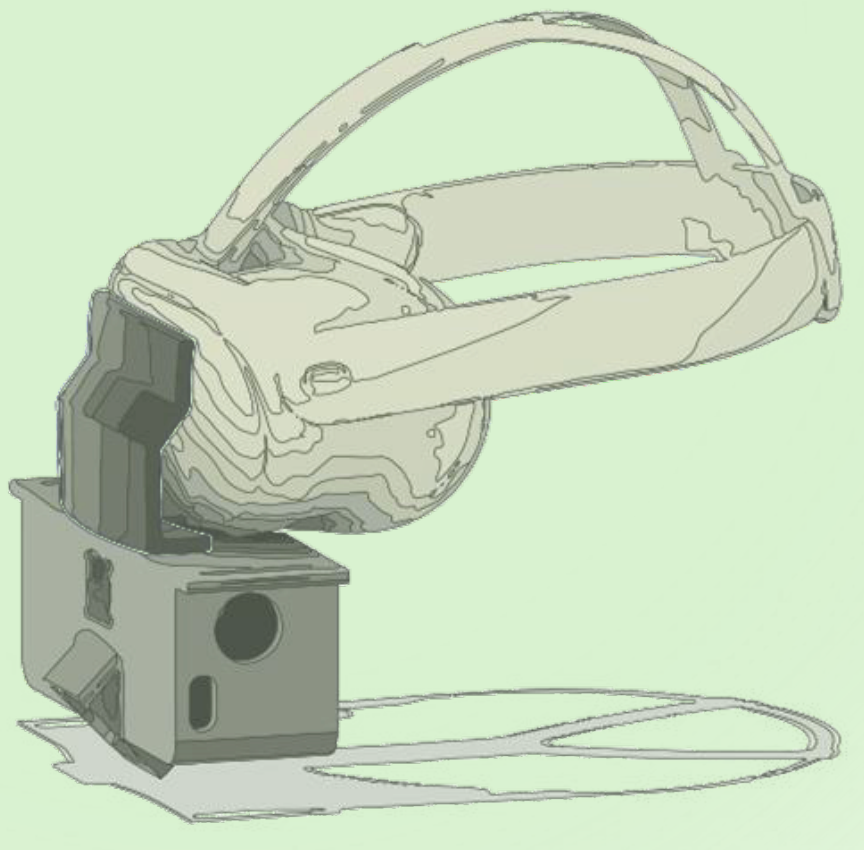


# Integration of Olfactory Stimuli in a Virtual Reality Experience for People with Dementia

*Exploring the added value of smell in a Virtual Reality  
experience for People with Dementia*



**MSc Industrial Design**

Faculty of Industrial Design  
Technical University Eindhoven

**Final Master project**

June 13<sup>th</sup>, 2024

**Author**

Ali Zohrab Sarabian

**Student number**

1638920

**Graduation Mentor**

Minha Lee

**Second Assessor**

Kristina Anderson

**Chair**

Gabriele Ferri

**Collaboration**

CWI Amsterdam, Pleyade Lobede, De Wever

**Company supervisor (CWI)**

Abdallah El Ali

## Abstract

This study explored the potential benefits of integrating olfactory stimuli in a Virtual Reality (VR) experience for people with dementia (PwD) while employing the principles of Warm Technology. The project aimed to develop a stimulating and enjoyable multisensory VR experience that overlapped with the participants' backgrounds or interests. Through an iterative design process involving expert interviews and workshops with PwD, two VR prototypes were developed and tested.

The final prototype featured a scene that incorporated visuals that were recognizable or interesting for the study participants, together with olfactory elements aimed at enhancing the immersive experience. The Scent in this VR prototype was released using an open-source olfactory display called Nebula.

Key findings highlight the varied responses among participants, emphasizing the importance of understanding the lived reality of PwD and their cognitive abilities. For instance, some participants demonstrated high levels of immersion and engagement in VR, while others used the VR scene as a catalyst for memory recall and storytelling.

A conceptual framework was used to interpret these results and categorize the participants' responses into five layers. These layers describe the lived reality from the participant's perspective, which provided insights into how PwD engage with multisensory experiences. These insights were used to formulate design recommendations that respect the personal differences between PwD and how they experience multisensory experiences. Despite the promising results and enjoyment of the VR activity, challenges like the small sample size were noted. Future research should focus on involving a larger, more diverse group of participants and work on more iterations to validate the findings and recommendations.

Finally, this explorative research contributes to the growing knowledge about using VR and multisensory stimuli in dementia care. It highlights VR's potential as a tool to create pleasurable experiences.

## Acknowledgments

This thesis could not have been completed without the help of many people involved. I want to start by thanking my coach, Minha Lee, for her support starting my first year at TU/e. Her guidance was invaluable for my development, both professionally and personally. Her steering helped me find my way to this topic and opened the doors to CWI and ECDT. They have enriched me with their expertise in conducting research, Human-Computer Interaction, and designing for People with Dementia.

I am equally grateful to Abdallah El Ali and Pablo Cesar from the Distributed and Interactive Systems group at CWI for welcoming me into the group. This collaboration offered a network of technical support, inspiration, a warm group of people, and fun outings during my thesis. Above all, they helped with the realization and implementation of Nebula. For this, I want to acknowledge Jack Jansen and Thomas Rögglä.

Petra van den Nieuwenhuizen from De Wever and Marian Hekkers from Pleyade were essential to the study. I want to thank them for their help in finding participants and arranging our sessions. I also want to thank Muriel van Doorn and Tijmen Stroeken for getting me in touch with the collaborating parties, De Wever and Pleyade Lobede.

I want to express my gratitude to my dad, mom, and twin brother for their unwavering support, starting long before I even arrived at TU/e. I also want to acknowledge my neighbor, Philip van Veelen, an alumnus of TU/e and a good friend, for always being there to chat, brainstorm, and just for being great company in general.

Last but not least, I would like to express my gratitude to the study participants who were willing to contribute to my research. I greatly appreciated our interactions and have learned a lot. They have made my thesis a wholesome experience.



# Contents

## Table of Contents

<i>Abstract</i> .....	3
<i>Acknowledgments</i> .....	4
<i>Contents</i> .....	5
<b>1. Introduction</b> .....	8
1.1 Background .....	9
Societal Importance .....	9
Activities for PwD .....	9
Multisensory Elements .....	10
Virtual Reality .....	11
Warm Technology .....	11
Summary .....	11
1.2 Thesis Focus .....	12
1.3 Stakeholders .....	12
1.4 Design Process .....	13
<b>2. Contextual Inquiry</b> .....	14
2.1 – Olfactory Exploration at The Meerpaal.....	15
<b>3. Methods</b> .....	16
3.1 Ethical Considerations .....	17
3.2 Participants .....	17
3.3 Semi-Guided Interviews .....	18
3.4 Session Setting .....	19
3.5 Familiarization with VR .....	19
3.6 Thematic Analysis .....	20
<b>4. Interviews</b> .....	21
4.1 Expert Interview .....	22
4.2 Associative Memories Interviews .....	23
May Month .....	23
Profile P1 .....	24
Profile P2.....	25
Profile P3.....	25
Profile P4.....	27
<b>5. Design and Development</b> .....	28
5.1 Integration Olfactory Stimuli in VR .....	29
5.2 First Prototype Realization .....	30
5.3 Second prototype realization.....	32

<b>6. Results</b>	<b>34</b>
6.1 Conceptual Framework	35
6.2 Prototype Evaluation	35
Results Prototype V1	36
Results Prototype V2	37
6.3 Conclusions	40
Conclusion Prototype V1	40
Conclusions Prototype V2	40
<b>7. Discussion and Recommendations</b>	<b>42</b>
5.1 Summary Key Findings	43
5.2 Interpretations	43
Personal Relevance	43
Story Telling	43
Olfactory Stimuli as an Addition to VR	44
VR and Memory Recall	44
VR in Elderly Care	44
5.3 Limitations	44
5.4 Implications and Design Recommendations	45
5.5 Conclusion	46
<b>Bibliography</b>	<b>47</b>
<b>Appendices</b>	<b>51</b>
A – Olfactory session Meerpaal	52
B – Information letter	54
C - Informed consent form	69
D - Toestemmingsformulier	74
E – Approval letter ERB	75
F – Data Processing Impact Assessment	77
G – Protocol semi-guided interview with caregivers	93
H – Protocol for Associative Memories workshop	94
1. General information	94
I – VR session protocol	95
1. General information	95
J – Illustration thematic analysis	96
K - Expert Interviews with E1 and E2 from Archipel	97
L - Participants reactions in the Associative Memories workshop	99
M – Transcriptions and observations of the evaluation	128



# 1. Introduction

In today's world, the care and well-being of people with dementia (PwD) have become increasingly important; with approximately 420.000 people having dementia by 2030 in The Netherlands (Zaken, 2020) and evolving technologies, this study aims to contribute to the warm healthcare provided for this target group. To contribute, I delved into the background of dementia, conducted interviews, and worked towards a potential innovation in dementia care, focusing on creating a multisensory experience in Virtual Reality (VR) as an activity for PwD.

This introduction will cover the background of dementia care, introduce the thesis' focus, list the key stakeholders involved in this study, and elaborate on the study design.

- 1.1                      **Background**  
*Societal importance, Activities for People with Dementia, Multisensory Elements, Virtual Reality and Warm Technology.*
- 1.2                      **Thesis Focus**  
*Goal, Hypothesis, and Research Question.*
- 1.3                      **Stakeholders**  
*Care homes and collaborators.*
- 1.4                      **Design Process**  
*Original study plan and the actual process.*

## 1.1 Background

### Societal Importance

Approximately 280,000 people are presently living with dementia in the Netherlands. That number is expected to increase to approximately 420,000 in 2030 and 520,000 in 2040 (Zaken, 2020). Depending on the dementia subtype, people with dementia (PwD) experience various difficulties and needs, including cognition and language barriers (Moheb et al., 2017), everyday functioning problems (Giebel et al., 2017), behavioral problems (Mukherjee et al., 2017), and mobility limitations (Fritz et al., 2016).

The progression of dementia typically involves advancing through distinct stages characterized by varying levels of cognitive decline and functional impairment (Yuan et al., 2021). Table 1 overviews dementia stages with impairments, care needs, symptoms, and duration. People affected by dementia benefit from appropriate post-diagnostic care (Baker et al., 2003), which can include anything from receiving a paid carer coming to their home, accessing support groups and activities in the community, information, a befriending service, visiting day care centers, psychological therapy, to getting equipment adaptations to the home or accessing a care home, which can be very costly, increasing in cost by the level of dependence the person with dementia experiences (Wübker et al., 2015).

### Activities for PwD

Among the various forms of support, meaningful activities are crucial in enhancing PwD's quality of life. Activity Theory maintains that older adults who remain engaged in the community have improved psychological and physical well-being compared to those who withdraw (Havighurst & Albrecht, 1953). This position is evident in the dementia care field, where the idea that activity may benefit PwDs is valued (Kane, 2001). Dementia decreases the well-being of PwDs and their caregivers, whereas activity participation may promote positive outcomes; this makes it essential to understand what makes activity meaningful from the perspective of caregivers to foster well-being and improved quality of life (QoL) (Roland & Chappell, 2015, p. 559).

What encompasses activity is diverse, consisting of household chores, recreation, work-related endeavors, and social involvement; what makes it meaningful is doing things that matter, the sense of pleasure, connection, and autonomy associated with activity participation, regardless of the level of dependency or cognitive impairment (Vernooij-Dassen, 2007). In-depth conversational interviews with PwD (mild to moderate) find that involvement in various household chores, social engagements, and leisure activities fosters pleasure, a feeling of belonging in the world, and a sense of self-identity (Phinney et al., 2007). Harmer and Orrell (2008) provide insight into meaningful activity from the perspectives of PwDs and caregivers in a long-term care facility, including staff and family. Activities important to PwDs are maintaining past values, beliefs, and interests, addressing psychological needs, and being enjoyable. At the same time, staff and family believe meaningful activities for PwDs are activities that maintain physical abilities. Barriers to activity are identified as accessibility and motivation by residents and insufficient resources by staff and family caregivers (Harmer & Orrell, 2008; Roland & Chappell, 2015, pp 559-560).

**Table 1**

Dementia stages and level of impairment (Yousaf et al., 2020)

Dementia stages	Care needs	Impairment	Duration
Normal	None	No abnormalities	n/a
Mild dementia	Rather Independent	-Moderate memory impairment. -Moderate disorientation and difficulty with time. -Moderate judgment and problem-solving impairment. -Unable to perform independently in community affairs. -Slight home and hobbies impairment. -Need assistance in personal care.	2-4 years
Moderate dementia	Needs assistance with self-care, such as bathing and dressing	-Severe memory impairment. -Severe disorientation and difficulty with time. -Severe judgment and problem-solving impairment. -Unable to perform independently in community affairs. -Moderate home and hobbies impairment. -Need moderate assistance in personal care. -Severe memory impairment. -Oriented to a person only. -Unable to make judgments and problem-solving.	2-10 years
Severe dementia	Requires assistance 20 hours per day	-Unable to perform community affairs. -No significant function at home. -Need severe assistance in personal care.	1-3 years

## Multisensory Elements

In addition to meaningful activities, incorporating multisensory elements into the care of PwD has shown promising results, particularly in the context of olfactory stimulation. Within the objective of this study, multisensory refers to an experience, as defined Sánchez et al. (2013) in therapeutic settings, that does not focus on cognitive stimulation but encourages people to engage with sensory stimuli of their choice. Mixed findings have been reported on olfactory stimulation. For instance, a significant decrease in the frequency of observed agitation was reported following two months of scent exposure during activities in a daycare center (Moorman Li et al., 2017). These improvements were not found in other domains observed, like restlessness/wandering, anger, and anxiety. In contrast, a shorter-term study by and Glachet & El Haj (2020) demonstrated that during scent exposure, memories were more specific, more emotional, and retrieved faster than in an odor-free condition.

## Virtual Reality

Virtual reality offers different qualities that make it an attractive tool for creating multisensory experiences. First, it combines visual and auditory stimuli while providing opportunities for new developments, like the olfactory integration introduced in this study. Second, it offers the possibility of simulating real-world environments or creating new experiences. Lastly, the technology offers a relatively inexpensive contribution to costly post-diagnostic care interventions for PwD.

There has been growing interest in exploring the role of VR in dementia care by designing it for reminiscence therapy (Khirallah Abd El Fatah et al., 2023), cognitive training (Manera et al., 2016), engagement, apathy, and mood states (Moyle et al., 2018). For reminiscence therapy, Khirallah Abd El Fatah et al. (2023) VR and the VR Wander application were used to create familiar and nostalgic settings, which helped trigger personal memories and improve emotional well-being—for cognitive training, Manera et al. (2016) explored how VR training programs can improve functions such as memory, attention, and problem-solving skills in PwD by providing them with tailored and interactive cognitive challenges. Regarding engagement, Moyle et al. (2018) VR experiences can enhance mood, reduce feelings of apathy, and increase overall engagement by offering stimulating and enjoyable activities that captivate the interest of PwD.

## Warm Technology

Warm Technology is based on user-centered design and involves treating PwD with dignity and respect, developing mutual trust, and understanding their personal histories, contexts, and preferences. It is done by including co-design processes, where PwD are active participants in the technology design. This iterative engagement ensures that the technology meets users' needs and preferences. The design process should incorporate insights from semi-guided interviews and continuous feedback, creating a technology that is deeply aligned with the lived experiences of PwD. To develop Warm Technology, I must consider their lived experiences and perspectives as a starting point. Therefore, the process will focus on enhancing subjective well-being by incorporating the five cornerstones of Warm Technology, defined by IJsselsteijn, Tummars-Heemels, and Brankaert (2020, p. 40):

1. A focus on the possible, the potential, and the wealth of skills and experiences older individuals possess or may wish to develop.
2. Support for social and emotional needs, enhancing feel-good moments.
3. Familiar technology that is personally empowering, non-intimidating, and highly user-friendly, thus increasing self-reliance and self-efficacy.
4. Aesthetically pleasing, non-stigmatizing design solutions acknowledging the rich diversity in older age.
5. Personalized designs utilize and support the richness of natural human sensory and motor systems and acknowledge personal context and history.

## Summary

Dementia is a growing challenge in the Netherlands and globally, with an increasing number of people affected and a broad spectrum of issues associated with the condition. Post-diagnostic support is essential for enhancing well-being, encompassing a wide range of services and activities. Meaningful activities, which include household chores, recreation, and social involvement, are crucial for maintaining psychological well-being and fostering a sense of identity and belonging. Additionally, incorporating multisensory elements, particularly olfactory stimulation, has shown promise in improving specific aspects of memory and emotional response at PwD. The potential of Virtual Reality (VR) as a tool for dementia care reflects on reminiscence therapy, cognitive training, and enhancing engagement. While various initiatives

have provided valuable insights, there remains a limited body of research on combining multisensory elements with personalized design principles inspired by Warm Technology when designing VR experiences for PwD.

## 1.2 Thesis Focus

This study investigated the effect of a multisensory Virtual Reality (VR) experience for PwD by employing the design of Warm Technology as the approach. It is based on user-centered design and involves treating people with dignity and respect, developing mutual trust, and an understanding of personal histories, context, and preferences; this means including PwD as co-designers of the technology, using iterative engagement and ensuring there are many touchpoints with PwD (Brankaert et al., 2015).

In line with these principles, the VR prototype created during this study aimed to provide an engaging activity for the user. This activity incorporates aromas and visual elements derived from insights gathered through interviews about associations with visual and olfactory stimuli. The hypothesis is that combining visual and olfactory stimuli in VR can enhance the immersive experience for PwD. The following research question will guide this exploration:

*“How does the integration of olfactory stimuli elements in a Virtual Reality (VR) activity impact the experience for People with Dementia (PwD)?”*

## 1.3 Stakeholders

The successful completion of this research project was made possible through the collaboration and support of several key stakeholders: ECDT (Eindhoven Centre for Dementia and Technology), CWI (Centrum voor Wiskunde en Informatica), and Pleyade de Bolder and De Wever (care organizations in the Netherlands).

### *ECDT (Eindhoven Centre for Dementia Technology)*

ECDT provided an environment with experts, a network, and frequent involvement with the target group, which was essential for starting the project.



### *CWI (Centrum Wiskunde & Informatica)*

CWI played a significant role in the technical development of the VR prototype. The collaboration provided the necessary software and hardware support to create the olfactory stimuli with the VR concept.



### *Pleyade de Bolder*

Pleyade de Bolder, an elderly care organization, facilitated access to one participant and provided a supportive environment for conducting the first sessions.



### *De Wever*

Another critical care organization, De Wever, supported the project by providing three more participants. Their involvement included participants and close collaboration with the caregivers.





## 1.4 Design Process

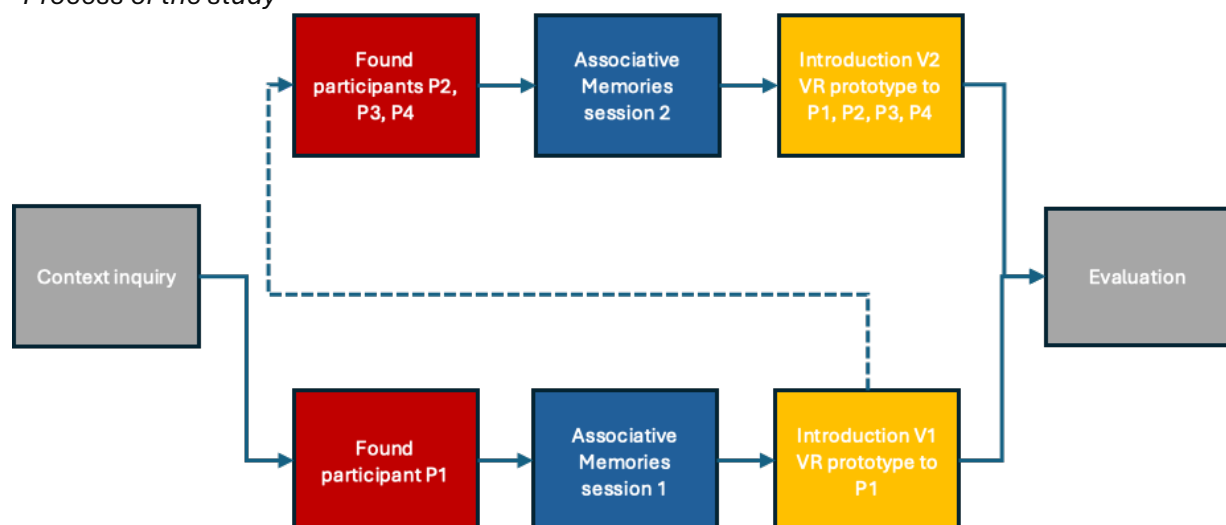
This study is considered formative research because it involves a variety of qualitative measures, such as transcripts and video. To explore the research question, the study aims to aid current and future stakeholders or researchers in VR intervention design for PwD and inform them of study procedures and difficulties. The study will also help facilitate relationships between researchers and target populations/organizations for future work.

The original study design aimed to involve multiple participants with dementia in an Associative Memories interview. Participants were prompted with images and smells during these to gather associations. The insights gained from these sessions were planned to be used in developing the first version of the olfactory VR prototype. This prototype would then be introduced to all participants, and their feedback would be used to iterate and refine it. Thus, the goal was to ensure that the prototype would be based on a broad range of experiences and reactions from multiple participants by having multiple touchpoints with the PwD.

However, the reliance on care organizations played a significant factor in this project. It did not result in deviation from the original study design, but it caused the V1 prototype to be developed only on insights from one participant. This offered the opportunity to familiarize with the planned procedures from beginning to end and develop a first-version prototype. As three more participants joined the study, more insights were acquired to develop the second prototype. The diagram in Figure 1 illustrates the overall process of the study. It began with a context inquiry, which included an informal olfactory session to understand how PwD react to certain aromas, alongside a literature review and networking activities to recruit participants. After recruiting the first participant (P1), an Associative Memories interview was conducted, which led to the development of the first olfactory VR prototype. After that, the prototype was introduced to P1. Subsequently, additional participants (P2, P3, P4) were recruited, and another round of Associative Memories workshop was conducted with these new participants. The insights gained from these sessions contributed to developing the second VR prototype. Finally, this iterated prototype was introduced to all participants (P1, P2, P3, P4), leading to the evaluation phase.

**Figure 1**

*Process of the study*



## 2. Contextual Inquiry

To explore the effect of olfactory stimuli and PwD's associations with smells, a participatory approach was used for an initial engagement with the target group during a workshop. First, an informal activity was organized (Figure 2) with a group of people with mild dementia at the community center “De Meerpaal”<sup>1</sup>, affiliated with KBO Kring Eindhoven<sup>2</sup>.

**Figure 2**

*Informal olfactory session at the Meerpaal.*



---

<sup>1</sup> <https://demeerpaal-eindhoven.nl/>

<sup>2</sup> <https://www.kbokringeindhoven.nl/>

## 2.1 – Olfactory Exploration at The Meerpaal

The workshop was added to the community center's program, which lasted three and a half hours. The program began with a nostalgic activity, during which participants were shown TV shows from the 1950s and 1960s (E.g., Swiebertje, The Thunderbolts, Bonanza, and Texas Rangers). Following this, four participants engaged in the olfactory exploration workshop, which lasted one hour.

A Salking Aroma diffuser<sup>3</sup> and six different essential oils (Figure 3) were used for this session. The diffuser transforms a fragrance oil and water mixture from the container into a fine mist while changing the color of the vintage-looking metal casing. The aim was to explore the reactions of PwD to different smells using essential oils and conversational probes. Due to the informal nature of the session, data was collected through observation. Four volunteers participated: Participant A had full olfactory function, Participant B had partial olfactory loss, and Participants C and D had lost their sense of smell entirely. The aromas used in this session as a starting point were floral-scented essential oils<sup>4</sup>.

A full report on the workshop can be found in Appendix A. In short, the session concluded that:

1. Olfactory abilities vary among PwD; not all participants have an intact sense of smell.
2. Scents evoked memories associated with specific locations.
3. Social connectivity was found in the shared storytelling among participants.
4. Regardless of their ability to smell, prompted familiar scents made PwD talk, relive, or share memories.

**Figure 3**

*The diffuser used during the olfactory session at the Meerpaal*



<sup>3</sup> (SALKING Aroma Diffuser, Metalen Ultrasonie Aromatherapie Diffuser Voor Etherische Oliën n.d.)

<sup>4</sup> (EUQEE Bloemen Etherische Oliën Set 6x10ml, Zuivere Etherische Olie Voor Diffuser, Lavendel, Roos, Ylang Ylang, Jasmijn, Geranium, Kamille : Amazon.Nl: Gezondheid & Persoonlijke Verzorging, n.d.)

# 3. Methods

This chapter outlines the methodologies involved in the design activities, which include ethical considerations, information about the participants, the development of VR and olfactory displays, semi-guided interviews, familiarization protocols for VR technology, and thematic analysis.

## 3.1 Ethical Considerations

*Information letter, Informed consent form, Toestemmingsformulier, ERB Approval, Data Processing Impact Assessment (DPIA).*

## 3.2 Participants

*Recruitment, Experts, Participants.*

## 3.3 Semi-guided Interviews

*Experts, Associative Memories Interview.*

## 3.4 Session setting

## 3.5 Familiarization with VR

*Approach to familiarize/introduce VR to participants.*

## 3.6 Thematic Analysis

*Excerpts, statement cards, and themes.*

### 3.1 Ethical Considerations

The study's ethical considerations were addressed thoroughly to ensure safe practice. An information letter (Appendix B) was used; this letter is a re-written informed consent form, modified to be more suitable for the elderly, and approved by the Ethical Review Committee at the TU/e. It provides the participants with details on the study's purpose, procedures, risks, benefits, and data protection measures. Informed consent (Appendix C) was obtained through a Toestemmingsformulier (Appendix D) from all participants or caregivers after explaining the study with the information letter. The preliminary study design received approval from the Ethical Review Board (ERB) (Appendix E), which evaluated the study design and participant protection measures. Finally, a Data Protection Impact Assessment (DPIA) (Appendix F) was conducted to ensure compliance with data protection laws and safeguard personal information through anonymization and secure storage.

### 3.2 Participants

Recruitment for this study involved four participants (Table 2) with severe stages of dementia, one partner, and three formal caregivers. The caregivers E1 and E2 worked at Archipel on a psychogeriatrics unit for dementia care and were contacted via email. They provided insights during an expert interview. E3 was the caregiver of participants P2, P3, and P4 at de Wever and was found through an affiliated researcher at ECDT. Participants P1, P2, P3, and P4 were identified by briefing their caregivers about the study design. Whereafter they selected participants they deemed suitable for the session activities.

**Table 2**

*Participants, the study phases in which they were included, stages of dementia, and organization.*

Participant	Study phase	Stage of Dementia	Organization
E1, E2	Expert Interview	n/a	Archipel
P1	- Associative Memories interview - Evaluation phase	Severe	Pleyade
S1 (P1 wife)	- Associative Memories interview - Evaluation phase	n/a	n/a
P2, P3, P4	- Associative Memories interview - Evaluation phase	Severe	De Wever
E3	- Associative memories interview - Evaluation phase	n/a	De Wever

### 3.3 Semi-Guided Interviews

Semi-guided interviews were conducted to learn from the experiences of healthcare workers and explore PwD's associations and memories related to visual and olfactory stimuli. This method was chosen due to its flexible structure, which prompts and encourages participants to seek insights when introducing a new line of knowledge (Adams, 2015). These interviews were held with experts before the experiments and with participants during the Associative Memories session.

#### *Experts*

An interview with two caregivers was conducted with the Archipel Care organization<sup>5</sup>. This organization could not collaborate for the study with participants, but they were willing to do an interview, providing the opportunity to gain insights into everyday care and firsthand perspectives. A semi-guided interview protocol (Appendix G) was prepared to learn more about the work routine, activities with clients, difficulties working with the clients, and the emotional support they want or need in their work lives.

#### *Associative Memories Interview*

An interview protocol (appendix H) divided the session into three sections; each section addressed a specific topic contributing to the session's goal. The first section, "Warming up," aimed at getting acquainted with the participant and creating a comfortable and trusting environment, e.g., the researcher brought sweets and held light conversations about anything the participant wanted to share. The warming-up was concluded by presenting the information letter and signing a consent form with the caregiver, family member, or partner present. The data collection started with the second section, "Visuals and Smells," which delved into the participant's associations, e.g., memories and emotions, towards a set of images (Figure 4) and smells brought by the researcher. These images were used to find associative memories in ongoing research at ECDT conducted by Rucha Khot. Therefore, they were employed for the same purpose in this research. The images are coded as A, B, C, D, E, and F for reference. After showing the visuals, different smells were introduced. Additional essential oils like Bakery, e.g. (SugarCookie), Nature<sup>6</sup> (e.g., pine tree), or Coffee<sup>7</sup> were acquired to use as prompts. The third section focused on informally finalizing the session, building trust, and making a follow-up appointment.

**Figure 4**  
*Images used during the Associative Memories interview.*



<sup>5</sup> <https://www.archipelzorggroep.nl/>

<sup>6</sup> <https://www.amazon.nl/SALUBRITO-natuurlijke-etherische-berglucht-cadeauset/dp/B0CP5MVG5>

<sup>7</sup> <https://www.amazon.nl/Aromatherapie-etherische-Diffuser-luchtbevochtiger-aromatherapie/dp/B07SGQ9CHB?th=1>



### 3.4 Session Setting

The VR sessions with Participant P1 were conducted in his living room with S1 present (Figure 5). For participants P2, P3, and P4, the sessions took place in a facility meeting room, with caregiver E3 present (Figure 6).

**Figure 5**

*VR session setting for P1.*



**Figure 6**

*VR session setting for P2, P3, and P4.*



### 3.5 Familiarization with VR

To ensure participants' comfort during VR sessions, I employed the following approach to familiarizing them with the VR headset: See Appendix I for the VR sessions protocol.

#### *1. General Introduction*

Each session started with a warm-up activity. This could involve sharing personal items, small talk, or reviewing previous meetings. Participants learned about VR by comparing it to familiar experiences, like "watching TV through big glasses." Another critical aspect of the introduction was to re-state the information letter and ask for consent.

#### *2. Scene Introduction*

Participants were briefed on the specific VR scene they would experience (e.g., a chapel in Tilburg). However, to elicit candid and genuine responses to the smells, participants needed to be informed about the olfactory aspect of the scene.

#### *3. Customization based on participant readiness*

Before putting on the VR headset, I assessed each participant's readiness using the caregiver's judgment. If a participant was not ready to use the headset, I held it before them instead of fixing it on their heads. We aimed to ensure the participants felt comfortable and engaged.

## 3.6 Thematic Analysis

A thematic analysis approach was employed, as outlined in the Convivial Toolbox by Sanders & Stappers., (2012), to analyze the data collected during this study. Thematic Analysis helps identify, analyze, and report patterns (themes) within data, providing rich detail and interpretation (Braun & Clarke, 2006). This method transformed transcripts into insights in two steps: interpretation and pattern finding (Figure 7). Statement cards are used for interpretation and comprise a quote, paraphrase, and ID. After processing raw data into statement cards, they were clustered to find patterns or themes. This approach allowed for a systematic examination of the data, revealing underlying themes and patterns that contributed to a deep understanding of the participants' personhood.

**Figure 7**

*Interesting excerpts from the interview transcripts (left) were turned into statement cards (middle) and clustered themes(right). See appendix J for a bigger illustration.*





# 4. *Interviews*

Expert interviews and Associative Memories sessions were conducted to lay the groundwork for the prototype's design and development. The Expert Interviews provided insights into the importance of familiarity for clients, olfactory stimuli, physical activities, and emotional support for caregivers in care homes. The interviews from the Associative Memories workshop revealed participants' associations with prompts, which were used to create participant profiles. Chapter Five will use these profiles to substantiate the Design and Development.

## 4.1 Expert Interviews

## 4.2 Associative Memories Interview

## 4.1 Expert Interview

The caregivers from Archipel highlighted the importance of creating familiarity in clients' every day activities by understanding and incorporating their personal preferences, history, and perspectives. E2 emphasized, "Music can reach these people. Look, people that are in a late stage of dementia, like this one lady here that can't talk anymore, will start singing and swinging along if you put on an old song from their time." This illustrates the effectiveness of music, particularly older music from the clients' past. E2 added, "These people go back in time, and you try to move there with them. So, we let go of the present music and entertainment and put on whatever they would put on," demonstrating the effort to connect with clients by aligning activities with their remembered preferences.

The use of smells is limited to the living room and bedroom, particularly for clients nearing the end of life. It primarily involves lavender, which is known for its calming properties. E2 explained, "You know, lavender is known to be calming; what you see is that we put diffusers in clients' rooms in the last phase of their lives." The caregivers stated that smells do not evoke memories but help recognize everyday scents from the home, garden, or kitchen. E1 mentioned, "It is not so much that specific smells evoke specific memories, it is that they recognize the smells from everyday stuff within their house, garden or kitchen," which aligns with their focus on recognizability when providing care.

Physical activities are adapted to individual capabilities, often involving seated exercises due to mobility and balance issues. E1 noted, "The physical activities do not require standing up; they often stay seated because of mobility and balance issues," highlighting the tailored approach to physical engagement. VR could be a valuable tool for moving clients virtually without physical relocation. E2 suggested, "That could be the added value of VR, that you can move people to a place without physically relocating them, showing them there is more than just this home, which otherwise costs a lot of time and effort."

Lastly, caregivers emphasized the need for emotional support due to the challenging work environment. E2 shared, "Work for us is not just work. We work with people, and we are people too. Our clients are not the easiest; we deal with aggression, sexual impulsivity, decease. We deal with a lot," highlighting the demanding nature of their roles. They also underscored the importance of colleague support in dealing with these challenges, stating, "We as professionals are trained for this, and we also support each other a lot because we know what this work entails."

### *Summary*

The caregivers from Archipel highlighted the importance of creating familiarity in clients' every day activities by understanding and incorporating their personal preferences, history, and perspectives. The use of smells is limited to the living room and bedroom, particularly for clients nearing the end of life. It primarily involves lavender, which is known for its calming properties. Caregivers stated that smells do not evoke memories but help recognize everyday scents from the home, garden, or kitchen; this aligns with their focus on recognizability when providing care. Physical activities are adapted to individual capabilities, often involving seated exercises due to mobility and balance issues. VR could be a valuable tool for moving clients virtually without physical relocation. Lastly, caregivers emphasized the need for emotional support due to the challenging work environment, highlighting the importance of colleague support in dealing with aggression, sexual impulsivity, and death. For an extended interview with more transcripts and insights, See Appendix K.

## 4.2 Associative Memories Interviews

In this section, profiles of each participant derived from the Associative Memories sessions will be presented. They are labeled as participant profiles and not personas or archetypes because, unlike personas or archetypes, these profiles are not meant to represent generalized user types. Personas, as defined by Williams et al. (2014), represent fictional characters based on user research to capture the needs and behaviors of broader user groups, while archetypes describe universal behavior patterns seen across different cultures. Instead, the participant profiles focus on personhood. The purpose of sharing these personal portraits is to emphasize each participant's personality and establish a connection. This approach aims to make the study more personal and relatable, encouraging a deeper understanding and appreciation of the individuals behind the data. The profiles will be presented with a short ID and interpretation. For the responses to correlated prompts used to create these profiles, see Appendix L.

### May Month

The Associative Memories Interviews took place in May, which is significant for the second prototype developed in this study. May is the month dedicated to Mary in the Catholic Church, and the entire month has been set aside to honor her. During my visits to De Wever, it became evident that the 'month of Mary' is central to the caregivers, as they organize field trips to the Hasseltse Chapel (a well-known Chapel in this area) and use it as an opportunity to engage the clients in a familiar activity and environment.

The Hasseltse Chapel is not part of the participants' personhood and is, therefore, not included in their profiles. However, it is essential to note that P2, P3, and P4 are all connected to this place through memories of visiting with their own families when they were younger. Since P1 did not live in Tilburg, he was unfamiliar with the Chapel, but as P1's profile will elaborate, he was very fond of churches. Because this Catholic chapel overlapped with all participants, it was a critical factor in developing the second prototype.

## Profile P1

P1 is an individual who denies having dementia but is aware of his forgetfulness and relies on his wife to remember their shared experiences. This is evident from P1 referring to S1 when he does not remember a place or memory, e.g., "Yes, you know better; it is good you are here." They shared a passion for travel and exploration, having visited many destinations worldwide. S1 elaborated on this, stating, "We wanted to see the world and travel more; that is what we decided when we were 50" and "he (P1) did not like many hobbies close to home, he preferred traveling; for example, if the house needed painting, he would hire someone to do it."

While S1 talked mostly about scenery and views, P1 emphasized the sports being much fun. For example, "We went on this holiday (winter skiing) for the sport." S1 adds, "Also for the views," to which P1 responds, "That is a bonus." P1 also shared, "Golfing on itself is also a nice sport." As a response to S1 saying, "I still remember standing under olive trees at this Algarve golf course; it felt like paradise."

Another thing that P1 always enjoyed while traveling or biking in The Netherlands was visiting churches and cathedrals. He said jokingly, "Yes, I am a 'church-o-phile'; I find it beautiful." This personal interest was not shared with his kids, who often sat in the car or stayed behind when visiting these holy Christian places. P1 elaborated on this by saying, "No, they were not that religious."

During the session, P1 used humor and a light-hearted, sometimes self-mocking approach to comfort or help his wife cope with challenging situations. For example, when S1 said she would still like to golf, but her knee was not working, P1 responded, "I also stopped playing. Why is that? Because I am confused, or just lazy?" and "Yes, we were very good at golfing, haha." He used sarcasm to lighten the mood.

### Interpretation

The themes reveal that P1 is a person who values family activities, travel, and cultural experiences, with churches and cathedrals being a particular interest. Despite his denial of dementia, he is aware of his forgetfulness and relies on his wife, S1, to remember their shared experiences. P1's humor and light-hearted approach help him and S1 cope with the challenges of dementia. Throughout the interview, it is clear that P1 finds much comfort in S1's support when he gets lost in his thoughts and forgets certain things.

**Figure 8**  
*P1's portrait*



## Profile P2

P2 is deeply connected to her family and nature, which is evident from the memories prompted by images and smells that revolve primarily around her family and being outdoors. For instance, P2 would elaborate; “we would sit in the grass, and Dad and Mom would bring all the stuff, and we would sit on a towel and have a picnic.” Her affinity with nature can be further supported by her saying, “The cows could be roaming around, too.” These moments that involve nature and family are what P2 would describe as ideal: “As a farmer's family, you eat outside and work outside. Everything is outside; it is ideal”.

In addition, P2 can be described as a social person, which is evident from how her definition of the ideal life shared with family, friends, or neighbors: “We did not go pick nicking with family only; friends and neighbors joined too.” The farmers' lifestyle also meant that everybody had their responsibilities. P2 elaborates, “When we finished picnicking, dad would clean up, and we would start working,” and “Everybody had their responsibility; we were not asked to work; it was just like that.” This lifestyle created a strong bond between P2 and her siblings, which is reflected in the sentimental value placed on communication through letters when she was at boarding school; P2 continues saying she would even recognize the different handwriting: “All of them had different handwriting, one cursive, one curly, one straight. When a letter would arrive, you would immediately know from who just from the handwriting”.

### Interpretation

The themes reveal that P2 values family and nature, which are integral to her identity and life experiences. Her memories are often tied to specific locations and events, indicating a strong sense of place and tradition. The sentimental value placed on communication through letters and modern methods like video chat underscores her desire to stay connected with loved ones.

**Figure 9**

*P2's portrait*



## Profile P3

P3 has a passion for trading and collecting goods; this holds a significant part of his identity that became evident when he enthusiastically shared certain artifacts in his room, mainly relics and Delfts Blauw ceramics. This is a specific things that hold his interest; when asked whether he traded other goods like post stamps, he would answer, “No, no, I did not have a lot of those,”

P3's strong work ethic is evident when he answered whether he used to bike a lot by saying, “No, trading took all my time. I had a storage unit under an apartment for this. Sometimes, I would work 60 hours a week to have longer weekends for trading.” This passion became a family activity, involving his son and daughter in the markets and his wife cleaning the goods. P3 described this as quality time: “Yes, I went to trading fairs and stored all the goods at home. My wife never joined the fairs but cleaned and maintained the goods. My son would frequently come along, as would my daughter.” When he stopped trading, his son played a particularly significant role by gifting P3 a medal. P3 proudly showcases this memento, which his son gave him during the onset of his dementia, as a symbol of his son’s involvement in taking care of him. Despite the circumstances, P3 remembers receiving the trophy as a proud moment, not as the end of his passion.

Besides trading, P3 is often reminded of Austria, a favorite holiday destination. He elaborates, “Because I worked different shifts, I was saving free days; that is how I managed to see Austria every season.” This excerpt includes a statement about hard work, affirming his work ethic. In response to the running children visual, P3 also recollects his children joining Austria when they were younger, stating, “This reminds me of my own children when they were younger, they would join to Austria, we had beautiful forests and nature.”

### Interpretation

The themes reveal that P3 values hard work and family. However, his passion for trading and collecting goods was shown as a significant part of his identity. P3's strong work ethic is evident in the long hours he dedicated to his job and trading activities, which gave him a sense of pride and accomplishment.

**Figure 10**  
*P3's portrait*



## Profile P4

P4 is an active individual with a lifelong passion for gymnastics. She used to be a physical exercise (PE) teacher and loved doing this, which showed when she elaborated, “I really liked it; we would do a lot of different sports, and teaching kids was great; they are the future.” She continues, emphasizing how active she is despite her age, as she stated, “I might be 80, but tomorrow at 10 AM, I will be doing gymnastics already.” Regardless of her abilities, she takes pride in caring for herself as a gymnast, stating, “I still train; I have to keep up my body.” One of the memories involved in her active lifestyle was coaching. P4 used to coach her grandson and elaborated on this: “I give classes and go to competitions with my grandson,” and “he is in the Olympic direction.

Sports also provided P4 with a strong connection to nature and camping, with many memories of camping trips with the gymnastics club. She elaborates: “I went on many holidays with the kids and turn union. We would go to the Veluwe, or with the kids, we would go camping at Beekse Bergen,” and “There were many forests there.”

P4 also had a notable playful character; while smiling and laughing, she talked about the attraction fairs when prompted with the Christmas visual: “The attraction fair! Ha Ha. I am a fan of this. We always go there, the fair in Tilburg,” “I have grandchildren and grand-grandchildren, I will take them with me, guaranteed,” and “bumper cars are my favorite.” These excerpts refer to one of the biggest attraction fairs in the Netherlands, which takes place in Tilburg, one that she enjoyed a lot in the past.

### Interpretation

The themes reveal that P4 led a highly active life centered around sports and gymnastics. This connection to sports also strongly linked her to nature, mainly through fond memories of camping with children from the gymnastics club. Her identity is best described by her involvement in gymnastics and her relationship with children, both sources of happy memories. The interview also shows how age and dementia have impacted her sense of self and well-being, given that her active lifestyle is central to her identity.

**Figure 11**  
*P4's portrait*



# 5. *Design and Development*

This section will start by explaining how olfactory stimuli were incorporated into VR. After that, it will elaborate on the two prototypes created using insights from the Associative Memories workshop.

- 5.1                      Integration of Olfactory Stimuli in VR  
*Open-source olfactory display (Nebula), Unity, scene-configuration*
- 5.2                      First Prototype Realization
- 5.3                      Second Prototype Realization

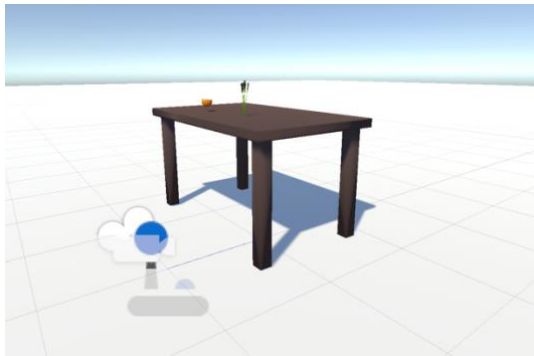


## 5.1 Integration Olfactory Stimuli in VR

To incorporate olfactory stimuli into the VR experiences, an open-source solution called The Nebula Olfactory Display was implemented and developed D'Andrea et al. (2022). Several modifications were made to the assets provided by the authors<sup>8</sup> to tailor the olfactory experience to the experimental needs of this study. First, the table and floor were removed from the NebulaSampleScene (Figure 12). Then, the orange and lavender objects that served as the source for diffusing scents were scaled down by a factor of 0.001 to ensure they would not be visually detected. The following adjustment was made to the NebulaManager script, where the playerHeadRadius variable was increased to ensure a bigger sphere collider. With these adjustments, Nebula could release two scents into the scene using keyframes that make the orange and lavender objects enter the scene at predetermined time intervals (Figure 13). The scene's visuals were added using 4K 360 videos applied as a Skybox in Unity version 2021.3.37f1.

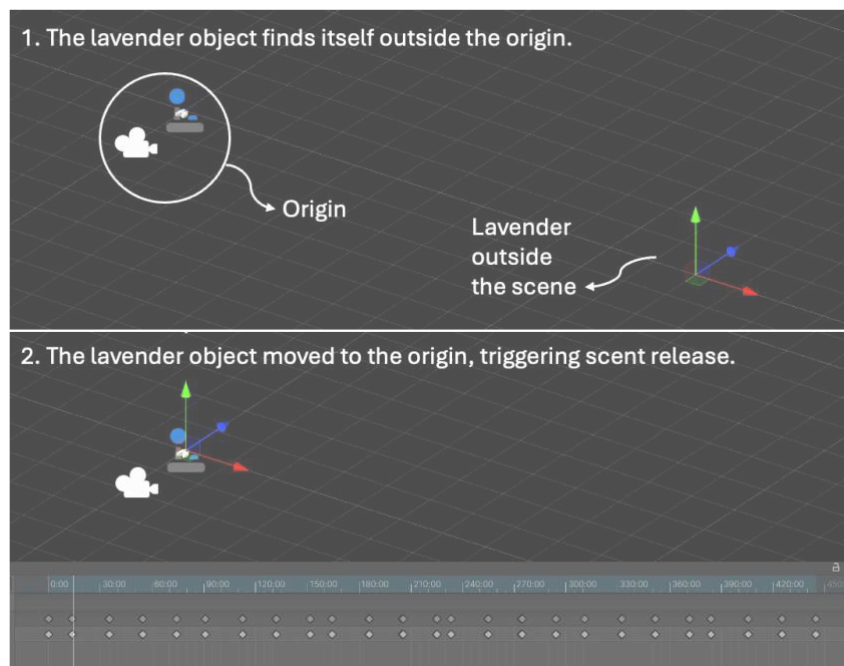
**Figure 12**

*NebulaSampleScene that was used to create the prototypes.*



**Figure 13**

*Adjustments made in Unity to control scent diffusion.*



<sup>8</sup> <https://github.com/liris-xr/Nebula-Core/tree/master>

## 5.2 First Prototype Realization

As explained in the study design, the prototype went through one iteration, resulting in two versions. The first version (V1) was created and tested after conducting P1's Associative Memories Interview. The second prototype (V2) was created after P2, P3, and P4 joined the study and participated in the Associative Memories Interviews. This section will elaborate on the motivations behind the design decisions of each scene.

### Scene

The main objective of the first VR olfactory prototype was to assess the effect of olfactory stimuli within a VR environment and gather feedback on user reactions and interactions. To make the scene, the following actionable insights were identified from P1's Associative Memories interview.

#### Insights

1. The participants' presence, stage of dementia, and overall personality can be described as wheelchair-bound, with short-term memory difficulties, curious, and talkative.
2. P1 expressed intense enjoyment of the sports they practiced abroad and on holidays. According to his wife, the views during these sports were beautiful.
3. Only one scent, coffee, was used as a prompt. This left olfactory stimuli relatively unexplored.

#### Actions

1. Considering P1's overall functioning, the goal was to present a calming and static scene to avoid disorientation and implement a low entry barrier.
2. Despite the participants fondly reminiscing about playing sports like biking, golfing, or skiing, the decision was made to go with a static nature scene<sup>9</sup> (Figure 14). This cautious approach ensured a gentle and non-disorienting introduction to VR, considering the participants' unfamiliarity with the technology.
3. The scent used in this scene needed to fit the scene's context. Therefore, a pine tree scent was chosen from the Nature Essential Oils set.

**Figure 14**

*The nature scene used in the V1 prototype.*



---

<sup>9</sup> <https://www.youtube.com/watch?v=yormE7aOvf4>

### *Scent diffusion*

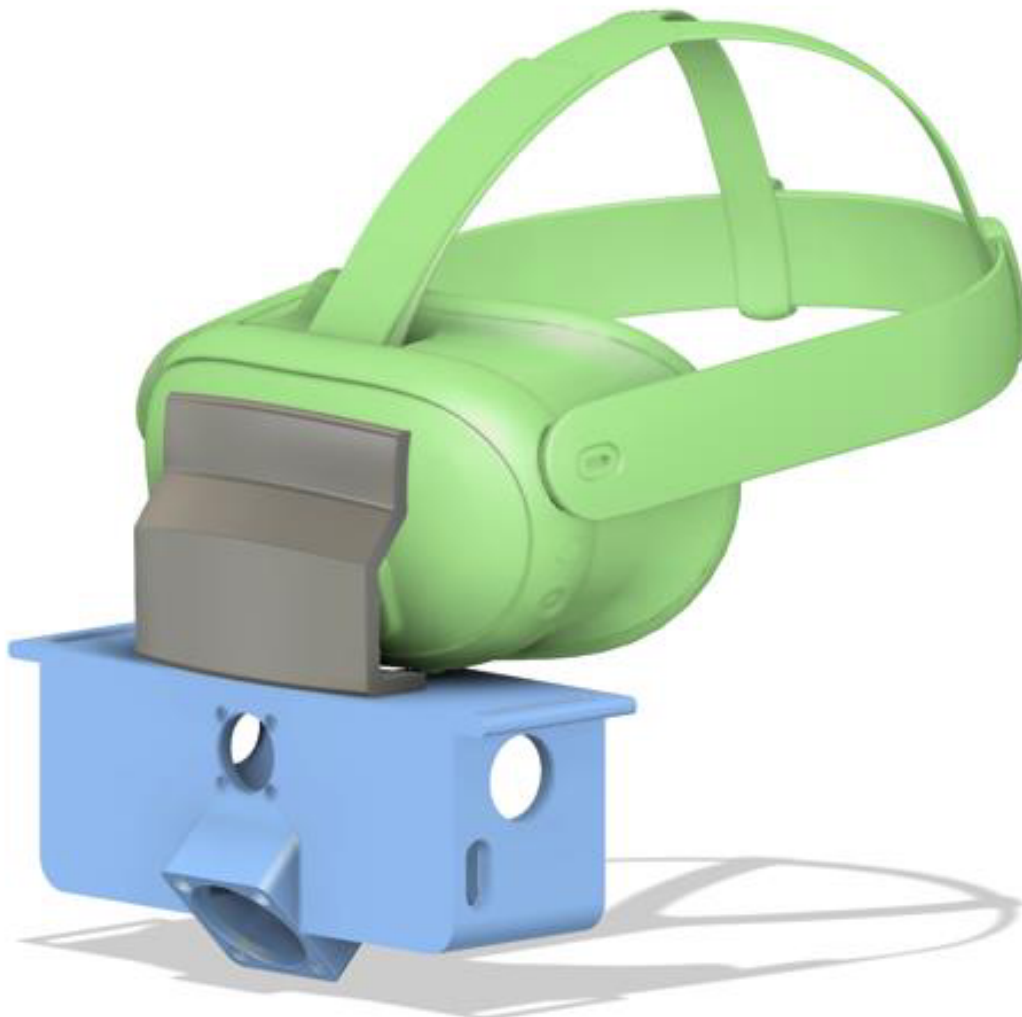
The nature scene is supported by an essential oil that represents the aroma of pine trees. This essential oil was chosen to match the context of the scene. The release of the scent was animated to diffuse for 30-second intervals, with a 5-second pause after each interval.

### *Nebula mounting*

The integration of Nebula needed a new mount (Figure 15) to fit the Meta Quest 3<sup>10</sup>, which is thinner than the Meta Quest 2<sup>11</sup>. This made mounting with the straps—the original method from the Nebula authors—impossible. Therefore, a mount was designed in Fusion360<sup>12</sup> that follows the curved surface of the headset to allow proper fixing with double-sided tape. This mount was printed on a Creality Ender 5 Plus, using a 0.4mm nozzle and PLA filament.

**Figure 15**

*V1 mount made to fixate Nebula onto the Quest 3.*



---

<sup>10</sup> <https://www.meta.com/nl/quest/quest-3/>

<sup>11</sup> <https://www.meta.com/nl/quest/products/quest-2/>

<sup>12</sup> <https://www.autodesk.com/products/fusion-360/personal>

## 5.3 Second prototype realization

### *Scene*

The second virtual reality (VR) scene was created for and presented to all participants. This scene aimed to introduce visuals and olfactory stimuli relevant to all participants, whether because of their familiarity with the chapel or interest in it. The following actionable insights for creating the scene were identified from the Associative Memories interviews with participants P1, P2, P3, and P4.

### *Insights*

1. P1, a Catholic, expressed a strong interest in churches and cathedrals, which S1 confirmed. Additionally, P2, P3, and P4 shared fond memories of visiting the Hasseltse Chapel as children or with their families in May, showing a strong positive connection to the location.
2. In May, the Hasseltse Chapel sells sweets outside. P2, P3, and P4 all shared stories about these sweets.

### *Actions*

1. Considering P1's affinity with churches and the chapel's historical connection with P2, P3, and P4, I decided the scene would take place at the Hasseltse Chapel in Tilburg (Figure 16). For this prototype, a 360-degree video was recorded at the chapel.
2. To match the olfactory stimuli with the scene and participant recollections of the location, a new scent was used that had not previously been introduced to the participants. This scent was Frankincense<sup>13</sup>, a gum resin commonly burned in Catholic churches. It can be described as an aromatic cloud that feels almost sacred.

**Figure 16**

*The chapel scene used in the V2 prototype.*



### *Scent Diffusion*

Similarly to the nature scene, the scent diffusion was timed by animating the orange objects towards and away from the origin. The release of frankincense was animated to diffuse for 30-second intervals with a 5-second pause after each interval.

---

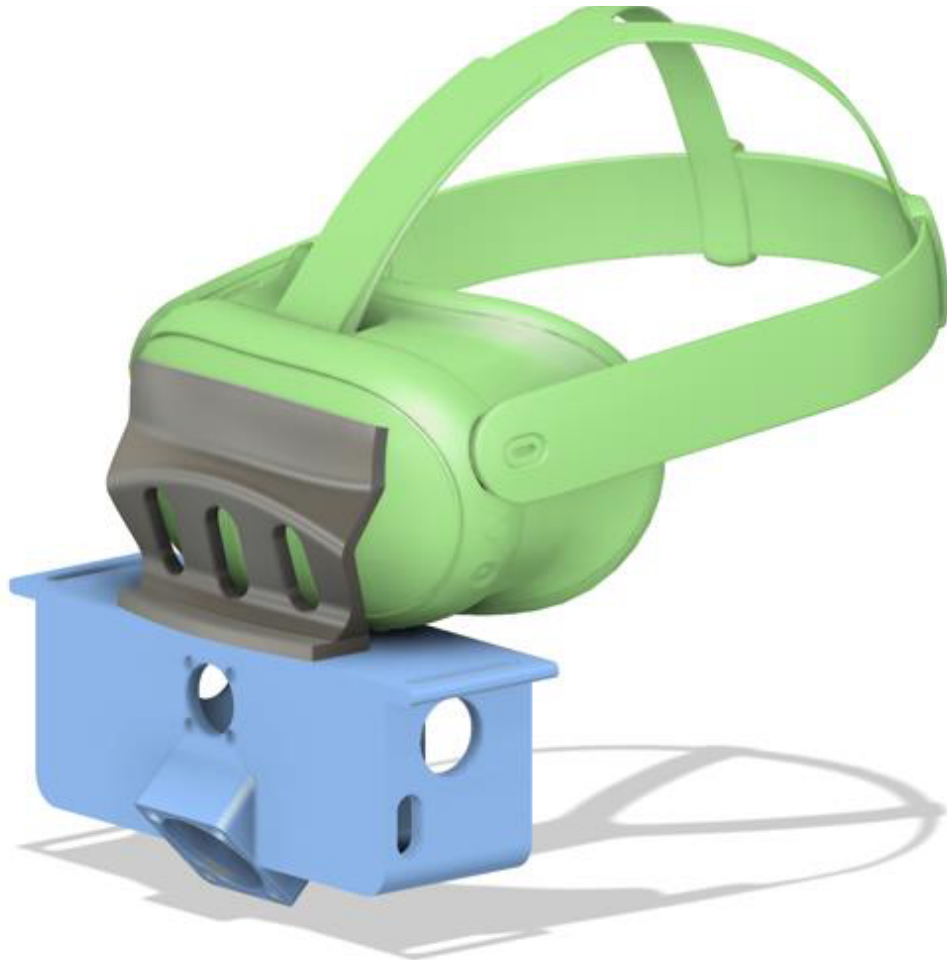
<sup>13</sup> <https://www.amazon.nl/Greenwood-Essential-Frankincense-therapeutische-gedestilleerd/dp/B083QK8N1F?th=1>

### *Nebula Mount*

To improve on the previous mount, the shape was changed to expose the Quest's sensors. This proved necessary, as the V1 mount covered some sensors and prevented the controls from working correctly. The V2 mount (Figure 17) was printed on a Creality Ender 5 Plus, using a 0.4mm nozzle and PLA filament.

**Figure 17**

*V2 mount made to fixate Nebula onto the Quest 3.*



# 6. *Results*

This chapter will first introduce a Conceptual Framework that will help conclude the results and support the Discussion and Recommendations in Chapter 7. It will then evaluate the prototypes based on observed experiences. Lastly, this chapter will conclude with insights that lead into the Discussion and Recommendations chapter.

## 6.1 Conceptual Framework

## 6.2 Prototype Evaluation

*Results Prototype V1, Results Prototype V2*

## 6.3 Conclusions

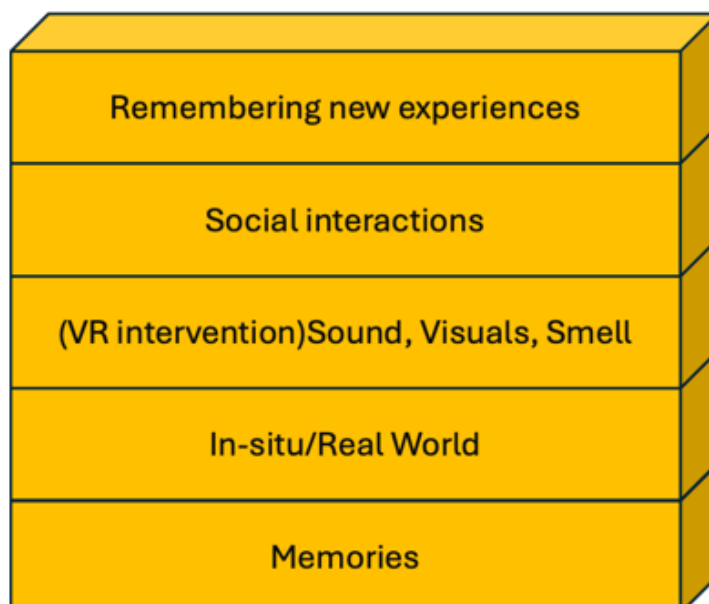
## 6.1 Conceptual Framework

To understand the results, I aim to introduce a conceptual framework (Figure 18) that categorizes the participants' reactions. This framework places the observed experiences into five layers, each presenting the participants' lived reality. In the memory layer, participants experience their memory as a primary reality and are less receptive to external stimuli; they will divert into memories instead. In the in-situ layer, participants perceive the real world as their reality and interact with its according stimuli; in the VR-intervention layer, participants can experience the virtual intervention as their reality and show immersion; and in the social interaction layer, participants will maintain a social connection with someone they trust to stay comfortable and make sense of the stimuli. The participants' experience lies in the layer of reality they either choose to be in, or involuntary find themselves.

## 6.2 Prototype Evaluation

This section will evaluate the participants' experience with VR prototypes and summarize the key observations and findings. There were two constants across all sessions. Firstly, the olfactory aspect of the scene was deliberately not explained to ensure a candid and unbiased reaction. Secondly, all participants were observed for initial reactions and provided with reassurance when needed to ensure they understood and felt in control of the experience. Given the differences in character and cognitive abilities among participants, the experiences with the VR prototypes varied significantly. Therefore, the findings will be substantiated with an overview of participant-relevant insights. For detailed transcriptions of each session that include the Start of the VR activity, participants' reactions and interactions, Post-VR scene interview, and a conclusion, see Appendix M. Each session is documented by following code [session no]-[prototype no]-[participant no], e.g., session 1-V1-P1.

**Figure 18**  
*Conceptual framework.*





## Results Prototype V1

### *Immersion*

The first thing P1 described when the headset mounted was, “I see rocks in front of me, and over there too, and I see water, everywhere water.” When asked what he saw if he looked around, he would describe the surroundings again. When I asked whether he found it fun, P1 answered, “Yes,” while sitting relatively static and unengaged, not exploring independently. This continued until the two-minute mark when P1 was asked if he felt comfortable and not nervous with the VR glasses; a six-second pause followed this, whereafter he answered, “Ah, I see pretty nature now.” This was accompanied by more looking around.

### *Reaction Olfactory Stimuli*

Due to a technical problem with Nebula, the scene was offered without the olfactory display. However, the prototype's olfactory aspect was introduced by infusing cotton with a pine tree essential oil and water mixture. When held under the headset and P1's nose, his reaction to the scent can be described as brief and surprised. He commented, “Yes, but now it is gone.”

### *Emotional Responses and Comfort*

P1 expressed enjoyment during the VR session, as evidenced by his positive responses to questions about the experience. When asked if he thought the VR session was fun, P1 responded with “Yes” and described the nature scene as “Pretty.” However, moments of confusion and fatigue were also noted, with P1 asking at the end of the session, “I don't know, wh- what should I do?” This was the final comment that made me remove the headset.

### *Tiredness*

After the headset was removed, P1 asked for coffee, sounding tired. “Do we have more coffee?” Before making the coffee, S1 said, “You know what it is? He becomes exhausted.” To which P1 said, “Yes, yes,” and “I could fall asleep.” S1 explained how this is common for P1: “He gets tired quickly; it happens after eating or going to the toilet.”



## Results Prototype V2

This second prototype was evaluated with multiple participants, and different reactions were observed. Therefore, I will start with the differences in immersion for each participant, followed by the behavioral themes observed across all sessions. I will conclude the results by categorizing the experiences within the layered framework to support the Discussion and Recommendations.

### *Immersion Differences – P1, P2, P3, P4*

P1's first reaction to the headset mounted was to describe the environment: "I can see chairs" and "looks like an altar." As the session progressed, he experienced fluctuations between layers by socially connecting with his wife in the real world and showing immersion in the virtual chapel scene. His social connection showed when P1 was asked if he could smell the space, and before P1 could answer, S1 suggested, "Incense?". P1 responded, "Yes, yes, incense," – conforming to his wife. His immersion in VR was observed when I wanted to point out, "In the middle, you can see-" and he responded before I could finish with, "Maria statue, with a Jesus child." He added, "It is a pretty chapel."

P2 exhibited a high level of immersion in VR throughout the experience. She accurately identified the scene, stating, "I am in a chapel; I believe it is the Hasseltse chapel, our little chapel," and "It is like I am standing here in the chapel." Additionally, she expressed her desire to touch the statue of Maria. She commented on the realism of the VR experience, saying, "You can grab it, looking around there is no end to it, with the Maria statue on the side that is waiting for you, and when you turn she is still there, it is beautiful."

P3's first reaction when the headset was fixed was, "Yes, now I can see the Hasseltse chapel." I asked if he found it a nice view, and P3 answered, "Yes, it is pretty; this is what I see when I visit." When I asked him if he could locate the sounds, P3 said, "No, I cannot, my ears-" and he was interrupted by the church bell in the scene; P3 continued, "Here now, that is the sound of the clock," he then immediately went on to talk about his work "I also worked in the textile industry...". As I noticed his deviation from his memories, I asked him if he was done with the little chapel, to which he said, "Yes, I finished looking."

P4's first reaction to the VR headset can be described as confused. Based on E3's judgment, I did not mount the headset to maintain P4's comfort level. Instead, I kept holding it in front and asked if she could recognize the place. P4 answered with "Yes, uhm," followed by three seconds of thinking and "I see the organ of the chapel; I see it from the inside." I then asked her what the organ reminded her of, to which P4 answered, "We always went in May. Our mom and me, we were with three girls, and yes, I was the oldest, I am the oldest, all three are still alive, so I am from '44, and I turned 80 years old last week."

### ***Behavioral Themes - Olfactory absence***

Initially, P1 confirmed the presence of a scent when his wife suggested the smell of church or incense, saying, “Yes, yes, incense.” However, he could not place the smell accurately as the session progressed. When I asked him again if he could smell anything, he commented, “Not really.” P4 also did not exhibit an olfactory response. When asked about the smell, she replied, “Well, at the moment, not something like that, no.”

### ***Behavioral Themes - Visual and olfactory alignment***

Both P2 and P3 demonstrated a notable alignment between visual and olfactory stimuli, effectively smelling what they were seeing. P2 remarked on the musty smell, saying, “A musty smell, yes, like it has been closed for a while,” which aligned with the organ she was looking at. Similarly, P3 identified the smell of candles, stating, “the scent of the candles, that smell,” which corresponded to the candles he was looking at.

### ***Behavioral Themes - Religious Connections***

P1 expressed a religious connection to the chapel when asked what feeling this chapel gave him; it made him look around and answer, “A holy place.” In addition, I asked him what emotions he felt, to which he responded, “Maria Worship.” When I asked him if he enjoys spending time in places like this, he said “yes” and continued elaborating, “Yes, we grew up with this; during lower school, we would go every week; regarding this, our religion changed a lot” I asked, “You visit the church less now?” and P1 answered “yes, way less,” I responded with “but you still find it important?”, whereafter P1 said “Yes.” When asked if he would like to visit, P1 answered, “Yes, of course; where is it?” and “Oh, that is far.”

### ***Behavioral Themes – Emotional connections***

Emotional connections were observed in different ways by the participants. P2 mentioned “Our little chapel” when she entered the scene. P3 mentioned family during the session; “I used to go to the chapel more often, but now I do not have a car. If I want to go, I need to go with someone. I can use public transport, but all the kids have cars, so they could come with me and visit the chapel.” Moreover, P4 recalled her memories that involved family, as mentioned in the *immersion differences between participants* section.

### ***Behavioral Themes – Enjoyment of immersion***

During the session, P2 reacted without being prompted, like “You see a lot, wow,” while holding her hands. She continued, “Maria too, yes, yes, really fun, even Antonius, no wait Maria,” and, “It is like I am standing here in the chapel, and there is the area where you can go inside and outside.” When I asked P3 if he enjoyed the scene, he responded, “Yes, yes, I am just looking; it is a nice experience.” Another form of enjoyment can be noted by P1, who answered “Yes” when I asked whether he enjoys being in places like this.

### ***Behavioral Themes – Post-VR Recollections***

P1’s session ended because he needed to go to the toilet. Once he got back, ten minutes of small talk ensued. Then, P1 looked at the headset and said, “That thing there, I have watched it, right?”. I said, “Yes, did you like it?” and P1 answered, “Yes, yes, I believe so.” P1 seemed not to remember what he watched with the headset, so I elaborated, “It was a small chapel”. This made P1 say, “Oh yes, yes, I am crazy about chapels.” As I mentioned the Maria statue, P1 smiled a little bit and said, “Yes, yes, I like that stuff.” I asked him why he likes chapels, and P1 answered, “Because I am Catholic; that is how we grew up, with chapels left and right. We would go there on the bicycle; that is where we would see Maria statues”. I asked with whom he would bike to the chapels, to which P1 responded, “With S1, we would bike there; in Vethuizen,

we would bike there; that is what we liked doing. We were religious catholic people; this was part of it”.

One week after the VR experiments, E3 conducted a follow-up with P2, P3, and P4 to gather feedback on their respective sessions. Both P3 and P4 did not recollect anything about the sessions. However, P2 shared that she talked about the session with her son and shared how she could not reach the Maria statue while wearing the glasses. She also remembered the musty smell of the organ.

## 6.3 Conclusions

### Conclusion Prototype V1

P1's initial engagement with the scene can be described as fluctuating between immersion in VR and maintaining interactions with S1 and me. It is noteworthy that he was less receptive to my questions when he was immersed. Olfactory stimuli were provided on cotton, and the scent not sustaining suggests that the olfactory stimulus was not sustained enough to maintain his attention or that he was experiencing the world reality over the virtual reality; this explanation is in line with the fluctuation of his immersion. His reaction about finding the scene pretty underscores a positive emotional response. At the same time, his confusion, in the end, showcased how he intermittently needed to reconnect with the real world, seeking guidance and comfort. P1 was notably tired after the session; this can result from the activity, but according to S1, it was expected "like an after-food dip."

### Conclusions Prototype V2

#### *Immersion Differences*

P1 exhibited fluctuations between two layers of the framework: social interactions and VR intervention. These fluctuations seemed to be influenced by the presence of P1's wife. P2 showed a high level of immersion, accurately identifying and interacting with the virtual chapel while maintaining awareness of the real world. This indicated her control of experiencing the VR intervention layer and the In-Situ layer. P3 initially showed immersion, but as the scene developed, his lack of immersion became prominent as he started talking about his work while being unaffected by the church bell. P3's experience can be described as 'task-oriented,' requiring real-world stimuli to perceive the virtual one. This can be categorized in the In-Situ layer. P4 had an experience characterized by storytelling and memory recall rather than total immersion. Despite limited interaction with the virtual environment, the VR scene effectively triggered personal memories and narratives about her family and past visits to the chapel, suggesting her experience through the memories layer.

#### *Behavioral Themes - Olfactory Absence*

P1 initially recognized a scent when prompted by his wife but failed to do so independently later, indicating his sensory engagement was influenced by real-world interactions. P1's initial ability to place the scent can be cross-referenced to his immersion level, characterized by his maintained social interaction with his wife. P4 did not acknowledge any scent during the session, which aligns with the immersion level of memories and storytelling, making her less receptive to the olfactory stimuli.

#### *Behavioral Themes - Visual and Olfactory Alignment*

Both P2 and P3 demonstrated a notable alignment between visual and olfactory stimuli, effectively smelling what they were seeing. P2 remarked on the musty smell that aligned with the organ she was looking at. Similarly, P3 identified the smell of candles, stating that it corresponded to the candles he was looking at. In these observations, P2's response aligns with her immersion level, as she experienced through the VR-intervention layer. However, P3 approached the VR experience through the In-Situ layer. This suggests that while he recognized the scent, the depth of his sensory engagement may have been influenced by his perception of the VR session as an assignment rather than a fully immersive experience.

### *Behavioral Themes - Religious Connections*

P1, the only participant unfamiliar with the Hasseltse Chapel, expressed a prominent religious connection compared to P2, P3, and P4. This might be due to having no memories connected to the chapel or a more religious background. However, his general interest in churches and his answer to what he would like to visit suggest that this religious connection originates from his identity and personal history. Since P1 fluctuated between layers of the framework, the moments of Religious Connection may have occurred in the VR intervention layer.

### *Behavioral Themes - Emotional Connections*

P2 referred to the chapel as “Our little chapel” upon entering, and P3 mentioned family and highlighted the logistical challenges of visiting the chapel. Within these observations, P2’s response might indicate a sense of nostalgia or endearment, while P3 referred more to real-life difficulties than to emotional connections. This again aligns with the layer of immersion through which they experienced the scene, with P2 being immersed emotionally through the VR-intervention layer and P3 having a focus on the practical aspect of the location. P4 recalled memories involving the family in May; this suggests that the VR scene triggered emotional memories associated with the chapel.

### *Behavioral Themes - Enjoyment of Immersion*

During the session, P2 displayed enjoyment, reacting spontaneously without prompts, actively pointing, and looking around, indicating a genuine reaction. In contrast, while P3 stated he enjoyed the session, his response, “Yes, yes, I am just looking; it is a nice experience,” seemed more like he provided a polite/correct answer. This conclusion also aligns with his immersion level being In-Situ.

### *Behavioral Themes - Post-VR Recollections*

P1 recognized the headset but initially could not recall what he had watched. After being reminded that it was the chapel, he smiled and expressed his liking for it, creating a pleasurable moment. P1 relived happy memories in this moment, explaining how he used to bike with his wife to chapels. This indicates that while P1 might not remember the scene in detail, it evoked happy associations and brought back positive memories. In contrast, P4 did remember the details of the VR experience and even shared the memory of the musty scent with her son. This suggests that while P1’s recollection was more about emotional resonance, P4’s experience was detailed and specific.

# *7. Discussion and Recommendations*

This study investigated the potential benefit of olfactory stimuli in VR for PwD following an iterative exploration involving expert interviews and workshops with four participants with dementia. Consequently, two VR scenes were created for the participants based on a theme that was relevant to all of them. This section will first discuss the findings from the process, then the interpretations. The limitations of the study will follow this. Finally, Implications and design recommendations will be drafted, and conclusions will be offered.

- 7.1                      Summary Key Findings
- 7.2                      Interpretations
- 7.3                      Limitations
- 7.4                      Implications and Design Recommendations
- 7.5                      Conclusion

.

## 5.1 Summary Key Findings

The research question of this study aimed to investigate the impact of integrating olfactory stimuli in a Virtual Reality (VR) experience on PwD. The results show that while integrating olfactory stimuli in VR can enhance the immersive experience for some PwD, the impact varies significantly depending on their cognitive abilities. The results indicate that some participants had high levels of immersion and engagement with the multisensory VR environment. In contrast, others used the VR scene as a prompt for memory recall or maintained real-world interactions. These findings support the findings by Moyle et al. (2018), who noted that VR experiences can increase engagement and well-being for PwD. However, this study also suggests that olfactory stimuli alone may not be a primary factor in enhancing VR immersion but rather serve as an additional layer that can trigger personal memories and emotional responses. In relation to the participants of this study, the results interpret that participants' reactions can be categorized into five distinct layers of perceived reality: social interactions, VR intervention, in-situ/real-world, memories, and emotional connections.

## 5.2 Interpretations

### Personal Relevance

The Expert Interview underscored the importance of creating familiarity in every day activities by catering to the clients' historical preferences. This aligns with the fifth cornerstone of Warm Technology, which emphasizes personal context and history when developing technologies (Ijsselstein et al., 2020). This connects well with the results of this study, which suggest a strong relationship between the personal relevance of the VR content and the participants' responses. For instance, P1's strong affinity with churches showcased an emotional response to the chapel scene despite being unfamiliar with the Chapel. For P2, P3, and P4, the chapel's historical context mattered the most, which enabled the VR scene to induce emotional storytelling and sharing of memories. These findings also align with previous research conducted by Khirallah Abd El Fatah et al. (2023) that emphasize the significance of nostalgic environments to enhance engagement and immersion for PwD.

### Story Telling

P4's interaction with the Olfactory VR scene, characterized by emotional storytelling rather than deep immersion, demonstrates the potential of VR as a catalyst for memory recall. P1 did the same storytelling about visiting a Chapel in Vethuizen with S1. These observations indicate that VR activities can benefit PwD's well-being, as they align with the findings of Phinney et al. (2007), who stated that activities fostering personal storytelling and memory recall could enhance a sense of self-identity among PwD.

## Olfactory Stimuli as an Addition to VR

While participants P2 and P3 showed a noticeable connection between visual and olfactory stimuli, P1 and P4 did not. These results indicate that olfactory stimuli, although intended to complement visual elements and enhance immersion as hypothesized, were only recognized by two participants. This finding emphasizes the importance of incorporating Sánchez et al.'s (2013) definition of multisensory experiences in designs, which states that such experiences should not focus on cognitive stimulation but should encourage people to engage with sensory stimuli of their choice.

## VR and Memory Recall

P2 exhibited a high level of immersion, and noteworthy was her ability to remember and discuss the VR experience with her son after the session. This connects to findings by Manera et al. (2016), who explored how VR training programs can improve cognitive functions like memory. This indicates that VR can help PwD process and recall new experiences. However, this leaves room for discussion about whether it was due to the VR experience or P2's current cognitive abilities.

## VR in Elderly Care

As this project involved many visits to various care homes, I would like to address the practical addition VR could make to these organizations. During the Expert Interviews, E2 mentioned how she believes VR could be a valuable tool to move clients to a place virtually without needing physical relocation. This was also addressed by Harmer and Orrell (2008) and Roland and Chappell (2015), who identified these barriers as significant challenges for residents and caregivers. As shown in this study, VR can help overcome these obstacles by providing engaging, immersive experiences that can be accessed from the comfort of a care facility or home, thereby reducing the need for physical relocation and extensive resources.

## 5.3 Limitations

It is essential to recognize this study's limitations. First, the reliability of the olfactory display was affected by the over-saturation with different essential oils in Nebula. This highlights an area for improvement for the hardware. Also, the number of iterations was limited due to the difficulty of finding participants. This affected the data collection and created time constraints, resulting in only one iteration.

Additionally, the small sample size limited the generalizability of the results. For the exploratory sessions, a point of improvement is to emphasize the olfactory exploration to find more recognizable scents or overlooked insights. Despite these limitations, this study counterbalanced with in-depth conversations during the interactions. In conclusion, future work asks for research with a larger, more diverse group of participants and further iterations to validate the interpretations and recommendations.



## 5.4 Implications and Design Recommendations

The findings from this study build on existing evidence by Khirallah Abd El Fatah et al. (2023), Manera et al. (2016), and Moyle et al. (2018) that indicate that VR can be a valuable tool for enhancing engagement and fostering well-being in PwD. In addition, this study introduced a framework to better understand the layers of reality experienced by PwD when engaging in a multisensory environment, like the Olfactory VR experience developed during this study. This framework intends to make designers consider the reality PwD experience when engaging in a multisensory environment. For instance, the task-oriented approach of P3, who finds himself in the In-Situ layer, could benefit from a VR activity that mirrors real-world tasks and routines, providing a sense of accomplishment and relevance. This layer also aligns with Vernooij-Dassen's (2007) emphasis on the importance of real-world activities in fostering a sense of autonomy.

The results of this study suggest practical implications and lead to specific design recommendations based on the layered framework below:

### **1. Memories layer**

Contextual familiarity is essential within this layer. Therefore, it is recommended to incorporate familiar locations, objects, events, or activities that are likely to trigger personal memories. Subtle prompts within the VR scene (e.g., smells or visual cues) that aim at recalling specific memories should be highly relevant to the participant unless they can switch layers and provide momentary VR immersion.

### **2. Social Interaction Layer**

If a design is focused on social interactions within the VR experience, it is recommended to include elements that encourage conversations with caregivers, loved ones, or any other trusted individual that the person with dementia reverts to frequently. To enhance engagement, designers could implement scenes that include shared activities or collaborative tasks, and if this is too complex for your participant, they could focus on guided Interaction. This could be created by including interactions where caregivers can prompt and support the participants' engagement with the VR environment.

### **3. VR Intervention**

When designing VR activities for PwD who can experience the VR activity by immersion, it is recommended to ensure consistent and sustained integration of visual, auditory, and olfactory stimuli. In the context of this study, it is best to make the stimuli relatable or as recognizable as possible. High-quality visuals, accurate sounds, and appropriate scents can further help create a realistic and immersive environment that PwD can enjoy. Additionally, interactive elements like touchable objects or responsive environments can further enhance the experience.

### **4. In-situ/Real World Layer**

Within this layer, it is recommended that participants like P3, who would approach multisensory experiences in a task-oriented manner, should engage in activities that incorporate interactive tasks requiring pragmatic solutions similar to real-world challenges. For instance, a VR activity that mirrors real-world tasks or follows real-world routines could enable participants to feel a sense of accomplishment or relevance. These tasks should be simple yet engaging to maintain interest and provide a sense of purpose.

### **5. Remembering new experiences**

For participants in this layer, it is not so much about layers 1-4, in which PwD live their multisensory experiences. It is about stimulating the participant to share what they saw, heard, and smelled to improve or create feel-good moments. Therefore, it is recommended that participant shares their multisensory experience with family or caretakers, as it could foster positive emotions, interactions, and feel-good moments.

## 5.5 Conclusion

This study investigated how PwD experience an olfactory VR activity. By including PwD as co-designers of the technology, the VR prototypes were tailored to meet the participants' lived experiences or intrinsic interests. The findings indicated that olfactory- and visual stimuli can evoke meaningful responses in PwD, uncovering personhood, meaningful stories, and feel-good moments. However, the combination of these two concepts in an olfactory VR experience resulted in varying effects among individuals. To understand why, a conceptual framework was introduced to grasp the layers of reality in which the participants experienced such a multisensory activity. While some participants were fully immersed and engaged with the VR environment, others experienced the activity in a different layer of their personal reality; they either drifted into their own memories, maintained social interactions in the real world, or connected real-world experiences to the virtual experience. This underscores the importance of understanding the lived reality of PwD when designing multisensory VR activities.

The hypothesis based on the research question proposed that combining visual and olfactory stimuli in VR can enhance the immersive experience for PwD. The results demonstrated that smells can go unnoticed, and visual cues can affect smell perception. In addition to this, the notability of olfactory stimuli was minimal as participants had to be prompted with the question if they could smell something. These findings indicate that olfactory stimuli is not primarily perceived, and suggest minimal added value in a multisensory VR experience. However, since scents have shown to be effective prompts for PwD to talk, relive, or share memories post-intervention, further exploration into its enhancing quality within multisensory experiences needs to be done.

Despite the promising results, this study had limitations, including a small sample size and the need for more extensive olfactory exploration during the associative memories sessions. Future research should aim to involve a larger and more diverse group of participants to validate the findings. Overall, this research contributes to the growing body of knowledge on using VR and multisensory stimuli in dementia care. By integrating the principles of Warm Technology, it offers valuable insights into creating engaging and supportive environments for PwD, highlighting the potential of VR as a tool for enhancing their quality of life. Further testing and research is needed to refine these design recommendations and ensure a broader applicability.

## Bibliography

- Adams, W. (2015). Conducting Semi-Structured Interviews. <https://doi.org/10.1002/9781119171386.ch19>
- Åkerborg, Ö., Lang, A., Wimo, A., Sködlunger, A., Fratiglioni, L., Gaudig, M., & Rosenlund, M. (2016). Cost of Dementia and Its Correlation With Dependence. *Journal of Aging and Health*, 28(8), 1448–1464. <https://doi.org/10.1177/0898264315624899>
- Aromatherapie Coffee etherische olie voor Diffuser, 100% Pure Coffee Scent etherische olie voor luchtbevochtiger, Koffie etherische, 10ml aromatherapie Coffee Olie voor Maken van de zeep: Amazon.nl: Gezondheid & persoonlijke verzorging. (n.d.). Retrieved May 13, 2024
- Baker, R., Holloway, J., Holtkamp, C. C. M., Larsson, A., Hartman, L. C., Pearce, R., Scherman, B., Johansson, S., Thomas, P. W., Wareing, L. A., & Owens, M. (2003). Effects of multi-sensory stimulation for people with dementia. *Journal of Advanced Nursing*, 43(5), 465–477. <https://doi.org/10.1046/j.1365-2648.2003.02744.x>
- Butler, R. N. (1963). The life review: An interpretation of reminiscence in the aged. *Psychiatry*, 26, 65–76. <https://doi.org/10.1080/00332747.1963.11023339>
- D'Andrea, F., Tischler, V., Dening, T., & Churchill, A. (2022). Olfactory stimulation for people with dementia: A rapid review. *Dementia (London, England)*, 21(5), 1800–1824. <https://doi.org/10.1177/14713012221082377>
- EUQEE Bloemen Etherische Oliën Set 6x10ml, Zuivere Etherische Olie voor Diffuser, Lavendel, Roos, Ylang Ylang, Jasmijn, Geranium, Kamille: Amazon.nl: Gezondheid & persoonlijke verzorging. (n.d.). Retrieved May 13, 2024
- Fritz, N. E., Kegelmeyer, D. A., Kloos, A. D., Linder, S., Park, A., Katak, M., Adeli, A., Agrawal, P., Scharre, D. W., & Kostyk, S. K. (2016). Motor performance differentiates individuals with Lewy body dementia, Parkinson's and Alzheimer's disease. *Gait & Posture*, 50, 1–7. <https://doi.org/10.1016/j.gaitpost.2016.08.009>
- Giebel, C. M., Sutcliffe, C., & Challis, D. (2017). Hierarchical Decline of the Initiative and Performance of Complex Activities of Daily Living in Dementia. *Journal of Geriatric Psychiatry and Neurology*, 30(2), 96–103. <https://doi.org/10.1177/0891988716686835>
- Glachet, O., & El Haj, M. (2020). Effects of Olfactory Stimulation on Past and Future Thinking in Alzheimer's Disease. *Chemical Senses*, 45(4), 313–320. <https://doi.org/10.1093/chemse/bjaa016>
- Greenwood Essential Pure Frankincense etherische olie (Boswellia carterii) 100% natuurlijke therapeutische kwaliteit stoom gedestilleerd 15 ml (0,50 oz): Amazon.nl: Wonen & keuken. (n.d.). Retrieved May 13, 2024
- Harmer, B. J., & Orrell, M. (2008). What is meaningful activity for people with dementia living in care homes? A comparison of the views of older people with dementia, staff and family carers. *Aging & Mental Health*, 12(5), 548–558. <https://doi.org/10.1080/13607860802343019>
- Havighurst, R. J., & Albrecht, R. E. (1953). *Older People*. Longmans, Green.
- Kane, R. A. (2001). Long-term care and a good quality of life: Bringing them closer together. *The Gerontologist*, 41(3), 293–304. <https://doi.org/10.1093/geront/41.3.293>
- Khirallah Abd El Fatah, N., Abdelwahab Khedr, M., Alshammari, M., & Mabrouk Abdelaziz Elgarhy, S. (2023). Effect of Immersive Virtual Reality Reminiscence versus Traditional Reminiscence Therapy on Cognitive Function and Psychological Well-being among Older Adults in Assisted Living Facilities: A randomized controlled trial. *Geriatric Nursing (New York, N.Y.)*, 55, 191–203. <https://doi.org/10.1016/j.gerinurse.2023.11.010>
- Manera, V., Chapoulie, E., Bourgeois, J., Guerchouche, R., David, R., Ondrej, J., Drettakis, G., & Robert, P. (2016). A Feasibility Study with Image-Based Rendered Virtual Reality in Patients with Mild Cognitive Impairment and Dementia. *PloS One*, 11(3), e0151487. <https://doi.org/10.1371/journal.pone.0151487>
- Meta Quest 2: Meeslepende, alles-in-een VR-headset | Meta Store. (n.d.). Retrieved May

25, 2024, from <https://www.meta.com/nl/quest/products/quest-2/>

Meta Quest 3: Nieuwe mixed reality VR-headset - Shoppen | Meta Store. (n.d.). Retrieved May 25, 2024, from <https://www.meta.com/nl/quest/quest-3/>

Moheb, N., Mendez, M. F., Kremen, S. A., & Teng, E. (2017). Executive Dysfunction and Behavioral Symptoms Are Associated with Deficits in Instrumental Activities of Daily Living in Frontotemporal Dementia. *Dementia and Geriatric Cognitive Disorders*, 43(1–2), 89–99. <https://doi.org/10.1159/000455119>

Moorman Li, R., Gilbert, B., Orman, A., Aldridge, P., Leger-Krall, S., Anderson, C., & Hincapie Castillo, J. (2017). Evaluating the effects of diffused lavender in an adult day care center for patients with dementia in an effort to decrease behavioral issues: A pilot study. *Journal of Drug Assessment*, 6(1), 1–5. <https://doi.org/10.1080/21556660.2016.1278545>

Moyle, W., Jones, C., Dwan, T., & Petrovich, T. (2018). Effectiveness of a Virtual Reality Forest on People With Dementia: A Mixed Methods Pilot Study. *The Gerontologist*, 58(3), 478–487. <https://doi.org/10.1093/geront/gnw270>

Mukherjee, A., Biswas, A., Roy, A., Biswas, S., Gangopadhyay, G., & Das, S. K. (2017). Behavioural and Psychological Symptoms of Dementia: Correlates and Impact on Caregiver Distress. *Dementia and Geriatric Cognitive Disorders Extra*, 7(3), 354–365. <https://doi.org/10.1159/000481568>

Phinney, A., Chaudhury, H., & O'Connor, D. L. (2007). Doing as much as I can do: The meaning of activity for people with dementia. *Aging & Mental Health*, 11(4), 384–393. <https://doi.org/10.1080/13607860601086470>

Roland, K., & Chappell, N. (2015). Meaningful Activity for Persons With Dementia. *American Journal of Alzheimer's Disease and Other Dementias*, 30. <https://doi.org/10.1177/1533317515576389>

SALKING Aroma diffuser, 100ml metalen ultrasone aromatherapie diffuser voor etherische oliën, 7 kleuren nachtlampje aromadiffuser voor thuis, slaapkamer, kantoor, yoga: Amazon.nl: Gezondheid & persoonlijke verzorging. (n.d.). Retrieved May 13, 2024, from <https://www.amazon.nl/SALKING-aromatherapie-etherische-nachtlampje-aromadiffuser/dp/B07D13CTGX?th=1>

SALUBRITO Set natuurlijke etherische oliën, natuurlijke geurolie voor diffuser, kaarsen maken, regen, zeebries, grenen, berglucht, bamboe, cadeauset voor vrouwen: Amazon.nl: Gezondheid & persoonlijke verzorging. (n.d.). Retrieved May 13, 2024, from [https://www.amazon.nl/dp/B0CP5MVGMM5?psc=1&ref=ppx\\_yo2ov\\_dt\\_b\\_product\\_details](https://www.amazon.nl/dp/B0CP5MVGMM5?psc=1&ref=ppx_yo2ov_dt_b_product_details)

Sánchez, A., Millán-Calenti, J. C., Lorenzo-López, L., & Maseda, A. (2013). Multisensory stimulation for people with dementia: A review of the literature. *American Journal of Alzheimer's Disease and Other Dementias*, 28(1), 7–14. <https://doi.org/10.1177/1533317512466693>

Sanders, E., & Stappers, P. (2012). Convivial toolbox: Generative research for the front end of design. *Bis*.

Tominari, M., Uozumi, R., Becker, C., & Kinoshita, A. (2021). Reminiscence therapy using virtual reality technology affects cognitive function and subjective well-being in older adults with dementia. *Cogent Psychology*, 8(1), 1968991. <https://doi.org/10.1080/23311908.2021.1968991>

Vernooij-Dassen, M. (2007). Meaningful activities for people with dementia. *Aging & Mental Health*, 11(4), 359–360. <https://doi.org/10.1080/13607860701498443>

Williams, I., Brereton, M., Donovan, J., McDonald, K., Millard, T., Tam, A., & Elliott, J. (2014). A Collaborative Rapid Persona-Building Workshop: Creating Design Personas with Health Researchers. *International Journal of Sociotechnology and Knowledge Development*, 6, 17–35. <https://doi.org/10.4018/ijskd.2014040102>

Wübker, A., Zwakhalen, S. M. G., Challis, D., Suhonen, R., Karlsson, S., Zabalegui, A., Soto, M., Saks, K., & Sauerland, D. (2015). Costs of care for people with dementia just before and after nursing home placement: Primary data from eight European countries. *The European*

Journal of Health Economics: HEPAC: Health Economics in Prevention and Care, 16(7), 689–707. <https://doi.org/10.1007/s10198-014-0620-6>

Yousaf, K., Mehmood, Z., Awan, I., Saba, T., Alharbey, R., Qadah, T., & Alrige, M. (2020). A comprehensive study of mobile-health based assistive technology for the healthcare of dementia and Alzheimer's disease (AD). *Health Care Management Science*.  
<https://doi.org/10.1007/s10729-019-09486-0>

Yuan, J., Maserejian, N., Liu, Y., Devine, S., Gillis, C., Massaro, J., & Au, R. (2021). Severity Distribution of Alzheimer's Disease Dementia and Mild Cognitive Impairment in the Framingham Heart Study. *Journal of Alzheimer's Disease*, 79(2), 807–817.  
<https://doi.org/10.3233/JAD-200786>

Zaken, M. van A. (2020, November 30). National Dementia Strategy 2021-2030—Publication—Government.nl [Publicatie]. Ministerie van Algemene Zaken.  
<https://www.government.nl/documents/publications/2020/11/30/national-dementia-strategy-2021-2030>



# Appendices

- A – Olfactory Session Meerpaal
- B – Information Letter
- C – Informed Consent Form
- D – Toestemmingsformulier
- E – Approval Letter ERB
- F – Data Processing Impact Assessment
- G – Protocol Semi-Guided Expert Interview
- H – Protocol Associative Memories workshop
- I – VR session protocol
- J – Illustration thematic analysis
- K – Expert interviews E1 & E2
- L – Participants reactions in the Associative Memories workshop
- M – Transcriptions and observations of the evaluation

## A – Olfactory session Meerpaal

To explore the effect of olfactory stimuli and the associations people with dementia (PWD) have with smells, a participatory approach was used for an initial engagement with the target group. Because no collaborative party or care organisation was found at this point of the study, an informal activity was organized with a group of people with mild dementia at the community center “De Meerpaal,” which is affiliated with KBO Kring Eindhoven. The day began with a nostalgic activity where participants were shown TV shows from the 1950s and 1960s (E.g. Swiebertje, The Thunderbolts, Bonanza and Texas Rangers). Following this, four participants engaged in a associative memories session (see image X).



A Salking Aroma diffuser<sup>14</sup> and six different essential oils were used for this session. The diffuser transforms the fragrance oil and water mixture from the container into a fine mist, while changing the colour of the vintage looking metal casing. The aim was to explore the reactions of people with dementia to different smells using essential oils and conversational probes. Due to the informal nature of the session, data was collected through observation. Four volunteers participated: Participant A had full olfactory function, Participant B had partial olfactory loss, and Participants C and D had lost their sense of smell entirely. The aroma's used in this session were Floral scented essential oils. (e.g. Lavender <sup>15</sup>)) Participants showed interest in the diffuser's appearance, and the first three fragrances; Rose, Lavender, and Cherry Blossom gave interesting reactions. The remaining scents were perceived unfamiliar or unpleasant to the participants.



### Questioning Round 1: Reactions to Essential Oils

- **Rose:**
  - Participant A liked it as it reminded her of candles at home.
  - Participant B liked it but couldn't identify the scent.
- **Lavender:**
  - Participant A disliked it, associating it with a garden and wasps, to which they were allergic.
  - Participant B could barely smell it. When asked about lavender, Participants A, B, and C mentioned it reminded them of France and its lavender fields. Participant D remained neutral.
- **Cherry Blossom:**
  - Participant A disliked the smell, based on personal preference.
  - Participant B could only slightly detect it. The smell did not evoke any memories for the group.

The responses indicated that the essential oils were not effective prompts, likely because the floral scents were unfamiliar to the participants. However, the overall topic of smell was

<sup>14</sup> (SALKING Aroma Diffuser, Metalen Ultrasonie Aromatherapie Diffuser Voor Etherische Oliën n.d.)

<sup>15</sup> (EUQEE Bloemen Etherische Oliën Set 6x10ml, Zuivere Etherische Olie Voor Diffuser, Lavendel, Roos, Ylang Ylang, Jasmijn, Geranium, Kamille : Amazon.Nl: Gezondheid & Persoonlijke Verzorging, n.d.)



interesting to each participant for various reasons, regardless of their olfactory abilities. This became apparent during a second round of questioning, where conversational prompts were used to discuss different smells they remembered clearly or fondly.

### **Questioning Round 2: Conversational Probes**

- **Fresh Bread:**
  - This scent triggered storytelling from all participants. They shared childhood memories of their mothers baking bread, even without an oven, by taking dough to a bakery.
- **Wet Dog:**
  - One participant reminisced about walking their dog with their partner at the Beatrixkanaal in Eindhoven.
- **Incense:**
  - Evoked memories of church days, with neutral emotions observed.
- **Fuel:**
  - One participant liked the smell of gasoline, which prompted stories about his Kreidler motorcycle, holidays to the Isle of Man, and Zippo lighters. He was particularly enthusiastic in sharing these memories.
- **4711 Cologne:**
  - Two participants recalled their mothers wearing this cologne, describing its commonality and distinct scent clearly.

During this round of questions the researcher did not prompt all the smells; incense, fuel, and 4711 cologne were mentioned by the participants themselves when asked about memorable scents.



# Onderzoek naar “Een zintuiglijke Virtual Reality ervaring”

# Introductie

- We vragen u omdat u in aamerking komt door uw medische diagnose
- U kunt kiezen of u mee wilt doen.

U bent uitgenodigd om mee te doen in het onderzoek "Een zintuiglijke Virtual Reality ervaring" omdat u in aamerking komt door uw medische diagnose.

Deelnemen aan dit onderzoek is vrijwillig: u beslist zelf of u mee wilt doen. Voordat u beslist om mee te doen willen we aan u vragen om de volgende informatie door te nemen, zodat u weet waar het onderzoek over gaat, wat we van u verwachten en hoe we de data verder verwerken. Op basis van deze informatie kunt u via het toestemmingsformulier aangeven of u toestemming geeft om mee te doen in dit onderzoek en om uw data te verwerken.

U kunt natuurlijk altijd contact nemen met de onderzoeker [name researcher] via [e-mail researcher] als u vragen heeft, of u kunt de informatie bespreken met mensen die u kent.

## Onderzoeker

- Zohrab Sarabian, van de Technische Universiteit Eindhoven.



Dit onderzoek wordt uitgevoerd door Zohrab Sarabian van de Technische Universiteit Eindhoven.

Zohrab Sarabian heeft een achtergrond in Human Computer Interaction en werkt nu aan een afstudeer project waar hij een VR ervaring voor dementie wil creëren.

Voor vragen, opmerkingen, klachten of tips kunt altijd Zohrab bereiken via [A.Z.Sarabian@student.tue.nl](mailto:A.Z.Sarabian@student.tue.nl).

## Expertise Centrum Dementie & Technologie



# Expertise centrum dementie & technologie



Dementie is aangrijpend voor iedereen die ermee te maken krijgt. Met de positieve benadering van Warme Technologie ondersteunen we hen en bieden we hen een hogere kwaliteit van leven. Dit doen we vooral met mensen met dementie en hun omgeving samen.

Nog te vaak wordt technologie ontwikkeld voor ouderen, in plaats van met ouderen. En te vaak komen de technologische mogelijkheden, zoals interactieve schermen en sensoren centraal te staan in plaats van de behoeftes, wensen en mogelijkheden van de doelgroep. Dat moet beter. Met de inzet van Warme Technologie verbeteren we de kwaliteit van leven en bevorderen we het welzijn. In dit concept is technologie een middel en geen doel. Het inzetten van warme technologie kan helpen om het leven te blijven omarmen, gehecht te blijven aan de vertrouwde omgeving en contact te houden met de mensen die je liefhebt.

Het centrum is een initiatief van TU/e en Alzheimer Nederland om de levens van mensen met dementie positief te veranderen door de inzet van Warme Technologie. Daarin werken we samen met zorgpartijen, bedrijven, onderzoekers en burgers. <https://ecdt.nl/>

## Doel onderzoek

- Het doel van dit onderzoek is om een gepersonaliseerde Virtual Reality ervaring te creëren met ouders.

- Het doel van dit onderzoek is om een gepersonaliseerde Virtual Reality ervaring te creëren met ouders. Deze ervaring zal verrijkt worden met zintuiglijke stimulans. Om dit te realiseren zal uw bijdrage in de vorm van focus groepen en workshops belangrijk zijn.



# Workshop



U zal deelnemen in een onderzoek waarin we informatie verzamelen door u deel te laten nemen aan workshops samen met andere ouderen. De focus zal liggen op positieve herinneringen en uw voorkeuren en sentiment omtrent geuren, kleuren, texturen en afbeeldingen. Hiermee bedenken we ideeën om voor u een leuke en gepersonaliseerde Virtual Reality ervaring te creëren. Ook zal u gevraagd worden om iets mee te nemen, zoals een foto of een ander voorwerp, waar u een leuke herinnering of ervaring over wilt delen.

Vervolgens testen we deze ideeën uit middels een prototype waar uw verhalen en voorkeuren in zijn verwerkt. Uw terugkoppeling zal gebruikt worden om de ervaring te verbeteren.



# Interview



U zal deelnemen in een onderzoek waarin we informatie verzamelen door u te interviewen over hoe u de Virtual Reality prototype hebt ervaren. Deze interviews zullen plaats vinden na de workshop, en uw zorgverlener zal hier bij zijn.

## Evaluatie



U zal deelnemen in een onderzoek waarin we informatie verzamelen door u te vragen om een Virtual Reality prototype te evalueren.

De Virtual Reality ervaring wordt aangeboden via een headset die u moet op doen. Door deze headset zal u een nieuwe omgeving waarnemen. Deze omgeving zal gepersonaliseerd zijn aan de hand van uw verhalen en voorkeuren verzameld tijdens de workshops. Voor de evaluatie zijn we benieuwd naar hoe u de Virtuele Realiteit ervaart.



## Observatie



U zal deelnemen in een onderzoek waarin we informatie verzamelen door observatie van uw ervaring. We kunnen uw gezichtsuitdrukkingen niet zien, daarom zullen we met u in gesprek blijven terwijl u de headset op hebt. Op deze manier kunnen we een goede indruk krijgen van hoe u de prototype ervaart, en tegelijkertijd een leuke ervaring verzekeren.

## Deelnemen aan studie

- Deelname is vrijwillig.
- U mag stoppen wanneer u wilt.
- U hoeft niet alle vragen te beantwoorden.

Deelname aan dit onderzoek is vrijwillig. U beslist zelf of u mee wilt doen en mag altijd stoppen met het onderzoek als u niet meer mee wilt werken. U hoeft geen reden te geven als u wilt stoppen.

U hoeft niet alle vragen te beantwoorden. Tijdens de workshops zullen we u ook vragen stellen over de verhalen die u verteld. Wij stellen deze vragen alleen in het belang van het onderzoek. U hoeft geen vragen te beantwoorden die u niet wilt beantwoorden.

## Verzamelde informatie

- Tijdens de studie verzamelen wij
  - Uw naam en contact informatie
  - Demografische en medische informatie.
- We leggen het onderzoek vast met een telefoon in vliegtuigstand.
- Tijdens het onderzoek verzamelen we video beelden

Demografische en medische informatie wordt gebruikt om de resultaten te documenteren en te presenteren. Deze zullen gepseudonymiseerd worden zodat de resultaten niet naar u terug te leiden zijn. Bent u Johan, een 77-jarige man, met Alzheimer's in de beginnende fase? Dan noemen we u bijvoorbeeld Paul, een man tussen de 75 en 80 jaar oud met Alzheimer's in de beginnende fase.

Het onderzoek wordt opgenomen met een telefoon in vliegtuigstand. Deze opnamen worden uitgeschreven in tekst (getranscribeerd). Wederom gebruiken we hier uw pseudonym (Paul) in plaats van uw echte naam (Johan). De uitgeschreven tekst gebruiken we vervolgens voor analyse. De foto's worden gebruikt om de workshops en uw creaties vast te leggen. In de foto's wordt u geanonimiseerd door uw gezicht wazig te maken. Video materiaal zal worden opgenomen met een camera, en wordt verwijderd na analyse.

## Verwerking informatie

- Wij zorgen ervoor dat uw data geanonimiseerd en veilig opgeslagen wordt.

Wij doen er alles aan uw privacy zo goed mogelijk te beschermen. We zorgen ervoor dat u niet herkenbaar voorkomt in de resultaten die wij publiceren. Tenzij u in het toestemmingsformulier expliciet aan heeft gegeven dat u toestemming geeft om herkenbaar foto's, video's, of quotes van u te publiceren. De persoonlijke data die we hebben verzameld via de groep sessies en andere documenten binnen dit project worden opgeslagen op een beveiligde locatie bij de Technische Universiteit Eindhoven op. Alleen de hoofdonderzoeker Zohrab Sarabian zal toegang hebben tot de data waarin u nog herkenbaar voorkomt. De data waar u herkenbaar in voorkomt wordt bewaard voor een periode van 10 jaar, hierna zullen de herkenbare gegevens worden verwijderd. De onderzoek data zal, als nodig, alleen anoniem gedeeld worden met mensen buiten de onderzoeksgroep. Dit onderzoek is goedgekeurd door de ethische commissie van de Technische Universiteit Eindhoven.

# Terugtrekken?

- U mag altijd stoppen.

Deelnemen aan dit onderzoek is geheel vrijwillig. U mag uw deelname in het onderzoek ieder moment stop zetten. Ook mag u ieder moment uw toestemming terugtrekken, zonder daar een reden voor te hoeven geven. Deelname eindigen heeft geen negatieve gevolgen voor u.

Als u er voor kiest om uw deelname te eindigen tijdens het onderzoek zal de data die u tot dat moment heeft gegeven gebruikt worden in het onderzoek. Wilt u het onderzoek eindigen, of als u vragen en/of klachten? Neem dan contact op met de onderzoeker Zohrab Sarabian via [Zohrabsarabian@gmail.com](mailto:Zohrabsarabian@gmail.com) of met de begeleider Minha Lee via [M.Lee@Tue.nl](mailto:M.Lee@Tue.nl).









Voor vragen over de omgang van persoonsgegevens kunt u de functionaris gegevens bescherming van de TU/e benaderen

[functionarisgegevensbescherming@tue.nl](mailto:functionarisgegevensbescherming@tue.nl). Verder heeft u ook het recht om een klacht in te dienen bij de Nederlandse Autoriteit Persoonsgegevens.

Verder heeft u ook het recht tot inzage, wijziging, verwijdering of aanpassing van uw gegevens. Dien uw verzoek in via [privacy@tue.nl](mailto:privacy@tue.nl) en kijk voor meer informatie op <https://www.tue.nl/storage/privacy/>.

# Wilt u mee doen?

- Toestemmingsformulier

Toestemmingsformulier voor deelname										
 Is mijn verbande naar het onderzoek over past.	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
 Ik neem vrijwillig deel aan dit onderzoek en snap dat ik beter meermint kan stoppen.	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
 Ik snap mijn persoonsgegevens documenten (voornamen, leeftijd, geslacht, woonplaats).	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
 Ik snap documenten of ik de eerste heb. Ik snap de tijd en oorzaak weten.	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
 Ik snap geld en andere zaken van voor geschenken en ik begrijp dat ik het op mijn naam kan krijgen.	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
 Ik snap dat ik in mijn naam kan krijgen dat ik op dit en deze documenten heb.	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
 SPECIELE VERBODENDE: Ik snap welke naam en welke van mij. Informatie (die niet anders) heb ik in onderzoek.	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
 Ik snap dat van mij bevestigen voor toekomstig onderzoek in onderzoek.	<input type="checkbox"/> Ja <input type="checkbox"/> Nee									
<table><tr><td>Naam deelnemer</td><td>Naam partner / zorgverlener</td><td>Naam onderzoeker</td></tr><tr><td>Hoofdtelling</td><td>Hoofdtelling</td><td>Hoofdtelling</td></tr><tr><td>Datum</td><td>Datum</td><td>Datum</td></tr></table>	Naam deelnemer	Naam partner / zorgverlener	Naam onderzoeker	Hoofdtelling	Hoofdtelling	Hoofdtelling	Datum	Datum	Datum	
Naam deelnemer	Naam partner / zorgverlener	Naam onderzoeker								
Hoofdtelling	Hoofdtelling	Hoofdtelling								
Datum	Datum	Datum								

TOESTEMMING



## C - Informed consent form

### Instructiepagina

Consent formulier HR

**Dit toestemmingsformulier (incl. privacyverklaring) gebruik je in de volgende situatie:**

Je werkt in het kader van onderzoek samen met deelnemers en je verwerkt van hen onder andere bijzondere persoonsgegevens (zie [FAQ](#)).

De publieke taak van de TU/e om wetenschappelijk onderzoek uit te voeren, is de verwerkingsgrondslag voor het verwerken van persoonsgegevens in het kader van het onderzoek. Vanwege het gebruik van bijzondere persoonsgegevens en de gevoelige aard en special juridische status van die gegevens, moet daarnaast ook toestemming worden gevraagd aan de deelnemer voor het gebruik van die bijzondere persoonsgegevens.

Gebruik bij een medisch-wetenschappelijk onderzoek het template van CCMO.

De informatie in de zijbalk is een toelichting bij de betreffende tekst. Deze comments dienen bij afronding uit het daadwerkelijke document te worden verwijderd. De gele blokken geven aan welke informatie in ieder geval aangevuld dient te worden of waar een keuze gemaakt moet worden door de onderzoeker. Gelieve deze informatie in dit formulier in zo eenvoudig mogelijk taalgebruik te delen. Het template moet zo goed mogelijk gevolgd worden en er mogen géén subkopjes verwijderd worden.

Op basis van deze informatie kan een potentiële deelnemer een geïnformeerd en formeel besluit nemen met betrekking tot zowel participatie aan het onderzoek als de verwerking van zijn of haar persoonsgegevens in dat kader.

#### Informatie in delen

Het is belangrijk dat deelnemers alle relevante informatie ontvangen, maar dat hoeft niet allemaal in één keer. Denk bijvoorbeeld aan verschillende informatiemomenten, zoals:

- Flyers;
- Meer informatie op de website;
- Debriefings.

#### Integreren in websurvey etc.

Het is mogelijk dit formulier te integreren in een online websurvey. Toestemming kan namelijk ook worden gegeven middels een digitale ondertekening of het zetten van een vinkje. Zorg er in het geval van een websurvey voor dat dit formulier aan het begin van de survey wordt ingesloten. Gebruik geen weblink die leidt naar een aparte pagina.

Het is, indien passend, wel mogelijk om onderdelen 1 t/m 7 te vermelden op de hoofdpagina van een website/survey, met daaronder het toestemmingsformulier en de resterende onderdelen 8 t/m 10 op te nemen in een aparte weblink. Gebruik dan de hiervoor opgestelde tekst zoals opgenomen onderaan onderdeel 7.

drive

#### Afwijken van het template

Als onderzoeker ken jij de (potentiële) onderzoekspopulatie het beste. Je bent vrij om onderdelen van het template samen te voegen en zo te schrijven dat het past bij jouw onderzoek. Dit geldt ook voor verplichte tekstonderdelen, maar zorgt dat de boodschap overeind blijft.

#### Controle

Vul het formulier in door gebruik te maken van track changes en deel deze vervolgens met de [data steward van jouw faculteit](#) ter review. Voor aanvullende ondersteuning en maatwerk kan eveneens contact opgenomen worden met de data steward.

## **Informatieblad voor onderzoek "Een zintuiglijke Virtual Reality Reminiscentie-ervaring".**

### **1. Inleiding**

De Technische Universiteit Eindhoven (TU/e) nodigt u uit om deel te nemen aan het onderzoek "Een zintuiglijke Virtual Reality Reminiscentie-ervaring" omdat u bent doorverwezen door **xxx**.

Meedoen aan dit onderzoeksproject is uw keuze. Uw deelname is volledig vrijwillig en brengt geen lichamelijke, juridische of financiële risico's met zich mee. U bent niet verplicht vragen te beantwoorden die u niet wilt beantwoorden en u kunt zich te allen tijde uit het onderzoek terugtrekken uit het onderzoek, zonder dat u hiervoor een reden moet geven. Niet deelnemen of stoppen met deelname na de start van het onderzoek, hebben geen nadelige gevolgen voor u.

Voordat u besluit, kunt u de volgende informatie doorlezen. Zodat u weet waar het onderzoek over gaat, wat er van u verwacht wordt en hoe wij omgaan met uw persoonsgegevens. Na het doornemen van deze informatie, kunt u zich aanmelden op het bijgevoegde formulier.

Als u vragen heeft, kunt u deze stellen aan de Zohrab Sarabian via A.Z.Sarabian@student.tue.nl. Ook kunt u de informatie uit dit informatieblad bespreken met mensen die u vertrouwt.

### **2. Doel van het onderzoek**

- Dit onderzoek wordt geleid door Zohrab Sarabian. Het onderzoek betreft een samenwerking tussen de TU/e, CWI (Centrum voor Wiskunde & Informatica), en ECDT (Expertise Centre Dementia & Technology).
- Het doel van dit onderzoek is om een leuke en therapeutische Virtual Reality ervaring te creëren die op maat gemaakt is voor de deelnemers.

### **3. Verwerkingsverantwoordelijke in de zin van de AVG**

TU/e is verantwoordelijk voor uw persoonsgegevens binnen het onderzoek. U kunt de TU/e bereiken op:

Technische Universiteit Eindhoven,  
De Groene Loper 3  
5612 AE Eindhoven.

### **4. Wat houdt deelname aan de studie in?**

In het onderzoek gaan we uw persoonsgegevens op de volgende manier verzamelen:

- Interviews waar de onderzoeker benieuwd is naar gelukkige momenten en positieve ervaringen die u heeft meegemaakt en relateerd aan bepaalde geuren.
- Uw antwoorden worden genoteerd/opgenomen via een audio-opname/video-opname. Er zal ook een transcript worden uitgewerkt van het interview.
- Groepsgesprek en co-creatie sessie. In deze sessie wordt u gevraagd iets te maken ter inspiratie voor de onderzoeker met de hulp van een Virtual Reality prototyp.
- Gebruikers test: In deze sessie zal u een op maat-gemaakte Virtual Reality ervaren, en terugkoppeling geven aan de onderzoeker voor verbeteringen.

Tijdens het onderzoek, kunnen vragen aan u worden gesteld die gaan over het gevoelige onderwerp Dementie. Wij stellen u deze vragen uitsluitend in het belang van het onderzoeksproject. U bent niet verplicht om te antwoorden.

U ontvangt voor deelname aan dit onderzoek geen vergoeding.

##### 5. Welke persoonsgegevens verzamelen en verwerken wij van u?

Wij verzamelen de volgende persoonsgegevens die noodzakelijk zijn voor het doel van het onderzoek:

Categorie	Persoonsgegevens	Doelinde	Bewaartermijn
Contactinformatie	Naam, email, adres, woonplaats	Met u communiceren, u uitnodigen voor evenementen, analyseren van de geografische herkomst van participanten en zodat u uw privacy rechten kunt uitoefenen	Gedurende het onderzoek.
Medische gegevens	Dementie diagnose	Analyseren van gegevens met betrekking tot uw gezondheid.	Gedurende het onderzoek.
Uw levens verhalen	Positieve momenten uit uw leven, gelukkige herinneringen	Met deze gegevens zal er een persoonlijke Virtual Reality (VR) ervaring gecreëerd worden.	Tot 10 jaar na het afronden van het onderzoek. (voor wetenschappelijke integriteit- en publicatie doeleinden).

Uw persoonsgegevens worden enkel bewaard voor de termijn zoals genoemd in de tabel hierboven. Het bewaren van uw gegevens helpt ons om aan wetenschappelijke beginselen te voldoen. Na deze termijn worden uw persoonsgegevens verwijderd of geanonimiseerd, zodat deze niet meer aan u gelinkt kunnen worden.

##### 6. Stopzetten deelname, intrekken van toestemming en uw rechten

Als u besluit uw deelname te stoppen of om uw toestemming voor het verwerken van de bijzondere categorieën persoonsgegevens in te trekken, dan gebruiken wij uw persoonsgegevens vanaf dat moment niet meer.

Indien u vragen of klachten heeft, of indien u uw deelname wilt stopzetten of uw toestemming wilt intrekken, dan kunt u contact opnemen met Ali Zohrab Sarabian via [A.Z.Sarabian@student.tue.nl](mailto:A.Z.Sarabian@student.tue.nl)

U heeft het recht een verzoek tot inzage, wijziging, bezwaar, verwijdering of aanpassing van uw persoonsgegevens te doen. Dien uw verzoek in via [privacy@tue.nl](mailto:privacy@tue.nl) of [A.Z.Sarabian@student.tue.nl](mailto:A.Z.Sarabian@student.tue.nl)

Met zorgen of vragen over de omgang met persoonsgegevens kunt u een mail sturen naar de Functionaris voor de Gegevensbescherming van de TU/e via [functionarisgegevensbescherming@tue.nl](mailto:functionarisgegevensbescherming@tue.nl). Ook kunt u een klacht indienen bij de Autoriteit Persoonsgegevens.

##### 7. Basis voor het verwerken van uw gegevens

Wij verwerken uw persoonsgegevens omdat het onderdeel is van onze publieke taak als Universiteit om wetenschappelijk onderzoek te doen, zoals is vermeld in artikel 1.3 van de Wet Hoger onderwijs en Wetenschappelijk onderzoek. Bij onderzoek houden wij ons altijd aan de geldende gedragscode voor wetenschappelijke integriteit en de richtlijnen voor onderzoek.

Voor het gebruiken van de bijzondere categorieën van uw persoonsgegevens, zoals gegevens over uw verleden hebben wij uw uitdrukkelijke toestemming nodig. U kunt uw toestemming aangeven in de bijgevoegde toestemmingsverklaring.

##### 8. Wie heeft toegang tot uw persoonsgegevens?

Toegang tot persoonsgegevens binnen TU/e en CWI.

Alleen geautoriseerde medewerkers die betrokken zijn bij het onderzoek, zoals de onderzoeker (Ali Zohrab Sarabian) en zijn mentor (Minha Lee, Abdallah El Ali) hebben toegang tot uw persoonsgegevens, maar alleen als dat nodig is voor hun taken. De geautoriseerde medewerkers zullen uw persoonlijke gegevens vertrouwelijk behandelen.

*Toegang tot persoonsgegevens door andere partijen*

Wij delen uw persoonsgegevens niet met andere derde partijen, tenzij we hiertoe wettelijk verplicht zijn.

**9. Hoe worden uw persoonsgegevens beveiligd?**

TU/e heeft samen met het CWI passende technische en organisatorische maatregelen genomen om uw gegevens te beschermen. De samenwerking is contractueel aangegaan door middel van het contract: Collaboration and Data Sharing Agreement. Deze maatregelen omvatten het gebruik van centraal beheerde en geverifieerde onderzoeks- en opslagtools.

Verder zal uw data beveiligd worden door middel van encryptie- of door middel van opslag op beveiligde locaties die worden verzorgd door de IT-afdeling van de TU/e.

**10. Vertrouwelijkheid, opslag van gegevens en toekomstig onderzoek**

De verzamelde gegevens worden opgeslagen op de opslagfaciliteit van de TU/e: Onedrive.

Wij zorgen ervoor dat gepubliceerde onderzoeksresultaten geen vertrouwelijke of identificeerbare informatie over u bevatten, tenzij u daar expliciet toestemming voor heeft gegeven, bijvoorbeeld als u wilt dat uw naam of uw quotes worden vermeld in publicaties.

Uw persoonsgegevens worden mogelijk gebruikt voor toekomstig onderzoek, maar alleen indien uw gegevens echt nodig zijn voor het onderzoek, de erkende ethische normen voor wetenschappelijk onderzoek worden gevolgd en als de nieuwe onderzoeksdoeleinden overeenkomen met de huidige onderzoeksdoeleinden. Als uw gegevens worden gebruikt in toekomstig onderzoek, dan nemen wij alle redelijke stappen om u hierover te informeren. U kunt bezwaar maken tegen het gebruik van uw gegevens voor nieuw onderzoek.

Dit onderzoeksproject is beoordeeld en goedgekeurd door de ethische commissie van de Technische Universiteit Eindhoven.

**\*\*\* Scroll naar beneden voor het toestemmingsformulier \*\*\***

### Toestemmingsformulier onderzoek volwassene

Door dit formulier te ondertekenen verklaar ik:

1. Ik heb voldoende informatie over het onderzoeksproject uit het losse informatieblad gehaald. Ik heb het informatieblad gelezen en heb daarna de kans gehad om vragen te stellen. De vragen zijn naar tevredenheid beantwoord.
2. Ik neem vrijwillig deel aan dit onderzoeksproject. Er is geen expliciete of impliciete druk voor mij om deel te nemen aan dit onderzoeksproject. Ik begrijp dat ik op elk moment kan stoppen met deelname, zonder uit te moeten leggen waarom en ik hoef geen vragen te beantwoorden die ik niet wil beantwoorden.
3. Ik weet dat mijn persoonsgegevens worden verzameld en gebruikt voor het onderzoeksproject, zoals is uitgelegd in bijgevoegd informatieblad.

Daarnaast geef ik toestemming voor de volgende onderdelen van het onderzoek:

4. Ik geef toestemming voor de verwerking van bijzondere categorieën persoonsgegevens, te weten: mijn contact informatie, medische diagnose, en levensverhalen, zoals opgenomen in paragraaf 5 van het informatieblad.

JA ☐ NEE ☐

5. Ik geef toestemming om mijn antwoorden te gebruiken voor quotes in de onderzoek publicaties – zonder dat daarbij mijn naam wordt gepubliceerd.

JA ☐ NEE ☐

6. Ik geef toestemming om mijn echte naam te vermelden bij de quotes zoals bedoeld onder 5.

JA ☐ NEE ☐

Naam Deelnemer:

Naam Onderzoeker:

Handtekening:

Handtekening:

Datum:

Datum:

## D - Toestemmingsformulier

### Toestemmingsformulier voor deelname

	Ik <b>snap voldoende</b> waar het onderzoek over gaat.	Ja	Nee
	Ik neem <b>vrijwillig</b> deel aan dit onderzoek en snap dat ik ieder moment kan stoppen.	Ja	Nee
	Je mag mijn <b>persoonsgegevens</b> documenteren (voornaam, leeftijd, geslacht, woonsituatie).	Ja	Nee
	Je mag documenteren of ik <b>dementie</b> heb. Je mag de fase en oorzaak weten.	Ja	Nee
	Je mag <b>geluid opnames</b> maken van onze gesprekken en de dingen die ik zeg (quotes) <u>anoniem delen</u> in onderzoek.	Ja	Nee
	Je mag <b>foto's</b> en <b>video's</b> maken waar ik op sta en deze <u>anoniem delen</u> in onderzoek.	Ja	Nee
	[SPECIALE TOESTEMMING] Je mag <b>audio, foto's, en video's</b> van mij <u>herkenbaar</u> (dus niet anoniem) delen in onderzoek.	Ja	Nee
	Je mag data van mij <b>bewaren</b> voor <b>toekomstig onderwijs en onderzoek</b> .	Ja	Nee

Naam deelnemer	Naam partner / zorgverlener:	Naam onderzoeker:
Handtekening:	Handtekening:	Handtekening:
Datum:	Datum:	Datum:

Notities: \_\_\_\_\_

## E – Approval letter ERB

A.Z.Sarabian@student.tue.nl  
Ali.Sarabian@CWI.nl



Date  
February 26, 2024

Reference  
ERB2024ID11

Ethical Review Board TU/e

T +31 (0)40 247 6259  
ethics@tue.nl

intranet.tue.nl/ethics

### Ethical review research proposal

Dear

It is a pleasure to inform you that the Ethical Review Board (ERB) has discussed and preliminary approve your application.

Furthermore, the Board wants to draw your attention to the terms and conditions in the appendix.

Success with your research!

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Lakens'.

Dr. D. Lakens  
Chair Ethical Review Board TU/e

Enclosures  
1

The ERB retains the right to revise its decision regarding the implementation and the WMO<sup>1</sup>/WMH<sup>2</sup> status of any research study in response to changing regulations, research activities, or other unforeseen circumstances that are relevant to reviewing any such study.

The ERB shall notify the principal researcher of its revised decision and of the reasons for having revised its decision.

<sup>1</sup>WMO: Law on Medical Scientific Research Involving Human Beings (in Dutch: Wet medisch-wetenschappelijk onderzoek met mensen)

<sup>2</sup>WMH: Medical Device Directive (in Dutch: Wet op de medische hulpmiddelen)

## APPENDIX 1

Terms and conditions

### ***Amendments***

When considerable amendments are made to the design of the study or educational activity, or when the time period between ERB approval and start of the study is longer than one year, please consult the ERB.

### ***Privacy and research data management***

The ERB would like to point out that collecting, handling and storing personal information is subject to the General Data Protection Regulation. Please visit TU/e intranet for the latest information and regulations on [www.tue.nl/rdm](http://www.tue.nl/rdm)



## F – Data Processing Impact Assessment

### Data Protection Impact Assessment (DPIA)

Eindhoven University of Technology

Name service/department:

Industrial Design

Name data controller (data domain owner):

Jos Hermus

Name data steward/data domain coordinator:

Mariana Oshima Menegon

Name data protection officer:

Laura Hooijen-De Vries

Name Project leader:

Ali Zohrab Sarabian

### Introduction

*This DPIA form is composed for my thesis for which I intend on making a Virtual Reality (VR) Reminiscence experience for people with Dementia. This process involves the collection of sensitive privacy information like stage of dementia, contact information of caregivers and recordings of the sessions with my target group. Alongside this DPIA I have prepared an ERB form, Informed Consent Form, a preliminary protocol for the first phase of my exploration, and a Dutch translation and adapted version of the Informed Consent form that I intend to use for better ease of understanding for my participants and their caregivers.*

### Introduction

*This DPIA form is composed for my thesis for which I intend on making a Virtual Reality (VR) Reminiscence experience for people with Dementia. This process involves the collection of sensitive privacy information like stage of dementia, contact information of caregivers and recordings of the sessions with my target group. Alongside this DPIA I have prepared an ERB form, Informed Consent Form, a preliminary protocol for the first phase of my exploration, and a Dutch translation and adapted version of the Informed Consent form that I intend to use for better ease of understanding for my participants and their caregivers.*

## Description of characteristics of processing activity

<b><i>Planned processing activity</i></b>	<b><i>Objectives</i></b>	<b><i>Interests of processing</i></b>
<i>1. Collecting contact information of the caregiver</i>	<i>Make appointments, invite for follow-up activities</i>	<i>Staying in touch with the participants and being available for them.</i>
<i>2. Collecting demographic information of participant</i>	<i>Gather age &amp; geographical region (e.g. western Europe, north America etc.) or 'country where data subject grew up'.</i>	<i>Have information available for development of VR experience tailored to participants demographic information</i>
<i>3. Documenting stage of dementia from participant</i>	<i>Understand participants and their cognitive functions, create empowering experience based on remaining abilities of the target group.</i>	<i>Correlate results of study (qualitative data or quantitative data from measures) with stage of dementia.</i>
<i>4. Focus groups and co-creation: Recording audio, photo and video when story sharing or interviewing with caregiver or participant.</i>	<i>Collect stories and dialogues, document participants body language</i>	<i>This will lead the iterative prototype process.</i>
<i>5. Transcribe audio/video recordings</i>	<i>make transcriptions</i>	<i>Transcribe contact moments, collect qualitative data. Body language data can reveal objective insights of a reaction. This will support the iterative prototype process.</i>
<i>6. Documenting personal artifact of participant</i>	<i>Document (e.g. photograph, sketch) artifacts that the participants brings voluntarily as part of the reminiscence session.</i>	<i>Understand and incorporate the positive memories associated with the artifact in the Design research.</i>
<i>7. Collect opinions about experience using the VR prototype through an interview (voice recorded and transcribed)</i>	<i>Gather subjective/selfreported insights on the VR experience.</i>	<i>Understanding and incorporating based on insights from the participant. This data could also serve at making scientific statements of significance.</i>
<i>8. Pseudonymization of all textual data and anonymization of non-</i>		

<i>textual data (blurring faces, for example)</i>		
9. Analyzing and archiving research interview transcription	Analyze interview transcription to measure user experiences of a prototype.	Understanding the experience of the participant in order to iterate on the prototype or draw scientific conclusions.

## 1. Proposal

The proposal for this study, called: A Sensory Virtual Reality (VR) Reminiscence experience to Empower the Minds of People with Dementia, was created with the aim of studying the impact of a multisensory Virtual Reality (VR) experience, particularly incorporating olfactory elements (smells), on the overall quality of life for People with Dementia (PwD). Motivation for this direction comes from the challenges in finding nonpharmacological interventions for dementia. Previous studies explored VR's potential as an intervention for PwD (Khirallah Abd El Fatah et al., 2023; Wendy Moyle et al., 2016; Maho Tominari et al., 2021), the proposed research will continue exploring by integrating olfactory stimuli into the VR experience. This approach is based on the understanding that multisensory experiences, like olfactory stimulation, can be important for PwD.

The proposal involves several parties, including the main researcher , responsible for data collection, storage, and analysis, internal organizations like ECDT (Expertise Centre Dementia & Technology), as well as external parties such as CWI Amsterdam for mentoring, and care organization centers for recruitment of study participants.

This DPIA is relevant to the data that will be collected during the collaborative approach with PwD, caregivers, and relatives throughout various phases. Firstly, an informed consent form will be reviewed and signed by the participants. Personal contact information will be collected from caregivers, alongside demographic and medical/health data like stage of dementia of the participant. Secondly, data will be gathered through audio and video recordings during sessions. Interviews with PwD, caregivers, and relatives will be audio recorded and transcribed to gain subjective and objective insights on the VR experience.

Khirallah Abd El Fatah, Nawara, Mahmoud Abdelwahab Khedr, Mukhlid Alshammari, and Safaa Mabrouk Abdelaziz Elgarhy. "Effect of Immersive Virtual Reality Reminiscence versus Traditional Reminiscence Therapy on Cognitive Function and Psychological Well-Being among Older Adults in Assisted Living Facilities: A Randomized Controlled Trial." *Geriatric Nursing (New York, N.Y.)* 55 (November 25, 2023): 191–203. <https://doi.org/10.1016/j.gerinurse.2023.11.010>.

Moyle, Wendy, Cindy Jones, Toni Dwan, and Tanya Petrovich. "Effectiveness of a Virtual Reality Forest on People With Dementia: A Mixed Methods Pilot Study." *The Gerontologist* 58, no. 3 (May 8, 2018): 478–87. <https://doi.org/10.1093/geront/gnw270>.

Tominari, Maho, Ryuji Uozumi, Carl Becker, and Ayae Kinoshita. "Reminiscence Therapy Using Virtual Reality Technology Affects Cognitive Function and Subjective Well-Being in Older Adults with Dementia." Edited by Gianluca Castelnuovo. *Cogent Psychology* 8, no. 1 (December 31, 2021): 1968991. <https://doi.org/10.1080/23311908.2021.1968991>.

## 2. Personal data

Category data subjects	Category personal data	Personal data	Type personal data	Source
Caregiver	Name & contact details	Initials, first name, last name, email	Regular	Directly from caregivers, through a form

Category data subjects	Category personal data	Personal data	Type personal data	Source
<b>Research participant</b>	a. Demographic data; b. recording interview; c. Personal artifact; d. Opinions about their experience using the prototype	a. Gather age & geographic region (e.g. western Europe, north America etc.) or 'country where data subject grew up'. of participant; b. Image/sound recording to make transcripts; c. An artifact that the participant associates with positive experiences. E.g. picture, statue, souvenir. Some artifacts like pictures might include identifiable information, this will be blurred or covered to maintain discreteness; d. Opinions (pseudonymized).	Sensitive	Directly from data subject or via a second party, e.g. caregiver
<b>Research participant</b>	Medical/Health data	Stage of Dementia	Special	Directly from data subject or via a second party, e.g. caregiver

### 3 & 4. Processing activities & purposes

Processing activity	Personal data (categories)	Processing purpose
1. Request for information/collect contact details	Name and contact information (E.g. telephone number)	To contact the participant / caregiver for research related contact. To be available to them.
2. Collecting demographic data from participants	Age and <i>geographical region</i> (e.g. western Europe, north America etc.) or 'country where data subject grew up'.	Have information available for development of VR experience tailored to participants demographic information
3. Documenting stage of dementia of participant	Stage of dementia (early, middle, late):	Understand remained cognition (E.g. regressed concentration, memory, sensing, etc.). Used to lead iterative design approach, make sure designs empowers the participant by meeting their imperative needs.
4. Video/audio recording of co-creation sessions and interviews.	Voice, facial expressions, body language	Assess objectively the experience of participant
5. Transcribe interview recording	Image/video/sound recording. Interview recordings will not be done to collect personal data, they will be focused on subscales about the subjective experience.	Writing out the recording, so that the recording can then be deleted.
6. Documenting personal artifact	Personal artifact is an object of meaning for the participant. Identifiable information, if any, will be pseudonymized.	Including personal items in the prototype may contribute to the experience, i.e. for recollection purposes.

Processing activity	Personal data (categories)	Processing purpose
7 & 9. Conducting, analyzing and archiving transcription of interviews	<p>Transcription of the interview, this does not include special category data. Information will be about how the prototype is experiences. It will be for example focused on the next subscales [1]</p> <p>Presence: <i>"The virtual environment was responsive to actions that I initiated."</i></p> <p>Immersion: <i>"I felt physically fit in the virtual environment."</i></p> <p>Emotion: <i>"I enjoyed being in this virtual environment."</i></p> <p>Skill: <i>"I felt confident selecting objects in the virtual environment."</i></p> <p>Judgement: <i>"Personally, I would say the virtual environment is impractical/practical"</i></p> <p>Technology adoption: <i>"Learning to operate the virtual environment would be easy for me"</i></p>	Analyze interview transcriptions from research participants to measure user experiences of a prototype. This data will be coded to the pseudonymized participant, it will be derived from a Likert scale that assesses opinions, attitudes, or behaviors quantitatively.
8. Select, aggregate and/or pseudonymize	All of the above	Selecting data relevant for the purpose, and grouping them to make their analysis easier and/or pseudonymizing them to reduce risks for data subjects. Images that will be used in the study will be anonymized (blurring, covering of recognizable features).

[1] Tcha-Tokey, Katy, Olivier Christmann, Emilie Loup-Escande, and Simon Richir. "Proposition and Validation of a Questionnaire to Measure the User Experience in Immersive Virtual Environments." *International Journal of Virtual Reality* 16, no. <https://doi.org/10.20870/IJVR.2016.16.1.2880>.

## 5. Involved parties

Name party	Role party	Functions/departments with access	(Categories of) personal data	Data processing agreement
TU/e (including ECDT)	Controller	Main researcher and supervisor	All mentioned personal data	N/A
SURF (Research Drive)	Processor	Qualified employees who need access in order to perform their tasks	All mentioned personal data	Data processing agreement, work in progress
Microsoft	Processor	Qualified employees who need access in order to perform their tasks	Transcription of interviews	Yes, Campus and School amendment (concluded 2019 through Surf)
CWI	Third party (collaborator)	Qualified researcher at CWI who might need access in order to	N/A. CWI Only gets access to anonymized data or to	Collaboration and Data Sharing Agreement,

Name party	Role party	Functions/departments with access	(Categories of) personal data	Data processing agreement
		perform their tasks as mentor.	pseudonymized data without having access to the key.	work in progress
<b>Care organizations (potentially: Egala Raffy, Archipel, or Meerpaal)</b>	Support in recruitment of participants	None	N/A	N/A

## 6. Interests in processing activities

Involved Parties	Interests
<b>TU/e</b>	Conducting and publishing scientific research; educating the involved master student(s) to become researcher(s).
<b>Research participants</b>	Personal advantages to the participants is the development of a VR experience tailored to them by co-creation. Participants could perceive their participation as important, because the results could lead to improving, or adding to, the practices involved in non-pharmacological dementia care. This could (potentially) lead to social benefits. Not only could the care for patients in similar situations become better and faster, but it could also contribute to making the care in general better, (potentially) more efficient and more affordable.
<b>CWI</b>	For the research institute, particularly the DIS group (Distributed Interactive Systems), this research will contribute to their ongoing work on immersive and social VR. The research will add to their body of work.
<b>Care organisations (as mentioned in the <a href="#">table under 5</a>)</b>	The study will positively influence these organisations by organizing fun co-creations sessions for the PwD under their care. The sessions will be fun and socially engaging events. Care organisations are still being approached at the time of writing this DPIA. But it will be most likely a collaboration with Egala Raffy, Archipel, or Meerpaal.

## 7. Processing locations

Processing activity	Processing activity location	<a href="#">Transfer mechanism</a>
All mentioned processing activities	Within the EEA	N/A

## 8. Processing activity technology and method

Processing activity	Technique and method
<b>1. Request for information/collect contact details from caregiver</b>	Recording in Excel the contact details gathered from consent forms/ registration in standard data processing software under a license of the university: Microsoft Word, Excel, PowerPoint.
<b>2 &amp; 3. Collect demographic</b>	Recording the demographic information and stage of dementia, gathered directly from data subject or via a second party, e.g. caregiver. Done in standard

Processing activity	Technique and method
<b>information &amp; stage of dementia</b>	data processing software under a license of the university: Microsoft Word, Excel, PowerPoint.
<b>4. Recording video footage from focus groups and co-creation sessions</b>	Recordings will be done by using an offline Nikon D900 DSLR camera.
<b>5. Transcribe interview recording</b>	Recordings are transcribed via Microsoft Word, afterwards the recordings will be deleted, and the name of the participant will also be deleted from the transcript.
<b>6. documenting personal artifact</b>	Documentation of personal artifact will be done by either; photo-video graphing or sketching.
<b>7. Conducting, analyzing and archiving an interview transcription</b>	Audio recorded interview done using phone in flight mode. The audio is transcribed using MS Word and then deleted. After transcription, the data is saved and stored on OneDrive and archived in Research Drive with files containing personal data being encrypted.
<b>8. Editing of pictures/video, including anonymization (blurring faces)</b>	Editing in creative software, like Adobe Photoshop, from Creative Cloud. The files will only be kept/saved locally, not on the Adobe Cloud.
<b>8. Select, aggregate and/or pseudonymize</b>	The data gets clustered via the cluster analysis procedure in SPSS. As soon as data is collected, it will be labeled and saved under a pseudonym. A key file will be made where participants are linked to the pseudonym. This key file will be kept separately on OneDrive, and deleted as soon as there is no need for the document, e.g. after finalizing the last session. Only the main researcher will have access to the key file in OneDrive.
<b>9. Analysis quantitative data (from TBD selfreflective/QoL measures)</b>	SPSS will be used to analyze the anonymized data and to find correlations between the parameters. SPSS will also be used to make graphs and tables to illustrate the results of the research. SPSS will solely receive pseudonymized data, without possibly having access to the key or to any other additional information that is necessary to attribute the data to a specific individual. Consequently, SPSS will receive 'anonymized data' only. TU/e will store the key/additional information separately and subject it to technical and organizational measures to ensure SPSS has no legal means available to enable itself to access the additional information necessary to re-identify any data subjects involved. The data can therefore be considered anonymous for SPSS. Data will (also) be shared with the research partner (CWI) via SURF Research Drive.

## 9. Legal and policy framework

1. Article 1.3 Wet op het hoger onderwijs en wetenschappelijk onderzoek (WVO)
2. The TU/e codes of Conduct on Research Integrity and Academic Practice do apply regarding long term storage/archiving (10 years) of research data.
3. The study was approved by the Ethical Review Board, specific regulations mentioned in the approval letter will be adhered to.

## 10. Retention periods

Processing activity	Category personal data	Retention period	Motivation
<b>1 &amp; 2. Registration research participants</b>	Name contact details and demographics	6 weeks after interview	Couple of weeks after the interview in order to collect enough research data and possibly ask questions
<b>3. Analyze medical / health data</b>	Medical / Health data (pseudonymized)	10 years after finishing research	In order to safeguard research integrity and verifiability of research results.
<b>4, 5, 6 &amp; 8. Analyzing audio, photos and video files</b>	Voice recordings and audio recordings of the sessions with the participants	6 weeks after data collection	Couple of weeks after the interview in order to collect enough research data and possibly ask questions
<b>7 &amp; 9. Perform and archive an interview transcription</b>	Transcription of the interview (with any identifiable and sensitive information redacted)	10 years after finishing research	In order to safeguard research integrity and verifiability of research results

## B. Processing activities legal assessment

### 11. Legal basis

The legal basis for processing personal data will be public task of general interest, article 6(1)e GDPR, as TU/e has formally been assigned the task to conduct scientific research in article 1.3 of the Dutch Higher Education and Scientific Research Act. Special category of personal data can be derogated from the generic prohibition to process special categories of personal data, based on article 9(2)(a) GDPR jo. article 22.2(a) uAVG: explicit consent.

### 12. Special categories of personal data

Processing activity	Special data type	Exception ground
<b>3. Analyze medical / health data</b>	Medical / Health data (Stage of Dementia)	Explicit consent based on art. 9(2)(a) GDPR jo. article 22.2(a) uAVG.

Considering the characteristics of the participants in this study, the TU/e template consent and information form will be used in an adapted form to ensure participants can understand as good as possible, the scope and impact of the study. Next to that caregivers and participants will be briefed about the study via a very clear PowerPoint presentation.

### 13. Purpose limitation

Any personal data will only be gathered for the specified, explicit, and legitimate purposes stated in the consent form and in this DPIA. The data will not be processed in a manner that is incompatible with any of these purposes.

### 14. Necessity and proportionality



Taking into account the nature of the personal data involved, the fairness and lawfulness of the processing activities in connection with the security measures taken to protect personal data as much as possible, the privacy infringement of the participants involved should be considered **proportionate** in relation to the research purposes. It is not reasonably possible to achieve the research purposes without using any personal data, with less personal data or in a - for data subjects - less intrusive way. The personal data is therefore **necessary** for conducting the research.

**1. Requesting for information (contact details):** obtaining via the informed consent form is the most consensual approach, and essential for continuation of the project. Participant of caregiver can engage on own initiative. They both are provided information, in an appropriate and for them understandable manner.

**2. Documenting stage of dementia:** Developing an experience tailored to the patient's needs makes acquiring this information absolutely necessary. It is of essence to understand their needs thoroughly when making a scene, e.g. make sure they don't have to use cognition abilities that they lost, because the experience needs to be empowering. Therefore, there is no less disadvantageous way to the participant than disclosing the stage of dementia or 'status quo' of their health.

**3. Transcribing interview recording:**

Processing data is part of the iterative design process employed during this project. Additionally, making a recording is the least burdensome way of acquiring data once the PwD participate. E.g. it will not require them to work on a questionnaire. This processing activity infringes in the participants privacy by recording voice and other characteristics traits, but the data will be deleted after transcribing where only relevant material for the iteration process will be stored. This makes the processing activity reasonable in connection to what is needed to the research while respecting the data subjects capabilities & privacy.

**4. Select, aggregate and/or pseudonymize:**

For the approach in selecting what will be aggregated or pseudonymized the researcher will ensure to only collect and process data that is relevant to the current objective, e.g. in the exploration phase only what brings relevance to the design of the VR scene. Pseudonymizing from the data subjects perspective is an advantage as their input is used but not directly traceable, therefore most reasonable.

In conclusion, the data processing within this research is necessary and proportionate for achieving the research purposes which are of general interest for society as a whole, and for dementia-care-organizations and future persons with dementia in specific.

## 15. Data subjects' rights

Data subjects' right	Procedure	Limitation based on legal exception
<b>Right to information</b>	Data subjects are informed about the processing activity and about their rights via a (consent) form, which is also referred to as: the privacy statement. To ensure the accessible and easy transfer of this information, the researcher will provide participants with a form that matches the TU/e template consent form, with a PowerPoint called "information letter", supplemented by a consent form which is appropriate for	N/A

Data subjects' right	Procedure	Limitation based on legal exception
	the target group of the study (people with dementia) .	
<b>Right of access</b>	Participants can contact the main researcher and ask for accessing their data, to have the data rectified, deleted or having their processing limited/objected. Researcher will handle the request under the GDPR, without undue delay. This information will be communicated to the participants via the informed consent form/presentation. As mentioned. the data will be pseudonymized. Once the pseudonymization key is erased, it is no longer reasonably possible to uniquely identify a person in the data set. As a result, the researcher can no longer enforce the subject's right to object from that moment onwards in that data set.	When it comes to scientific research, and the necessary measures have been taken to ensure that the personal data can only be used for statistical or scientific purposes, Articles 15, 16, and 18 (right to access, rectification, and restriction of processing) can be excluded
<b>Right to rectification and completion</b>	See 'Right of access'	
<b>Right to restriction of data processing</b>	See 'Right of access'	
<b>Right to be forgotten</b>	See 'Right of access'	
<b>Right to data portability</b>	See 'Right of access'	N/A
<b>Right to object</b>	See 'Right of access'	N/A
<b>Right not to be subjected to automated decision making</b>	No automatic decision-making is being used	N/A

## C. Description and assessment of risks for data subjects

Risk	Description	Likelihood	Impact	Motivation
<b>Personal data is used for other purposes than defined beforehand</b>	Data subjects need to be informed beforehand of the data processing purposes and if this is not done beforehand, then the researcher and the TU/e are not compliant with article 5 of the GDPR nor with article 12-14 GDPR.	Low	High	Not following the research proposal would be harmful to the (reputation of the) researcher, as ERB approval and funding depend on it. Nevertheless, the impact would be high, as it involves sensitive data. Purposes are clearly defined leading to a low likelihood that data is used for other purposes. If there is an interest in the data to be used for another purpose, it will only be done if

Risk	Description	Likelihood	Impact	Motivation
				there is a possibility to ask participants for additional consent and only if such consent is given.
<b>Unauthorized user gets access to the system where personal data is processed</b>	Somebody gains access or keeps access to a system where personal data is processed but does not need this access (anymore). Dependent on the kind of authorization this person has, it might be possible that he/she can make changes to the personal data.	Low	Medium	Regular authorization checks and logging checks are performed, and the authorization of TU/e employees is immediately withdrawn when their employment ends. The places where data is stored and processed are password protected. Access only available on need-to-know basis.
<b>Unauthorized sharing of datasets with third parties or other persons</b>	The researcher can accidentally share personal data with third parties, for example when pseudonymization isn't done correctly or the key is accidentally also shared with recipients such as CIW. Another example would be when the dataset is saved on a computer (which is necessary to make certain calculations). However, this is not agreed upon beforehand and therefore not permitted, because the dataset cannot be supervised this way and other (unauthorized) persons might have access to the dataset as well.	Low	High	The TU/e researcher would ruin his/her academic career with this, and the motivation to do so is unclear. As we are working with a vulnerable group, the impact is considered high. The number of people who will have access to the data has been clearly defined. Furthermore, the storage space where data will be kept is password protected and the data will be processed on computers with encryption, thus there is a low likelihood of unauthorized access to the data. Pseudonymization key is held in a separate One Drive folder that only the main researcher has access to.

Risk	Description	Likelihood	Impact	Motivation
<b>Loss of data</b>	Data can be accidentally deleted or lost, or data storage location crushed	Low	High	The negative consequence from accidentally deleting or losing of data arise from carelessness of the researcher or malfunctioning / corrupted soft- or hardware. If this happens, the research will stop, relieving the subjects from participation. The data will be stored in a secure location with automatic back up, thus the risk of the loss of data is very minimal.
<b>The blurring/covering of footage is not done correctly.</b>	Data subjects, erroneously, remain recognizable in the footage if the images are not blurred or covered in the correct way.	Low	High	Low likelihood of happening because any use of blurred/covered footage (e.g. presentations or demo-day video's) will be reviewed by the students coach. Secondly, the blurring of original files will be done irreversibly.
<b>Pseudonymization is not done correctly</b>	The method of pseudonymization is described under paragraph 8 hereabove. Nonetheless, it is possible that the described method isn't strictly followed in practice. This leaves open some risks for data subjects.	Low	High	researcher could be in doubt about how to pseudonymize. They could, however, get in touch with the data-steward in that case.
<b>Data subject surrenders special category data during interviews at own initiative</b>	Data subject might mention things in the interviews that fall in the special (or sensitive) data category.	Medium	Medium	This part of the interview will not be included after the transcription, and thereafter deleted together with the recordings.
<b>Deletion of data on hardware is forgotten</b>	The Nikon camera and the phone used in flight mode for making audio- and video recordings of interviews before transcribing, might be incorrectly done or forgotten all together.	Low	High	The original files of the blurring
<b>Participants don not give consent freely,</b>	Participants may feel pressured to participate because of care givers	Low	High	Likelihood is low because of trust in

Risk	Description	Likelihood	Impact	Motivation
<b>but feel pressured to participate</b>	asking it in some type of way, or insisting of friends or family members.			<p>the caregivers approval, as they know the participant best. For friends and family it is also assumed that they do not force the participant in doing anything they don't want.</p> <p>This risk is out of the researchers control, therefore signs of uncomfortable feeling from the participant will be used during the sessions to verify, with the caregiver, if the participant wants to be 'here'.</p>

If any of the above situations take place, they may have an impact on the people involved. Specifically, if unauthorized parties have access to data and there is unauthorized sharing of the data with third parties the impact will be high, as it influences the participants directly and can have an impact on their daily lives. For example it can cause potential reputational damages, discrimination and/or exclusion. Furthermore, loss of data will have a high impact on researcher's project progress. If the project cannot be finalized, the participants will not be able to benefit from the potential outcomes of the project.

## D. Description of mitigating measures

### 17. Measures

Risk	Measures	Residual risk and risk estimation
Personal data is used for other purposes than defined beforehand	The financing conditions of this research project are based on the research proposal where the purposes of the research are stated and are approved after ethical review. The researchers will share their (most important) findings of their research within the TU/e in order to verify if their analysis is in line with their research objectives	The residual risk is low, because the financing is dependent on what is agreed upon in the research proposal and there is accountability because of the reporting of the findings
Unauthorized user gets access to the system where personal data is processed	The access to the datasets on the Research Drive is very limited. There is a strict authorization matrix established. Based on their role and tasks a person will be authorized to certain parts of the system (need to know basis). The authorization will be revoked as soon as the person does not need access anymore. The technical manager is responsible for authorization checks very two months.	The residual risk is negligible, because there are regular authorization checks

Risk	Measures	Residual risk and risk estimation
	Regarding TU/e employees, whenever they are no longer employed by the TU/e their access will be automatically revoked.	
Unauthorized sharing of datasets with third parties	All researchers of the TU/e have signed an NDA as part of their employment contract. This NDA states that they will exercise uttermost diligence and they are also not allowed to share other datasets than those that are contractually agreed upon.	There is little to no advantage for researchers to share datasets and therefore the risk is very low.
Loss of data	In order to prevent complete loss of data, all the data will be stored in a storage space that is regularly backed up. Videos are recorded in a dedicated offline device and the files are transferred to the secure storage as soon as possible and then deleted from the device. The offline device will be a DSLR camera (nikon D600), a device without internet connection possibilities. It will be stored in the ECDT office (on campus at the TU/e) accessible only to authorized personnel.	As the storage is maintained by the TU/e (ECDT office), the ECDT office is an on-campus office, accessible with regular authorization on a TU/e employee card. The likelihood of data loss is, for that reason, still medium. Impact for data subjects are considered medium.
The blurring/covering of footage is not done correctly.	Researcher will have access to experienced research colleagues at ECDT. They will guide- or help in the process of blurring/covering to ensure it is being done correctly.	In case of doubt a data steward or privacy officer can check if process was done correctly leading to a very low residual risk
Pseudonymization is not done correctly.	Researcher will have access to experienced research colleagues at ECDT. They will guide- or help in the process or pseudonymization to ensure it is being done correctly.	In case of doubt a data steward or privacy officer can check if process was done correctly leading to a very low residual risk
<b>Data subject surrenders special category data during interviews at own initiative.</b>	This part of the interview will not be included after the transcription, and thereafter deleted together with the recordings.	Leading to a very low residual risk.
<b>Deletion of data is forgotten</b>	An extra check will be incorporated into data management plan of this study to ensure researcher is reminded of the obligation to delete the data from both data carriers after transcription.	Leading to a very low residual risk.
Participants do not give consent freely, but feel pressured to participate	Signs of uncomfortable feeling from the participant will be used during the sessions to verify, with the caregiver, if the participant wants to be 'here'.	Impact of non-freely consent is high, but unlikely. Caregivers are expected to prevent uncomfortable participants from partaking in the experiment. If a participant shows signs of discomfort, this will immediately be

Risk	Measures	Residual risk and risk estimation
		discussed with the caregiver.

### Overall (residual) risks

*The overall residual risk of the study is low in likelihood but high in impact (mostly because participants are a vulnerable group and special category data is being processed).*

## E. Privacy by design

### 18. Lawfulness, fairness and transparency

**Is there a manual so that the relevant people know how to handle the personal data that are processed in the application?**

First of all, the researcher will complete the e-learning course “Privacy – the basics” to find his way in processing the personal data accordingly. Secondly, the researcher will maintain in contact with his coach and his data steward during the project if questions or requests arise. Lastly, only the main researcher and supervisor will handle personal data. They are both informed about the obligations of the GDPR.

### 19. Accuracy and up-to-date processing

**In what way is it guaranteed within the application or process that personal data are kept accurate and up to date?**

The main researcher will regularly check whether the personal data is accurate and up-to-date. If any inaccuracies or changes are found, this will immediately be adjusted. The participants may be contacted to confirm the accuracy of the data.

### 20. Confidentiality and integrity

**Which persons or which departments have access to the personal data?**

Supervisor; assistant professor

Main researcher; Master student.

**Is there an authorization matrix?**

Yes. Personal data are primarily accessed by the researchers managing the data, then (if necessary) by the data domain owner and the board.

**In what way are the personal data accessible?**

The data will be pseudonymized as described under 8 and stored on OneDrive in an encrypted form using cryptomator. Only the main researcher will have access to the data while the project is ongoing. After this period, the data that needs to be kept for the purpose of scientific verification of the published results is going to be anonymized, transferred to the supervisor and stored in Research Drive for 10 years. If applicable, the collaborators from CWI Amsterdam will have access to the pseudonymized (and for CWI anonymized) data through Research Drive. No other parties will have access to the data.

**Are the relevant people familiar with the data breach procedure?**

- the assistant professor, is well known with the data breach procedures of the TU/e. And the

researcher conducting the study is also informed about how to proceed in the case of a data breach.

- Data subjects will be informed through the approved informed consent form & information letter. The information- & consent letter is checked and approved by team Privacy Operations.

## 21. Obligation of accountability

**Is the data controller (data domain owner) aware of and in agreement with all that is stated above?**

Yes, the managing director of the Industrial Design department (data domain owner) is going to be informed about this DPIA and receive its final version.

## Conclusions and advice

Team privacy Operations:

Considering the importance and societal beneficial impact of this study on a society with an ageing population balanced against the potential impact of the data-processing in the study on participants in connection with the mitigating measures taken to minimize this impact as much as possible, the study is considered **proportionate**.

Taking into account that it is not reasonably possible to reach the objectives of the study without the use of personal data and considering that the principle of data minimization is complied with in this study, the processing of personal data in this study is considered **necessary**.

Next to that, **the DPIA has been extensively carried out and provides all the required information** in order for the DPO to give her advice.

Consequently, a **positive DPO-advice** on the study as described in this DPIA, could follow.

Date: 18-3-2024



## G – Protocol semi-guided interview with caregivers

### **Semi-guided interviewprotocol met zorgverleners bij Archipel**

**Doel:** Het verkrijgen van inzicht in de ervaringen, perspectieven en activiteiten van zorgverleners bij Archipel, met specifieke aandacht voor dagbestedingsactiviteiten voor mensen met dementie en het voorstel van een VR-beleving met geurintegratie.

#### **1. Inleiding (5 minuten)**

- Introductie van mezelf
- Verduidelijking van het doel van het interview en de onderwerpen die zullen worden besproken.
  1. Ik wil het hebben over jullie ervaringen rondom dagbesteding/leuke activiteiten.
  2. Mijn idee voor een VR applicatie voorleggen.
- Toestemming voor opname of notities (indien van toepassing).
- Verzekeren van vertrouwelijkheid en anonimiteit.

#### **2. Ervaringen met dagbesteding (15 minuten)**

- Welke verschillende dagbestedingsactiviteiten worden georganiseerd voor de mensen?
  1. Hoe ziet een dagelijkse routine eruit?
  2. Doen jullie dit individueel, or als groep?
  3. Hoe reageren jullie cliënten op de activiteiten? Wat vinden ze leuk of waar reageren ze het beste op?
  4. Kunnen jullie meer vertellen over individuele voorkeuren in termen van activiteit?
  5. Wat voor stimulans helpt objectief het beste voor de welzijn van cliënten?
    - Bv. Spelletjes, naar buiten, geuren, beelden, fotos van vroeger?

#### **3. VR-beleving met geurintegratie (15 minuten)**

- Introduceer het idee van de VR-beleving met geurintegratie.
- Vraag naar de mening van de zorgverleners over dit idee en hoe zij denken dat dit in de praktijk kan worden toegepast.
- Verken welke scènes zij zich voorstellen als geschikt voor de VR-beleving en hoe deze kunnen bijdragen aan het welzijn van mensen met dementie.

#### **4. Wat voor support missen jullie in dit vak?**

- Wat voor support hebben jullie op het werk?
- Wat voor emotionele support hebben of willen jullie op het werk?

#### **5. Afsluiting (5 minuten)**

- Bedank de zorgverleners voor hun deelname en waardevolle inzichten.
- Geef hen de gelegenheid om eventuele aanvullende opmerkingen of vragen te delen.
- Informeer over verdere stappen of vervolgacties.

## H – Protocol for Associative Memories workshop

*Reminiscence – ‘the act or process of recalling the past’ (Butler, 1963, p. 66)*

### 1. General information

- a. **Goal:**
  - i. Get acquainted with participants
  - ii. Document stage of dementia.
  - iii. Introduce scents and visuals to understand context of positive experiences lived, i.e. happy memories, musical memories, etc.
- b. **Participant pool/criteria:**
  - i. Person with dementia.
  - ii. No history of paranoia and no people that are grieving over unresolved loss because these groups might not respond favorably to reminiscence intervention, (Hamilton 1992).
- c. **Recruitment process:** By mailing project managers or caregivers from the care organisation
- d. **Place:** At care home facility.
- e. **Language:** Dutch (NL)
- f. **Materials:** A collection of essential oils (Floral, Baking scents, sea scents), Nikon D600, phone on airplane mode for voice recording
- g. **Preparatory task:** Create associative images document, collect essential oils
- h. **Data to be collected:**
  - i. Audio/video recording of session
  - ii. Transcripts of focus group & interviews

### 2. Protocol: activities and questions

- a. General introduction (15-20 mins)
  - i. Introduction of researcher.
  - ii. Present ‘information letter’ and sign ‘toestemmingsformulier’.
  - iii. Explain session activity.
- b. Start session activity (60-90 mins)
  - i. Introduce images and smells:
    1. Have a show and tell of personal memories associated with the diverse images and scents that will be introduced.
    2. Emphasize emotions and feelings with memories.
- c. Conclusion (15-20 mins).
  - i. Closure, inviting participants to share any last thoughts about the topics previously discussed.

Hamilton D. (1992) Reminiscence therapy. In: Nursing Interventions: Essential Nursing Treatments (eds Bulschenk, G. & McCloskey, J.), pp. 292–303. W.B. Saunders, Philadelphia, PA.

Butler, R. N. “The Life Review: An Interpretation of Reminiscence in the Aged.” *Psychiatry* 26 (February 1963): 65–76. <https://doi.org/10.1080/00332747.1963.11023339>.

## I – VR session protocol

### 1. General information

- a. **Goal:**
  - i. Share olfactory VR scene
  - ii. Measure experience through semi-guided questioning round
- b. **Participant pool/criteria:**
  - i. Person with dementia.
  - ii. Caregiver (formal or informal)
- c. **Recruitment process:** By mailing project managers or caregivers from the care organisation
- d. **Place:** Care home (Lobede/tilburg)
- e. **Language:** Dutch (NL)
- f. **Materials:** VR headset Quest 3, Nebula, Nikon D600, phone on airplane mode,
- g. **Preparatory task:** Create olfactory VR scene
- h. **Data to be collected:**
  - i. Audio/video recording of session
  - ii. Transcripts of focus group & interviews

### 2. Protocol: activities and questions

- a. General introduction (15-20 mins).
  - i. Introduction; coffee or tea, share personal memorabilia
  - ii. Explain the session activity.
  - iii. Re-state the information letter and ask for consent.
  - iv. Start session activity; Introduce participant to olfactory VR experience
- b. Start session activity (60 mins)
  - i. Introduce olfactory VR headset by holding it in front of participants' eyes.
  - ii. Assess the participants' readiness with the caregiver's judgment.
    - 1. If the participant reacts receptive, proceed to strap the headset.
    - 2. If the participant does not react receptively, hold the headset in front of the participant.
    - 3. If the participant reacts negatively, remove the headset
  - iii. Proceed with the questioning round, observe, and communicate with the participant.
    - 1. Ask the participant what they see: "Can you describe what you see around you?"
    - 2. Check for comfort: "Do you feel comfortable with the headset on?"
    - 3. Introduce olfactory stimulus: "Can you smell anything? What does it remind you of?"
    - Encourage exploration: "Try looking around. Do you see anything that catches your attention?"

## J – Illustration thematic analysis

Interesting excerpts from the interview transcriptions (1) were turned into statement cards (2) and clustered (3).

00:40:00 Spreker 4

**De sport het**

00:40:02 Spreker 4

**De sport het was de sport**

00:40:05 Spreker 2

**De uitzichten ook**

00:40:10 Spreker 4

**Die krijg je er automatisch bij he.**

00:40:11 Spreker 4

[inaudible] ..geschied

00:40:13 Spreker 2

**Maar weet je wat mooi is, golven hebben we ook gedaan.**

00:40:14 Spreker 2

1



2

S1

P1's wife brings up the story of winter holidays, and how the kids did not want to join church in the evenings.

Wintersport deden we wel altijd met de kinderen. Ooit waren we in IJtter met de hele familie. Toen gingen we 's avonds naar de nachtmis. Geen een van de kinderen wilde mee.

P1

P1 remembers how his kinds would sit in the car when they went into the church. Repeating how they were not that religious.

Nee zo gelovig waren ze niet.

Peter

It seems P1 enjoyed the holidays for the sport. Although the views are a nice bonus.

Het was voor de sport. [P1's wife adds to this] Ook de uitzichten. [P1 responds] krijg je er automatisch bij he

3

### P1 is a physically active person

P1

P1 likes music, en finds piano beautiful. But he will not go to a concert for hours, sitting too long gets tiring for him. He can also say this because currently he is always sitting, he cant walk anymore.

Piano zoek ik niet op. Als iemand mooi piano kan spelen is dat prachtig, maar zoek het niet op. Als iemand dan uren, veel te lang.

P1's wife

P1's wife talks about how they used to walk with their kids on forest walks on sundays. Together with their dog.

Zondags gingen we wel vaak wandelen met de kinderen in het bos. Toen hadden we ook een hond. Het was een caveliertje.

P1

P1 made a joke, saying they are good in golf. He said it laughing, hinting at it sarcastically.

Ja golven zijn we goed in, ha ha

P1

P1 adds to the views and travels that golfing is a fun sport and activity.

Ja, golven op zichzelf is Natuurlijk ook een leuke sport om te doen, hè?

## K - Expert Interviews with E1 and E2 from Archipel

The session started with a question about the daytime activities, and how they approach it. E2 kicked off by elaborating on music *“Music can reach these people. Look, people that are in a late stage of dementia, like this one lady here that can’t talk anymore, will start singing and swinging along if you put on an old song from their time”*. They give an example that music works well, specifically older music from a time that the person with dementia remembers. In the context of daytime activities, E1 adds to E2's response that creating recognisability is important. When asked if it's possible to generalise this by putting something on that everybody likes, E2 added “These people go back in time, and you try to move there with them. So, we let go of the present music and entertainment, and put on whatever they would put on”. Thus, E2 is describing an effort they put into grasping the client's point of view. This could be described as empathy, and it requires them to get to know the people personally in order to find their preference. E1 adds to this that images of the past also work, but to a lesser extent “Music always stays around more”.

The caregivers were then questioned about smells, and if- or how they employ aromas. E2 explained how they use smells that have calming qualities for clients that are in the last phase of their life by putting a diffuser in their room “You know lavender is known to be calming, what you see at us is that we put diffusers in the rooms of clients that are in the last phase of their lives”. They then added they also have a very strong diffuser for the livingroom, where E1 mentions the limitation of being restricted to one aroma “with that we are limited to 1 smell in the livingroom”. When asked if they think the smells are linked to memories, E1 elaborates “It is not so much that specific smells evoke specific memories, it's that they recognise the smells from everyday stuff within their house, garden or kitchen”. E2 adds to, saying “Yes, go bake a cake in the livingroom and talk to the people, this evokes all kinds of stories”.

When questioned about the kind of games and activities they organize and the level of active participation, E1 explained that not everybody is able to play cards but that they do a lot of word games where the client finishes old Dutch expressions, and how the clients are generally good in this “If I look at what we do here, we do quite some word games with the clients that are not too far. We will play expressions and sayings with information from their time, they are pretty good in this”. Physical activities are experienced differently by everybody, E1 explains “one is able to do more than the other”, “the physical activities don't require standing up, they often stay seated because of mobility and balance issues”, and “it is either focussing on an activity or mobility, doing this together is difficult for this target group”.

The caregivers were then briefed about the olfactory VR experience that this study aims on introducing, and what kind of visual or olfactory stimuli they would like to see incorporated. According to E1, a happy moment could be created if the scene would have recognisability “I think if you create recognisability, it could become a happy moment”. E2 adds to this saying “the people here sit inside most of the time, and only on occasion go out with either family or caregivers. I can imagine that for some “going

away on a trip' can be fun", "They will not understand VR, however, asking them if they would like to see the sea will work" and "That could be the added value of VR, that you can move people to a place without physically relocating them, showing them there's more than just this home, which otherwise costs a lot of time and effort".

Finally, the topic of emotional support in their worklives was addressed. When asked if they need emotional support, E2 responded with "Work for us is not just work. We work with people, and we are people too. Our clients are not the easiest, we deal with; aggression, sexual impulsivity, decease. We deal with a lot" and "we as professionals are trained for this, and we also support eachother a lot because we know what this work entails". E1 added to this that although the psychologists within the organisation are meant for the clients, that they are also available for the employees.

## L - Participants reactions in the Associative Memories workshop

P1

### Detailed profile

P1 is an individual who denies having dementia but is aware of his forgetfulness and relies on his wife to remember their shared experiences. This is evident from P1 referring to S1 when he doesn't remember a place or memory, e.g., "Yes, you know better, it's good you're here." Together, they shared a passion for travel and exploration, having visited many destinations worldwide. S1 elaborated on this, stating, "We wanted to see the world and travel more; that is what we decided when we were 50" and "he (P1) did not like a lot of hobbies close to home, he preferred traveling; for example, if the house needed painting, he would hire someone to do it."

This also validates P1's curiosity and eagerness to learn, reflecting on their travels where they actively explored different cultures and sports (e.g., doing cruises, traveling to distant destinations like South America, Russia, New Zealand or the US, and golfing or skiing in Portugal, Turkey, or Switzerland). While S1 would talk mostly about scenery and views, P1 would put emphasis on the sports being a lot of fun, e.g., "We went on this holiday (winter skiing) for the sport." S1 adds, "Also for the views," to which P1 responds, "That is a bonus, he" and P1 answers, "Golfing on itself is also a nice sport." as a response to S1 sharing, "I still remember standing under olive trees at this Algarve golf course, it felt like paradise."

His love for sports also became apparent in recollections that he didn't remember clearly, except for the fact that he enjoyed the sports. For example, "That is where we also played sports, isn't it? That is something I enjoyed, right? I liked sports." This affinity with sports can further be explained by the fact that he does not like to sit still for too long, derived from his opinion towards music and concerts; "If someone can play the piano, I find it beautiful, but if someone is playing for hours, that's too much for me."

Another thing that P1 always enjoyed while traveling or biking in The Netherlands was visiting churches and cathedrals. He continued, stating jokingly, "Yes, I am a 'church-o-phile'; I find it beautiful." This personal interest was not shared with his kids, who would often sit in the car or stay behind when visiting these Christian holy places. P1 elaborated on this by saying, "No, they were not that religious."

During the session, P1 used humor and a light-hearted, sometimes self-mocking approach to comfort or help his wife cope with challenging situations. For example, when S1 said she would still like to golf, but her knee is not working, P1 responded with, "I also stopped playing. Why is that? Because I'm confused, or just lazy?" and "yes, we were very good in golfing, haha." Using sarcasm to lighten the mood. P1 also has fond memories of his professional life, having worked at a tobacco company as a technical manager. With a humble attitude, he would talk about how he finished his higher technical education and traveled for his work.

The reactions from both P1 and his wife towards the images were mainly reminiscing about their travel stories. This is a defining part of P1's personhood.

### Interpretation

The themes reveal that P1 is a person who values travel, cultural experiences, and family activities. Despite his denial of dementia, he is aware of his forgetfulness and relies on his wife, Marie, to remember their shared experiences. P1's humor and light-hearted approach help him and Marie cope with the challenges posed by his mobility issues and memory loss. His passion for seeing the world and engaging in various activities is evident, even though his physical limitations have impacted their lifestyle. P1 also has a strong sense of nostalgia and sentimentality, often reminiscing about his professional life and past activities with fondness.

## Prompts and interactions

Peter went to toilet

Marie

Peter does not accept, or he denies, having dementia.

Weet je wat Het is, peter heb ik het woord dementie nog nooit horen uitspreken. Peter zit ook hier omdat hij niet kan lopen, hè?

Marie

Peter can't walk anymore. This is one of the reasons he is living in the care-home. If not for this Marie could have taken care of him.

Peter zit ook hier omdat hij niet meer kan lopen. Hij was thuis een paar keer op de grond gevallen, en toen kon ik hem ook niet meer optillen.

Marie

Marie is feeling lonely. She struggles without her partner around.

Dan zit ik thuis en denk ik god dorie, we hadden zo een sociaal leven. Ik zit elke avond alleen. Soms ga ik met een vriendin naar de film, dan voel ik me ook niet lekker.

Marie

She does not want to tell how hard she's having it with her husband around.

God ik wil het niet triest maken. Ik vertel het gewoon, maar wil het niet vertellen waar Peter bij zit.

Marie

Marie is talking about travelling, and how they were able to do it a lot, more then their friends. She explains how he did not enjoy small hobbies, but a lot of travelling.

Hij houdt niet van hobbies he? Hij zou het huis als het geschilderd moet worden, dat kon hij. Het liefst liet hij het doen.



Peter came back from toilet  
Session can start



Marie

Marie tells about how they used to take snacks when going out for biking. They always brought bread.

Picknicken hebben we niet echt gedaan. We gingen wel fietsen, en we namen altijd brood mee, we zochten ook een tafel op altijd.

Peter

Peter likes food, but it has to be comfortable. He thinks a picnic could be uncomfortable. He reminded Marie that they have a camper.

Ik denk aan eten, ik houd wel van eten. Maar wel comfortabel. Wij hebben tegenwoordig een camper. Maar ja naar de toilet gaan ging een beetje moeilijk. Ik ben niet meer zo snel.

Marie

Marie said they used to go to Ommen, she remembers their biking trips there

Marie

We gingen in Ommen

Peter

Peter agrees with Marie that they always brought bread, he puts emphasis on it being fairly cheap.

We gingen niet duur of zo. We namen zelf brood mee.

Marie

When travelling with the caravan, they would stop the car and put seats and a table outside to drink a coffee

met de caravan ook weggingen gingen we een eindje rijden en naar alle zin en koffie. Nou, dan zetten we de stoelen buiten die tafeltje buiten.

Peter

Peter remembered that they used to bike in Ommen. He adds to it that it is in the province Overijssel. He also got distracted by the outside weather, pointed out it was raining. He then laughed a little bit about the weather

Ommen ja da's in Overijssel.



Marie

Marie and Peter did not sent letters to eachother.

Oh nee, meestal ging Peter voor een dag of 3-4 op reis voor werk. Dat was meestal bellen ofzo.

Marie

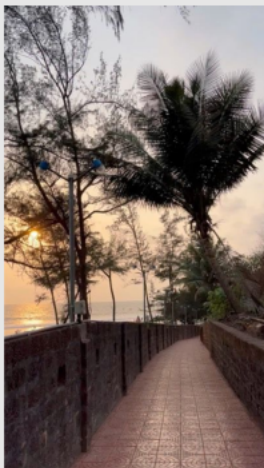
Peter really likes to see churches.

Waar was dat toch, volgens mij in Spanje of zo, dan ging je een kathedraal bekijken. Jij was altijd gek op kerken. Je kon geen kerk voorbij komen of we moesten de fiets aan de kant zetten.

Peter

Peter really likes churches and kathedrals. Marie recalls how the Sagrada Familia was under construction when they visited.

Ja ik ben een kerkofiel. Dat vind ik prachtig. [Marie adds to this] Toen wij daar waren stond die in de stijgers.



Marie

Marie speaks for Peter here, stating he always said that he wants to see the world. Peter agreed saying "yes, yes."

Dat zei jij ook altijd, 'ik wil de hele wereld zien'.

Marie

As a couple they would travel a lot from when they were 50. Especially to see the world, they considered Mallorca as a destination that would always be possible

Maar weet je wat we zeiden tegen elkaar ik vind het nou leuk om wat van de wereld te zien. Toen waren wij vanaf onze 50ste af elk jaar ergens heen gegaan. Mallorca en dat soort landen kun je altijd naar toe gaan wanneer je 60/70 bent.

Peter

Peter is aware that he is forgetful even though he never acknowledged dementia. He mentions how it's good that Marie is here to remember all the stories

Dat weet jij wel. Het is goed dat je erbij zit.

Marie

Marie recalls a holiday they had in Turkey. Here they took a cruise to Greece.

Toen waren we naar Turkije voor een rondreis. Ja en toen gingen we in Turkije een of andere plaats op een boot voor een cruise naar Griekeland.

Peter

Even though his memories are vague or lost, Marie often asks questions that Peter answers instantly.

[Marie asks question] Hoe heet de hoofdstad van Griekeland ook alweer?

[Peter answers]: athene

Marie

Marie recalls how they travelled to Buenos Aires for a 25 day cruise. She states that this is around the time Peter started to have trouble walking.

Mijn ieder geval en toen zijn we nog een keer naar Buenos Aires gevlogen. Daar hadden we een cruise vakantie gedaan van 25 dagen. Ja toen begon je slechter te lopen.

Marie

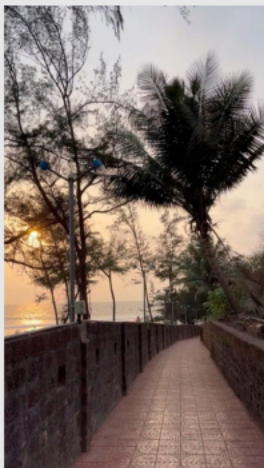
Marie recalls how they also did bridging holidays (bridging is a board game). These were with a big group, and in the weekend there would be a musical (Lion King).

We deden ook bridge vakanties, deden we ook. Hier in Nederland. Met een hele groep, het mooiste was dan in het weekend was er een musical, de lion king.

Peter

Peter likes music, and finds piano beautiful. But he will not go to a concert for hours, it gets tiring for him.

Piano zoek ik niet op. Als iemand mooi piano kan spelen is dat prachtig, maar zoek het niet op. Als iemand dan uren, veel te lang.



Marie

Marie speaks for peter here, stating he always said that he wants to see the world. Peter agreed saying "yes, yes."

Dat zei jij ook altijd, 'ik wil de hele wereld zien'.

Marie

As a couple they would travel a lot from when they were 50. Especially to see the world, they considered mallorca as a destination that would always be possible

Maar weet je wat we zeiden tegen elkaar ik vind het nou leuk om wat van de wereld te zien. Toen waren wij vanaf onze 50ste af elk jaar ergens heen gegaan. Mallorca en dat soort landen kun je altijd naar toe gaan wanneer je 60/70 bent.

Peter

Peter is aware that he is forgetful even though he never acknowledged dementia. He mentions how it's good that Marie is here to remember all the stories

Dat weet jij wel. Het is goed dat je erbij zit.

Marie

Marie recalls a holiday they had in Turkey. Here they took a cruise to Greece.

Toen waren we naar Turkije voor een rondreis. Ja en toen gingen we in Turkije een of andere plaats op een boot voor een cruise naar griekeland.

Peter

Even though his memories are vague or lost, Marie often asks questions that Peter answers instantly.

[Marie asks question] Hoe heet de hoofdstad van Griekeland ook alweer?

[Peter answers]: athene

Marie

Marie recalls how they travelled to Buenos Aires for a 25 day cruise. She states that this is around the time Peter started to have trouble walking.

Mijn ieder geval en toen zijn we nog een keer naar Buenos Aires gevlogen. Daar hadden we een cruise vakanties gedaan van 25 dagen. Ja toen begon je slechter te lopen.

Marie

Marie recalls how they also did bridging holidays (bridging is a board game). These were with a big group, and in the weekend there would be a musical (Lion King).

We deden ook bridge vakanties, deden we ook. Hier in Nederland. Met een hele groep, het mooiste was dan in het weekend was er een musical, de lion king.

Peter

Peter likes music, and finds piano beautiful. But he will not go to a concert for hours, it gets tiring for him.

Piano zoek ik niet op. Als iemand mooi piano kan spelen is dat prachtig, maar zoek het niet op. Als iemand dan uren, veel te lang.



Marie

The last theater show they saw was in Enschede. They went to see Andre Rieu.

Ja de laatste keer in Enschede, in schouwburg. Dat was Andre Rieu. Wij zijn niet echt klassieke mensen, he?

Marie

Marie talks about how they used to walk with their kids on forest walks on sundays. Together with their dog.

Zondags gingen we wel vaak wandelen met de kinderen in het bos. Toen hadden we ook een hond. Het was een cavaliertje.

Peter

Peter explains the name of the dog, which means happy thief in french.

Katoesh. Zo heette de hond. In frans betekend het 'vrolijke dief'.

Marie

Marie talks about how they used to walk with their kids on forest walks on sundays. Together with their dog.

Ja, ja toen waren de kinderen. Hoe oud waren ze toen jaar of 13, 14? En die wilden een hond hebben, eigenlijk zon zo een. Golden retriever.



Marie

They have not seen delft. But Marie mentioned how they used to visit cities in NL by train to see, and that is was not great because Peter was not able to walk very well.

Maar ja, weet je wat Het is? Weet, ik ging ook wel eens met de trein mee. Maar als je slecht kan lopen valt dat wel enorm tegen.

Peter

Peter looked at the painting after he was asked if he recognises it. He asks if it is Brugge. After saying it is Delft he asks if he can see the painting/hold it.

Is dat Brugge? Mag ik even kijken? Delft kennen wij helemaal niet. Kan me niet herinneren.



Marie

P1's wife brings up the story of winter holidays, and how the kids did not want to join church in the evenings.

Wintersport deden we wel altijd met de kinderen. Ooit waren we in Iitter met de hele familie. Toen gingen we 's avonds naar de nachtmis. Geen een van de kinderen wilde mee.

Peter

P1 remembers how his kinds would sit in the car when they went into the church. Repeating how they were not that religious.

Nee zo gelovig waren ze niet.

Peter

It seems P1 enjoyed the holidays for the sport. Although the views are a nice bonus.

*Het was voor de sport. [P1's wife adds to this] Ook de uitzichten. [P1 responds] krijg je er automatisch bij he*

Marie

P'1 wife brought up that they also used to play golf, as part of their active life.

Maar weet je wat mooi is, golven hebben we ook gedaan. Als we het hebben over uitzichten; dan sta je bij de zee, met al dat groen, en nou die olijfbomen weet je wel. In Turkije, Spanje, Portugal

Peter

P1 made a joke, saying they are good in golf. He said it laughing, hinting at it sarcastically.

Another example of P1's sense of humor, adding to his wives story with details about their friend

*Ja golven zijn we goed in, ha ha*

Marie

P1's wife describes the view in Algarve, Portugal, as amazing.

*Nou, in mijn geval vind ik ook nog niet zolang en ik weet nog dat ik dat stond onder de olijfbomen ook. Ik voelde me net in het paradijs*

Peter

P1 recalls someone called Klaas. Joking about him being a surgeon with fat fingers. It shows his humor, and the importance of this acquaintance over the views.

*Klaas was die tandarts he? Das een beetje een ouwehoer. Kon ik echt mee lachen met die man, dat was leuk. Hij had van die hele dikke grote handen, ik denk man dat jij nog tandarts kan zijn?*

Marie

Marie is also experiencing body pains that disable her from being active

*Ja, dat vind ik nogsteeds mooi, Maar ik heb op het moment zo ik last van knie.*

Peter

Peter adds to the views and travels that golfing is a fun sport and activity.

*Ja, golven op zichzelf is Natuurlijk ook een leuke sport om te doen, hè?*

Peter

After Marie said she would still like to golf, but her knee is not working, Peter made a joke and asked why he was not playing anymore? Because he's confused, or lazy? It was a funny remark. It showed his approach in comforting his wife on his own characteristic, funny way.

*Ik doe het ook niet meer. Waarom? Nu doe ik het ook niet. Verwarring misschien? Te lui?*

Peter

Peter was an active person, saying again that he enjoyed the sports they were playing.

As Marie was talking about other golf courses in the Netherlands (Zwolle, Wierden), Peter said: *'Daar hebben we ook gesport he, vond ik wel leuk sporten'*

Peter

Peter was showing where he had his office at a tobacco company, at a workshop that he was managing.

*'Hier achter was de technische dienst, daar was een werkplaats en daar was ik een beetje z'n klein baasje.'*



Peter

Peter said he did not smoke, but after Marie brought up La Paz, he remembered he smoked small cigarettes.

Marie said 'ja maar jij hebt wel gerookt, hoor', after Peter answered 'Ja, maar niet veel'. After this Marie said 'La Paz', And peter answered: 'Ja, sigaren wel, gewoon van die lekker kleine sigaretjes zo'.



Peter

After La Paz cigars were brought up, Peter mentioned Agio Gouden Oogst. He remembers smoking these with Marie's dad, saying jokingly how they used to make the room smokey. He then repeats it again, saying he remembers. He seems to enjoy remembering this.

*"Agio Gouden Oogst, jouw vader rookte die ook. Dan staken we alle twee een sigaret aan, en dan stond de hele kamer blauw."*

*"Agio Gouden Oogst, ik weet het nog. Dat waren knoepers van sigaretten"*



Peter goes to the toilet

Sticky note N

Marie

Previously Peter was able to talk a lot about their holidays, Marie notes how Peter is declining with his recollections.

*Ja het is anders. Voorheen kon die ook nog als we ergens op vakantie waren geweest, dan kon die je zo alles vertellen*

Marie

Maries talks about sunflower fields in France after talking about the smell of lavendel. She thinks happily back about these views. She follows up with saying they were great together.

When talking about scents like lavendel, Marie brings up: Toen waren we in Frankrijk op vakantie bij allemaal van die zonnebloemen. Ja vond ik ook heel mooi, we hebben altijd leuke vakanties gehad. We konden altijd heel goed met elkaar overweg.

Marie

Marie states again how they used t move a lot, doing a lot of biking.

Sportief waren we altijd. Fietsen deden we veel.

Marie

Marie is saying how she is feeling less strong, mentioning her medical problems.

De hele winter heb ik in de lappenmand gezeten. Ja, ik had hier de pols gekneusd. En mijn knie, ja slijtage waarschijnlijk, moet ik een nieuwe knie hebben.

## P2

### Detailed profile

P2 is a person deeply connected to her family and nature, which is evident from the memories prompted by images and smells that revolve mostly around her family and being outdoors. For instance, P2 would elaborate; “we would sit in the grass, and Dad and Mom would bring all the stuff, and we would sit on a towel and have a picnic.” Her affinity with nature can be supported by excerpts like “With good weather, we would grab our instruments and walk to the forest near our home” and “The cows could be roaming around too.” These moments that involve nature and music are what P2 would describe as the good life; “Music and nature, that was enjoyable, that was the good life” and “As a farmer’s family, you eat outside and work outside. Everything is outside, it is ideal”.

In addition, P2 can be described as a social person, which is evident from how her definition of the good life was shared with family, friends, or neighbors: “We did not go pick nicking with family only; friends and neighbors joined too.” This farmers’ lifestyle also meant that everybody had their responsibilities. P2 elaborates, “When we finished picnicking, dad would clean up, and we would start working,” and “Everybody had their responsibility; we were not asked to work; it was just like that.” This lifestyle created a strong bond between P2 and her siblings, which is reflected in the sentimental value placed on communication through letters when she was at boarding school: “When I was in boarding school, in Belgium, we wrote each other a lot of letters. This is how we maintained contact”. P2 continues saying she would even recognize the different handwriting: “All of them had different handwriting, one cursive, one curly, one straight. When a letter would arrive, you would immediately know from who just from the handwriting”.

In addition, her memories are often tied to specific locations that involve her family. For example, she would share how the attraction fair was visited with the entire family: “We were known as a big family, so the guy made us wait so the 9 of us could play the shooting game together”. P2 also recalled the Ferris wheel, which was something her dad enjoyed a lot: “Our dad like that, for a day to go out with the kids.” However, P2 follows this up with an association between her dad and his work ethic, just as she did when talking about pick-nicking: “But afterward we would go back to work. It was always working” and “as a family, we would not spend more than a day at places like this because work had to be done (back on the farm).” This was shared without animosity, as she would add, “As we got older, he also made us study.” Another location P2 shared was Antwerp as a response to the Vermeer painting, saying, “This looks like Antwerp, because of the churches. Antwerp is full of churches” and “Antwerp without churches is impossible. That is like Tilburg without the Hasseltse Chapel”.

Overall, her love and connectedness to her family is a defining part of her personhood.

### Interpretation

The themes reveal that P2 values family, nature, and music, which are integral parts of her identity and life experiences. Her memories are often tied to specific locations and events, indicating a strong sense of place and tradition. The sentimental value placed on communication through letters and modern methods like video chat underscores her desire to stay connected with loved ones.



## Prompts and interactions



Dit is perfect weer om te picknicken. Heeft u vroeger gepicknicked?

The image reminds the participant of sitting in the meadow grass, together with her parents that would bring stuff. This came across as a warm memory.

Als ik de foto bekijk dan kijk ik naar de ruimte ga ik vandaan komen. Dat dorp dat dorp zelf is z'n afbeelding. Je gaat buiten in de wei liggen en je hebt brood bij en je hebt alle mogelijke dingen bij en dan gingen we altijd daarin in het gras zitten. En PA of Ma die bracht het spullen mee die hij bracht. Je had altijd een gedekte tafel op het weiland.

The details of the stories when picnicking go beyond family, details of the surrounding is also remembered.

Het kon ook zijn dat de koeien daar rondliepen. Met de familie en met vrienden maakte niet uit. Het ging allemaal met die Mensen, gingen picknicken. We hadden dan een klein boerderijtje, dus had dan een laken neergelegd, anders zou je in het vuil zitten zitten en dan gingen we daar picknicken waar wij dan picknicken nou.

The thought of sitting in the grass also brings up the memories of her working family, that were farmers and always hard workers. This outside life is described as ideal.

Als we dan klaar waren, dan zou die (pa) alles opruimen, en dan moesten we de weiland in. Dan moesten we weer gewerkt worden. Een boeren familie. Ja, maar ja, dan eet je ook buiten, en werkt buiten. Alles was buiten, dat is ideaal.

En op reis gaan, deden jullie dat ook samen?

Travelling was not a thing, as farmers a lot of country work had to be done.

Wij gingen niet op reis, dat kende we niet want we moesten werken.

Before the interview started with P2 talking about the weather, the languages she speaks. Early on, she stated how she talks online with her brothers and sisters to stay in touch every wednesday. En dan hebben we dat contact met ieder.

Waar uit belgie kwam u? "tussene het gentse en de zee". Gents is aan andere taal.  
P2 is Roman Catholic "ja is dat rooms katholiek rooms katholiek, ja. Dat is denk ik voor de meeste."

Hoe langf heeft u daar gewoon?

Marie

40 jaar. En uit liefde ben ik naar nederland gekomen.

She describes herself as a real outside person, which she also associates with playing music instruments outdoors, which *they did a lot*

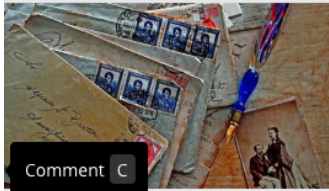
Ik ben echt een buitenmens, ja heel erg, zo ver, dat ik met mn broers en zusjes, vader moeder, we speelde allemaal muziek. Gitaar, banjo, mandoline.

From the forest to the terrace, they would meet with music instruments with family and neighbours, sing, these are fond memories of her.

Als het goed weer was, dan nam iedereen zijn instrument onder de naal een wandelend wandelend het bos in, want daar zaten we ook tegenaan tegen het bos en daaruit begonnen we liederen te zingen. Mee start kwamen dat we daar en daar overal burens die kwamen dan met hun instrumenten. Toenbij ons buiten op het terrasje zitten en daar werd gespeeld en gedanst en gedaan.

The music and being in nature is what encompasses 'the good life'

Dus muziek en natuur dat was genieten, dat was het leven.



Comment C

letters remind her of boarding school, especially the letters sent by her brothers and sisters when she lived in Belgium. This is how they maintained touch.

Dat doet denken aan al mijn broers en mijn zussen die me allemaal geschreven hebben in de loop der tijd. Toen ik gewoon in België nog was, ik ben een kostschool geweest. Ja, en dus daar werd heel veel geschreven van A naar B en waar b naar C. Toen werden de brieven geschreven, en gebleven we op die manier ook op de hoogte van elkaar.

Letters also make her think about home, and how that's also where she received letters from her brothers or sisters. She was even able to distinguish the handwritings from one another.

Het geeft gevoel van Van ja terug naar huis, even thuis weer. Onder de pannen zijn zoals wij dat zeggen, gewoon weer lekker thuis. Dan gaan we weer een brief kreeg ja, wat ook heel apart was. Die hadden allemaal andere handschriften. De ene is schreef meer zo gekruld de andere schreef meer recht en dan de brief die binnenkwam, dan zie je, oh, Dat is een brief van het die.

Dus brieven zijn een leuk iets. Daar werd u wel vrolijk van?

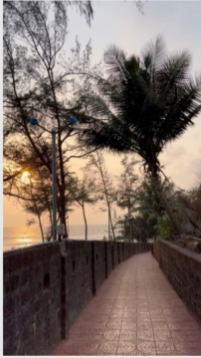
Receiving letters is a fun thing for the participant, because it is from her brothers or sisters.

Meestal wel. Het was meestal van thuis dat brieven kreeg, of van broers of zussen.

The contact that was maintained through letters reminds of current contact she has through video chat. She was discussing if they had letters that their parents sent, these letters hold sentimental value.

Daar had ik het toevallig deze week nog over met video call. We hadden het over of we nog de brieven van onze pa en moeder hebben. Dat is het enige wat we van hun nog hebben. Dat is wat het nu waarde geeft. Als we nu 's avonds contact hebben (video call) dan kunnen we daar zo lang over doorpraten.

Ik ben er eentje van 9 kinderen. Als ik dan ruzie had met die, dan kon ik naar die andere gaan als ik ruzie had. Er was altijd iemand om mee bezig te zijn.



She likes pictures as 'an art', just like music. It reminds her of her daughter in law that is also good in photography.

Staat er mooi op. Ja bij ons, net als muziek, maakte we veel fotos. Zelfs de schoondochter. Die is kwa fotografie op de hoge school ook bezig met fotografie.

Holidays were mostly spent by walking in nature, being in nature seems her definition of relaxation.

Zeg maar over vakanties zelf, lekker rond veel wandelen. Echt in de bossen, puur natuur.

Zelfs hier, dan denk ik, zou daar niet zitten. Wil ik dan even hier zitten dat ik de zon



What are you seeing in this image? Does this make you think of something?

The attraction fair is associated with running children, and proper clothes because you had to be dressed nicely to go. Jumping was necessary to reach at the stalls too.

Ja dat doet men denken aan de kermis bij ons in het dorp kermis. [why?] Omdat hier de kinderen flink rennen in het bos. Die heeft andere kleding aan, die heeft nettere kleding, dan mocht je zo naar de kermis. Als ik kijk naar deze die springt, dan denk ik terug aan die kraam waar we met ons allen bij een kraam stonden.



The attraction fair was visited with the entire family, and since her family was big, they would have to wait for all 9 to play the shooting game together.

Bij de kermis dan kende die man ons van jaren. Dan zei die allemaal even 5 min wachten want familie de xxx komt, dat was mijn familie naam, en dan mochten wij allemaal met 9 man schieten.

The drawing reminds of Antwerp because of the many churches in that city.

Lijkt wel op antwerpen [als dit antwerpen is, waar doet dit u aan denken]. Dan komen de torens tot hun recht, en kerken. Antwerpen staat vol met kerken.

Antwerp cannot be imagined without churches. She brings up the Hasseltse Kapel, and how tilburg would be different without it.

Antwerpen zonder kerken dat kan niet. dat is net als de Hasseltse kapel, zonder dat kapelleke kan het niet, dat hoort er gewoon bij.

She perceived the two people depicted in the painting as two older people either departing or arriving

Het is wel een mooie foto. Die twee oudjes hier kunnen vertrekken of aankomen.

Talking about the water, participant reminisces about that one time her brothers were teasing her in the water and she almost drowned. There was little animosity talking about this, and its best described as friendly sibling play.

Ik ben alleen een keer flink door het water gezakt en toen dacht ik dat ik verdrank. Toen hadden mn broers me naar beneden getrokken. Dat was gewoon vriendelijk pesten. Zulke dingen heb ik daar beleefd, dat was dan in Antwerpen.



GEUR - Pinetree scent

The big star makes participant think about Antwerp during Christmas, and the ferriswheel, was also found in Antwerpen, which her father liked a lot, especially with the kids. However, only for the day because afterwards there was farmers work to be done. These associations strongly involve her family, especially her father.

Dit .. helemaal in antwerpen. Da's een grote ster, die hadden we met kerst. Een draaimolen, die hadden we ook altijd op de kermis. Dat vond onze pa wel leuk, voor een dag met de kinderen uit. Maar dan moest er weer gewerkt worden. Het was altijd werken.

Participant's father was a hard worker, with experience in the mine and farmer work. Everybody had their responsibility and tasks around this household. However, there is a proud tone in saying that father steered them towards studying when they reached that certain age.

[wat voor werk?] M'n pa van origine was een mijnwerker, en die is zover geweest dat hij zn pensioen niet haalde omdat hij twee jaar tekort had. Toen hij stopte was hij overgegaan op de boerderij, en daar werd pa veel voor ingezet. [hoe voelde dat?] Iedereen deed zijn taak. Ons werd niet gevraagd om te werken, dat was gewoon. Toen wij ouder werden moesten wij studeren van hem.

Participant continues sharing how her dat steered them into the right direction, and that he knew individually how to manage everybody's qualities in a big family.

Toen wij ouder werden moesten wij studeren van hem. Studie ging voor. Dat had voorrang, plezier maken is leuk, maar we moesten wel studeren.

Ja ja wat Zonder geleerd zoals mijn Pa ook niet, maar hij wist wel altijd heel precies alles letten precies dat plaatsje voelen, Dat is beter voor jou, dan moeten jij beter.

Scent makes participant remember nature, green grass. Specifically that of a meadow, something closely related to the place she grew up

het herinert mij naar een weiland geur. Groene gras. Daar zit die geur voor mij.

GEUR - Pinetree scent

Scent makes participant remember nature, green grass. Specifically that of a meadow, something closely related to the place she grew up

het herinert mij naar een weiland geur. Groene gras.  
Daar zit die geur voor mij.

GEUR - Ocean breeze

Participant liked it but could not place it. After suggesting the ocean, she said "yes that could be". When asked what it reminds her of, she answered "we have been there a lot, we (family) went biking to the sea.

Het is heel lekker, maar waar het vanaf komt kan ik niet zeggen. [het is oceaan geur] Ja, dat zou kunnen. [waar doet u dat aan denken, was u vaak bij de zee?] Wij zijn er veel geweest, op de fietske daar naartoe. Goh hoe is het mogelijk, ineens komt dat.

"Oh how is it possible" showed how the memory became clear while smelling the Ocean Breeze scent. It seemed that the memory became linked to the smell once she knew where to place it.

Goh hoe is het mogelijk, ineens komt dat.

GEUR - sugar cookie

The sweet smell made p2 say "oh god thats nice", it made her feel like eating candy. Moreover, it reminded her of the Hasseltse Kapel, specifically the sweets. It seems that the chapel is associated with sweet stuff.

Waar doet dit u aan denken? Oh god dat is lekker. [Waar krijgen we zin in] snoepjes ha ha ha. Hasseltse kapel, ja, chocolade. Het zoetige bij de Hasseltse kapel.

## P3

### Detailed profile

P3 is a person with a passion for trading and collecting goods; this holds a significant part of his identity that became evident when he enthusiastically shared certain artifacts in his room, mainly relics and Delfts Blauw ceramics. This is one of the specific things that hold his interest, as he would answer, “No, no, I did not have a lot of those,” to the question of whether he traded other goods like post stamps. P3 would elaborate through a Dutch expression how he always remained busy, saying, “Sjaggeren tot je erbij neervalt, it means staying busy till you drop. I was always busy”.

P3's strong work ethic is underscored by his answer to the question of whether he used to bike a lot, “no, trading took all my time. I had a storage under an apartment for this. Sometimes I would work 60 hours a week to spend the longer weekends on trade”. This passion can be seen as a family activity, too, as it involved his son and daughter in the markets and his wife cleaning the goods. It could be described as quality time. P3 described, *“Yes, I went to trading fairs, all the goods I stored at home. My wife never joined the fairs, but she cleaned and maintained the goods. My son would very frequently come along, my daughter too”*. It is especially his son that he includes, saying he was gifted a medal by his son when he stopped trading: “Then, at some point, I did not have a car. That is when my son said “if you quit the trade, I will give you this trophy,” P3 is particularly proud showing this memento. This gesture also highlights his son's involvement in taking care of his dad, as he got this present during the onset of his dementia, while P3 remembers it as a proud thing and not as an end of his passion.

As previously stated, biking, sports, and other exercises were not a big part of P3's life because he was occupied with trading when time allowed it. However, P3 holds dear memories about frequently going to Maastricht to ‘house-sit’ their acquaintances' house. His wife would clean the house while he would explore the city by bike. P3 elaborates on this, saying, “In Maastricht, there is a Ferris wheel; I have been there a lot to visit our friends. I would park the car in their garage. My wife would clean, and I would explore the city. Just for the weekend”. This was also something they did ‘on the side,’ shown by P3, that gave the hand gesture for money (figure x).

Besides trading, P3 is often reminded of Austria, which was a favorite holiday destination. He elaborates, “Because I worked different shifts, I was saving free days; that is how I managed to see Austria in every season.” This excerpt includes a statement about hard work, affirming his work ethic. In addition, as a response to the running children visual, P3 also recollects his children joining Austria when they were younger, stating, “This reminds me of my own children, when they were younger they would join to Austria, we had beautiful forests and nature.”

Overall, P3's direct family, trading passion, and work ethic are a big part of his personhood. His trading passion was not so much an individual activity as the involvement of his family was instrumental. Just as with his recollection of trading, his recounting of holiday trips to Austria also involved his work ethic and, most importantly, a dedication to making meaningful family experiences.

### Interpretation

The themes reveal that P3 is a person who values hard work, family, and exploration. His passion for trading and collecting goods is a significant part of his identity, providing him with a sense of pride and accomplishment. P3's strong work ethic is evident in the long hours he dedicated to his job and trading activities. Family plays a central role in his life, with many of his activities and holidays involving family members. Travel and cultural experiences, particularly in Austria and Spain, are cherished memories that enrich his life. P3 values sentimental communication through letters and gifts, highlighting his appreciation for meaningful connections. Lastly, his love for exploration and learning new areas indicates a curious and adventurous personality.

## Prompts and interactions

<p>Wat voor beroep had u?</p>	<p>Participant worked in shifts for the majority of his life. However, the trading he did on the side was described as a passion, something he was proud of.</p> <p>Ik werkte in 5 ploegen, heb ik jaren gedaan. Dan kun je die tijd die je vrij hebt benutten. Dan ging ik inkopen en ook verkopen.</p>	<p>Trading goods on fairs and thrift shop events was a family activity that involved his son and daughter. It was something they could bond over or do together according to the participant. P3's wife used to clean/maintain the artefacts</p> <p>[deed u dat ook met uw kinderen?] Ja ik stond op rommelmarkten, en al die spullen hield ik thuis. Mijn vrouw ging nooit mee maar deed wel poetsen en schoon houden. Mijn zoon ging dikwijls mee en mn andere dochter ook.</p>	<p>Austria is also connected to his trading hobby/passion. It is where he got one of the paintings in his room, it's a place they always went to with his wife and kids by car. This makes Austria connected to both holiday memories and his passion</p> <p>Schilderijen zoals die, die heb ik uit oosterijk meegenomen, ik heb 40 jaar aan stuk altijd naar Oosterijk gereden, met auto vrouw en kinderen.</p>
	<p>"ah yes food". He continues explaining about how his daughter started working in Austria. This story did not seem very connected to the pick-nick topic, as he continued sharing how his daughter made her way to Austria.</p> <p>Ah eten. Het was zo. Mijn dochter werkte in oosterijk. Ze was nog geen 18 jaar. Ze was in Oosterijk en ze ging daar werken omdat ze Duits sprak, terwijl ze nog geen papieren had van school. Ze is daar toen gaan werken op kantoor, als aanspreekpunt voor het hotel.</p>		
	<p>When asked about picknicking again, he said yes I know this. He said "sjaggeren tot je erbij neervalt", the meaning he explained was staying busy till you fall.</p> <p>Ja dit ken ik wel, lekker buiten zitten. [grabs something] 'Sjaggeren tot je erbij neervalt' betekend dat je altijd bezig bent. Ik was altijd bezig, en ik had op een geven moment geen auto meer, toen zei mijn zoon als je stopt met de rommelmarkt krijg je deze gedenkteken. .</p>	<p>He continues saying how he always stayed busy. Then, at some point he did not have a car. Thats when his son said "if you quit the trade, I will give you this trophy". P3 was proud showing this artefact, amongst other things in his room like Delfts Blauw and other memento's.</p>	
	<p>Ik reed rond, en stond een grote container waar mensen hun spullen in gooiden. Die hoed had ik meegenomen maar wist helemaal niet wat dat was. En toen ik die hoed op had bij de kraam, riep iedereen mario mario. Zo doende heb ik deze beker gekregen van mijn zoon</p>		
<p>Fietste u veel?</p>	<p>When asked if they biked a lot, P3 answered "no, trade is what took all my time", "I had a garage under an apartment building for this". He continues saying he worked for two bosses in the textile industry, "sometimes even 60h a week". The time left he spend on trade.</p> <p>Nee. dat handel ging alle tijd in zitten. Ik had ook een garage en die stond onder een flat.ik werkte bij twee bazen, in textiel. 37 jaar. Heb zelfs 60 uur gewerkt.</p>	<p>This excerpt could describe P3 as a workaholic and that trading goods was a passion of his. He seems proud putting emphasis on the amount of hours he worked his job, to continue doing the trading of goods in his spare time. The was little time for other things.</p>	





Participant would not describe himself as a writer, he would make other people write his letters saying "I would make other people write if I had to make a nice letter". This shows how P3's interest lied elsewhere,

This shows how P3's did not have interest in post stamps, pointing out it was not part of his trade "no I did not have a lot of them".

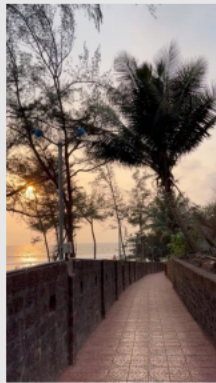
Buitenlandse postzegels, brieven. [waar doet dit u aan denken?] Ik ben niet zo een schrijver, een mooie brief schrijven liet ik door iemand anders doen.

"Nee nee daar had ik niet zoveel van"

Ontvangt u ook brieven?

When asked about receiving letters, P3 shows a letter from a girl in Austria that wrote a Dutch letter to him. most importantly, this women also gave him a relic as a present. It shows how the people around him also know his love for 'things' and trade.

Ja kijk deze is helemaal in het nederlands geschreven, maar het is een Oostenrijks meisje. Die heeft de brief zelf geschreven. [Grabs a relic that he received as a present] en dit heb ik van dat meisje gekregen als aandenken.



Ja dat zie ik wel dat het tropisch is, dat zie ik aan de bomen.

Talking about sunny holidays reminds P3 of acquaintances from Maastricht that bought a home in Spain. P3 used to go to Maastricht and house-sit the apartment.

Maar die kochten een huis in spanje vanwege het klimaat. Dan gingen ze voor een half jaar daar, en dan hier. [Dat waren vrienden?] Kennisen

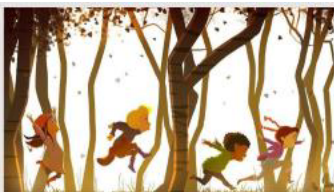
Participant describes the house in Maastricht as something they did 'on the side'. But at some point, they were also invited to Spain by the acquaintances. With this, P3 now describes his relationship as more friend-like.

Was in maastricht, dan maakte mijn vrouw daar school en gingen we over het weekend weer terug. Dan moesten we op en neer rijden van tilburg naar maastricht. En toen waren we ook uitgenodigd om daar naartoe te komen.

Weinig zon vakanties gedaan?

As far as other holidays go, it is mostly Austria that he visited. P3 elaborates "because I worked different shifts, I was saving free days, that is how I even saw Austria in all four seasons".

Ja ik heb wel, omdat ik verschillende diensten had deed ik dagen opsparen. Dus toen heb ik Oosterijk in alle 4 jaargetijden gezien.



The picture of running children reminds P3 about his own children, and them joining to Austria, with forests and pretty nature. This shows how Austria overlaps with his children, nature and holidays.

Ja aan m'n eigen kinderen he. Toen ze klein waren gingen ze ook mee naaar Oosterrijk. Allemaal bossen en mooie natuur.

For a holiday destination food is important. P3 takes Austria as an example, and describes it as a sausage country.

Als er maar goed te eten is dat is belangrijk. Worst land is het ook wel, zit dicht tegen de duitse grens aan. Waar we zaten bij de boeren. Dan kregen we smorgens ontbijt, en smiddags moesten we het zelf regelen, en savonds gingen we meestal naar een restaurant, maar dat was betaalbaar wel.



P3 leans forward to inspect the Vermeer painting, it shows his 'nature as a trader'. He inspects the drawing more meticulous than the others by describing details "This is Dutch, look at the clothes, it is old dutch"

[shows interest, leans forward] Dit is Nederlandse afbeelding, kijk die kleding dat is nederlandse kleding. Die kerken ook, als het kerken zijn met torens als dit, zijn het meestal katholieke kerken he.

[are you also catholic?] Nee, wel opgevoed, maar ik ben niks geworden.

Talking about the Vermeer painting and Delft, P3 is prompted to tell about the Delfts Blauw that he collects, telling a story about how they visited the workshops in Delft and travelled through the Netherlands by train. This memory is also linked to his interest in trade is also intertwined with travelling.

We zijn ook op bezoek geweest waar ze die delft blauw maken. Dat kon toen, een treinkaart kochten we dan met 7 gratis ritten daar hebben we jaren gebruik van gemaakt. ook al was het weer niet zo prachtig we gebruikte het, door heel nederland.

Joopoe huisman ken je dat? [nee] Toen zijn we met het openbaar vervoer daarheen gegaan. Dan pakte we een trein, dan bus, en dan weer een bus, en uiteindelijk waren we bij een museum voor een paar uur, en toen moesten we alweer weg.



The ferris wheel reminds P3 of Maastricht, a place he went often when their acquaintances left for holiday. P3 points out his wife would clean the house, and he would explore on the bike.

Dat ken ik wel dat is een reuzenrat, daar heb ik wel eens ingezet. In Maastricht hadden we dat ook he, zijn we heel veel keren geweest vanwege die mensen die een flat hadden. Dan zette ik de auto onder de garage, en dan ging ik fietsen terwijl mijn vrouw de flat ging schoonmaken.

P3 does not describe himself as sportive, answering "I would explore and learn the area because Maastricht is big" but he would not go too far on the bike, keeping it doable "I would go out for a couple of hours and come back, keeping it doable".

Was u sportief?

Ik leerde de omgeving kennen he op de fiets, Maastricht is een grote stad he.

En kwa eten?

Toendertijd was in maastricht al die bekende zaken, V&D of bijenkorf, daar gingen we eten.

## **P4**

### **Detailed profile**

P4 is an active individual with a lifelong passion for gymnastics. She used to be a physical exercise (PE) teacher and loved doing this, which showed when she elaborated, “I really liked it; we would do a lot of different sports, and teaching kids was great; they are the future.” She continues, emphasizing how active she is despite her age, as she stated, “I became 80 years old yesterday, and I’m still involved in everything,” and “I might be 80, but tomorrow at 10 AM, I will be doing gymnastics already.” Although P4 expresses a strong belief in her ability to continue these activities, she is no longer able to partake in them. This strongly shows her enthusiasm for gymnastics and sports but also paints a picture of the very active lifestyle she used to live.

As this active lifestyle is central to her identity, the excerpts also show the impact of age and dementia on her sense of self or ‘being.’ Regardless of her abilities, she takes pride in taking care of herself as a turner, stating, “I still train; I have to keep up my body.” One of the memories involved in her active lifestyle was coaching. P4 used to coach her grandson and elaborated on this: “I give classes and go to competitions with my grandson,” and “he is in the Olympic direction.” This illustrates a certain pride in coaching, as well as her grandson’s achievements.

Part of coaching was traveling, which she mainly did for the sport, as she elaborates: “We would travel by bus or car; I’ve been everywhere, like Portugal,” and “They are now in France.” P4 also states she did not travel when she was younger due to being a war child and experiencing a period of rebuilding/reconstruction: “I am a war child, so I have experienced a lot of reconstruction with my parents; they have suffered and all.” This suggests that sports may have provided her with experiences and opportunities that she might have missed out on as a child. It also shows how grateful P4 may be towards sports and the opportunities it provides.

Sports also provided P4 with a strong connection to nature and camping, with many memories of camping trips with the gymnastics club. She elaborates: “I went on a lot of holidays with the kids and turn union, we would go to the Veluwe, or with the kids we would go camping at Beekse Bergen,” and “there was a lot of forests there.” When asked what she enjoyed the most from camping, P4 stated, “Yes, the campfire, in tents, and together with the kids, and playing games.” Continuing about Beekse Bergen, P4 describes it as a place that has everything for the kids: “It’s a big park, with everything for the kids, sports halls, but also a zoo.”

P4 also has a notable playful side as she talked, while smiling and laughing, about the attraction fairs when prompted with the Christmas visual: “The attraction fair! Ha Ha. I am a fan of this. We always go there, the fair in Tilburg,” “I have grandchildren and grand-grandchildren, I will take them with me, guaranteed,” and “bumper cars are my favorite.” These excerpts refer to one of the biggest attraction fairs in the Netherlands, which takes place in Tilburg, one that she clearly enjoyed a lot in the past.

In all, P4 maintains her love for gymnastics and sports, which is evident from her energy and smiles when talking about it. One aspect of her recollections is the involvement of kids and children, whether it is the fair or camping trips; they seem to be involved in these fond memories.

### **Interpretation**

The themes reveal that P4 is a highly active and engaged individual who values sports, particularly gymnastics, and enjoys an active lifestyle even at the age of 80. Her connection to nature is strong, with many fond memories of camping and being outdoors. P4’s busy and productive life is evident in her continuous involvement in sports and teaching. She has a playful side, enjoying fairs and entertainment activities. Cultural and artistic engagement also play a role in her life, with dancing and singing being significant memories. Nostalgia and sentimental value are evident in her recollections of specific scents, places, and activities, often tied to family and her lifelong passion for gymnastics.

## Prompts and interactions



Participant is reminded of camping, which she used to do a lot. But she stopped doing that, she is too busy now for things like that. P4 describes herself as a busy women.

Ik heb wel gekampeerd heel veel. Maar dat doe ik niet meer. Geen tijd meer voor.

Gymnastics seems to be a very important part of her past and current life. She elaborates "In still doing gymnastics, and I also teach my grandson, he is on his way to the Olympics". She is proud of her grandson too, doing well in the sport that is foundational to her life.

[houd u van natuur] Ik zit nog steeds in turnen. Jaa, maar dan moet ik veel mee les geven. Naar wedstrijden van mijn klein zoon. [daarvoor moet u veel reizen?] Ja met de bussen, of met de auto. Hij zit nou in de olymische richting.

P4 sees herself as very busy, and mentions how her team is at the olympics in France, and that she will join them soon. When asked where she went for gymnastics, she responded "I've been everywhere, like France."

Ze zitten nou in Frankrijk voor de olympische spelen. Ik ga er ook naartoe. [waar bent u geweest voor turnen?] Ja ik ben overal geweest, Portugal.

A coffee was served by a care giver, after which P4 stated "and I don't have time for that, I turned 80 last week, and I'm still in everything (referring to the sports activities)". This shows how busy she feels.

En ik, ik heb daar helemaal geen tijd voor want ik ben gisteren 80 geworden, en zit gewoon nog overal in. En ik heb er helemaal geen tijd voor.



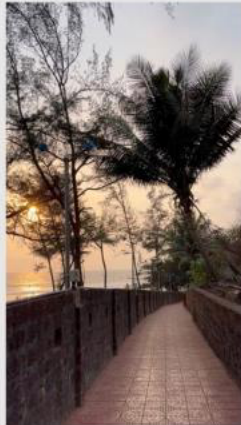
Waar doet dit u aan denken?

Making postcard is something P4 is still doing because PR was her job. This job was also provided by the gymnastics union, they arranged everything for her. This reaction shows how an important part this organisation was to her, with providing her work as well.

Nou, ik ben zelf ik maak ook kaarten. Ik heb ook PR gedaan vroeger. Vanuit de bond heb ik dat gedaan, zij regelde alles voor mij.

As a turnster, taking care of the body is important, she states, by saying "I still train myself, just keeping up my body"

ik train mezelf ook nog, dat ik mezelf bijhoud met mn lijf.



P4 did not go on a lot of vacations, stating "I was a war child, experiencing a lot of reconstruction". This insinuates that holidays were not very common growing up

[hoe denkt u terug aan vakanties] Dat heb ik veel gedaan als kind. Ik ben een oorlogs kind, dus heb veel opbouw meegemaakt met mijn ouders, en wat die hebben geleden en gedaan.

When asked if she saw different places with gymnastics, P4 states "I went away on holidays with the kids and the gymnastics club a lot. We went to the Veluwe, and camping in the Beekse Bergen". It seems that holidays were not very common for her, but the ones she did go to were from the gymnastics organisation.

[En met het turnen veel andere plekken gezien?] Ik ben heel veel met kinderen op vakantie gegaan, Met de bond naar de Veluwe. Met de kinderen gingen we kamperen, en overal naar toe gaan. In Beeksebergen.



For the gymnastics, P4 used to go for camping. Like in the image, she remembers a lot of forest and camping from a young age.

[wat voor herinnering roept dit op?] Ja beekse bergen, en kamperen. Heel veel bos was daar, beetje een idee van zoiets (wijst naar plaatje). Het begon heel vroeg, toen ging ik als kind al mee.





P4 really likes the fair, as she started laughing and saying "I am a real fan of the kermis". She adds that they always went to the Tilburg fair, it started when she was a child herself.

De kermis! Ha Ha. Ik ben een kermis fan. Daar gaan we altijd naar toe (smiles), de tilburgse kermis. Als kind al.

P4 reminds us that she turned 80 years old, saying "in this age it's a different situation. But thankfully I have grand children, I will take them with me guaranteed". This shows how P4 likes to do activities with children, inside but also outside the gymnastics organisation.

Met de kinderen. Ik zit nou op de rand van uh uh. Ik ben 80 jaar geworden, dus zit ik net op de scheiding van leeftijd toestanden. En ik heb achter klein kinderen, die neem ik mee gegarandeerd. Met de klein dochters.

Something that P4 likes in particular are the bumper cars at the fair. In general, this section of the interview made P4 smirk a lot, especially talking about the different attractions.

[Het geeft u veel plezier] Bots auto's. [En schieten?] Ne nee, ik vind dat eng.



After explaining this is a dutch painter and a dutch city, P4 said it made her think of Utrecht or Zutphen. After disclosing it was Delft, P4 became enthusiastic saying "Thats where I danced! I did a lot of exercising and dancing."

[Dit is een nederlandse schilder, en een nederlandse stad] Dan denk ik aan utrecht, en ook Zutphen. [Dit is delft] Daar heb ik gedanst! Vroeger heb ik in de mis dans gedanst. Ik heb heel veel gedaan, sporten en bewegen.

P4 explains why she does not bike a lot anymore, but will soon pick it up "I want to bike again, I have not biked a lot because of fluid in my legs, but its going good and I will start exercising again soon". This shows how P4 is somewhat aware of her physical condition, but still wished to move and work out.

Fietsen doe ik graag. Ik wil weer gaan fietsen. Vanwegen mijn benen, daar zat vocht in. En dat was een ramp eigenlijk, dus dat (fietsen) heb ik een tijd niet gekunt. Maar het gaat goed gelukkig, ik ga lekker bewegen.

Cookie	<p>[Beetje zware geur: Koekjes, zoete bakkerij geur?] (no real reaction).</p>
Koffie	<p>Nee niet zo zeer. Misschien komt het omdat ik al koffie drink.</p>
Denneboom	<p>As opposed to the previous smells, this one is liked by P4, stating "yes this one I prefer". When suggested it's the smell of nature, P4 continues saying "I like being in the woods. That's really lovely. We used to camp a lot with the gym". This recollection, that involves woods and trees, corresponds with the smell of the essential oil perfectly.</p> <p>Ja deze heb ik liever. [Ja dit is de geur van natuur, denneboom] Ik ben graag in de bossen hoor, dat is heerlijk man. Ah, wij gingen vroeger heel veel kamperen, met de gym.</p>
	<p>Camping involved the kids from the club, P4 states "we would go camping with the kids, in Beekse bergen". When asked what she liked from these holidays, P4 answers "the campfire, sleeping in tents with the kids, playing games". This suggests, that the camping memories are mostly linked to Beekse Bergen, and they always involve kids.</p> <p>Dan gingen we in de grote vakantie kamperen met de kinderen, beekbergen. [wat vond u leuk aan kamperen] Ja kampvuur, in tenten, met kinderen samen, speeltochten maken.</p>
	<p>Continuing about Beekse Bergen, P4 describes it as a place that has everything for the kids "It's a big park, with everything for the kids, sport halls, but also a zoo".</p> <p>Heel groot park, ga ik dikwijls heen. Zit alles voor de jeugd in, we hebben eigen sporthallen daar. Maar maar ik ga ook vaak naar de dierentuin vanuit daar.</p>



<p>Ocean breeze</p>	<p>P4 really likes the smell, but could not place it. After disclosing it's the smell of water, P4 started smiling and said "oooh I also like that, sea an water. You should know, I also go into the water. I swam a lot of competitions. An still, I might be 80, but tomorrow at 10:00 AM I will go to the gym again.</p> <p>Die vind ik heel lekker. Je moest eens weten, ik heb ook veel gezwommen. Veel wedstrijden ook. Ik ben echt actief, en nog hoor. Ik ben wel 80 maar morgen om 10 uur heb ik gymnastiek.</p>	<p>P4 perceives herself as a very busy person that likes to stay active. After talking about the other sports she did besides gymnastics, she states for a xth time "I might be 80", following it up with "but tomorrow 10 AM I will be doing gymnastics again"</p> <p>Create and share the link can acc</p>
<p>Vind u het ook leuk om te zien? Gymnastiek</p>	<p>P4 is a big coach "of a world champion". It seems that both being a trainer and having a world/olympic champion student is something she takes pride in.</p> <p>Ik ben coach, hele grote coach. Van wereld kampioen. Mijn kleinzoon is olympisch kampioen en wereld kampioen.</p>	
<p>Bent u opgegroeid in Tilburg?</p>	<p>P4 is saying she is from Tilburg, and calls herself a "kruikenzeiker". When asked about the Hasseltse Kapel, P4 said "Yes I know that very good, near the hospital?". This shows how she is familiar with the chapel and its outside surroundings.</p> <p>Ja, ja ben echt een kruikenzeikster. [kent u de hasseltse kapel] Ja ken ik heel goed, vlak bij het ziekenhuis?</p>	
<p>[wat staat u bij van de hasseltse kapel?</p>	<p>P4 is aware the Chapel is important in the month of May, but also thinks it is a pretty and rustic place. P4 also remembers there were sweets, signing an eating gesture with her hands giving a mischievous smile. She elaborates on the different kinds of candy.</p> <p>Ja in mei maand ga ik dikwijls. Dan gaan we bidden, en naar de hasseltse kapel. Maar het is ook een, gewoon een fijn kapelletje. Mooi en rustiek. Daar zijn we als kind met de ouders ook heen geweest. Er is altijd (signs food/eating gesture) ha ha. Als kind kon je bepaald soort snoep kriegen enzo. ha ha.</p>	<p>P4's memory of the chapel is quite clear, especially the surrounding area and the sweets are explicitly remembered. Talking about the sweets made P4 laugh and smile, suggesting she either has a sweet tooth or enjoyed this part of the May month the most</p>
<p>En wat voor snoepjes zijn daar gangbaar?</p>	<p>Providing the Sugar cookie smell again makes it possible for p4 to place the smell at the chapel, saying "that is what you smell, sweet stuff, that's what the kids like.</p> <p>Uhm, dropjes, en ook een beetje zoals op de kermis. [gives cookie smell again] Ja dat ruik je, zoetigheid, zoetigheid. dat vinden de kinderen lekker. (smiles)</p>	

	<p>P4 used to go at the chapel to light candles, and remembers the place as pretty and rustic. P4 now explained how she used to walk a lot from the hospital to the chapel for exercise when she had fluid in her legs. Even though she went to the chapel when dealing with a medical complication, walking or exercising is mentioned, not immobility.</p> <p>Wij gingen daar ook naar toe. Kaarsjes aansteken, was een heel mooie rustiek kapelletje. Ik heb toen in het ziekenhuis lag ben ik er ook veel toegelopen. Om te oefenen, ik had veel te veel vocht in mijn benen.</p>
	<p>P4 used to be a PE teacher, which was something she really enjoyed doing.</p> <p>Ik praat eigenlijk niet heel veel tilburgs. Ik zit in het onderwijs, basisschool, ben ik vakdocent. De eerste vrouwelijke basisschool, lichamelijke oefenen. Die opleiding heb ik ook allemaal gehad. Vond ik heel leuk.</p>
En wat vond u heel leuk?	<p>P4 liked doing different sports as a PE teacher. Besides this, it is teaching kids that she enjoyed a lot. P4 described the kids as "the future".</p> <p>Vond ik heel leuk, dan kreeg je alle sporten in de opleiding. Altijd les geven aan kinderen, dat is echt de toekomst.</p>
Bent u al bij de hasseltse kapel geweest?	<p>When asked if they already went to the Chapel, P4 answers with with yes while smiling, saying "when I'm nearby I will buy candies at the stands"</p> <p>Ja (smiles) als ik dan in de buurt ben snoepjes kopen aan de kraampjes. Ik vind dat zo iets aparts he, en die omgeving met dei oude huisjes.</p>
Voor wat voor feestdag?	<p>Dat is voor de rozenkrans waaraan je kan bidden. Maar Oktober is ook een extra maand wanneer het groots is, op dat plein helemaal.</p>

P4 has a nice voice, and remembers going to the church with her father to sing. Both of them had good voices. He was also a sport  
*my just like the mother*

Heb ik ook nog gedaan in m'n jeugd. Ik had een mooie stem, die heeft niet zoveel geleden. Ik heb heel lang gekomen naar de kerk om te zingen, en met mn vader mee. Die had ook een mooie stem, en die was ook een sportman. En mn moeder ook

## M – Transcriptions and observations of the evaluation

### *Session 1-V1-P1*

#### **Start VR activity**

Following the session protocol we started with a general introduction. First, personal memorabilia was shared as a fitting warming up. This approach was chosen, considering P1 and S1 did the same during the Associative memories session. Next, the VR activity was explained by comparing it to ‘watching TV through big glasses.’ The headset was first held in front of P1’s eyes without Nebula and fixed with the straps once the participant felt comfortable. Due to unexpected problems with opening the scene with Nebula, the session was conducted without the olfactory display attached. Instead, the olfactory stimuli were introduced by infusing cotton with a pine tree essential oil and water mixture. This approach still allowed the exploration of olfactory stimuli.

#### **Participants' reactions and interactions**

Participants wore the VR headset for approximately four minutes and twenty seconds. The first thing P1 did was describe what he was seeing: I see rocks in front of me, and over there too [00:05], and I see water, everywhere water [00:15]. For the first 30 seconds, the participant looked forward and did not really explore on his own. When asked what he saw if he looked around, he started looking to his left. Describing his view from the new angle, he described the tree trunk. He continued, mentioning the green bushes and pointing at them. At [01:05], S1 asked, “And what about the other side?” which prompted P1 to explore more of the scene, looking forward he described mountains and sky: “Now I am looking in the distance, I (inaudible) the trees and” [01:26]. At [01:33], P1 was asked if he thinks this is fun, to which he responded, “Yes.” His exploration continued at his own pace, and at [01:56], P1 was asked if he felt comfortable and not nervous with the VR glasses; this was followed by a small pause of six seconds, whereafter he answered, “Ah, I see pretty nature now.” At [02:26], he said, “But yeah, I also can’t see it very sharp.” A scent was introduced to P1 at [03:25] by using an infused cotton with essential oil, to which P1 turned his head towards the cotton and said, “Yes, yes, but now it’s gone.” At [03:57], the DSLR camera clicked, which made S1 ask a question about the camera. Immediately after this, P1 asked, “I don’t know, wh- what should I do?”. As he seemed to be done with the VR scene and confused, the VR headset was removed.

#### **Post-VR scene interview**

After the headset was removed, P1 was asked what he thought of the nature, to which he answered, “It was pretty” under his breath. P1 then asked, “Do we have more coffee?”. Before making the coffee, S1 said, “You know what it is? He becomes very tired”, to which P1 said, “Yes, yes,” and “I could fall asleep.” S1 said that it would not be nice while having visitors; on that note, the session ended.

## **Conclusion**

P1's interaction with the nature scene was generally positive, as shown by his verbal responses and engagement with the environment. At [01:56], when asked if he felt comfortable, there was a notable six-second pause before he responded, "Ah, I see pretty nature now." The pause, followed by his positive comment while looking around, suggests that the immersiveness of the scene effectively captured his attention and made him feel comfortable and appreciative of the nature scene. He expressed that he found the nature scene "pretty," although he also mentioned it was not very sharp. The introduction of olfactory stimuli gave a reaction that made P1 seem surprised to smell something. However, the smell was not sustained, possibly explained by P1's olfactory abilities. This session also made P1 severely tired and sleepy, which was evident from his energy level and S1's comment. Overall, this session underscored the acceptability of VR for PwD, the potential of visual stimuli meeting the interest, and the need to explore olfactory integration in the VR experience further. In general, P1 displayed instances of being fully absorbed in the VR environment, showing engagement and interest. For example, there was a moment when P1 paused before not answering a question, but instead commented on the beautiful natural scenery, saying, "Ah, I see pretty nature now." However, these periods of engagement were occasionally disrupted by moments of confusion when P1 disengaged from the experience.

## *Session 2-V2-P1*

### **Start VR activity**

Following the session protocol we started with a general introduction. First, small talk was done while enjoying a coffee. After explaining the concept of VR glasses, as done in session 1, the couple was briefed on the scene by elaborating it was a chapel in Tilburg. Once ready, the headset with Nebula was held in front of P1 and fixed with the straps once the participant felt comfortable.

### **Participants' reactions and interactions**

Participants wore the VR headset for approximately six minutes. The first thing P1 said was, "I can see chairs". In response, he was rotated towards the center of the chapel [00:15]. While rotating P1's wheelchair, he stated, "looks like an altar." Between [00:40-01:05], a small anecdote about the chapel was provided: "In this chapel, the Maria statue is central. It was built in the 1800 and constructed in a Baroque style". P1 answered that he couldn't see a Maria statue. Despite our attempt at rotating him at the start of the session, he was still not facing the center of the chapel. Thus, at [01:40], we moved the wheelchair slightly to be oriented towards the altar again, to which P1 said, "Now I can see it." At [01:47], P1 was asked if he could smell the chapel; before P1 could answer, S1 suggested "incense?". P1 responded, "Yes, yes, incense". P1 was then [02:06] asked whether the chapel reminds him of a place from a holiday or not, to which he responded, "I have been to a lot of chapels like this." This was followed up [02:15] by the question if he likes places like this, to which P1 responded "yes." The next question, at [02:30], was whether he would light candles when visiting chapels or pray, to which p1 responded "yes." Up until this point, [02:45], P1 was not very explorative and facing one direction. At [02:50], P1 was asked what kind of feeling this chapel was giving him, to which he started looking around slightly and answered, "A holy place." He seemed to look around more, and at [03:00], I asked him if he found this interesting, to which P1 answered "yes." At [03:05], P1 was asked what drew his attention in the chapel; he first said, "One moment, I am not sitting comfortably" while re-adjusting in the wheelchair, after which he answered [04:30] "that is a church-corner, where the clerics pray." P1 continues describing the view, mentioning the candles. At [04:50], I told P1, "In the middle, you can see-" to which he responded before I could finish, "Maria statue, with a Jezus child." He added to this by saying, "It is a pretty chapel." At [05:10], p1 is asked if he'd like to visit the chapel; he asks, "Yes, of course, where is it?" and "Oh, that is far" after finding out it is in Tilburg. At 5:28, the church bell rings in the VR scene. P1 asked if I made this, and I answered yes, to which P1 said, "Oh, that is fun." At [06:00], P1 is asked, "What kind of emotions do you feel in the chapel?" to which he responds "Maria Worship." At [05:10], I stated, "I think you enjoy spending time in these places," to which P1 answered "yes." S1 adds to this by saying, "Yes, we grew up with this; during lower school, we would go every week; regarding this, our religion changed a lot" I asked, "You visit the church less?" and P1 answered "yes, way less," I responded with "but you still find it important?", whereafter P1 said "Yes." At [05:55], I asked P1 again if he could smell the chapel and if the scent reminded him of a church environment. He answered, "Not really". He followed up by saying, "I let out a little fart," making a joke, and following it up with, "I need to go to the toilet." On that note, the session ended.

### **Post-VR scene interview**

A short interview with S1 took place while P1 was taking a restroom break. When asked what she thought of the session, S1 answered, “I think you came up with something fun.” I asked how the session compared to the previous VR session, where we introduced a nature scene; S1 answered, “This was more vivid” and “There was more to see for P1”.

When P1 joined us, S1 jokingly said, “Why do you look tired? Why are you acting like you worked?” P1 answered, “I never worked in my life; I just pretended.” After breaking the ice, P1 seemed very tired, as he had been at the end of the previous session, and approximately 15 minutes had passed of making small talk while I wrote in his visitors' book. Then, P1 looked at the headset and said, “That thing there, I have watched it, right?”. I said, “Yes, did you like it?” and P1 answered, “Yes, yes, I believe so.” P1 seemed not to remember what he watched with the headset, so I elaborated, “It was a small chapel”. This made P1 say, “Oh yes, yes, I am crazy about chapels.” As I mentioned a detail from the scene, saying there was a Maria statue, P1 smiled a little bit and said, “Yes, yes, I like that stuff.” I asked him why he likes chapels, and P1 answered, “Because I am catholic; that is how we grew up, with chapels left and right. We would go there on the bicycle; that is where we would see Maria statues”. I asked with whom he would bike to the chapels, to which P1 responded, “With S1, we would bike there; in Vethuizen, we would bike there; that is what we liked doing. We were religious catholic people; this was part of it”.

### **Conclusion**

P1's interactions were primarily observational, describing various elements such as the altar and the Maria statue. He did not seem very proactive in exploring the scene during the first two and a half minutes but would look around more when prompted at [2:50] with questions that required him to assess the environment. P1's verbal responses indicated a positive connection to the chapel, with feelings of holiness and worship. This positive connection he held towards the chapel was further elaborated by P1 when he answered [05:10], “I have been to many chapels like this”, [02:15] expressed interest towards the chapel, and [05:10] stated the importance of visiting these holy places. The olfactory stimuli aspect of the scene was questioned two times: The first time, S1 suggested incense, which made P1 agree. The second time, P1 answered independently, stating “Not really” as to whether he could smell the chapel.

### *Session 3-V2-P4*

#### **Start VR activity**

Compared to the previous VR session, this session protocol aimed at asking more olfactory-related questions. We started with a general introduction following the session protocol (Appendix X). First, I introduced myself because P4 did not recognize me. After this formal introduction and small talk about her clothes, the concept of VR glasses (figure x) was explained as done in session 1. P4 was briefed on the scene by elaborating that it was the chapel in Tilburg. Once ready, the headset with Nebula was held in front of P4. As opposed to P1, P4 did not show the responses and readiness to mount the VR headset. Following E3's judgment, we decided not to mount and hold the headset in front of P4.

#### **Participants' reactions and interactions**

Participants wore the VR headset for approximately two minutes and forty seconds. Once the headset was held in front of P4's eyes she was asked, "Do you recognize the place?". P4 answered "Yes, uhm," which was followed up with three seconds of thinking and "I see the organ of the chapel; I see it from the inside." This was followed [00:20] by "What memories does the organ remind you of?" to which P4 answered, "We always went in the May month. Our mom and me, we were with three girls, and yes, I was the oldest, I am the oldest, all three still life, so I am from '44, and I turned 80 years old last week." Hereafter [01:00], P4 was asked if she could smell the chapel in the scene; after taking a good breath, P4 answered, "Well, at the moment, not something like that, no." Then [01:19] P4 was asked if she remembered the smell of the chapel. She responded, "Yes, but a lot of people can fit in there," to which I asked, "It is always busy there?". "Yes, that is why it is always busy," and "I also go in the May month. If I am in the neighborhood, back when I was in the hospital, I went there just to walk for my body because over the years I had fluid in my legs, so I had to walk, not running, just walking; there is a difference". After her elaboration, another employee joined the session to draw blood, whereafter the session was concluded.

#### **Post-VR Scene interview**

Before P4 went for blood drawing, a short conversation was held. This conversation started with the question, "What did you think of the Hasseltse Chapel?". P4 answered with "a very pretty, intimate chapel; when we were younger, we were allowed to get candy from the stands outside." To the question of what she liked the most at the chapel, p4 answered the organ; when asked if she was able to see the organ through the glasses, P4 answered, "I can also see without glasses, but I have a strong prescription for reading and far away. This followed with the question "P4, I am curious, you cannot smell very good anymore?". P4 answered with "no, not only smelling, it is everything. I am a national coach, and I need everything: hearing and feeling. When turning, I need everything because you do it with music. On this note, the interview was ended.

#### **Conclusion**

The reaction at [00:20], where P4 answered the question "What memories does the organ remind you of?" with "we always went in the May month," indicates she recognized the Hasseltse chapel, even though she has not mentioned the name explicitly. She continues describing her family, which suggests that she remembers the



Hasseltse Chapel with her family. Then, P4 started elaborating on herself and her family in detail, immersing herself in memories of their shared experiences. This elaboration could be described as deviating-from-topic, which happened for a second time after [01:00] and during the Post VR Scene interview. The gap between what she saw (e.g., the altar, and what she talked about (e.g., “I am the oldest, all three still live, so I am from ’44, and I turned 80 years old last week”) suggests that the VR scene was not engaging enough, i.e., Not immersive. In all, her initial reaction might indicate an association with the smell of a crowded place, although this interpretation leaves room for discussion.

## *Session 4-V2-P2*

### **Start VR activity**

Session 4 started with both P2 and P3 in the same room. It was not discussed in advance that the VR session would be done with multiple participants in one room, but as E3 brought them at once, the decision was made to continue in this setup.

The introduction started with a recap of our last meeting. I mentioned that we talked about associations toward images and that I prepared a VR fun VR scene for today. I explained the concept of VR like in the previous sessions. Once P2 was ready, the headset with Nebula was held in front of her; with E3 judging P2's readiness, the headset was fixed with straps.

### **Participants' reactions and interactions**

Participants wore the VR headset for approximately two minutes and 50 seconds. Once the headset was fixed, the participant described what she was seeing after being asked what she was seeing, "I am standing in a chapel, I think the Hasseltse chapel" and "and uhm, a nice red floor." When asked what it reminds her of, P2 said, "To our little Hasseltse Chapel." At [00:40], P2 was asked if it gave her good feelings, and she answered, "Yes, yes." P2 was then asked, "If you look around, do you find it realistic? Do you feel like you are there?" she responded, "I am here; yes, I am here, at the organ where I stand." At [01:00], P2 was asked if she could smell something, and she answered, "Yes, this thing needs replacement; it is much needed." When asked to clarify, P2 said, "This musical instrument," while pointing towards the organ, "It has a musty smell, yes, like it has been closed for a while," and "It is a different smell than if you look at the chairs." This was followed up [01:50] with "Would you say it smells like the chapel?" P2 answered, "It smells like the chapel and like the flowers there in the corner, and uhm, you see a lot, wow," while holding her hand up (figure x). She continued with, "Maria too, yes yes, really fun, even Antonius, no wait Maria," while pointing up (figure x), "it is like I am standing here in the chapel, and there is the area where you can go inside and outside." Then, at [02:50], P2 said, "Now I feel like the glasses are sagging," we responded by taking off the glasses and ending the session.

### **Post-VR scene interview**

The first thing P3 said after the VR headset got removed was, "Ooh, haha," and "That was fun." She continued, "It was as if I could grab it" while making grabbing motions at the table. She continued recollecting the experience: "You can grab it, looking around there is no end to it, with the Maria statue on the side that is waiting for you, and when you turn she is still there, it is beautiful," she continues, "If you go to the hassle chapel now, and you put in the pin code for the atm to get money, that feeling I have here when you have the maria statue, but I cannot grab it," P2 ended with "Its realistic, that is beautiful," before continuing with the introduction for P3.

## **Conclusion**

P2 had a positive response and feeling with the scene and chapel; for instance, at [00:50], when asked what the scene reminds her of, she answered with “Yes, yes, our favorite little chapel,” suggesting a warm familiarity. When asked if she found the VR scene realistic, her response, I am here, yes I am here, at the organ where I stand,” implied some immersion in the VR experience. When asked if she was smelling something, P2 said she smelled an old, musty smell, “a musty smell, yes, like it has been closed for a while.” This perspective towards the smell contradicts her reaction to the essential oil that was introduced after P3’s VR session, where she stated, “It looks like it, but it is not the same.”

### **Start VR activity**

After P2 was finished with her session and the post-VR interview was done, P3 was sitting ready and asked if he should take off his glasses. I told him it was fine to leave on his glasses. Once the scene was ready, the VR headset was held in front of P3. As he seemed ready, describing what he saw instantly, the headset was fixed with the straps to start the session.

### **Participants' reactions and interactions**

Participants wore the VR headset for approximately six minutes. Once the headset was fixed, the participant described what he saw after being asked if he could see it, "Yes, now I can see the Hasseltse chapel." I asked if he found it a nice view, and P3 answered, "Yes, it's pretty; this is what I see when I visit." "I can see the organ". He continued at [01:05], saying, "I go there regularly; yes, I used to go more than now because I don't have a car anymore. If I go to the chapel, I always have to go with someone. I can go with public transport, but yes, all the kids have cars, so they would come and we will visit the chapel". This was responded to with the question if he was there alone now, P3 answered "I am now here alone yes". P3 was asked whether he can smell the chapel [01:50], he answered "yes I can smell a little bit", I asked "can you place the smell?", P3 answered "the scent of the candles, that smell" and "when we went the last time, it was stronger, all those candles would be burning and you would feel the heat, but I think it is fun seeing this". At [02:10] I asked what emotions he feels at the moment, "its like im here, because of the glasses". I followed up with "do you think it is fun?", P3 responded with "yes yes I am just looking, it is a nice experience". Then, E3 asked, "and, do you have the feeling you are there?", to which P3 said "yes I'm feeling that now". And then I asked "can you tell me where the sounds are coming from?" P3 said "no I can't my ears-" and he was interrupted by the church bell in the scene [03:20], P3 continues "here now, that is the sound of the clock". He continues "I also worked in the textile industry. They advised me to wear ear protectors for the sound, but I didn't use them often. From there, I started in the tire factory, where I worked for 20 years. The place where I worked for 20 years was loud, with many machines. There was a room with new machines and with old machines, but I worked in the room with new machines". After this, I asked, "Are you done with the little chapel?" to which P3 said, "Yes, I finished looking".

### **Post-VR scene interview**

After removing the headset, I asked P3 how he experienced it; he answered, "Yes, it was nice to see." I asked if he would like to see other places in the same way, to which P3 answered, "Yes, I would be willing to use it more often." I asked whether he would like to see Austria, and P3 answered, "Austria would work because there are many views." Then, I asked P3 what she would like to see in the chapel, and he answered, "That could be anything; I could list a lot." Then, I asked both P2 and P3 if, alternatively, they would like to move around in the space; P2 answered "Yes, I would like to do it as long as I do not fall down. It would be interesting to me to find out where the noises were coming from, the statue, and the smell. I would like to open a window because it stinks here; those windows were closed for too long" and "That's is how I would like to explore; how is it possible." Then, P4 was asked how he felt about the sounds of the scene, he answered "yes there was a sound, but no no I don't need to know where it is coming

from.” E3 added, “a colleague came with the idea to show you old Tilburg, it would be nice if we can go back in time.” I continued with the questioning round, and asked about the smell of the chapel, and P3 answered, “I smelled the candles,” after which P2 added, “I smelled the candles because you mentioned it.” When asked whether P2 smelled a more dusty smell, she answered, “Ugh yes, it is like an old television, ugh.” I then grabbed the Frankincense essential oil and asked P2 whether this was the musty smell she mentioned. P2 answered after sniffing “it looks like it, but it’s not the same.”

## **Conclusion**

P2’s responses to the scene indicate that he thought of the activity more as an assignment rather than an experience. For instance, when he was describing what he saw, he went into detail without sharing or elaborating feelings, e.g., at [02:10], I asked what emotions he felt in the moment, “it is like I’m here because of the glasses” and his answer to if he thought it was fun “yes yes I am just looking, it is a nice experience.” Another way of interpreting this might be that P3 didn’t engage with the VR experience because of a lack of interest in exploring the VR environment, supported by his answer when asked about the sounds in the scene, to which he responded, “Yes, there was a sound, but no, no, I don’t need to know where it is coming from,”

Regarding the olfactory aspect, P3 identified the smell of candles in the VR scene, which might have been influenced by his visual focus on the candles in the chapel. This suggests that visual cues can enhance the perception of smells, or rather induce them, as the essential oil used, Frankinsence, does not resemble the aroma of candles.