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A Pilot Study of Robot Reminiscence in Dementia Care

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***Abstract*—**In care for older adults, behavioral and psychological symptoms of dementia (BPSD) like agitation and aggression are distressing for patients and their caretakers, often resulting in premature institutionalization with increased costs of care. To improve mood and mitigate symptoms, as a non-pharmaceutical approach, emotion-oriented therapy like reminiscence work is adopted in face-to-face communication. Telecommunication support is expected to be provided by robotic media as a bridge for digital divide for those with dementia and facilitate social interaction both verbally and nonverbally. The purpose of this case study is to explore the conditions in which robotic media can effectively attract attention from older adults with dementia and promote their well-being. As a pilot study, we introduced the pillow-phone Hugvie®, a huggable humanly shaped communication medium to five residents with dementia at a care facility, to investigate how the following conditions work for the elderly when they use the medium; 1) no sound, 2) radio, non-interactive, 3) daily conversation, and 4) reminiscence work. As a result, under condition 4, reminiscence work, the five participants kept concentration in interacting with the medium for a longer duration than other conditions. In condition 4, they also showed larger amount of utterances than under other conditions. These results indicate that providing topics related to personal histories through robotic media could affect communication positively and should, therefore, be further investigated. In addition, the issue of ethical implications by using persuasive technology that affects emotions and behaviors of older adults is also discussed.

***Keywords*—**BPSD, reminiscence, tactile telecommunication, utterances.

I. Introduction

As population aging advances worldwide, the ways of utilizing new technologies in care for older adults grow with our knowledge in social robotics. With a focus on support in dementia care with simple robotic media, this study will look into a pilot research case conducted at a residential care facility. Seeing as United Nations data [1] point towards a growth in the population aged 60 or above and that the worldwide percentage is projected to be more than 1.4 times in 2030 and exceed 2.1 times by 2050, there is a rapidly growing need for assistant technologies in the elder sector. The need for assistance is not limited to people with dementia, older adults in general could benefit from robotic mobile services, but seeing that the proportion already exceeds 27% of older adults aged 65 in Japan with an increase in senile dementia, we should give these people our attention.

Communication difficulties considering those with dementia could be helped alongside with other needs such as daily living, care services and staff shortage through high-tech devises, e.g. assistive technology. Robots can give the feeling of natural interaction, unlike computer systems that require continual manual interactions and input, thus likely to be accepted by its older users with cognitive disabilities. Anxiety, crying, shouting and aggression as symptoms of dementia make care difficult due to substantial burden on care staff, family members and for the older adults suffering from BPSD. Telecommunication through robotic media could lessen the burden and reduce symptoms of dementia as an alternative to traditional communication especially for older adults with progressive dementia. Giving the communication technology a human like shape, i.e. embodied communication technology (ECT) can make it recognizable as a remote communication device and serve as a bridge for digital divide which is the reason why we need to investigate ways to encourage users' engagement with assistive technology and strive to recover their well-being.

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II. Related Work

When looking at assistive technology for communication purposes, studies have been conducted in both computer-based assistance and tactile interaction through social robotics for communication improvement both verbal and non-verbal. In pursue of problem-solving, we should also see how we can nourish the human-robot relationships.

A. Reminiscence and BPSD

Reminiscence intervention as a communication aid for older adults has shown effect through emotional responses and conversation engagement by triggering long-term memory even for people suffering from dementia [2]. The importance of conversation among people with dementia, care staffs, family members and volunteers can be seen in studies like the CIRCA computer reminiscence program and the networked interaction therapy based on Web technology [3]. IP videophones and video-sharing tools have been adapted to networked sessions in reminiscence therapy where interviews with caretakers showed that there was a reduction in verbal abuse [4]. As it becomes a big issue in dementia care to improve various BPSD such as agitation, depression and aggression, telecommunication media has the potential to improve symptoms of dementia and the user's relationship with care-takers and aid other social interactions.

As an alternative to computers, interactive touch screen

television platforms with web services and easily understandable displays are under development for older adults to give them a way for social interaction with friends online [5]. Mobile and motorized wheeled type of video conferencing technologies have already been developed to enhance interaction. As for the robotic telepresence platforms, the Giraff robot is an example of the remotely controlled types that can provide limited physical interaction by tilting its head, while audio and video communication is provided to make it look friendly for older users [6]. The missing part of physical interaction like touching, holding or even closer contact has been partially provided through autonomous type of robots like the seal Paro made for the purpose of tactile interaction and stimulation of older adults with dementia though not offering two-way conversation [7]. The challenge here is to develop media which can comply with both verbal and nonverbal communicative needs of older adults in an effective manner.

B. Social Robots as Assistive Technology

There have been many studies on zoomorphic robots resembling lovable animals like Paro the seal, Phyno the penguin and more as companion robots for older adults to decrease loneliness and give them stimulation [8]-[11]. It has even been shown among older adults who cannot keep up with new technology that there is a positive psychological effect from interaction with robotic media technologies [7], [12]. The reported use of Paro, the pet-like seal robot, for comfort has therapeutic effect on mental and physical stress similar to animal-assisted therapy, and the human touch in psychological stress reduction [13], [14]. In other studies, the huggable communication medium Hugvie with its minimal human shape has shown a reduction of anxiety for older adults conversing through it [15], [16]. The human-like shape gives the perception of human presence, thus enables people to act as so which helps to shape relations to the android itself and the interlocutor. Research on minimalistic human design robots has started with the android robot Telenoid [17]-[19], and it is expected that these tele-operated media will help to change social interactions amongst people. Even when the operator changes, the robot will still be easy to hold, hug and let users project their images on it. Further investigation is needed to see if humanly shaped robotic media that promotes both non-verbal and verbal interactions like Hugvie and Telenoid could encourage older adults, even with dementia, those who tend to be isolated or have problems, to communicate with others and to improve their mental health and behaviors, e.g. well-being.

III. Purpose of the Study

Our research explores the possibility of preventing older adults with dementia from BPSD such as agitation and anxiety that tend to take place in the evening by talking to them properly through robotic telecommunication media. In this pilot study, our purpose is to clarify the conditions in which robotic media can effectively attract attention from those with dementia and promote their conversations. We explore the reactions of older adults with dementia to a huggable humanly shaped communication medium named Hugvie. It was also unclear whether its media design is acceptable for people with dementia and if it could be an interaction partner. To see their natural reactions, we conducted a field experiment where they live to keep the environment as real as possible. The points to see for evaluation are to what extent the attention of older adults with dementia could be attracted (attention span) and how many utterances could be extracted from them in each condition during the media usage.

Fig. 1 Older adults using Hugvie®

IV. Field Experiment

As a pilot study, we introduced a huggable communication medium to a care facility, to investigate how certain conditions work for older adults with dementia when they use the medium.

A. Method

A field experiment was conducted at a long-term care facility, which is a daily living space for older adults with dementia. The experiment included five participants (three females and two males). They were all diagnosed dementia (M=89.8 years, SD=6.85), who had tendency to show some BPSD, and were invited to hold the Hugvie described below. The conversation partner was the same person, a university male student in his 20s. Prior to the experiment, he received basic information and life histories about all participants. Experimenters introduced Hugvie to participants individually to investigate how the following Conditions ('C's) work for older adults with dementia; C 1) No sound, C 2) Radio, non-interactive, C 3) Daily conversation, and C 4) Reminiscence work. Reminiscence work is based in the tradition of psychodynamic theory as an emotion-oriented non-pharmaceutical approach to facilitating communication with people suffering from their symptoms. In each condition, the time for individual participants to interact with Hugvie was up to 15 minutes. All interactions between participants and the medium were recorded, and the duration of their concentration to it and the amount of utterances were counted. When participants' behaviors and utterances were not directed to nothing else than the medium, it was counted as the time when they were concentrated on it. Regarding utterances, their speech was transcribed, and the amount of words and particles was counted. Prior to the experiment, we received approval for it from the facility's administrator, all participants, and the participants' family members, based on the approval for the

experiment from the ethical committee at Waseda University (Approval code: 2017-173).

B. Communication Media

The Hugvie (Fig. 1) was developed by Osaka University and ATR Hiroshi Ishiguro Laboratory. Inspired by an android robot with a minimalistic design of human that is called Telenoid [16], Hugvie is a 600 g, 75 cm pillow-phone in a minimalistic human form with open arms, designed for talking whilst hugging to enable users to feel the presence of anybody remote during communication after placing a mobile phone inside its head.

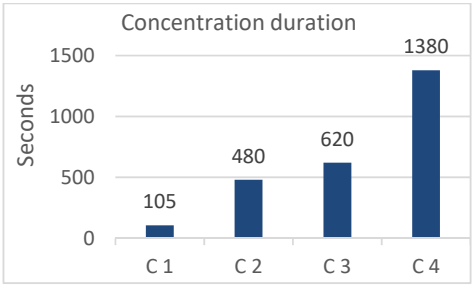

Fig. 2 Total duration of concentration to Hugvie by all participants in each condition ('C' in figure)

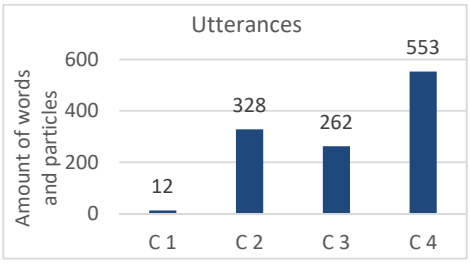

Fig. 3 Total amount of utterances by all participants in each condition ('C' in figure)

V. Result

We observed and compared the duration of concentration and the amount of utterances. As an overall result, under condition 4, reminiscence work, the five participants kept concentration in interacting with the medium for a longer duration of 2.23 times more than condition 2, radio, non-interactive, and 2.88 times longer than condition 3, daily conversation, as depicted in Fig. 2. The maximum duration was more than 10 minutes. In condition 4, they also showed 2.11 times larger amount of utterances than condition 2 and 1.69 times more than condition 3 (Fig. 3). Furthermore, a participant kept talking negatively in condition 3, but in condition 4 she changed her mood and kept talking positively.

Although the overall result showed that reminiscences work kept the interaction going for longer, the individual results point in more directions. Two of the participants did not show reactions in four conditions. One kept rejecting to hold Hugvie, and another was almost sleeping on that day. Concerning condition 3, daily conversation, participant 3 (P3) did not speak so much but paid more attention to Hugvie (Fig. 4), whereas participant 4 (P4) spoke more here than under other conditions (Fig. 5). Under condition 2, radio, non-interactive, participant 5 (P5) talked almost the same amount as in condition 4, reminiscence work. In condition 1, no sound, the participants barely showed any reaction for neither concentration nor utterances.

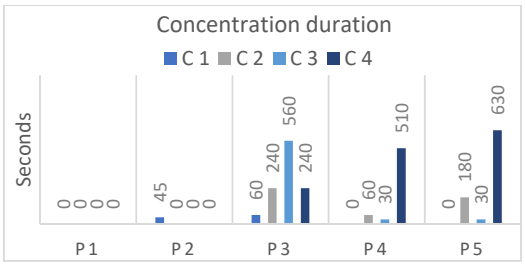

Fig. 4 Duration of concentration to Hugvie by each participant ('P') in each condition ('C')

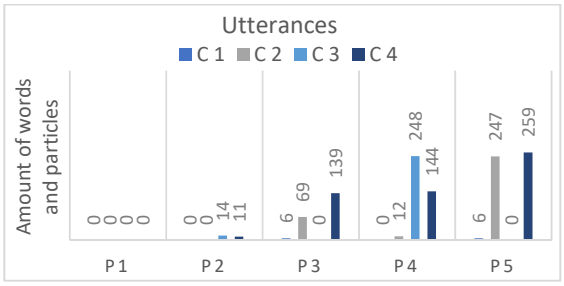

Fig. 5 Amount of utterances by each participant ('P') in each condition ('C')

VI. Discussion

The overall result indicates that by adjusting to suitable conversational topics, which recall their memories, older adults with dementia can keep concentration and communicate with others in remote longer than in daily conversation or radio, non-interactive condition. A result also indicates that providing topics that trigger personal memories could even in remote change the mood of older adults and improve communication.

The results of individuals indicate that promoting interaction is not limited to reminiscence work and that other approaches might be more suitable for some people. For instance, one-way communication like a radio might be enough to lead some people. Therefore, it is now necessary to figure out which conditions would fit what type of people, so we can create and facilitate better ways for verbal and non-verbal communication in dementia care. It is our future work to investigate if the preferred conditions for interactions are related to types or severity of dementia or personality.

At the same time, we also think that it is necessary to further discuss the ethics around emotional and behavioral persuasion of older adults when applying persuasive technology. To bring further benefit to older adults, we need to investigate effective ways of utilizing memories or personal information that could encourage communication through robotic teleoperation

systems. Robots can efficiently collect and convey highly personal information with superior memory and can seem convincing to users by anthropomorphism [20]. By making robots persuasive, users may have difficulty controlling their own information flow by themselves. Ethical concerns are raised when personal data are dealt with, but it goes further than privacy implications. Robotic persuasive technologies that affect emotions and behaviors challenge our ideas about ourselves as subjects of our own lives. The question comes, if it can be morally justified to deliberately influence the user's will and behavior in a specific direction. In the development of teleoperation systems and artificial intelligence, the decision-making process for older adults is required to support, who are facing the possibility of not only providing their information to robots but also being led by them involuntarily.

There are explanatory approaches to respect the user's own will by the Belmont report and research ethics [21], [22]. Another approach could be to convince users of superior merits when providing information by attempting to change their will. But that raises a question: can it be morally justified to deliberately influence the user's will and behavior in a specific direction? Any form of mediation should be critically examined according to the Foucauldian approach to freedom if it dominates users, so they have no control on or go against the impact of media technology [23]. More research is needed to clarify under what conditions people with dementia can modify the impact of technological mediation, and what democratic procedures should be developed when we allow media to enforce specific behaviors. This research opens a new interdisciplinary area.

VII. Conclusion

Based on the results obtained, we conclude that since it was suggested that providing topics related to personal histories with robotic media even in remote could affect communication positively, there is a potential for us to improve the well-being of the elderly with BPSD. Therefore, we need to further investigate effective ways of utilizing memories or personal information that could encourage communication through teleoperation systems of robots in a better way than face-to-face. On the other hand, we also need to explore what works for different types of people and why.

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