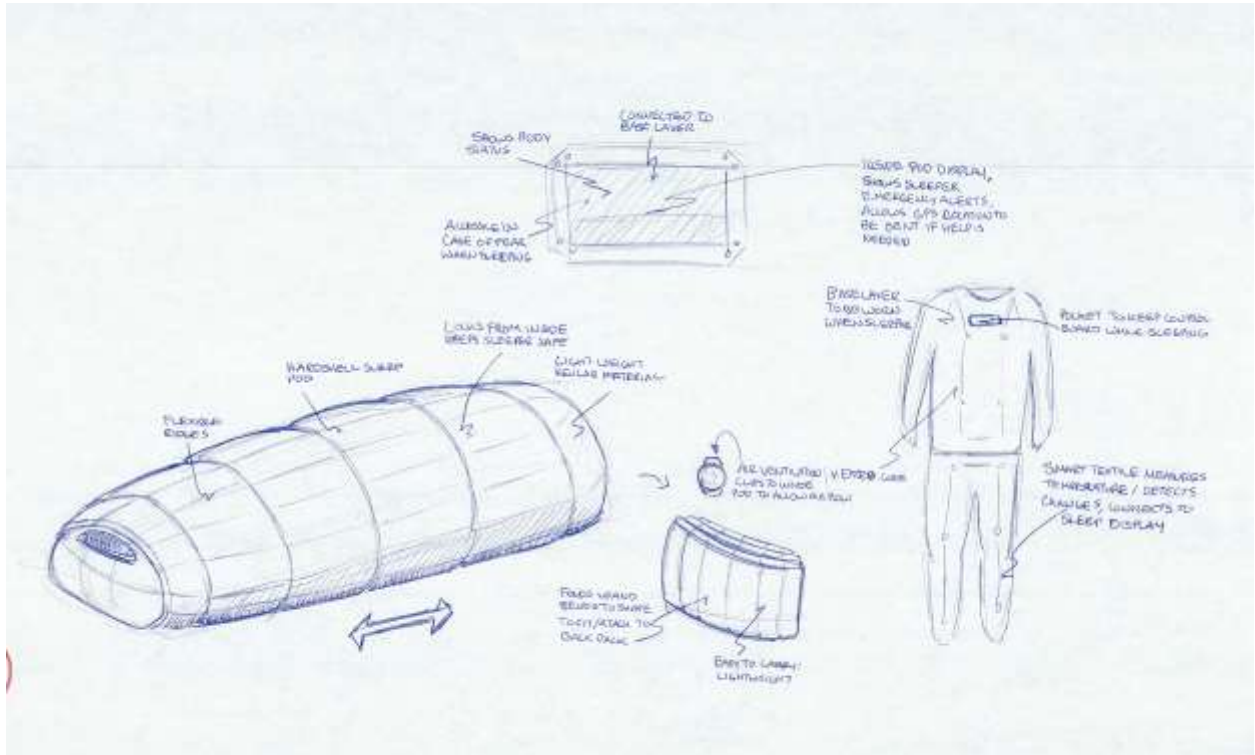
Sticky not sketches and key ideas and words were explored and posted up to organize and make connections between what is needed to address pains points and gain creators.

4.2 Preliminary Concept Exploration

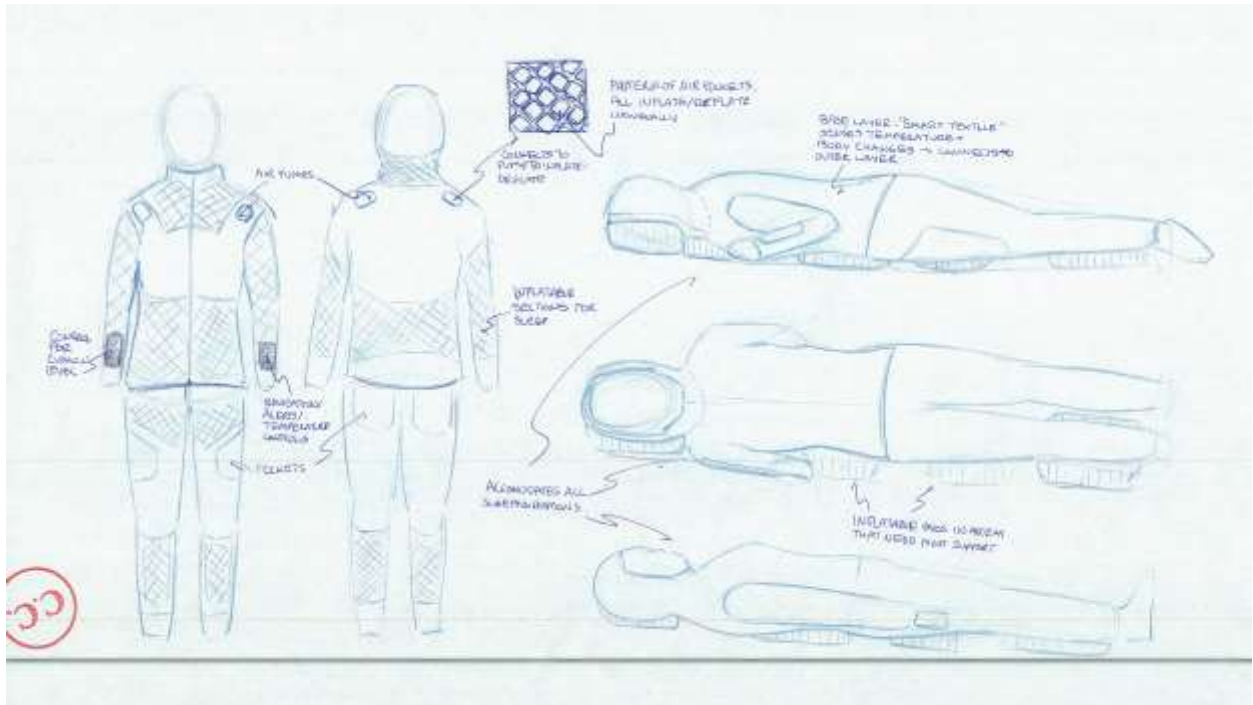
Concept one reflects the issues of weight carriage and safety/warmth while sleeping. The slightly far fetched concept draws on automotive styling elements to bring forward an idea of agile movements that would allow this GPS navigated "pod" to follow the user. They would then be able to relax and sleep inside the heated and safe pod at night.



Concept two addressed the sleep issue more traditionally with is sleeping bag shaped pod that packs up to be carried. It would incorporate the same features as the above concept but in a softer and maybe more feasible solution.



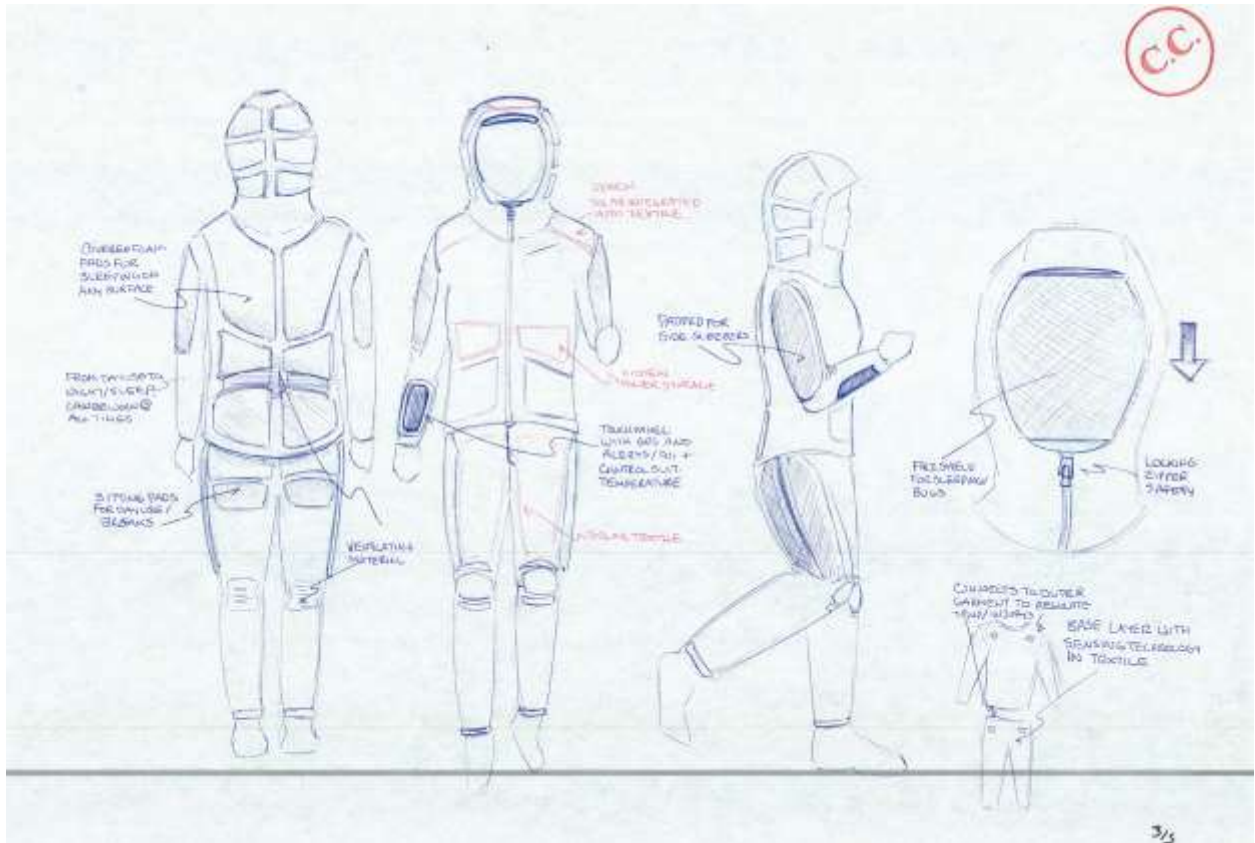
Concept three is a completely wearable solution that incorporates inflatable pockets in order to create a comfortable sleeping experience wherever the user may be. This concept focuses most on the sleep elements and comfort through rest and ergonomically positioned inflating pockets.



All three concepts address the same problem but in unique ways. The main concept that was chosen was concept three and will be shown in later sections to incorporate additional elements from the other two concepts.

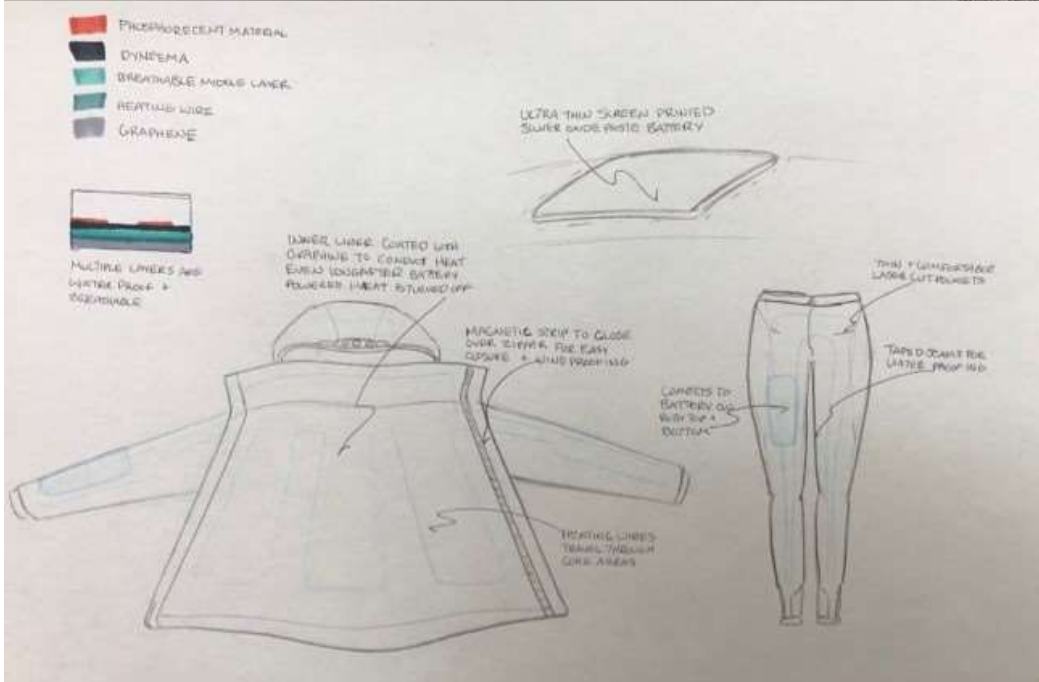
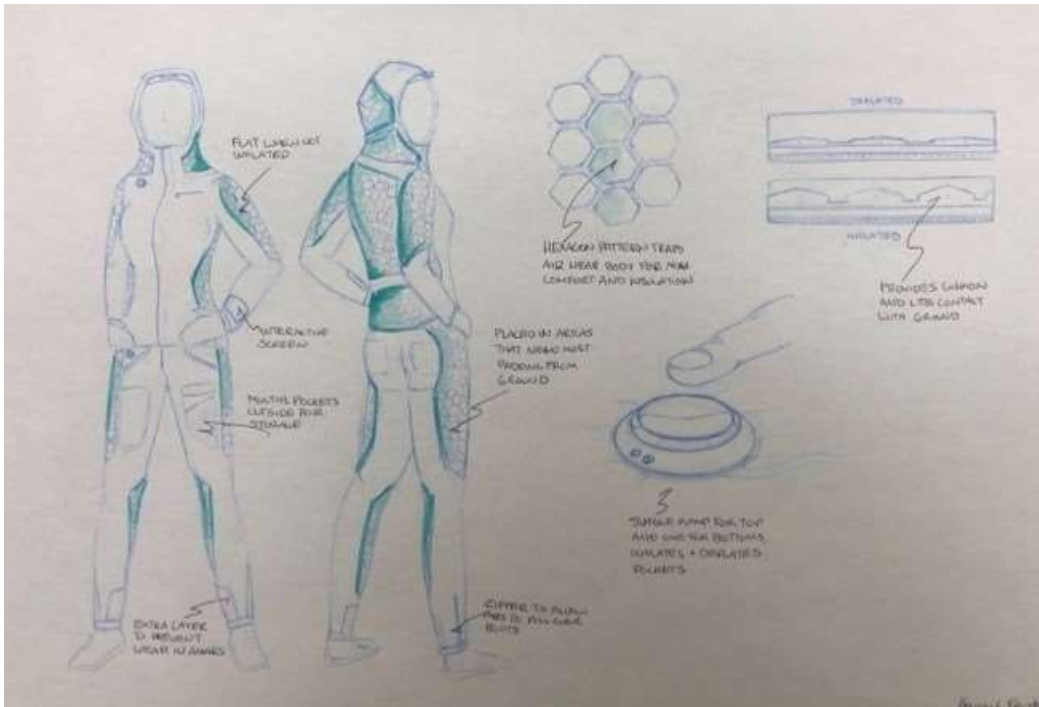
4.3 Concept Refinement

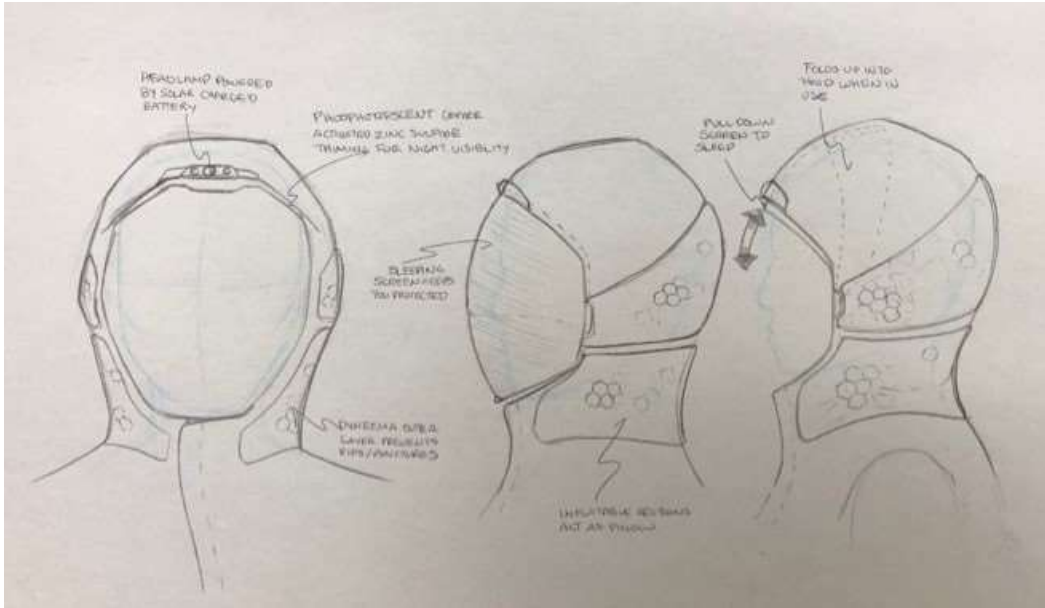
The sketch that follows is the basis for the rest of the thesis. The finalized concept included inflatable sections for sleep, GPS location tracking, heated inner layers, solar powered battery and pump features.

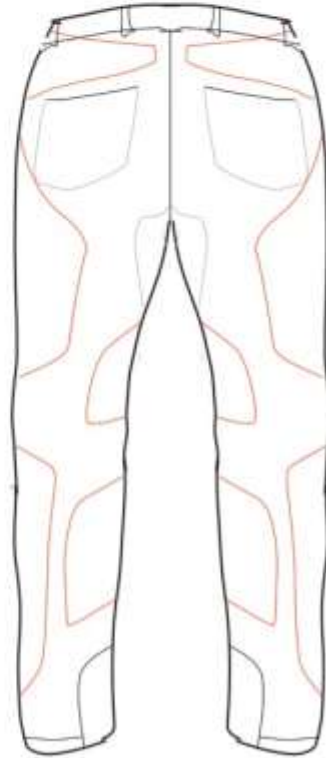
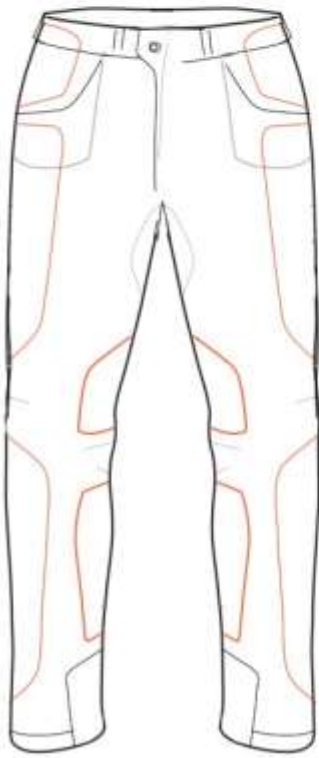
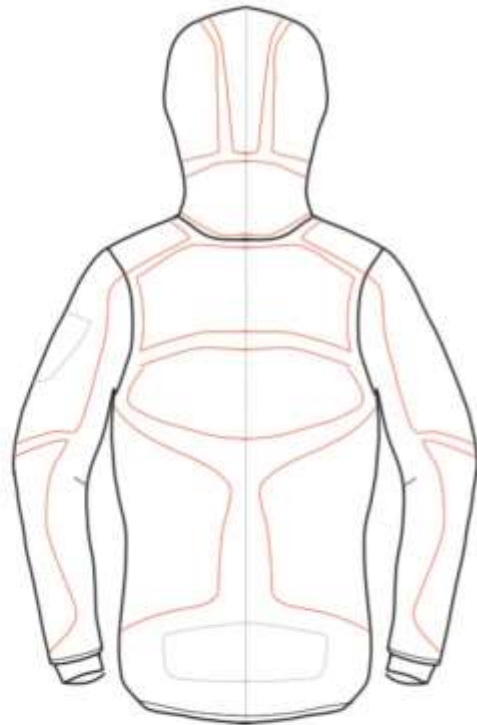


4.4 Detail Resolution

Detail resolution was focused on identifying the technologies and features that would be needed to resolve address the needs for this garment. It goes through the heating elements, the inflatable pattern sections, the pump mechanism and the hoods details.



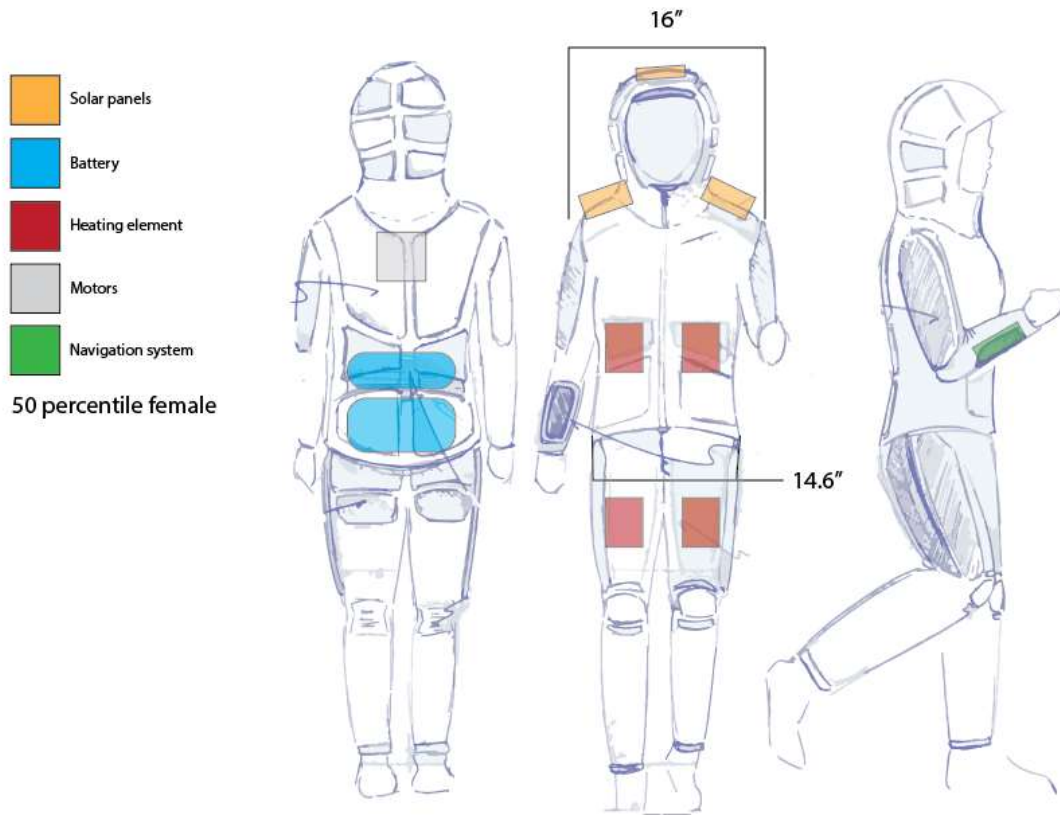




Once the details were worked out, a pattern was created in order to make a sketch model for fit testing.

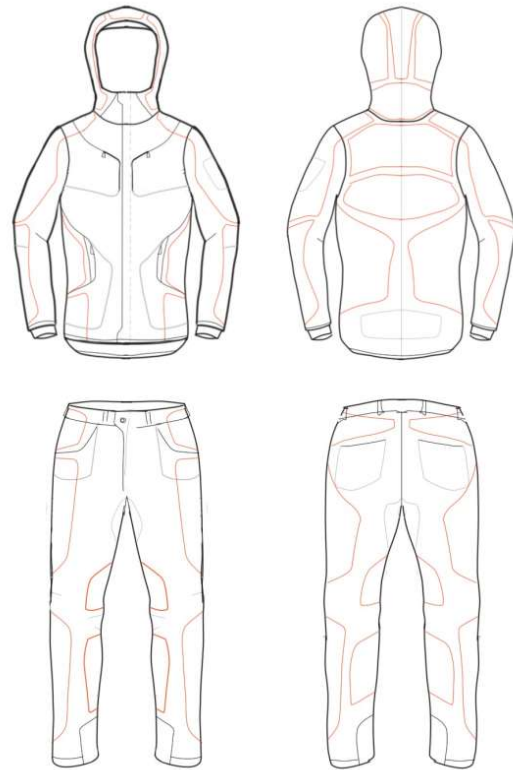
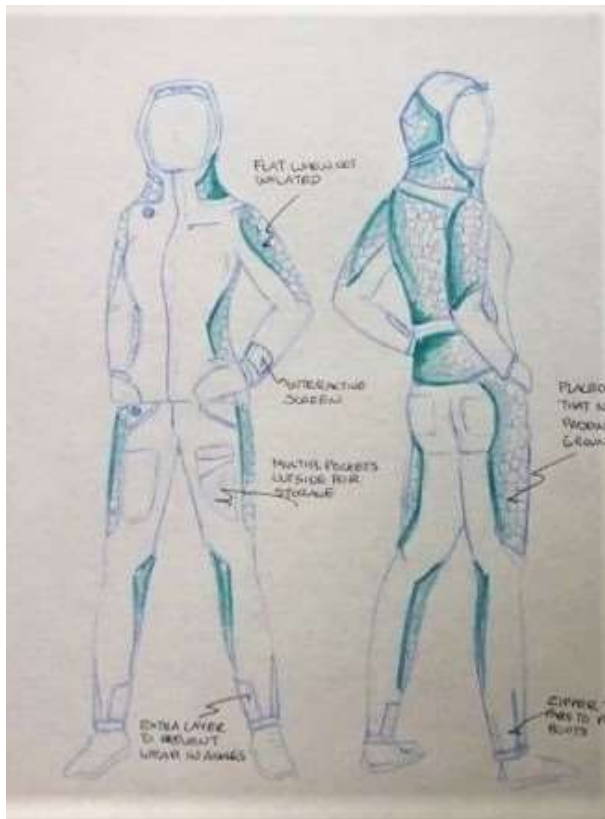
4.5 Sketch Model

A sketch model was created to better understand the sizing of the garment and to fine tune the size and placement of the key features. These were the inflatable sections, the battery, the solar fabric, the alert buttons and pump buttons.





4.6 Final Design



The final design is a mix of all the previous sections content. The finished design intends to reflect organic natural shapes, address the needs of the user, and give a feeling of safety and confidence.

4.7 CAD Model



The first step in the CAD process was to layout the pattern pieces for the base layer of the garment. This was done using the sketch model pattern as a base and tracing these into this digital format in Clo3D. The pattern pieces can then be sewn together and placed onto the model (50th percentile female sizing.)



After the jacket of the base was complete, the base for the pants was done using the same method. All of this was done through trial and error and making small adjustments along the way to see how the pattern changes would fit on the model.



As the additional inflatable sections were added, then become the material specification and the color selection. The colored section were then adjusted in thickness to show the inflation.

4.8 Hard Model Fabrication History

The pattern from the CAD model was transferred to the appropriate fabrics and the base was sewn. This included zippers, packets, linings, wire hood trim, Velcro and hems. Testing on scraps along the way to figure out the best methods of attachment and to make sure a professional finish was achieved on each step along the way.





5 Final Design

This chapter will summarize the previous data and present the final design outcome in the way of criteria, ergonomics, materials and processes, renderings, model photos, and sustainability.

5.1 Summary

Description

Hyg is an outdoor garment that is designed to increase comfort. It does this by providing heat when needed, padding for sleeping, moldable hood, and an emergency alert safety feature.

Explanation

These features allow the user to feel safer, more confident and overall, more comfortable than compared to conventional outdoor garments. The combination of these features eliminates the need for the user to carry a tent, sleeping bag or sleeping mat, which drastically decreases pack size and weight. This further contributes to the feeling of comfort and confidence, with increased freedom and power to move efficiently through the trek. The use of solar cell textiles integrated into the outer shell, allows the user to get power in any scenario. The thin and flexible battery packs allow movement and reduce weight further than traditional power storage. Satellite navigation provides further safety by having an emergency contact or first responders on call.

Benefit Statement

Hyg provides increased comfort, safety and confidence to the user. It has the potential to increase trekking activity with women, and increase safety and comfort of existing female trekkers. Increasing safety and comfort in regards to heat, satellite navigation and sleep quality is valuable and beneficial to any female trekker where previous solution were not existing.

5.2 Design Criteria Met

This section will address the design criteria and how it was met through this concept design.

5.2.1 Ergonomics

This design incorporates all body sizes from 5th percentile to 95th percentile. This is done through pattern grading where the pattern is sized up or down to fit between size xs and xl or smaller or larger depending on the person. It has the correct ratio to fit a human body in any size through grading.

Through experimentation, the best location for padding for side sleeping was determined to be under the head, mid back, under the legs, and between the legs. This elevates the hips from the ground and reduces stress on the spine and neck. For the back position, the best support was determined to be under the head/neck, lower back and under the clavicles. Inflatable panels are located so that female hip area, lower back and waist area are adequately accommodated from sleeping positions. The inflation levels in these areas can be larger or smaller depending on the person, reducing the contact that the hips and buttocks have on the ground. The back, arms and legs have inflation level to allow side sleeper comfort while keeping the knee area separated for optimal spinal alignment. The hood features large inflation pockets to act as a conventional pillow would. This keeps the spine neutral again on either the back or the side.

As for the location and placement of the battery, it is placed on the lower back in order to be out of the way and prevent any restriction of movement. This would be the largest piece of required technology and can be concealed in that area successfully and inflatable section can be built around and on top of the area to prevent it from becoming uncomfortable to the user.

5.2.2 Materials, Processes and Technologies

Materials used in current outdoor garment and gear are using existing technologies in new ways to make them more sustainable and/or more effective in outdoor use. Material using recycled polymers are becoming more popular among mainstream brands, and things like biodegradable materials are also being seen to some extent. Materials and coating can be applied in ways to make garments waterproof, warmer, or more breathable. These are important to recognize as they all play a role in the comfort and effectiveness in the product. This specific concept would use a recycled polymer fabric for any textile that doesn't need to be waterproofed, and a coated nylon for the inflatable sections to be rf welded together to get the airtight and waterproof sealing for the panels.

The manufacturing methods used in this concept would be similar to current process. It would need to be sewn together for the main part, with the inflatable section using some kind of welding to seal the edges and compartments. This is a common method used in manufacturing inflatable sleeping mats that could be applied easily to the process. The technological aspects (batteries, solar textiles, heat wiring, GPS) would need to be sourced from their unique suppliers, as they are quite innovative and in a unique niche.

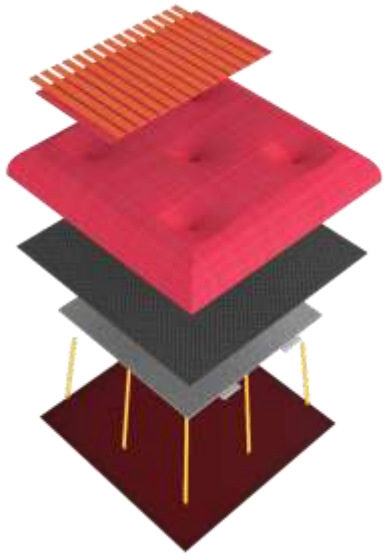
5.2.3 Manufacturing Cost Report

QTY	Concept Item	Estimated Cost (\$)
4 meters	Outer material, coated nylon	30
4 meters	Inner liner, recycled polymer	40
3 meters	Inflatable section material, coated nylon	25
1	Printed battery	300
1	SAT nav system	400
1	Heated wiring system	10
1 meter	Solar cell textile	100
Total		905

Prices are based on existing materials that are similar to the concept items. The total material cost would be estimated around \$905 not including the labor costs and manufacturing methods associated with this concept.

5.3 Final CAD Renderings





5.4 Hard Model Photographs





5.5 Technical Drawings



5.6 Sustainability

With mainstream companies making moves towards more sustainable and environmentally conscious materials and manufacturing, it is slowly becoming a new standard in the largely wasteful textiles and fashion industries. The material choices for this thesis project is aiming for

a truly sustainable future and reduction of waste and excess consumption. In addition to that, the product would be made to last a lifetime. It is designed to be used in harsh environments and would reflect that in its manufactured form. Repair would also be an option in the event of any damage due to its construction method and the ability to patch holes or replace damaged technical components.

6 Conclusion

Hyg is an innovative approach to outdoor garments. It improves comfort for female trekkers and increases safety and confidence, allowing more females to get outdoors and start trekking. Being outdoors comes with extreme mental and physical benefits, and Hyg can contribute to that experience. It can connect the user closer to nature and all with being comfortable, safe and confident.



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8 Appendices

Appendix i – Discovery

This report will summarize and analyze two different interviews with female participants in trekking activities and provide primary research and a basis to start making connection between user experience and secondary research.

Method

The method used to obtain information was through semi structured interviews. One was conducted in person and the other was over the phone. The reason this method was chosen was to be able to go in depth about each user's personal experience and to be able to go further in depth about the user experience. Semi structured format allows the conversation to flow freely but still get to the point of what needs to be addressed.

Findings and Evidence: Interview 1

Interview Date: Wednesday, October 9, 2019

Interviewee name: Hailey Louise

Gender: Female

Interviewee age: 26

Interviewee location: Marathon Ontario

Trekking experience: Beginner

Contact information: Facebook

Interview method: Phone call

What is your experience level with trekking?

Okay so I'm pretty new with it, just been out twice with a length of 4 nights each time.

Where was it that you went?

Outside of marathon national park. Its pretty rough terrain and pretty rocky along the coast.

What was the weather like?

Very wet and it rained a lot.

How did you like dealing with the rain?

It was awful, I complained a lot. It wasn't too bad actually because it didn't rain as much in the morning and we were able to take down our stuff, but it would rain throughout the night and the last day was the worst like it rained the whole day so lots of wet stuff. Wet shoes and our backpacks got soaked.

Did you have any gear for the rain?

We had rain covers for our bags that came with the backpacks and rain jackets.

You still got wet?

Yeah it was so much and pretty heavy so we still got wet.

What was most challenging?

Probably the rain. It was the most annoying, once the boots were wet it was just miserable. It takes so long to dry. We got them dry one night and the last day we were hiking they were soaked but wouldn't have dried if we stayed longer.

What did you enjoy most about it?

Probably it being pretty scenery and nice campsites to stay at so that was nice. It's a really nice trail even though its roughed and hilly, it's a nice area for sure.

Do you enjoy the physical aspect?

Yeah it was challenging in the ways that there was a lot of steep incline and half on rocks which made it really slippery. My shoes didn't have a lot of traction so I was sliding and falling a lot so that made it challenging for sure.

Did you fall?

Yeah, I had some bruises and some cuts, because it was raining and wet but even if it wasn't raining it was pretty tricky. You're climbing over rocks and you really have to watch what you're doing.

Did you carry everything in backpack?

Yeah, my backpack was 55 liters and it was pretty full. It was a little heavy for me, Chris had more stuff than I did but it was still pretty packed, as much as I could pack it.

Do you feel you brought enough?

I think we over packed. We brought too much food so that was annoying, but I don't think we missed anything just way too much food and thinking we would eat more than we did. I think we thought it wouldn't be filling enough especially the freeze-dried food but we ended up snacking all day and not eating as much of the meals we brought.

Was it pretty heavy then?

Yeah for sure, very heavy.

Did you adapt your gear in any way to change or make it better for yourself?

Not that I can think of, just found that getting the bag to sit right on my hips was hard just because I don't know how it's actually supposed to fit and it took some time to get used to and to figure out how to get everything comfortable. Eventually I got it to fit okay. I found the chest strap was a bit awkward because it was uncomfortable and it was really squishing me in and the placement was kind of in the wrong spot.

What did you sleep on?

We had a Thermarest mat, they're not too bad. Thankfully we didn't have any issues with holes or deflating and it wasn't too cold during the night. Our tent was pretty good too, although one night the tent got water in and things got wet but we fixed the fly and it was okay after.

Did you find you slept well then?

I think I slept pretty well, the sleeping bag was annoying because I move a lot in my sleep so being confined to my bag was annoying but I wasn't too uncomfortable, it's a Marmot bag and the limit is minus 3.

Did it get that cold?

No, it didn't go below zero so I was fine..

Did you feel unsafe or scared for any reason?

Yeah one time there was wildlife and we didn't know if it was a bear or moose outside the tent so that was little scary cause we didn't bring anything for bears or anything. I don't know what I would do, how to handle it if it was a bear I would just freeze out of fear. I just assume nothing would happen to me. I just kept hearing noises and I thought it was a bear and I said "oh that's a bear" and Chris said "maybe" and I said "no you're supposed to say it's not a bear!"

Would you ever consider going trekking alone?

Probably not, for me I think I'm just so nervous. I don't like the thought of being out there alone like what if something happens and I just like the thought of having people around me and having people to talk to you know. Maybe someday but not now just being so new to it, and if it was somewhere I knew well maybe but most likely not.

Yeah, it's nice to be around people sometimes,

Yeah that's probably the main reason I would continue to do backpacking is because of the social piece, and the athletic part too, but mainly the social piece.

Did you meet anyone else along the way?

Yeah there was actually a lot of people doing it by themselves which was surprising to me. The one guy stayed at one of the sites we were at. He was doing the whole thing like there and back, he was on his fourth day I think and he was planning to finish in the next 2 days. It would have been 120km total. We saw someone else; I don't think she was doing the whole thing but a part of it and someone brought their dog. It was just a little dog that was surprising, I would think it would be hard on a dog.

Did you end up talking much to these people?

We talked to the one guy a bit yeah, but most people we just stop for a minute along the way, say hi and have a little chit chat about how it's going and where they're from stuff like that and then they move on.

Did you find them friendly?

Yeah for sure everyone was super nice.

Would you ever be worried about other people, if there would be a threat there?

I don't think so. I think if I was by myself I would be more worried but no, everyone seemed really nice. But if I was by myself, I think it would be kind of comforting to know there was someone else out there so no it wouldn't really bug me. I would feel more nervous in the city, when people are backpacking you just kind of assume, they're into the same things as you I guess you feel like you would be friends with them or something.

Findings and Evidence: Interview 2

Interview Date: September 28, 2019

Interviewee name: Lisa Zimmer

Gender: Female

Interviewee age: 50

Interviewee location: Brighton Ontario

Trekking experience: Beginner

Contact information: Phone/email

Interview method: In person

Transcript

Tell me about your experience backpacking Europe in your 20s.

Well I couldn't find a backpack to start because I couldn't find one that fit me. I was 105 pounds and 5ft tall so because I was short and small, my shoulders are small my breast are large and anything just didn't fit and everything was way too wide and anything sitting on my shoulders felt so heavy no matter if it weighed 5 pounds or 20 pounds. It would have hurt because it was all resting on that small space of my shoulders. It should have been up higher because everything was hanging below my bum because I was so short so it got in the way. When I went to Australia about 15 years ago and finding a backpack, I got the same brand of backpack as Derek. The only difference was mine was just a bit shorter in the frame and I couldn't notice any other difference for the women's version, although it didn't make a difference.

In what sense was it smaller?

The amount you could carry was less, you could only fit a bit less because it was shorter. The straps seemed the same as the men's version, the only things were just the amount you could fit in the pack. It was still too wide for my back and too wide for shoulders. It was just a smaller volume amount.

What about recently has anything changed?

The only one I've found was the Osprey backpack. Last time I was at Sail I looked for backpack and Osprey had the XS, S and M for the women's sizes which I thought was pretty good but any other brand didn't differentiate the size difference within the women's versions. So, depending on the frame of the women there was nothing, just the size of how much you could carry not actually how its designed for your body.

Do you think that having the right gear for you would dictate what you do for your trip?

Yes, it would affect it for sure. Two summers in a row I went on two different backpacking trips. When I used the Osprey pack, I felt I could walk and do stuff fairly easy with it because it fit me better and had some air circulation around my back. I have seen bags where they say there is air flow but it doesn't work. So that summer I felt confident in what I was carrying and I could walk from the airport to where I needed to be and felt fine. So, the next summer I took the old bag from Europe, and even though I brought less stuff than the previous summer it felt so much

heavier and uncomfortable and I took it off every chance I could get. That backpack was not designed for me. It was so hard to walk with it; it would dig into my shoulders and my back everywhere. So, I definitely think that design makes a huge difference in how you can move with something like when I wore the Osprey one, I could move my arms and could walk normally and it wasn't in the way of my bum.

Oh, and on those inflatable sleeping mats if you were to lay on your back it might be fine but as soon as you turn over to your side it's so uncomfortable. For someone that has hips you need way more support there. I could have slept better if I had more support.

What do you think would make that better?

This is something I just thought of, but when you lay on the bed the heavier I've gotten, the more support I need between my knees because if you lay on your right hip then your left hip is higher and isn't square with itself. If there is something elevating your knees it keeps things square. I would make it dipped if I could so the weight is distributed more evenly and not just the hips. I also find it would be good to have softness in the shoulder area as well.

Do you find pain when you wake up?

Yes, hips and shoulders.

Are you less comfortable on your back?

Yeah, I find laying on my back is harder on my lower back, there's too much pressure there because I would need my feet elevated.

Would you ever consider hiking alone?

In the state I am right now no. I don't feel strong enough right now. I think hiking alone would give you a good feeling of independence and accomplishment. For me hiking alone I would probably feel a bit scared. Scared of the unknown, not so much of falling and stuff but what I would be scared of is other people and people I don't know what they're about, you know. As a woman in a secluded area and you run into a male figure and you don't know them I think a lot of people feel "eek" because you think "is this person going to take advantage of me, can I trust them" and most of the time men seem to be stronger than women. They generally have more

muscles. General body composition that tends to be how it is, not trying to be stereotypical it just is how bodies are made. So that means they would be able to overpower easier. So, if I was to go alone, I would want to be stronger and physically fit, make sure I could contact people and get some kind of help and they would know my position, take some kind of self defense course and know how to protect myself. If I went hiking in the mountains and there were bears or cougars I would want to know how to protect myself from wildlife. Also carrying water, I would need to carry a lot of that and that's a big thing because of the weight it's so heavy.

If you were trekking, what would be more of a concern, people or another factor of safety?

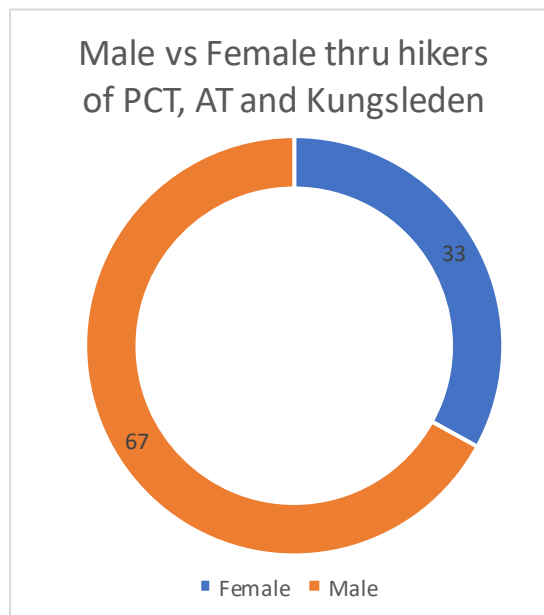
Probably animals would be my biggest concern. These are things I think of in Canada, regardless if I am with someone or myself.

What would prevent you from going on a trekking trip?

I could get over the hygiene factor if I was alone but if I was with someone it would be more of a concern. Making sure I can brush my teeth and everything is clean. It probably because I care what other people think. Another thing would be safety like falling and hurting myself and how will I continue or get help.

Appendix ii – User Research

User Profile



The objective of this section will identify who the ideal users for this product will be. Research will be conducted into user demographics, user behavior, and user profile in order to create a persona which will help to guide decisions to arrive at the final design.

User Demographics

This section will explore targeted demographic information on the intended user for this comfort trekking solution. These will be age, gender, ethnicity, income, purchasing power and education.

Method

The method used for this search will be through an image search and a literature search. The image search will use various keywords that are input into Google images in order to find the product user and will then be assessed and evaluated in terms of demographics. The literature review will consist of quotations from literature which explore demographic data of the targeted user group.

Image Search Findings

Search terms used:

- trekking female
- trekking woman
- female thru hike
- female trekking sleep

The image search provided insights into some demographic information. Age seemed to vary, showing results for women who look in their teens and range to senior women. They are all female, as that was specified in the search terms and is the main target group. The ethnicity portrayed is primarily Caucasian, with almost no results showing any other ethnicity. Results related to income are not clear, although some gear shown in the images can be quite expensive. The primary purchaser of these products would be the user, or in some cases with teens it is possible there could be influence from parents. The results show no information regarding education, although with the looks how prepared they appear, they may have education directly related to the outdoors.



Figure 2 Lund, J. (2019) Portrait of woman on trekking expedition [Digital image] Retrieved from <https://jacoblund.com/products/portrait-of-a-woman-on-a-trekking-expedition?variant=30274616131653>



Figure 3 Women at Philmont [Digital image] Retrieved from <http://www.watchu.org/Women.php>



Figure 4 [women camping Digital Image] Retrieved from <https://www.ellis-brigham.com/sleeping-bags/sleeping-bag-buying-guide>



Figure 5 [Digital image woman eating] Retrieved from <https://bearfoottheory.com/complete-pacific-crest-trail-gear-list/>

Literature Search

Search terms used:

-Trekking demographics

-Female trekking

-Trekking gender differences

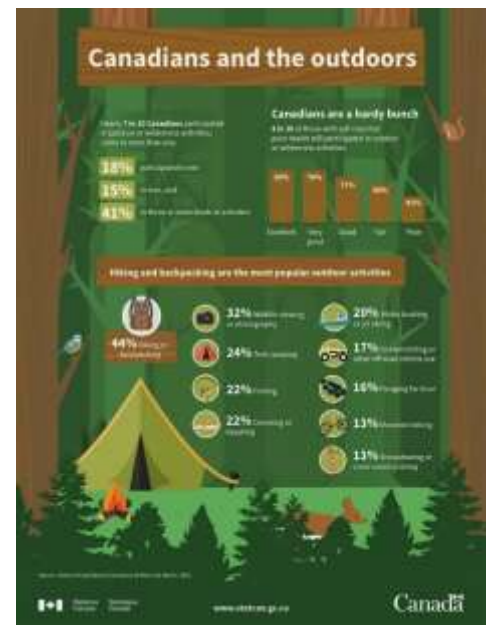
Literature search results:

“Among nonparticipants, race was significant for two constraints, personal safety and no companions. The companion constraint was significant but negative, implying that blacks are less likely than whites to be constrained by not being able to find someone with whom

to recreate.” (Johnson, Bowker, & Cordell, 2001) “Participating women were more likely than men to report being constrained by two structural constraints, personal safety and inadequate facilities. Women who did not participate were more likely to feel constrained by insufficient funds.” (Johnson et al., 2001)

Discussion

These demographic statistics show that on average, more men participated in long distance thru hikes than women did. In the stats Canada infographic, it is shown that almost 70% of Canadians participate in some form of outdoor activity, with 44% of that being hiking and backpacking, and including 24% camping. It is unclear what the clear definitions of hiking, backpacking and camping are, as they could be overlapping with each other in some interpretations. These statistics show that there is a large market for products centered around trekking. This information shows that even people who perceive themselves as in poor health still participate in these types of outdoor activities. 44% of people is large portion that has perceived poor health, which present a large opportunity to explore solutions for this specific group and to dig into what percentages are female and how this poor health effects their experience and how it can be improved.



User Observation

Needs Statement

How might we improve comfort and safety for female trekkers?

Description

This thesis proposal investigates the comfort, safety, and ergonomic requirements of female-specific trekking gear. Trekking is a popular and rewarding leisure activity enjoyed by both men and women, but current products are lacking in adequate female-specific solutions. Current female-specific products are often only size-adjusted male products, but neglect all of other aspects that make female needs different from male needs. This thesis proposes an in-depth study of user interaction and functionality of existing trekking products using various methods of data collection, including literature review, interviews, contextual inquiries, and surveys. Analysis of this data will be aimed at the experiences of users and increasing the comfort, safety, and enjoyment in relation to where these products are being used and where concerns are present, including but not limited to load carriage, sleep, temperature, and injury. A one-to-one scale ergonomic buck will be built to evaluate ergonomics and human factors in the context of the established problem area to ensure full-bodied human interaction design.

Research Objectives

The research objective here is to assess the comfort and safety of females in a trekking scenario through either first person or third person perspectives through an existing video analysis as well as a primary video source. The primary source video will assess the comfort and safety of one of the key activities performed.

Key Activities

The key activities in the user observations are going to be the actions that are part of packing a backpack for trekking. The goal of observing these key activities will be to assess ergonomic and human factors considerations.

Target Users

The target users are female trekkers. More specifically, females that are trekking in cool climates and covering significant distance each day. These users are interested in the outdoors and physical activity, as well as traveling and enjoying themselves.

User Environment

The user environment is going to be outdoors, in nature, and cool climates. These areas can include more populated areas or total remote wilderness where access is limited. The scope of this can be quite wide, although it is specific to temperate and tundra climate regions. The user will be outdoors for extended amounts of time, exposed continuously to changing weather conditions and terrain changes. Often trails will include steep climbs and possible water crossings.

Preliminary Video Observation

Preliminary Video Scoping

Source: https://www.youtube.com/watch?v=b-QO_CDfb3Q

This video begins with a woman as she starts her 440 km journey through northern Sweden. This is a first-person video, and it follows her through each day. The first night she talks in her tent as it is very windy and she tries to sleep. The next day she continues to walk and stops to take a swim in a small lake. She gets very cold and gets dressed again. She stops at mountain huts along the way but stays in a tent every night. She is emotional on day four, where she describes her homesickness but is confused because she is meeting great people and seeing beautiful things. The toilets she passes are essentially just holes in a plank of wood which go into the ground. People that she has met walk with her for a bit, and they pick and eat berries. As she continues, she needs to cross a few rivers and uses a rowboat. The weather throughout is windy, rainy, cold, and foggy, as well as some clear days too. She gets cold and very wet for a few days. One night she struggles to find a camping spot and is stressed because it might get dark soon, and she wants to avoid setting up at night. At one point, she gets lost because there is a reindeer fence in the way, so she crawls underneath it. She can also be seen cooking and eating throughout the video and filling up water in the streams. On the final day, she reaches the end of the trail and celebrates.

Video Observation

Four key activities can be identified in the video. These are: hiking while carrying all gear, setting up/taking down camp, cooking/eating, and sleeping. Some challenges with this can be seen, such as the ergonomics of the gear she is wearing and how much she needs to walk each day as well as the way she needs to set up and take down the tent. A lot of this activity is done close to the ground and involves crouching, bending and pressure on knees. While cooking and eating, it involves waiting time and weather conditions. She speaks about sleeping and having trouble with that on some nights. She sleeps on a mat with a sleeping bag inside the tent. Some issues with this are that it can be uncomfortable and cold.

Survey Results

Timestamp	What is your How many What was What is your Where did How many What 'm What non Did you e Did you fe Is there ar If you eve If you che Did anythi What was What was Is there ar If you enj												
2019/10/2 Female	1 8-14 days	21 Europe	1 Tent, slee too much	Cold;Snov	Somewha warmer clothing, proper footw	Nope!	Finished as e	Too much time spent driving.					
2019/10/2 Female	More thar Less than 30/35/40/	Australia/	4 Water/sw Camera/n	Cold;Snov	Somewha Rain pant: Personal i	Falling an	Nope!	Fin Being in tl Finding places to sleep					
2019/10/2 Male	1 8-14 days	23 Australia	1 Tent, wat Books, fir	Rain	Very well No	Personal i	didnâ€™t	Nope!	Fin Views Getting wet				
2019/10/2 Male	2 Less than	20 Switzerlar	3 As much v Electronic	Cold;Snov	Somewha More sock	The dark/ Canâ€™t	g	Nope!	Fin The views Random v Keep traveling but d				
2019/10/2 Female	More thar Less than	21 Austrian a	07-May Sleeping i Bluetooth	Hot;Snov	Somewha Fire starte	Wildlife;C	Weather	â€”	Nope!	Fin Exploring There are a lot of â€œdull area:			
2019/10/2 Male	1 3-7 days	16 Jordan	2 Tent, and all necess	Hot	Somewha Camera						Great advi To short	esh755@	
2019/10/2 Male	More thar Longer thâ€”	23 West coas	0 (just my Camera, h Coffee, iP	Cold;Hot;	Somewha Warmer sl	Being alor	Got caught	Nope!	Fin The peopl	The heat. I could adc #rossacros			
2019/10/2 Female	More thar 3-7 days	45 British Col	10 Sleeping i Cell phon	Cold;Hot	Somewha Better hik	Physical fi	We ran ou	Nope!	Fin It was the Bathroom I would lik jackie.hof				
2019/10/2 Male	More thar Longer thâ€”	19 Sweden â€”	Start with Warm clof	Everythin	Cold	Somewha A beanie				Nope!	Fin The air The mosquitos	I think you	
2019/10/2 Male	0 Less than 3 days												
2019/10/2 Male	More thar 3-7 days	18 Inca Trail,	10 tent, slee lâ€™ll tak	Cold;Rain	Very well	Ã \ (â€”f,)	Personal i	Well itâ€™	Nope!	Fin Nature an	Finding suitable cam	Victor.w@	
2019/10/2 Male	More thar 3-7 days	24 Kungslâ€”	1 Tent, pack Deck of ca	Rain	Somewha Better rai	Personal i	My wife f	Nope!	Fin The scene	The backache from t	Patrikwlfr		
2019/10/2 Male	More thar 3-7 days	17 Muskoka	2 Tent, slee Fishing ro	Hot	Somewha Food	Lack of fo	Dependec	Nope!	Fin Being out	Bugs Everyone should exp			
2019/10/2 Female	More thar Longer thâ€”	35 New Zealâ€”	2 Water filt toothbrus	Cold;Hot;	Very well sticks	Personal i	crossing ri	bad weath	nature	blisters			
2019/10/2 Male	More thar 8-14 days	40 Mount Kil	My dad an Camelbac	No non es	Cold;Hot;	Very well camelbac	Personal i	Weather i	Sickness;C	Being wit	Having to	daily strug	Anytime g
2019/10/2 Female	2 8-14 days	21 Europe	1 Tent, slee Makeup, r	Cold;Rain	Somewha Fanny pack					Nope!	Fin Being in a	Going home	
2019/10/2 Male	More thar 3-7 days	20 Canada , c	Multiple Sleeping i N/a . No c	Cold;Hot;	Very well No	Weather c	Bad weath	Nope!	Fin Experienc	Some aspi	No	Benjaminj	
2019/10/2 Male	More thar 3-7 days	24 New Zealâ€”	4 tent, slee pillow	Cold;Hot;	Somewha tarpaulin	Personal i	it made m	Major inju	experienc	another person. haha			
2019/10/2 Female	0 Less than	18 Belgium	We were Tent, slee Mascara, f	Wind;It w	Not prepa	It wasnâ€™	Personal i	I had a lot	Nope!	Fin The satisf	The pain and the big bag		
2019/10/2 Male	More thar 3-7 days	18,19 Ontario, N	1 Bivy bag, i	Camera, p	Cold;Snov	Somewha Only whe	Weather c	Climbed a	Nope!	Fin The scene	Of any trip its usually the drive		
													people along the way and sometimes they appear sick or unsafe because of others. You notice youâ€™re getting dehydrated quicker then youâ€™d thought; from then one, you drink at a river and
2019/10/2 Male	1 3-7 days	28 Kungslâ€”	0 (just my Sleeping i	Camera, p	Hot;Rain	Very well None	Concern f	imedia	Nope!	Fin Night hike	A long do	Some peo	You know
2019/10/2 Female	0 8-14 days	19 California	16		Cold;Hot	Very well prepared	Personal injury (spr	Nope!	Finished as expected				
2019/10/2 Male	More thar 3-7 days	17 Killarney f	3 Tent, slee Seasoning	Cold;Hot;	Dependin	I just wish	Weather c	The weath	We were	Lack of co	Cooking can be a pai	Nathan.va	
2019/10/2 Male	0 Less than	73 Netherlan	0 (just my Food and Candy	Hot	Somewha a bike	Physical fi	Tired, no	Nope!	Fin see nice t	alone	its on my age not ea		
2019/10/2 Male	More thar 3-7 days	21 Italy, swei	1 Tent, slee Fishing ro	Cold;Hot;	Somewha A knife,	Physical fi	Thunder/		Seeing all	Freezing my ass off	You know		
2019/10/2 Male	More thar 3-7 days	20 Peru	1 Raincoat, Animal cr	Cold;Hot;	Somewha Warmer sleeping bag				Nope!	Fin Sleeping i	The cold up there	Instagram	
2019/10/2 Male	More thar Longer thâ€”	25 United Kir	2 Water bottle	Cold;Rain	Somewhat prepared	Personal i	Lack of tre	Nope!	Fin Improving fitness over time				
2019/10/2 Male	More thar Longer thâ€”	22 Australia f	1 Sleeping bag, head l	Hot;Rain	Somewha Not sure	Physical fi	Australia i	Nope!	Fin Experienc	Nothing			
2019/10/2 Male	1 Longer thâ€”	19 Sweden	3 Good hiki Powerbar	Cold;Hot;	Very well A well fitt	The tent v	You don't	Sickness	The views	There was none			
2019/10/2 Male	More thar Less than	27 Italy	0 (just my Map, com A beer	Cold;Snov	Somewhat prepared	Weather c	Low visibi	Nope!	Fin The views	The wind	Knobbo_9		
2019/10/2 Male	More thar Less than	22 Alps	5 Sleeping i	Camera, b	Cold;Rain	Very well prepared	Personal i	Old knee	Nope!	Fin Arrival on	Drive home and unp	Simon Kaf	
2019/10/2 Male	More thar Less than	26 Northern	2 Lifestraw, Small seat	Cold;Hot;	Somewha Not overly	Wildlife	I just didn	Nope!	Fin Being disc	Not enoug	Would also like to m		
2019/10/2 Female	1 8-14 days	29 Europe	Six Tooth bru Cell phon	Cold;Rain	Somewha Na					Culture sc	Getting or Na		
2019/10/2 Male	More thar Longer thâ€”	26 California	0 (just my Tent + Poi	Air mattre	Cold;Hot;	Very well None	Wildlife	Mountain	Nope!	Fin Detaching	The ants g	Good luck arman.am	
2019/10/2 Female	More thar Less than	31 Canmore	2 Bear spray	Camera	None	Very well prepared	Wildlife;C	In the mo	Nope!	Fin Scenery	Up hill most of the way. Lol		
2019/10/2 Male	More thar 3-7 days	21 Otway Na	0 (just my Tent, slee Pillow, ca	Hot;Wind	Somewha Spare sho	Wildlife;T	Dangerou	Major inju	Seeing th	The injuries and exh	dylan@big		
2019/10/2 Male	2 Less than	21 Algonquir	3 Tent, slee Cell phon	Cold;Snov	Somewha Tarps for wind breaks and extr					Nope!	Fin Spending	The first snow	
2019/10/2 Male	0 Less than	19											
2019/10/3 Male	More thar 3-7 days	23 Newzeala	1 Tent, slee Camera, d	Rain	Somewha A knife	Lack of fo	My friend	Nope!	Fin The Isolat	The unpredictable weather			
2019/10/3 Male	1 3-7 days	19 East coast	1 Tent, blan Pillow, ce	Rain	Very well prepared					Nope!	Fin Bonding with my frie	My trip wasnâ€™t ex	
2019/10/3 Male	More thar 3-7 days	33 Algonquir	1 Sleeping i Alcohol	Cold	Somewha Sleeping c	Concern f	The perso	The never	Spending	How short it was.	blakegossi		
2019/11/0 Female	More thar Longer thâ€”	19 Several pl	5 Water bot Xbox	Thunder/l	Very well No	No	No	No	Having se	Got bitter	No		

Appendix iii – Product Research

Determining Products which Bracket Key Benefits for the Thesis Topic

A key element to a unique and original design is to start with thinking about the user and their needs, rather than current products.

The point of this exercise is not to design a product, but to understand the user and what their key needs are.

Starting design with current products can seriously bias the development of a unique solution.

Thesis Topic

Product that increases comfort for female trekkers and campers.

Benefits that bracket topic

1. Maximum comfort provided in use
2. Easy of carry/transport when not in use

Benefit #1: max comfort in use:

- mattress
- pillows
- warm clothing (hats, coats, pajamas)
- running shoes

Benefit #2: easy to carry/portability:

- backpack
- rolling suitcase
- purse/fanny pack
- wallet

Based on this, two Tables for [Linking Benefits with Needs](#) are generated, one for max comfort, and the other for ease of carrying.

Benefit #1: maximum comfort

[Product that Affords: mattress](#)

BedStory Lavender Memory Foam Mattress 12 Inch, Queen Mattress with CertiPUR-US Certified Foam

Price: CDN\$ 399.99 & **FREE Shipping.**

- Born For Better Sleep: BedStory 12 Inch Lavender Memory Foam Mattress is designed for all kinds of sleepers for a better night sleep, such as back sleepers, side sleepers and stomach sleepers. All foams we use are CertiPUR-US Certified, eco-friendly and durable. The mattress meets CFR1633 Standard which means itself is hard to burn, therefore safe to use.
- Design For Maximum Comforts: Constructed with 2.5 inches Pure Memory Foam Layer, 7 inches Air-Circulation Foam Layer, 2 inches High-density Support Foam Layer inside the mattress. This ergonomics design enables the mattress to mold to the sleeper's natural shape and keeps you cool while you sleep, it strikes a balance between firmness and softness.
- The Only Lavender Mattress: Unlike other Memory Foam Mattress, BedStory Lavender Memory Foam Mattress comes with sweet scent due to the Lavender essential we infused. Lavender is a natural air purifier and also relieves stress science has proved this. And this is the key point to improve sleeping quality.
- She's not 'HOT': The mattress cover is made of knit fabric, which absorbs moisture, dries quickly, and helps the body breathe. Inside the mattress, the 7 inches Convuluted Foam keeps the air flowing, ensures sleeping in a thermal comfort zone.

https://www.amazon.ca/BedStory-Mattress-CertiPUR-US-Certified-Ventilated/dp/B07GK2RSGT/ref=sr_1_1_sspa?keywords=mattress&qid=1569014558&sr=8-1-spons&psc=1&spLa=ZW5jenlwdGVkUXVhbGlmaWVyPUEyMUtQMUczVDRFSE05JmVuY3J5cHRlZEIkPUEwNDkxOTEzMjBFWUNRRkxCV0oxMyZlbnNyeXB0ZWRBZEIkPUEwNjA3MjQzMUIWM0NaUzND0UDJRSZ3aWRnZXROYW11PXNwX2F0ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU=

TABLE: Linking Benefits with Needs (Benefit #1 Maximum comfort)

Product- Mattress				
Needs	Benefits and Underlying Needs	Level of importance		
		Slight	Moderate	High
Basic Needs	<i>Physiological</i>			
Food, water, shelter		Slight		
Pleasure, gratification (<i>sensory, compulsive responses</i>)	Sensory, touch			High
Security	<i>Safety, securing resources</i>			
Safety	Secure and stable Doesn't leave your back sore ergonomic			High
State, Group, Individual	Individual/two people			High
Securing resources	<i>Optimization of limited resources (cost effectiveness)</i>			
• Value • Accumulation of resources (wealth)	Price (\$399.99)		Moderate	
	Reliability		Moderate	
Control over environment (tasks)	<i>Product (tool) that amplifies human abilities</i>			
Convenience Ease of Use	Easy while using (<i>doesn't leave your back sore</i>) Easy to get on/off Comfortable to touch (handle)		Moderate	High High High
Flexibility Speed (fast, less time) Control (precision, responsiveness, power)	Home use only	Slight		
	Responsiveness to movement	Slight		
Long Term Security/Stability of Group				
Health/care/education of children Environmental sustainability Insurance (car, house), pension, investments	Materials and process, end of lifecycle		Moderate	
Social Belonging	<i>Effort / resources to belong to a 'tribe'</i>			
Fear of Abandonment	Provides safe place at end of day		Moderate	
Fear of the enemy	Safe space to rest		Moderate	
Tribal Identity	Sticking to same group of products, family feeling	Slight		
Behavior cues for survival (<i>copying behaviors... safe to eat, learned skills</i>)	Sleep is needed for survival	Slight		
Behavior cues for social interaction of group (<i>copying behaviors... Interaction cues, play, have fun</i>)	Mattress can be space for two people, interaction		Moderate	
Peer Pressure				
Social Expectation (<i>social covenant (gift)</i>)				
Esteem	<i>Personal influence in 'tribe'</i>			
Social Status (<i>The elite have it...I want to be like them'</i>)	Feeling part of an important group	Slight		
Social Recognition				
Sexual attractiveness	Connection to product/experience	Slight		
'Higher Order' Functions/Needs	<i>Needs that differentiate humans from non-primates</i>			
Intrinsic pleasure	Natural need for sleep and pleasure of sleep		Moderate	
Creative endeavors				
Experiential (extrinsic)	Experience on external factors, other people	Slight		
Experiential (intrinsic)	Sleep essential to life, quality is naturally important			High
Emotional	Connection to bed and sleep		Moderate	

Summary Table: Benefit #1

Product:	Mattress	
Linking Benefit:	Comfort	
Needs – long term	Needs – short term	Benefits
Basic needs	Pleasure	Sensory, touch, sleep
Security	Safety	Secure and stable Doesn't leave your back sore ergonomic individual or two people
	Control over environment (tasks)	Convenience: Ease of use <ul style="list-style-type: none"> • Easy while using (<i>doesn't leave your back sore</i>) • Comfortable to touch (handle)
Higher order needs	Experiential (intrinsic)	Sleep quality, essential to life and recovery

Statement of Need (*comfort only*)

A comfort device for female campers which affords:

- 1) Security for the user
- 2) Basic needs of pleasure
- 3) Higher order needs

Specific needs to be considered include:

- Safety for the user based on ergonomic requirements
- Stable and reliable for one or two people
- Control over environment, easy to use, comfortable
- Sleep quality

Benefit #2: easy to carry/Portability

Product that Affords: fanny pack

AQIWO Mens Fanny Pack Pineapple Waist Pack Bag Hip Pack Running Pack for Men Women



Product Description

- This cute pineapple fanny pack is made of high quality nylon, well made and durable.
- This waist pack bag can hold everything you need to free hands: Designed with one spacious pocket with anti-thief hidden zipper which can hold iPad mini, power bank, folding umbrella, car keys
- Dimension: 17.7"L x 5.9"H x 9"W. This hip pack is compact yet spacious, perfect for running, dating, shopping, daytrips, biking and outdoor activities in daily life.
- Adjustable strap: This hip pack has adjustable strap ranges from 31"-48".
- Breathable and comfortable mesh Lumbar pad prevents moisture and sweat buildup, great as a running pack.

https://www.amazon.ca/AQIWO-Fanny-Pineapple-Waist-Running/dp/B07GLQLDB9/ref=sr_1_17?keywords=fanny+pack&qid=1569026485&sr=8-17

Product- Bassinet				
Needs	Benefits and Underlying Needs	Level of importance		
		Slight	Moderate	High
Basic Needs	<i>Physiological</i>			
Food, water, shelter				
Pleasure, gratification <i>(sensory, compulsive responses)</i>	Comfort for user (hands free, adjustable)			High
Security	<i>Safety, securing resources</i>			
Safety	breathability of mesh panels (prevents build up)		Moderate	
State, Group, Individual	individual		Moderate	
Securing resources	<i>Optimization of limited resources (cost effectiveness)</i>			
• Value • Accumulation of resources (wealth)	Price 25.99			High
Control over environment (tasks)	<i>Product (tool) that amplifies human abilities</i>			
	Convenience			
	<i>Ease of Use</i>	quickly & easily access pockets for items		High
	<i>Flexibility</i>	Adjustable waist sizes		High
		Use for hips or chest		High
	<i>Speed (fast, less time)</i>	Quick access to main pocket		High
	<i>Control (precision, responsiveness, power)</i>	Placement on hips	Moderate	
Long Term Security/Stability of Group				
	<i>Health/care/education of children</i>			
	<i>Environmental sustainability</i>	Materials, polyester, recyclability	Moderate	
	<i>Insurance (car, house), pension, investments</i>			
Social Belonging	<i>Effort / resources to belong to a 'tribe'</i>			
Fear of Abandonment	Know that belongings are secure			High
Fear of the enemy	Anti theft pocket, security of belongings			High
Tribal Identity	"cute" pattern			
Behavior cues for survival <i>(copying behaviors... safe to eat, learned skills)</i>	Keep personal items safe		Moderate	
Behavior cues for social interaction of group	Fun, hands free, participation in activity		Moderate	

<i>(copying behaviors... Interaction cues, play, have fun)</i>				
Peer Pressure	Fit in with trends		Moderate	
Social Expectation <i>(social covenant (gift))</i>	Trends, gift ability	Slight		
Esteem <i>Personal influence in 'tribe'</i>				
Social Status <i>"The elite have it...I want to be like them"</i>	Who else has this, fashionable		Moderate	
Social Recognition		Slight		
Sexual attractiveness		Slight		
'Higher Order' Functions/Needs <i>Needs that differentiate humans from non-primates</i>				
Intrinsic pleasure	Visual appeal, pleasure through colour/pattern		Moderate	
Creative endeavors	Expression through pattern			
Experiential (extrinsic)	Used in/around other people, what do they experience from it	Slight		
Experiential (intrinsic)	Need for carrying things		Moderate	
Emotional	Connection to patterns/colours Emotional reaction/attachment			High

Summary: Benefit #2

Product:	Fanny pack	
Linking Benefit:	Portability/ease of carrying	
Needs – long term	Needs- short term	Benefits
Basic Needs	Pleasure, gratification	Comfort for user (hands free, adjustable)
Security	Securing resources	Price
	Control over environment (tasks)	<i>Convenience</i> <i>Ease of Use</i> : quickly access pockets <i>Flexibility: Adjustable waist straps, hips or chest</i> <i>Speed: quick access</i>
Social Belonging	Fear of Abandonment	Knowing belongings are secure
	Fear of the enemy	Anti-theft pocket, knowing everything is safe
Higher order needs	emotional	Connection to pattern and colour, reaction and attachment

Statement of Need (portability only)

A portable device for female campers which affords:

- 1) security and comfort user
- 2) control over tasks for the user

Specific needs to be considered include:

- comfort for the user
- safety of belongings
- allow user to act freely without restriction
- reduced fear of abandonment and enemy

Combined Statement of Need for Benefit #1 and #2**Statement of Need** (portability and comfort)

A comfortable and portable device for a female camper that affords the user maximum comfort while in use to and portability during the campers trip length.

Specific needs include:

Fundamental Human Needs

Linking the product benefits with fundamental human needs will utilize two models: Maslow's 'Hierarchy of Human Needs', and 'Fundamental Human Needs' (according to the school of "Human Scale Development" and Manfred Max-Neef).

The 'Fundamental Human Needs' is similar to Maslow's model, but with some important additional categories. For example, in the 'leisure' category, one has 'games, parties'. Games are fun and often highly addictive.

Below is a table summarizing these categories.

Need	Being (qualities)	Having (things)	Doing (actions)	Interacting (settings)
subsistence	physical and mental health	food, shelter, work	feed, clothe, rest, work	living environment, social setting
protection	care, adaptability , autonomy	social security, health systems, work	co-operate, plan, take care of , help	social environment, dwelling
affection	respect, sense of humour, generosity, sensuality	friendships, family, relationships with nature	share, take care of, make love, express emotions	privacy, intimate spaces of togetherness
understanding	critical capacity, curiosity , intuition	literature, teachers, policies, educational	analyze, study, meditate, investigate,	schools, families, universities, communities,
participation	receptiveness, dedication, sense of humour	responsibilities, duties, work, rights	cooperate, dissent, express opinions	associations, parties, churches, neighborhoods
leisure	imagination, tranquility, spontaneity	games, parties , peace of mind	day-dream, remember, relax, have fun	landscapes, intimate spaces, places to be alone
creation	imagination , boldness, inventiveness , curiosity	abilities, skills, work, techniques	invent, build, design, work, compose , interpret	spaces for expression, workshops, audiences
identity	sense of belonging , self-esteem , consistency	language, religions, work, customs, values, norms	get to know oneself, grow, commit oneself	places one belongs to, everyday settings
freedom	autonomy , passion, self-esteem , open-mindedness	equal rights	dissent, choose, run risks , develop awareness	anywhere

Common benefits and the correlating fundamental human needs

Commonly cited product benefits are the following: *easy, efficient, convenient, comfort*

These are related to **control over one's environment**. Correlating needs are (Max-Neef model):

Protection: **autonomy**, adaptability, work, planning, take care of

Freedom: **autonomy**, self-esteem

Another group of benefits are **experiential**, e.g. *exciting, stimulating, exhilarating*

These are related to experiences. Correlating needs are (Max-Neef model) are:

Leisure: **spontaneity**, games, have fun, imagination

Freedom: **autonomy**, self-esteem, risk-taking

Beauty and style are important categories not specifically addressed by either the Maslow or Max-Neef models. "Beauty is the quality of being pleasing, especially to look at, or someone or something that gives great pleasure, especially when looking at it." *Wikipedia*. What is pleasing is either innately or culturally derived.

For purposes of this exercise of associating benefits with fundamental human needs, **style and beauty** will be associated with the term **aesthetics** or higher order activities such as **self-fulfillment** and **creativity**.

Benefits and Corresponding Fundamental Human Needs

The fundamental human needs corresponding to the product benefits (*reference Product Research REPORT*) was determined and displayed in the Table below. The relative strength of relationship (strong/moderate/weak) was also indicated.

Table: Benefits and Corresponding Fundamental Human Needs
Female Camping Comfort

	Benefit	Possible Corresponding Fundamental Human Needs (FHN)	Relationship between Benefits and FHN
1	Comfort	Control, security, self-esteem (mastery)	strong
2	Style	Esteem, belonging, aesthetically pleasing	moderate
3	Efficiency	Accomplishment, autonomy, self-esteem	strong
4	Ease	Accomplishment, autonomy, protection, security, control, self-esteem (mastery)	strong
5	Fun	Leisure (excitement), Participation, Belonging (shared fun)	strong

Comfort in this context is making the experience of camping more enjoyable by the feeling of being safe, connection with the outdoor environment and freedom to explore with sense of safety and confidence. It includes the ability to be in control of the situation and reduce amount of risk associated with the activity, increasing the sense of safety and security.

Security is the major fundamental human need met. Does the user feel safe and in control of the experience.

Style is an important expression of individuality. What is considered by the group as stylish increases **self esteem**. It can be aesthetically pleasing and increase the connection to the product.

Efficiency is defined as the effort required to perform at a particular level. This is related to **control** the user has during the activity (**autonomy**). Camping offers feeling of accomplishment and through the product usage could directly relate to self esteem.

Ease is in many ways related to efficiency in terms for fundamental human needs (i.e. **control, autonomy**). How does the product offer security and control to the environment and the user.

Fun related to **leisure** ('travel' to new interesting environments) and **belonging (shared fun, participation** between female camper and the environment). How does the product offer excitement and increase the opportunity for sharing and connection between individuals.

Statement of Need

Camping is a purposeful activity (user accomplishment, connection to environment, **mastery**) based on fun (**leisure, excitement, shared fun**), efficiency (**autonomy, self-esteem**) and comfort afforded the user (**comfort and security**).

Camping can also be a **social** activity, since most camping can involve interaction within a group or new individuals along the way. **Esteem** can be afforded by good styling/quality cues of the device.

Benchmarking Pool

Product 1: Therm-a-Rest NeoAir UberLite Sleeping Pad – Unisex



Link: <https://www.mec.ca/en/product/5064-153/NeoAir-UberLite-Sleeping-Pad>

Search Google: sleeping camping

Description: What's about the size of a beer can but weighs half as much? Introducing the NeoAir UberLite, the smallest, lightest insulated sleeping pad ever. Therm-a-rest shaved tons of weight off their popular NeoAir pad by using crazy light external fabric and internal reflective film. The result inflates to give you 6.4cm of cushy sleeping comfort but packs down small and light enough to delight the ultralight crowd.

- Made of 15-denier high-tenacity nylon that is insanely lightweight.
- Triangle core matrix with reflective film traps heat and creates a stable sleeping platform.
- Air-only pads have no insulation that can be compromised by moisture, often added when you inflate them by mouth.
- Includes a stuff sack and repair kit.

Specifications:

Weight	170g (Small) 340g (Large) 250g (Regular)
Ideal for	Backpacking
Capacity	1-person
Type	Inflatable pad
Insulation	Reflective coating
Shape	Mummy

Top Fabric	15-denier HT nylon
Bottom Fabric	15-denier HT nylon
Inflation method	Mouth Pump
R value	2
Thickness	6.4cm
Length	119cm (Small) 196cm (Large) 183cm (Regular)
Width	51cm (Small) 63cm (Large) 51cm (Regular)
Rolled length	15cm (Small) 19cm (Large) 15cm (Regular)
Rolled diameter	8cm (Small) 10cm (Large) 9cm (Regular)
Additional feature(s)	Repair kit included Stuff sack included Ultralight
Made in	USA

Product 2: Patagonia Hybrid Sleeping Bag



Link: <https://eu.patagonia.com/pt/en/product/hybrid-down-sleeping-bag-short/70065.html>

Search Google: sleeping bag

Description: For light-and-fast alpine climbing, our Hybrid Sleeping Bag embodies a fundamental tenet of minimalism: it eliminates redundancies. Its 850-fill-power Advanced Global Traceable Down (goose down certified by NSF International from parent farm to apparel factory to help ensure the birds that supply it are not force-fed or live-plucked) is encased in an ultralightweight Pertex® Quantum shell fabric, which is down-proof and warms from the torso to the toes. Above, the bag continues with a single layer of whisper-light, windproof nylon fabric—1.2-oz 15-denier 100% nylon ripstop with a DWR (durable water repellent) finish—creating a heat-trapping cocoon when paired with your belay parka. The half-zip saves precious weight, and drawcords atop the insulated portion and at the hood help seal in warmth, preserving your energy for the summit push.

Specifications:

Ultralightweight Pertex Quantum® shell uses interlocking Y-shaped nylon fibers to enhance the performance of the DWR (durable water repellent) finish

Featherweight 100% nylon ripstop liner with a DWR (durable water repellent) finish

850-fill-power Traceable Down (European goose down traced from parent farm to apparel factory to help ensure the birds that supply it are not force-fed or live-plucked)

Paired with a high-alpine insulated jacket or parka, the hybrid sleeping bag becomes an ultralight backcountry sleep system

Custom foot-box pattern eliminates dead space and bulk, maximizes warmth and affords ample room for movement

Adjustable drawcord at waist for sealing in warmth

Ultralight stuffsack included

451 g (15.9 oz)

Product 3: Naturehike CW300 Goose Down Sleeping Bag Ultralight Mummy 630grs



Link: <https://www.hikeroutlet.com/product/naturehike-cw300-goose-down-sleeping-bag-ultralight-mummy-630grs/>

Search: sleeping bag ultralight

Description: Naturehike CW300 Goose Down Sleeping Bag Ultralight Mummy 630grs

brand: naturehike

item: CW300 mummy goose down sleeping bag

comfort: 6 Celsius

fabric: 20D 400T nylon

filling : 300g 90% goose down 750FP

size: 200*80cm

storage size: 13*29cm

weight about: 630g

Product 4: Outdoor Research Helium Bivy



Link: https://www.rei.com/product/867215/outdoor-research-helium-bivy?cm_mmc=aff_AL--132239--159795--NA&avad=159795_d1790bdc1

Search: bivy bag

Description: Weighing in at only 18 oz., this is the lightest weight bivy available from Outdoor Research. With a classic clamshell design, it's waterproof, breathable and ready for many seasons of adventures.

Specifications:

Light and supple Pertex® Shield+ 2.5-layer ripstop nylon fabric with fully taped seams creates a waterproof, windproof and highly breathable barrier against the elements

Waterproof, 70-denier nylon floor features an anti-fungal coating to cut the funk

Shockcorded Delrin® overhead pole, high-volume toe end and removable no-see-um mesh netting at the opening add comfort to this minimalist shelter

Features 5 stake loops, 1 guyline loop, sleeping pad straps and a small internal mesh pocket

Best Use	Backpacking
Seasons	3-season
Sleeping Capacity	1-person
Weight	1 lb. 2 oz.
Packed Size	4 x 15 inches
Bivy Length	84 inches
Shoulder Width	26 inches

Product 5: M12™ Heated AXIS™ Layering System with HYDROBREAK™ Rain Shell



Link: <https://www.milwaukeetool.com/Products/Work-Gear/Heated-Gear/Heated-Jackets/203RN-21>

Search: (google) Milwaukee heat gear

Description: Our MILWAUKEE® M12™ Heated AXIS™ Layering System with HYDROBREAK™ Rain Shells are designed to protect you from the cold and rainy weather elements. Powered by M12™ REDLITHIUM™ Battery Technology, the AXIS™ heated jacket uses carbon fiber heating elements to create and distribute heat to the chest, back and shoulders. A one-touch LED controller heats up the jacket to three heat settings, creating a comfortable temperature for any environment or weather. The heated jacket has a new Quick-Heat function that allows you to feel heat three times faster than our previous jackets and market competitors. These jackets are built strong to last long with new AXIS™ Ripstop Polyester providing a lightweight, compressible design that can be used as an inner layer or mid-layer jacket and protects you from wind and water resistance to survive the elements. The HYDROBREAK™ Rain Shell combats against rain and snow conditions. The 2.5 layer rain shell is designed with ripstop polyester for tear and abrasion resistance and a polyurethane laminate to keep you dry all day. Available in gray with sizes ranging from small to 3XL, this kit comes with the M12™ battery powered heated jacket and HYDROBREAK™ rain shell, one M12™ REDLITHIUM™ CP2.0 battery, and an M12™ compact charger and power source.

Specifications:

Voltage 12V

PRODUCT SPECIFICATIONS

Outer Material Ripstop Polyester

Heated Gear Warranty 1 Year

Washing Washer and Dryer Safe

Inner Material Brushed Tricot

Color Gray

Heat Settings (3) Heat Settings: High, Medium, Low

Battery System M12
 Weather Resistant Wind/Water Resistant
 Insulated Yes
 Power Source Cordless

Product 6: USB Rechargeable Heated Gloves



Link: <https://www.milwaukeetool.com/Products/Work-Gear/Gloves/Heated-Gloves/USB%20Rechargeable%20Heated%20Gloves>

Search: Milwaukee heat gear

Description: Milwaukee® REDLITHIUM™ USB Heated Gloves are built for tradesman to use on and off the job. Focused on providing reinforcement in areas where other gloves fail, GRIDIRON™ Ripstop Polyester protects against abrasion and tearing while 100% leather palms and fingers add dexterity and extra durability. Powered by REDLITHIUM™ USB, these gloves offer up to 6 hours of runtime, keeping users warm in extreme cold.

Specifications:

Clothing Product Type

Gloves

Color

Black

Color Family

Black

Gender

Neutral

Glove Features

Cut Resistant, Insulated, Leather Palm, Puncture Resistant, Touch Screen

Glove Material

Polyester

Glove Size

Medium

Glove Type

Heated

Gloves & Mittens Product Type

Outdoor & Work
Mitten/glove style
Glove
Pack Size
1

Product 7: Heated Sleeping Bag by Ravean



Link: https://www.kickstarter.com/projects/ravean/sleep-naked-camping-heated-sleeping-bag-liner-by-r?utm_source=kickbooster-direct&utm_medium=kickbooster&utm_content=link&utm_campaign=hxlzvwlv

Search: (google) heated sleep gear

Description: The heated core and feet elements in Ravean's new electrically heated sleeping bag liners deliver warmth where it's needed, eliminating uncomfortable feet and bodies in any camping condition.

Specifications:

12V WEARABLE HEATED SLEEPING BAG LINERS

Power your 12V controller with a heated core and feet elements eliminates uncomfortable cold feet and backs while camping.

Will last up to 10 hours on a single charge!

Turn the heating element on you can increase your sleeping bag rating by 20 degrees. (20° increase in temperature)

Adjust your internal temperature as the weather outside changes.

Water resistant outer shell meant to keep you dry from the outdoors.

Our jackets can handle a washing machine. No need to worry about being comfy with this bag!

Comes with a stuff sack and patch cover to fit in your pack or suitcase.

Use the lithium polymer battery to charge your mobile devices.

For camping, sporting events, travel, etc.

Your dog(s) will stay nice and toasty while you sleep.

The length can be adjusted with vertical draw strings to put the heat on your feet where you want it.

Keeps the air in place while you sleep, and the heat inside the bag where you want it.

INCREASE YOUR SLEEPING BAGS EN RATING UP TO 2 SEASONS

YOUR BAG + OUR BAG LINERS = 20° OR 2 SEASONS INCREASE YOUR EN TEMPERATURE RATING

FEATURES	BAG LINER	WEARABLE BAG LINER
HIGH, MEDIUM, LOW TEMP CONTROL	☐	☑
DUAL ZONE HEATED AREAS FOR CORE & FEET	☐	☑
DWR WATER RESISTANCE	☑	☑
100% WASHABLE	☐	☑
LIGHT & STUFF-ABLE	☐	☑
CHARGE YOUR DEVICES	☑	☑
HEATED HOOD	☐	☑
ADJUSTABLE HEIGHT	☐	☑
UNICURF DESIGN	☐	☑
WEARABLE AS A JACKET	☐	☑

Product 8: Selk'bag Adult Lite 5G Wearable Sleeping Bag



Link: https://www.amazon.com/dp/B015JRENN8/?tag=097-20&ascsubtag=v7_1_4_wr5_1zc9_4_x01_-srt10-

Search: wearable sleeping bag

Description: The Selk'bag Lite 5G Fully Body Sleeping Bag is made of soft polyester with a durable water resistant finish on the shell providing comfort and functionality for a variety of weather conditions; redesigned for a more anatomical fit and increased comfort. The Selk'bag defies categorization, it is a sleeping system and the ultimate lounge partner; use it in the tent, take it on a hike, make marshmallows by the campfire or catch a morning sunrise down on the beach! Removable booties easily unzip so you can wear your own shoes without taking off the Selk'bag; with reinforced outsoles, the booties can fully zip for heat preservation while sleeping or on the move outside. The Selk'bag broadens horizons and presents new possibilities by marrying the warmth and comfort of a sleeping bag with the function and fun of a snowsuit. Exaggerated draft tubes stop heat loss around the zippers while a thermal collar around the head

and neck prevent drafts; zippered leg and chest vents shed unwanted heat if you feel too warm. Designed with elastic no-hassle hand openings to allow hands in and out of the bag effortlessly. The Selk'bag Lite 5G Fully Body Sleeping Bag comes with a convenient carry sack for compact portability. We invite you and your kids to enjoy the warmth, comfort and practical functionality of this award-winning, innovative and fun sleepwear system! Temperature rating 44° F.

Specifications:

- 100% Polyester shell
- Made from soft polyester with a durable water resistant finish on the shell providing comfort and functionality for a variety of weather conditions; Fits heights 5'11" – 6'4"
- The ultimate lounge partner and sleeping system; Use it in the tent, take it on a hike, make marshmallows by the campfire, catch a morning sunrise down on the beach
- Removable booties easily unzip so you can wear your own shoes or keep the booties closed for heat preservation; Reinforced outsoles protect the material while on the move outside
- Exaggerated draft tubes stop heat loss around the zippers while a thermal collar around the head and neck prevent drafts; Zippered leg and chest vents shed unwanted heat if you feel too warm
- Designed with elastic no-hassle hand openings and double front zippers for quick entry; Comes with a convenient carry sack for compact portability

Table of Products



Appendix iv – Needs Analysis

Needs Statement

- Objective:** To generate a needs statement for your product.
To identify main benefits for comparable products.
To relate product benefits with fundamental human needs.
- Method:** Promotional media (literature/internet) of comparable products are researched and evaluated to determine benefits and design opportunities for your product category.
- Product benefits are linked to latent needs (in this case consider fundamental human, and their relative importance to the design of a new product).
- Topic:** Female camping/trekking

Preliminary Needs Statement

- Device female campers/trekkers that:
- Increases comfort
 - allows user to feel safe

Purpose: Recreation

Sections:

- 1 Initial Needs Assessment
- 2 Linking Benefits to Fundamental Human Needs
- 3 Generate a Needs Statement

1 Preliminary Needs Assessment

What the product does

Comfort for female campers

360 initial inquiry

Who are your target market group?	Female campers
What does it do?	Increase comfort
Where will it be done?	Outside, continental climates
When is it done/used/needed?	Day/night
Why is it needed?	Increase comfort, improve experience, make users safe

Why would someone buy this product?

- Increases comfort of camping
- Allows users to participate safely
- Makes users feel safer and more capable
- More enjoyable experience

2 Linking Benefits to Human Needs

Products with similar benefits were determined, and promotional media for them gathered.

A more in-depth look at the benefits listed in the promotional literature was carried out.

These benefits were related to Human Needs using:

- 1) Hierarchy of Human Needs (*Mazlow*) and
- 2) Fundamental Human Needs (*Max-Neef*)

Direct User Observation

Chronology



Mikayla starts the packing process by gathering all the items she needs and packing the backpack with it laying face up on the ground. The pack is loaded from the front, and she stuffs the items inside in no specific order.



When she is done packing, she makes sure everything is pushed in and fitting properly and then zips up all the zippers.



She still needs to add the tent, but it won't fit in the main pocket of the bag, so she brings it over to clip to the outside. There are two thin straps at the bottom of the bag with clips on the ends of the straps, which she loosens fully. She positions the tent and then clips the straps in place.



She tries to tighten the straps, but it is difficult, and they are stiff. She struggles for a bit using her nails to try and loosen it up before she can tug it tight.



Once satisfied with the tent attached, she flips the bag up and clips in the top closure and pulls the straps tight. She performs all these actions while kneeling on the floor with her knees.



She stands up and pulls the bag with her by one of the straps. It looks slightly heavy as she uses momentum to bring the bag up off the ground.



She gets the one shoulder in the strap and then bends slightly to wiggle her arm on the other side. She uses her fingers to try and feel for the strap because she can't see where it is behind her.



She gets it on both shoulders and jumps up a little to make sure it is securely positioned on her as she gets ready to do up the additional straps.



She buckles up the hip straps first. She has to loosen them first to get them clipped together, and then she tightens them, so it pulls the bag securely against her back.



Then she moved to the chest strap. Bending her chin down to see where the buckles should clip together, she bends her arms and fastens them. She then pulls on the straps to tighten it properly against the body.



To remove the bag, she bends her one arms and slides it from the back through to the front of the bag and uses that to push the one side away from her body. She shifts the weight to the opposite shoulder and lets the bag fall onto that side.

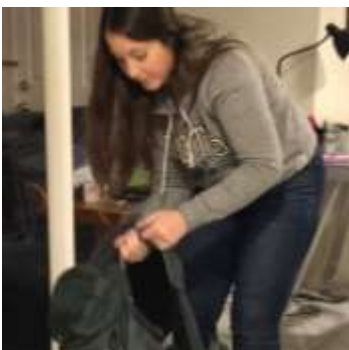


She does the same with the other arm and lets the bag fall down the last arm. She grabs the other side with her first arm and the top strap with the last arm to lower it to the ground as she bends at the hips slightly until it touches the ground. She is now done\.

Organizing Data



- User is struggling with tightening straps
- A task that has to be done but is most challenging so far
- Has to kneel, hard on knees



- Picking up the bag is a large part of where ergonomics can be analyzed as it put the body in an awkward position.
- Puts stress on the arms and backpack



- Uncomfortable neck position

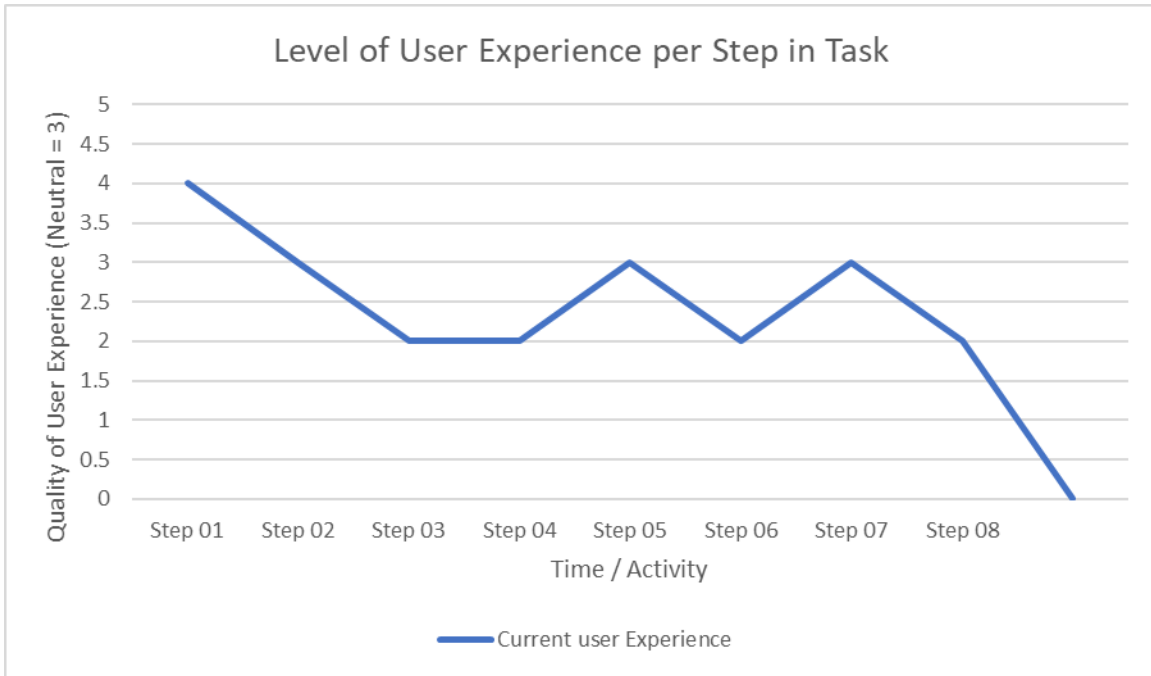
- Arms are in an unnatural position

User Experience

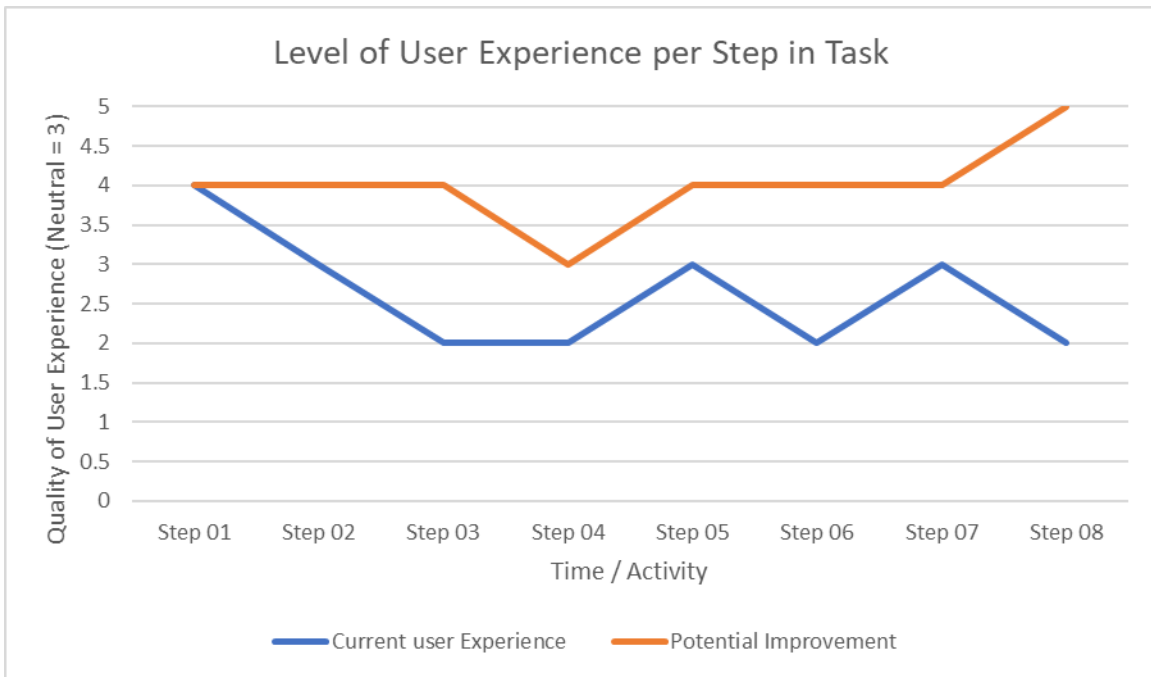
User Experience Map

Task: Packing backpack		
Step #	Description	Gradient Scale of Pain – Pleasure Points
		Negative = 1; Neutral = 3; Positive = 5
		1 2 3 4 5
01	Packing items	○ ○ ○ ○ ⊖
02	Zipping up bag	○ ○ ○ ○ ○
03	Buckling tent straps	○ ○ ○ ○ ○
04	Tightening tent straps	○ ○ ○ ○ ○

05	Securing bag top	○ ○ ○ ○ ○
06	Putting on bag	○ ○ ○ ○ ○
07	Fastening bag to person	○ ○ ○ ○ ○
08	Taking off bag	○ ○ ○ ○ ○



Potential Experience Improvement Chart

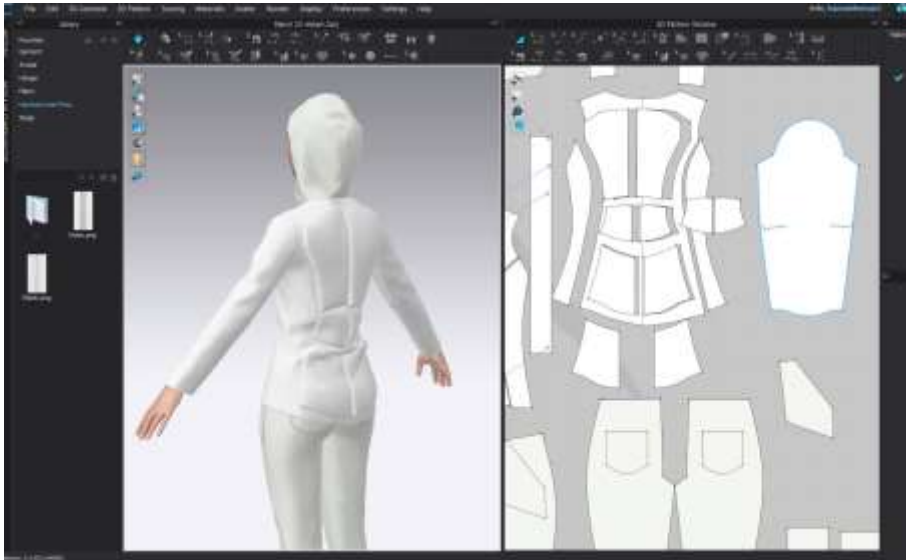


Overall Analysis

During this observation, some of the most notable things to discuss were as follows. The user was kneeling on her knees continuously when packing the bag and was kneeling until she was

done and ready to put on the bag. After she was done packing when she adjusted the straps, they were very tight, and she had to pick at them with her fingers, this was extremely uncomfortable and not ideal for someone trying to pack effectively. She then has to pull up off the ground, cause some awkward and uncomfortable positions for her back and arms. The same happened when putting the bag onto the other arm as well as taking the bag off. The amount of weight in the bag would also affect what stress is put on the joints. These factors are important because of the ergonomic evaluations that can be made from this information. Human factors are extremely important to the comfort and usability of a product. These stresses to the body are things that can be changed and used to improve existing designs or to create new ones.

Appendix vii – CAD Models



Appendix viii – Hard Model Photographs



Appendix viiii – Technical Drawings



Appendix ix – Manufacturing Cost Report

QTY	Concept Item	Estimated Cost (\$)
4 meters	Outer material, coated nylon	30
4 meters	Inner liner, recycled polymer	40
3 meters	Inflatable section material, coated nylon	25
1	Printed battery	300
1	SAT nav system	400
1	Heated wiring system	10
1 meter	Solar cell textile	100
Total		905

Appendix x – Sustainability Report

Abstract

This report discusses materials, manufacturing methods and sustainability for current outdoor garments as well as future possibilities for outdoor garments. This is done through benchmarking current products and evaluating the current thesis project design from a sustainability standpoint. Various efforts are being made by companies in order to keep up with environmentally conscious consumers and this thesis will continue to work towards sustainable options for textiles and tech elements.

Keywords: benchmarking, manufacturing, sustainability, textiles

Technical Report - Sustainability

2.2.4 Benchmarking – Materials & Manufacturing

When it comes to outdoor clothing, typically users wear a base layer, an insulation layer and something to keep the inside layers dry. Current materials for base layers can vary between silk, wool and different synthetic materials like polyester and synthetic fleece. The importance of these materials is that they wick moisture away from the body as you sweat, which keeps you warmer. Materials like cotton should be avoided in any type of outdoor wear, as it absorbs sweat and traps it close to your body. (Montana Fish, Wildlife and Parks, n.d.) In cold conditions this can be dangerous. Common insulating materials used in jackets can include down, synthetic down, or a combination of layers of fleece or polyester. Outdoor jackets use more durable and weather proof materials for the outer most layer to keep the user protected and to add longevity to the garment. Typical outer shell materials can be variations of nylon and polyester or blends of other synthetics (The North Face, 2020).

Most of the current products are made from soft comfortable materials when in contact with the skin and insulating materials within the layers or on the inside of the product. These are geared towards providing comfort and maintaining durability in use. Materials used in sleeping bags include a nylon shell, either down or synthetic down as a filler and a synthetic inner liner (see Appendix E). Inflatable sleeping mats often use a durable outer material and a foam core that is easily compressed when not in use. All of these items are either stitched together or using radio frequency welding techniques to seal the edges.

2.2.5 Benchmarking - Sustainability

There is a big push in recent years for companies to produce sustainable and environmentally conscious products. This can range from ethically sourcing materials like down and initiative that ensure workers are paid livable wages. Materials in various clothing items are now advertised as using recycled materials such as plastic bottle to make new fibers, or offering a repair service for products to ensure longevity and limit the need to buy new items to replace damaged ones.

Patagonia is a leading outdoor clothing brand that is a leader in sustainable practices, with their repair program, use of recycled and reclaimed materials, and work with BLUESIGN standards to manage the impact they have on the environment (Patagonia, 2020). “Because the value chain of the textile industry and similar industries must be increasingly accountable, BLUESIGN inspires and equips brands, manufacturers and chemical suppliers with comprehensive sustainability solutions, so that the industry continuously fosters safer work environments, increasing levels of environmental responsibility, enhanced business value and deeper consumer trust.”

(BLUESIGN, 2020)

3.5 Sustainability – Safety, Health, & Environment

The key differences in material choice for this thesis project versus what is readily available in today’s outdoor equipment is the addition of smart textiles, displays, heat elements and renewable energy sources. Smart textiles are able to detect and relay information regarding the body’s condition, allowing for the user to safely participate in what could potentially be a risky activity in certain conditions, as well as incorporating the added safety of keeping warm without the need to carry extra fuel or produce heat by body movements. The renewable energy from the sun is applied in this design as a safety feature to the user and as a sustainability element.

Harnessing the sun’s power as the user walks for hours outside each day is used as a way for them to be self-sufficient for the entirety of their trip. The versatility of this design also encourages the purchase of only one garment to fit the needs of the user, rather than purchasing many different layers and garments that would be required for warmth otherwise.

Sustainability

With mainstream companies making moves towards more sustainable and environmentally conscious materials and manufacturing, it is slowly becoming a new standard in the largely wasteful textiles and fashion industries. The material choices for this thesis project is aiming for a truly sustainable future and reduction of waste and excess consumption.

References

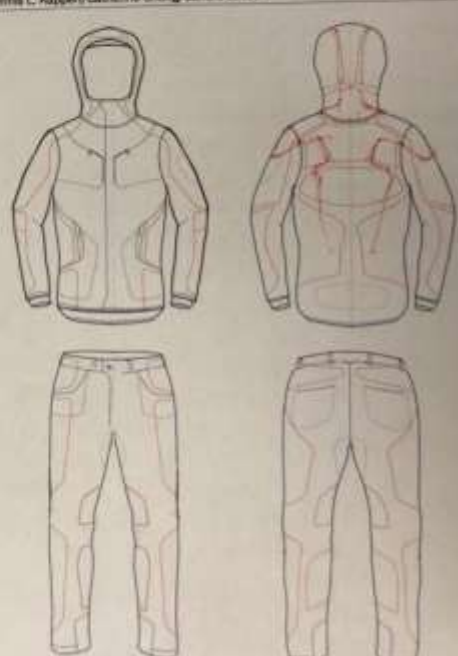
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The North Face (2020). Innovation for the Modern Explorer. *Retrieved from:* https://www.thenorthface.com/en_ca/about-us/technology-innovation/technology.html

Appendix xi – Topic Approval Form

<p>Humber Institute of Technology & Advanced Learning School of Applied Technology Bachelor of Applied Technology – Industrial Design Winter 2020 IDSN 4502 Senior Level Thesis Project II Dennis L. Kappen/Catherine Chong/Sandro Zaccaro</p> <p style="text-align: right;"><i>Handwritten:</i> Hannah F.</p> <p>This design is approved to proceed for the following:</p> <p><i>Handwritten:</i> CAD Design Phase → CAD 360 in 1:1 scale</p> <p><i>Handwritten:</i> Rapid Prototyping and model building phase → preparing for CAD review</p> <p>COMMENTS:</p> <p><i>Handwritten:</i> CAD → replace aspect of stitching/patterns</p> <p>Signed Catherine Chong / Dennis L. Kappen</p>	<p>Humber Institute of Technology & Advanced Learning School of Applied Technology Bachelor of Applied Technology – Industrial Design Winter 2020 IDSN 4502 Senior Level Thesis Project II Dennis L. Kappen/Catherine Chong/Sandro Zaccaro</p> 
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Appendix xii – Advisor Meetings

