Frontiers of Architectural Research (2017) 6, 111–122

Available online at www.sciencedirect.com

Frontiers of Architectural Research

www.elsevier.com/locate/foar

RESEARCH ARTICLE

Architectural factors influencing the sense of home in nursing homes: An operationalization for practice

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Received 20 November 2016; received in revised form 19 February 2017; accepted 20 February 2017

KEYWORDS
Sense of home;
Aging-in-place;
Older people;
Residents;
Alzheimer;
Caregiver;
Architecture

Abstract
Various studies have shown that the architecture and design of a nursing home can have a profound impact on the sense of home of old people residing in the nursing home, next to psychological and social factors. However, adequate guidance on how these factors can be operationalized in practice is not provided for architects and interior designers. This study investigated which architectural factors contribute to a sense of home and how these can be implemented in the design guidelines. Two existing data sets were used, combining the most recent evidence from the literature and experiences of residents, family caregivers, and professional staff of Dutch nursing homes. These analyses resulted in theoretical implications for the private space, quasi-public space, the look and feel of the nursing home, and the outdoors. Furthermore, these analyses were used for the design of a demonstration apartment that integrates the factors of the sense of home. This description was concluded by a checklist for practice, in which design guidelines were formulated. A holistic

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Peer review under responsibility of Southeast University.

http://dx.doi.org/10.1016/j.foar.2017.02.004

understanding of which factors influence the sense of home could lead to improvements of the sense of home of nursing home residents.

1. Introduction

A great variation in nursing homes exists across the world. In general, nursing homes provide an alternative place of residence, where 24-h care and assistance is offered by professional caregivers when people can no longer reside in their own home environment due to increasing need for assistance in daily activities, complex health care, and nursing needs (van Zadelhoff and Verbeek, 2012; Sanford et al., 2015). Admission to a nursing home is a major life event, because most individuals do not wish to leave the home they have lived in for a long time (Gillsjö et al., 2011). Nursing homes have a dual nature as an institution and as a home. Traditionally, the nature of being an institution was emphasized, because nursing homes were based on a medical-somatic model of care, emphasizing illnesses and treatments of underlying pathology. Nursing homes were institutions; they were protected settings, in which all caregiving was aimed at keeping residents safe (Foldes, 1990), with rules and routines permitting minimal individualization. Physically, nursing homes resembled hospitals, incorporating design features, such as a nursing station, shared bedrooms and bathrooms, and staff in uniforms. Nowadays, however, patient-centered models of care are prominent, which emphasize strengthening residents' autonomy and overall well-being.

Older people should be able to continue their lifestyle prior their admission to a nursing home (Verbeek, 2016). Therefore, several health care organizations attempt to provide living arrangements that focus on "the good life" and create an environment that resembles a home to its residents, instead of a health care facility in which they reside (van Dijck-Heinen et al., 2014). Delivering both good (clinical) care and a homelike environment is challenging. Focusing on safety and health requirements can create risk-aversive environments against the quality of life in nursing homes (Parker et al., 2004). These notions reflect the statements on nursing homes, which, in the words of Goffman (1961), are a total institution. A total institution is a place of residence in which a group of people with a similar situation live together; the place is formally administered away from the wider mainstream community around its residents. Despite being separate communities, evidence shows that a nursing home can be perceived as a home (Wahl, 2001).

One of the challenges in modern day nursing home care is creating a sense of home for the residents. The sense of home is a multifactorial phenomenon, which is highly influenced by social and personal characteristics, as well as the built environment or architecture of the facility. A sense of home is related to personal experiences and emotions. It does not happen overnight but is gradually developed by the person in whom independence, security and the source of own identity, choice and controls, and memories, are essential (Bland, 2005; Kane et al., 1997; Nakrem et al., 2013; Molony, 2010; Cooney, 2012; Falk et al., 2013; Rijnaard et al., 2016; Van Steenwinkel et al., 2012; van Hoof et al., 2015a, 2016b, 2016b; Felix et al., 2015; Sixsmith, 1986). Developing a sense of home is closely related to place attachment theory (Scannell and Gifford, 2010). Place attachment is a multidimensional phenomenon that describes the emotional bond between people and place, which is influenced by one's personal experiences.

Rijnaard et al. (2016) systematically reviewed the factors influencing the sense of home of old people residing in a nursing home. Their review showed that the sense of home of nursing home residents is influenced by 15 factors, which are divided into 3 themes. The first theme comprises psychological factors, including the sense of acknowledgement, preservation of one's habits and values, autonomy and control, as well as coping. The second theme consists of social factors, which include interaction and relationship with staff, residents, family, friends, and pets, as well as activities. The third theme is the built environment, which includes the private space and the (quasi-)public space, personal belongings, technology, the look and feel, and the outdoors and location. van Hoof et al. (2016a) studied the factors influencing the sense of home of old people residing in a nursing home from the perspective of residents, relatives, and care professionals through a photo-production study. Findings showed that the building and interior design are major contributing factors to a sense of home. The main challenge for architects, facility managers, and interior designers is to translate these themes into an integrated and realizable design. The themes constituting a sense of home should be elaborated in each programming and design phase, and conforms with healthcare organizations.

Another challenge for architects, facility managers, and interior designer is integrating a design specification that relates to the sense of home into a design of nursing homes, which is often based on dementia-friendly design models. Zeisel (2005), among other scholars, stated that several dementia care units exhibit a holistic understanding of integrating the separate elements of design guidelines to achieve an increased quality of life for the residents. Even willing designers did not seem to understand the full extent of the guidelines for designing a setting that provides residents with cues to help understand where they live. Guidelines that correlated the environmental design to behavioral outcomes (Zeisel et al., 1994, 2003; Fleming et al., 2003; van Hoof et al., 2010) alone are thus not yet a guarantee that all goals are achieved.

Despite existing evidence, constituting a sense of home in nursing homes was proven difficult in daily practice. The care environment does not often match with the therapeutic goals

that person-centered care approaches aim to realize, which is perceived as an important barrier (Cohen and Weisman, 1991; Verbeek, 2016). Thus, the present study aims to examine the architectural factors that contribute to a sense of home and how these can be implemented in design guidelines for practice. This study elaborates the theoretical themes related to the built environment in relation to the sense of home, and suggests these themes to practice health care organizations, architects, and decorators by formulating a preliminary overview or checklist for architects. Findings are presented as a case study or operationalization, i.e., as a design for an apartment that was retrofitted in a Dutch nursing home in Q1–Q3 of 2016.

2. Methodology

This study is divided into two parts. Part I includes a theoretical overview of how factors in the built environment affect the sense of home of nursing home residents. Part II concerns the operationalization of these findings into the architectural design of a nursing home apartment that was retrofitted in 2016.

In Part I, a secondary data analysis was conducted using existing data sets. These data sets were obtained from an international systematic literature review (Rijnaard et al., 2016) and integrated with the original findings from a user-centered perspective, i.e., real-life experiences of residents, family caregivers, and professional staff as collected in the photo-production study by van Hoof et al. (2016a) in the Netherlands.

The first data set (Rijnaard et al., 2016) was derived from a systematic review of mixed studies. Five scientific databases (including MEDLINE, Scopus, and CINAHL) were searched using a combination of two groups of keywords: one focusing on the "meaning of home" or "sense of home" and the second on "care home" or "nursing home". The full-search strategy is found in the study of Rijnaard et al. (2016). The inclusion criteria were as follows: (1) original and peer-reviewed research; (2) qualitative, quantitative, or mixed methods research; (3) research about participants who reside in a nursing home or a similar type of housing facility; and (4) research aimed at investigating factors that influence the sense of home, meaning of home, and at-homeness or homelikeness. Seventeen out of 2618 articles were included. The majority of these studies only contained qualitative research data. In the study by Rijnaard et al. (2016), the sense of home of nursing home residents is influenced by 15 factors, which are divided into three themes. The third theme is the built environment, which include the private space and the (quasi-)public space, personal belongings, technology, the look and feel, and the outdoors and location. For this design study, the findings in the third category (built environment) were reconsidered for the operationalization phase.

The second data set was derived from van Hoof et al. (2016a), who studied the factors influencing the sense of home of old people residing in nursing homes, focusing on people with chronic somatic illnesses and mild dementia from the perspective of residents, relatives, and care professionals. A total of 78 participants (n=34 residents, n=18 relatives, and n=26 care professionals) from 4 nursing homes in the Netherlands were engaged in a qualitative study, in which photography was used as a supportive tool for subsequent individual interviews (with residents both with and without dementia) and focus groups (with relatives and staff). The data were analyzed based on open-ended coding, axial coding, and selective coding (van Hoof et al., 2016a).

The current design study used the data to specifically investigate the role of the built environment in developing a sense of home.

Part II of this study addresses the design in a supposed operationalization phase that was guided by both data sets of Part I. Furthermore, the data were used to develop a checklist for architects. The design was based on the joint description of a fictional persona by two of the authors (JVH and AE). The persona was operationalized in a design scenario, which is described as a sequence of the rooms and spaces, and the way design features contribute to a sense of home. Moreover, the retrofitting project also incorporated design features that address the independence of residents and human factors of care professionals. The design of the apartment was applied in the actual retrofitting of an apartment inside an existing nursing home in Eindhoven, the Netherlands. The surface area of the apartment was 58 m^2, which is relatively large for Dutch standards. The apartment would be used as a test and training facility for a nursing home organization and its care professionals and residents.

3. Results: feeling at home in nursing homes and the role of the built environment

The themes and quotes of both data sets were merged, and five "architectural" themes were identified, which reflect the state of the art of the scientific literature and residents' perspectives. The built environment includes the layout of a space, its interior design, and the surroundings. Results from the literature and qualitative study from the perspective of residents, their family members, and staff show that the following factors contribute to a sense of home: private and public spaces, personal belongings, technology, look and feel, and the outdoors and location (Rijnaard et al., 2016; van Hoof et al., 2016a). These factors constitute the theme "built environment." This theoretical section outlines how these factors influence the sense of home.

3.1. Private space

A "sense of home" is associated with having a private room in a nursing home. A shared bedroom is often unacceptable for most residents. The desire for a private room may have a foundation in having opportunities to be on one's own, the wish for privacy, and having personal belongings around oneself. Residents value spending time in their own room or apartment, and being engaged in domestic chores. Residents have a need for being on their own, withdrawing to their own room, and creating their own environment. These sentiments are also shared by their family members.

> *"Having your own key is essential. I now have the key to my mother's room, we always had a key." [relative]*

The need for privacy seems to be a main driver for having a private room. The spontaneous opening of doors of private rooms is one of the actions hindering privacy. Residents want to stay in control of their own room and how it looks.

> *"It is important that my table is full of stuff, and that I am allowed to leave it full of stuff." [resident]*

All residents indicated that having a private room with private sanitary facilities is a must, as well as having a separate bedroom or recess for sleeping. Some residents indicated that their private rooms were over-furnished and that they want a larger space. Residents with larger apartments may have better opportunities to have visitors when they want. Having a private bathroom was also indicated, especially if they could access it without difficulties, and they could wash and shower by themselves. Sharing a bathroom with another resident may result in a lack of control in using the toilet.

3.2. Public space

Residents should come out of their private room to engage with others. A shared living room may reflect unclear and rather inconsistent expectations. Sometimes the communal space can also cause distraction and confusion. Interior symbols in the living room, such as family photographs, carpets, and tablecloths, should be clear and consistent to provide the room an ambience of a living room instead of a waiting room. The boundaries between the public and private spheres are ambiguous and thereby differ from the comparatively sharp boundaries characterizing a home. In general, a smaller residential density, including family-style dining, increases the perceptions of belongingness. In many facilities, residents may have their own place around the (dining) table. Having a private chair can help residents to feel at home. In terms of a familiar interior design, relatives speak of chairs, special crockeries, and having a private chair in a preferred spot.

Adequate closet space, display space, and storage for personal items and professional equipment should be provided. The building should be designed in such a way that care professionals cannot lock themselves away from the residents because they should be easily approachable. Some other aspects of the public space were found to be important, such as the need for a place to walk (e.g., an oval so people would not arrive at a dead end). Residents must be able to reach all parts of a space from a wheelchair. Wide corridors and wide doorways were considered vital for easy access for those with wheelchairs.

> *"I don't understand that you put all these obstacles in the corridor. Lately, the corridor has been empty, and I thought that was a positive thing." [staff]*

3.3. Personal belongings

Personal belongings seem as an essential element in developing and maintaining a sense of home. They help create an attachment to a place in terms of nesting[1] and being in charge. Bringing personal histories into the place through beloved items and cherished furniture may contribute to feeling at home.

> *"I brought as many things from home as I possibly could." [resident]*

Certain pieces of furniture in the private rooms of residents were only meant to accommodate significant others, such as family or guests, and thus were considered important. Individual and unique pieces of furniture were a source of delight and could evoke memories. Among the items that were deemed most important were pictures, paintings, and pieces of furniture. Personal belongings reflect emotional value to individuals. Moreover, paintings have particular decorative values and make the room more homelike. Some of the pieces of furniture were brought along at the time of admission for practical reasons, such as lift chairs. An emotional value is often attached to pieces of furniture, because these items remind people of their former home or they were purchased together with a person important to them. Furthermore, residents value the freedom in the choice and positioning of furniture to make their room cozy. To some of the residents, their personal belongings do not contribute (yet) to a sense of home, because the new living situation is rather overwhelming.

3.4. Look and feel

The factors that constitute to the "look and feel" relate to architecture, interior design, and general maintenance. A facility must both look and feel like a home or have a homely feel to be considered as a home. The building should be homey, organized, and welcoming to family members.

> *"Now that the room is all decorated, she has a peace of mind. And she is very content." [relative]*

Satisfaction was negatively influenced by concerns about the physical design, as well as cleanliness. Cleaning tools and products kept inside the private room indicate a sense that the room was kept clean and tidy. In addition, flowers may contribute to a homely atmosphere. The decor, color, warmth, and light of the facility were also important to residents. A homelike environment may also be created by putting residents' artwork on display. Participants did not report the same ease or contentment in settings that were not "homely." A sense of home connected with warmth and coziness. Some of the residents mentioned that daylight access, color, and a "fresh" appearance without smelly odors were important. A hospital-like environment was something all residents participating in the study wanted to avoid. Furthermore, buildings with long corridors and "nooks and crannies" were deemed unsafe. Engagement with the senses by ventilation, a window nearby, or music may provide comfort right at the end of life. Some residents may require an environment that is free of noise or free of excessive visual stimuli. A physical environment that makes

[1] Nesting was specified by Falk et al. (2013) as personalizing an environment by transforming a room to a place of recognition and familiarity that strengthens one's self-identity. In addition, the environment should compensate for the loss of function and frailty.

activities accessible, promotes pleasure and stimulation, and supports all the senses with lighting, acoustics, fresh odor, and tactile qualities, is especially important for those with limited mobility. Moreover, physical comfort was considered a major aspect by the residents sharing a room. Chairs that did not fit the body shape were a major problem. A homelike appearance in the shared rooms was preferred to encourage a sense of home for the residents. Furniture were preferred to have homelike characteristics, such as having an old style or wood as a material. Institutional environments with neutralized single hue interiors without contrasts and natural lacquered wood furniture were undesirable.

3.5. Outdoors and location

The outdoor environment constitutes the outdoor space within the premises of the facility and the neighborhood at large. Nursing homes located in large or significantly large cities had a higher proportion of residents who do not feel at home in the facility. Nursing homes located within the hometown or old neighborhood were preferred. The presence of loved ones and children plays a role in this preference. Inaccessibility or loss of familiar places that provided memories of experiences was considered a negative factor in developing a sense of home. Residents may also have a desire going to shops and stores in the neighborhood for making small purchases. Landscaping should be done with care. Solid fencing that blocked a view was a reason for dissatisfaction. Many family members expressed dissatisfaction with the lack of connection to nature and the absence of a garden. A nursing home with a green environment was appreciated.

"Yes, I love being outside." [resident]

Using outside spaces to facilitate engagement with the senses and participation in meaningful activities was regarded as remarkably important by family and caregivers.

"This is the new greenhouse of the nursing home. She always had one herself at home, as well as a vegetable garden. Until a year ago she had chickens as well. About three. And she always had fresh eggs. To her this is a homelike thing." [relative]

Residents may express a desire to go outside the facility more often. Having a view in itself was also important to residents. Residents may not make a distinction among the types of view from the room. Any type of view was appreciated, whether it was a park, traffic, a playground with children, a lively street, or a building. Residents may value balconies and the views from the room.

4. Results: operationalization and design guidelines in constructing a sense of home

In the preceding sections, we have summarized the theoretical factors of the built environment that constitute the sense of home of nursing home residents. We have translated these factors into the design of a nursing home apartment. This apartment can be used as an example to facilitate the sense of home for residents living in nursing homes.

4.1. General design checklist

Table 1 shows an overview of the theoretical factors related to the built environment and the way they influence a sense of home, including psychological and social factors, as well as challenges and design solutions. The table is based on both data sets in Part I of this study and is created to translate the themes to starting points for the operationalization phase of the construction of a sense of home. The purpose of the table is to support architects, facility managers, and interior architects in translating the themes of a sense of home into an integrated and realizable design. The social and psychological factors in this table provide an understanding on why these factors are supportive to a sense of home. This table can be used as a checklist, and it enlarges the chance to support a sense of home for residents.

4.2. Design description

Figs. 1 and 2 show the floor plan of the apartment before and after the architectural transformation. The transformation included adaptation of the floor plan; refurbishment of walls, ceiling, and floor; and placement of technology and furniture (Table 2).

The floor plan of the apartment is dominated by a large living room area with an adjacent kitchen area. Residents enter the apartment through their own front door, which leads to a small corridor area with an adjacent meter cupboard and a laundry room. Sliding doors provide access to the laundry and living rooms from the corridor area. A separate bedroom is located next to the living room, which leads to a private bathroom. Like a snail's shell, the sequence of spaces leads from semi-public spaces to the most intimate and private area, the bathroom.

For the design of the apartment, a persona was written based on the fictional character of an 82-year old female resident with a personal preference for certain pieces of furniture, a particular color scheme, and personal possessions (Fig. 3). This person was set as the central character for the description and inclusion of design features contributing to a sense of home, as well as the factors supporting professional care and self-care, and independence within the limits of the capacities of someone residing in a nursing home. The space will be dealt with sequentially based on the persona. The persona enables the designers to make a distinction between (1) overall design recommendations that apply to older occupants in general, and (2) the personal interpretation of interior design and decoration that are different from one person to the other. In practice, nursing homes should provide a degree of freedom to residents in decorating a space according to personal preferences as much as possible, without hampering occupational safety of staff and national fire regulations.

4.2.1. Entrance and adjacent spaces

The front door of the home can also be accessed by staff, for instance, to provide residents with new supplies. A digital

Table 1 Checklist for the built environment.

Factor	Sense of home	Challenges to create a sense of home	Design solution
Private space	Nesting; creating attachment to a place; need for privacy; being on one's own; talking in private	Spontaneous opening of doors hinders privacy	A private room, large space, guest space, workspace, separate bedroom. or recess for sleeping; Individual sanitation can be accessed without difficulties
(Quasi-)public space	Engaging with others; physical exercise	Distraction and confusion by ambiguous boundaries and different expectations	Family-style dining; space for private conversations in the living room; a place to walk; accessibility to wheelchairs
Personal belongings	Nesting; being in charge; representing memories and emotional value	Overwhelming new living situation is	Space for personal belongings and furniture in the private space
Technology	Being in charge; improving the ease of life; distraction and link to the outside world	Should be understandable and acceptable to the elderly	Television set in the private room
Look and feel	Satisfaction; welcoming to family members; warmth and coziness; safety		Clear and consistent interior symbols; cleanliness, visually appealing, and without smelly odors; daylight access; balanced engagement with the senses; Contrasting colors; natural lacquered wood; ergonomically designed chairs
Outdoors and location	Presence of loved ones or children; engagement with the senses	Inaccessibility or loss of familiar spaces; degree of urbanization	Walkways, outdoors, and trees; open view (not blocked by fences); garden or balcony; connection to nature; a view of the outside; shops and stores in the neighborhood

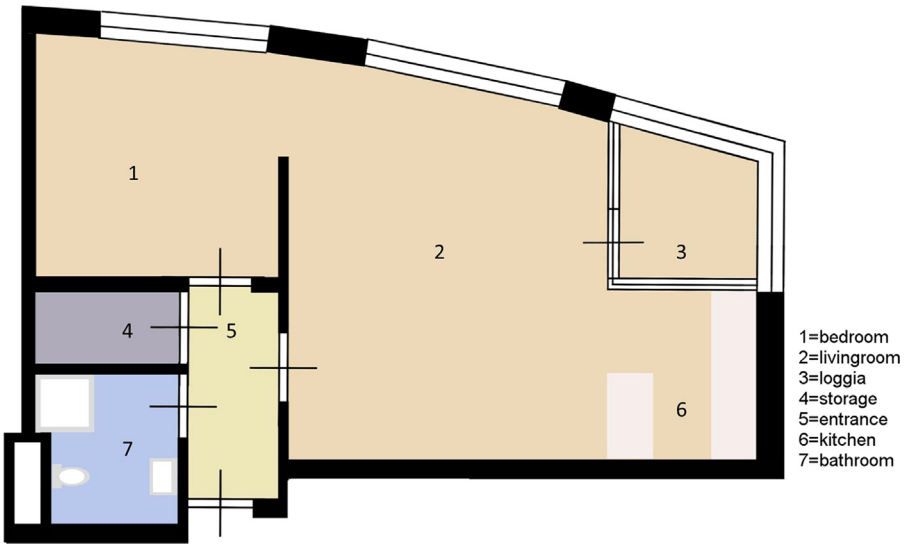

Fig. 1 Floor plan of the "sense-of-home apartment" before retrofitting.

doorbell registers who is standing in front of the door. This device is mainly used by visitors without dementia, such as relatives and staff. Residents control who is allowed to come in by being in charge of opening the front door. Facilities for laundry are placed to create normalcy. Family carers can help assist doing laundry; thus, relatives no longer need to take home worn clothes, or tag clothes and send off to a professional laundry facility. Towels can be disposed in the bathroom by inserting them into a laundry basket that empties into the meter cupboard (switchboard) area. Fresh linens and towels can be placed into the cabinet by the staff without entering the private areas of the home. Some residents value having small talk with these staff members, although in the ever-individualizing society, some residents prefer their sense of privacy. Sliding doors are chosen because they provide better access to people in wheelchairs, and they can also be shut and opened to some extent to control visual access and privacy. Some space for storing a mobility scooter or wheeled walker at

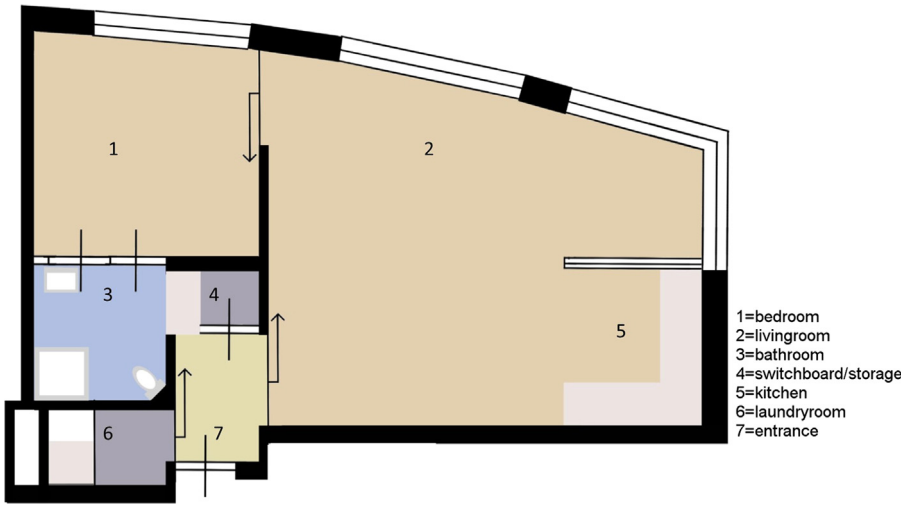

Fig. 2 Floor plan of the "sense-of-home apartment" after retrofitting.

Table 2 Overview of the changes before and after retrofitting.

Element	Before	After
Bathroom	Next to the entrance	Connected to the bedroom; better control of privacy; easier to provide care
Kitchen	Two white blocks in front of each other on a significantly short distance	U-shaped; accessible to wheelchairs; homelike by color variation
Doors	Swinging doors	Sliding doors; better control of privacy
Cupboards for laundry	Accessible from the entrance hall	Accessible from the entrance hall and bathroom for privacy
Loggia	Too small because of the windows that open inwards; climate similar with the interior, because it is within the thermal insulation skin of the apartment	Connected to the living room; designated as a small sitting area.
Facilities for laundry	Not available	Added to stimulate normalcy
Floor	Uniformly colored	Wood-like image; sensors (out of sight) to measure fall incidents.
Walls	White	Multiple hue colors to indicate different places; clear difference in colors between floors and walls to clarify space
Ceiling	Hard	Acoustic; limitation of reverberation times' hidden cables and wires to decrease excessive visual and acoustic stimuli
Electric lighting	Static	Biodynamic lighting to support biorhythm positively
Hoist	Mobile hoist	Ceiling-mounted hoist from the bedroom to the bathroom; rails integrated in the ceiling; better comfort and efficiency
Television	Available if brought by residents	Interactive to support a link to the outside world
Doorbell	Analog	Digital
Furniture	Mix of furniture owned by the nursing home and the residents	Partly ergonomic and partly from old home; refurbished fireproof and waterproof; represents memories and emotional value
Memorabilia	Nonexistent	In the living room and bedroom; represents memories and emotional values

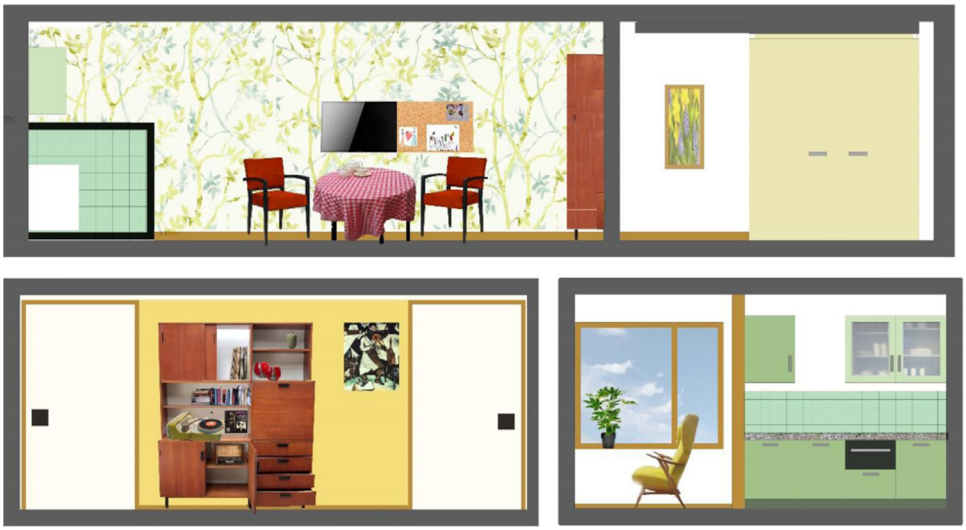

Fig. 3 Impressions of look and feel of the "sense-of-home apartment" based on a persona.

Fig. 4 View of the kitchen and illumination.

the switchboard, and for charging these items when needed is provided. The storage keeps the apartment free of excessive visual stimuli.

4.2.2. Living room

The living room is located within the private area of the resident and is designed as a small-scale quasi-public space (Figs. 4-6). Several nursing homes for people with dementia in the Netherlands provide quasi-public living rooms for six to eight people and smaller private space (between 15 m^2 and 24 m^2). The boundary among the living room, corridor, and bedroom is clear, supported by clear differences among colored walls. The living room enables the residents to vary and control their activities; it consists of an area for dining, lounging, contemplating, and enjoying the view outdoors. The dining table allows four to five places and comfortable chairs, which enable the residents to eat and drink with co-residents (neighbors), relatives, and the staff. The furniture (partly wooden) represents the fondness and memories of

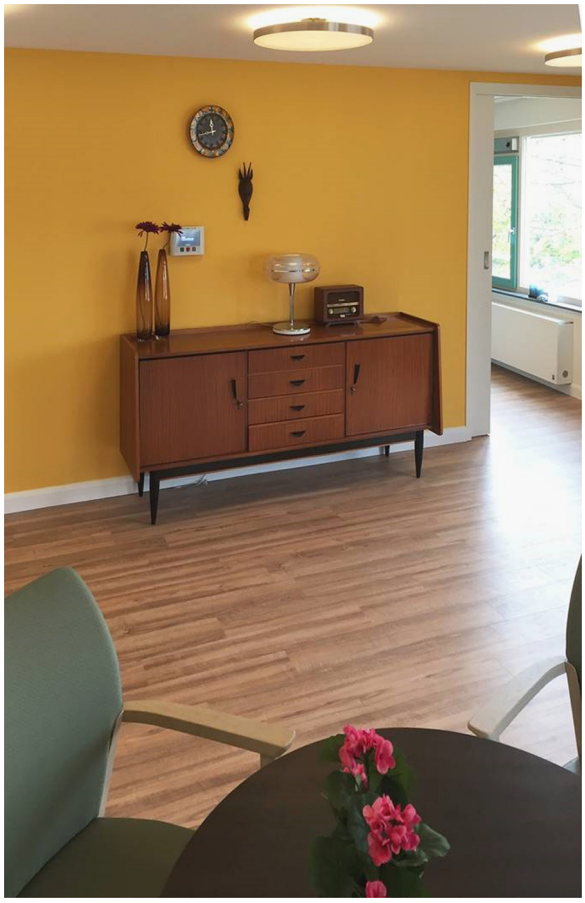

Fig. 5 View of the living room and dresser.

the residents; certain pieces of furniture in the lounge area accommodate only guests and relatives. Two chairs from the old home have been refurbished with similar upholstery, which is fireproof and waterproof. Several books, vases, and an old radio are placed in a secondhand sideboard to personalize the apartment. The living room also consists

Fig. 6 View of the living room and kitchen.

of modern elements complementary to the memorabilia to enhance the interaction with others (e.g., an interactive television screen to show, for instance, recent photographs by relatives, to chat (with or without help) with others, and to play (serious) games). The apartment is indirectly connected to an outdoor space or balcony. One corner, with a large view to the city and the local football stadium, is designated as a small sitting area to relive past experiences. The amount of daylight access, north and west, is large and completed with artificial, biodynamic lighting. The daylight simulation lighting will positively influence biorhythm, as well as support variations in the perception of the colors and textures. The combination of multiple-hue colors from the walls, curtains, floor, furniture, and memorabilia support the sense of home. The floor looks like real wooden oak floor planks and is easy to clean. Falls will be detected by a smart floor system (vinyl floor with underfloor sensors), of which the technical supplies are designed out of sight to keep the apartment free of excessive visual stimuli. This feature limits the need for excess cameras and visible sensors. The ceiling itself is acoustic, which limits the reverberation times inside the room, and hides the cables and wires above.

4.2.3. Kitchen

The mint green kitchen, in open connection to the living room, allows relatives to prepare a simple meal and make coffee or tea (Fig. 6). The difference between the kitchen and living room is clear because of the variations in the color of the floor and cupboards. The refrigerator is on eye height, and cups are easy to find and visible behind glass doors; these arrangements are made to support autonomy, control accessibility of the kitchen for those in wheelchairs, and ensure safety in terms of the limitation of the water temperature and connection of the stove. The design is homelike; the cooking utensils are partly visible; and the cupboards vary by colors, in shade, and by frosted glass doors.

4.2.4. Bedroom and bathroom

The residents can control their own privacy in the bedroom by a sliding door connected to the living room. If some relatives stay for a while, then the residents can still rest. Even when the residents are confined to their bed, they can still enjoy watching and hearing the activities of the relatives or staff in the living room. The colors of the wall and curtains in the bedroom vary from those in the living room to support the sense of rest instead of activities. The floor is similar to that in the living room and supports moving around without fear of falling. The boundaries among the wall, door, and floor clearly differ in color and texture. The wooden (medical) bed combines the sense of home, safety, and comfort (Fig. 7). The technology, which is not omnipresent in its appearance, monitors the heart rate and weight, and detects the distinctive movements of the residents in bed; data are coupled with the emergency response system. The bathroom is directly accessible from the bedroom to stimulate the autonomous use of the toilet during day and night. The toilet itself can be raised in height, because the structure is mounted to the wall using a flexible panel. The bathroom is a compact prefabricated concept; the operable swing door allows the staff to assist the residents within the compact area, and the swinging sink enables the staff to wash the residents in bed. The transfer from the bed to the bathroom is comfortable for the residents and staff because of the presence of a ceiling-mounted hoist. Therefore, the bathroom is suitable, comfortable, and provides different ways of washing, which depend on the physical abilities of the residents. The colors of and contrast among the walls, floor, sanitary devices, and doors support the visibility and familiarity of the elements, especially when the vision or comprehension of the residents is impaired. The surface of the doors has a wood pattern, and the walls are designed similar to textured

Fig. 7 View of the bedroom and bathroom, including the bed, swing-door washbasin, and ceiling-mounted hoist.

ceramic tiles, which refer to a normal homelike bathroom (Fig. 7).

5. Discussion, conclusions, and implications for design practice

This study found that the built environment—both from theoretical and user-centered perspectives—can contribute to a sense of home in nursing homes. The study introduced a novel and reliable overview that evaluates the impact of architectural programming and design in creating a sense of home in nursing homes. The sense of home is composed of different scale levels, from the connection with outdoors to the quality of furniture and architectural layout of the room. A particular apartment was refurbished to demonstrate how the architectural themes are operationalized and to connect both data sets in architectural practice. The construction of demonstration dwellings stimulates the discussion and education on the role of architectural features in supporting adequate healthcare and improving the quality of living at an old age (van Hoof and Kort, 2009; van Hoof et al., 2013). The retrofitting of the apartment is an example of how scientific research results are translated into an actual architectural design, and is therefore an example of integrated and evidence-based design (van Hoof et al., 2015b). Through the evidence-based design, architects can bridge the gap between the realms of evidence-based healthcare and architecture. The Center for Health Design (2017) defines evidence-based design as "*the process of basing decisions about the built environment on credible research to achieve the best possible outcomes*." This design process includes eight steps: defining evidence-based goals and objectives; creating design concepts; collecting baseline performance measures; monitoring of design implementation; and constructing and executing a post-occupancy evaluation. This process is in accordance with the study of Brawley (2005), who stated that the goal of evidence-based design is to improve outcomes and continuously monitor the success of designs for subsequent decision making. The step of conducting a post-occupancy evaluation with tenants is scheduled; this evaluation is according to the effects of the built environment on the sense of home. Through the use and occupancy of the apartment, the real-life experiences of residents and professionals are collected, for example, through workshops and qualitative research. For instance, a psychogeriatric training school is offered by a nursing home organization, wherein the participants take care of professionals as a part of their training. The caregivers experimented with features in the apartment and discussed issues, such as privacy and implications for their own practice. Their feedback and that of other visitors are collected in a special "guestbook." Thus, the apartment service is a platform that can be improved step-by-step in an ongoing design effort. For example, during the renovation projects, good practices are shared and implemented throughout the organization and even with the wider community.

Previous research mainly focused on functional design solutions, such as the measures related to accessibility and logistic caregiver support. The design of future nursing homes should ideally incorporate all the available knowledge on dementia and design to provide the best possible housing solutions for residents with dementia and their professional caregivers. The design must highly support the needs of people with dementia. Our findings are in accordance with a recent study, which showed that the physical environment supports a personalized approach and a sense of home in people with dementia (Fleming et al., 2015). Furthermore, the five factors reported in this study should be incorporated in environmental assessment tools (Waller et al., 2016). Several audit tools are available to assess the environment; these tools particularly focus on establishing "dementia-friendly" designs (Marquardt et al., 2014). These tools are helpful in highlighting areas of change. In contrast to traditional audit tools, specific instruments should be developed for use in contemporary homelike environments. The Environmental Audit Tool is one example that consists of a set of design principles for nursing homes that provide long-term care for people with dementia; in addition, this tool assists in selecting design modifications that promote the quality of the physical environment and of the life of the residents (Fleming, 2011).

By looking at the sense of home as a design challenge, new solutions and lines of thought come to the fore. Sense of home is easily mistaken for homelikeness or homeliness; the two themes are closely related but the former has more architectural and interior design connotations. The sense of home applied in the living laboratory differs from the homelikeness or homeliness through the special needs of older people with dementia. These needs include the special attention to visibility, and recognition of architectural elements and elements that refer to the long-term memory of the occupant. For example, the small tiles in the bathroom refer to the seventies, eighties, and early nineties in the Netherlands. The design also differs from a "normal" home by adapting to the intrusion of caregivers in the private domain of the residents. An example to solve this problem is the use of cupboards for laundry. These cupboards can be accessed from the hall by anyone, and from the bathroom by the occupant and well-known caregivers and/or relatives. In the Netherlands, the main focus is the creation of small-scale homelike environments for people with dementia (Verbeek et al., 2016; van Hoof et al., 2009). Although many architectural solutions or lines of thought are available, the focus on small-scale facilities that are homelike often leads to an architectural template or typology for a dwelling occupied by six to eight people. Physically reducing a large-scale nursing home into a small-scale unit for people with dementia does not necessarily provide homelikeness, nor does a sense of home emerge from both the building and its psychosocial context. Rijnaard et al. determined five environmental factors that support a sense of home; however, they did not find a relationship between the scale of a facility itself and a sense of home in nursing homes.

Moreover, the current project was based on the situation in the Netherlands. Nevertheless, the redesign of the apartment was based on the data that came from an international systematic review. The Netherlands has a large institutional care sector, and its national government actively stimulates aging-in-place through a multitude of policies. Van Hoof et al. (2009) conducted a pan-European comparison of healthcare and housing schemes for older

people with dementia, and reported that the countries bordering the North Sea have a relatively large nursing home sector. Their study reveals that the findings of the current study are most applicable to countries with similar schemes; however, the results are also applicable in North-American and Australasian contexts. In these countries, the existing nursing homes have their own architectural particularities.

This study and the data sets collected by Rijnaard et al. (2016) and van Hoof et al. (2016a) support the architects, facility managers, and interior designers in creating a sense of home in nursing homes. The retrofitted apartment and the design checklist (Table 1) are an example of evidence-based design, in which the psychological and social aspects of a sense of home are translated into design solutions.

In this study, the construction of new nursing homes is considered in terms of design and user needs. In practice, finance plays a major role in the total process of building new properties. The Dutch Healthcare Authority (*Nederlandse Zorgautoriteit, NZa*) is the supervisory body for all healthcare providers and insurers in the Netherlands. This agency also dictates the financial figures for investment in real estate and the inventory for Dutch healthcare facilities. One of its policy guidelines deals with the costs of housing, which is expressed in terms of normative housing and inventory components for care organizations that offer both care and housing (NZa, 2017). The height of these components is linked to the demand for care of the residents and is applied to (the substitution of new) facilities and maintenance. The yearly sum allows the care organizations to finance the costs of housing (including interests and maintenance costs) at a 97% occupancy rate. A similar set of rules is applied to the inventory of a nursing home. In practice, when a potential resident receives psychogeriatric healthcare assessment, the available investment per person is €127,665 for basic housing and €9500 for support services. Together with the treatment and day care facilities, the total available investment is €163,867. People with more severe healthcare assessments have higher available finances for investment. Even though these figures also include the costs for common living areas and corridors, this amount is sufficient for constructing high quality rooms or apartments for nursing home residents, considering that the price level of total investment costs is approximately €2223 per meter square and includes a 21% value added tax rate (Meijer, 2017).

This paper focused primarily on the sense of home in the nursing home environment and how these aspects are integrated into a physical design. Apart from these design features, architects and nursing home staff also consider other aspects of environment that affect the health, function, and safety. These features further support independence, self-care, and functioning among nursing home residents.

Acknowledgments

The authors are thankful to the financial support of the Regional Attention and Action for Knowledge (RAAK) circulation scheme, which is managed by the Foundation Innovation Alliance (*Stichting Innovatie Alliantie*, SIA) with funding from the Dutch Ministry of Education, Culture, and Science (SIA project number 2014-01-05P, *Project Het verpleeghuis van de toekomst is (een) thuis*). RAAK aims to improve the knowledge exchange between SMEs and Universities of Applied Sciences in the Netherlands. SIA-RAAK had no role in the study design, data collection, analysis and interpretation of data, writing of the report, and the decision to submit the paper for publication. The authors are also thankful to Vitalis WoonZorgGroep for their cooperation in the realization of the demonstration apartment at its Vonderhof premises. The enterprises Heijmans NV, CCG Holding BV, Rooms for Care BV, Tarkett Nederland, Tarkett Holding GmbH, Tarkett GDL SA, Waldmann BV, Wissner Bosserhoff Nederland BV, ErgoCare Vennik BV, Lensen Projectinrichters BV, Mardoors BV, Jaga Konvektco Nederland BV, Verkerk Service Systemen BV, Actiaal, Miele Nederland BV, OWA Benelux BV, MAT Afbouw BV, MCS Keuken & Comfort, EGM Architecten BV, Viega Nederland BV, Ideal Standard Nederland BV, Gira Giersiepen GmbH & Co., KG, Kvadrat BV, Van den Hoff Installatiebedrijf BV, Samsung Electronics Benelux BV, Indomo BV, Forest Group (Nederland) BV, and Sikkens Verkoop BV are appreciated for their financial and in-kind contributions to the realization of the apartment. The authors are also grateful to care organizations, BrabantZorg and Summa College (Summa Construction & Infrastructure/Summa Interior & Design), for their efforts in the realization of the apartment.

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