

M. OTAKE, T. FUJINAMI (Conveners) **Application and acceptance of technology for people with dementia and people who care for them: Towards assistive intelligence via artificial intelligence.** *Gerontechnology* 2014;13(2):116; doi:10.4017/gt.2014.13.02.235.00 **Participants** Shohei Kato (Japan), Kiyoshi Yasuda (Japan), Takako Mizuoka (Japan), Mihoko Otake (Japan). **Issue** Bayesian-based detection of mild cognitive impairment and mild Alzheimer's disease; An agent system for reminiscence therapy; Application of cognitive training to healthy older adults, older adults who need care, and older adults with dementia; Decision-making for installing tube feeding to an elderly person. **Content** Applying gerontechnology to the real world leads us to consider various issues involved in caregiving, family, and community. What becomes evident in applications depends on contexts and may be determined by factors such as the nature of technology employed, the condition of the cognitively impaired person, the roles played by people supporting him or her, the relationships between them, and the social insurance system, among many other things. A dependency on context makes it rather difficult to identify the functions of assistive technologies and their influences in the real world because the same technology may bring about different effects depending on the context. We believe that designing assistive intelligence via artificial intelligence is one of the solutions to the problem. Artificial intelligence is an engineering approach to human intelligence and may help or complement human caregiving, training, rehabilitation, and diagnosis by augmenting the cognitive capability of the person with dementia, as well as the person's caregivers, and medical professionals. It may enhance the quality of care. It may increase the intensity or total application period of training and rehabilitation. It may support an early diagnosis of cognitive decline. Ideal compensation or coevolution of human intelligence and artificial intelligence is expected. We invite researchers and practitioners who have some experiences in applying their work to real world situations to share and discuss their views and insights. **Structure** There will be four paper presentations, followed by a question-and-answer session and a general discussion. The titles of the papers are as follows: (i) Bayesian-based detection of mild cognitive impairment and mild Alzheimer's disease: discrimination performance using cerebral blood flow activation during daily conversation; (ii) An anime agent system for reminiscence therapy; (iii) An involvement of caregiver in decision-making for installing tube feeding to an elderly person; (iv) Application of co-imagination method to healthy older adults, older adults who need care, and older adults with dementia. **Conclusion** The process of accepting technology cannot be a simple agreement in which researchers propose something and users accept it. It can be a long-term process for establishing mutual understanding of the technology by which attitudes to technology undergo a transformation both in researchers and users. How it can happen varies in contexts.

Keywords: early detection of cognitive decline, cognitive training, reminiscence therapy

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S. KATO, H. ENDO, R. NAGATA, T. SAKUMA, R. WATANABE. **Bayesian-based detection of mild cognitive impairment and mild Alzheimer's disease: Discrimination performance using cerebral blood flow activation during daily conversation.** *Gerontechnology* 2014; 13(2):116-117; doi:10.4017/gt.2014.13.02.211.00 **Purpose** With the goals of promoting fruitful and healthy lives for the elderly and a society with greater longevity, this study reports the discriminatory performance of a Bayesian-based early detection method of mild cognitive impairment and mild Alzheimer's disease for elderly. **Method** There are several studies^{1,2} that suggest associations with Alzheimer's disease and verbal performance. This study focuses on cerebral blood flow activation during casual conversation as one of several verbally-based cognitive activities. During the study, an elderly person talks about various topics such as their favourite season, travel, gourmet food, and daily life. With the use of functional near-infrared spectroscopy (fNIRS), that can measure cerebral blood flow activation non-invasively, we collected 42 channels of fNIRS signals from the frontal, right and left temporal areas from 22 elderly participants (7 males and 15 females between the ages of 64 to 89) at a specialized medical institute. The elderly participants were classified into three clinical groups: five patients with mild Alzheimer's disease (AD) and ten participants with mild cognitive impairment

(MCI) and seven cognitively normal persons used for controls (CN). The MMSE scores were 29.3 ± 1.0 (CN), 28.6 ± 1.9 (MCI), and 23.4 ± 2.5 (AD). To design an algorithm for computer-aided diagnosis of cognitive impairment in the elderly, we developed a screening process with the help of a specialist in geriatrics. We thus propose a two-phase Bayesian classifier³ (Figure 1) based on the assumption made during the screening process, that firstly checks the suspicion of the cognitive impairment (CI) or not (CN) from given fNIRS signals; if

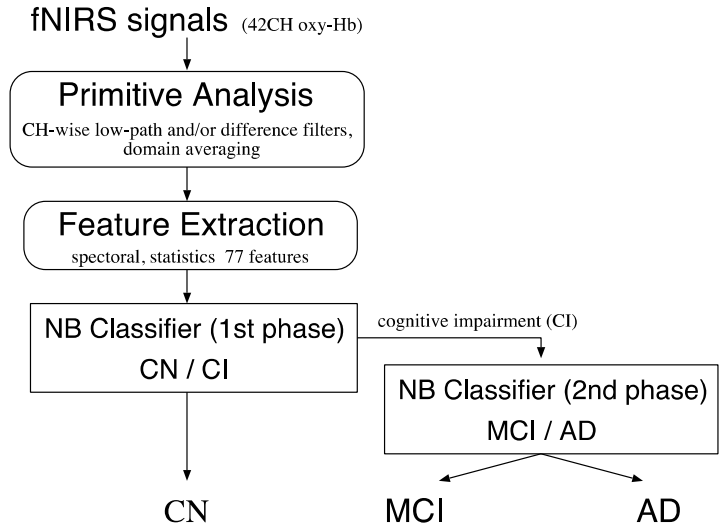


Figure 1. Two-Phase Bayesian classifier for patients being tested for Alzheimer's disease (AD), mild cognitive impairment (MCI), and controls (CN)

any, and then secondly judges the degree of the impairment for MCI or AD. **Results & Discussion** We conducted statistical tests using fNIRS signals and examined the detection performance of the proposed Bayesian classifier that can discriminate among elderly individuals with CN, MCI, and AD. Consequently, cross-validation of empirical results indicated this method had an accuracy rate of more than 95% and suggests that the proposed approach may be an effective tool that can be used to screen the elderly for cognitive impairment.

References

1. Hailstone JC, Ridgway GR, Bartlett JW, Goll JC, Buckley AH, Crutch SJ, Warren JD. *Brain* 2011;134(Pt 9):2535-2547; doi:10.1093/brain/awr205
2. Taler V, Baum SR, Chertkow H, Saumier D. *Neuropsychology* 2008;22(2):188-195; doi:10.1037/0894-4105.22.2.188
3. Kato S, Endo H, Homma A, Sakuma T, Watanabe K. 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society 2013; pp 5183-5186; doi:10.1109/EMBC.2013.6610873

Keywords: health & self-esteem, early detection of dementia, verbally-based cognitive tasks

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T. MIZUOKA, T. FUJINAMI. **Involvement of caregiver in decision-making to administer tube feeding to elderly person.** *Gerontechnology* 2014;13(2):117-118; doi:10.4017/gt.2014.13.02.237.00

Purpose Japanese society often recommends the elderly to choose a 'natural death' when it becomes difficult for them to eat orally and when their ability to make decisions declines¹. Caregivers can, however, opt for tube feeding to be administered to the elderly, who have little time to live, so that they can spend more time with their family members². Our study was aimed at clarifying the decision-making process involved in introducing tube feeding to an elderly person by focusing on the relationships between him, his family, and his caregiver.

Method A fieldwork survey was carried out from November 25, 2013 to January 8, 2014 (ongoing) at an adult day care center. Field notes were taken about the relationship between an elderly person and his caregiver. The relationships between the elderly person, relatives, and a caregiver were investigated through semi-structured and informal interviews. We described the ethnography of the collected data, analyzed it by focusing on the relationship between the stakeholders, and synthesized the results of analysis on the decision-making process. **Results** X was the caregiver, who took care of Y. X was also a nurse and care manager who ran an adult day care center. Y was 74 years old and an elder brother of Z, to whom X had been a

friend for 20 years. Y and Z had long been distanced. Y was passed around in 2011 from hospital to hospital due to his impaired cognition caused by hydrocephalus. X tried to move Y from a hospital to a nursing home near Z's house to support Z and his wife. However, he was not admitted to the nursing home because the staff refused to take him in after meeting him. X could not help to take care of Y at her adult day care center and lived with him until another nursing home was found. At that time, X agreed with Z and his wife that they would not have life-sustaining treatments administered to Y. However, he gradually improved due to X's care, and humane relations were formed between X and Y. The relationship between X and Z (including his wife) also evolved as a result, i.e., their relationship was transformed from a relationship between a family and a caregiver to a relationship between a family and Y's primary caregiver. When it became difficult for Y to orally ingest nutrients due to aspiration pneumonia in the summer of 2013, Z and his wife wished for a 'natural death' as they had agreed in advance. However, X proposed gastrostomy tube feeding on the grounds that Y's physical and cognitive states were being restored. Z, his wife, and X concluded Y be fitted with a nasal tube through discussions with a physician. Y's condition improved due to nutrients administered through the tube, and he was then able to ingest nutrients through only being fed orally. **Discussion** This study analyzed the process of decision-making in medical technology with a focus on relationships. As a result, we observed the process in which a caregiver participated in a discussion on decision-making with a family and a family doctor and caused a change in the relationships between the caregiver, an elderly person, and his family. Families are substitute decision-makers for elderly with cognitive difficulties in Japan, and a common practice by caregivers is to help families accordingly. However, the choice of medical technologies that is discarded in common practice is picked up by primary caregiver who participate discussions on an equal basis. This suggests that it is important not to be tied to relations based on a framework, and to discuss issues as equals based on specializations. We consider that this conclusion is beneficial as a suggestion to practitioners in the field of medical care.

References

1. Ishitobi K. Peaceful Death. Tokyo: Kodansya; 2010
2. Mizuoka T, Fujinami T. Decision-Making Process of Family Caregivers: Gastrostomy for Elderly People with Cognitive Difficulties [in Japanese]. Japanese Journal of Qualitative Psychology 2014;13:238-252

Keywords: health & self-esteem, tube feeding, decision-making, relationship, ethnography

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K. YASUDA, M. FUKETA, J. AOE. **An anime agent system for reminiscence therapy.** *Gerontechnology* 2014;13(2):118-119; doi:10.4017/gt.2014.13.02.239.00 **Purpose** A virtual agent system was developed to serve as a conversation partner for individuals with dementia^{1,2}. The computer screens showed an animated face resembling 'a five-year-old grandchild' (Figure 2). The agent could ask any of 120 reminiscent pre-set questions^{1,2,3}, automatically detect the end of an individual's reply, and follow with a new question⁴. **Methods** Experiment 1 included eight individuals with Alzheimer's disease. Their average age was 78.5 years, and the mean Mini-Mental State Examination (MMSE) score was 22.2. A subset of 15 questions was selected. For the same 15 questions, each participant replied to the agent (agent condition 1) and to a human partner (58 year old, human condition 1). In Experiment 2, we observed a multi-party conversation between the agent and two participants with dementia or mild cognitive impairment. Their average age was 75.9 years and the mean MMSE score was 24. Five participant pairs conversed with this agent (agent condition 2), or without the agent (human condition 2). We evaluated the influence of the agent on their conversation using original psy-

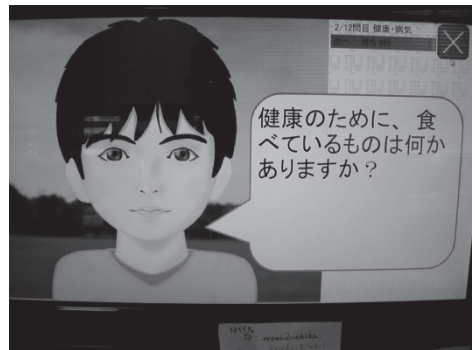


Figure 2. The virtual anime agent

chological five-scale ratings. **Results & Discussion** For Experiment 1, we calculated the number of syllables included in each participant's reply for the two conditions. All the participants uttered 5,494 (74%) syllables in the agent condition 1 compared with 7,406 (100%) syllables in the human condition 1 (Figure 3). For Experiment 2, two participants conversed well with this agent. On the other hand, the agent adversely affected on the conversation of one pair. We discussed the effectiveness of this virtual agent system for the participants and multi-party conversations.

References

1. Kuwahara N, Yasuda K, Tetsutani N, Morimoto K. International Journal of Computers in Healthcare 2010;1(2):126-143; doi:10.1504/IJCIH.2010.037458
2. Yasuda K, Kuwahara N, Kuwabara K, Morimoto K, Tetsutani N. American Journal of Alzheimer's disease and other dementias 2013;28(5):508-516; doi:10.1177/1533317513494440
3. Yasuda K, Kuwabara K, Kuwahara N, Abe S, Tetsutani N. Neuropsychological Rehabilitation 2009;19(4):603-619; doi:10.1080/09602010802586216
4. Sakai Y, Nonaka Y, Yasuda K, Nakano YI. Listener agent for elderly people with dementia. Proceedings of the 7th annual ACM/IEEE international conference on Human-Robot Interaction; 2012

Keywords: health & self-esteem, agent, anime, dementia, conversation, reminiscence

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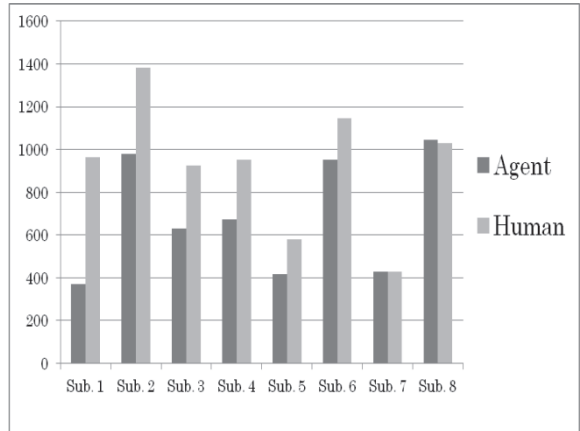


Figure 3. The number of syllables included in the participants' replies in the experiment 1; All participants uttered 5,494 (74%) syllables in the agent condition 1 compared with 7,406 (100%) syllables in the human condition 1

M. OTAKE. Application of co-imagination method to healthy older adults, older adults who need care, and older adults with dementia. Gerontechnology 2014;13(2):119-120;

doi:10.4017/gt.2014.13.02.247.00 **Purpose** Prevention of cognitive decline and dementia may contribute to improving quality of life of both older adults and their families¹. We propose a novel method called the co-imagination method for the purpose of prevention. It was invented for training cognitive functions which decline at an early stage of dementia. Training includes the use of episodic memory, division of attention, and planning by doing everyday tasks such as participating in group conversations. The co-imagination method is defined by the following rules: (i) Participants choose their own photos, illustrations, music, or real objects relevant to a predefined theme; (ii) In order to ensure active participation, the order and allocated time for each participant to describe the photos are determined. The purpose of this study is to design effective protocols of the coimagination method to older adults with diverse cognitive functions through practices. **Method** The co-imagination method was applied to older adults at a care prevention facility, a care facility, and a hospital in Japan. At the care prevention facility, healthy older adults practiced the method as cognitive training for other healthy older adults in the community in order to prevent cognitive decline. At the care facility, staff practiced the method as day service activity for older adults who needed care. At the hospital, a group of medical doctors, occupational therapists, clinical psychologists, and nurses practiced the method as brain rehabilitation for mild dementia patients. Protocols were designed for each facility, keeping in mind the the cognitive level of participants. **Results & Discussion** Each protocol was classified into three stages: (i) preparation, (ii) conversation, and (iii) recall. At (i) preparation stage, the theme of the forthcoming session was provided for the participants. Healthy older adults prepared topics and took or selected photos by themselves. Other participants were interviewed about their topics by practitioners. Practitioners at the care facility took photos on behalf of participants who couldn't take them by themselves. Practitioners at the hospital prepared materials and objects according to the interview, and took photos of them

with the patients. At (ii) conversation stage, healthy older adults and older adults who need care described topics by themselves watching the photos on the screen. Older adults with dementia skipped the description of topics sessions because it was difficult for them. Question and answer sessions were conducted at every facility. Participants asked questions and gave comments at the care prevention facility and the care facility while practitioners helped at the hospital. At (iii) recall stage, memory tasks were conducted at care prevention facility and care facilities. The participants selected a combination of the photos. At the hospital, alternative sessions were conducted instead of the memory task. Practitioners conducted review sessions and showed the photos, which were used during conversation sessions, and triggered free recall for each topic. To summarize, the method was applicable to older adults of different cognitive levels by adjusting the protocol for each participant. Preliminary results suggest that lexicons of the participants, which is inaccessible in Alzheimer's disease, were maintained. Future work includes investigating long term effects of the application of the method and each protocol on cognitive function of each participant by analyzing lexicons of utterances

References

1. Otake M, Nurzaman SG, Iida F. Embodied Cognition in Psychological Therapy. *Journal of Cognitive Science* 2012;13(4):431-452

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