Food for Thought

Using speculative design to facilitate discussion on health and wellbeing of older adults at the height of demographic aging

Nathalie Kamp
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BSc. Thesis Creative Technology
Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS)

Biomedical Systems and Signals (BSS)
Supervisor: Dr. Femke Nijboer
Critical observer: Lara Siering

UNIVERSITY OF TWENTE.

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ABSTRACT

Demographic aging is one of the most pressing issues of our time. Within the next 20 years the ratio of older adults in our population will reach 50 older adults (65+ years) for every 100 adults of working age (15 to 65 years). One of the biggest concerns caused by this is an increased pressure on the healthcare sector. To avoid the healthcare sector getting overwhelmed, novel ways to improve the health of our population need to be found. Above all, we need to shift our healthcare's focus from treating existing diseases towards preserving health. This study aims to investigate how we can open a debate on desirable futures for technology-supported healthy aging, to support the development of such technologies. The approach chosen is speculative design, a practice that uses emerging technologies to reflect on the impact of emerging technologies. To investigate how speculative design can support the development of novel health technologies aiming at prevention, a case study on the topic of malnutrition in older adults is performed.

Older adults' motivations and struggles with eating healthy were explored in literature and personas were developed, which were then used to develop a concept for a speculative design. The developed concept is the app “Food for Thought”, realized in the form of an interactive prototype and three accompanying scenarios. Set in the year 2037, in which a big part of personal care is replaced by digital health interventions, “Food for Thought” denies its user access to all communication with their loved ones as long as they have not consumed a nutritious meal. The prototype was evaluated through interviews with an expert in the field of healthy eating for older adults, two older adults (70+) and two roundtable discussions. During the roundtable discussions the artifact and accompanying scenarios were used as a basis for a discussion on health and wellbeing of older adults at the height of demographic aging. After the discussions, the participants were asked to provide feedback on the effectiveness of speculative design, in general, and this design in particular, as a tool for discussion.

I conclude that speculative design offers great potential to support the development of novel technologies addressing the increased pressure on the healthcare sector caused by demographic aging. Through facilitating debate on desirable and undesirable futures for technology-supported healthy aging, insights were gained that can be used as a base for the development of novel technologies, as well as to reimagine current practices.

CONTENTS

CHAPTER 1 - INTRODUCTION

In this first chapter the challenge prompting my research is explained through providing context on demographic aging and its impact on the healthcare sector. This is followed by the research questions being stated. This chapter concludes with the structure of this report being described.

1.1 Context

Demographic aging, the shift of the population towards older ages, is a worldwide phenomenon. More people than ever are reaching retirement and old age due to reduced mortality. But at the same time, fertility has decreased. More people reaching older ages and less people being born causes the demographic to age rapidly [1]. Today, worldwide, people aged 60 years and over already outnumber children under 5 [2]. The Netherlands is no exception to demographic aging. The median age of the Dutch population, illustrated in figure 1, throughout the 1960s and 70s was consistently around 28 years, starting in the 1980s it increased drastically up to around 43 years in 2020 [3]. Over the next 30 years this number is predicted to increase at a slower speed than previously, reaching a media age of around 47 in 2055 and only slightly increasing after [3].

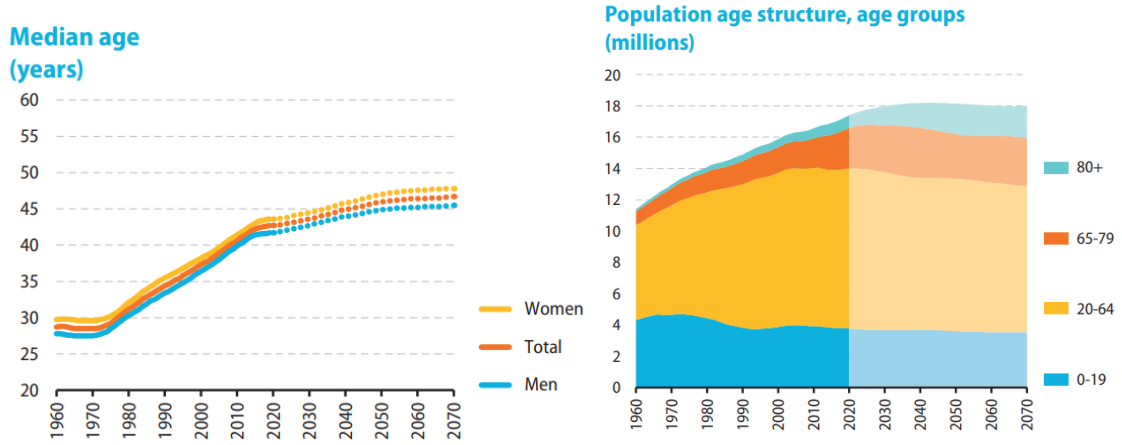


Figure 1. Median age of Dutch population from 1960 to 2070 (left) & population age structure (right) [3]

One of the main concerns raised by demographic aging is an increased old age dependency ratio, the number of older people in retirement (over 65 years) compared to the number of people of working age (15 to 65 years) [1]. As shown in figure 2, this ratio is predicted to increase drastically over the next 20 years [3], which will influence various sectors of society, one of which is the healthcare sector. As the covid-19 pandemic has shown, capacities of our healthcare system are too low to meet an increased demand. A population with a high number of older adults, living with a higher risk of chronic diseases, cannot solely rely on healthcare that treats existing diseases. It needs new approaches that focus on preventive measures in order to reduce the pressure on the healthcare system.

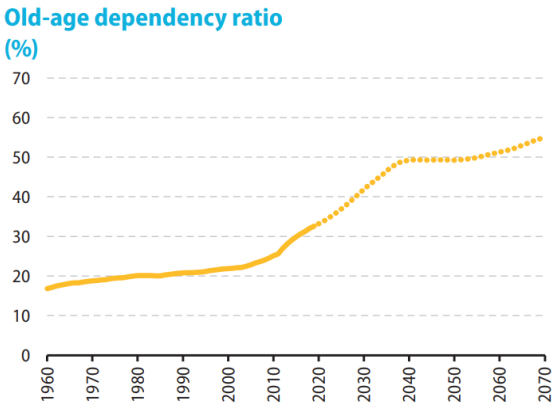


Figure 2. Old-age dependency ratio for the Netherlands [3]

To avoid the healthcare sector getting overwhelmed, the way we think of health and care needs to be reimagined. One possibility would be to use more technology. Emerging technologies have great potential to take pressure off the healthcare sector. Those emerging technologies and their potential can be explored through speculative design, a design method that concerns itself with designing for possible futures, in a thought-provoking way [4]. Speculative design can provide a starting point for renegotiating the healthcare system through exploring its social, legal and ethical dimensions.

In this project we use speculative design in the case of healthy eating. Specifically, the challenge of this project is to explore the future of healthy eating for older adults through designing a speculative artifact. The artifact will depict a future in which society addressed demographic aging and the pressure it puts on the healthcare sector through preventative measures that keep older adults healthy through supporting them in maintaining a healthy diet. Through the artifact, such a future is made tangible. The ultimate goal of this artifact is to facilitate discussion on topics of health and wellbeing of the older population in a time of demographic aging. These discussions could then be used by researchers and designers to explore our societies wishes and fears about the future and support them in making design decisions during the development of new technologies.

1.3 Research questions

At the start of this project, a core research question was defined as *"How can speculative design be used to develop design requirements for the design of positive health technologies supporting healthy eating in older adults?"*. In order to gather enough insights to answer this question, The following sub research questions need to be answered.

Sub-RQ 1: How does aging influence eating behaviour and what consequences does this have for an older adult's health?

Sub-RQ 2: What types of interventions can be taken to address malnutrition in older adults?

Sub-RQ 3: What is speculative design and what benefits does it offer compared to traditional design approaches?

After completing the research phase, in which the sub-questions were addressed through literature research, the initial main research question is adapted to incorporate the findings. The new main research question is "*How can we facilitate discussion on ways to prevent malnutrition in older adults through healthy eating, to support the development of future technologies, using speculative design?*"

1.4 Structure of the Report

The following report consists of eight chapters, of which the first seven, with an exception of chapter three, correspond to the six phases of this graduation project. The first chapter introduced the problem at hand and the general approach in the form of the derived research questions. In the next chapter, corresponding to Phase two of this project, extensive background research in literature, as well as the state of the art on related technologies is presented. Next, in chapter three, the methods employed in this research are discussed. After that, chapter four provides insights into the ideation process. Following that is chapter five with the specification process. Next, chapter six explains the realization process and introduces the final prototype. In chapter seven, the evaluation of the developed prototype is explained. Finally, chapter eight draws a conclusion on the work done and answers the research questions, as well giving an outlook on future work.

CHAPTER 2 - BACKGROUND RESEARCH

After defining the challenge of this graduation project as exploring the future of healthy eating in older adults in the context of demographic aging through speculative design, background research on the topic is performed. This chapter starts by presenting findings of literature research on topics of healthy eating in older age, effects of aging on eating behaviour, malnutrition, and ways of addressing malnutrition. Next, speculative design is researched on its benefits and uses in healthcare research. Lastly, the state of the art on technologies aiming at preserving health in older adults as well as speculative design is described.

2.1 Literature research

Before moving to the Ideation phase and developing a concept for the speculative artifact, literature research on the topics of healthy eating in older age and speculative design is conducted. This is done to gain an understanding of the underlying issues concerning healthy eating in older age and to investigate how to approach these through speculative design.

2.1.1 Healthy eating in older age

The World Health Organization (WHO) defines a healthy diet to consist of at least 400g of fruits and vegetables per day, no more than 10% free sugars, no more than 30% fats, with a preference for unsaturated fats, and no more than 5g of salt [5]. For the most part dietary recommendations for older adults are not much different from recommendations for adults in general. Though some suggest a reduced energy need in older age due to reductions in lean body mass and muscles and a more sedentary lifestyle [6]. Other sources argue that nutritional needs can increase in older age due to a need for more protein in order to maintain abilities and fight infections [7]. To combat this the consumption of nutrient-dense foods, such as fish, lean meat and soy products is recommended to ensure a sufficient nutritional intake [7]. Additionally, it is recommended to eat 5 to 6 smaller non-fatty meals over the course of the day, as opposed to the usual 3, to increase variety in food intake [7]. Older adults are also recommended to drink a lot of fluids [7].

2.1.1.1 Effects of aging on eating behaviour

The recommendations mentioned above are based on the fact that aging has various effects on eating behaviour. These include physical changes to an aging person's body that restrain the ability to eat certain foods, medical influences such as side effects of certain medication or disease, and social factors such as loneliness or significant moments like widowhood or retirement.

The body of an aging person is undergoing a variety of physical changes that can influence the person's eating behaviour and energy intake. These changes result in an altered nutritional need due to changes in lean body mass, physical activity, and intestinal absorption [6]. Sarcopenia, the loss of skeletal muscle mass and function, as well as cachexia, the involuntary loss of fat-free mass such as muscle, organ, or tissue, are natural occurrences in an aging body and display a risk to the general health of the aging person [8]. These need to be combated by maintaining a healthy diet, however there are several physical effects of aging that make that difficult for older adults.

For one, aging causes gastrointestinal changes such as an increase in hormones that induce satiety and decrease appetite [7]. Reduced saliva flow has a similar effect by slowing down peristalsis, muscle contractions in the digestive tract, causing the older adult to feel sated faster and consequently stop eating prematurely [8]. Research has also shown that the induced satiety is not sensory-specific, meaning that the older adult feels no decreased desire to eat the same food again and again [7], resulting in reduced variety of nutritional intake. Changes in the gastrointestinal tract also often lead to digestive problems. Gastric acid and pepsin secretion decreases, which makes it harder for the body to metabolize certain nutrients such as vitamin B12, iron and protein [8]. Additionally, reduced saliva production increases constipation [8]. These digestive problems cause older adults to avoid hard to digest foods and eating much in general.

Another factor influencing eating behaviour in older age is decreased oral health. Tooth loss and decreased occlusal strength, common occurrences in older age, have a significant influence on the variety of food eaten by prompting older adults to chew longer and avoid hard to chew foods, such as meat, raw vegetables, and nuts and to chew longer [6, 7]. Similarly, many older adults struggle with dysphagia, a difficulty swallowing, due to reduced salivary flow [6, 7, 8]. This leads them to blend or otherwise modify food to make it easier to swallow, which again reduces the variety of food by favouring cooked over raw meals [7]. Another effect of blending the food is that it looks less appetizing which declines appetite [7]. In conclusion, reduced oral health in older age results in reduced food intake and less variety and thereby a deficiency of certain nutrients.

Aging also results in decreased sensory perception. Reduced ability to taste and smell, both through natural and medically induced causes, significantly increase the risk of malnutrition in older adults [8]. Loss of other senses such as visual or auditory perception might also limit the ability of older adults to prepare nutritious food and eat independently [6]. In general, decreased sensory perception leads to a lowered interest in food related activities such as cooking [7] and reduces food enjoyment and variety [8].

Besides physical changes and the person's health status, medical factors can influence eating behaviour as well. Certain diseases and medications are shown to have a negative impact on the appetite and thereby food intake of the patient [6, 7], as well as reducing sensory functions [8]. Refusing to eat is a common issue in patients with Alzheimer's [7]. It is often associated with difficulties swallowing, changes in appetite and preference and feeding difficulties [7]. Significant moments in an aging person's life, such as the onset of dementia or other diseases can also negatively influence eating behaviour [7]. These medical breaking points disrupt the life of the patient significantly and can lead to the adaptation of unhealthy eating habits [7].

Social factors also play a role in influencing the eating behaviour of an aging person. Similarly, to medical breaking points, there are also social breaking points that can disrupt the life of older adults and have a negative effect on their eating habits [7]. Examples of significant moments in the social life of an aging person include widowhood and retirement.

Studies have shown that people on average spend less money on food after retirement [7]. Widowhood often leads to the consumption of less home cooked dishes and more frozen or premade ones, as well as less variety in meals consumed [7]. Widowhood, and aging in general, is also often linked to loneliness [6, 7]. Eating alone reduces food enjoyment and consequently lowers calorie intake [6, 7]. Other social factors such as shopping environment, the marketing of healthy food, social support, and the availability of community-based food events, are not necessarily unique to older adults but can also have an impact on their eating behaviour [6]. Lastly, dependence also plays a crucial role in food intake in older adults. Moving into a nursing room means giving up a part of independence and ability to choose what to eat [7], which can result in lowered interest in the meals.

Effects of Ageing	Resulting Behaviour
Decreased hunger & increased satiety	Eating less, stopping to eat quicker
Decreased oral health (saliva, strength, teeth)	Avoiding hard to chew foods (raw vegetables, meat…)
Decreased sensory functions (smell, taste)	Less variety in food choices, less food-enjoyment, less interest in food-related activities (cooking…)
Digestive problems	Avoiding hard to digest food
Social factors (e.g. dependence & loneliness)	Reduced interest in food-related activities, eating simple meals
”Breaking points” (e.g. widowhood & onset of disease)	Various (e.g. less home-cooked meals, reduced food-enjoyment…)

Table 2.1 Overview of effects of aging and their resulting eating behaviour

Generally speaking, it can be said that due to physical limitations that come with aging, as well as disruptive moments in the life of an aging person, a high number of older adults experience overall less food enjoyment which leads them to consume a small and unbalanced diet, which ultimately leads to malnutrition.

2.1.1.2 Consequences of malnutrition in older adults

The above mentioned effects on eating behaviour, leading older adults towards less variety in their meals and overall reduced food intake, put them at a high risk of malnutrition. Malnutrition is characterized by an overall state of poor nutritional status, including under- and overnutrition and leads to overall poor health as well as chronic diseases [8]. As such, it is one of the leading threats to health, autonomy, and well-being of older persons [7]. Malnutrition is commonly associated with poor appetite, insufficient dietary intake, loss of weight, both in muscle mass and fat, reduced hand grip strength and fluid accumulation [6, 8]. Nutrient deficiencies can cause various health risks. They can cause or worsen the older adults' frailty and functional limitations [6, 7] and increase the need for hospitalization [7]. A deficiency in Vitamin B12, which is most common with institutionalized older adults, puts them at risk for cardiovascular disease and reduced bone density, which leads to more hip fractures [8]. Deficiencies in Vitamin D and calcium have similar effects on bone density,

putting them at risk of Osteoporosis, as well as delaying healing and recovery [8]. In conclusion, malnutrition can significantly affect the quality of life of an aging person [7].

2.1.1.3 Interventions against malnutrition

Research suggests various approaches for preventing malnutrition in older adults. The WHO argues that it requires the involvement of multiple sectors and stakeholders such as the government, as well as the public and private sectors [5]. Traditional approaches to address malnutrition include supplementation of vitamins and other nutrients [6 ,8] and dietary modifications towards a more balanced or nutrient-dense diet [8]. Other approaches focus on the underlying causes of malnutrition in older adults, by fostering independence in community dwelling adults [4], improving meal context or overall food enjoyment [7]. Addressing malnutrition though meal context includes changes to the social and physical context in which meals are consumed. In the social context, shared meals are suggested to improve food enjoyment [7]. The physical context of meals can be improved by adjusting the location in which the food is consumed. Studies show that the energy intake in a restaurant is higher than in a canteen and dementia patients eat more in a room with good lighting and table setting contrast [7]. Other modifications that could be made include adding music or smells to improve overall ambience [7]. To improve food enjoyment, literature suggests addressing sensory dimensions such as texture, flavour and aroma [7]. Simple changes such as placing condiments on the table or adjusting texture based on the older adult's wishes are shown to increase food intake [7]. There were also experiments done to add additional flavour to a meal to combat age related loss of taste, but the results of those were inconclusive [7].

In conclusion, there are four ways to address the problem of malnutrition in the older population. On the one hand the traditional approaches of supplementation and dietary modifications. On the other hand, one could also address the underlying issues by improving meal context or food enjoyment. However, holistic changes, as needed to improve the underlying issues, are often hard to implement due to the need to involve multiple sectors.

2.1.2 Expert Interview

In addition to researching the topic of healthy eating in literature, a short semi-structured interview, as described in chapter three, with the coordinator for eating and drinking at livio was conducted. During the interview the expert confirmed the findings in literature. The expert confirmed that the reduced ability to smell and taste that often comes with aging has a negative influence on an older adult's eating behaviour, as found in section 2.1.1.1. Similarly, are loneliness and dependence common factors that keep older adults from following a healthy diet.

Further, the expert explained how their department focuses on increasing food enjoyment in their inhabitants, one method of addressing malnutrition found during literature research in section 2.1.1.3. They do that through encouraging people to eat together and through including them as much as possible in decisions. For example, in their cafe the inhabitants can give their input on what snacks they would like to see in the future. Older adults who struggle with or forget to eat are supported by caretakers and encouraged to eat in a shared space together with other inhabitants. The expert judges it especially important for this to happen in smaller groups where the caretakers can pay more attention to the individual people. Further, they always cook fresh and avoid ready-made meals.

2.1.3 Speculative design

Speculative design is a design practice that concerns itself with reflecting on current developments in society and technology through envisioning the future those developments

can lead to. It is closely related to design practices such as critical design, discursive design, design probes and design fiction [4]. All these practices make use of prototypes to make the envisioned future, or alternate present, tangible. The main purpose of speculative design is to “facilitate a more desirable, responsible path into the future" [10] through enabling discussion on current and future practices. The created speculative futures can be used in a practical manner, to test potential products or services before they exist [4] or to initiate change on a societal level through opening debate on “potential, ethical, cultural, social, and political implications” of emerging technologies [11, p.47]. But speculative design can not only be used to reflect on future developments but also to rethink current practices. Through the creation of alternate presents, which make use of current technologies but use them in the context of different ideologies, current practices can be questioned, and change can be initiated [4].

2.1.3.1 Benefits compared to traditional design methods

Speculative design was chosen due to the benefits it offers compared to traditional design methods. Traditional design methods are bound by external constraints such as technological limitations, laws, or social taboos. Those constraints become especially apparent when used to research ambiguous contexts such as future healthcare [10]. In the case of this project, implementing holistic changes such as improving meal context or food enjoyment often require the approval of multiple sectors (laws, retirement homes etc.). Speculative design can make an impact on the way we conceptualize healthy eating in older age, without the developed prototype needing to be actually usable. Instead of being reactive (to laws, society structures etc.), speculative design allows for proactiveness in shaping the future [10].

One key benefit of speculative design is that it is free from judgment, the designer does not try to impose their ideology on the viewer, and as such is free to explore positive but also negative futures that do not need to be socially acceptable [11, p.51]. Further, allows speculative design its users to suspend belief by removing it from the context of the present and adding a new context to view the design in [10]. Lastly, being removed from the commercial sector gives designers the freedom to create controversial designs that initiate debate among its viewers [4]. These debates can not only be used to initiate change on a societal level but also in research through design. Research participants can be confronted with possible futures through the means of speculative designs to get deep insights into their feelings about current and future practices [10].

2.1.3.2 Successfully using speculative design

The most important requirement for successfully using speculative design to facilitate discussion is the careful management of the speculation [4, 12]. Different from science fiction, the designer should be careful not to speculate wildly but instead base the speculation on logical trajectories of emerging technologies [4]. Another way to ensure the developed concepts are plausible is to carefully examine certain trends over time and to consider how similar developments played out in the past [12]. Designers should be careful not to alienate viewers. If an artifact is for instance set too far in the future that could cause the audience to feel unrelated to it [4]. The same goes for creating alternative presents, most rules of the alternative world should be the same as ours to maintain familiarity for the viewer [4].

Research further suggests that using the right word to describe the design at hand plays an important role in how it is perceived [4]. A designer should carefully consider what word they chose to explain the artifact to its viewers. The word “fiction” for example indicates that the artifact is not real, while the word “probe”, as in “fiction probe” indicates the relation of the artifact to research. Using words such as “critical” inform the audience of the goal of

the artifact to start a debate [4]. Auger [4] judges the word “speculative” to be ideal because it makes clear the connection between the existence of the design and the present.

2.1.3.3 Uses of speculative design in healthcare research

Applications of speculative design in research are spare but the ones that do exist suggest that speculative design can be a useful tool to gain insights into stakeholder needs.
One application of speculative design found through literature research is in the development of a field study research tool for researching diabetes type 2 [13]. In the case of Hoang et al. [13] speculative design was combined with co-creation, the practice of involving stakeholders directly in the design process, to research how speculative design can be used to do research through design. The result of this research was a fiction probe in the form of an interactive storybook about living with diabetes. The speculative part of it is achieved through the creation of an alternative world in which healthcare is conceptualized differently than in the real world. It was created to be used by researchers together with people with diabetes to gain insights into their motivations and struggles [13]. This research showed that speculative design can be used in healthcare research to support field research.

2.1.4 Conclusion Literature Review

Reviewing related literature on the topics of healthy eating in older age and speculative design, has greatly enhanced understanding for the underlying problem to address in this project and provided starting points for the ideation phase of the design process. Literature on healthy eating for older adults and the effects aging has on eating behaviour was consulted to determine the main problem to address in this project. This problem was found to be malnutrition, one of the leading threats to an aging person's health. It was examined how malnutrition can be addressed and chosen to focus on improving the underlying issues through improving meal context and overall food enjoyment in older adults. Next, these findings were confirmed through an interview with an expert in the field of healthy eating for older adults. Lastly, the main method employed in this project, speculative design, was examined based on the benefits it offers compared to traditional design practices. It was concluded that speculative design can be of great use to develop new ways of arranging healthcare, free from restraints such as technological limitations, policies, and social stigmas.

2.2 State of the art

Before a concept or design can be developed it is crucial to examine the state of the art of existing products and learn from their strengths and weaknesses. As this project aims to develop a speculative design about the future of healthy eating in older adults, the state of the art consists of both existing health technologies for older adults and speculative designs on related topics such as aging and health. Due to a lack of health technologies focusing on healthy eating in older adults specifically, other preventative health technologies, for older adults and more general target groups, as well as technologies supporting aging in general are included.

2.2.1 Health technologies (for older adults)

There are several health technologies on the market, but few focus on older adults specifically. In this section an overview of currently available technologies to stimulate healthy eating in general and for older adults are examined. Due to a limited catalogue of said technologies, it was chosen to also include technologies that support older adults and aging in general, but the focus here remains on solutions targeting healthy eating. The

products in this chapter are selected based on their target group and variety in approaches. As the technologies differ quite a bit from each other, they are not compared among each other, instead each technology is accessed individually.

2.2.1.1 Digital Companions

There are a few digital companions on the market, similar to google home [14] or amazons alexa [15], that focus on helping older adults age in place. One of them is “ElliQ” [16], a voice operated social robot that provides empowerment and companionship to older adults aging in place. It offers a great variety of services in the fields of Entertainment, Health, Social connections, and daily activities. In the domain of Health specifically, ElliQ does daily check-ins, reminds its user of doctor appointments, helps them set, track and reach their health goals through providing physical activity videos and assesses their general health.

Figure 2.1 ElliQ, digital companion for older adults

Another example of a digital companion for older adults is “Tinybot Tessa” [17], which similarly aims to support independent aging. The main difference is that Tessa is designed to be used in cooperation with a caregiver, who can control her via an App. Another key difference is her design, while ElliQ looks like a Robot, Tessa is designed to look like a human. Tessa's functionalities are also limited compared to ElliQ, she cannot operate independently, instead she needs to be given tasks by the caregiver. In general Tessa is more focused on assisting the caregiver than being a companion to the older adult.

Figure 2.2 Tinybot Tessa

The main advantages of digital companions for older adults are their focus on older adults and their individual needs and their potential to reduce pressure on care facilities. Tinybot Tessa claims to save two hours of work for its caregiver while providing round the clock support for the patient. Setting the focus on companionship and assisting in daily life can have great potential to promote healthy habits and support aging in place.

2.2.1.2 Nutrition Measurement Apps & Smart devices

As for technologies that focus on the issue of malnutrition there exist a few smart devices and Apps supporting the general population in tracking their nutrition intake. Smart Nutrition Scales, such as the one from Renpho, while not necessarily designed with older adults' needs in mind, can be used to address problems of malnutrition in older adults that age in place. The same can be said about Nutrition Tracking apps such as “Fooducate” [18], which not only tracks nutrition intake but also provides community and recommendations for healthy eating.

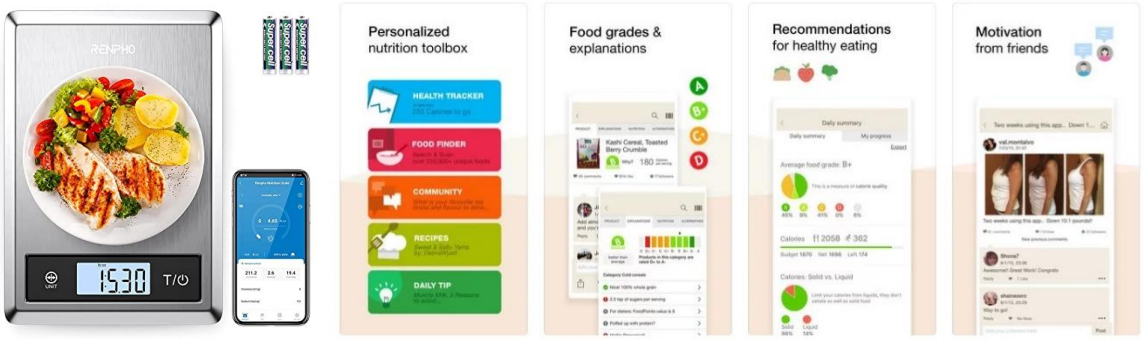


Figure 2.3 Renpho Nutrition scale & Fooducate App

2.2.1.3 Plate checking AI research

This product is not yet developed but was included anyways due to a lack in solutions focusing on older adults and healthy eating. Canada's University of Waterloo, Schlegel-UW Research Institute for Aging, and University Health Network are working on an artificial intelligence system that can assist nursing homes in tracking the nutrition intake of their residents [19]. The system gets information on the type of food and photos of before and after meals from the care professional and based on that provides information on the nutrition intake and predicts malnutrition.

Figure 2.4 Example of before and after photos taken by the system

2.2.1.4 Smooth foods

Biozoon in Germany [20] developed “seneoPro”, a range of powder mixes for smooth foods for older adults that struggle with eating due to chewing or swallowing difficulties. The foods are developed to be easy to prepare by staff in nursing homes or family members.

Figure 2.5 Example of a smooth food meal

2.2.1.5 Conclusion state of the art - health technologies

Few technologies actively address healthy eating in older adults, but there are some technologies that can be used by older adults to support them in aging and nutrition intake. All of the found technologies focus on increasing or measuring the food intake by the older adult, none of them focus on improving meal context or food enjoyment. This is where there is room for my project to add to the existing state of the art and dress the problem from a different angle.

2.2.2 Speculative Designs about Health & Aging

As the literature review on speculative design identified this approach as valuable to address the problem of demographic aging, the state of the art must also include speculative designs

addressing topics of health and aging. One can find a wide range of speculative artifacts speculating on a future on the height of demographic aging. Each of the speculative artifacts below was chosen based on its relation to the topic of this graduation project and the insights gained from investigating it. Various approaches, both technological and societal are included.

2.2.2.1 E.chromi

E.chromi [21] is an example of how real emerging technology can be used as a base for speculating about its future uses. The underlying technology here was developed in 2009 by undergraduate students of Cambridge university, and consisted of genetically engineered bacteria that can produce a variety of colours, visible to the naked eye. They used BioBricks, standardized sequences of bacteria, from existing organisms and inserted them into the bacteria, to let them produce colours. In combination with other BioBricks, the bacteria could be programmed to detect certain components and indicate this by changing the colour.

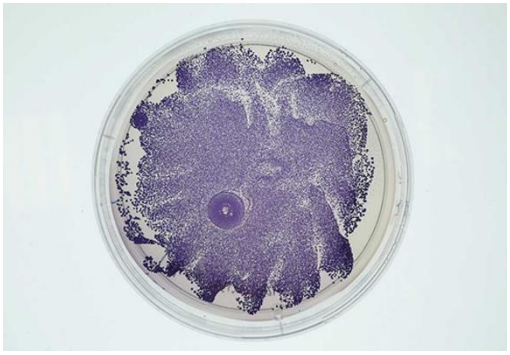


Figure 2.6 Example of E.chromi bacteria colouring a sample

Shortly after first results were produced, designers Alexandra Daisy Ginsberg and James King speculated on future uses of this technology. They created a timeline showing how this technology could develop over the next century, from being used to detect ground water contamination in 2010, over companies being able to patent colours in 2049, to pollution mapping bacteria in the atmosphere to tell citizens when it's unsafe to go outside in 2069. In 2039 the bacteria could be used as cheap personalized disease monitoring. Ingested through yogurt, the bacteria colonize the gut and produces a specific colour if they detect a disease which will be visible after digestion.

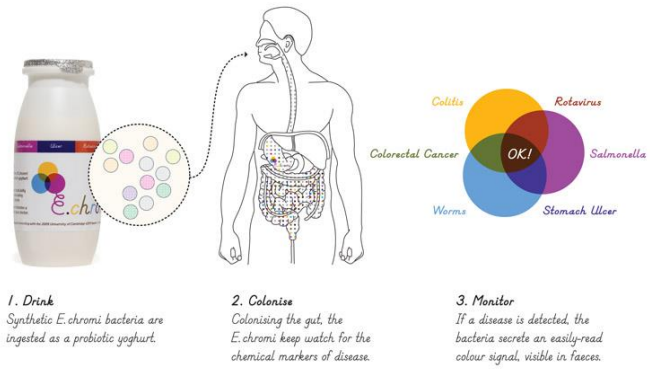


Figure 2.7 E.chromi speculative use case

This project shows how useful it can be to start speculating early on in the development process. Collaborations between researchers and designers in early stages of development can help greatly to assess the potential impact of the tech developed, positive and negative, and steer its use in the right direction. This artifact in particular shows how the E.chromi technology can be used to reduce the weight on the healthcare sector and thereby addresses the same underlying problem as my graduation project, which makes it a useful source of insights into practicalities surrounding the design process. For one it shows the potential of speculative design, when used in combination with emerging technologies, to make the potential use of these technologies tangible. For my own project I will also focus on integrating emerging technologies into the design process. As for how to approach the speculation process, Ginsberg and King, show that it could be useful to take smaller steps instead of immediately jumping 50 years into the future.

2.2.2.2 Health / Water / Light

The exhibition “Gezondheid / Water / Licht” [22] at the Dutch design week 2021 explores an approach to keep citizens healthy in a world at the peak of demographic aging. Developed by Studio Marleen van Bergeijk and Studio Sociaal CentraaI, it proposes health as a civic duty within a neighbourhood. This speculative future is set in the year 2034, on the peak of demographic aging, where every citizen uses health and vitality insurance, focused on keeping them healthy rather than treating their illness. But not only is being healthy a citizen's duty, it is also a shared responsibility of society. There are special neighbourhoods designed to monitor and maintain its inhabitants' health through chips implanted in its inhabitant’s bodies. Within these neighbourhoods there exist community health hubs in which the chips can be scanned, and the status of the inhabitant’s health goals can be accessed. If health needs to be improved, the system can link the person with a buddy.

Figure 2.8 Community health hub exhibition

This is a project that is closely related to the topic of my own research, focusing on health in a world with an older demographic. As such, it provides a lot of insights into speculating about health systems of the future. The VitalGezond neighbourhood focuses on improving health, rather than treating illness. It places the responsibility within society instead of focusing on one sector or the individual person, which is an approach that is shared by many speculative designs in the field of healthcare. Further, the installation is scenario based, an approach I will implement as well in my final artifact, making it possible for the viewer to fully immerse themselves in this proposed future. This design also supports the conclusion made in section 2.1.3 to avoid speculating too far into the future, by placing it only 13 years in the future. Lastly, the scenario links the future to the present by mentioning current events such as the heightened pressure and consequent untenability of the health system during covid-19.

2.2.2.3 Negentropic Landscapes

The student winner of the 2021 Core77 Design Awards [23] “Negentropic Landscapes” reimagines community structures to support aging within the community as opposed to apart from it in hospices and care facilities. It aims to challenge the current systems which treat aging and death as disposable. It proposes a community-led hospice model, having all age groups of society work together. As such, older adults are for example in charge of attending the gardens and helping in childcare. Everything in this neighbourhood is interconnected, high school students build cremation urns from clay found in the community’s rivers and burial pods are used as fertilizer. Death plays an integral role in this community structure, it provides advanced facilities in which older people can plan and prepare for their death, relatives can take active part in cremation and children are early on taught about death as a natural consequence of life, teaching them empathy.

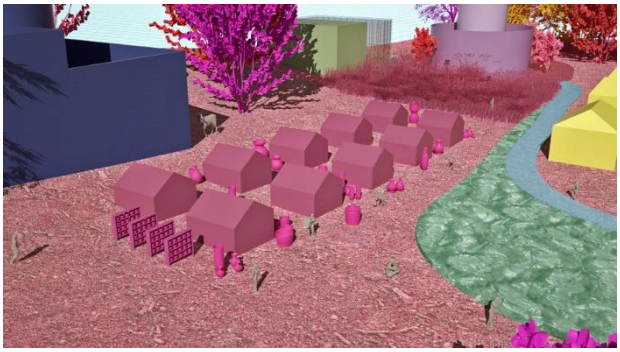


Figure 2.9 Negentropic landscapes render

This speculative design provides insights into how the restructuring of current practices is necessary to approach modern challenges such as demographic aging. A similar approach can be used in the context of this graduation project, restructuring the way meals are consumed in a nursing home for instance. The designers involved in this project made use of a negentropic framework to design in opposite to current practices, which is an interesting approach to consider in this project as well. The project was also created in co-creation with experts in the field of death, supporting the importance of including people in the design process.

2.2.2.4 Afterlife

Designed in 2009 by Auger Loizeau, “Afterlife” [11] aims to provide tangible proof of life after death in the form of technology that allows for the electrical charge of a deceased body to be converted into a battery that can then be used to power whatever the deceased or their relatives wishes. Using the battery in a meaningful product can provide comfort to the deceased and their relatives. This artifact is based on the shift in belief systems from organized religion to science and facts based and aims to facilitate debate. While at first being perceived as highly morbid, it was slightly adjusted in later exhibitions to focus on the question of what one would like their battery to power [11], shifting the conversation towards the meaning of life rather than life after death. The choice of what to use the battery for is a deeply personal one, examples include light sources for comfort or objects related to the deceased interests. Another question raised is how often the battery should be used, saving its energy for special occasions or using it daily during the grieving process.

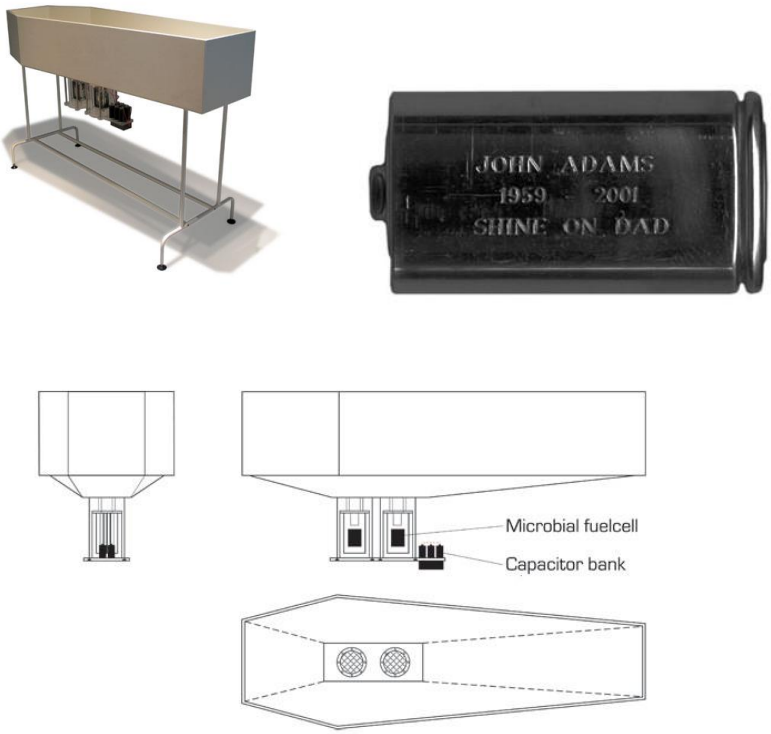


Figure 2.10 Illustration of the afterlife battery

The afterlife battery is a more artistic approach than the projects discussed above. Nonetheless, it provides meaningful insights into designing around sensitive topics such as death and aging. When aiming to spark conversation it is important to contain the controversy associated with the artifact to a necessary minimum, not to distract from the underlying question that it aims to ask. It shows the importance of how an artifact is presented to the public.

2.2.2.5 Conclusion state of the art - speculative design

Through reviewing the state of the art on speculative designs on topics of health and aging a variety of installations were found. Current problems such as demographic aging and a shift in the way we view death, together with emerging technologies often functions as a base for designers to speculate on possible futures and question current practices. The research showed the potential of speculative design in combination with emerging technologies to make the path that novel technologies can lead us on tangible. Through providing a base for discussion of the future, speculative design could be used to specify requirements of novel technologies. To test the hypothesis that speculative design can be used in combination with emerging technologies to support the development of novel technologies, this project conducts a case study. The case study consists of designing a speculative artifact based on an emerging technology, that will be decided on in the iteration phase, that addresses malnutrition in older adults through changing meal context or improving meal enjoyment.

2.3 Conclusion background research

The background research has provided many important aspects to base this project upon. The main problem to address is found to be malnutrition in older adults. This underlying

problem of malnutrition, that will be used as a base for this project, is reduced food enjoyment in older age. The approach to address this will be through changing meal context or improving food enjoyment, based on the outcomings of the ideation phase. The method of speculative design was researched and found to be a valuable approach to addressing the problem through making it tangible. Speculative design will be the main method employed in the design process. The state of the art research exposed a lack of solutions for malnutrition in older adults specifically, which will be addressed by my project, as well as inspiration for speculative designs related to health and wellbeing.

CHAPTER 3 - METHODS AND TECHNIQUES

In the following chapter the various methods utilized in the design process of this graduation project are described. It starts by discussing the main method of speculative design. Next the creative technology iterative design process is explained together with the various methods employed during its four phases.

3.1 Speculative Design

The main method employed in this research is speculative design. Its definition and benefits are discussed in chapter two. This section aims to further specify in what way speculative design will be used in this project. There are two directions speculative designers can take: alternative presents and speculative futures [4]. Their relation to the here and now is illustrated below in figure 3.1. This project will concern itself with designing for speculative futures, designing for a possible future based on logical trajectories of current developments in technology.

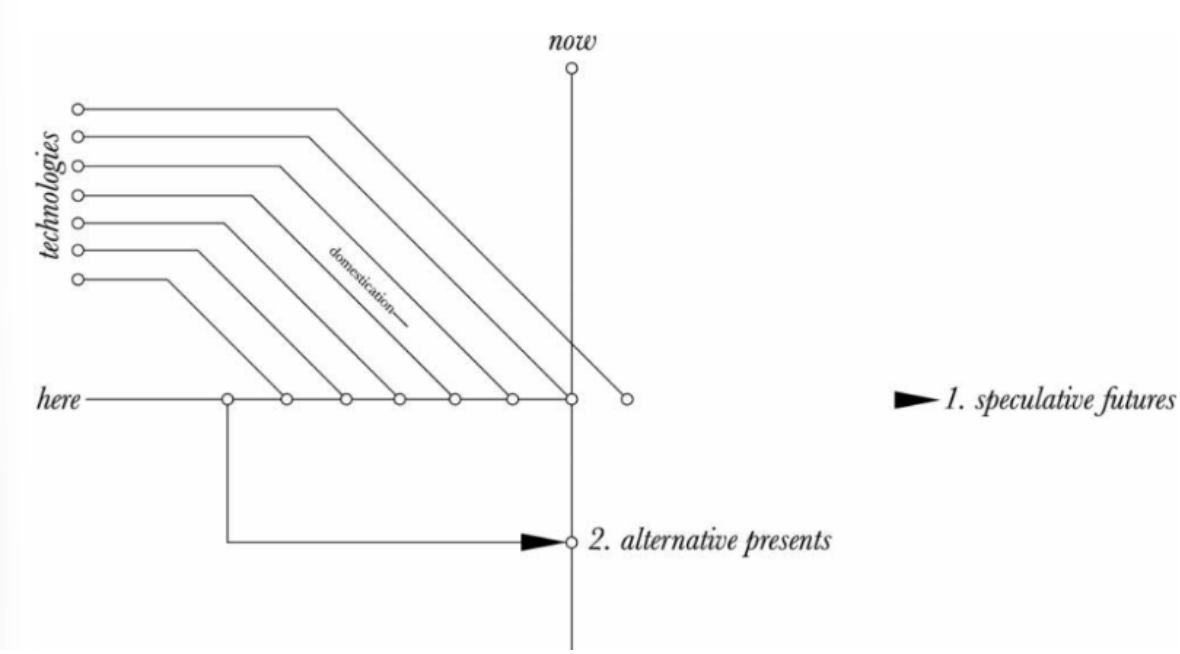


Figure 3.1 Speculative futures and alternative presents and their relation to the present [4]

Within speculative design there are more methods to use, as illustrated below in figure 3.2. This project will make use design fiction and critical design, and thereby lie inside of speculative design and art in the ven-diagram below.

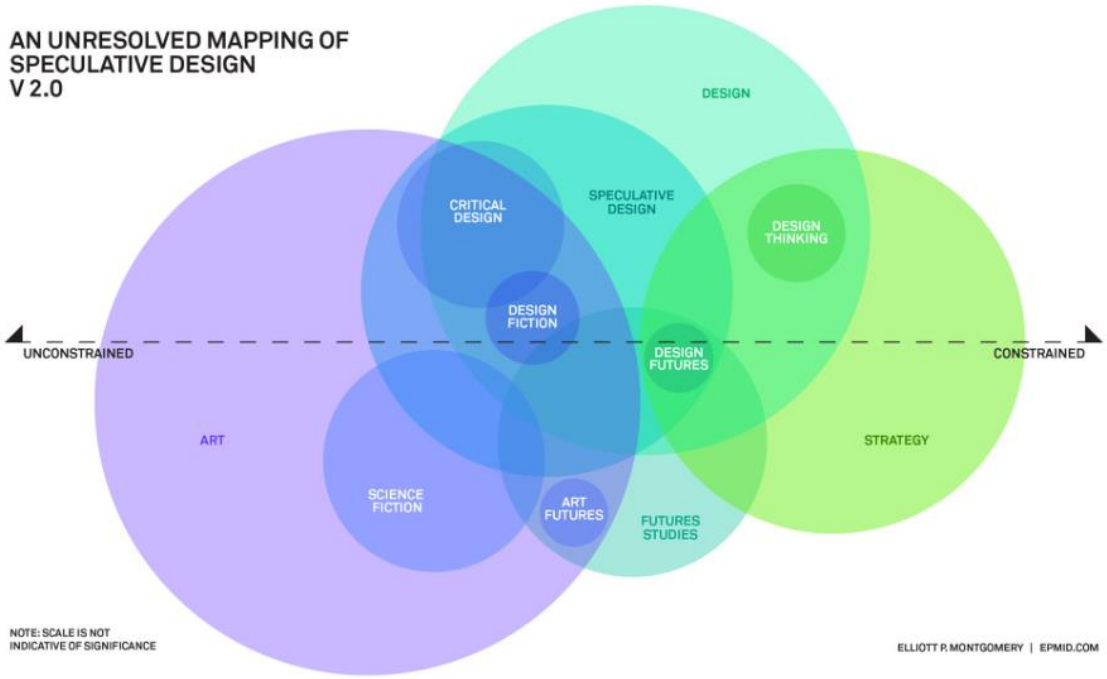


Figure 3.2 an unresolved mapping of speculative design [24]

3.2 Creative Technology Iterative Design Process

This thesis is written for the bachelor of creative technology. Creative technology is a multidisciplinary field based on Information and Communication Technology, combining aspects of design as well as engineering studies. Mader and Eggink [25] define the goal of Creative Technology (CreaTe) as, to improve the quality of all aspects of daily life. Fittingly, the aim of this graduation project is to improve the daily life of older adults by stimulating healthy eating.
A core principle of the CreaTe philosophy is to explore novel uses of existing technologies, as opposed to developing new technologies. The design material used can be anything related to technology, from wearables to new media. In the case of this project, the technology explored for novel uses is artificial intelligence.

The CreaTe design process is structured in 4 phases (see figure 3.3): Ideation, Specification, Realization and Evaluation, all producing intermediate results that are carried to the next phase and all being iterative in themselves. In the case of this Graduation project these phases are preceded by problem analysis and background research. In the following, the four phases and the methods employed within them are discussed.

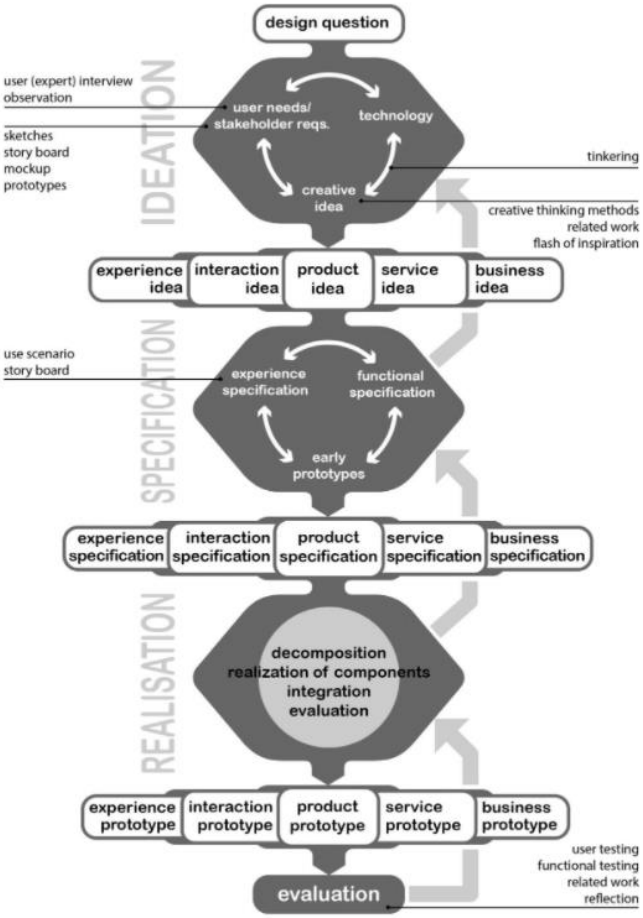


Figure 3.3 CreaTe iterative design process

3.2.1 Ideation Phase

The first phase in the Creative Technology iterative design process is the Ideation phase. Here the intermediate results of the first two phases of this project, the problem statement and background research, are used to develop a first concept of a solution for the problem at hand. During the ideation of this project three personas of older adults were developed based on the findings in the literature research. Through these personas a deeper understanding of the target audience was achieved. In the next step, the personas were used in a brainstorming session with a group of fellow CreaTe students. This session resulted in three concepts, out of which the most promising was selected and carried over to the specification phase.

3.2.1.1 Personas

Personas are a way to develop deeper understanding for a certain target group, older adults in this case. Based on examples found in literature [26] three personas of older adults were developed. Each persona consists of the same parts: a quote summarizing their persona, personal details, information on their interests, health status, diet and meal enjoyment, and short explanations of their motivations, pain points and context in which they consume meals.

3.2.1.2 Brainstorming

To generate ideas for a speculative design addressing the problem stated in the first phase of the research (see chapter one) through the means found in the literature research (see chapter two), a brainstorming session was held. This session was conducted with a small group of three creative technology students. The session was planned to be bigger, but a limited number of participants was available. To provide the participants with insights into the target audience they were provided with personas as described in the previous section.

3.2.2 Specification Phase

In the Specification phase, the second phase of the CreaTe design process, the ideas derived during ideation are translated into a loop of first concepts and prototypes. The various aspects of the concept, such as design, software and electronics are explored, and design requirements are defined.

3.2.2.1 MoSCoW Method

The MoSCoW prioritization method [27] is used to sort requirements based on their importance. Every requirement is categorized in one of four categories below.

Must have: minimal requirements the prototype needs to meet
Should have: requirements that should be met but are not strictly necessary.
Could have: requirements that would be ideal to have but are not necessary
Won't have: requirements that will not be met within this project

3.2.2.2 Functional & non-functional requirements

The requirements set for the final prototype are further classified as functional (FR) or non-functional requirements (NFR) [28]. In the case of this project functional requirements are used to describe requirements that are related to the functionality of the prototype, such as which components it consists of. These requirements can be tested without users, during a functional evaluation. Non-functional requirements are requirements that are related to the performance of the prototype, such as whether it functions as a good conversation starter. These requirements are tested with users during a qualitative evaluation.

3.2.3 Realization Phase

During the Realization phase, the third phase of the CreaTe design process, the results of rapid prototyping during the previous phase are used to develop a final high-fidelity prototype.

3.2.3.1 User Scenarios

To accompany the artifact and provide context on the world it is set in, short user scenarios were developed [26].

3.2.4 Evaluation Phase

The developed prototype is evaluated based on functionality, requirements set in earlier phases and through user testing during the Evaluation phase, the final phase of the CreaTe design process.

3.2.4.1 Semi-structured interviews

To evaluate the prototype two semi-structured interviews are performed. One with older adults and one with an expert for healthy eating for older adults. Semi-structured interviews consist of predetermined main questions and are open-ended [29]. Through the open-endedness of the questions points for discussion are found that then prompt further questions.

3.2.4.2 Roundtable discussion

The prototype is further evaluated through two roundtable discussion sessions. Roundtable discussions are sessions of two or more participants that come together to discuss a certain topic [30]. There is often no strict agenda, instead there are conversation topics. The discussion is lead by a person who is well versed in the topic that is up for debate. Tips on how to facilitate a successful roundtable discussion include keeping clear focus on the topic, starting with warmup questions, and giving each person the same opportunity to speak.

CHAPTER 4 - IDEATION

After concluding the background research on the topic of healthy eating in older age, the results of that phase are used to ideate on a concept for a speculative design. The main topic for this design to address was chosen to be malnutrition, as this was found to be the leading threat to an older adult's health. The concept should describe a way in which malnutrition could be prevented in the future through novel approaches such as improving food enjoyment and meal context, as described in chapter 2. It was further paid attention to including emerging technology as a basis for the concept, in order to keep the design relevant and realistic. In the following chapter the ideation process is described. It starts with the development of three personas of older adults, that were then used in a brainstorming session, which resulted in three concepts for this project. After describing the three concepts, the process through which one of the three concepts was selected is described. The result of this phase is a concept for a speculative design that will be carried over to the specification phase.

4.1 Personas

In order to make the effects of aging on eating behaviour more tangible three personas were developed, as described in chapter three. They were each given typical characteristics that were found during the literature research in chapter two. These personas are developed to be used throughout the creation of the prototype, starting with functioning as help for the designer and participants of the brainstorming session to empathize with older adults and get familiar with their situations. Later, during the Specification and Realization phases, the personas are adjusted based on the concept chosen and used to develop use scenarios of the design fiction. The personas developed are Joke, Ton & Sieglinde.

Persona 1: Joke

Joke, 74

> Retirment has been the best part of my life, I enjoy every second of it.

Personal Details

Marital Status : married for 55 years

Living Situation : shared apartment with husband in an apartment complex for older adults with shared community room

Family : one daugther and one grandaugther, weekly visits

Interests

Books | Cooking | Card games

Health Status ●●●●○

Joke is a very active person in her community, meeting her friends almost daily. She doesnt do sports anymore but walks most places. Her sigth is decreasing, so she started wearing reading glasses.

Diet ●●●●◐

Joke eats a balanced diet, but her new dental implant makes it hard for her to chew harder foods, such as nuts and meat, so she has started to avoid them.

Meal Enjoyment ●●●●●

Joke enjoys the food she cooks for herself and her husband, but she especially enjoys eating out with her friends.

Meal Context

Joke cooks daily dinner for herself and her husband. They eat together at the dining table while talking about their day. For lunch Joke often visits the nearby cafe with her friends from the appartment complex. After lunch she and her friends often play card games while drinking tea or coffee. When her daughter and granddaugther come to visit they often bring cake with them, which they eat in the living room, talking about their life.

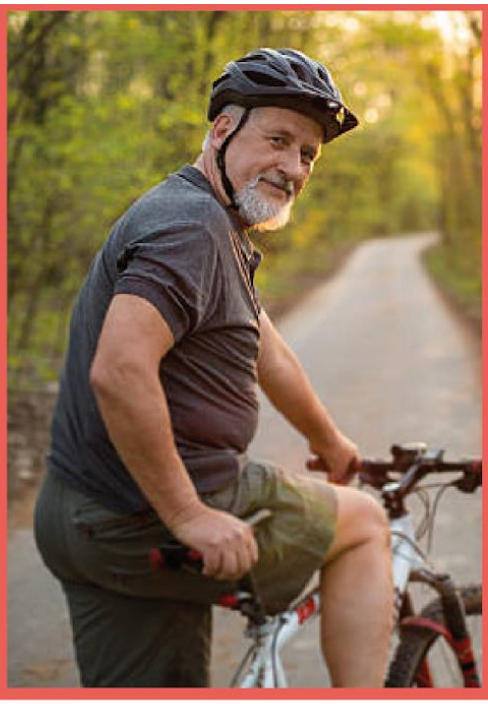
Motivations

Joke enjoys living surrounded by other people her age. She has made many friends who motivate her to stay fit. The weekly visits of her daughter and pregnant granddaugther also motivate her greatly. She looks forward to holding her first great-grandson in her arms and watch him grow up.

Pain Points

Joke knows that she is growing older and is no longer able to run after a toddler. She fears on missing out on forming a deep connection with her great-grandson due to her physical form.

Persona 2: Ton



TON, 67

> My wife used to cook for us, with her gone I dont like eating alone, so I avoid it.

Personal Details

Marital Status : widowed for 6 months

Living Situation : recently moved into apartment complex for older adults with shared community room and kitchen

Family : one daugther, lives 2 hours away, visits on holidays and his birthday

Interests

watching TV

Nature

Cycling

Health Status ●●●○○

Ton has always been active, going on daily walks and cycling most weekends. He continues to go outside at least once a day, but often lacks the energy to walk. Lately, he has been feeling very lonely.

Diet ●●○○○

Tons diet consists mostly of ready-made microwave meals. He often buys those in bulk.

Meal Enjoyment ●○○○○

Ton no longer enjoys eating, he just eats because he is hungry.

Meal Context

When his wife was still alive they ate every meal together. His wife was a passionated cook and put big emphasis on eating a balanced diet. Now, Ton avoids eating as much as possible. He doesnt like cooking as it reminds him of his wife. He lost all structure in his meals, eating ready-made microwave meals whenever he is hungry. He rarely eats at the kitchentable anymore, most of his meals he eats infront of the TV to avoid the silence of eating alone.

Motivations

Ton spend many summers cycling, both in the netherlands and on holiday, often joined by his daugther. Ton still enjoys cycling but doesnt have the energy for it as the moment. His daugther knows this and, even through she would not say it, she misses cycling with him. He would like to get his energy back to go on another cycling trip with his daugther

Pain Points

Ton doesnt like eating alone and he doesnt enjoy cooking, as it reminds him of his wife. He knows that the apartment complex he lives in has a shared kitchen but he is reluctant to go there, as he has not made any friends yet.

Persona 3: Sieglinde

Sieglinde, 81

> "I miss my family but I did not want to be a burden to my daugther."

Personal Details

Marital Status : widowed for 11 years

Living Situation : has been living in a retirment home for the past 6 years

Family : one daugther, one granddaughter and five great grandchildren. Visit every two weeks.

Interests

Botany

Knitting

Family

Health Status ●●○○○

Sieglinde spends most of her time alone, in her room. When her familiy visits they sometimes take a walk together, but walking gets increasingly difficult for her, tiring her out.

Diet ●●●○○

Sieglinde eats what the cooks in her retirement home serve her but rarely finishes her plate due to feeling satieted quickly.

Meal Enjoyment ●●○○○

Sieglinde finds the food in her retirment home acceptable but rarely really enjoys it. She misses the times when she was in charge of her meals.

Meal Context

In Sieglindes retirment home meals are served at the same time every day. Back when she lived on her own with her husband she cooked whenever she felt like it, Sieglinde misses this freedom. Meals are served in the dining room, together with the other inhabitants. The other inhabitants often engage in vivid conversations but Sieglinde stays mostly quiet.

Motivations

After her husband died, Sieglinde lived alone for a while, in an apartment next to her daugthers, but soon became dependent on the help of her daugther. After her daugther offered Sieglinde to move in with her she drew the line. She never wanted to be a burden to her family, so she decided to move into a nursing home. She always looks forward to the next visit of her family.

Pain Points

Sieglinde misses her independence and longs for the time when she lived close to her daugther and could eat together with her. The inhabitants of her retirement home are all friendly to her but she has not made any real friends.

4.2 Concept generation

After gaining further insights into the target audience and their struggles with healthy eating, the next step is the generation of several concepts addressing the problem of malnutrition in older adults. First ideas were generated during a brainstorming session with fellow CreaTe students. These ideas were then used to arrive at three concepts for a speculative design. Lastly, one of the concepts is selected based on a number of criteria.

4.2.1 Brainstorming

Together with a small group of three CreaTe students a brainstorming session was held to come up with a first idea of a design fiction. The brainstorm was based on the results of the background research conducted in chapter two and subsequently on increasing meal context and food enjoyment but, to allow for a variety of ideas to form, not limited to it. To allow the participants to emphasize with the target group of older adults, the personas developed prior were used to inform the participants on the struggles older adults face when it comes to eating healthy. The results of the Brainstorm can be seen in the form of a Mind Map in Figure 4.1.

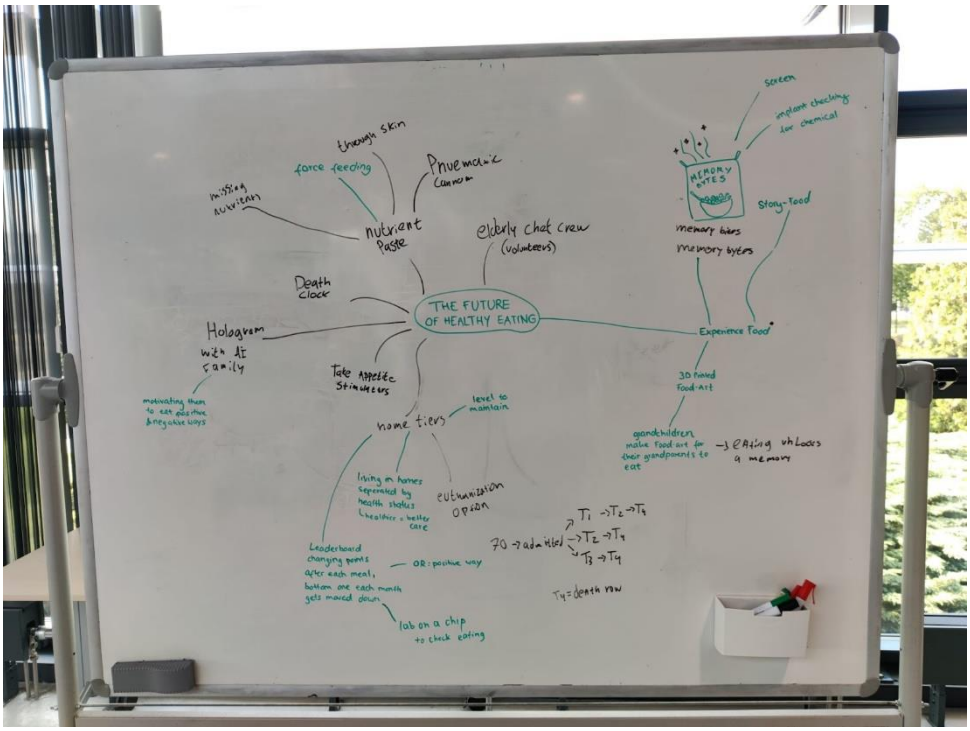


Figure 4.1 Brainstorming Mind Map

4.2.2 First Concepts

The brainstorming session resulted in many ideas for this project, out of which some were more grounded in the here and now, while others were based further in the future and often rather controversial. All ideas were inspected again and used to develop three possible concepts, as described below.

Idea 1: health as a requirement for healthcare

- Having different tiers of nursing homes that you get sorted on based on your eating behavior (trial period where food intake gets monitored before moving in)
- Food intake is monitored through implanted chip → data collected and viewed by insurance company
- Chance to rise up or down a tier at the end of each month based on data collected
- Leaderboard hanging in public room at retirement home, everyone can see who is doing good and who isn't
- The higher up the better the care provided
- Topics addressed: data privacy, healthcare sector
- Emerging technology: lab on a chip, internet of things

Idea 2: MemoryBytes

- Addressing malnutrition and loneliness in one
- Either Implant in teeth or AI can detect if food was consumed and then unlocks a message from family or a nice memory on a screen or in an app
- Extreme: you don't eat healthy, so you don't get to have contact with your loved ones (you don't see the messages they send you)
- Emerging technology: lab on a chip or AI

Figure 4.2 Sketch of Idea 2

Idea 3: 3d printed foodart made by grandchildren

- Older adults have 3d printer in their home, relatives can use an app to scan the drawing of a child into the app
- Older adults receive the 3d-artwork printed using high-nutrition material
- Interesting structures and motivation through grandchildren
- Food via mail, also from other older adults or staff
- "hacking" the 3d printer to get unhealthy food
- Emerging technology: 3d printing (food)

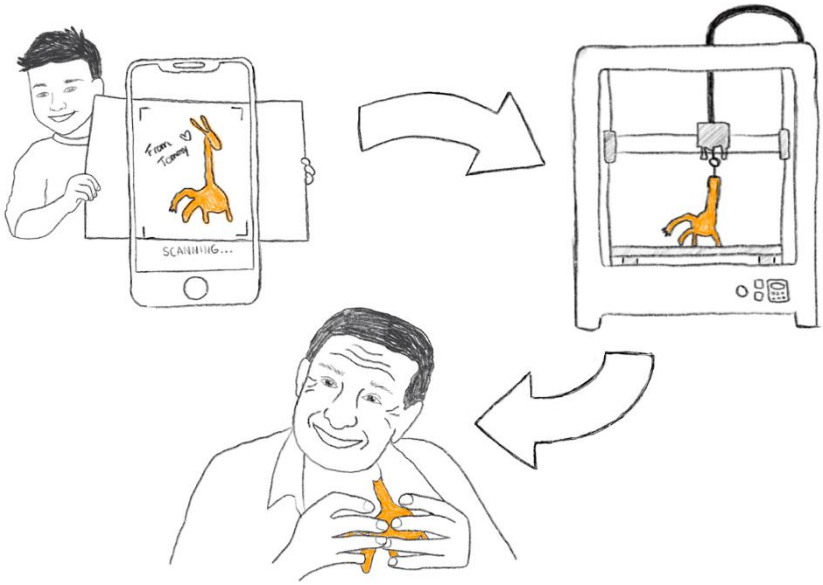


Figure 4.3 Sketch of Idea 3

4.3 Selection

After arriving at the three concepts described above, the final selection was made. The selection was made mainly in discussion with a fellow student of creative technology. But feedback of the supervisor, who preferred the controversial nature of idea 2, was considered as well. The discussion with the other student was based on the question of “how does this concept relate to the goal of my project and what kind of conversations does it start?” This resulted in three criteria that were ultimately used to select the final concept.

1. Potential to start a conversation on topics related to healthy eating in older adults that gives insights into the populations fears and wishes for the future and prompt positive change in the way healthcare is conceptualized
2. Considering the stand of the technologies utilized in the three concepts, how realistic is the concept?
3. Feasibility of translating the concept into a tangible artifact within a bachelor graduation project

The first criteria and the question “What conversations could this prototype prompt?” was discussed in detail. During this discussion it became apparent that Idea one has the biggest potential to ensure conversation on the way healthcare is conceptualized today and should be in the future. It allows for a very critical design, critiquing and addressing current hot topics such as data privacy, and questions such as “How do we want to treat our elderly?” and “Whose responsibility is it to keep people in retirement homes healthy?”. Idea two, especially in its most controversial version (denying access to memories or messages until a healthy meal is consumed) was also found to have potential to start relevant discussions. Some discussion points predicted to arise from this concept are “How far can healthcare go to keep us healthy?” and the topic of loneliness in older adults. Idea three is less controversial and more a fun exploration of how an emerging technology can be used in the future. If this idea was to be chosen it would need to be worked out further to allow it to be more controversial, to say more about current or future healthcare practices.

One of the most important requirements for speculative design to be successful is that it needs to be based in reality, making this the second criteria for selection. The three concepts are investigated based on their underlying technology and how realistic it is for those technologies to become reality within the next 30 years. All three concepts can be imagined using real emerging technologies that all show potential to impact our lives in the future. The underlying technology of idea one was found to be realistic, as well as flexible, as the measuring of older adults' health can be achieved through various means (AI, implants, smart devices…). However, an increase of data privacy laws, resulted in this concept being judged as less realistic than the other two. Idea two was found to have the biggest potential as it could be based on one of the emerging technologies found in the state of the art research, an artificial intelligence that can analyse an older adult's nutrient intake based on photos of the meal (see chapter 2.2.1.3). Idea three seems promising as well. 3D printing with edible material is still in early stages of development and far from being adapted on a grander scale but we can already see some applications in gourmet restaurants.

Lastly, criteria three, the feasibility of making the concept tangible in the form of an artifact was taken into consideration. Here it was concluded that all three concepts are made tangible with relative ease when using the means of a detailed scenario in combination with a simple prototype. All three ideas include a form of digital application (a leader board, an app that blocks family contact, an app to scan and send artworks), that could be made tangible through the means of a mix of wizard of oz and programming or digital mock-ups. However, the most feasible is idea two based on its simplicity and main concept being the app itself.

Considering the points discussed above, the discussion resulted in the decision to opt for Idea two, due to its potential to start conversations on the topic of responsibility for health, malnutrition, and meal context. While Idea one had potential to do this as well, Idea two was found to be more meaningful to address through technology and more based on a specific emerging technology.

4.4 Conclusion Ideation Phase

The goal of this phase was to gain insights into the target audience and explore the potential of emerging technologies to address the problem. For this purpose, personas were developed that reflect various problems older adults face when it comes to eating healthy. Based on the developed personas a brainstorming session was held, resulting in three concepts that were worked out further. Lastly, the most promising concept was chosen. Idea two, denying access to memories or messages of loved ones if the user does not eat healthy, is worked out further in the Specification phase.

CHAPTER 5 - SPECIFICATION

The focus of this chapter lies in specifying the concept chosen in the previous chapter in preparation of developing a prototype in the next phase. The prototype in the following is defined as consisting of two parts: (1) an artifact and (2) a descriptive scenario. The artifact is specified through design and technological specification, while the descriptive scenario is specified through the concept specification.

5.1 Concept Specification

As described in the previous chapter, idea two, initially called “MemoryBytes” was selected. In the following that concept is further elaborated through specifying the idea and the

descriptive scenario used to accompany the artifact. This section is used in the realization phase as a basis for the development of the descriptive scenario.

5.1.1 Idea Specification

The initial idea, as stated in chapter 4.2.2, is further elaborated in preparation of the realization phase. The extreme version of that idea, where contact with loved ones is blocked by the system until the older adult consumes a nutritious meal. First and foremost the concept aims to address avoiding malnutrition through motivating older adults to eat healthy. It does that through means of changing the context in which meals are consumed, as was defined in the conclusion of chapter two. An older adult no longer just eats to stay healthy but to keep contact with their family. The family of an older adult was found to be one of their biggest motivators, as illustrated in the personas in chapter four. This is exploited in this speculative concept to force older adults to eat healthy. The speculative design was given the name “Food for Thought”, as a nod to its use as a tool for debate and to refer to the concept of eating in order to get the messages (or thoughts) of loved ones.

Concretely, the concept is a digital application that blocks all incoming messages from the people registered in the system. Who gets registered is discussed together with the caregiver of the older adult and the people who get blocked. All incoming messages, no matter through which apps they are sent, of those people are now blocked until the older adult performs a certain task. Those tasks include consuming a nutritious breakfast, lunch, or dinner. Each time a meal is consumed the older adult needs to scan their plate before and after consumption to get approved by the system. The older adult is responsible themselves for eating healthy and feels direct consequences if they don't. If they refuse to eat and thereby miss out on messages, meaning they cannot reply as well, they might risk estrangement from their family. The system does not account for the older adult cheating, so the ultimate responsibility for their health still lies at the older adult themselves. The family however also plays an active role in supporting the older adult to eat healthy by sending them messages in the form of text, photos, video, or audio. The app can be used by older adults living in any living arrangement but is mostly intended for people living on their own or in an apartment complex for older adults.

5.1.2 Scenario Specification

As discussed in chapter 2.1.2.2 a careful management of the speculation is essential to a successful speculative design. As such, the world the concept is set in should not be too different from our current world, as the viewer otherwise might feel alienated by the concept, which would limit the insights that can be gained through using the artifact in a research setting. For one, the artifact should not be set too far in the future. For “Food for Thought" the year 2037 was chosen. 15 years in the future is a realistic time period for both the technology to be developed far enough to be widely adopted by healthcare and for demographic aging to have been addressed by politics and the healthcare sector.

Apart from not wandering off too far in the future, it is also important to base any changes in society illustrated in the described future, on logical trajectories of current developments. As such, the covid-19 pandemic was chosen to be included in the context, as a starting point for a reformation of the healthcare system. In the future described, the healthcare sector reacted to the unmanageable demand observed during covid-19, by implementing digital health interventions. These are meant to increase the health of the (older) population and prevent diseases and the need for treatment. They replace big parts of personal care for older adults and thereby manage to lift some pressure off the healthcare sector. One of these digital health interventions is “Food for Thought”.

As discussed in chapter 2.1.2.2 the underlying technology should be based on a logical trajectory of current emerging technologies as well. This is achieved through basing “Food for Thought” on an artificial intelligence (AI) found in the state of the art research of

this project (chapter 2.2.3). This AI is intended to be used by caretakers in retirement homes to track the nutrition intake of their inhabitants. “Food for Thought” in the context described above, describes one possible way in which this technology could be used in the near future.

5.1.3 Conclusion concept specification

The final concept is an app called “Food for Thought”, set in the year 2037, in which a big part of personal care is replaced by digital health interventions. “Food for Thought” denies its user access to all communication with their loved ones as long as they have not consumed a nutritious meal. The concept is based on a real emerging technology of an artificial intelligence made to analyse older adult’s nutritional intake.

5.2 Requirements

As described in chapter three, the MoSCoW (Must have, Should have, Could have, Won't have) prioritization technique is used to develop and sort requirements of the prototype. Additionally, the requirements are sorted into functional and non-functional requirements, as explained in chapter three, as preparation for the functional and qualitative test during the evaluation phase. The requirements are sorted below in table 1.

No.	MoSCoW	FR or NFR	Requirement
1	Must have	NFR	The artifact must focus on **starting a conversation** on the topic of healthy eating and malnutrition for older adults.
2		NFR	The prototype must be experienced as **adding value** to the conversation
3		FR	The artifact must be **tangible**
4		FR	The prototype must consist of an **artifact accompanied by a descriptive scenario**
5	Should have	FR	The scenario should be accompanied by a **visualization** of some sort
6		FR	The artifact should be **interactive**
7		NFR	The prototype should be **controversial but not too triggering**
8	Could have	FR	The artifact could be accompanied by a **video** depicting a scenario in which it is used
9		NFR	The prototype could be utilized in the research of **BSS** or **moccia**
10		NFR	The prototype could be **displayed in a retirement home over a longer period** in order to investigate how it impacts the people living there and what conversations it starts later on

11		NFR	The prototype could also be used to **address loneliness** in older adults
12	Won't have	NFR	The prototype won't **address issues unrelated** to the health of older adults.
13		FR	The artifact won't be **fully functioning** and as such won't be **linked to any real people**

Table 1. Requirements sorted using MoSCoW

5.3 Design Specification

As the prototype is to be evaluated with older adults, it should be designed for them. In the following it is described how the design of the prototype is chosen to accommodate for the needs of older adults through the use of text and colour.

5.3.1 Use of text

“Atkinson Hyperlegible” is a font developed by the braille institute to ensure “greater legibility and readability for low vision readers” [31] The font is originally developed for readers with low vision but is also suitable for older adults, who often suffer from visual impairment caused by aging. The font ensures maximum readability through increasing character recognition through consisting of distinct characters. A demonstration of the readability of this font can be seen below, in figure 5.1.

Figure 5.1 Demonstration Atkinson Hyperlegible font

Next to choosing the right font it is also important to consider the size of the text displayed. When designing interfaces, such as apps, for older adults it is recommended to choose bigger font sizes. A minimum size of 16px is recommended [32]. Whenever possible, but at least in the case of buttons and titles, this is taken into account when designing the final prototype.

5.3.2 Use of colour

Next to the appropriate use of text, colour and contrast are important to ensure maximum clarity and readability. With aging comes a reduced sensitivity to contrast in colour [33]. It is therefore important to use contrasting colours whenever displaying text or important elements. Colour confusion increases with older age, the most common one being red-green colour blindness [33]. Further, vision was found to yellow with age, causing older adults to struggle with distinguishing green and blue [33], so combining those should be avoided. To accommodate for the effects aging has on vision, the final prototype uses a simple colour palette with the main colour being a calm blue, as can be seen in figure 5.2.

Figure 5.2 Colour palette used in final prototype

The blue was chosen because it is calming while still providing high contrast to white (and black when used in different shades). To complete the design of the prototype, various shades (see figure 5.3) of the main blue were used. The lightest two shades were used as backgrounds for black text to increase contrast and readability. The darkest blue was used as text on a white background and the second darkest was used only as accents and not as background or text.

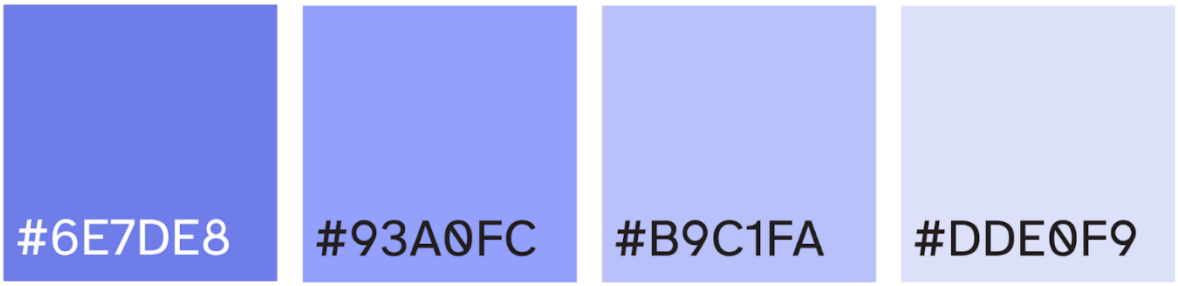


Figure 5.3 Shades of blue used in final prototype

Next to colour other measurements were taken to ensure maximum clarity and contrast. As suggested by literature, white space was used between elements to avoid clutter [33]. Further, all icons used were labelled [32] and visual reminders [32] of the food consumed already were added in the final prototype, as can be seen in chapter six.

5.3.3 Conclusion design specification

Every iteration of the prototype resulted in more adjustments to accommodate the needs of older adults. The final design of the prototype uses “Atkinson Hyperlegible”, a font specifically designed for visually impaired people, as well as a calm blue colour with high contrast. Icons are labelled throughout the whole prototype and visual reminders of the food consumed were added in the final iteration of the prototype.

5.4 Technological Specification

As described above, the prototype will consist of an artifact and a scenario. In the following section, the technology used to develop the artifact will be explored. The artifact developed is an application envisioned in a future scenario, as such it functions more as a way to make this future scenario tangible than as a prototype for the application itself. Due to this nature the artifact can be limited to wizard of oz. It is however important that the artifact is interactive (see requirement six in section 5.2). In figure three it is illustrated how the interaction with the system could look like.

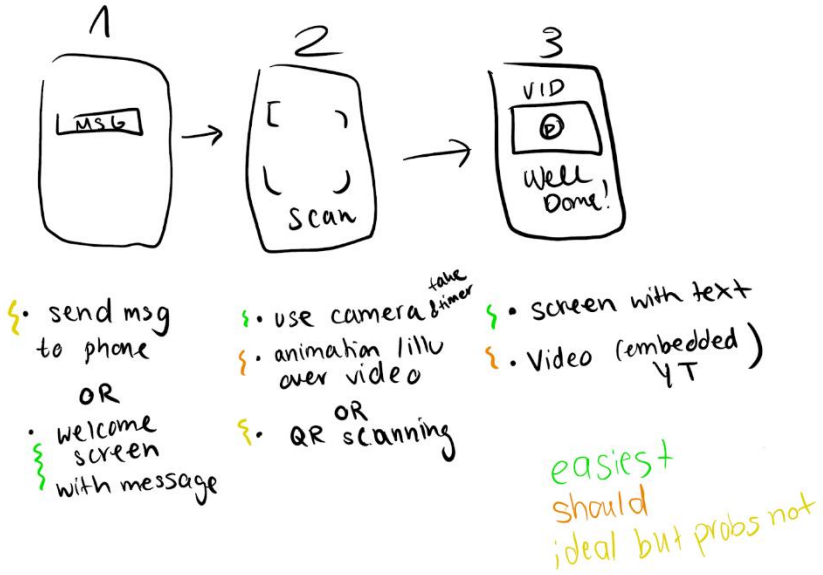


Figure 5.4 Interaction Diagram

Based on this interaction, various ways of developing the artifact are examined. Different options of technologies used during the creative technology curriculum are explored on if they could be used to develop the artifact. The options are examined based on: (1) familiarity, as there is no time to learn a new technology and (2) functionality, they need to allow for the creation of an interactive prototype.

5.4.1 Programming Languages

During the creative technology curriculum various programming languages are taught. Those could be used to develop an application. Below those are assessed based on the two criteria mentioned above.

5.4.1.1 Processing

Processing, a programming language based on Java, is the most used one within the bachelor program of creative technology. As such, this is the one I am most familiar with. Through the use of libraries, it allows for the use of a device camera, which could be used to mock the scanning of a meal. Libraries on image recognition and scanning of QR codes exist as well. The latter was tried out and seemed to be rather complicated to use. Nonetheless is processing judged as a good option to develop an interactive prototype in.

5.4.1.2 Python

Python is introduced during the sixth module of creative technology, as such my familiarity with it is not as high as with processing. Running into problems is expected to happen frequently if python were to be chosen to develop the prototype in. For the functionality, python does seem to offer everything necessary. There are libraries that allow for the use of the device's camera and image processing as well as scanning qr codes. Overall python seems to be a good choice concerning its technical abilities but not a good choice based on my limited experience with it.

5.4.1.3 Html/CSS/JavaScript

During the first module of creative technology students are introduced to creating websites using html, CSS, and JavaScript. My familiarity with these languages is limited to the basics. Concerning the language's capabilities, it seems possible to create a simple version of the envisioned concept in JavaScript. However, due to limited experience this option is judged as suboptimal.

5.4.2 Interactive mock-up programs

Programs used to create interactive mock-ups of web pages and applications, such as Adobe XD or Figma were not part of the creative technology curriculum. Nonetheless I have some experience with the Adobe suite and Adobe XD in particular. As for technical possibilities, mock-ups are limited in their abilities. It is not possible to use the device's camera, so the scanning part would need to be replaced by a mock-up. In conclusion, using an interactive mock-up program, particularly Adobe XD, would be possible but not ideal.

5.4.3 Full wizard of Oz

Wizard of Oz prototyping has been an integral part of the creative technology bachelor program. A wizard of Oz prototype, which only works when being operated by someone behind the scenes, seems to be a good option for this project due to my familiarity with it and its unlimited possibilities. One possibility could look as follows:

1. Someone sends my phone a fake message asking me to unlock a message through eating
2. I open a QR scanner to scan a QR code on a plate
3. QR code leads to a website with the video (or just the video on YouTube)

This would be the simplest version of the prototype, which could be worked out further during the iterative process of the realization phase. It would be very easy to make and could work for demonstration purposes. However, this option is not ideal either as it does not allow for the prototype to be displayed anywhere on its own and allows for limited interaction with it.

5.4.4 Conclusion technological specification

Based on the assessment of the options as described above, the decision is made to create an interactive prototype using Adobe XD. As discussed above this option is not ideal. Nonetheless it was chosen based on the limitations that naturally come with a graduation project. The time to complete the prototype is limited, so unnecessary time spent on fixing problems or learning a (partially) new programming language, should be avoided. In future work outside of the constraints of this graduation project the mock-up prototype could be translated into a programming language such as processing or JavaScript. For now, Adobe XD will offer all the necessary means to translate the concept into an interactive prototype that can be tested with participants.

5.5 Conclusion specification phase

The goal of this phase was to elaborate on the initial idea selected in the ideation phase to arrive at a final concept. The future in which the artifact is set was specified, requirements for the final prototype were defined, designing for older adults was investigated and possible uses of technology to realize the prototype were explored. The specification phase resulted in the development of the concept for “Food for Thought”, a digital health intervention set in the year 2037, that blocks contact of older adults to their loved ones if they have not consumed a nutritious meal. The technology used to realize this concept was chosen to be Adobe XD. In the next phase, this final concept is translated into a prototype.

CHAPTER 6 - REALIZATION

As mentioned before, the prototype consists of two parts: (1) an artifact and (2) a descriptive scenario. In the following chapter the final phase in the development of said prototype, the realization, is described. The artifact is developed using Adobe XD, a vector-based user experience design tool. The artifact is designed in an iterative manner. The first version was tested with an expert in the field of healthy eating for older adults, and adjusted based on their feedback, resulting in the second prototype. The second version was subsequently tested in a roundtable discussion and adjusted again. The third version was tested with two older adults as well as in another roundtable discussion and adjusted one last time, resulting in the final artifact. In the following chapter, the four iterations of the artifact are described. The evaluation of the prototypes, on which the alterations are based, is described in chapter seven. After the description of the various artifact iterations, the scenarios developed are shown.

6.1 Artifact

As decided in the previous phase, the artifact should be constructed using Adobe XD, a design software that allows the creation of interactive mock-ups of applications or websites. Before starting the design process, the general structure of the mock-up was drawn up, as can be seen in figure 6.1. Based on this, the first version of the artifact was developed.

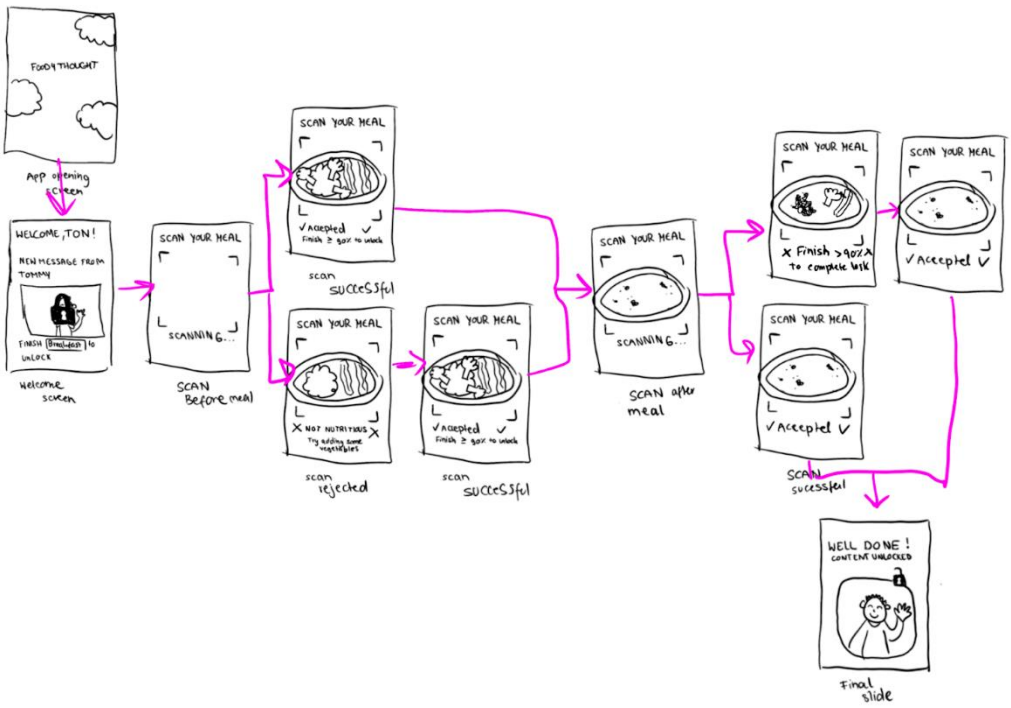


Figure 6.1 Mock-up Structure

6.1.1 First iteration

The first iteration of the prototype is rather straightforward, displaying the main function of the system: scanning a meal in order to unlock a message. The structure of it can be seen below in figure 6.2. This iteration consists of four sections: (1) the start screen with a pop-up indicating a new message, (2) the scanner, (3) a simple home screen and (4) the unlocked message.

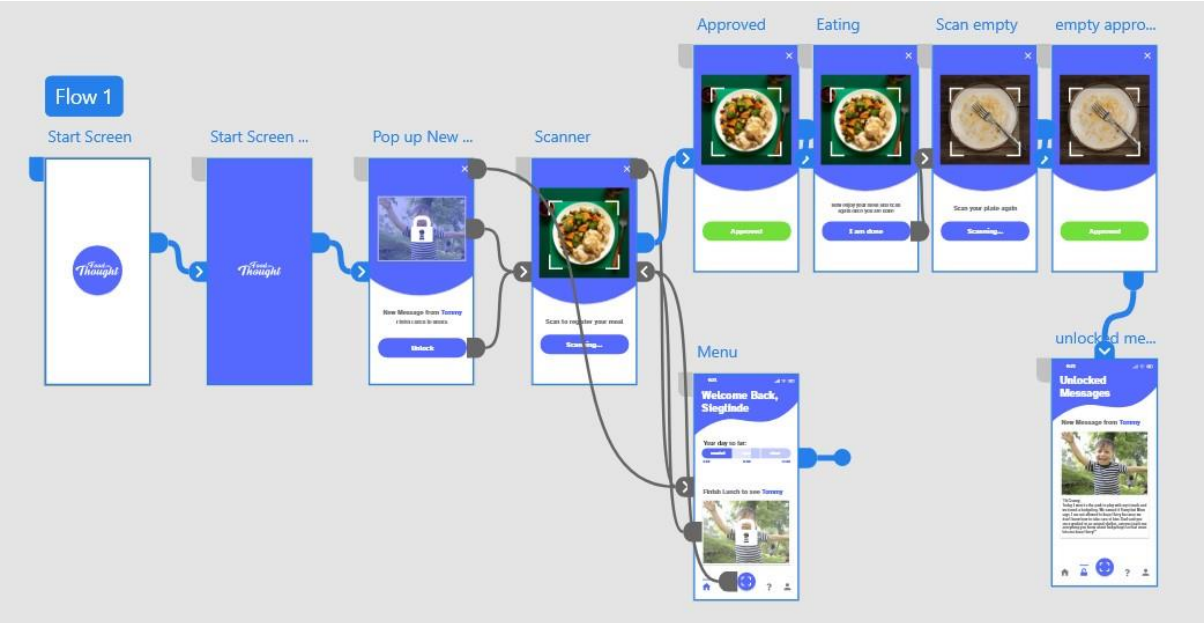


Figure 6.2 First iteration artifact in Adobe XD

6.1.1.1 Start screen with pop-up

When the user opens the app a start screen with an animation appears (see figure 6.3). This animation leads to a popup indicating a new message. The user can see that the message is coming from Tommy and that they have to finish lunch to unlock it. The user can now choose to either unlock the message, by clicking on the button saying “Unlock” or the preview of the message itself, or they may choose to close the popup by clicking the “x” in the top right corner. In the first case they are led to the scanner described in section 6.1.1.2, while the second option leads to the home screen described in 6.1.1.3.

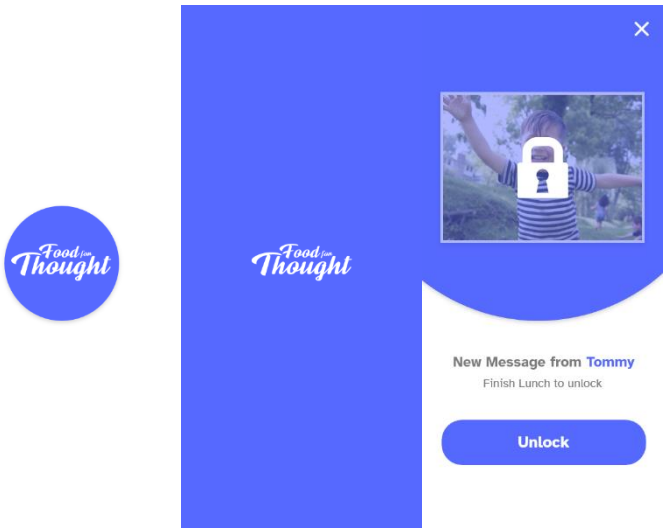


Figure 6.3 Start screen with pop-up sequence

6.1.1.2 Scanner

Below, in figure 6.4, the scanner sequence is shown. The user can reach it through the popup in the beginning, through clicking on the locked message in the home screen or through the scanner icon in the menu. Once arrived at the scanner sequence, the user is asked to scan their meal. After scanning an animation indicates that the meal was approved. Next, the user is asked to eat their meal and return once they are done, to scan their empty plate, which once again gets approved by the app. During the entire sequence the process can be stopped through clicking on the “x” in the top right corner, which leads to the home screen. After successfully scanning the meal, the prototype leads to the unlocked message.

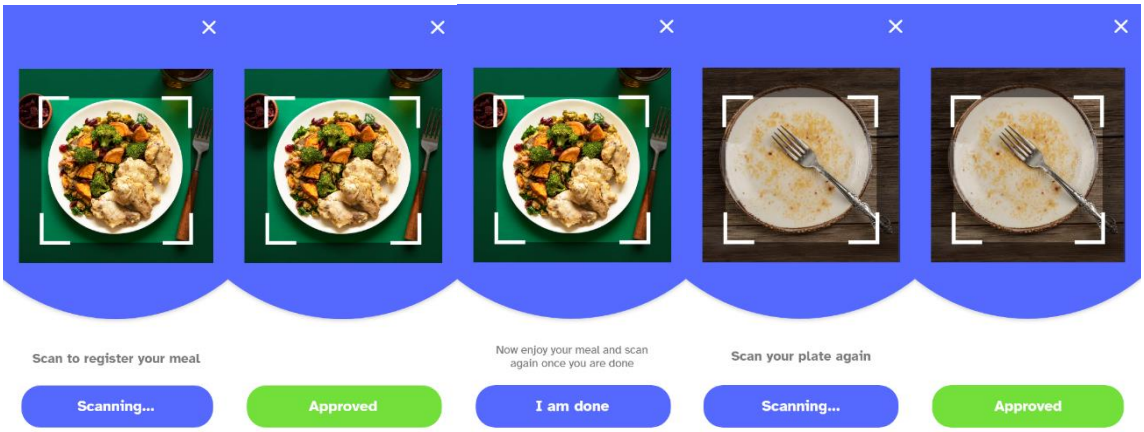


Figure 6.4 Scanner sequence

6.1.1.3 Home Screen

On the home screen (figure 6.5) the user can find their progress for the day as well as locked messages, if they have received any. The progress bar indicates which meals have been consumed yet and how much time there is left to finish the next meal. In this first iteration of the artifact, this screen can only be reached through leaving the scanning sequence without completing it. From this screen there are two interactive elements, the scanner icon in the menu and the locked message, which both lead to the scanner sequence.

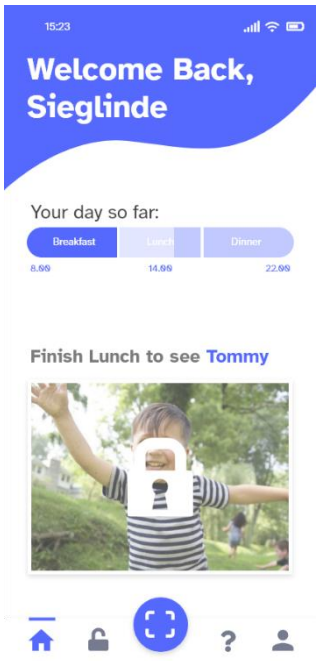


Figure 6.5 Home screen

6.1.1.4 Unlocked message

The last section of the first prototype is the “Unlocked Messages” screen, where the user can see all messages from their loved ones that they have unlocked so far. In this first

iteration of the artifact, this part is only reachable through completing the scanning process and not yet through using the menu on the bottom of the screen.

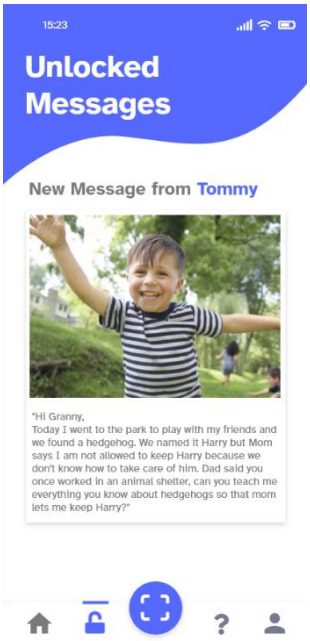


Figure 6.6 Unlocked message

6.1.1.5 Conclusion first iteration

The first iteration of the artifact was a simple version to visualize the concept. It serves its purpose of making the concept tangible to the expert but leaves room for improvement. Based on the feedback from the expert, as described in chapter 7.2.1, the artifact was developed further, resulting in its second iteration.

6.1.2 Second iteration

After evaluating the first iteration with the expert from livio, as described in chapter seven, the artifact was adjusted to incorporate the feedback of the expert. The main change made was the introduction of eating recommendations on the home screen, in order to offer more value to the user. The start screen with popup and the scanner remains the same as in the previous iteration and will therefore not be discussed again. Some small changes were made to the design, based on research on designing for older adults, as described in chapter five. As the time before the next evaluation session was limited, changes to the design were limited to the main colour and adding text to the icons in the menu. Further, during the development of this second iteration the three accompanying scenarios, as described in section 6.2, were developed as well.

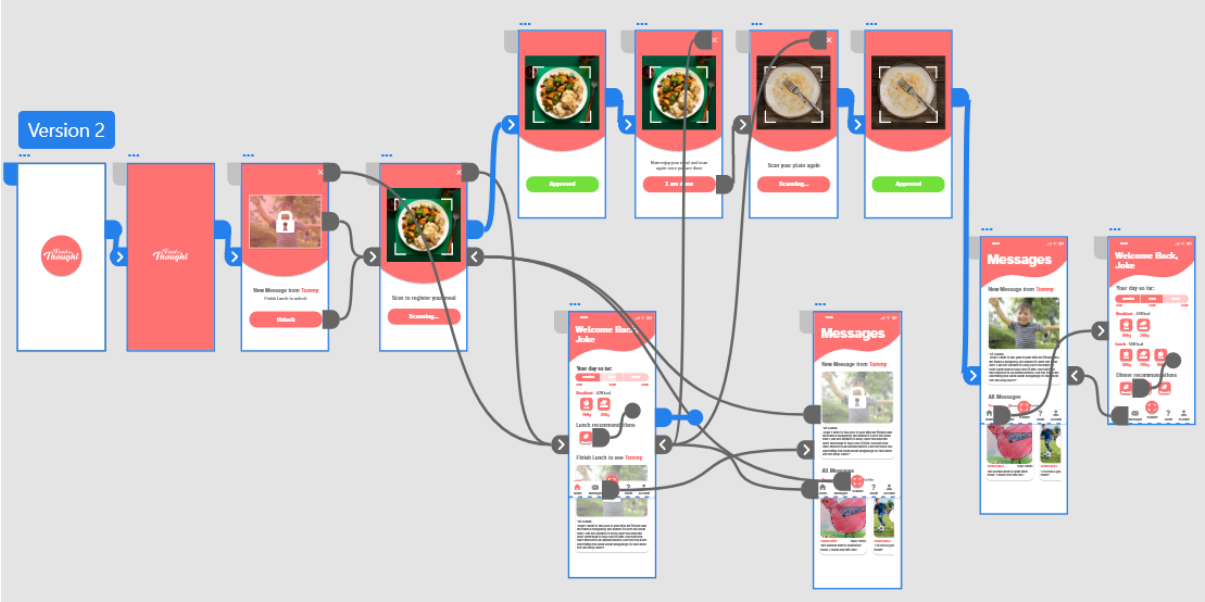


Figure 6.7 Second iteration artifact in Adobe XD

6.1.2.1 Home Screen

Compared to the previous iteration, the home screen has undergone the biggest change. In addition to showing the user which meals were consumed so far, it now also gives insights into the type of meal and calorie intake. Based on that it also provides recommendations for the next meal.

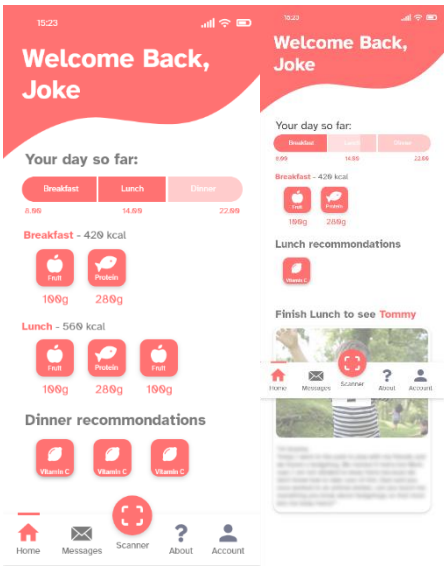


Figure 6.8 Home screen after scanning (left) and before (right)

6.1.2.2 Messages

The messages section was changed to include previous messages as well. To accompany this, change the icon for messages in the menu was changed from a lock to an envelope and the title was changed from “Unlocked Messages” to simply “Messages”. The way the system handles messages was further specified based on questions that the expert asked during the evaluation on whether it blocks old messages too. Old messages, like shown in

figure 6.8, are not blocked. Under “All messages” the user can view old messages of different types. It includes three examples of messages, a photo, a video, and a text. Instead of only showing a locked version of the picture to indicate a new message, the text of it is displayed as well but blurred out, to give more information on the type and length of message received.

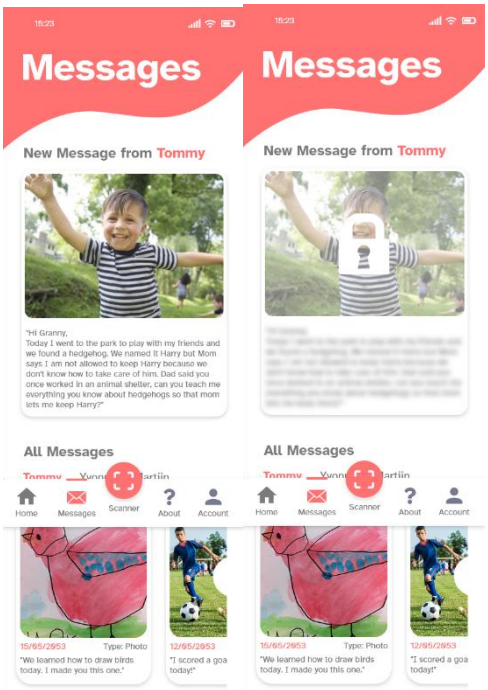


Figure 6.9 Messages after scanning (left) and before (right)

6.1.2.3 Conclusion second iteration

The second iteration of the prototype, which now consists of the artifact and the accompanying scenario, as described in section 6.2, was evaluated in a roundtable discussion, as described in chapter 7.2.3.1. Based on the feedback of that session and earlier ideas that were not yet implemented due to limited time, the artifact is adjusted resulting in its third iteration.

6.1.3 Third iteration

The third iteration of the artifact was improved based on feedback from the first roundtable session (see chapter seven) and the supervisor of this project. The main change is an adjustment suggested by one of the supervisors of this project. An onboarding sequence was added to help explain the use of the system to the viewer. Additionally, the design was further adjusted based on the findings on designing for older adults stated in chapter five. For the colour a toned down version of the blue of the first iteration was chosen. Illustrations were added to support the clarity of the artifact. Aside from the colour and the adding of an illustration the scanner and messages sections were not changed in this iteration and will therefore not be described again.

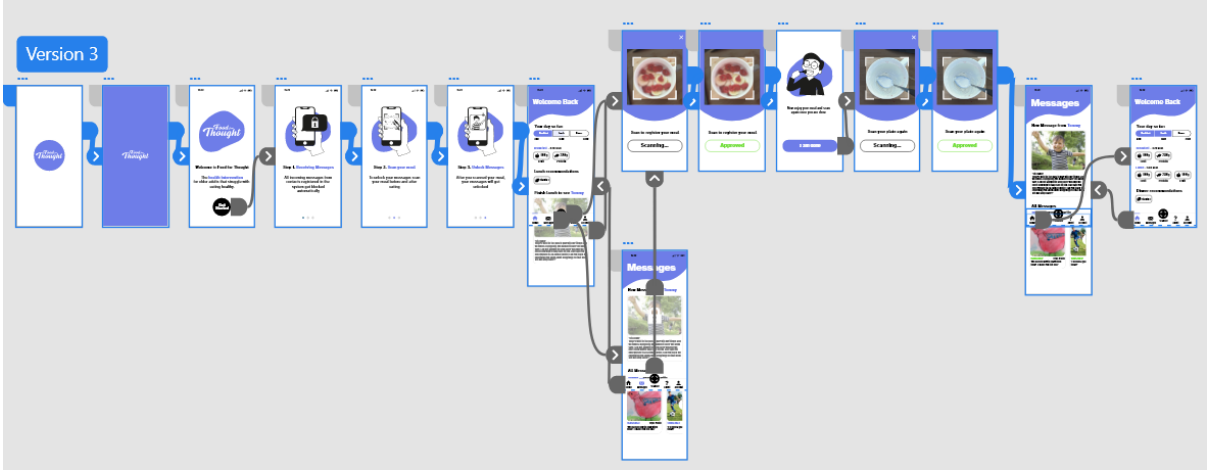


Figure 6.10 Third iteration artifact in Adobe XD

6.1.3.1 Onboarding Sequence

The main difference between this iteration and the last is the inclusion of an onboarding sequence. This is a way for app designers to provide information about the app and its functionalities to first time users. Regular apps, that are meant to be used frequently or even on a daily basis do not need a repeated onboarding sequence, as the user will already be familiar with the app's functions through their repeated use of it. In the case of this artifact, the onboarding is displayed every time the app gets opened and not limited to first time users. The onboarding sequence offers some context by mentioning "health intervention" and explains the way the app works to its user.

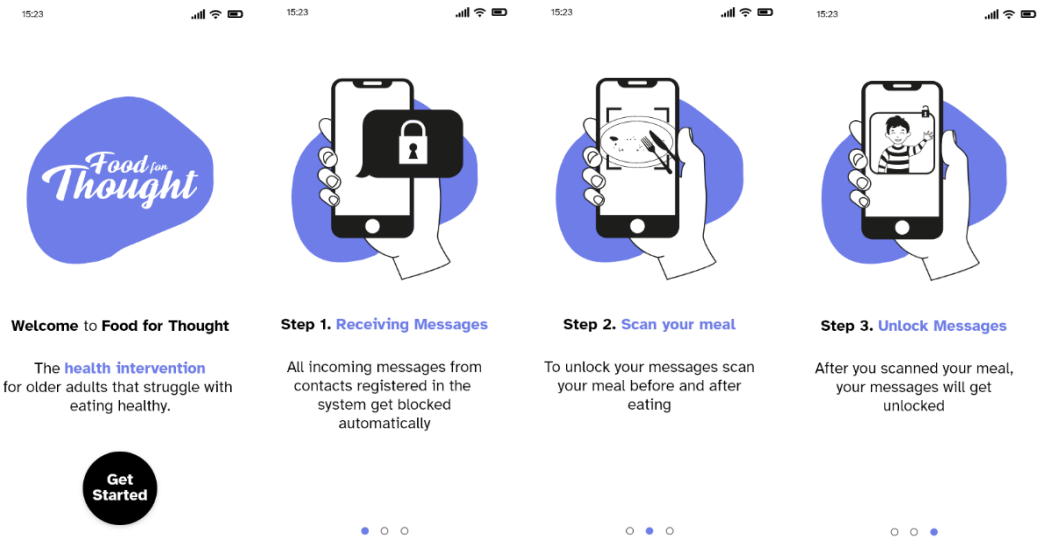


Figure 6.11 Onboarding sequence

6.1.3.2 Home screen

On the home screen a first attempt was made to make the information on the meals consumed and recommendations clearer, based on feedback during the first roundtable session. Compared to the second iteration the text is now bigger and the contrast in colour to the background is bigger.

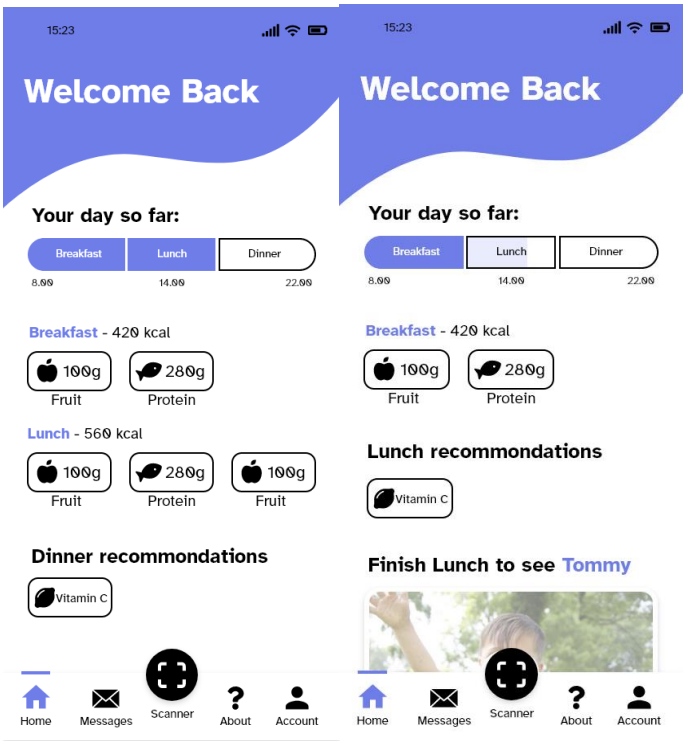


Figure 6.12 Home screen after (left) and before (right) scanning

6.1.3.3 Conclusion third iteration

The third iteration of the artifact is the last one which was evaluated. It, together with the scenario (section 6.2) was tested with two older adults as well as another roundtable discussion. The feedback from these sessions, which can be found in chapter seven, was used to take one final step in the development of the artifact, arriving at the final iteration.

6.1.4 Final iteration

Based on the feedback on the third iteration, which was tested, as described in chapter seven, with two older adults as well as in a roundtable discussion the final artifact was developed. Functionally the changes are limited to the inclusion of a new section, “about”, which provides the user with context on the world the artifact is set in, demographic aging and the intended use of the prototype. The other change is the design of the artifact, which was worked out further based on the research done in chapter five.

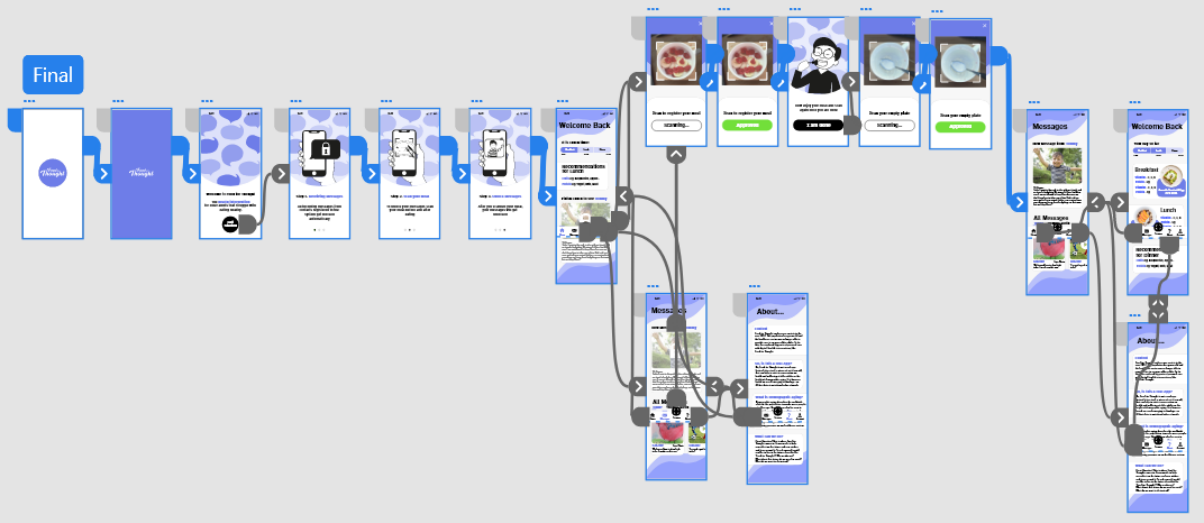


Figure 6.13 Final Iteration in Adobe XD

6.1.4.1 Onboarding Sequence

The onboarding sequence remains mostly the same as in the last iteration. The only change made here was in the design of it. The speech bubble pattern was introduced to add a visual reminder of the artifacts purpose as a facilitator of debate.

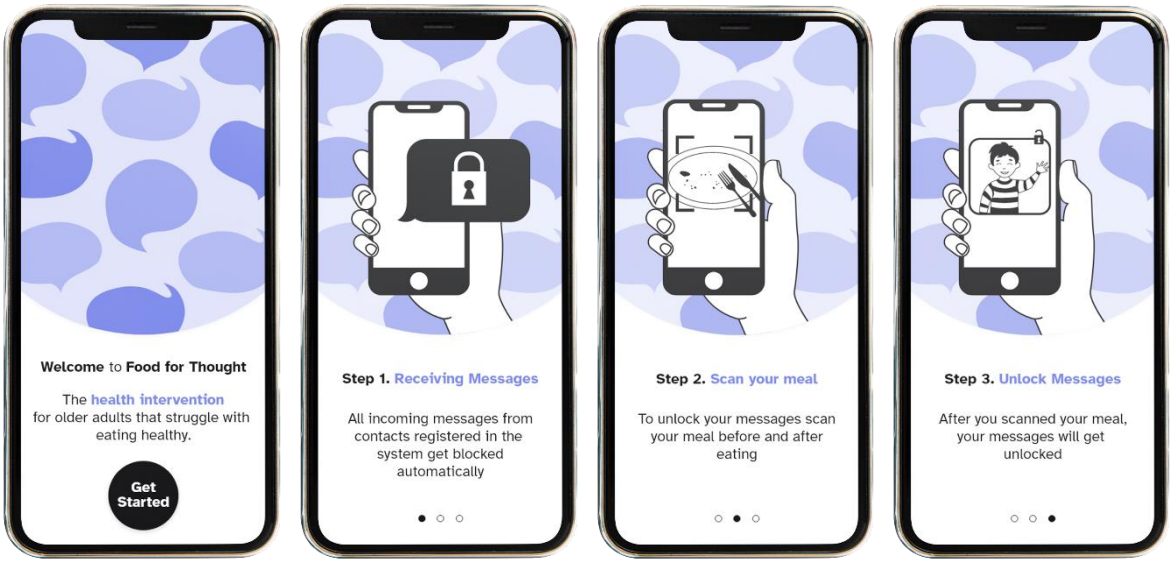


Figure 6.14 Onboarding sequence

6.1.4.2 Home

The design of the home screen was adjusted based on feedback of the participants of the second roundtable discussion. The name in the title was removed as participants were experiencing it as distractive. When a meal was not yet scanned the title of the progress bar now reads “It is Lunch time” to remind the user to consume lunch. The information on tracked meals of that day is now accompanied by a picture as a visual reminder.

Figure 6.15 Home screen before (left) and after (right) scanning lunch

6.1.4.3 Messages

The messages section was, apart from the colour, not changed compared to the third iteration.

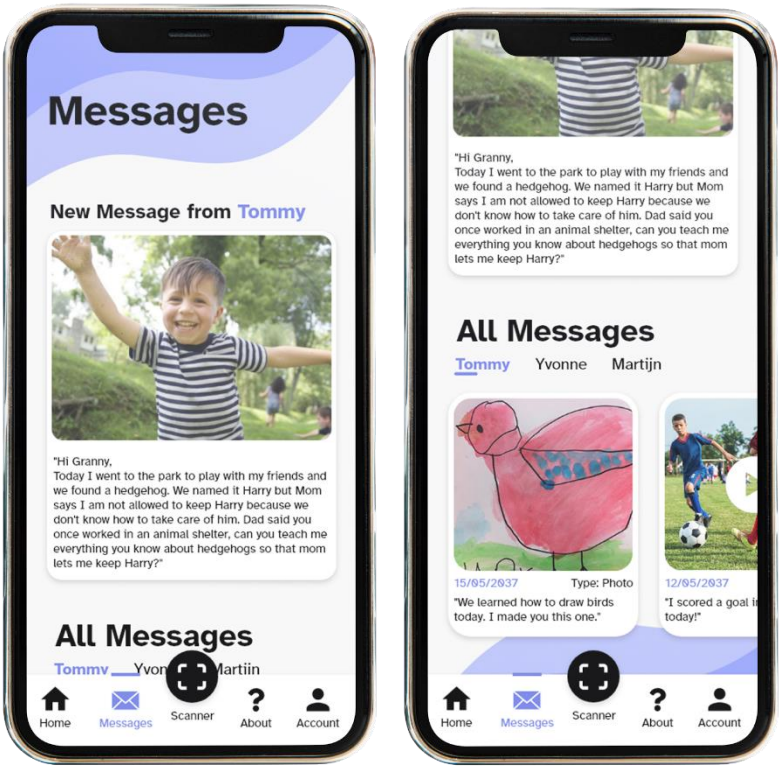


Figure 6.16 Messages screen after unlocking

6.1.4.4 Scanner

The scanner sequence was not changed functionally. The design was adjusted to fit with the new style and the speech bubble pattern was used again.

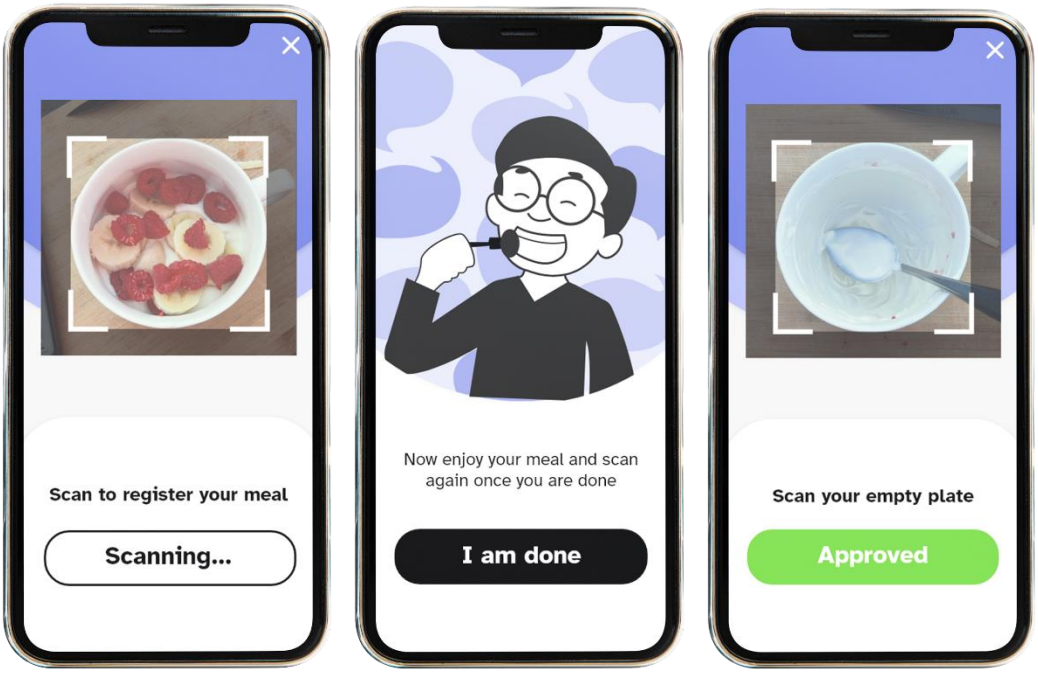


Figure 6.17 Scanner sequence

6.1.4.5 About

The latest addition to the artifact is a page on which the user can find more information on the prototype. This was implemented to support viewers in identifying the artifact as speculative, as the previous evaluation session had shown that the artifact on its own was not clearly identifiable as speculative. The section starts with providing context on the world the artifact is set in, then addresses whether or not the artifact is a real app, gives information on demographic aging and lastly talks about the use of the prototype.

Figure 6.18 About screen

6.1.4.6 Conclusion final iteration

Through four rounds of iterations, each based on an intermediate evaluation session, the final prototype was developed. The final iteration of “Food for Thought” consists of 5 sections: (1) the onboarding sequence, (2) the home screen with information on the meals consumed so far, (3) the messages, locked and unlocked, (4) the scanner sequence and (5) the about page providing the user with context. It consists of all the information needed to function as a basis for discussing the future of healthy eating for older adults.

6.2 Descriptive scenario

The second part of the prototype is a descriptive scenario. This scenario is developed in order to make the world the artifact is set in more tangible. It consists of information on the context of the world the artifact is set in and three user scenarios, that are based on the personas developing in chapter four.

6.2.1 Context

The year is 2037. Idk years after the covid-19 pandemic first defeated our healthcare system. Since then, healthcare has been restructured to accommodate for the increased need of our aging population. The median age of a Dutch citizen is now at 4x and there are 50 older adults for every 100 adults of working age. Healthcare system would have collapsed under the added pressure if it would not have been for the introduction of digital health interventions. Nowadays, a huge part of personal care is replaced by those digital health interventions. There are many different ones, all focusing on supporting healthy aging. One of them is “Food for Thought”, an app that

6.2.2 Scenario 1: Sieglinde “The selfless mother”

After her husband died, Sieglinde lived alone for a while, but soon became dependent on the help of her daughter Anne. She noticed that this put a lot of stress on Anne, even though she would never admit it. After Anne offered Sieglinde to move in with her and her family she drew the line. She never wanted to be a burden on her family, so she decided to move into an apartment building for older adults, where she could get help from caretakers. But Sieglinde doesn't like to be dependent on anyone, especially not strangers. So when she started to struggle with eating regularly she didn't tell the caretakers. Her daughter is very busy raising her children, so she doesn't notice at first. A few months later one of the caretakers invites Anne to talk about her mother, one of their regular checks has shown that Sieglinde is starting to show signs of malnutrition. The caretakers have tried to get Sieglinde to eat more but she refuses to take any help.

A few weeks later Anne gets a call from the hospital, her mother has been admitted due to severe malnutrition. She gets treated and soon is allowed to go back home. Since she got back home Sieglinde didn't change much about her eating habits. Her daughter wants to sign her up for a health intervention, but Sieglinde shrugs it off: “I don't need that, I can do this on my own''.

One day during a visit by her daughter's family, Anne leaves the room to get a call. Sieglinde got up to go to the bathroom and overheard the conversation. It was her daughter's insurance company. She seemed very worried. Sieglinde realized that her poor health put a lot of financial stress on her daughter. She never wanted to be a burden. She is scared her family will resent her for it. The next day she contacted her caretakers to sign her up for a health intervention. After reviewing her situation, they suggested “Food for Thought” and Sieglinde accepted. She told her daughter that she had changed her mind about it but not why, that she would take to her grave.

6.2.3 Scenario 2: Joke “The loving grandma”

To Joke, her family is the most important thing in her life. She is especially close with her 5 year old grandson Tommy. Her daughter, Yvonne, and Tommy come to visit her every weekend and Joke always plays with Tommy. He is a very active little boy and loves playing chase in the garden. Joke has always been very active and never had trouble keeping up with her grandson. But lately that started to change. Yvonne notices that Joke increasingly suggests staying inside, playing board games, or reading to Tommy. But Tommy loves running around and always tries to get his grandma to play catch with him. The few times she agrees to play outside with him, she is exhausted almost immediately.

After observing the situation for a few weeks, Yvonne sits her mother down to ask her about it. Joke opens up to her daughter about her struggles with eating: “I just don't feel hungry like I used to, I often forget to eat all day and only realize in the evening. By then I am too tired to cook for myself”.

Yvonne wants to help her mother. Together they think of solutions. For one, they could all eat together at Jokes house on the weekend. But what could they do during the week? Yvonne has to work, and Tommy spends his days in the kindergarten, where he gets served most of his meals as well. Yvonne contacts her insurance and they suggest signing her mother up for a digital health intervention. Together, the two look through the options and decide on “Food for Thought”.

After a few weeks, they already see results. Joke seems way more energetic and is back to playing catch with Tommy. Tommy seems to notice as well and is very happy to have his grandma back. He and his mother make sure to support Joke by sending many messages throughout the day, to motivate her to keep eating. But sometimes they are too busy or simply forget, those days Joke also forgets to eat.

6.2.3 Scenario 3: Ton “The rebel”

When Ton's wife Merel was still alive they ate every meal together. Merel was a passionate cook and put a big emphasis on eating a balanced diet. Merel died 6 months ago and since then Ton avoids eating as much as possible. He doesn't enjoy cooking, he never really learned it, his wife took care of it after all. He lost all structure in his life, eating premade microwave meals whenever he feels like it. Most of his meals he consumes on the couch in front of the TV to avoid the silence of eating alone.

His daughter Melissa lives two hours away. She works a lot but tries to visit her father every few months. During her last visit they got into an argument when she noticed the microwave food piling in the kitchen. Melissa wants him to eat healthy, but Ton doesn't listen. He doesn't like being told what to do, especially not by his daughter. She left the apartment furious.

A few days later Ton received a message from her: “I signed you up for a digital health intervention. Don't be mad, dad, it is for your best”.

When the people from “Food for Thought” came by to set up his phone, he didn't speak a word to them. After a few days he decided to give it a go and started using the app. He still does not like it, doing the bare minimum to keep the app and his daughter happy. His daughter doesn't seem to notice, she tells him how proud she is of him for trying to eat healthier. Ton is still mad at her but has decided not to bring it up, he doesn't want to fight with her. Weeks go by and their relationship grows colder and colder.

6.3 Conclusion realization phase

The realization phase results in an interactive prototype of “Food for Thought”, as well as a descriptive scenario. In the next chapter, the evaluation of the various iterations of the artifact, as presented in this chapter, is described. To conclude the realization, phase the interaction with the system is illustrated below in a few pictures.

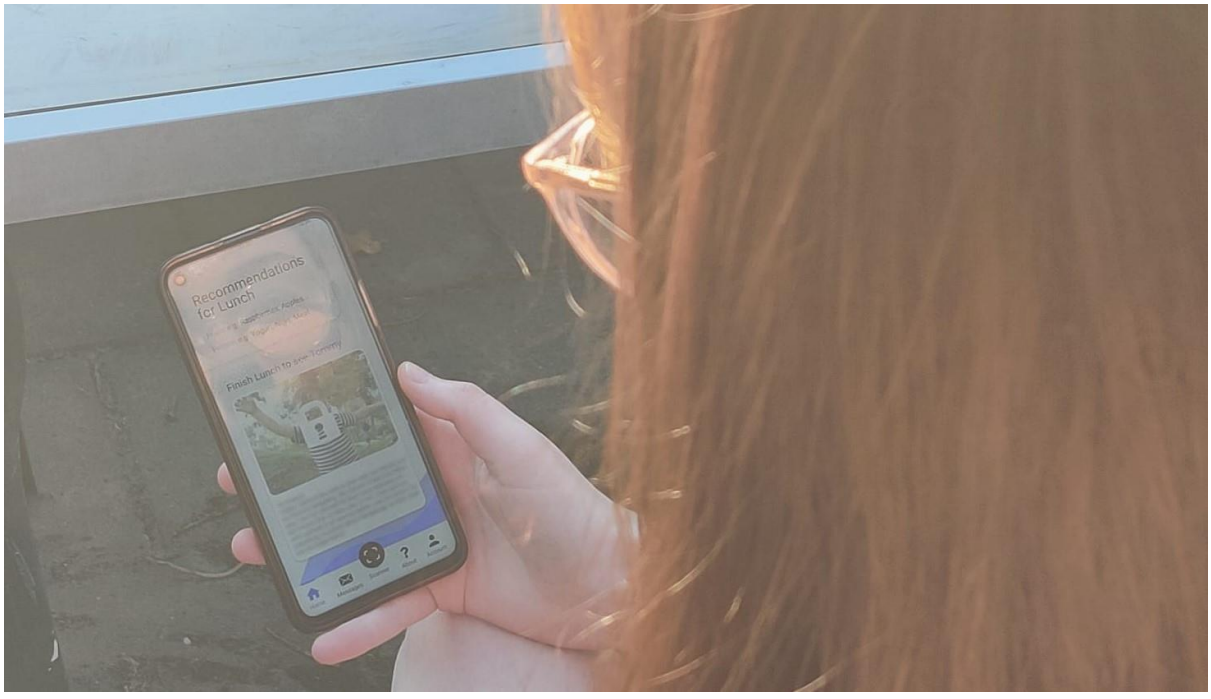


Figure 6.19 User receives message

When receiving a new message, the user is notified. If the user has not yet finished their meal for the time of day the message is blocked and the app asks the user to consume a meal, lunch in this example, to unlock the message.

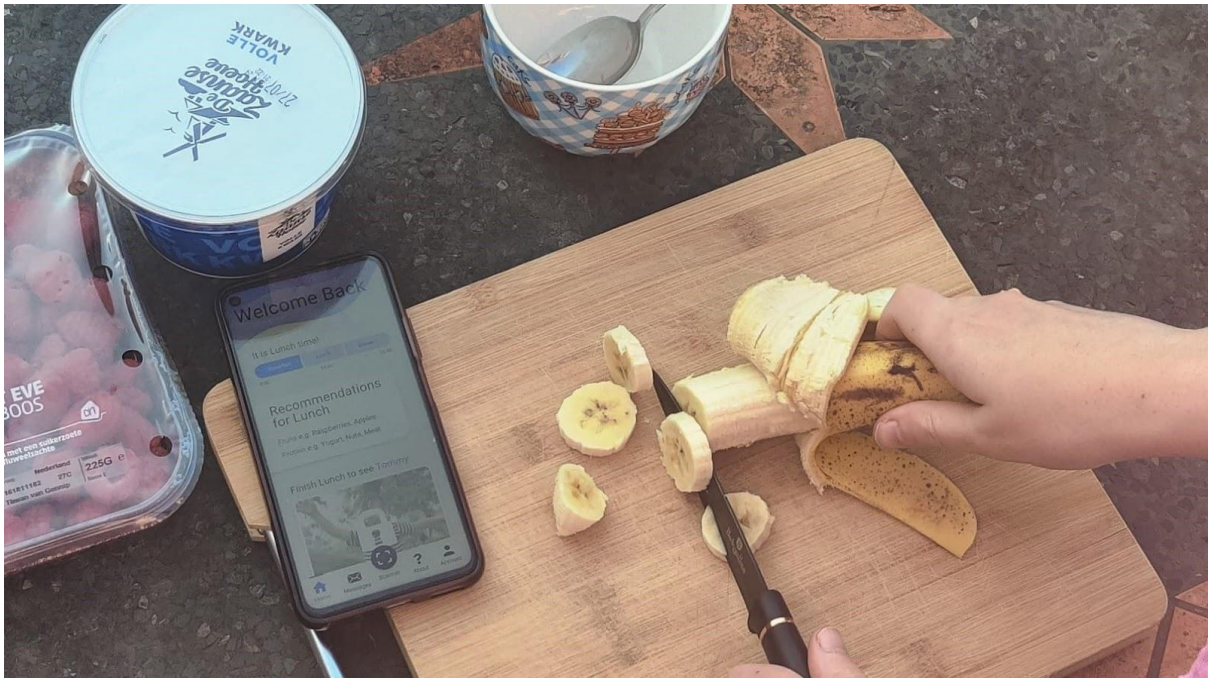


Figure 6.20 User prepares lunch based on recommendations of the app

Based on the recommendations made by the app to include protein and fruit in their lunch, the user prepares yogurt with raspberries and banana. After preparing lunch the user scans their meal to get it approved by the system.

Figure 6.21 User eats their lunch

After getting their meal approved, the user can take their time to eat it.

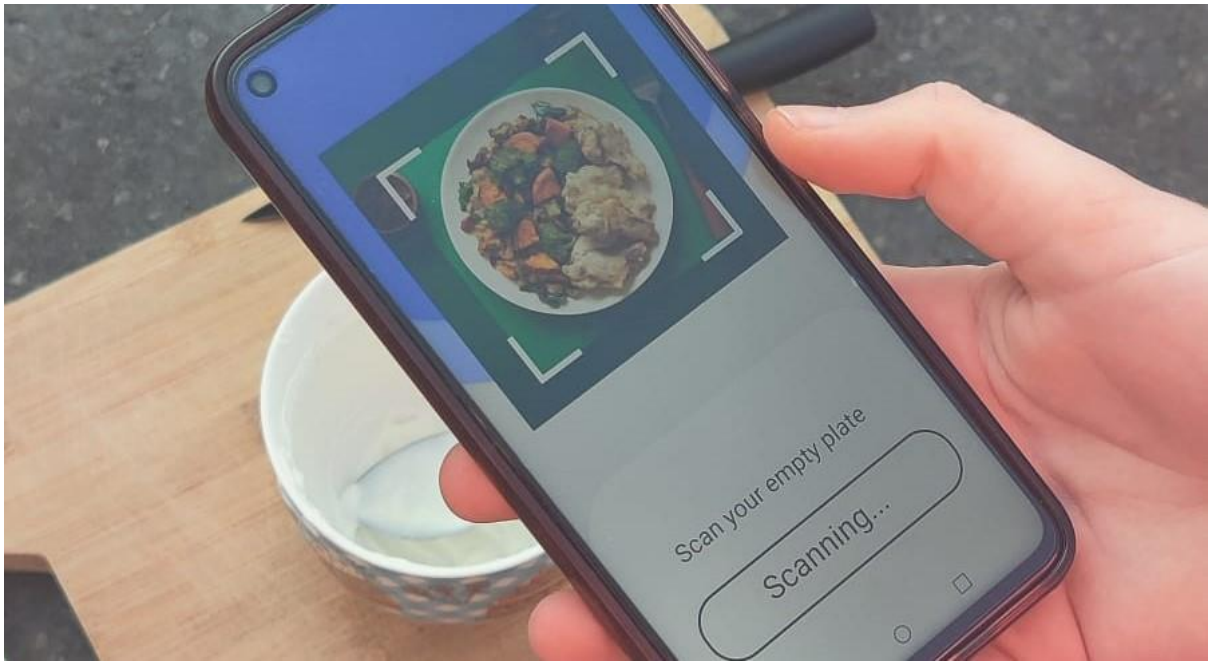


Figure 6.22 User scans their empty meal

After finishing lunch, the user lets the system know and scans their plate again to confirm that it is empty.

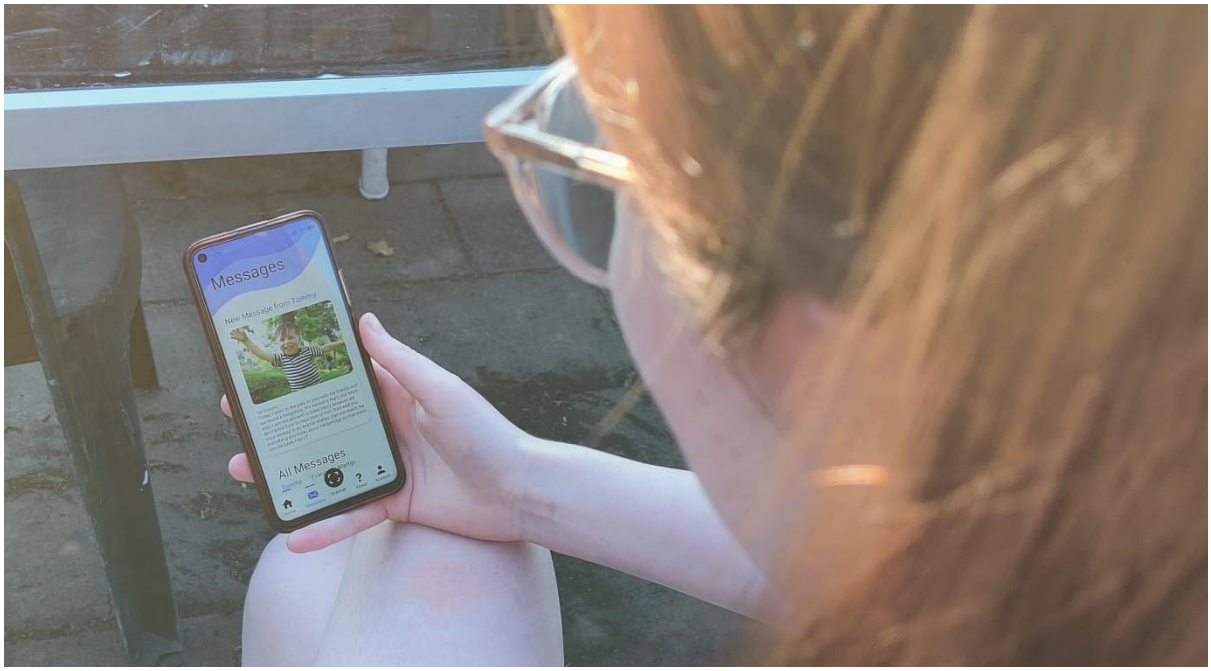


Figure 6.23 Message is unlocked

After the system approves the meal consumed, the user gets access to the message of their loved one.

CHAPTER 7 - EVALUATION

This chapter describes the means through which the prototype developed in the previous phase is evaluated and the results of those evaluations. The prototype is evaluated on two levels, a functional and a qualitative level. First, through a functional evaluation, the final prototype is assessed based on if it meets the functional requirements defined in chapter five. Next, during the qualitative evaluation, the prototype is assessed based on if it meets the non-functional requirements defined in chapter five above all how well it functions as a facilitator for discussion. This was done multiple times throughout the design process, starting with an evaluation with an expert in the field of healthy eating for older adults. Further, the prototype was tested with two older adults and in two roundtable discussions.

7.1 Functional evaluation

During the functional evaluation the final prototype of “Food for Thought” is assessed based on the functional requirements defined in chapter five. In Table 7.1 the functional requirements are listed together with their assessment. The assessment is done in four categories: “Yes” marks requirements that are completely fulfilled, “Yes, but” marks requirements that were partially fulfilled, “No, because” marks requirements that are not fulfilled but with a good reason and “No” marks requirements that were not fulfilled in the final iteration of “Food for Thought”.

No.	MoSCoW	FR or NFR	Requirement	Assessment
1	Must have	FR	The artifact must be **tangible**	Yes
2		FR	The prototype must consist of an **artifact accompanied by a descriptive scenario**	Yes
3	Should have	FR	The scenario should be accompanied by a **visualization** of some sort	No, because of time constraints
4		FR	The artifact should be **interactive**	Yes
5	Could have	FR	The artifact could be accompanied by a **video** depicting a scenario in which it is used	No, because of time constraints and to avoid participants getting overwhelmed by the amount of information given during the discussion
6	Won't have	FR	The artifact won't be **fully functioning** and as such won't be **linked to any real people**	No

Table 7.1 Assessment of functional requirements sorted using MoSCoW

7.2 Qualitative Evaluation

During the qualitative evaluation the developed prototype is evaluated based on how well it functions as a tool to facilitate debate on topics related to healthcare for older adults at the height of demographic aging. For this purpose, the prototype was evaluated through an interview with an expert in the field of healthy eating for older adults, with two older adults and during two roundtable discussions. Evaluations were performed during various stages of the realization phase, resulting in an iterative design process. In the following sections, the results of the various evaluation sessions are discussed. The resulting changes in the prototype can be found in chapter six and a detailed explanation of the methods employed in the evaluation sessions can be found in chapter three.

7.2.1 Expert Evaluation

To get initial feedback on the concept and first version of the prototype (artifact with some context, no scenarios) a semi-structured interview, as described in chapter three, with an expert in the field, the coordinator for eating and drinking at livio, was conducted. During the interview, the expert was confronted with the concept of “Food for Thought” and the first prototype. The expert struggled to understand the concept of speculative design, even if it was explained as art, and was very practically oriented. She wanted the prototype to be a solution in itself instead of merely a tool to discuss the future and potential solutions. As such, she did not judge “Food for Thought” to be useful.

It became apparent that the artifact, in its first iteration, is causing a lot of questions, which are limiting the discussion. Questions about its functionality such as whether it blocks older messages as well and how an older adult comes to using the app should be answered through future iterations of the prototype. After conducting the interview, it became clear that more attention needs to be paid to the way the concept is presented to the evaluation participants. Instead of experts in the field of healthy eating alone, the evaluation should be held with a diverse group of people that also includes designers themself. Through including people that are knowledgeable on research through design practices, the true use of “Food for Thought” as a tool for discussion could become more apparent to the group as a whole.

This evaluation further made clear that the context in which the artifact is presented is very important, a museum or art installation for example provides additional context to how the artifact should be viewed. Making this the ideal place to display the artifact and evaluate it. While that is not possible within the constraints of this project, it is something to consider for future work. For now, adjustments that can be made to improve the context are limited to the nature of the session, and the information provided in and around the artifact. The setting of a roundtable discussion about the broader topic of health and wellbeing of older adults in a future on the height of demographic aging is expected to help as well in making the purpose of the prototype clear. To improve understanding of the functionalities of the described system, the prototype is worked out further to include more details.

7.2.2 Evaluation with older adults

To explore how potential users of “Food for Thought” would feel about it, a short semi-structured interview was conducted with two older adults (70+ years). During this session they were given context on the project, got to try out the prototype and were asked to give their opinion on it. Due to limited time in the session, they were not shown the scenarios. Instead, they were asked to give their opinion based on the artifact itself and context provided on the time it is set in and its function as a replacement for personal care. To keep it simple the word “speculative design” was replaced by “art piece”. Nonetheless, the

participants struggled a bit with grasping the idea of using the prototype in a not literal sense.

The main worry the testers voiced with using this technology is that it needs to be used consistently at every meal. One of them does not use their phone a lot so that would be very difficult for them. Further, they both describe themselves as not very tech savvy, and fear they would need a lot of help using the app. When addressing the topic of taking away messages if people don't eat, they react by saying that their messages are very important to them and they would not want to lose them. When asked if that would make them use the app, they struggle to imagine it, as they themselves already eat healthy. When asked about who should be able to decide that the older adult needs to use the app they are unsure if this decision should lie at the family of the older adult. On one hand they find it to be too controlling but on the other hand it is for the best of the older adult. After a small discussion they concluded that the intervention in their freedom and privacy would be too big if it were to be decided by a family member. When asked how they think about it when this decision would lie at the doctor, they both immediately state that they would respect the decision if it came from a doctor. As reasons for that they name the expertise of the doctor and that they would not suggest such an intervention if not absolutely necessary.

To conclude, the potential users of “Food for Thought” did not completely reject the idea of withholding access to their families’ messages, which they both deem very important to them if it would be for the benefit of their health. Here it is important to consider who makes the decision that the older adult has to use the app, as the testers were more willing to accept it if it comes from a medical professional. Surprisingly, these older adults accept losing a bit of their freedom if it is for the sake of their health.

7.2.3 Roundtable Discussions

To evaluate the main function of the prototype, to facilitate debate on topics related to health and wellbeing of older adults at the height of demographic aging, a series of roundtable discussions was held. Roundtable one used prototype two and consisted of three students of the university of Twente. Originally four had signed up but one cancelled due to getting infected with covid-19. Roundtable two used prototype three and consisted of two young adults (20-25 years), one of which also participated in the first roundtable, and two middle aged adults (50-55 years).

7.2.3.1 Roundtable 1

At the start of the session, the participants were introduced to the artifact without any scenarios, to get a first impression. When asked if they would like to live in the world described by the artifact, the discussion arrived at the topic of keeping people living longer without or instead of improving the quality of life. The group discussed voluntary euthanasia as something they hope for in the future, instead of the idea of just endlessly prolonging a life that, in their opinion, is not worth it. They discussed who should be forced to use the app and concluded that people whose quality of life is low and who don't want to live any longer should not have their contact with their loved ones taken away. That would only make their situation worse. They decide that it heavily depends on who uses the app if it would be ethical and effective. While they think it would be effective in some cases, they also think this is not something they could do to their family members (signing them up for the app) because it is too manipulative.

When presented with the Scenario of Joke and the question whether “Food for thought” was the right choice to make for Joke and her daughter, the participants engaged in discussion about alternative solutions for her situation. One of such was for the daughter to prepare meals for her mother on the weekend, which Joke can then eat throughout the week. To address the problem of Joke forgetting to eat, they suggest that Yvonne should remind her herself. This led to a small discussion about responsibility, which ultimately led to

the conclusion that Yvonne owes it to her mother to take care of her. When asked what they think of the pressure that this system puts on Tommy to keep sending messages, the participants agreed that, while it was disturbing to involve a child in this, it is ultimately acceptable as long as he is not aware of it. They decide that it should not be Tommy's responsibility alone to send messages and he should not be forced or pressured into it. The responsibility should lie with Yvonne, since she was the one who suggested using the app. Even though the system was presented as being effective in Jokes case, the participants ultimately agreed that it was not the right decision and judged Yvonne for not helping her mother herself.

After hearing Tons scenario the discussion immediately got back to the earlier topics of personal freedom and unnecessarily prolonging the life of someone who has no interest in that. When asked if risking the relationship between Ton and his daughter to keep him healthy is worth it they answer with a clear no. "If Grandpa also loses his daughter, then what does he even live for?", asks one of the participants. After being asked if it was ok of Melissa to sign Ton up, they think that different than in Jokes case, it was ok. Both because Melissa is not able to care for Ton herself because she lives far away and because they judge Ton to be a person that could resist it if he really wanted to. They however also acknowledge that there are people who would not resist and agree that in their case it would not be fair to sign them up against their will.

In the case of Sieglinde's scenario, the discussion quickly arrived at the responsibility of an individual to work towards the good of their society. The participants debated whether someone who doesn't do anything to stay healthy should be entitled to the same care as someone who does their best to stay healthy but is affected by factors outside of their control. One of the participants was persistent that people choose to live unhealthy lives and should be bearing the consequences themselves. This started a debate, as the other two participants disagreed. One compared Sieglinde's situation to a person addicted to drugs, who might have chosen to start taking drugs in the first place but is now in a situation that makes it impossible for them to stop. All participants agree that this person should get the help they need if they accept it. The point that started a debate here was for what happens if the person, after receiving help, falls back into their old habits. How long until we should stop helping them? This was a difficult question to answer, and no clear answer was reached. Another question that came up was whether there should be consequences added to people who repeatedly get admitted with the same issue, due to their own behavior, either in the form of extra costs or receiving care of lower quality. The main concern the participants had with this idea was the potential abuse of it by insurance companies, pushing the standard for who is considered healthy further and further until it will become virtually impossible to be considered healthy.

To conclude, the first roundtable discussion resulted in a lively discussion of the way healthcare is structured today and how it should be in the future. While the session started off with a lot of questions about the future the artifact is set in, it ultimately arrived at a variety of topics related to health and wellbeing in the future. Improving quality of life instead of prolonging life, legalizing voluntary euthanasia, and responsibility of an individual towards their loved ones and their society were the biggest topics in this session.

7.2.3.1.1 Evaluation form 1

After concluding the discussion, the participants were asked to evaluate the prototype based on how well it functioned as a tool for debate. The responses were mostly positive. All participants experienced speculative design as an effective tool to spark debate. One said it surprised them how much it helped as a base for the conversation: "It works better than I expected to spark conversations, it gets the discussion going really well". The scenarios were perceived to be helping a lot with creativity in finding new discussion themes. As for "Food for Thought" specifically, they judged it to be an effective tool to discuss health and wellbeing of older adults on the height of demographic aging. Most participants see potential

for the prototype to create discussion if it were to be displayed in a public space, such as a museum or art exhibition. They also considered it a useful tool to use in the development of new technologies related to health and wellbeing of older adults. Opinions vary on if the main conversation topic is health and wellbeing. One participant notes: “I think it could definitely be used to start discussions, but not only about health and wellbeing but also about e. g liberalism and government control.”
The scenarios were perceived as adding value to the discussion that could not have been achieved by the prototype on its own, as they provided different subtopics to support the discussion.

While the feedback was mostly positive, participants also had some suggestions for improvement. For one not everyone thought the artifact on its own is clearly identifiable as speculative. It is important that it is clear to the viewer that the artifact is speculative, to allow them to discuss the topics it addresses without deception. Further, one participant suggested adding an extra level of interactivity through adding the side of the family member. They suggest displaying the two-person version in a museum where people can play through the interaction. While this is not possible within Adobe XD or the scope of this project, this is a possible next step after the completion of this bachelor project.

7.2.3.2 Roundtable 2

Just as in the first roundtable session, the participants were first introduced to the artifact on its own, without the scenarios. When asked for their initial reaction to the world described by the artifact, they voice one major concern: loneliness. The future described itself is perceived as very lonely by the participants and they fear the app is only making that worse. In their discussion they compare it to the measures taken in retirement homes during the covid-19 pandemic. During that time retirement homes were closed for visitors, to protect their inhabitants. The consequent loneliness many older adults felt was, in the eyes of the participants of this discussion, not worth it. They think similarly about “Food for Thought”. Risking to increase loneliness among older adults and thereby reducing their quality of life is not justified by increasing their physical health. In this conclusion the discussion already hinted at the idea of legal and accessible euthanasia, which the group discussed further at a later point.

Even before being confronted with specific problems as described in the scenarios, the participants engaged in a lively discussion on possible alternatives to the described digital health interventions. As they deemed loneliness to be the biggest issue in the future described, they discussed ways of combating loneliness in a world where there are not enough caretakers to rely on personal care. They saw potential in robot companions for older adults that track their health, maybe even based on implants. Some participants voiced concerns on if the interaction with those robot companions would feel “too robotic”, while others trusted in future developments of artificial intelligence to enable them to “feel human”.

When presented with Joke's scenario one participant initially judged the decision to use “Food for Thought” the right one. The other participants disagreed, they questioned whether it is too much to ask of Joke to change her habits so late in life, basically on her own. Similarly, to the first roundtable group, this group also started to think of alternative solutions for Jokes problem. They discussed making use of food delivery systems to order all her meals. They also discussed the problems with this concept such as the questionable nutritional value of the ordered food and the fact that the few healthy options are often limited to bigger cities. They also considered that this solution might then put too much pressure on the food delivery industry, if it was to be used by all older adults like Joke.
Another topic discussed during the session was responsibility. The shared responsibility of the family members registered in Jokes “Food for Thought” app, to keep sending her messages to motivate her to eat, should not be extended to Tommy. Because of his young age he could not consent to being included and it is not fair to put such a pressure on a

child. The participants fear that, in the case that Joke gets seriously sick or dies due to malnutrition, Tommy might start blaming himself as soon as he is old enough to understand the app.

When confronted with Ton's scenario it is interesting to note that participants of this session brought up the same example of drug addiction that was also used in the first roundtable discussion (it was in both cases not brought up by the person attending both sessions). However, while the first group used it to compare it to Sieglinde's situation, this group brought it up during Ton's. In this group the consensus was reached that, while it is ethical to force a person with a drug addiction into recovery, it is not ethical to force Ton to use “Food for Thought”. One participant asks “What if someone doesn't want to get old? Why should we force them to live healthy?”. Shortly after this the group reached a conclusion: people should not be forced to eat healthy but if they choose not to accept the help (for example through “Food for Thought”) they should suffer the consequences on their own.

From here the discussion arrived at the question whether someone like Ton, who refuses help, should be treated in the case that his unhealthy lifestyle causes any diseases. This once again prompted the participants to relate the scenario to covid-19. This time it is compared to choosing to stay unvaccinated. Several participants shared the opinion that people who choose to stay unvaccinated without medical reason, should also forfeit their right to be treated in case of an infection with covid-19. One participant questions this way of addressing health, “How would you then measure a healthy lifestyle, how far would that go?” They argued that being overweight for example does not always indicate an unhealthy lifestyle and questions where to draw the line. No answer to this question but the dilemma itself caused the participant to judge this approach to healthcare as unethical. Instead, they came up with a new solution: restructuring our community to include older adults more with their own age group but also with the rest of the population. They expect that the support such a close community can offer would help older adults stay healthy.

After being shown Sieglinde's scenario the discussion returned to the topic of euthanasia. The group agrees that, with a dependency ratio of 50% euthanasia should be legal and accessible to those who want to end their life. They do however voice concerns of people feeling pressured to commit euthanasia once they have reached a certain age and feel like they are putting too much pressure on society if they continue to live. Overall, they voice a wish for the healthcare sector to focus more on improving the quality of life instead of prolonging life. One participant brings up the example of an acquaintance, who said they have been “done with life” for the past 20 years and no longer enjoy it. People like them should have access to human ways of ending their lives. Towards the end of the session the conversation once more returns to rethinking our communities to increase health and wellbeing among older adults. The solution proposed earlier to have close communities for older adults was formulated as “student houses for older adults”. Houses in which groups of older adults live and eat together, just like many students do.

To conclude, the second roundtable discussion resulted in a lively discussion on topics of health and wellbeing of older adults today and in the future. Popular topics during this session included loneliness among older adults, the legalization of euthanasia and rethinking community structures. While the participants do not want to live in a future in which personal healthcare is replaced by digital health interventions and similar technologies, they do fear this might become a reality. Instead of relying on technologies, future society should focus more on building supportive communities of older adults. They also expressed the wish for solutions that focus on improving quality of life over prolonging life.

7.2.3.2.1 Evaluation form 2

After concluding the discussion, the participants were asked to fill in a short evaluation form, as described in chapter three, to evaluate the prototypes based on its role as a facilitator for

discussion. The participants judged “Food for Thought” and speculative design in general to be a useful tool to discuss the future. One participant writes: “I think it's good that people start looking more into the future because this allows us to prevent bad things from happening, in our own lifetime”. Another participant writes “I think it [“Food for Thought”] is very useful to highlight the importance of making the future of our society discussable”. These comments reflect the overall high scores given by the participants on questions of usefulness and clarity of the prototype.

The evaluation also showed some points of improvement. Participants were divided on whether the artifact on its own, without the scenario, was clearly identifiable as speculative. This should be addressed in future iterations. One participant was further unsure whether the scenarios added value to the conversation that could not have been achieved by the artifact on its own. “You never know where a discussion can lead you”, they write. Participants also made suggestions for future iterations. Again, more interactivity is suggested: “I think it helps if you can see [the artifact] on your own phone before the discussion and it is made so that you can use it yourself to make the discussion more interactive.” Another suggestion is to add onto the context in which the app is set. One participant suggests structuring the discussion sessions in levels, always using the results of one session to develop new scenarios that dive deeper into the topics discussed, and then to discuss those new scenarios with the same group. Lastly, someone suggested adding a functionality to the system, automatic feedback being sent to the caregivers. This could additionally open discussions on whether it is ethical to share this information.

7.2.3.3 Conclusion Roundtable Discussions

The roundtable discussions have shown to be an ideal setting to present a speculative artifact. The leading questions and scenarios helped identify the purpose of the artifact as a tool for discussion. Nonetheless, the discussions showed points of improvement, such as adding more context to the artifact itself. How these suggestions are implemented can be seen in the final prototype as discussed in chapter six.

The sessions provided a lot of insight into the values of current members of society and their wishes and fears for the future. Popular discussion points in both sessions were the legalization of euthanasia and current healthcare practices focusing too much on prolonging life and too little on improving quality of life. Both sessions showed that the future described by the prototype matches with real fears the participants have for the future. Fears voiced include the automation of care, the loss or reduction of physical contact with doctors and caregivers, loneliness and living longer but not better lives. The participants however also voiced their wishes for the future. Wishes voiced include closer community structures that involve older adults actively, legalization of euthanasia and for healthcare to focus more on improving quality of life.

It was noticeable that even without asking the participants for alternative solutions, both groups discussed them multiple times. Another observation made was that participants often compared the described future to recent occurrences such as the covid-19 pandemic, which often seemed to help them relate to the future described. During the second session the participants were provided with more information on the context around “Food for Thought”, which helped to eliminate questions on the context towards the beginning of the discussion and allowed them to instead start the discussion immediately.

7.2.4 Conclusion Qualitative Evaluation

Based on the results of the qualitative evaluation the prototype is evaluated on the non-functional requirements defined in chapter five. In Table 7.2 the functional requirements are listed together with their assessment. The assessment is done in four categories: “Yes” marks requirements that are completely fulfilled, “Yes, but” marks requirements that were partially fulfilled, “No, because” marks requirements that are not fulfilled but with a good

reason and “No” marks requirements that were not fulfilled in the final iteration of “Food for Thought”.

No.	MoSCoW	FR or NFR	Requirement	Assessment
1	Must have	NFR	The artifact must focus on **starting a conversation** on the topic of healthy eating and malnutrition for older adults.	Yes, but also broader topics of health and wellbeing in older adults were discussed
2		NFR	The prototype must be experienced as **adding value** to the conversation	Yes, but one tester was unsure about this
7	Should have	NFR	The prototype should be **controversial but not too triggering**	Yes
9	Could have	NFR	The prototype could be utilized in the research of **BSS** or **moccia**	No, not yet
10		NFR	The prototype could be **displayed in a retirement home over a longer period** in order to investigate how it impacts the people living there and what conversations it starts later on	No
11		NFR	The prototype could also be used to **address loneliness** in older adults	Yes, but the discussions were not focused on it (but could be adjusted to fit it)
12	Won't have	NFR	The prototype won't **address issues unrelated** to the health of older adults.	No

Table 7.2 Assessment of non-functional requirements sorted using MoSCoW

7.3 Conclusion evaluation phase

During the evaluation phase of this project the prototype developed was tested with an expert in the field of healthy eating for older adults, two older adults and two roundtable discussions. Based on the results of those tests the prototype was assessed on whether it meets the requirements set in chapter five. The qualitative evaluation resulted in recommendations for the final iteration of the prototype, as described in chapter six, as well as future work. It further functions as a basis for the conclusion drawn in the next and final chapter of this report.

CHAPTER 8 - DISCUSSION

In this final chapter, the findings of this research are discussed. It starts by giving a summary of the findings. Next, it draws conclusions based on the research questions defined in the

first chapter. After that, limitations of the study are discussed. Lastly, recommendations for future research are given.

8.1 Project summary

The goal of this study was to investigate how to open a debate on desirable futures for technology-supported healthy aging, to use the insights of such a debate to support the development of such technologies. Background research, through means of literature and state of the art research, was conducted on the topics of healthy eating in older age, effects of aging on eating behaviour, malnutrition, and speculative design. Based on this research it was decided to conduct a case study in which a speculative artifact, addressing the topic of malnutrition in older adults, was developed. The concept for the speculative design was ideated through a brainstorming session with fellow students, using personas developed based on the findings in literature. Next the concept was worked out further in the specification phase, where the context the design is set in was defined and options for realizing the artifact were explored. This phase resulted in the concept of “Food for Thought”, an app that denies its user access to messages from their loved ones until they have consumed a nutritious meal. The concept is set in the year 2037, where big parts of personal healthcare were replaced by digital health interventions to combat the growing pressure on the healthcare sector. Next, the concept was translated into an interactive prototype and three scenarios. Lastly, the prototype was evaluated with an expert, two older adults and in two roundtable discussions. The conclusions drawn from this research are discussed below.

8.2 Conclusion

In the following the main research question and its sub-questions are answered based on the results of this research project. First the sub-questions are answered to help formulate the answer to the main research question. The answers are based on findings in literature, the expert interview and, most importantly, observations made during the evaluation sessions.

8.2.1 Sub-RQ 1: Effects of aging on eating behaviour

Sub research question one: “How does aging influence eating behaviour and what consequences does this have for an older adult's health?” was answered through literature research and confirmed during an interview with an expert for healthy eating for older adults. Aging was found to have various effects on eating behaviour. These include physical changes to an aging person's body that restrain the ability to eat or experience certain foods, medical influences such as side effects of certain medication or disease, and social factors such as loneliness or significant moments like widowhood or retirement that disrupt the routine of an aging person. These natural changes in the life of an older person cause a high number of older adults to experience overall less food enjoyment, which leads them to consume a small and unbalanced diet, which ultimately leads to malnutrition. Malnutrition, which was found to be the leading threat to an older adult's health, puts older adults at higher risk for disease and increases their fragility.

8.2.2 Sub-RQ 2: Interventions against malnutrition

Sub research question two: “What types of interventions can be taken to address malnutrition in older adults?” was answered through literature research and consulting an expert in the field of healthy eating for older adults. Four main strategies for addressing malnutrition in older adults were found. The traditional approaches include supplementation

and dietary modifications. While more recent approaches focus on the underlying causes of malnutrition in older adults, by improving meal context or overall food enjoyment. The latter are confirmed to be applied in practice by the expert. The expert and literature research confirmed that even small changes to the context in which meals are consumed, for example though involving the older adult in the decisions of what meal is cooked or what condiments are served, can have positive influence on the food intake of the older adult.

8.2.3 Sub-RQ 3: Benefits of speculative design

Sub question three: “What is speculative design and what benefits does it offer compared to traditional design approaches?” was answered by examining literature and the state of the art on speculative design and applications of it in the context of healthcare. Speculative design was defined as a design practice that concerns itself with reflecting on current developments in society and technology through envisioning the future those developments can lead to. Often speculative designs are based on emerging technologies. The ultimate goal of speculative artifacts is to facilitate reflection, possibly in the form of discussion, on current developments and their future implications. Speculative design was found to offer many benefits compared to traditional approaches. Those include freedom from technological limitations, social taboos, laws, judgment, and commercial goals. All these combined allow speculative design to be proactive in shaping the future and novel approaches to current issues.

8.2.4 Main RQ: Facilitating discussion through speculative design

The main research question “How can we facilitate discussion on ways to prevent malnutrition in older adults through healthy eating, to support the development of future technologies, using speculative design?” was answered through means of the case study “Food for Thought”. The following conclusion is based on the observations made during the evaluation sessions and the feedback received from the participants of those sessions. Overall, the conclusion can be made that speculative design in general, as well as the case study “Food for Thought” in particular, is a useful tool to facilitate discussion.

The roundtable discussions that used “Food for Thought” as a basis for their debate resulted in lively discussions on various topics of future healthcare. Valuable insights were gained on wishes and fears of the participants for the future of healthcare that can be used as a starting point in the development of novel technologies. For example, both sessions showed that the future described by the prototype matches with real fears the participants have for the future. Fears voiced include the automation of care, the loss or reduction of physical contact with doctors and caregivers, loneliness and living longer but not better lives. These are things that should be avoided or actively worked against in the development of novel technologies. During the discussions wishes of the participants towards the future became apparent as well, those can be used as starting points or goals to work towards when developing new technologies. Wishes voiced include closer community structures that involve older adults actively, legalization of euthanasia and for healthcare to focus more on improving quality of life. Especially a focus on quality of life and designing for closer communities can be used as starting points to develop new healthcare solutions.

Next to possible starting points for the development of novel technologies for technology-assisted healthy aging, the research also resulted in requirements for successfully using speculative design as a tool for field research. Literature suggested the careful management of the speculation to be the most important factor in successfully using speculative design. The case study “Food for Thought” confirmed that managing the speculation through means of basing the design on real emerging technologies and logical trajectories of current development as well as relating it to current occurrences such as the covid-19 pandemic, increased relevance and helped the participant relate it to the current world. But while it is found to be important, it was not observed to be the most important one.

The most important factor in successfully using speculative design as a tool for debate, observed during this research, is presenting the artifact in the right setting. In one on one (or one on two) semi-structured interview settings participants struggled to understand the prototype as speculative. The setting of a roundtable discussion allowed the participants to identify the purpose of the artifact as a tool for debate with relative ease. These sessions were observed to result in insights into the participants' opinions on broader topics than the prototype itself, the interviews on the other hand resulted in feedback and comments on the specific approach of “Food for Thought” instead of discussions of the broader topic of future healthcare. It can be concluded that the setting in which the speculative artifact is presented influences the outcomes of the discussions.

Another important factor observed is the context given. In the first roundtable discussion, the context given was limited, to allow for the participants to fill in the blanks on their own. However, this resulted in many questions at the beginning of the session. During the next session more context was given, while still allowing for some ambiguity for participants to interpret things on their own. This session was more successful, as the added context was found to support the participants in immersing themselves in the scenarios.

Related to the context is the word used to describe the artifact during the sessions. As suggested by literature found in chapter two, this should be chosen carefully. Literature suggested the use of the term “speculative design”, however, during my research it became apparent that participants do not associate anything with this term. Instead, the findings of this research suggest using simple and widely known words such as “art” and “science-fiction” to explain the concept. Lastly, it is important to choose the right participants for the discussion. Ideally both professionals like caretakers and dietitians but also the end users such as older adults and their family are included. As the design is set in the future, younger people, the older adults of the future, can be included as well. In general, it is recommended to have a wide variety in professions and age.

8.3 Limitations

While this study resulted in valuable insights on how speculative design can be used to benefit the development of future technologies through facilitating debate on topics of healthcare for older adults, these findings must be seen in light of some limitations. In the following, limitations in the final design as well as in the research process are discussed.

8.3.1 Design limitations

The final design is limited mainly in its interactivity. Multiple participants expressed the wish to test the artifact from “both sides”, to get fully immersed in the experience. This could also provide valuable insights into the perspective of the family member of the older adult. Using the technology employed in the final prototype, an interactive mock-up, this was not possible to implement. The system further did not allow for using the device's camera to mock-up the scanning part. The scanning of the food and subsequent receiving of the message is an integral part of the experience. Having this part be more realistic could have allowed the testers to further immerse into the scenario and provide deeper insights. Further, the design process is informed by literature and not by first hand experience, as would be the case in co-creation. Including users directly in the design of the artifact might have left to different choices in the design of the concept.

The type of technology chosen to realize the artifact also came with some limitations during the evaluation sessions. While evaluation participants were able to interact with the prototype themselves, this interaction sometimes proved difficult. During the evaluation, multiple devices (phone, iPad, laptop) were used to display the artifact on, to allow participants to inspect it simultaneously instead of having to wait, as well as to have it in front of them for reference during the discussion. The mobile version of Adobe XD (as used on the phone and iPad), intended to easily test prototypes of apps, proved difficult to navigate

for some research participants. The mobile version allows you to display one flow (iteration of artifact in this case) at a time, which was set to the most recent one by me. However, there is the option to switch between flows or to inspect all artboards. This was discovered by one of the participants, causing them to wander off into older iterations, instead of following the path laid out for them. In the future, this could be avoided by saving a new version of the file with only the most recent flow in it and providing a short introduction on how to use the prototype.

Another limitation of the artifact itself is that in its current state it is not functional enough to be displayed, for instance in a museum, without supervision. One problem here is the interactivity. The artifact must be reset after every use and therefore would need someone standing next to it. Another problem is the descriptive scenario. It is an integral part of the concept but right now only exists in the form of text. If the prototype were to be displayed it would be accompanied by a lot of text, which is unlikely to be read by viewers. Instead, the scenario should be translated into illustrations or videos. Lastly, the artifact itself, if it were to be displayed somewhere outside of the context of a roundtable discussion, might result in discussions that quickly move away from the health and wellbeing of older adults. This can be avoided by making the scenarios an integral part of the experience and mimicking the role of the discussion facilitator through questions and points of discussion suggested by the system itself or the scenario.

8.3.2 Research limitations

Next to limitations in the design of the final prototype the research process was limited as well. The biggest limitation encountered was the inability to find older adults to participate in co-creation and later in the evaluation phase. Initially this project set out to actively involve older adults, as well as care professionals (cooks in retirement homes, caretakers etc.), in the design of the speculative artifact. A lot of this was spent recruiting and contacting retirement homes, but without success. Relatively early on it became clear the care professionals do not have time to participate in my research. So, the plan was adopted to only involve older adults in the design. However, after calling, emailing, visiting, and leaving flyers at multiple retirement homes in Enschede, no older adults were found. Using grandparents of myself or friends of mine was not possible either as they live too far away. This is a major limitation for my project, as co-creation would have provided valuable insights into the target audience and benefited the design process. Further, the recruitment of co-creation participants, and later evaluation participants, took a lot of time, that is now not reflected in the work done. It caused delays in the design process and forced the design to rely on findings in literature and ideas developed by students instead of getting direct insights into the target group of older adults.

Another limitation encountered in the research process were language barriers. I, as the main researcher, speak Dutch well enough but not perfectly. However due to the limited number of available participants and the target group at hand, almost all evaluations were held in Dutch (with exception of the first roundtable discussion in which I presented the context and artifact in English but then switched to Dutch during the discussion). In most cases this was chosen because the testers did not speak English at all or very limited. In the remaining cases it was chosen based on the preferences expressed by the participants. While I do believe this caused the participants to be able to have deeper discussions on the topic presented, it required a lot of preparation from my side. It also made it more difficult to react spontaneously to topics that arose during the discussion. Further, as I am not a native speaker, it was sometimes difficult to bring across the rather complicated topic of speculative design, even when using simpler words such as art.

8.4 Future Work

Based on the current state of the prototype and the evaluation sessions several recommendations for future work are made. Recommendations for future work are separated in two types: recommendations for “Food for Thought” specifically and recommendations for researching the use of speculative design in general in the development of novel technologies.

8.4.1 Recommendations for “Food for Thought”

The final evaluation of the prototype resulted in several recommendations for future work on the case study “Food for Thought” specifically. Firstly, the interactivity of the prototype should be improved. One suggestion was to construct a system that allows the users to experience the scenario from both sides, the older adult struggling with eating healthy and the family member who is sending them messages. This could not be achieved through Adobe XD, so finding alternative technology, such as a programming language, is advised. The program could then be constructed so that it allows for one user (the family member) to send a message from one phone to the other (the older adult). This could be expanded further through constructing a set of the living room or kitchen of the older adult and asking the participants to act out the scenarios, to allow the discussion participants to get fully immersed in the world the artifact is set in.

Further, it is recommended to improve the independence of the prototype. In its current form it is not possible for users to interact with it outside of the supervision of the designer, as the system requires it to be restarted after every use. This could be improved if the current prototype were to be translated into a program, for instance using processing or JavaScript. The new iteration could include the option to receive a prompt containing a scenario or a question that provides the viewer with something to discuss or think about. Another screen or simple pen and paper could be placed next to the prototype for the viewers to note their feelings and thoughts towards “Food for Thought”. A more independent prototype would also allow for it to be displayed in a public space, for instance a museum or art installation. Good options for this would be the museum Tetem [34] or the yearly exhibition Gogbot [35] in Enschede, or the designlab at the university of Twente. In Tetem it could be used in the setting of a workshop as well. It could further be used by researchers in the Biomedical Signals and Systems research department of the university [36] in their research with older adults.

Another recommendation for the prototype is to visualize the scenario. Currently only the artifact is visual, while the scenarios and context are presented in text form. Adding visualizations like videos or illustrations to the scenarios could improve participants' engagement and help them visualize the situation at hand. One recommendation for this is to create a fictional magazine using the cover story vision canvas [37, 38] This magazine cover and the stories on it can provide the participants with insights into the state of the world at the time the artifact is set. For “Food for Thought” a health themed magazine is recommended. Possible cover stories could include specific information on digital health interventions such as “New policy accepted: digital health-interventions, such as “Food for Thought”, no longer require patients’ approval to block contacts and access personal data”. They could also give more general insights into the way healthcare is conceptualized in the described future: “CEO of “Health Interventions” announces next phase in his plan to solve the healthcare crisis “Within the next 10 years we will eliminate any need for humans in the healthcare sector”.

Lastly, more user testing should be done to gain more insights into the demographics fears and wishes for the future of healthcare. During this project, roundtable discussions were conducted with students and adults in their 50s. Future research should include a diverse group of participants in the roundtable discussions, including older adults and care professionals. A suggestion made by one of the evaluation participants is to work with one

and the same group but in levels over multiple sessions, developing new scenarios in between sessions based on the topics discussed in the last session. This way the sessions could give deeper insights that can further support the development of novel technologies. It should also be evaluated how “Food for Thought” functions in the context of the real development of a novel technology and investigated how it influences the design process.

8.4.1 Recommendations for future research

Speculative design in general has shown great potential to be used in the development of novel technologies, through facilitating discussions that provide valuable insights into the target groups values, as well as wishes and fears for the future. Nonetheless there is more to research on how speculative design can be used within a research through design approach. For one, research could be conducted on how co-creation, in combination with speculative design, can support the development of novel technologies through providing even deeper insights into the target group. First attempts were made on this, as described in chapter 2.1.3.3, but further research is required to confirm its benefits. During the co-creation session various stakeholder groups should be involved, among which are older adults and workers in retirement homes, such as cooks and caretakers, but also dietitians and adults of all ages (the older adults of the future).

Further research should also investigate how a speculative design can be used in the development of a novel technology through conducting case studies. During these case studies a developed artifact, for instance “Food for Thought”, could be used during a roundtable discussion that, next to various stakeholders, also includes designers that are working on developing a novel technology to address current issues in society (malnutrition in older adults and demographic aging, if “Food for Thought” were to be chosen). Through this research it could be investigated how the use of speculative design as a tool for discussion influences the design process and results. Lastly, alternative applications of speculative design as a tool for discussion should be researched. One would be to shape future policies in the healthcare sector. Sessions with politicians and insurance companies could be conducted to develop a shared vision of future healthcare together with the general population.

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APPENDIX A

information brochure and informed consent expert interview

Information brochure & informed consent

This research is conducted within the scope of a Graduation Project for the Bachelor of Creative Technology at the University of Twente.
Main researcher: Nathalie Kamp
Supervisors: Dr. Femke Nijboer (femke.nijboer@utwente.nl) & Lara Siering (l.siering@utwente.nl)

Research

The goal of this research is to investigate the future of healthy eating for older adults by developing an artifact that depicts said future. This was done through speculative design, a practice that designs for possible futures. With the help of this technique a digital artifact and a descriptive scenario are developed that should now be evaluated with a group of older adults. During the evaluation the participants get to interact with the artifact and discuss the future it describes. The evaluation will be conducted in the form of semi-structured interviews discussing the artifact and scenario. The Questions are open-ended and participants can, at any time, without giving reason, refuse to answer a question or leave the interview, if they wish to. The interview is estimated to take 45 minutes.

Data

The interview session will be audio recorded. All data collected is anonymous. The recordings are only listened to by the researcher and not made available to third parties. After analyzing the recording, the results will be published only within the frame of this research and anonymously. It is possible that quotes from the interview are used within the research paper, in which case they will be presented in a way such that they are not traceable to the participant.

Contact

Should there be any questions regarding this research, you may contact the main researcher Nathalie Kamp (n.kamp-1@student.utwente.nl). In case you do not feel comfortable addressing the researcher directly, the ethics committee can be contacted via Petri de Willigen, secretary of the Ethics Committee (tel. 053-489 2085, ethicscommittee-cis@utwente.nl). This is a committee of independent experts at the university, they are available for questions or complaints regarding the research.

Informed Consent

Yes No

I'm fully informed about the research. The goal of the research and the methods are clear, any questions I had after reading the explanatory text were answered.	☐	☐
I understand that I can refrain from answering certain questions or withdraw from the research completely, without giving a reason, at any time without consequence.	☐	☐
I give permission for my participation in the research and for collecting and using my data as described above.	☐	☐
I give permission to record the session for the purpose of this research.	☐	☐
I give permission to use anonymous quotes from the interviews in the context of this research	☐	☐
I understand that taking part in the study involves the use of notes taken during the sessions by the researcher and the participants.	☐	☐

Signatures

_____	_____	_____
Participant	Signature	Date
_____	_____	_____
Researcher	Signature	Date

Information brochure and informed consent roundtable sessions

Information brochure & informed consent

This research is conducted within the scope of a Graduation Project for the Bachelor of Creative Technology at the University of Twente.

Main researcher: Nathalie Kamp

Supervisors: Dr. Femke Nijboer (femke.nijboer@utwente.nl) & Lara Siering (l.siering@utwente.nl)

Research

The goal of this research is to investigate the future of healthy eating for older adults by developing an artifact that depicts said future. This was done through speculative design, a practice that designs for possible futures. With the help of this technique a digital artifact and three descriptive scenarios are developed that should now be evaluated on their usefulness in a discussion.

During the evaluation, the participants get to interact with the artifact and discuss the future it describes. The evaluation will be conducted in the form of a roundtable discussion in which the researcher functions as the moderator. The researcher will give an introduction in the topic, show the prototype, and walk through the three scenarios. After each scenario there will be one or more questions posed that a discussion can be formed upon.

Main Question for the session: What will life look like, especially for the most vulnerable people under us, in a world on the height of demographic aging? And how do we want it to look?

The participants can, at any time, without giving reason, refuse to answer a question or leave the session, if they wish to. The complete session is estimated to take 45 minutes.

Data

During the session, the researcher will take notes. These notes are used only within the frame of this research and viewed exclusively by the researcher. At no point will they be made available to third parties. All data collected is anonymous. It is possible that quotes from the discussion are used within the research paper, in which case they will be presented in a way such that they are not traceable to the participant.

Contact

Should there be any questions regarding this research, you may contact the main researcher Nathalie Kamp (n.kamp-1@student.utwente.nl). In case you do not feel comfortable addressing the researcher directly, the ethics committee can be contacted via Petri de Willigen, secretary of the Ethics Committee (tel. 053-489 2085, ethicscommittee-cis@utwente.nl). This is a committee of independent experts at the university, they are available for questions or complaints regarding the research.

Informed Consent

	Yes	No
I'm fully informed about the research. The goal of the research and the methods are clear, any questions I had after reading the explanatory text were answered.	☐	☐
I understand that I can refrain from answering to certain questions or withdraw from the research completely, without giving a reason, at any time without consequence.	☐	☐

I give permission for my participation in the research and for collecting and using my data as described above.	☐	☐
I give permission to use anonymous quotes from the session in the context of this research	☐	☐
I understand that taking part in the study involves the use of notes taken during the sessions by the researcher.	☐	☐

Signatures

_____	_____	_____
Participant	Signature	Date
_____	_____	_____
Researcher	Signature	Date

APPENDIX B

Roundtable planning

Semi-structured roundtable discussion & evaluation form at the end
No recordings but note taking

Part 1: Roundtable Discussion “The future of healthy eating” (ca.35 min)

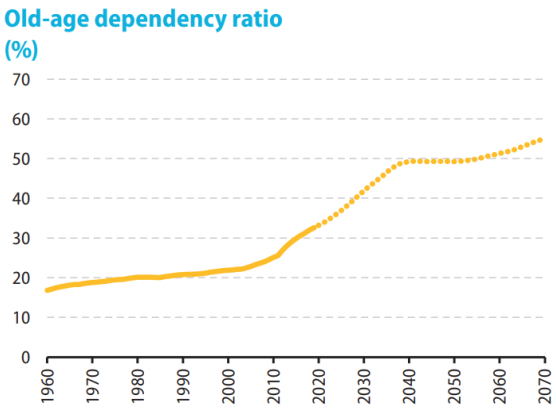
Introduction (ca. 10 min)

Demographic aging statistics
Demographic aging, the shift of the population towards older ages, is one of the leading problems we face today. Also in NL demographic aging is very noticeable. The median age of the dutch population throughout the 1960s and 70s was consistently around 28, starting in the 1980s it increased drastically up to 43 in 2020.

Vergeizing
Demografische vergrijzing, de verschuiving van de bevolking naar een hogere leeftijd, is een van de belangrijkste problemen waarmee we vandaag worden geconfronteerd. Ook in NL is de vergrijzing sterk merkbaar. De mediane leeftijd van de Nederlandse bevolking lag in de jaren zestig en zeventig constant rond de 28, vanaf de jaren tachtig nam het drastisch toe tot 43 in 2020.

Healthcare sector overworked
One of the main concerns raised by demographic aging is an increased old age dependency ratio, the number of older people in retirement (65+), so that need to be cared for, compared to the number of people of working age (15-64).
WIthin the next 20 years this ratio is predicted to rise from 34% to 50%.
With so many older adults, who are at high risk for chronic disease, the healthcare sector is bound to get overwhelmed.

Zorgen
Een van de belangrijkste zorgen die de vergrijzing met zich meebrengt, is een grotere afhankelijkheidsratio van ouderen, het aantal gepensioneerden (65+), dus voor wie zorg nodig is, in vergelijking met het aantal mensen in de werkende leeftijd (15-64 jaar).).
Binnen de komende 20 jaar zal deze ratio naar verwachting stijgen van 34% naar 50%.
Met zoveel oudere volwassenen, die een hoog risico lopen op chronische ziekten, zal de gezondheidszorg ongetwijfeld overweldigd raken.



Need for preventative measures

To avoid this we need to shift healthcare away from merely reacting to existing disease and towards preventative measures.

One of such measures : keeping people healthy though healthy diet

But older adults more than other groups struggle with maintaining healthy eating habits
There are many reasons for this, most of which are based on natural changes that come with age: loss of smell & taste, dental or digestive problems, or a disruption in their routines such as widowhood or retirement.

Voorkomen
Om dit te voorkomen, moeten we de gezondheidszorg verschuiven van alleen reageren op bestaande ziekten naar preventieve maatregelen.

Een van die maatregelen: mensen gezond houden door gezond te eten

Maar oudere volwassenen worstelen meer dan andere groepen met het handhaven van gezonde eetgewoonten.

Hier zijn veel redenen voor, waarvan de meeste gebaseerd zijn op natuurlijke veranderingen die met de leeftijd gepaard gaan: verlies van geur en smaak, tand- of spijsverteringsproblemen, of een verstoring van hun routines zoals weduwschap of pensionering.

Emerging tech
Emerging technologies seem to offer great potential to address this problem
One such is : AI developed at uni in canada that can analyze the nutritional intake based on pictures of the plate before and after consumption.
In a few short years this might be used by staff in retirement homes to monitor food intake of the inhabitants.
But what if we think further? On the peak of demographic aging, when the care sector is so overworked with a dependence ratio of 50%, how could this tech be used then?

Emerging tech
Opkomende technologieën lijken een groot potentieel te bieden om dit probleem aan te pakken
Een daarvan is: AI ontwikkeld aan een uni in Canada die de voedingsinname kan analyseren op basis van foto's van het bord voor en na consumptie.
Over een paar jaar zou dit door het personeel in bejaardentehuizen kunnen worden gebruikt om de voedselinname van de bewoners te controleren.
Maar wat als we verder denken? Op het hoogtepunt van de vergrijzing, wanneer de zorgsector zo overwerkt is met een afhankelijkheidsratio van 50%, hoe zou deze technologie dan kunnen worden gebruikt?

The concept (ca. 5 min)

To answer this question I have employed speculative design to critically examine how our future could look like. This resulted in a speculative artifact. This artifact is set in the year 2037 in which our society has resorted to implementing various personal digital health interventions. One of those is “Food for Thought”, an app that aims to motivate older adults to eat healthy by denying them access to messages from their family if they don't eat nutritious meals.

Om deze vraag te beantwoorden heb ik speculatief ontwerp gebruikt om kritisch te onderzoeken hoe onze toekomst eruit zou kunnen zien. Dit resulteerde in een speculatief artefact. Dit artefact speelt zich af in het jaar 2037 waarin onze samenleving zijn toevlucht heeft genomen tot het implementeren van verschillende persoonlijke digitale gezondheidsinterventies. Deze digitale gezondheidsinterventies vervangen een groot deel van de persoonlijke zorg. Een daarvan is 'Food for Thought', een app die oudere volwassenen wil motiveren om gezond te eten door hen de toegang tot berichten van hun familie te ontzeggen als ze geen voedzame maaltijden eten.

Walk through prototype with them

Discussion (ca. 20min)

These are ways to get a conversation started, but it is ok if the participants find their own discussion points. I will function as the moderator. I will try to involve participants and ask questions to steer the discussion.

leave the prototype to them to inspect themselves
I will take notes

Main Question for the session: *What will life look like, especially for the most vulnerable people under us, in a world on the height of demographic aging? And how do we want it to look?*

Prototype (Warm up)

What is your first impression of this future? Would you like to live in it?

Scenario Joke

Did they make the right decision? Was this an appropriate way of addressing the issue? Even though he might not understand it yet, there is a big responsibility on Tommy to keep his Grandma healthy, is it fair to put this on him?

Scenario Ton

What sacrifices (like alienating Tons daughter) are we willing to make to ensure health and to put pressure off the healthcare care sector?

Scenario Sieglinde

What do we do when people don't want our help? Could we force them to eat healthy if they otherwise put too big of a burden on their families or the healthcare sector?
Who is responsible for the health of the most vulnerable people under us?
Do we want to be each responsible for our own health or should we share this responsibility?

Conclusion

Again, is this a world you want to live in?

If not, what do we have to change to avoid it?

Part 2: Evaluation Form (ca.10 min)

The Evaluation focuses on the use of the artifact in a discussion, not on the usability of the system in general

hand them the evaluation form

On a scale of 1-5, 1 being completely disagree and 5 being completely agree, how much do you agree with the following statements:

Speculative design, in general, is a useful tool to discuss the future.

The speculative design “Food for Thought” functions as an effective tool to discuss topics related to health and wellbeing of older adults in a world on the height of demographic aging.

The speculative design “Food for Thought” could be used in the ideation phase of developing new technologies related to health and wellbeing of older adults.

The speculative design “Food for Thought” could be used to make design decisions when developing new technologies related to health and wellbeing of older adults.

When viewing the artifact and scenario it is clear that the main topic it addresses is health and wellbeing of older adults in the future.

The artifact on its own (without the scenario) is clearly identifiable as a speculative design.

The scenario helps make clear that the artifact at hand is speculative.

The scenario helps identify the purpose of the artifact as a conversation starter.

The scenario presented offered added value to the discussion, in a way that could not have been achieved by the artifact on its own.

While the artifact might be used to address different topics, the main one it starts a conversation on is health and wellbeing

If the artifact, together with the scenario, were to be displayed in a public space (for example a museum or a design exhibition) it would initiate a conversation about topics related to health and wellbeing of older adults in a world on the height of demographic aging.

The artifact and the scenario were controversial but not too triggering

The artifact and scenario are controversial

The artifact and the scenario are triggering to certain groups of people

The artifact and scenario are the right amount of controversy to facilitate debate without being offensive.

Do you have any comments on any of the statements above, please let me know:

_____

What did you, in general, think of using speculative designs to discuss the future?

_____

Apart from general health and wellbeing of older adults, what other topics, if any, could be addressed through “Food for Thought”?

_____

APPENDIX C

Results evaluation form roundtable 1

3 responses

Accepting responses

Summary | Question | Individual

On a scale of 1-5, 1 being completely disagree and 5 being completely agree, how much do you agree with the following statements:

Speculative design, in general, is a useful tool to discuss the future.

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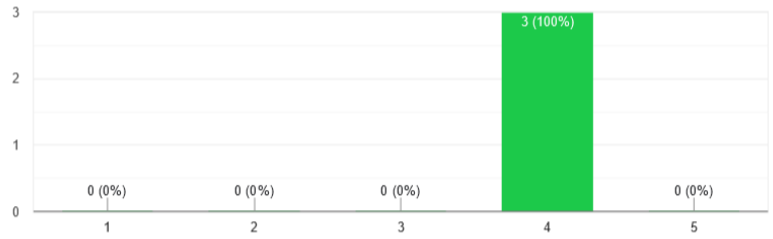
3 responses



The speculative design "Food for Thought" functions as an effective tool to discuss topics related to health and wellbeing of older adults in a world on the height of demographic aging.

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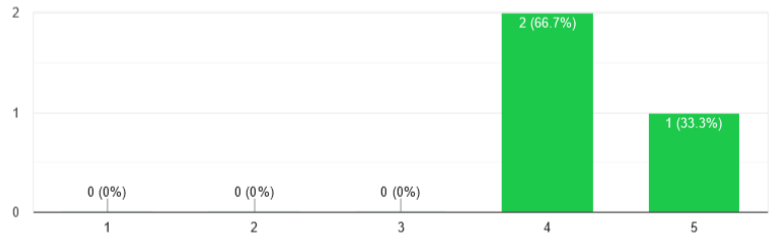
3 responses



The speculative design "Food for Thought" could be used in the ideation phase of developing new technologies related to health and wellbeing of older adults.

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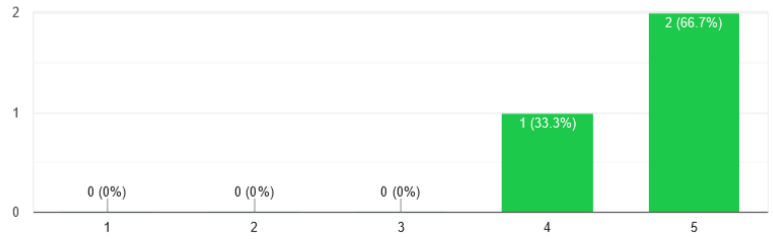
3 responses



The speculative design “Food for Thought” could be used to make design decisions when developing new technologies related to health and wellbeing of older adults.

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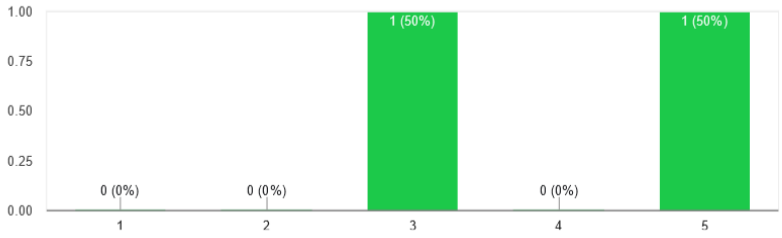
2 responses



When viewing the artifact and scenario it is clear that the main topic it addresses is health and wellbeing of older adults in the future.

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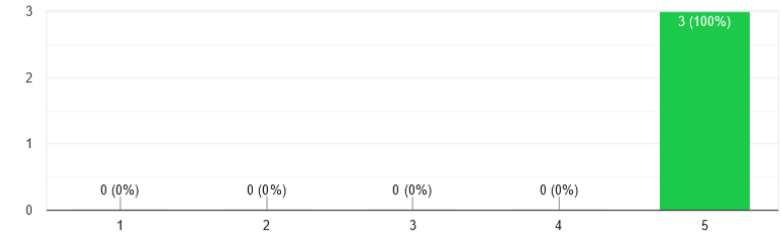
3 responses



The artifact on its own (without the scenario) is clearly identifiable as a speculative design.

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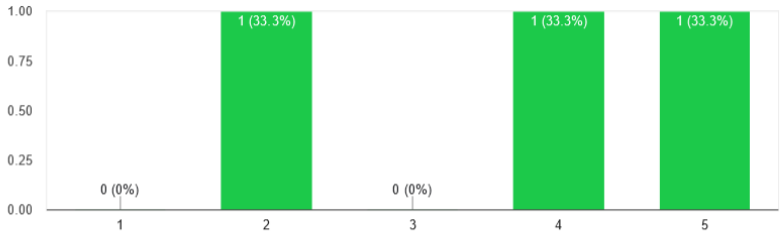
3 responses



The scenario helps make clear that the artifact at hand is speculative.

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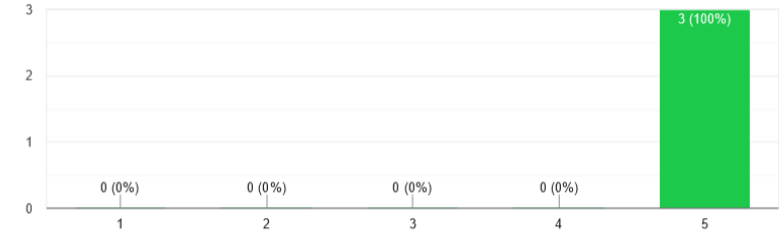
3 responses



The scenario presented offered added value to the discussion, in a way that could not have been achieved by the artifact on its own.

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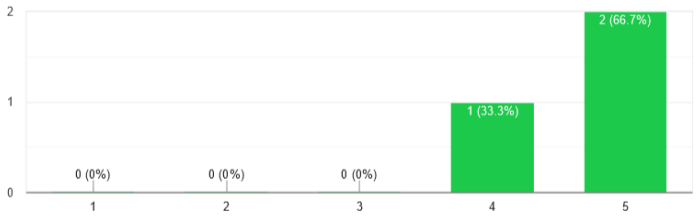
3 responses



While the artifact might be used to address different topics, the main one it starts a conversation on is health and wellbeing.

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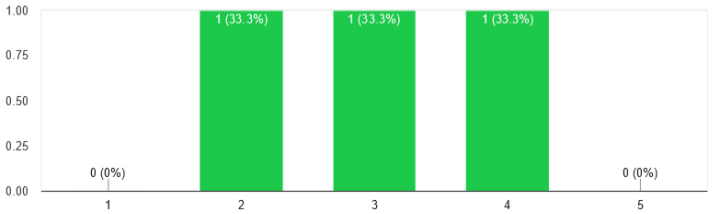
3 responses



If the artifact, together with the scenario, were to be displayed in a public space (for example a museum or a design exhibition) it would initiate a conversation about topics related to health and wellbeing of older adults in a world on the height of demographic aging.

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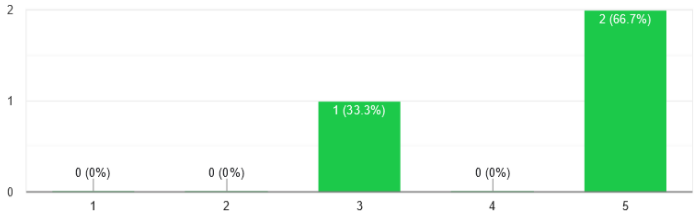
3 responses



The artifact and scenario are the right amount of controversy to facilitate debate without being offensive.

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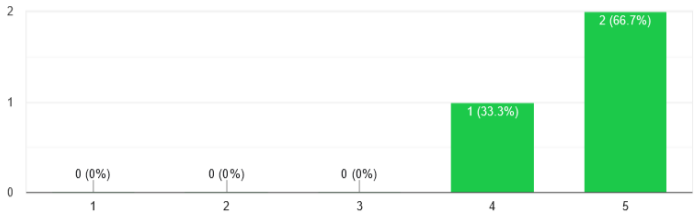
3 responses



APPENDIX D

Do you have any comments on any of the statements above, please let me know:

2 responses

I think it could be taken a bit broeder than just food, some more ephasis on society as a whole

I think it could definitely be used to start discussions, but not only about health and wellbeing but also about e. g liberalism and government control.

After this session, what do you think of using speculative designs, in general, to discuss the future?

3 responses

It's an interesting tool

Its a good tool, examples spark creativity

It works better than I expected to spark conversations, it gets the discussion going really well.

How do you think "Food for Thought" could be improved to meet its goal of facilitating discussions about health and wellbeing in the future?

3 responses

Maybe a slideshow for during the concept explanation and scenarios, to facilitate in understanding and grabbing attention

Make it more interactive, so 2 parties can try it out. Or relate it more to younger generations where social contact is not as important

For now I just cannot imagine it being used, but with the predictions about more and more older people maybe this would become necessary. If that would be the case I don't have any improvements for this system as far as I've heard.

Any final remarks?

2 responses

It was an interesting conversation, fun subject to discuss

Good luck with the rest of your project!

Results evaluation form roundtable 2

4 responses

Accepting responses

Summary | Question | Individual

Op een schaal van 1-5, waarbij 1 helemaal mee oneens is en 5 helemaal mee eens, in hoeverre bent u het eens met de volgende stellingen:

Speculatief ontwerp is over het algemeen een handig tool om de toekomst te bespreken.

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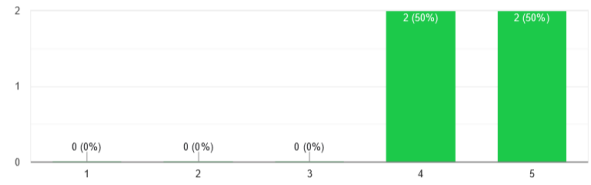
4 responses



Het speculatieve ontwerp "Food for Thought" functioneert als een effectief tool om onderwerpen te bespreken die verband houden met de gezondheid en het welzijn van oudere volwassenen in een wereld op het hoogtepunt van vergrijzing.

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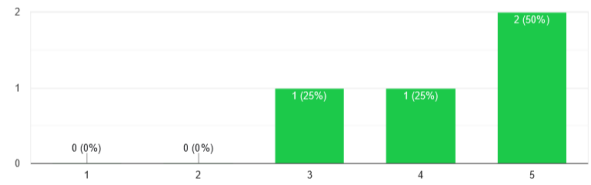
4 responses



Het speculatieve ontwerp "Food for Thought" zou kunnen worden gebruikt in de ideefase van de ontwikkeling van nieuwe technologieën met betrekking tot de gezondheid en het welzijn van oudere volwassenen.

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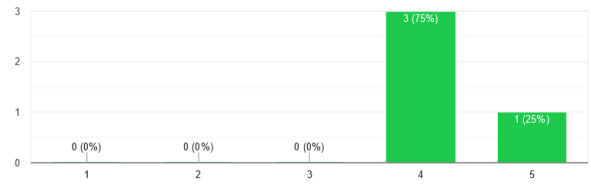
4 responses



Het speculatieve ontwerp "Food for Thought" zou kunnen worden gebruikt om ontwerpbeslissingen te nemen bij het ontwikkelen van nieuwe technologieën met betrekking tot de gezondheid en het welzijn van oudere volwassenen.

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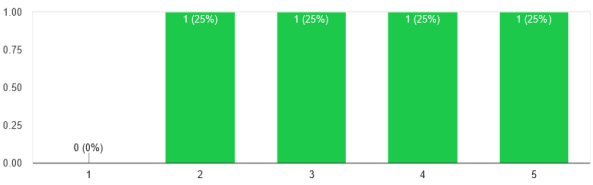
4 responses



Bij het bekijken van het artefact en het scenario is het duidelijk dat het belangrijkste onderwerp dat het behandelt de gezondheid en het welzijn van oudere volwassenen in de toekomst is.

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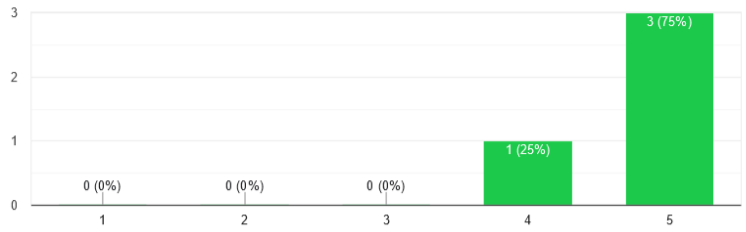
4 responses



Het artefact op zichzelf (zonder de scenario's) is duidelijk herkenbaar als een speculatief ontwerp.

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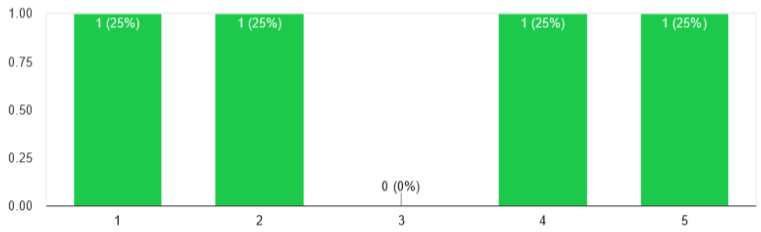
4 responses



Het scenario helpt duidelijk te maken dat het betreffende artefact speculatief is.

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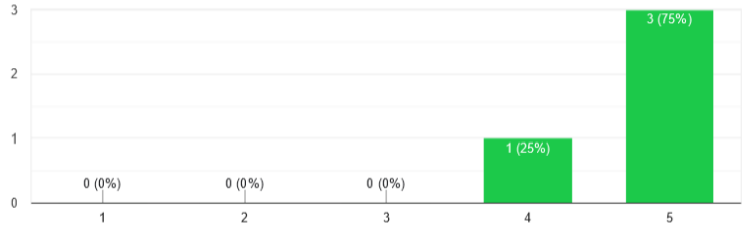
4 responses



Het gepresenteerde scenario bood een meerwaarde aan de discussie, op een manier die het artefact alleen niet had kunnen bereiken.

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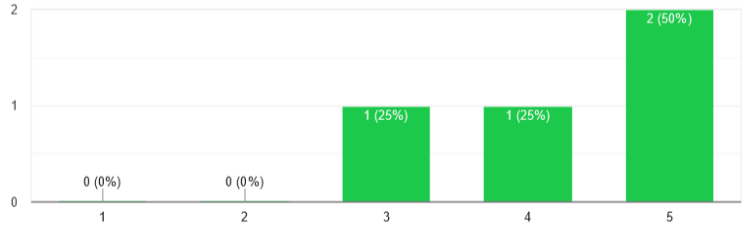
4 responses



Hoewel het artefact kan worden gebruikt om verschillende onderwerpen aan te pakken, is het belangrijkste onderwerp waarover het een gesprek begint, gezondheid en welzijn.

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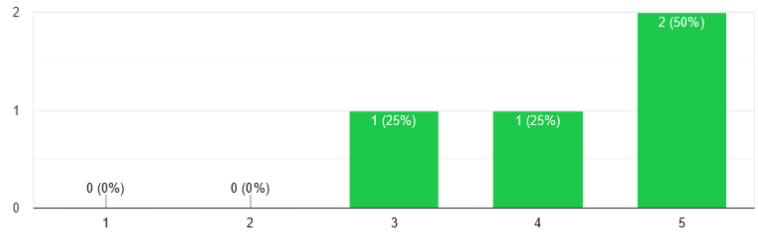
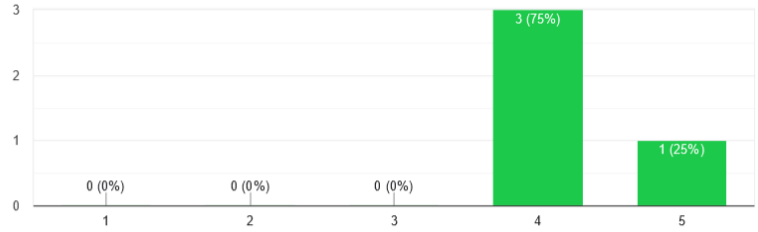
4 responses



Als het artefact, samen met de scenarios en informatie over de tijd in die het zich afspeeld, zou worden weergegeven in een openbare ruimte (bijvoorbeeld een museum of een designtentoonstelling), zou het een gesprek op gang brengen over onderwerpen die verband houden met de gezondheid en het welzijn van oudere volwassenen in een wereld op het toppunt van demografische veroudering.

Copy

4 responses



Het artefact en het scenario zijn de juiste hoeveelheid controverse om het debat te vergemakkelijken zonder aanstootgevend te zijn.

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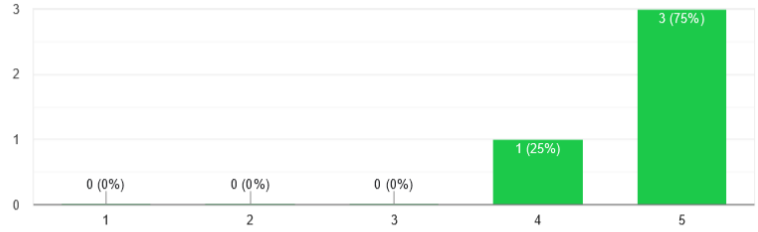
4 responses



Heeft u opmerkingen over een van bovenstaande stellingen, laat het mij dan weten:

3 responses

Het is moeilijk om na te denken over of het scenario uiteindelijk voor een meerwaarde zorgt. Omdat ik niet weet of wij daar ook waren gekomen zonder die scenario's. Je weet nooit hoe een gesprek loopt.

Nee, alles was heel duidelijk.

Nee

Wat denk je, na deze sessie, ervan om in het algemeen speculatieve ontwerpen te gebruiken om de toekomst te bespreken?

4 responses

Ik vind het goed dat mensen meer in de toekomst gaan kijken omdat wij hiermee veel meer, in onze eigen beleving, vaak slechte dingen kunnen voorkomen.

Ik denk dat het goed helpt om met elkaar de noodzaak in te zien van het bespreekbaar maken op de toekomst van de samenleving.

Zeer zinvol

Goed idee

Hoe denkt u dat "Food for Thought" kan worden verbeterd om het doel te bereiken om discussies over gezondheid en welzijn in de toekomst te vergemakkelijken?

4 responses

Uiteindelijk dat je in levels gaat werken. Zo kan je bijvoorbeeld de al gediscusieerde onderwerpen in de toekomst gebruiken voor nog moeilijkere scenarios die uiteindelijk voor echte vakmensen gebruikt kan worden. Zo is voor iedereen in te stappen en wanneer je meer over dit specifieke onderwerp weet dat je uiteindelijk echte keuzes kan gaan maken.

Ik denk dat het helpt als je voor de discussie op je eigen telefoon kan zien en het geschikt is gemaakt om er zelf mee aan de slag te kunnen om de discussie interactiever te laten zijn.

Feedback aan de verzorgende toevoegen. Controle of de oudere wel goed eet. Is dit ethisch verantwoord?

Misschien wat meer een wereld om het project heen bouwen. Wat is op dat moment de staat van de wereld, waarom zijn zulk soort apps nodig

Nog laatste opmerkingen?

4 responses

Was gezellig :)

Dank je wel.

Compliment voor de vormgeving! Daardoor wordt het heel realistisch.

Neen