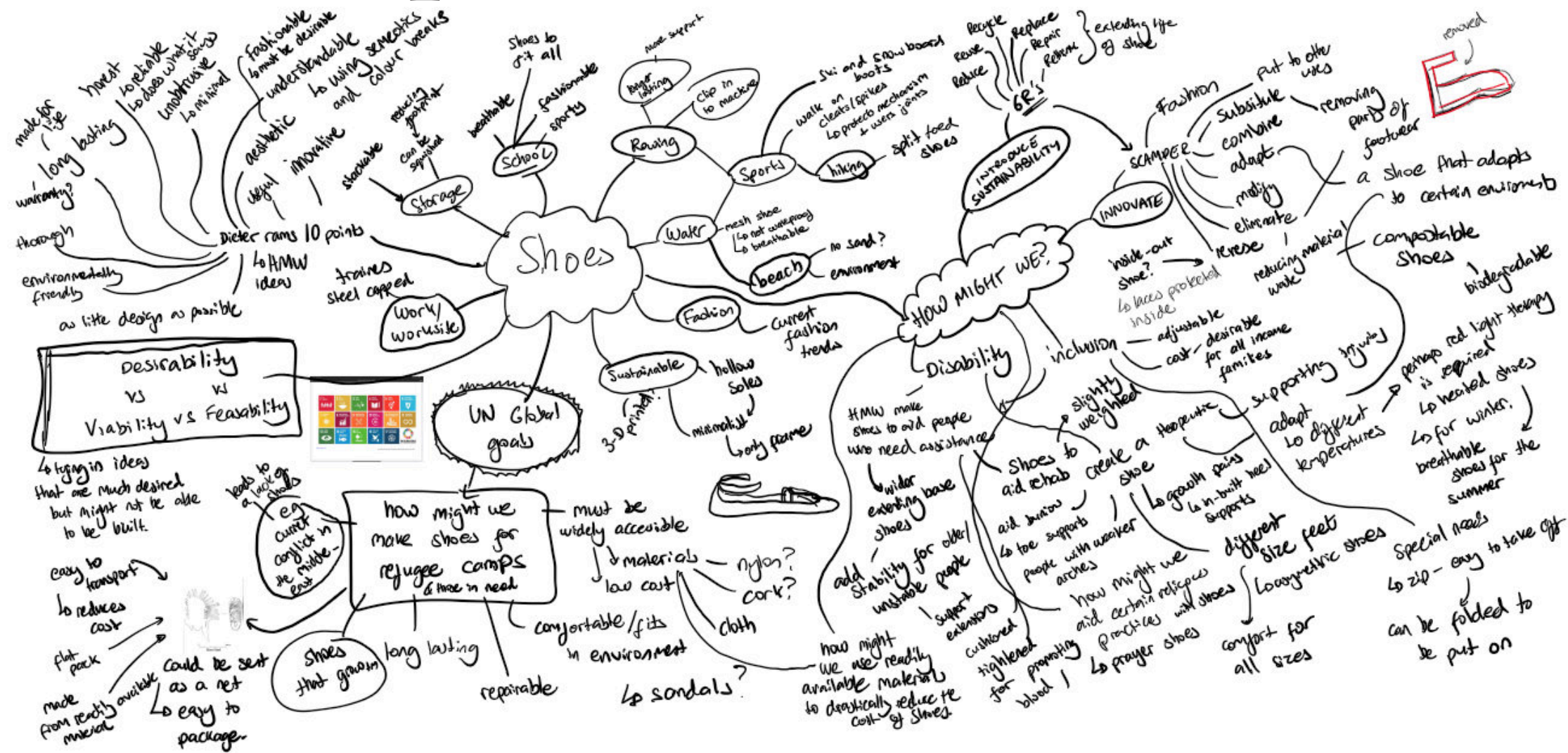


Low-cost shoes

by Nicholas Elton

December 2025

Initial Exploration

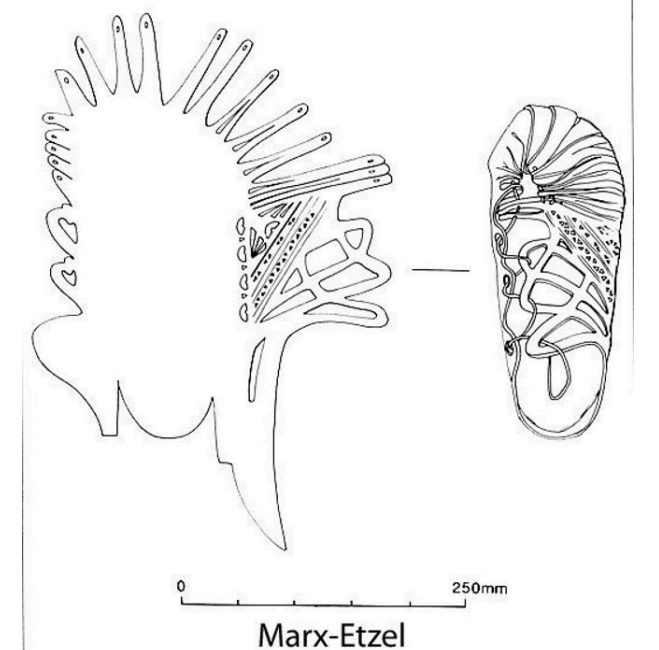


Current cheapest slider: £3.00



Design for a shoe that grows [5]

Current design for flat-pack sandals



Simple Sandal construction (Made from EVA foam)



Webbed shoe sole - Reducing material use



Minimal shoe sole - Idea for exoskeleton shoe



Adjustable Velcro



Current flat-pack solution for shoes



Tarp alternative for upper shoe



Cork Sole



Cheapest flip-flops available: £2



Current solution on the market for minimal storage



Sustainable Development Goals



Sandals made with recycled cord



Target Goals for the shoe design

5W's

Who

.. will buy the shoes?

Low-budget consumers
Underprivileged households
Homeless people
Refugee camps
NGO's and Humanitarian Aid

All ages

.. will manufacture the shoes?

Aid suppliers
Local manufacturers
Self-assembly

What

.. materials will be used?

Local-sourced and widely available materials

Recycled Materials

.. processes will be used?

Die cutting/Punching

Simple recycling and

design for repair

Flat-pack distribution

.. features are essential?

Low cost and Durable

Comfort, **Universal** sizing

On-site Assembly

When

.. can materials be sourced?

Continuously through recycled footwear

Constantly keeping **stockpile** full

.. can the shoes be delivered?

Immediately for rapid response

Cyclical aid packages

Constantly for stockpiling

.. will these shoes be worn?

All year round in arid climates

In crisis (outdoor and interim)

Where

.. will the shoes be manufactured?

Low cost countries

.. will the materials be sourced?

Ethical and Recycled materials

.. will funding come from?

Humanitarian & NGOs

Crowdfunding

.. will the shoes be stored and made?

On-site & self-assembled

Why

.. focus on cost-effectiveness?

Increases **accessibility** and impact

Lack of footwear for those in need

.. will these be different to any other shoe?

Flat-pack design

Assembly by the **user**

One-piece

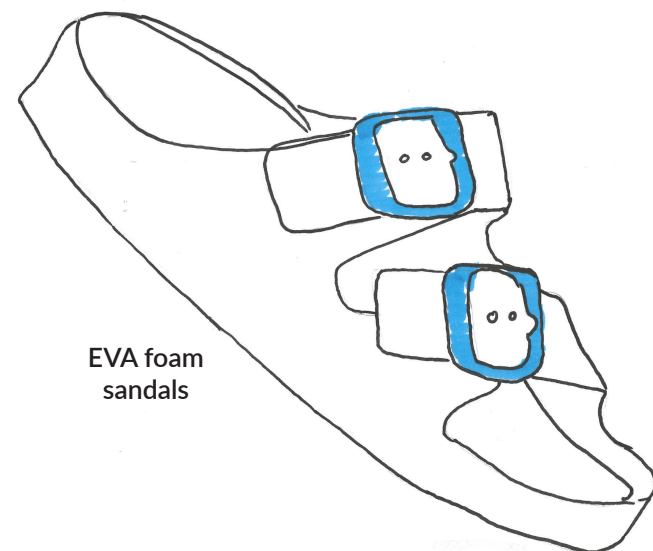
Uses widely available resources

Integrates with **aid supplies**

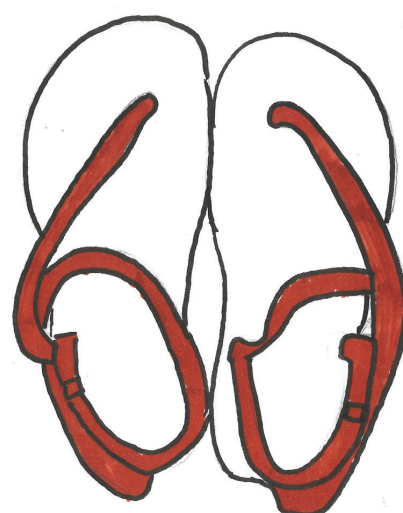
Universal

Durable

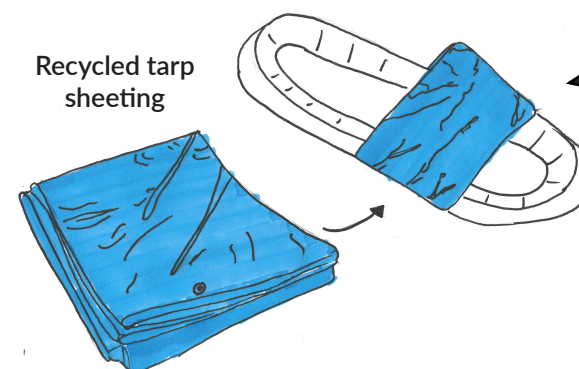
Not cheap quality for a cheap price



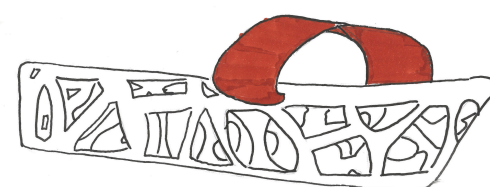
EVA foam sandals



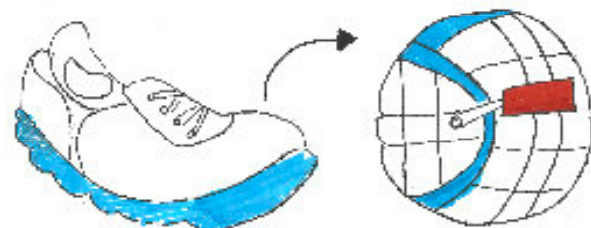
Recycled cord sandals



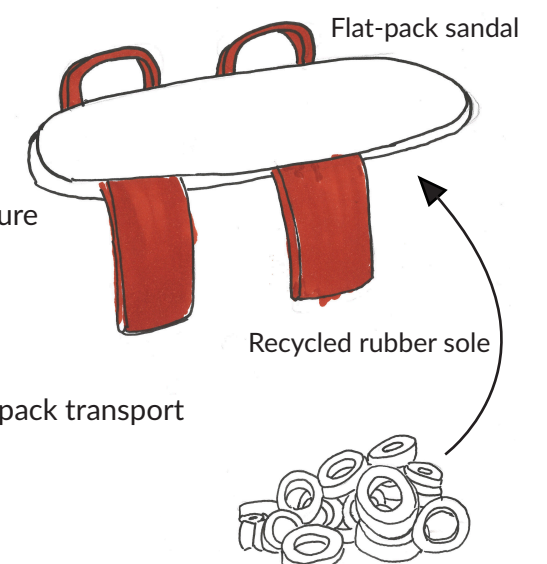
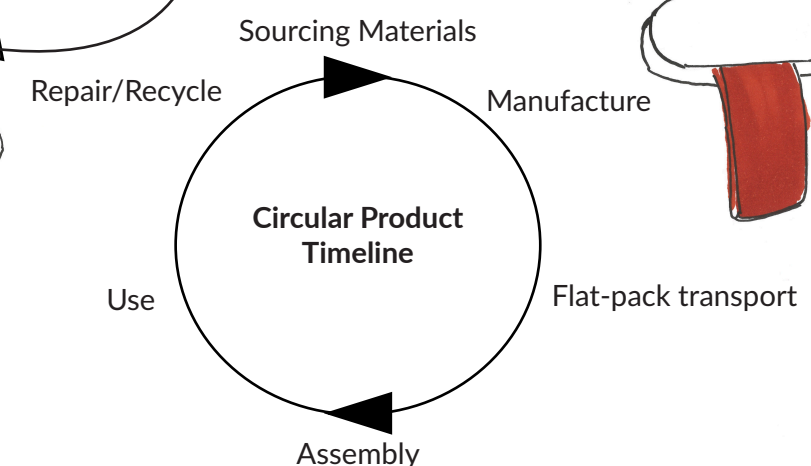
Recycled tarp sheeting



Hollow based slider



Shoe which transforms into a ball



Flat-pack sandal

Recycled rubber sole

Flat-pack transport

HMW's

How might we

.. design a shoe for the essential features?

Recycled tyre sole.

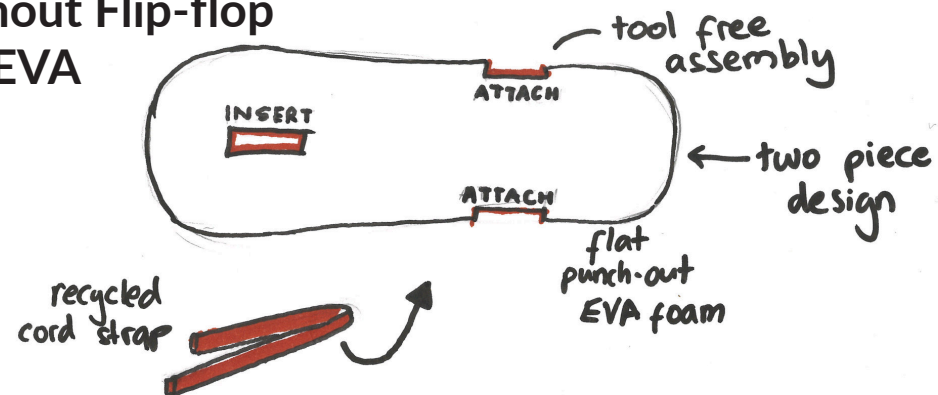
Shoe strap made from cord.

Modular shoe design.

Shoe strap made from tarp.

Foldable sandal.

Punchout Flip-flop from EVA



How might we

.. create a shoe using the materials discussed?

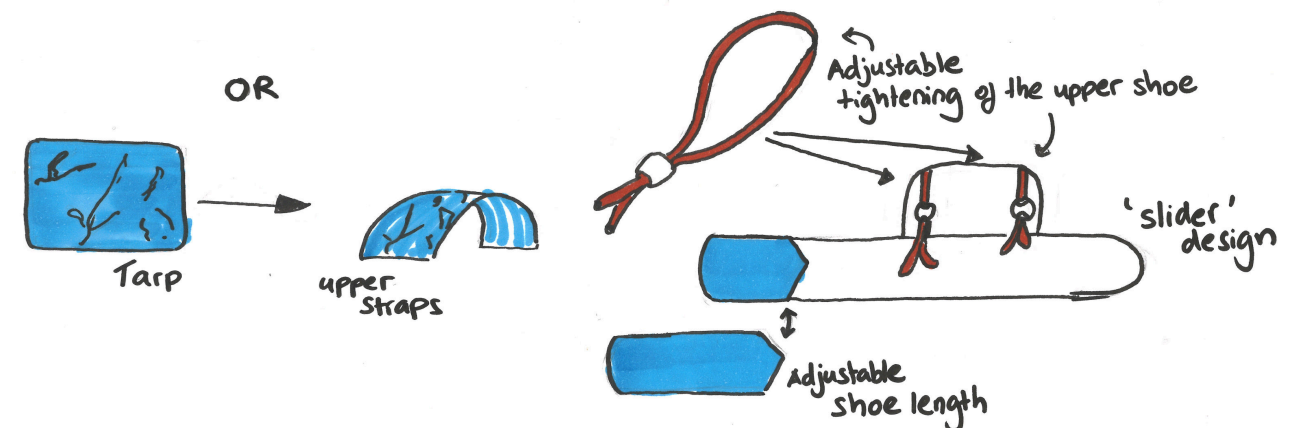
EVA punch-out flip-flops.

Tarp strap.

Webbed shoe design from PET bottles.

Recycled cord lace or tyre/cork sole.

Using materials available in an area of need.



How might we

.. design shoes that can be easily repaired or repurposed?

Modular shoe design.

Design for recycling.

The shoe could be made **in situ**, with a **template** and set of **instructions**.

Tool free assembly.

Semi-permanent joints.

How might we

.. simplify the manufacturing process to reduce cost?

Minimal piece design

Tool free assembly.

Using standardised material

Low post-processing.

How might we

.. simplify the manufacturing process to reduce cost?

Minimal piece design

Tool free assembly.

Simple QC.

.. market the shoes to investors/funding sources?

Humanitarian impact.

Unlike any other shoe.

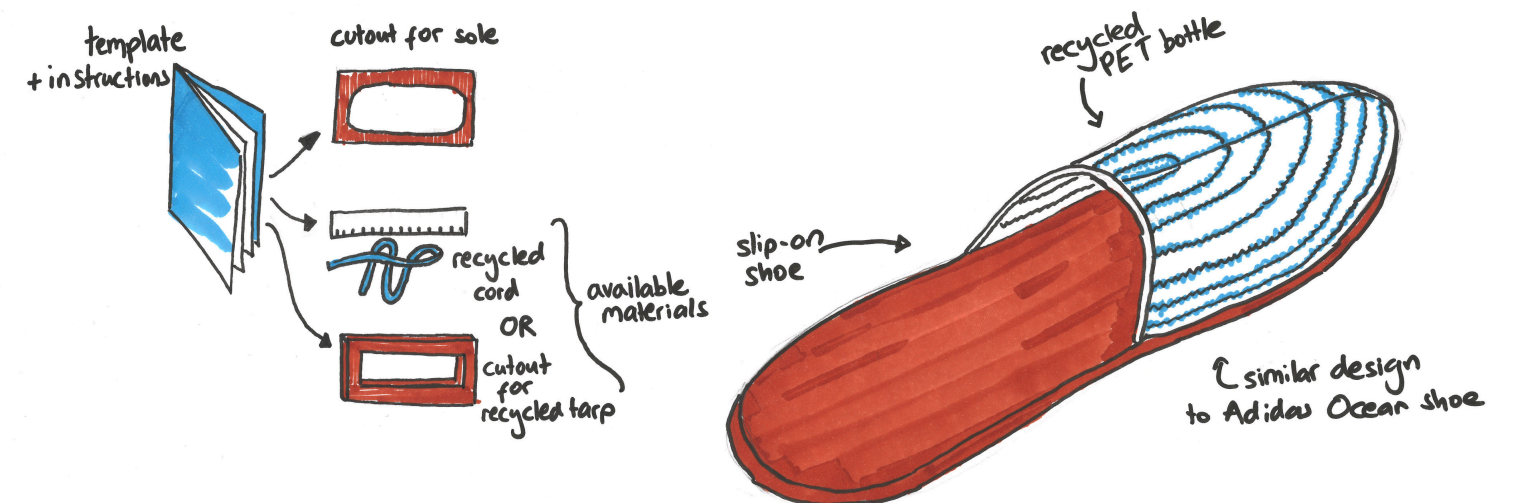
Addresses current day issues.

Using standardised material

Low post-processing.

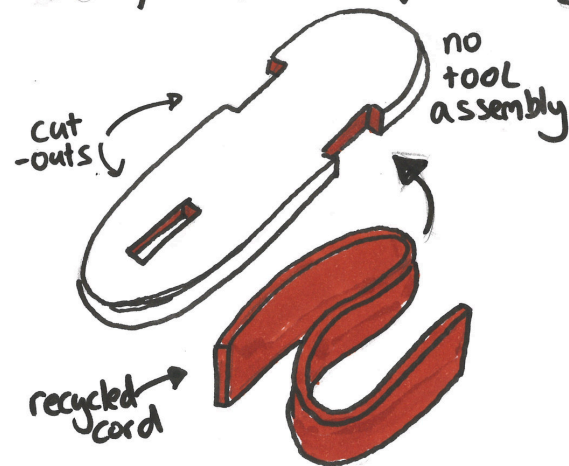
Cost-effectiveness.

Available for those in need.

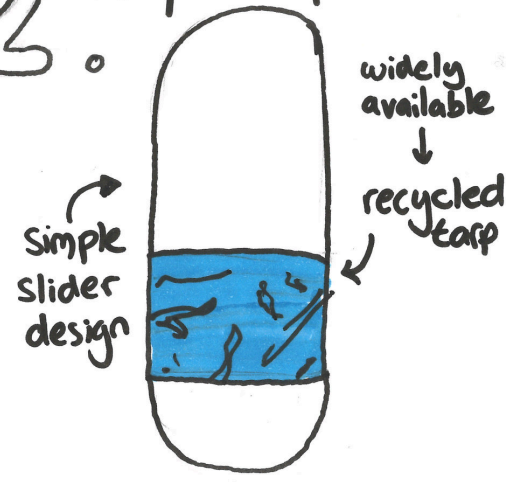


15 Ideas

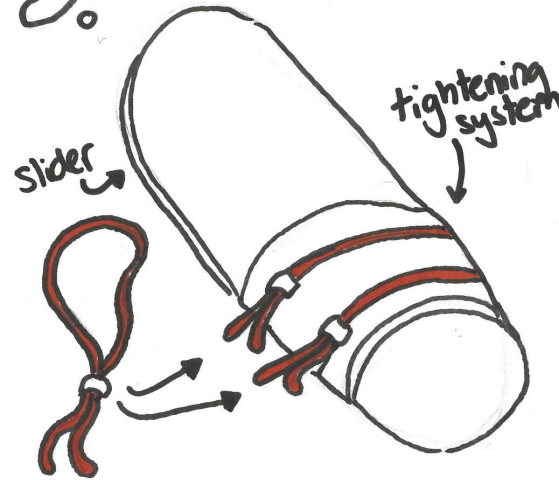
1. Punch out EVA flip-flop



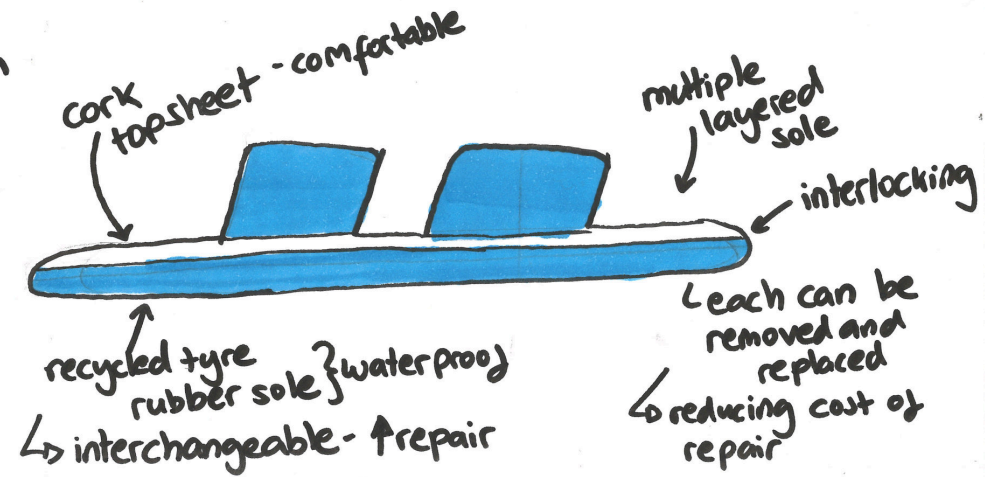
2. Tarp strap slider



3. Corded Slider (Adjustable)

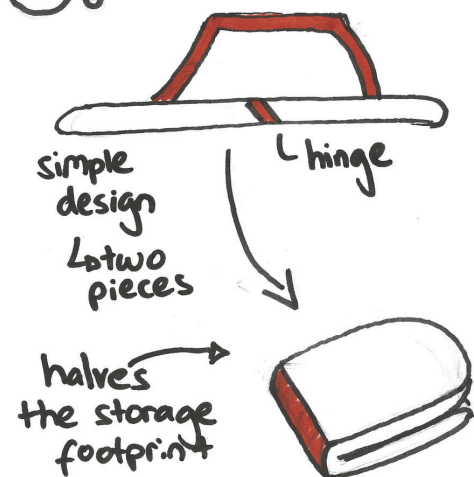


4. Cork/Recycled tyre rubber lower shoes

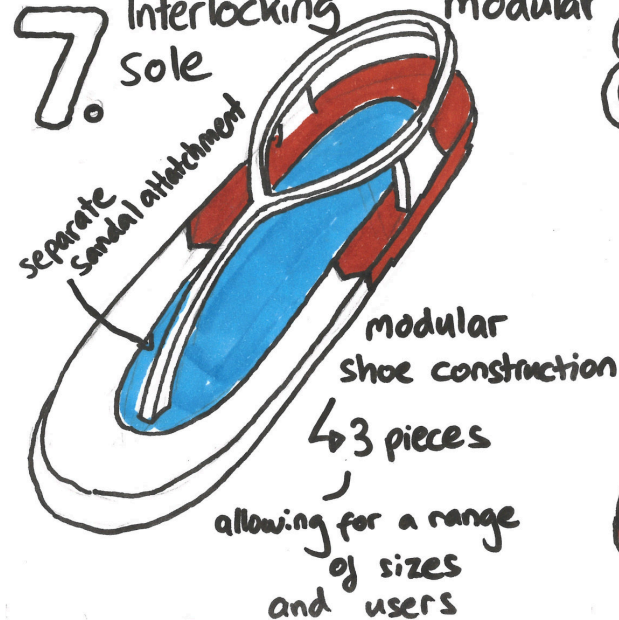


5. Modular Sole design

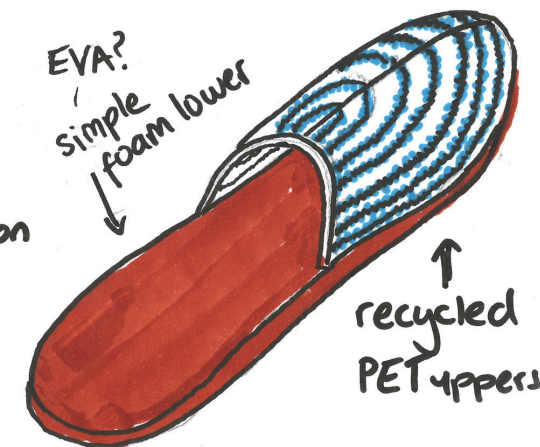
6. Foldable Flip-flops



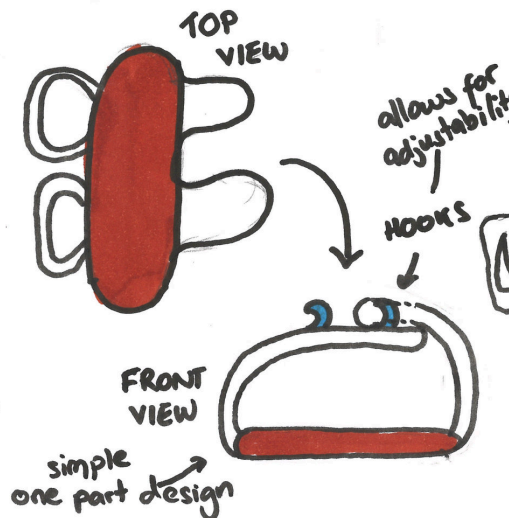
7. Interlocking modular sole



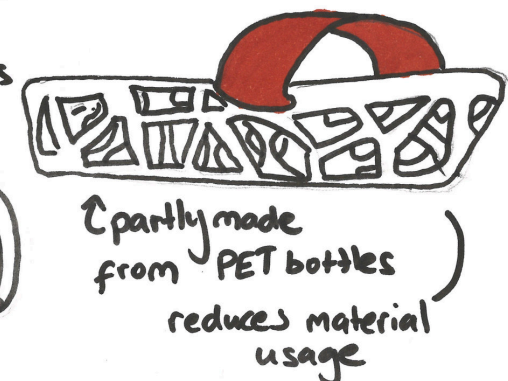
8. Recycled PET slide-ons



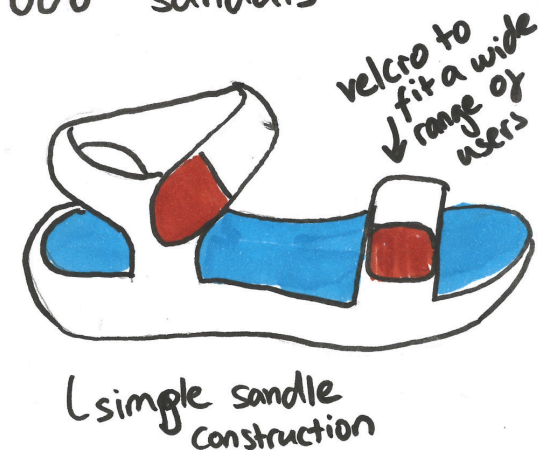
9. Flat pack Sandals



10. HOLLOW Sole slider



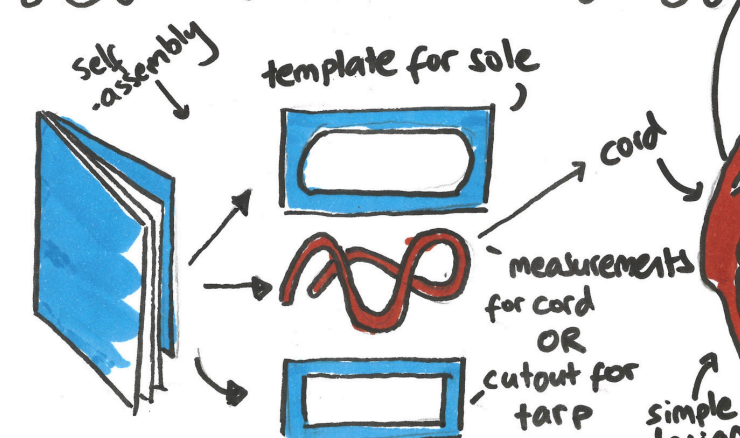
11. Adjustable Velcro sandals



12. Slider frame



13. Instructions & template



14. Recycled Cord Sandals

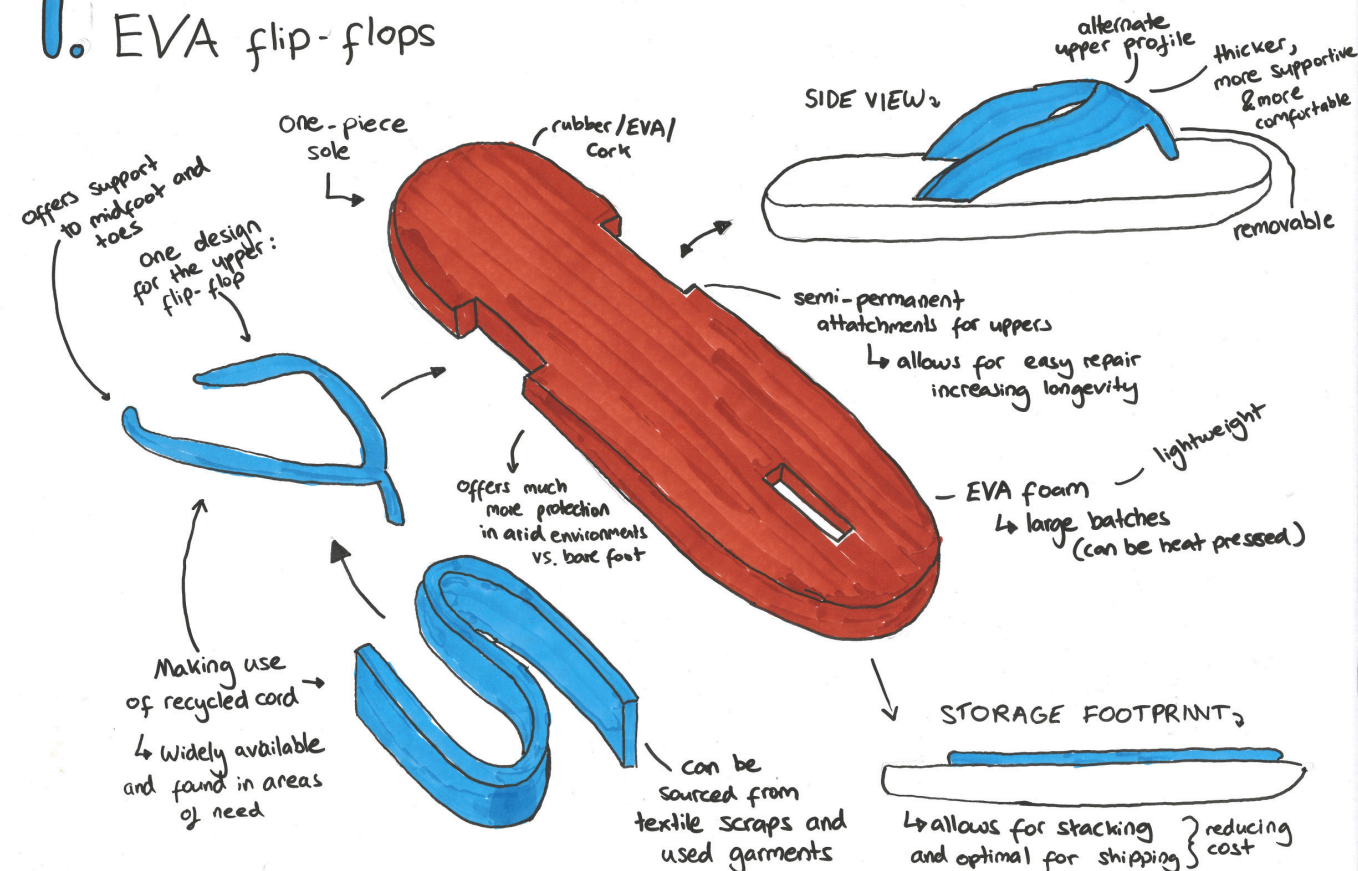


15. Recycled PET Shoes



3 Idea Exploration

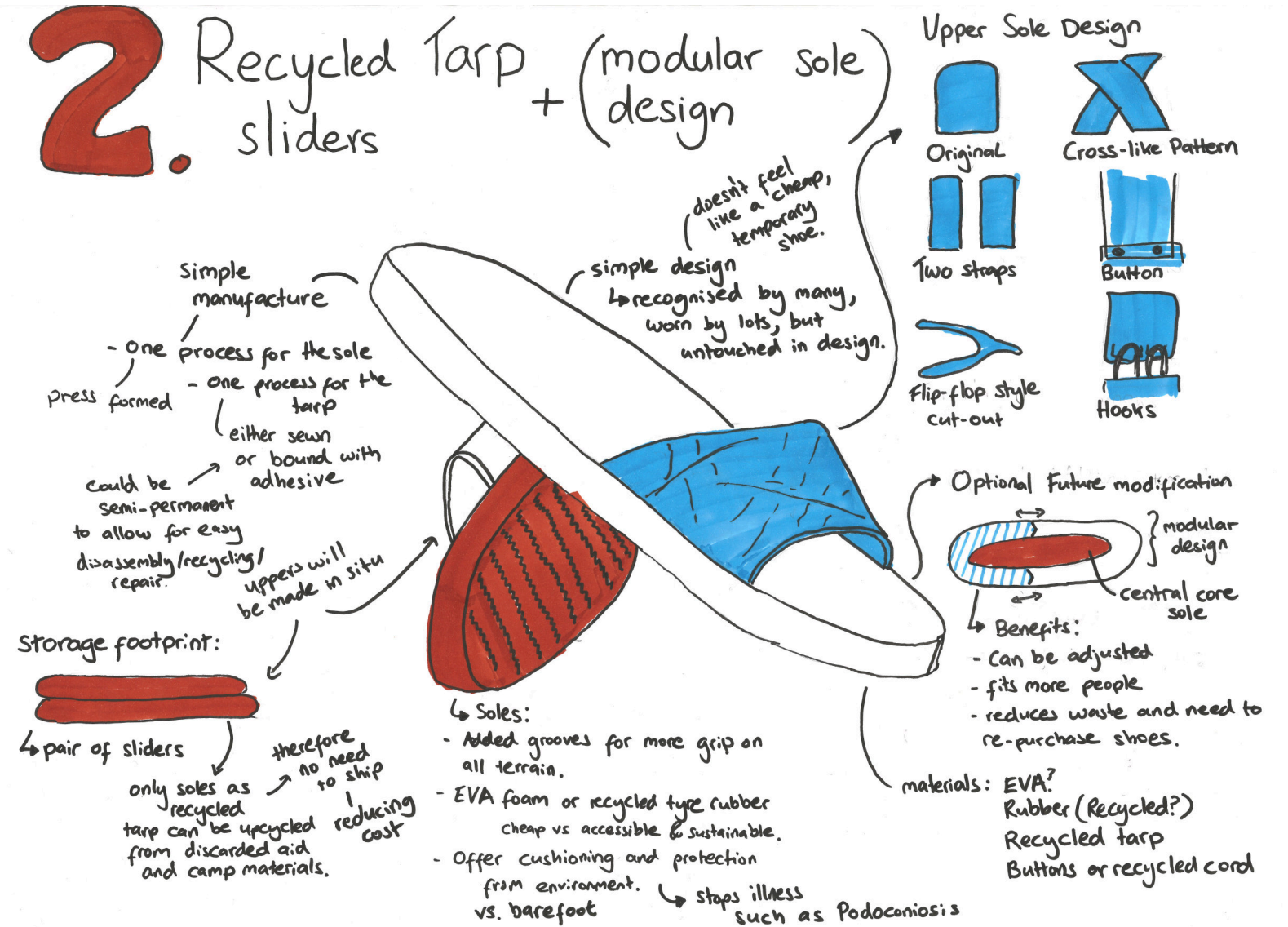
1. Punch out EVA flip-flops



3. Flat-pack Sandals + (Adjustable sizing)



2. Recycled Tarp + (modular sole) sliders



Evaluation and Reflection:

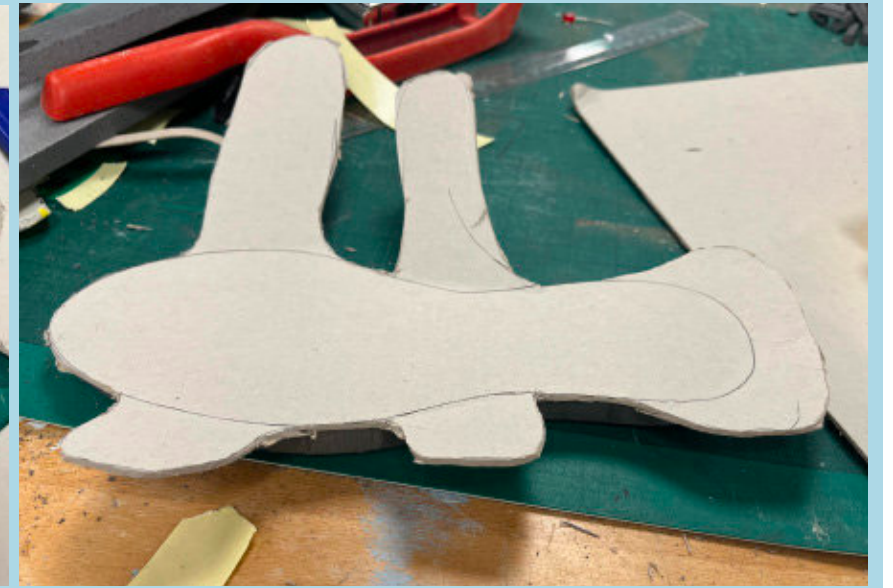
- A focus on **accessible, low-cost footwear** suitable for humanitarian aid.
- Each shoe addresses **affordability, transportation and repairability**.
- Idea One explores **extreme simplicity** for mass production.
- Idea Two integrates **local materials** and reused materials reducing **dependency** on imported materials
- Idea Three focuses on **adaptability** through tightening and **self-assembly**.
- Overall, these ideas close the **gap of aid distribution** (Explored in Initial Research) where donated shoes often **fail** to offer a solution for everyone due to **sizing, transport volume, or durability** in harsh conditions.

Prototyping

Practice Model 01

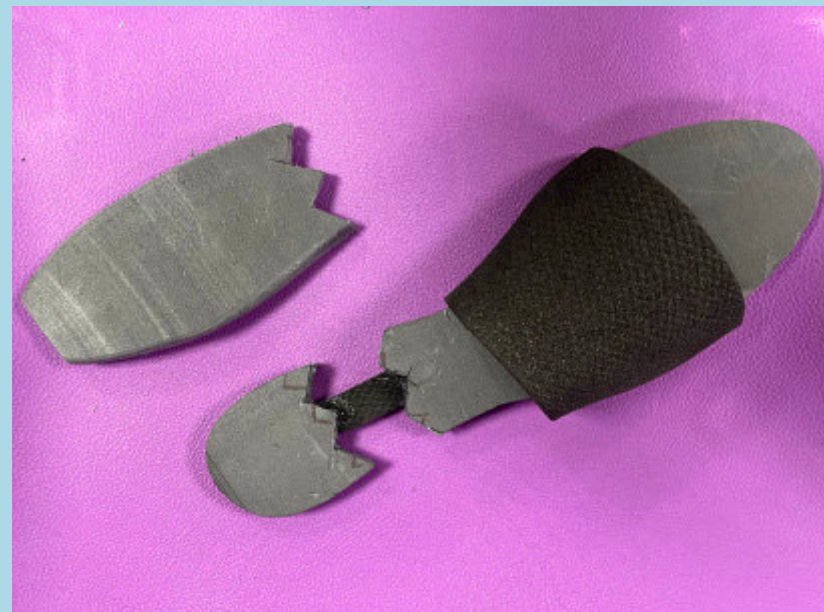
- Explores **form, proportion** and **assembly**.
- Birkenstock-style design.
- Helped me develop the foam's interactions with being shaped and cut.
- Thicker foam **inhibits flat-pack**.

Sole shaping practice to inform other prototypes



Flat-pack Sandal Prototype

The prototyping revealed the **need for durable joints**, which would allow for bending into shape. The assembly is **very fast and intuitive**, allowing for easy assembly. Each part can be **easily stacked** and transported. The prototype is made as two pieces, which is not the same as the final product.



Recycled Tarp Slider Prototype

I **tested** the use of a **flexible upper**, similar to tarp, combined with the foam sole. The combination works, but the tarp will need to be **secured properly**. The modular sole was also **tested**, and allows for **different size feet** to wear the shoes.



Punch-Out Flip-Flop Prototype

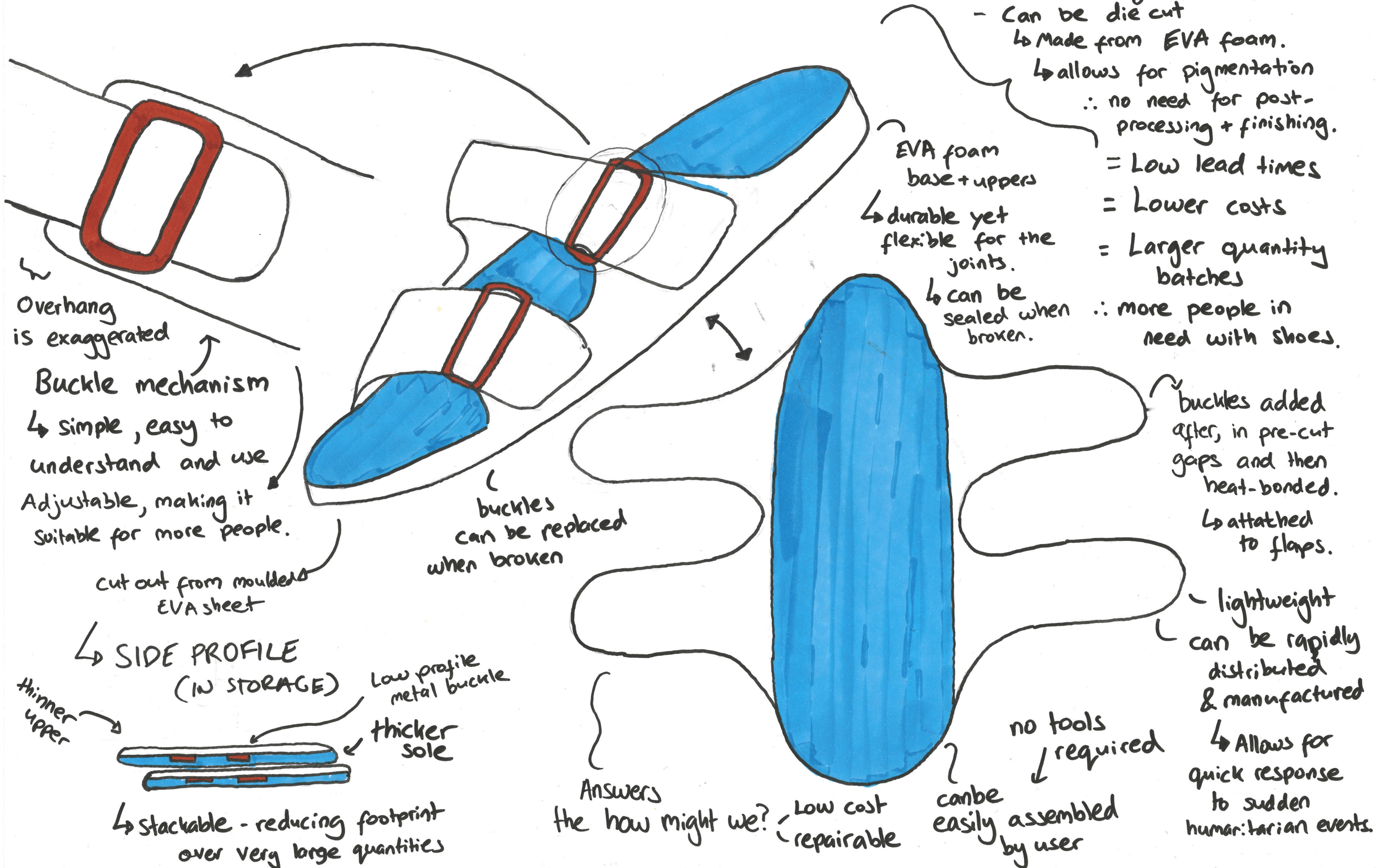
Prototype of cut out EVA sheet, with both parts made from it. The thong strap fits into **pre-cut holes**, which I **tested**, enabling **quick assembly**.

The holes will **need to be more durable**, as the shoe currently only works as a **short-term solution** for crisis distribution.



Most efficient in material use and transport.

Final Idea: Flat-pack Sandal



Design Specification & Requirements

Design Requirements:

● Must have:

- The production cost $\leq$ **£2 per pair**.
- **Flat-packable** into a single EVA sheet, and stackable for shipping.
- Assembles **tool-free**.
- **Adjustable** universal sizing.
- **Durable** as an intermediary solution.
- The sole must be at least **10mm thick** to withstand force.
- The buckle must be able to **withstand a 15–20 N pull force**.
- **Simple** manufacturing process.

● Should Have:

- **Minimal** material waste.
- **Visual instructions** on/with the EVA sheet.
- **UV-resistance and waterproof** (EVA foam).
- No **sharp** corners
- A **grippy and textured** tread pattern.

● Could Have:

- Multiple strap/sole **colour** options.
- Local **repair kits**.
- **Etched size guides** on the footbed.

Design Specification:

1. Function

- **Must protect feet** from hot, rough, or uneven terrain.
- Must allow **comfortable daily walking** of several kilometres.
- Must be **simple to assemble without tools**.
- Must remain **secure** on the foot while walking.

2. Target User

- Must be **accessible** for refugees and displaced people of all ages and genders.
- Users with **no prior experience must be able to assemble** the shoe.

3. Materials

- It must be made from **EVA foam**.
- Straps can be EVA, recycled tarp, or webbing.
- All materials must be waterproof, lightweight and UV-resistant.
- Buckles must be simple metal fasteners with die-cut slots.
- Material thickness must be $\geq$ **10 mm** in the sole for **shock absorption**.

4. Manufacturing

- Must be manufacturable via die-cutting and should **cost a maximum £2 pp**.

- The entire sandal should fit onto **one flat sheet**, and suitable for mass production.
- Must be manufactured with an anti-slip tread pattern.

5. Durability & Comfort

- Straps must **resist tearing** when tensioned repeatedly, due to long period of walking.
- EVA must maintain structure under temperatures **up to 50°C**.
- Buckle or slot fastening must be **replacable**.
- **Adjustable straps** must allow sizing across a wide range of feet.
- EVA must **compress slightly** for cushioning (3-5 MPa).
- **Must not rub or cause blistering** on common pressure points, with no sharp edges.

6. Storage & Logistics

- Must be fully **flat-packable**, stacking efficiently in high quantities.
- **Must assemble without written language** — pictogram instructions preferred.

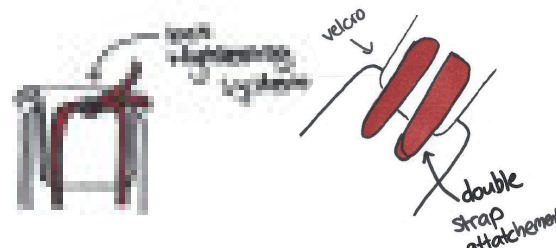
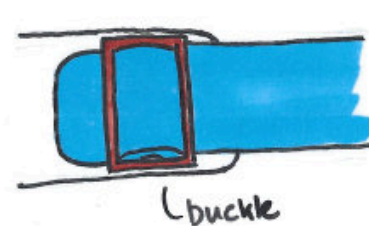
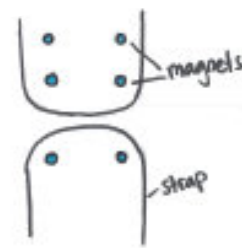
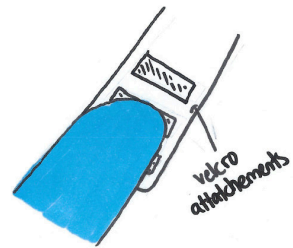


The image was generated using chatGPT_[11], based of my sketch on the final design page.

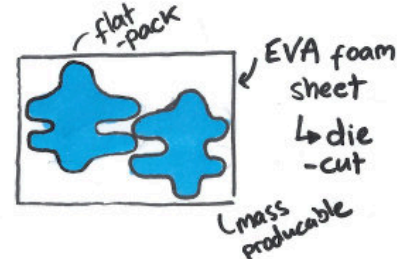
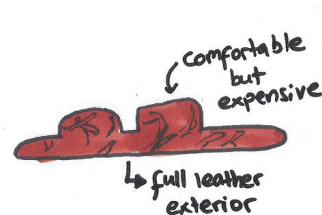
Morphological Analysis

Subsystem: Means: Key:
 means selected

Fastening	Velcro	Magnet	Buckle	Lock	Strap	Interference
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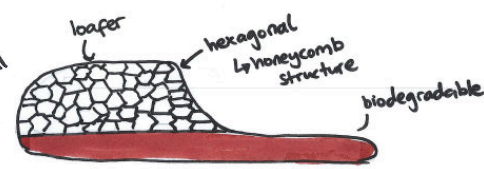
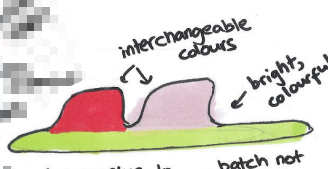
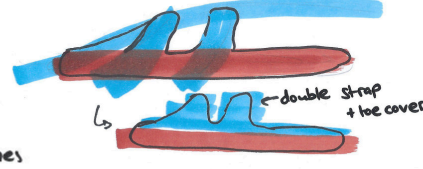


Material	Leather	EVA	Recycled Rubber	Mesh	Recycled Tarp	Recycled Polyester
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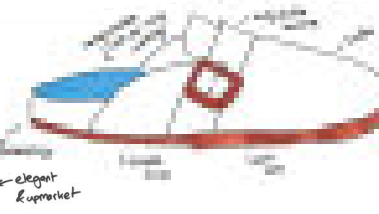
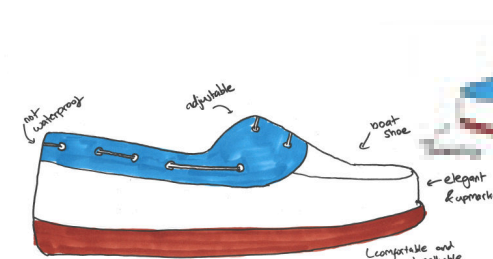
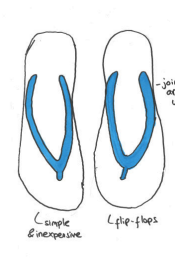
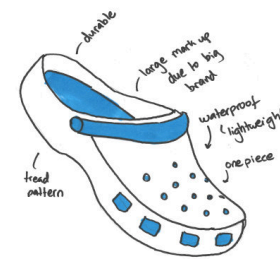


Aesthetic	Universal	Minimalist	Fashionable	Designer	Colourful	Biomimicry
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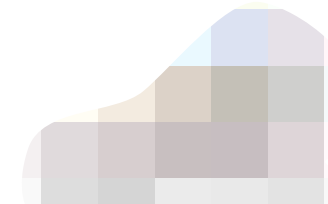
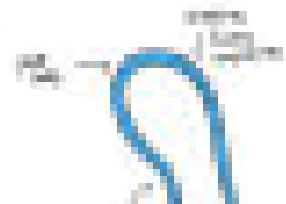
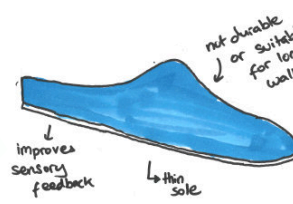
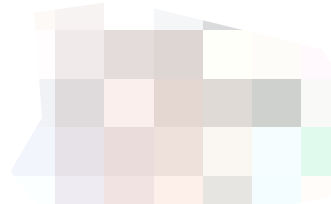
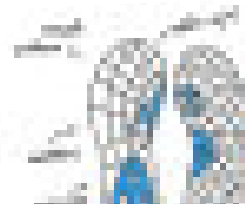
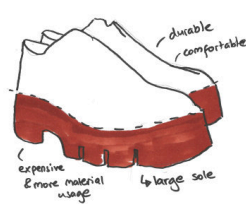
Universal:
 ↳ simple
 - smooth curves
 - neutral
 - earthy, dull tones



Shoe Form	Sandals	Sliders	Crocs	Flip-flop	Boat	Mules
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Sole form	Rocker sole	Tread pattern	Sharp edges	Thin sole	Felt sole	Studded/Ripples
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Justification:

- The **buckle** is the cheapest and most durable, fitting the brief the best.

- **EVA** is the best solution as it is lightweight, waterproof and durable.

- Combining a **universal** and **minimalist** approach meet the design criteria the best.

- The **sandal** allows for a cheap, durable and adjustable solution, without extra costs.

- The use of **tread patterns** will add grip and traction for everyday use.

Storyboard

All images are generated using
chatGPT 5.1^[11]



Storyboard explanation:

Panel 1: Many refugees walk long distances without adequate footwear.

Panel 2 & 3: Flat-pack sandals take up much less space compared to normal pairs, allowing them to be transported and distributed effectively.

Panel 4: The shoes can be folded and assembled easily in minutes, without the need for tools.

Panel 5: The shoes now provide protection and comfort, allowing for safer travel and a higher overall living environment.



Final Design:

COMPACTA HUMANTARIAN RELIEF SANDALS



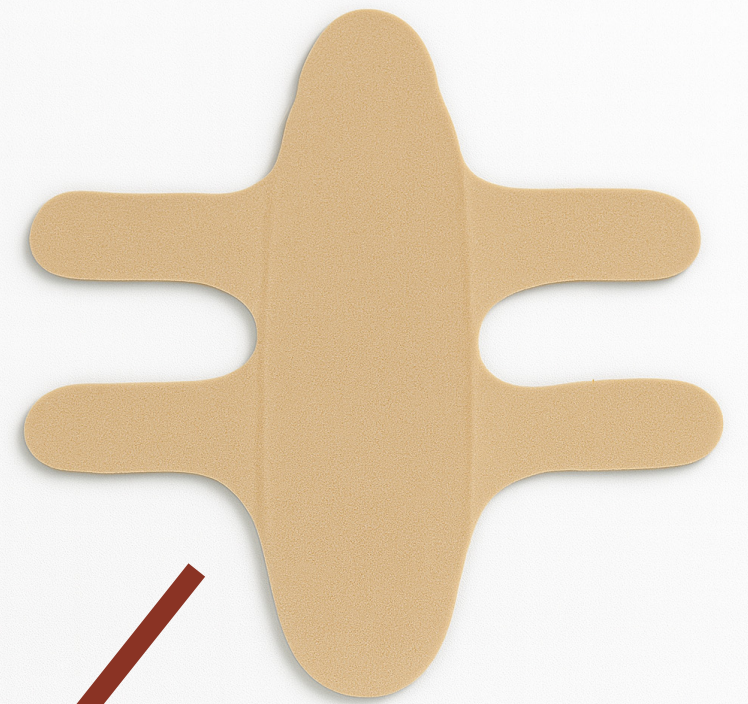
Manufacturing:

It will be cut from a **singular EVA sheet**, using a **die**, allowing for a **lower lead time** as one process is used. The metal buckle is pressed on using heat and tabs, as part of post processing, keeping **minimal processing**, and keeping **overall costs down**.

The logo design keeps **core ideas clear**, and shows the product off.

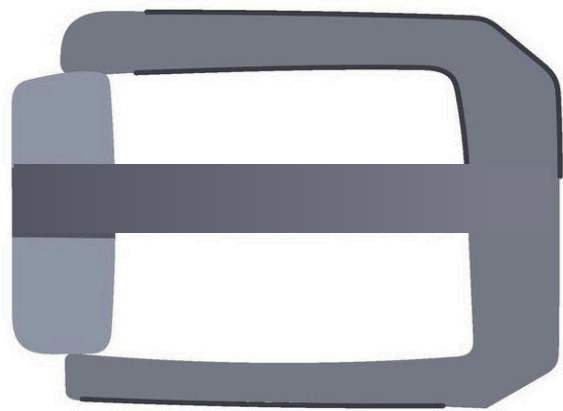
Transport:

- The shoe will be shipped in the position on the right, **buckles face down**.
- This allows for much more shoes to be shipped per container, reducing the overall cost.



Buckle System

- Buckle is attached with heat and pressure allowing for a **permanent join**.
- The EVA strap simply passes over and under the metal buckle which allows for **adjustment** and **easy use**.



The render and logo were made with a combination of chatGPT_[11], and Adobe Illustrator.



The shoe is in final form, **folded** together with the metal buckle holding the straps in place. Made from **EVA** and **zinc alloy**.

Benchmarking & Validation

Calculations:

Will the EVA strap be durable?

Avg user mass = 70 kg

Using $W = m \times g$ $\therefore W = 687 \text{ N}$

I will assume for this calculation that the peak force as the user walks is $1.5 \times$ body weight:

$\therefore F_{\text{peak}} \approx 1.5 \times 687 \approx 1030 \text{ N}$

Making another assumption that roughly 30% of this peak force goes through the shoe buckle:

$0.3 \times 1030 = 330 \text{ N}$

Using a cross-section of the EVA foam and buckle to be 15 mm in thickness and 30 mm in width:

$A = 15 \times 30 = 450 \text{ mm}^2 = 4.5 \times 10^{-4} \text{ m}^2$

$\therefore \text{stress } (\sigma) = \frac{F}{A} = \frac{330}{4.5 \times 10^{-4}} \approx 0.73 \text{ MPa}$

A typical EVA foam used for footwear will be around 2 - 4 MPa:

$\therefore 0.73 < 2 \text{ MPa}$

This means that the strap is strong enough to be used with a safety factor of around 3.

Will the sole be safe?:

Looking at the weight of a user, assuming that only half of their weight is on each shoe:

$W = 687 \text{ N} \Rightarrow \frac{1}{2} \cdot W = 343.5 \text{ N}$

Assuming the user has a size 10 shoe, we can model it as a rectangle:

contact area = $28 \text{ cm} \times 10 \text{ cm} \approx 280 \text{ cm}^2$

But, the whole foot will not be in contact with the ground, therefore a more accurate model would be 65% of the foot in contact:

$0.65 \times 280 = 180 \text{ cm}^2$

The pressure on the shoe while standing will be:

$P = \frac{F}{A} \Rightarrow \frac{343.5}{180} \approx 19 \text{ kPa}$

We will next assume that the peak force during walking is $2 \times$ the standing force:

$\therefore 2 \times 19 = 38 \text{ kPa}$

The compressive strength of EVA is as follows, therefore the shoe is safe and comfortable to wear:

$38 \text{ kPa} < 78 \text{ kPa}$

Does the flat-pack actually help?

Using the same assumptions for shoe (size 10) volume, assuming a width of 6 cm, a length of 10 cm and a height of 6 cm:

Normal Shoe Volume = $28 \times 10 \times 6 = 1680 \text{ cm}^3$

Compared to the flat-pack sandal:

$28 \times 10 \times 1 = 280 \text{ cm}^3$

Comparing both of these numbers, we can generate the ratio:

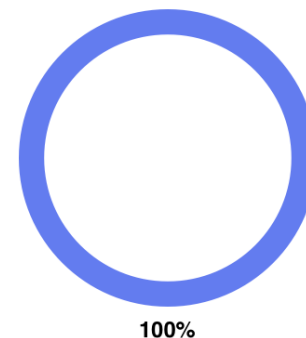
$\frac{V_{\text{normal}}}{V_{\text{flat}}} = \frac{1680}{280} = 6$

This therefore means 6 flat-pack sandals can be fit into the same volume 1 normal shoe takes up.

Market research and validation:

1. Is the sandal intuitive to assemble without instructions?

The questionnaire I produced, concluded that **everyone could easily understand the function of the shoe**. This is very promising but noted that everyone asked was from Imperial and therefore **skewed** the results, although not enough to completely invalidate the results found.



2. Will the EVA thickness provide enough comfort on rough terrain?

Yes, as calculated on the left.

3. Will the sandal stay comfortable across multiple foot sizes?

Yes, achieved with a combination of **cushioned EVA foam**, and **adjustable** sizing.

4. Is the product durable enough for typical daily use in a refugee setting?

Yes, explored on the left.

5. Does the flat-pack format meaningfully reduce shipping volume?

Yes it does, as calculated on the left.

Cost of the buckle:

The metal buckle as seen on the right costs approx. **£0.10 - £0.20 per unit**, which is the mechanism that will allow for the shoe to be **tightened and adjusted**.



The price will **decrease** with an increase of quantity of **order volume**.



Cost of the EVA:

One sheet of foam will fit roughly **70 shoes** on it, by **tessalating** the design. The price

per sheet of EVA foam is £29.14^[12], at a **thickness of 10mm**.

Therefore, the price of EVA foam for each shoe will be **£0.42**.

Overall costs:

The price per unit for materials will be **£0.57**, meeting the criteria of being cheaper than £2.

Similarly, using die cutting for the EVA foam, will keep the **cost down** for manufacturing over **large production runs**.

Supplementary pages

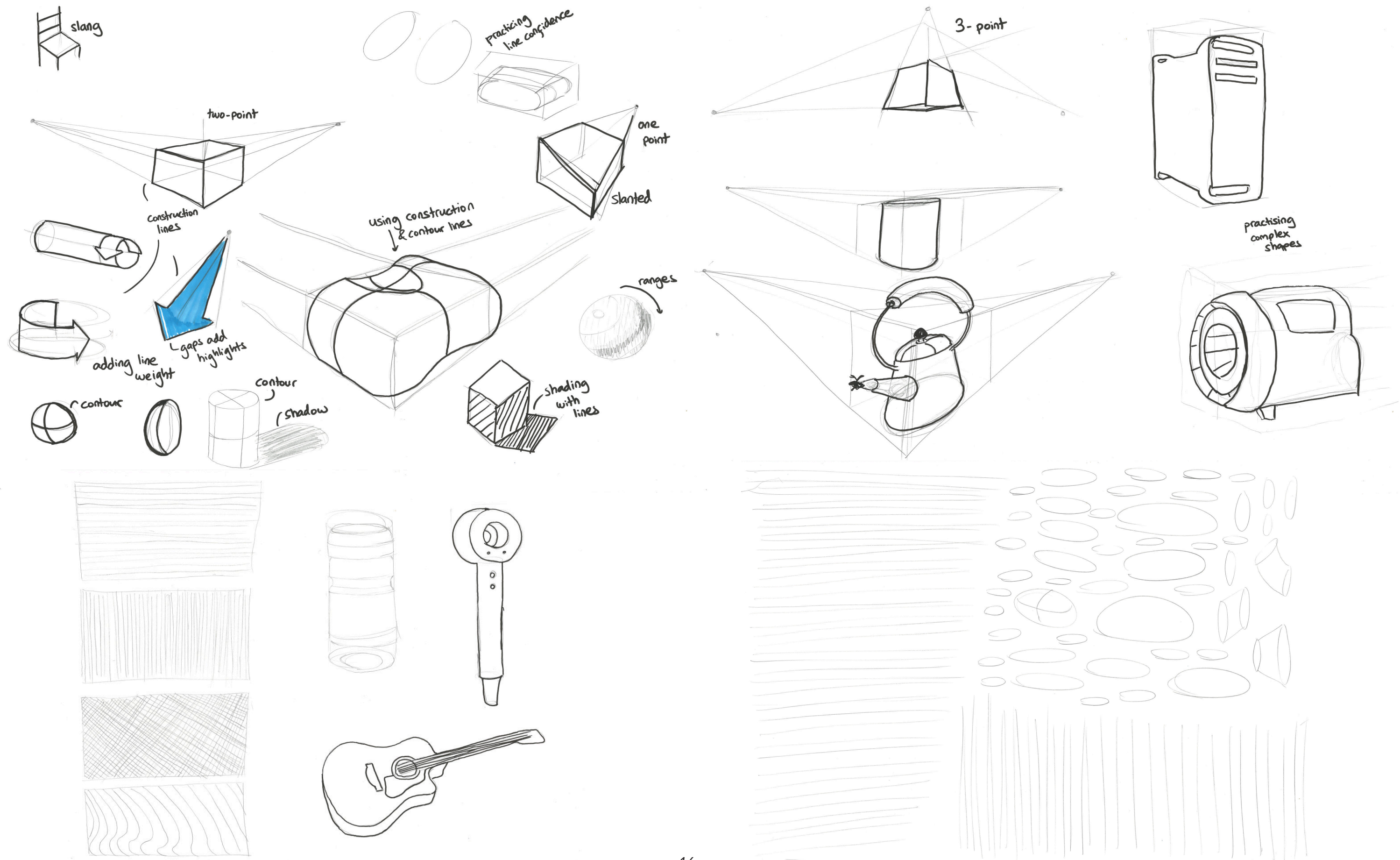


Sketching Practice pt. 1

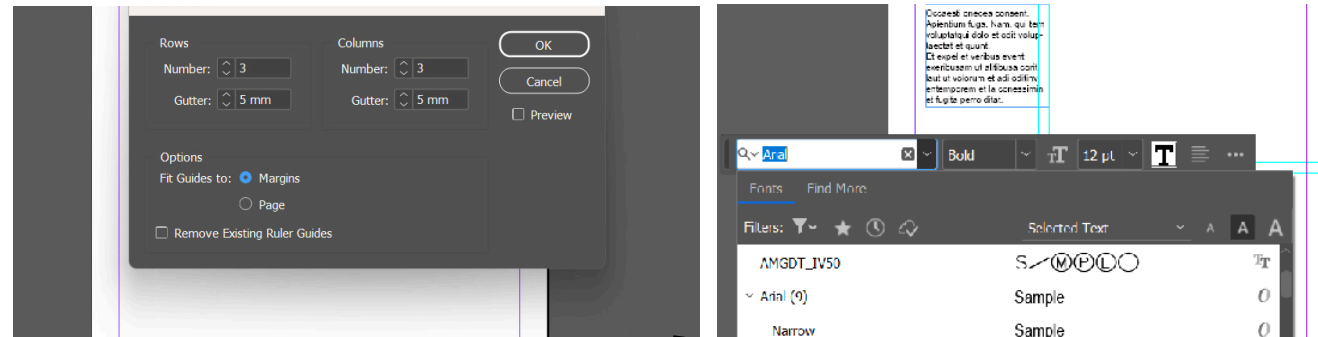


NB We are not concerned regarding the quality of sketching at this stage. The important consideration is communication of the idea.

Sketching Practice pt. 2

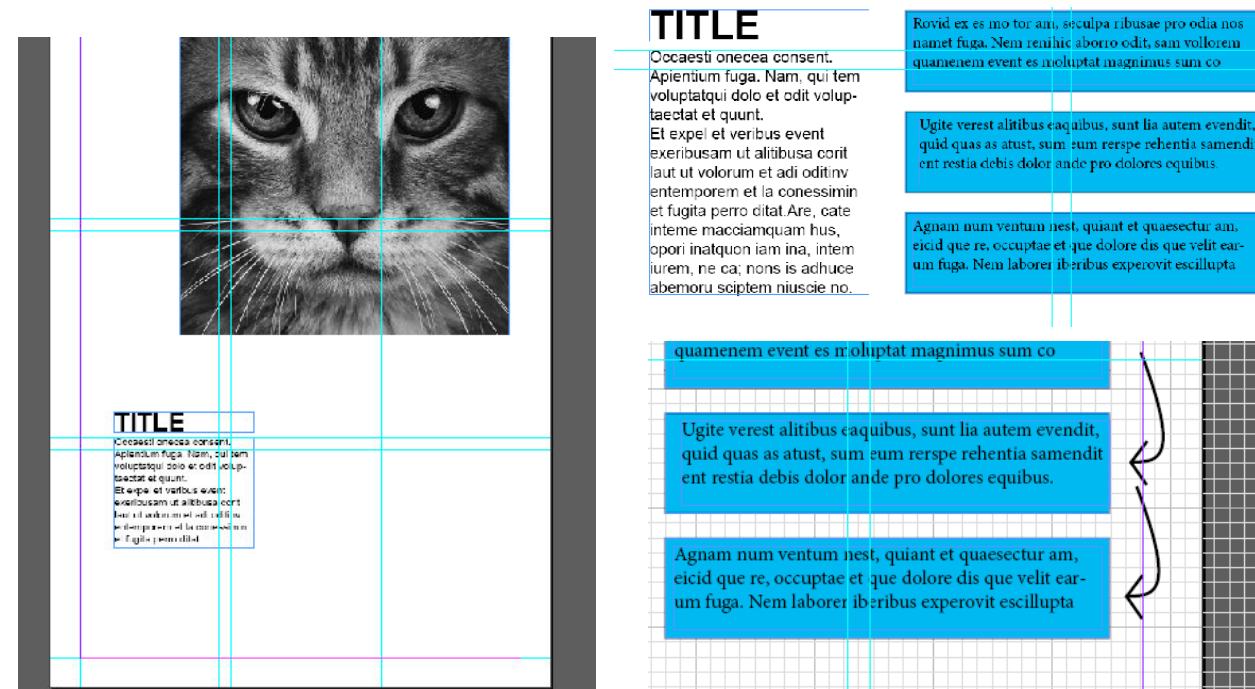


Exploring InDesign



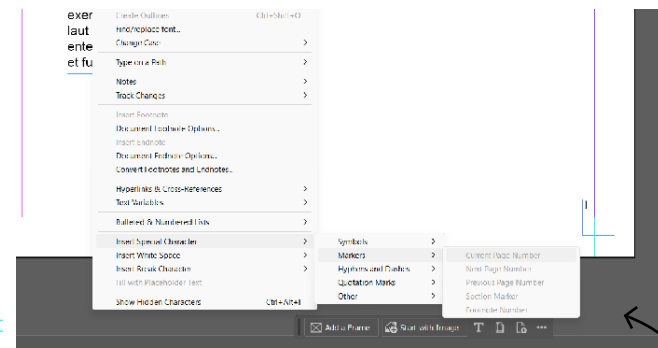
Creating simple guides, I created a guide to help with the rule of thirds as well as using the document's grid.

I next explored the various fonts, and application of them to my template. I also researched and learnt about the various uses of font pairings.



As seen above, I have explored placing images, as well as using the rule of thirds to layout the page. The idea being that attention will largely be drawn to the image, and then the title and content, grabbing a readers attention.

Next, I focused on the addition of colour. In this instance I used a darker blue compared to my selected colour palette, but this was simply for practice. I also looked at the use of arrows, directing the flow of the reader's attention to the required sections.



A key step for laying out my portfolio was inserting a page number in the 'A-parent' page, which would allow for all pages to be numbered and therefore remain in order, allowing for a chronological time line.

My selected font pairing



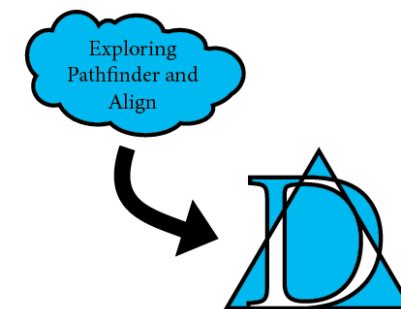
Exploring both font pairings and colour palettes.[1] [3]

I selected Lato font for the main body

I selected Dejanire Headline for the Titles

EXPLORING INDESIGN

Using the gradient tool, I wanted to delve into different ways to layout the title of a page, without a simple rectangular block of colour or white background. In the example above, I have tested the radial effect.



Final page of exploration

EXPLORING INDESIGN

- Henderunde doles audanis mo- lentanda aliquat quibus nonedit parciatatur sunt volo il lilest am quaeatet as mo cust, nim dolor simpos es veliquas ad quodiam que sum etur?
- Quis nabit as eos illa voluptae sunt rate que est cus rest quo dolorit volo ipuntia voluptatur sit adi re nis pelitas maximas.
- Elio ulian, seque pelliceaque verunt labo.
- Nequi veliciant illa acrum exaequi veribus eum quamed ellagati doliendi rereratur adio cum nam eosesc itate laut et fugitiam eos int voluptae nobita



SUBTITLE

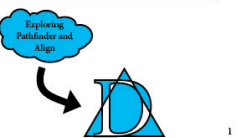
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Finally, the last parts of my exploration included placing a QR code, as well as using both the pathfinder and align tools to create more complex shapes. The final page is shown on the far right above, which summarises all of my different learnings on InDesign, from knowing nothing to being able to make a coherent page.

Websites Used

<https://colors.co/> 22/10/25

<https://fonts.adobe.com/> 22/10/25

Preliminary Research

Problem: Lack of access to affordable and practical footwear.

Brief: How might we innovate footwear?

Context:

- Over **100 million** globally are displaced or in crisis zones.
- **Logistics** typically account for anywhere between **60% and 80%** of the total expenditure of a humanitarian intervention.
- Limitations of transport into these areas.
- **Current minimum cost of £2 per pair** (as cited in Initial Exploration and on the right)
- It's estimated that **60% of donated items** arriving at disaster sites cannot be used immediately, and often have to be destroyed or sent back.

Market Research:



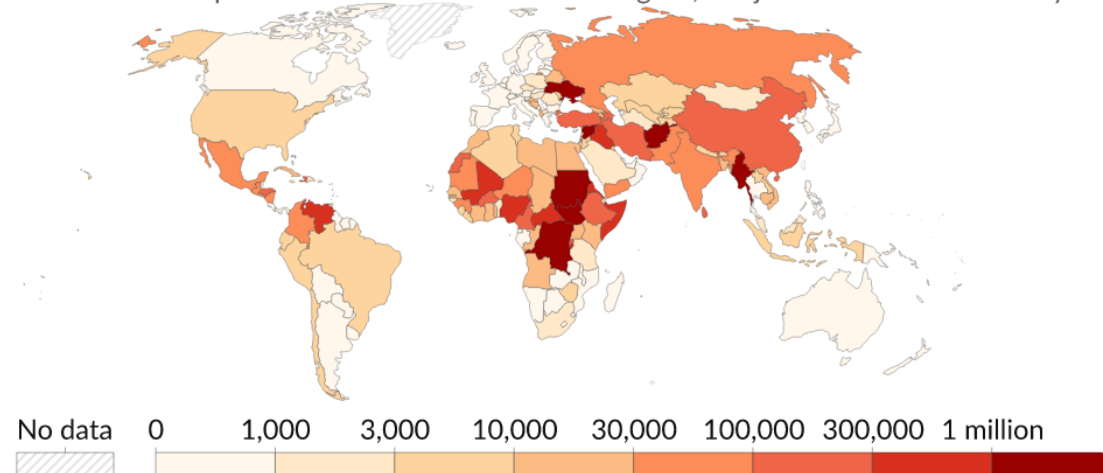
Cheapest flip-flops available: £2



Cheapest slider: £3

Refugees by country of origin, 2024

People who fled their country of origin because of serious threats against which the authorities of their home country cannot or will not protect them. This includes all refugees, not just those who fled that year.



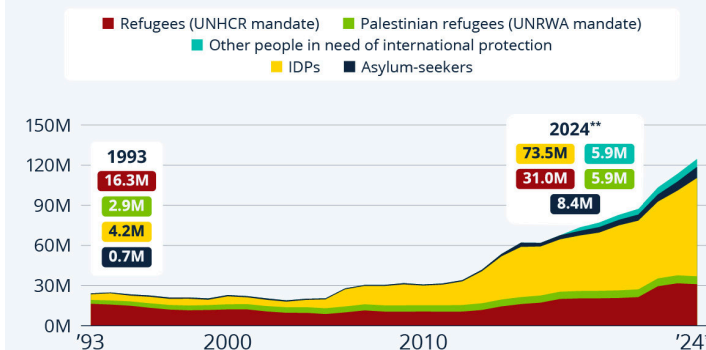
Data source: UNHCR (2025)

CC BY

In the graphs above, it shows the the number of displaced as well as where they are originating. As seen on the right, it shows the drastic increase in refugees and others displaced., which directly increases the requirement for shoes and basic supplies. Similarly, as shown on the left, the majority of refugees originate in Central Africa and East Asia, meaning most footwear donated is not useful and designed for the climate. This is a gap in the market and gap in humanitarian aid that I wish to explore. [8][9][10]

The Number of Forcibly Displaced Has Skyrocketed

Annual number of refugees under UN mandates, IDPs*, asylum seekers and other persons in need of assistance



* Internally displaced persons ** Preliminary figures
Data shows the number of people identified by the UN as forcibly displaced and so actual numbers are likely even higher
Source: UNHCR



statista

Why it matters?

- "Lack of adequate clothing and footwear remains a critical unmet need among displaced populations." UNHCR 2023
- "Displaced people in Gaza are struggling to find even basic necessities like footwear." Rudaw News 2024
- "Footwear was poor and unsuitable... fungal infections and open fissures were common." QMU
- Footwear is often the only thing standing in the way of injury and infection (such as Podoconiosis) falling under the human right to adequate clothing.

Response: How might we design a low-cost shoe that can be manufactured and distributed efficiently for people in need?

Insights and Inspirtation

Material Insights:

- **EVA Foam**
- **Lightweight, durable, waterproof and cheap.**
- Easy to cut and manufacture.
- During production, cuts can be tessellated to **reduce waste.**
- **Cork Sole**
- Comfortable, with a lower impact on the environment.
- It cannot be used in flat-pack as it is **brittle.**
- It is also **higher cost** than EVA foam.
- **Recycled rubber**
- **Durable, high traction** and can be die-cut.
- **Too stiff, heavy** and cannot **fold.**
- **Leather**
- Great **tensile strength**, very **durable** when dry.
- Provides maximal comfort and luxury.
- Requires stitching or bonding, therefore **cannot be made for mass production.**

Key Design Insights:

Based on my preliminary research done above, on the exploration page and here, the shoe will need to cost **under £2 per pair**, most likely be made from EVA foam, and allow for a **flat-pack** feature to be intergrated, as this will solve part of the issue with the high cost of **logistics**. It also needs to be suited towards **equatorial climates**, as seen in the graph above.

Product & Video Inspiration



- <https://www.youtube.com/watch?v=xS-Q2sgNjl8>
↳ What refugees carry with them (UNHCR 2016)
- <https://www.youtube.com/watch?v=ly-wa1IT3C8>
↳ How flip-flops are made (Jack Bennet 2018)



- Flip-flops and sandals on the market:



Currently £30.



Currently £115.

- Current flat-pack solution on the market:

- \$89.00
- Allows the user to assemble themselves



Ideas Evaluation

Concept	Feasibility	Innovation	Sustainability	Cost	Useability	Durability	Ease of Assembly	Weighted Total /500
1	3	4	4	4	2	2	4	330
2	4	3	3	4	4	3	4	370
3	3	2	3	3	3	4	2	295
4	3	2	2	2	4	3	2	255
5	2	3	2	2	3	3	2	230
6	2	3	3	2	2	2	2	215
7	3	3	3	2	2	2	2	235
8	4	3	4	2	4	4	1	300
9	5	4	4	4	3	2	4	380
10	2	2	3	1	2	2	1	170
11	4	1	3	3	4	4	2	320
12	4	2	3	2	3	3	2	275
13	2	3	5	5	1	1	5	330
14	4	1	3	3	3	3	3	310
15	4	3	4	2	4	2	1	270

Key:

5 - Best ■
1 - Worst ■

Interpreting the results:

Weighted Scaling:

- Feasibility 20%
- Innovation 5%
- Sustainability 10%
- Cost 25%
- Usability 10%
- Durability 15%
- Ease of Assembly 15%

Reasoning:

Ideas that are **unrealistic** do not fit the design specification or the goal set out. Therefore feasibility is weighted slightly more than others.

Innovation is valuable, as that is the overall goal, but the **practicality** of the design is more important for the **humanitarian goal**.

Recycled and local materials are important, but ultimately the design goal takes priority.

Cost drives my brief, therefore it is weighted the most.

The shoe must be **wearable** and safe for **long-distance use**.

Footwear must be **usable**, and endure **harsh terrain**, as explored in the Initial Exploration.

Low-cost manufacture and **ease of shipping** are vital to the overall life cycle.

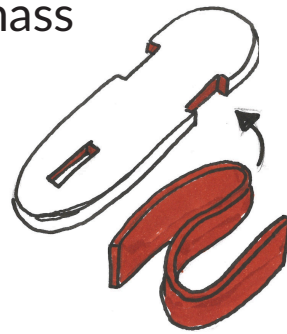
Concept Selection & Evaluation

Based on prototyping, material selection and evaluation against the design goal, I have used this page to explore which shoe concept meets the desired qualifications for the brief.

Punch-Out Flip-Flop

Single-sheet EVA design for mass manufacturing.

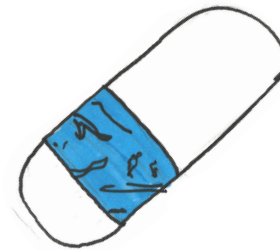
↳ Simple and scalable.



Recycled Tarp Slider

Repurposed Tarp combined with EVA sole.

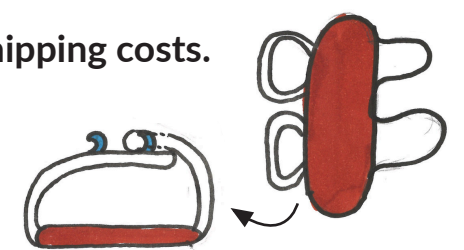
↳ Material re-use and durable.



Flat-Pack Sandal

Adjustable, modular design for self-assembly.

↳ Versatility and efficient shipping costs.



Criteria	Weight	Flip-Flop	Tarp Slider	Flat-Pack Sandal
Cost	25%	5	3	3
Durability	20%	2	3	4
Repairability	15%	3	4	3
Ease of Manufacture	15%	4	3	4
Comfort & Fit	15%	2	4	5
Sustainability	10%	3	4	4
Weighted Total		3.2 / 5	3.5 / 5	3.8 / 5

Interpreting the results:

- The Punch-Out Flip-Flop offers **simplicity** and **scalability**, with the draw back of a short lifespan.
- The Recycled Tarp Slider showed promise in **material reuse** but would be less efficient in use and in mass production.
- The Flat-Pack Sandal balances **functionality**, **cost-effectiveness**, and **sustainability**.

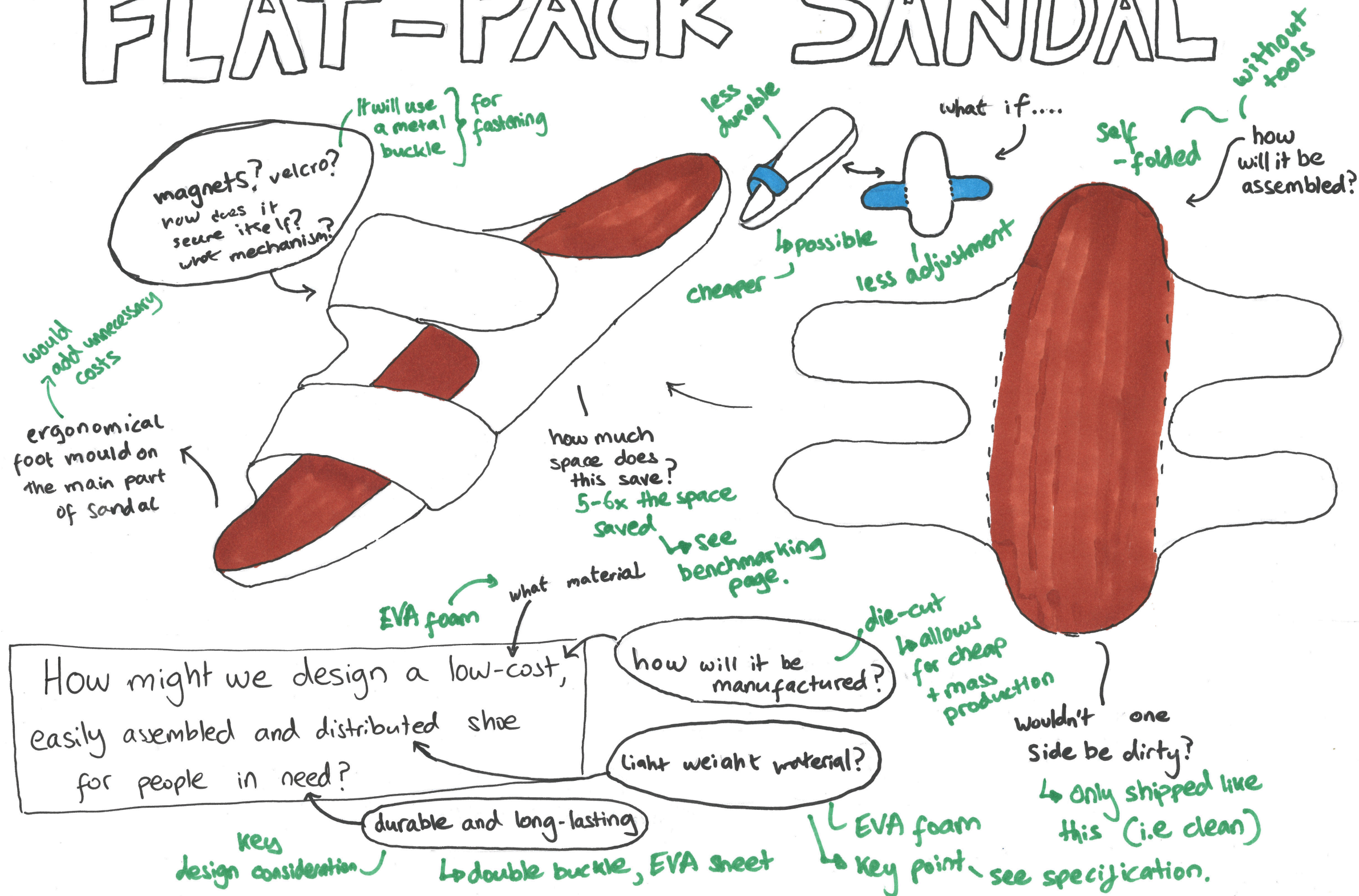
I have decided to move forward with the Flat-Pack Sandal as it's modularity, repairability and transport possibilities stood out against the challenges identified in early research.

Conclusion:

I am moving forward with the **Flat-Pack Sandals**. It was the clear winner in both selection and evaluation pages, and was the shoe that was most relevant to the design question I have answered.

Peer Review and Feedback

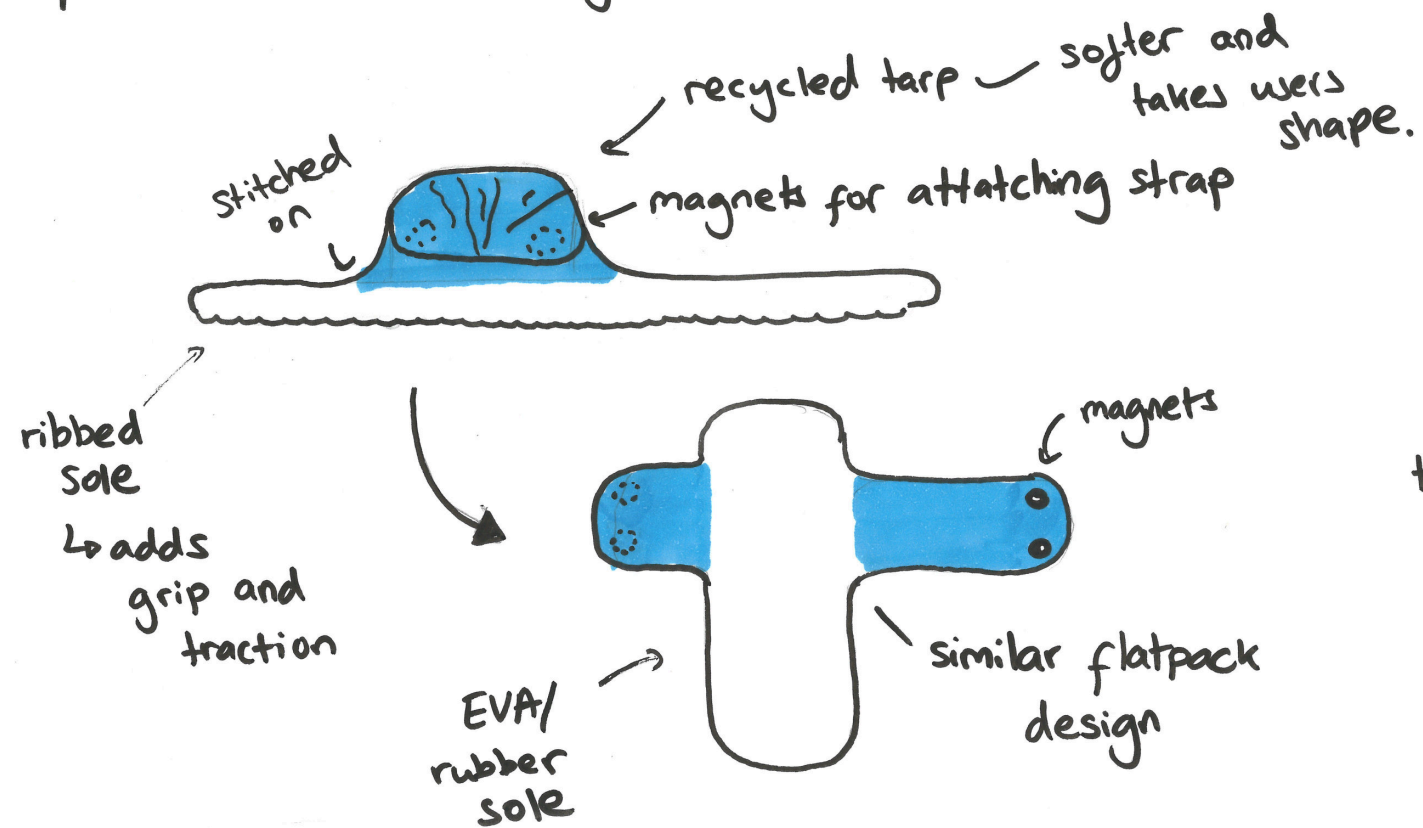
FLAT-PACK SANDAL



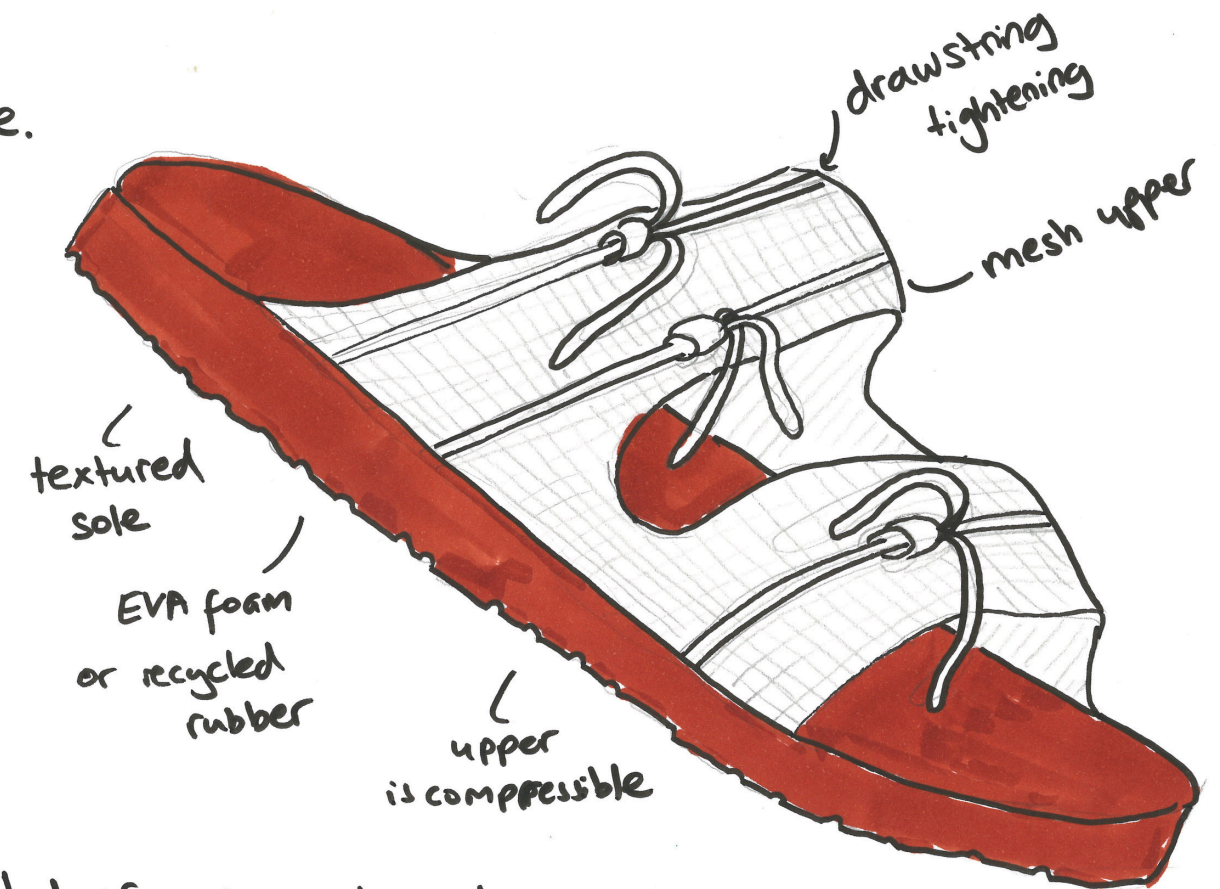
Morphological analysis shoes

On this page, I wanted to continue the morphological analysis, by combining some of the ideas into actual shoe concepts, which I could then decide from and compare against my concept.

Tarp slider with magnet & rippled sole

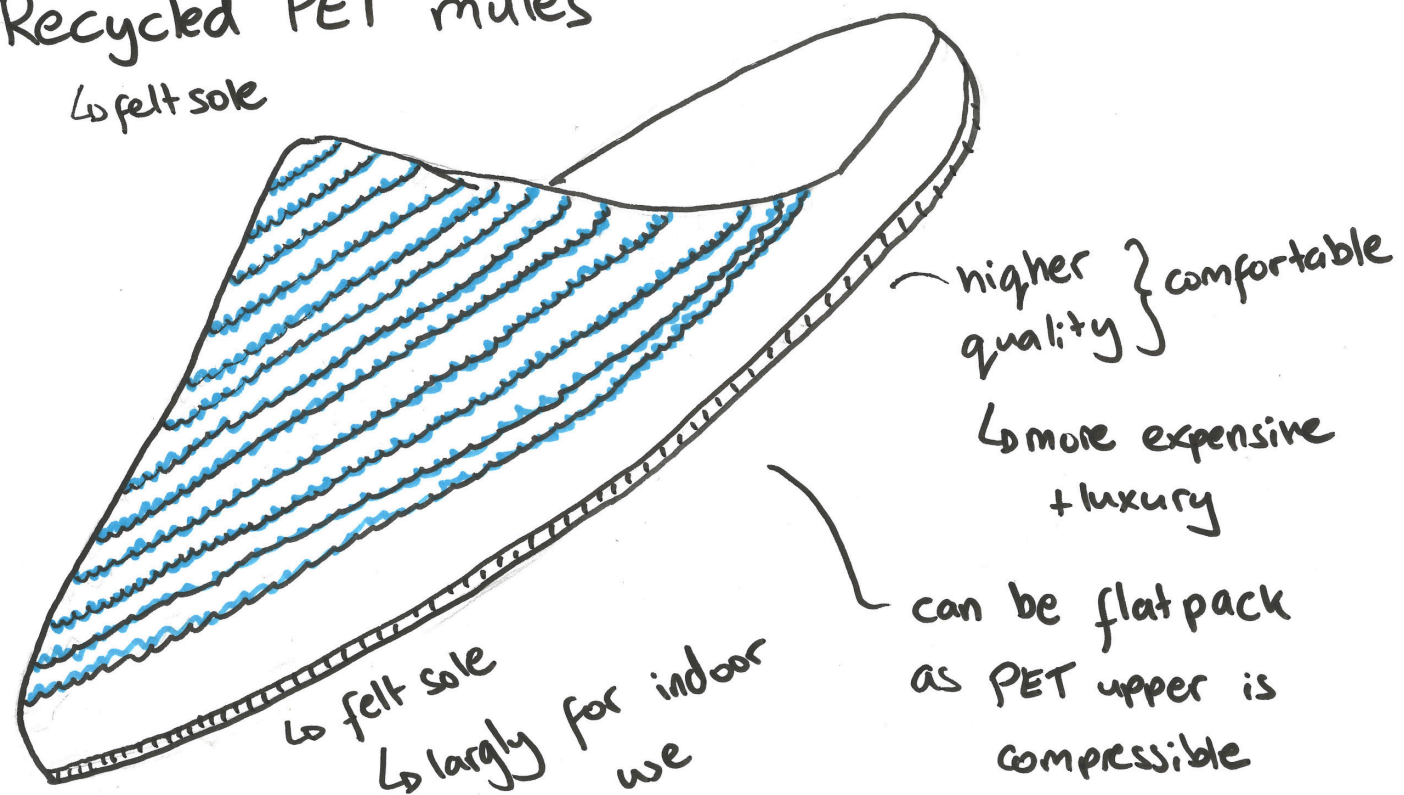


Mesh sandal with lock

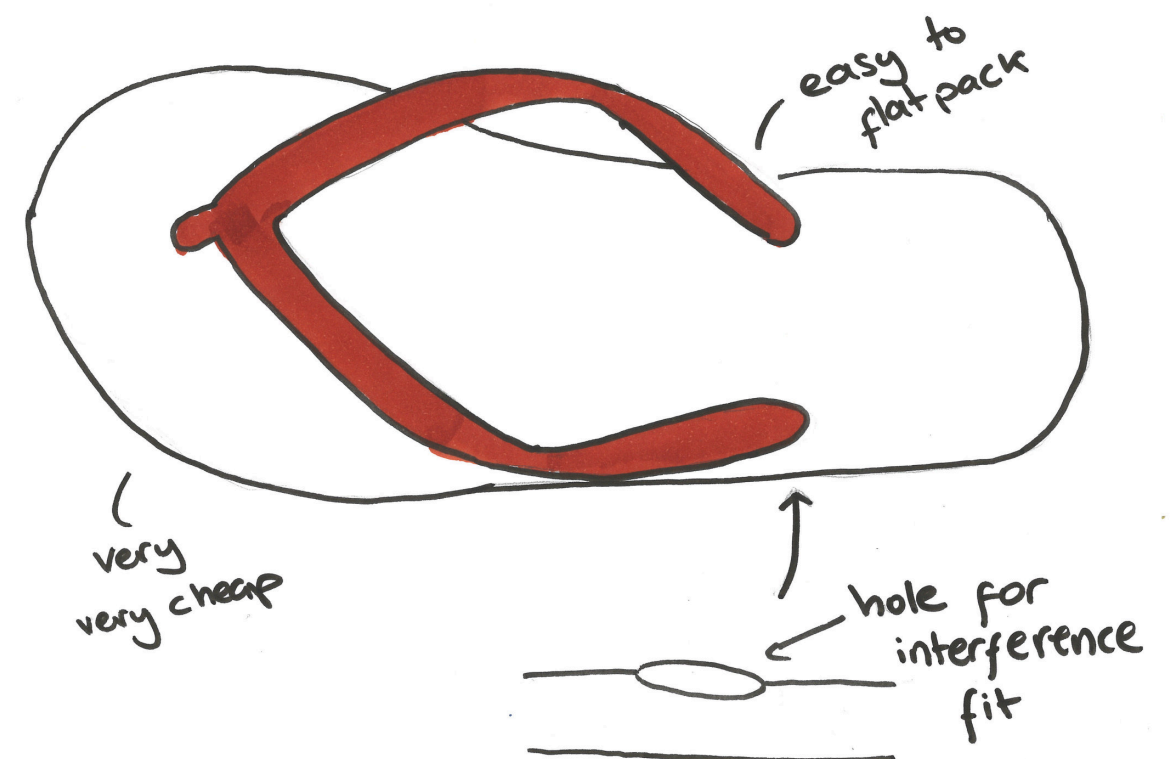


Recycled PET mules

↳ felt sole



Interference flip-flop



Validation cont.

On this page I want to compare my final design to my specification points to ensure it has achieved what I want it to.

Design Requirements:

- The shoe **costs less than £2 per pair**, as calculated above.
- The shoe is **flat-packable**, as shown in the final design.
- It can be assembled **tools free**, as shown in the final design.
- The shoe can be **adjusted**, as shown in the final design.
- The shoe is **durable**, as calculated in the page above.
- The sole can withstand force, as shown above.
- The strap will withstand adequate force, as shown above.
- The manufacturing process is **simple**, as laid out in the final design.
- There is **minimal material waste**, as described on the page above.
- There are no visual instructions, the shoe **misses this requirement**.
- The EVA foam is **waterproof** and **UV-resistant**, as explored on the materials page in supplementary section.
- There are **no sharp corners**, as laid out in the final design page.
- There are no colour options, **missing this design requirement**.
- The shoe does not have any repair kits, **missing this requirement**.
- There are also no etched size guides, **missing this requirement**.

The shoe meets all requirements except one from the 'Should have' and three from the 'Could have' sections of the design requirements, therefore **all 'Must have' requirements have been met**.

Design Specification:

1. Function

- The shoe protects the user, as calculated above.
- The shoe will be durable for daily use, as calculated above.
- The shoe can be assembled without tools, as shown in the final design.
- The shoe remains secure, as the strap is secure, as calculated above.

2. Target User

- It is accessible for refugees, explored above and in the final design.
- All users can assemble the shoe, as explored on the page above.

3. Materials

- The shoe is made from EVA foam, as shown on the final design page.
- The straps are made from EVA as well, also shown in the final design.
- EVA is waterproof, lightweight and UV-resistant.
- The buckles are made from zinc alloy, as stated on the final design page.
- The sole is thicker than 10mm, as explored on the page above.

4. Manufacturing

- The shoe is die-cut, as shown in the final design page.
- The entire shoe is one sheet, as displayed in the final design.
- The shoe has an anti-slip tread, as shown on the final design.

5. Durability & Comfort

- The straps are resistant to tearing, as calculated above.
- The EVA foam most likely holds structure up to 50°C.
- The buckle is not replaceable, **missing this specification point**.
- The shoe most likely does not rub or cause blistering.
- The strap is adjustable, as shown in the final design.
- The EVA does compress slightly, as calculated above.

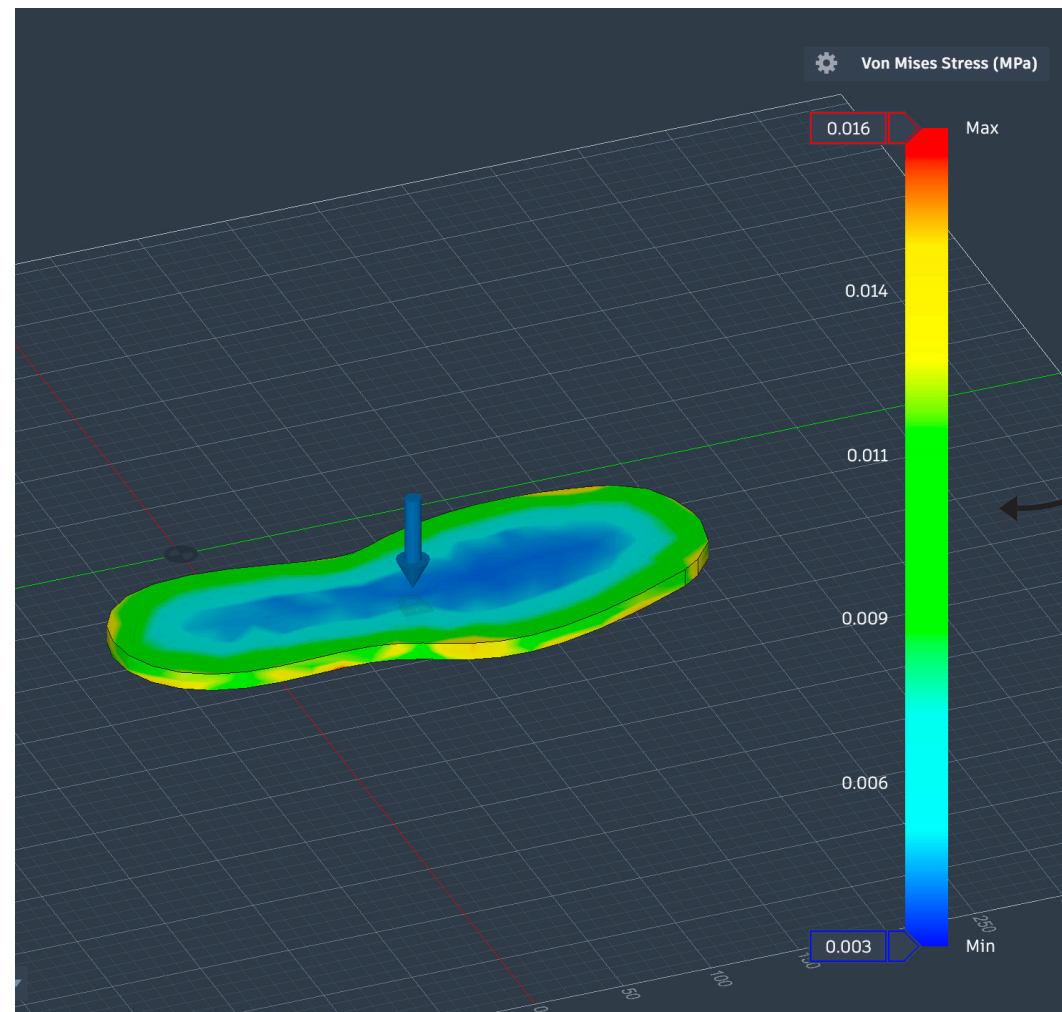
6. Storage & Logistics

- The shoe is flat-packable, as laid out in the final design.
- The shoe has no instructions on it, **missing this spec point**.

The shoe meets all specification points except two, which is a successful design compared with what the shoe set out to do.

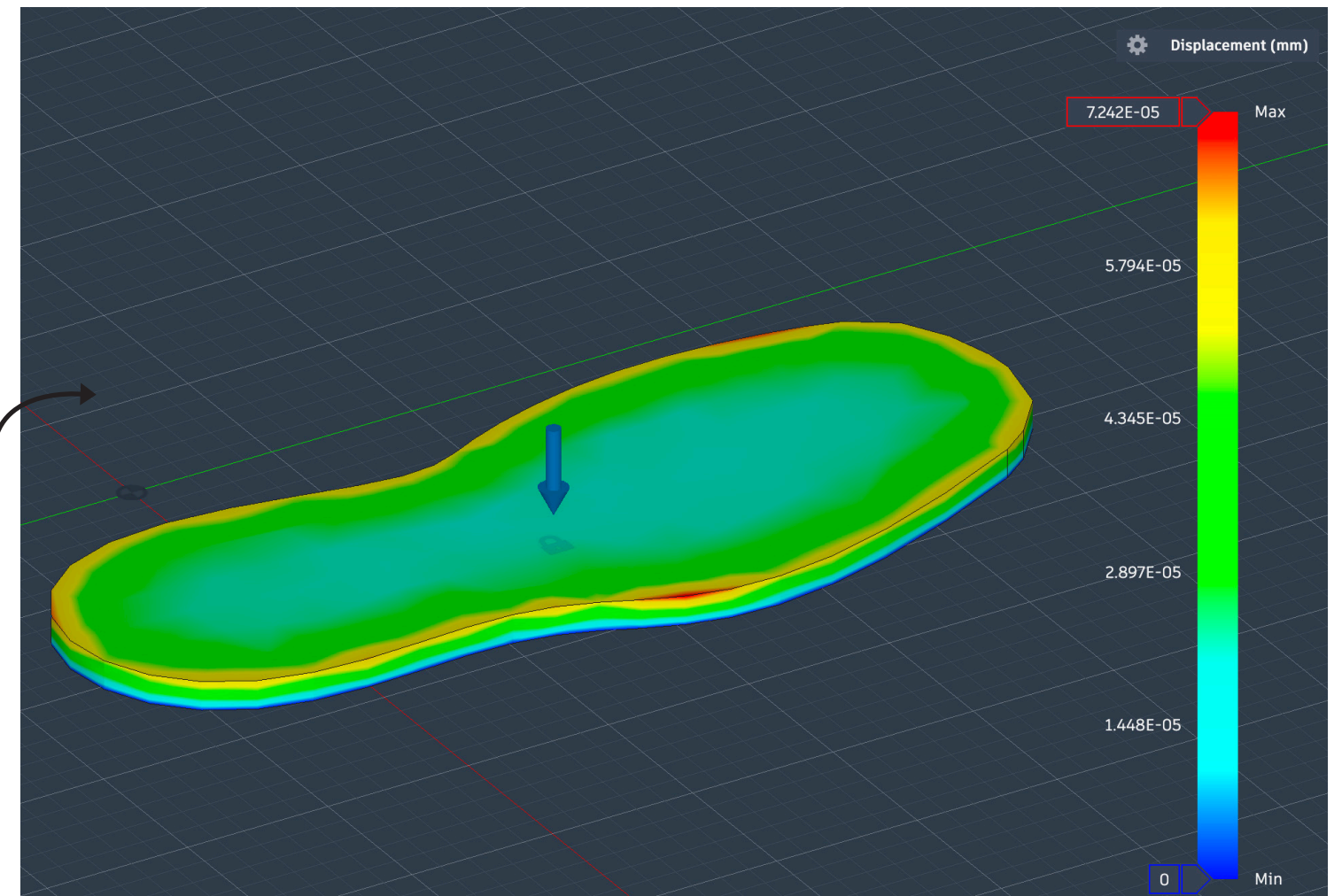
Fusion testing & Product comparison

I decided to further investigate the 10mm thick EVA foam sole, as well as practice simulating a material of fusion. The results of the simulation are shown below, which confirms what was found in the benchmarking page, that the sole will be enough to provide support and comfort.



On the left, I explored the stress across the sole when the user stood on the sole of the shoe.

On the right, I explored the displacement of the EVA foam across the sole when the same force was applied.



Further product comparisons:

Comparing the final design of the shoe with further examples already on the market:

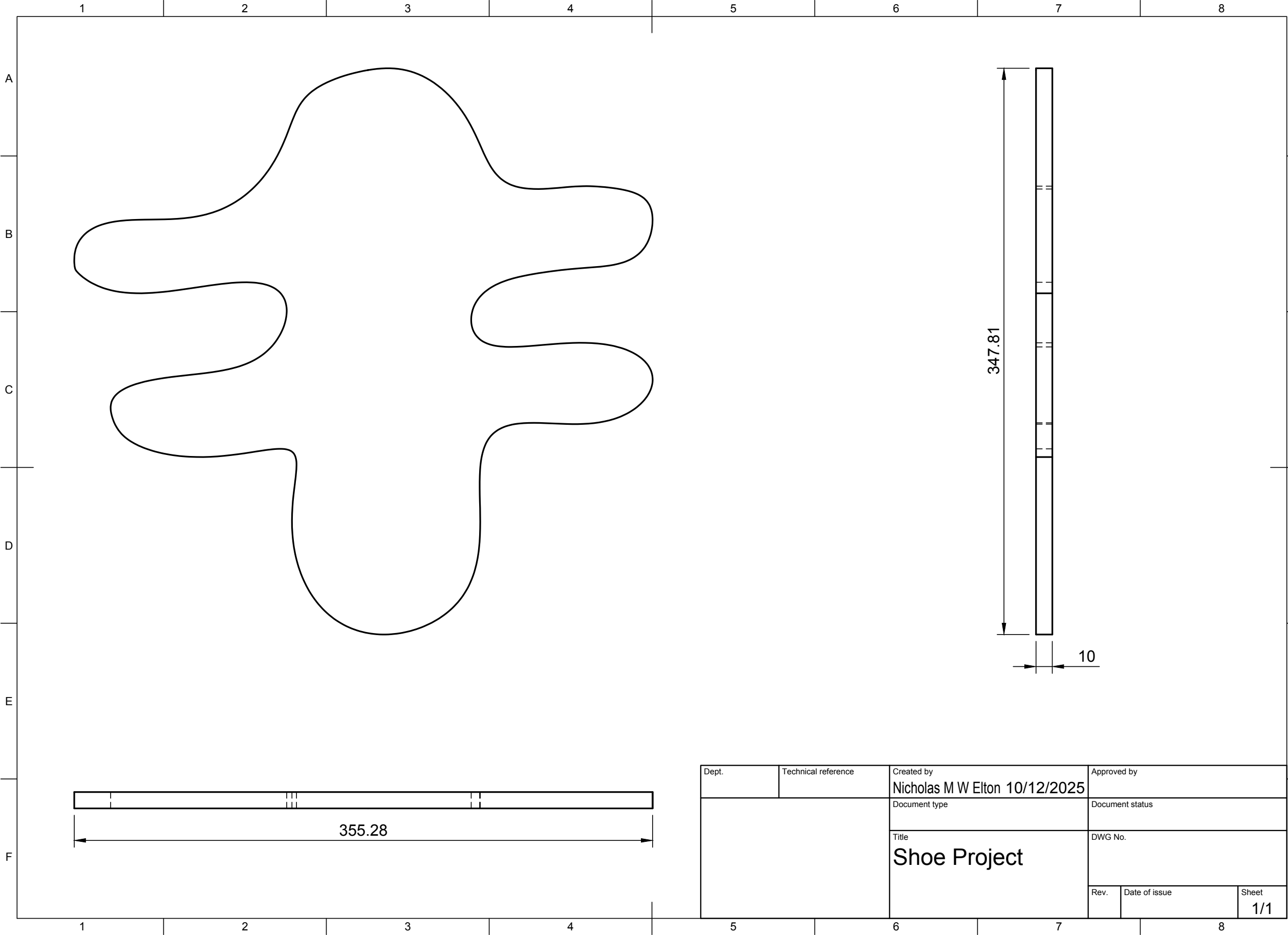


- Shoe from Primark: £1
- Also made from EVA foam.
- Not intended for long use.
- My shoe design is cheaper than this shoe, with better quality.
- My shoe is much more durable.

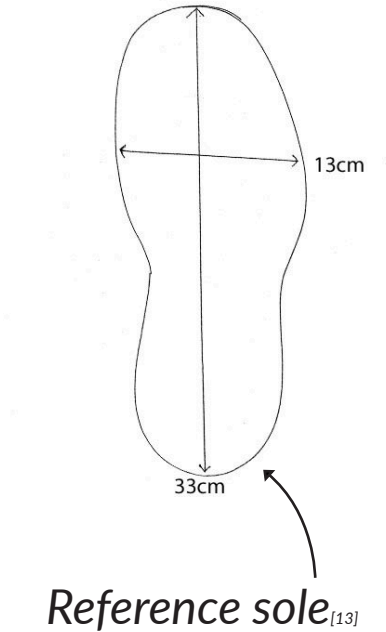


- Shoe from Birkenstock: £115. Similar aesthetic and made with cork and suede. More luxury and possibly more durable, but very expensive and can't get wet.

Orthographic Drawing



I have made a very rough orthographic drawing showing my shoe in **flat-pack form**. The dimensions are based of a UK **size 10 shoe**, and I used this page to explore the form, dimensions and my CAD skills.



References

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- [2] Bob Barker® Eva Sandals (no date) Bob Barker. Available at: <https://www.bobbarker.com/footwear/sandals> (Accessed: 24 October 2025).
- [3] Colors - the super fast color palettes generator (no date) Colors.co. Available at: <https://colors.co/> (Accessed: 22 October 2025).
- [4] Humanity, P. for (no date) Pet sandals, Prototypes for Humanity. Available at: <https://www.prototypesforhumanity.com/project/pet-sandals/> (Accessed: 24 October 2025).
- [5] Made in Brunel: 'one-size-fits-all' shoe designed to ease refugee journey (2017) Brunel University of London. Available at: <https://www.brunel.ac.uk/news-and-events/news/articles/Made-in-Brunel-One-size-fits-all-shoe-designed-to-ease-refugee-journey?> (Accessed: 24 October 2025).
- [6] Soles4Souls (2025) Recycled tires become shoes in Indonesia, Soles4Souls. Available at: <https://soles4souls.org/bridgestone-indonesia/?> (Accessed: 24 October 2025).
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- [8] Tull, K. (2020) Cost-effectiveness in humanitarian outcomes: Logistics, figshare. Available at: https://opendocs.ids.ac.uk/articles/report/Cost-Effectiveness_in_Humanitarian_Outcomes_Logistics/26429113 (Accessed: 31 October 2025).
- [9] Schöneberg, S. (2019) Let's send help: Fixing Shipping and logistics for humanitarian aid, The Supply Chain Logistics Platform. Available at: <https://www.flexport.com/blog/lets-send-help-fixing-shipping-and-logistics-for-humanitarian-aid/#:~:text=That%20level%20of%20inefficiency%20is,Fixing%20it%20together> (Accessed: 31 October 2025).
- [10] Refugees by country of origin (no date) Our World in Data. Available at: <https://ourworldindata.org/grapher/refugee-population-by-country-or-territory-of-origin> (Accessed: 31 October 2025).
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- [12] Eva foam - high purity EVA foam: Nanochemazone® (2023) Nanochemazone. Available at: <https://www.nanochemazone.com/product/eva-foam/> (Accessed: 07 December 2025).
- [13] Victory sole size 10 (no date) Twitter. Available at: <https://www.leatherandgrindery.com/Victory-Sole-size-10> (Accessed: 10 December 2025).
- [14] Vizcom. Available at: <https://www.vizcom.com/> (Accessed: 10 December 2025).