

# What Should a Robot do for you? - Evaluating the Needs of the Elderly in the UK

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**Abstract**—The increasing interest in the use of robotic assistive technologies in elderly care for the UK makes it necessary for roboticists to evaluate the needs, problems and demands of possible end-users of such technologies. Users of these technologies can be divided into three groups: informal caregivers (family members and friends), formal caregivers (medical staff, social workers, home-help), and the elderly themselves. In this paper we present the results of a series of focus groups conducted between March and May 2012. We used the metaplan method to evaluate the opinions and needs of each of the three different potential user groups mentioned above. In these discussions we extracted a variety of problem dimensions and their interconnections in order to understand in which parts of everyday life assistive technology could help, and is needed the most.

**Keywords**—elderly care; evaluation of needs; robotic assistive technology

## I. INTRODUCTION

The general aim of the work presented in this article is to develop scenarios and socially acceptable behaviours for a service robot that can be used for home assistance for elderly people, to facilitate longer independence for them at their own homes. In order to evaluate what a robot in such a setting should or should not do and how it should behave towards the users, we involved different potential user groups right from the beginning of the project. Our user-centred approach will help to make sure that the results will realistically reflect the everyday experience and needs of the potential end-users of assistive robotic technology.

This work was undertaken as part of the EU FP7 Project ACCOMPANY (Acceptable robotiCs COMPanions for AgeiNg Years) [1]. The goal of this project is to create a system in which a robot companion is integrated within a smart-home environment in order to facilitate independence at home.

We will start our paper by giving an overview of the motivation for this research, based on the demographic changes in the western population and a description of the ACCOMPANY project. This will be followed by a

description of the metaplan method and the experimental structure we used. At the end of the paper we will present our results and discuss their implications for the design process of robot home companions.

## II. MOTIVATION

The demographic shift presented by falling birth-rates and increasing life-spans is leading to an ageing population worldwide [2]. In the United Kingdom it is expected that by 2050 one person in four will be above the age of 65, and one person in twenty above the age of 85 [3]. These changes are presenting challenges to the way that geriatric care is provided.

Many researchers are suggesting that a serious consideration in how such care is provided and organised is needed [4]. This will necessarily involve further adoption of technological solutions, tele-care, along with smart-home sensor environments which are already proving to be an effective means for people to maintain independent living for longer [5]. Robotics technology is particularly attractive as it allows for physical interactions and practical assistance within the home environment. Roy et al. [6] argue that, from a technological perspective, the falling cost of sensor technologies and computing power increasingly bring personal robotics in eldercare into the realm of feasibility and also highlights a series of applications that a personal service robot may have.

Within the ACCOMPANY project we have defined 3 groups of users. (1) Professional caregivers, such as nurses, social workers, home helpers and care assistants, (2) informal caregivers, such as relatives, spouses, neighbours and friends, and (3) the elderly themselves. Recognising that these three groups may represent three distinct experiences of the issues facing the elderly, we realise that there is a need to consider all three groups. Previously, researchers in robotics have examined these perspectives from a more general point of view. Tsui and Yanco [7] examined applications and attitudes towards robots in healthcare amongst professionals, and

found that this user group primarily saw robots as work-tools that could be used by the carer to aid in the performance in specific tasks, like lifting tools, deliveries and for information sharing. When examining the views of the elderly, Cesta et al. [8] found that, while their preferred usage-scenarios addressed the realities of their everyday life, it was challenging to relate them to the realities of the available robotic platform, reducing direct applicability of these to the developers of an assistive robotic system. Harmo [9] also recognises the distinction between carers and the elderly, and their findings echo those of Tsui and Yanco in terms of how professional carers viewed the role of an assistive robot. Harmo also highlights the importance of directly relating findings from potential users to possible technical solutions.

### III. APPROACH

We are aiming to examine user needs and translating these into specific usage-scenarios using an iterative process in which the findings arising from consultation with potential users are tied directly to the technical development within the ACCOMPANY project in a manner similar to that which we have done previously with other types of user-groups [10]. This iterative approach allows for meaningful user involvement at all stages in the development of the system.

In order to evaluate the perspectives of the three user groups mentioned above, we organised a first set of focus groups using the metaplan-method [11]. The metaplan-method aims at defining different problem dimensions in a moderated discussion amongst group members. The idea is to use the creativity and interaction dynamics of the group members to extract ideas from the group, ideas that single members might not have been aware before the brainstorming. To create this kind of group dynamics the minimal size of the group should be 4 or more.

We used a three-step approach. We started by having each group member write down the issues and specific problems they think are important independently on post-it notes. Second, all these notes were put on a white board and then organised in a discussion by the group members into problem clusters, which were then defined as different problem dimensions. The last step was to rate these problem dimensions, and discuss possible connections between them. The professional caregiver group consisted of 4 women, in the group of the informal caregivers were 5 women and in the elderly people group were 2 women and 3 men. The average age of the elderly participants was 76.2 years, ranging from 70 to 83 years. An actual robot was not mentioned in the focus groups, instead the more general question "What everyday problems threaten independent living for elderly people?" was asked.

### IV. RESULTS

#### A. Problem dimensions

In a first step different problem dimensions were identified in each of the user panels. Most of these general problem spaces were similar between the groups. Yet some of them differed, depending on the priorities and perspectives of the groups.

#### B. Professional caregivers

In order to fully explore the insights the professional caregivers have into the issue, we used a two-step approach with this group. We conducted a metaplan focus group at the University and then used the findings of this user panel to inform a second discussion with employees directly at a local care facility. During focus group discussion the formal caregivers agreed on 7 main problem dimensions - Environment, Physical Health, Mental Health, Communication, Society/Family, Personal Traits and Self-confidence.

Each of these dimensions was discussed in detail and for each a list of specific problems and subcategories of problems was given. The environment dimension was specified as problems with modern living, finances, access to services and lack of family and friends. As specific problems for physical health, the nutritional status, complicated medical treatment, incontinence, not being able to cook anymore, inability to manage house, loss of senses (mainly sight, touch, hearing), fear of falling, inability to dress, immobility and loss of strength, as well as dexterity were given. Mental health problems were named as inability to retain instructions/guidance, Alzheimer/dementia, loss and bereavement resulting in depression and anxiety, forgetting to eat and memory loss. According to this group, examples of problems with communication are the inability to understand the jargon used in IT and the Internet, as well as by doctors and nurses. Examples of problems with family and friends, which could challenge everyday independent living, were defined as isolation, loneliness, the fact that the family cannot cope with the situation, a lack of support, and problems with managing the personal financial situation. Personal traits that could be a problem for independent living were specified as the inability to recognise the need for help, not to want help in general, low frustration tolerance ("I can't do it, so I won't anymore") and the opinion that one doesn't want to be a burden.

At the end of the discussion we asked the group members to specify the interactions between each of the problem dimensions. In the case of the professional caregivers the resulting structure was very interesting. We found that they defined almost all dimensions as being in interaction with each other, and that the lack of confidence is the central issue that threatens independent living of elderly people in everyday life most (Figure 2).

#### C. Informal caregivers

For the informal caregivers we held the focus group at the University. This group contained people who were

caring for one or more relatives at their home. The focus group uncovered 9 primary problem dimensions - Emotional Situation, Physical Decline, Cognitive Decline, Economic Situation, Infrastructure, Reluctance to use Technology, Security, Family and Society/Public Attitude/Policy.

As in the professional caregiver group, each of these dimensions was illustrated by a list of specific problems. The problems defining the emotional situation were specified as fear of the future, fear of family interference, negative moods (e.g. anger, irritation, etc.), resistance to appropriate help from others, resistance to helpful adaptations, a lack of subtleness and/or sensitivity on the caregivers' side, frustration not be able to do things independently, having to wait until someone can do things for you, and the perception that time passes slowly when one cannot leave the house. The physical decline dimension was defined by mobility problems, loss of senses (mainly sight, hearing, touch), incontinence, loss of dexterity, poor arm strength and flexibility, as well as balance issues. Problems constituting the cognitive decline were given as memory loss, inflexibility of ideas, dementia and suspiciousness increasing with the age. Problems in the economic situation were defined as caused by an insufficient income to pay the type of help wanted, and income issues in general. According to this group, they would result in problems with shopping and eventually eating. Infrastructure was another problem dimension, specified as the lack of transport and accessibility of the public space, poor and unsuitable housing conditions, as well as limited access to hospitals.

The reluctance to use technology was specified as a dislike of "modern gadgets", unfamiliarity with the proper use of new technology, and timidity about using technology. According to the informal carers, security problems have two aspects.

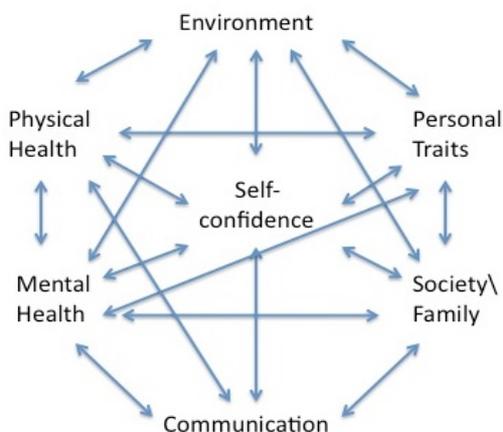


Figure 2: Problem dimension space for "Professional Caregivers"

One is the individual feeling of being insecure about moving around in the house (e.g. fear of falling), and the

other is the fear of intruders. Issues with family and friends could be that they live too far away, that the caregiver wants to organise and control the person, that the person hides things from the caregiver for fear of being put into a home, and that the caregiver does not want the person to be aware of the fact it is hard to care for her. The last two problems can be summarised as an atmosphere of secrecy between family members. These problems are closely related to what was described as the society/attitudes/policy dimension. According to the unofficial caregivers, its main factors are isolation, the feeling of loneliness, the attitude of other age groups towards older people, and the need to find various professionals (e.g. gardener, hairdresser, etc.) to come to the home.

The interaction structure of the problem dimensions differed significantly from the one given by the professional caregivers. The informal caregivers did not connect all the dimensions with each other and also did not assign a central role to any of the dimensions. The emphasis for them was on the emotional situation of the elderly person, which, according to them, was influenced by, and influenced most of the other problem dimensions (Figure 3).

C. Elderly people

The focus group for the elderly was arranged at the University as well. The participants were on average 75 years old and not younger than 65. For this group we found 12 different main problem dimensions - Physical Health, Emotional Health, Family/Friends, Mobility, Security, New Technologies, Communication, Services, Transport, Public Finance Control, Personal Finance and Lack of Trust in General.

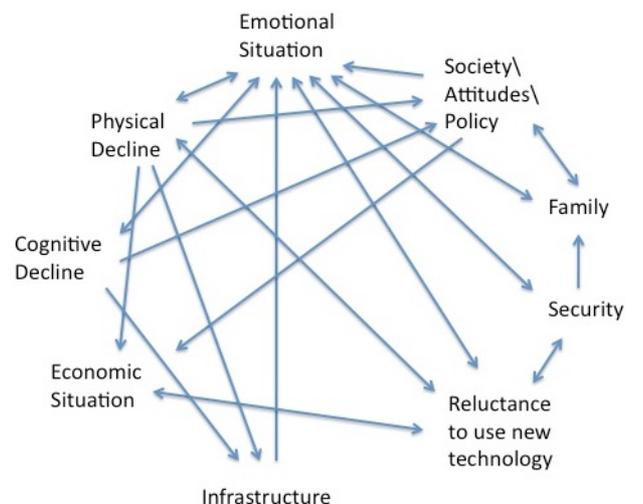


Figure 3: Problem dimension space for "Informal Caregivers"

The deterioration of physical health was the problem discussed by the elderly in most detail. A lot of examples were given to specify the general issue of becoming old and less able to do things: the loss of sight (limiting reading for any length of time as well as other

similar tasks), problems with knees, hips and other joints (making it difficult to get out of bed, impairing seating positions, making it difficult to kneel down, to climb stairs, to carry heavy things, like shopping bags around the house), difficulties of getting up from low lavatory seats or chairs without arms, the fact that arthritis makes gardening and housekeeping difficult and that cooking becomes problematic. These problems are closely related to the dimension of services and carers. The elderly find it problematic to hire someone to help with general housekeeping and gardening. Getting this sort of help usually implies to let someone unfamiliar into the house, and thus creates a feeling of insecurity for the elderly.

The problems for emotional health were defined as the worry about how to cope with the potential necessity of downsizing or going into a care home, the fear of how to cope with the death of the partner and the reliance on home care. As the main problem with family and friends, they indicated the absence of their proximity. Mobility was specified as another problem dimension: difficulties with stairs, impossibility to drive a car and the related restricted travel possibilities in small villages, the loss of general physical mobility. Issues with public transport were identified as closely related to these problems. The lack of an efficient public transport system, and the general limitations of public transport were named as main issues. The problem of security was described as the general concern of the criminal element. For the elderly new technologies represent another aspect of everyday life that causes problems with independent living. The reliance on computers in the public domain, and the limited knowledge they have of these devices, causes the elderly to worry. As an example, they pointed out the difficulty of scheduling a GP appointment online. Problems with communication with official entities due to a incomprehension of specialised language was named as another issue potentially limiting independent living. For example, the use of pro-forma letters without a specific point was mentioned. Another problematic aspect pointed out by the elderly was the financial situation. This problem dimension was defined as two-sided. On the personal finance side, problems were considered to arise due to changes of pensions and the resulting insufficient funding. On the public finance side, the two big problems mentioned were the feeling of not being in control of ones own finances and the need for a better health system. The last important point mentioned during the elderly group discussion was their perception that it has become increasingly difficult to trust someone, due to developments in the society.

The specific interaction structure given by the elderly between the problem dimensions was more similar to the one given by the informal caregivers than to the one given by the professional caregivers. Despite the fact that they did not connect all dimensions with each other, and did not assign a central role to one of the

dimensions, they also did not emphasize one of the problems (Figure 4).

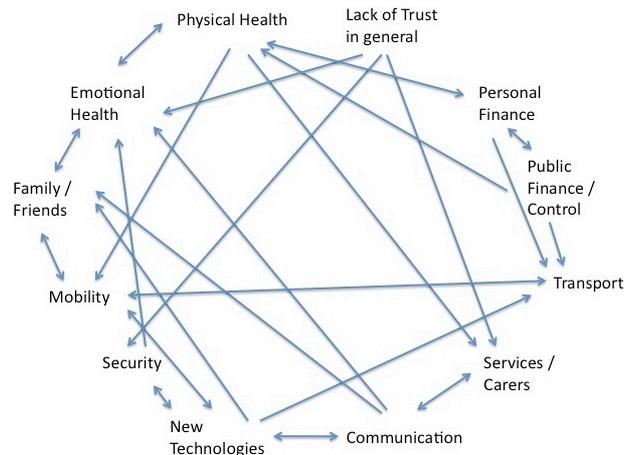


Figure 4: Problem dimension space for the “elderly”

*D. Similarities and differences*

There are five main problem complexes, which were mentioned by the three user groups. These are the decline of [1] physical health, [2] the economic situation, [3] family and friends and [4] transport, mobility and infrastructure.

Both the informal and the professional caregivers additionally mentioned the cognitive decline or mental health, and attitudes in the society in general. For the informal caregivers, as well as for the elderly, the emotional situation, security issues and the need to find service persons like hairdressers or gardeners to come into the home are substantial problems. The professional caregivers and the elderly mentioned the inability or lack of communication as one of the most important factors threatening independent living in everyday life. Some of the problem dimensions were only mentioned by one of the user groups. The professionals mentioned personal traits as a problem, and emphasised on self-confidence as a central issue. The informal caregivers singled out the reluctance of the elderly to use modern technology as a central issue. The elderly focussed on the lack of trust in contemporary society, a general fear of the criminal element and the use of new technologies in society.

In general it can be said that physical health and the problems related to limited physical mobility are the biggest and most important problematic dimensions. Issues in house keeping and personal care related to arthritis, loss of dexterity, joint pain and the loss of senses are the most prominent specific problems mentioned. This is closely related to the absence of friends or family, which were also mentioned by the three user groups. This is not very surprising, but strengthens the point that special robotic home companion technology can be a great help in assuring independent living of the elderly.

The most interesting differences are that for the group of elderly people there is an emphasis on trust towards unknown people and uncertainty about personal safety with regard to the criminal element in society. It seems that older people feel more threatened by their environment. Another point is that the elderly are seeing the existence and the widespread use of new technologies as one of the major problems, whereas the informal caregivers see the reluctance on the side of the elderly to use new technologies as the problem. These findings are consistent with several results of studies and surveys concerned with the “grey” digital divide [12, 13]. The formal carers on the other hand put a lack of self-confidence elderly people have about their abilities in general in the centre of their thoughts. In their opinion all other dimensions are influenced by this factor.

In general most of the specific problems mentioned by all three groups are similar and differ only by in their categorisation. For example, the financial situation was categorised as a society issue by the professional caregivers, but for the informal caregivers and for the elderly it was an independent problem dimension. These categorisation differences reflect the importance given to the problem by the corresponding user group.

## V. DISCUSSION

The problems immediately relevant to the ACCOMPANY project are the issues in house keeping, arising from limited mobility and decreased dexterity due to deteriorating health, as well as security, communication, the reluctance to use new technologies and psychological problems arising from being lonely.

Current service robots are developed towards achieving functions such as safely navigating around the home and helping with some tasks in the house, reminding users to take medicines and to eat regularly, helping with some kitchen work and serving, and potentially helping with mobility issues, e.g. opening doors. Note, in particular those activities that involve the robot carrying out complex manipulations of objects are still highly challenging from a technological perspective. These abilities, if implemented efficiently and for safe operation, could potentially aid everyday life and thus improve the life quality of elderly people.

Among different robotic platforms, for example the Care-O-bot® 3 represents a potential possibility to be used as a companion in a domestic environment [14]. It can draw on a sophisticated set of sensors, enabling it to detect people, detect and recognise some objects in its environment, as well as safely navigate in environments where it has to co-exist with humans.

At the University of Hertfordshire Robot House [15], these capabilities could be joined within an ecologically valid testing environment, which allows for the detection of activities through different sensors situated in the

house itself. Together, these features would potentially allow for a wide set of functionalities and usage-scenarios.

The integrated nature of the robot house sensor networks, and their ability to communicate with the robot itself, implies that it can collate a substantial amount of information and to utilise this information for the benefit of different user groups. In other words, it can alleviate a considerable amount of stress that the informal carers expressed regarding not knowing how much help the assisted elderly actually needs, and potentially address some of the security issues [6] mentioned by the informal caregivers. Of course there are serious ethical concerns associated with this type of information sharing with third parties [16], which we aim to address in subsequent user studies.

A robot companion can also help with problems of loneliness, especially when equipped with individual features, which allow the user to identify themselves with their robot. One possibility to achieve this would be to enable robot customisation. Results from studies with the Roomba robotic vacuum cleaner illustrate that people start to describe the robot in aesthetic and social terms [17]. Additionally the use of tele-presence robots has shown that people intuitively start to individualise the robot they are interacting with. Ethical issues arising from a potential emotional attachment to a machine will also have to be examined and evaluated carefully in structured user studies.

Ultimately, a combination of smart sensors and a robot companion would be helpful in the context of care. Our evaluation has shown that we need to take three different perspectives into consideration and not only focus on the needs of the elderly, but to address the needs of professional and informal caregivers, as they also play an important role in the integration of robotic assistive technology into elderly care. The differences in the problem dimensions we have found in our evaluation illustrate this very clearly. Any new technological development needs to be accepted by the key stakeholders involved. This is a key element, in addition to e.g. cost effectiveness and service delivery models, for bringing these systems into the real world.

Since both the informal caregivers and the elderly mentioned the reluctance or inability to use new technologies as a significant problem, it seems that improving the elderly people’s acceptance of robotic companions is going to be one of the immediate issues, if an integration of robot companions into the elderly care process is going to be successful. To address this particular problem, we plan to involve potential users in extensive Human-Robot Interaction studies in the robot house at the University of Hertfordshire as part of the later stages of the of the ACCOMPANY project.

## VI. CONCLUSION

The results reported in this article represent the first step of the design cycle, whereby the described user panels were conducted with different stakeholders, without any information given about possible concrete robots to be used in this work, so as to avoid a bias of their views and attitudes due to the technology. Further rounds of user panels will follow to refine the tasks and scenarios throughout the duration of the project.

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