THE EFFECTS OF BUILT ENVIRONMENT DESIGN ON OPPORTUNITIES FOR WELLBEING IN CARE HOMES

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Abstract

The built environment influences the wellbeing of older people in care homes. In order to design for enablement, physical activity, and social connectivity there are lessons to be learnt from current care home buildings. Uncovering this design information is key for the future improvement of environments for older people. To the field of architecture, this paper presents an analysis of ethnographic observations (utilising an adapted form of the AEIOU heuristic) from five urban care homes in the UK. Findings provide insight into the qualities of the built environment that have impact on the activity and potential wellbeing of older residents. Five significant qualities of the built environment are identified: Spatial Legibility, Spatial Interconnectedness, Spatial Traversability, Spatial Diversity, and Spatial Aesthetics.

Keywords: *Care homes; wellbeing; ethnographic observations; human building interactions; user study*

INTRODUCTION

The built environment does affect wellbeing

Previous studies have evidenced the effect of the built environment on the wellbeing and quality of life of care home residents. Many correlations between particular built environment features and the effects on wellbeing have been uncovered (Burton & Sheehan, 2010; Day, Carreon, & Stump, 2000; Joseph, Choi, & Quan, 2015; Marquardt, Bueter, & Motzek, 2014). Objectively measurable environmental conditions (e.g. temperature, ambient sound level, light intensity), which map closely against Built Environment comfort factors (heating and cooling, acoustics, lighting and ventilation), are fundamental to wellbeing (Al horr et al., 2016). Studies have previously demonstrated a relationship between these measures and quality of life (QoL) measures (Garre-Olmo et al., 2012).

Whilst many studies have focused on one specific factor, 'Design in Caring Environments' (DICE) (Parker et al., 2004) attempted to assess the potential impact of 300 built environment features across 36 UK care homes. DICE found statistical significance in correlations between some sets of features and the wellbeing of both residents and staff.

Knowledge for design

The built environment is a significant part of what care providers offer care home residents. The Scottish National Care Standards state that care home environments must enhance residents' quality of life as well as being pleasant places to live (Scottish Executive, 2005). Knowing how to best meet this need is a significant challenge to both care providers and the built environment professionals who facilitate the creation and maintenance of those environments (McIntyre & Harrison, 2016). In the context of this design challenge, it is not enough to provide evidence of the existing correlations, it is understood that architectural research must push past existing 'application of design knowledge and previously conceived solutions' (Demirkan, 2007, p. 34). All

design has the potential to enable or disable its users (Goldsmith, 2012). A holistic understanding of user needs is necessary in order to support design for wellbeing.

Wellbeing improvement understood through promoting certain types of everyday activity

Whilst the definition of wellbeing is problematic, the New Economics Foundation (NEF) and UK Government Office of Science's Foresight Programme offer a way in which the contribution of everyday personal activities to wellbeing can be considered. The 'five ways to wellbeing' is framed as a call to action highlighting the potential in everyday life to pursue activities to promote personal wellbeing (Foresight Mental Capital, 2008; New Economics Foundation, 2010). The five categories (connect, be active, take notice, keep learning, and give) highlight types of personal activity that are understood to contribute to an individual's wellbeing.

Homeliness and facilitating activity

Previous qualitative work, focused on interview techniques, has identified factors important to various stakeholders in residential care environments. In Bradshaw's review (Bradshaw, Playford, & Riazi, 2012) a homelike environment was identified as the key environment-related factor (the other three being acceptance and adaptation, connectedness with others, and caring practices). In addition, a second strand to the environmental effects highlighted the importance of facilitating meaningful activities of daily life including opportunities to go out. In Rijnaard's review of 17 studies that concentrated on the perspective of care home residents and the factors influencing this 'sense of home' (Rijnaard et al., 2016), the built environment was identified as one of three domains of factors (the others being psychological and social factors). The contributions of privacy, variety in spaces, provision for personal belongings, control over spaces, access to outdoors, and look and feel of the environment were all highlighted. As identified within these studies 'home, is a highly subjective phenomenon' (van Dijck-Heinen, Wouters, Janssen, & van Hoof, 2014), this makes it a difficult concept to generalise.

In the context of dementia specific care homes, Fleming et. al. presented a significant correlation between QoL and environmental quality (Fleming, Goodenough, Low, Chenoweth, & Brodaty, 2014). They found the most significant environmental elements to be those in support of activity. These were identified as opportunities for engagement with objects and activities, access to ordinary activities of daily life, and the provision of a variety of spaces allowing for both privacy and social interaction.

Understanding the built environment by the qualities it exhibits

The built environment can be understood from different perspectives; a functional quality of the environment is one aspect. Examples such as the Maggie's Centres (Jencks & Heathcote, 2010) make it impossible not to recognise that architectural expression makes a valuable contribution to people's wellbeing. It is through inhabitation and enactment that this expression is brought to bear through everyday processes of consumption and production (de Certeau, 1984). Architecturally, the built form can be divided into elements e.g. openings, enclosure, focus (Ching, 2014); however, it is in combination that these elements act as architecture to create the settings for everyday life. The architectural composition can be understood to exhibit qualities, such as how easy it is to navigate, that affect its functionality. This paper sets out to identify examples of these sorts of qualities enabling or disabling opportunities for resident activity.

Aim of the study

Having identified the possibility of improving resident wellbeing through support and enablement for daily activities, this study explores how the built environment affects the activities of care home residents. We identify qualities of the built environment which alter its ability to enable and disable the everyday activities of residents.

METHOD

For this exploratory research, the ethnographic method of observation was adopted to gather a 'systematic noting and recording of events, behaviours, and artefacts in the social setting' (Marshall & Rossman, 2006, p. 98). Through gathering a breadth and detail of examples, the objective of using this method was to create insight into the spatial factors that affect the activity and therefore wellbeing of care home residents.

Sample

The observation study was completed across a purposeful sample of five urban care homes (Table 1), within the UK, capturing 236 recorded observations. The sample was selected for variation across care type (residential or nursing), building type (purpose-built and retrofit) and home type (single-unit and multi-unit). Four homes are from areas classified as 'large urban areas' and one from an area classified as 'other urban area' (Granville, Mulholland, & Staniforth, 2009).

Table 1: Care Home Sample (Source: Authors).

Site	Care type	Building type	Home type	Mean living group size	Communal space per resident	Secure external space per resident	Circulation space per resident
B	Residential	Retrofit with purpose built extension	single unit	35	4.5 m^2	26.8 m^2	10.4 m^2
C	Nursing	Retrofit with purpose built extension	single unit	28	4.0 m^2	65.3 m^2	6.3 m^2
D	Residential	Retrofit	single unit	25	5.6 m^2	8.7 m^2	3.8 m^2
E	Nursing	Purpose Built	multi-unit	13	4.4 m^2	3.1 m^2	7.0 m^2
F	Residential	Purpose Built	multi-unit with social hub	13	6.5 m^2	4.3 m^2	9.9 m^2

Observations were selected opportunistically, with the emphasis on capturing a variety of activity across types of space and times of the day. As such, this is an illustrative data set offering a breadth of insight. Researcher time in homes was timetabled across communal and circulation spaces. As observations were negotiated on a home-by-home basis, access to spaces at certain times was not always possible. When a researcher was scheduled to observe a space that was uninhabited at that time the lack of use of the space was recorded and the researcher would continue to observe across nearby spaces. Each observation records a set of interrelated interactions and as such they vary in length, detail and the insight gathered; therefore, a count of the observations recorded provides only an approximate indication of coverage (Table 2).

Table 2: Distribution of Recorded Observations (Source: Authors).

Site		Primary Space Type		Time of Day		Activities Observed		Day Type	
B	56	**Communal**	**114**	00:00 - 06:00	0	Administration of the Home	33	Weekend	50
C	40	Lounge/Dining	33	06:00 - 08:00	2	Domestic	36	Weekday	18 6
D	40	Group Lounge	44	08:00 - 10:00	9	Medical Care	16		
E	48	Quiet room	2	10:00 - 12:00	101	Dining	44		
F	52	Dining	21	12:00 - 14:00	16	Sleeping	4		
		Third Place Social Space	11	14:00 - 16:00	54	Care	50		
		Third Place Salon	3	16:00 - 18:00	25	Arrival and Departure	19		
		Circulation	**117**	18:00 - 20:00	14	Moving About the Home	86		
		Foyer	34	20:00 - 22:00	15	Free-time	141		
		Narrow Corridor	40	22:00 - 24:00	0	None	7		
		Corridor	34			Misc.	36		
		Wide Corridor	8						
		Stair	1						
		Non-domestic	**1**						
		External	**4**						
		Private	**0**						

Design ethnography data collection method

Architecturally trained researchers observed the use of the building recording interactions between the built environment and the users (residents, visitors and staff). During observations, the researchers adopted the stance of the observer as participant (Gold, 1958). Under these terms, the population of the care home knew the researcher was there to carry out observation activities (as advertised through posters, badges, and through staff). Furthermore, the researchers participated in the activity of the home (e.g. quizzes and talking with residents and their families).

The AEIOU heuristic, formed of the five mutually exclusive and collectively exhaustive elements of Activity, Environment, Interaction, Object, and User (Hanington & Martin, 2012), provided a structure to capture interactions taking place between residents and the care home building. Adaptations within this tool are encouraged and in the context of this study two important elements were lacking: Wellbeing and Spatial Relationships. Therefore, a notation identifying opportunities for improving personal wellbeing was added to the framework. The 'Five Ways to Wellbeing' (Foresight Mental Capital, 2008; New Economics Foundation, 2010) namely Connect, Be active, Take notice, Keep learning, and Give were used to code observed activity to identify where opportunities for wellbeing were being affected. In addition to the descriptions under these headings in our AEIOU-W framework, space-codes, sketches, and floor plans were also used to identify the space in which the observation was happening along with details of the spatial interrelations.

Grounded theory data analysis method

Based on the paradigm of Grounded Theory (Glaser & Strauss, 2009), the aim was to uncover concepts that developed inductively from the observation data. Affinity Mapping (Moule, 2012) was employed to open-code the data. To improve on the reliability of using these codes as a way of representing the data, a series of inter-rater reliability tests and a complete coding of the data were carried out. Borrowed from quantitative approaches to data coding (Robinson, 2002), inter-rater reliability helped to judge the potential misinterpretation of code definitions and define how

reliable the application of those codes was to the data. By reiterating this process, areas of concern were identified and addressed. The combination of affinity mapping with an inter-rater-supported coding approach aided in producing a refined theme set. Researchers independently coded observations to this theme set with a high inter-rater agreement of 86% (mean of per observation agreements which were calculated by the number of codes agreed divided by the total number of codes applied). These codes were grounded in the data and a structured dataset in support of those themes was produced.

FINDINGS AND DISCUSSION

Activities providing opportunities for improving residents' well-being in care homes were recorded and the built-environment qualities that facilitated or inhibited these activities were identified. Five high-level qualities emerged: Spatial Legibility, Spatial Interconnectedness, Spatial Traversability, Spatial Diversity and Spatial Aesthetics.

Spatial legibility

Examples of spatial and temporal cues affecting residents' activity and ability to understand and find their way through the care home building(s) were observed. Effects of misinformation on spatial legibility were also recorded.

Spatial cues

Spatial cues, including landmarks and spatial identifiers (such as furniture, signage, personal objects and colour), were observed aiding wayfinding around the care home. There were instances of spatial cues being present and used (I204, I262, L220b, L278, L293), and times when they were not found or understood (I189, I249, L217, L240, L257, L265b, L271, L297, L311). The most widely observed impact of not being able to interpret spatial cues available was residents becoming confused over which direction to walk in (I189, I204, I249, L240). This challenge was often overcome through assistance from staff who would either point the resident in the correct direction (I189, I204, L238, L297), or physically guide residents to where they wanted to go (L217, L311).

A high level of similarity between different parts of the environment created problems for residents. This was highlighted when a resident was unable to identify if she was in the right part of the home (L240). A lack of distinguishing differences between lounge doors and private doors (such as bedrooms) was highlighted when a resident walked past her desired destination of the lounge and needed assistance from a member of staff to find her way back (L297). During another occasion, the lift wasn't visually distinctive for the resident and resulted in them not being able to find it (I249).

Residents' wayfinding difficulties were observed when foyers between suites in the care home lacked a form of useable directional information or spatial cue. A lack of distinguishing features or useable directional information resulted in cases of residents needing staff members to support them in finding their way to the correct suite (L238, L240).

Spatial cues were observed supporting wayfinding, for example, when a confused resident identified the duty office as an appropriate place to go for help (I204). Legibility was found to be increased by internal windows offering views into rooms and open doors. These enabled residents to see what the room is, who is in it, and if they were allowed to go in it (L278). In addition, functional elements of daily life were seen to give spatial cues in denoting areas, such as tablecloths and crockery in the dining area (L287). Types of signage, including homemade signage of a resident's name and a street name (L293), were observed to be used by a resident in assisting him to identify spaces.

Temporal cues

Temporal cues such as the smell of food, lighting levels, and cleaning floor signs were observed being used in identifying the time of day, seasons and in supporting activity.

In interpreting mealtimes via the environment, the setting up of tables and chairs (L197), crockery and cutlery table settings (L219a, L220a, L287, L296) indicated preparation for dining. Other prompts for meal-times included staff turning down the volume of the TV and turning on the radio (L219b, L220a) and smells from the preparation of food (such as the smell of toast in the morning (L259)). The location of the kitchen was found to provide opportunities for residents to take notice of meal-times; for example, when trolleys from the kitchen were pushed past their bedrooms to the dining areas of the home (L282).

The environment was also used to prompt changes of activities, such as the change of watching TV to crafting (L261). In this instance, the TV was turned off and music was turned on as the dining tables were changed into crafting areas with the 'craft kit' becoming an obvious feature in the space.

In understanding if a room was 'open' (in use) or 'closed' (not in use or private), it was noted that residents would make use of glass windows in doors to see what was happening inside (L278). On one occasion when residents were all in a common lounge, the observation note questioned whether the darkly lit hallway and 'caution cleaning' floor sign prevented/limited/restricted residents in being active (L255).

Windows that gave views to the garden also gave signals as to the season and weather (L204 L189). Similarly, seasonal and holiday decoration (such as Christmas trees (L213, L220a)) and media (such as Christmas music (L220a) and movies (L234a)) around the home helped to reinforce the time of year. These elements provided interest and topics for conversation and were also found to be used as tools of distraction by staff in creating destinations for residents to walk to (I264), harnessing the potential to be active for a reason.

Environmental triggers such as closing the curtains were observed as instigating the night-time preparations for residents (I218, L214). The night-time routine was also seen to be supported by a 'cosy' atmosphere aided by a lit fire and a radio or television at low volume (I217). In another instance, the winding down of the day was assisted by a movie where a member of staff explained that the residents were 'just chilling' (L279).

Temporal cues were found to offer opportunities for residents to take notice of their surroundings, time of day, and the routine of the home. These cues were also found to encourage residents to be active (in moving to dining areas (L197)) and in other instances, connect with those around them (including other residents (L287) and staff (L197, L287)). An effect of a lack of temporal cues was also observed. Confusion between times of morning and evening/night was an issue for residents in the care homes (e.g. I262). In one example, it was recorded that there was no real difference between levels of noise through the day and levels of noise at night-time; a resident woke due to noise and thought it was morning (L301).

Spatial lies

Occasions were observed when the built environment gave misleading information and inappropriate or wrong cues to the residents. These spatial lies hindered legibility and were seen to affect activity.

During several observations (L265B, L299, L306), spatial lies occurred in the scenario of the locked door advertising itself as a usable door. Residents became visually frustrated as they repeatedly tried to push and pull the door handle until a staff member intervened. Certain features of the door such as a prominent door handle and glass panel, which meant they could see down the corridor, seemed to cause increased frustration with the residents not understanding that they were not 'allowed' access through the door (L306). Other examples of spatial lies, which were experienced by visitors to care homes, included placement of 'caution wet/cleaning floor' signs in the corridor when the floor was dry (I182) or a pull style door handle that could only be opened if it was pushed (L270). Spatial lies were observed to specifically impact on the enablement of residents

to be active and resulted in the need for staff intervention. A positive result of these interventions was that they often led to social interactions.

Discussion

We have observed resident activity enabled by spatial legibility, facilitated through spatial and temporal cues and inhibited by spatial lies.

This reaffirms previous research focused on wayfinding in highlighting the importance of well-articulated and appropriate cues in support of wayfinding. In attempting to quantify the impact of some spatial cues, a study investigating the colour of doors in a dementia long-term care setting found that using a subdued colour palette similar to the wall for doors not meant for resident use along with stronger brighter palette did almost entirely eliminate residents using those doors to access restricted areas (Cooper, Mohide, & Gilbert, 1989). Torrington recognised the important role lighting plays in creating visual distinction and orientation for wayfinding and in creating place identities which help signify the expected behaviour in those places (Torrington & Tregenza, 2007). Although our findings highlighted the benefit of cues provided by signage (using a resident's name and/or a street name) it is also important to note that Barnes (2002, p. 781) warns against the use of patronising cues.

The positive impact of appropriate spatial and temporal cues and the negative impact of inappropriate cues and spatial lies observed within this study and previous studies highlights legibility as one of the key spatial characteristics affecting the everyday activities of residents in these homes.

Spatial interconnectedness

The degree of interconnectedness of spaces within a care home was a factor observed affecting resident activity. This included various levels of visual and acoustic connection as well spatial interconnections (provided by elements such as doors, servery hatches and internal windows), open plan spaces (providing an interconnection between different zones within one space), and spatial convergence (provided by an interconnection between routes).

Open plan and highly interconnected spaces

Open plan lounges with multiple areas, or indeed multiple spaces with very high interconnectedness through openings, were seen providing particular affordances to both residents and staff in the care homes. Different groups of residents provided interest or engagement to each other (I154, I203, I253), and residents were able to watch staff activity in one area from another (L219a). In one example a large lounge with partially separated seating areas facilitated different pub quiz teams to explicitly alternate between private conversations and engagement with the larger group (I164). It was also noted that different groups of people around a space provided visiting activity with points of interest that became topics of conversation (L252).

Where staff groups were able to naturally inhabit part of a larger open plan area, they were facilitated in completing tasks whilst still being on hand and aware of residents. Observed examples included staff sitting at a table completing paperwork whilst residents undertake different activities (e.g. reading, listening to music and watching TV) (I174, I245), staff engagement with craft activity within one group whilst also being available to others (L261) and staff assisting one resident to eat whilst still being connected with the larger group (L234). These types of interconnectedness facilitated opportunities for natural supervision by staff in situations where staff were able to be on hand when needed, without spending time away from other tasks and without overtly appearing to be monitoring resident activity.

Negative impacts of the ambiguity of open plan spaces were also observed, for example in instances when residents competed and argued for particular seats (L263). The undesired impact of noise travelling from one part to another of an open plan space was also experienced (L264).

Combinations of seating and circulation areas within the same space, or readily connected spaces, contributed appropriate rest stops, opportunities for people watching, and increased social activity. People watching was also facilitated by an interconnectedness of spaces – be it watching staff activity (I207), watching people coming and going at the front door (I203), or watching people walking through space (I172, L216). Communication and social activity were enabled through serendipitous, brief and cordial encounters (I193, L187). Rest stops were provided for 'taking a breather' (L265, L277) or waiting (L300). This occurred both when the predominant space was circulation, e.g. sitting people watching in a hallway (I193), and when it was predominantly lounge, e.g. a route cutting through a lounge facilitating morning greetings between residents (I254). Open access to staircases, especially where they were well connected with other circulation spaces, was seen to support both access and activity (I196).

Openings

Where lower levels of interconnection were facilitated by an opening this also enabled particular activities. For example, an open door was enough to facilitate people watching from one space to another (I193). Bedroom doors were observed as being used to control levels of privacy and when open provided connection to hallway and goings on in the home (L293) including 'hellos' between staff passing and residents in rooms (L282). An open doorway to a hairdresser's salon space acted as an invitation bringing people in and creating a destination point (L253) and an open doorway into a lounge was enough for staff to be able to keep eye on resident to ensure safety when walking (I194).

An open door from an office enabled staff to monitor the front door (L196); however, in homes where this wasn't possible, building systems such as phone entry were also used to mitigate the difficulties in maintaining security (I196).

Even fairly low-level interconnection between spaces, such as acoustic only connections, were seen to have an effect. For example, noise transmitting through a closed door led a resident to incorrectly think someone was trying to enter (L312), whereas, an acoustic connection between the kitchen and hall, through multiple open doors, provided atmosphere (I259) and enabled social interactions between staff and residents (I263).

Spatial convergence

Interconnections created through the convergence of routes were also identified during observations. These focal points in the layout of the circulation spaces of the homes created opportunities for increased interest and social connection both for residents and between staff. This included chance encounters such as staff meeting and helping residents (I145) and residents meeting each other whilst walking (L195). It also supported people watching when seating was provided at these busy points (I176, I201). These crossover points supported other communications including staff exchanging messages with each other in passing (I152, I176), and also with visitors (I207). These convergences also had observed negative effects manifesting as congestion slowing down or hindering the navigation of the home (e.g. I207). This was especially true where it was exacerbated by elements such as narrowing of clear widths at these points of convergence (L194).

Disconnect

Barriers to some activities were witnessed when levels of interconnectedness were low. Instances were observed when staff were not readily accessible when needed due to the spatial disconnection of isolated lounges (I155, I169, I218, I229). Also, a lack of reassuring presence of staff was noted where visual connections between spaces were not provided (I190).

In relation to other users of the building, difficulties for visitors and staff in welcoming, securing, and entering the home were observed in isolated entrance and arrival spaces (L240, L242, L257, L271). Also, difficulties of staff locating each other and communicating were highlighted in areas with low spatial interconnection (I177).

Interconnection with back-of-house spaces

Where interconnections bridged the divide between resident spaces and staff spaces there were specific affordances seen. These connections happened across various kinds: visual, physical, audible, convergences, and openings. Sometimes the connection's benefit was primarily functional, for example a servery hatch providing physical access and visual connection (L214, L220a,). A major contribution was in providing opportunities for residents to observe and take an interest in daily activities including in the kitchen (L282) and drying laundry (L212). The increased connection between staff whilst doing tasks and residents led to increased opportunities for social connection. This included staff carrying out laundry and storage activities whilst chatting to residents (I175), staff chatting and singing with residents through a hatch whilst doing dishes in adjacent servery area (L261), and even a wolf-whistle from the kitchen as a resident returned from the hairdresser (I245).

These points of interconnection formed hubs for communication and interaction. For example, a kitchen door acted as a welcome point and communication hub (I235) or a duty room with an open door to the corridor providing the same (I196, I205). Having these points accessible to residents supported activities such as residents clearing crockery (I145) and walking to request (I253) or fetch (I237) a drink. These activities which are not only physically active are also giving residents opportunities to contribute to the operations of the home.

Discussion

In this study, spatial interconnections within the care homes were observed facilitating social and physical activities as well as providing increased opportunities for providing interest. This study provides examples of the contributions made by openings, open plan layouts and convergence of routes to the interconnectedness of the home.

Similarly, previous work has also highlighted the positive contribution spatial interconnectedness might have on a care home environment. The established space syntax approach has provided previous research with methods for assessing levels of visual and accessible spatial interconnectedness and finding statistical correlations linking these measures with behaviour. Within the context of care homes, positive correlations between measures of interconnectedness and quality of life measures were found in conjunction with the DICE study (Hanson & Zako, 2005). The contribution of interconnectedness to legibility and therefore resident orientation is previously recognised (Marquardt & Schmieg, 2009). However, as previously recognised by Kidd (1997), the level of reliance on spatial interconnectedness depends on the underlying design strategy. For an introverted plan type, with an activity core, visual access is a key feature whereas an extroverted plan may rely more heavily on familiar spatial cues. The importance of convergence spaces and high visual interconnection in these spaces was previously recognised in its contribution to informal social activity (Campo & Chaudhury, 2012). Also, seating with high visual interconnectedness to other areas of a home was highlighted as a popular attractor point (Campo & Chaudhury, 2012).

Following on from previous studies, this research highlights further examples justifying the positive contribution of spatial interconnectedness in care homes.

Spatial traversability

How easy a building is to move through, i.e. its traversability, was observed as a spatial quality with a repeated impact on resident activity. Obstacles and aids to movement, door usability, circulation layout, and clear-width were observed as providing for or reducing the ability of residents and other building users to move through the care home.

Obstacles and aids to movement

Features and fittings of the built environment such as handrails, something to lean against, or a chair being too low to get up out of were identified as specific obstacles and aids to movement.

Where handrails were provided, they were witnessed being used by residents to support themselves during movement in corridors (L190, L193, L305, L308,) and also on stairs (L266) and ramps(L194). Handrails were also used to rest against (I163, L304). Also, on occasion, they seemed to provide reassurance for example residents only lightly touching or running their hand along them (L187). Breaks in handrails did hinder movement at those points where they occurred (L266, L299, L312). On one occasion where a handrail was not the right height for a particular resident she was observed using the wall instead (L194). Also, when handrails were not provided other objects were used by residents to support themselves this included columns (L203), furniture (I146), walls (I197), trolleys (I215), and door frames (I215).

Furniture was observed hindering as well as aiding movement; for example, a chair being difficult to get out of (I243). Objects within circulation areas did provide obstacles including a laundry trolley and clothes tangling a walking aid(I167), wet floor signs (I182, L255), and a fire extinguisher (L193).

Types of flooring were not seen as significant with examples observed of residents walking on hard floorings, smooth carpets, and paved surfaces with no hindrance. However, changes in flooring did provide moments of caution to residents with some residents being careful when stepping over thresholds (L220b, L239, L268, L309, L311).

Single or small sets of steps did provide a hindrance to movement but were observed being overcome by residents (I145, L203). Likewise, residents were observed using stairs (L187, L196, L266) to access other floors as well as lifts.

Door usability

There are observations of doors being used without difficulty (e.g. L293) and indeed examples of residents helping staff with doors (e.g. L305). The weight of doors was seen as a barrier to use, in some cases residents had to rely on others opening them (L243). Door security systems were recognised in support of resident safety; this included buzzer entry phone systems (I196, I203), code pads (L281), release buttons (L266), key locks (L222). Staff were observed spending time operating these and the usability of these systems did cause problems such as staff stuck on the wrong side waiting for assistance (I180), visitors left standing outside (L271). The period of unlock was observed being too short causing difficulties for a visitor to use the system (L270). When combined with also assisting someone using a wheelchair the security systems were observed as more difficult to use (L281). Codes were sometimes shared with visitors (L270) facilitating quicker entry or exit and sometimes restricted to staff ensuring better security (I264). The use of remote controls facilitated operation in some cases (I203).

Circulation layout

The layout design of circulation areas affected the traversability of the homes. The distance between destinations, proximity of rest areas, provision of alternative routes, and circulation capacity were features identified impacting on the activities of the residents.

The benefit of including resting stops within the layout of circulation spaces was highlighted. Providing an option for seating within a route enabled residents to rest during their walking (L207, L265, L278). It was also suggested, but could not be positively identified, that the provision of these also provided reassurance to those who did not need them on the occasion that was observed (L237, L276). Observations also recorded other spaces such as the dining room (L207) or staff office (L210) being used as a rest area off the circulation route. Similarly, waiting spaces with seating (I236), and assembly spaces (L303) supported residents in moving as a group or in coordination with others.

The relative proximity of destinations was also significant. Immediate access to outside was observed facilitating everyday chores (L273). When journeys were longer residents were observed making use of assistance from staff to complete them (L295). When multiple possible destinations

were relatively close and with visible links between them this was interpreted as a positive feature affording 'walking tours' (I263).

The toilet was a common en-route destination for residents to stop off at before proceeding to their original destinations. Toileting was prompted in residents by walking past a clearly identifiable toilet (I171). The proximity of a toilet (or a number of toilets) to social spaces enabled this common journey (I152, I239, L192, L217, L220b, L249, L267, L311).

Another common journey observed in a home was the storage and retrieval of wheelchairs and other personal mobility aids. This activity was hampered when the storage was not in proximity to the used communal spaces (I180, I212, I213).

Congestion was identified as decreasing the traversability of a space with 'face offs' between residents (I153) resulting in them having to make use of objects such as meds trolleys and door frames to provide support whilst waiting for others to clear out of the way (I215). The layout was seen contributing to congestion when for example a bottleneck was created at vertical circulation (I252), a narrowing of circulation space occurred at the joining of routes (I207), or extra space wasn't provided at the joining of narrow hallways (L194). Congestion was also seen associated with positive effects when recognised as a type of increased spatial interconnectedness resulting in, for example, serendipitous social encounters (I207, I211). The availability of more than one possible route to a destination within a layout was observed increasing traversability allowing residents to avoid temporary barriers (I253).

Clear width

The open width of spaces to move through, such as doorways, corridors and furniture arrangements, was seen affecting movement, particularly when assistance was required from staff or personal mobility aids.

Narrow clear width was observed impeding movement in examples from having to squeeze through (I147, L192), getting walking aid wedged (I162), having to dodge around others (I149, I161, L190), having to wait for others to go past (I153, I215, I264), walking slowly behind others (I205, L191, L193), difficulties with wheelchairs (I212), and having to walk one in front of the other (L201).

Narrow corridors, with a clear width of less than 1500mm, were the most common context of examples of clear width hindering activity. This was mitigated where these corridors had sections which opened up providing passing space (I186, L294).

When clear width was wider this was seen enabling ease of access with hoists (I208), people watching (I203), use of trolleys (I197), independent movement with mobility aids (L215), wandering (L223), and walking together with others (L278, L295). Wide corridors, with a width of 1800mm or wider, were seen facilitating social walking (L278) and it was also suggested they might have reduced the effect of dead ends whilst wandering (L223) by allowing for a more natural turning.

Doors and openings naturally form pinch points along a route and so the reduced clear width at these points was seen having an effect in reducing traversability (I215, L303). Traversability problems were also associated with temporary reductions in clear width by objects in corridors including laundry trolleys being stored (I147), cleaning-in-progress signs (I182), bain-maries being used for service (L278).

Discussion

The effect of traversability was observed in relation to residents' independent and supported movement. We have observed various building elements (ranging from handrails to walls) used to support traversability throughout the homes in this study. Residents' ability to engage in physical activity was also associated with knock-on effects on other activities facilitated by movement around the home such as taking notice of surroundings and social activity.

Previous work has emphasised that ease of access (distance to travel and availability of handrails and lifts), and safety (existence of obstacles) as being the main features impacting on

traversability (Burton & Sheehan, 2010). Indeed, and in agreeance with our findings, Burton and Sheehan also identified that spaces that offered opportunities to stop and chat were important. The importance of providing paths that lead to interactions and engagement with other activities is associated with lower levels of agitation (Fleming et al., 2014) and freedom to walk is highlighted as vital (Burton & Sheehan, 2010). The importance of unobtrusive safety interventions designed into the built environment is not doubted (Fleming et al., 2014). However, achieving a balance in design is fundamental. This was previously highlighted by the DICE study which found a negative correlation between Health and Safety features and quality of life by way of reduced enjoyment of activity for low dependency residents (Parker et al., 2004). In support of previous opinion, this study highlights traversability as fundamental to residents' wellbeing.

Spatial diversity

The observations recorded a wide range of activities in care homes all putting differing demands on the built environment. The diversity of spaces available affected the ability to meet these sometimes-competing demands and was seen to be supported by a flexibility in furniture, a choice of rooms, and a variety of conditions.

Flexibility of furniture

Ability to arrange and rearrange seating to suit particular use at a particular time was witnessed in support of social activities. This included seating moved to form smaller areas for particular use such as hosting visitors (L189, L252); seating rearranged and brought together for groups events such as performances (L246); a seat moved to set-up a particular view into the garden (L198); and the inclusion of wheelchairs and high dependency chairs within a larger seated group of residents (I183). Flexibility, allowing for a layout to be adjusted during use, enabled activities such as visitors to sit and add themselves into spaces resident are already settled in (I214, L250, L264) and residents to sit with other residents who are already settled as they want (I189). The particular disabling effect on the key social activities of visiting and hosting when that wasn't possible was also noted (L247).

The flexibility of areas of tables provided for medical visits (I254), staff paperwork (I154), alternative seating areas (I172), visiting with tea and dining (I223). Temporary folding tables and tables on wheels allowing flexible arrangements for dining (I225), tea service (I189, I199, I209), or managing newspapers (I208).

Trolleys were used to facilitate temporary activities such as serving meds (I215, I262, L220c), cleaning (I252), serving tea (I154, I199, I209), and making a base of operations for support and administrative tasks at the most convenient point, for example in the corridor (I182) or in a lounge (I177). Spatial design to accommodate these trolleys made their use easier and when not provided this created barriers to staff activity such as a step before a scullery meaning a trolley had to be at a distance (I151). In other cases, trays and the facilities to use them such as sideboards fulfilled some of these functions (I221).

The room's temperature was often a topic of conversation with residents more often feeling cold rather than warm (I227, I194, L290). Tactics for managing this on an individual basis involved using cardigans and blankets.

As well as meeting functional requirements the flexibility of furniture was observed empowering the activity of making spaces and the expression of being able to adjust and personalise arrangements (L218a).

Choice of rooms

Occasions were observed when the choice of alternative spaces provided the opportunity to provide for different types of activities, for example facilitating the choice for quiet solitary activity when a group activity is happening elsewhere (I250), sitting away from the TV (I201), or private visiting (L274). Also, the availability of a choice of spaces provided destinations to encourage walking and physical activity (I149, L210).

On occasions when the availability of different spaces ran out or was limited, the effect of the restriction of this choice was observed, for example, lunch delayed by the overrun of opticians (I253), or when there is no alternative available and a resident was returned to the lounge she had just left (I204).

Variety of conditions

The provision of a choice of spaces does not guarantee any will satisfy different needs/desires, however, there were enhanced opportunities observed when there was variety between the options. Variety in conditions enabled a variety of activities to occur across different areas of one space as well as across spaces. For example, all simultaneously within one room a set of tables and chairs provided for having tea with a visitor, whilst comfy seat against a wall provided for dozing, and an area close to windows provided for view watching (L259). Choice of comfy seats or seats with tables supported choice between crafts or lounging (L263). Larger spaces were observed enabling group physical activity (I247) whilst small spaces allowed for intimate atmospheres for visiting and chatting (L287) to happen. The availability of choice was seen enabling physical activity in encouraging moving between these areas and also in social activity meeting new groups and enabling options of who to sit with in smaller groups (L209). Negative effects of the variety in conditions were also recorded, for example, when one area is strongly favoured and becomes over-crowded whilst another is neglected (L264).

A variety of communal space types were observed as available to residents across the sample of homes including dining rooms, group lounges, dual function lounge/diners, large lounges, small and quiet lounges, specialist spaces such as salons, and small nooks and seating areas. Secondary lounges and quiet spaces were seen to be enabling choice. Quiet rooms were used for one-on-one interactions between staff and residents (I150, L188). Some spaces taking on third-place characteristics were observed and found to give particular affordances akin to opportunities to leave home without leaving the security of the care home. Third places were understood as the social spaces that a person inhabits in daily life, which are neither workplace or home e.g. cafes, pubs, and clubs etc. (Oldenberg, 1997). Spaces set up as a Hair Salon (L253, L307) were observed to be not only facilitating the hairdressing activity but also impacting on social activity and opportunities for residents' engagement with surroundings. Cafe-like social spaces facilitated larger gatherings of people (L189, L245, L252) and interaction with people that they know less well than those they share a usual lounge with (L251).

Discussion

We have observed spatial diversity supporting the variety of resident activity within care homes. Spatial diversity was enhanced by a flexibility in furniture, a choice of rooms, and a variety of conditions.

Previous studies have demonstrated a correlation between scales of observed wellbeing and higher levels of gradation of space (Barnes, 2006). Barnes suggested that the variety provided an enhanced sense of control over personal privacy as well as enhancing opportunities for decision making. Burton and Sheehan (2010) also found that that 'to a degree, differences can be accommodated within homes by providing a variety of spaces and different types of rooms'.

The characteristics of third place spaces in encouraging social activity have been previously examined (Campbell, 2015) and in this study, these have again been captured as providing a contribution to residents' opportunities for ways to wellbeing when they are included within the range of options provided to residents.

Spatial aesthetics

The aesthetic qualities of a space were observed in relation to activity and findings uncovered affordances and impediments by way of style of decor and furnishings, connection to outside, and points of interest.

Style of decor and furnishings

The style of the decor was noted within the observations relating either to homeliness or domesticity, or to non-domesticity or sparseness of space. The observers linked style factors to the atmosphere as the context for activity, for example, comfortable informal seats leading to an informal atmosphere which is the context for staff-resident interaction (I150). Observers have recorded these suspected interactions with atmospheres, however, as these are subtler effects explicit enablement and disablement are not recorded. Possible enablements and disablements are suggested, for example wayfinding difficulty observed in a sparse environment (L240), or cafe-like qualities providing affordances for social interaction (L189). Elements enhancing a sense of homeliness or domesticity in the observer are identified, for example doorbell (I144), curtains (I227), floor finishes (L191), style of chairs (L241, L260), wall decoration, domestic storage (I178), intimate scale of space (L287) but these are not directly linked to enabling any identified personal activities with opportunities for ways to wellbeing.

Connection to outside

Various types and levels of connection to outside were observed and were associated with opportunities for residents to be active and to take notice. A view outside provided a focus for attention (I146, I181, L204, L260) and, in some examples impetus to physical activity where residents are drawn to walk up to and look out of windows (I163, L235, L295, L304), in one case a resident moving a chair to sit and look out (L198). Views also provided background setting to a group sitting around a window (I154). Openings to outside also contributed connections which were not views; such as natural light (I177), fresh air (I148), a sound of rain (I177), and sunshine (L260).

Physical access out and secure and safe space for walking facilitate not only physical activity in the going-for-a-walk activity but also the take notice related activities in observing plants and weather (I148, L258, L276). Physical access was further enabled by sheltered porch areas allowing protection from the weather (L268) and by multiple points of access – from main foyers (L268), corridors (I163), lounges, and direct access from a resident's room (L273).

Access outside also facilitated smoking activities (L280) which formed the focus of some residents' days, providing encouragement to physical and social activity and in some cases even when the access is difficult this motivation helped them overcome that barrier (L236a).

Points of interest

An interesting environment was observed enabling social connections and 'take-notice' activities. Much time spent with televisions on was observed. Some observations recorded high engagement with the television (e.g. I242, L264), and some low engagement with either something else happening and it being in the background (e.g I202) or only some people in the space engaged with it (I124). Use of radio and music was also observed, this was sometimes as the focus of engagement and interest with singing (I249, L240, L245) or dancing (I155, L200, L219a, L246) and sometimes as a background or signifier for an activity (e.g. L261).

Views, be it from one space to another (see interconnectedness), externally (see connection to outside) or simply watching a space (I189), were observed providing interest to residents to take notice of. People watching, be it of the activities of other residents, staff (L282), visitors, or the street (L235) provided interest. A space which provided a variety of views provided for a walking tour activity (L195).

Items provided within the home were observed affording opportunities for focused interest including notice boards (I263), ornaments (I232), photographs (I144), mailbox, wall stickers, dolls (I150), printed media such as newspapers (I183, L188, L209), and temporary features such as Christmas tree (I227, I264). Personal items such as sunglasses (L263b) and handbags (I250) were also observed as the focus of interest. These items could be 'too much' with flashing Christmas tree lights being complained about by residents (I221). Significantly, items which are primarily fulfilling other needs

such as the lift (I258), fire extinguishers (L308), and furnishing fabrics (L247) were also providing this type of interest to residents. Time spent engaged with these items not only facilitated activities with opportunities for taking notice it also encouraged physical and social activity.

Discussion

Spatial aesthetics have been observed affecting resident activity through points of interest, connections to outside, and the style of decor.

During this study, items of interest provided focuses for attention, prompts to activity, and topics for conversation. Marquardt previously reviewed studies of the impact of sensory enhancement and concluded that there is sufficient evidence to recommend the positive effect of appropriate stimulus but with a proviso of a need to identify appropriate levels (Marquardt et al., 2014). Campo highlighted the importance of points of interest within the environment to social interactions; however, also highlighted the importance of finding a balance and the dangers of over stimulation and distraction (Campo & Chaudhury, 2012). This study has highlighted everyday and personal objects providing stimulation and also functional environmental objects being of interest to residents.

An emphasis on homelike decor is common among previous studies using interview techniques (Garcia et al., 2012). It is also previously recognised that although this topic is common it is reported as difficult for respondents to identify elements or features which contribute to this or examples of effects (Campo & Chaudhury, 2012). During this study, some examples of decor contributing to different settings within the home were identified but, possibly due to the functional focus of the research method, homeliness has not been identified as a dominant theme.

Examples from this study further concur with established findings on the possible benefits of connections to outside, be that by active or passive engagement (Joseph et al., 2015). This study has identified examples of some different forms this connection can be designed to take ranging from different levels of access, to views, to windows that open.

CONTRIBUTIONS AND LIMITATIONS

This study contributes to an evolving architectural debate, generating evidence-based knowledge for designing environments that have the potential to improve the wellbeing of inhabitants.

The method was successful in providing a way of gaining insight to enablement and disablement within care home settings. This study collected an illustrative dataset of interactions across a cohort of care homes describing environmental factors for consideration. There is a strong call for experimental evidence within this domain that this study does not address; however, as previously recognised, in these environments, not all research objectives can be addressed through methods such as control trials or large samples (Marquardt et al., 2014). A rigorous observation procedure has resulted in a measured review of influencing factors without a preference to those which are easier to prove by experimental methods. This is of relevance to architectural researchers and designers and has practical applications for the design, management, and procurement of care homes.

On reflection, it is challenging to unpick the effects of built-environment qualities and other environmental/contextual qualities such as the culture of the home or qualities of the care provided. Likewise, the everyday management of the environment affects its qualities alongside design decisions. The human environment has been previously found to have a greater effect than the physical environment (Garcia et al., 2012). Although the care regime or home culture may be seen as a possible separate determinant of observed effects, it is important to highlight the potential for the built environment to effect these factors themselves and therefore produce a secondary effect (Barnes, 2006). The environmental effects on staff activity are also, therefore, relevant to the total impact on resident activity.

This study contributes a breadth of insight into immediate observable effects of built environment qualities on everyday activities. Capturing short snippets of interactions meant that longer term effects such as the impact of exposure to bright light on mood noted in previous studies (Joseph et al., 2015; Marquardt et al., 2014) were therefore not captured by this work. Therefore, the findings would be extended by consideration alongside results of other methods including for example longitudinal sensor-based collection of activity levels and environmental measures.

The importance of supporting everyday activities in providing routes to improve wellbeing formed the focus of this study. The grounded theory analysis methods have produced a structured illustrated set of functional qualities of the built environment of care homes. As a study of Human Building Interactions, the previously recognised danger of a reductionist approach (Kidd, 1997) is considered and the important potential for architecture to elevate the spirit is not disregarded. However, the focus on everyday activities means there is an emphasis on functional attributes, with emotional or other elements receiving less focus and less evidence in the data set. Therefore, the findings would be strengthened by consideration alongside results of other methods such as interviews.

CONCLUSIONS

As the built environment influences the wellbeing of older people in care homes, a holistic understanding of user needs in this context is essential. This study has observed natural human-building interactions in care home environments and the five ways to wellbeing (New Economics Foundation, 2010) were used to highlight those everyday activities which provided opportunities for wellbeing.

Within the context of older people's care home environments, this study provides insight into the effect qualities of the built environment have on activities and wellbeing. This study of five care homes provides an evidence-base built of examples of the way these qualities are seen to affect everyday activities and the ways environmental elements contribute to these qualities.

- The positive impact of appropriate spatial and temporal cues and the negative impact of inappropriate cues highlighted legibility as one of the key spatial characteristics affecting the everyday activities of residents in these homes.
- Contributions made by openings, open plan layouts, and the convergence of routes to the spatial interconnectedness of the home were seen to support and enhance social and physical activities as well as providing increased opportunities for taking interest.
- The effect of traversability was observed in relation to residents' independent and supported movement. Features providing obstacles and aids to movement, layout design, and clear width were all observed to be affecting residents' ability to engage in physical activity. This was also associated with knock-on effects on other activities facilitated by movement around the home such as taking notice of surroundings and social activity.
- The importance of choice and flexibility in domestic space provision was witnessed supporting the diversity of residents' everyday activities. Furthermore, affordances provided by the inclusion of diverse spatial qualities, such as third place spaces, have been captured contributing to residents' opportunities for increased wellbeing.
- The style of décor along with the provision of points of interest and connections to outside all contributed to the way spatial aesthetics were witnessed affecting resident activity. Points of interest including personal and environmental objects as well as views provided significant focuses for attention, prompts to activity, and topics for social interaction.

Legibility, Interconnectedness, Traversability, Diversity, and Aesthetics have each been illustrated as qualities deserving significant consideration during the spatial design and management of care homes.

RESEARCH DATA STATEMENT

A data set in support of this paper is available. References in the style I### or L### refer to an observed occasion recorded in the supporting data set.

McIntyre, L. & Harrison, I. *Recorded Observations in Care Homes from BESiDE Study* [Data Set]. University of Dundee. doi: 10.15132/10000124

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REFERENCES

Al horr, Y., Arif, M., Katafygiotou, M., Mazroei, A., Kaushik, A., & Elsarrag, E. (2016). Impact of indoor environmental quality on occupant well-being and comfort: A review of the literature. *International Journal of Sustainable Built Environment, 5*(1), 1-11. doi:10.1016/j.ijsbe.2016.03.006

Barnes, S. (2002). The design of caring environments and the quality of life of older people. *Ageing and society, 22*(06), 775-789. doi: 10.1017/S0144686X02008899

Barnes, S. (2006). Space, choice and control, and quality of life in care settings for older people. *Environment and Behavior, 38*(5), 589-604.

Bradshaw, S. A., Playford, E. D., & Riazi, A. (2012). Living well in care homes: a systematic review of qualitative studies. *Age and ageing, 41*(4), 429-440. doi: 10.1093/ageing/afs069

Burton, E., & Sheehan, B. (2010). Care-home environments and well-being: Identifying the design features that most affect older residents. *Journal of Architectural and Planning Research*, 237-256.

Campbell, N. M. (2015). Third Place Characteristics in Planned Retirement Community Social Spaces. *Journal of Architectural and Planning Research, 32*(1), 55-67.

Campo, M., & Chaudhury, H. (2012). Informal social interaction among residents with dementia in special care units: Exploring the role of the physical and social environments. *Dementia, 11*(3), 401-423.

Ching, F. D. (2014). *Architecture: Form, space, and order. New York ; Chichester*: John Wiley & Sons.

Cooper, B., Mohide, A., & Gilbert, S. (1989). Testing the use of color in a long-term care setting. *Dimensions in health service, 66*(6), 22, 24.

Day, K., Carreon, D., & Stump, C. (2000). The therapeutic design of environments for people with dementia: a review of the empirical research. *Gerontologist, 40*(4), 397-416.

de Certeau, M. (1984). *The Practice of Everyday Life* (S. Rendall, Trans.). Berkeley: University of California Press.(Original work published 1980)

Demirkan, H. (2007). Housing for the aging population. *European Review of Aging and Physical Activity, 4*(1), 33-38. doi:10.1007/s11556-007-0016-z

Fleming, R., Goodenough, B., Low, L., Chenoweth, L., & Brodaty, H. (2016). The relationship between the quality of the built environment and the quality of life of people with dementia in residential care. Dementia-International Journal Of Social Research And Practice, 15(4), 663-680. doi: 10.1177/1471301214532460

Foresight Mental Capital. (2008). *Wellbeing Project (2008) Final project report—executive summary*. London: The Government Office for Science

Garcia, L. J., Hébert, M., Kozak, J., Sénécal, I., Slaughter, S. E., Aminzadeh, F., . . . Eliasziw, M. (2012). Perceptions of family and staff on the role of the environment in long-term care homes for people with dementia. *International Psychogeriatrics, 24*(05), 753-765. doi:10.1017/S1041610211002675

Garre-Olmo, J., López-Pousa, S., Turon-Estrada, A., Juvinyà, D., Ballester, D., & Vilalta-Franch, J. (2012). Environmental determinants of quality of life in nursing home residents with severe dementia. *Journal of the American Geriatrics Society, 60*(7), 1230-1236.

Glaser, B. G., & Strauss, A. L. (2009). *The discovery of grounded theory: Strategies for qualitative research*. Transaction publishers.

Gold, R. (1958). Roles in Sociological Field Observations. *Social Forces, 36*(3), 217-223. doi:10.2307/2573808

Goldsmith, S. (2012). *Designing for the disabled: the new paradigm.* London: Routledge.

Granville, S., Mulholland, S., & Staniforth, J. (2009). *Use and Understanding of the Scottish Government Urban Rural Classification.* Edinburgh: Scottish Government.

Hanington, B., & Martin, B. (2012). *Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions. Beverly, Mass.: Rockport.*

Hanson, J., Zako, R., & Van Nes, A. (2005). Configuration and design in caring environments: Syntax and quality of life in a sample of residential care homes for older people. *Presented At: Proceedings of the 5th International Space Syntax Symposium June 2005*, Volume 2. (2005).

Jencks, C., & Heathcote, E. (2010). *The Architecture of Hope: Maggie's Cancer Caring Centres.*London : frances lincoln ltd.

Joseph, A., Choi, Y.-S., & Quan, X. (2015). Impact of the Physical Environment of Residential Health, Care, and Support Facilities (RHCSF) on Staff and Residents A Systematic Review of the Literature. *Environment and Behavior*. *48*(10), 1203-1241. doi:10.1177/0013916515597027

Kidd, B. (1997). A journey with Alice. In M. Marshall (Ed.), *State of the art in dementia care.* London: Centre for Policy on Ageing.

Marquardt, G., Bueter, K., & Motzek, T. (2014). Impact of the design of the built environment on people with dementia: an evidence-based review. *HERD, 8*(1), 127-157. doi:10.1177/193758671400800111

Marquardt, G., & Schmieg, P. (2009). Dementia-friendly architecture: environments that facilitate wayfinding in nursing homes. *American journal of Alzheimer's disease and other dementias, 24*(4), 333-340.

Marshall, C., & Rossman, G. B. (2006). *Designing qualitative research* (4 ed.). Thousand Oaks, Calif. ; London: Sage.

McIntyre, L. J., & Harrison, I. R. (2016). Knowledge exchange methods in practice: knowing how to design for older adults. *Architecture Research Quarterly, 20*(3), 271-280. doi:10.1017/S1359135516000361

Moule, J. (2012). *Killer UX design. Collingwood,* Australia: SitePoint.

New Economics Foundation. (2010). *Five Ways to Well-being*. Retrieved from https://issuu.com/neweconomicsfoundation/docs/five_ways_to_well-being

Oldenberg, R. (1997). *The Great Good Place and how they get you through the day*. *San Francisco*: *Marlowe and Co.*

Parker, C., Barnes, S., McKee, K., Morgan, K., Torrington, J., & Tregenza, P. (2004). Quality of life and building design in residential and nursing homes for older people. *Ageing and society, 24*(6), 941-962.

Rijnaard, M., van Hoof, J., Janssen, B., Verbeek, H., Pocornie, W., Eijkelenboom, A., . . . Wouters, E. (2016). The Factors Influencing the Sense of Home in Nursing Homes: A

Systematic Review from the Perspective of Residents. *Journal of Aging Research, 2016, 6143645*. doi: 10.1155/2016/6143645

Robinson, C. (2002). Real world research: a resource for social scientists and practitioner-researchers: Oxford: Blackwell.

Scottish Executive. (2005). *National Care Standards: care homes for older people.* Edinburgh: Scottish Executive.

Torrington, J., & Tregenza, P. (2007). Lighting for people with dementia. *Lighting Research and Technology, 39*(1), 81-97.

van Dijck-Heinen, C., Wouters, E., Janssen, B., & van Hoof, J. (2014). The environmental design of residential care facilities: a sense of home through the eyes of nursing home residents. *International Journal for Innovative Research in Science and Technology, 1*(4), 57-69.

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