

**User-sensitive Home-based Systems for Successful Ageing in a Networked Society**

# Deliverable 1.3a – Project Presentation

## (public)

**Version number and date: V1.0, Nov 30 2009**


Contact person: John Waterworth

Umeå University
Sweden



AAL Joint Programme Project ID: aal-2008-1-014

## Table of Contents

## The Agnes Project

AGNES is a carefully planned response to the growing number of elderly people living alone in their own homes, but in need of both social and practical support to maintain their daily activities and a good quality of life. Currently, they often suffer the effects of social and physical isolation - effects which include cognitive decline, mild dementia, low activity levels and poor mood states.

The main objectives of AGNES are to prevent, delay and help manage these common chronic conditions, so as to improve and maintain the well-being and independence of elderly people wishing to continue living in their own homes - as well as to reduce healthcare costs. To achieve this, advanced but increasingly affordable home-based technologies will be developed and integrated in new user-centred ways, connecting the elderly person with family, friends and carers in user-sensitive ways.

The project brings together 10 partners from six European countries (Sweden, Germany, Austria, Greece, Spain and Italy), comprised of two SMEs, a research institution, three universities, a consumer electronics company, as well as end-user organizations in Greece, Spain and Sweden. Areas of research include psychology of ageing, activity detection, emotion recognition, social networking, and tangible and ambient interaction. AGNES is a 3-year project, started in September 2009. It has a total budget of close to 3.6 million Euros, of which about 2.0 million Euros is provided by the AAL Joint Programme[1].

AGNES focuses on improving the mental and physical wellbeing of elderly people living alone at home, who often suffer the effects of social and physical isolation - including cognitive decline, low activity levels and poor mood states. AGNES will carry out novel technological interventions in an area that is emerging as the new frontier in ageing research. The project will use scientifically-based knowledge on ageing and innovative technology to intervene in the lives of target users in specific and carefully selected ways, and the effects of these interventions on cognitive functioning and quality of life will be evaluated, going beyond the existing state of the art. The results will provide significant new knowledge on the potential of new information technologies to delay, help deal with, and even prevent common chronic problems experienced by the elderly population.

[1] User-sensitive Home-based Systems for Successful Ageing in a Networked Society - AGNES for short - is a project funded under the Ambient Assisted Living Joint Programme, a new joint research and development (R&D) funding activity implemented by 20 European Member States and 3 Associated States with the financial support of the European Community based on article 169 of the EC treaty. See: http://www.aal-europe.eu/

## Progress through AGNES

AGNES will provide a user-sensitive home environment based on information and communication technologies (ICT) supporting a personalized and person-centric care process. Central to the proposed idea is the combination and integration of home-based ICT and a dedicated social network, connecting the elderly person living at home with their families, friends and carers, on various levels. The project will provide the technological means to exploit the power of social networks and the beneficial effect of social inclusion and activities on cognitive and mental processes. By detecting subjective states and activities of the elderly person, better-tailored and timely attention and care will be provided. Feelings of loneliness and insecurity will also be reduced.

The AGNES platform will also provide an information and communication channel to the elderly person from the network (news, updates on activities of close persons, reminders on birthdays etc, reminders of things “to do”, notification of present and future location of close persons, etc.). To support these functions, easy-to-use ambient devices will be designed and tested, as a means of information visualization and interaction between the network and the elderly person in both directions, as well as to unobtrusively update the network on the person’s state of wellbeing and activities.

ICT-based interventions will be developed to enhance mental and physical wellbeing by encouraging the older person to respond to physical, social and cognitive stimulation from outside, thus maintaining and even improving selective attention, memory span and prospective memory. Formal carers looking after elderly people in their homes will be assisted to manage their workload and better understand the needs of the elderly person, thus also providing improved communication and services. Informal carers, friends and family members will have greater access to information about the person, and those at a distance will be enabled to keep in touch and share activities with their elderly family member or friend, and to know their current condition. Social organizations and authorities will reduce costs and improve services.

AGNES adopts an approach - ICT-based interventions - which is emerging as a new frontier in ageing research. The 3-year project will use scientifically-based knowledge about ageing and innovative technology to intervene in the lives of target users in specific and carefully selected ways. The effects of these interventions on cognitive functioning and quality of life will be evaluated, going well beyond the existing state of the art. The results will provide significant new knowledge on the potential of new information technologies to delay, help deal with, and even prevent common chronic problems experienced by the elderly population.

AGNES will develop systems and devices that can be turned into products two years after project completion, using a modular approach building on a basic social networking system. All implementations will be specifically designed for the target user population, and extensively tested for practical, social and psychological impact and effectiveness in real users’ home situations.

AGNES technologies and services fall in the broader area of Ambient Assisted Living (AAL) and have a strong potential for significant technological and societal impact, as a result of the phenomena of falling birth rates (in an overall declining European population) and rising longevity. AAL services also constitute a growing market for vendors, service providers, integrators and application developers. A key technological challenge in this market is the need for universally designed products and services, which address the needs of broad ageing groups and can thus achieve high market penetration. At the same time highly populated ageing groups have particular needs that can only be addressed by specialized technological developments.

The project goes well beyond the state of the art in integrating diverse technologies and products into new innovative solutions, all in the service of helping to prevent and manage chronic conditions such as mild cognitive impairment and dementia in the elderly person still living in their own home.

## The AGNES Partners

**Partner 1 and project coordinator,** Umeå University in Sweden (UmU), has extensive experience of project coordination, as well as considerable expertise in the design, development and testing of novel forms of human-computer interaction, new digital media, virtual and augmented reality. The University has close ties with various stakeholders in regional and local development, including healthcare providers and companies. Umeå will also contribute to the design, development and assessment of new interaction protocols, novel interactive devices and environments, extending previous work - some of which has focused specifically on the needs of older users, utilising skill in interaction design, electronic engineering, computer science and user psychology. UmU will liaise with the local user organisation for Sweden.

**Partner 2, CanControls** of Germany, is a young SME (founded 2005) working on technologies to precisely locate and track a person within their home and have already implemented a working demonstrator in this area. In AGNES this technology will provide important cues about the state of the elderly person. CanControls is also active in the field of expression and facial feature analysis. This technology will be used to capture non-audible, emotional cues from the user, for example during ambient interaction with the home-based AGNES system.

**Partner 3, Athens Information Technology** (AIT), Greece, is a research centre with expertise in user-centred, network and systems technologies. Amongst other topics, they will particularly contribute to AGNES in the areas of state, orientation, activity and location detection and analysis, and system integration. AIT has a fully equipped and integrated Smart Lab, which will be used as a test-bed environment for developing ambient devices for the AGNES system, in collaboration with partner 7 (KMOP).

**Partner 4, Graz University of Technology** (TUG), Austria**,** has broad experience in new interaction technologies, and is a world leader in the field of detecting and characterising subjective states based on objective measures. They will contribute to principally to the work on sensing, emotion and behavioural detection and analysis.

**Partner 5, Universidad Nacional de Educación a Distancia** (UNED), Spain, contributes a wealth of expertise in cognitive psychology and the cognitive neuroscience of normal and pathological ageing, under the direction of Professor Soledad Ballesteros, an international authority in the field. UNED is principally responsible for leading the user involvement work package and for tracking and evaluating the psychological and other effects of AGNES's technological interventions on individual users.

**Partner 6, ModernFamilies GmbH** (MF), Austria**,** is a technology startup (since 2007) that provides social systems - applied information technologies for modern society. MF is founded on the belief that technology can make a difference when integrated into everyday life and when it simplifies matters. MF aims to understand and model human behaviour in the context of personal relationships and private communication and information patterns, and has applied for a patent in this field in the EU. ModernFamilies will provide AGNES with a social network website and associated technologies, adapting the service to the requirements of the project, including the integration with ambient devices. MF has a pending patent on social systems that will directly contribute to the project.

**Partner 7 KMOP**, Greece, is an Athens-based NGO that focuses on issues pertaining to social welfare and health. In 1977, KMOP was recognized by the United Nations as a partner organization, and a year later received recognition from the Greek Ministry of Social Welfare as a specialized welfare organization. It is also a recognized entity by Hellenic Aid, the humanitarian aid department of the Greek Ministry of Foreign Affairs. One of KMOP's earliest projects of great substance was the design and operation of the first centres of open care for the elderly in four locations of Attiki, established in cooperation with the Greek Ministry of Health and Social Welfare. Within AGNES, KMOP will focus on user involvement throughout the project, and work closely with AIT - also located in Athens.

**Partner 8, ONDA communication S.p.A,** Italy, is a dynamic private equity company concerned with product development and the realisation of customised and unique proprietary products. They evaluate, test, customise and integrate technical products and service solutions. ONDA will lead the Exploitation work package, focusing on commercialization of the results of AGNES, as well as contributing to integration activities.

**Partner 9, Fundacion Instituto Gerontologico Matia** (INGEMA), Spain, is a non-profit organisation focusing on the needs of and support for the elderly in Spain. Their Madrid office is under the direction of Maria Teresa Sancho, who has for many years also been Director of the "Observatorio for the Elderly" for the Spanish ministry responsible for social issues and wellness. INGEMA already have a good working relationship with UNED, also based in Madrid - where the Spanish user involvement and pilot testing will take place.

**Partner 10. Skellefteå Municipality in Sweden** (SKOMM) has a population of 72,000. The Social Welfare Office (with a staff of 2100) is responsible for care of the elderly, which includes 700 accommodations for the elderly, 300 communal living establishments, 60 short-term stay homes and 13,000 home-help hours per year. The Kommun`s role in the project will be that of a care provider recruiting citizens for the design and testing of systems developed in the project. The responsible person for this will be Quality Manager Louise Lundholm, who has 20 years experience of elderly nursing care, and has since participated in and led many ICT-related projects in the area.

**All partners make essential contributions** to the project. User organisations in the countries where prototype tests and pilot tests are conducted will play a vital role in keeping the users involved at all stages of the project (KMOP in Greece, INGEMA in Spain, and SKomm in Sweden), as well as contributing their insights into user needs. This and the cognitive psychological knowledge of UNED, and experience in user-centred design and testing of UmU, will guide and feed directly into the technical work done on sensing (mostly by TUG and Can), ambient interaction (UmU, AIT and others) and social network development (mostly MF). In turn, these activities steer the development and validation of the AGNES integrated solutions, supervised by AIT. Commercial partners (Can, MF and ONDA) will spearhead exploitation activities led by ONDA, who have broad experience of commercial exploitation.

## The AGNES Approach

AGNES will start by providing a basic ICT platform to create and maintain an easy-to-use web-based social network for individual elderly persons. This platform will be used to stimulate the elderly person. The in-home system will be enhanced with technology to assess the subjective and objective states of the elderly person along carefully selected parameters. Timely information will be passed to the network on the activities and subjective state of the elderly person.

The project will develop innovative applications to support the needs of family and carers, and reduce healthcare costs by improving care provision and extending the period of independent and successful living of the older person in their own home.

The project will address chronic conditions such as mild cognitive impairment, and develop and test solutions to alleviate and/or prevent them. In doing so, the project also answers the need of the elderly person to feel useful and have a meaningful role, be involved in the family and society yet independent, and have an improved quality of life. Informal carers, friends and family members will have greater access to information about the person, and those at a distance will be enabled to keep in touch and share activities with their elderly family member or friend, and to know their current condition. These solutions will respond sensitively and adaptively to the states and characteristics of the individual user.

The project takes an holistic approach, through which several different technologies and devices will be integrated to provide solutions aimed at the needs of the individual elderly person, as well as secondary users such acarers (including family members and friends). These include:

- Innovative technologies for the unobtrusive detection of user states and activities, based on inexpensive mass-market components such as web-cams and mobile phones.
- A social networking technology platform specifically designed to meet the needs of, and be usable by, the elderly person, and providing the communications channel through which people and applications will communicate.
- Ambient devices for the display of information and events and for easy interaction with the home-based system and connected others.
- Diverse applications specifically aimed at the needs of the older person, to help deal with, or even prevent, the mild cognitive impairment that tends to be a chronic and worsening feature of this user population.
- Features that also support the needs of carers.

The approach is modular, starting with basic services, and adding components of increasing sophistication, constituting a range of products for future exploitation.

**A simple AGNES scenario: Living Alone, but keeping in touch and feeling cared for**

Lola is 83 and happy to still live in the house she and her husband bought 40 years ago. Although it is quite big, and she has lived alone for the last 3 years after her husband's death, she likes living in the familiar environment - her own place. But she feels very lonely from time to time, and misses the family members who once shared the place with her.

For the last few months she has felt less lonely, because her children Anna and Alan have bought her an AGNES system. She can tell whenever messages or photos arrive for her, because that little rabbit device starts to flash and wave his arms. Then she just touches the rabbit and points at the wall, and she can look through the latest photos she's been sent (usually from Alan and his children).

Anna sends her mother lots of messages and reminders through AGNES, because she feels she has the main responsibility for making sure her mother is OK - even though she has a demanding full-time job in town. She worries that Lola sometimes forgets to eat lunch, which leads to her feeling unwell. One thing Anna she likes about AGNES is that it sends her an sms if her mother does not start making lunch at about the right time, or if she is too inactive for too long during the day - daytime sleeps of more than a few minutes tend to leave Lola feeling confused and anxious.

When she feels like it, she can look through old photos or play games with AGNES. Often she plays with her family, too, or her good friend Jorge who lives on the other side of town now. And she can always see when smeone is due to visit her. Sometimes she prefers to be alone, maybe doing the handiwork she still enjoys, or just reading the newspaper. Still she knows that if she needs company or help, the new system will connect her with those she wants to contact.

Lola isn't interested in how the thing works; the main thing is that it seems to do what she wants by waving at it, and it always lets her know when she should look at a message or get ready for a visit.

## Progress beyond the state of the art

**AGNES goes well beyond the state of the art** in integrating diverse technologies and products into new innovative solutions, all in the service of helping to prevent and manage chronic conditions such as mild cognitive impairment and dementia in the elderly person still living in their own home. A growing body of evidence emphasizes the potential of new interactive technologies to maintain health and independent living, and even improve some cognitive functions in the elderly. The basic AGNES platform will be designed to be affordable, scalable and adjustable to the needs of users, and extendable from a basic configuration through a modular approach to application development.

**Integration of existing technology:** although existing examples of most of the technologies to be used in the project can already be found, they have yet to be combined in a usable and affordable way, aimed directly at the needs of the elderly person living alone with, or at risk of, some degree of cognitive impairment - as will be done in this project. We see maintaining and supporting social integration as a necessary part of dealing with the chronic conditions of older people in a realistically sustainable and humane way, not as a separate issue, just as important as the function of detecting states and activities. Health, independence, dignified life and social contacts cannot be meaningfully separated.

**Ageing user involvement:** The inclusion of a partner with deep expertise in the psychology of ageing, as well as with special knowledge in the area of maintaining cognitive functions, will ensure the validity of our approach to meeting the needs of our user group. Commercial and technical partners have competencies that compliment each other in adapting, developing, and integrating these diverse elements. Organizations focused on care will maintain the involvement and cooperation of actual users, and help ensure the relevance of the work for current and future care practices.

Throughout the project, end users will be involved in the innovation process, including design inputs for components and applications, early evaluations and ongoing feedback, and field trials of installations in the home. This intensive and extensive approach to end user involvement is unusual, and will ensure that the technology that is developed is a good fit with the actual needs of the users. As we have partners in north, south and central Europe, we will be able to ensure that our solutions are applicable throughout the region.

**Self-management:** The project will apply ICT in innovative ways to support a personalized and person-centric care process, emphasizing the role of the home as the care environment in which chronic conditions are largely self-managed. The aim is to allow the elderly person to retain their independence in the home by supporting their daily activities and maintaining their social relations, while also supporting the roles of both informal and formal carers. Tracking of physical activities will also assist the elderly and the carers to plan and perform exercises and help to keep an appropriate diet. As well as bringing an improved standard of health and wellbeing in old age, this will result in economic benefits for healthcare providers, families and older people themselves. As is well recognized, long-term care in institutions is a poor solution to extended longevity from many perspectives, not least economic.

**Palette of marketable/adaptable new products:** The modular approach to applications developments, and the now inexpensive component technologies to be developed and integrated, will lead to a family of products that will be affordable in the short-term future economic circumstances - and also flexible in terms of the level of sophistication of service deployed. The ever-widening spread of broadband internet access, combined with the falling costs of access, components and consumer devices, suggest that our approach will be economically sustainable as new applications are developed in the future.

**Impact on care and the individual:** We believe that the integrated solution we will develop will have a significant impact not only on the individual level, but also on care organizations and European societies as a whole. Cognitive impairment in the elderly is a widespread and chronic problem through Europe. It compromises the capacity of the older person to live independently in their own home, as well as increasing the burden placed on formal and informal carers. Preventing or exacerbating the negative impact of mild but common cognitive impairments by reducing these negative consequences may have a major effect on cost effectiveness - thus easing the pressure of increasing costs in European social and healthcare systems. Increased self-management and independence will also allow more effective use of limited resources and especially that of an increasingly scarce workforce. The situation of the older person living at home will become more sustainable, through the deployment of these ICT-based solutions, as well as opening up new business opportunities.

**Europe-wide use of AGNES:** technological results from AGNES will provide European industry with affordable techniques and devices for unobtrusive long-term monitoring of a person's state. The approach to human-system communication, utilising this derived knowledge and integrated through a flexible approach to ambient interaction, will also have a large potential economic impact. European industry will become the first to implement such products on a large scale. AGNES is an ambitious, but realistic and strongly focused project to develop and evaluate these technologies with clear social goals and benefits.

## Scientific and technical contributions to knowledge in the field

### Research into Ageing and Wellbeing

Today, we have an excellent understanding on age-related changes in basic cognitive processes such as speed of processing, working memory, episodic memory, and sensory functions (Baltes & Lindenberger, 1997; Nilsson, 2003; Park et al., 2002; Salthouse, 1996) . Moreover, recent advances in the neural understanding of age-related differences in cognitive functions have shown that older adults show additional frontal compensatory recruitment compared to young adults while performing memory tasks. Several findings suggest that there is considerable flexibility and reorganization in neural circuitry with ageing (e.g. Park & Gutchess, 2004; Reuter-Lorenz & Lustig, 2005). Cognitive ageing researchers are seeking how this knowledge can be used to improve the functional well-being of the elderly. Traditional approaches have investigated how training those mental abilities that decay with age produces global cognitive enhancement. Thus far, instead of a global improvement in cognitive processes, disappointingly the improvement is limited to the trained ability (Ball et al., 2002). More interestingly, other approaches that do not try to train a particular ability but to improve cognitive function by exploiting intact cognitive process (such as implicit memory; Ballesteros & Reales, 2004; Ballesteros et al., 2007; Ballesteros et al, in press) or by using broad-based intervention techniques of intellectual and social stimulation result in a global increase in cognitive function (Park, et al., 2007).

Cognitive health in ageing depends on a mix of environment, genes, and life experiences. The social context of older adults is receiving renewed interest as a factor that mediates cognitive health and wellbeing. Social relations are considered important for the emotional as well as physical and psychological health of the elderly and serve as a protective factor against risk of cognitive decline and dementia (Cacciopo et al., 2006; Seeman, 1996). There is a strong inverse relationship between the strength of social networks and the incidence of dementia among the aged (Barkley, 2007; Fratiglioni et al., 2000). Prodromal cognitive decline may precipitate exclusion from existing social relationships. Therefore, the AGNES project focuses on establishing and maintaining social inclusion and involvement in societal and family life for the older individual.

In addition to the benefits of reduced social isolation new, stimulating environments can be expected to improve cognitive functioning (Park & Minear, 2005) (biological research has already indicated that, for example, older rats show neuron growth when faced with new, stimulating environments (Greenough et al., 1986)). The AGNES project seeks optimal communicative interventions for older individuals.

AGNES will carry out novel interventions in an area that is emerging as a new frontier in ageing research, especially taking advantage of those mental processes (such as implicit unconscious memory, vocabulary) preserved in ageing. The project will use scientifically-based knowledge on ageing and innovative technology to intervene in the lives of target users in specific and carefully selected ways, and the effects of these interventions on cognitive functioning and quality of life will be evaluated, going beyond the existing state of the art. The results will provide significant new knowledge on the potential of

new information technologies to delay, help deal with, and even prevent common chronic problems experienced by the elderly population.

### Detecting user states and activities

AGNES uses, enhances and investigates several technologies to realize a diverse and omni-prominent state and activities detection. Those technologies are:

- Interaction and activity interpretation
- Person position/motion detection and tracking
- Detection of gestures, body movement characteristics, and posture
- Face detection and facial expression analysis

Those state-detection technologies partly try to detect similar states in the user based on different physical, logistic and temporal foundations. The results of the various technologies will be fused into one view using sensor fusion techniques. Fusing features of various information sources, we will explore new types of features, approaches to merging them, at different abstraction levels, as well as optimal combinations of existing classification techniques (e.g. Support Vector Machine and Hidden Markov Model) in a voting scheme. In order to provide continuously valid data the data fusion integrates the collected data and analyzes it for information confidence.

Interactions and support of daily activities are a central part of the AGNES philosophy. Monitoring and analyzing such actions are hence crucial for evaluating the success of the applied methods. Further, since interactions with other persons in the home or via the network as well as regular independent activities in the home are the central goal of this project and all actions of the system are working towards these, interaction and activity patterns will be used to adjust the different components to optimize their mutual efforts. This novel user-centric approach will provide new insights into interaction patterns of the elderly and how they can be positively influenced by use of ICT technologies.

We will develop a person-detection and tracking system that will use only mass-market devices such as mobile phones with integrated motion sensors and low-end, commodity webcams. Compared to state-of-the-art camera equipment, webcams have substantially lower image quality (i.e. lower resolution, worse noise reduction and worse colour adaptation). A challenge here is to develop a system based on state-of-the-art technology that despite these shortcomings is still able to precisely locate and track the user. While the state of the art relies on multiple dedicated motion sensors which need to be carried by the user, as an additional information source we will develop methods to infer a person's activities using a single motion sensor which is integrated in, for example, a mobile phone. The resulting system will be very robust using two independent methodologies. It will also be affordable to the end-user and thus have a higher impact on the mass-market than current solutions.

Using the same equipment we will investigate how specific hand, arm and head gestures, body movement characteristics such as gait, and postures correspond with relevant user states, and exploit those results. As a further source of data we will analyse facial features when and where possible. Particularly when using the technology we can assume the user will be facing the interaction device as

well as potentially being in need of assistance. Close-up facial feature information will be a valuable information source in this situation. The majority of the previous work on facial expression analysis has been done in the scope of fundamental research with a focus on methodology rather than applicability in everyday home environments. Consequently only very few of the current methods achieve robust person-independent analysis with real-time performance, and these have not been evaluated under realistic, real-world conditions. Within AGNES, we are aiming at marketable end products. Algorithms to be used in the system will be specifically targeted at the envisioned use cases, reducing the complexity of the task. We will specifically take into account that the algorithms will have to work under real-world conditions. Furthermore, existing algorithms make the assumption of an arbitrary user. We will investigate how to adapt the system to the specific user in a (semi-) automatic process. Finally we require real-time performance to be usable in the user-system interaction loop.

### Ambient Interaction and Devices

The market of ambient devices is very young, and the range available limited. Typical users today are technology freaks and early adopters. AGNES would spearhead the development and use of commercial, cheap ambient devices to be used for a very different group - but which comprises a huge potential for suitably-designed products. AGNES will provide great insight into barriers to use, adoption patterns and patterns of use. This information would spur further innovation. The ambient devices we need (and which hold the greatest promise) will help AGNES to accelerate the rollout and use of the internet to currently uncovered areas, people and institutions (e.g. day-care centres and retirement homes).

### Social Networking and Co-Presence

Current social networks are all based on qualified person-to-person relationships. This approach has a number of disadvantages:

a) It presents a significant barrier to its use since every user needs to painstakingly build their own personal network on an individual basis.
b) Because of a) many passive internet users will not use them.
c) This in turn reduces the value of such systems in the social contexts of very heterogeneous populations such as families, so that even active internet users are frustrated.
d) Without the active internet users, participating networks will not grow.
e) Its limitation to such users means that the vast majority of people in one's real-world network will not exist, and cannot be referred to. This also means the elderly cannot be served even when equipped with ambient devices, since these devices are so simple to use that they do not offer logins, definition of preferences, acceptance of invitations and other complex interaction.

AGNES will use the latest generation of social networking systems that are much smarter and do not require every person to actively establish a mutual relationship with everybody else. They recognize relevant relationships and assign them to other people automatically or semi-automatically. In this way a significant hurdle for the inclusion of social networks will be solved and social networks can be deployed and relied upon to disseminate information directly and automatically when needed. For example, the fact that an elderly person in a day-care centre is not feeling very happy can be disseminated to the right

persons without any additional setup requirements on that person. The relevant persons will be, for example, family, extended family, family friends and personal friends.

### Designing Innovative Technology for the Ageing Population

A successful innovation system in the human sector needs to be based on how people live and act. This necessitates that projects involving human research subjects should have additional needs parameters built in over and above those, involving traditional tests of endurance and reliability. If design research is carried out with an insight into and respect for how people live and act, entirely different aspects will emerge. The AGNES project will contribute to raising awareness in the European research community regarding ethical issues involving aged people, and the importance of real user involvement in innovation.

This project will strengthen ethical considerations regarding design and vulnerable groups from the perspective of contributing to the development of technology as well as using it. The impact, scientifically and at the societal and industrial levels, is within the human sector where people work with and for other people. In most European countries, relatives account for around 70% of the care-giving for elderly people. Innovations that improve conditions for relatives and friends have as yet an untapped human, national economic and business potential.

## Improving quality of life

Research into ageing and cognition has demonstrated the close relationship of sensory functioning and social communication to maintaining cognitive performance and mood in the elderly, yet in modern societies elderly people are increasingly isolated and under-stimulated, both physically and psycho-socially. This situation results in accelerated cognitive decline and the suffering associated with loneliness and confusion. Health services cannot keep up with the demand for home visits and day-care centres that can alleviate this problem. Incorporating new healthcare technologies for proactive health and elderly care into everyday living environments can contribute significantly to supporting the elderly and their carers and is to become a major priority over the next decade. Our proposed approach to keeping the elderly mentally and socially stimulated and in contact with others by combining state detection and social network technologies would constitute a significant breakthrough in the innovative application of technology to cognitive, social and personal needs of increasingly larger groups of such people in present and future societies across Europe.

AGNES is strongly motivated by recent research showing strong relationships between levels of social integration and mental stimulation and the maintenance of cognitive functioning and psychological wellbeing. Today there is widespread awareness of the increasing numbers and proportion of elderly people in European societies; but in modern societies elderly people are increasingly isolated and under-stimulated due to increased mobility and consequential geographic distance of family members and friends, as confirmed by recent surveys. Isolation breeds loneliness, which in turn results in cognitive and physical decline (Rabbitt, 2005), compromising the older person's capacity for continued independent living. AGNES answers this phenomenon by providing technological means to not only keep the elderly connected with significant others but by also actively informing caring persons on the person's state and well-being and evoking appropriate responses. Lack of social participation increases the risk of Alzheimer´s (AD) disease-like dementia (Barklay, 2007), and loneliness resulting from social isolation is a serious risk factor for depression among home-dwelling older adults (Fiske & Jones, 2005). According to Cacciopo et al. (2006), loneliness is characterized by: a) isolation (distant from relatives and friends; b) feelings of being disconnected (not having close friends); and c) feelings of not belonging (not identifying with or not feeling accepted by valued social groups). The main aim of AGNES is precisely to provide for the support older people need to overcome or avoid chronic loneliness and so achieve a better quality of life.

Monitoring physical activity is another important facet of our holistic approach. As there is also evidence that physical activity may help people maintain their cognitive abilities, AGNES' monitoring and scheduling options allow use of human activity. As a side effect, activity monitoring combined with a daily calorie overview among other things will help people to maintain a healthier lifestyle.

The end users will be involved in all stages of the project, from requirements specification to the design process, and on to taking part in testing and evaluating implemented components and the developed prototype systems. Field evaluations of technical performance and user experiences will involve tests

with end-users in their homes. In addition, social impact and psychological effects on the older person will be specifically assessed. The evaluation of the developed systems will provide a wealth of new knowledge, centrally including the effects on the older people themselves, on their own wellbeing and their social relations with close relatives. This also provides the most important means to evaluate project progress against objectives.

The systems developed in AGNES will contribute to increased personal independence, prolonging active participation in society for the ageing population. These will potentially open up new markets for independent and active living products, and strengthen European industrial position in ICT and Ageing technologies and services.

### Summarized Benefits of AGNES

- More cognitively agile, active and socially engaged elderly people with better mood states, enhanced perceived wellbeing and general health.
- Increase in quality of life for a growing proportion of the European population (more than 30% of people in the EU will be over 65 years old by 2050) (or 23% in 2025).
- Management and prevention of common chronic mental conditions, leading to an increase in sustainability of independent living amongst the elderly.
- Improved quality of service of care service providers due to better planning possibilities, intensified social communication between carers and clients, and better inclusion of the carer in the client's social network.
- Informal carers will have more time for themselves and other family members, increasing their life quality and giving them chance to better care for themselves, e.g. sports, medical check-ups, further education, hence reducing future societal costs and improving their ability of prolonged independence (28% of population will be in caring age for their parents (25-49 years old)) (or 31% in 2025).
- Cost reduction of health services.

### Demonstrating AGNES as a systemic solution

The main goal of our pilots is to demonstrate and assess the effectiveness of the systemic solution developed in the project in improving the wellbeing of the target older people living alone and suffering loneliness. In other words, the goal here is to demonstrate that our prime objective has been met: providing a user-sensitive ICT-based home environment that supports a personalized and person-centric care process by detecting, communicating, and meaningfully responding to relevant states, situations, and activities of the elderly person with regard to mild cognitive impairment or dementia.

AGNES is envisaged as a scientific and technological systemic solution developed to provide important scientific breakthroughs not only in the area of science and technology but also in terms of its psychological effects in older users and their relatives. The component technologies are known to work in isolation, but have never been integrated to provide a systemic solution of this kind before.



# AGNES

## User-sensitive Home-based Systems for Successful Ageing in a Networked Society

**Deliverable 1.3b – Project Slide Presentation**

**Version 1.0, November 30 2009**

# Objective:
# Successful Ageing with Innovative ICT

- **Target users**
  - Elderly people, living alone, often with mild cognitive impairment, their family and other caring persons

- **Reduce isolation and loneliness**
  - Increased social interaction
  - Sensitive emotional support
  - More participation in shared activities
  - Practical support for daily needs
  - Enhanced feelings of security

- **Extend independent living in own home**
  - Alleviate, delay, even reverse psychological decline

- **Explore the new frontier of ageing research**
  - ICT and its possibilities for improving cognitive wellbeing in the elderly

# Summary of Effort

- **Ten partners in 6 countries**
  - 3 user organisations (in Sweden, Greece, Spain)
  - 3 companies (in Germany, Austria, Italy)
  - 4 universities/research centres (in Sweden, Spain, Greece, Austria)

- **400+ person months over 36 months**
  - total cost: €3,6 million
  - AAL funding: €2,4 million

- **Start Date: September 2009**

# AGNES partners

- Umeå University, Sweden
- UNED, Spain
- Can Controls, Germany
- Graz University of Technology, Austria
- AIT, Greece
- Modern Families, Austria
- KMOP, Greece
- ONDA Communication, Italy
- INGEMA, Spain
- Skellefteå Municipality, Sweden

# The AGNES Vision

- **Wellness and active social participation go together**
  - Technology can increase social participation
  - Combating loneliness and mental deterioration

➢ A secure social network system for the older person

- **Elderly people retain implicit cognitive knowledge**
  - Interaction with technology should capitalise on this
  - Most current systems and devices rely on explicit knowledge for use

➢ Design/develop tangible interaction around the retained skills of older users

- **Family members need to be informed about elders' states and needs**
  - Can then respond in a timely and sensitive way
  - Contact/visit/involve as needed, not intrude

➢ Unobtrusive detection/communication of activities and states

- **All this demands user-led innovation for success**

Ballesteros, S., Reales, JM. (2004). Intact haptic priming in normal aging and Alzheimer's disease: evidence for dissociable memory systems. Neuropsychologia, 42, 1063–1070.

# AGNES User-led innovation

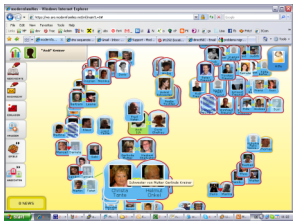
- **We don't know in advance what will work for older people & their families**
- **An evolutionary approach to design and implementation**
- **Users actively involved in design ad testing from the beginning**
  - Requirements, scenarios, suggestions, reactions
  - Iterative design prototypes - system and components
    - Allow older users to communicate requirements, preferences
    - Discussion objects, test use, selection, field trials
- **Creative tension with technical work**
  - Technologists want early specifications
  - User-led innovation **means** keeping design options open

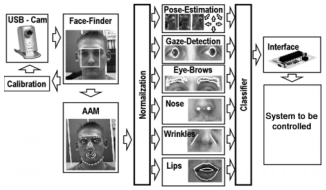
Waterworth, E L & Waterworth, J A (2006). The ELITE approach to designing IT for elderly. Gerontechnology, 5(2), 2006.

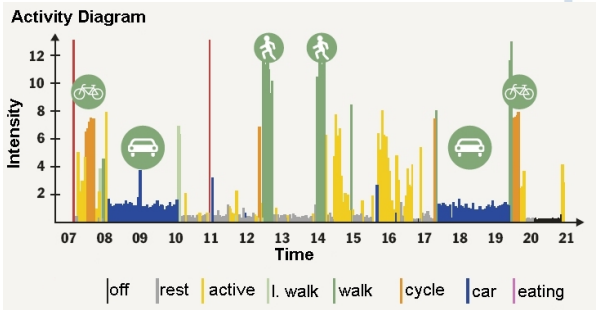
# Work plan

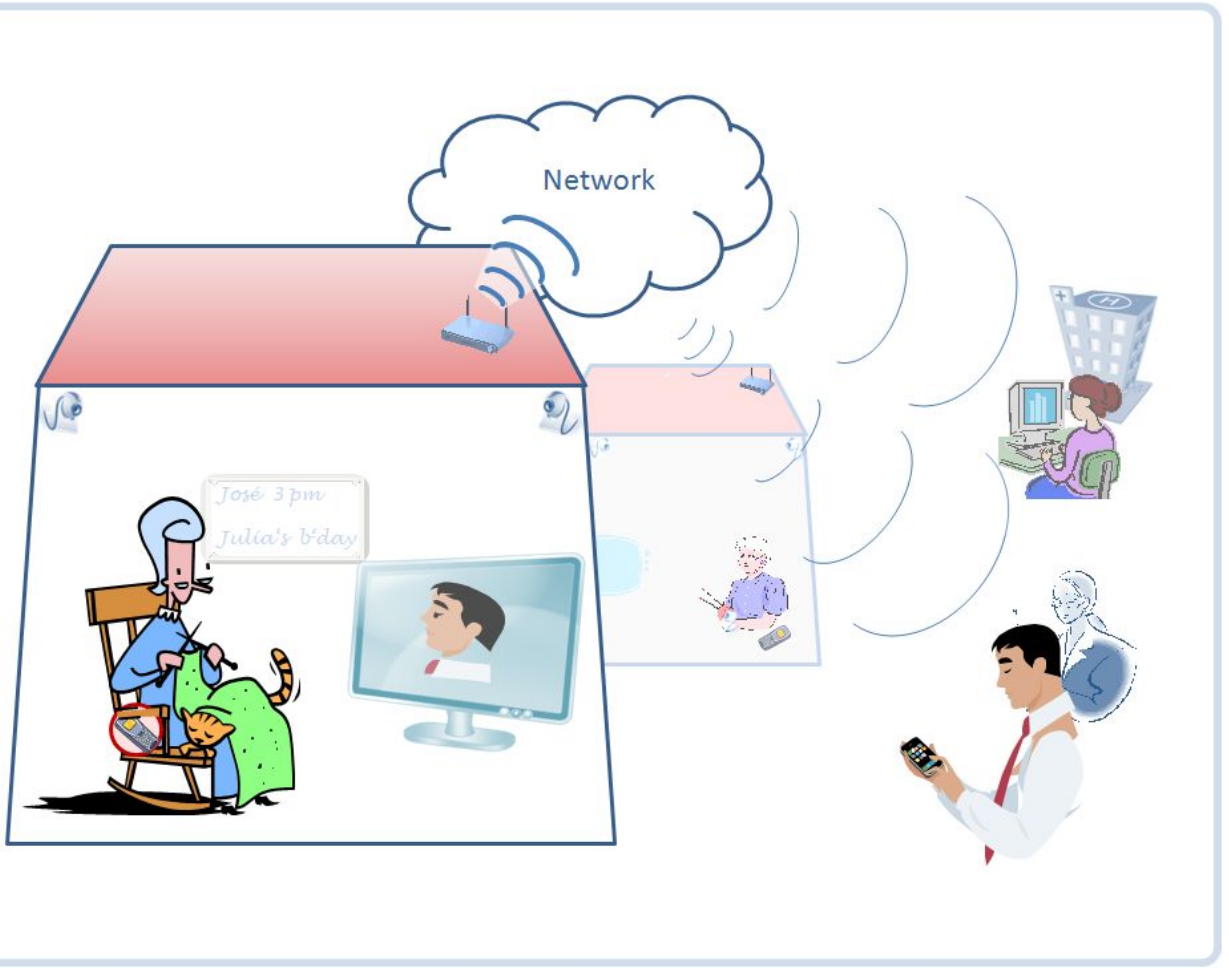
- **Incremental and modular design and implementation**
  - Involving users at every step in design and evaluation in use
    - Approach and components
    - Including field trials of 3 stages of prototype
- **Starts with a dedicated family social network**
  - Built around the old person and family
  - Can include non-active networkers (e.g. pets, babies)
- **Progressively add, test (and remove!) features:**
  - Detection of users' states and activities without intrusive sensors
  - Ambient devices for display and interaction
  - Tangible interaction objects for participation
- **Provide a platform for future modular applications**
  - Develop test applications (e.g. Games) that use platform
- **Investigate psychological and social impact**

# A sketch of the elements of AGNES





# Evaluating impact on users and their families

- **Investigating the psychological and social impact**
  - Before, during and after, with and without AGNES, across 3 cultures
  - Users, family and other caring persons
- **Select end users, calibrate wellness status at the start of trials**
  - indicator of changes in general health and cognitive functioning over time
- **Tests of specific cognitive abilities and mood states,** e.g.
  - Mini Mental State Examination tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language.
    - Versions are available for all relevant languages.
  - Self-Assessment-Manikins (SAM), devised by Lang (1980),
    - extensively tested in conjunction with the International Affective Picture System (CSEA, 1999)
    - graphical version can be used across different language speakers
- **Interviews, both structured and unstructured,**
  - with elderly users, family and other caring persons
    - including social and practical aspects

# Commercialisation aspects

- **ONDA Communication, ModernFamilies, CanControls**
  - Plus user organisations and other partners
- **During AGNES, we will:**
  - Develop a commercial dissemination plan
  - Conduct specific assessment of market values
  - Aim towards cheap technology for mass deployment
  - Develop a specific product roadmap
- **Market opportunities include:**
  - Stimulation of bandwidth requirements
  - Devices for state/activity detection, ambient/tangible interaction
  - Services, especially in social contexts
- **Telecoms, equipment, device and service suppliers**

Financial support for AGNES is provided by the Ambient Assisted Living (AAL) Joint Programme, a new joint research and development (R&D) funding activity implemented by 20 European Member States and 3 Associated States with the financial support of the European Community based on article 169 of the EC treaty.