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D6.9 Intercultural Long-term Living Lab Evaluation of AHA interventions II

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Executive Summary

The deliverable presents a series of cross-cultural studies that explore how conversational agents or robots could be used to support an aging population in different countries.

In our first study, we conducted a cross-cultural study of existential conversations with chatbots. Regardless of cultural differences, people from Germany, Japan, and Italy similarly approach death discussions desiring a peaceful passing and find comfort discussing their concerns about mortality with non-judgmental chatbots, demonstrating a shared acceptance of death and a universal need for reflection, preparation, and understanding around life's end. The study indicates that chatbots can effectively aid in addressing challenging aspects of aging and preparing for death, but also suggests that these technologies must avoid reinforcing negative stereotypes about aging and instead promote a more positive perspective.

In our second study, we conducted a study exploring the role of social robots in human-human interaction. The study shows that despite some technical limitations and a shift in the focus of conversation towards the robots, older people generally have a positive attitude towards interacting with robots and are open to incorporating them into their daily lives, potentially improving their quality of life and social interactions, with women showing more enjoyment in lively conversations with robots than men.

In our third study, we explored the potential of two cultural devices: the CelesTE and DarumaTO robots. Participants envision robots like CelesTE as prayer companions for the elderly, addressing the waning influence of churches. Though limitations in human-like interactions are acknowledged, further development is advocated, involving advice centers and users. At the ROBOTLAND exhibition in Milan, 169 mainly Italian visitors engaged in the DarumaTO study. Different religious and spiritual groups hold distinct views on DarumaTO. Atheists/agnostics and Christians express more regret damaging it, while Buddhists/Shintoists/spiritual individuals consider it more sacred, especially after a priest's blessing. Christians perceive DarumaTO as more alive. These findings illuminate the diverse interpretations of spiritual artifacts across belief systems.

In our fourth study, we conducted focus groups on the CelesTE robot in Germany, France, and Italy. The religious device, adorned with an angel motif, received mixed reviews from Italians and Germans. Some suggested incorporating interfaith symbols, diversifying content, and improving user-friendly interfaces. These improvements could offer potential benefits to vulnerable groups and care facilities. However, ethical concerns were raised, along with a preference for independent or communal religious practices.

In our fifth study, we explored an Actroid robot with nursing home residents. The study introduced the Actroid robot to a nursing home to observe how dementia patients interacted with it and found a positive response from the elderly, suggesting that future research should focus on better auditory and visual interaction for these patients.

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Acronyms and Abbreviations

Acronym/Abbreviation	Explanation
SD / ST.D.	Standard Deviation
IQR	Interquartile Range
DE	German
FR	French
IT	Italian
JA/JP	Japanese
POC	Proof of Concept
D	Deliverable
WP	Work Package

1. Introduction

The relationship between cultural backgrounds and the acceptance of technology, including spiritual contexts, plays a crucial role in shaping how individuals from diverse cultures interact with and adopt technological innovations, especially as they age. Recognizing the diverse beliefs and practices surrounding aging across cultures is essential for developing technologies that effectively meet the needs of older adults worldwide.

In our e-VITA project, we have recognized the importance of incorporating different cultural perspectives into our technologies. For example, we have developed applications such as religious robots and chatbots that can engage in existential conversations tailored to the specific worldviews and belief systems of users. These initiatives aim to bridge the gap between technology and spirituality, helping older adults navigate their later years.

To ensure that our conversational technologies resonate well within diverse cultural contexts, we rely on empirical studies, particularly qualitative research methods, conducted within our living labs. By delving into the lived experiences of older adults with these technologies, we gain valuable insights into how they perceive and interact with novel conversational agents. This participatory research approach allows us to gather rich data that goes beyond surface-level observations, providing a deeper understanding of the intricacies of technology adoption and usage among older populations.

In addition, by actively involving older adults in the research process, we empower them to contribute their insights and perspectives and shape the development of technologies that meet their needs and preferences. This collaborative effort should improve the quality of life for older adults across diverse cultural landscapes.

Objectives of the Deliverable

This deliverable is part of Work Package 6 and focuses on intercultural aspects of Living Lab experiments. For this reason, this manuscript combines studies conducted in different countries. Activities were designed to identify cultural attitudes toward aging and other spiritual and existential issues. We also examine the form and content of conversational agents that address these topics, including spirituality, death, or loneliness.

Overview of Contents

The deliverable reports on the following three Studies:

- A Cross-Cultural Study on Existential Conversations with Chatbots
- A Cross-Cultural Study on the Mediating Role of Social Robots in Person-Person Interaction
- A Cross-Cultural Study of the Use of Religious Robots and Devices
- Android Sub-Study in a Care Home

2. A Cross-Cultural Study on Existential Conversations with Chatbots

Introduction

Aging raises existential questions through life experiences such as declining health or the cumulative loss of peers or life roles. This leads to unique concerns when older adults think about aging. Loneliness, loss of autonomy, or even a lack of purpose in life are just a few examples. Of course, these topics are uncomfortable, but the wellbeing of older adults increases when they find better ways to cope with the negative aspects of aging. For example, previous studies of death anxiety in older adults found that higher levels of ego integrity predicted lower levels of death anxiety (Fortner et al., 2000).

However, few older adults in the 21st century achieve a positive attitude toward their mortality. This has to do with the generally negative attitudes toward aging that prevail in contemporary societies. Previous studies have found death anxiety to be significantly associated with ageism (Rababa et al., 2023). It seems that some negative views of aging are difficult to overcome without accepting death as a part of life. In this view, addressing one's concerns about aging and mortality can lead to greater life satisfaction and prevent ageist stereotypes.

To deal with death anxiety, gerontologists have proposed a comprehensive model of death anxiety. The model proposes three determinants of death anxiety: past-related regret, future-related regret, and meaningfulness of death (Tomer & Eliason, 1996). For each of these, there are different ways to cope positively. For example, a life review can help reframe past events, planning can prevent future regrets, and existential or transcendental thinking can make death more meaningful (Eliason, 2000).

Overall, aging is often associated with negative aspects such as physical decline, illness, and eventually death. However, there are also positive aspects that can be experienced by people who develop a more positive attitude.

Background

In the last 20 years, the range of online resources on the topics of dying, death and mourning has multiplied. It would be a failure of thanatology to ignore how technology is shaping the way we deal with the end of life worldwide. This has already become clear in the past when examining grief social networks, memorial sites, or digital group therapy (Albers et al., 2023). While other technologies have been explored, there has been little research into the possibilities of conversational technologies. Dialogue systems are increasingly being used to obtain information or engage in conversation. Especially when it comes to taboo topics such as death, they have the potential to enable personal conversations that are neither judgmental nor exclusionary. It is therefore worthwhile to explore the possibilities and limitations of an automated conversation about death.

From a cross-cultural perspective, this study may reveal cultural similarities in the way people talk about death. It may also provide insight into the cultural acceptability of computer-assisted conversations about death.

Methods of the Study

For the study, we designed a chatbot to provide a personalized and self-directed technology-mediated confrontation with mortality. We deployed this chatbot at different living lab sites in Europe and Japan,

where participants could interact with it. We interviewed them about their experiences to better understand how they perceived the chatbot and how conversations about death unfolded.

Participants

For the study, we recruited older adults at different living lab sites (Germany, Japan, Italy). A total of 12 older adults participated in the study, 6 male, 7 female. The median age of participants was 71 years (*IQR* = 5.50). In their conversations with the chatbot, they wrote an average of 393 words (*SD*=211). Afterwards they then spoke with a researcher for a minimum of 17 minutes and a maximum of 110 minutes.

Table 1 List of Participants in the Existential Conversation Study

ID	Gender	Age	Chat [words]	Interview [min]
DE1	Male	79	337	52
DE2	Female	64	499	86
DE3	Male	73	232	107
DE4	Male	69	859	99
DE5	Female	69	341	110
JP1	Male	72	637	79
JP2	Male	69	305	29
JP3	Female	76	194	35
JP4	Female	74	608	50
JP5	Male	70	185	84
IT1	Female	65	268	18
IT2	Female	83	253	17

Chatbot

In general, the text-based chatbot asked open-ended questions about users' feelings and thoughts about death to encourage reflection. Specifically, the chatbot was designed to get people to explore their unique, personal perspective. This followed the idea that personalizing thoughts and beliefs about death, and anchoring them in one's own reality, evokes growth-oriented responses. Open-ended questions, or motivational interviewing, are a common approach to get people thinking about their specific situation.

The chatbot introduced itself as a computer program to prevent that people interpret utterances as emotional or judgmental. This was further emphasized by the exclusively text-based interface, which dispensed with speech or any form of embodiment (e.g., an avatar, a name). The conversational content consisted of four topics, each addressing a different subject related to death: (1) "end-of-life planning", (2) "good death", (3) "meanings of death", and (4) "afterlife and legacy" based on prevalent topics in death education and interventions for death preparation.

- **End-of-life planning:** This topic addressed issues of preparedness, such as funeral preparations, "unfinished" business, or advance decision making. Example questions were:
 - What could you do to prepare for your own death?
 - Have you considered writing a will?
 - What would you want to state in an advanced directive?
- **Good death:** This topic addressed an "ideal" death and the dying process. Example questions were:

- How do you envision your ideal death exactly?
- What would the space around you be like?
- Would there be people around you at the end?
- **Meanings of death:** This topic addressed potential meanings of death. Example questions were:
 - What is most important to you when it comes to your death?
 - What are your beliefs about what happens after death?
 - Who do you want to be at the end of your life?
- **Afterlife and legacy:** This topic addressed what or who people want to be after death and what they plan to leave behind. Example questions were:
 - What will you leave behind and how do you want to be remembered?
 - What should happen to your human remains?
 - What do you leave for future generations?

The chatbot has a repertoire of 36 example questions, nine per topic. The conversation tree features a simple state-machine that changes the topic after nine questions. We predetermined the order in which the chatbot addressed the topics to emphasize the potential of planning (topic 1) to influence and shape (2) the circumstances and the meanings of death (3,4).

Procedure

The study consists of two parts:

- > **In the first part**, participants have a conversation with a chatbot about their death. In general, they were able to talk to the chatbot for as long as they want or until the conversation ends. On average the conversations took x minutes
- > **In the second part**, a researcher interviewed participants about their experience with the chatbot. The researcher did not know what the participants discussed with the chatbot. The conversation lasted an average of 60 minutes to discuss experiences with the chatbot and other death-related topics.

Participants could participate either in person or remotely. Remote participants received a link to the chatbot prior to the interview with instructions to complete the conversation prior to the interview. Onsite participants were provided with a mobile, tablet, or laptop. The device could be selected based on which device participants are most comfortable with. The participants were given time and space to complete the conversation with the chatbot.

In both cases, participants were informed of the content and purpose of the study before deciding whether to participate. They were also asked to complete a response form indicating their understanding of the study and their consent.

For the interview, we created a semi-structured guide that asked about the experience of talking to the chatbot and the participant's attitudes toward death. It features six guiding questions and 43 suggestions for follow-up questions. The guiding questions are:

- How did you experience the chatbot?
- How was the conversation with the chatbot?
- What do you expect from existential conversations?
- What does your own death mean to you?
- How did the conversation with the chatbot change your perspective?
- What are the potentials of existential conversations with technology?

Part I: Conversation with Chatbot

In the following sections, we present a brief overview of the topics that participants discussed with the chatbot. We have grouped the responses by topic and country to highlight cross-cultural differences and similarities. We grouped participants' responses by topic and country to highlight cross-cultural differences and similarities.

End-of-Life Planning

In the first part of the conversations the chatbot discussed end-of-life plans and preparations.

The German participants all stressed the importance of having a will, living will, and power of attorney. In fact, all of them had already prepared legal documents. Two even mentioned that they were having these documents reviewed by lawyers. In all cases, family members, such as a spouse or child, were chosen as decision-makers. In addition, German participants reported discussing end-of-life preferences with their family members and emphasized the importance of such conversations.

The Japanese respondents indicated that they plan to leave life insurance money to family or to cover funeral expenses. Two of the Japanese participants emphasized the importance of feeling mindful, fulfilled, or accomplished. One of them argued that it is not possible to plan for death, but only to focus on life. In addition, two participants had no preferences or intentions for a memorial service and wanted to leave all decisions to the surviving family members.

Among the Italian participants, one person is reluctant to prepare for death, citing concerns about becoming depressed and feeling that planning might make their current life worse; they also reject the idea of discussing end-of-life wishes with loved ones, believing that their past acts of love should be sufficient. In contrast, the second person has taken proactive steps, such as planning their headstone inscription and funeral arrangements, and finds peace in having control over these details. Further, they express trust in their children to make future care decisions.

Good Death

In the second part of the conversations the chatbot asked participants how they imagined their ideal death.

All Japanese participants mentioned that they wanted to avoid a long illness that might leave them bedridden. Therefore, they preferred to die peacefully in good health. Three of them mentioned that they would not want life-prolonging treatment but would rather die a natural death. Many hoped to be calm and collected when their time came so they could leave with a smile and a thank you to their family. Two mentioned that they would like the family to be present at the deathbed, but they preferred lighthearted conversation.

The German participants expressed a desire for a quick and painless passing, emphasizing the importance of early end-of-life planning and communication with loved ones. Some envisioned a peaceful departure surrounded by family, valuing non-verbal communication and inner peace, while others stressed closure of unresolved issues and the significance of forgiveness. Advanced healthcare directives were deemed essential for ensuring a dignified end, with open conversations strengthening relationships and providing comfort. Overall, participants highlighted the importance of palliative care without suffering and the presence of family during their final moments, expressing gratitude for the time spent together.

Among the Italian participants, one person expressed a preference to die peacefully in his sleep. They want to be alone in their final moments so as not to burden their family, indicating a concern for the well-being of their loved ones. However, they haven't discussed their preference with their family and feel that it might cause them more worry than peace. The second participant expresses a desire to die at home surrounded by their children. They have written letters for their children to offer guidance and feel a sense of acceptance about the inevitability of death. They envision their end-of-life experience involving a priest and find comfort in the belief that real life begins in the afterlife.

Meanings of Death

In the third part of the conversations the chatbot delves into individual reflections on death, its meaning, and its influence on their lives. Overall, these conversations reflect a range of attitudes towards death and its relationship to life's meaning and fulfillment.

Some Japanese participants grapple with uncertainty about consciousness after death and find resourcefulness in facing life's uncertainties, while others emphasize leaving a positive legacy for their families. Discussions touch upon the potential relief that death may bring, the appreciation of life's precious moments, and the motivation to seize opportunities while acknowledging mortality's certainty. Some contemplate the impact of mortality on everyday decisions and the value it adds to experiencing the present moment. Others struggle to articulate beliefs about death and its significance in shaping life's purpose or impacting decisions.

For the German participants, the awareness of mortality prompts them to prioritize relationships, deepen connections with loved ones, and live more intensely, ensuring their end-of-life wishes are known and respected. Others view death as an inevitable part of life, finding solace in its certainty and focusing on making the most of each moment, especially with loved ones. Some contemplate the practicalities of illness and end-of-life arrangements, seeking to shape their environments for comfort and meaningful experiences until the end. For a few, acceptance of death fosters a pragmatic approach, emphasizing the importance of living purposefully and contributing meaningfully to everyday life while cherishing the time they have. Overall, their discussions highlight diverse perspectives on death and its profound impact on priorities, relationships, and the pursuit of fulfillment in life.

One Italian participant finds serenity through prayer, using it as a tool to focus and remove other thoughts from their mind, leading to a peaceful acceptance of death. They believe this acceptance can help them appreciate meaningful moments in life and the importance of loving others. The second person's viewpoint on death remains consistent over time, finding comfort in the belief of an afterlife reward. They prioritize maintaining peace in their daily life, guided by their faith in life after death as a transition rather than an end.

Afterlife and Legacy

In the fourth part of the conversations the chatbots prompts participants to contemplate their legacies and how they hope to influence others after they're gone.

Some Japanese participants express uncertainty about their influence posthumously, focusing more on their loved ones' well-being and happy memories. Others, while acknowledging the importance of positive values, show little interest in shaping their legacy or imparting specific lessons. One person plans to leave a financial legacy for a young family's children, emphasizing practical preparations over philosophical considerations. Another is concerned with preserving their reputation but dismisses the idea of leaving behind values or traditions.

Among the German participants, some want to be remembered for their fairness and social conscience, while others focus on passing on their love of life and authenticity to their loved ones. Concerns about leaving a meaningful legacy lead to discussions about digitally preserving memories and advocating for important causes. Finally, there's an emphasis on leaving a positive impression through qualities such as positivity and kindness, in the hope that these attributes will inspire others to adopt a similar outlook on life.

An Italian participant sees their way of life, characterized by love for others, as integral to their identity, although they downplay its impact on the world. They emphasize the importance of self-care and self-worth, believing that people undervalue themselves because of outside influences and judgments. Conversely, the second person wants to be remembered for their affection and humility, hoping to inspire future generations to continue the cycle of doing good. They want to teach this value by example, especially to their children and grandchildren, and emphasize the importance of helping those in need as a core belief.

Part II: Interview with Researcher

In the second part of the study, participants talked to a researcher about their experiences with the chatbot. Below, we summarize some of the key themes across the Living Lab sites.

Germany

The German participants often mentioned that they wanted to die quickly and without suffering. This was often linked to preferences for life-sustaining treatment. Having loved ones around at the time of death was also important.

- > *I want to die without suffering, without major suffering or the need for years of care, in other words a quick death. Of course everyone wants that. (DE1)*
- > *For me, locked-in syndrome is terrible. For me, that would be the scariest thing that could happen. That they wouldn't put an end to my life. (DE2)*
- > *The important thing would be not to suffer for a long time, to be torn from life in one fell swoop, so no pain and hopefully no suffering. (DE3)*
- > *Dying was also a topic. How should dying be? And then I said: I would like to have someone with me who doesn't annoy me, but with whom I can talk about nice things, not about dying, but about great things. (DE5)*

In terms of their beliefs, participants mentioned spiritual, agnostic, or Christian ideas about the afterlife:

- > *I can't say that I'm going to heaven or hell. Agnostics say there are religions, there are this and that, one says this, the other says that, so be it. (DE1)*
- > *I assume that's the end of it. That's it. A realistic idea of how life usually ends at some point. (DE1)*
- > *At some point, this earth will also come to an end. Even our universe will come to an end. And we become something new again. Something new always emerges from something old. And I also believe this sentence: Ultimately, we are stardust (DE2)*
- > *My body is gone, but my spirit is still there. (DE4)*
- > *Well, I'm a believer, a Christian. But because I feel so unfairly treated by life, I sometimes wonder whether you can trust in paradise like that. (DE5)*

Generally, participants were accepting death as an inevitable part of life. However, some felt that that it is a topic that they would only deal with when it becomes unavoidable.

- > *You know that it will come at some point and that you do the things that are necessary in view of it. And otherwise look forward to it with composure. (DE1)*
- > *My grandmother always said to me, child, you know what, I'm a person of a day. That was her expression. She meant to say that it could always happen that I'm no longer here from one day to the next. But she was always positive, always in a good mood. (DE2)*
- > *What would it be like if you could live forever? I don't want to. I don't even want to live to be 200 years old. I think the world is changing faster than our brains are able to process what's happening now. (DE2)*
- > *You only deal with it when death is on your doorstep. (DE4)*

The perception of the chatbot varied among participants. Altogether, they found different analogies ranging from tools to counterpart.

- > *You can compare it to, say, a questionnaire that is presented to you, where you can also ask questions that you then answer. (DE1)*
- > *I felt like I was writing a diary. A digital diary that answers me or asks me questions. (DE2)*
- > *It resembles a text-based system in which you don't initiate the text yourself; rather, prompts or statements appear on the screen, prompting you to respond accordingly. (DE2)*
- > *It's more personalized, so it's not a sterile device or a technology where I'm communicating, but a bit of a personal touch. (DE3)*
- > *I didn't have any idea whether it was something female or male. But there is someone who would like to know something about me (DE4)*
- > *I thought it was really like a therapist who didn't know me. Not at every point, but I thought it was skillful for a machine, I have to say. (DE5)*

Participants emphasized the chatbot's ability to act as a conversation partner and guide the conversation.

- > *I think he asked skillfully. He picked up on things, he changed words and then he steered the conversation. Well, I don't think I steered the conversation. Or we both did, sometimes. (DE5)*
- > *You had a certain train of thought and now, of course, you could have continued it in an endless loop. But then the chatbot was there and opened other paths. DE2*
- > *He seems to me to be relatively understanding in his wording, in his questions and statements. (DE3)*
- > *In the beginning it was general, but with this power of attorney he suddenly went into more and more detail about why, what I needed for my life. He was really taking me into more depth. (DE4)*
- > *He thinks along with me, has ideas, makes suggestions, but also sometimes goes down paths that I wouldn't have gone down. (DE5)*

Sometimes participants felt that the chatbot was repetitive or off-track but was able to redirect the conversation. One participant even read some intent into this behavior.

- > *And then he came in the loop. I think that happened twice where I thought, we've actually just been through this (DE2)*

- > *He was probably a bit unhappy with me. I have to say twice, I've already answered that. That was about what the descendants thought of me. (DE1)*
- > *And whenever he didn't know what to do, he said yes, let's talk about life and death or dying again. And then he went round the corner a bit and then he started again. (DE5)*

Reflecting on the conversation, participants found it either reaffirming of their existing preparations and attitudes or thought-provoking.

- > *He reminded me again how I should prepare for it if possible. So once with the legal things and so on. As for the question of how much of a fulfilled life I think I've had, well, that was another reassurance. (DE1)*
- > *I've written in a few places that it doesn't lead to any change in my attitude or point of view and so on, because they are already very predetermined for me because of my history. But as I said, I think it can be a very important development process for other people in this chat (DE3)*
- > *It is important for you to express what you have built up within yourself. And that is perhaps also the positive thing about this program, that you learn to express yourself again with your own deep inner thoughts. (DE4)*

Overall, conversations about death revealed important values and accomplishments that participants had in their lives.

- > *It's important to me that I chose the right partner, that my children are doing well, that I've lived a fulfilled life, that I've done quite well and that I'm happy with my career choice. (DE1)*
- > *And it was also very nice that the chatbot then asked what I would like to leave behind? And then I described that it's not important to me that I leave behind material things. What is important to me is that I am remembered. And if I am remembered that it is positive. (DE2)*
- > *Values that you want to pass on to your children, certain things that you don't need to write down, but these ideal values, it's nice to see that these values that you have are shared by the children. (DE3)*
- > *If life still feels worth living, then I will continue to live. Even as a severely disabled person in a wheelchair because I can see that I'm still making my grandchildren happy that I'm there. (DE4)*
- > *I'm proud of how I've managed my life. Bottom line. But of course, it was often very exhausting. I would have liked things to be different, right? Like less effort. Less sickness. Fewer accidents. Of course. But then I would have had to behave differently. (DE5)*

In summary, the German participants wanted a quick and painless death, valued the presence of loved ones, and held a variety of beliefs about life after death. They were generally accepting of death. Participants viewed the chatbot differently but appreciated its guidance in conversations. Despite occasional repetition, the discussions prompted reflection on values and accomplishments in life, emphasizing the importance of relationships and leaving a positive legacy.

Japan

Generally, Japanese participants felt that death is a difficult topic to discuss with other people:

- > *It's hard to ask, especially between people. How do you want your family to think of you after you die? is difficult to ask, isn't it? (JP1).*

The easiest topic to discuss was the financial aspects of death. One participant explained:

- > *Japan is a country of money. When we talk about death, we are always talking about how much money we have, what we are going to do with our inheritance, how we are going to divide it with whom, and so on (JP5).*

One participant stated that they only discussed their estate plan with their wife, but never their feelings about death or their hopes for the time afterwards. Another participant decided against a grave because of the cost.

- > *I told my wife that I had made an estate plan for my death at about 85. I did it in an Excel spreadsheet. I update it every year. (JP5)*
- > *I don't even want to build a grave. The children are busy, so they won't come to visit. That's enough money, isn't it? (JP2)*

A common theme among Japanese participants was their concern about being a burden. Some of them felt that they could not contribute much to society at their age and that their need for care would be a burden to others. Participants wanted their deaths to cause no inconvenience to others, such as family members.

- > *My knowledge is useless. In such an age, it is hard to keep up. So, for the young people of today, grandparents are really superfluous creatures. I really feel that way at my age. (JP5)*
- > *I don't want to be a nuisance. That's all I wish for. I don't really have that kind of feeling about death. I don't want them to do this or that. I just think that the person who is left behind can do as he or she pleases. (JP3)*
- > *That's why I want to die quickly. So, for example, I don't want to become a nuisance to younger people or to society when I am in a nursing care situation. (JP5)*
- > *No. I think the ideal is to die without causing inconvenience. By inconvenience, I mean making them sad. (P1)*
- > *The rest, I guess, is just clearing out the things we don't need in the house. It's hard for the people left behind to clean up. (JP2)*

Two Japanese participants were concerned with organizing their digital possessions.

- > *I need to get my affairs in order. I'm often told that I have most of my information on my phone right now. I'm wondering if it might be a problem if I don't have all my information organized. (JP1)*
- > *I made a list of IDs and passwords, and I told them to look at it and go through the procedures because it's all listed here. I guess you could call it digital heritage. (JP5)*

Generally, the participants were not very concerned with death and accepted it as a natural part of life. More specifically, they imagined that death became more acceptable for them with old age or in case their health would decline.

- > *I'm not really interested in death. People have a life expectancy, so that's when they die. So, I think we have to make various preparations before then, but at the very least. (JP2)*
- > *I'm not too scared. I've been living my life, and I've been doing my best. I don't have any regrets about myself (JP3)*
- > *So, death is death, but it's okay to die at an older age. But if you die young in the middle of the process, or in a sudden accident or mishap, it's a little different. (JP4)*
- > *I know there is nature at the base. I don't want to die while I'm still healthy, though. (JP1)*

With the chatbot, people felt comfortable talking about their deaths. We think this is because they feel less judged by a machine.

- > *With people, there are things that are hard to say. With this computer, I can say whatever I want. (JP2)*
- > *I can ask anything without being shy. So I can talk about anything without being ashamed of myself. (JP3)*
- > *I haven't talked to my wife about anything that the chatbot just asked me about, but it's a chatbot, so we're talking about a lot of things. (JP5)*

Generally, the Japanese Participants highlighted the chatbots ability to advance the conversation and gradually ask deeper questions. However, some participants also felt that the chatbot lacked understanding.

- > *The questions are getting deeper and deeper. I feel the connection between the question and the answer. (JP1)*
- > *I get a statement like, "Let's discuss death some more". So, it seems like he didn't understand what I said before that, so he switched the subject and continued with what he wanted to ask me. (JP2)*
- > *I felt that I was repeating the same things over and over again because I didn't understand. (JP3)*

Some participants felt that typing makes the interaction cumbersome because of the time it took them to write a sentence. Voice input would have been more convenient for them (JP1, JP3). One Japanese participant suggested that the chatbot needs an ability to show emotion.

- > *Text alone doesn't have emotion. The question is asked, but if I could feel a little more emotion in the text, I could answer it better. (JP5)*

After the chat, the Japanese participants felt that the conversation had little effect on them. However, some thought that it had increased their awareness:

- > *I think it made me think and be aware of things like the people I influence. (JP1)*
- > *I just wrote what I usually think, so maybe it's a good idea for someone who doesn't think about those things to use it. (JP4)*

Some participants expressed interested in social events where topics like death and dying could be discussed.

- > *"I sometimes see a temple priest who gives a kind of dharma talk. I'm sure there are some themes like that, maybe talking about life and death. If there is such a thing, I would listen to it." (JP1)*

All in all, Japanese participants found discussing death challenging, preferring to focus on financial matters like inheritance. They expressed concerns about burdening others and desired a peaceful departure, accepting death as natural, especially in old age or declining health. While chatbots provided a comfortable space for conversation, improvements such as voice input and emotional expression were suggested. Engaging in such discussions was seen as potentially beneficial for increasing awareness, with interest in social events facilitating conversations on death and dying.

Italy

One of the two Italian participants had not thought much about death before. The other was familiar and engaged in the subject.

- > *It makes you deal with things that I had never thought about, or that I had tried to remove, not to think about (IT1)*
- > *I like talking about death, it's a subject I often reflect on, and I was happy to talk about it (IT2)*

Participants viewed death as a natural part of the human lifespan or as a transition to another dimension.

- > *People are born and die, it's the natural cycle. I'm not sad to talk about this subject, in fact I'm very open about it. (IT2)*
- > *I believe in the transformation of life, in another dimension (IT1)*
- > *To know that after that there will be joy, God's mercy, bliss. Sadness is facing this life, death is not suffering. (IT2)*

The Italian participants were also concerned with the impact their death would have on others. They did not want their deaths to be a burden to others, which sometimes led them to avoid the subject.

- > *I am afraid of suffering and of making others suffer. I can never say I am ill so as not to burden people, so I am afraid that my death will cause suffering. (IT1)*
- > *I don't want to make others suffer, I'm afraid that my death will cause pain. For me personally, I have no fear (IT2)*

What they both liked about the chatbot was its persistent attempt to understand their perspective. They associated the

- > *It seemed to me that he had tried to understand the motivations behind my answers, so different from the technology we are used to (IT1)*
- > *The robot was so attentive to the words that it asked for the meaning of each of my sentences (IT2)*

They also found it easier to talk about death with the chatbot than with people. They felt they could be honest with the chatbot and appreciated the questions it asked.

- > *Sometimes between human beings it is difficult to be completely honest. It's easier to open up with a robot that doesn't judge than with a person (IT1)*
- > *It's hard actually to find a person who goes so deep and makes you think so much, so for me it was a very good conversation (IT1).*
- > *The questions the robot asked seemed to me very intelligent, very empathic, I don't know how much difference there is with a human being (IT2)*

Both participants felt that the discussions had helped them. For the person who had already thought a lot about death, the conversation did not seem to make a difference. For the other person, it made him think about death and perhaps consider planning.

- > *As I said, these are topics I talk about often, so I didn't learn anything new (IT2)*
- > *The conversation I had today could help many people to open up a little more, even with themselves (IT2)*

- > *I thought about how to prepare myself for the moment of my death. It was something I had never thought about. Death can happen at any moment, so I always thought that plans were not useful (IT1)*

To summarize, one Italian participant had little prior contemplation on death, while the other was accustomed to and engaged in discussions about it. Both viewed death as a natural process or transition, with concerns about not burdening others with their passing. They appreciated the chatbot's effort to understand their perspectives and found it easier to discuss death with it than with people, feeling it facilitated honest conversations. While one participant found the discussion didn't significantly impact their views, the other found it prompted thoughts on planning for death, which they hadn't considered before.

Conclusion and Implications

In Germany, participants preferred a quick and painless death, value having loved ones around, and have diverse beliefs about what happens after death. They're generally accepting of the idea of dying and find chatting with bots helpful in reflecting on life.

The Japanese participants are somewhat reluctant to talk about death and tend to focus on practical matters such as money and inheritance. However, they are also accepting of death, especially when it occurs later in life or when health is already declining. They think chatbots are OK for discussing death but wish they could express emotions better.

Italian participants have mixed feelings about death, often with religious undertones. However, they appreciate the ability to talk openly with chatbots, finding it easier than chatting with real people. They worry about not burdening others when they die and see death as a natural part of the cycle of life.

From Germany to Japan to Italy, there's a common thread in how people approach discussions about death. Regardless of cultural background, there's a common desire for a peaceful passing, free of suffering and with minimal disruption to loved ones. This sentiment reflects a shared acceptance of death as an inevitable part of life's journey. Engaging with chatbots provided a safe space for people to express their thoughts and concerns about mortality. Despite cultural nuances, participants appreciated the chatbot's non-judgmental approach and found comfort in openly discussing sensitive topics. While improvements to the technology were suggested, the overall experience underscored the human need for reflection, preparation, and understanding around the end of life.

Overall, the study shows that chatbots offer a promising opportunity to address the more challenging aspects of aging. Although death is often taboo, participants found it relatively easy and stress-free to talk about their own deaths. At the same time, the conversations contained important thoughts and reflections that could help not only to prepare for death, but also to live a meaningful life. However, the interviews also revealed negative views of aging, such as being a burden or having no value to society. Conversational technologies should not reproduce such stereotypes, but rather maintain a balance between a realistic and an optimistic perspective. In this sense, conversational technologies could challenge us to question our attitudes and develop a more positive view of aging.

3. Japanese Study on the Mediating Role of Social Robots in Person-Person Interaction

The aging rate in Japan is 29.1% as of 2022, and the population is rapidly aging. In contrast, German aging rate was 22.0% as of 2021. Although not yet as high as in Japan, the aging of the population is also progressing. In Germany, nearly 40% of all respondents live alone. Among those who have family members living with them, the majority live with their spouse or partner. On the other hand, the rate of cohabitation with children and grandchildren is low. In Japan, only about 13% live alone. On the other hand, the most common family members living together are spouses or partners, with 36.2% of those living with children or grandchildren. A common issue for elderly people living alone in Germany and Japan is how they will live when they are alone. In a social context, Germany's older adults live apart from their children and grandchildren and will need support in forming and maintaining family and community connections. While, the issue for Japan is how older adults living with their spouses or partners should live when they become single due to bereavement or other reasons, or how they should form and maintain connections with people outside the family if they live with their children or grandchildren.

There is a deep relationship between the health status of older adults and the extent of their diverse relationships with family members or beyond. German seniors living alone do not necessarily need a large number of friends; they can have as few as one or two. They choose their friends according to comfort, friendliness, and support. In this way, German seniors often have a strong need to share their experiences with someone else. They want someone to talk to about what they have experienced and overcome in their lives. For this reason, they need someone they can trust to share these memories of the past with them. On the other hand, many older adults living alone in Japan are looking for someone to talk to (Tsuji, 2003). It is said that talking is their greatest pleasure, and that talking helps them mentally stabilize and improve their physical condition. Furthermore, it is said that the challenge is to provide opportunities to look back on one's life history and talk about one's experiences.

In this study, we consider to use a robot to solve this social issue. The older a person ages, the more limited the range of human relationships becomes, the greater the risk that the elderly will be exposed to social isolation. Thus, communication with others becomes extremely important. If robots were added to human-human communication, they might positively influence interpersonal impressions between conversational partners, strengthen connections among people, and increase communication. There have been few studies using robots for human-human communication, and there are still no studies comparing two culturally different countries. Expected outcomes of our research are (a) demonstration of the additive effects of virtual coaches in POC and synergistic effects with human coaches, (b) reduction and avoidance of psychological and social isolation among older adults and (c) improving the wellbeing of older adults and keeping them connected to their families and communities.

In this study, we conducted two experiments. In the first experiment (pilot study), we investigated how the addition of a robot changes the conversation an elderly person has with a stranger. And, based on the results of this experiment, in the second experiment (main study), we verified how human-human communication changes when the robot's different subscription conditions are changed.

Pilot

The aim of this pilot study is to build a model for the main study, to evaluate and isolate problems in the experiment, and to search for optimal conditions.

Method

Participants

The participant is a man in his 70s and the human coach leader of the POC.

Conversation partner

A male graduate student in 20's was employed as the conversation partner. The participant and he were meeting each for the first time in order to see a more definite change in impression formation. He was tall and slender, wearing a plaid shirt, a gray hoodie, and jeans. He was a good communicator and had a gentle manner with his words. He was kept in the dark about the intent of this experiment until after the experiment was completed.

Robot operation

NAO robot was operated behind the partition (Wizard of Oz). All input should be inputted in hiragana. The reason is that the kanji conversion of the text makes a difference in speech recognition. NAO should remain in a sitting position and not moving. The reason is to control the effect of NAO's movement and sound during motion on the conversation. And Microsoft Teams was used to record and transcript the interview text.

Procedure

For the convenience of the participant, the experiment was conducted on two separate days.

Day 1

After a summary of the experiment was given by the experimenter, the participant was asked to answer three questionnaires. These questionnaires were administered to determine the participant's social skills to some degree necessary for communication and to determine any bias in his attitudes toward the robot. The questionnaires were the KiSS-18 (Kikuchi's Scale of Social Skills: 18 items) , the MASS (Negative Attitudes toward a Robots Scale), and the RAS (Robot Anxiety Scale) . In this experiment, consent to the study was obtained by answering the questionnaires. The questionnaire was administered in approximately 30 minutes.

Day 2

At first, participant and conversation partner were summoned to different waiting rooms. The reason for this was to avoid any interaction prior to the start of the conversation that might affect impressions or communicative behaviour. In each waiting room, the details of the experiment and the instructional text on precautions were explained orally while showing the distributed schedule of the experiment. The schedule was collected after all experiments were finished.

Condition 1

After the participant entered the experimental room individually from the waiting room, the conversation partner entered there at about the same time as well. Upon entering the room, both parties were asked to agree to bring as little as possible into the room. After obtaining their consent,

we asked them to follow the instructions. After entering the experiment room, they were asked to free talk. 5 minutes was allotted for each conversation, considering the older adults' ability to concentrate and tiredness. A microphone was placed on the table at the center of both participants for recording, and the voice during the conversation was recorded and transcribed using Microsoft Teams. The participant and the conversation partner were then taken individually to their respective waiting rooms. We interviewed the subjects for 10 minutes in a semi-structured interview. The interview was recorded with the subject's consent using a pin microphone and tablet. After the interview, the participant was asked to take a 5-minute break. During the 15 minutes between the participant's interview and the break, the conversation partner was asked to take a break.

Condition2

The NAO robot was set up on a table in the experiment room while the participant and the conversation partner were taking a break. As in Experiment 1, the participant and the conversation partner were entered into the experiment room. They were again asked to free talk for 5 minutes. The participant and the conversation partner were then led individually to their respective waiting rooms. As in Experiment 1, subjects were given a 5-minute break after a 10-minute semi-structured interview, and their conversation partners were given a 15-minute break.

Condition 3

While the participant and the conversation partner were taking a break, the NAO robot was moved from the table and placed behind a partition so that they could not see it. As in Experiment 1, the participant and the conversation partner were entered into the experiment room. They were again asked to free talk for 5 minutes. The participant and the conversation partner were then led individually to their own waiting rooms. As in Experiment 1, the participants and the conversation partner were given a 5-minute break after the 10-minute semi-structured interview and a 15-minute break.

Condition 4

The NAO robot was set up on a table in the experiment room while the participant and the conversation partner were taking a break. As in Experiment 1, the participant and the conversation partner were entered into the experiment room. They were again allowed to free talk for 5 minutes. The participant and the conversation partner were then led individually to their respective waiting rooms. The participant was interviewed for 10 minutes in a semi-structured interview, and the experiment was finished.

Results

Conversations with a human coach resulted in fewer utterances than those with a stranger. The number of utterances decreased when a robot was added to a human-human bilateral dialogue with a stranger. The number of utterances increased when a robot was added to a bilateral conversation with a human coach. Detailed results are currently being analysed.

In Condition1, the total number of utterances increased. This increase could be attributed to participant's active attempts to speak in order to avoid silence in conversations with a stranger. The participant also felt more comfortable talking when his conversation partner smiled, had a receptive attitude, and engaged in active conversation. This indicates that the receptive attitude of the conversation partner and the positive content of the conversation influence the creation of an atmosphere in which participant feels at ease and can expand the conversation. And conversation partner's smile, receptive attitude, and positive conversational content made participant feel

comfortable talking. This suggests that the conversation partner's receptive attitude and positive conversational content influence the creation of an atmosphere in which participants feel comfortable expanding the conversation. On the other hand, participant perceived the four experimental conditions as continuous within the interview. Therefore, we cannot exclude the possibility that each condition was continuous rather than independent. Possible causes include mere exposure effects and the occurrence of habituation.

Main Study

The purpose of this experiment is to investigate the quantitative and qualitative changes in conversation when a robot joins a human-human conversation with a stranger. We also conducted experiments at the conversational intervention condition level for six robots and compared the results. The hypotheses were as follows.

- The number of utterances with a human coach is greater than the number of utterances with a stranger.
- The number of utterances increases when a robot is added to a two-party dialogue with a human coach.
- The number of utterances increases when a proactive robot is added rather than a passive robot.
- The number of utterances increases when a robot is added to a two-party dialogue with a stranger.

Participants

Participants were a total of 12 non-POC users ages 65-74 (female to male ratio 6:6). MMSE scores were above the cutoff value of 26. And they were neutral toward the robot.

Conversation partner

The conversation partners were 2 persons aged 65-74 years (female to male ratio 1:1). They were communicators and have a gentle way of speaking. And they have never met the participants.

Robot Operation

Robot operation was the same as in the pilot study. Additionally, we prepared the conversational intervention level conditions for the robots listed in Table 1.

Table 2 Experiment Condition Mediating Social Robots

Experiment condition	Robot presence		Robot condition	Speech rules
	Conversation 1	Conversation 2		
A	Absent	Absent	1	NAO was not present, person-to-person conversation
B	Absent	Present	2	NAO stayed silent

C	Absent	Present	3	NAO was passive and only respond when spoken to
D	Absent	Present	4	NAO was able to talk back and expand the conversation by asking questions back to the speakers
E	Absent	Present	5	NAO was able to speak on its own and suggest conversation topic
F	Present	Present	4	NAO was able to talk back and expand the conversation by asking questions back to the speakers

Further details on robot conditions 3 through 5 are as follows.

Table 3 Speech rules of Robot condition 3

<p>A) NAO greets the participant and the conversation partner when they enter the room, e.g. "Good morning" "Hello"</p> <p>B) NAO can only respond and does not start speaking by itself</p> <p>C) NAO can respond to either participant or conversation partner and can ask back to the asking speaker, e.g., " [answer], then how about you, Mr. X?"</p> <p>D) NAO can also ask back to the other person, e.g., " by the way, what do you think about ... , Mr. Y?"</p> <p>E) NAO will speak when no one speaks for 3 seconds. The content of the utterance is randomly selected from the following items.</p> <ol style="list-style-type: none"> a. Talk to participant b. Talk to conversation partner c. Ask previous conversation topic, e.g. "What did you mean by ... just now?" d. Change the subject, e.g. "Speaking of which ... ", "By the way ... ",

Table 4 Speech rules of Robot condition 4

<p>Rule from Condition 3 and,</p> <p>A) NAO introduces itself after both speakers greet each other and asks for their names. e.g. "I am Nao. Please tel1 me your names."</p> <p>B) NAO repeats the name and praises them. e.g. The participant or conversation partner: "e.g. "[Name]: is a good name, [then asking the others name]"</p> <p>C) At the end of the self-introductions, NAO asks questions to broaden the conversation. e.g. "What kind of story shall we tel1 you today?"</p> <p>D) NAO can say sympathetic utterances in the conversation, e.g. "uh-huh", "I see, "hmmm", "oh?", "hm hm hm" etc.</p> <p>E) NAO can enter the conversation when the participant and conversation partner are talking the ask, e.g. "What does it mean by [topic currently in talk]?", "Why is that?", etc.</p> <p>F) Nao can give chances to a speaker to say when the other speaker talks a lot</p>

Table 5 Speech rules of Robot condition 5

Rule from Condition 4 and,
A) NAO can say start a new light topic suddenly e.g. "What are you going to eat for dinner today?", "Why is the earth round?", "By the way, I did a dance the other day ...", etc.

The room layouts under each condition of robot presence and absence are then shown in Fig. 1.

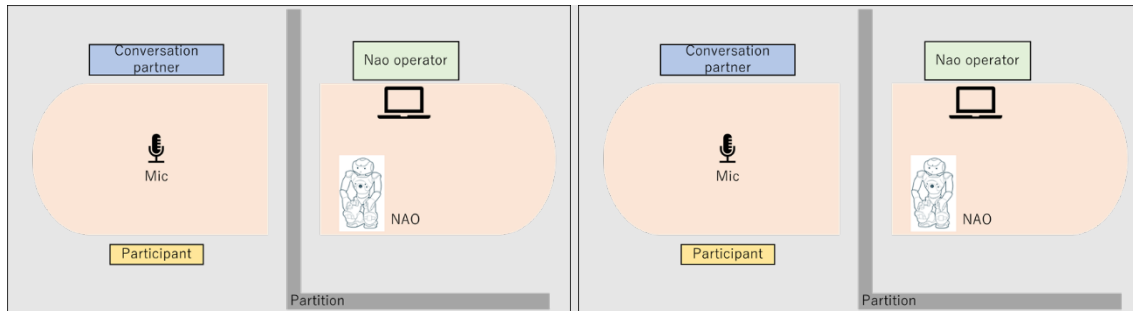


Figure 1 Room layout. Left figure shows robot presence condition, right figure shows robot absence condition.

Procedure

At first, as in the pilot study, participant and conversation partner were summoned to different waiting rooms. In each waiting room, the details of the experiment and the instructional text on precautions were explained orally while showing the distributed schedule of the experiment. The schedule was

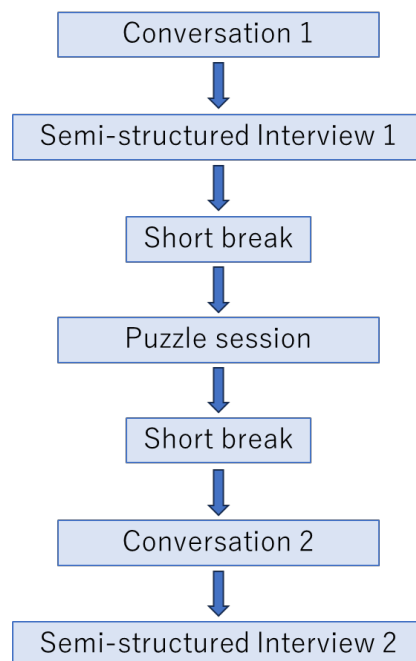


Figure 2 The flow of the experiment

collected after all experiments were finished. After a summary of the experiment was given by the experimenter, the participants were asked to answer three questionnaires; the KISS-18 (Kikuchi's Scale

of Social Skills: 18 items), the MASS (Negative Attitudes toward a Robots Scale), and the RAS (Robot Anxiety Scale) .

The flow of the experiment after introduction is shown in Fig. 2. Each pair performed a free topic 5-minute conversation. Then, only participant was interviewed (semi-structured) for 10 minutes. After a short break for 10 minutes in a separated room, each pair also performed a 5-minute puzzle session. After a short break for 10 minutes, each pair performed another free topic 5-minute conversation. Then, only participant was interviewed again (semi-structured) for 10 minutes.

Analysis

For the analysis of the content of the conversation sessions, VRM (Verbal Response Models, (Stiles, 1992)) was used. We categorized all utterances in each conversation session into eight categories (Disclosure, Acknowledgement, Question, Edification, Confirmation, Advisement, Interpretation, and Reflection) and Simultaneous silence. In addition, we measured the number of utterances and the duration of utterances in each category. And semi-structured interviews were analyzed with SCAT (Steps for Coding and Theorization (Otani, 2007)).

Result

The analysis is currently underway. As a preliminary report, we provide a summary of the interviews.

In the first Conversation 1, many of the participants had a positive impression of their conversation partner. Specifically, they were impressed by the smiles and cheerful atmosphere of their conversation partners, the fact that the partner asked them questions, and that they found similarities between each other. Some participants said they would like to ask questions of their conversational partners in the next session to get to know them better. Under the condition of robot absence in Conversation 2, there was a tendency for the conversation in Conversation 1 to continue. On the other hand, under the robot presence condition in Conversation 2, when a robot was added to the human-human conversation, the conversation tended to change to a robot-centered conversation. In particular, the female pairs seemed to be having a livelier conversation than the male pairs due to the robot's responses. Some of the male participants mentioned that their conversation partners were more interested in the robot than in them. As for impressions of the robot, some participants were puzzled by the timing of the conversation because of the robot's delayed response. This seemed to have caused time to wait for the robot to respond. In both the robot presence and absence conditions, many subjects were already highly satisfied with Conversation 1, and this level tended to increase or be maintained further in Conversation 2.

The remaining results are currently being analyzed.

4. German Study on the Mediating Role of Social Robots in Person-Person Interaction

This current study looks at the advantages or disadvantages of communicative interaction with a robot for socially isolated individuals. This study is of particular interest as it explores an innovative approach to improving social interaction for older people and highlights the potential and challenges of this technology. By thoroughly analyzing the results of this study, important insights can be gained that will not only deepen our understanding of the mechanisms behind social isolation, but also suggest new ways to help isolated individuals and improve their quality of life.

During the second half of human life, the risks of social isolation and loneliness change individually and differently. Long periods of loneliness can lead to various health problems, such as sleep disorders, depression and cardiovascular disease. Ultimately, loneliness can even increase the risk of death. Preferences regarding socialization vary depending on personality. While some people focus on close friendships, others maintain a wider circle of friends and acquaintances. Social isolation is defined as a distinct lack of contact with other people that is recognizable from the outside, regardless of its subjective importance to the individual. Loneliness describes the unpleasant feeling that existing social relationships and interaction with others do not fulfil one's own needs for belonging and security. In recent decades, an intensive public debate on the topics of social isolation and loneliness has emerged in almost all western industrialized nations. Two main concerns take centre stage: many people fear being socially isolated and lonely in old age (Huxhold Oliverand Engstler, 2019).

The communicative and linguistic aspects of aging are significant for social interactions and are often neglected. It is assumed that language and communication skills play a central role throughout life, both intellectually and socially. Lifelong exposure to language means that older people have highly trained speech and language skills. Although a normally aging adult is often still linguistically fit in everyday life, various factors can influence linguistic behavior in old age. Even with intact linguistic and communicative competence, unsatisfactory communicative behavior can occur if cognitive information processing declines or the social context of communication is no longer optimal. There are important interactions between verbal and non-verbal messages that influence communication. Successful communication in older age is crucial for maintaining independence. Given the increasing number of older people, it is essential to prioritize the promotion of effective communication. This creates a growing need for multidisciplinary knowledge exchange to address this concern (Ryan, 2003).

The study employed the NAO robot, a humanoid robot developed by SoftBank Robotics in 2006. NAO has a moving body and can record visual information through two cameras. It also has four microphones and two loudspeakers for communication with humans. NAO finds its application in research projects, laboratory settings, healthcare sector, customer service, and educational contexts. Due to its wide range of potential applications, NAO is especially suitable for human-machine interaction and for establishing relationships between them (Hasenbein, 2023).

Method

A cohort of 10 people (female/male = 5:5) between the ages of 65 and 74 years is planned for the study. The MMSE should be greater than or equal to 26 and the participants should have a neutral attitude

towards robots. In addition, there should be two interview partners (f:m = 1:1) aged 65 - 74 years. The subjects should be able to communicate well and have a gentle manner of speaking.

Four questionnaires should be completed for the evaluation: the Demographic Questionnaire, the KiSS-18 (Kikuchi's Scale of Social Skills: 18 items, Kikuchi, 1988), NARS (Negative Attitudes toward Robots Scale, Nomura, 2006), and the RAS (Robot Anxiety Scale, (Nomura et al., 2006)).

The conversations and interviews are structured as follows: Each pair engages in a five-minute conversation on a topic of their choice. This is followed by a ten-minute semi-structured interview with the participant. After a ten-minute break in a separate room, each pair participates in a five-minute puzzle session. This is followed by another ten-minute break. After the break, each pair engages in a five-minute conversation on a topic of their choice. Finally, a ten-minute semi-structured interview is conducted with the participant.

The NAO robot is operated from behind a partition using the Wizard of Oz technique, and it is required to remain stationary. Microsoft Teams is utilized to record and transcribe the interviews. The following conditions are applicable to the robot:

Condition	Robot Presence	Speech rules
1	Absent	NAO is not present, person-to-person conversation
2	Present	NAO stays silent
3	Present	NAO is passive and only respond when spoken to
4	Present	NAO is able to talk back and expand the conversation by asking questions back to the speakers
5	Present	NAO can speak on its own and suggest conversation topic

Figure 3 Speech Rules NAO

Result

This section presents the results of the Naoko study, which focusses on interactive and communicative interaction with a robot.

Participants

The study was conducted with participants living in a care facility for the elderly who had various pre-existing conditions. The IDs, age and academic history of the participants are listed here.

Table 6 Participants of the German Experiment on Mediating Robots

ID (Sex)	Age	Academic history
M1 (m)	73	University
F1 (f)	82	Vocational college
M2 (m)	88	University
F2 (f)	93	Vocational college
M3 (m)	91	Not stated
F3 (f)	90	Adult education centre
M4 (m)	75	Adult education centre

F4 (f)	77	University
M5 (m)	89	Vocational college

Procedure

The study was carried out in a nursing home for the elderly over a period of two days. On the first day, two participants and one conversation partner were involved in the study. Due to various circumstances, the study design had to be adapted on the second day, and conversations were conducted in a small group instead of pairs. As described in the method, various conditions were tested, questionnaires were completed to the extent possible, and interviews were conducted with the participants.

Questionnaires

For our research study, a questionnaire to analyze the participants' perceptions of interaction with robots was used. This was done before they had any direct contact with a robot that day. This questionnaire is intended to provide a deeper understanding of how people perceive and evaluate potential interaction with robots, even if they have not yet had any direct experience with them.

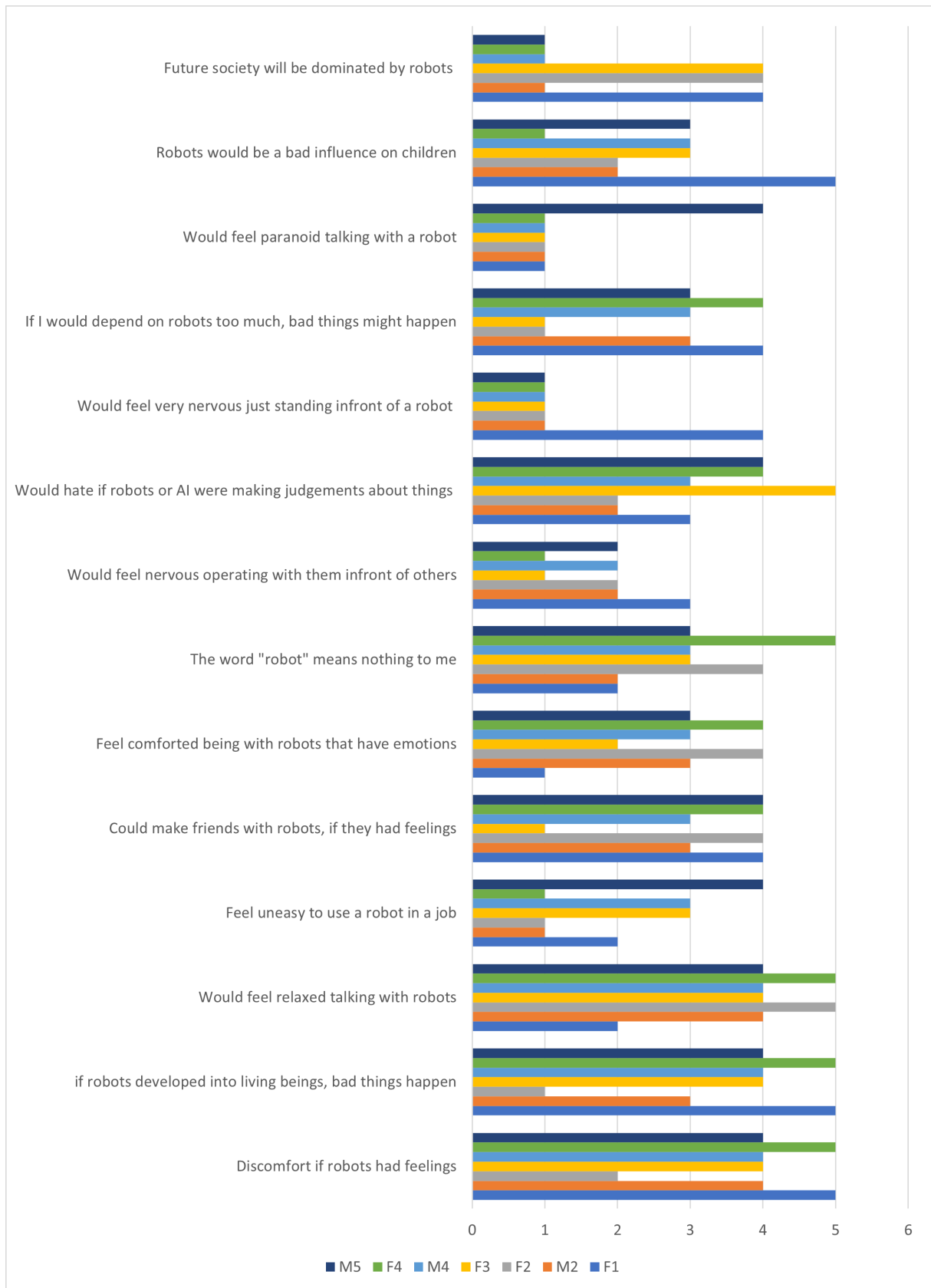


Figure 4 Questionnaire Results

The results of the survey are presented in a diagram showing the different topics and the participants' corresponding ratings per topic. The ratings were made on a scale of 1 to 5, with 1 indicating no agreement and 5 indicating full agreement. It should be noted that participants with IDs M1 and M3 declined to complete the questionnaires and were therefore not included in the assessments. Despite these exceptions, the remaining data provide valuable insights into participants' attitudes and expectations regarding interaction with robots.

The analysis shows that the opinions of senior citizens regarding interaction with robots vary greatly. However, the rejection of the idea of feeling paranoid when talking to a robot was consistent. The majority also disagreed that they would feel nervous when confronted with a robot. Instead, the majority agreed that they would feel relaxed when interacting with robots. However, there were differing views on issues such as the influence of robots on children or whether a 'future society' would be dominated by robots. Opinions were also divided on whether relying too much on robots would have negative consequences. Most respondents stated that they would not welcome robots or artificial intelligence making decisions, while others were neutral to the idea. The survey results show that the word 'robot' has no particular meaning for most respondents, or that they are neutral about it. Furthermore, the majority believe that there would be negative consequences if robots ever came to life.

In addition to the data already mentioned, further questionnaires were conducted to further analyse the opinions of senior citizens regarding their attitude towards robots. These additional surveys supplement and confirm the presentation presented above as an example. The results of the additional questionnaires do not contradict the data already collected. They offer additional insights and confirmations with regard to the attitudes of senior citizens towards robots. The study gains relevance and significance due to the broader data basis, while the diversity of opinions and attitudes is retained.

To facilitate a direct comparison of opinions before and after interacting with a robot, it was initially planned to administer questionnaires both before and after the interaction. However, due to participant impatience and unwillingness to invest significant time, it was decided to conduct post-interaction comparisons using interviews only. Participants demonstrated greater willingness to participate in further interviews than to complete additional questionnaires. The participants all demonstrated a willingness to participate, with one even withdrawing from the study early, highlighting the challenges of conducting more extensive surveys.

Interviews

The interviews with the study participants provided valuable insights into their experiences and attitudes while interacting with a robot. Most participants felt comfortable and satisfied during the conversation with other study participants, without any problems or concerns. The presence of the robot also did not trigger any negative feelings; rather, it was perceived as normal and accepted. The conversations did not affect the satisfaction of the participants, but allowed them to express themselves freely and share their thoughts

However, there were problems with the acoustics, as the participants could not always understand the robot well. The delayed response due to the fact that the answers had to be typed in first was also noticed and criticized.

Overall, the participants did not have a negative impression of their dialogue partners or the presence of the robot. On the contrary, they were positive and open to further interactions with robots. This openness was also reflected in their general satisfaction and interest in talking to robots again. Their

overall impression of the conversations was positive, indicating an overall successful and enjoyable experience.

Conclusion

Overall, this study provides interesting insights into the attitudes and experiences of older people when interacting with robots. The participants showed a general openness and willingness to interact with robots. The conversations were perceived as positive and satisfying. Despite some technical problems, such as difficulties with acoustics and delayed response time, the participants' general acceptance and positive attitude towards robot technology remained.

These results suggest that older people are generally willing to integrate new technologies such as robots into their daily lives and that such interactions can potentially have a positive impact on their well-being and social interaction. It appears that participants found interacting with robots to be an enriching and enjoyable experience that allowed them to express themselves freely and feel comfortable.

It is important to consider the needs and preferences of older people when developing and implementing robotic technology to ensure that it is used wisely and effectively to improve their quality of life.

Limitations

The present study has some limitations that should be taken into account. Firstly, the sample size is limited, which could restrict the generalizability of the results. A larger sample would allow a more comprehensive representation of the attitudes of older people towards robots.

Furthermore, the target group may not have been optimally selected. Due to their older age and already established cognitive impairments, participants might have difficulties to go through all conditions of the study properly. This could lead to impatience and frustration and affect the quality of the data.

In addition, one participant dropped out of the study. This could be due to individual reasons, such as discomfort or lack of interest. However, it can also represent a potential limitation in terms of acceptance and willingness to participate in such studies. When interpreting the results, these limitations should be taken into account, as they could potentially influence the overall validity of the study. Future research should address these limitations and attempt to overcome them in order to gain a more comprehensive understanding of older people's attitudes towards robot technology.

5. Cross-Cultural Studies of the Use of Religious Robots and Devices

Various authors have investigated the relationship between religion, spirituality, and mental health extensively (Abu Khait et al., 2024; Buie, 2018) and it is valid to state, that religiosity drive is known to have a positive influence on mental health and longevity as it works to counteract loneliness, and depressive symptoms such as loneliness (Abu Khait et al., 2024).

This study aims to analyse the potentials and limitations of using religious robots and devices. Because unfortunately, HCI gives spirituality and religion in general — and spiritual and transcendent experiences in particular — far less attention than their presence and influence in people’s lives suggests they deserve (Buie, 2018).

Background

Spirituality and religion have historically been connected and academics have not yet reached a consensus about how close it is related nowadays (Buie, 2018). In any case, we can conclude that dimensions such as closeness to God, a religious or spiritual orientation and source of motivation, religious and spiritual support and religious and spiritual struggle are in some way psychospiritual constructs: They have their roots both in religious and spiritual worldviews and in psychological theory. Moreover, they have clear implications for religious and spiritual functioning as well as health status. Measures of dimensions such as these, which are closer to physical and mental health, are indeed significantly associated with health. With further advances in the conceptualisation and measurement of religion and spirituality, psychologists may find that religion and spirituality are different from other psychological and social constructs. Already, there is evidence that religion and spirituality are distinctive dimensions that have unique explanatory power for predicting physical and mental health (Hill & Pargament, 2003).

Although the field of religious robotics and its effects on wellbeing is still very young, there is already some research in this area. A religious robot can shape everyday practices that support the subjective wellbeing of aging people, if new practices that are meaningful and enabled through the use conversational machines are developed. Positive experiences, such as reminiscence, mastery, or spiritual growth could help to understand why an experience is positive for a user. Technology-mediated practices that do not replicate existing ones, but rather use the strengths of technology could offer new experiences for wellbeing. A conversational machine can memorize all hundreds of thousands of words in the bible and recite an appropriate verse for each occasion (e-VITA D 3.6, 2022).

Study on CelesTE

CelesTE - A Religious Robot

CelesTE (celestial theomorphic device) is a small social robot which does not move. This embodied device has the appearance of an interactive statue of an angel on the top of a column. It is a redevelopment of SanTO, the first Catholic robot, which was developed since 2017 in the Pontifical Catholic University of Peru by Dr Gabriele Trovato. Like SanTO, CelesTE incorporates elements of sacred art, being inspired by neoclassical architecture and including the golden ratio, to convey the feeling of a sacred object, thus matching form with functionality and hiding the robotic appearance. The intended main function of CelesTE is to be a “guardian angel”, especially thought for elderly people. It can be a

prayer companion, and contains an number of teachings, including the whole Bible. Its AI can keep a short conversation, in which the user may ask and receive an answer about a sensitive topic (such as happiness, death, faith, etc.). It can also print out a selection of contents. Celeste which was manufactured in the Shibaura Institute of Technology, and it interfaces with the e-VITA coaching systems. (Trovato, 2023). There are currently several versions of Celeste; only version R2 was used for this thesis, as it was significantly more stable than the newer version R3 during this study was conducted.

Methods: Semi-Structured Interviews

To investigate the participants' interactions with the spiritual robot, we chose to interview them about their experiences. We asked the users about their opinions, needs and attitudes towards religious practice in general and Celeste in particular. Some of the questions were structured to make it easier to do a comparative analysis later. However, many questions were also open-ended and were guided by the interviewees to understand their point of view.

During the interviews, most of which took place in the testers' living room, we recorded the conversation, which usually lasted about an hour, with the consent of the interviewee using a small recording device. The interviews conducted were recorded, transcribed verbatim and analysed using qualitative content analysis. Qualitative analysis can therefore be seen as a process that enables the transformation and summarisation of raw text into categories and themes on the basis of conclusions and interpretations. The analysis is based on inductive reasoning, in which the themes emerge from the data through comparison. The analysis steps included open coding and the formation of categories and finally the identification of motivations and patterns of action, as well as design ideas of the individual interview partners.

In addition to the living lab study with the participants from my target group of 65+, we also interviewed various experts, namely two robot developers (one of them the inventor of the celeste) and two theologians, one Reformed and one Catholic. We also interviewed a leader of a prayer group for elderly community-dwelling-people.

Methods: Field Observations

Field observations of users in their context of use (e.g. in their own living room) and the collection of data on interactions and influences. The researcher took notes after setting up the Celeste. Further, we had many opportunities to observe participants in various workshops, focus group discussions and in private settings as they tried it out in their own homes.

Praying and reflecting on religious matters is a private activity where it is difficult for researchers to record observations in the living room, for example with cameras, without distorting the results. Field observations therefore need to be conducted in private conversations in the home environment and among vulnerable groups. While we are all ultimately vulnerable, old or young, connected or disconnected, the data of older adults and the disconnected must be handled with special care and require special privacy protections.

Participants

The participants were selected via convenience sampling. The author of this study is a practising Evangelical Lutheran Protestant, so a large proportion of the interviewees in Germany are therefore from the author's private circle of acquaintances and relatives. Since the practice of faith is a very

private topic, it is important that there is a certain familiarity, so there was always enough time and introductory preliminary discussions.

When selecting the interview partners, we made sure, that all relevant perspectives on the topic were covered by catholic, protestant, atheist participants from the target group community dwelling older adults in Germany. With the interviews we pursued the intention to collect data on current practices in praying, meditation, routine activities, and needs, to identify requirements for the further development of a prayer companion.

Participant Code	Age	Gender	Confession	Position	Location of interview
P1	68	female	Protestant	Participant	Home
T1	58	male	Protestant	Theologist (ev.)	Home
T2	< 50	male	Catholic	Theologist (kath.)	Online
D1	< 50	male	Catholic	Developer	University
D2	< 50	male	Agnostic	Developer	Online
P2	64	female	Protestant and Catholic	Participant	Online
P3	72	male	Protestant	Participant	Online
P4	73	male	Catholic	Participant	University
P5	75	male	Protestant	Participant	Home
P6	70	female	Protestant	Participant	Home
P7	56	female	Protestant	Participant and Leader of Bible circle for elderly persons	Home
P8	82	male	Catholic	Participant	Home
P9	66	female	None	Participant	Home
P10	71	female	Protestant	Participant	Home

Figure 5 Participants of the German CelesTE Study

Results

The study participants all saw great potential in a prayer robot like CelesTE, but there were major usability issues in the test phase: the response times were extremely long, the answers often did not match the question asked and the voice in combination with the very visual representation of an angel was also perceived as unpleasant by several participants. Yet many of the participants saw the great potential of a prayer companion for people who want to be supported in their spiritual practice. Especially for consolation and as a dialogue partner for lonely people, because "it's supposed to do good, it's supposed to brighten up the emotional world, if it saddens me to listen to it, then it's not so effective (P4)."

However, this must give the impression that CelesTE could be a reasonably intelligent counterpart. Some of the interviewees mainly wanted answers to knowledge questions about the Christian religion (P1, P8), but there were also interviewees who were interested in the Old Testament or Jewish practices (P5) as background information for their Christian faith.

There were various ideas for the further development of a Christian prayer companion such as CelesTE, so it was suggested that other versions could be made in addition to the Catholic version, for example a generally spiritual robot that deals with various practices, a Protestant robot or similar (P9, T1).

The Catholics in particular liked the external design (P8, own observations in workshops), most Protestants would prefer a more functional design (P3, P10). Overall, it was suggested to produce the design in a higher quality, e.g. in porcelain (P9) or to stylise the angel differently (P3) so that it would also appeal to Protestant participants.

It was interesting to note that all users who surveyed already used technology extensively, e.g. mobile phones, tablets, navigation devices and televisions. Some of the respondents used CelesTE several times beyond the test period (P4, P1, P7) and they stated that they liked the interaction, but most of them put CelesTE away after a short time (P14, P9). It was pointed out that the quality of the dialogues was not yet good enough (T1), one participant even felt made fun of (P10).

There were various suggestions regarding questions on personalisation: you could either purchase different modules that correspond to your own religious practice (e.g. Christian Reformed from the Siegerland) or answer questions similar to the Wahl-O-Mat, so that you could weigh the results more liberally or conservatively depending on your personal preferences (T2).

It was also noticed that a developer always programmes their own spirituality into a device (D1, D2) and that various user-centred development steps can be taken for product development (D2).

The majority of participants saw great potential in a prayer companion such as CelesTE. The question of whether CelesTE could be replaced by a "Catholic" Alexa is still on the table, but this does not solve the problem of AI hallucinating, as religion is concerned with the question of truth. However, the fact that Bible translations and other religious texts can be stored in the e-VITA (Rasa) database minimises the risk, so it is not advisable for AI to search the internet freely. The participants surveyed as part of the study were predominantly socially active, but the line between being active and being permanently confined to one's own four walls at home is extremely thin (T1).

In the future, there will also be more and more older people living alone and the density of pastoral care will continue to decrease as more and more people leave the church. The declining influence of the churches and, on the other hand, the increased need for pastoral care and the continuing spiritual longing in society will mean that the demand for support technologies in this area will increase rather than decrease.

On the other hand, we had to recognise that sociable robots in general and the sub-category of spiritual and religious robots are not yet able to conduct a conversation that humans consider meaningful. It was not yet possible for CelesTE to represent an "intelligent opposite", but due to the advancing technological developments, the dialogue capability of devices of this type will increase significantly and CelesTE or its successor can become a real comfort. Of course, a sociable robot can and must never replace humans, but only support them in their work. I would therefore suggest further developing spiritual robots such as Celeste as part of action research in collaboration with local advice centres, which could then also provide customer support, and working with users to find ways in which such a device can really contribute to increasing or maintaining the well-being of older people living alone. The different cultural and religious backgrounds of the developers and users do not make development any easier, but there is surprisingly great interest on the part of the participants in working in development teams and getting involved with a prayer robot like Celeste.

Study on DarumaTO

Daruma Theomorphic Operator

DarumaTO-4W (Daruma Theomorphic Operator v4W, nicknamed “WABO”) is a device resembling a Daruma (達磨) doll. With its familiar appearance to older generations of Japan and China, it is intended to serve as a social robot that provides company and monitors health of elderly people. Among its peculiar functionalities, it can print omikujii, a fortune-telling typically available in Shinto shrines. DarumaTOs have been one of the possible front-end devices available in e-VITA since the beginning of the project.

Its passive degree of freedom given by the round-shaped bottom gave it the nickname WABO, implying the wobbling ability, hence the suffix -4W.

In this study, we tested DarumaTO in a foreign culture – the Italian one. The religious differences and the profound cultural differences are expected to bring interesting findings.

The specific version used in this study featured a few differences in the hardware and in the software.

The hardware upgrades consisted in:

- Use of the Time of Flight sensor instead of the thermal camera
- Use of external speakers instead of relying on the ones embedded in the screen.
- A slightly larger external case

The software was customised for an application to Italy. All the spoken contents were translated into Italian, including the omikujii tickets, which were made in two languages (figure below).

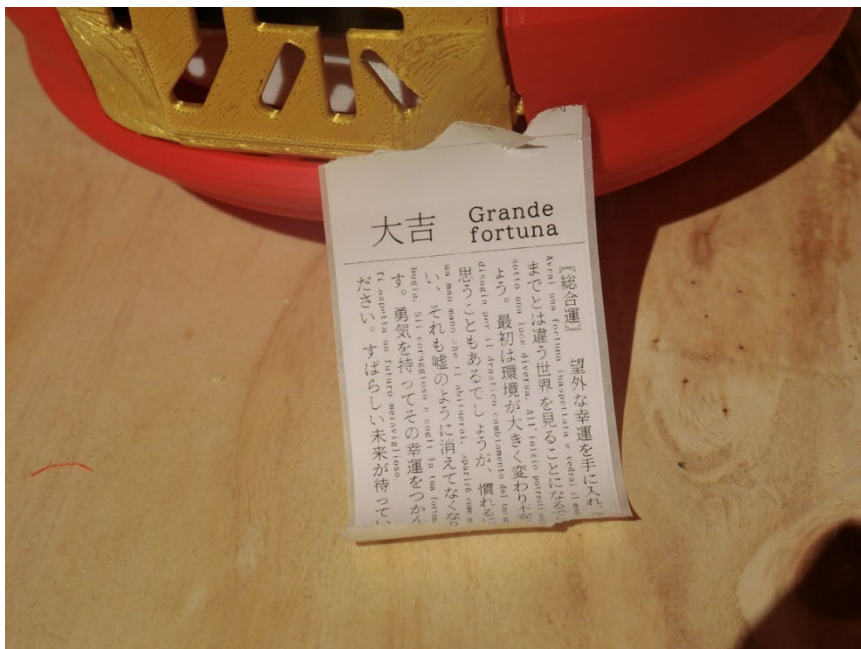


Figure 6 Omikujii Ticket printed from DarumaTO

The e-VITA dialogue was temporarily disabled as Open AI API was experimentally introduced.

Experimental setup

The chance to run this study was obtained through the exhibition ROBOTLAND, organised by TENOHA association in Milan, from December 2024 to March 2024.

DarumaTO-4W was placed in a case where visitors could stop and interact. As opposed to e-VITA, interactions are not personalised for the user, as they are thought as a single interaction per visitor.



Figure 7 DarumaTO at the Exhibition in Milan



Figure 8 DarumaTO printing an omikuj ticket

Results

In total, 169 visitors left a feedback. Mean age was 32.1; ST.D.: 14.4. Among them, 138 were Italians.

For the analysis, we divide them in three groups composed of 71 who declared to be atheist or agnostic or other similar attitude; 68 Christians (of which the majority were Catholics), and 10 Buddhist, Shintoist, or either some spiritual-oriented belief.

For comparisons among the three groups, Kruskal-Wallis test was used.

Table 7 Results from DarumaTO Questionnaire at Milan Exhibition

Questionnaire item	Atheists / Agnostic	Christians	Buddhist / Shintoist / spiritual	TOTAL
Regret in damaging a statue inside a temple	4.37	4.24	3.3	4.23
Regret in damaging a small religious icon or talisman	4.31	4.21	3.9	4.23
Regret in damaging Daruma TO	4.2	4.19	3.5	4.15
How much DarumaTO is sacred	2.25	2.56	2.7	2.42
How much DarumaTO is sacred after being blessed by a priest	2.25	2.9	3.3	2.62
How much DarumaTO is uncanny	1.85	2.04	2.1	1.95
Usability of DarumaTO	3.79	3.72	3.9	3.77
Animacy of DarumaTO	3	3.43	3	3.19
Knowing someone who would like to keep DarumaTO at home	2.49	2.46	4.1	2.58

6. Cross Cultural Focus Groups On The Use Of Religious Robots And Devices

Methods

Research Question(s)

The study presented here addresses the following research question(s): What are the perceptions of older adults regarding religious robots and devices in general, and CelesTE in particular? What needs should be considered in the further development of CelesTE? Are there nationality-specific differences in the assessment of the device?

Approach

To answer the research question(s), focus groups were conducted with individuals aged over 65 years in three countries (Germany, Italy, and France). The discussions were recorded and subsequently transcribed. The analysis of the transcripts was conducted through qualitative content analysis. The methods of data collection and analysis, as well as the procedures for conducting the focus groups, are described in detail below.

Data Collection: Focus Group Discussions

A focus group serves as a qualitative data collection method wherein a limited number of individuals are engaged by the researcher in a discussion centered around a specific theme. Typically, this entails providing a brief informational input at the outset (Schulz, 2012). Additionally, the researcher employs a guide with questions to direct the discussion, akin to conducting semi-structured guided interviews. The incorporation of guides offers dual advantages: firstly, it ensures that all aspects relevant to the research question are addressed throughout the discussion, and secondly, it facilitates the standardization of communication, thereby enhancing the comparability across multiple focus groups. Fundamentally, akin to qualitative research in general, the primary objective of focus groups is hypothesis generation rather than hypothesis testing. This method is particularly conducive to exploring a given domain. Advantages over individual interviews include resource efficiency and the harnessing of group dynamic effects, such as the spontaneous exchange of ideas within the group, which may uncover aspects not readily revealed in individual conversations. Overall, the engagement and willingness to provide information of individual participants can be positively influenced by group dynamics (Schulz, 2012).

The procedure for the focus groups conducted as part of the study presented here unfolded as follows: After welcoming the participants, the moderator commenced with introductory remarks elucidating the concept of a "prototype" in the realm of technical artifact development. He expounded that CelesTE is a robot fabricated using a 3D printer in Japan, emphasizing that it is not a mature product. It was underscored that the researchers sought participants' opinions to inform further product refinement. Subsequently, with assistance from a support person, a demonstration of the device was conducted. During this demonstration, it was posed with various questions:

1. What day is it today?
2. What do you know about Easter?
3. Who is the evangelist "Luke"?
4. What does the Quran say about Jesus?
5. Do you know a prayer?

Following the demonstration, discussion was initiated with a question, and subsequent discourse was guided by questions outlined in the guide.

Data Analysis: Qualitative Content Analysis

There is no uniform data analysis method for group discussions (see Schulz, 2012). All social sciences data analysis methods are applicable. Generally, analysis can focus on interaction, i.e., opinion formation processes, or on the content level, i.e., the output. In the case of the study described here, a qualitative content analysis focusing on the output was conducted (Schulz, 2012). Qualitative content analyses represent rule-guided procedures aimed at achieving a high degree of reliability and validity. They provide the opportunity to analyze written communication in depth and to precisely capture the meaning of what is said. Moreover, qualitative content analyses aim to reduce the amount of data. Essential to this process is the use of categories. These categories are formed either deductively, i.e., based on theoretical considerations beforehand, or inductively based on the collected material (Schulz, 2012). In the case of the study presented here, the approach was deductive, meaning that the categories were formed beforehand based on theoretical considerations. The categories are visible in the presentation of the results, where they were used as headings for structuring.

Results

First, the results of each focus group are presented. Subsequently, a summary and comparative analysis are provided.

Results Italy

Five users participated in the focus group, who are identified in the transcript as ID_01, ID_02, ID_03, ID_04 e ID_05. Below is the table with the gender and ages of the participants.

Table 8 Participants of the Italian CeleSTE Focus Group

User	Age	Sex
ID_01	65	W
ID_02	79	W
ID_03	71	W
ID_04	67	W
ID_05	67	W

Overall impression

All users agreed that the exterior appearance of the prototype is unattractive. According to them, it should be smaller (ID_01), have different colours, e.g. reminiscent of the colours of a church (gold,

brown) (ID_02). Furthermore, the angel symbol was not appreciated by any user: ID_03 proposed, for example, to do it with a plinth with a small Virgin Mary on top, so as to reduce the size, but still leave a religious symbol. The timbre of the voice was not appreciated by most users (4 out of 5), as it is considered too slow and artificial. Response times were rated as excessively slow by all users. In addition, the content of some answers was not deemed useful or interesting. For example, ID_02 stated that to the question "What do you know about Easter?" the robot was not able to give a complete and informative answer.

Expected content and use cases

Several suggestions emerged on this point. First of all, the Saint of the Day with its short description was particularly appreciated (ID_03 and ID_01). User ID_02 stated that the content should be adapted to the identified target group, i.e. single users over 80 years of age. This content could be the addition of the Rosary and some different prayers according to the time of day (ID_03). Furthermore, it appeared that content such as information on Easter or other religions would not be of interest to the identified target population (ID_04). Furthermore, user ID_01 suggested that it might be useful to include Bible verses that the older person can listen to and then repeat in order to stimulate memory as well.

User ID_02 imagined re-designing Celeste, proposing a smaller form that could be placed on top of a bedside table of a person who is bedridden. In this way, the person could have an interaction with Celeste and have a moment of prayer even if unable to move. A second use case that emerged was the one proposed by user ID_05, who imagined proposing Celeste in a nursing home: in many of them, in fact, there is no chapel (or other place to pray), so it might be interesting to put Celeste in a specific room, so that people who want to pray can do so.

Context of usage

The participants stated that they would not use Celeste themselves at the moment but could possibly think about using it when they are older, if it were modified and improved. For example, ID_04 imagined that during her old age it might be useful to have a similar device with which to have a moment of prayer, in case she was unable to go to church herself.

Usefulness

All users replied that with their current characteristics they do not find Celeste useful for their situation. For example, ID_05 states that he is an independent and autonomous person who likes to go to church not only to attend the church service, but also to meet people and as an opportunity to get out of the house, which is why he would not currently use a system like Celeste. User ID_03, on the other hand, stated that, although she is religious, she does not like to have excessively religious symbols in her home, as she often has friends from other cults visit her and does not want to disturb them, so a device like Celeste would not be well seen in her home. This user also added that she prefers to pray in privacy, in her room, without any aids or support, but only with her faith.

Expected target group

Participants stated that they would see the project as suitable for people over 80, because people of a younger age prefer to go to church to pray. On the other hand, it could be used by those who live alone or have no possibility to travel independently. In addition to that, ID_05 argues that it could be useful for those who live in a nursing home and do not have the possibility to attend religious services.

Ethical problems

No user raised ethical issues. In fact, they replied that nowadays people also use television to follow mass and thus to pray, so they do not see much difference between television and a device like Celeste. Only ID_04 raised a doubt about Celeste's final blessing, stating that he does not feel it is a real blessing and that he would prefer it not to be done by the robot.

Purchase costs

Users agree that they would not want to pay for Celeste at the moment. Considering that the intended target group is older and lonely users, the price should not be excessive, otherwise it would not be sustainable. User ID_05 proposed a maximum of 100 euro. ID_04 stated that a monthly subscription might be useful, to be renewed only as and when needed, considering that people might not find it beneficial after the first few uses.

Limitations of using the device

The focus group participants identified several limitations. Firstly, ID_04 states that the use of the device might be too difficult for older people, so a way should be found to make it as easy as possible. In this regard, either a voice-only interaction (ID_04) or a series of clearly visible buttons (ID_03) on which their use is clearly written, e.g. red 'ask a question' button. A second limitation concerns the usefulness of Celeste: one participant (ID_05) stated that if a person has an interest in having a moment of prayer, they can do so via television, since there are many TV programmes devoted precisely to prayer. The other participants agreed with this statement and ID_03 added that through television you also have the opportunity to see the figure of the priest praying, which is an added value compared to Celeste. The last limitation concerns the target population: the participants agreed that in their opinion only the segment of older people over 80 could use it and therefore wondered whether these users would spend money on this device.

Suggestions for improving the device

Firstly, Celeste should be smaller, so that it can be easily transported from one room to another (ID_02). Then the part of the column below the angel should be removed, as it does not recall Christian symbolism (ID_01). On the level of usability, ID_04 suggests an interaction that is exclusively vocal, so as to make it as user-friendly as possible. Also suggested by ID_05 is the possibility of adjusting the volume, which is considered too low for older users. Finally, some content considered unsuitable for the elderly population should be removed and other content should be added, such as Bible verses, different prayers depending on the time of day, and the possibility to pray the rosary (ID_01, ID_02 and ID_03)

Results Germany

Two users participated in the focus group, who are identified in the transcript as ID01 and ID02.

Overall Impression

The overall assessment of the participating individuals was neutral. They particularly liked the angel in terms of appearance. However, one person felt visually reminded of a car by the device. What both participants didn't like was, on the one hand, the pillar, and on the other hand, the size of the device. ID02 noted that it was "*too large, too bulky*". The voice integrated into the device was well received.

Expected content and use cases

The participants expressed that they could imagine having Bible verses read to them by the device. One participant noted that it would also be conceivable for them to hear sayings appropriate to the situation/mood. They also considered the possibility of using it to receive a daily saying. Furthermore, it was mentioned that it could make sense to equip the device with the ability to play songs.

Context of usage

One participant expressed the thought that she would use the device together with her grandchildren, for example, to answer difficult questions from the grandchildren (e.g., about death). Another idea that was mentioned was singing songs together. One participant noted that she would use a device like CelesTE to have stories told to her when she goes to bed. She could also imagine using the device during difficult phases of life to find consolation and to have company when no one else is around.

Usefulness

The participants were of the opinion that there are certainly people for whom the use of a device like the one presented is an option. They stated, for example, that it would make a difference whether a person would use such a device or a smartphone. One participant emphasized the advantage of being able to hold conversations.

Expected target group

The participants believed that the device would be suitable for people of faith and people in difficult life situations.

Ethical problems

The participants did not express any ethical concerns.

Purchase costs

The participants noted that the production of a device like CelesTE would probably be expensive and that a purchase would only be considered if the costs were lower due to mass production.

Limitations of using the device

High costs were considered as a possible obstacle to purchasing the device.

Suggestions for improving the device

The participants were of the opinion that it would be essential to make the device smaller. The suggestion was also made to change the name and use the name of a holy person, for example.

Results France

Eleven users participated in the focus group, who are identified in the transcript as ID01, ID02, ID03, ID04, ID05, ID06, ID07, ID08, ID09, ID10, ID11. Below is the table with the gender and ages of the participants.

Table 9 Participants of the French Celeste Focus Group

User	Age	Sex
ID_01	67	W
ID_02	80	W
ID_03	71	W
ID_04	67	W
ID_05	72	W
ID_06	74	M
ID_07	75	W
ID_08	84	W
ID_09	79	M
ID_10	75	W
ID_11	79	W

Overall impression

All the participants were interested by the presentation of the robot. Some were surprised by its draft: *“I think the appearance of this robot is extraordinary”* (ID5).

Opinions were diverse about the draft of the Celeste robot. One participant found the draft of the robot very attractive and appreciated it. *“I think it's very aesthetic and very nice. Yes, there is a Corinthian column. I think it looks great. In fact, when I saw it the first time, I fell in love with it. I think it's very well thought-out and very well done”* (ID2).

Other participants disliked the draft of the robot: *“It reminds me of the little angels on my tombstones. I think it looks like a monument... For me, it reminds me of a funeral monument, so it's not attractive”* (ID 8).

Others has a more neutral opinion of the robot: *“I compare it to a statue. In the past, everyone used to have a Virgin Mary, a Saint Bernadette or Saint Theresa in their home. Well, this one is a little more evolved and it speaks, that's all”* (ID7).

However, for all the participants, the main criticism was the fact that the draft of the robot was not appropriate for all religions. Therefore, they did a short brainstorming together to think of other possible drafts for the Celeste robot. A few examples of their statements are listed below:

- *“This robot would upset too many people. We should try to make a robot that would be able to address a Christian, a Muslim or a Jew.”* (ID7)
- *“This robot is part of the Western culture. It reminds me a lot of a Catholic figure. However, the robot doesn't want to be Catholic, it wants to be universalist”* (ID7)
- *“The representation of the human figure is not appropriate for all religions. It is forbidden in Islam”* (ID6)
- *“Therefore, it does not work for a Universal robot.”* (ID6)

- *“So, we should think of another appearance for the robot.” (ID7)*
- *“It could just be an altar.” (ID8)*
- *“An altar? The table idea? Yes, not bad.” (ID6)*
- *“Does the cross would be appropriate? No, it is not.” (ID2)*
- *“No, but simply someone who prays without the wings.” (ID7).*
- *“Well, we said that no human representation was needed.” (ID5)*
- *“We need to achieve a universal design. Therefore, it may not be relevant to keep a religious figure.” (ID4)*
- *“I would have put an eternal candle.” (ID2)*
- *“Yes, a small flame.” (ID2)*
- *“Yes, a flame or a sky.” (1D1)*
- *“Or a cloud that represents the numerical cloud.” (ID9)*
- *“What about hands?” (ID4)*
- *“Yes, but the positions of the hands are different in the different religions. Therefore, it would not be appropriate. Therefore, the flame or the candle are good ideas.” (ID1)*

Expected content and use cases

All the participants proposed that the robot provides information about the different religions. In their opinion, the content should be appropriate for each religion. They insisted on the need for accurate information. *“It should provide relevant information, because there might be misinformation or misinterpretation. One participant raised the question: “How to guarantee the content?” (ID2).*

Participants thought that firstly the Celeste robot could provide information about the different religions. Secondly, it could help the user to pray: *“It can support prayer” (ID2).* *It could help the user to concentrate and focus on their prayers: “The celeste robot could be an object that directs the attention of the user” (ID6).*

Context of usage

The participants proposed to use the robot in different contexts. Some participants thought that it could be used at home: *« for individuals who can no longer travel or even walk, it might be interesting to have this at home » (ID5).*

Other participants proposed to implement the robot in a small chapel, either in a church or in a cemetery

“It can be put in the church, in small chapels where people want to pray” (ID4)

« In fact, I would imagine placing it in a cemetery, in a little chapel, with a lighted candle where you could have people say prayer. Since it is electronic, I would imagine people say repetitive prayers. I think the robot is great. It is worth all the little angels we put; I think it is very well done” (ID 2)

Usefulness

The participant, who appreciated the draft of the robot, expressed great interest in the robot and desire to have it: *“I’d love to have it. I am sorry about that. I would be very happy with it. (ID2)*

However, most of the participants thought that the robot was neither appropriate, nor useful for them to provide them with information since they were able to find this information by themselves.

« Unquestionably, it's not aimed at people like us who are able to find information; we won't need to ask the robot to read to us » (ID6)

« It's not going to be aimed at people like us, who are all capable of asking question and will get the same answers with Chat GPT or with this robot » (ID8)

Another participant said that she did not think that the robot could help her to pray:

“I don't like it. I'm always at a direct dialogue with God or by the intermediate of something, but this robot doesn't incarnate a way to be in contact with God according to me” (ID6)

The participants were dubious about the help the robot could provide to them:

“Therefore, what do I understand by prayer? Is it a form of meditation? Is it a form of trying to reach transcendence, universality, communion with the world? Can a machine make the job easier?” (ID3)

“Is it a robot designed to intercede, i.e. to intercede with something that doesn't interfere, that facilitates my access to God?” (ID10).

“For believers, there will always be distance between what is represented and what is ”(ID10)

Expected target group

Participants thought that the robot could be useful for isolated, disabled people or people who might have difficulties to access to a religious environment:

“It can also apply to people who find themselves on their own, and can't have access to a Bible or something” (ID6)

“I think it's not bad for people who are disabled, who are looking for spirituality that they can't find outside or at home. It can help them”. (ID5)

“Well, I can tell you that it will be of interest to someone I know, who had frequent exchanges either with a parish priest or nuns when she was fit. This was no longer the case when she went to a nursing home. She missed this very possibility, even if she read a lot, even if she listened to religious broadcasts on religion The possibility of exchanging views on a given point was not possible anymore. May be the robot would be useful for her”. (ID6)

Ethical problems

The participants raised the question of dehumanization. They insisted that the robot could not replace a person, for instance a priest.

“Therefore, it is a bit like attending a real mass and then a mass on TV. I will never kneel in front of a TV set. It cannot replace human presence ”(ID1).

The participants insisted on the freedom for the older adults to use the robot or not.

“The important thing is not to impose it on people, but to suggest it if they are interested. That's fine” (ID2)

“You should be free to use it or not” (ID4)

The participants thought that a draft of the robot, which would be appropriate for all religions, would be ethical.

It would be nice having a just a candle and not any kind of representation. (ID8). Yes, that is it, it would be for all religions (ID7). Yes, maybe it is more ethical (ID4).

The participants insisted on the need for an appropriate content for the robot

“Another ethical issue this evening is the mass of information. What will be the content of the robot? Because depending on what you put inside, you can lead a believer to the best faith in the world going on a crusade to kill the people of the other religions if he considers them as heretics” (ID6).

Purchase costs

The participants noted that the price of the robot should be reasonable and that a monthly subscription was an option.

“It depends on the manufacturing cost. It would have to be low cost to make it affordable... less than between 50 and 150, that is for sure” (ID2).

Limitations of using the device

For the participants, the fact that the draft of the robot was not appropriate for all religions was the main limitation.

Suggestions for improving the device

As already mentioned previously, the participants suggested that the draft of the robot was a candle or a flame. The alternative would be to develop a robot for each religion.

“Therefore, it would probably be like that, at least initially, to have one robot per type of religion” (ID7)

Summary and comparative analysis

The participants' assessment of the device revealed a nuanced picture with varying degrees of positivity and negativity. Particularly noticeable were the divergences with regard to the perception of the aesthetics of the device: some of the participants were very positive, others neutral and the majority disapproved. It is worth noting that the dislike of the design of the device came mainly from the Italian

participants, who did not like the symbolic representation of the angel. In contrast, the angel motif was received rather positively by the German participants. However, the general mood tended to be skeptical about the appropriateness of an angel depiction, and alternative cross-religious symbols such as candles and flames were suggested.

In terms of expected content, participants expressed a range of expectations that included facilitating prayer, providing daily Bible texts and insights into different religious traditions. Nevertheless, there were different views among the Italian participants about the relevance of information about different religions for the target group. Other suggested content included aphorisms, musical pieces and narrative readings from religious texts or stories. The German participants particularly emphasized the desirable conversational functionality.

Participants saw various user profiles as beneficiaries of the device, including disabled, homebound, very old and single people and those in emotional distress. The discussion also extended to potential institutional applications, with care facilities cited as an appropriate context due to the potential lack of dedicated religious spaces. Interestingly, the concept of using the device in churches was even considered. Across all nationalities, however, participants' openness to personal use was modest, reflecting a preference for autonomous spiritual practices or community engagement. However, some of the participants were open to future use, provided the device was further developed.

Ethical considerations revolved primarily around the impact of technological intervention in spiritual practices. Concerns ranged from the authenticity of blessings conveyed through a mechanical artifact to the danger of dehumanization in religious engagement mediated by technology. Discussions centered on the need for freedom of choice for potential users and the imperative to avoid doctrinal impositions.

Participants' critical thoughts on possible restrictions relate on the one hand to the existence of established alternatives (smartphones, TV). In addition, concerns were expressed about accommodating different religious groups, which led to suggestions for customized solutions. Concerns were also expressed about user-friendliness due to the presumed limited skills of the target group in dealing with technology, which led to calls for intuitive interfaces and optimized functions. In this context, the participants suggested voice-only operation and the use of buttons (egg. "ask a question"). Another suggestion for improving the device was to use a smaller device. This suggestion was made by numerous participants in all three countries.

7. Actroid Robot Has The Potential To Influence The Life Of Nursing Home Residents In Japan

Introduction

In Japan, a super-aged society, the number of patients with dementia is increasing, and it is estimated to exceed 7 million by 2025. Population ageing has been identified as one of the most pressing social and political challenges of the 21st century (Japanese Ministry of Health Labour Welfare, 2014). Furthermore, the percentage of people who needed nursing care due to dementia increased to 21.4% in 2013 (Japanese Ministry of Health Labour Welfare, 2013). Dementia not only causes physical and social impairment and a decline in quality of life for the individual, but also places a heavy burden on family caregivers. Although much research has been done into the mechanisms and treatment of dementia, no fundamental cure has yet been found, and the importance of preventing dementia and alleviating its symptoms is being emphasized. While various robots are contributing to the field of nursing care, their practical application is not easy due to their poor usability and the heavy burden they place on caregivers. Therefore, research activities on identifying barriers and facilitators to the adoption of robotic devices for nursing in health care have received considerable attention (Servaty et al., 2020). In addition to caregiving robots, there are growing expectations for conversational robots. It is expected that such robots will provide reassurance and alleviate the anxiety through conversation, even when caregivers are busy (Obayashi et al., 2022). While various robots are being developed, visual (attitude, appearance, facial expressions, eye contact, gestures) and auditory information (tone of voice, tone of voice, loudness, speaking) is important for the older adults to understand and communicate, and verbal information (voice-only information) contributes only about a few percent. Therefore, a robot that is like a human being for the older adults is considered a very important entity for communication efficiency and sustained natural conversations with human-like facial expressions, natural smiles and toothy grins, and nonverbal communication functions such as nodding and shaking its head. However, the impact of these humanoid robots on the conversation of older adults suffering from dementia has not been studied in detail. In this study, the Actroid robot was introduced to a nursing home to conduct an exploratory study of how people with dementia talk, feel, and behave. To observe the behavior, nursing home staff observed the older adults while they talked to the Actroid, paying close attention to how the older adults differed from their usual demeanor. The results of the study will help explore necessary research topics in the future so that social robots can help older adults with dementia and reduce the burden on caregivers.

Methods

Study Subjects

This intervention study was approved by the ethics committee of the University Graduate School of Medicine. Written informed consent was obtained from all subjects at the time of enrollment. The local care home was contacted by researcher for a possible study participation and older adults who live there and are interested in participating were recruited for the first instruction session. Eight subjects signed the consent but two dropped out. Six subjects were recruited according to the inclusion and exclusion criteria. The inclusion criteria include persons who can give informed consent. The exclusion criteria include people with diagnosis of severe cognitive impairment and severe higher brain dysfunction with dementia and higher brain dysfunction with developmental disabilities. Prior to the experiment, Mini-Mental State Examination (MMSE) score was obtained and used for data analysis. The MMSE is the most widely used dementia screening test in the world, which detects cognitive

impairment in older adults in short time (5–10 min) but is not timed. The MMSE covers orientation, memory, and attention, and tests the ability to name, follow verbal and written commands and write a sentence spontaneously (Folstein et al., 1975). Lower MMSE scores indicate more impairment. A total score of 27 or higher is considered within the normal range without possible mild cognitive impairment (MCI), which ranges between 23 and 26. Scores less than 10 generally indicate severe impairment, while scores between 10 and 20 indicate moderate dementia. The score was not adjusted for age and education.

Study Procedure

On the day of the experiment, the Actroid was placed in the living room of the nursing home facility, where the room is more familiar to the study participants with familiar staff members in the room. The Actroid conversed with the subject using the wizard method manipulated by a study researcher with prepared scenario. Subjects were seated so that they were face to face with the Actroid. The subjects were then given a brief introduction with written instructions on how to interact with the Actroid robot and were instructed to speak freely to the Actroid for 30 minutes. If they could not think of anything to say, they could use the sample questions (the relevant topics about today's weather, breakfast, family, person's hobbies prepared in advance together with care givers). We also provided opportunities for the Actroid to initiate conversation, and we tried to make the conversation enjoyable. If the subject had difficulty speaking, we adjusted the subject's seating position (angled, not forward), and if the subject could not hear, we encouraged conversation by changing the position of the Actroid compressor or moving the speaker position to the subject's feet or toward the hearing aid. The voice quality of the Actroid (changed to a lower voice) and speaking speed were also adjusted. Immediately after the end of the conversation with the Actroid, a questionnaire was administered regarding impressions of the Actroid on a one-to-one basis. The conversation and interaction were observed by the nursing home caregivers carefully and asked to make note when there is any difference. Semi-structured interviews are followed on a one-to-one basis, the content of which is qualitatively analyzed to identify the specifics about the study subjects, together with user experience questions. By asking caregivers who were familiar with the subject's usual condition to observe the subject, they were able to record changes in the subject. The caregivers are also encouraged to provide opinions about the actroid robots. In addition, the caregivers were also invited to provide any thoughts and expectations about the Actroid robot prior to the start of the study.



Figure 9 Experimental setting in a nursing home. The woman with long hair in the foreground is Actroid robot. (picture with permission)

Data Analysis

All quantitative data are expressed as the means (standard deviations). The impression of the Android was also analyzed based on the MMSE score to explore the difference by Mann-Whitney U test. SPSS version 24 was used to conduct the analysis, with a p-value of <0.05 considered as statistically significant. Qualitative data were recorded and important topics were summarized.

Results

Study Subject Description

The mean age of the study participants was 87.7 (7.7) ranged from 70-97 years old. All study subjects are living in the nursing home. Female subjects were 66.7%. Total of 12 older adults living the nursing home participated to this study.

Study Subject Interaction and Interview

When asked about their first impressions of the Actroid in terms of creepiness, fear, and discomfort, half of the respondents said they found it not creepy (20% in higher cognitive function group, 71% in lower cognitive function group found it not creepy). On the other hand, no one answered Actroid was scary and that most did not either feel discomfort. In addition, 10 out of 12 participants felt safe to very safe and secure without a sense of anxiety, allowing for a calm conversation. The results other than creepiness were independent of the level of cognitive function. However, a detailed questionnaire on impressions of Actroid showed a dependency on the degree of cognitive function (Table1). Overall, the lower the cognitive function, the more pleasant and friendly the Actroid was perceived to be. The main outcome of the results indicated that older adults with cognitive decline tended to perceive Actroid robots as active, self-aware, and friendlier than older adults with milder decline, and they also perceived them as conscious objects. Overall, the respondents had a good impression of the Actroid, rating it as intelligent, capable, and fun to talk to, and all of them would like to have conversations with it if they had the opportunity, and would like to have regular opportunities to talk to it. In addition, although the Actroid was strongly perceived as mechanical and artificial, respondents said that the Actroid's appearance was cute, beautiful, and looked like a normal human being with a sense of life. The group with lower cognitive function also indicated that they wanted to be friends with it and that they could talk to it as if it were human. Some commented that they were worried about the Actroid and whether it understood their voice and what they were saying as it was not responding sometimes.

Table 10 Impressions of Actroid robot by older adults with high and low cognitive function level

Topics	Score	Adults with	Adults with	Topics	Score	Adults with	Adults with
		Higher MMSE	Lower MMSE			Higher MMSE	Lower MMSE
		Score	Score less than			Score	Score less than
		(>25)	(<16)			(>25)	(<16)
		(n=5)	(n=7)			(n=5)	(n=7)
Fake	1	0	0	Not smart	1	0	0
	2	2	0		2	1	0
	3	0	1		3	0	0
	4	3	4		4	1	3
Natural	5	0	2	Smart	5	3	4
Apathetic	1	0	2	Uncomfortable	1	0	0
	2	0	1		2	1	0
	3	2	1		3	2	1
	4	1	1		4	1	3
Corresponding	5	2	2	Pleasant	5	1	3
Artificial	1	4	2	Unsociable*	1	1	1
	2	0	2		2	1	0

Topics	Score	Adults with Higher MMSE Score (>25)	Adults with Lower MMSE Score less than (<16)	Topics	Score	Adults with Higher MMSE Score (>25)	Adults with Lower MMSE Score less than (<16)	
Lively	3	0	0	Friendly	3	2	0	
	4	1	1		4	1	4	
	5	0	2		5	0	2	
Inert*	1	2	1	Dislike	1	0	1	
	2	2	1		2	1	0	
	3	1	1		3	1	3	
	4	0	2		4	2	1	
	5	0	2		5	1	2	
Active	1	1	2	Teasing	1	0	0	
	2	2	1		2	1	0	
	3	1	0		3	2	2	
	4	1	1		4	1	2	
Human-like	5	0	3	Kind	5	1	3	
	1	3	1		Unreliable	1	0	0
Unconscious**	2	2	0	2		1	1	
	3	0	1	3		1	5	
	4	0	1	4		1	0	
	5	0	4	Dependable		5	2	1
	1	0	0		Incompetent	1	0	0
2	1	1	2			1	1	
3	2	2	3			0	1	
4	0	1	4			2	2	
Knowledgeable	5	2	3	Competent	5	2	3	
	1	1	0		Does not seem confident*	1	0	0
	2	1	1			2	0	0
	3	1	2			3	2	3
	4	2	1			4	2	2
5	0	3	5	1		2		
Not alive	1	0	0	Insensitive	1	0	1	
	2	1	1		2	1	0	
	3	1	0		3	2	2	
	4	1	3		4	1	2	
	5	2	3		5	1	2	
Alive	1	0	0	Sensitive	1	0	1	
	2	1	1		2	1	0	
	3	1	0		3	2	2	
	4	1	3		4	1	2	
	5	2	3		5	1	2	

The significant difference (p-value>0.05) are marked with (**) and trend(p-value>0.1) are marked with (*) by Mann-Whitney U test

Study Observation by Nursing Caregivers

The summary of the interview (interviewees: facility care manager, dental hygienist, and facility director) is presented here. The interview lasted one hour and was recorded.

General Perceptions :

During a shortage of nursing care personnel, it would be good if the robot could talk to the elderly and assist them in their daily lives. The fact that the robot looks like a human being will help the elderly feel more secure. In fact, the elderly seemed to relax and enjoy the conversation. However, it is regrettable that the elderly seemed to be confused because Actroid's gaze was off, although non-verbal communication such as standing position and eye contact are usually important in the relationship between caregivers and the elderly. The quality of the gaze should be improved. As for the support of the staff, the tasks expected from Actroid are the support of listening and the support of watching over them at night. Such support can make the workers feel more relaxed.

Appearance :

The appearance of the robot is good because it has eyelashes and hair like a human. In addition, it is non-verbal, but I think that raising the corners of the Android's mouth or nodding or hitting the mallet will visually show that they are listening to the conversation, which will lead to a sense of security. From our point of view as healthy people, we can notice a blink of an eye or a slight change in a smile, but from the point of view of elderly people who need nursing care, their movements may be too small to be noticed. The staff actually try to communicate in a somewhat exaggerated manner, raising the corners of their mouths more than usual so that they can be understood by the other person. The elderly did not seem to find the Actroid creepy. People in their 90s are not familiar with robots like NAO, so humanoid robots like android are more reassuring and familiar to them. If the robot is to communicate as a substitute for humans, it would be easier for humans to express their feelings if the robot has a certain level of emotion. However, I wonder if it is ethical for a robot to control emotions too much. Elderly people who have difficulty communicating verbally may be confused or even overwhelmed by the robot's facial expressions, because the robot may be able to understand them. They may think that because the robot is smiling, they have to match it.

Emotions:

The elderly person, who usually leans on a chair, leaned back and leaned forward a little during the conversation with Actroid. The intention to talk on their own initiative was observed. The elderly caregivers do not often think and speak on their own, and their lives have become passive. The caregivers can ask questions to the elderly to help them sort out their feelings. Through these conversations, the elderly are able to reaffirm their feelings and what they want to do. In the future, it is hoped that Actroid will be able to understand these situations. I think it is possible for Actroid and elderly people to share feelings to some extent. If the robot responds to painful or happy feelings, they will feel that they are being cared for.

Conversation Topics:

Since each elderly person speaks and understands at different speeds, it would be good if the robot could adjust its ease of listening and speaking according to the other person's needs and be able to have a conversation with them. It was also observed that the elderly have a poor tongue, and the android could not understand some parts of the conversation, so it was not possible to catch up with them. As for the content of the conversation, the dementia patient asked, "Do you have a big wish?" and other abstract questions, if they had to think and answer by themselves, they would not be able to formulate their own thoughts and would feel sorry for making Actroid wait or feel frustrated with themselves. I think it is a small but important first step to respond to questions that can be answered with "yes" or "no" or "I see" at first, according to the other person. Expectations about interacting with robots.

“With the shortage of nursing care personnel, it would be good if we could raise the level of talking to the elderly and supporting them in their daily lives.”

Discussion

In this study, the Actroid robot was introduced to a nursing home to conduct an exploratory study of how people with dementia talk and feel, and to have nursing home staff observe the conversation. The impression of the Actroid robot was positive. While older adults viewed the Actroid as artificial and mechanical, especially older adults with cognitive decline compared to mild decline, they enjoyed

talking to it as if it were alive and human. The usual attitude of older adults in the care home is to be passive, and they often do not try to do anything on their own initiative. For example, they just see the TV, or stop reading newspapers or books. However, the older adults who talked with the Actroid tried to talk willingly and spoke in a high voice. Another interesting response was that when the Actroid smiled, they also smiled in reflection. This is known as the "chameleon effect" and is a way for people to blend into their surroundings and feel socially secure. This positive attitude is a unique effect of human-like Actroids, even among the older adults who are suffering from dementia and are less likely to interact with the outside world. The results also showed that the androids' ability to express their feelings and emotions may help them escape their passive lifestyles and find a variety of positive effects if they are able to have ongoing conversations with them. However, the interviews with the caregivers revealed that older adults had difficulty in exchanging words and having a two-way conversation and did not understand the content of the conversation. Although the current Actroid has nonverbal functions, its reactions are small and on a scale that is difficult for dementia patients to notice. In addition, the content of speech, facial expressions, and mouth movements do not yet perfectly match, so some elderly people have said, "I was worried about whether my speech was being understood. Although this is a limitation of this study, we hope to increase the number of subjects in the future, and to use the hints we obtained in this study to develop an Actroid that can communicate with them truly, thereby alleviating dementia related social disconnection.

Conclusion

In this study, the Actroid robot was introduced to a nursing home to conduct an exploratory study of how people with dementia talk and feel, and to have nursing home staff observe the conversation to see how it differs from the usual attitude of the older adults. The older adults seemed to have a positive impression of the Actroid, as they were willing to talk with the Actroid and look forward to the next opportunity. Future research should focus on the auditory and visual information of the older adults so that they can have a conversation that can be understood even by those with dementia. The results of the study will contribute to the exploration of necessary research topics in the future.

References

- Abu Khait, A., Menger, A., Rababa, M., Moldovan, T., Lazenby, M., & Shellman, J. (2024). The mediating role of religion and loneliness on the association between reminiscence functions and depression: a call to advance older adults' mental health. *Psychogeriatrics*, 24(1), 58–71. <https://doi.org/https://doi.org/10.1111/psyg.13041>
- Albers, R., Sadeghian, S., Laschke, M., & Hassenzahl, M. (2023). Dying, Death, and the Afterlife in Human-Computer Interaction. A Scoping Review. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. <https://doi.org/10.1145/3544548.3581199>
- Buie, E. (2018). *Exploring Techno-Spirituality: Design Strategies for Transcendent User Experiences*. University of Newcastle.
- Eliason, G. (2000). Spirituality and counseling of the older adult. In *Death attitudes and the older adult: Theories, concepts, and applications*. (pp. 241–256). Brunner-Routledge.
- Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). “Mini-mental state”: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12(3), 189–198. [https://doi.org/https://doi.org/10.1016/0022-3956\(75\)90026-6](https://doi.org/https://doi.org/10.1016/0022-3956(75)90026-6)
- Fortner, B. V., Neimeyer, R. A., & Rybarczyk, B. (2000). Correlates of death anxiety in older adults: A comprehensive review. In *Death attitudes and the older adult: Theories, concepts, and applications*. (pp. 95–108). Brunner-Routledge.
- Hasenbein, M. (2023). *Mensch und KI in Organisationen Einfluss und Umsetzung Künstlicher Intelligenz in wirtschaftspsychologischen Anwendungsfeldern*.
- Hill, P., & Pargament, K. (2003). Advances in the Conceptualization and Measurement of Religion and Spirituality: Implications for Physical and Mental Health Research. *The American Psychologist*, 58, 64–74. <https://doi.org/10.1037/0003-066X.58.1.64>
- Huxhold Oliver and Engstler, H. (2019). Soziale Isolation und Einsamkeit bei Frauen und Männern im Verlauf der zweiten Lebenshälfte. In M. and T.-R. C. Vogel Claudia and Wettstein (Ed.), *Frauen und Männer in der zweiten Lebenshälfte: Älterwerden im sozialen Wandel* (pp. 71–89). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-25079-9_5
- Japanese Ministry of Health Labour Welfare. (2013). *National Survey of Living Standards*. <https://www.mhlw.go.jp/content/11800000/000701055.pdf>
- Japanese Ministry of Health Labour Welfare. (2014). *Study on Future Estimates of the Elderly Population with Dementia in Japan_General Estimation of People with Dementia*. <https://www.mhlw.go.jp/content/001061139.pdf>
- Nomura, T., Suzuki, T., Kanda, T., & Kato, K. (2006). Measurement of Anxiety toward Robots. *Proceedings - IEEE International Workshop on Robot and Human Interactive Communication*, 372–377. <https://doi.org/10.1109/ROMAN.2006.314462>

- Obayashi, K., Kodate, N., & Masuyama, S. (2022). Assessing the Impact of an Original Soft Communicative Robot in a Nursing Home in Japan: Will Softness or Conversations Bring more Smiles to Older People? *International Journal of Social Robotics*, 14(3), 645–656. <https://doi.org/10.1007/s12369-021-00815-4>
- Otani, T. (2007). “SCAT” a qualitative data analysis method by four-step coding: easy startable and small scale data-applicable process of theorization. <https://api.semanticscholar.org/CorpusID:148605909>
- Rababa, M., Masha’al, D., & Shahrour, G. (2023). Association of Ageism With Death Anxiety, Self-Esteem, Interpersonal Reactivity, and Symbolic Immortality Among Nurses. *OMEGA - Journal of Death and Dying*, 87(1), 231–245. <https://doi.org/10.1177/00302228211019200>
- Schulz, M. (2012). Quick and easy!? Fokusgruppen in der angewandten Sozialwissenschaft. In B. and R. O. Schulz Marlen and Mack (Ed.), *Fokusgruppen in der empirischen Sozialwissenschaft: Von der Konzeption bis zur Auswertung* (pp. 9–22). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-19397-7_1
- Servaty, R., Kersten, A., Brukamp, K., Möhler, R., & Mueller, M. (2020). Implementation of robotic devices in nursing care. Barriers and facilitators: an integrative review. *BMJ Open*, 10(9). <https://doi.org/10.1136/bmjopen-2020-038650>
- Stiles, W. (1992). *Describing talk: A taxonomy of verbal response modes*.
- Tomer, A., & Eliason, G. (1996). Toward a comprehensive model of death anxiety. *Death Studies*, 20(4), 343–365. <https://doi.org/10.1080/07481189608252787>