

Development of a group conversation support robot Bono-05 for cognitive health of older adults

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Purpose Needs for prevention, intervention and care for dementia are increasing due to longevity worldwide. One of the risk factors for dementia is social isolation (Livingston et al., 2017). In order to increase social interaction opportunities, we experimentally provide a group conversation program. The purpose of this study is to develop a robot which supports group conversation for the cognitive health of older adults. **Method** In this study, we developed a robot which moderates group conversation supported by the Coimagination method (CM). CM was designed for dementia prevention by increasing the intensity and improving the quality of social interaction of older adults which may involve multiple cognitive functions (Otake-Matsuura, 2018). CM assists interactive conversation which is defined with two rules: 1) themes are predetermined and topics with photos are prepared beforehand, 2) period for speech, listening, questions and answers are defined in order to guarantee interactivity and equal participation during conversation. **Approach** We design a physical group conversation support robot **Bono-05** (Fig 1). The design is based on the previous versions, namely, from Bono-01 to Bono-04. The latest version is developed to be used for a 12-week randomized controlled trial (RCT) of CM. For this purpose, we consider the following eight requirements to develop the robot. **R1:** Large enough for an appealing existence as well as small enough for portability. **R2:** Appearance is acceptable and relaxing to older adults. **R3:** Fault-tolerant and liable for maintenance. **R4:** Having minimum degrees of freedom for moderating and supporting turn-taking during group conversation. **R5:** It moves with minimum noise. **R6:** Loudness of the voice is tailorable to participants with and without hearing loss. **R7:** Easy for programming and its motion is stable. **R8:** Safe enough for older adults. **Development** Figure 1 shows the group conversation support robot Bono-05. The size of robot is 263 mm high, 208 mm wide and 145mm in depth. Therefore, we can put the robot in front of the group of participants as well as put in the wheeled carry-on (**R1**). The facial design is based on a previously developed robot that is reviewed by some nurses in the hospital (Miyake, Shibuwaka, Masaki & Otake-Matsuura, 2019) (**R2**). Exterior packages that were heavy-duty lightweight molded plastics and easily obtainable devices were selected for servomotors and microcomputers (**R3**). The robot has 4 degrees-of-freedom, namely the head pithing for 50 degrees in order to express nodding for a user, and the torso yawing at maximum 300 degrees in order to face each participant, both arms raising 150 degrees respectively in order to point to a certain participant (**R4**). Silent servomotors were selected (**R5**). A dial was placed for modulating variable resistance (**R6**). Microcomputers were customized by compatible to general-purpose ones, namely, Arduino so that integrated developing environment can be used (**R7**). The size is portable with lightweight exterior and minimum moving part as described above for safety (**R8**). **Result and Discussion** We have developed the group conversation support robot Bono-05 based on the eight requirements in order to conduct the RCT. The robot has been robust enough to conduct the RCT successfully (Otake-Matsuura et al., 2019). As the next step, we would like to evaluate the current usability of the robot with older adults. After conducting the RCT several times and the effect of the CM supported by the robot on cognitive health is confirmed, we are planning for commercialization of the robot.

References

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Figure 1. Group conversation support robot Bono-05