



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Major Project Research:
Self-securing shoe

Rhys Michael O'Leary

Student Number: 1902028

BA Product and Furniture Design

Supervisors: David Jarvis and Matthew Archer

Target Market:

I have identified the target market for this product to be everyday consumers, sneakerheads and the ‘Average Joe’. Reason being this product is not to be marketed as a specific shoe for a sport or a certain type of consumer, but a shoe that anyone can be of interest of.

Aim of my product:

The aim of the product is to create a self-securing shoe that is affordable, durable, aesthetically pleasing and isn't a visual eye-sore, a widely available self-securing shoe and to create an innovative product for the shoe industry. I believe there is strong reasoning for a product such as this as lace less shoes are becoming more normal such with the YEEZY brand with their Foam Runner clog style shoes as seen below:



Market research on existing models

Key:

Design

Cost

Innovation

Overall Opinion/Score

My Takings From This

Nike Go FlyEase sneaker.



With this Nike model, Nike set out to achieve a sneaker that is not only self-securing but also stylish and functional for all. Released early 2021 the Fly Ease sneaker was an instant hit with consumers. The downside of the release was it was not a general release, lucky consumers had to be selected to be able to purchase the shoe. The negative of having to be chosen to purchase, is that the general public and consumers that would benefit from this missed out and now must pay extortionate resell prices on the resell market.

Nike Go FlyEase

Celestine Blue

100% Authentic

Condition: New



Size: US M 10 ▼

Buy
or Bid

Lowest Ask
£153

Sell
or Ask

Highest Bid
£125

Last Sale:

£126

▲ £8 (6.8%)

View Asks

View Bids

View Sales

On the resell website StockX the Nike Fly Ease in the average male size of US 10 or a UK 9 the lowest ask for the sneaker is £153 or \$207 USD. In the UK the shoe retailed for £88 and retailed for \$120 in the US. That is equal to a £65 increase in price for the UK market and a \$87 USD increase for the US market.

Design: Hands free design for easy to slip on style. Bright pastel colour scheme. Innovative design for the collapsing of the shoe and how materials work for the outer sole. Midsole is covered by a plastic rim to help the structure of the shoe when folding.

Cost: £153 GBP or \$207 USD on the resell market. None available on general release sale at this point in time.

Innovation: Folding design of the shoe, manipulation of the outsole and the materials to allow the shoe to bend without the need of the user to assist or bend down.

Overall Opinion/Score: My opinion of the Nike Go Flyease is that it is a innovation within sneaker design and it is a push in the direction of self-securing sneaker.

My Takings from this: my takings from this is how the shoe is put together and how it physically bends and it can manipulate when being put on. How it is heat sealed and fused together on top of stitched fabrics to make it more secure and stronger for longer.

Nike Air Mags (Back to the Future Shoe)



First seen in the second instalment of the Back to the Future trilogy, the Nike Air Mags were debuted in 1989 when Marty McFly, Doc Brown and Jennifer Parker travel to the future being 2015, where to fit in with the current times of the future Doc hands Marty the infamous pair of Air Mags. When Marty puts his foot into the sneaker, the sneaker laces themselves, something only someone could dream of in 1989.

In 2015 on the exact date Marty, Doc and Jennifer all travel to the future being October 21st, 2015. Legendary sneaker designer Tinker Hatfield who designed the sneaker for the film back in 1988-89 handed a fully functioning version of the sneaker to Michael. J. Fox to lace up. This was a monumental moment in sneaker design because it marked a new era in technology, design and innovation.

Design: The overall design is very dated for our time but for when it was designed in 1988/89 by Tinker Hatfield for the back to the future 2 film. The design was to look like a shoe that would be designed in the year 2015. The design is the design of the late 80's and early 90's.

Cost: the cost varies on the model and year it was produced and released. The cheapest would be the 2011 model which doesn't self-lace and it would cost £13,400, and the dearest which is the 2016 model which can self-lace itself would cost £38,500 at the lowest.

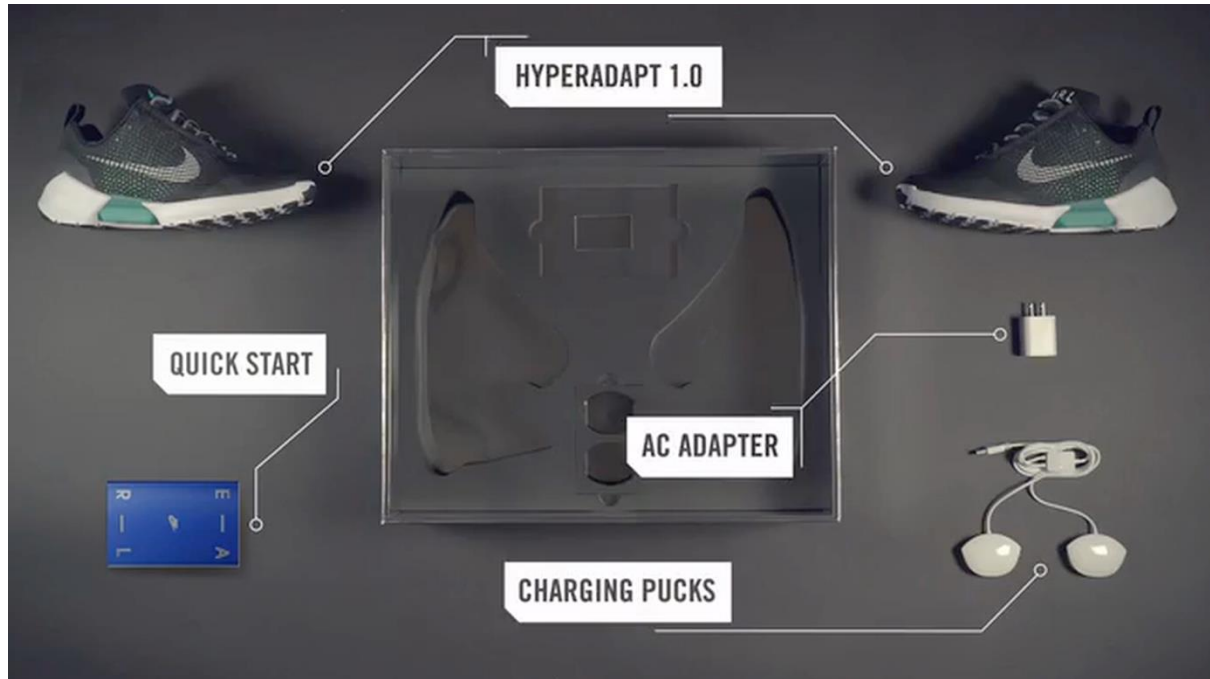
Innovation: The innovation is well known and that it can detect the wearers foot in the shoe and lace itself when the user's foot is in the shoe. It was the whole concept behind the design as well.

Overall Opinion/Score: My opinion on the shoe is that the design and innovation hold up extremely well within today's current designs and innovation. It has the feel and look of a retro 80's sneaker but also a design from the future with the styling and the innovation.

My Takings From This: what I've taken from this is the overall concept and how the design is. The main thing is the innovation, but also how it functions as a shoe as a whole and how it is put together from a conceptual and physical standpoint. Physically its impressive how there isn't many visible stitches on the shoe. But looks like the components have been placed onto the upper.

Nike Hyperadapt 1.0 (E.A.R.L)





Design: The design of the hyperadapt 1.0 is a push in sneaker innovation and what makes a sneaker a sneaker. The design was made around the technology from Nike which they call ‘E.A.R.L” which stands for Electric Adaptive Reactive Lacing. And the technology was based off the Nike MAG (Back to the future shoe). The shoe features flywire laces that contract and retract when the shoe is lacing themselves up for the user. The shoe features buttons by the tongue that allow the user to adjust the fit to their desire and allow it to be pre-set for every time the user wants to wear the shoe. The shoe features a magnet on the bridge of the outsole where the battery is encased which allows the battery to be charged wirelessly using the magnet chargers provided within the box the sneaker comes in.

Nike HyperAdapt 1.0

Black (1st Release Black Box)

100% Authentic Condition: New



Size: All ▾	
Buy or Bid	Size: 9 £346
Sell or Ask	Size: 8.5 £139



Only 7 left

Get it before it's gone!

Last Sale:

£219

▼ -£217 (-50%)

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Cost: The current cost for the Nike Hyperadapt 1.0 is £346 GBP on StockX and this is for the most average male size 9. This is a major issue for this shoe as this is a resale price not the

release price. This makes the shoes harder to obtain by regular consumer that could use this technology for their selves.

Innovation: Like the Back to the Future Nike MAG the shoe's innovation is the self-lacing, the shoe was inspired from the back to the future shoe's lacing feature and the technology within the shoe. The Hyperadapt is in existence because of the Nike MAG.

Overall Opinion/Score: My opinion on the Hyperadapts is that they feature technology which is innovative for our time and the building blocks for the future of sneakers. The main issues I have is that it features a very clunky and outdated design for how futuristic the shoe is supposed to be.

My Takings from This: What I have taken from the sneaker is that it is very well designed. The structure of it makes sense, the way it has been constructed and put together by adding multiple layers in the upper to give the fit more secure feeling and more comfort.

My takings from the market research:

After conducting market research into self-lacing shoes that are on the market by Nike it shows that Nike are leading the way in the market for self-securing and self-lacing shoes. The only downside from the information I have gathered from these shoes is that most pairs are in the hundreds of £'s and are designed for a specific reason. There is not a lifestyle self-securing shoe that costs less than £150, and all the shoes available are only available on the after market for prices higher than when they were in retail stores when first released.

Shoe Deconstruction.

I deconstructed a pair of Adidas yung-1's to better understand how a sneaker is constructed and understand what I can take from it and how I can redefine what makes a sneaker a sneaker.



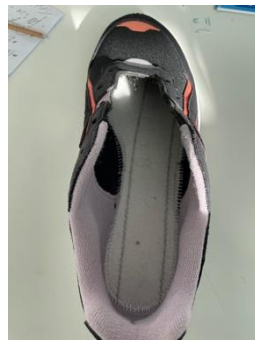
Image one here is the shoe before I deconstructed. The first step was to remove the laces which I did before the image was taken and are absent from the image. The next step is removing the tongue to allow better access inside the shoe to remove the upper.



In the images above I have removed the tongue from the upper of the sneaker. The tongue itself was only held in using a simple stitch across the top of the toe box. Simple black stitch used in a single line to secure it in.



Once the tongue was removed, I furthered studied how it is constructed. The tongue is simply constructed with foam inner, mesh on the back to allow breathability within the shoe for the feet and added comfort on the ridge of the foot. The front side bears a plastic Adidas logo that is stitched underneath the fabric to allow it to stay in place. There is a fabric loop on the front for the laces to be allowed to pass through. And a suede on the front gives it more of a stylistic aspect rather than function. All these elements are held together using a simple single stitch.



Next stage was to remove the insole of the sneaker to see what it was made of. The insole was easy to remove as it was held in by some light glue on the underside of the insole. The insole itself is made of 2 parts the top part being made from a fine felt material and has a unique print on it, the foam is a simple Eva foam found on most sneakers for easy comfort. The foam doesn't last a long time after consistent wear of the shoe. The felt used isn't great for breathability within the shoe and could cause the foot to sweat when worn for along time and cause discomfort. Once the insole was removed and studied the next stage was to remove the upper from the outsole.



In the images above demonstrates the upper being removed from the midsole, the process was rather simple. Simple stitching under the insole connected the upper to the midsole also part of the upper was heat fused within the midsole so it simple wouldn't tear away. The upper consists of simple materials that were stitched together using a simple stitch, the upper mainly consists of 2 different mesh materials, suede, leatherette, felt within the heel area and a reflective material under the lace holes and near the top area of the toe box. The heel area included a lot of padding in bulk, this is common on most sneakers especially sportwear sneakers, this is simply for comfort and to stop the ankle from sustaining injuries. From studying the upper its clear to me that a upper is more often than not the most complex part because of many materials and layers it requires to create even a simple upper like the Yung-1's.



In the images above shows how I deconstructed the upper's layers to reveal and for me to get a better understanding of how many layers there are within a shoe upper even for a simple silhouette for a shoe. I removed the adidas logo from the back how different it was in sizing compared to the logo on the tongue. The logo is the same size, also when removed it is held in the same way as the logo on the tongue, simple stitching and a outer layer of suede for stylistic effect. Next thing to do was to remove the heel cup within the heel area of the upper, to do that I had to cut through the fabric of the upper and pry the cup out and removing the glue that held it in and to the fabrics. Once removed to my surprise it was not as solid as I thought but very flexible. As I studied the heel cup the material used looked more and more as if it was made from recycled materials because of the texture and grain effect the material has. The upper consists of 2 different Mesh materials one thicker and one thinner, polyester, Foam, Suede, Leatherette and layered padding within the heel section. The glue used to hold the layers together also helped the fabrics be strengthened and not be easily split. The final material used is a reflective material on the top toe box and under the lace holes.

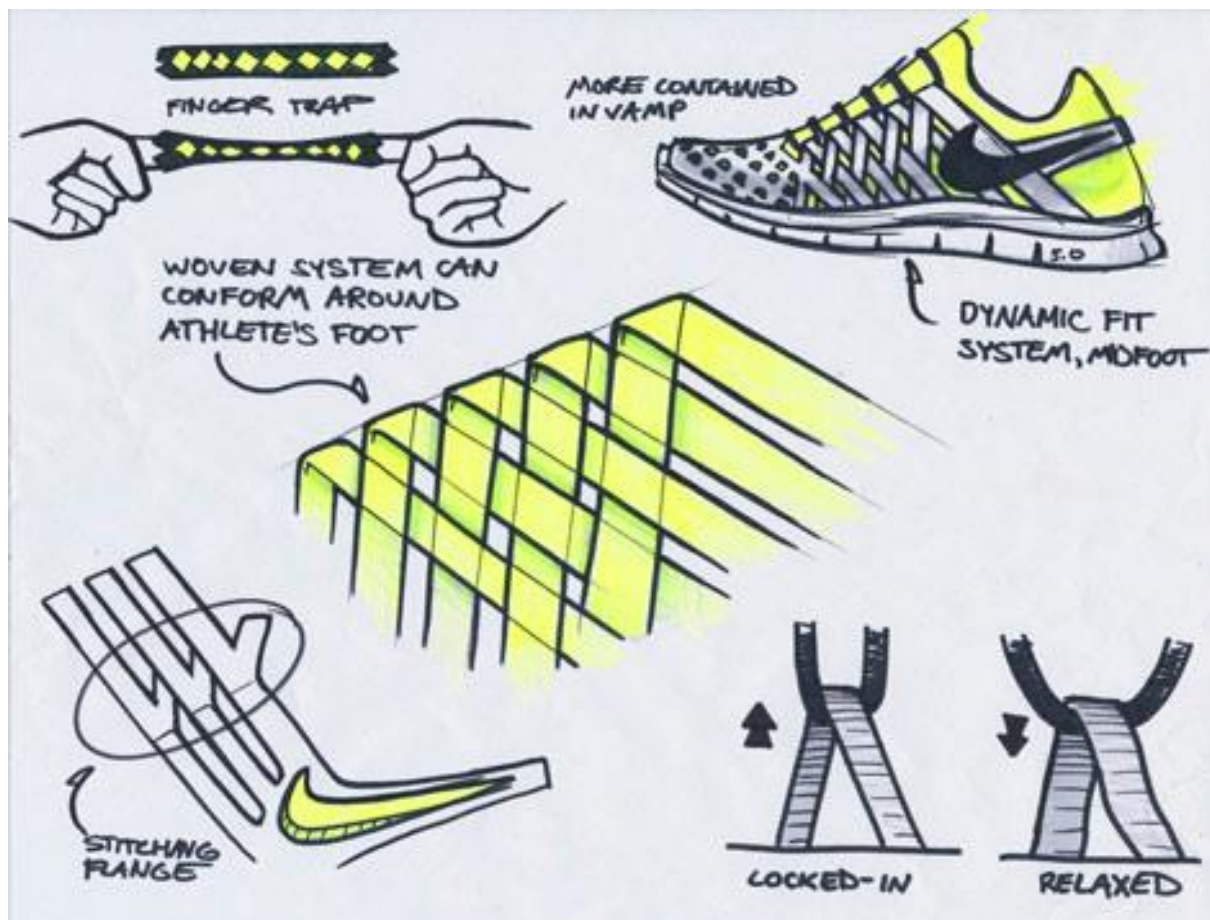
My takings from deconstructing a shoe:

- 1) what makes a shoe a “shoe”?
- 2) the sole of the shoe must somewhat be comfortable for the wearer.
- 3) Can a shoe be split into 2 sections?
 - Upper is section 1 and can be stylistic
 - Midsole and outsole are section 2 and can be where the technology that the shoe possess is encased and is a functional midsole and outsole.
- 4) Can origami be introduced within the design and be the functional part of the shoe? It can be a unique way and a new innovative way of making a shoe function.
- 5) Look and study how feet are at different heights and how a foot bends when moving (picture and document the study)
- 6) Study and research the most stressful areas of the foot and where they need protection and reinforcement.
- 7) What Innovations have been made in the self-lacing and securing

Origami and Chinese finger traps



traditional finger traps are made from bamboo, which is a material that does not stretch. But some finger traps are made from fabrics, ribbon and even paper.



Nike played with the idea of a finger trap design on the shoe, this was just around the middle of the foot. The shoe still had laces, but the finger trap style allowed the shoe to comfortably

wrap around the users foot for a more 1:1 feel. Maybe this can be applied to a design that wraps the whole foot rather than just the middle of the foot.



Nike Finger trap 5.0 inspired by finger trap.

Origami and Origami within the fashion industry.



Pictured above is a small child outfitted in clothing that is inspired by origami, but this garment has a different twist to it as the child grows the garment grows along with the child. Therefore, the garment is growing along with the small child. This aspect of the clothing could be brought to the sneaker world using the different fabrics and allow the user to have a unique fit for the shoe to their foot.







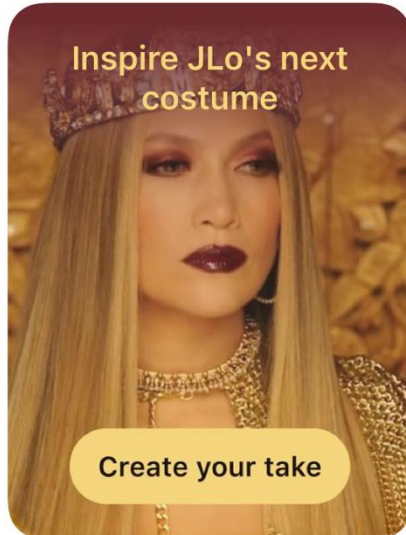
Looking at some fashion aspect and the use of origami within the fashion industry it opens the possibility of new and innovative ways to consider for the upper of the shoe. As the use of a single material within the upper is not a new concept for a shoe but with the idea of a self-securing shoe it is a innovation.



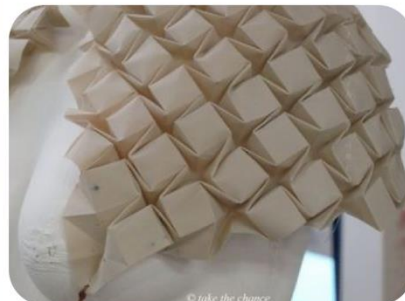
origami fashion fabric manipulation

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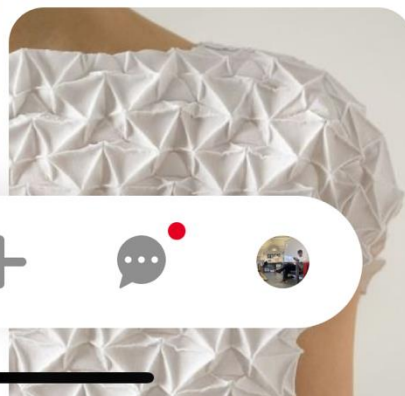
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Draping Fabric On The Stand



Ultrasuede Peel Jacket by Teresa Maria Widuch (Ultr...





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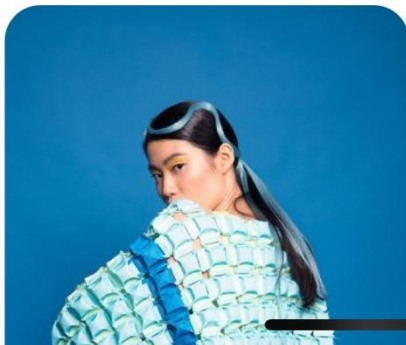
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Georgia Hardinge. A sculptural label.



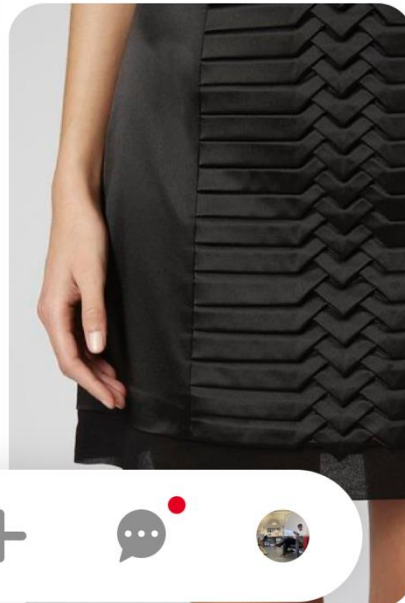
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Just by looking into origami within fashion on a face value, I can see how they manipulate the material/materials to form new exciting shapes for items of clothing.

What can I take from this?

The use of fabric manipulation

Single piece of fabric used (origami is traditionally the technique of folding a single piece of paper to create new forms and shapes)

Single fabric used means less waste and this helps reduce the amount of fabric needed to use.

Most used materials

Fabrics and materials have been used to create sneakers for decades. But what are the most popular and most used fabrics? And what fabrics can I use to create my product effectively?

1) Leather

Leather is flexible yet durable at the same time. Its elastic so it can be stretched and yet it resists tearing and abrasion. It is also a breathable material as it insulates the heat and helping regulate temperature. This all helps leather conform to the wearers foot a lot better and like no other material can. Leather is most used on men's dress shoes.

2) Textiles (Fabrics)

Textiles are available is a wide range of colour and varieties. With textiles the possible variations include different fibres, denier (Fabric weight), weaves and knits. The advantage using textiles in shoes is the sheer vast of variety and versatility in styles and designs. Each textile has its own physical properties that must be considered when choosing to wear it or not, these include variations in breathability, support and temperature control such as hotness or coolness.

The most common textiles used in shoe making are:

- Cotton
- Polyester
- Wool
- Nylon

3) Synthetics

Synthetic materials go by many different names PU leather or simply PU, synthetic leather or simply synthetics but they're all the same in being man-made composites of two layers: an external surface adhered to a backing layer composed of polyester fibres. All types of synthetics used to make shoes are also the same in making for supportive yet affordable sports shoes. Like their textile counterparts, synthetic materials also come in a variety of colours and textures. Factors in the composition of the two layers comprising synthetic materials, such as whether the polyester used for the backing is woven or non-woven, or the method of adhesion used, whether a wet or dry process, determine the quality and durability

of the resulting synthetic. Lower quality synthetics may not have a perfectly smooth surface, even possibly showing creases and wrinkles. The advantage of shoes made from synthetics is that they tend to be comparatively quite inexpensive for both the manufacturer and consumer as compared with other types of shoes. Because the material is less durable than its leather and textile counterparts, however, synthetic shoes tend to degrade faster and need replacing more often.

4) Rubber

Rubber is most used in shoes to make soles. While not the only material used to make outsoles, it is among the most popular in sports shoes, like running shoes and tennis shoes. While most shoe rubber over the years has been made from polyester, a more environmentally friendly alternative is increasing in popularity as an alternative.

5) Foam

Is the most common material used to provide support in the uppers of shoes of all sorts, be they leather, textile, synthetic or even rubber. The different types of foam used for this purpose are innumerable, though they're all generally divided into two categories: open and closed cell. All foam is made from plastic. In open cell foam, the material is permeable, allowing water and air to pass through; in closed cell foam, these open cells are sealed, preventing the gasses inside them from escaping. Open cell foam, also known as KFF or KF foam, is made of polyurethane plastic and tends to be softer than closed cell foam. Open cell foam can often be found in the collars and tongues of shoes. There are many different types of open foam, the most open of which is reticulated foam, frequently used to create ventilation features in shoes. Closed cell foam is a denser material commonly used to make shoe midsoles. Types of closed cell foam include polyurethane and polyethylene, EVA foam, Neoprene and Latex. Each type of closed cell foam features its own properties, such as waterproofness or elasticity. Knowing the various materials most prevalent in shoes helps immensely in choosing the right shoes to match your needs at the time. Understanding the variations in type, considerations of quality and maintenance, and the prospective benefits and drawbacks of each type will help ensure that you wear every pair of shoes you buy with pride.

After studying and researching the most used materials I believe the best way forward would be to incorporate a mixture of them all. But used on different areas of the sneaker instead of one material covering the entire shoe.

I believe the most used materials I will be using will be the use of textiles, leather, and PU for the upper, rubber for the outsole and midsole and foam for the comfort aspect of the inner lining and sole of the shoe.

Fabrics and their properties

Cotton

- Softness. The cotton plant is soft and fluffy and results in a fabric often retains that soft feel.
- Durability. The cotton plant's cellular structure is strong, creating a tough and wear-and-tear resistant fabric.
- Absorbency. Cotton fabric is very absorbent fabric because there is a lot of space between the cotton fibres.
- Holds dye well. Due to its absorbent nature, cotton takes dye very easily and can be made into a wide variety of colours.
- Breathability. The fibre structure of cotton makes it more breathable than synthetic fibres.
- No static cling. Cotton does not conduct electricity, therefore static is not an issue with cotton.

Polyester

- It's durable. Polyester fibres are incredibly strong, meaning they don't tear, stretch, or pill easily like cotton and other natural fibres. This strength means polyester clothing can easily handle abrasion from machine-washing and doesn't require special care. The durability of polyester fabric has made it especially popular for outdoor clothing.
- It's moisture resistant. Polyester fibres resist liquid droplets, meaning that the fabric will wick away moisture rather than soak it up—making it a popular material for outdoor clothing and gear (like tents) that need to keep off rain and precipitation. Also, polyester's ability to resist moisture helps it remain stain resistant. However, polyester's moisture resistance makes it a less breathable fabric. If you sweat while wearing polyester, the fabric will trap in the moisture (rather than wicking it away) and make you feel hot and sticky.
- It retains its shape. While linen and cotton fabrics can retain wrinkles and require ironing, polyester is wrinkle-resistant and will better hold its shape, drape, and rigidity. Polyester's wrinkle-resistance made it especially popular in the 1970s as an alternative to clothing that required consistent washing and ironing to avoid wrinkling.
- It can be coarse. Unlike many natural fabrics, polyester doesn't have a very luxurious feel; cheaply made polyester can have a slightly coarse feel too sensitive skin. However, there are several different methods of creating and weaving polyester fabric that will affect its texture, making some polyester coarse. Other types of polyester like China silk fabric are almost as smooth as natural silk or satin fabric.
- It's typically non-biodegradable. Many natural fibres are biodegradable, which means they will break down over time and avoid clogging up landfills. The environmental impact of most polyester yarns is quite the opposite—polyester doesn't easily break down and is not typically biodegradable.

Wool

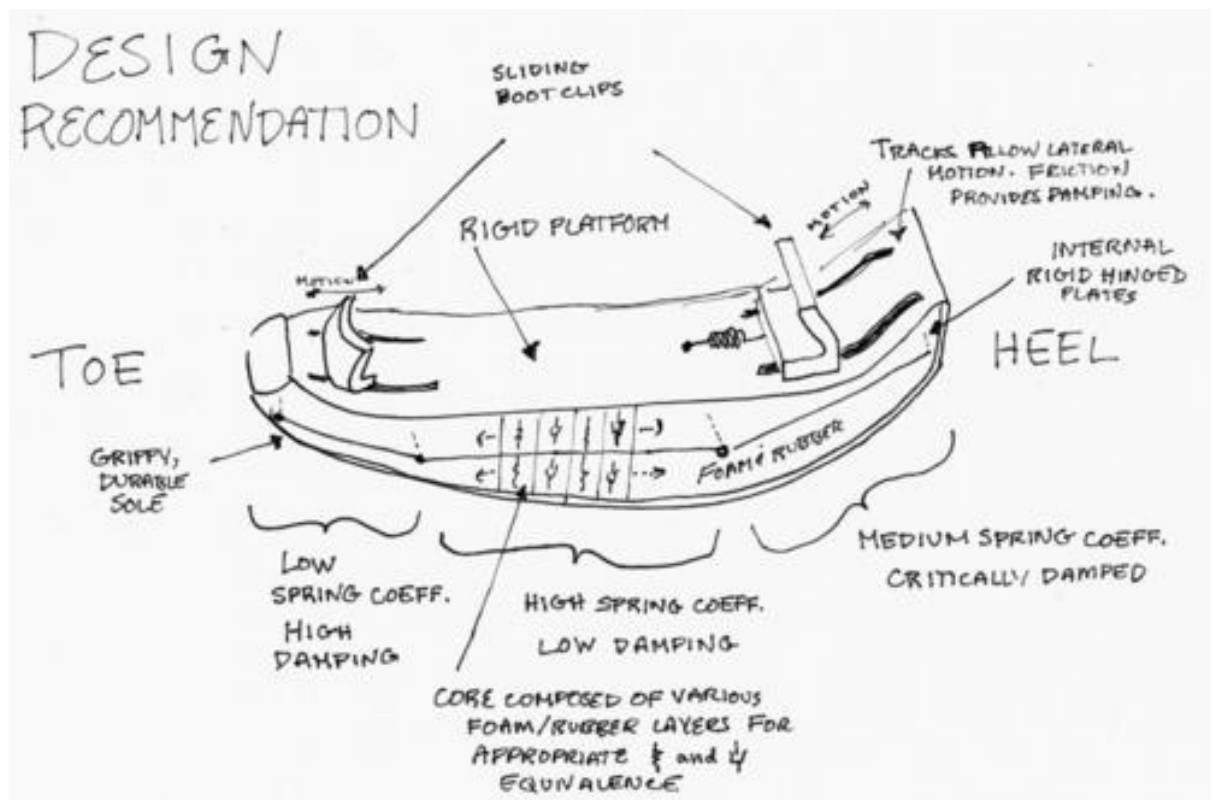
- 1) Wool has natural UV protection
- 2) Wool has natural antibacterial and antimicrobial properties
- 3) Wool is stain resistant
- 4) Wool is easy to care for
- 5) Keeps you warm in winter and cool in summer
- 6) Insulates even when wet
- 7) Wool is durable

Nylon

- 1) Rugged durability
- 2) Stretch and elasticity
- 3) Resistant to tears and abrasions
- 4) Resistant to heat and water
- 5) Melts instead of catching fire

After Looking at all these common fabrics and their properties I believe the best way forward for me is to use 1-2 of them together. I believe the best ones to use would be polyester and Nylon due to their properties and how much they are used on shoes and they have the correct and most useful properties for my shoe.

Skis, Ski boots, snowboarding boots.



Ski boots have a feature on the bottom that allows the boot to click into the ski. The front and back of the ski boot have a ridge that allows the boot to slip in the simply lock into place.

Maybe this feature of a slip and click into place could be designed to be featured within a sneaker? Or a upper that clicks into different soles depending where you are going or environment.

Ski boots also have clip lock system on the boot that allows the boot to lock down on the foot for a secure fit- this has its downsides; it can be painful because of it being too tight for the users foot/leg and also it can be uncomfortable.



Snow Peak Mens Snow Boots - Grey

Mountain Warehouse



See price

Save



Product details





Snowboarding boots have a feature in which the user turns a knob to tighten the wires on the boots to adjust the fit of the boot to their desire.

This feature is unique because it allows the user of the boot to have a fit that is unique to them.

This feature could be taken and altered to fit within a sneaker to allow a fit that is unique and comfortable for the user.

This feature could be designed to be within the upper of the sneaker and be styled to conceal the wires and change the knob for a gear to allow more space within the sole and midsole to fit the mechanism.

Snowboarding boots are typically made from materials that are very insulated, for the environment the boots will be typically used.

Snowboarding boot have typically three different types of lacing systems:

- Traditional/ standard lacing which is laces
- BOA which is where a knob is turned and tightens the boot with wires, there is a version called double BOA where one knob tightens the lower of the boot and then the other tightens the upper of the boot.
- Speed Lacing, where the user just slips their foot into the boot without having to tie them.

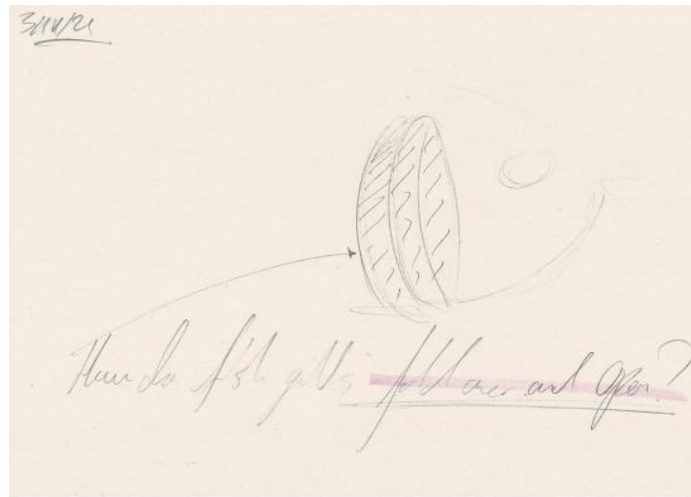
Each lacing system has its pros and cons when it comes to their uses. But from looking at the pros and cons I have identified that BOA or Double BOA would be best suited for a sneaker concept. Maybe it could even be altered and tweaked to be smaller and also more flexible for a sneaker.

Pros and Cons list Below:

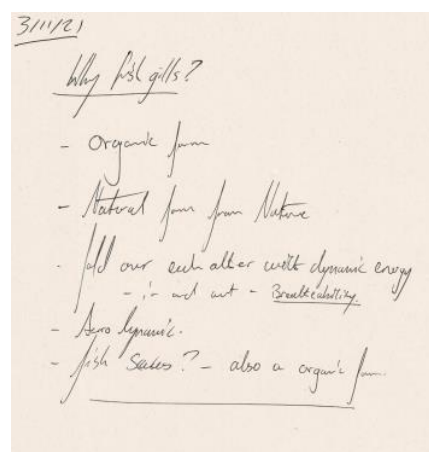
Lacing System	Pro	Con
Traditional / Standard	• Control how loose and tight the boot is for the user. And for different parts of the boot that need to be tighter and looser. • Less prone to creating pressure points on the foot when using. • Cheapest option on the market • Cheap to replace and repair laces as they are widely available.	• Hard to get them tight for long periods of time when in use. • Need to remove gloves to tighten laces every so often because they loosen. • Loosen throughout the day.
BOA and Double BOA	• Easy to get tight • Less likely to experience heel lift when using these options. • Less likely to create pressure points (Double BOA) • Can adjust areas more precisely to create a fit that is perfect for the user. (Double BOA)	• Can cause pressure points (BOA) • If they break it is critical and not easy to repair or replace.
Speed Lacing	• Quickness of putting boots on. • Lightweight • Can tighten with gloves on. • Dual systems offer the ability for some independent tightening of the lower and upper sections of the boots. • Has ankle harness to help with heel lift issues.	• Can be difficult to get tight. • Can slip off easily when the fit isn't tight. • Foot is not as secure with this system.

Fish gills

Fish gills are interesting in the sense of why I explored fish gills. I explored fish gill for one reason and that is how the gills fold down onto themselves when the fish breathe. This way of folding onto one and other is something to consider for my product as the upper could fold onto itself to secure the shoe. With the modified BOA system this is a viable option and a interesting design concept for a self-securing shoe.



As seen in the diagram above I sketched how the gills of a fish fold onto each other when the fish breathe. This is a folding idea and is like the look of scales on a reptile and the scales as seen on a fish.



Some notes I made from this research. What helps this with the design for the shoe itself is that it is a natural form and an organic one. With way the fish breathe using their gills it could be easy to make the shoe light weight and breathable.

Sketches to understand my vision

Image 1

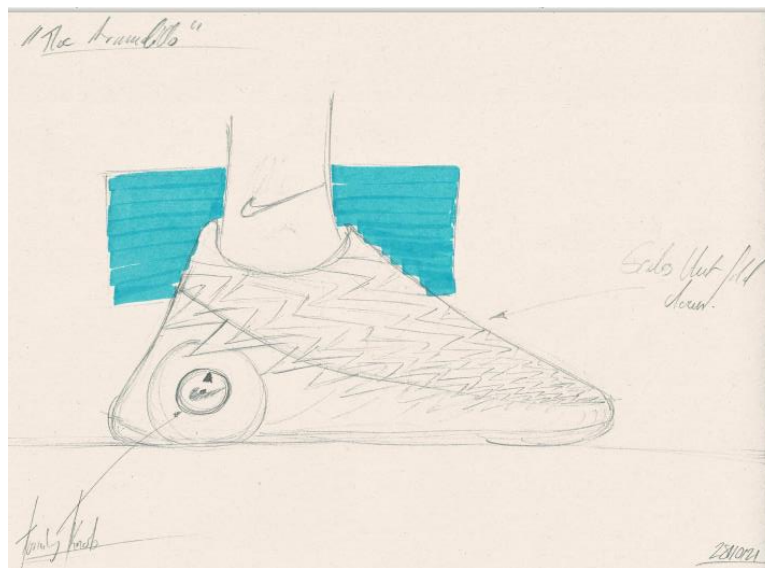


Image 2

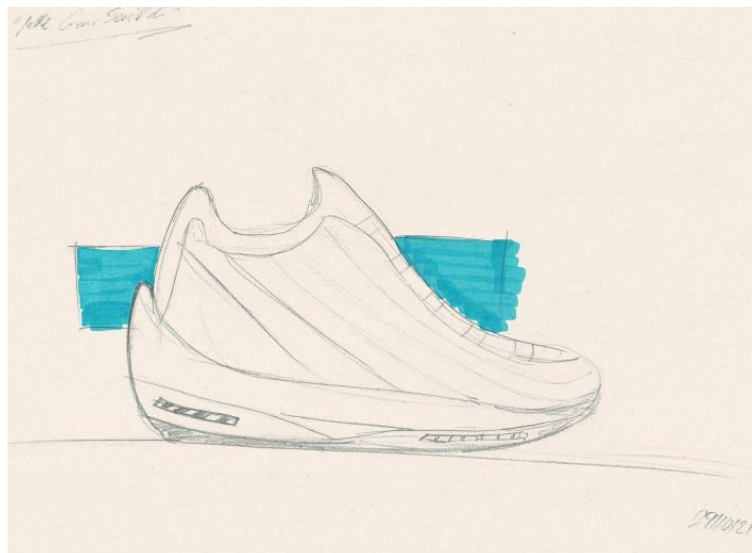
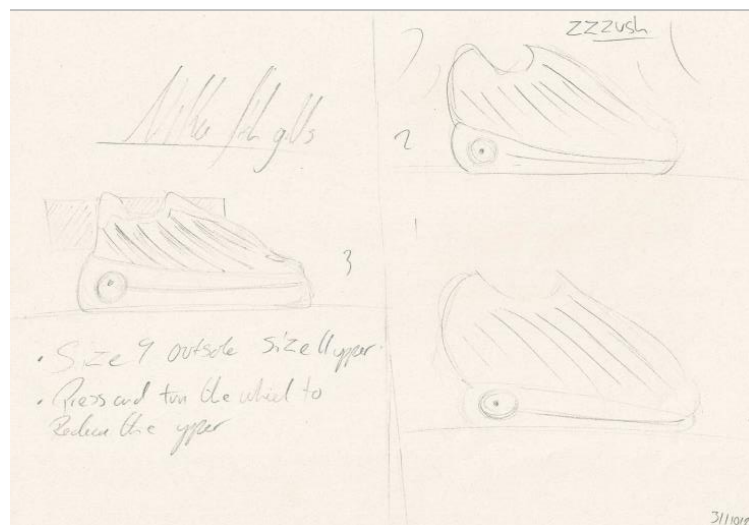


Image 3



Using the information gathered already these are concept ideas to help me along my design direction. With these visions in mind the next step in the research is to figure out where on the foot needs to be secured more than other areas. To do this I will need to use the shoe sole from the deconstructed Adidas Yung-1 to better understand and see where there needs to be more structure and security within the overall design to carry on with the research.

One idea that has come from the concepts above is the gear system in concept image 2. Where being a white space of the gear system on the inside part of the foot near the big toe and the gear on the same side but on the back near the heel area. With this idea in mind the user could tighten the shoe with their feet instead of their hands. This concept paired with a BOA system from a snow boot but modified is an idea for exploration and consideration.

Stress and pressure points:

To gather information about the stress and pressure points of a foot I asked some of my colleagues to walk barefoot and with their shoes on to see just where the foot bends and creates the stress and pressure points.

Below are the images of two of my colleagues walking.

Barefoot:



From the barefoot photos and observing my colleague, I can clearly see three areas of pressure, the ball of the foot in the front, the toe area mainly the big toe to use for balance and to push off and the heel of the foot to plant the foot firmly when stepping.

Shoes on:

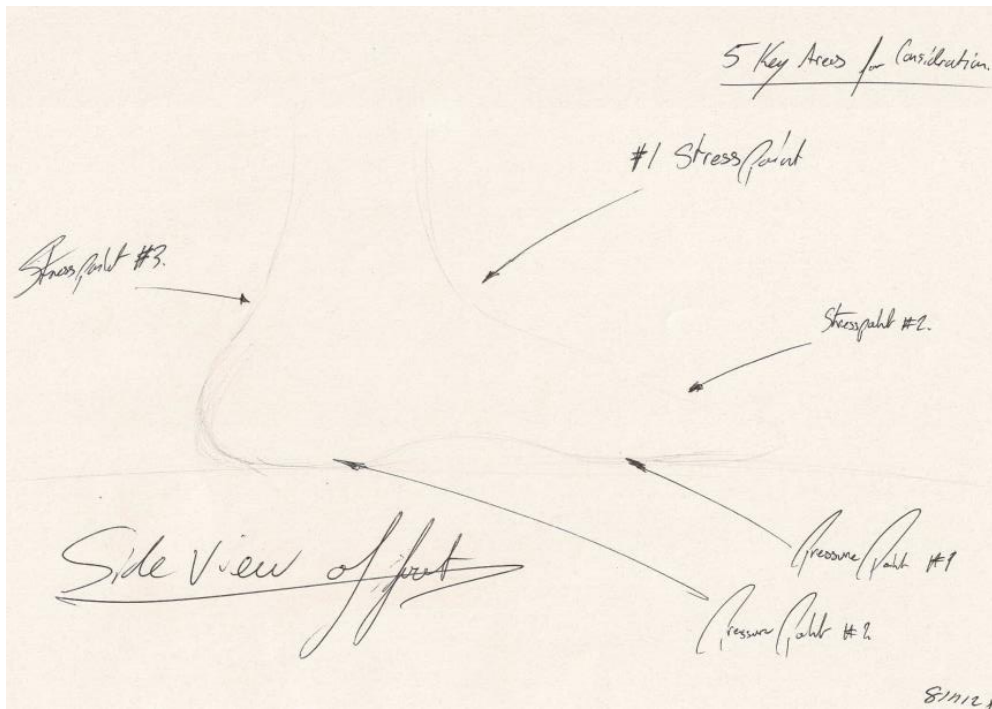


As identified with the barefoot images, with this set of images it is clearer to see the same areas of stress and pressure but there is another area that with a shoe on is more clearly highlighted. The new area is the area at the top of the shoe where my colleague has tied their laces together. This shows that where you tie your laces creates stress on the shoe.

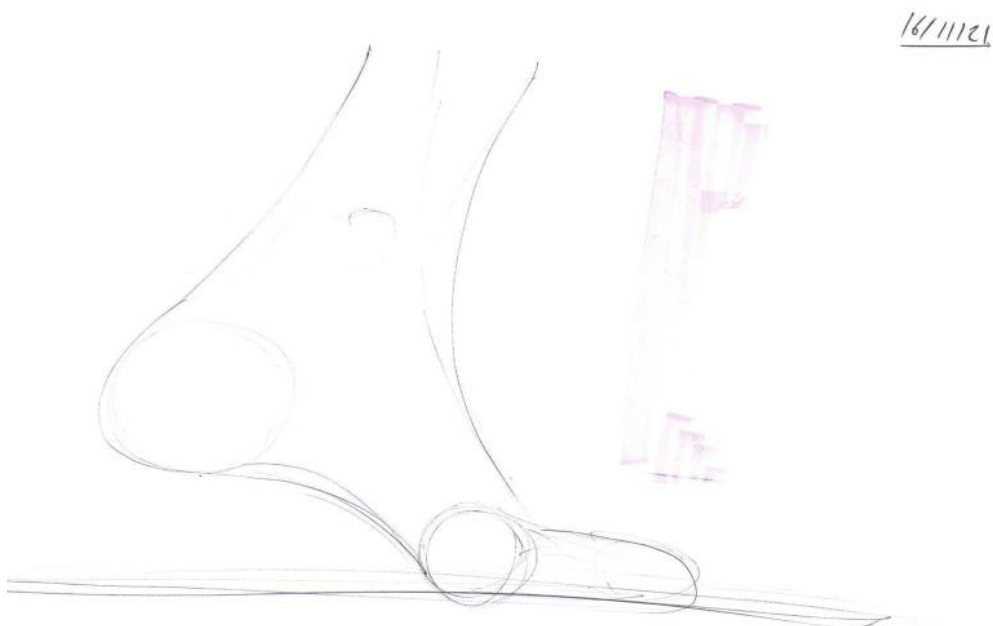
With this evidence collected my next step is to implement these findings onto the sole of the Adidas Yung-1 that I deconstructed to see if my findings match up and where that information takes me next.

Sketches of foot with stress and pressure points highlighted

Sketch of a foot resting



Sketch of foot in motion



Implementing my findings

With the use of elastic, I glued different sizes of the elastic onto the midsole of the Yung-1 to where the areas of stress were to see if these areas are the place I need to reinforce and take into consideration when I come to designing my shoe.



With the elastic in place in the areas of pressure and stress. Next step was to see just how well they were on foot to see if my theory was correct.



On foot and when on foot the elastic was in the correct places and felt comfortable when walking.

From the information gathered from this I have understood that with these pressure and stress points noted I can better understand where I need to focus and move on when designing the shoe.

Also, this helps me understand better where I need to place the wires or lace elements of my product and understand where needs to be secured down when walking and to feel comfortable.

Gear system

Using a BOA system as inspiration and a starting point, the theory I have is that this type of system can be used for everyday lifestyle sneakers. As shown in the YouTube video below.

BOA Lacing System – How It Works – YouTube

The BOA Lacing System is a simple mechanism that tightens the laces by rotating the knob and to release and loosen the laces you pull on the knob.

With these observations made and how simple this mechanism is to the eye; would it be possible to either 1) use this mechanism within my sneaker as a function or 2) use a deconstructed version of it to create a more streamlined sneaker.

Out of the two options I have listed the easiest option would be to simply take the mechanism and place it onto the sneaker which can work. But the deconstructed idea is what appeals to me the most and it could create a sneaker that is aesthetically more pleasing than one with a knob on the front or the side.

To carry into my theory of deconstructing this mechanism to fit within the shoe but also to be visually hidden apart from the lace's aspect. The theory I have is that I can make this deconstructed version small enough to fit within the sole of the sneaker rather than the upper. The problem that arises with this is that can the sole still be comfortable enough for the user to wear with this mechanism planted within it.

To start this deconstruction, I need to first figure out how small I need to make the mechanism to fit within the sole of the shoe. Again, using the sole of the Adidas Yung-1 that I deconstructed, I will be using this as a base to conduct the tests to see if it is possible to fit within and still work.

First step I did to conduct this was to 3D print a small gear in different sizes to see just how small it can go before it got too small.

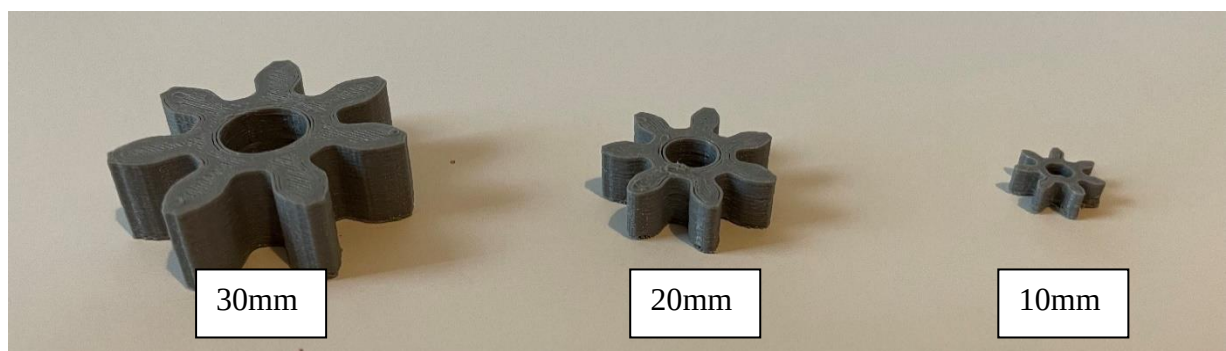
First size printed was 50mm in diameter.

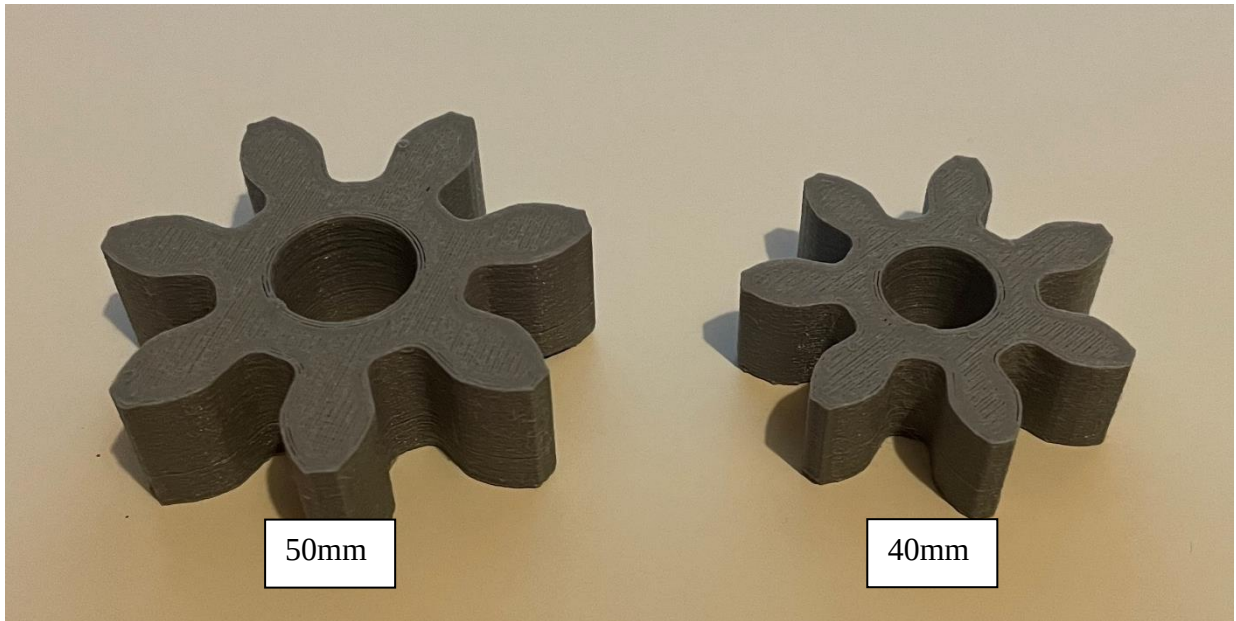
Second size printed was 40mm in diameter.

Third size printed was 30mm in diameter.

The last two sizes were printed at a diameter of 20mm and 10 mm in diameter.

Images Below.





Gear sizes on sole of shoe for size comparison





As seen from the images above I placed the different gear sizes which are resembling the BOA system to see how small I could potentially make it before it gets too small. This could lead to me using multiple sizes in example a smaller size for the heel area and a larger one in the front foot area to allow tightening at different stages. This would mean I would have to connect the two, but this is possible because of the double BOA system.

As shown in the images above the sizes ranged from 50mm to 10mm. The sizes that fit best without being too small are, 30mm, 40mm and 50mm. these sizes worked best as they would be the size the mechanism will be able to work for the sneaker.

For different shoe sizes the mechanism will have to shrunk down to accommodate for this. The shoe size used in the test was a UK MENS 8.5 Adidas Yung-1.

The area the gears were placed is roughly where the gears for my other mechanism idea which is inspired from a BOA system but it is deconstructed to be able to make the shoe more aesthetically pleasing.

Motion of tightening system

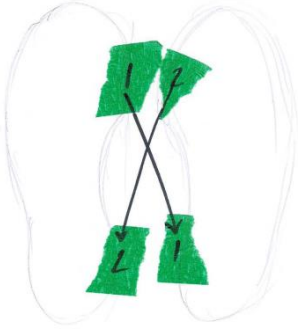
Test notes:

Theory Testing

16/11/21

1. → 2 different Taps were placed on a pair of shoes.
2. • Aim is to get the user who has the Taps on their shoes to emulate the motion of turning gears in the heel area with the Great Toe of the opposite foot (See diagram).

Diagram of Test:



The aim:

- To get Better understanding on how this mechanism could work.
- To see if the user can use / do the function without any problems.
- Observe and act accordingly
- See if any change need to be implemented to the design theory.
- To see how the users interact with the device
 - Observe
 - How do they interact with it?
 - Are they Balanced?

16/11/21

Test outcome (Taps).

16/11/21



- Courtney's Taps
- Can see she hit the Targets very well
- Hit while looking and also without looking.



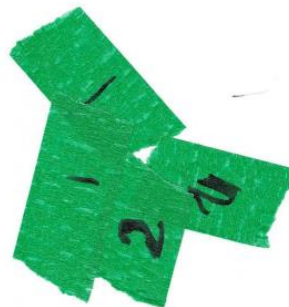
- Yumita's Taps
- Hit the targets very well
- well Balanced.
- Both looking and without looking



- Rhys O's (He) Taps
- Hit the Target effectively
- Balanced well when
- Hit targets when looking and without looking.

Test outcome (Taps).

16/11/21



- Siobhan



- Lauren Good

18/11/21

Tanya



Molly Mason
- Hit the Target very well
Boots felt more stray
Completed with ease.

Notes taken, analysis and thoughts after the test.

16/11/21

Completed:

List of participants

How did they get on?

Rhys O (Me) 43
Nike Precision 4 -

Well Balanced, Completed with ease

Courtney 43 Burgundy -
Chelsea.

Unfairly Balanced, Had trouble hitting target but got in the end.

Khawter 43 Adidas -
Sneakers

Well Balanced, No trouble hitting the target
Completed with ease.

Molly 43 F15 Low
Cut Boots

Well Balanced, Took the Concept and idea well and understood the concept. Completed with ease.

Sivan 7312

16/11/21

Observing the Testing

First Looks/Observations

- ✓ Easy to do.
- ✓ Strong Balance from Most of Participants
- ✓ Most Displayed weaker Balance on weaker foot.
- ✓ Beans are in good Place for the function to theoretically work.

Images from test participants









What have I gained from this test?

The aim of this test was to visually see if the motion of using the inner toe area (as stated in test notes and shown in diagram) to the inner heel area to stroking and rubbing them together in a backwards motion would work well enough to consider it an option for the design of the self-securing system within the shoe.

After studying and observing the test for myself with multiple different participants, my main observation was that each participant had a different style of shoe on ranging from everyday sneaker to Chelsea boot. This effected the tester in only one way from observing, and that being with the participants with low cut shoes on had slightly more flexibility within the ankle area compared to the ones with higher cut shoes on. Participants with higher cut shoes on had more balance for longer because of the support offered with the higher cuts compared to participants with lower cuts. This information alone will be helpful with my design of the shoe later.

The test worked as I had hoped if not better than originally theorised. Within the notes I kept the participants tags from the shoes when they conducted the test, reasoning for this was to see how much damage the tags had taken from the test to see how well the participants hit them. All participants hit the targets while sitting, standing on one leg on weaker and strongest feet this was to see if a user could be able to do it everyday situations, we normally put a shoe on.

The test solidified for me that this motion is possible with a BOA system in the areas in which theorised. This information is key to the design direction of my sneaker.

How can I Produce the product?

There are many options on how to produce the sneaker, the first option being to make it myself, second being outsourcing the manufacturing to a shoe manufacturer and option three would be to 3D print the sneaker itself. I will need to assess and weigh in all the options.

Option 1 : Making it myself

This option would require myself to learn new skills which would benefit me and allow me to learn skills for the industry. Downsize to this and it is the biggest factor is that I do not have access to some machinery that allow to create some patterns and undercuts for the mid and out sole as well as the upper. The sole would need to be injection moulded and or compression moulded as stated on the website [Compression and injection molded EVA midsole \(solereview.com\)](https://solereview.com) the midsole will need to be made would of a durable material such as EVA foam or PU (Polyurethane). EVA is traditionally used within running footwear and is durable but has been known to deteriorate over time and the properties of PU are more viable for the sneaker to be more sturdy and secure.

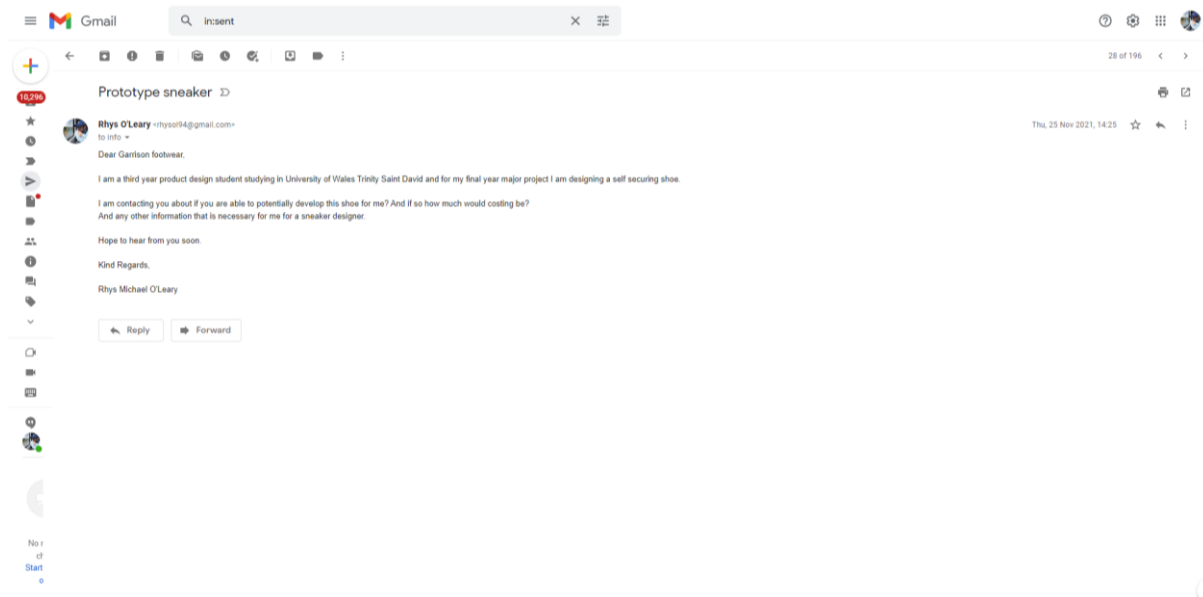
With this it would be harder for myself to create these moulds and receive the materials to be able to create this.

For the upper I would need to understand cutting patterns and sewing techniques some of which are simple, but some are more complex without the help of industrial machinery.

Therefore, I do not believe doing all aspects of this sneaker myself is a viable option and I would have to outsource some aspects of the sneaker to be able to produce the highest quality finish and product I strive for.

Option 2: Outsourcing and contacting manufacturers.

Option two is a very viable option because of the many shoe manufacturers there are within the country to be able to contact and source and produce the product for myself. This would be a viable option due to these companies such as <https://garrisonfootwear.co.uk> garrison footwear who are based within the UK, would be able to produce a sneaker for me. I have contacted the company on the 25th of November 2021 as seen below:



I contacted the company for information about costing and about prototyping a sneaker for myself. The company is yet to reply. Another company I discovered while on Instagram was the company @aggfootwearfactory who are based in Guang Zhou and Hong Kong China. This company produce and design midsoles for sneakers but also uppers. This company sells pre moulded soles and for a larger fee from what advertised upon their page on Instagram they can produce samples of your own design.

From the information gathered and the access to higher quality machinery I believe this is a viable option to proceed with moving forward.

Option 3: 3D printing

3d Printing a sneaker isn't a new idea but to print an entire sneaker is. Adidas released a 4D printed running performance shoe with a printed midsole being the Ultra Boost 4D FUTURECRAFT.



This midsole alone proves it is possible to print a sneaker but just how strong will it be?

As 3D printers print with plastic is it possible to print with a flexible filament just like Adidas but for the entire shoe rather than just the midsole?

This information is viable, and it is a viable route to start with prototyping and developing idea quickly but for a finished high-quality product it does not seem viable. But it is an avenue to research into as there are filaments for the printers that could allow a print to be flexible for an upper or a midsole that is durable enough to withstand heavy forces without breaking.

3D Printing notes

Below are the notes I made when I was researching how I could make my sneaker and also with what filaments and materials I could potentially use.

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How Can I Model
the Shoe?

3D Printing?

What type of filaments are there?

TPU - Soft + Can be bent and fold
- Hard / Messy to print with.

PLA - Brittle compared to others
- Huge Range of PLA Filaments.
- Natural, Environmentally Friendly
and Biodegradable filament.

ABS - More durable options include PLAPLUS & Carbon Fibre PLA.
- Stronger than PLA - + More durable.
- Higher Printing Temp.
- Heated bed Needed to print.
- Non-Toxic and Prints well and keeps colour.

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Hips (High impact Polystyrene).

- Similar to ABS
- Uses Limonene as Solvent.
- Stronger + less likely to warp.
- Biodegradable + Safe to use
- Requires High temps for Printing.
- HiPS is great for Support Material and for lightweight Prints.

PVA - Polyvinyl Alcohol.

- Stiff, Non-toxic, biodegradable filament.
- Water Soluble - dissolves in water must be kept dry before use.
- Easy to print ~~with~~ makes a good support material. particularly with PLA Filament.
- Dual extruder 3D printer to provide support for overhanging features.

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Conductive

- Modified PLA.
- Slightly flexible and is conductive to low voltage circuitry.
- Can be used for simple electronics like LEDs and sensors.
- Can be fused on a double extruder with PLA to make a single circuit board.
- Not that durable.

ASA (Acrylonitrile Styrene Acrylate)

- Similar to ABS - Main difference is that ASA is UV Light Resistant
- Print will not be damaged by the sun over time - perfect for outdoor prints.
- Needs to cool very slowly to avoid cracking.

Nylon (Polyamide).

- Most Versatile filament
- Very strong and can be flexible or rigid - depends on how thick the print is.
- Needs to be kept dry - can be affected by moisture:

Flexible filament

- opens up opportunities to make Rubber-like prints
Such as watch straps as well as other accessories like phone cases
- May require Modification of the printer or extruder.

What did I find out?

From my notes and the research, I gathered within them, there are several filaments that I could use to print an upper, midsole or the sole itself of the shoe. These filaments range in quality and properties from PLA which is a firm hard plastic when cooled which could be perfect for more rigid parts, TPU is a flexible filament which could be used for the upper which would need more flexibility due to the stress from the foot bending but could also be used for the midsole and it could reduce the pressure and absorb the impact when walking. The final filament would be Nylon, this filament would be perfect for the midsole because of its properties, it is strong and flexible to an extent, this depends on how thick the print is, the only con it has is that it is affected by moisture and needs to be kept dry.

3D Printing

To test out to see if I was able to print a midsole and sole of a shoe together, I printed a scaled down version of the Adidas Ultra Boost 4D FUTURECRAFT on my personal 3D printer.

The printer is a Ender 3 Pro from Creality. Filament used was PLA in a grey colour.

The test had one purpose and that was to print a midsole successfully. And if not to see what I could do to problem solve and take this information into account when the design of the shoe will be finalized.

Print 1:





The first print was a complete success. It completed printing within 12 hours. Next step now was to print it again but scaled up to a bigger size to test where the limit is with the printer.

Print 2:





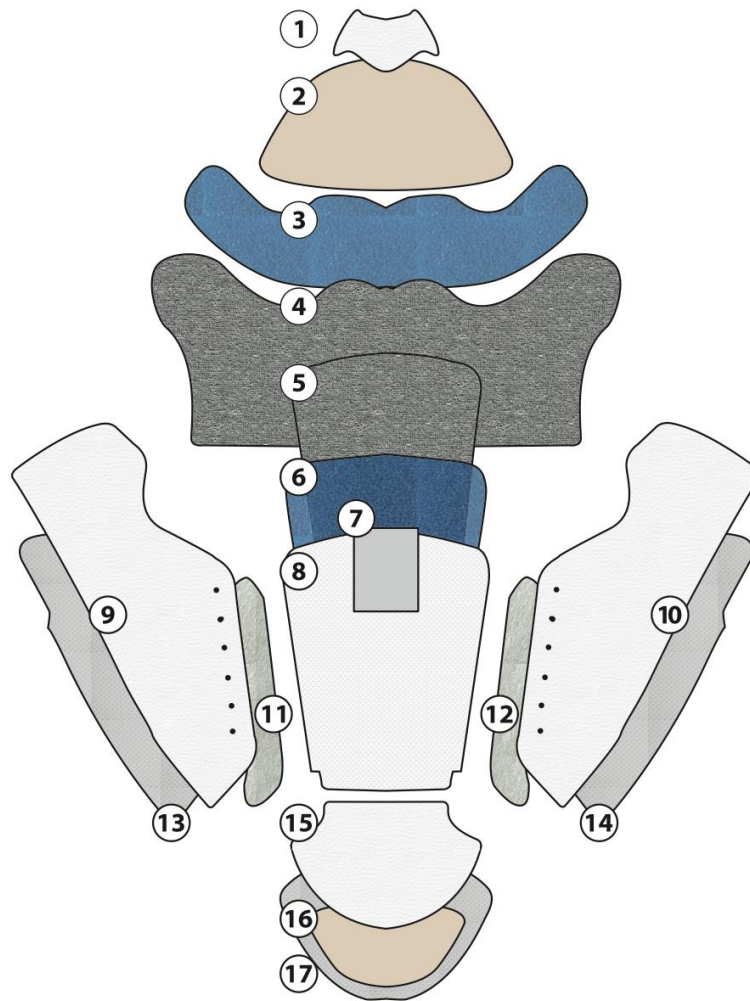
The second print was not as successful as the first print. The second print was scaled up by twice the size of the first print. Unfortunately, the print failed at the 13-hour mark. This could be several reasons as to why it failed, main reason judging from the print is that the bed was not heated properly, and the print did not set correctly on the first few layers.

From these prints I can see that 3D printing is a viable option but also a risky option as one small factor can cause the print to fail.

Cutting patterns

Most shoe companies such as Nike, Adidas, New Balance use cutting patterns for their sneakers. This isn't just a sneaker design trait but also a fashion industry trait.

Brands use cutting patterns out of paper and trace the measurements onto the paper then cut the patterns out and lay them onto the desired fabrics then to be cut. Sportswear companies and fast fashion brands use machines to do this to eliminate wasted time. To be able to make my shoe I will be using cutting patterns for the upper out of fabrics or knitted fabrics.



The above image is a simple diagram on how a shoe's upper is cut into different segments then sewn together. Understanding this will help me know what parts of the shoe's upper are the most important.



Larger companies use machines such as the one above to cut multiple patterns out at the same time, this speeds up the process and allows the brands to produce multiple pairs at once. When patterns are cut to their correct measurements, they will then be sewn together to create the designed upper just like the Nike Atsuma that uses all aspects of the cutting patterns to create less waste.

[The puzzle-like pattern on these Nike sneakers cuts waste \(fastcompany.com\)](https://www.fastcompany.com/3045555/nike-atsuma-shoe-patterns)



With the cutting patterns creating a lot of waste when cutting into the materials a key element I will have to consider is the amount of waste that could be generated due to the product and its complexity.

There are many ways of pattern cutting fashion brands use the main two used are, Flat Pattern Cutting or known as Creative Pattern Cutting and the second is Computerized Pattern Cutting or also known as CAD or Gerber methods.

Some fashion cutting pattern software are Fashion Cad and Teletia. One software FootwearCAD that allows creating cutting patterns for shoes easier for the designer.

[Shoes patterns design software - MiriSys FootwearCAD](#)

I believe that using cutting patterns will be how I tackle to create the upper for my shoe. And the use of the software FootwearCAD will be of help to create these patterns. With the patterns it will be easier to create the complex designs for the upper as it will have to accommodate the mechanism

Conclusion: My design direction

My design direction will be to create a self-securing sneaker for lifestyle wear. The aim is to create a sneaker for the future market that allows the user to secure the shoe without the use of their hands to tie laces or press a button to tighten or loosen the sneaker. I will be designing the sneaker for 5 years' time as footwear companies design for 10 years in advance. Therefore, I will be doing the same as these brands.

With the information and research gathered by myself I believe the direction this product will take is that it will be:

- 1) Aesthetically pleasing and not clunky looking on foot and in hand
- 2) Easy to use and understand out of the box.
- 3) Comfortable to wear for long periods of time.
- 4) Not heavy but also not extremely lightweight.
- 5) Product for the future market.
- 6) Affordable for everyone.
- 7) Readily available.

Links and useful Videos used

[Shoes patterns design software - MiriSys FootwearCAD](#)

[The puzzle-like pattern on these Nike sneakers cuts waste \(fastcompany.com\)](#)

[What Sneaker Designs Have Looked Like Over the Years \(insider.com\)](#)

[What is Origami? Exploring the The History of Origami \(mymodernmet.com\)](#)

[Origami-inspired clothing range that grows with your child wins Dyson award | Ethical and green living | The Guardian](#)

[Compression and injection molded EVA midsole \(solereview.com\)](#)

[Polyurethane-foam midsoles in running shoes - impact energy and damping - ScienceDirect](#)

<https://www.foot.com/7-important-features-look-winter-boots/>

[Boa Technology: How Does It Work? | Shoulders of Giants](#)

https://librarysearch.uwtsd.ac.uk/permalink/44WHELF_UWTSD/1ir6fgh/cdi_informaworld_taylorfrancis_310_1080_09511920412331292637

[BOA Lacing System - How It Works - YouTube](#)

https://www.youtube.com/watch?v=7wrw19K_g_M

https://technologyoutlet.co.uk/blogs/news/3d-printer-filament-types-explained?gclid=CjwKCAiA7dKMBhBCEiwAO_crFH2unlVaRQNGkVn_mKrubINErMgTh_0-gr09osLY5I6bRkxRJJ3jPxoC85cQAvD_BwE

[Nike Hyperadapt 1.0](#)

<https://www.youtube.com/watch?v=C9Plog9I1JY>

[Garrison footwear: Manufacturer](#)

<https://garrisonfootwear.co.uk>