

Designing therapeutic and social spaces for older adults facing Mild Cognitive Impairment: Priorities in spatial and furniture layout

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doi.org/10.21606/iasdr.2023.174

Mild Cognitive impairment (MCI) is the stage between healthy cognitive functioning and Dementia, in which individuals still live independently at home but develop difficulties related to memory, executive functioning, and decision-making. MCI is mainly managed with therapeutic activities such as physical exercise, cognitive training, nutrition, and occupational therapies. While individuals living with MCI tend to isolate themselves, social interactions are known for their potential to slow or interrupt cognitive decline, being an important therapeutic component for MCI. Previous studies show how the built environment affects social interactions for Dementia patients living in residential care facilities, specifically through the layout of spaces and furniture. However, it is unclear how the design of therapeutic settings can stimulate the same type of interaction among older adults with MCI. We conducted a survey with healthcare experts in MCI to evaluate whether therapeutic spaces' spatial and furniture layout could foster social interactions among older adults with MCI and identify what should be prioritized in designing these spaces. Survey results showed five priorities when designing therapeutic spaces tailored to older adults with MCI: seating close and facing each other to facilitate conversation in living areas; outdoors therapeutic environments with multi-sensory stimuli; visual access to natural environments; natural lighting in living and dining spaces to motivate their use; and seats available to everyone in social areas. Our findings provide design recommendations that can improve social interactions in these types of settings, potentially contributing to reducing cognitive decline for their users.

Keywords: mild cognitive impairment; social interaction; spatial and furniture layout; therapeutic spaces



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1 Introduction

Mild cognitive impairment (MCI) is the stage between the expected cognitive decline, observed in healthy aging, and more advanced cognitive decline, observed in patients with Dementia (Koepsell & Monsell, 2012). MCI usually occurs in adults over 65 years old and may affect various cognitive functions such as memory, language, practical judgment, decision-making, and the ability to react to external stimuli (Pernecky et al., 2006). Cognitive challenges commonly manifest in instrumental activities of daily living, which require multiple tasks or steps (e.g., complex cooking, financial planning), as opposed to basic activities of daily living (e.g., toileting and eating) (De Vriendt et al., 2012). While more than half of the individuals with MCI tend to have a further decline in cognition, leading to Dementia in less than five years (Gauthier et al., 2006), such a decline can be decelerated (Yates et al., 2017). Different kinds of therapeutic activities may help practice various skills for older adults, with purposeful activities like gardening and physical activity helping enhance an individual's feelings of self-worth, warding off depression and anxiety, and thus improving quality of life (Zou et al., 2019). On the other hand, social interaction is recognized as a protective factor against cognitive decline (Yates et al., 2017; Hughes, 2013; James et al., 2011; Bassuk et al., 1999), albeit particularly challenging for older adults with MCI. Social interaction can be decreased by the higher incidence of anxiety and depression in patients diagnosed with MCI and increased by including family and friends in their social networks, preventing or delaying cognitive decline (Yates et al., 2017). In older adults, which commonly have reduced sizes of social networks and lower amounts of social interactions, social ties are associated with higher levels of psychological well-being and physical health (Sullivan & Chang, 2011). Cognitively challenged individuals, in turn, find it difficult to maintain social ties and networks, as they may start losing confidence to socially interact with others while also losing members in their social networks and having reduced opportunities to get out of their homes and be exposed to other people (Yates et al., 2017).

According to multiple studies, the built environment may help increase the likelihood and quality of social interactions, independently from users' cognitive abilities (Sullivan & Chang, 2011). In the context of cognitively challenged individuals, a study shows how the layout (physical arrangement and positioning) of spaces and furniture can facilitate social encounters for Dementia patients at residential care facilities (Ferdous & Moore, 2015). However, older adults diagnosed with MCI often live independently at home and are exposed to social interactions in less structured, known, and studied spaces. These individuals have only recently started to interact in MCI-dedicated facilities with spaces tailored to offer therapeutic programs, like the Atlanta-based Cognitive Empowerment Center (Aflatoony et al., 2020), where individuals diagnosed with MCI and their care partners (friend or family member) go weekly to spend approximately eight hours interacting in scheduled activities such as yoga, nutrition, and occupational therapy classes, for one year (Mynatt et al., 2022). While promoting cognitively stimulating social interactions in these therapeutic settings is key during the early stages of a disease with no pharmacological treatment, the role of the built environment is still to be investigated and discussed in this type of environment. Focusing on expert perspectives on MCI, this study was developed to evaluate whether the spatial and furniture layout of therapeutic spaces can foster social interactions among individuals with MCI (as they would for individuals with more advanced cognitive impairment) and to identify what should be prioritized in the design of these spaces to maximize social interactions among these individuals.

2 Therapeutic and social interactions for elders with cognitive impairment

Therapeutic activities like gardening and physical activity may improve older people's social networks, life satisfaction, and psychological well-being, helping reduce loneliness (Tse, 2010). Group-based training for MCI patients (e.g., mind-body exercises such as Tai Chi and yoga) may also contribute to social interactions, helping with stress reduction and peer support, enhancing postural stability, and providing additional cognitive stimulation to improve memory, attention, planning, multitasking, perceptual speed, and visual-spatial ability (Zou et al. 2019). Additionally, therapeutic activities focused on mental, physical, or social exercises may enhance cognitive reserve by making people deal with social cues and issues, processing information, and being physically active, ultimately helping protect against the decline of one or more cognitive domains (Wang et al., 2013). Associations between the type of activity and cognitive functioning can be observed, with mental activities being connected to global cognition, language, and executive function, while social activities are connected to global cognition. In addition, Wang et al. (2013) found that all these types of activities - mental, physical, or social exercises - protect against cognitive decline in women, while only mental and physical activities protect men's cognition. On the other hand, for both genders, participation in a minimum of one type of activity was associated with maintained or improved cognitive function. Their results also show that there is a dose-response pattern regarding the number of activities and the cognitive functions: the more types of activities the individual was involved in, the stronger the protection against cognitive decline.

Bassuk et al. (1999) stated that social interactions and ties are components of social engagement. They can be measured by the existence of persistent and numerous social connections and social activities between individuals. Although there is no clear definition for high and low social contact or strong and weak social networks, the general rule observed is that the more, the better. Low participation in social activity is a risk factor for cognitive decline that may be prevented, as individuals that more frequently engage in social activities have a lower risk of progressing from mild to severe cognitive impairment (Hughes, 2013), reducing the decline in global cognitive function significantly (47%) (James et al., 2011). Compared to people with five or more social ties, elders without ties presented an increased risk of cognitive decline (Bassuk et al., 1999), with social engagement being influenced by having a spouse; establishing monthly visual contact with 10+ friends and/or relatives; attending religious services; being a group member; having regular social activities (Bassuk et al., 1999); going to restaurants, sporting events, tele track or playing bingo; going on day or overnight trips; doing unpaid community or volunteer work; visiting relatives' or friends' houses; participating in groups; and attending religious services (Bennett et al., 2005; Buchman et al., 2009).

3 Built environments supporting therapeutic and social interactions

The built environment is known to influence social behaviours (Chaudhury et al., 2013; Hillier & Hanson, 1984), and previous studies suggest that it also supports therapeutic and social interactions for older adults with advanced cognitive impairment. Studies focused on nursing residential care environments for Dementia patients show that environmental affordances are interdependent with individuals (e.g., age and cognitive decline level) when composing therapeutic systems that play a role in social interactions (Chaudhury et al., 2018; Hung & Chaudhury, 2011; Sullivan & Chang, 2011). The layout of spaces and furniture affects spatial preference and usage, and the way people communicate, thereby contributing to the quality of meal interactions, physical activities, and general face-to-face

interactions among groups in shared spaces such as dining rooms, lounges, and outdoor spaces (Chaudhury et al., 2018).

In these types of settings, social interactions may be promoted by interior design features, such as different types of furniture layouts (Sharp et al., 2019) and moveable seating, which have been found to impact spatial qualities such as accessibility and visibility between spaces, people, and activities (Choudhury et al., 2018; Chmielewski & Eastman, 2014; Zeisel et al., 2003). Other physical features such as the size of spaces, the presence of noise distractions, and access to outdoors and daylight also play a role in supporting or hindering social interactions in this context (Chaudhury et al., 2017; Hung & Chaudhury, 2011). Noise has been found to make interactions difficult (Hung & Chaudhury, 2011), while spaces with access to nature have been found to have cognitively rejuvenating effects on people, including windows that allow views of nature and plants placed in interiors (Matsuoka & Sullivan, 2011). More precisely, a recent systematic literature review about memory-care facilities (Ferdous, 2019) identified 19 main environmental affordances that foster social interaction among people living with Dementia, which are presented in Table 1.

Items
1. Seating close and facing each other to facilitate conversation in the living areas
2. Therapeutic environments outdoors with multisensory stimuli (e.g., touching flowers while gardening)
3. Visual access to natural environments, such as gardens and patios
4. Natural lighting in living and dining spaces to motivate their use
5. Seats available to everyone in the social areas (e.g., living rooms)
6. Family-style living and dining areas, allowing the interaction of small groups of people (e.g., with a non-instructional arrangement and home-sized spaces)
7. Circulation areas with access to natural light to facilitate visual orientation
8. Visual reference at strategic points (e.g., signage), such as places where corridors meet, to facilitate orientation in the internal space
9. Corridors with a simple layout (e.g., do not change in direction and do not have ramifications) to facilitate navigation in the space
10. Physically arranged spaces so that noise is not heard from adjacent rooms
11. Corridor width that allows the visualization of all windows and doors from any reference point to facilitate orientation
12. Multifunctional group spaces, instead of specific rooms for each kind of activity
13. Diversity of spaces that allow patients to choose among different activities happening simultaneously (e.g., cognitive training and physical exercises)
14. Visual access to all living areas from any spot in the room to facilitate orientation
15. Contrasting colours identifying different areas of the environment to facilitate orientation (e.g., walls and floors)
16. Relaxing music during meals
17. Learning environments with a non-instructional configuration (e.g., without chairs organized in fixed rows or facing the same direction)
18. Spaces that are customizable with props (e.g., magazines and craft implement)
19. Decentralized dining spaces distributed around the main dining area

Table 1: Affordances of spatial and furniture layout of residences for patients with Dementia. Source: Ferdous (2019)

While the environmental affordances identified by Ferdous (2019) refer to residential care settings for patients with Dementia, our research focuses on therapeutic settings for non-residents with MCI. Therefore, our study focused on investigating to which extent the affordances listed in Table 1 would apply to non-residential therapeutic facilities, promoting social interactions among individuals facing MCI, and identifying which affordances should be prioritized in this emerging type of environment.

4 Methods

Using Ferdous' (2019) list of environmental affordances impacting social interactions in memory-care facilities for people with Dementia, we developed a survey for healthcare professionals familiar with the needs of MCI patients in Brazil.

4.1 Sample

A total of 33 experts in MCI responded to the survey, including 13 (39.4%) mental health professionals (psychiatrists and psychologists), 6 (18.2%) physicians, 6 (18.2%) physiotherapists and physical educators, and 8 (24.2%) experts from other healthcare professions. Concerning their academic background, 42.4% hold master's or Ph.D. degrees, and the remaining participants have medical internships or similar as highest academic degrees. Their average time of experience is 13.4 years (SD=11.9) in healthcare in general, and 7.5 years (SD=9) in treating patients with MCI.

4.2 Data collection instrument

The survey used in this study was based on the extensive literature review developed by Ferdous (2019), who proposed intervention guidelines derived from 13 affordances of spatial and furniture layout that could impact the social interactions of patients with Dementia. From these affordances, we were able to list and explore 19 attributes that could potentially be used in the design of therapeutic facilities for older adults living with MCI subcategories.

Developed and hosted on the online survey platform Survey Monkey, the survey was organized in two blocks of questions. The first block presented participants with questions related to age, experience, and academic background, also defining terms adopted in the study (e.g., therapeutic space and MCI). See below the survey introduction to participants.

You are being invited to participate in a study on the effect of design factors (spatial and environmental) of therapeutic settings on the social interactions among patients with mild cognitive impairment. Consider therapeutic settings as non-residential environments in which patients spend at least half-days developing multiple activities, such as individual and group consultations, cognitive training, physical exercise, have meals, among others. In these settings, patients have free time to interact with each other.

Here we adopt the current definition of mild cognitive impairment (MCI) of the World Health Organization: 'Mild cognitive impairment (MCI) causes a slight but noticeable and measurable decline in cognitive abilities, including memory and thinking skills. (...) Mild cognitive impairment causes cognitive changes that are serious enough to be noticed by the person affected and by family members and friends, but do not affect the individual's ability to carry out everyday activities. (...) People living with MCI, especially MCI involving memory problems, are more likely to develop Alzheimer's disease or other Dementias than people without MCI.'

*However, MCI does not always lead to Dementia. In some individuals, MCI reverts to normal cognition or remains stable.*¹

The second block of questions comprised the 19 attributes and sentences based on Ferdous' study (2019), stating environmental and furniture layout characteristics that would be desirable to stimulate social interactions among individuals with MCI in non-residential therapeutic facilities. Before administering the final survey, all sentences were submitted to face and content validation with two psychiatrists and a speech therapist with extensive experience working with patients diagnosed with MCI. They were asked to evaluate the survey items on their relevance and clarity.

In the final survey, participants were asked to rate the potential of each one of the 19 survey items to stimulate the social interactions of patients with MCI in therapeutic settings. They used a scale of 1 to 7, with 1 being "low" and 7 "high". To guarantee that participants would answer specifically about social interaction, the survey stated: "Please note that it is not generally questioned how important the design factors listed are, but how much they can really impact [MCI] patients' social interactions with each other."

4.3 Recruitment and data collection

Through the researchers' professional networks, participants were recruited using convenience and snowball sampling. Inclusion criteria were set as (1) being a healthcare professional and (2) who has previously worked with elderly patients diagnosed with MCI. Links to the online survey were sent via e-mail to prospective respondents who fit the inclusion criteria. Upon clicking on the link, participants were informed that participation was voluntary and that all answers would be anonymous. They were subsequently asked to agree with an informed consent form before answering the survey.

This study was evaluated and approved by the ethics committee of *Universidade do Vale do Rio dos Sinos*, Brazil (CAAE: 33547720.2.0000.5344).

4.4 Data Analysis

We used the Statistical Package for the Social Sciences (SPSS version 21.0) to analyse the survey data, applying descriptive statistics (means and standard deviations) to describe the results of the 19-item scale. We calculated the standardized deviation scores to compare the items' scores. By subtracting the individual mean of each item from the overall mean and dividing it by the overall standard deviation, we could identify affordances of spatial and furniture layout with scores that are equal to or above 1.0 and defined them as design priorities (Tortorella & Fogliatto, 2014).

5 Results

Results showed participants perceiving all 19 characteristics of spatial and furniture layout as relevant and applicable for older adults with MCI in non-residential therapeutic spaces. Table 2 presents means and standard deviations for all 19 items (Cronbach's Alpha=.91).

Observing the standardized deviations scores, the overall mean for the 19 items was 5.42 (SD=.46). By subtracting the mean of each item from the overall mean and dividing it by the overall standard

¹ Source: World Health Organization, https://www.alz.org/alzheimers-Dementia/what-is-Dementia/related_conditions/mild-cognitive-impairment (July 29, 2020)

deviation, we identified five affordances of spatial and furniture layout with scores that are equal to or above 1.0. They can be considered priorities in projects focused on patients diagnosed with MCI: (i) seating close and facing each other to facilitate conversation in the living areas; (ii) therapeutic environments outdoors with multisensory stimuli (e.g., touching flowers while gardening); (iii) visual access to natural environments, such as gardens and patios; (iv) natural lighting in living and dining spaces to motivate their use; and (v) seats available to everyone in the social areas (e.g., living rooms).

Table 2. Means and standard deviations of agreements with each environmental factor contributing to the interaction of people living with MCI

Items	M	SD
1. Seating close and facing each other to facilitate conversation in the living areas	5.97	1.59
2. Therapeutic environments outdoors with multisensory stimuli (e.g., touching flowers while gardening)	5.94	1.58
3. Visual access to natural environments, such as gardens and patios	5.89	1.52
4. Natural lighting in living and dining spaces to motivate their use	5.88	1.47
5. Seats available to everyone in the social areas (e.g., living rooms)	5.88	1.19
6. Family-style living and dining areas, allowing the interaction of small groups of people (e.g., with a non-instructional arrangement and home-sized spaces)	5.85	1.06
7. Circulation areas with access to natural light to facilitate visual orientation	5.82	1.47
8. Visual reference at strategic points (e.g., signage), such as places where corridors meet, to facilitate orientation in the internal space	5.67	1.87
9. Corridors with a simple layout (e.g., do not change in direction and do not have ramifications) to facilitate navigation in the space	5.49	1.75
10. Physically arranged spaces so that noise is not heard from adjacent rooms	5.49	1.7
11. Corridor width that allows the visualization of all windows and doors from any reference point to facilitate orientation	5.27	1.59
12. Multifunctional group spaces, instead of specific rooms for each kind of activity	5.27	1.84
13. Diversity of spaces that allow patients to choose among different activities happening simultaneously (e.g., cognitive training and physical exercises)	5.27	1.72
14. Visual access to all living areas from any spot in the room to facilitate orientation	5.21	2.01
15. Contrasting colours identifying different areas of the environment to facilitate orientation (e.g., walls and floors)	5.15	2.02
16. Relaxing music during meals	4.97	2.04
17. Learning environments with a non-instructional configuration (e.g., without chairs organized in fixed rows or facing the same direction)	4.82	1.76
18. Spaces that are customizable with props (e.g., magazines and craft implement)	4.67	1.67
19. Decentralized dining spaces distributed around the main dining area	4.49	1.72

6 Discussion and conclusions

Our research was developed to identify design guidelines for therapeutic facilities serving older adults facing MCI so that these environments can be developed to be socially stimulating. More specifically, we have hypothesized that the same spatial and furniture layout affordances identified in spaces for patients with Dementia (typically residential long-term care facilities with 24h assistance) could be applied to therapeutic spaces used by people diagnosed with MCI, where there are weekly activities

scheduled during the day, with a focus on independence (limited assistance). Results from our survey with healthcare experts in MCI confirmed our hypothesis that the environmental affordances aimed at Dementia patients might also help those diagnosed with MCI. Furthermore, five environmental affordances were highly rated by participants in our research, identifying priorities in the design of therapeutic and social spaces for older adults with MCI.

Two priority affordances relate to the layout of seating, one concerning seat availability and another concerning seating arrangements. These findings are supported by studies that suggest that seating arrangement can facilitate social encounters and visual access and that seating should be placed at certain angles instead of in a row or along the room's walls. Chairs should also be organized in a conversational arrangement to positively impact social interactions between cognitively impaired older adults (Geboy, 2009; Ferdous, 2019).

Other three priority affordances relate to outdoor and natural spaces and stimuli, highlighting the importance of having visual access to natural environments such as gardens and patios, exposure to natural light in living and dining spaces, and access to outdoor therapeutic environments that provide multisensory stimuli. According to De Keijzer et al. (2016), having green spaces available can benefit people's cognition, albeit inconsistent results for its association with cognitive decline in older adults. According to Nordin et al. (2017), ensuring that all areas of the facility have access to natural sunlight and garden views can help Dementia care residents with their daily activities. This corroborates with multiple other studies finding that lighting quality positively impacts mental health and behaviour (Ferdous, 2019). In the context of Dementia care, Ferdous (2019) also shows that access to outdoor gardens can help cognitively impaired individuals when containing several types of stimuli such as scented non-toxic flowers, viewing platforms, a variety of flooring, raised beds of plants, gazebos, and fishponds. Purposeful outdoor activities can encourage social interactions during group activities (Wang et al., 2013; Zou et al., 2019; Tse, 2010; Ferdous, 2019).

While we recognize that there are differences between designing for individuals with different levels of cognitive impairment (e.g., Dementia and MCI), we find value in these spatial and furniture affordances showing important design aspects to be considered in the design of MCI-focused spaces aimed at improving social engagement for individuals at early stages of cognitive decline. Since the priorities found are focused on seating arrangements and contact/visual access to natural environments and lighting, we can infer that these are the most important types of stimuli to promote therapeutic and social interactions for older adults living with MCI. Designing the built environment in a way that will stimulate them to interact with each other (e.g., seating in a conversational matter, having chairs in social areas) and with the natural world (e.g., gardening, having access to natural light) may keep them socially engaged and thus impact the course of their cognitive decline progression.

This study has some limitations, which could point to future research directions. First, the extent of the participants' knowledge regarding healthcare facilities specifically designed for patients with MCI was not assessed, which may have influenced their evaluation of the design guidelines. Second, while this study is focused on the experts' views of the built environment, we did not explore the patients' perspectives. Lastly, the present study did not investigate the environmental and behavioural differences between MCI-focused therapeutic facilities (used weekly, during the day and at scheduled times) and Dementia-focused residential long-term facilities (used 24h), which can be explored in future research.

We believe that this study contributes to design research and interventions related to therapeutic facilities supporting older adults with MCI. Environmental affordance priorities posed by the study can inform future design guidelines and help designers and architects create and improve therapeutic facilities that positively impact the social interaction of its users.

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