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Dementia and Robotics: People with Advancing Dementia and Their Carers Driving an Exploration into an Engineering Solution to Maintaining Safe Exercise Regimes

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Abstract. The merging of the human world and the information technology world is advancing at a pace, even for those with dementia there are many useful smart 'phone applications including reminders, family pictures display, GPS functions and video communications. This paper will report upon initial collaborative work developing a robotic solution to engaging individuals with advancing dementia in safe exercise regimes. The research team has been driven by the needs of people with advancing dementia and their carers through a focus group methodology, the format, discussions and outcomes of these groups will be reported. The plans for the next stage of the research will be outlined including the continuing collaboration with advancing dementia and their carers.

Keywords. Robotics, advancing dementia, exercise, collaborative research, cocreation

1. Introduction

The paper is based upon the initial research undertaken exploring the reaction to a basic mobile robot, possible individual acceptance of a mobile robot and potential use of a mobile robot as suggested by the individuals and their carers.

The merging of the human world and the information technology world is advancing at a pace, even for those with dementia there are, for example, many useful smart 'phone applications including reminders, family pictures display, GPS functions and video communications.

Dementia is a progressive disorder which affects many aspects of an individual's life. As problems mount people with dementia and their carers may decide that 24 hour care is needed. At this point carers and people with dementia usually decide that they need to move to a care home. Although as carers we may gradually lose the ability to communicate verbally with people with dementia they still need, and benefit from therapeutic interventions that can stimulate their interests and give them some fun.

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However due to the effect of Dementia on their capabilities this can be problematic as potential risks need to be balanced against perceived benefits.

In health care we know that exercise has positive benefits for individuals of all ages and lack of exercise can have serious adverse effects particularly later in life [1] and yet we frequently see images of people with dementia in care homes sitting alone or in groups.

It has been suggested that the reason for such sedentary care is due to staff wanting to maintain their duty of care and reduce the risk of falls or injury or anxiety to those in their care [2]. However, evidence suggests that exercise engagement is not only possible but also of benefit to those with dementia [3] but there remains very little research around exercise and individual safety.

It is also known that amongst those suffering with dementia there is evidence of 'wandering' [4] which can have serious negative outcomes [5].

Wandering represents one of the three categories of disruptive behaviour of people with dementia. The behaviour is disruptive from the carer's point of view. Restless wanderers may make up 50% of the population of inpatient special care dementia units [6]. However, the behaviour can also be considered as an expression of a person's goal or needs and when treated properly can become meaningful and potentially useful in directing nursing care.

Our vision is to design a companion robot which will move around in a residential area, home or care home. The mobile robot would be made to navigate the environment autonomously. The robot could just be there to provide a (positive) distraction to residents. The more ambitious idea would be that the robot becomes a robotic companion which accompanies restless nursing home residents or invites and persuades inactive residents to walk.

Wu, Fassert & Rigaud [7] tested the impact of representations and perceptions of robots on older people with mild cognitive impairment living at home and suggested that the most attractive robots for their target population should have the following characteristics:

- they should be relatively small in comparison to human-size;
- should have some traits between human/animal and machine.
- should be like a familiar object in a home setting.
- finally, creativity in the design of the robot's appearance is desired.

However, the target population of our project differs from Wu, Fasser & Rigaud's; our robots are designed for users living in nursing home, rather than in their own home. Therefore, we will use these guidelines as a starting point only. Evaluation tests to measure the residents in nursing homes acceptability of the robots will be obtained by adapting Wu, Fasser & Rigaud's study.

The idea of a robot companion for people suffering from dementia was initially discussed with a few professional carers. The feeling was that there needs to be something that connects the resident to the robot. The resident may simply forget that the robot is with him or her. There are a few options. One is that the resident holds a stick which is connected to the robot, as for instance described in Ghosh et al [8]. However this option was judged too rigid. Another option was to use the equivalent of a dog lead as suggested by Young et al [9]. This seemed the better option and we worked it out into a simple demonstration.

2. Methods

We wanted the people living with dementia and their carers to drive this research and direct the engineering work. Thus we produced four main research questions to share with focus groups:

- General: is a robot acceptable or are we shown the door immediately?
- What is an appropriate size?
- Are there suggestions on how the robot should look (our Pioneer robot is very much a mechanical device, PARO looks soft)
- Are there suggestions on how the robot should behave, what it should do?

One of our team had links with a local mental health care trust and the local Alzheimer's society who were able to help in the recruitment and facilitation of focus groups. We conducted two rounds of focus groups amounting to three groups in total.

In the first round two groups of people were convened, one being people with dementia who were still able to live at home and communicate verbally accompanied by their carers (n= 16), the other being carers (n= 6) of people with more advanced problems who are living in a 24 hour care setting. Both groups were introduced to the idea of our research in a brief presentation which identified the focus which was to develop a robot for people with dementia living in a 24hour care setting.

Initially the wide use of robots in healthcare was discussed and a clip of the PARO robot (the robot used for some people with dementia [10]) interacting with a person with dementia was shown. The static nature of this was identified and another clip of a mobile search and rescue robot was shown to illustrate potential for a moving robot.

We outlined our idea of a mobile robot that was connected to the person through the use of a lead. A demonstration of the basic idea took place followed by a slide show of pictures of different sizes and shapes of robots. This was used to stimulate discussion around their thoughts on the most acceptable configuration. The demonstration took the form of one student taking the role of a person with dementia by holding the lead and walking along with the robot whilst another student remotely controlled the robot.

For the demonstration we used a Pioneer-3AT 4-wheel robot (dimensions 30x40x20) with a commercially available dog lead: a spring-loaded retractable lead which keeps the lead taut; the end of the lead was fixed on the robot.

Figure 1. Robot and lead demonstration photograph

In the second round of focus groups we showed designs for dressing the robot, moving from a 'technical' object towards that of a possible companion to another focus group comprised of people with dementia and two of their carers (n= 5).

Figure 2. Three dressed up robots

The designs were not given a name, nor an explanation of what they resembled; they were just shown as they are for the group to consider and discuss.

3. Results

All participants in the focus groups were very pleased to have been part of the initial planning stages. They found the relaxed environment helpful in that they were able to be very vocal in their contributions and proposed a wide range of differing formats for the robot. They all fully supported the idea of the robot being an additional therapeutic intervention for people with dementia.

The idea of a lead to connect the person to the robot was also seen as a positive aspect and they were clear that the robot should be robust enough to withstand any destructive behaviour and yet not so large that it was seen as a threatening presence.

The people with dementia felt that they should have some sort of relationship with the robot. They wanted the robot to be engaging and interesting and yet fit for purpose in that its outer covering should be washable. They were clear that it should not be robotic but rather more person/animal like. Warm and friendly were words that were used by one of the participants with dementia.

One participant who is a carer stated that they had been very against the idea initially but following the focus group they were now most definitely in favour. They were all looking forward to working with us in this development and were reassured that we would be continuing our work in this field.

In round two of this study the focus group unanimously chose the middle design as their favourite, with comments that it has a face (the face of the left design was not clearly visible) and it smiles (the right one does not smile).

Though in the discussion it turned out that they were not clear about what the nose or the mouth of this design was. This seems to suggest that the technical/very clean look of the left design was rated lower than the fancier look of the middle design. The right design evokes direct association with a role (school girl) while the middle design does not seem to refer to an everyday role and the confusion in the group about the mouth did not lead to the design being liked less.

4. Discussion

This project has brought together people living with dementia and robotic technology to determine the potential combination that would be acceptable and helpful from the individual's and the carers perspectives to help with managing and maintaining an exercise regime appropriate and safe for the individual.

We will continue to investigate how to improve the acceptability of the robot by varying in the first instance the appearance of the robot (size, material etc.) and at a further stage varying the behaviour of the robot using feedback from people with dementia and their carers.

The future challenge of the project is to investigate whether nursing home residents would be willing to accept a robot companion. We are aware that the appearance of the robot will have a significant impact on how the robot will be perceived by the residents. It should look interesting and be perceived as worthy companion. Through further engagement with those with advancing dementia and their carers we shall design and build a prototype robot and develop appropriate functionality to deliver a 'companion' to an individual in a care home to help with a safe exercise regime.

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References

[1] Frank W Booth, Christian K Roberts and Matthew J Laye, Lack of Exercise is a Major Cause of Chronic Disease. *Comprehensive Psychology*. 2:1143–1211 (2012)

[2] Lin GU, Nursing interventions in managing wandering behavior in patients with dementia: A literature review. *Archives of Psychiatric Nursing*, In Press: 17 July 2015

[3] David W Thomas, Carolyn Glogoski and Jodi Johnson, The effect of a Supervised Walking Program on Wandering Among Residents with Dementia. *Activities, Adaptation and Aging*. Vol 30, Issue 4 (2006)

[4] N Ali, S L Luther, L Volicer, D Algase, E Beattie, L M Brown, V Molinari, H Moore and I Joseph, Risk assessment of wandering behavior in mild dementia. *International Journal of Geriatric Psychiatry*, doi: 10.1002/gps.4336. (2015)

[5] Junichi Furumiya and Yoshiaki Hashimoto, A descriptive study of elderly patients with dementia who died wandering outdoors in Kochi Prefecture, Japan. *American Journal of Alzheimer's Disease and Other Dementias*. Vol 30: No 3: 307-312 (2015)

[6] Cipriani, G. et al., 2014. Wandering and dementia. *Psychogeriatrics*, 14(2), pp.135–142.

[7] YH Wu, C Fassert and AS Rigaud, Designing robots for the elderly: Appearance issue and beyond. *Archives of Gerontology and Geriatrics*, 54(1), pp.121–126. (2012)

[8] A.J Ghosh, J Penders, P Jones and L Alboul, Following a Robot using a Haptic Interface without Visual Feedback, *ACHI2014*, Barcelona March (2014).

[9] JE Young, Y Kamiyama, J Reichenbach, T Igarashi and E Sharlin, How to Walk a Robot: A Dog-Leash Human-Robot Interface. *International Symposium on Robot and Human Interactive Communication, RO-MAN*, pp.376–382. (2011) Available at: http://medcontent.metapress.com/index/A65RM03P4874243N.pdf [Accessed April 14, 2014].

Robinson, Hayley, Elizabeth Broadbent, and Bruce MacDonald. "Group sessions with Paro in a nursing home: Structure, observations and interviews." *Australasian journal on ageing* (2015).