

Accessible and Secure Backpacks for Daily Use

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Abstract

Backpacks are a staple for people to carry essentials on day to day life. Evolution of the backpacks have started from carrying essentials either in belt strap or bindles created from sticks and canvas. Modifications are seen within the backpacks used for photography, hiking and travelling, whereas there is minimal design upgradation of the backpack used on a daily basis. Current innovation in backpack includes solutions such as waterproofing, anti-theft, or posture correction design, on the other hand there is no popular modification for accessibility for the backpack in rush situations where backpack needs to be accessed while still on the back. Thus, this research paper focuses on problems faced by students and working professionals, while using backpacks on daily basis. Data was collected and assessed through triangulation method. Modification in security and accessibility will create a space for product development for daily use backpacks. More secure and easy to access backpacks will make the backpack functional for daily use.

Key words: Accessibility, security, organized, backpack, anti -theft

Introduction

Backpacks are important as they allows user to carry articles on the back using shoulder straps. Current backpacks come with smart technology and waterproof material. Backpacks have been in existence since 3300BC and the earliest one being known to be made of Hazelwood frame and leather to carry essential items like fungi medicine, sticks, etc. Traditionally people use to carry articles either in belt strap or bindles created from sticks and canvas [1]. Design intervention in backpack started occurring in late 1800s which became static after the World War II. As the wars came to rest it became common for students to carry their books in bags, and since then it has been widely used. The design although solves the problem of portability of objects, it makes it difficult to access those articles. The success of a product depends on various factors such as utility, affordability, accessibility, capability, functionality. Within the other factors accessibility plays a very important role for a product [2]. Accessibility is the extent to which a product can be used by people in its widest range of capability. In order to access small items from the backpack, a user has to remove the backpack from their shoulders, which makes it difficult and time consuming [3]. Places such as airports, petrol pump, schools/colleges and even crowded and tourist places requires a user to access the bag frequently for small accessories. Hence evolution of backpack in terms of accessibility is questionable [4].

This research paper aims to find out importance of accessibility for a backpack and what problems it causes for the students and working professionals. The study involves research on how big of an issue is accessibility of backpacks and solutions that exist currently.

Literature review

The popularity of Backpacks has been in trend since many years, as it gave consumers solution to carry articles while keeping their hands free. The backpack was first designed in 1877 for the U.S military. Adopting the same concept from U.S military, in 1938, first zipper bag was created. This zipper bag became popular in kids going to school [5]. As the backpack evolved, in 1952 backpack with metal frame was created which formed the base for modern backpack. 1959 saw the use of plastisol ink for printing on the backpacks which opens up a whole area for aesthetics and visually appealing backpacks [1]. Since then the design became static, but a lot of innovations emerged in terms of material and framing to make the bag lighter and waterproof. In 2016, features like separate compartments were used for maximum storage [2]. Even though portability of articles became easier through the use of backpacks, access to compartments still remained a problem, as every-time to access any item, whole backpack need to be removed and opened [6].

Current existing backpacks have different types of accessibility to access the main compartment. First is Top Loading in which the backpack is loaded from the top, where the items not needed until the end of the day go deep inside the backpack. This type of loading takes weight off your back to the hips [7]. Second Front Panel Loading in which the main compartment opens up similar to a suitcase [8]. Benefit of this backpack is that it has appropriate weight distribution. Third is side access where main compartment is accessed through the sides. Y access backpacks gives you the choice to either access through top or can be fully accessed through the front. Clamshell backpack lies fully flat on either of its main surface when it is completely unzipped. Splayed backpack is similar to clamshell with multiple compartments and is not opened all the way to make it lay flat. Other than these main compartment accessing methods, there are extra attachments for easy access which include lash tabs, gear loops, elastic cords, daisy chains, molle, elasticized pockets and G hooks [9].

There have been attempts to make backpack accessible by incorporating organized compartments inside the backpack. An attempt was made by Wang S to make bag accessible by dividing the bags in top, bottom, side, mid, front and back panels, to make the arrangement organized and keeping the urgent accessing things in top and side compartments. However, this idea requires the user to take time to arrange the items accordingly and just helps them to navigate to the things easily. Problem of accessibility was not solved [10].

Other prior attempts were to access the whole backpack from the front without removing it. In order to achieve this it included strap arrangements that allow the bag portion to be slid or lifted around the body of a user for access upon removal of a strap, or by simply re configuring the strap. This solution requires a lot of weight shifting from shoulders to front and back again, which may cause problems in long run [11]. Also these solutions require the user to arrange the straps after every use making the task more awkward and complex [12]

Other solution consists of backpacks with an articulated frame secured to the back portion and the swing-around portion and allows a user wearing the backpack to pivot the swing around portion around the user's side and access the contents therein. A securing latch is added to control the swing portion. Products based on this solution have already been launched like Wolffepack access backpack. Although, this method majorly solves the problem of accessibility, it still lacks when the backpack is heavy. Since the latch is connected to one shoulder it may cause pain in the arm through which action is being performed. Also, the weight of the mechanism is added to the already existing weight of the backpack [13].

In contrary to above solutions new solutions focused on a particular part of the pouch to move instead of the whole bag. This invention generally relates to carrying devices, more particularly to pouches which are carried on a user's back, as part of a backpack or otherwise, and which may be flipped over for convenient access in the front of the user's body. One such solution was that of accessing the pouch on the back panel to the front by flipping the pouch over user's shoulder. Basically, moving the pouch from behind the user to the chest through the path of the shoulder strap [14]. This solution requires the pouch to be of the same width to that of the strap, thereby making the pouch small or may cause in the increase of the width of the shoulder strap, and in both the cases it is unnecessarily complex solution to carry out.

Another invention provides improved backpack and waist bag carrying systems in which a waist bag rotates through a lower compartment of a backpack to allow the bearer of the backpack to access the contents of the receiver of the waist bag by rotating the waist bag to the front of the bearer's torso. The waist bag is attached to the belt which is secured through the user's waist and can be accessed through that. This solves the problem of accessibility, but the space is limited and an extra belt for the waist is attached, on which this solution can be worked upon [15].

All the above mentioned solutions solves the problem of accessibility in one or the other way, but are specially designed by keeping in mind a specific professions. These solutions work for travelers, hikers, photographers and people who need backpack for their profession. None of the above listed solution is being implemented for general public as the solutions will increase the price and hence won't be considered by general people. Also the design focuses only and only on the accessibility aspect of the backpack, ignoring the comfort of the user by incorporating comfortable straps and material. The solution should also be focused on people carrying shoulder backpacks on a daily basis to school, college, office, airports, etc. And even in places like petrol pump, markets, etc.

Currently we are familiar with daypack, rucksack, laptop bag, sling bag, drawstring backpack, tote backpack, frame backpack and anti-theft waterproof backpack, all solving some purpose by applying a design change but mostly ignore accessibility as an issue. Sling bag does solve accessibility to some extent but then fails to be ergonomically appropriate backpack as it puts all pressure on single shoulder [16].

Methods and materials

For this research, the target group was people who use backpacks on daily basis. Triangulation approach was used to collect data. Survey form was circulated among people of different age groups through the method of snowball sampling. Out of 112 surveys 72% of participants use shoulder backpacks for their daily commute. Hence participants not using the backpacks were excluded. Semi-structured interview were then taken to understand the need and accessibility problems faced by people while using the backpack on daily basis. All the Interviews were taken after the participants consent to record the interview.

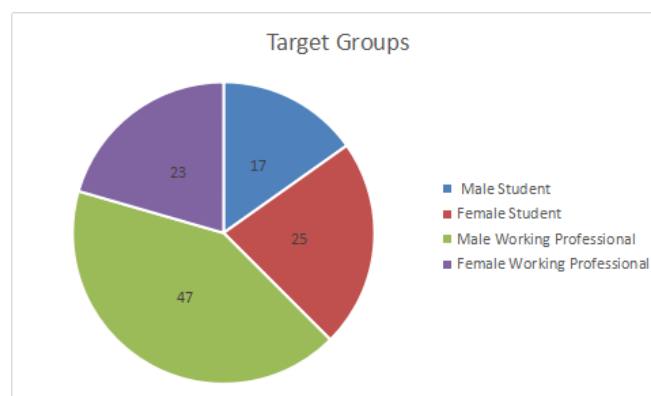
Questions asked were structured in a way to analyze if the participants find that accessibility is a problem, how they use the backpack and if it is adding up to the difficulty faced in accessing the backpack and what all measures are been taken by the participants to make the accessibility of the backpack easier.

Out of 112 people 42 were students, 70 were working professionals. Interview was taken to analyse how often they need to access backpacks and for what all accessories they do it. The quantitative data within the interviews was analyzed by creating themes. Thematic analysis was used to interpret the meaning of the data through organizing the collected data thematically.

Result

The participants interviewed were divided into two major groups of students and working professionals based on the way the backpack is use and the accessories they carry. Further the groups were subdivided in male and female as they have different requirements and needs. Results showed that females intend to carry separate bags for different purpose and would prefer dividing the weight of the backpack in two separate bags while males tend to carry a single backpack to different regions and heavy weight is not really an issue to them.

Figure 1:Shows the participants divided according to target groups. .

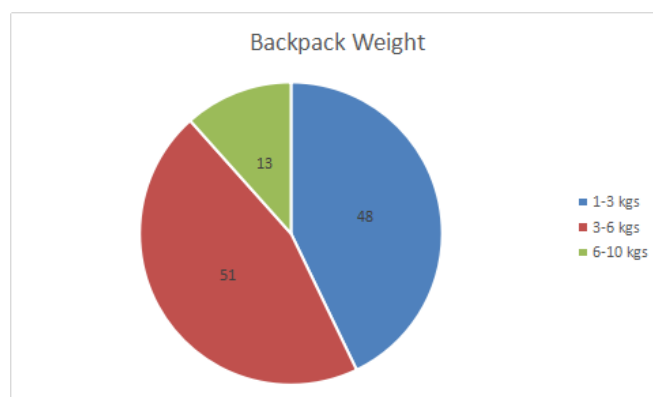


A. Weight of the Backpack

Weight plays an important role in carrying and accessing backpack as heavy backpacks are difficult to carry and also to access from the back as it becomes problematic to revolve it

across the pivot to the front. Maximum weight carried for general use was 9 Kgs. The weight was broken into three groups of 3kgs each for easy understanding.

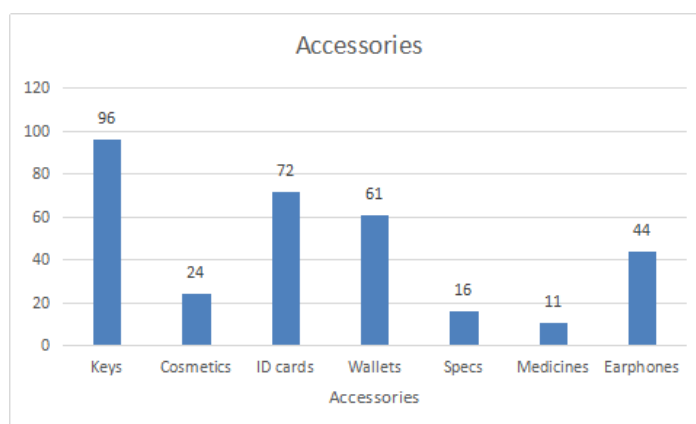
Figure:2.Shows the weight carried by participants in backpack



B. Accessories Carried

Accessibility is mostly required to access small and important accessories which can be required at any point of time, like keys, wallets, passport, IDs etc., and frequency of its requirement, and hence play an important role in deciding the importance of accessibility.

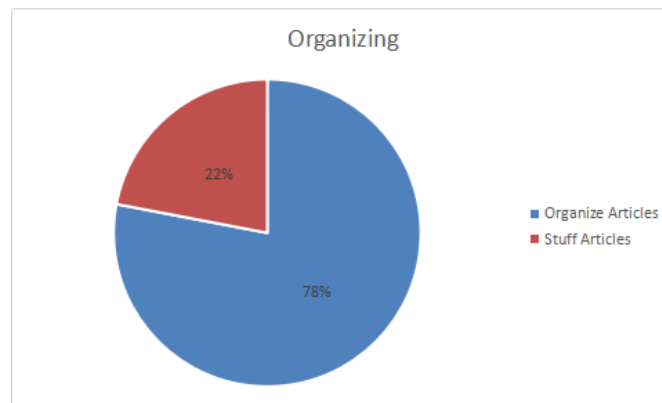
Figure 1. Display different quick required accessories



Organizing and Accessibility

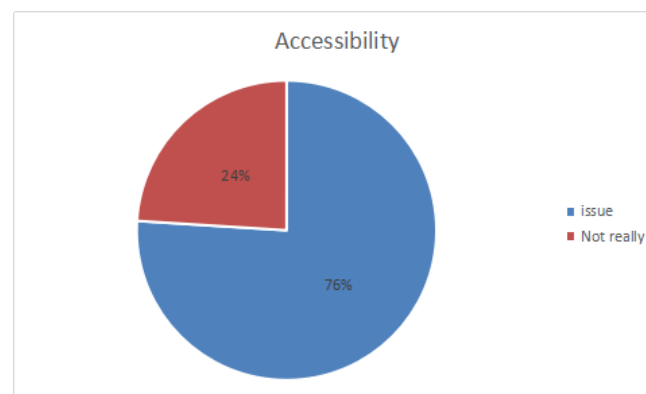
When asked about accessibility majority of people lead their response towards organizing their stuff in backpack, as it makes it easy for people to navigate through their stuff. Although organizing stuff makes it easy to find articles in the backpack, it still does not solve the issue of accessing the backpack while its still on the back.78% organize stuff in backpack for ease of accessibility.

Figure 2. **People who organize accessories in Backpack**



Accessibility Issue

On asking if participants actually felt that accessibility is an issue and if they feel that its difficult to access the backpack while still wearing it on the back, 76% of the participants agreed on it being a trouble. It is an issue while travelling on a bike, walking or even while travelling through airports, train or buses.



Discussion

Backpacks have been in use for a very long time but the existence of the modern backpacks is not older than 44 years old [1]. Although backpack's material and technology changed with time, the concept and framework remained the same. Although it is easy to carry articles in the backpack from one place to another, accessing them still remains a potential issue.

A. **Students Backpack Accessibility**

Currently backpacks are being used by almost every person, irrespective of job, age or gender [17]. The backpacks are most commonly used by students and young working professionals. As per the data collected, male students usually use the same backpack at almost every place they go such as college, airports, markets, night outs, as backpack is a go to commute thing for them. On the contrary female college students use different types of bags for different purpose. They carry different backpacks depending on the amount of accessories they require and thus taking appropriate size backpack accordingly .Due to heavy usage of backpack and quick access items like wallets, IDs, keys, male college student's focus on functionality,

whereas for female students backpack's aesthetics and weight matters more than the function, thus they would prefer bags depending on the place they want to use it for wallets, mobile phones, IDs and small cosmetics like lip balms, sunscreens, etc.

Most students do organize stuff in bag pockets to navigate easily through different items [18]. On asking it was also found that they do have to take their backpacks on one shoulder time to time to access items like wallets and IDs. Accessibility becomes difficult when one needs to take out articles while on the go, be it to access sunglasses while walking, or grabbing wallet from the bag in local trains, taking out passports at airports, all such scenarios require to access backpacks while they are on the back .

B. Young Working Professionals

Young working professionals commonly travel through public transport like local trains, buses and metros, where other than accessibility, wearing the backpack on the front also becomes an issue. While using such modes of transport they prefer keeping wallets and other accessories in the bag itself and it becomes an issue to access it at any point of time, since the places are crowded.

Most commonly backpacks are accessible from the front, the part which is away from the user, it makes it difficult for the user to access such backpacks and also poses a security risk in crowds and tourist areas [6].

They carry the backpack not only to their offices but to business meetings and for other travelling purposes making the single backpack for different use. They travel through a lot of crowded area where carrying the backpack itself is difficult, accessing it in those areas becomes even more problematic as they access it by getting it on a single shoulder and doing that in a public place, poses a chance to hurt others.

Mostly working professionals were found organizing articles in the backpack to find their way to the required accessories easily at any given point of time and it makes it less time consuming at that particular moment when the article is actually required.

Accessories

The most common accessories carried in backpacks are keys, IDs, earphones, wallets, specs, medicines and other such things. Along with the use of backpacks, males use trouser pockets to keep things that they require frequently, but at crowded areas they shift them to backpack pockets, whereas females have small or no pockets, so they use backpacks to carry articles. Since they have backpacks only to carry articles they use different size articles in different size backpacks.

Organizing and Weight Distribution

Ergonomically, weight of the backpack is supposed to be 10-15% of the actual body weight [19]. The distribution of the articles also serves a role in accessibility as lighter the backpack easier it is to carry and thus easier to revolve around the pivot and access [20].Organizing

makes it easier to access items as it makes it easier to navigate to them, it also helps distributing the weight of the backpack making the backpack feel less straining and thus feel less heavy on the shoulders [21].

Weight of the Backpack

Weight of the backpack should ideally be not more than 15% of the actual body weight of the person. Through the research it was found that mostly students carry a weight of more than 4 kgs which makes it difficult to carry the backpack and access it on a single shoulder. More weight in the backpack also makes it difficult for the user to balance the weight properly on the shoulders. Distributing the weight properly also helps in making the accessibility of the backpack easier.

There are some solutions that let the user access the bag while wearing on the back but they either require awkward body motions, or they can contain very limited varieties or quantities of articles. On the basis of interviews taken accessibility being an issue is highly subjective on the basis of mode of transport used and frequency of using backpacks. Since according to surveys, most common public transport in India is bus and number of two wheeler are way more than cars, accessibility does become an issue in India.

Conclusion

Backpacks are used most commonly to carry articles from one place to another. They carry many small and frequently used accessories like wallet, keys, ID cards, earphones, medicines, which needs the backpack to be used while on the back. Although backpacks have made carrying the articles easier, accessing those articles is relatively difficult while wearing the backpack. Backpack becomes easy to access when it is brought in front, but it is difficult to maintain appropriate posture due to shift in center of gravity. Backpack makes it easy to carry articles hands free and distributes the weight across the body. Ideating and constructing an accessible backpack will make it more convenient and easy to use. The backpack has evolved around this problem keeping specific professions in mind and not really meant to solve problem of common citizens using backpack on daily basis, hence the need of designing the accessible backpack emerges to fulfil the requirement of consumers using the backpack daily.

References

1. Grandin M. The Simple-Basic Backpack
2. Mertes, A. (2019). What is the History of Backpacks?. [online] Available at: <https://www.qualitylogoproducts.com/promo-university/history-of-backpacks.htm>
3. Gulliksen, J., Harker, S., & Steger, J. (2001). The ISO approach to the development of ergonomics standards for accessibility. Inclusive design guidelines for HCI, Taylor & Francis, London.
4. Jupiter, J. A. (2001). U.S. Patent No. 6,230,952. Washington, DC: U.S. Patent and Trademark Office.

5. Forno, S. (2015). The Evolution of Modern Backpack. [Blog] From prehistoric wicker basket to state of the art pack. The modern backpack is younger than you think Available at: <https://onyourterms.com/the-evolution-of-the-modern-backpack-2df9340ff31e> [Accessed 26 Nov. 2019].
6. Moreno, K., & Moreno, S. (2006). U.S. Patent Application No. 10/915,288.
7. Gleason Jr, D. W. (2010). U.S. Patent No. 7,673,777. Washington, DC: U.S. Patent and Trademark Office.
8. Lehrman, M. A. (1999). U.S. Patent No. 5,979,725. Washington, DC: U.S. Patent and Trademark Office.
9. Bratcher, J. T. (2015). U.S. Patent Application No. 14/335,343.
10. Wang, S. (2005). U.S. Patent Application No. 10/727,235.
11. Marik, L. (2011). U.S. Patent No. 8,070,030. Washington, DC: U.S. Patent and Trademark Office.
12. Vierthaler, P. R., Lewis III, C. S., & Vierthaler, C. R. (2014). U.S. Patent No. 8,887,976. Washington, DC: U.S. Patent and Trademark Office.
13. Coxworth, B. (2015, May 2). wolffepack lets you access your backpack – without taking it off. Retrieved June 5, 2019, from <https://newatlas.com/wolffepack-backpack/34370/>.
14. Murdoch, D. H., & Sturm, M. (2014). U.S. Patent No. 8,690,029. Washington, DC: U.S. Patent and Trademark Office.
15. Startup Selfie. (2019, August 10). Paxis: Swinging backpack for quick access to your gear. Retrieved from <https://www.startupselfie.net/2019/07/14/paxis-swinging-arm-backpack-quick-access-to-your-gear/>.
16. Ken, R. (2019, August 22). 17 Types of Backpacks: The Complete List (2019). Retrieved from <https://www.carryallguide.com/17-types-of-backpacks-complete-list/>.
17. Rateau, M. R. (2004). Use of backpacks in children and adolescents: a potential contributor of back pain. *Orthopaedic nursing*, 23(2), 101-105.
18. Dannewitz, C. (2009). U.S. Patent Application No. 12/252,408.
19. Brackley, H. M., & Stevenson, J. M. (2004). Are children's backpack weight limits enough?: A critical review of the relevant literature. *Spine*, 29(19), 2184-2190.
20. Ford, T. J. (2016). U.S. Patent Application No. 14/562,372.
21. Noice, F. M. (1978). U.S. Patent No. 4,096,978. Washington, DC: U.S. Patent and Trademark Office