Jeka-Joka Dance Chair

Project 2 Design

DPB200

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Abstract

This report showcases the design process for creating the Jeka-Joka Dance chair, a deliverable for the course "Project 2". The following design challenge was used; How can we use dancing as a tool to improve the quality of life for people with dementia? A co-design approach was followed, along with a reflective transformative design process. Methods used include semi-structured interviews, peer feedback and user tests.

This report aims to inform readers about the design process by explaining step by step why and how the final product is created. The report describes the context, project goal, design process, method, and findings. Evidence from interviews, scientific sources and user testing will be used to explain the design decisions. According to the user tests, the chair is comfortable to sit in and fun and safe to use. It motivates people to move and therefore increases physical activity. Furthermore, the physical contact between the person with dementia and their caregiver positively impacts their interaction with each other.

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Introduction

In contemporary society, the population is aging at an unprecedented rate, resulting in a corresponding increase in the number of individuals living with dementia [1]. The majority of these individuals reside in care facilities, where their opportunities for social interactions have been significantly reduced [2]. Caregivers often employ various activities, such as group gatherings and physical exercises, to provide entertainment for people with dementia. One activity that has been found to positively impact the mood of individuals with dementia is listening to music [3]. Not only does it elevate their energy and happiness, but it also evokes fond memories of the past [4]. This, in turn, brings family, friends and loved ones together through shared enjoyment and participation in the activity, such as dancing.

Though, dementia has been shown to cause a decline in muscle strength, balance, and coordination [5], rendering it challenging for those affected to keep up with the movements of a dance routine. Furthermore, dementia can also impact an individual's cognitive ability to process and comprehend information [5], making it challenging to adhere to instructions or retain the steps of a dance routine.

In an effort to enhance the musical experience of individuals with dementia, particularly those with physical disabilities, we developed the "Dancing Chair." People with dementia who do not have the physical ability to dance are enabled to participate in music and dancing with others through our device, promoting social engagement and emotional well-being.

Project Goal

Our main goal for this project is to give people with dementia the feeling and benefits of dancing, while strengthening the connection between them, their loved ones and caregivers. We envision that people with dementia will feel relaxed and safe while sitting in the chair and also reconnect with the people they care about. The users can choose their own music, which will hopefully make the experience even more enjoyable and personal for them. To achieve this, we also set a few sub-goals. The chair must be safe to use and should not cause danger to the users in any way. Besides this, the chair must be comfortable to help people feel relaxed. Furthermore, there should be physical contact between the person sitting in the chair and the person guiding the chair, to enhance their connection.

We followed a co-design approach during the project, so the main expertise area that will be focused on is "User & Society". This also suits the personal development goals of our group since we all want to learn how to involve potential users in the design process. Besides this area, we also want to incorporate "Technology & Realization" in order to create a working prototype, and we want to focus on "Creativity & Aesthetics" to make a visually appealing chair.

Related Work

A benchmark analysis resulted in a few existing concepts related to the dancing chair. Several places have projects and initiatives consisting of dance classes for people with dementia. A few examples are listed below.

"Remember to Dance" is a project from Green Candle, together with East London NHS Foundation Trust and the Alzheimer's Society. The project consists of dance sessions that are being organized weekly for people in the early stages of dementia and their caregivers. The classes are free and open to everyone, even those who must remain seated because of physical disabilities. The main findings of this project include a positive effect for people in different stages of dementia on the quality of life, motivation, confidence, relationships, social competence, functioning, creative and emotional expression, and overall well-being [9].

"We dance again" is a German initiative aiming to improve the lives of people with dementia through dancing. Dance classes are organized monthly at several dance schools spread across the country. The classes are also open to people with walking aids, frames, and wheelchairs. The classes resulted in people having fun together while simultaneously improving their mental and physical conditions [10].

"Sit and Dance" is an Aspen Senior Day Center initiative. It consists of daily dance sessions for people with dementia where everyone sits in a chair. Because everyone is seated, the classes are also open to people with physical disabilities. People with dementia benefit from these dance classes because they enjoy them, and it helps them to meet the daily exercise needs of older adults. Physical exercise helps to increase autonomy, self-esteem, and mental abilities [11].

The care facility "Huize Kohlmann", located in Arnhem, organized weekly dance sessions for people with dementia. Everyone can participate in their own way and at their own level of intensity. These classes were found to stimulate people's senses and enhance contact between the residents. Participants could really be themselves during the dance classes and appeared calmer and more relaxed afterwards [12].

Besides these dance classes, the music chair has been designed for people with dementia (See Figure 1). It has built-in speakers and two wheels under the back of the chair. The goal of this chair is to help people relax and bring back memories [13].

Figure 1 *The music chair [13]*

Process

During this project, we followed the Reflective Transformative Design Process model (See Appendix A). In this model, each step is iterative and cyclical. This means that the design process is not linear. Each step informs the next, and looping back to previous steps are critical for the process. The process is designed to be adaptive and responsive to changing conditions, and it is thought to be an effective method for creating designs that are both innovative and socially responsible. Moreover, this approach emphasizes the importance of reflection throughout the design process and encourages critical thinking on the social implications of a design [6].

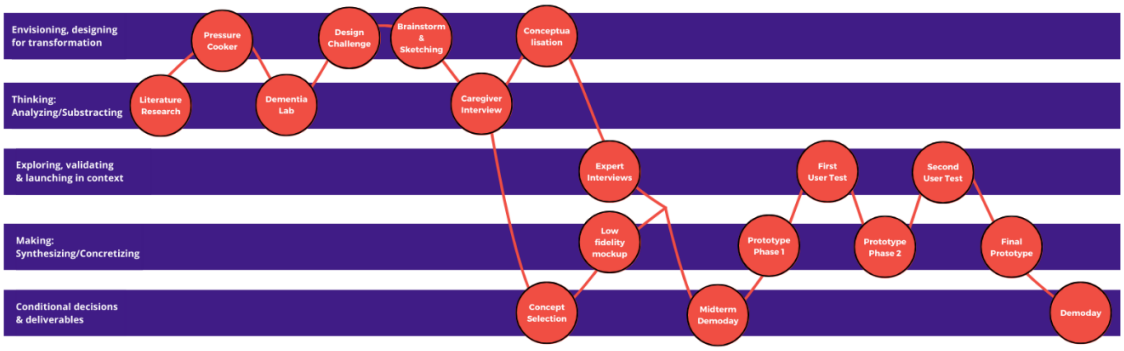

Figure 2 *Design Process Summary (See Appendix E for scaled image)*

Research

In order to gain insight into the effect of music and dancing on people with dementia, we started the project by doing literature research. We found that dancing can benefit people with dementia on cognitive, physical, emotional, and social levels [14]. Social dance sessions seem to have meaning to both the people with dementia and their caregivers. It can enhance communication, behaviour, and positive feelings [15]. Music can improve people's mood, behaviour, and cognitive function. The music does not need to be familiar to have these effects.

Furthermore, people do not need to have any knowledge or be musically inclined, in order to enjoy music and respond to it [16]. Activities with music, song and dance utilise and develop the healthy aspects of people with dementia [17]. Our findings helped us identifying user needs and goals, understanding user behaviors and preferences, identifying design best practices, and address potential design challenges.

Dementia Lab Conference

On September 20 we travelled to Leuven to attend the Dementia Lab Conference. There, we joined a workshop held by a designer and a music therapist with experience in the field of Dementia. We were introduced to a new design process method where we ideated without having done a lot research on the topic of the design case. We were presented with a set of daily life problems for people with dementia (inspired by real cases witnessed by the experts holding the workshop). To solve these problems, we had to create a superhero where his superpower could solve the daily problem presented (See Figure 3). Afterwards, we had to transform our hero into a product/service. At the end, we created a dirty prototype of our concept. This was very insightful as we learnt some of the problems our user group faced and a new design method. This design method was fun, fast and efficient.

Also, we got to expand our network with people in the field of dementia that could be of help in the future of this project.

Unfortunately, none of the concept ideas we came up with fitted the design case of this project, but we gained a lot of knowledge and a bit of experience on designing for people with dementia .

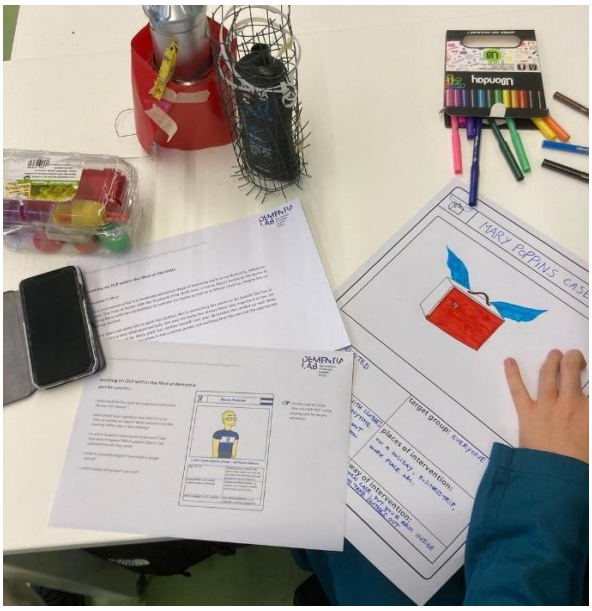

Figure 3 *Dementia Lab Conference Ideation Process*

Ideation

Using the information we gained at the Dementia Lab conference, we came up with three ideas. Each concept was thoroughly evaluated for its potential. Subsequently, a meeting was convened to discuss the ideas and to make a final selection.

The first idea proposed was the implementation of a dance floor with visual projections (See Figure 4). The concept involved the use of a projector to display interactive dancing games on the floor, such as coloured blocks or a moving line to be avoided. However, it was ultimately discarded due to concerns that the target population may not possess the ability to move quickly.

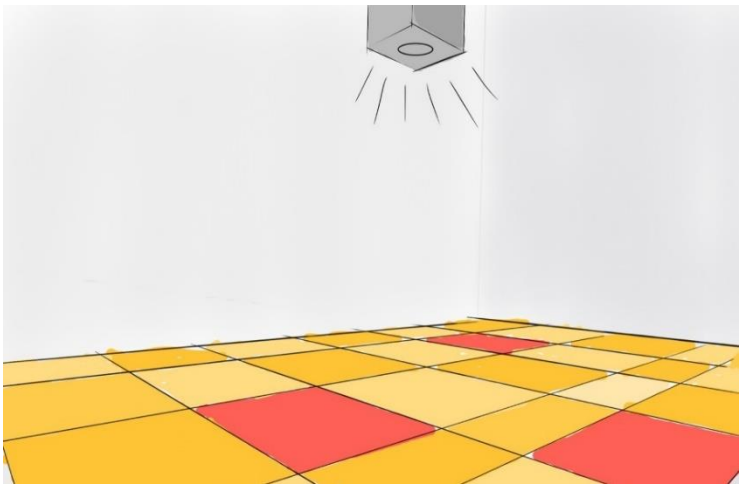

Figure 4 *Dance floor with visual projetions sketch*

The second idea was a collaborative music panel (See Figure 5), where multiple individuals would have access to panels containing loops of specific instruments. Each panel would have four buttons, with each button activating a different loop, allowing individuals with dementia to make music with family and friends. While this idea had the potential to promote social interaction, it didn't align with the project's focus on "Dementia and Dance". It didn't promote dancing directly. So, in the end. We scrapped the idea.

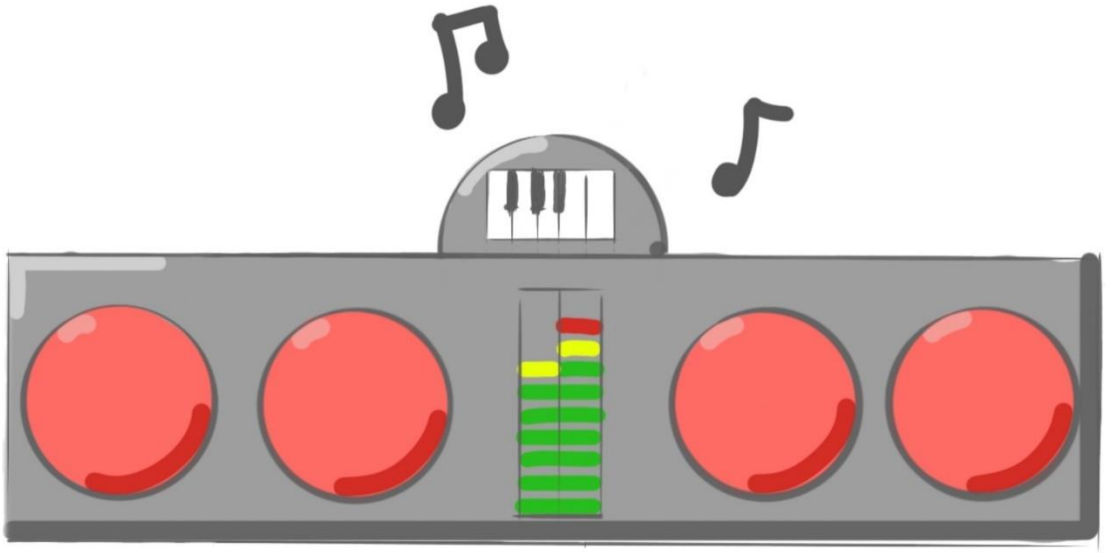

Figure 5 *Collaborative music panel sketch*

The final and chosen idea was the "dancing chair," which underwent significant modifications from its original form. Initially, the concept included a chair with motors, allowing it to move autonomously and providing individuals who are no longer able to dance with the sensation of movement to music. However, after consulting with a caregiver and a design expert in the field of dementia, it was determined that this aspect of the idea would likely result in feelings of disorientation and panic among individuals with dementia.

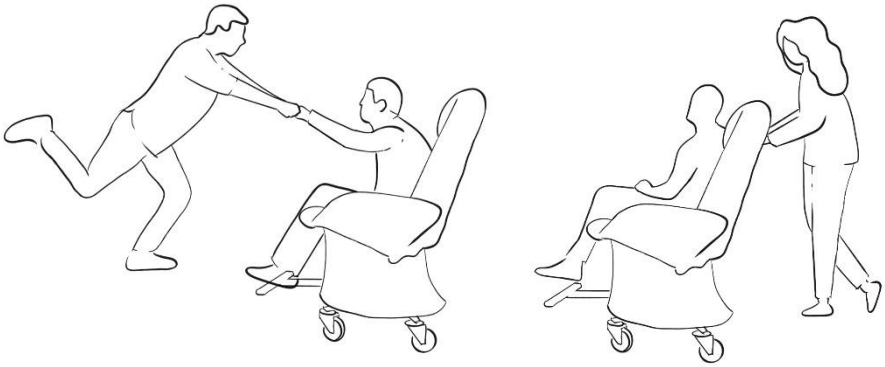

Figure 6 *Sketches of moving the chair from the front/back*

As a result, the concept was altered to involve a chair that is moved by holding the hands of the person sitting in the chair or by holding the headrest, providing a clear point of reference for the person with dementia and promoting social interaction through dancing together.

First Iteration

The design knows different stages, and because of the iterative design approach, it also knows multiple iterations. When the idea of the project was chosen, the sketches of the first iteration were created (See Figure 7).

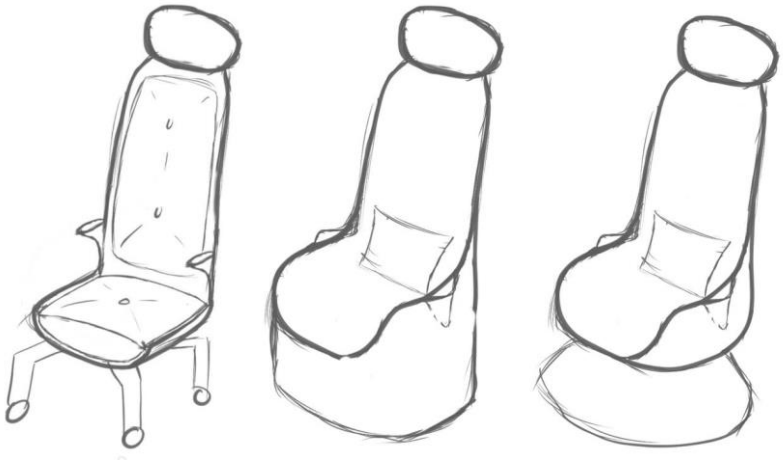

Figure 7 *First iteration cycle different chair variations sketches*

Research showed that certain colours were better than others for our first iteration. The combination of mint green and light pink is a good choice for a physical product designed for dementia patients because these colours are calming and soothing. Mint green is often associated with nature and has a calming effect, while light pink is a soft, nurturing colour that helps reduce aggression and anger. On top of this, the last colour dementia patients lose the ability to see is green [9]. Together, these colours create a sense of comfort and security, which can be particularly important for individuals with dementia who may be experiencing anxiety or confusion.

Additionally, these colours are easy on the eyes and not too bright or overwhelming, making them suitable for use in a medical setting. Overall, the combination of mint green and light pink can help create a calming and welcoming environment for dementia patients. Therefore, the colour code chosen was mint green and pink. The most aesthetically pleasing sketch was selected and coloured (See Figure 8)

Figure *8 Final sketch of the chair's first iteration (coloured)*

Afterwards, a low-fidelity mock up was created using cardboard (See Figure 9). The mock up together with the sketches also functioned as visuals for midterm Demoday.

Figure 9 *Carboard mockup of the chair*

Midterm Demoday

For the Midterm Demoday many tasks needed be executed. Firstly, we followed the "How to present your project" workshop. It was very insightful for the group but what stood out more that nobody known was the role of visual hierarchy on exhibition stands.

The use of visual hierarchy on exhibition stands is a crucial aspect of effective design. This refers to the arrangement of elements on the stand in such a way as to direct the viewer's attention and guide their gaze to the most important information. This can be achieved through the manipulation of various design elements, including size, colour, and position. By creating a clear visual hierarchy, the exhibition stand is able to effectively communicate its message and draw the viewer's attention to the key products and information being displayed. In a crowded exhibition environment, it is essential for exhibition stands to effectively differentiate themselves and attract the attention of potential clients and customers. A well-designed visual hierarchy can help to make the exhibition stand stand out and ensure that it effectively communicates its message to the intended audience.

With the use of this knowledge, we prepared an appropriate pitch, poster, logo, printed some of our sketches and also showcased a low-fidelity prototype. Notes were also available for stand visitors to feel in their feedback. During the pitch, the design process so far (see Appendix D), the product chosen and the future plans were presented.

Figure 10 *Midterm Demoday setup*

Next, using the feedback from the Demoday and the vision we had, we started conceptualizing our idea.

Second Iteration

Following the Midterm Demoday we made a planning. For the user tests to be done a prototype had to be available as fast as possible. Therefore, we decided to not build a chair from scratch, as this was an unrealistic goal considering how much time we had to, instead we took a chair available in our inventory and built upon it.

The base of our prototype is a leather chair (See Figure 11).

Figure 11 *Base leather chair*

The chair had a metal frame we could attach the wheels to and the leather was easily removable. Making it convenient to work with. The leather also makes the chair easy to clean. This is important because the for people with dementia who will use it, urine Incontinence is a common problem [8].

We made four metal plates with bolts welded onto them. The bolts make it possible to screw the wheels onto the plates. Then, we welded the plates to the frame of the chair. Safety is the most important thing of our product. We wanted to make sure that the user feels as safe as possible. So, we attached two metal bars to the frame of the chair for extra stability and strength. We also added a footstand to the chair. Because the user can't put their feet on the ground while the chair is moving. This made the chair even more stable and more comfortable to sit in.

Figure 12 *Second Iteration Prototype*

After that, we made the speakers. We used two speakers. One on the right of the headrest, and one on the left. This allows us to have a stereo sound system. We connected an amplifier and a bluetooth receiver to the speakers. We also connected a battery to the setup, and a powerbank to make the bluetooth receiver last longer. To attach the speakers to the chair, we used a piece of PVC pipe. We made a hole into the pvc pipe, so the speakers would fit inside of it, and cut part of the pipe so we could clamp it around the headrest of the chair. The placing of the speakers is well thought through. When looking at the target group, the speakers are placed at ear height to have the best stereo music experience. This setup gives the feeling of having the music playing "inside" your head.
When we did the interview with the design expert, we talked about how people with dementia react to certain design aspects. One thing that was mentioned is that

people with dementia get intimidated by designs easily. They usually don't like busy designs with bright colours. So, we decided to keep the colour of the chair black. This makes the chair look simple and approachable.
Shortly after the first prototype being done, we had our first user test at the KBO (See Method & Findings for more details).

Third Iteration

After the first visit to the KBO session, the users gave feedback on the prototype. The users said that it was hard to ride the chair around. They wanted smoother rolling wheels, speakers inside the chair instead of on top of the chair (See Figure 13). and an additional 5th wheel to stabilize the whole chair.

The wheels that were used in the first iteration of the chair were small swivel wheels without any bearings inside of them. These two factors made the chair difficult to maneuver. So when looking at better wheels these were the criteria that was searched with. The wheels of the first iteration were 75 mm in diameter, and the wheels of the second iteration of the chair are 100 mm in diameter. This bigger diameter makes it easier for the wheels to roll over small things on the floor and gives the chair a greater momentum. Also, the new wheels have ball bearings inside of them. This makes them roll with less friction, especially when there is weight on them.

During testing it was clearly visible that there had to be a stabilizing wheel to make up for the fact that the users tend to put their weight on the footrest. This ended up tipping the whole chair forward and this scared the users. The added 5th wheel, that is used to stabilize the chair, is placed under the footrest (See Figure 14).

Using the feedback from the KBO session, the design's last iteration was taking its shape. Next to these feedback points, the chair got a more pleasant look due to the fabric that is put over the frame of the chair (See Figure 13). Next to that, the speakers are put inside the chair instead of on top to make the chair look nicer.

After all these iterations and improvements on the chair's design, the final version had all the features that the group desired in this project (See Figure 14).

Figure 13 *Putting the speakers inside the chair/ Sewing fabric to the chair*

Figure 14 *Pictures of the final prototype*

Final Demoday

Figure 15 *Final Demoday Pictures*

Method

We followed a co-design approach during this project, this is a method of designing products, services, or systems that involves active participation and collaboration between designers and stakeholders, including end users, throughout the design process. The goal of co-design is to create solutions that meet the needs and desires of all stakeholders and are therefore more likely to be adopted and used effectively.

Interviews

Co-design typically begins with a research phase, one of the key methods for gathering information in the research phase is through early expert interviews. The goal of these interviews was to gather insights, information and expert's point of view on the matter.

We interviewed a caregiver, who works with people with dementia, to gain more knowledge about people with dementia in general. This way, we could get a better understanding of these people. We asked some general questions, but also some questions connected to our project. For instance, how people with dementia react to music. At the time of this interview, we had multiple ideas. So, we asked the caregiver to choose their favorite, and give feedback. With this feedback, we were able to make a decision and pick one idea.

We also interviewed a design expert who designs for people with dementia. This was helpful in another way. We could ask more design focused questions. We asked about the importance of user testing and what to pay attention to when you do these user tests. We also asked if there are any patterns in terms of design language. This was really helpful, because now we understand these people better from a design perspective. Furthermore, we asked the expert to give us feedback on our ideas. Just like the interview with the caregiver, at this period of time, we had multiple ideas. So, we discussed all of them and got some pros and cons on each of them. Then we discussed which idea might be the best. This helped us make a final decision and continue with one idea.

The third interviewee was Hans van Groenendaal, one of the founders of the company MHA Music Chair. Before he started this adventure he was already a passionate entrepreneur in the furniture industry. His knowledge and experience in designing for people with dementia, and especially a chair was very useful for this project. His motivation, making people feel good, helping them to participate again, getting them moving and experiencing moments of happiness, matched perfectly with our motivations for the Jeka Joka Dancing Chair. With use of the interview we held, Hans gave us very good detailed insides that were overlooked by ourselves. Such as how crucially important it is to design this chair that we had in mind together with the users. Or that it is smart to use an easy-to-wash material with this particular user group. Or even that the music that is played can really make or break the product. He also told us that it is very important to also enthuse the caregivers about the chair. "They (the caregivers) have to make sure the product is used, without them the chair would be worthless."

The fourth interview was with another expert in the field of dementia, who has done a lot of research and also interacts with people with dementia often. We presented our idea, and the expert was very excited about it because she noticed that many people with dementia do not move or exercise a lot, and often need to get motivated to get up. She thinks the chair, in combination with the music can really excite people to get more active. Furthermore, she pointed out that we need to ensure that people won't

get scared of the music. She suggested making eye contact or physical contact first, and asking if the person in the chair would like to hear music. This way, people are prepared and will not get scared of the sudden sounds. She also told a bit about her experience with people with dementia and how they respond to music. She often sees people lift up and singing along. The music really seems to brighten their mood. Lastly, we discussed the safety of the chair. We were thinking of adding a seatbelt, but the expert pointed out that this might make people feel trapped and scared. She also said that having a familiar person pulling the chair can definitely help the person in the chair feel more at ease.

ERB-form

Co-creation and getting feedback directly from the target group was a very important part of our project. Interviews can provide a lot of useful information and user tests can give you insight on things you can't get elsewhere. it allows you to design a product specifically for the user.

However, to be able to do interviews and host these user tests, you have to make an ERB-form. This form essentially contains all of your plans in terms of co-creation. When filling in this form, we asked ourselves a lot of questions. For example, who are our participants exactly? Can we include people with dementia in our user tests? This way, we could make the interviews and user tests as ethically correct as possible.

User Tests

Also, in the co-design process user tests are conducted after an idea has been developed. These tests are used to gather feedback from end users about the usability, desirability and feasibility of the designs that have been proposed. The feedback obtained from these tests is used to make adjustments and refinements to the design. Before we performed user testing, we first made sure that all safety and ethical protocols had been followed. The first user test was everyone's first time user testing, so it gave useful input on what to improve on the design (See Page 14) but also acted as a lesson and prepared the group more for the next time.

Figure 16 *Picture from the first user test*

During the second user test we were able to confirm that the changes we made to our design based on previous time's feedback were indeed effective. Moreover, as this was our final prototype, it was up to question whether we reached the design goal and overtook our design challenge.

Figure 17 *User 3 user test picture*

Figure 18 *User 1 user test picture*

Findings

Final User Test Results

During the final user test, we got a lot of positive comments. They were laughing and smiling, and the room's energy was really positive. One woman came to us and told us that she used to dance with her partner. But her partner isn't able to dance anymore due to physical issues. She told us that when she used the chair with her partner, it felt like they travelled twenty years back in time when they used to dance. We could also see that her partner really enjoyed it, as his face lit up and he showed many positive emotions. We are happy that we created a product that could make people this happy.

The Circumplex Model (See Appendix F) can be used to quantify and analyze the emotional responses of participants. During the testing process, participants were observed and their emotional reactions to the product were recorded (See Appendices B,C). Using some emotion values, taking their averages from all the participants, it can be quantitively seen that there was improvement from the second to the third iteration.

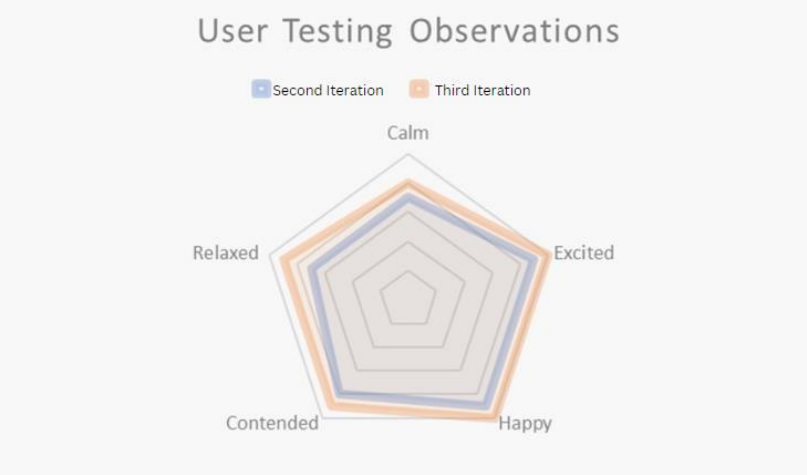

Figure 19 *Quantified emotions radar chart*

Concluding, from both qualitative and quantitative findings it can be deducted that the chair had a really positive mental and physical impact on people with dementia.

Discussion

Comparison to related work

There are already various options for people with dementia to dance, as shown in the related work section. However, especially for those with physical disabilities, it's hard to really match the feeling of dancing. During the dance classes, people are sitting in a normal chair and move their arms around. For this project, the goal was to get closer to the feeling of dancing, while strengthening the connection between the person with dementia and their loved ones and caregivers. The main differences with existing products and services are the wheels underneath the chair, to easily move around, and the implication of physical contact between the person in the chair and the person pulling the chair.

Future implications

In the realm of interactive products, there is always room for improvement. This is because there are constantly new ways to enhance the user experience and improve the functionality of the product. This is especially relevant in the current digital age, where consumers have high expectations and are constantly seeking out the most advanced and innovative products available. As such, it is essential for companies to continually strive to improve their interactive products in order to meet the changing needs and preferences of their users. This can be achieved through the implementation of new features, the streamlining of existing ones, or simply making the product more intuitive and user-friendly. By doing so, a company can maintain a strong market presence and stay ahead of the competition.

Safety

Safety comes first, especially when designing for vulnerable people. Therefore, after the user testing sessions and the Demoday demonstration, two things were brought upon that could be improved on the prototype.

A safety brake. The user dragging the dementia patient around should be able to brake the chair anytime, it could be the case that the chair got out of control or an obstacle is on the way. Without a brake, the dementia patient or the other user could get hurt. Also, another benefit of the brake is that it would be possible to store the chair somewhere without it being shaken around.

Secondly, at the moment the design of the foot rest is a rectangular metal with soft edged knobs. The problem is, because the material is hard and the metal linear, the sides of it could lightly hurt/discomfort a person's legs. To solve this, the sides of the metal should be rounded and the metal should be shaped as an angular (instead of a linear) line.

Ergonomics

Height adjustability in the chair head pillow and armrests is a crucial aspect of ergonomic design. The ability to position these components at the appropriate height for the individual user can significantly reduce the potential for musculoskeletal discomfort and pain, particularly in the neck and shoulders. Furthermore, height adjustability promotes a higher level of customized comfort, which can increase overall satisfaction with the seating and sound experience. Additionally, the capacity for height adjustment accommodates for individuals of varying stature, increasing the overall versatility and inclusivity of the chair, particularly in shared spaces such as a caregiving facility. As such, the inclusion of height adjustability in the head pillow and armrests of a chair is an essential aspect of designing ergonomic seating solutions.

Aesthetics

While the final prototype is aesthetically pleasing, there is a small detail that should have been fixed. Above the wheels, the bolts protrude the wheels surface. If the product continues to be worked on or if it were to be commercialized, for it to be fully polished the bolts protruding should be cut off.

Conclusion

The main goal of this project was to give people with dementia the feeling of dancing, while strengthening the connection between them and their loved ones and caregivers. The sub-goals included safety, comfort, and physical contact. When looking at safety, a few things can be improved, as mentioned in the future implications. When these things are added, the chair will definitely be safe to use, and won't cause any danger to users. Without these things, the chair is safe to sit in, but accidents might occur when people are getting out of the chair, or when the people pulling the chair lose control.

According to the reactions from the participants of the user testing, the chair is quite comfortable and people enjoy sitting in it. Since the chair is intended to be used by one person sitting in it and one person pulling from the front and thereby holding each others hands, physical contact is also present.

If the safety is improved, all the sub goals are achieved. From the user test, it appeared that people definitely got the feeling of dancing, and the connection between the person with dementia and the person guiding the chair also seemed to strengthen. However, more tests would be needed to be entirely sure about this.

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Appendices

Appendix A. Reflective Transformative Design Process

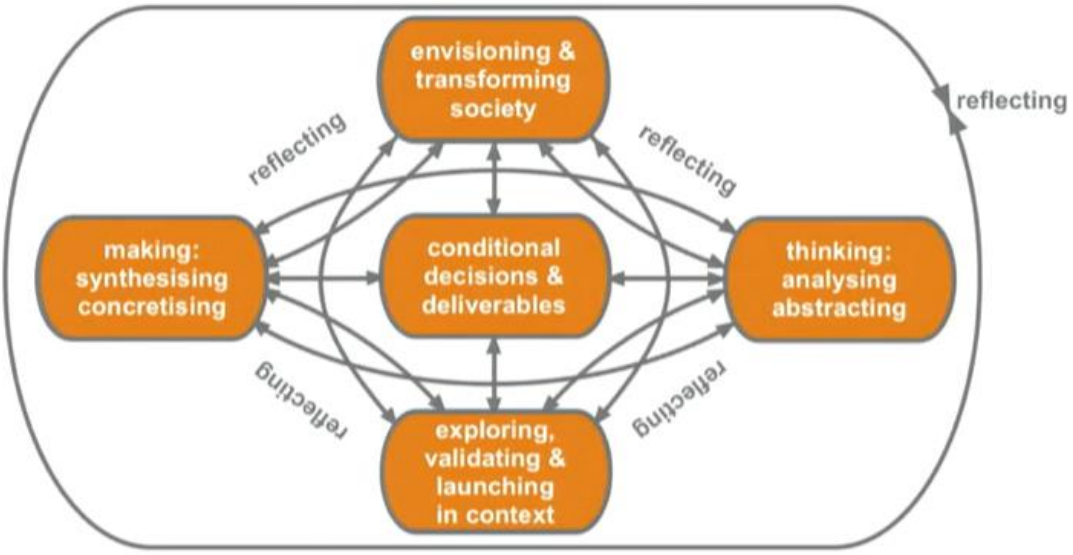

Figure 20 *Reflective Transformative Design Process Model [7]*

Appendix B. First User Test Raw Data & Observations

Table 1. James Russell's Circumplex Model of Emotion Raw Data from first user test.

	User 1	User 2	User 3	User 4
Alert	3	2	2	3
Excited	4	4	4	5
Elated				
Happy	4	4	4	5
Contended	3	4	3	3
Senere				4
Relaxed	3	5	2	3
Calm	3	3	3	3
Fatigued				
Lethargic				
Depressed				
Sad				
Upset				
Stressed				
Nervous	1			
Tense	2		1	

Additional Qualitative Observations

User 1:

- Got into the chair relatively easily
- Hands Movement
- Touching the sides and liftings hands back up
- Bit difficult to get off the chair at the end, someone needed to hold the chair.

User 2:

- Got into the chair relatively easily
- Hands stand not very convenient
- Stood up by the chair really easily (without any help)

User 3:

- Got into the chair relatively easily
- A lot of talking
- Talking Spanish (later we were informed she used to be a Spanish teacher)
- Uno, dos, tres (means one, two, three)
- Stood up by the chair easily
- Danced Standing & Started singing

User 4:

- Bit difficult to get into the chair
- Danced with his partner
- Both him and partner show a vast range of positive emotions

Journal

Before Tests:

The chair gathers attention immediately, it's different than the usual setting.
First Test:

- Random Elder: "Ooh!" (With excitement)
- All: Discussion & Laughing
- All (at the end of the test): Discussion & Interest

Second Test

- All: More Discussion & Laughing

Third Test:

- All: Less Discussion and More Laughing

Break:

- Kai discusses with users, attention is gathered to him and the chair. Everybody seems interested
- Second user talks with confidence saying he liked the experience
- First user agrees by nodding (though, he seems a bit in distress)
- Third user is silent, afterwards starts asking for coffee by singing while tapping her legs rhythmically.

Fourth Test:

- Third user is still singing and claps for the next user to enter and try the chair.
- All: Rock n Roll discussion & jokes
- All (before ending): Claps with joy

Appendix C. Second User Test Raw Data & Observations

Table 2. James Russell's Circumplex Model of Emotion Raw Data from second user test.

	User 1	User 2	User 3
Alert			
Excited	5	5	4
Elated	5	5	2
Happy	5	5	4
Contended	4	3	4
Senere			
Relaxed	5	5	3
Calm	4	4	4
Fatigued			
Lethargic			
Depressed			
Sad			2.5
Upset			
Stressed			2
Nervous			
Tense			

Additional Qualitative Observations

User 1:

- Tapping Legs
- Partner Claps
- Really Happy
- Chair is easy to move around (due to the big wheels)hair is easy to move around (due to the big wheels)
- Spin moves
- After some time, dancing around with the chair looks more natural, easier, more fun and dance moves are more advanced.

User 2:

- Chair hit with 2 small objects twice, dancing space should be bigger
- User seems very happy, he is cracking jokes
- Happy reactions across the whole room
- The chair moves around very easily
- Partner seems a bit jealous

User 3:

- Weighs a bit more, so the movement is not as smooth
- One hand is injured, so someone also needs to push the chair from behind
- Caregiver said she never seen her so happy
- Looks are hard to interpret
- Happy smirks at the end
- Got out of the chair on her own even with the injured arm

Journal

Before Tests:

The chair has gathered most of the attention againgathered most of the attention again

During Tests:

Discussion and laughing

After the tests:

3 elders (one of them is the second user), discuss on the chair

1 looks from far in excitement

1 shows interest, asks questions and starts discussion with the caregiver

Appendix D. Midterm demoday poster

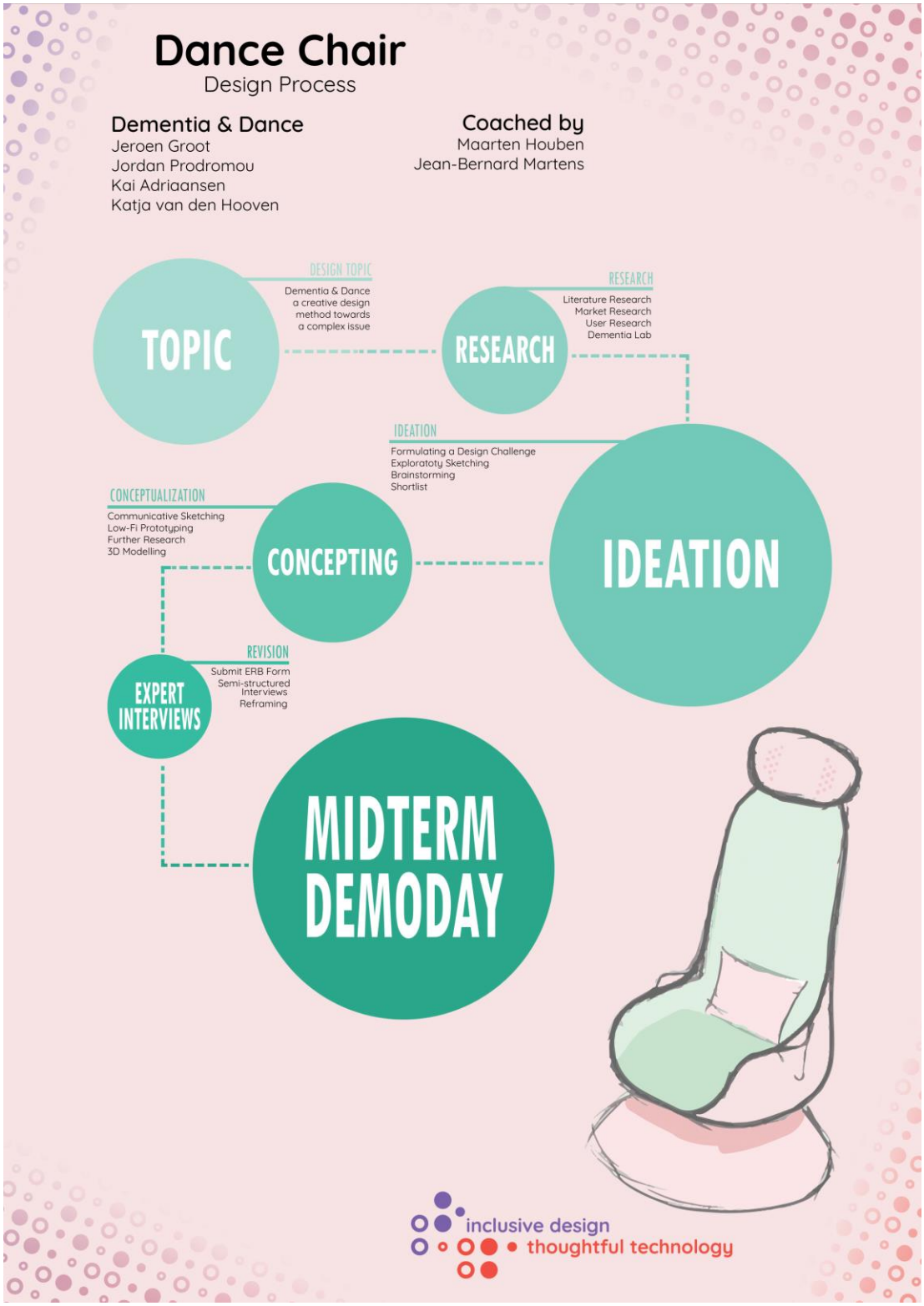

Figure 21 *Midterm demoday poster graphic*

Appendix E. Design Process (scaled image)

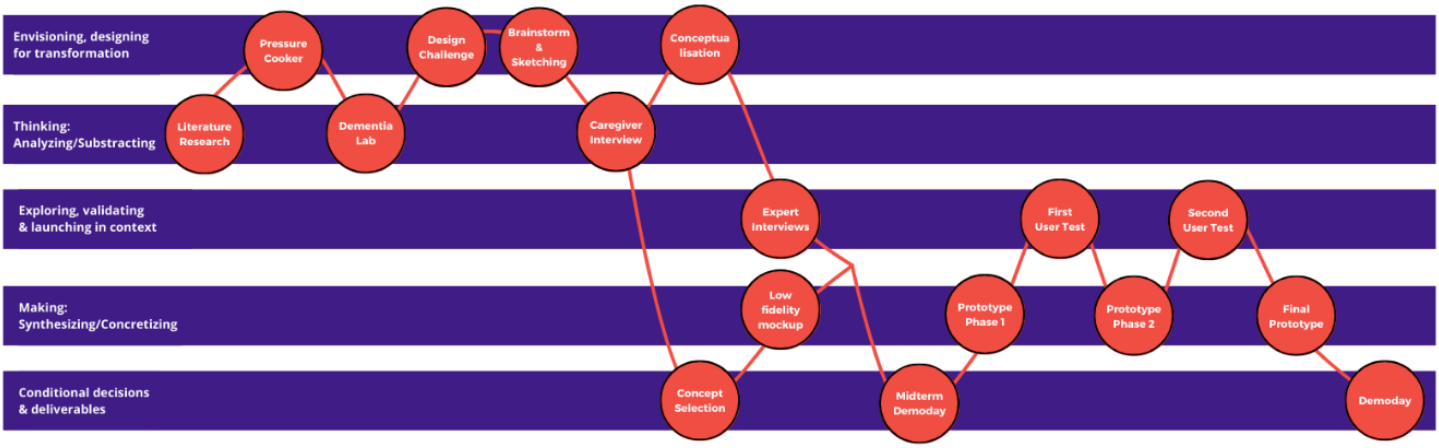

Figure 22 *Design Process Visual (scaled)*

Appendix F. User Test Quantitative Data Gathering Method

James Russell's Circumplex Model of Emotion [18] is a psychological model that describes emotions as a combination of two underlying dimensions: valence and arousal. The model posits that all emotions can be represented as points in a two-dimensional space, with valence on the x-axis and arousal on the y-axis [18]. This model had the potential to be a valuable tool for our team to gather and analyze observational data from the user testing of the Jeka-Joka Dance chair.

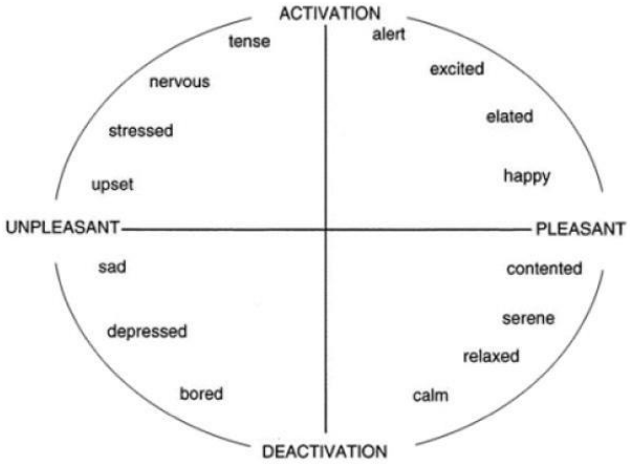

Figure 23 *A graphical representation of the circumplex model. [18]*

When testing a physical product, such as an assistive device for individuals with dementia, the Circumplex Model can be used to quantify and analyze the emotional responses of participants. During the testing process, participants were observed and their emotional reactions to the product were recorded, such as pleasure, displeasure, excitement, and calmness. This data can then be mapped onto the Circumplex Model, allowing us to see at a glance which emotions were most commonly experienced and at what levels of valence and arousal.

The ability to map emotional responses onto the Circumplex Model is valuable in assessing the usability and effectiveness of the product. It allows researchers to quickly identify whether the product primarily elicits positive emotions (high valence, high arousal) or negative emotions (low valence, high arousal) and whether it is primarily eliciting calm and relaxing emotions (low arousal) or exciting and stimulating emotions (high arousal). Additionally, patterns can be identified in the data and it can be seen whether there are specific moments or scenarios where the participant showed a different type of emotion than the general trend. Therefore. Making it possible to point specific areas of the product and features that need improvement.

It's important to note that gathering observational data is subjective and one should consider the limitations and the possibility of bias. Additionally, from what we were taught in the "Tech Ethics Lecture" and the "Vulnerable people" workshops, when dealing with elderly with dementia, it is essential to ensure that the testing process is conducted in an ethical and respectful manner. The cognitive limitations of these individuals should be taken into consideration and appropriate measures should be taken to ensure the testing process does not cause distress or discomfort.In conclusion, the model used allowed us to quantify and analyze emotional responses and identify patterns in the data, ultimately providing valuable insights into the usability and effectiveness of the product.

Appendix G. ERB Form

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Ethical Review Form Education

(Version 17.07.2020)

This Ethical Review Form should be completed for every research study that involves human participants or personally identifiable data. The form should be submitted and approved by your supervisor before potential participants are approached to take part in the research study.

Part 1: General Study Information		
1	Student name and email	Jeroen Groot, j.r.s.groot@student.tue.nl Iordanis Prodromou, iprodromou2student.tue.nl Katja van den Hooven, k.a.m.j.v.d.hooven@student.tue.nl Kai Adriaansen, k.f.g.adriaansen@student.tue.nl
2	Supervisor name and email	Maarten Houben, m.houben1@tue.nl
3	Degree Program	Industrial Design
4	Bachelor/master	Bachelor
5	Bachelor/master end project?	No
6	Course name and code	Inclusive design and thoughtful technology, DEP001
7	Project title	Dementia and dance
8	Research location	• Remote • Care home • TU/e
9	Research period (start/end date)	14/10/2022 → 20/01/2023
10	[If Applicable] Proposal already approved by (external) Ethical Review Board: Add name, date of approval, and contact details of the ERB	N/A
11	Research question	How can we use dancing as a tool to improve the quality of life of people with dementia? During this project we want to investigate how people with dementia react to different kinds of music and movements, and products related to music and dancing.
12	Description of the research method	We want to use a co-design approach in this project. More specifically, we want to do semi-structured interviews with caregivers, relatives of people with dementia, experts in the field of dementia and people in the beginning stages of dementia. The interviews will be 1 hour maximum. With given/written consent we will record the audio of the interview with our phones and store it on 'Surfdrive'. A transcript will be made of the audio. The interviews will be about what it's like to work with people with dementia, ask for feedback on our ideas, ask for feedback about our prototypes. Furthermore, we want to host a dance session and test low fidelity prototypes with people in the beginning stages of dementia at the KBO session. We will make field notes while observing the dance session.

1

Figure 24 *First page ERB form*

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Ethical Review Form

		We also want to do participatory workshops with the caregivers/experts. We will also take pictures during the co-creation sessions to illustrate the interactions with the prototype, and the general atmosphere during these sessions. We will ask for consent before taking these pictures and anonymize these pictures by cropping recognizable features or blurring faces.
13	Description of the research population, in- and exclusion criteria	In this study we will include people who work with people with dementia, family members of people with dementia, experts in the field of dementia and people in the beginning stages of dementia at the KBO session, who are still able to give consent and answer questions themselves.
14	Number of participants	Maximum: • 5 caregivers • 10 family members • 5 experts • 20 people in the beginning stages of dementia
15	Explain why the research is socially important.	There is no possible harm to society. It is socially important to improve the quality of life for people with dementia since that target group keeps growing. Research has shown that there aren't many existing products on this topic. It also showed that dancing could definitely have a positive effect on people's general well-being and mood. It can also benefit people with dementia on cognitive, physical, emotional, and social levels.
16	Describe the way participants will be recruited	We will give people information about the project and research methods beforehand. Participants will have to sign an informed consent form. We will find these participants via: • KBO session • TU/e • Personal contacts • Internet
17	Provide a brief statement of the risks you expect for the participants or others involved in the research and explain. Take into consideration any personal data you may gather and privacy issues.	In terms of the interviews, the burden will be minimal, and it only requires a relatively small time investment. We will not ask for any or sensitive information such as religion, and the interviews will take place in an informal atmosphere where participants can feel at ease to share their experiences. We will make audio recordings, field notes and pictures, which will all be stored on 'Surfdrive'. These things will only be taken with written consent from the participants. Participants are free to leave at any moment or skip questions. Collected data will be stored in 'Surfdrive'. We will process and analyse the data applying a thematic analysis. The data will be anonymous because we won't ask for any personal information except for age. The data will only be accessible for the four people mentioned in the first question.

2

Figure 25 *Second page ERB form*

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Ethical Review Form

		We will store the data for 3 years in 'Surfdrive'. The end date will be 14-10-2025.

Figure 26 *Third page ERB form*

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Ethical Review Form

	Part 2: Checklist for Minimal Risk	Yes	No
1	Does the study have a medical scientific research question or claim (see definition below) *Medical/scientific research is research which is carried out with the aim of finding answers to a question in the field of illness and health (etiology, pathogenesis, signs/symptoms, diagnosis, prevention, outcome or treatment of illness), by systematically collecting and analysing data. The research is carried out with the intention of contributing to medical knowledge which can also be applied to populations outside of the direct research population.'*	☐	☒
		If yes or maybe: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 2
2	Does the study involve human material (such as surgery waste material derived from non-commercial organizations such as hospitals)?	☐	☒
		If yes or maybe: This is only allowed if your supervisor has consulted with the medical coordinator. Continue with question 3	If no: Continue with question 3
3	Will the participants give their explicit consent – on a voluntary basis – either digitally or on paper? Or have they given consent in the past for the purpose of education or for re-use in line with the current research question?	☒	☐
		If yes: Continue with question 4	If no: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval
4	Will the study involve discussion or collection of personal data? (e.g. name, address, phone number, email address, IP address, BSN number, location data) or will the study collect and store videos, pictures, or other identifiable data of human subjects?	☒	☐
		If yes: The handling, storing and de-identification of the personal data should be discussed with your supervisor. Continue with question 5 if you met all requirements for handling personal data (see …)	If no: Continue with question 5

4

Figure 27 *Fourth page ERB form*

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Ethical Review Form

		Yes	No
5	Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g. children, people with learning difficulties, patients, people receiving counselling, people living in care or nursing homes, people recruited through self-help groups)?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 6
6	May the research procedure cause harm or discomfort to the participant in any way? (e.g. causing pain or more than mild discomfort, stress, or anxiety)	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 7
7	Will the participants receive any compensation for their participation? Such as a coupon or a chance to win a prize?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 8 or 10, depending on the type of study (see red text below)
The following questions 8-9 are for *observational* research (e.g. (semi-)structured interviews; focus groups; (participatory) observations). If your research is *experimental*, then skip questions 8-9 and continue with question 10			
8	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people)?	☐	☒
		If yes: This is only allowed when observing behavior in public space. If so, continue with question 9. If you observe people in non-public space without their consent, your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 9
9	Will participants be asked to discuss or report sexual experiences, religion, alcohol or drug use, or suicidal thoughts, or other topics that are highly personal or intimate?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with part 3

5

Figure 28 *Fifth page ERB form*

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Ethical Review Form

The following questions 10-13 are for *experimental* research (e.g. measurements on yourself or another person; testing a prototype/device; influencing behavior through manipulation (e.g. light or temperature). If your research is *observational*, then skip questions 10-13 and continue with part 3			
		Yes	**No**
10	Is the study invasive (i.e. it affects the body such as puncturing the skin; taking blood or other body material (such as DNA) from the participant)?	☐	☒
		If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 11
11	Does the device have a medical purpose sucs as diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease or injury?	☐	☒
		If yes or maybe: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	If no: Continue with question 12
12	Will the experiment involve the use of physical devices that are 'CE' certified for unintended use (meaning you will use existing CE certified devices for other things than they were originally intended for?	☐	☒
		If yes: This is only allowed if they are completely harmless. They should have a harmless voltage of <5V and hazardous waste (fumes/gas/substances) should not be released. You should discuss with your supervisor whether you need to have the device tested for safety	If no: Continue with question 13
13	Will the experiment involve the use of physical devices that are not 'CE' certified?	☐	☒
		If yes: This is only allowed if they are completely harmless. They should have a harmless voltage of <5V and hazardous waste (fumes/gas/substances) should not be released. You should discuss with your supervisor whether you need to have the device tested for safety	If no: Continue with part 3

6

Figure 29 *Sixth page ERB form*

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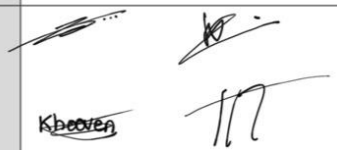
Ethical Review Form

Part 3: Enclosures and Signature		
1	Enclosures (tick if applicable): ☒ Informed consent form (link to template); ☐ The survey the participants need to complete, or a description of other measurements (such as interview questions or a description of the prototype); ☐ Text used to find participants (such as brochures, flyers, etc); ☐ Approval other research ethics committee;	
2	I hereby declare that I have completed this form truthfully Signature(s) of the student(s) Date: 14-10-2022	

Discuss this form with your supervisor. If any of the boxes your ticked in Part 2 suggest that your supervisor should submit your study to the ERB for ethical approval, try to change your research design in such a way that your supervisor can approve it instead. If this is not possible, ask your supervisor to submit the proposal to the ERB. It will take two to five weeks before you receive a decision from the ERB.

Part 4: Review by supervisor			
		Yes	**No**
1	Does the data storage adhere to all requirements of responsible data management (link toevoegen)?	☒	☐
		If yes: Continue with question 2	If no: Discuss with your student the necessary steps to adhere to the requirements
2	Does the research proposal adhere to all requirements for automatic approval?	☒	☐
		If yes: Please skip the questions 3-6 and sign the form	If no: Discuss with your student if any alterations can be made in order to adhere to the requirements for automatic approval. If you decide that the study cannot adhere to the requirements, then you as a supervisor need to submit the proposal to the ERB. Please answer the following additional questions (3-6)

7

Figure 30 *Seventh page ERB form*

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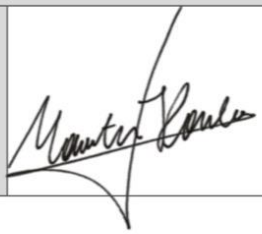
Ethical Review Form

Additional questions for ERB approval		
3	Elaborate on the topics from part 2 that do not allow for automatic approval. Describe how you safeguard any potential risk for the research participant for each topic.	
4	Describe and justify the number of participants you need for this research, taking into account the risks and benefits	
5	Explain if your data are completely anonymous, or whether they will be de-identified (pseudonymized or anonymized) and if so, explain how	
6	Who will have access to the data?	

Part 5: Signature by supervisor		
	I hereby declare that I have completed this form truthfully Signature of the supervisor Maarten Houben Date 14.10.2022	

8

Figure 31 *Eighth page ERB form*

Appendix H. Media

Figure 32 *Picture from elderly couple dancing during the second user test*