

ERGONOMIC COMBINED CHILDREN BAG DESIGN



POLITECNICO
MILANO 1863

School of Design
Master of Science in Design for the Fashion System
Academic Year 2018/2019
Supervisor: Prof.ssa Alba Cappellieri
Assistant: Elisa borboni, Livia Tenuta
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ABSTRACT

Nowadays, Children play more and more important roles, also in the fashion world. Many fashion elements are used on children products design and unexpected effects is occurring. Kids fashion adds a lot of energy to the fashion world. Children converge with playing, discovering, learning, and dreaming. In their childhood, they are happy, but they also have more and more pressure, and they are getting more and more heavy bags on their shoulder. Based on market research, user research and trend analysis of children backpacks, this thesis concludes that children backpacks should regard practical, intelligent, interesting, healthy, environmental protection and customization as the development direction in the future. Regarding the ergonomic combined children bags as the theme and the school-age children as the targeted user group, the design of the children bags aims to reduce burden and correct the child's posture through the intelligent carry system with smart sensor which connected with parents' APP. Another key point involved in the project is the functionality and interestingness of the backpack. The assembly and disassembly design can meet the needs of children in different using occasions, and it is beneficial for children to develop a good habit of organizing. At the same time, DIY customized design can meet the characteristics of children and stimulate the potential of children and improve the user experience.



Overview And Trend Analysis

CHAPTER

1

1.1 The research and analysis of children's demand of bag

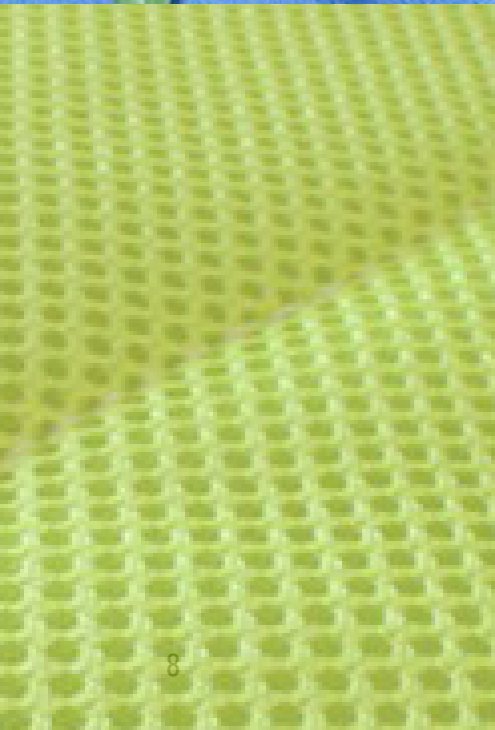
Children like to discover, learn, dream, play, express, imagine. Nowadays, children products try to be different. A lot of unexpected elements were incorporated into its design, which produced a number of interesting fashion vanes. Kid's product is getting its importance and scope in today's market. Dynamics of children's wear are changing with manufactures& retailers burgeoning private brands. Considerable amount of studies of have been done on kids wear market. Recent studies show that markets for children's wear were increased from time to time. As an important part of children products, backpack is an indispensable part of children's learning and living. With the global economic growth, the development of new technologies and the change of life style, people have more and more new demands on children's backpack. It is not only a simple tool to carry things, but also a carrier of functionality and fashion, which could meet all the needs of children. According to the market research, the demands of children backpack consumers refer to the following aspects:

First, quality. Consumers attach great importance to the quality of children backpacks. Practical and durable and good quality are the key factors when consumers choose children backpacks. The quality of children backpack has a direct impact on its use value. When consumers choose a product, they will first consider the quality of the product on the basis of cost. According to the survey, 40% children backpack have the durable years of 1 to 2 years. In addition to the reason of children growth, it mostly dues to the quality problem of the

Front:
Cosumers' focal points
of children bag.

Back:
Hanna Andersson
children backpack





backpack, such as the damaged parts, wearing fabrics of the backpack. Combined with the physiological characteristics of children their own age, lively and active, they are more physically active than people in other age group, which accelerates the damage rate of the product. Therefore, consumers pay more attention to the quality and durability of products when buying children backpacks.

Second, safety , health and environmental protection. Children are weak, lack the self-control and are easily hurt. Therefore, consumer pays attention to the safety of children backpacks. Safety refers to the material safety and travel safety. In order to reduce the cost, many products in the market pay little attention to the physical and mental health of children, which leads to threats to security. A good children backpack will fully take the physiological development of children into consideration in the process of designing. Different products aim for the corresponding age group and the psychological growth of children will also be considered. The structure should conform to the physiological characteristics of children. The used materials should be healthy and harmless. As people's awareness of environmental protection has increased, more and more people are beginning to be keen on environmentally friendly fabrics. What's more, parents attach great importance to the safety of children when they go out. The design of backpacks should consider adding safety equipment or other safety auxiliary measures to solve children's safety problems, through which cultivate children's independent consciousness within the safety range.

Consumers' focal points of children bag.

Function, comfort, health and environmental protection are important factors for consumers.

Third, comfort. The design of backpack should meet the needs of the children's physical development, and take children's physiological

characteristics in consideration to meet children's visual, hearing, touch, smell needs. The design of backpack should be based on ergonomics to meet children's comfort to the greatest extent with reasonable data for the reference. It looks comfortable and subjective on the vision. On the other hand, it refers to the objective physical perception. The decompression of a backpack is an important factor affecting its comfort degree. Children backpacks will influence children on shoulders, backs, soles and walking gait in varying degrees, which because the weight of the backpack and the design of the backpack is not ergonomic. This is an important problem that needs to be solved in the design of backpack.

Fourth, function. P C Mehra, Professor of marketing, International Management Institute, he found that people prefer functional kids' apparel rather than branded ones. Functional backpacks mainly emphasizes the usability, pays attention to the internal structure and focuses on a rational and structural design. The backpack is a necessity in children's life. In addition to the school use, it should meet the using demands of children when they play outside or other places. The design needs to consider the types of the article put in. For example, if children need put books, the backpacks should design different function partition according to the size and thickness of the books. In the open air, the backpack should possess the conveniences of putting and taking of the article such as clothing, water cup, umbrella. It should provide more additional functions based on the premise that does not affect aesthetics or decompression. The design of the functional backpack, on the one hand, is inseparable from lightweight, practical, waterproof and moisture-proof, real-time GPS positioning and security equipment. On the other hand, it should be combined with the new needs of children,



Consumers' focal points of children bag.

Backpacks need to meet the needs of children when they in the school and after school.



Right:
Fjallraven Kanken
kids backpacks in
different colors

Left:
Fábula
Kids shirt with colorful
animal pattern

paying attention to the new products, new technology innovation, and trying to produce the multi-purpose backpacks. Besides, its intelligent design should be enhanced and the mobile terminal and electronic equipment should be added into the design. it should be combined with the new needs of children, paying attention to the new products, new technology innovation, and trying to produce the multi-purpose backpacks. Besides, its intelligent design should be enhanced and the mobile terminal and electronic equipment should be added into the design.

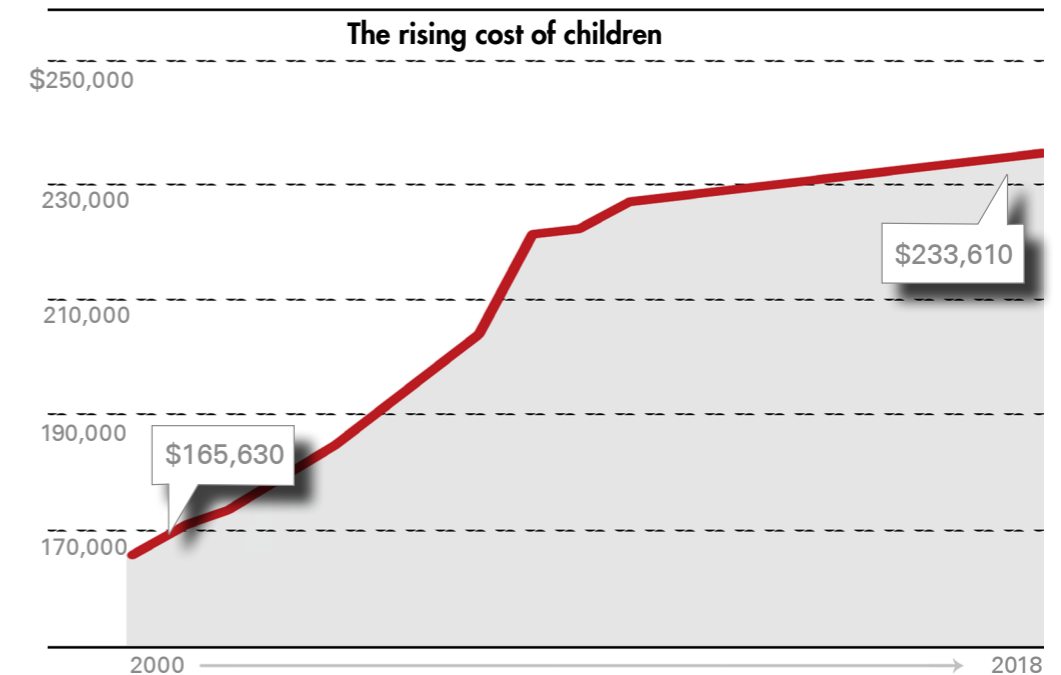
Fifth, appearance. With the development of children's fashion industry, parents and children pay more and more attention to the aesthetics of backpacks. As a general rule, the beauty of products determines purchasing desire of consumers. The appearance design of children backpack should start from children's psychology and take children's favorite colors and patterns as the design starting point. The shape design of children's products should meet the children's body size at their age stage and combine the data and parameters of product internal structure design. Color design is determined according to the age and gender. Through long-term research, Hans Children Color Research Center found that children have higher preference degree for the warm colors such as red (R), purple red (RP). They prefer the primary color with a higher chroma. Besides, with age, their color preference will turn to cool colors from the warm colors. Thus it can be seen that the bright and lively color with high purity and high contract could satisfy children's psychological characteristic and aesthetic requirement. In terms of gender, most of boys prefer cool color of bags and girls prefer warm color of bags.

Sixth, price. Consumers tend to consider whether the price of the backpack matches its value. According to the analysis of the prices of children backpacks on various e-commerce platforms, the single selling price of regular children backpacks is mainly between 10 and 30 euros. Comparing the five popular rational price children backpacks, the price of Little Life on AMAZON is \$30. Momoailey is around \$28. The price of SKIP HOP is around \$17. The Goldbug giraffe is priced at \$15. Angel DEPT is around RMB \$35. However, with the improvement of living standards, people are spending more and more money on children backpacks. The children bags of some luxury brands and some intelligent high-end brands are more and more popular among consumers. Such intelligent high-end brands are more and more popular among consumers. Such backpacks possess high quality and versatility and they cost a lot more than ordinary backpacks, but they are better in terms of performance than rational price backpacks. Generally, consumers who choose this kind of backpacks pay more attention to the quality or performance of children backpacks, and their considerations of price often comes second. However, no matter the children backpacks on which price, the good cost performance is still an important factor.

1.2 The industry of children's bag and the fashion world for children

The Children's bag industry is booming. The global children's wear market has not influenced by the global economic slowdown. When many luxury brands have struggled to sell in multiple categories. The global children's wear market is growing more and more prosperous.

Overall, there will be a growing market for children backpacks because of the reasons of wealthier parents, the growing influence of fashion trends on consumers and rising household incomes.



The rising cost of children

The cost of a child from birth to age 18 in 2018 is \$233,610 – excluding the cost of college – for a middle-income family, according to the U.S. Department of Agriculture. That's up nearly 40% from 18 years ago.

1.2.1 The analysis of the global children bag industry

International luxury bands or light luxury brands have entered into children bag market.

More and more brands have launched children bag or focused on the children bag. High-end bags have great potential in the market. The children bag has attracted the attention of luxury brands since



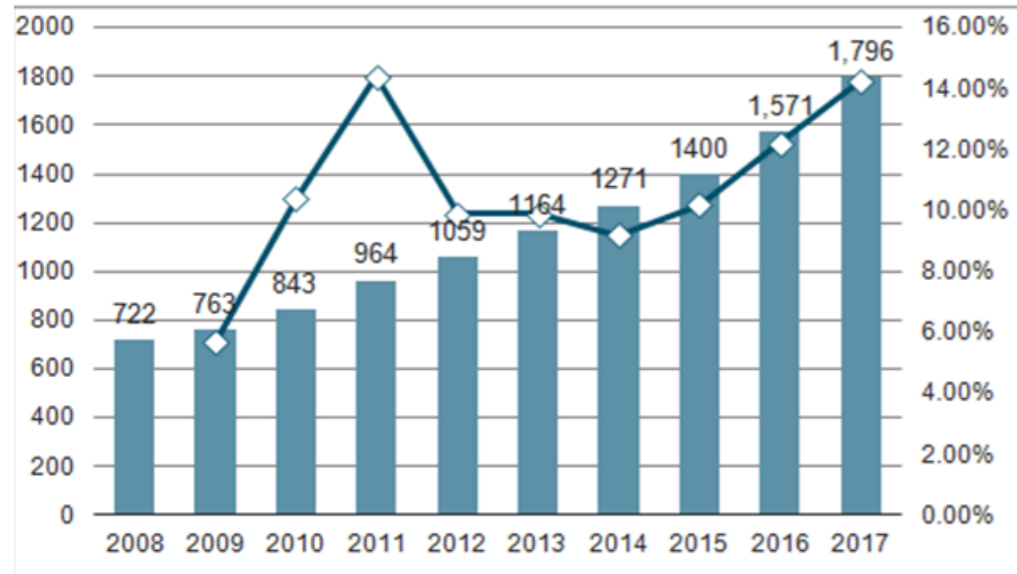
**Fendi
Backpack baby
Fall/Winter2018-2019**

the 1960s. As the leader in the field of children bag, Christian Dior takes the lead in children's products. He had designed the children bag with special bear head, which is very popular with children. Since 2000, Gucci, Chanel, Loewe, Fendi, Line luggage and so on have expanded or developed their product line of children bags. Gucci has a very rich product line. Compared with many Gucci bags that is very expensive, children bags are much cheaper. Gucci children bags are mostly painted with classic and iconic patterns. Although they are a little old fashioned, the cute pets like cats, little monsters and deer are painted on the bags. The baby elephant bag released by Loewe is another popular series in the luxury children bags industry. The bags comes in a variety of colors, sizes, colors, patterns and other animal shapes, such as pandas. There is bag key chain in the same style, which is eye-catching when hung on the bags.

The professional children bag brands and children bags boutique stores around the world have emerged and become popular. For example, Scout schoolbag, a famous German brand, founded in 1975 and has a history of 40 years. Scout focuses on schoolbags and backpacks for students. It is the most highly praised backpacks by German parents. It possesses the advantages of beautiful, light, ergonomic, waterproof and antifouling, traffic reflective safety instructions and so on. Another example is Jeune Premier, a Belgian brand for children backpacks. In May 2012, "Jeune Premier" was officially launched in Europe and sold 100,000 copies as soon as come into the market. It gained a large number of fans around the world by virtue of its appearance and high-end quality.

The market of children bags has grown significantly in developing countries, especially the developing countries in Asia.

Size (100 million yuan) and growth of 2008-2017 China children's wear market



Moreover, the development speed of children's wear industry has been ahead of that of men's clothing and women's clothing, and the growth gap is gradually widening. The rising middle class in emerging markets, coupled with abolition of the one-child policy in China, is resulting in greater per capita expenditure. Take China as an example, during the period from 2013 to 2017, the birth rate in China gradually increased from 12.08‰ to 12.43‰, and the proportion of people aged 0-14 years old in China also increased year by year, from 16.4% in 2013 to 16.78%

**Ritzy, luxury mall Plaza 66
1266 Nanjing W Rd,
NanJing XiLu, Jingan
Qu, Shanghai Shi,
China**



in 2017, reaching 233 million, an increase of 19 million compared with 2016. (as shown in the figure).As the “second pregnancy craze” continues to heat up, it is expected that the number of people aged 0-14 will still steadily increase, thus laying a solid population foundation for children bag demand.

The offline and online sales of children bags are hot.

Harrods department store, an offline physical store, recently expanded the size of children’s wear department store to 66,000 square feet (about 6072 square meters).For Spring Summer 2016, Harrods has announced the launch of its exciting new Mini Superbrands concept that is now beautifully situated on the fourth floor in Childrenswear. The Mini Superbrand space has undergone a complete transformation, housing newly designed boutiques from Dior, Gucci and Loro Piana; the perfect place for little shoppers to view an array of sophisticated and fashionable styles from each of the brands. It created a good platform for the growth of children bags market. The online and offline sales of children bags are hot. The online sales are more favored by consumers during the economic slowdown, and will continue to promote the development of children bags industry. The performance growth of the e-commerce in online sales such as Alex and Alexa which mainly sells the products of Dior, Fendi, Burberry and other luxury brands is significant. Net-a-Porter bought a domain name of children’s wear e-commerce that called petite-a-Porter as early as 2009.

The design of children bags is developing towards the trend of imitate adult bag and parent-child bag series.

At the high-street level, children’s bag has begun to imitate adult bag,

Harrods department store

Located on Brompton Road in Knightsbridge, London. Dior’s children’s boutique on the fourth floor in Harrods is the largest of it’s kind, spanning across 2,000 square feet. The space features clothing for all ages from babywear to childrenswear, along with the season’s must have shoes and bags.



as parents' desire for their children to be "on-trend" has increased and their consumption habits have shifted towards more frequent purchases. In the late 2000s and early 2010s, a flurry of designer brands, including Marc Jacobs, Dior, Stella McCartney, Lanvin, Gucci, Fendi, Dolce & Gabbana and Roksanda, jumped to tap this trend, launching their first forays into the childrenswear market. While some brands — such as Vince and Tommy Hilfiger — operate children's labels via licensing agreements, many are made in-house and correspond closely to a designer's women's and men's collections, playing into the desire for "mini me" outfits where parents and children dress the same. For example, the children's products line of Dior is called as "Baby Dior". The design of Dior's children bags is almost exactly the same as that of "Lady Dior", which gives people a feeling of a parent-child bag and is almost a miniature version of the adult bags. The famous Princess Diana handbag also launched a children's version. Generally speaking, an adult will choose the Diana bag with five compartments, while the children bag has three compartments and looks more delicate. Many color that are not available in adult versions can be found in the children's version bags. There is a Princess Diana handbag made of denim covered in graffiti, which is more characteristic.

The safety and comfort of children bags are drawing more and more attentions.

Children's bag has also followed recent trends in men's and women's fashion, which priorities comfort and performance. "Athleisure is important," says Kalenderian. "Most kids probably are not going to the gym, but mirror the parents' way of dressing." Leading a healthy lifestyle and helping children grow up healthily have become the

**Baby Dior
Petit Kids Girl Bags
Fall/Winter2017-2018**





Sanrio
Hello Kitty Backpack
Fall/Winter2018

design tenet of more and more children bags brands. Many brands have launched lightening backpacks, spinal protection backpack and other products designed according to the ergonomics of children to protect children's health. In addition, the toxicity of chemical dyes in textiles has been reported by the media for many times. Children's products made from pure natural materials or eco-friendly materials is more and more popular, and the demands of these product is growing.

Increase brand acceptance among children through empowerment or transboundary.

Many brands of children bags increase the added value of bags and attract more consumers through the cartoon characters. For example, Hello Kitty, the famous Japanese brand of children bags, was born in 1974 when SANRIO was scheduled to launch a small purse and they hoped to design a new character as the pattern. The designer Yuko Shimizu designed a small white cat with a red bow. This cat was paint on the wallet and then come into fashion. The success of Hello Kitty had also brought huge commercial benefits to her business partners. SANRIO licenses this design to more than 500 companies in Japan and hundreds of enterprises overseas. Now the unique image of Hello Kitty has appeared on more than 22,000 products that is being sold in more than 40 countries. Unlike Doraemon and Garfield, Hello Kitty is a commodity without any support of movies or comics. Children bag brands add the recent popular cartoon image in the design through cross-border authorization, which is very popular among children. Success cases include Barbie Princess and Spiderman.

Celebrity's influence on children's fashion has increased.



**Harper Beckham with
Bonpoint kids bag**

It is easy to find that there are more and more children of celebrities appearing on the fashion weeks. In addition to the traditional adult fashion weeks, there are children fashion weeks. For example, the biennial children fashion week Petite PARADE that began in 2010 and the first Global Kids Fashion Week in London in 2013, the tickets with the price of \$150 were quickly sold out. In recent years, children's cognitive psychology and imitation psychology have been greatly improved. As endlessly star emerging in the market, children began their trip of star chaser. The celebrity effect is an important factor of the development of the children's wear industry. In recent years, the parent-child entertainment programs have become popular, such as Dad where are we going, The superman has returned and so on. Parents and children are greatly inspired by the dress collocations children in the programs, and they imitate a lot. Laura Wilkinson-rea, the spokeswoman of eBay, said: celebrities' children have always been making headlines in recent years. It is nothing new that these children have become the fashion icons and promoted the goods selling on the website.

1.2.2 Fashion trends of children's bag

Children's fashion is on the rise. "Back-to-school" is not just a time to stock up, but also a time for kids to express themselves. Back-to-school has become their red carpet. Kids are more aware of fashion trends than ever before. With the change of consumers' tastes, materials of the children bags are more diverse. Leather, PU, polyester, canvas, cotton and linen is gradually leading the direction of fashion. Besides, in a flaunting personality age, the

styles of simple, back-to-ancients and cartoon catered to consumer demand from different aspects. Designers of children bags try to be unique, creating a lot of fashion vanes and incorporating unexpected elements into their designs. The style of children bags can be divided into four types by analyzing and summarizing some fashion trends in recent years.

Elegant and classic

In current world of children, fashion classics and iconic elements can be seen everywhere, such as British plaid, ruffle, Liberty printing and so on. As the reviving of good value, vogue is not following the trend anymore, but abandoning the redundant adornment and pattern. Children's fashion began to advocate excellent materials, perfect tailoring and carefully selected colors.

British style. "Natural, elegant, implicit, noble" is the typical characteristics of British style. The British style emerged from the Victorian period and it was prevailed at that time. British style puts a special emphasis on details, which conveys the noble temperament of a gentleman and lady. A lot of parents who buy the product in British style want that their children could possess the elegant temperament from childhood like the gentleman and lady in England. A lot of children have the princess and prince complex in childhood, and the temperament of gentleman and lady that British style shows, just satisfy children's illusion of the princess and prince in the fairy tale story. Besides capturing the heart of parents, British style also won the affection of children. The Cambridge satchel in a crossbody style or backpack style is the perfect example of British style.

Cambridge satchel

Founder of Cambridge satchel compenry Dean e's daughter, Emily, and her son, Max, during a modeling shoot, 2008





Lef:
Jeunepremier
Captain backpack

Right:
Jeunepremier
Cavalerie royale mini
backpack



Preppy style. The preppy style become popular among children since 2010, which appears as the woaded blue, bright and lively colors, pinstripe, plaid, university badge, which are casual but elegant. The “preppy” in the English name of the preppy style refers to the Ivy League, such as the preparatory course students in Brown University, Columbia University, Harvard University. The children hope to be as excellent as them. The preppy style shows the elegant and elite temperament, which brings them the hard-working temperament. They tend to wear the striped or plaid bubble cotton jacket, striped cardigan sweater, and plaid Bermuda shorts or match the polo shirt with Chino and the Miniseri canvas leather schoolbag, which looks cool and brisk.

Delicate classical style. Although it is a bit overcautious, the new petty bourgeoisie style is the symbol of the ideal image. With the luxury brands developing into the children’s market, the delicate classical style began to spread in the children’s fashion circle. The luxury brands such as Burberry, Chloe, Gucci developed their own children’s wear lines according to the children’s market and made the corresponding adjustment of the corporate image. They keep in line with the classic style, retain their mark, material or brand design and add the bowknot and cartoon to attract children’s attention without ignore comfort of the products. The pace of children’s fashion development has been greatly accelerated in just a few decades. Some designers of the fast fashion brands such as Zara and H&M have also successfully developed the children’s product lines and they have also set off this classic fashion, but what distinguishes them from some luxury brands is the selection of materials and the novelty of styles. Their style is between traditional elegance and small crowd style. Humorous quotes and strong colors

Gucci
Kids collections
Fall/Winter2018-2019



make the classic style less monotonous.

New romanticism style. Flowers, leaves, grass and candy box, this combination gives people a rural atmosphere that is soft and fresh. Perfect gradients of blue, cream-colored fabric, pink, pale green, lavender, nude, cornflower and hay, all these things give a new romanticism atmosphere. They often combined the fine linen, poplin and linen with English embroidery, mesh lace, crochet and antique embroidery. The brand Bonpoint that was founded in 1975 revived the romanticism with modern elements. The romanticism fashion they established possesses the advantages of both the British elegance and the American practicality, which is the typical representative of new romanticism.

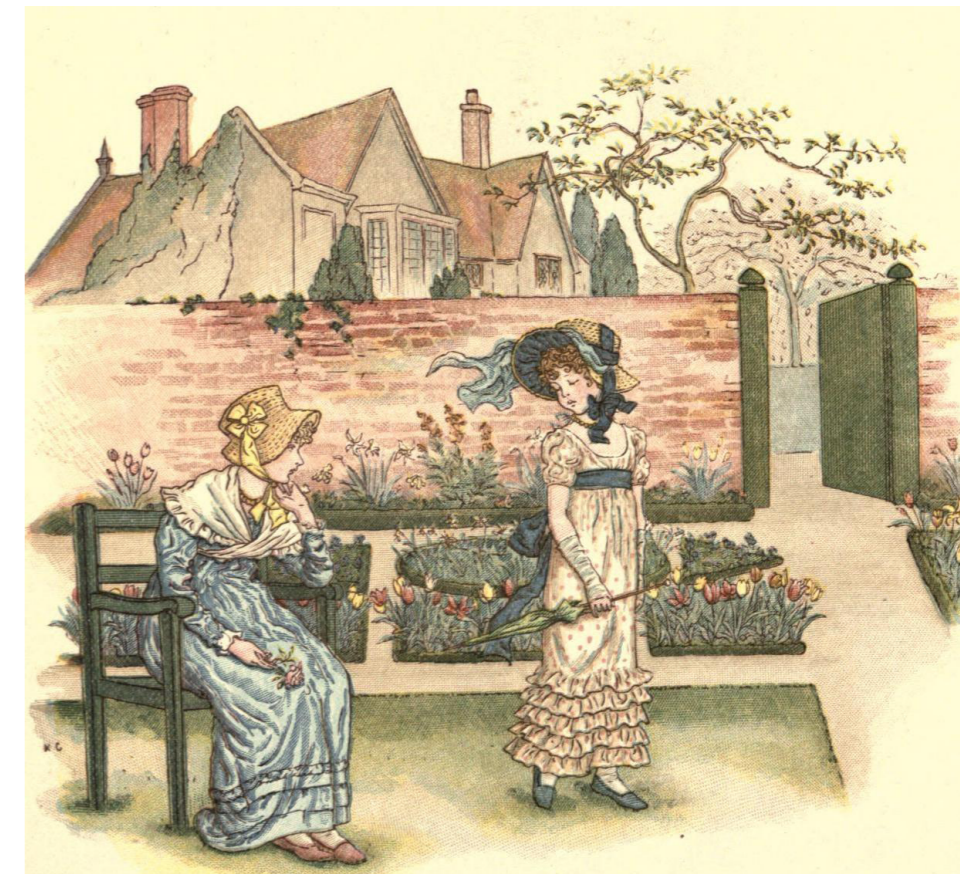
Simple style. There are no complex details. The dazzling adornment and graph are abandon and the children fashion is designed in an elegant simplicity. Just like the principle advocated by the Bauhaus school of architecture, the function is more important than the appearance. A lot of Northern Europe brands focus on the modern simple style that is simple and unadorned and advocates that less is more. Fjallraven, founded in 1950, is a well-known top-level outdoor brand in Sweden, as well as the only outdoor brand used by royal members. Fjallraven developed from the backpacks making and develop into a comprehensive global professional outdoor leisure brand now, becoming the national backpack in Sweden. The square shape became the unique style of KANKEN, which has been extended into the children's products line. In the 1970s, Mr. Ake Nordin, the founder of Fjallraven, found that backpacks used by Swedish schoolchildren would put the weight on the bottom of backpacks



Above:
Boupoint
Spring/Summer 2014

Below:
Paintings from
Catherine Greenaway
(17 March 1846 – 6
November 1901)
A British Victorian artist
and writer

In the 19th century British Victorian era, the rise of the artistic trend made "the pursuit of beauty" become the only belief of people. The children's wear brand boupoint from France brings people back to Catherine Greenaway's illustration.





Boupoint
Summer show 2019

Presented at the Palais de Tokyo, the summer 2019 collection is a new journey to the heart of joy and freedom. Artistic director of the House, Christine Innamorato imagines a poetic collection inspired by the beauty and riches of the world, from the blue-toned lights of Lisbon to the fragrances of Provence, from the sounds of Africa to the colours of India.



when placed too many things. The backpacks would deform, which would increase the burden on users and even cause injuries of the spinal. He used four Swedish phone books as a model to make a square backpack that could be carried by both back and hands, besides the design of full opening in the front cut the time needed to find things in half. The special straps in the W shape and the design of vertical type gravity sharing prevent the backpack from deforming and improper stress of the straps. It became the specified backpacks of the schoolchildren in Northern Europe.

Slow life

Nowadays, people's consumption patterns have changed greatly. People tend to the consumption patterns that is sustainable, green, environmental friendly and in line with the good moral rules. People should stop wasting, be responsible, be a locavore and be concerned about the extinction of species. Parents support their children to adopt the healthy lifestyles and engage in the sustainable development and earth protecting actions. The vintage trend brings beauty to used materials, and makes old things and colors glow with unique charm. People's pursuit of health gradually turns into the pursuit of simple things in the daily life, which will not deteriorate or lose their value with time. In the slow life and the slow fashion, children have more time to find themselves and think of the most basic things.

Nature first. The desire to get in touch with nature makes children prefer the primitive beauty. They prefer the raw materials: rattan, bamboo weaving, felt, hemp ropes, which could be easily found in the forest. This raw material is also favored by more and more designers.



Left:
Zara
Children straw woven
bags
Summer /spring 2018

Right:
Louisemisha
Little basket with
peacock pompoms.
Carefully handmade in
Morocco.
Summer/spring 2018





**Yarn bombing
A knitting graffiti
movement started in
2005**

Yarn bombing seeks to resurrect traditional handicrafts .“more typically associated with grandmothers, like knitting, canning, gardening and even raising chickens,” said Annette DiMeo Carlozzi, a curator at the Blanton Museum of Art in Austin, Tex. In March it commissioned Ms. Sayeg to cover the trunks of 99 trees in front of the museum. Yarn bombing has become synonymous with the current feminist movement due in part to the reclamation of a traditionally feminine act (i.e. knitting and/or crocheting) to partake in the traditionally masculine and male-dominated graffiti scene.

**Left above:
Grace Brett, 105years
old, loves knitting**

The relationship between children and nature, in a larger sense, is the relationship between human beings and nature, which needs to be rethought with endless creative ideas. For example, the straw woven bag that was once known as mom’s basket for carrying vegetables and food items is deeply loved by consumers because of its advantage of green environmental protection now. The straw woven bag that makes from the natural plant such as grass, cane, hemp is simple and natural with the decorations of flowers, pompoms, bows, fruit and so on, which is the best choice for children when travel in the summer days. The children straw woven bags that were launched by Zara that is nifty and lovely are popular among children. St Tropez, the most classic bag of Kayu, a brand focusing on children straw woven bags, also launched the mini model with lovely pompous decoration, which is suitable for children.

Knitted handicrafts. The new knitted fabric products have its unique appeal. Site likes Golden Hook, founded by Frenchman Jeremy Emsellem in 2008, , where you can customize your hat or scarf, and make it knitted by a real identified grandma. These knitted handicrafts connect people of different generation; Anne Claire Petit (Breda, The Netherlands, 1962) is a knitting designer. In 2002 Anne-Claire chose to shift her focus to a kids & home collection. Without the seasonal cycle of fashion, she feels free to create and to translate her love for color and natural materials into a wide variety of items. As the objects became bigger and bolder over the course of time, this grew into two separate lines: Anne-Claire Petit Accessoires, consisting of toys and playfull accessories and Anne-Claire Petit Home with its furniture and decorative objects for the home. With all the love and

energy put into the objects by her and by the women who do the handwork, Anne-Claire believes they are made to be cherished for a long time; In 2005, American knitting enthusiasts set off the knitting graffiti movement. The start of this movement has been attributed to Magda Sayeg, 37, from Houston, who says she first got the idea when she covered the door handle of her boutique with a custom-made cozy. They covered the city with colorful knitted fabric, such as bicycles, street lamps and pillars. Knitting graffiti is more environmental friendly than street graffiti. It doesn't use the chemical paint and makes the city warmer. Knitting graffiti has been popular around the world and is being held in cities such as New York, Paris, Sydney and Hong Kong. Joann Matvichuk of Lethbridge, Alberta founded International Yarnbombing Day, which was first observed on 11 June.

Casualness in the Bohemian style. Handmade skills from all over the world inject the craftsmanship style elements into children's fashion, which enriches the patterns of children products. Scandinavian geometric patterns, Slavic cross-stitch, Japanese style patterns, Mayan embroidery, woolen embroidery, tie-dye, batik, the designers mixed these elements together and created a borderless, free style, which fade the haze in the city. After being added these folk arts, children's fashion is like a colorful palette, full of passionate patterns. In children's fashion circles, designers choose the lightweight and comfortable fabrics and match it with the chic folk elements, such as hollow design and the pompon on the sleeves, yarn edge and embroidery to achieve the effect of folk style. The bag and hand chain that is decorated with the tassel, all sorts of color, all these things make the products more fashionable. From the fine custom-made clothing and the Bohemian



Above:
Eulalievarenne
Kids bag
Spring/summer 2017

Below:
Brass Razoo
Kids backpack
Spring/summer 2018

style, we can find that designers put their unlimited creativity and imagination into the design, and babies in these clothing are just like to participate in a Bohemian carnival.

Love animals. The theme of nature and life is always be displayed in the fashion world repeatedly, which also include the animals. Whether it is small insects or brave animals, they all have given designers countless design inspiration. Designers find a new path or get rid of the stale and bring forth the fresh, trying to add the animal into the fashion world. Animals that enrich children's world also step into children's fashion trends . The fashionable design of these decorations makes animal friends of children become more lively and interesting. Those interesting, wonderful and weird animals arouse children's attention to the earth more or less, which is the best proof of ecological care. It is necessary for children to know that we are not the only creature in the world. The use of animal elements is the best way to integrate humans with nature. They make the child's heart softer and kinder. The cute animal images was brought into the world of children and they accompany them in their happy childhood. Animal elements have become one of the favorite elements of many children bag designers. Affenzahn is a brand of high quality backpacks for kindergarten kids and its representative products is the animal series. Affenzahn means "little monkey's tooth" in German. The products in the animal series possesses the personalized function and its design details are suitable for children.

Happy and free

Children in the digital age have various wearing styles and designers

Above:
A shot from the campaign for Stella McCartney's first children's collections for GapKids and babyGap in 2009.

"OK, I've got to get into the same mind-set of a kid and what they might like," said McCartney as she stood on the sidelines of the campaign shoot for the collection — which stars a host of children posing with baby animals — at a London studio in late summer. "It's quite a good thing to have kids when you're designing a kids' collection, to be aware that they actually have their own point of view."

Below:
Donsje Children bags collection Spring/summer 2019





**Affenzahn
Small Friends collection**

Affenzahn has a variety of small and large animal backpack friends to travel with kids everywhere. These fun and functional animal-inspired backpacks are perfect for your child's first schooling experience. Affenzahn animals are best friends who come from all over the world and have their own special abilities and talents. It is more than a bag – it is a traveling companion and a familiar face that is a comforting piece of home.

have a perfect command of all kinds of style, printings and colors of the children clothing. Happiness and freedom are the natures of children. Bright colors and interesting shapes are used by children's fashion to create an enjoyable sense of comfort and infectious lively sense. The bright colors of the Pop Art creates the atmosphere of freedom from care, which would make children relaxed and happy. Today, children are masters of their own little worlds. Children can get creative and create their own vogue. Designers add a few art, humor and magic elements in children's fashion. At the same time, the popularity of rock and roll makes children fashion break the convention.

Pop Art. Pop art is an art movement that emerged in the United Kingdom and the United States during the mid- to late-1950s. The movement presented a challenge to traditions of fine art by including imagery from popular and mass culture, such as advertising, comic books and mundane cultural objects. One of its aims is to use images of popular (as opposed to elitist) culture in art, emphasizing the banal or kitschy elements of any culture, most often through the use of irony. It is also associated with the artists' use of mechanical means of reproduction or rendering techniques. In pop art, material is sometimes visually removed from its known context, isolated, or combined with unrelated material. Due to its utilization of found objects and images, it is similar to Dada. Pop art and minimalism are considered to be art movements that precede postmodern art, or are some of the earliest examples of postmodern art themselves. Nowadays, due to the bright color conveys humor and happiness, the pop art displays a new round of fashion theme. Pop style is not a simple and consistent style, but a mixture of

Left:
Billieblush
childrenswear
Full/winter2016

Right above:
JumpFromPaper
Turquoise Spaceman
Backpack

JumpFromPaper is a brand of 2D Bags & Cartoon Bags from Taipei. The brand plays with graphics and illustrations to create real-world bags that literally look as if they 'jumped from paper'. The bold two-dimensional appearance of each bag is guaranteed to turn heads and serves to bring joy and fun to the mundane.

Right below:
Efvva
Children shopping bag
Spring/summer2019



various styles. It pursues the popular interest and opposes the pure and lofty in the modernism. It emphasizes novelty and uniqueness and boldly adopts gaudy colors in design. Now the children's pop style, which began in the 1960s, is making a comeback. The pop style in children's backpacks mainly appears as the pattern splicing, cartoon splicing, contrast color and wave point. Handsome design, dot, heart, chromatic fruit drop stripe make children vogue more rich and colorful. Gorgeous colors also make vogue and motion become optimal combination. Inspired by a variety of racing outfits, such as cycling, surfing, skiing, children's sports brands often opt for more vibrant colors. In order to highlight the comfortable technical details, special clothing style, fluorescent shoelaces, reflective bag belt, zigzag stitching and other elements are used to emphasize the contrast colors. This dazzling color makes children's fashion full of vitality.

Dadalism and Surrealism. Dadalism and Surrealism are art movements that began in the early 20th century in French. Surrealism is the result of Dadaism. The art of Dadalism spanned visual, literary, and sound media, including collage, sound poetry, cut-up writing, and sculpture. Dadaist artists expressed their discontent with violence, war, and nationalism, and maintained political affinities with the radical left. Dada was born out of negative reaction to the horrors of the First World War. This international movement was begun by a group of artists and poets associated with the Cabaret Voltaire in Zürich. Dada rejected reason and logic, prizing nonsense, irrationality and intuition. The origin of the name Dada is unclear; some believe that it is a nonsensical word. Others maintain that it originates from the Romanian artists Tristan Tzara's and Marcel Janco's frequent use of the words "da, da,"

Eugenia Loll's surreal worlds

Eugenia Loli is an illustrator and collage artist. Her work, that has been published in numerous magazines since 2013, are these modern vintage collages of an incredibly colorful world. She uses scanned photographs of vintage magazines and scientific journals, to create mysterious visual narratives.



meaning "yes, yes" in the Romanian language. Another theory says that the name "Dada" came during a meeting of the group when a paper knife stuck into a French–German dictionary happened to point to 'dada', a French word for 'hobbyhorse'. Surrealism is best known for its visual artworks and writings. Artists painted unnerving, illogical scenes with photographic precision, created strange creatures from everyday objects, and developed painting techniques that allowed the unconscious to express itself. Its aim was to "resolve the previously contradictory conditions of dream and reality into an absolute reality, a super-reality". The group aimed to revolutionize human experience, in its personal, cultural, social, and political aspects. They wanted to free people from false rationality, and restrictive customs and structures. Works of surrealism feature the element of surprise, unexpected juxtapositions and non sequitur; however, many surrealist artists and writers regard their work as an expression of the philosophical movement first and foremost, with the works being an artifact. Leader André Breton was explicit in his assertion that Surrealism was, above all, a revolutionary movement. They do not describe the present world, while displays the subconscious, dreams, fantasy and other invisible elements. Although Dadaism and Surrealism belong to the category of literature and art, but in the world of fashion designers, it has been applied widely, which includes the application in the children's fashion. Designers add the children's bizarre magic vision in their design work spontaneously and begin to apply the elements of Dadaism and Surrealism. They are rich in association and game interest. Designers do not keep on the rails. They explore the new field with the methods of anatomy analysis and dislocation principle according to the instincts, dreams, subconscious and other

Right:
Efva
Wonderland collection
Full/winter2018-2019



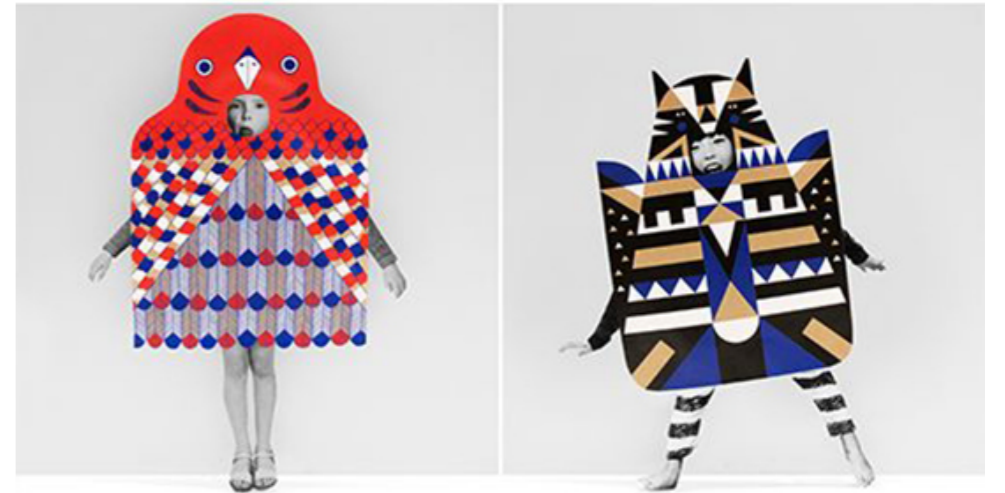


Left:
Quiet kid, Lucky boy
Sunday
Knitted children pillow

Burberry
children backpack
Full/winter2018-2019

Bangbang Copenhagen
Sweatshirt
Full/winter2015

Right:
Children's animal
costumes at Le Bestiaire
Vautrin Biennale



characteristics of children. Their design works have a unique beauty, which is full of freedom and humor with the features of strange, weird, humor, childlike innocence and exaggeration. For example, a cardigan with strange sleeves, a dress with an eye, Alice's scroll mirror, all these things are the improvements of the tedium in our daily life. Children's life is full of surrealism. Children is willing to break the rules of art and find new ways to look at the world. They create art without thinking, and they combine the past and future, reality and illusion, seriousness and funny together, which is odd but funny.

Rock and roll style. Music has always played an important role in fashion. In the 1950s a new kind of music jolted the American mainstream: rock 'n' roll, a loud, fast, liberating sound that primarily appealed to teenagers. The song titles and lyrics of early rock 'n' roll hits, most of which were written specifically for teenage audiences, expressed the feelings of the era's young people. Teens who embraced rock 'n' roll began looking and dressing in ways that veered from the accepted norm. Teenage boys wore tight-fitting blue jeans and white T-shirts: an outfit that represented the essence of rock 'n' roll rebellion. Or they adapted the "greaser" look favoring tight T-shirts and dungarees, a type of jean, along with black leather jackets. This style is easy to be distinguish with other styles and has its own unique personality, which is just like the uninhibited youth time when the natural flavor and modern urban civilization merge in the collision. The essences of rock and roll style are skinny jeans, T-shirt, a skinny blazer, a mini jacket, and the rivet bag. Matching with black, the fluorescence color make the rock and roll style more eye-catching. Teddy Boys and Rockability, popular in the 20th century, were revived in the children's world. It has

**Diesel
Children collection
Full/winter2018**

The Fall/Winter 2018 collection is all about a cool rock attitude, which is deeply rooted in Diesel' DNA and developed across three main stories: Occasion to Rock is one of the strongest themes of the collection. The looks are represented by the signature touch of denim enriched by details.





Diesel
Children collection
Spring/summer 2019

a deep impact on today's children even early from the kindergarten. Cowboys are playing a very important role in children's rock and roll style. More and more brands of children bags have also started to involve rock and roll styles, encouraging children to show their difference. The cowboy became the ornament that cannot be ignored in the rock and roll style with the image of elegant, street and naughty. Diesel is the epitome of rock chic for children. Diesel Kid was originally created in 1984 under the name Dieselito. It was inspired by Diesel founder Renzo Rosso's own kids, designed to meet high standards right from the very beginning. In 1999, reflecting the growing importance of the global kids-wear market, it became Diesel Kid, an independent company based in Marostica (Vicenza) in Northern Italy, not far from the Diesel head office.

3D digital. Children growing up in the digital age are more receptive to new things. They like to play with high-tech touch-screen tablets that look like the magic chalkboards, and they like to watch 3D movies. These digital kids are fond of the work of painter David Hockney that is finished on iPhone and iPad. They are immersed in the colors and shadows of artist James Turrell. Dreamy and futuristic stories, visual patterns, shadow games or magic lights can quickly catch the attention of children. Visual patterns, shadow games or magic lights are easy to capture. Many designers of children bags also follow the trend and apply these elements of digital fantasy in the design of children backpacks. The world is dynamic and children backpack should be no different. New technologies such as 3D printing and the application of the new materials have made more futuristic children backpacks. Fashion designers have already unveiled bags, shoes and clothing made via 3D



printing, in which plastic material is deposited layer upon layer to create a three-dimensional structure. 3D-printing is an all-but-inevitable part of the ongoing digital revolution. Now it may be poised to upend the fashion industry. The jewelry and accessory industries continue to be revolutionized by 3D printing. The technology has been utilized in the production of various items, from bags and watches to rings. If convenience and customization are potential advantages of 3D-printed fashion, so is recyclability. Conventional accessory can be broken down and turned into new fibers, but only about 0.1 percent of the textiles collected by charities and take-back programs actually gets recycled. In contrast, 3D-printing can simply turn the plastics into powder that can then be used to print out something new. And since 3D printing easily allows for custom sizing, the process is inherently frugal with materials. MadPax are 3D inspired backpacks and power packcessories that are the perfect fusion of fashion. The MadPax backpack includes the adult lines and children lines. The brand has designed a variety of magical and interesting backpack shapes through 3D printing technology.

1.3 The trend analysis of children's innovative bag and future vision

In the future competition of children bags industry, with the maturity of mass consumption concept, consumers' sensitivity to bag performances will gradually improve while their sensitivity to price will decline. With the gradual maturity of children's market, the focus of the competition will transform from price and marketing to multi-dimensional aspects such as technology research and development, innovative design and brand service, which

Left above:
MadPax
BUBBLE backpack

Left below:
MadPax
BLOK backpack

Right:
MadPax
FULL SCALE backpack



is also the inevitable trend of the future development of children bag industry. As a combination of children's fashion, products, accessories and even household, the children bag plays a very extensive and important role in children's life. In recent years, people's consumption level and quality of life have gradually improved, which leads that people's lifestyle has gradually changed. The design of children bag should also improve with the trend, and the application of new technology, new fabrics, invested the children backpack with all possibilities. The adult world is changing, and so is the world of children. People are no longer satisfied with the monotony and uniformity of bags. Innovative bag is more and more popular among people, which lead that the children bag industry will also enter a new era. According to the analysis of consumer's demand, children backpack market and children's fashion trend, it can be concluded that the design of children bag mainly develops in the following directions: practical, intelligent, interesting, healthy, environmental protection and customization.

Practical

The professional function division of children bag is more perfect and more humanized. It is necessary to meet children's physiological and psychological needs, including that of cognitive behavior, physical behavior, social behavior and so on, and pay attention to the interaction between the internal environment and the external environment in the growth process of children. The main living places of children are schools and families, and they are mainly affected by their interpersonal relationships and hobbies. The design of bag should try to meet the versatility of different occasions, and the designers should understand

Front:
Trend of children
innovation bag

Behind:
J.Crew
Kids collection

the children's daily life and the places they often go to, transforming the emotional thinking into the design thinking. The practicality of bags is mainly reflected in the quality, functionality and other aspects of bags. Practical bag should be of good quality since children are lively and active. The design of children bag should pay attention to the characteristics of children, such as the application of new lightweight, waterproof and wear-resistant high-tech fabrics, so as to extend the service life of the backpack and improve the usage experience of the consumer. In terms of the functionality, full consideration should be given to children's learning and lifestyle that are various. The problems encountered in children's life should be solved by different backpack design. For example, the design of the zipper position and opening mode of the bag, the distribution and quantity of the bag layer, the material and structure of the strap, the application of the tie rod, the structure of the load reduction system and so on. The perfection of these problems will greatly improve the practicability of the bag. The perfection of these problems will greatly improve the practicability of the bag.

Intelligence

Enhance the intelligent design of the bag and incorporate the mobile terminals and electronic devices into the design. The development of cloud computing, big data and the Internet of things is pushing the continuous evolution of intelligent terminals. The combination of terminals and the Internet of things and other new technologies is profoundly changing the form and functions of terminals. Smart wearable devices are increasingly required by people, including children's wearable devices. The rapid development of science and

POMO WAFFLE Children smart watch

POMO WAFFLE is a GPS smartwatch that helps kids to understand responsibility and express creativity to develop a healthy level of independence. Consistently available for entertainment, helping the child grow and keeping them safe.



technology drives consumers to have higher demands for children's products, and intellectualization has become an inevitable trend of children's development. High-tech intelligent products not only satisfy the curiosity of consumer groups (including children and adults), but also optimize the interactive experience between consumers and products. The wearable devices appear as portable accessories of all kinds of terminal, which has the calculation function and can connect with mobile phones. The mainstream products include watches and bracelets that are worn on the wrist; shoes, socks, or other leg wear products that are worn on the feet; glasses, helmet, headband that are worn on the head and other kinds of non-mainstream products such as smart clothing, bag, crutch, accessories. At present, the main functions of children's wearable devices on the market mainly focus on two aspects: health monitoring and positioning navigation. GPS positioning technology is a positioning method which mainly displays the final position information. It is widely used in children's smart backpack. Although the current function is relatively simple, which is nothing more than the function of positioning, calling, recording, taking photos and some accompanying functions. These functions can be achieved by any mobile phone, but children are obviously not the right users in the mobile phone market. Children's intelligent products can directly provide safe and practical functions, and eliminate the function of the terminal that is not suitable for children to use, which is undoubtedly the rigid needs of parents. It is also the inevitable choice under the specific times. It is an important direction of its development to increase the functionality and practicability of children's intelligent products. For example, integrate some functions such as companionship, social contact and questions and answers, and find out how to combine

Kids smart walking suitcase

The children use the simple 2.4G remote control to tell suitcase to move forward, reverse, turn left, turn right, or set to storage mode. Reduce the cranky whining of little travelers with this great carry-on that rolls along with them. Keep child occupied in an airport, train station, or just for fun.





Gululu The Interactive Smart Water Bottle & Health Tracker For Kids

Gululu is the interactive water bottle that helps keep child hydrated, enhancing mood, sleep, cognition, and concentration. The virtual Tamagotchi-like pet lives in a Gululu World on Planet Ima, that regularly updates with new characters, skills, tricks and continuous education and exploration. Let children choose their favorite whimsical pet to embark on a journey of health, play, rewards and a connected app for parents. The system auto-updates with educational game content to build healthy habits that will last a lifetime.

Leka Robot

Leka Robot is a smart toy that is set on "changing the way children with developmental disorders learn, play and progress." The autonomous features, achieved with Leka's new fully integrated sensors, demonstrate how children can engage with the robotic toy independently, making it more humanlike and interactive in nature. The robot's responsiveness aims to help children better understand social cues and improve their interpersonal skills. Leka will also unveil its updated iOS mobile app with Bluetooth connectivity, and four educational applications. The applications can be used as multiplayer activities, with parents, therapists, and siblings, to motivate social interaction, or as autonomous activities, to help a child play on his or her own, fostering confidence and independence.



these functions with children's study and life. Otherwise, the current children's wearable devices are at the initial stage of development and not mature enough, there are still many problems to be considered and improved. For example, problems in positioning accuracy and battery life are still existed in children's wearable devices. At present, the positioning function of children's wearable devices is not accurate enough with errors ranging from tens to hundreds of meters. There is a great improvement for a product that needs to locate individuals. Second, the invasion of children's privacy. As the child getting older and wiser, they will realize that he is always under the supervision of parents, which will not only cause the shadow in growth, but also affect the parent-child relationship. These are the problems that designers of children's intelligent products need to consider, which is also a direction of the development of children's intelligent products.

Interesting

Novel and interesting products can always attract people's attention. Children are no exception. Everything in the world is fancy to children who are more curious than adults and want to understand, dig and feel the outside world. However, due to their age, they are characterized by poor psychological stability, hyperactivity and lack of self-control. Therefore, backpack design should be based on children's thinking characteristics to meet children's concerns. On the basis of the functionality of children's bag, the feelings and connotation should be endowed on the design, which will makes products resonate with children's psychology and promote them to release their real nature and develop their imagination. Therefore, the innovative children bag should meet the following requirements:

Superhero computer coding game

The computer coding game is a really fun way to introduce the basic concept of computer coding to young kids. Even better if you make it a superhero computer coding game. Plus kids don't actually have to have a computer, so it's a cool tech-free idea. This homemade coding game was pretty easy to set up and can be played with over and over again with any type of pieces. Use superheroes,LEGO, My Little Ponies, Star Wars, or whatever kids have to learn a little about programming.



- Promote the development of children’s thinking
- Experience the process of growing up while playing
- Make friends with the products through the process of playing
- Learn in the lively activities and games.

In the process of children bag designing, designers are often influenced by their own factors and design children’s products from the perspective of pleasing adults. Such design makes children’s products gradually lose the childlike innocence. In the future design, more children’s interesting elements will be added to emphasize the childlike innocence. Interesting design will also become the future trend of children bags.

Healthy

Children’s health is the most important concern of parents. In the future development of the children backpack industry, parents will pay more attention to the material safety of children backpack in purchasing. Beautiful and lovely child bag may become the “killer” for children health and safety if the quality is unqualified. Greenpeace conducted a sampling inspection for 12 internationally renowned fashion brands and more than 80 items of children’s clothing and accessories. All the items have been detected dangerous chemicals. These dangerous chemicals include softeners and nonylphenol polyoxyethylene ether (NPE) and fluorine-containing chemical PFC. Experts from Greenpeace say these substances can have hormone-like effects on the human body, and some of them may even cause cancer. At present, the safety and health risks of children backpacks can be mainly divided

Logos of Safety fabric certification



into two categories: the first risk is the physical injury. Once the small ornaments, buttons and other small parts on children backpacks fall off and are swallowed, it will make children choke or suffocate. Children may also be cut by burrs, sharp touchable edges, sharp touchable tips, and other defects in zippers or accessories. The second risk of the chemical injury, for example, high levels of formaldehyde will damage the respiratory system and cause all sorts of inflammation, wearing the clothes that make from the aromatic amine (azo) dyestuff a long time will lead to headache, disgusting, tired, insomnia, vomiting, cough and other bad symptoms and even cancer. In addition, the backpack fabric with poor dyeing fastness is prone to fade when it reacts with water and sweat stains. The dye molecules and heavy metal ions in the pigment may be absorbed by the skin, endangering children's health. The infant product should pay more attention to this problem, because infants often bite objects in the mouth and the residue will do harm to the health of the infant. Therefore, the safety and health of children's products are highly valued. Governments in any countries stipulate that zippers on the children products should be free from burr and sharp edge, sharp tip and other defects, and the zipper puller should avoid the deformation, discoloration and rust after washing and ironing. Greenpeace has asked international fashion houses to keep their promise to give up the use of dangerous chemicals by 2020. In addition to the safety and health of materials, lifestyle changes are shaping new trends in children's product design. More and more urban people who pay more attention to healthy lifestyle are showing in the life scenes related to sports, such as running, fitness and cycling. Children backpack design should also follow this trend and pass on a healthy lifestyle to children.

**Healthy lifestyle
Family bike rides**



Eco-friendly

We should not pursue fashion at the expense of the environment and should not pursue the beauty at the expense of the health of earth. Environmental problems caused by the Fashion industry are increasingly significant, and the green trend and moral consciousness are also rising day by day. From Ethical Fashion, Eco Friendly to Sustainable Fashion, various popular words and new concepts are appealing that fashion and environmental protection can also be balanced through the joint efforts of people. Sustainable fashion, also called eco fashion, is a part of the growing design philosophy and trend of sustainability, the goal of which is to create a system which can be supported indefinitely in terms of human impact on the environment and social responsibility. It can be seen as an alternative trend against fast fashion. Characteristics of sustainable fashion match the philosophies of "slow fashion": buying vintage clothes, redesigning old clothes, shopping from smaller producers, making clothes and accessories at home and buying garments that last longer. New ideas and product innovations are constantly redefining slow fashion, so using a static, single definition would ignore the evolving nature of the concept. Nowadays, designers advocate eco fashion, and children's fashion designers are no exception. They use environmentally-friendly materials instead of animal leather, or advocate the environmental protection in fashion shows. Many brands continue the development and application of environmental protection materials, and with the help of sustainable production mode, promoting the development of environmental protection fashion and improving the feasibility of sustainable fashion. The environmental protection fabrics that we advocate refers to three professional knowledges:

Bobo Choses To Make a Garden Spring/summer 2019

What would we do if bees were to disappear? These little insects provide the food we all eat one way or another. But honey bees are disappearing globally at an alarming rate. Looking after the bees means looking after ourselves. And the best way to do it is by planting a garden. It doesn't matter how small it is. Bees will make sure it grows. Bobo Choses' New Spring Summer 2019 collection To Make a Garden is a global call for saving the bees by planting gardens everywhere, everytime. Make the bees happy. Never stop planting.





Left:
Bobo Choses
Dear World collection
Full/winter2017

They will be making a cool statement about our environment with this Plastic is Over? slogan sweater. This jumper was produced to raise awareness about the effects plastic is having on our oceans.

Right:
An artwork made of plastic caps comes from the visual art and recycling website "clip it"



production ecology, namely the environmental protection of production; user ecology, namely the environmental protection of user, which requires no toxic effects on users; processing ecology refers to the environmental protection processing after the fabrics being used. Most traditional fabrics are made of chemical synthetic fiber while the environmental protection material is much better than it, which is made of the natural fabrics such as cotton, linen, wool, silk. It slams the door in more than 130 harmful chemical material such as formaldehyde resin additives, and instead, the natural materials, such as natural pigment is applied that can be degraded in the natural conditions within two years. In addition, the improved polyester fabric has the characteristics of light and biological double degradation, which has a faster degradation rate than that of pure cotton fabric. In natural environment conditions, it can be decomposed into carbon dioxide and water in a year or so. Besides fabrics, a lot of brands show the environmental protection consciousness from the design and color. The attachment such as button and zipper is also showing the concept of environmental protection, which is made of the pollution free green raw material. Environmental protection is combined with the inner needs of modern people. The green fashion has become development trend in the field of fashion, including children's fashion.

Customization

Individualization products and distinctive products are always attracting people's attention. Thanks to factors like more efficient manufacturing, 3-D printing and ecommerce platforms, mass customization—the production of products that meet individual tastes—has become more mainstream. From running sneakers to high fashion hand

bags, today's marketing is stamping our names on the things we buy, setting us out as unique individuals - and banking on it. To get to this point, marketing has moved from a focus on the product itself to consumers, who they are, and how they think. The customized service is a targeted service. The users are classified and they can take part in the design process. More people began to pursue upgraded services in terms of the articles for daily use. Fashion brands – like Gucci, Burberry, Rag & Bone, and Jimmy Choo – have joined the likes to Louis Vuitton and Goyard in enabling consumers to personalize their products, while others more mainstream brands, such as Cuyana, Vans, and Madewell, have begun banking on the power of customization. Emerging today is a move away from market segments with many consumers to markets of one. In other words, moving away from understanding the needs of a group of consumers (and creating standardized value) to creating unique value propositions for one customer through customization and personalization. Children's product plays an important role in the consumer market. With the of the development of children's products market, many industries have launched the customized services. Children's products with customized labels are gradually gaining popularity. In the new era, customized services for children's products have obvious advantages and broad market prospects. The customized services strengthen the functionality of products. The keypoint of the customized service is the innovative design for children. The focus of children's products is not only the nature of the products, but also the creative function of the products. For example, in the functional design of children bag, the articles should not only meet the requirements of children's psychology, but also be designed according to the



life needs of children. The design of children bag should reflect its application, aesthetics, but also to show the children's individuality. The integration of children's products with the individualized elements is the most important concept of the customized service in the development of children's products. The child likes the publicizing individuality and they like that their picture is displayed on the articles. Then in the process of functional design, it is necessary to label children's products according to their own needs. For example, the children's favorite cartoon pattern can be printed on the backpack. The design of individuation element can make children things more distinctive.

In the further customized services, children can make products according to their own needs. DIY personalized customization can not only allow the children to make the unique products but also improve their intelligence development. For children, design and production is a process of entertainment and intellectual development, allowing children to put what they think into practice. It is a good opportunity for children to improve their abilities in an enjoyable atmosphere. There are some of the benefits of DIY for Kids:

-Boost Self Esteem: DIY activities create a sense of achievement inside kids and give a boost to their self-esteem. Teaching a kid to create something tells them that they are in control. This will build immense confidence in them.

-Encourages Self Expression: DIY is a great way to allow children to express themselves. It can bring out the hidden feelings and emotions in introverted children.

LITTLE MASHERS

Children's Diy Stamp T
Shirt

-Promotes innovation and creativity: DIY provide a platform for the kids to create new things. It makes them think differently and to innovate. The ability to solve problems the kid encounters while taking up a project work promotes creativity. In short arts and crafts will make kids more resourceful and versatile.

-Enhances decision-making skills: Solving artistic challenges will help a kid in making correct and effective decisions. The decision-making ability will improve the kid's ability to face other problems and take quick decisions.

-Improves Memory: Apart from learning new shapes and colors, kids also learn about different patterns and figures. Some DIY activities require visualizing complex designs and the habit of visualizing and remembering complex designs will help the kid in improving his memory.

In the future, children's customized services will be integrating with the concept of "Internet +" and private customization. The design of children's products needs to incorporate more new factors in order to gain the market share. The application of customized service in children's products is to connect children's products with the era development. The integration of "Internet +" and the concept of private customization reflects the progress of concept and actual execution in the children's customization industry, which is a major trend of children's customization industry in the future.

KIDS' NIKE BY YOU

Nike By You for kids lets boys and girls express their style with made-to-order shoes. Kids can customise shoes from a range of colours, materials and performance options for a look and feel all their own. Use the Nike By You builder online to create custom shoes for kids from infant to grade school.



Black



White



Turbo Green



DONE

The Application of Ergonomics in Children's Bag Design

CHAPTER

2



2.1 Children's ergonomics analysis

Ergonomics is the process of designing or arranging workplaces, products and systems so that they fit the people who use them. Ergonomics applies to the design of anything that involves people workspaces, sports and leisure, health and safety. Ergonomics (or 'human factors' as it is referred to in North America) is a branch of science that aims to learn about human abilities and limitations, and then apply this learning to improve people's interaction with products, systems and environments. To achieve best practice design, Ergonomists use the data and techniques of several disciplines:

Anthropometry: body sizes, shapes; populations and variations

Biomechanics: muscles, levers, forces, strength

Environmental physics: noise, light, heat, cold, radiation, vibration body

Systems: hearing, vision, sensations

Applied psychology: skill, learning, errors, differences

Social psychology: groups, communication, learning, behaviours

The difference between children's backpack and other products is that it is used frequently and possesses special functions. From the perspective of children's health, the design of children backpack needs to follow the ergonomic data. Carrying a backpack with unreasonable design for a long term will damage children's health. Accurating size of children backpacks can ensure the rationality and comfort of children schoolbags. The physical growth and development of children is complex, and the body size varies greatly among different ages. Therefore, it is necessary to analyze and summarize the ergonomic

**Child back
measurement**



data of children.

2.1.1 Characteristics of children physical growth (Take school-age children for example)

There are two peaks of children growth , the first is the period of infant, and the second is the period of adolescent. School-age children aged 6-12 years old are in the period between the two growth peaks, and they are in a stable growth period in physical development. Therefore, a stable and healthy growth environment is needed for them to ensure the normal development of children's bodies. Please refer to the chart on the right for the size of each part of children body aged 1-16.

The chart shows that the height change of school-age children who have entered the development stage is the most obvious growth item, with an average annual increase of 5-7.5cm and weight increase of 2kg, while the growth of other body girths is not obvious. The children aged 6-9 years have a high sitting position cervical vertebra point, waist height and the crotch length increase obviously with an average increase of 2-7cm, while the points of collar position, chest circumference, shoulder width and back length increased by 1-3cm. During the period of 10-12 years old, children's chest circumference, waist circumference and body weight changed greatly, which gradually approach to the indexes of each dimension of adults, while the sizes of other parts were still changing slowly.

Children's physiological development has many complex features. Children's height, weight and the circumference of the body vary in

Child Body Measurements and Size Chart

Month/ Years	New born	3M	6M	1Y	2Y	3Y	4-5Y	6-7Y	8-9Y	10-12Y	13-14Y	15-16Y
Height (CM)	52	59	66-73	85	90±5	100±5	110±5	120±5	130±5	140±5	150±5	160±5
Weight (KG)	4	6	8	10	12.5	15±2	18±2	23±3	28±3	38±3	48±5	56.6±5
Head circumference	46	47	47	48	50	51	53	54	55	56	57	58
Neck		25	26	27	28	28.5	29.5	31	32.5	34.5	36.5	38
Chest	40	44	45	52	56	56	56	60	64	68	72	80
Chest width		19	20.5	21.5	22.5	23.5	25	26.5	28	30	32.5	34.5
Shoulder width		19.5	21	22	23	24	25.5	27	28.5	31	33.5	35.5
Maximum shoulder width		20.5	22	23.5	24.5	26	28	30	31.5	36	38	40.5
Small shoulder width		6.3	6.8	7.4	7.8	8.1	8.9	9.5	10.2	11.1	12.2	13.1
Back length		18	19	21	23	24	26	27.5	30	33.5	36.5	38
Sitting cervical vertebrae height				30	34	38	44	46	50	52	56	59
Waist height				44	51	58	65	72	79	87	93	98

Data sources: Fang Xuebing, Research on the usability of visual information clarity of human-machine interface. Journal of Jiujiang University, 2011

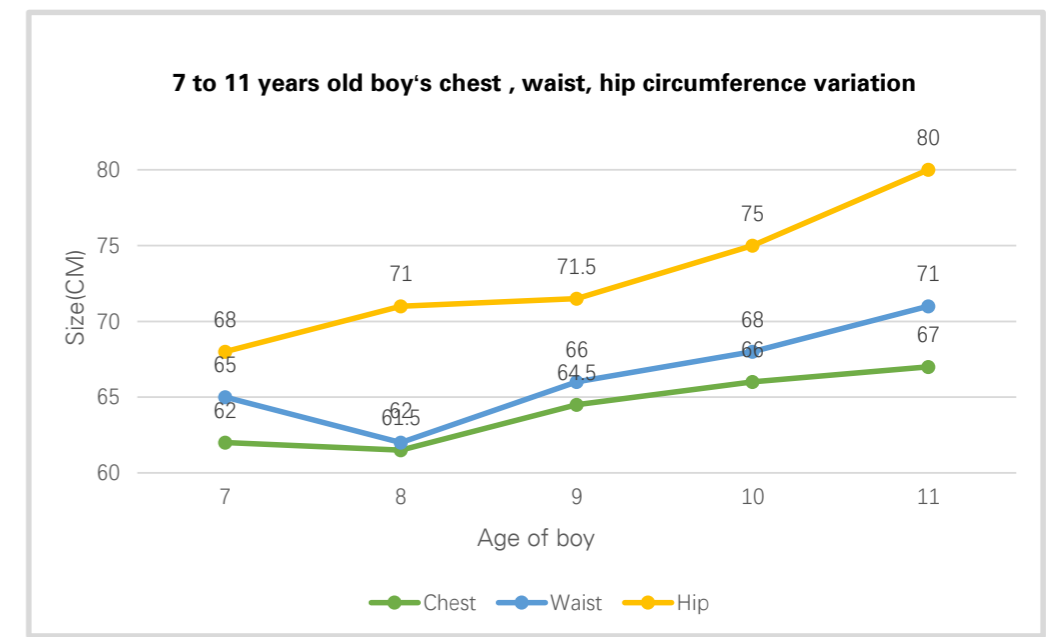
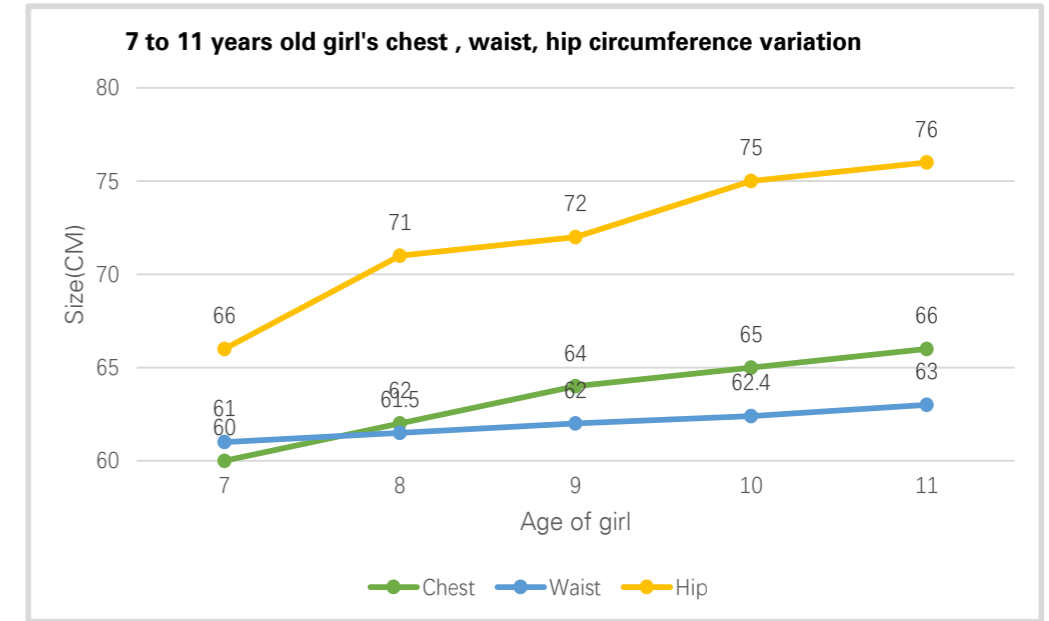
different age and gender. In addition, children's bone characteristics and muscle characteristics are also very different from adults. Therefore, the child's physical development characteristics should be fully considered when designing the child's backpack. The ergonomic backpacks design can greatly enhance the comfort of the backpack and ensure the healthy growth of children. According to the research, girls of school age developed faster than boys of school age as for the data of each body part. In terms of the physical characteristics, there was no significant difference between boys and girls, with similar upper body shape and no obvious waist line. The overall characteristics are summarized as follows:

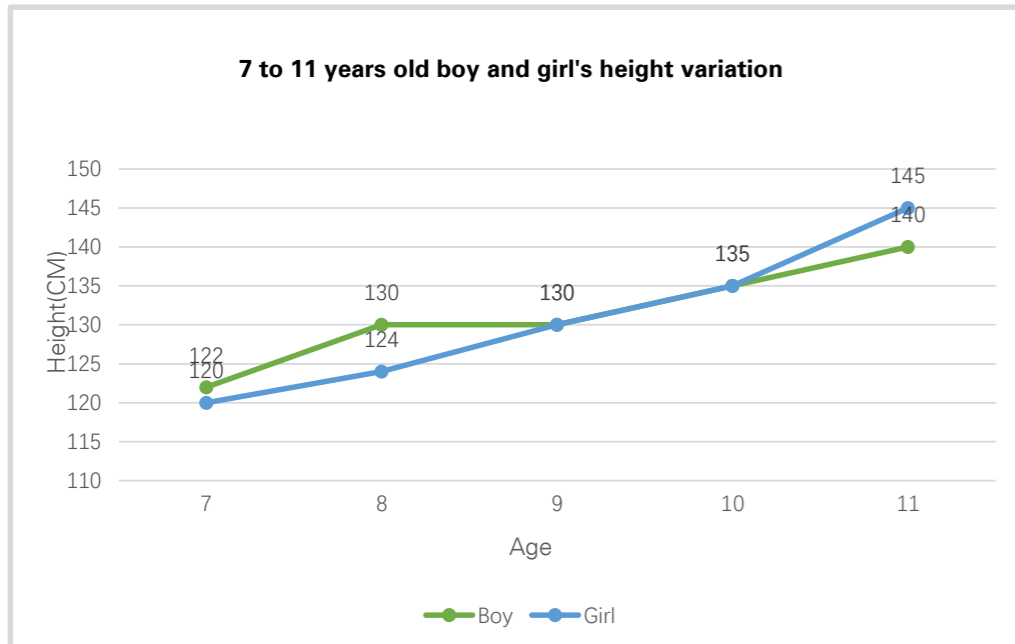
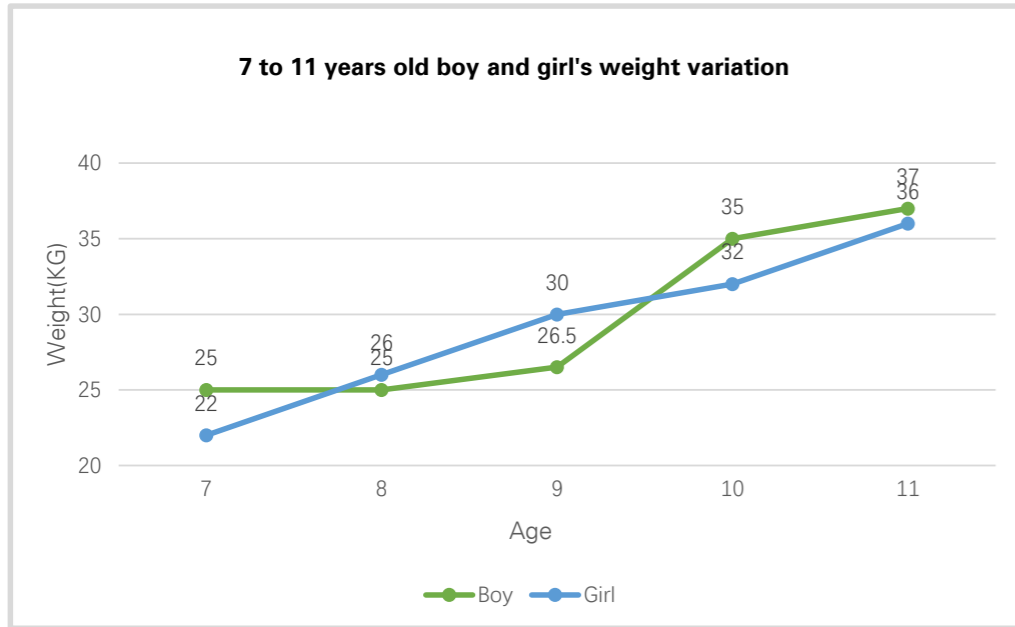
Changes of chest, waist, and hip circumference

It can be concluded from the statistics of chest, waist, and hip circumference of boys and girls aged 6-12 years that the circumference of chest fluctuates between 65-71cm and that of hip fluctuates between 68-80cm in school-age boys entering the development period. Compared with boys in the same period, the chest changes of girls are more obvious due to physiological differences, with the circumference fluctuating between 59-66cm, while the hip circumference varied between 64-78cm. 9 years old is the watershed of children's growth and development. After 9 years old, the change of children's chest, waist, and hip circumference is more obvious than that before 9 years old. Girls' buttocks develop fast between 9 and 10 years old, while during the period after 10 years, the breasts develop rapidly. The circumference of each body part of boys increases steadily after the age of 9.

Data sources: Wang Jinping, Study on skeletal development status of school-age children, China medicine and clinical, 2009
Wang Guixia, Statistical analysis of children's physical development, 1997

The changes in the chest of school-age girls who have just entered the developmental period are more pronounced than in boys. After 9 years old, the change of children's chest, waist, and hip circumference is more obvious than that before 9 years old. The circumference of each body part of boys increases steadily after the age of 9.





Data sources: Wang Jinping, Study on skeletal development status of school-age children, China medicine and clinical, 2009
Wang Guixia, Statistical analysis of children's physical development, 1997

The body weight and height of school-age children increased significantly. The average height and weight of boys were significantly higher than those of girls, especially the kids between 9 and 10 years old.

Changes of height and weight

The weight can reflect the weight of bone, muscle, subcutaneous fat and back organ weight and the comprehensive situation of the growth. The body weight and height of school-age children increased significantly. The average height and weight of boys were significantly higher than those of girls, especially the kids between 9 and 10 years old. The weight gain period of girls was mainly between 8 and 9 years old, and during this period, the change in height was not obvious compared with that of boys. The weight change of girls was significantly faster than that of boys between the ages of 9 and 10, but their average height was lower than that of boys.

The characteristics of bone development

The bones of school-age children develop rapidly, and there are many cartilages in the bones, among which the content of water and bone collagen is high, while the content of inorganic salt is low. Bone density is poor. In this case, bones are elastic but not strong. Bones with density and great toughness are not easy to be completely fractured when they fall down, but they are prone to bending and deformation. Maintaining the poor posture for a long time will bring adverse effects on the growth and development of children's bones.

The characteristics of muscle development

Comparing with the skeleton, the development of muscle is relatively slow. Since the moisture in muscle is much while the protein, adipose, inorganic salt are little, muscle is delicate and its contractive function is weaker. After 8 to 9 years of age, the development rate of muscle of children begin to accelerate, so the strength gradually increased. The

law of muscle development is that during the phase of accelerated growth when growth of height is accelerated, the muscle mainly develops longitudinally. The length of the muscle increases rapidly, but the rate still lags behind the growth of bone. Therefore, the contraction power and endurance of the muscle are poor, which leads that children are easy to produce a sense of fatigue. Besides, the contraction ability of children's muscle tissue is poor. Maintaining a position for a long time and by a certain degree of pressure will bring a burden on the muscle growth. On the other hand, however, the recovery capability of children muscles is strong and the muscle can be rejuvenated quickly after proper rest.

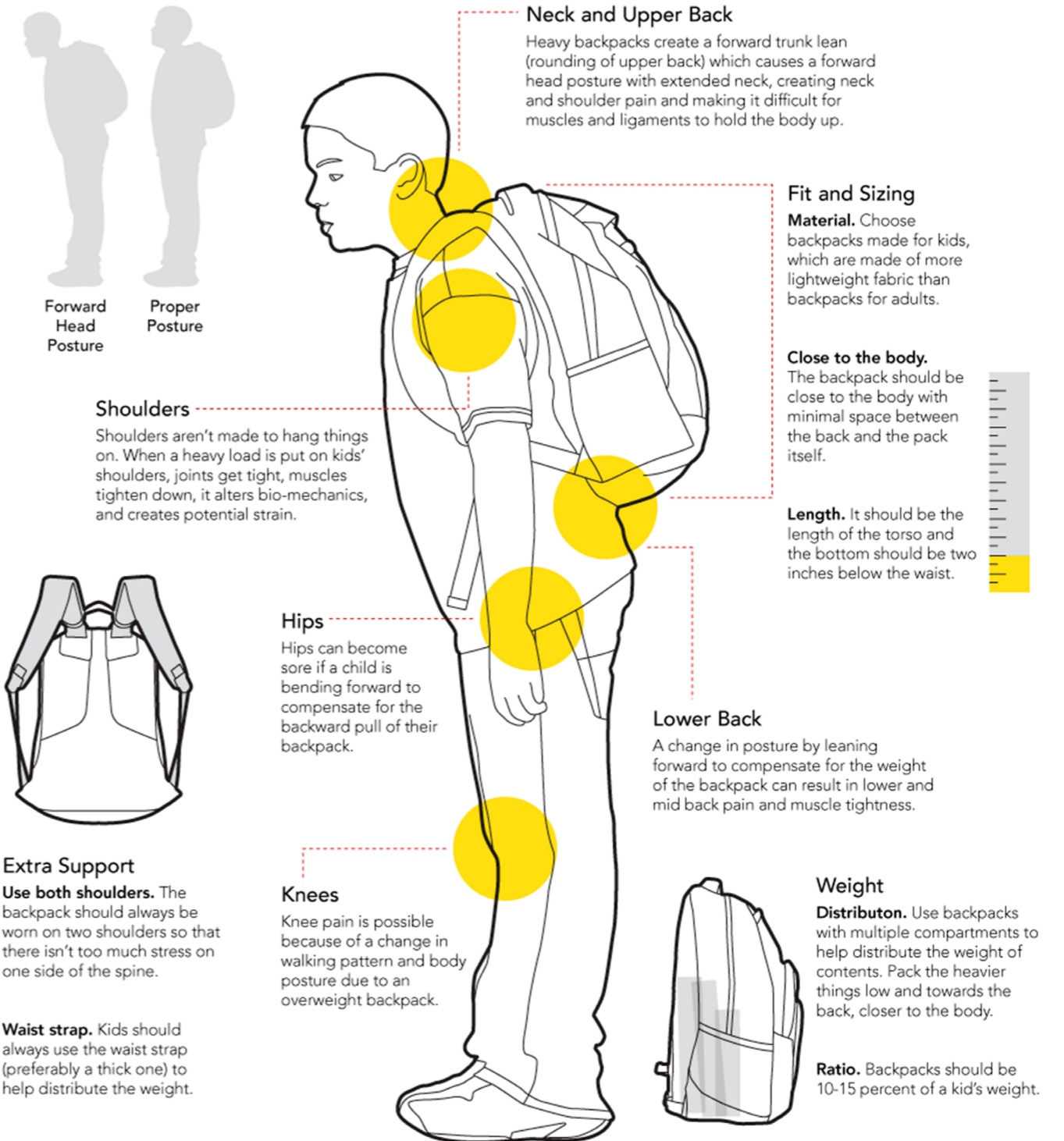
2.1.2 The effects of backpacks on children's bodies

According to the U.S. Consumer Product Safety Commission, about 5000 children visit emergency rooms each year because of backpack-related injuries, and at least 14,000 children are treated for them every year. Overweight loads, wrong carrying way and unreasonable design of the backpack can cause neck, back and shoulder pain and more. The weight of a backpack should be less than 10-15 percent of a child's body weight, but that isn't always the case. Too often, children don't wear their packs correctly, increasing risk of injury. "Improperly used backpacks may injure muscles and joints and can lead to severe back, neck, and shoulder pain, as well as posture problems.

Muscle strength is the result of muscle contraction, the size of which depends on the number of muscle fibers, volume, nature, length before contraction and the excited state of the central nervous. When school-age children carry the schoolbag, the weight of the schoolbag is first

The Backpack Safety Tips Infographic from the Huffington Post

It explains exactly what can happen to kid's body from traveling with all of that extra weight on their backs — and what you can do about it.





Unreasonable backpack design and wrong carrying posture can adversely affect children's body

compressed on the shoulder through the shoulder strap, which causes the compression on the muscoli levator scapulae and two muscles of the trapezius (as shown in the figure). In the process of walking, users of the bag need to lift the shoulder from time to time in order to prevent the slide of the shoulder belt. At this time, the trapezius and muscoli levator scapulae need to contract together to generate the muscle strength. However, as the shoulder muscle is compressed by gravity, the muscle strength required by muscle contraction is much greater than that required in the state of carrying nothing. Therefore, carrying the bag for a long time will increase the workload of shoulder muscles, which will lead to the shoulder muscle strain, ischemia and pain. By the means of the field investigation and research of a primary school pupil's schoolbag weighing and items in bag checking, it is found that, for most students, books inside the backpack lie scattered, which causes the uneven schoolbag weight distribution.

In the process of walking, books will produce the backward component force that would drag the backpack straps, which would press the clavicle of children. Besides, in the process of running, items in the bag may swing back and forth and slap the children on the back, which will damage the normal development of bones and muscles in the back. Also, backpacks with tight, narrow straps that dig into the shoulders can interfere with circulation and nerves. These types of straps can lead to tingling, numbness, and weakness in the arms and hands.

According to the on-site inspection, the left and right shoulder straps of most children's schoolbags are in the different height, which is ignored by parents and children in daily life. Through the study, it is found that

different height of the two shoulder stripes will lead to different height of the left and right shoulder, which will cause the scoliosis in the long term. The long-term of the pressure on the children' shoulder and neck would make the children tend to lean backward. In order to reduce the compression of shoulder and neck and overcome the backward component force of the schoolbag to maintain the stability of gravity center, children would arch the back, which would lead to humpback in the long term.

Therefore, the design of children's backpacks is necessary to basic on the ergonomics, to solve the common problems and guide children to carry the backpack in a correct way, so as to reduce or avoid the impact of the backpack on children.

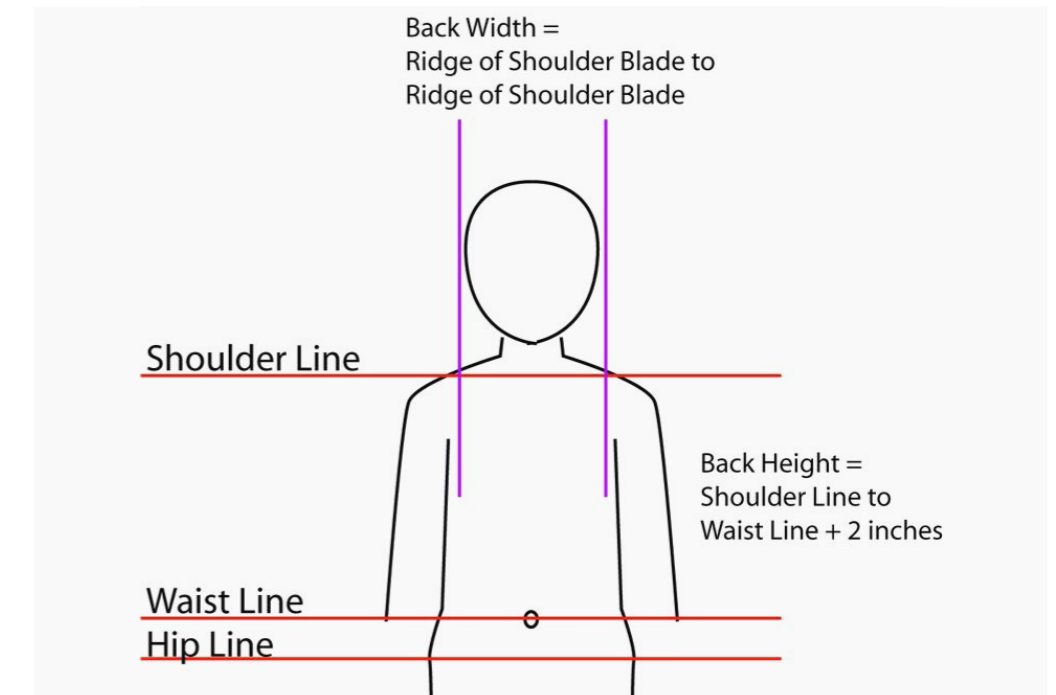
2.2 The comfortability of children's bag and brand analysis

The comfort of backpacks plays an important role in the healthy development of children and is an important factor needed to be focused in the children backpacks designing. The main factors affecting the comfort of backpacks are the size, weight, material and the design of the carrying system. As the important parts of the carrying system, the shoulder straps and backboard of backpacks play key roles in the comfort of backpacks. In addition, the internal structure of the backpack also affects the comfort of the backpack.

2.2.1 Analysis of the children backpack size

A good ergonomic backpack should be no larger than a child's back. Take two measurements of child's back and use them for the maximum height and width of the backpack. This will ensure that the backpack is the proper size for the child's body.

Children backpack size measurement method



Find the maximum height by measuring the distance from the shoulder line to the waistline and adding two inches. The shoulder line is where the backpack straps will actually rest on the body. This is located about halfway between the neck and the shoulder joint. The waistline

is at the belly button. The backpack should fit two inches below the shoulders and up to four inches below the waist, so adding two inches to the measurement will produce the right number.

The width of the back can be measured at a number of locations, each with different results. For a backpack, the core and hip muscles usually carry the most weight. This is why the backpack should be kept centered between the shoulder blades. To find the proper width for a backpack, measure between the ridges of child's shoulder blades. Adding an extra inch or two here is acceptable.

By analyzing the ergonomic data of children, sizes of children backpacks in the market and the actual measurement results, it is found that the size of backpacks suitable for school children aged 6-12 years is (the average value):

Children Backpack Size Chart

Size(CM)	Backpack	
	6-9 years old	9-12 years old
Height	33-42	40-47
Width	27-30	29-32
Thickness	13-17	15-20
Width of strap	5-8	6-9

2.2.2 Analysis of the carrying system design

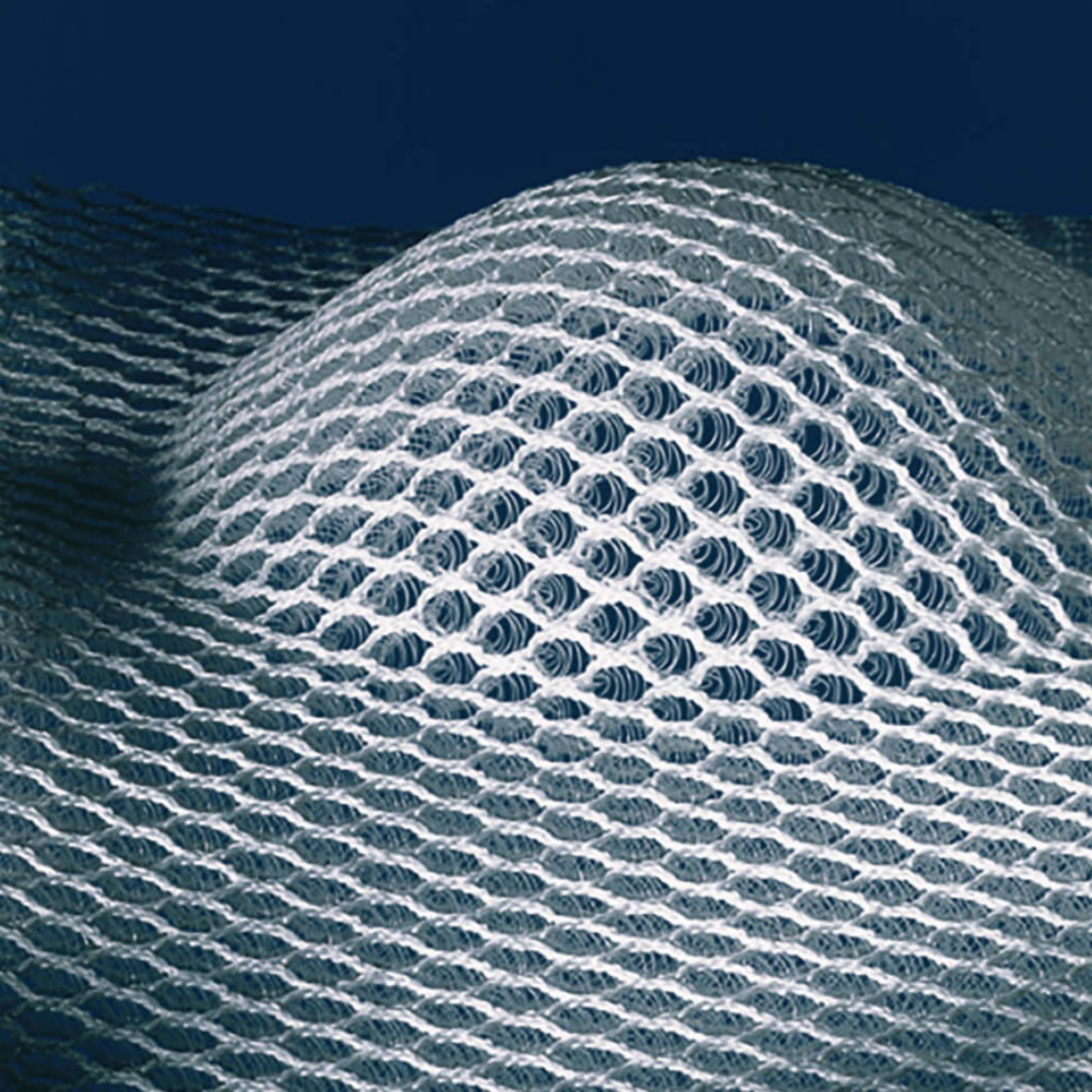
Good carrying system design can greatly improve the comfort of backpack and reduce the pressure on children's body, which is conducive to children's development and health. Straps, backboards and internal partitions of the children backpacks are important factors affecting the performance of the carrying system. In the current market, there are many different designs that try to optimize the carrying system. The content below is the investigation and summary of some specific cases.

Design elements of the backpack straps

The fatigue of shoulder muscles in the process of carrying result from the compression of backpack straps. According to the investigation and study, more than 60% of school-age children's backpack weight has exceeded the reasonable range the body could bear. Therefore, the backpack straps should be optimized. Compared with backpacks for school-age children, professional outdoor bags have more professional carrying system design due to its special use. The following analysis is about different types of outdoor backpack straps in terms of materials, structures and shapes.

Material

The strap is usually made of elastic hollow material. With the feature of air permeability, the wet and hot air can be discharged quickly. In the process of carrying, this strap can make up for deficiencies of different height of the two straps by the function of expanding and contracting. The elastic fabric can disperse the pressure on the shoulder in the



Air mesh fabric

stretching process. Air Mesh and off-loading foam as elastic hollow materials are widely used in backpack straps. Fabric. Air mesh fabric is a kind of fabric made of knitted machine. It is made of three parts. It is like sandwich, so air mesh fabric is also called sandwich fabric. With the shape of net, air mesh fabric looks fashion and sport. It uses polymers synthetic fibres by the one-time precision machine woven together. Air mesh fabric is durable and belong to the warp-knitted fabric boutique. Is now widely used in sports bags. Air Mesh fabric has the following characteristics:

-Good air permeability and moderate regulation ability. With the solid mesh structure, it is known as the breathing fabric. Compared to other flat fabric, sandwich fabric breathability is stronger, and air circulation, surface to maintain comfortable and dry.

-Unique elastic function. With the structure of net and heat setting in production. When subjected to force, extends along the direction of the force, when tension decreases when the withdrawal, mesh and restored to its original shape. Material can keep certain elongation in the transverse, longitudinal, and not relaxation deformation.

-Wear-resistant and never pilling. Sandwich fabric is composed of tens of thousands of polymer synthetic fiber yarns, refined from petroleum. Knit weave of warp and become, not only a solid, able to withstand high levels of tensile and tear, smooth and comfortable.

-Mold proofing and antibacterial. Material is through mold proofing antibacterial processing, can inhibit the breeding of germs.

-Easy to clean and dry. Sandwich fabric can be adapt to hand wash, machine wash and dry cleaning, easy to clean up. Structure of three-layer is breathable, ventilation and easy to dry.



EVA (Ethylene-vinyl acetate) foam

-Stylish appearance. Sandwich fabric for clear and soft, colorfast. Even with a-dimensional mesh pattern, follow fashion trends, and maintain a certain classic style.

In order to increase the comfort of the strap, the foam is usually added inside the strap. There are only a few types of foams that are typically used.

-Open cell foam is a very soft and compressible foam .because it is so compressible, open cell foam is not great for backpacks that if they are carrying weight, which is all backpacks. Under the weight of a loaded backpack, the foam will compress to the point that it is ineffective at providing much comfort and padding. So while it is comfortable for lighter loads, it's not great for backpacks with larger volumes.

-Closed cell foam is air chambers that are surrounded (or closed) by foam and not interconnected. Essentially, encapsulated pockets of air cells. Close cell foam, which is also called Ensolite, is more suitable for padding on the straps as it doesn't compress as easily as open cell foam. Since the air cells are encapsulated, Ensolite doesn't absorb water like open cell foam, which can soak up water like a sponge. Closed cell foam used to be an attribute of better backpacks, but is now very common.

-Dual density foam utilizes both of them by having a layer of of open cell foam against the body (for comfort) with a layer of close cell foam to provide more support, providing comfort under both lighter and heavier loads.

-Another type of foam that is often used in better backpacks today is EVA (Ethylene-vinyl acetate) foam, also known as PEVA (poly ethylene-



vinyl acetate) foam. EVA is a very good materials to use for backpack straps and padding as it is higher in density, durable, and springs back to shape against pressure.

Structure

Some straps use the three-dimensional air pod structure. The air pod can separate the shoulders from the back and buffer the pressure on the shoulder, which solve the insufficient blood supply that result from the fatigue and muscle compression of the shoulders. For example, The NIKE MAX AIR shoulder strap has a row of small air pods inside, which can effectively reduce the weight of the shoulders and backs, and meet the ergonomic arc pressure to enhance comfort. At the same time, the gap in the middle of the air pods is conducive to the circulation of air, so as to achieve the effect of perspiration. The other strap with air pods is JFT Air Cushion Strap. Thanks to advanced air cell cushion technology , It reduces 30% pressure on the shoulder. The strap has tested that it can effectively reduce the shoulder load of over 30% weight and absorb the shock you may encounter. The air cells on the underside of the strap constitute a cell cushion system to save people from heavy load work. Each unit has 9 air cells, the mutual flowing between each air cell cushion results in a uniform compression “anti-gravity” effect.

Shape

The shape of the shoulder straps can affect how comfortable a backpack feels on your shoulders. The shapes on backpacks are straight, contoured, and a bridged strap. As the names might suggest, contoured straps are curved more similarly to bodies, either in a

JFT Air Cushion Strap

single outward curve (like a crescent) or a shallow S-curve that curves inward just above the sternum, then back outward below arms. Straight straps, on the other hand are more straight. Contoured straps can reduce the amount of rubbing between body and the straps and reduces pinching around trap muscles by shaping around them instead of going over them. Most school bags and laptop backpacks have at least a small amount of contouring in their straps, while fashion-focused bags are more likely to be straight. Bags with large volumes intended for heavier loads, such as hiking packs or trekking bags, are expected to have the most contoured shape. In addition to the shape of the shoulder straps, the width of the strap itself also plays a role in how comfortable a backpack is. The wider the strap is around the points of contact with shoulders, the more effective it will be at distributing the weight, as it increases the strap-to-shoulder surface area. Narrow straps put a lot of weight on a concentrated area of shoulder. However, overly wide straps can push and rub against your armpits or the sides of neck.

Based on the existing design of shoulder straps in the market, it can be concluded that there are several methods to improve the comfort of shoulder straps:

- Reduce the pressure of shoulder straps by elastic material or increasing the buffer space.
- Enhance air circulation by using hollow fabrics.
- Increase the contact area and distribute the force evenly by S-shape to make the surface of the shoulder strap closed to the human body.



S-shaped backpack straps

Design elements of the backboard

Compared with children backpacks, professional outdoor backpacks focus more on the user's carrying comfort and freedom in the physical activity, and it has higher requirements for the design of backboard. Through the analysis of the backboard of professional outdoor backpacks, the design principles can be applied to children backpacks targeted, so as to optimize the performance of children backpacks.

Material

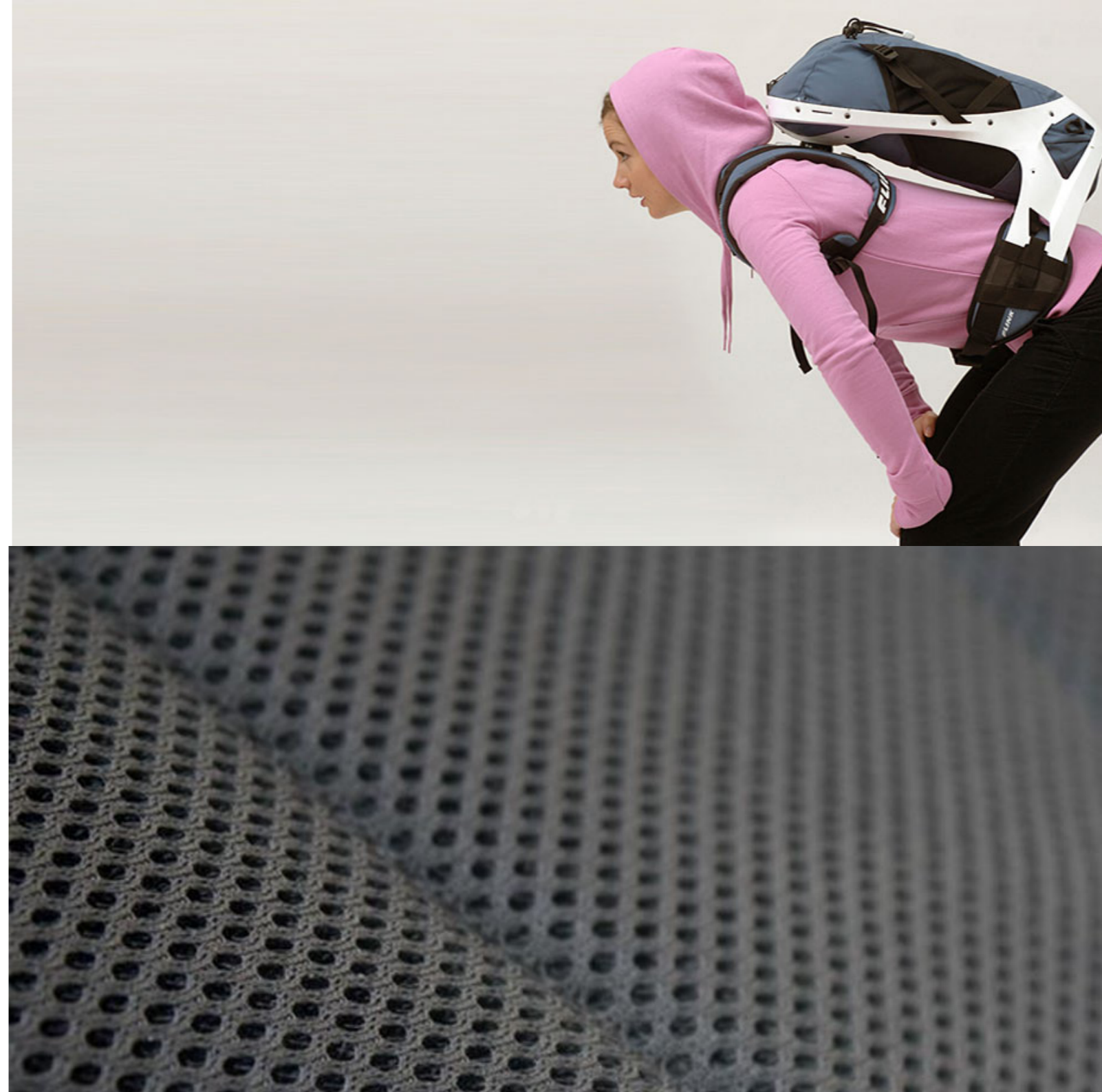
Same as straps, the elastic hollow material such as air mesh fabric and foam also used in the back padding. The elastic hollow fabric creates a cushion that reduces the impact of the backing on the body. This material promotes the circulation of air and has the function of perspiration and venting to keep the back dry. It can be close to the back curve, which can reduce the friction and collision with the body.

Structure

Some outdoor backpacks enhance the comfort of the backpack by using special backboard structure. For example, FLINK ball joint. The Flink System offers the athlete maximum comfort with minimal impairment to the range of motion: Thanks to a central ball-and-socket joint, the shoulder straps are motion-detached from the actual backpack. This provides the upper body with nearly unrestricted freedom of movement. The frame uses the weight as a supporting element and distributes it over a large surface area. The load's centre of gravity is therefore as unencumbered as possible and is transferred from the spine and back musculature to the hip area. The exoskeleton, adjustable using the hip belt, holds the backpack at the optimal distance from the

Above:
The first Flink System
backpacks in 2005

Below:
Air mesh fabric back
padding





**HoverGlide x First
"Floating" Backpack**

Pack Features Patented
"Suspended Load Tech-
nology" That Reduces
Impact Forces on Users
While Walking or Run-
ning by Up to 86%.

body. This prevents the back from getting damp with sweat. In addition, Suspended Load Technology (SLT) is another backboard design that can reduce the stress of the weight load on your back, neck, knees, and ankles as you walk or run. HoverGlide, World's 1st "Floating" Backpack, using this technology. With a patented double-frame and pulley system design, HoverGlide dramatically reduces the dynamic forces impacting the pack. Suspended Load Technology (SLT) allows the carried load to seamlessly move up and down with respect to the person walking or running. This keeps the load at a constant height with respect to the ground. It looks like magic or computer generated imagery, but it's science. While standing still, a 50 lb load in your backpack exerts 50 lbs of force (static weight). This changes when people walk or run, where the peak force exerted on the body can be up to 3x the weight. Suddenly a 50lb pack can put as much force on the body and joints as if it weighed 150 lbs. With the movement of SLT, this additional force over and above the static weight can be reduced by as much as 86%.

Shape

With the support of the internal supports curvy frame, the shape of the backboard is closed to the curve of spine, which decomposes the gravity effectively and avoid the oppression of the spine. It is also a way to prevent sweat buildup along the back panels in hot weather. The frame pushes packs away from your skin and provides an air channel through which sweat can evaporate and escape. The curve of the frame is adjustable for optimal air flow and fit. No extra padding necessary.

Another way to increase the comfort of the backpack is the 3D back

padding design. Through the analysis of the force and pressure point on the back, the strength can be evenly distributed to the back by 3D design back padding, so as to reduce the pressure on the local part. Currently, the designs of back padding of children backpacks with features of pressure reducing and spinal protection are mainly divided into 3D streamlined groove shape and 3D u-shaped. Both of these forms exert a certain amount of pressure on the lumbar spine, which forces the child not to slouch, on the one hand, and disperses some of the force of gravity around the waist, reducing the pressure on the neck and shoulders. The key parts of the spine are avoided. It protects the spine and increase the air cyclability.

Based on the existing design methods of backpacks in the market, the ways to improve the comfort of backboard can be summarized as follows:

-Back support can effectively reduce the pressure on the waist. Therefore, most mountaineering backpacks are equipped with a waist support module, which helps the body to keep the spine forward when carry the bag and reduce the pressure on the waist.

-The bones of school-age children are in growth and development period. The incorrect posture in long-term is easy to cause the spine growth deformation. According to the study of early data of children's body and the research on the stress of bones and muscles when carry the bag, the size and the corresponding position of children's spine can be determined. The comfort of the backpack can be improved by avoiding the key position of the spine in the backboard design.



Left:
3D streamlined groove
shape back padding

Right:
3D u-shaped back
padding



Exploded view of
backboard of Ergobag
children backpack

Design elements of internal structure

According to the research, the contents of the schoolchildren's backpack are relatively scattered, and the reasonable weight distribution in the backpack can effectively alleviate the burden of the body. Through the investigation and research on the mountaineering bag, it is found that there are certain reference standards for the weight distribution of the articles inside the mountaineering bag. The heaviest items are placed on top, which makes the center of gravity move up and the body be stressed uniformly. Items with lower weight are placed at the bottom of the backpack. The lightest item is placed on the outside of the backpack. According to this principle, the multi-layer and multi-grid backpack not only helps children to classify textbooks, but also makes it easier for children to carry since the center of gravity of schoolbag more stable and the weight of backpack is evenly distributed to all parts of the body.

2.2.3 Summary of comfortable factors of children backpack and brand analysis

The design elements that are conducive to improving the comfort level of children's backpacks are obtained through the analysis and summary of professional outdoor backpacks:

- Suitable size.
- The backboard curve that suits for children can protect children's spine, which conform to the children's ergonomics. This design makes the backpack more fitting, close to the body and more comfortable, more stable when used, ensuring that the weight evenly distributed

throughout the back and reducing the burden of children.

- Breathable and ensure the ventilation of the back. Whether it is the backboard of EVA moulding-die or the backboard of the sponge with screen cloth, the design should involve a groove for air circulation.
- Ergonomic shoulder straps aimed at children. Appropriate width, length, fill material and the S shape shoulder straps that accord with ergonomics can make the bag more fit to the back of children when children carry it on the back and avoid bruising and sliding. The distance between the other two straps is close, which could prevent the straps from slipping off.
- Adjustable breast strap. Avoid the slip of the shoulder strap and enable children to move comfortably and freely.
- Detachable and adjustable belt that ensures the stability.
- Anti-slip pads at the bottom on the backboard. The bottom of the backboard is slightly raised by the three-dimensional pressure mold, and the wear-resistant and anti-slip materials were adopted, which can effectively ensure that the weight center of the bottom of the backboard maintain in the hip and hipbone, which sharing the pressure of children's spine and waist
- Preformed flexible and elastic steel frame. This frame accord with the ergonomics, which could keep strong and stable in the maximize load. This frame can effectively make a certain space between the back cushion and children's back, which ensure the air circulation.
- Reasonable internal partition. Make the backpack center of gravity more stable, so that the pressure is evenly distributed.

At present, many children backpack brands are committed to improving the comfort of backpacks. The comfort of children backpack has been

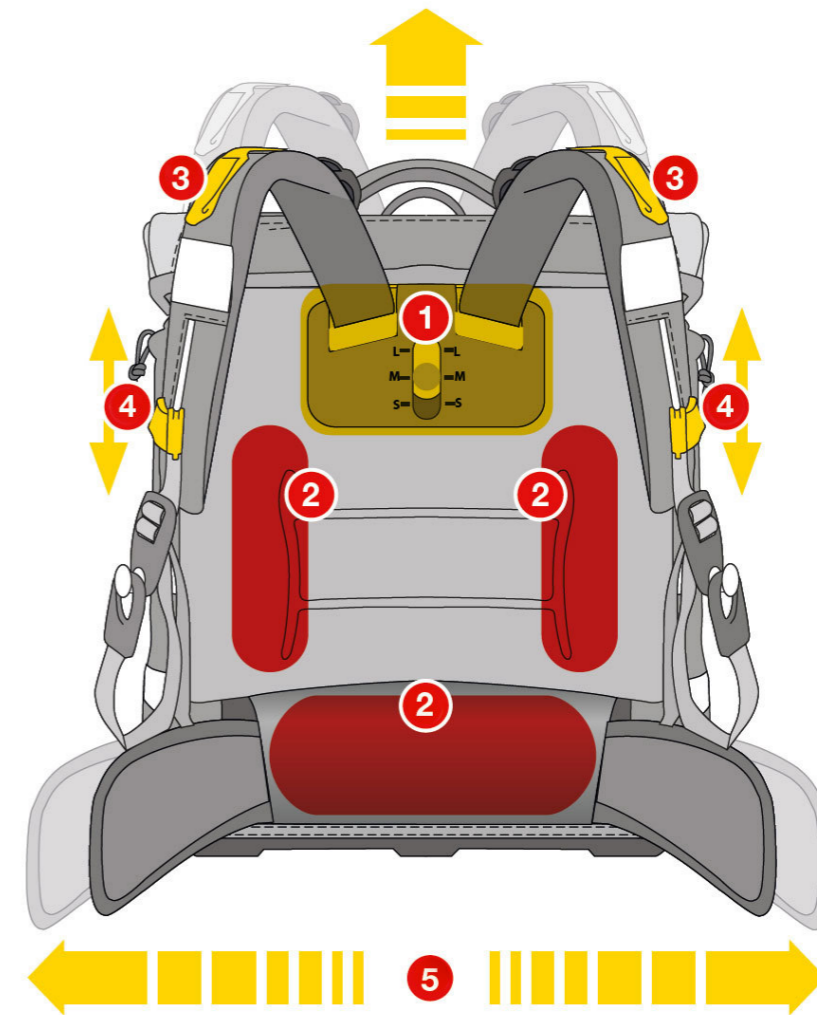
improved by the scientific design. What follows in the passage is an analysis of the performance of the representative German children backpack brand McNeill, which is a reference for the backpack comfort design.

McNeill, first children schoolbag brand in Germany, was founded in 1963. After the development of more than 50 years, McNeill has become a classic in the schoolbag industry in Germany. McNeill made a major innovation in 1975, distinguishing backpacks from professional student backpacks. After this innovation, the schoolbag culture was born in Germany. At McNeill, the satchels meet the latest ergonomic standards. Those who manufacture satchels carry a high responsibility - for quality, functionality, and most importantly the ergonomically correct fit of the satchels. Because children in primary school often must carry many books back and forth, a correct fit of the school satchel to the child's back is very important so that the child's back is protected on his way to school. This is why McNeill develop the school bags in close collaboration with renowned experts in back health. Physiotherapists Werner Krass and Anna Wallmen-Krass advise McNeill in the development phase of the school satchels and evaluate the results of usage tests. McNeill is providing not only quality, but also a range of satchels that have excellent carrying properties.

Werner Krass and Anna Wallmen-Krass, have set the goal of developing a completely new carrying system. The result of this collaboration is the SmartFlex carrying system with 3-point ergonomics. With the SmartFlex carrying system, the school satchel quickly and flexibly adapts to the needs and the physique of the child. The back padding

SmartFlex support system

The height of the bag's strap can be adjusted via the SmartFlex support system. This system has three gear positions. The gear can be adjusted to the appropriate height according to the growth of the child's height. This not only makes the backpack more suitable for the child's body shape, but also extends the use time of the backpack.



- 1 SmartFlex support system
- 2 3-point ergonomics
- 3 Tensioning straps
- 4 Height-adjustable chest strap
- 5 Removable and adjustable lap belt



**Left:
Back padding**

3-Point Ergonomics: Ergonomic back-padding which adapts to the outline of the carrier's back; three supporting areas ensure a stable and accurate fit as well as optimized ventilation even if carried over a longer period. Different collection of backpacks with different back paddings, which provide an accurate and suitable carrying system for almost every child's back.

Straps

Width is 5 cm. Filled with soft padding. Ergonomic shoulder straps with rapid closing system and compression straps. The optimal carrying position of the bag is ensured. The perfect shape of the strap will be close to the neck, and there will be no tightening or shoulder strap sliding.

**Right:
McNeill
Ergo explorer EN collection**



moulds to the contour of the back, and the three resting surfaces ensure a firm and ergonomically correct seat while ensuring good ventilation. The flexibly adjustable chest and lap belt provide additional support. The lap belt is also detachable. That's how easy perfect carrying comfort can be. The SmartFlex carrying system is available with 3-point ergonomics models ERGO Light COMPACT flex and ERGO Light MOVE. With professional zoning design, perfect carrying system and personalized design, McNeill became a model of student backpack:

- The shape of the backboard with ergonomics, matching with the back strap with soft cushion, which makes the schoolbag light and comfortable and provides accurate and appropriate carrying system for each child's back. The ergonomically designed back carrying system is certified by the German spinal health association (AGR). In addition to sharing the burden to shoulder and back, it can effectively prevent spinal curvature and correct bad walking posture.

- The backboard involves a groove for air circulation. The strap is about 5 cm wide which is the best width. It close to the neck, which will not tighten or slide down from the shoulder. The top of the backboard is level with the shoulder, and its bottom lines up with the upper edge of the pelvis. Shoulders and the top edge of the bag is kept at the same level, so users can keep arms free while running and playing.

- Removable and height-adjustable chest strap enable the child to move freely and maintain the stability of the backpack.

- Removable and width-adjustable hip belt reduces the pressure on the shoulders and back

- The internal large main compartment with 2 slide compartments for

ideal weight distribution not only can maintain the orderliness and clean of the book, but also can develop children's ability of self-management.



The Innovative design of children's bag

CHAPTER

3

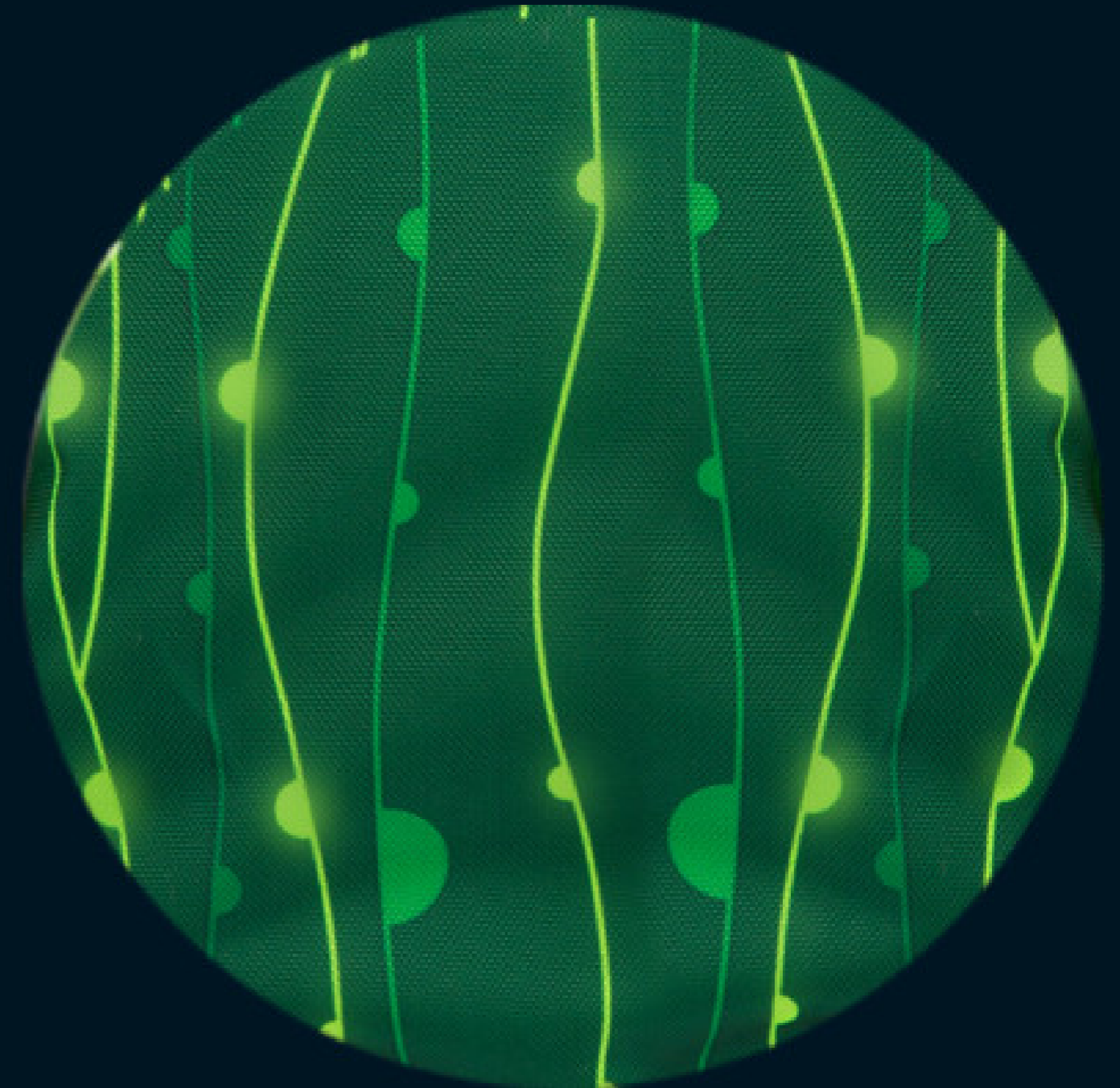
3.1 Multi-Functional innovation design and case study

With the improvement of people's requirements for the life quality, the single-functional bag is no longer able to meet the needs of children. In order to cater to this trend, more and more children bag brands focus on various problems encountered in children's life and start to devote themselves to developing new functional children bag so as to make children's life more colorful and convenient. After the investigation, the innovative multi-functional children bag on the market mainly focus on solving children's safety problems, increasing the convenience of life, providing the assistance of living and learning and so on. Here are some of the functional elements that are common on the market:

3M stereoscopic reflective plate. This high quality reflective strip is used on the fire, medical and police, and the effect is very obvious. 3M reflective material is a novel reflective material that combines the reflective layer formed by glass beads with the polymer material by a special craft. It can reflect light in dark or low light while in real life, it will give a huge visual impact. Many brands now use it as a part of their backpack decoration. If the child is still outdoors after dark, when the car lights illuminate, the reflective surface can be seen from the front or side, which can timely remind the driver to avoid and ensure the safety of the child.

Fluorescent printed fabrics. It is generally believed that the materials that can be strongly absorbed in the visible range and emit the fluorescence is called as fluorescent dye. It is functional dye, possessing the conventional dye color characteristics, and emitting the

Fluorescent printed fabric



fluorescence, which will increase the vividness and saturation of the fabric. Textile processed by the fluorescent dye have a fancy appearance. The printed fabric showed a reversible and rapid photochromic response during ultra-violet excitation without fatigue. The fastness properties including washing, crocking, perspiration, sublimation/heat, and light are described. With the development of science and technology and the development of the fiber varieties fluorescence dye more and more been used in clothes and accessories. For example, the Special Editions series of the German children package brand ergobag, using the fluorescent print technology, make the patterns on the backpack present a colorful glow, which is very bright even in the daytime. It makes the backpack beautiful, interesting and improves the safety of children.

Anti-lost traction rope. This kind of backpack is designed for preschoolers aged 1-6 years. The structure of this backpack is simple. The hook and traction rope structure are added into basic structure of children backpack. Detachable anti-lost belts are very practical. Parents can not only protect their children with the help of the traction rope, but also give their children freedom to develop their independence and self-confidence. Parents can adjust the length of the traction belt and lead their babies to go forward slowly. In the crowded, parents can shorten the length of traction belt and control the baby in their field of vision effectively. For the baby just learning to walk, parents can buy the anti-loss backpack in the lifting style, which can help the baby to maintain balance with the lifting up power of the strap.

Three-wheel trolley bag. Trolley bag gets popular recently, and its



**Disney
Anti-lost backpack with
traction rope**



Affenzahn
Funny label design

advantage is to strength saving and reduce the heavy burden on shoulders. But the trolley bag is very inconvenient when climb the stairs, children have to lift the backpack with one hand, which is very strenuous. Therefore, many children backpacks apply the three-wheel after improvement and improvement. Through the improvement of the wheel structure, the three-wheel trolley bag is suitable for climbing stairs.

Detachable partition. Most of the children backpacks are equipped with compartments, which can not only ensure the orderly arrangement of the items in the backpacks and is convenient for children to take things, but also enable children to develop a good habit of storage. However, due to personal differences, number and location of the partition needs are different for different person. Some designers create the detachable partition, and the partition can be installed or dismantled according to the needs by fixing the partition by the zipper or Velcro.

Label and schedule. There are tags and school schedules on some children backpacks. The name and phone number of the child can be marked on the label to help find the backpack after it is lost. The combination of the schedule and the backpack can serve as a good reminder to children to prevent them from leaving textbooks needed next day. German brand Affenzahn, for example, combines labels and bags in a very interesting way. Their schoolbags are shaped like animals, combining the label with the tongue of the animal, and the tongue of the animal can be pulled. When the child pulls the tongue of the animal, the label pops out. This design not only increases the functionality of the backpack, but also increases the interestingness,

which is popular among children.

Children's needs for their backpacks vary depending on the situation in different regions or countries. In addition to these common basic functions, there are some backpacks designed to meet these special needs.

Randoseru

A randoseru is a firm-sided backpack made of stitched firm leather or leather-like synthetic material, most commonly used in Japan by elementary schoolchildren. Traditionally it is given to a child upon beginning his or her first year of school, whereupon the child uses the same bag until grade 6. The term is a borrowed word from the Dutch "ransel" or German "Ranzen" meaning "backpack", a clue to its origins nearly 200 years ago as used in the Netherlands. The use of the randoseru began in the Edo era. Along with a wave of western reforms in the Japanese military, the Netherlands-style rucksack called ransel (randoseru) was introduced as a new way for the foot soldiers to carry their baggage. The shape much resembled the randoseru bags used today. In 1885, the Japanese government, through the elementary school Gakushūin, proposed the use of a backpack as the new ideal for Japanese elementary school students. At Gakushūin, the practice of coming to school by cars and rickshaws were banned, promoting the idea that the students should carry their own equipment and come to school by their own feet. At this time, the bag looked more like normal rucksack. This changed, however, in 1887. The crown prince of the time was given a backpack upon entering elementary school (at Gakushūin). To honour the soldiers of the country, the shape of the backpack



**Coulomb Randoseru
Black Leather Backpack**



**Japanese pupils with
Randoseru**

resembled the backpacks used in the military. This quite immediately became the fashion, and the shape has continued to become the randoseru used today. However, at that time most of the Japanese people could not afford such an expensive bag. Until the dramatic rise of economy in Japan in the post-World War II period, the main school bags in Japan were simple shoulder bags and furoshiki (square folding cloths). The distinctive backpack worn by schoolchildren has become one of the most iconic symbols of modern Japan.

In more conservative schools the color, brand and design is mandated, typically with red as the traditional color for girls and black for boys. However, due to changing attitudes toward gender stereotypes, more colorful versions such as pink, brown, dark blue, green, blue and even two-tones are more widespread. These varieties have existed since the 1960s but sold poorly due to the lock-step mentality of the education system that gradually began changing in the early 2000s. The increased variety of colors is partly as a compromise for parents to retain some tradition within modernized schools which no longer require the use of traditional uniforms or the randoseru. A typical randoseru measures roughly 30 cm high by 23 cm wide by 18 cm deep, and features a softer grade of leather or other material on those surfaces which touch the body. When empty, it weighs approximately 1.2 kilograms (2.6 pounds). However, due to demand for a lighter, more robust randoseru, as of 2004 approximately 70% are made from the synthetic leather Clarino. Manufacturers usually offer "randoseru" in two sizes, with a slightly larger one sized to hold modern A4 flat files. Most randoseru production is carried out by hand. A randoseru is constructed of a single-piece body and around

200 fittings, a combination of die-cut materials and urethane backing plates. Assembly involves crimping, machine-sewing, walnut-gluing, drilling each shoulder strap, and riveting. The bag's materials and workmanship are designed to allow the backpack to endure the child's entire elementary education (six years). However, the care usually given to the randoseru throughout that time and afterwards can extend its life and preserve it in near-immaculate condition long after the child has reached adulthood, a testament to its utility and the sentiment attached to it by many Japanese as symbolic of their relatively carefree childhood years. The bag is initially bought when children enter elementary school and discarded at graduation 6 years later. As the bags can be quite expensive, it is customary for grandparents to buy it as a gift for their grandchildren. Because the same bag is used for 6 years, the bag seems to shrink as time passes and the child grows. This, my Sensei explained, is one of the reasons parents appreciate the bag — it's a reminder of their child's growth. When the child graduates from elementary school, the worn-out Randoseru can be brought back to the manufacturer to transform it into a mini version, which is viewed as the commemoration of graduation. It's used as an ornament and can be kept forever.

Randoseru focuses on the safety design and it can protect the traffic safety and personal safety of children. There is reflective material as the decoration on the cover and side of the schoolbag. When the sky is dark, this design makes sure the child walks on the road can attract the attention of the vehicle, which promotes the safeguard traffic safety. There is a cushion board inside the bag, the soft design of the back, can reduce the impact when the child falls down. If the child fall

SOS alarm





down, the bag will protect the child's head like a pillow. In case of a car or bicycle coming from the back, the bag will also protect the child's body. When the child falls into the water, the bag can float on the surface of the water to prevent the child from drowning. Japan is a country with frequent earthquake, Japanese pupils can use schoolbags to protect their heads during an earthquake due to the special structure of the bags. There is also a hook where is the alarm apparatus on the shoulder strap of each bag or on the side of the bag, which is the easiest place to touch. When encountering danger, children can press it and send out shrill alarm sound, through which draw the attention of passers-by. School bags in Japan will also be equipped with automatic positioning system that is installed by Japanese government for free. In case of emergency, parents, school and security department can receive the message at the same time if the button is pressed. It is mandatory for the Japanese government to install GPS positioning system on children schoolbags.

Bulletproof backpack

The backpacks are made to protect students from shooting. In America, school shootings have become more frequent in recent years, leaving kids afraid and parents anxious. The violence has led to a surge in the number of companies selling products designed to help kids protect themselves better against handguns and some shotguns. In all, 39 – or nearly one-quarter of the 160 U.S. mass shooting incidents that occurred between 2000 and 2013 – erupted in elementary schools, high schools or institutions of higher education, according to a report by the FBI and Texas State University. Mass shootings in schools remain rare and have declined since the 1990s, according to recent research

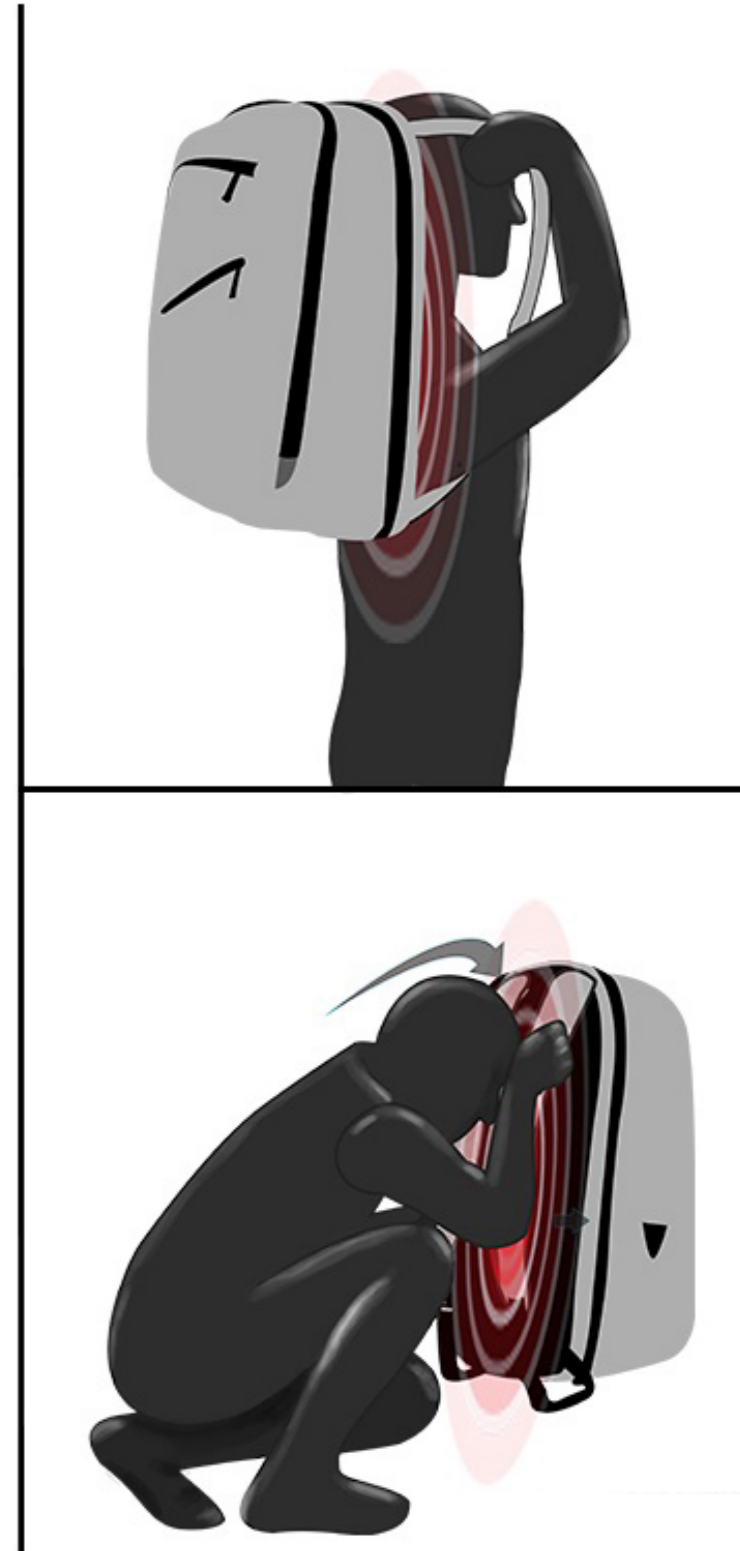
Above :
Japanese pupils use schoolbags to protect their heads during an earthquake drill.

Below:
Floating experiment of Randoseru

by James Alan Fox, a professor of criminology at Northeastern University, and Emma Fridel, a doctoral student. Despite the trend, the results of a survey released on Aug. 14 by Hardwire, a Maryland-based company that produces bulletproof whiteboards, emergency response shields and backpack inserts shows that concern about shooting violence is top of mind for many parents of school-age children. In all, 74 percent of the 1,000 parents who participated in the national online survey said they were concerned about a school shooting happening at their child's school this year, and 63 percent said they were more concerned than they were last year. And nearly one in five said they had already purchased some form of ballistic protection for their children. The survey reflected responses from parents with children in grades K-12 and had an error margin of plus or minus 3.1 percentage points. Along with spurring a national debate about gun rights and restrictions, the school shootings have spurred a variety of business, government, do-it-yourself and other efforts designed to keep students safe. Several safety companies said in February they had seen a jump in sales immediately after the Parkland tragedy. Although the spike has moderated, they say 2018 sales are higher than last year. And, in a sign of mainstream success, two national retail chains are selling bulletproof backpacks. One bulletproof-backpack manufacturer said sales are up 200 to 300 percent since 17 people were killed in the Parkland, Florida, shooting in February.

More than a half-dozen manufacturers now make bulletproof backpacks for children, ranging from elementary to high schoolers. The products also have caught on with college students. For example, Guard Dog Security is a recognized tactical self defense brand. Guard Dog is

Method of using bulletproof backpack





**My Child's Pack
Bulletproof backpack**

committed to providing personal self defense, security and protection for everyday use with highly effective and affordable products. The Guard Dog bulletproof backpacks is for both adults and children. The bulletproof effect is achieved by adding a bulletproof panel to the backpack. All backpacks are officially tested and certified by the National Institute of Justice for bulletproof protection. Bullet Blocker is another website that sells bulletproof backpacks. 'My Child's Pack' is Bullet Blocker's smallest bag, designed for young children. The bulletproof panel is made of Kevlar, a high performance bulletproof material made of synthetic fibre. The children's' backpacks are capable of stopping a "357 Magnum, 44 Magnum, 9mm, .45 caliber hollow point ammunition and more," in addition to featuring "Large zippered exterior pockets to hold essentials like your phone or snack."

Repurpose Schoolbag

The Repurpose Schoolbags is much more than just average backpack. The upcycled, waterproof, and solar-powered backpack, has the potential to keep children safe on their way to school and gives them an important tool to succeed in their studies and earn a better life. The impressive project is part of the South Africa-based Rethaka Foundation, which helps ensure access to education for underprivileged children. The organization, founded by Thato Kgathanye and Rea Ngwane, also aims to reduce plastic waste, utilize solar energy, and empower children to realize their ambitions. Rethaka noticed some of the economic and social challenges facing those living in low-income communities in South Africa. What stood out was that many children did not have access to a light source after dark to do their homework and basic supplies for school. There was a lack of employment



Repurpose Schoolbag

The children are using solar-powered light to study at night.



opportunities for low-skilled women and there was a gross amount of pollution, which many had not really thought about as being a resource.

Repurpose Schoolbags are solar-powered backpacks made from recycled shopping plastic bags. While a child walks to school, the solar panel charges and then doubles up as a light for the child to study at night. It provides up to 12 hours of light for reading or doing homework. Not only is it environmentally friendly, but it can be directly lifesaving. The use of kerosene lamps by those who don't have electricity can be deadly, and given that some 11.4 million learners walk to school daily, then it's an ideal means for providing the ability for children to study without any unnecessary risk. The Repurpose Schoolbag design also integrates retro-reflective material that effectively increases the visibility of children as they walk to school in the early morning, especially during those dark winter morning months.

This business is not only lighting the way for learners, but is also creating jobs for their community in the North West province of South Africa. In this way, they are tackling two social problems with one solution - helping children learn and injecting jobs into the area. They currently have eight employees who are responsible for the entire process from the collection, washing and sorting of the plastic bags, through to the final stitching and delivery of the Repurpose Schoolbags. Rethaka has manufactured 10,000 Repurpose Schoolbags to date, distributed in five provinces within South Africa, as well as distributing into countries like Namibia, Niger and Nigeria. Rethaka has employed a total of 20 women. They have recycled over 400 thousand plastic

bags and show no signs of slowing down. In South Africa where the country's energy shortage has led to rolling blackouts every week, the schoolbags Rethaka makes might just be the solution for everyone who needs to burn the midnight oil for study and work. Even for those who are lucky enough to never have a shortage of lights, perhaps this is a way for anyone anywhere to conserve energy - after all sunlight is free and clean - the buzzwords of the future of energy globally.

3.2 Application of intelligent system and case study

With the development of the smart hardware market, children's smart hardware market is also showing explosive growth: products are diversified; smart watches, smart toys, smart shoes, smart robots have entered the children's world. The application of artificial intelligence technologies such as speech recognition and man-machine interaction will greatly improve the performance of children's intelligent products.

of children's intelligent products. Many enterprises have launched children smart backpacks. Children smart backpack is mainly composed of hardware module, cloud service and mobile App, which realizes the intellectualization. According to the market research, the intelligent application of children's backpacks on the market at present is mainly reflected in children's travel safety. Though many critics have been quick to brand kids wearables as tracking devices, their potential is enormous. They have the power to fundamentally shape a child's relationship with health and wellbeing, and the ecosystem surrounding them.

Study king smart schoolbag

Study king, a Chinese brand, children smart schoolbag was founded in 2017, has functions of GPS positioning, security fence reminder, two-way call, one-button help, photo taking and sports. The main control device and IOT card are placed in the schoolbag. The smart system of the schoolbag can also be activated without the SIM card to bind the Study king APP, through which all functions except two-way call can be realized. There is a Micro USB besides the SIM card slot, which can be used to charge the schoolbag. The longest standby time of the bag is about 10 days. The set functions are complete, including photo albums, address book and so on. The users can make the necessary functional settings on the smart schoolbag, such as forbidden in class. The display device is automatically disabled during the set period.

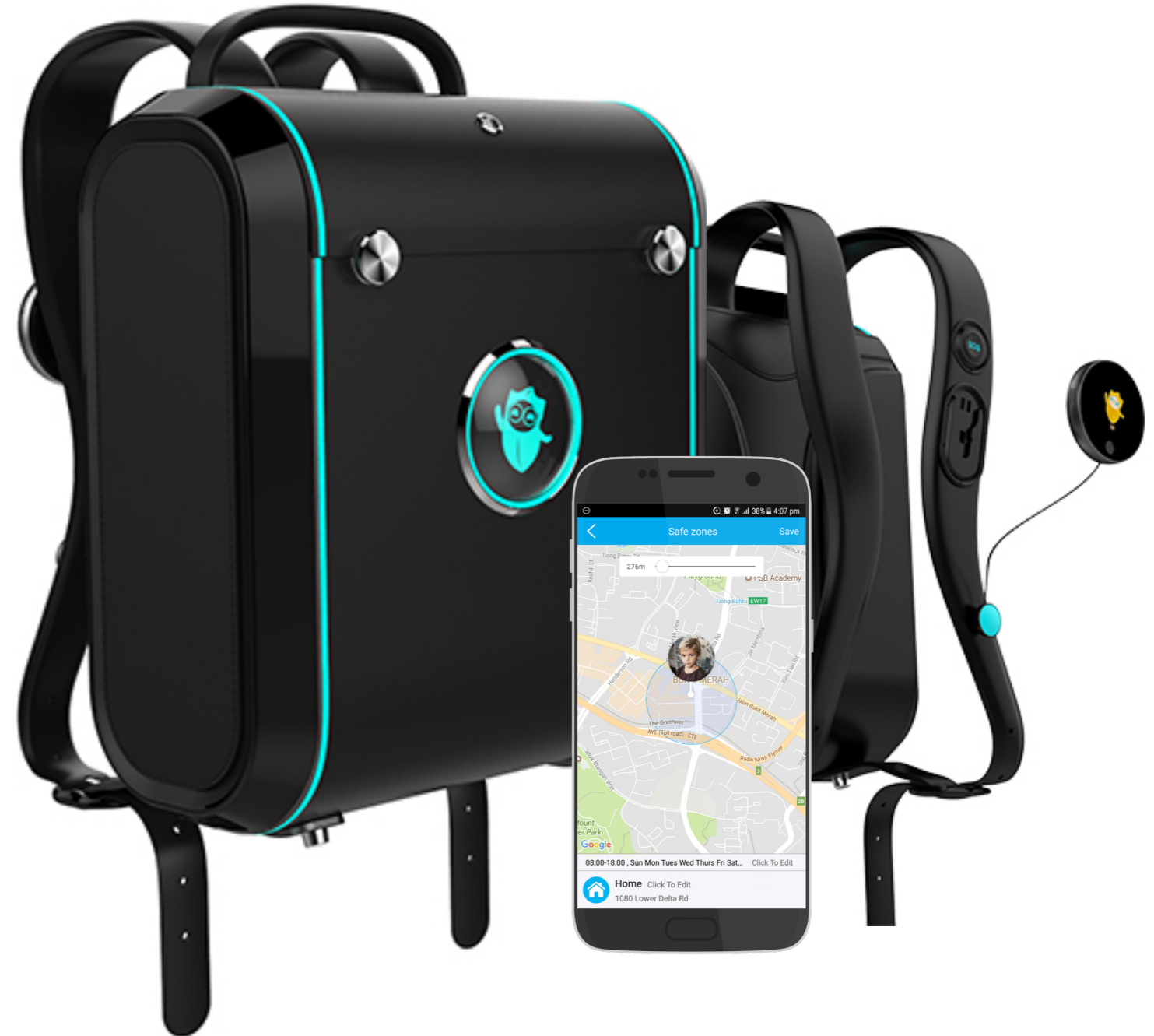
-GPS positioning. The display device of Study king smart schoolbag can be connected to parents' cell phone and parents can get their children's location and activity status at any time. With the help of Beidou dual-mode satellite positioning, the accuracy of GPS is up to 10 meters. You can know the location of the child in real time on the mobile app. No matter the starting point or the end point of the children's track, as long as it is the place where the child has passed by, the track record can be displayed in the app.

-Safety fence. With the backpack as the center, the safety range can be set as far as 1000 meters. If it is beyond the safety range, the app will push the alarm information.

-Two-way call and video function. Children can make and receive calls on the site. This function makes the children keep in touch with their families at any time and place. The phone card is put into the backpack

Study king smart schoolbag

The backpack smart system can be connected to the parent's mobile app.





Above:
SOS button

Below:
Touch screen

hardware, and the user can bind 10 phone numbers with the backpack, which enables the communication and interaction between parents and children. The parent not only can get the information of children at any time, but also can deepen the communication with children.

-Voice calls . Similar to the WhatsApp, can carry out simple voice intercom, and dynamic emoticons are also built in, which is very interesting.

-SOS asking for Help. In the emergency case, the user can press the button for 3-5 seconds to start up the help warning system on the backpack, and it will automatically send the information to the APP. There will be the voice and small window reminding on the app and the current environment will be shot by the rear camera to avoid missing the first time of rescuing.

-Step count. This function can record the number of steps your children take every day in detail. The parents can check the detailed movement data through the mobile phone client.

In addition to the realization of multi-functional, backpacks also strive to the lightweight and simple design that will not increase the size and weight of the backpack because of the intelligent device on it. The device is equipped with a 1.54-inch IPS screen with the resolution of 240*240. The child operates these functions through a rounded display on the straps. Besides the functions of making phone calls, chatting, taking photos and photo albums, the screen interface is simple and easy to understand, which is easy for children to learn. The display device is also equipped with a base and an elastic lifting rope. In addition to the function of storage, the base can charge the display device. The elastic lifting rope can be extended to about 45cm.

The round shape of the display device is designed to support the touch operation. The menu can be viewed by sliding in the left or right direction. The round is display also equipped with a camera at the top and a speaker below, and it can be used to take a selfie and make a video call while the camera is on.

3.3 Personalized and DIY design and case study

Nowadays, kids lay emphasis on individuality and want to be unique. As a result, many brands have launched the customized children backpacks. Children can choose their favourite colors, patterns, materials and texts so as to get a unique backpack of their own. In addition, in order to improve the customer experience, many merchants also added a child DIY service in the custom service, so that children can do it by themselves to create their favorite backpacks. DIY service can not only improve the entertainment of customized services, attract children to participate and cultivate children's independent creation and hands-on ability, but also greatly increase children's love for the backpack they made. After all, children will cherish backpacks made by themselves more.

McNeill

McNeill has been making satchels of the premium class for many years. To make this start an unforgettable experience, there is now the limited edition ERGO Light Leather by McNeill. The ERGO Light Leather is the perfect satchel for kids and parents who are looking for something special and individual. The highlight: on request, an individual text is embroidered in the leather, such as the date of the

**McNeill
ERGO Light Leather
collection website page**



①	schwarz 001	soft pink 018	azure 044	flieder 046	natur 051	purple 107	cherry 200		
	türkis 226	platin- gold 227	limonen- gelb 228	dark navy 229					
②	schwarz	blau	pink	flieder	rot				
③	schwarz	grau	weiß	blau	türkis	pink	flieder		
	rot	gelb							
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school enrollment day. The satchel can be individually assembled in color and frame and is then made individually and by hand. So the first satchel becomes an exclusive and stylish unique.

Ergobag

The ergobag school backpack combines the ergonomic design of innovative trekking rucksacks with everything required of an elementary school bag. The highlight for kids are the Kletties that they can collect and switch. Kletties discover more than 30 themes. The ergobag contour come in 8 different shapes. For an extra individual collection and more fun when swapping with friends. Just change the look of the backpack instead of buying a new one. In addition, kletties can also be used for DIY design. Children can create Kletties with the iron-on bead Klettie set: With 1000 beads in 10 different colors. It includes a template and three Klettie surfaces. Children also can draw patterns on the Kletties. These blank Kletties are large enough for your very own hand-drawn designs. And ergobag isn't the only thing you can put them on: The set features three sticky Klettie backs and two that can be ironed onto clothes, so you can wear them whenever, wherever and however you want. You can create your own Kletties on the website. Whether self-drawn, self-painted or a photo of your pet or of your holiday. With the Klettie configurator everything is possible! It's as simple as that: Choose whether you want to design four different Kletties or a single Klettie. After your selection, you will be redirected to the page of our cooperation partner caseable and you can get creative immediately. The design of Ergobag interchangeable Velcro not only allows kids to change the design on their backpack at will, but also allows them to share their Velcro with friends, which not only improves



Ergobag with different Kletties



children's manipulative ability, but also improves children's social skills.

Upixel

Children bag brand Upixel was founded in Shenzhen, China. Upixel created the pixel art bag. Each bag is an unique piece of art work of the user's own design. The Upixel's mission is to provide users with the products to meet the desire for their art creativity and their enthusiasm for DIY. Unlike traditional bag design concepts, Upixel bags are born with cross-industry ingenuity. Boldly mix and match the silicone and various fabrics which are Eco-friendly. It is distinctive from the ordinary bags and to make more fun with it. When the pixel art met the bags, there it is—Pixelbags. This unique Panel-pixels design is a highly flexible tool that made the creating of pixel images art more easily and instantly. The surface is attached with a matrix board, along with the pixel chips to fit the dots, everyone can create a pixelbag with the unique pixel art work. This mix-and-match species is given the value of the innovative pixel art, the Do-it-yourself and the parents-children game idea.

-Do-it-yourself. No matter what's on your mind, as a user you can create image art with pixels and finally get to customize your true one-of-a-kind bag.

-Parents-children game idea. One way to connect with your children is to play with them. When the parents co-work with the children to accomplish the job, parents get to understand how their children think and do, To the children, it's very helpful to teach them to think independently, get hands-on skill, and be concentrate.

**Upixel
DIY children backpack**

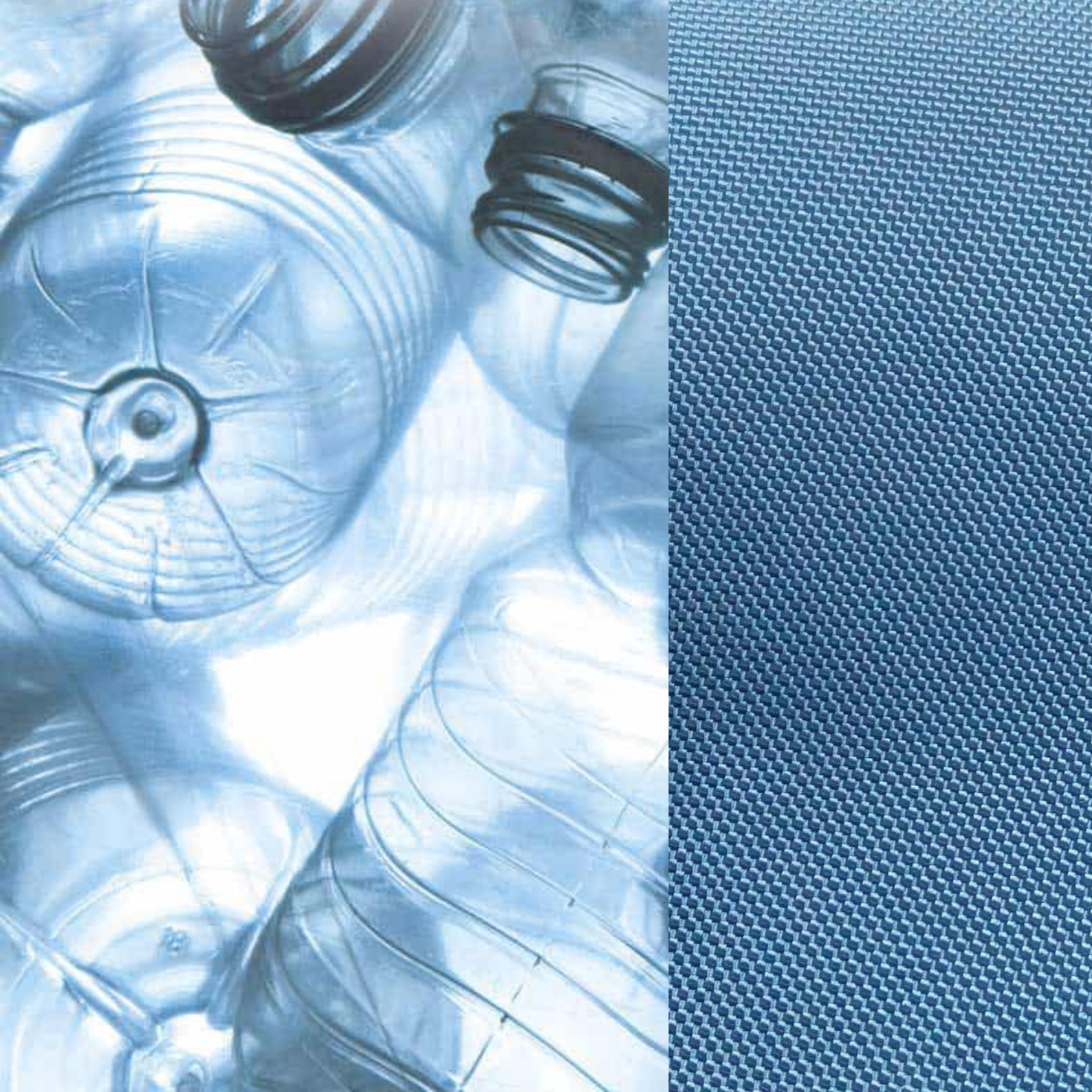
3.4 Application of environmental-friendly material and case study

Environmental protection has gradually become a design trend that cannot be ignored. Since the second half of the 1980s, the international fashion design masters have set off a trend of “ecological heat”, constantly launching the clothing in the environmental protection series. In the 1990s, with the improvement of the environmental protection consciousness all over the world, this craze has been more and more popular. Earth Pledge held a Fashion Show called FutureFashion on January 31, 2011, which kicked off the New York fashion week. 30 outfits made by the world’s top fashion designers was displayed on the show, and all these outfits was made from sustainable materials. This change not only reflects the progress of science and technology, but also reflects the continuous improvement of people’s requirements for the quality of life. The progress of science and technology makes such a change possible. In addition to the pursuit of fashion, people need to pay attention to the environment protection, and environmental protection fabrics will be the trend of the future development. Nowadays, this trend has entered into the children’s fashion circle. Many children’s wear and accessories brands are following the trend, using the green and environmental protection fabrics in their designs. At present, the eco-friendly fabric for backpacks are mainly divided into pure natural fabrics and recycled fabrics. Several types of “eco-backpack” in the current market are as follow:

- Canvas bag
- Cotton cloth bag

Little girl dressed in the princess dress made from a silver foil.





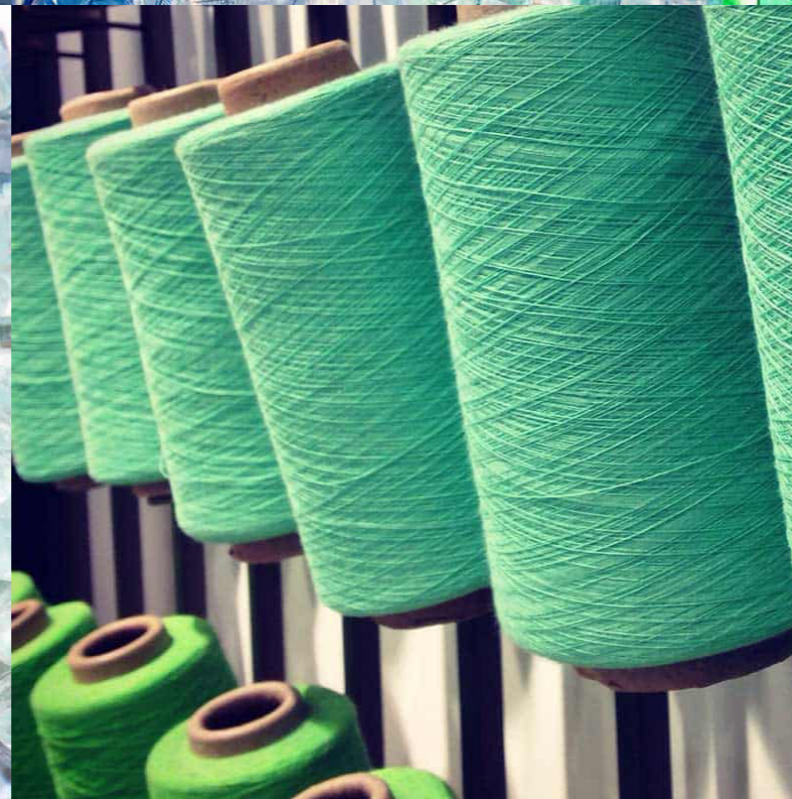
- Flannelette bag
- Straw bag
- Bags made of other environmental protection materials

The bags, which are made of natural materials, will degrade in a short period of time after being discarded without any residual solid waste, so as not to cause any harm to the environment. The canvas is a typical natural environmental protection material. In the field of sustainability, there is a new buzzword with an environmental meaning, recycle. In addition to being recyclable, the material source of many recycle bags is the product of a regeneration process. Maybe its original material source is not the natural cloth, but the recycling process endow these things with new recycling value.

Recycled PET Fabric

Recycled PET Fabric is a kind of eco-friendly fabric. It has been developed using the clear plastic water bottles, or PET as the raw material. PET is the name of the resin used to make light, transparent bottles for drinks, juices, soap and etc. PET is 100% recyclable. The recycled PET yarn can be used either alone or together with other fibers to weave a fabric. These fabrics were used to create strong, durable items, such as coats, shoes, bags, jackets, accessories. Because the recycling process reconstitutes the fiber on a molecular level, there is no difference between recycled polyester and virgin polyester. Performance and durability, benefits, including high strength and functional versatility of recycled polyester is the same than traditional polyester but with a lower environmental impact.

Recycled PET Fabric



- The energy needed to make the RPET is less than what is needed to make the virgin polyester.
- Recycling pet to create the fabrics prevents it from going to landfill.
- Recycled polyester doesn't require new petroleum to create, lowering the demand for new petroleum extraction and reducing our overall carbon footprint.
- Producing recycled polyester is better for the climate, creating 75% less emissions than virgin polyester.
- By providing a use for post-consumer and post-industrial.

The steps involved in the production process are as follows:

1. The collected PET bottles are sorted at a recycling facility where are sterilized, thoroughly cleaned, dried and the labels are removed. Then, the bottled are separated by color (For producing a white polyester yarn - clear bottles, for green polyester yarn - green bottles).
2. The bottles go into a grinder where are ground into small chips.
3. The chips are heated and dried to remove any moisture.
4. The dry chips are shoved through hot pipes to melt them into a liquid. The liquid gets filtered through a dye plate with tiny holes.
5. The filaments are then harden and pool and are sent over air rollers.
6. The machine spools the yarn and stretches it.
7. This yarn is then dyed, made into bales and ready to be woven into polyester fabric.

Steps and methods of producing Recycled PET Fabric





Fjallraven
Re-kanken backpack

Nowadays, this kind of environment-friendly fabric is also popular among many backpack brands. Due to its safety, lightweight and waterproof, it is also widely used in children's backpacks. For example, Fjallraven, a Swiss backpack brand, has been adhering to the concept of environmental protection since its establishment more than 50 years ago. It encourages and inspires people to enjoy outdoor life and protect the natural environment and creatures. Fjallraven launched Re-kanken series backpack, which is made of RPET fabric. The adult backpack is made of 11 recyclable PET bottles, equivalent to 9 PET bottles for children's backpack, and all the backpack materials can be recycled. Complete color at the same time through SpinDye® technology, spinning and dyeing synchronization is complete, the production process greatly reduce the consumption of water resources, the use of chemicals and energy consumption and carbon emissions. They also give fabrics excellent colour fastness to light, washing, abrasion, perspiration and even bleaching. In addition, famous children's bag brands such as Dutch children's backpack brand Petit Monkey and German ergobag also follow the trend of environmental protection and apply RPET fabric.

Piñatex

Piñatex is an innovative natural textile made from pineapple leaf fibre. The leaves are the byproduct of existing agriculture, and their use creates an additional income stream for farming communities. Piñatex is a natural, sustainably-sourced, cruelty free material. Leather has been used for thousands of years, however as the industry demands more – and cheaper – supply, its production has become environmentally unsustainable. Tanning is a complicated process,



involving approximately 20 stages and 250 chemicals (including toxins and heavy metals such as hexavalent chromium, aldehyde, cyanide, zinc and lead) to halt decomposition, which are extremely damaging to both people and the environment. Synthetic alternatives such as PVC (polyvinyl chloride) are not the solution, as these are ecologically toxic to both produce and dispose of. Piñatex addresses these issues as a sustainably sourced textile, made from a natural waste product, created low water use and low production waste, containing no harmful chemicals or animal products.

Piñatex is made of fibre from the leaves of the pineapple plant. These leaves are discarded from the pineapple harvest, so the raw material requires no additional environmental resources to produce. The long fibres are extracted through a process called decortication, which is done at the plantation by the farming community. Ananas Anam has developed the first automated decortivating machine to assist with this process, allowing farmers to utilise greater quantities of their waste leaves. Once the leaves have been stripped of fibre the leftover biomass can be used as a nutrient-rich natural fertiliser or a biofuel, so nothing is wasted. The fibres then get degummed and undergo an industrial process to become a non-woven mesh, which forms the base of Piñatex. The rolls of non-woven mesh are then transported to Spain for specialised finishing. This unique process is what gives Piñatex its leather-like appearance, creating a textile that is soft and flexible, yet very durable. Piñatex is also said to be a strong, yet versatile, breathable material which can be easily printed on, stitched and cut making it suitable for a number of fashion products. Piñatex has won a number of prizes over the years thanks to these unique characteristics. It was the

Steps and methods of producing Piñatex

first raw material to win the Innovation Award in 2015 and named the Grand Designs Green Hero in 2016. The brand was also named a certified cruelty-free label in 2015 by PETA. The fashion industry has responded very positively to Piñatex and there is already a wide range of brands which use or have sampled Piñatex, ranging from footwear, fashion accessories, clothing and interior furniture brands. Piñatex is made from the leaves of the pineapple plant, the byproduct of the fruit industry, which are traditionally discarded or burned. Adding value to this waste has created a new source of income for farming communities who otherwise rely on a seasonal harvest. Once the fibre has been stripped from the leaf the leftover biomass is retained to use as a natural fertiliser or biofuel, offering a further economic prospect. As news concerning the brand continues to grow, Piñatex is very aware that its next big step is to continue developing and stabilizing its supply chain to meet the growing demand for its pineapple leaf, in a way which does not compromise its mission and fundamental values concerning environmental, ethical, social and economic sustainability.

SnapPap

SnapPap is a combination of cellulose and latex, in other words, paper and natural rubber, developed in Germany. The material resembles very thick cardboard and is basically an alternative for leather as it looks and works like leather does. This unique paper is, however, 100% vegan and what makes this vegan leather paper so remarkable is that it can be ironed, washed even in 60°C in the washing machine and sewn at home circumstances! The thickness of SnapPap is 0.55 mm and at the moment, it is available in white, light grey, light brown, dark brown and black. The vegan leather paper does not contain any harmful

SnapPap
Vegan leather paper



substances such as pentachlorophenol, PVC or BPA, which is harmful to the environment and health. During washing or drying, any fibres are not shed. SnapPap can be sewn, glued on, printed on with color or flex foil, painted, stamped, shaped or dyed. SnapPap is tear-resistant and the surface can be wiped off. SnapPap can be printed on in different ways and dyed. For example use transfer mediums or fabric paint. If you wash SnapPap in a washing machine with normal detergent, it gets a characteristic leather-look (see picture on the left, the right one is SnapPap before washing.). This effect can be intensified if you crinkle the material when it is moist. Before washing SnapPap is as stiff as thick cardboard but once it is wet, it feels like very soft leather. The strange thing is that the material does not release moisture when it is wet. So you can easily work with SnapPap, if it is in this condition without for example dripping on sewing machine. After drying it is completely stiff again. Today, some backpack brands use SnapPap, such as the Italian fashion brand Spazzuk. In addition, SnapPap is widely used in DIY projects, and the SnapPap kit is ideal for kids' DIY projects.

In addition to these material, some brands have developed the innovative and renewable fabrics on their own, such as used car tires, abandoned truck tarpaulin, fruit leather and so on. Although the use of these fabrics is not widely used, but it lays a good foundation for the further development of the green and environmental protection fabric by the creative thinking of recycling the waste to create the new fabric. It is believed that more and more innovative environmental protection fabric will be widely used and promoted through the perfection of

technology and improvement. And eco-friendly fabric will be a good choice for children's bag.

Project of Ergonomic Combined Children Bags

CHAPTER

4



The project brief

In this chapter, the ergonomic combined children bag design is carried out under the guidance of the preliminary research of school-age children's backpack. The project regarded school-age children as target group. According to the research on fashion trend of backpack for children, market demand, product research, children's characteristics, and found the children's needs and pain points when using backpack, as well as made innovative design based on fashion trend, ergonomic carrying system, functionality, interestingness, and environmental protection. Due to the particularity of children's physical development, health of carrying is the primary key problem to be solved under the premise of fashion in this project, which is related to the normal development of children's muscles and bones when they grow up. In the bag design, following the rules including pertinence, buffering, reminding, through the reasonable carrying system design to release children's back fatigue and adjust children's carrying posture. The application of interaction somato sensory design can help check children's posture when they are carrying bags and keep remind children about their wrong carrying postures, to promote the protection of the child's health, and to reduce the adverse effects of the backpack on the child's body. Another key issue involved in the project was the functionality and interestingness of the backpack. The assembly and disassembly design can meet the needs of children in different using occasions, and it is beneficial for children to develop a good habit of organizing. At the same time, due to the phase of children's psychological cognition at an important stage of development, children's behavior gradually manifests the independence, are curious

about new things, are fascinated with exploring, and hope to get the recognition and respect, for which the assembly and disassembly design and DIY design can meet the characteristics of children, so that improve the user experience. Children can match colors, patterns and modules by themselves to create their own unique backpack. Finally, by using eco-friendly fabrics, it creates a green and healthy lifestyle for children. As well, all the research before is valued, summarized, and presented via a series of boards. They will help to tell the story of the project focus and findings, presenting with an overview of my research findings. The reader will be also introduced to the details of the projects, including technical drawings and the phototypes.



Concept

-The interaction ergonomic carrying system

The design of carrying system is optimized to improve the comfort level of the backpack. Based on the research on the ergonomics of children, 3D design was carried out on the shoulder straps and backboards of backpacks, so that the force of each pressure point of the carrying system was evenly distributed to a larger range of children's bodies, avoiding local compression of the body by backpacks. At the same time, through the use of somatosensory interaction design, the sensory vibration is used to remind and correct the child's bad posture, which helps the child to develop good habits.

-The modular system

The combined bag design inspiration is from military field combined bags. Thanks to the special structure of Molle Plug-in System, children can do bags combination in multiple varieties, which not only meets the children's functional requirements in different occasions for different backpacks, but also exercises the children's organizing ability.

-DIY customized system

Children can personally design their own unique backpack on the website. It is for kids and parents who are searching for something special and unique. The bag can be customised by colour, frame and material.

Target

Primary school student(6-12years old)

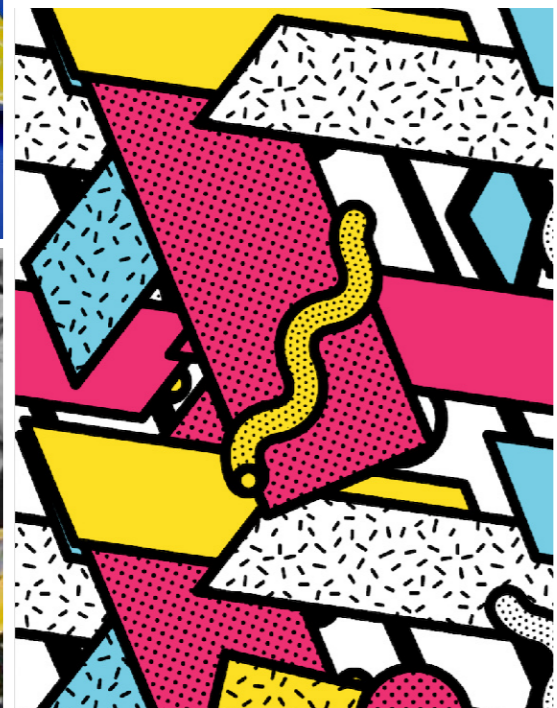
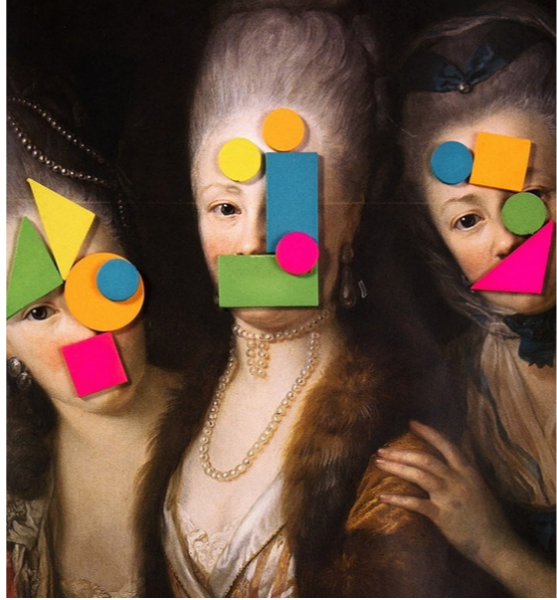
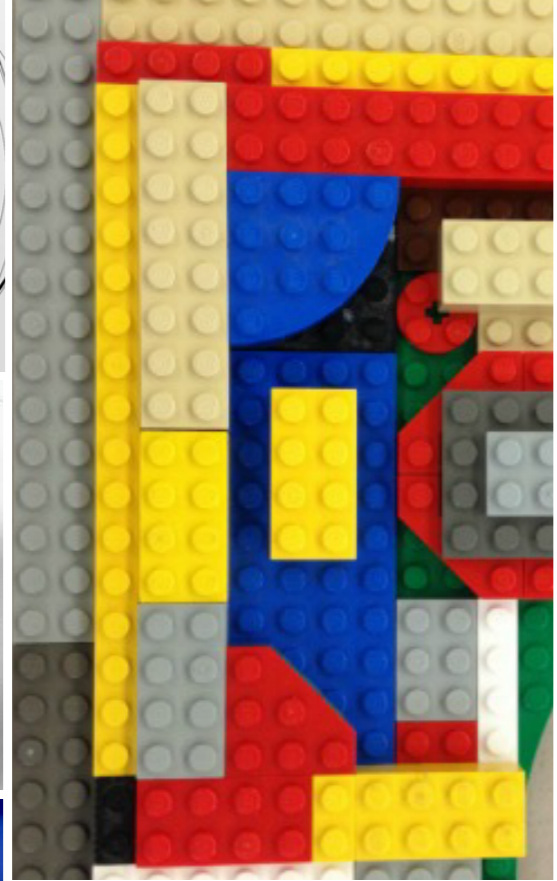
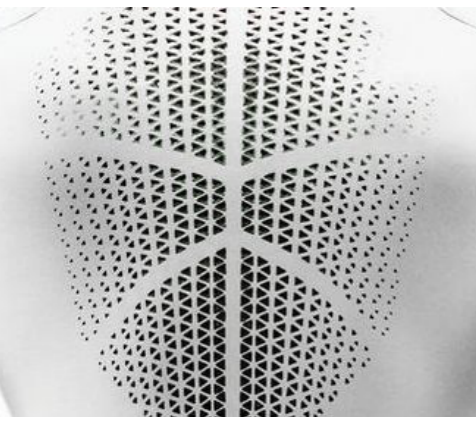
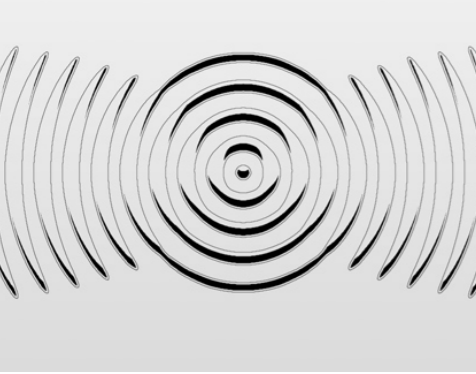
-Psychological characteristics

This period is a significant turning point in the development of children's thinking, which gradually transits to the main form of abstract logical thinking, but still with great specificity. Attention, observation and memory develop in an all-around way. It shows that the voluntary attention begins to increase, the observation ability rises, and children are with intense curiosity. The memory turns from mechanical memory to comprehension memory, which has shown that abstract words and concrete images can be remembered as well. Imitative imagination still dominates, but in painting, handicraft, game, children have a lot of creativity imagination. Children further deepen the understanding of themselves and others, which makes new development on their own personality and sociality, which is the key period of the formation of children's personality.

-Physiological characteristics

At this stage, children's height and weight are growing steadily. The bone tissue contains relatively more water, less calcium, salt and phosphorus, and bone density is thin. As a result, children's bones at this stage are with low hardness, high toughness, which is easy to get deformation, dislocation and damage. Muscle also contains relatively more water, less protein and inorganic components, they are soft and slack, and vulnerable to be damaged, but the recovery rate is fast. When joining the activity, exercise intensity should not be too high, and time should not be too long.





Moodboard

Keywords: Protection, Remind, Free creation, Collage, Moduler, Memphis style, Dadarism

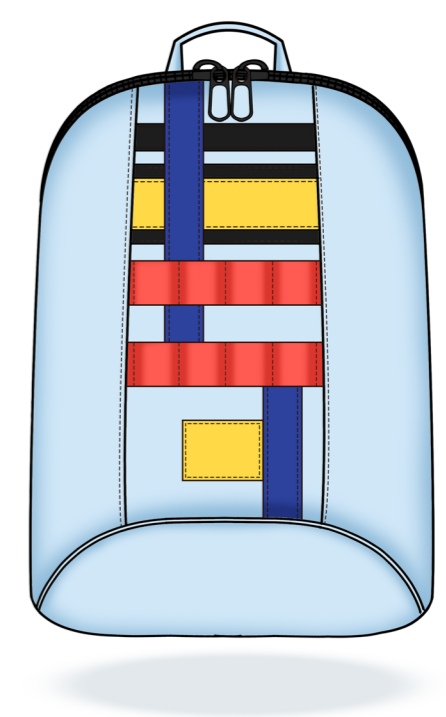
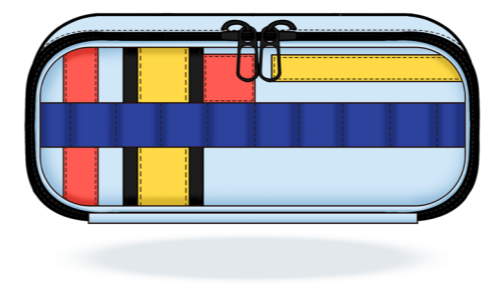
It not only provides protection for them, but also gives them a free display of personality. It has been accomplished that accompanying the healthy growth of children from both the physical and psychological aspects. The free pattern collage, the color matching, the module combination, will bring the children into a multicolored abstract world, which like a magic box always supplying surprises, and children are the little magicians who control the box. Mixing simple pattern with color, you never need worry about how amazing the effect could be.

Color board

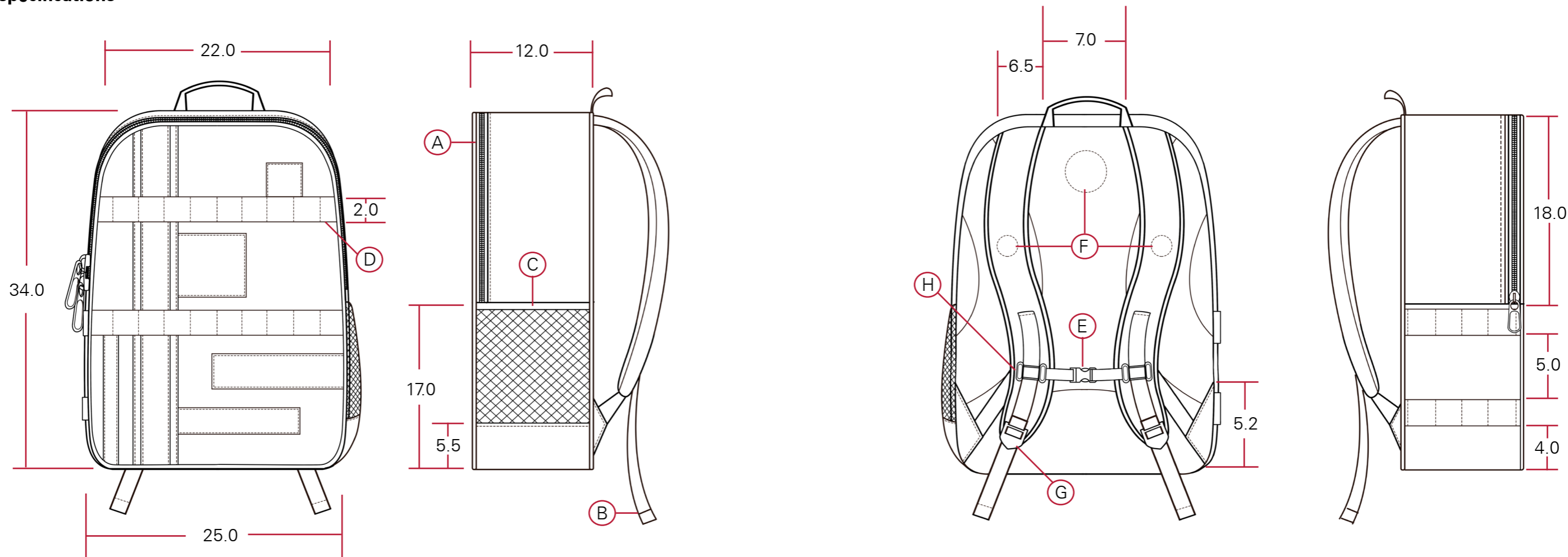
Children's world is colorful. Bright, saturated colors are the children's favorite ones. Bright colors make children's fashion world full of vitality. It pursues bold color matching, strong contrast, bright effect, and it is full of impact.



Mockup



Backpack
Tech specifications



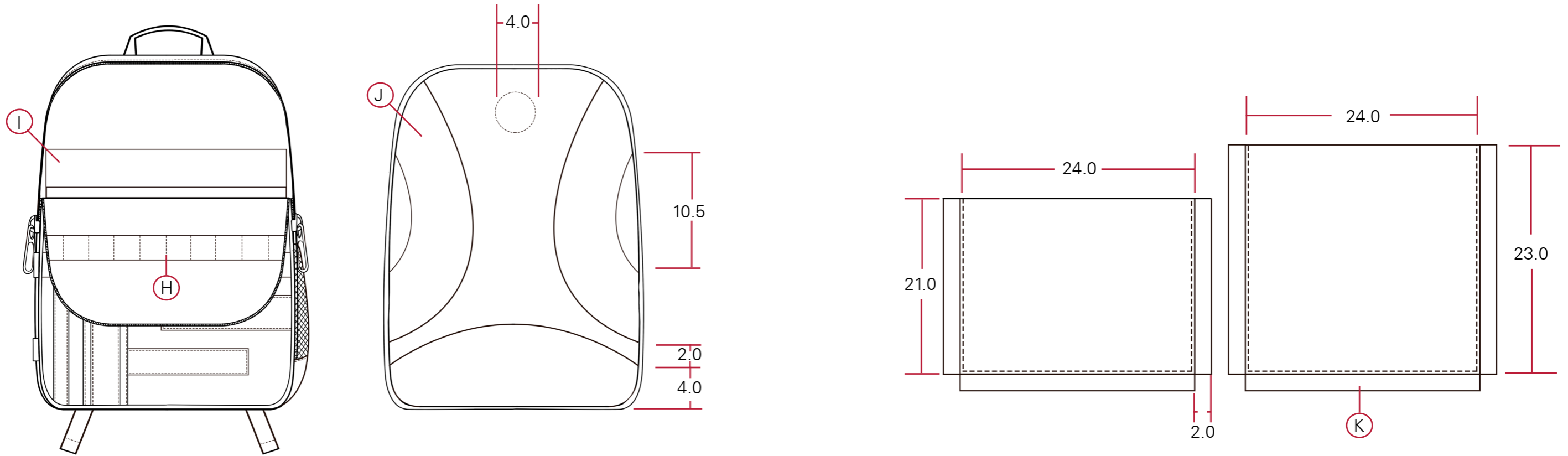
Material list:

- RPET Fabric Main Material
- Nylon Strap
- Polyester Air Mesh Fabric
- Oxford fabric Lining Material

Features:

- (A) Zipper
- (B) 2CM Nylon Strap
- (C) Side Mesh Fabric Pocket
- (D) Molle Plug-in System
- (E) 2CM Buckle
- (F) Interactive Vibration Sensor
- (G) 2CM Adjustable buckle
- (H) 2CM Tension Lock

Backpack
Tech specifications



Material list:

- RPET Fabric Main Material
- Nylon Strap
- Polyester Air Mesh Fabric
- Oxford fabric Lining Material

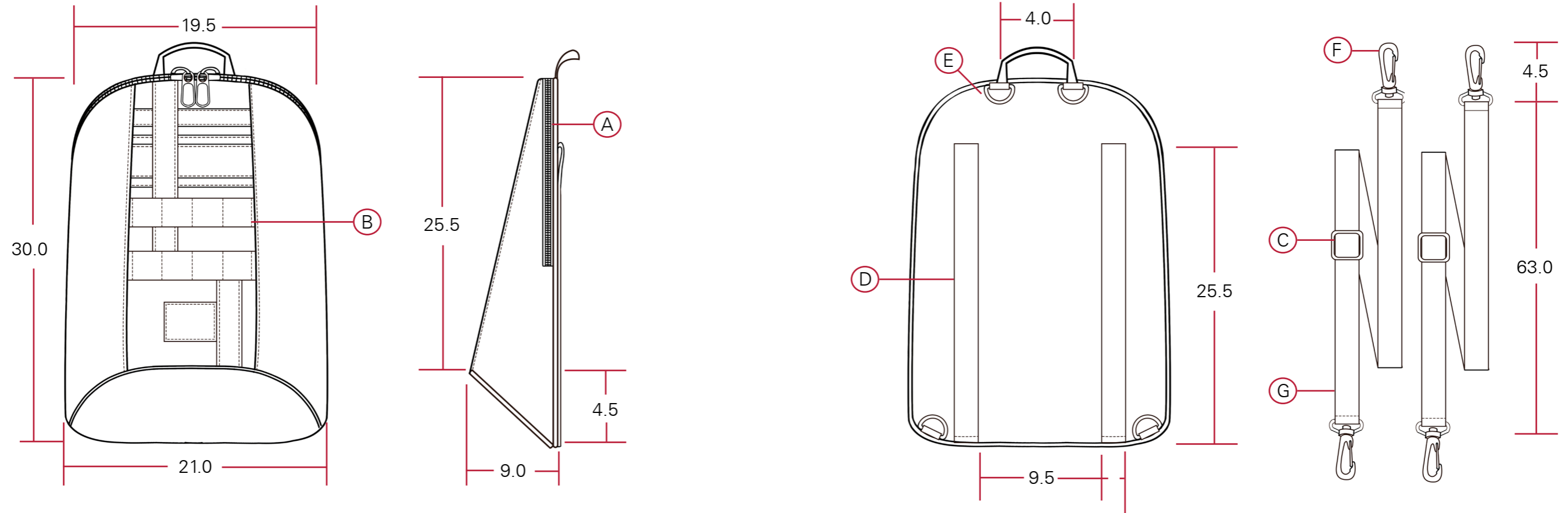
Features:

- Ⓛ Molle Plug-in System
- ⓗ Removeble Compartment
- Ⓝ 3D Air Mesh Back Padding

Ⓚ Velcro

Gym bag

Tech specifications



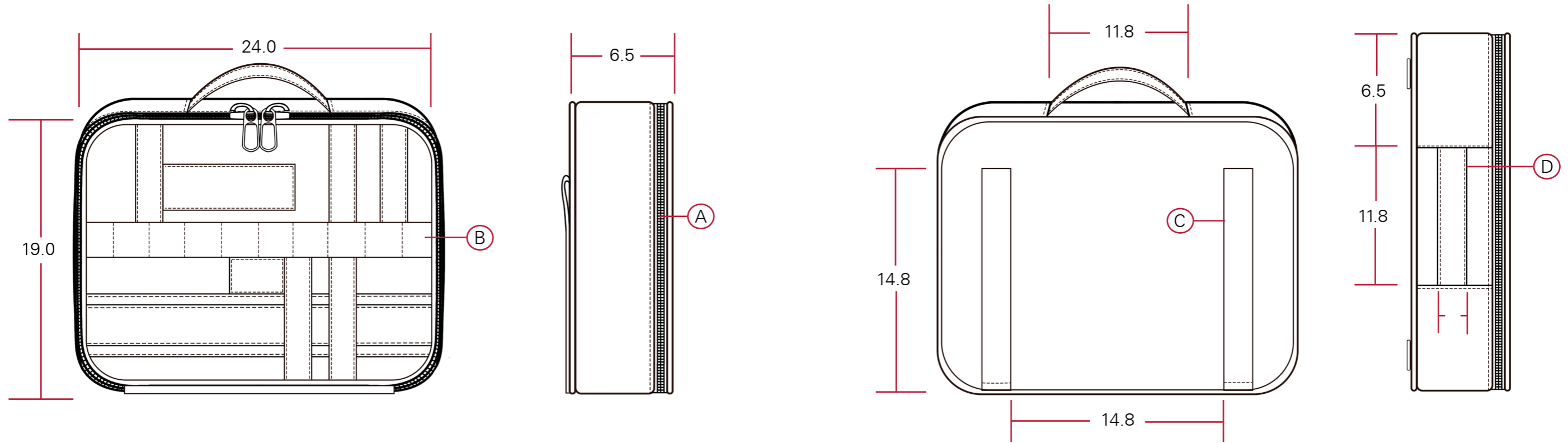
Material list:

- RPET Fabric Main Material
- Nylon Strap
- Velcro Strap
- PVC Waterproof Fabric Lining Material

Features:

- (A) Zipper
- (B) Molle Plug-in System
- (C) 2CM Ladder Lock
- (D) Velcro Strap
- (E) 2CM D-ring
- (F) Lobster Clip
- (G) Removeable Nylon Strap

Lunch bag
Tech specifications



Material list:

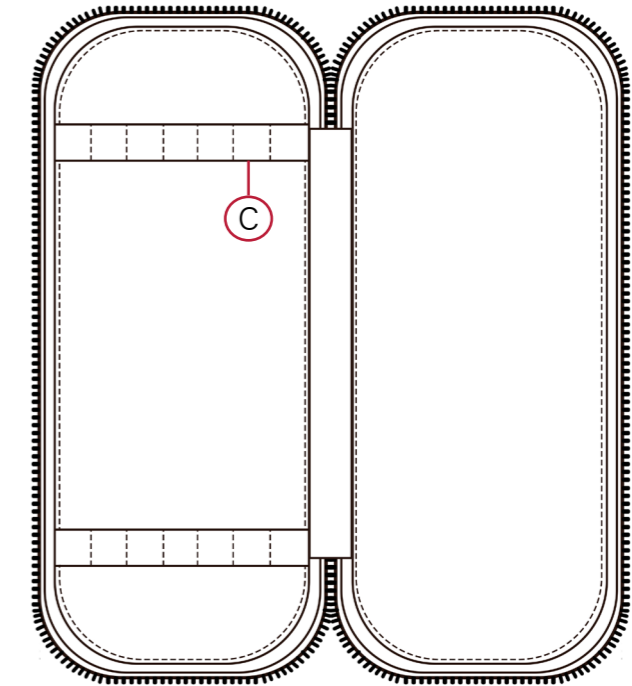
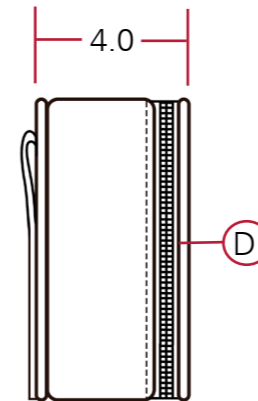
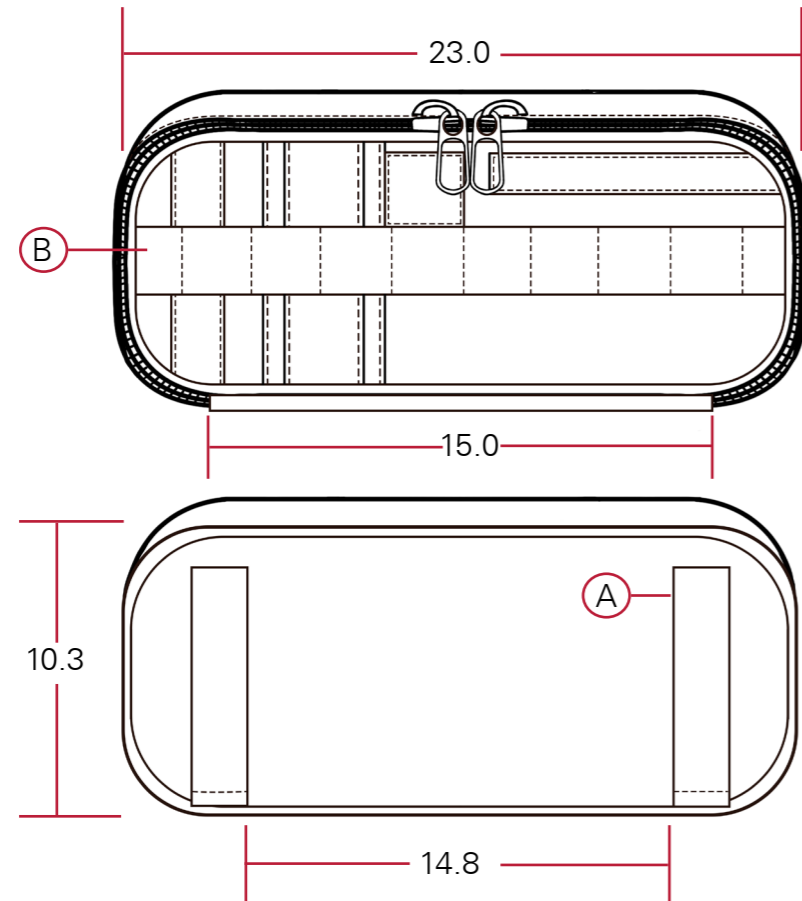
- RPET Fabric Main Material
- Nylon Strap
- Velcro Strap
- EPE Insulated Lining Material

Features:

- (A) Zipper
- (B) Molle Plug-in System
- (C) Velcro Strap
- (D) Adjustable handle

Pencil bag

Tech specifications



Material list:

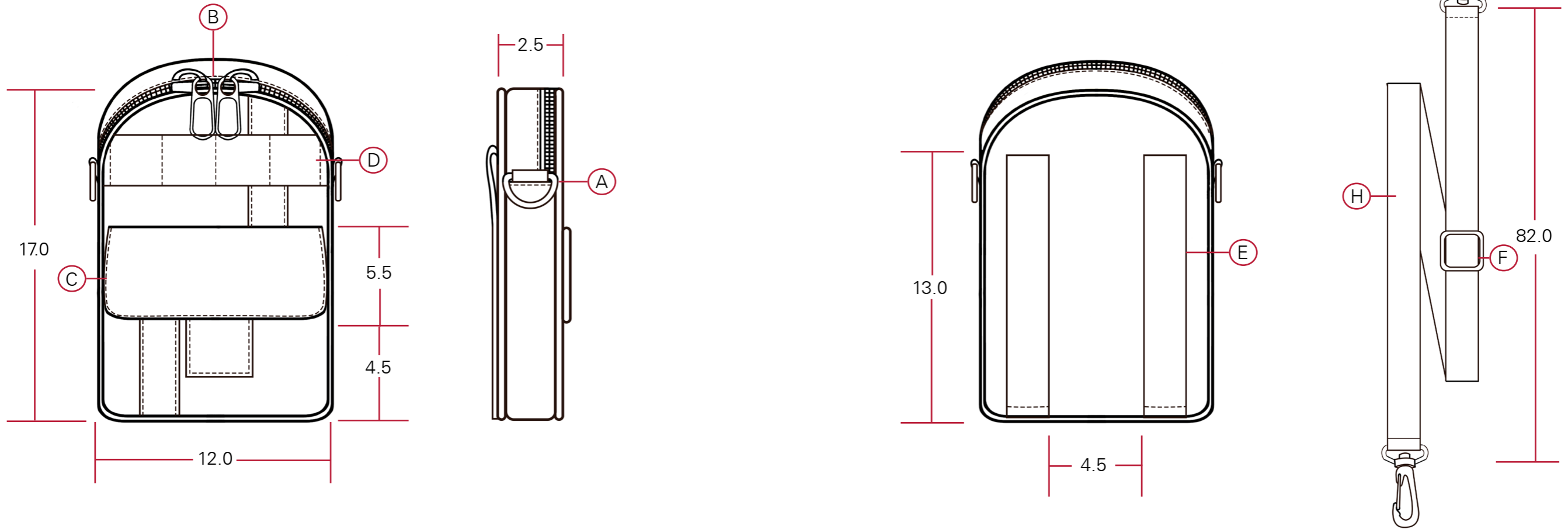
- RPET Fabric Main Material
- Nylon Strap
- Velcro Strap
- Oxford fabric Lining Material

Features:

- (A) Velcro Strap
- (B) Molle Plug-in System

- (C) Nylon Pen Ribbon
- (D) Zipper

Crossbody purse
Tech specifications



Material list:

- RPET Fabric Main Material
- Nylon Strap
- Velcro Strap
- Oxford fabric Lining Material

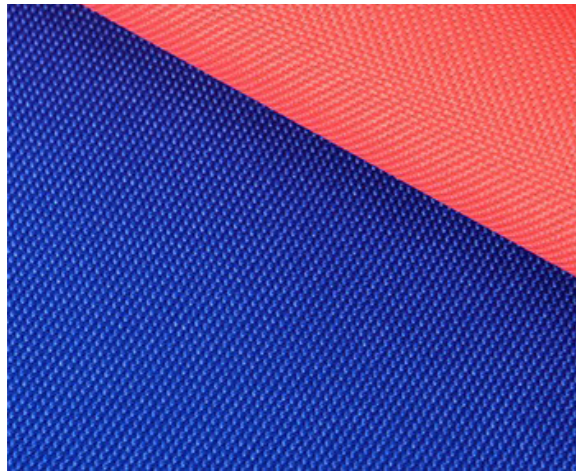
Features:

- (A) 2CM D-ring
- (B) Zipper
- (C) Front Pocket
- (D) Molle Plug-in System
- (E) Velcro Strap
- (F) 2CM Ladder Lock
- (G) Lobster Clip
- (H) Removeble Nylon Strap





Materials



Recycled PET Fabric (Main material)

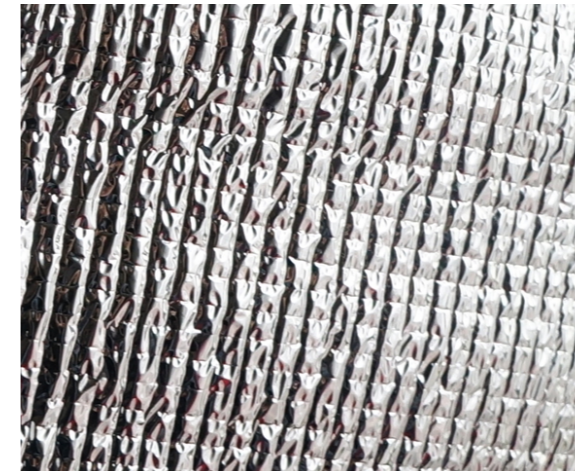
Recycled PET Fabric is a kind of eco-friendly fabric. It has been developed using the plastic water bottles. These fabrics were used to create strong, durable items, such as coats, shoes, bags, jackets, accessories. Performance and durability, benefits, including high strength and functional versatility of recycled polyester is the same with traditional polyester but with a lower environmental impact.



Air mesh fabric (Back padding & belt)

Air mesh fabric is durable and belongs to the warp-knitted fabric boutique. It is now widely used in sports bags. Air Mesh fabric has the following characteristics:

- Good air permeability and moderate regulation ability.
- Unique elastic function.
- Wear-resistant and never pilling.
- Mold proofing and antibacterial.
- Easy to clean and dry.
- Stylish appearance.



Aluminum clad laminated expandable polyethylene (Lunch bag lining)

The insulation is made of three layers that include 600D polyester, aluminum clad laminated and expandable polyethylene (EPE), which make it waterproof, durable and lightweight.



PVC 500D waterproof fabric (Gym bag lining)

PVC 500D, which is also used to make inflatable boats. The material is water repellent so it won't absorb any water and dries really fast. It is extremely easy to clean.



Surface



Zipper



Pattern



Frame

Material

DIY customized system

It is for kids and parents who are searching for something special and unique. The bag can be customised by colour, frame and material. The result is a bag that is exclusive and stylish.

The modular system



CLAUDIO
9 years old
Milan, Italy

My class time is from 8 am to 1 pm. My school is not far from home. Sometimes I choose to walk for about 20 minutes. Sometimes I take the subway for about 8 minutes. I don't need to bring too much items, but sometimes I still feel a little tired with my backpack. Every day I have lunch at home after school.



- **Backpack**
- **Pencil bag**
- **Crossbody purse**



EMMA
12 years old
Washington, United States

My class time is from 8.45 am to 3 pm. My school is a bit far from home, so I take the school bus to school. My school offers lunch, so I eat lunch at the canteen. I don't have to carry too many items and I don't think my backpack is heavy. But tomorrow I will have an outdoor swimming class, so I have to prepare swimsuit, towels and shoes.



- **Backpack**
- **Gym bag**



Tianyu
8years old
Beijing, China

My class time is from 8.30 am to 5.30 pm. My school is a bit far from home. Sometimes my parents drive me to school. Sometimes I take bus to school with my grandfather. I have a lot of courses every day and I need to carry a lot of books, I feel that my backpack is a bit heavy. My school offers lunch, but my parents sometimes still prepare some food for me.



- **Backpack**
- **Pencil bag**
- **Lunch bag**
- **Crossbody purse**



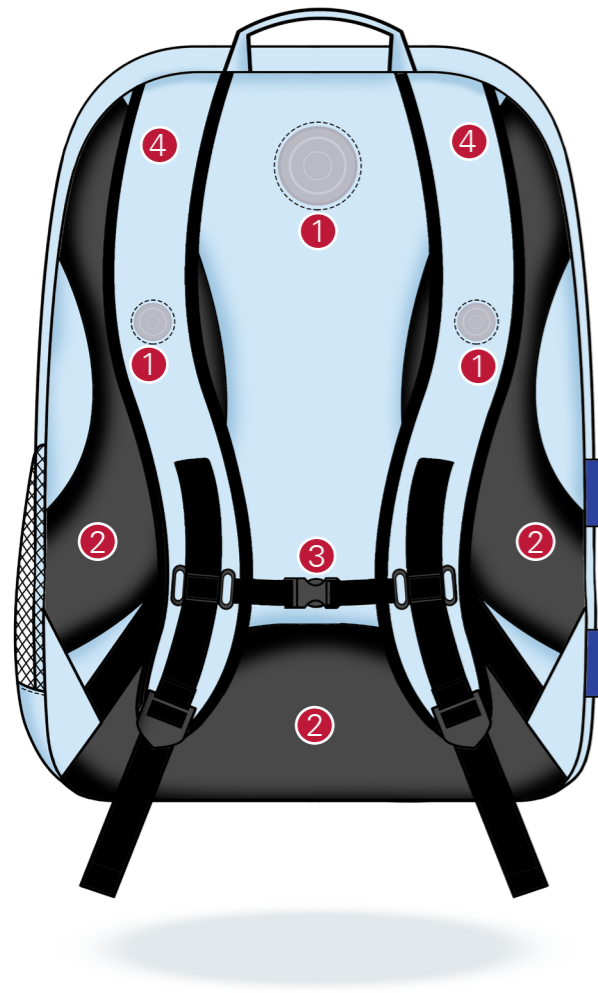
Francesca
6years old
Bresso, Italy

My class time is from 8 am to 1pm. But I need do some activities and homework at school in the afternoon and go back home at 5.30pm. My school is very near from home. Only 8 minutes for walk. I eat lunch in my school canteen and my parents prepare some fruites and snack for me. Every day after school I left my backpack at school because I don't need do my homework at home.



- **Lunch bag**
- **Crossbody purse**

The interaction ergonomic carrying system



- 1 Interactive vibration sensor**
- 2 3D ergonomic back padding**
- 3 Height-adjustable chest strap**
- 4 S-shaped belt**



The backpack interactive vibration sensors are connected to the parent's APP. Parents can set the child's age, height, weight, body tilt angle and maximum backpack weight. The sensors alert the child's bad posture by vibration. The reminder report will be fed back to the parents' APP to correct the child's bad habits in time.



Bags

DIY

Factors

APP

Service

[Backpack](#) [Gym bag](#) [Lunch bag](#) [Pencil bag](#) [Crossbody Purse](#)



The smart ergonomic backpack

The backpack ergonomic 3D back panel design reduces the stress on the back of the child. At the same time, the smart sensor is connected with the parent APP to help the child develop a good walking habit.

Details

Volume: approx. 15 Liter

Weight: approx. 800 g

[Discover now](#)



backpack gym bag lunch bag pencil bag crossbody purse



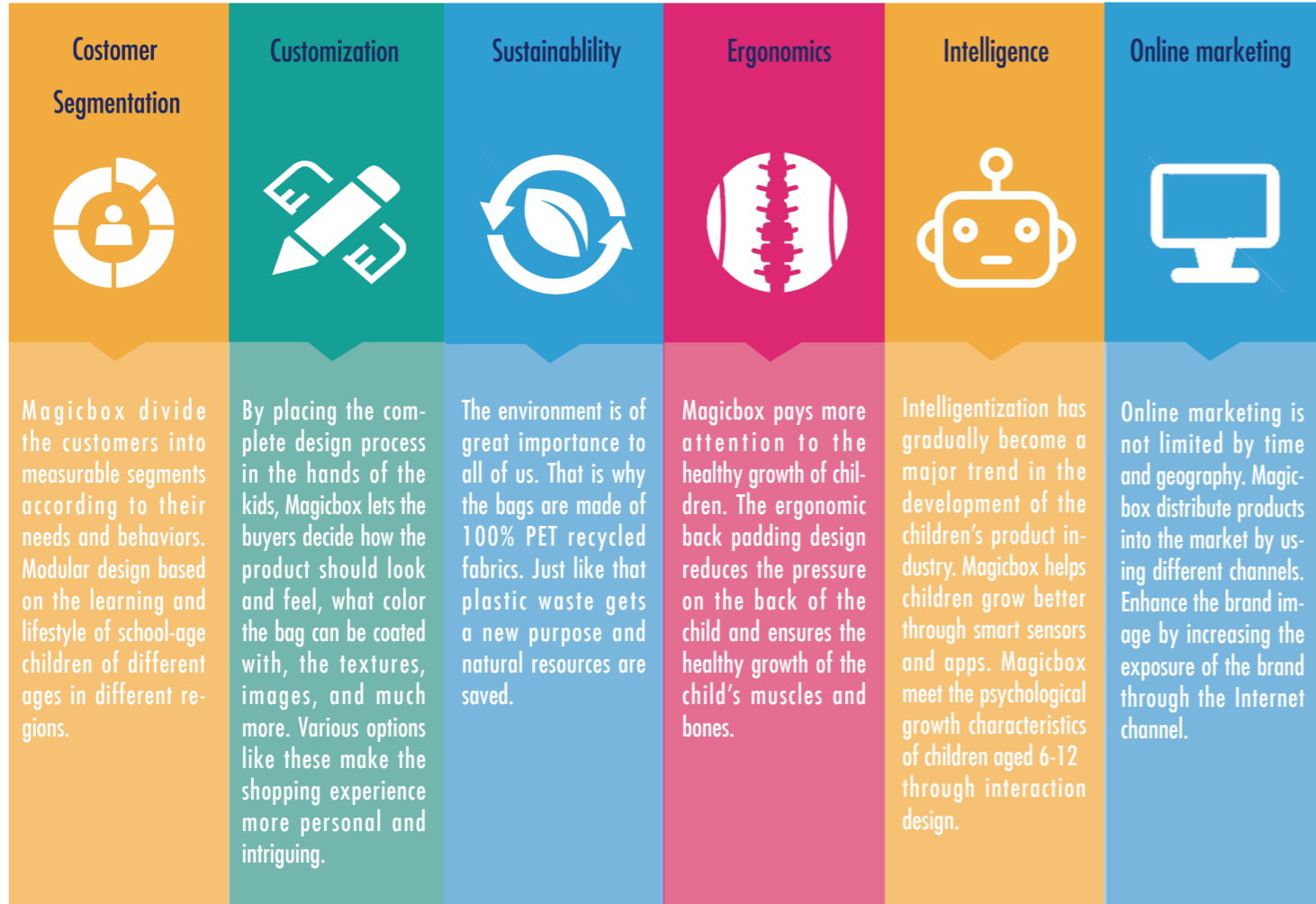
- Surface
 - Color swatches: brown, red, pink, orange, yellow, lime green, dark green, light blue, dark blue, purple, black
- Zipper
 - Color swatches: brown, red, pink, orange, yellow, lime green, dark green, light blue, dark blue, purple, black
- Pattern
 - Color swatches: brown, red, pink, orange, yellow, lime green, dark green, light blue, dark blue, purple, black
 - Color swatches: brown, dark red, maroon, brown, olive green, dark green, grey, dark blue, purple, pink, grey
 - Color swatches: purple, light purple, magenta, red, dark red, brown, light blue, teal, dark blue, olive green
- Frame
- Material

Creat now

Label and package



Marketing competitive advantage



Cost sheet

BRAND: MAGICBOX	DESCRIPTION: CHILDREN BAG
COOLECTION NUMBER: 5	SELLING PRICE:

1. MATERIAL	YARDS	PRICE	AMOUNT
RPET	3	10	30
AIR MESH	0.5	5	2.5
EPE	0.5	4	2
OXFORD	2	8	16
PVC500D	0.5	8	4

TOTAL MATERIAL COST 54.5€

2. TRIMMINGS	QUANT.	PRICE	AMOUNT
D-RINGS	6	0.2	1.2
ZIPPERS	5	2	10
LOBSTER CLIPS	6	0.2	1.2
BUCKLES	4	0.2	0.8
VELCRO	10	0.4	4
FOAM	1	2	2
NYLON STRAPS	1	5	5
LABELS	5	0.5	2.5
TENSION LOCKS	4	0.2	0.8
SENSORS	3	35	105

TOTAL TRIMMINGS COST 132.5€

3. LABOR	AMOUNT
CUTTING	50
SEWING	50
WEBSITE, APP	50

TOTAL LABOR COST 150€

4. TOTAL COST	AMOUNT
	337

TOTAL LABOR COST 337€

5. SUGGESTED RETAIL	AMOUNT
	599

SUGGESTED RETAIL 599€

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