Circular Design and development of footwear: A Case Study

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Dedicacion

I dedicate this thesis to all the footwear enthusiasts and professionals who have a passion for creativity and innovative sustainability in footwear design.

The commitment to advancing the footwear industry in a better way for the planet has inspired me to pursue this research and develop new approaches to designing footwear with circularity in mind. Thank you for your dedication to this field, and I hope this work contributes to our collective efforts to create more sustainable footwear for the future.

Acknowledgements

I dedicate this work to everyone who supported me, both directly and indirectly, in bringing this project to fruition. Your guidance and encouragement have immensely contributed to my professional and personal growth. To my parents, thank you for your unwavering support, the sacrifices you made, and your unconditional encouragement in my pursuit of personal goals. To my sisters, your presence has been a source of motivation and strength. I would like to express my deepest gratitude to my supervisors and co-supervisors, Professor Marco Gomes, Professor Joana Teodoro, and Ana Duque, for their time, guidance, and sharing of knowledge throughout this journey. Finally, I extend my appreciation to the companies that assisted me, both at a technical and conceptual level, in carrying out this project. Without their invaluable contribution, this project would not have been possible. Special thanks to Aloft and their design team, especially José Pedo Correia for facilitating the company visit and supporting me throughout the project's development. Thank you all for your unwavering support and belief in me. This achievement is as much yours as it is mine.

Abstract

In a rapidly global context, the field of footwear design is confronted with the urgent need to reassess its practices in light of pressing environmental challenges and embracing circularity. This project, focus on footwear design with in the framework of the Circular Economy, employs Design Thinking methodologies to integrate Circular Design principles in to the development of a specific footwear product, Circularstep. This initiative underscores the imperative to reevaluate available resources, with strong emphasis on product durability, recycling potential, and repairability.

The footwear industry faces a mounting issue of discarded shoes overwhelming landfills, demanding an immediate shift towards sustainability and circularity. This sector contributes to various adverse environmental impacts, including the excessive use of fossil fuels, unsustainable leather sourcing, and the promotion of a disposable footwear culture. To address this challenges, the project aims for a more circular and resource-conscious product.

Rooted in the ever-evolving landscape of sustainability challenges with in footwear industry, guided by analysis of circular material flows and meaningful stakeholders' engagement through a return policy and reeducating users.

Regarding project development, it unfolds through the creation and exploration of concept, moodboards, and iterative sketching phases, ultimately resulting in a product that embodies aesthetics, and comfort, with a sense of responsibility ad commitment to the circular economy.

Keywords:
Circular Economy; Footwear Design; Modular Design;Circular Principles; Recyclable materials

Resumo

Num contexto global em rápida evolução, o campo do design de calçado enfrenta a necessidade urgente de reavaliar as suas práticas à luz dos desafios ambientais prementes e de abraçar a circularidade. Este projeto, focado no design de calçado dentro do enquadramento da Economia Circular, utiliza metodologias de *Design Thinking* para integrar princípios de Design Circular no desenvolvimento de um produto específico de calçado, o Circularstep. Esta iniciativa destaca a necessidade premente de reavaliar os recursos disponíveis, com forte ênfase na durabilidade do produto, potencial de reciclagem e capacidade de reparação.

A indústria do calçado enfrenta o problema crescente de sapatos descartados que sobrecarregam aterros, exigindo uma mudança imediata em direção à sustentabilidade e circularidade. Este setor contribui para vários impactos ambientais adversos, incluindo o uso excessivo de combustíveis fósseis, obtenção insustentável de couro e promoção de uma cultura de calçado descartável. Para enfrentar esses desafios, o projeto visa um produto mais circular e consciente dos recursos.

Enraizado no cenário sempre mutável dos desafios de sustentabilidade na indústria do calçado, orientado pela análise de fluxos de materiais circulares e envolvimento significativo das partes interessadas através de uma política de devolução e reeducação dos utilizadores.

Quanto ao desenvolvimento do projeto, desenrola-se através da criação e exploração de conceitos, *moodboards* e fases iterativas de esboços, resultando num produto que incorpora estética e conforto, com um sentido de responsabilidade e compromisso com a economia circular.

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01 Introduction

1. Introduction

1.1 Purpose and scope of the project

In today's global context, designers are facing increasing pressure to consider the broader systems surrounding users (Circulab, n.d.). By adopting a circular approach, designers can delve deeper into footwear design and explore new business opportunities that align with circularity principles. This approach seeks to extend the lifespan of footwear while reducing energy consumption associated with material extraction, supply, and manufacturing processes (Circulab, n.d.).

The primary focus of this project is to examine the design and development of shoes with in the framework of the circular economy, using design thinking methods.

The specific objectives include:

- Identification and integration of key principles of circular product design into the development of a specific footwear product;
- Reassessment and careful consideration of available resources, with an emphasis on product durability, upcycling potential, and repairability (Dennis, 2022).

The footwear industry, a substantial segment of the fast fashion sector, contributes to the escalating issue of shoe waste, with an estimated 23 billion pairs of shoes discarded in landfills annually. Additionally, the continuous influx of new footwear designs flood the market daily, exacerbating the issue (Dennis, 2022).

This industry's environment impact can be attributed to factors including;

- Reliance on fossil fuel;
- Large carbon footprints;
- The use of toxic glues;
- Unsustainably sourcing of leather, leading to deforestation in the Amazon rainforest;

The presence of non-recyclable metal components in shoes (Dennis, 2022).

Despite the essential role that shoes play in our daily lives, the alarming increase in discarded shoes reaching landfills has reached a critical level that can no longer be ignored (DiNapoli, 2022).

Moreover, the footwear industry significantly contributes to environmental degradation through its greenhouse gas emissions, accounting approximately 1.4% of the global greenhouse gas emissions according to a study by Quantis (Bird, 2021).

The Portuguese footwear industry faces specific challenges in implementing circular initiatives for end-of-life shoes, characterized by inadequate infrastructure and growing awareness regarding shoe recycling and repurposing. The rising prominence of sustainable fashion emphasizes the urgent need for the Portuguese industry to embrace circular practices (Uma Empresa Que Não Adote Boas Práticas Ambientais Está Condenada Ao Insucesso, 2020).

Detrimental industry practices including the generation of significant amounts of waste, including leftover fabric, leather, and plastic. Insufficient measures are taken to minimize this waste, contributing to environmental degradation. The use of chemicals, such as hazardous solvents and dyes, in the manufacturing process also poses adverse effects on water and air pollution. Additionally, the industry's production practices prioritize mass production and short-term trends, perpetuating a culture of disposable footwear. Low-quality materials further exacerbate the issue, resulting in shorter product lifespans (Robinson, 2022).

The composition of shoes typically involves a combination of materials specifically engineered to adhere together, making disassembly a nearly impossible task (Van Gendt, 2021). Common assembly processes, such as cemented construction, vulcanization, strobel construction, slip-lasting, combination-lasting, and box-construction, making it challenging and nearly impossible to separate materials for recycling or repurposing.

Furthermore, the replacement frequency of shoes varies among individuals, with an average range of every 8 to 12 months. Running shoes, in particular, tend to wear out faster,

necessitating replacement after covering a distance of approximately 300 to 500 miles (ca. 805 km). However, it should be noted that these timelines are subject to individual factors such as body weight and the materials used in the shoes (DiNapoli, 2022).

Nowadays, in the highly competitive industry marked by evolving market dynamics and perpetual need for brand relevance, the development of shoes with shorter life cycles has become commonplace. This trend has led to an increased shoe production and, consequently, higher levels of waste (“British Footwear Association”, 2005).

Footwear production requires substantial amounts of raw materials, energy, and water. Reducing waste generation can help to conserve resources and minimize their environmental footprint. The environmental and pollution problems associated with the footwear industry are well documented, notably the environmental consequences of pollution stemming from the disposal of a significant number of shoes at the end of life cycle, which contaminates soil, surface, and groundwater. (“End-of-Life Implications of Footwear Products”, n.d.).

By incorporating these additional points and making the changes, the project will offer a more comprehensive view of the environmental challenges in the footwear industry and the critical need for sustainable and circular design solutions

image 01. Waste landfill

02

Circular Design

2. Circular Design

2.1. Explanation of the Circular Design

The environmental impact of a product is largely determined by the design, material choices, and production phase, which account for approximately 80 to 90% of the overall impact (Ferris, 2022). In the traditional linear design model, products are made from raw materials, and once they have served their purpose, the materials used are deemed waste (Ferris, 2022). (It's Time for a Circular Economy, n.d.)

In contrast to the linear model, the circular model follows a more sustainable approach. In the circular model, once a product reaches the end of its life cycle, its materials can be reclaimed and repurposed for other uses (image 02) (Ferris, 2022).

Circular design is inherently connected to and aligns with the concept of the circular economy. It plays a crucial role in the modern economy by adopting a broader approach to sustainability issues like environmental pollution. Circular Design focuses on optimizing available resources and embracing new business models that prioritize minimizing resource usage through reusing, recycling, and regenerating (Elmansy, 2023). Both the Circular Economy and Circular Design are committed to reducing waste and lowering the carbon footprint. By implementing this model, products can be designed with circularity in mind, ensuring they have longer life spans and can easily be repaired, upgraded, recycled, and maintained.

Circular Design principles are illustrated in a butterfly diagram (image 03), witch depicting four loops that can be used to extend the life of materials and the product. In essence, is a design approach that aims to create product that are more sustainable with circularity in mind, these loops include:

- **Material reuse and regeneration**: emphasizes using materials that can be easily **repurposed, reused** or **regenerated** once the product reaches its life cycle;
- **Durability and Repairability:** the products are design to be durable easy to repair, promoting longer lifespans and reducing the need for replacements;
- **Resources Optimization:** the design process prioritizes minimizing resources usage, by adopting strategies like recycling, remanufacturing and refurbishing;
- **User-Centred Design:** involving the understanding of user needs and integrating them into the design process to ensure the products are relevant and useful. (Elmansy, 2023).

As for its design process, it is divided into four stages: **understand, define, make, and release**. (image 04)

The application of the Circular Design is supported by the Design Thinking methodology. Design Thinking is a user-centred design approach that integrates the needs of the user, technological possibilities and business requirements. It encourages designers to think outside the box and delve deeper in to problem-solving (Friis & Yu, 2022). Designers consciously refrain from immediate seeking solutions to state the problem. Instead, they devote their initial efforts to understand the fundamental issues. This problem-solving approach aims to enhance products and services by analysing issues and identifying contributing factor (Friis & Yu, 2022).

The design thinking approach and process revolve around the trifecta of **desire, feasibility, and viability** (image 05), originally formulated by IDEO in the early 2000s. Product development must align with what the customer truly requires **(desirability)**, be based on available technologies **(fesability)**, and be profitable while maintaining the business model **(viable)** (Orton, n.d.).

In the context of climate change unpredictability, the integration of Design Thinking and Circular Design becomes essential. Traditional linear manufacturing practices are no longer sustainable for the planet and their population. There's a pressing need to shift towards a ze-

ro-waste midst, moving away from linear thinking. The Ellen MacArthur Foundation, in collaboration with IDEO, has developed a design for sustainable development based on the concept of circular economy through the application of the Design Thinking methodology.

Traditional manufacturing has been inherently wasteful, primarily, focusing on the end-user. Embracing the Circular Mindset, the scope of vision expands significantly, considering not only the end-user but also stakeholders involved in extraction, construction, usage, and disposal (Mindsets, n.d.).

The Circular Design guide, developed by Ellen MacArthur Foundation, in collaboration with IDEO, consists of four major stages: **understand, define, make, and release.**

During the initial stages, designers ask questions such as “What are the current barriers to its functionality?” This process involves gaining a comprehensive **understanding** of circular flows and brainstorming potential product cycles from both technical and biological perspectives. It also entails considering the shift from solely selling a product to transforming it into a service. Designers should explore ways to meet user needs beyond product ownership, examine the service experience, identify necessary systems, determine required partnerships, and consider important feedback or data. Additionally, understanding the implications of the materials used in everyday products is crucial (Methods, n.d.).

In the **defining stage,** designers need to articulate the circular challenges they aim to address. They should develop compelling strategies and business models from a circular perspective and create propositions that align with the brand’s promises (Methods, n.d.).

Moving on to the **make stage**, the focus shifts to the consumer and user systems. Designers brainstorm ideas based on circularity principles, prioritize concepts that align with circular objectives, and creates prototypes to test the concepts and mitigate risks. This stage ensures that the product is developed with circular principles in mind, contributing to sustainability and reduced environmental impact.

By Designing with Circularity in mind using design thinking methodology, designers can create products and systems that not only meet user needs but also align with waste reduction, and promoting environmental sustainability.

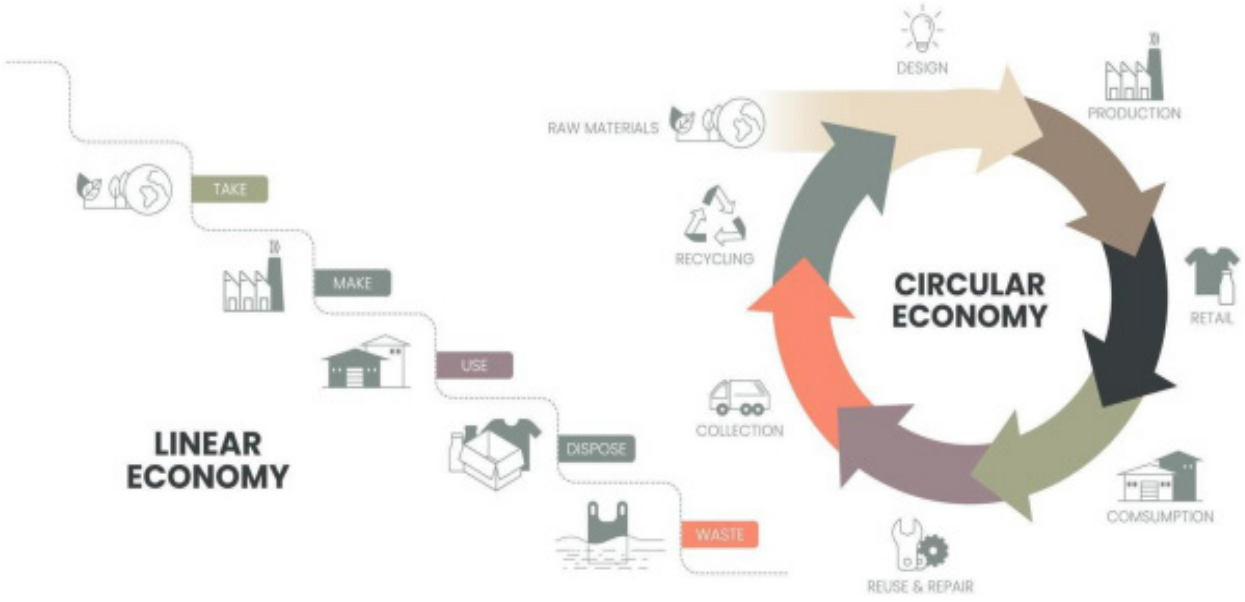

image 02. Visual representaction of the linear economy and circular economy

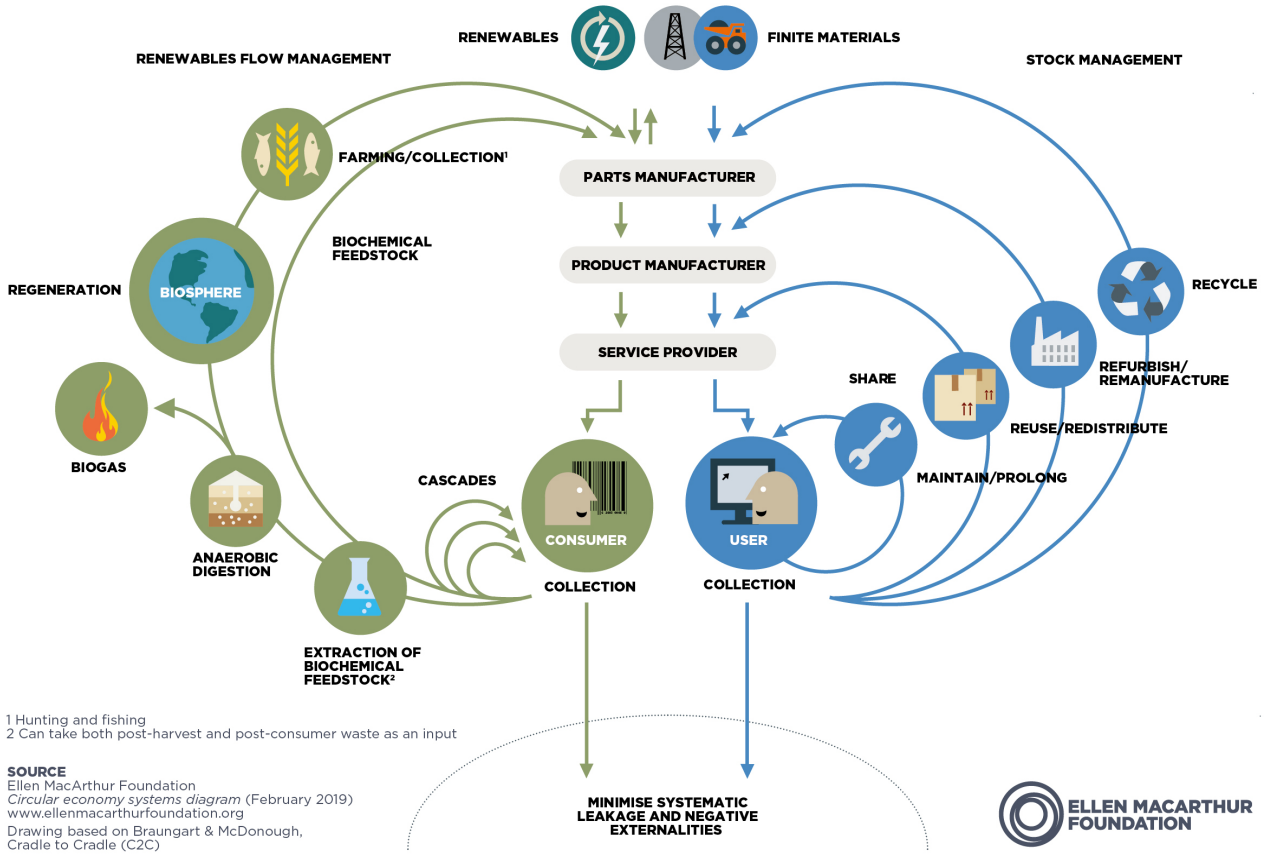

image 03. butterfly diagram

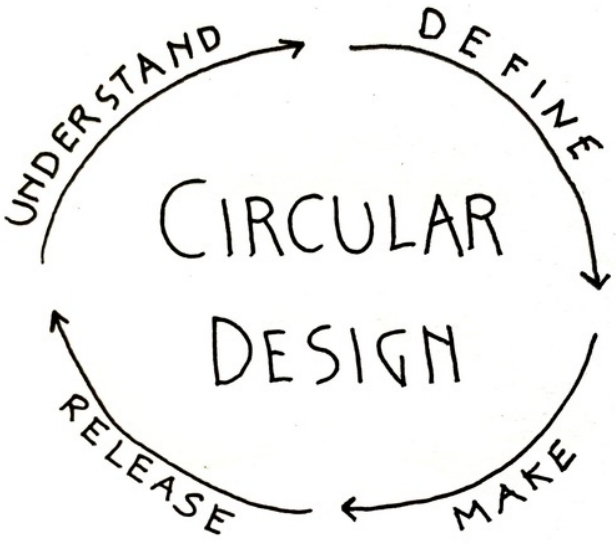

image 04. Circular design stages

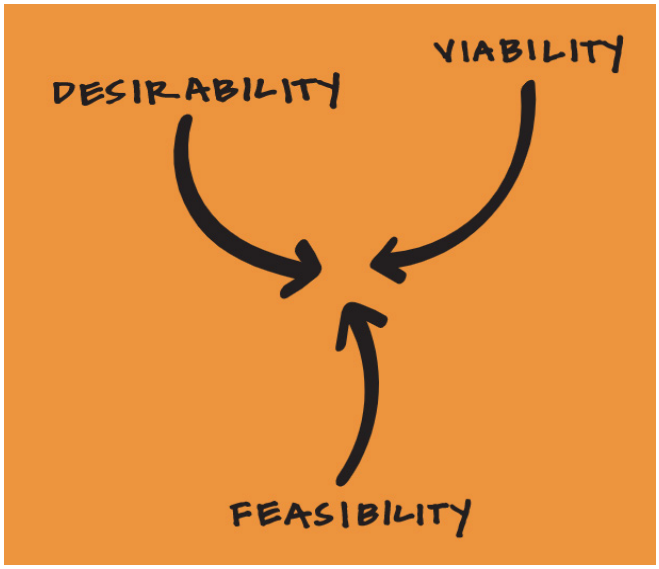

image 05. The triard of design thinking

2.4 Case studies

2.4.1 'Re-designing plastics packaging for a New Plastic Economy'

An example of circular design thinking is the project of Kaye Toland, which demonstrates a holistic and comprehensive approach to circular economy principles combined with a commitment to solving a complex design challenge. This work by Toland's focuses on the redesign of plastic packaging within the framework of the new plastic economy, which was recognized and esteemed by the Unilever Sustainability Award.

Toland's project exhibits a deep understanding of the systemic nature of the circular economy and its potential to transform the way we approach packaging design (MacArthur, s.d.). After choosing the subject "conservative world of feminine sanitary products as the central theme," Toland went to brainstorm and rethink the whole system surrounding the product. 'Zooming out' to understand the problems associated with feminine sanitary products and identify new circular opportunities

Through the embrace of the principles of recycling, reusing, and reducing, the project tackles the pressing issue of plastic waste, aiming to create a more efficient and sustainable packaging system. This project brief, Re-designing Plastics Packaging for a New Plastic Economy', sets the stage for a forward-thinking approach that recognizes the need to move towards a circular system that makes good resource management (MacArthur, s.d.).

Toland's work goes beyond mere functionality and aesthetically appealing; it is also environmentally responsible throughout its life cycle. Toland's states, "There always has to be another story, and that's why I was looking at how women would benefit economically and socially from the product."

By extending their focus beyond the product itself and challenging the existing business model, Tolland's project explores the potential of the concept of a cooperative to offer more affordable products, addressing issues such as the 'Tampon tax'. "Then it made sense to organize a monthly delivery system through a subscription scheme. And once I thought about delivery, the next step was to think about collection. From considering collection, it sparked an investigation into composting, and therefore they had to be organic tampons." (Toland Kate).

By developing an understanding of not only the circular flows of the product but also user behaviour, Toland's demonstrates a comprehensive consideration of how each part of the system influences one another. Including the material flows associated with the product. This includes aspects such as material selection, recycling, and end-of-life options. The project wholeheartedly embraces the core principles of the circular economy and design thinking, with the goal of minimizing waste and maximizing resource efficiency (MacArthur, s.d.).

Furthermore, Toland's work serves as an exemplary model for designers and practitioners, illustrating the potential of a systemic approach to drive positive change and shape a more circular and sustainable future. The project showcases the importance of considering the entire lifecycle of a product, from production to disposal, and the interconnections between various stakeholders and components within the system. This systemic approach helps identify opportunities for innovation, such as exploring new material alternatives, implementing recycling programs, and encouraging responsible consumer behaviour.

Overall, Toland's project demonstrates the power of design thinking rooted in circular economy principles to create meaningful and impactful solutions. It serves as an inspiration for designers and practitioners to adopt a systemic mindset and contribute to a more sustainable and circular future.

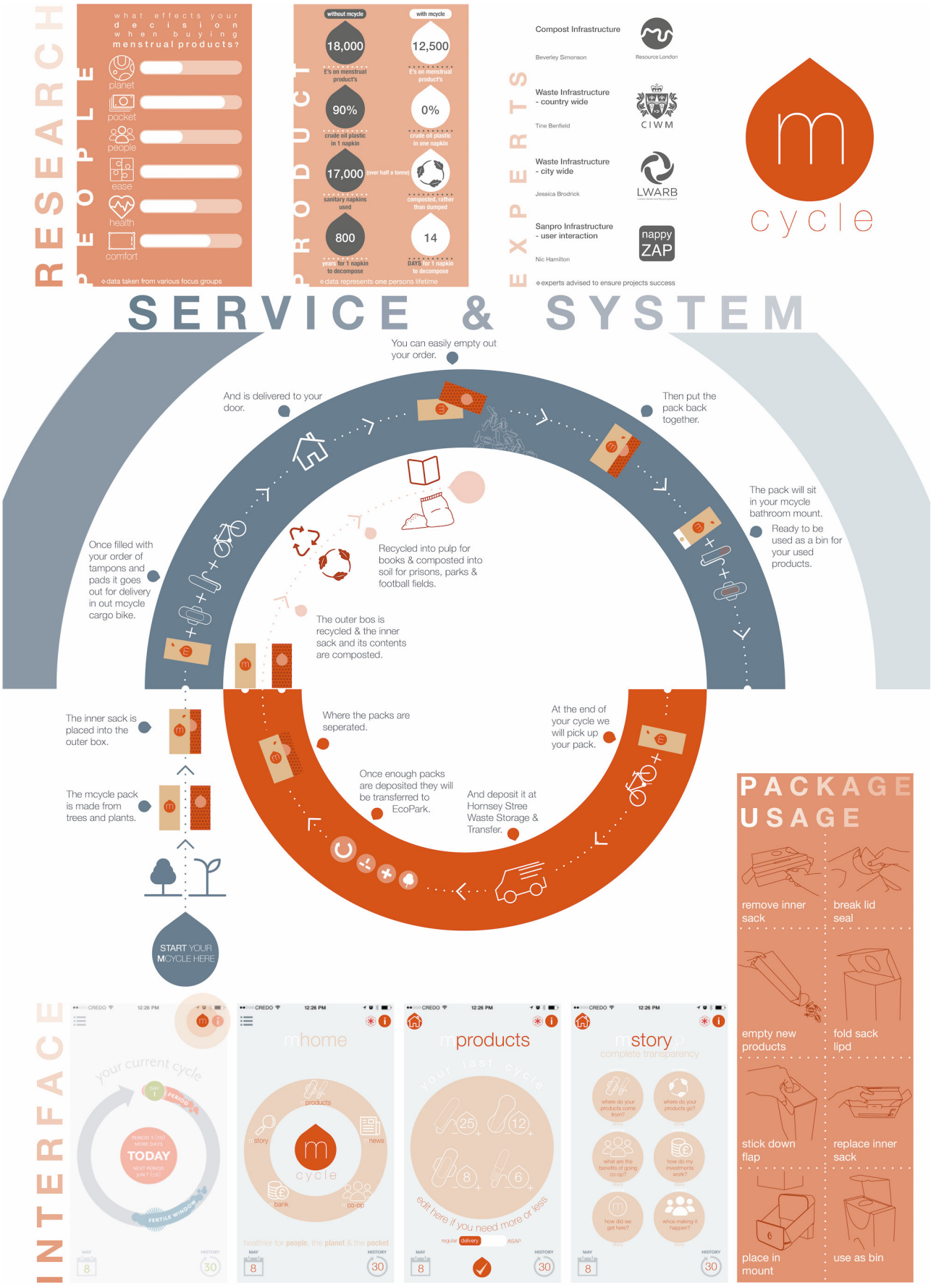

image 06. *'Re-designing plastics packaging for a New Plastic Economy'*

2.4.2 Shoey Shoes

Another embodiment of circular design thinking applied to product development and the footwear industry is Shoey Shoes. Created by Thomas Leech, an industrial designer, this product approaches children's footwear by adhering to circular principles (MacArthur, s.d.). The underlying concept of this product revolves around using waste materials as the primary source of shoe production and engineering them to be disassembled, reused, and recycled, minimizing waste and promoting sustainable consumption patterns.

The key highlight of this product lies in its transformation of wasted materials into functional footwear. By sourcing wasted materials as the main input, the product reduces the consumption of virgin resources, thereby mitigating the environmental impact of the shoes' life cycle. This approach not only addresses the issue of waste accumulation but also promotes resource efficiency as the waste materials find new life and purpose in the form of functional children's footwear (MacArthur, s.d.). In addition to sourcing sustainable materials, Shoey Shoes's design approach also extends to its disassembly, reuse, and recycling capabilities. The shoes are engineered in a manner that allows easy disassembly into individual components. By doing so, it simplifies the process of repair and refurbishment, extending the shoes' lifespan and reducing the need for frequent replacements. Such an approach promotes a shift from the prevailing linear model of "take-make-dispose," encouraging a more circular approach to consumption.

By embodying the circular design principles, this product stands as an exemplary case study in sustainable product innovation because of its commitment to using wasted materials, disassemblability, and recallability, reflecting a holistic understanding of the circular flows.

Leech's devotion to circular economy principles demonstrates how innovative design approaches can redefine product development and contribute to a more sustainable and regenerative future. This product serves as a tangible manifestation of the circular economy's potential to transform conventional industries and foster a more environmentally responsible and resource-efficient economy.

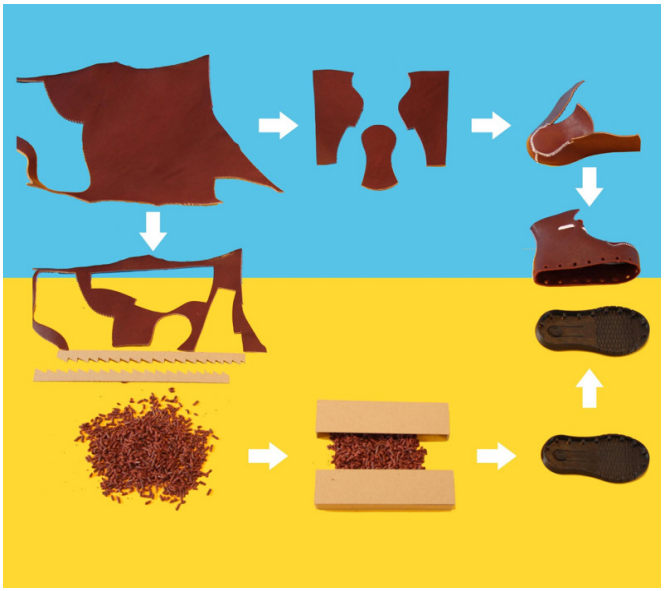

image 07. Shoey shoes process

image 08. Shoey shoes colletion

03

Footwear Design in the Circular Economy

3. Footwear Design in the Circular Economy

3.1. Footwear Design in the Circular Economy in Portugal

The footwear industry has been grappling with significant sustainability challenges in recent years, given the alarming amount of shoes that end up in landfills annually.

However, by adopting a circular design approach, it is possible to mitigate the negative environmental impact of both the manufacturing and maintenance life cycles.

Circular design strategies prioritize production and consumption models that emphasize sharing, reusing, leasing, repairing, refurbishing, and recycling, thereby extending the lifespan of products (Circular Economy: Definition, Importance, and Benefits | News | European Parliament, 2023).

By integrating these principles into footwear design, the industry can reduce its reliance on virgin materials during the manufacturing process. This approach promotes resource efficiency and diminishes the environmental consequences associated with raw material extraction, consequently reducing the industry's dependence on such materials by managing the resources available efficiently.

Moreover, circularity emphasizes the importance of reducing waste to a minimum (Circular Economy: Definition, Importance, and Benefits | News | European Parliament, 2023). In the particular case of footwear, it can involve designing shoes with modular components, making them easy to replace or repair, and extending the product life span. By adopting reparable and upgradable designs, manufacturers are able to reduce the number of shoes that end up in landfills and contribute to waste reduction.

Extending the lifespan of the product is crucial, and they should focus on longevity and durability. By prioritizing these aspects, designers can create shoes that withstand wear and tear, ensuring that the product remains functional and fashionable. This approach helps reduce the frequency of shoe replacements and the environmental impact associated with shoe production.

Consumers are increasingly demanding more sustainable practices from brands and expect to witness positive outcomes from their purchasing choices. A study in the consumer products and retail sector suggests that nearly 80% of consumers wish to contribute to conserving the environment for future generations (Capgemini Research Institute | Who We Are, s.d.). By adopting circular design principles in this industry, brands can align with consumer expectations and enhance their reputation.

Adopting circular design principles in the footwear industry aligns with the growing demand for sustainability from consumers and offers countless benefits and advantages. By doing so, designers can meet consumer expectations, enhance the brand's image, achieve cost savings, ensure supply chain resilience, and foster innovation.

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In conclusion, adopting circular design principles in the footwear industry aligns with the growing demand for sustainability from consumers and offers countless benefits and advantages. By doing so, designers can meet consumer expectations, enhance th

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A S P O R T U G U E S A S

image 09. AS PORTUGUESAS footwear

image 10. AS PORTUGUESAS shoes with cork sole

image 11. Tríbio footwear

04

Product Design and Development

4. Product Design and Development

4.1. Description of the specific project focused

This project arises from this pressing need and concern regarding the ever-increasing volume of discarded shoes, which calls for innovative solutions while prioritizing material separation, environmentally friendly materials, and manufacturing processes. Utilizing the design thinking process within the circular economy and embracing the circular mindset.

By incorporating this mindset into the design thinking approach, a more holistic perspective is gained, considering all stakeholders involved in the lifecycle of the shoes, including extraction, construction, usage, and disposal.

The aim of this project is to consider the broader perspective of the stakeholders throughout the footwear industry, from the development and production to the hands of the final user, and ultimately reintegrate the product into the closed-loop system.

Furthermore, it is also crucial to educate and engage their end-users in more sustainable practices and encourage them to adopt a circular mindset.

4.2 Understanding

4.2.1 Understanding circular flows

During this initial stage of shoe development, it is important to assess what it would take for this new product to function effectively and identify any current barriers to achieving this goal. This process involves a comprehensive understanding of circular flows and brainstorming potential cycles from a technical perspective. In order to apply this approach to the technical cycle of the shoe, we started by considering how the product can be reused, refurbished, remanufactured, or recycled. By answering two questions for each of these aspects, you gain insights into the feasibility and challenges associated with each option. This allowed us to assess the feasibility of implementing a circular approach and identify any technical challenges or barriers that need to be addressed.

After answering the questions for each technical cycle, several key considerations emerged on what it would take for this product to work, what is needed, and what stands in the way.

Firstly, incorporate a modular design approach. By prioritizing modularity, the shoes could be constructed using easily detachable and replaceable components. This approach would facilitate the product being repaired and refurbished, extending its life span.

The separation of the shoe into distinct parts is pivotal. A clear delineation between components such as the sole and the upper fabric would facilitate the recycling or refurbishment of the parts. Ensuring that the materials are appropriately managed and processed, rather than treating the product as a single unit during the end-of-life stage.

Simplicity in design is another of the key considerations that has emerged. By adopting this approach, it would make it easier for the shoe to be disassembled and separated into constituent parts. Complex constructions and intricate details can hinder material separation, possibly impeding recycling and remanufacturing processes.

Furthermore, creating a unisex design would enhance the shoe's versatility and market appeal. By eliminating the gender barrier, the shoes could be more widely reused and redistributed. This approach would contribute to resource efficiency and mitigate unnecessary material consumption.

Lastly, establishing a take-back system would help ensure efficient material separation and recycling. By collaborating with consumers and retailers, we can implement a comprehensive system to collect used shoes and return them to the manufacturer for proper material

separation and recycling.

By incorporating these considerations and addressing the challenges associated with material separation, design simplification, modularity, and establishing a take-back system, we can align the shoe's development with the principles of circularity. This approach would not only minimize waste generation but also contribute to the long-term sustainability of the footwear industry as a whole.

	what would take for it to work?	what is needed and what stands in the way?
Reuse	making it modular; making it simple; making it unisex;	separating the shoe into parts; the manufacturing process;
Refurbish	making it modular; making easy desmanteling parts and separation ;	the use of glue and joints with chemicals;
Remanufacture	separating the matirials and colors; making it modular; making a simple design;	the use of glue and joints with chemicals; separating the sole and the tissue part of the shoe; having a company to get the matirial back to the manufaccture
Recycle	separating the matirials and colors; ponting the exact material used in each part; making the matirial separation easier an the end of use of the shoes	the use of glue and joints with chemicals; separating the sole and the tissue part of the shoe

image 12. Understanding circular flows

4.3. Target Audience

Targeting the Portuguese market with anime merchandise, specifically footwear, towards individuals between their mid-20s to mid-30s.

Firstly, this age range likely corresponds to individuals who grew up during the rise of anime in Portugal, establishing a strong affinity and emotional connection to anime shows, characters, and themes from their formative years. Leavening this nostalgia becomes an effective market strategy, since it influences the purchasing decisions.

"In the late 1990s and early 2000s, anime gained traction among millennials through various series like "Dragon Ball Z," "Pokémon," "Naruto," and "Sailor Moon." These shows were widely available on television networks and garnered a dedicated fan base among millennials who grew up watching them." (How Did Anime Go From Nerdy Cringey to Mainstream Pop-Culture?, 2023).

The Portuguese market provides a conductive environment for targeting this audience. Over the years, Portugal has witnessed a significant increase in the anime popularity, evidenced by the growing numbers of conventions, events, and dedicated online communities like Iberanime, in Lisboa and Porto, Comic-Con, and blogs and websites like the OtakuPT e PTAnime, have attracted and reunited "otakus" from all over the country (Lima, 2022). The prevalence of these platforms and the presence of the fandoms indicate a strong market potential for this type of product.

Portugal also has a very strong affinity for Japanese culture and entertainment, creating a favourable context and environment for the product in development. (Japan-Portugal: A Long and Historical Relationship, 2020)

By offering footwear that incorporates design elements inspired by nostalgic anime series, we can tap into this target audience emotional attachment and cater to their desire of self-expression.

This demographic is also economically significant, since this age range typically consists of individuals in their prime earning years, with disposable income to spend on their hobbies and interests.

In conclusion, targeting the Portuguese market with footwear based of anime with empha-

sis on the nostalgic characters from the target audience childhood, presents compelling opportunities. The emotional connection and affinity of this demographic, along with the growing popularity of this genre in Portugal, establish a favourable market context.

image 13. Iberanime 2023 Portugal

4. Define

4.4.1 Define Challenges

After the initial phase, where we gain a deeper understanding of the circular flows of the product and identify the target audience, it is time to articulate the challenges we will encounter and stablish some goals. In this second stage of our product development, it is crucial to assess the requirements for the new product function and effectiveness and identify the existing barrier to achieve this goal. Circularity, being inherently systemic, needs a clear definition of what we aim to achieve, as well a well-plan approach to address it. Doing so requires an interdisciplinary approach and a range of support (The Circular Design Guide, 2023).

To initiate this process, we begin by breaking down barriers and elucidating key questions that will aid in articulating and framing the challenges we aim to solve.

The Circular Design Guide´s barrier sheet serves as a valuable tool in this endevor. Through its application to the specific product under consideration, we can clarify our goals, set achivavle milestones, and define the intended impact of the product we are develpoing.

As we follow the barrier sheet, our goal is to define the intended impact we hope the product under development will have, by doing so we can address critical questions such as:

1. What impact do we hope to achive with the product in question?
2. What does a successful product look like?

Our vision for the product involves educaring the user about the concept of circularity and waste management, with the ultimate goal to create an envoromentally friendly and resource-efficient footwear.

A successful product, as envisioned, should ideally align with our target audience.It must be user-friendly, possess inherent circular qualities, and effectively convey the message of circularity,thereby meeting our set objectives. To achieve this, we must address various aspects, including material sourcing, design for disassembly, implementing a circular business model, efficient waste management, and designing for product longevity.

To enhance the success of the our product, we can considerstrategies such as increasing visibility on social platforms, thereby reaching a broader audience.

Additionally, making the product more simple and affordable ca attract a larger customer base.To ensure accessibility, we must establish multiple distribution channels to maximize its impact.

Nevertheless, we have some factor that may work against the success of the product in question. These include the introduction of a new product typology and the need to familiarize consumers with the concept of circularity that is inherent of the product. Addressing these challenges is an esenscial aspect of our product development process.

In summary, this chapter outlines the phase of setting goals, and defining the intended impact, and identifing potencial challenges in the circular product development. By adressign

these aspects with clarity and strategic thiking, we aim to create a product that aligns with our vision and contributes to circular practices.

5.4.2 Define Circular Opportunities

Making a product more circular can be initiated through incremental changes. This process involves considering the aspects we have direct control over, while also keeping in the broader perspective and scalable solutions for the future through careful observation. (Karoline K.)

Once we have developed a clear understanding of our target audience, identified the potential circular flows of the product, and determined the challenges we aim to address, we can begin asking a series of pertinent questions. These questions should be rooted in the knowledge acquired during the preceding steps, and each one should be thoroughly evaluated to identify viable opportunities. It is essential to assess what seems feasible at the present moment and carefully evaluate whether the proposed innovation would genuinely enhance the customer experience. Additionally, we need to consider any requirements that the product may entail, which may currently be beyond our immediate reach. In such cases, we should explore potential collaborations that would be necessary to facilitate the product's development.

In order to facilitate this process, it is beneficial to create a comprehensive mind map that encompasses various aspects. This mind map should include the questions related to the purposeful inputs and outputs, strategies for prolonging the product's life, and key information gathered during the early phases. By adopting this systematic approach, we can effectively document and organize all the relevant details for easy reference and ensure clarity throughout the development journey.

The purpose of this mind map is to provide a visual representation of the interconnected elements and considerations involved in achieving a circular product.

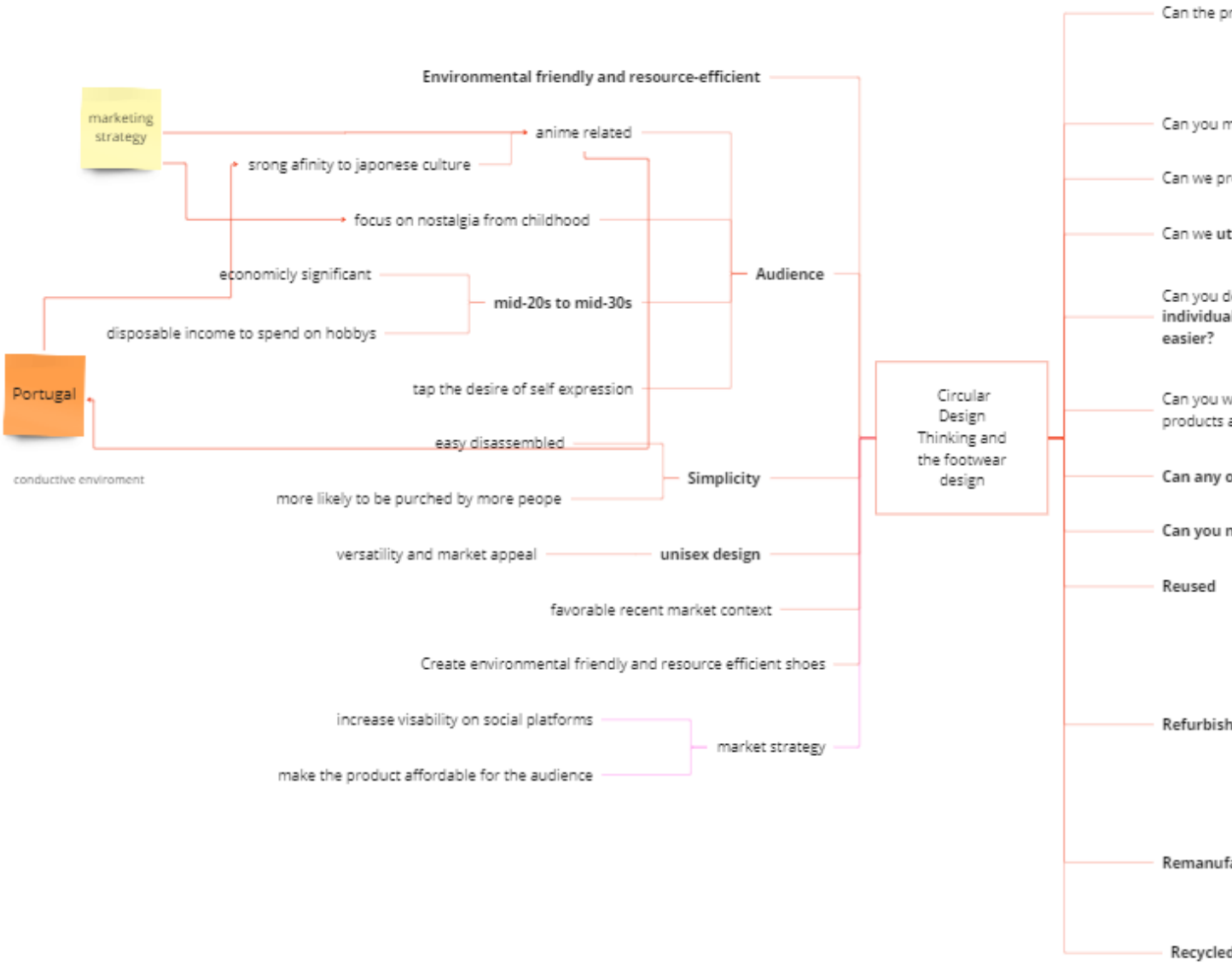
It serves as a tool for brainstorming and structuring our thoughts, enabling us to explore different avenues and possibilities. By incorporating questions related to purposeful inputs and outputs, we can identify ways to optimize resource use, minimize waste generation, and enhance the overall efficiency.

In addition, the mind map should include strategies for prolonging the life of the product, entailing consideration on approaches such as repairability, upgradability, and modularity to extend the product lifespan and reduce the need for frequent product replacements. By incorporating these considerations, we can design more durable, adaptable and easily maintained products.

Furthermore, the mind map should also include key information gathered during the early stages of research and analysis. This includes insights into the target audience, their preferences, and behaviours, as well as an understanding of potential circular flows and challenges associated with the product. By incorporating this information, we can ensure that our approach is tailored to its intended user.

In conclusion, adopting this systematic approach and creating the mind map, we can effectively navigate the complexities of making this product circular, allowing us to holistically consider various factors, explore opportunities and make proper decisions throughout the product design process.

Ultimately, this approach enhances our ability to create a product through the design thinking process with circularity in mind.


Environmental friendly and resource-efficient
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Circular Design Thinking and the footwear design
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Prolonging the life of the materials used
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ake it easier for The users to repair it themselves?
yes
ovide a maintenance service to sustain the life of the product?
yes
ilise waste or recycled materials for your materials?
yes
esign the product to be more modular, so
l components can be upgraded or replaced
yes
Facilitate the product to be repair and refurbished
easily detachable and replaceable components
ork directly with your manufacturer to restore your
fter their first use cycle?
no
f your materials be sourced more locally?
yes
inimise the waste stream your product produces?
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ed
Making it modular
Easy detachable and replaced components
easy to repair andrefurbishe
extend lifespan of the product
ensure matirial management by easy separation of components
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using matirial that can be reused

4.4.3 Brief

Based on the comprehensive mind map developed in the previous chapter, that provides an overview of all the crucial considerations for the development of the product and organize the information coherently, we then proceed to create the project brief. The project brief aims to give a clear definition of what we intend to develop and outline the key objectives and goals.

Project Brief : Sustainable footwear development through the Circular Design Thinking process in the Portuguese market

Project overview :

The footwear industry in Portugal faces sustainability challenges due to the significant number of discarded shoes and wasted materials. To address this issue, we propose the development of sustainable footwear using the Circular Design thinking process and principles. By adopting a circular design approach, the industry can reduce its reliance on virgin materials, promote resources efficiency and minimize waste generation.

Project Objectives:

- Develop a pair of footwear that aligns with circular design principles such as;
- Extend the lifespan of the product by incorporating modular components for easy repair and refurbishment;
- Educate and engage the target audience on sustainable practices and circularity;

Target Audience :

- Individuals between their mid-20s to mid-30 in Portugal;
- Economically significant demographic with disposable income
- By tapping into their emotional connection to anime from their childhood and promoting sustainable practices, we aim to attract and retain a loyal customer base.

Must-have features:

- Regenerative, mono-materials: ;
- Modular Design;
- Unisex approach;
- Circular mindset;

Good-to-have features :

- Collaborative take-back system;
- Local Production;
- Innovative Materials;
- Anime inspired;

Design Considerations :

- Resource efficiency;
- Durability ;
- Market Appeal;
- Circular Flows;

The project brief presents a clear and well-defined plan for the sustainable development of Footwear through the process of circular design thinking in the Portuguese market. The objective is to address the sustainability challenges faced by the footwear industry and reduce its environmental impact by embracing circular design principles.

Overall, the project brief sets a solid foundation for the development of the product, combining creativity, sustainability, and consumer engagement to achieve a successful and impactful outcome.

5.4.4 Building partnership

In the pursuit of the development of this product in the Portuguese market, it is crucial to build a partnership in order to understand if this product is feasible and ready for the market.

Building a partnership will allow us to access specialized knowledge and expertise.

Collaborating with organizations that possess experience in the market and are also sustainable in their practices and innovative manufacturing techniques enhances the quality and effectiveness of our product.

Moreover, partnering with an eco-friendly martial supplier would ensure that we have access to a diverse range of sustainable materials. By sourcing materials with low environmental impact, we can create a product that aligns with circularity principles and reduces reliance on virgin materials and resources.

One of the good-to-have features is a collaborative take-back system, where used shoes are collected and returned to the manufacturer for proper recycling or refurbishment.

Establishing partnerships with logistics and

reverse logistics companies ensures an efficient and responsible end-of-life process for our products.

5.4.4.1 Aloft

In the pursuit of developing a sustainable footwear product for the Portuguese market, establishing strategic partnerships is crucial to assessing feasibility and readiness for market entry.

By collaborating with organizations possessing marketing experience, sustainable practices, and innovative manufacturing techniques, we can gain access to specialized knowledge and expertise, elevating the quality and effectiveness of our product.

A pivotal aspect of partnering strategy involves joining forces with a company that uses environmentally friendly materials. By sourcing materials with low environmental impact, we can create a product that aligns with circularity principles and reduces reliance on virgin materials and resources.

One of the good-to-have features is a collaborative take-back system, where used shoes are collected and returned to the manufacturer for proper recycling or refurbishment.

Establishing partnerships with logistics and reverse logistics companies ensures an efficient and responsible end-of-life process for our products.

After conducting research and outreach to potential partners, we successfully established contact with Aloft, a distinguished sole producer based in Portugal.

Aloft's reputation for technical expertise, innovation, and sustainable practices aligns with what we needed in a partnership. Mainly, they operate with injection equipment, featuring 23 advanced machines that empower them to transform raw materials into high-performance soles. Equipped with automatic extraction, injection sprue with conveyor belt, manual insert application, MDP volumetric dosing, temperature control, and raw material drying and dehumidifying capabilities Aloft caters to an extensive range of materials, including PVC, TPU, TPR, SEBS, ABS, PPH, PS, PA, POM, and PE. The company is committed to making its production more sustainable, reducing its carbo footprint. However, it's important to note that some materials used are not yet part of a circular process

Furthermore, Aloft's unwavering commitment to sustainability is reflected in some of their material sourcing and waste management. If possible, it is reused and goes directly back into manufacturing, or the wasted rubber is collected and then sold to other companies. The alignment of their wasteful management with circular principles showcases the company's dedication towards reducing environmental impact. With their state-of-the-art injection equipment, commitment to sourcing eco-friendly materials, and introduction of the groundbreaking Expanded TPU material, Aloft emerges as a valuable partner in our journey towards sustainable footwear development.

Aloft's relentless pursuit of innovation culminates in the introduction of expanded TPU, a cutting-edge material that marks a paradigm shift in the realm of performance footwear. Renowned for its remarkable energy return, lightweight properties, and unrivalled cushioning capabilities, it showcases Aloft's commitment to pushing the boundaries of footwear innovation.

image 15. Aloft logo

4.5 Make

Circular Design Thinking calls for an exploratory approach in spotting opportunities and brainstorming ideas. This phase encourages creative thinking and the integration of diverse perspectives to generate a wide range of potential solutions, challenging the designer to think beyond conventional boundaries and embrace strategies that prioritize sustainability and resource efficiency.

4.5.1 Market research

The realm of anime-inspired footwear has witnessed a remarkable surge in popularity, demonstrating the growing impact of anime culture on the world of fashion. Leading sneaker brands, including Adidas, Nike, and Puma, have enthusiastically embraced this trend by forging partnerships with well-loved anime series such as Dragon Ball Z, Naruto, and One Piece. The outcome of these collaborations has been an unprecedented demand for anime-themed shoes, with fervent fans eagerly seeking to own footwear that embodies the essence of their cherished characters and cherished moments from the shows they hold dear. The fusion of anime artistry and expert sneaker craftsmanship has given rise to a diverse array of distinctive and highly sought-after footwear options, appealing to collectors and anime enthusiasts alike.

This market research serves as a compass, guiding through the dynamic landscape of consumer preferences, industry trends, and competitive landscapes.

To facilitate a comprehensive assessment, we explored some noteworthy shoes that emerged in recent years, catering to a similar target audience:

Naruto x Jordan Zion 1:

This collaboration brings together the iconic Naruto series and the renowned Jordan Zion 1 silhouette, blending some anime features with basketball-inspired design.

This pair of shoes is a prominent outrigger and enhances stability, support, and well-balanced cushioning since it incorporates a soft foam midsole. However, some users have expressed reservations about the quality of the material employed, suggesting it feels thin, lacks premium attributes, and has insufficient padding on the tongue area of the shoe. Overall, the product emerges as commendable and economically accessible. (Li, 2022)

Pokémon x Converse:

This collaboration is characterized by colours symbolizing some of the most beloved characters. In contrast to the normal image of the brand with loud graphics and prints, the collection focuses on subtle design elements that resonate with the classics of the series.

By using the colours palette and some small pixel art depictions of the chosen Pokémon on the tongue of the shoe, alongside a biographic motif near the heel displaying the character information, they reinforce the association with the franchise with small details. (Converse X Pokémon: Celebrating 25 Years, n.d.)

One Piece x Vans:

This collaboration gained immense interest from the market, captivating sneakers and One Piece fans by merging the aesthetics of Vans with iconic elements of the series, evoking a sense of nostalgia. This collaboration is still quite recent since the live action is now streaming, gaining more popularity. (Vans X One Piece, 2022)

Attack on Titan x BAIT x Adidas:

The collaboration showcases the Adidas Ultraboost shoe silhouette, constructed with premium materials such as Prime knit and adorned with TPU cages and shoelaces for striking visual appeal. (BAIT X Attack On Titan X Adidas Consortium UltraBoost Online Entry Form, n.d.)

Jujutsu Kaisen x Dolce & Gabbana:

The fusion of the anime with Dolce & Gabbana has resulted in the creation of the Daymaster sneakers. Made with premium calf leather and featuring colourblock patterns with perforated detailing, The round toe and front lace-up fastening ensure a comfortable fit, while the logo patch at the tongue and branded insole showcase attention to detail. The sole is composed of 100% rubber, and the outer materials are crafted with calf leather and lining, enhanc-

ing overall comfort. (‘;;’, 2019)

Dragon Ball Z x Adidas:

This collaboration features seven unique shoes, each representing an iconic character from the series. The footwear showcases signature colours and elements inspired by the characters, using the existing models of Adidas and pairing them with the essence of the respective characters and their journey. (McCartney, 2018)

Notably, these collaborations demonstrate two distinct approaches to design: one that features more directly the character’s image and another that incorporates allusive design elements and symbols.

However, it is essential to acknowledge that while the market reception of these limited editions has been positive, sustainability remains an area of improvement since none of the currently examined footwear models present sustainable options, and most of the materials do not meet the circular design principles. As consumers prefer eco-conscious products, as referred to before, incorporating sustainable practices may enhance the overall market appeal.

In summary, the market research emphasizes the successful fusion of anime culture in the footwear industry, resulting in a collection of unique and captivating footwear. While the adaptations of existing shoe models to fit the characters have been well-received, there is an opportunity to further explore sustainable practices and create unique designs.

By integrating both creativity and sustainability, footwear brands can continue to captivate anime fans while contributing to a more environmentally conscious and socially responsible market landscape.

Naruto x Jordan Zion 1

118euros

Pokemon x Converse

69euros

One Piece x Vans

90 euros

Attack on Titan x BAIT x Adidas UltraBoost

Jujutsu Kaisen x Dolce & Gabbana

Dragon Ball Z x Adidas

660 euros

image 16. Market research of anime inspired shoes

4.5.2 Concept selection

After conducting a design brief and comprehensive market research, the next crucial step in the product development process is concept selection. We aim to create footwear that resonates with the nostalgia of our target audience, specifically those who grew up watching anime during their childhood. To achieve this, we must identify and draw inspiration from mainstream anime that aired on television during that era and were particularly popular among our target audience.

By understanding the impact and significance of these shows during their initial year of broadcast in Portugal, we can tap into the emotional connection of our target audience has with them. The key is to evoke a sense of nostalgia and appreciation left on the viewer of the series.

After some quick research of mainstream anime during the childhood of our target audience in Portugal, we have identified Naruto as a compelling choice for the product, since it is a beloved anime series that gained immense popularity worldwide.

Naruto has a dedicated fan base, with viewer who have grown up watching the series and continue to cherish it as a significant childhood memories. " It would have been the first anime for many who watched the series' original run, and they grew up alongside the characters into Shippuden, following the adventures as they matured side by side with Naruto himself. Having such a long attachment and connection to a form of media during its early years of development can subconsciously connect one to it, allowing it to find a place in one's mind and heart beyond its end." (Johns, 2022). The emotional attachment and fondness the audience has for the show makes it an ideal for the development of the product we are aiming to create.

The series also features iconic characters like Naruto Uzumaki, Sasuke Uchiha and Kakashi Hatake, among others, each with their unique visual aesthetic and symbols. These recognizable elements provide a wealth of design inspirations for creating distinct, meaningful shoe design that resonate with fans.

Naruto also offers a diverse range of characters and environments, allowing us to explore design styles, colour palettes and motifs.

Moreover, by selecting Naruto as our concept inspiration, we can align our footwear with the "Triad" approach which incorporates three essential elements-quality, comfort, and sustainability. The enduring popularity of the series ensures our footwear will garner attention from both loyal fans and consumers of quality and comfortable footwear.

In summary, choosing Naruto for the product inspiration is a strategic decision that leverages its popularity, and emotional connection with our target audience.

4.5.3 Moodboards and inspiration

Moodboards hold a crucial place in the creative process, serving as indispensable tools to facilitate the development of innovative products. By curating various visual elements, such as colours, textures, images, and themes, mood boards create cohesive collages that evoke specific moods or concepts.

Once the concept has already been determined, our focus shifts to selecting the main character of the anime series that aligns with our vision. As we are developing a pair of footwear, our goal is to capture the essence of the chosen character by carefully assembling elements that resonate with their unique traits.

In conclusion, mood boards and inspiration serve as invaluable guides in the creative journey of developing anime-inspired footwear. By thoughtfully curating visual elements that evoke the desired mood and selecting the main character that epitomizes the essence of the series, we can craft a pair of footwear that captures the hearts and imaginations of anime enthusiasts while staying true to our vision of delivering quality and aesthetic excellence.







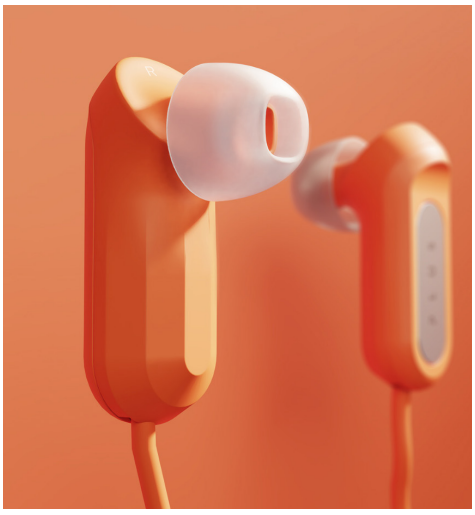
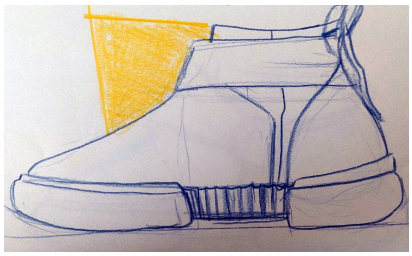
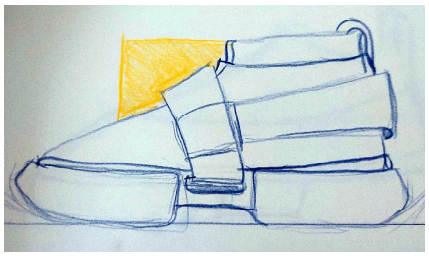
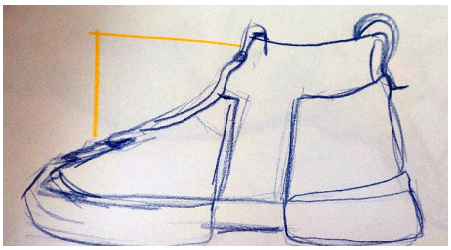
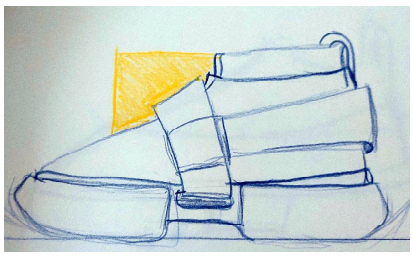
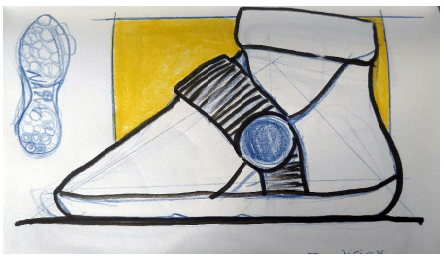
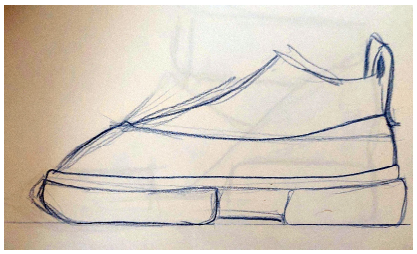
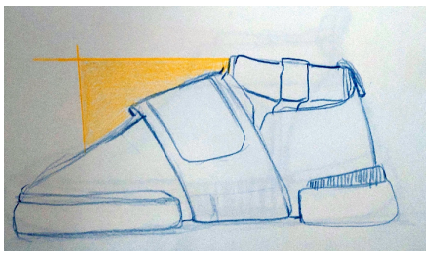
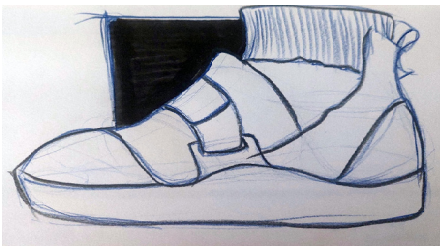
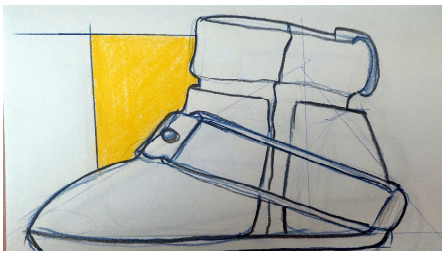
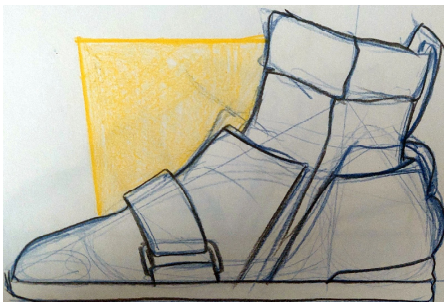
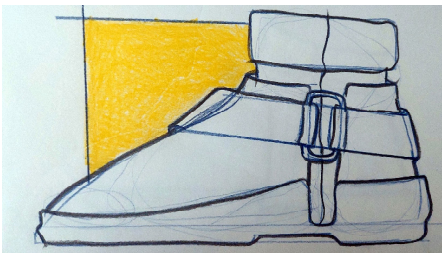



image 187 Moodboard

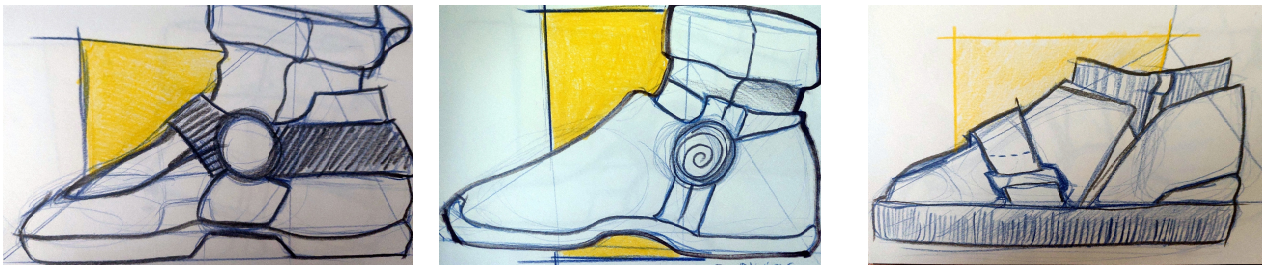








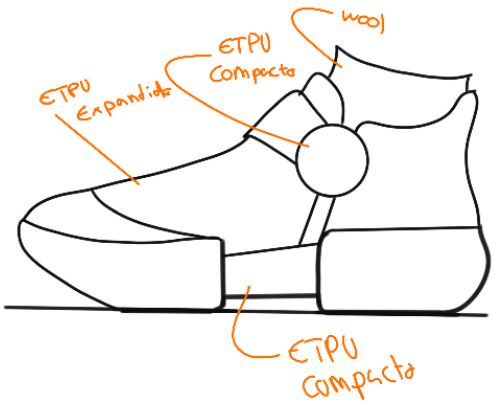

4.5.4 Sketching phase 01

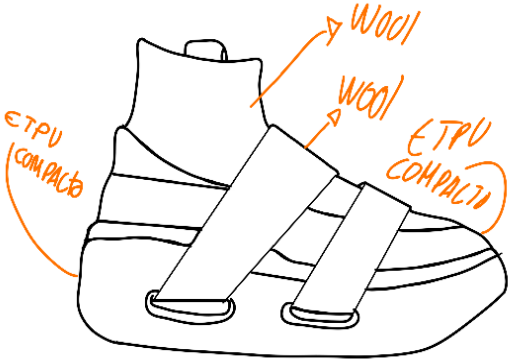
The sketching phase is indeed a pivotal stage that allows the designer to unleash creativity and imagination during the design process. As we embark on developing the product, we begin to give shape to our ideas based on the inspiration drawn from the mood board. This phase serves as a foundation for visualizing and conceptualizing the product that will shape the final product.

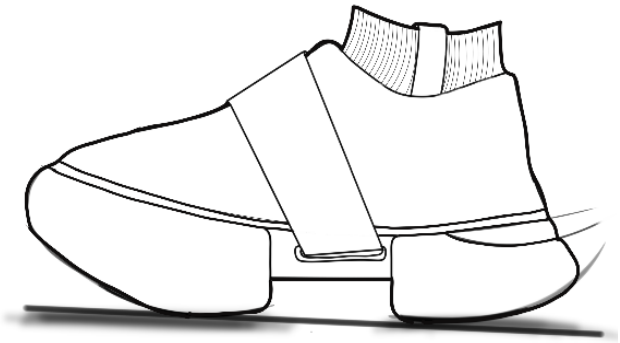
The primary purpose of this phase of sketching is to explore and brainstorm a diverse array of ideas that resonate with the mood board themes and aesthetics. Through this process, we are able to translate abstract concepts and characters traits into tangible visual representations.

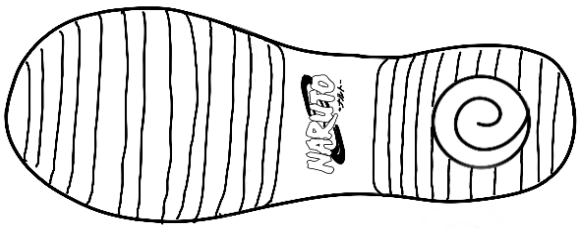
During this stage, we encourage the generation of multiple ideas, as we aim to create a rich and varied pool of concepts, that will later allow us to select the most promising ones for further development. The sketching phase allow us to push the boundaries of creativity and explore innovative design possibilities.

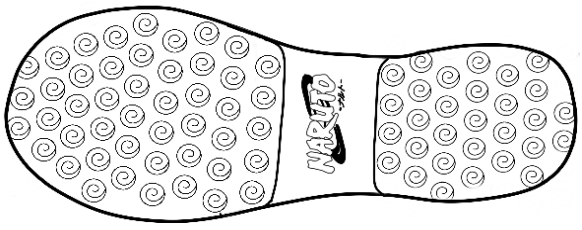


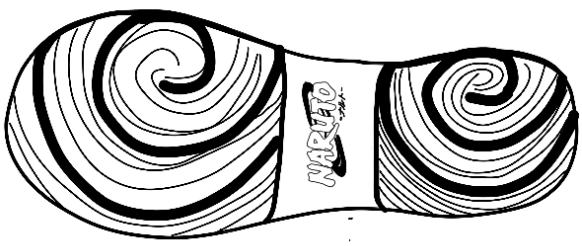












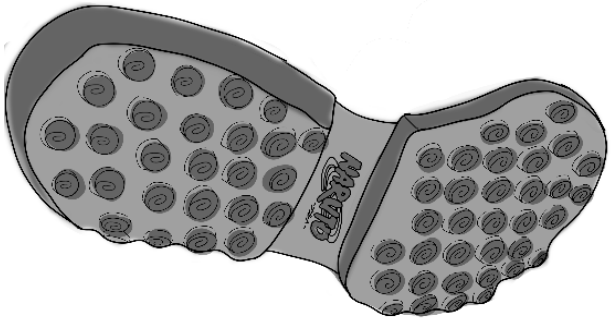


image 18. Sketch phase 01

4.5.5 Sketching phase 02

In the second phase of the sketching process, we take the diverse array of ideas generated in the phase 01 and begin to refine and develop them further.

This stage involves a more focused and critical approach to the selected concepts, evaluating their feasibility, practicality, and alignment with the project objectives.

From the pool of ideas generated in phase 1, we evaluate the concept's potential and elaborate further the most promising.

With the selected concepts, we begin to refine the ideas we sketched, This involves making some necessary adjustments, adding details, exploring variations, and experimenting with different materials or colour schemes.

The goal is to strike the right balance between aesthetics, functionality, and sustainability.

After reaching a conclusive decision on the direction to pursue, we proceeded with further sketching, keeping production considerations in mind. This phase involved naming specific materials, refining the sketches to be as realistic and proportional as possible, and ensuring that the designs aligned with the feasibility of the production process.

More over during these phase, we had some crucial help from the designers at Aloft, José Pedro Correia e Barbara, giving me constructive feedback on what could be improved, and to ensure that the ideas are feasible. Given that, this phase was particularly challenging, and in addition to aesthetics, we paid close attention to technical aspects, such as the structural integrity of the design, material compatibility and manufacturability. The goal is to create sketches that can be translated into a real, functional, and sustainable product.

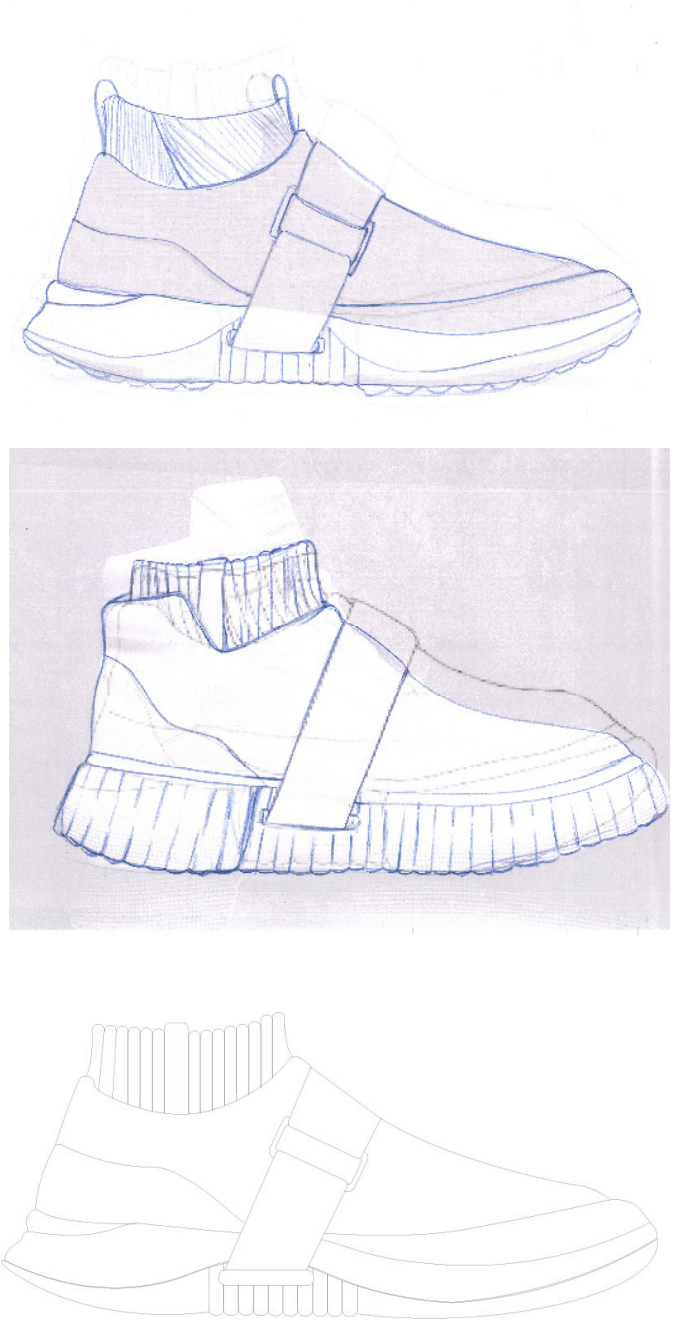


image 19. Sketch phase 02

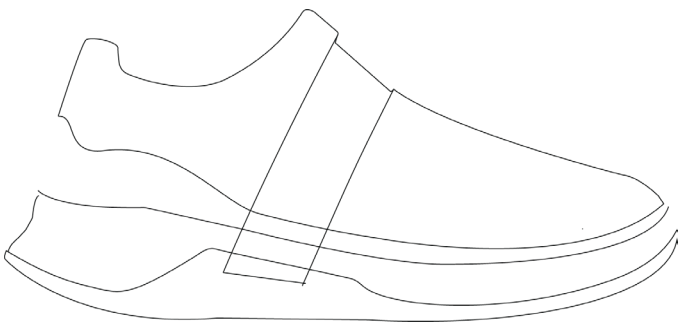


image 20. Sketch base lines

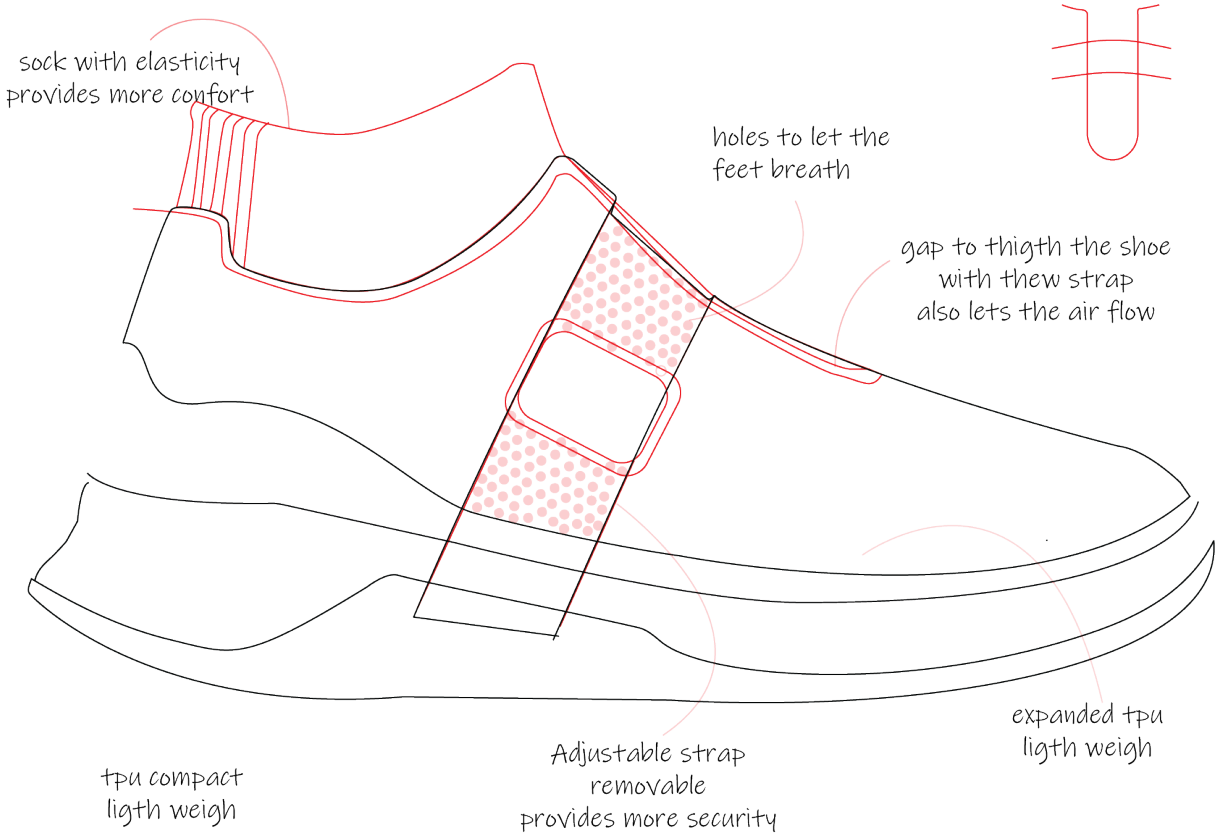


image 21. Sketch 01 with notes

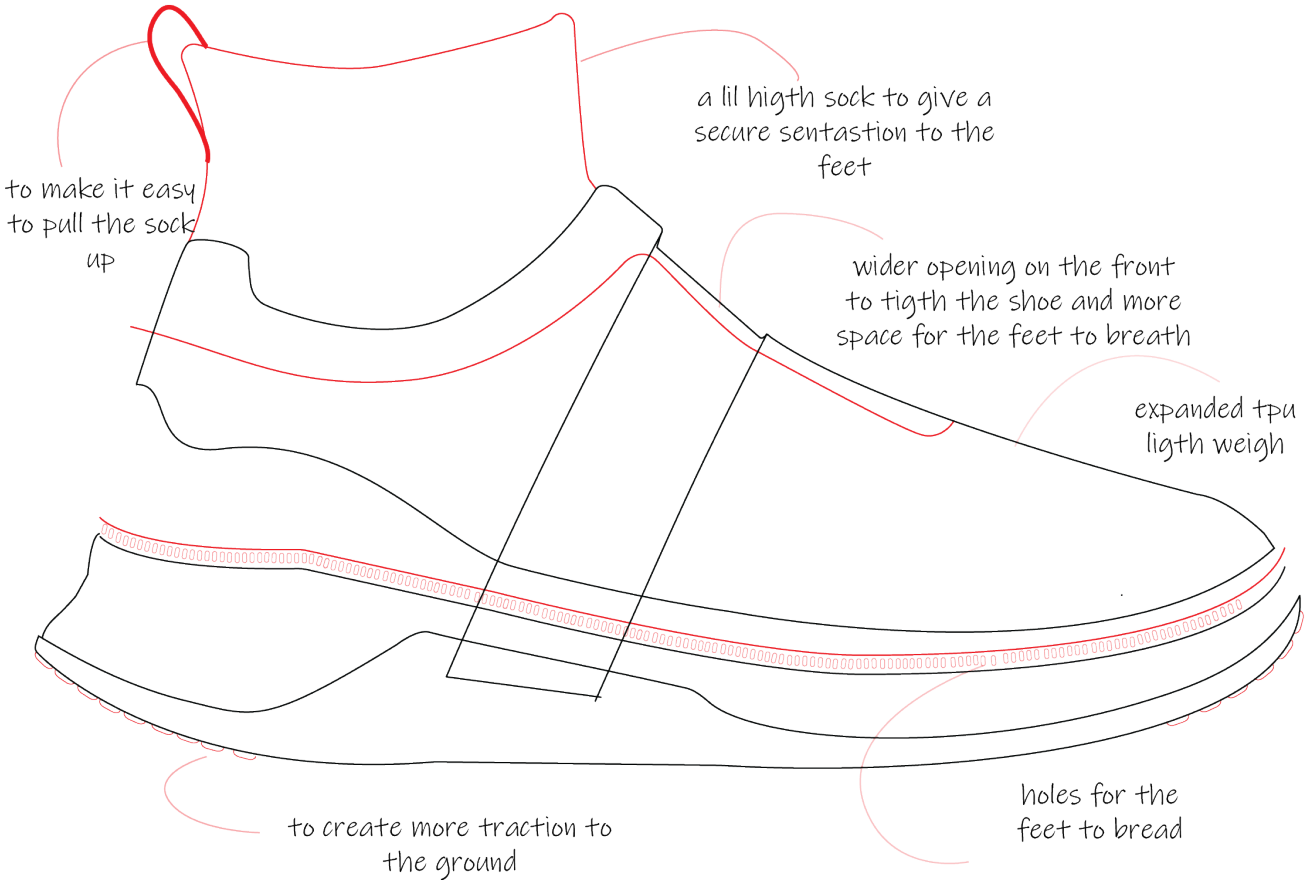


image 22. Sketch 02 with notes

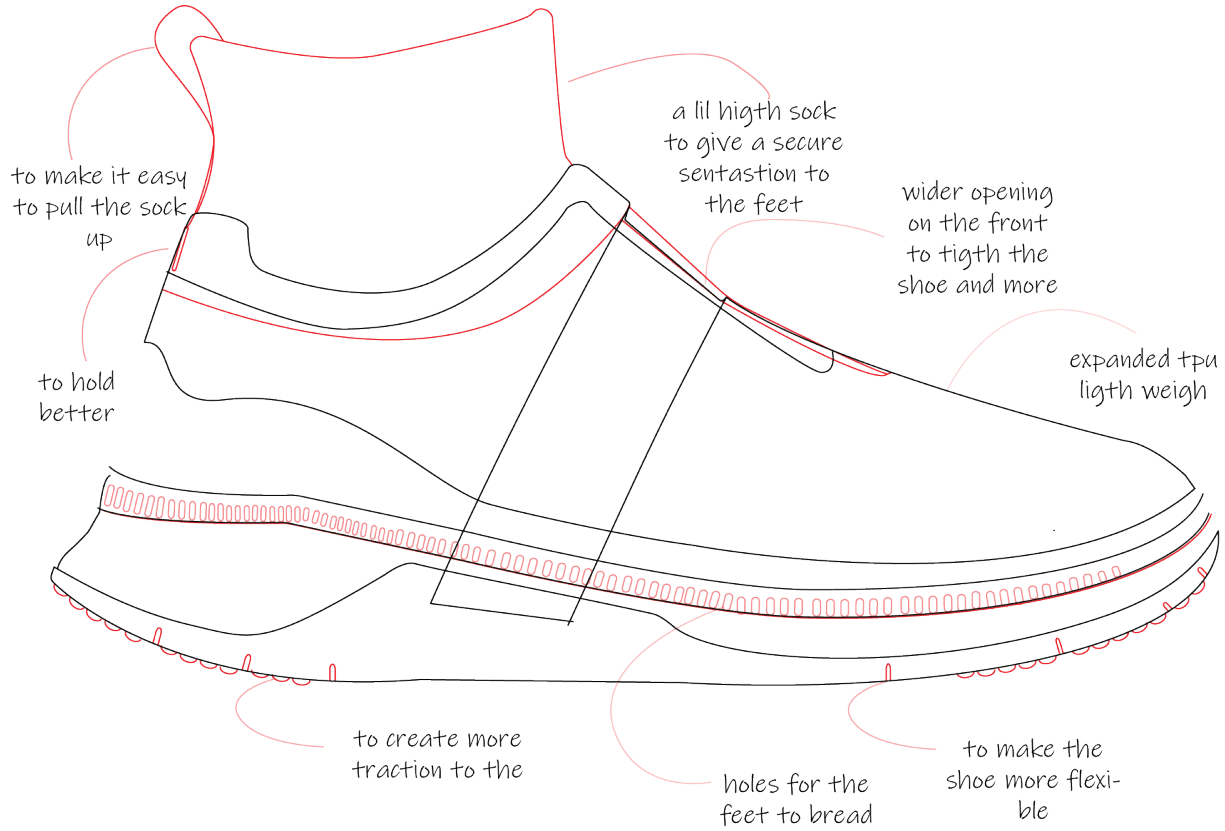


image 23. Sketch 03 with notes

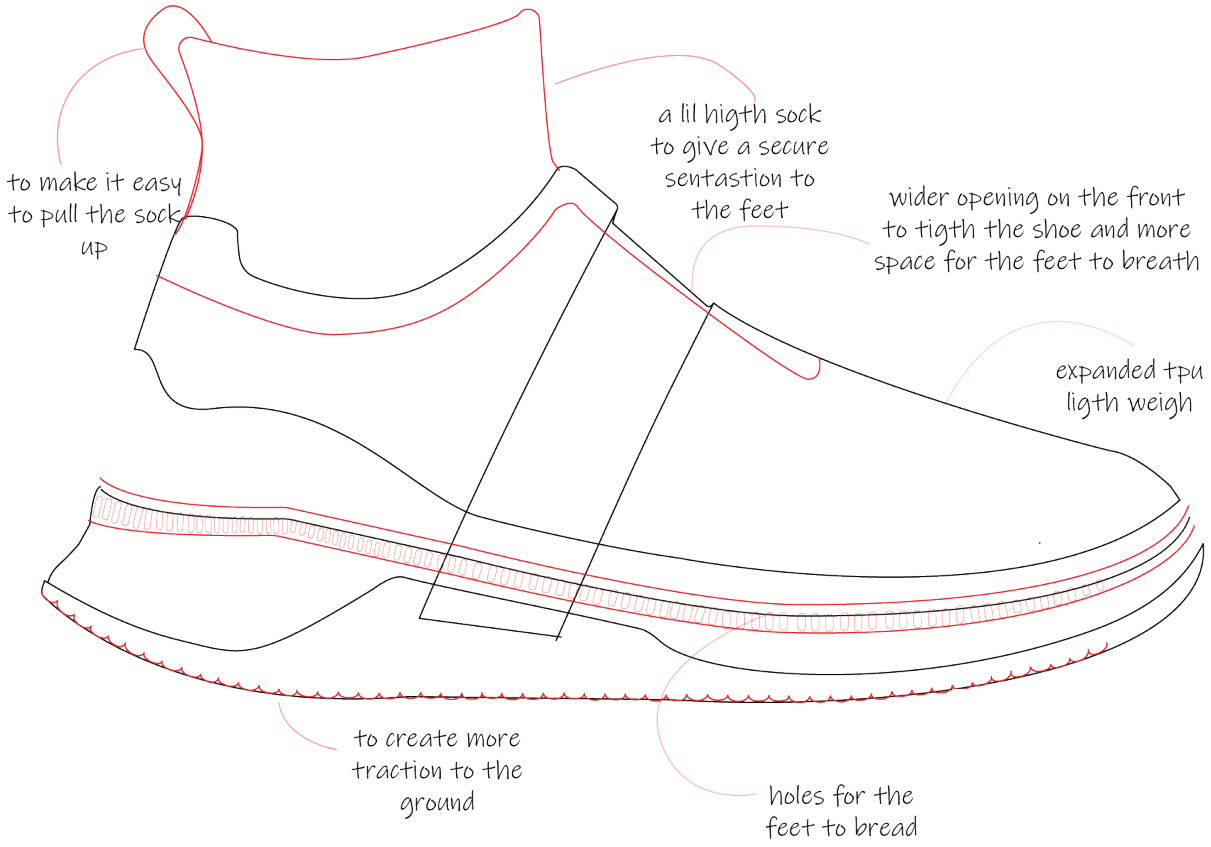


image 24. Sketch 04 with notes

image 25. sketch perspective 01

image 26. sketch perspective 02

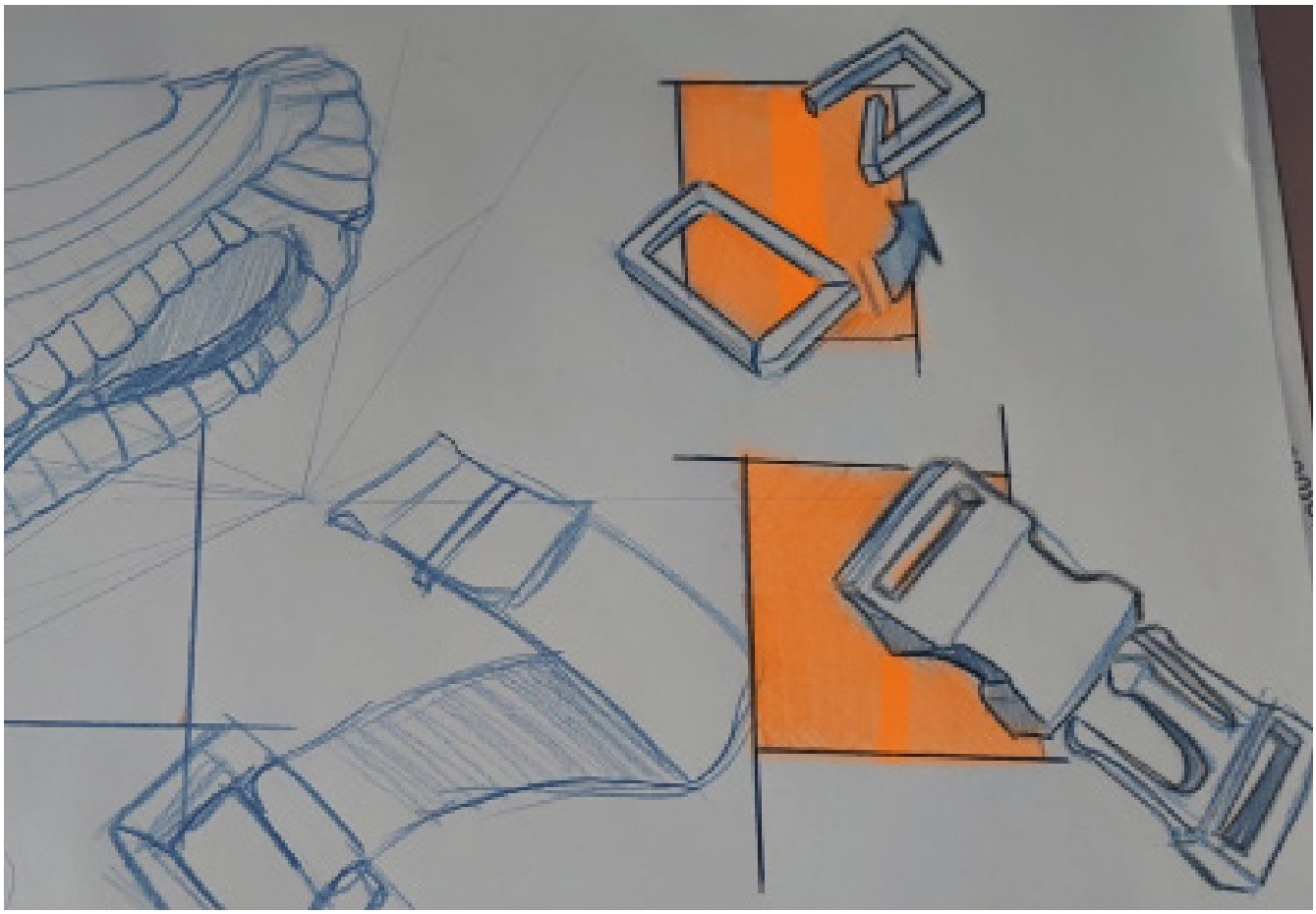


image 27. sketch details

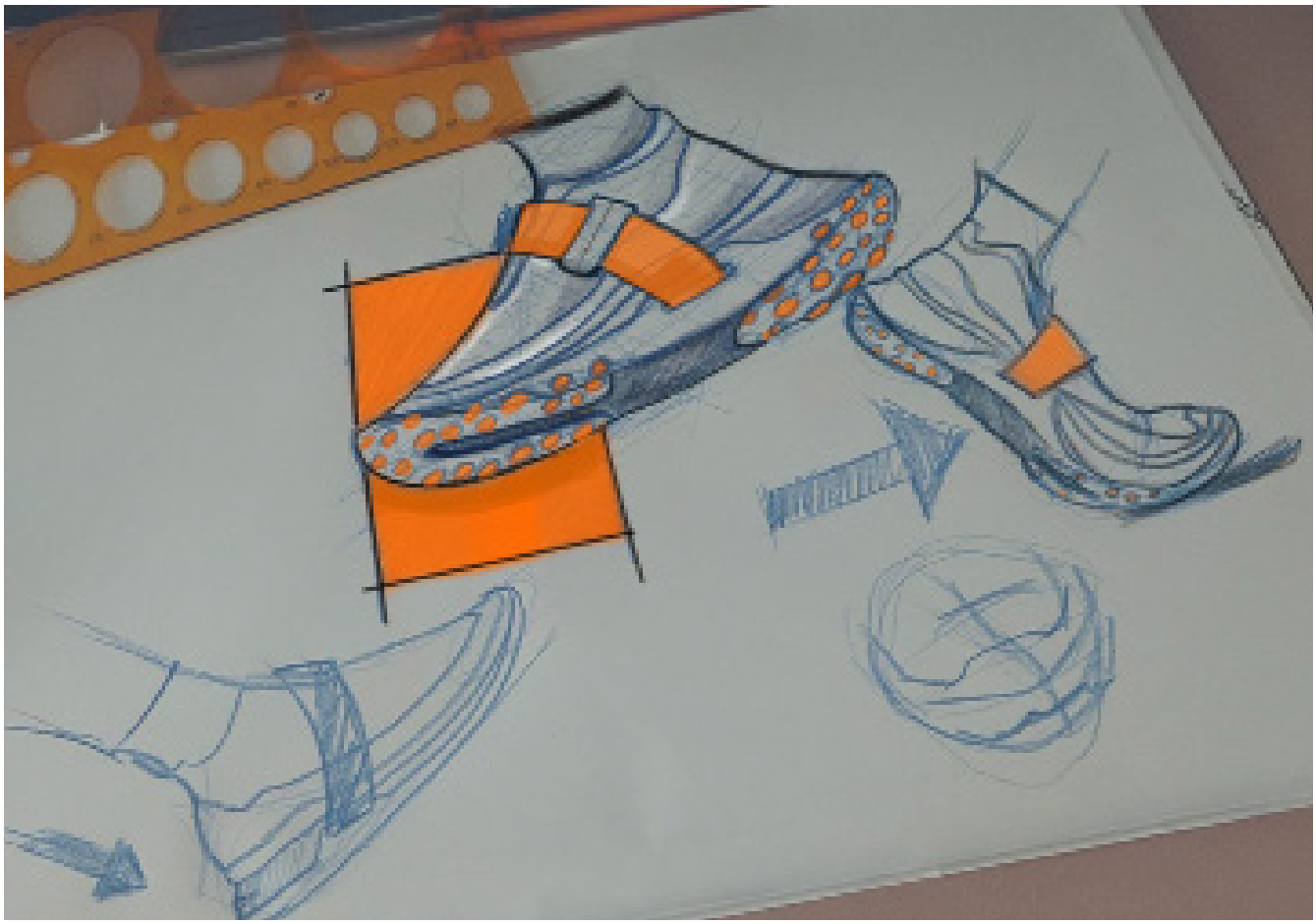


image 28. sketch perspective 03

4.5.6 Smart Material Choices

In the pursuit of sustainable and innovative footwear design, the materials' selection has become a pivotal consideration.

In this dynamic world of footwear design, the selection of materials is driven by the quest for comfort, durability, and recyclability.

Given this and after some research and further considerations, we decided on the following materials: Compact thermoplastic polyurethane (TPU), expanded TPU, and bamboo tissue

These materials offer unique opportunities for revolutionizing the way we craft footwear that aligns with the modern, current demand for more sustainable products.

Starting with TPU, it emerges as a versatile and impactful material. Its attributes lend themselves to various aspects of being desirable when it comes to footwear creation.

TPU has remarkable adaptability under varying temperatures, which makes him a prime candidate when it comes to crafting diverse components, from midsoles to rugged outsoles.

Moreover, it is also a resilient material that can resist abrasion and has high tensile strength, which brings durability to the product, ensuring longevity and performance. Alongside the durability, it is also a very responsive material when it comes to comfort, with inherent elasticity contributing to a good walking and running experience since it can provide support and responsive cushioning. And last but not least, a key feature of TPU is its sustainability spectrum, since it aligns with circular practices as the material can be recycled and reused.

Bamboo tissue, on the other hand, presents a refreshing perspective by offering distinct advantages in its application. This material takes a progressive stance towards sustainability, primarily owing to its rapid growth rate and minimal resource requirements, positioning it as an ecologically conscious alternative to traditional materials. Furthermore, bamboo tissue boasts exceptional breathability, effectively mitigating moisture accumulation and enhancing overall wearer comfort.

One of its noteworthy attributes is its innate antibacterial properties, which play a pivotal role in eliminating odours and maintaining a hygienic environment within the product. The material's inherent softness, characterized by its velvety texture, provides an additional layer of comfort and luxury. Collectively, these attributes make bamboo tissue an enticing option for applications in the domain of innovative product design.

image 29. TPU

image 30. Bamboo

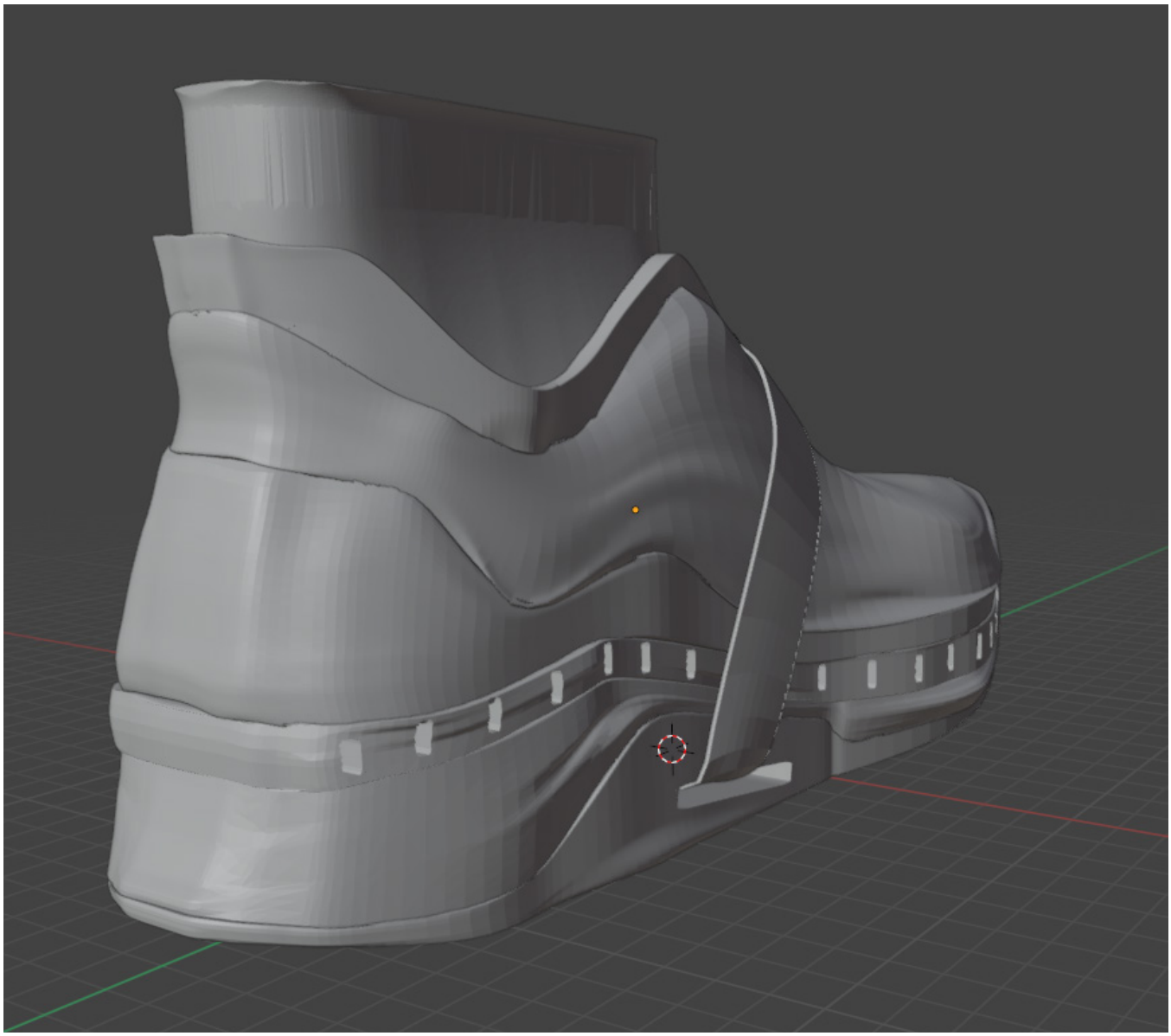


image 31. 3d model in blender perspective

5.5.7 3D model

The transition from a conceptual sketch into a tangible product was transformative in the development of this case study.

The creation of the 3D model of the product provides a comprehensive understanding of the physical product appearance, potential in-store display, and its feasibility for prototyping and printing.

Crafting a 3D representation of the envisioned product serves as a foundation, facilitating a comprehensive assessment of proportions.

Relying on redefined sketches of a side view and the sole of the products as well as a form in the program Blender, we start to give shape to the product.

image 32 . 3d model in blender side view

image 33 . 3d model in blender top view

image 34. prototype side view

4.5.8 Rapid Prototyping

In this phase of the process, we begin to translate the conceptualized design into a tangible reality. Rapid prototyping serves as the bridge that connects our 3D model with a physical representation of our envisioned product. It plays a vital role in validating our product concept's feasibility and refining the intricate details that make our footwear functional and aesthetically pleasing. This phase allows us to identify areas for improvement, enabling us to refine the design further. To achieve this, we utilize 3D printing and select materials.

After some analysis, we determined that it would be more beneficial to incorporate inclined spaced holes and refine specific areas of the model to achieve a more polished appearance. This adjustment would enhance the overall aesthetic of the design.

image 35. prototype back view

image 36. prototype prespective

4.6 Release

As we reach the final stage of the product journey, we embark on the release phase.

This phase represents the culmination of our extensive efforts in the design of the final product, where our footwear concept takes place in the world and market, ready to make an impact that extends far beyond functionality.

4.6.1 Product Journey

We initiate this phase with the creation of a product journey map. This map provides a visual representation and narrative of the product's life cycle, from its creation until its eventual disposal. The map serves as a dynamic tool for communicating the product's circularity and sustainability features to stakeholders, customers, and partners.

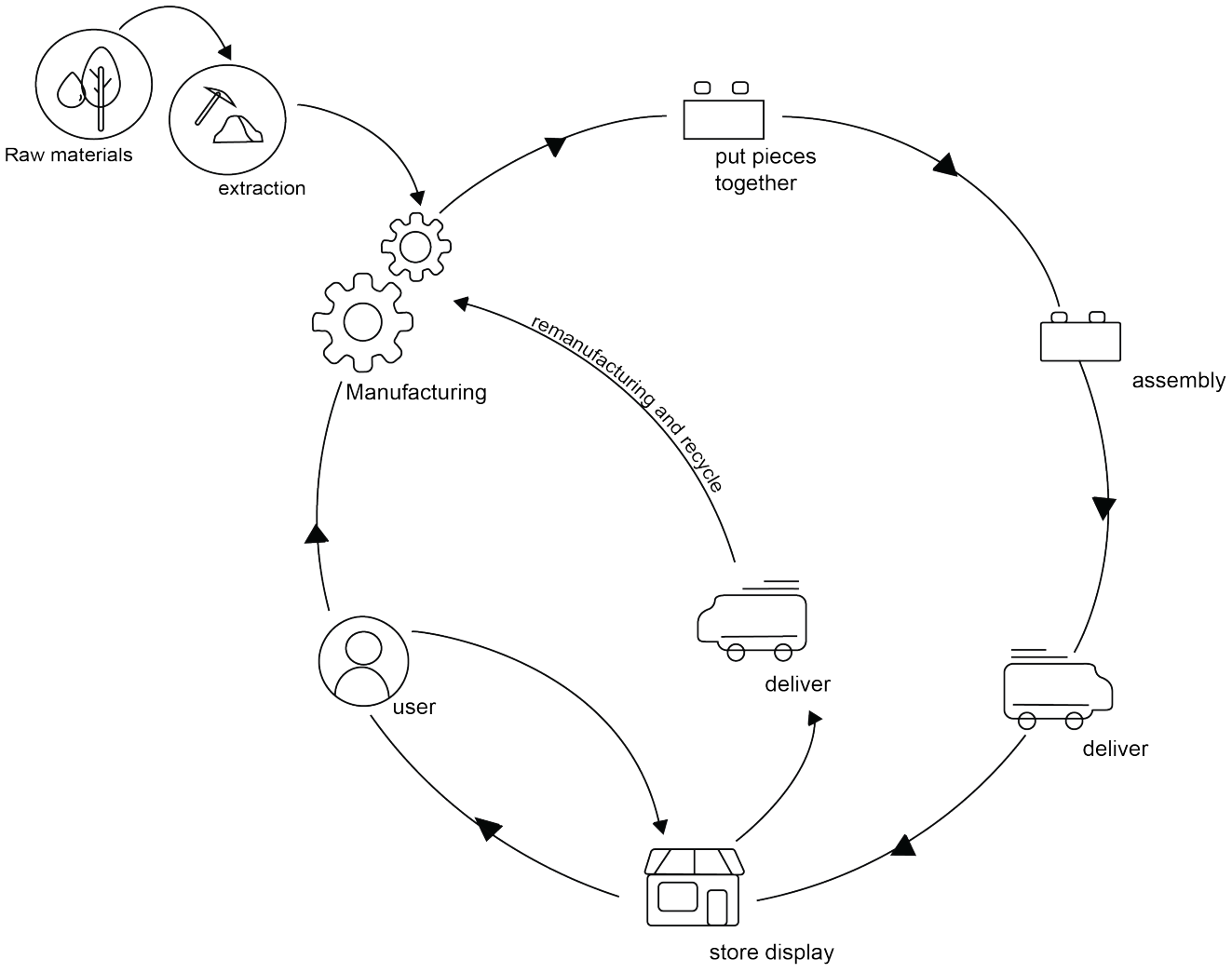


image 37. Product journey map

4.6.2 Imagining New Partnerships

Collaboration remains at the centre of our project. In this phase, we explore and imagine new possible partnerships with retailers who share our product commitment to sustainability. These partnerships extend our research and ensure that the product aligns with evolving market demands and sustainable practices.

Within this collaborative framework, we envision the establishment and the partnership being centred on the creation of a platform for the display of the product, showcasing some of its inherent circularity.

This display would also serve as a means to introduce circular principles to consumers and accentuate their circular attributes, fostering environmental consciousness among potential buyers.

Furthermore, this partnership with the retailers would extend beyond the presentation of the product by introducing a recent return policy. Under this policy, customers are incentivized to return the modular parts of our product once they reach the end of their life cycle. In return, the customers receive a discount on their subsequent purchase, thus reinforcing the concept of circularity within the product. This approach not only promotes sustainable consumption b, but also actively engages our customer base in the principles of circular practices. With this, we can conclude that through these collaborations, we will facilitate product visibility and educate consumers about circular practices, fostering a sustainable ecosystem that extends beyond the immediate product lifecycle.

4.6.3 Product

Finally, the release phase and the final product in question This phase culminates with the unveiling of our final product and represents the embodiment of the vision, design and prototyping refinement.

Our footwear is more than a mere accessory. It is a statement of responsible design and commitment to a more sustainable product.

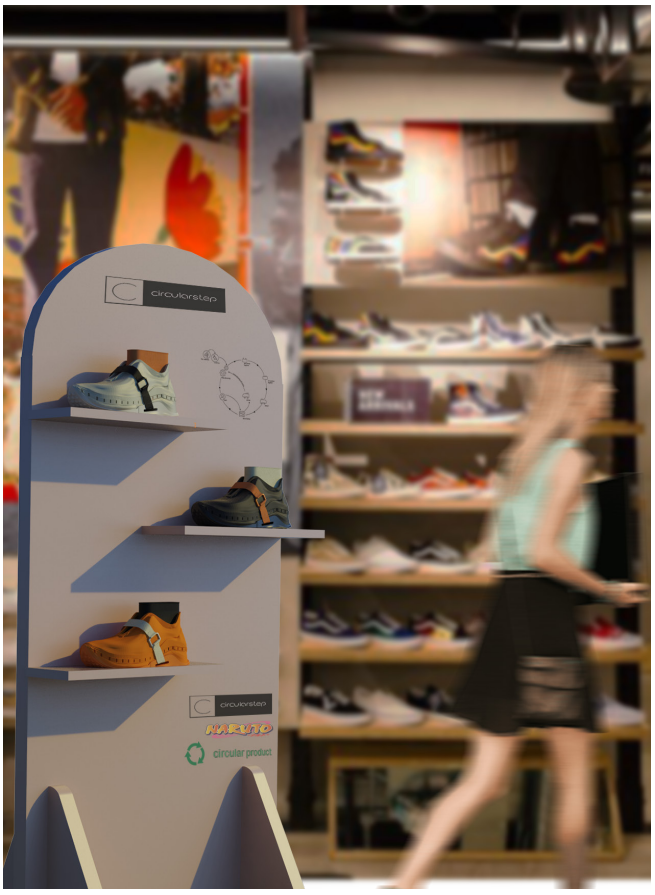


image 38. store display

“Our footwear is more than a mere accessory, it is a statement of responsable design and enviroment to a more sustanable product””

image 39. circularstep

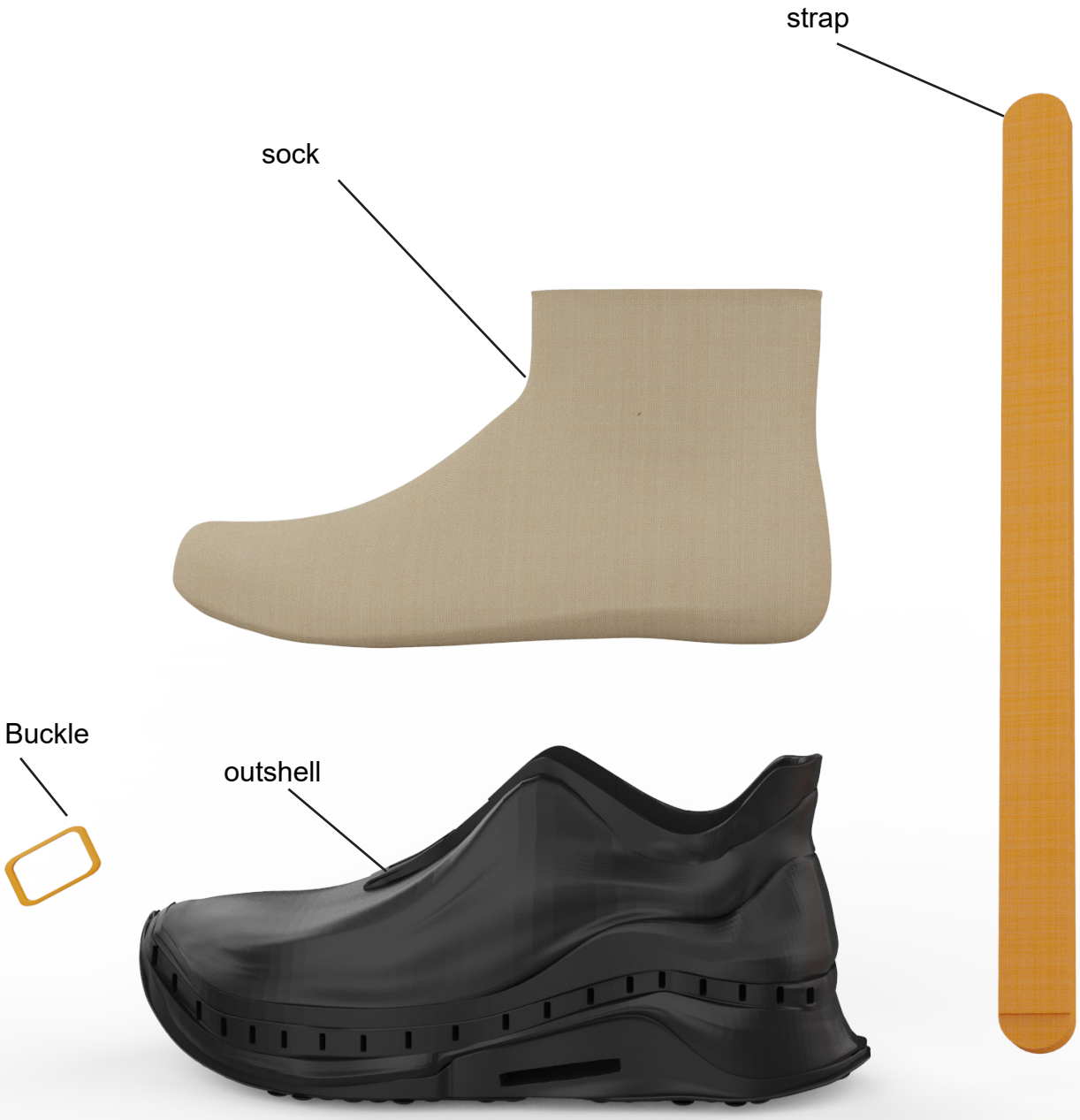


image 40. circularstep parts

Costumizable:
Personalize your style with a range of design options.

Confortable:
Enjoy all-day comfort with cushioned support.

Innovative:
Incorporates cutting-edge technology for enhanced performance.

Durable:
Designed for long-lasting wear, reducing the need for frequent replacements.

Breathable:
Keep your feet fresh and comfortable all day.

Sustanable:
Made with eco-friendly materials and circular design principles.

Versatile:
Ideal for both casual and active wear.

Lightweight:
Experience a feather-light feel for effortless movement.

image 41. circularstep chacateristics

image 42. circularstep possible combinations

image 43. person wearing Circularstep

image 44. store return policy

05
Conclusion

5. Conclusion

5.1 Summary of key findings and outcomes from the project

At the end of this journey through the entire process of product development, we arrive at the culmination chapter of the project, named Circularstep. This serves as a reflection on the discoveries, and outcomes that have unfolded along the course of this product development.

Throughout this project, we delved into the intersection of sustainable footwear design within circular principles, catering to individuals in their mid-20s and mid-30s. Our research through the development of Circularstep was guided by our commitment to address the sustainability challenges plaguing the footwear industry and our determination to integrate circular design into the product development process.

The key findings and outcomes of the project can be the result of the following:

Circularity is a driving force.

Circularstep has highlighted the significance of circularity as a driving force for change in footwear. By reimagining product life cycles, minimizing waste, and embracing sustainable practices, we can position circular design as a pivotal point for the industry's. This project sheds light on the unique challenges and opportunities present by integrating circular design principles, recognizing the potential to embrace it and contribute to circular initiatives in the local industry.

Collaboration and Partnerships

Collaboration has emerged as we developed Circularstep. Our vision partnerships with retailers, in particular, holds the promise of fostering circular ecosystems and educating consumers regarding circular practices. From conceptualization to 3D modelling, rapid prototyping, and eventual release, Circularstep represents our vision of what a circular sustainability is.

In conclusion or project envisions a more sustainable way of navigating trough footwear design. We align our efforts with circular design and fosters collaboration to drive positive change.

5.2 Reflection on the potential impact of the project in the footwear industry

As we bring this project to its final conclusion, it is imperative to cast our gaze forward and consider the potential impact of our product in the broader context of the footwear industry. This reflective analysis provides insight into the potential changes our project could bring to this dynamic sector.

As an embodiment of circular design within the sector, Circularstep showcases that sustainable footwear can seamlessly blend style, comfort, and innovation.

We developed this project with an emphasis on circular design, aiming for it to serves as a catalyst for change within the footwear design, offering a blueprint for manufacturers and designers to embark on the journey towards circularity.

Circularstep extends beyond being a product, and serves as an educational tool for the consumer. Through our incentivized return policy, we aspire to raise awareness about product longevity and responsible consumption. This engagement with consumers holds the potential to initiate a paradigm shift in how individuals perceive and interact with footwear.

Furthermore, our project envisions a future where collaborative ecosystems thrive. Partnerships with retailers and industry stakeholders, as we envision, could create a network of sustainability advocates, fostering a sense of shared responsibility for neutering circularity.

Circularstep showcases that circular design, and sustainability are not mutually exclusive, but rather intertwined elements that can drive success in an evolving market.

In conclusion, the potential impact of Circularstep is multifaceted, extending from redefining sustainability standards to acting as a catalyst for transformative change, educating consumers, fostering collaborative ecosystems, and serving as a blueprint for adopting circular practices. As we close this chapter of our project, we hope for a new era of sustainable footwear design.

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Glossary

Glossary

3D models
A construct used to portray an object in three dimensions. In GIS, 3D models are often referred to as 3D feature;.

ABS (Acrylonitrile Butadiene Styrene)
A common thermoplastic material known for its strength, impact resistance, and versatility. ABS is used in a wide range of consumer products, including some shoe components.;

Biodegradability
The ability of materials to decompose naturally overtime, typically without causing environmental harm;

Box Construction
A shoe assembly approach that involves creating a one-piece upper and sole, making material separation challenging.

Business Model Canvas
A strategic management and entrepreneurial tool used to outline key components of a business model;

Butterfly Diagram
A graphical representation of the circular model's elements, illustrating loops that extend the life of materials and products, including reuse, refurbishing, remanufacturing, and recycling.

Carbon Footprint
The total amount of greenhouse gases, particularly carbon dioxide, emitted directed or indirectly by product, organization, or individual;

Cemented Construction
A common footwear manufacturing method that uses adhesive to join materials together, making disassembly for recycling difficult;.

Circular Design
A design approach focused on creating products with extended lifecycles, minimal environment impact, and sustainable resource use;

Circular Economy
An economic model aimed st reducing waste and promoting the reuse, remanufacturing and recycling of products and materials;

Combination-Lasting
A construction method that combines multiple techniques, typically complicating the recycling or repurposing process.

Consumer Journey Map
A visual representation of the steps and touchpoints a consumer goes through when interacting with a product or brand.;

Design Thinking
A problem-solving and creative process that emphasizes empathy, ideation and prototyping in order to develop innovative and user-centric solutions;

Disposable Income
The money available for spending or saving after all essential expenses have been covered;

Environmental Footprint
The impact of an industry or product on the environment, typically measured in terms of resource consumption, emissions, and waste generation;

Fast Fashion
A business model characterized by the rapid production of inexpensive, trendy clothing and accessories, often resulting in short product lifecycles and high levels of waste;

Feedback Loops
Mechanisms that allow for the exchange of information and insights among stakeholders to improve the design and sustainability of products;

Greenhouse Gas Emissions
Gases that trap heat in the Earth's atmosphere, contributing to climate change;

Linear Design Model
A traditional approach to product design and manufacturing in which products are created from raw materials, and once they are no longer useful, the materials are considered waste;

Mind Map
A visual representation that organizes information, ideas, and concepts, often in a hierarchical or interconnected structure, to aid in brainstorming and problem-solving;

Moodboars
a board covered with pictures from magazines, pieces of material, etc. that shows the colours and styles to be used when decorating a room, planning a wedding, etc.; a file on a computer that shows similar information

Overconsumption
The excessive purchase and disposal of products, often driven by fast-fashion trends and short product lifecycles.

PA (Polyamide)
A strong and durable polymer commonly known as nylon. Nylon is used in various applications, including some types of shoe fabrics and components.

PE (Polyethylene)
A widely used plastic material known for its low cost and versatility. PE comes in various forms, including low-density (LDPE) and high-density (HDPE) variants. While not commonly used in shoe components, it is used in various other products.

POM (Polyoxymethylene)
A high-strength engineering plastic with excellent wear resistance. POM is used in some shoe components, such as eyelets or buckles.

PPH (Polypropylene)
A thermoplastic polymer known for its chemical resistance and relatively low density. Polypropylene is used in various applications, including some shoe components.

Prototypes
Early, often simplified versions of a product or system that are created for testing and refinement;

PS (Polystyrene)
A versatile, lightweight, and rigid plastic material often used in applications that do not require high impact resistance. While commonly used in packaging, it may not be the best choice for shoe components.

PVC (Polyvinyl Chloride)
A widely used plastic material known for its durability and versatility. PVC can be rigid or flexible, making it suitable for various applications, but it is important to consider its environmental impact, as it is not always considered a sustainable choice;

Rapid Prototyping
a process used to build a physical model from a computer drawing by creating layers of the shape and joining them together;

Recallability
The ability to recall and repurpose materials from disassembled products for use in other applications or products.

Refurbishing
The process of restoring a product to like-new condition for resale;

Remanufacturing
Disassembling a product to reuse its parts in the manufacturing of new products;

Resource Efficiency
Maximizing the use of resources while minimizing waste in a sustainable manner.

Scalable Solutions:
Solutions that have the potential to grow and adapt as the product or process evolves, ensuring long-term sustainability and circularity;

SEBS (Styrene Ethylene Butylene Styrene)
A type of thermoplastic elastomer typically used in products that require flexibility, such as shoe soles and grips. SEBS is known for its resilience and weather resistance;

Slip-Lasting
A shoe manufacturing process in which the upper is pulled over the last (shoe form) and stitched to the sole, creating difficulties in separating materials;

Systemic Approach
An approach that considers the entire system, including all components and their interactions, when addressing a problem or designing a solution;

Systemic Mindset
A mindset that considers the interconnections and interdependencies within a complex system when addressing challenges or pursuing innovations;

Strobel Construction
A shoe assembly technique that involves stitching the upper to the insole, often making disassembly complex;

Supply Chain Integration
Consider how these partners fit into your product's supply chain. Efficient supply chain integration ensures smooth operations and minimal disruptions in the development process;

Supply Chain Resilience
The ability of a supply chain to withstand disruptions and maintain operational continuity;

Sustainable Fashion
The fashion industry's focus on producing clothing and accessories in an environmentally friendly and ethical manner;

Take-Back System
A system that facilitates the collection of used products and their return to the manufacturer for proper material separation, recycling, or refurbishment;

Technical Cycle
The process of designing, developing, and maintaining a product from a technical perspective, considering its entire lifecycle;

TPU (Thermoplastic Polyurethane)
A flexible and durable plastic material, often used in products requiring both elasticity and toughness. TPU is known for its abrasion resistance, making it suitable for applications like shoe soles;

TPR (Thermoplastic Rubber)
A type of rubber-like plastic material that combines the properties of plastic and rubber. TPR is commonly used for shoe soles, as it provides a good balance of flexibility and durability;

Vulcanization
A process used to strengthen rubber and other materials, making them durable but challenging to recycle;