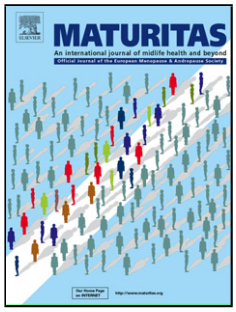

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PII: S0378-5122(19)30175-6
DOI: https://doi.org/10.1016/j.maturitas.2019.06.011
Reference: MAT 7209

To appear in: *Maturitas*

Received date: 15 March 2019
Revised date: 15 June 2019
Accepted date: 27 June 2019

Please cite this article as: Ludden GDS, van Rompay TJL, Niedderer K, Tournier I, Environmental Design for Dementia Care Towards more Meaningful Experiences through Design, *Maturitas* (2019), https://doi.org/10.1016/j.maturitas.2019.06.011

Environmental Design for Dementia Care Towards more Meaningful Experiences through Design

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Highlights

- (Systematic) reviews from the fields of assistive technology for dementia care and healing environments research show opportunities for environmental design for dementia care.
- Insights from both fields could better inform the designers of dementia care environments.
- A multidisciplinary and user-centred design approach might broaden opportunities for more meaningful environmental design for dementia care.

Abstract

Dementia is generally considered to be one of the most pressing societal issues now and in the years to come. Although insights from different disciplines have contributed to a better understanding of dementia and the development of interventions targeting dementia symptoms, there is a lack of integration of insights from these different perspectives for the purposes of design for dementia. The aim of this paper is to show how insights from environmental psychology and advances in technology can inform a user-centred multidisciplinary design approach. To this end, first a brief meta-review of (systematic) reviews from the fields of assistive technology for dementia care and healing environments research is presented, after which gaps and opportunities for a multidisciplinary design approach are identified. To illustrate what such an approach could look like, two exploratory case studies are presented in which technology-enhanced prototypes of an experience handrail (aimed at facilitating wayfinding by providing meaningful sensory experiences) and a virtual nature installation (aimed at providing relaxation and stimulating social engagement) were implemented at a Dutch care centre for people with dementia. Preliminary evaluations indicate that these designs contribute to the wellbeing of people with dementia and confirm the fruitfulness of the design approach presented in this paper. Furthermore, this approach may not only provide a means to optimize existing environments and enhance ease of living, but may also lead to novel solutions to the challenges people with dementia face on a day-to-day basis, and improve their quality of life.

Keywords: dementia; design; environment; multi-sensory experience; user-centred design approach

Introduction

Dementia (characterized by a progressive decline in cognitive, social, and emotional abilities) is a growing global challenge. To illustrate, in 2010, close to 36 million people were living with dementia worldwide, and this number is expected to double every 20 years [1]. In other words, whether it is in our own lives or in the lives of those close to us, dementia (of which Alzheimer's disease is the most common and well-known variant accounting for 50% to 75% of all cases [2]) will increasingly become part of our daily lives.

Not surprisingly then, over the past decades much attention has been given to design for people with dementia, and the people who care for them in their daily lives. Most of these efforts have originated from either the field of assistive technology (with a focus on assistive devices and systems aimed at supporting people in activities of daily living), or from the field of healing environments and environmental psychology (aimed at studying how the design of home and care environments could support people with dementia, and contribute to their wellbeing).

This increasing attention for design for dementia notwithstanding, there is a lack of integration of insights from these different perspectives for the purposes of design. That is, assistive technology approaches are primarily centred on technology development and less so on user needs and psychological processes involved. On the other hand, insights from environmental psychology may be highly relevant for the design of care and healing environments, but it is often difficult to make these findings actionable for designers. Additionally, focus in this domain is usually *not* on technology development, which is unfortunate considering the many opportunities offered by technology when integrated in the built environment.

Hence, in this paper, we argue that this lack of integration from findings across disciplines results in less than optimal environmental designs for people with dementia in terms of meaningful experiences and wellbeing. To make our case, we will first present a brief meta-review of recent reviews in the fields of assistive technology to support dementia care and healing environments research. Based on the gaps and opportunities identified here, we will argue for a user-centred design approach in which meaningful sensory experiences and social engagement are enhanced through technology-inspired design. To illustrate the fruitfulness of such an approach, best practices from the field of product design (for dementia) will be discussed, after which we will present two case studies demonstrating how this approach may also be successful when emphasis is on environmental design.

Methods

Search strategy

We performed systematic searches in Scopus, PubMed and MEDLINE (Web of Science) aimed at identifying (systematic) reviews in two different fields that study design for dementia care, as explained in the introduction. Reviews published until May 2019 were included.

To identify reviews in assistive technology supporting dementia care we used the following search terms: “assistive technology” AND “dementia” AND “systematic review”. To identify reviews on the influence of the care environment on wellbeing (and related outcome measures) of people with dementia we used the following search terms: “nursing home environment” OR “built environment” OR “architectural design” AND “dementia” AND “systematic review” OR “review”.

Selection of studies

The combined searches led to a total of 51 articles (21 on assistive technologies and 30 on the design of environments, see Figure 1 for PRISMA diagram). We excluded articles that were not complete systematic reviews and those that were not in the English language. We also excluded studies that focused on support of only one particular outcome measure (i.e. wandering behaviour, wayfinding or memory support). Furthermore, we excluded reviews that did not exclusively focus on people with dementia (but, for example, on mental disabilities or elderly in general). Finally, five relevant systematic reviews were identified for assistive technology supporting dementia care and four systematic reviews were found on influences of the care environment on wellbeing of people with dementia.

Next, we will further discuss the results of these two fields separately and will then come back to how the combined results inform future opportunities for the design of dementia care environments.

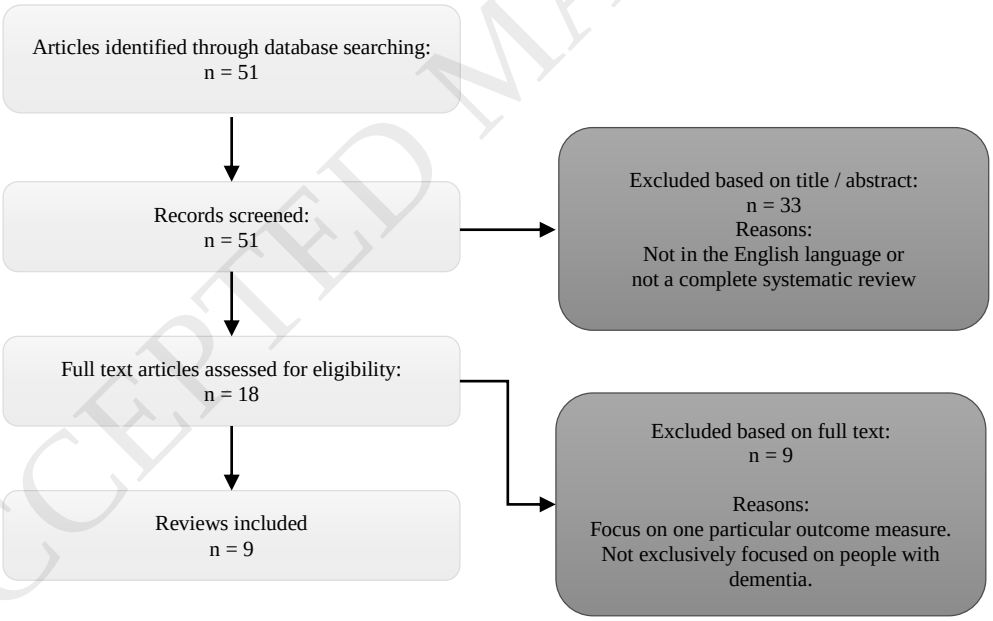

Figure 1. PRISMA diagram with exclusion criteria.

Results

Assistive technology supporting dementia care

Table 1 presents an overview of the systematic reviews on assistive technology supporting dementia care that were included in this brief meta-review, the number of studies that were included in the final stage of the reviews, and the main conclusions from the reviews. Systematic reviews in this field have both been focused on identifying assistive technologies used in dementia care as well as on studying their effects on (the lives of) people with dementia. Although all reviews concluded that the range of ATs is expanding [3,4,5,6,7], the conclusions of the reviews on their effectiveness in providing support to people with dementia and their carers differ. Most of the devices and systems identified focus on activities of daily living (such as eating, bathing, and dressing), safety-related monitoring (e.g., identifying patterns of abnormal behaviour), and assistance with cognitive or physical tasks (such as cognitive assistants or memory aids). However, as also pointed out by Evans et al. [3], research exploring technologies to support leisure or recreational activities or facilitating social engagement amongst people with dementia is scarce. Furthermore, when looking at design processes adopted in this field, few studies report on user centered or participatory design approaches in which user needs, preferences and values are the starting point of technology development [3]. As a result, many technologies target a vast and heterogeneous population comprising people with dementia in different stages and with different needs and capabilities [4, 7].

Table 1. Systematic reviews on assistive technology supporting dementia care

Reference	Title	# studies	Main conclusions
Fleming & Sum (2014)	Empirical studies on the effectiveness of assistive technology in the care of people with dementia: A systematic review	41	General use of the assistive technology available did not establish a positive difference to the lives of people with dementia.
Evans, Brown, Coughlan, Lawson, & Craven (2015)	A systematic review of dementia focused assistive technology	176	The majority of AT currently available support day-to-day living activities and can assist in health care. Devices merely address the 'ease of living' rather than focus on 'quality of life'.
D'Onofrio, Sancarlo, Ricciardi, Panza, Seripa, Cavallo, Giuliani & Greco (2017)	Information and Communication Technologies for the Activities of Daily Living in Older Patients with Dementia: A Systematic Review	26	There is a potential for ICT's to support dementia care at home and to improve quality of life for caregivers, reducing healthcare costs and premature institutional care for these patients.
Ienca, Fabrice, Elger, Caon, Pappagallo, Kressig & Wangmo (2017)	Intelligent Assistive Technology (IAT) for Alzheimer's Disease and Other Dementias: A Systematic Review	571	The IAT spectrum is expanding rapidly in volume and variety over time, and encompass intelligent systems supporting various assistive tasks and clinical uses. At the same time, the results confirm the persistence of structural limitations to successful adoption including partial lack of clinical validation and insufficient focus on patients' needs.
Daly Lynn, Rondon-Sulbaran, Quinn, Ryan, Mc Cormack, Martin (2017)	A systematic review of electronic assistive technology within supportive living environments for people with dementia.	61	An extensive variety of technical interventions were found. A wide range of positive outcomes as well as several challenges were found associated with the use of technology solutions. Acceptance of the intervention by the person living with dementia can be challenging. Interventions need to be well defined and structures to be effective.

Influences of the care environment on wellbeing of people with dementia

Table 2 presents an overview of the reviews that were included, the number of studies that were included in the final stage of these reviews and their main conclusions. Reviews in this field have stressed the importance of environmental factors such as unit size, building layout, homelike character sensory stimulation and lighting conditions on wellbeing, and related measures such as orientation and restless walking (i.e., wandering), social

engagement, and feeling at home [8, 11]. Another review focused on the effectiveness of built environment interventions in managing behavioural and psychological symptoms of dementia [9]. Additionally, promoting physical activity has been a goal of one of the reviews [10]. Although the approaches of the reviews included differ, most interventions are functional in nature and foremost address safety and related tasks such as wayfinding. Conclusions about the effectiveness of interventions differ largely. Chaudhury et al [11] conclude that more diverse sample populations and longitudinal study designs are needed.

Table 2. Systematic reviews on influence of the care environment on wellbeing of people with dementia

Reference	Title	# studies	Main conclusions
Marquardt, Bueter & Motzek (2014)	Impact of the design of the built environment on people with dementia: An evidence-based review	169	Specific design interventions are beneficial to the outcomes of people with dementia. Overall, the field of environmental design for people with dementia is well researched in many aspects and only few gaps in the knowledge were identified.
Soril, Leggett, Lorenzetti, Silvius, Robertson, Mansell, Holroyd-Leduc, Noseworthy & Clement (2014)	Effective use of the built environment to manage behavioural and psychological symptoms of dementia: A systematic review	5	The range of built environment interventions is broad… There is inconclusive evidence to suggest a built environment intervention which is clinically superior in long-term care settings.
Anderiesen, Scherder, Goossens, Sonneveld (2014)	A systematic review - physical activity in dementia: The influence of the nursing home environment	24	Positive results on levels of physical activity were found for music, a home like environment and functional modifications. Predominantly positive results were also found for small-scale group living concepts. Mixed results were found for bright or timed light, the multisensory environment and differences in the building footprint.
Chaudhury, Cooke, Cowie, Razaghi (2018)	The Influence of the Physical Environment on Residents with Dementia in Long-Term Care Settings: A Review of the Empirical Literature	103	There is substantial evidence on the influence of design interventions on residents' behaviors and well-being in care facilities. Future research needs to place greater emphasis on environmental intervention-based studies, diverse sample populations, inclusion of residents in different stages and with multiple types of dementia, and on longitudinal study design.

Conclusion and discussion

Both in the field of assistive technology supporting dementia care as well as in reviews on the influence of the care environment on people with dementia, we observed that the majority of interventions is aimed at (monitoring for) safety and at management of behavioural symptoms of people with dementia. At the same time, in both fields this focus on safety and symptom management is noted and calls for more research attention to 'quality of life' [3], 'addressing patients needs' [4] and 'homelike and multisensory experiences' [8,10] are voiced, although evidence to warrant such strategies is still scarce. Furthermore, in reviews on assisted technology development, the lack of a multi-disciplinary approach involving stakeholders (including end users and designers) is pointed out as a reason for the lack of adoption of assistive technology. In reviews on the influence of the care environment, there is less consensus at this point.

Design for dementia

Although design practice certainly benefits from insights on effects of environmental factors and assistive technologies, the reviews discussed reveal several issues which thwart successful implementation of these insights in design practice. And although several best practices from the domain of product design can be identified which *do* fuse a multidisciplinary approach with a focus on patient needs and technology, such best practices are often highly personalized, which prevent generalization to people with dementia in general. Additionally, they usually address product (rather than environmental) design, and by consequence address dyadic interactions involving a person with dementia and a particular caretaker or family member rather than multiple people with dementia (such as residents in a care center). Nonetheless, these best practices may be highly inspirational.

For instance, consider the LAUGH project [12] which aims at developing highly personalized designs aimed at providing sensory stimulation and promoting connectedness to

others. Based on findings from participatory workshops testifying to the importance of playful activities that induce laughter, a set of six Giggle Balls were developed (for a woman who had enjoyed being a bowling club member for many years). The balls are made of felt and contain a small tilt sensor, speakers and microcontroller containing sound files of children's laughter. When turned over in the hand, the balls 'giggle'.

Similarly, the TACTILE DIALOGUES project [13] revolves around the design of an interactive textile pillow for communication between sufferers of dementia and their carer(s). Interaction between people with dementia and their carer(s) is often difficult, but at the same time hugely important. This cushion, with its built-in vibratory pads, stimulates physical communication, reacts to the touch and movements of the hand, and thus initiates a dialogue between the patient, family and caregivers.

These practices show how design and technology may be fused in a user centered design approach order to address needs for social engagement, fun and relaxation (precisely those aspects which are often ignored in the fields of assistive technology and environmental factors). In the next section, we will present two case studies which demonstrate how a similar fusion may also inform environmental design for dementia.

Case studies – Rationale and Setup

The case studies discussed next depart from the potential of multi-sensory design and nature elements. Importantly, when moving through the stages of dementia, cognitive functioning gradually diminishes whereas capacities for sensory exploration and mindful experience in the immediate moment (i.e., direct experience not mediated by cognitive interpretation; [14]) remain intact. Both multi-sensory experience and exposure to nature have been shown to be successful strategies [15], precisely because they promote mindfulness through directing attention to sensory experience in the present moment.

In both cases, the final designs (i.e., functional prototypes) were implemented in close collaboration with a Dutch residential care and nursing home at the corridors of the psychogeriatric ward. In both case studies, ethical guidelines and related behavior protocols established by the supervisory board of the care centre were observed.

Case study I – Experience handrail

The objective of the first case study was to design an environmental intervention that reduces restlessness and related wandering behavior and provides meaningful sensory experiences instead. Wandering is very frequent during dementia (between 15% to 60% of diagnosed people) and is associated with higher risks of negative events such as falling, getting lost, fatigue, or emotional distress [16]. Wayfinding difficulties appear to be closely related to wandering [17], and are present in early stages of dementia due to cognitive changes [18].

Current solutions often involve applied graphics (e.g., large-scale door or wall stickers) aimed at facilitating room identification and at improving orientation around the ward). Such solutions have been shown to promote autonomy by enabling people with dementia to walk alone [e.g., 19]. What is also apparent from these examples is that such cues might facilitate wayfinding by creating distinctive spaces and zones with clearly assigned functions and meanings (i.e., a wall sticker clearly designating an area as reading area [18, 20, 21 ,22]. On a more abstract level, such cues might create perceptual contrasts (i.e., contrasting colours) which assist residents in identifying where one area stops and another one begins [cf. 18].

However, although various design efforts in this domain have already been successful, they have so far not led to integrated design solutions. One of the drawbacks of door stickers, for instance, relates to the fact that they only address the visual sense whereas

they represent a multi-sensory scene. As a result, they may trigger certain bodily actions (grasping a door knob or ringing the bell) which vision-only representations do not afford. This may induce feelings of anxiety and this is particularly unfortunate when considering the potential of multi-sensory design for people with dementia.

Specifically, findings from dementia research on multisensory stimulation in the care environment suggest that it can increase brain activity, alertness, and enhance general wellbeing [e.g., 23]. For instance, associations triggered by various textures, colours, and sounds may implicitly (i.e., without requiring cognitive effort) inform residents about their location in a specific setting. The observation of shorter reaction times for multisensory (rather than uni-sensory) items in older adults without cognitive impairments suggests a benefit to combine stimuli originating from different (natural) objects to compensate age-related sensory declines [24]. Similarly, multisensory information might facilitate the perception and orientation of people with dementia by making their environment more coherent. Finally, variations in terms of, for instance, color and texture could trigger curiosity of residents, encouraging them to walk towards the stimulus or to explore it further.

Hence, the design direction for this case was defined as developing a multi-sensory, technology-enhanced design intervention in the environment which would diminish restless walking and hence promote wayfinding by directing attention at specific elements representative of different places along the corridor. For this goal, it was decided to design an experience handrail. Taking the insights presented as a starting point, the experience handrail was designed (see Figure 2).

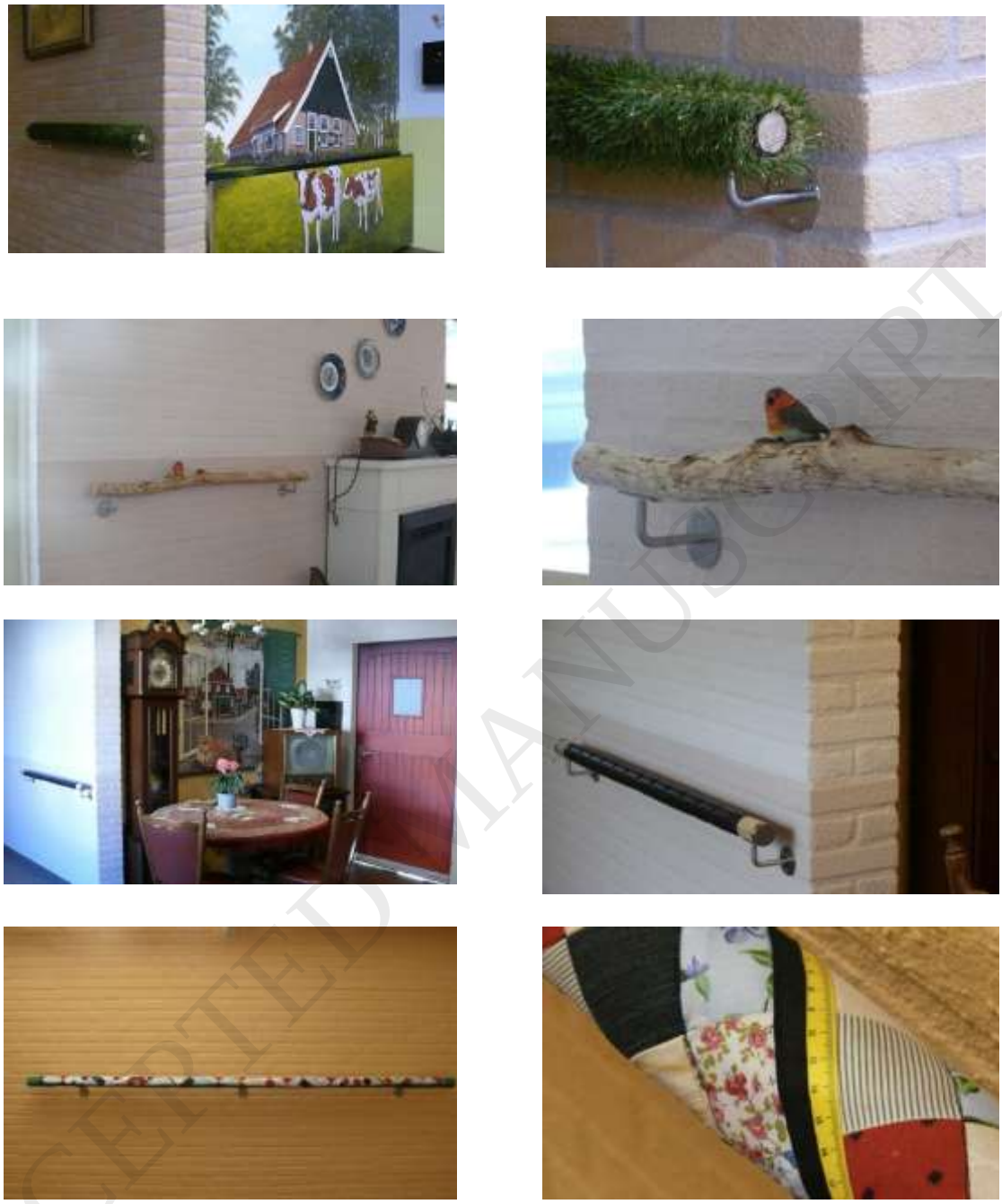

Figure 2. Handrails matching different scenes (4 of the in total 6 categories are shown). (From top to bottom: farm scene with grass handrail; handrail near garden with bird, living room scene with leather handrail, handrail near sewing room).

A series of different handrails were developed which integrate meaningful multi-sensorial elements in order to support orientation, purposeful walking, and wayfinding. To this end,

handrails with various textures, colours, and sounds were designed to match existing scenes along the walking path of the psychogeriatric ward. This resulted in 6 categories of multisensory handrails (i.e., handrails for, respectively, the sewing room, kitchen, cinema, living room, garden, and farm). For each scene, recognizable features were integrated in the design and fitting materials, textures, and (where applicable) sounds were selected to be congruent with the depicted environment.

For example, the handrail guiding residents towards the sewing room is covered in several fabrics sewed together, whereas the handrail near the farm comprises a tactile cover resembling grass. As for technology-enhanced design features, the handrails are equipped with sound-activating sensors (either reacting to absence of light or reacting to pressure). For instance, when someone puts pressure on the handrail near the sewing room, the sound of an old sewing machine is played. Likewise, upon touching the handrail next to the garden, a bird (positioned on top of the handrail) starts singing.

Six categories of handrails were actually implemented in the care environment. To introduce residents to the new handrails, they were taken along for a walk along the corridor by a care professional. Preliminary observations and informal talks suggested that residents mostly enjoyed the different experiences provided by the handrails. Subsequent interviews with care professionals revealed that residents walking along the corridor showed a tendency to spontaneously grab the handrail throughout their walk at various moments. Hence, the textures and colours stimulated further exploration and tactile interaction.

Case study II – Virtual Nature

Departing from studies in environmental psychology testifying to the benefits of interacting with nature, in this case study we aimed at enhancing social engagement amongst residents, thereby also promoting relaxation and reducing restlessness.

Interestingly, a large number of studies suggests that benefits from visiting or spending time in nature may also transpire when exposure is indirect (e.g., watching videos or pictures of nature; [25]), as is also the case in virtual reality (VR) where people can have the feeling of exploring places (and experience related emotions such as excitement and a sense of adventure or awe). Recently, VR technology has become popular in dementia care [26, 27, 28], usually with the aim to calm patients and improve their mood. An advantage of VR is that it offers easy and safe access to natural environments regardless of weather conditions or availability of nursing home staff accompanying residents outside. Additionally, VR comes without the risk of hazard (e.g., falling or getting lost). These two factors (i.e., hazard and limited time) are reported as two main barriers to the use of a (real) garden for people with dementia [29].

When further looking at research in nature psychology, Kaplan and Kaplan's [30] attention restoration (ART) theory offers an explanation for *why* nature is wholesome. Specifically, the idea here is that nature is restorative (and therefore calming and relaxing) because it presents an infinite richness of stimuli (e.g., small leaves rustling in the wind, clouds passing by), but at the same time appeals to people's attention mechanism in an effortless manner (it does not take cognitive effort to behold clouds rolling by). It is this key characteristic that has been labelled 'soft fascination' [30] in order to stress nature's explorative potential ('fascination') and its non-demanding character ('soft'). It is this non-demanding (soft) character that makes nature so wholesome for frail elderly, including people with dementia. Furthermore, nature is intrinsically linked to positive affect and positive

emotions [30] which broaden one's focus [31], and which facilitate initiatives to engage and connect to others.

Additionally, recent findings have stressed the importance of spaciousness as it may be particularly suited to enhance social interaction. That is, on a psychological level, spaciousness has been shown to stimulate communication [32, 33]. For instance, Okken et al. [32] showed that spacious surroundings stimulate self-disclosure (i.e., the willingness to engage with others in social interaction). Furthermore, in a study addressing the relationship between natural (wild) surroundings and (spiritual) inspiration, participants pointed to the expansiveness of the landscape as an important precondition for inspiration and wonder [31, 34]. Finally, Piff, Dietze, Feinberg, Stancato, & Keltner [35] recently showed that spacious settings promote a more collective (as opposed to a more individual) mind-set, likewise promoting social interactions.

In short, incorporating soft fascination in spacious nature scenes might be a particularly promising design strategy for promoting relaxation and engagement. Based on these insights from nature psychology, a variety of technology-enhanced nature scenes were designed based on the soft fascination and spaciousness principles discussed above.

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Figure 3. Virtual nature. Top row: animated forest scene; middle row: animated cloudscape; bottom row: animated ocean scene

As can be seen in Figure 3, all scenes portray a still spacious scene (first layer); a vista to look out over. The second layer comprises a multitude of animated fascinating elements to look at (e.g., a flock of birds, trees, or a cloudscape), ensuring there is the feeling of something happening which prompts interest, wonder and subsequent conversation. The virtual nature installation was installed in the corridor of the ward. The animated virtual nature scenes are projected via a beamer on the wall. Using a Kinect camera, positioning of users (seated on a bench in front of the projection) is tracked, and a shadow is projected in the scene, thereby enhancing the feeling of actually being there. By bringing people together in

this way and by and providing them with a conversation starter (things happening in the scene), an informal setting for exchanges with residents and visitors is provided which offers something concrete and in the present moment to talk about that is not illness-related. In line with this notion, previous research in dementia care testifies to the importance of a non-institutional character for prompting and supporting informal social interactions [36, 29].

Shortly after installation and several months later, care personnel indicated that the VR nature scenes were highly successful in promoting a positive, relaxed atmosphere, and in promoting social engagement amongst residents at the care centre and family visiting. The combination of a still scene with an added layer of subtly animated stimuli successfully triggered conversation as indicated, amongst others, by pointing behaviors by residents (as illustrated in Figure 3). Importantly, it is this spontaneous unfolding of informal interactions that is difficult to initiate and support by caregivers. These preliminary findings attest to the potential of technology-enhanced nature scenes incorporating evidence-based nature features (such as spaciousness and soft fascination in this case).

Conclusion

What these case studies show is that the fusion of technology and insights from (environmental) psychology may inform a user-centered design approach which not just provides means to optimize existing environments, but can also lead to novel solutions to address challenges people with dementia face on a day-to-day basis. Thus, design can be considered as a vehicle within which these different disciplines can be brought together for the purpose of providing people with dementia with tangible and engaging applications which not only provide solutions to problems, but also enrich people's lives by enabling autonomy, empowerment, and social engagement.

Importantly, both designs were prototyped and implemented in an existing care setting. Observations and informal interviews provided first indications that these designs may indeed promote social engagement (virtual nature), reduce restlessness (both cases), and facilitate wayfinding (experience handrail). They also indicated that such design interventions are easy (and safe) to implement in nursing homes and are well received by staff members. Obviously, more structured evaluations are warranted in order to assess their effectiveness in the long run. In future studies it would be important to include more formal and in-depth evaluation methods. Specifically, it would be worthwhile to include rating scales as a means to get a better and more fine-grained understanding of the diverse effects of our design interventions. For instance, what specifically ensured that the nature scenes were successful in triggering sustained attention and prompting conversations? To this end, rating scales tapping appreciation of specific scenes and experienced fascination for specific elements in the scenes (e.g., animated elements) could be included. Where possible, such rating scales could be administered among residents. Alternatively, caretakers could provide assessments here, including their impressions on the extent to which different scenes inspired animated conversation (activation) rather than calm or states of drowsiness or sleep (deactivation). Additionally, it would be worthwhile to complement such traditional methods with advanced means of interaction analyses. For instance, research in human computer interaction testifies to the potential of proxemics (concerned with the way people use interpersonal distance to understand and mediate interactions with others) and the creation of context-aware environments (which can for instance track location, movement, and orientation of residents) in order to measure social engagement (see for instance Greenberg et al. [37]. Similarly, for the hand railing, it would be worthwhile to not only include more formal assessments by care personnel on effectiveness of the railing (including assessments of the frequency of incidents or episodes of getting lost), but to also use indoor navigation tracking to actually observe

whether the multi-sensory handrails indeed enable wayfinding and provide 'points of interest' (reflected in stops at specific places) along the way. Finally, it would be interesting to see whether interventions of the kind proposed here also relieve burdens of care personnel and informal caretakers. For instance, autonomous wayfinding by residents and prolonged viewing of nature scenes with other residents might also provide moments of relaxation for them. In short, we propose to combine traditional methods with more advanced means of observation and include both patients (where possible) and (formal and informal) caretakers.

Even without these more rigorous evaluation studies we feel safe to conclude that these interventions are promising in so far they a) depart from specific patient needs, b) are based on research findings from the domain of assistive technology and/or environmental factors, c) incorporate technology (i.e., sensor technology and VR), and d) focus on facets of experience usually ignored in other domains (i.e., leisure and social engagement; [3]).

In addition to the benefits outlined before, the designs presented also granted people with dementia with a sense of autonomy and empowerment. That is, in both cases, care personnel could take a step back as residents themselves became the initiators of action (i.e., physical action in the handrail study and social [inter]action in the virtual nature study). Apart from unburdening care personnel, an increase in autonomy may also provide opportunities for interactions with family members to unfold in a more natural and intimate manner. In sum, we propose that the design approach outlined in this paper complements and contributes to existing practice of designing for people with dementia.

Contributors

Geke D. S. Ludden performed the literature review, participated in the execution of case studies, and drafted the review.

Thomas J. L. van Rompay contributed to the revision of the review and participated in the execution of case studies.

Kristina Niedderer contributed to the drafting and revision of the review in relation to the value of design.

Isabelle Tournier contributed to the drafting and revision of the review.

Conflict of interest

The authors declare that they have no conflict of interest. All authors declare that they have no financial and personal relationships with other people or organizations that could inappropriately influence (bias) this work

Funding

No funding was received for the preparation of this review.

Ethical approval

People with dementia participated in case studies with approval of the patient board of Zorggroep St Maarten, Denekamp, The Netherlands.

Provenance and peer review

This article has undergone peer review.

Acknowledgements: We would like to thank Roy Damgrave, Manou Visschedijk, Melissa Smeets, Joost van Vliet and Care Centre Sint Maarten, Gerardus Majella, Denekamp for their collaboration in the design cases discussed in this paper.

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