Designing a new food informatics system

-- A different angle to record and understand food behaviour

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Msc. Design for interaction
Graduation thesis
Delft University of Technology
Master thesis

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-- A different angle to record and understand food behaviour

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When looking back at the project, it can’t be possible without so many people’s support and encouragement along the way.

Special thanks to my chair Natalia, mentor Gert and also Kadian, for your guidance and support during the project. Thanks for your patience and encouragement in the process, it means a lot to me. Thanks for the collaborators in the FoodSampler project, it was pleasure to do the user research with you in the beginning phase. Thanks Laura, for assisting in contacting the participants and the translation work.

Tong, thanks for our multiple Facetime chatting with 7-hour time difference, one of which broke the record ever of five hours! It is a great blessing to discuss about everything at any time no matter it’s about the project or life issues, it makes me feel our connection goes beyond the distance over these years. Jeannie, I am very grateful to have you support me mentally when I was bothered with doubts in the process and I really appreciate our long and sincere conversations. Lina, my close graduation buddy, it is great to become close to you during the last few months and I will always remember the “rolling on the grass” time, “Luna” time and “hotpot” time. Sakiinah, it really takes me a long time to accept that I need to go through the project without our spontaneous trips and relaxing moments, always miss you! Jiwei and Matty, thanks for our music and food gatherings, those joyful nights lighted up the dark winter days. Alev, thanks for giving me the listening ear when I needed, it means a lot to me.

Last but not least, thanks for my family to give me unconditional support during all these years.
Glossary

**Personal Informatics**
A class of systems that help people collect personally relevant information for the purpose of self-reflection and gaining self-knowledge.

**Self-monitoring**
An individual recording the occurrences of his or her target behavior.

**Quantified Self**
A Meetup community sharing personal stories and organizing events to exchange ideas of self-tracking. It is also used to describe the practice of self-monitoring.
Food, not only exist as a source of energy and nutrition to human beings, but also gives emotional comfort and carries cultural values in people’s daily life. Thus, the consumption of food is no longer related to fulfilling the need of hunger, but also as a way to deal with human emotions, facilitate social bondings, celebrate cultural events and etc. Improper way of consuming food can result in negative consequences in people’s health condition, such as getting overweight and obese, as well as many other types of diseases.

To help people manage their own eating behavior, food-tracking tools were designed to keep a record of people’s food intake, as a reference to access their eating and for themselves to make changes accordingly. How do we design a food tracking tool that can support people to collect meaningful data around their eating behavior and reflect on them in an engaging way?

From the literature research and user research great insights were drawn on the current experience of using food-tracking tools. Based on that, through iterative developing, an mobile application design was detailed and evaluated.

The project aims to provide a new perspective on how people can manage their eating behavior by self-tracking food they eat and the related influencing factors. The idea behind it is to empower them in discovering how the implicit reasons are repeatedly affecting the way they eat, environmentally and psychologically, rather than to regulate people to follow specific diet rules.
Introduction

This Chapter starts with introducing where this graduation project originates from, namely the Foodsampler research project it belongs to. The assignment was described together with the preliminary reflection on the initial focus. Based on the assignment, the main research structure was formulated to direct the following research activities carried out in the research phase.
1.1 Food Sampler Project

FoodSampler is a multidisciplinary research project between Connected care, HAN Lectoraat Voeding en Gezondheid, and TU Delft Industrial Design Engineering Department, that aims to generate knowledge on the success of food measurement tools. The FoodSampler project brings together researchers and practitioners on nutrition as well as on e-health technologies to innovate the ways in which subjective and objective food behavior knowledge can be generated. In addition, this project aims to serve as a stepping stone for the design of self-management tools to actively engage people in the prevention of overweight.

The parties involved in FoodSampler Project are:

Delft University of Technology, Hogeschool van Arnhem en Nijmegen, Connected Care, Center for Overweight Adolescent and Children (COACH), Stichting Overgewicht Nederland, Knowledge Center for Dieticians Overweight and Obesity (KDOO), and the Dutch Dietetic Association (NVD).

Why?

After receiving the graduation assignment from FoodSampler project, the question “Why do the overweight and obese group need to collect and reflect on the data of their food behavior?” came to the first place before constructing the research questions. And “Can the current food tracking tools provide enough benefits to the target users?” was asked to find out if the current functions are in line with that initial purpose. To answer these two questions, the behavioral treatment of obesity was investigated to identify the main principles dietary monitoring need to follow (Chapter 2.1.3). Literature research and benchmarking was conducted to recognize the function scheme of food tracking tools on the market, as the basis to answer the second question.

1.2 Graduation Project

Assignment

Food informatics belongs to the ehealth area, specially used for the management of overweight and obesity. Currently, collecting data of what they eat are mainly through self-reporting using food measurement questionnaires and available commercial apps on the market. The current tools used by the overweight and obese group for collecting food data have achieved little success in engaging people in active self-reporting, and also the reflection process on why people have eaten what they eat was not supported in available food informatics.

The graduation project is part of FoodSampler Project, and the initial goal is stated as:

Design a food informatics system especially for older obese adults to feel engaged in collecting and reflecting on relevant and meaningful data around food behaviour and its context.
Research Questions

The research questions were formulated based on the initial assignment received in the beginning of this graduation project.

They mainly cover three parts: What is food informatic system, who are the target group and how they are experiencing food logging currently? Sub-questions were proposed under each part with a more specific focus and they can be found in Figure 1-1. The questions will be answered through literature research and user research in Chapter 2 and Chapter 3.

What
- What is food informatic system?
- What are the benefits of it in managing personal health?
- What types of data are relevant and meaningful in managing food behavior?
- What are their motivations and goals in doing so?

Who
- What are the characteristics of this group?
- Who are also involved in managing their food behavior/health?

How
- How do they experience collecting and reflecting on food data currently?
- How can we make the data experience engaging?

**Figure 1-1: Research structure formulated based on the assignment**
Project Approach

The design project applied the “Double Diamond” model developed by the British Design Council in 2005. Integrating the divergent and convergent stages in the design process, it is comprised of four main phases: Discover, Define, Develop and Deliver.

Extensive research has been done to have an overview of the current development of food informatic systems, the strengths and underachieved potentials in the personal informatics field and the current experience of target group using the available dietary monitoring tools. The purpose of the literature research and user research conducted in the Discovery Phase is to uncover the unmet needs of target users when using the current tools to track their food intake, as well as locate the opportunities as the foundation for the Develop Phase.
Design Vision
- Design Goal
- Interaction qualities
- Design Guidelines

Concept Development
- Ideation
  - Personal brainstorming
  - Ideation session
- Conception Directions
- User Testing
- Conception Direction selection

Concept Finalisation
- Concept Iteration
- Workflow of the concept
- Key screens of the concept
- Evaluation
In this chapter, the essential aspects of obesity is introduced as the background research. After that, the behavioural treatment of obesity is investigated to understand the main principles as the guiding foundation of using self-monitoring diet in the process. Self-tracking culture which dietary monitoring belongs to was also researched upon to gain the knowledge of the advantages and limitations of this arising culture. After that, factors that affect food choices were introduced as the meaningful data of food behavior, which are promising to be integrated to provide new values to the user and fill in the current gap spotted in self-tracking culture. In the last part of this chapter, benchmarking was made on the food tracking applications currently available on the market.
2.1 Understanding Obesity

2.1.1 Definition and classification

Obesity can be defined as a condition of abnormal or excess fat accumulation in adipose tissue, to the extent that health may be impaired.

Body Mass Index (BMI), which is calculated as [(weight in kg) / (height in m)^2], is considered to be the most useful population-level measure of obesity, and it is a simple index to classify underweight, overweight and obesity in adults. The WHO has classified overweight and obesity in adults based on various BMI cutoffs.

These cutoffs are set based on comorbidities risk associated with BMI (Figure 2-1). However, obese individuals differ not only in the amount of excess fat that they store, but also in the regional distribution of that fat within the body. The distribution of fat induced by weight gain affects the risks associated with obesity, and the kinds of disease that result. The visualized body shape among different ranges of BMI can be found in Figure 2-2.

Adapted from WHO, 2004

Figure 2-1: Classification of obesity and the corresponding risk of comorbidities (WHO, 2004)

Figure 2-2: Visual body shapes for different stages of obesity
Prevalence in the Netherlands

From the 2017 National Health Survey/Lifestyle Monitor, conducted by Statistics Netherlands (CBS) and the National Institute for Public Health and the Environment (RIVM), the rate of any form of obesity among people aged 20 and above is 14%, which is 2.5 times of that in 1980s. Additionally, there is a 36 percent of moderately overweight, so added together half of the Dutch population is overweight or obese among people of 20 years old and above (Figure 2-3).

From Figure 2-4, it is displayed that women are more likely to get obese compared with men.

And among all the age groups, 65-74 years old group ranks highest in the obesity proportion with a 20 percentage. The target group of this project covers the top two highest age group of the obesity rate.
2.1.2 Consequences

# Health

The health consequences of obesity are many and varied, ranging from an increased risk of premature death to several non-fatal but debilitating complaints that have an adverse effect on quality of life. Obesity is also a major risk factor for NCDs such as NIDDM (non-insulin-dependent diabetes), Cardiovascular disease (CVD) and cancer, and is related to multiple psychosocial problems in many industrialized countries.

# Psychological

The psychological impact of obesity may be shaped by both physical and social processes. Obese individuals are highly stigmatized and bearing various types of prejudice and discrimination due to their weight. The weight bias can be witnessed by inequities in employment settings, healthcare settings and educational institutions, resulting from the deep-rooted negative stereotypes that overweight and obese individuals are closely related to laziness, low motivation, poor self-discipline, low competence, non-compliance and sloppiness.

# Social

1) Bias from employment settings

In Puhl and Brownell’s review at 2001, they summarized emerging evidence showed that overweight and obese workers are receiving stereotypical attitudes from their employers, resulting in the disadvantages in hiring, salary, job promotion and termination due to their weight condition. In a study conducted with the adults living in the European Union (N = 17,767 women and 34,679 men), it was found that an increase of 10% of average BMI came with a reduction of hourly wages for male and female by 1.9% and 3.3% respectively.

2) Bias from the medical settings

It is also not rare to see health-care providers ranging from physicians, nurses, to psychologists and medical students uphold stereotypical assumptions towards their obese and overweight patients. Physical inactivity, overeating, food addiction and personality characteristics were believed to be the most important causes of overweight by the health providers. In a study of 600 general practitioners in France, 30% among them claimed overweight and obese patients to be more self-indulgent than the normal-weight group, and 60% deemed lack of motivation as the most common problem during the treatment. However, it was found by Befort and a colleague that patient self-reported level of motivation for weight management was higher than Physicians’ perceptions.

In a study with 89 GPs in UK, a victim-blaming approach was found according to the participants, that the patients are responsible for both the cause (eg. eating too much) and solution to their weight issue. While the patients in the study are more inclined to assign obesity to medical causes or low income. The positive communication about weight management or healthy lifestyle change might be hindered by the differences in perceived motivation and cause of obesity between doctor and patient.

For the overweight and obese patients, the biased attitudes from health providers are not unnoticeable and doctors are claimed to be the second common source of stigma among over 20 possible sources.

3) Bias from media

As one example, an analysis of overweight and non-overweight characters in popular television programs shows that the overweight characters are more often the object of jokes, less likely to be portrayed as leaders and in romantic relationships, and more often shown as eating out of control (Greenberg, Eastin, Hofshire, Lachlan, & Brownell, 2003).
2.1.3 Management of Obesity

Behavioral treatment of obesity

Three main features of behavioral treatment

First, it is a goal-directed process. Goals should be set with specific terms so that the result could be measured clearly. It can be as specific as walking four times a week, lengthening meal duration by 15 min or reducing the times of self-criticizing.

Second, behavioral treatment is process-oriented. Apart from helping people decide what to change (eating, activity, thinking habits etc.), it is more important to help them find out how to change along the way. With the specific goals set, the patients are encouraged to recognize factors both assist and hinder goal achievement. Here problem-solving skills are used to act upon those insights to overcome the barriers. In this view, it is the skill of problem-solving rather than the will power that is the key to successful weight management.

Third, the behavioral approach is encouraging small rather than big changes. The successful experience obtained from small changes is more helpful for overweight patients to work towards bigger goals over a long period.

The behavioral package

The behavioral treatment usually consists of multiple parts, namely keeping food and activity records (ie, self-monitoring), controlling cues triggered eating (ie, stimulus control), nutrition education, slow eating, physical activity, problem solving and cognitive restructuring (ie, cognitive therapy). Among the above, self-monitoring and physical activity are found by studies (Beker RC, 1993; O’Neil PM, 2001) to be consistently related to better weight control, respectively during short-term and long-term.

Unrealistic expectations of overweight patients

Definition of successful weight loss

For health professionals, a 10% weight loss are generally regarded as successful (together with associated improvements in other aspects). However, patients commonly are expecting a weight loss to the extent of 30% (Foster GD, 1997; O’neil PM, 2000; Jeffery RW, 1998; Foster GD, 2000).

Guide focus to nonweight outcomes

The improvements in other health metrics (such as serum lipids, blood pressure and glycemic control) are also worth noting even though it might not directly reflected in body weight. It will also help to encourage patients to evaluate the change in their life quality, in terms of increased energy level or better performance with light exercise.

Biological Limits

It is also important to acknowledge to the patients that people can weigh differently even though they eat and exercise the same due to biological reasons. That also set different limits for degree of weight loss among different individuals.

Discussion

Weight management or stimulus management?

From the principles of behavioral treatment of obesity, we can see that weight should not be taken as the only indicator of success, since the biological limit of weight loss is varied individually and obese patients tend to have much higher expectations of their weight loss. It can be discouraging to use the number of weight change as the measurement to evaluate the progress in weight management.

On the other hand, it is more important for the obese patients to find out the factors that are hindering the achievement of their specific goals, rather than giving too much emphasis on their will power. From the example behaviour chain of obese group illustrated in Figure 2-5, we can see that lifestyle behaviours that are highly induced by multiple stimulus are leading to the repetitive pattern of how they eat. That could be putting more attention to the stimulus management, like reducing the frequencies of eating in front of TV, passing by the fast food restaurant, etc.
2.2 Self-tracking cultures

Quantified self (QS), also described as self-tracking, self-monitoring etc., is a relatively young but growing trend, where people track their own state and behavioral patterns with tools ranging from the old-fashioned paper and pens, to personalized digital devices such as smartphones and wearables for continuous and unobtrusive tracking. Lead by the motto “Know Thyself”, the quantified self movement has been largely supported by the prevalent adoption of internet and internet-based services, as well as the availability of ubiquitous technology embedded in personal devices like smartphones with multiple embedded sensors.

It was estimated that in 2013 60% of the US population tracked some aspect of their life (eg: weight, exercise etc.), 33% of the adults tracked health indicators or symptoms (eg. blood pressure, blood sugar, headaches or sleep patterns) (Fox,2013). As Fox (2013) has shown, self-trackers are more likely to be living with chronic conditions themselves or caring for a loved one, who is living with such condition; and generally they are more tending to report that tracking had an impact on their health.

What are people tracking?

Katarzyna Wac analyzed 609 Quantified talks given mostly during 2012-2015, of which the topic is described by its attached tag. In figure 2-6, it provides an overview of the distribution of the topics involved in self-tracking practices discussed in those talks. From the figure, Katarzyna concluded that physical activity (97 talks) and nutrition(72 talks) are probably the top two topics tracked most by individuals, followed by weight, sleep, productivity and emotions. From Figure 2-7, which illustrates the change of distribution of the topics over the years, she concluded that “activity” remained the popular topic tracked by people, while “nutrition”, “sleep” and “weight” are gaining increasing attention over the years.
An important dimension of data practices linked to self-tracking is the emphasis on self-improvement and realizing one’s best self. From many posts on websites around the topic of self-tracking or life-logging shows (such as www.quantifiedself.com), maintaining behavior change is a key motivation to engage in self-tracking practices.

People usually start the tracking with a specific goal, for example to improve or manage a certain health condition (tracking the blood glucose to keep it in a target range), to achieve a goal (tracking the body weight to fall back to the ideal number), to find triggers to certain symptoms (tracking the food intake to find the source of allergy), or answer a specific question (What is the right dose of medication use?).

Digital self-tracking devices provide channels to shed light on the workings of the body and the self (McClusky 2009). Self-tracked data can provide greater insights than the information observed from people's senses, disclosing the unnoticeable patterns and correlations; Self-tracked data can also be a source of motivation, inspiring action, by entering the loop of feedback.

However, there’s also a growing doubt about the value of the data generated from quantifying the self. As stated in an article published on The Huffington Post, it can be difficult to perceive the meaning and value of one’s data. The author further points out that it may be insufficient to change a person’s behavior by simply “knowing your number”, “We can visualize the data we collect from countless gadgets, but will we understand what those data means? Even if you know your retirement number, does that knowledge empower you or unnerve you? How does the data vary under a variety of conditions and factors? For example, does a rapid heart rate indicate an underlying disease or did you forget that before you downloaded the data you ran up the stairs to access the web as fast as you can to use that new supercool health visualisation app?”

From this perspective, it can be said that isolated “numbers” alone may tell us nothing. It is the contexts where numbers (or any forms of data about self) are produced that are of greater importance. As two designers state it: “context humanizes the numbers and places them back into our lives in meaningful ways. For example, a fitness tracker can tell us that our physical activity is down from the previous month. But it cannot tell us that the inactivity is due to a sprained ankle. Given that context, those declining numbers might tell a different story: that we are recovering steadily rather than slacking off. Even in that simple scenario, it is clear that a small bit of context can frame data in a much more insightful way” (Boam and Webb 2014).
4) Representation of self-tracked data

From the interview of Finnish people using self-monitoring devices to track their physical activity and heart rate, Ruckenstein and Pantzar state that when the participants were shown the graphs generated from their heart rates, new forms of affective ties were formed between users and their personal data (Pantzar and Ruckenstein 2015; Ruckenstein 2014). **They also mentioned the importance of visual representations of personal data for the participants to respond to the data with high levels of engagement and interest.** Relatedly, the numbers coming from the tracking also gained new significance and emotional attachment, since it is the elements of one’s own body being measured.

What’s more, in their study some participants noted that the visualizations disclosed some aspects of their lives that they might have been doubtful about (like the stressful nature of their work), so the data tracked can confirm those impressions. While some other participants claimed that the data displayed findings beyond their anticipation (For example they were more physically active than they thought). The personal data collected by these devices together grow into a biographical repository of special significance and meaning to the user.

2.3 Self-monitoring food

Food tracking practice were originally applied for food assessment in clinical practices, aiming to help health providers assess patients’ nutrition intake and understand their eating habits (Gladys, 1982).

Typical food assessment methods include interviews (e.g., food recall (Patricia etc, 1994), recording diet history (Bertha S Burke, 1947)), questionnaires (e.g., food frequency questionnaire (FFQ) (Walter C Willett. etc,1985)), and paper-based diaries (e.g., dietary records (Rosa etc, 2015)). Different food assessment methods are used for different purposes. For example, the 24-hour food recall is used for accessing recent food intake, and dietary history mainly helps the understanding of long-term eating patterns (Gladys,1982).

**Styles of self-monitoring in treatment for weight loss**

In a study conducted by Lora E. Burke.etc investigating individuals of their reflections, attitudes and behaviors while using a paper diary to self-monitor their diet, after they completed a behavioral weight loss treatment.

There are three types of styles identified in the study, and the comparison of attributes among the three types can be found in Figure 2-8, in the aspect of adherence, degree of weight loss and attitudes towards self-tracking respectively.
1) Well-disciplined

The well-disciplined group is the type that benefit from self-tracking their food most. They have a high adherence and “do it for myself” attitude, and in the end also achieves a high degree of weight loss from it.

Integrating self-monitoring into their everyday routine, the “well-disciplined” group can look beyond the process of calculating and recording daily food intake and identify the value of making use of they are recording for daily or weekly food plan. They can benefit from their efforts by recognizing their own eating patterns. They can recognize the strong link between self-monitoring and weight loss, so in turn the achieved weight loss strengthens their motivation of self-monitoring. They also have support from the family or colleagues through incorporating the strategy.

2) Missing-the-Connection

This group shows moderate adherence to the self-tracking of their food, get moderate to low weight loss, and has negative attitude of “boring” “not easy” “something like your homework” to self-monitoring.

Since the “missing-the-connection” group not well aware of how to make use of their food recordings, they claim there is less impact on before they consume, although they can maintain the adherence to self-monitoring throughout the year of the program. They don’t completely understand the rationale behind self-monitoring and they could not resist emotional arousal. In addition, they encounter difficulties independently compared to Group weight loss programs. They also seem to receive little support from significant others.

3) Diminished support

The diminished support group has poor adherence to food recording, accompanied with poor weight loss or weight gain, resulting from coexisting negative factors like a abrupt life changes, food addiction, or lack of support from other people.
To benefit from recording food, it is crucial to understand why they are recording their daily food intake and how to make use of the results of their recordings. The positive loop is to make use of the recordings of last period and make adjustments based on that in the next period, to make self-improvement step by step, for example, taking former week’s eating as the reference to make the plan for next week can be a good justification of the value of doing food recording when put in the loop. At the same time, unable to make good use of the results of food recording while still doing the recording with a medium adherence will not bring the desired value and probably lead to relapse out of efforts that could not pay back.

**Insights drawn from the comparison among the three styles of self-monitoring**
2.4 Factors that affect food choices

This part will look into factors that affect food choices of people, which is to answer the research question “What types of data are meaningful and relevant in managing food behavior? “ We would like to find out the step before the real eating behavior is happening, which are the driving forces of type of food people choose as well as the portion. The details and mechanism of factors that affect food choices are elaborated below. At the end, the main factors that are promising to be integrated into the design phase were recognized.

1) Internal factors

Hunger, satiety and satiation

From a physiological perspective to understand food intake, it is the interplay of hunger, satiety and satiation.

Hunger signals, generating from the inner environment and suggesting a current and anticipated state of need, triggers the initiation of the meal. Satiety, the duration of inhibition of hunger after the consumption of certain amount of food, determines the interval between this meal and the next initiated meal.

Hunger and satiety together determine meal pattern (meal number and meal to meal intervals). Another mechanism “satiation”, determines meal size, which is highly responsive to the sensory characteristics of the food.

2) Environmental factors

Before introducing what consist of the environmental factors that affect people’s eating behavior, it is important to understand in which way those factors are exerting the influence in a brief manner. There are two terms involved in the process, consumption norm and consumption monitoring.

Consumption norms provide flexible benchmarks

One key element is consumption norm that is functioning in the eating process. For many people, deciding how much to eat or drink has relatively low mental involvement since it is nuisance to constantly and accurately monitor in everyday setting, so people will depend on the consumption norms to help them decide how much they should eat. Such norms propose an acceptable quantity or a range for people to consume. The consumption norms can be based on how much one usually buys or eats, and further influenced by other cues appeared in the environment, such as the number of items in the container or the eating behavior of the eating companion that are used as normative benchmark to measure one’s eating. The way people use consumption norms can be relatively automatic and may often happen without conscious awareness (Schwarz N. 1996).

Consumption monitoring moderates consumption discrepancies

The other key element is consumption monitoring, which helps people to keep the accordance between the perceived and actual consumption. The influence of environmental factors are augmented since they can bias people’s estimation of how much they have eaten. It is whether the person consciously pay attention to how much he or she ate that mainly determines how much one eats in a distracting environment.
The environment can be divided into eating environment and food environment according to Wansink (B Wansink, 2004) (Figure 2-11). Eating environment refers to the ambient factors independent of food, but related to the eating of food, such as atmospherics, social interactions during eating, possible eating distractions and etc; while food environment describes the factors that determine how food is presented, like salience, package or portion size, stockpiled or not, the perceived structure and variety of food and etc.

A) Eating Environment

Eating environment includes eating atmospherics, eating effort, eating with others and eating distractions. Eating atmospherics are mainly aspects that form the immediate eating atmosphere such as light, sound, temperature, noise and odor. The atmospherics affect people's eating duration of the meal and in the end affect the consumption volume; Eating effort is related to the access or convenience to which certain food can be consumed. The effort it take to get food indicates what food people prefer and how much they might consume (Wing RR, Jeffery RW. 2001).

Among the aspects of eating environment, the obese group are especially sensitive to the influence of eating with others and the eating distractions.
In terms of eating with other people, there are two effects found by previous studies, namely “Modeling effect” and “Social Facilitation”.

**Modelling effect** – When eating with other people, people may use the intake of other people as the guide to appropriateness. More precisely speaking, other people’s intake is referred to draw the line between appropriate between excess. Interestingly, there is a tendency recognized when people eat with two opposite types of eaters.

**Social Facilitation Effect** – people tend to eat more in a group, dependent on the size of the group. The possible explanation of this effect is that, as the size of the group increases, any individual is more likely to look for someone else who is eating a great deal as the reference, so they are more comfortable with eating more without violating the notion of “excessive eating”.

The food consumption of people is affected by the social setting; it has been found an increase of 40-70% energy intake when eating with friends or family present in the occasion compared with eating alone (Shide & Rolls, 1991). It could be caused by the extension of meal duration and having a more pleasant atmosphere to consume meals and snacks (Herman et al. 2003), which will extend the exposure to food cues and increase the possibilities for people to eat (de Castro, 1990). Eating alone tends to be taken as a functional and tedious activity. While Eating with friends and family is usually seen as a significant part of social and cultural experience, so the focus tend to be allocated to the food sharing and interaction with other people, causing people to lose track of how much they have consumed. Additionally, the selection of particular food that is easy-to-eat, highly palatable and high-energy is boosted for its social function compared to solo eating.
Eating distractions

Eating distractions like watching television and reading can result in the increase of food consumption by initiating eating, obscuring the monitor of consumption and extending the duration of eating.

Initiating eating

The eating distractions can provoke consumption scripts that initiate consumption due to the association between the distraction with food. No matter it is the hotdog at a soccer game, popcorn during a movie or chips during a favorite TV program, people’s eating behavior is possibly evoked by behaviorally ingrained eating scripts. It means that their eating with these distractions are more out of habit rather than hunger.

Obscuring the monitor of eating

Another aspect of distractions leading to overconsumption is that they will hinder people’s attention on accurately monitoring how much has been eaten. TV watching, reading, sport events and other distractions might cause people to ignore the internal signals of satiation and continue eating (Poothullil JM. 2002). In a controlled study, it is found that people who ate lunch while listening to a detective story consumed 15% more than those who had lunch in silence (Bellisle F, Dalix A-M. 2001).

Extending the duration of eating

In a diary survey of obese people showed that they stopped eating because the TV program they were watching ended or they just finished reading a magazine (Tuomisto T, 1998). In this sense, a longer TV program or a longer article may cause the stretching of the eating period.

The connection between distraction and food intake might have a more fundamental association with obesity, since the past research has shown that obese people are easier to be distracted than nonobese people (Rodin J, 1974).
B) Food environment

Food environment includes food salience, structure & perceived variety, size, stockpiled or not, way of serving it and etc (Figure 2-12).

Figure 2-12: Aspects of food environment
3) Psychological factors

It has been observed for a long time that emotions, mood and food choices are interplaying with each other, ranging from strong and obvious to subtle and subconscious ways.

The influence between emotions&mood and food choices are mutual; On one hand, mood and emotions could influence food choices through physiological effect by changing appetite, or broader food-related behaviours such as purchasing or cooking certain types of food. On the other, food choices in turn could lead to the alteration of mood, consciously or unconsciously. Eating a particular type of food could convert the mood by sensory effects, related social context, cognitive expectations, psychological distractions, changes in appetite etc (Gibson, 2006).

Figure 2-13: Factors recognized to be more relevant to the target group
Among the factors that affect people’s food choices, eating with people and eating distractions are the two prominent ones from environmental aspect, and mood is the other one from the psychological aspect, for overweight group. Studies show that they tend to be more easily influenced by the social setting and the distractions existing in the environment. Mood is another important factor which is often related with the consumption of comfort food which usually contains high level of sugar and fat.

Four factors (Figure 2-13)were eventually chosen from the main dimensions of factors that affect people’s food choices considering the relevance and degree of importance to the target group of this project. The factors are eating companion, eating distractions, mood and location. Eating companion, eating distractions and mood were elaborated in this chapter, while location is another factor recognised from the user research and will be described in Chapter 3.

In this part of literature research, “eating companion”, “eating distractions” and “mood” are highlighted as the factors highly relevant to the target group among other ones mention earlier. Based on this, to integrate with the findings from user research, a comparison graph will be made in the next chapter to identify the overlapping area of factors that affect target group’s food choices. In the end, four types of data were selected as “meaningful food data” to be applied in the design phase.

Further recognition of influencing factors were made in Chapter 3
2.5 Benchmarking on current products

To have a fundamental understanding of the available mobile applications on the current market as the basis for the design phase, representative apps of tracking food were first investigated to compare their strength and weakness across several categories. Afterward, apps within the general personal health management category were also reviewed to understand other approaches used in self-tracking in other personal aspects, such as food response management for people with diabetes and female mental monitoring.

Goal and selection

Apps for tracking food, apps for personal health tracking, apps applied notable strategies for user engagement

After researching on the popular food tracking apps on the market considering their review ratings, reviews of articles, four food tracking apps were chosen for further comparison and benchmarking, which are Myfitnesspal, Mijn Eetmeter, CalorieMama and Nutrino.

My fitness pal is a well-known app available in the international market, target on the management of exercise and nutrition at the same time and famous for its powerful database. Mijn Eetmeter is a food tracking app mostly famous in the Dutch market, issued by Dutch Nutrition Center and supported by scientific knowledge, used or known by most of the target users involved in the User Research part in the next Chapter. Calorie Mama got highly rated for its significant efficiency improvement of its data entry step, thanks to the incorporation of the Artificial Intelligence Technology. Nutrino is inviting users to record more diverse dimension of persona data apart from food such as mood, medication, activities and etc.

After going through the main flow of the chosen apps, the common steps are recognised and illustrated in Figure 2-14.

1> Input the current body statistics (height and weight)
2> Set the goal to achieve (lose weight, gain muscle, gain weight, etc)
3> The system set the maximum calories for each day
4> User logs daily food intake and get the macronutrients breakdown and calorie calculation

Figure 2-14: The common steps of using calorie-oriented food tracking app
From Figure 2-15 comparing the four main food tracking apps on the market, we can find that

1) **They are all calorie-based recording of daily food consumption**

2) **They target on different aspects of the food tracking experience.**
   For Myfitnesspal, it is designed to manage the exercise and diet at the same time, with a quite inclusive food database (6 million foods) to support users' fitness goals. For CalorieMama, it employs the AI technology to automatically recognize the type of food from the camera with a relatively high degree of correctness, easing the process of entering the food information (Figure 2-16). Nutrino invites the user to record diverse dimensions of data such as their feeling (mood, energy level, muscle soreness), sleep condition and medication to have a more holistic view of his/her body performance (Figure 2-17). Eter meter is an food tracking app developed by the Dutch Nutrition Center, mainly targeting on the Dutch population.

3) **They all have a premium function set based on the basic recording functions.**
   They mainly provide the meal plan and recipes according to their personal goals, as a paid premium function embedded in the app. Apart from this, My Fitnesspal enables the user to customize the dashboard of their recording, so they can choose which type of information will be displayed that they value most. Calorie Mama integrates the friends and community function to the section where other users' activity feed can be commented upon and liked.

<table>
<thead>
<tr>
<th>Categories of data</th>
<th>Myfitnesspal</th>
<th>CalorieMama</th>
<th>Eet Meter</th>
<th>Nutrino</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food, water, exercise, weight, status</td>
<td>Food, Cardio, workout, body weight, water, caffeine, soda</td>
<td>Food, water, exercise, weight</td>
<td>Food, activity(workout), feeling(energy level, pressure, mood, muscle soreness, hunger), water, measurement (weight, body fat, waist size), sleep(duration &amp; quality), medication(database)</td>
<td></td>
</tr>
<tr>
<td><strong>Main Features</strong></td>
<td><strong>Basic</strong></td>
<td><strong>Premium</strong></td>
<td><strong>Premium</strong></td>
<td><strong>Premium</strong></td>
</tr>
<tr>
<td>Logging food &amp; drinks (photo, scanning, search)</td>
<td>Logging food &amp; drinks (photo, scanning, search)</td>
<td>Logging food and drinks Daily calorie counting</td>
<td>Logging food (photo, voice input, barcode), Setting personal goals Daily summary (Carbs, Fat and Protein)</td>
<td></td>
</tr>
<tr>
<td>Setting personal goals</td>
<td>Setting personal goals</td>
<td>Daily calories counting</td>
<td>Meal planner, daily tip, recipe browser</td>
<td></td>
</tr>
<tr>
<td>Daily calories counting Nutrition Analysis (calories, nutrients and macros)</td>
<td>Daily calories counting</td>
<td>Food, activity(workout), feeling(energy level, pressure, mood, muscle soreness, hunger), water, measurement (weight, body fat, waist size), sleep(duration &amp; quality), medication(database)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight Progress Blog posts on food and fitness</td>
<td>Personalized meal plan &amp; recipe Community &amp; Friends</td>
<td>Recipe recommendation Tips for resisting temptations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custom Dashboard Logged foods highest in three macronutrients</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>AI food recognition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>External data import options</strong></td>
<td>A wide variety of related apps under themes like fitness, wearables etc.</td>
<td>Apple health, Withings, Fitbit, Garmin, GoogleFit, Strava, Helix DNA analysis</td>
<td>None</td>
<td>Apple health, Nokia Health(withings), Fitbit, Garmin, Jawbone, Runkeeper, Moves, Oura, 23AndMe(DNA)</td>
</tr>
</tbody>
</table>

*Figure 2-15: Comparing the four main food tracking apps on the market*
Figure 2-16: Interfaces of Calorie Mama

Figure 2-17: Interfaces of Nutrino
Nutrino Food-Print Program

Nutrino Food-print program for people with diabetes uses CGM (continuous glucose monitor) and user-tracked data to build a personal “Foodprint” for the user to recognize and even predict eating patterns, as well as resulting blood glucose trends for people with diabetes. In the weekly summary part, it displays the overview of the number of meals, numbers of steps and sleeping hours for each day. In the My foodprint Report, there will be a summary of an evaluation rating of different food for breakfast, lunch and dinner based on the user’s glucose response after the corresponding food consumption (Figure 2-18). In this way, users are building a more personalized understanding of how their blood glucose is responding to different types of food.

Relevance for this project

Nutrino food-print program proposed a more ambitious concept towards recording daily food intake compared with the current prevalent “calorie-centered” approach on the market, by establishing a personal record of bodily responses towards different types of food consumed, starting with the diabetes group. This points to a promising direction for the overweight group to manage their food consumption behavior as well, possibly with the focus on systematically recording the implicit triggers of eating, as a way to provide more understanding towards their own eating behavior.
Flo
-- mobile application to track female’s menstrual cycles and predict the next cycle in the long-term

The user is suggested to record the starting and finishing data of their period, as well as their different types of symptoms on each day (Figure 2-19). All these data together enable the app to increase the accuracy of predicting the next cycle of the user, giving suggestions to their current bodily symptoms and providing traceable patterns to understand their health condition as time goes by.

The analysis of recorded data are categorized into Cycle length, period length & intensity, patterns of your body and graphs of events (Figure 2-20).

This case provides insight into how we can include a set of related syndrome data to have a richer understanding of the overall body condition. With the self-monitoring tools, the users are enabled to witness the development of the target aspects of body condition, getting more knowledge of possible causes of certain syndromes, what can and cannot improve the condition etc.

This rationale has not been applied in tracking people’s food behavior yet, which means interrelated factors of eating are not taken into consideration to form a more holistic picture of how and why people eat those food.
Schijf van Vijf (Disk of five)

Schijf van Vijf (Figure 2-21) is dietary suggestion for daily food consumption consisting of five parts based on the latest scientific findings on nutrition. It was promoted by Nutrition Center supported by Dutch government, aiming to encourage healthy and sustainable eating among the public. The abstract version of Schijf van Vijf is provided in a visual way for easy reference, and people can also search for certain food item in their database for healthy food and unhealthy food. A set of tools are also provided for personal use, such as food diary Mijn Eetmeter, “Do I eat healthy” app, healthy recepies and etc. Mijn Eetmeter is widely used among Dutch population for recording daily food intake, which mainly focus on calculating the calories and nutrients in the food consumed. The information of Schijf van Vijf are also integrated in Mijn Eetmeter to enable users to search for healthier alternatives.

Tips for resisting temptations

On the website, it also gives tips on how to store food in the home environment to make the healthy eating easier, how to resist the temptation in outdoor setting (like train station, street or cinema ), and how to be mindful when eating with other people (Figure 2-22). This can be a nice starting point to support people to make healthier food choices by giving suggestions on managing the source of eating stimulus -- home environment in this case.
Walkr applied a story setting to link daily activity log with discovering the galaxy and building your own planet inside the app. The daily steps are automatically recorded with the pedometer in the phone and converted into the energy fuels in the game, which can be used to send the spaceship to discover new planets in the galaxy (Figure 2-23). The users can be encouraged to stay active to unlock and build their own collection of planets, spacefoods, and rare elements in the universe.

![Figure 2-23: Interfaces of Walkr]

**Energy log of daily steps**  
**Planet View**  
**Mission (list)**  
**Mission (achievements)**
Insights from benchmarking on current products

Functionality

1. The food tracking mobile applications available on the market are generally calorie-based, some of which are equipped with personalised strategy to tailor daily calorie limit and food recipes according to user’s personal goals and needs.

2. They basically all cover reducing the efforts of data entry step, by supporting several types of entry methods such as photo, voice entry, and directly searching in the embedded food database.

Nutrino includes recording a variety of other types of data apart from food (sleep quality, mood, exercise etc.), but those data were input in a separate manner and in the end are not showing the relation between those data and food consumption.

Flo, the app focuses on managing female’s menstrual cycles is not limited to recording the dates of each cycle, but also its accompanying bodily indicators (mood, symptoms etc.) to understand the body condition as a whole.

3. Nutrino Food-print program brings in the new concept of building a personal “foodprint” system specially for the diabetes group. Here it breaks the generic way of tracking food, by building a more personal link between food and the individual’s bodily response. It can help the user better manage his/her health by gaining deeper understanding of how different types of food are affecting their body.

Experience

Gamification

Walkr uses gamification strategy to turn the daily activity tracking into a more personal and rewarding experience. Their daily steps can be transferred into certain types of game elements to discover new planets in the story, together with the mission/achievement section, strengthening the feeling of achievement and curiosity along the usage. Social setting is also integrated to encourage cooperation and competition among friends.

Visual Representation

The visual representation of the chosen apps is generally standard statistical style, where numbers, pie charts and line charts are used to show the results of user’s recordings (Figure 2-24). They can be too abstract and formal for personal interpretation and also display the results in isolated manner, namely without providing the context information for that week or day.

Figure 2-24: Visual representation of the four apps
2.7 Conclusion

Self-tracking culture

In the first part of this chapter, we introduced the recently arising phenomenon of self-tracking culture. The biggest motivation for people to engage in the self-tracking practices is self-improvement and maintaining behavior change to achieve the “best self”. The advantages of self-tracking practices are providing more reliable insights to people compared to impressionable feelings from bodily senses, inspiring actions to form a feedback loop, and etc. However, there are also several issues emerging from those self-tracked data practices. Firstly, the meaning of data is hard to interpret. Secondly, the conditions where collection happened affect the validity of collected data. Thirdly, the contexts in which the data are captured are critical to understanding them in a personal and meaningful way.

The understanding of self-tracking culture can be an important foundation for interpreting the contexts of dietary monitoring of this graduation project in the next chapter. It provides a ground for us to spot aspects that are possibly hindering the advantages of self-tracking practices and also provides insights on opportunities to magnify the benefits of self-tracking such as including the context of generated data for meaningful interpretation.

Behavioral Treatment of Obesity

Self-monitoring dietary intake is one of many approaches used in the behavioral treatment of obesity. The main principles of behavioral treatment are: It is a goal-directed process where specific goals are more valuable than bigger ones; The improvement of obese group’s coping skills towards eating stimulus is more critical than the emphasis on the will power;

Benchmarking

Functionality

The food tracking mobile applications available on the market are generally calorie-based, some of which are including premium services of providing receipes and meal plans based on personal goals.

They basically all cover reducing the efforts of data entry step, by supporting several types of entry methods such as photo, voice entry, and directly searching in the embedded food database. This aspect should also be taken into consideration in the design phase.

Some case goes beyond the “counting calorie” mindset, but focus on building a more personal relationship between the user and the food they consumed (Nutrino FoodPrint Program). This could be promising to reshape the value of recording food for the target group of this graduation project, based on the needs of the overweight group, which is to be investigated in the next chapter.

Experience

Some apps from the general self-tracking categories are applying a gamification strategy to improve the experience of user. The recorded data were transformed into certain type of assets inside the game to create the “achievement” feeling and motivate the user to invest (data)continously in the long run to build up new things.

Visual Representation

The visual representation of the chosen apps is generally standard statistical style, where numbers, pie charts and line charts are used to show the results of user’s recordings. They can be too abstract and formal for personal interpretation and also display the results in isolated manner, namely without providing the context information for that week or day. This finding provides opportunity for design in the ideation phase.

Factors affecting Food Choices

Three prominent factors were recognized to be significantly affecting people’s eating in the literature research part.

Eating with people and Eating Distractions are the two important factors in the environmental influence on food choices, especially for the target group (overweight and obese people). These two factors are affecting people’s eating by prolonging the duration of eating activities, increasing the exposure to eating cues, and shifting the focus away from the food itself to obscure the monitoring of eating.

Mood is another important factor from psychological influence on factors. On one way, certain types of mood can drive people to eat special types of food; on the other, eating leads to the alteration of the mood.
38

Behavioral treatment of obesity

coping skills of eating stimulus is more important than will power

guiding principles

used in

Dietary Monitoring

belongs to
In Figure 2-25, the relationships among the insights from literature research and benchmarking are mapped out to show how they contribute to the understanding of the general topic and lead to the formulation of design vision in Chapter 4.

To understand dietary monitoring, the center topic of this graduation project, the origin of its use “Behavioral treatment of obesity” was investigated to find out the guiding principles as the foundation to re-evaluate the types of meaningful food data, and further how to collect and reflect on them. In parallel with that, the advantages and limitation of general self-tracking culture were researched upon, considering the dietary monitoring is one branch belonged to this culture. One prominent limitation of the current self-tracking culture is that, the conditions around the data collection happened have been overlooked so far, while they are essential to the validity of the data and also understanding and interpretation of the data collected.

This lead to the exploration of factors which have strong influence on people’s food choices. Those factors not only form the context for eating behavior, but also could provide insight on what are making people consume differently (more or better for instance) with one or a few factors than the rest ones. The relevant influencing factors have great potential to fill in the gap identified in the current self-tracking culture.

In the benchmarking part, the main food tracking apps on the market and other self-tracking apps are analyzed to spot design potential to be considered in the design phase.
In this chapter, user research activities were conducted to gain a realistic grasp of who the target group are, and their current experience of collecting data of their food intake. The contextual interviews (carried out by collaborated partners in FoodSampler project) and results of co-creation workshop were analyzed to understand the characteristics of the target group, the general process of using food tracking tools, users’ perception of food tracking tools and the current experience of tracking food intake.

Based on the findings from user research and literature research described in last chapter, opportunities for design were identified as the basis to formulate design vision in the next chapter.
3.1 User Research

In terms of the user research part, contextual interviews and co-creation workshop were conducted to seek answers of the research questions proposed in Chapter 1. Since the contextual interviews were planned ahead of the start of this graduation project and carried out mainly by collaborated partner HAN University, the author was contributing from analysing the interview materials onwards. For the co-creation workshop with the recruited target group, the author was engaged from the preparation and designing of the workshop till the analysis of the materials collected.

3.1.1 Contextual interviews

Goal

The contextual interviews are planned mainly to gather insights on the following aspects:
1. Target group’s eating habits and relationship with eating/dieting
2. Tools the target group have used/they are using to report eating behavior
3. What and who are influencing their food choices

The detailed interview questions can be found in Appendix A.

Methods

In this project, contextual interviews were arranged in the participants’ home environment since food behavior is the topic we aim to learn about. A semi-structured format was chosen to allow the dialogues with participants flow naturally and potentially more comprehensive understanding of the target group.

Participants of the interviews

There are eight participants in total joined the contextual interview held at their own home environment. They are from different cities spreading among Netherlands (see Figure 3-1). Among the participants, 3 of them are male and 5 are female, with self-reported BMI > 25 kg/m². The age of the participants is within the range of 50-80 years old and half of them have had bariatric surgery before. The contextual interviews were conducted by collaborated researcher from HAN University and the access to the interview data was granted for this graduation project.
Analysis of the interviews

All the interviews were recorded and transcribed into Dutch scripts afterwards, and then translated with language tools before the analysis. A Dutch speaker was actively consulted for understanding several confusing parts of the interview scripts to avoid possible misunderstanding. Since the research questions generated for the interviews are not fully in line with those proposed for this graduation project, data that are regarded less relevant for this project were excluded during the analysis activities.

The research structure introduced in Chapter 1 was referred to for the data selectiown. As a result, categories were summarised around “perceptions about food tracking”, “factors affect their food choices”, “general process of current food logging”, “disadvantages of current food logging”. The details of insights and conclusions from analysis will be elaborated in the next chapter.

3.1.2 Workshop session

Goal

In order to gather deeper insights on the feelings and preferred solutions of target users in some typical scenarios, which were identified in the contextual interviews, co-creation workshop was held with the same participants afterwards (Figure 3-4).

Setup

The eight participants were divided into two groups working on assigned persona respectively. Two personas were prepared beforehand as the material for the participants to empathize with and lower the barrier of directly talking about their own personal experience. The session consists of two parts:

1) Introduce the persona Jakob and Lieneke, and uncover things they enjoy in daily life by collective collage making within the group

2) Select a major challenge from the quote cards, then create the ideal support for the persona to better cope using the materials in the toolbox.

Figure 3-3 One interviewee was making collage during the interview
Analysis of workshop results

The analysis of workshop results was conducted with another main researcher involved in Food Sampler project (Figure 3-5). Insights were clustered and connections among them were recognized during the analysis. The results will be presented in the next part together with other findings.

Figure 3-3 Materials prepared for the co-creation workshop session

Figure 3-4 Co-creation workshop
Figure 3-5: Co-creation workshop result

Figure 3-6: Analysis of the workshop results
Figure 3-7: Overview of insights from user research

Personal Goals

- Self-acceptance
- Control over his own body
- To be healthy rather than losing weight

Eating

Tools they use to record food

- Breakfast
- Lunch
- Dinner

Tedious
Time-consuming
Forgetting some of the food eaten
Factors that affect food choices

Food Motion
- Visitors
- Location
- Eating companion
- Sleeping quality
- Weather
- Taste

Feeding

430Kcal
- Snack

778Kcal

556Kcal

Failure Report

Dietician

Why do I need to record my food?
3.2 Research Results

3.2.1 Understanding the user

Internal Characteristics

Feel lack of understanding

From the interviews, most participants frequently mentioned that they are hoping for more understanding from other people, including average people in daily settings and health professionals. They received a lot of judgement based on their appearance and people stereotypically attributing their obesity to lack of self-control and bad eating habits, which is regarded as their own fault. And other health professionals also jumped to the conclusion that obesity is the main reason for irrelevant syndromes and disease. As a result, some of the target group regularly share those problems caused by obesity with friends who are in the same condition because what they have been through can be well understood by their friends. Also they tend to have more security and accepted feeling when participating in private activities specially for obese group (private swimming hours and walking trip).

Frustrations from past weight-loss tryouts

Most of the interviewees had years of experience trying different approaches to lose weight, such as joining the weight-loss camp, different types of diet program, but all of them can at most result in a sudden weight reduction, without sustaining that for over three months.

Well informed with the nutrition knowledge

Since most of the interviewees have had years of experience consulting dieticians, they have good knowledge about categories of healthy food and unhealthy food. Some of them are also actively paying attention to the nutrition labels on the food package in order to recognize what are contained inside.

“Well, actually everything on that Schijf van Vijf is about. Not that I always eat everything well, but those are the healthy products.”

“Well basically the basic products, that’s good. So your bread, your milk, fruit, vegetables, potatoes, meat. Not all those weird things, ....”

“yes I have a lot of things at home. I have legumes, rice, bread ehhh , yes, all the simple things”
personal values towards their lives

**Honesty**

Honesty is mentioned by some participants when talking about underreporting some unhealthy food they consumed. This action makes them feel uneasy because it violates their value of honesty both to themselves and to people who have offered help.

**Self-acceptance**

From the interviews, we can see that some of them have been through the process of cultivating self-acceptance towards their eating behavior where occasionally indulgent eating often lead to disappointment about oneself and abandonment of the whole “healthy eating” goal.

“It does matter, but I know I'm not going to fool myself I accept that things do not go the way as I intended and ehh I know that it is not in accordance with the truths that I have set for myself, ‘take your time’..... I think acceptance is one of the things that I advise people to do, accept that you can not do everything and not everything just goes smoothly and do not put yourself under pressure unnecessarily”

“I am now aware that I am taking them and I am allowing them. I am now milder to myself that it is allowed. Because yes before when the choice was wrong in the morning, the whole day was lost so yes it does not matter anymore. And that switch I have now made of ok I take in the morning a ball with Nutella and I find it nice to then make the link again I take an apple and then another sandwich, I do not have that anymore a domino effect has become. I’ll be rid of that.”

**To be healthy rather than losing weight**

This statement was mentioned during the interviews concerning what is the right goal to work towards. Some of the participants were keeping weight loss as their one and only goal to evaluate if they have achieved progress or not, which might be the improper focus that could lead to constant frustration.

“It is important for me to be healthy in my case to have healthy and eh cheerful years. Which makes me feel good and where I am the boss of my body, it is not my goal to lose weight my goal is to just be healthy, so that is looking at things from value ..yes.”

**Control over his/her own body**

Losing control of their own body is one of the main frustrations mentioned in the interviews. It was experienced when they could not help themselves eating continuously at certain moments (binge eating and emotional eating) and also when they could not change the state of their body after various attempts over many years.
Aim of tracking food

**Attitudes**

Most of the participants claimed that they are not sure of the exact benefits of using food tracking tools in the beginning. They are evaluating the usefulness of tracking food intake along the way. The most important evaluating factor for them is weight change, where recognized weight loss is seen as the proof for being effective and without weight loss is regarded as no relevant value for them.

One interviewee described the food record as “failure report”, which constantly remind them of they were eating “unrecommended food”. As a result, the results of tracking food kills motivation of continuing to do it, creates a sense of failure, making them feel they are upsetting people who are helping in the process (Figure 3-8).

“You exceed the calories”

“You did this wrong”

*Figure 3-8: perception of food tracking tools*
The general process of food tracking

In order to understand the holistic experience of food tracking practice of the target group, a general user journey was made based on the insights from the contextual interviews. Since the way how dieticians do the consultancy is varied from each other, the common steps mentioned by the interviewees were depicted in the journey map. The journey map illustrates the experience and how people are doing the food tracking as a way to communicate with their dieticians (Figure 3-9). It shows what people do, think and feel throughout the stages. Four main stages were defined in the journey. The stages will be used to define the moments when the negative experience of the target users occur.

1/ First meeting with dietician

This is the stage where the consultancy with dieticians starts. It usually comes from the motivation of the target group to seek professional help for a better and healthier body condition. In this initial meeting with dietician, the eating habit of the patient was learned and diet plan will be made for the patient to adjust to. Together with the diet plan, the patients will be required to record their daily food intake in the following weeks. This stage is crucial to the patient in terms of if why they need to track their food is explained clearly by the dietician, which can affect their expectation and motivation towards putting efforts into tracking their food.

2/ Preparation of food tracking

Before the start of tracking their food, some patients need to wait until they receive the food diary sent from the dietician (dependant on the Dutch medical system). For those who will use mobile application, they need to download the app to their mobile phone or tablet.

3/ Tracking food intake

The stage of tracking food intake is decided by the personal style, which is decided by the user’s daily routine and lifestyle. Some of them took brief notes during the day or take a photo of their plate to prevent forgetting what they have eaten. They can feel frustrated and confronted when directly facing what they have eaten. As time goes by, doubt about if it is useful to track their daily food intake will emerge if they can't see any changes in their body weight.

4/ Meeting with dietician regularly

This stage is when the dietician and the patient are reviewing the results recorded for the past period together during the consultancy. The experience during this stage tends to be quite negative, because the patients have to be confronted with what they have eaten together with the dietician face to face after not being able to stick to the strict diet plan. It is possible that the consultancy is food-oriented that some dieticians won't spend time on learning the personal difficulties went through by their patients, and therefore corresponding support won't be provided to help the patients cope with difficulties they need to face in daily moments, such as temptation, emotional eating and impulsive eating. As a result, some of the interviewees have been through “trust issues” with their dieticians over time, leading to the result that they lost motivation in managing their diet. In the end, there is no more need to track their food anymore.
Figure 3-9: General process of food tracking
Tools they are using

The food tracking tools used by the participants range from paper-based food diary, digital spreadsheet to commercial apps and websites. Eter meter is the one used most among those who are taking the digital approach, since it is developed by the Dutch Nutrition Center. Some of them have used more than one type of tools over time.

“Well the usual diaries, the apps, I think I've downloaded something from the food center. Yes, that is the most of registration. And what I like the most at the moment is simply to keep my own nutrition plan. Because, yes, then I already wrote it down.”

Frequency of logging

In terms of the frequency of entering food data, there are mainly two types found from the interviews (Figure 3-10). One type is that they need to record the food after each time of eating, which means they need to use the recording tool many times throughout one day. The other type is they record everything they eat once mostly at the end of the day, at the risk of that they could not recall everything they ate during the whole day. Some of the interviewees came up with the solution that they will make brief notes in the middle of the day, and transfer them to a more complete format when they are back home.

“I've noticed for myself when I do it in the evening, that I've forgotten the half, because then you do not know what you put all in your mouth. So I have to do that several times over the day....when I was on the road, I wrote that briefly often in my diary. That I thought oh yes I should write down, because otherwise I do not know tonight.” -- Interviewee A

Figure 3-10: Frequency of logging
Factors affecting their food choices

In the category of “factors affecting food choices”, four main subgroups can be identified as food-related, personal state, companion and environment (Figure 3-11). The factors within each subgroup will be explained in the following paragraphs with quotes from the contextual interviews.

![Figure 3-11: Overview of factors affecting food choices](image)

### Food-related

**Flavor (Palatability)**

The palatability of the food is one of the first factors that will be considered when people are making the food choices, which is linked to the sensual pleasure people can directly get from having food.

**Price**

Price is another factor that is of great significance, however, instead of price alone, the price/quality ratio is taken into consideration more often when deciding where to buy the food. For example, the price is more acceptable when buying meat in the butcher's shop to some participants, while some vegetables sold in the supermarkets were deemed as overpriced so they would like to purchase the same type of vegetables at a lower price (in cheap supermarkets such as Lidl or Aldi).

**Energy Level**

Energy level is another factor that can lead people to choose something over the other, which usually happens after people check the nutrition information on the food packages.

**Preparation time**

Preparation time will play a role as well when there is a significant difference between how much efforts and time needed for different types of food. Quick and easy ones can be the preferred choice when people are in the low energy level or has limited time.
Personal state

Personal state is another aspect which is highly affective with people’s food choices in a subconscious way. When in a negative emotional state, people instinctively turn to food to seek the comfort thanks to its easy access and immediate effect.

Emotion (sadness, stress, boredom, seeking comfort)

Sadness, stress and boredom are the main reasons interviewees were claiming for evening snacking. They may lose track of how much food (usually high energy snacks like cheese and chocolate) they have consumed when flooded with the emotion. And it can gradually lead to a self abandonment mindset during the impulsive snacking when they related back to their long time struggle of body weight.

“It is important for me to eat with someone, then I eat at the table, and then you pay more attention to the food and you also pay less attention to the food. It takes longer to eat.”

“Yes food then gets, enjoy more, while if I do it on my own I would label it more as comfort, as a plaster, inattentive. It does not matter whether I eat my plate or not and that I would only eat chocolate on my plate. Then eating with his two has a social function for me.”

Sleep quality

Sleep quality can also have an effect on the appetite of people the other day according to the interviewee.

“I noticed it yesterday, I had not slept well, and then I notice that I’m going to eat more. That I tend more to the sugars than the other days. That I also want to eat more, that I think of no, this is not your rhythm. ..”

Companion

Due to the social meanings embodied in food, it will go beyond the practical function of providing energy when there are other people present in the eating occasion. For those who live with partner or children and have meals together regularly, it is more difficult to make independant food choices, but rather a result of collective negotiation. People may sacrifice their own considerations/standards of food choices to meet their visitors’ needs if they have to. Also, they may adjust their food choices in order to maintain certain impression in front of other people in some social occasions.

“Stress, that sort of thing. Then I’m going to make the bad choices. I also honestly admit that. Then that bag of chips goes, I just do not try to have it in the house either, but yes then ehhhh, you do not have to go shopping.”

“But the anger, the frustration, uuh yes that remains a kind of comfort, and I’m still looking for that in food.”

“but the anger, the frustration, uuh yes that remains a kind of comfort, and I’m still looking for that in food.”
Environment

Temptation (airport, train station, supermarket)

According to the interviewees, the temptation from food is difficult to resist especially when they are on the transit. This can be due to the smell stimulus from food shops and also the need to bear boredom when there is long time of waiting ahead in the train station or airport.

"that's very tempting when you walk on the station, smell of everything and ...difficult environment...and the smell that then, immediately ehhh, triggers action".

Weather

Some interviewees mentioned their eating can be affected by the weather condition, which often happens by way of influencing their mood and thus craving certain types of food.

Season

Food choices are also affected by the availability of food in different seasons. The variety of vegetables and fruits is more abundant with lower price in summer time than winter.

What are their reactions after recognizing these influencing factors?

Some of the interviewees mentioned their own ways of coping with the tempting moments when they tend to be easily affected.

One interviewee stated that she knows herself is easily tempted at the train station by the smell coming from the food shops after work. This is the moment she needs to face every day especially during the cold winter days. To make herself deal with the temptation better, she came up with the idea to prepare some warm drink in her bag in advance, and it turned out to be a good way to reduce the power of temptation.

Another interviewee took a similar approach to deal with the hungry moments back home from work. She tends to be struggling with buying food on the way or eating home-cooking meals at home. She decided to cook a larger portion of food beforehand and put them in the freezer. In that way, it is easier to overcome the impulse to buy food on the way home.

Identifying it's the mood functioning

There’s one interviewee mentioned how being more aware of the influence of mood affects how she deals with the impulsive eating moment later on. She has participated in a camp where she got instructed on recognizing the emotion before she directly turns to food to comfort that emotion. The ability she gained to intentionally observe the emotional stimulus taking an effect on her, helps her to tell the emotion from the real hunger when those moments occurred again after the camp.

Potential for design phase

Positioning the new food informatic system as a supporting tool rather than a regulating tool

providing more knowledge on how their eating are affected by the implicit environmental and psychological influence

Discussion

It can be interpreted from the reactions they had after acknowledging the stimulus/moments that they are more proactive to generate ways to manage the effect those stimulus can have on them. On one hand, this is in accordance with the principles of behavioral treatment elaborated in Chapter 2.1, where stressed that the key point is about gaining the skills of managing eating stimulus rather than the “will power”. On the other, we can see people who belong to the target group are gaining more self-efficacy after identifying the most “dangerous moments” of consuming food impulsively. That directs their attention away from self-blaming to a more meaningful approach of building up their own coping system. With more control over the eating impulse can equip them with more confidence of managing their eating behavior. This can be seen as an important opportunity for redefining the new food informatic system in the following concept phase.
In Chapter 2, three factors were identified to be most relevant to the target group's food choices, which were also constantly mentioned by the interviewees in the contextual interviews.

Some of the interviewees are emotional eaters and most of them stated their emotions are a very important reason or trigger for bad eating moments. Secondly, they described that they eat quite differently when they are with different people around, no matter it is for a regular occasion (living with children or partner), or special case (grandchildren's visiting or social gatherings). Eating with other people sometimes provides reason for them to break the healthy rules they tried to stick to. Thirdly, the location factor is from the fact that they are faced with huge temptations to eat in certain places, like train stations and supermarkets. Besides that, location is the basic parameter of each eating occasion, which also fundamentally decides the types of food people can consume. Forthly, eating distractions can be hard to be related to overeating by people themselves, but it could be beneficial to be included to uncover the unnoticed eating patterns for the target group.

Figure 3-12: The overlapping of the factors that affect food choices between literature and user research

Figure 3-13: Four prominent factors that affect the target group's food choices
Current experience with food tracking

Negative aspects of current food tracking experience

Tendency to lie during the food recording

Under the pressure to show the dietician of what they have eaten, the interviewees admitted that they chose to hide the “bad things” in the food record to avoid the confrontation with dietician.

“...in the notebook showed a perfect week, that it is actually not, I know that sounds very crooked, but, yeah.”

“You know when you have that diary, you always have to do that, you have to fill in that from a dietician, well then you make the truth, the reality always much nicer than that the actual. I have not taken that bar of chocolate at all. You hit very easily and you skip things.”

Time consuming

It is frequently mentioned by the interviewees that it takes a lot of efforts and time to record what they eat on a daily basis. It is due to the incomplete coverage of food database and also the hassle of manual entering the precise information of the food consumed.

“It takes too much time. And from then on you were looking for things and they were not there again. And I did not have the same thing about such difficult products. ”

“Nowadays there is a lot in it, but then you take for example half a slice of cheese, is that just not in, you just can not indicate. I think it’s a lot of hassle. Because I have to indicate the number and I have to say whether it is a gram or a cut and then I have to say what it is..”

The passion only lasts in the beginning

Some interviewees claimed a slope of the passion decline they have in keeping up the food recording. They are motivated in the first 3-4 weeks and then the passion seems to fade away because the efforts it takes and no obvious benefits out of it.

“If I start enthusiastically, then the first few weeks it goes well, and then ehhh, just the slop goes in.”

Sense of confrontation

The food record itself, no matter it is paper diary or mobile applications, creates a sense of confrontation to the user. It could be due to the fact that there are always those record of eating food that are not permitted by the dietician or commonly known unhealthy food. That also creates a sense of failure to the users, which will definitely discourage them from using it.

“You do not walk around all day with such a notebook, it is annoying, it is too confronting, it is too confronting to write it down, you see it continuously on paper, and with an app, you write it away somewhere, and then the next part of the day comes up again, and then that is another clean slate.”

“I don’t want to hear that you have done wrong, that you have failed, that you, yes, yeah I used to have already suffered from as a child. With fear of failure. Look scared of everything that I did wrong.”
Current food logging tools are solely focusing on counting calories

Some of them are realizing calorie should not be the only thing to be recorded, since you can eat very different types of food but with the same amount of calories. This fact also affects their adherence to recording food.

“Yes, and then you’re not going to fill it in at all anymore, because, and I also have something like counting yes calories is not the only thing you have to pay attention to. No, I learned that too. Their are also really very on the calories, because ooh you had eaten too many calories.”

source: www.medicalnewstoday.com
3.3 Persona

Based on the findings from the user research activities, a group of characteristics can be identified to generate a Persona as the representative for the target group. What are deemed as critical dimensions are attitude towards tracking food and expectations of food-tracking tools.

It can be recognized that the participants recruited for the user research activities belong to the "Miss the connection" type of style in self-monitoring in treatment for weight loss described in Chapter 2.2.

**Jakob**

- Age: 67
- Work Status: Retired
- Family: Partner, Children, Grandchildren
- Pension: Yes
- BMI: 32Kg/m2

"The stimulus that arises to consume more is much worse for that person than adjusting the diet."

**Personal value**

Freedom to make his own food choice at that moment
Improving health to enjoy life

**Things affect food choices**

Taste, price/quality ratio, mood and people he’s eating with

**Selection of food**

Fruit and vegetables lover, precooked food sometimes
Checking the labels of food to be aware of the ingredients

**People to eat with**

Mainly eating alone, other times with his children and his girlfriend

**Food tracking tools used**

Paper Food Diary, Eeter meter (mobile application)

**Attitude towards tracking food**

Not seeing any added value of writing down food he eats,
Not affecting his eating behavior much afterwards

**Expectations of food tracking tools**

The guidance should be much broader than the intake behaviour.
Fun thing to do, people want to actively take a part

**Technology Literacy**

Figure 3.13: Persona
Conclusion

With all the findings get from the user research activities, the conclusions were structured based on the main research questions proposed in the first chapter. How those research questions are answered will be described as follows.

**What**
- What is food informatic system?
- What are the benefits of it in managing personal health?
- What types of data are relevant and meaningful in managing food behavior?
- What are their motivations and goals in doing so?

**Who**
- What are the characteristics of this group?
- Who are also involved in managing their food behavior/health?

**How**
- How do they experience collecting and reflecting on food data currently?
- How can we make the data experience engaging?

**Figure 3-14: Structure of research formulated in the beginning of project**

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**What are the benefits of self-monitoring food?**

The benefits of self-monitoring food are the benefits of general self-tracking practices applied to food behavior. The critical part is to activate self-reactivity towards the record of the target behavior, in this case food consumption. Enabling the user who are engaged in self-tracking practice to gain more self-knowledge, it aims to aid user’s self-improvement towards the aspects they care about.

**Who are the target group?**

From the findings about the characteristics of the target group, we can conclude that they have a relatively vulnerable psychological state due to their body condition and the closely related social judgement generally received over the years. This will act as the fundamental insight as the basis for the design stage that the common strategy to motivate average people with an ideal body weight or body image should not be included here, because it will probably provoke further disappointment and anger within the target group.
How do overweight older adults experience monitoring their food intake?

The main problem is that most of the participants do not fully understand the value of tracking their food intake and they evaluate the effectiveness of tracking by checking the changes of their body weight. This might be due to the ineffective communication between the obese patients and their dieticians. Most of the interviewees fell into the “Missing the connection” style of tracking described in Chapter 2.3, who are taking recording food as a homework to passively follow and did not initiate any changes to their eating behavior afterwards.

Their perception of the food record is “Failure Report”, whose presence constantly provokes a sense of failure for themselves. The “failure feeling” is probably caused by the fact that they are not able to stick to the ideal diet plan every day as planned by their dieticians. To avoid the confrontation with the dieticians as well as themselves, they chose to underreport food that is not included in the diet plan. In addition, the current approaches to keep the food record is time-consuming and takes a lot of efforts when they need to manually enter/write down the ingredients several times every day.

Nearly half of the interviewees have mentioned the insufficient role of counting calories. Calories are probably the most pervasive metric used in weight-loss and nutrition journaling, which draws a definitive line for people’s eating and are not able to include the dimensions of the real eating behavior. Living with obesity for many years of their lives, they are developing deeper insights about what are the key points for managing their food behavior (such as mood, people they are eating with and temptations from the environment), which seems to be largely overlooked in the overall consultation with dieticians.

The influence of various factors on their food choices are mentioned during the interviews. It is mainly based on their impression and self-observation, which might lack a systematic perspective to link those influencing factors with the food they eat. Two of the interviewees are taking the initiative to come up with their own way to resist the temptation in supermarket and the susceptible afterwork hunger moments. These examples can prove the potential of the corresponding increase of self-efficacy and coping actions once the eating stimulus (external and internal influence) are recognized by target group.
04 Design Vision
Introduction

From the findings of the literature research in Chapter 2, we can conclude that self-tracking data practices are beneficial to the user by way of inspiring the use to reflect on the gathered & analyzed information of how their own body is working, and forming a feedback loop to support the maintaining of their intended behavior change. The mechanism of self-tracking practices is through tracking the data of their own body, it activates the self-reactivity towards the recorded data of target behavior, where people are adapting their behavior for self-improvement. Another aspect of successful self-tracking practices is the role of self-efficacy.

From the user research activities introduced in Chapter 3, it is found that the most fundamental reason for the target users’ disengagement is that they did not see the value of recording of their daily food intake. Furthermore, the result of their recording is “Failure report” according to their perception, further harming the motivation of adhering to the food tracking practice and could not provide actionable insights to improve their eating behavior. Last but not least, it is not about how much the user turned out to eat and the calories of the food, but what are the stimulus for them to make that food choice and consume that volume.

4.1 Approach

Reshaping the value of recording food and facilitate self-discovery

In Chapter 3, we got the conclusion that the guidance our target group received from dieticians is a “perfect and ideal” diet structure, which is unrealistic to follow in daily life and inevitably flooded them with confrontation and disappointment. Based on this, the intended self-reactivity with self-monitoring is not able to happen among our target group, and turned out to be a reversed role “regulation” harming both the experience and adherence of recording food.

From the research part we found that the current way of recording food intake (detailed ingredients and estimated calories) only gives attention to the end results of what people eat. The fact about how they arrive at eating certain food for how much under what kind of circumstances are not included in the “recording”. Nevertheless, these “neglected” aspects are exactly what the target group need to live with on a daily basis and are lacking of deeper understanding about how they affect their eating. Also, the contextual factors are easier and more natural for people to relate back to the eating scenarios in real life.
4.2 Design Guidelines

Inform the value of food tracking to target users in an effective way

From the user research, we can identify that the target users don’t acquire enough understanding about why they should monitor their food intake, as a result not aware of the benefit of doing it. It can possibly be caused by the way how dieticians are doing the consultancy. As a result, the opportunity for the new food informatics system is to convey that information to the target users during usage or before adoption.

Broadening their understanding of how they are making food choices

The frustration and self-blaming recognized in user research could be related to the fact that they are directly seeing their food choices as a result of level of self-control.

However, from the interviews we can see that there are various aspects of factors playing a role in the food decision process. The opportunity here is to integrate contextual factors to the current food intake recording, to build a more comprehensive understanding about food behavior.

Motivate & Engage them through the process

Motivation and engagement theories should be applied to improve the overall experience of doing food tracking. Considering the current available food tracking products are only emphasizing functional capabilities, there’s great opportunity to design better experience during target users interacting with food informatics systems.
4.3 Design Goal & Interaction Vision

Design Goal

Motivate & Engage older obese adults (50-65 years old) in recording their food intake and other contextual factors around it, in order to gain more consciousness and self-knowledge concerning their own food behavior.

Desired Interaction Qualities

Judgemental-free -- The food logging concept design should avoid creating the feeling of being judged for the target group, especially towards their food choices. By judgemental-free, we mean that they will not receive the “good” or “bad” judgement towards their food choices.

Engaging -- The interaction and experience of using food logging tool should be engaging for frequent use everyday, which should not be a burden for the user.

Inviting -- The design should bring inviting feeling to the user no matter it is the first time use or longer period use for the possible beneficial result.

Context of use

The intended context of use is mainly for personal use in everyday life since we would like to stimulate the target users to actively manage their health by using food logging tools. We would like to reduce the regulation effect created by the regular appointment with dieticians and provoke personal initiative from within. Focusing on personal use also gives room for target users’ reactivity to the record of their own food behavior, in the end towards improved food behavior.
In this chapter, concepts are generated based on findings from literature research and user research, as well as Design Vision formulated in the last chapter. The conceptualisation phase was definitely not a linear process, in a way that new ideas emerged along the way and the focus of the chosen concept was also adapted accompanying the understanding of the topic deepened. The main steps happened during the conceptualisation phase were illustrated in Figure 5-1.
5.1 Ideation Process

The overview of ideation phase is visualized in Figure 5-1. It is the second phase in the overall design process which connects the research phase to the design phase. The opportunities identified in the research phase are translated into “How might we” questions for the ideation workshop. The ideas generated in the personal brainstorming and ideation workshop can be found in Appendix C.

There are mainly four stages in the ideation process. Various ideas were generated in personal brainstorming and an ideation workshop with four design students. They were clustered and combined into concept directions and then selected based on how much they achieved the desired interaction qualities. After selecting one concept direction, alternatives were explored within that direction.
5.2 Concept Directions

There are two concept directions formulated in the ideation process. The first one focuses on motivating the user through the using and the second one redefines the functions of the food logging application. The details of the concept directions are elaborated in this part.

Concept Direction 1

Food service: Log a reward

This concept originates from an idea generated from the ideation workshop, which is about setting a series of goals every week to give the user motivation to keep up with using the food logging app. The concept is linking the real-life rewards with the action of logging food behavior in the app. The types of rewards are personalized to individual user and encouraging group activities instead of material goods, which is matching the insights gained from the co-creation workshop session. In the welcome page of the app, the user is invited to choose the topics they are interested in such as cooking, outdoor activities, gardening etc. Then a list of award options will be provided to the user under each topic he/she has chosen. For different award option, different period of continuous logging will be required.

Inside the app the user will be able to see their process towards the reward once he/she has chosen one of them. The user needs to log 3 regular meals and snacks per day together with other factors to go forward on the progress map. The main interfaces are shown in Figure 5-2.

The concept is employing the strategy of giving rewards for people's intended behavior.

Figure 5-2 : Concept Direction1- Log a reward
Food mission

The second concept is called Food Mission, which is built upon a strong storyline throughout the usage. It is developed from target group's confession that they have more trust in researchers than their dieticians during the contextual interviews. The insight evolves into the background story that to build the personalized food platform in the next decade, scientists are trying to gain more comprehensive understanding of human's food behavior and food profiles will be established based on typical types of food behavior. Therefore, the user will be invited to contribute to this social program by logging their food data, with the benefit of gaining more self-knowledge of their own eating and a sense of social recognition.

The concept mainly consists of three parts, logging food behavior, and food profile. Within logging food behavior part, the users are invited to not only take the photo of what they have eaten, but also select the contextual factors influencing their food choices in that situation. With the increasing diversity of their logged food behavior, the app will help them recognize the main factors that influence their food choices by giving the food profile a corresponding character. Main interfaces can be found in Figure 5-3.

The other focus of the concept is to improve the experience of logging food behavior. The main entry approach is taking photo of the food, accompanied by scanning barcode and manually searching for food items as optional choices.

The storytelling itself is a fundamental part to relieve users from the negative feeling facing the record of food they have consumed, as well as inform them the value of gaining more in-depth insights about their personal food behavior.

1. Background story of the app

3. Growing of the food profile

Figure 5-3: Concept Direction 2 -- Food Mission
5.3 Concept Direction Selection

5.3.1 User Test 1

Aim of test

Considering the evaluation purpose is for quick iteration in the process (before formal testing with the target group), the focus is on how well desired interaction qualities are achieved in the two different concept directions. The user test was intended for a casual format, which focuses on collecting insights from the participants’ feedback during the test rather than getting the results of selection out of the evaluation form. The insights from the evaluation test will be used to refine the concept and select one concept direction which achieve the desired interaction qualities to the better extend.

Preparation

Digital prototypes on smartphone
paper material for the food art mode

Procedure

Before User Test 1, pilot tests were conducted with 2 design students and 1 person with prior experience of using food recording tools. The two concepts were shown on the computer screen and their feedbacks were collected afterwards. After the pilot test, clickable prototypes were made to help participants to experience the interaction flow in a more realistic way, and evaluation form was prepared to compare how the desired interaction qualities are achieved in the two different concepts.

The two concepts were evaluated by four people individually. To begin with, the background information of the project were briefly introduced to the participants, and then they are invited to try out the main functions of the two different concepts. They are encouraged to freely give comments to any aspect of the prototype in the process and ask questions if anything is not clear to them. The evaluation form was provided at the end of the prototype test session, together with a brief interview to gather participants' extra feedbacks.
5.3.2 Results of testing

After analyzing the evaluation forms (Figure 5-5), we can see the second concept direction is meeting the design goal and interaction vision better.

The second direction aims to turn the logging action into a self-discovery journey, and focus on uncovering the personal side of each user’s eating behavior. There’s no right or wrong notion planted here, but supporting the user to gain more knowledge on what are the hidden influence they are not able to systematically acknowledge. One user can be influenced by people around more, for another emotion/mood can be the strongest stimulus towards eating. The new insights on the external influences are also important trigger for their reflection, and the good part is that this kind of reflection is not directly leading to self-blaming, but providing more actionable clues to manage the occurrence of those influence factors, and in the end manage their food behavior.

Conclusions of user test 1
5.4 Concept Development

After choosing the “Food Mission” concept direction to continue with, the main functions and concept elements were reconsidered to make the core message strong and simple to ease the understanding of the embodied value. Therefore, the main stages of using the new food informatic system are defined as the basis to further exploration within the recording phase (data input stage) and interpretation phase (data output stage).

Stages of using the new food informatic system (food tracking app)

1) The first stage is the input stage that users capture the food they eat and other four types of information that can collectively illustrate the context of their eating. So not only the results of what they ate are recorded, but also the implicit external influences of their eating are included in the recording.

2) The second stage is when the app analyses the recorded information of food together with the context information, and provide the insights to the user weekly. Here the insights of their eating are ready for interpretation and reflection.

3) The third stage is the reflection stage for the user. It can be based on the four aspects included in the input stage, namely location, people they eat with, things they are doing while eating (eating distractions) and mood.

Figure 5-6: General flow of the use of the new concept
Based on the four categories of influencing factors of eating behavior (eating companion, eating distraction, mood and location) illustrated in Figure 5-7, a small mindmap was generated for the common choices occurred in our daily eating scenes. The user interviews conducted in the research phase were also referred to include the main options within the four categories. The mindmap was visualized in the right section in Figure 5-8.

To find the basic categories of mood which can cover the main types of human mood variations, literature is reviewed. There are four mood states recognized consistently across diverse descriptor sets, time frames, response formats, languages, and cultures, which are demonstrated in the two axises in Figure 5-9. These four mood states together can cover half to three quarters of the common varieties in the mood terminology (Watson, 1988). Watson and Tellegen (1985) further proposed that within each basic mood category, it consists of several correlated but distinguishable moods. For instance, being nervous and being irritated can both belong to “energized-unpleasant” mood state. Based on this, to maintain the simplicity yet not sacrificing the nuances of the mood scale, Peter. etc (2016) include two moods for each of the four basic mood categories. The eight distinctive moods were mapped out based on the four basic mood categories in Figure 5-9.

Taking the eight basic categories of mood as the reference, they were translated into the options for measuring mood state in the concept development phase.
Figure 5-8: Mapping of the common choices under four categories

Figure 5-9: Eight basic categories of mood
In order to reduce the efforts of filling in the relevant factors on the daily basis, the first version of interface design is applying a straightforward and linear interaction style, that user could scrolling down this page and directly fill in by sliding or selecting the displayed icons.

More variations of interaction for this inputting step after taking the photo of food are explored for a more engaging and intriguing experience. A visual storytelling alternative is generated after the first version, where a vibrant illustration of the eating location is displayed as the early step to the user, acting as a virtual container based on which the following aspects filled in by the user together build up a visual eating scenario. Guided through the steps of choosing location, people they are eating with, things they are doing while eating and mood, the user could feel more intuitive and invited to record these factors together with the food photo.
Figure 5-11: Option A for data input

Option A

Data Input → Data processing → Data Representation

A

Food photo
Icons of options
Categories of factors

Food Profile
Patterns

Emerging eating patterns by category

take the photo of food

fill in the relevant factors
Figure 5-12: Details of the possible patterns of the influencing factors
Explorations of option B of data representation

Three types of ways were explored to see the possibilities of representing the analyzed results based on the rationale of the data analysis. The detailed interfaces explored here can be found in Appendix D.

Conclusion

Why a visual style is chosen after all the explorations?

1. It creates more fun and engaging experience for people to enter the relevant information of their meal

2. With the visual eating scene, faced with the options, the time users take to make a choice creates a moment for them to recall and recognize the influences (location, people, distractions, and mood) they have never noticed before. Also visualized feedback of their choices is also a way to strengthen their (possibly) weak awareness of the existing influences.
Figure 5-14: Explorations of Option B for data input and data representation
5.5 Final Concept

5.5.1 Concept Introduction

Food4U is a new concept of recording people’s eating behavior by including the four main influencing factors of their food choices, in order to uncover the implicit influences from people they are eating with, eating location, eating distractions and their mood states. It aims to provide actionable insights for the users to gain new knowledge of their eating, reflect upon the new knowledge and adapt their eating accordingly.

Simple Food Entry

The concept is taking a photo-based approach to ease the entry of food they are eating. Instead of manually entering the detailed ingredients of the food, the photo of food captures the whole picture of the eating scene, which people can easily recall based on the rich information contained in the photo.

Building up eating scenario

The process of inputting the four influencing factors was turned into an engaging experience of building up the eating scenario. The options user chooses are turned into corresponding visual elements as the collective reflection of their eating context. During the process of entry, user’s awareness of these influences will also be provoked.

Interpreting and reflecting on the results

The new insights and knowledge are provided to users through the weekly results of their logging. By checking the results by categories, the user was encouraged to reflect on how they eat differently in different location, with different people and in different moods. With long time usage, the user can manage their eating by seeing the evolution of the influencing factors.

Figure 5-15: Overview of the final concept
Figure 5-16: Main steps of the application usage
Workflow of the app

Figure 5-17: Workflow of the app
5.5.2 Key screens of the final concept

As the ideal use scenario for first time use and regular use described earlier, the interaction between the user and the concept was illustrated from the user’s perspective. Here the key screens of the final concept will be introduced in this part, from the product perspective, showing how the design of key interfaces support achieving the design goal and desired interaction qualities.

Onboarding screens: Welcome story of the new concept

The onboarding screens are the first touchpoint between the (potential) user and the new food informatic system. The value of the new application is communicated here in the first encounter with vibrant illustrations. Different eating situations are visualized here under each categories (location, people they eat with, eating distractions and mood) with questions to provoke the user to relate back to their eating experiences. Here the onboarding interfaces are used to show the first time user real benefits that will be delivered by this brand new app, instead of giving the function introduction in the traditional way.

At the same time the welcome story is also laying the foundation for the user to understand why they need to input the four types of data together with the food photo after they start using the new application. The last screen of the onboarding part is briefly mentioning what the user needs to do to track their eating behavior with the new app.
brief introduction of what the user needs to do
After the user goes through the welcome story, he/she can sign up for a new account or log in to their existing account. For the new users, they can register a new account with their email. They can set a profile photo for their account, to have a more personal feeling with the food data they input regularly.

In the account page, users can manage their notification settings, invite friends or get help on the use of the application.
When the user opens the app, the default page will be Today’s overview of food that have been logged. All the meals that have been input are displayed by the time order. The information of the four influencing factors are shown with the icons at the bottom of the food photo. The history of meals of a specific day can be checked by changing the date after tapping on Today.
Stage I Food Data Input

1. Inputting the food photo
2. Inputting the influencing factors

Here taking a photo of the food the user is going to eat is used as the main entry method to reduce the efforts of entry and more importantly to capture a visual format of food record which could support the user for later reflection. When the camera is activated, in the center of the capturing part, a reminder will appear to instruct the user to take the photo of the complete food container rather than the details of their food (Figure- 5-21).

In case of the user is not able to or forget to capture the photos of some meals, a food database is also provided for them to search for similar photos so they have the option to keep a complete record of what they eat over a period.
Inputting the influencing factors

Right after the user took a photo of their food, the app will enter the part of inputting influencing factors, which starts from the location. In this part, a visual approach is used in the way that the user is building up the eating scene in the app while they are inputting the influencing factors one by one.

The user will be given the option to directly save the photo on the interface of asking location, which means skipping entering the following context information for that moment. In accordance with that, a refill context information function is provided for each photo on the daily overview page. This skip-refill function here aims to avoid giving the user an obtrusive feeling of inputing all the information, which will probably harm the overall experience and even the long-term engagement of using.

Figure 5-22: Interfaces for inputting influencing factors
Factor 1/ Asking Eating location

“Good morning! Where are you eating at for this meal?”
Default options: #home, #restaurant, #cafe, #workplace, #train station

A gentle greeting is made based on the time when the user is entering the food, followed by the question asking the user about their eating location. Five common eating places are shown in a visual way, which are recognized from the user interviews. They can add more eating locations with the add button section on the map, such as park etc. After choosing eating location, the user will enter a corresponding interior background for the next step. In figure 5-23, it shows the different interior background for eating at home and eating at a restaurant.

Factor 2/ Asking who they are eating with

“Are you eating with someone else?”
Default options: #Alone, #with partner, #with friend, #with a group

After the eating location, who the user is eating with will be asked. This is based on the finding from both the literature and user research part that people's eating is affected by the people they are eating with. The four default options are extracted from the user interviews. When the user is choosing from the options, the instant feedback is given visually to their choice. For example, when choosing #alone, the other empty chair in the scene will be moved closer to the table, while if choosing #with partner, another person will be shown sitting in the second chair eating with the main character in the interface.

Figure 5-24 : Asking people they are eating with
Factor 3/ Asking eating distractions

“Are you doing something else while eating?”
Default options: #Watching TV, #Reading newspaper, #Using computer, #Reading books, #None

Following asking people who the user is eating with, the user will be asked if he/she is doing something else while eating. The question is an adapted way of asking the distractions of their eating. The default options of distractions here are distracted from user interviews from the user research part. Similar to Factor 2, visual feedback will also be given for the user’s choice. A Television will be added to the eating scene when the user chooses #TV, a newspaper will be added to the table next to the plate when the user chooses #reading newspaper. When choosing #none, a text bubble with “It’s great that you are quite focused on your eating” will show up on the eating scene.
Factor 4/ Asking mood

“How do you feel before eating?”
Default options: #Irritated, #Tense, #Sad, #Bored, #Calm, #Relaxed, #Excited, #Cheerful

After asking things people are doing while eating, options of mood states are provided. The choice of eight basic mood categories were described in Chapter 5.4. Here the questions were specified to ask the mood before people’s eating, considering some participants mentioned that the mood can be very different before the eating, during the eating and after eating.
Overview of the input food photo and influencing factors

After the user finishes inputting their mood, the summary visual of all the input factors will be shown before saving them to the daily overview (Figure 5-27). Encouraging words will be shown in the speaking bubble at the summary page, also as a way to facilitate the user to keep up logging continuously to know more about their eating behavior. On the daily overview page, an instant encouragement text bubble will also pop up for the user’s complete logging.

![Four influencing factors saved to the meal as icons](image1)

![Instant encouragement for user’s complete logging](image2)

Figure 5-27: Overview of the input food photos and influencing factors

Overview of weekly eating

A notification will be sent to the user on the update of the past week’s eating overview. When tapping on the notification, user will be directed to the overview page of the app directly. The setting of the notification for weekly overview can be changed according to the user’s preference in the account page.

![You eat most frequently](image3)

Figure 5-28: Notification for the new week’s results overview
When the user tapped to view details of one influencing factor (for example eating location), he/she will be shown the top three most frequent ones for eating places, with numbers of how many times they ate in each option indicated. There are also stack of photos under each eating place for the user to check all the food photos they took at that eating place.

At the right edge of each category, the color strip of next category is shown to indicate the user to swipe through the categories. At the top part of the interface, the user can also navigate through different weeks. A floating home icon is also provided at the bottom part for the user to exit the weekly overview page.
Figure 5-30: Checking the food photos
Desired workflow of use

1. Today’s overview
When the user opens the app to log the new meal, he will first land in Today’s overview page. There are two entry points for taking a new photo.

If the user wants to skip the following steps on the eating spot, he can directly save the photo for that moment. The in today’s overview page, it will be reminded to refill the context at any time.

2. Capture the food photo
User takes the photo of his dinner, and confirms the photo to go to the next step.

Figure 5-33: Desired workflow of logging a complete meal
3. Fill in the influencing factors

The user will be guided to fill in eating location, eating companion, eating distraction and mood step by step.

4. Saved to today

After filling in everything, the new food entry will be saved to today’s overview. A speech bubble will appear to give encouragement if the user makes a complete logging.
1. Receive the notification for the weekly overview

User receives the notification for the update on the weekly overview of their past week’s food logging. He/she can directly tap on the notification to enter this week’s overview. User can also check the weekly overview from the lower part of the floating buttons on the home page.

2. Check the weekly overview

Entering this week’s overview of logged food data, user was presented with the most frequent options of the four influencing factors.
3. Check by different factors

When checking the details of each factor, top three options were shown with the number of times and stacks of food photos. User could slide through different categories for quick navigation.

4. Check the food photos

By tapping on the photo stacks, user could check all the food photos under that option by days of the week. To check the filled in factors for each photo, the user could directly tap on the food photo which he/she is interested in.
Benefits of reflecting on influencing factors

From the interviews and the feedbacks from the user testing during the process, it can be noticed that people are not completely unconscious to these influencing sources on how they are eating. With different levels of consciousness of identifying the influences, it can be foreseen that different people would benefit from the concept in different ways.

For people who have never identified the influencing things from the environment and their own mood state, it would be a great stimulus for them to start paying attention to the four factors - location, eating companion, eating distractions and mood, and probably initiate the process of learning more about how their eating are influenced by them, and start to reflect on the new knowledge.

For those who have basic impression about they might be influence by one or several factors among the four, the value of the concept would be supporting them to confirm that vague impression and shed light on more details of that impression. After the confirmation, the reflection could be initiated and the concept could be used to monitor how those influences evolve with their following management.

Figure 6- X: Effect on people with different level of consciousness
In this chapter, evaluation tests were conducted for the final concept. The setup and findings of the evaluation tests were described in details. Based on that, conclusion was drawn and recommendation was given for further development in the future.
6.1 User evaluation planning

Aim and Research Questions

The aim of the user test is for validating how the final concept of new food tracking mobile application is meeting the design goal and interaction qualities generated in the design vision part. Suggestions for improving the concept will also be gathered at the end of the evaluation.

Research Questions

1. How do the participants understand the added value of the proposed new concept of food tracking tools?

2. How do the proposed concept meet the needs of the participants?

3. How do they experience the new concept of food tracking tools? (experience and usability aspect)

Environment

Home environment is chosen to be the most suitable place considering the scenarios formed for the testing.

Time duration

One hour

Setup

1. Welcome words and introduction of the project background, what food tracking apps are used for and the new concept to be tested

2. Pre-test interview: to get to know the basic information of the participant and their attitude towards his/her daily eating behavior

3. Evaluation of the four main scenarios: The participant will be introduced to four scenarios where he/she will be shown interfaces of the concept or invited to click on the interactive prototype on the digital device. He/she will be interviewed for their experience after each scenario.

4. Filling in the Experience evaluation form

5. Discussion with the user about their overall experience and suggestions

6. Closing words

Participants

Due to the difficulty of accessing the preset target group (overweight older adults) in that specific time span of the project, the final evaluation test was carried out with three participants, two of which are concerned with their daily eating aged 70+, and the other one are in the maintaining phase of weight loss, who also has earlier experience of using food-tracking applications (My Fitnesspal).
How it works in the new concept

1. Take the photo of your plate
2. Fill in the four factors that could influence your eating
3. Weekly overview at the end of the week

Introduction of the new concept

Figure 7-1: Eating scenario cards for the test
6.2 Results of evaluation

Figure 7-2: Participant A and B showing their food storage

Figure 7-3: Participant A and B during the test
The evaluation test with participant A and B were carried out in their living room setting. They are a retired Dutch couple aged at 72 and 74.

They do care about their daily eating and also sugar intake. They prefer to watch TV programs which are talking about healthy food as inspiration source to cook healthily. They mentioned several times “common sense " as a way to keep track of their eating rather than stick to diet rules strictly.

How do they respond to the different daily scenarios?

**Eat on the go** -- they would like to take the photo first and fill in the other information at the end of the day

**Eat at home** -- They may have other things to do so they will also complete the logging at the end of the day

When would they complete the logging?

**After dinner at the couch**

He will probably fill in the rest information around the time he is using the computer after dinner, which is his daily routine to read the news every night.

He used to see the dietician for a short period very long time ago to improve the intake of vegetables. So if the dietician asks them to use the new concept, they think it would be very nice to use.

Participant C gave quite elaborated considerations when asked about imagining how he would use the new concept in the six common eating scenarios. He said he would do the tracking enthusiastically for “eating ice cream in a good weather”, “eating in a restaurant” and “ordering pizza at home”. For “eating ice cream with a friend in good weather”, he thought it would be a good conversation starter and he would be curious about how his friend would put in the information. In terms of “eating in a restaurant”, he said eating companion is very relevant because he wants to know if he eats less when with 4/5 people and eat more when with 2 people or alone. "I want this app to confirm that feeling— for example, you tend to overeat when eating alone when you're eating with two people, there can be a very interesting discussion and when you get full you won't realise it; and when I get irritated at work, I might go to a restaurant to eat. "

For ordering pizza at home, he said how he ate will considerably change when he's alone or he's with two people. He said, "Before this I really won't think about it if I want to know or don't want to know, like completely unaware of that, now this app is starting a switch that I become curious about that ".

Figure 7-4: Participant C during the evaluation test
“You don’t need to enter the quantity, the weight, no, take a photograph of what you eat and that’s it. This is more sustainable, this is more fun. It’s telling you soft information that has a very big impact on how you eat.”

Participant C can be classified as pragmatic type of user, who is putting the functionalities and features of the application in the first place. He values the information he can get from the application more than the experience of using it.

“Even there is a list for me I will have the same enthusiasm. I don’t need the motivation in terms of the animations but need the motivation in terms of the features. For me I am more interested in the information.”

“There’s a problem now I realize, when I am angry I eat, when I am alone I eat, watching tv I don’t know I eat, 50 times that i don’t realise before, and people don’t realise.”

“I will become more mindful, by mindful I don’t mean I am in the meditation zone or something, ok I will know that I am eating this because I am angry. Earlier I don’t know this, now i know this, next time I am angry but i will not eat, or substitute with something else.”
Evaluation form results

Participants were invited to evaluate the product with the experience rating form at the end of the test, which can be found in Appendix X. The results of their ratings are summarized in Figure 7-6. The desired interaction qualities formulated in Design Vision part are all achieved from the evaluation form. The other qualities presented in the experience rating form are also generally met, although it shows that participants have some doubts about the level of innovativeness of the concept.

Influence of the personality of the user

The personality of the user could affect which aspects they value for using the new application. For example, the participant C puts the functions of food tracking apps in the first place, so he thinks entering the data in a list manner will provide the same value to him. We may get the conclusion that, it could be more inclusive to provide two modes of entering the data, for the user to choose from based on their preferences.

Since the idea behind the concept is to introduce a new perspective to manage eating behavior—not on the results of the food consumption, but on what forces are making them arrive at that consumption results, which is never found in the food tracking applications on the market before. It could take different levels of mental efforts for people to receive and embrace that message, providing that it does not touch people's conventional notion about calculating calories. It could take longer time for the general group to understand the benefits of tracking their eating in the new way, as the basis for adapt their eating being aware of what are driving them to eat.

Figure 7-6: Results of the evaluation form
Limitation of the evaluation test

First of all, due to the difficulty of recruiting the target user (overweight older adults) in the specific time span when the evaluation test is planned, the participants are not strictly falling in the categories of the target users. For the further development of the concept, more tests should be conducted with the overweight group.

Secondly, the evaluation test is based on short time use of the participants and they needed to imagine their experience of using the application on a daily basis, so their experience described during the test could be different from that of using for a longer period.

Thirdly, only part of the functions were tested with a clickable prototype during the evaluation. Therefore, the overall usability of the concept should be tested for further development and future implementation.
6.3 Conclusion

Self-tracking culture

From the literature research, we had two important findings about the self-tracking culture. The first one is that people apply self-tracking practices for the purpose of self-improvement and targeted behavior change based on the mechanism of self-reactivity. The self-tracked data can disclose unnoticeable patterns, trigger self-reflection and inspire action based on the feedback. The second one is the limitations of current self-tracking practices. The contexts where the self-tracked data were generated are critical for understanding and interpreting the meaning of them.

A new angle to record and reflect on food behavior

The biggest innovation point of the concept is providing a new perspective to see how people are consuming food by way of uncovering the implicit influences people are receiving from the main sources -- eating location, eating companion, activities done while eating (eating distractions) and mood. It differentiates itself from the prevalent calorie-centered approach among the digital applications on the market designed to support people in managing their eating activities.

This new design aims to suggest a new direction of reflection -- not only reflect upon isolated results of consumed food, but on what are the hidden forces that are leading to that eating result, which are constantly repeating the influencing forces yet hard for people to gather the evidences to be certain of and act upon. The critical indicator of the desired reflection being provoked or highly promising to be provoked is that people who get to know the idea behind the concept start to recall how they eat differently when they are eating with different people, with or without TV on for instance. It can be seen as a sign that they start to make new associations between food and influencing forces from the environment, start to realize what are driving them to eat for that much and that type, and possibly react upon the influencing forces rather than simply battling with their willpower over eating.

From the results of the evaluation test, we can see that the desired interaction qualities - “judgemental-free”, “engaging” and “inviting” are achieved.
6.4 Recommendation

**Broader market to reach**

Although the project starts from designing for a specific use -- during the diet consultation dieticians conduct with overweight group, there is great potential for the final concept to reach a more general user group (without extreme body conditions) who are motivated to gain more knowledge on what drive them to eat in the current way and make adaptations according to that new knowledge.

It can be a great appealing alternative especially for those who expect to use a “softer” approach to record their daily eating compared to the precise calculating style and actively manage their daily eating without a specific focus on the change of body weight.

**Integrating with Image Recognition technology**

In the current final concept, there is not yet technology used to recognize the content of the food photo captured by users. It relies on the user to interpret what they have consumed from the photo collections. In the benchmarking part mentioned in Chapter 2, artificial technology has been used in some food tracking apps to recognize the types of simple food from the photo entry. In the future, with more advanced food image recognition technology, it will extend the the value of the concept significantly if portion size, level of nutrition balance, cooking method etc are becoming recognizable from the food photos.

**Collaboration with health professionals to provide personalized feedback**

The current concept focuses on the personal use of the food logging application, without involving the possible stakeholders from the health department. It could be beneficial to collaborate with health professionals to support users to recognize and interpreting the trend of food consumption in the weekly overview part with their expertise when needed.

It can also be developed into a new format of “diet consulting”, where the focus is not to set an ideal diet plan for people to execute but to provide lifestyle adaptation skills and tips based on the rich contextual information of people's eating behavior.

**Testing with more diverse group**

Considering the final evaluation test was conducted with three participants who are not exactly falling into the chosen target group, more tests should be carried out for further validation with the overweight older adults group.
6.5 Reflection

What would I do differently?

First of all, the time and process management of the project should be improved significantly. The research phase went smooth as planned as a good start, however, from the ideation phase I was a little bit rush to form concepts which now seem too complete at that stage, without a clear judgement on all the emerged ideas.

Secondly, I will plan the process of literature research in a more defined way. In the beginning, I perceive monitoring food is the intersection of so many fields -- the management of obesity, self-tracking culture and also nutrition knowledge. I spent a lot of time and energy to understand for what purpose dietary monitoring is used with this target group, and what working mechanism lies behind the self-tracking culture etc. When I stretched the topic to this grand scope, it become difficult to connect the findings to arrive at a suitable conclusion with a proper focus for the design stage. Although it is helpful to understand the topic from the root, boundaries should be set so it won't hinder the whole progress of the project.

Thirdly, I will plan the iterative tests during the conceptualisation in a different way. The impression I hold that the mindset of the target group is too different from the ordinary people, so to avoid misleading feedback I did not conduct enough small tests to collect feedbacks on different alternatives for some design decisions.

Fourthly, I would use more paper prototypes quick and early when developing the digital interfaces. Due to the lack of experience in developing digital products and the pressure of time, I started the design of interfaces in a too detailed level, which takes a lot of time to do adjustment for later-on iteration.
Reference


Appendix

Appendix A  Contextual interview questions
Appendix B  Co-creation workshop setup
Appendix C  Ideation workshop
Appendix D  Explorations in concept development phase
Appendix E  Evaluation Test
Appendix A

Contextual interviews Questions

The contextual interviews conducted by the collaborated stakeholder HAN University greatly contributed to the findings of the user research part, so the interview questions were provided here.

Procedure: Face-to-face, in-depth and individual interviews are conducted in dutch to examine the context of food behavior and tools to report food behavior (why people eat at a specific point of time) addressed to overeating. The interviews are semi-structured and other questions emerge from the dialogue between interviewer and participant. Scenario’s about eating and reporting dilemma’s will be proposed to gain more insight in behavior. The interviews will be taped and transcribed (using a program TUD is familiar with).

Format: Interviewguide

(a) Introductory question
-- Can you tell me in what way our call to participate in this study did appeal to you?

(b) Sequence 1: About eating habits and relationship towards dieting/eating

Goal: To understand the reasons behind their food choices and allow patients to define their good and bad food choices.
-- Can you describe to me what is your relation with eating?
-- Can you focus on a particular example of this experience?
-- Can you describe a specific event or particular experience in over eating?
-- Can you describe as fully as possible how food choices are made during the day?
-- Can you refer to your last episode of eating more than you planned to/your diet allows you?

(c) Sequence 2: About tools that report eating behavior
Goal: To assess how they become more aware of their food choices and understand their trust and acceptance of the tools they are using. Here the interviewer asks TU Delft questions regarding the tools.

(d) Sequence 3: About contextual eating behavior
Goal: To understand the What and Who influences their food choice? Interviewer also ask TU Delft questions on Context + Social Context

For adult interviews only. We will be creating a social map in order to get insight into the people that play an important role in your life.
Step 1: Fill in step by step the persons that play a role in your social network who support you or influence your food intake behavior. (Think about family members, but also about you GP, or you fitness instructor)
Step 2: Write down their role/the type of relationship you have with them.
Step 3: place them in the map, close to you means they play an important role, further away means they play a smaller role.

Meanwhile, when the participant is explaining the role of the person, as questions such as:
-- Why and how do they play a role in your food behavior?
-- How does he/she influence your food choice?
-- Does he/she support you in eating healthy? How?
Appendix B

Co-creation Workshop

Setup

The eight participants were divided into two groups working on assigned persona respectively. Two personas were prepared beforehand as the material for the participants to empathize with and lower the barrier of directly talking about their own personal experience. The session consists of two parts: 1) Introduce the persona Jakob and Lieneke, and uncover things they enjoy in daily life by collective collage making within the group. 2) Select a major challenge from the quote cards, then create the ideal support for the persona to better cope using the materials in the toolbox.

Activity 1.

Instructions
Carefully examine the collage, which is representative of Jakob’s current situation. Please feel free to add/remove/change to it to make this Jakob’s persona more meaningful to you. Using words and pictures answer the following questions.
What makes Jakob happy? Why?
What is Jakob’s favorite movie? Why?
List three must-haves that Jakob takes to his dream vacation

Activity 2a.

Instructions
We now know more Jakob. Select which of this cards represent a major challenge that Jakob frequently faces.

Activity 2b.

Instructions
Using the toolbox, let’s create the ideal support for Jakob to feel better about himself and cope with such a situation. Place a picture in each category to answer the questions. Note well there are four categories in the toolbox: Learn, Support, Motivate and Do.
Imagine Jakob in the actual moment of being faced with the trigger
How we want Jakob to feel?
What does he need to learn to point him in the right direction?
What support does he need to learn that?
How can he feel motivated to learn?
What does he need to do to learn that?
How could he use that learning in the future?

When do you think Jakob would be involved in such learning?
Sometime in advance
Continuously
In the moment
Appendix C

Ideation workshop

Approach

“How might we” questions are short actionable questions to kick off the brainstorming session. The insight statements and opportunities summarized from the research phase need to be re-formulated into the “How might we” questions with a proper scope, which can not be too broad or too narrow. HMW questions usually have a specific focus or perspective for the design group to start generating ideas. Using the word “might” to start the question is to encourage the team to think of wild and original ideas which go beyond the boundaries.

How might we questions:

1. How might we turn the food tracking experience into a positive & fun one?
2. How might we recognize their efforts & reward them both in dietary modification and tracking their food intake?
3*. How might we support them in their impulsive and emotional moments?
4*. How might we connect them with people in the similar condition?

Note: The four “How Might We” questions formulated in this stage were not equally contributing to the later phase of conceptualisation. The last two HMW questions (marked with star sign) were regarded less relevant due to the evolution of focus of the design vision, as the author of this graduation project gained deeper understanding of the issue as the project carries on.

Participants

3 IDE Msc Students, 1 Architecture Msc Student
Concept Ideation

Please generate multiple concepts informed by the design challenge and the How Might We ideas
Feel free to combine ideas and let the imagination run wild!

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Results of the ideation workshop
Appendix D
Explorations in Concept development phase
Appendix E
Evaluation user test

How it works in the new concept

1. Take the photo of your plate
2. Fill in the four factors that could influence your eating
3. Weekly overview at the end of the week

brief introduction of the concept

scenario cards
Experience rating form

judgemental-free

engaging

inviting

generic
personal

boring
intriguing

useless
beneficial

traditional
innovative

obtrusive
unobtrusive