Human Coach Technology Reactance Factors and their Influence on End-Users' Acceptance of e-Health Applications

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***Abstract*—Project e-VITA is a joined research force from Europe and Japan that examines various cutting-edge e-health applications for older adult care. Those specific users do not necessarily feel technology savvy or secure enough to open up for innovative home tech systems. Thus, it is essential to provide the support that is virtual and human beside each other. Human coaches will provide this support to fulfill this role as a mediator between the technological system and the end-user. Reactance towards the system from the mediator's role could lead to the system's failure with the end user, thus failing the development. The effect of technology reactance in the integration process of a technological system can be the decisive factor in evaluating the success and failure of a technological system. We used part-standardized, problem-centered interviews to understand the human coaches' challenges. The sample included people who act as the mediator role between the user and the technological system in the test application in the study centers. The interviews focused on experienced or imagined hurdles in the communication process with the user and the mediator role as well as the later relationship dynamic between the mediator, end-user, and technological system. The described technological challenges during the testing phase led the human coaches to responsibility, diffusion and uncertainty within their role. Furthermore, they led to a feeling of not fulfilling role expectations, which in the long term could indicate missing self-efficacy for the human coaches. We describe possible solutions mentioned by the interviewees and deepen the understanding of decisive factors for sustainable system integration for e-health applications.**

Keywords*—Technology acceptance; technology reactance; human-machine-interface; technology mediator; technology leverage; human coach, digital health; e-health; virtual coach; active aging, healthy aging; healthcare information technology introduction

I. Introduction

A. Project e-VITA

Under the EU Horizon 2020 program, as well as MIC funding regarding the Japanese Society 5.0 movement, project e-VITA, a Virtual Coach for Smart Aging, forms a research group that aims at conducting knowledge about new technologies and methods to help an aging society deal with specific problems of their older people. The team of sociological, medical, and technological experts joined in one research team spread all over Europe, and Japan aims at developing an innovative coaching system focused on the needs of older autonomous living adults, i.e., a virtual coaching system that can provide personalized recommendations and everyday help to improve older adults' life quality.

B. The Human Coach in Project e-VITA

e-VITA is aimed at older adults that not necessarily feel technology savvy or secure enough to open for innovative home tech systems. It is thus essential to provide the support that is virtual and human. At least one human coach will provide this support as a mediator between the technological system and the end-user. As a first step, each study center will recruit human coaches to fulfill this critical role. Project e-VITA has various test centers in Japan, Italy, France, and Germany to conduct a human trial such as feasibility studies and proof of concept studies to evaluate the developed virtual coaching system. The main tasks of the human coach will be as follows:

- Teaching end-users about the e-VITA virtual coach (usage, maintenance, support). If needed, end-users will be trained and supported by a team of researchers daily during the study.
- Regular phone calls between the human coach and end-user to answer questions and provide needed support, e.g., explain the appropriate use of the virtual coach.
- Organize real personal meetings of users once a week in the local community.
- Ensuring the security and safety of users, e.g., checking temperature to avoid overheating, safely placing the technical device in the home environment.
- Mentoring, creating awareness, and encouraging behavioral change, encouraging during the intervention.
- Reporting users' requirements, questions, and feedback to the developers to steadily improve the system.

C. Problem

In the first step within the e-VITA study, the human coaches will be primarily employees or volunteers with a particular affinity for technology and an advanced training status due to their particular relation to the project. In the

expected application of the final concept in the actual field, the human coaches accompanying the technology integration will be employees of care institutions, care services, social associations, and/or family members and local community volunteers. The effect of technology reactance in the integration process of a technological system should not be neglected because it can be a decisive factor in evaluating the success and failure of the technological system used [20]. The final human coaches will act as a kind of 'salesperson' for the system, thus mediating between the human end-user and the technological system. Reactance towards the system from the mediator's role could lead to the system's failure with the end user, thus failing the development [17]. Potential hurdles and reactance factors [25] from the role of the human coach will be explored in more detail in this study.

D. Contribution

Even though the participants of this study within project e-VITA might possess a fundamental technological affinity, they will be competent enough to deliver valuable information regarding the potential challenges a later human coach will face and, thus, possible technology reactance factors. As mentioned above, technology reactance factors from human coaches in their mediator role will influence the later successful technology integration in the field and following should be considered during the design phase for the technological system. Thus, this study aims at exploring the following three research questions:

- Which technology reactance factors can we find in the role setting of the human coaches?
- How do these factors influence the later end-user relationship towards the installed technology in private home settings?
- Which prospect aspects can overcome reactance tendencies, and which human coach motivating factors play essential roles?

II. Theoretical Background and Related Works

Advancing Information and Communication Technology (ICT) in healthcare can revolutionize delivering healthcare. From easy access to medical records to the ability to consult virtually with specialists, ICT has the power to improve the patient experience significantly. For providers, ICT can help improve patient outcomes, reduce costs, and increase efficiency. With access to Electronic Health Records (EHRs), providers can quickly access critical patient data, such as medical history and insurance coverage, without waiting for paperwork to be completed. This leads to more accurate diagnoses and faster treatment.

Additionally, ICT can allow providers to communicate quickly with other healthcare professionals, collaborate on patient care, and refer patients to specialists when needed. Moreover, ICT, installed in older people's homes, can ensure longer independent living situations for older people, especially in countries with vast demographic challenges and/ or labor shortages in elderly care. In short, ICT, as developed in project e-VITA, can revolutionize healthcare, providing older people with better access to care and providers with more efficient ways of providing it. The following section describes the theoretical backgrounds of these interrelations as a foundation for this study.

A. The e-Health Ecosystem in General

The healthcare sector is of paramount societal significance, and Information System researchers have long studied it empirically. The e-health ecosystems are emerging as an effective way to deliver healthcare services to older people cost-efficiently. These ecosystems are comprised of a network of entities - including healthcare providers, tech vendors, and other stakeholders - that facilitate the exchange of data and the provision of health services. This can revolutionize healthcare and open new possibilities for providers and older people [7, 12].

The development of e-health ecosystems is driven by the need for healthcare providers to access/ share data quickly and securely and the demand for cost-effective health services. As such, e-health ecosystems comprise various components, including electronic health records (EHRs), patient portals, health information exchanges (HIEs), telemedicine tools, and other technologies. By leveraging these components, healthcare providers can access and share data in real time, reducing administrative costs and providing better patient care access [1].

The e-health ecosystems offer numerous benefits for older people. For example, by providing access to patient or client portals, older people can access their medical records and communicate with their healthcare providers more easily. Furthermore, e-health ecosystems can enable the delivery of care through virtual coaching alongside the personnel in the form of human coaches. However, those technical systems present themselves as another stakeholder in the whole ecosystem, which also comes with several barriers and facilitators [25]. Schreiweis et al. define a list such as limited exposure/knowledge of e-health (e.g., poor digital health literacy), lack of necessary devices, and problems with financing e-health solutions as the top three barriers; as well as facilitating factors such as the involvement of all relevant stakeholders, integration into the overall care, and ease of use [3]. Stephanie and Sharma discuss the critical elements of digital health, including the emergence of digital health ecosystems, formulating a vocabulary of research and sensitizing concepts, and design issues and challenges in creating a viable patient-centric e-health ecosystem. They emphasize the potential of digital health innovations such as evidence-based data analytics, artificial intelligence, Internet-of-Things in remote monitoring and diagnostics, and blockchains for secure, compliant, transparent data management [7]. All authors find common ground in describing the importance of carefully integrating knowledge about the systemic complexity of e-health ecosystems, especially about the formal and informal caregivers as direct contacts to the end-users when integrating technological artifacts for care purposes [8].

B. Technology Reactance and the use of e-Health Applications

Technology reactance is an important concept to consider when developing and implementing e-health solutions.

Especially the above-mentioned complex ecosystems introduce a variety of critical points with diverse stakeholders in which technology reactance might lead to tech-system-failure [11]. This refers to people's psychological resistance to using technology, particularly when they feel it is being imposed upon them. This can be due to various reasons, such as feeling overwhelmed by the amount of technology available, feeling that technology is intrusive, or feeling that technology is not necessary to reach a desired outcome [20,16]. Technology reactance can potentially hinder the adoption and utilization of e-health solutions. To reduce the likelihood of this happening, developers and promoters of e-health solutions should strive to create user-friendly, intuitive, and reliable solutions that offer clear benefits to their stakeholders. The goal for many years has been to implement health information technology (HIT) for its apparent advantages; however, a significant obstacle to overcome is user resistance. Healthcare professionals should be provided with proper training and support. Attention should be paid to user needs and psychological concerns to create an environment of acceptance and understanding by using Psychological Reactance Theory (PRT) [18]. The psychological reactance theory assumes that people's behaviors are motivated by the desire to protect their "freedom" to carry out a particular behavior in a particular context [13]. The introduction of technology is generally accompanied by new processes demanding the change of (work) routines and task dependencies between employees/people. These processes can potentially cause power imbalances that may lead to perceived helplessness. According to the PRT, resistance is a result of reactance. It is defined as the response to losing freedom [18]. Svioja et al. point out the importance of carefully designed UX in complex systems, especially in safety-critical domains, to overcome stakeholders' possible reactance or resistance tendencies [23]. Subhasisch et al. present a study along the technology acceptance model (TAM) in which they prove that perceived ease of use positively impacts a system's perceived usefulness [4].

Additionally, perceived usefulness and prior use of the system significantly impact the actual use of the system in the end [4]. Parker et al. describe, in general, how work-technologies influence employees such as caretakers. The most publicized risk is the erosion of the need for human workers. Rather than solely speculating about which jobs will vanish, research should address the urgent and prevalent matter of how tasks might best be shared between humans and machines and the consequences of different choices in this respect. It is essential to consider design issues to come to grips with the potential effects of digital technologies and associated changes and to help steer technological development toward desired care futures [19]. Ultimately, technology reactance can significantly impact the success of e-health solutions. By understanding the potential for technology reactance and taking appropriate steps to address it, developers and promoters can help ensure that their intended audiences adopt and utilize their e-health solutions [2,15].

C. Sustainability Factors in Technology Development

The traditional approach to automation design has focused on optimizing operational efficiency and safety by minimizing human involvement and making systems easier to use for the operator. However, this approach is often met with a lack of acceptance, more severe failures, and an erosion of the sense of purpose that comes with meaningful paid or voluntary work [14]. To address this, more recent theories such as Experience Design, Positive Design, and Design for Well-being propose that technology should be crafted to actively contribute to meaningful, fulfilling work [5,9,10]. Therefore, to place well-being at the center of design efforts, autonomous systems must be created to support meaningful practices. A strong correlation exists between meaningful practices and situational commitment, creativity, and well-being. However, the connection between meaningful practices and technological artifacts is not yet fully understood, especially in work contexts. Smids et al. identify various frameworks that comprise meaningful work, such as pursuing a purpose, social relationships, self-development, self-esteem, exercising skills, and feeling autonomous [25]. Therefore, the design of autonomous systems should consider fulfilling human social needs and ensure sustainable usage based on users' and stakeholders' well-being [21, 22].

III. Methodological Approach

A. Interviews and Sample

We used part-standardized, problem-centered interviews [24] to interview the human coaches currently involved in the study at the four test centers (Japan, Germany, France, and Italy). The sample included people who act as the mediator between the user/ older person and the technological system in the test application in our study centers. The part standardized interview focused primarily on experienced or imagined hurdles in the communication process with the user and the mediator role; furthermore, the effects on the mediator and the later relationship dynamic between the mediator, end-user, and technological system. The interviews were conducted in English and German in the EU and Japanese in Japan using Zoom for the meeting and the recording. Two interviewers conducted the interviews. The interviewees were between 21 and 82 years old, with an average age of 49,2 years. We interviewed five persons in Japan, one in Italy, two in France, and two in Germany. The interview length was between sixty and ninety-eight minutes. The interviewees cover a wide range of job expertise shown in Table I. Also shown in Table I are references to the interviewees' role in the test centers, their experience in elderly care, and their self-assessed technology competence. We do not name the interviewees' countries in the table to ensure anonymity.

TABLE II. INTERVIEW DETAILS

Age	Job Expertise	Role test entre	Expertise Elderly care	Technology competence
82	Bank Manager, now civil servant and mediator/ judge	“My role is to listen carefully to the users and be a dedicated listener. I also understood that if they had any problems, I would give them advice.”	“When I was a community welfare volunteer, I was also an officer of the local social welfare council, so I had opportunities to listen to the elderly people at their gatherings and so on. When I was a community welfare volunteer, I also visited elderly people who lived alone, so I had opportunities to talk to them.”	“I'm not familiar with technology at all. I'd say I'm a three at best."
70	Project Manager IT, now Freelance same field	"The role of the coach about this project is to first understand the purpose of the project and then to communicate the actual theme of the robot, how easy it is for the user to use, and how to make the robot do what it is supposed to do, and then to help the user to do it."	“I started going to the neighborhood association the year before last, so we are almost the same age. Also, the members of the Go club are almost older than me. The people in the club are so into Go that the members of the club are more of a hobby, and they play against each other on the spot. We play a game about once a week. Those people look forward to playing games, so if anything, I started after 60.”	"I've been working with computers all my life, so I don't like to be asked about the level of IT technology involved in networking and things like that when I say with confidence, but I'm between 5 and 10. So then, I'll say 7."
69	Sales employee for IT	“My job is to guide the assistant robot and help the user.”	“There are so many. There are only elderly people…. One is a non-profit organization, one for …. and then another one as a civic contribution, and the third one is the delivery of meals for the elderly and disabled. I am in contact with them through these three. The other thing that I do is with them."	“I'm a ten on the concepts and a 3 or 2 on the technical aspects of contents. The technical stuff, the details, not at all.”
63	Accounting employee	"I think it is about eliminating the anxiety of users, being close users, and enjoying (the experience) with them."	“My mother is 94 years old, so I also meet people who are close to her. But, just a while ago, not too long ago, people used to come over for tea and chat. Now they have moved away to live with their children… My social interaction is about visiting daycare service…”	“Because I do not know how savvy is 10 (points). About the basic only. Maybe 2 or 3. 2.5.”
71	Call-center employee for mobile phone business, now social activities for the community	“After all, coaching means (to be) fairly well versed in coaching content and able to tell it simply (to users); I think those things are important.”	“I participate in my local residents association's salon once a month and I also help the local comprehensive center once a month as long as time permits. Because of those (activity), (I have some interaction with the elderly) to some extent.”	“I think (I am) already close to zero.”
30	Psychologist	“I am mainly involved in user recruitment, interviews, and test		“Maybe nine?”

		administration."	"I work with senior people, senior with older people, and often with people with dementia or Alzheimer's. And um my, I also work like a psychologist, e-Vita. So outside, e-Vita and I yes, I work with these kinds of people. I do cognitive stimulation or cognitive rehabilitation."	
24	Research Engineer	"My role is to first create a user guide. And after implementing all the technology in the home of the older person of the participants and to answer their questions when we are in their home."	"I think because I started to work with Senior when I am when I was in a master's degree. So four years old, I think I work with them. In contact." "I had contact in an internship and after my first job as a researcher also."	"I think I'm eight because I like technology, but I'm not a developer, so or gamer, or so like that. So I use them, but I use all the technology like to see what is possible to do, but I'm not touching technical system or like that and it's not my job."
21	Engineer	"I am currently helping in that project, just like a human coach would do. Calling participants and going to participants' houses to see what's going on."	"Not really. I have done a little project from my engineering, from my engineering formation, which was a sort of remote control for the TV, which was used by the seniors, which were they were doing just like this."	"I really like technology. I'm a bit familiar with them, with it. And I would like to say nine, I think. Nine is great."
28	Project Manager in Social Science	"My task as a human coach was, on the one hand, to install the devices, to introduce them to the devices, and to record the feedback from the users. And when there are technical difficulties, we go to the users and see what's going on and how we can solve it."	"(You were already a physiotherapist in training. Did you then also often deal with senior citizens? Probably also in this context. But-) "Yes mostly actually."	"9… Well, I don't understand, of course not, the complete complexity behind the device, but I can familiarize myself with the practical processes relatively easily and get it down to the chain quickly, quickly. So I can quickly acquire new technologies and new technical knowledge. "
32	Student Medical and Health Science and Caretaker in part-time	"I'm writing my bachelor's thesis about the study, and then the project manager asked me or asked me if I wouldn't like to take on a role as a human coach."	"So, starting at home with my friend and with his grandmother in his grandmother's house, he has dementia. I also take care of them privately. Then I worked in a nursing home before. Many years. I've always had very close contact with the residents, so there was also an amicable, family atmosphere."	"It all depends on whom you're comparing yourself to. Because I have programming experience, but I'm not exactly a programming expert, and I wouldn't say that at all. Let's say if I compare myself to people who study computer science, I would say a seven."

B. Analysis Process

After transcribing the interviews, they were coded for anonymization. According to the different nationalities of the participants, corresponding abbreviations were distinguished to assign them later to possible inductive categories like cultural differences or demographic comparisons. The anonymized texts were then openly coded with the help of four research questions:

- Which technical reactance factors can be found in the role setting of the human coaches?
- How do these factors influence the subsequent relationship of end-users to the installed technology in the home environment?

- Which aspects can overcome reactance tendencies, and which motivating factors of the human coach play an essential role?
- What important information does the interviewee provide concerning their role as an intermediary?

The first category summarizes all statements about the technological reactance factors of the human coach, including the components of their occurrence. In the second group, all quotes were collected on the relationship dynamics between the human coach, end user, and technology. Category 3 dealt with the solution ideas to potential or actual problems, and the last category contained information about how the respondents felt in their mediator role and how they would define it.

The recorded citations were sorted in a table. The individual codes were then analyzed to identify similarities or abnormalities. These were carried out separately by two researchers, whose results were then summarized and processed. In addition, this study explored general knowledge and cultural or demographic characteristics, which we examined as inductive and open-ended.

Based on the collected findings, theories were then formed, and connections developed to filter out the influence of intermediaries on the acceptance of technology and to be able to specify this intermediary role.

C. Validity Threats and Limitations

Following Engelhardt [6], we can summarize that the interview method was very well suited to finding the needed background information and personal attitudes for this sub-study. The procedure made it possible to ask in-depth questions about certain statements. This ensured that the interviewee was understood correctly and underlying attitudes could be found. This understanding was the basis for further analysis to correctly process the interviewees' statements and not allow personal interpretations to flow in [24]. However, the exact procedure during the interview might differ from the interviewers. One limitation was that different people conducted the interviews due to the language barrier. Each interviewer might have had their interview style, which may have influenced the statements made by the interviewees or even led to certain aspects not being addressed at all or in sufficient depth. In addition, the different cultures of the interviewers and the interviewees could have influenced how openly specific topics were discussed or how vehemently questions were asked about problems of understanding. People of a wide range of ages were interviewed for this study. So, we cannot entirely rule out that questions were understood differently; therefore, comparability might not be entirely given. Probably the most significant limitation of the study was the different languages used. The interviewees gave the interview in Japanese as a native language, English as a non-native language, or German as a native language. Translations were, therefore, necessary for the analysis process. As a result, quotations could have been falsified or statements modified within the translation process, even if a professional translation service proceeded. However, since we conducted the data and proceeded with the analysis under the close supervision of the leading researcher, who also coached the executing researchers beforehand, we eliminated validity threats as best as possible for this international and complex sub-study.

IV. Results

A. Category 1: Human Coach Technological Reactance Factors

During the analysis process of the first category, we were led by the question of which aspects the interviewees reported about specific use situations and self-responsiveness to the tested technologies. Furthermore, when and where those aspects arose, and which psychological content-wise link can we draw from the given statements?

All those surveyed named the fact that fluent conversations were not possible as probably the most considerable criticism of the tested systems. The devices had limited topics of conversation and had difficulty understanding what was being said, leading to frustration among the seniors. Some seniors were disappointed by how "little" the devices could do. Some of them started the tests with high expectations and were then disappointed. For them, using it was sometimes more severe work than fun.

In general, the interviewees found that the system for communicating with a robot was still in development, making conversation difficult at the beginning due to its response. It was found that the conversation was not going smoothly due to changes in the example conversation in the manual, and it was suggested that the conversation should be more cumulative to improve this. It was mentioned that while care should be taken not to exceed certain limits regarding technology, it should not be intrusive regarding privacy. In addition, it was criticized that the voice would sound metallic and invite only limited conversations. There was sometimes a lack of feedback from the system, for example, when it started processing for a search, but it needed some time. It was repeatedly criticized as unnatural that one had to press a button to start a call. This was also difficult for some seniors to understand. However, it was positively emphasized that the robot would turn its head in the direction of the voice. This made the conversation more natural for the seniors. The simultaneous textual reproduction of what was said on the Gatebox gave seniors certainty that the device understood what was said correctly.

The limited functions were another disappointment for the seniors. They could only perform a few, often simple actions with the devices and needed a smartphone for them. This would make it easier for them only to use the standard apps, so the e-VITA devices hardly offer them any added value. Some seniors also had difficulties using Telegram because they were unfamiliar with this app or Messenger in general and thus had to learn several new technologies at once. According to some seniors, these limitations in connection with the poorly functioning voice control made the devices either just a kind of entertainment without added value or useless. During the experimental period, the users noted that it was a toned-down version of the commercial version, not providing the expected response or reaction. The user hoped that the robot would suggest activities such as going outside

and showing empathy when the user was crying. They raised concerns about how the robot would be used and suggested positioning it as a pet or healing tool. One interviewee expressed surprise at how well the users responded to the robots and found them helpful in relieving loneliness. The interviewee also wonders if the robots could be used to help people with dementia and if those with more difficulty could operate them. The interviewees also reflect on their experience with technology, feeling that their world has opened and expanded. They noted that the older adults they had accompanied were apprehensive about robots but would accept basic conversations about everyday topics. They observed that many of the older adults did not understand how to use the technology or that it was usual for the robot to get hot, which scared them.

Some respondents received feedback from seniors during testing that they felt the systems were inappropriate, which concerned, for example, the design and the character, but also the structure of the functionalities. Some of these were not self-explanatory enough, so they needed help to use them.

Other problems that arose were, for example, that the seniors in small apartments had too little space for the devices. In addition, some voiced concerns about the power consumption and the associated costs or the overheating of the devices. Poor WLAN also sometimes posed a hurdle for use. One of the respondents expressed criticism of the further plans in the e-VITA project, that they were not specific enough about data use. For example, the interviewee mentioned that information should be passed on to health insurance companies through the devices in the future. However, this passing on could also be to the detriment of the senior citizen if he/she does not maintain a healthy lifestyle and the health insurance company refuses to provide benefits.

Overall, it can be said that the tested technologies are not yet failsafe enough for the seniors; the voice control needed optimization, and more possible actions tailored to seniors would have to be implemented so that the systems tested in e-VITA would unite the seniors have actually added value and can therefore be used sustainably.

The mentioned technological challenges during the testing phase led the human coaches to responsibility diffusion and uncertainty within their role. Since we followed a relatively open interview style, those interconnections were steadily mentioned during the recording phase without specific questioning. The technological challenges led to a feeling of not fulfilling their role expectations or job descriptions entirely, which in the long term could indicate missing self-efficacy for the human coaches. This aspect might lead to a problem when integrating a new eHealth system with a sustainability focus.

We will now analyze the mentioned psychological challenges with the following analysis parts.

B. Category 2: What Relationship Dynamics can we see in the usage Triangle of Human Coach, end user, and Technology?

Both caregivers and seniors in the study expressed disappointment at how little current devices could do. They each had higher expectations and were disappointed. For example, it was criticized that the systems did not respond to the senior as an individual but remained very impersonal or gave generic answers. Overall, the conversations should be more natural and focus more on the senior instead of simple question-and-answer exchanges. There was also criticism that too many individual, non-networked applications should be tried simultaneously. As a result, and due to the limited functionality and personalization, some of these were not tailored to the announced project goal, namely, to increase senior citizens' well-being and advise them on health and social issues.

Several respondents said it was positive that there was a lively exchange between senior citizens, intermediaries, and developers. This allowed them to act as facilitators, giving feedback and getting answers from the developers about how something worked or why it worked a certain way. This social inclusion through involvement in the development of the system that was not initially part of the study phase might be an essential indicator for the later integration of the system and its further development.

The participating older adults often saw the robot as a kind of pet or assistant that reminded them of medication, for example, but also encouraged them to talk and interact. To do this, however, the system must also respond to the character of the individual seniors. For example, it must act if the senior using the device suffers from dementia and needs different treatment than a senior without dementia.

Several intermediaries stated that they considered it crucial to also convey to the seniors what the robot can and cannot do, to deal with their sometimes very high expectations. Some older adults were disappointed when something did not work and reacted angrily. The mediators found this critical since they wanted the systems to enrich the lives of older people. They were convinced that long-term, sustainable use would only come if seniors also wanted to use the technology and could try it out over a more extended period to experience the added value for their lives. This approach to the aspects of enrichment and the limits of technology was described as an essential task of a mediator. However, the seniors were perceived as curious about the technology and interested in interacting with the devices. There were a few exceptions, where some respondents felt that the seniors were only participating in the project to please them and were, therefore, less motivated to try the devices.

The interviewees described as an essential basis for the cooperation that a basic trust between the senior, mediator, and developer is necessary. It is also important not to patronize the seniors but to let them set up the devices themselves if they feel up to it or to accept if they do not want to use specific devices. Several mediators empathized with the seniors, enjoyed the cooperation, and appreciated mutual respect.

C. Category 3: Which Solution Ideas are Offered by the Respondents?

In conclusion, it is vital to understand the needs of older people individually and in more depth, such as what they need

and want, so it is necessary to collect data more widely, the interviewees summarized. It is essential to make the operations as simple as possible and to explain the vision in a way that is easy to understand for older people. It is crucial to foster mutual understanding between the older user and the robot and create a sense of control for the target group. Finally, it is essential to make sure that the technology is suitable for the needs of older people and that it is entertaining.

To develop technology that is tailored to seniors, the data collection in advance should focus more on their needs and perceive the seniors as individuals, according to the respondents. Some said there is more than one group of seniors, and one needs to identify which groups of seniors have which needs and, therefore, would benefit from a particular technology. In addition, some intermediaries expressed that they would instead test several small functionalities one at a time to be sensitive to feedback and to be able to develop technology in a more tailor-made way. Also, before handing out the technology to the seniors, ensure the systems will improve their lives, not complicate them. They suggested that vocal interaction was better than other forms of interaction and that medical reminders would be beneficial. They also suggested that physical activity advice was essential and that robots should have an emergency button. Finally, they noted that it was unclear whether robots should be rented or bought and that some older adults preferred to rent them monthly, while others preferred to buy them outright.

Respondents would like more time to prepare and try the devices before bringing them to the seniors. In this way, they could familiarize themselves more intensively and, for example, get the missing power adapter or better prepare the presentation to the seniors. The level of this presentation should also be as low-threshold as possible since many technologies are new to seniors, so they must learn them from the very beginning. In addition, the intermediaries wanted to receive a kind of operating manual at the beginning to get a common understanding of the project and the devices.

According to those surveyed, senior citizens and caregivers should not only be provided with operating instructions and explanatory videos, but continuous support from caregivers. In this way, the latter would have the opportunity to explain or practice things several times, thereby optimally supporting the seniors in learning to operate systems. It is also essential to respond to the seniors' level of knowledge and adapt the explanations accordingly.

When introducing the devices, the vision or goal of the development should also be addressed to involve the seniors in the project. In addition, it would have to be communicated that the technology was still in development. In this way, the seniors can be better involved. According to the intermediaries, it is also imperative that nothing is hidden from the user. They must be told openly what the robot is doing or why, i.e., if data is recorded and how it is used. Even if one feels that the seniors do not understand the topic of data protection, for example, everything should still be explained to them openly.

According to those surveyed, the devices themselves should not be too complicated to use and should make the user happy. This requires a specific range of functions since the seniors were disappointed with how little the devices could do. The seniors must be able to switch off the systems at any time and thus control them. Voice interaction must work better if one wants to use social robots, and conversations must be set up and conducted from the user's point of view. The interaction could also be loosened up with jokes, for example, and the seniors should be able to choose between different voices or ways of interacting, such as severe or funny.

According to the interviewees, there should be a direct contact person for technical problems, and a better complaints management system should generally be introduced. This would allow the problems of older people to be addressed more quickly and flexibly. The intermediaries themselves could seldom solve technical problems on their own; they could only pass them on. This led to frustration for both agents and seniors. In addition, the exchange timing should be based more on the everyday life of the seniors instead of being geared toward the developers or mediators.

We argue that considering the solutions given by the human coaches themselves when designing the technological e-health system will help to develop a more sustainable solution.

D. Category 4: What Important Information does the Interviewee Provide about their Role as Intermediary?

All respondents agreed they would have needed more time and opportunities to prepare in advance. The interviewees suggest that they could have had more success if they had taken more time to stay with the seniors and explained how the robot works in more detail. They stated that they were often unable to answer senior citizens' questions and therefore felt uncomfortable. They felt that, in this way, they could not meet the needs of the seniors and also did not fulfill their role as mediators. Those surveyed would have liked to have tested the devices more intensively in advance to have more experience using them. One intermediary even reported that the senior knew more about the device and technology than he did, which made him uncomfortable in his role. A technical meeting beforehand, in which the devices and how they work, could have helped them with these problems. In addition, they would have liked to have had a more extensive range of operating instructions or additional in-depth information to better prepare for their role. To do this, the human coach should prepare in advance, including getting familiar with the project, the robot, and the user. The coach should also be aware of the user's age, background, and technical savvy to be able to communicate effectively and teach them. The interviewees felt the university was unprepared, lacked a manual and information, and did not complain. They believe the goal is to eliminate users' anxiety, be close to them, and enjoy the experience together. Technical knowledge is only at a basic level but the basis for building trust in the relationship triangle. The interviewees feel it is better to make users feel interested and have fun with the technology instead of making them feel like they cannot use it.

In addition to providing support with problems and answering seniors' questions, respondents also saw it as part of their role to be there for the seniors, to address their fears, and to build a relationship with them in general. They felt that listening to the seniors and not making them feel like they were being guinea pigs was essential. They wanted to interest users in the technology and motivate them to use it, but not persuade them. It was also important to them to respect the seniors and treat them as equals. The interviewees' self-conception is that the role of the human coach in this project is to listen carefully to the user and provide advice if they have any difficulties. They should be able to explain the project's purpose, how to use the robot and its functions, and how to nurture it. The human coach should also have a good understanding of the technology and hardware involved and can provide clear instructions and explanations. They should also empathize with the user to build a trusting relationship.

When working with the seniors, the mediators wanted to respond to the seniors' level of knowledge to adapt their explanations accordingly. At the same time, it was stated that explaining technologies such as messenger services to seniors unfamiliar with them was challenging.

If they could not answer the seniors' questions, they saw it as their job as mediators to forward them support. However, this sometimes led to frustration because no solution was found due to the long distances, and they could not help the seniors. As a further task, some of those interviewed defined setting up the devices for the senior citizens and picking them up at the end of the project phase. However, one of the facilitators made it very clear that he did not want to feel responsible for programming the robot, installing anything, and making it operational. Another criticized that he felt very uncomfortable going to the seniors with equipment that was not fully working.

In conclusion, human coaches must be outgoing and confident when interacting with people to help them better understand and use technology.

For the future, the wish was expressed to organize an information event before the equipment was set up for the seniors, at which the seniors would be informed about the project goal and what the devices would be like. In addition, some people wished to have more face-to-face meetings with the seniors to provide them with the best possible support and get to know them better. In this way, the intermediaries could first demonstrate the device and then start the explanations, as desired by one of them. There was also a demand that more information should be provided about data collection and processing so that intermediaries can pass on this critical information to older adults.

They also suggest that having a technical meeting with someone experienced with the technology and showing the seniors how the robots work in real life would help them understand how to use the robots better. The problem for the interviewees was that there was not enough time to get used to the devices before the study began. This led to negative feelings and a sense of responsibility as they had to justify any problems that arose. They felt motivated to ensure the study was successful but had to limit their involvement as they were not a full-time employee. They believed it was essential to be familiar with the devices and technical context to explain while promoting self-efficacy experiences. These discrepancies should be considered for the latter human coaches to enable them for their task and ensure the technological system will be used sustainably.

E. Cultural Differences and Demographic Aspects

We could not find any aspects in our data that justify a cultural difference comparison. We could see that depending on the cultural setup for care facilities and care infrastructure, the technical needs of the used technical system differ a lot. However, for examining the role of the human coach, we could not identify cultural specifics that would justify a category on its own within this sub-study. Furthermore, we could not identify specific differences for comparing, e.g., age aspects in perception or role understanding. It was striking that the older respondents often not only report from the perspective of the older adults within the study but also consider their perspectives. In addition to possible functions or possible uses, this also affected the view of the current devices in the study. The younger participants did not have this perspective and remained in a more objective state of the report.

V. DISCUSSION

A. Findings

Based on the interview data, it can be deduced that language interaction was significant to the respondents. They expected fluent conversations and a more comprehensive range of topics to discuss. Some also complained that the robots' voices sounded too technical. We found that the interviewees stated most prominently that the tested technologies had limited functions, poor voice control, and poor design and character. Furthermore, the structure of the functionalities was not self-explanatory enough. For example, respondents would like the system to notify the user when processing an entry or performing a search. The user should therefore be informed about the current system status, including its actions. The ability of the devices to have realistic, profitable conversations, including action explanations, seems to have an important influence on the reactance.

The range of functions also influenced the reactance. The respondents had high expectations of the devices, which were not met. In addition, some felt that the systems were not tailored to them. Therefore, it seems necessary to offer users functions with added value tailored to their needs. The technological challenges led to responsibility diffusion and uncertainty for the human coaches, potentially resulting in a lack of self-efficacy.

Category 2, which introduced the focus of relationship dynamics in the usage triangle of human coach, end user, and technology, indicated that it was felt to be very optimistic that there was a lively exchange between seniors, mediators, and developers. Questions could be answered quickly, and problems or feedback passed on. The mediators found this to be positive since they had a technical contact person and could get help despite the short preparation time and resources. In

this way, an essential trust could also be created as a prerequisite for cooperation. The seniors often viewed the devices as some pet or assistant, so they had certain expectations. These were not always realistic, which could lead to disappointment and frustration. It is, therefore, crucial that the mediators are fully informed about the functions and can also pass this information on to the seniors, right from the start. In combination with a higher level of reliability, the intermediaries could imagine sustainable use. In addition, the mediators would like to be socially included in the development process. Lastly, there seems to be a necessity for essential trust between all involved - mutual respect and appreciation of cooperation. We can thus summarize that for the relationship triangle of technology, user, and human coach; it is vital to consider those possible challenges that might lead to responsibility diffusions mentioned above and false, hindering expectations from all parties.

Category 3, which offered the opportunity to give in participatory ideas from the interviewees, showed us that data collection should be more comprehensive to understand the needs of individual seniors. Intermediaries should test functionalities one at a time and customize technology accordingly. They need to have enough time to prepare for and try out devices to ensure a good user experience. Explanations should be low-threshold and tailored to the individual's knowledge level. The introduction of the devices must also take place at the knowledge level of the seniors; the level must be tailored to them and their understanding of technology. These principles make it possible for the older person to feel in control of the robot and be able to use it without outside help. According to the mediators, this is the only way to achieve sustainable use.

To adapt the introduction for the seniors, the facilitators would need more time and information in advance to prepare optimally and start interacting with the seniors with a feeling of security. In addition, the intermediaries could also help with problems more quickly instead of often going through lengthy detours via the developers.

When setting up the ecosystem, it is thus of essential importance to consider an additional service that might help with upcoming tech challenges.

In Category 4, the interviewees reported in detail about their role as intermediaries. The facilitators agreed they needed more preparation before going to the seniors with the devices. In addition, they would like more time with the seniors to slowly introduce them to the individual devices and to be able to explain their functions in peace.

It would have been essential for their role to feel like a competent contact person for the seniors. This was often not possible for them due to a lack of advanced information and preparation time and, in some cases, the equipment's susceptibility to errors. In the event of problems, the mediators often could not help immediately and had to contact the developers themselves. They said this could have been avoided with better, more intensive preparation and detailed instruction manuals.

In addition to introducing the devices, the facilitators considered the emotional component crucial to their role. They wanted to be able to develop a relationship with the seniors to address their fears and worries and to be able to resolve them. They aimed to meet the older persons on eyelevel and to motivate them to use the device, but not to persuade them.

Summarizing, we can state that respondents wanted more time and opportunities to prepare in advance, as they felt uncomfortable if they could not answer questions from the senior citizens. They also desired to be able to test the devices more extensively before the event and become familiar with the technical context. Furthermore, respondents saw it as part of their role to be there for the seniors, to address their fears, and to build a relationship with them. When setting up the e-health ecosystem, we argue that it is necessary to consider the psychological aspects of the involved human coaches as much as those of the end-users to ensure sustainable technology usage and integration.

B. Limitations

A general limitation of qualitative research is a certain degree of subjectivity. The previous experience and working methods of the person carrying out the work can always influence the result. The weighting or interpretation of individual statements may also differ between different researchers. This was at least a little prevented in the present study because two different study participants looked at the results independently and evaluated the citations. The results were then processed together. Nevertheless, a certain degree of subjectivity is difficult to rule out completely.

In the present study, with 10 participants, comparatively few people were interviewed. To make matters worse, they formed a very heterogeneous group. There were several nationalities and an extensive age range represented. In addition, the participant's experience and knowledge about technology and robotics differed significantly. Due to this broad spectrum, whether generalizable results can be derived must be questioned. Technological competence could lead to the participants defining and fulfilling their roles as intermediaries in very different ways.

The unique view of one's role as an intermediary could also have been influenced by how long the respondents had already been employed in the associated e-VITA project and what tasks they had already carried out as part of this activity.

The distribution of nationality and age was very heterogenic. While five Japanese participated in the survey, only two German participants, for example, who were both relatively young, commented. This makes it difficult to compare the individual groups of participants.

Since we interviewed persons currently involved in the study, we cannot entirely ensure that the latter human coaches would present the same assessment as our interviewees. Since we are faced with several open questions regarding the system itself and the surrounding ecosystem, we must consider that those open aspects might influence the relationship dynamics of the triangle of human coach, user, and technological system. For example, we are still not sure about the final legal

aspects. The legal aspects of the system must be clarified: Who will be responsible for its later use and instruction? Furthermore, the target group of the human coaches must be considered: Will they be a diverse target group or a homogenous target group? The community level must also be considered: What part will the community play in supporting or hiring human coaches? Municipalities must determine which of the current ICT instructors will be the final human coaches in the final use of the system. Finally, social services and welfare organizations must consider which services they already offer for tech coaching and if they can be used for the later use of the tech system. To name some aspects that might be relevant for the relationship triangle and the latter assessment of the technology used.

Since we just had access to ten human coaches within this study, we must evaluate the sample as relatively small. However, we discussed in detail and at great length how the human coaches feel about the technological system and its relationship dynamics. We, thus, considered the sample sufficient for a first qualitative approach.

We also expect that conducting data in a group with similar technological savviness or ignorance might influence the results. However, since we could not access this kind of group within the study and concerning the open aspects mentioned above, we consider the results valuable indicators for our study, the development of project e-VITA, and other e-health developments.

C. Future Studies

In the future, we see the need to research the differences between different cultures, age groups, and levels of technological savviness to provide an excellent opportunity to explore the potential of future e-health technologies. For example, research into how people from diverse backgrounds interact with technology could reveal ways to bridge the gap between tech-savvy and those who are not. Additionally, research into the potential of human coaches, who are not currently involved in a particular setting, could provide valuable insights into how e-health technology can facilitate learning and growth. Finally, research into the effectiveness of e-health technology in a setting without open aspects and a fixed framework could provide valuable insights into how this specific technology can be used to create a more dynamic learning environment. All of these research opportunities could help us better understand how e-health technology and the ecosystem can be used to benefit people from different backgrounds and provide them with better access to healthy living opportunities at a later stage in life.

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