
HERMES – Cognitive Care and Guidance for Active Aging

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D.2.1 Report about the elderly's needs

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Abstract

In this document the different methodologies that have been followed in order to collect the elderly's needs are described. Also, some general conclusions and input to the technological field is provided.

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1. Introduction

The main goal of the HERMES project is to provide novel assistive technology for integrated cognitive care. Specifically, HERMES will built intelligent, pervasive and non-obstrusive systems and associated cognitive training games, with a view to drastically reducing age-related decline of the elderly cognitive capabilities, while at the same time assisting users where necessary. Analyzing and understanding the elderly needs (in general, but also in relation to their cognitive decline) is a key prerequisite to building added value assistive technology, which could have a substantial impact on the end-users' daily life. To this end, HERMES employed a systematic requirements collection and analysis procedure, as part of the WP2 of the project. The purpose of the present deliverable is to report on the needs of elderly people that have to be covered by HERMES system in the areas of health and prevention, security and safety, cognitive training and sharing. In fact, there are a broad range of needs that elderly people present. The aim of the present work is to focus on the more important, prevalent and disturbant needs susceptible to be covered by the system in the following cores:

- Facilitation of episodic memory
- Cognitive training games
- Advanced activity reminding to assist the user's prospective memory in performing everyday tasks and to support independent living.
- Conversation support on the grounds of interactive reminiscence based on the recordings of important moments in everyday life.
- Mobility support to address the needs of the user outside of the house

In this collection of elderly's needs two partners have been mainly involved: INGEMA (Spain) and CURE (Austria), with the help of AIT (Greece) in the questionnaire administration. The same methodology has been applied in these countries in order to compare the final results. This methodology has combined both quantitative and qualitative approaches. Also, the methodology has tried to collect elderly people's needs regarding both indoor and outdoor environments.

2. Scope of this deliverable

In the present deliverable an overview of elderly needs with regards to cognitive support is presented, based on:

- The state of the art comprising known facts from recent studies on elderly problems in general and cognitive decline in particular.
- Needs collected in the scope of HERMES, based on a methods mix specifically chosen to match the diversity of the target group. These methods are: (i) questionnaires, (ii) cultural probes, (iii) diaries, (iv) focus group, (v) interviews and (vi) objective and subjective memory assessments.

The deliverable presents the results of the first task in a series of three that are aimed to provide a user-centered background for the HERMES project. Based on the results from the user requirements that are described here, interfaces are chosen and conceptually

developed that match with the needs from older users, as is described in deliverable D2.2. Finally, scenarios and use cases are developed based on both the user needs analysis and the chosen interfaces and are presented in deliverable D2.3. These three documents together provide the necessary user input to be able to work on technology development that matches with the user needs in all further work packages.

The deliverable is structured as follows: Section 3 presents the state of the art about the needs of the elderly, while Section 4 advances the state of the art based on results that collected in the scope of the HERMES project. Specifically, section 4 illustrates the methodology which was adopted to elicit elderly requirements, along with results from the analysis of these requirements. Accordingly, section 5 the elderly's needs are summarized and how this implies for the future HERMES development. An outline of how elderly's needs may affect technical work in the future is exposed in section 6. Finally, in section 7 the main conclusions of this deliverable are shown.

3. State of the art about needs of elderly people

3.1 Statistics for Age-Related Memory Impairment at the EU

Even if getting older as a stage of life is not a new issue, the aging process among large groups of population who are going to be in need of specific resources is actually quite new, as it is new the aging of population itself. If demographic predictions made by the Eurostat are broken down based on age ranges criterion, it is shown that the group of people younger than 40 is decreasing at the EU: in 5 years, there will be 8.9 million people less than now (-3.8%). And, from year 2010 on, the only group which will increase its members will be the "older-than-55-years-old" group. People in their last decade of working activity (55 to 64 years-old), who are currently 17% of the population of those who are on a working age (i.e. 15-64 years-old range), will increase up to 18.5% on 2010 and will be 23% by 2030.

Regarding people older than 65, it is expected an even faster increase in the middle-term. Eurostat predicts that population ranging from 65 to 79 years old will increase 3.4% in the next five years and 37.4% between 2010 and 2030. In 25 years there will be 80 million people in this age range, ranking the second among the most numerous age groups, only after the age group ranging from 40 to 54 (nearly 93 millions) and slightly before young people between 25 and 39 years old. Population older than 80 will increase by 17.1% from 2005 until 2010, and by 57.1% between 2010 and 2030, so this population will increase from the current 18.8 million up to 34.7 million older people in the next 25 years. It is likely that many of them will live alone, especially, women. Putting together both groups, people older than 65, that currently constitute approximately a 17% of the EU population, will be close to 25% in a 25 years time.

In the following [figure](#), the trends in some countries of Europe, in comparison with data from year 2000, can be seen.

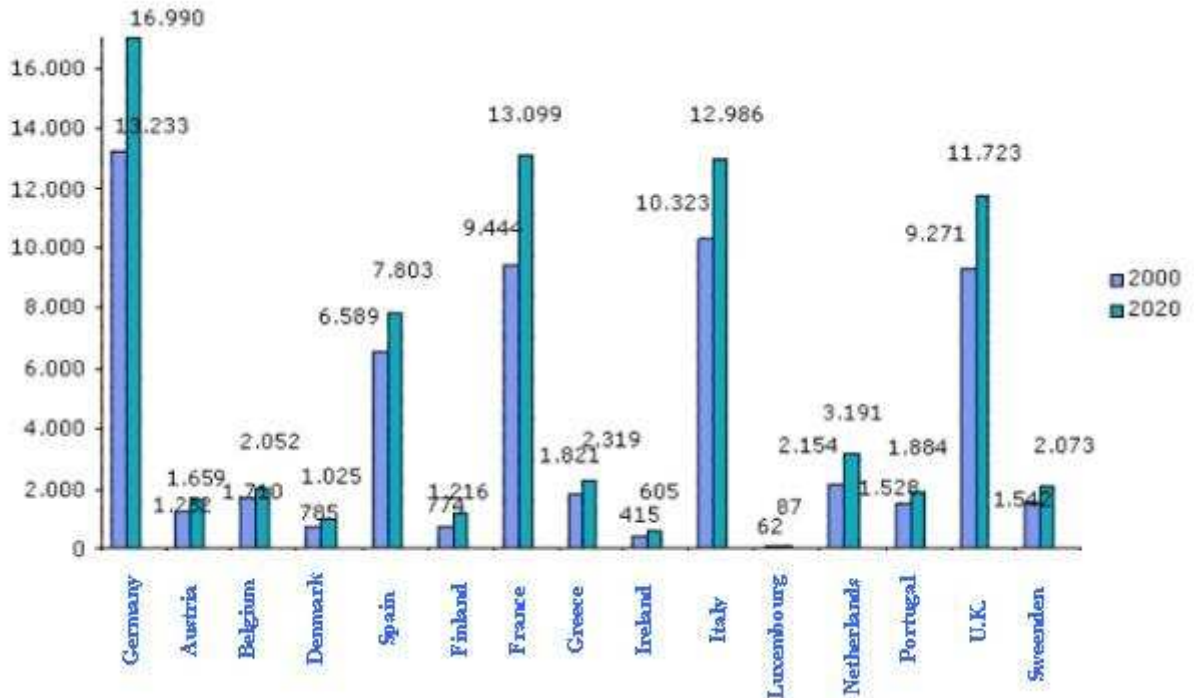


Figure 1: Elderly population increases expected in 2020. Font: Elderly People in Spain. 2000 Report (2000) IMSERSO

There seems to be an agreement when it comes to recognize the existence of an age-related cognitive impairment; the main issue is to establish the limit between normal and pathologic decline. It is known to be a continuum between normality and dementia where isolated memory disturbances are found first, and cognitive disorders without dementia have a subsequent onset, being the latter a construct which is currently known as Mild Cognitive Impairment (Bermejo, Vega, Olazarán, Fernández & Gabriel, 1998).

Several trials have been made in order to name and treat memory disturbances related to age. Kral called them “senescence benign memory loss” or “benign memory loss” (Kral, 1962). In 1986, Crook, Bartus, Ferris, Whitehouse, Cohen, and Gershon wrote criteria and proposed the label of Age-Associated Memory Impairment (AAMI)..

Prevalence for AAMI may vary its results depending on the restriction of applied criteria. Statistics describing 3.6% of prevalence for 40-65 age range and 17.1% for people older than 65 have been presented (Hänninen, Koivisto, Reinikainen, Heléala, Soininen, Mykkänen et al., 1996). In these processes, not only the memory, but also other associated processes are affected, more specifically, different cognitive factors are implied: reduced attention abilities, processing speed decrease due to slowness and working memory disturbance (Craik, 2002). However, it may happen that methodological problems may arise to distinguish among different factors implicated.

Tuokko & Hadjistavropoulos (1998) describe *cognitive impairment* as the group of changes (i.e. impairment) in elderly people’s normal functioning that is larger than expected within a normal aging process. According to Davis & Rockwood (2004), that performed a revision of existing literature about cognitive decline associated to age, there are many conditions that can be presented as cognitive decline causes but which

do not fulfil criteria for a dementia diagnosis. They state, however, that population-based studies suggest that mild cognitive impairment classifications are unstable and confusing, and that a clarification of age-related cognitive decline profiles is needed in order to specify to what extent these cases may constitute a preclinical status of Alzheimer's disease.

In relation to this, Wilson, Beckett, Bennett, Albert, & Evans (1999) tried to evaluate changes in cognitive functions of elderly people, and concluded that there was no relation among the aging process, and the initial and subsequent progression of cognitive decline. For Lisso (2004), however, we can refer to an age associated cognitive decline, which would include a decrease of at least a standard deviation in some cognitive area or function when the individuals are compared to people who are their same age.

Overall, cognitive decline is initially observed, in the majority of population, between the 50 and 60 years old age range. However, this decline does not occur in every individual neither in every area, nor in the same way. Moreover, differences among individuals are very strong and there is some implication of educational, occupational, social and affective factors. Also, memory functioning of elderly is different among diverse memory types or subsystems. While some keep preserved, others show disturbances (Montenegro, Montejo, Reinoso, De Andrés, & Claver 1998).

According to Petersen, Doody, Kurz, Mohs, Morris, Rabins et al, (2001), prevalence for age related memory decline ranges from 17% to 34% on elderly population, while prevalence on age related cognitive decline has been estimated to be 26%.

HERMES project, since it is focused on elderly people with neither diagnosis of dementia nor other degenerative disorders, concentrates its interest on Age-Associated Memory Impairment (AAMI) and on subjective complaints' prevalence among elderly.

3.2 Elderly people's needs in HERMES domains

Numerous studies show that elderly people's concerns are basically oriented to present, are linked to problem-solving processes, and are mainly focused on their own health, and on their and their families' wellbeing. Thus, elderly people's needs are going to be oriented to these areas and to the sense of safety they may gain if they keep these domains under control. With respect to the four domains included in HERMES (i.e. health, security, memory and sharing) we indicate in the following sections the main needs gathered in recent studies regarding elderly people in Spain and Europe.

3.2.1 Health and prevention

In general, up until 70 years old, people have a good perception of their own health. This subjective perception is mainly because they perceive disturbances as normal or logical due to their age. On the contrary, the ageing of negative perceptions is due to, among other factors, loneliness, gender differences, age, financial resources and family factors.

Despite the fact that it is known which pathologies or diseases may be more prevalent in elderly people, overall and divided by gender or age (see

	Total	
Age	16-65	65 and older
Total*	28,404.1	6,957.3
Arthrosis and rheumatic disorders	9.1	46.1
Hypertension	8.0	41.3
Bad blood circulation	6.6	29.3
High levels of cholesterol	7.3	23.4
Heart disease	2.4	19.8
Diabetes	3.0	17.8
Osteoporosis	1.9	13.3
Asthma, chronic bronchitis or emphysema	3.6	13.1
Hernias	4.0	10.1
Depression	4.3	9.9
Allergy	10.4	7.6
Headaches, migraines	6.3	7.6
Stomach ulcer	1.9	5.1
Other mental disorders	1.6	3.3
(*)Thousands		
Diagnosed by the Medical Doctor. Vertical percentages; it can sum more than 100.		
Source: INE-MSC: National Health Survey, 2003		

Figure 2 below), it may be better for the purpose of this project to focus on the activities that elderly people may both practice, remember and keep in mind, because these are activities that give them a sense of safety.

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Diagnosed by the Medical Doctor. Vertical percentages; it can sum more than 100.		
Source: INE-MSC: National Health Survey, 2003		

Figure 2: Comparison of main diseases by age groups

For example, it is known that, frequently, elderly people use strategies to compensate an impaired performance; more specifically, agendas to remember appointments, write down some data in a place where they are unavoidably going to pass through (i.e. the entrance door of their home) or other kind of more personalized strategies. Some studies support even the fact that elderly people may perform more efficiently than younger people if they use these external aids, and are more likely to forget things when they do not use them (Montejo y Montenegro, 2006).

Strategies shown to solve daily life forgetfulness are specific to each kind of forgetfulness (Montejo, Montenegro, Reinoso, De Andrés & Claver, 2003) and are linked to different methods, since the way or preferences (e.g., visual, auditory) to apply them is inherent to each person.

If elderly people keep control of their own health and health prevention, in a way that allows them not to forget their appointments and to continue with as an independent life as possible, they will achieve personal security for this and other domains. Thus, promoting a sense of security in these areas with devices or techniques they may use to keep autonomy in this domain, we may assume that self-perceived security regarding how to keep a good health would necessarily be increased.

3.2.2 Safety and security

In general, elderly people expect to be assisted on their own homes and give to family a major role: 78.6% would prefer to live at their own homes, 14% with other relatives, 2.5% on a geriatric residence and 0.6% on a housing type which is specialized in monitoring elderly people (IMSERSO, 1998).

In a study of informal social support (IMSERSO, 2004), it is revealed that, even in case of a need to live with permanent care and supervision, “aging at home” is undoubtedly the main wish, preference and belief in a majority of the elderly. Other issues that, according to research, are related to elderly people's needs and demands are: tele-alarm needs (devices that allow the person to call emergency services immediately), home-assistance services, possibility to access to day centres, and possibility to access to day time stays, technical aids and accessible (i.e. adapted to disabilities) houses.

It is relevant to enhance that both elderly men and women start from different points and use to behave in a different way when they have to readapt themselves to a different occupational status (Ministerio de Sanidad y Consumo, 1999). In some cases, due to necessity, men must do housework (and this is something they had not ever done before retirement) either because they are alone or because their couples cannot assume the entire housework burden (Elvira, Rodríguez & Zoa, 2005). However, it seems that they prefer things to be in this way and they feel safe since they keep doing things with a sense of autonomy.

The Study of the Health and Consume Ministry (Ministerio de Sanidad y Consumo, 1999) shows that apart from needs related to health, actions oriented to fight loneliness would be the main concern of elderly people. Loneliness, according to the elderly, is the main source of unhappiness.

3.2.3 Cognitive training

Normal aging is characterized by an increase of variability among individuals in terms of cognitive functions (Ritchie, Leibovici, Ledésert & Touchon, 1996). Education, activity level and genetic factors, among others, are variables that, one way or another, may influence different abilities across their lives and can determinate their status when they are elderly.

Despite this variability, it can be stated that, in elderly people, cognitive functioning may be “quite acceptable”, and it can be generally concluded that there may be a slowness of cognitive and motor functions, a decrease on the ability to simultaneously manage large amounts of information (both already known and new information), and a decrease of performance accuracy (Yanguas, Buiza, Echeverria, Galdona, González, Arriola, et al, 2006). This can give the elderly a subjective sense of loss or impairment of these functions; this is why this issue has oriented professionals working on gerontology to search cognitive stimulation systems, in diverse formats and presentations, which can serve as a “training” of these functions in an amusing and playful manner.

Cognitive stimulation programs, games, puzzles, computer programs, memory groups and entertaining games in these areas are increasingly common and are perceived by the elderly as something common in their daily lives. In fact, they perceive these resources as a good “practice”. Regarding cognitive stimulation programs, these can vary and depend on the way they are supported, either on cognitive stimulation groups with elderly people, on pencil-and-paper exercises or in software specifically developed for these purposes.

As it is specified in Cochrane database (Clare, Woods, Cook, Orrell & Spector, 2005), cognitive training can be offered through individual or group-oriented sessions, or can be assisted by family members supported by therapists. Tasks can be presented on pencil-and-paper exercises, by means of a computer, or can include analogous daily life activities. A range of different difficulty levels should be available within a standardized group of tasks, in order to allow a selection of the level which is more appropriate for each patient (Buiza, Gonzalez & Yanguas, 2008).

Cognitive training or cognitive stimulation is composed of diverse techniques in order to work such different issues as memory stimulation, verbal communication, recognition, rhythm, coordination, and corporal scheme (Peña-Casanova, 1999), among other domains. Its main objective is to slow down cognitive decline, thus preserving functions that have not declined yet, in order to facilitate elderly people's autonomy as long as possible (Buiza, Gonzalez & Yanguas, 2008). Recent studies have shown that cognitive plasticity and learning potential do not only exist in patients with Alzheimer disease, but also in healthy elderly people (Kemperman, Gast y Gage, 2002; Fernández-Ballesteros, Zamarrón & Tárraga, 2005; Yanguas et al., 2006). A very recent study of Buiza, Etxeberria, Galdona, González, Arriola, de Munáin et al. (2008) shows that learning potential can continue at enhanced levels in trained subjects over an intervention period lasting two years, thereby increasing rehabilitation potential and contributing to successful aging.

Cognitive training must be adapted to cognitive abilities preserved on each patient. That is, difficulty level must be accurate so it may become a challenge the patient can cope with and resolve successfully, but which does not imply a difficulty level that may be unbeatable and, hence, frustrating. Nowadays, it has shown a great rate of success what is known as Errorless Learning Approach, as a system for cognitive stimulation and rehabilitation (Clare, et al, 2005).

Training usually includes a guided practice to a set of tasks designed to work on specific cognitive functions, such as memory or attention. The main assumption is that practice has a potential for improvement, or, at least, to maintain functioning levels in particular domains, and that any effect of practice will be extrapolated beyond the immediate training context (Buiza, et al, 2008).

Different studies have shown that even people with dementia in early stages are able, to some extent and with enough support, to learn and re-learn relevant information which can be personally meaningful, to keep this learning across time, and to apply it in a daily life context (Clare, Wilson, Breen & Hodges, 1999; Clare, Wilson, Carter, Hodges & Adams, 2001; Anderson, Arens, Johnson & Coppens, 2001), that they can produce compensatory strategies such as the use of an external aid (Clare, Wilson, Carter, Breen, Goces & Hodges, 2000), and that they can maintain or improve their functional abilities in daily-life activities (Josephsson, Backman, Borell, Bernspang, Nygard & Ronnberg, 1993).

Donostia Longitudinal Study (DLS) was a research developed between 2001 and 2004, with the main goal of studying the efficacy of non-pharmacologic interventions (cognitive training) in both healthy and Alzheimer's Disease (AD) diagnosed elderly people (Yanguas, et al, 2006). Intervention type in this program was based on a theoretical model developed by these same authors. Intervention itself had as its main goal to train cognitive functions and variables associated to patients' wellbeing, including an approach to cognitive, emotional, behavioural and social aspects. For subjects with a Global Deterioration Scale (GDS) (Reisberg, Ferris, De Leon et al., 1982) of 1-2, not showing clinical features apart from subjective complaints about their cognitive functioning, a general work on all cognitive functions was developed, including those which imply a general cognitive functioning and which are basic for the maintenance of subjects' autonomy and quality of life. In this group, special attention was focused to memory, since it is one of the main concerns of this population, and it is also the domain where more subjective complaints are reported. Also, work regarding other issues related to people's global wellbeing was developed, issues like health self-care, social skills, daily life problem-solving and decision-making, relaxation, self-esteem, and so on. The purpose was that intervention went beyond "Memory lessons" in order to become a global and integrated intervention, mainly directed to the improvement of elderly people's quality of life. In the group with a GDS score 1-2, intervention was developed in groups from 10 to 15 participants, in 90 minutes sessions with a frequency of twice a week, in morning or afternoon hours, depending on the group availability. After a year of intervention, subjects had approximately attended 90 sessions. In this group, results related to learning potential and abstract reasoning must be enhanced, since these are basic abilities in daily life, for which statistically significant improvements in the experimental group were obtained (Yanguas, et al., 2006).

Cognitive training programs developed by means of a computer and software based on the internet are potential mechanism for cognitive stimulation. Different cognitive training techniques have been developed by means of computer-based interactive programs. Currently existing programs can be divided into two blocks, depending on the aim they were developed for:

1. Programs oriented to rehabilitate specific cognitive processes and to train specific abilities.
2. Programs oriented to the training of subjects in the general cognitive functioning, following an ordered sequence of programs from a greater to a smaller complexity.

In relation to this second block, they are continuously more computer-based resources constituting “packages” of general exercises oriented to cognitive training, each of which has its own supporting and validation method, since they can be oriented to different type of populations.

3.2.4 Sharing

For many elderly people, it is important to keep contact with family members, especially with children and grandchildren. When the couple dies, family links, while being providers of love and affection, are also health providers (Elvira, et al, 2005).

Some studies (INC - Ministerio de Sanidad y Consumo, 1999) indicate that, in Spain, approximately in 4 out of 5 houses elderly people do live with company, and the main company is just one person, usually their couple. It is more frequent among women to live alone, because they become widows with more frequency than males. Loneliness is though the main concern of the elderly who live in an autonomous way.

Psychosocial factors mediating between behaviour and health are the self-perceived control and self-efficacy, disease awareness and knowledge, disease representation, threat perception, coping and social support (Yanguas, 2007). Hence, these factors will be the rulers of successful aging and quality of life in elderly people. If these factors do not exist or their relationships get worse, it is likely that the elderly person would have problems to age with health and quality of life; thus, it is important to maintain each of these factors in a good level.

These *sharing* needs are focused in communication with relatives and friends, search for interaction with other social groups (apart from family and friends), and the need to create new contacts and leisure activities.

According to Iglesias de Ussel (2001), within the family context it seems to be an agreement in terms of that, the existence of a large amount of contacts full of emotional and affective content, contribute to a great extent to happiness in elderly people. It is remarkable that visits to relatives and friends, or received phone calls, are very useful in terms of reinforcing social support networks, and to facilitate family and social integration.

In relation to friends, they seem to have a greater influence in satisfaction and wellbeing in the elderly than relationships with relatives. Friendship is a unique relationship because people choose who they want as friends, which is of a great significance to the elderly, since they can feel a loss of control over their own lives in many other domains.

Despite all this, spending time with friends does not lead to a higher total satisfaction with life, while this satisfaction can be actually achieved with the couple, according to Wolfe, Morrow & Fredrickson (1996). Friends are a source of immediate short-term satisfaction, while family provides an underlying sensation of a greater safety and support.

Starting with new friendships results on a task that, for many elderly, may have two faces: in one hand, an investment of time and effort is needed, but, on the other hand, it is the only chance of a social and affective life that is left, specially, after retirement or widowhood.

In relation to support sources, Jackson & Antonucci (1992) remark a main influence of social support among friends or other people out of the family as a greater influence than support from relatives, thus remarking the relevant of the quality of the support rather than its quantity. Perceived social support in this stage of life will depend to a great extent on the personal history of the individual, on the exchanges performed during his/her life, and on the social group of previous support.

According to Iglesias de Ussel (2001), one of the main ways in the process of reorganizing life after widowhood and which may contribute more to prevent loneliness consists of avoiding the abandonment of those extra domestic activities that used to be performed before the event.

Overall, population dedicate a great part of their time to a passive type of leisure, mainly based on watching TV and listening to the radio. This becomes more frequent among elderly people, and specially among elderly women (Ministerio de Sanidad y Consumo, 1999). Statistics show that, among the elderly, 97% watch TV at least once a week, and 71% listen to radio. Moreover, in elder population there is a great proportion of people which dedicate time to reading, more specifically, 3 out of 5. There are more male elderly who read diaries, and more elderly women who read magazines.

In general, the fact that someone does not feel good is the factor that determines the development of his/her daily living; thus, a state of mild functional limitations, mobility outside their own homes and relationships with their environment become crucial.

Moraes & Souza (2005) describe the profile of a successful elderly person as a person with a positive vision of the future, ability to accept changes, high self-esteem, positive self-image, sense of autonomy, well developed mechanisms to select goals (including meaningful goals), as well as to optimize resources and compensate loss (in order to develop strategies that compensate errors), and a reserve of capacity and resistance that let him/her overcome, adjust and readapt to new situations that may emerge in his/her daily lives.

3.2.5 Needs focused on memory of elderly people.

The most frequent complain that elderly people state regarding their cognitive functioning is related to their daily life memory functioning, which is the memory they use in the individual's usual environment (Klatzky, 1991). For example, remember people's names, where the things are left (glasses, documents, keys...), doing some kind of shopping, remember people's faces, what we have done lately, and so on. Daily life memory includes the so-called daily life forgetfulness. Researchers and clinicians who try to evaluate these oversights have included in their questionnaires issues such as: distractions or lapses, forgetting places, persons, current life topics, conversations, data from books and films, object use, actions, nowadays topics, personal life topics, and so on. Apart from these individual differences, it must be differentiated in terms of what is called **time** (prospective, retrospective or immediate memory) and **type of memory** (spatial, faces, names...).

Memory in advanced-aged people continues to be a differential element, understanding that this is, to some extent, worse than in younger people (Vera-Cuesta, Vera-Acosta, H., León-Benito & Fernández-Maderos, 2006). Memory in elderly people is recognized as vulnerable to age, mainly in memory and learning activities that require an effort, and those less affected by age are remote memory and automatic processes. Recognition is also less vulnerable than retrieval itself, that is, elderly people will tend to obtain better results in tasks in which they only have to recognize whether some information was previously presented or not, than in those tasks that straightly force them to remember or retrieve some information (Yanguas, et al., 2006).

In relation to daily life memory, to its performance and to the strategies developed by the elderly to solve little daily life oversights, some studies have been found (Montejo et al, 2006) in which participants, with neither neurological nor psychiatric damage, and with a cognitive level adequate to their age, showed a greater disturbance on remembering an appointment (prospective memory), in remembering an object (what it is and where it is put), in remembering a story, and, to a lower extent, dates and drawings recognition. Recognition is always better than evocation in memory tasks and, as it has been mentioned above, that recognition process is usually better in all age ranges, and it is better for objects than for faces. Principal deficits were presented by subjects on auditory memory, a fact that is in agreement with other studies in which visual, tactile and auditory memory have a greater decline than verbal memory when associated to age. This is the reason why visual, auditory or tactile clues will be better remembered if they are attached to verbal clues (Benton, Eslinger & Damasio, 1981).

In summary, and regarding memory on aged people:

- They need more time to select information and subsequently store it.
- They need more time to encode this information.
- They use worse remembering strategies.
- They loose abilities to associate images and words.

Regarding the influence of knowledge of memory strategies over the relation among memory and metamemory (term to define the perception that people have about the functioning of their own memory) in elderly people when they perform memory tasks, research presents divergent results, particularly, in relation with the goal establishment,

self-efficacy, motivation, and performance-related expectancies. While the results on some studies show that the influence is significant, other studies conclude that perceived memory does not have any influence on memory performance (Ochoa, Aragon, & Caicedo, 2005).

Montejo et al (2006), studied the subjective evaluation of memory impairment done by the same profile of subjects that are going to be assessed in the present project, ranking in the first position memory complaints related to the tip-of-the-tongue phenomena, followed by losing objects at home, checking whether they did something or not (i.e. turn the gas off), forget what they said yesterday, and so on. Also, it is not very frequent for them to get lost in well-known places, doing things twice, not recognizing close relatives or forgetting something important like the place where they live.

In relation to subjective complaints, these increase with age (50% of those older than 80), and are also shown by people with no pathologic impairment. These subjective complaints are not shown, on the contrary, in a considerable proportion of Alzheimer's disease patients.

Also, other factors like depression increase these subjective complaints, and it tends to be developed also in over-concerned, self-critic people or in those who are attached to a high level of exigency. Another important factor that may provoke memory problems that may become memory complaints is anxiety related to the possibility of losing information or of being in the starting point of a dementia: "the complaints cause anxiety, rather than the other way around" (Verhaeghen, Geraerts, & Marcoen, 2000). This mentioned study found that perception of memory loss in elderly people is intimately related to the fear of suffering an incapacitating dementia. Even if these results show a negative influence when complaints increase (as a result of the fear appearing in some people when faced with a possible mental decline), it is also true that other studies have not found such an influence, neither a difference between the performance among elderly adults who complain and those who do not (Ochoa et al, 2005). In this revision, incongruences are found in the revised studies in relation to memory accuracy. In most cases, older adults in general (and not only those with cognitive decline) seem to underestimate their memory performance and memory accuracy.

Anyway, subjective complaints are important in order to analyze both: a) the sense of insecurity produced by the fact of not being able to access some type of memories, and b) the lost of self-efficacy as a factor that can be determined by that insecurity: this may lead to an effect, to a sensation of loss of autonomy and independence. Even if, so far, a significant relationship between self-efficacy and memory has been reported, other studies developed with larger samples of elderly adults do not show evidence enough to establish a significant relationship between the memory self-efficacy and the performance on memory tasks (Ochoa et al, 2005). Hence, even if people may have negative beliefs about their memory functioning, their actual performance on memory tasks is successful.

As it happens with beliefs, some researchers are interested in the relationship among the emotional status and memory performance, more specifically related to gender differences; to this respect, results have shown to be contradictory. Some studies have found that elderly women perceive a higher anxiety than men when they perform

memory tasks (Jonker, Smits & Deeg, 1997), while, in others, results do not show such differences (McDougall, 1998).

4. Methodology used in HERMES project for collecting elderly's needs

4.1 Questionnaire

4.1.1 Aim of the questionnaire

One of the first steps in HERMES project that was developed to collect elderly people's needs was the application of an extensive questionnaire (annex 1). This survey's main purpose was to gather a big amount of data with overall information about 3 specific areas of each person: sociodemographic information, needs and information to be reminded, and experience with technology. The justification for this specific kind of information to be gathered relies on the need to identify clearly the features of the user participating in HERMES and for whom a project like HERMES is developed, identify their needs in different areas with different mentions to cognitive status, and check the feasibility of the application of a product whose technical complexity has to be adapted to a very specific population (people aged 60 or older with no cognitive decline or Age Associated Memory Impairment) that may not be familiarized with new technologies appearing constantly in our society. With the results obtained with this extensive survey, a more focused interview was later developed.

First, in relation to sociodemographic information, there is a subsequent division of this domain in three specific areas:

1. Demographic factors: where specific information about birthday, age, gender, marital status was gathered.
2. Social information: where information about whether the person lives alone or with relatives, friends or pets; type of housing; type of supervision received in their housing (where applied), occupation, social contacts and financial status was collected.
3. Health information: where data about the frequency with which the person may have demanded any kind of medical or health attention in the three months previous to this assessment were asked. There is a specification of different health/social services and resources, and the person has to indicate where applied whether he/she has attended any of them. After that, questions about sensory disabilities, chronic conditions, performance in Activities of Daily Living (ADLs) and overall memory problems were asked.

Second, the domain about needs and information to be reminded constitutes the main part of the questionnaire, where the majority of information about user's requirements was collected. The needs area inquires about the specific needs people may have, regarding to their health, security, memory, and sharing/social support. The information to be reminded is asked on the context of the hypothetical existence of a device which may help them to remember specific information. Thus, they were asked what information would that be. Also, suggestions were included about they preference for a device that may include cognitive games to develop their memory abilities. A special remark on common daily-life memory slips is made, so people can answer about the

usefulness of a hypothetical device which might help them with specific memory problems.

Third, a special section was included at the end of the questionnaire to gather information about the people's past and present experience with technology, and with the use of electric and electronic home and office devices. They were asked not only whether they used these devices, but also about the specific problems they might have experienced in the use of these technologies, likes and dislikes about specific devices, and relevance of technology in their daily life duties performance.

4.1.2 Methodology

For the development of this questionnaire some standard recommendations were taken into account (Courage & Baxter, 2005). These recommendations are the following:

- To combine open and close-ended questions, in order to gather more information from our users.
- Make the questionnaire attractive and easy to comprehend. For this purpose, the questionnaire was split into different sections
- Different variants of the questionnaire were developed in order to find the most suitable version to the users' language and understanding.

Finally, an evaluator's version was developed for variable data analysis and a user's version was subsequently developed to facilitate the users' performance and motivation with a questionnaire that included the same questions than the evaluator's version, but presented in a more understandable and less technical language. The application and response to the questionnaire was individual. The participants in this survey were already participating in cognitive stimulation groups (i.e. Memory Groups) and the questionnaires were given to each of them in the course of a session.

4.1.3 Sample (recruited in Athens, Vienna and San Sebastian together).

The sample for the application of this questionnaire was collected from 3 different locations and countries: Spain (San Sebastian), Austria (Vienna) and Greece (Athens).

The sample in Spain was taken from the cognitive stimulation groups performed at INGEMA. It was composed of 63 subjects (14 male and 49 female) living in San Sebastian, with a mean age of 70.15 years ($sd = 6.30$), ranking from 59 to 89 years-old. More specifically, 1.67% were less than 59 years old, 43.33% were 60-69, 46.67% were 70-79, and 8.33% were 80-89. Regarding their marital status, 40 were married (63.49%), 18 were widowed (28.57%), 4 were single (6.35%) and 1 was divorced (1.59%). Also, 17 of them (26.99%) lived alone, 32 (50.79%) lived with their partner only, 6 (9.52%) lived with their partner and children, 3 (4.76%) lived just with their children, 2 (3.17%) with other relatives and 3 (4.76%) with their partner, children and other relatives.

The sample in Austria was composed of 33 subjects (6 male and 27 female) living in Vienna, with a mean age of 69.94 ($sd = 7.20$), ranking from 57 to 85 years-old. More specifically, 3% were less than 59 years old, 54.6% were 60-69, 33.3% were 70-79, and 9.1% were elder than 80. Regarding their marital status, 13 were divorced (39.4%), 11 were widowed (33.3%), 6 were married (18.2%), and 3 were single (9.1%). Also, 21 of

them (63.6%) lived alone, 8 (24.2) lived with their partner only, 1 (3%) lived just with their children, and 3 (9.1%) lived with other people.

4.1.4 Results

The results are shown according to the same sections described in section 4.1.1. It is important to notice that the total sample was composed by 96 participants, however, in some questions not all of them have answered. For this reason, the percentages are calculated in based on the total sample.

4.1.4.1. Sociodemographical information

A total of 96 elderly people have answered the questionnaire in San Sebastian and Vienna.

Results for combined samples from INGEMA and CURE (n=96) showed that household type was the domestic/family house for a majority of users (69 out of 96, 71.9%), while 25 of them (26%) lived in a residential or sheltered housing. From those living in a residential or sheltered housing, the majority of them (20 out of 25) lived independently with no kind of supervision.

Regarding the use and visits to healthcare and social services, the most demanded services were medical doctors, physical therapist and nurses. 90.6% of the sample reportedly visited primary care doctor in the last 3 months, while 45.8% visited the district nurse. In terms of frequency of visits to the doctor, 88.4% visited him less than once a week, while 1.2% made visits once a week and another 1.2% less than 3 times a week. The percentage of people visiting the nurse less than once a week was of 41.7%. The mean of visits for each health resource was respectively of 2.35 visits to primary care doctor in the last 3 months (sd = 2.29) and .77 visits to the district nurse (sd = 1.11). Even if there are some missing data from the frequency of visits to the physical therapist, the range of visits in the last three months was from 0 to 24, with a mean of .84 and an SD of 3.36.

For further detailed results about the usage of healthcare and social services, please see the Annex 1.b.

Sensory and motor impairments:

From the whole 96 users sample, hearing impairments were reported in 31 (32.3%), while visual impairments were reportedly present on 70 (72.9%), and mobility impairments on 24 (25%). More specifically, 19 (19.8%) reported walking/gait problems.

Health data:

Only a small percentage (2.1%) reported problems with activities of daily living (i.e. washing and dressing), and 14 (14.6%) reported some problems when it came to perform usual daily life activities.

In terms of memory problems, 65 users (67.7%) reported memory problems, 5 (5.2%) described these problems as extreme, and 16 (16.7%) no reported memory problems at all. From those who also specified which kind of memory problems they had, the most stated problems were related to forgetting names (19.8% of the total sample reported it) followed by forgetting where objects had been left (for example, glasses, home keys...), reported by 12.5% of the users.

4.1.4.2. Needs and information to be reminded

Utilities for devices:

From the data extracted from the questionnaire, the most appreciated uses for a device would be to develop a device for shopping list (stated by 46.9% of the sample), followed by a device to record previous conversations with the doctor (43.8%), device for things to do today (37.5%), and device for previous informal conversations (29.2%). Also, 67.7% of them would appreciate a device to play some cognitive games, and 30.2% to register some places of interest for them (e.g. pharmacies, groceries), and then to remind them where they are.

Memory inconveniences:

Regarding the feeling of embarrassment or being uncomfortable with forgetfulness, our users main worry was to forget names (67.7% reported feeling uncomfortable when that happened), followed by forgetting to buy things or do tasks previously planned (45.8%). 38.5% stated feeling uncomfortable with forgetting important appointments, 30.2% with forgetting previous conversations' content, 27.1% with forgetting how to go somewhere and 16.7% with forgetting whether they have previously bought something or not (so they end up buying it twice).

Device preferences for information reception:

A great part of our users (41.7%) preferred, when they were alone, to receive information in a combined way of visual and auditory information, rather than just reading the information on a display (19.7%) or just hearing it (5.2%), with only 2.1% preferring a notebook. When they were in company of more people, combined visual and auditory information was still preferred (26%) rather than just visual (24%) or just auditory (4.2%).

In the other hand, the most preferred device from the already existing ones in order to receive information about appointments and things like that was the mobile phone (preferred by 39.6% of our sample), followed by the TV screen (9.4%), or a combination of both (10.4%).

Use of external aids (reminding systems):

Writing things on a calendar was the preferred reminding system for 28.1% of our sample, followed by the usage of an agenda (10.4%), both agenda and calendar (19.8%), and third parties reminding them the relevant information (18.8%). A few of them used a combination of all of them, and only 2.1% used a notebook as their unique reminder.

From the whole sample, 29.2% stated using no remembering strategies. From those few who used strategies, making stories or visual associations was reported by 5.2%, changing the ring of hand by 7.3%, notebook, tie a knot in a handkerchief and memo by 3.1% each; and calendar, writing on their hand, repeating appointments in mind and to be strict with oneself by 1% each.

4.1.4.3. Experience with technology

Regarding the use of existing technologies, the cooker and the microwave were stated as the easiest to use by 11.5% each, followed by radio (9.4%) and TV set (also 9.4%), and washing machine (8.3%). The most hated technologies, due to their difficulty and lack of previous experience with them, are the mobile phone (8.3%) and computer (5.2%).

Finally, the most rated feature for a device is utility (stated as very important by 37.5%, as important by another 37.5% and as somewhat important by 3.1% of our users –i.e. 78.1% in total); simplicity was rated as very important by 34.4%, as important by 39.6% and as somewhat important by 2.1%; finally, aesthetics were the least rated feature, with 13.5% not considering it important at all, just 10.4% considering it very important, 25% important and 26% somewhat important.

4.1.4.4. Correlations between questionnaire variables

After discarding a normal distribution of most of the variables appeared on the questionnaire, a chi-square test of independence was calculated, and we detail here those where significant interactions were obtained, most of them related to the variable that specified who was living the participant with (from now on, “living-with” variable).

First, a significant interaction was found ($\chi^2(10)=22.77, p<.05$) between the range of age and the use of specific remembering strategies. Most of the participants using memory strategies were between 70 and 79 years-old. The strategies mainly used by them were the calendar, “changing the ring of hand”, notebooks and “writing on the hand”. Those between 60 and 69 used “changing the ring of hand” with less frequency and were more in using the notebook. Those between 80 and 89 used as their unique strategy “to tie a knot in a handkerchief”.

Second, another significant interaction was found ($\chi^2(5)=13.57, p<.05$) between the “living-with” variable and the need for a device which reminded them what to do today. Those living alone showed a great reluctance to this device, maybe because it may constitute an attack against their autonomy. On the contrary, those living with their partner only, were divided: most were contrary to the device (63% of them), but some accepted a device for this specific use (37%). And finally, those living with their partner and children were the most oriented for the acceptance of this kind of device.

Third, a related significant interaction was found ($\chi^2(5)=11.65, p<.05$) between the “living-with” variable and the need for a device with other uses. Again, most of those who lived alone did not want it (92.85%), neither did those living with their partner only (81.48% did not want it vs. a 18.52% who wanted it). From the participants of the remaining “living with” groups, 61.54% did not want any device for other uses vs. a 39.46% who were more oriented to accept a device of this kind.

Fourth, another very significant interaction ($\chi^2(5)=18.10$, $p<.01$) was found between living with their partner only and feeling uncomfortable with forgetting important information (51.79% were uncomfortable, vs. a 48.21% who were not, among those living with their partner only). Most of those living alone (94.11%) did not show worries in this area. Those living also or only with their children and other relatives were also uncomfortable with this specific kind of memory slip.

Fifth, a very strong significant interaction ($\chi^2(40)=65.34$, $p<.01$) between “living-with” variable and the use of specific reminding systems. Agenda and calendar were mainly used by those living with their partner only. The majority of those who used both agenda and calendar were those who lived alone. The inclusion of relatives' help was minimal.

And finally, “living-with” variable was found to be interacting with the use of remembering strategies ($\chi^2(10)=22.77$, $p<.05$). More concretely, those living with their partner only were majority in not using any strategies but also in the use of some specific strategies, as “changing the ring of hand” and the notebook.

4.2 Focus group

4.2.1 Aim of the focus group

According to Courage & Baxter (2005), a focus group is one where six to ten individuals are brought together to discuss their experiences or opinions around topics introduced by a moderator. The main benefit of this kind of group is that the group dynamic brings up topics one may have never thought to ask about. Moreover, the group discussion can stimulate new ideas or encourage participants to talk about things they would not have thought about if interviewed alone. Hence, they can be used to gather multiple points of view in a short period.

In the context of HERMES, our goal is to develop questions that urge the participants to discuss topics regarding their daily life requirements and needs in general, and their requirements and needs regarding a device as the one that it is intended to be developed within the HERMES project.

4.2.2 Methodology

A unique session was held at INGEMA meeting room. Group was conducted by two INGEMA staff persons: a group moderator and a person performing note-taking and observation tasks.

The group session was 90 minutes long, divided in the following manner:

- 0-15 minutes: session presentation, staff and participants presentation, explanation about consent forms (both participation and recording consent forms), giving materials to participants and gathering of socio demographical data.

- 15-75 minutes: Discussion about 6 question groups, 10 minutes each. The participants are told that the time assigned to each topic is strict (except for topic number 4, if necessary), in order to have time for all the topics to be discussed. In the context of HERMES, the question groups are the following:
 - Topic #1: Participants' initial assessment of general daily life needs.
 - Topic #2: Health needs.
 - Topic #3: Security needs.
 - Topic #4: Memory needs (this topic may be extended in time)
 - Topic #5: Sharing needs.
 - Topic #6: Requirements for a reminding device
- 75-90 minutes: Summary of more important ideas, farewell, presents giving.

There are general open-ended questions to start each topic. If ideas do not merge, there are more close-ended questions to improve participants' implication. The topics were developed to gather information of each domain enclosed by HERMES, while questions not fairly answered on the previously explained questionnaires are more extensively covered.

4.2.3 Sample

Our group was composed by elderly people and staff participating (or having participated) in the School of Experience. School of Experience is a meeting place where elderly people can share experiences and receive training in different areas of social and personal interest with the objective of encouraging them to actively participate in our society. It is endorsed by the Basque Government and the Gipuzkoa Regional Council. It is aimed at all those who are above the age of fifty and wish to learn and actively participate in society. No previous qualifications are required.



Figure 3. Focus group at INGEMA lab
(Picture reproduced with participants' written permission)

4.2.4 Results

The session topics were presented as exposed in the Methodology section. As mentioned, an initial general open question about participants' initial assessment of general daily life needs was presented. The common answer of the participants was that the most needful requirement for an independent living was to maintain the cognitive function together with the maintenance of the functional abilities, that is, to perform the ADL (activities of daily living) by themselves.

Some of the participants stated the difficulty of lacking of either one or the other feature (that is, a) people with cognitive impairment and functional autonomy who were a burden for their caregivers, and, b) persons with optimal cognitive status but with physical and subsequent functional constraints). Thus, impairment in any of those 2 domains was a major concern.

In relation to the specific health needs, all of them stated having habits which could be considered good for health and wellbeing. They recognized that technology was good as an aid, but did not consider that health maintenance was a problem due to the lack of information or health resources. From their point of view, there is enough information available on the internet, on TV programs, books, newspapers and so on. They consider that health maintenance is, in most cases, an issue related to each person's attitude toward healthy habits, whether they put or not their knowledge about how to keep a good health into practice (i.e. it does not matter what you know, but what you do to maintain your health).

When it came to report about security needs, none of the participants noted much relevant requirements at this moment of their lives. They stated being very meticulous when it came to check whether doors or windows were closed, electronic devices were off, and so on. They were not very sure if they would answer in the same way some years after, but, at this specific moment, they considered that technological devices make you more dependent and it is better to make the effort of remembering by yourself what to do before leaving home.

Memory needs were more obvious when use of external aids were taken into consideration. They reported using calendar, manual agenda, writing notes, post-its, papers... or having another person (couple, wife) reminding them relevant information. They did not think that technology was useful for remembering things at this moment. One of them explained that routine is a common feature in their lives, to a extent that it is unnecessary to store information about more than 2 or 3 unusual events per week. Hence, they do not have so many "different" things to remember.

Finally, regarding sharing needs and integration of technology in this domain of their lives, they stated that the mobile phone is crucial for sharing experiences. When it came to the use of this specific device, they were mainly interested in functions that any old-fashioned phone may present: the function to call somebody else. They were not used to sending messages, playing games, taking photos or surfing on the internet, but they strongly believed that these features would be used by future generations of elderly, due to an overall increase of technology use among young adults (i.e. less than 55 years old).

Nonetheless, they assumed with great self-awareness and self-criticism that they are part of a generation in which technology has not been a major part in their daily living. Thus, they stated that it is likely that, in a few years time, next generation of elderly will tend to integrate the kind of device that is intended with HERMES project more easily.

In summary, the performance of this focus group raised up some interesting conclusions. First, maintenance of independent living (cognitive and functional) is set as a priority. Second, healthy habits and their practice are a matter of each person's attitude. Third, elderly people of this generation are reluctant to any technology that aims to reduce their autonomy or minimize their cognitive or functional effort, because it would mean *dependency*. Fourth, they use external aids that, if they were technological, should be easier and simpler than the currently used, because this generation of elderly is not specifically used to using technology. Fifth, routine is a common factor, and unusual events per week are few. Sixth, they consider the device that is intended to be developed on this project a useful device for younger people with complex jobs (i.e. executives) or maybe for elder and more cognitively impaired people. Seventh, they consider that, for the time this device will be developed, it will have a great acceptance. And finally, but not less important, they are doubtful about the nature of the recordings performed by these device from an ethical and legal point of view.

4.3 Interviews

4.3.1 Aim of the interviews

The interview is the most recommendable methodology when the aim is to obtain detailed information from individual users (Courage & Baxter, 2005). The end result of a set of interviews is an integration of perspectives from multiple users, that allow the research team to obtain a holistic view for the question or problem about they are asking.

In HERMES context, the interview has been used as another form to obtain information about the domains that the project will cover: health, security and memory and cognitive training needs as well as forgetfulness in general, problems and emotions, compensation strategies, and use of technology.

4.3.2 Methodology

Before administering the interviews, the questions have been identified by the research team. Some questions have been formulated in an open way. However, the questions that remained unclear after questionnaire administration have been formulated in the interviews, but under a closed approach.

4.3.3 Sample

In INGEMA a total of 15 people have completed the interview. All of them were over 60 years-old (average: 69.5 years, range: 61-79 years). The interviews have been administered face to face.

At CURE a total of 33 persons have completed the interview. All of them are over 60 years old (range: 60 - 88). All the interviews have been administered face to face. Two different interviewers performed the interviews. Each interview had the same 5 topics.

4.3.4 Results (from the interviews at INGEMA, annex 2)

These are the main results in each section:

- **Health needs:** Elderly people consider that they have information enough for caring their health. From their point of view the healthy behaviors are related to attitudinal factors more than to information lack.
- **Security needs:** They consider the cognitive abilities as the most important factor, due that the lack of these abilities implies not being able to maintain the security at home. The second more important thing, but much lower rated, is to establish a good communication with friends or relatives to maintain the social network and to have access to somebody in case of emergency. The third thing, it's to avoid possible dangerous forgetfulness, like to turn the gas off. Anyway, they consider that these two needs (i.e. communication and avoid dangerous forgetfulness) are dependent on the integrity of cognitive abilities, that is, maintenance of cognitive abilities is in their opinion the most essential feature for the fulfilment of other kind of goals and needs.
- **Memory needs:** It's important to highlight that most of them note down the things that they have to remember. Another common strategy is always putting the things in the same place. On the other hand, they give importance to keep their mind active. It is also considered very important to remember people's names

It has been also found that health care needs or control are relevant for the elderly, in terms of: visits to the doctor, sense of control regarding their acute or chronic diseases, surveillance of vital signs, etc. as a sample of health and wellbeing.

In general terms, they don't feel the need to have a device now. They are not able to imagine how the technologies can improve their life right now. However, they think that perhaps in the future the technology will help them. On the other hand, they have had unsuccessful previous experiences with technology. For this reason, some of them are reluctant to the use of new technologies in general.

4.3.5 Results from interviews conducted at CURE

The results are presented addressing each of the five topics of each interview.

Forgetfulness:

Elderly people predominantly tend to forget names and are experiencing problems with prospective memory, that is the capability to remember to do things. Another major issue is the fact that elderly people have to search for things more often and for longer times than younger persons. Due to a combination of lack of concentration and memory problems they sometimes are forced to search through their whole living space for little things like glasses or keys. A considerable amount of time is being lost for some of

them because of this. They also tend to forget stuff in their apartments when they are leaving for shopping or something else.

Problems and Emotions:

For most of them the forgetfulness at the current stage is not a problem and does not mean a restriction in their daily lives. They have developed techniques to overcome any problems regarding their forgetfulness though they admit feeling uncomfortable upon realizing that they again forgot something. Many of the interviewees report about getting angry at themselves and being annoyed when they need to search for something like glasses or keys for a long time because they forgot where they had put them. More severe is the fact that nearly all are worried about the future and the possibility that their memory could get worse or that they even might be affected by Alzheimer's disease or dementia. Especially worried are the ones who are experiencing or have experienced a relative being in such a condition.

Compensation:

Each of the 33 interviewees uses at least one calendar to write down appointments. Some of the interviewees use two calendars, one that is standing in their home always being visible and one that they carry around with them. Usually the calendar is used to write down appointments but there are also other things that people take notes off. These things include: to do's, notes about their health condition and notes on what tasks have already been completed are among them. Persons that use two calendars report that they never had troubles keeping them consistent. Usually the calendar gets checked once a day during the week and in the evening of Sunday to see what is up in the following week. Some report they need to check the calendar more often so they feel secure to not forget anything. Beside the use of the calendar other compensation strategies are used. People do use shopping lists so they will not forget anything. If they go to a concert or a theatre it is a common strategy to make the tickets visible on the table in the living room the day before the event takes place, otherwise they might go there without them. For extra important things post-it are being used as an additional reminder. Those are placed where they are always visible to the person. People define special areas for keys and glasses in their apartments. This way the time for searching those things gets minimized.

Cognitive Training:

All interviewees except of 5 are doing some form of cognitive training. More than half of them are attending a memory training course that takes place 20 times a year. Besides these formal training the interviewees do crossword puzzles, Sudoku and other types of puzzles if they encounter them in the newspaper. Some take courses in different languages. Hobbies like reading or playing different games like chess and card games give them a feeling of doing something for themselves while having a good time. It is a fact that all of them are aware that some cognitive training is good for them. Staying active and curious is being seen as important by all the interviewed persons. Some of them have developed mind games for themselves to keep them challenged. For example one reports about writing a shopping list and then not taking it to the supermarket. This way the person is forced to remember the items on the shopping-list. To remember names people report trying to build associations or trying to remember the name of the person together with attributes of that person, like color of hair, size of person, etc. Going through the names of the actors of their favorite soap is an exercise one person does because otherwise she tends to forget the names. For all interviewed older adults

but one the social component of the memory training course is regarded as highly important. They simply like meeting friends and doing some training together with them. The interviews revealed the importance of a cognitive game being entertaining on some level.

Use of technology:

The interest and use of technology within this group of persons covers a broad range. There are older adults that have been using technology their whole lifetime and are still interested in it. Others had to use technology towards the end in their careers and did not like it at all, so now they try to avoid it wherever they can. A third group never had to use technology and is not interested in doing so now. Generally when asked if they would adapt to a new technology like the HERMES System all except for one person were open to the idea. None of the interviewed persons felt a need for such a device at the moment of the interview. All interviewees pointed out that the usability and the price are relevant criteria in technology.

Generally we can conclude from the interviews that being able to live independently is highly important for older adults. For them this means staying fit. Fit in this context means exercising the body and the brain. People did not see how technology can help them with this but were open to give it a try should they be in need of it.

4.4 Cultural probes

“Probes are collections of evocative tasks meant to elicit inspirational responses from people not comprehensive information about them, but fragmentary clues about their lives and thoughts” (Gaver, Boucher, Pennington & Walker, 2004).

4.4.1 Aim of the cultural probes

Cultural Probes were used for the first time in The Presence Project in 1999 (Gaver et al., 1999) . The project focused on novel understandings of technology's uses, and the focus group was ageing people. Cultural probes consist of different tools to document ones personal life.

The Cultural probes developed for the HERMES Project consisted of a disposable photo-camera, a dicataphone, a map of Vienna, a diary with pens and several postcards with questions printed on them. We chose those tools to give the persons the freedom to use whatever tool they like. The Cultural Probes packages were given to the test-persons personally to explain the idea to them.

Cultural Probes provide an opportunity to “connect” with a user on an emphatic level. We see the strength of the method in providing us with glimpses of the life of our test-subjects. Figure 4 shows the Cultural Probes package that was given to the users. Figure 5, Figure 6, and Figure 7 show the tools that were in each Cultural probes package.



Figure 4: a HERMES probe package



Figure 5: Contents of the probe package



Figure 6: Contents of the probe package



Figure 7: Diary booklet and instructions

4.4.2 Sample

The Cultural Probes were handed out to six persons in Austria. The average age of the participants was 78 years of age. The oldest participant was 88 years old, the youngest 70.

4.4.3 Results from the Cultural Probes

The Cultural Probes gave us insight in the lives of the 6 participants of the study. All of the participants have their own ideas about how they prefer to spend their time. They all experience forgetfulness to a certain degree, but none of the participants feels their life being overly restricted because of it, i.e. they cope very well with these problems or do not experience it as problems per se.

The people in our study represented a very diverse group. This can be seen as a result from a life-long development process and the fact that in this stage of their life they alone can decide on the daily routine. The diversity manifests itself in the description of their daily routine (each person is having a different day). The participants tended to have a very clear mindset when it comes to how they live their life. A technology like the HERMES System has to be very clear in explaining the benefits it can provide – otherwise there is not a big chance that they would be interested in it.

Social contact, meeting with friends and family, is very important for the participants in the study. All the participants are leading an active life. They see the key in staying healthy and independent in the possibility to stay active. This implies that a technology assisting them has to focus on providing possibilities to train themselves. For example, a technology that tells the user that they need to turn off the light is not appreciated as it takes away control over their own life routines. Older adults know that they themselves have to be able to know when to turn off the light. If they only can do it when a system tells them to do they feel very dependent from this technology and that is something that all the participants do not want. As literature revealed (Hirsch2000), people may rather radically change their life because of specific problems than accept that they suffer from something and ask for help in the form of technology. This is an element that was

brought up by the participants in our study as well. For the same reason of 'feeling-of-control' and independency, cognitive training support (as part of HERMES developments) is very much welcomed. The focus in the development here has to be on the user experience.

A third result from the Cultural Probes is that the highlights for the participants of the study were the times when they went out of their homes, be it the garden, the balcony or out into the nature and the city. Most of the times they find it even better when they can experience such events together with friends, family or visitors.

When it comes to the use of technology the probes reveal that in the daily lives of the participants technology does play a minor role. Modern, computer based technology tends to get avoided because it seems too complicated to use. One key concept that participants mention, is the many possibilities of new technology, which makes the technology hard to use in return. For example a mobile phone can be used as a phone but at the same time one can write text messages with it and can be used to organize oneself and even more possibilities are provided. The participants in the study are used to have one appliance for one thing – one TV-set, one radio, one phone and one car. The computer seems to be the hardest thing to understand for them.

These findings imply that if we want to successfully introduce new technology into the homes and lives of the participants, we have to be appliance and simplicity focused with regards to the HERMES interfaces. Older adults will be more open towards the HERMES system if they feel it is easy to understand and related to something they already know. Regarding the mobile part of the HERMES system we have to develop a highly intuitive interaction design which is either completely integrated in the mobile phone, or an appliance that is *only* used for the HERMES calendar application and does not have any of the other many possibilities that a mobile phone offers. A further discussion on the interfaces most suitable for the project is included in the next deliverable D2.2. on interface design for older people.

4.4.4 Diary

In INGEMA a diary (annex 3) has been developed and administered to 30 elderly people. The main aim of this Diary was to collect all forgetfulnesses that occur during one whole week in the daily lives of the participants. This diary has been split into four parts, which correspond with the following questions:

1. The thing that I have forgotten
2. The moment in which I have noticed that something has been forgotten
3. Why have I noticed something has been forgotten
4. If I have done something in order to avoid this forgetfulness in the future (strategies)

4.4.5 Sample

A total of 30 people over 60 years have completed this diary. The diary was administered by the monitor of the sessions when people went to the Cognitive Training Sessions at INGEMA. The instruction was that they had to fill the diary in, and to give it back to the monitor in one week.

4.4.6 Results

These have been the most common results:

Question A: The thing that I have forgotten

- The keys inside the house
- Things that they need to take before going out house (i.e. credit card, glasses...)
- To buy or do a task in the street (i.e. to buy the bread, to withdraw money from the bank...)
- To take their medication
- To phone somebody
- Only 2 or 3 people forgot to turn the plate off. It's not very frequent but it's dangerous

Question B: The moment in which I have noticed something has been forgotten

- Usually, people notice it when they need the thing they forgot (i.e. when they need to go in the house; they need the bread; etc).

Question C: Why have I noticed something has been forgotten

- Most of them, because they needed the thing they forgot

Question D: If I have done something in order to avoid this forgetfulness in the future (strategies)

- People who does something:
 - Write it down
 - To take the things visible (i.e. the keys in the door, the medicine on the table...)

Most of them have from 5 to 7 events of forgetfulness per week

4.5 Memory assessment

4.5.1 Aim of the memory assessment

Since the HERMES sample is composed by elderly participants with no cognitive decline or Age-Associated Memory Impairment (AAMI), a condition that includes presence of memory complaints for everyday tasks as well as a decline in performance in memory tests, it was consider relevant to obtain reliable measures of both features of this decline (i.e. memory complaints and memory performance). This relevance of memory complaints is captured in the literature. Muñoz (2002) exposed that the group of knowledge, beliefs and attitudes the subjects have about the functioning of their mnemonic processes is associated with actual memory impairment. According to Pousada (1998), low self-rated memory expectancies, together with the lack of spontaneity in the use of memory strategies, would be the main factors for AAMI. Whitbourne (2001) states that elderly people are more sensible to memory losses, but not all the individuals are able to predict precisely their performance in a memory task,

some of them being too optimistic and others too pessimistic, an issue that seems to be linked to self-efficacy of memory. Stevens, Kaplan, Ponds, Diederiks & Jolles (1999) studied the relationship between memory and variables like lifestyle, social support and locus of control, and stated that self-rated memory variables themselves may help to define elderly subgroups that are more likely to develop cognitive decline, assuming that self-reports and lifestyle may constitute a sign for cognitive decline.

Given the relevance of both subjective and objective memory performance, two different memory measures have been obtained from our sample, one of them based on self-reported memory complaints and the other one based on participants' performance on different memory tasks.

First, the memory complaints were assessed with the Memory Complaint Questionnaire (MAC-Q) (Crook, Feher & Larrabee, 1992; Montorio & Izal, 2002, for the Spanish version). This test was designed to address memory complaints for the AAMI criteria. MAC-Q is a self-report questionnaire of 5 questions addressing daily activities, three questions addressing overall memory functioning comparing present moment to when the person was 18 to 20 years old (where the respondents must choose one of the 5 options ranging from "very good" to "very bad"), 1 question addressing the sense of worry about one's memory and 4 questions about the perceived frequency of specific types of forgetfulness typically associated to old age.

Second, the neuropsychological test used for the "objective" memory assessment was the Wechsler Memory Scale – Third Edition (WMS-III) (Wechsler, 2004 for the Spanish adapted version), developed for the deep assessment of memory in adults (see [figure 8](#) for material exposition). It is an individually applied scale, with an application time ranging from 60 to 90 minutes. It is the first variant of this popular memory scale that is published in Spain, whose Spanish criteria have been developed from a sample of almost 900 subjects ranking between 16 and 90 years old. Compared to the preceding versions (WMS and WMS-R), this is much more than a revision, since this is an instrument adapted to the most modern conceptions that allow to assess completely the complexity of cerebral and behavioural dimensions implied in learning and memory. It gives the possibility to evaluate together immediate, working or delayed memory. Each of these types of memory is evaluated in two modalities (auditory and visual) with two types of tasks (recall and recognition). It is composed of 11 subtests, 6 mandatory and 5 that are optional. The 6 mandatory scales are applied twice with a time interval of 30 minutes among two applications. With the purpose of increasing the sensibility of different subtests, test floors have been taken down and difficulty roofs have been taken up. Correction system allows obtaining scale scores, indexes, centils and confidence intervals, in order to obtain a more flexible interpretation.

immediate memory, delayed auditory index, delayed visual index, delayed memory and working memory) and additional scores, from which we will enhance digit span as a measure of attention. Table 1 presents these results:

Table 1. Main indexes and additional scores obtained from WMS-III

	N	Mean	Standard Deviation	Minimum	Maximum
Immediate Auditory	18	20.78	5.86	7	30
Delayed Auditory	18	22.78	5.32	11	32
Immediate Visual	18	25.00	5.85	13	36
Delayed Visual	18	24.89	6.05	14	36
Immediate Memory	18	45.78	11.16	20	66
Delayed Memory	18	57.89	12.55	29	77
Working Memory	18	22.78	5.15	13	31
Digit Span	18	12.11	2.35	8	17

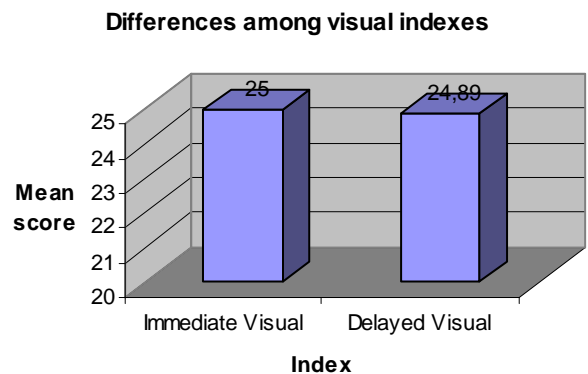
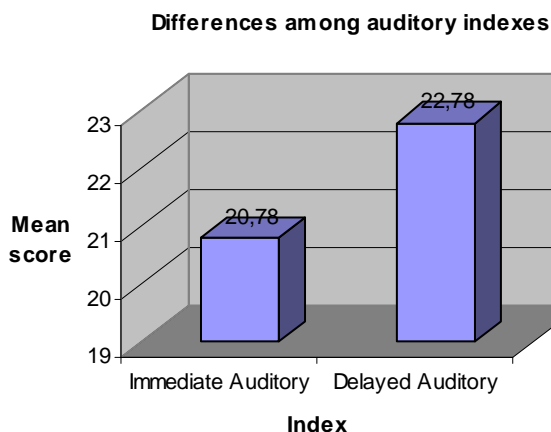
Initially, a Kolmogorov-Smirnoff test was developed to confirm whether our sample followed a normal distribution on the variables measured here. Results showed a normal distribution for all the main indexes as well as for digit span score. Later, due to the sample size, we decided to perform a Wilcoxon test to establish comparisons among different scores.

First, we first compared whether there was a difference among the indexes and subindexes which compose immediate and delayed memory measures, more specifically, a) differences among immediate and delayed auditory indexes, b) differences among immediate and delayed visual indexes, and c) differences among immediate and delayed memory. Table 2 summarizes the differences that have been found.

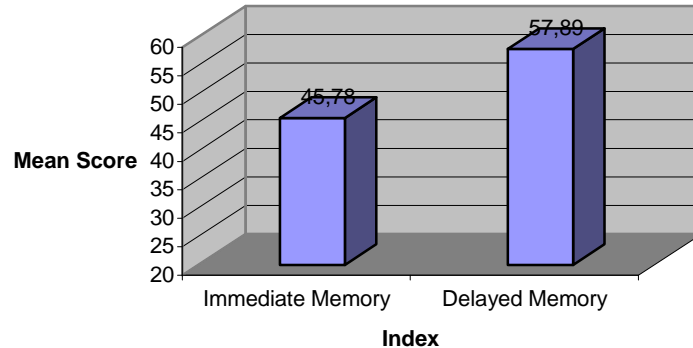
Table 2. Differences among immediate and delayed indexes

	Delayed Auditory – Immediate Auditory	Delayed Visual – Immediate Visual	Delayed Memory – Immediate Memory
Z	-2.737**	-.119	-3.726***
Sig.	.006	.905	.000

* $p < .05$, ** $p < .01$, *** $p < .001$



Differences among immediate and delayed memory



As can be seen from the tables and figures above, regarding immediate and delayed auditory indexes, scores for the delayed index ($x = 22.78$, $sd = 5.32$) appear to be higher than those from the immediate index ($x = 20.78$, $sd = 5.857$). After performing a Wilcoxon test, results show that this differences are statistically significant ($z = -2.737$, $p < .01$), that is, that delayed auditory memory is better than the immediate.

Regarding immediate and delayed visual indexes, no statistically significant differences have been found.

Finally, composed measures of delayed memory vs. immediate memory show that the differences pointing to a higher performance in delayed memory ($x = 57.89$, $sd = 12.55$) when compared to immediate memory ($x = 45.78$, $sd = 11.16$) are statistically significant ($z = -3.726$, $p < 0.001$), that is, delayed memory is better than immediate memory.

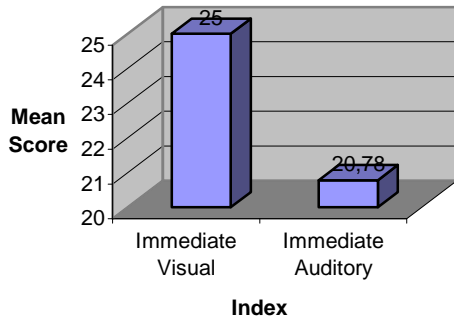
Second, we compared visual and auditory indexes. More specifically, differences among immediate indexes (visual and auditory) and among delayed indexes (visual and auditory) were studied. These differences are gathered in table 3:

Table 3. Differences among visual and auditory indexes

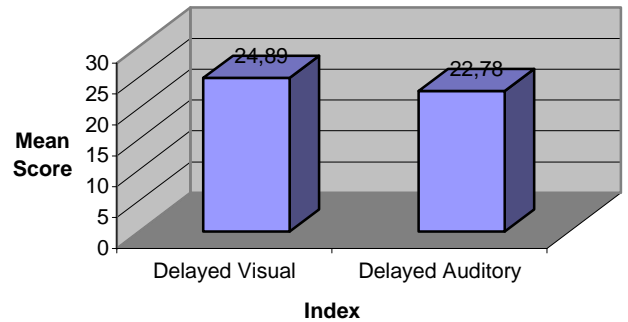
	Immediate Visual– Immediate Auditory	Delayed Visual – Delayed Auditory
Z	-3.452**	-1.498
Sig.	.001	.134

* $p < .05$, ** $p < .01$, *** $p < .001$

Differences among immediate indexes



Differences among delayed indexes



On one hand, statistical analysis show significant differences among the immediate indexes ($z = -3.452$, $p < .01$), thus, indicating that, among immediate indexes, the visual ($x = 25.00$, $sd = 5.85$) is better than the auditory ($x = 20.78$, $sd = 5.86$). On the other hand, no statistically significant differences were found among delayed visual and auditory indexes.

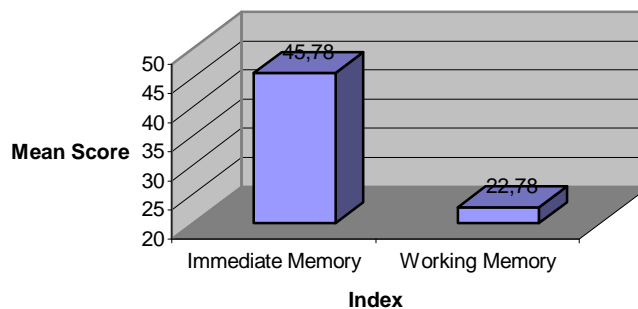
Third, we analyzed differences among working memory and immediate memory, as presented in table 4.

Table 4. Differences among visual and auditory indexes

	Working Memory – Immediate Memory
Z	-3.726***
Sig.	.000

* $p < .05$, ** $p < .01$, *** $p < .001$

Differences among Immediate and Working Memory



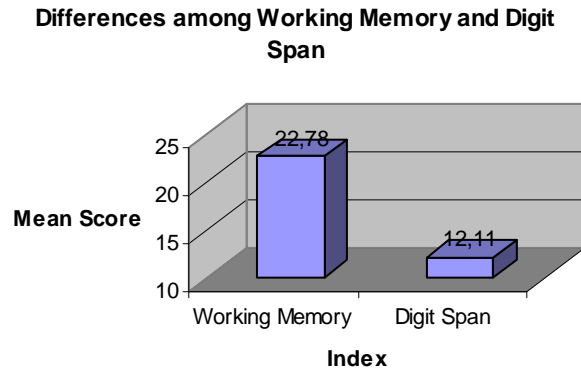
Wilcoxon test showed very significant differences ($z = -3.726$, $p < .001$) in favour of a much better performance in immediate memory ($x = 45.78$, $sd = 11.16$) than in working memory ($x = 22.78$, $sd = 5.15$).

Fourth, differences among digit span (i.e. an attentional task) and working memory were studied, as can be seen on table 5.

Table 5. Differences among Working Memory and Digit Span

	Digit Span – Working Memory
Z	-3.734***
Sig.	.000

*p<.05, **p<.01, ***p<.001



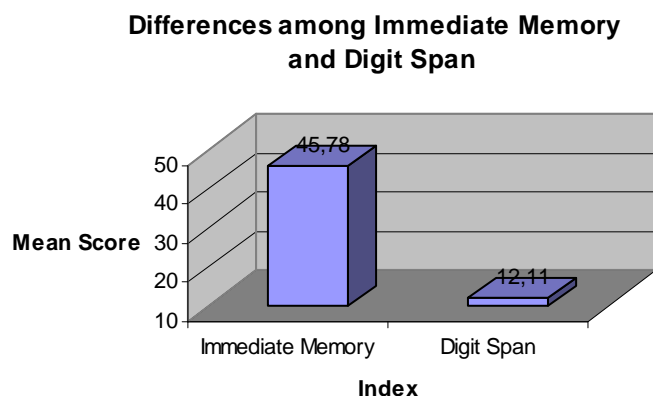
Statistical analysis showed a strong significant difference ($z = -3.734$, $p < .001$) in favour of a better performance in working memory ($x = 22.78$, $sd = 5.15$) than in an attentional task such as digit span ($x = 12.11$, $sd = 2.35$).

Finally, by extension of the third analysis (immediate memory was better than working memory) and the fourth analysis (working memory was better than digit span), a comparison among immediate memory and digit span showed a very significant difference ($z = -3.727$, $p < .001$) in favour of immediate memory ($x = 45.78$, $sd = 11.16$) when compared to digit span ($x = 12.11$, $sd = 2.35$), as it is exposed on table 6.

Table 6. Differences among Digit Span and Immediate Memory

	Digit Span – Immediate Memory
Z	-3.727***
Sig.	.000

*p<.05, **p<.01, ***p<.001



MAC-Q (Memory Complaints Questionnaire)

We administered this test to the same 18 people that were assessed with the Weschler Memory Scale. Results arising from elderly's perception about their own memory were the following.

Daily activities

First, 55.6% described their ability to remember a new person's name as bad, while 38.9% describe this ability as normal and 5.6% described it as good.

Second, 61.1% described their memory as normal when it comes to remember data from a newspaper article they have just read, 16.7% described it as good and 5.6% as very good, being only 16.7% who thought they are bad in this domain.

Third, most of our sample described themselves as good (38.9%) or very good (38.9%) when it comes to remember specific tasks as turning off the light or electric devices, and locking the door when leaving home; 16.7% described this ability in themselves as normal and only 5.6% thought they are bad with this specific task.

Fourth, in prospective memory tasks related to taking objects previously planned to take, only 11.1% thought they are bad at remembering this kind of things. 27.8% thought they are normal, 38.9% thought they are good and another 22.2% thought they are very good.

Fifth, when it comes to remember recently received specific verbal instructions to reach one address or place, only 22.2% thought they are bad at it; 16.7% thought their memory in this area is normal, 33.3% assessed it as good and 27.8% as very good.

Overall memory functioning

Three questions of this set showed the following results:

First, when it came to describe their own memory when compared to the average of people of their same age group, 16.7% thought it was bad, most of them (61.1%) thought it was normal, and 22.2% described it as good.

Second, when it came to compare their memory among now and the moment their memory was at its best performance, most of them described it as bad (50%) or very bad (5.6%), 38.9% described it as normal and only 5.6% described it as good.

Third, also comparing the present and the moment they perceived the memory was at its best performance, most of them described their remembering speed as bad (50%) or very bad (11.1%), 33.3% described it as normal, and 5.6% described it as good.

Sense of concern about one's own memory

Regardless the previous description of their overall memory functioning, most of them reported a normal concern (38.9%) or a very low (close to null) concern (33.3%), while 22.2% reported being quite concerned and 5.6% being very concerned about the functioning of their memory.

Specific forgetfulness typically associated to old age

Information about four questions was gathered regarding specific type of daily life forgetfulness in the elderly.

In case #1, “Frequency of forgetting that you had already told something to someone and you finally tell the same again to that person”, a majority our sample reported that this kind of oversight happened to them only sometimes (22.2%) or almost never (33.3%), while for 11.1% this was a normal oversight and for 33.3% this was a quite frequent oversight.

In case #2, “Frequency of having difficulties to remember a specific word they plan to use”, the majority reported that this was a quite frequent (44.4%) or a very frequent event (5.6%). Another 27.8% reported this to be a normal event in their lives, while only a few reported that the frequency of occurrence of this kind of forgetfulness was only sometimes (11.1%) or almost never (11.1%).

In case #3, “Tip-of-the-tongue phenomenon”, everybody reported having suffered this experience at any time. 11.1% reported to suffer it very frequently, 44.4% quite frequently, 33.3% described it as a normal event, and only 11.1% stated that it happened to them only sometimes.

Finally, in case #4, “Frequency of meeting people that look familiar but without being able to remember when you have seen them before”, a majority of 44.4% reported it was a quite frequent event, 27.8% described it as a normal event in their lives, 16.7% stated that it happened to them only sometimes, and another 11.1% stated that it had never (or almost never) happened to them something like that.

5. Implications for HERMES

From the requirement analysis composed of different methods some major conclusions can be drawn. These conclusions are described in the table below and matched with implications for the development of HERMES.

	Conclusions	Implications for HERMES
1.	The population of the older adults is very heterogeneous.	HERMES system must be flexible and adaptable to different elderly people's needs, in the context or our users

2.	Older adults do not want a system that makes them feel dependent of it. For them, it is very important to keep their cognitive abilities, and they know that if they do not exercise these capabilities they will loose them.	HERMES will employ pervasive technology aiming at developing assistive systems that are as non obtrusive as possible
3.	They are reluctant to any technology that aims to reduce their autonomy or minimize their cognitive or functional effort, because it would mean dependency	HERMES will employ cognitive training to reinforce their autonomy rather than making them dependent on technology. Cognitive games will offer them to work with their personal information, instead of offering reminders without any cognitive effort.
4.	When users forget something, this is usually things that are not usual in their lives. So, it is better to pay attention to these unusual things in their lives.	HERMES must provide users the opportunity to record both routinary activities if needed as well as activities out of the usual daily life schedule. The focus however should not be on repeated actions with regular time intervals but on events that take place irregularly or only once.
5.	Older adults generally do prefer using things they're already familiar with. For instance, they are very used to write down their appointments and important things that they have to remember.	Any development must imply an advantage in comparison with their agendas, calendars etc to be usable and accepted by older people. The system shall make it possible to provide this kind of free-form information and not restrict the user to forms and fixed inputs.
6.	Older adults do appreciate and need interaction with other people	HERMES should provide a way for different users to play cognitive games and share information on-line
7.	In order to live independently as long as possible older adults need to be able to lead an active lifestyle. To achieve this they are convinced that a healthy lifestyle is a prerequisite. A healthy lifestyle includes good nutrition, adequate habits, and ways to train the body and the mind. In order to follow this healthy lifestyle they consider that they have enough information. Sometimes, the problem is a matter of each person's attitude, so motivation plays a central role in the adoption of certain behaviors.	HERMES activities and games must be easy to use, intuitive, and reinforcing enough to facilitate that the user has the habit to interact and play with the system. The system has to motivate users and motivate them to use the training aspect.

8.	For some elderly people it is difficult to imagine how technology can help them. For this reason, they are a bit reluctant to the various kinds of terminal devices. They assume that, in a few years time, next generation of elderly will tend to integrate this kind of device more easily.	This generation's elderly people cannot imagine technology until they have it in their hands and can actually use it, as it is shown by the extended use of mobile phones among the elderly. It is likely that by the time a prototype is developed and they can manage it physically, the reluctance will decrease.
9.	Participants assess the cognitive training positively, but some remarks remain. Working memory and digit span are the indexes showing the lowest scores, and are related to immediate auditory processes.	It is not recommended to present tasks as part of the cognitive exercises that demand sustained attention from the user, based only on auditory information. Any material (i.e. cognitive games) to be developed in HERMES should allow the elderly users to have enough time to process and draw up incoming information, as it is suggested by the better score of most of the delayed indexes when compared to the immediate indexes
10.	Visual processing and memory are in better shape and allow the users to process them at their own speed without losing important contextual information.	Any task should be based on visual clues and visual information, on or a combination of auditory and visual information, as may be concluded by an evident better performance of the elderly people in tasks involving visual memory processes.
11.	Attentional processes are the ones with the lowest performance in the assessment of the users.	Any task or material presented should give support to attentional processes.

6. Conclusions

After the development of different resources (questionnaires, diaries, focus groups, cultural probes, interviews and memory assessments) to gather features and needs of elderly people, some common conclusions may be extracted.

It seems clear that a flexible, intuitive, easy-to-use system must be developed, which is able to be used by differently skilled elderly people, a device able to integrate the heterogeneity of the people who are 65 years-old and older. This focus on different skills, and personalized levels of difficulty (specially for cognitive games) does not imply that the system has to be a reminding device with no demand of efforts from the user, since they have clearly stated that they do not want a device to make them more dependent.

They may record both routinary and unusual events of their lives, but this information will not return to them just as a reminder; instead, they will be able to play cognitive games with previously provided information in a way that should be easier or, at least, as easy as the use of a normal calendar or agenda, and with a presentation attractive enough to make them feel that using the system is useful and amusing. This presentation, if it aims to be both attractive and useful, must be based on a combination of visual and auditory information, giving support to attentional processes and letting the user enough time to process and draw up incoming information. Also, considering the needs of socialization and sharing, the possibility of using HERMES to share information and games on a real-time basis by different users (i.e. different relatives or friends using HERMES at the same time) should be kept in mind.

Finally, it is clear enough that possibilities for elderly people to imagine a device like this without seeing, hearing and touching it are limited, but it is also clear that reluctance will decrease if the previously address needs and suggestions are covered efficiently.

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8. Annexes

8.1 Annex 1.a: The Questionnaire

SECTION 1. SOCIO-DEMOGRAPHIC INFORMATION

1.1 DEMOGRAPHIC INFORMATION

1.1.1. Date of birth (dd/mm/yyyy) / /

1.1.2. Gender

Male Female

1.1.3. Marital status

Married

Separated

Divorced

Single

Cohabiting

Widowed

1.2. SOCIAL INFORMATION

1.2.1. Household composition. Who do you live with at the moment?

I live alone

I live with my partner only

I live with my partner and children

I live with my children, without a partner

I live with other relatives

I live with others

1.2.2. Total number of adults I live with _____

1.2.3. Total number of children (under the age of 18) I live with _____

1.2.4. I live with pets

yes no

1.2.5. If yes, which kind and how many _____

1.2.6. Household type. What type of accommodation do you live in?

1.2.6.1. Domestic/family house or flat

yes no

1.2.6.2. Residential/sheltered (non-hospital) housing

yes no

1.2.6.3. If yes, is the residence or sheltered housing:

Staffed 24 hours

Partially Staffed (not-24 hours)

Un-staffed at all times

1.2.7. What was your occupation before you retired? _____

1.2.8. Are you in contact with people of your age?

yes no

1.2.9. Do you receive any economic aid?

yes no

1.2.10. What kind of aid do you receive?

public private

1.2.11. Who do you speak with when you have a problem?

1.3. HEALTH

1.3.1. Have you used any of the following services in the last 3 months?

Use of health and social services			
	Yes	No	
Visited your primary care doctor	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Visited your district nurse	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Hospital as inpatient	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how many days in
Hospital as outpatient	<input type="checkbox"/>	<input type="checkbox"/>	total? __
Hospital Emergency unit/department	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Mental health services	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Psychologist/Psychiatrist	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Social worker	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Home care	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Adult day centre	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Occupational Therapist	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Physical therapist	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Lawyer/solicitor	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Self-help group	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
Telephone help-line	<input type="checkbox"/>	<input type="checkbox"/>	If yes, how often? _____
			If yes, how often? _____

1.3.2. Have you used any health or social services which are not listed above?
If so, please tell us which services and how often you use them:

1.3.3. Do you have any hearing impairment?

yes no

1.3.4. Do you have any visual impairment?

yes no

1.3.5. Do you have any mobility impairment?

yes no

1.3.6. Do you suffer from chronic diseases?

yes no

1.3.7. If yes, what chronic disease do you suffer from?

Diabetes

High blood pressure

Other: _____

1.3.8. Current state of general health

1.3.8.1. Mobility

I have no problems in walking about

I have problems in walking about

I am confined to bed

1.3.8.2. Self-care

I have no problems with self care

I have problems washing and dressing myself

I am unable to wash or dress myself

1.3.8.3 Usual activities (e.g. work, study, housework, family or leisure activities)

- I have no problems with performing my usual activities
- I have problems with performing my usual activities
- I am unable to perform my usual activities

1.3.8.4. Memory problems

- I have no memory problems at all
- I have moderate memory problems
- I have extreme memory problems

1.3.8.5. If moderate or extreme memory problems: at which moments do you experience the memory problems?

SECTION 2. NEEDS AND INFORMATION REMINDING

2.1 NEEDS

2.1.1. In your opinion, in general, which are your main needs in your daily life? Please, don't think about this long and hard, write the first needs that you think. If nothing crosses your mind, go to the following question.

2.1.2. Which are your needs in the following areas?

2.1.2.1. Health and prevention

2.1.2.2. Safety and security

2.1.2.3. Cognitive training, that means stimulate your capacities of memory, attention

2.1.2.4. Sharing the important information for you with your relatives and friends

2.1.3. Which conditions do you consider vitally important in order to live by yourself in your own house?

2.2. INFORMATION REMINDING

2.2.1. If a device would be able to record the important information for you: Which information do you consider so essential to be automatically recorded by such a device?

2.2.2. Would you appreciate a device that would be able to remind you the following items?

	Yes	No	Why?
Shopping list	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Because...
Previous doctor conversations	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Because...
Previous conversations with relatives, neighbours	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Because...
Things that you have to do in the current day	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Because...
Other	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Because...

2.2.3. Would you appreciate a device with these features?

2.2.3.1. A device in which you can play some cognitive games, in order to improve your memory, attention... capacities

<input type="checkbox"/> Yes	<input type="checkbox"/> No	Because...
------------------------------	-----------------------------	------------

2.2.3.2. A device able to register some places of interest for you (e.g. pharmacies, groceries), and then to remind you where they are

<input type="checkbox"/> Yes	<input type="checkbox"/> No	Because...
------------------------------	-----------------------------	------------

2.2.4 In which situations of the daily living you wouldn't feel comfortable because of not remembering something?

Forget buy or do any task

Forget any name, of a person or a thing

- Forget an important appointment
- Forget any conversation with someone
- Forget how to go somewhere or being disoriented
- Forget if I have bought something or buy it twice
- Other: _____
- Other: _____

Please specify other options:

2.2.5. If a device could remind you the important information for you, how would you prefer to receive this information?

2.2.5.1. If you are alone

- Reading the information on a display
 - Hearing (spoken by a computer)
 - Reading and hearing
-
- Other. Please specify which one _____

2.2.5.2. If you are with more people

- Reading the information on a display
 - Hearing (spoken by a computer)
 - Reading and hearing
- Other. Please specify which one _____

2.2.6. Which one of the following devices do you prefer for receiving information about your appointments and things like that?

- TV screen
- Computer
- Mobile phone
- Other. Please specify which one _____

2.2.7. Do you use any reminding system?

- No
- Agenda
- Calendar
- A relative reminds me my appointments
- Another system like make histories or visuals associations

2.2.8. Do you use any task for remind important events? (e.g.) I change my watch from one hand to the another hand

SECTION 3. EXPERIENCE WITH TECHNOLOGY

3.1. Do you like to use new technologies?

- I don't like to use new technologies at all
- I don't like to use new technologies
- No specific preference
- I like to use new technologies
- I like to use new technologies very much

3.2. Which technological devices do you already have/use in your daily life?

	Do you have this device in your home?	Can you use this device without help?	How often do you use it?
<input type="checkbox"/> House alarm	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Automatic lights	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Digital picture frame	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Children monitor (1-way radio)	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Electric coffee or tea kettle	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Mobile phone	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Land-line phone	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Fax	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Printer	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Copy machine	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Scanner	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> House phone (door phone)	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Electronic lock of the door / gate	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Fridge	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Hood	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Dishwasher	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Stove	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Kitchen robot	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Toaster	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Microwave oven	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Washing machine	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Drying machine	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Alarm clock	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Wall clock	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Lamp	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Mechanic bed	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Calendar with reminder	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Vending machine (e.g. for train tickets, bus tickets)	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Radio	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always

<input type="checkbox"/> TV	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> DVD player	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Photo camera	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Video camera	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Computer	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> Internet	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always
<input type="checkbox"/> PDA	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> never <input type="checkbox"/> Often <input type="checkbox"/> always

3.3. In your opinion, are any of these technologies able to help you in your daily life?

3.4. Do you buy the appliances on your own?

Yes

No

3.5. In case you use a computer: Which year did you start to use a computer?

3.6. What do you use the computer for?

3.7. Do you have some problems using these devices?

3.8. If devices would be easier to use, do you think you will be able to use more applications?

3.9. Which technology that you use is the easier for you to use?

3.10. Which technology that you use do you hate the most? Why?

3.11. How important are the following attribute in a device?

Utility Not important at all Somewhat important Important Very important

Simplicity Not important at all Somewhat important Important Very important

Aesthetics Not important at all Somewhat important Important Very important

8.2 Annex 1.b: Table results for the questionnaire

- Visits to the hospital as inpatient:

	Frequencies	Percentage
No	79	82.3
Yes	14	14.6
Total	93	96.9

- Frequency of visits to the hospital as inpatient

	Frequencies	Percentage
Never	79	82.3
Less than once a week	10	10.4
Less than twice a week	1	1
Total	90	93.8

- Visits to the hospital as outpatient:

	Frequencies	Percentage
No	75	78.1
Yes	19	19.8
Total	94	97.9

- Frequency of visits to the hospital as outpatient

	Frequencies	Percentage
Never	75	78.1
Less than once a week	17	17.7
Total	92	95.8

- Visits to a hospital emergency unit:

	Frequencies	Percentage
No	89	92.7
Yes	5	5.2
Total	94	97.9

- Frequency of visits to a hospital emergency unit:

	Frequencies	Percentage
Never	89	92.7
Less than once a week	4	4.2
Total	93	96.9

- Visits to mental health services:

	Frequencies	Percentage
No	85	88.5
Yes	9	9.4
Total	94	97.9

- Frequency of visits to mental health services:

	Frequencies	Percentage
Never	85	88.5
Less than once a week	8	8.4
Total	93	96.9

- Visits to psychologist/psychiatrist:

	Frequencies	Percentage
No	85	88.5
Yes	9	9.4
Total	94	97.9

- Frequency of visits to psychologist/psychiatrist:

	Frequencies	Percentage
Never	85	88.5
Less than once a week	8	8.4
Total	93	96.9

- Visits to social worker:

	Frequencies	Percentage
No	92	95.8
Yes	2	2.1
Total	94	97.9

- Frequency of visits to social worker:

	Frequencies	Percentage
Never	92	95.8
Less than once a week	1	1.1
Total	93	96.9

- Visits of home care services:

	Frequencies	Percentage
No	92	95.8
Yes	2	2.1
Total	94	97.9

- Frequency of visits of home care services:

	Frequencies	Percentage
Never	92	95.8
Less than once a week	1	1.1
Total	93	96.9

- Visits and frequency to adult day centre:

	Frequencies	Percentage
No	94	97.9
Never	94	97.9

- Visits to occupational therapist:

	Frequencies	Percentage
No	92	95.8
Yes	2	2.1
Total	94	97.9

- Frequency of visits to occupational therapist:

	Frequencies	Percentage
Never	92	95.8
Less than once a week	2	2.1
Total	94	97.9

- Visits to physical therapist:

	Frequencies	Percentage
No	80	83.3
Yes	14	14.6
Total	94	97.9

- Frequency of visits to physical therapist:

	Frequencies	Percentage
Never	80	83.3
Less than once a week	10	10.4
Once a week	1	1
Less than twice a week	1	1
Twice a week	1	1
Total	93	96.9

- Visits to lawyer/solicitor:

	Frequencies	Percentage
No	92	95.8
Yes	2	2.1
Total	94	97.9

- Frequency of visits to lawyer/solicitor:

	Frequencies	Percentage
Never	92	95.8
Less than once a week	2	2.1
Total	94	97.9

- Visits and frequency of visits to self-help group:

	Frequencies	Percentage
No	94	97.9
Never	94	97.9

- Visits and frequency of use of telephone help line:

	Frequencies	Percentage
No	94	97.9
Never	94	97.9

- Use of other services:

	Frequencies	Percentage
No	60	62.5
Yes	9	9.4
Total	69	71.9

- Other services used:

	Frequencies	Percentage
Quiropractitioner	2	2.1
Gynecology	2	2.1
Dentist	3	3.1
Emergency Telephone	1	1
Otorhinolaryngologist	1	1
Total	9	9.4

- Mean of usage of previously described services (number of visits):

	N	Minimum	Maximum	Mean	SD
Primary care doctor	86	0	12	2.35	2.30
District nurse	90	0	5	.77	1.11
Hospital as inpatient	90	0	13	.38	1.58
Hospital as outpatient	92	0	4	.30	.75
Hospital emergency unit	93	0	1	.04	.20
Mental health services	93	0	4	.14	.56
Psychologist/ Psychiatrist	93	0	21	.51	2.75
Social worker	93	0	1	.01	.104
Home care	93	0	1	.01	.104
Adult care centre	94	0	0	.00	.00
Occupational therapist	94	0	1	.01	.10
Physical therapist	93	0	24	.84	3.36
Lawyer/ solicitor	94		1	.02	.14
Self-help group	94	0	0	.00	.00
Telephone help-line	94	0	0	.00	.00

- Do you have any of the previous needs? Do you have any other needs related to security that were not mentioned here?

NEEDS RELATED TO MEMORY FUNCTIONING

- Do you usually forget where you have left things like home keys, personal documents...?

- Does it usually happen to you that you go to any room at home with a purpose and, when you reach to that room, you forget what you intended to do there?

- What do you think that it could help you to remember these issues?

- Do you sometimes need that something or somebody reminds you any specific thing? In which situations does it happen to you?

- Do you buy groceries *ad hoc* or do you carry a shopping list? Do you buy more things than what you really need and, instead, forget to buy essential things?

- Is there anything that your relatives or friends must remind you more often that you would like to?

8.4 *The Diary*

DIARY ABOUT DAILY LIFE FORGETFULNESS

Date to start the diary:

Date to finish the diary:

This document has been created in order to know a little bit more about daily life oversights. Please, write down the following information:

- **Things that you have forgotten:** i.e. what you have exactly forgotten (for example, a medical appointment, home keys, some food you planned to buy when you had gone shopping...). Write down everything you are aware of having forgotten.
- **When have I realized that I have forgotten something:** in this column, write down in which moment you realized that you had forgotten something (i.e., the day after, two days after, 5 minutes after...).
- **Why have you realized that you have forgotten something:** in this column, explain what happened for you to be able to realized that you had forgotten something (for example, when my daughter called me to ask me what the doctor had told me, then I realized that I did not go to the doctor that day...).
- **Have you arrange something in order not to happen this to you again?:** finally, if you have developed any strategy in order not to forget the same thing again, please write it down here. For example, write down whether, in order not to forget your medical appointment again, you have written down it in a calendar, whether you have put the keys next to the home door in order not to forget them again...

Write down every oversight that may happen to you which you are aware of in a week time. Afterwards, give this sheet to the person who gave it to you.

Information that you facilitate is very useful for us, in order to know better how we can prevent daily life oversights. We need neither your name nor your personal data, so it is not necessary that you write them down.

Thank you for your cooperation!!!

Note: the following structure was repeated for the seven days of the week.

DAY 1

What have I forgotten?

When have I realized that I forgot it?

Why have I realized that I forgot it?

Have I done anything in order not to happen this again?
