ROBADOM: The Impact of a Domestic Robot on the Psychological and Cognitive State of the Elderly with Mild Cognitive Impairment

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Abstract—This paper presents the French NSF project "The Impact of a Domestic Robot on the Psychological and Cognitive State of the Elderly with Mild Cognitive Impairment" (ROBADOM). This project aims at conceiving a robot with emotions and language in order to support at home the elderly with Mild Cognitive Impairment (MCI), living alone at home, and suffering or not from depression. The objective of this project is to explore the acceptability of the robot in a natural-living environment. The robot is used as to support the elderly with MCI in their home environments by trying to improve their psychological and cognitive state.

I. INTRODUCTION

The world’s population is growing older. Most of the elderly population suffers from the effects of social isolation and age-related cognitive decline (deterioration in memory, attention, concentration, etc.). The new trend in assistive technologies is promoting aging of elderly persons at home. In France, the number of older people is increasing and will reach 26.5% of the general population in 2050. The number of the patients suffering from the Alzheimer’s disease or other dementia in France is also increasing: the prevalence is around 860,000 nowaday and it is estimated to reach 1.3 millions in 2020 and 2.1 millions in 2040. Recent efforts have been made to implement preventive measures that target "MCI" (mild cognitive impairment) people who are at risk to progress to Alzheimer’s disease. There is no proven therapy for MCI. However, several studies on the efficacy of cognitive interventions in the MCI population report encouraging findings. These people wish to stay at home as long as possible but suffer from loneliness and solitude, which are sources of depression [1], [2], [3].

Little long-term research has been done in the area of therapeutic robots for individuals suffering from dementia and cognitive impairment. In their research work [4], Libin and Cohen-Mansfield describe a preliminary study which compares the benefits of a robotic cat and a plush toy cat as interventions for elderly persons with dementia. Furthermore, Kidd, Taggart, and Turkle [5] use Paro, a seal robot, to explore the role of the robot in the improvement of conversation and interaction in a group. Marti, Giusti, and Bacigalupo [6] justify a non-pharmacological therapeutic approach to the treatment of dementia that focuses on social context, motivation, and engagement by encouraging and facilitating non-verbal communication during the therapeutic intervention. And, Tapus, Tapus and Matarić [7] describe adaptable social, interactive, and cognitive aspects of robot behavior in an assistive context designed for the elderly individuals suffering from dementia in a music game therapy scenario.

In our present project several aspects will be approached:

- Exploit the interactive capabilities of the robot to stimulate and encourage the patient during daily activities and cognitive stimulation.
- Make the relationship more human and intuitive: the robot has emotions and can make use of speech. Elderly people interact directly with the robot.
- Use TV as an interaction interface. Television is a familiar, easy to use, and well-accepted object by the target population. The robot can turn on the television so that the individual can view his/her daily calendar, weather, his/her shopping list, and do the cognitive stimulation exercises.
- Provide personal services without being too intrusive: the person calls the robot when it is needed. The robot is not providing an ubiquitous monitoring. The robot is considered as a domestic available at all times. This empowers the person and make the product more readily acceptable.

II. PROJECT OBJECTIVES

This project fits perfectly in the current societal and economical situation. Human-robot interaction and socially assistive robotics that promote independent living and improve the quality of life of participants are included as important developing research areas in the robotics field.

The ROBADOM project plans on providing time-extended personalized help and cognitive therapy protocols and at the same time encouragement and motivation through the use of a mobile autonomous robot while saving therapist time. The project will evaluate the benefits of a robot that provides user tailored help and cognitive stimulation protocols.

This project will try to address different research points:

- Define the general adequate appearance of the robot for the elderly target population
- Define the robot’s capabilities and behaviors so as to provide a customized natural interaction. The robot should be simple enough and easy to use by seniors with cognitive deficits and should not be perceived as an intrusive system.
- Study the impact of the robot in everyday life aspect of the user (e.g., emotional, cognitive, quality of life ...).
• Study the way the robot is perceived (e.g., companion machine, intruder) by the user.

Moreover, the project will offer two types of results:

• The patient/participant’s feelings (e.g., acceptance, interaction) in a long-term (i.e., one month per patient) co-habitation with the robot.

• The impact of an assistive robot as a cognitive and emotional support to the target population. The project will assess the impact of the robot on two aspects: first, the fight against loneliness and depression among individuals and secondly, stimulation and cognitive support for people with mild cognitive impairment.

This project aims to design a robotic system with social abilities that exhibits personality and emotions through the use of verbal, non-verbal and para-verbal (e.g. pitch, volume) communication so as to help people with cognitive impairments, living alone and suffering from depression or not. Thus, the goal of this project is to improve quality of life of the users; this will be done through the use of a robotic agent that supervises, encourages, and engages the users as they perform daily tasks and cognitive stimulation.

III. PRELIMINARY RESULTS - FOCUS GROUPS

Our project started in January 2010. The first step of this project was to run some focus groups, with the main goal of obtaining user target population recommendations regarding robot appearance and robot capabilities.

A total of 15 older adults over the age of 65 participated in three focus group sessions. Three of them were male and twelve were female. Seven participants suffered from mild cognitive impairment while eight were healthy older adults.

The procedure was the following: the participants were asked to present themselves, to talk about their cognitive difficulties (i.e., those encountered in their daily lives), and to describe some of the strategies implemented to overcome these difficulties.

The participants were also asked to provide a representation of an assistive robot and its potential capabilities. Unfortunately, they couldn’t tell us spontaneously what they expected from a robot or how a robot should look like because none of them was familiar with robots.

Finally, over 50 different robot pictures and research movies showing the interaction between a robot and a person, were presented to the participants. The participants insisted on the importance of robot’s physical appearance “creativity”. However, the discussion of the participants wasn’t limited to robot appearance. The aesthetic judgments were underlied by ethical ones, such as authenticity of relationship with robots and fear of robot as substitute for human.

After the evaluation of the focus groups answers, Robosoft (one of the project partners) proposed the robot illustrated in Figure 1.

More details and results will be available by the time of the symposium, as this paper reports on ongoing work in progress.

Fig. 1: (a) Kompai robot designed by Robosoft-France ; (b) Kompai robot interacting with a user

IV. ACKNOWLEDGMENTS

This work is supported by French National Research Agency (ANR) through TecSan program (project ROBADOM). The project partners are: BROCA Hospital, Valoria, UPMC-ISIR and Robosoft. We are also grateful to our project partner: BROCA Hospital. Many thanks to Wu Yahuei, Christine Fassert, and Veronique Faucounau for their help with the focus group.

REFERENCES


