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# USABILITY FRAMEWORK OF SENIOR HOUSING

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## ABSTRACT

**Purpose** The aim of this study was to evaluate the usability of senior housing. The usability framework created in this study highlights the usability attributes in architectural design for the senior aged.

**Background** The aging population creates new requirements for residential housing solutions. The lifestyle of the senior aged is becoming increasingly different and more varied. Since getting older eventually means that functional capacity weakens and coping with daily duties becomes more difficult, usability issues should also be taken into consideration in architectural design.

**Methods** In order to investigate the usability features of the built environment, a usability evaluation process was created, and a walk-through was used as an evaluation tool. During the walk-through, five different attributes of the spaces were considered: functionality, safety/security, comfort, interaction, and orientation.

**Results** The usability evaluation consists of six “steps” along the way through the Loppukiri senior house case building in Helsinki, Finland. According to the results the main topics of discontent in Loppukiri were: noise, temperature, security and accessibility. In contrast, neighborly help, several cozy common spaces, and the beautiful, functional furniture in these spaces resulted in satisfaction.

**Discussion** The usability aspect is also an important factor in ordinary residential design. Thus, the results of this study provide valuable information on the usability of the built environment for authorities and designers, as we all grow older. In the future, the exploitation of these study results requires further research using measurable methods in different kind of senior houses.

**Keywords** usability, senior, housing, walk-through, user, experience

## 1 INTRODUCTION

The proportion of people aged 65 or over in the Finnish population is estimated to rise from the present 18 per cent to 26 per cent by 2030, and to 28 per cent by 2060. The demographic dependency ratio, that is, the number of children and pensioners per one hundred people of working age, will also rise in the near future (Fig. 1).

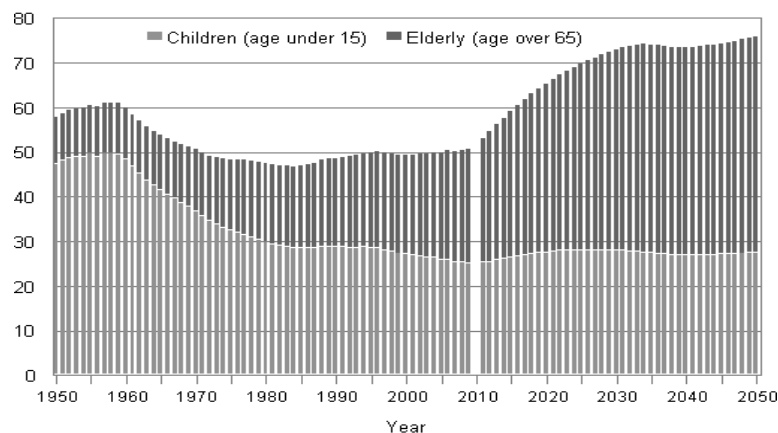


Fig. 1. Demographic dependency ratio in Finland in 1950–2009 and projection for 2010–2050. Number of children and elderly per 100 people of working age. Source: Statistics Finland, Population Structure 2011

As the baby-boom generation moves through the age pyramid, older cohorts will become more numerous than the younger ones. Combined with the rapid growth in the size of the elderly population, this means that substantial development investment will have to be allocated to different forms of residential care facilities and care services for the elderly (Aalto and Saari 2009).

The spaces, the apartment and the living environment are relevant factors for elders as regards coping independently at home. The physical environment affects the environmental experience of elderly people on the functional, symbolic and personal levels. The physical environment can either support the success of functions in a space or prevent their performance.

As Windle et al. (2006) state, difficulties experienced at home by some older people are related to their functional status, and is not necessarily a reflection of the condition of the property. On the other hand, if functional limitations are exacerbated by inappropriate housing conditions, then some occupants could face an increased risk of a poor health outcome (Windle et al. 2006).

Edvardsson et al. (2005, 2008) stress, that physical and the psychosocial environments are inseparable entities, interacting in such a way that it is the atmosphere or climate that either supports or hinders the person-centered outcomes of the quality of life (QoL) and well-being.

According to the research on aging, both physical and social environments are central to the residents' experience of place and to their well-being in the residential care setting (Nair, 2005; Cheng et al., 2011). Further, Lengen and Kistemann (2012) state that recognizing places, scenes

and landmarks, and encoding new place information is central in navigation and spatial orientation. A place forms an essential basis on which experiences can be unfolded in the memory and the imagination (Lengen and Kistemann 2012).

The physical environment also needs to provide its inhabitants with a sense of independence (Schwarz and Brent 1999), facilitated by way-finding cues, symbols and proper lighting to enhance visibility (Ulrich 1992). In addition, Wijk et al. (2002) state that a conscious color design can enhance the spatial demarcation of the room, sense of familiarity, and orientation in shared spaces which reinforces the elderly person's sense of independence and autonomy.

Altman (1975) defines three types of territories that influence a human's identity. Primary territories, such as places in the home, are private places in which the owner has exclusive rights to use the space. Primary territories are outstandingly important for the elderly since they spend so much time at home. The primary territory is personal and reflects the owner's social status. Secondary territories are semipublic places in which a person interacts with acquaintances or neighbors on a relatively regular basis. Examples of secondary territories are one's residential building, stairway and backyard. Public territories are spaces in which almost anyone is allowed temporary access, providing they observe the relevant regulations. Examples include a nearby recreation area or park.

The characteristics of the neighborhood influence the mobility possibilities of older people. In an inaccessible environment, even a small impairment of functional capability hinders independent living and causes the need for help. Everyday mobility diminishes, and this expedites the weakening of functional capability.

Routio (1986) states a good living neighborhood supports the independent coping of older people. A barrier-free, safe apartment, courtyard and neighborhood offer physically impaired people possibilities to manage in everyday tasks and have physical exercise and refreshment. Figure 2 shows the spatial structure of elders' living environment.

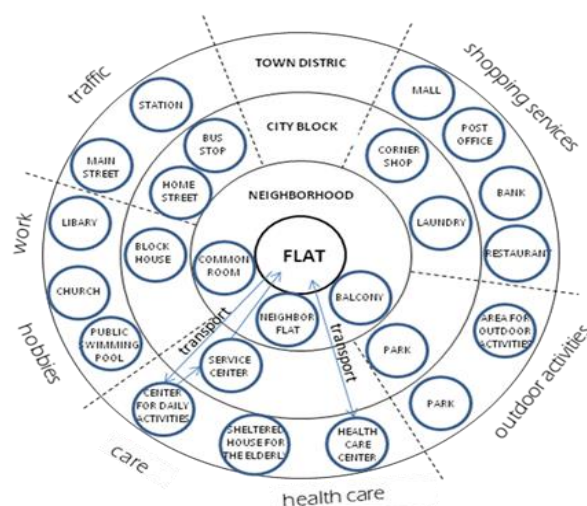


Fig 2. Spatial structure of elders' living environment (Routio 1986)

Although there is little of research on usability issues in the housing of senior aged people, a great amount of research on the housing of elderly people in general does exist (Oswald et al., 2007; Reid, 2004; Andersson et al., 2011; Fange & Iwarsson, 2005). In addition, the relationship of the residential environment with health and well-being has received particular attention in research on aging (Rioux, 2005; Wahl et al., 2009; Fernandez-Ballesteros et al., 1998; Fernandez-Mayoralas et al., 2004; Oswald and Wahl, 2004; Rojo-Perez et al., 2007; Wilson et al., 2004; Windle et al., 2006; Iwarsson et al., 2007, and many other).

One group, whose assessment of the usability of the built environment is particularly valuable, is the elderly with physical and sensory disabilities. When human functional capacity weakens, the usability of the living environment faces great challenges in ensuring that the elderly population cope independently and have a decent quality of life.

The great amount of the older population will pose new challenges to society. According to predictions, those over 65 will be wealthier and in better physical condition. In addition, the lifestyle of the senior aged is becoming increasingly different and more varied. The resources and experiences regarding aging will consequently differ significantly from former times.

### **Senior housing**

Independent living facilities, called senior houses, are a relatively new housing type for seniors in Finland. Senior houses are apartments for residents aged 55+ who can live independently and take care of themselves. Senior houses are not registered, and as a consequence we have no accurate data on the number of senior rental apartments or information on their locations in Finland (Tyvimaa, 2010).

This type of housing normally has no services or personnel, but leans on local services. The building, the apartments and the yard are all barrier free and the residents usually have security aids at home. According to Sonkin (1999), this kind of housing is suitable for the senior aged who are still active and participative in society, but whose need of help is approaching. They can still adapt in a new living environment, create their own social network and age in a familiar environment (Sonkin 1999).

### **Usability research**

As increased functionality does not necessarily mean improved usability in a building (Lindahl et al., 2003), housing for senior citizens in particular must be reviewed not only from the viewpoint of functionality, but also from the viewpoint of usability.

According to Hansen et al. (2011) the study of usability was first developed in the 1950s in Human Computer Interaction and is widely known in relation to applications within User Centred Design (UCD), Usability Engineering (UE) and user experience (UX), and is associated with the friendliness criteria (Fenker, 2008; Gulliksen, 2006).

ISO 9241-11 (1998) defines usability as the "extent to which a product can be used by specified

users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." For further definition:

- *Effectiveness*: Accuracy and completeness with which users achieve specified goals
- *Efficiency*: Resources expended in relation to the accuracy and completeness with which users achieve goals
- *Satisfaction*: Freedom from discomfort, and positive attitudes towards the use of the product
- *Context of use*: Users, tasks, equipment – hardware, software and materials – and the physical and social environments in which a product is used (ISO 9241-11, 1998).

According to Blakstad et al. (2010) a building's purpose is to support and shelter its users while they are performing their activities and living their lives. Depending on how well they support their users' activities, the physical surroundings contribute to efficiency, effectiveness and satisfaction in the users' lives. This is what we call the usability of buildings and built environment. Usability depends both on the physical environment and how the environment is used.

The concept of usability research has also been introduced in the research of workplaces and the built environment. According to Hansen et al. (2011) usability research on the built environment is associated with the International Council for Research and Innovation in Building and Construction (CIB) Task Group 51 "Usability of Buildings 2005", Workshop W111 – "Usability of Workplaces 2-2008" and "Usability of Workplaces 3-2010".

Usability measures the quality in use and usability evaluation is for tracking the process of quality in use (Bevan, 1995; Voordt, 2005; 2009); a process of understanding the interaction between facilities and its use, and the characteristics of that interaction. When evaluating usability, it is essential to consider what factors enhance or inhibit the effectiveness or performance of various activities.

Andersson et al. (2011) state that in order to create satisfaction and well-being, everyday life has to be made comprehensible, manageable, and meaningful. The usability of the physical environment clearly plays a major role in this context (Andersson et al. 2011)

Usability includes all aspects of the user's experience when interacting with the product, service, environment or facilities (Alexander, 2007). User characteristics, knowledge, personality, age and surrounding, and culture, also have an impact on the usability experience. Usability illustrates not only the accessibility of the environment but also the satisfaction of the residents. A well-designed living environment can provide a sense of security, as well as promote independence.

Different methods and tools can be used to make visible the usability elements that have an impact on the built environment. For instance, *Post-Occupancy Evaluation* (POE) is the process of systematic collection of data on occupied built environments, analysis of these data, and comparison with performance criteria (Preiser et al. 1988). POEs assess how well buildings match users' needs, and identify ways in which to improve building design, performance and

fitness for purpose.

According to Hansen et al. (2011), POE evaluation is still about the building rather than the user experience and primary process of the occupants, and the difference between POE and usability, which is the evaluation, depends on:

- Context specificity (Lindahl et al., 2011)
- Situated action (Fenker, 2008)
- Cultural sensitivity (Lindahl and Granath, 2006) and habits (Sinkkonen, 2000) in (Alho and Nenonen, 2008).
- Elements of user experience (Alexander, 2006)
- Characteristics (Mäntylä, 2001) in (Alho and Nenonen, 2008)
- Serviceability (Hansen and Knudsen, 2006; Strawderman and Koubek, 2006).

Further, Alexander (2008) states that usability is an extension and improvement of POE but emphasizes the user experience and perspective, and that the main criteria in evaluating the ability of design measured is based on their own experience.

Alho et al. (2008) describe a *Usability Rating Tool* developed for evaluating the usability of trade centers, in a method that allows managers, owners and designers to assess and develop the usability of different places. The tool analyses relevant usability attributes. The attributes are specified using different parameters identified during the research (Alho et al. 2008).

Further, according to Blakstad et al. (2007) the *Usability Walk-through* is a simple, quick way of obtaining the first overview and indications of the usability of a building, since it focuses on the understanding of operations taking place in the built environment. In fact, walk-through is not really one method, but a common term for several different techniques, in which informants are taken on a “tour” of the building, assessing different qualities and shortcomings of different parts of the building (Blakstad et al. 2007). Hansen et al. (2011) state that walk-through can also be used to acquire knowledge that can be used in the planning of new buildings.

In accordance with Hansen et al. (2011), walk-through is a generic term for a method using on-site inspection of a building for evaluating various aspects of its usability. A walk-through can be conducted in different ways, ranging from a completely open structure with evaluation based on spontaneous, subjective evaluations by random participants then and there, to predefined stops and evaluation criteria with selected participants.

For instance, Haron et al. (2011) have used usability walk-through as a research method in order to implement usability research in hospital environments. They claim that a walk-through, with an interview and observation methods, is a suitable method for collecting data dealing with human needs. Especially when it touches on field experience and reflection of experience (Haron et al. 2011).

The group taking part in walk-through evaluation should not be too large; a maximum of 10 to 15 people. If necessary, the walking tour can be performed in several stages. It is important to document all the emerging issues during the walk (De Laval, 2004). In addition, guides and

checklists help ensure that the usability perspective is taken into account in planning (Nenonen et al. 2007, Nielsen 1993, Alho et al. 2008).

Hansen et al. (2011) and De Laval (2004) stress the importance of staging during the walk-through. Every staging point must have a theme to discuss; to provide information for the project, while also raising questions. In addition, Dale Copp's (2008) *Customer Journey Map* consists of steps, and different user experiences at each step along the journey through a built environment (Fig. 3).

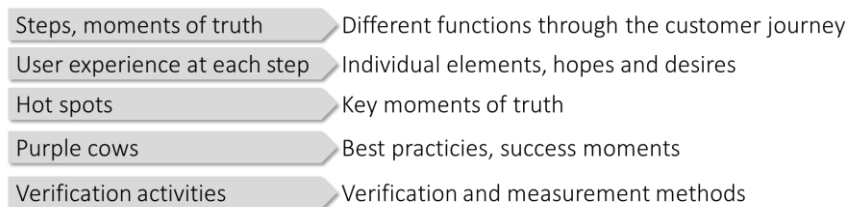


Fig. 3. Frame of Reference for Customer Journey (Dale Copp, 2008)

### Case building Loppukiri

The research subject chosen for the study was the Loppukiri senior house in the Arabianranta area of Helsinki. The building was completed in 2006. The residents took part in designing their own dwellings. Loppukiri represents a way of collective living, co-housing, following the philosophy of the Färdknäppen building in Sweden. The residents form six groups that clean communal spaces and make dinner for all the residents. Thus, each group of about ten people has to carry out a week's work shift about once every six weeks.

The idea of co-housing for seniors is not a new one and is an increasing trend in Northern Europe. Despite this, relatively few studies have examined the concept, and as a result, little research is available (Tyvimaa, 2011).

The Loppukiri building consists of 3115 m<sup>2</sup> in all; 58 owner-occupied dwellings varying from 36 to 80 m<sup>2</sup> – the average size being 54 m<sup>2</sup> – and 400 m<sup>2</sup> of communal spaces, which are mainly located on the ground floor. In addition, a sauna, gym and one guest room are situated on the uppermost sixth floor. When buying a flat, the residents also pay a share of the costs of the communal spaces.

Loppukiri houses 70 residents: 12 couples, 5 single men and 41 single women. The average age of the residents in 2011 was 67, varying between 55 and 91. None of them use wheelchairs but some have walking stick. The housing company's regulations state that one person from each household has to be at least 48 years old. All residents of the Loppukiri building are active senior citizens and have many hobbies. Thus, the building has many communal spaces for their activities (Fig. 4 and 5).





Fig. 4. Fireplace room.



Fig. 5. Dining room.

## 2 AIM OF THE STUDY

The aim of this study was to develop a suitable process for evaluating the usability of senior housing so that users of the premises can be involved in the evaluation process. Since we will need different kinds of housing solutions in the future, we have to create a usability framework for senior housing.

In order to determine the features in built environments that support coping and housing independently; guarantee functional, physical, social and virtual environments as well as quality of life, satisfaction and well-being, we drew up the following research questions:

1. What usability elements of the built environment support the aging and well-being of the senior aged?
2. Is a usability walk-through a suitable method to evaluate the usability of senior housing?

We knew that this theme faces particular challenges, since for instance accessibility, mobility aids, security factors, poor visual capacity, perception and hearing have to be taken into consideration. In addition, local services are important for senior citizens in order to activate their walking in the neighborhood. Thus, this study took into account not only the building, but also the immediate neighborhood.

Since interest in the co-housing scheme has increased among the senior aged in Finland, we chose the Loppukiri building as the target in this case study. As Andresen and Runge (2002) highlight, the idiosyncratic features of co-housing communities provide the potential for healthier ways of life and, in many cases, reduce the level of ill health among residents.

## 3 METHODS

In order to create the usability framework of senior housing, a suitable tool was built in order to evaluate the spaces and design solutions in the Loppukiri building.

### 3.1 Creating the tool

Since user experience is a highly significant characteristic in usability research, the usability

walk-through was regarded as a suitable method for this study. Implementing the usability walk-through in this study was seen as an evaluating process consisting of seven phases: 1) collecting the data, 2) exploring the target, 3) a professional tour, 4) planning the walk-through, 5) carrying out the walk-through, 6) analyzing the results, and 7) reporting the results. These phases are described in the next part of this paper.

### 3.1.1 *Collecting the data*

In order to collect the data on housing for the elderly, a literature review, questionnaires and interviews were carried out during 2006–2008.

*Questionnaires* carried out during 2007–2008 were directed at elderly people living in residential dwellings and in senior houses. A total of 164 elderly people answered the questionnaire; 76 per cent were women and 24 per cent men. Their age varied from 59 to 97.

Elderly people living in senior houses, in sheltered homes for the elderly and in ordinary residential flats were *interviewed* in the Helsinki metropolitan area. The researchers interviewed 22 people; 8 men and 14 women. Their average age was 79.1 years.

### 3.1.2 *Exploring the target*

The purpose of the exploring phase was to obtain a perception of the building and all the spaces as a place for comfortable living and coping independently. The implementation phase began by exploring the floor plans and other building documents. In addition, six Loppukiri residents were interviewed in their own dwellings: one couple and four single women. During the informal interviews, the residents talked about their home duties and any flaws or problems they had noticed in their dwellings and in the building.

### 3.1.3 *Professional tour*

On the grounds of the previously collected data, the researchers created a *usability checklist* for the professional tour of Loppukiri. The checklist consisted of 163 items. The titles of the checklist were 1) accessibility, 2) transportation and immediate neighborhood, 3) courtyard, 4) entrance hall and elevators, 5) communal spaces, 6) hallways, and 7) dwellings. During the professional tour, researchers took a closer look at the spaces, the residential environment in general, and the services in the immediate surroundings. The aim of the professional tour was to obtain an overall picture of the issues and themes to be taken into account in this particular senior house. During the professional tour, researchers made notes and took photos. One resident of the house accompanied the professional tour in order to open door locks and show them around.

During the tour, the researchers identified five main *usability attributes*: 1) security/ safety, 2) functionality, 3) comfort, 4) interaction and 5) orientation. Each usability attribute includes a variety of parameters, since usability appears in different ways in different phases during the users' journey in built environments (Fig. 10).

### 3.1.4 Planning the walk-through

The Usability Walk-through of Senior Housing implemented in this study is constructed by utilizing 1) Dale Copp's (2008) Customer Journey Map in order to create a customer path diagram with steps assessing the viewpoint of functions and user experiences in senior citizens' lives, and 2) Alho's Usability Rating Tool (Alho et al. 2008) in order to analyze relevant usability attributes, which are specified using different parameters identified during the research.

Next, a list of understandable *themes* for the Loppukiri walk-through was created. These themes arose during the professional tour and represented the main factors in this particular building (see De Laval 2004 and Alho et al. 2008). They are based on the usability attributes but are more precise and illustrate this specific building. The list of themes is intended to inspire the walkers to discuss different usability features in the staging points. In the Loppukiri case, the list consisted of ten themes, as shown in Table 1:

Table 1. Themes for the usability walk-through in Loppukiri senior house.

|     |  |
|-----|--|
| 1.  | Accessibility and functionality  |
| 2.  | Indoor conditions: temperature, indoor air, acoustics, lighting                |
| 3.  | Coziness, aesthetics   |
| 4.  | Security and safety  |
| 5.  | Orientation: clarity of floor plan, guiding/signs, colors, lighting, acoustics |
| 6.  | Views, contact with nature, contact with other spaces                          |
| 7.  | Multiple use of spaces   |
| 8.  | Furniture, equipment, machinery  |
| 9.  | Doors, windows, buttons, handles, plugs  |
| 10. | Virtual connections and interaction of the residents in the spaces             |

On the basis of the professional tour, the researchers made a plan for the actual usability walk-through and drew a route on the floor plans. The route covered all the important common spaces in the building. The dwellings were not visited, but the information about the usability of the dwellings were received from the interviews. All spaces along the journey are listed in Table 2, and the *customer paths* are shown in Figures 6 and 7.

Table 2. List of spaces along the walk-through

| Ground floor |                            | Ground floor |                        | Sixth floor |                             |
|--------------|----------------------------|--------------|------------------------|-------------|-----------------------------|
| 1            | Entry of stairway A        | 13           | TV-room                | 24          | Hall of stairway A          |
| 2            | Hall of stairway A         | 14           | Office room/guest room | 25          | Hall of sauna               |
| 3            | Dining room                | 15           | Storage                | 26          | Toilet for disabled persons |
| 4            | Library                    | 16           | Drying room            | 27          | Guest room                  |
| 5            | Kitchen                    | 17           | Laundry                | 28          | Fireplace room              |
| 6            | Terrace                    | 18           | Utility room           | 29          | Dressing room               |
| 7            | Hallway                    | 19           | Entry of stairway B    | 30          | Shower room                 |
| 8            | Toilet/cleaning equipment  | 20           | Bicycles               | 31          | Sauna                       |
| 9            | Toilet for disabled people | 21           | Hall of stairway B     | 32          | Outdoor terrace             |
| 10           | Bicycles                   | 22           | Storage/ bomb shelter  | 33          | Gym                         |
| 11           | Waste room                 | 23           | Elevator               | 34          | Ventilation room            |
| 12           | Technical equipment        |              |                        | 35          | Elevator                    |

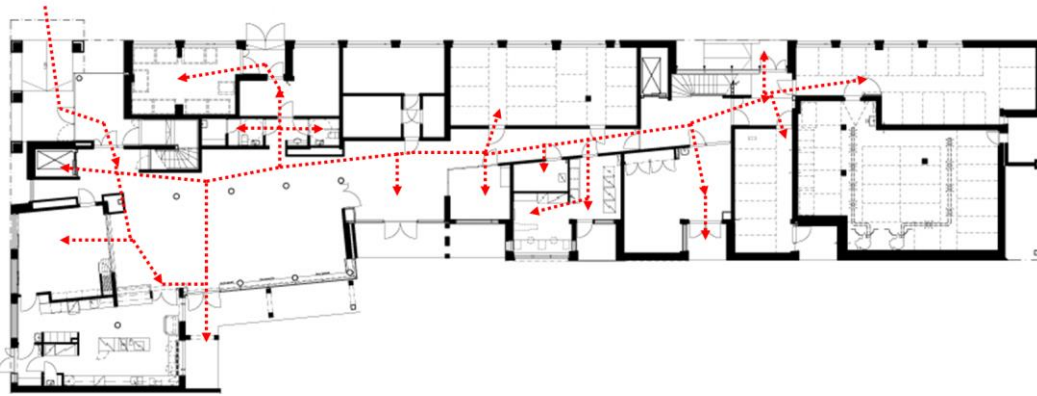


Fig. 6. Customer path on ground floor

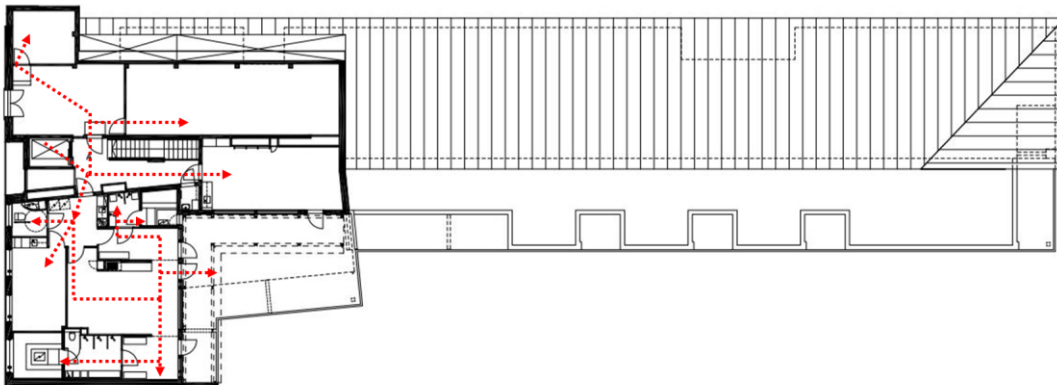


Fig. 7. Customer path on sixth floor

### 3.1.5 Carrying out the walk-through

A usability walk-through at a senior house has to be carried out at the most appropriate time for the residents. Enough time must be allowed for the tour in order to gather all the information. If needed, more than one day can be used for the tour. It is also recommended that the tour of the immediate surroundings is made on a different day.

A senior aged walk-through is best carried out in groups of 4–6 people. In a group of this size, people can easily discuss the themes and everyone has an opportunity to say something. Those with hearing and vision difficulties and those with functional ability problems contribute useful information regarding usability difficulties in the built environment.

Before the walk-through, a paper list of usability themes was given to the residents taking part in the session. At the beginning of the tour, the researchers explained the content of the themes and explained the purpose of the walk-through. During the walk-through, it is best to use a recorder and take photos, in order to help the analysis phase.

### *Walk-through of Loppukiri senior house*

The walk-through sessions at Loppukiri were executed on three separate days with three different groups of volunteers during the spring of 2009. The first two days' tours focused on the communal spaces in the building. On both days, the tour groups consisted of four volunteer residents; two women and two men. One of the participants had a walking stick and one had a hearing aid. None of the Loppukiri residents used wheelchairs, but the subject of accessibility was discussed during the tour. In the course of the tour, the group stopped in certain places and talked about the themes. A recorder was used during the walk-through.

### *Walk-through of the surroundings*

The walk-through of the surroundings started from the front door and proceeded to the grocery shop nearby, situated about 400 meters from the Loppukiri building, and back to the building. The participants were four women; one of them had walking difficulties because of painful knees and hips, but did not use a walking stick or other device. The themes for the walk-through of the surroundings are listed in Table 3.

Table 3. Themes for usability walk-through of surroundings.

|    |  |
|----|--|
| 1. | Accessibility and functionality                          |
| 2. | Barrier-free environment, distances                      |
| 3. | Circumstantial factors: windiness, shelters, lighting    |
| 4. | Coziness, aesthetics                                     |
| 5. | Security, maintenance                                    |
| 6. | Orientation: navigation, guiding/signs, colors, lighting |
| 7. | Views, plants, contact with nature                       |
| 8. | Virtual connections and interaction possibilities        |
| 9. | Outdoor furniture, building equipment, door phone        |

### *3.1.6 Analyzing the results*

After all the walk-through sessions, the recordings were transcribed. The themes and issues that were most often repeated in the text were listed. Since the walk-through sessions had been carried out with informal discussions, it was obvious that the issues that arose were genuine concerns of the users. The results could now be compared to the original themes and checklist, and the most important usability features of this particular senior house could be determined.

### *3.1.7 Reporting the results*

Ultimately, the researchers wrote a short report of the results and gave it to Loppukiri's housing company. In addition, the results were presented at an event held for all the Loppukiri residents.

## 4 RESULTS

### 4.1 Process description

The first result of this study formed a systematic process description for observing the factors affecting the usability of senior housing. The process developed in this study can be described as consisting of seven phases, which are listed in Figure 8.



Figure 8. Process of usability walk-through of senior houses

### 4.2 Questionnaires

According to the results of the questionnaires (N=164) directed towards the elderly living independently *in their own apartments*, the elderly were mainly satisfied with the characteristics of their apartments. The most dissatisfaction was with the functionality of the bathroom and poor access to waste containers, stockrooms in the basement and attic, and the sauna. Other factors causing dissatisfaction were access in and out of the residential building, and the laundry in the basement. Furthermore, difficulties in walking in the immediate surroundings and poor possibilities to perform everyday duties near home came up in the data (Määttä et al. 2008).

### 4.3 Interviews

Elders (N=22) *in three different home environments* were also interviewed for this study. Some of the interviewees were living *independently at home*, some in *senior houses* and some in a *sheltered home for the elderly*. In addition to the Loppukiri senior house, two ordinary senior houses were included in the study.

The results showed that the importance of nature, having one's own balcony and other people nearby are very important to the elderly. What caused problems was the elevator or the lack of it; the elevator did not reach the basement, where storage rooms, saunas and the laundry are usually situated. Those living *independently at home* appreciated the serenity and safety of the living environment, good transport links and local services. The familiarity of the surroundings, proximity to shops, parks and outdoor recreation areas increased their quality of life and brought ease and a sense of security. However, they wished for more benches and better lighting in the immediate surroundings (Aalto 2008).

All the interviewed *senior aged* appreciated accessibility, common spaces, good lighting and warm apartments. In contrast, domestic appliances that were too modern, slippery floor materials and noise problems caused dissatisfaction. According to the results, the senior aged of today do not content themselves with unsatisfying housing, but demand quality from their living environment and housing (Aalto 2008).

Those living in the *sheltered house for the elderly* are often so frail and sick, that they do not care much about their living environment. They most value a warm apartment and having nurses near them (Aalto 2008).

#### 4.4 Usability framework of senior housing

One result of this study was a usability framework of senior housing (Fig. 10). The description of the framework developed in this study assesses senior citizens' living environment by "doing something". It takes into account both indoor and outdoor spaces, as well as places for physical, psychological and social activities. In this case, the framework was formed on the basis of collected data and the usability walk-through implemented in Loppukiri building. The six "steps", illustrate a normal day in a senior's life. The steps are: 1) being at home, 2) activities at home, 3) leaving home, 4) activities in common spaces, 5) running business/shopping, 6) coming home. Figure 9 shows a usability framework of senior housing at the Loppukiri senior house.

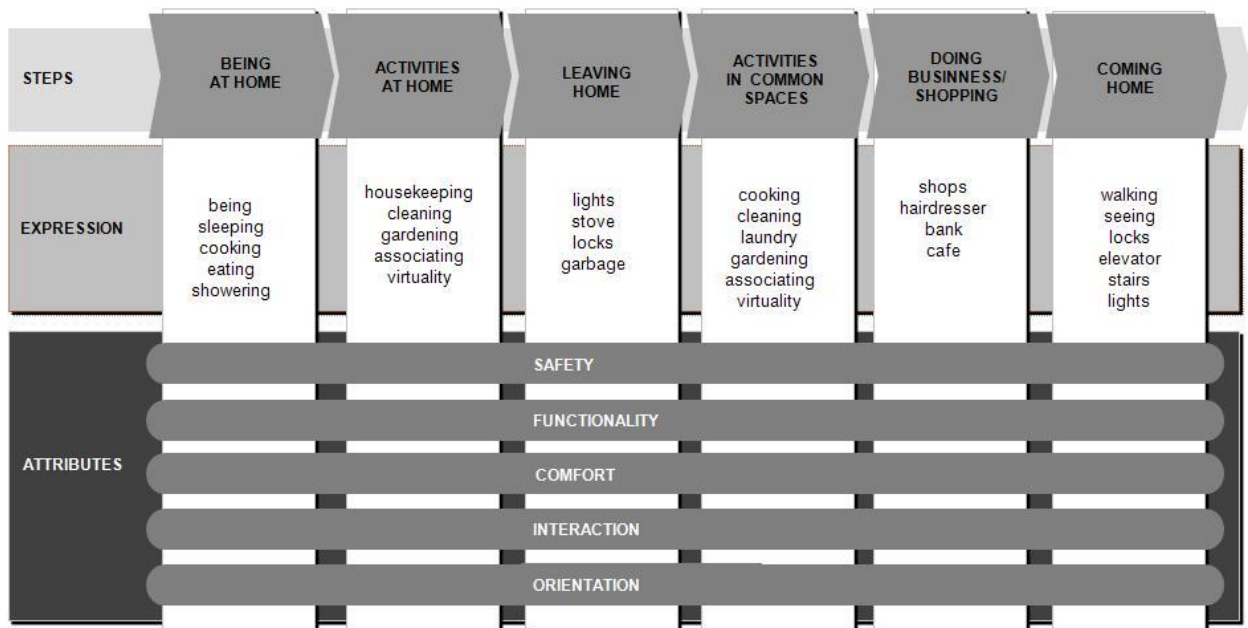


Fig. 9. Usability framework at Loppukiri senior house.

The results of the Loppukiri study show that the usability framework of senior housing can also be presented as an illustration of five main attributes, which are functionality, safety/security, orientation, comfort, and interaction. All these attributes emerged strongly in discussions during the walk-through. Figure 10 shows the attributes and the parameters that arose most often during the usability walk-through in the Loppukiri pilot case.

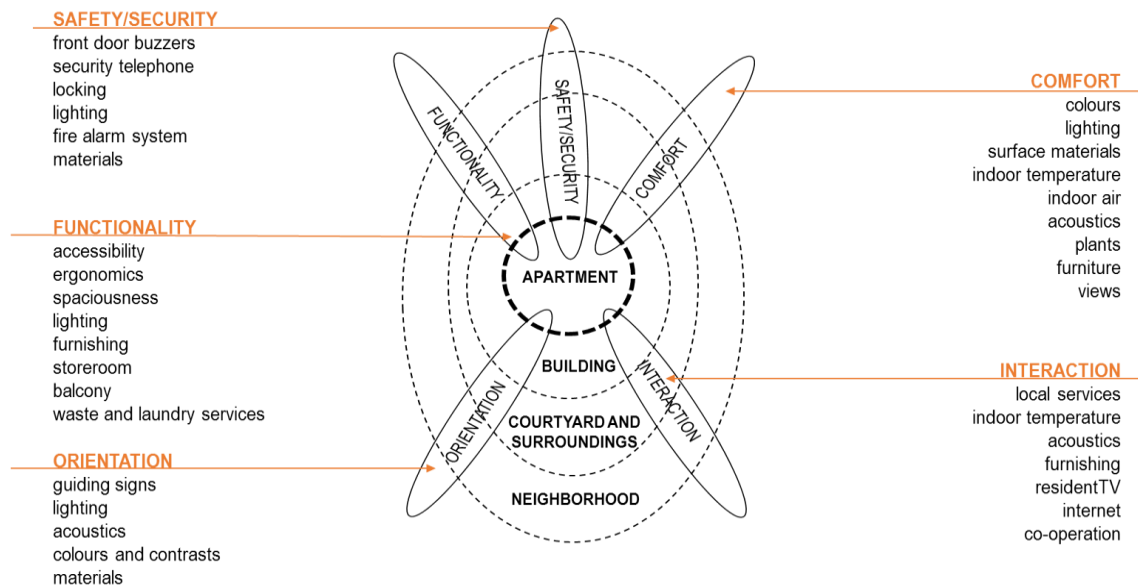


Fig 10. Usability attributes and parameters in senior housing

### *Usability of the Loppukiri building*

The study showed that in the Loppukiri senior house the residents were satisfied with their dwellings thanks to the co-designing model. The dwellings were small, but the residents had been able to choose the colors and materials, and even influence the lay-out. As a rule, criticism was directed towards the communal spaces.

Senior citizens at Loppukiri spend their time preferably at home or in the communal spaces. Noise problems are constant, both in dwellings and in communal spaces (ventilation, piping systems, music, conversation etc.). In addition, although everyone knows each other at Loppukiri, residents do not like the spaces with transit movement – such as the TV room or fireplace room, as they are too restless.

As regards usability in the co-housing premises, the principle of self-sufficiency has to be taken into account in cleaning and furnishing. Balcony glazing and the terrace floor have to be easy to clean, and the furniture in communal spaces cannot be too heavy to move. Adjustable worktops and electric socket placement at the height of approximately one meter help senior citizens a great deal in their daily duties.

Accessibility in the Loppukiri building has generally been implemented well. Although none of residents currently use a wheelchair, they have guests and relatives who use wheelchairs and prams, and accessibility is an important issue. According to the results of this study, the balconies and saunas in Loppukiri are not barrier free, thus a person in a wheelchair is not able to get to these spaces alone.



In addition, it is impossible for a person in a wheelchair to come to the building via stairway B. The door opens in the wrong direction, in the way of the arrival, and there is insufficient space in front of the door. In the winter time, the water freezes on the step due to the small size of the canopy, and the step is too high (Fig. 11 and 12).



Fig. 11. Door opens in wrong direction.



Fig.12. Step is too high.

The feeling of security is very important for an aged person. At Loppukiri, one resident is always responsible for security issues. This person checks the front door locks and sauna premises every evening. Fire drills are also held regularly. Automatic front doors help residents come and go easily, and front door buzzers bring a feeling of security.

### *”Purple Cows”*

The positive surprises of the walk-through of the Loppukiri building and the immediate neighborhood are listed in Table 4. These factors are significant in the process of designing senior houses, since the senior citizens of the future will be in better physical condition and demand more functional and usable environments than senior citizens today.

Table 4. Positive surprises in the Loppukiri senior house

|   |
|---|
| Philosophy of collective living supports working together |
| Co-designing ensures satisfaction and well-being          |
| Versatile, functional laundry facilities                  |
| Security technology solutions                             |
| Visible exits   |
| High utilization of communal spaces                       |
| Functional waste room; facilities for recycling           |
| Guest room  |
| Room for bicycles   |

### *Usability of the Arabianranta area*

The Arabianranta area offers a great deal of services for senior citizens within a one-kilometer radius: a shopping center, a cafe and a library. In addition, within 400 meters there is a post office, a restaurant and a kiosk, but not a bank for instance. Helsinki city center is not far and tram lines and buses run close. The Loppukiri building is situated near the sea, thus nature, cycle paths and footpaths are available to everyone.

However, Arabianranta is a new residential area and construction work has caused disturbance for many years. Dust, noise and trucks result in an incomplete, unclean environment. According to the senior citizens, street lighting, for instance, was put into place much too late.

The distance to the nearest grocery shop was reasonable but it was very difficult to do shopping there. Due to steep steps, a heavy front door and tight spaces, not many Loppukiri residents use this shop, though many of them would like to have a small grocery shop near home.

## **5 DISCUSSION**

The aging population creates new requirements for residential housing solutions. Encouraging old people to stay in their homes is one way of achieving social and economic sustainability.

According to Oswald et al. (2007) the emotional and social aspects of home are as important for life satisfaction as the accessibility and usability. Moreover, aging together – communal coping – increases the acceptance of aging and creates feelings of safety /less worry/ less social isolation (Glass 2013; Glass et al, 2013; Verma et al. 2011; Gonyea and Burnes 2013).

The neighborhood is a particularly important context for older adults, as reduced income status, limited mobility, and health decrements significantly reduce the sphere of leisure activities in later life (Kelly, 1996; King, 2001). Recent research has identified that the characteristics of neighborhoods, including safe footpaths for walking, accessible facilities, the presence of green and open spaces, the density of shops and houses, and neighborhood attractiveness affect older adults' participation in leisure time physical activity (LTPA) (Booth et al., 2000; Li et al., 2005; Michael et al., 2006).

According to previous studies, increased functionality does not necessarily mean improved usability. The ability to cope with everyday duties weakens as a person becomes older. The user experience of the built environment is not the same for all user groups, in particular for elderly and disabled people. Good design promotes social well-being and the notion of “aging in place”. Beneficial spatial design will help in way-finding and will also increase safety (Aalto and Verma 2010).

The development of independent living facilities called ‘senior houses’ has been increasing in Finland. However, there are no common criteria for the design of the dwellings or the common spaces in senior houses. In addition, the number of common spaces in senior houses varies largely. Some houses have just one common area, for example a salon, and the highest quality senior houses may have a restaurant, a fitness room, a physical therapy room, or other amenities

and services.

The fact that Loppukiri stands for collective living and the residents have been able to influence the interior so much can be seen in the design solutions. Usability in the Loppukiri building seems to be relatively good, despite obvious accessibility and noise problems in communal spaces.

Since interaction is a self-evident issue in senior citizens' lives, having a number of common spaces in the residential building increases satisfaction. The amount of people with impaired hearing, vision and mobility will certainly increase as the residents get older, thus features in the living environment that support orientation are important. In addition, the question of accessibility for residents using wheelchairs will certainly become an important issue in Loppukiri as residents get older.

Although there is some research concerning the usability of housing for the elderly (Malmqvist 2012; Andersson et al. 2011), its focus has mainly been on accessibility, functionality and flexibility. In addition, there is a lack of usability research on the residential environments of the senior aged.

As an increasing number of elderly and senior citizens are expected to live independently in their own apartments with communal or private help and care in the future, the usability of senior housing should be taken into account more seriously. The usability aspect is an important factor in ordinary residential design, as well. Thus, the results of this study provide valuable information regarding the usability of built environments for authorities and designers, as we will all grow old eventually.

## 6 CONCLUSION

The aim of this study was to evaluate the usability features of senior housing. The usability walk-through proved to be a suitable method for this. The senior residents involved were evidently devoted to their role as expert members.

The main finding of this study is the framework of usability features concerning the housing of the senior aged. Certain attributes shown in Fig. x have to be taken into account in housing design for people aged 55+ who want functional, comfortable, accessible premises, where interaction with other residents is pleasant and easy.

Usability problems in the Loppukiri building seemed to appear mainly in common facilities. They were mostly related to cleaning issues, for example difficulties cleaning balcony glazing and floor material. In the dining hall and the sauna department, transit traffic caused disturbance problems. On the other hand, noise, accessibility problems and troublesome plugs caused irritation in apartments.

The strength of using a walk-through in this study is the fact that the users, with their experience and opinions, were able to take part in developing the framework of usability. In addition, using

the walk-through as a tool in this study took the demands of not only the physically impaired but also of the sensory disabled into account, which is especially important in questions of usability in senior citizens' living environments.

The weakness of this method is the special feature of communality at Loppukiri, which ensures that all residents can influence their living environment. This is not usual, and thus cannot be generally applied to all senior houses. However, the living model of co-housing that Loppukiri stands for will probably become of general interest for healthy senior citizens in the near future.

In summary, the tentative results reported in this article are meant to illustrate the complex totality related to the usability dimensions of senior housing rather than give a complete solution to a specific problem. In order to assess the results more extensively, the framework developed in this study should be tested in different kinds of senior houses. Next, reliable measurement procedures must be developed for comparing senior houses to each other.

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