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-Comfortable Platform Shoes-

"A height-enhancing footwear design that balances comfort, lightness, and stability through modular and breathable innovation."

Elevate your every step.

Daisy Fang | 10/12 /25 | dikun.fang25@imperial.ac.uk

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Initial Exploration

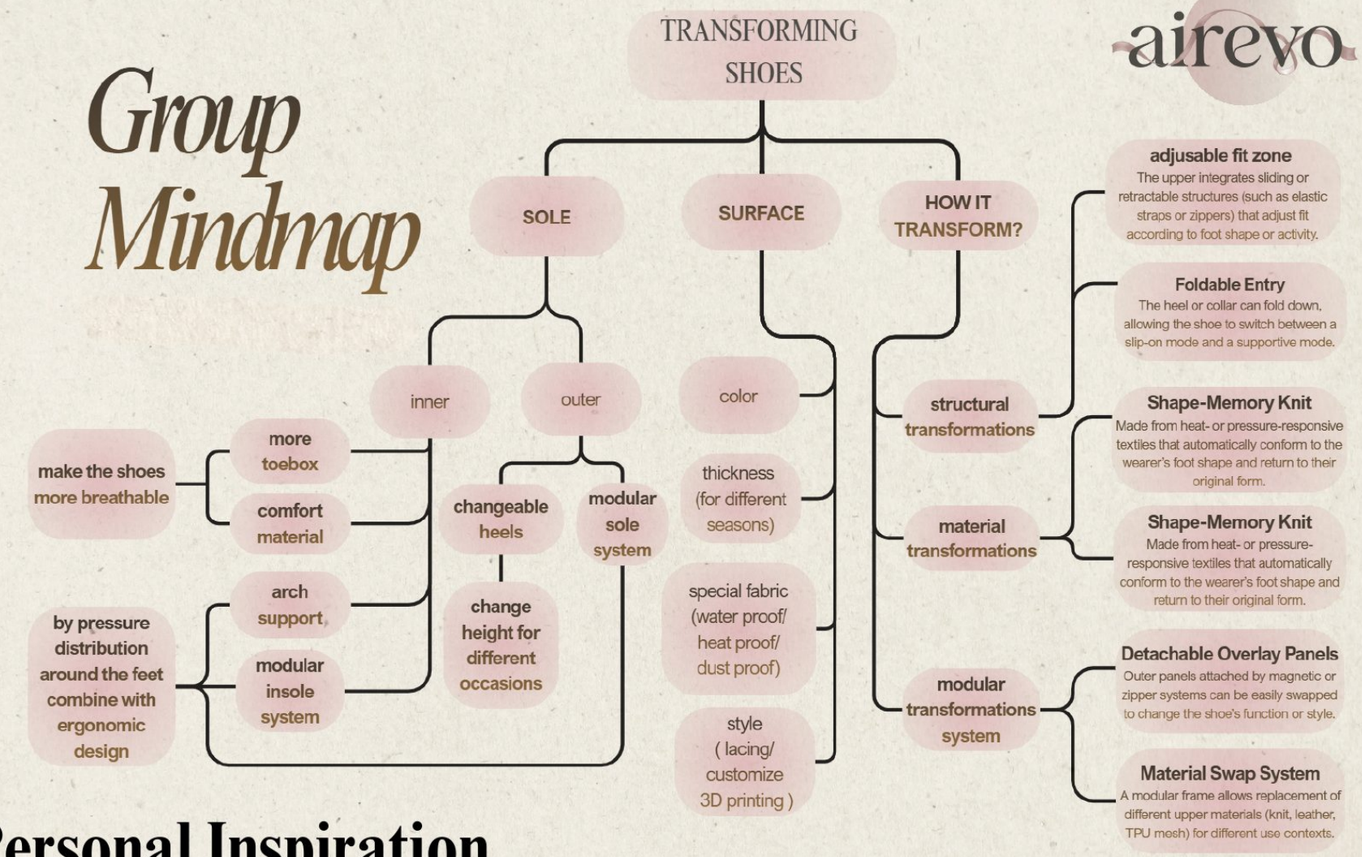




Existing Problems

- Discomfort & hard to balance
- Too heavy
- Unbreathable
- Too thick and unproportional

Group Mindmap

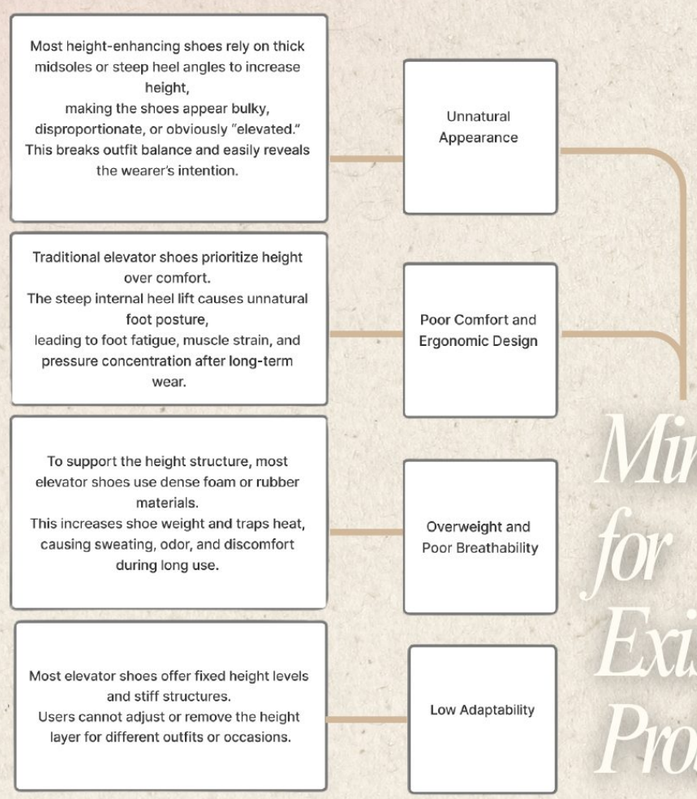


Personal Inspiration

The inspiration for this project comes from my personal experience wearing height-increasing shoes in daily life. These shoes provide a subtle boost to height and body proportions, but I noticed that most existing designs sacrifice comfort for appearance. As a result, every time I wear height-increasing shoes, the soles, due to the need for elevation, are usually too heavy and stiff, often causing an imbalance of pressure, fatigue, and unnatural posture during prolonged wear, which further affects health.

This made me realize that current height-increasing footwear focuses more on visual enhancement rather than ergonomic performance. Considerations for biomechanical balance, lightweight materials, and natural user movement are very limited. Therefore, in this project, I aim to explore how to redefine height-increasing shoes so that they can provide a natural, comfortable, and lightweight height-enhancing experience, bridging the gap between aesthetic appeal and human-centered functionality.

Mindmap for Existing Problems





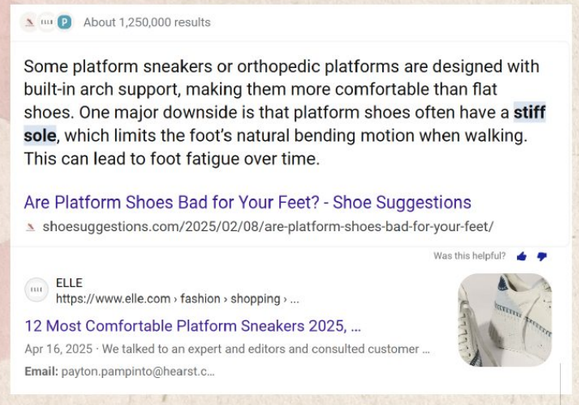
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Gathering Insight

Key findings from social listening/primary experience/customer searching behavior analysis

What comes up when people google platform shoes?



A quick Google search for "**platform shoes**" immediately surfaces related terms such as"**platform shoes uncomfortable**" and "**are platform shoes bad for your feet?**". Many fashion and footwear websites also publish rankings like "**most comfortable platform sneakers**", and health articles warn that "**platform shoes often have a stiff sole, which limits the foot's natural bending motion and can lead to fatigue over time**".

This online behaviour suggests that **while consumers are still highly attr-acted to the extra height and style of platform footwear, comfort and foot-health concerns are a widely shared pain point.** People are act-ively searching for ways to keep the height while reducing pain, stiffness and fatigue.

These findings validate the design direction of Airevo:

a height-boosting shoe that addresses the known issues of stiffness and fatigue through **a lighter midsole architecture and pressure-redistributing insole system**, instead of simply adding more rigid height under the foot.

Primary Experience

Living with height-increasing shoes

In my daily life I often wear height increasing sneakers to improve my body proportions. They do make me look taller, but the elevated soles are usually heavy and stiff. After a full day, I feel uneven pressure under my feet, fatigue and an unnatural posture.

This first-hand experience made me realise that most height-boosting footwear is designed for appearance first, comfort second. It directly leads to my project question: **how might we create height-increasing shoes that feel natural, light and ergonomic, instead of forcing users to trade health for height?**

Social listening from online chat



Analysing a Reddit thread about platform shoes, we coded each comment for explicit complaints and desired improvements. Most complaints focus on excessive weight, stiff soles, instability and an immature or chunky appearance, especially in professional or active contexts. At the same time, users are clearly asking for extra height (2–3 inches) combined with all-day comfort, mature professio-nal styling, better flexibility, and safer, more stable platforms that could replace heels.



These findings directly inform the design goals of Airevo: a lighter, more flexible and stable height-boosting shoe with ergonomic support and a professional aesthetic.

WHO I need to consider?

Young urban woman (20-35):

- Comfort
- Aesthetics
- Adapt to dofferent occasions.

WHAT will the shoes be like?

- Transforming footwear concept
- Hallow sole for lessen weight
- Breathable material for upper
- Insole for pressure balance

WHEN do people need it?

- Long daily use where comfort and height-boost must coexist.
- Situations requiring changing sole height for other activities.

WHERE will people use it?

- Commuting
- Workplace
- Social occasions (date & party etc.)
- Daily sports

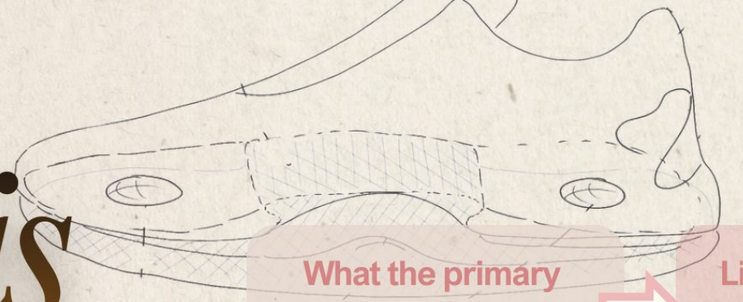
WHY my design important?

Current height-increasing shoes often neglect comfort. Our product will offer users a better experience with more comfortable platform shoes.

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Initial Analysis



What the primary need for platform shoes users? → Link the problem to "transformable" shoe design → Where and what we could add for more functions?

3 HMW's developed from insights, with analysed solutions.

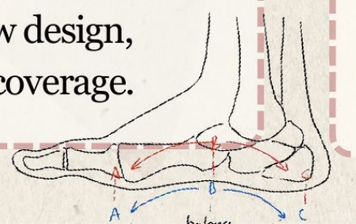
HMW design platform shoes that is more comfortable and easy to wear?

INSIGHT

"I couldn't bend my feet as much as non-platform shoes, and they also feel heavy"
- resident bee[2]

IDEAS

- **Insoles with zoned design provide better support for every part of the foot, while using a flat elevation instead of a sloped one to offer better balance.**
- Arch support, elevated at the heel.
- Mimicking spinal movement, the sole is designed in segments to provide greater foot flexibility.
- Inspired by bear paw design, offering all-around coverage.



HMW design a modular shoe system for different outfits or uses?

INSIGHT

"They're always very heavy, not to mention how often you roll twist your ankle in them."
- StationNo3[2]

It's really easy to trip over the soles of the shoes.
- My experience as using treadmill wearing platform sneakers

IDEAS

- Use a mortise and tenon structure to combine the two soles
- Create protrusions on the sole and upper part and use rubber bands to fix the two parts
- **Use the outer sole to half-cover the inner sole and make a buckle between the two soles.**
- Divide the sole into different areas and install them in sections (using buckles or threads).

HMW explore more possible functionality of shoes with high sole?

INSIGHT

"Can we make use of the extra space in the sole to add more functions?"
- feedback from Joyce

IDEAS

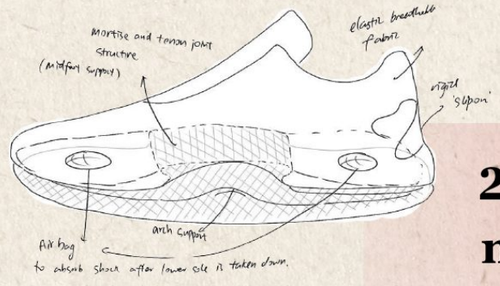
- Massage the soles with massage rollers/airbags in the soles.
- **Mechanical cushioning sole design, with a uniquely structured hollow section to make walking more easy and comfortable.**
- Roller shoes (thick soles with hidden rollers and rechargeable batteries).
- Soles equipped with heating plates that collect the energy from walking, converting kinetic energy into heat to help keep warm in winter.

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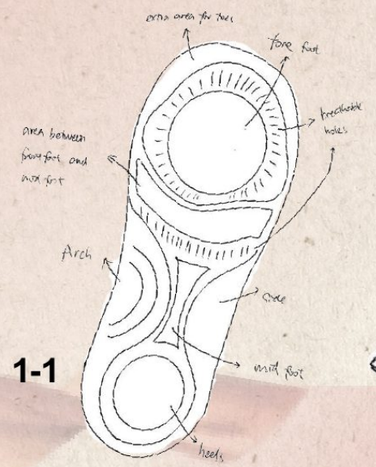
15 Concepts

Exploring ideas around the 3 HMW questions

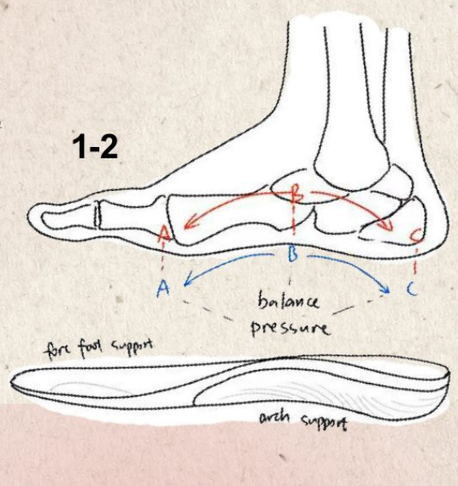
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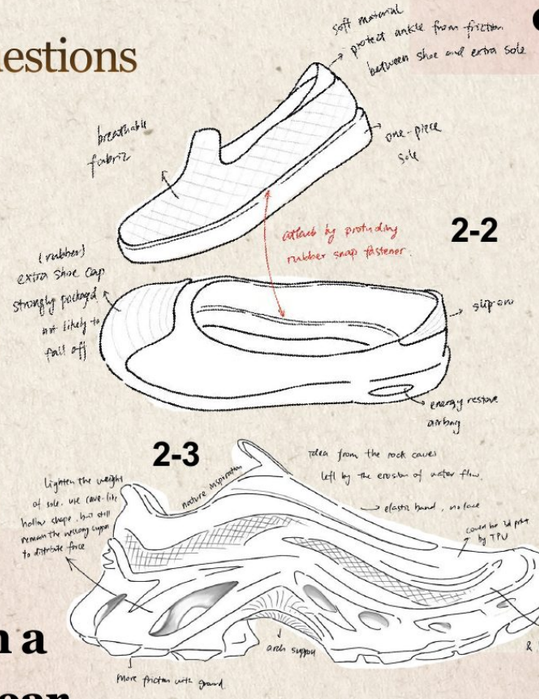
2-How might we design a modular shoe system for different outfits or uses?



1-1

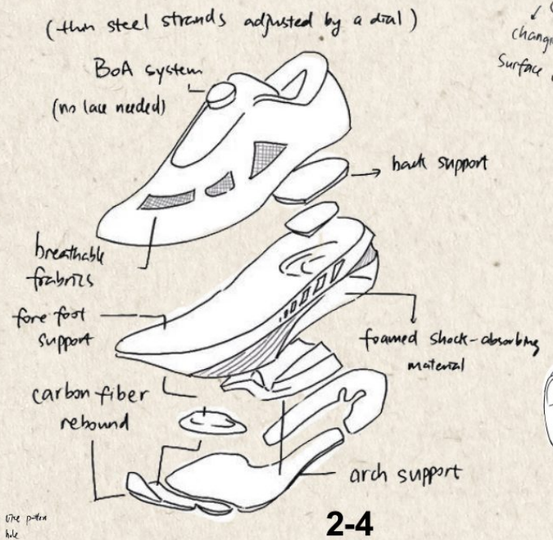


1-2



2-2

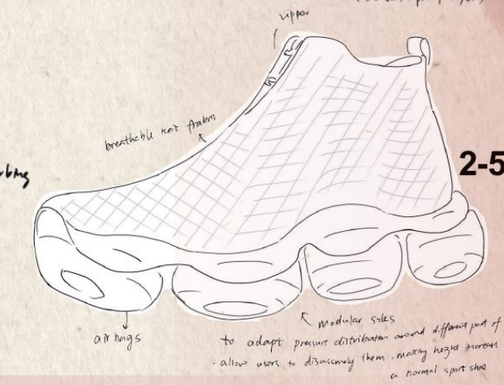
2-3



2-4

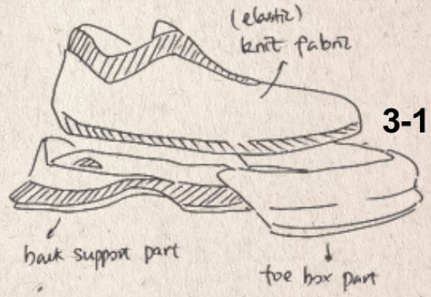


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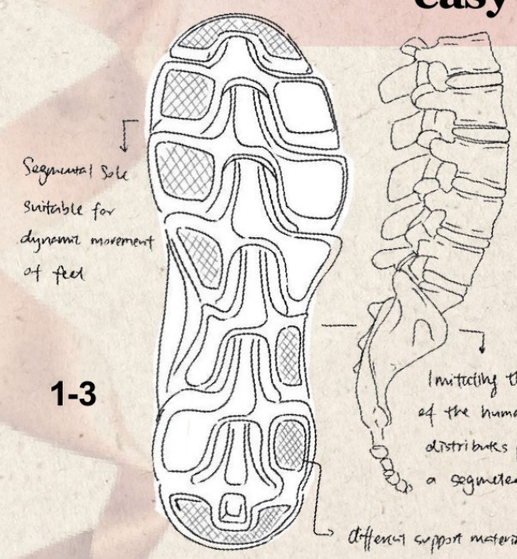


2-5

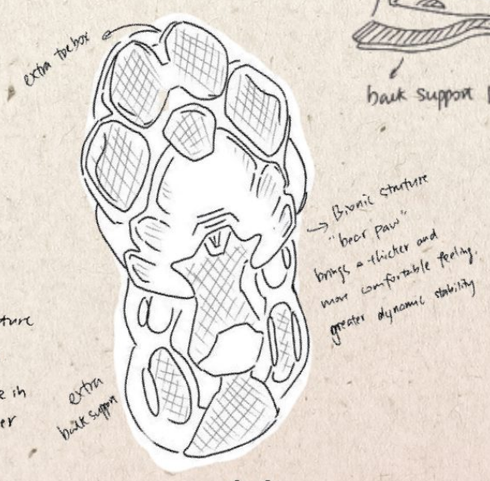
1-How might we design a height-increasing footwear that is more comfortable and easy to wear?



3-1



1-3

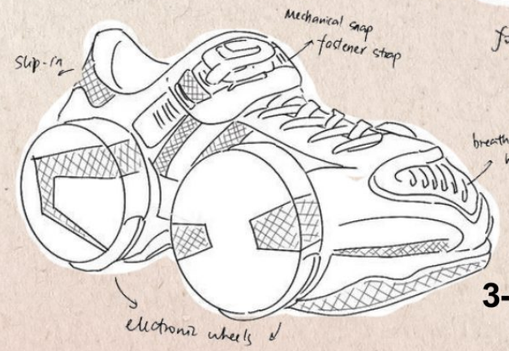


1-4

3-How might we explore more possible functionality of shoes with high sole?



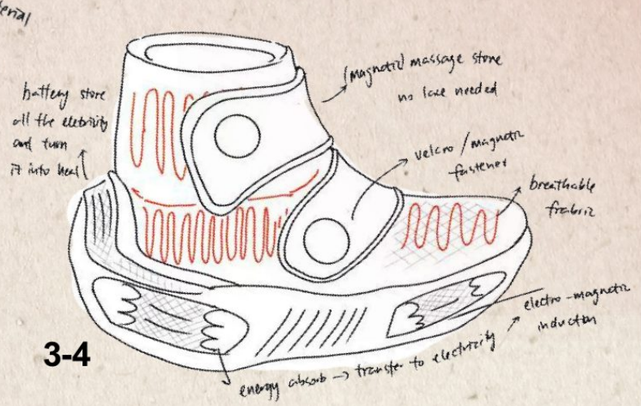
3-3



3-2



3-5



3-4

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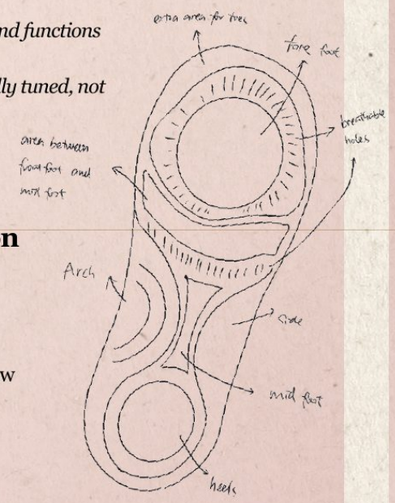
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Three main ideas

Exploring 3 selected ideas form each HMW

1.1 pressure distribution support insole

Different foot zones carry different loads and functions during walking or standing.
So the insole should bu zone and functionally tuned, not just a uniform block of foam.



Zonal Design

- divide the insole into 4 functional regions based on pressure mapping:

- **Heel Zone** – shock absorption
  -Soft foam or bio-gel insert; use hollow cavity or air pocket to absorb impact.
- **Midfoot Zone** – arch support & balance
  -Slightly firmer arch bridge structure matching the user's scanned foot curvature.
- **Forefoot Zone – pressure** distribution & cushion & energy return
  -Add a metatarsal pad to lift and redistribute load; use rebound materials (TPU plate or carbon spring) for push-off assistance.
- **Toe Zone – flexibility & ventilation**
  -Soft, flexible, breathable materials allow natural toe bending and provide better ventilation.



2.6 zipper two-layer shoes



The shoe functions as a modular system, adapting to user scenarios:

• Mode 1 – Rainproof urban high-top: waterproof outer + knit lining + optional fleece.

• Mode 2 – Breathable casual low-top: outer folded, exposing soft knit upper.

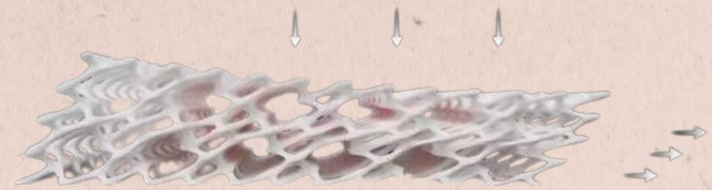
• Mode 3 – Transitional hybrid: half-zipped collar for aesthetic variety and temperature control.

Feature	Description	Design value
Convertible Structure	Zipper-based modular upper converts from high-top to low-top. The folded section forms a "shirt collar" aesthetic when unzipped.	Multi-style adaptability and playful expression
Waterproof Outer Shell	Semi-transparent waterproof TPU membrane with sealed seams.	Protects from rain while showing interior texture; stylish functional transparency
Inner Knit Layer	Soft elastic knit ensures comfort, breathability, and lightweight fit.	Enhances comfort and flexibility, suitable for long wear

3.5 mechanical energy absorption

Mechanical cushioning refers to a structural approach to shock absorption — instead of relying only on soft foam, it uses engineered geometry (such as lattices, honeycombs, or hollow columns) to manage how energy is absorbed and released during impact.

Structural Energy Absorption
The honeycomb structure consists of multiple hollow cells (like small hexagonal chambers). When the foot strikes the ground, these cells compress and deform, dissipating vertical impact forces through the bending of thin walls.



Energy Redirection and Return
After compression, the cell walls naturally spring back, pushing the midsole outward and forward — this creates a mechanical rebound that propels the runner forward.

Lightweight & Ventilation Benefits
Because the midsole is mostly hollow, the structure is lightweight and breathable, reducing material use while maintaining strength through geometry rather than density.



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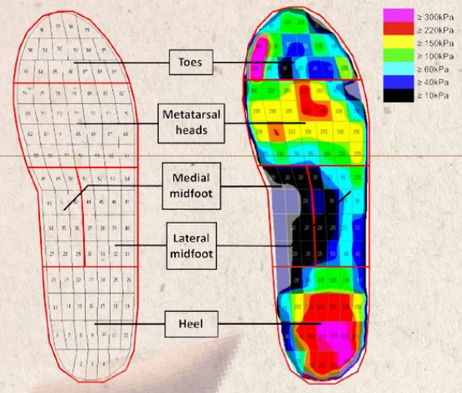
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One developed idea

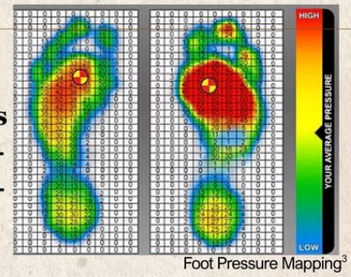
Deep researching in one idea from 3 ideas.

Ergonomic mapping

Ergonomic Mapping helps transform subjective comfort into objective, measurable data. By analysing plantar pressure distribution across toes, metatarsal heads, midfoot and heel, we identify which regions require cushioning, flexibility or stability. This ensures that the footwear design is biomechanically aligned with the user's natural gait, reducing injury risk and improving long-term comfort.



The coloured footprint on the right shows the pressure distribution in kilopascals. Darker colours represent higher pressure, which is concentrated under the heel and metatarsal heads. Lighter colours indicate lower pressure at the midfoot and toes. **This visual map directly informs where cushioning, flexibility or support should be prioritised in the sole design.**



Foot Pressure Mapping[3]

How Plantar Pressure Distribution Affects Walking Posture and Comfort?

Uneven pressure distribution alters walking posture

- In a normal gait, pressure transfers sequentially from heel → lateral midfoot → forefoot → big toe.
- If the shoe structure causes localized high pressure (red zones in the diagram), the foot compensates by changing the gait pattern — leading to overpronation or supination.
- Over time, this compensation results in joint misalignment and postural imbalance.

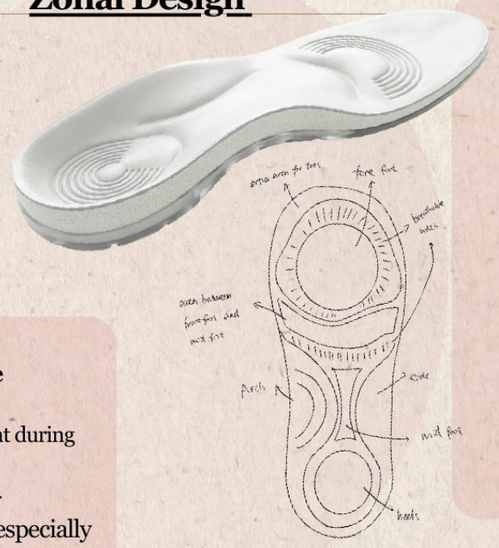
High-pressure areas lead to fatigue and pain

- The heel and first metatarsal heads (red/yellow areas) are the most fatigue-prone regions.
- Prolonged high pressure can cause:
  - Plantar fasciitis (heel pain)
  - Metatarsalgia (forefoot pain)
  - Toe overgrip and calf muscle tightness

Insufficient arch support causes collapse and instability

- The blue/black zones on the pressure map represent low-pressure regions — often the midfoot, which lacks sufficient support.
- During long walks, this leads to arch collapse, widening of the foot, and compensatory muscle strain.

Zonal Design



Zonal Design
- divide the insole into 4 functional regions based on pressure mapping:

- **Heel Zone – shock absorption**
  -Soft foam or bio-gel insert; use hollow cavity or air pocket to absorb impact.
- **Medial Midfoot Zone – arch support & balance**
  -Slightly firmer arch bridge structure matching the user's scanned foot curvature.
- **Forefoot Zone – pressure distribution & cushion & energy return**
  -Add a metatarsal pad to lift and redistribute load; use rebound materials (TPU plate or carbon spring) for push-off assistance.
- **Toe Zone – flexibility & ventilation**
  -Soft, flexible, breathable materials allow natural toe bending and provide better ventilation

INSIGHT & DESIGN

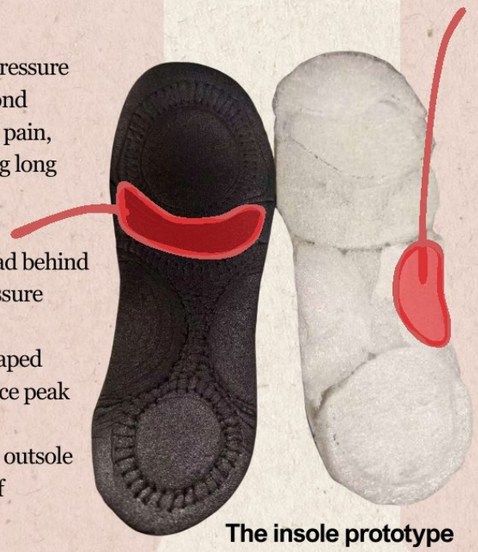
Metatarsal Heads – Forefoot Pressure Zone

- **Problem**

During the toe-off phase, excessive pressure concentrates under the first and second metatarsal heads, leading to forefoot pain, numbness, and muscle fatigue during long walking.

- **Design Solution**

Metatarsal pad : place a soft dome pad behind the metatarsal heads to shift the pressure backward and spread it evenly.
Horseshoe relief zone : use a ring-shaped structure with a softer center to reduce peak pressure directly beneath the heads.
Forefoot rocker geometry : curve the outsole slightly upward to smooth the toe-off transition and reduce forefoot load.


The insole prototype

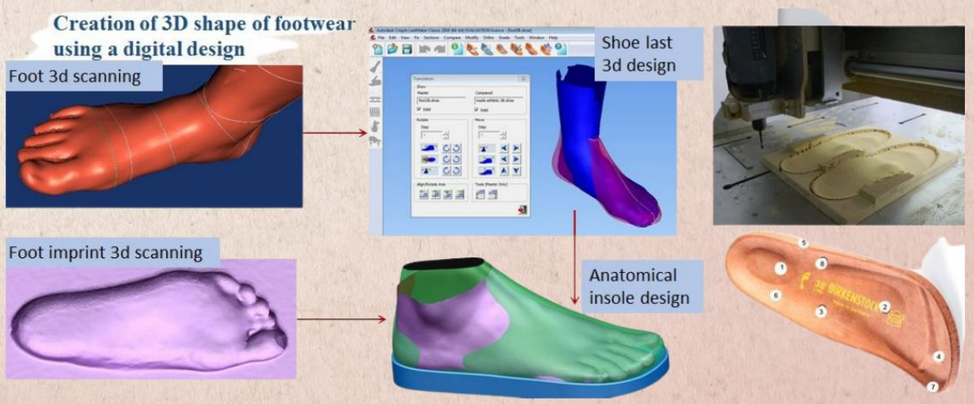
Lateral Midfoot – Stability and Balance Zone

- **Problem**

The lateral midfoot bears body weight during the mid-stance phase.
Without adequate support, over-supination or instability occurs, especially in elevated footwear.

- **Design Solution**

Lateral post or flange : add a thin lateral wall or reinforcement bar to prevent outward collapse and maintain balance.
Asymmetric stiffness gradient : slightly firmer lateral side (55–65C) and softer medial side for "stable outside, cushioned inside."
Lateral wedge: introduce a 2–4° wedge from the midfoot outward to realign body weight centrally.
Cuboid groove : small concave under the cuboid bone for comfort and ventilation.



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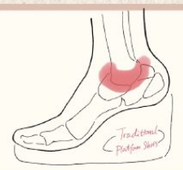
Requirements & Specifications

Identify flaws and address them with specifications.

AIM:

To develop a **lightweight, transformable platform shoe system** that allows young urban women (22–30) to switch between a **stable height-boosting mode** and a **low-profile daily mode**, delivering improved body proportions, **all-day comfort** and **reduced foot fatigue** in **multi-scenario use** (commuting, office, light sport and social activities).



REQUIREMENTS	WHY WE NEED IT?	SPECIFICATIONS
ALL-DAY COMFORT shoes must stay comfortable for long wear	Feet become sore and tired after a few hours in platform mode. 	• Zoned insoles: Soft cushioning for the heel and forefoot, with firmer support for the arch. • Flex grooves under the forefoot maintain natural walking motion.
STABILITY no extra risk of falls or ankle rolling	 Added height makes the user feel wobbly on stairs and uneven pavements.	• Slightly flared heel shape and multi-directional anti-slip rubber tread. • Rigid heel counter and side panels to hold the ankle in a neutral position. • Change the traditional sloped platform sole to a flat sole.
TRANSFORMATION height-boosting module must be quick and intuitive	If switching modes is slow or confusing, users stop using the product. 	• Tool-free locking system; switch between flat and platform mode in ≤ 30 seconds per shoe. • Clear click feeling and visible mark when the module is fully locked.
LIGHTWEIGHT must feel light and easy to move with	 Heavy soles cause fatigue when climbing stairs or walking long distances.	• EU size 38: ≤ 350 g per shoe in platform mode and ≤ 280 g in flat mode. • Platform uses hollow midsole structure to cut weight while keeping support.
STYLE design must match outfits and boost confidence	Shoes look too bulky or unnatural, so users won't wear them. 	• Minimal upper design that fits office, casual and date outfits. • Use more nude color theme to create more natural sense. • Visible lift of 30–50 mm for better leg proportions.

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Morphological Analysis

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Exploring all possible solutions.
(Shoes **material** design.)

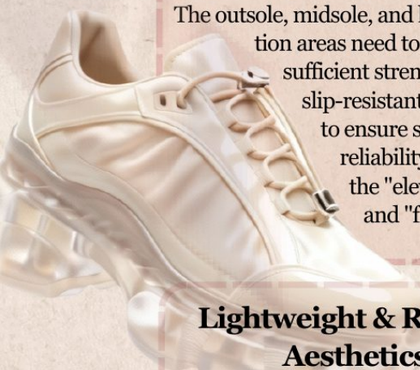
3 Main Criteria

Comfort & Breathability

Our target users are looking for shoes that can be used for commuting, sports, and social activities. After a full day, their feet may sweat or swell.
The materials should be soft, skin-friendly, and moisture-wicking to reduce friction, blisters, and stuffiness, supporting "all-day comfort."

Support & Stability

Our shoes have an elevated thick sole and a detachable structure. If the materials are too soft or too heavy, it can easily lead to instability and a higher risk of ankle twisting.
The outsole, midsole, and key connection areas need to have sufficient strength, and slip-resistant durability to ensure safety and reliability in both the "elevated mode" and "flat mode."



Lightweight & Refined Aesthetics

High-sole shoes are naturally heavier, so the materials must be as light as possible while maintaining a refined appearance without looking bulky, reflecting your positioning as an "elegant urban woman."
The fabric should be easy to clean, durable, and resistant to creasing or pilling to maintain a neat and polished look even with frequent wear.

Object

- Upper
- Lining
- Outer Sole
- Inner Sole

Selections

Upper


Silk


Velvet


Leather


Canvas


Patent Leather


Suede

Lining


Silk


Cotton


Fleece


Leather


Viscose


Synthetic Materials

Outer Sole

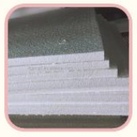

Solid rubber


TPR rubber

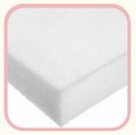

Transparent TPU

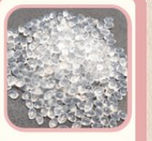

EVA + rubber blend


PU (polyurethane)


EVA foam

Inner Sole

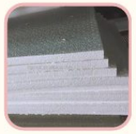

PU foam


ETPU beads


Phylon (compressed EVA)


EVA + rubber blend


Latex foam


EVA foam

Analysis

Silk adds **softness** and a **luxurious hand-feel** for the inner or accent panels, while **glossy patent leather** gives **structure, durability and water-resistance**, creating a polished, dressy look suitable for office and evening.

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Transparent TPU combines **high abrasion resistance, slip resistance and flexibility** with a **clear, glossy appearance**. It supports a thick, detachable platform without cracking, while **remaining lighter and thinner** than solid rubber. TPU also moulds well into air-cushion or honeycomb structures, improving shock absorption.

ETPU beads are chosen because they deliver **strong cushioning, high energy return and long-term resilience**. Compared with standard EVA or PU foam, ETPU **resists permanent compression**, so the height-increasing sole keeps its profile. Its **low density keeps the shoe light**, while the beaded structure spreads pressure and improves stability.

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Morphological Analysis

Exploring all possible solutions.

3 main Selection Principles
breathable (comfortable),
elegant (aesthetic),
easy to wear/use (Allow users to easily and quickly use all the features of this product)

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Fastening



bow laces



elastic strap closure



adjustable elastic cord



wide Velcro strap



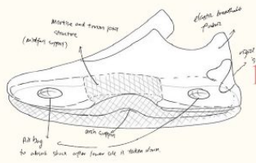
BOA lacing system

The adjustable elastic cord suits my design best because **it offers quick micro-adjustment, a secure fit on changing sole heights, and no loose laces.** It stays comfortable during long days, looks cleaner and less bulky than Velcro or BOA, and matches a stylish, versatile urban shoe for my target users.

Sole



The sole has a honeycomb hollow structure, with several protruding clips on the upper. The edge of the sole is made of rubber with some elasticity, allowing it to be stretched and secured onto the clips.



By using the mortise and tenon structure, the two shoe soles can fit together without any additional parts. Cons: the rubber may not be very stable in the long term. Using a hard sole is too rigid and is not good for the health of the foot.



Hollow transparent airbag midsole, TPU energy-return bladesThe two shoe soles are interlocked and linked together through the wavy springblade of the thin sole and the thick sole. Then, an elastic rubber rod passing through the interlocking area secures the shoes at the toe and heel, ensuring stability.



Modular sole design, different regions are equipped with different shoe sole modules, which are installed by using a knob or pressing a snap mechanism.

Pros: Modular design can adapt better to the pressure distribution around different parts of the foot.
Cons: can be too chunky, aesthetic not aligned

I chose the hollow air-bag sole because **it balances height, comfort and everyday usability** better than the other concepts. The mortise-and-tenon rubber sole gives a clean appearance, but the single hard material risks long-term deformation and feels too rigid for natural foot motion. The highly modular sole distributes pressure well, yet it becomes visually bulky, mechanically complex and less elegant for a feminine city shoe. In contrast, the hollow transparent air-bag midsole is **visually light** and **allows large weight reduction** while still **providing impact absorption**. Combined with TPU blades and my zoned insole, it can **tune stiffness by region, keep the ankle stable and still look refined** enough for work, commuting and social occasions.

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Storytelling with empathy map.

Story Board 1

airevo







New option AIREVO!

Empathy Mapping

- Emotions
- Says
- Thinks
- Does





Hollow airbag sole designed for **lighter weight**!

I feel fitness and comfortable now!



We are introducing you our new version of platform sneaker :

airevo

-Comfortable Platform Shoes-



After walking for several hours, those thick-soled **shoes seemed too heavy**, making them **unbearable.**

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Story Board 2

Wanna do sports after work?





Insight

"Traditional **platform shoes** often **twist my ankle**" --- user from reddit



No more concern now!

airevo are **Transformable**

airevo



Transformed with 1 simple step!





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-Comfortable Platform Shoes-

"A height-enhancing footwear design that balances comfort, lightness, and stability through modular and breathable innovation."

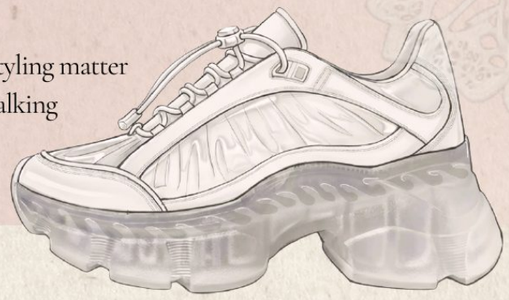
Brand tone:
elegant, feminine, slightly romantic, suitable both as a daily essential and as a gift set.

Positioning:
mid-to-high priced modular platform sneaker for style-conscious urban women.

Elevate your every step.

Use Scenarios

1. Social events and dating where height and styling matter
2. Travel/weekend outings that require long walking
3. Daily commuting and office wear
4. After-work gym or light workout





SwitchLift Modular Platform Sneaker

Seamlessly switch between everyday comfort and height-boost mode in 10 seconds.



Adjustable elastic cord Quick-pull lacing system lets users fine-tune fit in both flat and platform modes.

Lambskin lining Soft, breathable contact layer reducing friction and hotspots during long commutes or height-boost days.

Patent Leather upper Glossy structural shell providing support and shape, balancing aesthetics with side-to-side stability.

Silk upper Delicate overlay bringing soft touch and subtle sheen, enhancing feminine, dress-ready character of the sneaker.

Zonal insole Ergonomically contoured cushioning zones redistribute pressure for a 50 kg wearer, protecting heel, arch and forefoot.

Inner sole Rigid plug-in interface locking upper to platform base, maintaining alignment and stability in height-boost configuration.

Outer sole Transparent air-cushion platform reducing weight while absorbing impact and enhancing height.



Lace limited edition *For Winter Season*



A transformable sneaker for young urban women (20–35) who want a visible height boost without sacrificing all-day stability and comfort. A detachable platform midsole lets the shoe switch from a slim trainer to a 5 cm height-boost mode, using the same upper, fit and support.

Exploded View

One shoe, two heights:
visible lift with flat-shoe confidence.



Shoe Box *whole gift set*



Accessories Bag
(bow with matching color & free shoe cleaner included)

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Benchmarking

Comparing my design to relevant existing products.

By combining height increase + long-term comfort + sporty performance + feminine aesthetics + transformable sole for multi-occasion wear, Airevo fills the gap left by all three benchmarks. This makes it the most competitive option for 20–35-year-old women who need one pair of shoes to move confidently between commuting, working, exercising and social events.

1 **Best**
2
3
4 **Worst**

Each product ordered from 1-4 for every requirement

Requirements	My design	Platform sneaker	Springblade shoes	High-heels
				
Weight / perceived heaviness	Air-filled hollow sole reduces overall weight, feeling lighter than chunky platforms while still slightly heavier than the most minimal performance running shoes. 2	Solid foam platform makes the shoe feel heavy and clumsy; weight is very noticeable after longer walking or commuting compared with other options. 4	Lightweight polymer blade structure and mesh upper make this shoe feel very light on foot, especially compared with thick platform sneakers or high-heels. 1	Slim sole and stiletto heel keep material volume low, but concentrated weight under the heel feels tiring and unstable during longer walking sessions. 3
Comfort & fit	Breathable silk and babyskin lining, plus ergonomic cushioning, allow comfortable all-day walking and reduce pressure. 2	Softer and more stable than high-heels, but rigid midsole & insufficient arch support still cause fatigue and discomfort during longer walking. 3	Professional cushioning; however, narrow athletic fit and firm heel counter can feel restrictive in everyday casual wear. 1	Pointed toe box & steep heel angle create strong forefoot pressure; limited cushioning makes extended wear painful. 4
Ease of use (lace design/slip-in/stability when wearing)	Adjustable elastic lacing and supportive insole; transform-able outsole still locks safely, allowing stable walking and light sports without ankle twisting. 2	Traditional laces and wide base give basic stability, but very high rigid platform reduces ground feel and increases risk of rolling or twisting the ankle. 3	Standard running laces give secure lockdown; blade outsole grips well on tracks, yet feels unstable and awkward on irregular pavements or inside crowded trains. 1	Slip-on design with ankle strap is quick to wear, but narrow heel contact patch makes balancing difficult, especially on stairs or wet floors. 4
Height Increase	Adjustable elastic lacing and supportive insole; transform-able outsole still locks safely, allowing stable walking and light sports without ankle twisting. 1	Very thick platform midsole delivers dramatic visible height gain, appealing for fashion, but changes gait and may look exaggerated in some everyday situations. 2	Very thick platform midsole delivers dramatic visible height gain, appealing for fashion, but changes gait and may look exaggerated in some everyday situations. 4	high-heels significantly boosts height and visually lengthens legs, creating better proportion, though pressure distribution makes extended wear uncomfortable. 3
Aesthetic for target user (20-35 Female)	Combination of sporty sole and silky upper looks modern yet feminine; optional lace and bow edition adapts from office outfits to dating or social events. 1	Chunky Y2K-inspired silhouette suits streetwear trends and photos, but bulkiness limits pairing with tailored office looks or more refined evening dresses. 3	Highly technical running aesthetic with exposed blades communicates performance, not feminine; difficult to style with skirts, dresses, or smart-casual city outfits. 4	Classic glossy pump design matches formal dresses and evening wear perfectly, but feels too strict and impractical for commuting, errands, or relaxed weekend activities. 2

Weight Validation – Airbag Midsole vs. Solid Platform

Show that the Airevo hollow airbag midsole is significantly lighter than a conventional solid platform midsole of the same external size.

1. Geometric assumptions

- Target user: EU 38 female (≈24–25 cm foot length).
- Platform sole (per shoe) simplified as a rectangular block:
  - Length L = 25 cm = 0.25 m
  - Average width W = 8 cm = 0.08 m
  - Platform thickness H = 4.5 cm = 0.045 m
- Midsole volume (same for both designs):
  - $V_{\text{total}} = L \times W \times H$
  - $V_{\text{total}} = 0.25 \times 0.08 \times 0.045 \approx 0.0009\ \text{m}^3$
  - i.e. about 900 cm³

2. Conventional solid platform midsole

Material assumption

- Solid midsole made from high-density EVA/PU foam.
- Representative density for supportive platform foam:
  - $\rho_{\text{solid}} \approx 250\ \text{kg/m}^3$

Mass calculation

- $m_{\text{solid}} = \rho_{\text{solid}} \times V_{\text{total}}$
- $m_{\text{solid}} = 250 \times 0.0009 = 0.225\ \text{kg}$
- **Result:** midsole mass ≈ **225 g per shoe**

(Consistent with typical chunky platform sneakers ≈ 400–450 g per shoe.)

3. Airevo transparent airbag midsole

Structural assumptions

- Same external volume, but internal structure is hollow:
  - 60% of volume = air chambers
  - 40% of volume = structural frame (EVA / eTPU foam + thin TPU walls)
- Effective density of structural frame:
  - $\rho_{\text{frame}} \approx 200\ \text{kg/m}^3$
- Air at room temperature:
  - $\rho_{\text{air}} \approx 1.2\ \text{kg/m}^3$

Volumes

- $V_{\text{frame}} = 0.4 \times V_{\text{total}} = 0.4 \times 0.0009 = 0.00036\ \text{m}^3$
- $V_{\text{air}} = 0.6 \times V_{\text{total}} = 0.6 \times 0.0009 = 0.00054\ \text{m}^3$

Masses

- Structural frame:
  - $m_{\text{frame}} = \rho_{\text{frame}} \times V_{\text{frame}}$
  - $m_{\text{frame}} = 200 \times 0.00036 = 0.072\ \text{kg} = 72\ \text{g}$
- Air:
  - $m_{\text{air}} = \rho_{\text{air}} \times V_{\text{air}}$
  - $m_{\text{air}} = 1.2 \times 0.00054 \approx 0.00065\ \text{kg} \approx 0.65\ \text{g}$

Total midsole mass

- $m_{\text{Airevo}} = m_{\text{frame}} + m_{\text{air}}$
- $m_{\text{Airevo}} \approx 72 + 0.65 \approx 72.6\ \text{g}$
- **Result:** midsole mass ≈ **73 g per shoe**

4. Comparison and weight saving

- Solid platform midsole:
  - $m_{\text{solid}} \approx 225\ \text{g}$
- Airevo airbag midsole:
  - $m_{\text{Airevo}} \approx 73\ \text{g}$
- Mass saving per shoe:
  - $\Delta m = 225 - 73 = 152\ \text{g}$
- Relative reduction:
  - Saving $= \Delta m / m_{\text{solid}} \approx 152/225 \approx 0.68$
  - **≈ 68% lighter midsole**

If a conventional EU 38 platform sneaker weighs ~420 g per shoe, replacing the solid midsole with Airevo's airbag midsole would reduce total shoe mass to roughly:

$$420\ \text{g} - 152\ \text{g} \approx 270\ \text{g}$$

This moves the shoe from a heavy chunky platform into the weight range of lightweight running shoes, while keeping the same height increase.

There is further validations available in supplementary page

Validation

Assessing and reflecting on my design with feedback and calculations

Supplementary Pages

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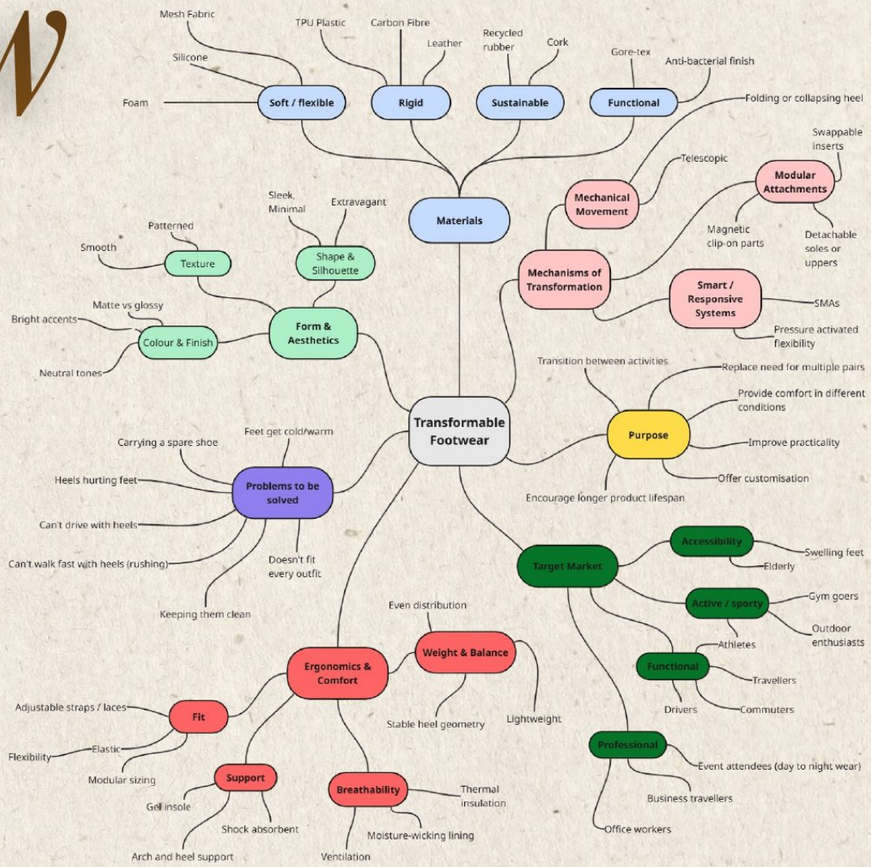
-Comfortable Platform Shoes-

"A height-enhancing footwear design that balances comfort, lightness, and stability through modular and breathable innovation."

Daisy Fang | 10/12 /25 | dikun.fang25@imperial.ac.uk

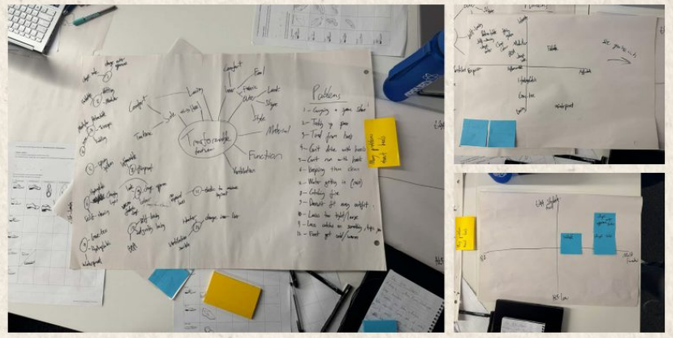
Elevate your every step.

Collaborative Ideation & Peer Review



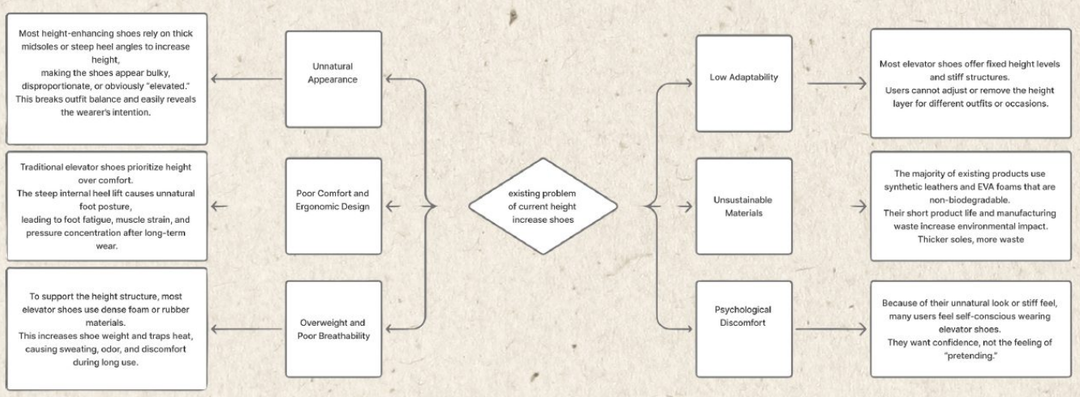
Our topic is transformable footwear, and during the brainstorming workshop, we explored many ideas of how transformable shoes could help and where can be transformed.

We consider the materials, aesthetics, problem to be solved, ergonomics, purpose, and mechanism of transformation.



In our tutor group of 19, we create a brain storm board during the tutorial,and use axis to analysis these idea initially.

I came up with the transformable platform shoes from my own experience on the product, and I made a mindmap of the problems of existing products.



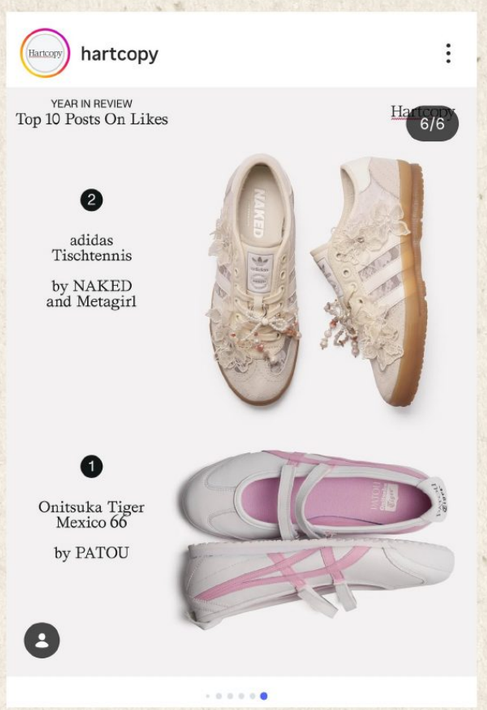


During the peer review workshop, I gathered feedback and insight from others. And this helps me to refine and restructure my idea to be clearer. Meanwhile, I give feedback to all of my teammates. In this mutual evaluation, I was able to identify the design blind spots that I had previously overlooked.

Design Research

The design journey of the shoes.





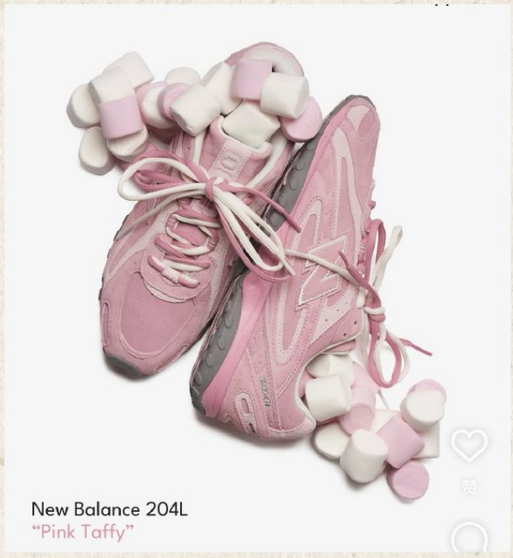
I searched online for trendy women shoes and come up with these, I collect some of the elements from these design







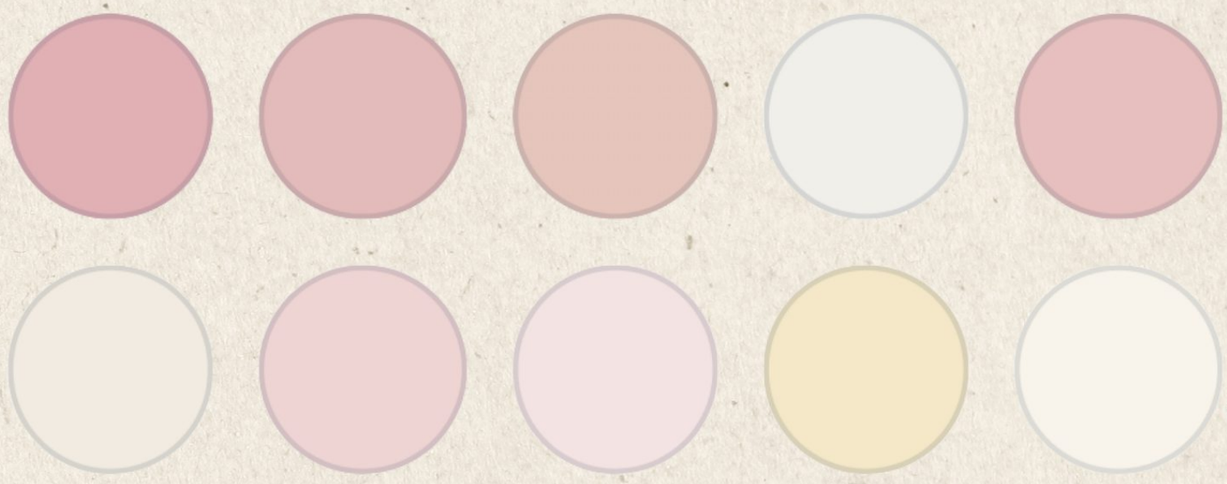
The streamline design appears slender.





Font & Color Consideration

During the whole project i refine the main color theme several time and here is my final decision:
theme color is nude and fairy pink since our target user is young urban woman (20-35).



I chose nude color because I got several feedback saying they consider nude as comfortable and peaceful. Also, users from Reddit leave comments like this:



Font & Color Consideration

Supplementary Pages

airevo
-Comfortable Platform Shoes-

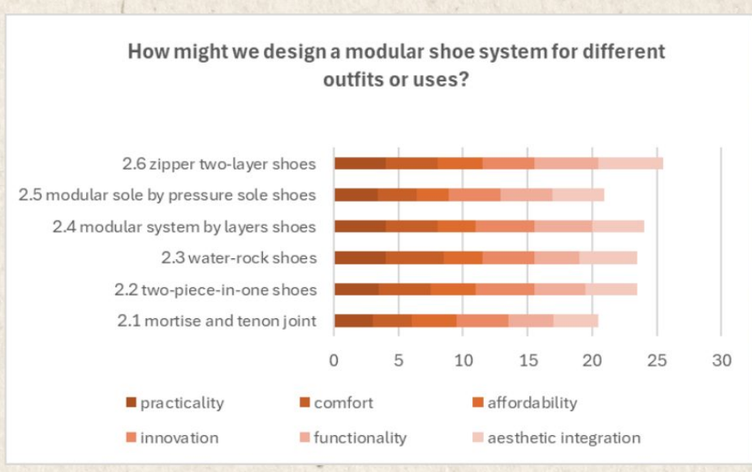
I chose these fonts because thay give a sense of peace and elegance, matching my theme.

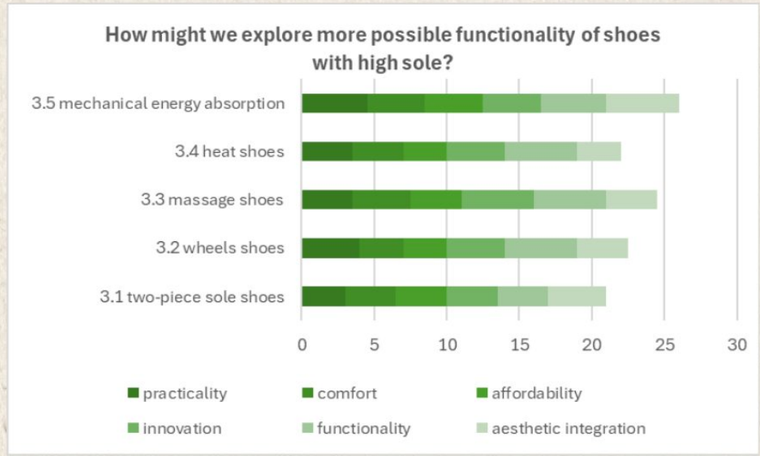
Concepts Evaluation

Revise HMW and quantative analysis of 15 ideas.

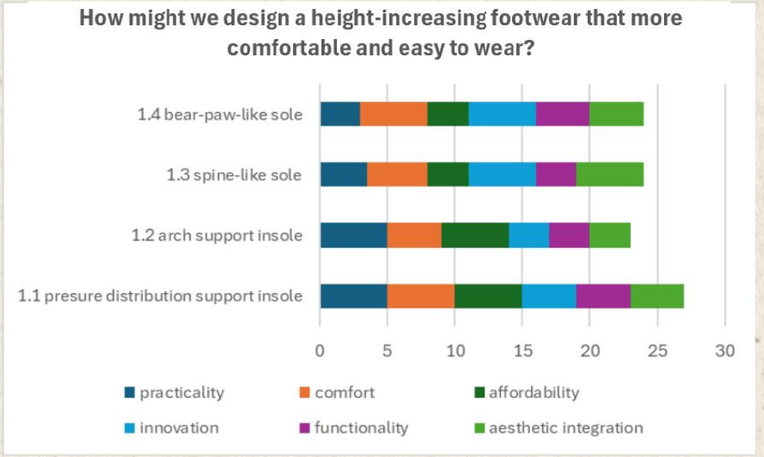
6 Evaluation Factors

- Practicality — The design must be easy to wear, produce, and maintain, ensuring real-world usability.
- Comfort — The footwear should provide ergonomic support and pressure relief for long-term wear without fatigue.
- Affordability — The concept must remain cost-effective and accessible, balancing innovation with economic feasibility.
- Innovation — The project introduces new structural or material solutions to improve traditional height-enhancing footwear.
- Functionality — Every feature must serve a clear purpose, improving performance such as stability, ventilation, and support.
- Aesthetic Integration — The appearance and function should merge seamlessly, achieving invisible height enhancement with natural style.



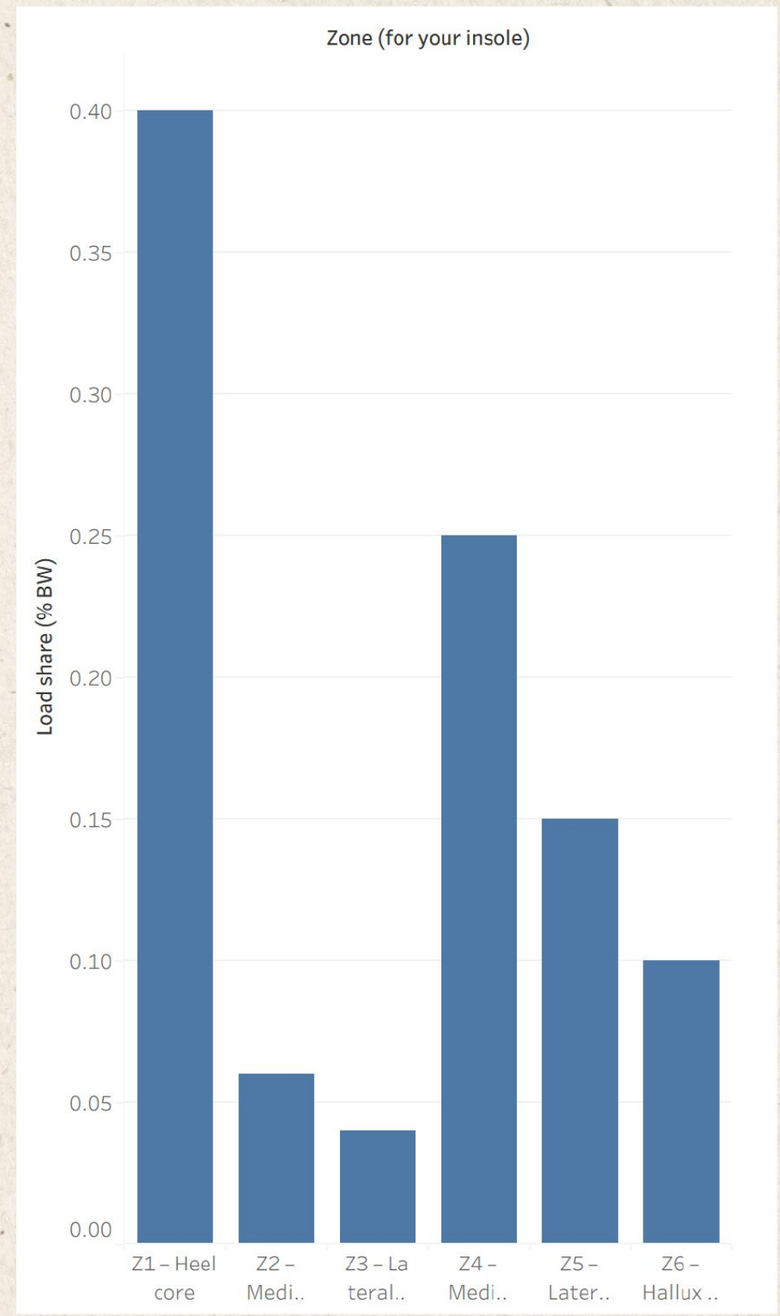


Design	practicality	comfort	affordability	innovation	functionality	aesthetic integration
1.1 presure distribution support insole	5	5	5	4	4	4
1.2 arch support insole	5	4	5	3	3	3
1.3 spine-like sole	3.5	4.5	3	5	3	5
1.4 bear-paw-like sole	3	5	3	5	4	4
2.1 mortise and tenon joint	3	3	3.5	4	3.5	3.5
2.2 two-piece-in-one shoes	3.5	4	3.5	4.5	4	4
2.3 water-rock shoes	4	4.5	3	4	3.5	4.5
2.4 modular system by layers shoes	4	4	3	4.5	4.5	4
2.5 modular sole by pressure sole shoes	3.4	3	2.5	4	4	4
2.6 zipper two-layer shoes	4	4	3.5	4	5	5
3.1 two-piece sole shoes	3	3.5	3.5	3.5	3.5	4
3.2 wheels shoes	4	3	3	4	5	3.5
3.3 massage shoes	3.5	4	3.5	5	5	3.5
3.4 heat shoes	3.5	3.5	3	4	5	3
3.5 mechanical energy absorption	4.5	4	4	4	4.5	5



Validation

Assessing and reflecting on my design with feedback and calculations



Choose Different Insole Materials for Each Zone

1. Assumptions (make these explicit on your validation page)

- User: 50 kg woman → body weight ≈ 50 × 9.81 ≈ **490 N**.
- Scenario: level walking / standing in a low-to-moderate heel everyday shoe (similar to your design context).
- Literature on healthy adults shows:
  - Plantar pressure is mainly concentrated under **heel** and **metatarsal heads**, with much less under the arch.
  - In a neutral shoe, typical **peak pressures** are roughly: heel ≈ 300 kPa, midfoot ≈ 100 kPa, metatarsals ≈ 280–300 kPa, toes ≈ 300 kPa.
  - Women tend to have **higher peak pressure on hallux, toes, forefoot and medial side** than men.
- We approximate **load distribution by region** for your persona (so you can do quick force calculations):
- We approximate **load distribution by region** for your persona (so you can do quick force calculations):
  - Rearfoot (heel): **40 % BW** ≈ 196 N
  - Midfoot / arch: **10 % BW** ≈ 49 N
  - Medial forefoot (1st–2nd met heads): **25 % BW** ≈ 123 N
  - Lateral forefoot (3rd–5th met heads): **15 % BW** ≈ 74 N
  - Toes (hallux + lesser toes): **10 % BW** ≈ 49 N

These numbers are in line with studies where the **heel and metatarsal regions dominate the load**, with relatively low pressure in the arch region.

Zone (for your insole)	Anatomical area	Load share (% BW)	Approx. force (N)	Typical peak pressure trend	Recommended material stack (top → bottom)	Target hardness & thickness
Z1 – Heel core	Central & posterolateral calcaneus	40%	~196 N	Very high peak P (~300 kPa) (SpringerLink)	PU foam or soft EVA pad over your hollow airbag / midsole	Soft EVA / PU: 20–30 Shore A, 5–6 mm thick local pad
Z2 – Medial arch	Medial midfoot & plantar fascia region	6%	~29 N	Low pressure, high ligament strain (Frontiers)	Thin soft top cover + firm EVA / TPU arch shell	Top: 25–30 Shore A (2 mm), core: 45–55 Shore A or rigid insert, 3–4 mm
Z3 – Lateral midfoot	Lateral midfoot	4%	~20 N	Low–moderate pressure	Soft top cover + medium EVA base	EVA 30–35 Shore A, 3–4 mm
Z4 – Medial forefoot	1st–2nd met heads & sesamoids	25%	~123 N	Very high during push-off (≈280–300 kPa) (SpringerLin	Soft EVA or PU met pad + medium EVA carrier	Top pad: 20–25 Shore A, 3–4 mm; carrier: 30–35 Shore A, 3–4 mm
Z5 – Lateral forefoot	3rd–5th met heads	15%	~74 N	High but slightly lower than medial (Brieflands)	Medium EVA for stability, small soft insert if needed	EVA 30–40 Shore A, 4–5 mm
Z6 – Hallux & toes	Hallux and toes 2–5	10%	~49 N	Hallux especially high in women (PMC)	Soft PU / low-density EVA toe zone + flex grooves	EVA / PU 20–30 Shore A, 2–3 mm, with flex channels

2. Medical / biomechanical understanding by region

Very short, for PPT annotation:

- **Heel (rearfoot)**
  - Main role: shock absorption at heel strike, high vertical impact + high peak pressure.
  - Clinical risk if poorly cushioned: heel pain, plantar fasciitis, calcaneal stress.
- **Midfoot / medial arch**
  - Main role: **load transfer + arch support**, relatively low pressure but high strain in plantar fascia and ligaments.
  - Needs structural support rather than extreme softness.
- **Medial forefoot (1st–2nd met heads + hallux)**
  - Main role: push-off; very high peak pressure and strong bending + shear on first MTP joint.
- **Lateral forefoot (3rd–5th met heads)**
  - Still high load but slightly lower than medial side; important for **stability and smooth roll-over**.
- **Toes (esp. hallux)**
  - Hallux bears high push-off pressure, lesser toes more for balance; need flexibility and not too stiff under the toe joints.

3. Material palette (what you'll reference)

From insole / orthotic literature:

- **Soft EVA (20–30 Shore A)** – very good for off-loading high-pressure areas and shock absorption. Low-density EVA ~23 Shore A reduced plantar pressure more effectively than a harder EVA (58 Shore A).
- **Medium EVA (30–40 Shore A)** – balance of cushioning and support, widely used in general insoles and orthotics.
- **Firm EVA / TPU elements (45–55 Shore A or rigid insert)** – used for structural arch support and motion control.
- **PU (polyurethane) foam** – very good shock absorption and pressure reduction across multiple regions; often outperforms a shoe alone.
- **Gel / airbag modules** – strong impact absorption but must be combined with structural layers to avoid instability. Heel cups made of ~16 mm EVA at 40 Shore A significantly reduced heel peak pressure.

Lo-fi Prototyping

Experimenting with materials through prototyping.



1 Pressure Distribution Support Insole

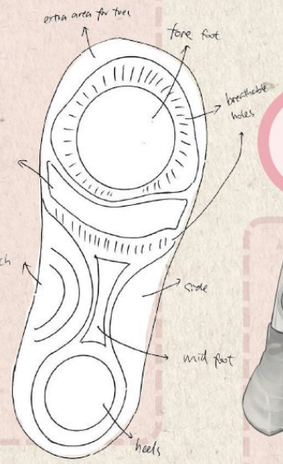


The distribution of pressure on the sole is an essential factor for the comfort of the foot. I attempted to design a sole that perfectly fits the curvature of the bottom of the mold assigned to me. First, I cut out the approximate shape using hard foam, then polished all aspects to a suitable thickness and shape. During this process, I gained a deeper understanding of the shape of the sole.

Then, by searching for information online, I learned that the pressure on the sole varies. So, I began to **install a foot ergonomics pressure distribution map to divide the sole into sections**, using soft foam to adjust the shape and thickness.

Finally, I placed a layer of black foam film on top to imitate the texture of sheepskin, and used a needle to make holes in the areas prone to sweaty feet, making it more comfortable.





Sketch 1

2 Upper Material Exploration

Sketch 2



I first obtained the shape of the shoe upper through **heat vacuum forming**, and then cut out the shape I wanted on it. This method is faster and more in line with the mold. At the same time, I also tried different production methods, such as weaving, etc.

I **got in touch with a student from UAL who was studying Texture**. She taught me how to use the knitting machine. Through learning how to operate the knitting machine, I explored the characteristics of **knitted fabrics**.







2 Sole Design & Modelling



Sketch 4

For the second design, I refined it a bit more, replacing the hollow structure with airbags. This way, dust would be less likely to enter the hollow part and become difficult to clean. At the same time, for this design, I connected the two soles in a segmented manner, similar to a spine, providing more flexible space for foot movement.

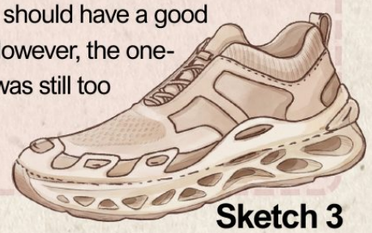
Real product picture generate from **nano banana AI tools**. help me to explore more color and looks.



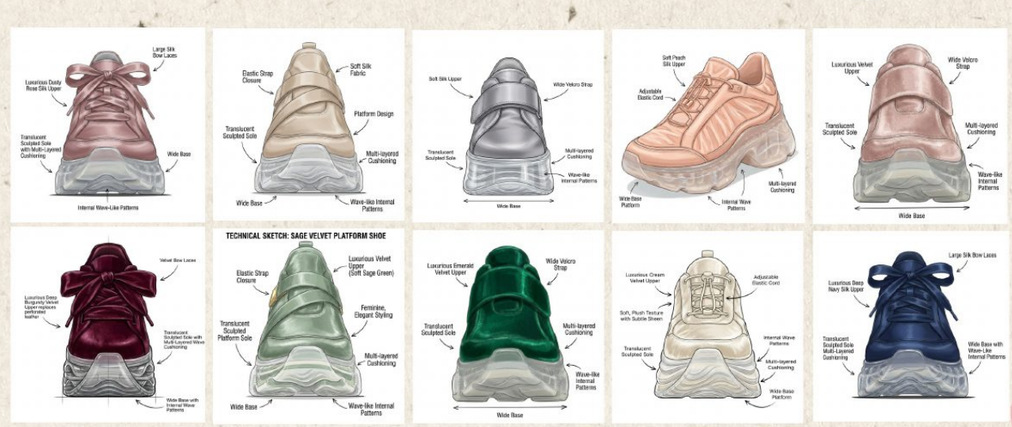
3D Printing Model

I use AI tools to **3d model** the sole and print it out as a sandal so we can actually try it out to test the rebound properties,etc. For filament I used TPU 95A

For this part, I designed it twice, both aiming for better height increase and mechanical shock absorption in the future. The first design was a hollow sole with a honeycomb shape, which should have a good shock absorption effect. However, the one-piece connection design was still too rigid, restricting the movement of the foot.



Sketch 3



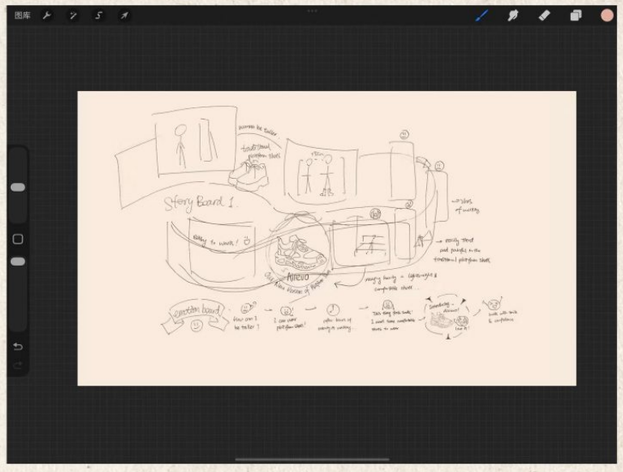
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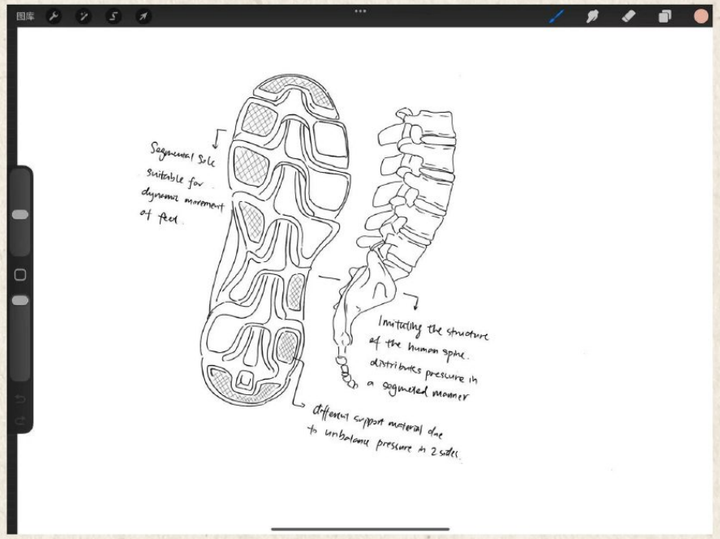
Sketching Exercise

Sketch for Story Board1

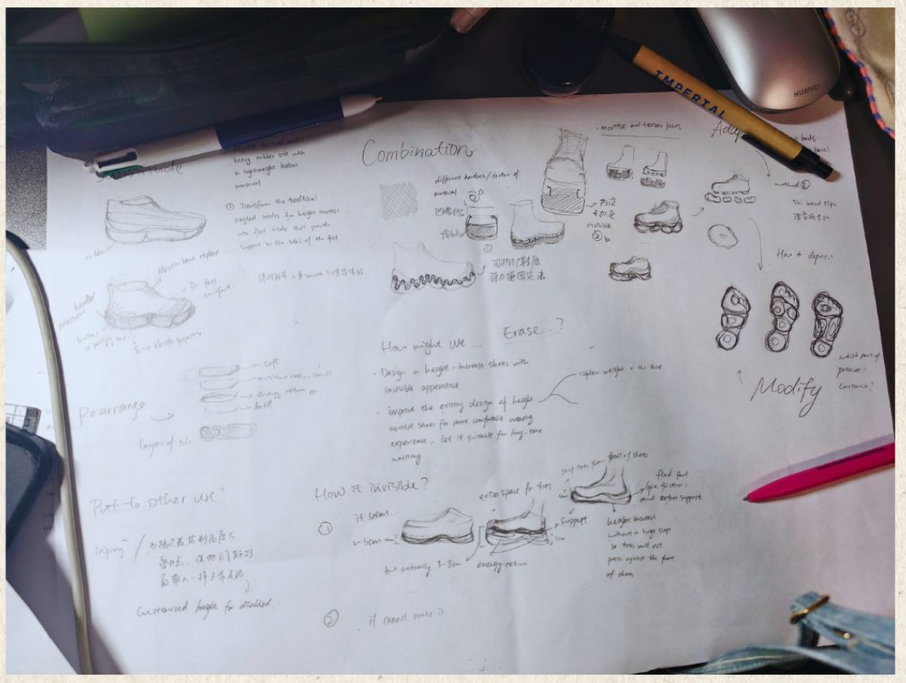


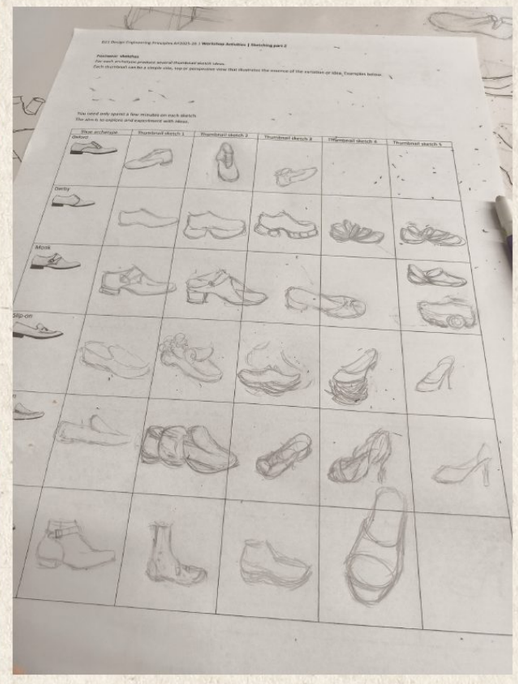


Digital drawing on Procreate



Sketching for initial ecploration



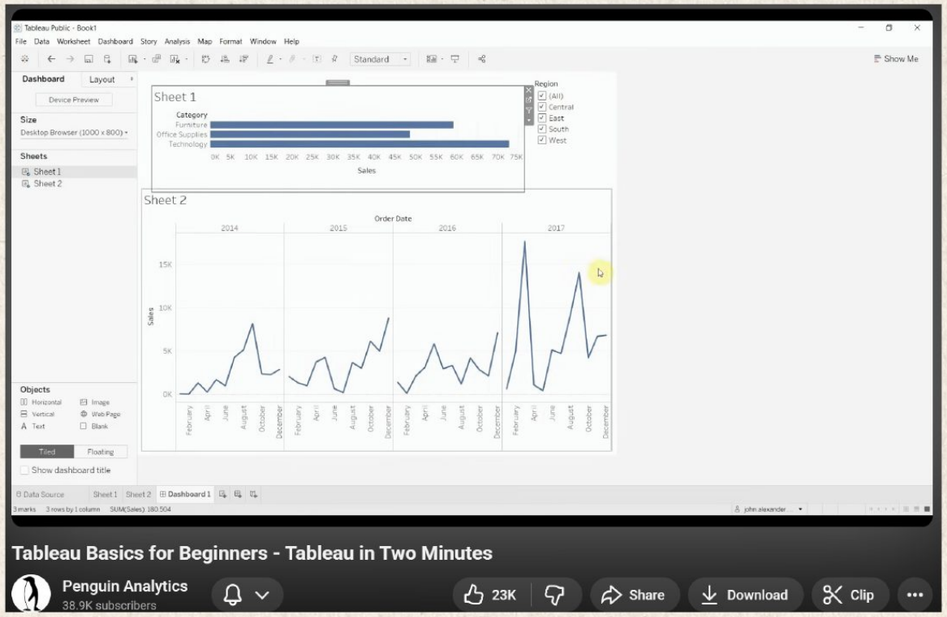




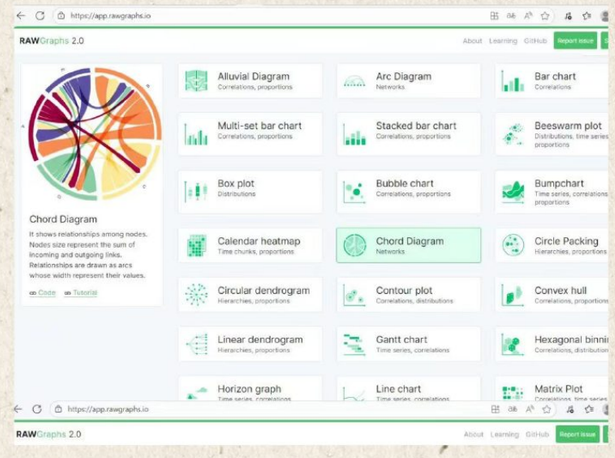
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Data Visualization

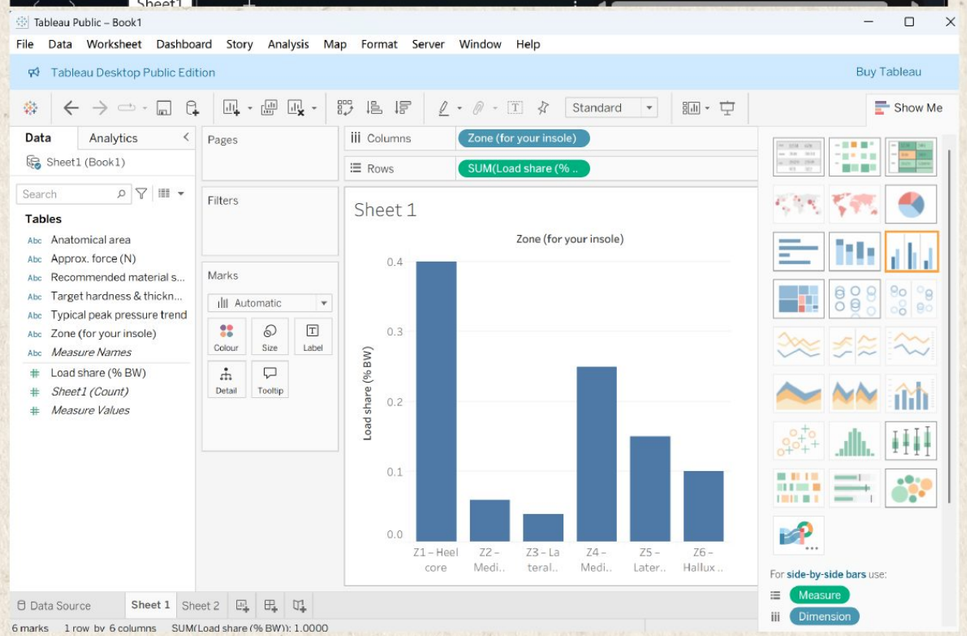


I learnt how to use Tableau to visualise my data, during the process, I learnt how different charts work and what kind of data they focus on independently.



I also explored other tools such as Graphy, Napkin, Raw Graphs, etc.

	A	B	C	D	E	F	G
1	Zone (for your insole)	Anatomical area	Load share (% BW)	Approx. force (N)	Typical peak pressure trend	Recommended material stack (top → bottom)	Target hardness & thickness
2	Z1 – Heel core	Central & posterolateral calcaneus	40%	~196 N	Very high peak P (~300 kPa) (Springer Link)	**PU foam or soft EVA pad** over your hollow airbag / midsole	Soft EVA / PU: 20–30 Shore A, 5–6 mm thick local pad
3	Z2 – Medial arch	Medial midfoot & plantar fascia region	6%	~29 N	Low pressure, high ligament strain (Frontiers)	Thin soft top cover + **firm EVA / TPU arch shell**	Top: 25–30 Shore A (2 mm), core: 45–55 Shore A or rigid insert, 3–4 mm
4	Z3 – Lateral midfoot	Lateral midfoot	4%	~20 N	Low–moderate pressure	Soft top cover + **medium EVA base**	EVA 30–35 Shore A, 3–4 mm
5	Z4 – Medial forefoot	1st–2nd met heads & sesamoids	25%	~123 N	Very high during push-off (≈ 280–300 kPa) (Springer Link)	**Soft EVA or PU met pad** + medium EVA carrier	Top pad: 20–25 Shore A, 3–4 mm; carrier: 30–35 Shore A, 3–4 mm
6	Z5 – Lateral forefoot	3rd–5th met heads	15%	~74 N	High but slightly lower than medial	Medium EVA for stability, small soft insert if needed	EVA 30–40 Shore A, 4–5 mm



Here is one of the graphs I have made for validation

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5. Junwptune Chunky Platform Sneakers Available at：https://juneptune.com/en-gb/products/chunky-platform-sneakers
6. **Christian Louboutin NEW Pigalle 120 Black Patent Leather High Heels Pumps in Box** Available at：https://www.1stdibs.com/fashion/clothing/shoes/christian-louboutin-new-pigalle-120-black-patent-leather-high-heels-pumps-box/id-v_5841581/ (Accessed : 16/11/2025)