

PORTFOLIO

Bsc Industrial Design Engineering
Msc Integrated Product Design

Dirk Lagemaat

dirkclagemaat@gmail.com

+31628605684

www.linkedin.com/in/dirk-lagemaat-66445b1a6

Dirk Lagemaat

Curriculum vitae

Vision

As a young designer, I discovered early in the bachelor of Industrial Design Engineering that I like to look at the bigger picture behind developments in our society.

With this broader perspective, I find it easy to come up with solutions that are best for as many people as possible. The reason why I use this approach is because I like helping others with my problem-solving skills. Definitely in an era where we as designers are supposed to take care of others on a sustainable way. I believe that as a designer, you should not only be able to come up with an idea. Meaning that I am able to not only designing products/services/systems, but also actually understand how to produce or program them, and how to successfully launch products to the market. Therefore, my skills are not limited to designing, and I can distinguish myself by fitting all sorts of projects and teams compared to average industrial design engineering graduates from the TU Delft.



Dirk Lagemaat

Product Design Engineer

MSc Integrated Product Design graduate from TU Delft with a strong foundation in industrial design, human-centred innovation, product development, system thinking, CAD modeling, prototyping, dynamic teamwork, and scientific research. Experienced in translating complex technical challenges into user-centered products, services, and systems. Combining engineering-oriented product development with entrepreneurship, innovation strategy, and stakeholder management.

Technical Skills

Rhino, Solidworks, Python, SwiftUI, Fusion360, SPSS, Adobe Creative Cloud, Microsoft Office, Blender, Cura, Figma, Raspberry Pi

Organisatory Skills

Design project management, multidisciplinary collaboration, holistic problem solving, analytical, data accuracy and processing, quick learning, iterative planning

Social Skills

Stakeholder management, co-creation, dynamic teamwork, user empathy

Languages

Dutch	
English	
German	
French	

Personal information

Nationality: Dutch
Location: Rotterdam, Nederland
Email: dirkrlagemaat@gmail.com
Phone: +31628605684
Portfolio:
Driver's licence: AM

Hobby's

Crafting, concerts, theatre, golf, soccer, cooking, reading

Education

(2023-2026) Msc Integrated Product Design, TU Delft
(2019-2023) Bsc Industrial Design Engineering, TU Delft
(2013-2019) VWO NT/NG Openbaar Lyceum 'De Amersfoortse Berg'

Experiences

(2026) Expert Panel, EpilepsieNL
Analysing and evaluating scientific epilepsy-related research proposals to be funded by EpilepsieNL for future research.

(2026) Expert Panel, BRAINS
Analysing and evaluating scientific research proposals related to the blood-brain barrier, neurotechnology and human-relevant brain models to be funded by the brain foundation called 'Hersenstichting' for future research.

(2025-2026) Application Developer
Developing, maintaining, and providing a wearable-connected epilepsy monitoring application for a scientific research study starting in January 2027 and executed by SEIN and EpilepsieNL, to collect data for epileptic trigger identification and seizure prediction.

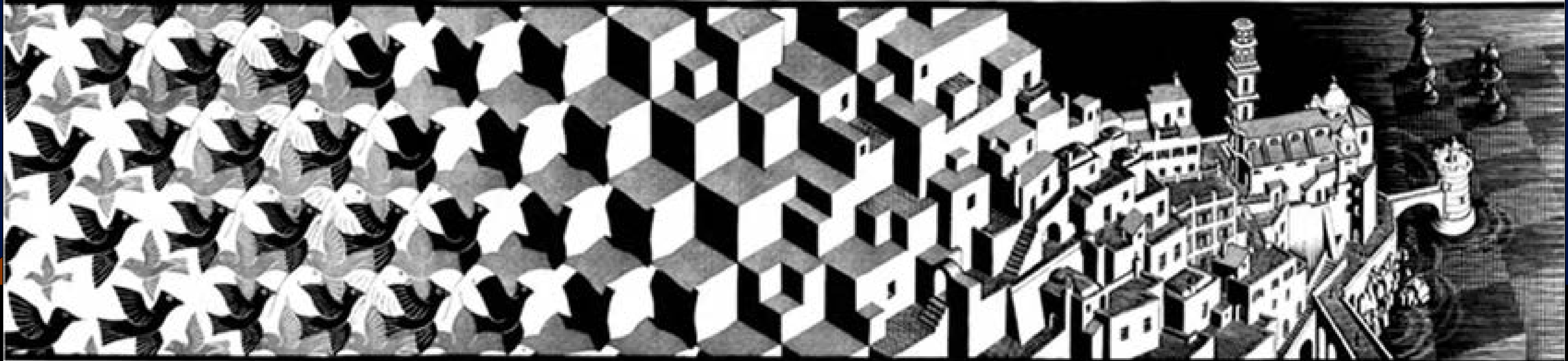
(2025) Landscape Management, Blooming Buildings
Managed a pre-designed ecological environment of the Groothandelsgebouw in Rotterdam.

(2023-2025) Event Hospitality and Catering
Employed via various agencies including AenF, Stella, and Staffyou.

(2022-2023) Sales Associate, Young Talent House
Connected companies with student talent, developed commercial communication skills, stakeholder management, and business development experience.

(2020) Host and Administrative Assistant, GGD
Handled administrative and organisational tasks at a vaccination centre during the COVID-19 epidemic.

(2019) Logistic Assistant, Pon Dealership
Supported logistics operations and inventory processes in a professional automotive environment.



Ambition

What I liked about my education is the variety of the different topics and projects during the courses and the different assignments. The design projects differed and there was a lot of cooperation with dynamic teams. In the future I would like to engage in various design projects where I can attribute to projects by working together with other types of engineers and designers. Also, I am eager to extend my knowledge into more diverse niches. For instance, during some projects, my team needed to design an interface. Personally, I think it is irresponsible to design anything without the knowledge of how to actually program/produce it, and therefore, I've introduced myself to Python, SwiftUI, and took some courses at

the Computer Science faculty. This provided enough knowledge to design and create a working application for my thesis project.

As a designer, I have a holistic approach. I like being involved in the whole process of designing a product/service/system. When starting a project, I am able to instantly see opportunities or problems which can be solved using out-of-the-box thinking. I believe problem-solving is my best quality, as I am dedicated to fix problems and think ahead of others.

For instance, epilepsy is characterised by unpredictable seizures, and not knowing what triggers seizures. With my thesis project, I've enabled the creation of a personalised dataset, allowing physiological data analysis, trigger

identification and provided all data required to train personalised predictive ML models for a patient's seizures, and also generate preventive warnings to counter-act seizures before they occur. I've enabled and provided all required data for clinicians and patients for a more effective, personal treatment, which was not possible before. This value has been recognised and a scientific research has been announced to test my application for a year with 50 patients, starting in January 2027.

Also, during my final bachelor project, I had the ambition to come up with something bigger than the provided assignment. The assignment was to come up with a design to 3D print from 1-2% of the recycled plastic waste that a hospital in Leeuwarden produced. When I heard that, I instantly thought to myself: "But

what happens to the rest of the plastic waste?" and "Is there a way to recycle more than 2%?" This has led to a design for a foundation that could collect, clean, recycle and reproduce all contaminated plastic waste of hospitals in the Netherlands, while being 100% eco-friendly and actually making a profit.

With these type of approaches, I start designing products, services and systems nobody thought of.

I am looking for a company which shares this innovative drive, is active in various types of projects and allows personal growth as a designer.

Graduation Project



A wearable-connected iOS app to detect personal triggers, and to predict and prevent seizures through synchronised physiological and contextual data.

During my graduation project, I wanted to tackle a problem that extends beyond current seizure detecting wearables; to identify patterns preceding a seizure. Current patient treatment lacks relevant data to provide any personal insights into a patient’s individual diagnosis. This motivated me to explore how subjective experiences and objective physiological measurements could be linked in a clinically meaningful way.

While wearable devices are increasingly capable of measuring physiological changes related to epilepsy, they still struggle to explain why these changes occur. Important contextual information, such as stress, sleep, activities or environmental triggers, often remains separated from the physiological data. The identified gap indicates no method to continuously collect and synchronise subjective/physiological data in a real-life remote context exists yet.

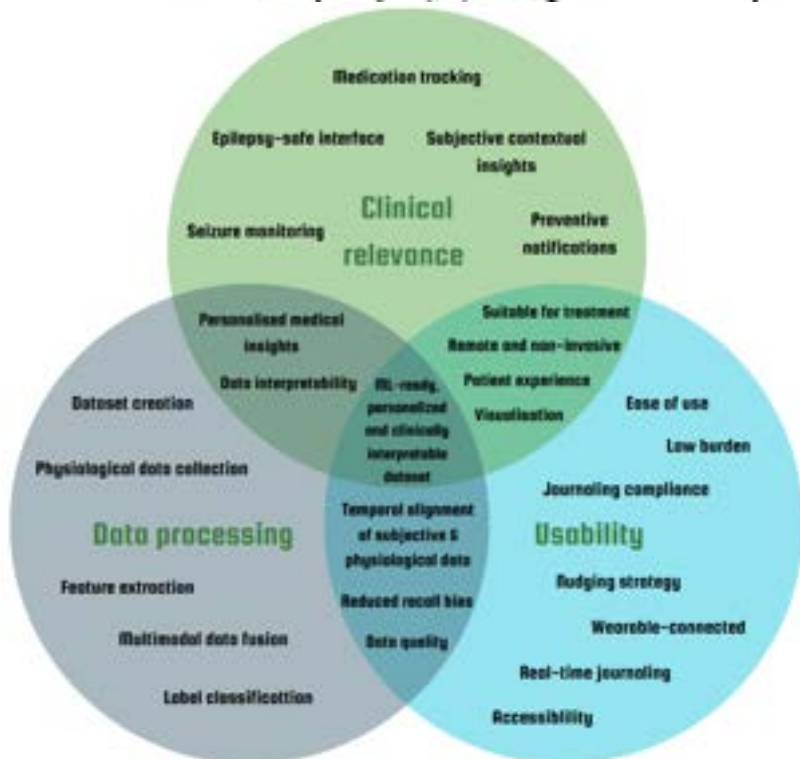


- Incomplete and biased self-reports
- No physiological data
- Generalised approach & lack of insight into individual triggers
- Ineffective seizure prevention
- Unable to anticipate the next seizure



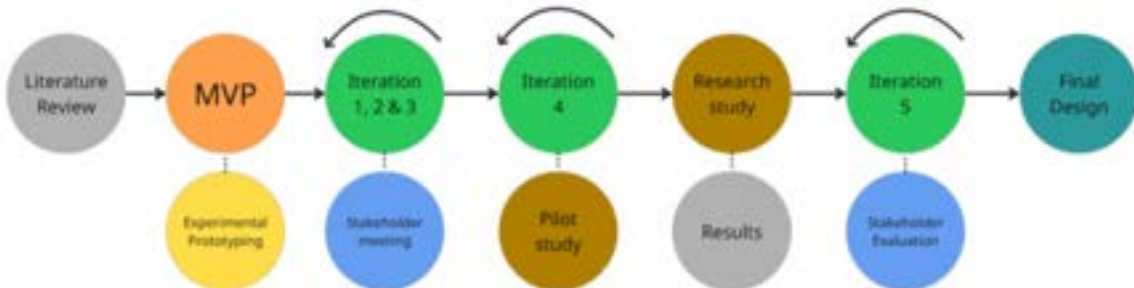
Design Context

This project extends beyond a normal IPD graduation project, by not only designing the application’s interface, but actually developing the whole working product using Xcode and SwiftUI. It also required clinical knowledge and expertise to ensure that all relevant types of collected data were properly managed and processed, while designing a usable, epilepsy safe interface for all stakeholders.



Design Approach

Current epilepsy technologies mainly focus on detecting seizures after they occur. However, future forecasting models require large datasets that link physiological signals to contextual information from daily life.



The planning included an iterative design process using literature research, stakeholder meetings, consultations with clinicians, and a pilot & research study.

The challenge related to the research study:
~ *How can we efficiently collect the most meaningful contextual data while keeping the burden of different types of nudges for users low enough to support long-term usage?*

The results of the study resulted in a personalised nudging strategy where users can select reminders which fit their own daily lifestyle.



System Design

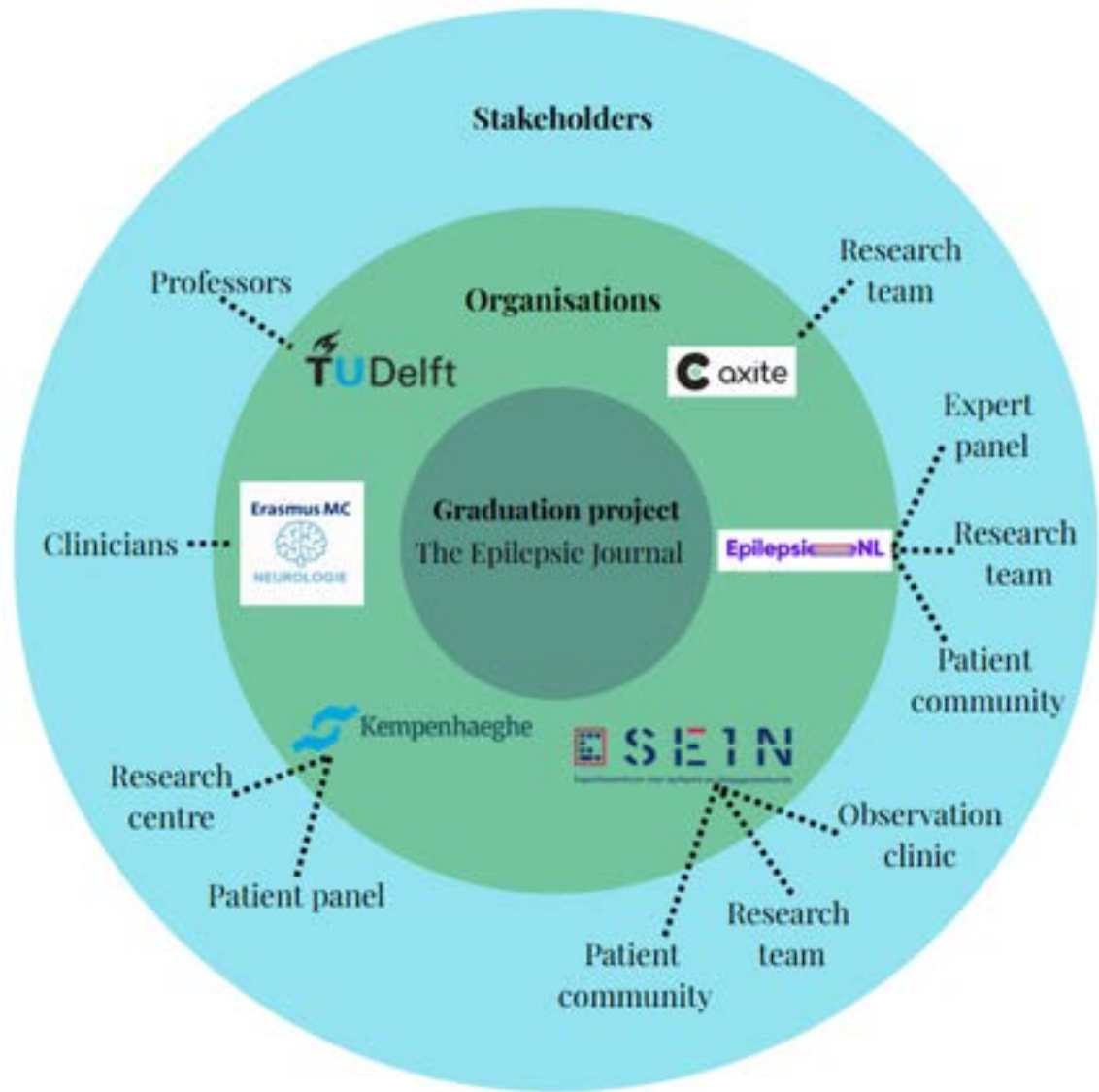
Rather than designing a single interface, I approached the challenge as a complete data collection ecosystem.

The result is a mobile application connected to an Apple Watch that combines:

- Physiological measurements and analysis
- Contextual journaling
- Medication tracking
- Timeline visualisation
- Personal insights & reminders
- Data export for clinical analysis
- Creation of a personalised medical dataset



The application allows users to log events using time-based registrations in multiple ways. This flexibility enables users to accurately capture situations without interrupting user’s daily lifestyle.

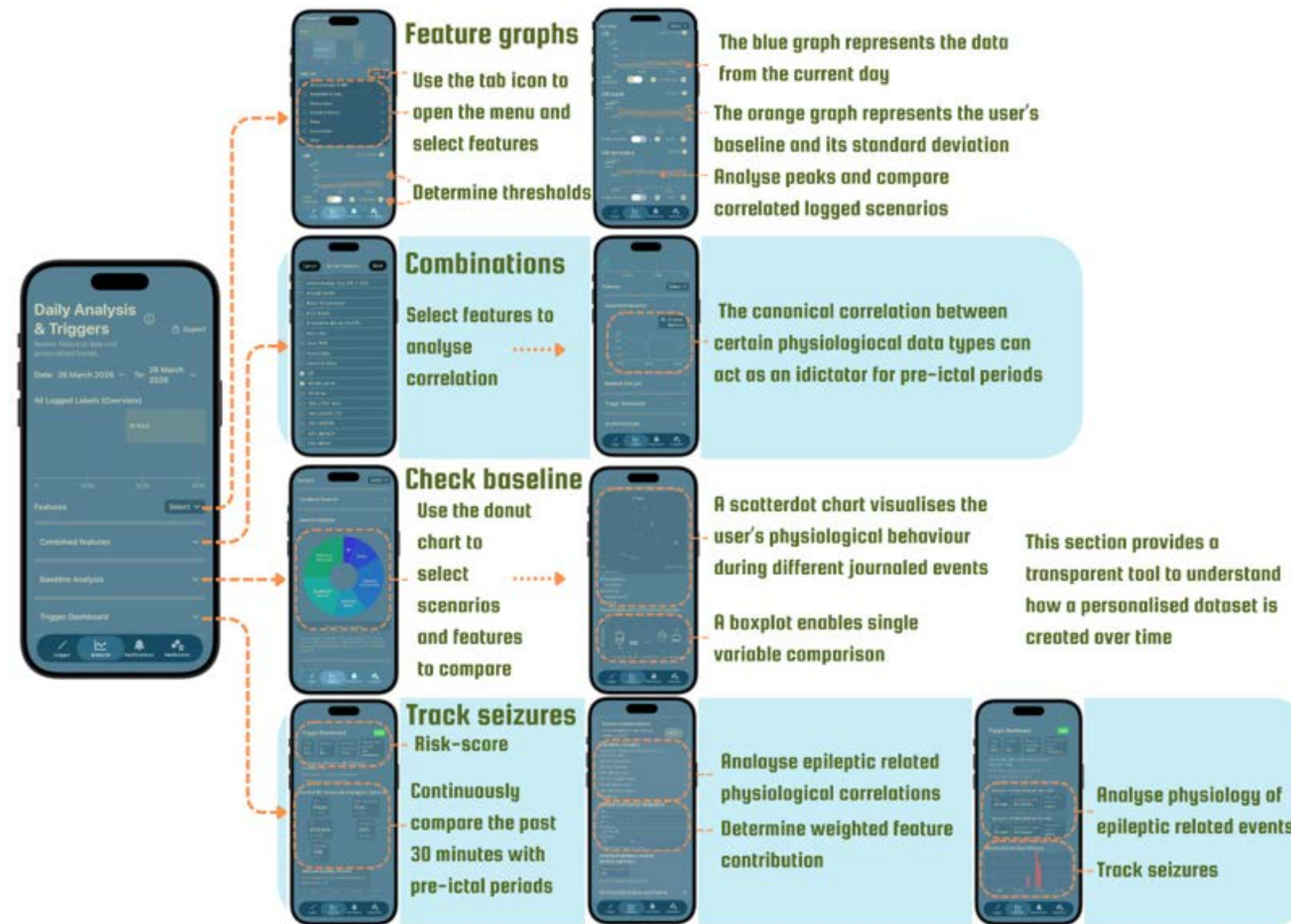


Stakeholders

Throughout the project, multiple stakeholders were involved to identify their needs and validate both the clinical relevance and usability of the system. Meetings and collaborations were conducted with epilepsy patients, clinicians, neurologists, researchers from SEIN, expert panels, the AXITE research team, and a machine learning researcher from TU Delft. Their insights contributed to the development of the journaling system, wearable integration, nudging strategies and future implementation possibilities for seizure forecasting research and personalised epilepsy treatment.

Analysis page

A specific page of the application which I want to highlight is the analysis page, where all collected types of physiological data and scenarios of a patient can be analysed using graphs, (canonical) correlations, 3D scatterplots, boxplots, and a mock-up version of a logistic regression model to calculate a seizure-risk score based on an individual patient's historical data.



Medication page

To be able to track medication usage of patients more accurately, patients can now register different types of medication, doses, and half-life cycles. An effect graph and 14 day bar chart of the taken medication is provided for a more clear overview for both clinicians and patients. A reminder can be selected when a medication's dose is beneath a certain level



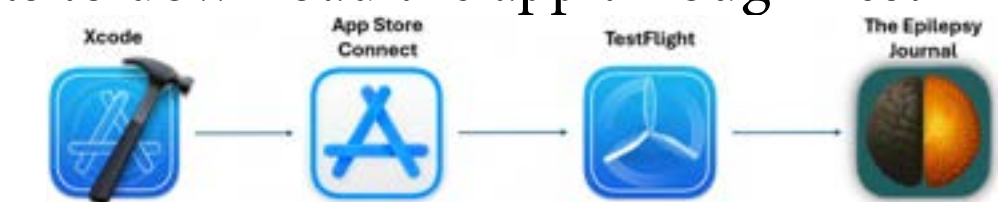
Nudging strategies

To be able to nudge users to journal relevant scenarios throughout their day, multiple types of reminders have been created. At fixed times, after a period of inactivity, or when a preplanned activity of a user's calender app has ended. More advanced personalised options are warnings after a specific (predetermined) threshold value of a physiological type of data has been crossed, or when a physiological type of data is behaving irregular, meaning that the value has crossed the standard deviation of a patient's baseline. Lastly, users can get a reminder when the medication dose has dropped below a certain level.



Distribution

The code of the application is programmed in Xcode, using SwiftUI, and to share and test the application with participants, an Apple developer account enables uploading an application to App Store Connect, which then allows participants to download the app through TestFlight.



Frontend & backend

Designing for epilepsy patients introduced constraints that went beyond standard usability principles. High-contrast transitions, flickering elements, and rapid colour changes were systematically avoided throughout the interface. The app runs in forced dark mode with smooth, fading transitions between screens to minimise photosensitive risk. On the technical side, the application continuously streams Apple Watch health data through HealthKit at 30-second intervals, locally buffering and timestamping all physiological measurements. This precision was essential: aligning subjective journal entries with objective physiological data required exact temporal synchronisation, so that a logged label and the corresponding wearable data could be linked to the same 30-second window for future ML model training. All data is safely stored on the user’s phone and exportable as a structured CSV file, formatted specifically for clinical analysis and machine learning preprocessing.

Study

To evaluate which nudging strategy best supports long-term journaling behaviour, a within-subjects study was conducted with seven participants over three consecutive conditions: fixed-time reminders, inactivity-based reminders, and personalised time-slot reminders. Each condition ran for three days, measuring the number of journaled labels, total time coverage, and response latency after a nudge. While no statistically significant differences were found, expected given the small sample size and high inter-individual differences, the effect sizes were medium to large, particularly for personalised nudges, which consistently produced the fastest response times. These findings were sufficient to inform a design direction: a hybrid personalised nudging strategy in which users select their own preferred reminder moments became the recommended approach for the follow-up study.

Constraints

One of the most significant design decisions was how to handle the risk-scoring algorithm on the analysis page. While the application includes a mock-up of a logistic regression model comparing a user’s recent physiological data to their pre-ictal baseline, it is explicitly framed as a proof-of-concept and not a clinical tool. This was a deliberate choice driven by the EU Medical Device Regulation (MDR), which classifies any algorithm that generates a medical risk recommendation as a high-risk device — requiring extensive regulatory approval before deployment. By positioning the output purely as a data visualisation rather than a clinical suggestion, the system remains within legal scope while still demonstrating the potential of a personalised forecasting approach. This trade-off — clinical relevance versus regulatory feasibility — shaped every aspect of the analysis page design.

Relevancy

By creating synchronised and timestamped datasets, the system provides a foundation for future machine learning models that could support personalised seizure forecasting. At the same time, the platform offers clinicians and patients additional insight into the relationship between daily activities, physiological changes and seizure risk.

For me, the project represented the combination of everything I value as a designer: a holistic approach, systems thinking, cutting-edge innovation, user-centred design, data-driven decision making and the ambition to create solutions that can improve people’s lives on a meaningful scale.

Follow-up research

I am excited to be able to tell that the value of my graduation project has been recognised, and in January 2027, SEIN and EpilepsieNL will conduct a follow-up research study where The Epilepsy Journal will be tested for a year with >50 epilepsy patients, to identify triggers, high-risk periods and relevant biomarkers for epileptic related events.

EpilepsieNL

Aims.

- To develop a user-friendly seizure tracking app
- To identify relevant timeframes and biosignals to define detection of high-risk periods for seizures

Methods.

We developed an iOS seizure-tracking app that integrates diary loggings with Apple Watch health data. This app will also record behavioural changes to determine the contributing factors at the granularity of individual seizures. We will recruit people with active epilepsy (at least one seizure per year) who use an Apple Watch and iPhone. Recruitment will be promoted by EpilepsieNL through their social channels. All participants will be asked to provide consent for extraction of the key epilepsy features from their medical files. Participants will be queried daily regarding their seizure frequency over the preceding 24 hours and to document potential precipitants (e.g., stress or poor sleep) or other relevant changes (e.g., medication adjustments) in their seizure journal. These entries are categorized into several domains—emotional/mood, lifestyle/environment, sleep, medication, and somatic/health—each comprising multiple prespecified labels (see Figure 1). Domains and labels were defined based on multiple focus groups. The user can indicate the time-period for each label (e.g., duration of the seizure or the stress period). Apple Watch health data (eg activity, heart rate, HRV (SDNN method), respiratory rate, sleep estimates, and menstrual cycle tracking) are streamed every three minutes to the diary logging app. We aim to record for up to 1 year. We aim to include at least 50 users. We will examine acceptability using app adherence and user satisfaction scores (including responses for all scales and the individual items). We will examine the proportion of subjects reporting triggers, the number of triggers, and consistency of triggers across seizures. As a second step we will select the most common precipitant and apply linear mixed models to examine whether their presence alters the physiological output. To allow these comparisons, the time periods will be aligned with the same clock times on days without precipitants or seizures. We will apply similar models to examine the association between physiological data and self-reported seizures while accounting for

Personal Development

This project provided the opportunity for myself to get better in programming and learn SwiftUI, experiment with different ML models, data management and processing, extend my (clinical) knowledge regarding epilepsy, and join an epilepsy expert panel to stay engaged in the latest developments regarding scientific researches related to epilepsy.

Advanced Embodiment Design



A low-cost, integrated measurement system to digitise infant growth data for community health volunteers in rural Cameroon.

Designing a low-cost growth monitoring system for Community Health Volunteers in Cameroon.

To collect, register, and digitalise medical data of babies of rural civilisations in Cameroon

The project focused on developing a portable anthropometric measurement device capable of measuring weight, height, infant length, head circumference and MUAC (Mid-Upper Arm Circumference) in remote healthcare settings. The challenge was to combine multiple measurement devices into a single integrated system while ensuring affordability, manufacturability, durability and measurement accuracy in harsh field conditions. The final concept consists of a digital measuring device, weighing scale, infant measuring mat and companion mobile application.

	MICRO	MACRO	META
AESTHETICS	 Many components No coherence	 Materials are not medical Not attractive	 Doesn't look medical Mistrust results
MEANING	 Second use Not special, worthless	 Separate parts More errors & less accuracy	 No specific equipment No sense of medical use
EMOTION	 No database Feeling of confusion	 Basic product Invaluable nor special	 Dangerous materials Feeling of mistrust

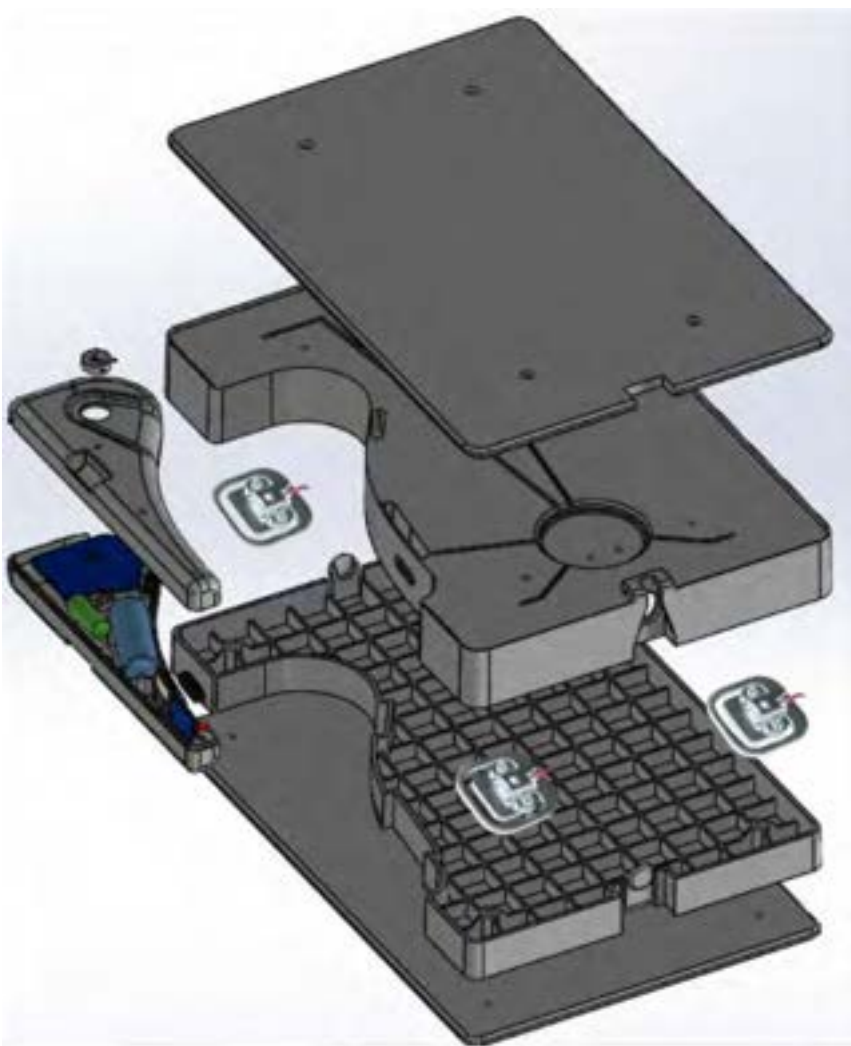


Problem

Currently, Community Health Volunteers travel through the rural environment of Cameroon with outdated tools. The current healthcare system is analog, meaning that the measurements are done by hand using analog tools and have to be processed in the hospitals into a medical file. This process takes time, effort and is prone to errors.

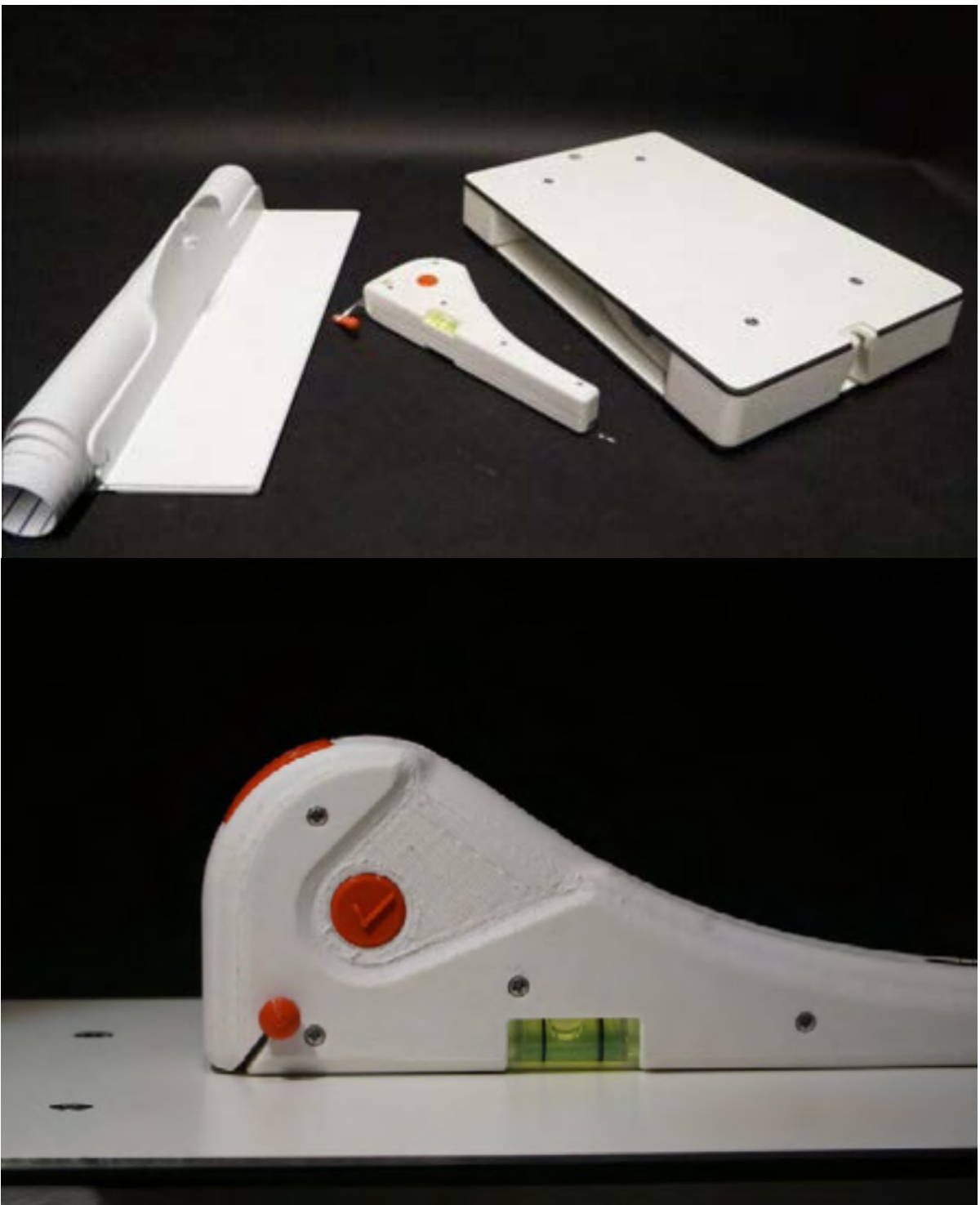
Approach

Throughout the project, detailed CAD models were developed and iteratively refined to balance usability, robustness and manufacturability. Particular attention was paid to the integration of mechanical, electronic and sensing components within a compact product architecture that could withstand intensive use in remote healthcare settings. The project required continuous trade-offs between functionality, production feasibility and cost constraints.



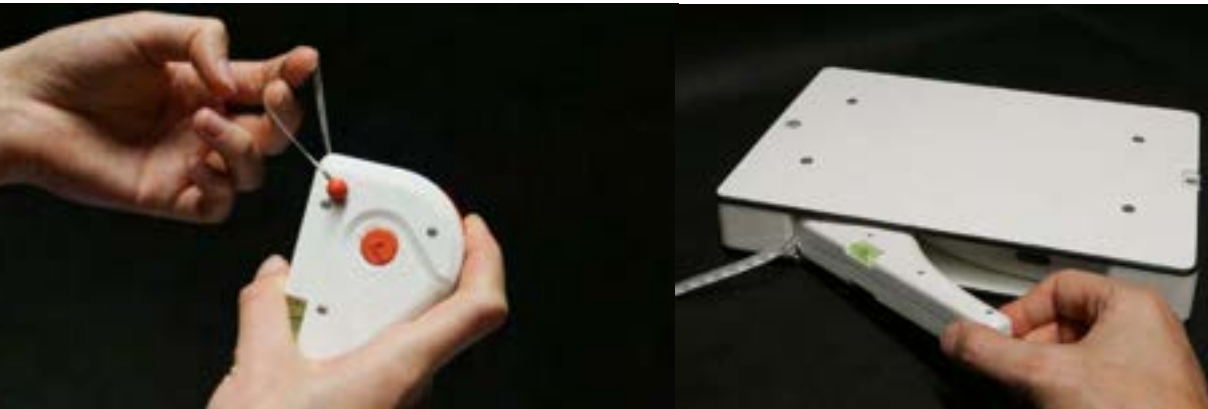
Design

The final solution combined a handheld measurement device, weighing scale and infant measuring mat into a single integrated system.

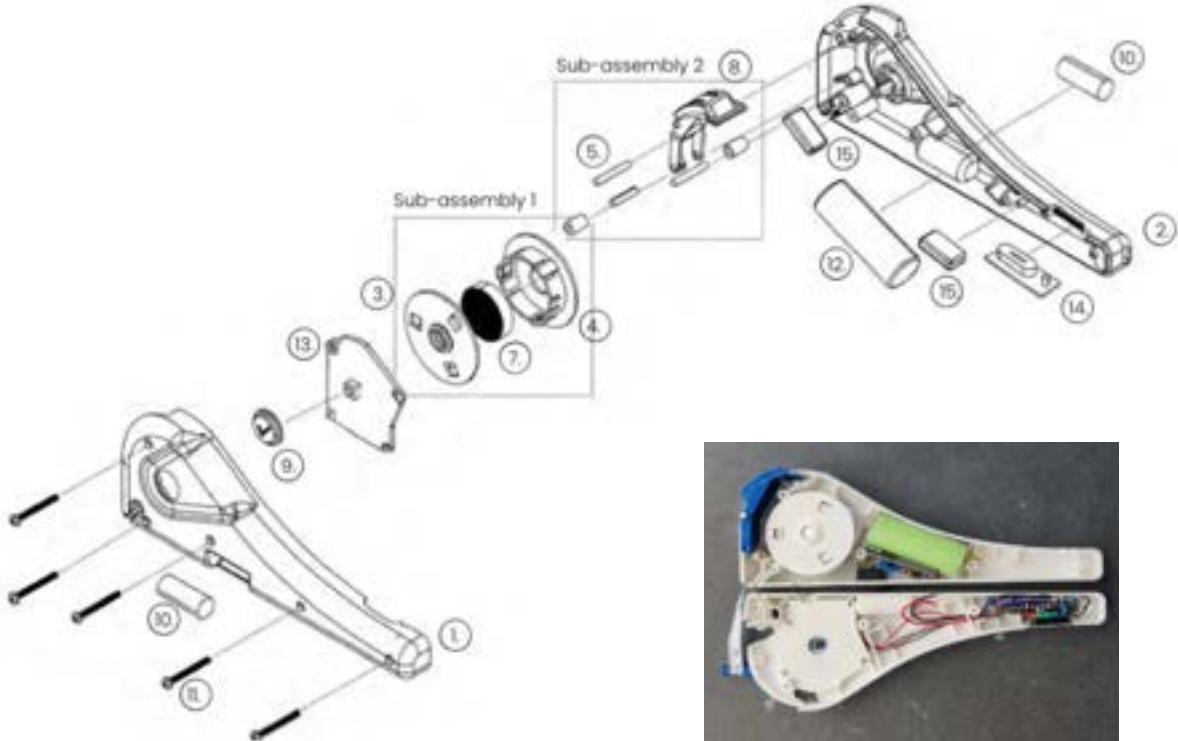
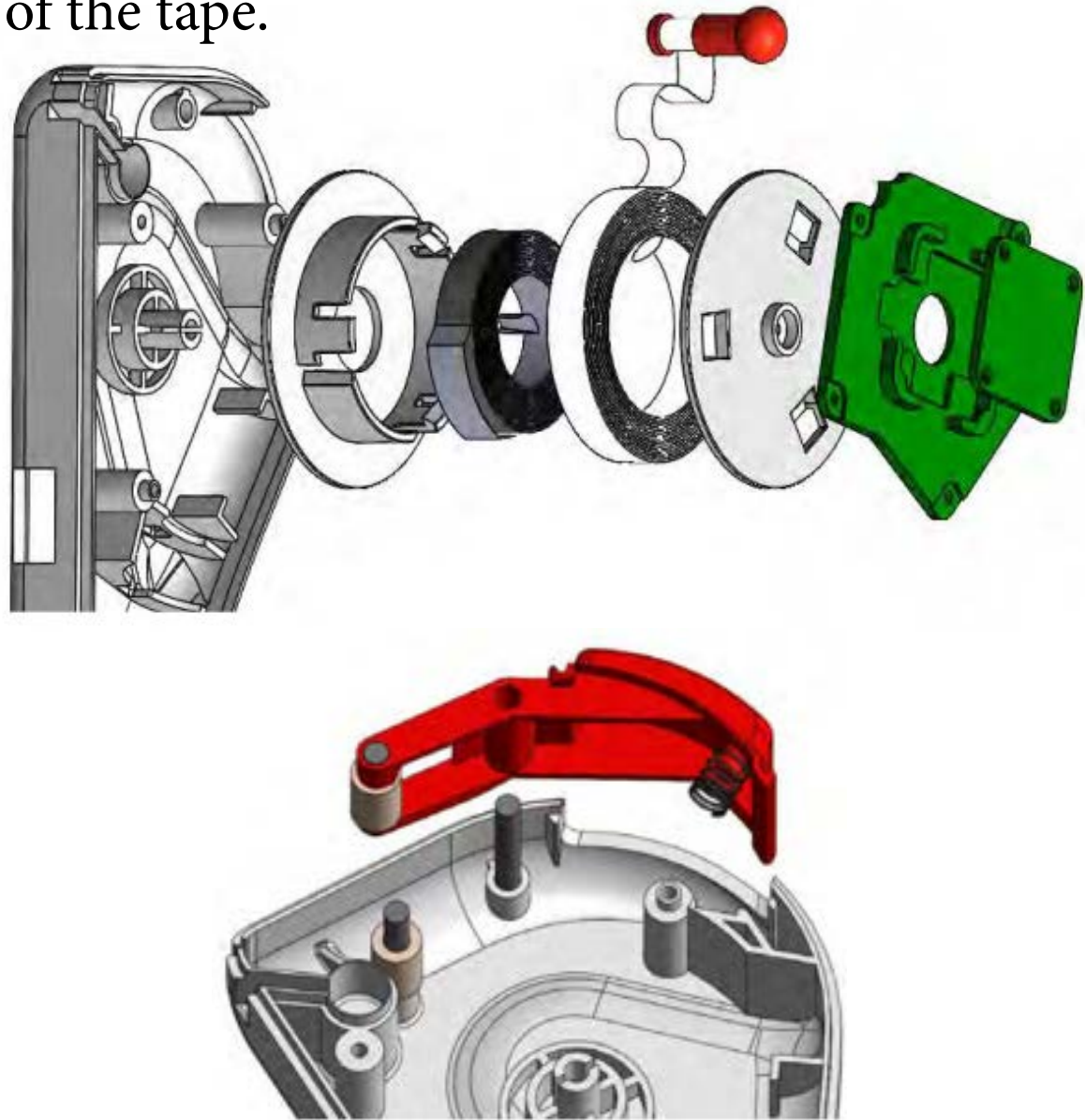


The Handheld Device

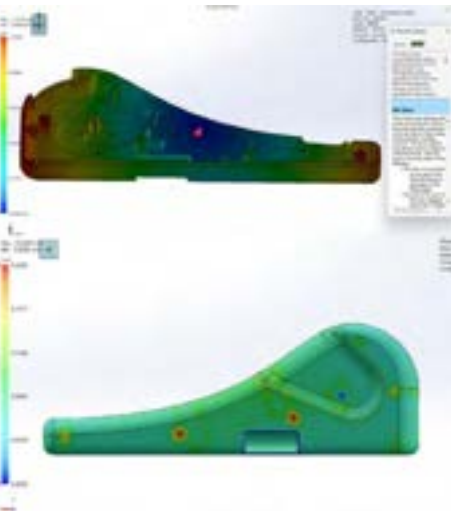
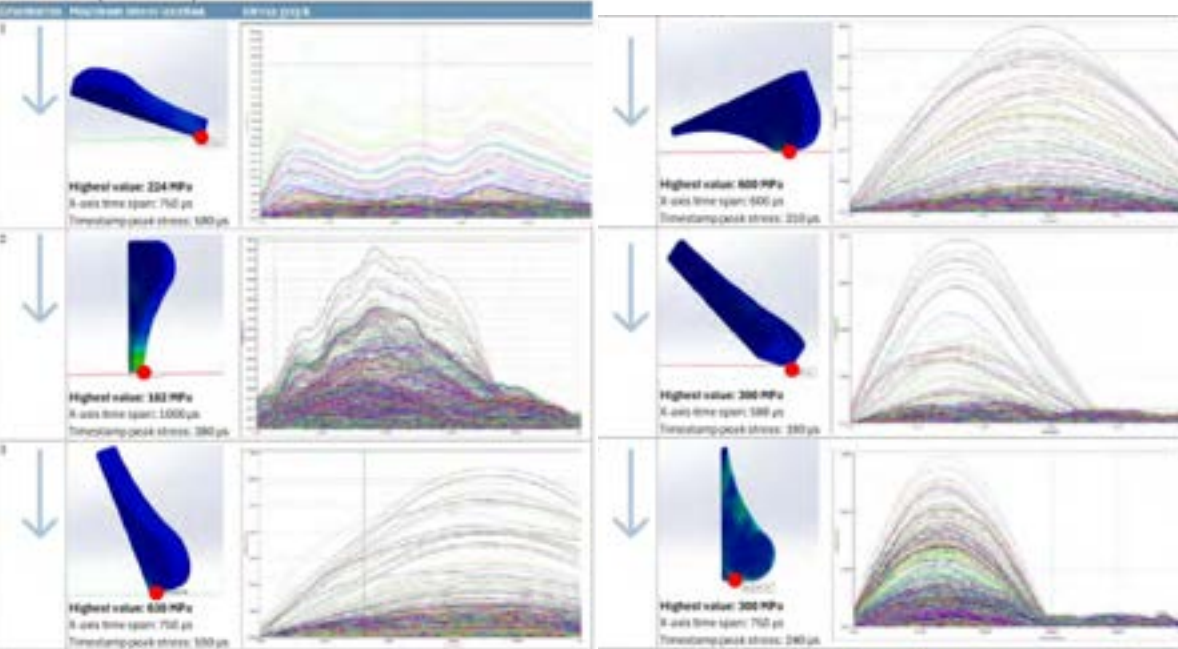
A handheld device can be taken out of the side of the scale. It is used to conduct the MUAC test and is attachable to the weighing scale and measuring mat.



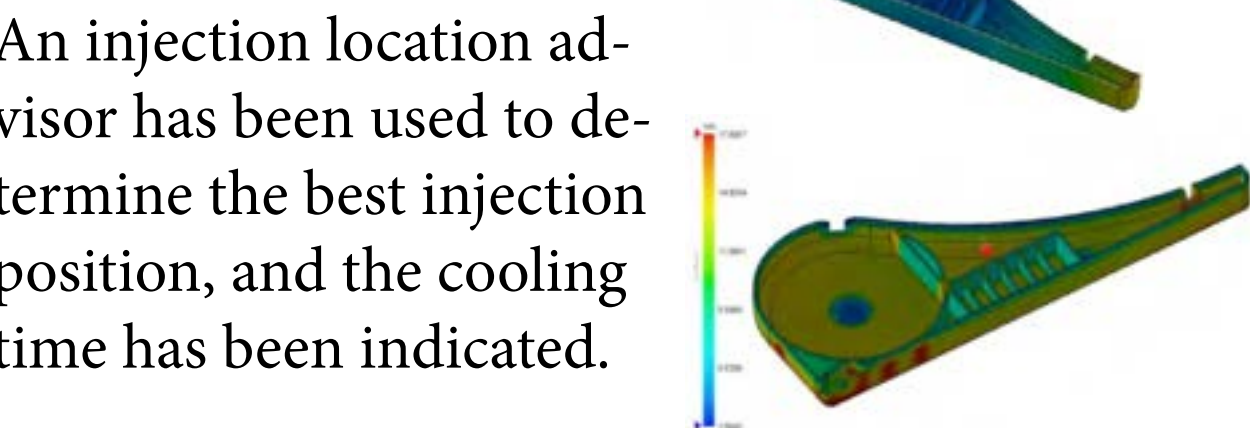
The handheld contains a PCB, battery, blue-tooth module, pogo pins, bubble level, magnets, and a retractable measuring tape which digitises the length's value using a rotary sensor. It contains two buttons, one to retract the measuring tape, and one to confirm a measurement which then digitises the current length of the tape.



To evaluate the handheld's strength, a drop test has been performed using SolidWorks.



A follow-up FEM analysis has been conducted to identify vulnerable parts of the housing.



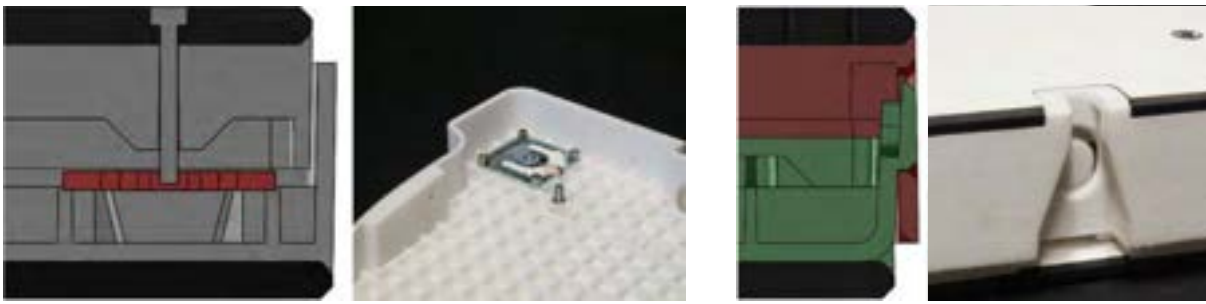
An injection location advisor has been used to determine the best injection position, and the cooling time has been indicated.

The Scale

The scale is designed using Rhino, with a FEM analysis using SolidWorks. The scale is the main part of the product-service-system and houses the handheld device and measure sheet.



The scale contains 4 load cells, and has two snap buttons to disassemble the top and bottom parts. This can be done to access all electronics and enable repairment.



The inside of the scale houses assembly points for the 4 load cells, locations for magnets for the handheld device, and waterproof locations for the PCB's and wires for the circuit.

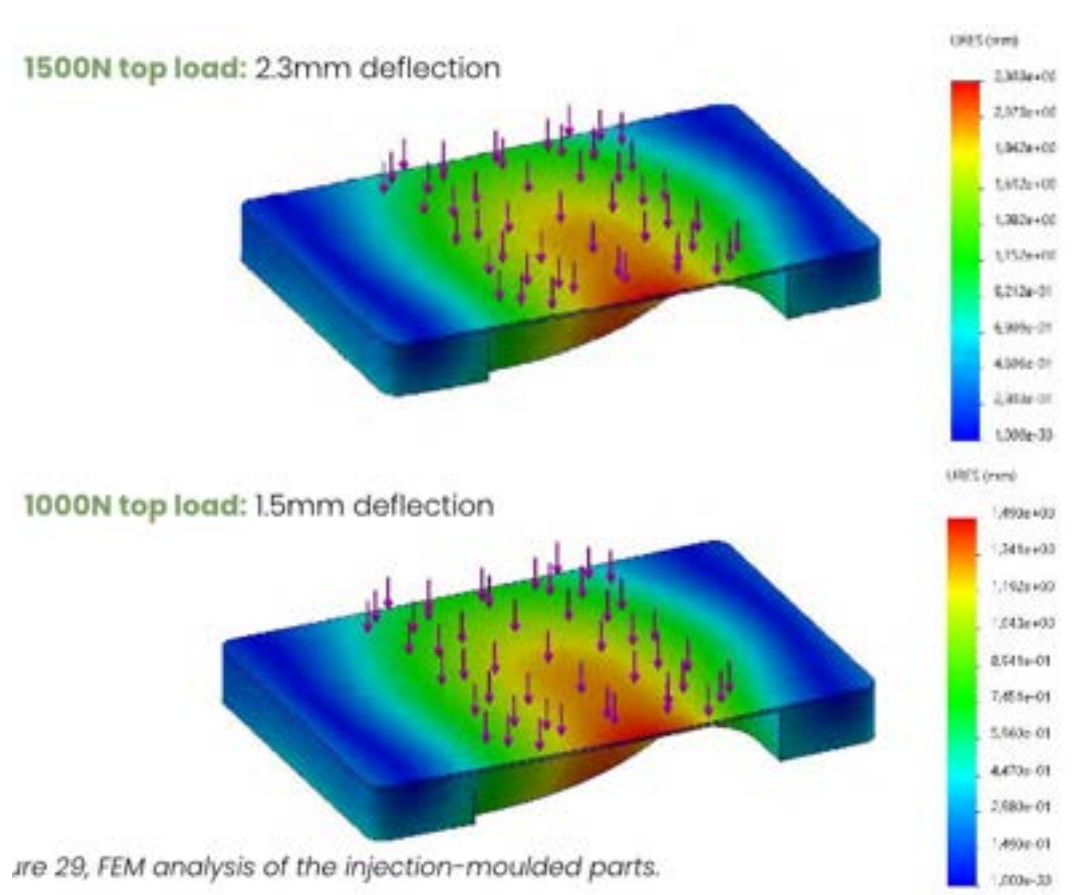
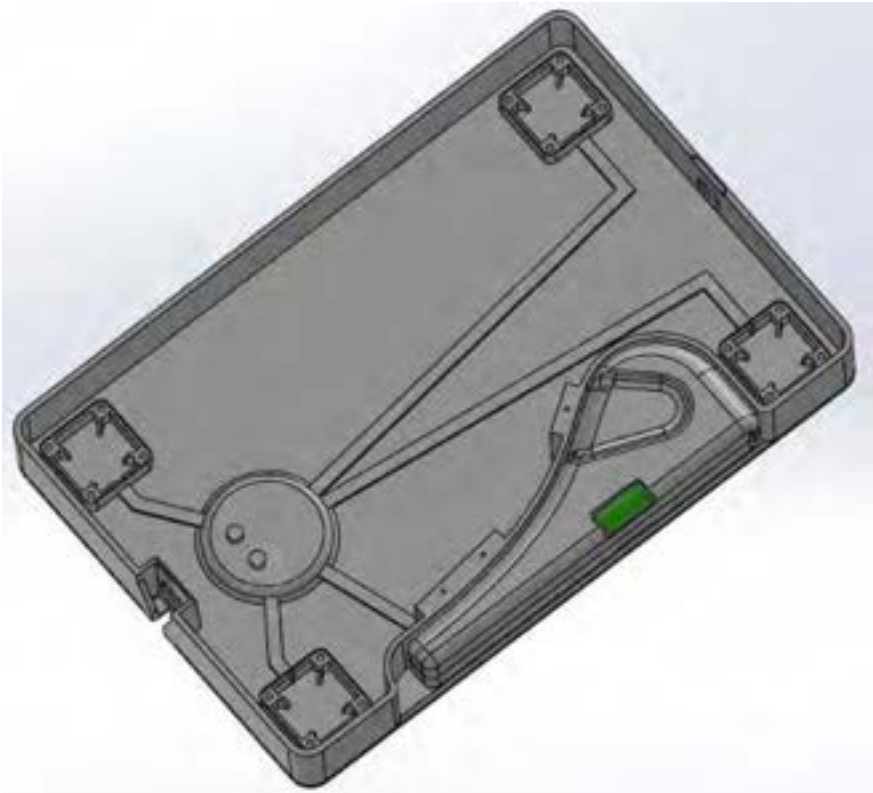
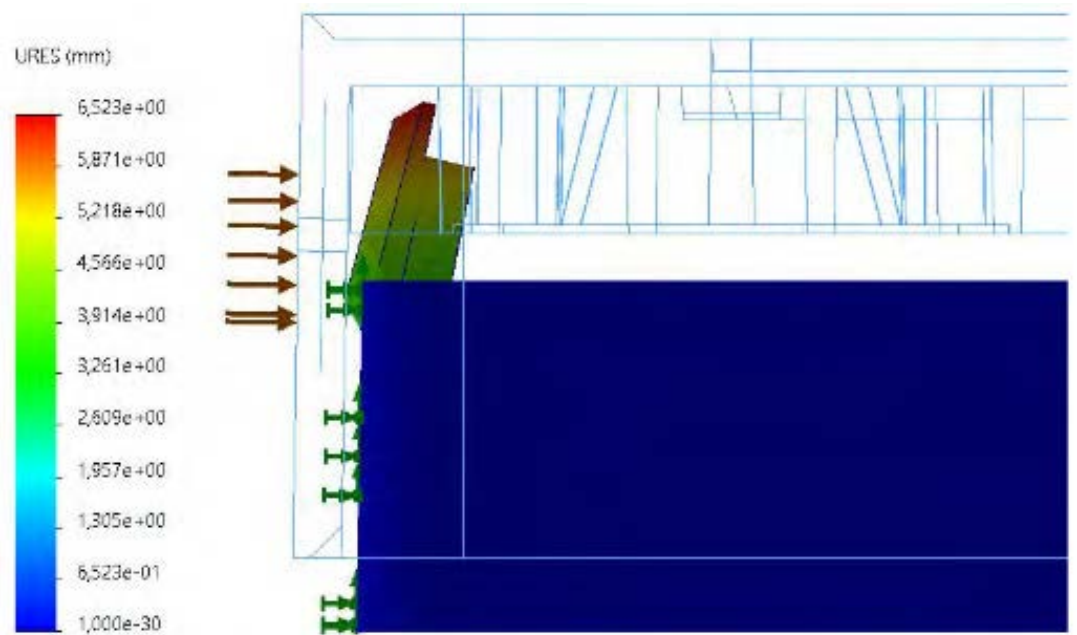


Figure 29, FEM analysis of the injection-moulded parts.



To be able to decide a proper manufacturing technique and choose a viable material which is suitable to meet all identified criteria, a FEM analysis has been performed. The design had to be robust, as it must endure the hard conditions during usage in Cameroon.

The Measuring Mat

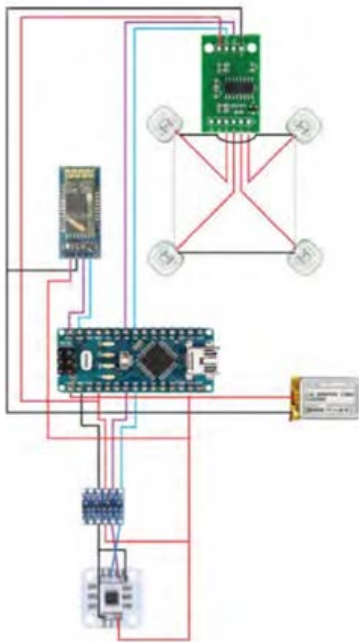


An unfoldable measuring mat has been integrated into the design, and is printed with measurements and the outline of a baby, functioning as an infantometer to measure their total length. At the top, the end of the measuring tape of the handheld device can be attached.



The Electronics

The load cell amplifier is placed in a separate cavity sealed with an O-ring to mitigate water and dust ingress. The wires from the load cells run through narrow grooves into the sealed cavity. The pogo pin connector is still exposed, because it can otherwise not be used. The wiring of the pogo pin connector is sealed using heat shrink tubing and also runs through a groove into the sealed cavity.



Use Case Scenario



The CHV greets the parent and explains what they are going to do, and then registers/log the patient in inside the app.



Pairing: The CHV takes the handheld out of the scale. and pulls the measuring tape out to pair with their phone.



MUAC: The CHV secures the measuring tape around the arm to measure the MUAC, then they retract and confirm the measurement, finally they release the measuring tape.



Infant length: The CHV releases the pin and rolls out the mat. Then they attach the measuring tape to the backrest.



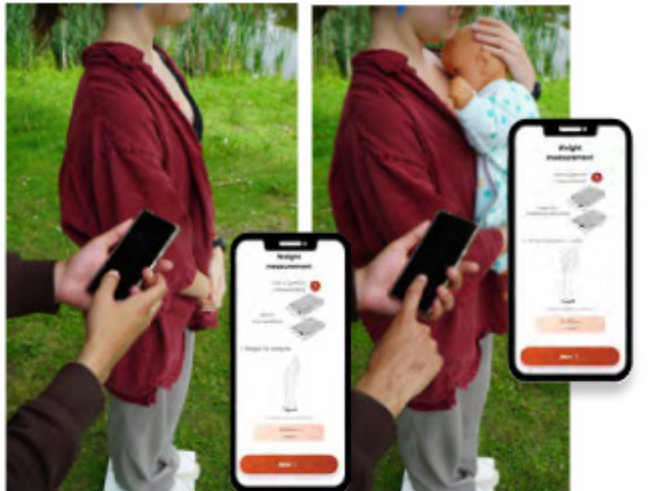
Infant length: The parent holds down the infant's head while the CHV pushes down on one knee. The CHV then retracts the tape to apply a bit of tension and ensures the handheld device is parallel to the lines on the mat. Finally, the CHV confirms the measurement using the dedicated button.



Storing the mat: The CHV cleans the mat with an alcohol wipe, rolls it up, and ensures the clean side doesn't touch the underside to keep the measurement surface clean.



Taring: CHV places the handheld inside the scale, which makes it tare itself. Then they ask the parent to stand on the scale



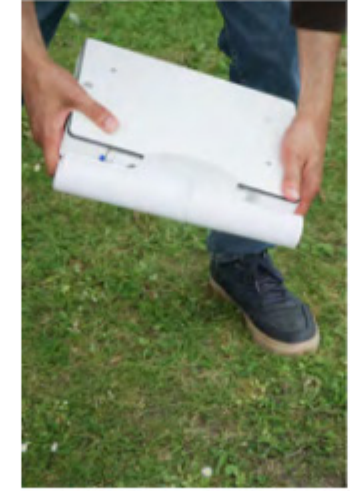
Weight: The CHV Confirms the reading, then asks the parent to hold the child and reads out the weight measurement again.

The Application

To be able to collect all relevant data and digitise the data immediately to create a medical file of all infants, a corresponding application has been designed. The handheld device contains a bluetooth module which connects to the user's phone. The interface guides the health volunteer through the measurement process.

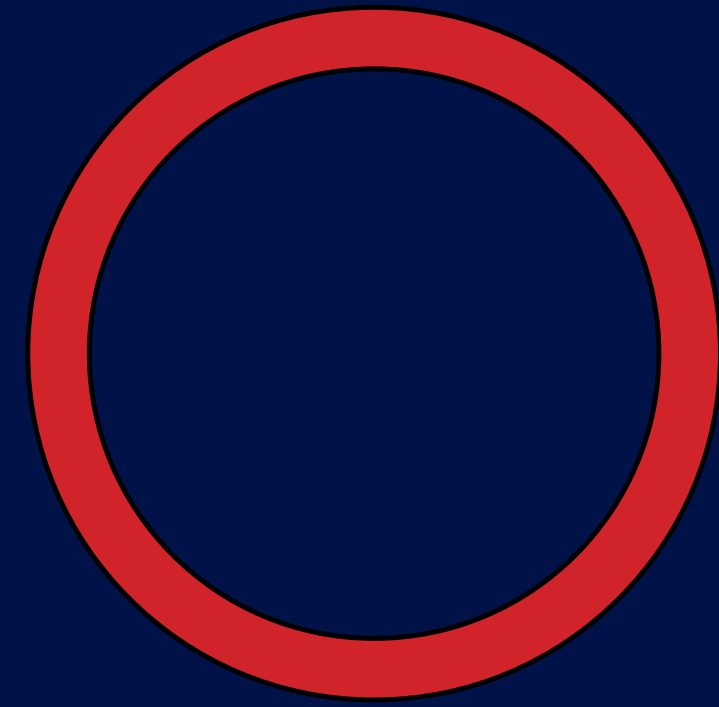


Verifying: The CHV checks if all measurements are done correctly and explains readings from the app and adds notes about the proceedings.

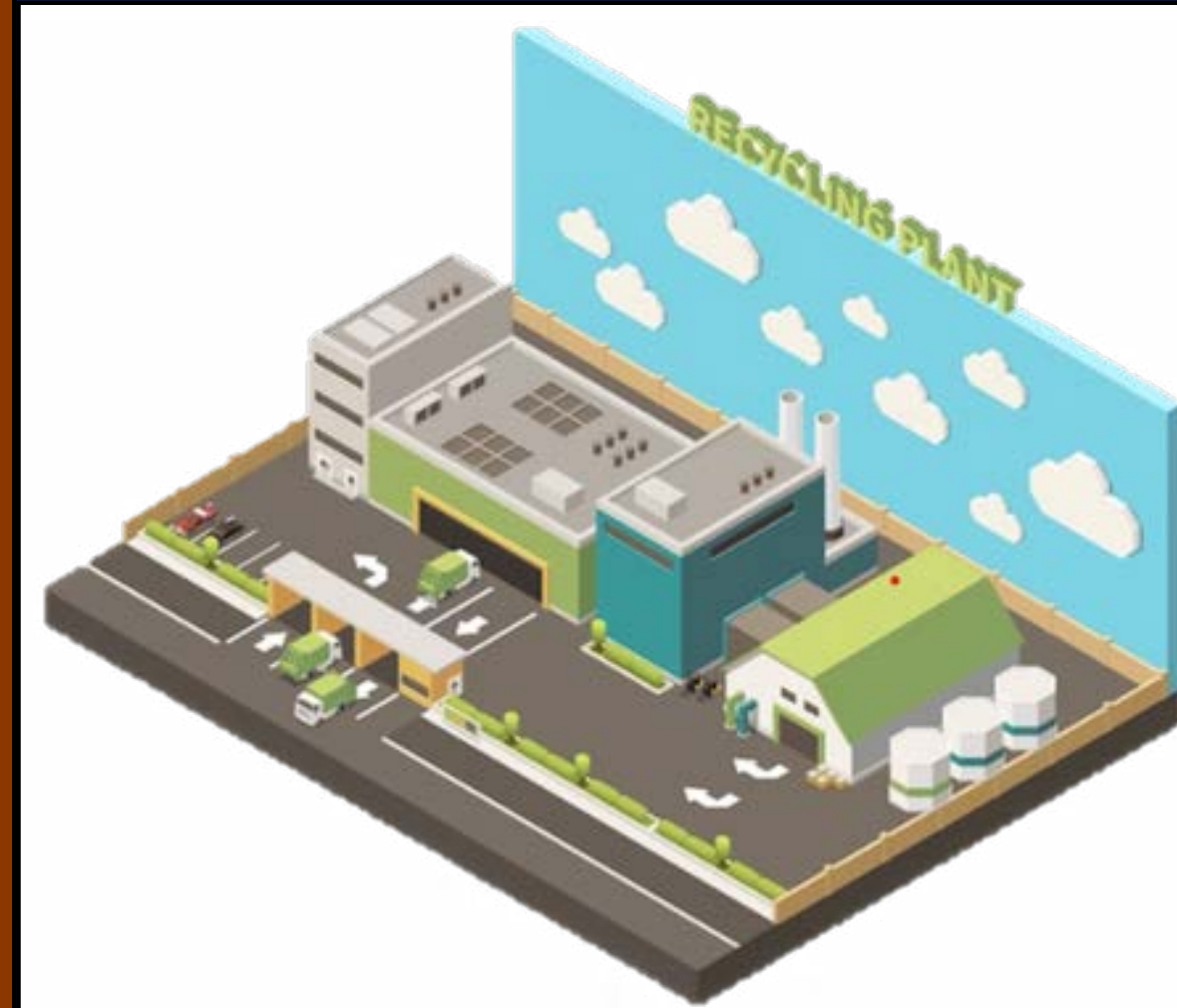


Storing: The CHV packs up the Pongo and puts it in his backpack, before going to the next patient or village.





Final Bachelor Project



A circular business model to recycle contaminated hospital plastic waste instead of incinerating it.

The sustainable foundation for medical plastic waste

To stop incineration of waste and set the first step towards circular healthcare.

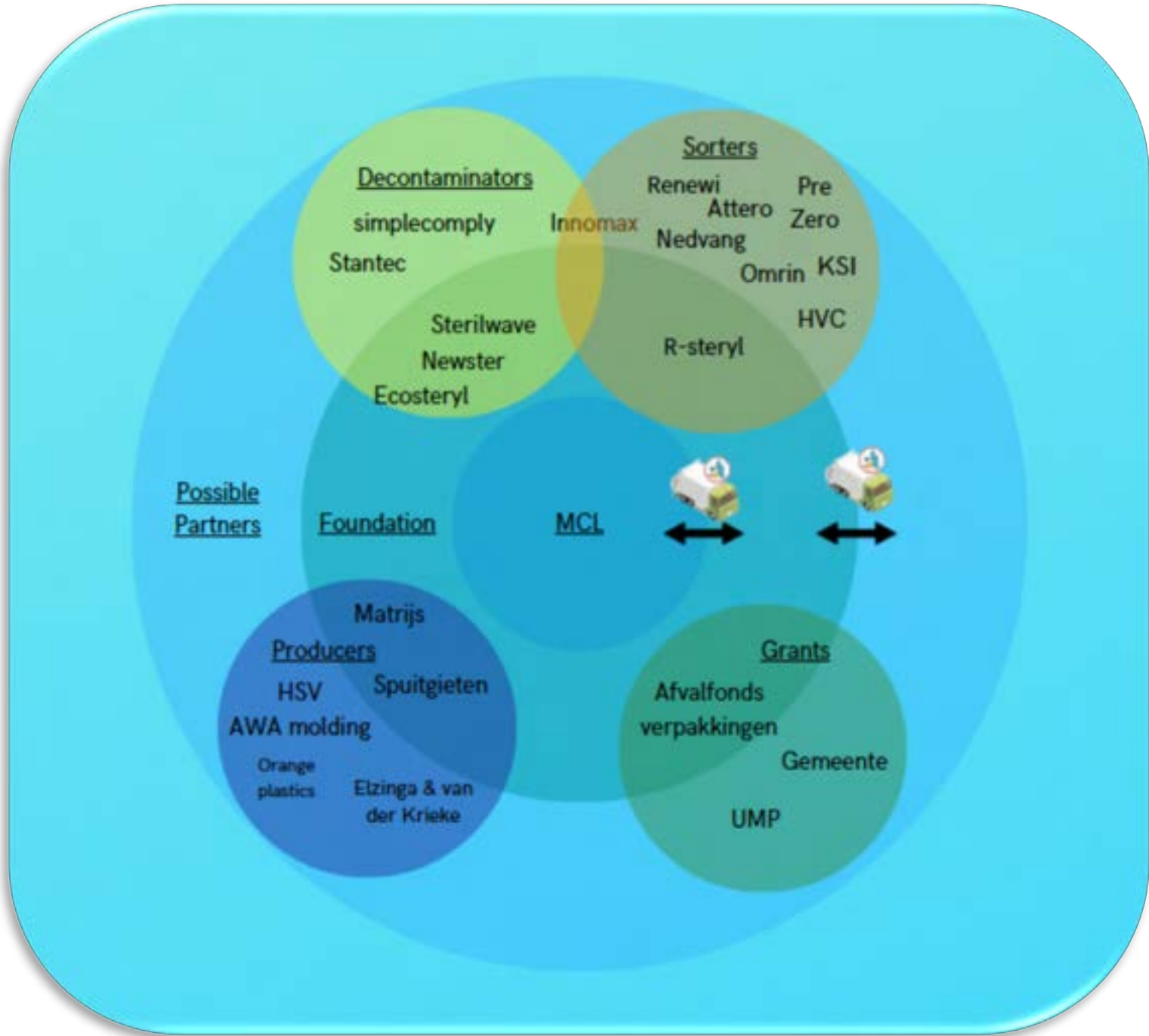
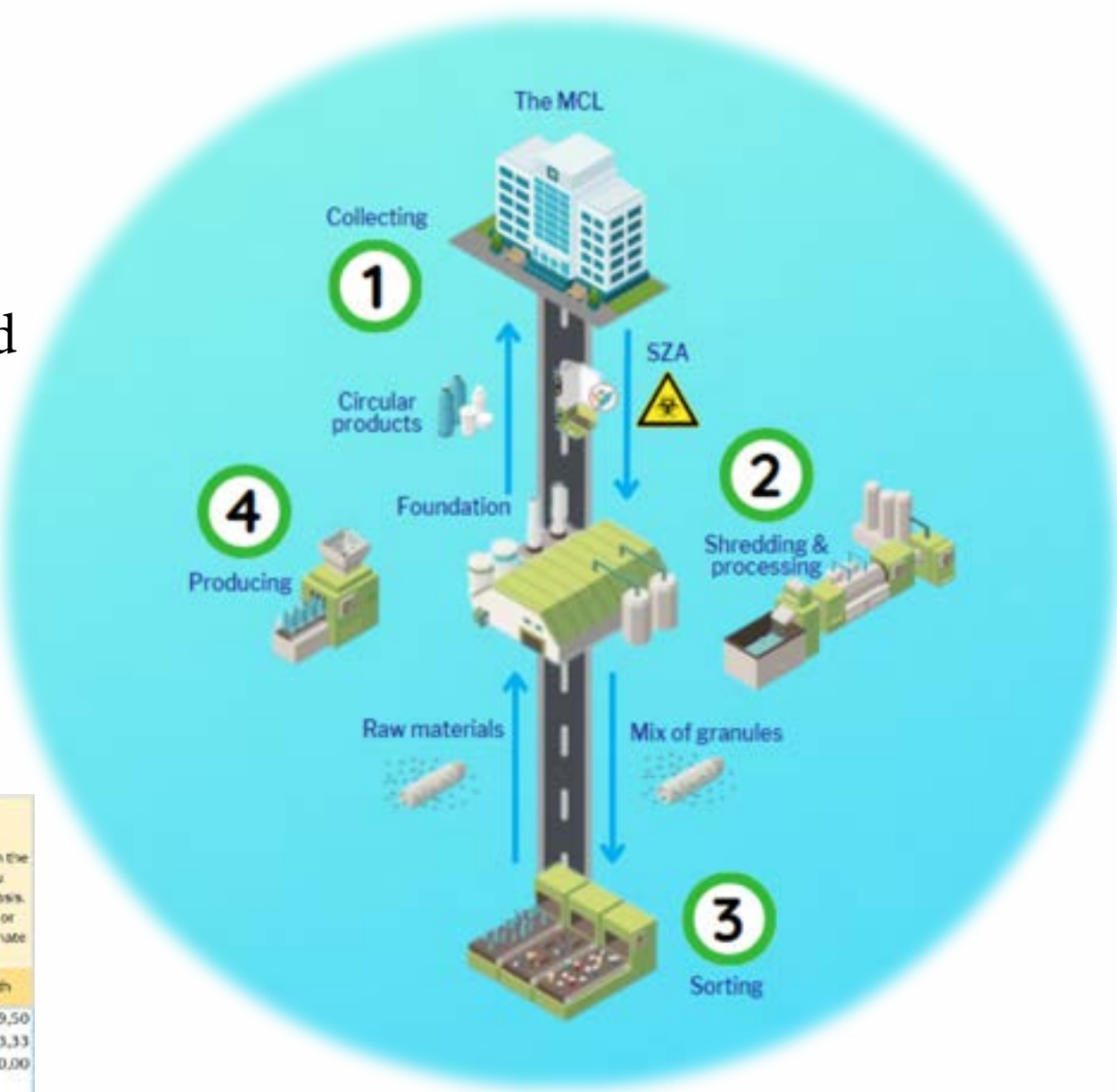
During my final phase of mu bachelor, I got the opportunity to not only focus on the designing process, but also how to turn a service into a sustainable businessmodel. it is the course that i personally enjoyed the most.

It was an eyeopening course, because all different aspects of the whole IDE bachelor were implemented and even more.

During the project, I started to think: ‘what if my idea actually is going to be applied in our

This is where I changed my mind and decided to design something else than a small product and started to look at the bigger picture behind the problem that was given to us as young, fresh designers.

Our healthcare is a hard functioning branche of our society, where all products and supplies are packed multiple times due to the risk of contamination of bacteria and the need of sterile tools during surgery. This means that every product that our doctors use, gets out of double plastic packaging, which is packed into a cardboard box, which is again enveloped in plastic.



Stakeholders

To make sure that all the different types of plastic are collected, shredded, cleaned, sorted and reproduced again into new products, a number of stakeholders have been linked who could potentially become future partners of the foundation.

The advantage of having all the necessities of the entire recycling process in one location is that transport operations between different companies are eliminated. This maximises system efficiency and minimises vehicle emissions.

Working Hours		Investment Costs		Fixed Costs	
Besides making products & services, you will have to spend time on doing other tasks. In this section, fill in your weekly activities and how many hours you will spend on each activity per week. Do not include the time to directly produce products or services.		These are the machines, tools, and other expenses you need to set up your workspace. These costs are also known as your "investment costs" and are only paid once.		Fixed costs are the costs that do not vary with the amount of products and services that you produce, but you have to pay on a regular basis. Some costs may need to be paid quarterly or yearly, so do some quick calculations to estimate them on a monthly basis.	
Weekly Activities	Hours per Week	Initial Investments	Cost	Fixed Costs	Cost per Month
Ecosteryl	2,7	Machine Ecosteryl 75	350.000,00	opex ecosteryl	6.849,50
Spuutgietsmachine	32,1	Injection moulding machine	66.000,00	opex spuitgietsmachine	14.843,33
		Mould costs cup	6.859,30	opex truck	3.600,00
		Location Grou	1.000.000,00		
		Volvo truck	310.000,00		
Dashboard		Sales Overview		Wages	
Start by entering your desired hourly wage, selling prices, and expected sales for each product. Then play around with your pricing, hourly wage, and expected sales to see how it affects the time needed to pay back your investment, monthly profit, and monthly pay. Make sure you set prices for your products and services so that the numbers in the profit margin column turn green, which means you are covering the costs of		Products & Services	Selling Price Per Unit	Number of Expected Sales Per Month	Total Product Cost
Pet	2,00	1.195,0	1,34	48,83%	
HOPC	2,00	3.375,0	1,34	48,83%	
PVC	2,00	105,0	1,34	48,83%	
LDPE	2,00	5.554,0	1,34	48,83%	
PP	2,00	395,0	1,34	48,83%	
PS	2,00	959,0	1,34	48,83%	
Bekers	0,00	29.675,0	0,05	-100,00%	
Beeping sein	1,25	12.167,0	0,00	124000,00%	
Subside	0,26	12.167,0	0,00	20900,00%	
Summary		Money Needed to Start		Months to Pay Back Investment	
		1.777.942,06		Too long!	
		Full Time Employees Needed		2,8	
		Revenue Earned Per Month		41.540,17	
		Fixed Costs Per Month		25.262,83	
		Material Costs Per Month		0,00	
		Total Wages Paid Per Month		9.789,23	
		Total Profit Earned Per Month		6.456,11	

Dirk Lagemaat

ROAD TO 2030

Recycling policy and methods

Understanding its potential impact and how it changes the way we process plastic waste

Goal

The goal is to fulfill the needs of as many target groups as possible. This is done by scaling up the recycleprocess of plastic waste so more circular products can be made.

Impact

When the recycling system is fully operational, the various waste streams can be used to reproduce circular plastic products. This will help the MCL with their objectives. The system offers the MCL:

- Circular products, which save 24.8% in waste costs.
- 42.5% less emissions in circular production compared to the production of new plastic
- 2.2 kg less CO2 emissions per kg of plastic due to recycling instead of incineration.
- Less virgin products = less use of primary raw materials when using circular products.
- 1,25 euro/kg waste when the current contract is broken

Why is it so important to take action?

Hartplastic and the MCL aim to separate and reuse as much plastic as possible. The MCL has joined the greendeal 3.0 where the following targets are to be met by 2030:

-  Health promotion of clients, patients and staff
-  Increased awareness and knowledge about impact of healthcare on climate and vice versa
-  Reduce CO2 emissions by 55% by 2030 and climate neutral by 2050
-  Primary raw material use reduced 50% by 2030 and maximum circular care by 2050
-  Reducing environmental impact of medication (use)

Producing

4

Circular products

Foundation

The MCL

Breaking contracts

SZA

1

Shredding & processing

2

Granules

Sorting

3

Entry-level models with stakeholders

As the MCL and Hartplastic are not waste processors, entry-level models were created with possible partners who could take on part of the recycling process, rather than investing in machinery for the recycling process themselves.

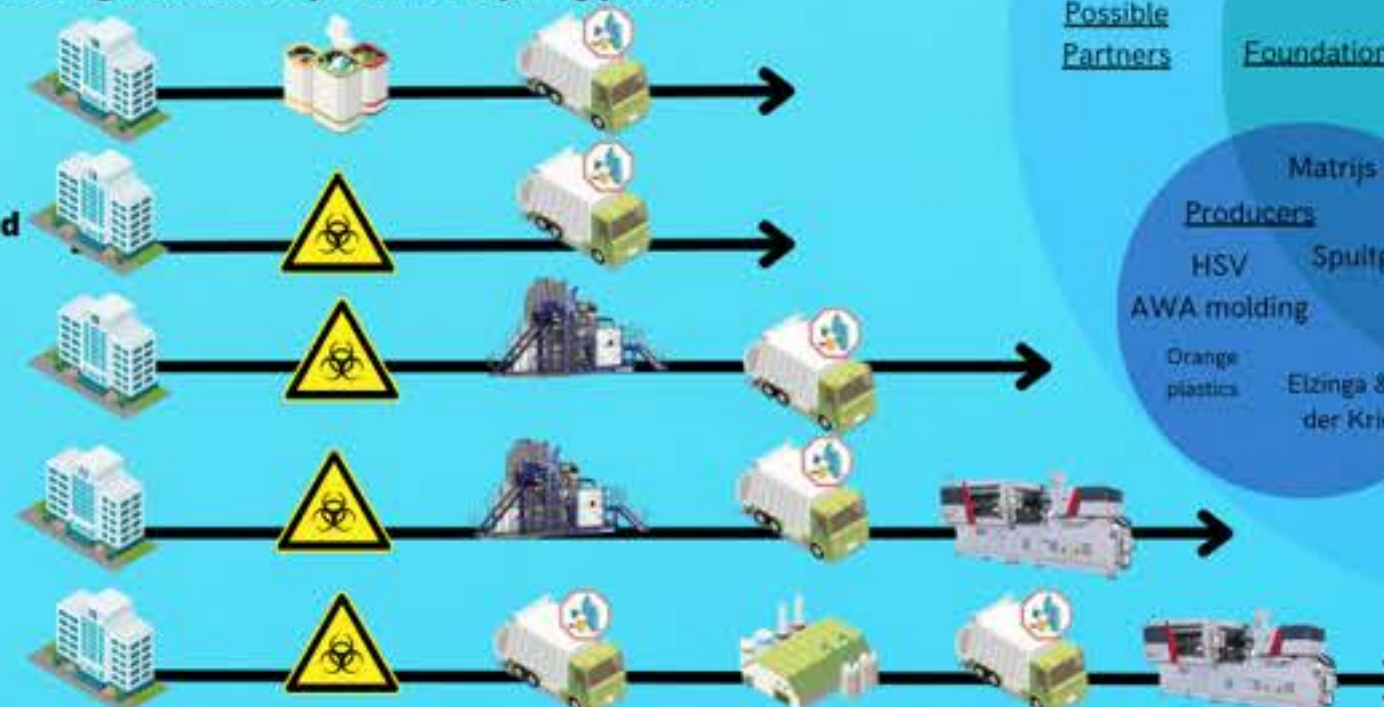
Have only 'clean' waste processed

Have all SZA processed (innomax)

Clean & shred it yourself

Clean, shred and produce it yourself

Process all SZA, only produce it yourself



Possible Partners

Decontaminators

simplecomply

Stantec

Sterilwave

Newster

Ecosteryl

Sorters

Renewi

Attero

Nedvang

Omrin

R-steryl

HVC

Pre Zero

KSI

MCL

Foundation

Matrijs

Producers

HSV

AWA molding

Orange plastics

Elzinga & van der Krieke

Grants

Afvalfonds verpakkingen

Gemeente

UMP



Milacron Elektron Evo 275

An Ecosteryl 75 and a Milacron Elektron Evo 275 injection moulding machine including mould will be purchased for this purpose.

Ecosteryl 75



About the process

Currently, the MCL does not separate clean and contaminated waste, it is all marked as 'SZA' and needs to be incinerated.

The MCL annually produces a total of 146 tons in kg of plastic waste.

Why is recycling so difficult?

The contaminated plastic waste stream must first be cleaned. However, only a few companies in the Netherlands can do this. In addition, MCL has a contract at the IFZ with another waste processor that cannot simply be broken.

Next, the sterile heterogeneous stream of granules has to be sorted into monostreams before it can be used again to produce circular products. Sorting into monostreams can only be done with very large sorting plants like KSI.

Foundation

For the ideal situation, a foundation will be set up centrally in Friesland that can carry out several steps from the recycling process for a minimum number of transport operations. These include shredding, cleaning and producing new products.

Computational Design



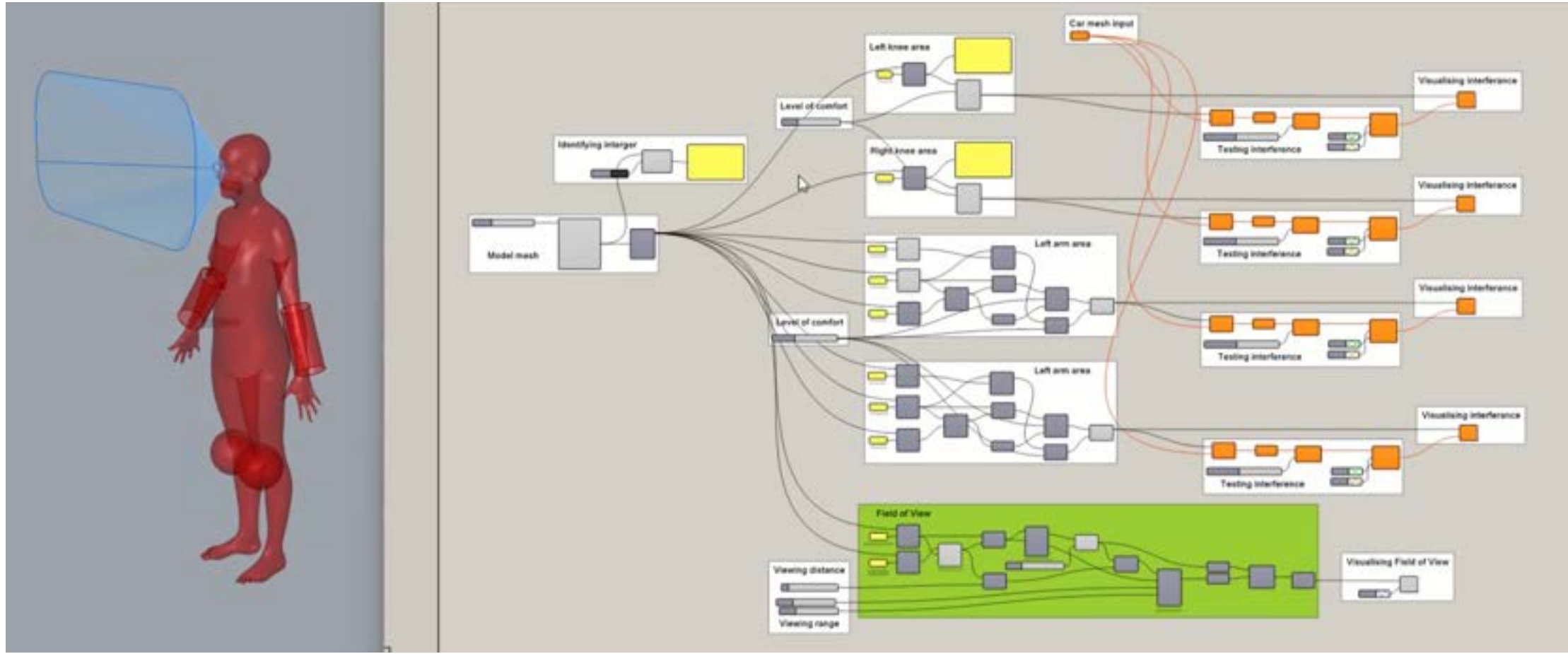
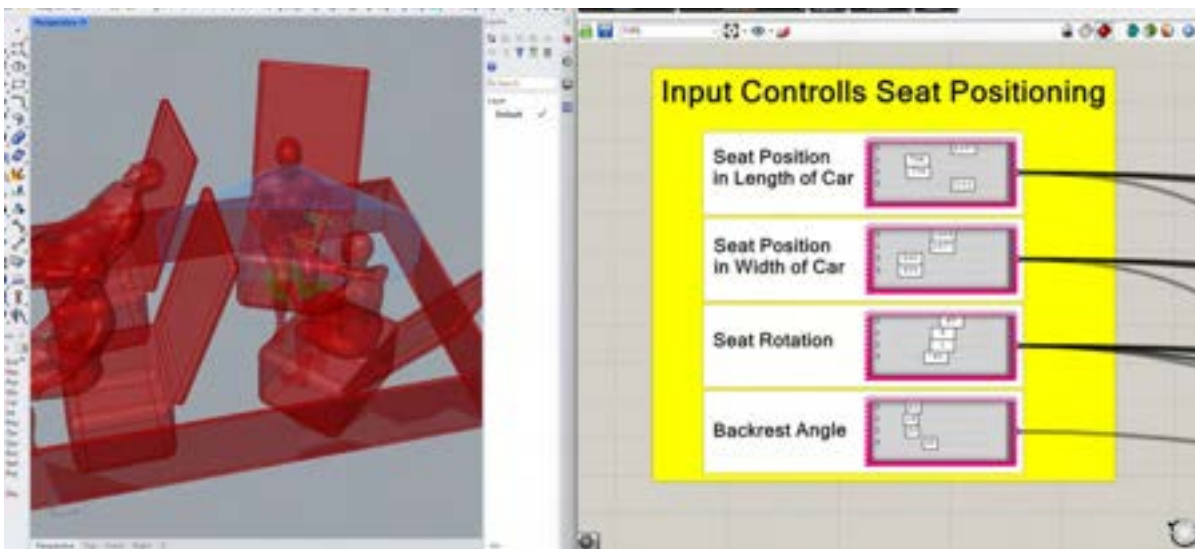
A parametric tool to design
and ergonomically evaluate
autonomous vehicle interiors.

Ergonomically-optimised interior layouts for automated vehicles

Using computational design and real anthropometric data to test how autonomous vehicle interiors hold up for every body, not just the average one.

As driving is automated away, the inside of a car stops being a cockpit and starts being a room, one that has to support working, relaxing, and socialising, for a much wider range of people than a traditional interior was ever designed for. My team and I took on the challenge of designing an autonomous vehicle interior layout with physical ergonomics as the starting point rather than an afterthought, including consideration for people with reduced mobility.

We built a parametric Grasshopper definition around a 2×3 metre cabin platform, where seat position, seat rotation, and backrest angle are all defined as adjustable inputs for each seat. The definition's logic follows a clear loop: position the chairs, position the occupants relative to those chairs, generate comfort geometry around each occupant, then check whether that geometry interferes with the cabin or with other occupants, feeding the result back as a comfort score before finalisation. This turns ergonomic evaluation into something the tool checks automatically for every configuration.



Occupant Diversity

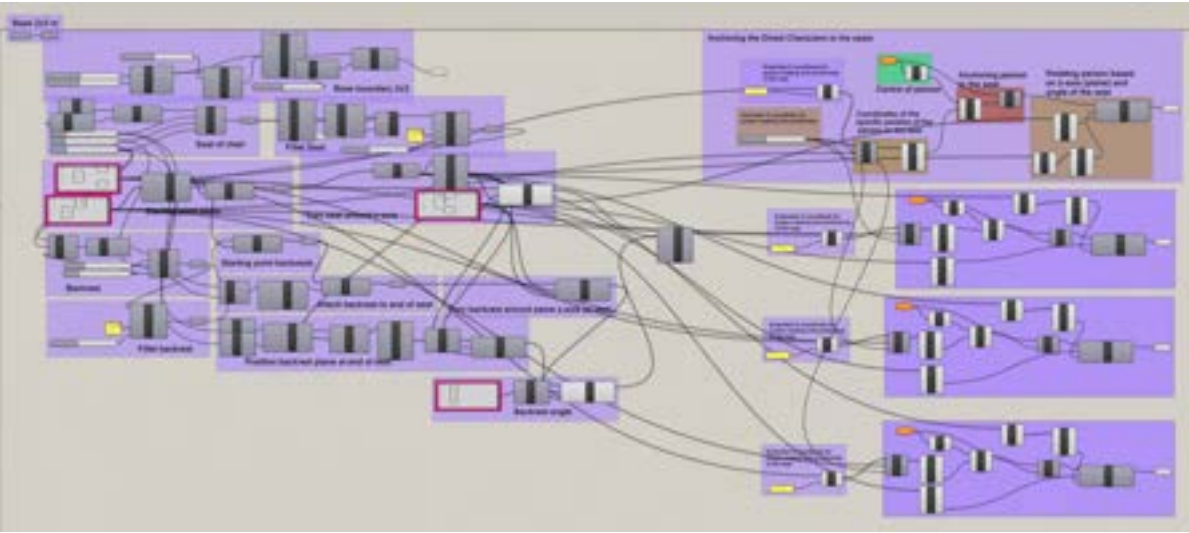
To make the ergonomic evaluation meaningful, we didn't rely on a single "average" body. We sourced real statistical shape data from TU Delft's DINED anthropometric database, selecting a spread of body types, from a P1 (5th percentile) to a P99 (99th percentile) build, so the layout is tested against the actual range of statures and body masses a vehicle would need to accommodate, not just a design mannequin.



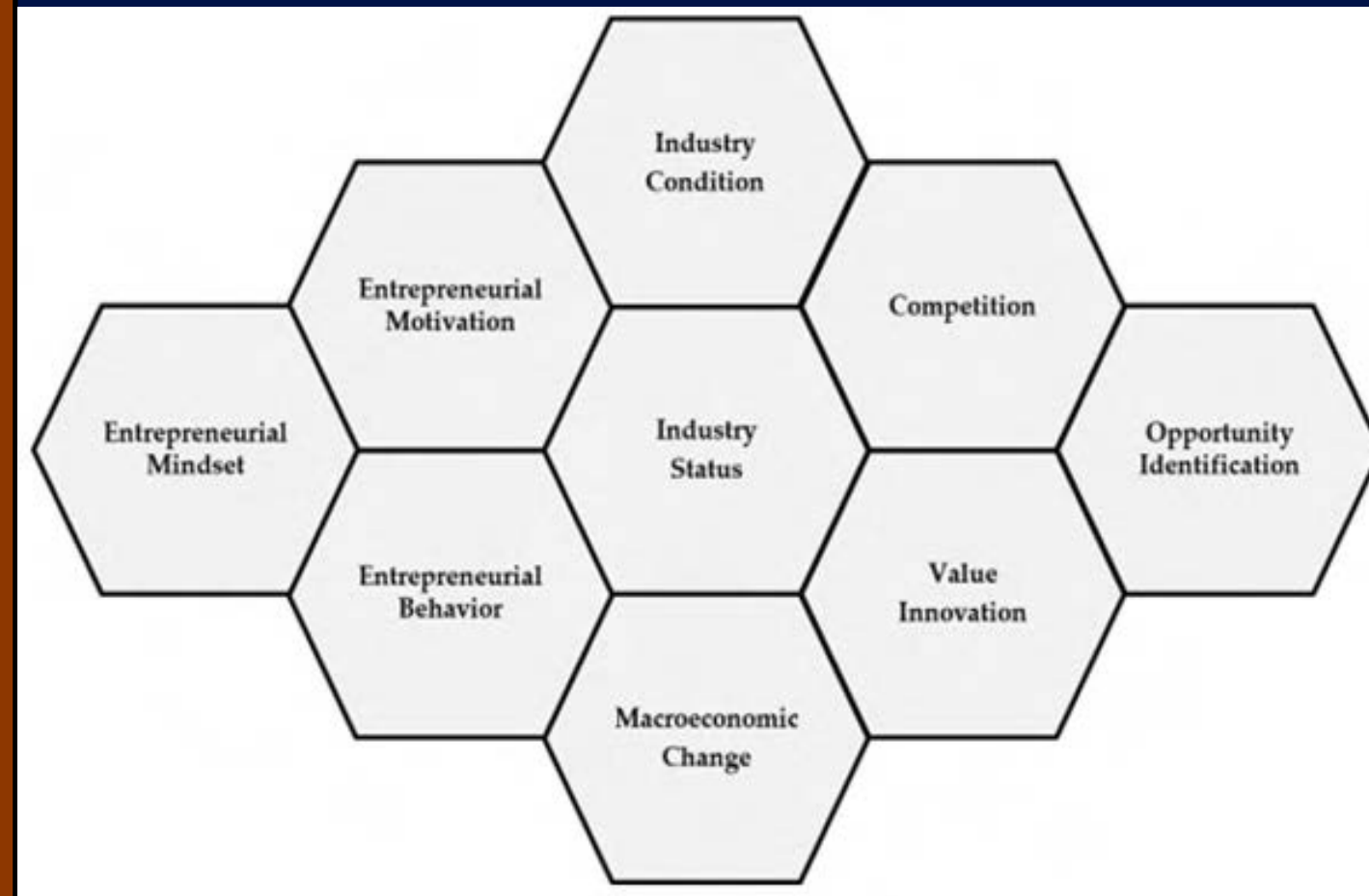
Anchoring Occupants to the Seats

Rather than placing bodies at fixed coordinates, we calculated each occupant's position relative to the seat's own centre point, then rotated the body to match the seat's individual rotation and backrest angle, so if a seat is angled for a collaborative-seating or working scenario, the occupant automatically follows. This meant a single change to seat geometry propagated correctly through to every posed body in the scene, rather than requiring to be repositioned by hand.

Each of these DINED-derived body meshes was then rigged and posed in Blender to reflect different in-vehicle postures, from upright seating to more reclined, relaxed configurations.



Entrepreneurial Electives



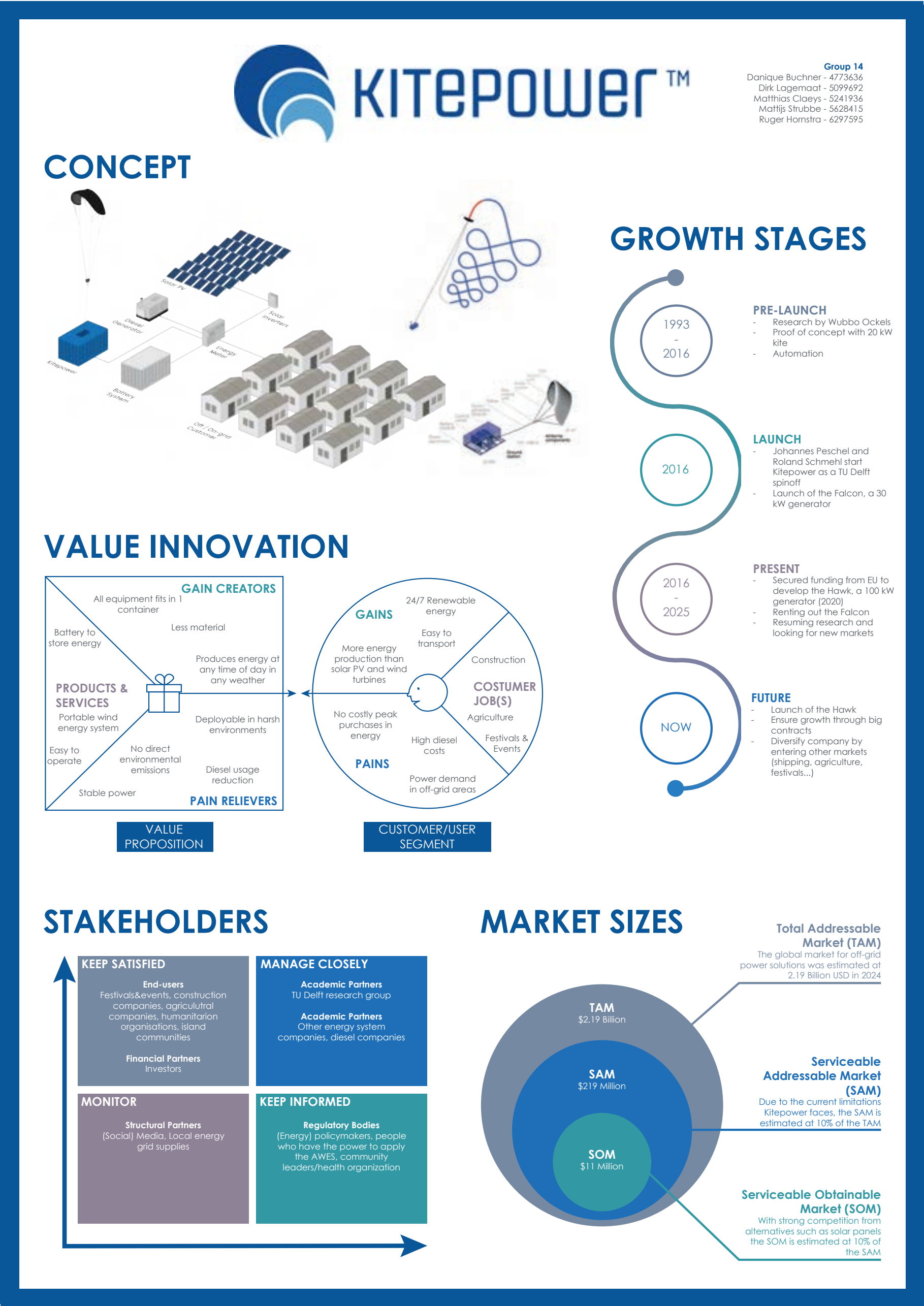
Extending skills in turning ideas into business models, executing market-strategy analyses, and collaborating with startups to help them scale and prepare for partnerships.

Entrepreneurial Electives

During my master, I have chosen to expand my design skills by following a set of courses at the Delft Centre of Entrepreneurship. My idea was to dive deeper into a more market based approach of designing to increase the potential of the products. Because even with a good designed product/service/system through many iterations, when you do not know how to maintain a business, everything can fall apart.

By analyzing multiple startups, I gained more insight into the challenges that new, innovative but still vulnerable companies face and how we can use methodologies to re-organize startups to prioritize the correct department at the right time, which is crucial for their existence. It suprised me that the different phases a startup goes through, is very comparable of the iterative process of a designer. This is why I am very interested to learn and know how design can be implemented in the creation of market strategies and help businesses grow.

Another course offered more insights in how to handle intellectual property and what to do with patents when designing a product using new innovative technology, which I think all designers must know.



By analyzing a startup spin-off from Vattenfall called ‘Cake’, I have learned how larger companies can collaborate with startups by using their IP. It was very interesting to learn how companies compete in their industry and how innovative startups can grow and help large, well-known brands and firms using their innovation and leverage their IP. By executing research I have suggested a few recommendations into Vattenfall’s startup program, including a shift of several components of two different incubation models.

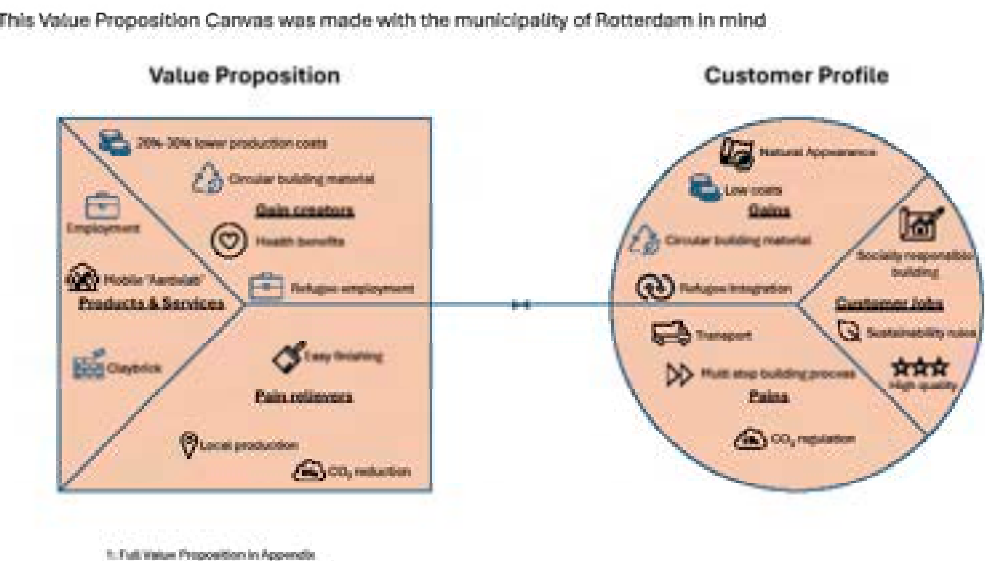
Resource Categories	Low Selective Model	Supportive Model	Incubator Model
Financial	Requires minimal financial resources; often low investment.	Needs external capital at early stages; public-private partnerships are common.	Major funding required; typically involves multiple funding rounds and investor engagement.
Organizational	Has minimal organizational structure; integrates within the research institution.	Requires a more developed structure; needs a critical mass of at least 20 people to function effectively.	Structured organization with dedicated teams for mentoring, support, and growth across various aspects of business development.
Human	Relies on a few people, typically faculty or staff within the institution; less emphasis on specialized expertise.	Requires skilled personnel, particularly in IP management and contract research; focuses on supporting academics.	Highly specialized human resources, including mentors and advisors with significant industry experience to provide comprehensive guidance.
Technology	Limited focus; mostly relies on existing institutional resources without significant investment in new technology.	Emphasizes leveraging existing technologies and supporting R&D; potential for tech transfer through partnerships.	Focuses on developing new technologies; the model usually requires access to advanced research facilities and equipment.
Network	Limited networks; primarily dependent on the existing institutional connections and reputation.	Strong local networks with specialized advisors, investors, and industries; vital for providing ad hoc services.	Broad and diverse network connections; encourages collaboration with venture capitalists, industry experts, and other startups.
Infrastructure	Minimal infrastructure needed; often operates without dedicated physical space apart from the institution’s existing facilities.	Requires some infrastructure support, such as incubation spaces or labs, to foster initial business development.	Typically equipped with dedicated incubator facilities, including collaborative workspaces, meeting rooms, labs, and other resources tailored to startups.

Another aspect what I liked is to explore more were more market research based approaches to come up with new ideas to help a startup.

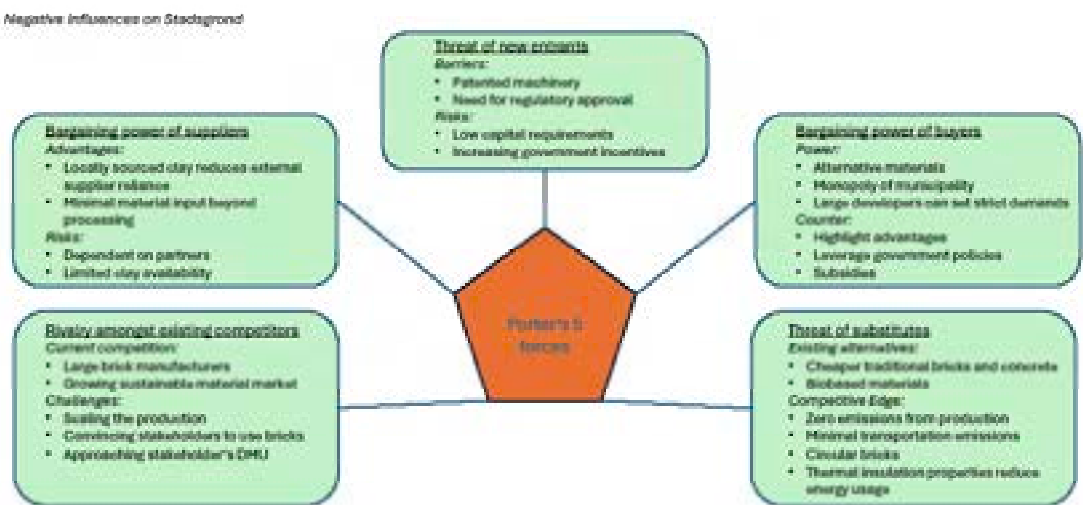
These are some examples of methods we used during a project related to ‘Stadsgrond’, a startup in Rotterdam which produces circular, 100% sustainable bricks from local clay.

By using multiple methods we came up with a new businessmodel for Stadsgrond and we prioritized different tasks and identified the most important next steps for the startup so they can grow and eventually partner up with larger firms.

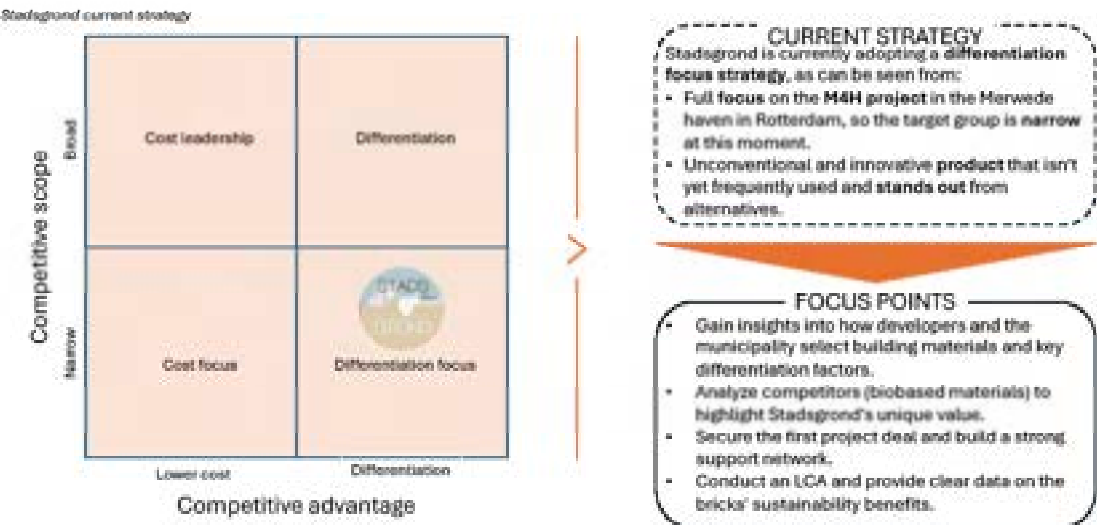
Value Proposition



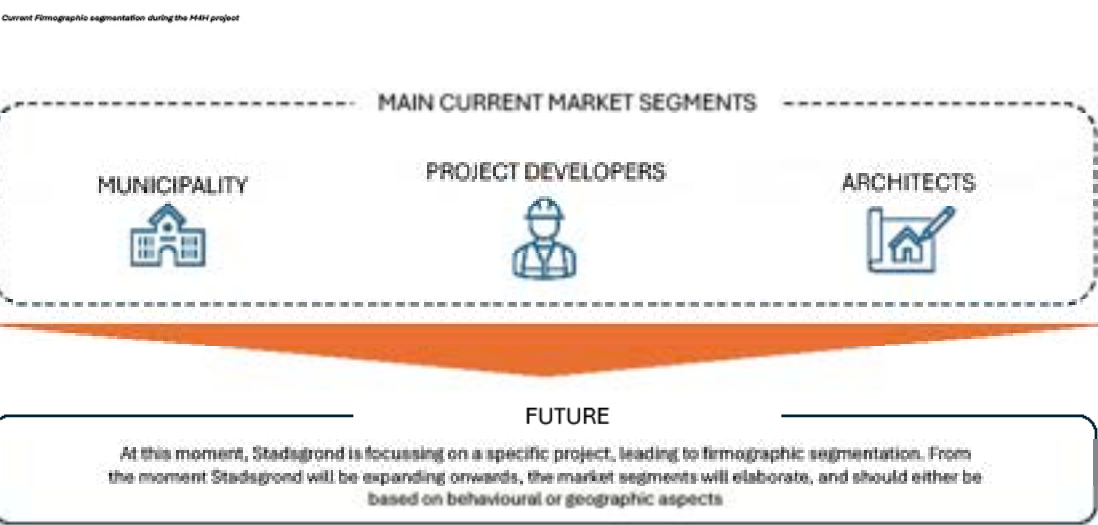
Porter's five forces



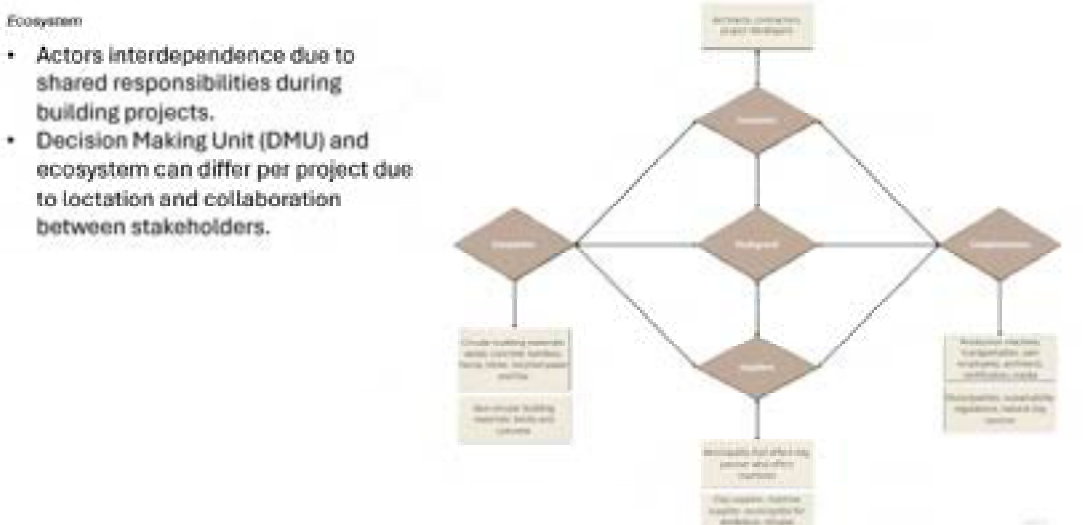
Porter's Generic Strategies



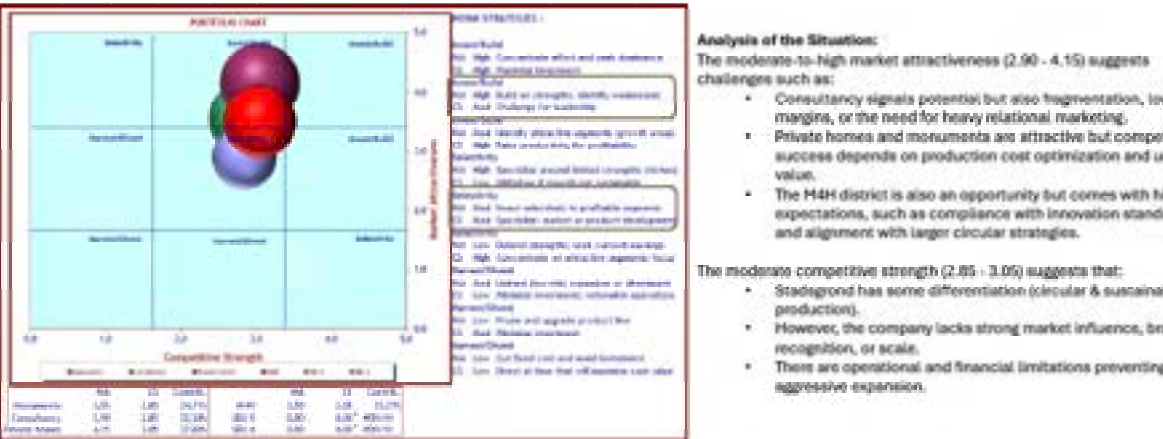
Market Segmentation



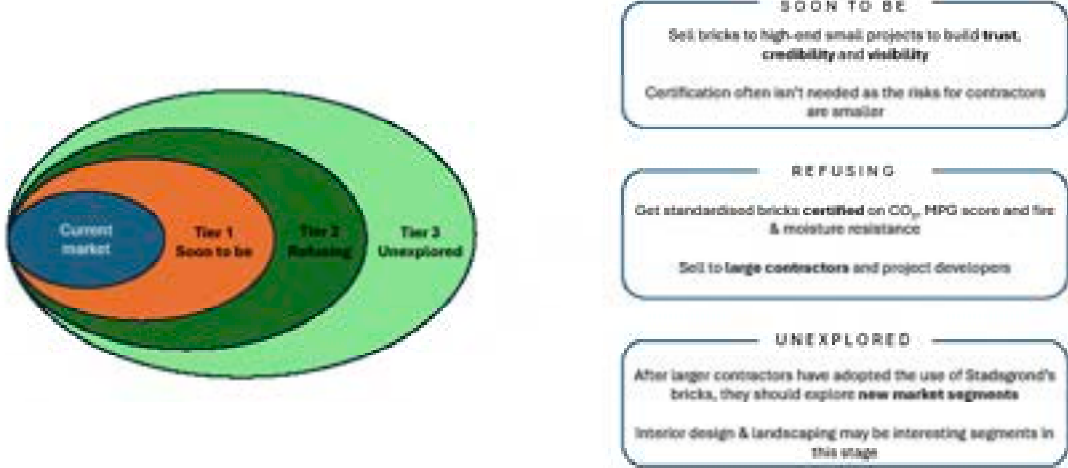
DMU can differ per project and location



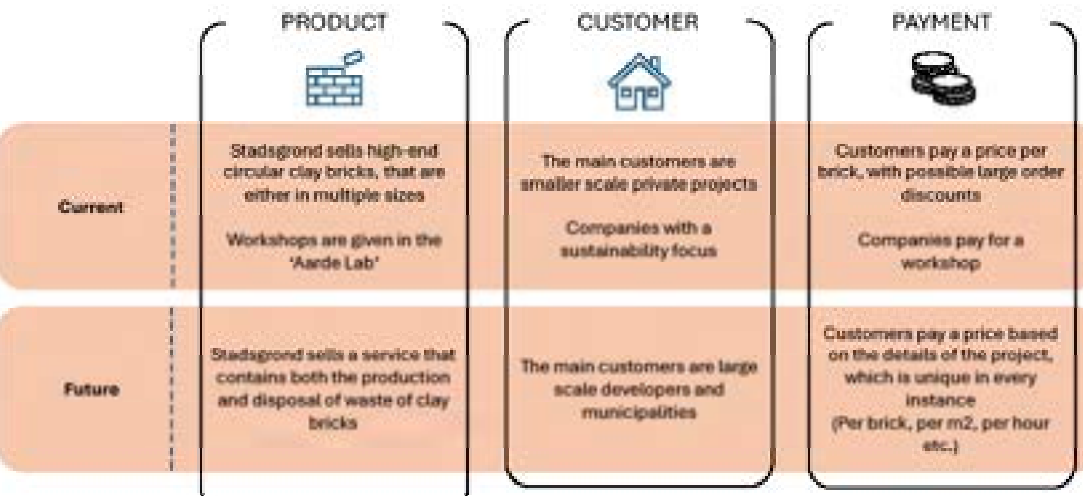
MABA analysis



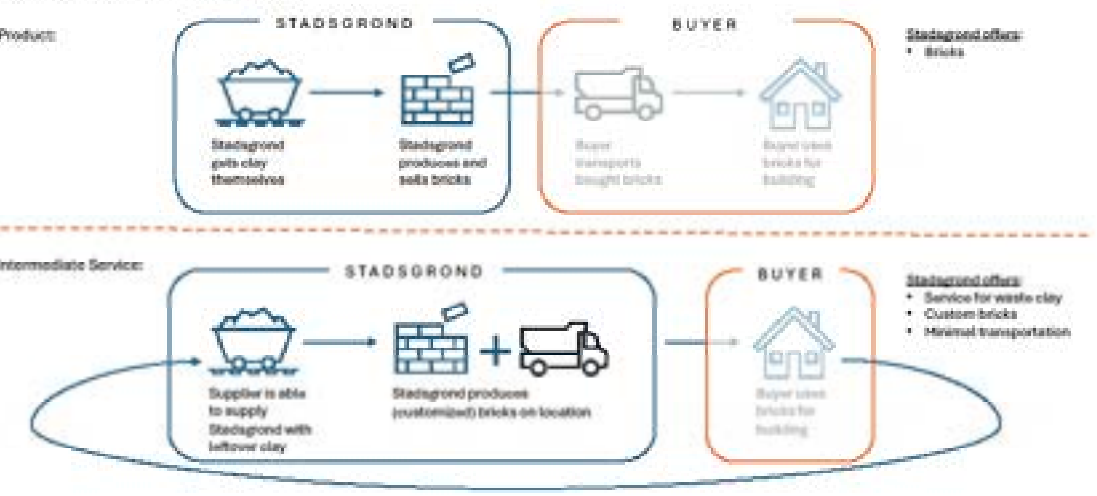
Stadsgrond firstly should prove their product, after which they can attract larger customers



Stadsgrond could transform its revenue model to a service revenue model



Stadsgrond could sell an intermediate service instead of a product



Lifecycle Assessment Methods



A component-level lifecycle model to
determine which cookware material is
truly most sustainable.

Comparing the environmental impact of aluminium, stainless steel and cast iron cookware

A full ISO-structured lifecycle assessment for BK, tracing every material, manufacturing step, transport leg and end-of-life pathway behind three pan materials.

Cookware is often compared on durability and recyclability, but it’s unclear which pan material actually performs best across its full lifecycle. I investigated this for BK, comparing aluminium, black steel (cast iron) and stainless steel frying pans: which type has the least environmental impact when used on a gas, electric, or induction stove?

Design approach

I defined the functional unit as providing a cooking surface for a household of three, four hours a week, over each material’s typical lifespan, and scoped the assessment cradle-to-cradle across nine scenarios, for every material–stove combination.

Method

Rather than estimating impact at a material-category level, I built a component-level inventory for each pan using the Idemat2023 database: the pan surface, handle, ceramic coating, rivets and packaging were each matched to a specific material and carbon footprint. I traced manufacturing as a real process chain (rolling, high-pressure casting, forging, coating) and modelled distribution as an actual freight route from the factory in Jiangmen, China, through the port of Yantian, by container ship to Rotterdam, and by truck to Delft, with distance and transport mode specified per leg. For the use phase I layered in a physical model of specific heat capacity, thermal conductivity and heat retention, combined with stove efficiency, dishwasher energy and soap use. End-of-life included disassembly and material-specific recycling credits, since recycled aluminium and steel return a net-negative emissions value.



Life cycle inventory	Weight per component (kg)	Process category	Category average carbon footprint (kg CO2e/kg)	Actual material carbon footprint (kg CO2e/kg)	Actual material carbon footprint (kg CO2e/kg)
Component description					
Aluminum	0.01	Aluminum	0.01	0.01	0.01
Steel	0.01	Steel	0.01	0.01	0.01
Cast iron	0.01	Cast iron	0.01	0.01	0.01
Coating	0.01	Coating	0.01	0.01	0.01
Handle	0.01	Handle	0.01	0.01	0.01
Rivets	0.01	Rivets	0.01	0.01	0.01
Packaging	0.01	Packaging	0.01	0.01	0.01
End of life process description					
Recycling	0.01	Recycling	0.01	0.01	0.01
Landfill	0.01	Landfill	0.01	0.01	0.01
Incineration	0.01	Incineration	0.01	0.01	0.01
Reuse	0.01	Reuse	0.01	0.01	0.01

Life cycle inventory	Weight per component (kg)	Process category	Category average carbon footprint (kg CO2e/kg)	Actual material carbon footprint (kg CO2e/kg)	Actual material carbon footprint (kg CO2e/kg)
Component description					
Aluminum	0.01	Aluminum	0.01	0.01	0.01
Steel	0.01	Steel	0.01	0.01	0.01
Cast iron	0.01	Cast iron	0.01	0.01	0.01
Coating	0.01	Coating	0.01	0.01	0.01
Handle	0.01	Handle	0.01	0.01	0.01
Rivets	0.01	Rivets	0.01	0.01	0.01
Packaging	0.01	Packaging	0.01	0.01	0.01
End of life process description					
Recycling	0.01	Recycling	0.01	0.01	0.01
Landfill	0.01	Landfill	0.01	0.01	0.01
Incineration	0.01	Incineration	0.01	0.01	0.01
Reuse	0.01	Reuse	0.01	0.01	0.01

Results

Stove type mattered more than expected: induction consistently produced the lowest emissions across all materials, gas the highest. A contribution analysis per lifecycle phase showed the use phase dominates total impact by a wide margin, with material extraction, manufacturing, distribution and end-of-life all comparatively minor. Within the use phase, black steel’s low heat-up energy and strong heat retention made it the most efficient performer overall, despite aluminium heating fastest.

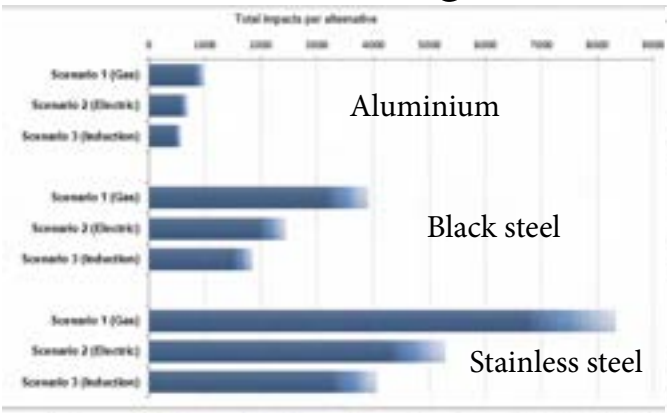


Figure 3: Total impact including the meal and conductivity (180 °C).

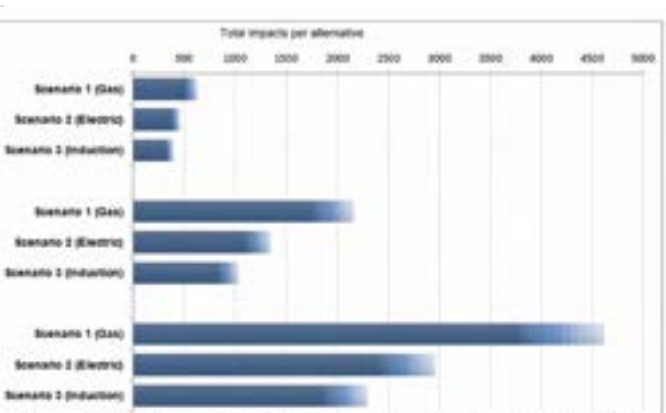


Figure 4: Total impact including the meal and conductivity (100 °C).

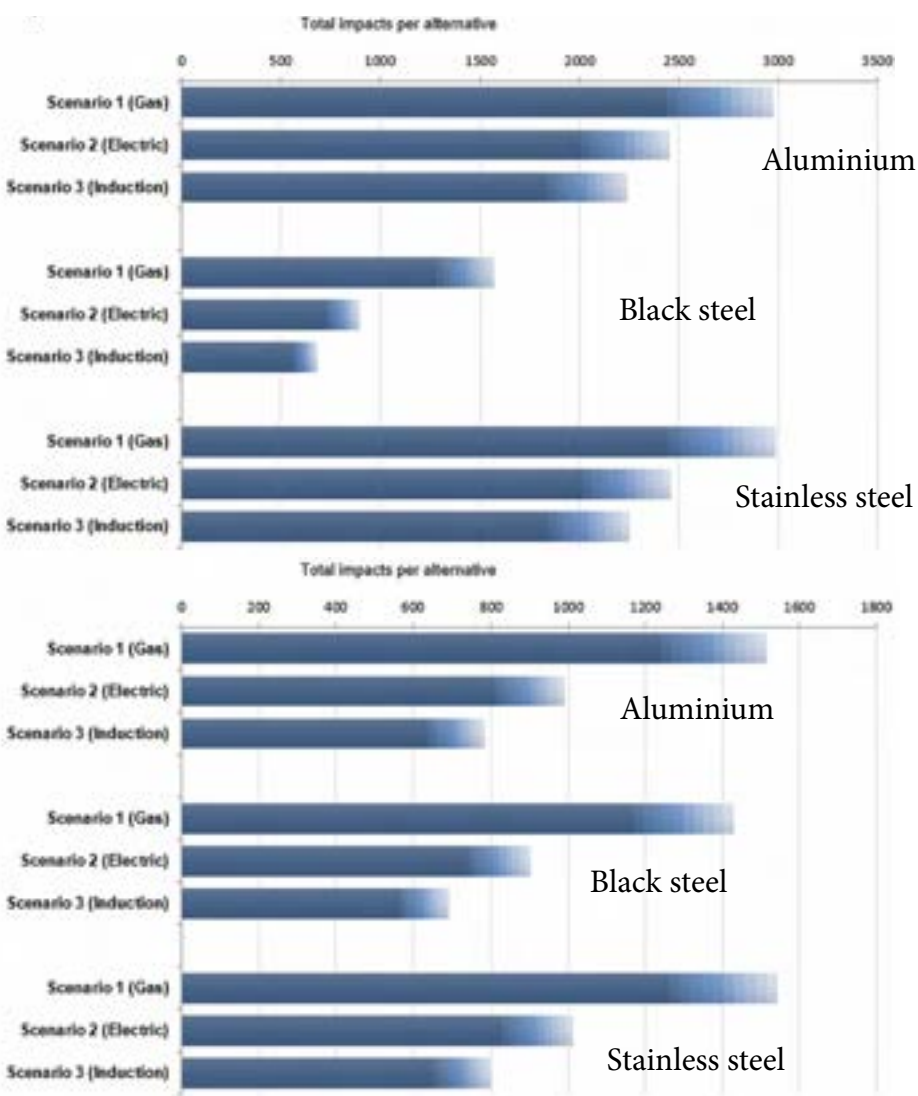
Relevancy

For a company like BK, this project is a working model showing exactly which factors (stove type, cleaning habits, cooking temperature) actually move a product’s environmental footprint, useful for both sustainability communication and consumer guidance.

Doing this project made clear that the lifecycle assessments of products can be misleading, based on the chosen included type of data and usage.

Sensitivity Analysis

I stress-tested the model with a 100-year reference flow and with/without dishwasher use. Black steel consistently had the lowest impact, while handwashing nearly halved emissions versus dishwasher use. The clearest finding: cooking behaviour and stove choice influenced total emissions far more than the material itself.



Personal Development

This project sharpened my ability to turn material properties into a quantitative model, and taught me how easily an LCA’s outcome can be shaped by which parameters are included, a finding I think matters more to a future employer than the headline result, since it shows I can read an assessment critically, not just run one.



P O R T F O L I O

Bsc Industrial Design Engineering
Msc Integrated Product Design

Dirk Lagemaat

dirkrlagemaat@gmail.com
+31628605684
www.linkedin.com/in/dirk-lagemaat-66445b1a6

Extra organisatory
project:

A boundary-object model
to diagnose and redesign
a government ministry's
innovation process.

Entrepreneurial Innovation by Design



Justitiële Informatiedienst
Ministerie van Veiligheid en Justitie

Changing innovation as Justid know it

To improve the innovation capacity of the ministry of Justice and Safety.

The reason why I found this course so interesting is because design does not only include products or services. This course was an eyeopener for me because we got to design something which was going wrong at the client at an organisational level.

As a designer, we can also adapt our problem solving skills to solve systematic problems, which other people do not have the insights for.

This assignment comes from the Justitie informattiedienst, or Justid for short. This organisation is part of the ministry of Justice and Safety and controls and secures all data inside the ministry.

Boundary object

Our boundary object is the IDER- model, as it portrays the optimal innovation proces, cut up into 4 stages.

A short view at the stages:

- Initiation (situation scoping, what is the situation we are working in)
- Design (problem design, what is the problem, iterating it along the way)
- Engineering (making the solution, making it viable)
- Realising (actually creating the innovation and implementing it).

Once a year they organise an 'innovation week', but they experienced some difficulties. For instance, there is a small number of proposals for experiments to work on during the week.

What is needed to get employees to come up with innovative ideas and to experiment with during the week?

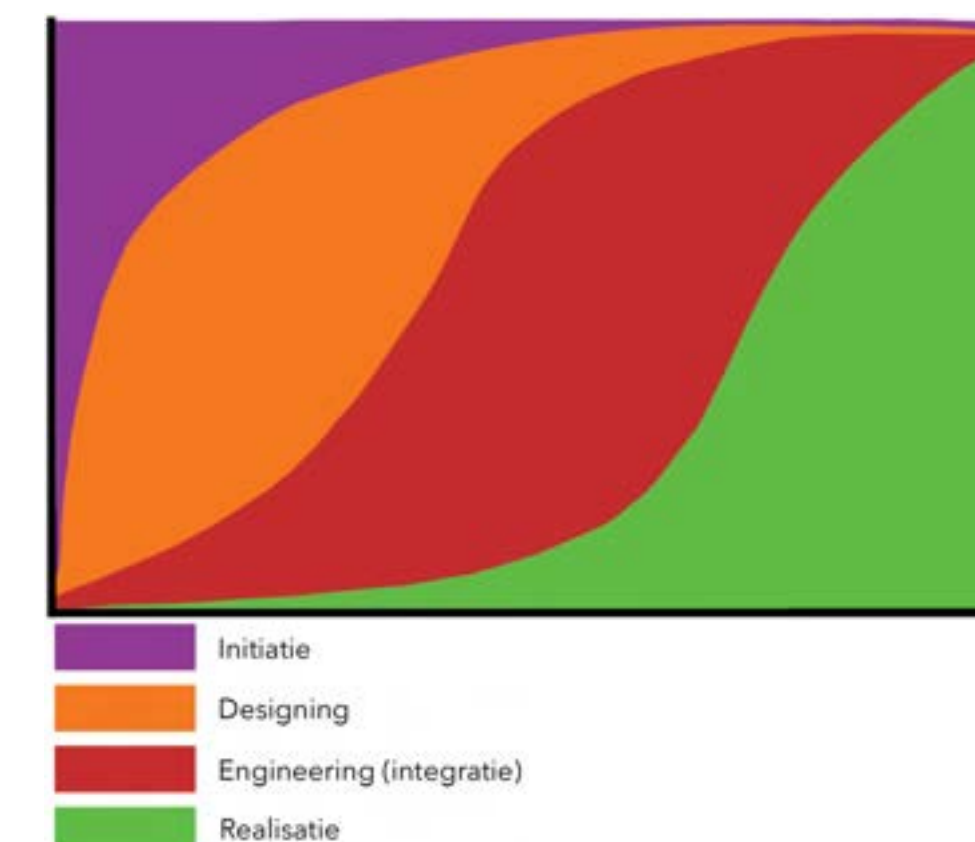
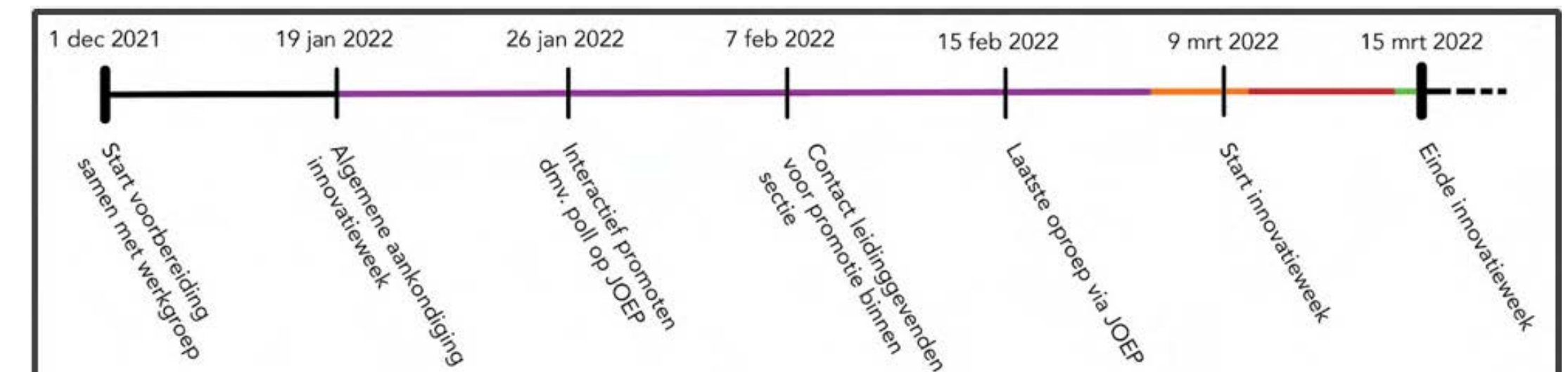
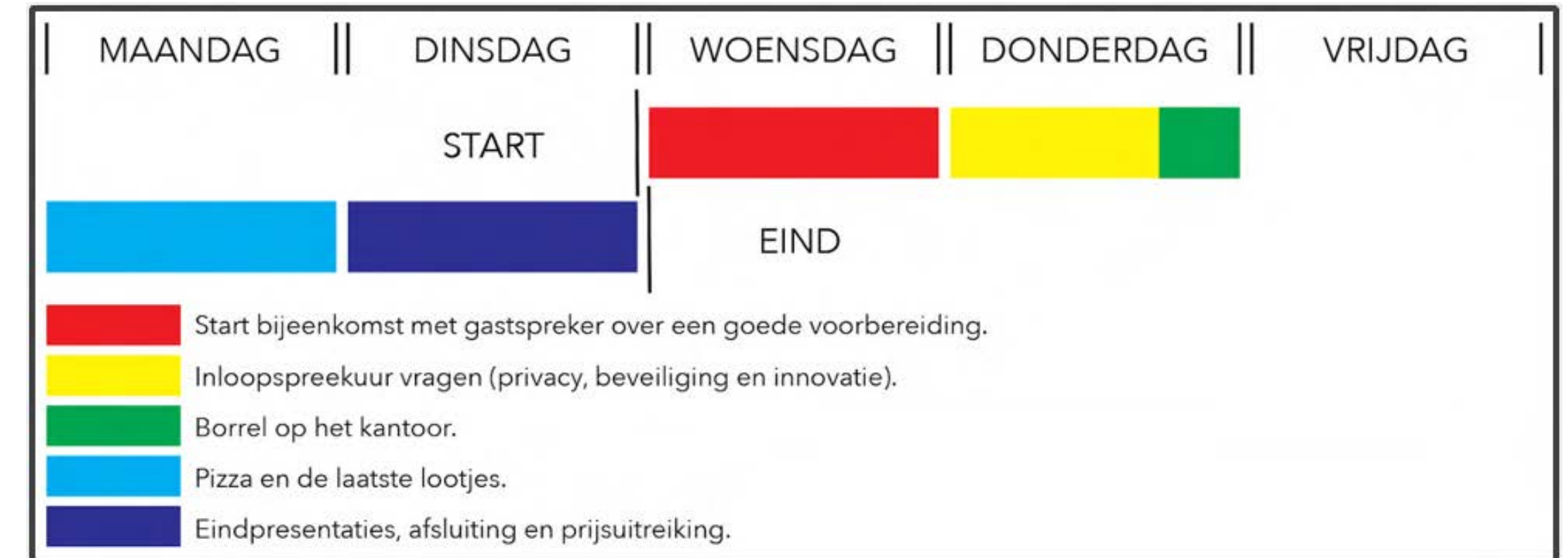


It is important that at every moment in time, all four stages are present, this is because innovation is an iterative proces and does not know any time limited stages (meaning they don't end). Within this iterative proces it is important that there is interplay between the colors, as this provides the most lucrative information and ideas. With the knowledge of this model and the proces it supports, the innovation week can be improved to solve all of the problems experienced by Justid at this point.

Current procedure

If we look at the current process we see lots of preparation, lack of motivation and lack of knowledge.

It also has some positive elements, such as a speaker and for the current layout, a break within the innovation week.



Deeper problem

The biggest underlying problems we found during our analysis is the missing knowledge of innovation (processes) and the lack of motivation.

Innovatie proces 'innovatiweek' traject



This gives us the IDER-model of the current innovation week, where there is too much initiation, almost no designing, hurried engineering and no realising which causes an unbalanced end phase.

Consult

Our consult is not as important as it might be with other cases, as our boundary object is the most important knowledge we are passing on. What we have as our consult is an example of how Justid could use the knowledge of the IDER-model to improve the innovation week.

New procedure

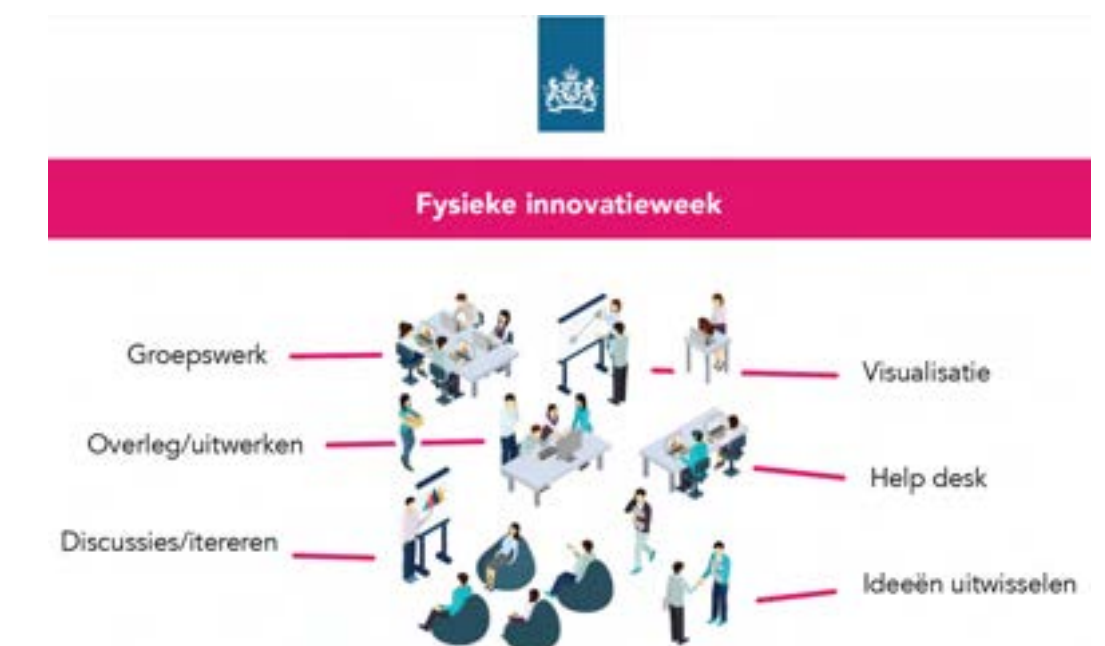
The new procedure offers a more balanced structure with more support during the whole week.

Supporting material

To ensure the participation of employees, some supporting materials have been made to get them started. The QR-code will be handed out before the innovation week, during the initiation phase.



And during the innovation week itself, multiple tools and guidance options are given to improve the quality of the designing and engineering phase.

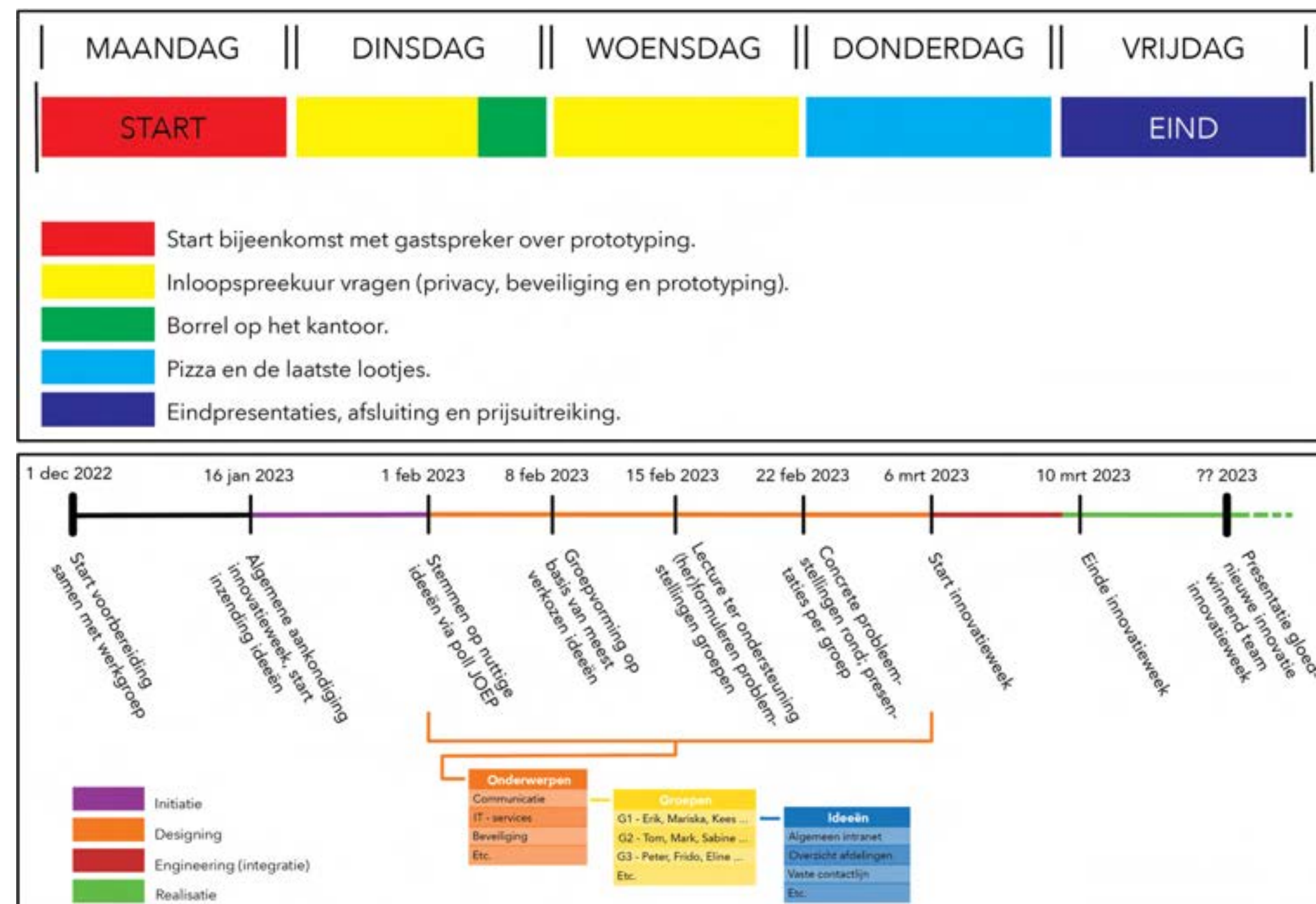
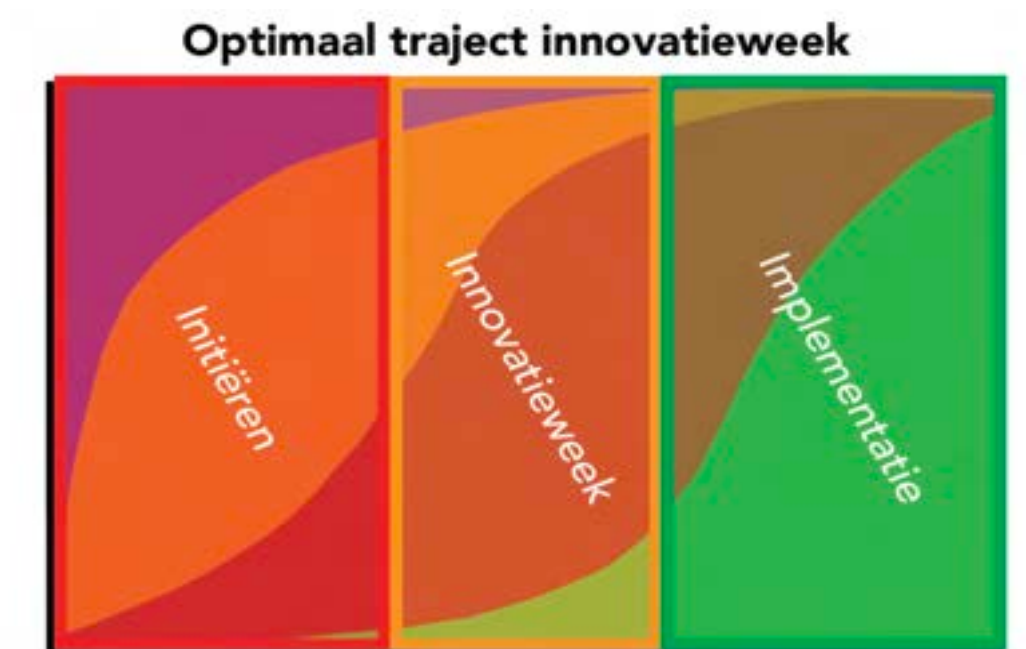


Final IDER-model

The final model we advice Justid to implement is split up in three phases, where the initiation phase begins before the innovation week.

During the week itself there is time and space, supported by innovation models and techniques to improve the designing and engineering phase.

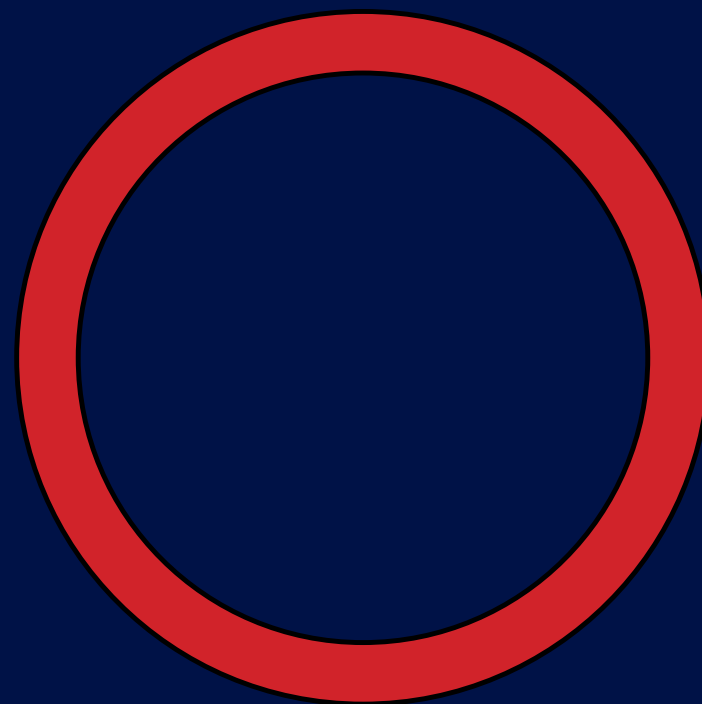
Where in the end, the ideas are more developed and of higher quality so they can be implemented after the week is finished.



Extra interior
project:

A three-coach interior
concept to match train
travel to distinct passenger
needs: working, relaxing,
and socialising.

Reimagining Mobility



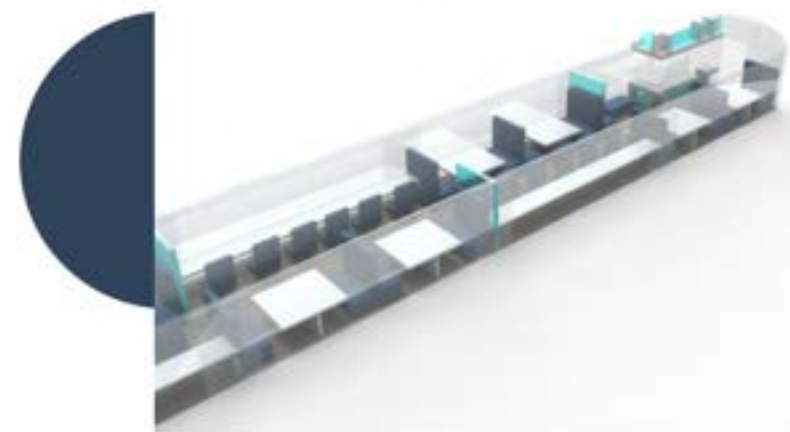
The multi coach interior

A new way of traveling, fulfilling travellers' needs.

This project I chose to highlight is very interesting to me because we had to design an interior which meets the needs of different types of people in our society, while it is accessible for everyone.

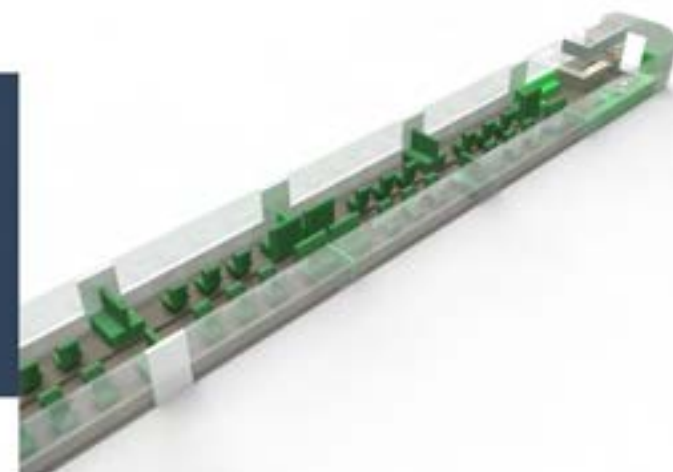
We accomplished this by including three different coaches in the current intercity trains of NS: the Relax Coach, the Soacial Coach and the Work Coach.

My project team and I believed that the current uniform wagons of the NS do not match any of the users' needs during a train trip/ In fact, the different needs cancel eachother out. Therefore, we designed the Multi Coach interior based on the different needs of people travelling with different kind of purposes.



The **Work Coach** is designed for everyone that wants to be productive on the train. The private and silent atmosphere increase productivity. And, because you are oriented to view the outside, it feels less like you are actually travelling.

The **Relax Coach** is especially designed for everyone who likes to chill on the train. Users can charge their phone, grab a drink and snack, and sit comfortably and privately in the single chairs.

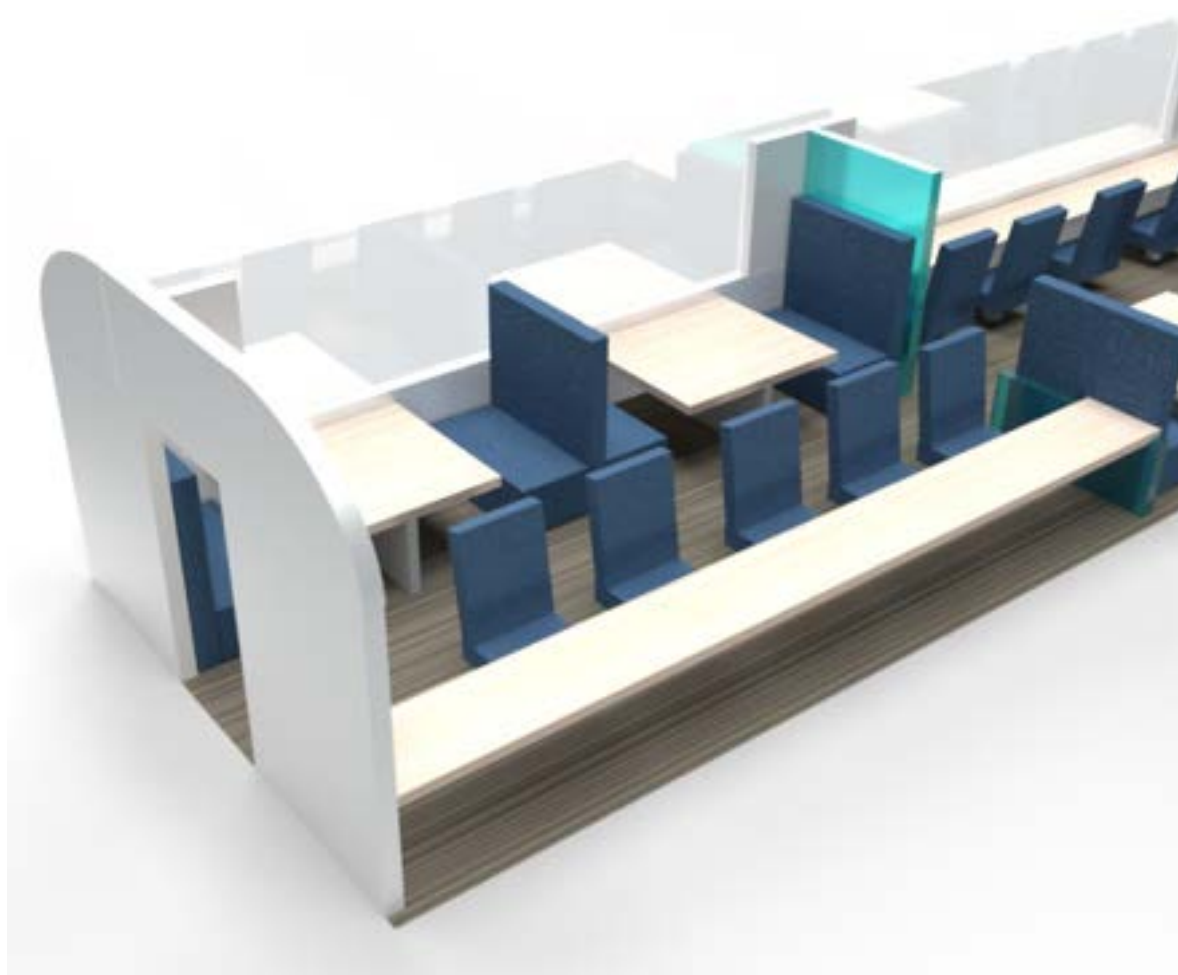
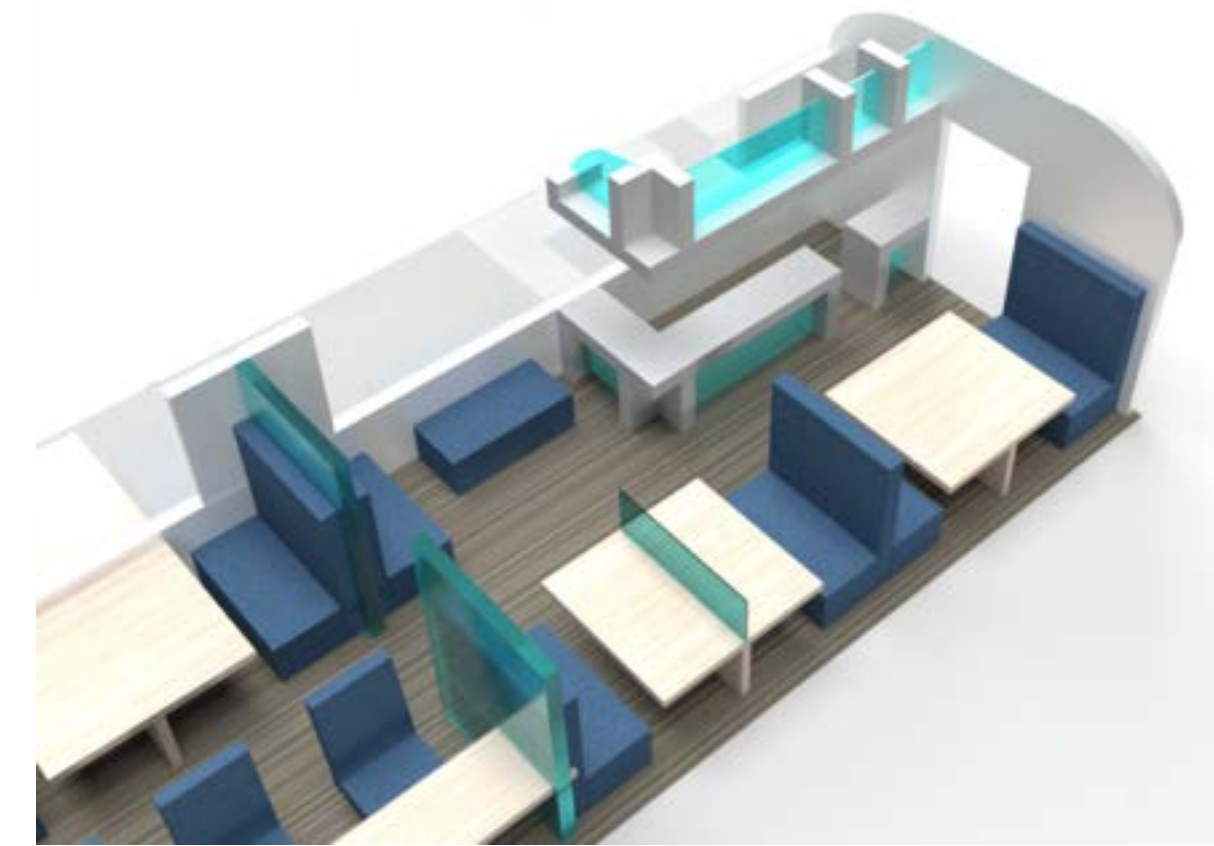


The **Social Coach** is designed for people who travel with a need of social cohesion. Therefore, it includes the most shared spaces of the three different coach designs. There are lots of opportunities to chat with other travellers, which the users experience as a feeling of company.



The Work Coach

The Work Coach is especially designed to accomplish the needs of the productive traveller. This is someone who does not want to feel like being on the train, and would like to continue working or studying. This should be done in a comfortable chair, where no one is able to disturb you and where it does not feel like there are too many passengers surrounding you.

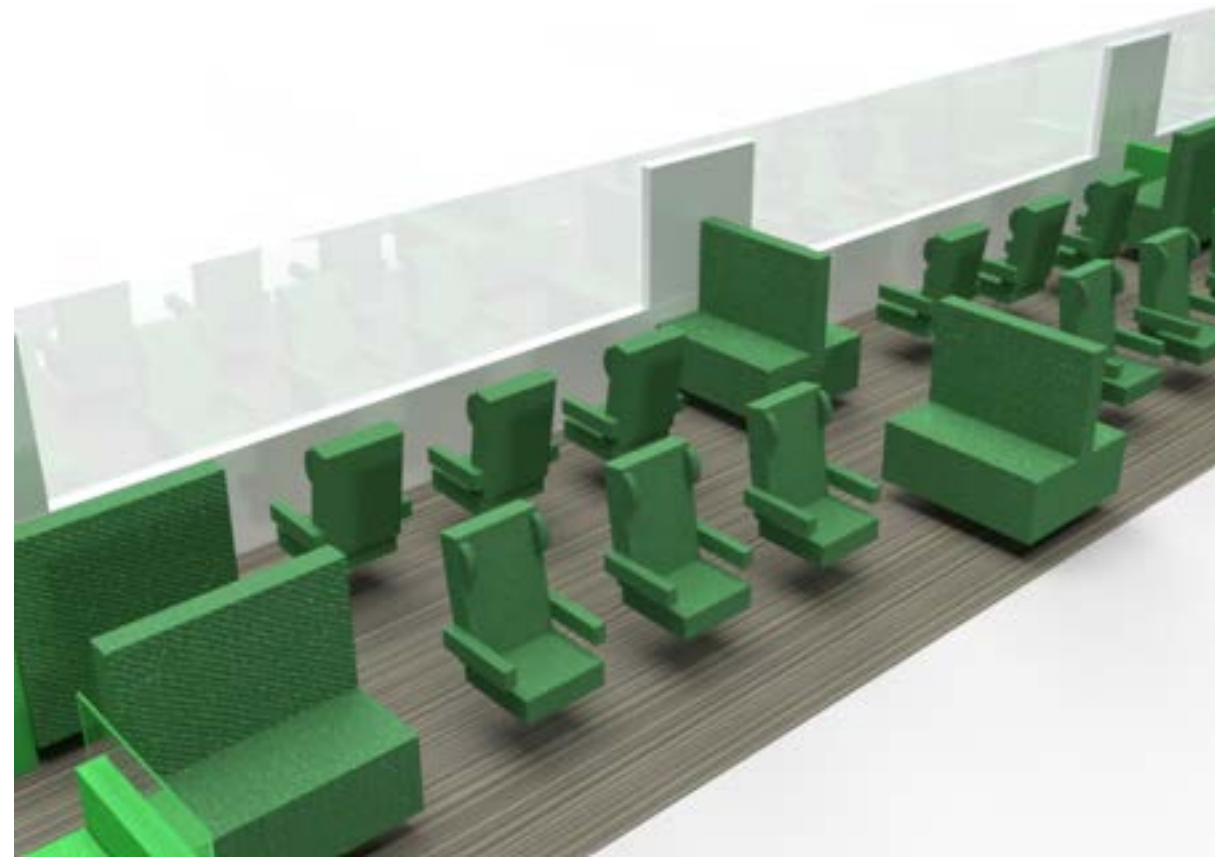


The coupe is equipped with a coffee bar, large windows, study spaces facing outside, outlets, wifi and separation walls to optimise concentration and decreasing any noise.

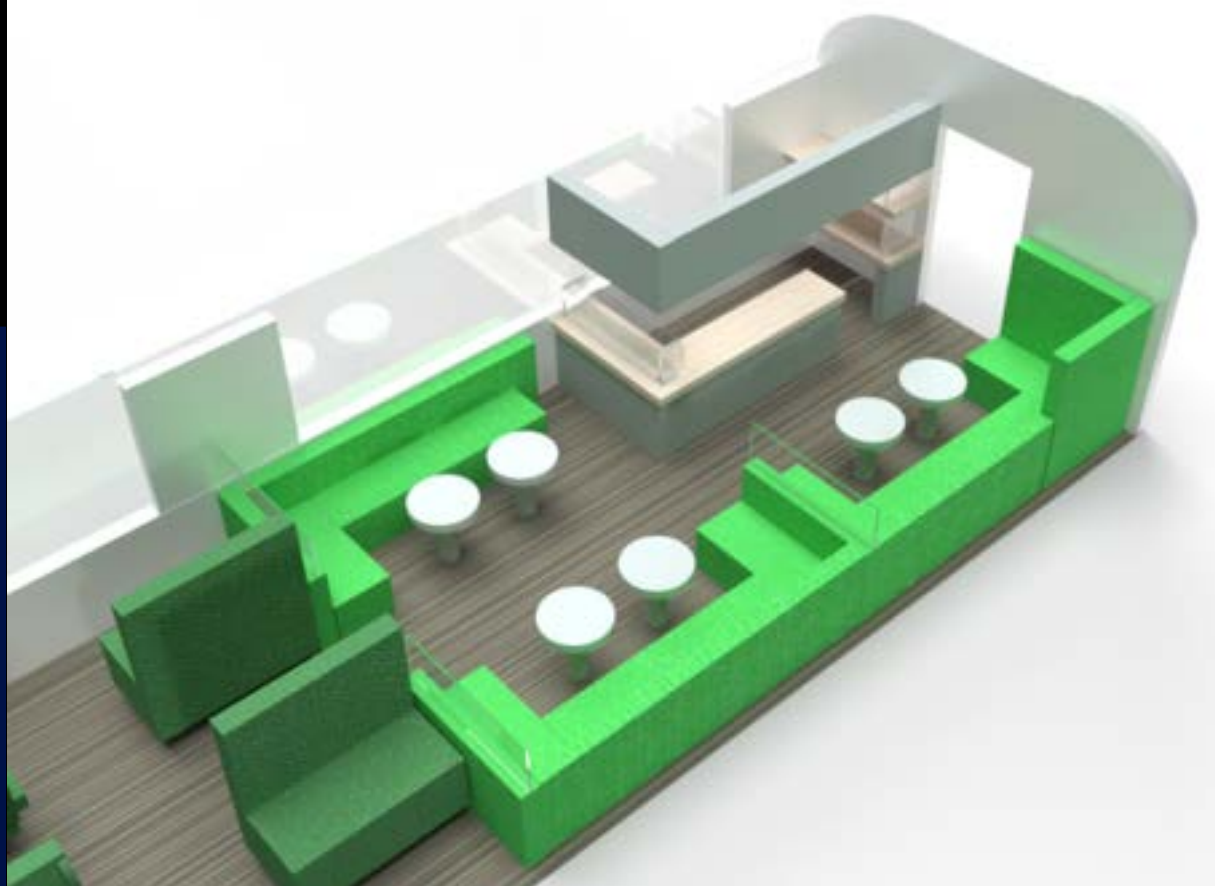
By increasing the feeling of autonomy, passengers can be more productive. This will especially help the passengers that usually spend their time on the train studying or working. To optimise this feeling of autonomy, the coupe is designed as a perfect work environment. Its inspiration comes from spaces where productivity is optimal, like University Libraries.

The Relax Coach

The Relax Coach is especially designed to accomplish the needs of the relaxing traveller. The needs that are met in this coach are physical and mental comfort, feeling of freedom and comfort of beauty. In this coach someone who prefers a quiet, pleasant trip will feel right at home. There are seating options on one of the couches, sofa's or adjustable solo chairs accompanied by a set of tables including wireless charging points, cupholders and regular outlets.

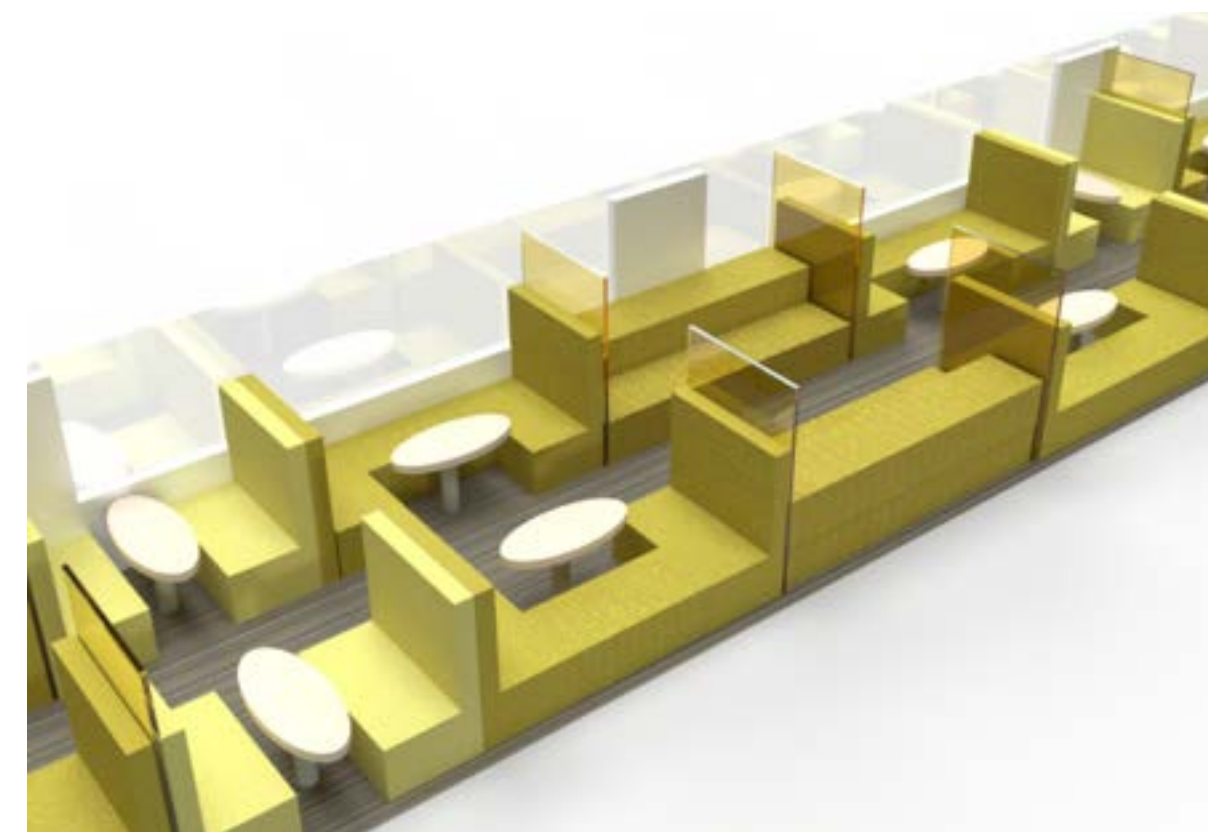
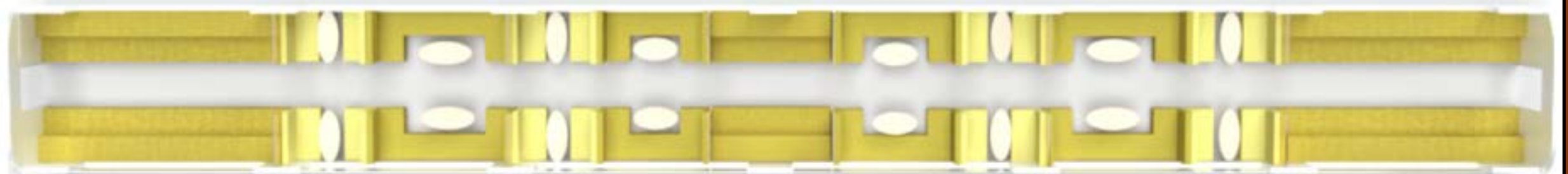
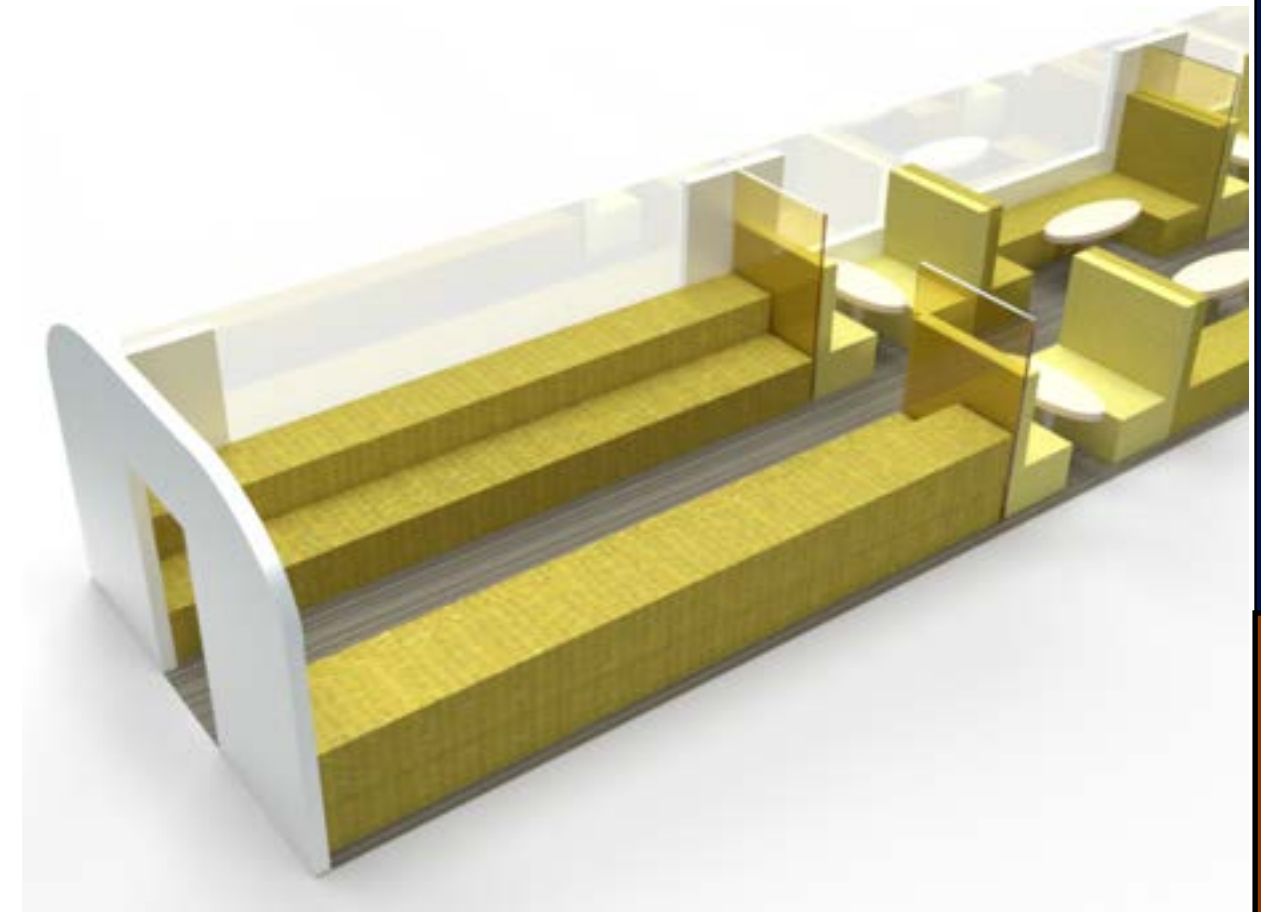


By increasing the feeling of comfort, passengers are able to relax on a physical and mental level. This will especially help to decrease the perceived travel time of the passengers. To optimise this feeling of comfort, the coach is designed including several facilities for optimum relaxation. The design originated from combinations of different aspects in long-distance vehicles, where people should be able to feel comfortable for a long time.



The Social Coach

The Social Coach is designed to accomplish the needs of the social people and people that travel in groups. These social travellers are more talkative and noisy, chatting with their buddies or with people on the phone. To cater to the needs for these travelers, this coupe is layed-out with comfortable and cozy group seats in multiple sizes. To enhance the social feeling of this coupe there will be soft background music playing to break the silence and make people prone to having conversations.



The social coach aims to improve the travel experience by focusing on the relatedness need. By catering to the people that travel in groups or want to call people, we help them to make the travel experience more pleasant and therefore the journey might feel shorter than otherwise. Furthermore, by separating the more noisy travelers from the other coaches, this will allow people in the Relax and Work coaches to travel unbothered, reducing the risk of nuisance.

P O R T
F O L I O

Bsc Industrial Design Engineering
Msc Integrated Product Design

Dirk Lagemaat

dirkrlagemaat@gmail.com
+31628605684
www.linkedin.com/in/dirk-lagemaat-66445b1a6