

## **Inclusive design of a sensitive virtual assistant to support people in vulnerable positions in their access to care**

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**Abstract.** In many European societies, the demand for health and social care for people in vulnerable positions is increasing. Together with a lack of personal and growing societal care costs, it is warranted to look for innovative ways to better support people in vulnerable positions in their care. People in vulnerable positions often face challenges in the timely access to various forms of care they need, for example due an intellectual disability, autism spectrum disorder (ASD) or a mental disorder. This project examines the possibility of a virtual assistant to improve access to care for people in vulnerable positions. Innovative in this project is the study of whether and how a ‘sensitive’ virtual assistant can be developed, i.e., a virtual assistant that modifies to the different needs of the target group through adaptive and inclusive artificial intelligence technology. The sensitive virtual assistant will be developed through a design thinking method, in which 1) the current and desired experiences of the target group regarding their care and support are mapped, and 2) the sensitive virtual assistant’s ability to address these needs and adapt its functionalities to different users will be explored. Interestingly, this study takes place in close collaboration with ‘citizen scientists’ who have a cognitive impairment such as intellectual disability or ASD. In this inclusive research trajectory, they ensure that the virtual assistant will fit the needs and lifeworld of the target population. This project is expected to generate theoretical, methodological and technological contributions to the field of chatbot research, citizen science and inclusive research.

**Keywords:** eHealth, co-design, AI-technology, chatbot, people in vulnerable positions, inclusive research, citizen science

# 1 Introduction

## 1.1 Background

People in vulnerable positions, for instance due to low (health) literacy skills or cognitive impairments, such as an intellectual disability, autism spectrum disorder (ASD) or a mental disorder, often face challenges to have timely access to the complex and various forms of care and support they need. In the Netherlands, there are concerns about the accessibility of information about different types of care, because information is scattered, unorganized, and often difficult to understand [1]. At the same time, the demand for care of people in vulnerable positions remains to rise in various countries around the world [2], as well as the shortage of care personal and the strong increase in societal care costs [3]. Therefore, it is warranted to explore innovative solutions that facilitate access to various forms of care in increasingly complex societies.

Virtual assistants have a high potential for being such innovative solution. Virtual assistants can serve as a low threshold means to access information and care, by using simple natural language dialogues [4]. In addition, virtual assistants have various advantages that may be of relevance for people in vulnerable positions. For instance, virtual assistants do not judge about what is being asked, thereby taking away feelings of shame that people can experience when asking for help [5]. Moreover, virtual assistants are always available [5]. Still, many e-health technologies such as virtual assistants are developed for the general population rather than people in vulnerable positions, who often have low literacy levels or limited digital skills [4]. Moreover, target groups are often not involved in the development of technologies, resulting in solutions that do not match their needs and lifeworld [6]. Therefore, there is a need for studies that explore the possibilities of a ‘sensitive’ virtual assistant (SVA), in collaboration with the target group, so that the virtual agent can adapt to users with different care needs, literacy or cognitive levels and digital skills.

In this project, people in vulnerable positions play a central role in the development of a SVA, not only by centralizing their experiences in the development process, but also by involving them as citizen scientists in the research. Their needs regarding access to care will be explored, as well as the possibilities of adaptive and inclusive AI-technology to develop a SVA that adapts to users with various needs and expressive capabilities. For example, by modifying the method of communication (e.g., speech rather than written communication), adapting to the users’ literacy level (e.g., through lexicon simplification), and using various visual presentations. This project is innovative in two ways. First, because it studies the development of a SVA for an underrepresented group in the field of chatbots, namely people in vulnerable positions [4]. Second, because the target group is closely involved in the project by inclusive research and co-design methods leading to better insights into their needs and ways in which a SVA can support them.

## 1.2 Objectives

This project has two overall objectives which will be tackled in five project phases:

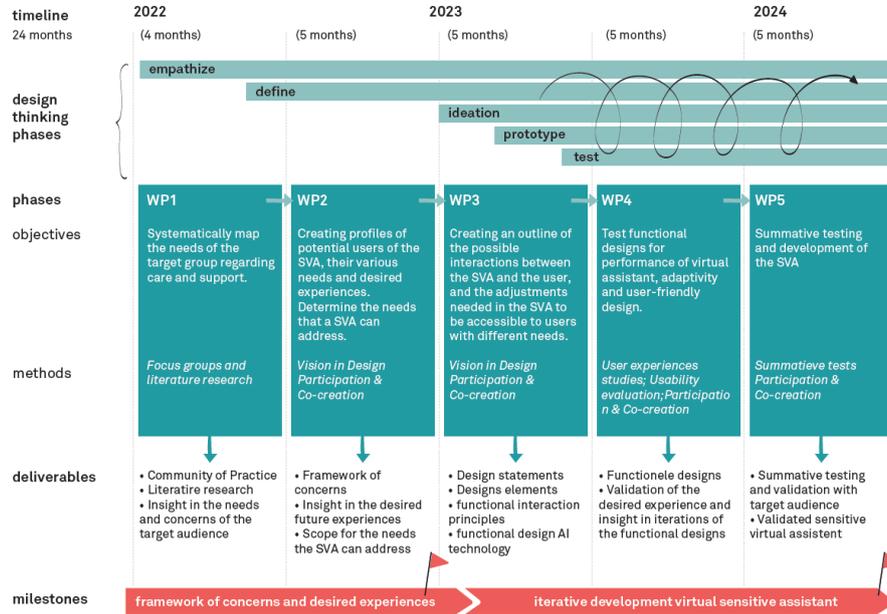
1. To systematically develop a virtual assistant with AI dialogue technology, together with citizen scientists, that fits the lifeworld of the target group.
2. To provide scientific evidence for the added value and necessity of citizen scientists in the development and implementation of technology, so that a wider application of citizen science can be pursued.

## 2 Methods

### 2.1 Development method

**Design thinking.** The SVA in this project will be developed by using the ‘vision in design method’[7], a form of design thinking. This method comprises three steps, namely 1) mapping the context, i.e., what are current and future developments in the context of care of people in vulnerable positions, 2) understanding interactions, i.e., what are the desired experiences for people in vulnerable positions in relation to their context of care, and 3) designing the product, i.e., how can a SVA contribute to accomplish the desired experiences. The vision in design method centralizes the needs and concerns of the target group in the development of the SVA.

**Project phases and methods.** The development process consists of five phases. In the **first phase**, the needs and interests of people in vulnerable positions regarding care and support are identified through focus group sessions with the target population, direct care givers and care professionals. In the **second phase**, different profiles reflecting users with different needs (regarding care and/or regarding the use of the SVA) are compiled. One group of users may want the SVA to help them getting overview of various options of care and access to information while for another group of users the SVA may be a means of reassurance or access to social contact. In this phase, it will be explored which of those needs a SVA can address. Co-creation sessions with citizen scientists, a design thinking agency, an AI technology partner and researchers, will be organized in this phase. Subsequently, in the **third phase**, the appearance and functionalities of the SVA, as well as the ways it can adapt to different user profiles will be explored. Based on literature research on existing SVA’s and through co-creation sessions, sketch designs will be made of the possible interactions with the SVA. In the **fourth phase**, user-experience studies will be performed, through small-scale, qualitative and iterative evaluations of various the actual usability and usefulness of the SVA for users with various profiles. The usability, helpfulness and appreciation of the SVA will be examined on a larger scale in the **fifth phase**, as expected through questionnaires. These questionnaires will be designed in collaboration with citizen scientists to be accessible to the target group of the SVA. Figure 1 provides an overview of the different phases and associated methods.



**Fig. 1.** Phases and corresponding methods

**Citizen science.** The project has a citizen science approach, meaning that the target group of the SVA is closely involved during the entire project – from the grant application, throughout the research and development cycle to the dissemination of the findings and implementation of the end product. For example, by co-moderating the focus groups, assisting with data analysis, co-assessing functional designs in the co-creation sessions, and providing advice on how to make the quantitative evaluation methods for user experience studies inclusive for the target group.

### 3 Expected contributions and preliminary findings

This project is expected to provide theoretical, methodological and technological contributions to the fields of chatbot research, citizen science, inclusive research and design, and public health. We will outline these below, including the preliminary findings that are expected to be available in November 2022.

#### 3.1 Theoretical contributions

This project provides insight into the care needs of people in vulnerable positions and whether and how a SVA can respond to their needs. In addition, insight will be gained into the limitations a SVA has to actually support people in vulnerable positions, for

example, when having limited digital skills. This study contributes to the understanding of how chatbots can be used for the social good, identified as an important research theme by Følstad et al. [4]. Also, we aim to create a framework of existing literature on the three fields that are combined in this study, namely virtual assistants, health and support and inclusive design. This will provide an overview of existing knowledge that can be used when designing a SVA for people in vulnerable positions, which can be combined with our empirical findings.

A first assessment of the needs of people in a vulnerable position with regard to their care and the role chatbots potentially play in this, are expected to be available during the conference in November 2022.

### **3.2 Methodological contributions**

Knowledge is developed on how to adapt quantitative evaluation methods in a way that they are suitable to use among people in vulnerable positions. Creative research and design methods are used to engage the target group during this project, for example, by using visual aids in focus groups and user experience studies. This allows to gain insight into a new user group of chatbots, namely people in vulnerable positions [4]. In addition, a process evaluation will be performed with the citizen scientists, which contributes to the understanding of inclusive design processes for technology. The methods and techniques by which we collaborate with citizen scientists, together with our findings, contribute to fundamental knowledge in the field of inclusive research and design, citizen science and chatbots, being relevant to a wide range of disciplines.

In November 2022, during the conference, we can share our first experiences with inclusive methods and the experiences of participants with these methods.

### **3.3 Technological contributions**

There have been developments to make chatbots more inclusive, for example by means of language understanding, which allows for different languages and dialects to be offered [8]. However, less developed is the adaptivity of chatbots to different literacy levels of users. Adaptive, inclusive AI-technology such as lexicon simplification is currently in its infancy, although it is seen as an important technology for the future to promote inclusivity [4]. This project explores the possibilities of adapting language to different users, as well as the ways in which AI-technology can contribute to better understanding of the users' needs and intentions, and adapting responses accordingly.

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