




# *Cavéos*

## *Time Bound Provocations*

MA/Msc Innovation Design Engineering  
Royal College of Art  
Imperial College London  
Year 1 - SuperGreen final Booklet

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*Design is a tool to enable and enhance freedom.  
To design is to be free.  
I design to reclaim agency for freedom.*

# Manifesto

*For Thinkers & Dreamers*

Since 1984 BC

To be Human is to be FREE



# Material Exploration



## Bacterial Nano Cellulose

BNC is a wonder material that is currently confined to specialized applications. The material is highly versatile with mechanical properties matching those of Aluminium and steel. It was hard to secure the material and harder to make it within the 5 weeks timeline.

## Gelatin

Gelatin is a common binder in the bio material processess. Using it as a direct material sounds counter intuitive but it has its own advantages as one can easily bind other materials to it.



## Ceramic X



## Eggshell Ceramic X

## Leaves

Leaves of various plants to understand how to mamke a product from them by increasing the life of the leaves as much as possible through natural processess.



# Inspirations

These are my inspirations from the mood board that I created at the beginning of the project

## The Braided



## The Soles

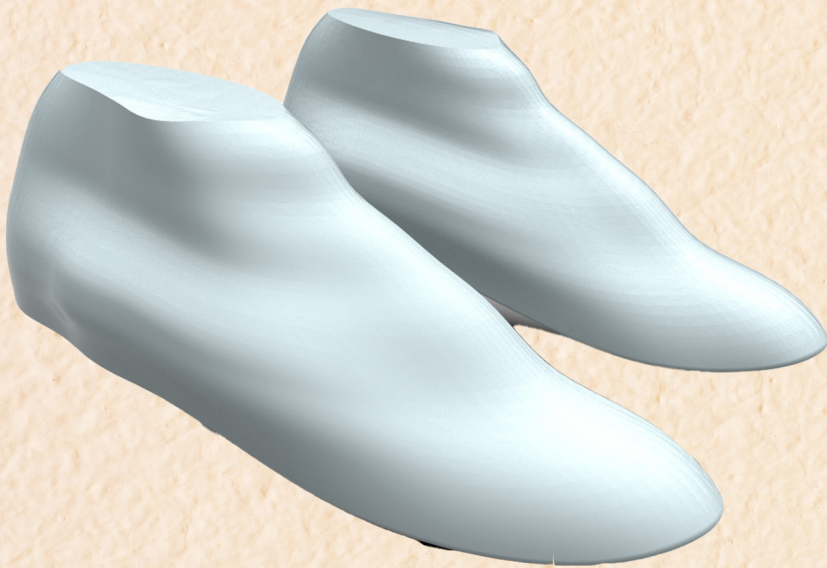




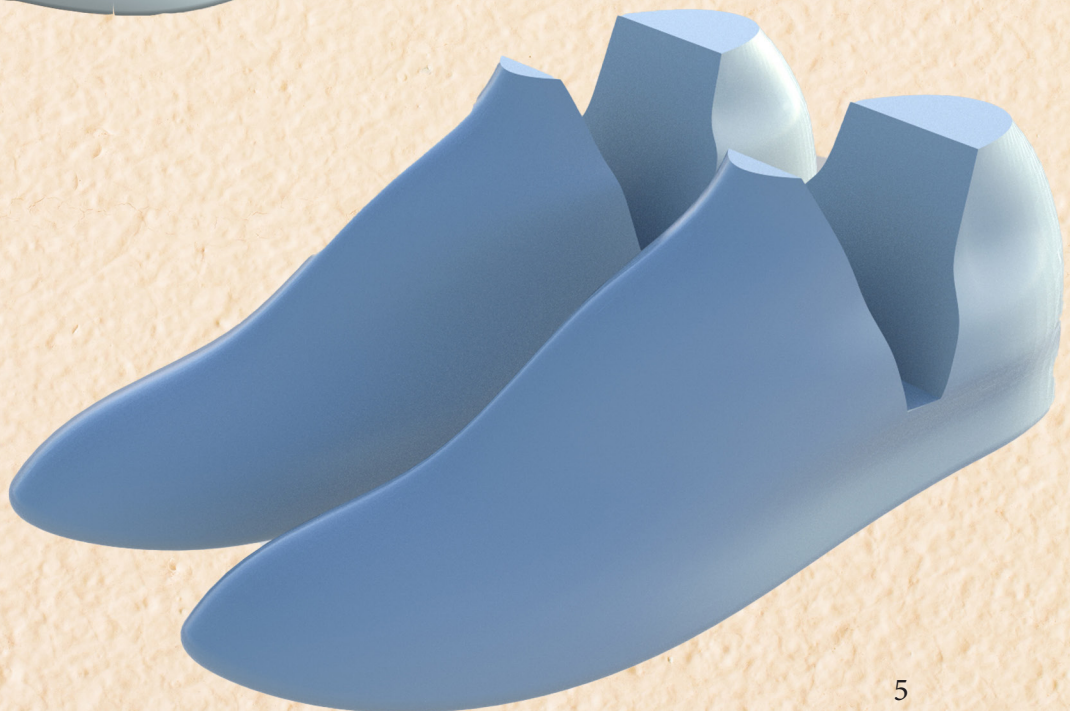
# Ideas & Ideation

*The initial idea is to braide the upper and other layers of the shoe and sew them to the sole. To that accord, Lasts were designed for the sizes shown below. These were the lasts of Sneakers/ Trainers.*

*The iteration 1 was 3D printed and Iteration 2 wasn't because of the change of plans of the final product from a trainer to a sandal.*



*Iteration 1  
Size : UK 15*



*Iteration 2  
Size: UK 9*



# Leaves, Leaves, and

Initially the idea was to use coconut (*Cocos Nucifera*) leaves for the following reasons.

1. The leaves have historically been used to craft bags.
2. SunbirdStraws used these for their product.

SunbirdStraws is a drinking straw manufacturing company in India. They made their straws from coconut leaves. These straws have a shelf life of 9-12 months and are completely hydrophobic without any external waxing.

The sandal project tries to leverage the same properties of the coconut leaves.

Since the coconut leaves are not very prominent in the UK and Europe, the designer tried various palm leaves that are, although not native, but are widely grown as indoor plants in the UK neighbour hoods.

This lead to the discovery of the palm leaves, which are used for this prototype. Although they pale in comparison to the coconut leaves in terms of wax content, fibercontent and durability, they could still be used for the aforesaid purpose.

The final product demonstrates the same.



# More Leaves . . .

There are a few significant differences between the Palm leaves and the coconut leaves. Here are a few.

1. The wax content in the leaf weight is significantly different.
2. The dexterity and the strengths of the leaves are also very different.

Leaf type	Wax Percentage	Properties of wax
Coconut	5%	Hydrophobic & Anti-fungal
Palm (Areca)	3%	Hydrophobic
Palm (Kentia)	0.5%	Barely Hydrophobic

Sunbirdstraws have a specific process that they use in the processing their leaves. They wash them, STEAM them, and then mould them into pens and straws.

Although the exact parameters of steaming are not known, since its the IP of the company, the most optimal parameters for steaming are found out through research.

(xAI - Grok is used for that specific research)

The steaming times also vary based on the type of leaf chosen and their wax content.

Epicuticular wax of these leaves is detrimental for the life of the end product made from these leaves.

The lower the wax content, the lesser its life.



# The Technicalities ^

Leaf Name	Scientific Name	Optimal Steaming time	Operational life(raw)	Life (steamed)
Coconut	Cocos Nucifera	15-20* minutes	2-4 weeks	1-2 months
Palm Areca	Areca Catechu	10-15* minutes	2-3 weeks	3-6 weeks
Palm Kentia	Howea forsteriana	8-12* minutes	1-2 weeks	2-4 weeks

Leaf Name	Life (S+B)**	Life(S+B+G)***	Life (S+B+G+E)****
Coconut	2-3 months	3-5 months	4-6 months
Palm Areca	1-3 months	2-4 months	3-5 months
Palm Kentia	3-6 weeks	1.5-3 months	2-4 months

\* The upper limit of the steaming time is based on the end use of the leaves. If used for making the sole, then use the higher time. For Uppers and others use the intermediate or middle times

\*\* S +B refers to steaming + Beewax sealing.

\*\*\* +G refers to Gelatin soaking and drying.

\*\*\*\*+E refers to addition of the ground egg shells to the mix.

^ All the data presented in this page is generated using Grok3, an advanced AI model of xAI.



Since Palm Kentia leaves have the lowest life and is the worst of the three, it is selected for prototyping.

The author believes that any success on palm kentia could be easily reciprocated on others with improved performance and results.

Palm Kentia Leaves are chosen for the current project of Supergreen, Archetype : Shoes.

Let's take a look at the differences in the Epicuticular wax of the three leaves that were explored in the material exploration.

<https://x.ai/news/grok-3>

<sup>8</sup> This is the image of Palm Areca leaves.

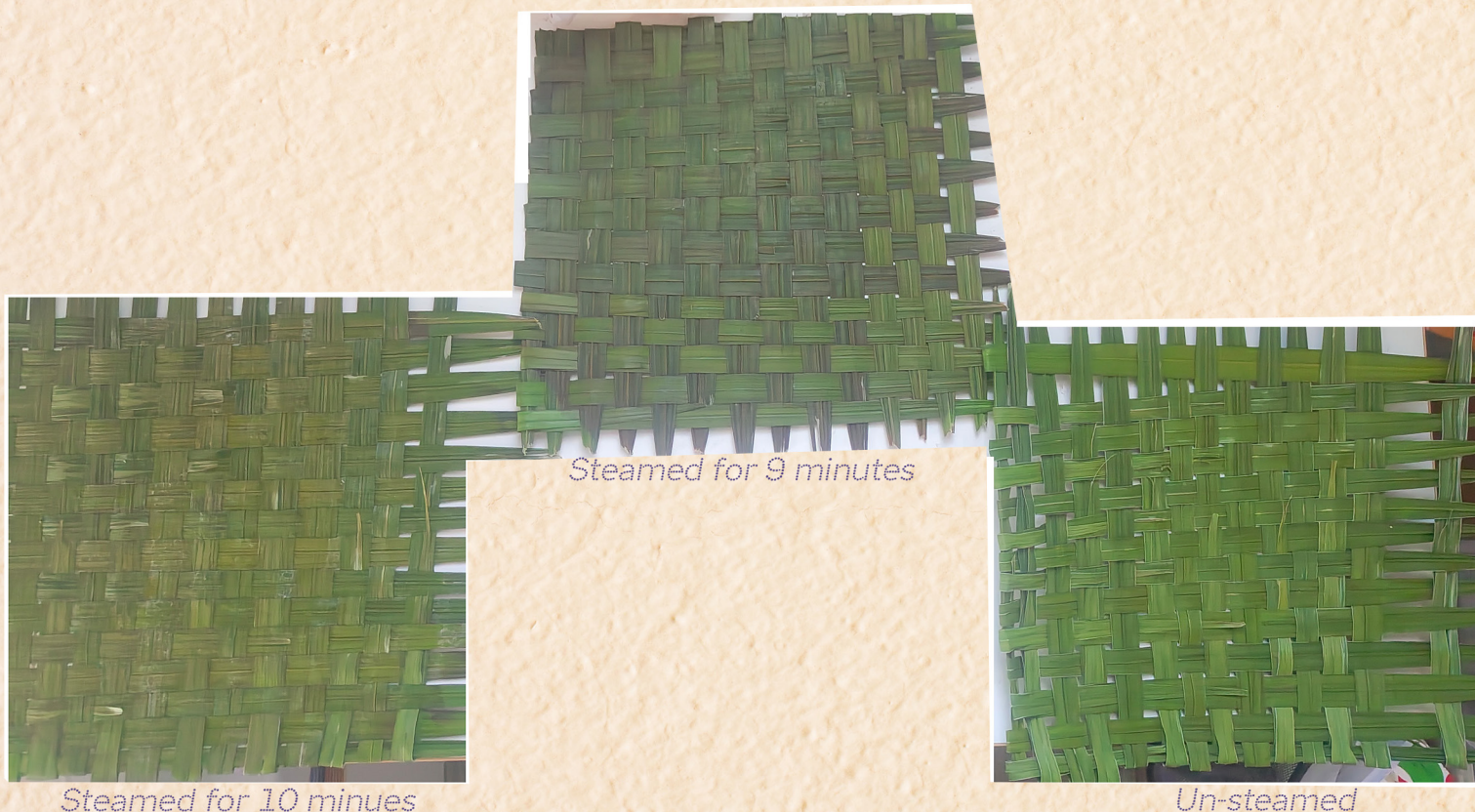


# The Epicuticular Wax

The Epicuticular wax is a lipid coating on the surface of the leaves, protecting against water loss, UV damage, and pests. They are primarily made of Hydrocarbons, Fatty Alcohols, Fatty Acids, Wax esters, and traces of Aldehydes.

Here's a detailed composition of the waxes of the three leaves.

Leaf Name	Wax Content	Key Components	Properties	Melting points
Coconut	3-5%	C29H60 C28H580 C16H3202 C44H8802	Thick, Sticky highly hydrophobic, durable	60-80 degrees
Palm Areca	1-2%	C27H56 C26H540 C18H2602 C44H8802	Thin, Crystalline, moderately Hydrophobic Fair duralbility	60-80 degrees
Palm Kentia	0.5-1%	C27H56 C26H540 C16H3202 C44H8802	Very Thin, Smooth, low hydrophbocity fragile	60-80 degrees



Although it is not clearly evident in the picture, the leaves glossed a little bit after the steaming process.



# The Process

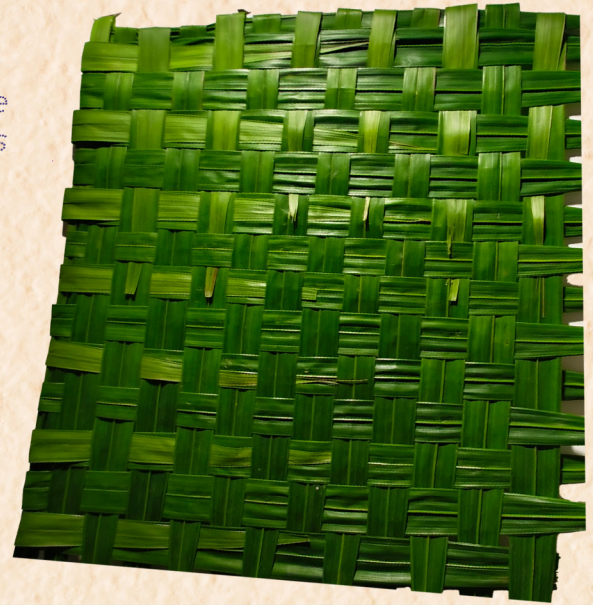
## STEP 1

### Braiding of Leaves

Braiding is an ancient technique widely used all across the world even today. The braiding of Palm kentia leaves takes about 2.5 hours for a braide of 14 X 14 leaves.



Steaming of Kentia leaves for 10 mins



Braided Kentia leaves

It is important to note that the leaf age affects not only the briade but also the quality of the wax layer post steaming.

It is very important to select and use only the old leaves for any purpose.

## STEP 2

### Steaming of Leaves

Steaming of leaves gives them a natural wax coating that improves their durability and prolongs their life. Kentia leaves are suitable for a steaming time of 8-10 mins.

The steam temperature should be around 90-100 degrees celcius, and the leaves must not touch the hot water while steaming.



Steaming of Kentia Leaves for 9 ,minutes



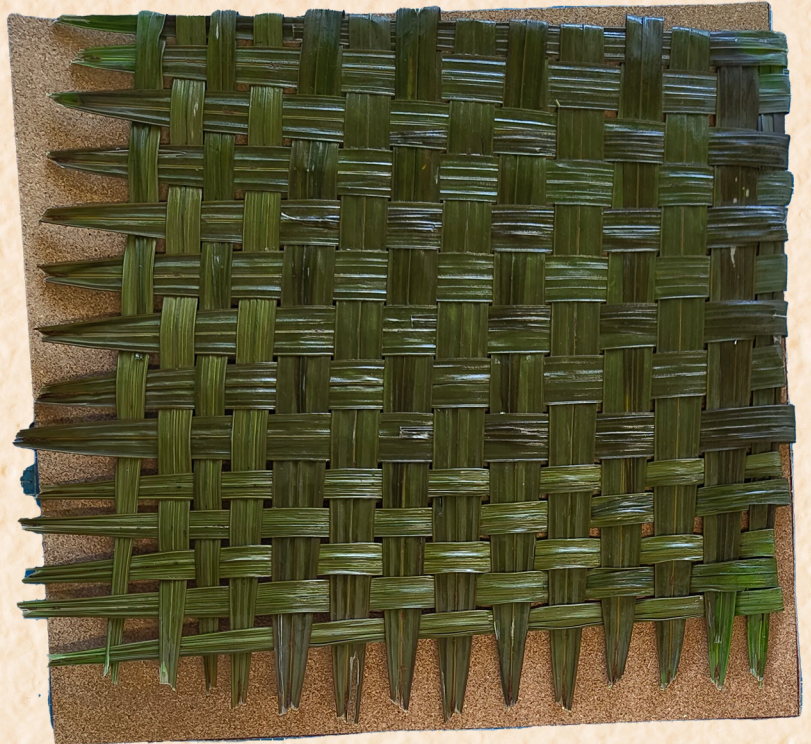
# The Process...

## STEP 3

### Applying the Beewax

The Bee wax is a natural and essential process required for the life of Kentia leaves. After the steaming, the bee wax is applied to the leaves and then they are cured for 10-15 minutes with a hair dryer to allow the wax to spread evenly and also to be absorbed into the leaves.

This not only improves hydrophobicity, and others, but also makes leaves stiff and durable.



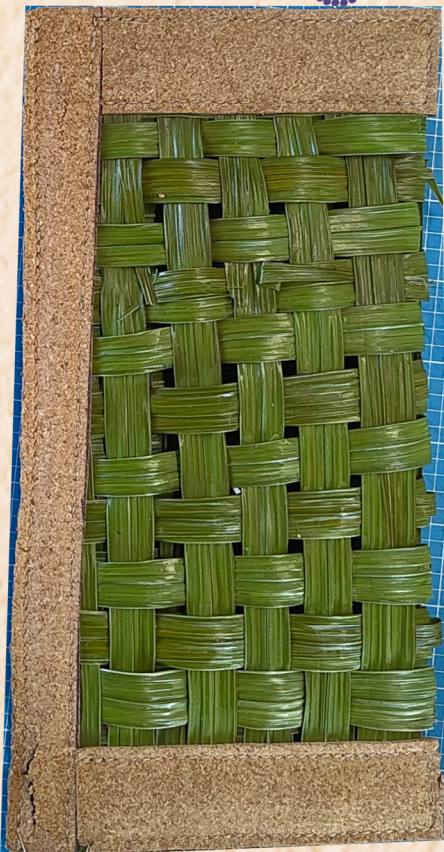
Applied Bee Wax Leaves

## Sealing the Leaf Braides

## STEP 4

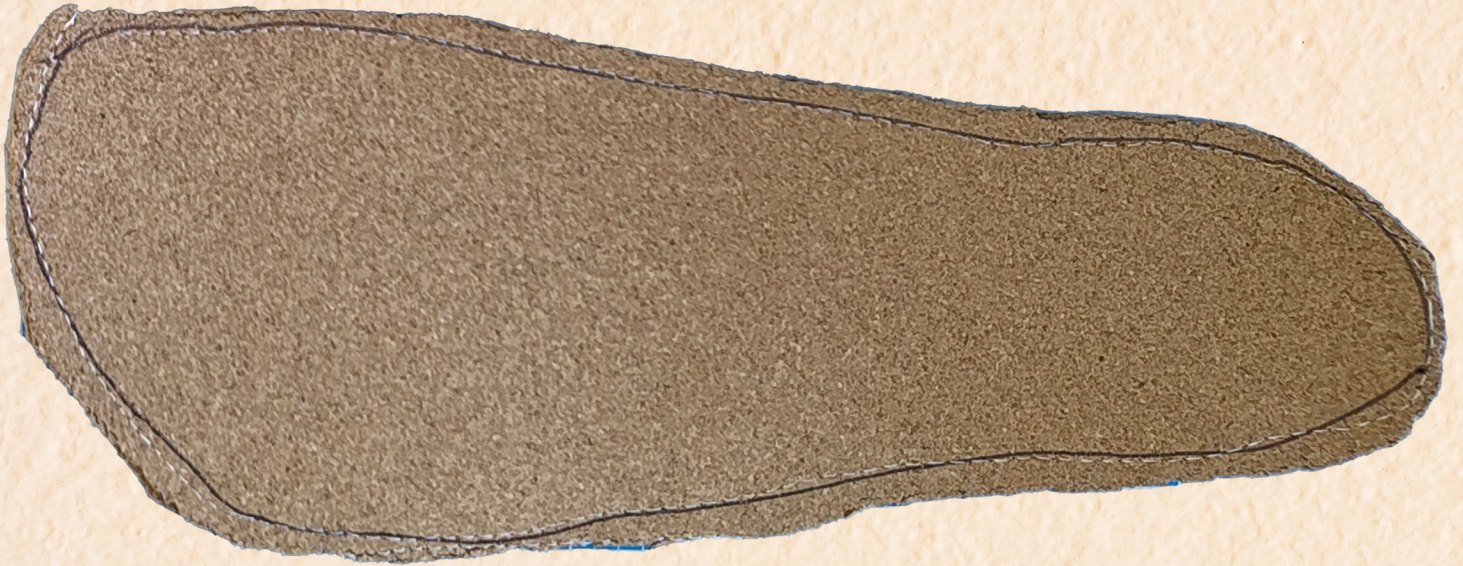
Sealing the leaf braide is essenial to ensure that the leafs don't fall out of the braide. It is imperative that sealing of the edges is done in some form or the other.

Here,, the author has used cork to seal the edges of the braide since the mateerial for the sole is also cork.





# Final Product Development



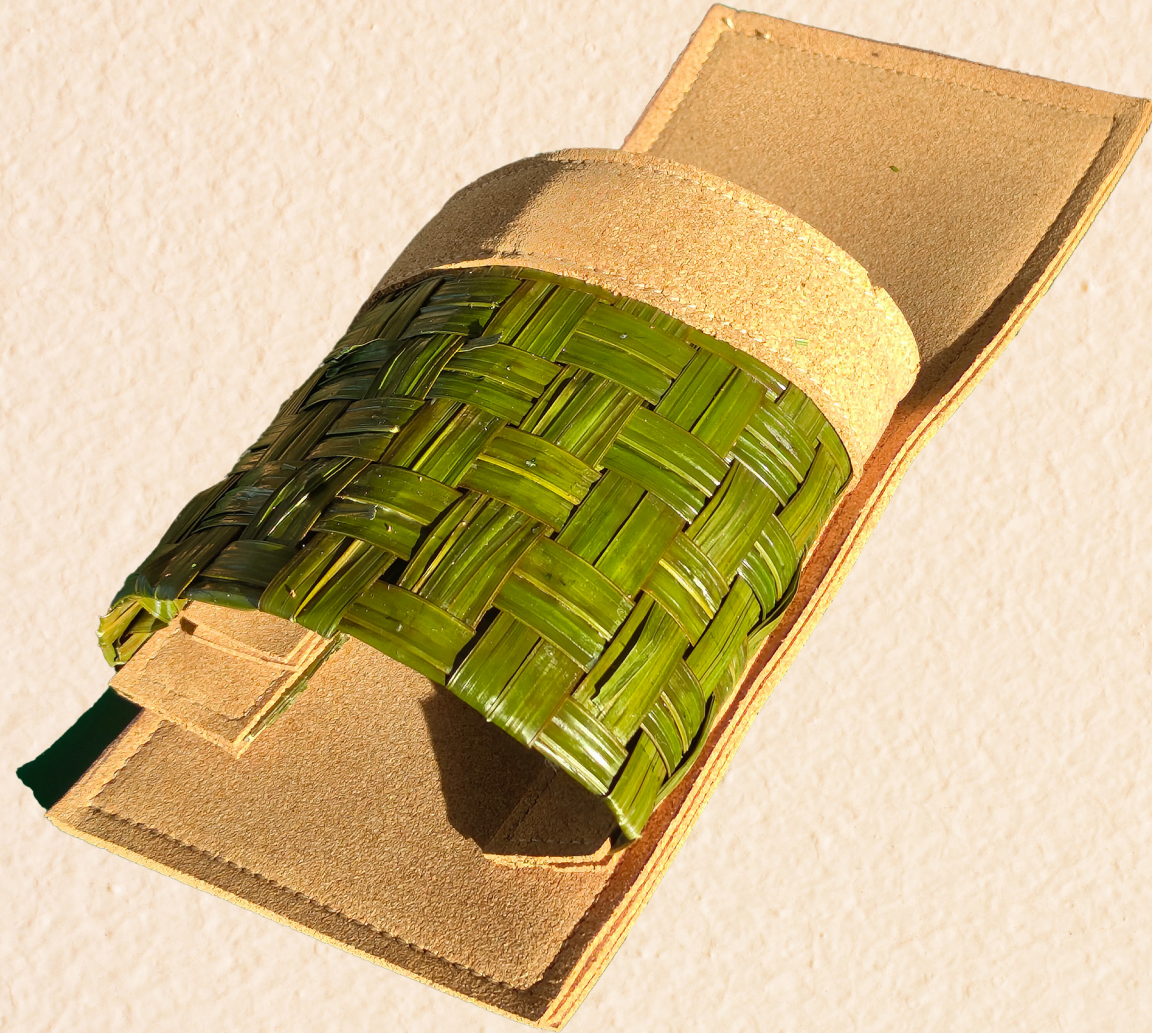
The sole prototype with 3 corks sheets of 1.6mm thick each sewn together using polyester thread.



Final sole of the sandal made with 3 cork sheets each 1.6mm thick, sewn together with polyester thread. The rectangle shape inspired by Japanese.



# The Final Product Development.. ..



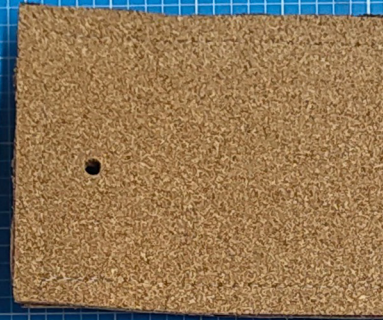
The upper of this sandal is detachable, leaving the user opportunity to change it to the one they prefer. Since the upper only lasts for 2 weeks, the user can opt for fancy uppers such as the ones made with rose petals, and like.



# The Bill of



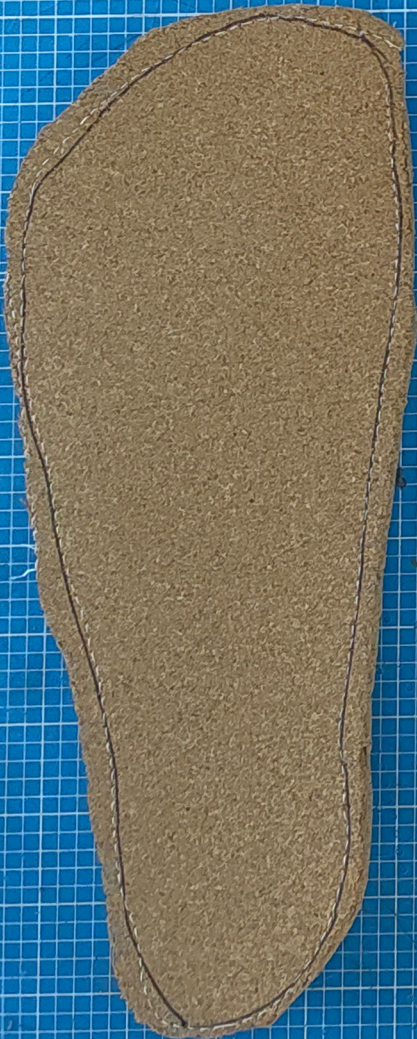
The upper for the left sandal



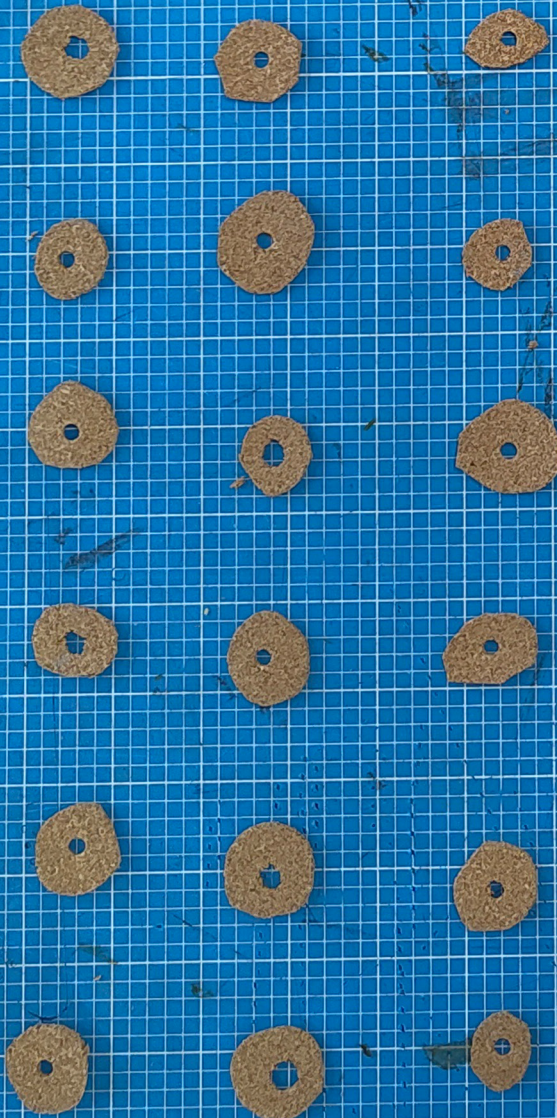
The upper



Binders



The sole prototype



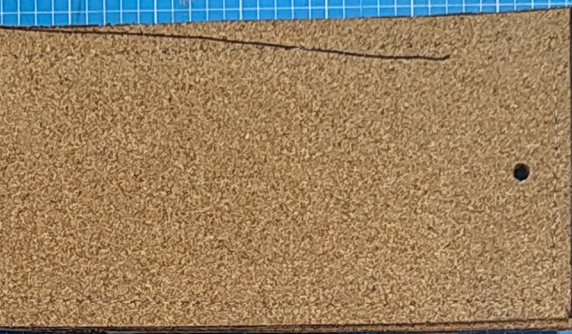
Washers



Sole for the M



# Materials



for the model piece



The upper for the right piece



model



Sole for the left foot



Sole for the right foot

NIQUE  
PROFESSIONAL CUTTING MAT



# The Assembly





# The Assembled







Hero  
Shots









# Model Piece







# Gallery







*Cavéos*

# SuperGreen Footwear

Designer  
**Vamsi Madhav Tata**

Cavéos is a provocation to one to gain agency over one's time as opposed to being a mindless cog in the modern industrialized society. It is the essence of conviviality. Historically humans have known time from the movement of the sun over the sky and other fellow living things. By making footwear (Flipflops) that are fragile and only last just over 2 weeks, Cavéos evokes slowing down, taking a breather, and looking around to find one's foot wrapped in nature, bringing them closer to nature and slowing them down due to the fragility of the footwear. Mindfulness over mad rush.



# Reflections

The leaf selection should prefer older leaves over younger ones to get better and stronger braide along with strength.

The gap between the braiding, steaming, and beewax application needs to be minimal, ideally immediately but less than a few hours for the best affects.

The cork is a fragile material. It would be best to pair it up with ply wood or layer it up with another material to give it strength. Pieces of cork kept coming off during the sewing session.

Despite the module's name being supergreen, the product is not completely green. The thread used for sewing is polyester. Instead of polyester, one could use the upcoming material IROONY!

Iroony is regenrated cellulose produced by chemically dissolving cellulose from waste textiles or from plants to make a new artificial fibre like viscose. Using this as the thread for sewing will make it truly sustainable.

The future pathway of improving the life of the upper and the sole could be done by the proposed gelatin and egg shell addition to the mix.

The steaming time of 9 mins and 10 mins for each of the braides had a good amount of impact on the leaves. The 9 mins one showing better performance than that of the 10 mins one. This should be confirmed through further experimentation.

# Vote of Thanks

Thank you AceX 151 for sacrificing two needles for my cause.



Thank you Stephanie, for all the feedback, guidance , and support.



# Declaration

All the work shown in the booklet is my own. I declare that I haven't used others work or did not credit when referenced.

## Inspired by

<https://nothing.tech/>

## Connect With me



Medium



Mobile



LinkedIn

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