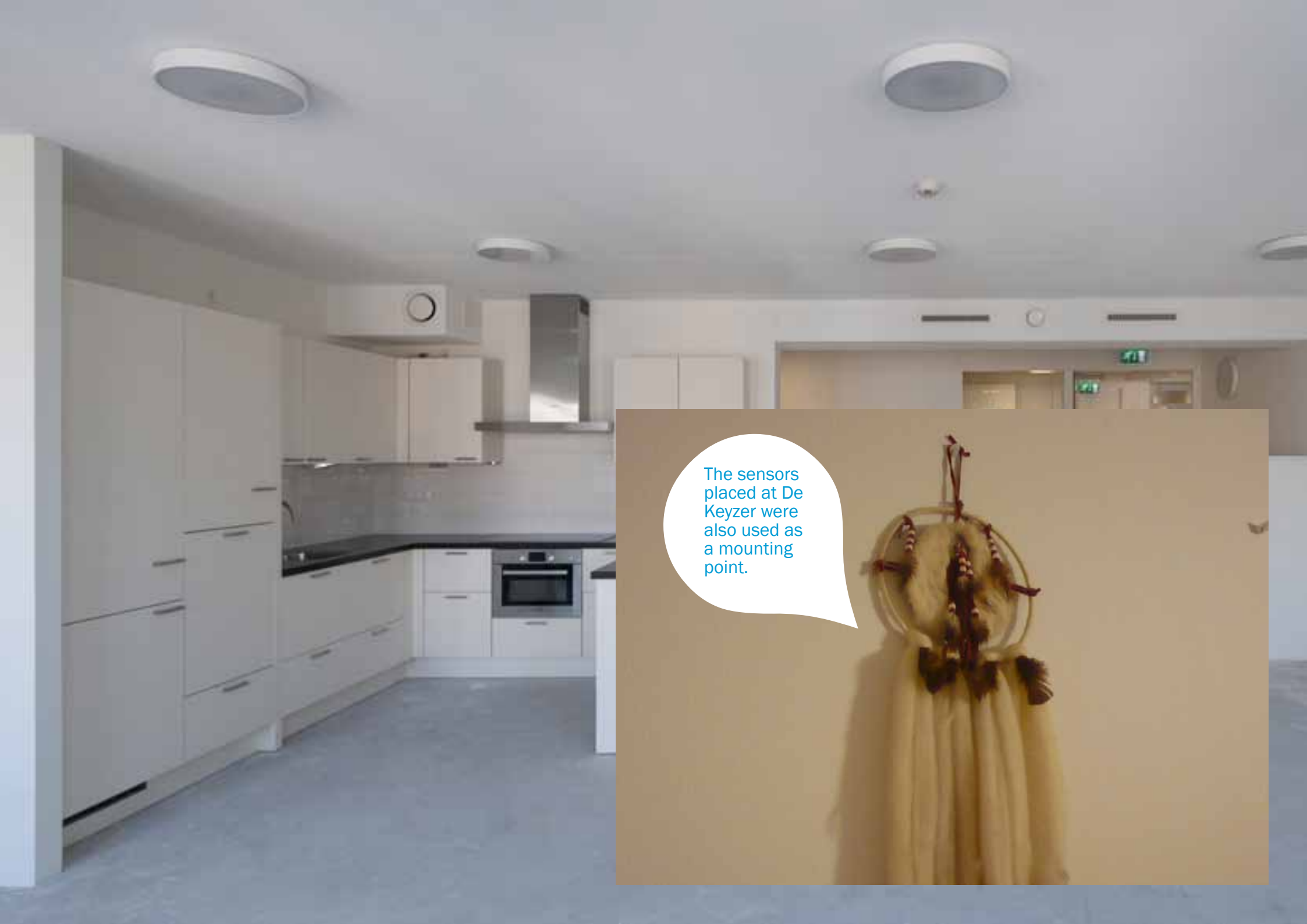


# Innovation in health care together with end users



Experiences and recommendations  
from Living Lab, Amsterdam



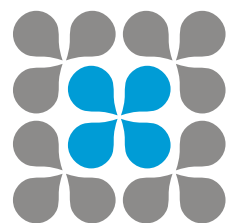
The sensors placed at De Keyzer were also used as a mounting point.





# Innovation in health care together with end users

Experiences and recommendations from  
Living Lab, Amsterdam



amsterdam region  
**zorg en ict**  
health-lab.nl

Testing applications with real users of health care.



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The Health-Lab team

# What did we do at Health-Lab?

## Health-Lab: an introduction

The Amsterdam regional authorities wish to take the first concrete steps in launching a regional initiative to encourage all stakeholders in this area to make Care & ICT a policy spearhead. Health-Lab was an open experimental environment in Amsterdam (with 'Living Labs' for Care & ICT purposes) with users taken as the starting point, an environment in which concrete applications could be developed and tested together with their actual users.

The essence of the project was that suppliers and users should come into direct contact. Health-Lab gave care organisations, knowledge institutes and governments, together with large and small businesses, the opportunity to find realistic solutions for one of our greatest societal challenges: how are we to safeguard the quality of health care, and control its costs, in an ageing population over the coming decades?

The project focused on three aspects::

- building and maintaining a platform for all care and other organisations playing a role in health care;
- developing Living Lab locations for the design and realisation of innovative care solutions that actually work;
- creating and adapting curricula aimed at the use of ICT in health care, both for students and in adult education settings.

## Why Health-Lab?

*Health-Lab: a unique partnership between care, education, business, research and end users.*

In this project, end users – residents, carers and family members – played a central role. On the basis of personal input – users' motives, needs, wishes and feedback – researchers, carers, designers and users together embarked on an iterative process. Interdisciplinary teams were able to share and utilise to best effect a wide variety of expertise. This generated a better understanding of the target group and the context in which its members live.

Consequently, the end results succeeded more often in meeting the target group's real needs and wishes. Short lines of communication between the different disciplines ensured that information or requests could be transferred and carried out quickly and effectively. Collaboration in this kind of multidisciplinary team is a win-win situation for everyone; policy-makers get a better 'feeling' for the target group, researchers and designers have access to end users, and carers can continuously feed their input into the process.

### *An open experimental environment*

In developing ICT care applications it is important that 'technology push' is abandoned in favour of working from the perspective of its actual users: care clients and care givers. This is why the Living Lab approach was chosen. It means that the various users were involved in the project at an early stage and played an active role in the research trajectory. This developmental methodology gives the greatest importance to users' physical surroundings, to users themselves, and to their first reactions to this use. Further development is inspired by the intended users and their use contexts, and links experience, content and technology.

### *Forming a new Care & ICT vision*

Close cooperation between policy-makers, researchers, developers and the care community allowed a nuanced picture to be formed of the applicability and relevance of ICT in care. This picture provided good input with which to shape a future vision of Care & ICT. Within a Living Lab, showcases can be developed which also help to create a foundation for this vision.



9.24  
WANNEER KOMEN  
JULLIE WEER?

9:02  
WANNEER KOMEN  
JULLIE WEER?

HENK

A care scenario  
made at one of  
the knowledge  
workshops.



### *Educating the professional practitioners who shape the future*

This can only be achieved by offering unorthodox combinations of disciplines, such as information science, care, technology and design, in close collaboration with the business world and the professional field. In the care technology minor that we have developed, care and technology students work alongside clients and professionals on selected healthcare issues. These issues can be addressed using (future) digital products and services. In the lessons, students learn how to design products in a user-centred way and gain knowledge of the newest technologies. A large part of this Dutch-language minor is devoted to work on a challenging project, which students do in groups for 2.5 days a week in the (care) organisation of an external client. On other days, the students learn about:

- technological developments in healthcare, such as care domotica, sensor systems, robotica, m-health, teleconsultation and gaming;
- modern design methods, taken from the creative industry;
- developing apps;
- the ethics of care;
- rules and regulations on care technology;
- applied research skills;
- team projects - working with different disciplines.

About 20 students a year are currently taking this minor. Working together with care professionals in different locations of the care organisation Amsta, over the last year residents and students have worked on several inspiring projects to develop and implement technology in care. (See the appendices for an overview of these projects.)

### Aims

The aims of this Health-Lab were to provide a framework for a future 'smart home' for elderly people in which they could lead independent lives for a longer time. The criteria for this framework were derived from the existing knowledge and expertise of all the project partners, and the 'user experiences' of the (future) residents of these houses.

The relevant questions here are: how are older people to live safely and independently for longer? How can this best be supported? How can respectful, meaningful interaction with support systems be instated? How does one offer support without taking over? How can sensors be used, not just to measure or safeguard the lives of older people, but also to enrich them? How do you make a system or a coach an agreeable partner that meets user needs? This brochure gives an overview of the issues and describes the project partners' approach.

### Partners

The consortium of knowledge suppliers and educational centres in the Living Lab comprised the VU Free University of Amsterdam (Vrije Universiteit Amsterdam, VUA), the University of Amsterdam (Universiteit van Amsterdam, UVA), the Amsterdam University of Applied Sciences (Hogeschool van Amsterdam, HVA), Waag Society (WS), the Amsterdam Economic Board, and of course the care provider Amsta. The following organisations were also involved in Health-Lab: INHolland, Sigra, Amsterdam DWZS, and Almere DMO.

The project was financed by the Dutch Ministry of Economic Affairs, Agriculture and Innovation; the Municipality of Amsterdam; the Municipality of Almere; and the Province of North Holland.

### The Health-Lab target group

The focus of our Living Lab approach was to enable elderly people to live independent lives for as long as possible. This meant that it was extremely important that the solutions put forward by the creative industry and ICT were 'accepted' by their end users. The aim was to equip several existing care complexes as Living Lab environments, to support the design and development of new care solutions using ICT (care technology).

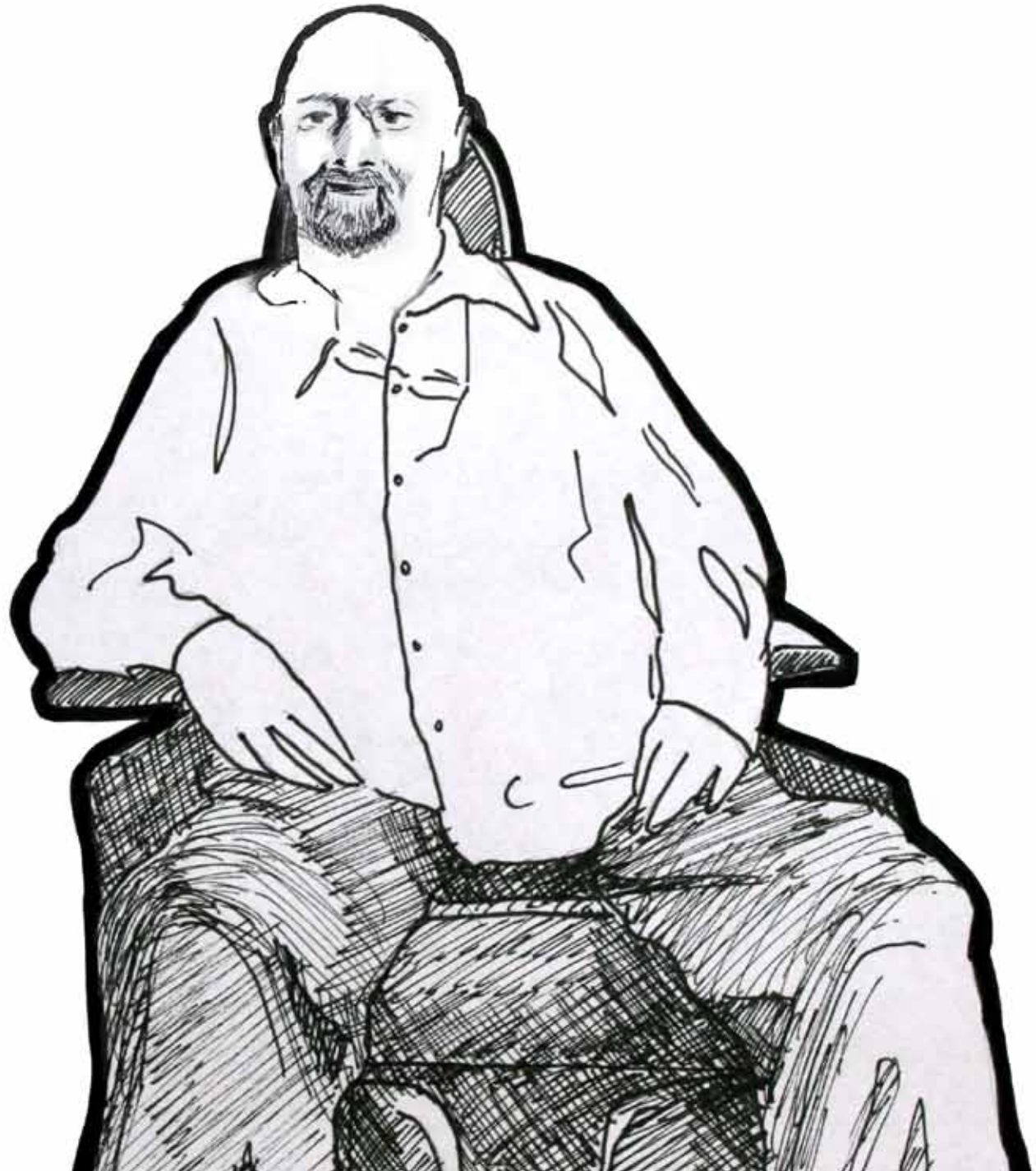
By practising in a 'real-life' setting, suppliers, users and customers got the chance to see what worked and what didn't before deciding to scale up proposed solutions.

The following Amsta locations were part of Living Lab Amsterdam within the Health-Lab project:

- de Keyzer
- Flesseman
- De Schutse
- De Poort
- Funenpark
- Overtoom
- Dr. Sarphatihuis
- Nellestein

Inspired by the Amsterdam projects, independent living projects have now also been launched in Blaricum (the Naarderheem / De Flank location).

On the next pages we will describe the cornerstones of the Health-Lab project.



## How did we approach ‘innovative care’?

### 1 Care technology (Care & ICT)

In our ever-more computerised society, care technology will inevitably play an important role as an ‘enabling’ technology, and it may even be the only way to manage the issue of costs and quality. By enabling more efficient care, ICT can make a substantial contribution towards solving the problem of rising care needs as the consequence of an ageing demographic.

### 2 Users as designers

‘Users as designers’ is a development methodology in which end users and other stakeholders are involved in the development of new products or services aimed at meeting user needs. An important part of this approach is the equal standing of the roles given to the user and the designer / researcher, and its recurring motif is the personal input, motives, needs, wishes and feedback provided by users.

### 3 Mixed methods

The Living Lab approach did not focus on a single research methodology, but sought to combine qualitative and quantitative data; subjective user data was linked to objective data obtained through sensors, for example. Insights gained during small-scale user research (interviews, focus groups) were tested over the longer term in the Living Lab environment (observation, interviews, sensor and system data logging).

### 4 Knowledge sharing

All knowledge gained in the Health-Lab environment has been made freely available via an online platform, meetings, and publications. Not only project partners, but any other interested parties have access to this information and can get in contact with each other through the platform. This knowledge will also form the basis for the creation of new educational programmes.

### 5 Real-life test environment

Health-Lab offered research institutes and companies the opportunity to discover the user experience of their applications in a real-life environment, and with access to expert knowledge and expertise. When testing in such real-life environments, the likelihood of acceptance is held to be higher.

### 6 Multidisciplinary teams

One reason that ICT remains underused in care settings is unfamiliarity with the possibilities. Working in integrated teams ensured that opportunities for using ICT to improve care provision were strongly expanded. Health-Lab partners included knowledge institutes, businesses, care providers, and also educational organisations, which played an important role and became a driving force for care innovation.



To follow is a short introduction of the methodologies that were used within the Health-Lab research.

# Health-Lab methods: which methodologies were used?

## *Design methodologies*

### Interviews

Interviews played an important role throughout the entire Health-Lab process. An interview is a crucial tool, both for obtaining direct insights into the target group and for keeping its members involved. After every knowledge workshop, the insights gained and issues identified were checked against the target group. Interviews were also used to obtain feedback on the applications and sensors being tested.



### Observation and co-creation

Observation is about watching how something happens or how someone behaves in practice, because what participants say in an interview is not always exactly what they mean. This was why it was essential to explain concepts, applications and systems to their users, preferably in their actual living environments. Combining interviews and sensor data with observations allowed an extremely rich data set to be collected. Users were also asked to take part in the design process, thereby adapting the design to their wishes.



## Shadowing

In 'shadowing', researchers spent a day accompanying the residents of a care home. For Health-Lab this meant that two researchers spent a day supporting an occupational therapist in supervising activities and lunch. In this way the researchers developed a feeling for the experiences of care clients, gained insight into their needs, and saw how these needs were appropriately met.

## Portraits

Portraits are personae based on real people rather than fictional ones. One familiar person is used as the starting point for a portrait. A portrait often provides a more consistent and thorough picture, because extrapolations derived from the creation of the portrait can immediately be tested against the actual person.



## Scale model

To support the co-creation process use was made of a scale model of the accommodation arrangements in the Keyzer. The scale model comprised seven sensors (detecting the number of people in the room, the use of the kitchen cabinets, the use of the toilet, etc.), imitating the situation in the subject's own accommodation, each connected to a separate display indicating the registration of an activity. The main aim of the scale model was to inform the Keyzer residents about the sensors their homes were being equipped with. The elderly residents could act out their daily activities in the model and get an idea of what was happening. This scale model will also be used for future research in other homes.



## Scenarios

Scenarios, or user scenarios, were used to visually describe the interaction between users and systems / applications or between system components themselves. Within Health-Lab these scenarios played an important role in supporting the interviews about sensors. The scenarios supported the researcher's explanations and questions, thereby helping the user to gain insight into the research project as a whole.



## Focus groups

Within Health-Lab a variety of applications were tested for usability, acceptance, etc. Focus groups were employed to get feedback from users. Focus groups are made up of a selection of people representing the users, brought together to discuss specific subjects and issues. The data collected was mostly qualitative, that is, it was information which could provide insight into people's opinions and values in relation to the applications being tested.

## Pilot studies

In pilot studies, a prototype was tested by a user over a longer period in their daily life. This allowed the researcher to examine whether the prototype was accorded a place in the user's daily life, and how it was experienced over the longer term, once the novelty had worn off.







## Knowledge workshops

An important part of Health-Lab were the 'knowledge workshops' specifically intended to allow project partners and experts to exchange knowledge and go deeper into specific research themes. Each workshop focused on a specific theme, and began with presentations of insights acquired and issues raised by project partners and experts. For each theme, participants jointly formulated the issues these workshops raised and how they would be presented to users. This was done using hands-on sessions and (for instance) portraits or scenarios.

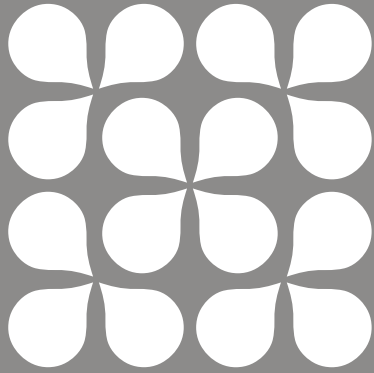
## Measurement instruments

### Questionnaires (qualitative and quantitative)

Health-Lab employed both qualitative and quantitative questionnaires. The qualitative questionnaires were especially useful for gaining insight into users' needs and experiences. The quantitative questionnaires were employed in order to support verdicts on the effects of a given intervention. Health-Lab also experimented with the development of empathic questionnaires; in these, the questions were visualised as far as possible and attuned to the daily living experiences of the user.

### Sensor data

In late 2011, eight homes for the elderly in the Czaar Peterstraat neighbourhood of Amsterdam were equipped with simple movement detection sensors that reacted if an activity took place: for instance, human movement, cupboards or doors being opened, or the toilet being flushed. This sensor data could then be analysed in a number of ways. We looked principally at Activities of Daily Life (ADL); by measuring these we could say whether someone was functioning relatively independently, and whether they might need a hand. We also sought to use sensors in combination with other products and services.



## What did we learn?

### Research recommendations

#### Living Lab design

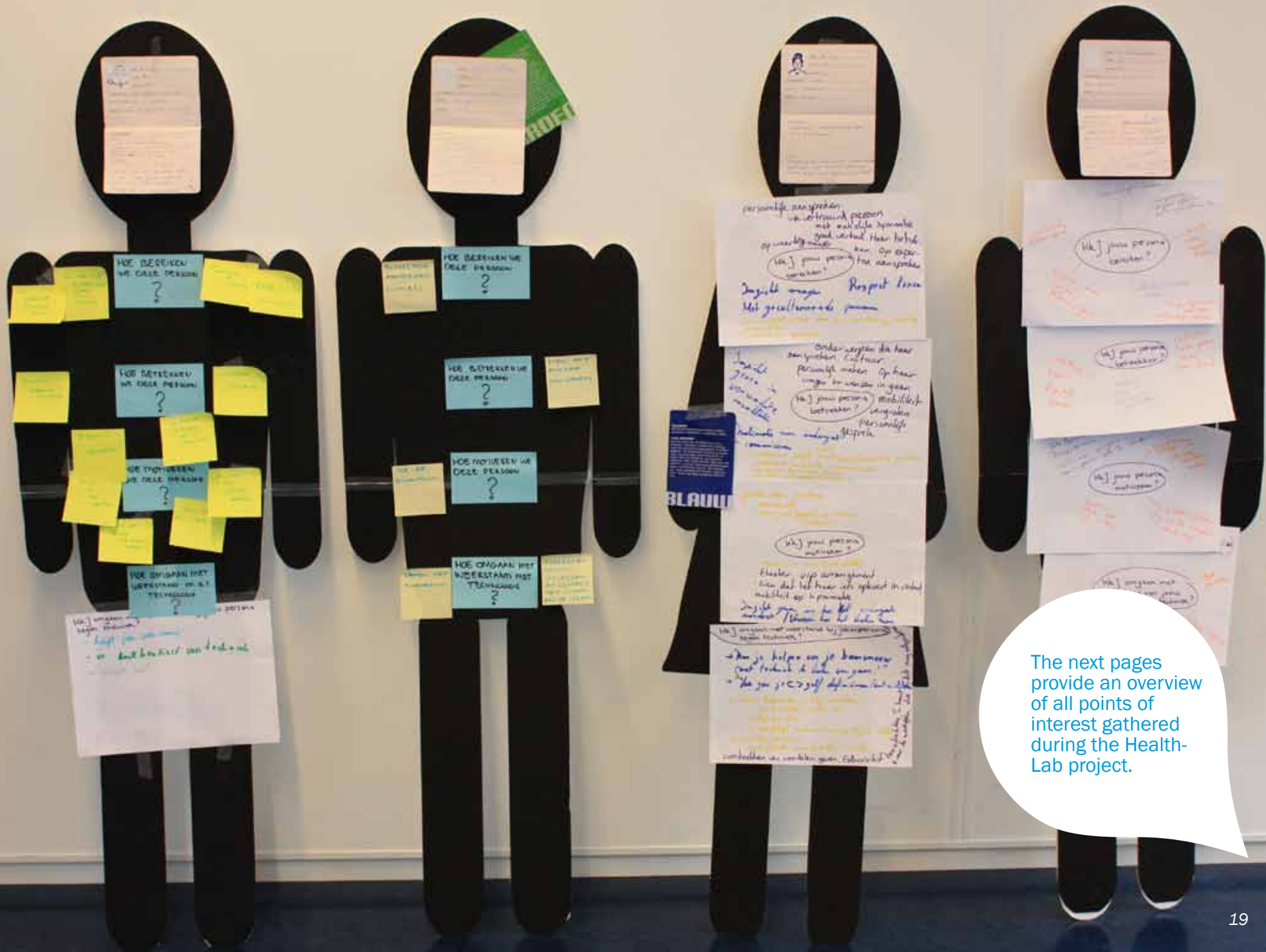
##### *Putting together a multidisciplinary team*

When putting together a multidisciplinary team, it is advisable to look at which aspects need to be covered and to select a team on this basis. Within Health-Lab the combination of care, education, research, design and policy worked very well. Another useful addition might have been the economic aspect – someone to look at business cases, implementation and valorisation. The experience within Health-Lab was that collaboration with small and medium-sized enterprises remained hesitant because of financing arrangements and intellectual rights issues.

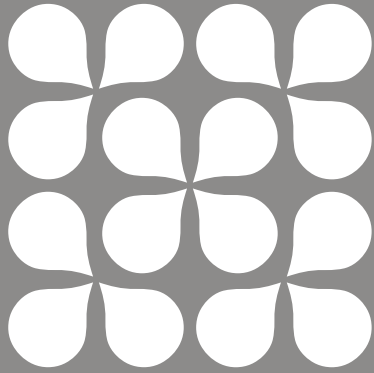
##### *Involving care professionals*

We recommend appointing a single person as a fixed contact within the care organisation. This might be the head of the department, or another person closely involved with the care organisation who knows the caregivers well. Working with this person, a strategy must be developed for involving the other carers; for instance, by establishing which of them are 'pioneer types' who would be the most interested in taking part in this research. However, careful attention also needs to be given to those who are not persuaded of the importance of the research. It is essential that all those involved feel heard and are taken seriously.

It is wise to approach caregivers before care recipients are involved in this research, so that they are in a position to answer residents' requests for explanations and details. It is also wise to inform them of every step being taken. A workshop on the applications being researched can also be helpful, so that carers have an opportunity to see them, and perhaps try them out, for themselves.



The next pages provide an overview of all points of interest gathered during the Health-Lab project.



#### *Involving care home residents*

Together with the caregivers, or a representative, the residents' profiles are examined: which residents need which approaches? Do any of them have special needs? Which residents would be most likely to be willing to take part in such research?

Within Health-Lab it became clear that when a caregiver approaches residents, reactions can vary. When a trusted person approaches the residents, this does much to ensure that the shyer, more retiring people amongst them can be persuaded to take part.

It is advisable that the caregiver warns the resident in advance that a researcher is going to be paying a visit. As a researcher it makes sense to ask, at the end of each session, whether you can come back, rather than trying to explain everything at once.

In order to get to know the residents better the researchers can also come and spend a day doing volunteer work; this applies not just to the contact people in the project team, but to the entire project team, who will then get a clear impression of the users they will be working with. It also ensures a more natural kind of contact, since each party becomes accustomed to the other. It is wise to do this well before the research begins, so that working methods can be adapted to individuals if necessary.

#### *Communicating with care home residents*

It is advisable to bring an information folder (with lots of pictures, a large font size, and contact details) to one's first meeting with care home residents, so that they can look at the information again later. It is always a good idea to have lots of good visual support for your presentation, for instance photographs and film clips. It is also important to ask after the resident's family, and to invite them, if this is appropriate, to the next meeting.

Residents need to be given enough time to think about whether they want to take part in the research. Post sent to care home residents can easily be mislaid, so it is advisable to bring important documents, such as consent forms, to every meeting.

Researchers should always remember that care home residents' experience of the world is a very different one from their own. Information, if it cannot be grasped in its entirety, can quickly become overwhelming. Information should therefore be given in smaller doses, and attuned to the resident's own experience of life.

#### *Doing tests with care home residents*

For most care home residents, the products or prototypes being tested are entirely new and unknown. If more than one product is going to be tested, as is often the case in Living Lab settings, start with one product and inform the resident about this product step by step. It is inadvisable to show all the products at once and ask the resident to choose which one they want to try,

as the sheer amount of new information may be overwhelming.

#### *Co-creation with elderly people*

With regard to the generation of ideas, co-designing with elderly people is not very different from other sessions that employ 'Users as Designers' methods. The attitude of elderly people may surprise; they are often rather modest, and are clearly unused to the idea of devising a concept in order to meet their own wishes. If the designer steers the process, however, by asking direct questions one step at a time, it is perfectly possible to co-design with old people. Their input is principally of practical value.

#### *Technical challenges*

In care institutions the presence of a Wi-Fi internet connection is by no means a given. Arranging internet access can take a long time, for all sorts of reasons, and it can even prove impossible. If a Wi-Fi connection proves impossible, it is useful to have 3G equipment to fall back on.

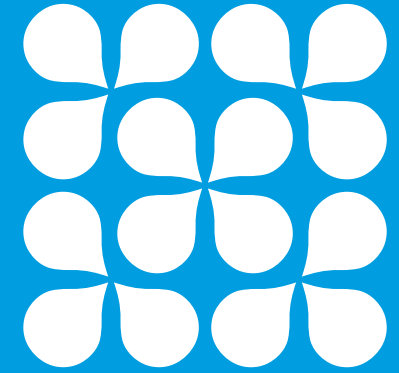
In Health-Lab, the sensors were installed in the living spaces well before the research began. The advantage of this was that the cabling and equipment could be neatly concealed. The future residents of these spaces were not asked about this, however, because at the time of installation it was not yet known which specific residents would live there. Ultimately sensors were installed in all the dwellings, while only three of the eight residents agreed to take part in the research.

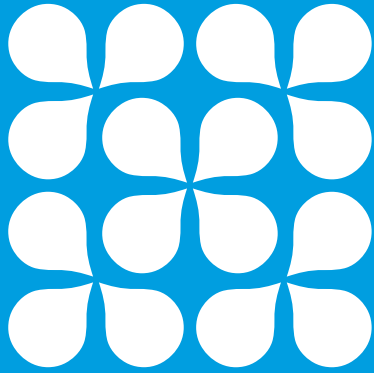
It is therefore open to question whether it was a good idea to pre-install the sensors, so it is advisable to consider the advantages and disadvantages of advance sensor placement.

#### *Scope of research domain*

The test environment of a care home offers only small-scale test possibilities. While it can deliver a great deal of valuable qualitative information, more robust conclusions can only be drawn on the basis of tests involving larger and more varied groups.

Within the Health-Lab project, the Living Lab was employed for the purposes of research and pilot studies. A Living Lab setting is also an excellent tool, however, with which to encompass the entire development trajectory of care innovations, including the development of business cases. A Living Lab can also be usefully employed to measure effects before and after an intervention, allowing reliable judgements to be made on its effectiveness.





## Documenting research results

### *Unexpected findings outside the research scope*

During a research project there can be findings that fall outside the scope of the research. It is nevertheless advisable to include these findings. In the Health-Lab project these results turned out to be so rich that they were regarded as an unexpected but interesting deliverable, such as the booklet 'Real life care stories'.

### *Noting learning moments*

In the course of a research project things occur that at first surprise, but later become 'normal'. It is advisable to make a note of such surprises as learning moments. Within the Health-Lab project, this was the case in a number of areas, such as how one should first approach residents (by visiting) and the unexpected fact that most residents read no mail.

## Ethical aspects

### *Offering tested products afterwards*

After each research project was completed participants were offered the opportunity of purchasing, at a small price, the products that had been tested. The participants were thereby offered a way to retain their new skills and possibilities. Several participants made use of this option.

### *Post-participation emotional impact*

Participants in these research projects are given extra attention for a considerable length of time and build up an emotional attachment with the researchers. After the project is over, this can lead to an emptiness in their lives. It is advisable to handle this issue carefully and sensitively.

## Cooperation between project partners

### *Expectation management*

It is important to reach clear agreements in advance with the project team on the aims of the research, its planning, its research questions, its design, the desired output, and who is responsible for what. A joint communication plan can be made detailing who should be contacted in the course of the research, how, and when.

It is advisable to appoint one or two contact persons within the project team to be responsible for maintaining contact with participants throughout the research project. It is important that communications with residents and carers are unambiguous. If persons other than these contacts wish to approach participants, it is advisable to set up a protocol in advance which lays out who can be approached and how, and specifies that the 'official' contact be apprised of this.

### *'Professional deformation'*

Working in multidisciplinary teams has great advantages, since everyone benefits from everyone else's expertise. The downside, however, is 'professional deformation': professionals tend

to see all problems from their own professional perspective. The solution demands empathy, but above all the willingness to let go of existing views. Professional jargon poses another possible problem to communication, especially if the same term has different definitions in different professional domains. Setting up a glossary of shared terms can help.

## Innovation recommendations

### User-friendly

#### *Simple and intuitive*

Older people often resist having to learn to deal with computers or unfamiliar technology, so an application's user-friendliness and the intuitiveness of its interface are very important. Safety and independent use also play an important role.

In contrast to today's trend towards all-in-one systems, in interviews older people often expressed a preference for one clear functionality per device. For instance, they would rather see an interactive week schedule on a separate screen than on their TV. And that separate screen should not be used as an interactive picture frame, either, because an additional decorative function is "a confusing distraction".

#### *Feedback to users*

In certain cases (such as for reasons of privacy) it

is desirable that systems or sensors provide user feedback, for instance to show whether they are switched on or off. In doing so it is important that this information is provided effectively (whether visual or textual) and appropriately to the person's individual needs (general or detailed).

Elderly people can be insecure because they are afraid of doing something wrong, so giving clear directions and affirmation is important. They also often need repeated explanations, such as daily training or a course in learning to use a tablet. Care training students can be useful partners in this respects, and can yield interesting learning experiences for both parties.

#### *Adaptiveness*

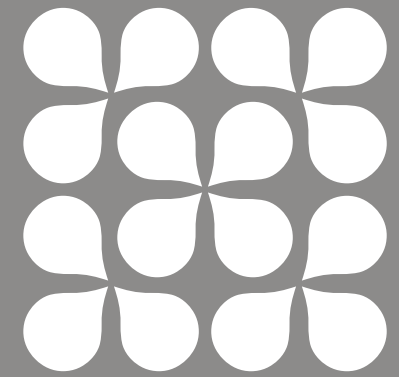
A 'smart' home is one in which integrated equipment can also adapt itself to the user's needs. If the user is going to be actively using the equipment, they will also have to adapt to its requirements in order to learn how it is operated.

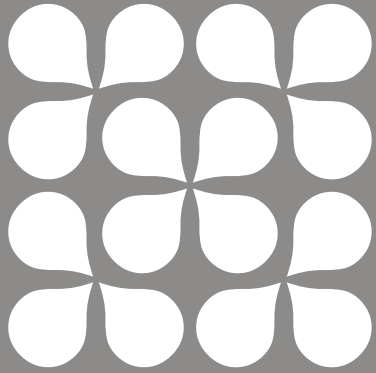
#### *Installation requirements*

'Smart' equipment can be installed in the home either temporarily / movably or permanently. Permanent installation can be a major operation and for some devices can be achieved only if installation takes place before the resident moves in.

### Usability aspects

The design of products and interfaces must take account of the physical and mental process-related constraints that older people face.





Physically, account must be taken of limitations such as trembling hands and waning fine motor skills, but also of the constraints faced by wheelchair users, who must also be able to reach buttons and switch devices on or off. If eyesight is impaired, contrast should be heightened and small details / letters avoided. Elderly people have themselves indicated that in their own experience the colours red and black are the most conducive to clarity.

### Privacy factors

#### *Anonymity and security*

If residential user data is collected then it is most important that their personal privacy is safeguarded, not just for ethical but also for security reasons. The data must therefore be made inaccessible to unauthorised persons.

#### *Privacy*

If sensors or other devices, for instance a digital coach, are present in the home of an elderly person, this can influence their sense of privacy. Notably, elderly people themselves often report having no problem at all with the privacy aspect of (for instance) sensors; it is often care professionals or family members who are more concerned. Research has shown that elderly people weigh up the privacy aspects against the advantages that the product confers. They feel strongly about safety, so older people are often inclined to accept the presence of sensors in their homes. The question is whether older people are fully able to appreciate the consequences of this kind of equipment.

#### *Autonomy*

An important aspect of wanting to live independently is the right to self-determination. Elderly people generally want to manage their own lives. This means that data cannot simply be stored without reason, but that everything should be discussed with the resident; they should also have the option of looking at the data for themselves.

#### *Trustworthiness*

A 'smart' home should give an elderly resident a feeling of increased safety and should support them in leading an independent life. The trust in the system itself is therefore crucial.

### Standardisation of technology

Older people become progressively less able to absorb new procedural knowledge, so it is important that technology is standardised so that users can exploit their existing knowledge.

### Undesired side effects

A care technology can have beneficial effects on well-being, but it can also have negative effects. If a care technology emphasises a person's limitations (for instance, failing eyesight means that an iPad is hard to use) or if it actually emphasises a person's lack of social contact (perhaps with the tiLumi) then an innovation will end up achieving the opposite of what is desired. It is important to examine these issues in the design and test stages.



# Target group recommendations

## Target group diversity

### *Cultural diversity*

Educational programmes and governmental policy make no distinctions on the basis of diversity. The native Dutch population is statistically much older than the immigrant population, but according to the CBS this demographic is going to change; the proportion of non-Western, elderly immigrants will rise strongly in the coming years. This means that the group of elderly people needing care will show increasing cultural diversity. Care staff have traditionally been female and Western, and care providers would do well to anticipate this development by including a larger proportion of allochthonous Dutch in their care staff in the coming years.

### *Target group diversity*

Elderly people are a very diverse group. There are differences in lifestyle, income, family circumstances, social background, and needs, besides differences in psychological and physical condition. 'Age' itself plays a role; there are 'young' and 'old' elderly people, and there is at present a large group of 'young' old people on the way with their own specific issues with the use of care technology. The developers of care systems for older people are therefore well advised to set these systems up in the form of a platform that enables older people to choose and create functionalities for themselves. Nevertheless,

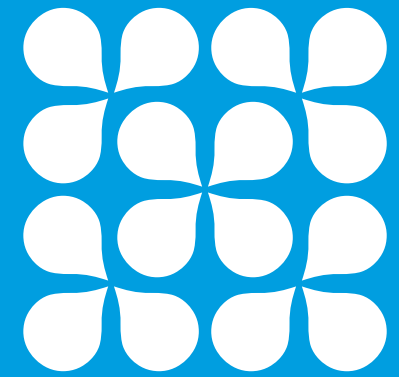
research has shown that many older people do share many of the same values: peace and quiet, self-determination, and social involvement are generally held to be important. Our own research showed that there were two main groups of older people. One wanted system output but was unwilling to generate its input, preferring to observe than to participate. They attributed this to difficulty, time constraints, and physical infirmity. The other was made up of older people who were keen to think along with researchers and designers about the subject, and willing to try out many different things.

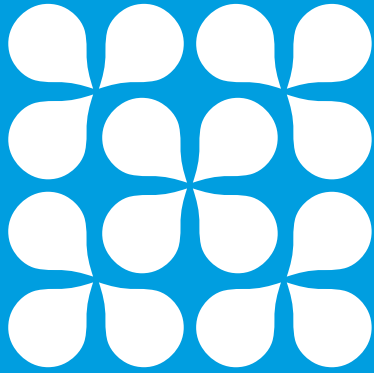
### *Differences between men and women*

If men and women are to be given equal care, account must be taken of sex-specific differences. According to caregivers men and women are susceptible to different ailments and often have different complaints, but in particular need they different things in order to prevent these ailments. In our research we also noticed that older men and women tend to have different ideas about their daily routines, preferred activities, and degree of social contact. The men showed less need for social activities, and preferred to determine their own level of social involvement, ideally through their own families. The women showed a greater need for contact with their immediate social environment, saying that they liked to know what was going on and to be part of it.

### *Surroundings*

Besides elderly persons' individual needs and wishes, it is becoming increasingly clear that their physical and social surroundings has an influence





on their ability to cope independently and their psychological health.

### Care client attitudes towards care technology

#### *Motivational aspects*

People have different motivational reasons for moving around more, for instance, or for starting an activity. These triggers work best when they are made to measure. Rewards are often needed, not just at the start, but at later intervals in order for people to stay motivated. For all the older people in our research, safety was a strong motivator for accepting a given system.

For users with certain physical limitations, technology can sometimes confront the user with this limitation, for instance in the case of the woman in the iPad study who had impaired vision. “I see it getting worse every day. That makes me unhappy.” She was unwilling to learn new and interesting things, because she would then know what she was missing if it became impossible later on.

#### *Using technology*

The use of technology played a central role within Health-Lab. Some older people were experienced users of technology, while others had no experience at all, or were even afraid of it.

#### *Motivation for participation in research*

In recruiting subjects for research, personal contact is particularly important. This gets people actively involved in the whole research

process, and gives them insight into how the research is progressing. This applies not just to care residents, but also to their families and professional caregivers. It is important that they see beneficial results. It also helps if key figures (people already known to them) affect their first introduction to any new technology.

#### *Acceptance*

The use of technology in care settings requires its acceptance by care clients and caregivers alike. The more favourably this acceptance can be influenced, the quicker this acceptance will be. Many care home residents are reluctant to try new technologies out, so it is advisable to begin by demonstrating simple, user-friendly technologies. Giving clear instructions, and providing help if there are any problems, can diminish their reluctance to trying out a new care technology for a while.

Interviews with residents of the Living Lab revealed that to make a system acceptable to everyone it would have to be adaptable to individual needs, because people’s wishes differ. Many also wanted to be able to switch the system on and off; this gave them a sense of control over the system, instead of the other way around.

Many of the older people in our research indicated that the visible intrusion of a technology posed no problem whatsoever. They were already quite used to the visibility of aids of various kinds, and this visibility bore no relation to the independence or safety these aids provided.

### *Perception*

It is important to understand why end users react in a given way to an intervention; why they are either in favour of it, or against it. Direct contact with the end user is important to this understanding. Contact with care professionals is important in putting things into perspective, but a care professional should not be approached without consulting the end user; care professionals can have a tendency to think on behalf of their clients too much, and may also reject new technologies because of perceived threat to their daily roles.

### Care professionals

#### *Attitudes towards technology*

Care professionals often display an ambivalent attitude towards new care technologies. On the one hand they are open to improvements that make their work easier; on the other, they are uneasy about a perceived threat to the human aspect to care, which must not be allowed to disappear, and fearful that new technologies might bring more administrative tasks.

#### *Motivation for participation in research*

Amongst care professionals, the motivation for taking part in research is very disparate. Within the Health-Lab project, closely involving care professionals at the earliest possible stage was an important part of promoting motivation.

#### *Acceptance*

Caregivers fear the complexity of technology while also fearing that it might make their job

redundant. This means that they should be introduced to these themes and technologies in a conscientious way, for example by holding a workshop in which a variety of technologies can be tried out. One often finds there are two groups of people, one group that greatly enjoys trying things out and is eager to get going, and another that is reticent because everything is new and unknown. With a reticent group it is advisable to start with a simple technology they can try out straight away, so they can see for themselves what possibilities it offers and what the consequences might be for their work.



## What has the Health-Lab project delivered?

- Research results and recommendations
- 'Smart' home, research tool
- Booklets 'Real life care stories' (published in Dutch and an English translation)
- Exhibition 'Portraits of residents' from the publication 'Real life care stories'
- Communication pack: website, Facebook page, publications (see Appendix)
- Scale model
- Care Festival
- Close collaboration / short communication lines within care, education and the creative industry in Amsterdam

### What next?

The Health-Lab project has taken firm steps towards employing new technologies in long-term care for the Amsterdam region. Through a variety of meetings we have created enthusiasm for its potential. Care education and training now makes use of modules developed by Health-Lab to prepare future caregivers for the future use of care technologies. And last but not least: in the various Living Labs we worked together with end users on care technologies that people actually want to use.

The aim was always to allow elderly people to run their own lives as long as possible by expanding self-reliance, stimulating social networks, and giving people a better grasp of the care they need. New technologies offer all

sorts of opportunities to do this, as was demonstrated in the various Health-Lab projects and workshops.

The care system will face serious challenges in the coming years. The decentralisation of care is shifting funding responsibility from the national (AWBZ) level towards the local (council) level. This enables the provision of more specific care, but it is being accompanied by a 25% budget cut. People will be expected to make less use of care professionals and to meet more of their own needs independently, with the help of their own social network.

The 'cheese slicer' approach to cost-cutting will not help us with these changes and budget cuts; such systemic changes mean that we have to think radically about how we organise, provide, and manage care itself. The key concepts in this process are self-reliance, social networking, and the more efficient use of professionals.

The overarching aim for the Health-Lab project, as agreed with the Amsterdam Councilman and the care institutions, was and remains: by 2025 everyone should be able to arrange and manage their own care. A variety of projects were launched to examine the role that technology could play in realising this objective: how video can be used to deliver care efficiently and appropriately, how tablets can play a role in maintaining warm and frequent contacts between geographically separated parents and children, how sensors can provide people with feedback and motivation, how a digital coach can help people to structure their days, and much more.

All these examples fit seamlessly into the direction in which our care system is going to start moving in the

coming years. The knowledge that has been gained in the Health-Lab project can therefore be used to build on. The networks it has brought about, linking professionals, volunteers and elderly residents, will be valuable assets in testing and scaling up new working methods over the coming years. Its focus on care clients and on support for their independence and self-determination has therefore created a solid foundation for this future.

Together with the partners involved in the Health-Lab project – the care institutions, knowledge organisations, municipalities, businesses and naturally the client organisations – we therefore look forward to setting up still more activities that are both inspiring and practical, and carrying them out to reinvent the care of the future!

Together we are definitely aiming to attain the aim of full care independence for all by 2025!

## Which specific research projects were carried out?

Research with end users is logically always depending on their cooperation and that of their social environment. That the content and relevance of research depends on the chosen research methodology has already clearly been explained before, but the physical location of the research definitely also defines part of its quality.

The care institution Amsta has facilitated research at several of their care homes. An important achievement in the success of the research was the involvement of Amsta. An essential step in the process was raising support among all personnel and of course the residents of the care homes and their representatives. Besides that, the Central Clients council was involved in the pilot studies and asked useful, critical questions about the workings of the equipment and the various privacy aspects.

Amsta employees made a valuable contribution to the following projects by providing the real issues in health care, by overcoming the scepticism about technology and by counselling many researchers and students. Every mentioned project hereafter has benefitted from that. That we can look back on so many successful projects is not only the merit of Amsta, but also of the partners that were willing to share their experiences in presentations and explanations.

### Measuring health using environmental sensors

Timespan: ongoing, began in June 2011  
Contact: s.m.b.robben@hva.nl

Elderly people living independently can be given specific support by sensors which can detect emergency situations (e.g. somebody has fallen) but also slow-moving, latent problems. This research project, part of the Digital Life lectureship of the HvA together with the UvA, is directed principally towards the latter situation. The central question is: can sensors be used to measure functional health? 'Functional health' indicates the extent to which a person is able to live at home independently and carry out their daily activities.

The project involved researchers and students from a variety of disciplines concerned with the technical development, data filtering and analysis, health measurement, and so on.

Researchers: Margriet Pol, Saskia Robben, Gwenn Englebienne, Bas Terwijn, Ahmed Nait Aicha, Ben Kröse, (Tiska Issing), (Rachel), (Kristin Rieping).

#### *Research design*

To determine whether functional health can be measured using sensor data, this data is being compared with the results of health assessments held every three months over a year-long period. Data is now being collected from 23 people in all, at four different locations. Much attention is being given to the ways that sensor data can be analysed.

Questions answered with the data include:

- Which data characteristics are important to measuring health? (includes characteristic extraction based on expert knowledge, using genetic algorithms and unsupervised clustering techniques).
- Is it possible to reliably detect visits?
- How should data best be filtered (noise, visits)?

#### *Principal findings*

Some characteristics are universal, but many of the characteristics that correlate with health vary per individual. For instance, some people withdraw if they feel ill, while others become restless.

The project has given much attention to the technology aspects; experience has been gained with developing a dedicated sensor network installed during a building's construction phase, and also with collaborating with a commercial party (not all companies want to share data).

With thanks to Zorggroep Vivium Naarderheem, Amsta, Stichting Blarickhof, van Dorp Installateurs, ZvM, and Gezondheidscentrum Delloods in Blaricum, without whom this research would not have been possible.

## What do elderly people think of sensor monitoring?

Timespan: ongoing research with a variety of sub-projects, involving many elderly people in the Amsterdam region.

Contact: s.m.b.robben@hva.nl / m.kanis@hva.nl

It is important to be wary of 'technology push': just because something can be done does not necessarily mean it is desirable. The HvA therefore values the opinion of elderly people themselves on sensor monitoring. Because the technology itself is invisible, the research is also examining how interactive technologies can be employed to help explain the principles of sensor monitoring. The project involves a small number of HvA researchers (Marije, Sander, Saskia, Ben) and a large number of students.

- Senior Create-IT: three students from the Intelligent Environments minor (Sean Alizadeh, Milad Khalili and Jesse Groen) developed a scale model and a simple application to help explain how sensor monitoring works, and interviewed five elderly people to find out what they thought about it. An improved version of this scale model was then developed in cooperation with Waag Society. (Denise Iglesias, Bas Withagen, Miriam Reitenbach, Marise Schot)
- CMD-2011: five groups of five students from the HvA's Communication & Media Design programme each made an application to make sensor data understandable for elderly people. The subjects were involved in this design process to ensure that the products developed would be usable.
- ET-Tech: three occupation therapy graduation students (Judith Hagen, Anne Bimmerman, Natasja

Wagelaar) then used these applications in their research into what elderly people thought of sensor monitoring. They carried out four part-projects: a survey (n=41), interviews (n=6), focus group sessions at which people could try out the applications (n=14), and finally the best application was tested at two elderly people's homes for a week.

- Linkage: A computer science student (Mike Trinh) ensured that the best application was linked up to the sensor systems, so that elderly people could try this application out at home.

### *Principal findings*

Elderly people do not want to share sensor data with everyone; for instance, they might be willing to share it with care specialists, but not always with their families (even if the families themselves are keen to know whether all is well). Visual tools help to explain how sensor monitoring works.

Most elderly people have no special interest in their own sensor data, but once the application has been installed in their home they do take more interest. Many acknowledge the usefulness of sensor systems, but this is often 'for when things get worse later' or 'for the next-door neighbour, she's not very strong'. Elderly people do not see themselves as old and needy.

A recurring theme amongst the elderly was the importance of cost. This was also seen in practice, when subjects would turn domestic equipment off to save on energy costs. It is vital that designers involve older users in the design process at an early stage; the students who often did so were more successful at designing products that older people actually used. This often begins with simple things like font size and

applications designed so that users didn't have to click through menus.

## Data importance and visualisation

Timespan: November 2011 – May 2012

Contact: s.m.b.robben@hva.nl

Sensor monitoring offers new possibilities to care specialists. Instead of using the information exchanged during a consultation, specialists have access to a new information source which makes it possible to continuously evaluate long-term behaviour patterns. This can help to detect latent health problems. However, it was still unclear how this data could best be interpreted for specialists. Computer science student Mario Boot therefore researched into the questions: which anomalies in activity are important to specialists? And how can these best – that is, most clearly – be visualised?

### *Research design*

In an iterative process, visualisations were presented to specialists (occupational therapist, physiotherapist, psychologist) to determine which was the clearest, most helpful way of presenting data anomalies. The specialists were also asked which anomalies were the most significant (through group discussions, focus groups and questionnaires).

### *Principal findings*

Most specialists want to be able to see a long-term overview in a single glance.

Which anomalies are most important depends on the specialism. For instance, for a psychologist shifts in

pattern are important, while for a physiotherapist the sequence of activities is unimportant as long as they are carried out.

#### *Follow-up: SensErgo*

To gain a better understanding of which anomalies in daily patterns are most important to which specialisms, in early 2013 four graduating occupational therapy students (Kimberley Baars, Gerlize Bijman, Elise Kroon and Marlon Mientjes) started a wider study amongst a larger number of care specialists. To support this research, a short film was made that explained sensor monitoring. The results of this research were not available at the time of writing, but it is known that 666 care professionals from a variety of backgrounds have completed the questionnaire.

### How are you doing?

#### 1: Exploration

Timespan: pilot project within the framework of the 2012 study programme  
Contact: s.m.b.robben@hva.nl / m.kanis@hva.nl

An increasing amount of technology is finding its way into elderly people's homes, both alarm systems and new systems that monitor a resident's activity and health. However, these do not usually allow older residents to tell others how they are feeling. A group of third-year CMD (Communication and Media Design) students was given the assignment to design a solution. The resulting technology had to be adapted to elderly residents' experience, rather than demanding that they themselves adapt to the technology.

Students were encouraged to involve elderly users

in early design stages, and to frequently show them interim results for small-scale user research. For this reason, many of the solutions employ metaphors that come naturally to older people. The result is eight very different prototypes which elderly residents can express how they are doing and be in touch with those around them. These solutions varied from speech recognition to televisions, easy-to-use social diaries and networks, mood dials and magnetic boards.

#### *Principal findings*

Many students experienced initial difficulties with this unfamiliar target group, many of whom are entirely unaccustomed to using ICT. Ultimately, however, they succeeded in identifying with their situation and designing devices in keeping with their experience of the world. An ongoing task is the more thorough evaluation of interfaces by older people and students not involved in their development. In addition, two students and a small company are working to combine the best ideas to create a new practical application for older people to use.

### How are you doing?

#### 2: Mood Dial

Timespan: Spring semester 2013  
Contact: s.m.b.robben@hva.nl

Working together with an installation company (Van Dorp zorg en welzijn), the best ideas from the first project are being developed for inclusion in an existing sensor system. The 'Mood Dial', a revolving dial (inspired by the thermostat) which allows someone to indicate how they feel, is particularly popular. Two students from the HvA Care Technology minor

(Amber Mollee and Rossy Lazarov) are now using focus groups to evaluate the best aspects of the eight applications. Two other students from the HvA Intelligent Environments minor (Andranik and Patrick) are building an improved prototype that can be integrated with the technology used by the company, and interviewing caregivers and care clients to identify needs and preferences.

#### *Principal findings*

The project was not completed at the time of writing, but a number of lessons may already be drawn from it. For an end product to be used on a larger scale, production costs have to be limited. This means that some good ideas have to be abandoned at the outset, and creativity is really put to the test.

As has also been shown in previous studies, it is caregivers who are most interested in sensor data; elderly residents themselves can sometimes be quite nonchalant about it. Elderly residents see little of a sensor system, while it does offer a degree of safety and security, but older people are not always motivated to actively send data on how they feel. Many older people also want to trouble their caregivers as little as possible.

### Design for wellbeing

Timespan: Spring semester 2012  
Contact: s.m.b.robben@hva.nl

Sensors offer possibilities other than the measurement of health indicators. The houses that Health-Lab fitted with sensors therefore also served as test-bed for other services. The Design for Well-being project (HvA

together with UvA, TU Delft, TU/e, Connectedcare, Flank Naarderheem) focused on the development and testing of a new application whose aim was to facilitate communication between elderly residents and volunteer carers (generally family members), who would then also gain more insight into the resident's activity patterns. What they get to see is a rather simple variant (e.g. 'present', 'asleep', 'in the kitchen'), since elderly people do not always want to share everything about themselves. The project also looked at how sensor data can help designers to test and improve a product. The Health-Lab researchers (Saskia and Bas) were accompanied by other researchers and students (Martijn Vastenburger, Natalia, Daan, Sven and Yorick).

#### *Research design*

For three elderly residents and a number of their family members, who had already installed the sensor system in their homes, the application was linked to the sensors. The application came in two versions, one for the elderly residents and one for the volunteer carers. A number of questions were addressed:

- Did the application make people feel more closely connected?
- For designers, what are the best moments to ask people questions about this? (experience sampling)
- Can sensor data show changes in behaviour after an intervention?
- For developers, how can application use (alongside sensor data) best be described?

#### *Principal findings*

Participant selection is crucial; one of the participants had few care needs, another had already made good care arrangements, and another's family members did not wish to take part.

Many participants have no experience whatsoever with digital equipment! Some participants had difficulties using a tablet (e.g. because of weakness in the hands).

In projects like this, in which several parties are involved, it is important to agree beforehand on data formats. This can save a lot of time later on.

### Reducing disorientation in dementia (interactive wall)

Timespan: Spring semester 2012

Contact: p.wiggers@hva.nl / s.m.b.robber@hva.nl

Disorientation is a common aspect of dementia in the elderly. Zorggroep Vivium Naarderheem therefore gave an assignment to three students of the Intelligent Environments minor to develop something that might lessen the problem.

#### *Research design*

The students first spent a lot of time in a (closed) psychogeriatric department to observe matters for themselves. It is hard to teach new things to someone with dementia, so many standard interaction options were inappropriate. The students observed how the residents reacted to changes in sound, light and projections, for instance. They noted that many disoriented people were looking for something (the question asked by one, "Do you know the way to Naarden?" became the title of the project). The students then designed an 'interactive wall' with a 'window' to the outside world, showing images of the surroundings. If sensors in the ceiling detect that someone was approaching, sounds were played to entice them to come closer to the 'window'. A small-

scale observational study showed that people stopped and reacted to the wall more frequently when it was 'switched on', and feedback from caregivers showed that it had also triggered conversations.

#### *Follow-up (2x)*

In early 2013 the project was followed up in the form of two student projects within the HvA's Intelligent Environments minor. A group of students continued the development of the interactive wall at Vivium Naarderheem, where caregivers had indicated that while the wall was useful and beneficial, they wanted to be able to adapt its content to individual residents. The students developed a simple touchscreen interface for caregivers so that the images and films shown by the wall could quickly be changed.

A second group of students developed a new version of the wall for the Keyzer. This version was developed specifically for a home for six elderly people with dementia; however, it was focused not on reducing disorientation per se, but on activating and stimulating the residents, who were in different stages of dementia and reacted to different stimuli. Students developed a system that used automatic face recognition to detect who was standing by the wall, to select photos and videos accordingly, and display them in digital photo frames and an artificial window in the wall.

#### *Principal findings*

- Dementia patients benefit from an interactive wall, but its content should be attuned to the individual's experience of the world.
- Caregivers play an important role in the effective use of the wall, so its operation should also be simple and straightforward for them.



## A 'smart home' – through the eyes of...

Timespan: September to December 2012  
Contact: marise@waag.org

In this qualitative user research project, Industrial Design student Philemonne Jaasma charted the needs of elderly people in the context of independent living and technology. The aim of this research was to evaluate the overall 'smart home' concept by particular reference to the wishes of elderly people themselves and their motivation to accept such a system in their own homes. This creates insight into ways in which these needs can be met, which in turn stimulates the development of innovative care. The study concerned four residents, aged between 77 and 87, of Amsta's Flesseman care home. The concrete aim of the conceptualisation session was to find out whether elderly people with different profiles also led to very different concepts.

### *Research design*

Interview sessions were held with four participants, two men and two women. Each session lasted about 45 minutes. A variety of methods were employed to gain an impression of the subjects' experience of the world. The selected methods, which best supported the researcher's desire to work in an empathic way and test hypotheses, were one-on-one interviews, observations, scenarios, colour cards (developed by Smart Agent to categorise users by lifestyle instead of using general data), profile sketches, probes and finally a co-creation session.

### *Principal findings*

It was clear from the outset that all elderly people are

different, and the research confirmed that every elderly person has individual needs. On the basis of personal interests, four very different variants of the 'smart home' were designed. However, the underlying systems would also appear to be suited to other elderly people; it is the way it is used that makes a system personal. Those developing systems for the elderly to use are therefore well advised to set their systems up as a platform that allows its users to determine and create its functionalities.

In the colour card test, the participants were 'Green' and 'Blue'. This is because elderly people share many of the same values: they attach great importance to peace and quiet, self-determination, and social engagement.

The co-creation session revealed that elderly people preferred a system to generate output, rather than that they had to generate input. They enjoyed 'watching' more than 'participating', and explained that this had to do with effort, time pressures, and physical infirmity. Three of the four participants chose the Green colour card, even though the qualitative information made it clear that they had entirely different attitudes to life.

This raises certain questions:

- Is the colour card test in this form suited to elderly people?
- Does a person's past and life story determine a person's character to such an extent that the test should be done with a focus on the past, on 'how things used to be'?
- Are older people, perhaps because they become less physically active and therefore drop many of their hobbies, more likely to find themselves in the 'Green' world?

## tiLumi

Timespan: February to March 2012  
Contact: marise@waag.org

The aim of this test was to investigate whether the tiLumi would be appropriate to a care setting and how it was experienced by its residents. A tiLumi is a lamp with an internet connection, which displays the time, personal or standardised messages between friends ('Lumis'), and information. The study was carried out on behalf of tiLumi by Waag Society. For this test a single tiLumi was installed in an elderly man's living quarters in a care home. He was wheelchair-bound, but mentally fit and alert, and he had experience with technical products.

### *Research design*

The tiLumi was installed for a four-week period at the home of a resident of the Living Lab. A project logbook was prepared, which had questions about prior expectations and initial experiences. For the four-week period the participant made entries in the logbook, evaluating the use of the tiLumi and the amount of contact the participant had with family, carers, friends, etc. Once a week the researchers discussed the logbook entries thus far with the participant, asking supplementary questions if necessary. After the project was complete, the product was given another general evaluation by means of an interview. The tiLumi was also tested for a week at Waag Society itself.

### *Principal findings*

1. The tiLumi will need some adjustments to its ease of operation before it can be used in by a care client.

The tiLumi's functions are controlled, and it is switched on and off, by means of buttons on the top. Wheelchair-bound clients cannot reach these buttons, so the lamp is always on and always in the same mode. A variety of other services can be switched on through the tiLumi's dashboard interface on the internet, but our participant had not noticed this.

2. The tiLumi is unsuited to individual use in a care home setting as long as family members are not accustomed to sending Lumi messages.

When the tiLumi displayed the same message continuously this actually had a confrontational effect on the user, because it meant he was receiving no new messages. He became disappointed that caregivers and researchers were sending so few messages. There were a number of reasons for the fact that the business of sending Lumi messages never really got off the ground.

The participant thought it was a pity he could send no messages back; this was because the senders had no tiLumi themselves. And if they had, the messages were often sent with no sender name, so it was guesswork who the sender might have been.

3. The TiLumi offers interesting possibilities for communication between the residents of a single care home.

The tiLumi brings about a principally one-sided communication. By placing the lamp in the common room of a care home, residents and caregivers sending messages to the lamp would be sending them to everyone. The lamp would then present a good motivation to walk over to check whether there had

been any new messages, or to get into conversation with other viewers. If there were no new messages, a resident would not take it personally. In the research done at Waag Society it also became clear that users were strongly motivated to send personal Lumis, probably because the users inspired each other and because they could experience directly the effect that a message could have.

### iPad study

Timespan: September to December 2012

Contact: [marise@waag.org](mailto:marise@waag.org)

<http://waag.org/health-lab>

In a qualitative study, HvA students Erwin Goris and Suzanne Kessels were assigned by Waag Society to research into four residents (age > 80 years) of Amsta's Flesseman care home. The study examined:

1. How elderly people / care clients reacted to the iPad, and whether they learned to use it.
2. Whether the iPad could contribute to a sense of social connectedness and self-reliance.

### Research design

The study comprised three parts: an initial interview, six instruction sessions, and a final interview. Semi-structured interviews were used to obtain insight into the user's personal situation (physical limitations, daily activities, and social situation). The six instruction sessions had the following topics: connecting with Wi-Fi and basic principles; the keyboard; the keyboard (repeat); App Store; Internet, email and Skype; any desired repeats. At each instruction session, a manual was handed over which used text and pictures to

explain again what had been covered in that session. The final interview, which also used a semi-structured approach, looked again at the user's personal situation, discussed what kind of place the iPad had been given in the user's life, and evaluated the instruction sessions.

### Principal findings

1. The iPad can have a positive influence on the social life of elderly people.

Because the iPad provides user-friendly access to email applications and videochat applications like Skype, the iPad can contribute towards social connectedness. One test person said that the iPad had definitely brought about more contact with friends and family. For him, Skype was an enjoyable and interesting way to be in touch with his children and grandchildren: "Now I can see them."

2. iPad – physical usability for elderly people  
From the results of the study it can be concluded that elderly people can use an iPad provided they have no physical or mental limitations that might form a hindrance. A physical factor such as impaired motor skill made it difficult for users to make a tapping movement; the iPad then either registered nothing or saw it as a swipe. Positioning the cursor could also be a tricky problem, but a touchscreen pen provided an effective solution.

People with impaired vision need higher contrast and a larger image. The small grey icon on the iPad plug which indicates how to insert it into the iPad is too small and offers too little contrast for many elderly people to see. A support stand, provided it is easy to use, is a good way to prop the tablet at the best

angle for viewing. Limitations in mental processing require frequent repetition before something can be remembered. Consistency in, and clear distinctions between operational controls is essential. Elderly people are often insecure because they fear they will do something wrong, so giving affirmation and clear directions is very important.

### Remote care (Brevidius)

Timespan: 2012

Contact: p.wiggers@hva.nl

Old age brings ailments with it. Rehabilitation centres like Vivium Naarderheem offer care and rehabilitation (including physiotherapy, occupational therapy and speech therapy), and while patients benefit greatly from these treatments, the fact that they have to travel frequently to the centre in order to have them at all is a serious disadvantage. For the therapist the disadvantage of the system is that they see their patients only a few times and have only those moments to determine whether their patients are doing their exercises correctly and adequately.

Occupational therapy and physiotherapy students, together with the Brevidius company and Naarderheem therapists, investigated whether technology might provide a solution. For instance, a therapist could use a videolink to be in touch with patients at their homes, and might also be able to use this link to give advice during exercises. At the same time, patients with videolinks could be in touch with each other, for example to exercise together – each in their own home.

### Virtual coaching for elderly people

Timespan: September 2010 – July 2013

Contact: p.h.m.p.roelofsma@vu.nl

Network enrichment, friendship course, self-management, and breaking out of a sedentary lifestyle. Virtual coaching is a digital support system for elderly people in their daily living environment. The digital coaches are 3D virtual representations who address elderly people via a tablet and a touch screen in the living room.

#### *Research design*

The idea is to translate existing, validated, face-to-face interventions into interventions by a virtual coach. The system is developed in an iterative process, with continual input from elderly people themselves and care experts. Researchers examined the user experience of 3D virtual coaches and avatars (for user self-representation). One of the pilots researched the first prototype of a system intended to support network enrichment through virtual coaching. This test also assessed elderly people's user experience of tablets. Researchers looked at ergonomic factors such as the tablet's legibility, audibility and weight, along with the user experience of the virtual coach and the friendship enrichment programme. The evaluation and improvement point suggestions were reported to the ICT developers (in the V2me project) to support further development of the system.

A second pilot examined a new version of the system which implemented additional functions for the virtual coach and the friendship enrichment course. This concerned a number of extra lesson modules and

functionalities for creating user avatars. The evaluation and improvement point suggestions were reported to the ICT developers to support further development of the system.

A third pilot examined a new version of the system with even more functionalities, such as instant Skyping, messaging, storytelling, social circles and new lesson modules. The system was used by elderly people at home for a number of days. The evaluation and improvement point suggestions were reported to the ICT developers to support further development of the system. This pilot made use of the same elderly people who had taken part in the first pilot; these had turned out to be more positive about having a newer version of the system in their home. However, the analysis showed that the system had been used relatively infrequently. On the basis of the feedback sent to the developers, it is expected that this will improve when a new version of the system is tested. To this end, a number of follow-up pilots and a field study are planned for the near future.

### Virtual coaching for self-management and breaking out of a sedentary lifestyle

Timespan: September 2010 – July 2013

Contact: p.h.m.p.roelofsma@vu.nl

Three internal tests were carried out and the results submitted to the developers (in the A2E2 project). A pilot with elderly people is planned, to test virtual coaching for self-management of daily activities.

#### *Principal findings*

The input of the internal and external tests gave ICT

parties important information with which to better attune their ICT systems development to an older user population. Testing the software they delivered took longer than planned, because iterations – and the ICT adaptations based on each iteration – turned out to be more time-consuming for the ICT parties than had been expected. This was particularly true for tests of the system for self-management and breaking out of a sedentary lifestyle. The iterative testing of ICT care systems is an important part of the Living Lab methodology, which is why the choice was not made for a method using fewer iterations.

The fact is that this sort of ICT innovation project tends to take more time, or cost more, than was expected. All in all, the process as a whole has delivered important learning experiences about working with ICT parties, knowledge institutes and end users within the Living Lab concept.

### Exploration of the possibilities for monitoring social networks

Contact: p.h.m.p.roelofsma@vu.nl

A follow-up version of the network enrichment system will be given new functionalities that could serve as a possible instrument with which to monitor the working of elderly people's social networks and their development. One of these functionalities will be the ability to present network trends to different people involved (the elderly people themselves, family members, carers). Other proposed functionalities concern the automatic analysis of the network monitoring input, with certain indicators based on this analysis. A platform of this kind will build on the social

network enrichment platform developed within V2me. More pilot studies of the possibilities of social network monitoring are planned for the near future.

### Exploration of the possible effects of OpenCeilings on people with dementia

Contact: p.h.m.p.roelofsma@vu.nl

The VU has been in recurring consultations with Michiel Jenniskens of OpenCeilings to examine the possible effect of OpenCeilings on behaviour and experience on people with dementia. Over a number of meetings, information was obtained on the OpenCeilings concept and its operation. A literature study was also carried out into the effects of light and views (the two most important elements of OpenCeilings) on people with dementia. A report on this study has been completed and will play a role in the further discussion of the plans.

#### *Designing a network for participant recruitment*

Another VU activity in this work area concerns the development of a participation strategy with which to create a network of parties having access to potential end users. A number of consultations to this end have already taken place, both with partners from the Health-Lab project and with external parties (such as Cliëntenbelang). Contact will be sought with more external parties and meetings organised at which the various parties can meet each other and be informed about the work of Health-Lab.

### Technology for independence

Contact: p.wiggers@hva.nl

Care Technology minor students are developing an iPad application that helps young people with a mental handicap to independently carry out various tasks. Up to now, photo books with pictures of the tasks have been used to give these youngsters some structure, but this approach still requires supervisory support. By interacting with a young person's activities, an iPad application help to make them more independent.

### Tips for dips

Contact: p.wiggers@hva.nl

Students are developing a self-management application for people with depression, building on an existing intervention that uses a carousel of cards giving tips on how to prevent a relapse. The application is being so developed that by indicating how they feel the user is given an appropriate tip with a minimal number of actions.

# Appendix: publications

## Papers

- Kanis, M., Robben, S., Veenstra, M., Kröse, B. (2012) Visualizing ambient user experiences: Any how. Proceedings of Workshop on Crafting urban camouflage, DIS 2012, Newcastle, UK
- Kanis, M., Robben, S., Kröse, B. (2012) Miniature play: Using an interactive dollhouse to demonstrate ambient interactions in the home. DIS 2012, Newcastle, UK
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- Robben, S., Englebienne, G., Pol, M. and Kröse, B. (2012) How Is Grandma Doing? Predicting Functional Health Status from Binary Ambient Sensor Data. In AAAI Technical Report FS-12-01 Artificial Intelligence for Gerontechnology, 2012 AAAI Fall Symposium Series, Washington.
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- M.R. Boot. (2012) Visualizing and identifying relevant deviations in data from ambient activity monitoring. Create-IT Applied Research
- Bimmerman, A., Hagen, J.M., Wagelaar, N.J. Graduation report. Care technology and elderly. (2012) ('Zorgtechnologie bij ouderen: Hoe staan zelfstandig wonende ouderen (65+) tegenover sensormonitoring van de dagelijkse activiteiten in de eigen woning?' In Dutch)
- Trinh, M. Manual for iPad Applications. Internal report in Dutch (2012)
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- How are you doing? Projects 8x of student groups.
- Jaasma, P. (2012). Smart living ('Slim wonen', in Dutch)

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Ministerie van Economische Zaken





The Amsterdam regional authorities wish to take the first concrete steps in launching a regional initiative to encourage all stakeholders in this area to make Care & ICT a policy spearhead. Health-Lab was an open experimental environment in Amsterdam (with 'Living Labs' for Care & ICT purposes) with users taken as the starting point, an environment in which concrete applications could be developed and tested together with their actual users.

The essence of the project was that suppliers and users should come into direct contact. Health-Lab gave care organisations, knowledge institutes and governments, together with large and small businesses, the opportunity to find realistic solutions for one of our greatest societal challenges: how are we to safeguard the quality of health care, and control its costs, in an ageing population over the coming decades?

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