

Ambient Assisted Living research in CareLab

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The ageing society

Demographic trends are signalling the overwhelming need for ICT based consumer health and wellness applications. One of the high potential growth areas is the elderly care domain: according to the World Health Organization, worldwide the proportion of people age 60 and over is growing faster than any other age group. Hence, there will also be a reduction in the number of people that can provide care to seniors. This clearly points to an opportunity for technological solutions to support independent living for seniors. Ambient Assisted Living refers to electronic environments that are sensitive and responsive to the presence of people and that provide assistive propositions for maintaining an independent lifestyle.

Health and wellness applications span the continuum from fitness applications up to remote patient monitoring systems for chronic care patients. The development of these solutions requires a continuous user involvement to ensure a seamlessly fit with user needs and preferences and to promote care provider endorsement.

CareLab



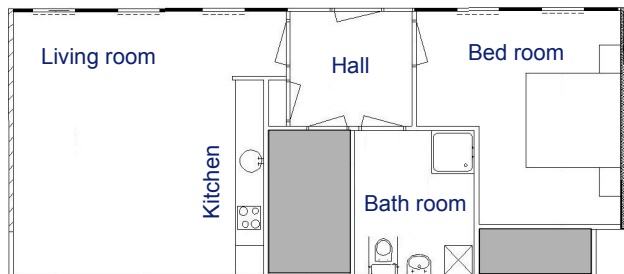
As an instrument for ensuring early user involvement in the development of innovative applications of technology, a CareLab is established at the Philips High Tech Campus in Eindhoven.



This CareLab resembles a one-bedroom apartment for seniors and is equipped with a rich sensor network to study the contextual settings in which people will use the health and wellness applications. The sensor information is processed and combined to extract higher-order behavioural patterns that can be related to activities and states, such as the presence of people, the state of the home infrastructure, etc.



With the CareLab it is possible to explore at an early stage the user's acceptance for these solutions and to assess the interactive and functional qualities of these solutions before deploying these into field settings.



Ambient Assisted Living

Both demographic and socio-economic trends have pointed to the need for Ambient Intelligence (Aml) concepts and technologies to go beyond the realisation of entertainment scenarios and to support people in maintaining their wellbeing. These Aml concepts and technologies should address user needs by focussing on the *safety and protection* of the personal environment and the *stimulation and enabling* of elderly to maintain an active lifestyle.

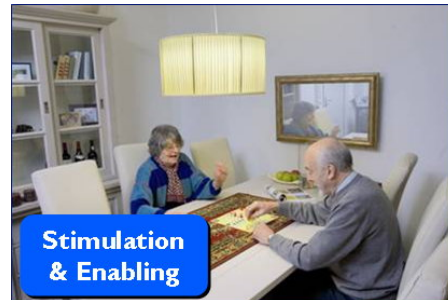
Safety and protection

According to the World Health Organization 30% of people over 65 and 50% of those over 80 fall each year (2004). Twenty to 30% of those who fall suffer injuries that reduce mobility and independence and increase the risk of premature death. In addition, depression, fear of falling and other psychological problems are common consequences of repeated falls. Within this context it is clear that there is an important role for intelligent environments to provide a feeling of safety and protection by means of contextual monitoring.



Stimulation and enabling

The process of normal aging comes with several forms of physical and cognitive decline. Such decline can lead to situations of reduced mobility and in turn leading to reduced social embedding in society. Aml environments can provide the feeling of self-efficacy by offering solutions for stimulating physical and cognitive fitness and enabling active participation in society.



Current research topics

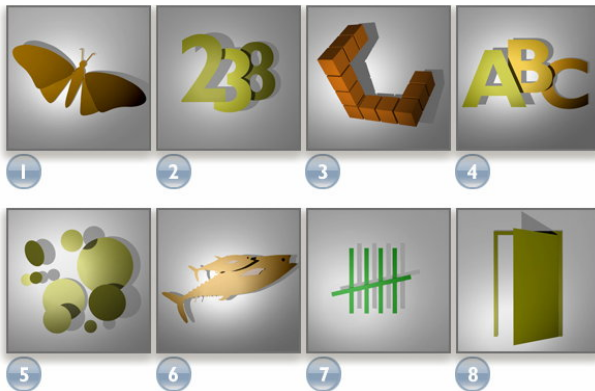
Lifestyle assistant



Within the CareLab we have implemented and tested a Life Style Assistant system that offers an intelligent and adaptive home environment system to enable elderly to maintain an active, healthy and independent lifestyle. It targets seniors' need for safety & protection by means of a remote monitoring service. A range of distributed sensors register activities inside the home, which are processed by a context-aware reasoning engine.

This reasoning engine identifies potential critical incidents and in response alerts care centres or relatives. In addition, the Life Style Assistant system offers several interactive comfort services for elderly, such as meal ordering.

Cognitive stimulation



Cognitive performance is known to decline as a result of aging. It is also known that mental activity can positively affect people's cognitive performance (Salthouse, 2006). By offering an interactive service proposition elderly can train several distinct aspects of their cognitive capacities. A community view representing members' frequency of playing induces a social motivation to further stimulate participation. This

promotes a feeling of participation in society, while diminishing their experienced loneliness and decelerating cognitive decline, hence promoting healthy and independent aging. The platform for this service is an IP-TV to allow for integration of multiple services and functionalities through a device that is familiar for the elderly. Our ongoing empirical studies have indicated that elderly experience this as an attractive proposition while there are quantitative indications that such training enhances their performance on tasks related to for example selective attention and stimulus discrimination.

Social connectedness

As humans we have a strong need for feeling connected to our social environment. Starting in early childhood development there is social interest that drives our personal and social development. Given the significant lifestyle changes (e.g. retirement, reduced mobility, losing a partner) that come with normal ageing, there is a need for elderly to feel included in society. This feeling can be elicited by means of awareness systems. Awareness systems are a class



of computer mediated communication (CMC) systems that help individuals or groups build and maintain a peripheral awareness of each other. In a social context, interpersonal awareness can be considered as an understanding of the activities and status of one's social relations, derived from social interactions and communications with them. Technology mediated awareness is achieved not by direct interaction or sharing a physical space but by means of CMC technology. Using a sensor network we have designed such an awareness system. This system captures and interprets contextual information related to the daily activities of elderly and presents automated diaries on a picture frame as awareness information for their children living at a remote location.

Our empirical studies (both in the CareLab setting and in field tests) have indicated that there is a significant increase in feeling connectedness between elderly and their children (as reported by the Affective Benefits of being Connected questionnaire) while the elderly report a significant reduction in the number of subjective complaints (as assessed by the Symptom Check List-90 questionnaire) when having the awareness system in their home environment.

Future research directions

Besides continuing our research into technological solutions for enhancing *safety and protection* of the personal environment and the *stimulation and enabling* of elderly to maintain an active lifestyle, future research within the CareLab is focussing on (i) end-user programming, (ii) ambient awareness and (iii) motivation and behavioural change.

End-user programming

In order to fully tailor the functionalities and benefits of an intelligent environment to individual needs and preferences, end-user programming techniques are being developed for seniors. With these end-user programming or end-user development (EUD) techniques elderly can easily set up the system according to their own requirements. This will provide them with a sense of control, thereby promoting the acceptance of Aml concepts and technologies. End-user programming techniques require research into user models and software component infrastructures (de Ruyter, 2006). With financial support of the European Commission ¹ a research roadmap into the development of EUD solutions was generated.

Ambient awareness

Providing end-users with a feeling of reassurance with regard to the wellbeing of remote friends and family requires some level of contextual awareness between people. Research into the semantics for capturing and rendering contextual information is essential towards the realisation of Ambient Awareness systems.

Motivation and behavioural change

As Aml concepts and technologies are becoming more integrated into our daily lives it is expected that these systems will go beyond providing entertaining experiences and move into the domain of inducing behavioural change. These Aml concepts and technologies will have to master techniques for motivating people to change the way they live in order to promote enhanced healthcare and wellbeing.

Conclusions

In the coming decades 'safety and protection' and 'stimulation and enabling' will be imminent areas for Aml concepts and technologies. In order to fully meet the demands of the elderly target group it is essential to understand acceptance issues, and user needs regarding for example end-user programming, ambient awareness and behavioural change. Integration of services addressing various user needs will stimulate acceptance and hence, market uptake.

¹ • EUD Net (2002-2003): Network of Excellence on End-User Development. The goal of EUD-NET was to help the European Commission to prepare a research agenda in the end-user development field for the next framework and to increase contacts among highly-qualified research centres, both academic and industrial, in order to speed-up the production of innovative ideas and approaches.

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About the authors



Boris de Ruyter has more than 11 years of experience in heading international and multi-disciplinary research projects. After his graduation, Boris de Ruyter has worked as a research assistant in experimental psychology, at the University of Antwerp. Since 1994 he has been with Philips Research where he works on user-system interaction research. His research focuses on user modelling and psychometrics. He is an author of multiple international publications and owns numerous patents. Since 2006 he has been appointed principal scientist and is coordinating the research domain Interactive Healthcare at Philips Research Laboratories Eindhoven.



Elly Pelgrim holds a Masters degree in Economic Psychology (Tilburg University) and a Professional Doctorate in Engineering (Eindhoven University of Technology). She has been working as a user-system interaction researcher, during which she has been involved in various multicultural research projects, leading to several scientific publications and presentations at internationally renowned conferences in the field of Human-Computer Interaction.