Sounds Like Home: Sonically Augmenting Care Environments to Offer a Sense of Home

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Onderzoeksvraag

In this project, we investigated:

RQ1: how we can capture meaningful elements from the domestic soundscape of a person with dementia and transfer these elements to a care home;

RQ2: how spatially distributed familiar sounds can create a 'sense of home' for people with dementia in residential care;

RQ3: how to make 3D-audio technologies accessible for people with dementia and compatible with existing care environments.

Basisidee

In this project, we adopted a participatory design approach to address the needs, values, preferences, and social and physical context of all involved stakeholders such as people with dementia, their caregivers and relatives. First, relatives of the residents with dementia identified specific meaningful sounds from the person with dementia's home or personal environment that have emotional value, as these are linked to personal interest, meaningful events or loved ones. Furthermore, we reappropriated existing 3D-audio technologies to facilitate meaningful and personalized 3D-audio experiences in the care context and provide opportunities for social and enjoyable activities in everyday care programs.

Het project Fieldlab Sense of Home is mogelijk gemaakt door:

Activiteiten binnen het project

1) Study preparation

1.1 ERB research proposal + GDPR + Data management plan

The general project outline was initiated and further determined during activity 1. This work mainly involved desk research by the researchers of TU/e and administrational set up, such as obtaining approval of ethics, GDPR and data management. The research protocol was further defined and the participant inclusion criteria (age, diagnosis, exact number of participants, stage of dementia etc.) were set in close collaboration with our partner in care practice (Vitalis). **This research protocol was submitted for ethical review and approved by the Ethics Review Board of the Eindhoven University of Technology** (see Appendix A: Approval Letter). We note that in addition to the evaluation of the ERB, the protocol was also checked and approved by the TU/e Data Steward in terms of compliance with the GDPR regulations. Furthermore, we also developed an additional protocol with measures regarding the COVID-19 pandemic to ensure the participants do not run any additional risk if they participate in this study (see Appendix B: Additional information on COVID-19 measures during research).

1.2 Selection study location and participants recruitment

Care organization Vitalis recruited the participants and selected a suitable care environment for this study. This study took place in residential care facility 'Vonderhof'. A main contact person from Vitalis was designated and was responsible for the recruitment of participants and coordinating the study, in close collaboration with the principal investigator from the TU/e (Maarten Houben). Furthermore, the partner in care practice (Vitalis) designated three care professionals who supported the workshops sessions described in *Activity 3.* The contact person at Vitalis together with the two professional caregivers, (who also provided support during the workshops) selected eligible participants for this study who were then invited to participate in the study. Proxy consent was sought from the legally authorized representative (i.e., legal guardian) of the participant with dementia. The caregivers at Vitalis provided the information letter and informed consent forms to eligible participants. In total, **we successfully recruited seven participants with dementia** living at care facility Vonderhof **and seven family members to be involved in this study**. One participant dropped out of the study due to illness.

2) Developing personal 3D-soundscapes

2.1 Personal 'sound inquiry' for family members

We developed a sound-based inquiry for the family members to identify meaningful ambient everyday sounds related to the participating residents with dementia and the corresponding place where these sounds are associated with. This inquiry consisted of a booklet with three small assignments for the family member, followed by a brief interview on the responses provided in the booklet. This booklet (see Figure 1 and Appendix C) was developed in close collaboration with the caregivers from Vitalis and the expert from Qwiek. The booklets were sent to the family members by post and were collected at the Vonderhof care facility.

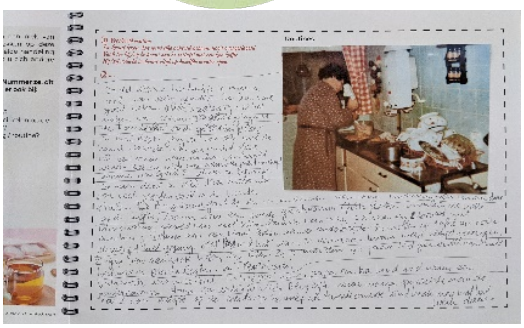

Figure 1: Screenshot of the booklet sent to the participants' family members.

In the booklet, the relatives could write, draw and paste photos and provide personal background information about the participants with dementia. The first assignment in the booklet focused on familiar spaces as the relatives were asked to draw – or paste in a picture of – a place of recognition for the person with dementia. In the second assignment, the relative had to describe the routines and activities that were performed at that particular place. The third assignment was to identify sounds related to the space and routines mentioned in the previous assignments. Based on the answers in the booklet, individual twenty-minutes interviews were conducted with the relatives via telephone. The aim of the interview was to reflect on and to complement the personal sounds and insights brought forth in the booklet. This information served as insights into what personal ambient everyday sounds could be potentially meaningful to the participating residents with dementia. Based on the outcome of this inquiry, we selected high-quality sound recordings and incorporated these recordings into personal 3D-soundscapes for every participating resident.

2.2 Development personal 3D soundscapes

The 3D soundscapes that arose from the sound-based inquiry were personalized for every participating resident. The insights collected from the booklets showed four reoccurring themes: 1) *place of birth*, 2) *place of residence*, 3) *past occupations* and 4) *holidays*. Each 3D soundscape reflects one of these themes. For each participant, two to four 3D soundscapes were developed (depending on the richness of user insights of the themes).

The 3D soundscape existed out of 1) *evenly spatial distributed background sounds that reflect the whole themes* and 2) *specific foreground sounds that are spatially distributed over the plane of the soundscape such left, right or dynamically changing between left and right.* (see figure 2). All 3D soundscapes were tested and validated by the involved professional caregivers before the workshops.

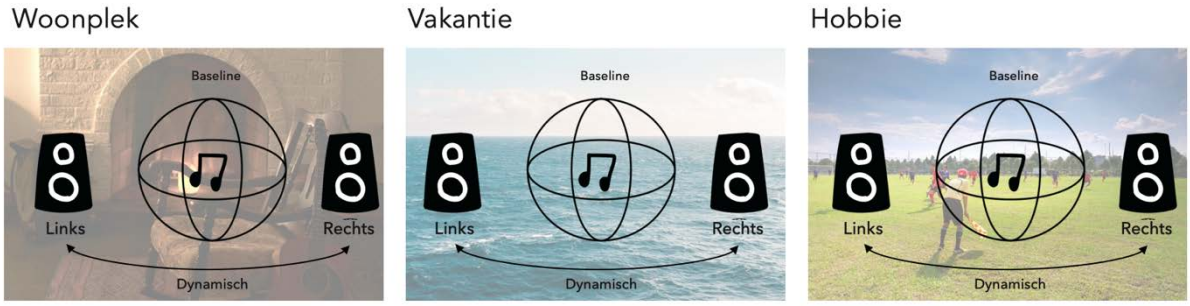

Figure 2: Example of personal soundscape.

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2.3 Selecting and modifying 3D-sound technology to facilitate the workshops

The 3D soundscapes were played to the person with dementia through a positioned set of speakers that can create a spatial 3D sound environment. After first-person user tests, speakers were chosen over headphones which would isolate the participant from the environment, and neck-speakers possibly felt strange on the shoulders. Next to that, the advantage of speakers was that sound remains in its position as it does not rotate with the participant (what does happen with headphones and sound wear). The participant was in the middle of this sound environment and could hear the 3D soundscape as a result.

Figure 3: Early user testing to explore suitable 3D audio technology for the workshops

3) Workshop sessions

Output:

3.1 Four workshops with people with dementia, their caregivers and family members

3.2 Exit interviews with relatives and care professionals

We conducted 6 workshop sessions with the residents with dementia and professional caregivers to explore the in-context responses to the 3d-soundscapes. The workshop sessions were facilitated by caregivers (Vitalis) and a researcher from the TU/e. The workshops sessions were observed and recorded on video for analysis of verbal and nonverbal responses to the 3D-soundscapes and the workshop activity. After the workshop sessions, we conducted exit interviews with the care professionals who were present at the sessions. Our partner from industry (Qwiek) provided expertise on the deployment and evaluation of technology and care settings. **The first pilot workshop was organized end of April, with the following six workshops planned in May and June**. This was later then originally planned, but provided additional time to prepare the 3d audio-soundscapes and workshop sessions.

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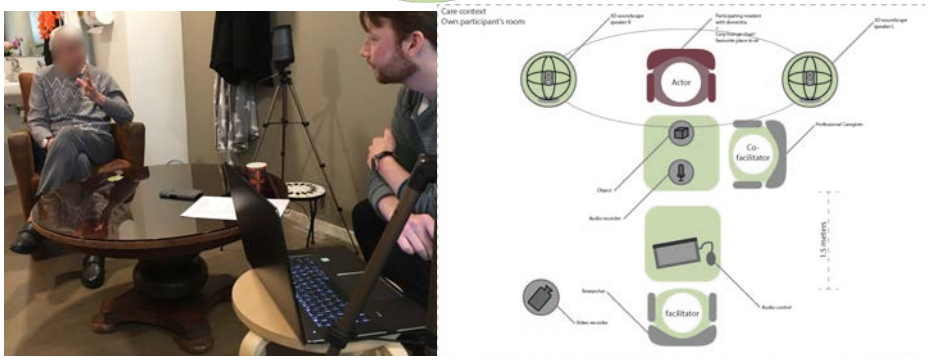

Figure 4: Overview of the workshop setting

4) Data evaluation + final report

4.1 Final report on workshop results for using 3D-audio technology in dementia

→ All results are documented in the research report (see Appendix D).

4.2 Guidelines for participatory approaches for auditory experiences

→ All guidelines are documented in the research report (see Appendix D).

4.3 Dissemination of project results

All collected data were analyzed by researchers from the TU/e and the main project findings were extensively reported in a final project report. The project findings are and will be further disseminated to general public through online media channels of the involved partners (Qwiek and Vitalis). Furthermore, our partner in industry will explore future product concepts and marketability of 3D-audio applications.

Published news articles:

- https://www.linkedin.com/posts/qwiek_qwiek-belevingsgerichtezorg-zorginnovatie-activity-6777197792210354176-QwX9
- https://www.linkedin.com/posts/vitalis-woonzorg-groep_onderzoek-naar-inzet-3d-geluid-voor-meer-activity-6774644196767739904-ZLUS
- https://www.vitalisgroep.nl/intensieve-zorg/goed-om-te-weten/laatste-nieuws/1285-onderzoek-naar-inzet-3d-geluid-voor-meer-thuisgevoel-bij-verhuizing

Presentation:

- Eindbijeenkomst Sense of Home; Warme technologie die je thuis laat voelen, Juni 2021 https://www.youtube.com/watch?t=2130&v=6a-tFbCMSlA&feature=youtu.be

Beoogde resultaat

The project outcome provided knowledge on the relevance and possibilities of 3d-soundscapes for people living with dementia in different care environments by evoking familiarity and providing 'a sense of home'.

Knowledge framework

The project generated knowledge on the importance and possibilities 3D-audio applications for people living with dementia in different care environments to create continuity between home and professional care contexts. In this project two main knowledge blocks were created:

Het project Fieldlab Sense of Home is mogelijk gemaakt door:

1) **A research-through-design knowledge block** is developed, to make 3D-soundscapes available for people living with dementia by establishing a collection of sounds and information on how these can be applied in practice. This provided 'know-how' to enable people living with dementia and family members to interact with 3D-soundscapes to provide meaningful activity through the use of non-musical sound applied in relation to care in the home environment using technology that is easy to use and promotes self-reliance, pleasure and quality of life.

   → *The 3D audio cued verbal and non-verbal interactions with the environment in all workshops. Two of the five caregivers involved indicated that the participants would feel safe and experience recognition in their own room. Several workshops also showed that the sound evoked conversation about personal items in the participant's room. This created conversations and meaningful expressions that were appreciated by the participants. This study showed that 3D audio links the sounds with the surroundings. It builds upon existing literature that emphasizes the importance of sound in the care context for people with dementia by integrating the surroundings in the space of one's own room. We discuss that the familiar and safe environment of a resident's room creates a space in which spatially distributed sounds aids the resident to explore and express identity and selfhood in a calm manner. (see research report Appendix D)*

2) **Participatory co-design guidelines** were developed on how to engage participants in in workshops, and in their natural context, in identifying and collecting personal and generic sounds, and categorizing them according to source, and potential emotional or behavioral impact.

   → *3D audio was brought to the resident's room in the form of a workshop where the setup was clearly visible. All professional caregivers indicated that no stress or problems were created by the workshops. The 3D soundscapes brought notions of calmness for five of the six participants. Four of the five caregivers validated this in the post interviews. We stress the importance of personal and individual-oriented research in the care context for people with dementia and the envisioned beneficial effect of helping caregivers evoke desired emotional states for people with dementia. We also identify cultural probes with post interview as a suitable method for identifying rich, personal insights on an individual with dementia through the perspectives of their relatives. (see research report Appendix D)*

Outcome for industry and practice

This project offers preliminary research on the application of 3D-audio technology in formal care settings. The insights of the workshops can be further implemented in iterations of technological products or innovations. For instance, the development of new products concepts based on in-context sonification of the care space through behavior, gestures and movement. Or enriching multisensorial products for people with dementia with 3D-soundscapes to offer fully immersive multi-modal experiences during socially engaging activities. The results also offered insights for caregivers working in care facilities on how to involve people with dementia in meaningful activities that provide social engagement through the exploration of familiar 3D-soundscapes:

→ *All caregivers expressed that they see potential for 3D audio, as applied in this study, to calm residents in one-on-one therapy. As the personal 3D audio cued stories that were untold, it could make it easier for caregivers to set up and enter in meaningful conversations with individuals with dementia.*

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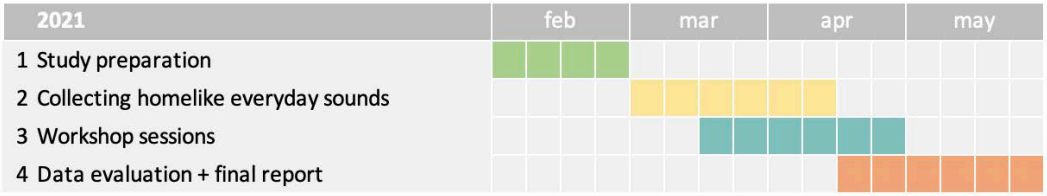
Planning

The project duration is set for four months starting in February 2021 and ending in May 2021.



Kennisdelen

Care practice: Vitalis shares relevant insights for care practice through their communication channels, such as website, social media, newsletter and relation magazines.

- https://www.linkedin.com/posts/qwiek_qwiek-belevingsgerichtezorg-zorginnovatie-activity-6777197792210354176-QwX9
- https://www.linkedin.com/posts/vitalis-woonzorg-groep_onderzoek-naar-inzet-3d-geluid-voor-meer-activity-6774644196767739904-ZLUS
- https://www.vitalisgroep.nl/intensieve-zorg/goed-om-te-weten/laatste-nieuws/1285-onderzoek-naar-inzet-3d-geluid-voor-meer-thuisgevoel-bij-verhuizing

Academic Dissemination: TU/e and Fontys will further analyze the results and synthesize the conclusion of the (preliminary) research report into an academic article for submission to a peer-reviewed conference or journal.

Mogelijke vervolg stappen

1) Future research projects

Future funding opportunities will be explored to ensure that the project has continuity, sustainability and longevity. A future project can investigate the in-context validation for 3D-audio technology in dementia care, based on the explorative findings of this project.

2) Implementation in care facilities

The potential of 3D-audio experiences to provide meaningful social activities or reduce stress and behavioral disorders in people with dementia can be further investigated through the implementation and evaluation of the workshop activity in the existing care process. **After the project each participant received a personalized speaker with their personal soundscapes** to enable sustainable use of the soundscapes after the project.

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Figure 5: During the last consortium meeting, the objects used in the workshops and personalized speakers with the participant's soundscape were delivered to the care organization.

Financiële rapportage

Zie begroting.

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