PLANNING MEMORY-FRIENDLY RESIDENTIAL ENVIRONMENTS

The Case of Kuokkalan Kalon in Jyväskylä, Finland

Luiza Sevele

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This master’s thesis is directed by the Sotera research group at the Department of Architecture, promoting independence and well-being for people with memory decline. Worldwide, more than fifty-five million people live with this condition, most of whom will live or want to live in their own homes. With proper assistance and a supportive built environment, aging in place can help retain independence and improve the overall quality of life. However, many built environments often do not anticipate the unique needs of people with memory decline due to decline in cognition, altered sensitivity to environmental conditions, and behavioral symptoms.

This thesis investigates the importance of the built environment for people with memory decline and studies how these environments can help preserve the sense of self and assure independence and safety at home. This thesis aims to create a safe, understandable, and familiar living environment throughout all stages of the condition, allowing people to age in place for as long as possible. The research part is addressed through literature review and case studies.

The design part is developed in collaboration with serviced housing company ‘Yrjö ja Hanna Foundation.’ The housing block ‘Kuokkalan Kalon’ in downtown Jyväskylä, Finland, focuses on multigenerational living, older communities, and a shared economy. One of the five apartment buildings aims to integrate memory-friendly solutions and layouts. This thesis’ design proposal focuses on different scales of residential environments, providing memory-friendly design solutions that range from private: apartments, semi-private: hallways, to semi-public: common spaces, and lastly, public: therapeutic outdoor areas.

Keywords: memory-friendly, memory decline, aging in place, personalization, adaptability, safety, independence, community, residential environment.
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GLOSSARY

DEMENTIA
World Health Organization (2021) defines ‘dementia’ as an umbrella term that describes progressive neurological conditions affecting the brain. Dementia is associated with a decline in memory and other thinking abilities severe enough to affect an individual’s ability to perform daily activities. The most prevalent form of dementia is Alzheimer’s disease.

MEMORY DECLINE
Throughout this thesis, the term ‘memory decline’ refers to people with dementia and also to people who experience cognitive impairment without a diagnosis. Most people who live with dementia do not have a formal diagnosis, with only 20% to 50% of dementia cases diagnosed in primary care in high-income countries (Alzheimer’s Disease International, n.d.).

AGING IN PLACE
The term ‘aging in place’ is commonly addressed to the elderly living within the community. To support this, people must retain some degree of independence when physical, sensory, and cognitive capacities diminish with age. ‘Aging in place’ also applies to moving to an alternative living place, but ideally not into an institutional setting (Alzheimer’s Disease International, 2020, p.64).

MEMORY-FRIENDLY / DEMENTIA-FRIENDLY
According to Alzheimer’s Disease International (2020, p.74), the term ‘dementia-friendly’ encompasses a variety of concepts, ranging from social attitudes toward memory decline and aging to environmental features and modifications that enable a person with memory decline to interact with the environment without fear or discrimination.
Our society recognizes and values someone who adapts quickly, remembers accurately, and thinks clearly. For people with memory decline, this often means carrying a stigma of disability and uselessness as they experience memory loss, among difficulties with understanding and comprehension. Moreover, they are often excluded from society not only socially and economically but also physically by being moved from their homes to care institutions.

Home represents safety, stability, routine, and without it, we become confused, lost, and disorientated. People with memory decline deserve to age in place surrounded by the warmth of their family, friends, and caring community. Aging in place for people with memory decline is not a new concept, but it must be enhanced and better understood.

As an interior architecture student, I have developed an interest in studying therapeutic environments and their impact on improving the quality of life for various population groups. After almost a year of studying this topic, it is my hope that this thesis project can contribute to a better understanding of the living environment’s healing potential and a more informed planning and design process that would result in an enhanced quality of life for people with memory decline, their families and caregivers.
The demographic shift due to population aging and the constant increase in life expectancy is one of the most significant changes in our world today. Medical advances, improved health care, advancements in technology, nutrition, and sanitation all contribute to people living longer (Feddersen & Lüdke, 2009, p.9). While the elderly population is healthier than ever before, sensory, cognitive, and physical health problems are still prevalent. Memory decline, particularly dementia, is one of the most frequent health problems associated with aging today.

Every three seconds, someone in the world develops dementia. It is a neurological condition that affects memory, thinking, emotion and behavior. The early symptoms include short-term memory loss, personality changes, and challenges with daily activities (Alzheimer’s Disease International, n.d).

Due to the decline in cognition, when life at home becomes too difficult, placement in an institution is often seen as an answer. According to Bartlett & Brannelly (2019, p.3), people with memory decline are a social group with the highest institutionalization rate in society. Institutionalization may often be associated with reduced quality of life and questionable quality of care. Despite this, in most Western societies’ institutional care for older people with high care needs remains a cultural norm.

It is expected that with the population aging, there will be a parallel decline in support and care services. According to Feddersen et al. (2014, p.70), in 1875, 95 younger people could potentially care for every 75-year-old. However, there were only 10.6 younger people in 2008, and that number is anticipated to drop to just 3.9 by 2050. Due to the expected lack of staff, the current elderly care system will encounter significant difficulty fulfilling its role.

Given these developments, we should consider alternative ways of living to encourage self-organized arrangements and integrate forms of mutual assistance. Whether those are new buildings (senior residences, co-housing, and others) or modifications to existing homes, the housing and care services must be designed to allow people with memory decline to age in the community and live full and independent lives for as long as possible.

INTRODUCTION

0.1 RELEVANCE

The demographic shift due to population aging and the constant increase in life expectancy is one of the most significant changes in our world today. Medical advances, improved health care, advancements in technology, nutrition, and sanitation all contribute to people living longer (Feddersen & Lüdke, 2009, p.9). While the elderly population is healthier than ever before, sensory, cognitive, and physical health problems are still prevalent. Memory decline, particularly dementia, is one of the most frequent health problems associated with aging today.

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0.2 BACKGROUND

This master’s thesis is part of MonIA project in the Sotera research group at the Department of Architecture. The MonIA project focuses on integrated diverse living solutions for memory care to find strategies promoting diverse, inclusive, and communal living solutions and lessen the social isolation of people living with memory decline.

This project’s founding partners are Aalto University, The Housing Finance and Development Center, and the Finnish Ministry of the Environment. The project consortium includes the following partners: the City of Helsinki, City of Jyväskylä, City of Pori, City of Porvoo, Municipality of Kirkkonummi, Saint Gobain Finland Oy Ecophon, and Yrjö ja Hanna Foundation. Eight thesis students from Interior Architecture, Architecture, Urban Planning, and Landscape architecture are participating in this project in 2021-2022.

This thesis is one of the few MonIA projects focusing on memory-friendly interior solutions. The outcomes from the research part are applied in the design case of ‘Kuokkalan Kalon’ in Jyväskylä, Finland. This case was provided by MonIA partners ‘Yrjö ja Hanna Foundation’.

0.3 RESEARCH QUESTIONS

This thesis is based on three research questions exploring topics such as safe, independent living and aging in place, adaptability and flexibility, and, lastly, a sense of self and sense of community within the residential environments.

1. How can the design of residential environments support independent living and aging in place for people with memory decline?

Designing for people with memory decline in hospitals and care institutions has long been recognized. However, with the rapidly aging population, environments for an independent living need to be considered. This thesis aims to understand how interior spaces can create a safe, predictable, and familiar living environment at home. The outcomes to this question are summarized in ‘Chapter 4 | Design guideline’ and ‘Chapter 5 | Design response.’

2. How to create an adaptable residential environment that accounts for the changes people with memory decline experience when the condition progresses?

Environments designed for people with memory decline should be able to accommodate more than a single, narrowly defined stage of the condition while considering the changing needs of each individual. This question is answered after studying the stages of the condition to understand how the behaviors, mood, and cognitive functions change and affect the person’s relationship with the living environment. The findings are summarized as practical design solutions in ‘Chapter 4 | Design guideline.’

3. What design features can help to enhance the sense of self and sense of community for people with memory decline?

Often the life after diagnosis changes due to the symptoms of the condition and due to other peoples’ reactions. As a result, people with memory decline might experience shame and isolation. This question seeks to understand how the residential environment can support people to continue their normal lives. The answer to this research question is presented through the design of safe and interactive common spaces that allow individuals to express themselves, feel confident, and be in control of their lives.

Figure 1. Development of research questions.
0.4 METHODOLOGY
The research part of this thesis has been developed through literature review and case study analysis. LITERATURE REVIEW summarizes and analyses scientific articles, books, and reports based on a memory-friendly design from 1988 to this year. It examines how memory care, design concepts, and environments have changed over the previous few decades. Lastly, it summarizes the design principles for memory-friendly residential environments.

CASE STUDIES gather information from three carefully selected memory-friendly projects. It allows in-depth exploration of how we should build successful and enabling interior spaces for those affected by cognitive decline.

0.5 THESIS FRAMEWORK
Apart from the introduction chapter, this master’s thesis is divided into five major chapters: background information on the subject, a thorough literature review, analysis of relevant case studies, design guidelines for various scales, and, lastly, design response.

Chapter 1 | BACKGROUND introduces the aging societies phenomena and memory decline on global and national scales. Then it presents the epidemiology of memory decline (types and stages) and describes the traditional care levels and the quality of life associated with them; lastly, it presents the most common non-pharmacological therapies for memory decline, including interior design.

Chapter 2 | LITERATURE REVIEW compares, analyzes, and summarizes six works of literature by researchers in the field (Calkins, Cohen & Weisman, Marshall, Fleming & Bennett, and others). The analysis is developed into nine memory-friendly design principles that support the final design response.

Chapter 3 | CASE STUDIES present housing projects showing current trends and practices for memory-friendly living environments in the Netherlands, Sweden, and Finland. In the selected projects, the people with memory decline live independently in their own apartments while also sharing common spaces with other residents. One case study is a concept project designed as a research and educational tool, while the other two are actual housing developments.

Chapter 4 | DESIGN GUIDELINE presents the findings from the two previous chapters summarized and categorized into four scales of residential environments - private: apartment, semi-private: hallways, semi-public: common spaces, public: outdoor spaces. The guideline provides practical design solutions on how to create spaces memory-friendly. These solutions can be applied to new buildings or as modifications to existing buildings.

Chapter 5 | DESIGN RESPONSE applies the design solutions to the ‘Kuokkalan Kalon’ housing project in Jyväskylä. This chapter presents memory-friendly solutions and layouts for regular and flexible apartments (studio, one-bedroom, two-bedroom), distinctive and safe hallways, common spaces with varying degrees of privacy and function, and therapeutic outdoor spaces.

Figure 2. Thesis framework.
Chapter 1
BACKGROUND

1.1 INTRODUCTION

Chapter 1 explores the demographics on a global and national scale, emphasizing current data on aging societies and the population living with memory decline. Recognizing this demographic data in different scales helps forecast future demands for living environments and care services.

Furthermore, this chapter presents how memory decline is defined. It discusses the symptoms, main types, and progression stages (early, middle, and late) and introduces the traditional types of care and quality of life in these settings.

Lastly, this chapter discusses various non-pharmacological therapies, including environmental interventions and modifications that can support and improve the quality of life for people with memory decline.
GLOBAL SCALE
Globally, people are living longer. Today, the majority of people can expect to live into their sixties and beyond. World Health Organization (2021) projects that the number of individuals aged 60 or over will reach 2 billion by 2050, up from 900 million in 2015.

Aging is a consequence of a decline in fertility and improvements in survival that characterize the demographic transition. By the late nineteenth and early twentieth centuries, Europe had begun the transition to lower fertility and increased longevity in almost all areas. Many European countries are now among the world’s oldest.

Among various physical and mental health problems that individuals experience in their later years, memory decline, especially dementia, is one of the most common causes of dependency among the elderly worldwide. According to the World Health Organization (2021), around 55 million people have dementia worldwide, and nearly ten million new cases occur yearly.

Dementia affects not only the individuals but also their families, caregivers, and society as a whole. As the prevalence of dementia rises with the aging population, so do the costs of dementia care, which have significant economic and social implications in terms of medical and social care costs, as well as informal care costs (World Health Organization, 2021). The costs put physical, emotional, and financial pressure on individuals and their families.

NATIONAL SCALE: FINLAND
Finland is one of the fastest aging countries in the world (United Nations, 2019, p.17). Individuals aged 65 and more account for 22% of the general population, and it is expected to increase to 28% by 2050. At the same time, the birth rate has decreased, and the number of working-age Finns is likely to fall, meaning that the cost of care services is growing while tax revenues are decreasing (Finnish Institute for Health and Welfare, 2021). It is predicted that by 2030, the Finnish economy will be unable to provide fully serviced care homes in accordance with the traditional elderly care model. As a result, effective home healthcare and other services for older adults living independently are needed (This is Finland, 2016).

As the aged population grows, so does the number of people with memory decline, posing a significant challenge to public health and the national economy. In Finland, memory decline is the most common cause of the need for services and is also the main reason for seeking a place from an institution, such as a nursing home (Finne-Soveri et al., 2015, p.12).

In 2015 about 100,000 people had mild memory decline, and approximately 93,000 people had moderate to severe memory decline. Alzheimer’s disease accounted for about 65-70% of all cases (Finne-Soveri et al., 2015, pp. 12). There are about 14,500 new cases diagnosed each year (Finnish Institute for Health and Welfare, 2021).

Finne-Soveri et al. (2015, p. 12-13) studied that some cognitive deficits occur in almost all clients of elderly care services. The number of people diagnosed with memory decline was as follows: 40% percent of regular home care clients; 75% of the residents of residential homes and nursing homes combined; and 62% of the residents of the long-term wards.

The costs of care are growing; therefore, it is suggested that early diagnosis and treatment can help to improve a person’s ability to function and improve their quality of life (Ministry of Social Affairs and Health, 2013, p.2).
1.3 MEMORY DECLINE - WHAT IS IT?

EPIDEMIOLOGY OF DEMENTIA

As seen in the previous sections, the term ‘memory decline’ is used throughout this thesis. ‘Memory decline’ refers to both - those living with dementia and those experiencing cognitive decline without a formal diagnosis. Research shows that the majority of individuals living with dementia do not have a formal diagnosis. In high-income nations, only 20%-50% of dementia cases are detected and recorded in primary care. This ‘treatment gap’ is undoubtedly considerably greater in low- and middle-income nations (Alzheimer’s Disease International, 2019).

As the majority of existing research focuses on ‘dementia,’ this chapter analyzes the epidemiology of dementia in order to provide an overview of the behaviors, symptoms, stages, and types of the condition.

Dementia is a neurological condition that affects each person differently; however, most commonly, in addition to memory loss, people experience symptoms related to communication, comprehension, thinking, orientation, language, and learning capacity (World Health Organization, 2021). Dementia is not a natural part of aging, despite being commonly diagnosed at an older age.

The condition is caused by brain cell damage. This damage impairs the brain cells’ ability to communicate with one another; resulting in the death of nerve cells. Over time, the brain shrinks dramatically, affecting nearly all its functions. Damage to the brain likely starts decades before the real symptoms begin to show (Alzheimer’s Association, n.d).

TYPES OF DEMENTIA

There are over 100 forms of dementia, but the most common are Alzheimer’s disease, Vascular dementia, and mixed dementia.

ALZHEIMER’S DISEASE (60-70%) begins slowly and progressively worsens. The early symptoms include short-term memory loss, forgetting conversations, or having difficulty recalling names. Later symptoms include loss of long-term memory, limited movement, and an inability to respond to the environment.

VASCULAR DEMENTIA (17%) occurs suddenly as a result of a stroke or repeated minor strokes. The most common symptoms are impaired judgment, reasoning, and planning. Memory loss may or may not be a noticeable symptom.

MIXED DEMENTIA (10%) includes symptoms of two or more of the other dementia conditions. In the most common form, the symptoms associated with Alzheimer’s disease are present with the signs of Vascular dementia.

DEMENTIA WITH LEWY BODIES (4%) develops slowly and gradually worsens over several years. The main symptoms of this type of dementia are hallucinations - seeing or hearing things that are not there.

FRONTOTEMPORAL DEMENTIA (2%) usually happens at the age of 50 to 60 when the loss of nerve cells is most noticeable in areas of the brain that regulate behavior, empathy, judgment, and foresight. This is rather an uncommon type of dementia.

PARKINSON’S DISEASE (2%) causes physical symptoms, such as shaking, difficulty with walking, stiffness, coordination, and balance. Problems with cognitive function, such as forgetfulness and difficulty concentrating, emerge later.

The final 3% includes a variety of rare dementias, the majority of which are dementias caused by Huntington’s syndrome.

Figure 5. Types of dementia.
People with dementia experience a gradual loss of cognitive capacity and eventually become dependent on family members and carers for assistance with many aspects of everyday life. Each person experiences the symptoms differently, and the rate at which the condition progresses varies. The phases of dementia are commonly divided into three stages: early stage, middle stage, and late stage. In medical terminology, they are often referred to as mild, moderate, and severe stages. The life expectancy on average is four to eight years after diagnosis; however, this can vary from four to twenty years depending on other factors.

**EARLY STAGE**
When dementia is in its early stages, the signs and symptoms are typically difficult to notice. People are generally able to care for themselves on their own. The most typical challenges they may have are memory-related, for example, difficulty recalling the names of new people, days, or some everyday things. Individuals may encounter problems when completing duties in a social environment, such as handling shopping.

**MIDDLE STAGE**
The middle stage of dementia is usually the longest. During this stage, individuals will require a greater level of care. It will become difficult for the person to express their thoughts and perform their daily routines, therefore becoming moody, often frustrated, or angry. People are commonly experiencing difficulties remembering events and personal history; they will also start experiencing changes in sleep patterns and tend to wander and become lost. People can perform daily activities with assistance; however, it is vital to simplify the tasks and the surrounding environment.

**LATE STAGE**
At the late stage of dementia, the symptoms usually become severe. Individuals may not be able to take care of themselves while performing daily tasks. They may lose the ability to respond to their environment, hold a conversation, and control their movement. People might need around-the-clock assistance at this stage as they will also experience changes in their daily and physical abilities, such as dressing, grooming, toileting, eating with utensils, walking, sitting, and swallowing. Their personality might change and become more emotional; people might experience outbursts, insomnia, and agitation, resulting in screaming and making a loud noise.

**STAGES OF DEMENTIA**

**EARLY STAGE**
- COGNITIVE CHANGE: Difficulties with learning, word-finding, problem-solving, and judgment.
- FUNCTIONAL CHANGE: Forgets details of the conversation, names of people, and days—challenges with reading, handling shopping, taking medication.
- BEHAVIOR CHANGE: Anxiety, irritability, apathy, withdrawal.

**MIDDLE STAGE**
- COGNITIVE CHANGE: Loss of recent memory, language, comprehension, orientation.
- FUNCTIONAL CHANGE: Needs reminders for basic activities, often gets lost, misplaces things, declined basic activities: dressing, grooming, bathing, walking.
- BEHAVIOR CHANGE: Depression, hallucinations, agitation, wandering, insomnia.

**LATE STAGE**
- COGNITIVE CHANGE: Very limited language skills, attention, apraxia.
- FUNCTIONAL CHANGE: Loss of basic activities: dressing, grooming, bathing, eating with utensils, walking, continence. Often bedridden.
- BEHAVIOR CHANGE: Agitation, outbursts with screaming, insomnia.

Figure 6. Cognitive, functional, and behavioral changes associated with the progression of dementia.
TRADITIONAL TYPES OF CARE

One's home serves as an anchor, a place where one feels safe and where things have meaning (Feddersen & Lüdtke, 2009, p.12). It is natural that people wish to remain in their homes until the end of their lives; however, health and socially related factors often determine the level of care and living environment for a person with memory decline. These factors often include health conditions in the later stages of memory decline, informal carers’ limited time, energy, or financial resources. As a result, people with memory decline often are admitted to a care institution.

IN-HOME CARE

Living at home in combination with professional home care is often promoted as a way to maintain independence, autonomy, and a sense of self while also maximizing financial resources. The house and belongings symbolize what an individual has achieved and provide a quality of life that is unmatched in an institutional environment (Van Hoof et al. 2010, p. 203). According to Alzheimer’s Association (2021), there are several in-home care services. The most common are non-medical assistance, such as help with daily activities - personal hygiene, mealtime, dressing, and others. The other in-home services involve medical care provided by health professionals.

ADULT DAYCARE

Daycare provides a chance for people with memory decline to be social and interact with others. Adult daycare offers therapy, health care, personal care, and daily activities in a safe environment; such activities include music and dance, painting, gardening, and others. These activities are frequently goal-oriented, and as a result, they are tailored to the interests and needs of each person.

SENIOR HOUSING

Senior housing is a well-equipped housing scheme consisting of apartments where the elderly live independently and require care and support only when needed. Senior housing usually enhances the sense of community through shared spaces for different activities and therapies (Feddersen & Lüdtke, 2009, p. 23). This living environment is generally for the elderly with no cognitive impairments or people in the early stage of memory decline. When the condition progresses, people are usually suggested to move to a more institutional setting. Today there are not many examples of senior housing for memory decline.

ASSISTED LIVING

Assisted living is a form of communal housing which provides a home-like, social setting where people live in single and double rooms and often have shared spaces and outdoor spaces for common activities. The basic principle of assisted living is that every person lives in their own four walls and leads their everyday life more or less how they wish. The individuals who live in assisted living facilities usually require some personal care; however, often, they are able to take care of themselves and live independently.

NURSING HOMES

Nursing homes provide 24-hour care from qualified health professionals. It is often seen that most families turn to nursing homes only in the later stages of memory decline, as this is also the most expensive form of care (Alzheimer’s Association, 2021). The living space usually includes private or shared rooms, some common areas, and usually limited outside areas. Today many of the care settings have Special Care Units (SCU) with staff trained specifically to assist individuals with memory decline.

EMERGING TRENDS OF CARE

Within the last decade, the model for elderly care has changed and experienced a shift in expectations and demands among older people. People seek a different philosophy and new policies that encourage and support healthy aging. Elderly today strive to maintain a sense of normalcy in their lives and seek continual control, preserving their dignity and autonomy through decision-making.

Nursing homes and assisted living facilities are often stigmatized and perceived as restrictive and confining living environments with lower quality of life for people with memory decline. Mainly because the design and development of these settings often lack the specific understanding of memory care.

Numerous studies comparing home environments with institutions have been conducted. According to a recent Norwegian study (Olsen et al., 2016, p.4), people who lived in nursing homes had a significantly higher quality of life than those who lived in nursing homes. This research was based on comparing cognitive and physical functions, exposure to light, social contacts, sleep patterns, and medication.

The research found that remaining at one’s home as long as possible is economically and health-politically beneficial and correlates with a greater quality of life.

Even after the diagnosis, the home should still be a safe place where people can continue to live life as long as possible. However, if they cannot remain living in their own homes due to the difficulty of adapting existing housing stock, the alternative of moving to an independent senior home that is tailored to their needs should be seen as a positive opportunity.

The ideal scenario in the future is that senior homes are regular, attractive homes built with memory-friendly solutions where people want to move and are given a chance to continue their regular life, live independently within the community that is helpful and encouraged to promote networks of mutual assistance.

Based on these findings, this project aims to promote memory-friendly residential environments that allow people to live and age independently while receiving tailored care services and avoiding the institutional care settings for as long as possible.

In order to design residential environments that support and improve the quality of life of people with memory decline, we must closely study and understand the relationship between the living environment and memory decline.
Currently, there is no pharmacological cure for memory decline. However, more recently, the evidence supporting the efficacy of non-pharmacological approaches has increased (Sanchez et al., 2015, p.341). Therefore, if we move our attention from pharmacological treatments to non-pharmacological treatments, then memory decline can be treated in various ways.

This section describes the most commonly known non-pharmacological interventions and therapies for people with memory decline. These interventions aim to minimize the symptoms and improve the quality of life and well-being.

### COGNITIVE INTERVENTIONS

Cognitive and emotional-oriented interventions aim to enhance cognitive, emotional, and social functioning. It typically entails exposure to and engagement with activities and materials that require some level of cognitive processing in a social context and is frequently group-based, emphasizing activity enjoyment. In most cases, this intervention is accompanied by activities such as word games, puzzles, and cooking. Art and reminiscence therapy are two of the most common therapies.

### SENSORY STIMULATION INTERVENTIONS

Sensory stimulation interventions activate one or more senses. Visual, tactile, auditory, and olfactory stimulation is offered to people using a variety of multi-sensory signals: lights, fiber-optic cables, aromatherapy, different music/sounds, tactile objects, and screen projectors (Sanchez et al., 2015, p.341).

Sensory stimulation intervention can also be performed in groups, such as music therapy - either participating or only listening; dance and physical movement therapy; and horticultural therapy (sensory gardening).

### ENVIRONMENTAL INTERVENTIONS

The well-being and behavior of people with memory decline are strongly determined by the design of the environments they live in (Marquardt, 2011, p.76).

The therapeutic environment has the ability to decrease disorientation and agitation, enhance navigation, and promote social engagement almost entirely on its own. On the other hand, a poor environment contributes to confusion and behavior that is distressing to both individuals and their caregivers (Fleming & Bennett, 2017, p.549).

According to Zeisel (2010, p.88), in a study for the US National Institute on Aging (NIA), they found that the most important factor on how to address memory decline through interior design is to link the design to three brain attributes with which the neurosciences are concerned - cognitive mapping, way-finding, and memory.

**Cognitive mapping** is the mental process through which our brains recall the routes that link the locations we travel between. As the ‘cognitive map’ tends to be impaired, the environment must provide cues to allow a person to function independently.

**Way-finding** is the mental and physical act of navigating through an environment. For people with memory decline, the more specific, explicit, and dominating a route is, and the more multi-sensory signals suggest the paths, the simpler it is to navigate.

**Memory**. Memory is not entirely formed in a single portion of the brain; instead, experience attributes are distributed across the brain. Therefore, memory-jogging and personalized physical settings ‘trigger’ individuals living with memory decline to access their memories.

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**1.5 NON-PHARMACOLOGICAL INTERVENTIONS**

**TYPES OF INTERVENTIONS**

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The well-being and behavior of people with memory decline are strongly determined by the design of the environments they live in (Marquardt, 2011, p.76).

The therapeutic environment has the ability to decrease disorientation and agitation, enhance navigation, and promote social engagement almost entirely on its own. On the other hand, a poor environment contributes to confusion and behavior that is distressing to both individuals and their caregivers (Fleming & Bennett, 2017, p.549).

According to Zeisel (2010, p.88), in a study for the US National Institute on Aging (NIA), they found that the most important factor on how to address memory decline through interior design is to link the design to three brain attributes with which the neurosciences are concerned - cognitive mapping, way-finding, and memory.

**Cognitive mapping** is the mental process through which our brains recall the routes that link the locations we travel between. As the ‘cognitive map’ tends to be impaired, the environment must provide cues to allow a person to function independently.

**Way-finding** is the mental and physical act of navigating through an environment. For people with memory decline, the more specific, explicit, and dominating a route is, and the more multi-sensory signals suggest the paths, the simpler it is to navigate.

**Memory**. Memory is not entirely formed in a single portion of the brain; instead, experience attributes are distributed across the brain. Therefore, memory-jogging and personalized physical settings ‘trigger’ individuals living with memory decline to access their memories.
Chapter 2
LITERATURE REVIEW

2.1 INTRODUCTION

Chapter 2 discusses various approaches to memory-friendly interior design. Six works of literature are compared and summarized. In this review, the design principles are used as a focal point for analysis and comparison as they often have substantial overlap and similarity.

The review is summarized into nine memory-friendly design principles for residential environments. The principles outlined have a primary goal of promoting active and independent aging in place, which addresses cognitive impairments, confusion, wandering, and stimulation. These principles must be studied and evaluated in each context to assess their applicability.
Figure 11 summarizes design principles from six books describing memory-friendly interior solutions in home environments, care institutions, and hospitals.

Designing for people with memory decline in hospitals and care institutions has long been recognized and has generated a large amount of literature. However, an increasing number of people with memory decline continue to live and will live in their homes within the community. Therefore, we must aim to develop design solutions that apply to more independent and inclusive environments.

The first three books by Calkins (1988), Cohen & Weisman (1991), Marshall (1998) are earlier publications and focus more on institutional care settings. All three overlap and are quite similar; however, Marshall (1998) emphasizes the importance of design for care staff.

Cohen & Weisman (1991) present an important point that is not mentioned in other books: ‘6. Adapt to changing needs,’ arguing that it is essential to design for memory decline as a progressive condition rather than only for one stage.

Grey et al. (2015) demonstrate the importance of enabling domestic activities within the living environment and providing safe access to outdoor spaces. Fleming & Bennett (2017) emphasize engagements, socialization, and places for privacy when needed.

The colors in Figure 11 indicate similar principles and ideas from different authors. For example, orange signifies ‘way-finding’ and terms related to it.
The literature review analysis identified nine key design principles for memory-friendly residential environments. Most of the principles selected showed significant similarities. The most common is ‘Way-finding and orientation,’ followed by ‘Safety and security,’ ‘Personalization and familiarity,’ and ‘Sensory environments.’

The principles such as ‘Accessibility and circulation,’ ‘Autonomy and control,’ ‘Flexibility and adaptability’ are less common in the literature, however as this project focuses on independent living, these principles must be studied and understood.

The principles regarding the design for care staff were excluded since this project focuses on aging in place rather than an institutional setting.
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I ACCESSIBILITY AND CIRCULATION

CIRCULATION
The circulation within an apartment building must be logical and legible upon entering. When designing or modifying a building, it is essential to consider the entire circulation as a continuous path. Sufficient data is available to demonstrate that dead-end pathways contribute to frustration and agitation. As a result, it is important to have a layout that incorporates some degree of continuity and forms a continuous loop over a dead-end or interrupted path (Cohen & Weisman, 1991, p. 70).

People with memory decline often experience other related problems, for example, impaired mobility, requiring particular adaptations to create accessible means of entry and circulation within a building. This may entail replacing steps with ramps, enlarging entrances to allow wheelchairs, and making other necessary adaptations. The transition from the entry to the building’s core areas must be physically accessible to all. Individuals should not be required to manage level changes or complex hallway or elevator sequences, compounding their sense of uncertainty and disorientation (Cohen & Weisman, 1991, pp. 91-93).

Exiting
The research shows that the possibility of independently leaving the apartment, walking around, and going outdoors will reduce restlessness and frustration (Grey, 2015, p. 57-58). However, sometimes exiting and wandering alone can pose a risk to a person’s safety.

Multiple measures that help prevent a person from wandering away are presented in Chapter 4, including door alarms, covering the doors, and others. It is essential to note that locking doors or incorporating complex locking systems is not suggested as it will likely result in agitation.

EXITING
For those living with memory decline, entering, exiting, and moving around the building is essential for their independence, safety, and well-being (Grey et al., 2015, p. 51).

ENTERING
According to Cohen & Wesman (1991, p. 92), the entrance area significantly impacts how people perceive the building; therefore, it should express a calm, welcoming atmosphere and be easily identifiable. The use of solutions such as painting the entrance door in a distinctive color, clear signage and graphics, and other measures will help to make it more recognizable and familiar (Grey et al., 2015, pp. 22-39).

Attention should be paid not only to the main entrance of the building but also to individual apartment entrances. The long hallways with similarly-looking apartment entrance doors often can be problematic for people with memory decline as they might get confused and have difficulty finding their homes. According to Grey et al. (2015, p. 61), measures that should be used in hallways to identify a person’s entrance door include adequate lighting levels, signs, and personalization of individual apartment entrances.

2 WAY-FINDING AND ORIENTATION

Remembering the layout and routes can be difficult for someone with memory decline, resulting in disorientation and anxiety (Grey, 2015, p. 120). The environments should assist people in identifying their present location and follow clear paths to desired destinations.

The environment can provide a range of indications and means to aid in way-finding. It can range from the direct sight of the desired destination or highlighting the path to landmarks by using furniture, lighting, color, signs, materials, plants, and others (Calkins, 1988, p. 22).

Some individuals can read and understand signs, while others may have lost the ability. Multiple cues providing the same information in several different ways will offer pertinent information to more people than a single orientation cue would (Calkins, 1988, p. 23). Additionally, using multi-sensory cues such as smells, sounds, or tactile surfaces may help reinforce orientation and legibility (Grey, 2015, p. 124).

Visual distinctiveness is the main environmental feature to aid in orientation. Some of the main components are contrast, colors, signage, and lighting.

CONTRAST
People with memory decline are prone to visual impairment and may have a progressive diminishing ability to see the contrast. As a result, environments should use tone contrast to aid the perception of surfaces and items, such as walls from floors, floors from furniture, food from plates, and others (Feddersen et al., 2014, p.106). According to Halsall & MacDonald (2015, p.98), the contrast between surfaces requires a minimum of 30 LRV (light reflectance value).

COLORS
Whether the person is affected by memory decline or not, the aged eye starts to degenerate. According to Halsall & Macdonald (2015, p. 97), the blue end of the spectrum is lost first due to the yellowing of the eye lens, and as a result, warmer, brighter colors are more visible. In a memory-friendly environment, vibrant colors should be used to compensate for the aging eye’s decline.

SIGNAGE
Signs should be used to help people orient themselves. The most common types of signs include text, photos, individual portraits, and resident name cards. Research conducted by Kleibusch (2018, pp. 37-38) suggests that signage should begin with a capital letter followed by a lowercase letter and be highly contrasted from the graphic and sign background.

LIGHTING
With age, people need far more light to see clearly. Marquardt’s (2011, p. 84) research discovered that residents require a minimum of 500 to 2,000 lux of ambient light in the areas such as apartments and activity areas in order to see the signage, cues, landmarks, or pictures that assist them in orienting and navigating through the building.
3 REGULATION OF SENSORY STIMULATION

NOISE
Overstimulation from noise is a major issue. When a younger person can easily screen out undesired background noise and does so subconsciously, older people cannot do the same (Calkins, 1988, p.94). Reduced sensitivity to high-frequency sounds makes the conversation more difficult to understand in environments with high background noise levels. Excessive noise has been linked to an increase in wandering, aggressive and disruptive behavior, and agitation (Fleming & Bennett, 2017, p. 21).

The core principle for creating appropriate acoustic environments is to increase sound while lowering noise. It is not just about blocking out undesirable sounds, but it is also a matter of ensuring that enjoyable and stimulating sounds are heard (Grey et al., 2015, p.140).

LIGHTING
Lighting is essential for enhancing helpful stimulation (Fleming & Bennett, 2017, p.24). Light regulates circadian rhythms (i.e., the human body clock), and the use of lighting appears to be a promising strategy for rebalancing circadian cycles; it may reduce sleep disturbances, such as restlessness (Grey et al., 2015 p.131).

TEMPERATURE
There is a small but growing body of literature on the negative impact of temperature extremes on individuals with memory decline. A pleasant room climate has been connected with less agitated and disruptive behavior (Fleming & Bennett, 2017, p.21).

CROWDS
Large numbers of people in one space can result in overstimulation. The use of spatial separations can help to decrease the conflicts between activities (Cohen & Weisman, 1991, p.105).

4 SAFETY AND SECURITY

People with memory decline require a safe and easy-to-manage internal and exterior environment to continue living their way of life and making the most of their abilities (Fleming & Bennett, 2017, p.470).

According to Grey et al. (2015, p. 144), the primary concerns identified are wandering away from home or getting lost; falling hazards, being scalded, or other domestic risks linked with everyday tasks. Other issues identified are trip hazards from carpets, access to sharp knives, stovetops, and hot water (Alzheimer’s Disease International, 2020, p. 64).

Risk management technologies and assistive devices are often used to bridge functional status and environmental needs. These include assistive devices and equipment that tackle physical mobility difficulties or cognitive limitations (for example, sensors and alarms) (Alzheimer’s Disease International, 2020, p. 64). However, because most of the older generation did not grow up with technology in their homes, they may feel scared or skeptical when using smart devices. Any technology put in the home must be done responsibly and with consideration for the rights and wishes of the residents.

5 AUTONOMY AND CONTROL

People stay engaged and have a better sense of connection to the environment and community when they can make decisions regarding their living environment (Cohen & Weisman, 1991, pp. 31-32).

When it comes to the design process, according to Grey et al. (2015, p. 17), it is essential to consult with stakeholders throughout the design process to ensure that the design complies with the individual’s objectives. The designer should consider engaging with the following stakeholders: 1) the person with memory decline and other occupants of the house, such as a partner or spouse; 2) the family members who provide care or are in regular contact with the individual; 3) relevant health professionals; 4) former carers.

People with varying cultural, geographic, and economic origins will have varying choices, experiences, and expectations (Fleming & Bennett, 2017, p. 32). Direct engagement will tell the designer about the wishes, preferences, and prior experiences, allowing the designer to incorporate elements such as colors, themes, and familiar objects into the residential environment (Grey et al., 2015 p. 67).
People with memory decline are experiencing ongoing changes both in themselves and in their world. It is essential to maintain connections to what is healthy, familiar, and comforting. They may not recall recent events, but their long-term memory remains intact until the condition progresses. Things from the past can stimulate the exercise and celebration of these remaining capabilities (Cohen & Weisman, 1991, p.33).

On the apartment scale, this means being able to have their personal belongings, furniture, and possessions. To personalize the rental apartments or care settings, residents should have the option of choosing the color of their walls. According to Halsall & MacDonald (2015, p. 103), even if the wallpaper is only on one wall, it can impart a traditional and familiar atmosphere.

In the apartment buildings, hallways should allow the personalization of individual entrances. The entrances can be personalized by adding personal items, photographs, or a memory box, among other things. Personal belongings in the building’s common spaces can create a sense of community and encourage residents to engage in conversation.

The need for socialization is a fundamental need for human beings. The essence of human socialization is communication, both vocal and nonverbal. Memory decline is commonly associated with a gradual reduction in communicative functions.

According to Fleming & Bennett (2017, p. 30), buildings that have a variety of spaces (private, semi-private, and public) with different functions provide an opportunity for greater environmental control. These environments allow people to venture outside their familiar private space and search for conversation and friendship in more public spaces. To allow this, the more public zones should have a variety of functions and characters, for example, a place for reading, doing arts and crafts, gardening, and others.

As important as increased opportunities for socialization are, it is also necessary to allow residents the opportunity to choose when they want privacy (Calkins, 1988, p.24). Spaces for privacy are an essential way to give people many choices for places to be; they can either participate in activities or sit and enjoy the view by themselves without being interrupted.

Before the diagnosis, every person has led a unique life with different memories, past experiences, and life expectations. The residential environments should allow people to live how they have learned to live and continue to do it so meaningfully.

It is essential for people with memory decline to live at home by making everyday activities (cooking, cleaning, or gardening) manageable and safe. Creating an environment that supports a variety of Activities of Daily Living (ADLs), Instrumental Activities of Daily Living (IADLs), and leisure activities not only promote independence but may also increase a person’s confidence and maintain residual abilities (Grey et al., 2015, p.76).

The environment should include opportunities for hobbies, therapies, and relaxation in a social setting. A variety of non-pharmacological interventions (see Chapter 1.5) are essential in promoting better health and well-being and improving quality of life. People should be encouraged to participate in therapies such as music, dance, gardening, art, reminiscence therapy, and others.

Residential environments designed for people with memory decline should be able to accommodate more than a single, narrowly-defined stage of the condition (Cohen & Weisman, 1991, p.33). Due to progressing condition stages, diminishing skills, and changes in behavior, people might require some modifications in the home to increase safety, accessibility, and legibility.

This principle studies how residential environments, particularly apartments, can be adapted to these changing needs. The main goal is to study how simple and effective design solutions can be implemented while avoiding the need for large modifications. According to Grey et al. (2015, p.107), large changes can result in anxiety linked with temporary relocations and stress connected with significant changes to one’s home environment.

All safety and technology solutions should be flexible and adaptable to progressing needs (Grey et al., 2015, pp. 148 - 155). Any technology put in the home must be done responsibly and with consideration for the rights and wishes of the residents.
Chapter 3
CASE STUDIES

3.1 INTRODUCTION
Chapter 3 studies three housing projects: ‘Zierikzee’ in the Netherlands, ‘SilviaBo’ in Sweden, and ‘Trekoli’ in Finland.

The first two case studies present the current trends and practices for memory-friendly residential environments. In these projects, the people with memory decline live independently while sharing various common spaces with other residents. The third case study is not a memory-friendly building; however, it emphasizes the importance of common spaces and communal activities in senior housing.
3.2 ‘ZIERIKZEE’ RESIDENTIAL CARE CENTER

**Design:** Gortemaker Algra Feenstra  
**Location:** The Netherlands  
**Project type:** Residential care center  
**Year:** 2022

‘Zierikzee’ in The Netherlands is selected as the first case study. It was presented on ARCH 22 Living+ Webinar on a topic related to the healing effects of a physical environment. ‘Zierikzee’ is a residential care center for people with varying stages of dementia with a focus on independence, autonomy, and self-direction.

**APARTMENTS**
The building is designed to have one floor, seven wings, and 93 apartments for people with varying stages of dementia. Each of the apartments has access to the outdoors and also another entrance to the common interior spaces of the building. There are multiple wandering routes, landmarks, and themes across the building to provide independence and orientation for each person. The entrance to each apartment has a ‘memory box’ where people can place their personal belongings, which helps them find their homes without confusion.

**COMMON SPACES**
Residents are encouraged to socialize and participate in group activities in the common areas. There are eleven common rooms, each of them have a specific function and a level of privacy. A variety of themes, such as the garden room, the music room, the kitchen diner, the games room, the workplace, the library, the hobby room, and others, are used to support the interests of various resident groups. Each of the eleven activity rooms has plenty of natural light.

**OUTDOORS**
There are multiple gardens, and each one is uniquely planned and designed to avoid repetition and stand out from the others. A diverse selection of walking routes encourages residents to go outside and choose an appropriate path for their level of mobility. Special features, such as railings around the sports track, plants and reeds along the pond, and terraces at the ends of the residential wings, assist with direction. Residents are free to move within the building and outside, with no limits on their movements. Each individual is provided with a ‘bracelet,’ which sends a location to caregivers and family members in case the person with memory decline gets lost (Gortemaker Algra Feenstra, n.d.).
### 3.3 'SILVIABO' ACCESSIBLE DWELLINGS

**Design:** Ikea, Skanska  
**Location:** Sweden  
**Project type:** Housing concept for elderly and people with dementia  
**Year:** 2015

Today, one-fifth of the Swedish population is over 65, and by 2025 it is expected to be nearly a quarter. People live longer and stay healthier. When a person or their partner experiences a disability or dementia, the home should still be a safe place where they can continue to live for as long as possible. Today, there is a shortage of adapted housing for the elderly in most municipalities in Sweden - and it can be difficult to fully adapt the housing in the existing stock due to the high costs (BoKlok, n.d.).

'SilviaBo' provides apartments focusing on accessibility, security, and community without being perceived as a home for the elderly and people with disabilities. This initiative aims to provide homes that are created with the needs of the elderly in mind, rather than homes that have to be adapted later.

#### APARTMENTS

The entrance door is painted in distinctive color to help with way-finding and orientation. The kitchen and living room are connected and form an open floor plan. Interior doors are equipped with grip-friendly handles. The bathroom is equipped with non-slip tiles on the floor and gloss-free tiles on the walls. The bathroom has underfloor heating and extra ceiling lighting that spreads the light evenly. The kitchen cabinets are see-through and have grip-friendly handles. The kitchen has gloss-free tiles. There are electrical outlets with timers on the kitchen surface. The bedroom is bright and spacious, allowing natural light to enter the room and can be controlled by the blinds on the windows. There are sensor lights that are controlled by motion.

#### HALLWAYS

Each apartment building in the neighborhood is marked with a house number. The stairs in the hallway have a light with a motion sensor. The first and last steps are marked extra clearly to avoid the risk of tripping. The elevator is marked with a different color from the wall. The buttons in the elevator are clearly marked. There is also a folding seat available if the resident requires a place to rest their legs.

#### OUTDOORS

The outdoor space is designed to function as a garden of senses, a therapeutic space that stimulates all five senses - feeling, hearing, smell, touch, and taste. The outdoor space is filled with berries, bushes, apple trees, and a flower garden. The common outdoor space serves as a gathering zone for socializing, celebrating, and spending time together. All pathways are well lit and free of dark and unsafe areas. The paths have curbs and low vegetation on the sides that frame them.
3.4 ‘TREKOLI’ SENIOR HOUSING

Design: Architects Rudanko + Kankkunen
Location: Finland
Project type: Senior housing, independent living
Year: 2018

‘Trekoli’ Senior Housing is not a memory-friendly building, but it was chosen as the last case study to present an age-friendly community that emphasizes the importance of common spaces and communal activities in senior housing. The aim of ‘Trekoli’ is to provide aging with grace. The project consists of a 1930s townhouse that previously served as a senior home and a new building with 26 senior apartments and communal areas.

The new apartments for the seniors are designed to be barrier-free, similar to the common spaces and the garden. The garden provides low-barrier workout equipment, a place for barbecue, a garden swing, and easily accessible bike parking.

APARTMENTS
The apartments range in size from studios to one- and two-bedroom apartments. They are available for rent and can accommodate one to two people, making them suitable for both singles and couples. The apartments are relatively small to encourage individuals to use common areas and connect, reducing loneliness and boredom. When entering the apartment, there is a hallway with storage space. The bathroom is equipped with moisture-resistant built-in furniture, drawers, and shelves; the support handles are installed next to the toilet seats. The bathrooms also include a shower seat with a shower set with a support handle. As the bathroom requires more lighting, a led light strip provides additional illumination. The kitchen furniture is equipped with standard white built-in furniture where the dishwasher, fridge, and freezer are integrated into the built-in. The bedroom is equipped with ample storage spaces that include shelves, a clothes rail with sliding doors.

COMMON SPACES
The ground floor of the building has a common lounge space that opens to the upper floors with a high ceiling (see Figure 22). This common lounge has multiple areas, which helps the elderly stay busy and interact with each other. There is a common living room, small kitchen, green wall, mailboxes, and an office of the activities coordinator. Reading balconies on the upper stories overlook the lounge space on the ground floor. The common spaces in the building also include storage space for the outdoor equipment, storage space for the furniture for the apartments, and plenty of bicycle spaces in the hall and the bicycle shed. There is a parking garage in the basement for the residents to keep their cars (Puuinfo, 2020).
Chapter 4
DESIGN GUIDELINE

4.1 INTRODUCTION
The design guideline is developed based on the literature review, particularly the works of Calkins (1988), Cohen and Weisman (1991), Van Hooff et al. (2010), Grey et al. (2015), Halsall et al. (2015), Flemming and Bennett (2017), as well as from the cases presented in the previous chapter.

It is important to note that this is a general guideline summarizing memory-friendly design solutions. Its implementation will vary depending on the size of the building, user groups, and other factors.

The guideline’s structure is built according to nine design principles presented in ‘Chapter 2’ and applied to four spatial scales.

- **Private**: apartments
- **Semi-private**: hallways
- **Semi-public**: common spaces
- **Public**: outdoor places
4.2 PRIVATE APARTMENTS

ENTRANCE

A person’s home and possessions present a lifetime of accomplishment and contribute to a good quality of life into older age. Home also allows the expression of self-identity and lifestyle choices (Alzheimer’s Disease International, 2020, p.62). Every apartment will look different as each person has unique needs, interests, and hobbies. However, multiple design solutions are commonly known to help with cognitive decline and altered sensitivity to the environment. This section summarises and highlights essential points to help design a memory-friendly apartment or modify an existing home.

The apartment’s entrance must be clearly identifiable, as individuals with memory decline may forget the location of their homes. This can be accomplished by providing adequate lighting in the hallway, using signage, and adding personal items. Personalization of the entrance entails the placement of objects that serve as a trigger for memories and foster a sense of continuity (Grey et al., 2015, p. 61); for example, ‘memory boxes’ filled with photographs, notes, and personal belongings can be an effective way for a person to recognize their apartment.

- The apartment entrance should be wheelchair accessible with a wide entry door and a clear area around it.
- Thresholds at the entrance door or inside the apartment should be avoided to prevent falls.
- Lever-style door handles are more grip-friendly in comparison to round doorknobs.
- The keyhole should be positioned above, not below, the handle, increasing visibility and eliminating confusion.
- A small code safe outside the apartment allows the caregiver or family member to acquire keys if the individual with memory decline cannot answer the door.

Access to the apartment should be clearly visible, and the entrance should stand out from the background. Door handles, locks, and doorbells contrast with the door.

A clear sign with the resident’s name, photo, and door number helps to identify the door.

A window at the entrance door helps the person connect to the outside and informs who is standing outside the door.

If adding a window is not possible, a camera adjacent to the inside of the entry door can alert residents about their visitors.

The contrast between the surfaces should be a minimum of 30 LRV (light reflectance value).

Walls and ceilings should be in lighter colors to maximize light reflection.

- ‘Memory box’ with personal items at the entrance helps the person locate their apartment. People identify and respond positively to their current or previous photographs, particularly those with personal importance, such as wedding or birthday photographs.

- The resident should be able to choose the color of their door or entrance nook based on a memory-friendly color scheme.

- The resident can place and display their personal items, photographs, and decor to feel more comfortable and reminiscent.

- Door alarms or door sensors can help prevent a person from wandering away from home. The sensor sends a text message to caregivers or family members to notify them that the door has been opened.

- Busy floor or wall patterns should be avoided as they might cause confusion or disorientation.

- Lighting at the entrance should be evenly distributed to avoid shadows or glare.

- The doormat should have cover strips (similar color to flooring) holding the mat down to avoid trips and falls.

- Avoid spotlights at the entrance, which can create dark shadow zones that can visually confuse a person and hinder their ability to navigate safely in their environment.

- Thresholds at the entrance door or inside the apartment should be avoided to prevent falls.

- The entrance door should stand out from the background. Door handles, locks, and doorbells contrast with the door.

- A clear sign with the resident’s name, photo, and door number helps to identify the door.

- A window at the entrance door helps the person connect to the outside and informs who is standing outside the door.

- If adding a window is not possible, a camera adjacent to the inside of the entry door can alert residents about their visitors.

- A small code safe outside the apartment allows the caregiver or family member to acquire keys if the individual with memory decline cannot answer the door.

SAFETY & SECURITY

- The contrast between the surfaces should be a minimum of 30 LRV (light reflectance value).

- Walls and ceilings should be in lighter colors to maximize light reflection.

- Busy floor or wall patterns should be avoided as they might cause confusion or disorientation.

- Lighting at the entrance should be evenly distributed to avoid shadows or glare.

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- The contrast between the surfaces should be a minimum of 30 LRV (light reflectance value).

- Walls and ceilings should be in lighter colors to maximize light reflection.

Memory-friendly design solutions for apartment entrance.
The living room is one of the most commonly used rooms in the apartment. Because a person may spend a significant amount of time there, the layout, visual access, accessibility, and safety are critical. According to Grey et al. (2015, p.78), it is essential to have an open floor plan to maximize visual access and communication.

Accessibility, sufficient space, and safety are primary concerns when designing balconies or terraces. Safe and accessible outdoor spaces provide numerous benefits, including access to daylight, fresh air views, and the opportunity to grow food, herbs, or plants; all of these can be highly therapeutic for someone experiencing memory decline (Grey et al., 2015, p.102).

**ACCESSIBILITY & CIRCULATION**
- Open-plan layout combining the living room with the kitchen allows visual access to other key areas of the apartment.
- Consistent floor material through the whole apartment helps to avoid the illusion of a shift in level.
- When possible, the doors in the apartment should be placed to create a circular walkway and avoid dead-ends.
- Direct access from living room to outdoor space/terrace help with orientation to time and season, provide fresh air and social interaction.
- Balcony should have a minimum depth of 1500mm or 1800mm to ensure enough space outdoors. This is especially critical if a person spends most of their time at home.

**WAY-FINDING & ORIENTATION**
- The light switches should be clearly marked and contain an ‘on/off’ button to assist residents.
- Use color to contrast the furniture from walls and floors, doors, and other essential features.
- Regardless of whether the living area is open plan or not, the attempt should be made to offer direct lines of view to key areas such as the toilet, kitchen, or dining room to aid with orientation and provide visual signals.
- Various elements can help to assist in navigating the room, such as a house plant that will point the way to the balcony or outside space.
- Provide a ‘view to green’ and ensure that the window cills do not obstruct a person’s view of the outdoors when lying down or seated.
- The contrast between the surfaces should be a minimum of 30 LRV (light reflectance value).
- Walls and ceilings should be in lighter colors to maximize light reflection.

**REGULATION OF SENSORY STIMULATION**
- Dimmer switches help to adjust the lighting throughout the day and evening.
- Soft furnishings help to absorb sound and assist in creating a calm environment.
- Large clocks aid in orientation to time.

**FAMILIARITY & PERSONALIZATION**
- Open shelves that display personal belongings, photos, and decorations help to trigger memory and create a familiar environment.

**SAFETY & SECURITY**
- Busy floor or wall patterns should be avoided as they might cause confusion or disorientation.
- Living room should have a sturdy furniture and objects without rough edges to avoid falls.
- Dark carpets should be avoided as they may create the illusion of a shift in level or appear as a hole.
- Carpets should have cover strips holding the carpet down with similar color to flooring.
- Keep floor lamps and wires out of the way. Touch-activated lighting is easier to use when it becomes difficult to locate switches.
- Underfloor heating provides consistent area heating and eliminates the need for radiators, which can cause burns in the event of a fall.

**FLEXIBILITY & ADAPTABILITY**
- If safety on the terrace becomes a serious concern, consider installing 1800mm high safety glass or balcony railings of full height, creating a ‘winter garden’ type balcony.
- When necessary, consider installing handrails on load-bearing walls to improve mobility around the apartment.
The kitchen is often referred to as the ‘heart’ of the home, where individuals spend their time doing daily routines such as dining, cooking, doing dishes, and cleaning. On the other hand, the kitchen can also be a potentially dangerous space. Apart from using sharp objects and stoves, individuals may want to cook independently and forget about it (Van Hoof et al., 2010, p.211). Therefore, the kitchen should be designed with independence and safety in mind allowing individuals with memory decline to continue their daily routines with the least amount of risk to their safety.

According to Van Hoof et al. (2010, p.211), dining is another activity to consider in the kitchen. During the early and middle stages of memory decline, people may eat and drink independently; however, they will need assistance when the condition progresses. Design solutions for independent dining include good lighting so that people can see their food, little background noise to non-distracting levels, as well as subtle cues such as food smells that remind them to eat.

### Memory-friendly design solutions for kitchen and dining room.

- **ACCESSIBILITY & CIRCULATION**
  - Store frequently used goods at a convenient height—the highest shelf, measuring between 1.40 and 1.70 meters.
  - The cooking surface should be the same level as the countertop.

- **REGULATION OF SENSORY STIMULATION**
  - When the kitchen is adjacent to the dining area, it allows the flow of cooking smells and views of food preparation. The smells coming from the kitchen contribute to smell sense activation.
  - ‘View to green’ and natural light aids in orientation to time, place, and season.
  - Dimmer switches help to adjust the lighting throughout the day and evening.

- **AUTONOMY & CONTROL**
  - Controls and switches that are intuitive and simple to use should be provided (oven, stove, light switches, water taps). It will create a feeling of control.

- **WAY-FINDING & ORIENTATION**
  - Chairs and dining table should contrast the floor and wall. Use color of the table that contrasts with the crockery and cutlery.
  - Open or glazed kitchen units ensure visual access to contents inside.
  - The light switches should be clearly marked and contain an ‘on/off’ button to assist residents.
  - Use constant color code for taps: ‘red’ for hot and ‘blue’ for cold.
  - Light in the drawers help with better visibility.
  - Images, labels, and signs on kitchen cupboards and drawers help to illustrate the contents.
  - Food-related images and objects in the kitchen can help reinforce the space’s identity.
  - Use overhead lighting to emphasize the dining table, sink, cooking area.
  - Walls and ceilings should be in lighter colors to maximize light reflection.

- **MEANINGFUL ACTIVITIES**
  - Writing board to write reminders, daily tasks, recipes can help the person recall the chores and routines.

- **SAFETY & SECURITY**
  - Busy floor or wall patterns should be avoided as they might cause confusion or disorientation.
  - Lighting should be evenly distributed to avoid shadows or glare.
  - Use stoves and other appliances that automatically turn the power off if the person forgets to turn it off.
  - Use induction hobs, which generate heat just where the pot or pan is put, leaving the remaining surface of the hob cold.
  - Anti-scald taps help to avoid scalding.
  - Sensors for smoke and heat should be connected to an alarm system. These should not emit a loud alert, as this may be scary and disorienting for someone experiencing memory decline. The alarm system can be integrated with an alert system for caregivers.

- **FLEXIBILITY & ADAPTABILITY**
  - When memory decline progresses, consider installing a locked cupboard or cabinet where the more dangerous appliances can be stored and not easily accessed.
  - When necessary, consider installing handrails on load-bearing walls to improve mobility around the apartment.

Walls and ceilings should be in lighter colors to maximize light reflection.
People with memory decline frequently experience sleep disturbances, such as insomnia, wandering, and nocturnal restlessness. The bedroom must be designed to facilitate optimum rest and sleep.

The bedroom is where various daily routines are completed, such as dressing, resting, and sleeping. Bedroom design can assist these activities by providing plenty of natural light, good ventilation, sufficient space around the bed, and safe access routes to the bathroom and wardrobe.

### Memory-friendly design solutions for bedroom:

<table>
<thead>
<tr>
<th><strong>BEDROOM</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>People with memory decline frequently experience sleep disturbances, such as insomnia, wandering, and nocturnal restlessness. The bedroom must be designed to facilitate optimum rest and sleep. The bedroom is where various daily routines are completed, such as dressing, resting, and sleeping. Bedroom design can assist these activities by providing plenty of natural light, good ventilation, sufficient space around the bed, and safe access routes to the bathroom and wardrobe.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ACCESSIBILITY &amp; CIRCULATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>When possible, a door between the bedroom and bathroom should be considered. It can make the nightly toilet visits easier as the person does not have to get through the entire apartment.</td>
</tr>
<tr>
<td>Wardrobes should be placed in such a way that they are visible from all areas of the room, particularly the bed. This provides visual signals for dressing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WAY-FINDING &amp; ORIENTATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>There should be direct visual access from bed to key spaces: bathroom, wardrobe, hallway and outdoors.</td>
</tr>
<tr>
<td>Illumination on the way to the toilet/in the hallway contributes to the safety of nighttime bathroom visits.</td>
</tr>
<tr>
<td>At night, smart technologies such as motion sensors or pressure mats that activate lighting when a person gets out of bed can be used to direct a person to the bathroom.</td>
</tr>
<tr>
<td>The lights inside the wardrobe drawers help the person to find their clothes easier.</td>
</tr>
<tr>
<td>Provide a 'view to green' and ensure that the window cills do not obstruct a person's view of the outdoors when lying down or seated.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>REGULATION OF SENSORY STIMULATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Window shades, doors, dimmer switches, and partitions are examples of environmental control and sensory stimulus regulation.</td>
</tr>
<tr>
<td>'View to green' aids in orientation to time, place, and season.</td>
</tr>
<tr>
<td>Black out curtains make the bedroom dark during the night and improve the quality of sleep.</td>
</tr>
<tr>
<td>Soft furnishings help to absorb sound and assist in creating a calm environment.</td>
</tr>
<tr>
<td>Creating areas that represent a tranquil atmosphere, away from external sources of disturbance and closer to sources of pleasant noises, such as outdoor sounds, birds singing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SAFETY &amp; SECURITY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The bed can be lowered, or the mattress can be placed on the floor to prevent falls.</td>
</tr>
<tr>
<td>Wherever possible, minimize or remove any threshold between the bedroom and the bathroom.</td>
</tr>
<tr>
<td>Busy floor or wall patterns should be avoided as they might cause confusion or disorientation.</td>
</tr>
<tr>
<td>Bedroom should have a sturdy furniture and objects without rough edges to avoid falls.</td>
</tr>
<tr>
<td>Dark carpets should be avoided as they may create the illusion of a shift in level or appear as a hole.</td>
</tr>
<tr>
<td>Keep floor lamps and wires out of the way. When it becomes difficult to locate switches, touch-activated lighting is easier to use.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>FLEXIBILITY &amp; ADAPTABILITY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>As the condition progresses, a wardrobe with transparent or open doors should be used to allow for visual access and signal for getting dressed.</td>
</tr>
<tr>
<td>Consider removing mirrors when people become more bed-bound and lose recognition of their reflections.</td>
</tr>
</tbody>
</table>

---

Memory-friendly design solutions for bedroom.
Personal care - toileting, bathing, and hygiene maintenance, is vital for self-esteem and independence. The bathroom must be thoughtfully designed, focusing on safety, accessibility, and visual access to accommodate these activities (Grey et al., 2015, p. 95). The bathroom is commonly considered a high-risk area; common injuries are slips and falls, burns, poisoning, cuts, electricity, and drowning. Measures to improve general safety can help create a secure and supportive environment for people with memory decline and their caregivers (Van Hoof et al., 2010, p. 207).

The bathroom should be centrally positioned in the apartment, with easy access from all areas. A wheelchair-accessible bathroom requires a space free of fixed furniture with a minimum diameter of 1500 mm and a maximum height of two meters. There should be no thresholds between the bathroom and the hallway. While the bathroom floor may be tiled in contrast to the carpet or wood in the hallway, the color and tone contrast at the threshold must be kept to a minimum to avoid the illusion of a step. Barrier-free shower with a wall-mounted shower seat adjacent to the shower (500 mm from the floor) can improve accessibility in the bathroom.

Busy floor or wall patterns should be avoided as they might cause confusion or disorientation. The bathroom floor should have non-slip and non-glossy tiles to avoid the risk of falling. Underfloor heating provides consistent area heating and eliminates the need for radiators, which can cause burns in the event of a fall. Consider safety features such as automated water shut-off valves in the event that the individual forgets to turn off the water. Anti-scald thermostatic mixing valves can be installed in showers to prevent scalding during bath time. In the event of a fall, smart technology such as motion sensors or emergency pull-chords might be beneficial.

Memory-friendly design solutions for bathroom.
4.3 SEMI-PRIVATE: HALLWAYS

HALLWAYS
For people with memory decline, hallways may often seem confusing and cause frustration if the hallways are long, repetitive, and artificially lit (Flemming & Bennett, 2017, p.371). The design goal is to create bright and inviting hallways, with occasional wider areas where people can take a seat and rest. The hallways should also be wide enough to avoid stress and frustration when two people with walking assistance pass each other.

Additionally, the hallways should be meaningful, providing landmarks and a sense of destination. According to Zeisel (2010, p. 88-89), the ability to see one’s destination or intended place from the current position significantly enhances one’s ability to move independently. Familiar and clear landmarks placed at the key decision points, such as the intersection of two hallways or the point at which a person must choose which direction to take, can reduce the risk that someone with impaired way-finding may become lost.

This guideline also includes points regarding the staircases and elevators in an apartment building.

ACCESSIBILITY & CIRCULATION
- Hallways should be wide enough for two people to stand side by side when using walking aids.
- Hallways should have handrails to support accessibility.
- Staircase and elevator doors should be well-lit and easily distinguished from the surroundings by contrasting colors.
- The elevator should have a folding seat if a person needs to rest their legs.

WAY-FINDING & ORIENTATION
- All signs and labels should have a legible, large font (sans-serif) and graphics contrasting with the background color.
- To reduce glare, all signs and labeling should be matte or satin finished and well-lit without producing excessive shine or reflection.
- Signs should be consistent in location to assist people in determining where to search for necessary information; signs should be placed with the lowest edge no more than 1200-1500mm above the ground.
- The contrast between the surfaces should be a minimum of 30 LRV (light reflectance value).
- Walls and ceilings should be in lighter colors to maximize light reflection.
- In hallways with few or no windows, provide a minimum of 500 lux of lighting to ensure that individuals can see cues and landmarks.
- If there are multiple, similarly designed hallways, consider distinguishing them by different colors, cues, and themes that are familiar to residents.
- Handrails in hallways should contrast and stand out from the background.
- Inside the elevator, the buttons and call buttons should have contrasting colors.
- In staircases, each step should be properly indicated, with the first and last steps being particularly well marked to avoid tripping and falling.

REGULATION OF SENSORY STIMULATION
- Provide themed landmarks (memory displays, large photographs, and more). These landmarks can incorporate multi-sensory cues. Some examples are the audio cues of tranquil nature sounds and tactile nature textures. Multi-sensory cues will aid in recalling personal memories, stimulate participation in the healing process, and help individuals recognize and orient themselves in the hallway.
- ‘View to green’ and natural lights from the hallway aid in orientation to time, place, and season.
- Soft furnishings help to absorb sound and assist in creating a calm environment.

SAFETY & SECURITY
- Doors that are not intended for the individual with memory decline, such as those leading to service or technical rooms, can be painted to match the walls and skirtings.
- The stairs should be well and evenly lit at all times to eliminate shadows.
- Consider eliminating mirrors from elevators to avoid any confusion. Similarly, care must be taken with elevator announcements to avoid confusing the residents.

FAMILIARITY & PERSONALIZATION
- If the hallways are wider than the minimum, some elements from the apartments can be brought into the hallway, such as furniture, decorations, plants, and more.

PRIVACY & SOCIALIZATION
- Each hallway should have a place of destination, for example, a small common room or an activity nook. It helps the residents to engage with one another on the same floor without going to common spaces on the ground floor or leaving the building.

Memory-friendly design solutions for hallways including stairs and elevators.
4.4 SEMI-PUBLIC: COMMON SPACES

COMMON SPACES
One of the main design goals is to create a memory-friendly residential environment with a domestic and intimate feel, rather than an institutional environment with hard finishes and large undefined spaces (Halsall & Macdonald, 2015, p. 98). The common spaces should encourage all residents to participate in social activities while also providing chances to be alone and watch others. This option provides inhabitants with some degree of control over their life (Calkins, 1988, p. 85).

It is seen that some care models move all residents into one central common space in order to facilitate efficiency. However, this should not be imposed, as too much activity and interaction can be overstimulating for some residents. Instead, the building should offer residents opportunities for different activities. Creating smaller clusters with varying degrees of functions and privacy can establish links with familiar experiences from the past (Cohen & Weisman, 1991, p. 105).

Decoration and furnishings that differentiate one common place from another help promote appropriate behaviors in each room. When the environment tells us what is expected of us, we tend to hear it. Research shows that people with memory decline are less likely to withdraw and isolate themselves in a setting where each common space is decorated to evoke a different mood. For instance, if someone likes to sit quietly and read, they may visit the library; if they wish to participate in a craft activity, they can visit the hobby room, and so on. The desire to be with others and help and care for them is a universal instinctive feeling that knowledgeable and creative design can evoke (Zeisel, 2010, p. 89).

ACCESSIBILITY & CIRCULATION
- Continuity in common space layout is essential for people with wandering behaviors. Dead-end pathways induce dissatisfaction and irritation.
- If dead-ends are unavoidable, there should be outside views or activity nooks at the end of the route.
- Wandering paths should include points of interest along the way to guarantee that wandering does not devolve into a useless physical activity.
- There should be direct visual access to key spaces such as stairs and elevators along the circulation route.
- The toilet should be centrally located with a distinctive door and a clear sign.

WAY-FINDING & ORIENTATION
- Distinctive activity spaces. Each room should have a clear function; this will enhance the identity of the space and provide further orientations cues.
- Memorable and unique landmarks along the way support residents with cues for orientation. The landmarks do not have to be large or distinctive in appearance; instead, they should have a specific meaning and identity.
- All signs and labels should have a legible, large font (sans-serif) and graphics contrasting with the background color.
- Common spaces should have a constant color code; for example, use orange color for toilet doors, while other doors can be green.

PRIVACY & SOCIALIZATION
- Tackle loneliness and isolation by providing spaces that attract a mix of people and stimulate engagement and participation; the spaces need to provide opportunities for both - being alone or with others.

MEANINGFUL ACTIVITIES
- Meaningful activities and hobbies can help people maintain a sense of normalcy in their lives. The reading/library area should include easily accessible open shelves, stable low tables, comfortable seats, and a peaceful setting with adequate task lighting. Cafe/bar areas - open, inviting food smells and accessible tables and chairs. Craft room - readily available supplies and equipment to promote creativity and relieve stress.

Memory-friendly design solutions for common spaces.
### 4.5 PUBLIC: OUTDOORS

**THERAPEUTIC OUTDOOR SPACES**

Outdoor spaces provide possibilities for multi-sensory experiences through physical exercise, interactions with the community, wildlife, greenery, exposure to daylight, and orientation of seasonal change and time of day, all of which are therapeutic experiences (Grey et al., 2015, p.98).

Outdoor seating and activity areas should be placed towards the sun to allow the body to produce vitamin D and optimize daylight exposure, which aids in circadian rhythm regulation (Halsall & Macdonald, 2015, p.83). If possible, there should be a place for shade in summer and a warm sheltered place in winter (Flemming & Bennett, 2017, p.244). Residents must be allowed to move freely and without interruption. Destinations should be visible with clear signs and indications, and residents should not find themselves at a dead-end with no way back (Flemming & Bennett, 2017, p.387).

According to Fleming & Bennett (2015, p.31), the stigma remains a problem for people with memory decline. Therefore, the building and its surroundings should be designed to blend with the existing community and not stand out as ‘special.’ Where possible, a ‘bridge’ should be built between the building and the community, providing a shared place. One example is a memory-friendly cafe, where a person with memory decline could go without assistance and interact with a wider community.

#### ACCESSIBILITY & CIRCULATION
- Safe, accessible, and attractive outdoor space should be visible and easily accessed from the interior spaces.
- The outdoor path should be two meters wide with even surfaces, continuous materials, and no steps.
- Sheltered and shaded transitional outdoor space allow people to sit outside without total exposure to the weather conditions.
- The entrance door can be opened by using a fob entry or swipe card system; however, they must be intuitive and straightforward to use. Ensure that the fob or card reader is logical and can easily be seen of arrival at the door.

#### WAY-FINDING & ORIENTATION
- Outdoor spaces should have good lighting along the paths and at the entrance to clearly identify the building.
- All signs and labels should have a legible, large font (sans-serif) and graphics contrasting with the background color.
- The front door must be recognizable from the outside. Use an entrance canopy or similar feature to reinforce the location and function of the main entrance.
- The planting helps to personalize and identify the main entrance.

#### REGULATION OF SENSORY STIMULATION
- Multi-sensory outdoor experiences are created by providing vibrant planting and materials to stimulate the visual senses, aromatic planting to stimulate the olfactory senses, textured objects, and plants for tactility.
- Plant species should reflect the seasonal change to help with orientation in time.
- If possible, incorporate natural views and sounds by including species that are attracted to wildlife - butterflies, birds, and bees.

#### PRIVACY & SOCIALIZATION
- Outdoor spaces should have movable, flexible seating nooks accommodating single persons, small groups (2-4), and larger groups (6-10). The seating should be near the entrance door and near activity spaces. The seating places should allow residents to interact with others or sit quietly to take in a view.

#### SAFETY & SECURITY
- All outdoor paths should be well lit.
- All plants should be non-toxic.
- Bushes along the paths can be used as ‘fences’. The bushes make people more comfortable because they decrease their fear of getting lost.
- Use non-slip, non-reflective materials for the walking and biking paths.
- Smart technology can aid in safety and security by offering sensory-activated lighting and security systems that monitor vulnerable individuals discreetly; to ensure residents’ safety, they may be provided with a ‘bracelet’ that sends their whereabouts to carers and family.

#### MEANINGFUL ACTIVITIES
- Raised planters for gardening along paths or benches make it easier for residents to participate in gardening activities. Consider growing vegetables, fruit, or herbs that can be picked and used – these activities may be therapeutic for people with memory decline.
- Include areas and routes that encourage physical activity, exercise, and exposure to sunlight.

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Memory-friendly design solutions for therapeutic outdoor spaces.
Chapter 5
DESIGN RESPONSE

5.1 INTRODUCTION
Chapter 5 summarizes all prior research and applies it to the Kuokkalani Kalon housing project. This chapter discusses the building’s existing status and layout. It intends to provide a fresh perspective on how this housing project can be modified to become memory-friendly while raising awareness to encourage similar solutions in other housing projects.
'Kuokkalan Kalon' in Jyväskylä, Finland, is a housing block made of wood. Currently, it is in the building stage. The block consists of five buildings and a courtyard connecting them all. This project was developed by the partners of MoniA project: ‘Yrjö ja Hanna Foundation’.

‘Yrjö ja Hanna Foundation’ is a domestic housing developer that provides homes for people of all ages and phases of life, including right-of-occupation housing, rental housing for seniors, and serviced housing for the elderly and special groups.

The project was designed in 2018 by the architecture office 'Collaboratorio'. The project focuses on the sharing economy, older communities, and multi-generational housing.

One of the five buildings was chosen for this thesis project to study in particular and implement memory-friendly solutions in apartments and common areas, emphasizing way-finding, legibility, and accessibility.

For this thesis, the ‘Kuokkalan Kalon’ site plan, building plans, and apartment layouts were provided by the architecture office ‘Collaboratorio’. The original design was a part of an architecture competition.

All layouts and graphics are modified by the author.

The visualizations are created by the author.
SITE PLAN

All five buildings in the neighborhood are oriented towards the inner courtyard, emphasizing community formation and social interaction. However, as highlighted in this scheme, there are only a few common spaces within the building block to support various community activities.
Based on the original design, the first floor has one small common space for the entire building. It can pose a risk of overstimulation if too many people are in the room at the same time or there is too much noise. According to Fleming and Bennett (2017, p.30), the common spaces are recommended to be smaller in size and provide a variety of activities to avoid overstimulation, as well as provide the possibility of meaningful wandering.

The storage and bike storage takes a significant part of the ground floor, which could be reduced and used for a more meaningful function to improve the well-being of people with memory decline.
SECOND-FIFTH FLOORS

All the upper floors follow the same layout. It consists of eight apartments and a circulation area. This layout can pose a challenge mainly due to the long and narrow halls, which can be difficult to navigate, especially if the apartment doors are open. The apartments’ entrances are similar and can confuse people with memory decline. It is necessary to add design solutions to differentiate each hallway and personalize the entrances.

There are four types of apartments, in total 35 apartments, ranging from studio to two-bedroom. Some apartments pose difficulties due to their limited accessibility; for example, in apartment 2.1, it may be difficult to access the terrace with a wheelchair; also, the bedrooms in the majority of apartments have limited accessibility. There are no places for shelves, personal possessions, or tv stands in any apartments. Additionally, the majority of apartments lack storage space at the entrance.

Second - fifth
2.1 One-bedroom apartment
2.2 Studio apartment
2.3 Circulation area
2.4 One-bedroom apartment
2.5 One-bedroom apartment
2.6 Hallway
2.7 One-bedroom apartment
2.8 One-bedroom apartment
2.9 One-bedroom apartment
2.10 Two-bedroom apartment
5.4 SPATIAL PROGRAM

ORIGINAL AND PROPOSAL

This drawing presents the original and proposed spatial programs. The main goal is to keep the layout without significant structural changes. The proposed spatial program focuses on new functions, especially meaningful common spaces on the first floor and smaller, distinctive shared areas on other floors.

Original spatial program and the proposal.
5.5 DESIGN PROPOSAL

The design proposal presents modified layouts and spatial design of the following four scales.

This proposal includes 30 apartments (studio, one-bedroom, and two-bedroom), four themed hallways, four distinctive memory-friendly common spaces, and therapeutic outdoor spaces.

The design proposal is supported by the memory-friendly design solutions presented in ‘Chapter 4 | Design guideline’.

5.5.1 APARTMENTS

5.5.2 HALLWAYS

5.5.3 COMMON SPACES

5.5.4 OUTDOORS
The main objective of the first-floor proposal is to expand the area of various common areas - memory cafe, library lounge, activity room, and sauna.

The outdoor spaces include a large terrace that connects the cafe to the outdoors, attracting neighborhood residents. Additionally, there is a space for gardening, which provides therapeutic sensory stimulation.
SECOND FLOOR

The second floor's hallway extends to a small common space (2.11) that overlooks the memory cafe on the first floor and allows visual and social interaction between the residents. There are seven apartments, of which four are flexible.

Second floor
2.1 Circulation area
2.2 One-bedroom apartment (flexible)
2.3 One-bedroom apartment (flexible)
2.4 Hallway
2.5 One-bedroom apartment
2.6 Studio (flexible)
2.7 Two-bedroom apartment (flexible)
2.8 Two-bedroom apartment
2.9 Opening to first floor
2.10 One-bedroom apartment
2.11 Common space
2.12 Opening to first floor

Second floor proposal.
THIRD-FIFTH FLOORS

The layout is the same from the third to the fifth floors - seven apartments, a hallway, and a common space. Each hallway has one common room (previously: studio apartment) that serves as a 'point of destination' and a gathering space for residents on the same floor or when their friends and family are visiting.

Third - fifth floors

3.1 Circulation area
3.2 One-bedroom apartment (flexible)
3.3 One-bedroom apartment (flexible)
3.4 Hallway
3.5 One-bedroom apartment
3.6 Studio (flexible)
3.7 Two-bedroom apartment (flexible)
3.8 Two-bedroom apartment
3.9 Opening to first floor
3.10 One-bedroom apartment
3.11 Common space

Legend:
- Apartments
- Hallway
- Common spaces
- Storage / technical space

Third-fifth floor proposal.
APARTMENT TYPES

The original apartment layouts are modified with memory-friendly design solutions. There are six types of apartments, and some of them are flexible in layouts. The apartments vary in size from studios to one and two-bedroom apartments, and they accommodate people with varying forms of memory decline and different care needs.

It is essential to emphasize that the residents of each apartment have their own furniture and belongings and can decide the placement and layout themselves; nonetheless, in this thesis, the layouts have been designed for each apartment type to show the suggested arrangements and circulation space.

Type 1: One-bedroom apartment 52m² (flexible layout)

Type 2: Two-bedroom apartment 66m² (flexible layout)

Type 3: Studio apartment 40m² (flexible layout)

Type 4: One-bedroom apartment 59m²

Type 5: One-bedroom apartment 61m²

Type 6: Two-bedroom apartment 74m²
APARTMENT TYPE 1

ACCESSIBILITY AND CIRCULATION
1 Entrance is wheelchair accessible with a wide entry door and a clear area.
2 Wheelchair-accessible bathroom requires a space with a minimum diameter of 1500 mm.
3 Open-plan layout combining the living room and kitchen facilitates visual access and legibility.
4 Hallway is equipped with storage.

WAY-FINDING AND ORIENTATION
5 Clear visual access from central areas (dining and living) to other key rooms and entrance.
6 Wardrobe with open doors provides visual access and signals for getting dressed.

SENSORY STIMULATION
7 'View to green' aids in orientation to time, place, and season.
8 Direct access to safe and accessible outdoor spaces.

PERSONALIZATION
9 The entrance nook (450mm) allows personalization by placing personal belongings.

PRIVACY AND SOCIALIZATION
10 Sliding doors create safe circulation and allow privacy when needed.
11 Window at the entrance door helps connect to the hallway and inform who is standing outside the door.

Type 1: One-bedroom apartment 52m²
(flexible layout)
The entrance serves as a point of identification and personalization for a person’s home. The residents have the autonomy to choose the paint or wallpaper for the entry door based on their preferences. The shelf next to the door acts as a ‘memory box’ where the person can place their personal belongings, photos, and decorations that help with orientation and trigger memory.

**WAY-FINDING AND ORIENTATION**

1. The entrance door has a bright, distinctive color. The number contrasts the background.
2. The keyhole is placed above the handle for better visibility.
3. Contrasting lever-style door handles

**SAFETY AND SECURITY**

4. Code safe outside the door from which a caregiver or family member may acquire keys in case of emergency.

**PERSONALIZATION**

5. Resident can choose the paint or wallpaper for the entrance nook based on their preference.
6. ‘Memory box’ or shelf to place personal belongings, photos and decoration.
7. For those without mobility equipment, a small stool, plant, or other personal object can be placed in front of the entrance window.

**PRIVACY AND SOCIALIZATION**

8. Window at the entrance door helps connect to the hallway and inform who is standing outside the door.

Personalized entrance to the apartment.
KITCHEN AND LIVING ROOM
This view presents the open layout of the kitchen, dining, and living room. As the person spends most of the time here, these rooms need to support various daily activities and routines while remaining safe and accessible.

WAYFINDING AND ORIENTATION
1. Open or glazed kitchen units ensure visual access to contents inside.
2. Contrast between the furniture, floor, and walls
3. Board to write reminders, daily tasks, recipes can help recall the chores and routines.

PERSONALIZATION
4. Open shelves display personal belongings, photos, and decorations.

SENSORY STIMULATION
5. Large clock aids in orientation to time.
6. ‘View to green’ aids in orientation to time, place, and season.

SAFETY AND SECURITY
7. Non-glossy kitchen tiles to avoid confusion.
9. Stove has buttons and a knob instead of ‘touch control’ to prevent confusion.
10. Carpet has cover strips holding the carpet down with similar color to flooring.

View to kitchen, dining and living rooms.
FLEXIBLE APARTMENTS

The flexible layout concept enables the apartment sizes to be varied on different floors. Combining two ‘Type 1’ apartments provides a flexible layout, which means that the same layout can be used for two different purposes: Option 1 contains two one-bedroom apartments. In comparison, option 2 consists of a two-bedroom apartment and a studio apartment.

Option 1

Type 1: One-bedroom apartment 52m²

Type 1: One-bedroom apartment 52m²

Option 2

Type 2: Two-bedroom apartment 66m²

Type 3: Studio apartment 40m²
APARTMENT TYPE 2 (FLEXIBLE)

ACCESSIBILITY AND CIRCULATION
1 Entrance is wheelchair accessible with a wide entry door and a clear area.
2 Wheelchair-accessible bathroom requires a space with a minimum diameter of 1500 mm.
3 Open-plan layout combining the living room and kitchen facilitates visual access and legibility.
4 Hallway is equipped with storage.
5 Multi-purpose room is used as a bedroom for caregiver, hobby or an activity room.

WAY-FINDING AND ORIENTATION
6 Clear visual access from central areas (dining and living) to other key rooms.
7 Wardrobe with open doors provides visual access and signals for getting dressed.

SENSORY STIMULATION
8 ‘View to green’ aids in orientation to time, place, and season.
9 Direct access to safe and accessible outdoor spaces.

PERSONALIZATION
10 The entrance nook (450mm) allows personalization by placing personal belongings.

PRIVACY AND SOCIALIZATION
11 Sliding doors create safe circulation and allow privacy when needed.
12 Window at the entrance door helps connect to the hallway and inform who is standing outside the door.

Type 2: Two-bedroom apartment 66m²
(flexible layout)
APARTMENT TYPE 3 (FLEXIBLE)

ACCESSIBILITY AND CIRCULATION
1 Entrance is wheelchair accessible with a wide entry door and a clear area.
2 Wheelchair-accessible bathroom requires a space with a minimum diameter of 1500 mm.
3 Open-plan layout combining the living room and kitchen facilitates visual access and legibility.
4 Hallway is equipped with storage.
5 Sofa bed can be used as a sofa during the day and as a bed during the night.

WAY-FINDING AND ORIENTATION
6 Clear visual access from central areas (dining and living) to other key rooms and entrance.

SENSORY STIMULATION
7 ‘View to green’ aids in orientation to time, place, and season.
8 Direct access to safe and accessible outdoor spaces.

PERSONALIZATION
9 The entrance nook (450mm) allows personalization by placing personal belongings.

PRIVACY AND SOCIALIZATION
10 Window at the entrance door helps connect to the hallway and inform who is standing outside the door.
APARTMENT TYPE 4

ACCESSIBILITY AND CIRCULATION
1 Entrance is wheelchair accessible with a wide entry door and a clear area.
2 Wheelchair-accessible bathroom requires a space with a minimum diameter of 1500 mm.
3 Open-plan layout combining the living room and kitchen facilitates visual access and legibility.
4 Hallway is equipped with storage.
5 Work space/hobby room with a window to hallway

WAY-FINDING AND ORIENTATION
6 Clear visual access from central area (dining room) to other key rooms and entrance.
7 Wardrobe with open doors provides visual access and signals for getting dressed.

SENSORY STIMULATION
8 ‘View to green’ aids in orientation to time, place, and season.
9 Direct access to safe and accessible outdoor spaces.

PERSONALIZATION
10 The entrance nook (450mm) allows personalization by placing personal belongings.

PRIVACY AND SOCIALIZATION
11 Sliding doors create safe circulation and allow privacy when needed. When doors are opened, they make a safe walkway without dead ends.
12 Window at the entrance door helps connect to the hallway and inform who is standing outside the door.

Type 4: One-bedroom apartment 59m²
APARTMENT TYPE 5

ACCESSIBILITY AND CIRCULATION
1 Entrance is wheelchair accessible with a wide entry door and a clear area.
2 Wheelchair-accessible bathroom requires a space with a minimum diameter of 1500 mm.
3 Open-plan layout combining the living room and kitchen facilitates visual access and legibility.
4 Hallway is equipped with storage.
5 Bedroom wall is moved to allow accessibility in the bedroom.
6 Terrace is made bigger to make it wheelchair accessible.

WAYFINDING AND ORIENTATION
7 Clear visual access from central areas (dining and living) to other key rooms and entrance.
8 Wardrobe with open doors provides visual access and signals for getting dressed.

SENSORY STIMULATION
9 'View to green' aids in orientation to time, place, and season.
10 Direct access to safe and accessible outdoor spaces.

PERSONALIZATION
11 The entrance nook (450mm) allows personalization by placing personal belongings.

PRIVACY AND SOCIALIZATION
12 Sliding doors create safe circulation and allow privacy when needed. When doors are opened, they make a safe walkway without dead ends.
13 Window at the entrance door helps connect to the hallway and inform who is standing outside the door.

Type 5: One-bedroom apartment 61m²
ACCESSIBILITY AND CIRCULATION
1 Entrance is wheelchair accessible with a wide entry door and a clear area.
2 Wheelchair-accessible bathroom requires a space with a minimum diameter of 1500 mm.
3 Open-plan layout combining the living room and kitchen facilitates visual access and legibility.
4 Hallway is equipped with storage.
5 Multi-purpose room is used as a bedroom for caregiver, hobby or an activity room.

WAY-FINDING AND ORIENTATION
6 Clear visual access from central areas (dining and living) to other key rooms and entrance.
7 Wardrobe with open doors provides visual access and signals for getting dressed.

SENSORY STIMULATION
8 'View to green' aids in orientation to time, place, and season.
9 Direct access to safe and accessible outdoor spaces.

PERSONALIZATION
10 The entrance nook (450mm) allows personalization by placing personal belongings.

PRIVACY AND SOCIALIZATION
11 Sliding doors create safe circulation and allow privacy when needed.
12 Window at the entrance door helps connect to the hallway and inform who is standing outside the door.

Type 6: Two-bedroom apartment 74m²
5.5.2 SEMI-PRIVATE: HALLWAYS

HALLWAYS

As discussed in ‘Chapter 4 | Design Guideline’, the hallways should be inviting, aid in orientation, and provide occasional areas for rest and interaction.

In the original design, the hallways are long, narrow, and similarly designed, which may confuse someone with memory decline. The goal was to design them with various familiar themes that would stimulate visual, tactile, olfactory, and auditory senses.

Various Finnish landscapes inspire the hallways: forest, sea, cliffs and meadow. Each hallway is unique with dominant colors, large-format photos, and memory displays. These methods offer the hallways a sense of identity, which assist residents in determining their location if they become disoriented within the building.

WAY-FINDING AND ORIENTATION

1. Themed hallway (forest) helps to distinguish from other hallways and avoid confusion.
2. Signs and labels have a legible, large font and graphics contrasting with the background color.
3. Handrails stand out clearly from the background.
4. Railing with glass allows seeing outside and downstairs.
5. Furniture, photos, colors, and materials are inspired from the theme: ‘forest’ - green, brown.

SENSORY STIMULATION

6. ‘View to green’ aids in orientation to time, place, and season.
MULTI-SENSORY MEMORY DISPLAY
Each hallway has a small lounge room for the residents to gather, meet family and friends. Inside the lounge rooms, there are multi-sensory memory displays that help to activate people's visual, tactile, olfactory, and aural senses. The memory displays have various materials and textures that can be touched and smelled based on the theme. The audio system gives a calm and quiet sound reminding residents of particular landscapes and personal memories.

The stairs and elevators have clearly marked buttons with the floor's number and color. Additionally, there is a fold-down seat in the elevator. For a person who uses stairs, each step is properly indicated, with the first and last steps being particularly well marked to avoid tripping and falling.

WAY-FINDING AND ORIENTATION
1 Themed hallway (forest) helps to distinguish it from other hallways and avoid confusion.
2 Signs and labels have a legible, large font and graphics contrasting with the background color.
3 Railing with glass allows seeing outside and downstairs.
4 Furniture, colors and materials are inspired from the theme: 'forest' - green, brown.

SENSORY STIMULATION
5 Memory display with materials that can be touched and smelled.
6 Task lighting above the board to ensure participation.

PERSONALIZATION
7 Materials such as tree bark, moss, leaves can remind people of some personal memories.

Second floor - 'Forest lounge' with memory display.
This design proposal provides a range of common spaces on the ground floor. As described in 'Chapter 4 | Design Guideline', common areas should be diverse in terms of function and privacy. The common areas are intended to foster socializing and provide space for various therapies, including sensory (dance, music, gardening), cognitive (reminiscence and art therapy), and others.

There are four different areas where residents can spend their leisure time: memory cafe, library lounge, activity room and sauna.

MEMORY CAFE
Memory cafe is a space that connects both residents and visitors to the building; this also helps to dispel the stigma frequently associated with this building type. Individuals with memory decline can assist employees by preparing drinks or food; others can relax indoors or on the outdoor patio. The memory cafe is designed through two floors and with a small opening up to the fifth floor.

WAY-FINDING AND ORIENTATION
1. Common spaces have constant color code for doors: Green - connecting rooms, orange - wc.
2. Contrast between the furniture, floor, and walls
3. Connection to upper floors.

SENSORY STIMULATION
4. Plants are used as sensory stimuli for visual, olfactory, and tactile stimulation.

MEANINGFUL ACTIVITIES
5. Residents can assist employees and participate in making drinks and preparing food.
LIBRARY LOUNGE

The library lounge is a bright space filled with natural light. It is a more relaxed environment where people can read, calmly spend time alone or with others. The green sliding doors lead to the activity room. The doors can be opened or closed according to the residents’ privacy needs.

The space has easily accessible open shelves, stable low tables, comfortable seats, and a peaceful setting with adequate task lighting.

WAY-FINDING AND ORIENTATION
1. Common spaces have constant color code for doors. Green - connecting rooms, orange - wc.
2. Contrast between the furniture, floor, and walls.
3. The green sliding doors open a view to activity room and allow visual access.
4. Signs and labels have a legible, large font and graphics contrasting with the background color.

SAFETY AND SECURITY
5. Carpet has cover strips holding the carpet down with similar color to flooring.

SENSORY STIMULATION
6. Vertical plant wall is used as a sensory stimuli for visual, olfactory and tactile stimulation.
7. ‘View to green’ and natural light helps to establish communication to outdoors.
8. Task lighting to ensure visibility and participation.

The lounge allows residents to socialize or relax in a peaceful setting.
ACTIVITY ROOM

Activity room is a multipurpose space. It can be used for various activities - drawing lessons, cooking, crafts, socializing with neighbors and family members. The tables are stackable so that they can be removed, and the room can be converted to accommodate a variety of physical activities, such as dance therapy or yoga classes.

This space can be used as an Adult Day Program, attracting residents from the neighborhood and creating a sense of community and engagement.

WAY-FINDING AND ORIENTATION

1. Common spaces have constant color code for doors. Green - connecting rooms, orange - wc.
2. Contrast between the furniture, floor, and walls.
3. The green sliding doors open a view to the library lounge and allow visual access.
4. Signs and labels have a legible, large font and graphics contrasting with the background color.
5. Blackboard allows residents to write reminders and draw on the wall.

SENSORY STIMULATION

6. ‘View to green’ and natural light helps to establish communication to outdoors.
7. Task lighting above to board to ensure visibility and participation.
5.5.4 PUBLIC: OUTDOORS

THERAPEUTIC GARDEN
The outdoor area of Kuokkalan Kalon is designed to appeal to all five senses - vision, hearing, smell, touch, and taste. The therapeutic garden features a variety of plants and trees; it also includes planting beds with a variety of seasonal flowers that residents can take care of. The paths are made of continuous material and contain no sharp turns. All paths are lined with low vegetation, which helps to frame the garden.

ACCESSIBILITY AND CIRCULATION
1 Outdoor path is two meters wide with even surfaces and no steps.

SENSORY STIMULATION
2 Garden supports a multi-sensory experience by using colorful planting and materials for visual and tactile stimulation.
3 Plant species reflect the seasonal change and help with orientation in time and season.
4 ‘View to green’ from indoors helps to establish communication to outdoors.

MEANINGFUL ACTIVITIES
5 Planters for gardening along paths or benches make it easier for residents to participate in gardening activities.

SAFETY AND SECURITY
6 Bushes along the paths are used as a ‘fence’; they can make some people more comfortable because they decrease their fear of getting lost.
CONCLUSION

Throughout this thesis, I have studied the possibilities and solutions of the interior design of residential environments to support aging in place for people with memory decline. When I began this project one year ago, I was unfamiliar with this topic but eager to study and understand it, as well as how I, as a designer, might contribute to a better knowledge of design for independent and safe memory-friendly residential environments.

The thesis process began with familiarizing myself with the topic's background on the aging phenomena and memory decline in today's society. I then investigated the epidemiology of memory decline to understand the relationship between the environment and the individuals who experience memory decline.

It was followed by the analysis of a range of literature sources and case studies to gain an understanding of the main principles and solutions for memory-friendly residential design. One of the realizations that shaped this thesis project was the need to focus our attention on the sensory experiences of environments. Clear and legible spaces that engage all of our senses create a sense of orientation, security, and identity, which benefits and aids not only individuals with memory decline but also the society as a whole.

From the summary of research methodologies, I developed a design guideline to present practical solutions for memory-friendly apartments, hallways, common spaces, and the outdoors. While most of the guidelines' principles have been well researched, others, such as 'Adaptability and flexibility' and 'Safety and security,' still need to be studied and better understood, as new assistive technologies are continuously changing and developing.

Working with the Kuokkalan Kalon project has been both challenging and rewarding. The design objective was to incorporate memory-friendly solutions without major changes to the building’s structure. While keeping most of the building as it is, a few proposals were made to modify the existing structure, including widening some of the balconies to improve accessibility, designing flexible apartment layouts, and creating a high ceiling memory cafe.

I learned that creating spacious common spaces on the first floor and smaller spaces on other floors effectively supports community and socialization among individuals who often experience isolation and loneliness. Also, opening some of the common spaces (coffee shop, sauna, adult day program) to residents from the surrounding buildings and the neighborhood can assist in reducing the stigma frequently associated with this building type.

While outdoor spaces are essential for memory decline, they were not extensively studied in this thesis. If I were to do this project again, I would place more emphasis on outside spaces, community, and the surroundings as they play a key role in how the building is perceived, understood, and accessed.

APPLICABILITY

With the rapidly aging population, designing and modifying buildings for people experiencing memory decline will become more prevalent. The design guideline presented in this thesis can act as a tool for people with memory decline, their families, caregivers, designers when designing a new building or modifying an existing one.

Even though designing memory-friendly environments requires collaboration with various stakeholders - policymakers, care providers, and others - it is my hope that this thesis and the design solutions for ‘Kuokkalan Kalon’ can foster a deeper understanding of how aging in place can be enhanced from a design perspective.

SUSTAINABLE DEVELOPMENT GOALS

This thesis addressed the following sustainable development goals:
- Good health and well-being,
- Reduced inequalities,
- Sustainable cities and communities.
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LIST OF FIGURES

All figures and visualizations are created by the author unless otherwise stated.


Figure 22. Common lounge space opens to the upper floors with a high ceiling. Image is taken by author: Luiza Sevele. (2021, September 22).


DESIGN RESPONSE: LAYOUTS AND VISUALIZATIONS

For this thesis, the ‘Kuokkalan Kalon’ site plan, building plans, and apartment layouts were provided by the architecture office ‘Collaboratorio.’ The original design was a part of an architecture competition.

All layouts and graphics are modified by the author.

The visualizations are created by the author.
I want to express my sincere thanks to everyone who has supported and assisted me throughout this thesis project.

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