REVIEW ARTICLE

Use of Robotic Media as Persuasive Technology and Its Ethical Implications in Care Settings

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Abstract

Communication support for older adults has become a growing need; as well, assistive technologies such as robotic media are expected to facilitate social interactions in both verbal and nonverbal ways. Focusing on dementia care, we consider two studies exploring the potential of robotic media that could promote changes in subjectivity in older adults with Behavioral and Psychological Symptoms of Dementia (BPSD). Further, we investigate the conditions that might facilitate such media's use in therapeutic improvement. Using case studies in dementia care, we investigate the potential and conditions that allow robotic media to mediate changes in human subjects. The case studies indicate that those with dementia become more open and prosocial, thanks in part to robotic intervention, by using suitable conversational topics to catalyze case study patients' reactions more efficiently. The two studies under review also mention the requirement of considering both the positive and negative aspects of using robotic media. With social robots being developed as persuasive agents, users sometimes have difficulty controlling the information flow, and thus when personal data is dealt with, ethical concerns arise. The ethical implication is that persuasive technology puts human autonomy at risk. Finally, we discuss the ethical implications and the effects on emotions and behaviors by applying persuasive robotic media in care settings.

Keywords: BPSD, communication, mediation, prosocial, reminiscence, persuasion, autonomy, freedom, ethics, feedback.

1. Introduction

As the aging of our society rapidly advances, the ratio of those with dementia increases along with the need for care systems that can support older adults with dementia, in a home or residential setting. Just as social media can promote people's interaction, especially among the young, robotic media technology may be able to help overcome the digital divide that disadvantages present older adults, including those with dementia. Further, technology that can affect sociability and behavior via persuasion is on the rise. Let us consider the use of such technology, its effects, and related issues in different approaches to using robotic media in dementia care.

In dementia care in residential or home settings, there is typically a severe lack of staff, so much so that the isolation of people with dementia has become a social issue. In such a situation, it is difficult for older adults with dementia to have dialogue opportunities and communicative stimulation in daily life. Several ways of using media technology have been proposed, but only a limited amount of research has explored the influence of social robotic media, including persuasive technology. The discomfort caused by media design that closely replicates the human form, such as androids and humanoid robots, is known as the *uncanny valley*. However, once we interact with robots, the discomfort is usually overcome. In fact, field studies with teleoperated androids have revealed that such robots create a sense of affinity, especially in older adults with dementia, and can promote positive attitudes while evoking imagination. By making use of such technology,

it is important to investigate its effects on lessening symptoms of dementia such as agitation and apathy.

On the basis of the studies considered in this paper, we investigate the effects and related issues while considering how robotic media affect the sociability and behavior of older adults in their relationships. Further, a pilot study shows that by providing topics related to a patient's personal history, positive effects could emerge in older adults with dementia. Consequently, it is expected that media technology incorporating such influential information could reduce the symptoms associated with dementia. Therefore, we need to investigate ways to enhance robotic operation systems as well as ways to make use of memory and personal information to promote dialogue using media technology, rather than a face-to-face encounter.

The purpose of this study is to investigate the nature of inductive media technology and subjectivity changes in older adults with dementia through the intervention of media technology. These investigations were made based on case studies on older adults' sociability, mediated by robots.

In the following sections, we first describe current research on welfare technology, social robotics, and persuasive technologies. Next, we explain previous studies conducted in Denmark, and then in sections 3 and 4, we present two field studies in Japan. In section 5, we discuss the implications of our experimental results as well as ethical issues, and conclude with summary remarks.

2. Related work

With the increasing population of older adults, the robotic approach to dementia care has become a hot topic, due primarily to staff shortages in care services, with people's demand for aging-in-place solutions, and the need for new technological approaches. Such technologies as Information and Communication Technology (ICT) and persuasive media technology could play a key role in assisting older adults and providing the tools for improved treatment settings.

2.1 A robotic approach to care for older adults

As a communication aid, reminiscence intervention has proven itself effective by triggering long-term memory to evoke emotional responses and facilitate conversation with older adults with dementia. Studies such as the CIRCA computer reminiscence program [1] and the networked interaction therapy based on Web technology [2] have shown the importance of conversation among people with dementia and those surrounding them to reduce various behavioral and psychological symptoms associated with dementia (BPSD) such as agitation, depression and aggression [3]. Telecommunication media have the potential to relieve such symptoms while improving relationships and social interaction.

The challenge of developing effective media comes from trying to satisfy both the verbal and nonverbal communicative needs of older adults. The Giraff robot is one of the video conferencing technologies that has been developed to enhance interaction [4]. It is remotely controlled and can provide limited physical interaction by tilting its head, while audio and video communication is provided to make it look friendly for older users. Other robots made for non-verbal tactile interaction have therapeutic and stress-reducing effects, such as the zoomorphic Paro the Seal, which was designed as a companion robot to decrease loneliness [5]. Telephone or video-conferencing systems such as Skype lack tactile interaction, whereas huggable communication media such as Telenoid and Hugvie, promote non-verbal and verbal interactions. The huggable communication medium Hugvie provides opportunities for tactile interaction and has the effect of reducing anxiety [6, 7]. With a human-like shape, it enables users to feel a human presence, as well as talking and listening to the Hugvie medium. Telenoid, a similar but more advanced version that can be teleoperated, inspired Hugvie's minimalistic human design [8, 9]. With the advantage of multiple modalities, robotic media technology is expected to improve mental health and behavior, i.e., to provide well-being for older adults with dementia.

2.2 Persuasive technologies

With the intent to change our attitudes and behaviors, researchers applying communicative robotic technology to assist patients with dementia are striving to add persuasive communicative features. As described in psychology literature, persuasion is "an attempt to shape, reinforce or change behaviors, feelings or thoughts about an issue, object or action" [10]. A key point in the definition is that true persuasion requires an intent to change attitudes or behaviors, i.e., intentionality. If in creating, distributing, or adopting a technology lies the intent to change attitudes or behaviors, the related technology inherits this intent from its human developers. Stated another way, a technology is persuasive in the sense that it mirrors the intent of its manufacturer. Methods of persuasion are plenty, and they are encountered in our daily use of technologies such as computers, mobile phones and videogames. Algorithms are often incorporated to achieve a developer's goal, for instance, advertisements based on user behavior or even in-app purchasing. Along with the use of technology, two types of human interaction, either through or with computing systems, have been examined as two separate issues. First, for computer-mediated communication, technology is used as an auxiliary mediator between two or more users, not as the terminus of a user's action [11]. Second, human interaction with but not through computing systems lies in the field of captology, "Computers as Persuasive Technology" [10], which underlines the persuading relationship between the users and the systems themselves.

Our focus here is on people interacting with media and the power of technological persuasion to affect social interaction and to apply social norms to behavior. Social dynamics is one of the main features of persuasive technology [12], and it reflects the relations between people and computing systems in a similar way to people following unwritten implicit rules, i.e., norms in interactions with each other. An example of attempting to shape attitudes in a specific way can be seen, for example, in digital toys for children such as the goods and characters that express emotions and ask users to respond with corresponding feelings.[1] By using such toys, children learn and adapt their behavior accordingly in their interactions with humans as well. In this context, we expect human-like robots to have the same effect through "ambient persuasion" as the persuasive and intelligent computing systems capable of directly interacting with users in their everyday life.

3. Reactions from users and non-users

Based on a case study on the acceptability of a teleoperated robot conducted in Japan, a field study was conducted at a care facility in Denmark, where assistive technologies are embraced and institutional care is being replaced with care housing [14, 15]. The purpose of the research in Denmark was to explore and compare reactions toward an android robot as a communication medium for older adults and to investigate whether its design technology was acceptable across cultures for supporting their quality of life. Denmark has an advanced welfare system, and welfare technologies are currently incorporated in it and continue to be developed. Social robots such as Paro and telepresence robots have been produced to support older adults in keeping their social connections and well-being; accordingly, the acceptability of teleoperated androids for seniors needs to be investigated. We started an experiment with the Telenoid® (Figure 1),[2] a 50-cm and 3-kg minimalistic human-designed teleoperated robot with the ability to let the operator move its head and arms while talking [15]. It was developed by Osaka University and ATR's Hiroshi Ishiguro Laboratories.

Figure 1: Older adult interacting with Telenoid

A participant who was aggressive gradually started showing prosocial behaviors.

3.1 User reactions

A two-day trial was conducted with two male participants who were living alone in houses attached to care facilities: a healthy 92-year-old (participant K) and a 75-year-old with mild Alzheimer's (participant L). In both cases, we set Telenoid up where they could relax and receive visitors. A connected room was used to set up the operating system for tele-operation by the researchers, nursing students, and a friend of the participants. In the individual homes, Telenoid encouraged positive responses and behaviors from both participants K and L, who willingly maintained conversations in a natural manner with Telenoid, from the beginning. We observed that their attitudes toward it were consistently positive and they both engaged well with Telenoid. Participant K did so by being talkative, while participant L included non-verbal communications such as hugging.

3.2 Public opinion

Since android robots require operators such as volunteers and family members, it is necessary to capture positive public opinion on the acceptability of implementing a robot, but integrating android robots to eldercare settings has already met resistance from non-users. Anxiety over the replacement of humans with robots has been expressed as concern about surrendering human relations to machines. For example, one report describes the strange sight of seniors interacting with the Telenoid robot, as did Participants K and L. The report quoted disdainful comments on a TV station's website about its feature story on Telenoid's visit to an older adult's home [16]. "*Nothing, absolutely nothing, will ever replace real and present compassionate touches and care. How sad that we have come to this point, where such a debate can possibly take place*," wrote one user [16].

According to an expert in information and media studies, it would be strange to deny such togetherness just because it does not follow the current social norms, adding that technology constantly creates new ways for us to be together, using Facebook as an example. Moreover, another expert in ethics said, "*When people talk on the phone, they also lose a degree of emotional feelings, expression of respect, and so on. You could easily reduce human emotions using robots. Relational Technology can therefore lead to curtailment of human emotions*" [16]. Even if emotional involvement is reduced, it has ambiguous aspects and can be seen both negatively and positively [17]; therefore, both types of effects require investigation. We should also explore the advantages of mediated communication, which could be attractive even when the option of interaction in physical proximity is available [18]. Therefore, we suggest long-term studies using android robots while keeping pitfalls such as novelty effects in mind.

4. Field study 1

We explored how the sociability of older adults with BPSD could be affected by use of robots, as described. For this purpose, we introduced Telenoid to a care facility for older residents with dementia, and we investigated changes in the subjects over time. As the initial state of a longitudinal study, the experiment was conducted intermittently for two months to minimize the novelty effect on the results. This study, discussed below, showed positive and prosocial changes [19-21].

4.1 Method

A field experiment was conducted at a care facility where Telenoid was introduced ten times, intermittently, for about two months (average interval, 6.6 days) to two female participants with Alzheimer's and BPSD, an 88-year-old (participant A) and a 93-year-old (participant B). We conducted a quantitative and qualitative study that collected narrative and behavioral data of the subjects during conversations. While interacting, the volunteer teleoperator spoke through Telenoid to the participants and replied with nodding and hugging them. A mock-up resembling Telenoid, which neither talks nor moves, was used from day 2 to 5 for comparison. The residents' behaviors were observed, classified, coded, and analyzed, based on ten-minute video recordings from each day. We divided reactions into positive (prosocial or altruistic behavior) and negative, verbal and non-verbal (Table 1). Prior to the experiment, we received approval from the Ethics Committee at Advanced Telecommunications Research Institute International.

4.2 Results

The study shows that the older adult residents developed prosocial behaviors and increasingly positive attitudes toward Telenoid. Participant A, who was aggressive due to dementia, started to calm down and gradually increased her interaction, verbally and non-verbally, with Telenoid, in showing prosocial behaviors such as stroking its head and attempting to give food to it (Figure 1). On the other hand, participant B, who tended to remain isolated and in her room, showed a strong attachment to Telenoid from the beginning, started to come out to see it, and then expanded the various ways of interaction, such as by sharing the conversation with other residents. Telenoid encouraged the older adult participants over time to be more communicative, and the prospect of verifying the android's effects on senior citizens in further longitudinal studies is promising.

From both participants, continuous and various reactions were shown. Positive reactions were shown by saying "It is smiling." or "It is cute." and, as time passed, participants started showing various ways of engagement (Tables 1, 2). At first, participant A was almost asleep and paid little attention to the robot next to her. However, in the adaption process, she gradually started speaking to the robot positively (Figure 2, 3). Participant B showed strong reactions from the beginning and increased her behavior by talking to other people around the robot and paid more attention to the robot, by taking care of it.

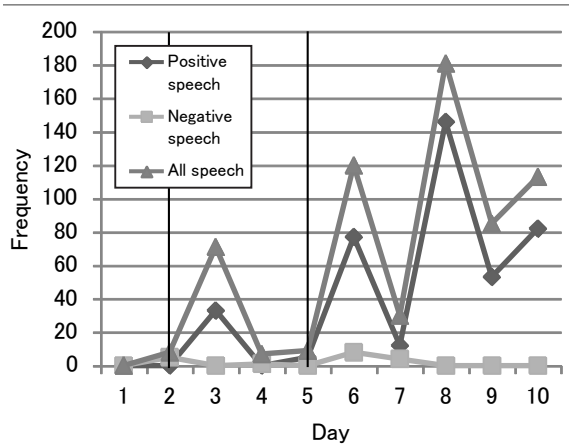
Table 1: Classification of participants' speech contents

Speech	Category	Example
Positive (mainly, altruistic behavior)	Praise	"Pretty eyes", grinning, "Good boy/girl"
	Affection	"Pretty child", "Come to me", "You are the best for me"
	Caring	Singing songs, sharing drinks, Defending
	Request	Singing together, inviting to go out to play
	Introduction	Daily events in life, telling others about Telenoid
Negative	Resistance	Discomfort from its stare, "Too smart"
	Heaviness	When holding and hugging
	Bad temper	"Get away", "Turn away"

Table 2: Classification of participants' behaviors

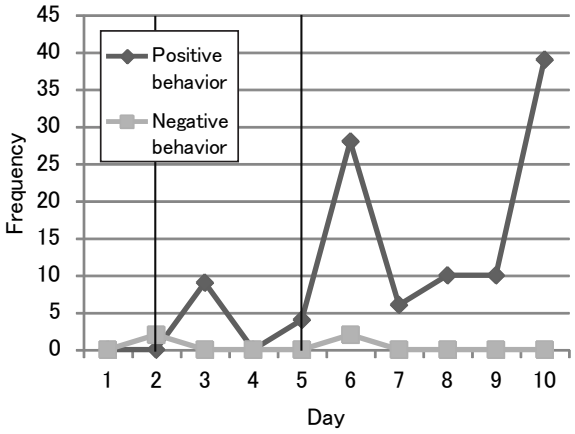
Speech	Category	Example
Positive	Approach	Beckoning, looking into eyes
	Touch	Rubbing, kissing, lifting the robot
	Synchroniza-tion	Nodding, imitating its motions
	Instruction	Showing by pointing, pointing at something to give
	Support	Holding a cup to share drinks, changing the robot's directions to avoid other residents
Negative	Resistance	Surprised by fast motions or vibration of the robot
	Heaviness	Looking for a person who can hold it instead
	Bad temper	Making a gesture of clutching a care staff member who was trying to hand over Telenoid

Figure 2: Change in frequency of speech of participant A



Positive speech content, e.g., "You are the best for me" gradually increased (A mock-up was used from day 2 to 5 for comparison).

Figure 3: Change in frequency of non-verbal behavior of participant A



Positive behavior, e.g., kissing gradually increased (A mock-up was used from day 2 to 5 for comparison).

She was pleased to tears with having the robot visit her, and she welcomed it from the beginning by saying, "It is good you came, to see such an old person like me. You look nice." Compared with participant A, participant B engaged with the robot positively from the beginning and kept this engagement, even with the mock-up, to some extent. In the comparison between Telenoid and the mock-up, when Telenoid moved, especially when responsive movements increased, the participants became more positively engaged. We also investigated whether there was a difference on average between the mock-up and Telenoid, concerning the amount of positive utterances and behaviors. In the case of participant A communicating with Telenoid, utterances were 6.5 times greater, while behavior was 4.7 times greater. For participant B, utterances were 1.8 times greater, while behavior was 1.3 times greater. In all cases, the frequency was higher with Telenoid than with the mock-up. This suggests Telenoid's utterances and movements are effective in extracting stronger reactions from older adults with dementia.

5. Field study 2

In this study we investigated whether there were conditions that could affect emotions and behavior in older adults with dementia [22] by introducing the huggable communication medium Hugvie® developed by Osaka University and ATR's Hiroshi Ishiguro Laboratories.[3]

5.1 Method

A field experiment was conducted at a long-term care facility for older adults with dementia. The experiment included five participants (three females and two males), all diagnosed with dementia (M=89.8 years, SD=6.85) with a tendency to show some BPSD. Their conversation partner was a male in his 20s who had received basic information and life histories about all participants in advance. Hugvie (Figure 4), a 600-g, 75-cm pillow-phone in a minimalistic human form designed to enable the feeling of presence while talking with it and hugging it, was introduced to participants individually, for up to 15 minutes per session. This was done to investigate how the following Conditions ('Cs') work for older adults with dementia: C1) No sound, C2) Radio, non-interactive, C3) Daily conversation, and C4) Reminiscence work. The interactions were recorded, and later transcribed, to count the duration of concentration and number of utterances (words and particles). Behaviors and utterances directed only to Hugvie were counted in the duration of concentration. Prior to the experiment, we had received approval from the facility's administrator, all participants, and the participants' family members, based on the approval for the experiment from the Ethics Committee at Waseda University.

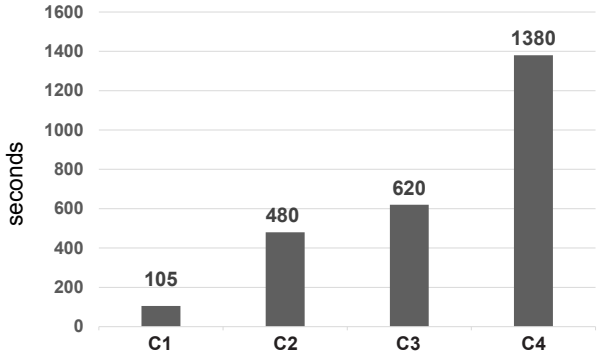
Figure 4: Older adults using Hugvie

Participants were given the medium with four conditions, i.e., (1) No sound, (2) Radio, non-interactive, (3) Daily conversation, and (4) Reminiscence work.

5.2 Results

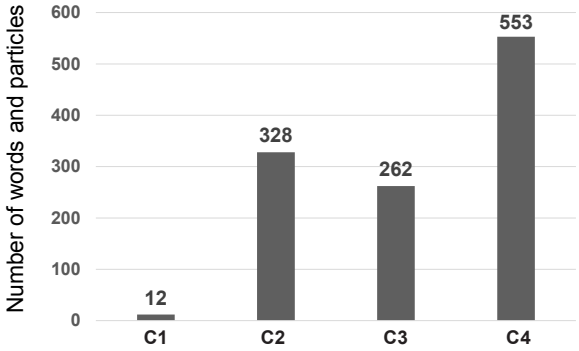
We observed and compared the duration of concentration and the number of utterances. As an overall result, under condition 4 (reminiscence work), the five participants maintained concentration in interacting with the medium for a duration of 2.23 times longer than condition 2 (radio, non-interactive) and 2.88 times longer than condition 3 (daily conversation) (Figure 5). The maximum duration was more than 10 minutes. In condition 4, the number of results was 2.11 times larger than in condition 2 and 1.69 times larger than in condition 3 (Figure 6). Further, one participant kept talking negatively in condition 3, but in condition 4, she changed her mood and kept talking positively.

Figure 5: Total duration of concentration on Hugvie by all participants in each condition ('C' in figure)



Reminiscence work (C4) provided the most prolonged concentration.

Figure 6: Total number of utterances by all participants in each condition ('C' in figure)



Reminiscence work (C4) provided the most utterances.

Although the overall results showed that reminiscence work prolonged interaction, the individual results imply that there are more nuances. Two of the participants did not show reactions in the four conditions. One kept refusing to hold Hugvie, and another was almost always sleeping on that day. Concerning condition 3 (daily conversation), participant 3 did not speak so much, but paid more attention to Hugvie, whereas participant 4 spoke more here than under the other conditions. Under condition 2 (radio, non-interactive), participant 5 talked almost the same amount as in condition 4 (reminiscence work). In condition 1 (no sound), the participants barely showed any reaction with either concentration or utterances.

6. Discussion

In the results of field study 1, changes were found in participants with dementia toward prosocial behavior. This result can be seen as an example of changes in human subjectivity via robotic media. In most cases, the Telenoid robot was perceived as a small child, but as observed in relation with the mock-up, passivity is not the only factor that promotes change. Through interaction with robotic media, we need to consider how best to motivate older adults with dementia, to engage them and help them change their behaviors.

In field study 2, we inferred that there is potential for efficiently gaining the attention of older adults through mediation. In this section, we discuss the implication of these studies, including ethical issues.

6.1 Promotive factors for voluntariness

Even today, where telecommunication is highly developed, devices for older adults with dementia are limited. It will be important to develop robotic media, such as Telenoid, that can diminish the barrier of the digital divide. The idea that robots can provoke or promote people's capability, i.e., extract their will, can be seen in the development of Babyloid, which cannot do anything but be taken care of. It is expected that older adults can take the role of caregiver to such baby-like robots, thus giving them a sense of self-esteem. However, there might be a limit to the ability to extract willingness from older adults, by using thoroughly passive robots without vocal capability, even for those who cannot recognize a telephone. As seen in our experiment with telecommunication, when that barrier is removed, it is possible for people with dementia to increase their willingness to talk. In fact, rather than a mock-up robot that cannot do anything, participants more vigorously reacted to the Telenoid, which can initiate a conversation, and so they became more willing to talk. Though participants took care of the mock-up and talked to it by saying, for instance, "You must be cold; let him wear some clothes." the use of Telenoid could more effectively extract speaking from participants with dementia and increase their willingness to communicate. The participants, once they could talk with Telenoid, started

stroking and patting its head and enthusiastically conversed by saying, for instance, "You became so smart; I am happy." and showed pleasure in seeing its growth. Although the weight of the robot did not change, a participant said, "You became heavier." and was pleased. Once the operator asked, "Please raise me higher and higher." The patient raised the robot higher and started holding it. In the beginning, she frequently complained that she could not hold it because of its weight, but she changed her mind and came to accept its request easily and engaged more willingly. By not only being passive but exchanging in words and explicitly transmitting intentions, such as asking questions, we think we may be able to enhance the willingness of older adults to take care of others without avoiding or diminishing their willingness. Therefore, we need to investigate appropriate ways of talking to them.

6.2 Enhancement of freedom by persuasion

The overall result of field study 2 indicates it is possible to prolong conversation and communication for older adults with dementia by shifting to suitable conversational topics, thus helping subjects recall memories. The study also indicates that topics triggering personal memories could change subjects' moods and improve communication for older adults, even at remote sites. Individual results pointing toward different approaches, other than reminiscence work, might be more suitable to promote interaction for some people. One-way communication, for instance, seems sufficient for some, so it is necessary to investigate which conditions are most suitable for each person, in order to create, facilitate and improve verbal and non-verbal communication in dementia care. For example, compatibility could be related to the types or severity of dementia or personality. Concerning compatibility, we also need to think about ways in which obtained memories and personal information could be used to encourage communication or persuade older adults through robotic teleoperation systems in order to further benefit them.

Applying suitable dialogue strategies with the use of persuasive technology might provide ways to direct older adults. In another field study, an older adult who initially complained about the weight of Telenoid eventually started to lift it and follow its instructions. Another individual also changed her attitude toward the robot over a short-term period and started helping it, upon request. These examples suggest that we might be able to lead others to follow the robot's instructions too. A way to explore the benefits of persuasion through technology is to guide older adults in promoting diet and health. As an example, robots can observe and help an older adult if he or she does not want to take daily medication. Using technology to persuade people is not new: We encounter it in our surroundings as an extra layer of environmental intelligence such as a car's eco-meter, where human behavior is guided in a specific direction in an unobtrusive manner. Some technologies even force people to act in a specific way such as a speed bump. It is still uncertain to what extent robotic media can change or manipulate human behavior. It is important to investigate if, how, and to what extent people follow robots' instructions.

A robot can effectively collect and convey personal information with instant recall and storage and has the ability to adjust its expression, voice, and gender, while continuously acting as an active listener, thus enabling it to incorporate interactive techniques necessary for psychological manipulation that seem to convince through anthropomorphism [23]. By making robots persuasive, users may have difficulty controlling their own information flow by themselves. With this in mind, we also need to further discuss the ethical implications around the emotional and behavioral persuasion of older adults when it comes to persuasive technology. When developing teleoperation systems and artificial intelligence, as a way to benefit older adults, we need to investigate effective ways to collect and utilize memories or personal information, thus encouraging communication through robotic teleoperation systems. A support system is also required for older adults who face the possibility of not only giving away their information to robots, but also being led involuntarily and thus losing autonomy. Ethical concerns are raised when personal data are dealt with, but this goes further than privacy implications. The ethical implication is that robotic media as persuasive technology pose a risk of undermining human autonomy. We need to consider autonomy and the unintended side-effects of robotic persuasion.

6.2.1 Two approaches to enhancing freedom

The notion of autonomy is problematic in relation to technology. So what kind of freedom can older adults have while being led by technology? As Berlin states, there is a distinction between "negative freedom" in the absence of limits and constraints and "positive freedom" indicating human autonomy [24]. Technologies that interfere with positive freedom do not simply externally constrain our actions, but also involve themselves internally in our intentions. This implies another type of liberty, i.e., "relational freedom" as coined by Verbeek, that shapes our subjectivity while interacting with technology, allowing us to adjust the influence of technology accordingly [25]. Older adults have a certain relational freedom in determining how their will and behaviors are being changed, while receiving the influence of media technology. As suggested by Verbeek, based on Foucault's thoughts on freedom as an alternative to the notion of autonomy concerning older adults' freedom, we need to take acknowledge and accept that any form of mediation must be critically examined when it dominates users, without a way to modify its impact.

The so-called "golden rule" of persuasive technology proposed by Berdichevsky and Neuenschwander goes along the lines of "never seek to persuade others to what you cannot accept yourself" [26]. Its support is the Rawlsian idea that you can only agree to be treated in ways that you would consent to from behind the "veil of ignorance" [27]. There are approaches to respecting the user's own will from the Belmont report and research ethics [28, 29]. In the report, three ethical principles are presented, where Informed Consent is one application embracing the principle of Respect for Persons, by letting people opt in or out of research activity by stressing information, comprehension, and voluntariness. Voluntariness is a key component of Informed Consent, and it protects against coercion or unjustifiable pressure. So other than the explanatory approach, which simply follows the users' will, we propose to adopt a feedback approach to change the users' will by convincing them of greater advantages when providing them information. Letting persuasive technology help us instead of seeing it as a threat to autonomy or relational freedom can in some cases support our capacity for self-government, thus enhancing our freedom under the influence of technology.

For instance, an app for weight loss or quitting smoking may encourage one's self-discipline and support one in a task by providing ideas and letting the person track his or her progress. One might even conclude that persuasive technology does not affect our freedom, since we are free to choose and voluntarily change according to its demands, so it does not deny us the right to autonomy. But, due to the characteristics of technological methods of persuasion, there are important ways freedom can be limited. One is when users cannot avoid attempts at persuasion by technology and must endure it, for instance, use of a neuro-implant device to impart electrical signals directly to someone's brain, which could result in changing his or her behavior in uninhibited ways. Second, it is always an empirical question whether persuasive or manipulative methods are employed in practice.

To enhance users' freedom and thus allow them to adjust the influence of technology, we can develop, for example, research ethics to balance the risks and benefits of research activities related to the individual, while also assuming that the good of society sometimes requires tradeoffs. For example, data breach and privacy loss could create risks an organization faces in improving the quality of therapy. As for data access and review, one might accidentally give out information that in retrospect could be deemed unwanted; therefore, subjects – or their assigned surrogates – need the freedom to review and amend personal records. There are therapeutic robot design options that give individuals the ability to understand and manage their information portfolio. It is important to both maximize the user's benefit and enable researchers to access resources such as data-sharing, based on Informed Consent. These capabilities should be incorporated in the design and deployment of therapeutic robots, by making use of robotic modalities, for instance, vocal systems in daily usage. Explanatory and feedback approaches, along with media design, need to be further investigated in parallel with conditions and methods for deploying persuasion. Also,

as Berdichevsky and Neuenschwander pointed out [26], cultural context could play a role in the impact of technology and thus needs to be investigated in relation to care settings.

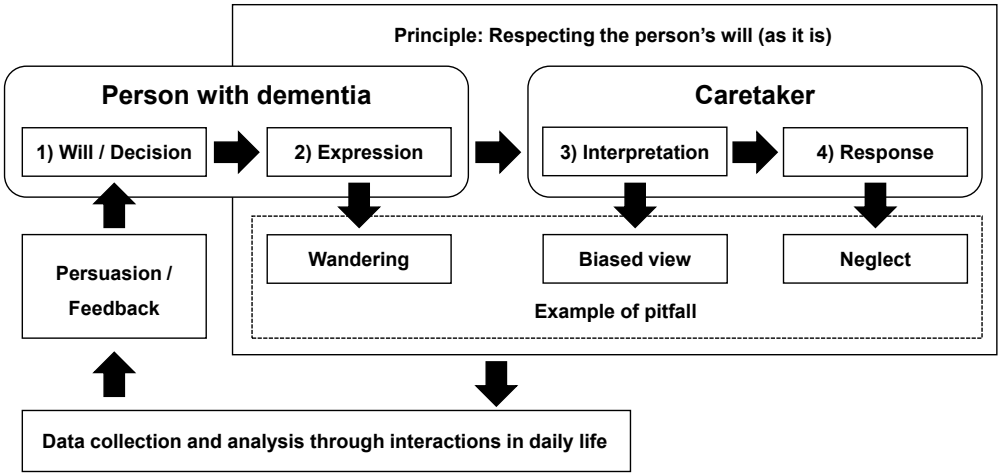
6.2.2 On-site ethical issues and the prospect for improvement

In on-site dementia care, there are cases in which people with dementia have difficulty refusing private information flow, especially when they lose the ability to control it by themselves or become passive towards care staff, due to the power balance of providing care and being taken care of. For individualized care, private information of older adults can be collected by the staff, even without approval. Privacy regulations are lacking in dementia care, for example, the assessment regarding to what extent the information of older adults should be allowed to be collected, creating ethical dilemmas for care staff challenged with individualizing care and respecting the patient's will, particularly when patients cannot express their thoughts and feelings.

Self-determination is deemed to be the principle that gives people the opportunity to make decisions based on their own choice, without coercion. Care staff are required to contrive ways to encourage self-determination of people with dementia, but they also face an ethical dilemma when a decision is made by a person with dementia, for instance, to go back home from a care facility, while the staff cannot provide such an opportunity.

Although several ethical issues and dilemmas arise on site, many of them appear when the older adult's ability to convey their will is disturbed or distorted in interaction with care staff, mainly due to dementia (Figure 7). Because of impaired judgment and deterioration of short-term memory, it takes time for people with dementia to decide a matter, and they sometimes also have difficulty in articulating their decision. For instance, a person with dementia might just wander away when he or she would like to have a glass of water or use a toilet, and in such a case, it is hard for the staff to figure out what the person wants, possibly resulting in a situation where patient self-determination is not respected (step 1 to 2 in Figure 7). Likewise, a dilemma occurs when staff members have a certain bias in interpreting the will of older adults (step 2 to 3 in Figure 7); for example, the staff members may interpret an old lady's wandering behavior as seeking a role to take on and ask her help to clean a room, but afterward her family tells the staff that she favors paper-related work, not physical work [30]. The same situation can occur, even if the interpretation seems to be correct, for instance, an older adult decided to go back home, but the staff ignores the decision, without any consideration for what he wants (step 3 to 4, in Figure 7). Temporarily, he may be able to go back home by arrangement, or he may just be looking for a place where he can feel at ease. In any case, it will be important for the staff to not only observe behaviors of older adults with dementia

Figure 7: Communication process for or against self-determination



In the process of encouraging self-determination of people with dementia, ethical dilemmas occur, e.g., from step 1) will/ decision of older adults to step 4) responses from caretakers.

but also to utilize records or data of their daily behaviors to have a better understanding. For this purpose, robotic media are suitable for data collection and analysis through interactions in daily life, and at the same time our feedback approach will be required.

Even in other types of ethical issues, data collection and utilization will be important; for example, if opinions of family members and caretakers are opposed to each other, collected information for making decisions will be required. Also, a balance of sharing versus not sharing information in a team could depend on the beneficence patients can receive by making use of their data. So, it will be worth considering, if it could be beneficial for patients to share their information with their team, for example, family members and even a hired third-party. In this way, we can argue in favor of the feedback approach to change the will of media users by convincing them of greater advantages such as joy and emotional well-being of an older adult patient with dementia, when providing others with a patient's information, instead of simply following the user's original will, using the explanatory approach. Thus, a key factor going forward would be to build an effective system of utilizing information so that robotic media users can be convinced of greater advantages by providing information, when the system of preventing the misusage of data may conflict. Considering the advantages of information-sharing, while balancing privacy concerns, we might need to look at other factors and previous established care systems, such as considering cultural background.

6.2.3 Retrieving the freedom of encountering with others

Considering the closed nature of residential dementia care sites, we can discuss an implicit assumption among group home managers in Japan that private space appears to cover the entire care site as their home, even when social services are provided [21]. Philosopher Hannah Arendt was astute to note that the privation of privacy lies in the absence of others and its nature, barely transformed [31]. Because care sites are enclosed spheres of privacy within which social services are applied, lack of transparency occurs, resulting in residential older adults being inadvertently deprived of being seen and heard by others. Against such dangers of hiding and confining older adults, possibly resulting in accidents, neglect or even abuse, we can then advocate for their right to be carefully watched over, by presenting a paradoxical viewpoint to show that an effective system of utilizing information would help older adults regain the freedom to encounter others.[4]

Managing technological knowledge may provide a chance for caretakers to respond deliberatively to a call for taking care of older adults with dementia.[5] Such a chance can be realized, by making use of robotic modalities, sensors, and connected systems and providing caretakers a way to ensure some greater access, even if only remotely, thus avoiding some of the problems of the closed nature of care service. The ethics of information and the use of persuasive technology for older adults with dementia requires a more extended dialogue among citizens and a more detailed analysis of the stakeholders' professional and moral positions.

7. Conclusion

Communication support for social interaction among older adults in dementia care is expected to be facilitated by assistive robot technology, so we explored two studies involving robotic media with the purpose of investigating the influential nature of robotic media and the effects on human subjects. These studies indicated that those with dementia would change their behavior, becoming open and prosocial through robotic mediation; further, by using suitable conversational topics, subjects' reactions could be extracted more easily. Those results indicate that there is potential for leading older adults in a specific direction. With further development of robotic persuasive technology, we can expect older adults' subjectivity to be led by such technologies in daily activities, sometimes even involuntarily. Regarding ethical implications, we pursued ways to enhance autonomy and discussed the freedom to adjust our relationship to technology. As protection against coercion, we considered the principle of voluntariness as a basic ethical element in Informed Consent. An explanatory approach to voluntary freedom

is to pursue a way to respect the user's will as it is; however, there is a limit to rationality, when asking questions to those with dementia. While still using that approach, we can also follow the feedback approach by balancing risk versus benefit. Hypothetically, with emotional appeal, those with dementia may satisfactorily change their will, when provided with enough information or appropriate mediation, thus being convinced of greater advantages by providing personal information. In other words, the likelihood of users of providing highly personal information might increase when obtaining usable and beneficial feedback from seemingly trustworthy robotic media. With the lack of data as a limitation of the current study, we need to investigate such a hypothesis through empirical study. Questions, however, arise: What ways can effectively let users of persuasive technology acknowledge the merits of disclosure? Will the users start to talk more by acknowledging and accepting the merits of providing information? The robotic persuasive technologies open a new interdisciplinary area of research on human subjectivity. More research is needed to clarify the conditions in which older adults with dementia can feel the freedom to modify the impact of technological mediation. Further, we should consider what kind of democratic procedures should be developed for applying persuasion through robotic media technology.

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Endnotes

1 Microsoft's ActiMates characters for children are examples of attempting to shape attitudes in a specific way and ask users to respond with corresponding feelings. ActiMates were a series of interactive toys such as Teletubbies and D.W. introduced in the late 1990s, marketed as educational tools, and designed to use implicit rules or norms, such as social dynamics to persuade children to interact with the characters. At that time, digital "creatures" like Furby, an owl-like creature, came along, dazzling children with their sociability. Social robots found ways to express their love and started presenting themselves as having feelings and needs. As Turkle describes their adaptation, children were brought to the belief that the machines were alive enough to care and be cared for [13].

2 Telenoid was developed by Osaka University and Hiroshi Ishiguro Laboratories at Advanced Telecommunications Research Institute International (ATR) in Japan.

3 The huggable communication medium Hugvie was developed by Osaka University and ATR's Hiroshi Ishiguro Laboratories.

4 As for the freedom of encountering with others, Nancy, J.-L. offers a valuable insight for redefining freedom and regarding it, not as the ideal or the rights held by subjects, but the fact in the relationship between self and others [32].

5 From the perspective of knowledge management, in reference to Aristotle's distinction of three types of knowledge, we can further develop arguments for the ambiguity of *technē* in making its combination not only with *epistēmē*, but also with *phronēsis*, the ability to judge, sometimes called insight, as a deliberative kind of action-oriented knowledge, which guides people to the common good in its performative enactment and functions in the presence of others, including robotic media [33].

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