

# THE ROBOTS IN ELDERLY CARE

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## ABSTRACT

In the wake of fast aging of populations the question is asked about the acceptance of robots by elderly individuals and their role in elderly's every-day life. The project ENRICHME - *Enabling Robot and assisted living environment for Independent Care and Health Monitoring of the Elderly* (which receives funding from the European Union H2020 Programme; Grant Agreement No: 643691C) employs a mobile service robot for long-term human monitoring and interaction, in order to optimise the independence of elderly individuals. For this reason, it is important to explore and assess the impact of such a system on the final users' life (elderly, caregivers, social reference group). Thus, the aim of the study was to develop a tool to collect opinions about the robot-related requirements and check its usefulness.

In this paper, we present the first results of the *Users' Needs, Requirements and Abilities Questionnaire* (UNRAQ). The tool was developed based on the literature review and ENRICHME researcher's expertise. Data collected by means of a creativity box - a part of the UNRAQ enabling the participants to express freely their ideas, worries, and critical opinions are presented. During the interviews pictures of the prototype of the robot were shown to the participants so as to provide them with a more realistic view of the robot concept. Data were collected in the countries involved in the ENRICHME project: France, Greece, Italy, Netherlands, Poland, and UK. However, so far only the results gathered from Polish participants are included. The results gathered from only 166 Polish participants are presented here.

The analysis of opinions presented in the creativity box was used to identify five areas: general attitudes towards the robot, expectations regarding the appearance of the robot, expected functions, conditions for safe use of the robot and controversies related to the introduction of robots into the lives of the elderly.

In conclusion: based on the preliminary results it can be stated that the use of robots by community-dwelling elderly is generally accepted both by the elderly themselves and younger people: formal and informal caregivers. The survey participants showed willingness to cooperate with researchers in the interviews and expressed their ideas and thoughts. The study results point to the necessity of involvement of end-users and secondary users in the process of designing technological solutions.

**Keywords:** robots, the elderly, needs, requirements, caregivers

## INTRODUCTION

As time passes, the human body changes; the process of ageing affects all systems and organs. In the central nervous system cognitive impairment may be observed.

Cognitive impairment includes, among others, symptoms of time and place disorientation, problems with concentration of attention, counting, reading, writing, but also problems with memorising new information or recalling information already memorised. These are inseparable elements of dementia. Their severity in patients with dementia increases over time. They affect emotional and behavioural functioning and limit functional independence.

Cognitive impairment is a necessary, but not sufficient element of dementia diagnosis. It is estimated that the number of persons afflicted with this dementia exceeds 35.6 million world-wide [1] and that due to the ageing of the world's population it will double by 2030.

However, it should be stressed that recent epidemiological data indicate a significantly lower frequency of dementia compared with the prognoses. This is explained by the steadily improving education of subsequent cohorts entering old age, a healthier life style, and a better prevention of cardio-vascular diseases [2]; for example, studies conducted by Matthews et al. [3] in United Kingdom in the years 1990-1993 predicted the occurrence of dementia in 2011 in 8.3 per cent of the studied population. In reality, in 2011 these disorders were diagnosed only in 6.5 per cent of the population, therefore, the prevalence of dementia was nearly 25 per cent lower than expected. This indicates a possibility of modifying the risk of the occurrence of cognitive functions disorders thanks to lifestyle changes. Consequently, this should be taken into account in the strategies of care for the elderly, in particular, those with an increased risk of dementia.

Mild cognitive impairment (MCI) is a transitional state between cognitive impairment resulting from normal ageing and dementia. It may progress to dementia. However, there is a subgroup of people with mild cognitive impairment whose cognitive state does not deteriorate and who will not develop dementia. Predicting the course of illness (persistence of MCI vs. progression towards dementia) is a real challenge.

Moreover, as there is no pharmacological treatment for MCI, a non-pharmacological approach is very important [4]. These measures include lifestyle changes as diet modification, smoking cessation, and increase of activity (intellectual, physical and social) [5].

The use of new technologies in the care for the elderly increases their chances of prolonging independence thanks to better cognitive efficiency. There is also growing interest in the use of robots for this purpose. Hence, extensive research has recently been carried out in this area. However, only a few projects including mobile autonomous robot companions operating in real life have been implemented in Europe so far. Additionally, only a few of them involve participants with cognitive impairment.

The project ENRICHME *Enabling Robot and assisted living environment for Independent Care and Health Monitoring of the Elderly* (which receives funding from the European Union H2020 Programme; Grant Agreement No: 643691C) pioneers in testing technologies for supporting elderly people with MCI in their living environment for a longer time. It tackles the progressive decline of cognitive capacity in the ageing population proposing an integrated platform with a mobile service robot for long-term human monitoring and interaction, which helps the elderly person to remain independent

and active for longer by enriching their day-to-day experiences at home. For this reason, it is important to explore and assess the impact of such a system on the lives of final users.

## **AIM OF STUDY**

The aim of the study was to develop a tool to collect opinions about the robot-related requirements of the potential final users (elderly persons and other stakeholders, e.g. formal and informal caregivers). Moreover, the usefulness of the tool for the assessment of the uses requirements was checked.

## **MATERIAL AND METHODS**

### Studied participants

The results of participants (n = 166) studied in Poland are presented. They were recruited among those who were interested in sharing their opinions regarding the usage of robots to assist elderly persons living at home and who accepted to take part in the study. Two groups of participants, potential end-users were defined:

elderly individuals - aged 65 years and older

other stakeholders (e.g., both informal [those who take care of someone with no professional background in care: family members, friends, neighbours, volunteers] and formal caregivers [those who are professionally prepared to provide care: social workers, nurses, physiotherapists, occupational therapists, psychologists, physicians]).

### Method of assessment

Based on the literature review and the expertise of the ENRICHME project partners the *Users' Needs, Requirements and Abilities Questionnaire* (UNRAQ) was developed. It is composed of two parts. The first consists of statements related to different aspects of every-day life as well as ethical and legal issues whereas the second is the creativity box, the purpose of which is to create an opportunity for the participants to speak out freely and to hear them out. This is in line with the view that the elderly should actively participate in designing facilities intended for them. The interviewer writes down in the creativity box all participants' ideas/suggestions for functions the robot might have, which might be useful in the everyday life of elderly people. Pictures of the prototype of the robot are shown to participants to provide them with a more realistic view of the robot concept. Data were collected in 5 countries involved in the ENRICHME project: France, Greece, Italy, Poland, and UK. In this paper we present the analysis of the results of the creativity box of 166 participants studied in Poland.

## **RESULTS**

### **Profile of the participants**

166 participants were studied, including 35 elderly individuals and 131 other stakeholders. A great majority of the participants were females - 131 (78.9%); 23 among elderly participants (65.7%) and 108 (82.4%) among other stakeholders. The mean age of a studied participant was  $41.5 \pm 18.2$  years; median - 34.0 years. The mean age of the elderly group was  $71.4 \pm 5.6$  years (median 70 years) and other stakeholders -  $37.1 \pm 12.5$  years (median 29 years).

The analysis of the opinions/suggestions presented in the creativity box was used to identify five areas described below.

### **1. General attitude towards robots among the elderly**

In this group the comments made by young participants are worth noting, as they were enthusiastic about the concept and pointed out to the usefulness of robots:

*Using robots by the elderly is a great idea. When I am old I would like a robot to assist me in my daily life* (female, aged 24),

*Using a robot for assistance with daily activities is absolutely desirable and valuable* (female, aged 27),

*A robot can definitely make the lives of the elderly easier* (female, aged 24).

However, an emphasis was made on the empowerment of the elderly in making the decision to use robots:

*We have to ask the elderly whether they would like to have such an assistant at home and whether they would feel comfortable living with a robot* (female, aged 29),

*An elderly person could choose a name for the robot, which would then be used by the robot* (female, aged 24).

There were also sceptical opinions, such as *the concept of a robot at home may generate a great deal of reserve and reluctance on the part of a potential user.* (female, aged 29).

### **2. Expectations regarding the appearance of the robot**

The desirable external features of the robot, indicated by the participants, included the following:

*it should be colourful* (female, aged 27), but it should also *be capable of changing colour* (female, aged 24),

*it should have hand holds allowing the elderly person to lean on it, get up* (male, aged 43),

*it should have soft elements (furry, plush), to make it warm to touch* (male, aged 43).

### **3. Expected functions**

Both the elderly and the caregivers expected the robot to perform a number of various functions. One of the participants even suggested five modes of robot's operation: *relaxation, household chores, medicine, family, vital signs* (male, aged 27).

A great deal of attention in the list of expectations was drawn to the functions of *collecting data on basic vital signs and their comparison in weekly and monthly summary reports.* This would be followed by *periodic check-ups with the doctor in charge via a video conference with the patient* (female, aged 29).

According to the participants, monitoring should include: not only physical activity and memory, but also the diet (including water intake) and controlling *the amount of food in the refrigerator and automatic ordering of the most frequently consumed products* (male, aged 28). With regard to medical and health interventions, the robot should:

*send prescriptions, get advice from doctors and nurses* (male,

aged 35), *connect rehabilitation equipment* (male, aged 35),

*learn new skills related to health - for instance, changing a dressing* (male, aged 35),

*in emergency situations - call an ambulance* (female, aged 29).

One important function that the robot would be required to perform is the ability to assist in the maintenance of social contacts (with family, friends) and in detection of potential threats in relation to contacts with strangers. According to the participants, the robot *should respond to the doorbell and the phone or intercom ringing, inform the elderly person about the identity of the person ringing* (female, aged 49). *In case the elderly person is unable to open the door, the robot should analyse the face of the visiting person*

*(...) and make the decision whether to open the door or not* (female, aged 24). Its role could also include *controlling the elderly person's security (warning against theft in case someone pretends to be a friend in need)* (female, aged 38). The robot should: *wake up the elderly person by saying some nice words (Good morning, I need you, It is good to have you here)* (female, aged 25). One of the participants even pointed out that the robot could *help and make the lives easier for those elderly people, who are lonely* (male, aged 27).

The role of the robot, often pointed out by the participants, would be to improve and control the process of drug administration. One of the participants in the study concluded that a *good solution in the process of drug administration would be to install in the robot special slots for pills which would open at a specific time of day* (female, aged 24).

As far as relaxation and leisure time is concerned, the participants think that the robot *could suggest one form of an activity per day, for instance an activity that the elderly person enjoys* (female, aged 24), i.e. fully respond to individual needs. One female participant, on the other hand, pointed out to the possibility of using leisure time for stimulating development - *it should be able to expand the person's interests* (female, aged 24). The most frequently suggested leisure time activity was reading. The participants also suggested using selected forms of art therapy as methods of activation. There were also many suggestions for the robot to act as a partner in logic and board games, as well as to conduct memory training, accompany the elderly person while listening to the radio and to provide access and use various types of information (for instance, downloaded from the Internet or from the robot's memory).

One interesting suggestion is creating a kind of a community of persons using robots by *connecting with other users of robots for the purpose of sharing experiences* (female, aged 29). *The robot should be voice-controlled* (female, aged 35).

Only a few stated that the robot could help the elderly persons with everyday activities, thus the robot should: *help with household chores (cleaning, washing, ironing)* (female aged 30), *carry heavy objects* (female, 29); *provide assistance with household chores* (female, aged 26) or *perform these activities on its own; vacuum, (...) inform about dirty places, places where something has been spilt* (female, aged 24).

#### **4. Conditions for the use of the robot**

It was noted that *at the beginning it is important that someone, who could provide help, should accompany him or her [the elderly person] - if the person lives alone this could be*

*a caregiver who would come and facilitate the acceptance process. This person would first explain what the robot could be helpful with, and then this person would show that the robot is really useful (male, aged 84). Another suggested option was the possibility to get used to the robot outside home, for instance, in the apartment of a person, who already uses such a machine. Another issue raised was the need for personalising the robot depending on the person's needs and health condition (female, aged 49).*

A security problem that proved to be of significance in the study was providing protection of the elderly person's personal information held by the robot. The flow of information should be *completely safe for the user (male, aged 67). One should always bear in mind that this is only a machine and it can get out of control, or the data it receives may be misinterpreted (male, aged 44).*

The responses to the question of who should control the robot were ambiguous. There were suggestions that *the user of the robot should have control over the machine (female, aged 24)* as well as that *outsiders, such as family members, should control the machine (female, 24).*

## **5. Controversy surrounding the introduction of robots into the community of elderly persons**

Elderly participants in the study, who are in good physical condition, see no need for the use of a robot as *this is not a machine for me. I can manage to do things on my own (female, aged 82).* In the same way, the idea of using a robot in the care of persons with many disabilities or those with severe health problems was rejected. As one of the female participants noted, *a robot seems to be definitely less functional in case of bed-ridden persons (female, aged 26).* In this context it was suggested that *a question on the kind of the disease involved should be placed at the beginning of the survey. A robot cannot be used to help with all of the problems elderly persons may have (female, aged 75).*

The youngest participants in the study were sceptical about the level of technological literacy among the elderly, which is a potential obstacle in the implementation of robots in their community:

*the generation of elderly people is not prepared to handle such sophisticated machines (female, aged 24),*

*operating such a robot may cause great difficulties for elderly people, who are completely unable to cope with such a technology (female, aged 26).*

It was pointed out that the robot *should be more of a helper rather than a companion (female, aged 26), but it should not be an alternative to social contacts (female, aged 24), as it will not substitute a human being (female, aged 54), while the vision of a robot as the only life companion for an elderly person is appalling, therefore one should watch out for any abuse (female, aged 27).* On the other hand, it was pointed out that *such technologically advanced machines may undoubtedly provide great help for families in which elderly persons require comprehensive care (male, aged 28).*

Another difficult issue, signalled in the opinions expressed by the respondents, was the problem of the elderly person's independence, the person's right to self-determination, the right to freedom, and the right to privacy. As concluded by a 29-year-old participant, *one cannot let the elderly person feel completely controlled, like a child, almost incapacitated. Caring and reminding of things - yes, but watching and prohibiting - no.*

## DISCUSSION

The aim of the study was to define the position of robots in assisting elderly persons suffering from MCI. One should emphasize the great involvement of the participants, both the elderly persons and their caregivers. The creativity box, as part of the UNRAQ, allowed to 'unlock' participants' creativity and encouraged the use of their imagination, thus providing us with a diverse range of insights about user needs and preferences. It should be borne in mind that the quality and effectiveness of design solutions rely, to a large extent, on the availability of information about the future users of new products, their needs and expectations.

It is important that as far as the core functions of the robot are concerned, the participants listed possible uses of the robot with regard to physical exercise, memory training, and increasing the level of social activity. Thus, this is not about getting someone to do something for these people, but about increasing their activity, as only this can help them maintain their abilities [4]. It is interesting that the participants expected robots to assist in social contacts, but pointed out to the inability of robots to become a substitute for social relations with humans, which is in line with the findings by Zsiga et al. [6].

Similarly the British participants, as stated by Lehman et. al. [7], pointed out to the use of robots to provide security and protection against theft. Additionally, our participants emphasized the significance of personal data protection - which is an important problem, though very rarely discussed in the literature related to this topic.

An opinion expressed by one of the elderly participants in the study seems of significance in the context of introducing robots into this environment. The person noted that the process of getting elderly persons 'used to' robots should be gradual and that someone else should be there to help at the very beginning. This is consistent with studies, which show that motivation to use technology may be increased by positive experience with its use [8]. It is emphasized that elderly persons should be successful in the use of technology, which is particularly important in the wake of complexity of the functions of robots [8, 9].

When talking about obstacles there were opinions that elderly persons have an insufficient level of technological literacy (interpreted as having information about a product/device, understanding its functioning and being able to use it as intended). Our results are in line with the findings by other authors [9].

## CONCLUSION

This study is the first one to demonstrate the uses of the research tool called *Users' Needs, Requirements and Abilities Questionnaire* (UNRAQ). It is also the result of the initial phase of the implementation of the ENRICHME *Enabling Robot and assisted living environment for Independent Care and Health Monitoring of the Elderly* project. The results of the study will hopefully help us define the needs and requirements of the project beneficiaries in a better and more comprehensive way, thus making ENRICHME a user needs driven project. Consequently, the functions of the robots introduced in the subsequent stages of the project will meet the expectations of the users.

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