PRACTICAL AND LIGHT EQUIPMENT FOR THE CURIOUS EXPLORER

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ABSTRACT

Often our backpacks are on our backs, and when we need to access items, we often take them off and put them on our chest to access them. This paper discusses the practical possibilities of high-elasticity straps for backpacks to reduce the stress on the user. Non-traditional backpacks would allow the curious explorer to access items faster while traveling or hiking, and if this approach is successful it could be adapted to the majority of backpacks on the market and to a wider range of people. This article explores the possibilities of a range of non-traditional backpacks that could provide a faster and more comfortable experience for people on the go. In the wake of the Covid19, Thailand has seen a gradual influx of travelers and backpackers, and the research methodology for this paper is to survey this target group to identify the main problems of backpacking and various secondary problems, then compare and contrast several different samples of backpacks, as well as refer to the literature on backpacking, and incorporate these answers to design a new backpack. This paper examines and designs a range of backpacks that are designed to make it easier for the user to access their belongings, exploring their possibilities and the problems they will encounter. For example, the elasticated shoulder straps cannot be used permanently and there is the problem of swaying when the backpack is cut in two. Further research will be needed to practice and improve these designs in the future.

Keywords: Backpacks, Curious explorers, Elastic straps, Convenient, Lightweight

1. Introduction

Going outdoors to relax has become the choice of many people. They go outdoors to breathe fresh air and explore the plants and animals they have never seen before, which is the exploration of life and also the exploration of themselves. Visiting nature can improve your mood. The atmosphere can also improve stress. Exposure to nature has been linked to a host of benefits, including improved attention, lower stress, better mood, and reduced risk of ... (Weir, 2020) Similarly, being in natural environments has been shown to improve mood in a general sense, and a positive correlation has been shown between the well-being of green space users and the species and habitat richness of those spaces (Russell R, 2013).

Curiosity is a quality related to inquisitive thinking such as exploration, investigation, and learning, evidenced by observation in humans and other animals. (DE, 1954) Taking into account the shortcomings of both curiosity-driven and optimal arousal theories, attempts have been made to integrate neurobiological aspects of reward, wanting, and pleasure into a more comprehensive theory for curiosity. Research suggests that the act of wanting and desiring new information directly involves mesolimbic pathways of the brain that directly account for dopamine activation. The use of these pathways and dopamine activation may account for the assigning of value to new information and then interpreting it as a reward. (Costa, Tran, Turchi, & Averbeck, 2014) (Kakade & Dayan, 2002) (Edleman, 1997) Therefore, curiosity makes people continue to explore, from a strange place to another strange place, never tired of it. To explore or adventure may be conceived of as a category of activities and experiences that stands out from daily life. As stated by Simmel back in 1911, its most general form "… is it's dropping out of the continuity of life" ((Ed.), 1971)The range of outdoor activities for curious explorers mentioned in this article can be found in jungles and cities in Thailand.

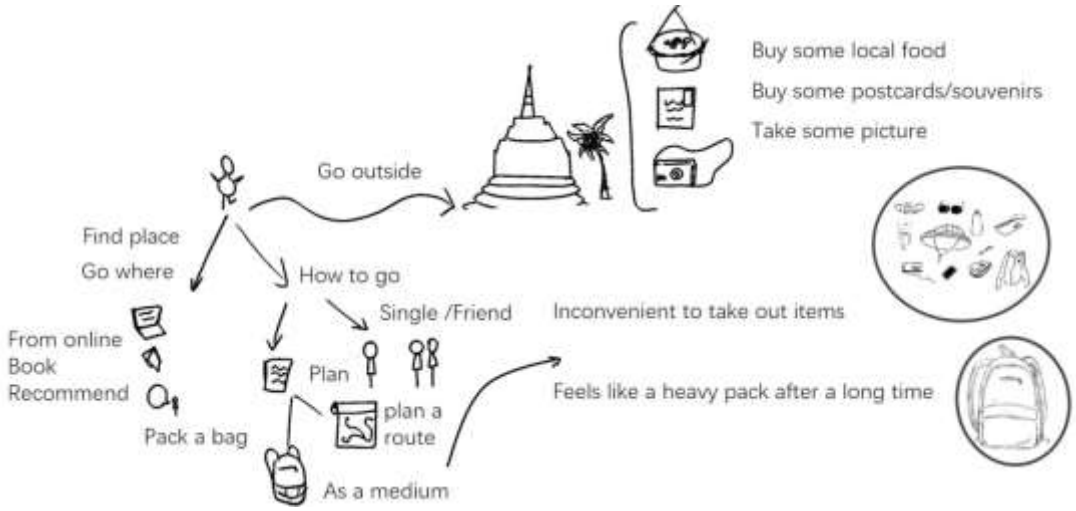

Figure 1 The thought process behind choosing Backpacks as the subject of the research

As a foreign traveler in Thailand, first I would look for places I want to visit, identify the spots I want to visit from my friends to find them or I can go online or look for them in a book. So how do I get there? I have to decide who I want to go with, then plan a route map and pack some essential things in my backpack. Then the backpack serves as a medium for me to go traveling or hiking outdoors. I use it a lot, and in terms of Thailand, after the Covid19, it opened up a lot of foreign tourists, and they did the same thing, and the backpack served as a tool that they had to use. So from this, the backpack was identified to be the object of my research. figure 1 is a diagrammatic representation of this thought process.

2. Objectives of the study

Figure 2 illustrates the framework for this process.

2.1. Access to relevant literature, and extract their design and knowledge principle. Development of literature-based and innovative design solutions.

2.2. Design Practical and light equipment for the curious explorer, for a pleasant journey.

2.3 Validate the feasibility of the design solution.

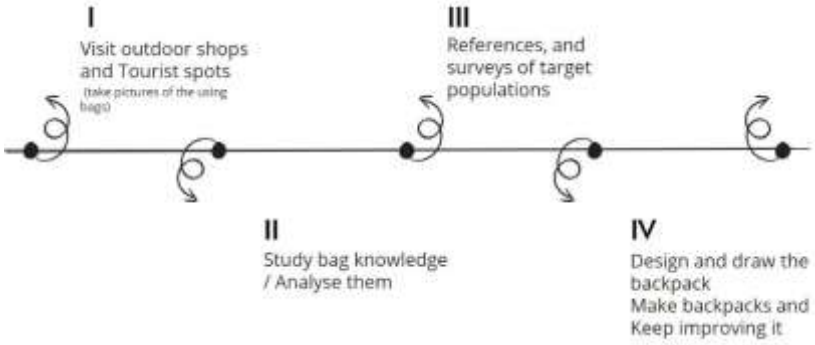

Figure 2 Conceptual Framework

3. Materials and methods

3.1 Backpacks

3.1.1 Types of backpacks are day backpacks, travel backpacks, school backpacks, water bags, work backpacks, tactical backpacks, sports backpacks, and Nontraditional backpack (BTP) as shown in figure 4. "...and a nontraditional backpack (BTP) in a young adult population…" "…and balancing the weights between the two pockets for the BackTpack (BTP)." (Kimberly D. Dahl, 2016)Travelers and outdoor travelers in Thailand, probably need backpacks with a capacity of 20-30 liters. Therefore, this paper chooses daypacks and short-distance backpacks as the research objects.

1) Daypacks: Daypacks are small to medium-sized backpacks designed for short trips or everyday use. They typically have a capacity of 10 to 30 liters, enough to carry essentials like a water bottle, snacks, a small camera, and a light jacket.

2) Hiking Backpacks: These backpacks are designed for day hikes or multi-day treks. They usually have a capacity of 30 to 50 liters for day hikes and 50 to 70 liters for overnight or multi-day trips. Hiking backpacks are equipped with features like hydration reservoirs, compartments for organizing gear, and external attachment points for trekking poles.

3) Rucksacks: Rucksacks, also known as military or tactical backpacks, are sturdy and durable packs designed for outdoor activities, military use, or survival situations. Their capacities can vary widely, ranging from 20 to 80 liters, depending on the specific purpose and the duration of the mission.

4) School Backpacks: These are backpacks designed for students to carry their books, notebooks, and other school supplies. They typically have a capacity of 15 to 30 liters, with some larger options available for college students.

5) Laptop Backpacks: Laptop backpacks are designed to carry laptops and other electronic devices safely. They usually have a dedicated padded compartment for the laptop and additional space for other accessories. Capacities can range from 15 to 30 liters.

6) Travel Backpacks: Travel backpacks are designed for globetrotters and frequent travelers. They come in various sizes, with capacities ranging from 30 to 70 liters or more. Many travel backpacks also have additional features like lockable zippers, multiple compartments, and detachable daypacks.

7) Hydration Packs: These backpacks are designed for outdoor activities like running, cycling, or hiking, where staying hydrated is crucial. They typically have a capacity of 5 to 15 liters and include a built-in hydration bladder or reservoir.

8) Climbing Backpacks: Climbing backpacks are specially designed for climbers to carry their gear and equipment. They often have a streamlined design with a capacity of 30 to 45 liters for day climbs and up to 70 liters for multi-day expeditions.

9) Camera Backpacks: These backpacks are tailored to photographers' needs, providing specialized compartments for cameras, lenses, and accessories. Capacities can vary widely depending on the equipment, ranging from 20 to 40 liters or more.

3.1.2 Fabric

To make a backpack, I would want to choose a fabric that is durable, strong, and able to withstand the demands of everyday use. Common fabrics used to make backpacks include:

1) Nylon: Nylon is one of the most popular choices for backpacks due to its excellent strength-to-weight ratio. It is lightweight, abrasion-resistant, and water-resistant or waterproof.

2) Polyester: Polyester is another commonly used material for backpacks. It is strong, durable, and more affordable compared to nylon.

3) Canvas: Canvas is a sturdy and durable woven fabric that can be made from cotton or a blend of cotton and synthetic fibers.

4) Ripstop: Ripstop fabrics are typically made from nylon or polyester and have a unique weaving pattern that prevents tears from spreading.

5) Dyneema: Dyneema is an ultra-high-molecular-weight polyethylene (UHMWPE) fabric known for its exceptional strength-to-weight ratio.

I chose Oxford fabric, the composition, and content are 100% polyester, density is 100T. yarn count is 420D*420D, grammage is 180, width is 150 cm, the fabric is plain, and the dyeing process is suitable for bags, outdoor clothing, etc. It is cheap, waterproof, tear-resistant, and wear-resistant, but the disadvantage is that the grammage is not light, but the expensive Dyneema fabric can do the job. And it is not easy to obtain.

3.1.3 Accessories include Zippers, Buckles, Padded, Straps, Mesh, Side Pockets, Reflective, Water-Resistant Materials...

3.1.4 Fabric market

Krung thon buri road of Thailand, but this market in Thailand only has some common fabrics and special accessories are hard to find.

3.2 List of contents of the backpack

1) Sunscreen, anti-mosquito spray, mask, and sunglasses.
2) Mobile phone, charger.
3) Tissues, water bottle.
4) Cash, wallet, pen, passport.
5) Hat, clothes.
6) Souvenirs, gifts bought on the road
7) Some snacks, and food.

3.3 Problems encountered

the questionnaire survey for target users, people felt that their backpacks were lacking in big capacity and convenience and lightweight. and that they wanted to add some functionality and comfort. Table 1 shows the online questionnaire for backpackers, trekkers, or students living in Thailand.

Table 1 A online questionnaire for backpackers or travelers or students living in Thailand

gender	**1. Do you think there are any shortcomings of your day travel backpack or short-distance backpack?**	**2. Your suggestions for your backpack (what features or improvements do you want it to have)**
Male	1) Backpacks are inconvenient 2) Being too tired to carry weights when you are older	1) There is a load-bearing frame 2) Collapsible shrinkage 3) There are air cushions
Female	Backpack heavy	Lighten up
Male	No, it depends on the distance and content	There are comfortable backpacks and shoes and other equipment

Table 1 A online questionnaire for backpackers or travelers or students living in Thailand (Cont.)

Female	Things can't be packed too much, a lot is needed outside	It can hold a lot of things, unique enough
Female	It's too small, and it's bulky if it's big	I think it is a storage bag that can put a lot of things, umbrellas, water cups, cosmetics, etc., and it is easy to find when looking for it
Female	1) The appearance is not very good 2) The shoulder straps are slightly narrow, which may be less comfortable when carrying heavy objects	1) Better looking including color and shape 2) The shoulder straps are designed to be stronger/more good-looking to cope with the need to carry heavy loads.
Female	Smaller capacity	Beautiful increased capacity and light material

Problems encountered by foreign travelers I interviewed at actual sites in Thailand, figure 3 is a drawing of a few of these questions relating to backpacks. The full list of issues is as follows

1) The shoulder straps of the backpack are too thin: the force is biased towards one shoulder, which is not good for your health.
2) it is not waterproof
3) One-handed operation is limited because you have to hold the bag down
4) Not good control/unstable position/low position
5) Small capacity, need another bag.
6) Depending on the design of the pack, accessing the contents may be difficult or time-consuming
7) Uneven weight distribution:
8) When the pack is overloaded or improperly packed
9) Knotting
10) Security issues: Backpacks are often left unattended, making them an easy target for thieves.
11) Sweaty backs: Carrying a backpack for long periods can lead to back sweating and discomfort, especially in hot weather.

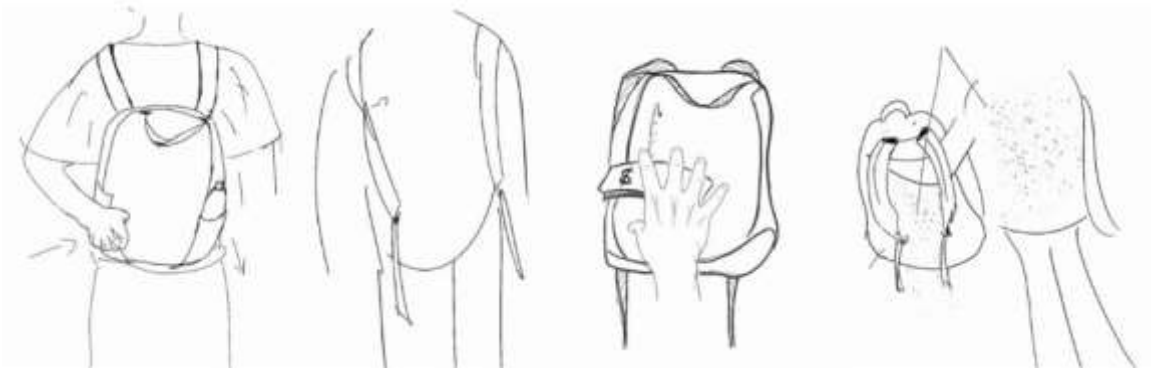

Figure 3 These are the problems faced by backpacks: from left to right, inconvenient access to items from inside the backpack; knots in the shoulder straps; safety issues; and the back of the backpack not being breathable.

Backpacks

3.4 Statistics on some backpacks

These are some of the different brands of backpacks for daily use, I chose 5 kinds of backpacks for my statistics as shown in Table 2, and concluded that they are not very waterproof and not easy to access items from the backpack.

Table 2 Functions and statistics of five common backpacks on the market

Brand	**price(£)**	**Put water (ice)**	**Bag charging port**	**Earphone port**	**easy access to things**	**Light weight**	**Stability**	**Size(Inch)**
G10L	23.99	√	×	×	×	250g	√	15.5*9*3.5
O	42.18	√	×	×	×	136g	√	17*8
P14L	70	×	×	×	×	477g	√	18*9.25*8.5
N18L	102.75	√	×	×	×	600g	√	11*5.9*19.2
N27L	125	√	×	×	×	1270g	√	17.9*5.9*13

Brand	Breathability	Fold	Dirt-proof	Zippep quality	Size(Inch)	Weatherproof	rain guard	Bag bottom guard
G 10L	√	√	×	×	15.5*9*3.5	√	×	×
O	√	√	√	×	17*8	×	×	×
P14L	√	×	√	×	18*9.25*8.5	√	√	×
N18L	√	×	√	×	11*5.9*19.2	√	√	×
N27L	√	×	√	×	17.9*5.9*13.7	√	×	×

Notes: **G10L**: G4Free 10L Small Foldable Backpack Hiking Lightweight Backpack for Women Men Outdoor Hiking Camping Travel Climbing; **O**: Osprey Ultralight Stuff Pack Review; **P14L**: Patagonia Backpack, Noble Grey, Altvia Pack 14L; **N18L**: The North Face Unisex's Basin 18 Backpacks, One Size; **N27L**: The North Face Kaban 2.0 Backpack 27;

3.5 Load reduction systems of backpack

3.5.1 Effects of loading on the human body:

For human weight-bearing changes in body muscles over time Research has shown that subjects completed four walking trials on an instrumented treadmill, every five minutes in duration while carrying no load or an additional 10%, 20%, or 30% of body weight. ...As the load increased, so did net metabolic cost, the duration of the stance phase, peak stance phase hip, knee, and ankle flexion angles, and all peak joint extension moments. (Silder A, 2013) So, the light weight of the equipment is a big problem that needs to be solved on this journey. Since Mäkelä (2006) has shown that Carrying a heavy backpack exerts compression on shoulders, with the potential to cause brachial plexopathy. (Mäkelä, Ramstad, Mattila, & Pihlajamäki, 2006)Since S. Abrahams (2001) has shown that Improper backpack use (unilateral or excessive posterior loading) has led to alignment issues such as forward head posture (FHP), rounded shoulders, kyphosis, low back pain, and an asymmetrical axial skeleton. (S. Abrahams, 2001)

3.5.2 Lightweight standard:

Ultralight backpacking is a subset of lightweight backpacking, a style of backpacking that emphasizes carrying the lightest and least amount of gear. (Cole, Jordan, & Dixon, 2006) While no technical standards exist, some United States hikers consider "ultralight" to mean an initial base weight of less than 4.5kg (10 pounds). (Clelland, 2011)

3.5.3 The lightening effect of elastic shoulder straps:

The mechanism of Anti Gravity System (AGS) backpack lies in the use of highly elastic shoulder straps to create a bouncing motion when the user walks, thus the user doesn't feel the constant load of the bag, which is similar to a bamboo pole(Figure 12). Theoretically speaking, under the same load, this results in a feeling of reduced exertion to users as compared to ordinary

backpacks. a comparative study was made to test the effect of AGS backpacks on relieving perceived exertion to users. It was concluded that given the condition of appropriate weight-bearing and walking speed, the backpack with AGS design could give users a labor-saving feeling and more regular growth of subjective fatigue compared with an ordinary backpack. (Xi Yang1, 2020)

3.5.4 A Nontraditional Backpack:

Since Kimberly (2016) has shown that A traditional backpack (U.S. Polo Assn Sport Backpack, Colfax, LA, USA) and a BackTpack (BackTpack LLC, Salem, OR, USA) were used to manipulate load carriage. (Kimberly D. Dahl, 2016) Since Y.S.S.M (2008) has shown that Load was added to the backpacks in increments of 1, 5, and 10 pounds to equal 15% and 25% of the wearer's body weight, representing loads below and above those recommended in the literature. (Y.S.S.M. Al-Khabbaz, 2008) (Y. Hong, 2003) (F. Kistner, 2012) This load was evenly distributed in the backpacks, placing the heaviest weight closest to the spine for the traditional backpack (BP) and balancing the weights between the two pockets for the BackTpack (BTP) as shown in figure 4. The more upright posture supported by the BTP may help reduce characteristics of poor posture and, ideally, help to reduce low back pain while carrying loads.

Figure 4. Traditional backpack (left) and Nontraditional backpack (BTP) (right) Adapted from “Load distribution and postural changes in young adults when wearing a traditional backpack versus the BackTpack” K.D. Dahl et al. / Gait & Posture 45 (2016) P.91

4. Results

4.1 Design of backpack solutions

4.1.1 Sketch of the design thinking process, as shown in figure 5, the single-shoulder bag can be rotated to the front and back, so if I have two single-shoulder bags, or if I cut the backpack down the middle. Then I connect the two bags with some buckles and I can get such a changeable backpack, as shown in figure 6.

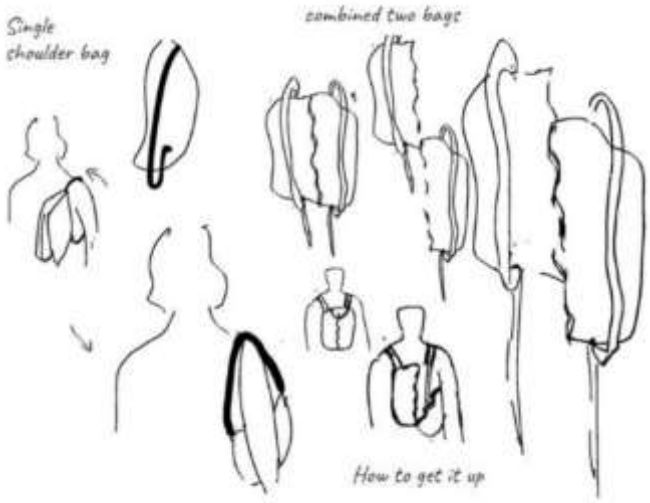

Figure 5. Sketch of the design thinking process

Figure 6. Three-Dimensional display image of a changeable backpack

4.1.2 Improvements based on common backpacks

Figure 7 shows an improved solution to suit outdoor hikers based on marketed backpacks. This kind of backpack (On the left side of figure 7) is often purchased by hikers, but its capacity is not big, although it is more convenient to take some things, its shoulder straps are too wide, and placing some objects in the front chest area of the shoulder straps will not be breathable, and can not place many things, and it will affect our walking. Water, which is often drunk by hikers, is also placed in the back of the pack. My solution is to enlarge the waist section for small items so that it can hold water bottles and larger items such as hats, tissues, clothes, or other items.

On the right side of figure 7 is a common shoulder bag that can be rotated around the waist to access items, but the disadvantage of a shoulder bag is that it is unevenly loaded on both sides of the body, which can lead to health problems if the weight is placed on one shoulder for a long time. So my improvement plan is to add another shoulder strap to the shoulder bag, and when you need to take the items, you can unbuckle one side of the shoulder strap, and then rotate the bag to the waist.

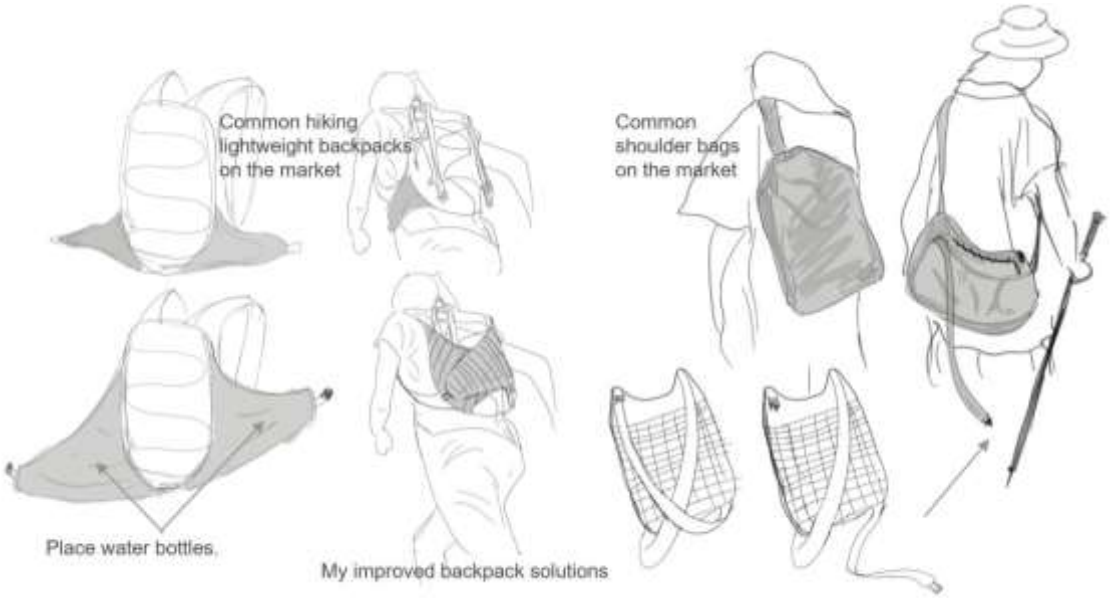

Figure 7. Improvements based on common backpacks

4.1.3 Solutions designed for different populations

4.1.3.1 Designed for Children

Backpacks are designed for children, as shown in figure 8. Their backpacks hold fewer items than adults, so the capacity of the backpack is also small probably around 10litres to 20litres. The age range for children is 6-10 years. As shown on the left side of figure 8, a child needs to undo one of the shoulder buckles and then pull the shoulder straps towards the front chest to the waist to pull the backpack to the front chest for use, as shown on the right side of figure 8, the backpack is made into two bags, so that when one is needed, the buckles can be undone and it can be placed on the front chest, and the frame on the back has a tacky back, which stabilizes the backpack from wobbling when the backpack is placed on the back.

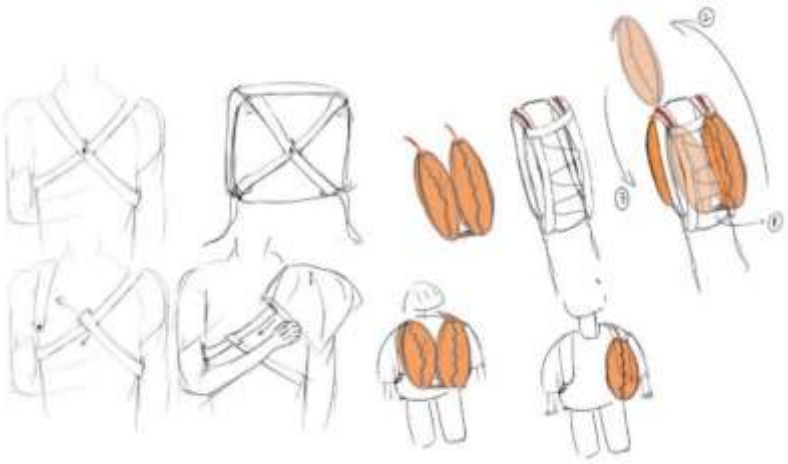

Figure 8. Drawing of backpacks designed for children

Notes: A child needs to undo one of the shoulder buckles and then pull the shoulder straps towards the front chest to the waist to pull the backpack to the front chest for use(left). The backpack is made into two bags, so that when one is needed, the buckles can be undone and it can be placed on the front chest, and the frame on the back has a tacky back, which stabilizes the backpack from wobbling when the backpack is placed on the back(right)

4.1.3.2 Designed for women

Designed for women, as shown in figure 9. Women have a narrower skeleton, so a backpack can be designed in a way that allows them to access the entire contents of the backpack by going from the head to the front of the chest, a way that requires only opening the two lumbar buckles, and then flipping the backpack forward over the top of the head. It can be made to be an accessory backpack, sewn to fit over a normal backpack so that women can easily access some common items.

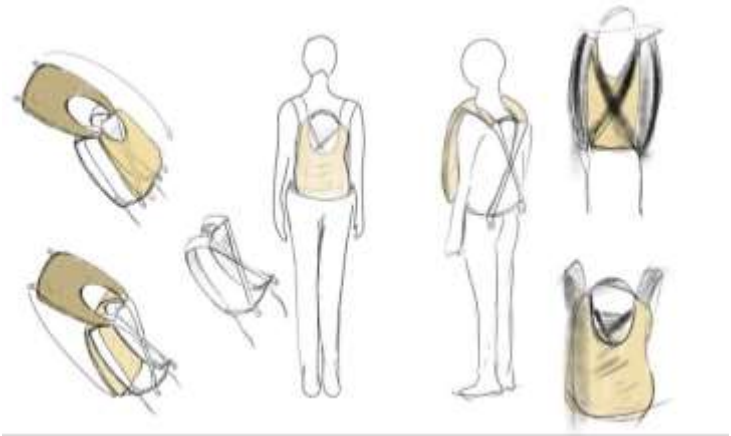

Figure 9. Drawing of backpacks designed for women

4.2 Execution of your design prototype

I chose figure 6 for the final product as shown in figure 10. From left to right, the backpack is carried in the state in which a person would normally walk, followed by the backpack with the buckle undone and closed around the waist, and finally with the backpack unzipped and in use.

Figure 10. Execution of my design prototype

5. Discussion

The backpack can be cut into two bags and placed separately on the front of the chest for easy access to items in the backpack (figure 11 left). The backpack's easy access design works, but because the pack is broken down into two bags, they sway against each other when placed behind the back and the user is walking. Could we then make a frame or strap to hold the two bags on the surface so that they don't shake from side to side? The easier solution is to place Velcro in the orange and blue labeled areas on the left side of figure 11 to act as to maintain the stability of the backpack.

The elastic shoulder straps can be used to reduce the load, so we can connect the elastic straps to the backpack, as shown in figure 11 elastic straps for backpack connections (right), Where the arrows are pointing is the elasticated fabric, which is used to connect the straps to the backpack, allowing the backpack to swing up and down to counteract the pressure. It is similar to the principle of a soft stretcher swinging up and down (figure 12). Compliant bamboo poles have long been used for load carriage in Asian cultures. Although this custom differs from Western conventions of rigid body attachments (e. g. backpack), potential benefits include reduced peak shoulder forces as well as metabolic transport cost savings. (Schroeder RT, 2018)The practicality of the elastic straps is low and after a period of use, they will fail, meaning they will lose their elasticity and will not work. Can many spare replacement elastic bands be replaced in time when they expire? Like electric toothbrushes, the brush head must be replaced within a certain period.

Figure 11 Place Velcro in the orange and blue labeled areas to act as a hold on the backpack(left); Elastic straps for backpack connections (right)

Figure 12 A farm worker carries a bamboo pole in northern Vietnam. The pole is supported at the shoulder with the hand (same side as the supporting shoulder) resting on top of the forward end to steady the system. Source: https://doi.org/10.1371/journal.pone.0196208.g001

6. Conclusion

A backpack for the curious explorer: 20 liters to 30 liters capacity, expandable, it does not affect the balance and is convenient for accessing the project, waterproof and resistant to dirt, lightweight, the backpack itself is very light or has a load-bearing role. In terms of practicality, the most important thing is the ease of access to the stuff from the backpack. The backpack is designed to be easy to access, so it can be cut into two pouches and placed on the chest for easy access to the contents of the backpack. It is different from traditional backpacks and is inspired by BTP as shown in figure 4 Nontraditional backpack (BTP) (right). The backpack can therefore be easily and quickly accessed from the inside of the backpack. The elastic straps can be used to reduce the load, so we can attach them to the backpack and allow the backpack to swing up and down to counteract the pressure, similar to the principle of a

soft stretcher swinging up and down. The practicality of elastic straps is very low and after a period of use, they will fail, meaning that they lose their elasticity and become ineffective. Maintaining the effectiveness of the elastic straps or finding a suitable replacement will therefore be an issue in the future. In the future, the idea is to find an elastic shoulder strap that does not lose its elasticity to connect the backpack and make it lighter. The weight of the backpack can be made lighter by using Dyneema fabric to make the backpack. The future design of the range of backpacks can be used for different people, such as children, women, men, and people of all body types, As well as being used on backpacks in a few professional areas.

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