Clear.

Service design for supportive health systems.

TU Delft

Master Thesis | Javier Poves

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The design of a service proposition in the fi eld of Personalised Nutrition, embedding the use of blood glucose monitoring in the adoption of better eating habits.

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Executive Summary

From 1970 to the present day, people from all-over the world are increasingly struggling with overweight and obesity problems [1], even to the point that obesity is currently considered an epidemic [2]. Obesity is proven to be a main cause for the Metabolic Syndrome: a series of chronic failures in the way that certain human organs operate (hypertension, insulin resistance, fatty liver, etc.) [3]. In order to reduce obesity rates and therefore the affluence of Metabolic Syndrome, the healthcare context is paying more attention to develop effective interventions to prevent the problem occurrence.

In order to do so, health interventions introduce several strategies aimed to help people acquire eating behaviours and nutritional habits that stay away from overweight, obesity, and the Metabolic Syndrome [4]. These strategies vary from providing knowledge, ensuring motivation and building capability in the person. [5]

Additionally, monitoring health technologies developed in recent years are able to collect data directly from the human body, and thus offer potential opportunities to be used as means for health interventions [6]. These health technologies allow for the monitorization of a wide range of biometrics related to the way our body uses and stores the food that we eat. (e.g. burned calories, heart rate, blood glucose concentration, etc.). The adoption of these technologies is moving beyond healthcare institutions, by the general consumer who is increasingly aware of her own health [7]. This is also causing a shift towards the domestic context as a key area to deploy preventive health interventions. [8]

The societal and technological events described previously create an ideal environment for the design and development of new value propositions that offer to the general consumer an effective way of monitoring their health and improving their nutritional habits.

This Master's thesis looks at the development of a **Service Design solution for a Supportive Health System in the field of nutrition**. The project is scoped within Clear, a young organisation using Continuous Glucose Monitoring technology (CGM) to support better nutritional habits. [9]

This thesis applies a mixed-methods approach, integrating quantitative and qualitative data collection and analysis to answer the following questions: (1) How shall responsible parties generate a Preventive Health behaviour in the individual? (2) How shall design parties integrate data in the design of Supportive Health Systems? And (3) How shall organisations deliver services that integrate Supportive Health Systems to facilitate Preventive Health Behaviour?

In alignment with these questions, this project presents four significant outcomes:

Fristy, literature review plus desk research helped to identify nine Key Requirements, i.e. guidelines for the design of a service integrating a Supportive Health System.

Secondly, qualitative research methods allowed for the understanding of five Success Factors for Clear's service proposition. These factors cover organisational capabilities, user needs, and market drivers.

Thirdly, the combination of Key Requirements and Success Factors, resulted in the definition of a new service. This new service can be labeled as a Learning Journey, in which, by means of a CGM device and a digital platform, people engage with practical challenges to incrementally learn actions that improve their own nutritional habits (for example, experiencing the effect of carbohydrates on their blood glucose). In order to explore the possibilities of this service, two methods were conducted: on the one hand, five participants underwent an explorative pilot study in which they could experience the new service for two weeks. On the other hand, a digital generative tool was used to gather quantitative insights from people on remote. Analysis from both research methods served to translate the new service into a Customer Journey Map that explains and delimits the service.

Lastly, the integration of the Learning Journey within Clear's current service creates an opportunity to evolve towards a long-term sustainable and scalable business model based on subscriptions. A description and guidelines for implementation of this business model is also included in this report.

The end goal of the final service solution presented in this report is to offer a proof of concept for a viable proposition in the emerging field of Personalised Nutrition. It is meant to be a guide for implementation to the collaborating organisation, and an actionable way to provide inspiration for key stakeholders of the field.

In conclusion, this thesis uncovers the potential of integrating Supportive Health Systems into consumer-oriented services that are good for society and for business. Through this, the author hopes to contribute to improving societal challenges linked to health and wellbeing.

Report Structure

This report is organized in 8 Chapters. It first introduces the topic, background and methodology followed during the project. After by a divergent research phase, design criteria is established. This criteria is the baseline for the ideation and conceptualization activities. Finally, a Service design solution is presented, evaluated and discussed. This report concludes with a discussion, reflection, and recommendations for implementation.

The chapters unfold as follows:

Chapter 1 describes the topic, as well as the background and relevance of this project. It introduces the research questions, assignment, project scope, and approach.

Chapter 2 provides a holistic understanding on how to design a service based on a Personal Health System for behavioural change. It also reviews the context and characteristics of Clear's current service. The literature review and desk research allowed to identify 9 Key Requirements that give answer to the main research questions.

Chapter 3 aims to define criteria for the final Service proposition. For that purpose, qualitative research methods are used to elicit opportunities and limitations for Clear's new service, and generative sessions are conducted to make strategic decisions upon these opportunities. In the end, 5 Success Factors for the final solution are identified.

Chapter 4 is meant to be a bridge that connects the outcome from previous chapters, defining a metaphorical box in which the new service will be contained. This box is shaped in the form of an inspiring design vision. Chapter 4 works as a stand-alone piece of information that allows to understand, in a glimpse, the reasoning and background that will support the decision-making contained in the development phase of following chapters.

Chapter 5 guides the reader through the development phase of the project. It provides an overview of the ideation activities, such as creative sessions and sketching. It also shows the conceptualization phase in which the service moved from the 3 Core Experiences it shall deliver, to specific touchpoints. To validate the effectiveness of the touchpoints in delivering the 3 Core Experiences, two validation methods were implemented: a pilot study with 5 participants and an online research tool.

Chapter 6 presents the final design concept for the Service solution including a Customer Journey Map and a Subscription-based business model, as well as the final evaluation, design recommendations, and limitations.

Chapter 7 focuses on the requirements and implications for implementation of the new service, and has been tailored to the organizational capabilities of Clear.

Chapter 8 concludes this project through a final discussion, and a reflection on the process.

The separate **Appendix Document** includes all the complementary material hasn't been introduced in this report.

Reading guide

To make the reading of this report lighter, specially for those parties who are not familiar with the design process and might want to scroll through the outcomes and results, a special section has been added at the end of each chapter with the main results.

All together, they consist of:

1. Overview of the **methodology** followed during the project.
2. 9 **Key requirements** for the design of a proposition using Supportive Health Systems.
3. 3 **Strategic Decisions** taken within Clear that, together with 5 Success Factors provided a direction in the process.
4. A **Service Framework** and a **Service Vision** that delimit the design of the new service.
5. 3 **Core Experiences** that Clear's new service will deliver through the Customer Journey.
6. Main **touchpoints** of the new service.
7. **Customer Journey Map.**
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9. **Implementation Roadmap.**

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Chapter 1

Setting up the stage

This chapter contains all the basic information to contextualise this thesis project. It presents an introduction to the project, its relevance, the project scope and the project approach. It presents an overview of the process and a reading guide for the report.

Chapter overview

Introduction

Background

Looking at the top priorities for healthcare in the coming years, it can be seen that **nocive behaviors** (excessive alcohol consumption, tobacco and drugs consumption, poor nutritional habits, lack of physical activity, etc.) are on the spotlight, since they are causing the rise of health-related problems and diseases (cancer, heart diseases, obesity, diabetes, etc.) [10]. These nocive behaviors are **connected to the top five causes of death globally**, and up to the top ten causes in high-income countries [11]. It is predicted that in 2040, 62% of Dutch population will be overweight and 9.8 million people will suffer from at least one chronic disease. [12]

Overweight and obesity have reached a pandemic situation, causing an increment in the number of patients for Metabolic Syndrome all over the globe [3]. The Metabolic Syndrome is constituted by a series of chronic failures in the way that certain human organs operate (hypertension, insulin resistance, fatty liver, etc.) [4]. Suffering from Metabolic Syndrome does not mean being affected by all the interconnected problems, but at least suffering one of them. However, what all these metabolic failures have in common is that they are affected in one way or another to the food that we eat and our nutritional habits. [13]

In order to reduce obesity rates and therefore the affluence of Metabolic Syndrome, the healthcare context is paying more attention to develop effective interventions to prevent the problem occurrence. Behavior change theories and methodologies aim to change unhealthy behaviors and attitudes, and therefore have been proven valid methods to help prevent the increase of the aforementioned diseases. [14]

From the existent literature on Behavioural change theories and methodologies, several strategies can be depicted to create health interventions aimed to improve nutritional habits [4]. Some of these strategies range from providing knowledge, ensuring motivation and building capability in the person [5]. However, the effectivity and characteristics of these interventions vary widely, depending on (1) the specific behaviour to tackle (eating less sugar, doing more physical activity, drinking less coffee, etc.), and also on (2) the stage of consciousness and commitment towards changing a behaviour when starting the intervention. [15]
In recent years, the development of monitoring health technologies, able to collect data directly from the human body, offer potential opportunities to be used as supportive health systems for behavioral change [16]. These health technologies allow for the monitorization of a wide range of biometrics related to the way our body uses and stores the food that we eat. (e.g. burned calories, heart rate, blood glucose concentration, etc.). [17,18]

With the availability of these technologies beyond healthcare institutions, there is a responsibility shift about who is in charge of preventing the Metabolic Syndrome. The responsibility is now moving from doctors and health professionals to the person itself, i.e. the "patient", that is now able to track his/her own health. The domestic context is therefore defined now as a key area to deploy preventive health interventions. [19]

Figure 1 - Background overview

Opportunities and threats of Supportive Health Systems

Moreover, there is a growing adoption of monitoring technologies by the general population, who might not suffer from any of the mentioned clinical conditions, but is increasingly aware of them. The research from Lupton [20], uncovers some of the discourses that support data-tracking cultures:

Emerging concepts of the self that value self-awareness and self-improvement.

> We live in an era of competitive individualism, where people embrace self-tracking practices to know more and improve themselves, in an attempt to be 'an optimal human being' and 'your best self'. Self-reinvention is about the pursuit of personal growth, achievement, career success, health or wellbeing. The growth of cosmetic surgery interventions, or the rising sales of self-help books are some of the proofs of this trend.

A moral and political environment in which taking responsibility for one's life and health is privileged and promoted;

> Western culture has always addressed mind and body as two separated entities within the human being. Embodiment practices establish a "responsibility" for the mind to exert control over the body. Modern societies associate "controlled bodies" (lean figure, good health) with disciplined and hard-working minds. Therefore, self-tracking technologies that allow us to quantify and control better our body by measuring it, are seen as a new means to embrace and express embodiment.

The emergence of the digital data knowledge economy.

> Knowing capitalism was the term coined by Nigel Thrift to refer to the current new form of global economy [21]. Knowing capitalism depends on technologies able to generate knowledge from big sets of data, i.e. Big Data. This knowledge provides potential to be applied into public services, healthcare, education, politics, etc. [22, 23]. As a consequence, companies like Google, Amazon or Facebook are growing digital empires around harvesting big data and finding profitable ways of using it.

Put together, the **push from healthcare to encourage individuals to take responsibility for their own unhealthy behaviour matches the pull from society, who is eager to produce and consume more and more data in seek of optimisation and individualisation.** This leads to a perfect situation for the design and development of new propositions, in the shape of products or services, that make use of data-tracking technologies, to support people achieving better health status [16].

Nevertheless, major implications arise when designing for these types of propositions:

Firstly, there is a thin line between encouragement and coercion when suggesting new behaviours. Specifically defining who should be in control of the individual behavior [24].

> The strategies that health systems adopt to facilitate a behaviour move in a range from Supportive, where they play a facilitator role, encouraging the individual to make the right decisions by themselves, to Assertive, in which is the technology who decides what is the behaviour that the individual shall directly execute. To the present moment, there is yet no right point in which persuasive technology shall be positioned in the assertive-supportive scale. For this reason it is important to define how a personal health system shall assist/support the behavior of its users, finding the right balance between encouragement and coercion.

Secondly, strict data-driven use of these technologies lacks understanding of the personal context and experience of the individual [20].

> It is hard for these systems to gain a broad perspective of the complete situation in which a behaviour occurs, since they normally gather data from one single source, thus creating a univariable behaviour metric. Consequently, these technologies are in need of combining different data sources that allow for a full understanding of a behaviour. However, there is still limited knowledge on how different data sources can be of value when designing for supportive health systems.

Thirdly, these technologies can reinforce cultural trends of continuous rationalization and optimization of human behavior [25].

> As described by Lupton, these technologies exist in a moment in which society is shifting from a continuous-growth mentality, both at economical and personal level, towards a sustainability and balance-driven mentality, in which the individual shall find her own way to interact and evolve with its environment. In order to facilitate sustainable growth, and act against self-destructive trends. It is hence important to understand how a supportive health system can be designed to provide a human-centered experience.

Initial Problem Definition

It is with the interest of this thesis project therefore to design a value proposition within an organisation that **(1) integrates a personal health system to support in the prevention of health-related problems and (2) finds the right balance between economic viability and human desirability.** The goal again is to find a balanced position in which the proposition takes advantage of the growing cultural trends adopting Supportive Health Systems, but staying away from the threats previously described. The intended effect is that individuals would be able to use this proposition as a tool to monitor their behaviour, and conduct it towards a healthier one.

For this purpose, this project is intended to give answer to the following research questions:

RQ1: How shall responsible parties generate a preventive health behaviour in the individual?

RQ2: How shall design parties integrate data in the design of Supportive Health Systems?

RQ3: How shall organisations deliver service propositions that use a Supportive Health System to facilitate preventive health behaviour?

Scope

Clear. B.V. is a young startup based in Amsterdam. Clear provides a service to help people achieve better nutritional habits. Clear helps people know better what effect food has on their own health, by looking at their blood glucose levels [9]. (Further explanation in Chapter 1> Clear.)

For this purpose, Clear has an app, the Clear app, where people can log what they eat and drink.
Second, Clear provides a Continuous Glucose Monitor (CGM). A CGM is a sensor designed to be placed on the skin. This sensor is able to communicate with a smart device, such as an smartphone, and tell, real-time, the blood glucose levels of the person wearing it.

Being Clear a startup founded one year before the beginning of this project, the service proposition of Clear is still limited: it does not allow for a scalable long-term service, able to deliver an engaging relationship with its users, that supports the adoption of better eating habits.

The use of the CGM tracking technology in the improvement of eating habits matches with the aim of this thesis project. Consequently, this project will give response to the above-stated questions via the service proposition of Clear.

Scoping therefore this project to the context and characteristics of Clear, it is necessary to answer the following question:

RQ4: Which aspects of Clear's service need to be redesigned in order to support lifestyle changes?

Assignment

From the context of Strategic Design, Service Design is the field that specializes in finding a fit between societal needs and the capabilities of an organization, in order to deliver services that help people solve relevant problems [26]. That is why, for the scope of this thesis, it was decided to follow a Service Design approach. The design solution envisioned as an outcome for this project is the materialisation of a new Service proposition of Clear that makes use of Continuous Glucose Monitoring technology to improve nutritional habits of their customers. As an outcome, it is expected to define and give shape to the service via the design of its Customer Journey and its Key Touchpoints.

In order to answer the research questions from previous sections, the following design assignment was created considering the Service Design approach and the implications of Supportive Health Systems:

The design of a service proposition for Clear that uses a Supportive Health System facilitating healthier nutritional habits and creates long-lasting relationships with users.

Project Approach

Through the 100-days duration of this Thesis project, a varied mix of methods were executed to guide in the design process that led to the results contained in this report. This section presents an explanation of the approach followed, and the connection between the used methods to develop the upcoming service solution.

A mixed-methods design approach

This thesis project was divided into four phases, grouped in two consecutive series of a diverging and a converging phase: Discover, Define, Develop, and Deliver. This Methodology is known as the Double Design Diamond, and has been proven as a relevant approach for design challenges such as the one contained within this thesis [27]. Through the four phases, a mixed-methods approach is followed, integrating quantitative and qualitative methods that allowed for data collection and analysis.

The process

Discover - Understanding of Supportive Health Systems

During the Discover phase, two goals are set. Firstly, the aim is to understand the nuances of designing personal health systems aimed at supporting behavioural change. Giving answers to the research questions (RQ1, RQ2, RQ3) will serve as initial requirements on which to base the final design of the service. Secondly, understanding in a broad perspective the characteristics and context of Clear's current service, will serve to elicit possible opportunity areas in which Clear can operate. With this purpose, Chapter 2 presents the procedure followed by means of literature review and desk research.

Since this thesis project touches upon different topics, (behavioural change, designing for health systems, service design) establishing ground knowledge on them was considered necessary for two reasons: First, exploring these topics would help to unveil existing theories and methods in which the solution can be based. Second, the literature review is intended to generate learnings that could not only be applied to the collaborating organisation (Clear), but to some extent, to any type of organisation integrating Supportive Health System into a value proposition. Therefore, the very first exploratory stage of this project consisted mainly in a literature review and desk research. It was in the project's interest to understand:

Theories and methodologies of behavioural change.

Behavioural change and habit formation are areas widely explored by scientific research. It was with the interest of this project to find basic guidelines to follow when designing a behavioural change intervention. For this, literature review evidenced different theories and methodologies. A generalisation of the implications from those methods was taken along in this project.

Design approaches that involve data in the design process.

The fields of data science and design collide in the exploration of human-computer interactions. There is then existing research on the use of data generated from technology such as monitoring technology in the decision process of a design project. From the explored methodologies, Data-enabled design resulted in the most promising for the aim of this project.

Existing Service design Practices within monitoring technology.

It was identified that there still is not extensive knowledge nor great examples on how to frame service propositions on the area of Healthy Behaviours. However, design techniques such as Business Modelling and Ecosystem Mapping can be effective to identify service opportunities in the e-health and preventive healthcare environment.

The specific context and characteristics of the collaborating organisation.

To ensure that this exploratory phase stayed within the scope of the project, desk research was conducted on Clear. For this purpose, I defined the characteristics of its current offering: a 2-weeks tracking program after which data-analysis generates results reported back to the customer.

In the end, it was possible to find 9 Key Requirements for the design of value propositions integrating Supportive Health systems. These Key Requirements serve to give answers to the first three research questions and create a relevant piece of information for the field of Design for Behavioural Change and Human-computer Interaction.

Define - Defining Clear's strategy

At the Define phase, the aim is to establish design implications that help envisioning the new service of Clear. For this purpose, firstly strategic decisions were made to delimit Clear's proposition. Afterwards, based on these decisions, 5 Success Factors were identified that ensure the feasibility, desirability and viability of a new service solution.

As explained in the previous section, the literature review and desk research conducted on the Discover stage addressed broadly on different topics. In order to narrow them down and create a fit between those learnings and the scope of the project, qualitative research techniques, mainly survey analysis and interviews, helped mapping out the current situation of the organisation and its service.

To familiarize with the organisation's service from a user perspective, the first technique conducted was a thematic analysis, using material from 196 respondents

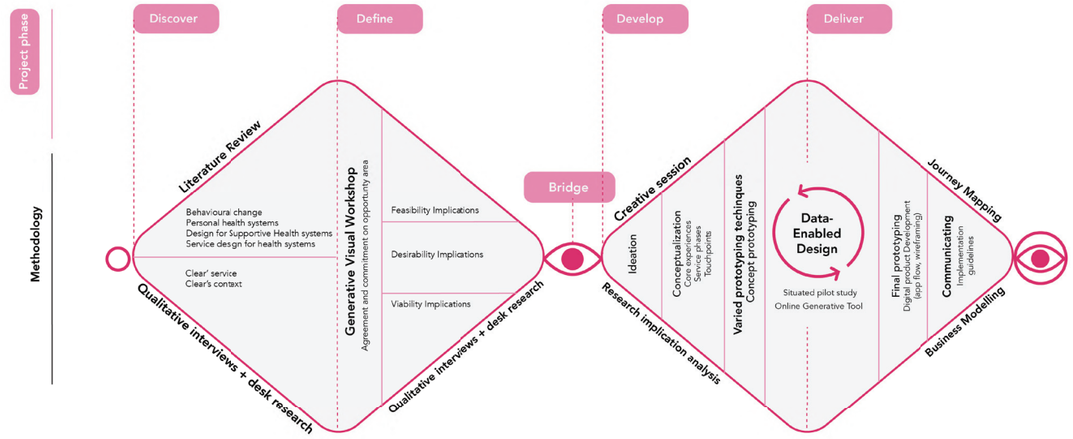


Figure 2 - Double diamond methodology

to an evaluation survey that Clear had been sending to their customers since some months (to ensure that the responses from the surveys addressed the current status of Clear's service, only were taken into account surveys responses from the previous three months). The analysis of these surveys allowed to find 20 improvement areas in which Clear service could be improved. This supposed a great beginning to identify what was the Clear service currently lacking. With this improvements areas in mind, interviews were conducted in three directions:

Firstly, it was intended to frame better what were the user expectations and motivations when purchasing the Clear product (at this point, Clear's proposition was a bit misleading on the sales channels, so people were coming in with different intentions/goals). A total of interviews with 6 new customers of Clear were conducted.

Secondly, interviews were performed with 3 professionals in the field of wellbeing and lifestyle that had some sort of collaboration with Clear. With this, it was intended to explore which were the consideration of other professionals of the field about Clear's service and the value of it.

Thirdly, interviews with the current 8 members of Clear were conducted. There it was intended to frame the internal view on the organisation and its service, pointing out towards the future to see where the company itself wanted to head towards.The internal interviews served to highlight points of discrepancy within the organization's strategy and direction (The why, the how, and the what of their service).

The insights from these interviews were very valuable and offered promising learnings to frame different propositions. Actually, three opportunity areas appeared. However, before moving forward on choosing, it was needed to align perspective and make consensuated decisions. The use of a Visual Generative Workshop with the members of the Clear Team helped immensely. After the 2,5 hours workshop facilitated in collaboration with a visual designer, there was a solid commitment on which opportunity area to explore (Personalised nutrition).

The consecutive line of thought was that there was a need to find which factors would determine the success of the proposition as agreed in the Visual Generative Workshop. To define these factors, three lenses were looked into: (1) Desirability, bringing back the insights from the surveys and the interviews with users to find a match with what people were looking for in Clear's service; (2) viability, exploring the nuances of the chosen opportunity area (Personalised nutrition); and (3) feasibility, keeping the foots on the ground by being realistic on what Clear can offer. In the end, 5 Success Factors resulted from this analysis.

Chapter 3 elaborates on the qualitative research techniques followed to define the Strategic Decisions, and the analysis and synthesis of information to establish the Success Factors.

Bridge - Delimiting the service

As a recap on the process, Phase 1 established 9 Key Requirements for any organisation to establish a proposition using Supportive Health Systems. Phase 2 framed these requirements within the organization that entails this project, defining 3 strategic decisions and 5 success factors that will ensure the (1) integration and (2) implementation of the outcome Service solution.

Looking at the double diamond design methodology, this point of the process corresponds to the end of the first diamond, and the beginning of the second one. This means that, by now, there should be enough criteria and specifications to define a metaphorical box in which the design solution is contained. Within this box, there is room for creativity and ideation (which is indeed the following stage), but provides firm boundaries on which direction to take. In order to give shape to this metaphorical box, two different

visualisation techniques were used. On the one hand, the elaboration of a Design Framework matching Key Requirements and Success Factors would provide, in an eye-blink, all the learnings from previous stages. On the other hand, the Generative Visual Workshop had created a first step for an inspiring vision of what the new Clear's Service outcome can be. So, why not adding the remaining learnings to this visual, and create a powerful and inspiring vision to drive the design of the service solution? Therefore, a synthetic framework of the service was elaborated, and the vision was re-drawn, to match the new learnings. These two means of synthesization are very valuable to justify every decision taken afterwards.

Chapter 4 translates the findings of chapters 2 and 3 in an Design Framework and an Inspiring Service Vision, that served as a scope and starting point for the rest of the process. This chapter is aimed to be a stand-alone piece of information that allows to understand, in a glimpse, the reasoning and background that will support the decision-making contained in the development phase of the following chapters.

Develop - Designing the Service

Three different goals were included within the Develop phase. First, defining the overall experience that the users will get from interacting with the service. Second, translating these experiences into specific touchpoints in which people will interact directly with Clear. Third, capitalizing on this new service through a revenue model that contributes to the sustained growth of the organization, and the creation of long-lasting relationships with its customers.

At the Develop stage, diverse techniques were deployed that helped to move the service from an abstract to a concrete level.

Initially, the power of creativity was needed to inspire an idea that, originated within the box that the design framework and vision established, had enough originality and potential to become a viable solution. For this purpose, a creative session with students of the Elective Course of Creative Facilitation at TUDelft was conducted. This session sparked the possibility of creating a service in which, by means of gamification, people would become aware of their nutritional habits and learn how to improve them. Validation on online blogs showed that people are indeed in need to find actionable tricks and tweaks to act on their health, confirming thus the potential of this idea.

However, this idea was still in a very undefined stage. Fitting the idea within the Service framework, unlocked the next level of concreteness: 3 Core Experiences. Each of these experiences describes how a user shall feel through the service journey to achieve better nutritional habits, and thus divides the overall service into 3 consecutive stages. The connection of these experiences (awareness of status, understanding of progress, and convenient integration) to Clear's capabilities, helped to define which touchpoints shall the new Clear service integrate (any interaction between the user of a service and the service itself is considered a touchpoint).

The validity of the Core Experiences was supported by the Design Framework. However, the extent to which the defined touchpoints were successful in delivering the Core Experience, was still unknown. In order to give an answer to this, two different validation methods were ideated, prototyped and tested.
On the one hand, a Pilot Study with real users of the service across two and a half weeks, provided rich insights on the accuracy and definition of the touchpoints. During two weeks, continuous contact was established with the people, following a wizard-of-oz approach.

On the other hand, an Online Interactive Tool was sent across digital channels to allow people experience the new ideated service, without the limitations of time and logistics that using a monitoring technology entails. The freedom that this online tool provides, helped to generate learnings not only on how were the core experiences delivered in the touchpoints, but also into which was the perceived value of the service, and how can therefore it be capitalized into a sustainable revenue model.

The intended goal with these two methods was to follow a Data-Enabled Design approach. This approach has been proof valid when designing for intelligent ecosystems, and allows for the translation of behavioural, experiential and contextual data into learnings that can, after analysis, be integrated in the solution.

In Chapter 5, the Final Service solution is moved from the idea towards a concept stage. The use of the two explorative validation methods helped to reach the final level of definition for the service. Insights collected from both methods allowed us to understand the possibilities of a subscription-based revenue model.

Deliver - Communicating results

Finally, during the Deliver phase, three main outcomes are created. The goal of these outcomes/deliverables is to serve as a mean of communication of the results of this project. Since the aim has always been to define a new service proposition for Clea that supports the adoption of healthy habits and creates long-lasting relationships with its users, the goal of these three outcomes is to ensure the implementation of such a service.

The characteristics of this thesis project (100 working days) restrict the definition of the deliverables what is time-wise possible. However, it is with the interest of the project to facilitate the implementation of the service as much as possible. For that reason, the last stage of the design was focused on creating material in a level of definition that would make possible its realization by the organization after the project is concluded. In the end, three main deliverables were elaborate.

The first outcome intends to develop a Journey Map. A Customer Journey map is a Service design tool used to communicate to different parties the key characteristics of a service. Following a timeline composition, this map combines the actions, emotions and touchpoints that a person is conducted through when interacting with the service. Additionally, it incorporates the operational logistics that the service needs to focus on through the journey.

The second outcome consists of an elaboration on main touchpoints, essentials to make the proposed service come true. These touchpoints are: clarificatory explanations of the relevance of glucose for health and wellbeing that Clear shall make accessible for their users; Interactive challenges that users would complete via the digital app from Clear, and guidelines for Clear to develop an intelligent algorithm that is able to predict the effect of a specific food item on a person, based on the data gathered from the CGM.

The third and last outcome is a suggested business model, with emphasis on the revenue stream that capitalizes on the unique advantages of Clear's new service.

Chapter 6 showcases and elaborates on all three outcomes. Chapter 7 summarizes key implications for the implementation of the new Clear service.

Specifications

Appendix explanation

As described before, Chapter 7 contains the most relevant takeaways for the implementation of the service.

Additionally, the process of this project led to many other relevant findings for Clear, which, due to the scope of the project, are not all included in these pages.

To make sure that these learnings are not lost after this project is concluded, this extra information is available in the following appendixes:

Appendix 3 - Internal Insights Documents
This appendix contains the findings from the internal interviews conducted with Clear's employees from 28-12-2020 until 30-12-2020.

Appendix 4 - Generative Visual Workshop material.
This appendix contains all the material from the Generative Visual Workshop conducted on 06-01-2021.

Appendix 5 - Survey Report.
This appendix contains all the insights from the analysis of all the user research that had been conducted before the start of this project (November 2020).

Appendix 13 - Strategic Document
This appendix contains the findings of all the research techniques used to find the unique value proposition of Clear.

Appendix 14 - Inspiring posters of Target Audience
These two posters provide sources of inspiration and guidance to help Clear empathise with its Target audience.

Vocabulary

CGM - Continuous Glucose Monitor.

Glycemic response - Glycemic response is the variation in the blood sugar levels as a response to the absorption of the carbohydrates contained in any type of food digested by the human body.

Diet - Diet is sometimes misunderstood as specific requirements and limitations in the food that a person eats, such as "low-carb diet" or "vegan diet". However, the word diet in this thesis refers to all food choices that a person makes in everyday life.

Participant - Since Clear currently delivers a service labeled as Program, it is commonly used the name "participant" to address the user of this program. During this thesis, both terms, "user" and "participant", are used to address the people that make use of Clear's service.

Health technology - Technology able to retrieve data from the human body.

Supportive technology - Technology used for behavioural change interventions.

Supportive health system - Combined use of health technology and supportive technology.

Ethical issues and participant recruitment

The involvement of participants in the pilot study at the development of this project was approved by the Ethics Committee of TUDelft.

The participants in this study were recruited using cluster sampling [28]. They were customers of The Clear Program that belonged to the desired Target Audience. For the pilot study, all participants joined voluntarily, gave signed consent, and were informed about their rights to discontinue the study.

Methodology overview

Here is presented an overview of the process followed to complete the assignment scoped within this Master's Thesis for Strategic Product Design: The design of a service proposition for Clear that uses a Supportive Health System facilitating healthier nutritional habits.

The design methodology followed is known as the Double Diamond, and it has been proven to be a valid approach to solve complex problems such as the one here tackled [27]. The double diamond consists of two consecutives cycles of a diverging (explorative) and converging (delimiting) stage.

The first diverging stage was conducted by means of literature review on the fields of behavioural change, persuasive technology, design methodologies for intelligent systems and service innovation. Additionally, research on the context and the current service of Clear was conducted.

The literature review and the desk research accompanied the process until the first converging stage. The output from interviews with the internal team of Clear was taken into a Generative Visual Workshop. This helped to make strategic decisions delimiting the service. These decisions were researched further to find implications for the service.

Before jumping into developing a service solution, a framework and a vision were created to collect the learnings from the first diamond and serve as guidelines for the second.

At the development phase (2nd diverging stage), a creative session provided enough ideation to identify the way to continue. Two generative methods were prototyped and implemented to redefine and validate the service solution: a pilot study with users of the service and an online tool that served as generative experience.

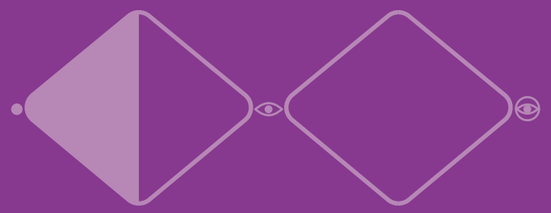
The methodology used was successful in delivering a solution for the scoped assignment. At the end, the new service solution is communicated through a customer journey map and a business model. As next steps, further validation of the outcome shall be done with the end users of the service.

	HOLISTIC UNDERSTANDING	DEFINING CLEAR'S STRATEGY	DELIMITING THE SERVICE	SERVICE DESIGN	RESULTS AND IMPLICATIONS
WHY? Objectives	Understand the integration of Supportive Health Systems into service propositions. With this, was given answer to the first three research questions. RQ1 RQ2 RQ3	Establish design criteria to delimit the new service proposition for Clear. With this, was given answer to the fourth research question. RQ4	Converge learnings from the previous two phases into visual guidelines that will serve for the design of the final solution.	Move the service from an abstract idea to a concrete solution. Ideating on possible solutions and validating the promising found idea was followed by identifying core experiences that the service shall deliver. these experiences were translated into touchpoints and explore by means of different generative methods.	Develop the final design of the solution. Stating organizational implications for its implementation.
HOW? Methods & Activitites	**Literature review** **Desk Research**	**Interviews** **Survey Analysis** **Visuak Generative Workshop**	**Visual Metaphor** **Design Criteria**	**Creative Session** **Online Validation** **Data-Enabled Design (informed stage)** Pilot study Online generative tool	**Digital product development** App flow Wireframing **Journey Mapping** **Business Modelling**
WHAT? Outcome	**9 Key requirements** These requirements represent basic guidelines for the integration of a service propositions that is aimed at improving the adoption of a healthy behaviour, by the means of technology.	**3 Strategic Decisions** These are three internal agreements that Clear defined and commited to, regarding its own service proposition. **5 Success factors** These factors are the criteria that would ensure the successful integration of Clear's new service into a proposition able to improve peoples nutritional habits.	**Design Framework** This framework converges all the learnings into an initial structure for Clear's new service. **Design Vision** This visual metaphor translates the Design Framework into a source of inspiration to guide in the development process.	**Service Core Experiences** These experiences are an intermediate step in the development process. They look at the service solution form a user perspective. **Main Touchpoints** These are the main points of contact between a service user and Clear trhough the entire service.	**Journey Map** Overview of Clear's new service: The Clear Learning Journey. **Business Model** Schematic visual of the main business areas related to the new service. **Recommendations for Implementation**
WHERE? Process stage					

Chapter 2

Holistic Understanding

This chapter focuses on gathering knowledge on how services can use personal health technologies for behavioral change. For that purpose, research is conducted into several subtopics. Additionally, this chapter looks into the main characteristics and context of Clear by means of desk research.



Chapter overview

Introduction

As a starting point for this project, it was considered necessary to establish a solid research basis. Creating good understanding on how to design health technologies for behavioural change, would help framing the requirements of the service proposition. With this aim, a research framework was established (Figure 3). The research framework divided the broad topic into addressable subtopics. By means of this framework, it was intended to understand:

> *General theory of behaviour and behaviour change methods.*
>
> *Existing personal health technologies and their use in behaviour change interventions.*
>
> *Characteristics of design approaches and methods aimed at designing Supportive Health Systems.*
>
> *Use of Service Design as a valid approach to solve similar challenges.*

Once the basic guidelines to design propositions integrating Supportive Health Systems were found, the next step was looking into understanding the organisation, the context and the system within which this project is scoped. In order to do so, it is needed to research on:

> *Clear as an organisation.*
>
> *The service proposition of Clear.*

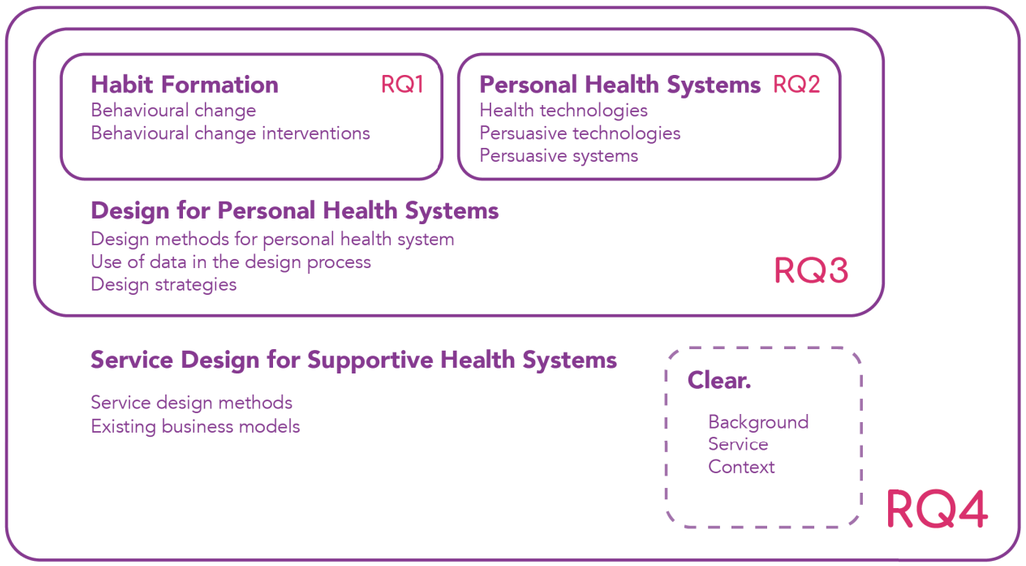


Figure 3 - Research framework

Habit formation

> To understand how shall a personal health system support in the adoption of habits, literature research is conducted to answer:
>
> *What is a behaviour and what influences it?*
>
> *How can a behaviour be changed?*
>
> *How does a behaviour become a habit?*
>
> *Which barriers are in the adoption of healthy behaviours and habits?*

Framing behaviour

Behaviour is defined by the Oxford dictionary as The way in which one acts or conducts oneself, especially towards others. [29].

Research into behavior change is primarily focused at the development of effective interventions to change a specific behaviour. These interventions vary widely, not only in the expected behavioral outcome, but also in the context and the techniques applied. Meta-studies on behavioural change frameworks were able to identify nine types of possible interventions: education, persuasion, incentivisation, coercion, training, restriction, environmental restructuring, modelling and enablement. [30]

In order to choose upon one type of intervention over another, behavioural change interventions are developed with a foundation on a specific Behaviour Model. The most extendedly used model is the Theory of Planned Behaviour (TPB) [31]. TPB describes a behaviour as the result of a behavioural intention. Behavioural intentions are the sum of these three constructs:

> **Your own attitude towards the behaviour** - is it good or bad for you?
> **A subject norm** - does society support it or not?
> **The perceived behavioural control** - is it easy or hard to do?

Whether these variables are positive or negative would influence the behavioural intention and thus, the final behaviour.

Michie et. al (2011) argue against the use of TPB and other models as basis for interventions, since they potentially exclude important variables like impulsivity or self-control. Instead, Michie et. al proposes a Behavioural Model in which Motivation, Capability and Opportunity as the intrinsic variables for any behaviour. [30]

> **Capacity** - Individual's psychological and physical capacity to engage in the activity concerned.
> **Opportunity** - Factors that lie outside the individual that make the behaviour possible to prompt it.

> **Motivation** - Brain processes that energize and direct behaviour. Not just goals and conscious decision-making

However, looking at these two models, it can be seen that they use different terminology to define similar variables that frame a behavior. In summary, what this literature on behavioural change teaches us is that a behaviour is mainly an action that results from: ***a behaviour is mainly an action that results from:***

Intrinsic motivations and beliefs of the person.

Internally, people have their own desires and expectations about how they want to be and what they want to achieve in their lives. These desires give shape to internal motivation, which is reflected in the actions we do in our daily life. But, are then always our actions connected to our internal goals? One could think that if it is only internal motivation what influences a behaviour, then human beings shall always behave accordingly to their internal goals, in a direction that gets them closer to achieve them. However, addictions and nocive behaviours are proof that this is not always true. So, what does motivate people to embrace negative behaviours? and what is needed to build internal motivations towards a positive goal? In the end, motivation and beliefs are only understood as a variable influencing behaviour when put together with the other two variables presented in this section.

Contextual norms and external conditions.

The environment and society in which a person exists and interacts have an influence in the way they shape their behaviour. Following this, a person will be more willing to behave in a way that is socially accepted or at least perceived as positive. A possible example is how in recent years, there is growing acceptance towards modifications of our bodies, such as piercings or tattoos. This positive perception is perceived in a continuous growth in the tattoo industry since 2007. [32]

Now, this partly explains why a person does not always act according to their motivations, since social norms also play a role. But then, what happens when a societal belief is in dissonance with an internal thought? What else has an influence on a behaviour?

Capability and control over the action.

Finally, the third variable that might make a behavior more or less likely to occur is the extent to which a person is capable to execute the required action. Capability is meant to be addressed both physically: having the person the physical ability to conduct the action; and/or psychologically, thus being the person in possession of the knowledge, mindset or mental structure that enables the action.

Now we know that any behaviour might be a result of three variables, that act in favour or against each other to influence the behavior. For example, a person might have the internal motivation to run 2 to 3 times per week, which is in fact supported by societal norms. However, the effort

and discipline required to execute a behaviour like that, might be a barrier.

Behavioural change

To understand how a behaviour occurs, Charles Duhigg provides an easy-to-understand model in his book *The Power of Habit* [33]. The author divides the process of a specific behaviour into three moments:

> **The Cue** - A trigger that leads to perform a behaviour, such as being hungry triggers you to calm your hunger.
>
> **The Routine** - The action that follows the cue. Following previous example, one possible action is going to the kitchen and eating a cookie.
>
> **The Reward** - The stage that closes the behaviour. Enjoying the cookie and not being hungry is the reward in our example.

To understand behaviour in a general perspective, we need to introduce the concept of habit. A habit is a recurrent behaviour that has been interiorized and automated by the person [33]. After many cycles of cue, action, reward, the human brain starts to get familiarized with the process, and in order to work in a more efficient way (which is what the brain always does) links them together.

In order to understand how behaviours become habits, we need to introduce cravings. Cravings are, according to the author, the hidden goal that a person starts seeking after many cycles of cue-routine-reward, without even realizing.

In the cookie example, the person who continuously eats a cookie, apart from the conscious reward of not being hungry, gets a sugar rise from the cookie that makes him/her feel energized or excited. After many days eating a cookie and without realizing, the person develops a habit for sugar craving.

From this we understand that:

The routine is the action influenced by the capability of the person, the nocive behaviour aimed to change.

Routine or action is understood as the specific shape in which a behaviour manifests. A very easy to understand example is smoking a cigarette. Every time a tobacco addict lights up a cigarette, she is executing the action of the behaviour. From a behaviour change perspective, changing the action is not always the most relevant part of the intervention. It is much more valuable to comprehend what is triggering the person to smoke a cigarette? What is the reward the person gets from it? Is the reward connected to a deeper layer of craving?

However, the action becomes relevant when there is a certain degree of capability or skill required to execute it. Normally, nocive behaviours grow because they indeed have a low threshold of capability (fast food is cheap, tobacco is part of social events, sleeping in requires no effort compared to an early morning run). In behavioural change interventions, it is important to make sure that the desired behaviour can be manifested by actions that have a low threshold, otherwise the responsible party shall build this capability first in the person.

The craving is linked to the intrinsic end goal that one seeks.

Now, we understand that motivation and internal beliefs are not always something we consciously decide on. Parallelly to our conscious decision making, our brain generates associations from specific behaviours to feelings, emotions, or even chemical reactions in our body (like the sugar rush). This unconscious internal motivation makes then a behaviour much harder to tackle and change. How do we know what is the real motivation that our body is looking to fulfill, if we are unaware of it? And, how else can external interventions influence in a behaviour? By means of the cue and the reward.

Cue and reward are the external variables of behaviour that can be influenced. To achieve the desired behaviour, cue and reward need to be modified so they arrive at similar craving via a different routine.

Staying with the cookie example, the person who is not totally aware that she is craving for sugar, just follows a pre-defined pattern of conduct shaped by her brain. To activate this pattern, a trigger needs to occur. In this case, it might be whenever she feels hungry in the middle of the afternoon, or might also be when he takes a break from working. Isolating and scoping this trigger, is necessary to change a behaviour. For example, if a person eats a cookie whenever she feels hungry in the afternoon (around 4), perhaps it is wise for her to have a more fulfilling lunch, and thus avoid the appearance of the trigger.

On the other extreme of the cue-action-reward model it is the reward. The reward is the means that a person finds to satisfy the craving. Even though the cue might be easy to isolate, since it repeats a pattern, the reward can only be altered once it is understood what is the craving that people have. In our example, until we realize that the person is actually in search of the energy that the sugar rush gives her to go through two more hours of work in the afternoon, we cannot replace the cookie (reward). Once discovered, Influencing the behaviour by means of the reward would entail changing the cookie by other activities that also energize the person or allow her to be focused. It is needed then to explore different rewards. A coffee, or doing a short physical activity that raises her heart rate, might as well be as effective as the cookie to provide energy.

Behavioural change interventions

With previous conclusions, we have looked at the variables influencing a specific behaviour in a specific moment, like eating a cookie at 4 pm. However, what happens when we want to tackle a behaviour from a broader perspective, like eating healthier, or being more physically active? To explore behavioural change in the long term, existing perspectives define different stages in which a person evolves, from a moment where she is not even aware of a nocive behaviour or a poor habit, to the moment that she completely changes and maintains a new acquired one [15]. The Transtheoretical Model of behaviour change (TTM) is the model mostly known and applied [30]. TTM identifies the following five stages a person goes through when changing a behaviour.

Figure 4 - Phases of Transtheoretical model

Since this thesis looks into Healthy behaviours, which are already presented by the WHO as top priority [11], we can assume that the interventions most interesting for us shall skip already the precontemplation stage, where the person is not even aware of a bad behaviour, and act directly on the contemplation.

Targeting specifically healthy behaviours, The Health Belief Model (HBM) aims to understand why people fail adopting disease prevention strategies, and can be used to design short- and long-term interventions for the adoption of healthy habits. [34]

The HBM states that the **intrinsic components** to reinforce healthy behaviors are:

> The desire to avoid illness, or to get well if already ill.
>
> The belief that a specific health action will prevent, or cure, an illness.

The **external variables** that constitute barriers/boosters for a healthy behaviour are:

> **Perceived susceptibility** of a person to be affected by the illness.
> **Perceived severity** of the consequences.
>
> **Cues to action** - the steps to avoid consequences.
>
> **Perceived benefits** of the action.
>
> **Self efficacy** of a person when taking action.

In order to develop effective interventions, the HBM proposes the following process:

> **Gather information** about risk and needs to determine the population that should be targeted. (Increase perceived susceptibility)
>
> **Convey the negative consequences** of the behaviours aimed to be changed. (Increase perceived severity).
>
> **Communicate the steps** that are involved and highlight the benefits to action. (Explain cues to action and increase perceived benefits).
>
> **Provide assistance** in identifying and reducing barriers to action. (Facilitating cues to action)
>
> **Skill development and support activities** that enhance the likelihood of successful behavior changes. (Build self efficacy)

Looking at this process, we can see how it is connected to the five stages of the Transtheoretical Model of Behavioural change. When any type of organisation or responsible party wants *to develop an effective intervention that covers all the five stages of behavioural change, it should execute different actions at different moments:*

In order to move a person from the precontemplation to the contemplation phase, it is needed to state the potential risks of the behaviour, until a person interiorizes them, and adds them to her own internal beliefs. By doing so with multiple people, it is also possible to influence societal perception to the behaviour, which we know is also an influencing factor. To move from contemplation to preparation, it is needed to explain the setup for the intervention, so people know what they need to do in order to change a behaviour, and which benefits they will get.

In the change from Preparation to Action, no more explanations are needed. Now is the moment to deploy the designed intervention. We have seen that training, teaching or restricting might be valid strategies to do so, but they should in each case be adapted to the audience and

behaviour targeted.

The change from Action to Maintenance is where the weight of responsibility moves from the intervention provider to the intervention receiver. Now the responsible party in charge of the intervention should gradually remove the scaffolding that the intervention had created, making sure that by then the person has enough capability and self efficacy to maintain a new adopted healthy behaviour.

Three main findings summarize the learnings from this section and serve as a recap. Now we know that, *in order to develop effective behavioural change interventions related to healthy behaviours, one should:*

Reinforce external conditions, by arising the perceived severity of an illness and the perceived benefits of a preventive action.

Trigger an intrinsic goal by increasing perceived susceptibility.

Provide assistance and support to perform the action by facilitating cues to action and building self efficacy.

RQ1

Supportive Health Systems

In order to frame the value of data for supportive health systems, literature research was conducted to understand:

Which biological variables are relevant to measure?

How are health technologies integrated into services?

How can health technologies support in behavioural change?

With the development of technologies able to collect biological data directly from the human body, new opportunities have appeared to use these self-tracking devices as personal health systems for behaviour change interventions. [16]

Parallelly, the line that separates lifestyle and healthcare is rapidly dissolving. Health practices are shifting to consider home and every-day context as a self-care environment; and patients as active responsibles for their own care. [19]

These two facts put together create a societal context in which the use of health technologies is increasingly introduced in everyday life for preventive healthcare and healthy lifestyle purposes.

In this thesis project, the term Supportive Health System is continually used to refer to a system composed by at least two elements:

Health technology

A health technology is defined as any type of monitor, sensor or tracker able to collect, measure and track data produced from the regular processes and functions of the human body. Health technology is also commonly named as biosensors, and the measures they take are referred to as biometrics or biodata. The most simple example of a health technology can be a scale that measures the weight of a person. It is not a complicated device or monitor, but still, it retrieves data from the human body.

Supportive technology

Supportive technology is a term that refers to the integration of technology into behavioural change interventions, towards a positive behaviour. For example, journaling has been proved to be an effective method to create awareness and possible action in changing a behaviour. However, journaling requires a specific set up to occur (mainly having a place to write, a pen and time to write the journal). In this way, technology can enhance the possibilities of journaling via a digital journal integrated within a smartphone or a computer of a person. There is still much to discover in the ways in which technology can support in the process of changing a behaviour.

From two previous examples, we can imagine that a person can weigh himself on the scale every day and write in his journal the amount. Over the days, he will have an impression on how the weight is evolving and could take actions to act in consequence. However, if an intelligent technology would be able to collect the data from the scale and store and process it, showing back to the person the evolution of the weight, wouldn't this be a much more convenient and effective way for the person to track his own weight? And, if, in addition, this technology could provide the person with advice, recommendation or facts about how to achieve a desired goal, wouldn't this result in a much more effective intervention than the one from the individual himself? This addition of technologies is what in this project is considered as a Supportive Health System.

Therefore, the definition that from now on shall be taken of a Supportive Health System is the combination of one or more Health Technology/ies used to reinforce the effectiveness and application of Supportive technology.

This section tries to shed light to the two elements of Supportive Health Systems that can be more interesting to deploy effective interventions.

Relevant health technologies

Heart Rate monitors - The most extended health technology. Tracks human pulse (beats per minute) with the use of light-based technology. Polar, Garmin or Fitbit are the most known commercial brands manufacturing these monitors for the general consumer.

Blood Glucose monitors - Measures the concentration of glucose in the blood (glycemia). Controlling glycemia allows meal and activity planning, and is useful in the treatment of insulin-related diseases. Continuous Glucose Monitoring (CGM) technology is growing in recent years, and extending its applications beyond the healthcare domain.

Blood Pressure monitors - Arterial blood pressure is widely used for patients with hypertension (high blood pressure) and for hypertension prevention. Currently, few smart watches in the market include blood pressure tracking and monitoring. [35]

Blood oxygen saturation monitors - Pulse oximetry is a method reading peripheral oxygen saturation (SpO2). Appart of its applications to monitor respiratory conditions or other diseases, the data that they provide can be used to improve aerobic conditions.

Gut Microbiome testing - Gut microbiome includes all the microorganisms that live in the digestive system. Microbiome controls digestion and benefits the immune system. There is currently an increase of health-related programs based on the insights gained after gut microbiome testing.

DNA testing - Genetic testing can generate information about genetic risk for various health conditions. The use of DNA testing for the general public aims to support informed decisions over lifestyle to achieve health and wellness goals.

Brain activity - Via electroencephalography (EEG) sensors, smart devices are able to track brain activity and correlate it with mental health and relaxation levels.

Looking at the scope of this project, we can narrow our attention to those Health technologies connected to nutrition and nutritional habits:

> Firstly, we notice blood glucose. When we eat, our digestive system decomposes the nutrients from the food and releases them in the blood streams, to be distributed to all the cells in our body. Our body decomposes carbohydrates into sugars, which our cells use as energy, or transform into fat and store it in case of abundance. Tracking how much and how often our blood streams are filled with sugar, is relevant to nutritional habits. [36]
>
> Secondly, we can pay attention to the gut microbiome. The gut microbiome is composed by more than 40 trillion microbial cells and up to 1000 different species [personalised nutrition]. The bacteria living in our gut, is responsible to help in the decomposition of food that is not yet dissolved by the gastronomic juices of previous stages of our digestive system. Recent studies have discovered that each person has a unique composition of bacteria living in their gut, and that this composition influences our health and metabolism. [37]
>
> Lastly, DNA testing is a way to find which genetics a person has that are linked to nutrition.For example, a person may have a mutation in the gene in charge of producing the enzyme that breaks down lactose. A DNA test can be valid to show these type of mutations. However, if a person consumes little or not lactose, this information might be irrelevant. [38]

Persuasive technologies

A current trend in computing is developing persuasive technologies to help people change their everyday behaviors in support of the lifestyle they wish to lead. [39]

As part of a controversial research into persuasive technologies promoting healthy lifestyle (which served as great inspiration for this project), Purpura et. al (2011) analyse 33 technology-based behavioral change programs. What is most interesting from this research, is that they found several similarities in the components that compose these programs [24]. This serves as a great contribution to this project, since with this information we can frame possible strategies in which supportive technology actually contributes in the adoption of healthy behaviours.

What Purpura et. al (2011) found, was that many supportive technologies integrate the following components:

1. **Initial assessment** - participants enter their weight, height, age and gender to determine their initial status. This data is processed by the technology and serves to determine their initial status. For example, height and weight can be used to calculate the Body Mass Index (BMI)
2. **Goal definition** - such as desired weight or number of fitness minutes per week to be set.
3. **Score** - Use of a tracking paradigm, requiring participants to record its behaviour through a quantitative variable (calories, minutes of activity, heart rate)
4. **Inspiration** - Quotes and articles about success stories or how to avoid common pitfalls, often addressing the change of environmental factors preceding behavior.
5. **Peer support** - Community-based components such as forum boards and groups.
6. **Positive reinforcement** - Emails or notifications sent to participants to encourage them to continue with the program.

What we see from these components is that data from the Health technology is used apparently on two moments: in the initial assessment, and to create the Score. It can also have an influence when defining the goal, if this goal is shaped by the biodata.

For the remaining components (partly goal definition, inspiration, peer support and positive reinforcement), it is the supportive technology who is in charge of providing the person with stimuli that reinforces the desired behaviour.

Thinking further in the proper combination of Health Technology and Supportive Technology to create a Supportive Health system, we see a possible integration into a program-type of service that delivers the following elements:

An Initial set up defining personal characteristics and aim (frame intrinsic motivation).

If we put together this initial evaluation that a supportive technology can have with the learnings from the previous section on behavioural change, we see that this setup supposes a perfect opportunity to frame not only the physiological status of the person, but also the psychological status towards the behaviour. That way, a supportive health system can understand much better what are the internal and external conditions of the person and implement an intervention that targets both.

A data-tracking and dashboarding loop (create awareness of current behaviour).

We have seen that the data from the Health technology can be translated into a score by the Supportive system. This Score is presented to the person and helps to create awareness of the behaviour. In an ideal situation, this Score is connected to the Action part of the behaviour. If a system can present a person with a metric or variable when they do an action, this will have much more power on the person executing the action. For example, if a system is able to tell a person the amount of calories that the meal that he/she is about to eat, and this amount turns out to be out of a desired range, the person can easily realize and act on it by for example, eating a smaller portion.

Diverse methods to influence externally in the behaviour (reinforce external conditions).

This point is influenced on the one hand by the societal norm explained in the Theory of Planned Behaviour. A system can make use of societal influence on a person to increase the likeability of a behaviour, by for example providing peer support or including elements of social proof in the system.

There is however, in the thesis author's opinion, a relevant element missing:

Flexibility in the consecution of the desired behaviour (Ensuring control and capability).

From the previous three points, it might seem very simplified the way a behaviour can be scoped (initial set up), tracked (dashboarding loop) and changed (external influence). However, we know that behavioural change interventions are not effective in the same way for every person. In other words, they can rarely be standardized. That is why it is important to include an element of flexibility within the Supportive Health System. A flexible element would allow for a person to follow an own approach within the intervention that adapts to her own capability. A Supportive Health System can therefore contribute to this flexible variable by providing the person a way to gain the ability, physical or psychological, to execute and maintain a behaviour.

Habit formation in the digital environment.

Now that we understand the characteristics and strategies used by Supportive Health Systems, we can identify opportunities and threats when using them as products or services placed in the market to provide profits to organisations.

What we see is that in the context of digital consumers' products and service, there is a different perspective towards behavioural change and habit formation. There, products and services need to fight for consumer attention in an over-stimulating environment. Therefore, behavioural change models are increasingly embedded within the products, in order to form a habit of use within the consumer [40]. For example, the author Nir Eyal, on his book Hooked: How to build Habit forming products, he elaborates on the Cue-Action-Reward model, adjusting it specifically for habit formation in the digital environment. This adjustment gives shape to the Hook model [40]. Through consecutive Hook cycles, digital products are able to create high user engagement,

In the current digital context, where products and service need to fight for consumer attention in an over-stimulating environment, releasing digital products able to form a habit of use is increasingly important.

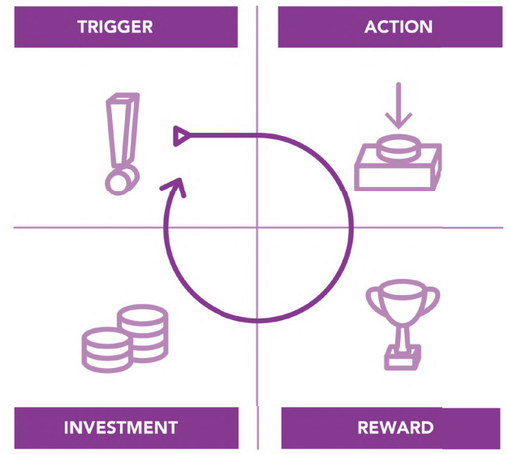


Figure 5 - Hook model of behavioral change

As we have learnt so far, the Cue and the Reward are the elements that can be altered in order to change a specific Action/Routine. What this model proposes is that by means of Cues and Rewards, a system can influence a person to do certain actions, or to invest certain effort in the system itself.

> A good example of how this model works is Facebook. For example, suddenly on a Monday morning you might get a notification from Facebook stating that a friend of yours has tagged you in a photo from the dinner you had last night. This notification is a trigger that makes you click (action) on the link to access Facebook page and see the photo of you and your friend enjoying your dinner together (reward). Afterwards, Facebook might ask you if you want to leave a comment to your friend (investment). If you agree to do so, this investment is used to load the next trigger (probably your friend will reply to your comment, causing you to then access again to see the response). By this continuous cycle of trigger, action, reward and investment, digital products can build habits of use in the people, and unfortunately, to certain extent, addictions.

However, what is mostly interesting to our research is that the continuous layers of data gathered into a supportive system can help people perceive more value in the product, and therefore stay attached to it. It is this attachment that needs to be leveraged in making sure a person improves the desired behaviour.

After analysing the most-frequently used health technologies and how they are used to develop behavioural change interventions and habit-forming products, we conclude that *the role that data plays in Supportive Health Technologies is:*

1. Create understanding of biological status - Due to an initial set up and evaluation.

2. Raise awareness of change in a specific behaviour - Via a continuous tracking loop translated into a "score".

3. Increase the perceived value of the product that integrates the data - Thanks to the continuous addition of personal data.

Additionally, the key strengths of supportive technology when integrated into program-like interventions are:

- Bringing social elements of reinforcement such as peer support or social proof.

- Adjusting to the conditions and capabilities of every person by providing flexible ways of incrementally acquiring the new desired behaviour.

RQ2

Design for Supportive Health Systems

In previous sections, we have framed the combination of Health and Supportive Technology into a System that helps in the adoption of better habits. We have also looked at different strategies these systems can adopt and how they can be introduced into consumers' products and services in the market. Now, it is time to look at these systems from a design perspective. Firstly, it is relevant to understand how can the data retrieved from the Health Technology be of value when framing the design of the Supportive Technology, and thus building a successful Supportive Health System. For this purpose, different design methodologies are reviewed. Additionally, it is interesting to dive in examples of Supportive Health Systems in design literature, and look into which recommendations are given for the combination of technologies.

> In order to understand how to design Supportive Health Systems using data, we need to answer:
>
> *Which theories/methods/techniques integrate data in the design process?*
>
> *How is data integrated in the design of personal health systems?*
>
> *What design requirements exist when designing Supportive Systems?*

Relevant design approaches and methods involving data

Interaction design is the area of design more closely related with data science, since they both have roots in the fields of computer science and psychology. However, problem-solving methods and approaches differ between data science and design. Whereas data science often works with a well-defined problem, from which data can provide an answer, the design field focuses on ill-defined and complex problems, where not a specific solution is possible. In those cases, data should not be taken as the absolute driver of the solution, but as consideration material to support the design decisions. [41]

In the literature reviewed, three different design approaches using data were identified. They differ from each other in the extent to which they give data the responsibility in the decision making.

Data driven-design

This approach relies on data as the absolute truth maker when solving a problem. A data-driven design approach becomes especially useful when solving concrete problems (for example, problems that have a yes/no solution). First, it is needed to establish success criteria that will confirm/debunk a hypothesis. Following, well-defined experiments are conducted, in which big sets of data are collected to test the hypothesis. Afterwards, statistical analysis gives a definitive answer to the stated question/problem. [42]

> **A/B Testing** - This is the most common method of data-driven design. In A/B testing, two almost-identical elements are designed as possible solutions to one specific problem. Large group of quantitative responses provide data to prove the validity of the final solution.

Data-informed design

In this approach, data from experiments is used only as guidance for design decisions in the design process. This approach allows therefore for a wider range of questions and problems than the data-driven approach. Problems from which a non-specific solution can be defined are suitable for this approach. Since Design and design thinking are known for its suitability to give answers to ill-defined problems and find non-obvious solutions, data-informed design is an approach that puts the responsibility on the designer and the design intuition to decide which conclusions and relevant information can be extracted from the collected data.

> **Participator Data Analysis (PDA)** - This approach combines data-analysis and interviews to understand human behavior [30]. PDA creates high-level visualizations of the data gathered from participants in one specific action/behaviour. Afterwards, these visualizations are used to gain understanding around the specific behaviour in qualitative interviews. [43,44]
>
> Personal informatics (PI) - PI is an emerging area in the field of Human-Computer interaction that facilitates people to collect and visualize personal relevant information for the purpose of supporting self-reflection and action for behavioural change. [45]

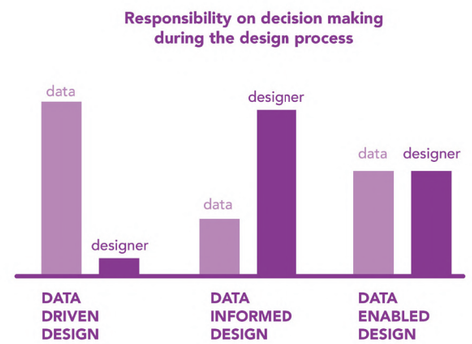


Figure 6 -Difference of data-driven, data-informed and data-enabled design approaches

Data-Enabled Design

When looking at the design of intelligent products, systems and ecosystems, data-driven and data-informed design approaches are limited in adapting to their dynamicity and evolution. Data-Enabled Design emerges as a methodological approach in the use of data to design for intelligent products, systems and ecosystems.

> Data-Enabled Design proposes an iterative approach where contextual, behavioural and experiential data is gathered from situated design experiments (using interactive prototypes), and used afterwards to inform continuous explorations and updates of the design solution [46,47].

What is most unique from Data-enabled Design is its explorative and iterative character.

> On the one hand, Instead of defining a problem from which data can give or guide towards a solution, Data-Enabled Design proposes an initial contextual step, in which multiple devices able to retrieve all types of data are used as a way to define the problem. It is the analysis and processing of this data which shall enlighten the designer to define a possible problem. Even though this sounds very promising, there is not a clear way in which a designer shall look at these datasets in search for a problem, adding difficulty to this step.
>
> On the other hand, Data-Enabled Design also proposes an informed step, a moment when, once the problem is defined, possible solutions are rapidly prototyped and introduced in the real context to inform about the viability of these solutions. Data-Enabled Design proposes the introduction of interactive prototypes in the real context of use from early stages of the definition process. The data generated by these first prototypes (research data), will then be taken to the design studio and processed. Once processed, it is expected that this data is reshaped into solution data, thus becoming part of the solution.
>
> To illustrate it with an example, a challenge suitable for Data-enabled-design might be similar to: Improving the habit of teeth brushing by means of a system that integrates a smart toothbrush and any other devices. In the contextual stage, sensors will be placed to gather research data from the intensity, strength, duration and time of the day in which a person brushes his teeth. Based on this data, different problems can be framed (the duration is not enough, the intensity is too high, etc.). After the problems are defined, prototypes are tested that transform research data (i.e. intensity of brushing) into solution data (a red light that turns on every time that the user passes a certain intensity as a warning to low it back again).

In conclusion, Data-Enabled Design is proven as a suitable approach when designing for evolving systems. Its capacity to design adaptive solutions is also interesting in design for behavioural change, as it offers the possibility of adaptation to the changing behaviour.

Data-Enabled Design resembles a relevant method to understand the nuances and possibilities of Clear's service proposition. However, the limitations of this project in terms of time and availability to different types of sensors, and the lack of accessibility to the real context due to the COVID-19 pandemic, make it difficult to elaborate a proper contextual stage. The informed stage instead seems as a suitable way to explore the definition of the final Supportive Health System integrated at Clear's service.

Role of data in Data-Enabled Design

Diving deeper into the Data-Enabled Design methodology, authors Janne van Kollenburg and Sander Bogers, also provide understanding on the role data plays when designing for intelligent ecosystems.

In this adaptation of the Data-Enable Design model, we can see the relevance of data in every stage of the design process. [41]

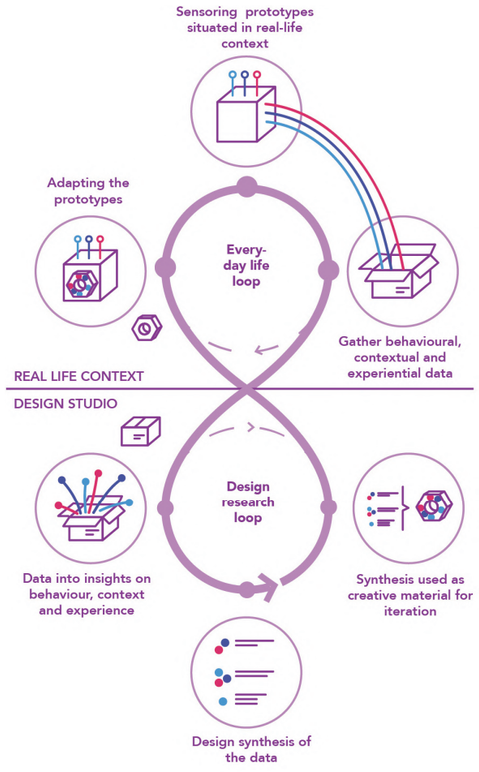


Figure 7 - Adapted model of Data-Enabled Design approach

Design strategies for Supportive Health Systems

As stated previously, Behavioural change interventions are often based on behavioural theories such as the TTM (see Chapter 1>Habit formation). These theories often ignore the larger social context in which these technologies are used, and the impact they have in the everyday world of the individual.

The field of Design is known to be an ambassador of putting the individual in the center of the solution [48]. Consolvo et al. (2009) [39] , propose 8 relevant strategies to include when designing supportive systems, based on behavioural change theories, but taking into account the fundamental social needs of the individual:

Looking at these strategies in a more general perspective, we see that they define two types of relationships that are established with the Supportive technology.

On the one hand, the relationship between the technology and the environment. There we see that a Supportive Health System needs to be integrated within the context as seamlessly as possible, for that, it shall be aesthetically pleasant, unobtrusive in its use, and accessible publicly. In the end, it needs to be a product/service that a person can use in whichever situation in their daily life, without causing interference and without bringing the attention of other people.

On the other hand, the relationship between the technology and the person. In this area, the Supportive Health System shall also be unobtrusive, and support freedom of use and control over it. In the end, the person using it needs to feel safe and comprehended when using the technology.

Supportive technology should be...	...so it allows for...
ABSTRACT AND REFLECTIVE	Freedom of reflection and interpretation on the data.
UNOBSTRUSIVE	Availability of data when needed, Ignorance when not.
PUBLIC	Comfortability when using publicly.
AESTHETIC	Engagement and raising interest.
POSITIVE	Rewarding the user for the performed behaviour.
CONTROLLABLE	Manipulation and control of the data by the user.
HISTORICAL	Awareness of change from past to current behaviour.
COMPREHENSIVE	Adaptation to user behaviour and needs.

Figure 8 - Strategies for the design of persuasive technology

In this section, we have explored design methodologies that are suitable for the problem within this thesis scoped. Additionally, we've looked into design strategies to take into account when designing Supportive Health Systems. After this analysis, it can be conclude that, *when designing for personal health systems using data, it is relevant to:*

Take into account the iterative evolution of research data and solution data during the design process.

Be seamlessly integrated in the social environment in which the behaviour occurs.

Facilitating freedom of use, interpretation and interaction with the data.

RQ3

Service Design on Supportive Health Systems

So far, we have superficially reviewed the integration of Supportive Health Systems into digital products and services available for the consumer in the market. However, a service is not only the front-end part that interacts with the person, but it is a complex network of operations and people who work towards delivering something that is meaningful and valuable for people, but also generates revenue and is beneficial to the organization itself.

> To dive into a deeper layer on how to design services that integrate Supportive Health System, it is relevant to ask:
>
> *Are there existing business models for services using Supportive Health Systems?*
>
> *In which field are these services positioned?*

Personal health systems have the potential to contribute in the future of preventive care [49]. E-health is an emerging field in the intersection of medical informatics, public health and business. E-health refers to health services delivered or enhanced through the Internet and related technologies.

Although e-health innovations have proved to be very promising, problems have been encountered in the adoption of most e-health innovations [50]. So far, research on supportive health technologies in ehealth services has focused on piloting the use of this technology in specific care and cure contexts, without paying much attention to the business interaction between organizations. That is why, in order to decrease the failure of health technologies in ehealth, the focus shall turn towards business model innovation . Unfortunately, there is yet limited understanding on which business models are suitable for e-health services, and how to find them. [51]

In recent years, the field of Design and design research has moved from looking into topics directly connected to the object of design, towards more complex areas, such as the interaction between the person and the object (interaction design), or the holistic comprehension of the integration of objects into a system (system design, organizational design). Strategic Design and Service Design, are the areas of design that focus on developing the value propositions and organizational strategies that ensure the viability of products and services. For that reason, service design does not only look at defining the characteristics of a product or service, but also defines what is the business model connected to the product/service, and the organizational operations required to deliver it. This is why Strategic Design, and more specifically Service Design, can be of value when addressing the challenge of finding a new business model for e-health service in the pre-care domain.

Business model design in pre-care services

Looking at Service Design methods that contribute to ideate new business models, we encounter that the design of a business model is normally shaped into visualisations that allow for mapping the complexity of services in a more comprehensible way. Some of the design tools valuable for designing business models are:

> **Business Model Canvas** - The business model canvas is a table in which several strategic domains for the development of an organisation are maped. This canvas provides an overview of the service in terms of value proposition, infrastructure, types of customers and financial model. It is useful to design and ideate on a new business model, understanding all activities needed to build cohesion and structure in the service.
>
> **Customer Journey Map** is a visual representation that describes a service from the perspective of how a user interacts with it. This is relevant to map what happens at each stage of the interaction between the service and the user. This is done via the touchpoints that the service delivers at each stage, and which feelings, experiences and obstacles might the user face when interacting with these touchpoints. This tool is very valid to change the point of view of a service, and have realization moments on what is mostly relevant to the person who is actually making use of it.
>
> **The ecosystem map** is a synthetic representation capturing a network structure of actors and value transactions that have an influence on the organization and service environment. To develop an ecosystem map, first all the involved entities shall be mapped (actors). Then, connections are established between these entities according to the transactions that they interchange (value transactions). These transactions can take any shape, from economical to emotional, but they should provide any type of benefit for the entity receiving it. Lastly, attached to each transaction are mapped the attributes and characteristics that both interconnected parties value most for that transaction to be optimal (value attributes).

What we see in these service design tools is that, in order to design new business models and innovational services within Supportive Health technologies, what would be relevant to do is framing all the operations, actors and transactions that entail delivering such service, and mapping them together in a way that allow for comprehension, but also for questioning and ideation. These visualisations should allow to capture a service from the perspective of an organisation delivering it, but also from the perspective of the user receiving it. It is believed that when the organisation is able to successfully

run internal operations that allow the user to receive the service without barriers or obstacles, the service is working correctly.

Research from case studies by van Meeuwen et al. (2015) analyzes business model creation for pre-care services, trying to unveil which actors, transactions and value attributes are key, thus facilitating the use of the previously described tools for any party interested in delivering a service in this context [51]. The major implications for the design and implementation of such services are:

1. Involve a health professional, since they will ensure reliability in the transactions between the client and the service.
2. Provide an online flow of information with regular interactions to the client in order to stimulate self-management of personal health.
3. Involve intermediate organizations with a large customer base to extend the service's reach.
4. Involve a service-dedicated health expert for personal face-to-face contact with clients in order to ensure and increase the perceived quality of the eHealth service.
5. Include social interaction with other clients of the online service with a view to motivating and supporting the self management of personal health.

In order to *design a new service proposition involving health technology, we can claim that:*

There is plenty of space for new business models in the context of personal health and e-health.

Proven business model design tools are focused on translating the complex network of actors, transactions, operations and value attributes into easy to understand visualisations.

Clear.

With the previous sections, it was intended to shed light over the research framework established. Now it is time to complement this framework by understanding the organization and context in which it will be applied.

Clear B.V. is a Dutch startup founded in September 2019 by Dr. Piet Hein Van Dam after envisioning new possibilities for Continuous Glucose Monitoring (CGM) technology.

With the support of venture capitals and the incorporation to the team of a Head of Product, and a Chief Science Officer, Clear set up a Minimum Viable Service to deliver their users a Program, similar to the ones studied by Purpura et. al. [24] (See Chapter 1 > Supportive Health Systems > Persuasive technologies).

The Clear Health Program offers Continuous Glucose Monitoring and insights on the glycemic response to food intake.

> For the scope for this project, it is relevant to establish understanding in:
>
> *What is Glycemic Response, and how is it linked to healthy behaviours?*
>
> *What does the current service of Clear, The Clear Program, consist of?*
>
> *How is The Clear Program a service integrating a Supportive Health System?*

Glycemic response: the origin

Blood glucose monitors have been widely used in the healthcare industry in the past 30 years for diabetes management [52]. The development of this technology made devices able to continuously monitor glucose available for the general consumer.

High levels of blood glucose concentration are connected with obesity and insulin resistance and therefore are a significant risk factor for type II diabetes. High blood glucose concentration is also linked to other diseases regarding the Metabolic Syndrome, such as hyper- tension [53], fatty liver [53] or neurodegenerative disorders like parkinson [55] or Alzheimer's disease. [56]

Blood glucose variation is affected by the carbohydrates contained in the food that we eat [57]. Scientifically, the effect of food on glucose is known as postprandial (post-meal) glycemic response (PPGR). Hence, **the dietary choices that we make are a determining factor for the control of blood glucose levels, and consequently the aforementioned diseases.**

In 2015, a research paper published by Zeevi et al. (2015), named *Personalized Nutrition by Prediction of Glycemic Responses* [58],gave conclusive results proving that **people eating identical meals presented high variability in postprandial glycemic responses.**

These findings were revolutionary in the field of health and nutrition. The same paper suggests the possibility of creating intelligent algorithms able to understand the personalized requirements of diets, by monitoring personal glycemic response, and other biological measures (mainly gut microbiome testing). [58]

Since the adoption of new technology developments is a proven strategy for innovation [59], new ventures across the globe are now trying to develop products and service propositions that combine glucose monitoring or gut microbiome testing to provide people better understanding of the effect food has on their own and unique metabolism. For this, companies like 23AndMe [60], DayTwo [61], Supersapiens [62] or Levels [63], have developed service propositions with offerings such as diet optimization, athletic performance optimization, and disease control. However, the factual feasibility of these propositions in delivering what they promise is still limited, since the connection of glucose, gut microbiome and long term health benefits does not yet have enough scientific validation.

For this reason, it is relevant to claim early in this report that this project shall always stay within what it is scientifically proven. The research and the final service proposition for Clear will stay away from unproven dietetic advice that may cause any harm to the service users.

Currently, the proven scientific knowledge on the monitoring of glycemic response in nutrition relies on lowering postprandial glycemic responses. In practical terms, this means avoiding high glucose concentration after a meal. A "good" glycemic response is the one that keeps glucose levels stable approximately 2 hours after a meal. On the other side, a bad glycemic response will be manifested by a high peak in the blood glucose concentration.

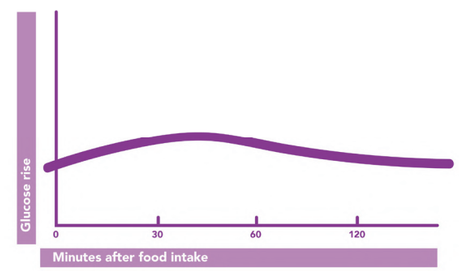


Figure 9 - Example of a good glucose response

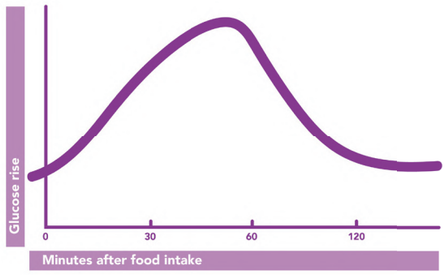


Figure 10 - Example of a bad glucose response

There are three main reasons why high blood glucose concentration is bad for our health:

First, when our blood streams are filled with too much sugar, the brain sends a message to the pancreas to release insulin, a hormone that helps in the absorption of sugar by the cells. If the process of sugar-insulin release happens too often, this can cause the cells in the body to not be sensible anymore to insulin, thus having no capacity to store and use sugars. This condition is known as insulin resistance.

Second, when the cells in our body are filled up with the quantity of sugar they need for their regular functioning, they store remaining glycogen (fat) in the fat storages of our body. The continuous addition of fat storage is what causes blood sugar to be a cause for overweight and obesity.

Thirdly, it can happen that when the pancreas releases insulin to help the cells absorb the sugar, it releases too much, thus causing our blood stream to be low in sugar. This sends an erroneous message to our body, making it believe that we are in lack of sugar, and cause feelings of hunger, fatigue and sugar craving. If a person responds to this fake stimuli by eating again and adding sugar to the body, a new cycle of insulin release might happen, turning therefore the process into a vicious cycle leading to the two previous points.

With this is established the connection between food, blood sugar and medical conditions and diseases. However, there are many other factors besides food that influence blood sugar levels, such as stress, sleep quality or physical activity. Understanding how the factors besides food influence the glycemic response, and how to monitor them to integrate them, are questions that still require scientific research. For this reason this project will leave out those factors and only focus on food and food intake as the ways to evaluate blood glucose and thus creating a service that improves nutritional habits and avoids the diseases and conditions that blood sugar is linked to.

In conclusion, we see that *Continuous Glucose Monitoring technology has potential in the field of adopting healthier habits and preventing diseases regarding Metabolic Syndrome.*
A service that makes use of CGM technology can influence eating behaviour that keeps the glucose levels stable after a meal. This allows for:

In the short term, higher energy levels during the day, and better sleeping quality.

In the long term, the prevention of metabolic diseases such as cardiovascular problems and type II diabetes.

The Clear Health Program

Making use of a Continuous Glucose Monitor, commercialized under the name Freestyle Libre 2 [20], Clear set up the following service proposition: **A two-weeks glucose-monitoring program after which people can see the effect of food on them via a personalised report.**

The Clear Health Program consists of different steps that are now explained. Figure 4 provides a visual overview of these steps.

1. Joining the program

After purchasing the product via the Clear website (clear.bio), people become a "Program participant" Clear guides the participant through the next steps: general understanding of glucose relevance for nutrition and information about the needed apps for logging food and scanning glucose.

2. Receiving the CGM sensor

In the meantime, the participant receives via post mail the Freestyle Libre 2 (FSL2) technology and some further instructions. The Freestyle Libre 2 technology consists of a cutaneous patch that includes an enzymatic filament able to sense glucose concentrations. The patch includes a 14-days battery, a memory, and an NFC chip to allow scanning the sensor by a smartphone. The scanning of the sensor can be done via the complementary mobile app Freestyle Libre App [64].

3. Starting the program

The program also requires the participant to download the Clear App [link]. This app complements the FSL App, and allows logging different data points: food, drinks, exercise, sleep, mood and supplements. Clear App, FSL App and FSL2 sensor are shown in Figure 11.

After an onboarding process in the Clear app, participants need to apply the sensor on the back top part of their arms, log their food intake and other data points in the Clear app, and scan the FSL2 sensor with the Freestyle Libre App to see the real-time glucose levels. Participants shall keep logging and scanning during the 14 days lifespan of the sensor.

4. Receiving results

After the first 7 days, participants receive insights based on their data. These insights consist of:

A graph with the daily-average glucose levels, compared with the average of previous participants (n=700).

A chart in which all the food a participants has logged is assigned a metabolic score, rating from 1 on 100 how much this meal affected the variability of glucose level in the 2 hours after the intake.

After 14 days, the FSL2 sensor stops working. Few days after, the participant receives:

The graph and chart previously described with the total data of 14 days.

The Clear Final Report (see an example of the report in appendix 1). This report contains additional information of the participant's glucose data.

5. Finishing the program

Once the sensor is inactive and participants have received the Clear Final Report, they receive a discount code for a repurchase of the program.

Figure 11 - The Clear App, FSL2 Sensor and FSL App

Now that the service proposition of Clear is understood, we can have a moment to reflect on it and understand its relevance for the aim of this project. When looking at Supportive Health Systems, we see that Clear provides a system that is currently integrated by three components:

Firstly, the Continuous Glucose Monitoring sensor, this component is the health technology that retrieves data from the human body; in this case, blood glucose concentration. This sensor is provided by an external party (abbot) within which Clear does not have any sort of partnership of collaboration. This causes that when pricing the service of Clear, the market price of this sensor needs to be added as a baseline. From a business perspective, this is not the most desirable situation, since it makes Clear's service more expensive. From an operational perspective, this complicates the shipping process and the responsibility on defectuous devices. Clear needs to order the sensors (or have them in stock), re-package them, and then send them to the person who has purchased the program. From a user perspective, the fact that they are presented with two different companies in the interaction with the service, can be confusing and misleading.

Connected to the CGM is the second element of Clear's Supportive Health System: The Freestyle Libre app. This app allows for the real-time tracking of the glucose, by enabling the NFC reader that is integrated with last-generation smartphones to read the data gathered and contained in the sensor. What Freestyle libre does is showing the person, by means of the smartphone's screen, a number with the concentration of blood in glucose (in mmol/L) and shows a curve in which glucose levels since the last time the sensor was scanned are sequenced on the horizontal axis (time). This part of the system also belongs to an external party (again Abbot, the manufacturer of the sensor). The Freestyle Libre app also creates a barrier for Clear to be in total control of its own service, forcing it to instead having to add its own contribution on top of an existing one.

Lastly, Clear's Supportive Health System integrates The Clear App. This app is currently used as a means for logging and journaling the food, exercise, mood and supplements that a person takes. This app is a tool that serves to complement the report that the user gets at the end of the 14 days. Gradually, and at the same time that this thesis project was developed, the Clear App has been gaining more and more attention from the organisation, and it now incorporates new features. The internal goal of Clear is to become app centric and eradicate the need and use for the Fina Clear Report. Therefore, when looking at defining an intervention within Clear's Service, the Clear App is the main means to look into.

In conclusion, we can see from an early exploration on Clear's service that a big factor influencing it is the fact that Clear is only partially in control of the Supportive Health System it integrates in its service. During the time of this graduation project, it was seen how the organization is making efforts in acquiring control over all the elements of the System. Even though these strategic collaborations and partnerships are relevant from a Service Design perspective, they will only be limited to this thesis. The main reason to do so is that they fall out from the interest of this thesis in looking for behavioural change interventions by means of supportive health systems. Therefore, on the following development of this project, attention will be only drawn to the part of the service that is indeed controlled by Clear and connected to behavioural change: The Clear App and the Clear end report.

Then, using the lenses of Behavioural Change Interventions using Supportive Health Technology to analyse

Clear's service, we see that right now Clear's program is not embracing any strategy to ensure the adoption of habits. Instead, Clear is a mere processor of data, and a channel of information to communicate the results of processing to its users. In order to develop an effective intervention, this project would need to define a value proposition for Clear's new service that is indeed aimed at helping people track, change, and maintain eating habits that keep them healthy and away from related conditions and diseases.

Now that Clear's proposition is understood, a moment can be taken to reflect on the relevance of this company for the scope of this thesis:

The adoption and applications of CGM technology is still limited, but a correlation with food and nutritional habits is possible.

Clear represents a good case study for the integration of Supportive Health Systems in service propositions. However, Clear has limited control on some elements of the Supportive Health system it uses.

The Clear aim matches with the aim of this thesis. For the rest of this project, the goal would be to transform the elements of Clear's Supportive Health System that Clear has control over into an intervention for behavioural change regarding healthy nutritional habits.

Chapter 2
Conclusions

Looking back to this chapter, three different angles were explored to generate understanding, and each of them provided valuable learnings, at different levels:

Research framework

After the literature research, looking at how to design behavioural change propositions that make use of health technologies, we can state that *the main ways in which Clear can have influence on people's eating habits are:*

Influencing their environment

Spreading the claims and benefits of adjusting your diet to keep your glucose levels stable, and how it helps in the prevention of diseases.

Framing their motivation

Finding the intrinsic goal they aim to achieve and facilitating cues to action.

Boosting their capability

Supporting, through the process, the adoption of a diet that lowers the glycemic response. Teaching the user along the way, building self-efficacy on them.

Creating understandable visuals of their status

Processing the Glucose data from the CGM and turning it into meaningful visualisations that allow understanding of the eating and nutrition, but also freedom of interpretation.

Using the additional layers of data to maintain user engagement

After two weeks of logging a meal at least 3 times a day, the data and time invested by an individual into the Clear Program, are enough to generate attachment to the product.

These 5 elements should therefore be ingredients of the final Service proposition.

Clear Service

From this section, we have learnt that the use of Continuous Glucose Monitoring technology has strong potential in *helping people find a beneficial diet.*

The benefits of such a diet would be connected to:

Higher energy levels during the day, and better sleeping quality

Prevention of metabolic diseases such as cardiovascular problems and type II diabetes.

Therefore, Clear needs to be positioned in a market where these two benefits are considered as relevant, and can produce stable revenue streams.

The Clear App should be shifted from a means for journaling, towards a tool that helps delivering behavioural change interventions.

In the following chapter, we look into the context in which Clear operates, trying to define criteria for the design of the final service proposition.

After a diverging explorative process supported by literature review and desk research, we aim to give an initial answer to the three first research questions stated for this project. These research questions together suppose an understanding of which shall be the path to follow for an organisation willing to develop a proposition that integrates Supportive Health Systems. In order to build this path, a total of nine Key Requirements have been identified. Following, they are introduced in addition to a brief explanation of what they imply, and in which sources they are based on.

RQ1: How shall responsible parties generate a preventive health behaviour in the individual?

These findings are mainly based on theories and models of behavioural change:

Transtheoretical model of behavioural change. [15]
Theory of Planned Behaviour. [31]
COM-B model. [30]
The Health Belief model. [34]

These three first requirements act upon the elements of a behaviour that can be altered, mainly the external conditions and the internal motivation, but do not comprehend the behaviour as a whole. Mainly, they leave out the execution of the nocive action itself. In other words, these three requirements aim to create external and internal ideal conditions for a behaviour to occur. However, the routine that is finally executed by a person is in the end unpredictable.

9 Key Requirements

Reinforce external conditions that facilitate the occurrence of the behaviour, by arising the possible severity of an illness and the possible benefits of a preventive action.

Literature review showed that one of the variables that influences an individual's behaviour and that can be altered from an external party, are the external conditions that surround the person and her behaviour. For example, The Theory of Planned Behaviour, states that the influence of society, and the way society perceives a behaviour (positive/negative) creates a subject norm that also shapes the way the individual perceives her own behaviour. The COM-B model also identifies the extent to which the environment is opportunistic for a person to develop a behaviour as an influencing factor. Lastly, the Health Belief Model (HBM), a model to frame interventions for healthy behaviour, adds further information by claiming that a specific external variable that influences a healthy behaviour is the perception on how nocive can the behaviour aimed to change be (perceived-severity). Therefore, it is believed that responsible parties shall make sure that a concerning message about the consequences of a behaviour shall arrive the surroundings of a person (the external conditions), in order to trigger a willingness to act on the behaviour.

Trigger an intrinsic goal in the individual by increasing the perceived susceptibility to suffer any form of medical complaints without preventive action.

What the Theory of Planned behaviour calls the own attitude of the individual towards a behaviour, can be referred as the Motivation, according to the COM-B model. What these two models address is that a behaviour also has an intrinsic component, an internal trigger in the individual that forces them to act on it and change her own actions. From a Health Belief Model perspective, is the desire to prevent an illness the intrinsic belief that has enough strength to encourage a change of behaviour. Thus, an effective intervention needs to find a way to make a person aware that the nocive behaviour can lead to an illness or disease, and plant this thought as a seed on the individual's mind, a seed that will trigger the growth of a motivation and internal desire to change the behaviour.

Provide assistance and support to perform the preventive action by facilitating cues to action and building self efficacy.

Lastly, the Theory of Planned Behaviour also mentions the perceived control a person has on its own behaviour as an influencing factor that acts towards the execution of the desired behaviour. This perceived control is seen as related to the Capacity of an individual to engage in the concerned activity, as put by the COM-B model. The Health Belief Model addresses capacity as the relevance of building self-efficacy in the individual to ensure the occurrence of a behaviour. Both the Health Belief Model and the Transtheoretical Model of Behaviour Change agree on the need to provide incremental assistance and support that reduce the possible struggles in executing one action. This assistance can be done either by the responsible party either by removing obstacles, or by teaching the person how to overcome them.

RQ2: How shall design parties integrate data in the design of Supportive Health Systems?

These findings are mainly based on design methodologies that incorporate the use of data in the design process (data-informed, data-driven, data-enabled), and studies from the design field which draw conclusions on case studies of Persuasive Health Technologies [19,24,39,40,41]

It is relevant to mention that these requirements are mostly extracted from propositions and technologies addressed to the general consumer. In this case, we are presupposing an interest and willingness in the person to change a behaviour, and designing a technology that will assist in the process to do so. When looking at the design of Supportive Health Systems in contexts where there is a need to quantify the behaviour much more accurately, such as the recovery treatment of medical interventions, or the preparatory training of a top athlete performance, these requirements might not be as relevant.

Take into account the social environment in which the preventive health behaviour occurs.

Normally, Supportive Health Systems tend to be univariable, meaning that they measure and track the behaviour of a person based solely on the data provided by whichever biosensor the system integrates. Isolating a behaviour, which is the result of complex factors, into a single metric generated by the human body without control or decision of a person, falls short in creating an accurate comprehension of the behaviour, and thus makes it hard to design effective interventions. That is why, in the design of Supportive Health System, there has to be room for qualitative variables. To start with, framing the experience of the person when executing the behaviour and gathering data from the context in which the behaviour occurs, allows for a much richer understanding.

Generate an iterative evolution of research data into solution data during the design process.

A positive aspect of designing for Supportive Health Systems, is that they allow for the conversion of research data: multiple data gathering points used to understand which is the possible behavioural problem to be solved; into solution data: finding a combined use of the different data points to provide a supportive system solution. That is why, when designing Supportive Health Systems, it is good to explore many sources of data and see how they can add value to each other.

Facilitate freedom of use, interpretation and interaction with the biological data.

Existent studies from the design field on supportive technology, show that there are different strategies to follow when presenting the data from a Supportive Health System to the person generating it. In general, what we learn from them is that the use of data should be as less obstrous as possible. Instead, Supportive Health Systems shall be adjustable to the degree to which the person wants to pay attention and be influenced by them. In this way, the individual can have freedom and control over the data.

RQ3: How shall organisations deliver service propositions that use a Supportive Health System to facilitate preventive health behaviour?

To identify common requirements into existing propositions that make use of Supportive Systems, it was reviewed:

- Case studies from the field of human-computer interaction and persuasive technologies.
- Literature on innovation and design of service in the pre-care area of health and e-health. [49,51]
- Drawing Conclusions from the example of the company collaborating in this project.

These Requirements are expected to be of help when establishing program-like interventions assisted by technology. However, literature looking into the future of the Personal Health System admits that this is only one of the multiple shapes that these Systems can be used to create behavioural change interventions, but there is yet not enough knowledge to identify other opportunities. In order to do so, it is needed to gain a more complex understanding of the ecosystem of actors, transactions and value attributes that surround the proposition.

Establish an initial set up and evaluation phase that creates understanding of the individual's biological status.

Establishing similarities from technology-based behavioural change programs, it was seen that the first step of these interventions is normally to frame the initial status of the individual when beginning the intervention. This is so because of two reasons: first, it helps the system itself to adapt better to the person, tailoring the intervention to. Second, in the preparation stage of an intervention (TTM) is desired to create awareness in the person, which is something that the initial evaluation creates. An initial evaluation is therefore recommended.

Translate the continuous track of biological data into an understandable metric that raises awareness of change in the individual's behaviour.

It is important to mention that an understandable metric does not implicitly mean numeral quantification. Actually, quite the opposite. Sometimes, people become more aware of the evolution of a behaviour when it is presented in a metaphorical or abstract manner, such as a shape that grows or decreases according to the intensity or occurrence of a behaviour.

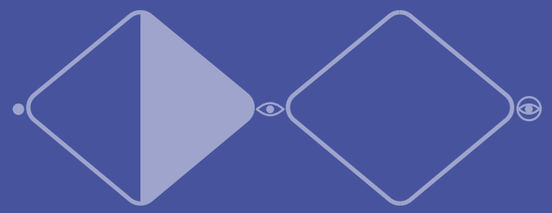
Leverage the continuous addition of biological data to elicit a feeling of attachment to the Supportive Health System.

From a business perspective, the more data a Supportive Health System gathers from an individual, the higher the perceived value of it would be. This is a fact that can be used in favour both for the viability of the organisation, that will ensure that the users of the system will remain attached to it, and in favour of the intervention, because once initial momentum is created, adding more layers of data will keep the wheel of the behaviour running.

Chapter 3

Defining Clear´s Strategy

This chapter aims to define criteria for the final Service proposition scoped within this project. For that purpose, key decisions are made to create internal alignment. Afterwards, criteria is established in three strategic dimensions: feasibility, desirability and viability.



Chapter overview

Introduction

Taking a moment to look back to the previous chapter, we now have identified 9 Key Requirements for a Service proposition that aims to integrate a Supportive Health System. It is then expected that these requirements are part of the solution that will be developed in further stages of this thesis. The extent to which the requirements are met in the final solution will be further elaborated in the final reflection of this thesis (See chapter 8)

Apart from the outcome of literature review, we have taken a look into the current service proposition within which this project is scoped: The Clear Health Program. What we have found by looking at Clear's current service is that it is limited by design. Firstly, Clear lacks control over part of the Supportive Health System that integrates its service. Secondly, the part of the system that Clear owns and controls (The Clear App and the Clear End Report), does not integrate strategies that make them a valid intervention for behavioural change. The Clear App is more of a journaling tool that allows Clear to match the glucose data to the food they eat, and process it together to showcase it to the Program participant.

At this point, it needs to be understood that Clear is a one-year old startup. It is therefore normal that it lacks from the capabilities and resources of a more established organisation. Nevertheless, the startup has reached a point where it needs to find its unique strengths and frame them into a value proposition. This will allow Clear to adhere to a direction and avoid being lost in the wander of exploring possibilities. In order to define this value proposition, two relevant angles appear:

> First, The Clear App has potential to become the Supportive Technology that integrated together with the CGM sensor, creates a Supportive Health System for the improvement of nutritional habits.
>
> Secondly, The Clear Program is still in an early moment of development, which still allows for making strategic decisions that align operations and efforts towards a direction that seems interesting.

Even though The Clear App has a lot of room for improvement, it is not ideal to start redesigning it right-away. Examples in Design literature show that innovation in complex environments such as the one where Clear operates, is not always connected to the best design solution, but to creating a better "design transition". [65]

Design transition is a key leadership competence to achieve effective outcomes [65]. It involves recognizing the complexity of the problem, understanding its key elements and driving forces, and choosing a starting point and acting on it in order to lead the organization towards successful outcomes. In order to do so, this chapter firstly introduces how, by means of desk research and qualitative interviews with users and collaborators of Clear, it was possible to unveil three main opportunity areas in which Clear has potential to operate and grow.

Once these areas were found, the next step was to decide which opportunity area shall lead the design transition. Examples from Strategic Design literature state that two major forces influence the effectiveness of design transitions [66] :

> **A shared vision of the project** that aligns perspectives and informs criteria for the decision making
>
> **A sense of ownership within the organization** that ensures the implementation of the solution.

Therefore, it was considered necessary **to create a shared vision for Clear's new service that will bring ownership and alignment upon the direction to follow.** In the process, qualitative interviews with the internal team of Clear were conducted to discover if perspectives were aligned, and there was already an existing consensus upon the direction to follow. The results after analysing the insights from those interviews showed that internally, the Clear team had different perspectives on the possibilities for the future of the organisation and its service. This diversity of opinion was mainly in three areas:

> **The why of the company.** There were different points of view when referring to what was the problem that Clear was trying to solve, and what made this problem a relevant one for people.
>
> **The how of the service.** To some extent, there was internal agreement that Clear strength is to provide insights on the effect of food on people. However, how shall this insights be provided by the organisation was not so obvious.
>
> **The what of the offering.** In the previous chapter, we have discussed that Clear is trying to become more app-centric and do not offer an End Clear Report anymore, but instead integrate the relevant insights for the people within the App. This transition is still in a very ideative stage, so there were different points of views on what shall Clear's service offer via the app that can substitute the Clear End Report.

The diversity of points of view and the lack of a shared direction, was blocking the decision-making process internally, and thus causing friction in the regular operations (mainly, the development department wasn't so sure how to plan the development roadmap for the coming period, and the marketing department had troubles promoting the unclear value proposition on different channels).

A Generative Visual Workshop was the method used to create alignment on the different perspectives. This workshop helped to define an Initial Vision that yielded strategic decisions on the why, the how, and the what of Clear's service. This vision also served to make a decision in the opportunity area to follow: Personalised nutrition.

After strategic decisions were made, and the two major forces of design transitions (alignment and ownership) were created, the next step was to find which implications would this decision have on the Service. To find these implications, it was decided to look into three strategic domains:

> **Viability factors -** What ensures the long-term success?
>
> Desk research on the possibilities and limitations of Personalised nutrition was conducted. This helped to find key drivers and limitations of the field.
>
> **Feasibility factors -** What is Clear able to Deliver?
>
> An analysis of the components that integrate the Clear service on which Clear can take the most advantage is done to unveil feasibility factors.
>
> **Desirability factors -** What do people need?
>
> In order to define the user needs from the Clear Service, and see which of them aligned with the Strategic decisions made, a thematic analysis was performed with the data from qualitative surveys that Clear provided.

In the end, the factors discovered for viability, feasibility and desirability were reviewed and reflected upon one more time. A selection of 5 Success Factors will be taken further in the development of the new Service proposition for Clear. The remaining factors are either left out for reasons explained at the end of the chapter, or taken into account with less priority

In the next chapter, the 9 Key Requirements previously defined are put together with the 5 Success Factors in order to define an initial framework on which to base the design of the new service. Additionally, this framework is translated into a visual, that constitutes the Final Vision of Clear's New Service.

Opportunity areas

To create a connection between the Discover and Define phase of this project, desk research was conducted to unveil different scenarios in which Clear's use of Glucose Monitoring Technology can play a relevant role. For that, online seminars on health and nutrition were attended, and netnography on blogs from the Quantified Self community were explored. Also, market research was conducted on existing propositions.

To find connections and opportunity areas within the existing market, a sequencing technique was used. In this technique, firstly is needed to find competitors at three different levels of competition:

> **Same product form** - These are the most closely-related competitors, those who make use of a similar product than you to offer the same benefits. In this case, 7 companies were found that use CGM technology and connect it to the food intake and nutritional habits.
>
> **Same product category** - Here are introduced competitors who are also related to the benefits that your product provides, but they fulfill them by a different means. 5 competitors were identifying who make use of health technology to connect it to eating and food intake.
>
> **Fulfilling the same need** - competitors in this area are solving the same problem to the customer than you. Here were introduced 3 competitors that help people to know more about their own health and metabolism.

What we see in this graph is that the competitive landscape of Clear can be shaped by two main criteria:

Health vs Performance oriented

> This criteria is connected to the main benefits that the proposition provides and the target audience from the services. On the one hand, some services are targeted to improve overall health and avoid illnesses. These propositions tend to be addressed either to people already suffering from a medical condition, or people who are aware about it. On the other hand, there are services targeted to people who are already in a good health condition, but want to achieve an even optimal status. Normally, these propositions are addressed to athletic young people.

Behaviour tracker vs Behaviour facilitator

> This criteria puts in different places those services that have a major implication in helping or supporting the user adopt a better behaviour, by means of a Supportive Health System, and those other services who are mere providers of information about the behaviour. In more specific terms, Behavioural Trackers offers a dashboarding of the behavioural data to the person producing it, and behaviour facilitators add an extra layer on that making suggestions and recommendations for the person to interpret better the data and act according to it.

Competitors:

Same product form	*1. Veri* *2. Day two* *3. Supersapiens* *4. Levels* *5. myLevels* *6. Nutrisense* *7. MillionFriends*
Same product category	*8. Lifesum* *9. Myfitnesspal* *10. Jumbo food coach* *11. Weight watchers* *12. Whoop*
Fulfilling same need	*13. Fitbit* *14. 23andMe* *15. Health practitioners (dieticians, coaches)*

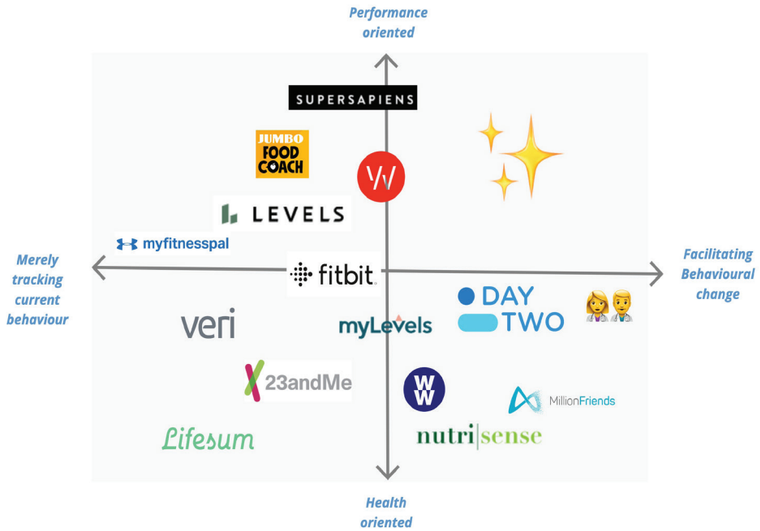


Figure 12 - Competitors matrix

By means of this sequencing technique and further desk research, three main areas were found for Clear to reframe its service proposition and deliver a service that truly acts in favour of people's healthy eating behaviours:

Healthcare

The fast-pace development of technology, and the shift of the caring role from healthcare institutions to the individual, arises new possibilities for actors such as Clear in the Healthcare ecosystem. As stated in the previous section (see Chapter 1 > Service Design on Supportive Health Systems) e-health is a market with room for development of new business models and propositions.

To get into this area, a strategic movement for Clear would be to **focus on one specific condition or problem, in which glucose is an influencing factor and/or relevant diagnostic marker, and try to help people achieve ideal glucose levels.**

> Glucose levels become dangerous for the human body when it has to continually process such a big amount, that it becomes indifferent to insulin. Insulin is the hormone that ensures the absorption of glucose in the cells.
>
> This condition of "Insulin resistance" results in instability of daily glucose pattern and overall higher glucose levels. Chronic elevation of glucose levels is connected to metabolic syndrome, coronary diseases and (pre) diabetes type two.

Due to several causes, the following groups have higher risk of developing insulin resistance.

> People with (severe) overweight or obesity.
>
> Hormonal disorders, such as polycystic ovary syndrome.
>
> Pregnant women during pregnancy.
>
> Sleep disorders, such as sleep apnea.

To have Clear integrated within the healthcare environment, Clear would need to have:

> *Clinical proof of beneficial effects in at least one specific medical condition.*
>
> *Endorsement by Key Opinion Leaders (KOLs), big actors in the field of healthcare (professionals, organizations, researchers)*

Sport Performance

Glucose is the most common source of energy that the cells in our bodies use. It is also the main source of fuel for the brain. This is why when we exercise, our cells use the glucose storage in our body as a primary source of energy.

Understanding the nuances of blood glucose when exercising is well understood. However, how is th glucose metabolised in an individual is a barely explored area.

To step into this area, *Clear would need to generate extensive knowledge* about:

> Effect of different exercises in blood glucose, at an individual level.
> The consequences these levels have on sport performance.

Once these questions are understood, *these knowledge might be integrated into an intelligent algorithm, able to provide understanding and thus, improvement of performance.*

> This algorithm could be widely adopted. Initially, by top athletes, such as the existing collaboration between Supersapiens, and Jumbo Visma [reference]. Eventually, big players in the field of sport performance tracking, such as Nike or Fitbit, could integrate the algorithm in their fitness tracker to make it available to the general consumer.

Personalised Nutrition

Currently, there is general thinking that the characteristics of food (calories, macronutrients, etc) is what defines the biological response. The Scientific findings from Zeevi et al. (2015) set proof that it is the characteristics of the body (genetics, biology, lifestyle factors) what defines the response [58]. This implies a change in mindset.

Personalised nutrition is a complex ecosystem of organisations that seeks to develop targeted nutritional advice, products, or services, based on the combination of an individual's genetic, biological, and environmental plus lifestyle factors.

Existing propositions in the field of personalised nutrition are characterised by:

> Taking into account the individual's dietary and lifestyle patterns and preferences.
>
> Making use of health technology to understand individuals' status.
>
> Delivering advice about food choice, eating patterns and lifestyle relevant to nutrition and health.

To play a relevant role with this ecosystem, *Clear shall deliver a service to the general consumer that serves as a Proof of Concept, providing understanding of the technology and knowledge needed to make personalised food advice possible on a large scale.*

The goal shall be to influence many stakeholders to accept/embrace the change in mindset (in thinking and acting).

Aligning perspectives

The context in which Startups evolve can be described as a fast-pacing and high-pressure. There is a wide extended metaphor that says that launching a startup is like trying to assemble the engine of an aircraft while the aircraft is flying. This metaphor describes quite good the environment at Clear. By the time this project was started, Clear was focusing on defining what shall be the next strategic movement that positions the company in a more stable position (finding product-market fit and generating recurring revenue). Since then, they had focused on generating sales volume through the summer, to prove that The Clear Program was something people were in need for, and to gather data from food intake and glucose data. Now, it was expected to leverage this data to define a new service solution that includes any sort of data-processing intelligent algorithm able to create value for Clear's users and improve Clear's service. Clear was then in an ideative stage where many directions and solutions were possible.

From the previous section, we have also identified that actually Clear's service can evolve in different areas and bring different value for different audiences. The nature of this ideative moment at Clear was suitable for leading a design transition. [66]

In order to lead this design transition, and build ownership and commitment to the future direction of Clear, defining the shared vision shall be initiated from the inside of the firm [65] . This will imply collecting insights from the different perspectives and ideas existing in Clear, and creating discussion and alignment.

The following process was conducted to identify internal perspectives and define a shared vision:

First, research was conducted on existing design methods that would help framing the direction of a company. Multiple resources were found from the field of Brand Strategy. In the end, the vision of a company should be the same or very similar to the Brand vision. From Brand Strategy examples, the Value Proposition Canvas and other templates were found. Collecting different methods and canvases allowed to craft an interview script.

The interview script contained many strategic questions (about Clear's core values, Clear's reasons to exist, Clear's unique advantages, etc.). The questions from this script were aimed at finding internal points of alignment and discrepancies within Clear employees. (See full interview script in Appendix 2)

Qualitative interviews with all employees of Clear (n=8) were conducted. These interviews were conducted online and had a duration of 45 minute approximately.
The results from the interviews were transcribed, and analysed by means of a thematic analysis. The generated insights from these interviews were collected into a document (See Appendix 3 for Internal insights).

The Internal Insights Document was presented and shared with the Clear team, to create awareness about which were the points of conflict and discrepancy.

Lastly, a Visual Generative Workshop was facilitated to bring these points of conflict together into a shared vision.

This section presents the outcomes of this process focusing on what is relevant for further stages of the project.

Points of conflict

The interviews resulted in a great method to unveil discrepancies within the organization. After reviewing them, **three main areas of discrepancy were found:**

1. Clear's reason to exist - WHY

Even though there was internal consensus that Clear's service can be beneficial for people at different levels of wellbeing, *there is yet no defined direction towards one of them.*

These levels of wellbeing are related to the opportunity areas previously found:

> **Level 1** - Avoidance and prevention of health conditions. (Related to Healthcare opportunity area)
>
> **Level 2** - Healthier lifestyle and wellbeing. (Related to Personalised Nutrition opportunity area)
>
> **Level 3** - Optimization and performance. (Related to Sport performance opportunity area)

These levels are interconnected, and can be seen as consecutive steps in the progress of health. In this way, a person that suffers from a medical condition might want to achieve a health status that entails not having this condition anymore. Following, people who have no specific condition, might want to achieve a health status that allows them to have an active and happy life. Among the people who already enjoy a good health status, they might want to go even further and achieve a level of health that allows them to perform and engage into activities that are not necessarily essential for a regular way of living but that require a high status of health and physical conditioning.

This stepped-connected approach offers a full range of points in which to deliver a proposition connecting blood sugar levels to nutritional habits. However, a decision needs to be made. Otherwise the lack of focus will cause a dissipation of the proposition value, and make the decision making process much slower for the organisation

2. Clear's approach - HOW

The analysis of the interviews revealed that there was an existing internal consensus agreeing that Clear can provide understanding of the effects of food on people, and that this was interesting enough to frame a value proposition. However, **four different approaches on how shall Clear provide this understanding appeared.** These approaches can be distributed in a scale that ranges from (1) a static approach, in which Clear acts as a passive information provider on nutrition and glucose, to (2) dynamic, in which Clear plays an active role in the dietary choices that help people maintain more stable blood sugar levels. These were the four approaches:

> **Approach 1- Health knowledge**
> For this approach, Clear acts as a reputed provider of complete scientific knowledge. Providing the latest knowledge in an understandable and accessible way will allow people to make well-informed decisions regarding their own health.
>
> **Approach 2- Self-made decisions**
> This approach focuses on ensuring that people learn about their own biology and empowering them. By learning about their health, they would feel empowered to act and therefore make healthier decisions.
>
> **Approach 3- Supported decisions**
> The expertise and knowledge that Clear possesses can be translated into scientifically-based recommendations for the people to improve their health. In this approach Clear acts as a data-driven dietitian that proposes healthy choices.
>
> **Approach 4- Direct actions**
> In this approach, the data gathered from the people is combined with the expertise and knowledge from Clear. This is processed in the background to present the people with ready-made choices to improve their health. Clear acts as an intelligent instruction manual to follow in order to achieve the optimal health status.

The exact point of the approach is yet to be agreed on.

3. Clear's product and service - WHAT

Lastly, another point of discrepancy appeared when looking into the future of what Clear can offer, in the shape of products or services, that would help people understand the effect of food on them. In the end, three main offerings appeared:

> **Offering 1 - accessible knowledge on food and how food affects people.**
> Based on the scientific knowledge about nutrition and health that Clear possesses, Clear could frame a product/service in which people would be granted to this knowledge.
>
> **Offering 2 - an experimental and iterative process to improve nutritional habits.**
> Taking the CGM as a starting point, Clear can also offer people a structured way to try, test and experiment with the food that they eat.
>
> **Offering 3 - an intelligent algorithm able to rank food according to glucose response.**
> Focusing on processing the data from the CGM, Clear can find unique insights on how blood glucose is affected by food. Presenting the user with these insights can be of high value.

These offerings seem all equally interesting, and in an ideal situation perhaps all three could be integrated under Clear. However, there was first the need to conduct users in order to define which of these elements is most unique and valuable for the people who are going to use them.

The three main domains of conflict create a tangled web of possibilities for the development of the Clear future service.

For example, a random combination of Level 1 (avoiding health conditions), Approach 2 (Self-Made decisions) and Offering 3 (intelligent algorithm) would result in a service that, for example, uses a CGM to retrieve data from prediabetic people and processes it in an algorithm able to propose improvements to this people's diet. In the end, Clear will propose people with prediabetes options they can take to improve their health, in a way that they have the freedom to decide for themselves.

The example from above is just one of the many shapes that the Clear service could take based on these points of conflict. This wide variation of opportunities is what was causing blockers in the decision making process of the company. Moreover, for the development of this project, there is also a need to establish a route to follow for the final scoped service solution.

In order to make consensuated decisions on the points of conflict, a Generative Visual workshop was conducted.

Shared vision

After these discrepancies were found, they were presented internally to Clear, to generate discussion. For the complete overview of internal findings, please look at Appendix 3.

Afterwards, a Generative Visual Workshop was conducted. The aim of this workshop was to solve the discrepancies and create alignment and commitment to a shared vision. The workshop aimed at giving answer to the following questions:

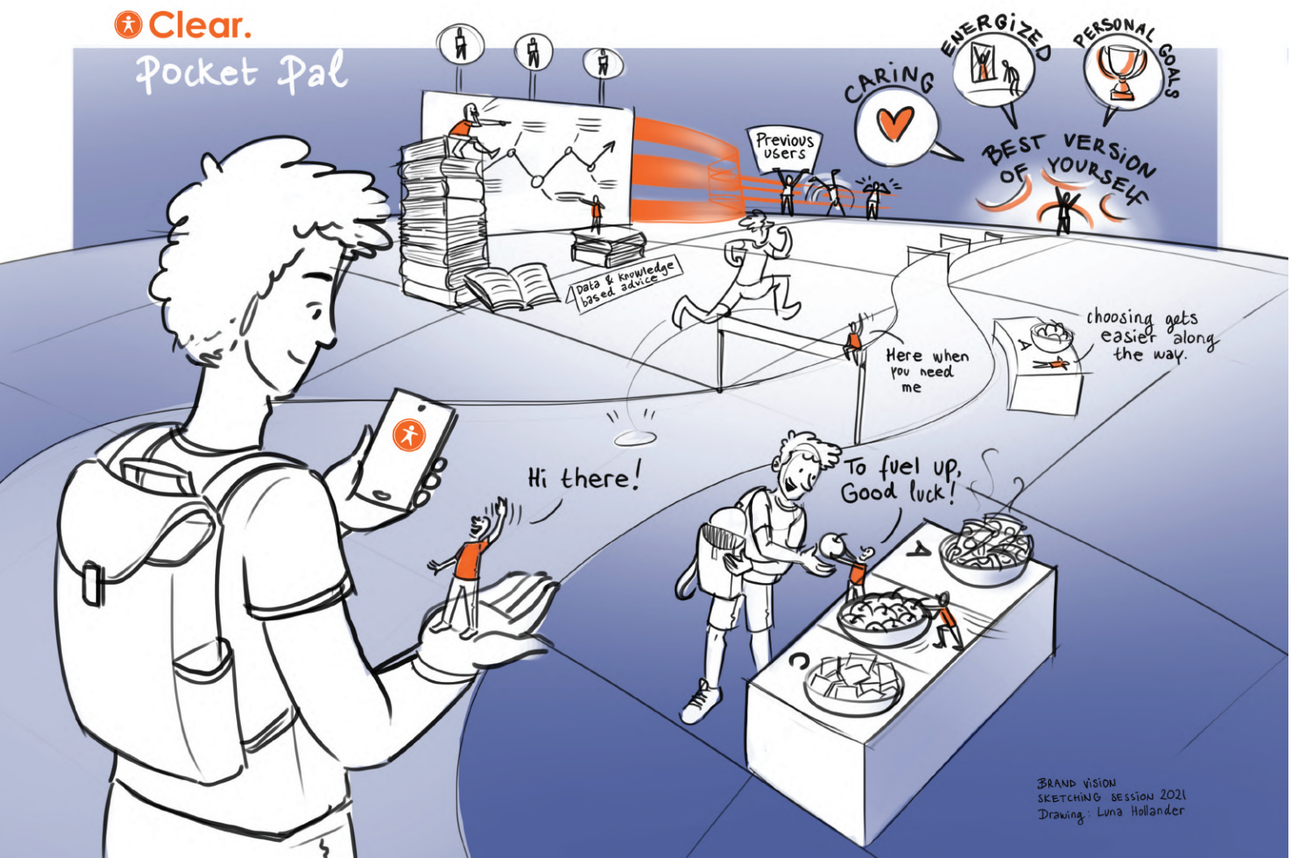
> *At which level of wellbeing aims Clear to be positioned?*
>
> *Which approach aims Clear to follow when enabling understanding of nutrition?*
>
> *What product/services does Clear deliver?*

It was decided to use a Generative Workshop because of the remote conditions. The power of visualisation also helps to frame your thought in a different way by means of metaphors. Metaphors are a very powerful tool to discuss complex problems and situations in a more distended manner.

> To illustrate how metaphors can be helpful, we can imagine that one of the members of the Clear team who participated in the workshop was against the approach of Clear giving direct actions to execute (approach 4). A way of framing this approach in a metaphor would be imagining Clear as an angry football coach, who shouts orders and directions to the team. If instead this person has a preference for the supportive approach (approach 3), Clear can be represented by a wise mentor that teaches a young pupil to overcome an obstacle.

The powers of metaphors were leveraged in a 3 hours workshop with 6 members of the Clear team, with the help of a visual facilitator, the following visual represents the metaphor that came as an outcome of the session:

Figure 13 - Initial vision



For an overview of the material generated during the workshop, please take a look at Appendix 4 - Generative Visual Workshop material. (Copyright and property of the visual material belongs to the visual facilitator, Luna Hollander)

What does the vision mean?

1. Clear wants to be your pocket pal: A convenient and engaging companion that helps you make better food choices.

Through the visual, there are major characteristics represented that define what shall the pocket pal do and how shall it behave

Adapting to your situation and context, the pocket pal will be present all along the journey ahead of you.

Backed up by consistent scientific knowledge

Approachable and easy-going interaction

Backed up by data

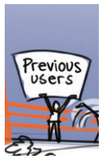
Reachable at any moment via your phone

Supporting food intake choices along the way

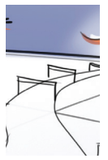
2. Clear's Service is envisioned as a journey where people become more confident about their diet, discovering through the process about what food is best for them.

Through the visual, there are implications for the Clear service as a discovering journey.

The service will become relevant to help you sort obstacles



Reinforced by previous users



Through the journey, obstacles get easier

The longer in the journey, the more accurate the choice

At the end of the journey is your personal and optimal health status

"Best" means for us whatever it means for you (regarding health)

Reflecting on the agreements made by means of this visualisation and looking back at the points of conflict, now we see that three strategic decisions were made.

These decisions are further elaborated at the end of the chapter.

Clear aims to play a major role in the lifestyle and wellbeing environment. This makes Personalised nutrition the desired opportunity area.

Clear prefers to follow a supportive approach, helping people make more educated food choices over time.

Clear will deliver insights into individual nutrition based on an intelligent algorithm.

Strategic Factors

After agreeing on the key conflict points, it was the moment to get hands-on and define which major implications these decisions will have on the scoped solution: The design of a service using health technology to support the adoption of healthier eating behaviours.

For that purpose, factors of success were found from three strategic perspectives:

> **Viability factors -** What ensures the long-term success?
>
> **Feasibility factors -** What is Clear able to Deliver?
>
> **Desirability factors -** What do people need?

Viability factors

In this section the opportunities and blockers of the personalised nutrition environment are reviewed.

Market growth

As reviewed in the previous chapter (See Chapter 1> Service Design on Supportive Health Systems) there is actually opportunity in the world of health technologies for personal health and preventive health.

The Market of Personalised Nutrition is rapidly growing. The Global Personalized Nutrition Market size is estimated to reach USD 16.6 Billion, from USD 3.7 Billion in 2019. [67]

Key market drivers

Rise in health awareness
The increase in health issues is pushing people towards a healthy diet, daily exercises, food supplements and weight management programs.

Ageing population
Globally, a person aged 65 years in 2015-2020 could expect to live, on average, an additional 17 years. By 2045-2050, that figure will have increased to 19 years. [68]

Demand for customised experience
Consumers are constantly finding personalization in their everyday experiences, moving away from one-size-fits-all media and meal consumption.

Main market blockers

Science proof.
Lack of scientific evidence that proves all the possible benefits of personalised nutrition.

Suitable technology.
Regardless of the fast development of technology, the current status of it is still very intrusive, in terms of size and application. This is a barrier for its adoption

Premium price.
The sum of parties needed for current approaches to personalised nutrition (technology supplier, intelligent algorithms, and food providers) creates high prices for the end consumer.

Lack of appropriate regulation.
Since it is a new field with lack of science proof, legislative organisations are still reluctant to contemplate it.

Data privacy issues
Since many personalised nutrition approaches gather data from the individuals, a honest and fair use of this data has to be ensured.

Supply chain flow
In order to make personalised nutrition complete, there needs to be connections created from all the parties involved, to deliver a cohesive service to the final user. Creating these connections entails logistic and coordination challenges.

In conclusion, Personalised Nutrition is an opportunity area with expected sustained growth in coming years, but with barriers along the way.

In order to overcome some of them, Clear's new service should:

Stay within scientifically-proven claims.

Provide a service that is affordable for the user.

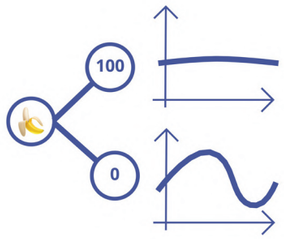
Ensure data privacy.

Address a population that is increasingly aware of their own health.

Feasability factors

Product wise, Clear is able to offer three main features.

Stability Score

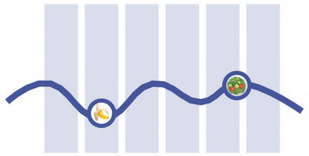


This stability score (1-100) marks how stable your glucose level remained after eating something. A score of 100 represents a good response: your glucose levels stayed stable.

A score of 0 indicates that your glucose levels varied drastically after eating.

Figure 14 - Stability Score

Food-glucose timeline



This visual provides an overview of the glucose concentration curve through the day, and matches it with the moment where food items are logged into the Clear app.

This creates visual overview and understanding of how the glucose levels are affected by food.

Figure 15 - Food-glucose timeline

Customer support center

Clear has a small operative team of people in charge of customer support and acquisition calls.

Figure 16 - Support centre

Looking at these two features in a more general perspective, what *Clear can deliver most uniquely is:*

Supporting food choices, based on what people can see on the Food Score and Glucose-food overview.

Insights on people's nutritional habits, based on the knowledge Clear has.

Contextual understanding of the meaning of glucose fluctuations.

Accessibility to one on one conversations in case of need.

Desirability factors

Some of the participants of The Clear Program felt Clear's service as an extra layer added on top of an existing technology that did not add extra value. Common feedback from users resembles this sentence:

> "I could have bought the sensor by myself and get the same insights you provided me, just by paying attention to what I ate. I could have saved more than half of the price."

To understand better what were the main user complaints regarding Clear's service, qualitative insights from 196 sources (surveys + interviews) were gathered and processed. A total of 20 improvement clusters appeared.

From these 20 clusters, four overarching themes appeared. These overarching themes cover, in a holistic way, the main user needs for Clear's service.

Personalisation

Customise the service to the user personal characteristics and requirements.
Provide the user with clear insights,

"Measure and what your goal is and tell what it should be in terms of values..."
"It didn't feel like a personalised approach. I didn't find an explanation why I was sleepy after the food"

Understanding

comprehend what they do.
Increase the communication points between Clear and the

"Was expecting Clear to steer me to a specific dietary guideline instead of summing up what did not work for me"
"I expected that after 2 weeks I had really tried everything and had a very good picture"

Guidance

Feedback and steps to follow.
Provide more or better information to the user, so they user.

"I would like to have some more information, useful tips, hints etc. during the program. Give the feeling that Clear is looking over your shoulder while you run the program"

Interaction

Increase the communication points between Clear and the user.

"Offer personal coaching or conversation"

"More personal contact in the initial phase so that someone better understands what the graphs and data entail"

It is relevant to put emphasis on these four overarching themes, and see them as **relevant requirements when designing the final value proposition.**

We can conclude that, *in order to improve Clear's proposition:*

Personalisation is relevant at two levels of the service: the personalised insights based on user data, but also a personal one-on-one approach that facilitates the interaction.

Users expect to be guided through the process, the customer journey should therefore feel like a guided learning process.

This learning process also entails understanding of health-related topics such as insulin or blood glucose, relevant for the proposition.

A more detailed overview of the process and findings described in this section can be found in Appendix 5 - Survey Report.

From all the implications found in the strategic domains of feasibility, viability and desirability, some of them were more interesting to take further to the development of the process. These five Success factors are presented at the end of this chapter and elaborate further.

Chapter 3
Conclusions

The goal of this chapter was to define a shared vision for the project, and create a sense of ownership within the organization. These two factors are highly influential in the success of strategic design projects. [65]

Since this project touches upon the most relevant part of an organization: its value proposition, creating a vision for the project entailed creating a vision for the entire organization. The visual workshop resulted in a great method to create alignment. Decisions were made, and a sense of commitment was created.

The next logical step was looking for strategic factors that would ensure the success of such a vision, and serve as design implications for the scope of this project. Design implications were found within the organisational capabilities, user needs, and market drivers. The conclusions at the end of each section of this chapter define those implications.

Reviewing the implications in a more general perspective, allows to narrow down the scope of this project, and reformulate the original problem into a new and final problem definition:

How to use the variation in glucose after a meal to provide a supported learning experience on healthy nutritional habits for people that are increasingly aware of their own health?

These 3 decisions were established internally by means of a Visual Generative Workshop, and are expected to create internal alignment and commitment towards business decisions in the near future of the organisation.

Clear reason to exist is to facilitate a healthier lifestyle and wellbeing, being a relevant stakeholder in the field of personalised nutrition.

This decision implies that Clear would focus on Personalised Nutrition. This market has a big potential to grow in the coming years. However, it is still in early development. This is both good and bad. On the one hand, Clear's early presence in the market will help it to consolidate a solid position by the time the market expands. On the other hand, the legislation and knowledge that still needs to be built to consolidate the market can result in obstacles.

Clear follows a supportive approach, facilitating people to make more educated food choices over time.

Even though Clear possesses knowledge to tell people which food is good or bad for them, Clear shall not force people to make changes in their diet based on dietary changes per se. Instead, Clear will support people in their decisions, suggesting possible recommendations and improvements, but always putting the last say in the mouth of the individual.

Clear services contains two main offerings:

An experimental and iterative process to improve nutritional habits

The use of intelligent algorithms able to connect food with the effect on health by means of blood sugar.

Clear will rely on two elements as core of their service: first, Clear service will facilitate a journey in which, by means of experimentation, people learn blood glucose and its relevance on personalised nutrition. Secondly, Clear will make use of the data from food logging and CGM scanning to create an algorithm able to provide insights for people about their food intake and lifestyle.

3 Strategic Decisions

In order to elaborate on the 3 strategic decisions made upon Clear and Clear's service, desk research and qualitative techniques were used to define criteria for the design of a service solution. In the end, criteria was established on these strategic domains:

Viability - What ensures the long-term success of the service?
Desk research on the possibilities and limitations of Personalised nutrition was conducted. This helped to find key drivers and limitations of the field.

Feasibility - Which valuable service elements is Clear able to Deliver?
An analysis of the components that integrate the Clear service on which Clear can take the most advantage is done to unveil feasibility factors.

Desirability - What are people in need of when using The Clear program?
In order to define the user needs from the Clear Service, and see which of them aligned with the Strategic decisions made, a thematic analysis was performed with the data from qualitative surveys that Clear provided.

The results and learnings from this chapter are aimed to answer the fourth Research question scoped within this Project.

RQ4: Which aspects of Clear's service need to be redesigned in order to support the adoption of healthy nutritional habits?

5 Success Factors

Stay within the boundaries of what is scientifically proven.

So far, Personalised Nutrition seems a very promising field, according to which in the future, people would have diet requirements adjusted perfectly to them, not only in terms of taste and preferences, but also in terms of what is best for our health. However, the claims that personalised nutrition gives should not be taken as a given yet. The existing scientific research in personalised nutrition has just taped the top of the iceberg of how the human genome, the bacteria living in our gut and the fluctuation of blood glucose can be used to personalise the diet of an individual. There are still many incognitas to be solved and factors to be understood.

Target population that is already aware of their own health

Overweight and obesity are big problems in our society. The sedentary lifestyle patterns of current societies and the misleading information about diet and physical activity cause people to not act on their health at all. These people can be highly benefited from elementary changes in their lifestyle like introducing regular physical activity or reduce the intake of processed food. Even though personalised nutrition might also be relevant for this person, it is not the people who might benefit the most of it. Instead, people who are already acting on their health, and have started to realize, after trying different diets, that their body does not respond as it is expected to, is a much more potential audience for a service in personalised nutrition.

Focus the service on providing contextual understanding to glucose fluctuation.

The variation of blood glucose concentration is related in the short term with energy levels through the days, and in the long term with health conditions such as type two diabetes. Looking at blood glucose fluctuation is therefore relevant, but is necessary to provide understanding or where to look at. Even though people aware of their health might be familiar with health metrics such as calories or heart rate, blood glucose is a completely new variable for most of them. The knowledge and expertise that Clear has on nutrition and its relation with glucose can be used to let people understand this variable better. The same way that people understand a heart rate of 180 increases the risk of a heart stroke, what are similar connections with blood glucose?

Leverage the data to unveil insights on people's nutritional habits.

The data that is collected by means of the CGM and The Clear App can be used to identify patterns in people's glucose behaviour through the days or weeks, and find correlations among people. For example, are people more susceptible for a sugar peak in the morning or in the afternoon? Are there specific habits that will maintain blood sugar levels more stable? How can these be integrated within a person's lifestyle? Looking for answers to these questions and similar ones is where the real potential of the data that Clear possess relies.

The customer journey shall be adapted to feel like a guided learning process, in which the user learns about his/her own metabolism.

Clear's service currently puts the responsibility for the effectiveness of the service on the user, who needs to spend two weeks of logging and scanning, waiting in the darkness to be enlightened by the information contained in the Report that Clear provides after two weeks. Instead, people would be much more satisfied if these two weeks of wearing the CGM sensor would be filled with realisation moments in which they learn about their blood glucose levels, and their nutritional habits.

These factors have been prioritized in the development of the service solution scoped in this project. However, it is important to mention that there are also other factors that have been identified, but will be taken into account with less or no priority. It is relevant to know these other factors to comprehend the limitations of the results.

Firstly, topics like affordability and data privacy are also relevant to ensure the viability of the service. Due to the early nature of Clear and the lack of resources, these are not factors that can be largely influenced currently.

Additionally, Clear has potential to ensure the adoption of healthy eating habits by for example giving food recommendations. This is interesting but might enter in conflict with scientifically proven claims, thus would need to be first cautiously explored. Besides, the customer support centre at Clear also has potential to be integrated into behavioural change interventions. However, this thesis is mostly interested in the role of technology, thus leaving out the human factor.

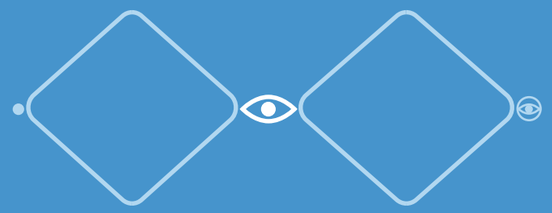
Lastly, other relevant desirability factors that were found as important for people when using Clear's service were (1) the personalisation of the nutritional advice given by the service and (2) the understanding of health related topics.

To be able to further explore to which extent the processing of glucose and food data allows for personalised advice, there is knowledge required into data-science and data processing. Parallelly, to make sure that the service is successfully providing users with understanding of health topics with regards to nutritional habit, there is knowledge needed into health and nutrition. During this project, continuous communication with the members of Clear specialised in data-science and nutrition was established. It is therefore expected to have complied with these two factors as much as possible. However, there might still be some limitations.

Chapter 4

Delimiting the Service

This short chapter is a bridge between the problem and solution definition. The learnings from previous chapters are translated into a Service Framework and a Service Vision. Both of them will be used as guidelines to develop the final service solution.



Chapter overview

Service Framework

Service Vision

This framework is the result of processing the results from previous chapters (Key Learnings, Strategic Decisions and Success Factors). Analysis on those results allowed to identify new connections amongst them. In the end, they have been rearranged to provide a first structure of what Clear's new service would be. For this, three main service elements are identified. Each element contains certain characteristics that links them to a behavioural change purpose, trying to make sure they constitute a valid intervention. Moreover, the framework includes additional criteria that needs to be established throughout the three elements.

From a behavioural change perspective, in order to jump from the preparation to the action stage [15], a person needs to be aware of their initial status before the intervention. Examples from persuasive technology literature prove that a way to do this is via an initial evaluation, which is normally shaped in a questionnaire or survey. For the Clear service, this evaluation needs to be tailored to the context of Personalised Nutrition. For that, people who already care about their health are the most suitable to target. Therefore, the first element of the service shall be an evaluation aiming to capture the nutritional habits and condition of people who are interested in adopting better habits.

Secondly, since Clear has yet no full control over its service, but it wants to support people make educated food choices, a second element of the new service is the facilitation of an experimental journey in which people discover more about their health by means of blood glucose. In this journey, Clear can be the facilitator of the experiments, process the outcome of them and give meaningful insights back to the people.

Lastly, another strength of Clear is the amount of data that it already has from previous users of its service. Studying which possibilities this data brings, and transferring it into a metric, can create a unique advantage in Clear's service against competitors. For example, step counting is a metric very familiar for people to take care of their health. A similar metric entailing blood glucose can facilitate the adoption of Clear's Service, and integration with other digital parties in the future.

CLEAR'S NEW SERVICE		CRITERIA FOR IMPLEMENTATION			
Based on Clear's capabilities, and research on behavoural change, the new service needs to integrate:	**In order to conform a Supportive Health System, each component shall be aimed to fulfill the following goals:**	**Scientifically proven claims** To prove validity of a service in the emerging field of personalised nutrition.	**Continuous addition of personal data** In order to generate attachment and retention.	**Contextual adaptability** To fit with the environment in which the behaviour occurs.	**User-centered interaction with the data** by means of freedom and control of usage.
1 **An initial evaluation to comprehend the biological status of the individual.**	**Reinforce external conditions to encourage people changing their nutritionall habits.** State which are the benefits of the service for a healthy lifestyle and wellbeing. Explain why personalised nutrition contribuites to avoiding diseases. **Trigger an intrisic goal.** Target population that is already aware of their health but susceptible to suffer metabolic syndrome.	Target conditions that are proven to be connected to blood glucose: - Energy levels - Prevention of metabolic syndrome	The data that the user provides in the initial evaluation shall be collected and evolve through the service.	In the initial evaluation, qualitative data that helps framing the context of the user shall also be collected.	The data provided from the initial evaluation shall be accessible and editable by the user at any moment.
2 **An iterative experimentation of dietary choices in relation to blood sugar levels.**	**Provide assistance and support by cues to action.** Adopt a supportive approach, not telling users what to do, but facilitating cues that would help them male more educated dietary choices. **Iterative evolution of research data into solution data** Leverage the data from blood glucose monitoring to unveil inishts on people's nutritional habits that, when presented back to them, create valuable realization moments.	When the user is encouraged to experiment, the experiments shall be backed up scientifically to provide valid evidence.	The results of the experimentation and learnings unveiled shall be collected and made available for the user to access.	When experimenting, the user shall be able to choose and adapt the experiments that match her own lifestyle and condition.	The experimentation journey shall be unique for each user, allowing them to progress at their own pace and convenience.
3 **An intelligent metric that connects diet with health via the variation of blood glucose levels.**	**Transform continuous track of biodata into an understadable metric.** To make data-tracking valuable for the user of the service, it is ideal to create a metric using blood glucose variation. This metric shall be easy to understand, and provide contextual explanations of the dietary choices that are good/bad.	When processing the data into an algorithm able to provide insights, there should be a high reliability on this insights.	A second layer of data processing can be done over the metric to generate new insights valuable for the user.	The metric shall be flexible, in a way that is valuable regardless of the situations of use.	The user shall have a certain degree of control over the metric.

Service Framework

It is relevant to mention the limitations that this framework might encounter. For that, it needs to be understood that behavioural change interventions normally entail a high degree of personalisation, because the exact same intervention would not work for persons in different situations. However, from an organisational perspective, the possibility of standardising the service and reaching to a big audience is desired. In the end, this framework is meant to be a solid baseline, valid for the development of multiple interventions. The service solution that is designed in the following chapters is one example on how this framework can be used to develop an intervention tailored for Clear.

Service Vision

A vision is a metaphorical visual representation of an ideal situation regarding an abstract element. It can be used to frame the requirements of a design solution, but also used to visualise the nuances of complex problem. Its value relies on it being a tool for communication across people and organisations. This visual technique improves the speed, creativity and effectiveness of collaboration and decision making in a dynamic environment. [69]

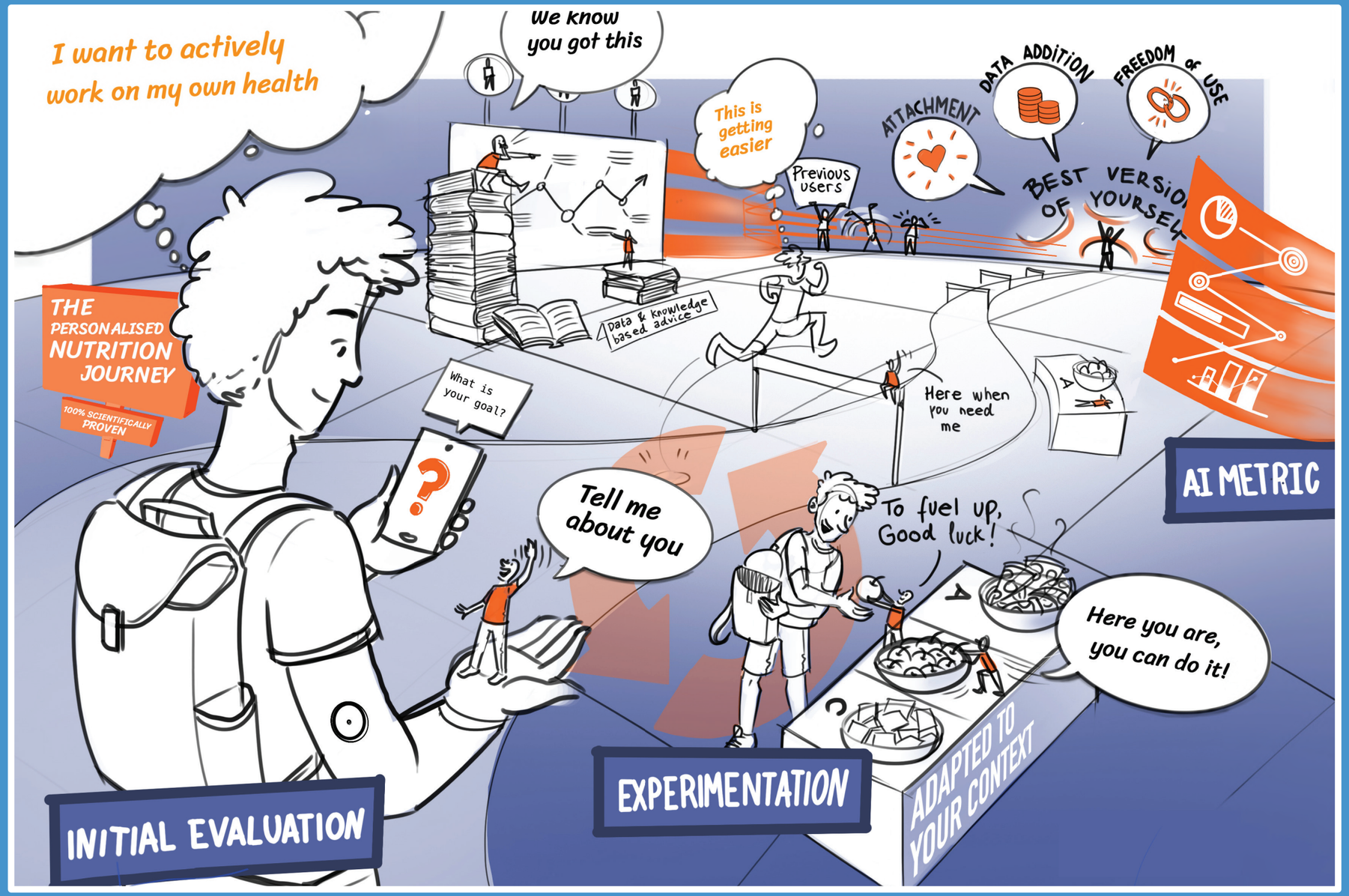
The Service Vision on the right represents the Ideal Clear service, based on the findings gathered on previous stages of the project.

On this vision, we can firstly identify a person who is eager to act on his own health actively. The person is wearing the continuous glucose monitor and looking at his phone. These two elements compose the Supportive Health System that will assist him through the journey he is about to start.

On the left, we see a sign that indicates what this journey is about: personalised nutrition. Since this is quite a new path, it remarks that what would happen during the journey is Scientifically proven, which is needed to create reliability and trustworthiness on the path.

On the first phase of the Journey, the person goes through an initial evaluation. This evaluation will generate an initial set of data about the personal aim of the participants and his context. Afterwards, the person enters an iterative experimenting loop in which Clear acts as a facilitator of experiments that the participant can do to improve his eating habits (represented with the hurdle). Of course, he is free of taking the experiments he wants, but the data that the service collects from him should facilitate that these experiments match the context and preferences of the participant, and let him progress in the journey.

Parallelly, the data from the blood glucose monitor is being stored and translated into an understandable metric by means of an algorithm. This metric is visible all along the journey, and contributes to achieve that, by the time the user reaches the end goal, he is attached emotionally to the service that contains all his data and lets him use it in the futute in a convenient manner.

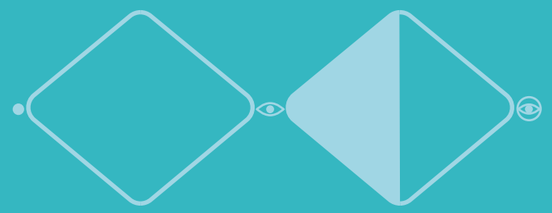


Together with the Service Framework previously presented, this Service Vision will be taken further in the design process, to inspire in the ideation phase. To do so, the service needs to be explored from the perspective of the user, finding validation into what relevant problems can people solve with a service like this. Additionally, it needs to be translated into the final shape that each of the elements will take, and mapped into a timeline that helps Clear implement it.

Chapter 5

Service Design

This chapter describes the process followed in the development of the final service proposition for Clear. Thanks to creative and analytical methods, the design solution moved from an abstract idea stage, to the design of specific touchpoints of the service.



Chapter overview

Introduction

At this stage of the project, we have already defined the guidelines for the development of the service solution. By now, we know which are the elements that Clear shall include in their service, and which criteria to follow when designing them. However, theory from service design shows that in order to improve the experience of a service by the user, the service shall feel as a streamlined and seamless process that takes the user from one stage to another in order to solve a relevant problem. [26]

This chapter elaborates on top of the Service Framework and the Service Vision to move the new service towards a concrete stage that is cohesive and round-ended. To do so, a creative session was used to spark an idea for an overarching way of looking at the service, connecting the elements in a streamlined process. The insights from the session were used to give shape to the following idea:

> Transform the Clear Program into a Learning Journey where people engage in gamified challenges presented in the Clear app. Users can do certain activities (mainly by eating certain food or under certain conditions) to explore the effect of these activities on their glucose levels and overall health.

This idea was fitted within the Service Framework to match a behaviour change intervention, moving the user of the service from a preparation stage to maintenance stage, through the action stage [15]. Fitting each stage of the behaviour change process with each of the service elements served to define the final concept, **The Clear Learning Journey**. This service will consist of:

> Before activating the sensor, the service is constituted by an onboarding process in the app that evaluates the user status with regards to nutrition and explains the main phase of the service: the challenges.
>
> During the two weeks that the user wears the sensor, Clear would make available practical challenges that people can complete to find actionable takeaways to improve their diet.
>
> After detaching the sensor, the user would be granted access to a predictive food score metric, that tells the suitability of a food/meal based on the data gathered in the previous stage.

In order to develop the required touchpoints for each of these three stages of the service, two generative techniques were followed. According to the Data-Enabled Design methodology, placing interactive prototypes able to retrieve data in the context of use, serves as a way of gathering insights for the design of digital systems that also make use of that data. Adapting this methodology to an own approach that suited the service design nature of this project, two generative methods were conducted to iterate and validate the Learning Journey concept:

A situated pilot study of the possible new service, with real customers of Clear.

> Five participants underwent a low-fidelity version of this new service for two weeks. Through constant communication and using a document that was updated daily to keep track of the challenges completed and available, it was possible to learn better about how shall this phase of the service be designed.

An online research tool that serves also as an initial proof of concept of the Customer Journey.

> An online tool used normally to conduct interactive surveys was used to prototype the service in a superficial way (without getting to too much detail). This online generative experience was sent across media channels to gather responses and provided insights on the other two phases of the service (initial evaluation, and intelligent metric).

In the end, both methods generated learnings for the decision making and definition of the service process and touchpoints.

This chapter describes the development process of the Learning Journey. At the end of the chapter can be found a visual recap with the most relevant information that is taken further. In the following chapter, the final level of definition for every stage of The Clear Learning Journey is presented and discussed.

Idea

Learning experience

Looking at the Service Framework defined in the previous chapter, we identify three loose elements that the new service solution is expected to contain:

> **An initial evaluation** to comprehend the biological status of the individual.
>
> **An iterative experimentation** of dietary choices in relation to blood sugar levels.
>
> **An intelligent metric** that connects diet with health via the variation of blood glucose levels.

Right now, these elements lack an overarching connection that brings overall coherence and cohesion to the service. [26]. Finding this cohesion was thus the starting point of the development phase.

In order to find inspiration on how a service can use a supportive Health System to empower healthier lifestyle choices, this problem was taken into a creative session with students from the creative facilitation course of industrial design engineering at TUDelft. Creative sessions like this are always a way of breaking fixations and finding possibilities that haven't come out yet. [70]

Through the session, the students realized a very insightful element: changing behaviour to improve overall health is difficult due to the intangibility of the reward. Because the possible benefit of eating healthier in the present moment will be rewarded in a long-distance future, it is hard to maintain that behaviour. This insight helped to re-conduct the session towards a new direction: **How can Clear boost the tangibility of future health rewards now?**

In the end, no specific solution was found (the focus of the session was on fluency of a high number of ideas). But interesting points came out:

> *Clear shall deliver a service in which people can feel their progress towards better health tangible.*
>
> *Additionally, the service should make this progress fun to engage with and ensure that people feel proud of their achievements.*

These insights served as a great source of inspiration for the overarching idea that can create cohesion to the service:

> What if we transform the Clear Program into a two-weeks learning experience where people, by means of gamified content and activities, can experiment with their own diet and understand ways of keeping their glucose level more stable, and therefore be empowered to repeat those learnings until they become healthy habits?

When looking back at the design framework, this idea fits with the second element described there: the iterative experimentation. Executing this idea would imply that the new Clear service, instead of letting the user freely explore the food that they eat during the two weeks that they wear the CGM, and send them a report with insights at the end, the users would now be an active actor during these two weeks, executing certain adjustments that help them to learn how to keep the glucose level stable.

Problem as Given:	How can Clear guide its users through a guided learning process on their own nutritional habits?
Problem as Perceived:	How can Clear boost tangibility of future health rewards now?
Solutions:	• Visualising your achievements to boost the awareness and pride. • Making a visual prediction of a future version of you. • Making the service fun to engage with. • Boosting the tangibility of future health rewards now, so people can feel more encouraged and motivated.

Table 1 - Overview of creative session

Idea validation

Having a match between the idea and the framework was rather expected, since we already knew where to look, based on the research done internally. To aggregate external validation to this idea of a learning experience, online research was conducted in online blogs and forums, trying to identify whether people would be interested in engaging in these sort of activities.

Figure 19 presents an example of what was found in the online research.

From these online validation we take that:

> *People are in seek of practical tweaks or tricks on their diet that they can implement right-away and have long term benefits for their health.*

These insights should then be taken into account when designing the gamified activities:

> *The learnings and takeaways from completing the activities should be actionable tricks to implement in the diet.*

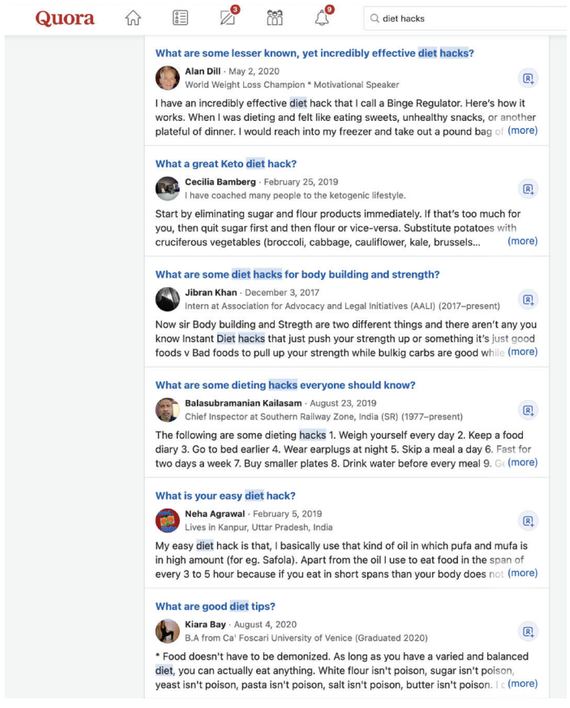


Figure 17 - Online validation of idea

Additionally, the interviews conducted with participants of the Clear program throughout the development of this project, also brought interesting quotes that support the idea that people would be interested in learning during the Clear service

Here are some of their remarked quotes:

> "I would like to know what are the buttons that you can push after such a period of not being so healthy to get back to your health balance"

> "Hopefully, to get a better understanding. That way I can get a better energy level"

> "To have better insights on what causes sugar peaks and skip unhealthy food"

> "First is to understand, have a greater knowledge on what food is good and what not"

> "Learn about myself"

> "In my case [what I want] is understanding. If I have the knowledge, I really want to have the independence to act on it myself"

> "Overall, my expectation would be that I get some more insights about what different types of foods do for my overall energy level"

> "Maybe I want to get a little bit more knowledge of what is good food for me. And maybe I could lose a little bit of weight, but I'm just getting to know what's right for my body? I would really appreciate it."

> "And how frequently to eat maybe that maybe I could learn something from that because I feel that I'm very sensitive to energy dips. And maybe I can learn something from that."

> "Maybe I have some convictions about, for example, that I'm eating very healthy, and it still spikes my sugar levels. So [I want to] get to know more, learn more about the influence of my foods on me."

With this, we consider the idea defined and validated. However, it is wise to recognise the possible limitation of such validation. Ideally, further validation with dutch population that is aware of their health would have brought better insights.

Concept

Learning Journey

Now that we have explored and validated the idea, the next step shall be to give more concrete shape to it. Ideally, this would mean defining which are the gamified activities and how are they presented to the user via the Clear app. Even though we would reach that stage later in this chapter, we cannot forget that the current status of the idea only contains one out of the three service elements contained in the Research Framework.

Referring back to the transtheoretical model of behavioural change [15], we recognise 5 stages that a person goes through when experiencing a behaviour change (precontemplation, contemplation, preparation, action, and maintenance). The learning experience via gamified challenges fits within the action phase, when people are already executing actions to change their behaviour. The question here is, **could the other service elements be used to cover the main goals of the contiguous behaviour change stages (preparation and maintenance)?**

In order to give an answer to this question, it was decided to understand better what is the main goal of each of these three stages of behavioural change. From the definition of the preparation, action and maintenance stage given previously in this project (Chapter 2> Habit formation), three core experiences that the service shall deliver to the user were drafted:

Core Experience 1 - Understanding Status

In the preparation phase, the service gives the required information to let the user know why her behaviour can be perjudicial, how it can affect her personally, and what are the benefits of changing it. Additionally, the service helps the user recognize the current status of her behaviour, and it gives her the means to start acting on it.

Core Experience 2 - Awareness of change

In the action phase, the service provides cues and triggers that lead to actions that the user is able to achieve. Increasingly, the way the user responds and completes these actions is used by the service to load the following cue. Through this process, the service makes the user accountable and aware of the progress.

Core Experience 3 - Convenient integration in lifestyle

At this point, the user is ready to apply the changed behaviour in her daily life. The role of the service is to provide the means that make this application easy, convenient and allow for freedom of use.

Taking into account these three experiences and matching them to each of the elements from the Service Framework, result in an initial service concept that comes as follow:

> **An initial evaluation** stage that makes sure the user feels prepared to start executing challenges and learning on her own metabolism.
>
> The initial evaluation can be used to explain the user about what she will learn during the challenge phase.
>
> **An experimental** 2-weeks process in which the user completes gamified activities from which she learns actionable tricks to implement in the diet.
>
> **A metric** that serves as a companion to maintain the learnings generated on the iterative experimentation.
>
> The intelligent metric that helps people gain insights on their health in a convenient way was considered as something present through the whole journey. In order to fit within the maintenance stage of behaviour change, it would mean that his metric becomes available after the user has spent two weeks completing challenges.

Now that we generally understand that the service is composed of three main elements that will be delivered in three consecutive stages to ensure that they provide the experiences required to change behaviour, it is the moment to give shape to the touchpoints that will conform the final service solution.

Defining touchpoints

In this section is presented how every part of the service solution (evaluation, experimentation, metric) was translated into different touchpoints, in order to deliver the expected Core Experiences (understanding, awareness, convenient integration).

Initial evaluation

The **first phase** of the service occurs when the user hasn't activated the CGM sensor yet.

The goal of this stage is to provide enough understanding for the user to make her feel prepared and empowered to take action and change her behavior.

To create this understanding, Clear needs to provide information about what are the benefits of the service, so the person comprehends why blood glucose is a relevant variable to judge whether a diet is healthy/unhealthy, and what does it take to have stable glucose levels. This information can be given in the shape of explanations. Given that the main point of contact between the user and the service is the Clear app, these explanations shall be integrated in the shape of videos or texts in the onboarding process of the app.

Similarly, the user is about to start an iterative process in which she will be challenged to do small adjustments to the food she eats in order to learn which food keeps her glucose levels more stable. Therefore, the Clear service shall also provide good explanations of what the challenges consist of, and how are they useful. Same as with previous touchpoint, the onboarding process of the clear app is suitable for this explanations.

Lastly, theory of behavioural change tell us that is important to trigger an intrinsic goal in the individual to elicit the willingness to change. In order to do this, the Clear service can include a surve/interview/questionnaire at the early stages of the process that capture the goal of the individual, so she can be reminded with it later.

By means of these three touchpoints, it is expected that the user is able to jump from the preparation to the action stage.

Phase 1 - Pre-activating the CGM sensor

Clear's Service ensures that the user understands (1) the connection between glucose and health through food and (2) how is the user expected to improve her own diet by challenges once the sensor is activated.

Core experience	**Understanding Status**
Goal	Creating the ideal situation to start the program
Behavioral change stage	Begin planning to make behaviour change and commmited to follow through.

PREPARATION

Main requirements

1. Explain information of what is **personalised nutrition and why is connected to blood glucose**.

2. Capture **users initial status with variables connected to blood glucose** (diet, physical activity, etc.)

3. Explain **how the two weeks wearing the sensor look like**

Touchpoints

1. Easy to follow **explanations** of the relevance of glucose to achieve better eating habits and avoid short-term and long-term problems

2. **Questionnaire/interview** asking about goal, and current habits regarding nutrition and physical activity.

3. Easy to follow **explanations** of what the program will entail during the two weeks.

Table 2 - Overview of phase A

Challenges

This stage is started once the user places the CGM sensor on the arm. From that moment and during two weeks, the user would log everything she eats in the Clear app, and will have access to the features that are included (Food score and Glucose-food timeline).

Additionally, in order to provide the learning experience, challenges would become available in the app. These challenges include small activities such as eating a high-carb lunch to generate micro-learnings in the individual.

By a continuous addition of challenges, it is expected that on the one hand, the user is engaged and keeps completing challenges, and that, on the other hand, with every challenge completed there is a practical takeaway that she can integrate on her nutritional habits.

About the final shape of the challenges, it was necessary to work in collaboration with the members of the Clear team which have expertise in data science and nutrition. Together, it was possible to define a set of initial challenges by looking at the three perspectives:

What the user was expecting to learn (using the interviews as source)

What was scientifically proven (based on the knowledge of the nutrition expert)

What is possible to develop from the glucose data retrieved from the sensor (based on the expertise of the data scientist)

Phase 2 - Wearing the CGM sensor

Clear's Service provides activities/challenges that users can execute by doing specific things on their diet in order to learn healthy tweaks to it.

Core experience	**Awareness of Change**
Goal	Maximising learning on diet improvements
Behavioral change stage	Implementation of behaviour modification to change previous behaviour.

ACTION

Main requirements

Based on existing scientific research and additional insights found during user interviews, knowledge that is interesting to convert into micro-learning activities is:

Metabolization of different nutrients into glucose, specially carbohydrates.

Complexity and limitations of glucose on physical activity.

Existing ways of improving glucose response.

Touchpoints

Set of **activities/challenges** to complete along the two weeks of wearing the CGM.

Use of the **complementary features** of Clear to provide contextualisation and visualisation of the activity outcome.

Table 3 - Overview of phase B

Recommendation vs Prediction

Defining this stage of the service into specific touchpoints was challenging. The goal of this stage is to provide the user with an easy-to-use tool, in the shape of a metric/score/percentage/advise that would accompany her after detaching the sensor. The utility of this metric is that it is accessible for the user when she needs it, in a flexible and convenient way, and it helps her to maintain the eating behaviour that she has recently learnt from the challenges of the previous stage.

In the end, two possibilities were envisioned to give shape to this phase of the service. The validity of one of them over the other would be explained in the validation phase of this service concept.

> On the one hand, a possible solution was to provide the user with food recommendations that matched with those foods that kept the glucose levels stable when she was wearing the sensor. The idea here shall be to develop an algorithm able to extract information from the data generated in the two weeks, looking for example at the macronutrient distribution of the foods that the user logged, and creating connections with existent foods from a database that might have similar distribution. Together with Data scientist at Clear was validated that this data model was possible up to 80% accuracy on recommendations

> On the other hand, another possible solution was to develop a data model that could predict (approximately) the effect that certain food or meal would have in the person, based on the existent data of the person (what the user has logged in terms of food and the glucose variation that this food has caused on her). Together with Data scientist at Clear was validated that this data model was also possible up to 75% accuracy on predictions.

It is relevant to mention that for this two models to be possible to implement, the food logging process of the Clear app shall be adapted into one that provides higher level of detail in the food that the person take. This would mean that after the food logging Clear has the data of quantity of food (in grams) and the distribution of macronutrients of the food (fats, carbohydrates and proteins).

Phase 3 - After wearing the CGM sensor

Clear's Service provides a solution for people to keep a diet that lowers their glucose responses based on what they did during phase 2.

Core Experience	**Convenient integration of new behaviour in lifestyle**
Goal	User applies the new knowledge. User continues attached to the service.
Behavioural change stage	Maintaining behaviour change and trying to prevent termination of new behaviour.

MAINTENANCE

Main requirements

> Convenient and easy to use, to ensure user's keep on with the new-learnt knowledge.
>
> This solution needs to be flexible, to fit comfortably within the user's life.

Touchpoints

> **Recommendation of food** with similar caloric intake and macronutrient composition than the one that gave the user a good score. This would allow the user to conveniently eat the recommended food and therefore keep a healthy diet.
>
> **Food response prediction** based on glucose data gathered from the user during the two weeks. This would allow the user to check whether a food/meal he is planning to eat is good/medium/bad for him in terms of glucose response.

Table 4 - Overview of phase C

Concept Validation

In Chapter 2, we reviewed different design methodologies that integrate data in the design process, in seek for a suitable methodology when designing for Supportive Health Systems. (See Chapter 2 >Design for Supportive Health Systems)

Data-enabled design, an iterative methdology suitable for the design of intelligent systems and ecosystems seemed the most relevant, due to the fact that this methodology incorportes the use of data in a dynamic way, able to adapt to the possible changes that occur when interacting with the product/system/ecosystem.

Data-enable design is based in two steps:

> First, a **contextual step** with focus in gaining understanding of the design space by utilizing quantitative sensor data and qualitative user insights.
>
> Secondly, an **informed step** in which prototypes able to retrieve data are placed in the context of use. This data is then analysed in the "design studio" and converted into learnings that allow for iteration of the prototype. Multiple iterations allow for the design of the final solution.

Since the focus of this project is on service design, i.e. designing how does the user interact with the organisation providing the Supportive Health System across multiple touchpoints, it was decided to skip the contextual explorative stage. Normally, this step includes the placement of multiple sensors able to generate different data points, and after a period in which these sensors retrieve data from the context of use, the designer looks into which problem can be solved with a joint use of all or some of those data points. In this project however, we have decided to stay within the boundaries of the data-collecting points that are already part of the Clear system (the CGM and the app). A possible way to have introduced the contextual step of data-eabled design would have been to conduct a diary study with a certain number of participants from the Clear program and gather, in addition to the food logging and glucose data, other qualitative data points, such as emotion or experience while going though the program. In the end, the informed stage of data-enabled design was implemented with the defined touchpoints that came out of the ideation phase.

In order to "place the interactive prototype in the context of use" as the methodology suggests [41], two different methodologies were followed:

> **An online generative tool** distributed across media channels to collect responses on remote.
>
> **A situated pilot study**, with real customers of Clear.

It is necessary to remember that, differing from existent examples of products and systems designed by means of data-enabled design, this project looks into service design.

Therefore, the goal of the informed stage shall not be to validate the utility of the product, or the experiences evoked when making use of it, but to understand the nuances of the interaction of the user with every touchpoint of the service, validating whether or not the ideated service serves to solve the problem of learning about dietary habits that keep the glucose stable and therefore prevent the occurrence of diseases.

The extent to which the proposed techniques are a valid way to integrate data-enabled design methodology into service design challenges, is yet uncertain because of the novelty. On the final conclusions of this project, a moment is taken to reflect on this. Following are introduced the explanation of the two techniques implemented and the reasoning on what was expected to generate from them.

The Pilot Study

To test the validity of the Touchpoints in the real context, participants of the Clear Program were contacted right after they purchased the current service, and asked whether they wanted to join this pilot study. In case affirmative, they were asked to sign a consent form (accessible if requested).

> During the two to three weeks afterwards, they experienced a low-fidelity version of the proposed Learning Journey. This allowed for gathering contextual, behavioural and experiential data.

The intention with this method was to let real users of Clear experience every stage of the Learning Journey that has been previously described.

For the *initial understanding phase*, before people activate the sensor, what was done is sending Clear users that showed interest in participating in the pilot an

Duration:	2,5 weeks
Participants:	5
Set up:	• Initial interview/intake call (appendix 6) • Pilot study explanation sheet (appendix 7) • Service explanation sheet (appendix 8) • Initial progress sheet (example on appendix 9) • Daily progress update sheet (example on appendix 10) • Mid-way interview. (Script on appendix 11)

Table 5 - Pilot study setup

explanation sheet containing the details of what the pilot would consist of. In this sheet, it was included a description of all the features that a person could interact with. At this moment, the Food Score feature was still in development, so the main feature that the user had in the app was the Glucose-food timeline. When this sheet was sent to the pilot participants, they were told that they could have access to a number of features, but that in order to use them they would have to contact the researcher and ask for it. The participants were given access to:

> The Food score stating the glucose response o a specific food they wanted to check
>
> Practical challenges to complete and learn about their personal reaction to food.

This explanation was sent together with the consent form to participate in the pilot. Once agreed to participate and having read the explanation sheet, an intake call was scheduled with the pilot participants. In this 15-minutes phone call, the pilot participants were asked questions regarding their lifestyle (nutrition, physical activity) and about their motivation to join the service. They were also given the chance to ask any type of questions with regards to the pilot or any other concerns.

> The goal with the explanation sheet and the intake call was to cover the objectives of the first phase of the service: ensuring that the user is ready to move from preparation to action and start completing challenges.
>
> The initial call served to validate to which extent did participants understand the explanations and which were their main concerns. Also, the information gathered about habits and motivations was synthesized and visualised in the sheet that would be used in the following stage.

Once the participants activated the sensor, the researcher sent them an Initial progress sheet. In this sheet (a .pdf document sent via Whatsapp) it was contained a profile section in which the insights from the call were mapped to remind the user why she was eager to learn about her health. Additionally, this progress sheet contained a description of the first challenge available. Through the two weeks of wearing the sensor, this sheet was updated daily (or almost) and sent to the participant, marking as completed the challenges that the participants were doing and making new challenges available.

> The goal of this approach was to explore the extent to which the participants engaged with the challenges and were eager to complete them. For that purpose, the daily update of the sheet had a mere informative character, and no other messages that could reinforce/stop doing the challenge were intended to be sent. In order to validate if the challenges were engaging and creating learning moments in the participants, an interview was scheduled after the pilot concluded.

Regarding the last phase of the pilot test, the goal was to let the participants experience both a food response predictor and food recommendations. However, in order to make a minimum viable version of the data models able to give recommendations or predictions, it was necessary to have data from the glucose response of participants to specific food items from which Celar had already good understanding.

> Therefore, in the progress sheet that was sent to participants on phase 2, there were included in the shape of challenges the requirements to (a) unlock the recommender and (b) unlock the predictor. It was believed that by looking into which of these two elements would pilot participants aim to unlock, insights could be gained from which was the preferred one.
>
> Additionally, in the interview held after the pilot, participants were asked about which of these ways to stay connected to the service would be more valuable for them.

The online generative tool:

It can be seen from the explanation on the pilot study, that it became more complex that it would be desired to extract sharp conclusions. The fact that the participants were contacted by Whatsapp also opened the channel for them to ask all types of questions regarding challenges and glucose. All these interactions were good to learn on how to improve the characteristics of the challenge and the service, but they were influencing the overall experience of the pilot and the service. At this point, if the aim of the pilot study was to validate the utility of the Learning Journey service in creating better habits for people, this amount of interactions were taking the study further and further away from what the real service would ideally be (mainly interactions with the Clear app).

Additionally, the fact that the Food Score feature wasn't integrated in the app yet and had to be delivered manually, and that the predictor and recommender required the user to eat specific food during the two weeks, was also making the pilot study differ from what the service was ideated to be.

That is why it was found necessary to find a way to let people experience the new service without the complexity and hurdles of the pilot study.

VideoAsk is an online user research software. VideoAsk allows for a video-based approach for research questionnaires and surveys. The respondent, instead of reading written questions and giving written answers, is presented with a video of the interviewer directly asking the question. The respondent is then invited to provide answers by video, audio, or text.

The online software for surveys VideoAsk was used to prototype the three phases of the service in an online generative tool. By means of successive video explanations and external inputs, this online tool is able to take a person through the overall experience of the Learning Journey, with enough level of detail to provide insightful responses about it, but without the hurdles of the pilot study. A total of 33 conditioned steps constituted this experience, letting the respondent take different routes along the way.

To see the research tool click on this link or scan the QR code on figure 18.
https://www.videoask.com/fl7r8u7xd

In the end, from the pilot study was possible to see the behaviour of the participants engaging with the challenges, and the afterwards interviews helped to shed more light over their overall experience.

From the generative tool, the questions at the end of the experience also served to generate understanding mainly on the preferred element for the last phase of the service: the score predictor.

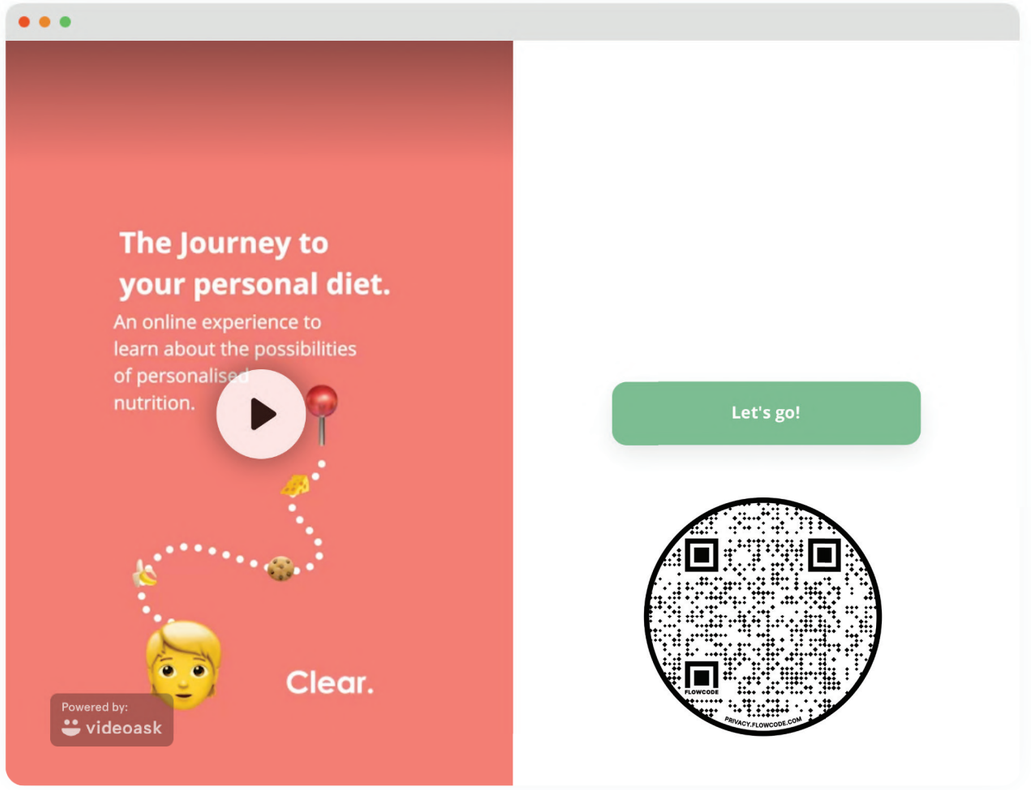


Figure 18 - Online Generative Tool

In the following tables there is a more structured recap of which were the touchpoints ideated for each phase of the new service, and which were the hypotheses that were embedded in touchpoints from the pilot study and the to validate the effectivity of the service delivering each of the three core experiences.

Phase 1 - Understanding Status

Success Variables

User understands the connexion of blood glucose and personalised nutrition.

- Effect of glucose in daily life.
- Effect on glucose in the long term.

User feels prepared to start measuring glucose

- Recognize goal and initial status when activating the sensor
- Know what the program will entail and proceed with it.

Validation with Research Methods

Touchpoint	Hypothesis	Prototyped touchpoints	
Explanation of relevance of glucose for personalised nutrition.	**Were people understanding and recognising the value of personalised nutrition with my explanations?**	Online experience	Explanations videos (VideoAsk screens 1-4) Explanation validation questions (VideoAsk screens 5-7)
		Pilot study	No need because they were already participants, but they were given the option to ask questions about it.
Framing current user behaviour	**Did the questions I asked help people to frame their motivation and stay focused?**	Online experience	Call simulation (VideoAsk screens 9-12) Profile explanation video (VideoAsk screen 12)
		Pilot study	Onboarding interview (See interview Script in Appendix 6) Top of page of profile sheet (See example of profile sheet in Appendix 9)
Explanation of the program	**Did people feel prepared to start the second phase of the service?**	Online experience	Decision moment where you can leave the experience (VideoAsk screen 12)
		Pilot study	Explanation sheet (See Pilot Explanation sheet in Appendix 7)

Table 6 - Phase A hypothesis and Touchpoints

Phase 2 - Awareness of Change

Success Variables

User gains understanding of own biology

- Complexity and limitations of glucose.
- General improvements on glycemic response.
- Personal improvements of glycemic response.

User is engaged with the Clear app

- Logging 3 meals per day
- Doing at least 1 gamified activity every 2 days.

Validation with Research Methods

Touchpoint	Hypothesis	Prototyped touchpoints	
Activities/ challenges that users can execute by doing specific things on their diet in order to learn healthy tweaks to it.	**Were challenges engaging enough and provided good realisation moments?**	Online experience	Interactive part of online experience (VideoAsk screens 13-24)
		Pilot study	Challenges from Progress Sheet (See Progress sheet on appendix 10) Together with the Data Scientist and Nutritionist of Clear, we translated different actions into challenges. To see better explanation of challenges, go to Appendix 12

Table 7 - Phase B hypothesis and Touchpoints

Challenge 1 - Your Carb Sensitivity

Eat two white sandwiches with jam and chocolate sprinkles and observe the result.

Challenge 2 - Eat a banana

This meal usually shows different results between our participants: peakers and non peakers.

Challenge 3 - Skip breakfast

Wait a couple of hours from your regular breakfast time.

Challenge 4 - Carbs + exercise

Take a long walk after a high-carb lunch (at least 30 minutes)

Challenge 5 - Improve low-score meal

Try to improve the bad response you had to a meal.

Challenge 6 - How much have you learnt?

Are you already an expert in glucose? Fill in the Quiz in this Link to find the answer:
https://fcs4ypb1flc.typeform.com/to/SpXY4i2M

Figure 19 - Overview of Challenges

Phase 3 - Convenient integration of new behaviour in lifestyle

Success Variables	User is satisfied with his/her learnings during the two weeks of phase 2. User continues engaged with the Clear App after detaching the sensor.

Validation with Research Methods

Touchpoint	Hypothesis	Prototyped touchpoints	
Deliver prediction of food response based on the data.	**Would people want to use their data afterwards to receive food recommendations?**	Online experience	Recommender feature in Interactive part of online experience (VideoAsk screens 13-24) Validated with questions after interactive part (VideoAsk screens 26-29)
		Pilot study	Prototyped webpage containing low-fidelity version of the recommender http://recommenderclear.eu-central-1.elasticbeanstalk.com/ Username: Clear Password: TestRecommender234
Deliver prediction of food response based on the data.	**Or would people prefer to have a predictive score of their food?**	Online experience	Interactive part of online experience (VideoAsk screens 13-24) Validated with questions after interactive part (VideoAsk screens 26-29)
		Pilot study	Prototyped webpage containing low-fidelity version of the predictor http://foodscore.eu-central-1.elasticbeanstalk.com/ Username: Clear Password: TestPrediction123

Table 8 - Phase C hypothesis and Touchpoints

Learnings

From both of the validation techniques implemented, it was possible to generate learnings that served to iterate on the touchpoints, and present in the coming chapter the definitive version (or at least, as definitive as this project will reach).

In order to provide structure to the learnings, they are presented clustered to the phase of the service where they belong. Additionally, at the end of this section there is a table summarizing the qualitative and quantitative findings from both validation techniques.

Phase 1 - Understanding status

There are three touchpoints in the first phase: explanation of the connection between blood glucose and health, explanations of the second phase of the service, and an initial questionnaire to frame the user's context and motivation.

Glucose explanations

About the explanations on blood glucose and personalised nutrition for preventive health, the respondents from the online generative tool were asked during the experience about the explanations that they encounter in the shape of video. For them, it was easy to keep track and understand the difference between a good and a bad glucose response. Participants from the pilot test did not mention any specific question about blood glucose or health that they wanted to know. It is possible that they did not consider the designer conducting the plo as the right person to ask about this topic, but they were still encouraged to ask during the intake call.

From this, we take the learning that the short explanation videos included in the online generative tool have potential to be a valid way of explaining people the benefits of the service.

Another general learning from the respondents of the generative tool is that the videos, and the online experience in general was quite engaging, it provided an innovative way of being given explanations and interacting with a questionnaire. The takeaway here is that Clear could include these, or better elaborate versions of the explanations from the online tool in an onboarding process of the Clear app. That way the service users, before starting the food logging and the challenges, can have an understanding of why it is relevant to change the eating behaviour towards one that keeps glucose stable.

Service Explanations

Apart from these explanations, this phase also includes explanations of the service itself; mainly letting the user know what she will be doing during the central part of the service (while wearing the CGM). In the validation techniques, these explanations consisted in the sheet that was sent to participants willing to participate in the pilot, and one explanation on the online experience, that showed visuals of what the following part of the experience would entail. Participants and respondents were not explicitly asked about how easy to follow were these explanations, or if they helped them to move towards the next phase. However, they were both given the option to discontinue, either by not joining the pilot or by leaving the online experience.

For the pilot test, 10 customers of Clear were emailed, from which 6 stated interest in participating in the pilot after being sent the explanation sheet.
From the 64 respondents that did the online experience, only 15 reached the stage in which this question was asked, from which all 15 continued the experience.

Is hard therefore to validate whether the explanations were clear enough, and helped in moving to the next phase. The digital tool presents however a good opportunity to make these explanations more engaging. The takeaway here is to include these video explanations in the onboarding process of the Clear app.

Initial questionnaire

What was surprising to find about the third element of this phase is that the questions prototyped in the online experience to frame the respondent profile gave much more concise answers than the ones from the intake call with participants of the pilot. Since the online software in which the generative tool allowed respondents to give answers by vide, audio, or text, some of the respondents felt free to send a video giving answer to the question.
When asked about the utility of the profile section included in the progress sheet that was based on these questions, participants from the pilot stated that they did not really pay much attention to it, it was more as something "nice to have". However, they stated that they expected the responses to these questions to be reflected in tailoring the service afterwards. For example, one participant stated on the question about nutritional habits that he normally does intermittent fasting (skipping breakfast in the morning). Still, he was presented afterwards with the challenge suggesting to try intermittent fasting. What is concluded from this is that the questionnaire could be used to tailor the challenges that a user will receive in the following phase.

For the final solution, it is suggested that Clear makes use of VideoAsko or a similar tool to introduce the explanations in the onboarding process of the app, and also uses this onboarding to ask the user questions that will classify which challenges will they receive later.

Phase 2 - Awareness of Change

The main touchping that we are interested to look at at the second phase of the Learning Journey are the challenges. The other features included in this phase (food score and food-glucose timeline) are already in the development roadmap of Clear and fall beyond the scope of this project.
What was interesting to see is that both participants of the pilot and respondents of the online tool found the challenges interesting and engaging. they thought that it was a good way to learn about their metabolism. However, the specific content of the challenges was not good enough to provide learning moments. Participants from the pilot stated that they would like to have more background on why a challenge was something relevant to do, meaning what was the connection with glucose and health. For example, if a person is challenged to combine a high-carb meal with a high-carb meal to reduce the glucose levels after the meal, the person would like to understand what is it between fat and carbohydrates that affects glucose. The same way, once the participant has completed a challenge, they were presented with the visualisation of the glucose curve to illustrate the outcome, For example, if they were challenged to go for a walk after lunch, they were shown the glucose curve with the lunch and the exercise mapped in it. People manifested that they would like to be given more specific implications of what was relevant to see in that glucose curve, in order to learn from the challenge.

The takeaway from this phase is that the challenges need to be improved and further defined, mainly in the contextual explanation of the and the implications that the user would need to remember.

Respondents of the online experience stated that completing challenges was a interesting way to learn about health, but they would also like more explanations in order to use a service like this one.

Challenges are engaging to complete and keep the user motivated, but needed more contextual information on what is the relevance of the challenge.

"If the challenges would have been in the app, [...] I think that would be really cool. And I would have been much more engaging for me. That would have been huge, because then it's almost like it's like gamifying it a little bit. And I'm like, super interactive and really wanting to update"

"Yeah, just that you want to complete them. So I think that's really appealing. So I think it's really good. Yeah."

Participants completed on average 3.5/7 challenges

Question from the online tool:
Now that you know the journey to find your personal diet, Would you follow it?

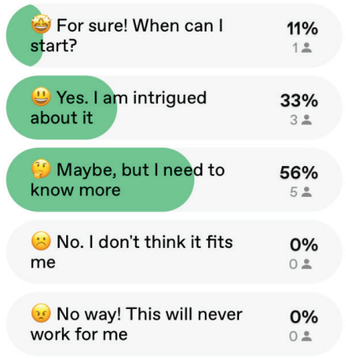


Figure 20 - Response VideoAsk 1

Challenges caused realisation moments for some of the participants. However, they had a hard time understanding what the outcome of the challenge was, and they expected better explanation from our side.

"I find it interesting to see what the long walk did to my sugar level."

"Because when you walk your body needs more energy and therefore uses the sugar. I already knew it, but not complete effects, you know what I mean? How? In what kind of way?"

"If I'm asked to do a challenge, and then I do it, I like some sort of follow up in the app. Like, "Hey, have you completed challenge one yet? Yes. Or no?" And then if it's yes, the app asks me to write a note or choose from categories, like, did it impact you? Did you spike outside of healthy? or whatever, you know?"

Question from the online tool:
If these features were real, how much will they help you learn about your metabolism?

(0=not at all, 10= a lot)

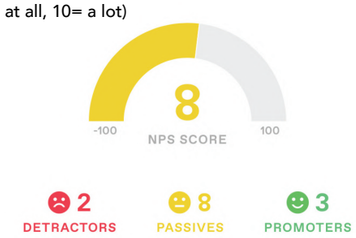


Figure 21 - Response VideoAsk 2

Phase 3 - Convenient integration in lifestyle

To validate whether response prediction or food recommendations were a valid method for people to maintain the eating habits that keep their glucose stable, what was most insightful was proposing these two possible concepts to the pilot participants, and learn from their response,
In the end, the majority participants of the pilot did not unlock the recommendations nor the score predictions, so they were only presented with them in the interview after the pilot.

In the end, the qualitative insights from the interviews afterwards brought the conclusion that people, despite seeing value in both options, preferred the food predictions because they could have control on it. To understand what having control means, we can use an example: if a person is planning to eat a bag of chips, she can use the food predictor to check whether the chips would be good or bad. In case they are bad, she can check for another option and another until she finds something that she likes that is also good.

Being given food recommendations, like recipes or food items, does not allow for that control and freedom of choice.

These responses are, in the end, speculative, since it was not possible to see in their behaviour during the pilot if they preferred one option over the other.
From the online tool, the responses also align with these findings, people valued the food prediction over the food recommendations.

Therefore, in the proposed final solution, the predictive score is suggested as the way to help people maintain eating habits that keep glucose level stable.

People showed more interest in the Score Predictor, so they can adapt it to their routine, and have control over it.

"For me the predictor is more interesting, because I am still in control, and I can still choose what I can eat. And if the thing tells me that is not good for me, I can still change it."

"I want to decide for myself, instead of being given one recommendation."

"When you recommend don't just recommend recipes, but recommend things I can remember easily like, like always pair one healthy fat, with a unit of this, because I know that things exist, right? [...] so it's not just the recipes. It's like, again, for me it is the combinations in the kind of food units that are optimal."

Question from the online tool
After finishing the experience, what would you like to keep doing in your daily life?

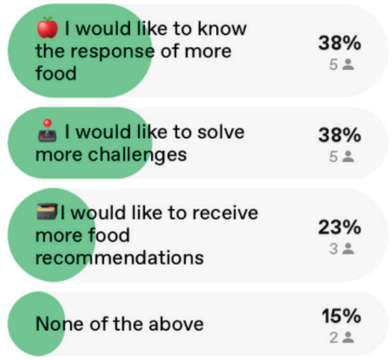


Figure 22 - Response VideoAsk 3

Phase 1 - Understanding status		
Were people understanding and recognising the value of personalised nutrition with my explanations?	Online experience	In general, people recognised the value of personalised nutrition. However, there were concerns about food that in general might not be good for the human being, or about behaviours that are on top of our ideal nutrition, such as sweet cravings. "Well lately actually, I have been having like some nutrition problems like my stomach was not processing good some foods. I thought that this was really interesting because indeed if I knew what are the foods that work better for myself. I could approach my nutrition in a different way."
	Pilot study	Out of 10 customer of Clear emailed, 6 agreed to participate on the pilot
Did the questions I asked help people to frame their motivation and stay focused?	Online experience	Not applicable
	Pilot study	People liked to be reminded their goal, but didn't feel as it was influencing in their behaviour. They wanted to have that goal embedded within the challenges that they receive "I look at it a little bit to it (the goal), but not like a lot. Yeah, because, it didn't change as much" "Not for me, I thought that was used internally for you for your algorythm. I would like if these questions were used to shape my experience with the product" "This could be used as sort of baseline to see where you are, and from there where you can get. Then after exploring your profile changes"
Did people feel prepared to start the second phase of the service?	Online experience	25% of the people who landed in the VideoAsk continued to Phase B
	Pilot study	Out of 10 people who were contacted to participate in the pilot study, with the explanation of it, 6 persons were interested. (60%)
Phase 2 - Awreness of change		
Were challenges engaging enough and provided good realisation moments?	Online experience	People marked the challenges as the top feature to use in the app. When asked if they would like to use challenges as a way to find their personalised nutrition, the response was positive (score of 8 out of 10).
	Pilot study	Participants valued the challenges as a nice way to learn. They recognized that they were engaged to solve them. However, they missed a bit of the why behind the challenge and also a better followup explanation of the results into context. "If the challenges would have been in the app, [...] I think that would be really cool. And I would have been much more engaging for me. That would have been huge, because then it's almost like it's like gamifying it a little bit. And I'm like, super interactive and really wanting to update"
Phase 3 - Convenient integration in lifestyle		
Would people want to use their data afterwards to receive food recommendations? Or would people prefer to have a predictive score of their food?	Online experience	50% of Respondents preferred food prediction over food recommendation (n=20)
	Pilot study	In general, participants of the pilot preferred food prediction, since that way they can adapt it better to their routines, "For me the predictor is more interesting, because I am still in control, and I can choose still what I can eat. And if the thing tells me that is not good for me, I can still change it." "I want to decide myself, instead of being given one recommendation."

Table 8 - Concept validation

Chapter 5
Conclusions

In this section, the Service Framework and Service Vision were translated into specific touchpoints of a service.

The new service solution for Clear is labeled as The Clear Learning Journey. This journey is composed by three phases: before, during and after a person has wore the CGM sensor provided by Clear.

Each of this phases has a main purpose, phrased as a core experience that the service would need to provide in order to be a valid behaviour change intervention.

Two techniques were conducted to define the final shape of the service touchpoints.

The analysis of the results from this techniques lead to the final solution, that is presented in the following chapter and is based in the following conclusions:

Phase 1 - Understanding status

The video explanations from the generative tool were engaging and easy to follow. They are a good option to incorporate in the onboarding process of the Clear app.

The responses to the questions framing the user's situation and motivation were more concise in the generative tool. They can also be implemented in the onboarding process of the Clear app.

People expected that their answers to the questionnaire would serve to tailor the challenge that they receive afterwards.

Phase 2 - Awareness of change

Challenges are engaging to complete and keep the user motivated, but needed a bit more of context on what is the relevance of the challenge for health in general and the person in particular.

Challenges caused realisation moments when the participants were given more explanation of the challenge outcome

Phase 3 - Convenient integration in lifestyle

Mostly, people would be interested in predictive score, so they can adapt it to their routine, and have control over it.

Core Experiences

At the development phase of this project, the Service Vision from previous chapter and the insights that lead to the Service Framework were taken along into an ideation stage, in which a creative session highlighted the relevance of making the progress towards changing a behaviour more tangible, so the person is reinforced to keep changing it.

This led to the following idea: what if we transform the two weeks of wearing the CGM sensor into a Learning Journey where the experiments that Cear proposes are framed as challenges in which the user can learn more about their own nutrition and health?

To validate the viability of this idea, online blogs gave reassurance that people are indeed interested in learning tweaks and tricks to improve their diet, which also fits with the insights from interviews with Clear's users, whose expectations were learning and understanding better their own body.

Taking these experimental challenges as the core of Clear's new service, the other two elements defined in the Service Framework were fitted accordingly to how shall the user feel and what shall the user do at each stage of this Learning Journey to ensure the validity of the service as a behaviour change intervention.

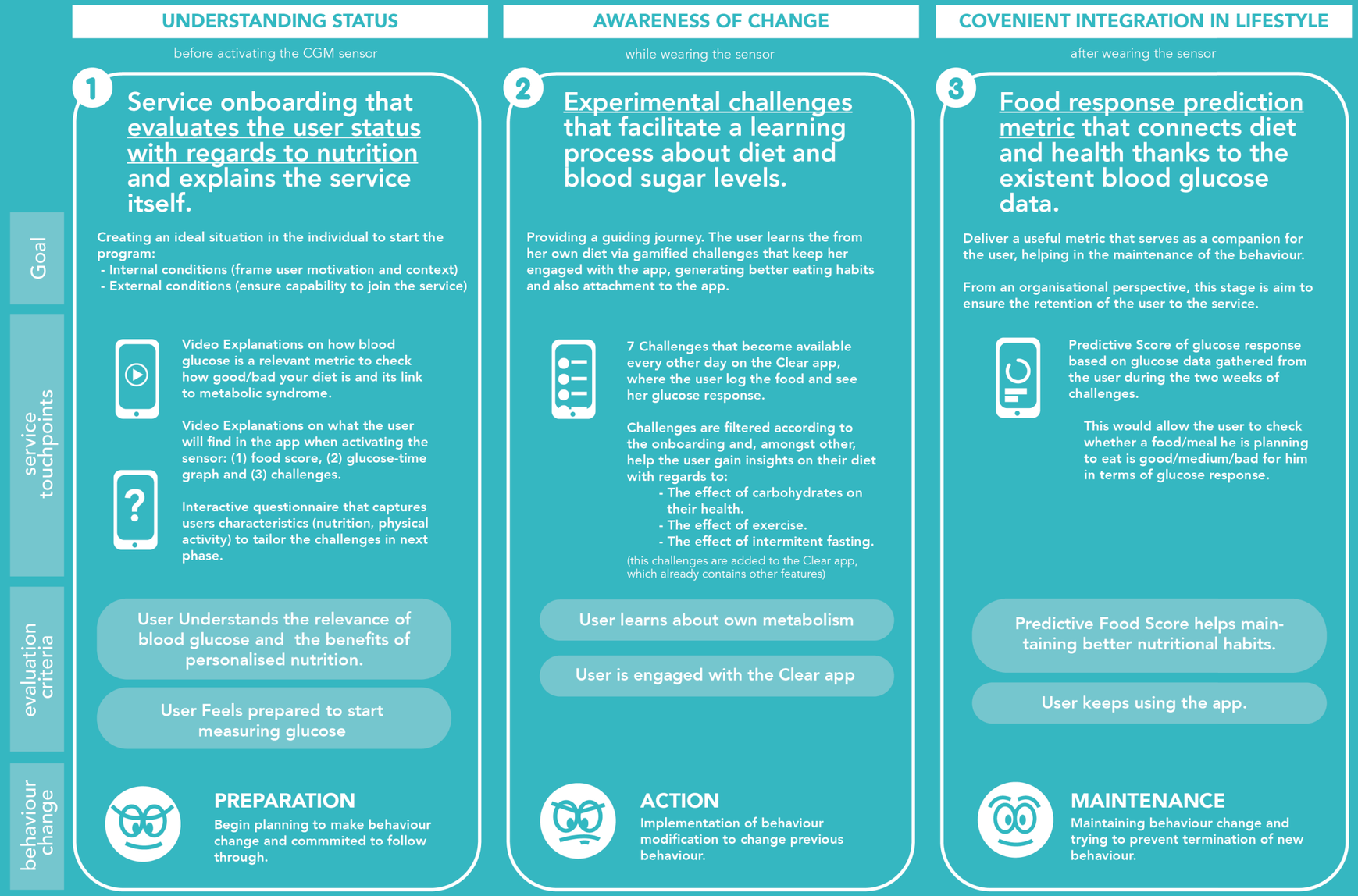
In the end, the service unfolds around three main **Core Experiences**:

Understanding status - In order to jump from a preparation to the action stage of behavior change, the user of Clear's service is presented with an onboarding process in the Clear app. In this, video explanations guide her through the relevance of glucose to evaluate dietary habits, and benefits of personalised nutrition for the avoidance of metabolic diseases. Additionally, explanations also introduce what the next phase of the service will entail, so she feels prepared to activate the CGM sensor and start the Learning Journey.

Awareness of change - Once the sensor is activated, and in addition to current features of the Clear app (food score and food-glucose timeline) the app now would make experiential challenges available for the user to complete. These challenges represent small learnings about the user's personal reaction to food. For example, by challenging the person to go for a walk after a high-carb lunch, she can see the effect of physical activity on her glucose levels and learn from it. The tangibility of the progress and the reward of completing challenges are aimed to support the action stage of behaviour change.

Convenient integration in lifestyle -This last phase contains the third service element defined in the Service Framework: the intelligent metric. The final shape of this metric is a predictive score that, based on the data gathered from the food logging and experiments of previous phase, can tell the user the suitability of a food element she is planning to eat. This score is aimed to serve as a convenient companion that contributes to the maintenance of eating habits (those that keep glucose levels stable.

In the end, this solution is coherent with previously defined framework and research. The validation methods used (pilot study and online generative tool) served to iterate on the touchpoints and develop them up to a mediumfidelity.



Chapter 6

Final Service Solution

This chapter showcases the final solution of the new service designed for Clear.

Chapter overview

Introduction

The validation methods explained in the previous chapter served to iterate on the elements that constitute the final service solution.

In this chapter, it is briefly explained what is the shape of the touchpoints of each of the three phases of The Clear Learning Journey. The biggest emphasis has been put in designing the central part of the service: the challenges.

Regarding the first part, the initial onboarding is constituted by the explanation videos that were used for the online experience, since they were proven to provide clear instructions. Additionally, it also introduced a set of questions that can be used to frame the user status. Implementing a final version of this stage would mean recording better videos that the ones used in the online experience and integrate them in the app onboarding.

In the second phase, an iteration of the challenges from the pilot study led to define a set of six challenges in a higher level of detail. The complete description of these six challenges can be found in appendix 15.

To facilitate the development process of the challenges, the first steps of digital product development were executed. First, it was defined as the app-flow of the challenges. From there, a first version of the wireframe composition of the challenges was prototyped digitally. (See appendix 16 for app flow and appendix 17 for wireframes of challenges)

For the last phase, the Food Response predictor was not designed digitally, since more research would be needed to define the final shape of this predictor. Instead, it is explored the possible revenue model that Clear can implement when integrating the predictor as the last stage of the service.

To consolidate the service solution, the operational areas of the organisation have been mapped into a business model canvas. This canvas is expected to provide guidance in the implementation of the service.

Lastly, the touchpoints have been mapped into a customer journey map that serves to provide overall understanding of the service.

Key Touchpoints

Phase 1 - Service onboarding

For the first phase of the service, three touchpoints need to be introduced in the onboarding process of the app:

> Explanation of Clear's approach to personalised nutrition, and the role that blood glucose plays in it
>
> Explanation of the features contained in the Clear app, to which the user is given access once she activates the CGM sensor.
>
> An initial questionnaire that helps to frame the user habits and motivations.

Here are presented, in text format, the mentioned explanations and questions. The ideal situation is that these texts are transformed into videos and an interactive questionnaire, and introduced in the Clear app. To facilitate this, it is advised to use the online software VideoAsk.

With these three elements, it is expected that the user feels much more prepared to start measuring glucose and empowered to actively act on changing eating habits for those that keep the glucose levels stable.

Questionnaire

Consumer profile
- Can you tell me a bit about your Eating patterns?
  (for example, how many meals do you eat, at what time, do you have any allergies or specific criteria like vegan, etc)

- Can you tell me about your Sport patterns?
  (for example, how active are you in your daily life, do you do any sport, which and how often

- Now I want to know if there are any other lifestyle patterns in your daily life that you consider relevant?
  (for example standing/sitting job, young children, taking care of someone, etc..)

- How would you describe your current Knowledge on nutrition and health, and where does it come from?

Motivation
-What do you expect to get as outcome? What is your goal?

-What improvements do you expect to achieve?

Explanation of personalised nutrition

Let me introduce what is personalized nutrition and why is it relevant for you.

In recent years scientists have proven that identical food can affect people very differently. This is because the microorganisms living in our digestive system are unique for each of us.

This means that the perfect diet for the human being doesn't exist, but there is an individual personal diet that suits bests each of us.

To Find your personal diet you first need to learn and understand your body's unique reaction to food.

How? by looking at your blood glucose concentration. Finding a diet that keeps your blood glucose levels stable is recommended for two reasons:

In the short term, unstable glucose levels can cause fatigue during the day and badsleeping quality.

In the long-term high blood sugar levels are linked to metabolic diseases such as type 2 diabetes

Explanation of personalised nutrition

Now, is the time to activate the Glucose monitor, the device that can look into your body and tell which food works for you.

After activating it, you will be able to see how food affects to you, you will track your food responses and solve challenges and quizzes to unlock the full potential of personalised nutrition.

Phase 2 - Experimental challenges

The interviews conducted after the pilot study with participants from it, served to understand how to proceed in the development of the challenges: the challenges needed to provide background information of why the action that the user was asked to do was relevant, with regards of health and glucose. Moreover, the outcome of the challenge had to provide some factual takeaways that the user can learn from.

Based on this, a new structure was defined for the information that each challenge shall contain. In general terms, the information elements that the challenges would contain is:

Title
Number of the challenge + a catchy name

How to complete it
Straightforward indications on what shall the person do to complete the challenge.

Personalisation
Some of the challenges can be personalised by suggesting improvements/actions on food items previously logged by the user.

Why is it relevant
Explanation on why this is relevant to be a challenge:
How is the action connected to blood glucose variation
What can the person expect to happen

Challenge outcome
Blood Glucose Visual of the outcome of completing the challenge.
Text explanation of what the personal glucose variation shows.

Learnings
What does the outcome of the challenge imply for the person? Which actions can they incorporate in their lifestyle based on the outcome of this challenge?

In the end, a total of six challenges were defined following this structure. The description of these challenges can be seen on appendix 15.

To facilitate the process of development of this challenge, two steps of digital product development were executed. In the first one, a flow map of the consecutive screens that the challenges need was defined. (See appendix 16 for in-app flow of Challenges)

In the second one, a general layout for all the challenges was wireframed into 7 screens (See appendix 17 for challenge wireframes).

On the picture on the right can be seen how it is applied one of the screens for one of the challenges.

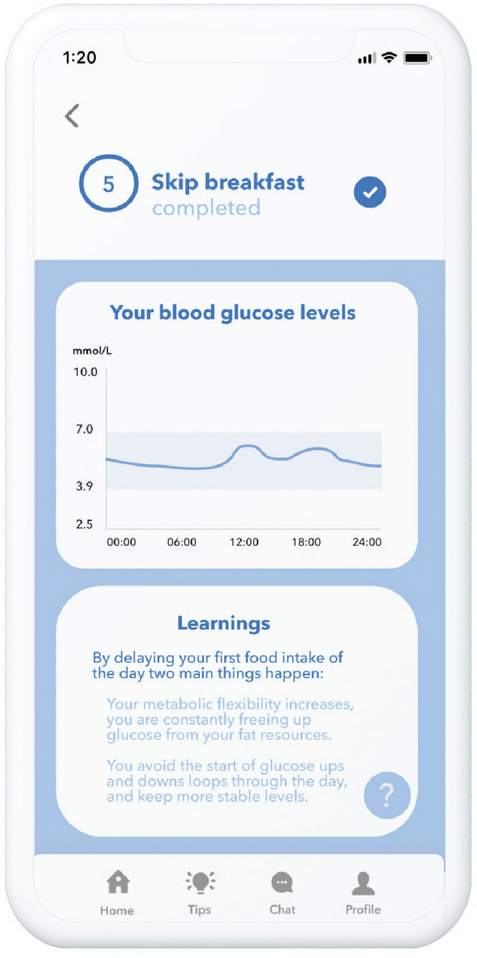


Figure 23 - Example Screen of challenge outcome

The following step in the development of the challenges would be to create an interactive prototype that allows to navigate amongst the wireframes, and conduct a usability test with people to test how intuitive and easy to use are the wireframes.

Phase 3 - Food response prediction

For the third phase of the service, Clear shall deliver a Predicitoon of food response after the user has detached the sensor.

The goal of this predictor is to help the user eat food that keeps the glucose levels stables in a convenient way.

In the end, this predictor does not only suppose an attractive tool for the user, but is also a means for Clear to diversify its revenue streams. The current revenue model of a one-time payment for two weeks of logging can be changed into a subscription model in which people, after the two eeks of logging, stay connected to the Clear service by paying on a monthly basis in order to have access to the predictor.

Figure 24 shows a possible package-based subscription model made to illustrate the idea of diversifying the revenue streams.

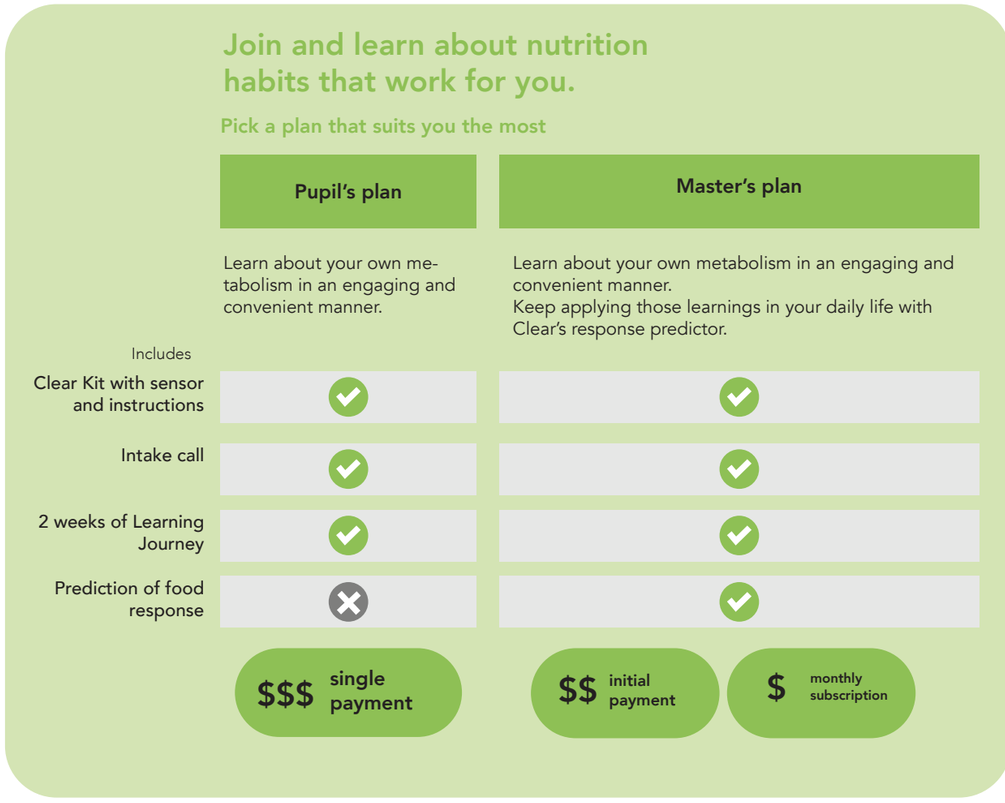


Figure 24 - Revenue Model

The use of a subscription model:

Would lowering the total price, making it therefore more accessible for users and expecting then a rise in sales.

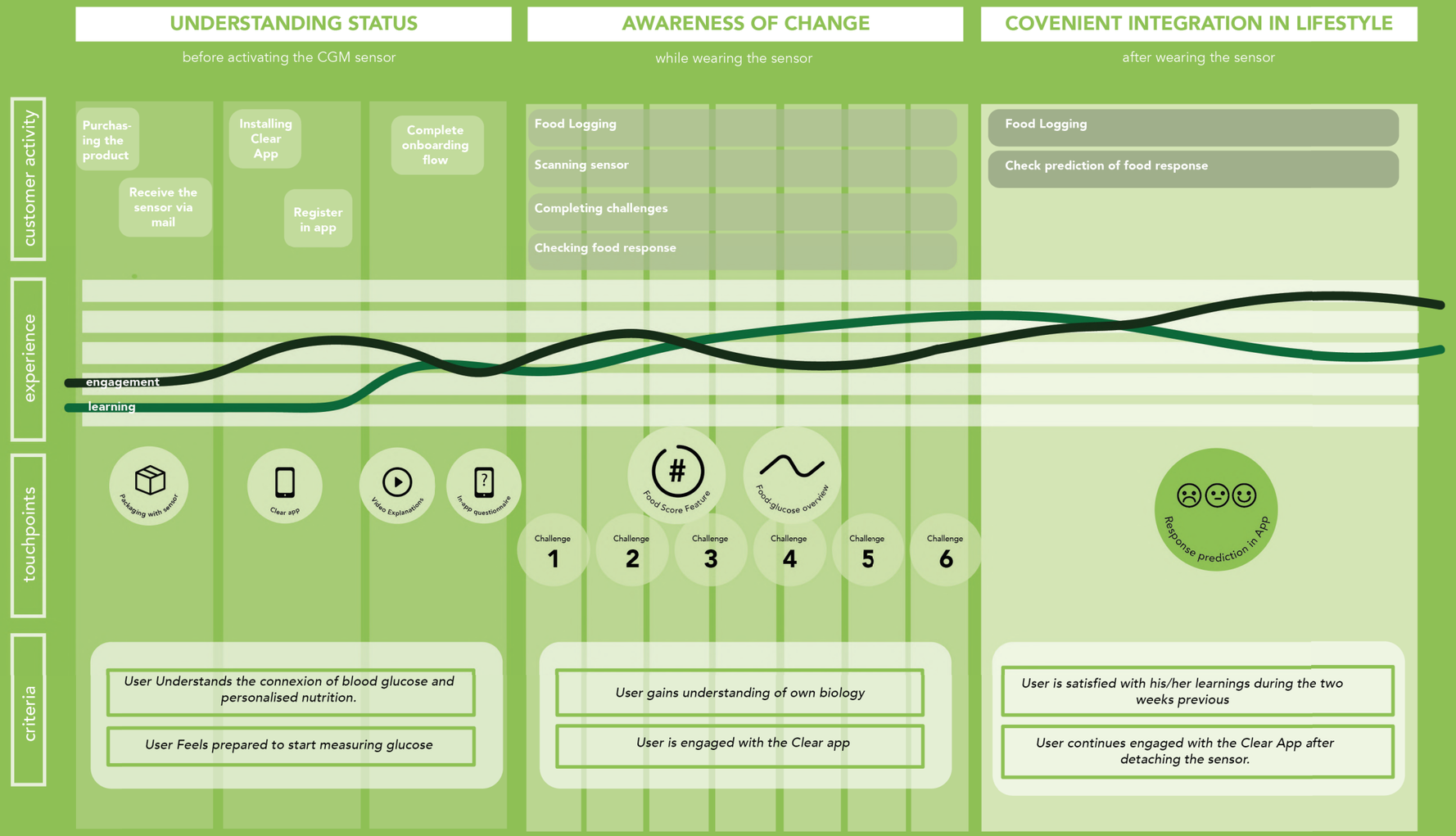
Would make part of the revenue not dependent on the CGM sensor, which helps saving costs.

It is therefore recommended that Clear studies the possibility of implementing this model.

To wrap up the design process that has conducted us to the service presented in this thesis, a service design tool has been used to facilitate an overview of The Clear Learning Journey. This tool is a Journey map, and is used to visualise the flow of all the touchpoints of a service, both from the perspective of the user and the service provider.

For the user, the map captures the actions that the user would need to execute on the interaction with the touchpoints, and also the experience that the user would feel as a consequence of those interactions.

From the organisation perspective, this map serves to define in which elements is the service constituted, what is the goal of each elemenent, and what are the internal opperations required at every stage.



Journey Map

Chapter 7

Service implementation

This chapter includes the recommendations for the implementation of the service solution, and personal recommendations for Clear.

Chapter overview

Guidelines for Implementation

To align the implementation of the service solution proposed in this project with the capabilities of Clear, an implementation plan with three steps is proposed.

The interest of this thesis was to understand how a service integrating a Supportive Health System can support in the adoption of healthy nutritional habits. Designing a service of this characteristics for Clear has supposed a great example from which to learn and make conclusions. In the end, the final service solution proposed has potential to become an effective behaviour change intervention, that is also paired with the economical interests of the organisation.

However, it is understood that the main objective of a young startup like Clear, which is aiming to find product-market fit, might not always be aligned with the objectives of forming healthy behaviour, at least in the short term. This is why, for the implementation plan of The Clear Learning Journey, there have been prioritized those steps that, being more accessible for Clear to reach, would have a bigger impact on the adoption and growth of their service, even when this would mean delaying the inclusion of behaviour chanfe elements.

In the end, it is proposed that Clear, implements the three phases contained in The Learning Journey in the following order

Step 1 | Seamless onboarding experience Q3 2021

Currently, the status of the Clear app is still in a transition, moving away from the digital food journal that it used to be, aimed at collecting data about the food intake and pairing it with the glucose data collected from the CGM. Now, Clear is incorporating features that make the app valuable by itself, such as the Stability Score. However, during the execution of this project it was found that Clear users are in need of basic guidelines and explanations to understand (1) the relevance of blood glucose for overall health and (2) how to make the most out of the two weeks of wearing the sensor. There are also other elements of the Clear service that the users struggle with, like the procedure to activate and connect the sensor.

My suggestion is that the first element that Clear shall introduce in its service is an onboarding process that provides guidance and explanation. For this purpose, the online software VideoAsk presents a great tool to start with.

From the findings of this report, the main points that this onboarding process shall include are:

- What personalised nutrition is.
- What the benefits of personalised nutrition are.
- How blood glucose is connected to finding a diet that works for the individual.
- What the consequences of a diet that causes high blood glucose levels are.
- How to place, activate and connect the CGM.
- How shall the user make the most out of the two weeks
- wearing the sensor (either by experimenting as much as possible, or by validating their habitual diet)
- What is the Stability Score and how is it valuable for the user.

With the implementation of a seamless and streamlined onboarding, it is expected that the perceived value and satisfaction with the Clear service already increases.

Elaborating these explanations, and perhaps including them into videos is not very costly, nor time-consuming. For this reason it is suggested that Clear aims to implement this onboarding process by the end of Q3 in 2021.

Step 2 | Non-sensor dependent subscription model - Q1 2022

From the service solution developed in this project, the next element that would have a higher impact on the quality and value of the Clear service, and that would take less effort and time to develop is the Food response prediction metric.

This feature opens up the possibility for the user to stay connected to Clear's service once the battery of the CGM sensor is over.

When the Clear app fully integrates the functionalities of Stability Score and the Food-glucose timeline, the user would get used to checking the reaction to the food that she eats and logs in the Clear app. After two weeks of receiving a Stability Score for at least 3 meals a day, a person can get quite used to making use of this feature. Offering the possibility of keeping on checking the responses after detaching the sensor has big opportunities to increase user retention of the service. Additionally, offering this feature in a subscription-based revenue model, distributes the revenue streams in a more sustainable way.

It is suggested the beginning of 2022 as the time to fully introduce the Food response prediction metric. In the process to do so, the following steps shall be accomplished:

- Research and validate which are the requirements on the food and glucose data that make the model possible.
- Develop the data model able to generate predictions.
- Explore the possible subscription model and pricing for this predictor as a feature offered after the two weeks of logging.
- Designing the experience and interaction of the user with this feature in the Clear app.
- Designing the final interface of the predictor for the app.
- Developing and implementing.

It has been decided to plan the introduction of this metric as the second step because it offers the biggest strategic advantage. Taking into account that glucose monitoring technology is being developed at a fast pace, it can be expected that the value of the CGM sensor that Clear currently uses would be decreasing in the coming years. Developing the food response predictor would imply that Clear's service and value is not dependent on the monitoring technology.

Furthermore, the knowledge that Clear will possess by developing this metric, can serve as a possible exit strategy for the startup, being acquired by a bigger player in the field of tracking technology for health and wellbeing.

Step 3 | Behavioural change challenges - Q1 2023

Even though the challenges have been the core of the service solution during all this project, the implementation of them would entail big efforts and resources that Clear does not currently have. These challenges serve the company vision of empowering a healthier world. However, before making the vision true, a startup needs to ensure its own survival.

It is suggested therefore that the challenges presented in this project are included in the long-term development roadmap, in a moment when the development team of Clear is bigger. The 6 challenges presented in this project are a good starting point. Nevertheless, more challenges could be ideated along with the new scientific findings in the field of personalised nutrition.

When firstly implemented, the challenges can be standardised and presented equally for every new user of the service. At some point , it would be ideal to implement an initial questionnaire in the onboarding process of the app that allows, via a ruled-based algorithm, to define which challenges would a user encounter that would be more valuable for her personal goal.
The implementation of the challenges is expected to be possible by the beginning of 2023, however, this estimation might vary in the always changing environment in which startups operate.

With this stepped implementation plan, it is expected that the first step improves the service from the perspective of the user that interacts with it. The second step is strategically oriented to improve the economic viability of the organisation. Lastly, the third step is aimed at creating a change in society, by contributing to make a healthier world.

Personal Recommendations

During the 6 month duration of this project, I have been able to identify some general points of improvement at Clear. I would like to use this section to provide personal recommendations that I believe are relevant to share.

Slow down and reflect

Since its foundation one year and a half ago, Clear has been in a continuous operation cycles. It is true that the first two years are key in the development of a Startup, where the main goal shall be to survive in the market and prove the value proposition and business model.

Clear, after two seed rounds of investment, has already proven its validity and its reason to exist. However, the are still many essential problems with the service that Clear provides.

Internally, Clear has a strong emphasis in product development. Currently, the roadmap of app development is seen as the main pillar and the point to look at to find the solution for everything that the service still misses. However, new features and functionalities are not the solution for these issues. The belief that "the next feature will be the one that will peak the sales" is not always true.

In my opinion, Clear needs to first properly understand the user expectations when using its service, and then make sure that the service catches up to these expectations. I would advise Clear to slow down the development of new features and take time to improve the limitations of current ones. By doing this, it will have a positive effect in the satisfaction of the users, which can lead to an increase in the number of referrals, and therefore to an organic increment of the sales, since referrals have no cost of acquisition.

Make achievable claims

Personalised nutrition is still a young developing field. Therefore, it is normal that many Clear users can be considered early adopters, people who might not fit within the desired target audience, but that is still looking for something valuable in the service.

Finding product-market fit is always the first goal for any startup, since this will bring stable revenue streams. However, personalised nutrition is still in development, and the market can still take many shapes to decide already where to look for product-market fit. My suggestion is to embrace these early adopters, and find out what did they like about Clear's service. This will serve to find the most unique advantage of Clear. Then, the next step would be to capitalize on it and find a way to extrapolate it to a wider section of the population.

In that way, Clear can really capitalize on things they are good at doing. Trying to capitalize on promises and claims that Clear is not yet ready to deliver in seek of a bigger share of a developing market will lead to customer dissatisfaction.

Escape own biases.

After months at Clear, the nuances of blood glucose and food are not so much a mystery anymore. Same happens for the rest of the team. To different extents, the Clear team is familiar with the basic relation of blood glucose and health. This can make Clear lose perspective of what is the knowledge that the user has about this topic.

What I have found during my project is that users are not aware of the relation that blood glucose has with health and nutrition. Instead, they have a general idea but, when presented with specific situations, they do not recognize what is the role that glucose plays. For example, I have talked with users scared because they saw a sugar peak after they have done physical activity, even though this is totally normal. I have also found users who thought alcohol was a good for them, since there was no glucose peak after drinking it (the characteristics of the alcohol do not cause any sugar peak).

I know Clear is making efforts to make this information available for the user. However, I would strongly recommend that Clear sets up a list of basic knowledge with regards to glucose and food, and finds a way to ensure the user has access to it.

Just by the learnings that this information will provide to the user, I can guarantee that the perception of the service would be much more positive.

Find room for user research

I can honestly say that Clear is an organisation with true interest in delivering a service that is not only beneficial for people, but also contributes to a better world.

Clear aims to be user-centered. Unfortunately, on the daily operations and decision making, there is no such inclusion of insights generated from user research.

I would like to state that the input that user research generates at many levels of the organisation, and not only to validate the design of app features.

My recommendation is that Clear sets up a protocol for user research in which is contained how are user insights going to be included in the decision making.

Chapter 7
Conclusions

This section has proposed recommendations for Clear on two levels:

On the one hand, a three-step approach to implement the service solution that matches with the capabilities and needs of Clear's service.

On the other hand general recommendations based on the experience and knowledge of the strategic designer author of this project.

In the end, these implications can be summarized in the following points:

The suggested plan to implement The Clear Learning Journey includes the following three steps:

Integrate a seamless onboarding experience that creates understanding of the service by the end of Q3 2021.

Develop the Predictive food score and use it to implement a subscrition based revenue model by Q1 2022.

Once the development team has grown, develop and include practical challenges tailored to the user goals by Q1 2023.

As general recommendations, it is suggested that Clear:

Spends time on solving existing problems rather than in developing new solutions.

Leverages the early adopters that currently use the service to define the young market of personalised nutrition.

Do not take the knowledge on glucose and health for granted in the users.

Embed user research in the everyday decision making of the organisation.

Implementation Roadmap

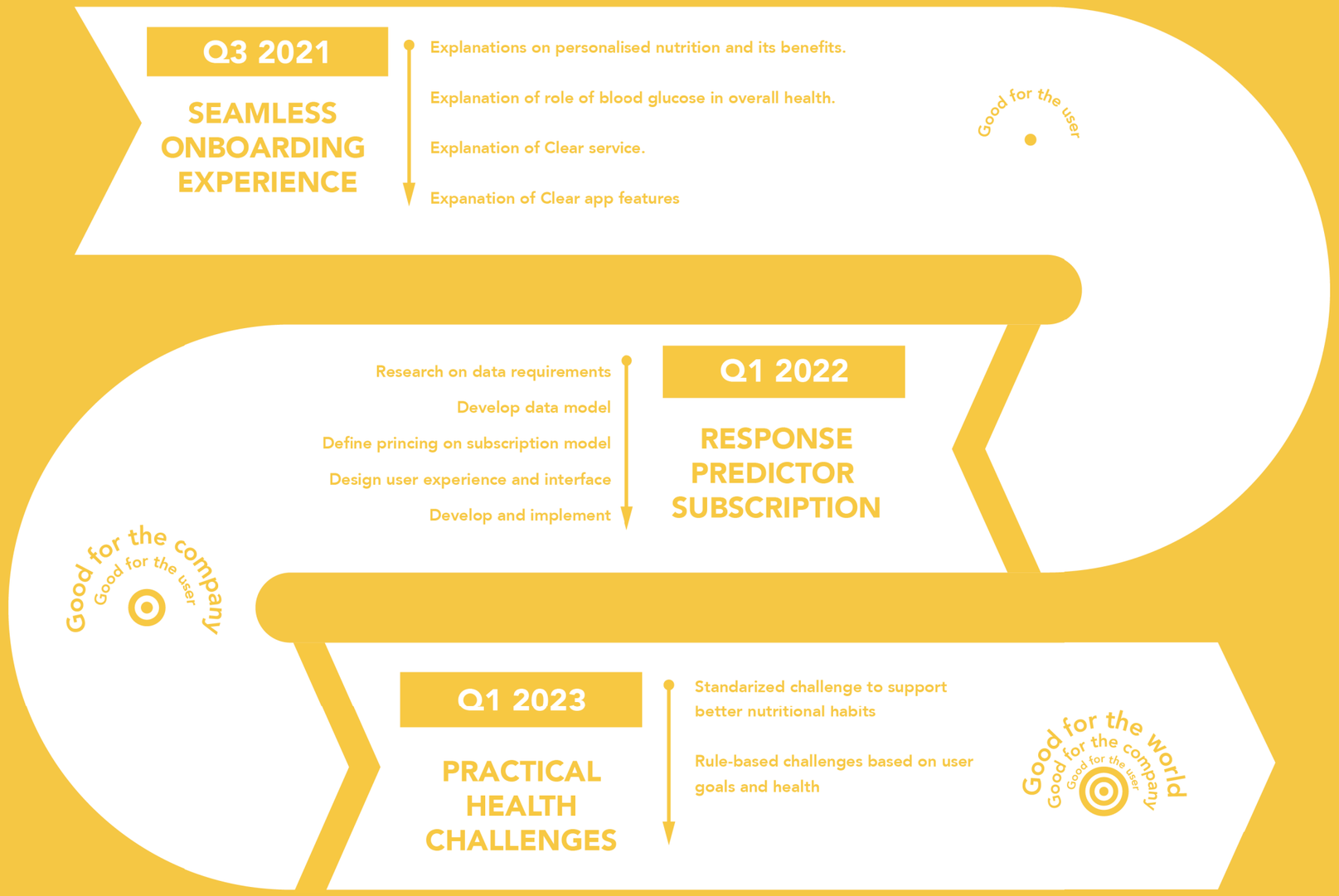
For the implementation of the Service solution developed in this project, it is suggested a three-step roadmap, tailoring each step with the capabilities of Clear and the potential benefits for the user, the organisation, and the world.

As a first step, it is proposed that clear integrates a Seamless Onboarding Process in the Clear app. This process shall provide explanations of the relevance of glucose levels and personalised nutrition, but also explain the features of the Clear app. Implementing these explanations by the third quarter of 2021 would create a better quality of the service and increase user's experience and satisfaction.

As a second step, it is suggested that Clear develops a data model able to generate Food Response Prediction, and uses it to offer a subscription-based service. The subscription would allow the user to check the suitability of specific food for their own health even after wearing the glucose monitor. Implementing this model by beginning of 2022 would suppose an strategic advantage for Clear, because it will not be dependent on the monitoring technology anymore, but will transfer the value of the company to the knowledge that this intelligent algorithm possesses. This also serves as an attractive point to be acquired by bigger players in the long term.

Lastly, once Clear has increased its internal capabilities, mainly in the technical development team, they can implement the Practical Challenges that help people learn about their own metabolism and their personal reaction to food. On a first stage, these challenges can be standardized. Afterwards, the ideal situation is that they are tailored to the user goals.

With each of these steps it is expected to contribute to (1) the user experience of the service, (2) the economic viability of the organisation and (3) creating a healthier world.



Chapter 8

Final Discussion & Reflection

The present chapter provides a conclusion for the overall process by opening up a discusion over the project contribution and limitations.

Moreover, there is a reflection on the process followed and the learnings generated.

Chapter overview

Discussion and limitations

The assignment scoped within this project entails different levels of complexity. For each of them, decisions were made through the process that have an effect of the limitations of this project.

On Supportive Health Systems.

Firstly, we encounter the layer of the role of technology in this project. The assignment tried to look into how a technology able to retrieve data from the human body (health technology) is paired with a technology able to interact with the user and have an influence on her decision making (supportive technology) in order to consolidate a system. In the end, this project stayed within the boundaries of Clear's current system, composed by the glucose monitor, the Clear app, and the Freestyle Librelink app. As we have seen in the competitor analysis from chapter three, the vast majority of competitors in the field have also systems based on a single variable to measure, track and improve health. It would have been also interesting for this project to investigate the possibilities of integrating other health technologies into the system of Clear, as a way of generating better insights and thus improving the service. The most interesting biometric to develop further research is the analysis of the gut microbiome. Developing a service that covers the causative effect of food reaction by understanding gut microbiome, and also the consecutive effect on the body by controlling blood glucose presents interesting opportunities in the field of personalised nutrition.

On Service Design.

On the next layer of this assignment, we encounter the service that makes use of the Supportive Health System. As it has been identified in chapter 2, there is plenty of room for innovating in the design of business models in the context of pre-care and ehealth. This project has decided to stay with the existing business model and service solution of Clear and elaborate on top of it, in order to ensure the feasibility of the implementation. However, another possible research direction could go into understanding the complexity of the personalised nutrition ecosystem, conducting generative workshops with relevant stakeholders of the field and looking in a broader perspective into what are the value transactions that can connect them. Further research in this direction might lead to developing new business models.

On Behaviorual Change.

Lastly, this project also touches upon behavioural change and habit forming methodologies. When designing interventions, we have seen that it is widely common to base them on an established model of behaviour change. Even though the research phase of this project tried to draw general conclusions from different models, the final solution covers mainly three out of the five stages of the Transtheoretical Model of behavioral change: from preparation to maintenance; and leaving out the contemplation and precontemplation phase. As stated by theory, the goal of an intervention that tackles these two stages shall be oriented to create a feeling of concern about a nocive behaviour in someone that is not even aware of it, nor willing to pay attention. A further research direction could explore how the scientific findings that link the consumption habits of modern societies with chronic dysfunctions and diseases, can be used to create the spark of concern in populations that are not aware of their bad behaviour yet. Covering these two stages of behaviour change in markets that have not yet been explored could bring strategic opportunities for a different service solution.

Process and learnings

I would like to use this section to reflect on the process followed and methods conducted during this project.

Discover stage - Research for design versus research through design.

At the beginning of this project, the goal was to cover both stages of data-enabled design methodology, following exploratory research methods to guide the process. Setting up open-ended experiments with specific hypothesis that could be validated by means of data was one of the capabilities I aimed to obtain during this project. Even though it has fallen outside this report, a short exploration of such methods was conducted. A realization moment came when I found the insights I was able to get by looking at the data were hard to grasp. I was unable to extract conclusions or criteria for the assignment based merely on data.

To solve this blocker, at certain point of this thesis, it was needed to come back to the comfort of more familiar methods, like literature research and qualitative interviews. This allowed me to get a better grasp of the project. I personally believe that the use of design methods that include data as an actor in the decision making are more suitable for later stages of the design process, when the problems to solve are more concrete and quantifiable.

Define stage - Communicating the role and value of Strategic design.

During the mandatory courses of the SPD Master at TUDelft, students are told about the importance of communicating the strategic value of design. By collaborating with a small organization, in which design is not contemplated in the same academic perspective as in the faculty of Industrial Design, I indeed encountered obstacles in communicating my value as strategic designer, and specially as Service Designer.

It was through clear examples of the use of creativity and creative methods when my value as professional was most latent. The Creative Workshops conducted, or the use of the online generative tool as a research techniques caused the biggest impression within the organization, creating thus impact of the value of design.

Develop stage - Business Design versus Service Design.

At the beginning of this project, my own vision on service design was related to business ideation, and ecosystem mapping. Honestly, I was not expecting myself to be tangled in a web of multiple interactions and experiences through several touchpoints and channels.

The take on Data-Enabled Design as an approach to design a service is far from being perfect, as contemplated in this project. However, it helped me envision a way of framing the process of service design in an iterative way, able to move from an abstract concept to the definition of more specific touchpoints. Even though a single loop of the Data-enabled process was conducted, I clearly see the possibilities of repeating similar pilot studies until arriving to a high fidelity definition of the touchpoints of a service.

The use of an online tool that generated insights at the same time that delivered the service experience, was a smart way of doing research. It is definitely a tool I can include in my designer toolkit.

Deliver stage - Intangibility of a service

Lastly, I want to mention how the intangibility of a service makes the final development of a solution quite abstract.

On the one hand, coming from an educational background in industrial design at a university where design is still strongly connected to the aesthetic and functionality of physical products, the fact that the outcome of my master's thesis project is going to be a Journey Map, definition of key touchpoints, and guidelines for a possible revenue model, creates some sort of clash with my inner product designer.

On the other hand, these last two years at TUDelft have taught me to feel very comfortable in the ambiguity and abstractness of complex problems.

Anyway, I am curious to see what is the opinion this project generates once it is not only me reading this words.

Takeaways

My takeaways from this project are pieces of advice for fellow Master sstudents from Industrial Design Engineering. These are three sentences I have heard from professors and other people during this last two years, and that have shaped my vision as a designer. I believe they can be valuable comments and source of inspiration for other designers in a similar graduation journey

"How do I design if I don't see what I design?"

- Frido smulders

Sometimes in TUDelft we are pushed to think thoroughly in our ideas, and the reasoning behind, before we actually get to execute them. This sentence taught me that sometimes, for designers, designing is the way we have to communicate and give shape to the reasoning that is in our head. So please, design to understand what you have just designed.

"It is never too early to leave the office"

- Gert Hans Berghuis

Designing is a good mean to communicate with yourself, but also with anyone else. During Graduation, you might realize that most of your eureka moments do not come alone over your desk, but when you put your ideas into words and share them with someone else. This someone else can be end users of your products, but can also be your roommates, your family and your friends. Go out to the world and explain what you are working in. I am sure you will be surprised with the unique angles people might find to a topic you thought to have completely covered.

"The 80-20 rule"

- Pareto principle (economic theory)

This rule became very true for me during my research. Personally, I am very skeptical and insecure with my own conclusions, and I tend to need many confirmation signs in order to validate something.

In the end, I realized that 20% of my research lead to 80% of my learnings and conclusions. So please, trust your intuition and analytical thinking, make conclusions through the process and keep moving forward. Otherwise, the paths of graduation can become a maze.

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Notes


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