

Assessing the Use of Communication Robots for Recreational Activities at Nursing Homes Based on Dementia Care Mapping (DCM)

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Abstract. Using information communication technology (ICT) and communication robots (hereafter referred to as “robots”), we examined a system to assist recreational activities at nursing homes. The system relies on visual content to deliver a variety of recreational activities, from exercises to reminiscence therapy. Robots support those activities by interacting with nursing home residents. These systems are currently being evaluated at various elderly care facilities, where the prototype has been installed. This report will review the recreational contents that are currently under examination and the outline of the assessments, as well as the summery of the data that has been gathered so far and the effectiveness of this service suggested by the summery.

Keywords: Dementia care · Communication robot · Recreation activity

1 Purpose of Study

Recreational activities at elderly care facilities play an essential role in the maintenance of a quality life of residents. Recreation serves more than the purpose of bringing enjoyment to the residents; it also helps with rehabilitation [1, 2]. On occasion, caregivers get stuck in a rut, and the less experienced staff in particular tends to resist taking the lead in livening things up. With regards to managing recreational activities, one of the issues that need addressing is the training of the young staff [3]. Because of this, nursing facilities frequently end up using DVDs or visual aid in leading exercises, singing and other activities. Although healthy elderly possibly enjoy such visual contents, it is difficult to sustain the focus of elderly dementia patients on visual contents. For these people, we developed a prototype of care home recreational service with a moving robot with active body interconnected with the recreational visual contents, and assessed its effectiveness.

Reports indicate that replacing message boards and other static forms of communication with robots that communicate improve the message’s reliability. Other reports have shown that when robots facilitated face-to-face communication between two elderly dementia patients through the TV phone, the subjects were more likely to direct

their gaze toward the TV monitor and liven up conversations [4, 5]. The presence of robots with active bodies was therefore expected to increase one's gaze and focus on the visual contents. It is anticipated that the addition of robots opens up the usual staff-to-residents communication to a three-way channel that creates more opportunities for communication between the care staff and the residents. As a result, expectations were that the services currently under examination would reduce stress on caregivers who manage recreational activities, and that will in turn bring about positive changes to the entire program.

Nippon Telegraph and Telephone West Corporation (hereafter referred to as "NTT West") and Nippon Telegraph and Telephone East Corporation (hereafter referred to as "NTT East") are currently examining the recreation system in the aforementioned system using ICT and communication robots. In collaboration with two nursing facilities in the Kansai region and two in the Kanto region, assessment of the expected effect mentioned above was conducted.

In this study, we examined how this care recreation service exerts the influence to the care quality provided to care receivers based on an evaluation by Dementia Care Mapping (Hereafter referred to as DCM), and considered the effect provided by this care recreation service.

2 Assessment Method

2.1 System Outline

Figure 1 shows the outline of the system. The hardware used was Hikari BOX⁺ [7], a set-top box provided by NTT West Japan, and a robot connected to that. We used FLET'S Hikari [8], an Internet service provided by NTT West Japan and NTT East Japan. Nursing home recreational activities (visual contents) will be available as application of Hikari BOX⁺. Hikari BOX⁺ and robot are connected via wireless LAN, and the robot will synchronize its actions with the visual content. The robot Sota [9], as seen in the drawing, will appear only as a torso, 30 cm in height and used on a tabletop. Hikari BOX⁺ is shaped like a box measuring 115 mm × 105 mm × 31.5 mm and operated with remote control buttons. The TV is connected through an HDMI cable. The content will vary from children's stories and exercises, to quizzes (calculations, kanji characters), reminiscing (topics from the past), and an introduction to famous local spots.

The nursing home recreation system can be activated with the mere press of a remote control button on Hikari BOX⁺. On the other hand, after the remote is used at the time of starting recreation activities or moving on to the next question on a quiz, the robot begins to operate. The robot will then gesticulate and speak words of starting recreations or encouragement.

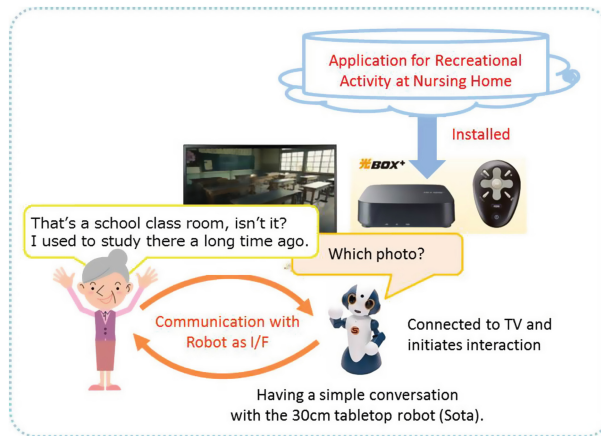


Fig. 1. System outline

2.2 Outline of Assessment Schedule

Care staff were given a 2-week pretrial period to become accustomed to Hikari BOX⁺ and learn how to operate the nursing recreation system. At the same time, contents were narrowed down to those that will undergo the assessment. Afterwards, 3 months trial was conducted. During the trial period, a portion of the usual recreational programs carried out at the facilities incorporated with Hikari BOX⁺ and robot system. Pretrial by NTT West Japan began in mid-June for the Kansai region's assessment, and the 3-month trial began in July. Pretrial by NTT East Japan began in August for the Kanto region's assessment, and the trial was held between August to October.

2.3 Facilities Collaborated with the Assessment

4 facilities in total collaborated with our assessment. In the Kansai Region, Super Court Co., Ltd., Kyoto Shijo Omiya (privately run nursing home, hereafter referred to as SC) and Telwel Nishi Nihon – Care Port Osaka Nishi Suita Center (day care, hereafter referred to as CP). In the Kanto region, Social Welfare Corporation Zenkokai – Butterfly Hill Hosoda (special elderly nursing home, hereafter referred to as BH) and Telwel Higashi Nihon – Setagaya Day Service Center (day care, hereafter referred to as SD).

2.4 Assessment Method

Assessment Outline. The assessment included a survey after the 2-week pretrial period that asked the subjects their impressions and opinions of each recreational activity, and the service improvement in response to that. Then, every two weeks during the 3-month trial period of the improved service, that followed, the GBS scale [10] for rating the severity of dementia and its qualitative differences are being used to measure the

subjects' emotional function and mental state. Furthermore, on the third month when the nursing staff and the residents have become fully accustomed to the robot and the recreational activities, two evaluations by DCM took place to assess changes in the quality of the facilities' nursing care caused by the incorporation of the new service. In this paper, the effectiveness of this service is discussed based on the result of 2 DCM assessments held at the aforementioned 4 facilities.

About DCM. Dementia Care Mapping is a method that evaluates person-centered care [11]. Person-centered care is based on a theory for dementia care developed by the late Professor of psychology at Bradford University, Tom Kitwood. DCM is based on observing a dementia patient for over 6 h.

Every five minutes, the patient's activities are codified in a Behavior Category Code; from there, the patient's state is further categorized into one of six Mood Engagement levels (+5, +3, +1, -1, -3, -5), which correspond to the highest level (well-being) to the lowest (ill-being). BCC stratifies the patients' verbal and non-verbal interactions with their surroundings into 24 levels, from A through Z. DCM is carried out by specially certified individuals called mappers. The mapping is typically performed by 2 to 3 such individuals, who after a period of observation, come up with a consensus on BCC and ME values before arriving at a final diagnosis.

Although DCM is commonly carried out with around 6 h observation, we kept the observation time to two hours in order to observe changes in the residents participating in recreational activities, which included group recreation time and the residents' free time. The evaluation was carried out by specially certified mappers. In the Kansai region, it was carried out by 3 mappers, and in the Kanto region it was carried out by 2 mappers, at each facility.

Participants to DCM. Each facility selected 3 people from their users, who became the observation subjects of DCM. The subjects were selected from residents whom the care staff expected to improve their conditions with this service. Table 1 shows the gender, age, nursing level [12], independent life level of participants with dementia and bedridden level [13].

3 Result of DCM Evaluation

3.1 Comparison of ME Value Averages When This Service Is in Use or not

As shown in Fig. 2, transitions of activities and ME values of each participant through time can be obtained through DCM. The series of alphabets recorded below the graph is the BCC corresponding to the activities of the participants assessed every 5 min, and the graph shows the transition of ME value expressing the conditions of participants during this time. Figure 2 shows the result of first DCM of participant G from care facility BH. At BH, DCM observation started at 10 AM, and care recreation using this service was conducted from 10:10 to 10:40. Moreover, another care recreation using this service was conducted from 11:08 to 11:40. Table 2 shows the codes appeared in Fig. 2.

Table 1. Participants to DCM

Care facility	Participant	Gender	Age	Nursing level	independent life level	Bedridden level
SC	A	Female	91	4	III	Unknown
	B	Female	88	4	IV	Unknown
	C	Female	81	2	IIIa	Unknown
CP	D	Female	84	2	IIb	A
	E	Female	95	3	IIIa	A2
	F	Female	95	4	IIIa	B1
BH	G	Female	90	4	Unknown	B2
	H	Female	89	4	Unknown	B2
	I	Female	82	2	Unknown	A1
SD	J	Female	94	1	Unknown	Unknown
	K	Female	85	1	Unknown	Unknown
	L	Female	78	2	Unknown	Unknown

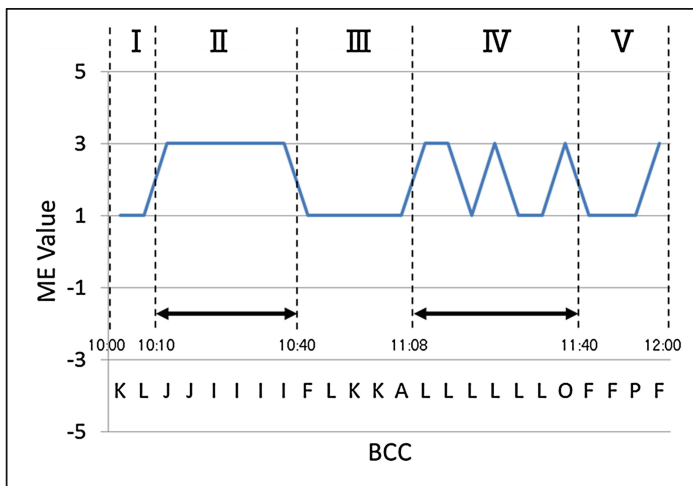


Fig. 2. Transition of activities and ME value following time

As shown in the Fig. 2, when this service is in use, I (mental activity), J (sports), L (leisurely activities) appears often, and F (eating and drinking) and K (moving) appeared often when not in use. In this paper, with the ME value gained through this method, the effectiveness of this service by comparing the conditions of the nursing home residents when they are using this service or not; for instance from Fig. 2 the average value of the area between II and IV, where this service is in use, and the average value between I, III, and V where this service is not being used. When ME value is +1, it is considered that the facility user is in relatively good condition, but this really means that he/she is in neutral state. +3 means he/she is in a good state, +5 means he/she is in exceptionally good state.

Table 2. BCCs and descriptions

BCC	Description
A	Verbal and non-verbal exchange with the surrounding (no other clear activity)
F	Eating and drinking
I	Prioritizing the use of intellectual abilities
J	Exercise or physical sports
K	Independent walking, standing or wheelchair-moving
L	Leisure, fun and recreational activities
O	Displaying attachment to or relating to inanimate objects
P	Receiving practical, physical or personal care

Firstly, the total data time using this service was 1335 min (BCC, ME Value, 267 samples), and the time when the service was not being was 1445 min (BCC, ME Value, 289 samples). Figure 3 shows the result of comparison of the average ME Values of these samples.

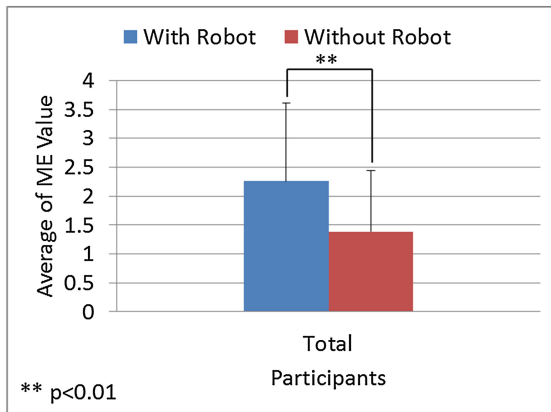


Fig. 3. Comparison of the average of ME values of the total samples

As shown in Fig. 3, when this service was being used, the average of ME value was high number of about 2.3. On the other hand, when this service was not being used, it was 1.8. Moreover, a meaningful difference was acknowledged between these average values. This suggested that using this service was effective to the improvement of the conditions of the nursing home residents.

3.2 Comparison of BCC Frequency When This Service in Use or not

Figure 4 shows the comparison of BCC frequency when this service was in use or not. Figure 4 demonstrates that when this service was in use, E (being involved in expressive or creative activities), G (reminisce or look back on life) or I (activities that mainly use mental faculty) were frequent. This shows that the contents of the care

recreation, such as Origami, local photographs or quiz, are being effectively used. When this service was not in use, the frequency of sections such as A (verbal and non-verbal exchange with the surrounding [no other clear activity]), F (eating and drinking) or J (physical activities or sports) was clearly higher. Moreover, the frequency of L (being involved in leisurely activities for enjoyment or change of mood) was about the same in the both situations.

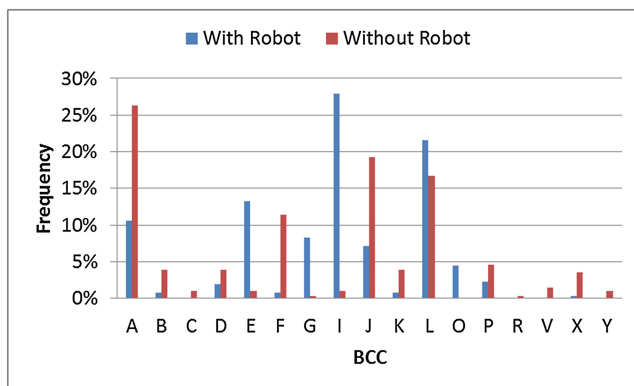


Fig. 4. Comparison of BCC frequency when this service was in use or not

Focusing on A, when comparing the averages of ME value when the service was being used or not, the value of former was 1.10 (SD = 0.62), that of the latter was 1.14 (SD = 1.02), thus meaningful difference was not displayed. On the other hand, the averages of ME value of other sections were 2.42 (SD = 1.29) for E, 3.76 (SD = 1.34) for G and 2.97 (SD = 1.11) for I, uniformly showing exceptionally high number. By using this service, it shows the reduction of a neutral state such as A, where the state of nursing home residents are neither good nor bad. It also triggered the increase of good state such as E, G or I. Therefore, it seems to be considered that this service can contribute to high quality care to the nursing residents.

Moreover, regarding J, though there were not many occasion while using this service, the average of ME value when using this service was 2.90 (SD = 0.77), that of when the service was not being used was 2.42 (SD = 0.77), both showing good states. However, it showed significantly higher number ($p < 0.05$) when the service was in use. Also, regarding L, the average of ME value when this service L in use was 1.93 (SD = 1.15), that of when the service was not being used was 1.05 (SD = 0.86), showing meaningfully higher number when this service was in use ($p > 0.01$). It was indicated that the nursing home residents were in better condition when the service was in use.

Finally, though it was not very frequent, regarding O (interact with objects, show emotional attachment/interest to objects) which shows the relationship between the

nursing home residents and the robot, the average of ME value when this appeared was 3 (SD = 1.41), indicating that interaction with the robot had positive influence on the nursing home residents.

4 Conclusion

In this paper, we examined the influence brought by the introduction of care recreation service using communication robot to care facilities on the quality of care for nursing home residents based on the result of DCM evaluation. By comparing the averages of ME value when this service is in use and when it is not during the trial at 2 facilities in Kansai region and 2 facilities in Kanto region with 12 participants (nursing home residents), it was demonstrated that ME value was significantly higher when this service was in use. In other words, the nursing home residents were in better state while receiving this service, which means that they received better quality care. The feedback from the care staff included many opinions that using this service gave them more time and mental space. There were also views that by leaving the recreational activities to the robot, the care staff could focus on helping the nursing home residents, leading one to infer that this extra space for the staff resulted in the higher quality care toward the nursing home residents. It is considered that this mental space resulted from the change in communication and relationship caused by the introduction of the robot in the relationship between the staff and the nursing home residents.

From the analysis of the observation results of the nursing home residents' activities, i.e. the analysis of BCC, it shows that by using this service, it triggers higher ME value, such as E (being involved in expressive or creative activities), G (reminisce or look back on life) or I (activities that mainly use mental faculty) more frequently, meaning that good state of the nursing home residents could be maintained. The care staff gave feedback that the activities often involve each person work on Kanji exercise book or other such material in silence. But by the robot of this service taking up the roles of MC and teacher, it enabled the nursing home residents and care staff to be involved in light-hearted intellectual activities together. This is regarded as the effect of the change in communication and relationship caused by the introduction of the robot between the nursing home residents and care staff. Moreover, significantly higher number was gained when this service is use regarding J (physical activities or sports) and L (being involved in leisurely activities for enjoyment or change of mood). This points to the possibility that, in addition to the mental space created among the care staff through the use of this service, it is the effect of the drawing power of the visual contents of the communication robot and concentration it causes. However, this needs further examination.

Finally, though it was not very frequent, regarding O (interact with objects, show emotional attachment/interest to objects) which shows the relationship between the nursing home residents and the robot, the average of ME value when this appeared was 3 (SD = 1.41), indicating the nursing home residents interact with the robot with emotional attachment. If two-way communication is realized in future, it is expected to lead to higher frequency of O, and consequently resulting in better condition of the nursing home residents.

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