

# AGE-FRIENDLY AND MEMORY-FRIENDLY ACOUSTIC ENVIRONMENTS

CERTAIN SPECIAL REQUIREMENTS MUST BE CONSIDERED  
IN THE ACOUSTIC DESIGN OF SENIOR AND ASSISTED  
LIVING FACILITIES.



Learn more about the  
new acoustic design  
recommendations  
that promote acoustic  
accessibility.

## INTRODUCTION

Memory disorders are topical national health and economic challenges. Finnish society is currently experiencing changes in both age distribution and demands on services, which makes developing memory- and age-friendly planning increasingly important. In its report, Alzheimer Europe estimated that the number of people suffering from memory disorders will almost double by 2050\*.

Ageing and memory disorders can lead to similar changes in hearing and speech perception. The most common changes are challenges in understanding speech caused by a decline in hearing or cognitive skills or a combination of the two. The consequent problems in social situations increase the risk of loneliness and social isolation.

This guide provides concise information on the special requirements of age-friendly and memory-friendly acoustic environments and design methods that promote well-being in senior and assisted living facilities.

\* Bintener and Miller, 2019



## GROUNDWORK FOR THE MONIA PROJECT

The guide is based on Viivi Salminen's master's thesis *Acoustic design in memory-friendly housing* (Aalto University, Master's Programme in Architecture, 2021).

Salminen's thesis is part of the MonIA project (diverse integrated housing for people with memory disorders) led by the Research Group for Health and Wellbeing Architecture (SOTERA) at Aalto University, which investigates new and flexible living solutions that lie between living at home and in an assisted living facility. Saint-Gobain Ecophon, which manufactures acoustic ceiling and wall systems, also contributed to the thesis work.

In addition to Aalto University, the parties involved in the MonIA project are: the Ministry of the Environment of Finland; the Housing Finance and Development Centre of Finland (ARA); the Cities of Helsinki, Jyväskylä, Pori, Porvoo and Kirkkonummi; HEKA Oy; Yrjö ja Hanna Kodit; and Saint-Gobain Finland Oy/Ecophon.

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## THE ROLE OF HEARING IN THE WELL-BEING OF A PERSON WITH A MEMORY DISORDER

Hearing plays a central role in interaction with others and orientation in a space. The World Health Organization (WHO) lists several negative effects of hearing loss on health and well-being: problems with listening and communication, cognitive decline, social isolation and loneliness, and mental health problems (WHO 2021).

In addition to hearing loss, WHO highlights the negative impacts of noise on health. Noise is a stress factor that has been shown to affect human health particularly as a result of long-term exposure. Sensitivity to noise is also common among people without a memory disorder – an estimated 25–40% of people suffer from it.

Hearing impairment makes communication with others difficult. Communication can be divided into five areas, and problems in any of these make discussion significantly more difficult:

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- Hearing
  - Remembering
  - Understanding what is said
  - Evaluating what is said
  - Responding
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## HEARING PROBLEMS RELATED TO AGEING AND MEMORY DISORDERS

Symptom	Effect
<b>Increased sensitivity to sounds</b>	A noisy environment or loud sounds may arouse fear or cause stress.
<b>Difficulty in tracking the source of sound in a noisy environment or in the presence of background noise.</b>	Discussions are difficult to follow, and misunderstandings may occur. This may lead to isolation or the avoidance of social situations.
<b>Inability to process auditory information, which causes difficulties in the recognition, separation and understanding of sounds.</b>	Discussions are difficult to follow, and misunderstandings may occur. Difficulties in finding words, can be reminiscent of verbal auditory agnosia. Challenges related to grammar. Sounds can be difficult to recognise.
<b>Verbal auditory agnosia</b>	Challenges in interpreting speech; difficulties in recognising familiar words, for example.
<b>Auditory disorientation</b>	Difficulties in understanding and orientating.
<b>Auditory hallucinations</b>	The level of disruptiveness varies individually, often linked to other hallucinations. Examples: low sounds and speech, and musical hallucinations (non-stop familiar basic melodies).
<b>Tinnitus, may be a form of auditory hallucination</b>	May cause difficulties with concentration and sleep.
<b>Craving for music (musicophilia). Musicophilia may be connected to increased sensitivity to sounds.</b>	Unusual emotional reaction to sounds. People with a memory illness typically retain the ability to respond to music even in advanced stages of the illness.
<b>Sound aversion</b>	Abnormal, often negative emotional reaction to a sound. May result from difficulty in recognising sounds.



## AGE-FRIENDLY AND MEMORY-FRIENDLY ACOUSTIC ENVIRONMENTS

As described above, acoustic environments play an important role in housing for people with a memory disorder. A recent study (Salminen, 2021) showed that living environments can be made more memory-friendly by taking advantage of acoustic design.

The study was used to draw up a table of guidelines to use as a tool for designing memory-friendly environments based on space categories and the special acoustic needs of people with memory disorders.

The following emerged as the main factors in the design of acoustic environments:

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- Individuality
  - Community
  - Recovery support
  - Safety
  - Cosiness
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## SOUNDS THAT SHOULD BE EMPHASISED IN LIVING SPACES FOR THE ELDERLY AND PEOPLE WITH A MEMORY DISORDER

Source of sound	Sounds experienced as pleasant
<b>Entertainment (TV, radio, instruments, choir music)</b>	Music that the person likes, singing, familiar melodies or songs.
<b>Phone calls and video calls</b>	Meaningful interaction with family, health services via a remote connection.
<b>Outdoor environment</b>	Natural sounds (e.g. running water, rustling of leaves).
<b>Other people (residents, family, carers)</b>	Meaningful interaction with others, day-to-day activities.
<b>Animals</b>	E.g., clucking of hens, purring of cats.
<b>Guiding sounds</b>	Varying sounds that facilitate orientation in a space and emphasise the sense of time and place.

## SOUNDS THAT SHOULD BE REDUCED IN LIVING SPACES FOR THE ELDERLY AND PEOPLE WITH A MEMORY DISORDER

Source of sound	Sounds experienced as unpleasant
<b>Outdoor environment</b>	Traffic noise, industrial sounds, abrupt loud noises (barking of dogs, crowds), construction noises, gardening noise (lawn mower, leaf blower).
<b>Mechanical sounds and functions</b>	Ventilation systems, pumps, lifts, wastewater and stormwater drainage, plumbing.
<b>Sounds of sudden impact (thumping and banging sounds)</b>	Items falling on a hard floor (tiles or wooden floor), washing machines, dryers, doors being shut.
<b>Residents</b>	Televisions, radios, other devices owned by the person, loud music or speech, clatter of cutlery or crockery, windows being opened or closed, noises from toilet facilities.
<b>Communication systems</b>	Phones, bells, audio signals.
<b>Safety systems</b>	Alarms, access systems.
<b>Personnel</b>	E.g. photocopiers, phones, vacuum cleaners, floor polishing machines, pill cutters, chatter among personnel, trolley wheels, dishwashers, cooking sounds, steps on hard floors and stairs.

## RECOMMENDATIONS FOR ACOUSTIC DESIGN

The recommendations created as part of Salminen's thesis offer information on the design of memory-friendly environments. They also create a basis for practical implementation to improve the effectiveness of recommendations and hence buildings.

The table on the following pages presents factors that are important in acoustic environments designed for people with memory disorders. The classification of space types is based on the RT construction information file for assisted living facilities. In this file, shared premises are divided into five categories: entrance, lobby and access facilities; shared functional spaces; staff premises; service, exercise and hobby spaces; and shared storage spaces (Rakennustieto, 2013).

The RT file focuses on group homes and assisted living facilities, which are both forms of community care. The space classification can therefore also be used in the design of acoustic environments in community care facilities.



## FACTORS TO BE EMPHASISED IN THE ACOUSTIC ENVIRONMENT

The theoretical part of the study identified the following areas for priority attention when designing acoustic environments for people with memory disorders: individuality, communality, sociability, recovery support, orientation, safety and cosiness.

In the area of **individuality**, sounds that are important to the person should be highlighted. The individual should be able to influence his or her surroundings and personal taste should be taken into account in the sounds and appearance of the space.

With regard to **communality**, sounds that are important to the community should be emphasised and special attention should be given to shared spaces and situations that promote interaction.

**Recovery support** refers to factors that help create a counterbalance to communality. Environments that support recovery include spaces and acoustic environments for relaxation.

In the area of **orientation**, factors that help with the recognition of time and place and clear acoustic environments are emphasised. Acoustic environments and spaces that are easy to understand also contribute to a sense of safety.

Communality and **safety** are also linked through human presence and linking sounds to day-to-day activities.

**Cosiness** comprises pleasant acoustic elements, such as music and pleasant social interaction.

### INDIVIDUALITY

Promoting self-image, confidence and a sense of control

### COMMUNALITY

Encouraging social interaction and reduction of loneliness

### RECOVERY SUPPORT

Creating tranquil/calm and therapeutic environments

### ORIENTATION

Assisting with the recognition of places, activities and time

### SAFETY

Nurturing a sense of safety and familiarity

### COSINESS

Making individuals feel at home and enhancing mood



## GUIDELINES FOR THE DESIGN OF AGE-FRIENDLY AND MEMORY-FRIENDLY ACOUSTIC ENVIRONMENTS: SPACE CATEGORIES

SPACE CATEGORY	INDIVIDUALITY	COMMUNALITY	RECOVERY SUPPORT	ORIENTATION	SAFETY	COSINESS
<b>HOME</b>	Private space and music that the person likes	Sound as part of day-to-day activities, e.g. music during washing	Possibility to influence the acoustic environment, e.g. adjustment of volume Tranquil bedrooms.	Familiar and recognisable sounds  Clear environment	Familiar sounds  Clear acoustic environment  Sound as part of care and day-to-day activities	Personal items and textiles that influence acoustics in a small space
<b>SHARED SPACES</b>	Different types of spaces and acoustic environments, offering choice	Low-threshold meeting spaces and shared spaces of various sizes  Support for hearing and interaction  Emphasis on sounds that are important to the community	Ability to influence the acoustic environment, e.g. adjustment of volume	Different acoustic environments that make spaces easier to recognise  Clear layout	Different acoustic environments that make spaces easier to recognise  Clear acoustic environment  Presence of other people	Music and natural sounds  Inspiring company and activities  Sounds from day-to-day activities
<b>SERVICE, EXERCISE AND HOBBY SPACES</b>	Emphasis on sounds that are important to the community	Support for interaction and activities	In spaces with a larger number of people present at the same time or where activities take place (e.g. sports), a larger area of sound-dampening/muffling materials is required	Different acoustic environments that make spaces easier to recognise  Clear layout  Sound beacons	Presence of other people	Acoustic design that suits the activities  Inspiring company and activities
<b>OUTDOOR SPACES</b>	Emphasis on sounds that are important to the community	Outdoor spaces that are suitable for relaxation	Minimisation of traffic noise	Sound beacon at the entrance	Familiar sounds	Natural sounds (trees, fountains, animals)
<b>CORRIDORS AND STAIRCASES</b>	-	Meeting point for brief conversations	Use of acoustic solutions to prevent sounds from carrying into other spaces from the corridors  Dampening/Muffling the sounds of footsteps	Making home easy to find  Use of colours, shapes, textures and sounds to facilitate orientation in space.	Shared spaces as part of the corridors, presence of others	Acoustical elements and decorative features (pictures, paintings, furniture, sounds)
<b>STAFF PREMISES</b>	-	Shared spaces for the personnel, pleasant break facilities	Sound dampening/muffling particularly in spaces where phones are used and in medicine distribution areas	Location in the building	Visual connection to the staff facilities, when necessary	Tranquil working and break rooms
<b>STORAGE FACILITIES</b>	-	-	Masking of machine noises	-	Access only allowed to staff, doors can be made inconspicuous	-

## GUIDELINES FOR THE DESIGN OF AGE-FRIENDLY AND MEMORY-FRIENDLY ACOUSTIC ENVIRONMENTS: ACOUSTICS

ACOUSTICS	INDIVIDUALITY	COMMUNALITY	RECOVERY SUPPORT	ORIENTATION	SAFETY	COSINESS
<b>SURFACE MATERIALS</b>	Appearance of acoustic elements	Acoustic elements that stimulate conversation, for example old photos printed on an acoustic panel	Class A acoustic elements to dampen sounds  Soft materials dampen/muffle sounds and hard surfaces reflect them	Use of colours, pictures and surface texture on acoustic elements and textiles to assist with orientation in space	Familiar environment	Upholstered furniture and textiles create a home-like atmosphere  Appearance of acoustic elements, for example photos printed on acoustic panels on the wall
<b>ACOUSTIC PROPERTIES THAT MAKE HEARING EASIER</b>	Music  Ability to adjust the sound selection and volume	Good speech recognition conditions  Short reverberation time  Minimisation of background noise  Avoidance of excessive silence	Dampening of sound, most effective with large surfaces (ceiling and walls)  Volume control  Noisy activities located in separate spaces	Reverberation time that is typical of the size and shape of the space  Clear acoustic environment	Minimisation of alarms and other loud noises  Clear and recognisable acoustic environments	Good speech recognition conditions  Short reverberation time  Minimisation of background noise  Music
<b>AIDS TO ASSIST WITH LISTENING</b>	Fixed induction or hearing loops can be used for watching television or listening to radio in a home setting	Hearing loops increase the adaptability of spaces, which is particularly beneficial in large spaces that often have multiple uses  Makes hearing easier at service desks or in spaces with a larger number of people present	-	-	To prevent hearing loops from overheating, they should be placed on different floors in different locations at a sufficient distance from one another	Accessibility also contributes to the pleasantness of the facilities

You can find Viivi Salminen's master's thesis online by searching:

**Acoustic design in memory-friendly housing**

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[www.ecophon.com](http://www.ecophon.com)

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