

Development of a dialogue robot Bono-06 for cognitive training of older adults

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Purpose Social isolation and loneliness are major QOL problems affecting older adult populations, thus social interactions and communication in the daily life of older adults is a key factor. Additionally, there appears to be a relationship between these social activities and cognitive functions, suggesting that they have the potential to prevent cognitive decline (Livingston et al., 2017). **Method** We introduce a novel dialogue robot that aims to provide cognitive daily training for especially those who do not have a chance to talk (e.g. living alone). Our final goal is to confirm an effect of cognitive training with a dialogue robot for older adults through a long term experiment. In this paper, we propose a dialogue robot, which aims to provide human robot interaction for older adults. The dialogue system provides the feature of talking that is based on the method called the Coimagination method (CM) (Otake-Matsuura, 2018). CM supports a conversation that is designed for timekeeping (e.g. question-and-answer of 1 minute) and using some themes that are familiar for participants (e.g. favorite food). We designed a physical dialogue robot **Bono-06** that aims to conduct the dialogue with older adults (Figure 1.). The dialogue is based on CM, since the dialogue is introduced question-answering style and strictly time keeping. We have a hypothesis that a physical robot has more an emotional attachment for the participants than using just a virtual agent or a smart speaker. Using the advantage, we would like to ask the participants to use the robot for a long term (e.g. 3 months) to show the cognitive training effect. To achieve the goal, we consider the following five requirements to develop the robot. **R1**: Able to represent an impression to talk as if the older adults speak to a human. **R2**: Appearance is acceptable for older adults and able to stand on a table at home. **R3**: Able to shake their head as if they are nodding. **R4**: Able to operate remotely in order to control without the participants are conscious of a robot operator. **R5**: Having a simple external interface which enables to avoid burdened operation such as touching software button. **Development** Figure 1 and 2 show the dialogue robot Bono-06. The robot has RGB LED in the head near the cheek, thus the robot can show the expression by the LED color (**R1**). The facial design is based on a previously developed robot that is reviewed by some nurses in the hospital (Miyake, Shibukawa, Masaki & Otake-Matsuura, 2020) (**R2**). The specification of robot is 180 mm height, 110 mm width and total weight is 181g. So, we can put the robot on the flat table at home in daily use. (**R2**). The robot has 1 degree-of-freedom, namely the head pithing in order to express nodding for a user. The head rotates at most 45 degrees (**R3**). The robot is able to operate with Bluetooth, which could be connected to a smart phone or a tablet, hence we can operate the robot at user's home remotely (**R4**). Bono-06 has a physical push button, which can be used interaction for the user intuitively without cumbersome operation (**R5**). The robot has both a microphone in the front side (Fig 1.) and a speaker in the rear side (Fig 2.), hence that meets the basic feature for the dialogue with a human (**R5**). Finally, the power switch is installed on bottom of the robot, since a user could operate to switch the power on/off intuitively (**R5**). **Result & Discussion** We have developed Bono-06 for cognitive daily training. As the next step, we plan to tackle an experiment to confirm the effect of intervention with the dialogue-robot.

References

- Livingston, G., Jonathan, H., Sommerlad, A., Ames, D., Ballard, Clive., Mukadam, N. (2017). Dementia prevention, intervention, and care. *The Lancet*, 396(10248), 2673-2734. [https://doi.org/10.1016/S0140-6736\(20\)30367-6](https://doi.org/10.1016/S0140-6736(20)30367-6)
- Miyake, M., Shibukawa, S., Masaki, H. & Otake-Matsuura, M. (2020). User-oriented Design of Active Monitoring Bedside Agent for Older Adults to Prevent Falls. *Journal of Intelligent and Robotic Systems*, 98, 71-84. <https://doi.org/10.1007/s10846-019-01050-w>
- Otake-Matsuura, M. (2018). Conversation Assistive Technology for Maintaining Cognitive Health. *Journal of Korean Gerontological Nursing*, 20(1), 154-159. <https://doi.org/10.17079/jkgn.2018.20.s1.s154>

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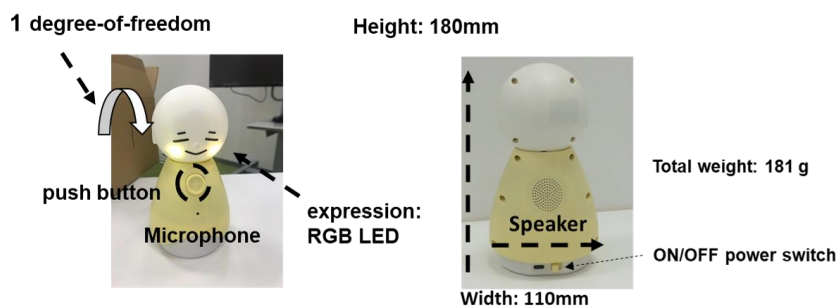


Figure 1. Front side of Bono-06 Figure 2. Rear side of Bono-06