Developing and evaluating serious games and input techniques for people with moderate to severe dementia using heuristic evaluation

Lucas Walters
Student number 5037883

Guido Soetens
Daily supervisor

Nina Rosa
Project supervisor, first examiner

Wolfgang Hürst
Second examiner

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Preface

This thesis is divided into two components. The first section contains the independent scientific paper outlining the primary contributions, and the subsequent section includes annotated appendices. The appendices serve to encompass additional related work, provide background information, and offer insights into aspects that were not covered in the main paper.

Developing and evaluating serious games and input techniques for people with moderate to severe dementia using heuristic evaluation

Author: Lucas Walters[1] [a] Supervisors: Nina Rosa[1] [b], Wolfgang Hürst[1] [c] and Guido Soetens[2]

[1]*Department of Information and Computing Sciences, Faculty of Science, Utrecht University, Utrecht, The Netherlands*
[2]*Tover BV, Utrecht, The Netherlands*
l.e.walters@students.uu.nl, n.e.rosa@uu.nl

Abstract: A large percentage of people with dementia in nursing homes suffer from apathy. In order to combat this and improve the quality of life, play has been found to have a positive impact. To encourage play, certain interactive virtual games have been made that promote physical activity, cognitive stimulation, sensory stimulation and social interaction. This has been found to reduce apathy in people with dementia. Designing games for this target group is difficult because they could be unable to share their own feelings on the experience and planning test sessions with them is more difficult than usual. The purpose of this study is to provide a heuristic evaluation method to analyse these games with professional care-providers instead of the target audience. This evaluation method is performed on a case game implementation. This serious game is designed specifically for mobility-restricted people with dementia to reduce apathy, using a list of recommendations that's created based on a literature study and an expert survey. The results of the evaluation show that the case game does incentivize physical activity, cognitive stimulation, sensory stimulation and social interaction, which suggests it can be used to reduce apathy. The heuristic evaluation method successfully produces a list of concrete next steps for the case game. The evaluation method can be applied to evaluate these specific kinds of games without needing the target audience.

1   Introduction

In 2018, Europe had nearly 9.8 million people living with dementia, a number projected to double to 18.8 million by 2050 (Georges et al., 2020).

A significant challenge for individuals with dementia is apathy, defined as "the absence or lack of feeling, emotion, interest or concern" (Marin, 1991). Over 70% of people with dementia experience apathy, leading to a lack of motivation for daily activities, indifference to new experiences, and diminished emotional responses (Cipriani et al., 2014; Starkstein, 2005).

Structured activities in nursing homes, like music and art therapy, have been effective in reducing apathy compared to self-selected activities (Ferrero-Arias et al., 2011). Interactive play experiences, encouraging physical activity, cognitive stimulation, sensory stimulation, and social social interaction, also have positive impact by reducing apathy in people with dementia (Anderiesen, 2017).

Projection-based game systems, such as the Tovertafel, have demonstrated positive effects on apathy in dementia (Anderiesen, 2017; Good et al., 2019). However, a limitation arises for residents unable or unwilling to access interactive tables, usually set up in common rooms. To address this, Tover introduced the Tovertafel Pixie, a mobile projection system that can bring stimulating experiences to residents' rooms. Despite its versatility, interactive use on vertical surfaces poses challenges, requiring standing and potentially excessive movement.

To make interactive games accessible to residents in their rooms, a method for more user-friendly interaction with the Tovertafel Pixie is needed.

When developing these interactive game systems, there are issues with evaluating the effectiveness of the end result or an intermediary prototype during the development process. This is because the target audience is a vulnerable group which makes it more difficult to perform user studies due to ethical constraints, often they are unable to provide consent

[a] https://orcid.org/0000-0001-9671-729X
[b] https://orcid.org/0000-0002-1892-9702
[c] https://orcid.org/0000-0002-5112-9774

Figure 1: The Tovertafel Pixie, a mobile device for projecting interactive games on flat surfaces.

for such a study themselves. Another issue is that evaluating criteria like the impact on apathy is more complicated than usual because it is difficult to ask about the participant's mood directly, they might not be able to answer or not be vocal whatsoever. Finally, setting up user studies with this group has shown to be difficult to do often, especially recently due to Covid-19 related precautions.

To tackle this issue an evaluation method could be created to be able to find issues in a game without the need of testing it with the target audience. To achieve this, a heuristic evaluation method could be used. A heuristic evaluation is a method of performing (usability) tests together with experts (Nielsen and Molich, 1990). It is meant to be more accessible and easier to perform than user tests, the purpose is to quickly find potential issues within a system.

If there was a heuristic evaluation method for games for people with dementia, they could be analyzed without the target audience themselves and instead with experts in the field, like professional care-providers for people with dementia.

The purpose of this paper - and the scientific contributions that it aims to provide - consist of three things:

- A list of recommendations for designing serious games and input techniques for people with dementia with the purpose of reducing apathy.

This is to provide a good foundation to base a game design on for this specific target group. It was found that experts at Tover, who could provide important insights on this topic, used game design principles that are not completely represented in literature. This is why it is important to base this list of recommendations not only on literature, but also on contributions from experts in the field through use of a questionnaire.

- Second, a heuristic evaluation method to be able to asses the game without the use of the actual target audience and instead with professional care-providers in the field. This evaluation method uses heuristics specifically defined for the domain of serious games for people with dementia to reduce apathy.

- And third, a case game implementation on which the heuristic evaluation method is used. The case game design is based on the list of recommendations and it is implemented to provide an example for how to perform the heuristic evaluation method.

1.1 Research questions

To achieve these purposes, the following research questions have been defined:

RQ1. What are the recommendations for designing an input technique together with a serious game for people in the mid to late stages of dementia, with the purpose of reducing apathy?

    RQ1A. What recommendations can be gathered from existing literature?

    RQ1B. What design principles for these serious games can be gathered from game experts in the field?

RQ2. To what extent can the design of an input technique and game for people in the mid to late stages of dementia be derived from these recommendations?

RQ3. To what extent can implementations of such designs be heuristically evaluated together with professional care-providers of people in the mid to late stages of dementia?

2 Literature study

The goal of this literature study is to answer RQ1A. Each part of the literature study will go through a different subject and then try to establish recommendations that are necessary for the design

of the game. These recommendations will be summarised at the end of this section.

2.1 Dementia and play experiences

Dementia is the term used to describe a decline in cognitive abilities severe enough to impact the person's ability to do everyday activities. Dementia affects memory, thinking, behaviour and functioning. The most common form of dementia is Alzheimer's disease (AD) (Brunnström et al., 2009). Other common types are vascular dementia, dementia with Lewy bodies and frontotemporal dementia.

Dementia is degenerative, meaning the impact on physical cognitive abilities will increase over time. To classify the extent to which the cognitive abilities have been affected the Global Deterioration Scale has been developed (Reisberg et al., 1982). People in stage one of this scale have no cognitive decline and appear normal. People in stage two can be slightly forgetful sometimes, in stage three, the first clear-cut deficits appear. Generally, in stage four, people start to display a decrease in memory of their personal history as well. Stage five is where the physical deterioration starts to become apparent but they will need only little assistance. In stage six, people will need assistance in most day to day things, and people in stage seven have very severe cognitive decline where all verbal abilities are lost and require assistance in every part of their lives.

For people with dementia, there is clear therapeutic value in playing games (Griffiths, 2005). When designing games for people with dementia it is important to take into account the stage of their cognitive decline and adjust accordingly (Anderiesen et al., 2015; Robert et al., 2014). In order to do this there needs to be knowledge on how the cognitive decline affects a person's experiences when playing games and how the degenerative nature of dementia affects a persons ability to experience play.

In general, when engaging in play, there are different kinds of play experiences a person could feel. 21 of these play experiences are categorised to help understand the foundations of a game (Korhonen et al., 2009). These play experiences are: captivation, challenge, competition, completion, control, discovery, eroticism, exploration, expression, fantasy, fellowship, humour, nurture, relaxation, sadism, sensation, simulation, subversion, suffering, sympathy and thrill.

The ability of having these play experiences could potentially depend on brain structures that are significantly impacted by dementia. Consequently, play experiences that depend on those structures may lose their inherent meaning and result in a lack of interest or feelings of frustration for individuals with dementia. Games that offer cognitively challenging play experiences to individuals with dementia tend to yield more positive effects compared to games that appear meaningless to them (Lucero et al., 2000).

Research has been done to find which of these play experiences would be viable for people with different stages of AD (Anderiesen et al., 2015). For this research, the authors defined another play experience specifically for people with dementia, namely: reminiscence. It was found that people in the advanced stages of AD (scale 5-7 on the Global Deterioration Scale) would likely only get enjoyment out of the play experiences relaxation, reminiscence and sensation. Relaxation is the experience of unwinding, relaxation or stress relief and calmness during play. Reminiscence is a nostalgic experience, something that reminds you of the past. Sensation is a meaningful sensory experience.

2.2 Apathy

Apathy exhibits itself as a lack of interest, enthusiasm, or concern about things that typically evoke emotions or engagement. Apathy is not simply a lack of motivation but it is described as a quantitative reduction of self-generated voluntary and purposeful behaviours (R. Levy and Dubois, 2005).

Apathy is often confused with depression because there is an overlap between the symptoms caused by both. However, usually a person with apathy lacks the negative thoughts, emotional distress and sadness, often associated with depression (M. L. Levy et al., 1998). It is these symptoms that differentiate apathy and depression. A low percentage of people with dementia meet both depression and apathy criteria at the same time (Starkstein, 2005), but antidepressants do not reduce apathy for those people (Rahman et al., 2004).

Apathy is one of the most prevalent symptoms of dementia. Over 70% of people with dementia are affected by apathy (Cipriani et al., 2014). This leads to a lack of motivation or effort to perform every day activities, lack of interest in new experiences, or learning new things, and lack of emotional responses to positive or negative personal events (Starkstein, 2005). Apathy appears in different forms of dementia (Aalten et al., 2008), but it may be more common in vascular dementia and frontotemporal dementia (Clarke et al., 2008; Fuh, 2005).

When examining the frequency of apathy across various stages of dementia, individuals in the

advanced stages are more likely to experience apathy due to the compromised state of their cognitive functioning. This is particularly true for older individuals who are already susceptible to further cognitive decline (Anderiesen, 2017; Ferrero-Arias et al., 2011; Landes et al., 2005).

Several different methods have been developed for apathy assessments in people with dementia (Robert et al., 2002; Starkstein, 2005; Strauss and Sperry, 2002). The most commonly used is the Neuropsychiatric Inventory, which does not only focus on apathy but assesses the presence of 10 different symptoms where depression and apathy are separately mentioned, which helps distinguish the two symptoms (Cummings et al., 1994). All of these assessments require interviews with or observations by the care-providers.

Ferrero-Arias et al., 2011 studied the impact of organised activities in nursing homes. They let people with dementia spend time with a free choice between games, music, television or reading books and then compared the reduction of apathy with structured activities that were organised like music therapy, art therapy and simple movement activities. It concluded that structured occupational activity for even a short period of time decreases apathy in people with dementia and is much more beneficial than free choice in a non-structured environment.

The Tovertafel has also been designed to reduce apathy for people with dementia. To evaluate the effectiveness of the Tovertafel, people with dementia were observed during three different conditions. When participating in a social coffee drinking activity, when there was no organised acitivity at all and when using the Tovertafel together. A care-giver would then observe and fill out a brief questionnaire to specify changes in behaviour and possible impact on apathy. (Anderiesen, 2017). Through this, the Tovertafel has been found to have a positive impact on reducing apathy in people with dementia. This is partly because it is also used as a structured occupational activity. Care-givers will invite residents to sit around a table and then let them play with the Tovertafel together, promoting physical activity, social interaction and positive emotions.

2.3 Serious games for people with dementia

Serious games are games designed for another purpose besides entertainment. This purpose is usually education but social change is also often used (Michael and Chen, 2005). Just like entertainment games, serious games can leverage interactivity, storytelling, and gameplay mechanics to immerse the players in an engaging environment. This effect can then be used to achieve a different purpose than entertainment, like for instance teaching the player about new subjects or making them aware of important things in society.

For people with dementia it has been found that serious games can offer benefits in cognition and a positive impact on apathy (Zheng et al., 2017). Most studies, however, focus only on people with mild cognitive impairment and mild AD and not on people with moderate to severe dementia (scale 5-7 on the Global Deterioration Scale).

Robert et al., 2014 compiled a list of eight recommendations when designing a serious game for people with dementia. These recommendations where defined based on a literary review of Bouchard et al., 2012; Fua et al., 2013 together with comments from a group of professional care-providers for people with dementia.

1. *Keep track of the player's cognitive abilities.* This is important for the care-provider to assess the impact of the game on cognitive performance and it could potentially be used to adjust the difficulty of the game.

2. *Determine an appropriate number of steps for the challenge.* Many steps could help train cognitive ability but too many could overload the players.

3. *Keep the player in their "flow zone."* Flow is the feeling of challenge-based immersion into an activity, caused by matching the difficulty with the player's skill level.

4. *Promote naturalistic interactions.* Naturalistic interactions are more intuitive to the user and take less time to learn.

5. *Use user-friendly interfaces for home-based exercises.* When creating games that can be used at home it is important to focus on a user-friendly interface so it can be used independently as well.

6. *Take advantage of the multimodal aspect.* Different forms of input or output systems can work together for a better experience.

7. *Take into account the impairments of the users.* In this case, the different stages of cognitive decline are important to take into consideration.

8. *Take into account the social and cultural background of the user.*

Because the recommendations listed above are based on recommendations made in other studies, it seems like the original guidelines listed in Bouchard et al., 2012 are summarised to where the original idea becomes less apparent. The guidelines about

minding visual impairment and using different kind of prompts when providing assistance are important to mention in this literature study as well. Suggestions for visual improvements include using warm and bright colors, having good luminosity and providing enough contrast. Using different kind of prompts when providing assistance is important because not every person with dementia has the same capabilities, one person might be visually impaired, so an auditory instruction might be useful while someone else might be hard of hearing so the visual instruction is more important.

Manera et al., 2015 created a tablet serious game for people in the early stages of Alzheimer's disease using the recommendations from Robert et al., 2014. The game was also designed for people that showed signs of apathy but this was seen as a design challenge because of fear the playful nature would not work for these people. However, after the study they found that people that showed signs of apathy actually played more compared to non-apathetic participants.

2.4 Input techniques

An input technique is the action that a user has to perform using an input device to interact with a system. The input devices are the tools used to implement the interaction techniques. Input technique can be typing on a keyboard to write text on a computer, pressing a button on a remote control to raise the volume on a TV, or using voice to give instructions to a device with voice recognition technology.

The input devices have to be natural, efficient and appropriate to work with a given technique (Salvendy et al., 1997). For instance, a limitation when playing games for people with dementia is that there is difficulty understanding the interfaces (Robert et al., 2014). The concept of "usability" refers to the ability and ease of accessing a product, encompassing factors such as learnability, efficiency, memorability, error handling, and user satisfaction (Czaja et al., 2019).

When creating a new technology for elderly, three key objectives have been identified: customisation to accommodate the user's physical limitations, ensuring familiarity and satisfaction with the device, and acknowledgement of the benefits derived from using the interface (Holzinger et al., 2007). In general, the golden rule for achieving seamless interaction with a system is through a natural user interface. Such an interface is intuitive, requiring no training or prior experience, enabling users to effortlessly engage with the technology (Steinberg, 2012). This is especially important when designing

for people with dementia (Robert et al., 2014).

In addition, when considering older adults, it is essential to take into account any changes that occur in their core cognitive abilities as a result of aging. Factors such as perception, attention, memory, and other functions that are integral to daily life must be considered to guarantee the usability of a specific interface (Gamberini et al., 2006).

Vallejo et al., 2016 performed a study where they compared five different natural interfaces in two different serious game tasks for people with dementia. The different interfaces tested were: a joystick, a touchpad, two motion and orientation detection game controllers that are used simultaneously and two different optical natural user-interaction sensors. One of the serious games was a navigation task where the participants needed to move their avatar in a virtual world. The other task was to set a virtual table with the correct kitchenware. It was found that the preferred interface is very much task dependent. When users could use their hand movements to move the kitchenware on the table it felt natural, but using hand movements to move the person's avatar in a virtual world felt unnatural because that is not a natural mannerism for a human. Natural user interfaces should be naturalistic, meaning they are representative of what we do in reality. Another conclusion was that people with dementia prefer to use an input technique that doesn't require fine control with small, accurate movements. In the avatar movement task, the joystick was preferred exactly for that reason. The touchpad, for instance, was very sensitive to touch and would require very precise motions to use correctly.

3 Recommendations

This section describes the recommendations for designing serious games and input techniques for people with dementia in order to answer RQ1. The list of recommendations is comprised of two parts: recommendations found in existing literature (RQ1A) and the results from an expert survey about design principles for games for the people with dementia (RQ1B).

3.1 Recommendations from literature study

To establish a list of recommendations, the literature study from section 2 is used. However, some of these recommendations are redundant or unnecessary for this list of recommendations. The recommendations

	Recommendations	Reference(s)
1	Take into consideration the stage of cognitive and physical decline.	(Anderiesen et al., 2015; Robert et al., 2014)
2	Balance the game's challenges with the user's ability to address and overcome them.	(Bouchard et al., 2012; Chen, 2007; Robert et al., 2014)
3	Should incentivise physical activity, cognitive stimulation, sensory stimulation, and social interaction	(Anderiesen, 2017)
4	Relaxation, reminiscence and sensation are the most applicable play experiences for people in late stages of AD.	(Anderiesen et al., 2015)
5	Take into account the social and cultural background of the user, especially when implementing a reminiscence play experience.	(Anderiesen et al., 2015; Robert et al., 2014)
6	Create good luminosity using warm, bright colors and clearly defined contrast.	(Bouchard et al., 2012)
7	Use different types of prompts (e.g. visual, audio) when providing assistance.	(Anderiesen, 2017; Bouchard et al., 2012)
8	Should offer structured occupational activity for (even) short periods of time	(Ferrero-Arias et al., 2011)
9	Make sure the input technique feels familiar to the user.	(Robert et al., 2014; Salvendy et al., 1997)
10	The input technique must match the task to be performed in order to feel natural.	(Vallejo et al., 2016)
11	Make sure the input technique does not require very small and precise movements.	(Robert et al., 2014; Vallejo et al., 2016)
12	Target people in mid to late stages of dementia because that is where the physical deterioration is prevalent and they show more signs of apathy.	(Anderiesen, 2017; Ferrero-Arias et al., 2011; Landes et al., 2005; Reisberg et al., 1982)
13	Avoid a feeling of making mistakes in the game, ensure the game focuses on what people are able to do instead.	Expert survey
14	Aim to keep players actively engaged by using active cues to recapture the player's attention when lost.	Expert survey
15	While creating the game, involve people with dementia in the design process by testing together with them.	Expert survey

Table 1: Recommendations for designing serious games and input techniques for people with dementia, gathered from literary study and expert survey.

from Robert et al., 2014, listed in subsection 2.3, have first been reviewed. Some of these recommendations have been merged together or partly omitted. The first recommendation is about keeping track of the player's cognitive abilities, which can be useful for care-providers to have extra insight into the changes of cognitive abilities of the person of dementia but it is not directly related to the experience of the person of dementia when playing the game. As this list of recommendations is specifically meant for designing games and input techniques for people with dementia, it is left out of the list of recommendations compiled here. The second recommendation talks about an appropriate number of steps required in the game but this has been left out as not every game would

necessarily have a clear-cut definition of what a step is inside it's context. The third recommendation, about keeping players in the "flow-zone", has been rewritten to make clear how to achieve that purpose for the designer. Namely that the activity in a game must balance the inherent challenge and the player's ability to address and overcome it (Chen, 2007). The second part of the fifth recommendation, about home-based exercises, has been excluded because not all serious games for people with dementia are created to be used for home-based exercises as well. Finally, the sixth recommendation has been excluded because it is listed as a way to train sensory and motor modalities at the same time and not as a way to improve apathy, the purpose of our list of recommendations. The list

of recommendations are presented in table 1, where the first part of the table lists the 11 recommendations based on the literature study. It also lists the references where each recommendation was found in other research.

3.2 Expert survey

In order to find design principles from game experts in the field, a survey is performed. This questionnaire explores what other recommendations could be made when designing serious games for people with dementia.

For this survey people who are involved in the design process of games for people with dementia have been asked to participate by answering a questionnaire with 25 questions. First, three questions are asked for each of eight design principles based on the list of recommendations. Only recommendations about the game design itself are used, and not the input techniques. This is because the scope of this questionnaire is limited to game design and not also input techniques as other people are usually responsible for that. These 24 questions provide an example of useful game design recommendations and are meant to inspire the participant when answering the final question, namely which other design principles they are familiar with that they would recommend when designing games for people with dementia.

Four voluntary participants have filled out the questionnaire. These participants consist of two game designers, a game developer and a user centered designers, all employees at Tover.

Through answering the final question of the questionnaire, participants have made a comprehensive list of recommendations. Some of these are specifications of already listed principles, for instance, that it is important to keep visual impairment in mind. But there are three recommendations that were not - or insufficiently - represented in the existing list of recommendations. These new recommendations are listed in the second part of table 1, where three new recommendations are added, bringing the total of the list to 15 recommendations. Interestingly, none of the recommendations were made by one expert alone, each recommendation was made by two different participants.

4   Case game implementation

In addressing RQ2, a game is developed, accompanied by an input technique aligned with the recommendations established for RQ1.

The game is tailored for individuals in mid to late stages of dementia (Global Deterioration Scale stages 5-7), chosen for two reasons identified in the literature: 1) Physical deterioration in later stages warrants interactive play experiences, especially for individuals confined to bed. 2) Apathy is more prevalent in later stages, making individuals in mid to late stages potential beneficiaries of apathy reduction.

To design the serious game, collaborative brainstorming sessions with Tover's game design experts were held, focusing on accessibility. The list of recommendations in section 3 guided the selection process, eliminating ideas inconsistent with these recommendations.

Accessibility is crucial, aiming for playability even for those unwilling or unable to participate in common room games. The chosen device is the mobile Tovertafel Pixie (see figure 1), facilitating gameplay in a player's room. The game requires an empty vertical surface for projection and the player needs to be able to hold and move the interaction device with one hand.

The game features a virtual orchestra projected on the wall, responding to a Bluetooth accelerometer sensor-equipped conductor's baton. Player movement influences music tempo, fostering a conductor-like experience. The game aligns with all recommendations in section 3.

The simplicity of the interaction suits mid to late stages well (Recommendations #1, #12). The game aims to stimulate physical movement, cognitive engagement, and sensory experiences through music and visuals. Social interaction is possible but not the primary focus (#3).

Incorporating musical elements, as supported by previous research (Benveniste et al., 2012; Riley et al., 2009), allows adaptation to a player's background. Specific songs may trigger feelings of reminiscence (#4, #5).

The chosen input technique is intuitive, matching game tasks and requiring minimal precision (#9, #10, #11). Free-form play and an accessible device enable challenge level adjustment (#2) and structural occupational activity (#8).

During development, considerations align with remaining recommendations. Visual elements prioritize bright colors and clear contrast (#6). Various prompts, such as music cessation and floating hands, maintain player engagement (#7, #14). The

Figure 2: The orchestra conductor game. The picture is taken while a song is playing.

game's simplicity aims to prevent a sense of mistakes (#13).

Notably, recommendation #15, involving people with dementia in the design process, is excluded due to the study's focus on situations where direct involvement is impractical.

5 Heuristics

Heuristics, commonly used in Human-Computer Interaction, typically define usability principles. Conventional heuristics fall short for games designed for people with dementia, necessitating a new set. Compiled based on recommendations from the literature study and game expert survey in section 3, these heuristics consist of best practices, explanations, and evaluation questions. Discussion with game design experts refined the heuristics, eliminating some deemed unnecessary or inapplicable for various reasons:

- Recommendation #12 is about which target audience to choose for a game. While this is an important decision to think about when starting to design a game, it is not something that fits in a design heuristic as it is not an intrinsic quality that can be experienced by the user when playing the game but rather an extrinsic fact about the game itself.

- #8 mentions that it is important that the game offers a structural occupational activity. This is less of a recommendation for the game design itself but more about how the game system should be used instead. It is important as a recommendation for designers but not necessarily something to be evaluated together with care experts. For instance, experts from Tover mentioned that something like the Tovertafel Pixie itself can be offered as a structural occupational activity in a nursing home setting but that is less applicable to the games on the device itself.

- #15, found through the game expert survey, says that it is important to involve people with dementia into the design process and while this is important it is not part of the list of heuristics. This is because this heuristic analysis is a form of evaluating the game exactly when doing so together with the target audience is difficult and it is also a decision made about the design process and not the design itself.

Apart from discussing the recommendations the experts were also consulted on the clarity of the heuristics and whether the groupings of recommendations made sense. Based on the list of recommendations and input from game experts, the following list of seven heuristics is formed:

H1: The game should consider cognitive decline

Explanation: Design the game with careful consideration of the cognitive decline experienced by players in specific stages of dementia. Tailor the game's challenges, interactions, and content to be appropriate and engaging for a defined range of dementia stages.

Evaluation questions:

- In your opinion, which stages of dementia is the game best suited for?
- Does the game accommodate the cognitive decline of the players with dementia which it is designed for?
- If not, how could the game be changed to better fit the range of dementia stages it is designed for?

H2: The game should give incentives for physical activity, cognitive stimulation, or social interaction

Explanation: Ensure the game encourages physical activity, cognitive stimulation, or social interaction. These elements should be enjoyable and beneficial.

Evaluation questions:

- Does the game encourage physical movement or activity during gameplay?
- Are there challenges or activities in the game that give cognitive stimulation?
- Does the game promote social interaction while playing?

H3: The game should provide emotional engagement and avoid negative feelings

Explanation: Foster emotional engagement by incorporating elements of relaxation, reminiscence, or sensory stimulation in the game. Ensure that the game does not make players feel like they are doing something wrong or making mistakes.

Evaluation questions:

- Do you think the game feels relaxing?
- Could the game evoke memories from the past or introduce nostalgic feelings in the player?
- Does the game give enough sensory stimulation?
- Is there a way to make mistakes in the game or is it possible to play the game wrong?

H4: The game should stimulate engagement and re-engagement

Explanation: Create a game that can capture a player's attention at the start and re-capture it if they lose focus. Length of engagement is typically much lower than conventional games.

Evaluation questions:

- How does the game first capture the player's attention?
- Is the game able to regain attention if the player becomes disengaged or distracted?
- How long do you think the game can keep the players engaged?

H5: The game should have a user-friendly input technique with task alignment

Explanation: The input method should be intuitive and easy to use and must accommodate for the physical decline of the player. Ensure that the chosen input technique aligns with the tasks and actions required in the game. Avoid input that requires small and precise movements.

Evaluation questions:

- How intuitive did you find the game's input technique?
- Does the input method align with the tasks and actions required in the game?
- Were there any challenges or frustrations related to the input technique that you encountered?

H6: The game should consider visual and auditory impairment

Explanation: Design the game with careful consideration of decline in visual and auditory capabilities. Create visuals using warm, bright colors with clearly defined contrast and good luminosity. When prompting the player with instructions ensure to use multiple types of prompt, usually both sound and visual.

Evaluation questions:

- Do the game's visuals feel like they work well for people with dementia?
- Are multiple types of prompts used in the game when instructing the player?

H7: The game should mind cultural and social backgrounds

Explanation: Take into account the social and cultural backgrounds of the players when designing the game. Incorporate elements that resonate with their experiences and preferences.

Evaluation questions:

- In what ways does the game incorporate elements from your cultural background or experiences?

6 Evaluation

The evaluation assesses the game's adherence to the heuristics established in this study and identifies potential issues. The Ethics and Privacy Quick Scan of the Utrecht University Research Institute of Information and Computing Sciences classified this research as low-risk with no fuller ethics review or privacy assessment required.

6.1 Participants

To analyze the game without involving individuals with dementia directly, professional care-providers are enlisted as experts in this heuristic evaluation. These experts, working in nursing homes and providing daily care for people with dementia, bring a perspective aligned with the target audience. Eight participants from four different nursing homes across the Netherlands were recruited for the study.

6.2 Materials

The evaluation centers on the case game implementation, utilizing a Bluetooth sensor-attached conductor's baton and a virtual orchestra. Data is collected through audio recordings, with one participant opting for a written summary of their responses and observations. Despite the game's design for use with the Tovertafel Pixie, logistical challenges led to the evaluation being conducted on a laptop connected to a projector (5) or TV screen (3). This approach, however, doesn't impact the evaluation of the game itself as the game was played in the exact same way.

6.3 Procedure

Participants receive an introduction to the research and the evaluation process, followed by a consent form for their review and signature. The game begins, allowing participants to interact with the virtual orchestra using the baton. Subsequently, the heuristic evaluation takes place, where care experts answer questions freely. Participants can seek clarification during the evaluation, which continues while the game remains active. Upon completion of the questions, there is time for open discussion on related topics. The entire evaluation lasts up to an hour.

6.4 Results

The care experts opinions and observations gained during the experiment are summarised for each listed heuristic. To do this, the audio recordings are transcribed and each sentence would be labeled. (e.g. an agreement to the question, a suggestion for improvement, etc.) As the evaluations are performed in Dutch, the answers to each evaluation question would then be translated and summarized based on the matching labels.

H1: The game should consider cognitive decline

In your opinion, which stages of dementia is the game best suited for?

The experts agree that the game designed for people with dementia is suitable for various stages of the condition. One expert mentions the diversity in individuals' understanding of the game, citing that even those in the early stages may not grasp it initially, while others in later stages perhaps comprehend it well. Another expert discusses individual interest, stating that anyone with musical inclination can engage with the game, depending on their attention span and how long they can sustain participation. Another expert underlines the importance that the game's purpose is clear. Overall, the consensus is that the game can be adapted for all stages of dementia, provided there is interest.

Does the game accommodate the cognitive decline of the players with dementia which it is designed for?

The experts acknowledge that the game takes into account the cognitive decline of players with dementia, but there are suggestions for improvement. One expert says it's a difficult question because it is not entirely clear how to explain to the players what they need to do. To tell them that going on the rhythm of the music makes it easier. In general the experts feel like the biggest problem is the responsiveness of the sensor.

If not, how could the game be changed to better fit the range of dementia stages it is designed for?

Experts recommend several enhancements. They propose improving responsiveness to small movements, enabling customization for sensor responsiveness on a per-player basis, and incorporating an introductory phase for clearer instructions. One expert suggests adjusting the sensor's sensitivity for each player, they suggest this can be done by adding a sort of volume control button which instead controls the sensitivity of the sensor. While visual cues like hand movements are deemed clear, experts recommend additional support through text or spoken instructions, prompting a debate on the suitability of each method. The consensus is that all

communication methods could contribute but are not all necessary. Another expert highlights the challenge of conveying game instructions, particularly for specific movements, and recommends synchronizing actions with the music's rhythm.

H2: The game should give incentives for physical activity, cognitive stimulation, or social interaction

Does the game encourage physical movement or activity during gameplay?

The experts all agree that the game encourages physical movement during play. One expert expresses a definite affirmation, noting that the extent of movement varies among individuals. Another expert acknowledges that the degree of movement varies based on individual usage. A third expert agrees, stating that while the movement may not be extreme, it does occur. Finally, a fourth expert mentions that game moves all kinds of body parts, hands, legs, feet, arms.

Are there challenges or activities in the game that give cognitive stimulation?

One expert notes that the cognitive stimulation mainly arises from the difficulty of using the game. Another expert sees a challenge in achieving the correct tempo, suggesting that this aspect provides cognitive engagement. A third expert mentions that any external input that activates the brain is beneficial, suggesting that the game provides cognitive stimulation.

Does the game promote social interaction while playing?

The experts all agree that the game promotes social interaction during play. One expert suggests that the game elicits memories and leaves players with a positive feeling, indicating a shared experience. Another expert believes that social interaction is encouraged, especially when multiple sticks are involved, as it stimulates collaboration and joint play. A fourth expert simply states that the players engage with each other during the game.

H3: The game should provide emotional engagement and avoid negative feelings

Do you think the game feels relaxing?

The majority of experts find the game relaxing, with all respondents expressing that it can provide that experience in most cases. One expert suggests the potential for further enjoyment by allowing players to select specific music, like Vivaldi. However, one

expert notes that understanding the game is crucial for it to be relaxing, and they mention occasional discomfort with the sound as it was set too loud.

Could the game evoke memories from the past or introduce nostalgic feelings in the player?

The experts generally agree that the game has the potential to evoke memories or a sense of nostalgia. One expert mentions that this effect is particularly noticeable with the right music. The idea of customizing the music for individual players is also highlighted by an expert as a way to enhance this nostalgic experience.

Does the game give enough sensory stimulation?

Experts provide varied perspectives on whether the game offers sensory stimulation. One expert notes that effectiveness varies among individuals, suggesting personalized music for improvement. Another expert appreciates the sensory experience and the flexibility of playing in players' own rooms. Two experts express positive views because of the visual and auditory aspects. However, another expert suggests a lack of variety in visual elements, indicating a potential area for improvement in sensory stimulation.

Is there a way to make mistakes in the game or is it possible to play the game wrong?

One expert notes that the game may not respond well at times and that it would work better if the game responded faster to movement. Several experts never get a feeling of doing something wrong in the game. A discussion ensues about the game's response to different hand movements, with a suggestion to incorporate difficulty levels based on rhythm proficiency. Overall, the experts express general satisfaction with the game's design, while acknowledging areas for potential improvement in responsiveness and difficulty adjustments.

H4: The game should stimulate engagement and re-engagement

How does the game first capture the player's attention?

One expert highlights the significance of the hands animation, music, and a conducting stick and describes the effectiveness of demonstrating to encourage mirroring behavior for the players. Another expert suggests that hearing some music before the game starts, possibly accompanied by visual cues, would be helpful. A participant mentions the opening of curtains revealing an orchestra as an

attention-grabbing element. There is a consensus that introducing the game with music and a directive, potentially through an introductory video, could enhance the player's understanding and engagement.

Is the game able to regain attention if the player becomes disengaged or distracted?

One expert suggests that the music serves as a trigger to regain attention, but if the player doesn't enjoy it, they may disengage. Another expert proposes the use of text prompts, such as a "Move your hand" prompt appearing on screen together with the moving hands animation. There is agreement on the difficulty of maintaining attention within the target audience. The consensus is that the game requires constant supervision and guidance, with the suggestion of someone from the team initiating interactions. One expert suggests that more variation in visuals is needed to sustain engagement.

How long do you think the game can keep the players engaged?

One expert believes the game can keep players engaged for about half an hour, considering the intensity of the activity. They appreciate the variability in song lengths, allowing for flexibility in playtime. Another expert suggests a shorter engagement window, proposing approximately 5 minutes per person, not exceeding the length of one music track. They indicate that a longer duration might be possible with a greater variety of music. One participant expresses a similar view, suggesting a duration of around 5 minutes per person with the potential for increased engagement with a diverse selection of music. One experts states the game is currently too unclear to be interesting for more than 10 minutes.

H5: The game should have a user-friendly input technique with task alignment

How intuitive did you find the game's input technique?

One expert finds the input technique easy to use but suggests that making large movements could be a drawback. They propose the idea of using non-sensor sticks for additional players to participate without affecting the game. Another expert feels that the use of a stick was clear and intuitive. They suggest the possibility of using two sticks. Several participants express satisfaction with the stick input, describing it as logical and comfortable. One expert mentions the potential for using a second stick to enhance the experience. Concerns are raised

about the vulnerability of the equipment. There is no reported challenge or frustration with the stick's use. Participants suggest that it might be interesting if players could select specific instrument groups. However, concerns are raised about the potential difficulty for players to accurately point to specific instrument groups. Participants express mixed opinions on the feasibility and desirability of allowing players to select instrument groups, with some finding it potentially enjoyable and others considering it too complex for the target audience.

Does the input method align with the tasks and actions required in the game?

The experts express a consensus that the input method aligns well with the actions required in the game. One expert specifies agreement but notes that the movements required when swinging the baton may be too large. Overall, the experts find that the input method accurately corresponds to the actions needed during gameplay.

Were there any challenges or frustrations related to the input technique that you encountered?

One expert notes that small movements were not always detected, leading to a sense of expectation without corresponding feedback. Another expert identifies a potential frustration when the game does not respond quickly enough. A third expert points out challenges related to uncertainty and lack of interest, particularly among players who have not engaged in such activities before.

H6: The game should consider visual and auditory impairment

Do the game's visuals feel like they work well for people with dementia?

In general, the experts were pleased with the visuals of the game. One expert noted it was not clear enough on a small screen. Another expert mentioned it's important to darken the room when playing to make the projection more visible. Other experts noted it had a good balance between too busy and capturing attention.

Are multiple types of prompts used in the game when instructing the player?

Most experts noted that only the hands are used when instructing the player. Some experts mentioned that other forms should be used, like a voice saying "Move your hands" in order for it to really work. One expert felt it worked well as it is now.

H7: The game should mind cultural and social backgrounds

In what ways does the game incorporate elements from your cultural background or experiences?

One expert suggests that the game might not resonate with some players, and incorporating different types of music, reflective of their cultural background, could enhance the experience. Another expert mentions the importance of including more personalized music choices to better connect with the player's background and preferences. A third expert acknowledges that cultural background does play a role in the gaming experience.

7   Discussion

H1: The game should consider cognitive decline

Initially, the expectation was that the care experts would define the game to be most suited for people in the later stages for dementia, as that is what it is designed for. Surprisingly, every expert mentioned that the game could work for people in all stages of dementia provided there is interest, a long enough attention span, and an understanding of what's expected. It seems like the evaluation question about which stages of dementia the game is best suited for needs to be formulated better. The experts likely interpreted it as asking which dementia stages the game could work for instead of which stages it would fit best.

Even though the game's difficulty was not mentioned as an influencing factor in their answer initially, it was clear that it was important to the experts because the most frequently mentioned improvement here is adding an easily accessible option to change the difficulty on a player by player basis. Even though the case game implementation did provide difficulty settings to change how much effort it takes to start playing, or to reach the right rhythm, these settings were not easily changed. As a large number of care experts made this suggestion for the case game implementation, it seems to be important to provide explicit attention to. The recommendations made in section 3 already specify that it is important to take into consideration the stage of cognitive decline and that the game's challenges should be balanced with the player's capabilities but these results indicate it might be beneficial to add another recommendation specifically about having an adjustable difficulty setting. This change should then also be represented in the heuristics more directly,

perhaps through a new evaluation question.

The experts also suggested improving the game by adding more types of prompts when attempting to recapture the player's attention, even though the heuristic question specifically dedicated to that is later in the evaluation. This suggests it is beneficial to change the ordering of the heuristics so that open ended questions like how to improve the game overall happen later than the ones about specific subjects.

H2: The game should give incentives for physical activity, cognitive stimulation, or social interaction

The experts all agree the game does stimulate physical activity, cognitive stimulation and social interaction in varying degrees. The questions also lead to an expert giving a suggestion to improve social interaction by using extra conductor's sticks without sensors in them so more people are stimulated to play at the same time. This was mentioned as a way to improve social interaction in the game.

H3:   The game should provide emotional engagement and avoid negative feelings

All experts except for one found the game relaxing. That expert mentioned the sound was set too loud sometimes. This is something to be mindful of for creating a relaxing experience, however, it's also a setting that's easily adjustable in the game already. This suggests it might not be something in need of improving right now but it was something unpleasant in that moment for the expert.

Some experts suggested adding personalised music that could be chosen by the care-giver. This same suggestion was made by experts at different questions of this heuristic. First when discussing how relaxing the game is, then by a different expert when talking about nostalgic feelings and again by a third expert when discussing the sensory stimulation of the game. It's interesting to see this topic come up at three different questions in three different groups of experts.

When discussing the question about the potential of making mistakes in the game, several different experts note that the game doesn't respond fast enough to movement or to small movement at times. This observation comes up several times during the evaluation, also when discussing the heuristic about the input technique. This could be seen as a redundant question because of that but it is important to note that this problem is specifically related to the input technique, if the experts instead discussed a problem related to something in the game itself, there would

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likely be no overlap and it would still be important to ask about the input technique specifically in order cover that entire heuristic.

H4: The game should stimulate engagement and re-engagement

The most notable suggestions gathered from experts through this heuristic is a possible introductory phase for the game, more ways of recapturing the player's attention, and again having a custom music selection. The second suggestion is interesting as when the game was designed, special attention was put into having two ways of recapturing a player's attention. Namely, through the music stopping and an animation of two hands that appear to instruct the player.

H5: The game should have a user-friendly input technique with task alignment

Even though a question simply asked whether the input technique felt intuitive, it started a discussion between experts about the possibility of pointing at specific music instrument in the game and directing them individually. The experts then doubted whether that would be a good addition as it was also mentioned that it might be too difficult for the target audience. It was clear that the experts felt like the input method matches very well with the actions required in the game. This was an important finding in the literature study, the experts agreed that not only does the input method match well, it is also intuitive. However, the experts again mention it does not respond fast or well enough to small movements.

H6: The game should consider visual and auditory impairment

When questioned about the visuals of the game, one expert noted it wasn't clear, but this seems to be related to that specific evaluation where a screen was used instead of a projection. All experts who performed the evaluations on a projection or larger screen did not mention this problem. It does underline the importance of using a large enough projection or screen when playing the game.

This heuristic also has a question dedicated to asking about multiple types of prompts when instructing the player. Two experts now made a similar suggestion as a group of three experts made in heuristic 4. Namely, to add text or a voice saying "Move your hands" when instructing the player to move their hands. Those Three experts actually

referred to that previous answer as well. It seems like there is an overlap in answers between these two questions, which makes sense as the two questions (how to regain attention, multiple prompts when instructing the player) could be much related. This suggests these questions can be merged into one or put under the same heuristic to avoid redundancy.

H7: The game should mind cultural and social backgrounds

This heuristic resulted in a repeated suggestion that the game should have a personalized music selection. Besides that, the experts did feel it was an important factor to keep in mind but there were no other suggestions mentioned on how to improve it for this game.

7.1 Suggested improvements for the game

Keeping in mind the discussion above, the suggestions made by the care experts on how to improve the game is summarized as follows:

- Enhance sensor responsiveness, ensuring it can also react well to small movements.
- Enable customization for sensor sensitivity on a per-player basis.
- Incorporate an introductory phase to incentivise the player to start playing, possibly through an introductory video. One possibility is to have the instruments "warm up" by playing a few notes or part of the song with lower volume.
- Add more cues for getting the player engaged with additional text or spoken instructions.
- Increase visual variety for improved sensory stimulation. Brighter colors and more contrast.
- Consider using non-sensor sticks for additional players to provide collaborative play.
- Provide clear instructions for achieving the correct tempo.
- Incorporate different types of music reflective of players' cultural backgrounds. Perhaps have personalised music choices with the possibility to add specific songs.

7.2 Limitations

The heuristic evaluation is a subjective evaluation in nature. Even though involving only a limited number of experts in a heuristic evaluation is not uncommon,

it is founded in these experts' opinions of the game. Different experts could yield different results in the evaluation. as the method is vulnerable to personal bias.

During the testing phase of the study, the case game developed for evaluation was not a perfect implementation. Though it wasn't necessarily an issue because the whole evaluations process was made to find exactly the issues that appeared, but the lack of responsiveness sometimes when using the Bluetooth sensor was quite disruptive. Almost all care experts in the heuristic evaluation listed it as an issue and something that needs to be improved. During the testing it sometimes had an impact on how a user thought they were supposed to play the game, which would then be incorrect. Several efforts were made to rectify the issue before the evaluations began but although the problem was significantly improved, it would still appear from time to time.

8   Conclusion

To answer research question 1, a list of 15 recommendations for designing serious games and input techniques for people with dementia, with the purpose of reducing apathy, is introduced in section 3. This list is not only based on literature, but also extended through an expert survey with professionals who work on serious games for people with dementia. The resulting list of recommendations provides a good starting point for game designers when working on serious games for people with dementia, specifically when also designing new input techniques and when the game's goal is to reduce apathy.

Most recommendations made in other studies referenced in this paper have a slightly different primary purpose than the one here, namely that the serious game provides a learning or training experience instead of reducing apathy. This is also why some of the recommendations made by Robert et al., 2014 have been omitted in this list, as described in subsection 3.1. But, because the recommendations focus not only on designing a serious game to reduce apathy but also an input technique to match it, the recommendations provides a comprehensive list for this unique use case.

For this research, the case game implementation had the purpose of reducing apathy for people with dementia. The list of recommendations was used to create the game design in order to answer research question 2. By comparing a game design idea to each of the recommendations, as described in

section 4, it can be used to see if the idea will not work or if it needs more refinement. The example that the case game implementation provides shows how a game design can be derived from the list of recommendations.

To answer research question 3, a list of heuristics together with evaluation questions is defined in section 5. The heuristics were made based on the list of recommendations and feedback from game experts in the field. The questions provided are designed to be suitable for professional care-providers of people with dementia as experts. They can be used to perform a heuristic analysis of serious games for people with dementia, focusing on reducing apathy. To showcase the extent of it, the heuristic evaluation is performed on the case game implementation together with different groups of these care experts.

The results of the heuristic evaluation applied to the case game shows that a large majority of the experts believe the game incentivises physical activity, cognitive stimulation, sensory stimulation and social interaction. With the strongest being physical activity and social interaction, where all experts agreed the game stimulates the behaviour. As these are important factors to reduce apathy in people with dementia, the heuristic evaluation shows that the game can be used to reduce apathy in people with dementia.

For this study, one of the goals was to evaluate a serious game for people with dementia without testing with the target audience themselves. The results from the heuristic evaluation performed with only care experts form a list of suggested improvements to the serious game to increase the effectiveness for the target audience. This shows that the heuristics created together with evaluation questions can be used to perform an evaluation and gather concrete next steps for serious games for people with dementia, without the need of involving the target audience themselves. The suggested improvements resulted from the evaluation in this study are described further in the next chapter.

8.1   Future work

While the extent of using the heuristic evaluation method on the case game implementation was shown, there is no validation performed on the heuristic evaluation in this study. One way to do this would be by comparing the results of this heuristic evaluation with a user study with the actual target audience and analyze the difference in problems that are found.

During the heuristic evaluations, it seemed like quite a bit of feedback for later heuristics was already

given in earlier ones. For example, while discussing how the game incorporates cultural background or experiences, in almost every evaluation answers to that would already have been given. In this case that care providers think the game's music could be recognizable based on their background. This suggests there might be overlap in some of the heuristics meaning or that the ordering could be changed for better results. This is something that could be investigated in further studies.

The list of suggested improvements made by care experts when performing a heuristic evaluation provide next steps for the game's development. One suggestion made by two care experts in separate sessions was that if the game is played in a group setting, other people present could also get a conductor's baton without the sensor in it. That way they are also prompted to swing along and would stimulate physical activity even though they have no impact on the music. It could be interesting for further study to analyze how such a game could work in a multiplayer setting using multiple batons.

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Annotated Appendices

These annotated appendices provide more insight in the decisions made that form the main paper and how the research was performed. This thesis was conducted with an internship at Tover, a company based in Utrecht, the Netherlands, that creates devices to play serious games mainly targeted for people with dementia.

A Original experiment plans

Originally the study had a different purpose. Namely, to find out which input techniques had the best impact of reducing apathy for people with dementia. Three separate game implementations would be made and could be compared together. The implementation of these designs would be tested on the target audience of people with dementia, but due to ethical constraints the evaluation phase of this thesis was changed. Evaluating games for this vulnerable group can be difficult due to multiple reasons. First, this might be challenging when requiring approval from an external committee and secondly, for measuring certain aspects when testing the game, retrieving the opinion of the participant is difficult and in some cases impossible because they are not vocal. This is also why measurements of impact on apathy is done by an observer instead of the subject itself.

To address these issues, RQ3 was changed to focus on creating a way to evaluate games without the need of testing them on this target audience. To answer RQ3, first, the game design created for RQ2 is implemented. While developing this game, a heuristic analysis method is created that will allow the implementation to be evaluated together with care experts, the professional care-providers of people with dementia.

B Game design concept process

In order to validate the list of recommendations from literature and game expert survey there would need to be a case game implementation. While performing the game expert survey and after working out the methodology, the game design was also being created. This was done by gathering information from game experts at Tover and went through several phases, outlined in this section.

B.1 Formulating initial ideas based on input techniques

Initially, the plan was to create three different games to compare them to each other. This was when the goal was still to measure the impact of the game on apathetic feelings of people with dementia, in that case it would be useful to have multiple games to also compare against each other. Each game would make use of a different input technique and that would be the condition being compared. However, due to the change of goal in this thesis it became unnecessary to create multiple games. Only one game as a case study would suffice and there would be no reason to create multiple as the goal is no longer to compare different things in the game.

For the initial ideas for the game design, it was the goal to look at different input techniques and design a game with that technique in mind if it was deemed viable for the target audience. The first list of possible input techniques included several things.

1. Accelerometer + gyroscope attached to headband for head movement
2. Wii remote aiming/pointing
3. Accelerometer and gyroscope hand tracking
4. Eye tracking
5. Voice recognition - Spoken words provide input
6. Volume recognition - Any noise provides input
7. Wii Balance board on a chair
8. Several large buttons on a cube
9. Camera based hand/skeleton recognition (e.g. Microsoft Kinect)
10. Throwing small objects at a wall that provides input(e.g. wads of paper)
11. Standing cycle
12. Heart rate and breathing sensor
13. VR device hand recognition

Many of these initial game design ideas were deemed unviable for the target audience. Most would provide an uncomfortable experience because the person would need to wear or use something that feels very foreign as they have never done anything like it before. (1, 4, 7, 12, 13) Some of the ideas were ignored because they required too much or too precise movement. (2, 10, 11) Only a few remained that would be tested against the findings of the literature study and the expert survey. (3, 5, 6, 8, 9)

B.2 Informal meetings with experts at Tover

While the list of recommendations described in section 3 of the paper was being formed, several informal one-on-one brainstorming meetings took place with game experts at Tover. The purpose of these meetings was to gather initial ideas for the games and discuss interesting input techniques. While discussing the input techniques, some initial ideas for the game designs would come forward. In these meetings three ideas came forward: First, a driving game where the player would use an unattached steering wheel that controls the virtual car projected on a wall. Secondly, a fairy tale storytelling game where a projection on the wall would give prompts, and when the player reads them out, the game will create an animation of those things appearing in projection. And finally, a virtual orchestra conductor game where the player could wave their hands or a conductors baton to control an orchestra projected on a wall in front of them.

It was also during these meetings that it became apparent the game design experts at Tover would suggest recommendations for the game design that could not be found through the literature study, which became a reason to perform the expert survey described in section 3.2 of the paper.

Figure 3: Original concept of the virtual maestro game.

B.3 Brainstorm session with multiple experts at Tover

After the list of recommendations was finished, a brainstorm session was held together with experts at Tover. The purpose of this was to define the exact game design of the case game. The session had seven game experts (one game designer, two user-centered designers, two game artists and two game developers). During this session, at first, the three initial ideas, which originated from the informal

meetings, were presented and provided as an example for other ideas. Every person in the room would then be given several post-it notes to write down as many ideas as they had. These ideas could either be about the game design or just an interaction technique. They stuck them all to a whiteboard, and to help gather the best ideas, each participant would be given three small green stickers that they could distribute among ideas they deemed best.

From this session, four ideas came out best because they got the most votes: First, the virtual conductor game (described in section 4. Secondly, a game where the player would need to spot birds in a forest and the game would use voice recognition as input method. Third, a game where the player would use some kind of pointing device that would work as a flashlight in the projection area which is about searching for things in the dark. And finally, a game where the player would need to manipulate virtual 3D objects and rotate them so the right side could be scanned (e.g. when scanning products at a supermarket) using a 3 degrees-of-freedom gyroscope input sensor.

After the session, the chosen ideas were compared to the list of recommendations and how well each of them matched. Eventually, when the scope changed to create one game instead of three, the virtual orchestra was chosen as the game design concept. This was because it fitted all recommendations gathered from literature very well, some of the other concepts did not incentivize physical movement much while the conductor game did. It was also deemed more interesting because the game was very much musically focused, which was something that was found to be very positive in other studies.

C Game development process

The game development process involved several different steps described in this appendix.

C.1 Comparing input techniques

Even though the game design idea was now chosen, the idea could still work with several different input techniques. One would need to be chosen. As described in appendix B.1, five input techniques were considered for this: Accelerometer and gyroscope hand tracking, Voice recognition - Spoken words provide input, Volume recognition - Any noise provides input, Several large buttons on a cube, Camera based hand/skeleton recognition (e.g. Microsoft Kinect)
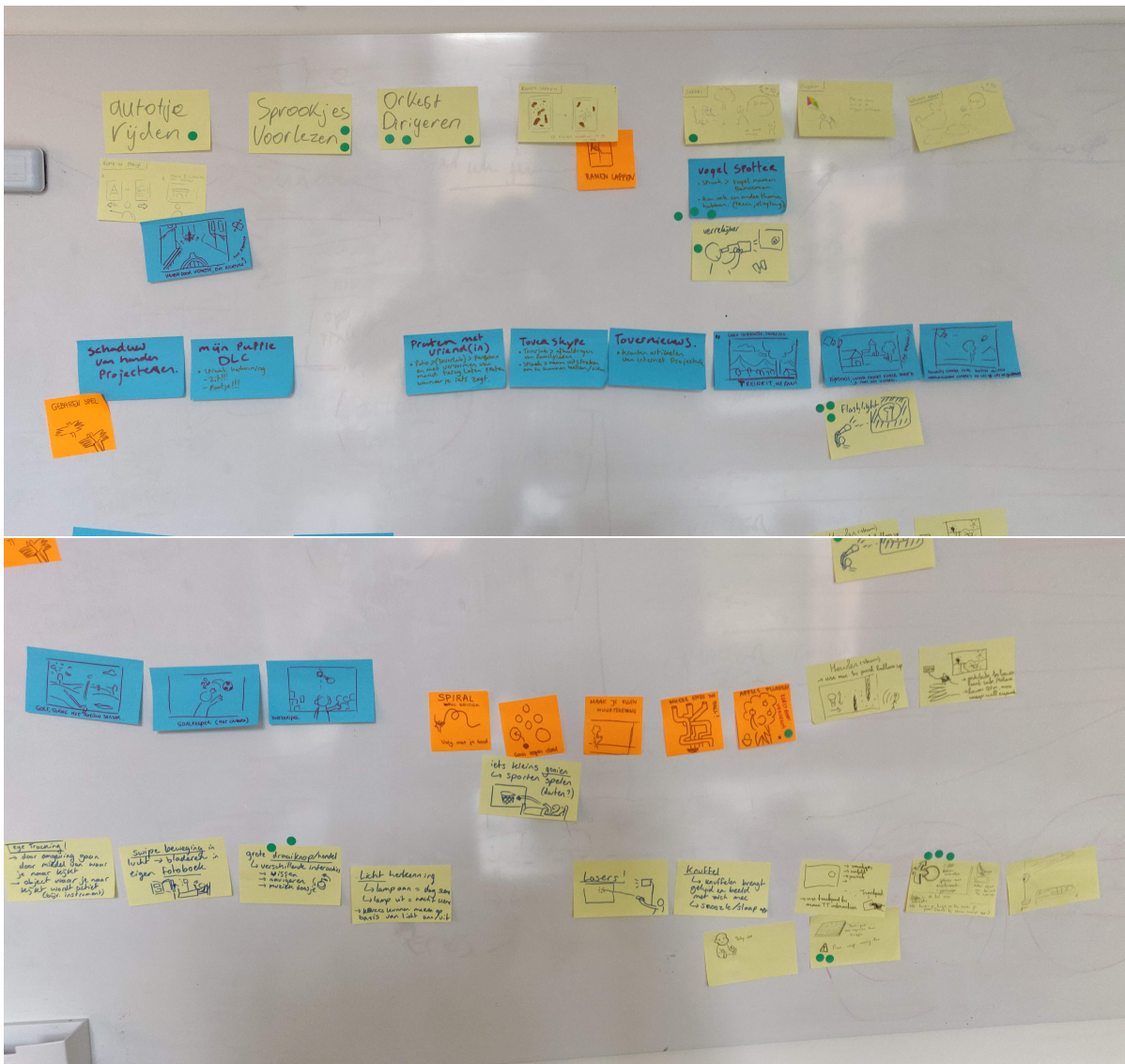
Figure 4: Brainstorm session results.

These were filtered based on a fact the literature study found: that it is important to match the input technique with the actions performed in the game. Because of this, the game concept - conducting a virtual orchestra - matches with two different input techniques: camera based tracking or accelerometer and gyroscope sensors based tracking.

For the camera based solution two ideas were originally considered: a microsoft Kinect based implementation or a conventional camera-based system. While the first would be an easier implementation, it would also have much overhead, the Kinect processes a lot of data (e.g. full skeleton tracking, pose tracking) and we are only interested in hand tracking. The Tovertafel Pixie is not designed

to work with a Kinect so it would likely cost more time than is available for the thesis to get it working. A conventional camera based system could work but it would entail much work. Creating a new hand tracking model using the Tovertafel Pixie's capabilities was considered but the issue is that available data necessary on hand tracking model training is only meant for hands tracked from a top-down perspective. Not for when the camera would be placed next to the player while they are lying in bed, for instance.

Because of the ease of implementation, an initial test using the accelerometer and gyroscope sensor was created. This was done using a Wii remote controller. Using this input technique felt intuitive

but the Wii remote controller looks and feels too different from a conductor's baton to be seen as one. It was decided to continue using the accelerometer and gyroscope sensor implementation and later switch to a much smaller sensor that is attached to an actual conductor's baton. This way the device felt much closer to what it was actually trying to represent.

C.2 Technical details

The game is created using the Unity game engine. It is developed using the C# programming language. For playing music in the game, the decision was made to make us of midi files, a standard protocol for letting electronic synthesizers process musical songs. To make this work in Unity, Maestro - Midi Player Toolkit is used.

The application uses Python to establish a Bluetooth connection with the accelerometer sensor inside the conductor's baton. For Linux, it uses the Gatt library to do this and it uses Bleak on MacOS. The reason for two different versions is because the Tovertafel Pixie runs on Linux but due to logistical challenges, it had to run on MacOS as well. The pipeline consists of Python printing out data from the sensor to a file and Unity reading that as fast as possible to use that input to influence what happens in the game.

Several other assets were used as well, listed in appendix F.

C.3 Expert evaluation sessions

The game prototype was tested together with experts from Tover several times. During the process several meetings where held where the experts could share their opinions on the prototype and provide suggestions for improvements for it. This was a free-form evaluation where the experts could provide any feedback they would like to share.

The first prototype of the case game implementation focused on being able to start and stop the music using the input of a Wii remote sensor. There was no influence of rhythm at all. During the first session of testing, experts from Tover found that it didn't provide enough of a feeling of accomplishment when playing the game because it felt like there was little influence, the background was too busy, and the instruments that were playing felt arbitrary.

For the next version, several things where improved: The game now had control on rhythm based on the players movements. More contrast was provided in the colors used and a less busy background was selected. Instead of a bulky Wii remote, a much smaller Bluetooth sensor with accelerometer and gyroscope was used so it feels closer to the objects it's trying to mimic (a conductor's baton). The game now contained an ending to songs where a fake audience would clap and curtains were added that would open and close at the end and beginning of each song. Apart from that, the musical notes appearing in the scene would be generated based on the instruments that were actually playing and only the instruments that were playing would actually be moving so that the effect feel less arbitrary. Tover experts suggested the main issue with this version is the lack of responsiveness and that it didn't really feel like there was control on the rhythm because the system would respond too late.

C.4 Final evaluation with Tover experts, together with heuristics

A final version for the experts at Tover was created, several issues of previous versions were addressed. Mainly the responsiveness issues were mitigated, but unfortunately not entirely removed. Songs were selected to be a bit shorter and there was now a setting that could be adjusted that changed the amount of influence the player has on the rhythm, though this setting was not easily adjustable when playing the game.

While evaluating this prototype, the experts used the lists of heuristics constructed to help evaluate the system. The experts also provided feedback on the clarity of heuristics, which was used to refine them into the list presented in this thesis.

The suggestions made during this testing session were used to make some final improvements to the case game implementations before it was used to perform the heuristic evaluations together with the professional care-providers. For instance, an active-cue was added: an animation of two hands holding a conductors baton waving across the projection, this would activate every time there has been no input for five seconds, prompting the player to start waving the baton again. It is important to note that the game was not perfect, but it was not the goal to create a perfect game, simply something that can be used as example to evaluate together with the professional care-providers.

D Expert survey questionnaire and results

This section details the game expert survey performed to generate the list of recommendations for designing games for people with dementia, listed in section 3 of the paper. The expert survey itself is described in section 3.2 of the paper.

D.1 Original purposes of first questions

Originally, the first 24 questions of the questionnaire served two purposes: to provide examples of design principles as inspiration for answering question 25 (the question with the sole purpose of finding expert recommendations for designing these games) and to potentially provide extra validation of the recommendations found through the literature study by asking about the experts usage of those principles. However, because the questionnaire only covered 8 design principles focused only on the game design and not the input interactions (as this is what the respondents have experience with designing), doing a proper validation of the literature study was deemed outside of the scope of this thesis. This meant the second purpose of these 24 questions was unnecessary and no conclusions are drawn from their answers in the paper. However, this doesn't mean the questions were unnecessary, as it still provided good examples of the design recommendations in preparation of question 25.

D.2 Game Expert Survey Summary

For this questionnaire, people who are involved in the game design process for people with dementia have been asked to participate by answering a questionnaire with 25 questions.

1. When designing games for people with dementia, take into consideration the stage of the player's cognitive and physical decline.

As expected, all participants keep this principle in mind when designing games. Participant 4 mentioned that to help mitigate physical decline sometimes an external peripheral is used to increase the range of motion of players.

2. When designing games for people with dementia, relaxation, reminiscence, and sensation are the most applicable play experiences for people in late stages of Alzheimer's disease.

Participant 3 mentioned they use the players GDS (Global Deterioration Score) to determine what kind of game and interactions fit that person.

3. Games for people with dementia should offer structured occupational activity for (even) short periods of time.

Participant 2 mentions that a theme is selected by a user centered designer for their games. It is not entirely clear how a theme is related to this design principle, maybe this design principle could be formulated better. Participant 3 notes that not all games really need to be a structured occupational activity and participant 4 suggests that it depends on the stage of dementia, that it is nice to have a structured activity for later stages and allow room for some choices for early to mid stages. This last suggestion seems good to keep in mind. There could be also be a bit less structure for people in the earlier stages of dementia.

4. Games for people with dementia should incentivise physical activity, cognitive stimulation, sensory stimulation, and social interaction.

It's interesting that participant 2 mentioned they usually choose 2 of these to focus on and then test to see if that works. Participant 3 seems to agree by saying not all games should incentivise all of them at the same time. Participant 4 does mention that all the effects will be included in their games but that 1 or 2 will be more prominent than others. It seems like this design principle could be changed to merely say to focus on the 4 topics but not necessarily all at the same time.

5. When designing games for people with dementia, determine an appropriate number of steps and aim to keep people in the "flow-zone."

The participants all have ways of changing the difficulty of the games to better match the players. It might be better for the design principle to simply say to keep the players engaged instead of using the term "flow-zone".

6. Games for people with dementia should promote naturalistic interactions and a user-friendly interface.

Participants mention that this is a very important principle, the older generation has less experience with technology, which should be kept in mind. Participant 1 mentions they try to avoid using a (graphical) user interface altogether and keep the interaction intuitive.

7. Games for people with dementia should take advantage of the multimodal aspect.

This is the only design principle for which a participant mentioned they never keep this in mind when working on their projects. They elaborate on this by saying all their games are multisensory so they don't do any testing related to that. Participant 4 mentions how they use external items to enhance

the game experience for their players. For instance, they use a soft pillow for a projected puppy game to make the puppy actually feel soft.

8. When designing games for people with dementia, take into account the social and cultural background of the user, especially when implementing a reminiscence play experience.

Participants mention that they definitely keep this in mind but it is difficult to evaluate. They create games for people in many different countries which makes it difficult to check if the themes and subject matter in games is recognizable to the players. Participants have also opted to allow custom content created by the users, which helps to make the game more personal and fit their cultural background.

Final question: Are there any design principles for serious games for people with dementia that you are familiar with and would like to add to the recommendations?

Participants have made a comprehensive list of recommendations. Some of these are specifications of already listed principles (e.g. participant 2 and 4 mentioned to keep visual impairments in mind, which fits with design principle 1).

But from the rest of the recommendations, a list of three separate new design principles is formulated. These recommendations were not - or insufficiently - represented in the existing list.

- **When designing games for people with dementia, ensure the game creates a positive experience by focusing on what users are able to do and not what they are not able to do. If users feel like doing something wrong, they might feel like they failed.** (Suggested by participants 2 and 4)

- **Games for people with dementia should aim to actively keep players engaged. Attention can be redirected to the game using active cues whenever concentration is lost.** (Suggested by participants 2 and 4)

- **When designing games for people with dementia it is important to involve people with dementia in the design process by testing together with them.** (Suggested by participants 3 and 4)

D.3 Questionnaire and results

Participants were asked to answer for each of the following 8 design principles if they use them during the design process for their projects and if they apply any evaluation method to check whether the project follows the design principle. For each design principle, 3 questions were asked. The first being "To what extent do you keep this in mind when working on your projects?", to which a Likert scale answer is expected (Never, Sometimes, About half the time, Almost every project, Always). Then the following questions is asked: "For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?" where three answers are possible: Yes, No, and Not Applicable. Finally an open question is asked per principle "Optional elaboration about your answers for this design principle." All questions in the questionnaire are optional, denoted with "..." in the answers listed below.

D.3.1 Design principle 1

When designing games for people with dementia, take into consideration the stage of the player's cognitive and physical decline.

Example: When designing a puzzle game for people with dementia, it is useful to make the difficulty level adjustable based on the individual's cognitive level and make sure playing the puzzle game does not require intense movement.

Q1
To what extent do you keep this in mind when working on your projects?

1. Almost every project
2. Always
3. Always
4. Always

Q2
For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. Yes
2. Yes
3. Yes
4. Yes

Q3
Optional elaboration about your answers for this design principle

1. ...
2. We test it with groups from the specific level we chose for the game
3. ...
4. We defined game levels (based on a cognitive framework) that match with a certain stage of dementia. Each level has its own characteristics.

For the physical aspect, in general we take into account that we are dealing with elderly people that often have more stiff muscles. In general, the further the dementia progresses, the more physical decline. We make sure that small movements already have a big effect (especially in the later stages of dementia, in this way everyone can participate). And this can also motivate people (give them the confidence) to make bigger arm movements. Sometimes caregivers also provide the players with an attribute (for example a foam tube or fly swatter) to extend the reach of the players.

D.3.2 Design principle 2

When designing games for people with dementia, relaxation, reminiscence, and sensation are the most applicable play experiences for people in late stages of Alzheimer's disease.
Example: When creating a virtual garden game where players can interact with nature, it is likely more suitable to make this a relaxing experience, listen to calming sounds, and view images related to their personal memories instead of making the game about watering the plants as fast as possible. To what extent do you keep this in mind when working on your projects?
Q4
To what extent do you keep this in mind when working on your projects?

1. Always
2. Always
3. Always
4. Always

Q5
For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. Yes
2. Yes
3. Yes
4. Yes

Q6
Optional elaboration about your answers for this design principle

1. ...
2. Again, if we make games for late stage dementia, we specifically test with that group
3. Depends on the GDS level of the players though.

4. We take this as starting point when developing games for late stage dementia

D.3.3 Design Principle 3

Games for people with dementia should offer structured occupational activity for (even) short periods of time.
Example: Introducing a game that simulates everyday tasks, such as cooking or gardening, providing a sense of purpose and engagement.
Q7
To what extent do you keep this in mind when working on your projects?

1. Almost every project
2. Sometimes
3. Always
4. Always

Q8
For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. Yes
2. ...
3. ...
4. ...

Q9
Optional elaboration about your answers for this design principle

1. ...
2. The theme is usually decided by the user centered designer. It is always something recognizable, but not always occupational. For example we made a pool game that works really well
3. Not all games require this though. Really depends on the goal we want to achieve.
4. People with dementia are dealing with apathy, they lack to take the initiative. Therefore, it is hard for them to initiate what they want to do. This is especially the case when dementia progresses. Then it is nice to just have a structured activity. In early (mid) stages a certain feeling of control is sometimes preferred, simple choices within a game can work (e.g. do you want to go to the beach or the forest?), but the activity/game is still structured then.

D.3.4 Design principle 4

Games for people with dementia should incentivise physical activity, cognitive stimulation, sensory stimulation, and social interaction.

Example: Multiplayer and encouraging players to collaborate, incorporating physical exercises, memory challenges, and sensory experiences are all good ideas for designing the games.

Q10

To what extent do you keep this in mind when working on your projects?

1. Almost every project
2. Almost every project
3. Always
4. Always

Q11

For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. Yes
2. Yes
3. Yes
4. Yes

Q12

Optional elaboration about your answers for this design principle

1. ...
2. Usually we choose 2 of these to focus on. And then we test if people really are engaged in those ways
3. Not all games should incentivise all these at the same time.
4. When we design a game, we think upfront which effects we want to reach with a game and design for that. In the end, all mentioned effects will be included in a game, but 1 or 2 are more prominent than others. Also in general we see that we design more sensory games for people in the late stage of dementia and more cognitive games for the early (mid) stages.

D.3.5 Design Principle 5

When designing games for people with dementia, determine an appropriate number of steps and aim to keep people in the "flow-zone."

Example: When designing a game with some level of challenge, it is important to keep it easy enough so the game is not overwhelming but challenging enough that it does not become boring. Designing a game with adjustable difficulty levels, ensuring a balance between challenge and skill level to maintain a state of flow for the player.

Q13

To what extent do you keep this in mind when working on your projects?

1. Almost every project
2. Sometimes
3. Always
4. Always

Q14

For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. Yes
2. Yes
3. Yes
4. Yes

Q15

Optional elaboration about your answers for this design principle

1. ...
2. I don't specifically think about the flow zone, but we try to keep them engaged. Tweaking the difficulty during the game is something we sometimes do, but in most games this is not really relevant. Of course we test the timings of everything to make sure people can follow along and the game does something encouraging when nothing happens for a while
3. We use a few different ways to achieve this. Some games have a game menu where the host /players can select a certain level of challenge. Other games do this dynamically where the game gets harder the better you do but also turns down the difficulty if we notice players start making more mistakes.
4. We match the games with a certain level / stage of dementia. Often it is the case that the players at the table are in different stages of dementia, therefore we make sure that the games are 'layered'. For example with a puzzle, some can make the puzzle, others can guess what image is appearing and others can talk about this picture. In general, we know it is important to not offer a too difficult game to someone in later stage of dementia (can make insecure) and an too easy game to people in early stages (can give them the feeling they are not taking seriously, they constantly ask 'what is the goal')

D.3.6 Design Principle 6

Games for people with dementia should promote naturalistic interactions and a user-friendly interface.

Example: Implementing intuitive touch-based controls and realistic gestures to facilitate easy and intuitive interaction within the game environment. This would be a lot better than for instance expecting the user to play the game through complicated commands that have to be typed out using a keyboard.

Q16

To what extent do you keep this in mind when working on your projects?

1. Always
2. Always
3. Always
4. Always

Q17

For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. Yes
2. Yes
3. Yes
4. Yes

Q18

Optional elaboration about your answers for this design principle

1. ...
2. I don't know about naturalistic, but it needs to be intuitive otherwise won't do anything. And we try to avoid user interface altogether. Also: it's better to have consistency in the type of interaction than realism, because seniors will repeat the same movements
3. This is one of the most important things to test with the players but can also be the hardest to get right, depending on the game/theme.
4. I think this is really important. When the interaction is natural and reacts in a way you expect, this will give people with dementia a feeling of confidence, 'hé I can do this!'. People with dementia are already confronted with many things that are going wrong and when the interaction is not logical/natural, they will blame themselves. Also this is an older generation that did not grew up with technology, most of them have not used keyboards and controllers and I will feel far from natural for them. Maybe in the future, when we are older, this is more natural.

D.3.7 Design Principle 7

Games for people with dementia should take advantage of the multimodal aspect.

Example: Incorporating visual, auditory, and haptic cues to provide multiple sensory channels for information processing and engagement. For instance, games using sounds and music are usually better than games without.

Q19

To what extent do you keep this in mind when working on your projects?

1. Always
2. Never
3. Almost every project
4. Always

Q20

For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. ...
2. ...
3. Yes
4. Yes

Q21

Optional elaboration about your answers for this design principle

1. But haptic is rather unexplored
2. I think all our games are by nature multisensory, so that is not something we need to test. We do take into account that some seniors are hard of hearing or have bad eyesight
3. We take these all into account but we can not always implement all areas as successfully
4. From the thesis from Hester le Riche, we know multi sensory experiences are important. With the Tovertafel we can create rich audiovisual experiences. Tactile is a bit harder, but for many games our users can use attributes to add an extra dimension (for example the Pixie game Puppy can be projected on a cushion to make it feel soft). We always take into account that it is not too stimulating, so we balance the sensory stimulation. For people with dementia it is important to offer the right amount of stimulation, we always test this in our co-design process.

D.3.8 Design principle 8

When designing games for people with dementia, take into account the social and cultural background of the user, especially when implementing a reminiscence play experience.

Example: When designing a game that is meant to spark feelings of nostalgia in the user, it is important to keep in mind what kind of memories actually cause that feeling in a person. For instance, it could be dependent on their cultural background.

Q22

To what extent do you keep this in mind when working on your projects?

1. Almost every project
2. Almost every project
3. Sometimes
4. Always

Q23

For your projects, is there any evaluation process applied to check if, or how well, your project adheres to this design recommendation?

1. Yes
2. Yes
3. Yes
4. Yes

Q24

Optional elaboration about your answers for this design principle

1. ...
2. We always test our themes and if seniors like them. Every person is different, so we try to have a range of themes in our games (or custom content) to make sure different groups have something that speaks to them
3. We are very aware of this but tend to only test in our own country as we are limited by the number of physical co-design locations we have. We do gather feedback from international partners after releasing the game though and might make changes to the games in the future based on that feedback. But we won't make a 'hutspot' game for example that will only be recognizable in The Netherlands
4. We always take this into consideration, but we cannot always tailor the games. We are active in 15 countries, and we always make sure that the elements in the game / images / music etc. are recognizable for people in all these countries. We check this with partners / care homes in these

countries. In order to tailor to specific cultural backgrounds (e.g. the Turkish, Surinam etc. communities in the Netherlands), we introduced Tover Lab. This allows caregivers to tailor games towards the cultural background of the people with dementia.

D.3.9 Final question

Q25

Are there any design principles for serious games for people with dementia that you are familiar with and would like to add to the recommendations? Don't worry if it's already (partly) listed before, any idea is valid.

Please list multiple recommendations here if you have them.

1. ...
2. - don't make object disappear or fly off screen (it is confusing for them)

- make sure seniors feel like they are doing well, whatever they do (if it doesn't respond as expected they are prone to feel like a failure and stop interacting)
- make sure there aren't too many distractions or different inputs. We often leave out the background to make it more clear and relaxing for people with late stage dementia
- they often have visual impairments, so make things big and with contrast, and keep in mind that certain color ranges will become less visible to them
- seniors tend to be more passive, so the game needs to actively encourage the player to do something

1. Test often with a wide range of players. Especially in the case of dementia as the mood and activity level of the players can vary so much from day to day.
2. - People with dementia remember events, music etc. the best from their youth (reminiscence bump), so include elements/images that match with this - "For the vast majority of individuals this reminiscence bump focuses on the memories of the teenage years and early 20's, largely due to the emotional intensity of this age group due to the number of choices and changes that occur then."

- Design for a positive experience - We always try to create a positive experience with the Tovertafel, we focus on what people still CAN do and not what they CANNOT do anymore. In level 2 and 3 it is not possible to make mistakes, from level 4 on this is

possible, but we gently show that an answer is wrong and encourage them to try again.

- People with dementia have a short concentration span, therefore it is necessary to keep them engaged and redirect their attention to the game when they are not focused anymore. We do this with active cues, for example with the leaves game, when players do not interact for some time, a 'wind' blows and the leaves automatically move.

- When designing for seniors (with dementia), take into account that their eye sight is diminished. So make sure that you use high contrast images and that the interactive elements can be easily distinguished from the background. We always look through our eyelashes to check if the important elements are well visible.

- Provide sufficient response time - you are dealing with older people (with dementia) so before they 1) have seen the element that they need to interact with and 2) moved their arm towards it, that will take quite some time.

- In general: involve people with dementia in your design process. Really co-design games with them to make sure the game truly matches the needs, wishes and abilities of the user.

E Transcripts heuristic evaluations with professional care-providers

In this section the transcripts from heuristic evaluations performed together with professional care-providers for people with dementia are listed. As the heuristic evaluations were performed in Dutch, this is also how they are provided here, as this is the "raw data" for this research. The last part listed is not a transcript, this is because the participant did not provide consent for an audio recording and the results were thus written down in summarised form on a piece of paper and digitally inserted here. During some evaluations, the professional care-providers were interested in letting residents from the nursing home try out the game. This was not a problem for the researchers, the care-providers at that point has a good idea of what the game consists of and could make the decision to let residents try it out. However, this is handled completely separate from the study, no data is gathered while residents would play the game. In two cases the residents played the game before the heuristic evaluation with only the professional care-providers was performed, this resulted in the experts sometimes referring to events they saw occur while the residents played the game. These situations have all been omitted from the transcripts due to privacy reasons because the residents are not part of the research study.

E.1 First Transcript

Onderzoeker: Als eerste vraag volgens jullie: welke stadia van dementie is dit spel het meest geschikt is?

1: Ik denk dat het dus heel erg afhangt van de interesse van de persoon, iedereen die muzikaal is kan dit, afhankelijk van de spanningsboog, ook hoe lang ze het volhouden.

2: Ik heb het idee dat het in alle stadia wel kan.

1: Ja.

3: Ik ook.

2: Als ze maar net de touch vinden om het te gaan doen, met hulp van iemand ernaast. Ik denk dat als ze het goed kunnen horen dat ze het allemaal kunnen.

1: En je van ritme en muziek houdt.

Onderzoeker: Denken jullie dat het spel goed rekening houdt met de cognitieve achteruitgang van de spelers? Of dat er dingen zijn waarvan je denkt: oh dat had beter gekund?

1: Je zegt het is een prototype: Ik zou dan per bewoner willen instellen hoe gevoelig die sensor is.

Onderzoeker: Dat je het per speler zou kunnen aanpassen, hoe makkelijk ze het kunnen?

2: Ja, en als iemand het al helemaal zelf kan dan is dat heel mooi meegenomen en als iemand een klein beetje een soort volume knop kan gebruiken om hem hoger of zachter te zetten.

1: Ja en nu zie je natuurlijk die handen bewegen, dat is opzich wel duidelijk, dan laat je visueel zien van "je moet nu spelen". Misschien zou je dat ook nog met een tekst kunnen ondersteunen. Iets als: "Beweeg uw handen".

2: Ja of iets laten spreken, laten uitspreken.

3: Maar dan hebben de mensen die slecht horen, dan vind ik wat [1] zegt, met het eronder onderzetten beter is.

1: Het kan ook alle drie hé.

3: Maar in ieder geval eronder zetten.

2: Dat is natuurlijk wel zo met dementie, met de ene kan je gewoon praten, of het gewoon voordoen. Het is zo verschillend wanneer ze in actie komen.

Onderzoeker: Denken jullie dat het spel lichamelijke beweging aanmoedigt?

2: Ja, niet extreem maar het gebeurd wel.

Onderzoeker: Denken jullie dat het ook cognitieve stimulatie biedt? Dat je goed moet nadenken over wat je doet als je het aan het spelen bent?

2: Ja, ik denk dat alles goed is wat van buitenaf komt, wat de hersenen activeren. Als zij niks doen dan gebeurd er niks.

Onderzoeker: Denken jullie dat het spel ook sociale interactie bevorderd tijdens of na het spelen.

3: Ik denk het wel, ik denkt ze elkaar stimuleren. Als je het ook hebt over meerdere stokjes dan gaan ze het meer met elkaar spelen. Ik denk het wel. [Weggelaten wegens privacy]

1: [Weggelaten wegens privacy]

Onderzoeker: Ervaren jullie het spel als ontspannend?

1, & 3: Ja.

2: Ja, absoluut.

1: Misschien is het ook leuk, bijvoorbeeld als iemand luistert naar Vivaldi dat je dan die aan kan klikken, zou dat kunnen?

Onderzoeker: Ja, dat je de muziek aanpast per persoon, dat is een goed idee.

1: [Weggelaten wegens privacy]

Onderzoeker: Dat gaat gelijk naar de volgende vraag: bevat het spel die herinneringen oproepen of een gevoel van nostalgie kunnen geven.

2: Ja, ik denk het wel. [Weggelaten wegens privacy]

Onderzoeker: Geeft het spel genoeg zintuigelijke stimulatie, van wat je hoort, wat je ziet, misschien wat je voelt met het stokje?

3: Ja, ik denk het wel.

1: Ja, ik ook

3: Je ziet het, je hoort het.

Onderzoeker: Daarover specifiek, hebben jullie het gevoel dat wat je nu ziet kwa instrumenten, is dat goed zichtbaar voor de doelgroep?

2: Ja op deze manier wel, maar als het plat ligt met de Tovertafel dan niet echt.

Onderzoeker: Het is ook bedoeld voor de Tovertafel Pixie, die kan ook op muren projecteren.

2: Oh, dan kan het wel.

1: Je moet het wel goed donker maken.

Onderzoeker: Hebben jullie het gevoel dat er een manier is om fouten te maken in het spel of een gevoel te krijgen dat je iets verkeerd speelt.

2: Nee, ik kan heel slecht maat houden, maar hier had ik helemaal niet het gevoel dat er iets fout ging.

1: Maar hij blijft gewoon muziek afspelen toch? Behalve als je stopt met bewegen. Gaat hij wel degelijk wat anders doen als jij iets anders doet met je hand.

Onderzoeker: In lichte vorm, hij doet een beetje soms dat die dan een klein beetje ervan afwijkt, maar dat kan ook weer aangepast worden. Eerst had ik aangezet dat je meer invloed hebt op het ritme maar dat is wel heel lastig merkte ik meteen al, dus nu heb ik het een stuk makkelijker gemaakt, je hebt wel wat invloed op het ritme maar niet veel, het voornamelijk start en stop.

1: Wellicht zou daar niveaus in kunnen maken, als je iemand met ritmegevoel hebt dat je hem dan moeilijker zet.

Onderzoeker: Ja, dat zou ook kunnen. Hoe denken jullie dat het spel eerst de aandacht trekt van de speler, en een beetje uitnodigt om te gaan spelen.

1: De gordijnen die opengingen, dat je dan het orkest ziet.

2: Misschien als je de muziek al eerder zou horen zou dat beter zijn.

3: Ja, dat het eerst start met muziek, dan kan je het een beetje benoemen, oke, je kan het zo gaan dirigeren, de muziek.

Onderzoeker: Dat je eigenlijk soortvan de muziek ziet inspelen, dat de instrumenten beginnen met opwarmen als het spel begint?

1: Ja een soort introfilmpje, dat je iets met een tekst in beeld zegt wat je moet, misschien met die handen te laten zien.

Onderzoeker: Hoe denk je dat het spel ook de aandacht weer terug kan pakken als de speler even de aandacht kwijt is?

2: Wel lastig hoor, met onze doelgroep.

3: Ja, het moet altijd onder begeleiding.

2: Het initiatief nemen zou toc h iemand van ons moeten sturen.

1: We hadden het er net over dat als je hoort en ziet "Beweeg uw hand"

3: Oh, dat je het constant herhaalt als iemand stopt? Dat zou kunnen.

Onderzoeker: Hoe lang denken jullie dat het spel een speler betrokken houd, aan het spelen houd.

2: Nou, 5 minuten. Per persoon bedoel ik.

1: Ik denk niet langer dan één nummer.

2: Ze zouden het leuker vinden als er verschillende soorten muziek bij zou zitten.

1: Je zou het eerder in een groep doen dan alleen.

Onderzoeker: Hoe intuïtief, hoe fijn vonden jullie het gebruik van het stokje? Voelde dat logisch, was dat fijn?

2: Ik vond het wel logisch, voelde fijn.

1: Ja.

2: Een tweede stokje zou ook kunnen.

Onderzoeker: Dat zou ook kunnen.

3: Met meer stokjes hou je wel de betrokkenheid van de hele groep. Dan hou je wel iedereen erbij.

1: En hoe kwetsbaar het het ding? [Weggelaten wegens privacy]

Onderzoeker: Het werkte nog, dus dat is goed. Nu ziet er piepschuim en duct tape omheen, ziet er niet heel mooi uit maar het is stevig.

3: En de sensor zit in het handvat?

1: Ja, dat klopt. Jullie hadden geen uitdaging of frustratie bij het gebruik van het stokje.

2: Ik vond het wel moeilijk om bij de bas gistaren te komen, ik had het gevoel dat die ook mee moeten doen.

Onderzoeker: Ja, dat ligt wel echt aan de muziek, ik had nog gekeken of het mogelijk is om te zorgen dat je met aanwijzen ook kan beïnvloeden welke instrumenten gaan spelen maar dat werd te ingewikkeld en kan het spel nu niet.

2: Ah oke. Dat dacht ik in het begin wel maar nu snap ik het wel.

Onderzoeker: Het had wel gekund maar dan werd het wel ingewikkeld, misschien is het nog iets om naar te kijken. Hadden jullie het wel leuker gevonden als dat wel kon?

2: Ik denk dat nu veel instrumenten spelen, en je bepaald het ritme, maar als er maar twee of drie groepen spelen. Ik zou het leuker vinden om een groep aan te klikken, bijvoorbeeld ik wil nu de violen hebben.

3: Ja, dat denk ik ook.

2: Nu zie je verschillende groepen door elkaar heen, nu bepaal je alleen ritme.

1: Maar je bedoelt echt het aanwijzen, wordt het dan niet lastig als mensen rondzwaaien en per ongeluk een groep aanwijzen.

2: Ja, misschien is het ook te lastig voor hun hoor. Ik denk zelf dat ik het leuk zou vinden maar voor de mensen zelf is het wel lastig.

1: Misschien is de optie wel leuk, dat het ook op spraak reageert "En nu de violen!"

2: Ja dat wordt wel lastig, misschien gewoon niet doen.

Onderzoeker: Laatste vraag: Op welke manieren zou het spel elementen nemen uit de culturele achtergrond en ervaringen van de speler.

3: Culturele achtergrond? Dat merk je wel ja, [Weggelaten wegens privacy].

Onderzoeker: Oke, hebben jullie nog vragen?

1: Ik niet

2: Nee ik ook niet, het is een leuk spel, goed bezig.

Onderzoeker: Nou dankjewel voor het meedoen aan het onderzoek.

E.2 Second transcript

Onderzoeker: Kunnen jullie identificeren wat jij denkt voor welke stadia van dementia het spel het meest geschikt is.

1: Verschillend, je hebt mensen die aan het begin van het stadia zitten en het niet snappen, en je hebt mensen die aan het eind zitten die het wel snappen. Dus iedereen is verschillend, [Weggelaten wegens privacy]. Dat is verschillende, net zoals dat jij iets zou kunnen en ik niet, terwijl we allebei op hetzelfde niveau zitten, de ene kan het wel en de andere niet. Als we een activiteit hebben dan kan de ene wel de puzzel maken en de andere niet. Terwijl ze hier allemaal hier zitten, eigenlijk voor het laatste stuk van hun dementie.

Onderzoeker: Oké, want dit verzorgingshuis is alleen voor de laatste fases van dementie?

1: Dit zijn de mensen die niet meer zelfstandig thuis kunnen wonen, dus dit is echt het laatste stukje van. En bij de een duurt dat 5 jaar, of 8 jaar, en bij de ander duurt dat een half jaar. Maar wij kunnen never-nooit zeggen hoe lang zoiets duurt.

Onderzoeker: Sluit je zich daar ook bij aan?

2: Ja, zeker.

Onderzoeker: Oke, houdt het spel goed rekening met de cognitieve achteruitgang van de spelers?.

1: Dat vind ik een lastige. Want het is heel moeilijk, zeker als je alleen maar dit moet doen. [De deelnemer maakt een zwaaiende beweging]. En niet op de maat van de muziek, dus uithalen of weet ik veel wat, om er dan in te krijgen wat ze moeten doen. [Weggelaten wegens privacy]. En ik zag jou net ook achter mij staan, ik ging

op de maat van de muziek en jij deed iets anders. Als je wel meegaat op de maat van de muziek, dan is het wel makkelijker. [Weggelaten wegens privacy]. Je ziet wel dat het iets triggert, het triggert wel. Je ziet wel aan de hand dat er iets moet gebeuren, maar als de beweging te slap is dan krijg je geen geluid. [Weggelaten wegens privacy]

Onderzoeker: Denk je dat het spel beter zou werken als het makkelijker is, als die sneller reageert en dat het niet uitmaakt wat voor een beweging je maakt?

2: Ja, dat denk ik wel.

1: Ja, ik ook.

Onderzoeker: Dat is eigenlijk ook gelijk mijn volgende vraag: Hoe zou je het spel veranderen om beter aan te sluiten hierbij? Zijn er nog andere dingen dat je denkt: Dat kan beter?

1: Nouja, misschien dat je het zo kan maken dat je voor degene die de minder kracht hebben of minder die beweging kunnen maken, want we hebben natuurlijk ook mensen met beperkingen of met schouder arm, of whatever, dat ze niet die hele grote kunnen maken. Als je hem zo kan aanpassen dat hij ook op de kleine bewegingen reageert, en voor de gene die die grote bewegingen wel kunnen maken dat je daar bijvoorbeeld een ander standje voor hebt dat die wel uitgenodigd worden.

2: Ja.

Onderzoeker: Ja precies, dat je soort van verschillende niveaus doet en dat je daaraan kan aanpassen aan de persoon die het gebruikt.

1: Ja, [Weggelaten wegens privacy].

2: Er zijn genoeg die niet eens goed kunnen bewegen.

1: Ja, we hebben natuurlijk ook mensen voor wie het niet eens meer mogelijk is, he, om die bewegingen te maken. Dus als je dan alleen nog maar dit zou doen [Participant maakt kleine beweging], dat zou top zijn.

Onderzoeker: Maar vinden jullie dat het spel lichamelijke stimulatie aangemoedigd?

2: Ja, dat is te zien.

1: Ja alles gaat mee, benen, voeten, handen, armen.

Onderzoeker: Denk je ook dat het spel cognitieve stimulatie biedt.

1: Dat kan

2: Gespreksstof heb je dan ook

1: Het kan ook herinneringen oproepen. En kijk, jij zei frustraties over het stokje maar kijk, ik heb niemand hier gefrustreerd zien zijn. Het is alleen dat als je verwacht dat als je beweegt dat die het doet, en dat is het niet. En dan is het van, doen wij iets verkeerd of het is het daar iets? Maar ik heb verder geen frustratie ervaren.

2: Nee, helemaal niet.

1: Het is meer het verfijnen, maar daarom is het een experiment.

Onderzoeker: Ja, en bevorderd het spel ook sociale interactie, tijdens of na het spelen?

1: Ja,

2: Dat denk ik wel

1: [Weggelaten wegens privacy]

Onderzoeker: [Weggelaten wegens privacy]

2: [Weggelaten wegens privacy]

1: [Weggelaten wegens privacy] Ik ben van de activiteiten, en ik krijg vaak de vraag: Waarom doe je dit want ze weten het later toch niet meer? Maar gevoel is belangrijk, het gevoel is het eerste wat je ontwikkeld, en het laatste wat je uitschakelt. Als ze een vervelend gevoel zouden hebben, dan blijft dat gevoel ook heel lang hangen. Ik weet niet zozeer of je wilt dat ze er over na praten of dat dat gevoel blijft hangen. De volgende keer dat ze komen zullen ze het misschien wel herkennen. Dat is een andere manier van denken. Ze leven in het hier en nu, he.

Onderzoeker: Ja precies, dat gevoel is wel belangrijk.

1: Jij bent eigenlijk precies hetzelfde, als jij een vergadering binnenloopt weet je precies of het een fijne vergadering is of een vergadering met heel veel spanning. Dat voel je. En dat is met mensen met dementie, er valt een hele hoop weg en het gevoel is eigenlijk iets wat alles overneemt, dus het gevoel is veel meer ontwikkeld als van ons. Mijn moeder is tweeëneenhalf jaar geleden overleden, ik kom hier binnen, heb niks gezegd, loop de huiskamer binnen en het eerste wat een mevrouw doet is die omhelst mij en geeft een me een pakkert, en zegt "Heb je nodig." Daarvoor hoefde ik niks te zeggen, ze voelde dat gewoon.

Onderzoeker: Dat is wel indrukwekkend.

1: We hebben een mevrouw die komt knutselen, die komt naar me toe en zegt "Ik vind het zo leuk daar, fijn." Maar die weet na 5 minuten niet meer dat ze bij mij geweest is. Het gevoel neemt ze wel mee, en dat is wel heel belangrijk.

Onderzoeker: Oke, dan een volgende vraag: ervaar je het spel als ontspannend?

1: Ja, zeker, alles gaat in beweging, big smile.

2: Ja helemaal.

Onderzoeker: Bevat het spel elementen die herinneringen kunnen oproepen of een gevoel van nostalgie kunnen oproepen.

2: Ja, zeker, [Weggelaten wegens privacy]

1: Zeker als je de goede muziek erbij zet, en je kan het praatje er daarbij aangaan. Dan komt dat vanzelf wel terug.

Onderzoeker: Geeft het spel ook genoeg zintuiglijke stimulatie, dus wat je ziet, wat je hoort?

1: Voor de ene wel, voor de andere niet. De ene snapt nog wel wat ze zien de andere snapt niet meer wat ze zien. Net zoals als ik een bord eten neerzetten, de ene zou gewoon gaan eten en de andere zou zitten kijken van: "Wat moet ermee?" Die hebben niet meer het besef van dat ze moeten gaan eten, of hoe ze moeten gaan eten, dat kan ook. Dus voor de ene wel en de andere niet. Lastig he?

Onderzoeker: Ja, dat hoort er wel bij. Maar de muziek stimuleert wel?

1: Ja, ja, zonder muziek wordt het heel snel saai.

2: Ja, muziek moet er sowieso bij. Je bedoelt deze muziek, die jij gekozen hebt?

Onderzoeker: Ja, bijvoorbeeld.

2: Ja nee dat is prima.

1: Want zou je hem ook kunnen maken op persoonlijke muziek?

Onderzoeker: Ja, op zich wel. Wat voor een muziek dan bijvoorbeeld.

2: Dat zou al helemaal leuk zijn.

1: [Weggelaten wegens privacy].

2: [Weggelaten wegens privacy].

1: Dan heb je en en en, je hebt persoonsgericht, je hebt ze in beweging, je hebt herinnering, je hebt stimulants.

Onderzoeker: Ja dat kan zeker, er zouden ook gewoon andere muziek bij kunnen. Is er een manier om fouten te maken in het spel, of is er een mogelijkheid om het spel verkeerd te speler, heb je het gevoel?

1: Nouja, niet verkeerd, maar wel dat die niet reageert. Ik weet niet of dat ligt aan je laptop of aan dat spel, als je de beweging te klein maakt nu dan reageert die niet en dan heb je geen muziek. En je merkt toch dat op die muziek zitten te wachten om die beweging te maken, dat is voor natuurlijk wel, dat dirigeren hebben ze natuurlijk in gedachten met muziek. Kijk, wij kunnen natuurlijk wel gewoon droog staan, we weten dat het een experiment is. Maar voor is het gewoon muziek maken.

Onderzoeker: Hoe denken jullie dat het spel eerst de aandacht trekt van de speler?

2: Door de handen denk ik

1: Door de handen ja, en de muziek. Als je alleen de handen laat zien, dan zullen ze wel even kijken wat die handen aan het doen zijn, maar er komt verder geen geluid bij. Ze worden niet getriggerd dan. Dus ik denk en de handen en de muziek. En natuurlijk het stokje he, het laten zien van. Want ik weet niet of je zag wat ik deed, ik begon over en dan stokje geven. Dat is het vaak, zoals wij noemen, spiegelen. Zodat ze zien wat ze moeten doen. Bij ene wel en de andere niet, bij de ene kan ik zeggen "We gaan dit doen" en dan snappen ze het meteen. Bij de ander, dan kan ik het zes keer zeggen maar dan snappen ze het niet meer, wat ik aan het vertellen ben. Als ik jou zeg "Ga je drinken opdrinken" dan pak jij je beker en dan ga je drinken. Maar als je niet meer weet hoe je je beker moet pakken, of hoe je moet drinken, dan is het lastig. En dan is het zien daarvan, het spiegelen, dat helpt dan wel.

Onderzoeker: Ja duidelijk, kan het spel de aandacht weer vasthouden als de speler niet betrokken of afgeleid raakt? Dat het de aandacht weer terugpakt eigenlijk.

2: Als je muziek speelt, dan ga je vanzelf mee doen. [Weggelaten wegens privacy].

1: Ja, het blijft triggeren, en weet je dit is de meest eerlijke doelgroep, zeg ik altijd. Als ze het niet leuk vinden gaan ze weg. Daar ben ik heel eerlijk in. Dat kunnen wij ook weten. Ik kan hier een hele muziektent neerzetten, maar als ze het niet leuk vinden gaan ze weg, heel jammer voor mij.

2: Ja, [Weggelaten wegens privacy]

1: [Weggelaten wegens privacy]

Onderzoeker: Hoe lang denk je dat dit spel de spelers betrokken kan houden?

1: Ik denk sowieso zeker een half uurtje. Het is best intensief.

2: Ja.

1: Zeker een half uur, en als je echt intensief bezig bent is dat echt lang.

2: Ja kijken als je inderdaad verschillende liedjes hebt, verschillende muziekstukken dan blijven ze wel zitten, vinden ze mooi.

1: En ik denk als die dan sneller reageert en makkelijker reageert, dat je een sneller stuk en een langzamer stuk achter elkaar zet dat je dan nog wat langer is. Dan ga je voor optimale play. Als wij Andre Rieu opzetten zitten ze soms ook anderhalf uur.

Onderzoeker: Ja, ik had hier een liedje van 1 minuut maar ook sommige van drie minuten, wat denken jullie dat de beste lengte is per liedje? Want ik zag dat na een liedje ook een moment is om het stokje door te geven, dan is weer iemand anders aan de beurt. Vond je sommige liedjes te lang duren?

2: Nee

1: Nee, ik denk dat het een goede combi is. Dan kan je zelf inschatten wie het langer en korter kunnen handelen. Dan moet je wel de deelnemers kennen, die houdt het wel vol, die houdt het niet vol. Net zoals als ik een dansavond organiseer, dat ik weet wie er gelijk acht achter elkaar kan doen en wie er na een gelijk even moet zitten om even bij te tanken. Dat heb je hier eigenlijk precies hetzelfde.

Onderzoeker: Ja, hoe intuïtief vonden jullie de invoertechniek, dus eigenlijk het stokje gebruiken?

1: Nou dat vond ik eigenlijk best wel intensief, moet ik zeggen.

Onderzoeker: Oh sorry, intuïtief, hoe makkelijk het voelt om te gebruiken.

1: Oh nee dat was heel makkelijk, het is alleen dat je grotere bewegingen moet maken. Wij zijn natuurlijk allemaal gewend om kleine bewegingen te maken, maar dit is echt theater, en we zitten niet in theater. Stokje was verder prima.

2: Ja, dat zit ook ingebakken bij mensen. Wat mij ook wel leuk lijkt is als je gewoon los stokjes geeft aan de andere, dat ze met z'n tweeën dirigeren, die dan misschien niet op de muziek reageert maar dat weten ze toch niet. Dat ze dan nep stokjes zonder stokjes hebben maar dan kunnen ze wel allemaal spelen. Dan hoef je niet zo met de sensor te doen maar dan werkt het wel.

Onderzoeker: Dat is een leuk idee. Verder had ik een vraag over frustraties over het stokje maar dat hebben we eigenlijk al besproken.

1: Ja

Onderzoeker: Daarover specifiek, hebben jullie het gevoel dat wat je nu ziet in de projectie, is dat goed zichtbaar voor de doelgroep?

1: Ja, zeker, het zag er leuk uit. Vooral die vliegende noten zijn mooi.

2: Ik had niet heel lang gekeken, toen ik eerst keek dacht ik dat het een beetje druk was maar toen ik later keek vond ik het eigenlijk wel leuk hoe die instrument bewogen.

1: Ja, ik vond het eigenlijk wel een goede balans tussen te druk en dat het wel goed de aandacht pakt.

2: Ja, dat klopt wel.

Onderzoeker: Is de uitleg in het spel duidelijk of moet dat ook op andere manieren gedaan worden? Bijvoorbeeld visueel en met geluid?

1: Nou op zich waren die handen wel duidelijk, het triggerde wel om beweging te maken maar de beweging werkte gewoon niet helemaal goed.

2: Ja ik vond die handen verder wel goed.

Onderzoeker: Ik heb nog een vraag: Op welke manieren zou het spel elementen overnemen uit de culturele achtergrond en ervaringen van de speler?

2: Ja, muzieksoort.

1: Als er bijvoorbeeld een Marokkaans persoon meedoet, die heeft met deze muziek helemaal niks. Dus dan denk ik dan, als je echt naar de achtergrond gaat en persoonlijker maakt. Dan is die top.

Onderzoeker: Nou mooi, dat was hem, heel erg bedankt.

1: Ja, alsjeblieft, ik vond het leuk.

2: Ja ik ook.

E.3   Third transcript

Onderzoeker: Vanwege de tijd zal ik snel beginnen met de eerste vraag: welke stadia van dementie denken jullie dat dit spel het meest geschikt is?

1: Nou, ik denk dat het echt afhangt van de persoon. Iedereen die van muziek houdt en een zekere spanningsboog heeft, kan ermee aan de slag, ongeacht het stadium. Het hangt ook af van hoe lang ze het kunnen volhouden.

2: Ja, ik denk dat het eigenlijk in alle stadia wel kan werken, verwacht ik.

Onderzoeker: Denken jullie dat het spel goed rekening houdt met de cognitieve achteruitgang van de spelers, of zijn er dingen die beter kunnen?

1: Ik denk het wel maar ik zou graag zien dat je per bewoner kunt instellen hoe gevoelig de sensor is, zodat het voor elke speler op maat is.

Onderzoeker: Dus meer aanpassingen op individueel niveau?

1: Ja zorgen dat het duidelijker wordt hoe je op de goede maat komt.

Onderzoeker: Denken jullie dat het spel lichamelijke beweging aanmoedigt?

2: Zeker, het gebeurt automatisch.

Onderzoeker: En biedt het spel ook cognitieve stimulatie?

2: Ja, nou denk wel dat ze even moeten nadenken, dat is goed.

Onderzoeker: Bevordert het spel ook sociale interactie tijdens of na het spelen?

1: Ja, dat kan ik me wel voorstellen, dat we kunnen praten over het spel enzo.

2: Het stimuleert misschien ook samenwerking, dat ze elkaar helpen.

Onderzoeker: Oke, ervaren jullie het spel als ontspannend?

1: Ja, zeker.

2: Absoluut, het is echt ontspannend.

Onderzoeker: Vinden jullie dat het spel herinneringen oproept of een gevoel van nostalgie kan geven?

2: Zeker, het ligt er maar net aan of de speler al eerder wel eens zoiets gedaan heeft. Dan kan het nostalgisch zijn.

Onderzoeker: Geeft het spel voldoende zintuiglijke stimulatie, qua zien, horen, en misschien voelen met het stokje?

1: Ja, ik denk het wel, er gebeurt veel tijdens het spelen, je ziet de muzieknoten vliegen en de instrumenten spelen, dat is erg leuk.

2: Precies, het is een complete ervaring. Het is ook leuk dat het gebruikt kan worden bij de mensen op de kamers zelf.

Onderzoeker: Denken jullie dat er manieren zijn om fouten te maken in het spel of het gevoel te hebben dat je iets verkeerd speelt?

2: Nee, eigenlijk niet. Het blijft gewoon muziek afspelen, tenzij je stopt met bewegen.

1: Maar het zou leuk zijn als er wat variatie is, misschien niveaus afhankelijk van het ritmegevoel van de speler.

Onderzoeker: Dat zou inderdaad een goede toevoeging kunnen zijn. Hoe denken jullie dat het spel de aandacht van de speler trekt en uitnodigt om te spelen?

1: Door de gordijnen die opengaan en de handen die laten zien dat je moet spelen. Ook dat je de instrument zo ziet staan helpt wel.

2: Misschien kan daar nog wel iets bij want ik had niet meteen door wat je moest doen.

3: Ja, misschien dat ze alvast starten met de muziek, dat kan goed werken.

Onderzoeker: Hoe denken jullie dat het spel de aandacht weer kan vasthouden als de speler even afgeleid is?

2: Nou die bewegende handen op het scherm zijn al duidelijk, denk ik.

Onderzoeker: Hoelang denken jullie dat het spel een speler betrokken kan houden?

2: Misschien zo'n 5 minuten per persoon. Of iets langer als ze het samen spelen.

1: Ja, waarschijnlijk leuker om in een groep te doen dan alleen.

Onderzoeker: Hoe intuïtief en fijn vonden jullie het gebruik van het stokje?

2: Heel logisch en fijn.

1: Ja, ik vond het ook makkelijk.

Onderzoeker: Matcht het gebruik van het stokje goed met wat je in het spel moet doen?

1: Ja dat matcht helemaal, denk ik.

2: Bedoel je of dat logisch overkomt? Ja dat denk ik wel.

Onderzoeker: Ja, waren er nog frustraties met het stokje?

2: Nou het voelde wel een beetje alsof hij soms traag reageerde. Ik weet niet of ik het dan verkeerd deed maar het voelde wel alsof hij sneller zou kunnen reageren als ik beging te bewegen.

Onderzoeker: Ja dat ging soms niet helemaal lekker, het was de bedoeling dat die sneller zou reageren. Wat vinden jullie van de zichtbaarheid van het spel op het scherm?

2: Ik denk dat dat wel duidelijk is, het is erg licht dus vast herkenbaar.

1: Ja, dat komt wel goed, denk ik, als je maar een goed scherm ofzoiets hebt om ermee te gebruiken.

Onderzoeker: Is de uitleg in het spel duidelijk of moet dat ook op andere manieren gedaan worden? Bijvoorbeeld visueel en met geluid?

2: Ja misschien ook met tekst op scherm ofzoiets.

1: Nouja, dat is misschien wel lastig lezen, misschien dat er een stemmetje komt ofzo? Eigenlijk moet het wel onder begeleiding, denk ik.

2: Ja, dat is wel zo.

Onderzoeker: Nou top, nog een laatste vraag: Op welke manieren zou het spel elementen overnemen uit de culturele achtergrond en ervaringen van de speler?

1: Nou als ze zelf ervaring hebben met het onderwerp, dirigeren, is dat zeker deel van hun achtergrond en daar houd het spel dan rekening mee denk ik.

2: Ja, maar als dat niet zo is dan werkt dat misschien minder goed, dan houdt het niet zo rekening.

Onderzoeker: Oke, duidelijk, dat was het, heel erg bedankt.

E.4   Fourth evaluation notes

Onderzoeker: Voor welke stadia van dementie denk je dat het spel het meest geschikt is?

1: Alle niveau's, wel belangrijk dat het duidelijk is en wat het doel is

Onderzoeker: Houd het spel goed rekening met de cognitieve achteruitgang van de spelers met dementie?

1: Ja, ze begrijpen wat ze ermee moeten.

Onderzoeker: Zo niet, hoe zou het spel veranderd kunnen worden om beter aan te sluiten bij deze groep?

1: Introductie nodig.

Onderzoeker: Moedigt het spel lichamelijke beweging aan tijdens het spelen?

1: Ja, als ze spelen.

Onderzoeker: Zijn er uitdagingen of activiteiten in het spel die cognitieve stimulatie bieden?

1: Ja, maar soms snappen ze het niet.

Onderzoeker: Bevordert het spel sociale interactie tijdens het spelen?

1: Ze bemoeien met elkaar.

Onderzoeker: Ervaar je het spel als ontspannend?

1: Als ze het snappen wel, geluid was soms niet fijn.

Onderzoeker: Bevat het spel elementen die herinneringen oproepen of een gevoel van nostalgie kunnen geven?

1: Zou kunnen.

Onderzoeker: Geeft het spel zintuiglijke stimulatie?

1: Niet genoeg variatie op beeld.

Onderzoeker: Is er een manier om fouten te maken in het spel of is het mogelijk om het spel verkeerd te spelen?

1: Nee.

Onderzoeker: Hoe trekt het spel eerst de aandacht van de speler?

1: Nieuwsgierigheid.

Onderzoeker: Kan het spel de aandacht weer vasthouden als de speler niet betrokken of afgeleid raakt?

1: Nee, meer variatie is nodig.

Onderzoeker: Hoelang denk je dat het spel de spelers betrokken kan houden?

1: 10 minuten, nog te saai, niet genoeg uitdaging, niet duidelijk.

Onderzoeker: Hoe intuïtief vond je de invoertechniek van het spel?

1: Stokje was duidelijk.

Onderzoeker: Stemt de invoermethode overeen met de handelingen die in het spel vereist zijn?

1: Ja, misschien niet genoeg - zwakke beweging.

Onderzoeker: Waren er uitdagingen of frustraties gerelateerd aan de invoertechniek die je tegenkwam?

1: Nee.

Onderzoeker: Zijn de visuele elementen op het scherm goed zichtbaar voor de doelgroep?

1: Nee het scherm was te klein.

Onderzoeker: Hoe zit het met de instructies voor de speler, zijn die duidelijk of moeten die ook met andere vormen, met geluid en visueel bijvoorbeeld?

1: Nee, het moet duidelijker.

Onderzoeker: Op welke manieren zou het spel elementen overnemen uit de culturele achtergrond of ervaringen van de speler?

1: Iets fellere kleuren.

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