

한국의 치매 돌봄을 위한 바이오필릭 건축 설계 프로토타입 개발

Development of Biophilic Architecture Design Prototypes for Dementia Care in Korea

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Abstract

This research examines the development of biophilic architectural design prototypes tailored to dementia care environments in Korea, addressing the country's rapidly aging demographic and the projected increase in dementia prevalence. The study focuses on integrating spatial and aesthetic strategies that draw upon established biophilic design principles—such as visual and non-visual connections with nature, thermal and airflow variability, dynamic and diffuse lighting, and the presence of water—into care facility prototypes. The findings offer architects and planners a practical, evidence-informed framework for reimagining dementia care facilities as supportive ecosystems that align with natural systems, thereby enhancing both the quality of care and the quality of life for elderly populations in Korea.

키워드: 바이오필릭, 치매 돌봄 환경, 치료적 디자인, 공간 구성, 한국의 돌봄 환경

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1. Introduction

South Korea is one of the fastest-aging societies in the world. The proportion of elderly citizens is projected to rise from 17.5% in 2022 to exceed 46.4% in 2067 (Jo, 2023). With the aging population and longer life expectancy, the risk of developing dementia is increasing significantly. In 2020, the estimated prevalence of dementia among the elderly over 65 years old in South Korea was 10.3% (approximately 840,000 people). For 2050, it is estimated to be 15.9% (3.2 million) of the elderly population. The economic costs of treating dementia and assisting dementia patients in national dementia management are projected to increase by around 100 trillion won in the future (Lee, 2022).

1.1 The Purpose of the Study

The purpose of this study is to investigate architectural examples of elderly care facilities with a focus on dementia care models that incorporate biophilic design and design strategies for dementia care environments. As a result, prototypes will be developed highlighting the therapeutic benefits of a nature-centered approach for people with dementia.

2. Understanding Dementia and Types of Dementia Facilities

Dementia is a brain disorder characterized by a progressive decline in cognitive abilities. It is diagnosed when an individual experiences chronic difficulty with cognition, most often memory,

along with impairments in at least one other domain such as language, visuospatial skills, or executive functioning. Dementia also requires a decline from the prior level of function and noticeable impairment in daily life activities. The most common forms of dementia include mixed dementia, Alzheimer's disease, cerebral vascular disease, and Lewy body disease (Arvanitakis, 2019). Aging is an important risk factor for all-cause dementia. Alzheimer's disease affects 5–10% of people older than 65 years, and 50% of those 85 years old (Alzheimer's Association, 2019).

According to the severity of each patient's case, there are different types of dementia care facilities. First, residential care is designed for individuals who may have difficulties living independently at home but do not require regular medical supervision. It provides support with personal tasks such as washing, dressing, and personal hygiene, meal assistance, and medication reminders. Second, nursing care offers the same support of residential care with the added presence of qualified nursing staff on-site 24/7. This type of facility is suitable for individuals with more complex health needs requiring continuous monitoring and treatment (MedlinePlus, 2023). Dementia villages focus on providing person-centered care in small-scale, homelike settings for people living with advanced dementia. These facilities address the social, psychological, and physical needs of the patients. It provides a secure environment that supports patients in participating in daily activities, enabling them to live as normally as possible (Lee, 2021).

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3. Principles of Biophilic Design

Wilson (1984) defines biophilia as an “innate tendency to focus on life and lifelike processes” or the “innate emotional affiliation of human beings to other living organisms.” In modern times, this existing human inclination to connect with nature continues to influence people's physical and mental health and well-being. Despite this, modern buildings and landscape design often treat nature as an obstacle to be overcome or neglect the natural environment altogether. The challenge of biophilic design is to adopt practices that create meaningful and satisfying experiences of nature within the built environment (Kellert, 2015).

In the report “14 patterns of biophilic design”, Browning (2014) highlighted the importance of biophilia in the built environment and categorized biophilic design into three principal groups: Nature in the Space Patterns, Natural Analogues Patterns, and Nature of the Space. For this paper, the focus will be on Nature in the Space Patterns, which encompasses specific biophilic design patterns that bring direct experiences of nature into the built environment.

Table 1: Elements of biophilic design – Nature in Space

Element	Detail
Visual Connection with Nature	A view of elements of nature, living systems, and natural processes
Non-Visual Connection with Nature	Auditory, haptic, and olfactory stimuli that engender a deliberate and positive reference to nature
Non-Rhythmic Sensory Stimuli	Stochastic and ephemeral connections with nature that may not be predicted precisely
Thermal & Airflow Variability	Subtle changes in air temperature, airflow across the skin, and surface temperatures that mimic natural environments
Presence of Water	A condition that enhances the experience of a place through the seeing, hearing, or touching of water
Dynamic & Diffuse Light	Leveraging varying intensities of light and shadow that change over time to create conditions that occur in nature
Connection with Natural Systems	Awareness of natural processes, especially seasonal and temporal changes, is characteristic of a healthy ecosystem

4. Biophilic Design in Dementia Care

In recent years, non-pharmacological interventions have been increasingly used to improve the well-being of residents with dementia and their caregivers. Gardens and outdoor spaces in care facilities offer diverse physical and emotional benefits for people with dementia (Whear, 2014). The evidence of benefits for people living with dementia from access to the natural environment can be grouped into improvement of emotional state (reduced stress, agitation, anger, apathy, and depression),—

improvement of physical health (skin health, fitness, sleeping patterns, eating patterns), and improvement of verbal expression, memory, and attention (Clark, 2013).

An example of applying biophilic design to dementia care is the WellCare Garden Fukasawa project for senior citizens, which incorporates the Dynamic & Diffuse Light pattern. Lighting supports healthy sleep cycles and promotes alertness during waking hours, thereby fostering positive psychological and physiological responses while maintaining circadian system functioning (Browning, 2014). Figure 1 shows the courtyard, which serves as a green space and allows natural light to enter the facility. Figure 2 depicts the entrance hall, which is connected to the courtyard, integrating artificial lighting with natural sunlight.



Figures 1 and 2: WellCare Garden Fukasawa by Nikken Housing System Inc. - Tokyo, Japan, 2017(<https://archello.com/fr/project/wellcare-garden-fukasawa-2>)

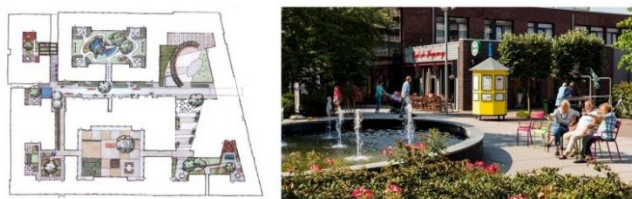
The presence of water has been shown to reduce stress, increase feelings of tranquility, and lower heart rate and blood pressure. Moreover, the water features improve concentration and memory restoration induced by complex, naturally fluctuating visual stimuli, while also enhancing psychological and physiological responsiveness when multiple senses are stimulated simultaneously (Browning, 2014). An example of this is the Residence for the Sisters of St. Joseph of Toronto, which includes 58 residential suites offering various levels of care, from independent living to long-term care and nursing stations. The reflecting pool surrounds the organically shaped chapel. The glass wall connects the outdoor space with the interior, and the water feature functions as an element of transition (Figure 3). The other reflecting pool is adjacent to the southern dining area (Figure 4) (Hidden Architecture, 2025).



Figures 3 and 4: Residence for the Sisters of St. Joseph of Toronto by Shim-Sutcliffe Architects - Toronto, Canada, 2013(<https://hiddenarchitecture.net/residence-for-the-sisters-of-st-joseph-of-toronto/>)

De Hogeweyk is the world's first dementia village, designed specifically to provide care for patients with severe dementia. It is structured as a normal residential neighborhood, where residents can freely walk through surrounding parks, small

gardens, and alleys with trees. The village also offers amenities such as a supermarket, hair salon, restaurant, and cultural center. The effective layout of the building creates open spaces within the built environment, which offers a direct natural experience, and residents can enjoy fresh air (Figure 5) (Dementia Village Associates, 2025). The facility has a human-scale design with several public areas where residents can interact with one another in a natural environment (Figure 6).



Figures 5 and 6: De Hogeweyk Dementia Village by Molenaar&Bol&VanDillen - Weesp, Netherlands, 2009 (<https://www.bethecareconcept.com/en/hogeweyk-dementia-village-hogeweyk-netherlands/>)

The Haesim dang project incorporates the biophilic design principle of visual connection with nature through its rooftop garden, designed with a variety of plants. Although modest in size (200 sqm), the rooftop functions as an eco-garden in the heart of the city. Residents can gather for barbecues, participate in gardening activities, and appreciate the view of the greenery. In addition, the common areas on each floor feature a green wall, creating a pleasant and natural atmosphere for users (Kim, 2022).



Figures 7 and 8: Haesim dang - 해심당, LH public rental housing by GEEUMPLUS and GAIN ARCHITECTURE, Dobong, Seoul, South Korea, 2021 (<https://archello.com/project/lh-public-rental-housing-haesimdang>)

4.1 Activities connected with nature: Gardening

Activities that foster a connection with nature, such as gardening, can improve the well-being of residents with dementia and their caregivers. A study conducted with staff in various dementia care facilities reported positive results about the contribution of plants to individuals with dementia. Most of the nursing personnel agreed with the following statements: “Familiar plants can evoke residents' memories”, “Nursing of plants can maintain the residents' functional ability”, “Plants can help residents to maintain their awareness of changing seasons”, and “Plants can help a resident to orient in space”. Moreover, they described how the residents were delighted when receiving plants and felt useful while caring for them. The study concluded that plant-related activities enable residents to apply their skills, preserve functional

abilities, and enhance self-esteem (Rappe, 2004).

5. Design Strategies in Dementia Care Environments

Along with biophilic design, other architectural features enhance the lives of elderly individuals living with dementia. Key design strategies include wayfinding and orientation, creating homelike atmospheres, utilizing environmental cues, and ensuring safety and accessibility. Incorporating these measures can transform built environments into enriching and therapeutic settings (Ghamari, 2025).

5.1 Wayfinding and orientation

People with dementia, especially Alzheimer's disease, often face difficulties navigating and understanding spatial layouts. Such problems are related to neurodegeneration and cognitive impairments associated with the disease. Therefore, when designing dementia-friendly care facilities, it is essential to ensure simplicity in navigation through straight, circular systems, visual accessibility, reduced decision-making points, and enhanced architectural legibility. (Marquardt, 2009).

5.2 Homelike atmosphere

Familiarity and a sense of comfort are essential in environments designed for individuals with dementia. The spatial organization should provide a gradual transition from public to private areas. Common spaces such as living rooms, kitchen units, and informal activity areas should be strategically placed in visible and accessible locations along pathways, contributing to a recognizable and easily navigable space (Ghamari, 2025).

An example of the homelike setting applied in a project can be found at the Injain Care Center in South Korea. The exterior design was conceived to create a homelike interior for the elderly that resembles a collection of homes (Figure 9). The building's facade is uneven to allow the insertion of a window in each room, which offers a clear view of the park outside, and the interior spaces are filled with sunlight. Moreover, instead of locating rooms along a corridor like in a hospital, the building was designed as a unit that resembles a common house with bedrooms and a living room (Figure 10). According to the architects, it was important to “design the interior like an ordinary home while creating a polished exterior so the elderly feel as though they have simply moved to a fancier home” (Han, 2017).



Figures 9 and 10: Injain Care Center – 인자인 요양원 by Unsangdong Architects – Gyeonggi Bucheon-si, South Korea, 2015(<https://www.joongang.co.kr/article/21092574>)

5.3 Environmental Cues

Incorporating sensory cues can significantly improve the well-being, autonomy, and daily activities of individuals with dementia. Examples include visual cues (contrasting colors and clear signage), olfactory cues (familiar scents), auditory cues (calming music), and tactile cues (textured surfaces) (Ghamari, 2025).

5.4 Safety and Accessibility

Comfort and safety are important elements in dementia care environments. Outdoor spaces are crucial for the well-being of the patients; the overall layout and accessibility should be considered. Features such as handrails, well-defined pathways, outdoor seating and the absence of steps can induce physical activity and engagement (Ghamari, 2025).

6. Conclusion

With the estimated increase to 15.9% (3.2 million) of elderly individuals with dementia by 2050 in South Korea, the development of facilities that can accommodate the growing number of patients has become essential. This study demonstrates that biophilic design holds significant potential to enhance dementia care environments and generate positive outcomes for users. By integrating biophilic design elements, architects can create spaces that promote emotional well-being, physical health, and cognitive engagement for residents with dementia. The care facilities presented in this research illustrate how biophilic principles can be applied in ways that align the therapeutic benefits with safety, accessibility, and orientation. As Korea faces rapid population aging and a rising prevalence of dementia, these findings provide a valuable reference for architects to reimagine dementia care environments as restorative, human-centered, and deeply connected to nature.

References

1. Alzheimer's Association. (2019). Alzheimer's Disease Facts and Figures. *Alzheimers Dement.* 2019; 15 (3):321–87.
2. Arvanitakis, Zoe; Shan, Raj C. & Bennet, David A. (2019). Diagnosis and Management of Dementia: A Review. *JAMA.* 2019 October 22; 322(16): 1589–1599. doi:10.1001/jama.2019.4782.
3. Browning, W. D., Ryan, C. O., and Clancy, J. O. (2014). 14 Patterns of biophilic design. *Terrapin Bright Green.*
4. Clark, P., Mapes, N., Burt, J. & Preston, S. (2013). Greening Dementia - a literature review of the benefits and barriers facing individuals living with dementia in accessing the natural environment and local greenspace. *Natural England Commissioned Reports, Number 137.*
5. Dementia Village Associates. (2025). <https://www.dementiavillage.com/projects/dva-de-hogeweyk/>
6. Ghamari, M.; Suvish; Dehkordi, A.A.; See, C.H.; Sami, A.; Yu, H.; Sundaram, S. (2025) Dementia Friendly Buildings—Approach on Architectures. *Buildings* 2025, 15, 385. <https://doi.org/10.3390/buildings15030385>
7. Hidden Architecture. (2025). <https://hiddenarchitecture.net/residence-for-the-sisters-of-st-joseph-of-toronto/>
8. Jo, H. Y., Lee, H., & Nam, E. W. (2023). Effectiveness of Social Prescribing for Preventing Depression and Dementia of the Elderly Living in the Rural Area. *Journal of Korean Academy of Rural Health Nursing*, 18(1), 1–10. <https://doi.org/10.22715/JKARHN.2023.18.1.1>
9. Kellert, S. and Calabrese, E. (2015). The Practice of Biophilic Design. www.biophilic-design.com
10. Kim, Seonghun. (2022). Haesim dang, a public rental housing for the elderly with ample communal spaces to enjoy. *Designboom.* <https://www.designboom.com/architecture/haesim dang-lh-senior-social-housing-korea-01-16-2022/>
11. Lee, Hyunjung. (2021). A Study on the Spatial Expression Characteristics of Biophilic Design Concept in Dementia Village. *Journal of the Korea Institute of Spatial Design*, Vol.16 No.1
12. Marquardt, G. and Schmieg, P. (2009). Dementia-Friendly Architecture: Environments That Facilitate Wayfinding in Nursing Homes. *American Journal of Alzheimer's Disease & Other Dementias*, volume 24, number 4.
13. MedlinePlus. (2023). <https://medlineplus.gov/>
14. Rappe E. and Lindén L. (2004) Plants in Health Care Environments: Experiences of the Nursing Personnel in Homes for People with Dementia. *Acta Horticulture.*
15. Whear, R. (2014). What Is the Impact of Using Outdoor Spaces Such as Gardens on the Physical and Mental Well-Being of Those With Dementia? A Systematic Review of Quantitative and Qualitative Evidence. *JAMDA* 15 (2014) 697-705.
16. WILSON, E. O. (1984): *Biophilia, the Human Bond With Other Species.* Harvard University Press, Cambridge (Massachusetts)
17. 이윤경, 치매정책 추진 체계의 현황과 과제, 한국보건사회연구원, 2022
18. 한은화, 병원 복도 대신 거실, 따뜻함 담은 마을 짓다, 중앙선데이, 2017