P3 Project Report

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Jogee Backpack

An semi-formal backpack for the wanderer in you.

Guide: Prof. B.K. Chakravarthy

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अभिकल्प विद्यालय

Acknowledgement

I would like to start by thanking my guide Professor B.K. Chakravarthy without whom this project would not be possible. He has been strict in terms of acheiving a certain degree in quality and how that will help me be competitive in market if I plan to sell my designed backpacks in the future.

Then, I would like to thank my parents, my sister and friends who have been my strength and support system forever.

Special thanks goes to P Kumaresan sir from the Proof of Concept lab who allowed me to use one of the industry grade Sewing machines for my project to come to reality. My most sincere gratitute towards Rohit sir who is incharge of the lab.

Content

1. Introduction

With the COVID-19 now almost over, and the shift to online modes of work with internet available almost at every corner of the world, there has been a shift in the work culture. People who work on computers have now started to work on their projects through various applications installed on their laptops. Even while traveling, attending meetings through video conferencing applications like Zoom and Google meet and Microsoft Teams has become convenient.
So, people are now able to take time out to travel with their friends, families, even if it is not a weekend.
While most backpacks that these people carry serve the purpose what they intend to, this generation which is obsessed with consumerism, quests for more efficiency, but in a minimal fashion.

Lets see how new techniques of mass manufacturing, availability of more variety of fabrics and requirement of a more sustainable options could call for a new generation of office backpacks.

2. Problem Identification/ customer discovery

I travel a lot and for the purpose of my research, I started to conciously see the pain points and the issues related to backpacks while on the move. I completed 6 trips on domestic aeroplanes, 2 trips on train, multiple on mumbai local, metros in Mumbai, Bangalore and Delhi and several bus journeys. This helped me further understand the situations where it can get tricky while handling backpacks.
For instance, devices with active battery are not allowed in their check-in luggages, for which they need separate cabin luggage with accessible features. While traveling in train, it is required that the bag be safe from theft and probably be used as a pillow if need be.

2.1. Primary Research

It is best to start asking questions to potential users and get to know their opinions apart from just noticing how they interact with the product. So I sent a survey form which outlines the user preferences below (Fig. 2.1.1 -2.2.10).

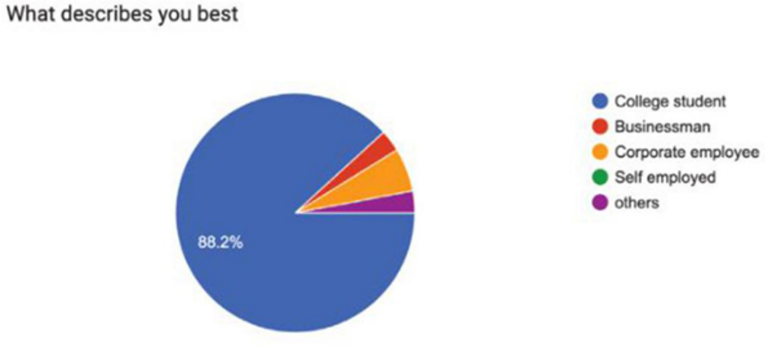


Fig. 2.1.1.

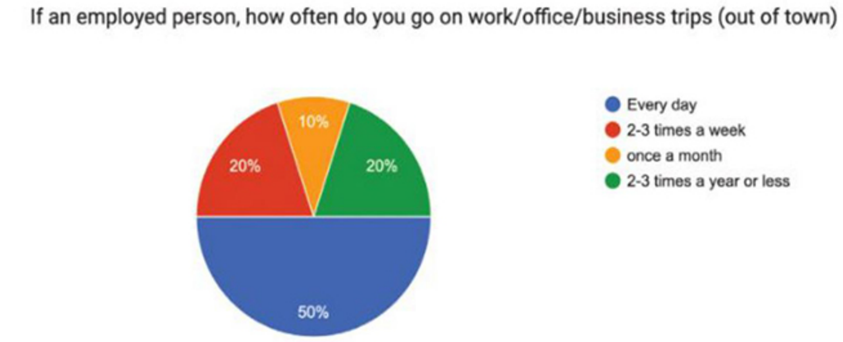


Fig. 2.1.2.

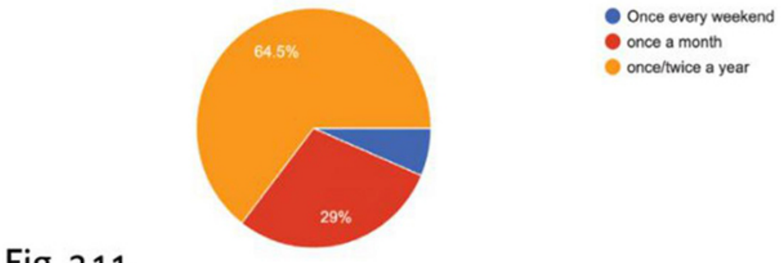


Fig. 2.1.1.

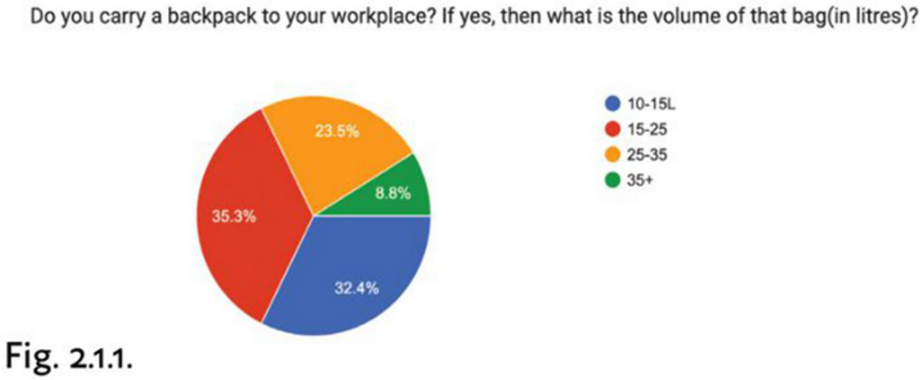
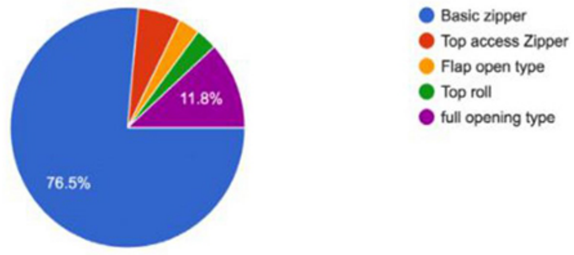


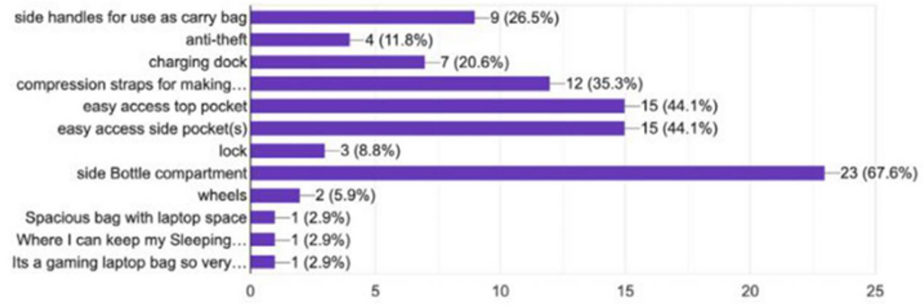
Fig. 2.1.1.

Which image best describes your CURRENT bag type (not the features)

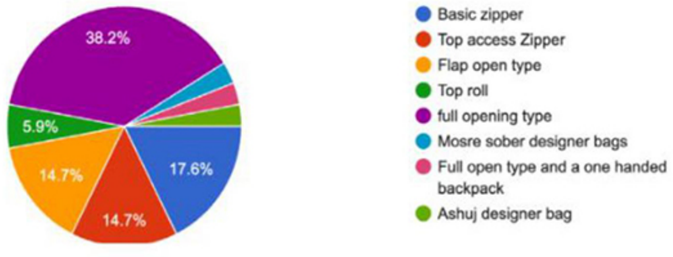


What all features describe your CURRENT bag

34 responses

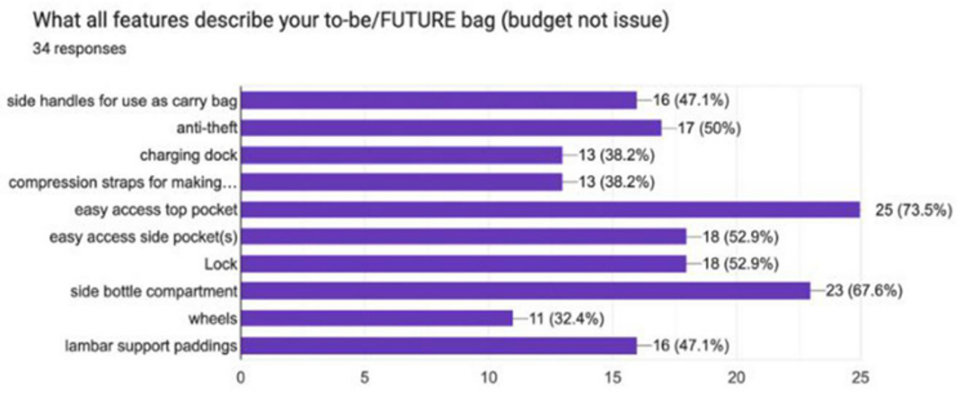


Which image would best describe your FUTURE bag type (not the features) that u'd want to buy as per your convenience (budget is not an issue)

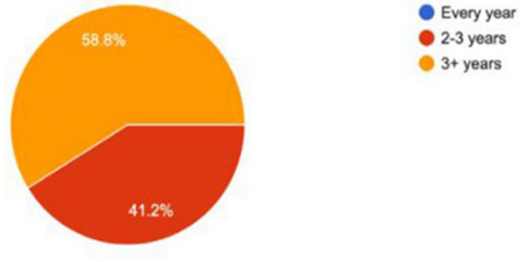


What all features describe your to-be/FUTURE bag (budget not issue)

34 responses



How often do you change/buy your primary type bag?



Does brand matter to you? If yes, then which brand to you prefer?

15 responses

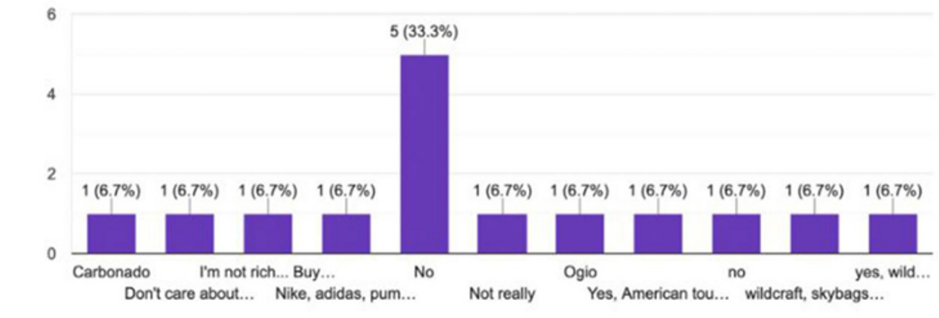


Fig. 2.1.2. Statistics of the user data

2.2. Primary Market Study

After getting to know the names of certain brands, I got a hint to what kind of bags to really look for and where to look for. Apart from looking at backpacks on e-commerce websites, I wanted to understand the supply chain of the entire industry.

Benefit of being in Mumbai is that you are at the heart of business and industry. I was in touch with Mr. Praveen from VIP backpacks to know where backpacks are manufactured for VIP and in general. He said, "The bags are made in cities across the state of Maharashtra like Nashik, Jalgaon, Sinnur, while there are certain categories that are manufactured in China. Apart from VIP, there are many local factories in South Mumbai where bags are made and then white-labled.
As soon as you reach Byculla, railway station, you start to see the shops where materials required to make the backpack can be found. Shops having fabrics, zippers, foam, all kinds of tailoring goods and so on. Most of the artificial fabric that is used in the industry comes from China through ships(fig 2.2.1 (a) & (b)).

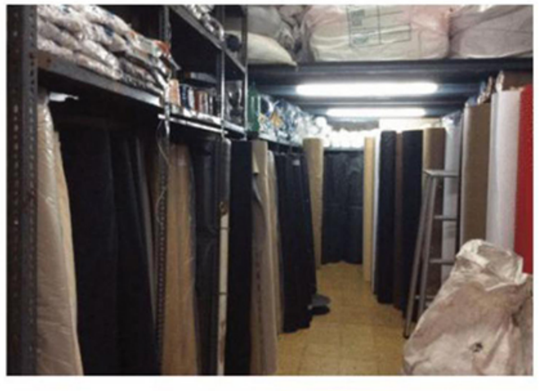


Fig. 2.2.1(a) & (b).

Byculla shops are full of all kind of polyester, nylon and artificial leather. They have all kinds of items that are suitable for middle segment backpacks. Most materials for upper segment backpacks are also available but certain materials directly ship from China to the brand logistics.

Apart from the backpacks material shops, there are shops for readymade backpacks which have been tailored at the nearby cottage industries by hand and machine(fig. 2.2.2(a)).

Fig. 2.2.2(a) & (b).

Shops continue from Nagpada till the Mangaldas market near the Chhattrapati Shivaji Terminus in the south part of Mumbai (fig. 2.2.2(b)).

2.2. Market Study - contd.

In Indian subcontinent, at e-commerce websites, Amazon and Flipkart, brands like Mokobara have been popular recently, along with some biking backpacks like Carbonado. Old brands like VIP have now acquired brands like Carlton London which have the weekender backpack line-up. These backpack, fitting our user segment go by the names like Weekender, Nomadic, Transit backpacks that are little smaller than the cabin backpacks, volume of these range from 20L till 35L.

Fig. 2.2.1(a), (b)& (c).

Figure 2.2.1 shows Mokobara, Carlton and Carbonado backpacks who have to offer varying features, catering to the same segment.

Image source - www.amazon.com

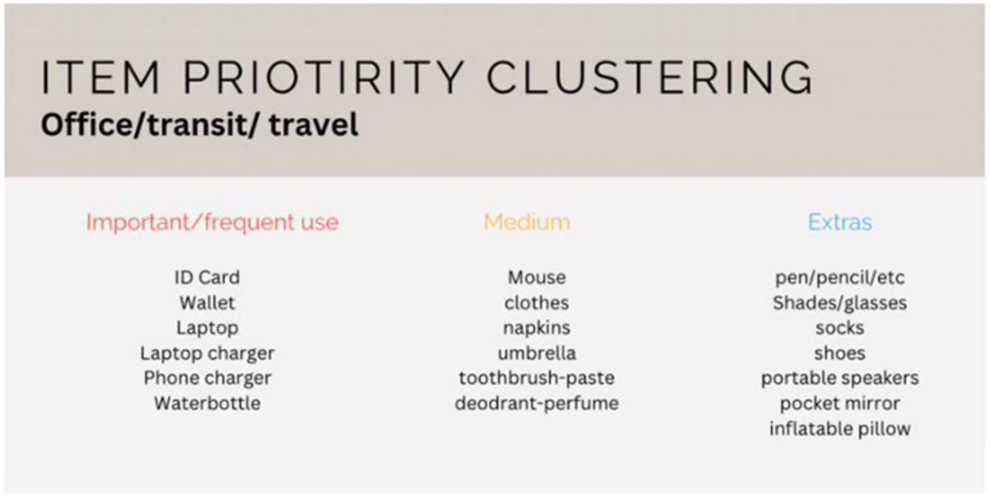
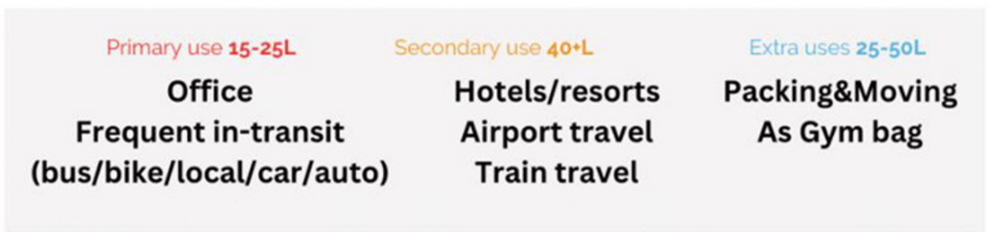


Fig. 2.2.2(a) & (b).

The main features of these backpacks are that they are mostly intended to carry the above mentioned items, while having more features depending on budget like more comfortable shoulder straps, better aerated back foam, trolley sleeve, etc. While they can be used for the following scenarios-



2.2. Market Study - contd.

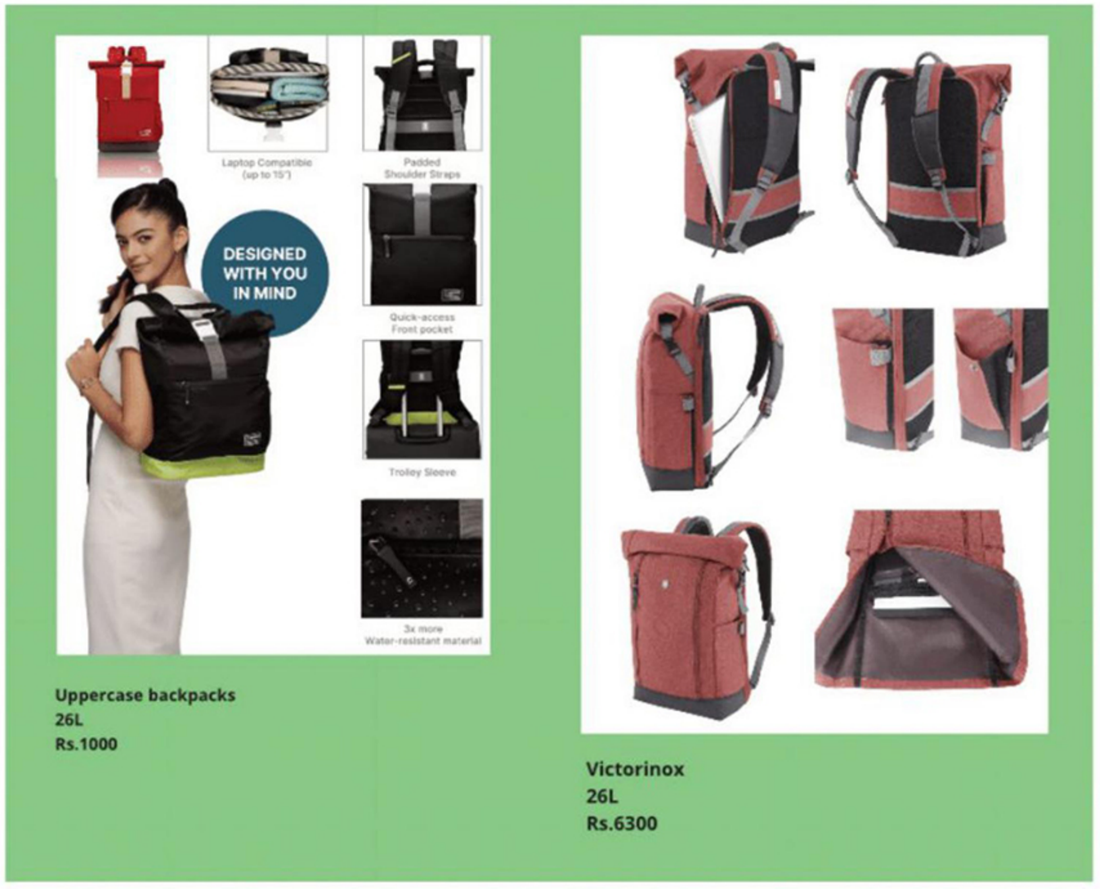


Fig. 2.2.3 (a) and (b)

Image source - www.amazon.com

2.2. Market Study - contd.

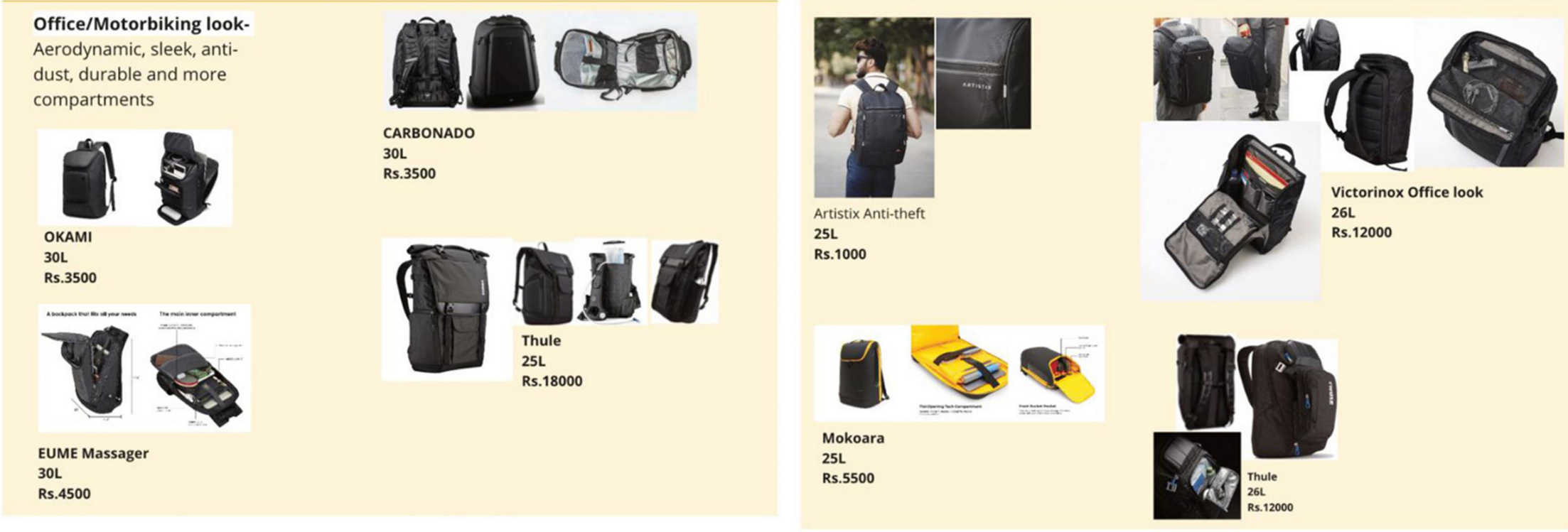


Fig. 2.2.4 (a) and (b)

Image source - www.amazon.com

2.2. Market Study - contd.

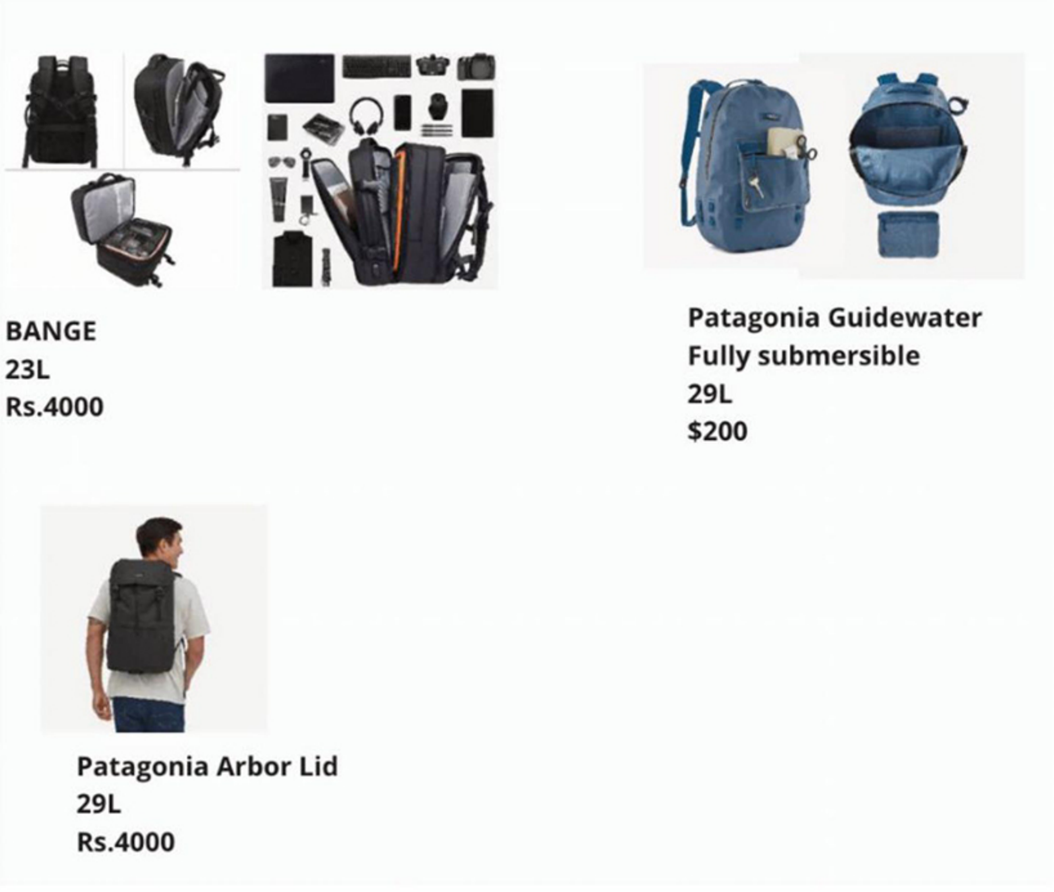


Fig. 2.2.5 (a),(b) and (c)

Fig. 2.2.5 (d)

Image source - www.amazon.com

2.2. Market Study - contd.

Sporty

Wildcraft 31 L
Rs.4500

VIP Jump
21L
Rs.1500

KAKA
40L
Rs.12500

Victorinox VX Touring
24L
Rs.19000

Ducati (Outsourced)

Fig. 2.2.6 (a) & (b)

Image source - www.amazon.com

2.2. Market Study - contd.

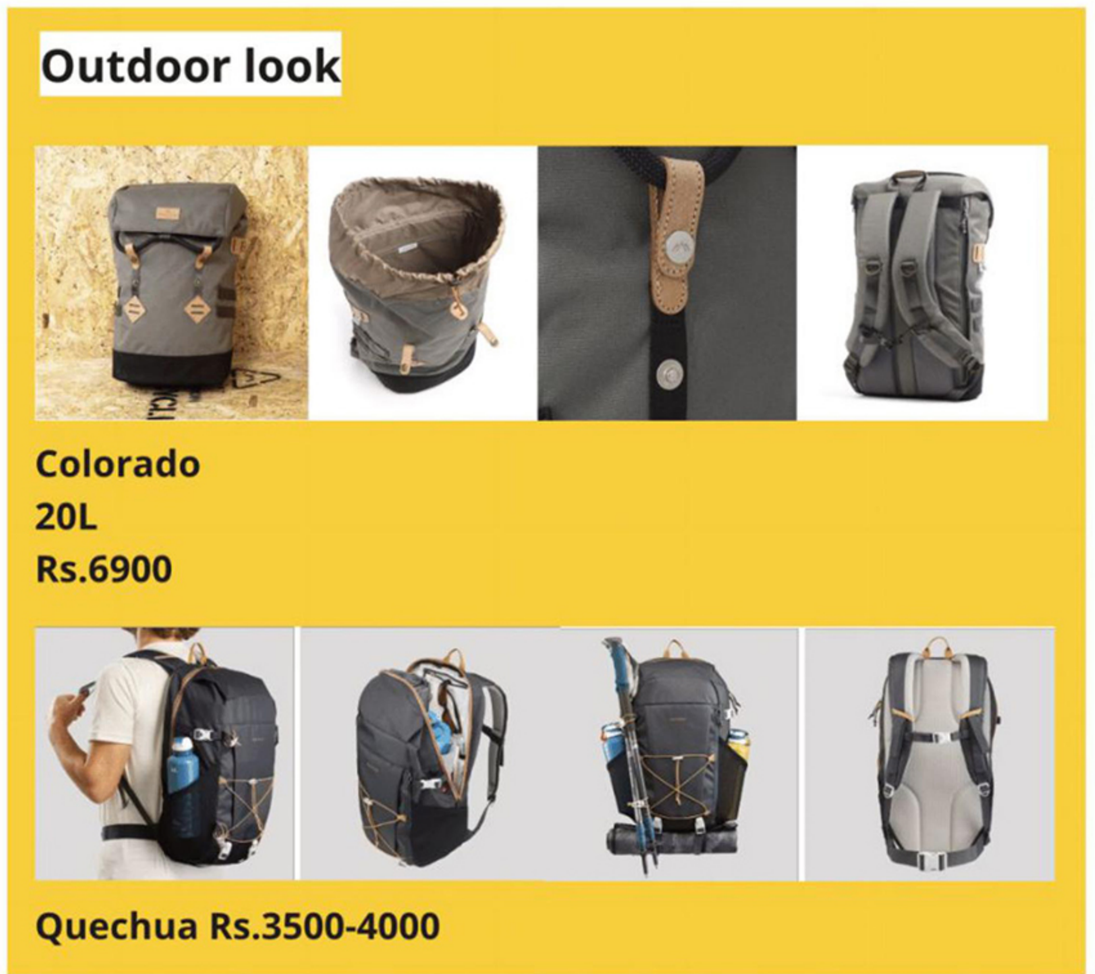


Fig. 2.2.7 (a) and (b)

Image source - www.amazon.com

3. Problem statement/ Brief

Traveling out of town to attend a meeting or a conference in another city or country is hassling and tiring if one does not have a functional backpack.
Having that same material One also misses out on good things around, worrying about looking out of place at a country resort.
Trying out the best possible contraption to give a better office and traveling experience lightweight, sturdy, elegant.

BRIEF - A backpack for office going professional who wants to use the same backpack for 2-3 day weekend or conference trips.

4. Persona creation

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Having that same material One also misses out on good things around, worrying about looking out of place at a country resort.
trying out the best possible contraption to give a better office and traveling experience
lightweight, sturdy, elegant.

Persona-1 - Mr. Satish (IT Prof.)

- Age - 26

- Height - 5’8”

- Working at IT firm in Bangalore

- Uses bike to travel, uses office cab sometimes

- Carries following during normal days in his backpack - laptop(15 in), laptop charger, phone, charger, mouse, 1 notebook, 1-2 pens, some cash, water-bottle

- Occasionally carries sunglasses, earphones/headphones, powerbank

- Sometimes need to travel for conferences(**train** mostly, flight sometimes) carries additionally- 1 pair of shoes-socks, 1 pair formals, 1 pair casuals, 2 undergarments, soap, 1-2 shampoo sachets, toiletries

Persona-2 - Mr. Dheeraj (Marketing head)

- Age - 43

- Height - 6’1”

- Working at marketing firm in Mumbai

- Uses car to travel to office, sometimes cab

- Carries following during normal days in his backpack - laptop(13 inch), laptop charger, phone, charger, 1 notebook, 1-2 pens, some cash, waterbottle

- Occasionally carries sunglasses, earphones/headphones, powerbank

- Sometimes need to travel for conferences, carries additionally- 1 pair of shoes-socks, 1 pair formals, 1 pair casuals, 2 undergarments, soap, 1-2 shampoo sachets, toiletries

International travel once in 2-3 months (carries passport)

Persona-3 - Mrs. Kriti (Brand Designer)

- Age - 29

- Height - 5’1”

- Working at branding firm in Pune

- Uses cab to travel to office

- Carries following during normal days in his backpack - laptop(15 inch), laptop charger, phone, charger, mouse, 2-3 notebook, 1 pencil pouch for art supplies, waterbottle, female purse for small mirror, make-up etc

(Out of town/city)- Needs to travel frequently for client meetings (2-3 times a month), carries additionally- 1 pair of shoes-socks, 1 pair formals, 1 pair casuals, 2 undergarments, soap, 1-2 shampoo sachets, toiletries

5. Secondary research

5.1. Diachronic study

In earlier days, backpacks were mostly for hiking and army purposes with internal or external frames.
Loyd Nelson made backpack, Trapper Nelson from seal skin and sticks in the 1922 and sold it across the country of USA for approximately 7.5$ (today's 112$). Sales mainly came from Forest Service firefighters and Geological Survey Teams (Fig. 5.1.1.)

Fig. 5.1.1(a), (b) & (c).

Gerry Cunningham made the first Zippered backpack in 1938.

Fig. 5.1.2(a), (b) & (c).

Dick and his wife Nena designed the bags in their garage in Glendale, California. As an aircraft engineer and Navy veteran, Dick used his expertise to construct small aluminum frames. Nena, meanwhile, sewed on material from a leftover military parachute, adding wool on the shoulder straps and a webbing belt to the bottom. She secured everything with clevis pins.

5. Secondary research

5.2. Manufacturing Process

The making of a backpack starts with the making of a pattern, which is basically the blueprint of various sections/sides of the backpack which will directly be cut as it is, onto the fabric material.

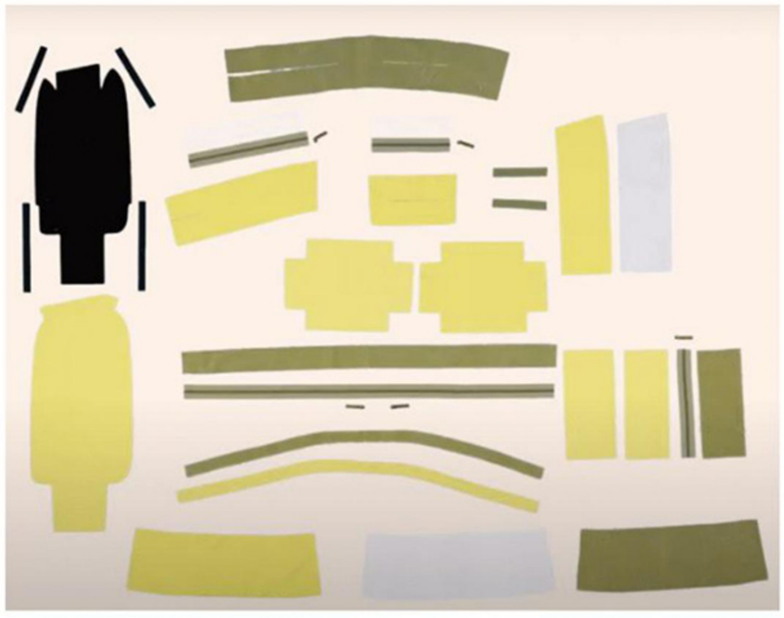


Fig. 5.2.1. Pattern (source- https://youtu.be/2x5lEbUqFko)

Then the main fabric is stitched with zippers and inner cloth in a fashion that it takes up a desired concave or convex form.

Fig. 5.2.2. Stitching (source- https://youtu.be/2x5lEbUqFko)

All the parts are then stitched together inside-out so that there are not stitch marks and when it is reversed, it becomes a clean looking backpack.

5. Secondary research

5.2. Manufacturing Process (contd.)

Various materials used for making the backpack have their own manufacturing process, like-

Nylon PLA Zippers - Two hot fasteners are fed through a notch in a plastic wire. Plastic thread is wrapped around these fasteners in different directions. Each loop is formed into a round knob by a head maker who uses air to cool the spiral. This method uses two machines to make spirals on both sides of the zipper.

Polyester - PET plastic pellets are melted and extruded through tiny holes called spinnerets to form long threads, which are then cooled to harden into a fiber. This process is called melt spinning. The shape and quantity of holes can be altered to create fibers with different qualities.

Synthetic leather - Synthetic leather is typically made by impregnating non-woven textiles with polyurethane to bond the material and give it the mechanical properties and feel (hand) similar to real leather. Generally, synthetic leather is made using an organic solvent by a wet coagulation or dry coagulation process.

5. Secondary research

5.3. Material Study

Material of the backpack is everything, it decides the durability, the form, the feel of using it 1st hand.
There are many types of fabrics available in the market that provide with variety of properties which when used in certain fashion will cater to the certain user in a certain scenario.

Criteria	Polyester	Nylon	Leather/rexine	Canvas	Nylon+Polystr	Can+Leathr
Form retainment	4	3-4	4	4	4	5
Durability	4	5	4	4	5	4
Weight	5	5	4	5	5	5
Aesthetics	4	4	5	5	4	5

Table. 1.

The combination of rexine/leather with good quality canvas will prove to be a great choice, since it is sturdy, durable upto 2-3 years, depending on the care taken. But I will try to sample the pattern with other combinations since data on paper can be deveiving sometimes.
Strength indicators in case of fabrics-
Denier - shows thickness or density of the material
Tenacity - how has is the fabric fighting tear
Stitching - Stitches are measured per inch. Backpacks that have 6–10 stitches per inch have a reliable strength. Less than 6 does not provide the required strength to the material.
Thread count - Thread count is the number of warps in one square inch of the fabric. Backpack ranges might be a few hundred T or above. More thread count shows more strength.

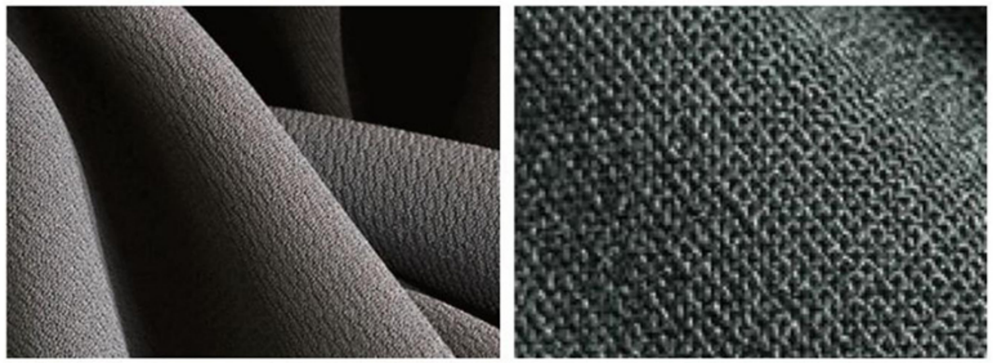


Fig. 5.3.2(a)- polyester & (b)nylon.

Main materials in the market are **Polyester and Nylon which are by-products of petro-chemicals and very harmfull to the environment** if the entire product cycle is not considered.
In case of backpacks, certain brands are considerate enough to make the backpack in such a way (single material) that it becomes easy to recycle in some countries where the recycling plants are uqibuitous. The fibres become micro-fibres upon subject to the harsh useage and end up in our water and soil bodies, polluting and stagnating the environment.
Nylon fabric are softer and smoother, while polyester fabrics are much harsher and reatian form to a certain degree, depending upon the thread count and thickness of the thread.
So, **use of good quality canvas will prove to be a great option**.
Fake leather is made out of Poly-urethane coated on top of polyester.

5. Secondary research

5.3. Material Study

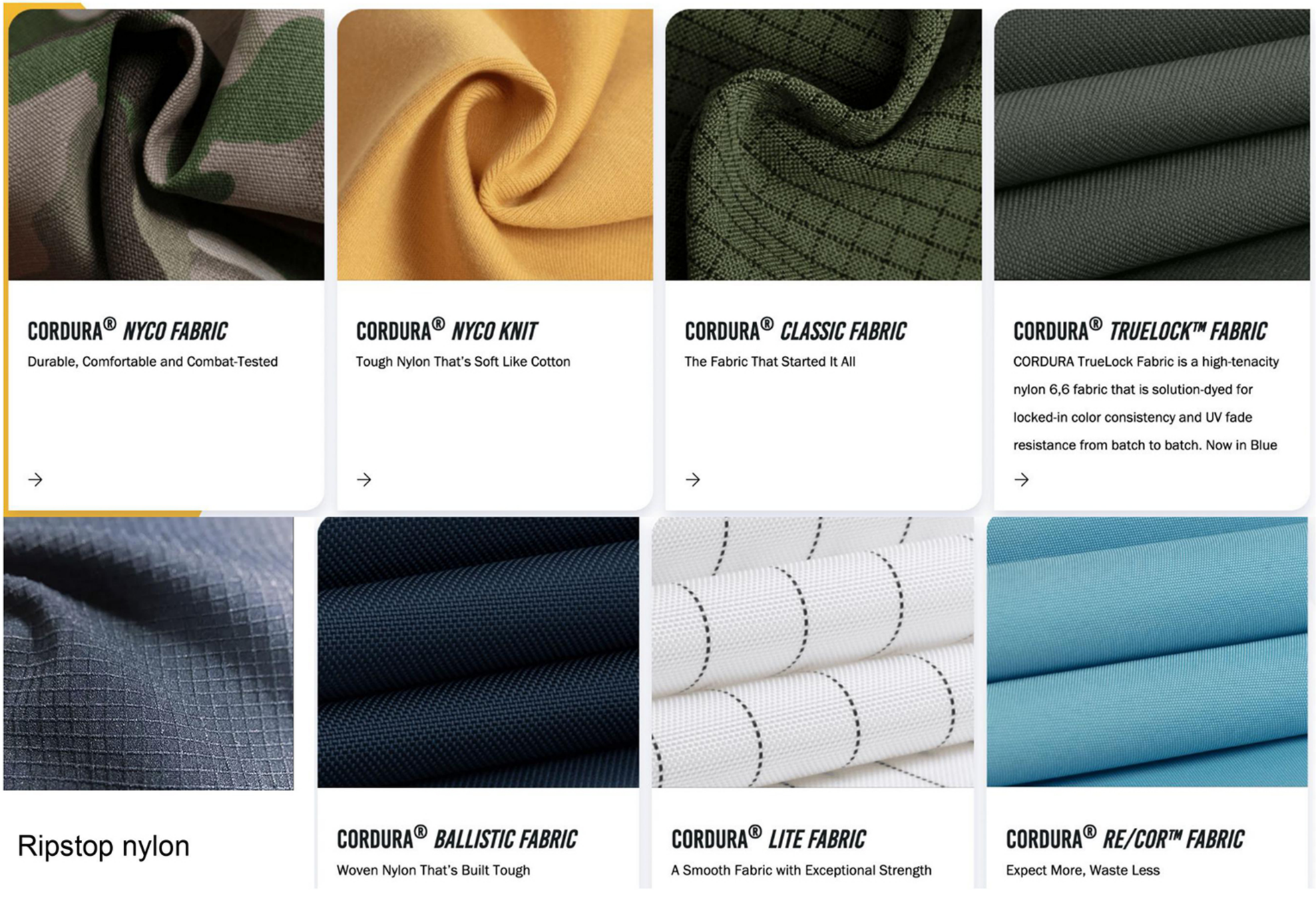
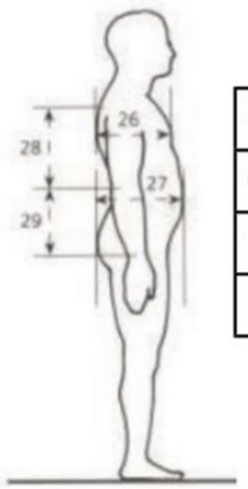


Fig. 5.3.3 (a) and (b). Branded material and types of fabrics. *Source- www.cordura.com*

5. Secondary research

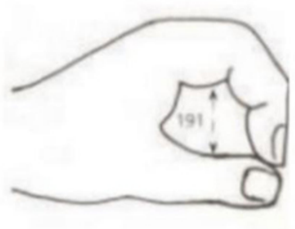
5.4. Anthropometric Data



This data is of the shoulder breadth for the purpose of straps to be made for backpack

Percentile	5th	25th	50th	75th	95th
Male	185	200	214	231	258
Female	160	190	207	237	293
					265

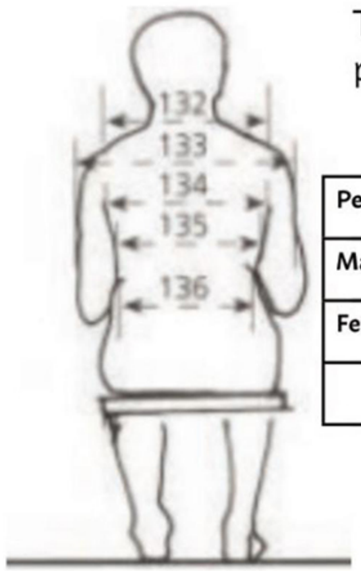
Fig. 5.4.a



This data is required for backpack handle diameter for better grip

Percentile	5th	25th	50th	75th	95th
Male	42	46	49	51	56
Female	42	42	51	49	52
	41				

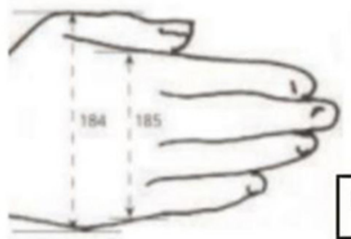
Fig. 5.4.b



This data is of the shoulder leangth for the purpose of straps to be made for backpack

Percentile	5th	25th	50th	75th	95th
Male	259	282	298	319	356
Female	217	255	277	293	313
					354

Fig. 5.4.c.



This data is required for backpack handle length for better grip

Percentile	5th	25th	50th	75th	95th
Male	86	93	99	104	111
Female	77	82	86	90	95
					109

Fig. 5.4.d.

Image source - Dev Kumar Chakraborty, Anthropometric data of Indian population

6. Scenario Building

6.1. Airport travel

The segment I wish to cater to is almost always on the move who frequents air travel and train travel. So, to understand what the user has to go through I made note of the major touch points and issues faced.
Mostly, the most common issue that the person faces is that the devices with batteries are not allowed to be checked in sometimes, which requires them to shift the items like laptops, powerbank and trimmers from check-in bags to the cabin bags. In case the person is only carrying one luggage, then it's an issue.
Other issues include mal-handling of the luggages by the logistics crew while transporting from chechin counters to the plane cargo compartments which lead to the damage of the internal goods if delecate. While there are some fashion related things that could be considered while traveling like saving sober swatches to the fabric material. Then, lastly, if the user travels to other countries where the inspection is strict, the border security officers prefer the luggage to be opened up like a clamp-shell for ease of inspection(Fig. 6.1)

One more thing to consider while domestic travel, the size of the backpack to be taken to cabin is 55x35

Fig. 6.1. Airport scenario

6.2. Train travel

One important thing to consider while traveling in train is the distance between the seats-
Train 3rd AC height between berths - 45cm(base to lower), 58cm (lower to middle), 59cm(middle to upper, 81cm (upper to ceiling).

7. Ideation

After careful considerations of the constraints and parameters required, I started with the idea generation phase -

The major separating factors are the way the backpack contains the items -
-Non-expansion, simple compartmentalisation
- Expansion when required
-Morph or convert

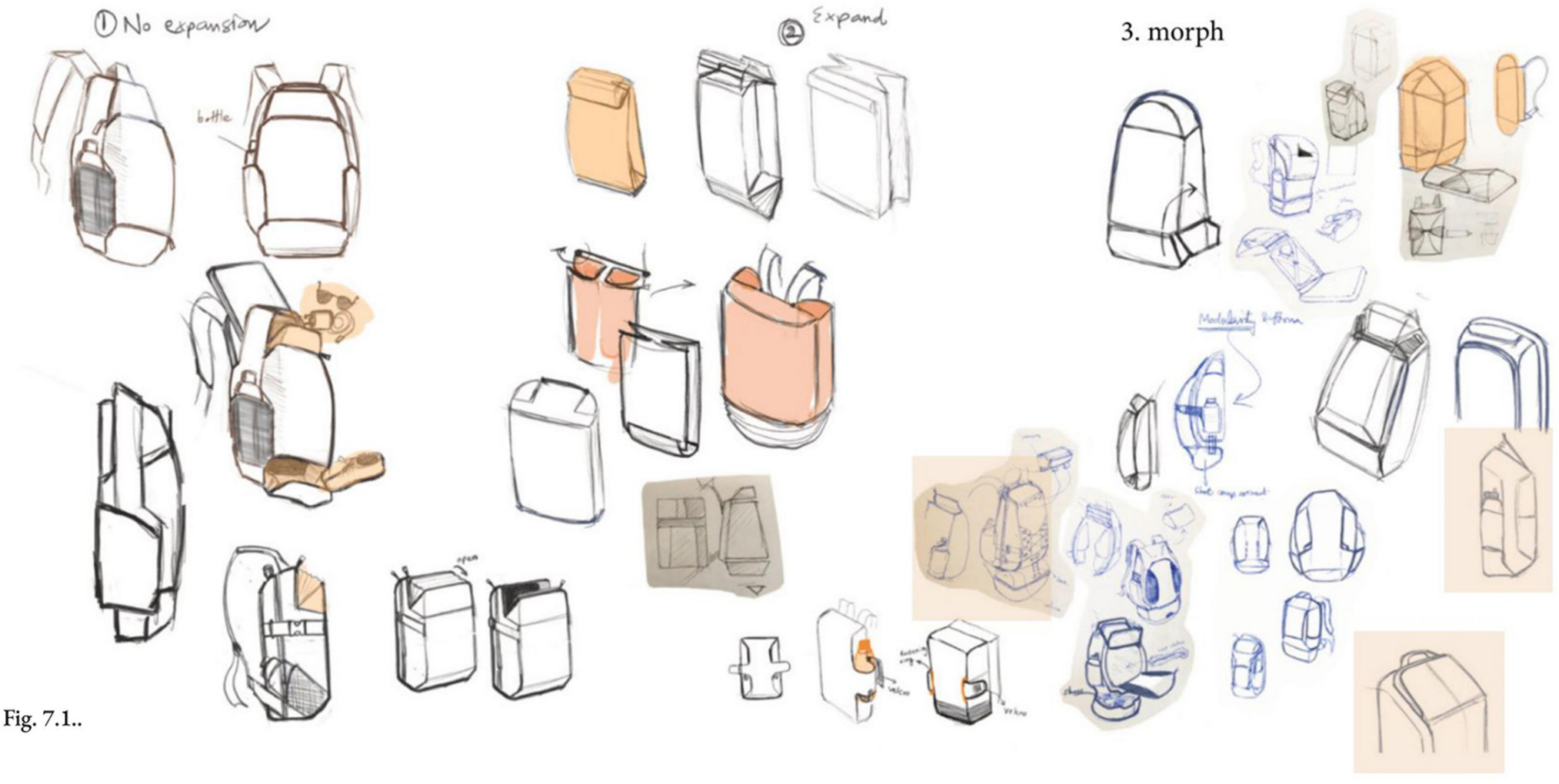


Fig. 7.1..

8. Mock-up

I learnt a simple technique to make compartments out of a sheet of paper that can help better understant the preliminary form generation from a flexible material.

The below image shows how folding paper to mimic retention strength of a fabric. The most important requirement in design to succeed is the familiarity in shape and form. So, I have tried to keep is looking like a backpack while exploring with the form.

Fig. 8.1.Mockup 1.

8. Mock-up (contd.)

Here the paper is folded and thermocol/styrofoam stuck in a way that compartments can be understood, from a side view and shoe compartment is added.

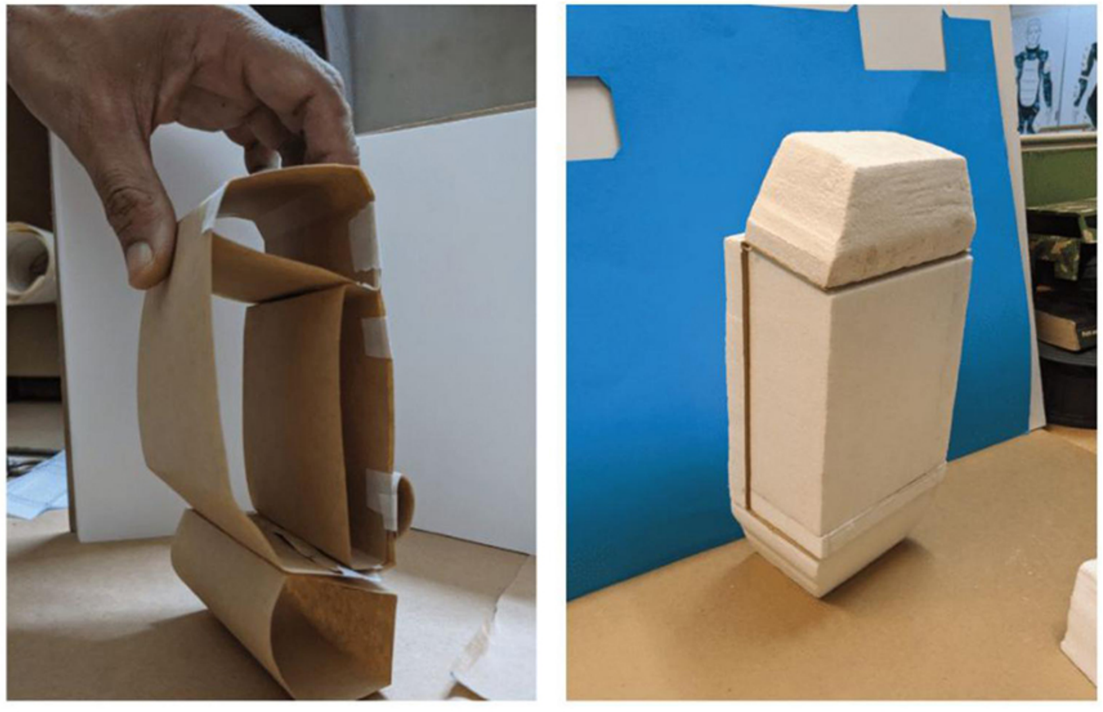
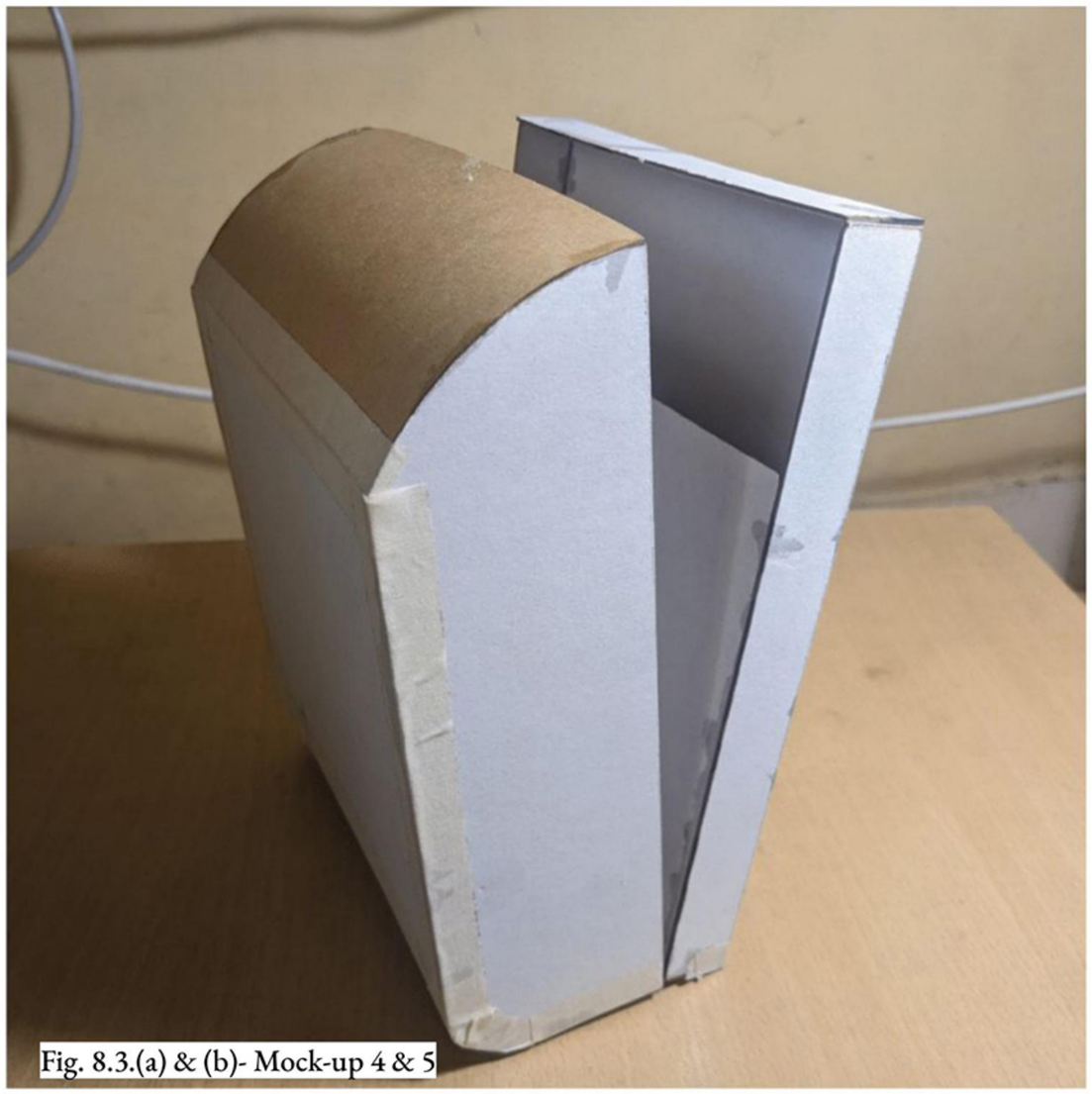


Fig. 8.2. Mock-up 2 & 3

8. Mock-up (contd.)

Two more scale mockups were made to check accessibility features of the backpack.



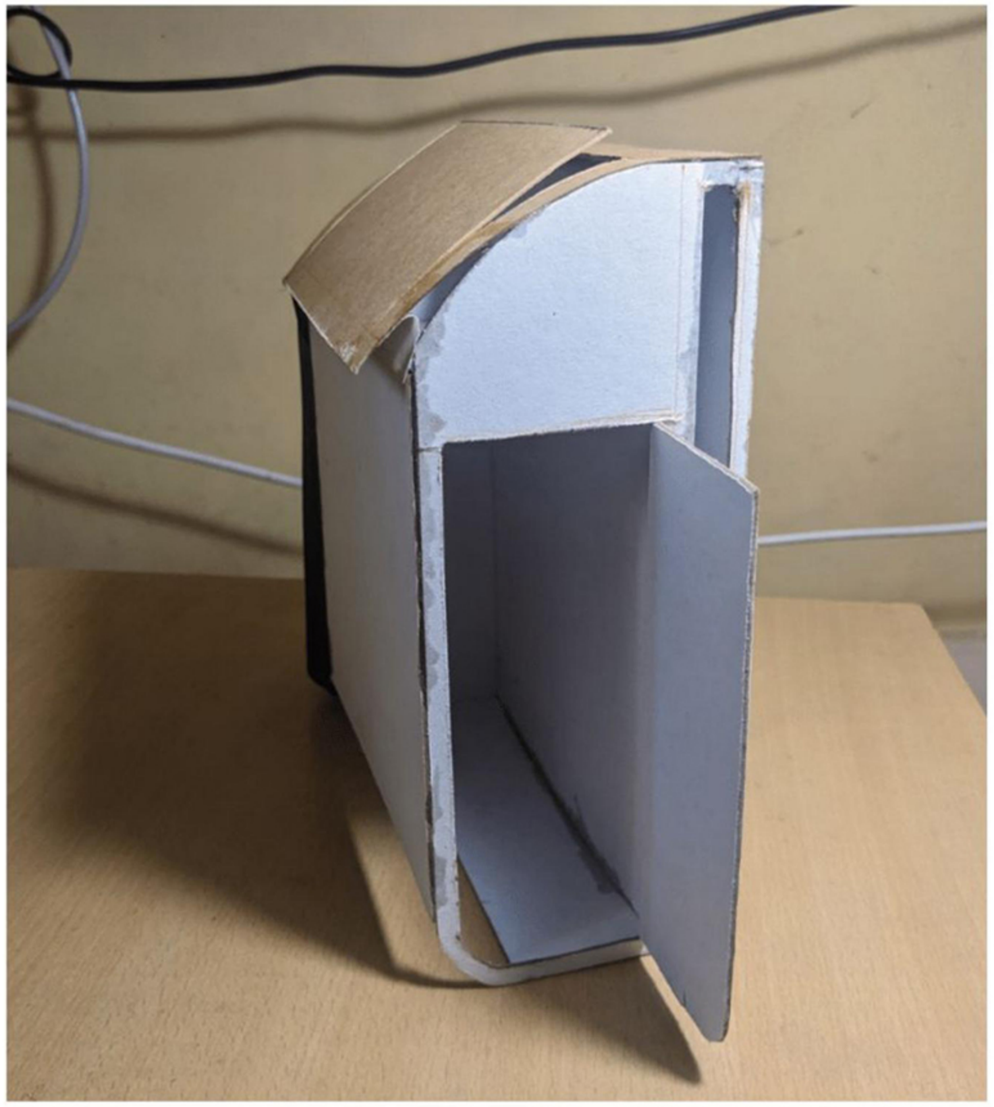


Fig. 8.3.(a) & (b)- Mock-up 4 & 5

9. Concepts- Concept-1

Here the shoe compartment is designed to be collapsible with velcro.

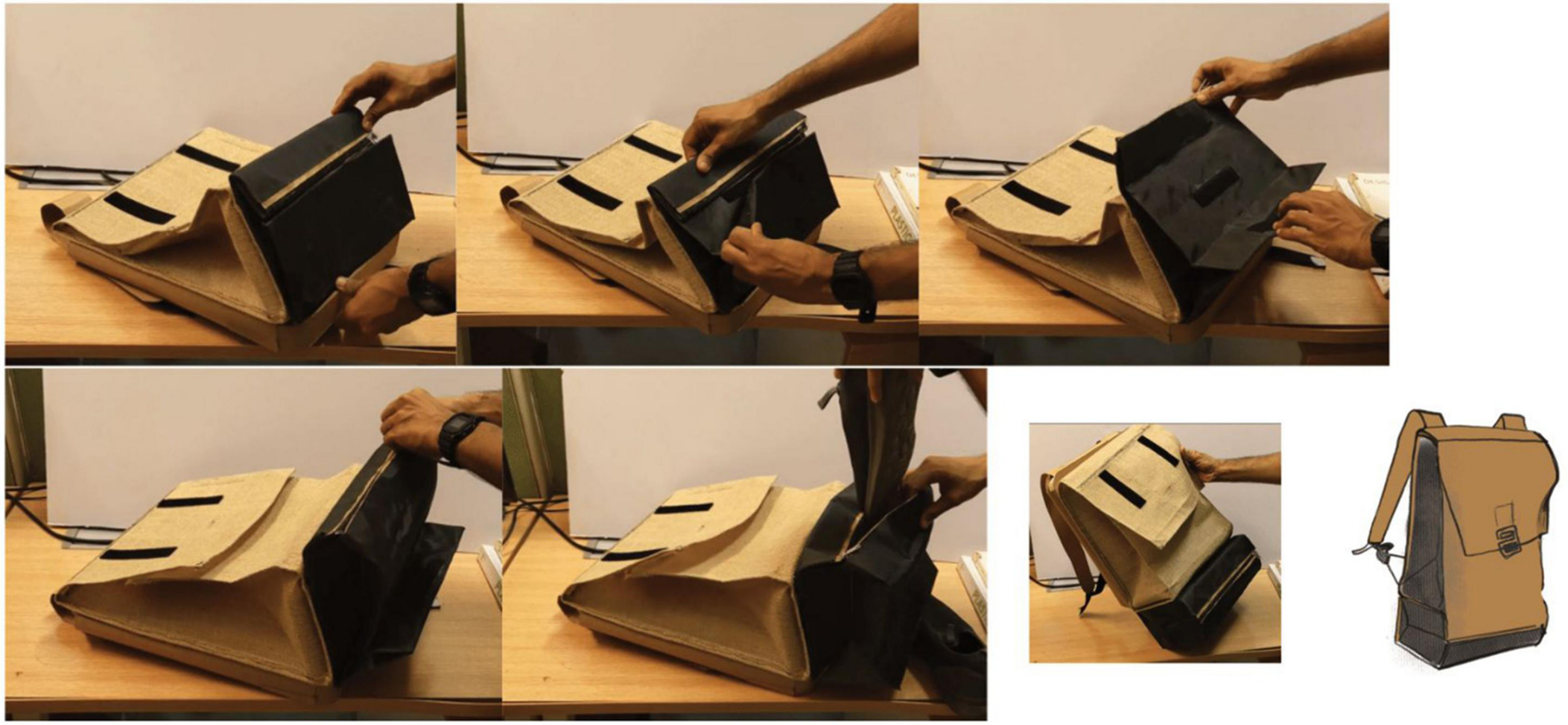


Fig. 9.1.

Making the backpack using a portable sewing machine.

Fig. 9.2.

9. Concepts- Concept-2

Derivation from concept-1, clam-shell based main compartments with detachable show compartment when need be.

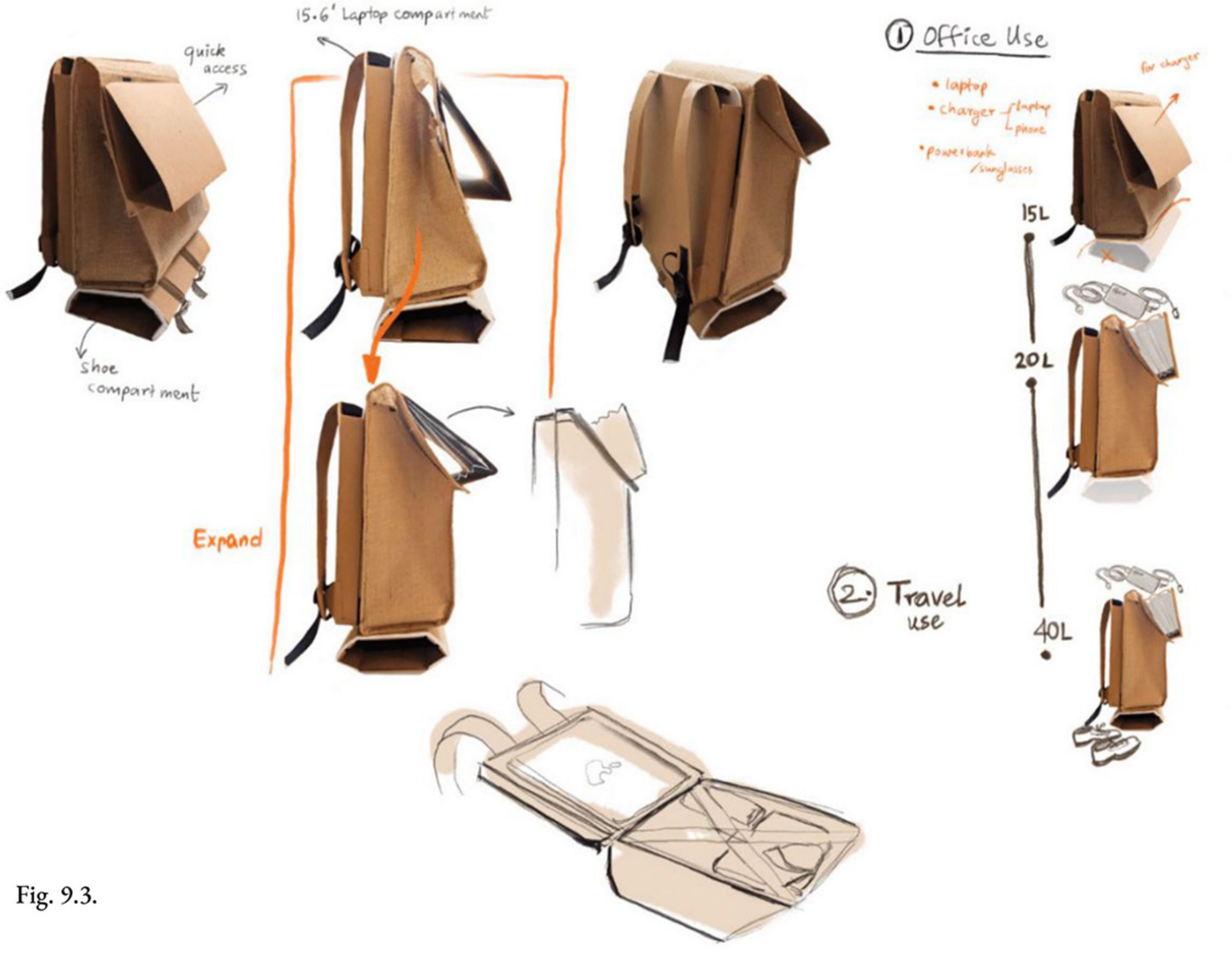


Fig. 9.3.

9. Concepts- Concept-3

The below image shows a backpack that has 3 compartments that are symmetric in nature and can then be opened and transformed to add another compartment for travel needs.

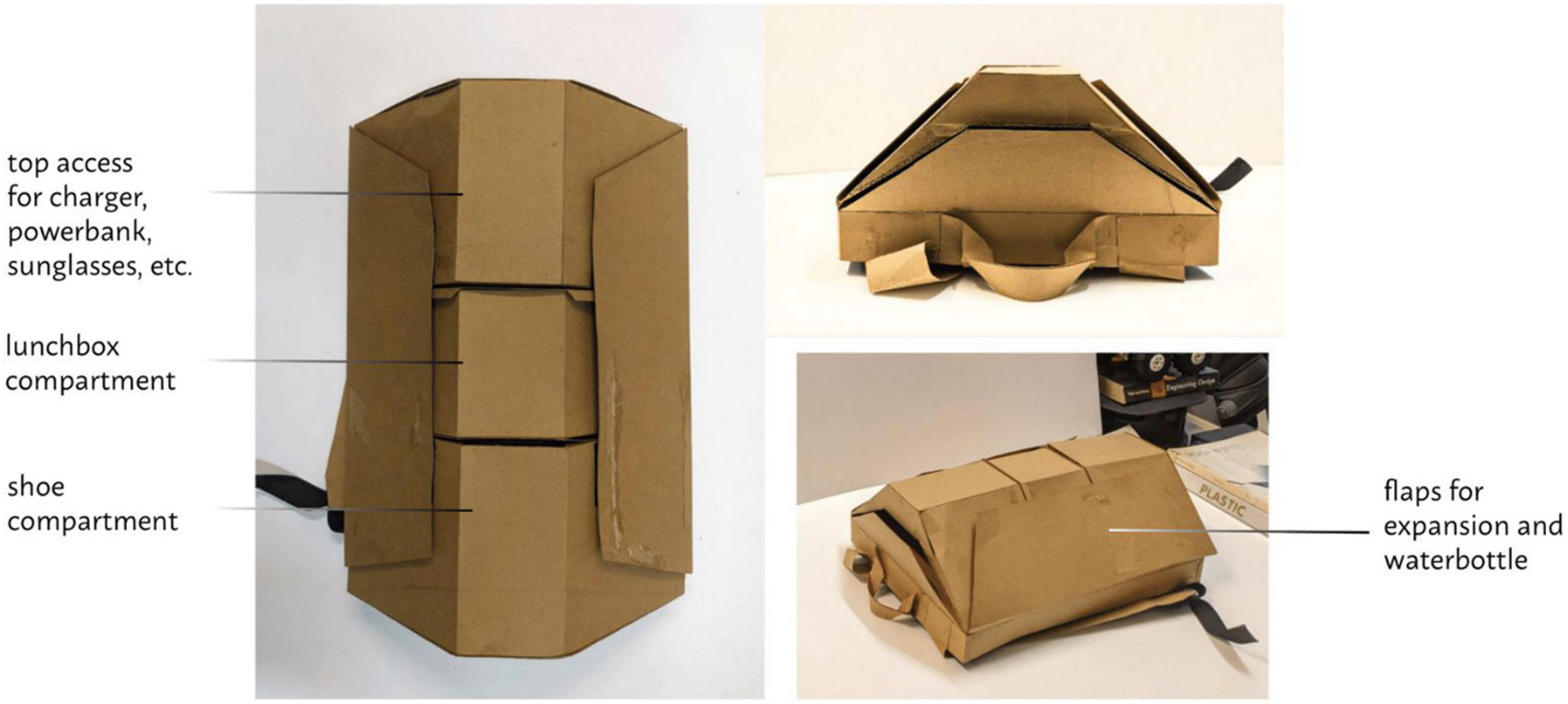


Fig. 9.4.

9. Concepts- Concept-3(contd.)

Below image shows how an additional compartment can be added to the office backpack

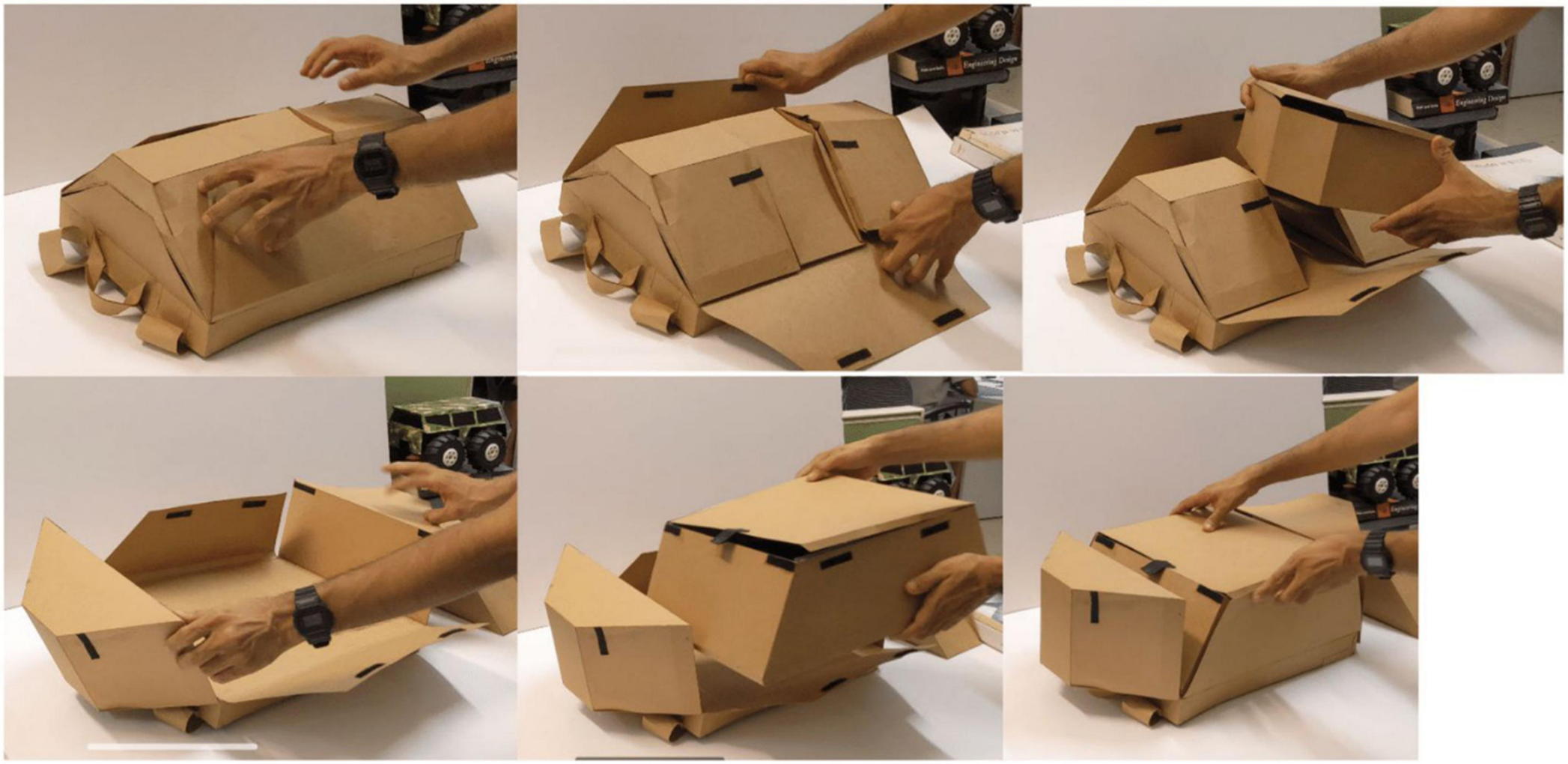


Fig. 9.5.

9. Concepts- Concept-3(contd.)

User testing

Fig. 9.6.

Inference -
The size of the shoe compartment is not big enough to accomodate a pair of shoes.

9. Concepts-

9.1. Evaluation

Table below shows evaluation of the concepts based on the primary and secondary requirements of the back at various scenarios intended to cover.

Criteria	Concept - 1 (/5)	Concept - 2	Concept - 3
Containment	✳✳✳✳	✳✳✳	✳✳✳✳
Transit friendliness	✳✳✳✳	✳✳✳✳	✳✳✳
Office Aesthetics	✳✳✳✳	✳✳✳	✳✳
Minimalism/trend	✳✳✳✳	✳✳	✳✳

Table.9.1

Concept 1 - Containment is in a boxy-planar fashion since the bag can be expanded and then in case there is no use, the bag can be folded to store it in some place. It is very simple and intuitive design, so it is transit friendly in both functional and aesthetic sense.

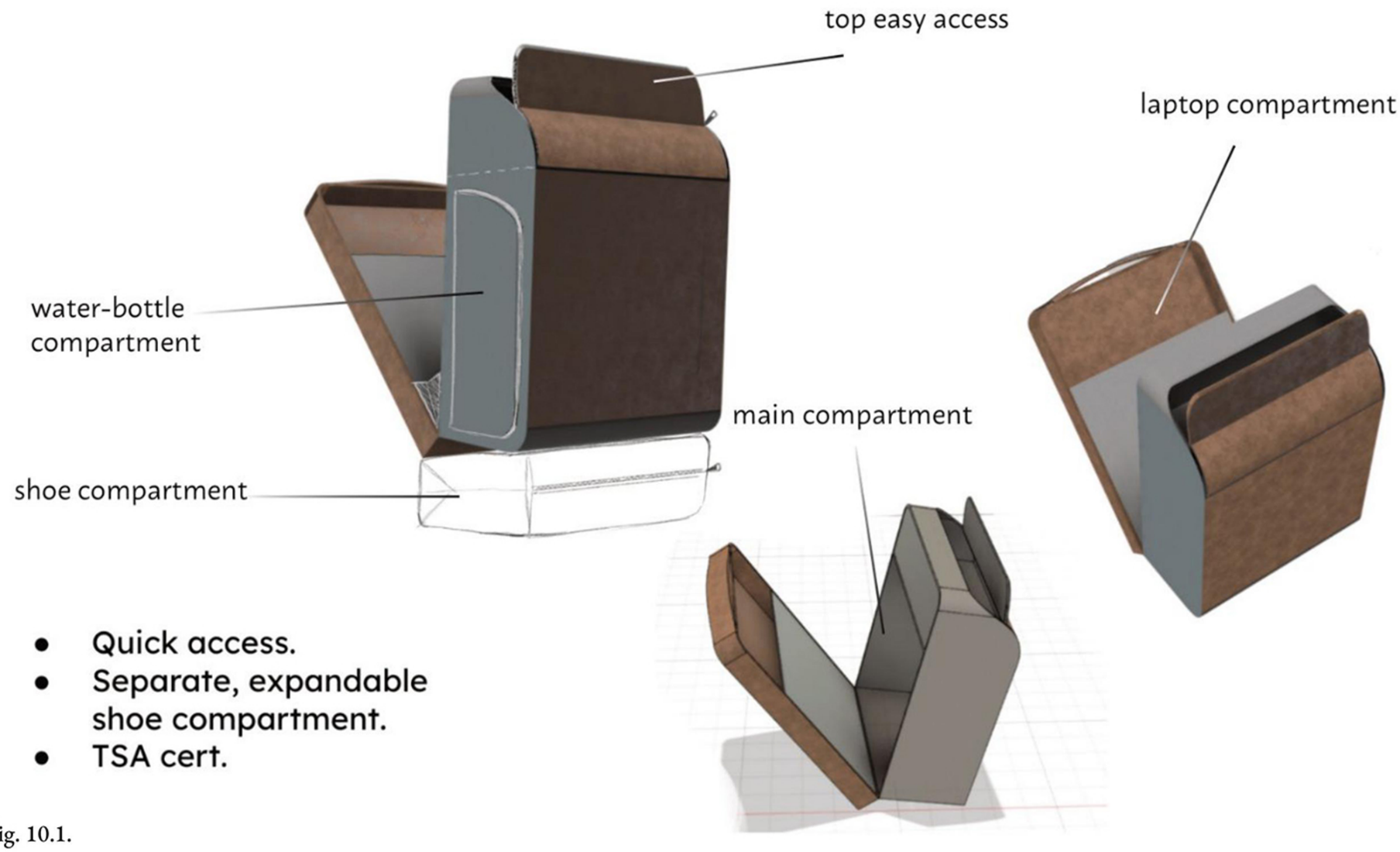
Concept 2 - Concept 2 is a derivation of concept 1 and has a drawback that the show compartment is separable and boxy. It can be great in the office, but while traveling, it can pose some disadvantages.

Concept 3 - Concept 3 is very innovative and very novel in a sense, but when it comes to usage, it is not very practical and not intuitive.

10. Final concept and prototype

10.1. Final Concept

Final concept is derived from concept-1, with quick access compartment on the top and main 20L compartment accessible through the main clam-shell openable zippers.



- Quick access.
- Separate, expandable shoe compartment.
- TSA cert.

Fig. 10.1.

10. Final concept

10.2. Prototype

I started to make pattern and then machine stitch the pattern to achieve the 1st prototype

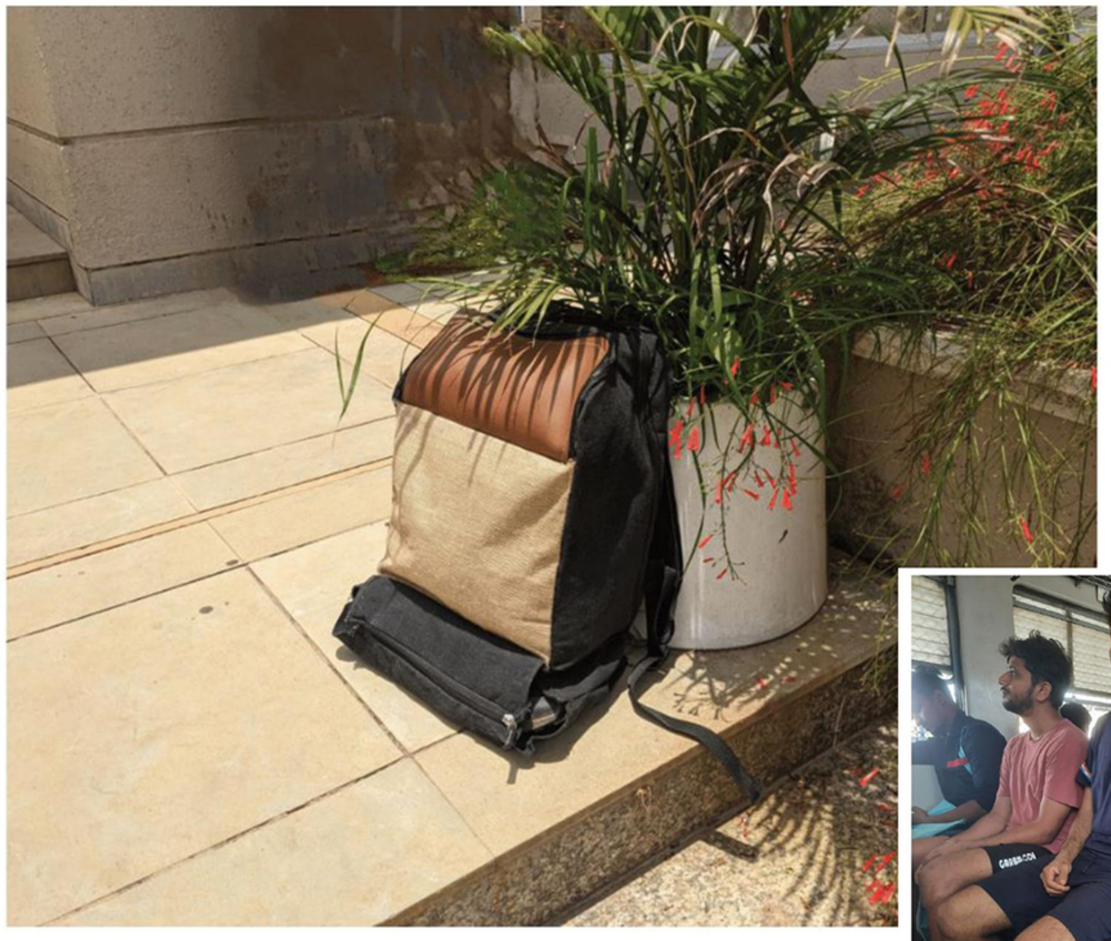


Fig. 10.2.

10. Final Concept -

10.3. Pattern

Patterns were made out with considerable margins of 2 cm to facilitate the stitching of corners.

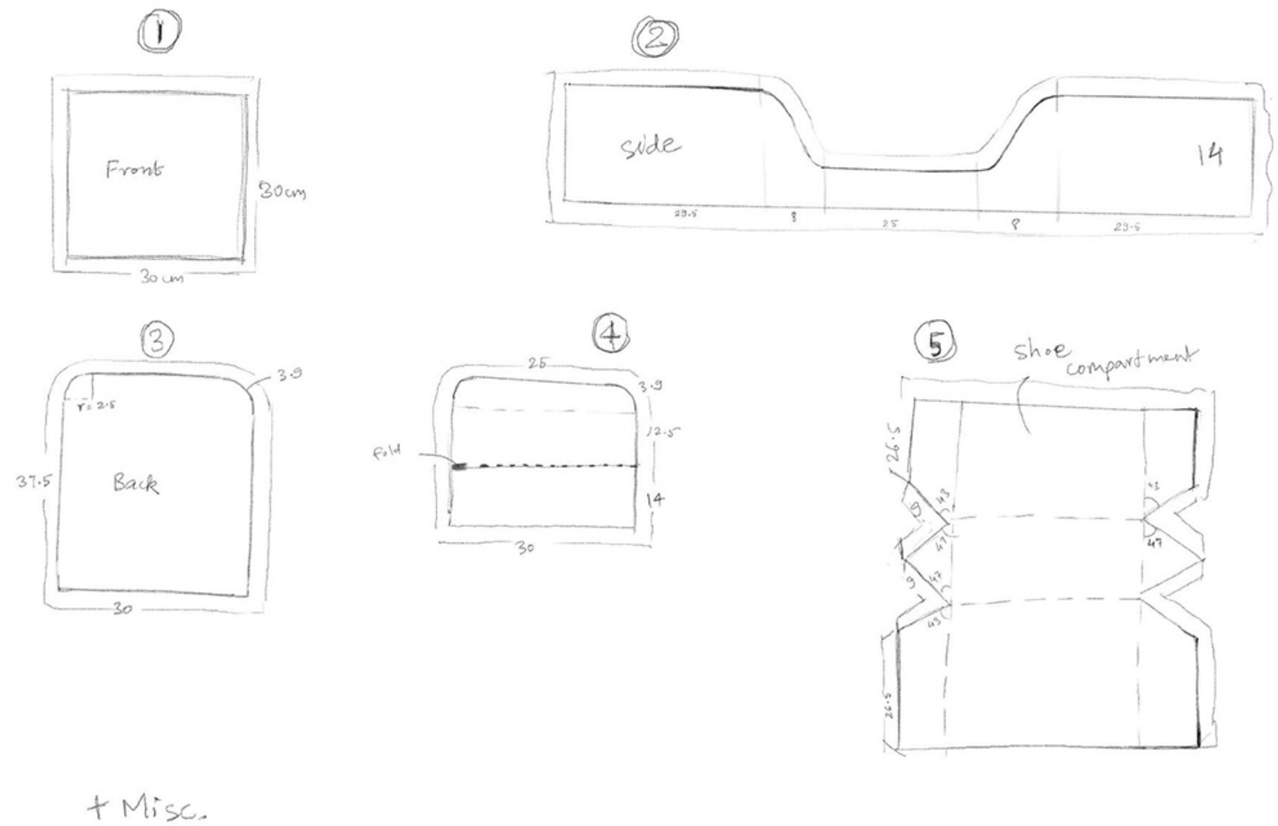


Fig. 10.3.

11. Moodboard/trend

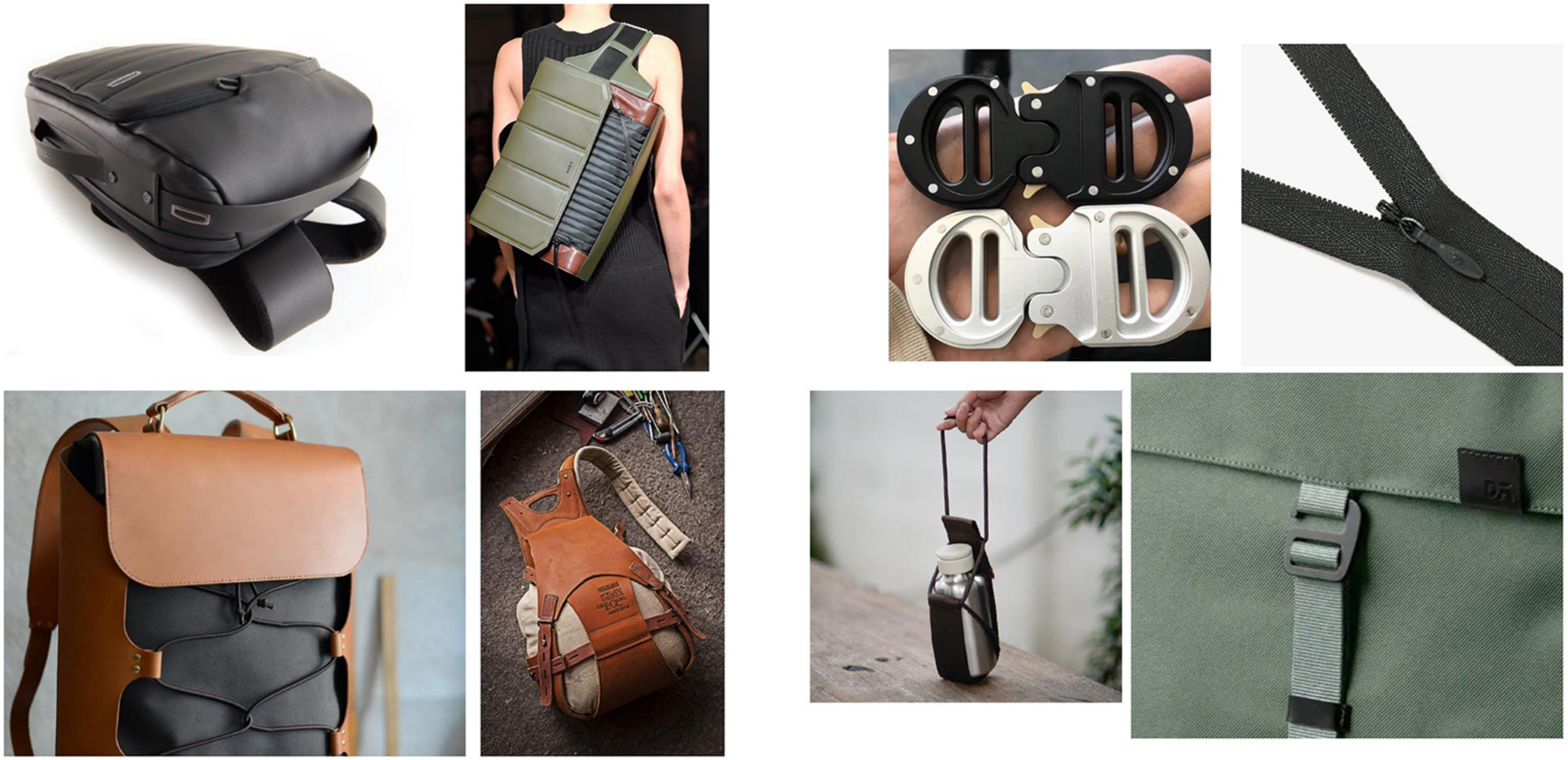


Fig. 11.1.

Image source - www.pinterest.com

12. Final Design - In the making

I stitched the final design since the vendors needed to do so were not available and also a minimum order of around 200 backpacks is required before the vendor agrees.

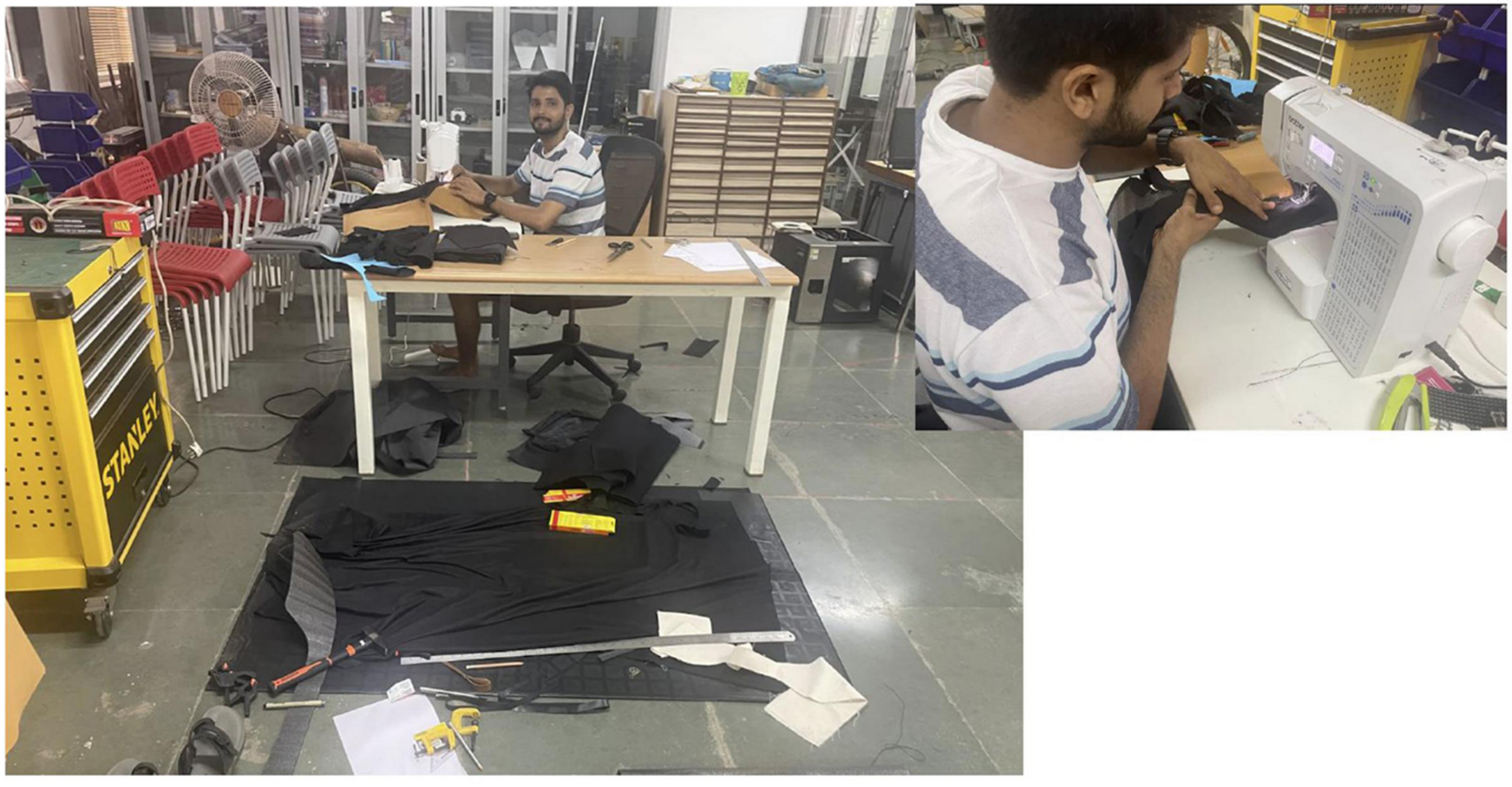


Fig. 12.1

12. Final Design- Bill of Materials

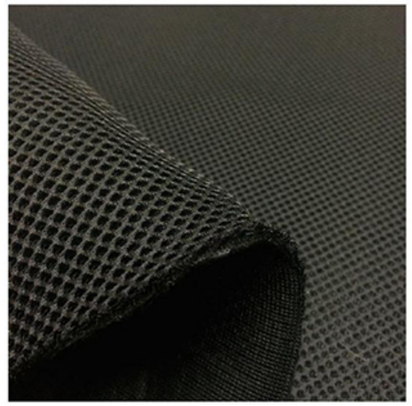


Fig. 12.2.(a,b,c,d,e).

- Big Zipper - Rs. 20 each, 2x20=40
- Small zipper - Rs. 10
- Continuous Zip - Rs. 40 per mtr, (2 mtr.)
- Teeth zip - Rs. 12 (18 inch)

- Nylon, coated fabric,
- Rs. 180 per mtr, 2 mtr used.

- Rexine
- Rs. 360 per mtr, 1/3 mtr used.

- Rexine
- Rs.40 per mtr. (1/2mtr=20)

- Mesh spacer, 120 per mtr., ½ mtr used

12. Final Design

Fig. 12.3.

13. Conclusion

After working on this project for almost 6 months, I developed respect for tailors and the effort they put into making backpacks is tremendous. I wanted to stitch the backpack for myself so that I can realise this. Although I had planned getting the final model stitched by a professional, I could not find a single vendor who could deliver it to me due to shortage of labours. The vendors also demanded at least a minimum number of samples to make backpack. My design was displayed in the Design Degree Show at IIT campus, at the Rahul Bajaj building where people loved my work.