



**Advanced design principles**

**W'innovate**

**Second project**

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**2018**

# What is hands-free lead and how it works?

The hands-free lead essentially is a waist belt with external attachments (metal rings) where the leads could be attached to. It is suitable for leading single or multiple dogs at the same time. The fact that the person is not busy holding the lead/s with one hand makes this lead perfect for jogging, hiking or even more extreme situations by having no contact with the person's hands.



Img.1



Img.2



Img.3

## Typical users

The belt lead is suitable for everyone! However, people with a passion for outdoor activities, sportive people, and owners of a large number of dogs might find the belt a necessity.



Img.4



Img.5



Img.6

# Reason to focus on this market

**The walking belts hold a very small portion of the pet care market and that is the reason why the market for this product is uniform and underdeveloped. The hands-free leads are normally highly overpriced simply because there is little to no competition. Therefore, Wilko could use this lack of competition and development as an advantage to take over the market by offering a better product at a competitive price.**

**I know W'innovate are willing to build Wilko's new brand name with products that can be easily recognised by their customers. For this reason, Wilko can build its new brand name by offering products that are specialised for a smaller particular market.**

## My aim

**During my research, I found out that people using belt leads very often struggle with back pain caused by the frequent use of the belt and the high amount of pressure applied to the lower back.**

**Thus I realised that these products must be focused especially on safety, comfort, and reliability. They have to withstand extreme pull forces, which can also cause serious back pain and even injuries.**

**My product must be centered around high-quality materials and great levels of comfort and safety.**

**I aim to design a belt lead that people could rely on for years. This goal can be achieved by:**

- the right choice of sustainable materials**
- a maximum level of comfort and ergonomics**
- modern, stylish, and practical design**
- a new development (internal or external) that can prevent back injuries**
- being suitable for everyone**
- washable (water resistant if possible)**

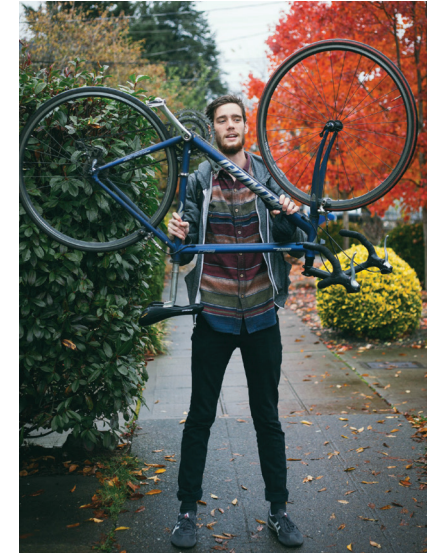
# What do people want?

## Target market

Since different people choose to buy and use different products, once I identify and segment my target group, I could start thinking about designing a product that will be more desirable and appeal to that specific market. This is why it is vital to find:

- who are the people who are in need of a belt lead
- what are the interests of my targeted market (how do people spend a regular day of their lives and that of their pets)
- what do people expect from the product
- what challenges do they face with the current products available on the market
- how can I improve the current product
- what challenges do they face with the available products

Img.7-12



# Customer/persona profile

Bryan is 34-year old physics teacher from Seattle, working in a local high school. He lives with his girlfriend and their three dogs in a small house at the outskirts of the city.

Bryan loves traveling and extreme sports. Every weekend he, his girlfriend, and their dogs go on trips to extreme destinations. They try to spend and enjoy as much time as possible with people, who like them live in a big city and have to return back to work on Monday.

Bryan considers their dogs as a part of the family, and he tries to take them with him on every trip. He uses various types of leads and methods to keep the dogs near him and still enjoy the weekend with his friends and girlfriend.

Having quality equipment is of high priority for Brian due to the fact that he and his friends like extreme sports and are very active. He needs to keep his three large dogs safe and at the same time free enough, so that he can enjoy his activities.



Img.13



Img.14-20

# My client

## Brand personality and reputation

**Wilko is one the biggest British retailer companies with more than 400 stores across the UK. Since the opening of the first store in 1930 in Leicester, Wilko's product diversity has not stopped expanding. Today, they are a place for household essentials, health products, kitchen and garden goods, stationery and more.**

**Wilko has also started its own label brand focusing on seasonal products, such as Christmas gifts, Easter decorations, and other accessories.**



Img.21



## W'innovate as a developer of the new Wilko brand name



Img..22,23

**W'innovate is a design consultancy part of Wilko Retail Limited. The team of 15 senior and graduate designers consists of product, surface pattern and print designers working together to create delightful yet simple products enhancing the everyday life.**

**They believe that nowadays' products should be environmentally friendly and the needs of the people should come before every current trend.**

# Wilkinson stores

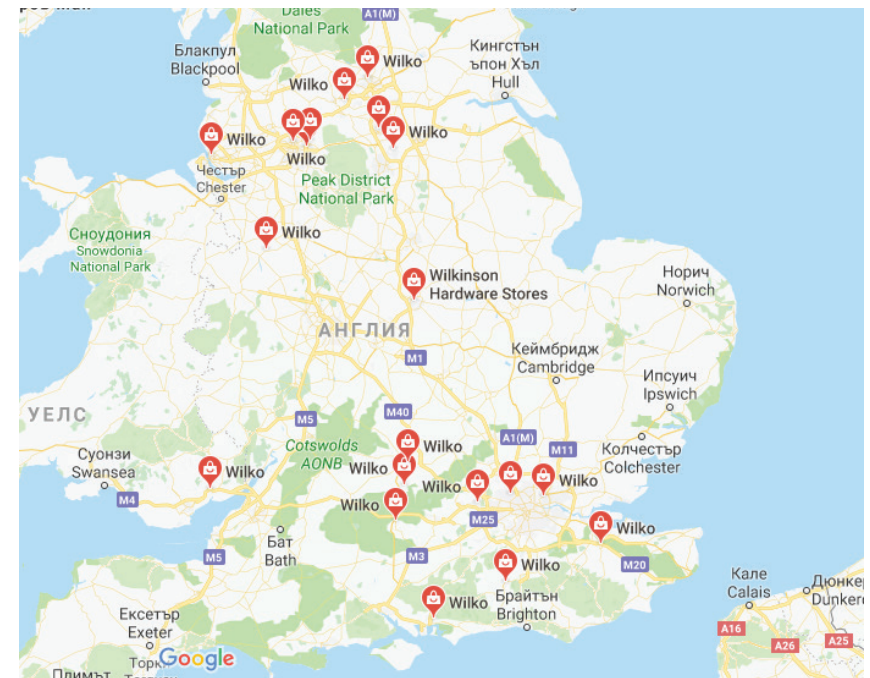
I visited two Wilko stores in Sheffield with a mission to find out more about Wilko's trends and what they offer in their stores in terms of pet care products.

I found numerous accessories and toys for a broad sort of animals including small birds, rodents, rabbits and so on.

What made an impression on me was the consistent use of plush in almost every toy.



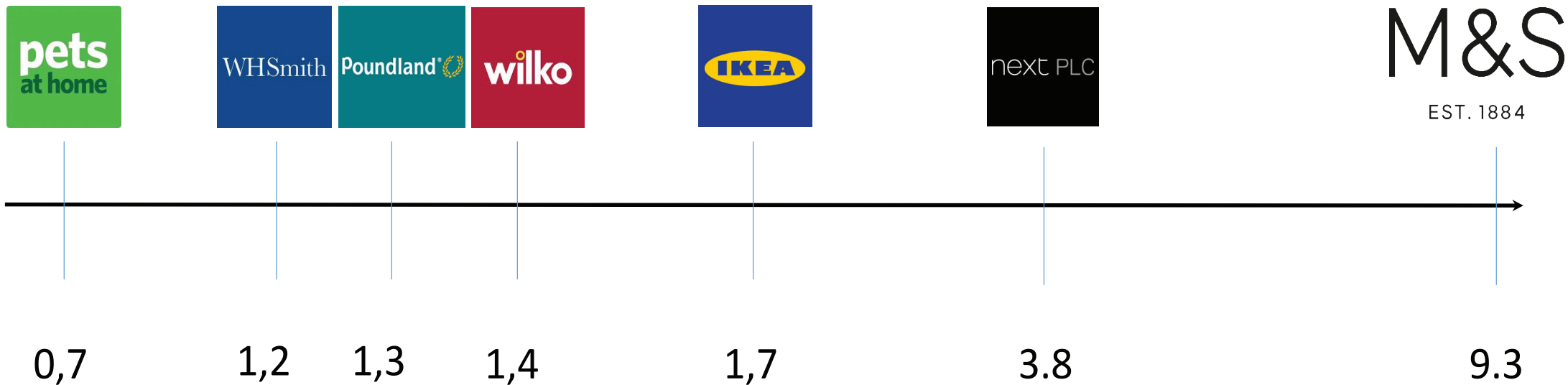
**Wilko stores Sheffield**  
(34-36 Haymarket, Sheffield S1 2AX), (41-43, The Forge, Boston St, Sheffield S2 4QF) (2017)



Img.24  
Largest Wilko stores across the UK, Google Maps

# Who are Wilko's competitors and where does Wilko stand on the table?

UK retail companies by sales and overall revenue in 2015-2016 in billion pounds.

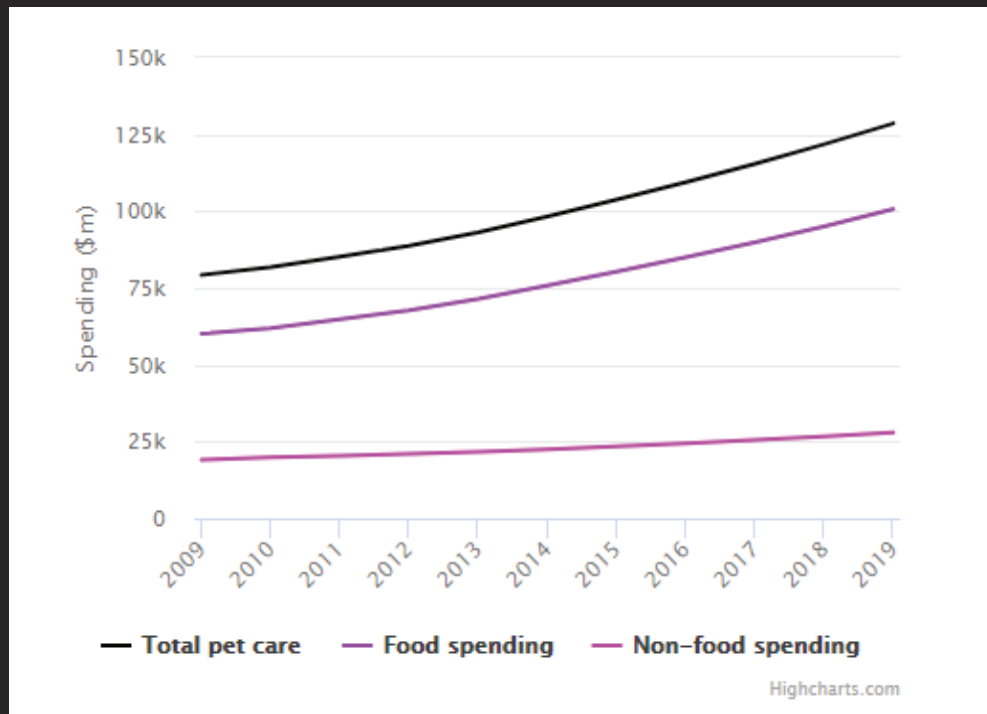


Source: RetailWeek. (14 FEBRUARY, 2017). Data: Top 50 retailers by sales during 2015/16 financial year. Retrieved from <https://www.retail-week.com/data/data-top-50-retailers-by-sales-during-2015/16-financial-year/7018511.article>.



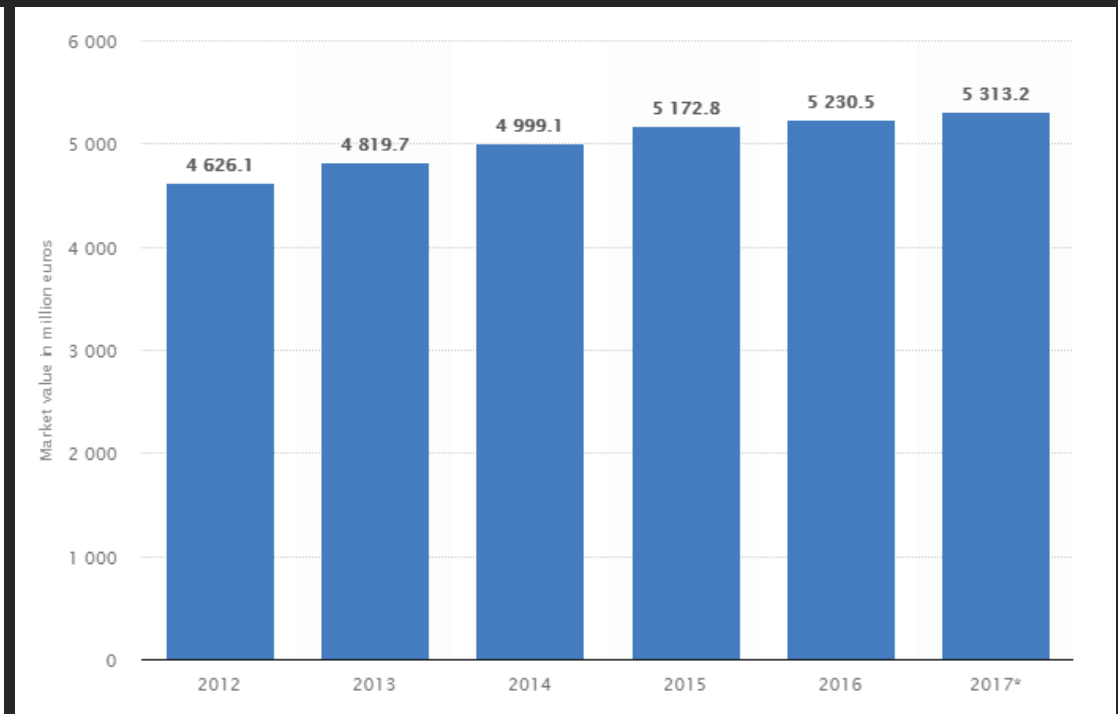
# Pet care products' market

## Global pet care spendings in 2009-2019 in US dollars



Graph. 1

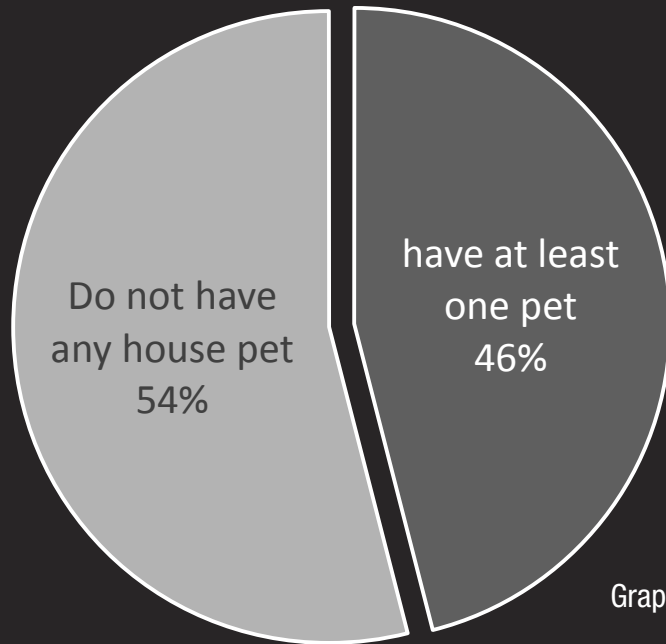
## UK pet spendings over the last five years in million euros



Graph. 2

I performed a market investigation of the global pet care spendings, as well as that of the pet care spendings in the UK alone. In 2015 for the first time, the global spending on pet care products like food, accessories, clothing, toys, etc. has surpassed 100 billion dollars. More interesting is that the UK is one of the biggest contributors to these numbers reaching 5,3 billion euros this year.

The two charts represent the predicted steady and constant increase of spendings on pet care worldwide.

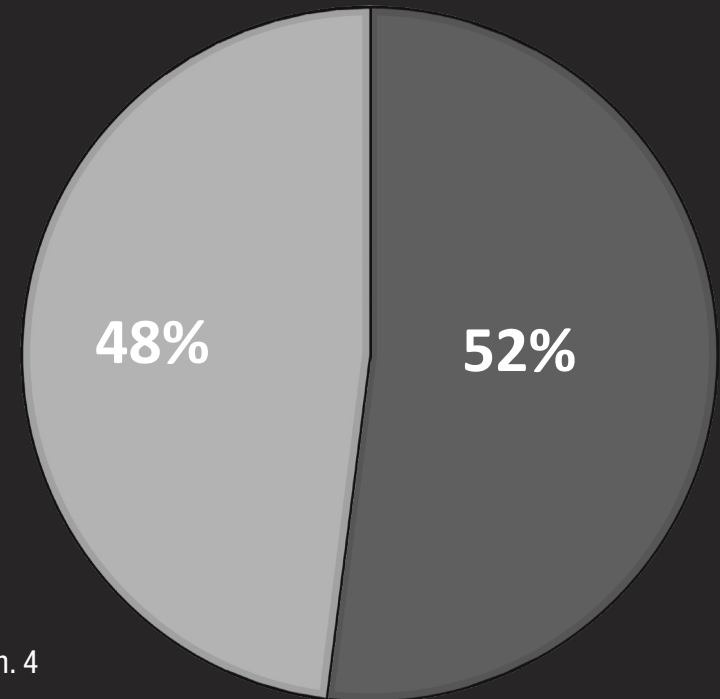


According to a study by “Visit Scotland”, there are 26,08 million households in the UK (as of March 2016). 46% of these households have one or more pets at home. This amounts to 12 million households with pets.

have at least one pet   
  do not have any pet

Moreover, 52% of these twelve million households have a dog for a house pet. These percentages account for around 8,5 million dogs, or in other words, more than half of the UK's pet owners have a dog.

Having that information from my research in mind, I focused my thinking in the direction of designing a product for the dog market.



dog   
  other animals

# First-hand observational research - Visit to a local dog asylum

RSPCA is a animal care and rehabilitation center based in Sheffield. I contacted a representative of the center explaining the intention of my visit while keeping my client's confidentiality. When the meeting date was set, I started to prepare a list of questions aiming to gather useful information for my project. Before I went to the dog's asylum, I also made a list of things that I had to accomplish on the first meeting to later help me decide the direction of my design idea.

On the day of the first meeting, I spoke with a senior employee of the asylum who openly showed an interest to help me collect the data for my research. I asked her many questions regarding all types of equipment they use in the center: what type of equipment is most frequently used in the center; what advantages and disadvantages do the employees face when using the equipment; what would they change in the gear the center carries, etc.

After I gathered all the information I needed, I managed to arrange another visit to the center, but this time to see the actual process of how the employees there interact with the animals - walking the animals, feeding them and examining the dogs' behavior.

RSPCA Sheffield (2017)



RSPCA Sheffield (2017)

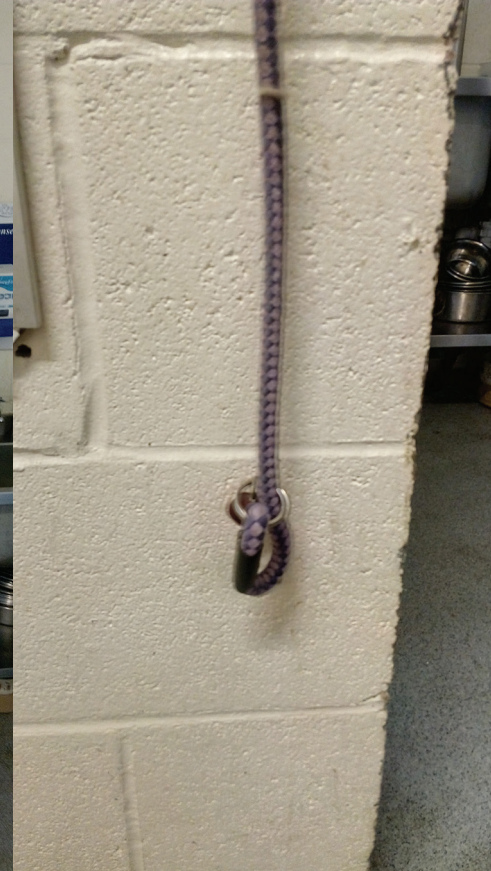




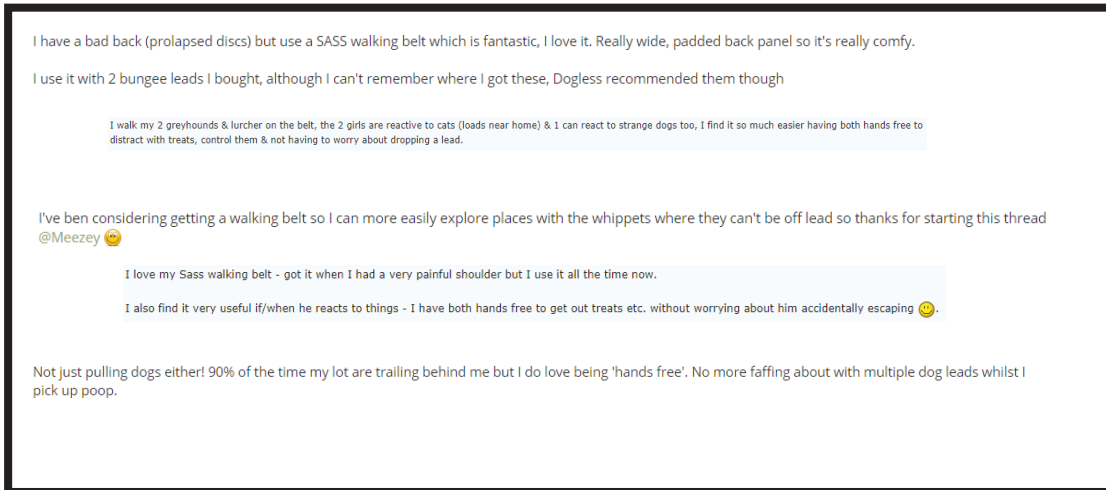
During my second visit, a member of the team in the dog's center showed me the place from the inside.

Every single dog in there was wearing a collar as well as a harness, which the employees call "two save points" protection. This means that if either the collar or the harness is damaged in any way, there will always be the other one to help keep the animal safe.

The importance that the center places on safety was a breaking point for me. I realised I will need to put special effort into finding the best protection when designing my product.








# Secondary research - online data, forums, reviews



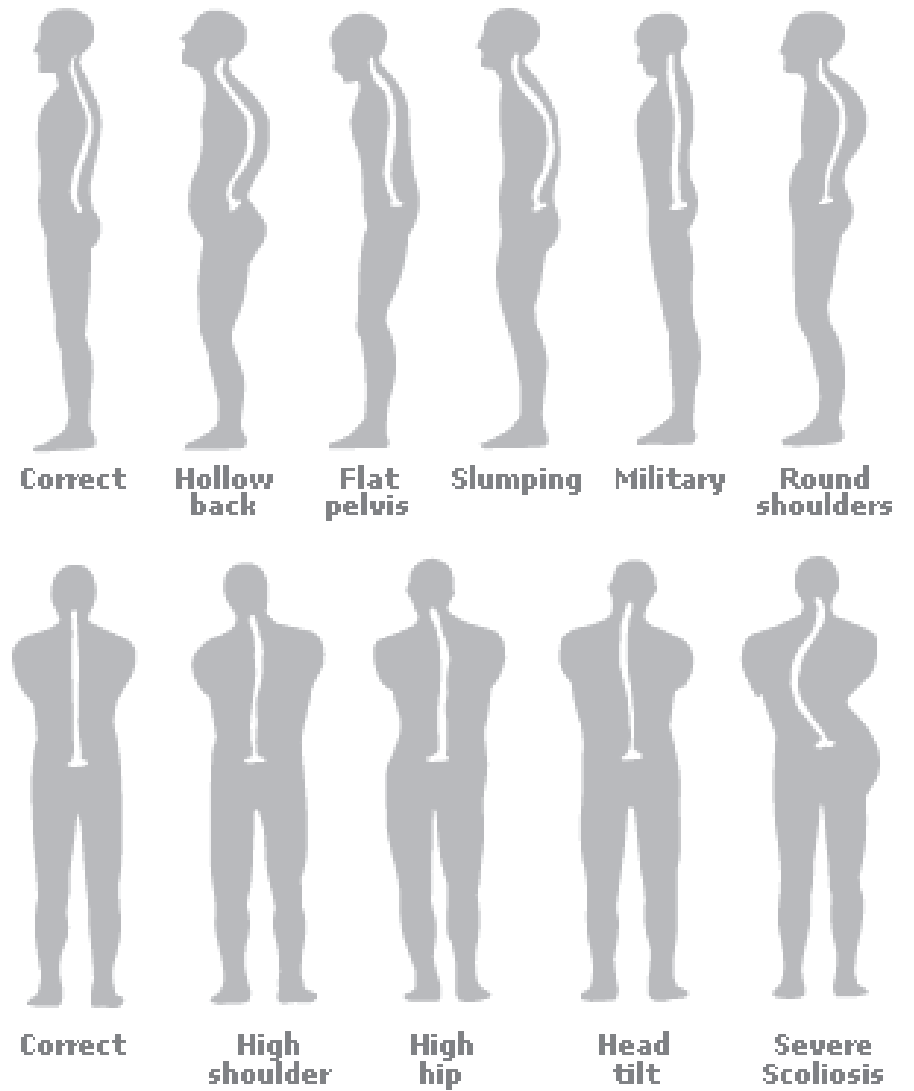
User's comments; (links in the reference page)

**There are 339 recognised dog breeds in the world which can be categorised by their size and posture. The amount of force applied to the lead can be determined by multiplying the weight of the dog and its initial acceleration. During the research, I found that even medium dog can generate enough amount of force to put a person out of balance. However, this amount of force can be greatly reduced by using shock absorbing materials that can take large amounts of the applied force.**

**After reading different forums and reviews from people who regularly use a belt lead for their dogs, I found valuable information regarding the design of my product. A large percentage of people complain from serious back pain caused by the pressure applied to the lumbar area of the back.**

Dog Size		Dog Weight		Examples of Breed
		lbs	Kg	
	Extra Small	1 - 10	1 - 4.5	Yorkies, Chihuahuas, Pomeranians, Maltese, Papillion's
	Small	11 - 25	5 - 11.5	Jack Russell, Dachshunds, Boston Terrier, Bichons Frises, French Bulldog
	Medium	26 - 40	12 - 18	Beagles, Miniature Schnauzers, Cocker Spaniels, Cavalier King Charles
	Large	41 - 70	18.5 - 32	Boxer, Bull Dog, Basset Hounds, Springer Spaniels, Labradors, Border Collie, Dalmatian
	Extra Large	71 - 100	32.5 - 45	Golden Retrievers, Standard Poodles, Boxer, Alsatian, Rottweiler

Since I am designing a product that will be worn by the pet's owner, the core idea is to provide the customer with high levels of comfort and safety for their back. The best way to prevent oneself from unwanted injuries is by keeping a correct body posture.

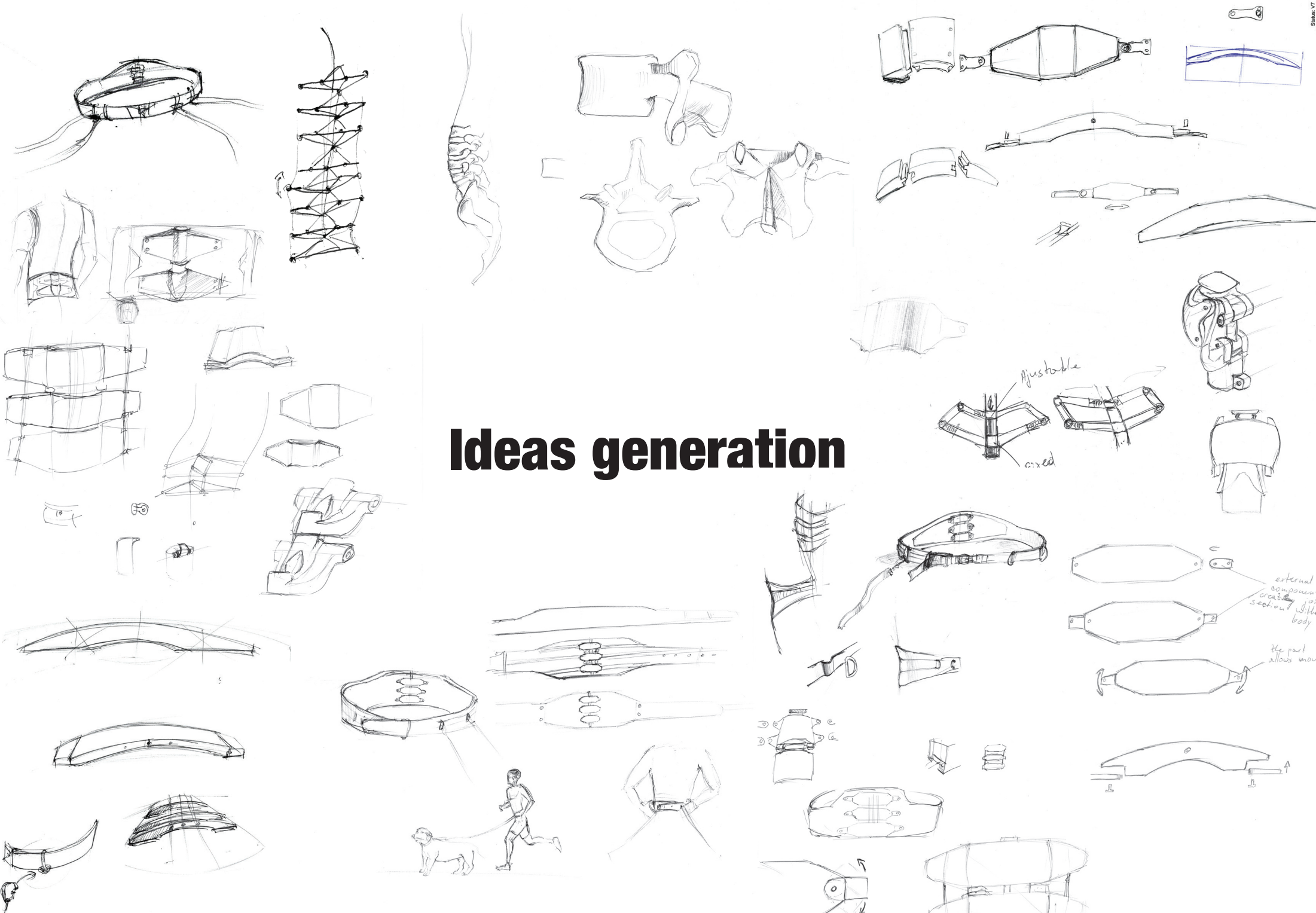


Img. 26

## **Belt lead with exoskeletal mechanism**

**After finding out that many users of hands-free leads are currently complaining about the pain caused by their belts, I wanted to design a mechanism that would help prevent people from back injuries. This mechanism will play the role of a simple exoskeleton-like feature. It will be attached to the inside of the belt lead, so that the mechanism can lay flat on the lower back of the person wearing it. Moreover, the addition of an elastic silicon tube to the mechanism will act as a shock absorbing system by keeping the pressure away from the spine. Overall, the inclusion of the exoskeletal mechanism and the elastic silicon tubes will aid people in keeping a correct posture when wearing the belt. Therefore, the users will feel less back pain and suffer from fewer injuries.**

# Ideas generation



adjustable  
fixed

external component creates joint section with body

the part allows movement



# Design inspired by nature - Biomimicry

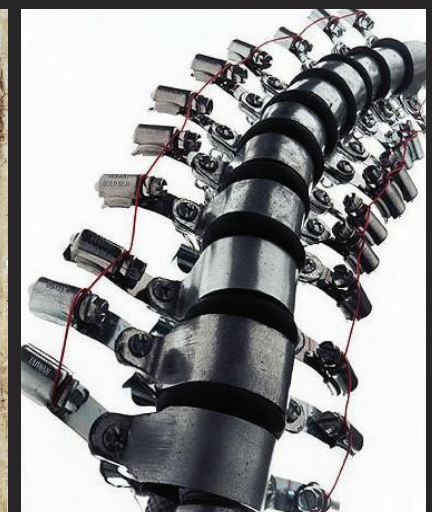
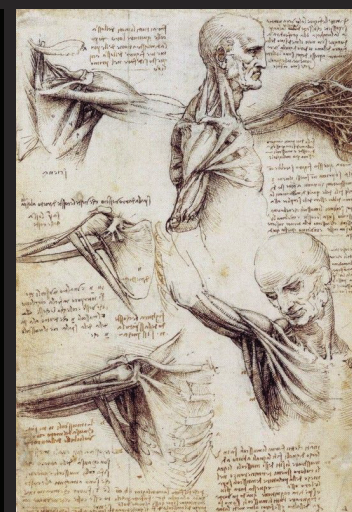
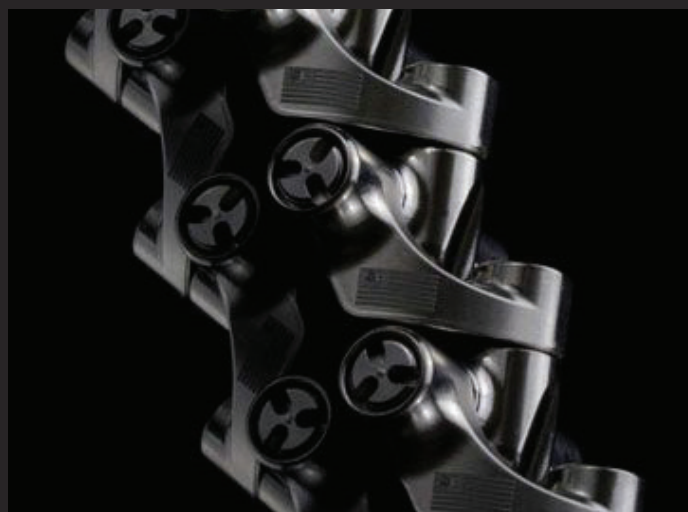
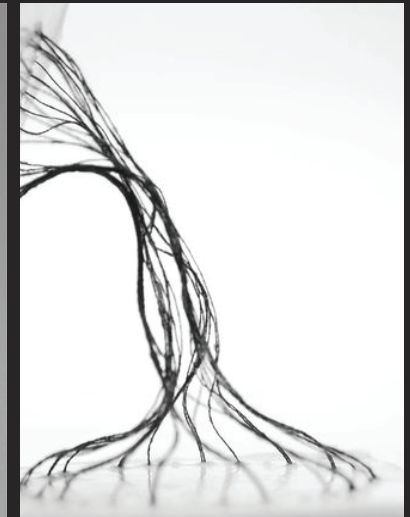
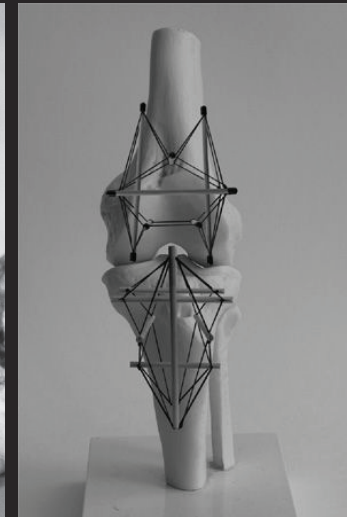
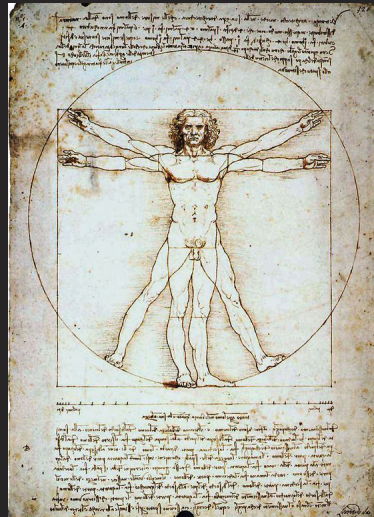
Img. 27-33

**“Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature’s time-tested patterns and strategies.” - Biomimicry Institute.**

**I examined and extracted principles of the human spine - its form, movement, and posture - by using several studies and articles. The design of my mechanism was purely inspired by the freedom of movement of the human spine. Studying human motion is achieved through a cycle of testing, finding and applying until the next step is discovered, which consequently will lead to repeating the cycle again.**

**Nature is driving design!**

**We as humans are surrounded by genius examples of million years of evolutionary progress. The decisions the designers make today are very often based upon realising and discovering the sustainability of the natural design processes.**





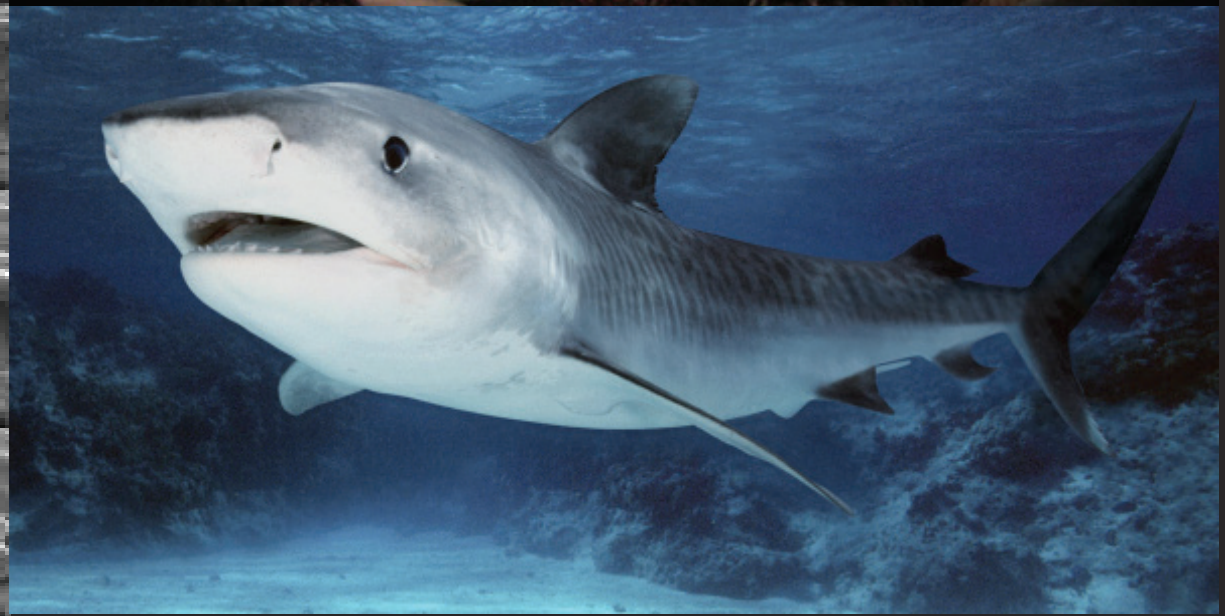
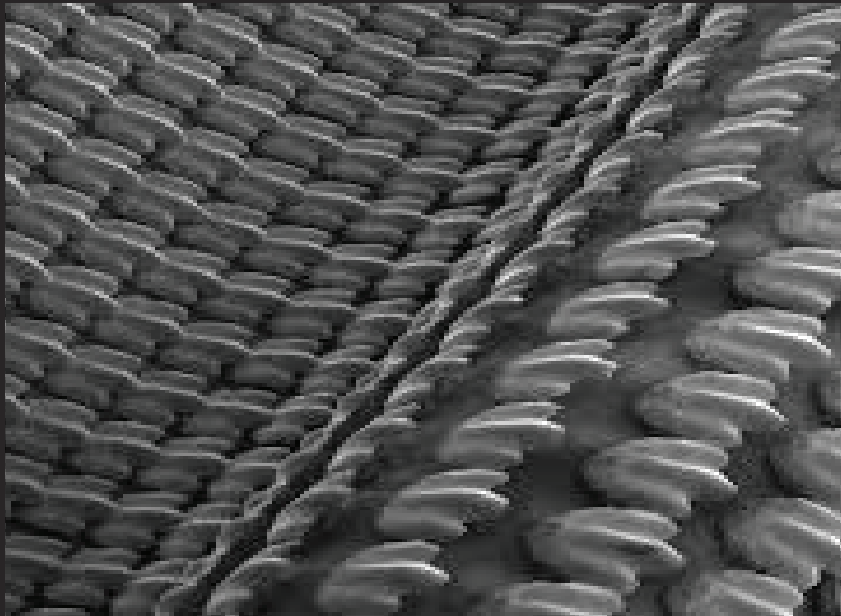
Img. 34,35  
**Japanese bullet train  
R500 Shinkansen and Kingfisher**



**Recently, I have started paying more attention to the objects surrounding us: their architecture and the general way our world is designed on principles as simple as an ant colony. I came to the conclusion that good design is not necessarily about innovation, but about implementing what we already know and exists in nature, and by applying these fundamental principles to our lives in order to make them simpler, sustainable and more complete.**

**The 2008 Speedo swimsuit line emulated the shark skin pattern and applied it into their swimsuits. That same year, 65 Olympic and 25 world swimming records were broken.**

Img. 36-38



# Exploring the genius of the human anatomy

Instead of looking for a new and innovative solution for my design, I decided to use the principles of our naturally created spine.

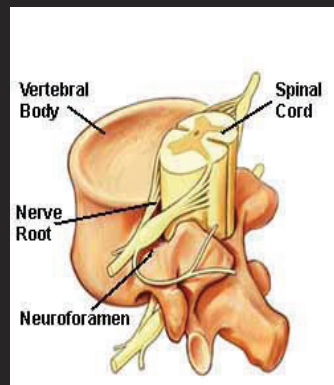
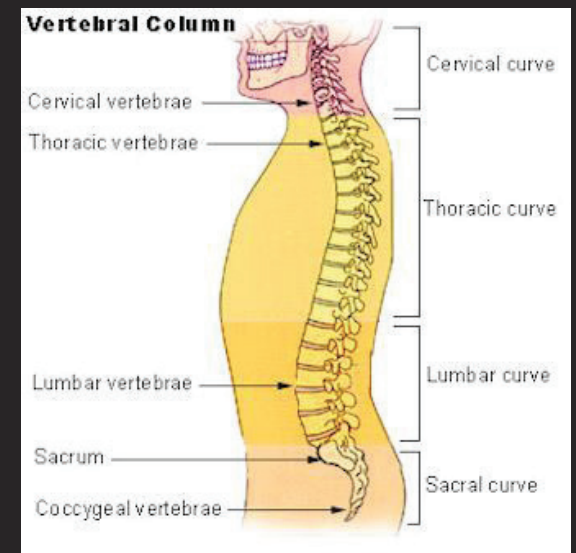
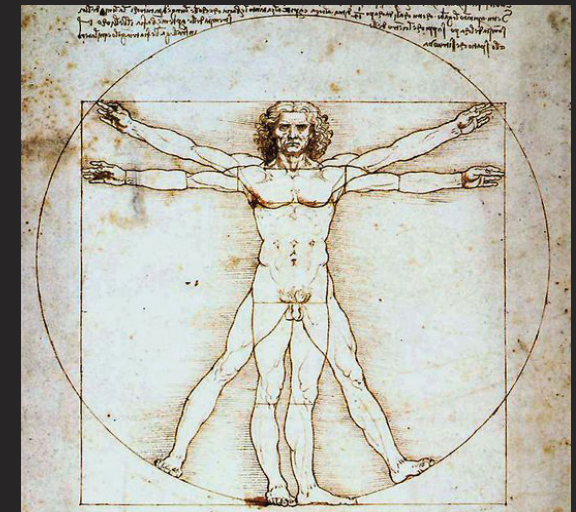
I started by exploring the position of the spine and how every bone structure in our bodies is somehow related to it and rely on in a different way. It provides posture and also flexible movement in every direction. The human spine also known as the vertebral column has 33 bones positioned vertically in 4 regions - 7 vertebrae in the cervical region, 12 in the thoracic region, 5 in the lumbar region, 5 in the sacral region, and 4 in the coccygeal region (which is a part of the sacral region).

Knowing that the principal idea behind my product is to provide comfort and safety to its users, I began a profound examination of how the joints in the lumbar vertebrae function. The five vertebrae in this region carry most of the upper body weight and, for this reason, this area is most prone to degradation and injury. Thus, they are the largest bones in the vertebral column. The spine curves naturally inward.

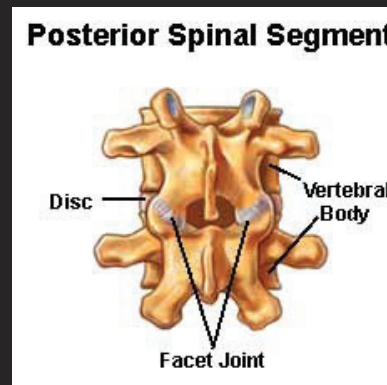
The vertebral bodies are linked together by spinal joints (facet joints) located in the upper and lower extension of the back side of the vertebral column. In addition, soft tissue discs prevent friction between the vertebral bodies. (Img. 42 and 43)

The center of each bone of the spinal column has a hole through which the spinal cord passes and connects the base of the skull to the bottom of the spine. The spinal cord is made of white and gray matter just as the one in our brain. There are 31 spinal nerves in the spinal cord, whose main function is to help us move and feel. (Img. 41 and 43)

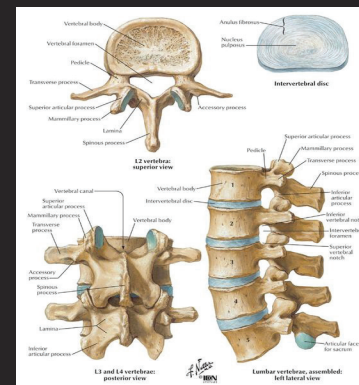
I tried to apply this extensive research foundation in my design and use it as a base for the improvement of my product.



Img.41



Img42



Img.43

# Prototyping and testing the mechanical principles

The creation of the prototyping phase began with merging my ideas with what I have learned from discovering about the human spine, my visit to the dog shelter and by applying the working and already existing principles of the human spine.

Before beginning the prototyping process, I had to find answers to a few more questions concerning the direction I was going to take:

- can I make all parts of the mechanism the same size, since this way the production process will be more efficient
- what size do the parts need to be
- where could the connection points be located
- how could I achieve free movement in all directions
- what material should I use for the shock absorbing tissue
- how could the mechanism be mounted on the belt

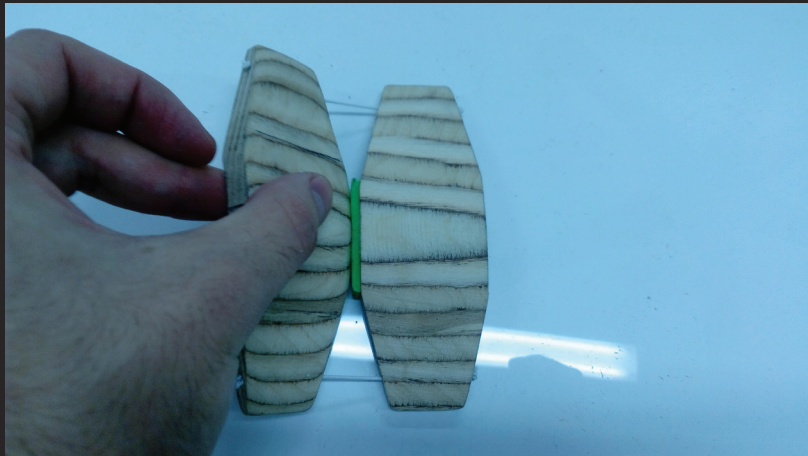
For the first prototype, I chose to use solid plywood.

The form of the parts follows a slight curve bending backwards, so that the mechanism would have a comfortable contact with the actual spine. I wanted to keep the form of the mechanism as natural as possible and yet make all the mechanical components visible. The idea of the first test model was simple: two holes were drilled through the left and right sides of each plywood part. In order to make sure that the holes are aligned, I used a vertical milling machine. Then I slipped an elastic cord through the holes creating two connection bridges between the parts. This allowed the mechanism to have a free and flexible movement.

To prevent friction between the parts, I glued a piece of foam to their side (where the two parts are in contact with each other).

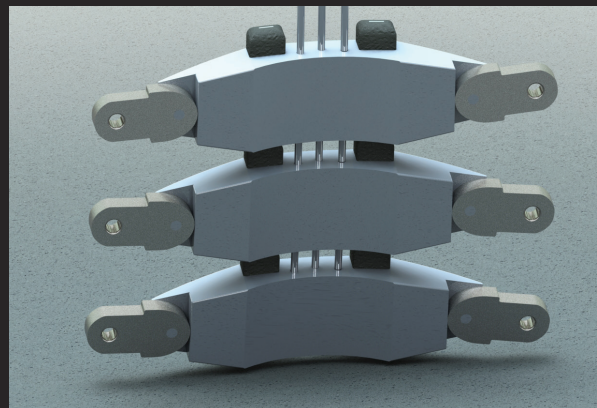
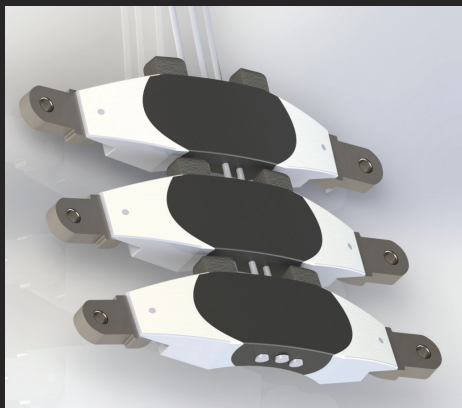
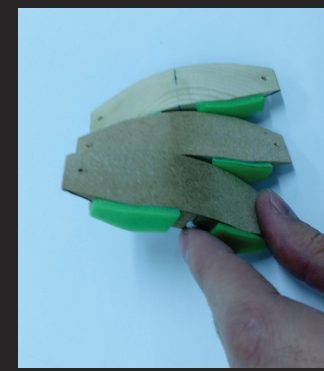
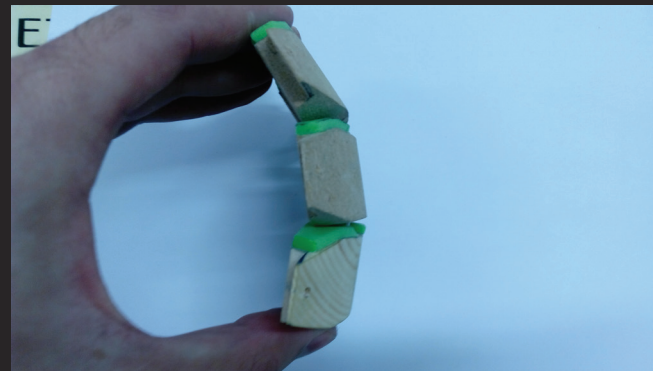
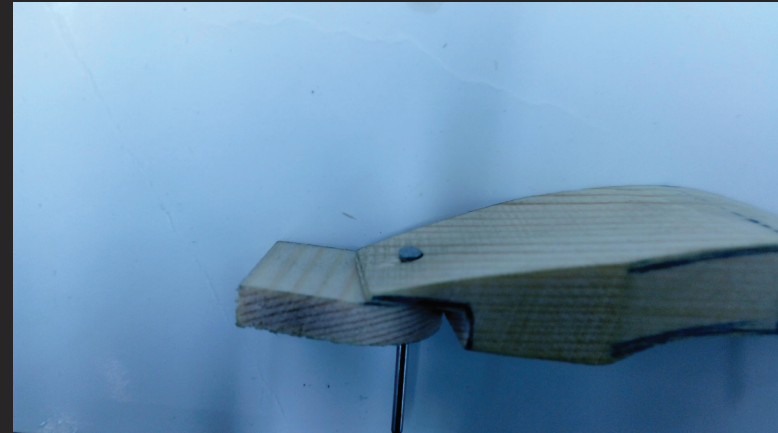


## First prototype



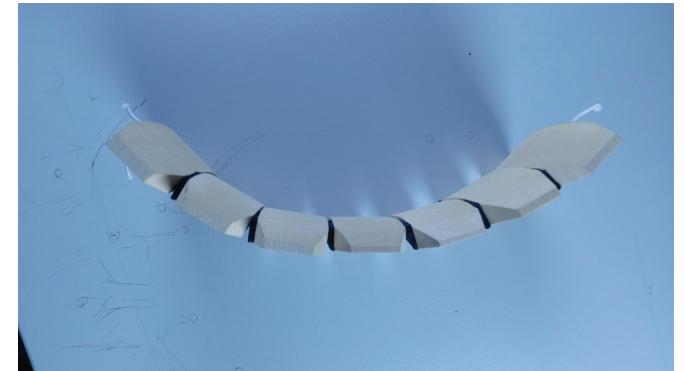
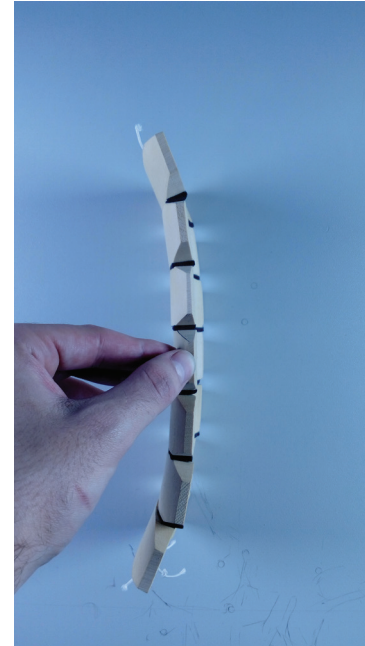
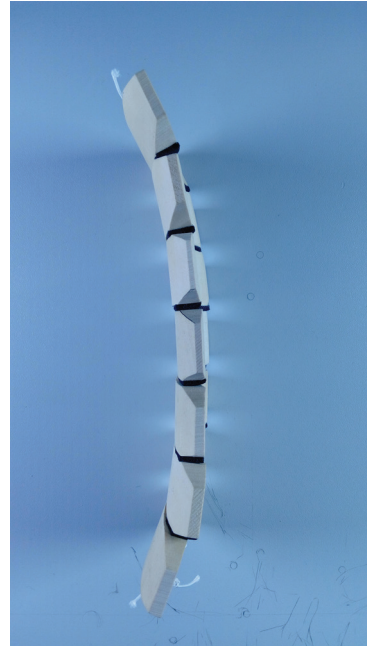
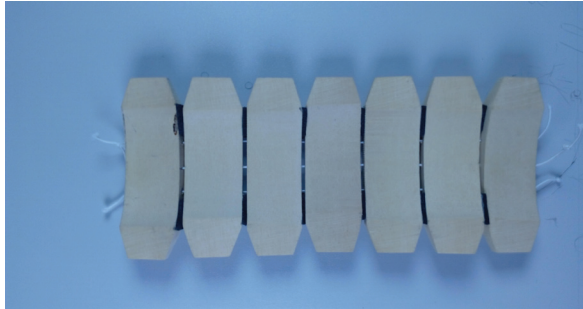
The prototype acted just as I expected and had a full range of motion causing no friction between the parts. The green foam material was a good solution because it absorbed the pressure that was applied to the surfaces of the parts. However, I was concerned about the way I was going to attach the mechanism to the back of the belt so that it could function properly. That concern led me in the direction of improving my design, and I went back to the drawing board for the second time.

## Second prototype

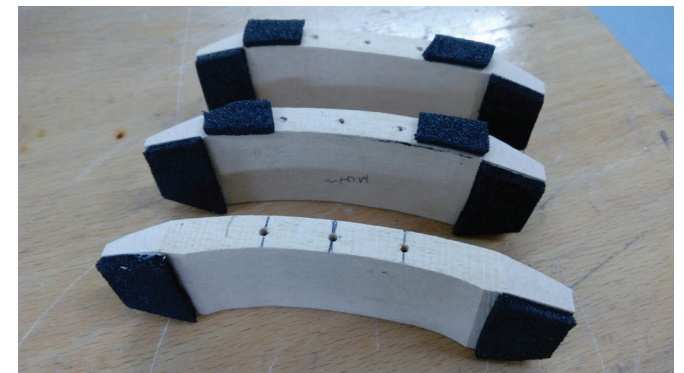


The second prototype did not vary much in terms of visual appearance from the first prototype design. However, external components and hinge joints were added with the mission to distribute the pull forces. This way, the distribution points became three, which made the entire mechanism more balanced. Also, this time I used only one elastic-cord strip connecting the parts in their dead center. I started work on Solidworks at a very early stage of this project. I had to be sure that the prototypes I was developing in the workshop would work in the CAD program.

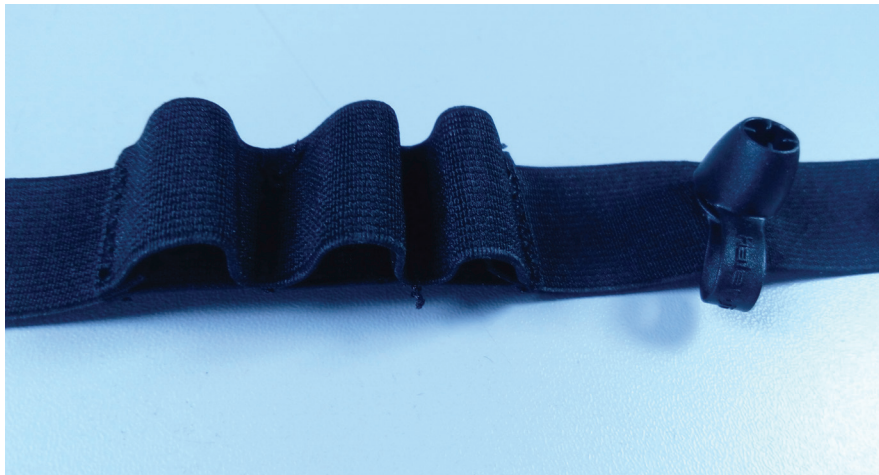
## Third and final prototype



**The third prototype, which I also used as my final test product, had a slightly different form from the previous two. Each component had a smaller radius of the main curve compared to the previous prototypes, and they were also slightly smaller in their overall shape. The most noticeable difference is probably the three elastic cords that go through the separate parts. The three cords keep the parts tightly together and prevent them from spinning disorderly. Also, the tension applied over the body of the person during the left, right, back and forth movements is distributed equally over the three elastic cords.**

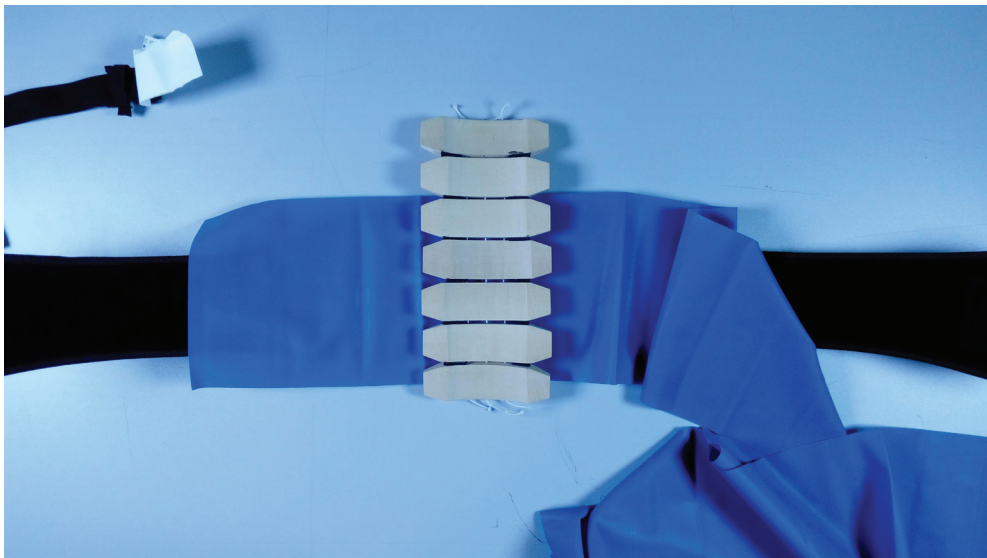






**For the physical tests, I had to make the belt out of materials that are easily accessible and at the same time durable.**

**I used a weightlifting belt made from strong material similar to the materials used in backpacks. Yet the belt was lined with soft cushion from the inside. Next, I used a running belt that has six added folds, and I sewed it to the weightlifting belt in order to attach the metal rings needed for the dog leads. By using this running belt, I can show how the actual locking mechanism (the belt buckle) I will be using in my final CAD model will look like, as well as the locations of the metal rings. Last I went to the fashion studios in the old post office building, and I stitched up the running belt to the back side of the main belt. The small pockets that the belt has allows metal rings and carabiners to be hooked up.**

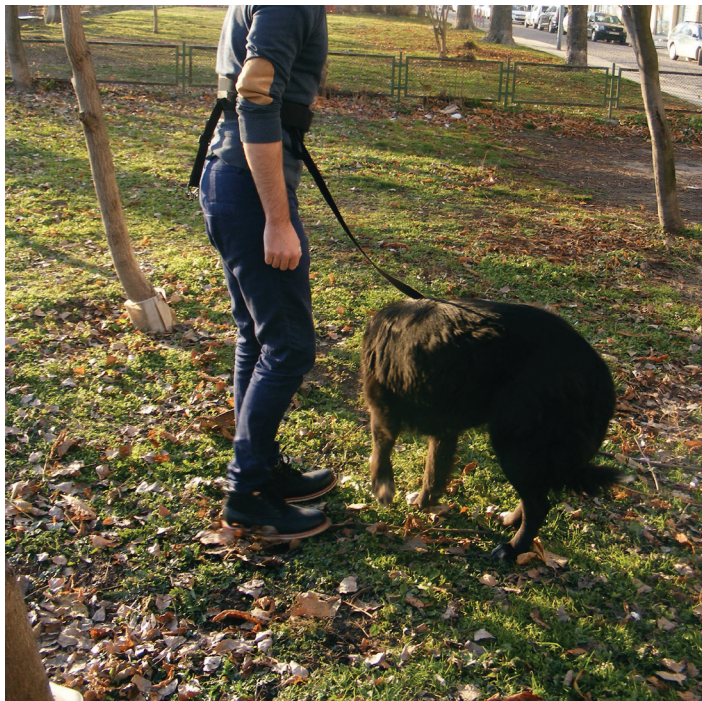


**In order to recreate flexible neoprene fabric, I bought some rubber material used for light exercising. I had to apply it to the inside of the weightlifting belt, so that once the exoskeletal mechanism has been attached, it would keep all of its functions. I glued the rubber fabric and then the mechanism by using a super glue.**



# Testing

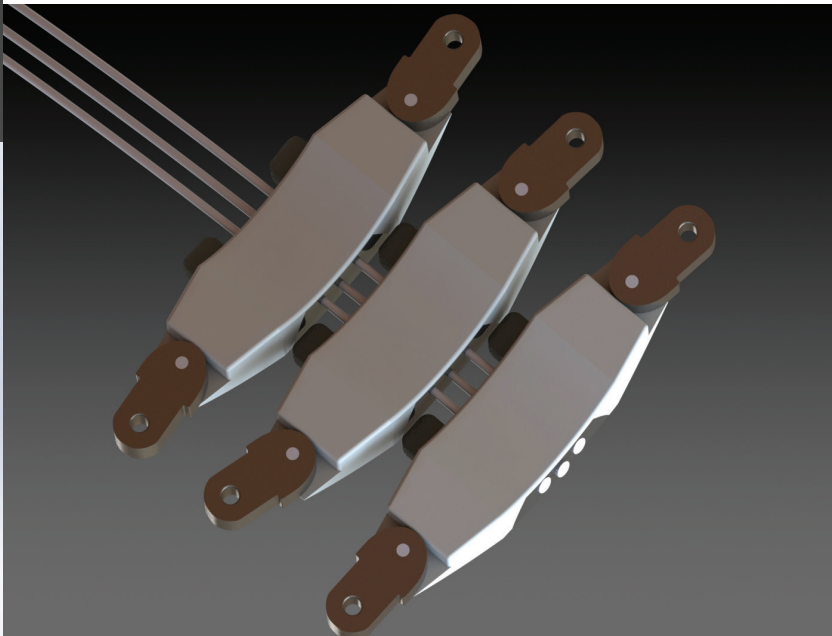
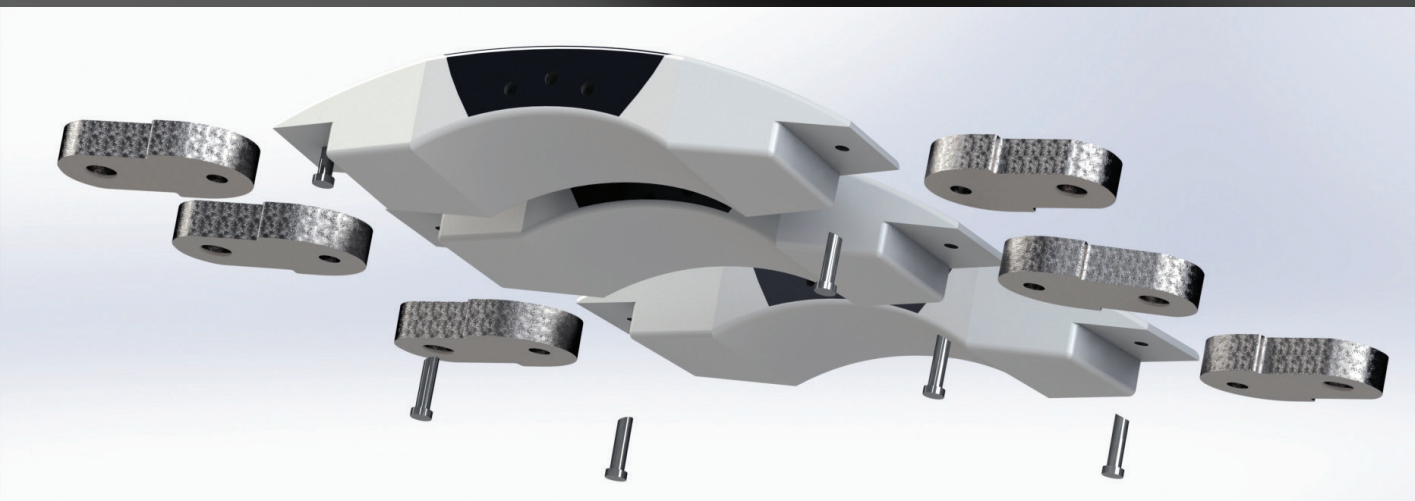
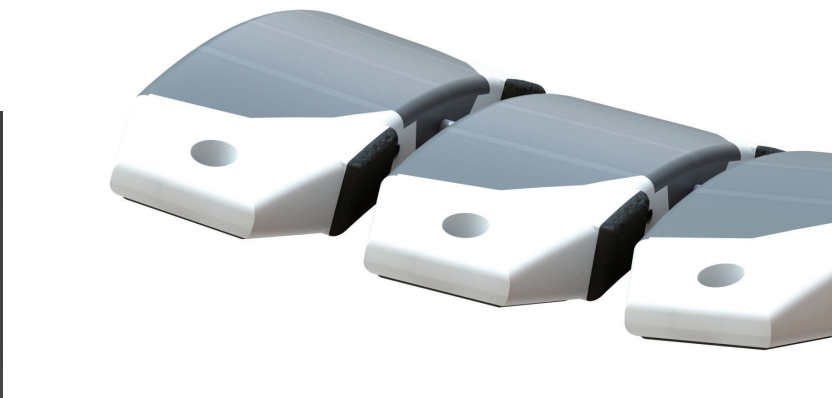
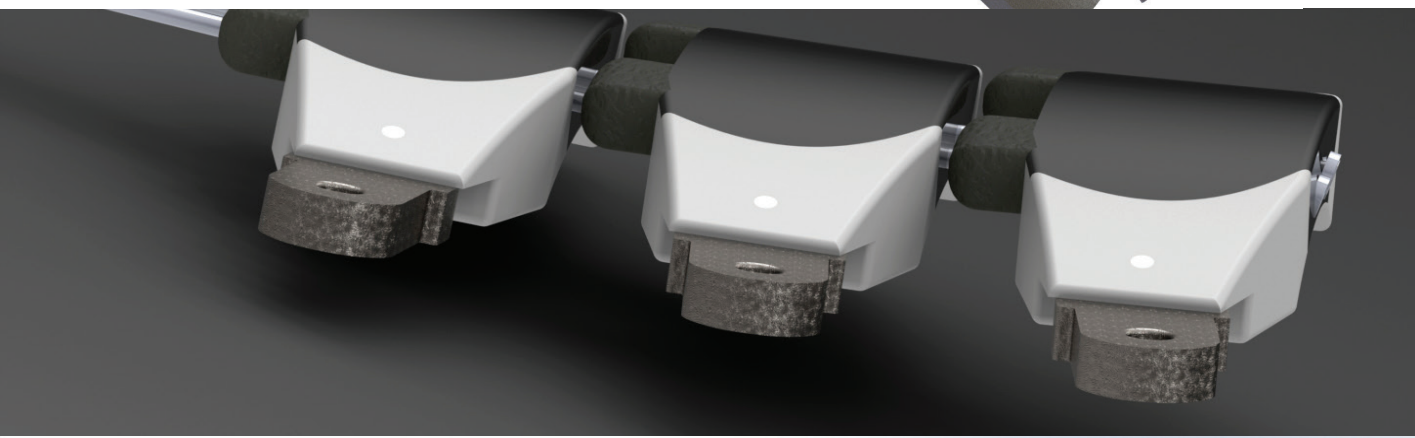
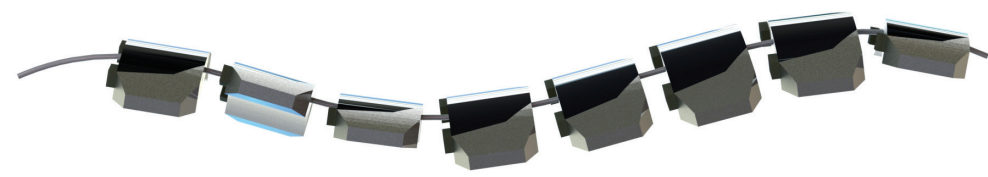
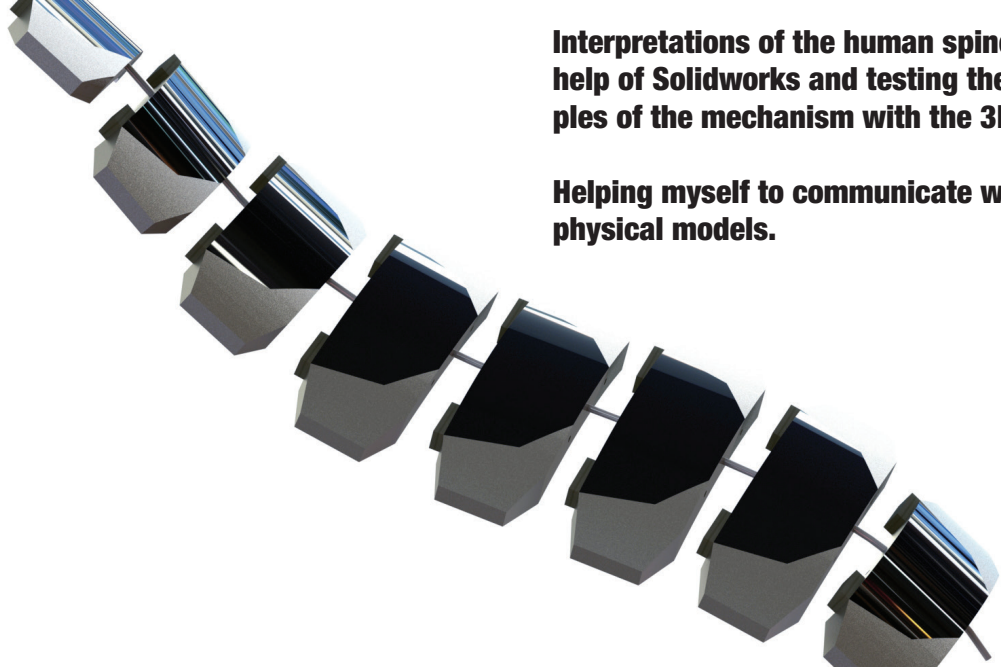




**The pictures illustrate the real-life testing of my test product. In order to prove the efficiency of my design, I had to find dogs of larger breeds.**

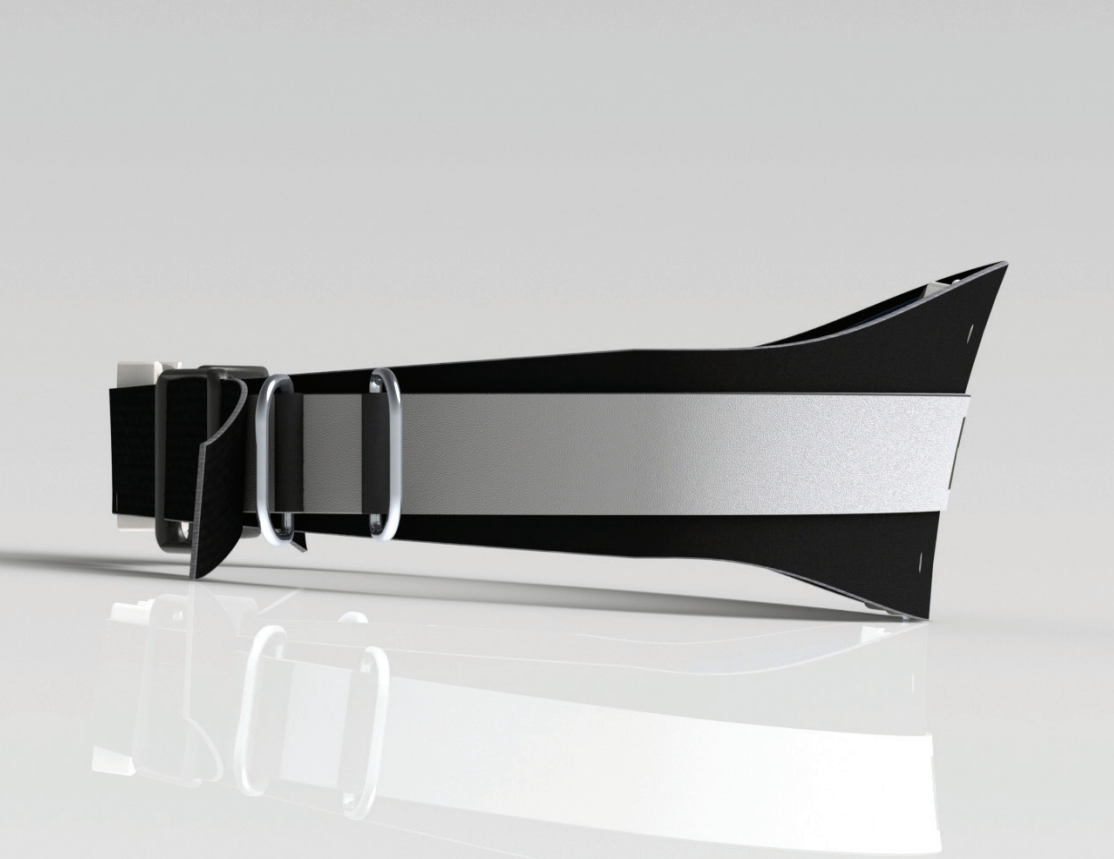
**Interpretations of the human spine with the help of Solidworks and testing the principles of the mechanism with the 3D program.**

**Helping myself to communicate with 3D and physical models.**

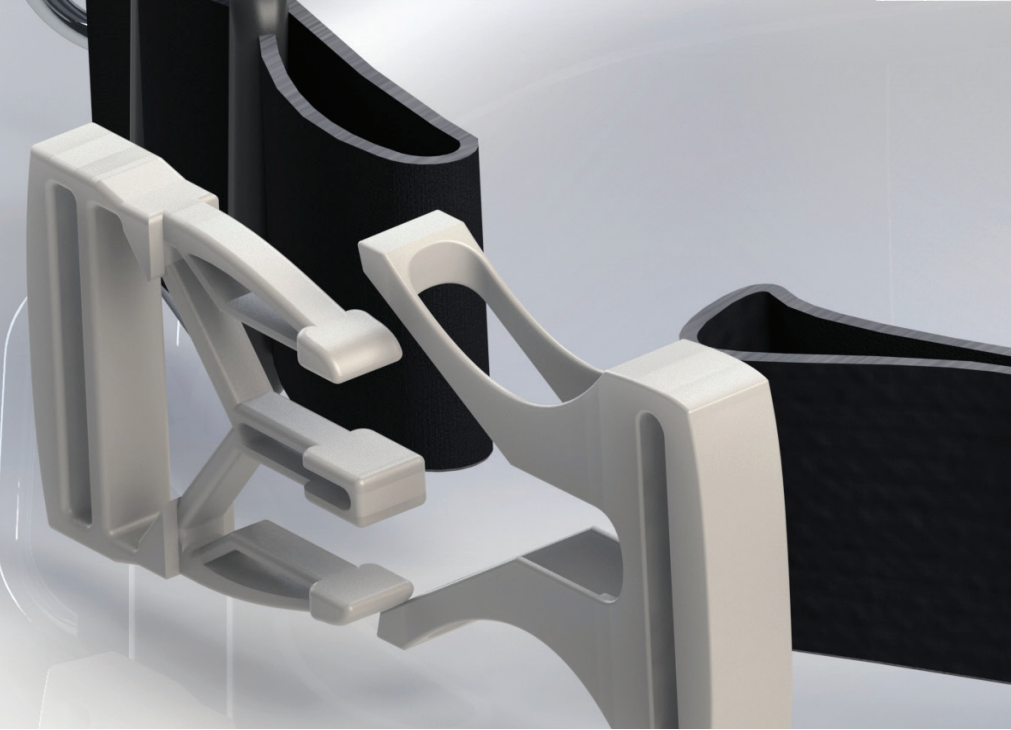
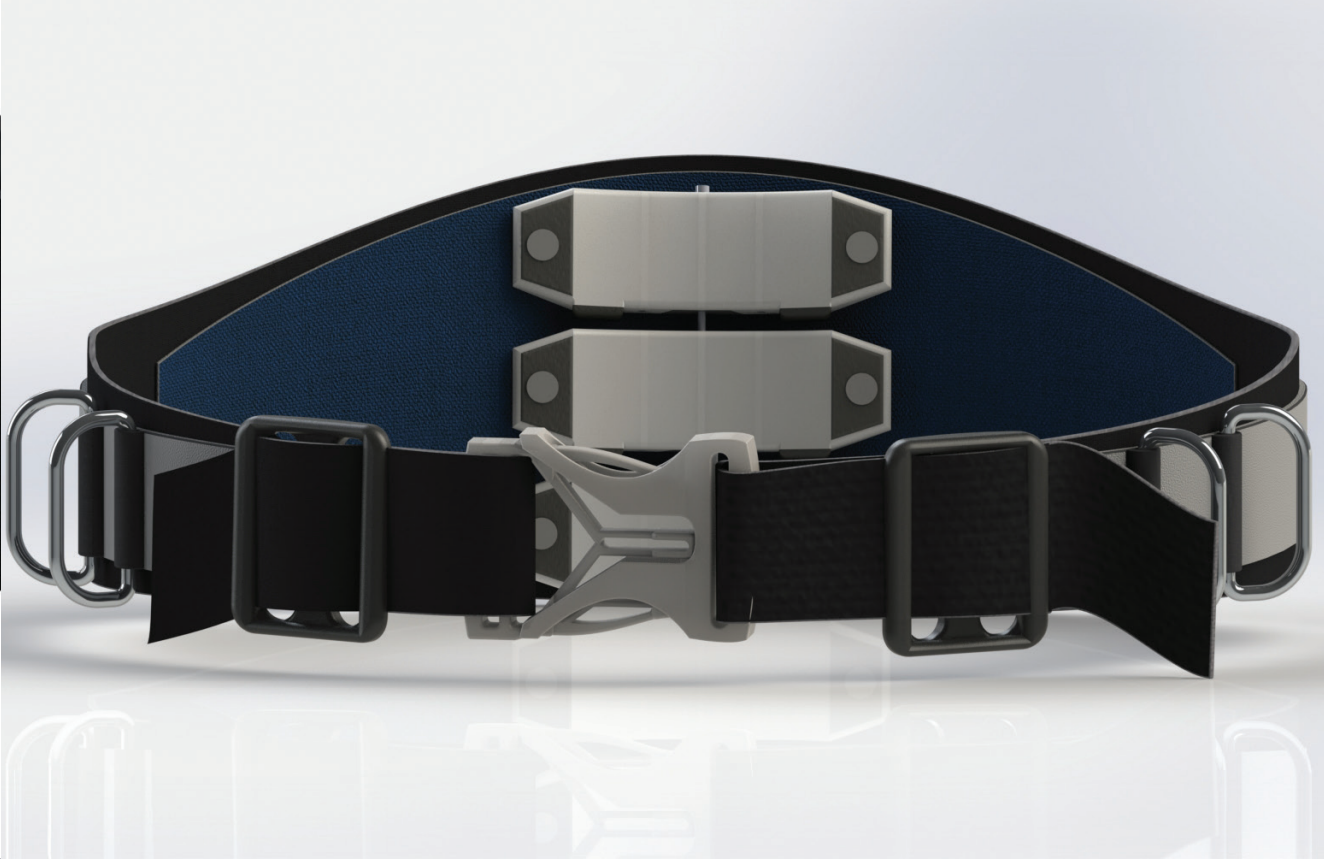
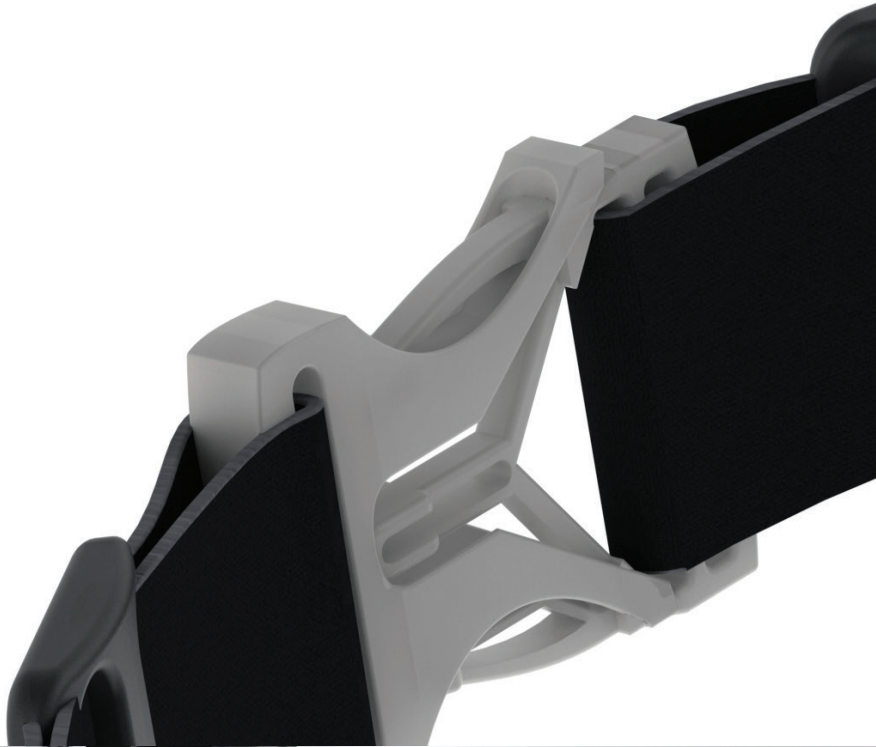


## Final outcome

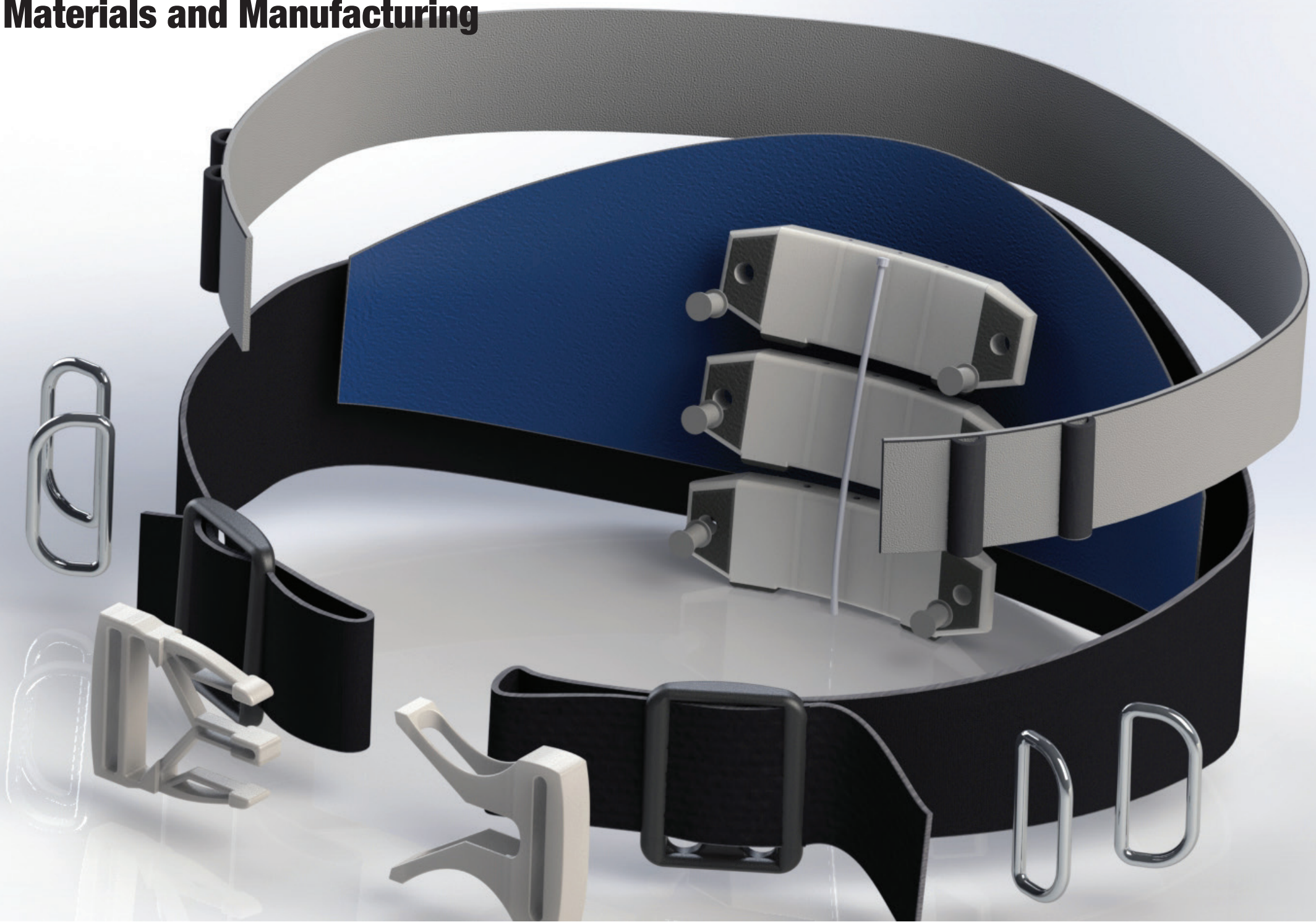






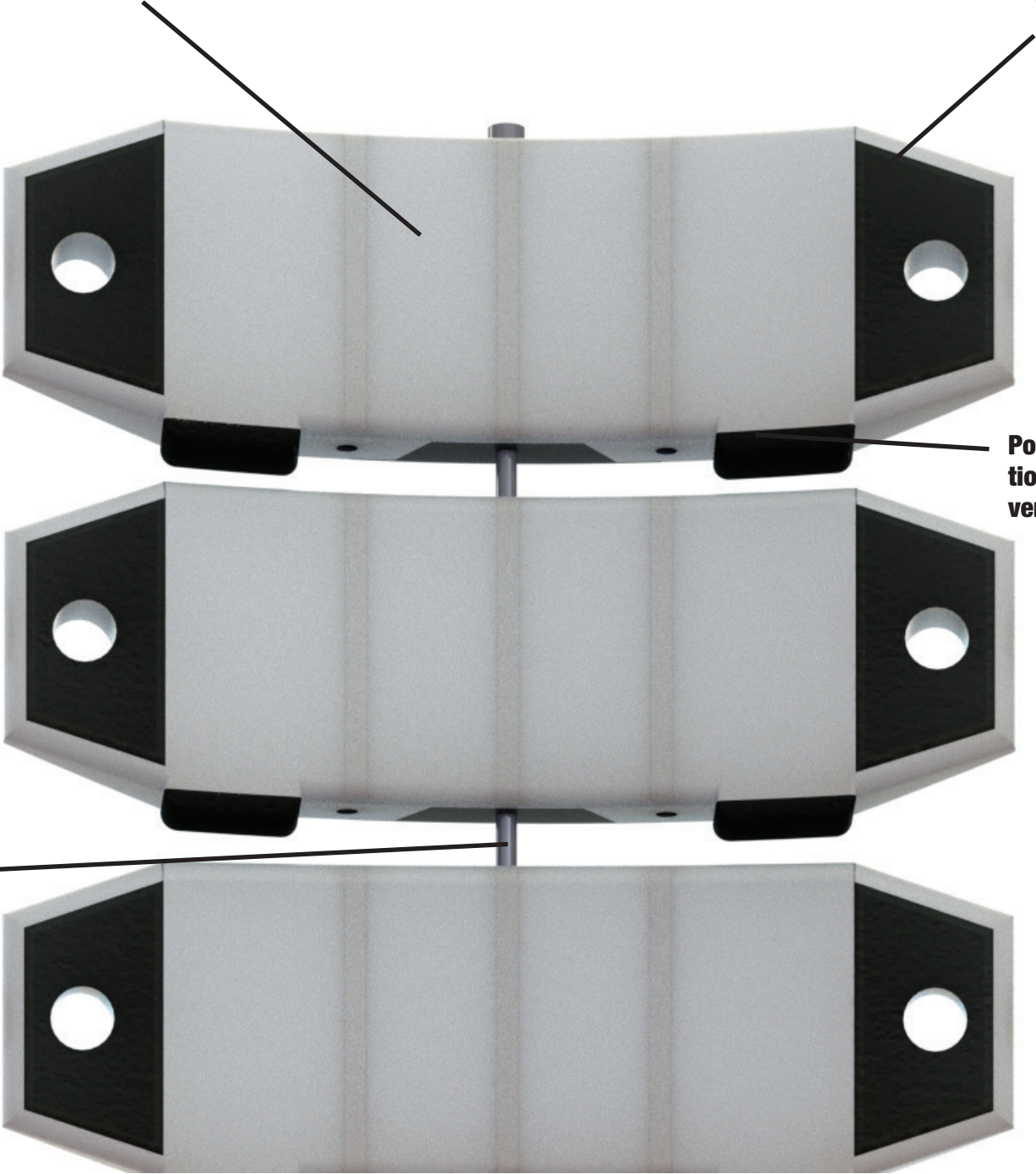


# Materials and Manufacturing



**The main parts of the mechanism will be injection molded out of polyurethane. As all three parts are the same size, the production cost will be slightly reduced.**

**Urethane foam rubber padding provides soft touch when it gets in contact with the person's back.**

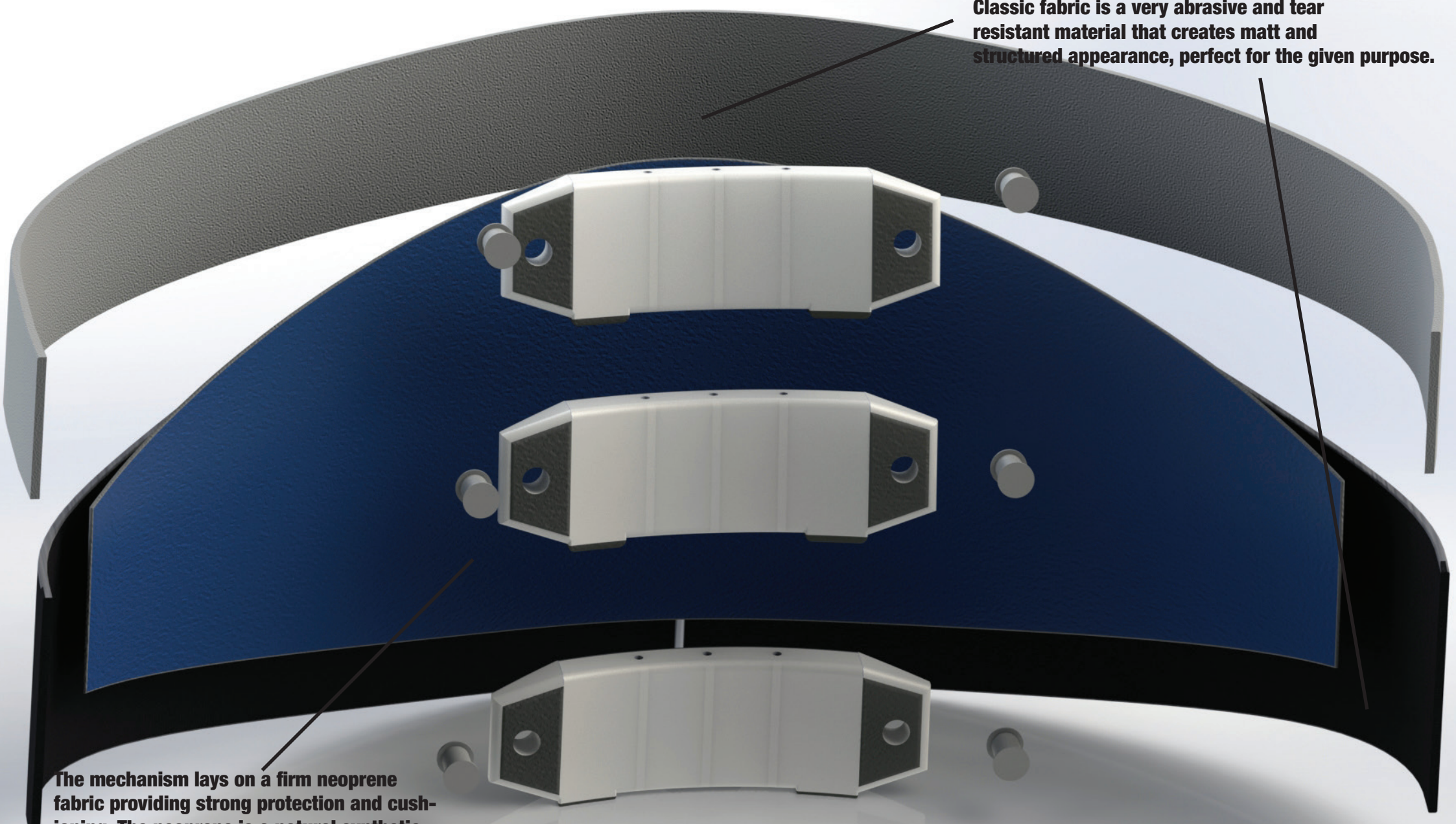


**Polysulfone (PSU) material prevents friction between the components and has a very high impact strength resistance.**

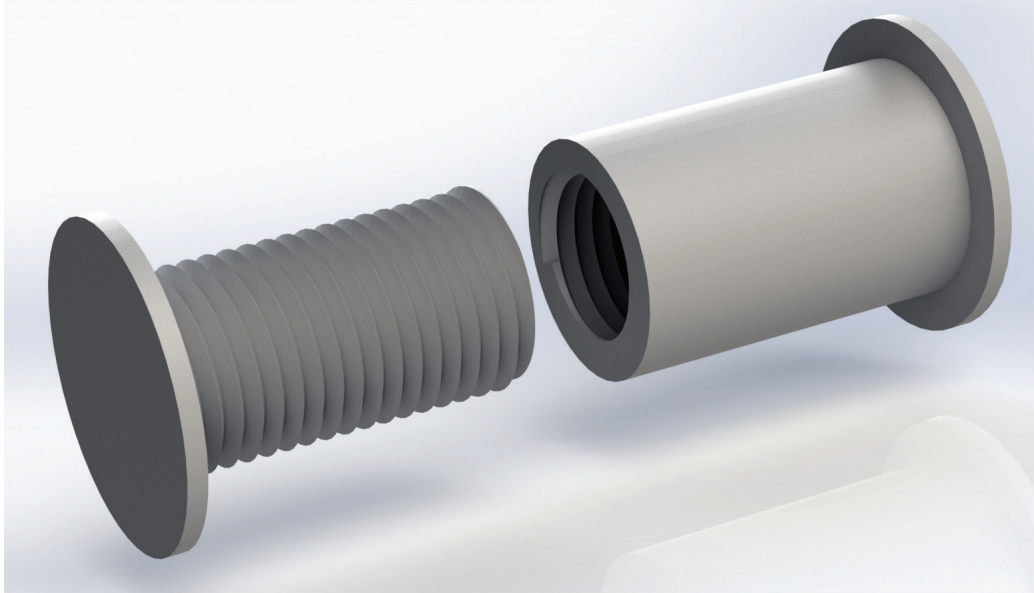
**The elastic tube holding the mechanism's components together will be made out of 5mm flexible silicone tube (Saint-Gobain).**

**The belt consist of 3 main fabric components:  
Main belt, external belt and neoprene material  
padded on the inner area.**

**The main belt (in black) and the external belt  
(in light gray) have to bear all the pull and  
stretching forces. The 1000D CORDURA  
Classic fabric is a very abrasive and tear  
resistant material that creates matt and  
structured appearance, perfect for the given purpose.**



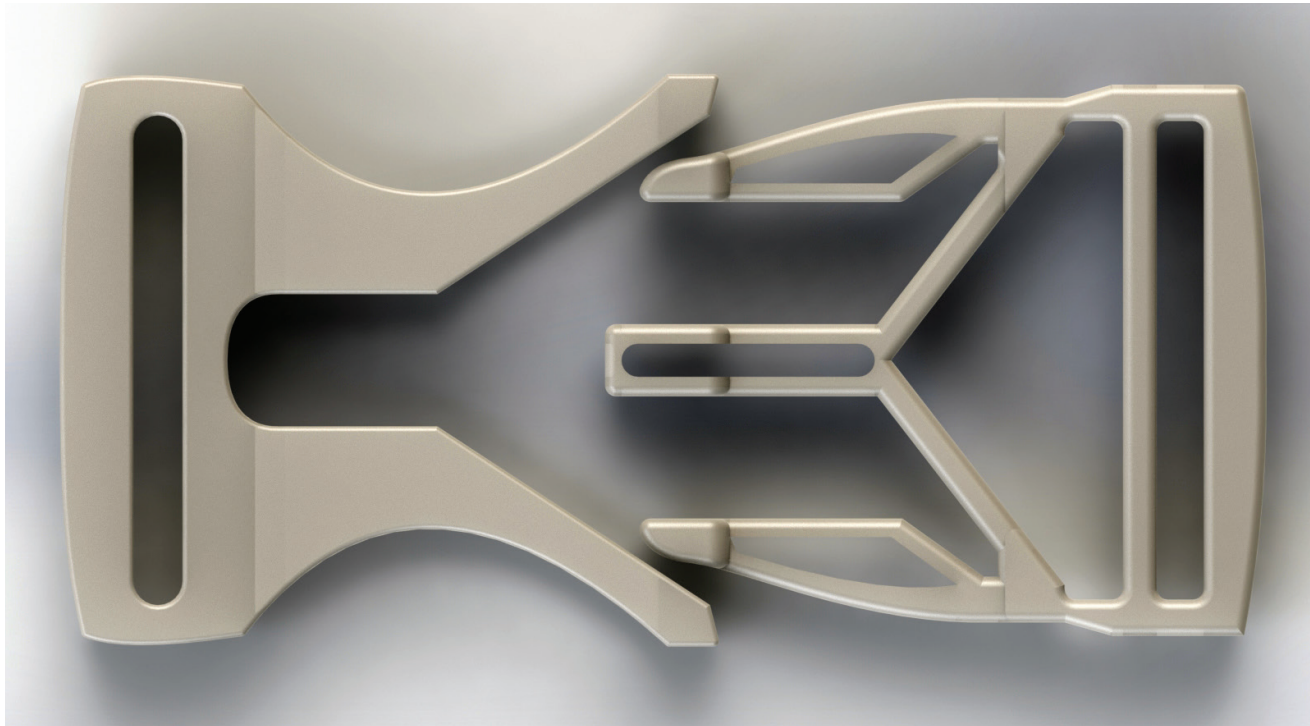
**The mechanism lays on a firm neoprene  
fabric providing strong protection and cush-  
ioning. The neoprene is a natural synthetic  
and is also latex free which makes it easy to  
manufacture.**



**ABS injection moulded plastic rivets.**  
The plastic rivets have male and female components with a simple thread. They are easy and cheap to replace if needed.

**Injection moulded polycarbonate buckle components.**  
The two components are designed in a way where the least possible amount of material can be used, so that the manufacturing cost can be reduced to a minimum.

**The metal hooks could be manufactured in many different ways. However, I would recommend cold bending stainless steel due to its high-stress resistance quality.**



# Customer Benefits

- **Walking one or multiple dogs hands-free**
- **Shock absorbing mechanism based on the human spine structure**
  - **Sustainable materials**
    - **Washable textile**
  - **Tension reduction in the lower back area**
- **Pull pressure absorption applied on the lead and the lower back**
  - **Adjustable straps**
- **Internal and external belt providing double protection from losing the lead**
- **Urethane foam rubber padded components causing no discomfort when worn**
- **Flexible neoprene fabric that follows the direction the mechanism bends**
  - **Four attachment rings (two from each side)**
    - **Easy to use**
- **Suitable for every person no matter the age, size or physical strength**
  - **Designed by using natural principles**
    - **Water resistant**
  - **Light and easy to carry anywhere**

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