

DCUX FRAMEWORK:
THE ROAD TO DESIGNING
INTERACTION PERSONALITIES
OF A DIGITAL SOCIAL COACH
FOR THE ELDERLY

MASTER THESIS BY FAMKE VAN MEURS



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MASTER THESIS - FAMKE VAN MEURS

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Executive summary

It is a well-known fact that society is getting older. This also means that elderly (65+) tend to live independently for longer. This challenges the healthcare sector in keeping an increasing number of seniors healthy and active, providing support to those seniors in need of care. One way to provide care for elderly in domestic settings is by using technology. In the healthcare context, such technology is referred to as socially assistive robots: robots that aim to provide assistance through close and effective human interaction. In this thesis the term digital coach is used to describe socially assistive robots since the main aim is to provide coaching through interaction with the technology.

The success of digital coaches depends on the acceptance by its users and understanding how they perceive the digital coach. The acceptance of digital coaches by older adults is generally poor. Acceptance relates to the user experience; how people feel as a result of interaction with a product or technology. In this thesis, the focus lies on a specific challenge: (mal)nutrition for frail elderly. It explores how the target group of older adults, aged 65+, reacts to digital coaches for healthcare. What influences their acceptance of technological innovations and how to improve that acceptance.

By building on literature and conducting a case study on how to design a digital coaching personality, this thesis contributes to existing literature. It proposes a framework for designing coaching solutions for the elderly while increasing acceptance of the technological solution. The process includes an iterative approach that combines top-down and bottom-up input to come to a final design. Each iteration contains a literature part, user insights, a design part, and concludes with key insights. In the case study, different coaching personalities are designed and tested. The goal is to find out how to give the digital coach the right personality.

User testing session with the final design give insights into the preference of elderly. Results show what factors influence acceptance when comparing a personalised version with a standard version. Moreover, results show that the framework can be used for socially assistive applications and in doing so, increase acceptance. In the end, a discussion and conclusion chapter discuss the limitations and future recommendations of this thesis.

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1. INTRODUCTION

1.1 Background

Aging society

The population in Europe is growing older. This challenges the healthcare sector in keeping an increasing number of seniors healthy and active, providing support to those seniors in need of care, while also enabling formal and informal caregivers to perform their duties (Čaić et al., 2018; Fasola & Mataric, 2013). Approximately, 90-95% of older adults (aged 65 years or older) in Europe still live at home, with one-third of older people living alone (Łukasik et al., 2018).

The newer generations of older adults indicate that they wish to remain at home for as long as possible. They have a strong value for independence (Ball et al., 2004). However, many older adults describe difficulties in self-care and needing to deal with the consequences of this unmet care (Johnson et al., 2020), including malnourishment. One way to provide care for elderly in domestic settings is by using technology. There have been an increasing number of technological innovations, most prevalent in supporting remote health monitoring domains using mobile phones, mobile applications, and smart sensors in home environments (Johnson et al., 2020). Innovations were effective in providing support for monitoring, however, mobile applications and smart sensors have been found to not function well enough for the elderly target group. One critique is that the technologies have mixed success in affecting lasting changes in the domain in which they are employed. The literature suggests an opportunity lies in the application of artificial companions such as social robots (Johnson et al., 2020).

Social robots

In the healthcare context, social robots are used to increase the wellbeing of humans and are referred to as socially assistive robots: robots that aim to provide assistance through close and effective human interaction (Feil-Seifer & Matarić, 2005). Socially assistive robots can be very well used in the domain of frailty, as it includes many aspects (such as physical decline or malnutrition) (Olde Keizer et al., 2019). There are many labels for socially assistive robots. For this thesis, the term 'digital coach' is used since the main aim is to provide coaching through interaction with the digital application.

Digital coaches seem to be a suitable solution to help frail elderly. They hold the potential to address the need for companionship and interaction. Digital coaches are proactive and always present. Moreover, they are an accessible solution and provide a natural interaction for the user. These digital coaches can enhance the independence of seniors and reduce the sense of isolation (Bhachu et al., 2012). Furthermore, they can assist not only older people but also their informal and formal caregivers (Łukasik et al., 2018). Digital coaches are considered to aid the elderly to live in their homes autonomously for longer, thereby decreasing the pressure on the healthcare sector (De Graaf et al., 2015). Even though elderly may benefit from introducing a digital coach into their lives, they have a generally low acceptance of new technologies (Broadbent et al., 2009).

Challenges in Acceptance

Acceptance of digital coaches is defined as the healthcare coach being incorporated into the user's life willingly (Broadbent et al., 2009). The success of digital coaches depends on the acceptance by its users and understanding how they perceive the digital coach (Alenljung et al., 2017; Heerink et al., 2010). When coaches are adapted to the wishes of elderly, the acceptance and thus adoption of this technology improves (Klamer & Allouch, 2020). A well-validated measure of acceptance is the Almere model as theorized by Heerink et al. (2010). The Almere questionnaire was specifically developed to test the acceptance of digital coaches by elderly users (Heerink et al., 2010). Different from other models this questionnaire also takes into account the social aspects of interaction with digital coaches by, combining principles from the TAM and UTAUT models (Technology Acceptance Model and Unified Theory of Acceptance and Use of Technology, respectively). Constructs that are taken into account include amongst others, social influence, intention to use, attitude towards technology, perceived enjoyment, and perceived usefulness.

The adoption process of new technology is dependent on how the user experiences the use of technology, and thus it is important to look into the user experience when it comes to the use of the product. User experience (UX), in short, is about people's feelings as a result of interaction with a product or technology, and UX is, therefore, crucial for the acceptance of digital coaches (De Graaf & Ben Allouch, 2013; Hassenzahl, 2011). UX encompasses subjective feelings as well as more objective usability, both important when making design decisions.

To illustrate the complicated nature of acceptance, literature studies are presented in chapter 3.3. The literature is undecided on the attitude of elderly towards digital coaches, with some reporting positive and others negative attitudes. How elderly experience the use of digital coaches improves when caregivers provide support and necessary information on their preferences (Łukasik et al., 2018). Johnson et al. (2020) did literature research and found that elderly's attitudes are positive and potential acceptance could be ubiquitous if proper attention is paid to their preferences. On the other hand, Broadbent et al. (2009) found that elderly and their caregiving network exhibited reluctance to accept digital coaching services. The challenge seems to be to design a coach that is accepted by its users, by paying attention to their wishes and needs. It is still unknown what those wishes and needs are.

Lastly, the physical design is another factor of influence on acceptance. The appearance of a digital coach is important because people usually assume that the capabilities of the coach correspond with its appearance (Bartneck et al., 2020). The appearance is not just the static look and feel, but also the design of the behaviour and language used. Additionally, it is not yet known how dialogue and behaviour must be represented in the digital coach, to maximize positive effects and facilitate interaction between the coach and the target group (Yaghoubzadeh et al., 2013). The focus in this research will be on all these appearance aspects, including dialogue and behaviour.

Dialogue

Related work on interaction with elderly has shown that spoken dialogue may be a suitable model for interaction (Yaghoubzadeh et al., 2013). Literature suggests that solutions may lie in changing the dialogue to accommodate a natural speech pattern fit for elderly. To design a dialogue, it is important to know what the current flow of interaction is in human-human interaction and human-robot interaction. Moreover, not only the flow of the conversation has to be designed. Also, the language used should fit the target group of elderly and should be clear and easy to understand. In this human-robot interaction, both verbal and non-verbal aspects play a part (Bartneck et al., 2020).

Research on dialogue systems in smart home appliances shows the limited possibilities regarding speech recognition, especially when the conversation needs to be natural and intelligent (Russo et al., 2019). There seems to be a mismatch between the user's expectancy and the actual capabilities of the digital coach. Too often the digital coach does not recognize or understand what is being said (Nakano & Komatani, 2020). Big technology giants still struggle with this. The speech recognition and spoken open dialogue exchange in digital coaches for the elderly is simply not yet feasible. A closed dialogue system will be used in this thesis which entails that the response options are restricted and predetermined.

Nutrition

In this thesis project, the focus lies on a specific challenge: (mal)nutrition for frail elderly. Because of this, the project fits well within two current running projects of ConnectedCare, elaborated on in the Company Brief in section 1.2. The specific nutrition case is a carrier for research purposes, not a challenge that this research focusses on.

Between 13.5% and 29.7% of older adults living at home are malnourished or at risk of protein-energy malnutrition (PROMISS, n.d.). A low protein intake is associated with frailty (Coelho-Júnior et al., 2018; Kobayashi et al., 2013; Schoufour et al., 2019). Frailty is a position in which someone is "at increased risk for future poor clinical outcomes, such as the development of disability, dementia, falls, hospitalization, institutionalization, or increased mortality" (Olde Keizer et al., 2019, pp. 595-596).

Current initiatives to support frail seniors in their dietary habits have not produced satisfactory results. A dietician can only do so much at a distance, plus their time is limited. Digital applications do not work well in the nutrition and behaviour change domain, especially for frail elderly (MyFoodCoach | RVO.NL | Rijksdienst, 2018). A relevant challenge provides itself in the application of digital coaches in the nutritional domain.

1.2 Company Brief

ConnectedCare Services b.v. is a creative company with a team of 8 designers and developers focused on design towards improving the healthcare experience. The team designs innovative interactive concepts in the pre-commercial phase, develops prototypes, and validates the concepts in the field. In current projects, the focus is on behaviour change and digital coaching solutions. The team of designers and developers has identified an opportunity for digital coaches to pro-actively engage frail seniors in behaviour change.

Reason for this project

ConnectedCare is developing a “digital foodcoach” Liz, who not only reminds seniors of things-to-do, but also provides information on nutrition, motivates seniors to change their nutritional behaviour, and functions as a hub between the dietitian and the patient. Liz acts as an extension of the dietitian. Despite the limited possibilities in current robot technology, in regards to dialogue and interaction, the goal of the digital coach is to provide an interaction that feels as natural as possible. One solution that is being investigated concerns the use of closed dialogues in combination with an expressive display. During development, a design challenge has been identified that will be addressed in this master thesis project. The design challenge is how to create an optimal user experience using this simplified dialogue (with only a few options available at each moment in time), while still providing the sense of an open dialog.

1.3 Refining the problem statement

To address the dialogue challenge as presented by ConnectedCare, several factors need to be investigated. The challenge formulated by the client will be looked at from an industrial design perspective, that provides a broader view of the subject and enriches the assignment and solution possibilities. The broader view will therefore include an investigation into the interaction, verbal and non-verbal aspects related to the human-robot interaction, and the physical design of the digital coach. Additionally, the user experience factors will be explored, because as mentioned in section 1.1, a good user experience is crucial for the acceptance of the digital coach. Moreover, the whole design should fit the target group, which is why the research will specify their needs and wishes.

A research question has been formulated that encompasses this problem. Step one in answering these questions will be a literature study, including state-of-the-art.

Research Question

“How can the interaction and user experience between frail elderly and a digital coach be designed such that it increases acceptance and adheres to the user’s wishes and needs, providing a sense of enjoyment that lasts?”

Sub Questions:

- What factors influence the acceptance of a digital coach?
- In what way does the design of the dialogue contribute to the acceptance of the coach?
- How can the closed dialogue be designed in such a way that it provides support and ensures a sense of naturalness in interaction for the users?
- How can facial expressions and gestures influence the nonverbal communication aspect?
- How can UX aspects contribute to the acceptance?
- How can the physical design contribute to the acceptance?
- How can the interaction be kept interesting over time? How can we provide a lasting sense of enjoyment?

2. METHODS & TECHNIQUES

2.1 Design approach

2.1.1 Theoretical Design process

Various UX design frameworks describe the design thinking process of developing a product (Plattner et al., 2018). A commonly used model is the double diamond (figure 1) developed by the Design Council (Design Council, n.d.). It shows the commonalities to the creative process. It is divided into four distinct phases: discover, define, develop and deliver. The double diamond indicates that exploration and narrowing down the best idea happens twice, once for the problem definition and once for the solution.

Another model is the design thinking model proposed by the institute of design at Stanford (figure 2) (Interaction Design Foundation, n.d.). The process follows the same timeline as the double diamond model. It is a solution focussed model with five stages: empathise, define, ideate, prototype, and test. The main difference with the double diamond is that the design thinking model is not linear. Iterations can be done after certain stages, and the five stages are not always sequential.

These two design thinking models were used as inspiration for the design process this thesis will follow, as described in section 2.1.2. The four and five distinctive stages of these models serve as input for the stages this thesis will follow. Next to that, the linear or iterative timeline is combined in the process of this thesis, with converging and diverging phases.

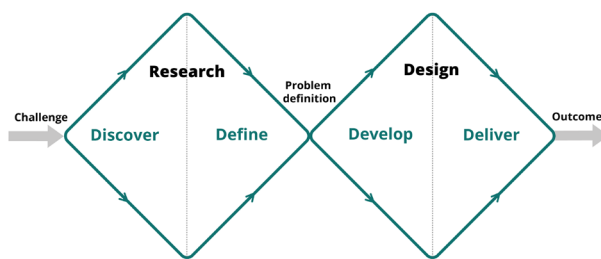


Figure 1: Double diamond model

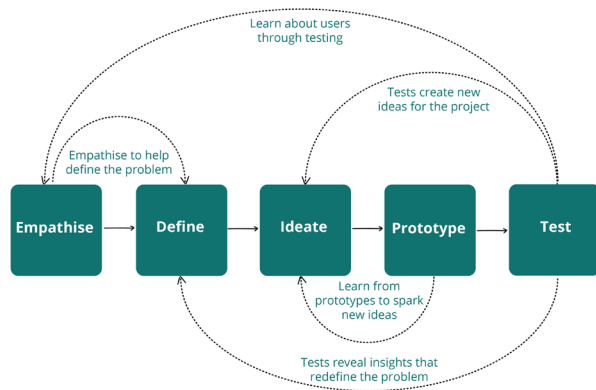


Figure 2: Design thinking model

2.1.2 Design process thesis

The thesis follows a user-centered design approach divided into three phases; analyse, ideation, and realization. Each phase features a list with specification of activities in that phase, see figure 3. The first phase, analyse, will end with a knowledge framework that specifies the relations between important factors found in literature. During ideation, there will be a process model of the framework. Design iterations will be done in ideation and insights will be gained throughout the whole design process. In the realization phase, the final design will be delivered and evaluated. The design approach is based on theoretical design processes as described in 2.2.1 and specifies the exact steps this thesis has taken. A timeline of the ideation process with iterations can be found in figure 4.

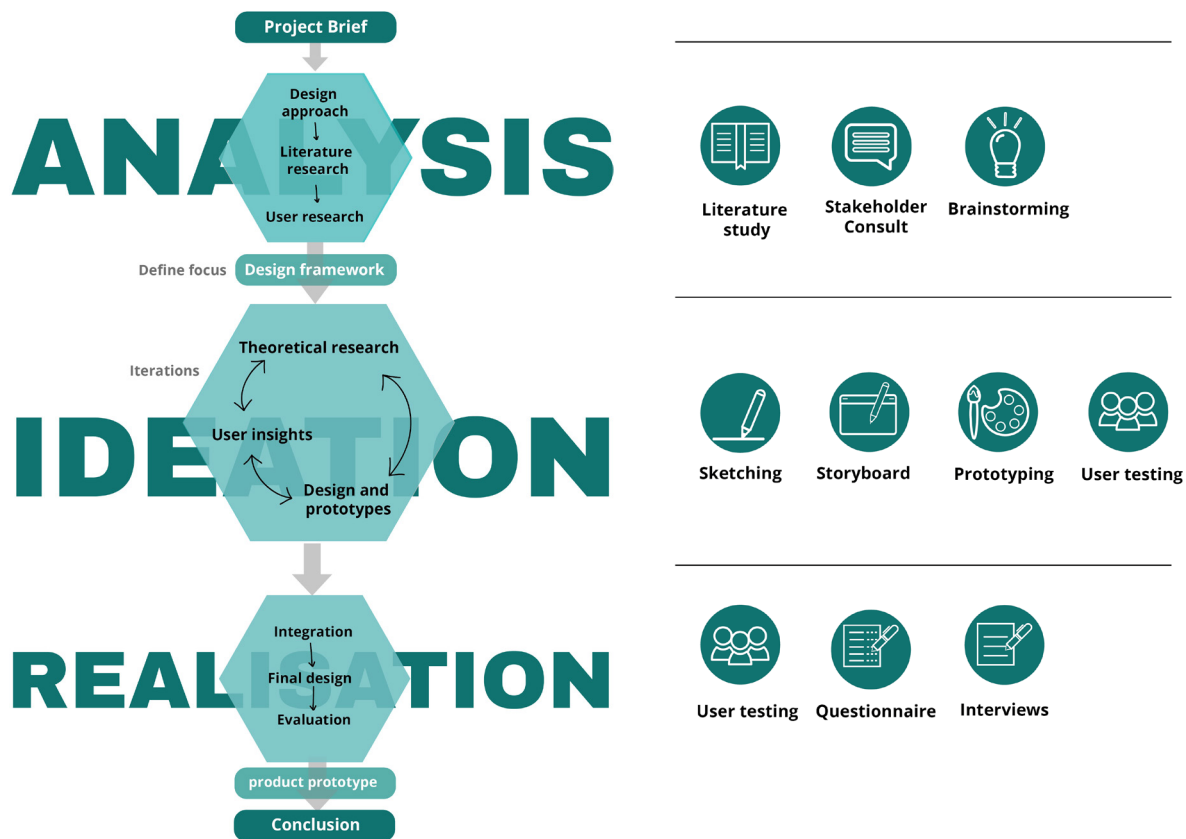


Figure 3: Design approach with techniques of each phase.

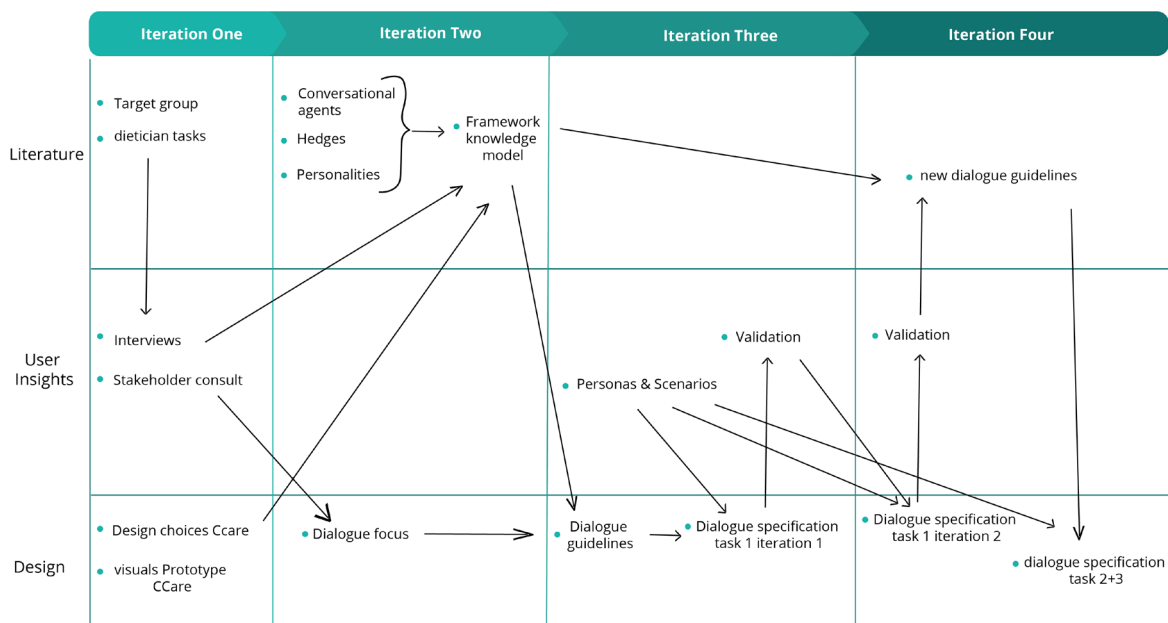


Figure 4: Timeline iteration chapters

2.2 Research Approach

This thesis consists out of different sections as can be seen in the design approach. It is approached in a human-centered design methodology, focusing on the people the product is designed for. This section describes the research approach of the design process phases.

1. Introduction

First, the topic and company are introduced. The problem statement is defined and concluded with a research question. Next to that, the approach is made clear.

2. Methods and techniques

In chapter 2, different design techniques are explained concerning the process from design until evaluation. The used questionnaire is mentioned as well.

Analysis

In the analysis phase, the goal is to discover the current state of the art and available literature relating to the research topic. A broader insight is gained into what is currently happening and where the gaps of research are. A solid foundation is laid for further steps.

3. Literature research

The main topic of the research question and all relevant sub-topics are addressed. A study was done into all the factors contributing to the acceptance of the technology and thus helpful for future design. The framework concludes the analysis phase and is based on the relevant literature. It serves as a guide for the ideation phase and as a foundation for design decisions to be made upon.

Ideation

The ideation phase is focused on the design process. It iterates through an acquiring information stage, a user insights stage, and a design stage. The information stage investigates gaps of knowledge needed to get to the next design steps. Next to that, user insights serve as input for the design. Several iteration cycles will be done.

4. Iteration one

The context and requirements are investigated. Insights are gained through user interviews and the design of the current prototype is specified with non-verbal visualizations.

5. Iteration two

New information is gained from literature research. Based on theory and user insights, the design chapter specifies the dialogue focus and the process framework.

6. Iteration three

Dialogue design guidelines are generated. These guidelines are implemented in one of the three dietician tasks. The dialogue is used in a lo-fi prototype which is validated with users. This first user test was performed to confirm the assumptions and design decisions made. Different personas that are representative of the target group are generated, to show the use of the digital coach with different types of users. These personas serve as an example of what users the product is meant for.

7. Iteration four

After the first validation, changes are made and the prototype is tested again in a larger setting, reaching more of the target users. A conclusion is given based on the validation. Requirements based on the validation are formulated and the next two dialogues are designed.

Realisation

This phase is focused on delivering a feasible and final solution. User tests and questionnaires are done to evaluate the user's sense of enjoyment. A conclusion of the extent to which the research question is answered is given.

8. Final design

This chapter describes the final design. It shows the visuals and explains the choices made.

9. Evaluation

The evaluation phase is answered with user tests and a questionnaire with an interview. Results based on the evaluation are given and discussed.

10. Future vision

The future vision chapter is a design exploration chapter that looks beyond what is currently possible. It gives future options to the company, exploring how a digital coach can be designed.

11. Conclusion

This chapter concludes this thesis. It also gives recommendations for future research.

2.3 Techniques

Several techniques will be used; scenarios, storyboards, rapid prototyping, user testing, and sketching and brainstorming. Due to the iterative process of this thesis, not all techniques are described in detail in this chapter. Instead each iteration will describe what specific methods are used and what choices are made.

Interviews: interviews with the target group can give valuable insights into a user's hopes, desires, and aspirations. By conducting interviews in the user's space you can learn about their behaviour and lifestyle. For this thesis, interviews were done during several user testing sessions, as described in the user testing section below. The specifics of the interviews can be read in corresponding chapters 4.2 and 9.3.

Brainstorming: brainstorming can be used to tap into a broad section of knowledge and creativity. It is best to promote openness, ideas and creativity and not necessarily feasibility. Brainstorms work best with a positive and optimistic mindset, focussed on generating as many ideas as possible (Osborn, 1953). Brainstorming results during this thesis are mentioned in chapter 5.2 and can be found in Appendix F.

Personas: Scenarios are built around a persona. A persona is a fictional character, based on research that represent different target group user types. Creating personas helps to understand the user's needs, experiences and goals (Pruitt & Grudin, 2003). The personas created in this thesis can be found in chapter 6.2 together with the accompanying scenarios of each persona.

Scenario: A scenario describes how the user or users in the story interact with the technology that is being designed. They are "rich descriptions of use situations containing one or more actors, their goals, the product, the context in which the use situation is taking place, the actions an actor takes and the events they have to deal with during their actions" (Bont et al., 2013). Scenarios provide a concrete use context that can be used to evaluate design concepts. In the context of design, scenarios are descriptions of the hypothetical use of a product. This can involve a narrative, storyboard, animation, or any other representation that shows the interaction in context of use (Bont et al., 2013). Scenario evaluation allows for early and quick explorations of future use practices. They can, therefore, accelerate an iterative design process, making it a valuable addition to prototype testing (Bont et al., 2013).

Prototyping: Prototyping is a way to make ideas tangible, to gain new insights through making, and to quickly get feedback from the users. Rapid prototyping and testing can help identify concepts with great potential and spot ways for improvement. Lo-fi prototypes save time and focus on the critical elements. With hi-fi prototypes, you can test the concept in more detail (Mackay & Beaudouin-Lafon, 2009). Prototyping was done during several iterations, more details into the prototypes can be read in the iteration chapters under the subsection 'design'.

User testing: usability testing is a technique to evaluate a product by testing it on users. It gives direct input on how users use the system (Nielsen, 1995). What user testing techniques were necessary differed per iteration. The questionnaire is one of them, others include interviews and online validations through videos and questions. For each iteration, the best user testing method was chosen. All choices can be read in the iteration phase, chapters 4 through 7 in subchapters titled 'user insights', and in chapter 9, the final design.

Questionnaire: A questionnaire consists of a series of questions that can indicate whether a person enjoys the design product or not. As mentioned before, the evaluation phase is done with the help of a questionnaire. The questionnaire is answered with a 5-point Likert scale, rated from do not agree to agree. For ease, the scale is accompanied by smiley faces (Heerink et al., 2010). The exact questionnaire used and the method of user testing will be discussed in chapter 9.3.

Part 1

ANALYSE

3. LITERATURE RESEARCH

This chapter presents a literature study performed to gain information on the topic of social robots with a focus on, dialogue and interaction, user experience, acceptance, and evaluation models. The findings from the literature research will be used as input to construct a design framework in chapter 3.7 that will then serve as a base for iteration in the ideation section and will be validated in chapter 9.

3.1 Social Robots

Social robots or embodied agents are defined as intelligent agents that interact with their environment, capable of engaging in interaction with humans employing the same verbal and non-verbal behaviour as humans (Bickmore & Cassell, 2005). This allows them to behave as social actors and for users to understand them as such (De Graaf et al., 2015). In order to design a social robot in the form of a digital coach, the development of social robots must be looked into.

There are various appearance forms for social robots, ranging from ones that evoke sociality by anthropomorphizing characteristics to those that provide a social interface (Marti et al., 2005). Humanoid robots resemble humans in appearance, while zoomorphic robots resemble animals. A robot's physical form can signal for ways to interact with it. People expect a humanoid robot to display humanlike things such as having the capacity to talk and think. The design needs to reflect the capabilities of the robot as people often assume that they match. Kahn et al. (2008) suggested principles to consider when designing robot forms, such as that the form and function must match. When a robot's looks do not match with the capabilities of said robots, people can become irritated. Furthermore, designers should be aware of the fact that age and cultural background can affect a person's interpretation of the robot (Bartneck et al., 2020).

To gain insight into what is already on the market a small state-of-the-art study has been done into different social robots. The result can be seen in Appendix A. The main conclusion that can be drawn from the state of the art, is that users are not happy with most of the resulting robots. Especially the dialogue part has been a struggle, researchers have not yet succeeded in producing a satisfactory natural and human-like dialogue. Results have had mixed success in affecting changes in many of the domains they are applied to. They were found to provide support for monitoring, but not for impacting the achievement of treatment goals (Johnson et al., 2020).

3.1.1 Social robots in elderly healthcare

Social robots are increasingly used to support prolonged independent living. Due to the societal challenge of the ageing society, technology is used to keep an increasing number of elderly healthy and active, and to support their self-management. A large part of elderly living alone struggle with malnutrition. Social robots hold the promise to aid the elderly in daily life and in doing so decrease the burden on the healthcare system (De Graaf et al., 2015). Robots help people live independently and more healthily. Additionally, social robots hold the ability to extend life expectancy and improve quality of life by (1) letting elderly live autonomously for longer; (2) helping elderly feel less lonely; and (3) helping elderly stay fit, thus improving their health (Broadbent et al., 2009).

Social robots in the healthcare sector, are expected to increase the health of elderly. Their purpose is to give assistance and achieve progress in aspects such as rehabilitation (Olde Keizer et al., 2019). The target group of this project, frail elderly, can use social robots for their malnutrition problems. Many elderly describe having trouble in household chores, self-care, and mobility tasks as well as having to deal with the results such as not eating (Johnson et al., 2020). Assistance in this area from social robots can harvest positive effects.

However, introducing social robots in healthcare can also bring unwanted effects, such as a loss of privacy and human contact, which could obstruct acceptance of using social robots. The elderly generally have a low receptiveness to new technologies, partially influenced by reluctance from people in their network of caregivers (Čaić et al., 2018). Previous research has shown that products developed for elderly are often rejected due to factors specific to this user group, such as social pressures or lack of adaptiveness to change (Heerink et al., 2010). To minimize the negative impact of these factors on acceptance, an optimized user experience is important, as discussed in chapter 3.4. A start can be made to make social robots less intimidating for elderly by not calling them social robots. In consultation with stakeholders, from now on, when referring to the design it will be called a digital coach.

3.2 Communication

Digital coaches aim to understand human interaction, e.g. through facial and voice recognition, enabling them to interact with humans and assist in health-related activities such as monitoring (Čaić et al., 2018; De Graaf et al., 2015). Interaction is made up of verbal and non-verbal components, both discussed in the sections below.

3.2.1 Verbal communication

Communication using natural language is an essential characteristic for a human-like digital coach. Generally, spoken dialogue is considered most natural in human-robot interaction (Russo et al., 2019). However, the availability of such a dialogue system is limited to research prototypes, including the integration of assistive robots to assist the elderly. Imitating natural communication is still a very challenging task, especially when the goal is to create a natural, context-aware, and intelligent interaction (Russo et al., 2019).

Verbal communication comprises of conversation using natural language. It contains methods for taking turns, contextual information, and interaction management (Yaghoubzadeh et al., 2013). To create an interaction that functions as a natural conversation requires capturing the current topic, the user's prior request, entities the user has mentioned so far, whether the previous utterance was recognized, and more (Moore, 2018).

To understand verbal communication, first, the language components need to be understood. An utterance is the smallest unit in spoken language. In spoken language, there are typically pauses between utterances. Spoken utterances can be short and consist of single words, such as 'Uhm, or they can last for many minutes. Words are the smallest units that we can utter to convey meaning (Bartneck et al., 2020). Further, conversational fillers serve to keep the conversation going without relating to a specific topic. They are an important part of communication because they allow a wide range of responses without disturbing the flow of conversation. This enhances the interaction experience between speaker and listener. In verbal communication, grammatical rules are less strictly applied.

For smooth human-robot interaction, natural communication is often crucial. A critical aspect of natural conversation is timing. A delayed response is seen as disturbing while a too quick reply is seen as insincere. The current state of the art, however, still does not allow spoken interactions with target groups different from what the speech recognition models are trained for. Elderly speakers for example still provide a challenge (Bartneck et al., 2020). Before digital coaches can be successfully used in the care of frail elderly, the speech library needs to be improved. This need was also identified in literature (Fasola & Matarić, 2012).

Research has shown that age produces modification in the vocabulary and syntactic structures used by elderly, which results in the need for technology to take these changes into account (Russo et al., 2019). The communication abilities of the coach have to be adapted to the target user to improve the understanding. For elderly, this includes a relatively slow speech rate, close-ended questions, repetition and verification questions, and a reduced complexity (Russo et al., 2019).

3.2.2 Non-verbal communication

In human-human interaction, verbal communication is enriched by non-verbal behaviour such as gaze, gestures, and facial expressions (Bartneck et al., 2020). Without non-verbal behaviour, it is harder to establish a strong connection with the person you are communicating with, because people almost automatically pick up on non-verbal cues when interacting. Non-verbal cues are used to communicate important information "between the lines", and are used to interpret the nuances of meaning, emotion, and intention in others (Bartneck et al., 2020). Non-verbal communication enhances interactions by facial expressions, posture, sound, and gestures. Through cues, people can signal mutual understanding and common ground. They can communicate thoughts and emotions and show they are paying attention in a subtle way. Non-verbal cues are typically used together with speech, to provide additional information on the digital coach's internal state (Bartneck et al., 2020). Non-verbal cues can hint whether a person enjoys the interaction with the digital coach, thus acting as a measure of engagement. To enrich the human-robot interaction, the design of non-verbal communication needs to be taken into account.

As previously mentioned, non-verbal behaviour is made up out of several factors. Gaze is an important factor in managing interaction. It signals interest, understanding, and attention. Gaze also facilitates collaboration and it can manage turn-taking; by looking from one person to another. Moreover, gestures can function along with speech or in place of speech. Deictic gestures refer to pointing to things in the

environment and can be used to establish joint attention. Iconic gestures go along with speech and support what is being said. Symbolic gestures can carry their own meaning, such as a wave goodbye. Lastly, beat gestures are used to go along with the rhythm of speech, picture moving arms while speaking (Bartneck et al., 2020).

Additionally, the timing and naturalness of gestures can affect people's understanding and perception of the digital coach. Non-verbal behaviour is synchronized to speech (Figure 5), e.g. raised eyebrows go along with emphasizing words (André & Pelachaud, 2010). Salem et al. (2013) found that including gestures along speech led to a more positive experience and a more likeable and anthropomorphic perception of the digital coach. When the coach's gestures do not match the rhythm of speech, or when it fails to respond appropriately to people's non-verbal cues, the interaction can become stiff (Bartneck et al., 2020). Non-verbal cues are thus imperative for effortless and natural interaction between human and digital coaches.

Communicative functions	Communicative behaviour
Initiation and termination	
Reacting	Short glance
Inviting contact	Sustained glance, smile
Distance salutation	Looking, head toss/ nod, raise eyebrows, wave, smile
Close salutation	Looking, head nod, embrace or handshake, smile
Break away	Glance around
Farewell	Looking, head nod, wave
Turn-taking	
Give turn	Looking, raise eyebrows (followed by silence)
Wanting turn	Raise hands into gesture space
Take turn	Glance away, start talking
Feedback	
Request feedback	Looking, raise eyebrows
Give feedback	Looking, head nod

Figure 5: Conversational functions and their behaviour realization by (Bickmore & Cassell, 2005)

3.2.3 Turn-taking

The timing in conversations is essential towards an optimal experience. In verbal communication, this timing is called turn-taking. Non-verbal cues can support this turn-taking by guiding attention to a conversation partner or signalling the end of a turn (Bartneck et al., 2020). Turn-taking is argued to be the foundation of human communication (Thomaz & Chao, 2011). It is a dynamic process, whereby conversation partners alternate engagement in different phases of seizing, holding, and yielding the floor through turns and backchannels (Duncan, 1974). For digital coaches to communicate naturally with humans, they should follow the same principles of human social behaviour.

Human conversation is organized with a preference for minimization (Schegloff & Sacks, 1973). Therefore, speakers should try the shortest of utterances that they think the other person will understand. Expansion can then be used in case the other person has trouble responding, understanding, or needs more information. Sequence expansion is also called "natural conversation understanding" as it requires dialogue and support for expansion to reach mutual understanding; it cannot be reached in one turn.

A "turn constructional unit" (TCU) is a unit that consists of words, phrases, or full sentences, after which the current speaker's turn is audibly over. Turns in a conversation then consist of at least one TCU. Speakers take turns, thereby generating sequences of talk such as adjacency pairs (Moore, 2018). Any conversation must be opened and preferably should be closed as well. In human-robot interaction, most first topics are welfare checks, name requests, offers of help, or statements of the digital coach's capabilities (Moore, 2018). For a natural conversation to occur between the digital coach to be designed and the users, this timing should follow general sequences.

The communication information will be used in the design of the dialogue. Literature shows that the conversation should be as natural as possible, and shows how to design a dialogue fit for elderly. Literature also identified the need for non-verbal communication components like facial expressions and gestures. It shows how important facial expressions linked to speech are and what facial expressions fit with certain communicative functions. Together with information about dialogues in chapter 5.1 and 5.3 these factors are taken into account in chapter 6.3 where the first dialogue is created.

3.3 Acceptance

Research has shown that applications developed for elderly are rejected due to factors specific to the target group, such as social pressures or lack of willingness to adapt to changes (Heerink et al., 2010). Since digital coaches are being developed to stay in the homes of elderly users, their motivations and the process by which they come to accept these technologies need to be understood. The concept of acceptance and perception of digital coaches is central to human-robot interaction since it is crucial for the users to interact with the coach in a natural way (Khan & Germak, 2018).

Research on acceptance can be divided into two parts: acceptance of the digital coach in terms of usefulness (functional) and acceptance of the digital coach as a conversational partner, with a human-like relationship (social) (Heerink et al., 2010). This two-part distinction is also made by Klamer & Allouch (2020), who mention a productivity-oriented side (utilitarian) and a pleasure-oriented side, called the hedonic. The utilitarian side has been widely researched and acknowledged to be important. However hedonic factors such as perceived enjoyment and perceived playfulness also seem to be important factors when trying to understand the acceptance of digital coaches (Klamer & Allouch, 2020).

Literature on acceptance models states that perceived enjoyment to some extent influences the acceptance. Since digital coaches are hedonic systems, this is important. When considering social acceptance of conversational digital coaches to also be an influencing factor, the acceptance model literature lacks information on digital robotic systems. The strength of enjoyment in the context of elderly care is therefore still uncertain (Heerink et al., 2008). Research by Heerink et al. (2008) shows that the correlation between intention to use and enjoyment is high, thus enjoyment needs to be part of an acceptance model for digital coaches used by elderly.

Countless factors are necessary for the acceptance of digital coaches among elderly and need to be taken into account during design, including ease of use, enjoyment, and controllability (Heerink et al., 2010). According to Broadbent et al. (2009), three basic requirements are needed for acceptance: motivation for using the digital coach, sufficient ease of use, and comfort in use. They have defined a few variables to be important; age, needs, gender, experience with technology, cognitive ability & education, culture, role, and anxiety & attitude towards digital coaches.

Social behaviour is important to achieve acceptance, but studies show that establishing a long-term relationship may not be needed (Heerink et al., 2010). Additionally, it was found that participants judged an extrovert digital coach (expressive voice and facial expressions) to be more socially intelligent than an introvert digital coach, and they were more likely to accept the expressive digital coach (Bartneck et al., 2004). Furthermore, it was found that participants that interacted with a digital coach with more social communication abilities felt more comfortable, while participants interacting with a less social coach reported feeling uncomfortable. Moreover, interaction shows that elderly tend to be more expressive when interacting with a more social coach (Russo et al., 2019). This shows that the personality of the digital coach contributes to the user experience and acceptance.

3.3.1 Evaluation models

There are validated measures to assess elderly people's needs, but very few measures for assessment when it comes to needs and preferences in digital healthcare coaches (Broadbent et al., 2009). The same goes for measures concerning the acceptance of digital coaches. In this section, the most promising and prominent evaluation models will be discussed. Visuals of the models can be found in Appendix B. After consideration, the evaluation model used in this thesis will be specified. A few alternatives not further specified are the ROSAS scale (Robotics Social Attributes Scale), the CSUQ (Computer System Usability Questionnaire), the SUS (System Usability Scale), and the UMUX (Usability Metric for User Experience). These alternatives were found too far away from the purpose of the assessment.

Godspeed Questionnaire

The Godspeed questionnaire was developed to measure the users' perception of digital coaches (Bartneck et al., 2009). The study by Bartneck et al. (2009) takes the concepts of anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety and proposes a set of five questionnaires for these concepts. The series is called "Godspeed" because it is intended to help creators of digital coaches in development.

Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis (1989), aims at understanding the productivity-oriented use of technology. The perceived ease of use and the perceived usefulness are the two most important factors that influence the intention to use the technology, which is the main predictor of actual use. Perceived usefulness is defined as "the degree to which a person believes that using a particular system

would enhance his or her job performance” (Davis, 1989, p. 320). Perceived ease of use is defined as “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989, p. 320). In turn, TAM defines acceptance as actual use.

Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) is composed out of the most reliable constructs in later technology acceptance models (Venkatesh et al., 2003). In UTAUT, perceived usefulness covers a broader definition than in the TAM model and is renamed to Performance Expectancy (expectancy that the user has about the performance of the system). Perceived ease of use is broader defined as effort expectancy, meaning the effort that the user needs to give to use the system. Two other factors have been incorporated; social influence and facilitating conditions. The model has been extensively validated and literature has shown it can be applied to human-robot interaction (Heerink et al., 2010).

Almere Model

The Almere Model was specifically developed to test the acceptance of digital social coaches by older users in a home environment. It takes into account the social aspects of interaction with social coaches, keeping elderly users in mind. The Almere model is based on the TAM and UTAUT models, combining factors to start exploring the acceptance of elderly users.

The UTAUT questionnaire is adapted to fit the target group and context of digital coaches in a (care) home (Heerink et al., 2008). To illustrate, the constructs performance expectancy and effort expectancy were renamed perceived usefulness and perceived ease of use to better suit the home environment. Next to that, social influence, facilitating conditions, intention to use, and actual use were adapted for the questionnaire. Additionally, anxiety and attitude towards the technology were included, because these factors were found to be influential in the literature (Heerink et al., 2010). Heerink et al. (2010) then added additional constructs to include the social aspects of interaction based on literature research. These constructs are as follows: (1) perceived enjoyment, (2) social presence, (3) perceived sociability, (4) trust, and (5) perceived adaptivity. All these factors are claimed to have a positive effect on the intention to use the technology. They made a theoretical model, describing the relation between all the constructs and tested that with participants. That resulted in a revised model, pictured in figure 6.

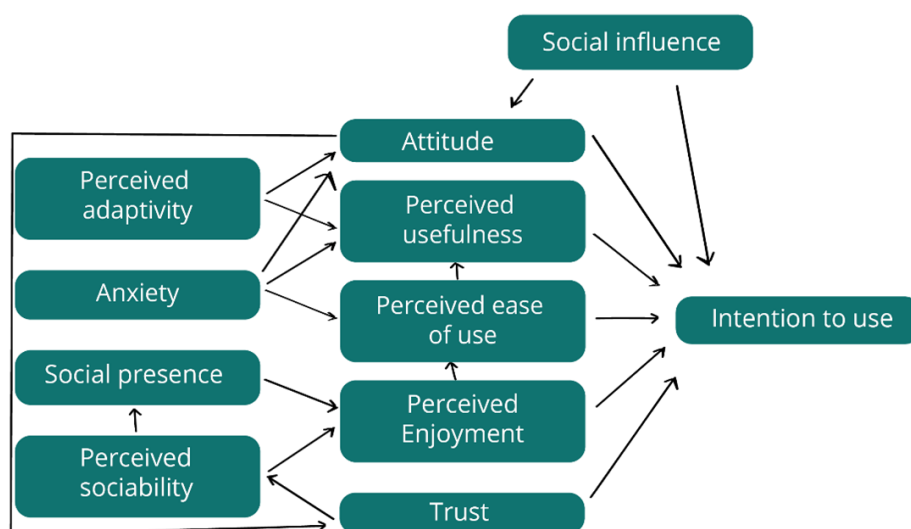


Figure 6: Almere model

Piasek & Wiczorowska-Tobis (2018) researched acceptance and long-term use of a digital coach by elderly users in a domestic environment using the Almere and Godspeed questionnaire. Results covered user acceptance, their attitude towards the digital coach, and perception of the coach, and show high acceptance of the digital coach in perceived enjoyment, ease of use, trust, and social influence.

Because there are so many factor contributing to acceptance and the intention to use the application, the acceptance models will be used as input for the framework developed in chapter 3.7. The Almere model seems to be the most complete and the best fit to the case of this thesis. In chapter 3.6 the key insights of the literature chapter will be discussed, among which, the factors influencing acceptance.

3.4 UX design

As mentioned before, acceptance needs to be maximized. This can be done by taking into account the target group and their wishes. To design for the user's needs and preferences, their experience when using the system is important. The next section will discuss the user experience design.

In Human-Robot Interaction (HRI), user experience (UX) can be defined as “the totality of the effect or effects felt by a user as a result of interaction with, and the usage context of, a system, device, or product, including the influence of usability, usefulness, and emotional impact during interaction and savouring memory after interaction” (Hartson & Pyla, 2012, p. 40). A positive user experience (UX) is needed to achieve the intended benefits in human-robot interaction (Alenljung et al., 2017), and thus for a digital coach to be helpful to frail elderly. It is essential for the user acceptance of digital coaches (De Graaf & Ben Allouch, 2013). User experience is about the users' feelings as a result of interaction with the product in a particular context (Hassenzahl, 2013). The user experience deals with cognitive, socio-cognitive, and affective aspects people experience while interacting with a product, such as enjoyment, aesthetics, and want for repeated use.

To design an effective digital coach, UX aspects need to be addressed (Olde Keizer et al., 2019). The user experience can be positively influenced by designing a high-quality interaction with target users and context in mind (Alenljung et al., 2017). For a positive user experience, it is vital for the expectations of the user to match the abilities of the digital coach (Khan & Germak, 2018). Since UX is related to users' feelings, these feelings need to be analyzed. By understanding the user and the context, an interaction can be designed that positively influences the UX (Lindblom & Andreasson, 2016). This means that to achieve a positive experience, the digital coach has to express its intentions and capabilities as clearly as possible, to meet the expectations and avoid disappointment.

Along with the functionality and usability, different pleasure aspects are important to improve user interaction with the product (Mahlke, 2007). For example, Mahlke (2007) proposes a user experience research framework that defines quality perceptions and emotional reactions as components of UX. Compared to other UX models, this one explicitly specifies emotional reactions as an essential part of UX and not as a consequence. There are a variety of factors that possibly contribute to the user experience, some factors of interaction with a digital coach explored in literature, however, a well-researched and accepted model is lacking (Olde Keizer et al., 2019).

When talking about the emotional part of the user experience, hedonic factors come into play. Hassenzahl et al. (2000) describe attributes that refer to the manipulation of the environment as pragmatic (e.g. useful and controllable) and all other attributes as hedonic (e.g. exciting and interesting). Hedonic aspects as such are described as the emotional impact that appears when the user interacts with the product (Alenljung et al., 2017). Hedonic systems are able to build long-term relationships with their users (Klamer & Allouch, 2020), and thus discussed in more detail in section 3.4.1.

3.4.1 Hedonic factors

Digital coaches are hedonic systems according to Klamer & Allouch (2020). Hedonic systems aim to provide self-fulfilling value to the user (Heijden, 2004). Digital coaches offer interaction abilities to build relationships. As long as technology adheres to expectations, people will find it enjoyable. Therefore, it is important to study hedonic factors to get an overview of what factors are important in the acceptance of digital coaches. When hedonic was first introduced, Hassenzahl suggested an “expanded concept of usability that incorporates key factors for designing appealing, enjoyable software interfaces and systems” (Hassenzahl et al., 2000). This definition is widely adopted and will be used in this thesis.

Hedonic qualities relate to the emotional needs of the user and can impact how an interactive product is experienced. Hedonic aspects are usually defined as the emotional impact that comes from interacting with a system. For example, the product can evoke feelings of autonomy or relatedness to others (Alenljung et al., 2017). Hedonic factors often relate to a positive effect, when designed right (Diefenbach et al., 2014). Negative UX can occur with a poor interface design or a lack of functionality. Both result in a negative emotional experience during interaction (Alenljung et al., 2017). Accordingly, the positive expectations can quickly shift to annoyance if the product does not live up to expectations. By designing a high-quality interaction with context and target users in mind, it is possible to positively influence the experience and contribute to the quality of interaction (Alenljung et al., 2017).

Hedonic factors include perceived enjoyment and perceived playfulness (Klamer & Allouch, 2020). These factors focus on intrinsic motivation, for hedonic systems these factors are the predictors for intention to use (Heijden, 2004). Perceived enjoyment is defined as “the extent to which the activity of using the system is perceived to be enjoyable in its own right, apart from performance consequences that may be anticipated” (Heerink et al., 2008, p. 1). To assess the intention to use, the relationship of perceived enjoyment with perceived usefulness and perceived ease of use should be proven. Van der Heijden (2004) proposed a model

(figure 7) that shows the correlation between these factors.

The value of a hedonic system comes from the amount of fun a user experiences when using the system (Heijden, 2004). To have a pleasurable experience, multiple sensations can be included. Designers can include animated images, colours, sounds, and other aesthetically pleasing visuals to please the users. This will encourage prolonged use (Heijden, 2004).

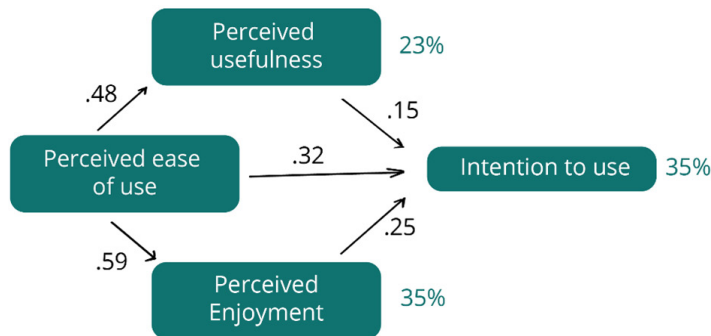


Figure 7: Structural equation model. Percentages indicate squared multiple correlations.

3.5 Design

In the same manner as human-human interaction, it can be expected that human perception of digital coaches largely depends on their appearance (Walters et al., 2008). Research needs to be done into the design aspects that may increase acceptance, specifically for elderly users. This section will address these design aspects and the way a digital companion is presented to future elderly users.

There are some principles to consider when developing the appropriate coaching form (Bartneck et al., 2020). The first principle is the matching of the form and function of the design. If the digital coach is humanoid, people will expect it to do human things, such as talk and think. A less anthropomorphic design might be better if this is not necessary. Secondly, underpromise and overdeliver. If people's expectations about the digital coach's intelligence are not met by its functionality, the experience is negatively affected. To avoid this, expectations can be decreased. This might include not calling the design a robot, as has been done in this thesis. Thirdly, the design should be holistic. This means that it might be strange if the digital coach is portrayed like an animal but talks like a human. This concept is known as the 'uncanny valley', as inappropriate matched abilities and appearances lead to negative impressions (Mori, 1970; Walters et al., 2008). Additionally, a person's age and culture can affect the interpretation of the coach's capabilities.

Uncanny valley

People will act more familiar towards digital coaches with human-like characteristics. However, when the digital coaches look human-like but their behaviour looks robotic, this effect becomes repulsive (Mori, 1970). This effect can be seen in Mori's diagram (figure 8). Mori (1970) concludes that although appearance is important regarding acceptance, the actual quality and content of the coach's movements may be more important. Goetz et al. (2003) reason that appearance should be matched to the type of tasks performed by the digital coach. If the appearance is more advanced than the true capabilities of the digital coach, people will judge it as dishonest. Whereas, if the appearance signals that the digital coach is less capable than it actually is, people will misunderstand or not take advantage to the fullest (Walters et al., 2008).

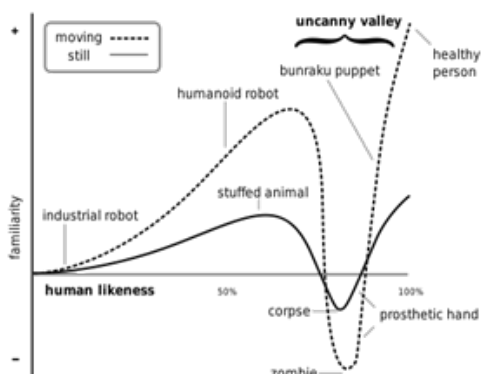


Figure 8: Mori's diagram, the Uncanny Valley (1970)

3.5.1 Design variables

There are many different design variables to consider. Literature has investigated what digital coach factors are involved in the acceptance and how they are involved. The factors appearance, humanness, facial dimension expressions, gender, size, personality, and adaptability play a role (Broadbent et al., 2009).

Appearance

The design of a digital health coach should take into consideration the disability and minimization of the stigma. Elderly users value their independence and may not use a digital device that portrays them as weak or disabled. The digital coach's appearance influences how people assess the abilities of the digital coach (Broadbent et al., 2009).

Humanness

The uncanny valley refers to users' unease when a digital coach looks almost, yet not quite, human. Many people prefer a less humanlike appearance (Broadbent et al., 2009; Mori, 1970).

Facial dimension expressions

Facial expressions are used to make sense of and react to others. The facial expressions and dimensions of a digital coach can affect how people perceive the coach. A shorter chin is associated with higher sociability and intentions to follow advice. Large smiles and slower transitions are more appealing than small smiles or quick transitions (Broadbent et al., 2009).

Gender

The gender of the digital coach can affect how people react to it. The perceived ability and knowledge associated with the coach due to stereotypes and gender norms influence how much people tell the digital coach about a related subject (Broadbent et al., 2009).

Size

The size of the digital coach is influential for practical reasons. Most older people prefer a small digital coach in a home setting. A small design can also be used to elicit a caring, protective response from humans (Broadbent et al., 2009).

Personality

The coach's personality will affect how people react. Literature showed that people prefer a digital coach whose personality matched their own in terms of extraversion (Broadbent et al., 2009; Walters et al., 2008). Controversially, user studies on verbal interaction styles of a digital coach show that users tend to prefer dialogue from a domestic coach that is chattier and thus employs an extrovert conversational style. This suggests that coaches that are perceived as more extroverted may be more acceptable overall (Walters et al., 2008). For the best possible outcome, customizable digital coaches in a home environment may provide the solution.

Adaptability

A digital coach's ability to adapt to the user's preferences and personality can help with acceptance. Adaptability is likely to be important for elderly, as they will have a range of individual problems, such as limited movement and impaired sight and hearing (Broadbent et al., 2009).

3.5.2 Interface

Next to the physical design, the interface of the online platform determines how successful an application is in its communication. The visual design, and thus aesthetics, affect the user experience (Chisnell & Redish, 2005; Djamasbi et al., 2011). Since this thesis will use a tablet-based coach, the design of the interface presented on the tablet should be taken into account. Guiding users is an important aspect of a user interface (Djamasbi et al., 2011). Guiding can be done through the elements on the page, such as text and images, and the size and locations of these elements. Usually, users first scan images and then start reading text. Additionally, large elements tend to be perceived as more important than smaller items. When an interface is clustered, has unclear elements, or other unfamiliar items, it may distract, confuse, or frustrate elderly (Chisnell & Redish, 2005).

Moreover, the target group needs to be considered when designing the interface, since both physical and mental functions decline when ageing. Elderly experience reduced sensitivity, attention span, and reaction time. When using a tablet, the areas affected most in this decline are vision, dexterity, touch, and cognition (Griffen, 2015). The decline in vision affects the elders' ability to read information on the screen and differentiate certain colours, like blues, greens, and violets. A weakened dexterity can make the use of a

computer mouse difficult, this is minimized in tablet use (Chisnell & Redish, 2005). The reduced capabilities impact the elders' ability to efficiently navigate through an application or site and complete tasks. This means that the design of the interface should have buttons and text big enough for elderly to read and click; it should not be clustered, a minimization of elements is preferred; it needs to have a distinguishable colour scheme; and important elements should be made larger.

The design variables are used as input for the design of the coach and the framework. They serve as requirements for context and appearance. This can be seen in chapter 3.7, the factors are integrated in the framework in an attempt to increase acceptance. The interface requirements are kept in mind during the design of the screens in chapter 6.3 and all screen designs from then onwards.

3.6 Key insights

In this chapter, background literature research has been conducted on digital coaches in connection to communication with elderly users. The user experience and acceptance of such coaches for elderly in a home environment have been researched. This literature research led to several key insights summarized below and divided in themes. Additional literature is added in later chapters, this was done consciously, to show the iterative design process of this thesis.

Context & target group

- Digital coaches hold the promise to support and guide people in a natural way. The target group of frail seniors, in particular, might be better supported by a digital coach compared to apps or other communication means.
- The elderly have a low receptiveness to new technology, including reluctance in their network of caregivers. Rejection can be due to factors such as social pressure or resistance to change. Digital coaches are potentially better accepted than current technological interventions.
- The design of the digital coach should take into consideration the target group and context. Most elderly prefer a small digital coach in a home setting. Additionally, the stigma surrounding possible disabilities visible when introducing service technology should be minimized through the design.
- Ability to adapt to the user's preferences and personality can positively influence acceptance. Adaptability is likely to be important for elderly, as they will have a range of individual problems such as impaired sight or hearing.

Appearance

- The form and function of the digital coach must match to align expectations. The physical form of a digital coach can signal for ways to interact with it. The appearance of the digital coach should be matched to the type of tasks performed by the coach, otherwise, the acceptance is negatively affected.
- One way designers can encourage prolonged use is to include animated images, colours, sounds, and other aesthetically pleasing visuals to please the users. Next to that, interaction should vary and be kept interesting over time to encourage prolonged use.

Communication

- Spoken dialogue is considered most natural in HRI. However, the technology is limited and speech recognition with elderly still provides a challenge. Age produces modification in vocabulary and syntactic structures, which results in the need for technology to adapt to these changes. The communication abilities of the digital coach have to be adapted to the target group to improve understanding. For elderly, this includes a slow speech rate, close-ended questions, repetition and verification questions, and a reduced complexity.
- Non-verbal communication can hint whether a person enjoys the interaction with the digital coach, acting as a measure of engagement. It enhances interactions by facial expressions, posture, sound, and gestures. Posture combined with facial expressions can communicate a person's emotional state. Additionally, large smiles and slower transitions are more appealing than small smiles or quick transitions. Including gestures along speech leads to a more positive experience and a better and more anthropomorphic perception of the digital coach. Non-verbal cues are imperative for natural interaction between humans and digital coaches.
- Human conversation has a preference for minimization. Thus, coaches should try the shortest version of utterances that are believed to be understood by the other person first. Expansion can then be used in case of trouble understanding.

User experience

- A positive user experience is needed for the acceptance of digital coaches. For a positive UX, expectations must match the abilities of the coach. By understanding the user and context, an interaction can be

designed that positively influences the UX.

- Hedonic systems can build long-term relationships with users and can impact how a product is experienced.
- The personality of the digital coach also contributes to the user experience and acceptance, especially in the coaching domain. Elderly tend to be more expressive when interacting with a more social coach.

Acceptance

- Perceived enjoyment, social presence, perceived sociability, trust, perceived adaptivity, ease of use, and controllability are all claimed to have a positive influence on the acceptance and intention to use.
- In the design of a digital coach for elderly a few factors are important; age, needs, gender, experience with technology, cognitive ability & education, culture, role, and anxiety & attitude towards digital coaches. Particularly because it is known that acceptance of digital coaches by this target group provides an extra challenge. Motivation to use the digital coach and comfort in use are required.
- The usability of the interface is a prerequisite to get to acceptance. Similar to other types of user interfaces, the rules of UI design apply.

In short – the design of digital coaches for senior users is a complex challenge that comprises many different aspects. This graduation project aims to bring together existing knowledge into a design framework, that can be used to optimize the UX and maximize acceptance of a digital coach.

Based on the key insights provided by the literature, a (preliminary) theoretical answer can be given to some of the sub-questions. In chapter 9 these answers will be validated with the design and evaluation.

- Factors that influence the acceptance are appearance (should match the function), user variables such as culture and age, verbal and non-verbal communication strategy, UX, personality, perceived enjoyment, social presence, perceived sociability, trust, perceived adaptivity, ease of use, and controllability.
- Facial expressions, gestures, hedonic UX aspects, and the physical design have been investigated as well. These factors need to be designed based on the theory and designer choices, whereafter they can be evaluated on their contribution to the acceptance.
- If the acceptance is high, a lasting sense of enjoyment is thought to occur.

3.7 Digital Coaching User Experience Framework

This chapter section presents the design approach and framework of this thesis. The framework is influenced by various UX design frameworks, as discussed in section 3.3.1. Additionally, it is based on the key insights from the theory in chapter 3.

The relation between the insights provided in 3.6 and the framework below is useful to note. The key insights are used as input for the framework, with the framework being the focus or guideline of all relevant points mentioned in 3.6. The key insights are a summary of the literature and partially answer the research sub questions.

The goal of this research is to create a product that provides a sense of enjoyment that lasts. For that reason, the 'intention to use' should be the end goal of the framework. The intention to use can be reached through acceptance, which in turn is influenced by a variety of factors as found in literature. Different 'first stage' iterations of the framework can be found in Appendix C. The Digital Coaching User Experience Framework, DCUX framework, will be iterated in the ideation phase. Here a knowledge model, based on literature, is presented.

3.7.1 DCUX framework - knowledge model

The DCUX knowledge framework depicts the relationship between appearance and behaviour. This model, see figure 9, is based on the theory of chapter 3. It will be the starting point for the process framework, iterated in the ideation phase.

The first iteration framework, with explanation, can be found in Appendix D. After a stakeholder discussion, a reorganisation of the framework was done. The factors and variables in the previous version were not of the same order. This reorganisation led to two main categories within the design group. The appearance relates to the looks of the digital coach and the behaviour relates to what it does. The behaviour category contains the dialogue part with the communication divided into verbal and non-verbal.

The behaviour and appearance design categories directly influence each other. For example, a change in 'humanness' can be achieved by designing a different 'sociability'. In the same manner, different humanness, achieved by facial expressions or personality, affects the sociability of the digital coach. Moreover, the factors within a category influence each other as well. All communication factors, among which is small talk, influence sociability. In addition, all design factors relate to the context. The design needs to match with the user variables of the context to reach acceptance.

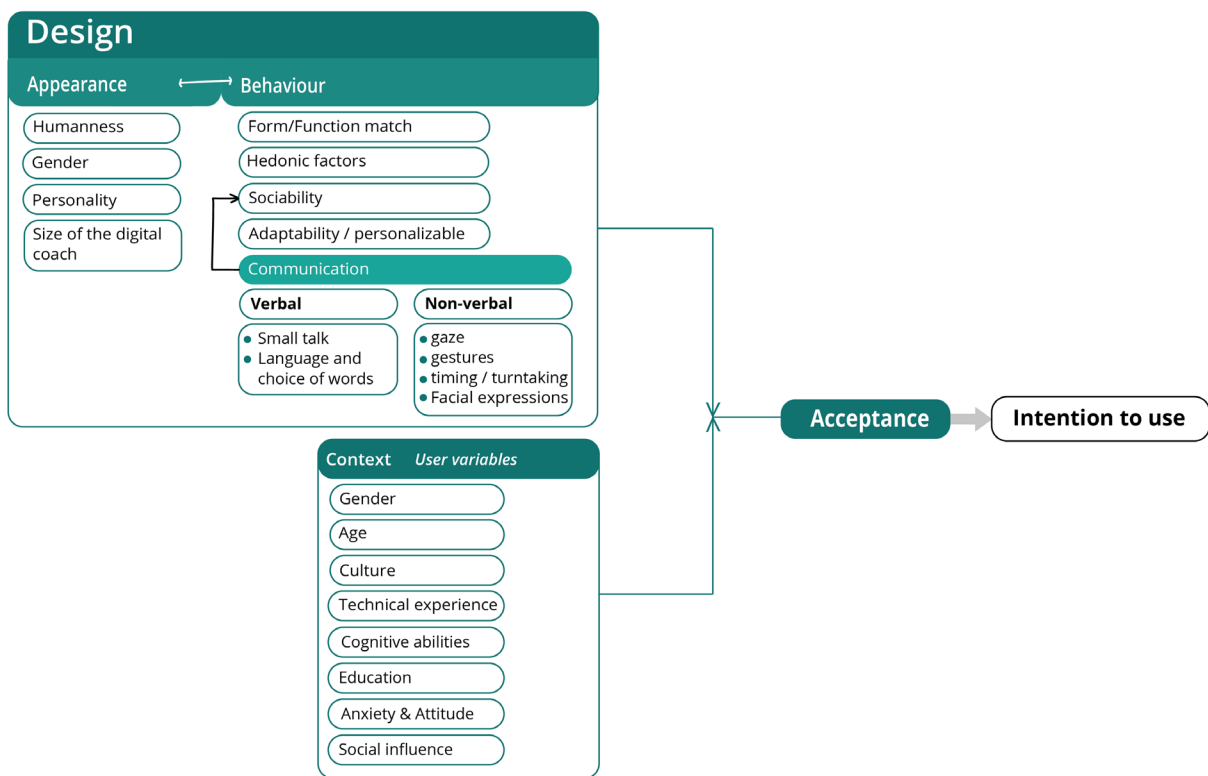


Figure 9: DCUX framework - knowledge model

Part 2

IDEATION

This ideation phase of the research project is made up out of four iterations. I will showcase an iterative research and design process. This iterative process is beneficial because a top-down analysis of the literature helps refine the problem, while a bottom-up start with the design makes ideas tangible and open to immediate reflection and adaptation. The iterative process also allowed gaining valuable user insights throughout the design process, it allowed for quick feedback on requirements and gives stakeholders better visibility into the progress at each iteration.

Iterations usually consist of a literature or knowledge part, a part user research, and a design or prototype that follows. The learnings from the prototype or user test are then used as input for the next iteration. This process can be done over and over again. The iterations in this thesis will follow the same chapter structure; acquiring information, user insights, and design, concluding with main takeaways from that iteration. The interpretation of the subchapters can be done in different ways, for example, user insights can come from interviews, but also personas or user testing sessions. The ideation phase concludes with a summary, whereafter the final design will be discussed.

4. ITERATION ONE

This iteration started with research on the target group and the case-specific details. To gain user insights, interviews were done. The theoretical research, combined with user research is used to better understand the problems frail elderly are facing. Design decisions made by ConnectedCare are specified and visuals are shown.

4.1 Acquiring Information

4.1.1 Target group and nutrition case

The target group of this thesis is frail seniors with nutritional problems. For that reason, (mal)nutrition will be discussed briefly in this section. The case was presented by ConnectedCare; the case originates from the MyFoodCoach project that ConnectedCare currently has running. This case and target group will be applied to the framework as explained in chapter 3.7.1 and different design iterations will be made, keeping the context in mind. The case will be used as a carrier to evaluate the design and the framework on. Background information, such as struggles the target group is facing, is needed to better understand the nutritional problems of frail elderly.

A healthy diet contributes to the prevention of chronic diseases. Malnutrition or an otherwise incomplete diet is associated with an increased risk for diseases such as diabetes or osteoporosis (Łukasik et al., 2018; Van Der Lubbe & Klein, 2019). Healthy eating habits are therefore very important. One of the biggest barriers in elderly healthcare is elderly's belief that their habits are healthy and don't need adjustment, as shown by European studies (Łukasik et al., 2018). When older people tend to stay home for longer, support is needed in performing daily tasks. As mentioned in chapter one, digital coaches are increasingly used in healthcare due to the shortage of healthcare workers and increased pressure on the healthcare system. Support in the nutritional aspects can come from digital coaches. Digital coaches can help remind the elderly to consume and prepare their meals.

4.1.2 Dietician tasks

While treating a patient, a dietician performs tasks that contain dialogue. A digital coach could take over these tasks. Based on the dietetic consultancy book, a selection of tasks is made for this research to focus on (Leibbrandt et al., 2016). The most diverse ones are chosen: set goals, give feedback or information, and provide reminders. Additionally, Scholten et al. (2017) show that users primarily want an ECA to give feedback and reminders, and in doing so setting goals can help reach targets.

4.2 User Insights

4.2.1 Interviews

Two interviews were done with women aged 84 and 85. These interviews were done to make a preliminary refinement of important factors. The elderly women fell slightly outside of the target group as they currently do not need help with dietary aspects and have never been in contact with a dietician. However, the insight is still relevant and important because it shows challenges all elderly face and differences in personalities. They both live alone and are cognitively still strong. Both are digitally proficient and use an iPad on a daily basis for activities such as reading the newspaper, the weather, and Wordfeud. Figure 10 shows the main topics addressed by the participants.

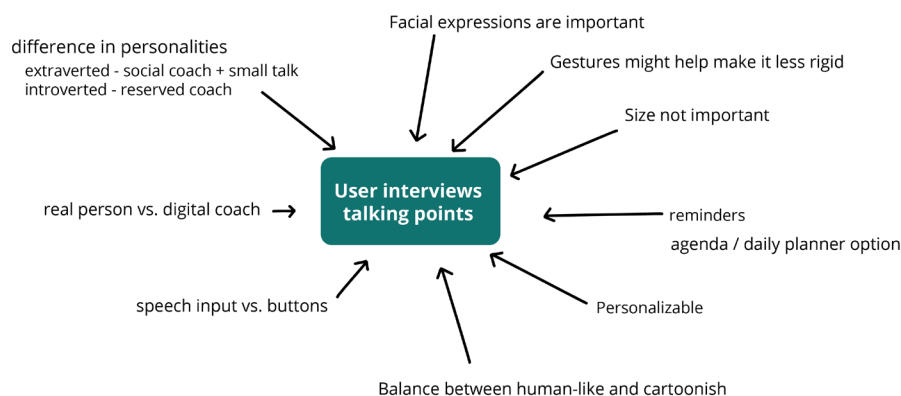


Figure 10: User interviews

Interview findings

The participants both discussed the fact that lonely elderly might want a real person to look after them. The digital coach should not be seen as a replacement of this care, instead, it should be an addition. Moreover, participants showed a difference in personalities when it comes to coaching preferences. One participant was extroverted and one introverted as judged by their own insights and researcher observations. The extroverted person would like a more sociable coach that included small talk, while the introverted person would prefer a more reserved coach with a calmer personality. This finding is supported in literature. Additionally, the introverted participant mentioned that this coaching preference would also include the design, preferring a design that is not dominant in her household.

Remarkably, when talking about design neither mentioned the size of the digital coach as being an important factor. What they did mention about the design aspects can be categorized under customizable factors. For instance, the gender of the digital coach. Participant one mentioned 'I would like a man because then the voice is deeper and I can more clearly understand it'. Next to that, more general statements were made. The design should be a balance of a humanlike and cartoonish character. This finding is supported by the uncanny valley theory in chapter 3.5; it should not be too realistic but also not too abstract. Moreover, reminders were deemed as very useful for both participants, suggestions included the use of a daily planner or agenda. Further, facial expressions were very important. They mentioned that the coach should not be too rigid and that facial expressions and gestures might help make it more humanlike.

4.3 Design

The literature showed that the current technology is limited in allowing spoken interaction with the elderly target group. The prototype for the coach, Liz, by ConnectedCare connects to this finding. The communication with Liz takes place through; speech output and text input, touch, and facial expressions that are linked to the dialogue. Liz is a digital coach meant to operate in the homes of elderly. She can give advice, reminders and helps clients with behaviour change regarding nutrition. This makes it possible for users to live independently for longer. Liz functions as an extension for caregivers to monitor patients remotely.

Some appearance and behaviour factors for Liz can already be decided upon based on previous research by ConnectedCare. Their parallel study "MyFoodCoach", shows design choices already made and justified. For example, previously done user tests show that the majority of people preferred a female coach with a human-like appearance. Currently, closed dialogue is used, because typing would be ill-suited and speech recognition leads to an unwanted delay in response time, it is unreliable and flawed especially for elderly, and it leads to unrealistic expectations. The digital coach will appear female, in the shape of a tablet with a designed front placed on it, named Liz (figure 11). It will be a small, table-held, object. Some facial expressions and gestures were already designed by a cartoonist. However, the right timing for each expression or gesture has not been determined yet. For this thesis, the focus will be on the communication part. Verbal and non-verbal factors will be designed and tested. Other factors are equally as important in the acceptance of the digital coach, but they fall outside of the scope and timeframe of this project.











Figure 11: Prototype of Liz made by Connectedcare

4.3.1 Non-verbal visualisations

In chapter 3.2.2 four types of gestures are mentioned, however, not all are included here because iconic and beat gestures go along with the rhythm of speech and are hard to implement. Symbolic and deictic gestures, however, are used in this prototype because they can add value to the interaction. Deictic gestures point to things in the environment and can be used to establish joint attention. While symbolic gestures carry their own meaning, such as a wave hello.

As mentioned in chapter 4.3 an existing set of facial expressions and gestures will be used, a small example can be seen in table 1 with the rest of the visuals in Appendix E. This set has been designed by a professional cartoon designer. The neutral stern facial expression was added by the researcher because in their opinion the neutral designed expression was too happy. Development of different skin colours and other facial design aspects such as make-up are currently researched by ConnectedCare, but not taken into consideration for this research.

Table 1: Facial expressions and gestures

Facial expressions		Gestures	
 Neutral	 Neutral eyes closed	  Neutral 1	
 Neutral stern - designed by the researcher	 Get attention	  Wave 3	

4.4 Main takeaways

The main takeaways from this iteration and the reason for another iteration are given here.

- Elderly healthcare has barriers that can be solved by digital coaches, but the specifics of providing support that is accepted by elderly is not yet known. More iterations are needed to fill in the gaps and find out what increases acceptance.
- The digital coach should be an addition to the care. Literature and user insights show a need for different personalities. This need will be explored in future iterations.
- Dietician tasks and user insights both mention reminders as an important task, hence, it is one of the tasks this thesis focuses on.
- User insights and designs by ConnectedCare show that a balance between humanlike and cartoonish character works best, the designs by ConnectedCare will be the base for future iterations.

5. ITERATION TWO

This iteration started with theoretical research. From the knowledge model of the framework, it appeared that more information was needed to arrive at the next design steps to move further along in the iteration process. User insights were gained with consultation from stakeholders and brainstorming sessions with a fellow IDE student. The design result is a dialogue focus, the personality choice is specified, and an iteration of the process framework with factors of importance is shown.

5.1 Acquiring Information

5.1.1 Conversational agents

A deeper literature study was done into the concept of embodied conversational agents, as it turned out this might be a good search term to focus on when looking for in-depth information on digital coaches and their communication strategies. Next to that, communication strategies for digital coaches giving advice are researched and discussed.

Embodied conversation agents (ECA) are animated anthropomorphic interface agents that use speech, gestures, gaze, posture, intonation, and other verbal and non-verbal behaviour to engage with users (Bickmore & Cassell, 2005). ECA's are increasingly used in the user interface area where copying of human-human communication is needed (André & Pelachaud, 2010). Virtual characters allow for communication styles that are common in human-human dialogue, and can thus be used in interaction with humans. Additionally, a personification of the interface can contribute to trust in the application (André & Pelachaud, 2010).

One strategy to build familiarity and trust, given that the interface is personified, is for conversation partners to disclose personal information about themselves. Another strategy is to talk about common ground topics, such as the weather and other small talk (Bickmore & Cassell, 2005). For the agent to communicate with users, it should have the means to perceive and understand the user, and it should be able to respond and provide information. The agents often rely on scripts; a temporally ordered sequence of dialogue actions that can be realized with speech, gestures, and facial expressions (André & Pelachaud, 2010). The scripts must allow for variations such that the agent does not become too predictable.

Personality seems to play a role as well. Users like agents that match their personality (introversion/extraversion) regardless of whether this personality is portrayed through text or speech (Bickmore & Cassell, 2005). Introverts perceived the agent as more trustworthy in a pure task-based face-to-face conversation than in conversation over the phone or including social talk. Conversely, social dialogue significantly increases trust for extroverts (André & Pelachaud, 2010). Messages should be tailored to the users personality to affect behaviour change.

5.1.2 Hedges and discourse markers

Theory on how digital coaches can give advice using natural language discusses communication strategies using hedges or discourse markers. Hedges include qualifying language such as "I guess", "maybe" and "sort of". The use of hedges in human conversation is very common, making their removal from conversation seem aggressive. Discourse markers include repeated words, and fillers such as "uhm", "like you know", "just", and "yeah". They reinforce the similarity between conversation partners (Torrey et al., 2013). Hedges are used one at a time in a message, while most messages include three to four discourse markers in human-human conversation. Both can reduce the commanding tone that is implied in direct advice statements (Torrey et al., 2013). A direct approach that is currently used a lot by digital coaches can come across as condescending or rude. A study done by Torrey et al. (2013) looked into the language used by human coaches to soften the force of direct advice. Hedges (words like "I think" and "probably") and discourse markers ("I mean" and "so") were used often. A user study done by Torrey et al. (2013) shows that a digital coach is rated less controlling when using either hedges or discourse markers. The strategies were not more effective when combined. They also show that when digital coaches use discourse markers, they are perceived as less controlling than the human equivalent. This finding can be used to design a dialogue that is perceived as less dominant and might work for more introverted users.

5.1.3 Coaching personality

Previous literature has stated that the personality of the coach is important in its acceptance. The acceptance is thought to be higher when the personality of the coach matches that of the user (Bickmore & Cassell, 2005). A deep dive into coaching personality literature shows a variety of approaches. Some papers use persuasion profiles to personalize the messages used by a system to influence users (Kaptein et al., 2015). However, these influence principles are hard to translate into personality types. Another widely known classification of personalities is the Myers-Briggs Type Indicator. This method is used to classify an individual's personality

based on four scales, leading to 16 personality types.

Closely related is the DISC method, which explores behaviour across four primary dimensions. It is one of the most extensively researched and reliable instruments for personality assessment (Prochaska et al., 2015). Whereas other tests can be useful in discovering a person's inner personality, DISC also reveals the individual's behavioural traits. The DISC model of behaviour focuses on psychological phenomena that are directly observable and measurable (Owen et al., 2017). DISC has been shown a predictor of success in areas such as medical treatment. DISC scores have been used as a measure of receptivity to medical treatment plans and show a strong correlation between disc profile and factors such as motivation, trust, and social interaction (Deviney et al., 2010; Owen et al., 2017). The DISC system has also been used as a tool to motivate patients in engaging in healthy behaviour, and shows increased success in persuasion to accept treatment plans (Scarbecz, 2007).

5.2 User Insights

Brainstorm sessions are done with a fellow IDE master student throughout the ideation phase to come up with new ideas. The results from these sessions can be found in appendix F. Sessions include brainstorms about the framework, about the dialogue, how to design for different kinds of users, and a brainstorm session about the design concepts mentioned in chapter 10. Next to the brainstorm, stakeholder consults with ConnectedCare led to user insights for the dialogue focus. Stakeholders were consulted in this phase since it was difficult to determine what to focus on when designing a dialogue and to come to the next step. Based on their knowledge and previous user testing done, stakeholders gave insights into the dialogue variables as can be seen in chapter 5.3.1. Moreover, they gave a priority list to focus on, which is also used as a guideline.

5.3 Design

5.3.1 Dialogue focus

The dialogues will be formed based on a couple of variables that are deemed important based on a literature study and input from the stakeholders. The variables are: (1) The number of words, (2) tense or verb pattern ('would you like' vs. 'Do it'), (3) Praise or no praise, (4) Task-only or social dialogue, (5) statement or questions, (6) number of sequence steps, (7) Non-verbal behaviour including gestures, gaze, and facial expressions.

Research by Cowell & Stanney (2003) shows that the utterance length is among the most important vocal cues regulating interaction. Next to that, the coach should have short dialogues with the user. By limiting the length, the coach will more likely keep up its credibility (Scholten et al., 2017). Thus, the number of words and the number of sequence steps are important. In the short dialogue version, minimization is preferred. This means that the sentence should use as few words as possible while still being clear to understand. The same goes for the number of sequence steps. In short sequences, the number of steps needs to be reduced as much as possible, while still reaching the intended goal that started the dialogue.

To include a sense of likeability and sociability, praises can be included in the dialogue. ECA's who use praises are better liked than those who do not, according to Scholten et al. (2017). Moreover, users are motivated by praise. As mentioned previously, personality plays a role as well. The difference between preference by introverts and extroverts can be attributed to the degree of sociability in the dialogue. Extroverts prefer a social dialogue, while introverts prefer a task-only ECA (Bickmore & Cassell, 2005; Clark et al., 2019). One way to include social small talk is to discuss common ground topics, such as the weather. Another strategy to build trust is to disclose personal information (Bickmore & Cassell, 2005).

Lastly, non-verbal behaviour has previously been proven an integral aspect of communication and greatly influences the perception of the coach. The focus here will be on gestures, gaze, and facial expressions, as they were identified as most important (Cowell & Stanney, 2003).

5.3.2 Personality choice

For this thesis, it was chosen to make use of the DISC model by Marston (figure 12). The DISC approach is one way to improve dyadic relationships by understanding conversational styles. The four primary types in the DISC model are factors that are closely related to effective communication (Deviney et al., 2010). Behaviour can be categorized into four primary types: Dominance, Influence, Steadiness, Conscientiousness. Dominance relates to confidence with an emphasis on achieving results, it is direct and decisive. Influence relates to persuasion in a favourable environment, building relationships with others, outgoing and optimistic. Steadiness emphasizes sympathetic, cooperative behaviour. Conscientiousness focuses on quality and accuracy (Owen et al., 2017).

The personality types will be translated to traits that can be designed into the coach. This will be done with the help of literature and design decisions made by the author. The design decisions will be tested later on and validated in the evaluation. The result will be four different variants of the dialogue, linked to the personalities. The different versions of the dialogue can be user tested on preference of different users. The dialogue design guidelines will depend on the type of coach and will be explained in detail later on. The focus within dialogue and coaching goals was discussed with stakeholders based on their prioritization.

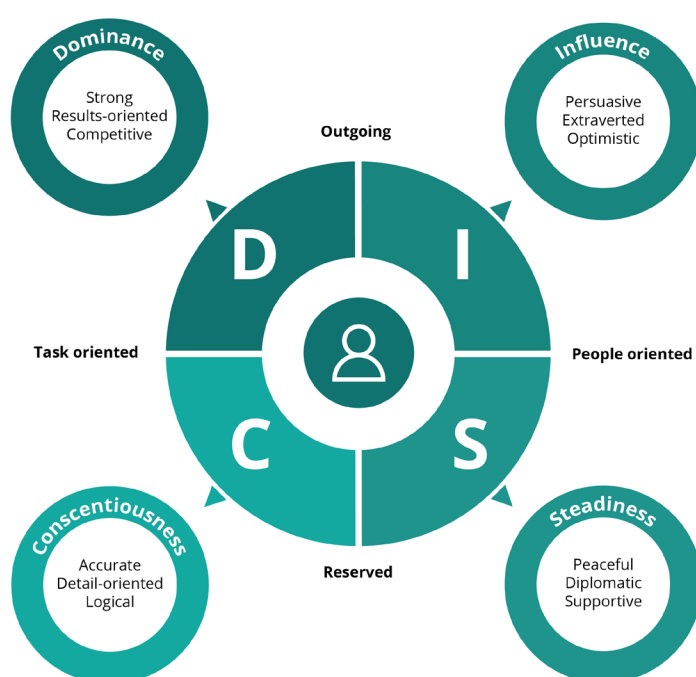


Figure 12: DISC personality types

5.3.3 DCUX Framework iteration

The first iteration of the Digital Coaching User Experience framework, DCUX Framework, is based on interviews with two target users, the literature research in chapters 3, 4, and 5, and factors that have priority for the company ConnectedCare. This led to a refinement of the knowledge framework with a preliminary elimination of factors deemed not important. This allows for more focus in future phases.

In the knowledge model, there are a lot of factors that influence acceptance. A scaffold was needed to get to the design stage. This scaffold was found in the theory about coaching profiles and personality types. The 'road to success' goes through personality types. In the new framework iteration, personality profiles are added before acceptance. The design leads to coaching personalities as specified in the DISC method. The context and user variables will lead to a user-specific personality type that should match the coaching personality type.

Eliminated factors

The size and humanness in appearance are eliminated from the framework because these factors are already determined in the prototype by ConnectedCare. Additionally, it was found that size is not an important aspect to the users. Next to that, the degree of humanness not that important, as long as it falls outside of the uncanny valley and is in correspondence with form/function. As long as the form/function is included, humanness could be eliminated. The gaze will be replaced by facial expressions. Since the current technology in the prototype does not include eye-tracking, designing a gaze would be difficult. However, facial expressions greatly contribute to the experience and can be designed. Moreover, the timing and turn-taking will be eliminated. There will be no human speech input that mimics a real conversation and therefore timing and turn-taking are less important. In this case, the digital coach will ask for feedback when it needs it.

The DCUX framework (figure 13) is divided into three parts, in the same way as the knowledge model. The difference with the knowledge model is the eliminated factors as discussed above, and the added personality profiles before the acceptance. The user's personality follows from the context category and the coaching personality profiles follow from the literature research into the personality literature, the four different profiles discussed as in chapter 5.3.2; dominance, influence, steadiness, and conscientiousness.

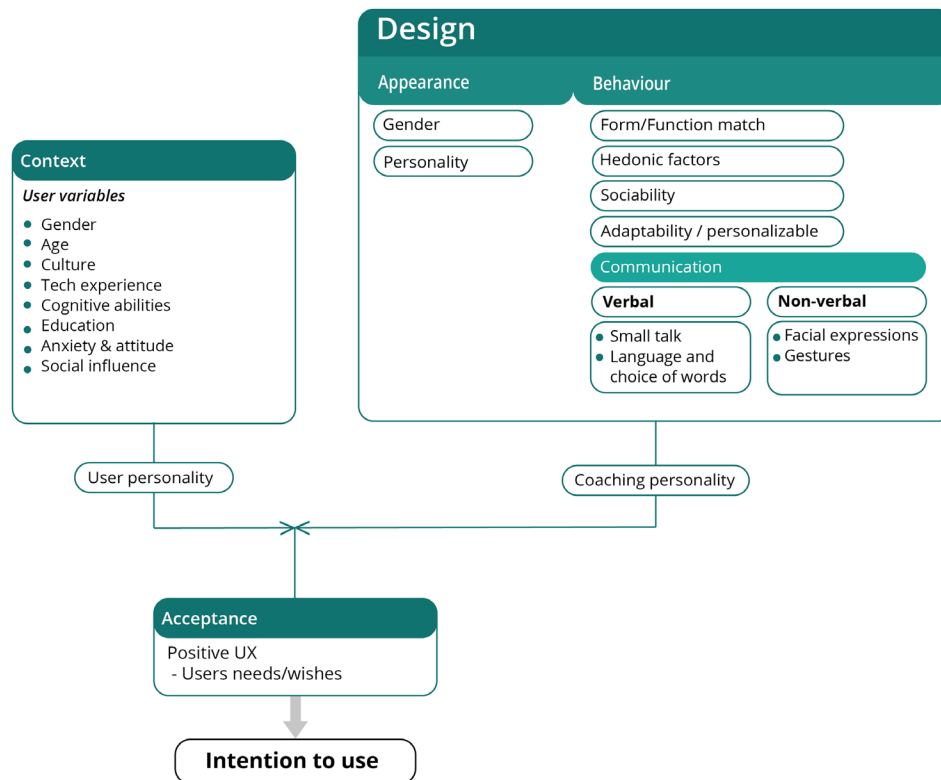


Figure 13: DCUX Framework iteration

5.4 Main takeaways

Takeaways from the second iteration and the reason for another iteration are given here.

- Personality profiles provide the road to success when it comes to acceptance of a digital coach, the interpretation of these personality types need to be designed and tested in next iterations.
- Theoretical information such as hedges and discourse markers along with design insights such as the dialogue focus provide foundation for the design of the dialogue.
- The personality choice dictates the personality profiles that need to be designed for the coach and specifies what each profile entails. This helps to design four different dialogues in the next iterations.
- The DCUX framework is now updated and shows only the relevant factors. Next to that, the personality factor is added in the visual.

6. ITERATION THREE

In the third iteration, dialogue guidelines are given whereafter the first dietician task can be designed. Since not all users want the same characteristics in a coach, it is desirable to offer a variety of coaching types. The literature on different coaching personalities, chapter 5.3.2, is consulted. The guidelines will specify the different decisions made for each personality type and how to communicate this through speech, gestures, and facial expressions. The goal of this phase is to design the dialogue for each personality type of the coach. The preliminary guidelines will be validated with users and then iterated based on the validation findings. The definitive guidelines are then used for future dialogues (chapter 7). The dietician tasks this project focuses on are specified in chapter 4.1.2.

6.1 Acquiring Information

6.1.1 Dialogue guidelines

The dialogue focus and the personality types discussed previously, led to the development of the guidelines in table 2 below. Each personality type is researched in literature and its characteristics are described and translated into concrete dialogue design decisions.

Table 2: Guidelines per personality

Personality	Dialogue translation	Specifics in dialogue choices
Dominant	<ul style="list-style-type: none"> • Less expressive, not a lot of facial expressions (more serious) • no small talk, instead be task-oriented. • Direct, to the point, and brief conversation. • Talk about how to achieve the goal 	<ul style="list-style-type: none"> • No use of name • "Do it" statements • Short sentences • Short dialogue sequence • Short, non-personal thank you
Influence	<ul style="list-style-type: none"> • Social talk • A lot of happy facial expressions & gestures (overly used almost). • Language: positive, praise, friendly, motivators • Reminders, small goals 	<ul style="list-style-type: none"> • Use name • "Would you like to" .. (question or suggestions) • Medium length sentences • Possibly expanded sequence • Wholehearted thank you
Steadiness	<ul style="list-style-type: none"> • exchange personal information • moderately used facial expressions & gestures. Use soft tone and body language. • no criticism. • Moderate use of small talk. • Long sentences to provide details, specifics, and clarification 	<ul style="list-style-type: none"> • Use name • "Would you" .. (questions or suggestions) • Sentences with details and explanation • Possibly expanded sequence • Personal thank you
Conscientiousness	<ul style="list-style-type: none"> • No criticism or correction • task-focused, no social talk • long sentences with specifics, support with data or examples • clear instructions • reassurance 	<ul style="list-style-type: none"> • No use of name • medium length sentences with explanations • "Could you" .. question or statement • Short sequence • Reassurance with thank you

6.2 User Insights

6.2.1 Personas and Scenarios



A day in the life of Jan

Jan van Berkomp

- 75 Years old
- Lives in Nijmegen with his cat, lost his wife 5 years ago.
- Recently bought an iPad he is trying to figure out.
- Used to be an technical drawer at a large international company
- Likes to spend his free time with his grand children

Jan starts his day at 7:30 when his alarm clock wakes him up. He has always stuck to the routine of his working days and does not like to sleep in. He gets dressed and eats breakfast around 8, taking the first few of his medication pills. He has high blood pressure. Usually he turns on the local radio station to listen to the news. If he has no appointments or other obligations, he likes to go for a morning stroll around the neighborhood. On Mondays and Thursdays his grandchildren come over for lunch. He enjoys this very much and gets to hear all about their day so far. Since having an iPad, he sometimes asks them for help with certain apps or notifications he is confused about.

The iPad allows him to stay more in contact with friends and family, and he can be found playing cardgames in the afternoons.

At five in the afternoon, after having cooked dinner for himself, he takes the rest of his medication pills. Since he has been diagnosed with high blood pressure, he puts more consideration into what he eats. Something which he discussed with his general practitioner is tips of what foods to avoid and what foods are good for him. She suggested a dietician for further advice.

The dietician gave him Liz to try out for a few weeks. His grandchildren loved to interact with Liz when they came over, and it has benefited Jan in giving advice for healthy foods.



A day in the life of Annie

Annie de Groot

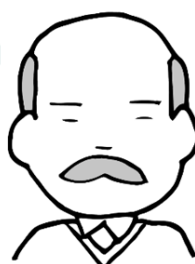
- 83 Years old
- Lives with her husband in a one-story home
- Has diabetes type II, and has a dietician
- Uses her iPad to play wordfeud with friends and family
- Likes to spend her free time outdoors, riding her electric bike

Annie is a very active person and likes to go on a morning walk before her husband wakes up. She used to do morning runs but her mobility no longer allows that. At 8 in the morning, she and her husband eat breakfast together.

When she turned 75 she bought an electric bike to be able to still practice her hobby. Now she has formed a biking club of friends that she will go on long bike rides with. If the weather allows for it, she and her husband arrange to go biking. They usually leave in the morning and pack lunch for on the road. In the afternoons she spends her time attending to small tasks around the house, she still has a vegetable garden that she maintains and her husband likes to play ball games at the local senior activity home.

She has come in contact with a dietician when she developed diabetes type II due to her age. Her dietician is very satisfied with the way she handles her diabetes and takes care for what she eats. However, she still recommends Liz, to get used to the digital coach. This might be useful for the future when she starts declining.

Annie interacts with Liz on a regular basis, but also judges that she can still do a lot of stuff herself. She likes the interaction and added benefits such as new recipes. Annie does not need reminders yet, but thinks it might be very useful in the future.



A day in the life of Geert

Geert Meijer

- 80 Years old
- Lives in sheltered housing next to a care facility
- Does not like technology, due to difficulty in understanding.
- Has trouble hearing, and is increasingly forgetful
- Is recently come in contact with a dietician to help his eating habits

Geert wakes up around 8 o'clock, when the sun shines through his blinds. He used to have an alarm clock, but due to hearing problems he no longer uses it. His internal clock works pretty well and he is always out of bed and eating breakfast by 8:30. Around 9, a nurse from home care comes to check on him and clean his apartment. He lives next to a care facility and usually spends his mornings there, chatting to other residents.

The nurse has noticed that he has been leaving his food in the fridge unopened and often forgets his meals. Since becoming forgetful he has been buying a lot of food, not remembering that he still has stuff left in the fridge. The nurse recommended a dietician to help him with his eating habits.

On Sundays his sister and nieces come over. His sister helps him with remembering appointments and assists in daily chores. His niece takes care of administrative tasks and handles the bills. He used to be able to do that himself, but when services turned online, he asked for help. He has never had any technology in his house, except for a radio and landline telephone.

The dietician noticed the lack of technology and found a very fitting solution in the form of colored sticky notes on his fridge and cupboards. She realised that a tablet would not work for Geert.

Personas were created to represent typical users. This is useful to consider goals, desires, and limitations of the users. Three different personas were created representing different user types and personalities. Scenarios are made describing a typical day and the possible use of the coach Liz. Personas and scenarios show that not all personalities fit the product and they give reason to pre-select or screen the participants in the user testing stage.

6.3 Design

6.3.1 Design specification – ‘setting goals’ task

The first dietician task that will be designed is the ‘setting goals’ task. This task is designed based on the guidelines in table 2. First, the concrete personality type is described with the help of literature research. Then, an example of a dominance dialogue is given where the coach, Liz, sets up a weight gaining or weight loss goal. The user can communicate via the tablet screen where either multiple-choice options or a slider option is given. A visualization of the influence, steadiness, and conscientiousness screens with facial expressions and gestures, as designed in Figma for each personality type, can be seen in Appendix G along with the dialogue.

Dominance Liz: Strong, result-oriented, competitive.

According to Owen et al. (2017), the D personality style tends to be direct and decisive. Their communication style is straightforward and brief. Next to that, they are competitive, tend to like leadership roles and they value time frames. They are motivated by setting and achieving goals and appreciate receiving recognition and rewards. These characterizations should be reflected in the dialogue. They tend to be blunt and come to the point directly (Owen et al., 2017; Prochaska et al., 2015). In the dialogue, this is translated into short sentences, with some formulated as statements instead of questions. As specified in table 3 and figure 14, facial expressions are mostly neutral, likewise for gestures.

Table 3: setting goals dominance dialogue example

POV	Dialogue	Facial expressions / gestures
Liz	Hallo, kan ik u vandaag helpen?	Neutral facial expression Neutral hands 3
User	<i>gewichtsgoed toevoegen</i>	
Liz	Vul uw huidige gewicht in.	Neutral stern facial expression, Neutral hands 1
User	<i>Kan slider optie invullen</i>	
Liz	Vul uw gewenste gewicht in.	Interested facial expression Neutral hands 3
User	<i>Kan slider optie invullen</i>	
Liz	Hoe lang denkt u daarover te doen?	Neutral stern facial expression, Neutral hands 3
User	<i>Slider met timeframe in weken</i>	
Liz	Herinneringen kunnen helpen om het doel te bereiken, wilt u die ontvangen?	talking facial expression Neutral hands 3
User	<i>Ja</i>	
Liz	Dank, het doel is opgeslagen en u kunt uw voortgang bekijken.	Neutral stern facial expression, Neutral hands 3

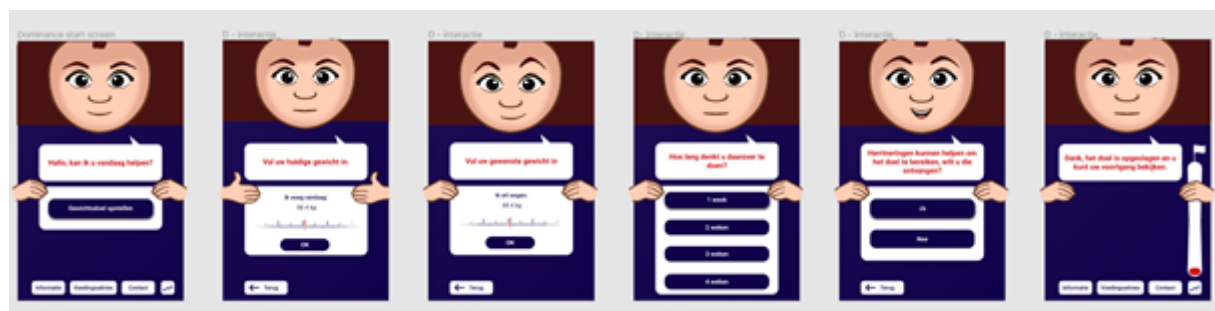


Figure 14: Figma screens dominance personality validation 1

Influence Liz: Persuasive, extraverted, optimistic

The I personality style is enthusiastic, optimistic, talkative, persuasive, impulsive, and emotional. They have a social nature and function best when around people. They are motivated by praise and acceptance by others, rejection is their biggest fear. They are creative and have a positive sense of humour. It helps them to write down details or to have someone check in on how they are doing (Owen et al., 2017; Prochaska et al., 2015). The dialogue, which can be seen in Appendix G, contains politely phrased questions and uses the name of the user. It gives praise when the user has done something right, accompanied by proud facial expressions. In this version, the facial expression and gestures will vary a lot throughout the dialogue.

Steadiness Liz: Peaceful, diplomatic, supportive

The S personality type is known for being steady, sympathetic, patient, and predictable. They have a good relationship with others, are dependable, friendly, good listeners, and multitaskers. They like routine and need a positive environment to thrive, being especially sensitive to criticism. They can adjust to change well when an explanation is given. They work well when you provide them with clarifications for tasks they need to do and when you build a personal relationship with them. Helping others and fitting in is important to them (Owen et al., 2017; Prochaska et al., 2015). The dialogue, which can be seen in Appendix G, consists of questions and provides a lot of information. This information gives reason for the questions or it provides background information to help the user in answering. A varying set of facial expressions and gestures are used.

Conscientiousness Liz: Accurate, detail-oriented, logical

The C personality styles are accurate and precise, making decisions with research to back it up. They avoid conflict and fear criticism. They don't need to be social at work. They like procedure and routine. They are motivated by information and logic, having clear instructions, doing work accurately and correctly. They feel safe when given reassurance that they are doing what is expected of them. Since they focus on details, supporting statements with data or examples is helpful (Owen et al., 2017; Prochaska et al., 2015). The dialogue, which can be seen in Appendix G, consists of questions and again provides a lot of information. In this dialogue, the phrasing is direct and to the point. Liz does not use the users' names to address them. Facial expressions and gestures are mostly neutral.

6.3.2 Validation of dialogue design choices

Validations with lo-fi prototypes are done to determine whether the made design decisions correspond to the personality types as intended. This validation will first be done with the task specified in 6.3.1. The other dialogues will be designed based on guidelines resulting from the conclusion of this validation. Using photoshopped images of UI screens in use context and an audio recording of the text with Microsoft speech platform, four videos are created. The screens are designed in Figma and are animated one after another, an audio voice is simultaneously speaking the text. After watching the video, the participants are asked to rate the personality qualities based on a 5-point Likert scale (with 1 disagree and 5 agree). These 14 statements are derived from the DISC classic personality questionnaire which consists of 28 questions. However, doing 28 questions four times seemed too much to ask. After that, an open question is posed that asks what contributed the most to the users' opinion on the personality. Users are encouraged to elaborate as much as they can.

The questionnaire statements as well as the attribution of each statement to the different DISC coaching personalities can be found in Appendix H. The screens used in the first validation can be found in figures 31-33 in appendix G. The links to the videos used in this validation can be found in Appendix I.

Participants

The first iteration will be tested with the researchers' network of people. Participants are reached online through a message that explains the research and the question to fill out the survey. In the first iteration, age did not matter as much, because the hypothesis was that the personality perception would be comparable across age groups. For the second iteration, more elderly people were wanted. The researcher reached out to their network of older people with the question to spread the research and questionnaire in their network of elderly. This way more 65+ers were reached.

Protocol

Due to the Covid-19 pandemic, the protocol and approach to the validation user testing had to be altered as it was not deemed responsible to visit lots of people and communicate in close interaction. Next to that, the recruitment of participants was made more difficult. Especially the target group of elderly 65+ is hard to reach online and very vulnerable during this pandemic.

6.3.3 Results

The raw data can be found in Appendix J. The questionnaire that was used answers based on a 5-point Likert scale, ranging from disagree to agree (disagree – slightly disagree – neutral – slightly agree – agree). These answers have been translated into numbers with disagree being one and agree being five. Visuals have been created that summarize the findings from the raw data. In the visuals, the score for each DISC variable is given by the average score from all participants, rounded up until two decimals.

Figure 15 shows the average score per DISC variable for the four coaches. With coach 1 being dominant, coach 2 influence, coach 3 steadiness, and coach 4 conscientiousness. You can see the values for coaches 1 and 2 are quite opposite based on the position of the lines. Coaches 3 and 4 are closer together on most of the variables, though you can see a small decrease or downward trend from 3 to 4 when it comes to the sociable values. A small upward trend can be seen for the values such as critical and authoritarian. These trend lines should be more distinct, based on intended design differences.

Figure 16 shows the average score of each coach on the DISC variables. It can be seen that the red and blue lines (coach 1 and coach 2) are quite opposite when it comes to social values and authoritarian values. Coach 3 and 4 are closer together on most values and less distinctive. The yellow line should be closer to the red line. Moreover, the green line should be a little closer to blue, only on some variables.

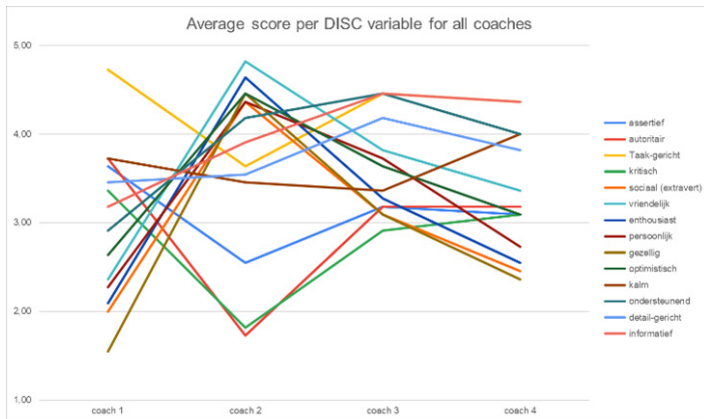


Figure 15: visual 1 iteration 1 results

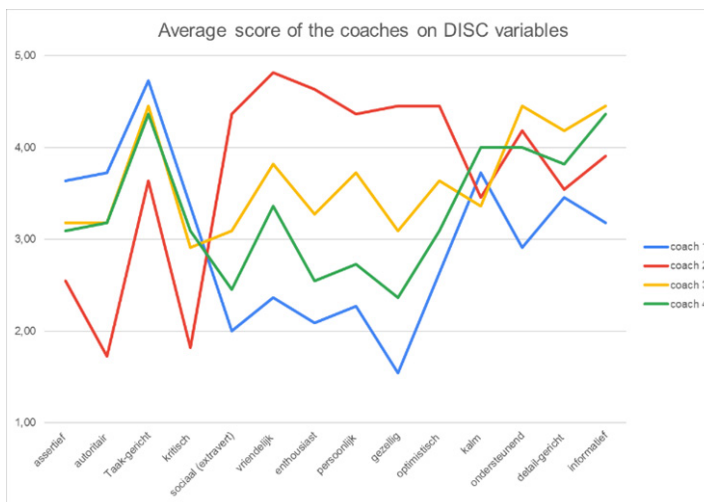


Figure 16: visual 2 iteration 1 result

Feedback

There were eleven responses of which nine were female and two were male. Respondents belonged in the age groups 18-25 (eight responses) and 55-70 (three responses). The dominance coach was most rated on facial expressions and use of language. Gestures are found as least important: "I was paying close attention to emotions and length and content of the messages, but less on the hands." Similarly, the influence coach is also most rated on facial expressions and language. However, the expressiveness of facial expressions and also gestures made for a more enthusiastic and personal experience. Users comment that the mentioning of 'doing it together' and the use of a name is very pleasant. "The coach seems like she understands you and wants to help." "Gestures attributed to positivity. That the coach makes it personal by telling you she forgets things herself, was a nice touch." Additionally, the steadiness coach is found to be personal but not as friendly and open as the influence coach. It is judged very informative and again facial expressions and language are mentioned. People seem to judge the sound of the voice (that should not be taken into account, and is the same for all coaches) differently in each coach, where it is perceived as more tolerable and pleasant in the more social coaches. Lastly, the conscientiousness coach was judged as pretty neutral across most aspects. Less mentioning of facial expressions and language, gestures are not mentioned here at all. It is found to be informative and impersonal. Moreover, people judged it as very serious.

6.3.4 Conclusion

General findings will be discussed here first, whereafter specific personality findings are highlighted. Dominance and influence are the best match, they are also the most diverse of the personalities. The diverseness might have helped make the personalities more distinct and easier to rate. Steadiness and conscientiousness had more subtle changes, that need to be made clearer. Furthermore, participants should be told beforehand that the voice of the coach should not be taken into account. All versions of personality have the same voice and people seem to be struggling with the sound of the voice. Another point of feedback was that the text was sometimes hard to read, due to small letters. In the actual life-sized prototype this will change, but still, messages are made shorter. This improves readability and understanding, in case of necessity, the sequence can be expanded for elaboration.

Specific personalities:

In figure 17 a visualisation of each coach can be seen that shows the average DISC values for each variable. Again, the questionnaire statements have been translated into numbers (1=disagree, 3= neutral, 5=agree). The neutral line has been marked, to clearly see which of the values are rated predominantly positive and which ones negative.

- **Dominance** matches the personality traits it was designed for: assertive, authoritarian, task-focussed, critical, and calm.
- **Influence** also matches the personality traits. It was found to be a social and friendly coach. The task-focussed parameter was also rated high, the same as the detail-focussed parameter. The task focussed parameter is thought to decrease when the small talk increases. For the prototype validation, this was not included, to compare the individual messages with each other across personalities.
- **Steadiness**: the detail-oriented, informative, and supportive traits are all rated positive, in line with the expectations. Again, the task-focussed trait is also rated high, which shows that there might have been confusion between task- and detail-oriented. People rate it as rather personal and friendly, but the given explanations contradict this finding. Therefore, more can be done to make it friendlier. The coach is rather neutral when it comes to sociality, so there is room for improvement. People think it is quite critical and authoritarian when this was not the intention at all. Thus, friendliness, optimistic, and calmness need improvement, while authoritarian needs to decrease.
- **Conscientiousness**: supportive, detail-oriented, and informative are all rated well. The task-focussed aspect is also rated okay. The critical and assertive aspects can be improved upon. The coach is found to be not personal and not as social, which is as intended. Conversely, it is rated above neutral for friendly, meaning that needs to decrease.



Figure 17: visuals for coach specifics iteration one

6.4 Main takeaways

The third iteration takeaways and the reason for another iteration are given here.

- The guidelines provided a good foundation for the design specification.
- The approach to the validation of the design seems to work, with users getting a good sense of the coaches through the lo-fi videos.
- Some personalities need to be changed in order to adhere to the intended personality traits. A new iteration is needed where these changes are made.
- After these changes are made, the other dietician tasks can be designed following the same approach.

7. ITERATION FOUR

The structure of this iteration chapter differs slightly from the previous ones. This chapter starts with user insights, based on the validation findings of the previous chapter, whereafter a design is made. Then, a subchapter on acquiring information and a design based on that information is specified. The information subchapter will specify the definitive guidelines that are used to design the other dietician tasks dialogues. Chapter 8 will then follow with the final design.

7.1 User Insights

7.1.1 Changes

Based on the first validation, the design choices were altered for the steadiness and conscientiousness personality. Additionally, one screen of the dominant coach is changed. Made changes are discussed below with a justification for the choices. The updated Figma screens can be found in the figures in appendix K.

Dominance

For the dominant coach, screen 5 face is changed. The facial expression is made more neutral instead of a happy interested face. This is done to make the coach more critical and authoritarian.

Steadiness

Based on evaluation it was found that the steadiness coach could be more personal and positive since the critical rating was still relatively high. This was done by changing the text in the 2nd, 3rd, 4th, and 5th screens. The text in the second screen was shortened and rephrased, making it more coherent and emphasizing the 'doing together'. In the third screen, more information was added, because participants mentioned that it was lacking information. In the fourth screen, praise was added and in the fifth screen, a sentence was added that focusses on personal experience. This is thought to increase relatability and friendliness. Next to the text, the facial expressions and gestures are altered. By looking at the influence coach to find out what contributed to the perception of friendly, changes (in the facial expressions and gestures) were made. The facial expression in screen 5 was changed to be more cheerful. The gestures in screens 4 and 5 are changed. A thumbs-up gesture was included to accompany the praise, and the hands in screen 5 are changed to increase the variety of 'neutral' hands.

Conscientiousness

The conscientiousness coach could be more critical and less friendly. This was done by changing the 2nd, 3rd, and 6th screens. The text in the second screen is again shortened, to improve coherence. The emphasis in the text is now more on the information and why it is important. Moreover, instead of asking "could you fill in.." it now asks the user to "fill in". In the third screen, again, more information is added based on feedback from validation session one. Additionally, the question is now changed into a statement to make it less friendly. Lastly, the first word of the sixth screen has now been changed. First, it started with an affirming word meaning well done, which has been changed to a simple thank you. It is thought that the exclusion of the affirmation will lessen the friendliness, while the thank you still produces gratitude to the user. The facial expressions and gestures for this personality are already quite neutral, and therefore not changed.

7.2 Design

7.2.1 Validation of dialogue design choices

In validation 2 the same voice will be used, in order for the researcher to find out if participants can ignore the voice when told to. Once a conclusion on the second validation is made, it might show that the voice needs to change in future testing and prototypes. In the second validation, some changes are made to the coaching personalities. The changes include facial expressions, gestures, and what is said. These changes are discussed in detail in chapter 7.1.1. Further, the validation has not changed much compared to validation one. The questionnaire remains the same; the lo-fi video prototypes are changed according to the made changes. As mentioned in chapter 6.3.2 the protocol stays the same. The participant group is older in the second validation, closer to the eventual target group. This is done to make the results more reliable.

7.2.2 Results

Raw data can be found in Appendix L. Similar to validation one, the questionnaire answers have been translated into numbers with disagree being one and agree being five. Visuals have been created that summarize the findings from the raw data. In the visuals, the score for each DISC variable is given by the average score from all participants, rounded up until two decimals.

Figure 18 shows the average score per DISC variable for each coach. Compared to validation one you can now see a more distinct difference between coaches. Especially coaches 2 & 3, and 1 & 4 are closer together on the social aspects. Moreover, they are opposite each other with coaches 2 & 3 being in the positive range for these variables and coaches 1 & 4 on the negative side. This figure shows a clear improvement compared to the first iteration.

Figure 19 shows the average score of each coach on the DISC variables. Similar to figure 19, this shows an improvement compared to iteration one. The more social coaches, 2 and 3, are now closer together and score higher on the social aspects, while coaches 1 and 4 are closer together on authoritarian aspects and rate higher there. It also shows that, as intended, coaches 3 and 4 are rated higher on supportive, informative, and detail-focussed variables.

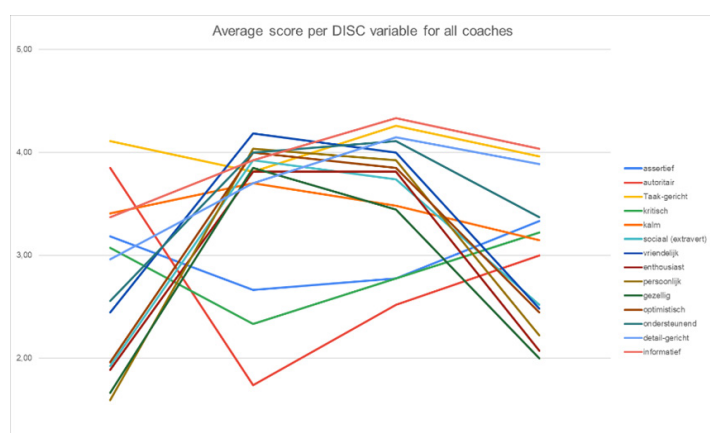


Figure 18: visual 1 validation 2

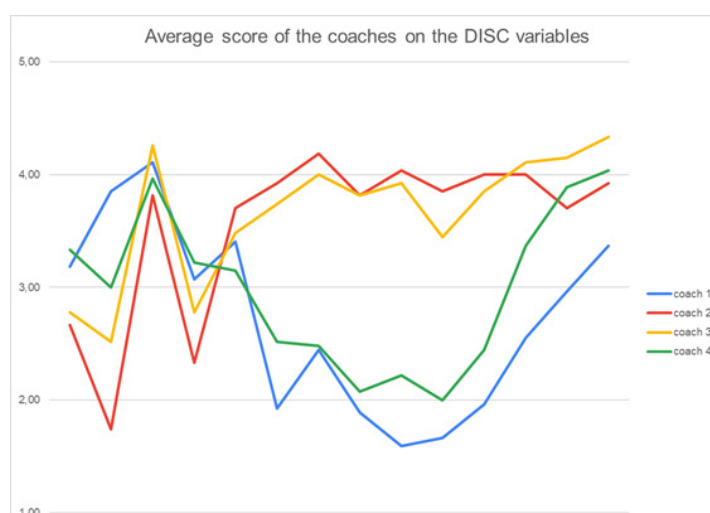


Figure 19: visual 2 validation 2

Feedback

There were 27 responses of which 18 female and nine male. Respondents belonged in the age groups 23-29 (four responses) and 50+ (23 responses). The dominance coach was found to be impersonal, authoritarian, and distant. Facial expressions, voice, and language were mentioned as reasons for this finding. Respondents mentioned they found the coach judgemental, impatient and uninterested, saying "The motivation would have to come from yourself, because it will not come from the coach." Secondly, the influence coach was rated more personal, positive, and friendly. It was found that respondents compared and measured this relative to the first coach. Facial expressions, gestures, and language contributed to this judgement. Thirdly, in regards to the steadiness coach respondents mentioned it was very informative and motivating, with some mentioning it might provide too much information in such a short time. This might be solved when they can take their own time to read through the whole message. It was found to be friendly and enthusiastic. Facial expressions, gestures, and language contributed to this. One respondent mentioned, "This coach uses more words making it friendlier, this coach has a little something extra when compared to coach number two (the influence coach)." Lastly, the conscientiousness coach was less pleasant and personal. The facial expressions and the way things were said played a big role in this judgement. One respondent mentioned "This is the least sympathetic variant, very neutral" while another said "Very business-like facial expression, which makes it more reliable when it gives me information. I believe and trust her." This goes to show two very different personalities judge the coach in an opposite way. One participant gave what seems to be the overall consensus saying "She calmly explains what the intention is. No more and no less. Facial expressions and gestures give the same picture."

7.2.3 Conclusion

One of the main findings is that the voice is so important that people can't seem to ignore it. That or they did not read the instructions, but that seems unlikely. Thus, for all future prototypes and user testing sessions, the voice needs to be taken into account. It should be designed in such a way that it is pleasant for most users to listen to. In addition, it should not distract from the message the coach is trying to convey. Another finding is that the steadiness coach and the conscientiousness coach are rated more closely to expectations and have made improvements compared to iteration one. It can be seen that all the values it was designed for are now above the neutral line (figure 20).

Specific personalities:

In figure 20 a visualisation of each coach can be seen that shows the average DISC values for each variable. Again, the questionnaire statements have been translated into numbers (1=disagree, 3= neutral, 5=agree). The neutral line has been marked, making it clear to see which of the values are rated predominantly positive and which ones negative.

- **Dominant:** In this validation, the assertive aspect is not rated as negative as it was expected, the average rating is neutral. Authoritarian and task-focussed are predominantly rated on positive, which is intended. Authoritarian is rated positive more convincingly compared to the previous iteration. This might be due to the significant age difference among participants. Moreover, critical is also rated more neutral than before, just as the calm aspect. Additionally, all social and friendly aspects are rated similarly to iteration one with a predominant negative rating. This is as intended. When comparing the detailed visualisations of figure 17 and 20, not much has changed
- **Influence:** Influence is rated positively on all social and friendly aspects, corresponding with the first iteration. Supportive and informative are also rated positively. This coach version has not changed and is judged the same as the first iteration. What can be observed is that respondents aged 50+ are less likely to rate it in the most extreme versions (number 1 and 5 on the Likert scale) and tend to rate it closer around neutral. However, that does not change much to the average values of the variables.
- **Steadiness:** comparable to iteration one, personal, friendly, and optimistic are rated positively. Calm is still positive, though more people lean towards neutral here. Detail-focussed, informative, and supportive are rated positive, more so than with the influence coach. This effect is as intended. By giving more information these values were expected to go up. When comparing to the previous iteration, many changes have been made that led to a difference in values for the variables. People rate it less critical and authoritarian, but not as low as coach 2. It has improved compared to the previous iteration, also on the friendly and social aspects which are rated more positively here.
- **Conscientiousness:** This coach is rated as detail-focussed, informative and supportive, just as in the previous iteration. When further comparing the two, it can be seen that this version is less social, optimistic, and friendly. This was the intention of the made changes. Assertiveness has slightly increased, though the expectation was that the changes would have more impact.

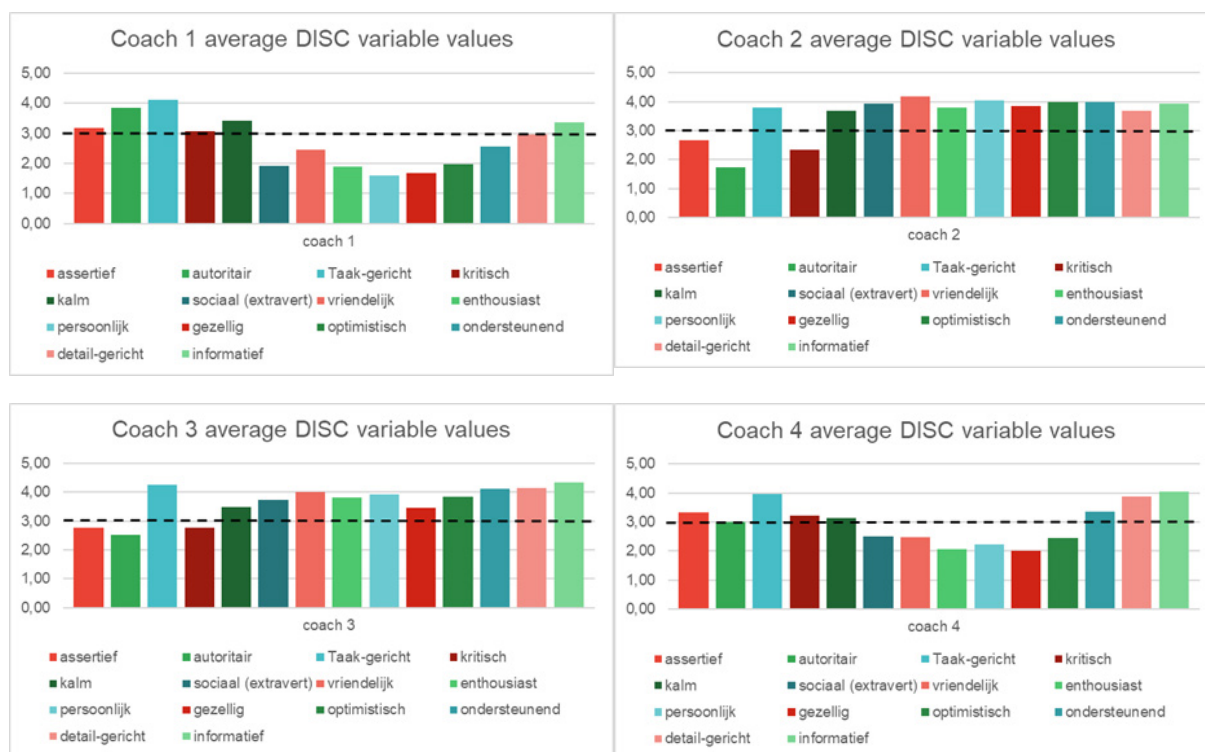


Figure 20: visuals for coach specifics iteration two

7.3 Acquiring Information

This section describes the updated guidelines, as requirements for the dietician tasks. Then, in the design section, the other two dietician tasks are developed for each of the four personalities.

7.3.1 Requirements

Table 4 shows the updated guidelines per personality after the validation phase. Based on the validation some specifics in the dialogue choices have been changed. The influence personality has stayed the same. In dominance, facial expressions are now specified as neutral or stern. In steadiness, the specific language that should be used has been specified. It includes the use of praises, personal experience, and a sense of togetherness. In the conscientiousness personality, the emphasis is on the information providence and a statement about facial expressions and gestures has been included. Instead of the previously used "Could you" questions, it has changed into statements or very short direct questions without any polite indicators.

Table 4: Guidelines per personality after validation

Personality	Dialogue translation	Specifics in dialogue choices
Dominant	<ul style="list-style-type: none"> • Less expressive, Neutral, or stern facial expressions • No small talk, instead be task-oriented. • Direct, to the point, and brief conversation. • Talk about how to achieve the goal 	<ul style="list-style-type: none"> • No use of name • "Do it" statements • Short sentences • Short dialogue sequence • Short, non-personal thank you
Influence	<ul style="list-style-type: none"> • Social talk • A lot of happy facial expressions & gestures (overly used almost). • Language: positive, praise, friendly, motivators • Reminders, small goals • Include personal experiences 	<ul style="list-style-type: none"> • Use name • "Would you like to" (question or suggestions) • Medium length sentences • Possibly expanded sequence • Wholehearted thank you
Steadiness	<ul style="list-style-type: none"> • Exchange personal information, • Moderately used facial expressions & gestures (>60%). Use soft tone and body language. • No criticism. • Moderate use of small talk. • Long sentences to provide details, specifics, and clarification • Language: praise, positive, emphasize togetherness • Include personal experiences 	<ul style="list-style-type: none"> • Use name • "Would you" (questions or suggestions) • Sentences with details and explanation • Possibly expanded sequence • Personal thank you
Conscientiousness	<ul style="list-style-type: none"> • No explicit criticism or correction • Less expressive in facial expressions and gestures; neutral. • Task focused, no social talk • Long sentences with specifics, support with data or examples • Clear instructions • Reassurance of task completion (e.g. great, the goal is now registered) • Language: emphasis on why information is important 	<ul style="list-style-type: none"> • No use of name • Medium length sentences with explanations • Short question statements (rarely "Could you") • Short sequence • Simple thank you

7.4 Design

7.4.1 Design specification – ‘feedback’ task

This subchapter describes the design of the feedback coaching task with accompanying dialogue. The development of the task is based on the dialogue design guidelines, found in table 4. For the specific dialogue choices, dialogue sentences used in feedback tasks from the current prototype are used. These current sentences will be the ‘standard’, and each personality will have an adapted version of the standard sentences. These sentences do not always form a sequence and can be separate sentences, serving as a pop-up message. Below, in table 5, the result of translation to personalities can be seen. Full dialogue can be found in Appendix M.

Table 5: feedback standard sentences

Standard sentence	Personality	Adaptation to personality
U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten	Dominance	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten.
	Influence	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Ga zo door [naam]!
	Steadiness	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Wat fijn, [naam]! Dit helpt u in het behalen van uw streefgewicht.
	Conscientiousness	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Dit helpt u in het behalen van uw streefgewicht.

7.4.2 Design specification – ‘reminder’ task

This subchapter describes the design of the reminder coaching task with accompanying dialogue. Again, the task development is based on the dialogue design guidelines, found in table 4. For the specific dialogue choices, dialogue sentences used in reminder tasks from the current prototype are used. The ‘standard’ sentences will be adapted to each personality. Below, in table 6, the result of translation to personalities can be seen. Full dialogue can be found in Appendix M.

Table 6: reminder standard sentences

Standard sentence	Personality	Adaptation to personality
Het is tijd om te ontbijten / lunchen / dineren. U kunt bijvoorbeeld kiezen uit..	Dominance	Het is tijd voor ontbijt. Eet een boterham.
	Influence	Goedemorgen [naam], het is tijd om te ontbijten. U kunt bijvoorbeeld kiezen voor een boterham
	Steadiness	Goedemorgen [naam], het is 8 uur, uw gebruikelijke tijd voor ontbijt. Meestal eet u een boterham met kaas.
	Conscientiousness	Het is 8 uur, tijd voor ontbijt. Eet u een boterham?

7.5 Main takeaways

The main takeaways of the fourth and final iteration are discussed here.

- The made changes from the user insights led to an improvement in the design subchapter. This improvement is validated and results show significant difference compared to first validation.
- The updated guidelines can be used for the design of the other two dietician tasks and future dialogues.
- The voice of the coach is crucial and should be changed to be as pleasant and realistic as possible.

7.6 Conclusion of ideation phase

The following section summarizes the ideation chapter. In the ideation chapter, a lo-fi prototype of a dialogue for one dietician task was created. This prototype was validated twice to get the best results. After the second validation, it can be said that the prototype has been improved and all variables that each coach was designed for have been satisfied. The new guidelines then served as a basis for the other dietician tasks.

Moreover, the role of speech and the sound of the voice turn out to be crucial to the experience of the users and their perception of the digital coach. Perhaps it is possible to change the perception of personality types in a digital coach, just by changing the voice and enunciation. This would be a future study subject. For now, the final design will use the Google cloud text-to-speech voice. More specifics about the voice and why it is chosen will be discussed in chapter 8.2.

Another finding is that some participants tend to rate the coach variables based on which coach they prefer. One coach is then found positive across all variables while the other coaches are negative. These results have been omitted, since this was not the purpose of the study and also not what was asked in the questionnaire. After all, it is then no longer about how the variables emerge in each personality type. However, it does show that based on the personality of the user, one coach is perceived as better. Since the 'best coach' varied among those eliminated users.

Part 3

REALISATION

The realization phase marks the end of ideation, the chapter structure here does not follow the same structure as the ideation phase. In the realization phase converging will take place. One final solution is proposed and elaborated on.

8. FINAL DESIGN

8.1 Setup

Coach Liz is hosted on a server. Running the different personalities on their own server provided technical challenges. It would present difficulties during testing because you would have to switch applications and manually set up push notifications for the reminders and certain feedback messages on a remote computer. This process would be very tedious and will not allow for observations during the testing. The notifications can also be triggered by setting a certain time, but the timing would have to be perfect during testing, which is difficult. Therefore, it was decided to use videos instead of a server-run program. This is an unfortunate choice but had to be made due to Covid-19 and technical challenges. The videos will be shown and user-tested in an actual prototype that now does not show the program but only the video. It will not be interactive, however, the server-hosted version would also not be very interactive as only a restricted dialogue is designed at the moment.

The Figma files (pictures of the screen) allow a continuous dialogue and a consecutive flow in the video file. The files will be transformed into an mp4 file with the voice as audio input. The video file can then be used for user testing. The prototype in figure 11 will be used to display the videos. The idea of making the video interactive by cutting it and using after effects to click the button areas that would link to the next video was considered. However, due to a limited time frame, this idea was discarded.

UX choices

This section discusses the choices made in UX and describes the design process in more detail. The text messages used are designed based on the already existing feedback and reminder messages in the current prototype. They are separate messages, thus they do not always follow a continuously flowing dialogue. This choice in separate messages was made, because with the two dietician tasks, feedback and reminders, the continuous flow was not as easily achieved as with the setting goals task. The messages in the current prototype sometimes show up as push notifications and not a whole dialogue, hence the separate messages. Moreover, a choice was made in the messages having some be positive and others as more critical or anticipating a negative answer from the user. The design of the text has been done in chapter 7.4 with the specification of the tasks. These have not been verified or iterated due to time limitations.

Facial expressions and gestures are designed based on the message. A positive message leads to positive facial expressions and maybe a thumbs up in gestures while the opposite is true for negative messages. In the designing of the facial expressions, the guidelines have to be taken into account, meaning that the dominance coach would have an overall more negative or neutral impression than the influence or steadiness coach.

The choice in making it a video file has as a consequence that the dietician tasks will follow one after another, without pause or interruption in-between. Moreover, a video with the standard sentences, as can be seen in chapter 7.4 and Appendix M, has been made. This is done to make the comparison between personality and standard version as fair as possible and to leave as few outside factors as possible that may influence this impression. This also prevents any changes in interaction between the app version and video file.

Lastly, Covid-19 and time limitations led to certain design choices. For example, the number of people that can be used for testing the final design. The number of tests done to verify that the other two dietician tasks also match the personalities as intended, and the validation of the dialogue sentences, to see if they represent the dietician task. The standard sentences were used as a guideline, but for future practices, the dietician could be more involved in this design process.

8.1 Visuals

In figure 21 and 22 the visual screens for the dominance personality of the two other coaching tasks can be seen. The visualizations of the influence, steadiness, and conscientiousness tasks can be seen in Appendix N.



Figure 21: dominance screens feedback task



Figure 22: dominance screens reminder tasks

8.3 Voice

For the final design, a different voice is used compared to the validations. To convert text into speech, an API powered by Google's AI technology was used (Google, n.d.). This API is said to have lifelike responses, engaging users with the interface. It is able to generate speech with humanlike intonation. Built based on DeepMind's speech synthesis expertise, the API delivers voices that are near human quality.

The voice used in the Liz is in Dutch, with voice type wavenet and the voice name nl-NL-Wavenet-D. It is a female voice with the speed at 1.00 and the pitch at 0.00. This voice is more realistic when it comes to intonation and pitch in comparison to the one previously used.

9. EVALUATION

9.1 Participants

Recruitment & selection

A predefined target group of people aged 70+ was selected. Participants were screened based on their opinion of technology and their view on interaction with a digital coach. Participants with a very negative opinion were excluded, for the prototype to be judged fairly. This also ensures that only the target group is reached. This selection was done before the start of the user test.

Two grandmothers of the researcher were approached and asked if they had an interest in participating in the study. The participants fit the intended target group. Additionally, their network of elderly was used to reach more participants. Those with an affinity with technology or an open mind were asked to join. In consultation with the participants, a day and time slot were selected that fit their schedule. Testing takes place in the Netherlands and all the participants are Dutch. The researcher will visit the elderly separately in their own homes with the prototype. In total the amount of participants is n=5.

Consent forms

Since the user study involves the observing of people's behaviour and the handling of their data, consent is needed. The consent forms are set up according to the faculty of ET regulations, University of Twente. The study was checked by Natural Sciences and Engineering Sciences Ethics Committee of the University of Twente and approved. The full consent forms and information brochures can be found in Appendix O and P, respectively.

9.2 Procedure

During the evaluation phase, the final design is tested. The research will include a paper questionnaire and a small interview that relates to the participants' experience. For this thesis, the Almere questionnaire will be used together with the added constructs by Heerink et al. (2010), because this specifically targets elderly users in a home environment (Appendix Q). Thus, it is thought to show the whole range of possible acceptance factors. The questionnaire will be translated into Dutch (Appendix R). The participants answer this questionnaire after having participated in a formal field experiment. In the experiment, the participants are shown different personality versions of a digital coach. The goal of the research is to find out if acceptance is higher when the coach is personalized to the users' personality type.

There are some Covid-19 considerations when it comes to user testing in person. The prototype will be cleaned between each session. The testing takes place in participants' homes, so they will not come into contact with each other or other outside factors. The researcher will get tested beforehand. The researcher will be keeping 1.5 m distance from the participants while wearing a mask. The participants will be aged 70+ and are selected on all having had a vaccination shot. The test was conducted in the first weeks of June in the participant's home in the Netherlands. The interview will be audio recorded for transcription, only with written consent by participants. Pictures of the setup might be taken with some of the participants, in case of included written consent.

9.2.1 Method

Evaluation was done by the researcher. Each test started with a standard introduction. The global idea was explained and participants are asked if they have any questions before the start. Participants first interacted with the current version of coach Liz, to get an idea of the interactions possible. Then the first standard video is shown, whereafter the questionnaire is filled in. After this, participants were shown a preferred personality version of coach Liz. Again, they were asked to fill in a questionnaire. This allows the researcher to compare the two versions rated on the same criteria. Observation was done during the user test and notes were taken on a computer. The conversation, a semi-structured interview, between researcher and participant was recorded. The results and conclusions drawn from the test and observations will be discussed in the following section. The full protocol can be found in Appendix S.

9.3 Results

After the user test session, participants completed a questionnaire that asked them about their experience and their thoughts on the digital coach. Questions are multiple-choice and rated on a 5-point Likert Scale, with one being 'strongly disagree' and five being 'strongly agree'. The five participants will from now on be called p1 through p5, based on the order of user testing. Based on observations and results from questionnaires and interviews, it can be seen that p1 through p4 were all open to the idea of a digital coach and had a positive attitude, while p5 was quite negative overall. Four of the participants had a preference for the personality chosen version, while p4 preferred the standard version of coach Liz. P2 chose a dominant coach, with all the other participants opting for the steadiness coach. All participants are women, aged 70+. All participants have basic knowledge of technology, using tablets or phones to use the internet and email. They indicate they are open to technology but are not familiar with all possibilities that technology offers. They, however, are satisfied with their limited knowledge and know-how.

9.3.1 Questionnaire results

Table 7: questionnaire results

Participant	Summary of results	Questionnaire codes
P1	<ul style="list-style-type: none"> Attitude towards technology, perceived adaptiveness, and perceived enjoyment have improved for personality chosen version and are rated more positive for personality chosen version No other significant differences in the questionnaire 	ATT PAD PENJ
P2	<ul style="list-style-type: none"> Attitude towards technology, perceived enjoyment, and social presence is rated more positive for personality chosen version Perceived sociability has slightly improved for the personality version compared to the standard version Social influence has become more neutral, where the standard version rated positively in this aspect 	ATT PENJ PS SI SP
P3	<ul style="list-style-type: none"> Anxiety in use is less for the personality version when compared to the standard version Attitude towards technology and perceived enjoyment have improved for the personality chosen version, being rated more positive Perceived adaptiveness and trust are rated slightly more positive in the personality chosen version 	ANX ATT PENJ PAD Trust
P4	<ul style="list-style-type: none"> Perceived enjoyment and perceived usefulness are higher for the standard version No other significant differences in the questionnaire answers P4 rated everything very positive and also indicated this during the interview and filling in of the questionnaire 	PENJ PU
P5	<ul style="list-style-type: none"> Anxiety regarding Liz in personality version has changed, with p5 finding Liz less scary and intimidating Perceived adaptiveness and perceived enjoyment are rated more positive in the personality chosen version P5 was quite negative during the whole user test Perceived ease of use, perceived sociability and perceived usefulness have slightly improved in the personality chosen version 	ANX PAD PENJ PEOU PS PU

9.3.2 Interview & observation results

During observation and interview, a few general conclusions can be drawn. First, the prototype should be tested over a longer period for the users to judge the personality and the coach more reliably. Participants indicated that they find it difficult to assess the coach due to the amount of information at once and because some statements in the questionnaire can only be properly assessed after a long period. Some participants stated that differences between the standard version and the personality chosen version are not noticeable, this might become more visible after a longer period. More elaborate notes can be found in Appendix T.

Table 8: interview results per participant

	Starts with	Chosen personality	Notes
P1	Standard	Steadiness	<ul style="list-style-type: none"> Does not see added value of facial expressions Difficulty in assessment due to limited interaction and thus limited knowledge of Liz. Makes it difficult to judge differences in versions. She says <i>'ideal for people who really need it, Liz can be of great help'</i> The personality version was clearer, provided more information. <i>'I find this one more pleasant'</i> The personality version provides explanation and clear information, facial expressions are an added value here. Even though the main focus is on reading the text. Preference for personality version. Would like to option to sometimes have more information and sometimes not
P2	Personality	Dominance	<ul style="list-style-type: none"> No noticeable difference in the two versions, no preference, even though the questionnaire shows a preference. Text is most important, facial expressions and gestures not as much. A lot of information to process. Mentions that differences might be clearer over a longer period, producing a clearer preference for one of the two versions Supportive, pleasant in use. Interaction is nice Preference for the personality chosen version after some deliberation
P3	Standard	Steadiness	<ul style="list-style-type: none"> Easy in interaction, interesting to listen to The personality chosen version is sympathetic and more clear than the standard version The personality chosen coach appealed to her more, partly because of how information is communicated Liz precedes her expectations concerning appearance <i>'I expected a rigid and robot-like figure, and Liz was very good'</i> Facial expressions were more pleasant in the personality version, also the tone and word usage have improved A lot of information to take in, longer testing time would be nice. Some difficulty with assessment due to limited testing time and interaction <i>'if I would need such a coach, this one would be pleasant and nice to have'</i> – p3 regarding the personality version Strong preference for the personality chosen version
P4	Standard	Steadiness	<ul style="list-style-type: none"> Very enthusiastic about the concept This personality version would be suitable for people with starting dementia. <i>'Very informative and concomitant'. 'if that is what you need this would be very nice, for me it is too much information because I do not need it'</i> Figures and data are clarifying Interaction is nice in both versions. Personality version feels more guiding, <i>'It is very steering, without it being annoying'</i>. Version 1, standard, is more generally informative Appearance is friendly. Not human, but it also does not feel like a robot. <i>'it is like you are on the phone or video calling someone' 'It feels like personal contact'</i> Personal preference for the standard version, due to the amount of information in the personality chosen version that she does not need yet. Mentioned during interaction: <i>'I find it almost touching you know', 'how wonderful, very nice', 'this is amazing, I find it really fantastic'</i>

P5	Personality	steadiness	<ul style="list-style-type: none"> • Unenthusiastic and fairly negative throughout the user test • The standard version is unemotional and unempathetic. • Facial expressions are minimal and do not come across as humanlike. <i>'make it humanlike or leave it be altogether'</i> • Does not like either version of Liz. Does not like the appearance or the voice. She does not look sympathetic, with too big a haircut. <i>'I would rather see a whole nursing cap with the cross'</i> • Finds it, at most, technically fascinating but not as a coach to have in-house: <i>'really horrible'</i> • For the personality chosen version she mentioned that it is a lot of information all at once. • Focused on the text, facial expressions do not matter • The coach is not pleasant and a little scary • The concept of coach Liz is good and would be good to use, but only if it is a completely different Liz • Easy in interaction, on its own it is interesting • Doesn't believe in technology, more in the people behind it. <i>'On the one hand, I think it is just a stupid doll, but on the other hand yes there are people behind it who communicate with me through Liz and that I like'</i> • Mentions she has a stubborn personality <i>'whenever I HAVE to do something, I will object in advance'</i> • In the future, I might think differently, because maybe I would need it then. <i>'It's hypothetical to me, so I'll give a different answer now than if I was really in a situation that I would need her'</i> • She has a preference for the personality version because the standard version is even bossier. • She would prefer a more abstract version, mentions the robots Tessa and Paro.
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9.4 Conclusion

Previous to the evaluation, it was expected that there would be a strong preference for the personality chosen version. This finding disappointed, with only a moderate preference on some of the questionnaire factors and a spoken preference during interviews. Moreover, participants not always noticed a difference between versions. For p2 this might be because her chosen personality is close to the standard version. For others, perhaps more time is needed to notice a difference and it might become greater if they can click through the answers themselves instead of a video, giving them time to observe longer. Next to that, there are a few common themes in answers and remarks during interviews. These were mentioned by all participants and therefore imperative for future actions:

- Difficulty in answering the questionnaire due to limited time interaction. By user testing over a longer period of time, this problem might be solved.
- A lot of information at once. By testing the prototype over a longer period, the amount of information can be dosed. Moreover, by adjusting from video format to actual prototype, participants can take their time reading the message and answering it. This might help digest all the information that is given.

10. **FUTURE VISION**

This chapter will discuss a future vision for the product. It looks beyond the current way of working and the current form of the coach. This chapter describes how I would design a digital coach should I have all the freedom in designing, with no restrictions. Drawing on my design skills and creativity. In the project for ConnectedCare, a conscious decision was made to answer the question the company proposed in detail. The research done can be used to further their prototype and project. This chapter will go further, I want to show from a product design perspective, how the design could look. I want to widen the perspective and give a future vision.

The prototype as shown in figure 11 is not the future of digital coaches. The technology that is available right now has led to the current prototype, but this is of course a limited frame for a designer to work in. I would like to give the company new ideas and stimulate them to look beyond current boundaries. Such a future vision is important and interesting for the company to look at because it might lead to new ideas and insights. For example, future explorations based on trends can help prepare for market demands. Next to that, you might discover new technologies in an early adopter stage, which will give you more influence over the technology and a competitive advantage. This chapter will give three radically different concepts that show other options. These options might be where the future is headed, so it is important to start thinking in that direction. These concepts will not be tested due to time limitations, however, the added value will be discussed in the conclusion of this chapter.

10.1 Approach

The starting point of this chapter is to find out how different personalities present themselves, taking away the humanoid form. A conscious decision was made to steer away from the humanoid form of digital coaches that are now so commonly used. This decision was made because many people actually prefer a less humanlike appearance (Broadbent et al., 2009; Mori, 1970). Instead, three radical scenarios are explored that take the insights gained in coach Liz's research and generalise the findings. These findings are translated into functionalities or behavioural aspects that can be used to design the three scenarios. An explorative study will be done that results in three nicely elaborated concept sketches, with as function widening the vision of the company. Concepts will be generated based on the researchers' creativity and stakeholder consultation.

10.2 Connection with coach Liz

The previously done research focused on coach Liz and its results can be used in this section of the report as well. Findings regarding the interaction between product and user can be generalized and used in generating the concepts mentioned in chapter 10.3.

The current communication method in Liz uses facial expressions and gestures as well as the actual language used. The movement and behaviour that is used in the expressions and gestures can be compared to and translated into the movement of an object. For example, you can imagine the movement of an object (e.g. ball) that is reserved. Its' movements will be shy, it could roll forward slowly and then back again, hesitant in approaching the user. This principle can be used for the different personalities as well. It shows that the personality not only depends on the face but also on more abstract aspects such as movement.

Research on this has been done by Lévy et al. (2011) who looked at implicit telepresence. Implicit telepresence looks for "minimal solutions for the sharing of presence, of emotions, of subtle information, or of simple remote actions (e.g. tangible designs and computer-based ones)." (Lévy et al., 2011, p. 2). Their findings show that in the context of communication, content is not necessary to trigger an emotional experience. In short, this research shows that physical aspects such as a face, are not necessary for the user to understand the personality or other message the product is trying to convey.

10.3 Concept realization

The realization of three radical scenarios is described in this section. Based on stakeholder discussion the general idea for each concept was introduced, to guide the design process ideas and not get stuck staring at a blank page. The three ideas are the use of the whole room, a utility or commonly used home appliance, and an abstract idea. While designing the concepts, the context of a digital coach with different personalities is still kept in mind. The purpose of the coach to help elderly in remembering or performing certain actions remains the same.

During ideation, one challenge presented itself in the fact that it is very hard to steer away from any

humanoid forms when considering human-like interaction with users. This shows that the concept of sociality is so strongly ingrained with a human that has a face and expressions, that it is difficult to come up with different ideas. After ideation of the concepts, when deciding what to develop further, the researcher decided to steer away from anything resembling a humanoid product or has a face. Instead, when designing the interaction, the researcher thought of movements in interaction. How the movement of a product might react to a human using it and how that can portray different personalities. The integration of personalities lies not only in the form or shape of the product, but maybe even more so in the movements.

The colours used for each personality in the concepts will be the same across concepts. Dominance will be red, influence will be yellow, steadiness will be blue, and conscientiousness will be green. The choice for these colours is made based on colour theory (The insights group, 2021) in combination with personalities, and these colours are also used in the DISC theory. Based on theory the colour red stands for a demanding and strong-willed personality; yellow is enthusiastic and sociable; blue is logical and organised; green is focused and efficient.

10.3.1 Concept 1 - Whole room

Concept one is based on the inclusion of the whole house or room that the user is living in (figure 23). It entails a multisensory experience that uses concepts from Internet of Things (IoT) to optimize the user experience. In this sensory concept lights, sound, texture, and colour play a role. The lights and colour are implemented in the normally used room lights and different lamps around the house. The sound is integrated into a sound system throughout the house. Texture is integrated into floor panels that pertain to the entire floorspace of the house. These panels can change 'shape' and thus texture. The shape is dependent on the personality that it portrays. All these physical objects are connected and embedded with sensors and technology through the internet to form a network that cooperates to create an immersive personality. In reality, it will be like the house has a personality that will help the user with certain tasks. For example, it can guide the user to eat or to take their medicine. The personalities that are used in the research and prototype of Liz are used here as well and implemented in different ways. The specifics for each personality are described below.

The specifics

The behaviour of the dominant room will be different from that of the influence room. This section explains how each personality is designed. The main difference is in the movement of the physical objects, which leads to a difference in interaction. In the way that for example the texture changes. There is a difference between the pure functional movement e.g. up and down, or flat and texture, and the way that it moves dynamically in time.

The floor will be made from a rubber-like material, providing a comfortable material to walk on. The texture of the floor has a double communication function. The symbolic communication of the texture pertains to the shapes and what they mean. For example, spikes communicate something different than ripples. Independently of the symbolic meaning, the shape communicates that spikes are not meant to be walked on. Thus, the dominant arrow is going to stop people from walking on it. This revelation led to the refinement of the concept. There should be an empty spot for people to walk on. The texture can either push them or guide them in the right direction. For the dominance, this means that the texture would appear behind the person and with movement push them in the right direction. Influence would be more of a tempting movement that starts in front of the user and tempts them to follow the rippling movement, the texture disappearing when the user moves to stand on the tile. Another option is to have the texture on all tiles surrounding the path the user needs to take. This is also quite pushy and can be used for the conscientiousness coach. The only flat tiles, in this case, would form the path the user needs to walk in, no other option is given. After completing the task or walking on the tiles, they should turn back to their flat resting state.

- The dominance movement will be an arrow that moves in the direction it wants you to go in. The texture will form behind the person it is directing, pushing/forcing them in the right direction. By combining the arrow with a surrounding area of tiles, the person quite literally has nowhere else to go.
- Influence will be rippling waves that act as a slowly guiding nudge in the right direction. The texture will disappear when people walk on it, only colour will remain which will allow people to walk on the guiding path comfortably.
- Steadiness will be blocks that slowly move up and down. Similar to the influence coach, this will be a nudge in the right direction, with the texture disappearing to allow people to walk on the tiles.
- Conscientiousness will be an on-and-off flashing texture. The texture will surround the path that the person is supposed to walk in, providing guidance and only one logical path to follow.

The movement can be seen in figure 24. It is a three image storyboard that shows the way the floor texture of each personality is portrayed. When reaching the destination, the texture and colour will disappear. In coach 2 & 3 lights will only appear when closer to the destination, making it not as dominant in the room. Coach 1 and 4 are shown in walking motion, while in coach 2 and 3, the movement of the tiles and texture is highlighted.

Concept 1 - Whole room
Multisensory experience, IoT
Light, sound, texture, colour

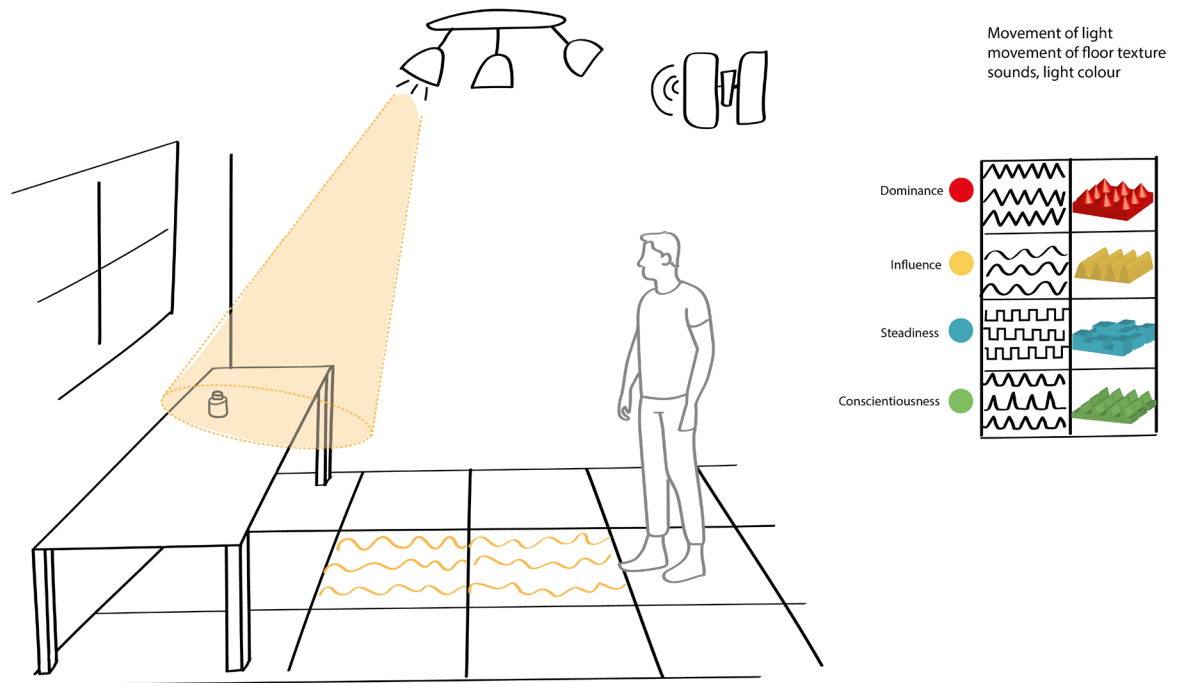


Figure 23: concept 1 visualisation

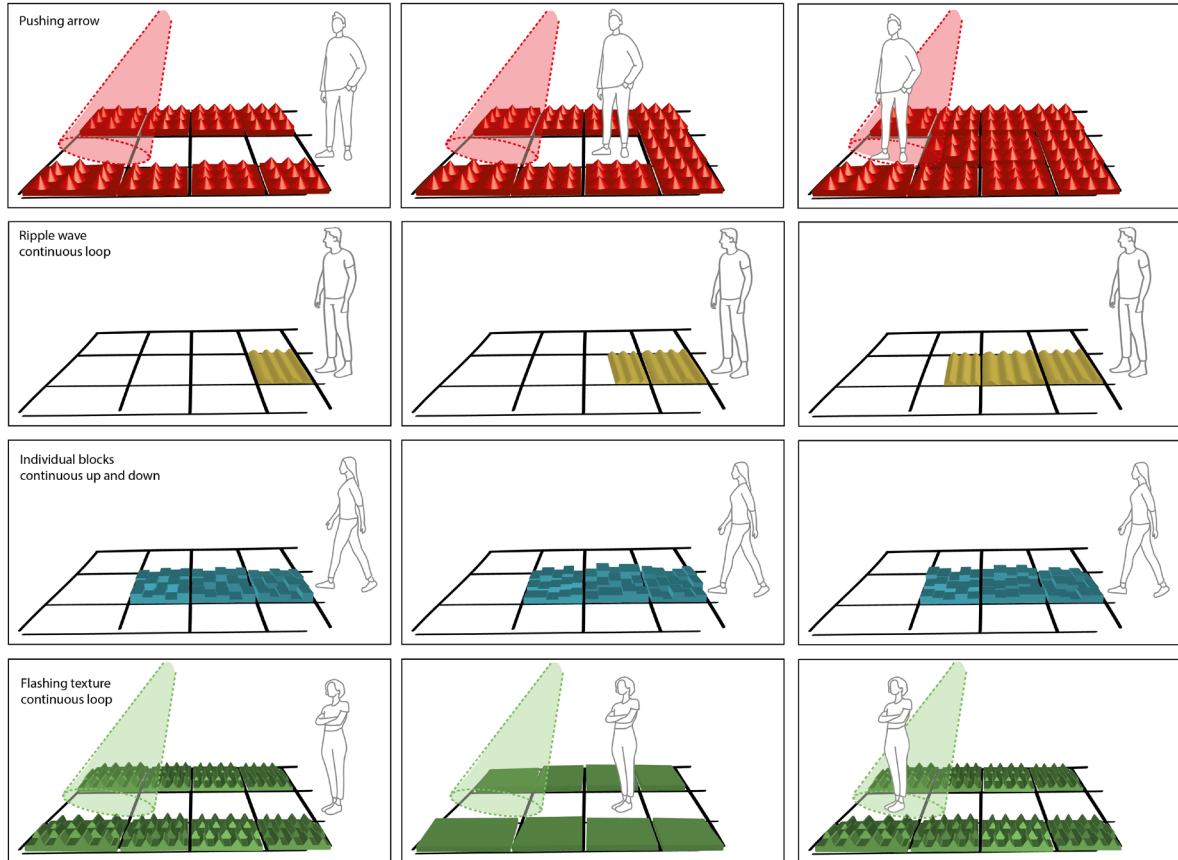


Figure 24: concept 1 visualisation floor movement

10.3.2 Concept 2 - Home appliance

Concept two is based on home appliances. After long ideation and deliberation, it was chosen to focus on a dish bowl. The inspiration from the shape of this bowl was then used in the ideation. The idea of two stacked bowl-like shapes was created and personality can be shown in the form and movement of said bowls.

The visuals in figure 25 show the movement of the bowl as intended. Short videos that properly show this movement for each personality could not be made due to time limitations. Visually, to aid the report, arrows are used and movement will be described below to give some insight into the behavioural movements.

The specifics

- The Dominance version of this concept will have a very alert attitude that is translated into an upright stance. The dominant coaching bowl will constantly look and turn with you, it has a 360-degree view. It will sometimes raise even higher in a very abrupt manner to gain attention, mimicking the raising of a finger almost. This signals that it wants your attention or that it wants to show its presence.
- The Influence coach is the extrovert coach. This is translated into a very active bowl that is constantly moving through the base, only stopping when it needs to perform a certain action or when in interaction with the user. It will also have a 360 view that can turn with the user, sometimes looking over the edge to show its presence. However, this is not as invasive and in-your-face as the dominant coach. Instead, it would be more of a peekaboo movement.
- The Steadiness coach exudes calmness. This bowl will turn in circles very slowly in its base, mimicking a store display. It radiates the message: "I am here when you need me, no worries". The movement will be steady and calm with no sudden outbursts or changes in movement. When in interaction with the user it can move slightly upward to create a more pleasant angle for the user to look at.
- Conscientiousness moves up and down and left and right throughout its base. It shakes or vibrates 'violently' / angrily when it wants attention. When in resting mode it will move from left to right, towards an upright position. Mimicking the movement of a pendulum.

Concept 2 - Home appliance

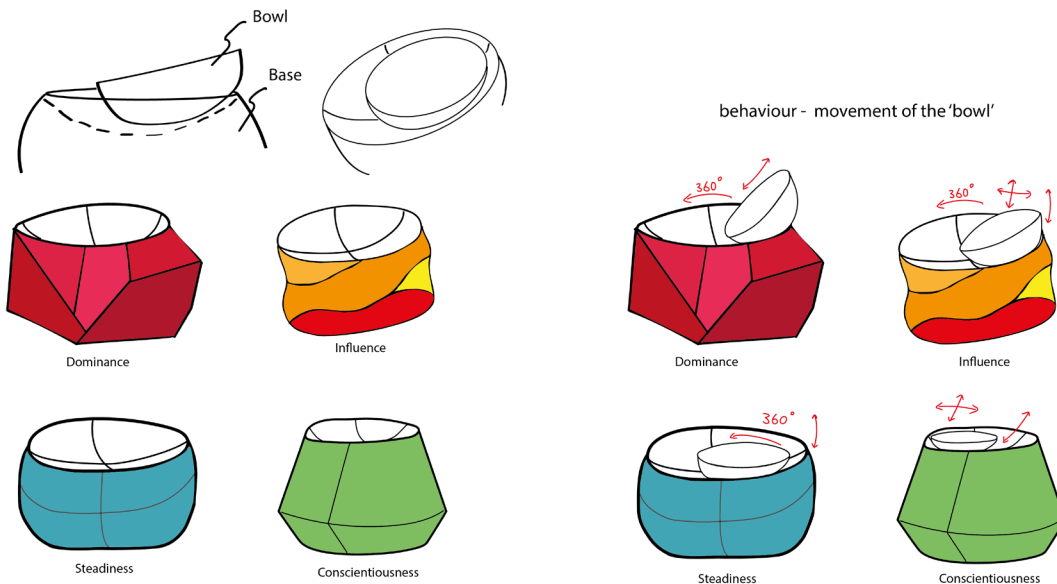


Figure 25: concept 2 visualisation

10.3.3 Concept 3 - Abstract

Concept three was started with an abstract product in mind. After spending some time ideating, the concept of a projected wave-like pattern that simulates a voice was developed. After deliberation with stakeholders, the concept of processing that wave into clothing or other objects was conceived. A conscious deliberate decision was made to steer away from any digital screens and other often used wearables such as bracelets. It was chosen to explore a radically different form of what is possible, not get stuck in a product that already exists. Other products such as utensils, and the concept to project it or include it in a whole room were steered away from, to not resemble the other two concepts.

The concept started with a round pattern that would dynamically change shapes, however in the end it was decided to make it a linear bar that moves. It would be something that you could carry with you or have on you. This eventually turned into a jacket sleeve. The pattern in the sleeve, the personality, would entice the user to move their arm. For example, it could lead to them grabbing an apple to eat or take their medicine. The pattern and colours change based on personality. The movement of the linear pattern changes in time. The movement is very difficult to convey in static visuals (figure 26), therefore the different movements for each personality type are also described below.

The specifics

The difference in personalities lies in the difference in pattern, colour, and movement. The difference in movement will be described here below.

- **Dominance:** the pattern for the dominance coach will be a geometrical shape that moves rigidly. Quick movements that can move in and out like a spring. It will have sharp corners and straight lines that interchange positions quickly. The movements become more rigid and quick when the direction that it wants to go in is not followed.
- **Influence:** the pattern for the influence coach will be smooth with curves that slowly and dynamically change over time. The result will be a wave-like pattern that flows in the desired direction, it can bounce around and give an energetic impression.
- **Steadiness:** the steadiness coach will have the same smooth curve pattern as the influence coach, but with some sharper edges. It will also have a wave-like pattern but the behaviour will differ from the influence version. This coach will move calmly in the desired direction.
- **Conscientiousness:** the conscientiousness coach will have a geometric pattern that moves more fluidly when compared to the dominance coach. This version moves towards the preferred direction calmly and vibrates when it is not followed.

Concept 3 - Abstract

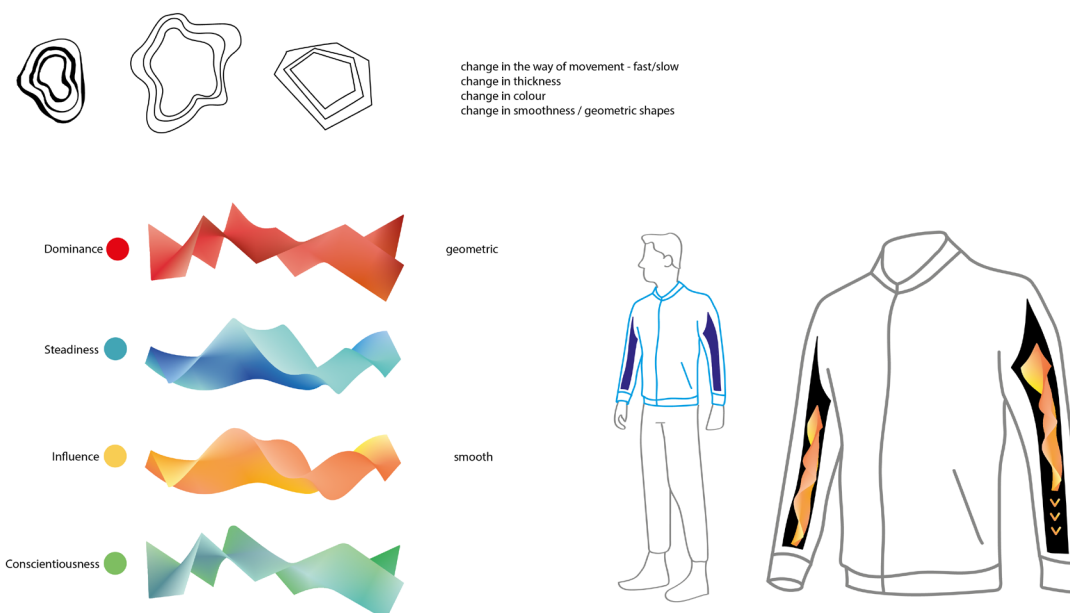


Figure 26: concept three visualisation

10.4 Conclusion/Discussion

The three concepts give insights that can be used in the design of Liz. Namely, the personality of a digital coach might not solely lie in the looks, but it can be a lot more abstract and focus mainly on the movements. In the development of the prototype for Liz, the main focus was on text, facial expressions, and gestures. In the development of radical concepts, the researcher focused on movement and how an object or otherwise abstract form presents itself. I show that the movement of one agent is an affordance for social action for other agents. This is also present in human-human interaction. For example, making a body gesture towards a door invites for going out. It does not rely on facial expressions, symbols or words. This subtle affordance movement can thus be designed for personalities as well.

Research through design is an approach that employs design practice with the intention of generating new knowledge. It is a reflective process that makes artefacts functioning as proposed solutions and hereby investigates future opportunities (Zimmerman & Forlizzi, 2014). This research through design has led to certain findings that might be interesting for interaction between Liz and the user.

For example, the dominance is leading in its' movements. This might be translated into an emphasis or focus on certain communication aspects in Liz that will put you in the same train of thought. By including movement in the prototype, you can entice the user to move as well. Either in the direction you want them to go in or by moving a limb to perform a certain action (concepts 1 and 3 respectively). This relates closely to the persuasive design area, often used in the public health domain, that focuses on influencing human behaviour through a product's characteristics. The radical scenarios allow you to break loose from convention. One piece of advice for other digital coach designers is to use radical scenarios. It would be an interesting method to brainstorm and to break free from the bubble you might be stuck in.

One participant mentioned during evaluation that the coach Liz did not work for her as she preferred a more abstract version with the same functionalities. I have not been able to test these concepts and get user input on the added value of these concepts. However, abstract robots seem to work for elderly just as well, look at Tessa and Paro (PARO Robots, U.S., 2014; Tinyrobot, 2015). By adding the theory of the personalities to the abstract designs, you can cover a base of different user preferences. ConnectedCare already concluded that Liz will not work for everyone based on the fact that some people do not like such a coach or any technological innovations for that matter (ConnectedCare, 2021). By making the coach into an object that they recognize, concept two, for example, their opinions might drastically change.

11. CONCLUSION

11.1.1 Discussion

This thesis shows the design process of a digital coach for the elderly by developing a framework to optimize the user experience. In an iterative approach, I researched how digital coaches are perceived amongst older adults and how to achieve acceptance for different types of users. Based on the insights, I developed a potential solution through research and design. This resulted in insights about the design of digital coaches for the elderly with their needs and wishes, the DCUX framework which provides a roadmap to coaching solutions for the elderly while increasing acceptance, and possibilities of including personalities in the design of a digital coach. The collected insights form the foundation for the answers to the research questions as previously defined:

“How can the interaction and user experience between frail elderly and a digital coach be designed such that it increases acceptance and adheres to the user’s wishes and needs, providing a sense of enjoyment that lasts?”

Theory, chapter 3, generated the first insights into what factors influence acceptance and how to improve the interaction between user and digital coach. Through iterations, it was hypothesized that personalities, customized for each user, would increase the acceptance and satisfaction in use. The user research results show that the majority of users indeed prefer a coach that was customized to their personality preference. However, as discussed in chapter 9.4 the finding was expected to be more convincing. Results show that not all factors from the questionnaire had a significant difference when comparing the standard version to the personality chosen version. One reason for this might be the fact that participants did not have enough interaction time with the prototype, thus not being able to answer statements on intention to use and perceived usefulness properly. Other reasons can be found in the limitations section of this chapter. The factors most participants rated more positively for the personality version are perceived enjoyment, perceived adaptiveness, and attitude towards technology. Perceived usefulness and perceived sociability were sometimes mentioned. Most other factors are not noticeably different when taking the average of all participants; individual results can be seen in chapter 9.3. Nonetheless, results show that the framework facilitated in making the design of the digital coach more accepted by its users. Additionally, during the iterative process, the voice of the coach turned out to be a crucial factor. The voice should be human-like and as pleasant and realistic as possible, given the fact that the design is humanoid. This is in line with the uncanny valley concept, as stated in literature, first and foremost, the form and function must match. More factors may become important when the prototype is tested over a longer period of time, giving participants more time to notice differences and contemplate their decisions. Other reasons that might contribute to different results are discussed in the limitations section.

The DCUX framework was presented and tested through a case study. The framework can be used for other design researchers that aim to increase acceptance of a socially assistive coach. It gives a roadmap of important factors designers need to consider. Moreover, the iterative process helped to implement the framework and made ideas tangible. It allowed for reflection and adaptation of both the framework and the design. Next to that, user insights were gained throughout the process, that gave quick feedback and input for changes.

An interesting question provided by my supervisor Jelle van Dijk led to the creation of chapter 10. He asked if the principles of personalities would hold even with more abstract designs. This chapter showcased my skills as a designer as well, having had limited freedom in the originally proposed assignment because the appearance and main functionalities were already decided on. The chapter shows that the differences in personalities can be seen, even in extremely abstract circumstances where there is no humanoid appearing application. It goes to show that affordance for social action can come from movement and is not necessarily related to facial expressions or words.

Chapter 10 added new insights to the thesis and showed, through exploration, how different designs could get similar results. It provides a different way of working, showing an approach that other design researchers can try as well. This approach might help think outside of the box and steer away from conventional designs. The humanoid form was discarded in this chapter because not all people prefer a human-like robot. To facilitate all users, different forms at least need to be explored. The different form also allows for different functionalities not possible in the humanoid form.

11.1.1 Limitations

One of the limitations of this thesis was the format used in the prototype. The prototype that was used to conduct the user studies used a video version of the digital coach, containing screens of the app version of the

coach. In these videos, the appearance is similar to the actual app version, but the functionality differs. Users were not able to interact with the coach as they normally would have, the focus here was on observation. The users could not click on the multiple-choice answer options, nor were they able to determine the speed of the conversation by confirming their answer. Instead, screens followed consecutively. Moreover, facial expressions and gestures were not animated but transitioned from one to the other without animation. The expected impact of this limitation on the results could be quite large. Participants could get more time in observing and registering their answers and may have a better judgement about the actual prototype if it was tested in the same format.

Additionally, the user test was somewhere between 30 to 40 minutes, minimized to not mentally overload or overwhelm the participants. However, participants stated that it was a lot of information to take in at once and sometimes they needed more time in interaction to come to a decision on the digital coach. Furthermore, the number of participants in user testing was rather small. Because of Covid-19 restrictions, elderly were a difficult target group to reach, limiting the number of people participating in the user study. Results should be checked with a bigger group of participants, to make sure the results are representable of the target group and generalizable for all elderly.

Participants all fell into the correct age category, however, none needed a dietician or had any nutritional problems. This can also affect their opinion of the robot and the help it offers. Some participants mentioned that their opinion would change, had they been in a situation where they would need such a coach. Moreover, all participants were women, the male participants would also need to be included in the study to make sure no noticeable differences exist between genders. Additionally, the study was also culturally limited, only Caucasian people were tested with a Caucasian appearing prototype. I can imagine that the appearance of the coach requires different versions as well, representing the whole population.

A conclusion that can be made after the design of the other dialogues in chapter 7.4 is the fact that these need to be user tested as well to see if the dialogue matches the personality of the intended coaching version. Right now, they are designed based on table 7, but these choices need to be validated too. Due to time and scope limitations, this was not possible.

Another limitation was the already fixed design. Chapter 10 provided me with some insights into how different concepts could look, but different appearances were not tested with elderly. So, I did not get to learn from their feedback. Chapter 10 showed that the personalities also work for abstract shapes, and user testing showed that personalities lead to more acceptance. Thus, the expectation is, that the personalized abstract shapes also lead to more acceptance. This expectation should be tested.

11.1.2 Future recommendations

Some limitations found during this thesis can inform future research. User tests were done with elderly, aged 70+, not in need of any help. However, the user tests should also be done with the actual target group, meaning elderly in need of nutritional advice, who (regularly) see a dietician. Liz would then serve as an extension of the dietician. In addition, the dieticians could also advise on the dialogue of the digital coach. The prototype now uses standard sentences found in previous Liz versions, but dieticians might have some insights in how to word certain phrases.

Next to that, only two of the four gestures discussed in chapter 3.2.2 were used, namely symbolic and deictic gestures. Beat gestures and Iconic gestures that both go along with the rhythm of speech can be integrated into future prototypes when the technology allows for seamless integration without delays. This recommendation would be further into the future.

The differences in acceptance between the personality version and standard version might be more convincing by allowing more customization of the coach. Personality styles helped slightly, but allowing the user to also influence the physical appearance might provide them with more freedom and thus acceptance of the digital coach. One sidenote raised here is whether it is desirable to leave all those choices to the user, and to build customization into the application. I can imagine that setting this up is not always easy for the elderly. Lastly, perhaps it is possible to change the perception of personality types in a digital coach, just by changing the voice and enunciation. This would be an interesting study subject. It could enhance the personality versions as they are now, or it could be a separate study altogether.

11.2 Conclusion

Based on a case study in which I researched how to design a digital coaching personality, I proposed a framework for designing coaching solutions for the elderly while increasing acceptance of the technological solution. The DCUX framework can be used to improve the acceptance of a digital coach or otherwise socially assistive robot by providing a roadmap of important factors designers need to take into account. For this case study, it was determined that the road to success would be through different personalities of the digital coach. My user studies reveal that the personality version does indeed increase acceptance for most users.

Through user validations, guidelines were made that define the design of dialogues specific for each personality, with rules on how to design the verbal and nonverbal parts of communication. These guidelines can be used for future dialogues of the used prototype and case study. This research expected to answer the gap in literature concerning elderly's acceptance of technological applications. It was hypothesized that the user experience could be optimized by introducing a customizable solution for elderly. To answer the research question as previously proposed; the interaction and user experience can be designed by following the DCUX framework and in doing so it increases the acceptance. By designing the personality styles, the application takes into account the users' wishes and needs.

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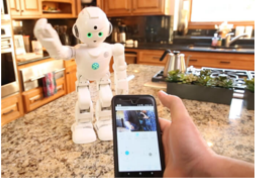







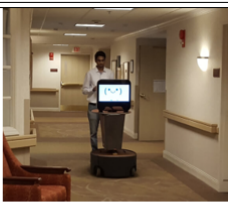


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Appendices

Appendix A - State of the Art

Table 9: State of the art of Social Robots		
	Human-like shape	Abstract shape
<p>Tangible action</p> <p>((non)-humanoids)</p>	 <p>Pepper → not available for personalized in-home use. Mainly used for hospitality purposes.</p>  <p>maatje →</p>  <p>Nao → not satisfactory in usability, to usefulness and enjoyment are positive. Sometimes hard to understand, especially with hearing problems. The speech library is not of good enough quality.</p>	 <p>pria → slow, dispensary doesn't always work, inconvenience to refill. Not a companion. Surprising lack of capabilities when looking at similar products.</p>  <p>ElliQ → very high price compared to functionality. Effective in reducing loneliness.</p>  <p>Zenbo → annoying child-like voice. 'weirdly creepy and expressive face'.</p>
	 <p>Lynx → adorable and unique looking, but instructions aren't very clear. Not enough features for the high price</p>  <p>Buddy – home assistant → looks cute, but is not useful. Kept mishearing commands and unable to strike up a conversation.</p>  <p>Cruzr → relatively short battery life.</p>	 <p>Paro – animal → reduces stress levels of users and stimulates interaction between elderly residents.</p>  <p>Jibo – IoT → feels like a luxury toy. Doesn't do as much as e.g. Alexa or Google and is more expensive. Short battery life and conversations are limited.</p>  <p>Robear – nursing care → in experimental stages. Needs improvements for security.</p>
<p>Intangible action</p> <p>(holograph, video-based, voice based, text based)</p>	 <p>Mabu →</p>	 <p>Olly's → still in development stage.</p>
	 <p>Sam – elderly care → User acceptance is found to be lacking. Telepresence seems less personal than actual human contact.</p>	 <p>Tessa → two main restrictions. The robot is not interactive and not aware of the environment (surroundings).</p>  <p>AV1 – reduces isolation of children with long term illness → inclusive design</p>

Appendix B - Evaluation models

In figure 27, the five Godspeed questionnaires can be seen, using five-point scales.

TAM, figure 28, is used to map influences on the user's intention to use and the actual use of the technology. The perceived ease of use and the perceived usefulness are the two most important factors that influence the intention to use the technology, which is the main predictor of actual use.

UTAUT covers a broader area than the TAM model, with two other factors that have been incorporated; social influence and facilitating conditions (figure 29). Gender, age, experience, and voluntariness of use were found to be the main moderating influences (Venkatesh et al., 2003).

Godspeed I: Antropomorphism						
Fake	1	2	3	4	5	Natural
Machinelike	1	2	3	4	5	Humanlike
Unconscious	1	2	3	4	5	Conscious
Artificial	1	2	3	4	5	Lifelike
Moving Rigidly	1	2	3	4	5	Moving elegantly
Godspeed II: Animacy						
Dead	1	2	3	4	5	Alive
Stagnant	1	2	3	4	5	Lively
Mechanical	1	2	3	4	5	Organic
Artificial	1	2	3	4	5	Lifelike
Inert	1	2	3	4	5	Interactive
Apathetic	1	2	3	4	5	Responsive
Godspeed III: Likeability						
Dislike	1	2	3	4	5	Like
Unfriendly	1	2	3	4	5	Friendly
Unkind	1	2	3	4	5	Kind
Unpleasant	1	2	3	4	5	Pleasant
Awful	1	2	3	4	5	Nice
Godspeed IV: Perceived intelligence						
Incompetent	1	2	3	4	5	Competent
Ignorant	1	2	3	4	5	Knowledgeable
Irresponsible	1	2	3	4	5	Responsible
Unintelligent	1	2	3	4	5	Intelligent
Foolish	1	2	3	4	5	Sensible
Godspeed V: Perceived safety						
Anxious	1	2	3	4	5	Relaxed
Agitated	1	2	3	4	5	Calm
Quiescent	1	2	3	4	5	Surprised

Figure 27: Godspeed questionnaire

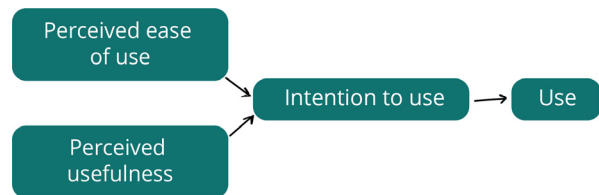


Figure 28: Basic TAM assumptions

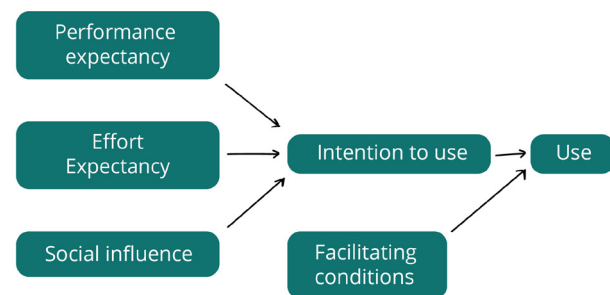
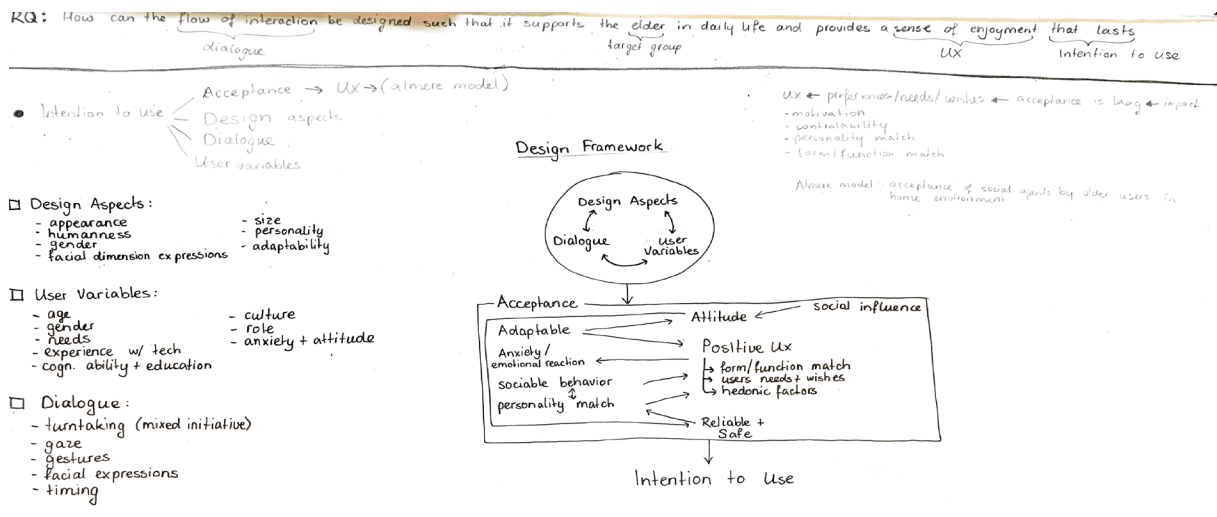
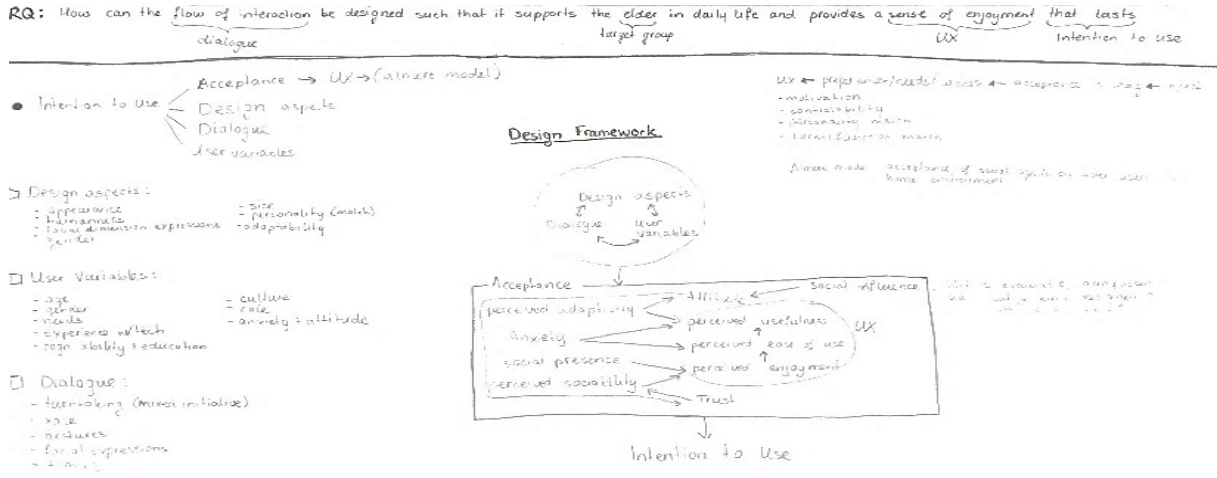
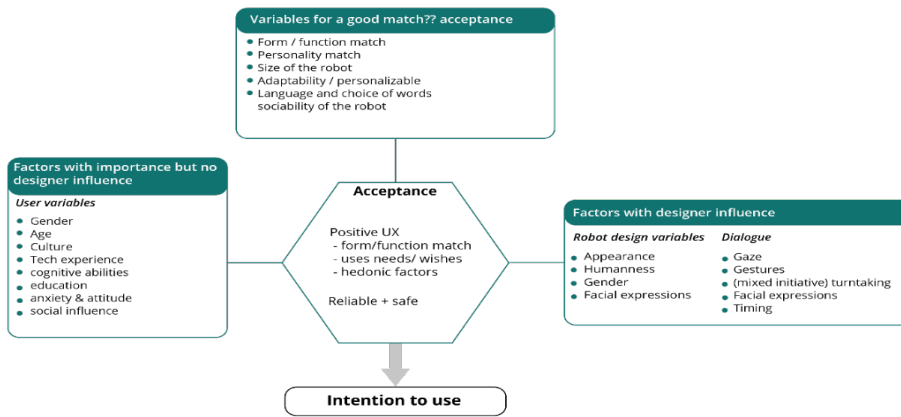


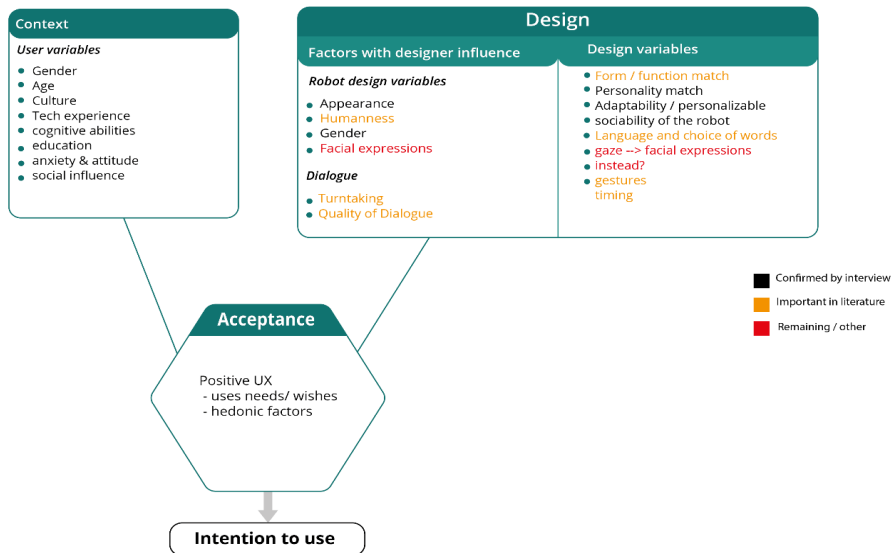
Figure 29: UTAUT model

Appendix C – framework iterations and process





Framework Iteratie 1



Appendix D – Iteration 1 knowledge framework

Iteration 1

The design variables are the things you can design for. They are things that can change and based on those changes, affect the factors with designer influence. Factors with a designer influence refer to how the user perceives and experiences the product. Within the design variables, the right decision needs to be taken to achieve e.g. a higher Quality of Dialogue. Improving the factors with designer influence will lead to a higher acceptance. However, the design should also match the user's needs and wishes.

The context provides the space in which the solution lies. Thus, the context can be seen as constraints for the solution. If the design stays within the constraints given by the context, then it can lead to acceptance. Acceptance in turn leads to the intention to use the product.

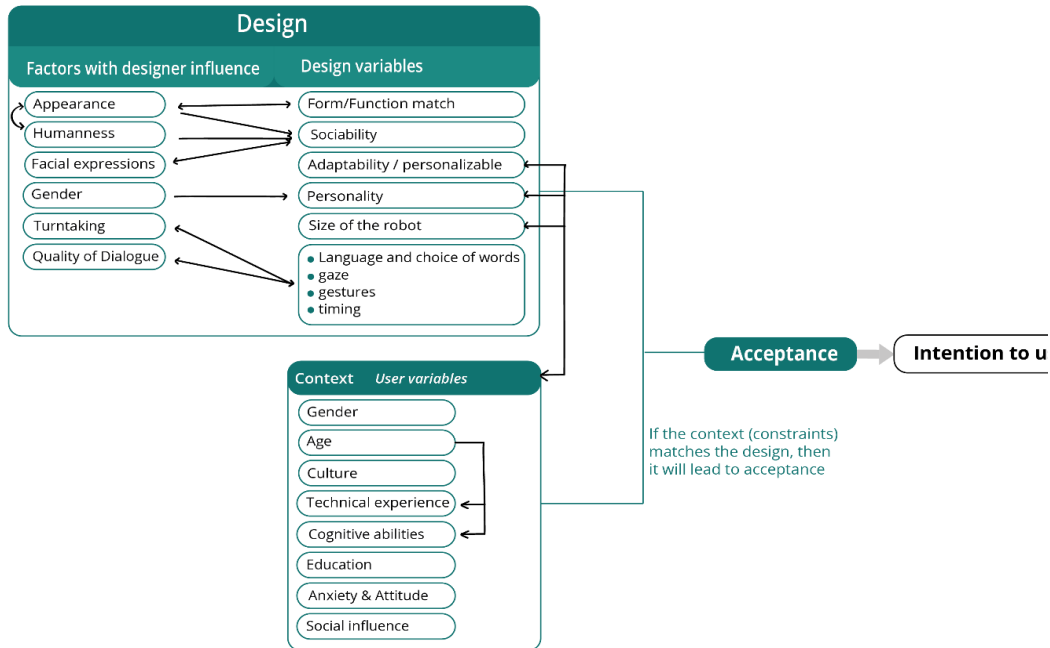




































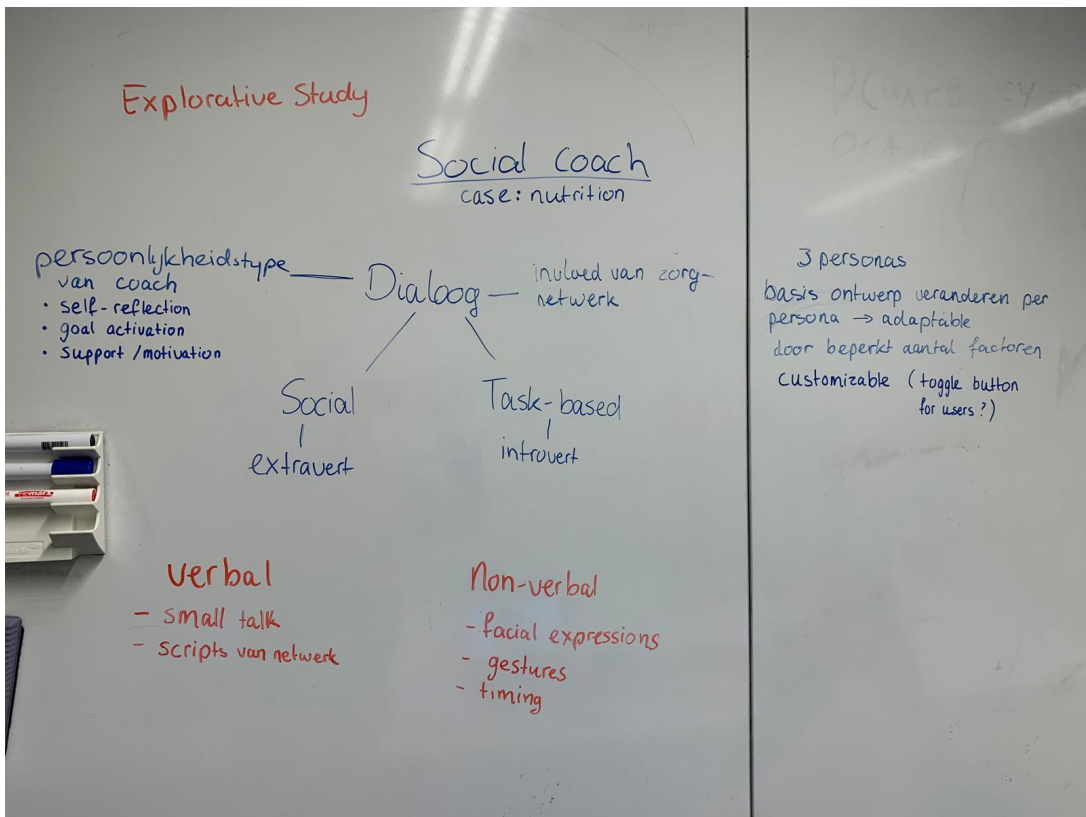
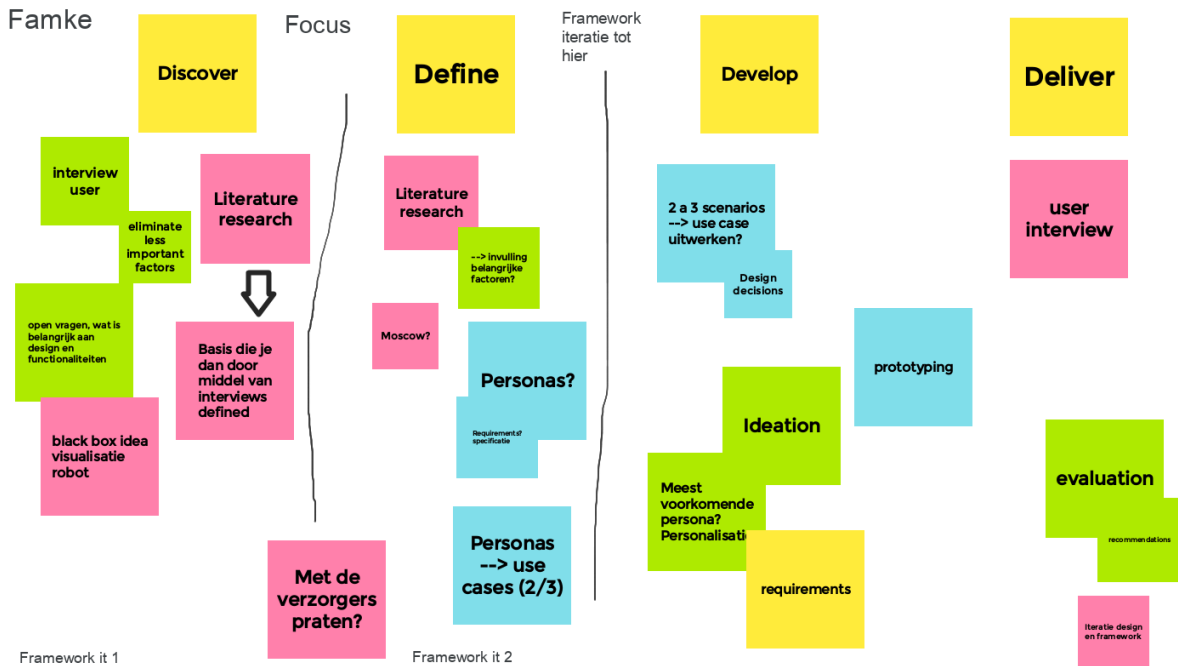
Figure 30: knowledge framework iteration 1

Appendix E - Current visualisation of facial expressions and gestures

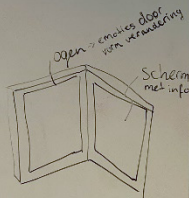
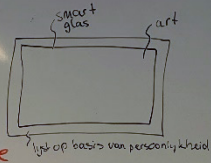
Facial expressions		Gestures
 Neutral	 Neutral eyes closed	  Neutral 1
 Sleeping	 Little frown	  Neutral 2
 compassion	 Get attention	  Neutral 3
 Glance right	 Glance left	  Thumbs up
 Glance up	 Glance down	  Pointing up

 <p>interested</p>	 <p>Proud</p>	 <p>Pointing down</p>
 <p>Little happy</p>	 <p>Very happy</p>	 <p>Pointing</p>
 <p>Sleep</p>	 <p>sad</p>	 <p>Wave 1</p>
 <p>Surprised</p>	 <p>talking</p>	 <p>Wave 2</p>
 <p>Neutral stern - designed by the researcher</p>		 <p>Wave 3</p>

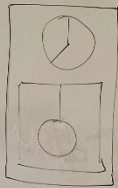
Appendix F - Brainstorm sessions



- schilderij
- smartphone
- kranst
- wandelstok
- salontafel
- eetstafel
- stoel
- boek
- Spiegel
- etui
- TV
- Klok
- servies
- Vaas



10:00



- abstracte AI
- glazen bol



360° projectie
↳ afstandsbediening?
/ knop

hologram

Appendix G - Dialogue specification settings 'goals task'

influence

Table 4: setting goals influence dialogue example

POV	Dialogue	Facial expressions / gestures
Liz	Hallo [naam], wat kan ik voor u betekenen vandaag?	Very happy facial expression, Wave
User	<i>Gewichtsdoel</i>	
Liz	Wat goed van u! Door samen een gewichtsverlies doel op te stellen kan ik u nog beter helpen gezond te blijven. Hoeveel weegt u momenteel?	Proud facial expression Thumbs up
User	<i>Slider optie</i>	
Liz	En welk doel zou u graag willen behalen?	Little happy facial expression, Neutral hands 3
User	<i>Slider optie</i>	
Liz	Oke, hoe lang zou u daarover willen doen?	Get attention facial expression, pointing hands
User	<i>4 multiple choice opties</i>	
Liz	Soms vergeet ik alle dingen die ik op een dag moet doen. Wilt u herinneringen ontvangen?	Interested facial expression Neutral hands 3
User	<i>Ja</i>	
Liz	Oke, Het doel is opgeslagen en u kunt uw voortgang bekijken. Hartelijk bedankt voor het doorgeven!	Very happy facial expression, Wave

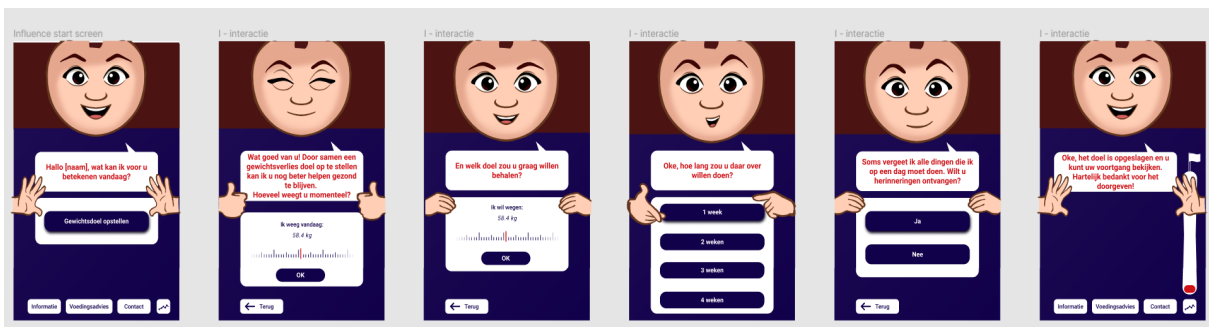


Figure 31: Figma screens influence personality validation 1

steadiness

Table 5: setting goals steadiness dialogue example

POV	Dialogue	Facial expressions / gestures
Liz	Hallo [naam], hoe kan ik u vandaag helpen?	Little happy facial expression, Wave
User	<i>Gewichtsdoel</i>	
Liz	Een gewichtsdoel kan helpen om het afvallen of aankomen concreter te maken. Doelen stellen geeft u een punt om naartoe te werken zodat u ook resultaat ziet. We kunnen samen een gewichtsverlies doel opstellen. Hoeveel weegt u momenteel?	Get attention facial expression Neutral hands 3
User	<i>Slider optie</i>	
Liz	En welk doel wilt u graag behalen? Een gezond BMI van iemand van uw leeftijd, lengte en geslacht zit tussen de 22 en 28	Neutral facial expression Neutral hands 3

User	<i>Slider optie</i>	
Liz	Oke, hoe lang wilt u daarover doen?	Interested facial expression Neutral hands 1
User	<i>Slider optie</i>	
Liz	Herinneringen kunnen helpen om uw doel te bereiken. Wilt u die ontvangen?	Neutral facial expression Neutral hands 3
User	<i>Ja</i>	
Liz	Oke, het doel is opgeslagen en u kunt uw voortgang bekijken Fijne dag [naam] en bedankt voor het invullen!	Proud facial expression Wave

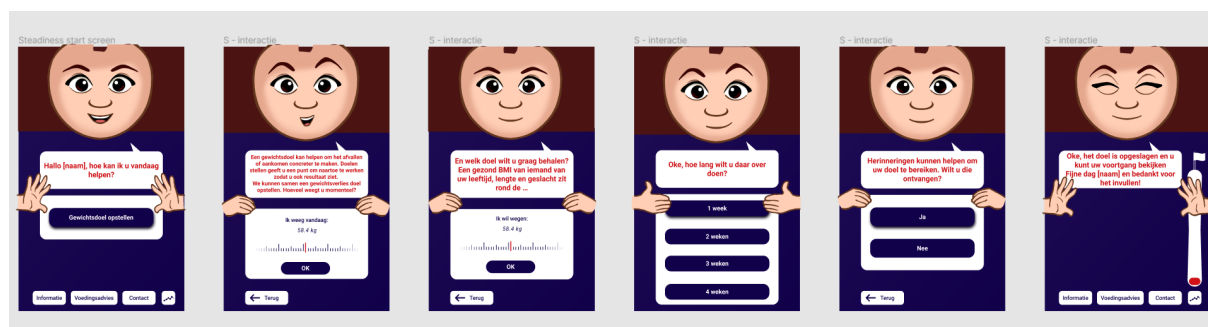


Figure 32: Figma screens Steadiness personality validation 1

Conscientiousness

Table 6: setting goals conscientiousness dialogue example

POV	Dialogue	Facial expressions / gestures
Liz	Hallo, kan ik u vandaag helpen?	Neutral facial expression Neutral hands 1
User	<i>gewichtdoel toevoegen</i>	
Liz	Een gewichtsdoel geeft u een punt om naartoe te werken zodat u ook resultaat ziet. We kunnen samen een gewichtsverlies doel opstellen. Zo kan ik u helpen gezond te blijven. Kunt u doorgeven hoeveel u momenteel weegt?	Neutral stern facial expression Neutral hands 2
User	<i>Kan slider optie invullen</i>	
Liz	En welk doel wilt u behalen? Een gezond BMI van iemand van uw leeftijd, lengte en geslacht zit tussen de 22 en 28.	Neutral facial expression Neutral hands 3
User	<i>Kan slider optie invullen</i>	
Liz	Hoe lang wilt u daarover doen?	Interested facial expression Neutral hands 3
User	<i>Slider optie</i>	
Liz	Om het doel te bereiken, kunnen herinneringen helpen, wilt u die ontvangen?	Neutral stern facial expression, Neutral hands 3
User	<i>Ja</i>	

Liz	Goed, het doel is opgeslagen en u kunt uw voortgang bekijken.	Neutral facial expression Neutral hands 1
-----	---	--

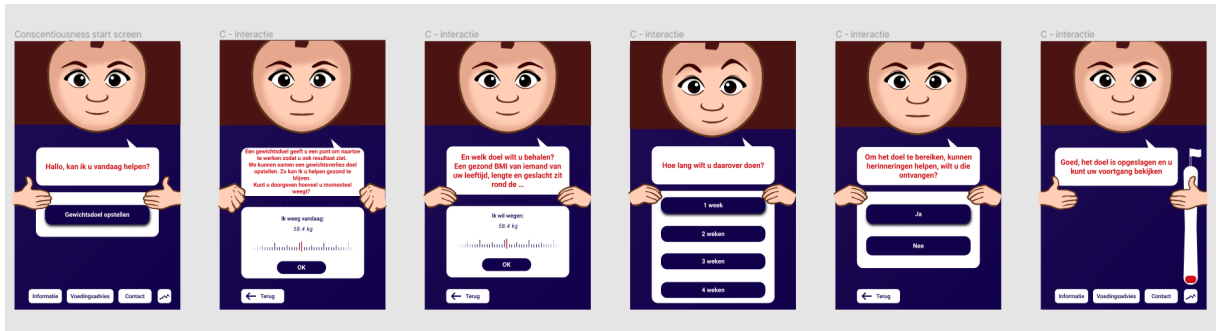


Figure 33: Figma screens Conscientiousness personality validation 1

Appendix H - Validation questionnaire

Hoe beoordeeld u coach type 1? *

	Oneens	beetje oneens	neutraal	beetje eens	eens
assertief	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
autoritair	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Taak-gericht	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
kritisch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
sociaal (extrave...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
vriendelijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
enthousiast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
persoonlijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
gezellig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
optimistisch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
kalm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ondersteunend	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
detail-gericht	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
informatief	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Coach	DISC variables
dominant	assertief autoritair taak gericht kritisch kalm
influence	sociaal extravert vriendelijk enthousiast persoonlijk gezellig optimistisch
steadiness	persoonlijk detail-gericht informatief vriendelijk ondersteunend kalm optimistisch
conscientiousness	detail-gericht informatief ondersteunend assertief/kritisch taak gericht

Appendix I - Validation videos

Links to videos in validation 1

<https://youtu.be/9mBk9Qh29wU> dominance coach

https://youtu.be/lksja_zQQJs influence coach

https://youtu.be/8dBpM8mN_K0 steadiness coach

<https://youtu.be/PfDA3doMUwU> conscientiousness coach

links to videos in validation 2

<https://youtu.be/j5rZVuA7Tgk> dominance coach

https://youtu.be/lksja_zQQJs influence coach

<https://youtu.be/BIFeFZZMvMg> steadiness coach

https://youtu.be/A7-Ha_1Ah6Q conscientiousness coach

Appendix J - Validation raw data iteration 1

dominant

Leeftijd	Geslacht	[assertief]	[autoritair]	[Taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
23	Vrouw	beetje eens	eens	eens	eens	beetje eens	beetje eens	beetje eens	eens	beetje eens	beetje eens	eens	eens	eens	beetje eens
19	Man	neutraal	neutraal	neutraal	beetje oneens	beetje oneens	Oneens	Oneens	neutraal	Oneens	Oneens	beetje eens	beetje oneens	neutraal	beetje oneens
19	Vrouw	beetje eens	eens	eens	beetje eens	beetje oneens	beetje oneens	Oneens	Oneens	Oneens	Oneens	beetje oneens	beetje eens	beetje oneens	beetje eens
23	Vrouw	beetje eens	beetje oneens	eens	beetje eens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	Oneens	beetje oneens	eens	neutraal	eens	Oneens
23	Vrouw	neutraal	neutraal	eens	neutraal	beetje oneens	beetje eens	neutraal	neutraal	neutraal	beetje eens	eens	neutraal	neutraal	beetje eens
23	Vrouw	beetje eens	neutraal	beetje eens	beetje eens	beetje oneens	neutraal	beetje oneens	beetje oneens	Oneens	neutraal	beetje eens	neutraal	neutraal	beetje eens
57	Vrouw	neutraal	beetje eens	eens	neutraal	Oneens	neutraal	neutraal	beetje oneens	Oneens	neutraal	beetje eens	beetje oneens	neutraal	neutraal
23	Vrouw	beetje oneens	beetje eens	eens	beetje oneens	Oneens	neutraal	beetje oneens	neutraal	beetje oneens	neutraal	neutraal	beetje oneens	neutraal	neutraal
55	Vrouw	eens	beetje eens	eens	beetje eens	beetje oneens	Oneens	Oneens	Oneens	Oneens	Oneens	neutraal	beetje oneens	beetje oneens	neutraal
22	Vrouw	neutraal	neutraal	eens	neutraal	beetje oneens	beetje oneens	beetje oneens	beetje oneens	Oneens	beetje oneens	beetje eens	beetje oneens	beetje eens	beetje eens
70	Man	eens	eens	eens	neutraal	beetje oneens	Oneens	beetje oneens	Oneens	Oneens	eens	beetje oneens	beetje eens	eens	neutraal

influence

[assertief]	[autoritair]	[Taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
Oneens	beetje oneens	neutraal	Oneens	eens	eens	eens	eens	eens	eens	neutraal	beetje eens	eens	eens
beetje oneens	beetje oneens	beetje eens	Oneens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje oneens	beetje eens	beetje oneens	beetje eens
neutraal	beetje eens	beetje eens	beetje oneens	beetje eens	eens	eens	eens	beetje eens	eens	beetje eens	beetje eens	neutraal	beetje eens
beetje oneens	Oneens	neutraal	beetje oneens	neutraal	eens	eens	eens	eens	eens	eens	beetje eens	eens	neutraal
neutraal	beetje oneens	neutraal	neutraal	eens	eens	eens	beetje eens	eens	beetje eens	neutraal	beetje eens	neutraal	beetje eens
beetje eens	Oneens	neutraal	beetje oneens	eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens
Oneens	Oneens	eens	Oneens	eens	eens	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	eens	eens	neutraal
beetje eens	beetje oneens	beetje eens	beetje oneens	beetje eens	eens	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	beetje oneens	neutraal
beetje oneens	Oneens	beetje oneens	Oneens	eens	eens	eens	beetje eens	eens	beetje eens	neutraal	beetje eens	beetje eens	neutraal
neutraal	beetje oneens	beetje eens	neutraal	beetje eens	eens	eens	eens	beetje eens	eens	beetje eens	beetje eens	neutraal	beetje eens
neutraal	Oneens	eens	beetje oneens	beetje eens	eens	eens	eens	eens	eens	eens	beetje eens	eens	eens

Steadiness

[assertief]	[autoritair]	[Taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
beetje eens	beetje eens	eens	beetje eens	beetje eens	eens	beetje eens	beetje eens	beetje eens	beetje eens	eens	eens	eens	eens
neutraal	beetje oneens	eens	beetje eens	beetje oneens	beetje eens	beetje oneens	beetje oneens	neutraal	neutraal	neutraal	beetje eens	beetje eens	beetje eens
eens	eens	eens	beetje eens	neutraal	beetje eens	beetje eens	neutraal	beetje oneens	beetje eens	neutraal	eens	eens	eens
beetje oneens	Oneens	beetje eens	beetje oneens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	eens	neutraal	eens	eens	eens
neutraal	beetje oneens	beetje eens	neutraal	eens	eens	eens	eens	beetje eens	neutraal	beetje eens	beetje eens	neutraal	beetje eens
beetje eens	beetje eens	beetje eens	beetje eens	neutraal	neutraal	neutraal	beetje eens	neutraal	neutraal	beetje eens	beetje eens	beetje eens	beetje eens
beetje eens	beetje eens	beetje eens	beetje eens	neutraal	neutraal	neutraal	beetje eens	neutraal	beetje eens	neutraal	beetje eens	neutraal	neutraal
neutraal	eens	eens	beetje oneens	Oneens	neutraal	beetje oneens	Oneens	beetje oneens	neutraal	beetje eens	eens	eens	eens
Oneens	Oneens	neutraal	Oneens	neutraal	beetje eens	neutraal	beetje eens	neutraal	neutraal	neutraal	eens	eens	eens
neutraal	neutraal	eens	neutraal	neutraal	beetje eens	beetje oneens	beetje eens	neutraal	neutraal	beetje eens	beetje eens	neutraal	beetje eens
neutraal	beetje eens	eens	Oneens	neutraal	beetje eens	beetje eens	eens	beetje eens	eens	beetje eens	eens	beetje eens	eens

conscientiousness

[assertief]	[autoritair]	[Taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
beetje eens	beetje eens	beetje eens	beetje eens	beetje oneens	neutraal	beetje oneens	neutraal	beetje oneens	neutraal	neutraal	neutraal	beetje eens	beetje eens
beetje eens	neutraal	beetje eens	beetje eens	beetje oneens	beetje oneens	neutraal	neutraal	beetje oneens	neutraal	beetje eens	neutraal	beetje eens	beetje eens
beetje eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	beetje eens	neutraal	beetje oneens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens
beetje oneens	neutraal	beetje eens	neutraal	Oneens	beetje eens	beetje oneens	beetje oneens	beetje oneens	neutraal	eens	eens	beetje eens	eens
neutraal	neutraal	beetje eens	neutraal	beetje eens	beetje eens	neutraal	neutraal	beetje eens	neutraal	eens	beetje eens	beetje eens	beetje eens
neutraal	neutraal	beetje eens	beetje eens	beetje oneens	neutraal	neutraal	beetje eens	neutraal	neutraal	beetje eens	beetje eens	neutraal	eens
beetje oneens	beetje oneens	eens	neutraal	beetje eens	beetje eens	Oneens	neutraal	Oneens	beetje oneens	beetje eens	beetje eens	neutraal	beetje eens
beetje oneens	neutraal	beetje eens	beetje oneens	beetje oneens	neutraal	neutraal	beetje oneens	beetje oneens	neutraal	beetje eens	beetje eens	neutraal	beetje eens
beetje eens	neutraal	eens	beetje oneens	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	beetje oneens	neutraal	beetje eens	eens	eens
neutraal	neutraal	eens	neutraal	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens
neutraal	beetje eens	eens	beetje oneens	neutraal	beetje eens	neutraal	neutraal	beetje eens	beetje eens	beetje eens	eens	eens	eens

Below, you see the tables used to create the visuals, with the Likert scale values translated into numbers.

coach 1																
respondent	Leeftijd	Geslacht	assertief	autoritair	Taak-gericht	kritisch	social (extravert)	vriendelijk	enthousiast	persoonlijk	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief
1	23	Vrouw	4	5	5	5	4	4	4	5	4	4	5	5	5	4
2	19	Man	3	3	5	4	2	4	2	1	3	1	4	2	3	2
3	19	Vrouw	4	5	5	4	2	2	1	1	1	1	2	4	2	4
4	23	Vrouw	4	2	5	4	2	2	2	2	1	1	2	5	3	5
5	23	Vrouw	3	3	4	4	2	4	3	3	3	4	5	3	3	4
6	23	Vrouw	4	3	4	4	2	3	2	2	1	3	4	3	3	4
7	57	Vrouw	3	4	5	3	1	3	3	3	2	1	3	3	2	3
8	23	Vrouw	2	4	5	4	1	3	2	3	2	3	2	3	2	3
9	55	Vrouw	5	4	5	4	2	1	1	1	1	1	3	2	2	3
10	22	Vrouw	3	3	5	3	2	2	2	2	1	2	4	2	4	4
11	70	Man	5	5	5	3	2	1	2	1	1	5	2	4	5	3
gemiddelde			3,64	3,73	4,73	3,36	2,00	2,36	2,09	2,27	1,55	2,64	3,73	2,91	3,45	3,18

coach 2																
respondent	Leeftijd	Geslacht	assertief	autoritair	Taak-gericht	kritisch	social (extravert)	vriendelijk	enthousiast	persoonlijk	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief
1	23	Vrouw	1	2	3	1	4	5	5	4	4	4	5	3	4	3
2	19	Man	2	2	4	1	4	4	4	4	4	4	2	4	2	4
3	19	Vrouw	3	4	4	2	4	5	5	5	4	5	4	4	3	4
4	23	Vrouw	2	1	3	2	3	5	5	5	5	5	4	5	3	4
5	23	Vrouw	3	2	3	3	5	5	5	5	4	5	4	3	4	4
6	23	Vrouw	4	1	3	2	5	4	4	4	4	4	4	4	4	4
7	57	Vrouw	1	1	5	1	5	5	4	4	4	4	3	5	5	3
8	23	Vrouw	4	2	4	2	4	5	4	3	4	4	3	4	2	3
9	55	Vrouw	2	1	2	1	5	5	5	4	5	4	3	4	4	3
10	22	Vrouw	3	2	4	3	4	5	5	5	4	5	4	4	3	4
11	70	Man	3	1	5	2	4	5	5	5	5	5	5	4	5	5
gemiddelde			2,55	1,73	3,64	1,82	4,36	4,82	4,64	4,36	4,45	4,45	4,45	3,45	4,18	3,55

coach 3																
respondent	Leeftijd	Geslacht	assertief	autoritair	Taak-gericht	kritisch	social (extravert)	vriendelijk	enthousiast	persoonlijk	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief
1	23	Vrouw	4	4	5	4	4	5	4	4	4	4	4	4	5	5
2	19	Man	3	2	5	4	2	4	2	2	3	3	3	3	4	4
3	19	Vrouw	5	5	5	4	3	4	4	4	3	2	4	3	5	5
4	23	Vrouw	2	1	4	2	4	4	4	4	4	4	5	3	5	5
5	23	Vrouw	3	2	4	3	5	4	5	5	5	4	3	4	3	4
6	23	Vrouw	4	4	4	4	3	3	3	4	3	3	4	4	4	4
7	57	Vrouw	4	4	4	4	3	3	3	3	4	3	4	3	4	4
8	23	Vrouw	3	5	5	2	1	3	2	2	1	2	2	3	4	5
9	55	Vrouw	1	1	3	1	3	3	3	4	3	4	3	3	5	3
10	22	Vrouw	3	3	5	3	3	4	2	4	2	3	4	4	3	4
11	70	Man	3	4	5	1	3	4	4	5	4	5	4	5	4	5
gemiddelde			3,18	3,18	4,45	2,91	3,09	3,82	3,27	3,73	3,09	3,64	3,36	4,45	4,18	4,45

coach 4																
respondent	Leeftijd	Geslacht	assertief	autoritair	Taak-gericht	kritisch	social (extravert)	vriendelijk	enthousiast	persoonlijk	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief
1	23	Vrouw	4	4	4	4	4	2	3	2	3	2	3	3	4	4
2	19	Man	4	3	4	4	2	2	3	3	2	3	4	3	4	4
3	19	Vrouw	4	4	4	4	3	4	4	2	2	4	4	4	4	4
4	23	Vrouw	2	3	4	3	1	4	2	2	2	3	5	5	4	5
5	23	Vrouw	3	3	4	3	4	4	3	3	4	3	5	4	4	4
6	23	Vrouw	3	3	4	4	2	3	3	3	4	3	4	4	3	5
7	57	Vrouw	2	2	5	3	4	4	1	3	1	2	2	4	4	3
8	23	Vrouw	2	3	4	2	2	3	3	2	2	3	4	4	3	4
9	55	Vrouw	4	3	5	2	2	3	2	2	2	2	3	4	5	5
10	22	Vrouw	3	3	5	3	2	3	2	2	2	4	4	4	3	4
11	70	Man	3	4	5	2	3	4	3	3	4	4	4	5	5	5
gemiddelde			3,09	3,18	4,36	3,09	2,45	3,36	2,55	2,73	2,36	3,09	4,00	4,00	3,82	4,36

gemiddelde														
coach type	assertief	autoritair	Taak-gericht	kritisch	social (extravert)	vriendelijk	enthousiast	persoonlijk	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief
coach 1	3,64	3,73	4,73	3,36	2,00	2,36	2,09	2,27	1,55	2,64	3,73	2,91	3,45	3,18
coach 2	2,55	1,73	3,64	1,82	4,36	4,82	4,64	4,36	4,45	4,45	4,45	4,45	4,18	3,55
coach 3	3,18	3,18	4,45	2,91	3,09	3,82	3,27	3,73	3,09	3,64	3,36	4,45	4,18	4,45
coach 4	3,09	3,18	4,36	3,09	2,45	3,36	2,55	2,73	2,36	3,09	4,00	4,00	3,82	4,36

gemiddelde gedraaid				
coach type	coach 1	coach 2	coach 3	coach 4
assertief	3,64	2,55	3,18	3,09
autoritair	3,73	1,73	3,18	3,18
Taak-gericht	4,73	3,64	4,45	4,36
kritisch	3,36	1,82	2,91	3,09
social (extra	2,00	4,36	3,09	2,45
vriendelijk	2,36	4,82	3,82	3,36
enthousiast	2,09	4,64	3,27	2,55
persoonlijk	2,27	4,36	3,73	2,73
gezellig	1,55	4,45	3,09	2,36
optimistisch	2,64	4,45	3,64	3,09
kalm	3,73	3,45	3,36	4,00
ondersteunen	2,91	4,18	4,45	4,00
detail-gericht	3,45	3,55	4,18	3,82
informatief	3,18	3,91	4,45	4,36

Appendix k - Validation 2 visuals

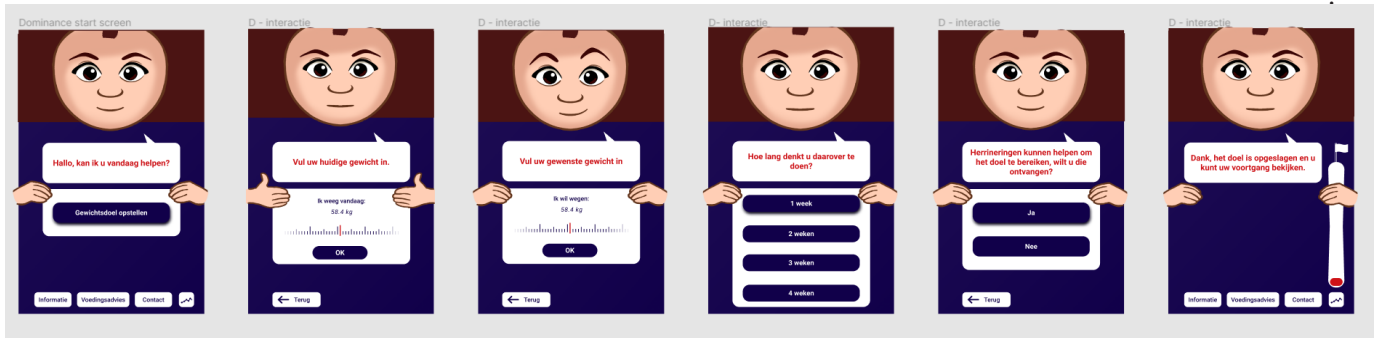


Figure 34: Figma screens Dominance personality validation 2

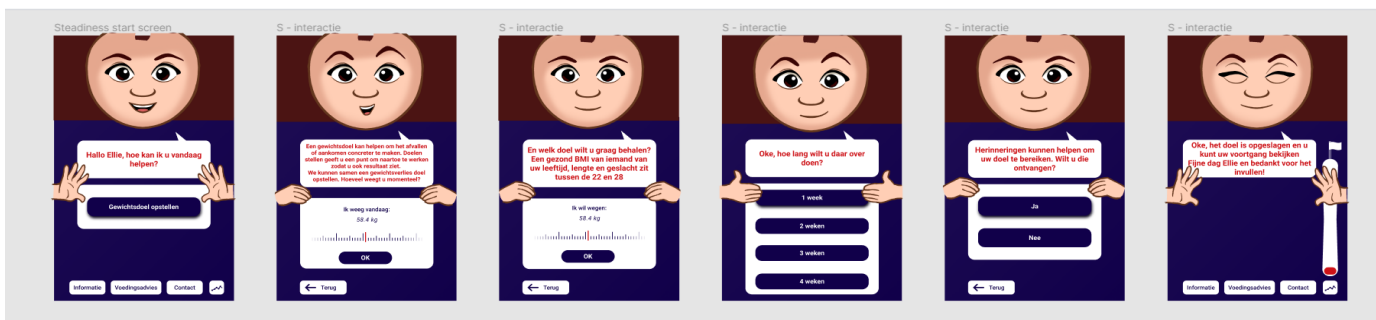


Figure 35: Figma screens Steadiness personality validation 2

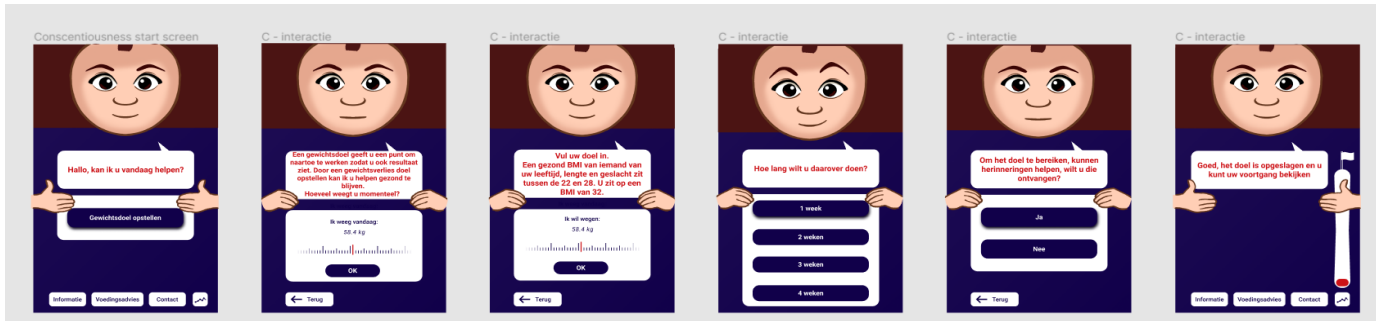


Figure 36: Figma screens Conscientiousness personality validation 2

Appendix L - Validation raw data iteration 2

Dominance

leeftijd	Geslacht	[assertief]	[autoritair]	[Taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
58	Man	neutraal	beetje eens	eens	neutraal	beetje oneens	neutraal	beetje oneens	Oneens	Oneens	neutraal	beetje eens	beetje eens	eens	beetje oneens
29	Vrouw	eens	eens	eens	beetje eens	Oneens	beetje eens	Oneens	Oneens	Oneens	neutraal	eens	Oneens	neutraal	neutraal
23	Vrouw	beetje eens	beetje eens	beetje eens	beetje eens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	Oneens	beetje oneens	neutraal	neutraal	neutraal	beetje eens
58	Vrouw	beetje eens	neutraal	eens	beetje eens	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	neutraal	beetje eens	neutraal	beetje eens	beetje eens
54	Man	neutraal	beetje eens	beetje eens	neutraal	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	neutraal	neutraal	beetje eens
64	Vrouw	beetje eens	eens	beetje eens	neutraal	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	beetje oneens	neutraal	neutraal	beetje eens
5 jaar	Vrouw	neutraal	beetje eens	eens	neutraal	Oneens	beetje oneens	Oneens	beetje oneens	beetje oneens	beetje oneens	eens	neutraal	beetje eens	beetje eens
51	Vrouw	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	Oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens
55	Vrouw	Oneens	beetje oneens	neutraal	neutraal	beetje oneens	beetje oneens	Oneens	Oneens	Oneens	Oneens	beetje eens	Oneens	neutraal	Oneens
57	Vrouw	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	neutraal	beetje oneens	neutraal	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje eens	beetje eens
23	Vrouw	neutraal	beetje eens	beetje eens	neutraal	Oneens	beetje oneens	neutraal	beetje oneens	Oneens	beetje oneens	beetje oneens	beetje oneens	Oneens	beetje eens
26	Vrouw	Eens	eens	eens	neutraal	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	neutraal	Oneens	Oneens	beetje eens
63	Man	eens	beetje eens	beetje eens	beetje eens	Oneens	Oneens	beetje oneens	Oneens	Oneens	beetje oneens	neutraal	neutraal	neutraal	neutraal
57	Vrouw	beetje oneens	eens	beetje eens	beetje oneens	neutraal	eens	beetje eens	beetje oneens	neutraal	neutraal	beetje eens	beetje eens	neutraal	neutraal
72	Vrouw	eens	eens	eens	eens	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	eens	neutraal	eens	eens
71	Man	beetje oneens	neutraal	neutraal	beetje oneens	beetje oneens	Oneens	Oneens	Oneens	Oneens	Oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens
61	Vrouw	neutraal	neutraal	neutraal	beetje oneens	beetje oneens	beetje oneens	Oneens	Oneens	Oneens	Oneens	neutraal	beetje oneens	neutraal	neutraal
56	Vrouw	beetje oneens	beetje eens	beetje eens	beetje eens	beetje oneens	beetje oneens	beetje oneens	Oneens	Oneens	beetje oneens	neutraal	beetje oneens	beetje oneens	neutraal
68	Vrouw	neutraal	neutraal	eens	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	eens	neutraal	eens	eens
52	Vrouw	Oneens	beetje eens	neutraal	neutraal	Oneens	neutraal	Oneens	Oneens	Oneens	Oneens	neutraal	neutraal	eens	neutraal
68	Vrouw	beetje oneens	neutraal	beetje eens	beetje eens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje eens	beetje eens	neutraal	beetje eens
53	Vrouw	neutraal	neutraal	eens	beetje oneens	Oneens	neutraal	Oneens	Oneens	Oneens	Oneens	neutraal	beetje oneens	Oneens	neutraal
68	Man	neutraal	eens	neutraal	neutraal	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	beetje oneens	Oneens	neutraal
68	Man	beetje eens	beetje eens	eens	neutraal	neutraal	neutraal	neutraal	Oneens	beetje oneens	Oneens	beetje eens	beetje oneens	neutraal	beetje eens
53	Man	beetje eens	beetje eens	beetje eens	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	beetje eens	Oneens	neutraal	beetje oneens
57	Man	beetje eens	neutraal	eens	neutraal	beetje eens	beetje eens	beetje oneens	beetje oneens	beetje eens	neutraal	beetje eens	beetje eens	neutraal	beetje eens
24	Man	beetje oneens	beetje eens	beetje eens	neutraal	beetje oneens	neutraal	beetje oneens	Oneens	Oneens	beetje oneens	beetje eens	beetje eens	beetje oneens	beetje eens

Influence

[assertief]	[autoritair]	[Taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
neutraal	beetje oneens	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	neutraal	beetje eens	beetje eens	beetje eens
neutraal	beetje oneens	beetje eens	neutraal	neutraal	eens	beetje eens	beetje eens	eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens
neutraal	beetje oneens	beetje eens	beetje oneens	beetje eens	beetje eens	beetje eens	eens	beetje eens	eens	neutraal	beetje eens	beetje eens	beetje eens
neutraal	Oneens	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	beetje eens	beetje eens
neutraal	neutraal	neutraal	beetje eens	neutraal	neutraal	neutraal	neutraal	beetje oneens	beetje oneens	neutraal	neutraal	neutraal	neutraal
beetje eens	neutraal	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens
neutraal	Oneens	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	neutraal	beetje eens
neutraal	Oneens	beetje oneens	Oneens	beetje eens	beetje eens	eens	beetje eens	eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens
Oneens	beetje oneens	beetje oneens	Oneens	eens	eens	beetje eens	beetje eens	beetje eens	eens	neutraal	beetje eens	beetje eens	neutraal
beetje oneens	Oneens	beetje eens	neutraal	eens	beetje eens	eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	beetje eens	neutraal
Oneens	Oneens	eens	beetje oneens	eens	eens	eens	eens	eens	eens	eens	eens	eens	eens
beetje oneens	beetje oneens	neutraal	beetje oneens	beetje oneens	neutraal	neutraal	neutraal	neutraal	neutraal	beetje oneer	neutraal	neutraal	neutraal
beetje oneens	beetje oneens	neutraal	beetje oneens	neutraal	beetje oneens	neutraal	neutraal	beetje oneens	neutraal	beetje oneer	neutraal	neutraal	neutraal
eens	Oneens	eens	Oneens	eens	eens	eens	eens	eens	eens	eens	eens	eens	eens
neutraal	Oneens	beetje eens	neutraal	eens	eens	beetje eens	beetje eens	eens	eens	eens	beetje eens	beetje eens	beetje eens
beetje oneens	Oneens	beetje eens	Oneens	beetje eens	beetje eens	beetje oneens	neutraal	neutraal	eens	beetje eens	eens	beetje eens	beetje eens
neutraal	Oneens	eens	beetje oneens	eens	eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	eens
neutraal	beetje oneens	beetje eens	neutraal	beetje eens	eens	beetje eens	eens	eens	beetje eens	neutraal	eens	neutraal	beetje eens
neutraal	Oneens	neutraal	Oneens	neutraal	beetje eens	neutraal	eens	beetje eens	beetje oneens	neutraal	beetje eens	neutraal	neutraal
Oneens	Oneens	beetje eens	Oneens	eens	eens	beetje eens	eens	neutraal	beetje eens	eens	eens	neutraal	beetje eens
neutraal	beetje oneens	beetje eens	neutraal	neutraal	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens
beetje oneens	neutraal	beetje eens	beetje oneens	beetje eens	beetje eens	neutraal	neutraal	beetje eens	beetje eens	eens	beetje eens	neutraal	eens
neutraal	neutraal	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	beetje eens	neutraal	beetje eens	beetje eens

Steadiness

[assertief]	[autoritair]	[taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
beetje eens	beetje eens	eens	beetje oneens	neutraal	neutraal	neutraal	beetje oneens	beetje oneens	beetje eens	beetje oneens	beetje eens	beetje eens	beetje eens
neutraal	neutraal	eens	beetje oneens	eens	eens	eens	eens	eens	eens	neutraal	eens	eens	eens
beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	beetje eens	neutraal	beetje eens	neutraal	beetje eens	beetje eens	eens
beetje oneens	beetje oneens	eens	beetje oneens	eens	beetje eens	beetje eens	neutraal	beetje eens	beetje eens	neutraal	neutraal	eens	eens
beetje oneens	Oneens	neutraal	Oneens	neutraal	neutraal	beetje oneens	neutraal	neutraal	neutraal	neutraal	beetje eens	neutraal	neutraal
beetje eens	neutraal	eens	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens	eens	beetje eens	eens
neutraal	Oneens	beetje eens	beetje oneens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	eens	neutraal	eens	eens	eens
neutraal	neutraal	beetje eens	neutraal	beetje eens	beetje eens	neutraal	beetje eens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens	beetje eens
beetje oneens	beetje oneens	neutraal	Oneens	eens	eens	eens	eens	eens	eens	beetje eens	eens	eens	eens
beetje eens	beetje eens	beetje eens	eens	beetje oneens	beetje oneer	beetje oneens	neutraal	beetje oneens	neutraal	neutraal	beetje oneens	neutraal	beetje eens
neutraal	neutraal	neutraal	beetje eens	neutraal	beetje eens	neutraal	neutraal	neutraal	beetje eens	neutraal	neutraal	neutraal	neutraal
Oneens	Oneens	eens	Oneens	Oneens	eens	eens	beetje eens	beetje eens	neutraal	beetje eens	eens	eens	beetje eens
beetje oneens	beetje oneens	neutraal	beetje oneens	neutraal	beetje eens	neutraal	beetje eens	neutraal	neutraal	neutraal	eens	eens	eens
neutraal	neutraal	eens	Oneens	eens	eens	eens	eens	neutraal	beetje oneens	eens	neutraal	eens	eens
Oneens	neutraal	eens	neutraal	eens	eens	eens	eens	eens	eens	eens	eens	eens	eens
beetje oneens	beetje oneens	neutraal	neutraal	beetje oneens	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	beetje oneens	neutraal
neutraal	beetje oneens	neutraal	beetje oneens	neutraal	beetje oneer	neutraal	beetje oneens	beetje oneens	beetje oneens	Oneens	neutraal	neutraal	beetje eens
beetje oneens	neutraal	eens	beetje oneens	eens	eens	eens	beetje eens	beetje eens	eens	eens	eens	eens	eens
beetje eens	neutraal	beetje eens	neutraal	beetje eens	beetje eens	neutraal	eens	beetje eens	beetje eens	neutraal	eens	neutraal	beetje eens
beetje eens	beetje eens	eens	beetje eens	neutraal	neutraal	neutraal	beetje eens	Oneens	beetje eens	eens	beetje eens	eens	beetje eens
beetje eens	eens	beetje eens	eens	beetje oneens	neutraal	beetje oneens	neutraal	beetje oneens	neutraal	neutraal	neutraal	beetje eens	beetje eens
Oneens	Oneens	eens	beetje oneens	eens	eens	eens	eens	eens	eens	neutraal	neutraal	eens	eens
beetje oneens	Oneens	eens	neutraal	beetje eens	eens	beetje eens	eens	neutraal	neutraal	neutraal	beetje eens	beetje eens	beetje eens
beetje oneens	Oneens	eens	beetje eens	eens	eens	eens	eens	eens	beetje eens	beetje eens	eens	eens	eens
neutraal	beetje oneens	eens	beetje eens	beetje eens	eens	eens	beetje eens	neutraal	beetje eens	neutraal	eens	eens	eens
beetje eens	neutraal	beetje eens	beetje eens	eens	eens	eens	eens	eens	beetje eens	eens	beetje eens	eens	beetje eens
neutraal	neutraal	beetje eens	neutraal	beetje eens	neutraal	beetje eens	neutraal	neutraal	beetje eens	beetje eens	beetje eens	neutraal	neutraal

Conscientiousness

[assertief]	[autoritair]	[Taak-gericht]	[kritisch]	[sociaal (extravert)]	[vriendelijk]	[enthousiast]	[persoonlijk]	[gezellig]	[optimistisch]	[kalm]	[ondersteunend]	[detail-gericht]	[informatief]
beetje eens	neutraal	beetje eens	neutraal	beetje oneens	beetje eens	beetje oneens	beetje oneens	beetje oneens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens
beetje eens	eens	beetje eens	beetje eens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	neutraal	beetje eens	beetje oneens	beetje eens	beetje eens
neutraal	neutraal	beetje eens	neutraal	neutraal	neutraal	neutraal	beetje oneens	beetje oneens	neutraal	neutraal	neutraal	neutraal	beetje eens
neutraal	beetje oneens	beetje eens	neutraal	neutraal	neutraal	neutraal	beetje eens	beetje oneens	neutraal	neutraal	beetje eens	beetje eens	neutraal
beetje eens	beetje eens	beetje eens	neutraal	Oneens	Oneens	Oneens	Oneens	Oneens	beetje oneens	Oneens	beetje eens	beetje eens	eens
neutraal	neutraal	beetje eens	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	neutraal	beetje eens	beetje eens	beetje eens
neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	beetje oneens	neutraal	neutraal	neutraal	neutraal	beetje eens	beetje eens
eens	beetje eens	eens	neutraal	neutraal	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneer	beetje eens	beetje eens	beetje eens
neutraal	neutraal	neutraal	beetje oneens	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	neutraal	beetje eens	neutraal	neutraal	beetje eens
neutraal	neutraal	beetje eens	beetje eens	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	neutraal	beetje eens	beetje eens	beetje eens
beetje eens	Oneens	eens	beetje eens	beetje oneens	beetje oneens	Oneens	beetje oneens	Oneens	Oneens	eens	beetje eens	beetje eens	beetje eens
neutraal	neutraal	neutraal	neutraal	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje eens	eens	eens	eens
neutraal	beetje eens	beetje eens	neutraal	neutraal	beetje oneens	neutraal	neutraal	Oneens	neutraal	eens	eens	eens	eens
beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	Oneens	beetje oneens	beetje oneens	Oneens	beetje oneens	Oneens	Oneens	beetje oneens	Oneens
neutraal	neutraal	neutraal	beetje oneens	beetje oneens	neutraal	beetje oneens	beetje oneens	beetje oneens	neutraal	neutraal	beetje oneens	neutraal	neutraal
neutraal	Oneens	beetje eens	eens	eens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje oneens	beetje eens	beetje oneens	beetje eens	neutraal
eens	eens	eens	neutraal	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	eens	eens
beetje eens	neutraal	eens	neutraal	neutraal	beetje oneens	beetje oneens	beetje oneens	Oneens	neutraal	beetje eens	beetje eens	beetje eens	beetje eens
neutraal	neutraal	beetje eens	beetje eens	beetje oneens	neutraal	neutraal	neutraal	beetje oneens	neutraal	beetje eens	beetje eens	beetje eens	eens
neutraal	neutraal	eens	neutraal	beetje eens	neutraal	beetje eens	neutraal	neutraal	beetje eens	beetje eens	beetje eens	neutraal	eens
beetje eens	neutraal	neutraal	beetje eens	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	Oneens	beetje oneens	beetje eens	beetje eens
neutraal	beetje eens	beetje eens	beetje eens	beetje eens	neutraal	Oneens	beetje oneens	beetje eens	beetje oneens	neutraal	beetje oneens	beetje eens	beetje eens
beetje oneens	neutraal	eens	beetje eens	neutraal	neutraal	beetje oneens	neutraal	beetje oneens	beetje eens	neutraal	eens	eens	neutraal
beetje eens	beetje eens	beetje eens	beetje eens	Oneens	Oneens	Oneens	beetje oneens	neutraal	Oneens	Oneens	beetje eens	beetje eens	eens

Below the tables are translated into numerical values, which are used to create the visuals.

Totaal gemiddelde alle coaches

coach	assertief	autoritair	Taak-gericht	kritisch	kalm	sociaal (extravert)	vriendelijk	enthousiast	persoonlijk	gezellig	optimistisch	ondersteunend	detail-gericht	informatief
coach 1	3,19	3,85	4,11	3,07	3,41	1,93	2,44	1,89	1,59	1,67	1,96	2,56	2,96	3,37
coach 2	2,67	1,74	3,81	2,33	3,70	3,93	4,19	3,81	4,04	3,85	4,00	4,00	3,70	3,93
coach 3	2,78	2,52	4,26	2,78	3,48	3,74	4,00	3,81	3,93	3,44	3,85	4,11	4,15	4,33
coach 4	3,33	3,00	3,96	3,22	3,15	2,52	2,48	2,07	2,22	2,00	2,44	3,37	3,89	4,04

gemiddelde gedraaid

coach	coach 1	coach 2	coach 3	coach 4
assertief	3,19	2,67	2,78	3,33
autoritair	3,85	1,74	2,62	3,00
Taak-gericht	4,11	3,81	4,26	3,96
kritisch	3,07	2,33	2,78	3,22
kalm	3,41	3,70	3,48	3,15
sociaal (extravert)	1,93	3,93	3,74	2,52
vriendelijk	2,44	4,19	4,00	2,48
enthousiast	1,89	3,81	3,81	2,07
persoonlijk	1,59	4,04	3,93	2,22
gezellig	1,67	3,85	3,44	2,00
optimistisch	1,96	4,00	3,85	2,44
ondersteunend	2,56	4,00	4,11	3,37
detail-gericht	2,96	3,70	4,15	3,89
informatief	3,37	3,93	4,33	4,04

Coach 1 Dominant

respondent	Leeftijd	Geslacht	assertief	autoritair	Taak-gericht	kritisch	kalm	sociaal (extravriendelijk)	enthousiast	persoonlijk	gezellig	optimistisch	ondersteunend	detail-gericht	informatief	
1	58 Man		3	4	5	3	4	2	3	2	1	1	3	1	3	2
2	29 Vrouw		5	5	5	4	5	1	4	1	1	1	3	1	3	3
3	23 Vrouw		4	4	4	4	3	2	2	2	2	2	1	2	3	4
5	58 Vrouw		4	3	5	4	4	2	3	2	2	2	3	3	4	4
6	54 Man		3	4	4	3	4	3	4	4	4	4	3	3	3	4
7	64 Vrouw		4	5	4	3	2	1	1	1	1	1	1	3	3	4
8	55 Vrouw		3	4	5	3	5	1	2	1	2	2	2	3	4	4
9	51 Vrouw		2	3	2	2	2	2	2	2	2	2	2	2	2	2
10	55 Vrouw		1	2	3	3	4	2	2	2	1	1	1	1	3	4
11	57 Vrouw		4	4	4	4	2	3	3	2	3	2	2	2	4	4
12	23 Vrouw		3	4	4	3	2	1	2	3	2	1	2	2	1	4
14	26 Vrouw		5	5	5	5	3	1	1	1	1	1	1	1	1	4
15	63 Man		5	4	4	4	3	1	1	2	4	1	2	3	3	3
16	57 Vrouw		2	5	4	2	4	3	5	4	2	3	3	4	3	3
18	72 Vrouw		5	5	5	5	5	3	3	3	3	3	3	3	5	5
19	71 Man		2	3	3	2	2	2	1	1	1	1	2	2	2	2
20	61 Vrouw		3	3	3	2	3	2	2	1	1	1	1	2	3	3
21	56 Vrouw		2	4	4	4	3	2	2	2	1	1	2	2	2	3
22	68 Vrouw		3	5	3	3	5	3	3	3	3	3	3	3	5	5
23	52 Vrouw		1	4	3	3	3	1	3	1	1	1	1	3	5	3
24	66 Vrouw		2	3	4	4	4	2	2	2	2	2	2	4	3	4
25	53 Vrouw		3	5	2	3	3	1	3	1	1	1	1	2	1	3
26	68 Man		3	5	3	3	1	1	1	1	1	1	1	2	1	3
27	68 Man		4	4	5	3	4	3	3	3	3	1	2	1	2	4
28	53 Man		4	4	4	1	4	1	1	1	1	1	1	1	3	2
29	57 Man		4	3	5	3	4	4	2	2	2	4	3	4	3	4
30	24 Man		2	4	4	3	4	2	3	2	2	1	1	2	4	4
gemiddelde			3,19	3,85		3,07	3,41	1,93	2,44	1,89	1,59	1,67	1,96	2,56	2,96	3,37

Coach 2 influence

respondent	Leeftijd	Geslacht	assertief	autoritair	Taak-gericht	kritisch	sociaal (extravriendelijk)	enthousiast	persoonlijk	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief	
1	58 Man		3	2	4	3	4	4	4	4	4	3	3	4	4	4
2	29 Vrouw		3	2	4	2	3	5	4	4	4	5	4	4	4	4
3	23 Vrouw		3	2	4	2	4	4	4	4	4	5	3	4	4	4
5	58 Vrouw		3	1	4	3	4	4	4	4	4	4	3	4	4	4
6	54 Man		3	3	3	3	4	3	3	3	2	3	3	3	3	4
7	64 Vrouw		4	3	4	3	4	4	4	4	4	4	4	4	4	4
8	55 Vrouw		3	1	4	3	2	5	2	4	4	4	4	2	4	4
9	51 Vrouw		3	3	4	4	4	4	4	4	4	4	4	4	4	4
10	55 Vrouw		4	1	4	1	4	4	4	4	4	3	5	4	5	4
11	57 Vrouw		3	2	4	3	4	4	4	4	4	4	4	5	3	4
12	23 Vrouw		3	2	4	3	4	4	4	4	4	4	4	3	4	4
14	26 Vrouw		1	1	2	1	4	4	5	4	4	5	4	4	3	4
15	63 Man		1	2	2	1	5	5	4	4	4	5	3	4	4	3
16	57 Vrouw		2	1	4	3	5	4	5	4	4	4	4	3	4	4
18	72 Vrouw		1	1	5	2	5	5	5	5	5	5	5	5	5	5
19	71 Man		2	2	3	2	2	3	3	3	3	3	2	3	3	3
20	61 Vrouw		3	2	3	2	3	2	2	2	2	3	3	2	3	3
21	56 Vrouw		5	1	5	1	5	5	5	5	5	5	5	5	5	5
22	68 Vrouw		3	1	4	3	5	5	4	4	5	5	5	4	4	4
23	52 Vrouw		2	1	4	1	4	4	2	3	4	2	3	4	4	4
24	68 Vrouw		3	1	5	2	5	5	4	4	4	4	4	4	4	5
25	53 Vrouw		3	2	4	3	4	5	4	5	5	4	3	5	3	4
26	68 Man		3	1	3	3	4	3	3	3	3	4	3	4	3	3
27	68 Man		1	1	4	1	5	5	4	5	3	4	5	5	3	4
28	53 Man		3	2	4	3	3	4	4	4	4	3	4	4	4	4
29	57 Man		2	3	4	4	4	5	3	4	4	4	5	4	4	4
30	24 Man		3	3	4	3	4	4	4	4	3	4	4	3	4	4
gemiddelde			2,67	1,74	3,81	2,33	3,93	4,19	3,81	4,04	3,85	4,00	3,70	4,00	3,70	3,93

coach 3 steadiness

respondent	Leeftijd	Geslacht	assertief	autoritair	Taak-gericht	kritisch	sociaal (extravriendelijk)	enthousiast	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief	persoonlijk 2	vriendelijk 2
1	58 Man		3	3	5	2	3	3	2	2	3	5	5	5	5	5
2	29 Vrouw		4	3	4	4	4	4	3	3	4	4	4	5	4	4
3	23 Vrouw		4	3	4	4	4	4	4	4	3	3	4	4	5	4
5	58 Vrouw		2	2	5	2	5	4	4	4	4	3	5	3	3	4
6	54 Man		2	1	3	1	3	2	2	3	3	4	3	3	3	3
7	64 Vrouw		4	3	5	4	4	3	4	4	4	4	5	4	4	4
8	55 Vrouw		3	1	4	3	4	3	4	4	4	4	5	5	4	4
9	51 Vrouw		3	3	4	3	4	3	3	3	4	4	4	4	4	4
10	55 Vrouw		2	2	3	1	5	5	5	5	5	4	5	5	5	5
11	57 Vrouw		4	4	4	5	3	2	2	2	3	3	4	3	3	2
12	23 Vrouw		3	3	3	3	4	3	3	3	4	3	3	3	3	4
14	26 Vrouw		1	1	5	1	1	5	4	3	4	5	5	4	4	5
15	63 Man		3	4	3	3	4	3	3	3	3	3	4	4	5	4
16	57 Vrouw		3	3	5	1	5	5	3	2	5	3	5	5	5	4
18	72 Vrouw		1	3	5	3	5	5	5	5	5	5	5	5	5	5
19	71 Man		2	2	3	3	2	3	3	3	3	3	3	3	3	3
20	61 Vrouw		3	2	3	2	3	3	2	2	1	3	3	4	2	2
21	56 Vrouw		2	3	5	2	5	5	4	5	5	5	5	5	4	5
22	68 Vrouw		4	3	4	3	4	3	4	4	4	3	4	4	4	4
23	52 Vrouw		4	4	5	4	3	3	1	4	5	4	5	4	4	3
24	68 Vrouw		4	5	4	5	2	2	2	3	3	3	4	4	3	3
25	53 Vrouw		1	1	5	2	5	5	5	5	3	5	4	5	5	5
26	68 Man		2	1	5	3	4	4	3	3	3	4	4	4	5	5
27	68 Man		2	1	5	4	5	5	5	4	4	4	5	5	5	5
28	53 Man		3	2	5	4	4	5	3	4	4	4	5	4	4	4
29	57 Man		4	3	4	4	4	5	5	5	5	4	5	4	4	5
30	24 Man		3	3	4	3	4	4	4	3	4	4	4	3	3	3
gemiddelde			2,78	2,52	4,26	2,78	3,74	3,81	3,44	3,85	3,48	4,11	4,15	4,33	3,93	4,00

coach 4 conscientious

respondent	Leeftijd	Geslacht	assertief	autoritair	kritisch	sociaal (extravriendelijk)	enthousiast	persoonlijk	gezellig	optimistisch	kalm	ondersteunend	detail-gericht	informatief	assertief 2	Taak-gericht 2
1	58 Man		3	3	5	2	3	3	2	2	3	4	4	4	4	4
2	29 Vrouw		5	4	2	2	2	2	2	3	4	2	4	4	4	4
3	23 Vrouw		5	3	3	4	3	2	2	3	3	3	4	3	3	4
5	58 Vrouw		2	3	3	4	3	5	2	2	3	5	4	3	4	4
6	54 Man		2	4	3	3	3	4	2	3	3	4	4	3	3	3
7	64 Vrouw		4	3	1	1	1	1	1	2	3	3	4	4	4	4
8	55 Vrouw		3	2	3	2	2	2	2	2	3	3	4	4	3	4
9	51 Vrouw		3	3	3	3	3	2	3	3	3	3	4	4	3	3
10	55 Vrouw		4	3	3	2	3	2	2	3	3	3	4	4	5	5
11	57 Vrouw		3	2	2	3	2	2	2	3	4	3	3	3	3	3
12	23 Vrouw		3	4	3	3	3	3	3	3	3	3	4	4	3	4
14	26 Vrouw		1	4	2	2	1	2	1	2	1	5	4	4	4	5
15	63 Man		3	3	2	3	2	2	2	2	4	5	5	5	4	3
16	57 Vrouw		1	2	3	5	3	3	1	3	5	5	5	5	2	5
18	72 Vrouw		4	3	3	2	3	1	2	4	4	4	4	4	3	4
19	71 Man		2	2	2	1	2	1	1	2	1	2	1	2	1	2
20	61 Vrouw		3	2	2	3	2	2	2	2	3	2	3	3	3	3
21	56 Vrouw		1	5	5	2	2	1	2	2	2	4	4	4	3	4
22	68 Vrouw		5	3	1	1	1	1	1	1	1	1	1	5	5	5
23	52 Vrouw		3	3	3	2	2	2	1	3	4	4	4	4	4	5
24</																

Appendix M - Dialogue specification feedback & reminder tasks

Feedback sentences

Table 8: feedback standard sentences

Personality	Standard sentence	Adaptation to personality
Dominance	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten.
	U heeft uw streefgewicht gehaald	Uw streefgewicht is behaald
	Uw gewicht neemt af, eet u wat meer koolhydraten?	Uw gewicht neemt af, eet meer koolhydraten
	U heeft een bericht van uw diëtist, zal ik het voorlezen?	U heeft een bericht van uw diëtist. Zal ik het voorlezen?
	Zal ik het advies van de diëtist uitleggen? Over welk onderwerp wilt u meer weten?	Ik kan het advies uitleggen. Kies een onderwerp voor meer informatie.
Influence	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Ga zo door [naam]!
	U heeft uw streefgewicht gehaald	Wat bent u goed bezig [naam]! Uw streefgewicht is behaald.
	Uw gewicht neemt af, eet u wat meer koolhydraten?	Uw gewicht neemt wat af. Ik kan je helpen dit op orde te houden. Zullen we samen proberen wat meer koolhydraten te eten?
	U heeft een bericht van uw diëtist, zal ik het voorlezen?	U heeft een bericht van uw diëtist. Ik lees het u met plezier voor, zou u dat willen?
	Zal ik het advies van de diëtist uitleggen? Over welk onderwerp wilt u meer weten?	Zal ik u het advies van de diëtist uitleggen? Over welk onderwerp zou u graag wat meer willen weten?
Steadiness	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Wat fijn, [naam]! Dit helpt u in het behalen van uw streefgewicht.
	U heeft uw streefgewicht gehaald	Goedzo [naam]! U heeft uw streefgewicht gehaald.
	Uw gewicht neemt af, eet u wat meer koolhydraten?	Uw gewicht neemt af. Wilt u wat meer koolhydraten eten? Koolhydraten zijn een belangrijke bron van energie en zorgen ervoor dat je gezond blijft. Je vindt ze in producten met zetmeel, vezels en suiker.
	U heeft een bericht van uw diëtist, zal ik het voorlezen?	U heeft een bericht van uw diëtist. Wilt u dat ik het bericht voorlees?
	Zal ik het advies van de diëtist uitleggen? Over welk onderwerp wilt u meer weten?	Wilt u dat ik het advies van de diëtist uitleg, [naam]? Over welk onderwerp wilt u meer weten?

Conscientiousness	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten	U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Dit helpt u in het behalen van uw streefgewicht.
	U heeft uw streefgewicht gehaald	U heeft uw streefgewicht gehaald. Goedzo.
	Uw gewicht neemt af, eet u wat meer koolhydraten?	In deze grafiek kunt u zien dat uw gewicht afneemt. Dat is niet zo best. Eet wat meer koolhydraten, dit is een belangrijke energiebron. Koolhydraten zijn vooral te vinden in producten met zetmeel, vezels en suiker.
	U heeft een bericht van uw diëtist, zal ik het voorlezen?	U heeft een bericht van uw diëtist. Zal ik het voorlezen?
	Zal ik het advies van de diëtist uitleggen? Over welk onderwerp wilt u meer weten?	Ik kan het advies van uw diëtist uitleggen. Kies een onderwerp voor meer informatie.

Dialogue specification reminder

Table 9: reminder standard sentences

Personality	Standard sentence	Adaptation to personality
Dominance	Het is tijd om te ontbijten / lunchen / dineren. U kunt bijv kiezen uit.	Het is tijd voor ontbijt. Eet een boterham.
	Bedankt voor het doorgeven	Dank voor het doorgeven.
	Ik vraag het later nog eens	Ik probeer het later nog een keer
	Zal ik u meer vertellen over	Zal ik u meer vertellen over eiwitten?
	U heeft nog geen maaltijd doorgegeven vandaag	U moet nog een maaltijd doorgeven vandaag.
Influence	Het is tijd om te ontbijten / lunchen / dineren. U kunt bijv kiezen uit..	Goedemorgen [naam], het is tijd om te ontbijten. U kunt bijvoorbeeld kiezen voor een boterham
	Bedankt voor het doorgeven	Hartelijk bedankt voor het doorgeven [naam]
	Ik vraag het later nog eens	Zou u willen dat ik het later nog eens vraag?
	Zal ik u meer vertellen over	Zou u wat meer willen weten over eiwitten?
	U heeft nog geen maaltijd doorgegeven vandaag	U heeft nog geen maaltijd doorgegeven, [naam]. Zullen we dat samen even doen?
Steadiness	Het is tijd om te ontbijten / lunchen / dineren. U kunt bijv kiezen uit..	Goedemorgen [naam], het is 8 uur, uw gebruikelijke tijd voor ontbijt. Meestal eet u een boterham met kaas.
	Bedankt voor het doorgeven	Bedankt voor het doorgeven [naam]!
	Ik vraag het later nog eens	Wilt u dat ik het later nog eens vraag? Door vaker een herinnering te krijgen zult u het minder snel vergeten.
	Zal ik u meer vertellen over	Wilt u dat ik u meer vertel over eiwitten?
	U heeft nog geen maaltijd doorgegeven vandaag	U heeft nog geen maaltijd doorgegeven, [naam]. Wilt u dat samen even doen? Zo krijg ik een beter beeld van hoe het met u gaat.

Conscientiousness	Het is tijd om te ontbijten / lunchen / dineren. U kunt bijv kiezen uit..	Het is 8 uur, tijd voor ontbijt. Eet u een boterham?
	Bedankt voor het doorgeven	Dank u wel voor het doorgeven.
	Ik vraag het later nog eens	Ik kan het u later nog eens vragen. Hierdoor vergeet u het niet.
	Zal ik u meer vertellen over	Ik kan u meer vertellen over eiwitten, wilt u dat?
	U heeft nog geen maaltijd doorgegeven vandaag	U heeft nog geen maaltijd doorgegeven vandaag. Door dit wel te doen krijg ik een beter beeld van uw gezondheid.

Appendix N - Final Design visuals

Feedback task - influence, steadiness & conscientiousness respectively

Influence start screen

U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Ga zo door Ellie!

I - interactie

Wat bent u goed bezig Ellie! Uw streefgewicht is behaald.

I - interactie

Uw gewicht neemt wat af. Ik kan je helpen dit op orde te houden. Zullen we samen proberen wat meer koolhydraten te eten?

I - interactie

U heeft een bericht van uw diëtist. Ik lees het u met plezier voor, zou u dat willen?

Ja, graag
Nee, dank u
Misschien later

I - interactie

Zal ik u het advies van de diëtist uitleggen? Over welk onderwerp zou u graag wat meer willen weten?

Minder zout
Voldoende water
Bewegen
Dagmenu

← Terug

Steadiness start screen

U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Wat fijn, Ellie! Dit helpt u in het behalen van uw streefgewicht.

Aantal etensmomenten deze week

Maandag	Dinsdag	Woensdag	Donnerdag	Vrijdag	Zaterdag	Zondag
3	3	3	3	3	3	3

S - interactie

Goedzo Ellie! U heeft uw streefgewicht gehaald.

S - interactie

Uw gewicht neemt af. Wilt u wat meer koolhydraten eten? Koolhydraten zijn een belangrijke bron van energie en zorgen ervoor dat je gezond blijft. Je vindt ze in producten met zetmeel, vezels en suiker.

Gewicht

1	2	3	4	5	6	7	8	9	10
100	100	100	100	100	100	100	100	100	100

S - interactie

U heeft een bericht van uw diëtist. Wilt u dat ik het bericht voorlees?

Ja, graag
Nee, dank u
Misschien later

S - interactie

Wilt u dat ik het advies van de diëtist uitleg. Over welk onderwerp wilt u meer weten?

Minder zout
Voldoende water
Bewegen
Dagmenu

← Terug

Conscientiousness start screen

U heeft de afgelopen week iedere dag 3 volle maaltijden gegeten. Dit helpt u in het behalen van uw streefgewicht.

Aantal etensmomenten deze week

Maandag	Dinsdag	Woensdag	Donnerdag	Vrijdag	Zaterdag	Zondag
3	3	3	3	3	3	3

C - interactie

U heeft uw streefgewicht gehaald. Goedzo.

C - interactie

In deze grafiek kunt u zien dat uw gewicht afneemt. Dat is niet zo best. Eet wat meer koolhydraten, dit is een belangrijke energiebron. Koolhydraten zijn vooral te vinden in producten met zetmeel, vezels en suiker.

Gewicht

1	2	3	4	5	6	7	8	9	10
100	100	100	100	100	100	100	100	100	100

C - interactie

U heeft een bericht van uw diëtist. Zal ik het voorlezen?

Ja, graag
Nee, dank u
Misschien later

C - interactie

Ik kan het advies van uw diëtist uitleggen. Kies een onderwerp voor meer informatie.

Minder zout
Voldoende water
Bewegen
Dagmenu

← Terug

Reminder tasks - influence, steadiness & conscientiousness respectively

Influence start screen

Goedemorgen Ellie, het is tijd om te ontbijten. U kunt bijvoorbeeld kiezen voor een boterham

Boterham met hutterkäse
Havermout

Is het al ontbijten? OK

I - interactie

Hartelijk bedankt voor het doorgeven Ellie.

I - interactie

Zou u willen dat ik het later nog eens vraag?

Ja, graag
Nee, dank u

I - interactie

Zou u wat meer willen weten over eelwitzen?

Ja, graag
Nee, dank u
Misschien later

I - interactie

U heeft nog geen maaltijd doorgegeven, Ellie. Zullen we dat samen even doen?

Maaltijd doorgeven
Misschien later

← Terug



Appendix O - Consent form

Informed Consent – digital coach

I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described in the aforementioned information brochure 'User Research Personality Types'. My questions have been answered to my satisfaction. I agree of my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the experiment at any time. If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my express permission. If I request further information about the research, now or in the future, I may contact Famke van Meurs (f.f.m.vanmeurs@student.utwente.nl)

I consent to the voice-recording of the interview (answer with yes or no)
I consent to the taking of pictures (answer with yes or no)

If you have any complaints about this research, please direct them to the Secretary of the Natural Sciences and Engineering Sciences Ethics Committee at the University of Twente, P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 2547; email: m.c.kamp@utwente.nl). Signed in duplicate:

.....
Name subject

.....
Signature

I have provided explanatory notes about the research. I declare myself willing to answer to the best of my ability any questions which may still arise about the research.'

Famke van Meurs

.....
Name researcher

.....
Signature

Enschede, date 03-05-2021

Information brochure User Research Personality Types

Dear reader,

In this letter, we would like to inform you about the research you have applied to participate in. The experiment will take place on dd-05-2021, at the participants' home. In the proposed research, entitled "Designing the interaction of a digital coach for elderly", behaviour is observed, four different digital coach versions are shown on a screen in a table-held prototype.

The research focuses on a digital coach that helps elderly at home with advice and guidance in behaviour change regarding nutrition. This research looks into the question of how we can design the coach for different types of users. The aim of the research is to establish whether a personalized coaching solution is more accepted by its users than a standard coach version. This research consists of four versions of a digital social coach that you can judge based on your preference. This will be measured with a questionnaire. We ask you to imagine yourself as needing such a device. After the questionnaire we might ask you some interview questions about your opinion, to find out what triggered your response.

Before participating in this experiment, we ask your opinion on technological innovations and applications such as digital coaches. If you are extremely against the use of any such devices, you may be excluded from this research to ensure we reach only our target audience.

The information that is gained with this research will be used in the development of the prototype, determining whether we are on the right track with our design. The research will be conducted by Famke van Meurs, student under supervision of Martijn Vastenburg of ConnectedCare Services b.v. and Jelle van Dijk professor at the University of Twente. The research will not have any negative side effects or other risks.

You can decide to stop at any point in the course of the experiment without this having any consequences for yourself and without giving any reasons. Any payments 'earned' up until this point will be paid out (in proportion to the duration of participation). In addition, you can still decide at the end of the research and up to 24 hours thereafter, that your data may not be included in the research after all. Other relevant aspects are that your data will be handled in a confidential manner, the anonymity of your data is guaranteed, and will never be disclosed to third parties without your permission. All data will be available to ConnectedCare for the remainder of the project and deleted afterwards.

The experiment lasts for a maximum of 1 hour.

Covid 19- considerations:

The prototype will be cleaned between each session. The testing takes place in participants' homes, so you will not come into contact with other participants.

The researcher will get tested beforehand. The researcher will be keeping 1.5 m distance from the participant while wearing a mask during the duration of the research.

Yours sincerely,

Coordinator: Dr. J. van Dijk, Horst building, Faculty of ET, University of Twente

Tel: +31 (0)53 489 4596 email: jelle.vandijk@utwente.nl

Research leader/Research assistant: Famke van Meurs Tel: 0627310090






email: f.f.m.vanmeurs@student.utwente.nl

Appendix Q - Almere Questionnaire

Table 10: Overview of constructs - Almere model

Code	Construct	Definition
ANX	Anxiety	Evoking anxious or emotional reactions when it comes to using the system
ATT	Attitude towards technology	Positive or negative feelings about the appliance of the technology
FC	Facilitating conditions	Factors in the environment that facilitate use of the system
ITU	Intention to use	The intention to use the system over a longer period in time
PAD	Perceived adaptiveness	The perceived ability of the system to adapt to the needs of the user
PENJ	Perceived enjoyment	Feelings of joy/pleasure associated with the use of the system
PEOU	Perceived ease of use	The degree to which one believes that using the system would be free of effort
PS	Perceived sociability	The perceived ability of the system to perform sociable behaviour
PU	Perceived usefulness	The degree to which a person believes that the system would be assistive
SI	Social influence	The persons' perception that people who are important to him think he should or should not use the system
SP	Social presence	The experience of sensing a social entity when interacting with the system
TRUST	Trust	The belief that the system performs with personal integrity and reliability
USE	Use	The actual use of the system over a longer period in time

Table 11: Questionnaire used - Almere model






			1	2	3	4	5
							
Anxiety	ANX1	If I should use Liz, I would be afraid to make mistakes with it					
	ANX2	If I should use Liz, I would be afraid to break something					
	ANX3	I find Liz scary					
	ANX4	I find Liz intimidating					
Attitude Towards Technology	ATT1	I think it's a good idea to use Liz					
	ATT2	Liz would make life more interesting					
	ATT3	It is good to make use of Liz					

Facilitating conditions	FC1	I have everything I need to use Liz					
	FC2	I know enough about Liz to make good use of it					
Perceived adaptiveness	PAD1	I think Liz can be adaptive to what I need					
	PAD2	I think Liz will only do what I need at that particular moment					
	PAD3	I think Liz will help me when I consider it to be necessary					
Perceived enjoyment	PENJ1	I enjoy Liz talking to me					
	PENJ2	I enjoy doing things with Liz					
	PENJ3	I find Liz enjoyable					
	PENJ4	I find Liz fascinating					
	PENJ5	I find Liz boring					
Perceived ease of use	PEOU1	I think I will know quickly how to use Liz					
	PEOU2	I find Liz easy to use					
	PEOU3	I think I can use Liz without any help					
	PEOU4	I think I can use Liz when there is someone around to help					
	PEOU5	I think I can use Liz when I have a good manual					
Perceived sociability	PS1	I consider Liz a pleasant conversational partner					
	PS2	I find Liz pleasant to interact with					
	PS3	I feel Liz understands me					
	PS4	I think Liz is nice					
Perceived usefulness	PU1	I think Liz is useful to me					
	PU2	It would be convenient for me to have Liz					
	PU3	I think Liz can help me with many things					
Social influence	SI1	I think my family would like me using Liz					
	SI2	I think it would give a good impression if I should use Liz					

Social presence	SP1	When interacting with Liz I felt like I am talking to a real person					
	SP2	It sometimes felt as if Liz was really looking at me					
	SP3	I can imagine Liz to be a living creature					
	SP4	I often think Liz is not a real person					
	SP5	Sometimes Liz seems to have real feelings					
Trust	Trust1	I would trust Liz if it gave me advice					
	Trust2	I would follow the advice Liz gives me					

Appendix R - Dutch translation Almere questionnaire

Translation into Dutch of Almere questionnaire

			1	2	3	4	5
							
Anxiety	ANX1	Als ik Liz zou gebruiken, zou ik bang zijn om er fouten mee te maken					
	ANX2	Als ik Liz zou gebruiken, zou ik bang zijn om iets kapot te maken					
	ANX3	Ik vind Liz eng					
	ANX4	Ik vind Liz intimiderend					
Attitude Towards Technology	ATT1	Ik vind het een goed idee om Liz te gebruiken					
	ATT2	Liz zou het leven interessanter maken					
	ATT3	Het is goed om gebruik te maken van Liz					
Facilitating conditions	FC1	Ik heb alles wat ik nodig heb om Liz te gebruiken					
	FC2	Ik weet genoeg over Liz om er goed gebruik van te maken					
Perceived adaptiveness	PAD1	Ik denk dat Liz zich kan aanpassen aan wat ik nodig heb					
	PAD2	Ik denk dat Liz alleen zal doen wat ik nodig heb op dat moment					
	PAD3	Ik denk dat Liz mij zal helpen wanneer ik dat nodig vindt					
Perceived enjoyment	PENJ1	Ik geniet van Liz die tegen me praat					
	PENJ2	Ik geniet ervan om dingen met Liz te doen					
	PENJ3	Ik vind Liz leuk					
	PENJ4	Ik vind Liz fascinerend					
	PENJ5	Ik vind Liz saai					

Perceived ease of use	PEOU1	Ik denk dat ik ik snel weet hoe Liz te gebruiken					
	PEOU2	Ik vind Liz makkelijk te gebruiken					
	PEOU3	Ik denk dat ik Liz kan gebruiken zonder hulp					
	PEOU4	Ik denk dat ik Liz kan gebruiken als er iemand in de buurt is om te helpen					
	PEOU5	Ik denk dat ik Liz kan gebruiken als ik een goede handleiding heb					
Perceived sociability	PS1	Ik beschouw Liz als een prettige gesprekspartner					
	PS2	Ik vind Liz prettig om mee om te gaan					
	PS3	Ik heb het gevoel dat Liz mij begrijpt					
	PS4	Ik vind Liz leuk					
Perceived usefulness	PU1	Ik denk dat Liz nuttig voor me is					
	PU2	Ik denk dat het voor mij handig zou zijn om Liz te hebben					
	PU3	Ik denk dat Liz mij met veel dingen kan helpen					
Social influence	SI1	Ik denk dat mijn naasten het fijn zouden vinden als ik Liz gebruik					
	SI2	Ik denk dat het een goede indruk zou geven als ik Liz gebruik					
Social presence	SP1	Tijdens interactie met Liz voelt het alsof ik met een echt person praat					
	SP2	Het voelt soms alsof Liz echt naar mij kijkt					
	SP3	Ik kan me Liz voorstellen als een levend wezen					
	SP4	Ik denk vaak dat Liz niet een echt persoon is					
	SP5	Soms lijkt het alsof Liz echt gevoelens heeft					
Trust	Trust1	Ik zou Liz vertrouwen als het mij advies gaf					
	Trust2	Ik zou het advies van Liz opvolgen					

MyFoodCoach

Designing the interaction of a social robot for elderly

ONDERZOEKSPROTOCOL VELDTEST

Version: Mei, 2021



Project details

Project title

MyFoodCoach – *Designing the interaction of a social robot for elderly*

Contact person

Famke van Meurs

Onderzoeksvragen

Doel

- De focus van dit gebruikersonderzoek ligt op de gebruikersacceptatie en de invloed van verschillende persoonlijkheden op deze acceptatie.
- We kijken of de persoonlijkheden tot een hogere acceptatie leiden dan de standaard versie die nu wordt gebruikt.
- Het prototype wordt getest met 5 ouderen

Onderzoeksvragen

Hoofdvraag:

Wordt de acceptatie van de digitale coach hoger als de gebruikers de mogelijkheid krijgen om de coach persoonlijkheid te kiezen, ten opzichte van de standaardversie?

Evt. Subvragen:

- Wenselijkheid (desirability)
 - Is het gebruik van FoodCoach leuk/plezierig voor ouderen?
 - Komen de ontworpen persoonlijkheden overeen met de verwachtingen van de oudere?
 - Sluiten de verschillende persoonlijkheidstypen voldoende aan bij de wensen van de gebruikers?
- Ontwerp
 - Hoe ervaren ouderen de fysieke vorm en uitstraling van de FoodCoach Liz?
 - Hoe ervaren ouderen het woordgebruik en de toon van de 'nieuwe' FoodCoach Liz ten opzichte van de 'oude' versie?
 - Hoe ervaren ouderen de gezichtsuitdrukking en gebaren van de 'nieuwe' FoodCoach Liz ten opzichte van de 'oude' versie?
 - Hoe ervaren ouderen de interactie met de 'nieuwe' FoodCoach Liz ten opzichte van de 'oude' versie?

Participanten

Ouderen van 70+

De ouderen zijn in staat de meeste taken nog zelf te doen, ze krijgen eventueel hulp bij de dagelijkse taken als boodschappen en schoonmaken. Ouderen worden gerekruteerd via het netwerk van de onderzoeker (familiekring) en het netwerk van gerekruteerde participanten.

Participanten worden gescreend op hun mening ten opzichte van technologie. Participanten met een sterke negatieve mening worden niet meegenomen in dit onderzoek.

Methode

Stap 1: Introductie

Wie

- Famke
- Oudere

Activiteiten

- In persoon, in het huis van de oudere
- Toestemmingsformulier ondertekend & informatie brochure gelezen
- Kennismaking
- Introductie en uitleg van het onderzoek
- Doornemen introductie prototype
- Doorlopen standaard versie
- Questionnaire
- Doorlopen persoonlijkheid versie
- Questionnaire

Stap 2: Evaluatie interview

Doel

Inzicht krijgen in de ervaring. Antwoorden op de onderzoeksvragen.

Wie

- Famke
- Oudere

Wat

- Interview (15min?)
- Op basis van de vragenlijst doorvragen
- Interview over ervaring met:
 - Coach Liz standaard
 - Coach Liz persoonlijkheid

Video's

Taak 1: doelen stellen

Taak 2: feedback berichten

Taak 3: herinneringen

➔ Taken zullen opeenvolgend afgespeeld worden

Video's zijn te vinden in onderstaande link.

https://connectedcare.sharepoint.com/:f:/s/Intranet/EqxVyMbNj5Go8zIzm2u3MBvWVaA-HA373G35W-sE6_4_g?e=9rlhtj

video 0: standaard

De standaard versie gebaseerd op het huidige prototype en de Figma schermen die door Judith de Koning zijn ontworpen. In de sharepoint map genoemd standaard prototype.mp4

video 1: dominant

Dialoog en schermen voor de dominante coach. Dialooguitwerking met gezichtsuitdrukking keuzes en stem is te vinden in hoofdstuk 5+6+7 van mijn werkbestand.

Deze coach wordt in het kort getypeerd door: Strong, result-oriented, competitive. Een uitgebreidere uitleg van iedere coach is ook te vinden in hoofdstuk 5 van het verslag.

In de sharepoint map genoemd Prototype Dominance.mp4

video 2: influence

Dialoog en schermen voor de influence coach. Dialooguitwerking met gezichtsuitdrukking keuzes en stem is te vinden in hoofdstuk 5+6+7 van mijn werkbestand.

Deze coach wordt in het kort getypeerd door: Persuasive, extraverted, optimistic

In de sharepoint map genoemd Prototype Influence.mp4

video 3: steadiness

Dialoog en schermen voor de steadiness coach. Dialooguitwerking met gezichtsuitdrukking keuzes en stem is te vinden in hoofdstuk 5+6+7 van mijn werkbestand.

Deze coach wordt in het kort getypeerd door: Peaceful, diplomatic, supportive

In de sharepoint map genoemd Prototype Steadiness.mp4

video 4: conscientiousness

Dialogoog en schermen voor de conscientiousness coach. Dialogooguitwerking met gezichtsuitdrukking keuzes en stem is te vinden in hoofdstuk 5+6+7 van mijn werkbestand.

Deze coach wordt in het kort getypeerd door: Accurate, detail-oriented, logical

In de sharepoint map genoemd Prototype Conscientiousness.mp4

Introductie

1.1 Demographics

Invullen door onderzoeker

- Leeftijd en geslacht
- Positie ten opzichte van technologie (gebruik van email/internet. Handigheid / openheid)

1.2 toestemmingsformulier

Voor u ziet u een toestemmingsformulier en een informatie brief. Ik wil u vragen eerst de informatie brief door te lezen en daarna het toestemmingsformulier. Dan wil ik u vragen het formulier in te vullen en te ondertekenen als u akkoord bent.

Verder wil ik u nogmaals vertellen dat u op ieder gewenst moment kunt stoppen met dit onderzoek zonder een reden te geven.

- ➔ Controleer of het formulier is ingevuld en ondertekend. Controleer of de participant nog vragen heeft.

1.3 kennismaking

Ik ben Famke, 23 jaar en ik ben momenteel bezig met de afronding van mijn master opleiding Industrial Design Engineering, oftewel, industrieel ontwerpen. Een onderdeel van mijn afstuderen is dit onderzoek, waarbij ik een procedure volg.

Vanaf nu ga ik het gesprek opnemen, vindt u dat goed?

- ➔ Opname starten

1.4 Project introductie

Bedankt voor uw deelname aan dit onderzoek. Graag zou ik willen beginnen met een korte introductie over dit onderzoeksproject. ConnectedCare, het bedrijf waarbij ik afstudeer, is het voedingscoach project gestart om oudere te helpen met adviezen en begeleiding in gedragsverandering rondom voeding. Het doel is om een coach, Liz, te maken die bij de oudere in huis kan worden gebruikt als verlengstuk van de diëtist.

In deze fase van het project willen wij graag meer inzicht krijgen in hoe we Liz de juiste persoonlijkheid kunnen geven. Hiervoor heb ik vier verschillende persoonlijkheden ontworpen voor Liz. Mijn vraag is straks welke u ervaart als het meest prettig. U krijgt zo de standaard versie en de gekozen versie te zien. Na de interactie vraag ik u een korte vragenlijst in te vullen. Er is hierbij geen goed of fout antwoord, het gaat puur om uw mening. Op het einde stel ik u nog een paar korte vragen over uw ervaring. Dit alles duurt maximaal een uur maar ik ga uit van 30-40 min.

Dat was mijn uitleg, heeft u nog vragen voordat we beginnen?

1.5 introductie prototype

Standaard versie in de Liz app openen, dit doet de onderzoeker zonder dat de participant het ziet. De oudere kan hier eerst doorheen klikken en de basic interacties ontdekken. Op de laptop kan de onderzoeker verschillende feedback berichten en reminders sturen en zo laten zien aan de participant. Zo krijgt de oudere een idee van hoe het standaard er nu uitziet. Bij de voorbeelden in de huidige versie wordt uitleg gegeven wanneer nodig en de participant kan vragen stellen.

1.6 standaard versie video

De onderzoeker legt uit dat de taken voor nu bestaan uit doelen opstellen, terugkoppeling en herinneringen. De onderzoeker legt uit dat deze taken opeenvolgend voorbij komen, waarbij de gebruiker niet meer de optie heeft om te interacteren (klikken op knopjes) met Liz, het zijn immers video's. Het opstarten van de video's wordt gedaan zonder dat de participant het ziet. De onderzoeker zorgt dat de participant duidelijk weet dat er in deze versie geen interactie plaatsvindt met het prototype. Hier wordt er verwacht dat de participant observeert en luistert naar de coach.

Bijvoorbeeld: *U krijgt nu de standaard versie van Liz te zien. Deze versie is in video formaat gemaakt, zodat de vergelijking met de persoonlijkheidstypes zo eerlijk mogelijk gaat. Bij deze versie is het dus niet mogelijk om op knopjes te drukken. Dat was niet technisch haalbaar. In de uiteindelijke versie zal dit natuurlijk wel weer mogelijk zijn. Voor nu is het belangrijk dat u observeert en luistert naar Liz.*

- video 0 opstarten
- *questionnaire invullen*

1.7 persoonlijkheidstypes uitleg

- Korte uitleg van alle 4 persoonlijkheden - gebruiker maakt keuze

Nu krijgt u een versie van Liz te zien waarbij gelet is op de persoonlijkheid. Er zijn vier verschillende versies. Welke spreekt u het meeste aan?

De eerste coach Liz is heel direct en beslissend in haar taalgebruik. In deze versie van Liz gebruikt ze weinig woorden en heeft ze een dominante houding. - video 1

De tweede versie is een sociale coach Liz, hier is ze heel gezellig en optimistisch en probeert ze een band op te bouwen, bijvoorbeeld door het geven van persoonlijke anekdotes - video 2

De derde versie is een informerende coach Liz, die is erg sympathisch en sociaal en probeert door informatie te geven u over te halen om advies op te volgen. - video 3

De vierde coach is een gewetensvolle coach Liz, deze is minder sociaal en richt zich op de kwaliteit van de informatie. Ze heeft hier dus ook veel informatie, maar is daarbij wat directer in haar taalgebruik. - video 4

1.8 persoonlijkheidsversie video

- Video van gekozen coach. De onderzoeker start ook deze video zonder dat de participant dat kan zien.

In de persoonlijkheidsversies zullen dezelfde taken voorbij komen als in de standaard versie. Ook hier is het niet mogelijk om op het scherm antwoorden aan te klikken.

- video 1-4 opstarten
- Questionnaire

1.9 interview

1. Hoe vond u de interactie met de Liz A en Liz B?
2. Merkte u verschil tussen de twee versies?
 - a. Zo ja, wat voor verschil?
3. Hoe vond u de fysieke vorm en uitstraling van Liz?
4. Hoe vond u de gezichtsuitdrukkingen en woordgebruik van Liz B?
5. Hoe vond u het woordgebruik en de toon van Liz B? en ten opzichte van Liz A?

1.10 afsluiting

Ik wil u bedanken voor uw tijd vandaag. Dit is het einde van dit interview. Heeft u nog dingen die u kwijt wil?

Heeft u verder nog vragen aan mij?

Appendix T - Observation notes

P1: Concentreerde in eerste versie op gezicht. Ziet niet de meerwaarde van alle gezichtsuitdrukkingen. Vind de interpretatie van sommige moeilijk.

Heeft moeite met de vragenlijst becijfering smileys en of ze dan wel de goede invult. □ vanaf nu eens oneens erbij schrijven. Ze weet soms te weinig van liz af om de vragenlijst goed in te vullen. Heeft langer de tijd nodig in interactie om goed oordeel te geven over sommige statements. Vult het in met de gedachte dat ze liz nu nog niet nodig heeft. Soms neutral als ze het nog niet zeker weet.

Vind de menselijke interactie prettiger dan met liz.

Geeft aan dat ze open staat voor vervolg testen.

Denkt dat het voor sommige mensen ideal is. Interessant, voor sommige kan het goed helpen, als je daaraan toe bent.

Merkte beetje, maar niet heel veel verschil tussen de twee versies. Moeilijk om te beoordelen.

Coaching versie vond mw duidelijker gericht op het 'probleem', duidelijker in vraagstelling. Dus ook makkelijker in te vullen. 'ik krijg nu informatie'. Ik vind dit veel prettiger.

Bij de standard moet je maar bedenken wat liz bedoeld, hier krijg je duidelijk informatie. Je krijgt meteen uitleg. Hierbij ziet ze ook meer verschillende gezichtsuitdrukkingen, dit toont het wel beter dan de standard. Maar ze leest meer dan dat ze op gezicht en gebaren let, kun je pas goed begrijpen als je er beter inzit.

De standard zou voldoende zijn, voorkeur gaat uit naar persoonlijkheidsversie. Geeft aan dat ze misschien de optie wil voor ene keer meer informatie en andere keer niet

Mw geeft aan dat het veel indrukken zijn in een keer.

Mw geeft aan soms confused te zijn door de likert scale en waar ze dan moet invullen. Mw geeft aan soms nog niet genoeg info te hebben

P2: begint met persoonlijkheidsversie, kiest coach 1: dominant

Merkt weinig verschil tussen de twee versies. Misschien omdat de gekozen persoonlijkheid redelijk overeenkomt met de standard versie. Mw geeft aan geen voorkeur te hebben voor de versies, dit is wel te zien in de questionnaire.

Lette niet zozeer op de gezichtsuitdrukkingen en gebaren en was vooral aan het lezen. Mw geeft ook aan dat het veel informatie is om op te doen in een keer. Bij langer gebruik zou het verschil misschien duidelijker worden evenals de gezichtsuitdrukkingen en gebaren, dan zou ze misschien ook een sterkere voorkeur hebben geeft ze aan.

Mw vroeg zich af of ze niet zou schrikken als Liz opeens begint te praten, een notificatie geluidje zou hier een oplossing voor zijn bijvoorbeeld.

Sommige statements kan ze moeilijk beoordelen omdat er te weinig interactie is geweest.

Vind het ondersteunend.

Vond de interactie goed, prettig in gebruik.

Weinig verschil tussen versies, ze dacht doordat het gebruik hetzelfde was. Het ging te snel om goed te kijken naar gezicht en gebaren.

Niet opgelet wat voor uitdrukking het was, misschien in langer gebruik kun je er beter op letten en beter mening geven.

Geen voorkeur voor versies, daarvoor heeft ze te weinig verschil gezien.

P3: begint met de standard versie. Kiest voor coach 3, steadiness

Mw geeft aan dat ze Liz makkelijk vindt in interactie en interessant om naar te luisteren.

Mw vindt de persoonlijkheidsversie sympathiek overkomen, ook was deze duidelijker dan de standard versie. The steadiness coach sprak meer aan, dit ligt deels aan hoe het wordt gebracht.

Vorm en uitstraling viel niet tegen, ziet liever een echt persoon. Maar dit zou een goede vervanging zijn. Had houterig verwacht en dat viel erg mee bij Liz.

Mw zag niet heel veel verschil tussen twee versies. Na doorvragen zag ze toch dat de gezichtsuitdrukkingen in de pers. Prettiger waren en dat de uitstraling sympathieker is. Ook is het woordgebruik en de toon verbeterd ten opzichte van de standard versie.

Veel informatie nu, langer de tijd zou helpen met de beoordeling

Als het nodig is zou het handig zijn om in huis te hebben.

Als het nodig is om z'n robot te hebben, dan vind mevrouw het prettig en fijn om te hebben.

Als ze een vraag niet weet, dan laat ze het vakje open. Sommige statements kunnen misschien niet worden ingevuld door de limited tijd en interactie met Liz. In vergelijking met participant 1 vult participant 3 in met de visie op de toekomst, dus tegen de tijd dat ze het nodig denkt te hebben.

Persoonlijkheids versie komt sympathiek over. ze vond deze versie heel duidelijk, duidelijker dan standaard versie. Sprak meer aan, prettig verwoord. Gezichtsuitdrukkingen prettiger. Woordgebruik ook. Geeft sterke voorkeur aan voor persoonlijkheidsversie

P4: begint met standard versie, kiest voor coach 3, steadiness

mw is erg enthousiast over het concept

In video format is het beperkt te beoordelen. Het gaat meer leven in app versie Wisselt questionnaire af met antwoorden alsof ze dietist nodig heeft of niet

Heel goed werkbaar. Interactie is niet echt te beoordelen. Gezichtsuitdrukkingen zeggen nu ook wat minder, want ga ervan uit dat als het wel een app is dat er dan andere expressies zichtbaar zijn.

Persoonlijkheids versie geschikt voor mensen die beginnen te dementeren. Heel erg informatief en begeleidend. Als je dat echt nodig hebt dan is dat heel erg fijn. Voor mij nu teveel informatie, omdat ik het niet nodig heb.

Schemas en grafieken werken verhelderend. Ze merkt duidelijk verschil

Interactie is met beide prettig

Tweede versie is met meer uitleg en voelt meer als bij de hand nemen. Ik kan me voorstellen als ik dat hard nodig heb dan is dat heel fijn. Heel sturend zonder dat het vervelend is, ligt aan hoe open je ervoor staat. Versie 1 is meer algemeen informatief

Uitstraling is vriendelijk, 'menselijk gaat me te ver, maar het voelt niet als een robot. Alsof je aan de telefoon zit eerder, of aan het videobellen bent'

Voor mezelf vond ik eerste video prettiger. Heb niet ontdekt dat er verschil was in gezichtsuitdrukkingen maar meer het taalgebruik.

Grafieken zijn nice maar teveel uitleg. De persoonlijkheids versie wat voor mw wat te betuttelend.

'ik vind het bijna ontroerend weet je dat, dat is echt heel grappig' 'wat geweldig, ontzettend leuk'

Voelt als persoonlijk contact.

Kiest voor 3 omdat ze niet op anekdotes zit te wachten meer op informatie, en ze wil ook een vriendelijke coach.

- *Naar mijns inziens, vind beide versies goed. Voorkeur ligt aan dat mw nog erg goed is en net 70 dus jong nog. Begeleiding niet nodig waardoor de minder informatieve voor nu beter werkt.*

'dit is geweldig, ik vind het echt fantastisch'

P5: gebruiker start met steadiness persoonlijkheid

Mw Lijkt afgeleid door omgeving.

Standaard is In begin heel stellig, niet erg emotioneel. Niet empathisch. Aan het eind werd het aardiger. De mimiek is pover. Gezichtsuitdrukkingen komen niet menselijk over. Duolingo is bijv veel meer variatie en uitbundiger

'doe het echt menselijker of laat het helemaal zitten'

Bij tweede questionnaire 'wat moet ik hier nou mee, ik heb gezegd wat ik ervan vindt'

Gezicht bevalt niet. Begin te gevoelloos.

Valt op dat mw buiten de doelgroep valt, omdat ze het totaal niks vind eigenlijk.

Hooguit technisch fascinerend

Was het ook niet helemaal eens met de statements en volgorde daarvan. 'Goeie vragen stellen is moeilijk, zeker in die volgorde'

'Ik denkt dat' .. ipv 'mij' maakt het minder persoonlijk en dus makkelijker te beoordelen misschien

'Als ik een keer gezegd heb dat ik het zonder hulp kan dan is de rest overbodig he'. De rest van de statements bedoeld mw hiermee

■ *Steadiness versie*

Teveel aan het woord, veel uitleg. Denk dat het veel tekst is voor iemand. Dus informatie is teveel tegelijk. Gezichtsuitdrukkingen hoeven van haar niet. meer gefocust op de tekst. Als je focust op gezicht is het miniem aan wat ze aan mimiek heeft.

Niet sympathiek eruit zien. Te groot kapsel. Met het rode kruisje wil ze dan ook liever een zusters kapje

Ze vind de coach niet prettig en een beetje eng. Maar niet intimiderend

However, wel een goed idee om te gebruiken, maar dan een andere Liz.

Wel eenvoudig in interactie.

Gelooft niet zo in de techniek, meer in de mensen erachter. Ze vind het een stomme pop, maar aan de andere kant degene die erachter zitten, zoals de dietist en mantelzorgers vind ze wel weer leuk. Het platform vooral

Op zichzelf vind ze het interessant dat ze er is.

Interactie was niet voldoende om alles goed te beoordelen.

Intonatie is vrij vlak

- *Kijkt niet naar Liz gezicht, naar 'die zuster'. Helemaal op de tekst geconcentreerd.*
- *'zodra ik iets moet doen, ga ik al steigeren'*
- *Teveel aan het woord, veel uitleg. Teveel tekst voor iemand in 1 keer. Teveel tegelijkertijd ligt ook aan video formaat*
- *Gezichtsuitdrukkingen hoeven van haar niet. Vindt mimiek miniem. Ziet er niet sympathiek uit. Komt door 'veel te groot kapsel', ziet liever een zusterskapje*
- *Het is niet mijn type' qua uiterlijk*
- *'denkt dat ze alleen doet wat ik wil, als er mensen achter zitten'*
- *Ze vind liz niet leuk, vind wel opzichzelf interessant dat ze er is, fascinerend*
- *'ik ben erg tegenstrijdig in mijn reacties. Aan de ene kant denk ik ja het is gewoon een stomme pop, maar aan de andere kant ja er zit aan de achterkant natuurlijk wel mensen die via liz met mij communiceren'*
- *In de toekomst misschien handig om te hebben*
- *Tweede, standaard, is baziger. Geen van twee spreekt aan.*
- *Het is heel knap gedaan.*
- *Het is hypothetisch voor mij, dus ik geef nu een ander antwoord als dat ik echt in die situatie zou zitten, dat ik haar nodig heb.*
- *lets abstracters, geeft zelf voorbeeld van bloempot en gepersonaliseerde hondjes, zouden haar meer aanspreken.*

was mw redelijk negatief over alles tijdens usertest. Ze gaf aan dat de liz vooral technisch interessant vond maar niet als coach om in huis te hebben 'echt verschrikkelijk'.

Vergelijking

De tweede is baziger, houdt ze helemaal niet van. Geen van twee spreekt aan. Stem is te vlak. Het zijn computerstemmen, wel knap gedaan. Stem zou menselijker moeten bijvoorbeeld door in te spreken.

In eerste versie vooral op gezicht gelet. Viel niet zo op in tweede versie.

De manier waarop bazig, maar wat ze zei komt op zich goed over.

Vraagstelling vindt ze inconsequent. Hypothetisch voor in de toekomst, dan geef je ander antwoord dan dat je in de situatie zit. Op zichzelf is het heel handig voor mensen die langer thuis moeten blijven wonen. Bloempotten zijn er bijv al. wat is dan toegevoegd waarde van deze

Die beschouwt zij als prettiger.

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