

## **Some universal indoor environmental requirements of the seniors from Northern-East to Southern-West Europe**

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### **SUMMARY**

The attitudes can reveal the hidden reasons behind the customer choices. Referred interview studies identified typical indoor environmental requirements of the residents and made international comparison of the feedback from both young families and senior citizens.

Good housing conditions have positive influence on people's wellbeing and they should be achieved without energy usage in vain. Even if most the elderly can manage well in nominal indoor air conditions, some of them might complain of draft or low room temperatures. The aged housing of the studied elderly lacked proper heating and good indoor air. Senior citizens' feedback was quite similar when comparing response from Finland and from Spain.

For the differences in the indoor air quality needs control possibility could be a solution. The acceptance of energy saving technology was low if the basic needs were not satisfied comfortable enough or the control set disturbs the routines of daily life, which in this case concerned the restrictive technology of room temperatures and in comparison that of home appliances in the sake of energy efficiency.

### **INTRODUCTION**

It is a well-known fact that better housing conditions influence people's health. Normally with this is meant such old problems as bad heating, draft due to leaking structures, lack of tap water, shower or toilet, large amounts of hard maintenance work due to materials wearing out easily and being difficult to clean or maintain otherwise, etc. As known, many accidents happen in homes [1]. Even then, the way of building matters.

Even if most the elderly can manage well in nominal indoor air conditions, some of them might complain of draft or low room temperatures easier than people on average, most obviously due to retarded vital functions and motions or immobility. The gender differences in thermal comfort are often underestimated. Latest research carried out by Karjalainen (in press) showed significant gender differences in thermal comfort, temperature preference, and the use of thermostats. Women were less satisfied with room temperatures than men, preferred higher room temperatures than men, and felt both more uncomfortable when cold and uncomfortable when hot than men. Men used thermostats in the households more often than women, although women were more critical of their thermal environments.

Healthy building design and construction has paid special attention to health, safety and security, and functionality. Green building is a building concept promoting sustainable development by energy labelling such as American LEED ([www.usgbc.org](http://www.usgbc.org)), British BREEAM (BRE Environmental Assessment Method), ([www.bre.co.uk/](http://www.bre.co.uk/)) or Finnish WWF

Green office ([www.wwf.fi/greenoffice/](http://www.wwf.fi/greenoffice/)), etc. The prime aim is an ecological building process and buildings, and energy efficiency. However, sustainable solutions can be many.

Many house owners favour ecological and energy efficient technology. Unexpectedly, the professionals – not homebuilders, consumers and housing associations – retard the implementation of new products in housing sector. The traditions of the conservative building sector have several reasons for this [4, pp. 9, 108–109], cf. e.g. [5]. For example, prejudices against new and loyalty to workable professional paradigms play their own roles, short-term financial arguments or existing long-term contracts might prevent the building provider from picking new technology or architects are afraid for their reputation if the new products turn out to perform in an improper manner.

The indoor air quality was important for the elderly. The seniors expressed their clear opinion of it by favouring mechanical ventilation during the Elderly housing survey (Table 1). They named also the lack of good indoor air when asked for the three most important matters their current homes were lacking (Table 5). Expectedly, an older person wants to have warm housing without draft more often than a younger person does. Often, the elderly housing is aged too and needs repair and better indoor air, which was obvious from the result of the Elderly housing survey carried out in Western Central Finland. An exception of the need of low indoor air velocity is the summer time in the Mediterranean countries, where people and the elderly particularly suffer from the periods of high temperatures. There can be a need of proper cooling and even the motion of air – unwanted in Northern climates – mitigates the hot feeling and will not necessarily be considered that bad in the Southern parts of Europe.

Indoor air quality was also the sixth most important option picked by the respondents of the interview study carried out in the Pirkanmaa region in Finland, when it was studied the residents' opinions of the smart home qualities [6]. Out of 39 smart home facility options, the top of five before the indoor environmental quality were about safety: fire-fighting equipment (55 per cent of the respondents), water leakage detector (55 per cent), automatic on/off system of home appliances (48 per cent), distant alarm receiver (41 per cent) and smart home security system (36 per cent). The respondents belonged to all adult age groups. Interestingly, also office workers valued indoor air quality control highly according to the study of intelligent building technology “What Office Tenants Want” by the BOMA and the ULI in USA. Furthermore, office workers in Finland complained of poor indoor air quality not only in the other high quality offices, but also in the intelligent office buildings according to the Intelligent Buildings Survey [7].

As there were personal differences in the needs concerning indoor air quality, personal control possibility could be a solution. The earlier Elderly housing survey gave evidence that the elderly could not combine together the indoor air quality and its controls [3]. Instead, many of them mentioned only good indoor air quality to be important for them. That was rational thinking. Actually, as mentioned earlier good indoor air was important for women, while men rather than women use the control devices [2]. Latest research by Karjalainen (in press) shows significant gender differences in thermal comfort, temperature preference, and use of thermostats among all aged subjects. Females were less satisfied with room temperatures than males. Females feel both uncomfortable cold and uncomfortable hot. Males use thermostats in households more often than females, if only females were more critical of their thermal environments.

**Table 1. The shares of those who were willing to have smart home features for building services at home according to the Elderly housing survey (in 1995, n=315, the percentages of the respondents) [3] <sup>1</sup>.**

<i>Air-conditioning, domestic water</i>	1
Mechanical ventilation	61
Water leakage alarm (alarming when water on floor)	48
Cooling in summer time	33
Electric metering tap (closing automatically)	24
Photoelectric tap (opening when hands are under the tap, automatic closing)	24
Irrigator for greenhouse	8
Other	3

<sup>1</sup> Pick of several choices of multiple-choice questions possible

**Table 2. Lackings of the current homes during the Elderly Housing survey (the numbers of the respondents) [3].**

SURROUNDINGS (altogether)	70
Services too far away, poor transportation facilities or too distant location	35
Disturbing traffic	11
Other problems	24
APARTMENT (altogether)	169
Unfunctional (the kitchen was mentioned 25 times among them)	40
Too little space (the bath room was mentioned 12 times among them)	37
Too little rooms (the entrance was mentioned 8 times among them)	22
Too many levels	13
Bad shape	13
Too much space	8
Too much maintenance	6
Too high housing costs	5
Too high heating costs	4
Other	21
MISSING SPACES (altogether)	143
Storaging rooms, cellar	67
Sauna bath	18
Washing room	17
Balcony	11
Second toilet	10
Other	20
MISSING OR POOR QUALITY EQUIPMENT (altogether)	100
Air-conditioning	25
Extra heating unit (fire place etc.) or poor quality heating (mentioned 7 times)	23
Elevator	18
Poor soundproofing	9
Windows unfunctional or in a poor shape	9
Other	16
UNCLASSIFIED (altogether)	19
Bad neighbours	4
Renovation irritates	3
Other	12

## METHODS

Urala (2005) has found that the respondents' attitudes have revealed statistically significant differences in both liking and purchase intentions. The study of attitudes can reveal the hidden reasons behind the customer choices, which often remain unclear even for the individuals themselves. The surveys referred in this paper had almost the same themes and used quite often similar questions [8], [10]. It has been possible to identify typical indoor environmental requirements of the end users, as well as to make comparisons within the international context between various customer groups based on feedback from both young families and senior citizens.

Within the EU 5<sup>th</sup> FP project Demulog (Living Conditions and Preferences of Families in Housing Need, Table 3) the numerical analysis were carried out (using the SPSS program). The qualitative responses to the open ended questions from the EU 5<sup>th</sup> FP project Elderathome (The Prerequisites of the Elderly for living at home: Criteria for Dwellings, Surroundings and Facilities, QLK6-CT-200-00405, Table 4) have been grouped, listed and summed up. Results from two corresponding Finnish studies were used as reference values (Table 5). All samples in each country were dominated by residents who dwell in the blocks of flats and in most cases in cities as well as their demography represented quite well the national averages cf. [10].

**Table 3. Summary of the cases of the Demulog project (n=294).<sup>1</sup>**

<i>Year</i>	<i>Location</i>	<i>Target groups</i>	<i>Sample</i>
1. Autumn 2000	1. Finland, Helsinki	1. The subjects from 500 applicants for social housing provided by VVO <sup>2</sup> .	1. 103
2. Spring 2000	2. France, Vienna	2. The subjects from some 1,500 households applying for social housing from OPAC Vienna <sup>3</sup> .	2. 101
3. Winter 2000-2001	3. the United Kingdom, Peterborough	3. The subjects from the applicant lists of the Nene Housing Society Ltd in the Peterborough City <sup>3</sup> and the Peterborough City Council Housing Department.	3. 90

<sup>1</sup> Personal face-to-face interviews, the same questionnaire for the interviews used in each country; <sup>2</sup>VVO Group was a private social housing provider and an owner of 35,000 properties in 72 municipalities; <sup>3</sup>a private social housing provider.

**Table 4. Summary of the Elderathome study from Finland and Spain (n=206).<sup>1</sup>**

<i>Year</i>	<i>Location</i>	<i>Selected case groups</i>	<i>Sample</i>
Spring and summer 2003	Finland Helsinki	Subjects aged over 55 years from three cases: - 32 members of an association of active seniors <sup>2</sup> , - 28 tenants of two housing real estate companies in Puotila housing area <sup>3</sup> and - 46 randomly accessed elderly living in Vuosaari housing area <sup>4</sup> from the data bases of the Population Register Centre.	106
Autumn 2002	Spain Barcelona and neighbouring towns	Subjects in the age of over 55 years from 15 cases living in regular housing, in senior housing, in private and municipal service homes for elderly.	100

<sup>1</sup> Personal face-to-face interviews, the same questionnaire for the interviews used in each country; <sup>2</sup> A group of seniors, who plan a senior house of their own; <sup>3</sup> The elderly were the majority and their houses need repairs.; <sup>4</sup> The largest residential area in Helsinki, where population was growing rapidly, because the recent new development since 1960's.

**Table 5. Summary of the Elderly housing survey carried out in Finland [3].<sup>1</sup>**

<i>Year</i>	<i>Data collection location</i>	<i>Target groups</i>	<i>Sample</i>
1995	The city of Tampere, a few municipalities in the Pirkanmaa region	A randomly accessed subjects aged 55 to 70 years by the Population Register Centre.	over 300 <sup>2</sup>

<sup>1</sup> Posted questionnaire; <sup>2</sup> the answering percentage of 32 per cent

## **ADJUSTMENT OF INDOOR AIR MEASURES FOR ENERGY SAVING**

The Demulog interview studied the user requirements of energy saving options carried out by the smart home technology, such as saving energy by reduced room temperatures or limiting the use of electricity for home appliances to certain periods of the day. The families in Finland (71 per cent of the responses) and in France (55 per cent) responding to the Demulog interview oppose an energy saving system using a restrictive technology [8]. Only in the United Kingdom 58 per cent was in favour of such savings. The preferable room temperatures turn out to be as follows [8]:

- A large majority (> 80 per cent) accepts lower temperatures when nobody was at home or during the night.
- A small majority (from 50 to 57 per cent) accepts lower temperature in the bedrooms but not in other living spaces, and a third (35 to 45 per cent) wants to have the same temperature all over the dwelling.
- A large majority (95 per cent in Finland, 93 per cent in France, 72 per cent in UK) wants as high or higher temperatures in the bathroom and toilet as in the living areas.

Nevertheless, the respondents did not oppose all other means of saving energy as the limitations of room temperatures. The acceptance of low energy consuming home appliances was very good in Finland (in most cases 99 per cent, n=106), good in the United Kingdom (in most cases from 91 to 96 per cent or more, n=90) and rather good in France (in most cases from 64 to 70 per cent, n=101). The acceptance of water saving measures was good (Finland 69 per cent, France 70 per cent, the United Kingdom 87 per cent), but the acceptance of a composting latrine was not that good (Finland 19 per cent, France 18 per cent, the United Kingdom 29 per cent).

The lesson of the result of the Demulog interview taught that if residents seem in practical terms flexible in timing during the daytime, still, when they were without any compulsory ties they do not feel free. The daily routines of the society were still usually followed. Changing the timing of domestic work is not necessarily possible.

The elderly can be considered as citizens without responsibilities and with free time, and thus flexible in the timing of daily activities. However, also they follow the common timing of daily routines. The travel experiments which have offered the elderly the chance to use public transportation with a reduced charge have resulted in a failure because those trips were not made to a great extent beyond the peak hours (Discussions at the NECTAR (Network on European Communications and Transport Activities Research) conference "Transport Innovations, Competitiveness and Sustainability in Information Age". no 4 in Israel). Furthermore, Fox (2004) found that seniors use computers on a typical day similarly to the younger computer users.

## **IMPORTANCE OF GOOD INDOOR ENVIRONMENT**

It was interesting to find out how similar the response from the two geographically and climatically very separated countries, Finland and Spain was when it concerns the lacking qualities of present housing of seniors. Within the EU 5<sup>th</sup> FP project the Elderathome such lacking qualities mentioned during the Finnish interviews as the lack of elevators or the need for other types of easy access out, needs for kitchen repair, poor soundproofing and indoor air quality, difficulties in using the bathtub or the wish to have a balcony (or two) and more

natural light, were common to all studied cases of senior citizens. Similarly to the earlier Finnish studies, the indoor air quality turned out to be important.

The Spanish respondents paid special attention on such shortcomings as (in order of importance) [9]:

Basic contraction issues

- Dwelling was not equipped with central or electric heating. (This was a frequent problem in old quarters.)
- The surface outside the entrance was not horizontal and on a different level with the surface of the entrance.
- No elevator.

The Spanish respondents paid special attention on such best qualities of housing as (in order of importance) [9]:

Positioning of the house in relation to the sun.

- Natural light.

Outside space.

- To have a terrace, a balcony, a little space outside where they can have some plants.

Neighbourhood issues

- Services in the neighbourhood and near to the urban centre. No one was worried about the house technical aspects. They thought that was too expensive and difficult to understand.

In Finland, the respondents to the Elderathome interview reported problems with the HVAC measures and technology in their current homes quite as often as problems with sounds and noises, after the major problems of mobility and spatial needs (Table 6). The result was quite same as gained earlier during the Elderly Housing survey (Table 2). When asked about the ideal future home for old ages the importance of the qualitative HVAC technology guaranteeing the good indoor environment turned out not to be that important by the Finnish respondents (Table 7). Similar result can be found from the summary of the Spanish responses.

The sample in Spain had the male majority or men were over presented compared to the national average in that age group, and the Finnish sample had the female majority or over presentation compared to the national average in that age group. Despite gender differences in the two samples, when comparing them in their entirety this study did not show any differences between genders in the needs and wishes for the indoor environmental requirements. However, during this study too the gender differences were found in the preferences of the choices between different control technologies [12].

## **DISCUSSION**

The concept of sustainability as a whole necessitates both the energy conservation activity and the human acceptance of it, because sustainability equals both the human wellbeing and integrity of the nature. According to the results of the Demulog project, the possibilities to use smart home control for energy saving were dependent on which home electronics and appliances were in concern and which types of means were used for the energy saving. The quality of the technical application counts in the acceptance of using energy saving measures. On one hand, a large majority accepted lower temperatures when nobody was at home or during the night, and on the other hand, a higher temperature in the bathroom and the toilet than in the living areas. A small majority accepted a lower temperature in the bedrooms but not in the other living spaces. The acceptance of energy saving technology was low if the basic needs were not satisfied comfortable enough, which in this case concerned the room temperatures. Using technology which saves energy and is ecological was also in favour. If

the control did not disturb every-day life, the daily rhythm or the routines of the activities, the control was acceptable. To prevent electricity consumption peaks by changing the time schedule of the domestic work does not seem to be possible largely.

**Table 6. The three worst shortcomings of present dwelling in the studied Finnish elderly homes (the numbers of the respondents).**

Problem type	Problem	n
Mobility	Entering the house: no elevator, too many steps or too small elevator cage	22
	Moving indoors: two floors and steps upstairs	5
Need of space	Too big apartment, garage and sauna bath in vain	8
	More space needed, too small rooms	8
	Missing space	22
Sound and noise	Poor soundproofing	7
	Noise from traffic disturbing or metro disturbing	3
HVAC	Bad air-condition or bad indoor air, draft	4
	Cigarette smoke in the balcony, cooker hood	2
	Personal control on air-conditioning needed	1
	Too hot in the summer time	1
Bathroom	Bathtub difficult to use, change of the tub to shower	7
Maintenance	The courtyard in the winter time overwhelming because of snow, caretaker takes care of removing snow and sweeping up and residents not allowed	8
	Too much work, too much to clean	2
	Other	4
Renovation	Old building needs renovation	4
	Planned renovation, future boiler room, bathroom or kitchen renovation, damages due to damp in the basement, bad structures, cold floor	7
	Renovation took too long time/renovation disturbing	2
Costs	Energy consumption	1
	Too high rent, dwelling (housing) is expensive	2
Electricity	Location of lighting switches could be better	2
Interior design	Thresholds, darkness, kitchen cabinets too high	4
Other		15
No complains	Satisfied	6

Both the Finnish and the Spanish elderly respondents kept the indoor environmental qualities as important. Both groups had problems with the HVAC measures and technology in their current homes but other factors than good building service technology counted less when they told about their "dream homes" for old ages. The Elderly housing survey [3] tested the importance of the HVAC measures against a limited number of factors, against those of the building services and then the importance of the HVAC technology emphasized (Table 1). The same was the case with the other Finnish study of the residents' opinions of the smart home qualities which also found the relevance of the indoor air requirements important for the residents [6]. All studies have concluded that the current homes of the elderly tend to be in such a shape that they need renovation, and the residents have problems with the HVAC measures.

This study found no gender differences in relation to the importance of the indoor air quality measures. However, the samples were small – although well representative [10], compared to that of Karjalainen (n=1000) [2], which showed gender differences in relation to the indoor air measures. Most importantly, the studies were not otherwise fully comparative either. The set of the questions were different. Importantly of all, the method of analysis was different. This analysis has reached up to the comparison of two sample as a whole – the one with

female majority and the other with female majority, on the basis of the response to the qualitative open ended questions and without any statistical comparison between gender factors. In stead, Karjalainen has accomplished careful scientific analysis on the gender differences [2].

Furthermore, the comparison of this study was made between two nationalities. Then, the cultural differences and climatic factors may influence the result. It can be concluded though that cultural differences often have less influence on the satisfaction of such basic needs as the indoor air quality [10]. However, the cultural influence on the standard of housing might have an effect on the requirements for the indoor air quality as was seen from the results of the Demulog study. The English were more ready to accept the lower temperatures than the Finnish or French respondents. When comparing the Finns and the Spaniards, the comparison was made between two nations where the housing habits were quite similar (most housing in the blocks of flats) despite climatic differences.

**Table 7. Important qualities in an ideal home building, especially, if the life as a senior citizen was in concern in Finland (the numbers of the respondents).**

Wish type	Wish	n
Services	All services available or near by	34
	Health service near by	6
	Services - cleaning, services – shopping	7
	Other	5
Mobility	Easy entrance (wheel-chair taken into account in design)	34
	Easy access indoors	6
	Good (public) transportation	11
Need of space	Sauna	6
	Balcony, balcony also next to bed room	5
	Enough space, applicable size, own room, missing rooms	10
Interior design	Functional lay-out and for domestic work, materials easy to take care	12
	Peaceful dwelling,	7
	Other	3
Bathroom	Bath easy to use, free access to bath, shower (no bath tub)	3
	Bigger bathroom, spacious enough and of good quality	3
	Floor heating, safety system in bathroom	2
HVAC	Mechanical air conditioning, good indoor air or air conditioning and no draft	3
Electricity	Safety system in electricity	1
Sound and noise	Good sound proofing	1
Maintenance	No winter maintenance – snow	1
Surrounding	Peacefulness, safe, sea near by, etc.	20
Neighbourhood	Friends, communality, help available, safety	17
Not classified	Not many floors	7
	Other	19

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