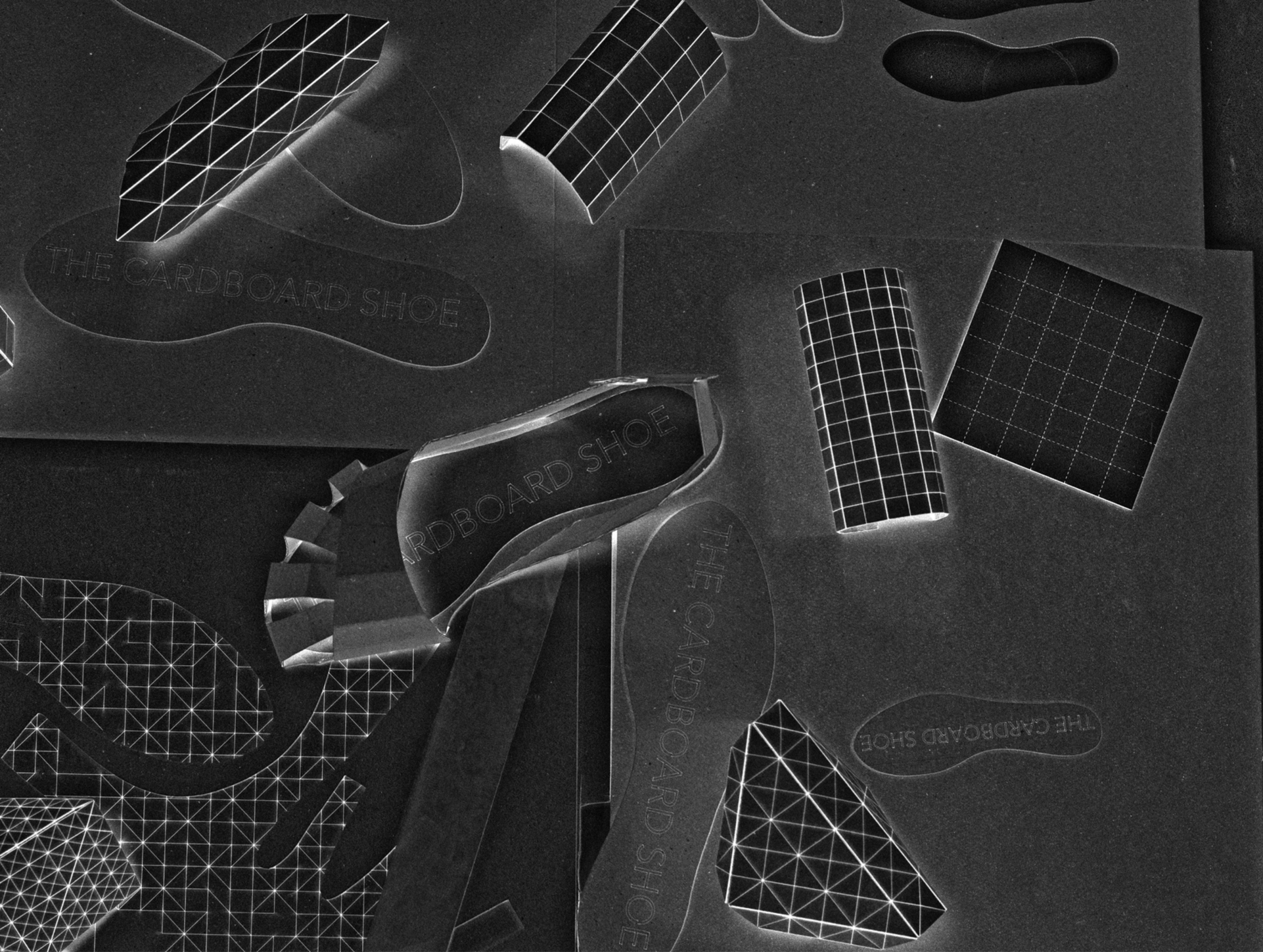
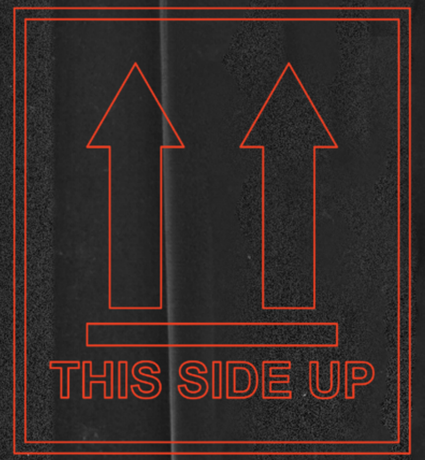




Zachary Berry

SG IMPERIAL Royal College of Art

Manifesto

The Latin prefix 're' refers to an event occurring again, and again, and again. In the case of re-generation, this can be understood as a cycle of growth and regrowth, repeating indefinitely.

However, I believe regeneration contains a more nuanced meaning. Regeneration is not just about repetition; it is not a closed loop. To explain this point better, I would like to provide the example of a bird's nest.

In winter months, trees go through the process of abscission: leaves die, and fall to the ground. Wind, and changing temperatures, also cause twigs to snap and fall likewise. Before summer, animals shed their winter coats, in preparation for warmer temperatures. Humans shed as well. Being humans, this comes in the form of plastic waste, across all four seasons.

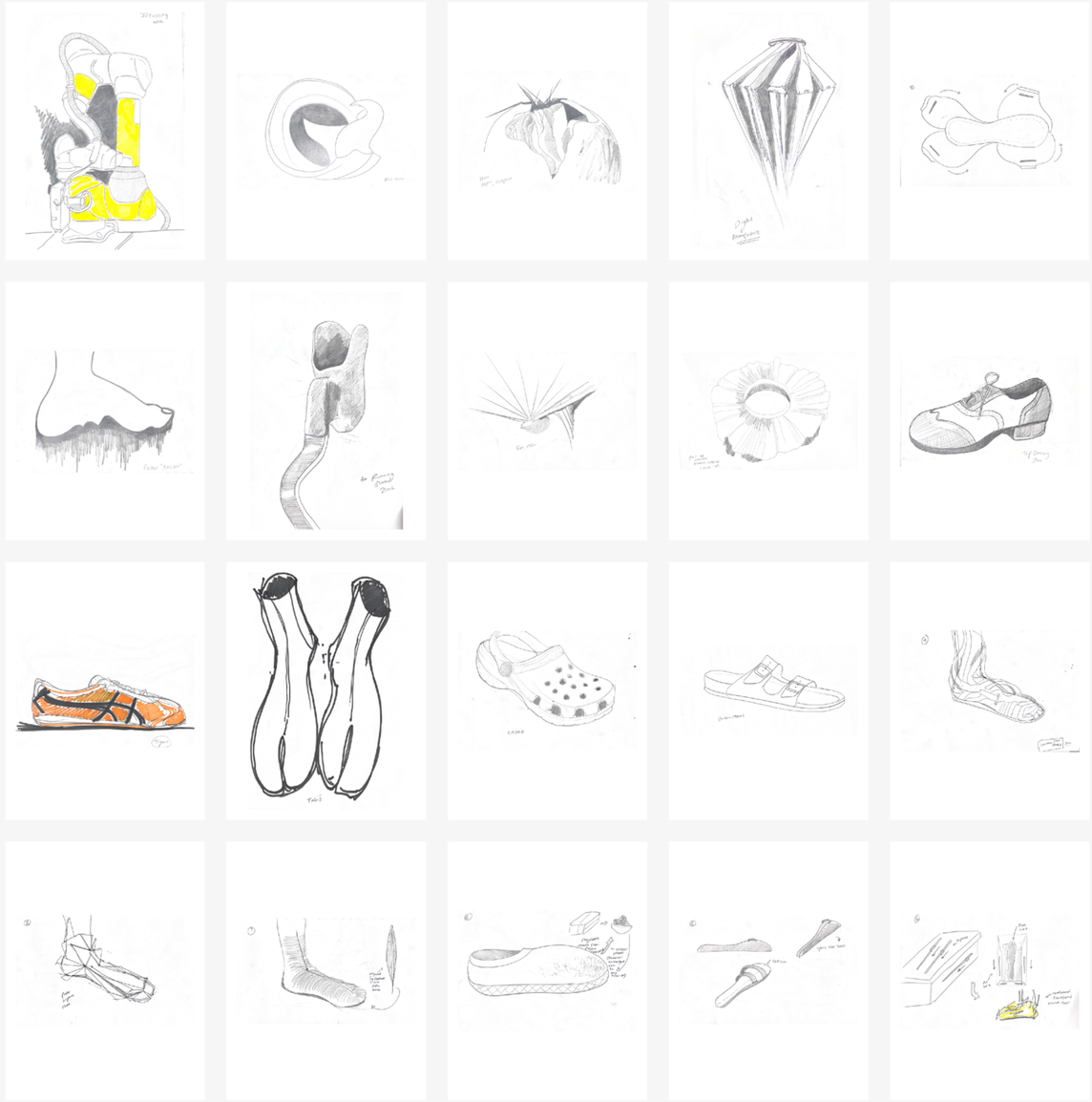
In each of these examples, the cycle of growth restarts; trees grow new leaves, animals new fur, and humans new waste. However, the debris lying on the ground is not dead. This is where regeneration takes on its second meaning.

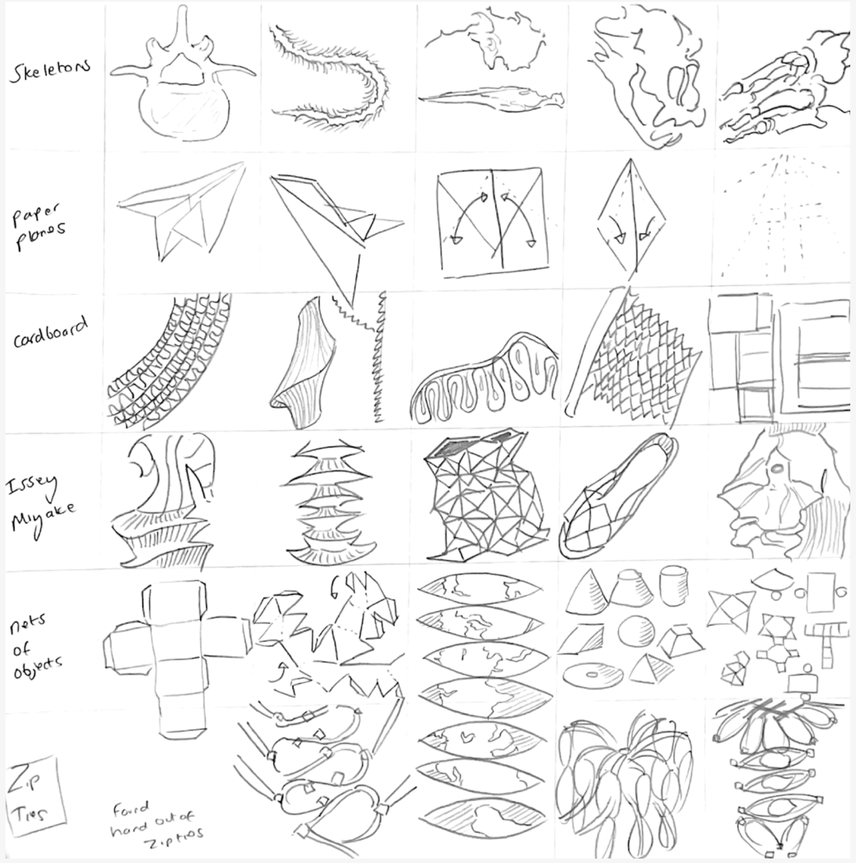
A bird, in this case, a weaver, enters the scene. In a process of careful selection, the weaver sifts through this debris, sorting by durability, availability and water resistance. With the skill of a master craftsman, the bird then weaves, layers and interlocks the materials to create a supporting exterior structure. Often, it uses mud, or its own saliva, as a binding material. Finally, it employs the softer debris to create a comforting layer of insulation for its chicks. Upon its completion, all the materials find a new life, and a new purpose, inside the nest - even the plastic.

This is regeneration, where materials do not die. They instead change careers. Their functions shift, and adapt to suit the needs of a different user. In the case of human regenerative design, we must not leave our debris to rot, but instead, build nests.

The nests of a house finch and a common yellow throat.

Ideation





For some initial inspiration, I visited the Victoria and Albert Museum to do some sketching (see left). I also started sketching out different paper forms, inspired by Issey Miyake, paper planes, animal skeletons and the nets of different icosahedrons.

Impact

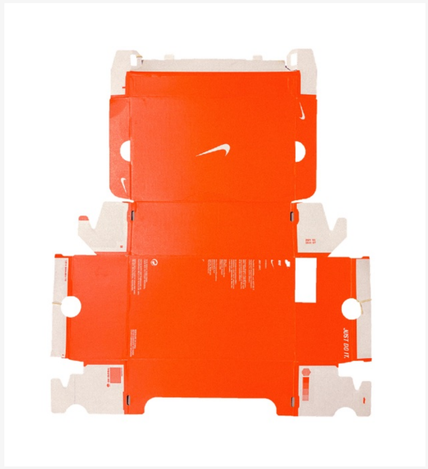
Each year, approximately 300 million pairs of shoes are thrown away by the British public. These shoes usually make their way to landfill.

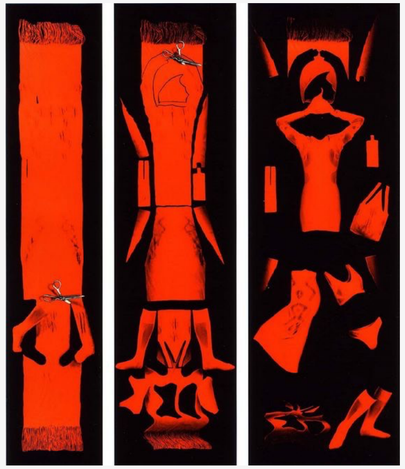
Disposable shoes - often used in hospitals, airports, hotels, spray tanning booths and on holiday - usually make their way to landfill. These are usually made from non-biodegradable materials such as EVA and polypropylene.

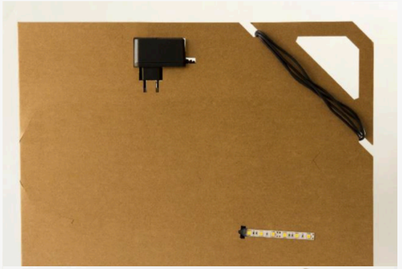
However, shoe waste does not end with the shoe itself. Cardboard shoeboxes, if not properly recycled, also end up in landfill. When cardboard breaks down, it releases methane, a greenhouse gas with a global warming capacity 21 times greater than carbon dioxide.

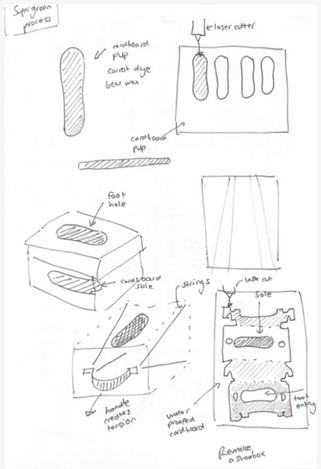
My shoe, entitled THIS SIDE UP, seeks to address both of these issues, with the creation of a fully biodegradable disposable shoe made from waste cardboard.

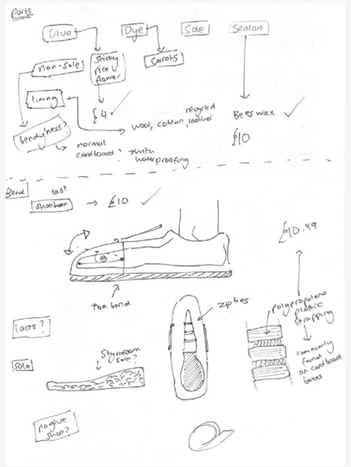
Ideation²

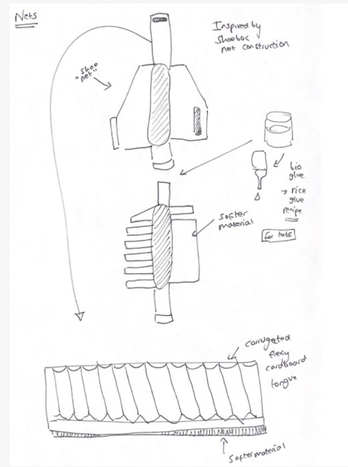


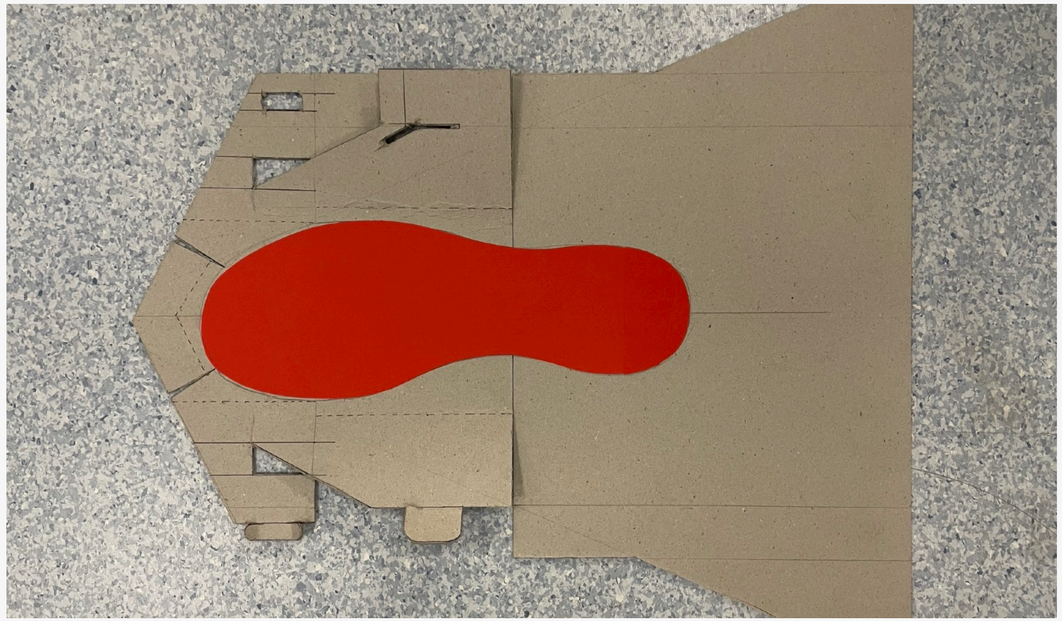










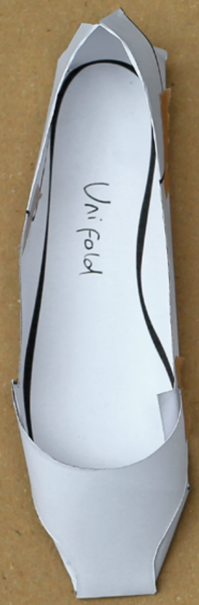


For the form of my shoe, I am heavily inspired by shoebox design, and package design in general. I would like my shoe to be shipped as either a box, or a flat singular piece. In both occasions, the wearer will simply fold the shoe around their foot, just like a piece of a packaging. Above are some examples of flat-pack fashion, inducing APOC by Issey Miyake, and some leather sandals by Louis Vuitton. I begun sketching and prototyping my flat-pack shoe. The red sole on the right indicates the part of the shoe which will be made from a different, more durable and waterproof cardboard material. The sides, which interlock, will be made from a different cardboard formulation which is more flexible.

Ideation[3]

Pattern from *Curiosity Box*

Pattern from *Louis Vuitton sandal*

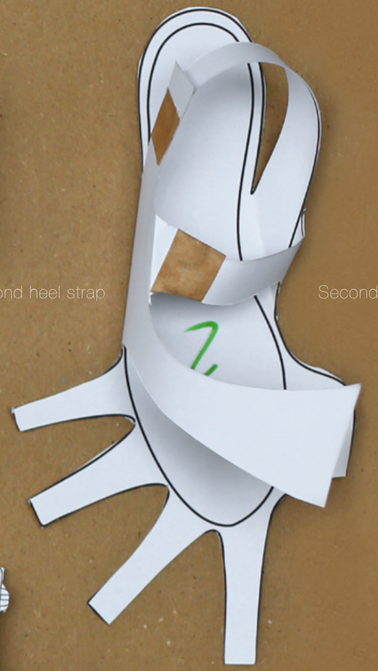


Pattern from *Unifold*

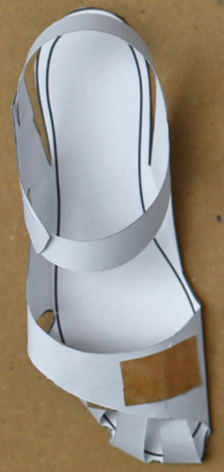
Toe joints

Toe joints[2]

Second heel strap



Second heel strap[2]



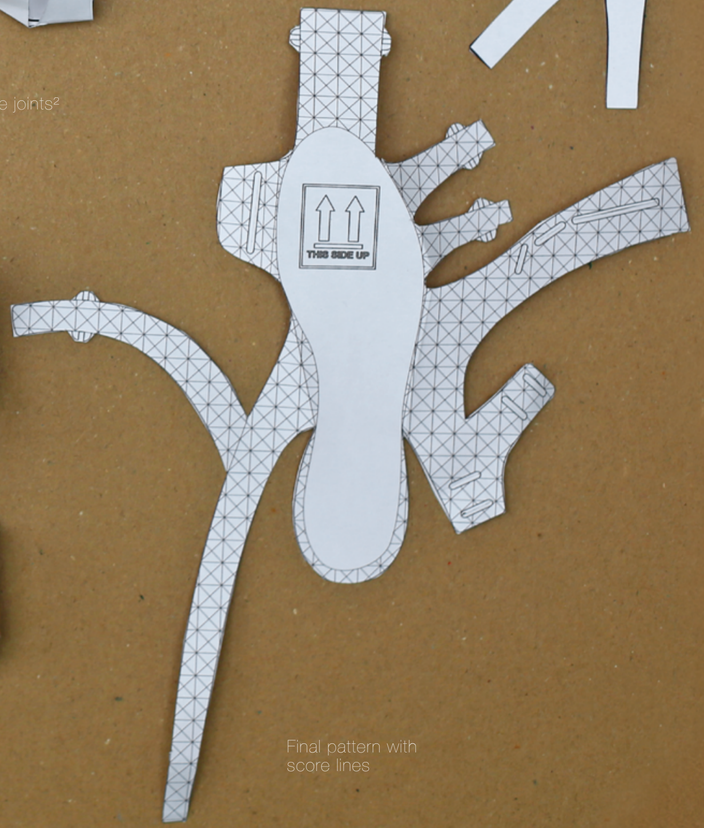
Quad strap toe

Third heel strap

Double strap toe

Triple strap toe

Triple strap toe[2]



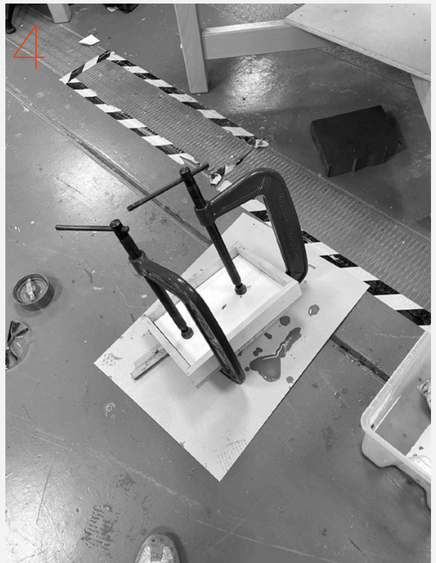
Final pattern with score lines

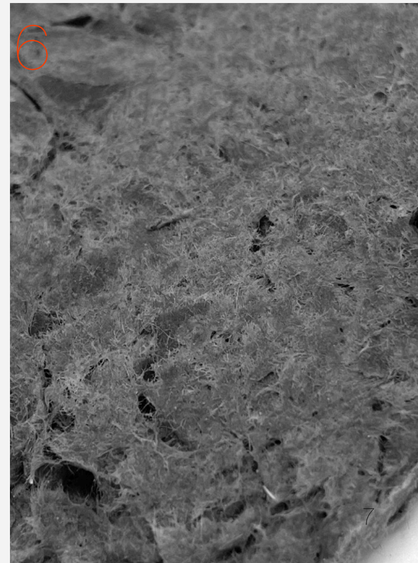
For the form of my shoe, I began creating some lo-fi prototypes out of paper. I was inspired by some of the sandal shoe patterns from Louis Vuitton, Unifold and Curiosity Box. Much of these iterations were researching the heel supports, which I will be creating with scored cardboard straps. Likewise, I did quite a few prototypes with the toe of the shoe, trying to determine the correct amount of straps so it wasn't overcrowded, and also how the straps would join at the toe without glue.

Material Exploration

I have decided to use the shoebox as the source of inspiration for this project, both with materials and form. Most are made from cardboard, which is a very versatile substance. It can be pulped, hardened, and even made waterproof. Taking inspiration from the shoe lasts I found inside some Salomon shoes, I began experimenting with making my own cardboard pulp.

First, I shredded a shoebox and soaked it for several days in water. I then blended the solution with a homemade Nutri-bullet. Next, I added 25 percent worth of rice paste, used to make sticky rice. This acts as a binding agent, strengthening the material. I built a wooden press, and used G-clamps to put pressure on the solution. After a day of pressing, the material unfortunately broke apart in did not hold as a single sheet. I need to create a different press, which doesn't stick to the material, and create a thicker layer next time.





Material Exploration²

Shredded recycled cardboard

Pulped cardboard material

62.5% cardboard
37.5% glutinous rice flour

Pulped cardboard material

Pressed and dried for 2 weeks

Shellac resin

83.5% isopropanol alcohol
16.5% de-waxed shellac flakes

(1) - Pulped cardboard material

Coat of shellac resin
Submerged in water for 24 hours

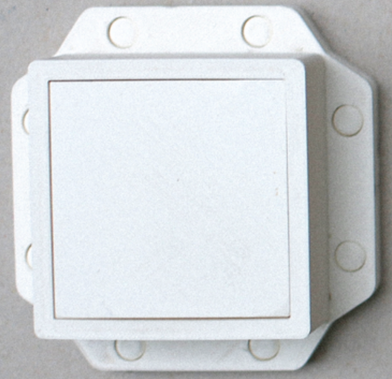
(2) - Pulped cardboard material

No coat
Submerged in water for 24 hours

(3) - Pulped cardboard material

Coat of beeswax
Submerged in water for 24 hours

(1) (2) (3)



3D printed PLA 3-part mould

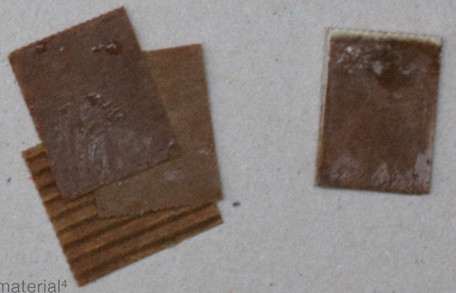
Pulped cardboard material

Pressed in 3D printed mould

Pulped cardboard material²

37.3% cardboard
22.4% glutinous rice flour
22.9% beeswax
14% honey

(4) (5)



(4) - Shredded cardboard

No coat
Submerged in water for 24 hours

(5) - Shredded cardboard

Coat of shellac resin
Submerged in water for 24 hours

Pulped cardboard material³

31.8% cardboard
19.1% glutinous rice flour
19.5% beeswax
14.8% honey
14.8% shellac resin

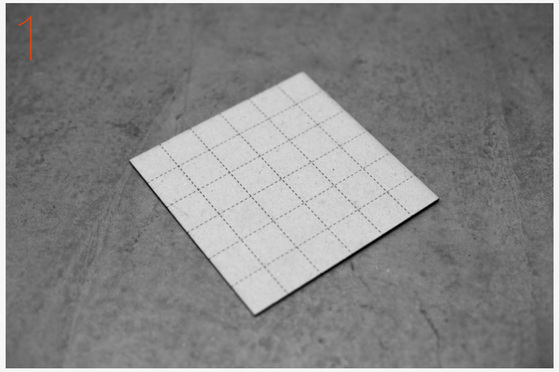
Pulped cardboard material⁴

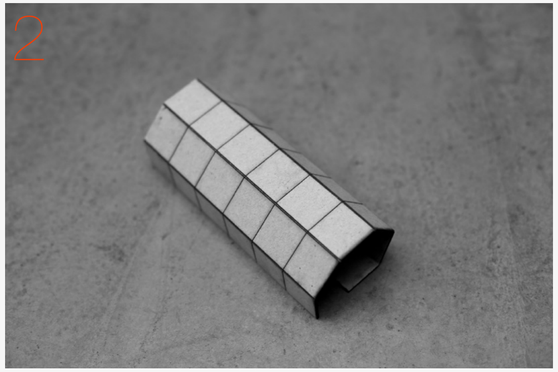
45.2% cardboard
27.1% glutinous rice flour
27.7% beeswax

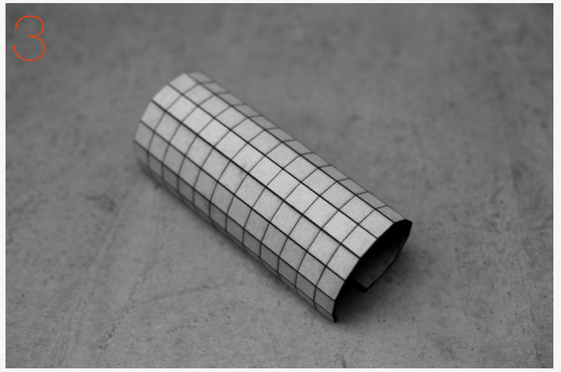
Pulped cardboard material

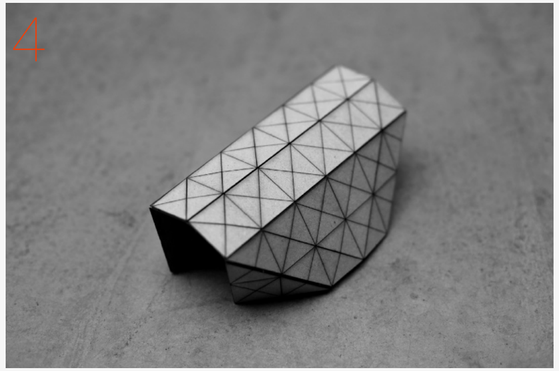
Scoring experiments

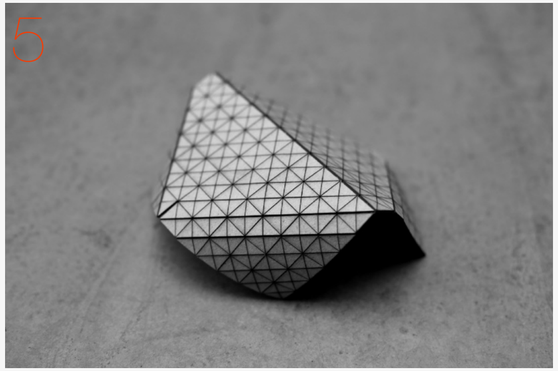
Scoring

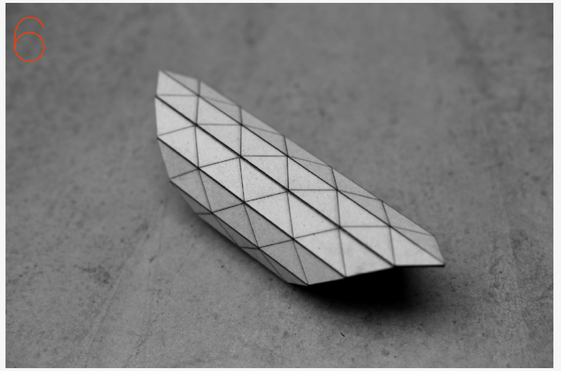


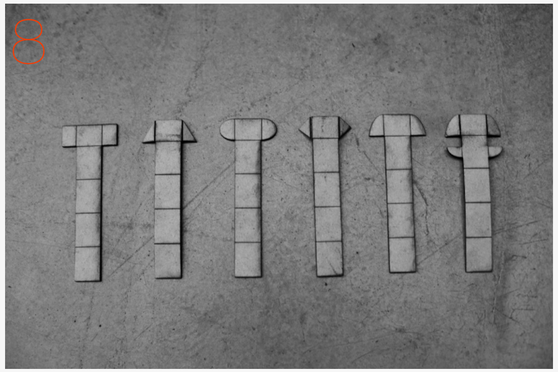


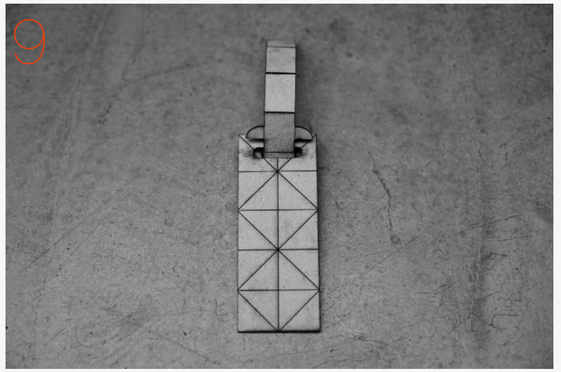










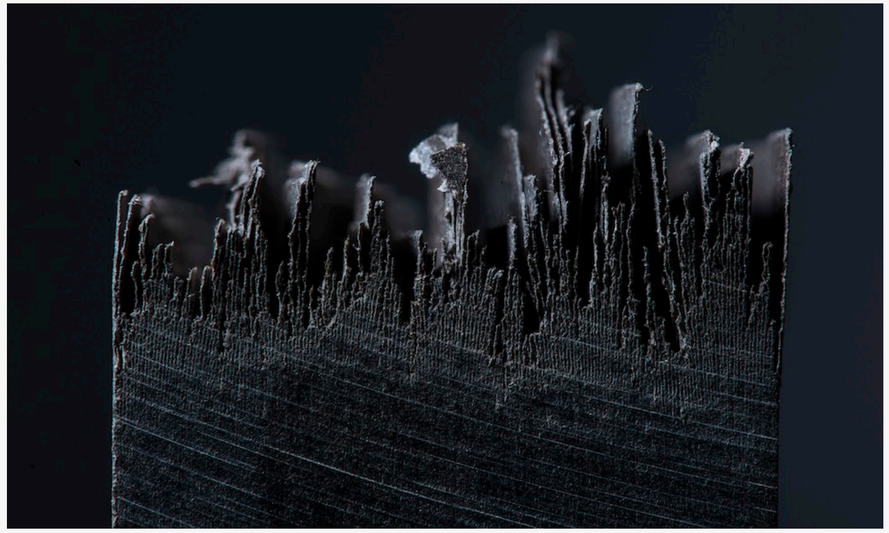


Inspired by the folds in origami and kirigami, I began experimenting with some different scoring patterns with the laser cutter. The shoe I am creating will be shipped as a singular flat cardboard sheet, so the material needs to be scored in a certain way which allows for flexibility. Moreover, the pattern I designed involves twisting the paper to form straps, so the scoring patterns also needed to account for that.

Scoring²

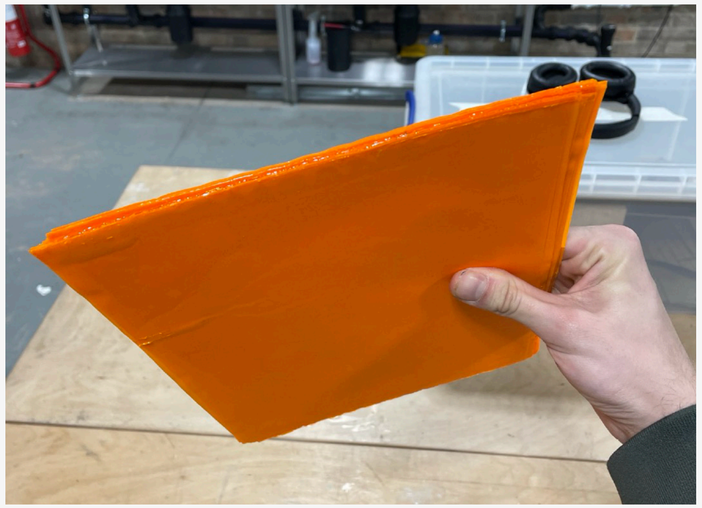
On Adobe Illustrator, I combined my scoring patterns with the pattern of my shoe. I then laser cut these experiments in grey board. Grey board is stiffer and stronger than regular cardboard, and twisted well with scoring. As a result, it is a suitable material for the upper of my shoe.

Sole



For the sole of my shoe, I planned to try create a new cardboard material inspired by Richlite. Richlite is a paper-based sustainable material created by layering sheets of recycled paper and food-friendly resin. It is then placed in a hydraulic press, where it hardens, and becomes waterproof. It is very durable, and is commonly used for cutting boards. I plan to create an even more sustainable version of Richlite by creating my own bio-resin out of shellac and denatured alcohol. For the sides of the shoe, I want to experiment with folded cardboard which I will sew thread into to prevent tearing. I then want to test out beeswax as a possible waterproofing solution.

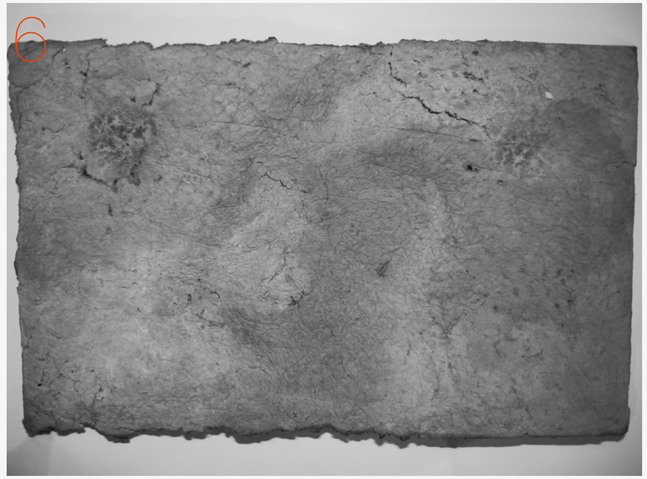
Sole²



I dissolved some shellac flakes in isopropanol alcohol, creating a natural resin. After coating the resin on 50 sheets of paper and placing it in a press for 24 hours the material unfortunately was still quite soft, and the paper sheets hadn't bonded together.

Product Development

My resin sole material failed either because of the ratio of alcohol to shellac, or because of the lack of pressure I applied to the paper sheets. As a result, I turned back to my material experiments, and decided to attempt a sole made from cardboard pulp, glutinous rice flour and shellac resin as a coating over the top. This material was very hard, and also quite water proof relative to my other cardboard material variants. I created a new press, which this time, I coated with grease proof paper to prevent sticking. I also put a lot of weight on the material as it dried to prevent it bending. I needed a flat sheet for use in the laser cutter.



Product Development²

Final Illustrator file to cut in grey board to create the upper of my shoe

Final

1

Final soles cut with my cardboard material, and coated with natural shellac-based resin

2

3

Final²

Final^3