The Inviting Music Player: *A Case Study on Design for Loss of Initiative in Dementia*

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Music can have a positive effect on the quality of life of people with dementia (PwD). Unfortunately, PwD have limited access to music due to difficulties in product use and loss of initiative. Most studies on designing for PwD focus on improving the interaction design and do not consider the loss of initiative PwD experience. We propose that products for PwD must be easy to use and consider the loss of initiative. We consider loss of initiative a critical factor in design for dementia and use the design and evaluation of a music player for PwD as a showcase to illustrate how to design for loss of initiative. This showcase demonstrates how an interactive product can invite PwD to play music and helps to identify ways to consider loss of initiative in design. Finally, we reflect on the design through in-situ evaluations with a high-fidelity prototype.

Keywords **–** Dementia, Design Principle, Interaction Design, Inviting, Loss of Initiative, Music.

Relevance to Design Practice – In this paper, we illustrate the importance of addressing the loss of initiative in design for dementia. We introduce *inviting* as a design principle in the context of dementia and provide a practical example of how this can be applied in product design.

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Introduction

Many people enjoy listening to music on a daily base. Music can bring joy or comfort, help you relax or activate you, and contribute to maintaining one's identity. People with dementia (PwD) experience difficulty maintaining quality of life as their physical and cognitive capabilities decrease. A growing number of studies show that music can improve the quality of life of PwD (Elliott & Gardner, 2018; Raglio et al., 2015).

For a long time, studies in the area of music and dementia focused on the effects of music therapy in professional settings (Elliott & Gardner, 2018). Recently, however, an increasing number of studies focus on the effects of listening to music in the home environment (Kulibert et al., 2018; Quinn-Lee & Mowry, 2019). This is an important development, since 60-70% of PwD live at home (Elliott & Gardner, 2018) and they too can benefit from listening to music in everyday life. Unfortunately, operating home electronic devices, such as music players, can be a challenge for PwD because of the inevitable cognitive decline that leads to difficulties in product use. This cognitive decline often leads to loss of initiative, reduced executive functioning and the development of apathy (Massimo et al., 2018; McGuinness et al., 2010; Nobis & Husain, 2018; Robert et al., 2018). Both difficulties in product use and loss of initiative limit the access to music of PwD. They hamper independent living and may reduce the feeling of autonomy (Wesselink et al., 2020). To improve access to music for PwD, we therefore need to consider two key aspects in the design of a music player: difficulties in product use and loss of initiative.

The impact of loss of initiative and apathy in daily life is considerable (Chang et al., 2021). It manifests in a withdrawn behavior, refraining from social conversations, and an overall reduction of self-initiated activities such as watching TV, listening to the radio, making coffee, doing puzzles, or gardening. Additionally, becoming less active has another drawback. Staying physically and mentally active is important for PwD to slow down the impact of—and live better with—dementia (Cheng, 2016; Nuzum et al., 2020). According to Nobis and Husain (2018), the presence of apathy has been related to greater caregiver distress, decreased quality of life, and increased morbidity. As loss of initiative has a great impact on the everyday lives of PwD and on their social context—including the way they use, or do not use, everyday products—it is imperative that designers take this into account.

Addressing loss of initiative in the design for PwD is an under-researched topic. Most products that are specifically designed for PwD, and most studies on this topic, aim to increase the ease of use. With a focus on improving interaction design for PwD they provide insight into how to make a product usable by PwD. However, using a product, starts with the intent to use it. When taking initiative fades, so will product use.

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If PwD do not take the initiative to turn on a music player, could we design a music player that invites them to do so? Can we prompt them into action, without taking away control, without harming their feeling of autonomy? To discover how this can be done, we explored how we could implement strategies from the field of persuasive technology and behavior change in the design of the music player (Figure 1). Inspired by related work in which objects with agency are positioned as partners or co-performers next to their user (Kuijer & Giaccardi, 2018; Rebaudengo et al., 2012; Rozendaal et al., 2019), we used the design of agency to embed these strategies in the product's behavior.

Figure 1. The music player invites participants to use it through light and sound cues.

Please note that we do not expect that addressing the loss of initiative in the design will solve the problem of taking initiative. Nor do we intend to reduce the cognitive decline that leads to loss of initiative and apathy. We do, however, expect that addressing the loss of initiative can lead to better products for PwD.

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In the next section, we will give an overview of related work. The following sections present our study in three phases. In the first phase, we identify possible ways to address the loss of initiative in the design. In the second, we use the design of a music player for people with mild-moderate dementia who live at home as a showcase to illustrate how these insights can be translated into a product with agency, which invites PwD to use it. And finally, in the third phase, we discuss the evaluation of the music player in the homes of PwD.

Related Work

In our study, we combine knowledge on design for PwD, design for behavior change and product agency to create a music player that invites PwD to use it. In this section, we discuss and reflect on how our study relates to earlier work presented in literature and to commercially available products.

Loss of Initiative Across Dementia

Loss of initiative is associated with impairment in executive functions and apathy. Impairment in executive functions, which is common in dementia, can cause problems with task-initiation and goal-directed behavior (McGuinness et al., 2010). Loss of initiative is a common symptom of dementia and one of the key indicators of apathy. Generally, apathy is divided and defined in three dimensions: lack of initiative, lack of interest, and emotional blunting (Esposito et al., 2014; Robert et al., 2009). Various studies indicate that apathy is one of the most common symptoms in dementia and that it is prevalent across dementia types, such as Alzheimer's disease (AD), frontotemporal dementia (FTD), Lewy body dementia (LBD), Huntington's disease (HD), and vascular dementia (VD) (Chow et al., 2009; Eslinger et al., 2012; Massimo et al., 2018; Nobis & Husain, 2018; Robert et al., 2018). Studies on apathy in dementia note it is the most common symptom in AD (Nobis & Husain, 2018) and even more prevalent in FTD (36-88% in AD, 60-90% in FTD. Chow et al., 2009). A recent study estimates a prevalence of apathy of 51-80% in AD, 90.5% in mild FTD, 100% in moderate and severe FTD, and 12-70% in PD-spectrum dementia, such as LBD (Massimo et al., 2018). Although the exact numbers vary, it is clear that a significant portion of PwD has to deal with apathy.

Music Players for People with Dementia

We are not the first to study or design music players for PwD. Several studies describe the development of music interfaces specifically designed for PwD (Seymour et al., 2017; Stoeckle & Freund, 2016; Thoolen et al., 2019), and a handful of music players for PwD is commercially available (e.g., Lifted's One Button Radio). These music players aim to simplify the interaction, but may, for two reasons, not be in line with the needs of PwD who live at home. First, a previous study (Wesselink et al., 2020) concluded that there is a gap between the standard music players, which offer rich functionalities but are difficult to use, and the ones designed for PwD: easy to use but too limited in functionality. Second, these music players do not take loss of

initiative into account. They provide an accessible interface to listen to music but remain unused when the user does not take the initiative to turn on the music player in the first place.

This paper shows how we designed and evaluated a music player that addresses these two issues: it offers rich functionalities in an accessible way and addresses loss of initiative by actively inviting PwD to use it.

Design for People with Dementia

Researchers in the HCI community have addressed design for PwD from various viewpoints. Since the majority of PwD live at home (Elliott & Gardner, 2018), the in-home context is a crucial one to consider. Design for PwD in this context is complex (Brankaert & Kenning, 2020). Not only because each individual has unique abilities and challenges that change over time but also because of the social dynamics of the in-home context. Designing for the in-home context means designing for PwD, their informal caregivers, family members, professional caregivers, and other visitors. Participatory approaches are important (Brankaert & Kenning, 2020) and becoming more popular for research and design in this context, but, due to the complexity in involving PwD themselves, often still rely on people surrounding PwD, such as informal and formal caregivers (Elliott & Gardner, 2018).

Many design studies for PwD focus on improving ease of use by reducing the complexity of interfaces and providing limited functionalities. Because capabilities of PwD change as the disease progresses, a simpler product interface might be a solution for one moment, but it does not align with the dynamics of the disease. Recently, more attention is therefore given to the adaptability of interfaces. A small number of music players (e.g., One Button Radio) and related studies (Seymour et al., 2017; Thoolen et al., 2019) encompass an interface that can be adapted manually, by an informal caregiver, to the changing capabilities of the user.

Previous studies on design for dementia present a range of design recommendations and principles. Some studies discuss how principles from related areas, such as Universal Design or User-Centered Design, could be applied to design for dementia (Donaldson, 2018; Outi & Päivi, 2009). Others translate insights from their studies, often design studies, into design recommendations (Blackler et al., 2020; Brankaert, 2016; Hyry et al., 2011; Mayer & Zach, 2013; Wesselink et al., 2020). In a previous study (Wesselink et al., 2022), we analyzed the recommendations in related work and translated them into a set of design principles. These design principles informed our design process (see the *Design Case* section).

Design recommendations in related work do not discuss loss of initiative and how to address it in the design of products for PwD. However, various studies and commercial products use reminders to activate PwD. Commercial products include a digital agenda informing about appointments (Van Galen, 2018), a social robot telling it is lunchtime (TinyBots), a light on a bottle that will blink when it is time to drink (Ulla-Labs), and a pill dispenser that provides an alert when medication should be taken (Medido). Related studies explore ways to inform when dinner is ready (Jönsson et al., 2019), promote hydration (Groß-Vogt, 2020), or aim to support PwD in activities such as cooking (Ikeda et al., 2011), brushing teeth (Peters et al., 2014) and other activities of daily living (ADLs) (Rudzicz et al., 2015). Reminders can be an effective way to activate. This paper proposes a more diverse and nuanced way to address loss of initiative in the design for PwD.

Design for Behavior Change

Products and technologies affect the way people behave, even if they are not consciously designed to do so. Design for behavior change using persuasive technology has been a topic of interest for the HCI research community for a while (IJsselsteijn et al., 2006). There is a great variety of behavior change strategies, but little is known about which would work best for PwD. Research on design for behavior change in the context of dementia has, so far, received little attention. Behavior change strategies predominantly rely on cognitive processes, which may be ineffective in the context of dementia (Nyman, 2019). Since PwD experience cognitive decline, we could explore strategies that do not heavily rely on cognitive processes. Nudging is a behavior change strategy that utilises prompts functioning on a nonconscious level to seduce or persuade and could therefore provide pointers for possible solutions (Thaler & Sunstein, 2008). The unobtrusiveness of peripheral perception—displaying information in the periphery of the user's attention, which is one of the key elements in peripheral interaction (Bakker et al., 2015)—might also provide a valuable perspective for it provides a way to communicate with the user on a nonconscious level.

As Shachar and Greenbaum (2019) discussed, design for behavior change requires careful ethical considerations, especially in the context of PwD. It might suggest that autonomy shifts away from the user, as his/her decisions are affected by the design. However, the opposite might also be true: behavior change technologies could empower PwD. They could, for example, decrease the dependency of PwD on their partner.

Product Agency

We expect that product agency can be used to empower PwD because it allows a product to collaborate with its user. Various studies on agency in product design show that agency can change the user's relationship with the product (Kuijer & Giaccardi, 2018; Rebaudengo et al., 2012; Rozendaal et al., 2019). Agency makes it possible to design product behavior that resonates with the user. The Addicted Toaster (Rebaudengo et al., 2012), for example, wants to be used and communicates this to the user. Rozendaal et al. (2019) and Kuijer and Giaccardi (2018) describe the interplay between users and products as partners, or co-performers, that affect each other and learn from their interactions. This type of agency can be referred to as Objects with Intent (OwI's), which is "a specific type of agents that take advantage of their meaning as everyday things as the site for their intelligence and agency" (Rozendaal et al., 2019, p.3). Users still consider them things and are less inclined to attribute extra, for example human-like, functionality to them. They differ from other types of agents, such as conversational agents and social robots, in their grounding

metaphor. These grounding metaphors help people understand the agent's behavior. Where conversational agents can be understood as human and social robots as being, OwI's are perceived as a thing (Rozendaal et al.).

Because users are less inclined to attribute extra functionality to OwI's, we expect it to be a specifically suitable agent type in the context of a music player for PwD. In this paper, we will embed agency in the behavior of a music player, and we will reflect on this in the evaluation of the music player with PwD.

Design for Loss of Initiative—*Inviting*

In this section, we will look at how designers can design for loss of initiative. How can a music player invite PwD to listen to music more often? To answer this question, we explored how PwD are currently prompted into action through reminders, and how strategies from persuasive technology and product agency can be used to embed invitations in a product.

Reminders

In related work, we have seen that reminders are used to activate PwD. Although these reminders can be effective, they are limited in their scope: they use explicit messages and work on a conscious level. Tromp et al. (2011) propose a classification that explains the different ways products can influence people's behavior. If we look at the two dimensions used in this classification, force and salience, we see that most reminders are apparent and often strong (see Figure 2). Since reminders are so apparent and often convey clear messages or instructions, they could decrease the feeling of autonomy: users are not free from controlling influences, which is an important element of autonomy (Smebye et al., 2016). Maintaining autonomy is important for PwD (Meiland et al., 2017; Smebye et al., 2016), and reminders could conflict with design recommendations that relate to autonomy, such as maintaining a sense of control (Donaldson, 2018) and empowerment (Brankaert, 2016).

It is therefore important to explore more subtle, implicit ways to prompt PwD into action. Subtle invitations to make them want to engage, instead of reminders to respond to. Adding ways to seduce or persuade PwD to use the music player will broaden possibilities to adapt prompts to each individual user.

Nudging

In the *Related Work section*, we have argued how nudging could provide promising pointers for the design of more subtle and implicit ways to prompt PwD into action. In a recent systematic review of using nudging in HCI, Caraban et al. (2019) discussed 23 types of nudging and their underlying mechanisms. In the following, we reflect on their potential use in PwD's context and translate some of the promising nudging types to design solutions for our music player.

Using behavior change strategies such as nudging, especially in the context of PwD, requires a sensitive ethical approach. We therefore reflect on ways of nudging not only from a functional point of view, but also from an ethical stance. In the design of the music player, we aim to enable the access to music for PwD, empowering them while increasing their autonomy.

Caraban et al. (2019) describe six categories of nudging: facilitate, confront, deceive, social influence, fear, and reinforce. From an ethical and functional point of view, the categories confront, deceive and fear seem ill-fitted for PwD. Moreover, they do not match our intention to subtly invite PwD to use the music player. Confront nudges work by confronting the user with potential risks or unwanted effects of their actions; deceive nudges use deception mechanisms to influence the user's choice; and fear nudges aim to increase feelings of uncertainty and fear to influence the decision-making process (Caraban et al., 2019). These three working-principles strongly conflict with our aim to empower PwD and they could harm the emotional wellbeing of PwD. Moreover, such a negative approach could possibly result in an aversion to the music player. Invoking fear and uncertainty

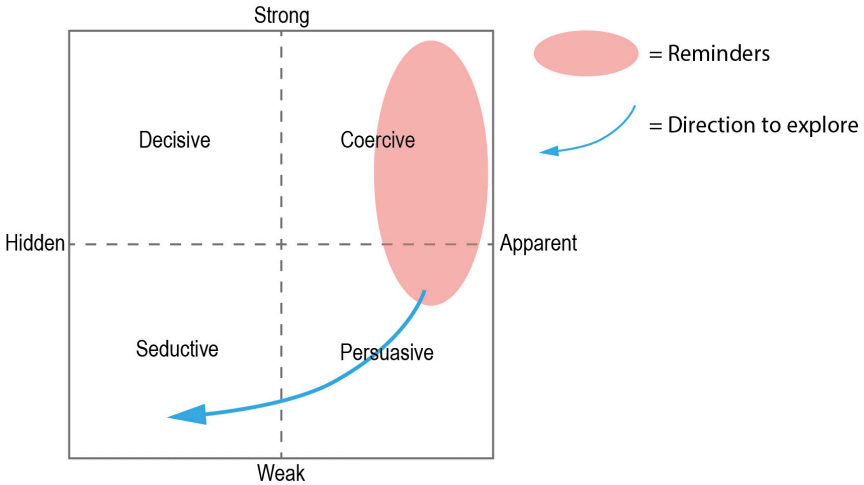

Figure 2. How reminders can be positioned in the four types of influences based on the dimension of force and salience. The figure is adapted from (Tromp et al., 2011).

conflicts with our ethical approach, it is what we try to avoid. We do not want to create a negative emotional product experience. Therefore, this study did not consider the categories of confront, deceive, and fear.

This study focuses on the categories facilitate, social influence, and reinforce. Table 1 shows the nudging types of these categories and indicates which ones we will use in our design. Some nudging types within these categories are not suitable in the context of our music player. For example, *hiding*, making undesired options harder to reach, is not relevant for us since we do not intend to have undesired options in our music player. Using this process of elimination and by exploring how potential candidates can be integrated into the design of a music player, we finally selected five nudging types for our design: default options, opt-out policies, raising visibility, just-in-time prompts, and ambient feedback.

Table 1. Nudging types and categories selected for the design of our music player.

Nudging type	Category	Selected
Default options	Facilitate	Yes
Opt-out policies	Facilitate	Yes
Positioning	Facilitate	No
Hiding	Facilitate	No
Suggesting alternatives	Facilitate	No
Invoking feelings of reciprocity	Social influence	No
Leveraging public commitment	Social influence	No
Raising the visibility of users' actions	Social influence	Yes
Enabling social comparison	Social influence	No
Just-in-time prompts	Reinforce	Yes
Ambient feedback	Reinforce	Yes
Instigating empathy	Reinforce	No
Subliminal priming	Reinforce	No

Agency & Invitations

We want our music player to be a friendly and supportive device that helps the user to listen to music more often. This matches with the OwI agency type—which we already proposed to use in the *Product Agency* section—where objects and their users work together to achieve a goal (Rozendaal et al., 2019). We propose to employ agency to naturally embed different levels of invitations. These invitations vary from subtle prompts that work on a nonconscious level to clear and concrete prompts or even autonomously playing music. Elements from behavior change strategies can provide pointers for the design of these invitations.

We expect the insights described in the previous subsections to be valuable for the designing for dementia domain. We summarized these insights in a new principle that can be used to design for PwD.

Design Principle—Inviting: the product should respond to a possible loss of initiative by actively inviting PwD to interact with it. To maximize the feeling of autonomy, a layered invitation design can be used. These invitations move between subtle prompts that are not consciously perceived and noticeable apparent prompts. Such a layered invitation design can be realized by implementing behavior change techniques—such as using default options, opt-out policies, raising visibility, just-in-time prompts, and ambient feedback—combined with product agency. It is important to naturally merge these elements, communicate them to the user, and embed them in the user's daily routine.

Design Case—*An Inviting Music Player*

In the design of our music player, we focused on the everyday music-listening needs of PwD, who still live at home. We identified these needs together with PwD in a previous study on the role of music in their daily lives (Wesselink et al., 2020), and they can be summarized as having easy access to their personal and preferred music—such as CDs, records and radio stations—and having a simple interface to control basic functions. In a following study, we explored design recommendations in related work and defined a set of design principles for designing in the context of dementia (Wesselink et al., 2022). Based on the identified needs, the design principles we extracted from related work, and our invitation design, we created the music player as illustrated in Figure 3. Since this paper focuses on addressing loss of initiative through a layered invitation design, we minimize a discussion on the product and interaction design. We like to explicitly note that this music player is just one of the many potential design solutions to address the loss-of-initiative problem PwD are facing. Although we created a high-fidelity prototype, which was required for our in-situ evaluation, this design should be considered a first step to gaining valuable feedback from PwD.

Figure 3. High-fidelity prototype of the music player, with the following components: 1. Volume knob, 2. Presets slider, 3. Control buttons (start, stop, previous, next), 4. Motion sensor, 5. Speakers, 6. Volume indicator, 7. Presets, images with light, 8. Product light, 9. Ambient light (on the back).

The music player is controlled by an integrated computer. The invitation design is programmed on this computer and can easily be updated and personalized for each participant in our

in-situ evaluation. The presets, both the images and the musical content, will be personalized for each participant based on their musical preferences and related recognizable images. We will now explain the elements of our invitation design and how they link to the product's components and the overall design.

Invitation Design

The invitations aim to support PwD in their goal to listen to music more often. They implement the five selected nudging types: just-in-time prompts, raising visibility, ambient feedback, default options, and opt-out policies.

Just-in-time prompts: The timing of the invitations is important. It is useless to start the invite when the user is not there to receive one. Therefore, timing the invitations to align with the user's daily routines is expected to lead to more positive responses. We use a motion sensor (Figure 3, no. 4) to respond to the user's presence, and we adapt the timing to the user's daily routines and use of the music player.

Raising visibility: The music player can sometimes raise its own visibility using the product light (Figure 3, no. 9). This reminds PwD of the fact that the product is there for them to use. The way this is done can vary from subtle lights in the music player to attention-grabbing blinking patterns.

Ambient feedback: The music player uses audio and light to create ambient feedback that directs the user to the music player. Lighting up the wall behind the music player can signal the user. This can happen in the user's periphery using the ambient light (Figure 3, no.10). The same goes for using audio, a soundscape, or subtle tunes from the user's favourite songs, can prompt the user to turning on the music player.

Default options: In our music player, the user can choose between 5 music presets (playlist or radio channel). We chose to always have one option selected: if the music player is turned on, there is always a preset selected (see Figure 3, no. 2 and 8). Moreover, we used default options in the design of the invitations and product-agency: when there is no response to the invitations, the music will start playing. So, the default behavior in case of no response, is to turn on the music. If users have difficulties operating the music player, or if they are not activated by the invitations, this default option could support them in listening to music and/or activate them.

Opt-out policies: We created a multi-level invitation design. The invites start very subtle, but when ignored, they become more intense and apparent. As described above, by default, the music will start playing if the user does not respond to the invites at all. However, the user can reject the invites, or stop the music, at any time by pressing the stop button (Figure 3, the square button at no. 3).

Combining Five Nudging Types into a Layered Invitation Design

Our music player will invite PwD to play music in two ways: 1. As its default behavior, it will subtly draw attention when it detects motion: light will fade in and out in a calm breathing-like fashion; 2. At personalized predefined times, it will start the layered invitation. How often and when these invitations should start differs from person to person. In our in-situ evaluation (see the *In-Situ* Evaluation section), we personalized the music player for each participant based on an interview. Each layered invitation will gradually build up in intensity through the following steps (as illustrated in Figure 4):

1. The music player lights up. The light slowly increases in strength.
2. 5 min. later: The light starts pulsating slowly, but the speed gradually increases.
3. 5 min. later: The ambient light turns on, in addition to the pulsating light.
4. 5 min. later: A sound starts playing and is repeated each minute, in addition to the pulsating light and ambient light.
5. 5 min. later: The music from the selected preset starts playing.

Pressing the stop button rejects the invite and stops all active prompts. Any other interaction with the radio—such as pressing start, increasing the volume, or moving the slider—accepts the invite and starts the music.

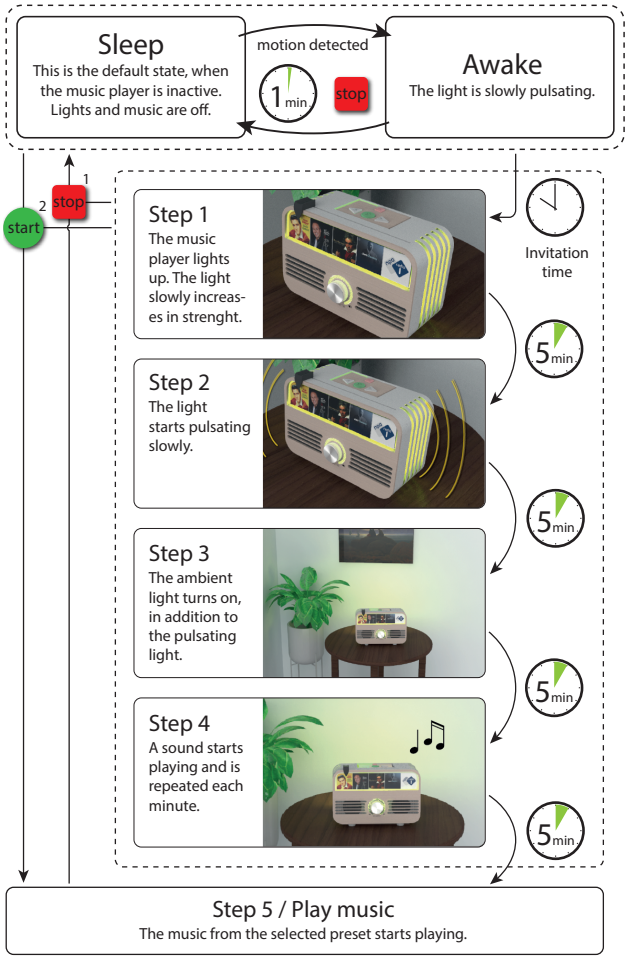

Figure 4. Diagram showing the default behavior, the five steps in the invitation design, and the interaction possibilities.

By building up the invitations, we gradually move from an implicit and weak influence towards a more apparent and strong influence, which can be categorized as a reminder (see Figure 5). Please note that Figure 5 illustrates the expected experience of the invitations. How PwD will actually perceive the invitations will vary from person to person and will be an outcome of our in-situ evaluation. Step 5 could, for example, be experienced as *seductive* or *coercive*. If the music starts with a soft fade-in, the user may not notice it at first and experience it as *seductive*. Yet, if the user clearly hears that the music starts but she/he does not want that, she/he is forced to go to the music player and stop the music. This might be experienced as a *coercive* prompt.

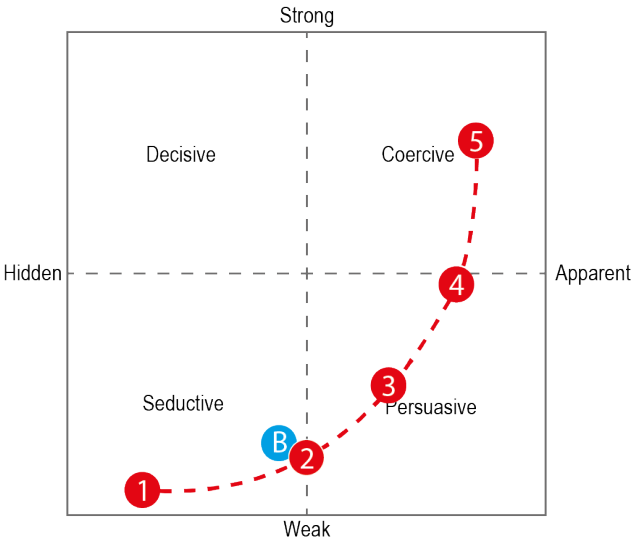

Figure 5. The intended experience of the steps in the layered invitation design (red) **and the default behavior** (blue) **mapped on the four types of influences and the dimension of force and salience** (adapted from Tromp et al., 2011)**.**

In-Situ Evaluation of a High-Fidelity Prototype

In this evaluation, we aim to find out how participants experience the invitation design and to what extent this can support listening to music. For the participants to experience the layered invitation design, they needed to use the music player in their home environment for a longer period of time. Data was collected throughout this period and used to update the music player's behavior if required. The Ethical Committee of University of Twente has approved this in-situ evaluation with PwD.

Participants

Together with dementia care professionals and based on our inclusion criteria (mild-moderate dementia, experiences loss of initiative, lives at home with a partner, can listen to music without headphones) we selected four participants for this study (see Table 2). All participants were contacted and informed through their professional caregivers. If they were interested in participating, they, and their informal carer/partner, received an information brochure, and finally, the researcher explained the study in person. If everything was clear to them, they signed an informed consent. Participation was completely voluntary.

Table 2. Participants of the in-situ evaluation.

Participant	Age	Gender	Dementia type	Days used
P1	80-84	Female	Alzheimer's	6
P2	65-69	Male	Alzheimer's	12
P3	70-74	Male	Lewy Bodies	15
P4	75-79	Male	Vascular	21

We anticipated the vulnerability of PwD and the complexity of including them in a study by taking several measures that are in line with suggestions made by Span (2016). These measures included continuously collecting data during the evaluation, investing extra time to meet and connect with participants, and ensuring they feel comfortable by creating informal conversations.

Methods

We performed four in-situ evaluations with a high-fidelity prototype of the music player (Figure 6). The evaluations were divided in three steps. To get a good view on how the music player is used and experienced, we gathered data using a mixed-method approach: logging by the music player, semi-structured interviews, observations, and recordings.

Step 1: Introduction and Personalizing

The music player was introduced and tried out for the first time, and the interactions with the music player were recorded on video. As related work (Elliott & Gardner, 2018; Stoeckle & Freund, 2016) stresses the importance of personalizing the music for PwD, finding suitable music presets was a vital element of this step. The recognizability of the music and corresponding images can draw attention and thereby invite PwD to interact with the music player.

We used a semi-structured interview to get the required information to personalize the music player, focussing on music preferences and suitable moments for music throughout the day. The interview was approached as an informal and open conversation about the role of music in their lives, touching on topics such as when they listen to music, what music they like to listen to and why, and how this may have changed in the course of their lives. Together with the participant and their partner, we determined the content of the five presets, which could be online radio streams or Spotify playlists. Information required for personalizing the music player—such as the five presets and the invitation times—was recorded in a checklist, and contextual information was recorded in field notes.

Using an interview to gather PwD's music preferences only works if the PwD or a family member can articulate these preferences. A different approach is required if access to this specific knowledge is lacking. For example, Stoeckle and Freund

(2016) explored their participants' music preferences by starting with a short list of popular songs from various genres and updated the playlist based on how the participants responded to specific songs. Park (2010) used the assessment of personal music preference to determine music preferences.

Step 2: Using the Music Player

The personalized music player was delivered to the participant and stayed there for two weeks. In this period there were three visits: delivery, check-up, and final interview. Upon delivery, the participant tried out the music player, and we checked if the presets were in line with the expectations. At the check-up, we discussed the use of the music player with the participant and checked for feedback. If required, we updated the music player. The researcher logged and checked the music player's usage regularly. Based on the logs, the researcher contacted the participant to clarify the data. This could, for example, happen when the music player was offline or not used for a few days.

Step 3: Final Interview

The final interview was used to discuss the participants' experience of the music player. Results from the previous contact moments, and the music player's log data, were used to inform the semi-structured interview. The interview was audio-recorded and done with the participant and their partner.

Figure 6. Four participants selected music on their personalized music player in their homes.

Results

The audio recordings of the final interviews were transcribed, and a thematic analysis with an inductive approach was performed (Boeije, 2009). We analyzed the video recordings and photos with a focus on interaction design aspects. Information on the use of the music player—including the responses to the invitations—was extracted from the logs, visualized (see Figures 7 and 8), and compared to the results from the thematic analysis.

Log Data

The visualizations of log data display the actions of, and interactions with, the music player. Figure 8 visualizes the log data of one full day. Figure 7 zooms in on the first hour of usage for that same day and shows that:

A. The layered invitations start at a predefined time (07:45h) and go through 5 steps. The user does not respond.
B. At step 5, the music starts automatically with a fade-in.
C. After the music started playing and faded to the default volume, the user increases the volume using the volume knob.
D. The user changes the preset (two times).
E. The stop button is pressed. The music stops playing.

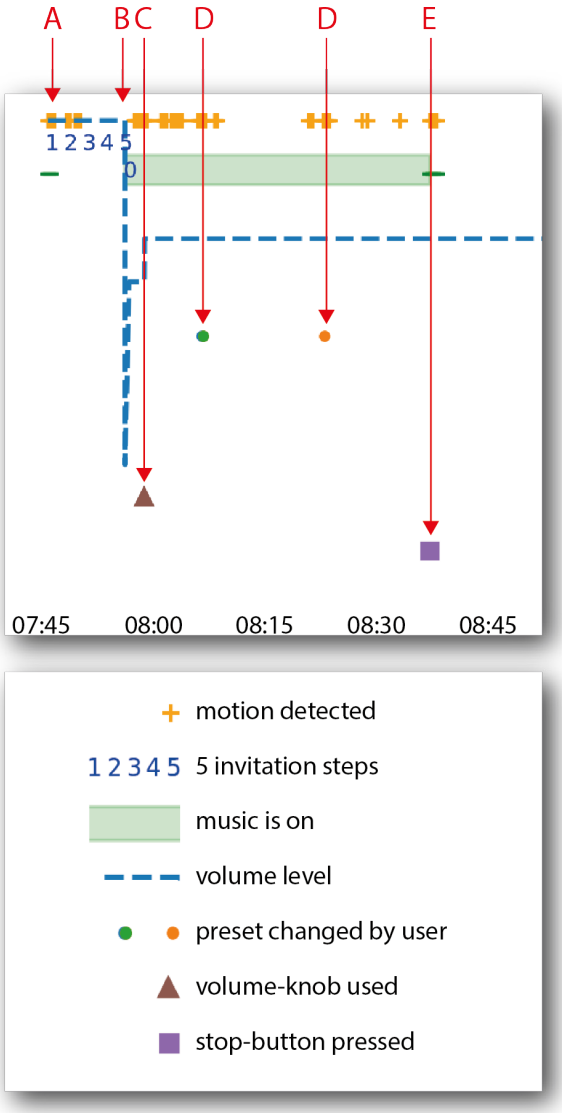

Figure 7. One hour of log data explained.

In Figure 8, we see that later that day, around 13:00h, the motion sensor triggered the *awake* behavior, and the user started the music shortly after. Around 17:00h, the music started after the five invitation steps and automatically stopped 20 minutes later. During that period, motion was detected, but there was no interaction with the music player.

Level of Initiative & Product Use

All four participants experienced loss of initiative in their daily lives; however, all were on a different level. P1 was in a later phase of dementia, dozed off often, showed no initiative, and only responded in our evaluation to clear instructions and support from her partner. Unfortunately, she had to stop participating after six days because she suddenly moved to a care facility. P2 was in an early phase of dementia, and although he showed some loss of initiative, he was still actively involved in music listening throughout the day. P3 and P4 showed a great loss of initiative but could be prompted into action.

In our study, the level of initiative seemed to have a greater impact on the use of the music player than the participants' physical capabilities or cognitive understanding of the interface. P3 and P4, for example, often had no significant problems using the music player but needed to be prompted to do so.

Overall Experience and the Interaction Design

All four participants and their partners were very positive about the overall experience. The fact that this music player brought their preferred music within their reach was much appreciated, even if using the product was still a challenge (P3) or almost impossible (P1) for the participant. This challenge was mainly linked to the slider used to select the music presets. P1, P3, and P4 sometimes pushed on the preset illustrations if they wanted to start that specific music preset. Having five presets with a variety of preferred music was much appreciated not only by the participants but also greatly by the informal caregivers. P4 could really be moved—and calmed—by minimalistic piano music, but he liked to listen to rock music from their past with his partner. The preferred type of music was context-dependent.

We consider other insights concerning functionality and interaction design, such as flexibility in changing presets and the usage of the interaction elements, respectively. Yet, those considerations are out-of-scope for this paper. Those topics are worth being investigated in future research.

Layered Invitation Design

The layered invitation design was, overall, really appreciated, especially when it fitted into the daily routine. Most participants preferred three predefined times a day for the layered invitation to start. This timing was always based on their activities. P4, for example, really liked that he now had music during breakfast and said: "Isn't it nice to have music early in the morning!" At these moments, P4 was sometimes triggered by the invitations, either by the light effects or the audio, but at other times the music would play automatically. The fact that the music player was an active element in their home was appreciated by P1, P3, and P4. P2 mentioned it would be perfect for someone in a later stage of dementia. Without the light effect from the awake behavior and invitations (see Figure 4), the music player would not be noticed (P3), and it would just be a dead thing (P1). P3 and P4 said that noticing the music player led to using it. They noted that the invitations increased the time they listened to music. On average, music was on for 3.8 (P1), 0.8 (P2), 2.5 (P3), and 4.7 (P4) hours per day.

The participants liked the audio notification and the breathing-like behavior of the light. The audio notification was the most apparent invitation, but it was not experienced as obtrusive. The fact that it can be heard from another room was a big plus for P4. Invitations often led to interactions, but not all participants actively responded to them. At P1's place, only the partner responded; P2 responded; P3 was activated by the partner; P4 responded and was sometimes activated by his partner. The auto-play function also led to interactions several times. Figure 8, for example, shows that after the music had started automatically around 8 am, a participant used the volume knob to increase the volume. Then, the preset slider was moved two times, and the stop button was pressed after one hour of listening.

Some suggestions for improvements to the invitational design were given during the final interviews. These improvements can be described as better fine-tuning the behavior to the context. For example, the auto-play function stops after 20 minutes, but it should stay on longer if people are present. Moreover, the auto-play function could be activated more often. Instead of only on the predefined times, it could, for example, turn on if it notices that people are present or nearby. P3 noted that it would be top-notch if music would turn on when you approach the music player. The awake behavior was too active sometimes ("I sometimes thought, hey thing, stop blinking," P4) and should be more context- and time-sensitive ("I sometimes go out of bed in the evening or at night, and I think: hey, the lights are on!", P2).

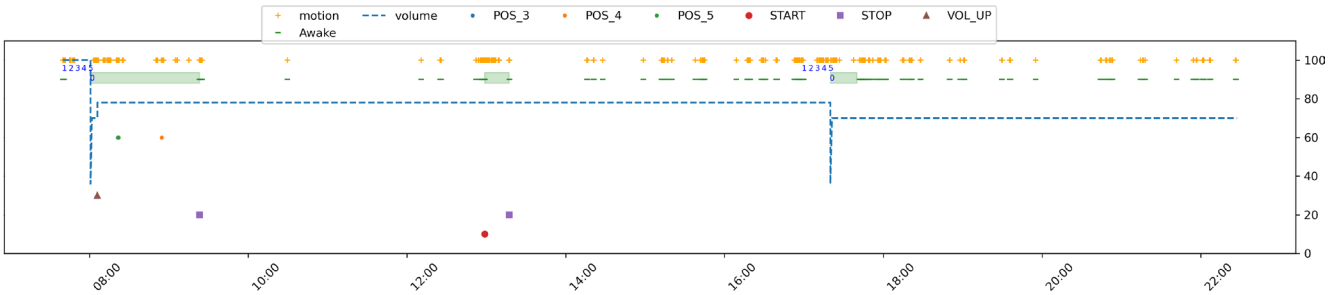

Figure 8. One day of log data visualized.

Discussion

Loss of initiative can easily be overlooked as an issue in using everyday products by PwD. Even if designers are aware of it, they may think it is out of scope because it concerns the step before product use. This paper, however, shows that it is not out-of-scope and that it can be vital to enable product use and lead to behavior that can positively influence quality of life. Our study indicates that applying the design principle we propose, Inviting can have a positive impact on product use by PwD. We expect this design principle to be a valuable addition to the recommendations and principles that are currently described in the literature on design for dementia.

Access to Music & Invitation Design

We started this study by pointing out that access to music is limited for PwD because of two key issues: difficulties in product use and loss of initiative. In the design of our music player, we addressed both issues. The results from our evaluation provide strong indications that applying our design principle of inviting can lead to improved access to music and reduce the dependence on informal caregivers. Access to music could be improved by updating the interaction and invitation designs based on the challenges and suggestions described in the results (see the *Results* section).

In our study, the invitation design partly worked through the participants' partners, who also were the informal caregivers. The partners turned on the music or instructed the participant to do so. Because the invitations were not always perceived as suggestions towards action, we expect that a more directive approach could be added to the invitation design. Further explorations on how to design invitations that activate PwD are needed to support a wider variety of users.

Behavior Change Strategies & Dementia: *Ethical Considerations*

In the *Design for Behavior Change* section, we mention the importance of careful ethical considerations when using behavior change strategies in the context of dementia. We were careful and cautious in both the design of the product and our in-situ study. By selecting only participants who lived together with a partner and keeping close contact with them, we assured that we could easily and rapidly intervene when needed. We want to share some perspectives to consider regarding these ethical aspects.

The first perspective, maybe the most obvious one, focuses on avoiding to harm the user. As PwD are generally considered more fragile, it is crucial to ensure that applied strategies do not make the user feel unpleasant. In our design, we avoided any approach or nudging type that was based on working mechanisms relating to unpleasant or confronting feelings.

The second perspective links to autonomy or empowerment. Strategies for behavior change can give the impression of controlling the users' behavior, taking over control, and taking away autonomy. It is crucial to make sure that the user is always in control. This does not mean that the product cannot act autonomously. In our view, a product with a level of agency can even improve the user's autonomy. Our music player, for example, can make it easier for a person with dementia to listen to music without depending on a caregiver. The music player helps, but the user is still in charge. Even if the invitations become increasingly apparent, up to the level where the music player automatically starts playing music, participants did not report this as a loss of autonomy. They liked it, for it was perceived as a feature of the music player, and they could easily stop it if they wanted.

The third perspective considers the ability to consent to being exposed to these strategies. In our study, the participants were in the mild-moderate stage of dementia, and we included their partner and the professional carer (case manager) to safeguard the participant's interests. During the study, we reflected with the participants and their partners on the music player's effect on their listening to music and how they experienced the music player's behavior.

The final perspective we would like to share centers the added benefits, which have to outweigh the possible drawbacks of using behavior change strategies in the context of dementia. If these strategies lead, for example, to an increased quality of life and reduced levels of pain, it might even be considered unethical to not implement them.

Relevance for Other Domains

The main contribution of this paper to the current literature is identifying loss of initiative as a critical element to consider in design for dementia and the suggestions on how this can be achieved. Although we illustrated this using the design of a music player for PwD as a showcase, our insights can be translated to other products and other contexts. We could, for example, integrate a significant part of our invitation design in a coffee machine to improve hydration or in a television to watch entertaining shows or the news. Still, instead of literally copying our invitation design, which is tailored to the context of a music player for in-home use by PwD, we suggest translating our insights into an invitation design tailored to the new product and context. For example, the smell of fresh coffee could be an effective yet subtle prompt that is specifically suitable for the invitation design of a coffee machine.

Moreover, we expect that our insights and suggestions on design for loss of initiative may be relevant in various other contexts where users experience issues with taking initiative, apathy, or motivation. Apathy, for example, is also present in other brain disorders, such as stroke patients, traumatic brain injury, depressive disorder, and schizophrenia (Robert et al., 2018). Design for people with these brain disorders might also benefit from our insights and suggestions.

Strengths and Limitations

During phases 1 and 2 of this study, access to PwD was complex and limited due to strict Covid19 restrictions and the absence of vaccines. The design of the music player—and its layered invitation design—was therefore mainly informed by findings in

our previous participative study on the needs of PwD in relation to music in their daily lives (Wesselink et al., 2020), our study on design principles for the context of dementia (Wesselink et al., 2022), other related literature, and our experience in research and design for and with PwD.

In phase 3, access to PwD had improved. In the evaluation, our music player was used by four participants for a total of 54 days, in which the music player was used daily. We gathered a rich data set ranging from interaction logs to videos and interviews. The collected data during the product-use period provided valuable input for the final interview. The diversity of participants provided insights into the applicability of the invitation design in various stages of dementia. However, the small number of participants limits the transferability of the results.

Communication with PwD in a study like this can be complex. It might, for example, be hard for PwD to recall certain situations or to explain which functions they do or do not like. Moreover, creating a comfortable atmosphere where PwD feel safe is crucial. In line with the findings by Span et al. (2017), we managed to create such an atmosphere in our meetings with PwD by taking extra time for small talk and allowing off-topic conversations during the interview, making sure they don't feel tested but explaining we need their expertise, having a regular moment of contact during the product use period, always include their partner, and by embedding the interview in an informal conversation.

Conclusion

In this paper, we argued that loss of initiative is an overlooked key issue in the literature on designing for PwD. We introduced Inviting as a design principle in design for dementia. After exploring ways to actively invite PwD to interact with a product, we showed how this new principle could inform the design of a music player for PwD who live at home: we combined agency and behavior change strategies to design the product's inviting behavior. This resulted in a music player that actively invited PwD to use it. The evaluation of the music player in the homes of PwD provided insight into how PwD experienced the invitation behavior and underlined the importance of designing for loss of initiative. This paper provides designers and researchers new insights on design for dementia and a practical example of how loss of initiative can be addressed in product design.

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