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Ethical Issues Raised by the Introduction of Artificial Companions to Older Adults with Cognitive Impairment: A Call for Interdisciplinary Collaborations

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Abstract

Due to the high costs of providing long-term care to older adults with cognitive impairment, artificial companions are increasingly considered as a cost-efficient way to provide support. Artificial companions can comfort, entertain, and inform, and even induce a sense of being in a close relationship. Sensors and algorithms are increasingly leading to applications that exude a life-like feel. We focus on a case study of an artificial companion for people with cognitive impairment. This companion is an avatar on an electronic tablet that is displayed as a dog or a cat. Whereas artificial intelligence guides most artificial companions, this application also relies on technicians “behind” the on-screen avatar, who via surveillance, interact with users. This case is notable because it particularly illustrates the tension between the endless opportunities offered by technology and the ethical issues stemming from limited regulations. Reviewing the case through the lens of biomedical ethics, concerns of deception, monitoring and tracking, as well as informed consent and social isolation are raised by the introduction of this technology to users with cognitive impairment. We provide a detailed description of the case, review the main ethical issues and present two theoretical frameworks, the “human-driven technology” platform and the emancipatory gerontology framework, to inform the design of future applications.

Keywords

Dementia; ethics; robots; technology

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INTRODUCTION

Due to the high costs of providing long-term care to older adults with cognitive impairment, artificial companions are increasingly considered as an opportunity to provide support while saving money [1–5]. For example, in Japan the government has subsidized companies developing artificial companions designed for older adults with cognitive impairment living alone and in residential care environments [6–8]. Defined as “typically intelligent cognitive ‘agents’ implemented in software or physical embodiment as a robot” [9], artificial companions can comfort, entertain, and inform, thus inducing a sense of being in a close relationship. Sensors and algorithms usually give these applications a life-like feel (see Table 1 for examples of artificial companions).

The rapid explosion of artificial companions, like the one discussed in this paper, has created a “cultural lag” between the rapid commercial introduction of these technologies and the paced evolution of regulations and ethical guidelines [10–12]. This lag originates from different practices governing each process.

On the one hand, artificial companions are typically conceived and built by developers who are usually driven by a desire to support users and their families. For example, the developer of the artificial companion analyzed in this paper invented his application after witnessing his grandmother’s loneliness in Taiwan after his family moved to America [13]. On the other hand, developers are competing to patent their inventions, introduce them to the market, and possibly have their products become reimbursable through public health programs and private health plans [14, 15]. Developers experience intense competitive pressures, especially since many of their products never make it to the market [16], which can make it challenging for them to take the time to support ethical inquiry and the kind of multi-stakeholder engagements needed to design workable guidelines [10, 17].

It is no surprise that guidelines are needed for artificial intelligence (AI). More generally, outside of the developer community, more than eighty governmental, non-governmental organizations, and other groups put forth detailed AI ethics guidelines over the past five years [18], but this has yet to lead to agreed-upon actionable steps for robot companion developers. Owing to their concern for supporting users, some developers have advocated in different venues for ethical governance—i.e., “a set of processes, procedures, cultures, and values designed to ensure the highest standard of behaviors” [12] of AI systems. A priority of these regulations is the incorporation of ethics into the design and implementation of AI systems before their dissemination [19]. Several charts discussing voluntary principles of robotics and AI have been developed [12]. IEEE, which is the largest technical professional non-profit organization dedicated to advancing technology for the benefit of humanity, launched a global ethics initiative in April 2016, with the aim of embedding ethics into the design of AI systems [15]. IEEE also recently published a thought piece on the importance of formulating a set of standards for advancing ethical governance [20]. The World Economic Forum recently launched a global initiative involving multiple stakeholders to develop policies to regulate new technologies [12,21]. Despite these efforts, “there is little evidence of good practice in ethical governance” [12].

One outcome of this cultural lag is a tension between the potential of artificial companions to support users and a series of unresolved ethical issues related to the fact that users might lack the capacity to fully understand the implications of using these technologies. Specific challenges of deception, monitoring and tracking, informed consent, and social isolation are raised by the introduction of these technologies in users with cognitive impairment (Table 2).

In this paper we focus on a case study of an artificial companion for people with cognitive impairment commercially available in the United States (<http://www.care.coach>). This companion is an avatar on an electronic tablet that is displayed as a dog or a cat. Whereas artificial companions usually rely on AI (e.g., algorithms, sensors), this pet-avatar relies on telepresence (i.e., the use of virtual reality technology, especially for remote control of machinery), as well as technicians “behind” the on-screen avatar, who via surveillance, interact with users. Its reliance on technicians guiding the pet-avatar while monitoring users makes this case particularly controversial because users might believe that they are interacting with an on-screen pet while in reality they are interacting with a human being. This case is notable because it particularly illustrates the tension between the endless opportunities offered by technology and the ethical issues stemming from limited regulations. This case is not unique. Zora, another artificial companion (Table 1), is also guided remotely by health professionals. Our goals in this paper are to provide a detailed description of the specific case, review the major ethical issues it raises, and briefly discuss possible ways of overall improving future ethical use of this technology as well as artificial companions overall. To ensure that these technologies are developed to serve and protect the values of their users, we emphasize the importance of interdisciplinary collaborations among developers, researchers, users, providers, policymakers, and ethicists.

CASE PRESENTATION

Overview of the technology

The technology is an electronic tablet that displays the avatar of a pet, either a dog or a cat. An avatar is the electronic representation of a live being. The purpose of this technology is to provide users with company, as well as emotional, instrumental, and informational support. The ability of this artificial companion to establish rapport with its users lies in its design. The user has the impression of conversing with the pet-avatar because the artificial companion is remotely guided by a technician who can hear users’ words and then replies by typing answers on a keyboard. Messages are then transmuted into sounds. In AI, this feature is named “Wizard of Oz manipulation through an avatar interface.” Specifically, behind the eyes of the pet-avatar are actual human eyes of one technician who is observing a specific user in real time through the camera of the tablet. Due to her/his ongoing and protracted observations, the technician is able to tailor the pet-avatar’s messages to the situation. To ensure financial feasibility, these technicians are hired in Latin America and the Philippines, after video interviews and criminal background checks [22]. Since they directly type their responses to the user, distinctive accents that may be foreign to users are avoided. The rotation of surveilling staff around the clock offers the chance to connect with users at any time. Before starting their shift, technicians can access a summary of the events that

preceded them. This rotation is invisible to users who see the same pet-avatar displayed on the tablet. This application can be purchased by private or corporate users for a monthly fee of around \$400. Internet connection is provided by the developer.

Functionalities

The tablet of the pet-avatar can be moved around in order for the pet-avatar to interact with users at any time [23]. The avatar greets them good morning and good night, shows them family pictures, offers music to play, reminds them to take medicine, plays games, and talks with users about topics that are meaningful to them. The pet-avatar also displays affection by smiling, emitting floating hearts, and saying “good morning beautiful” or “I love you.” In addition, the pet-avatar can display live videos of sports event, weddings, and religious celebrations. Because of its presence around the clock, this artificial companion can comfort users at any time of the day. Users can put the pet-avatar to sleep by command or by pressing buttons. As a result, they will see the pet-avatar sleeping. However, the pet-avatar can be programmed to sporadically activate its sensors in order to check on users also during its sleep mode.

Implementation data

Data on the number of users are not publicly available. As the visibility of the pet-avatar increases through press releases, media articles, and presentations at conferences (Table 3) [13], so has its funding and its uptake. In a recent article in the *Wall Street Journal* [2], a manager of an organization serving older adults in Boston reported saving of \$150,000 on reduced emergency room visits because of the use of the pet avatar by its clients. The interactions with the avatar decreased anxiety and confusion, thus reducing unnecessary and costly interventions. In a related vein, in 2018 the National Institute of Nursing Research awarded \$748,000 to its developer to test the ability of the pet-avatar to support nursing teams by mitigating delirium and risk of falling in their patients (R44NR017842 PI Wang).

User and provider data source

This case study draws from primary and secondary user data. The first author (EP) collected primary data during a presentation of the technology at a one-day seminar on living alone with dementia in Irvine, CA (April 2018) organized by Splaine Consulting. Specifically, she attended this seminar that was open to the public and widely publicized online. During the seminar, as a member of the audience, she asked questions and took handwritten notes. The first author also interviewed two providers in November 2018 who have been involved with the introduction of the avatar to patients with cognitive impairment, most of whom live alone. Both providers gave consent for this study, which was approved by the Committee on Human Research of the University of California San Francisco (IRB study number 18–26282). The interviews with providers were audio recorded, professionally transcribed, and uploaded in Atlas.ti, a software program for qualitative data analysis, where they were analyzed using content analysis. Secondary data derived from the first author’s cursory review (May 2018–August 2019) of online and printed media articles on the pet-avatar, as well all as the website of this artificial companion. These representations of the pet avatar were selected to illustrate the ethical issues and are not representative of all media coverage.

Provider impressions toward the technology in the case study

The benefits of the avatar further emerged from the interview with two providers working for a health care organization that used the pet-avatar to support its patients. Both providers shared their genuine enthusiasm for the ability of the pet-avatar to help users achieve salient tasks. “I love the product. I think that it’s the wave of the future and this is awesome,” said one. Their excitement stemmed from the breadth of tasks performed by the application that they observed. For example, the pet-avatar reminded users about appointments, helped them with financial calculations, and assisted them during phone calls to discuss payment of bills. They also praised the ability of the artificial companion to entertain and relax users. For example, the pet-avatar streamed church services and baseball games. The pet-avatar also answered inquiries and reassured with words and music, thus avoiding night calls to adult children. They also talked about the mixed reaction of one user who commented that the pet-avatar was “like a nagging wife.” However, when the user was offered the option to have the pet-avatar removed from him, he preferred to keep it because he found it helpful. They observed, “it’s like a regular human relationship.”

One provider explained that the avatar is typically introduced by social workers to users or proxies for those too impaired: “The avatar will ask you what your name is and what kind of music you like, and do a fun little demo ... And then at that point we would say, are you comfortable with this? Can we put this in your home?” She added, “We do briefly talk about that there’s a person there to talk to you at any time of day if you want. We don’t like hone in on that in particular if somebody’s anxious. We don’t want to say that this is watching you 24/7, that’ll make an anxious person more anxious.” She further explained, “To be honest, we don’t focus a lot about the technology piece of it, because most of our participants don’t really understand. So in that sense we kind of dumb down the technology piece of [to] just [saying] there’s somebody behind there that can contact [the organization] if you need anything.” She then reflected, “For a cognitively impaired person, does it matter to them that it’s a live person or a computer?”

On a related note, during a presentation of the avatar, the responsibilities of informing users emerged, especially after the developer noted that “Everything that [you] can possibly imagine that might happen if you were sitting in this person’s home 24/7, we’ve pretty much seen before.” Who is responsible for informing users that behind the eyes of the pet there is a camera revealing the images and sounds of the users and their surroundings to a rotating cast of strangers? This issue is critical because we may exhibit different behaviors in front of pets or computer screens, which are assumed to be “passive” attendants in our homes, as opposed to human observers. We may also handle confidential matters differently with pets or computer screens around us, compared with strangers.

When the first author asked about the responsibility to inform users, the developer explained that his firms’ responsibility was limited to ensuring that the avatar introduced itself by saying “I am an avatar powered by a team of professionals.” He also explained that users could infer that they were being monitored by the tablet’s fish lens and a sticker stating “This device is GPS tracking and audio video streaming for monitoring.” However, these messages do not explicitly inform users that behind the eyes of the pet are the eyes of technicians. To address this point raised by the first author, the developer explained, “It’s

slightly on purpose that the disclosure is slightly vague. We leave it a little bit up to the caregiver how they want to disclose it.” He concluded, “Clearly, it’s a grey area.”

Media representations of the technology in the case study

The grey area mentioned by the developer during his presentation originates from limited regulations on how to inform users about the mechanics of this application. An article from *Wired* dedicated to the pet-avatar [22] echoes this concern, as the journalist reflected, “the more disconcerting issue is how cognizant these seniors are of being watched over by strangers,” pointing to the limited information available to users. The existence of multiple stakeholders who could potentially be responsible for informing users—caregivers, healthcare providers, developers—further contributes to this grey area.

The *Wired* article describes one caregiver’s unease with introducing a German shepherd avatar to her cognitively impaired father without explaining to him the mechanics of the application to him. The article states, “Her initial instinct that the service could be the perfect companion for a former technologist had splintered into needling doubts. *Was she tricking him? Infantilizing him?*” Over time, the relationship between her father, a widower living alone in the countryside, and the avatar became extremely close, as the man shared more and more of his life with Pony, the name he chose for the avatar. One video available on the *Wired* website shows him stroking the screen over Pony’s paws and cheeks, with Pony chuckling back at him [22]. The journalist wrote that Pony often showed signs of affection, by saying, “You are my best friend” or “I love you.” The article also describes the positive reaction of the user upon hearing that he is loved. Looking at his daughter, he exclaims, “She does! She thinks I’m real good!”

ANALYSIS

This case study provides insights into the tension between ethical issues stemming from limited regulations and the benefits offered by technologies such as the pet-avatar to users and care providers. With regard to users, the pet-avatar has the ability to provide instrumental and emotional support to older adults with cognitive impairment. Instrumental support includes receiving reminders for appointments and medication as well as picking up the laundry, receiving help with calling telephone numbers, having someone talking with operators over the phone on behalf of the user, and receiving help with calculations. Emotional support includes the ability of talking with, and asking questions to someone at any time, hearing preferred music on command, and streaming meaningful events (e.g., church services, sport events, concerts). The pet-avatar also relieves formal and informal caregivers of the tasks above, which may lead to savings in long-term care expenses.

A purely utilitarian ethic might argue that so long as users feel cared for, that is all that matters, whereas biomedical ethics framework reaches a different conclusion by considering four key ethical principles [24]. We chose this framework because it uses multiple lenses to protect the rights of vulnerable individuals, in this case older adults with cognitive impairment. The first principle is *respect for persons*. Considered “the supreme principle of morality” [25] [p.151], this principle treats individuals as either presently autonomous moral agents “capable of deliberation about personal goals and of acting under the direction of

such deliberation” [26] or, in the case of people with cognitive impairment, dignified agents whose previously stated values need to be respected, and who need to be protected from being manipulated for other people’s purposes [27]. The second principle is *beneficence*, i.e., promoting the good of others [26]. The third principle is *non-maleficence*, i.e., not causing harm [26]. *Justice* is the fourth principle, i.e., treating persons according to “what is fair, due, or owned” [24]. This richer ethical framework reveals four ethical issues, detailed below, that outweigh the numerous benefits of the pet-avatar. It is critical to clarify that our analysis is tailored to a specific case of an artificial companion developed as a tablet (as opposed to robot) that requires human interaction (as opposed to AI intelligence solution). Thus, our analysis is limited in terms of its relevance to robots or entirely artificially-intelligent solutions.

Deception

People with cognitive impairment using the pet-avatar can be deceived in three ways. First, they never have been told, or have been told and forgotten, or not understood that human beings guide the avatar. The “grey area” of regulations about how to introduce artificial companions to users with cognitive impairment allows this deception. For example, the widower using Pony, even though he was a computer expert, was reportedly never told about the technician behind the screen because neither his daughter nor the developer had the legal obligation to inform him. Likewise, when inviting potential users to adopt the avatar, providers could “dumb down” its technological features. A second deception comes from programming the avatar to express feelings. The deception originates from the fact that the machines cannot have these feelings because they are not alive, and from directing these messages to individuals who may have limited discrimination in assessing reality. A deception specific to the avatar is that the “I love you” messages are manually typed by human beings who are unknown to the person with cognitive impairment. Even if technicians may feel genuine love towards their clients, their feelings are filtered through the avatar. Finally, users with cognitive impairment might believe that they are interacting with a pet. On that note, Sparrow [28] condemns the “sentimentality of a morally deplorable sort” of having users “mistaking at a conscious or unconscious level the robot for a real animal.” Related to this deception is the likely infantilization of users who are led to believe something false [28, 29]. On the other hand, how certain are we that users with cognitive impairment truly believe that they are interacting with a pet? In addition, given that attributing human form or personality to non-human items is common, as the example of Mickey Mouse illustrates [30], could it be possible that some users, those who still retain sufficient competence, choose to blur the real versus fake status of the “pet”? Where do we draw the line?

Monitoring and tracking

Because aging in place is a priority, older adults are increasingly willing to sacrifice some of their privacy in order to continue living in their homes [31]. In the case presented, however, the ethical issue arises specifically from the limited ability of users to understand when and how extensively they are being monitored because of their cognitive impairment *and* because of limited regulations in this area [17]. First, using technologies with limited regulations might expose persons with cognitive impairment to financial abuse, a threat common for this

population. In the case of the avatar, technicians could conceivably leverage their relationships with users to elicit private medical or financial or estate planning information over time. Second, users might feel uncomfortable knowing that they are being monitored by strangers. Third, because technicians and users usually reside in different countries, and sometimes continents, there is a potential for cultural insensitivity from the technicians' side. Finally, limited regulations allow only for the delivery of partial information to users. For example, users might be told that when they want a break from engaging with the avatar, they can put the pet to sleep. However, users might not realize that also when the pet sleeps, the application might still perform spot checks on them, thus monitoring them even if they indicate a desire to not interact with the avatar. More broadly, is it ethical to potentially violate the right to privacy of persons with cognitive impairment in order to provide them with artificial company? This is a critical question if we consider a generalized tendency of developers and institutions to underestimate the ethical implications of the technologies involved in surveillance [32, 33].

On the other hand, taking, once again, a broader stance, it is also important that we consider the potential benefits of monitoring and tracking performed by the pet-avatar. For example, technicians can monitor falls. They can also give warnings about negligent home care aides, as the providers explained in their interview. Furthermore, those users who retain sufficient understanding might find comfort in knowing that someone on the other side of the screen is watching them and is available to support them if needed. Users might also find it stimulating to know that someone on another continent is monitoring them. It is useful to weigh these considerations against concerns about the ethics of potentially violating a cognitively impaired person's right to privacy.

Informed consent

Given that monitoring potentially violates privacy, there is a strong obligation for whoever introduces monitoring technologies to users to obtain informed consent for those users who can provide it (those who are competent) and informed assent for those who lack competence [27]. Such consent is critical because it ensures respect for users as persons. However, these users often lack sufficient decision-making competence to understand and provide informed consent. Consent might be possible early in a neurodegenerative disease process, but as the disease progresses, at some point the person will no longer remember having given consent or the details of how the avatar functions. Under what conditions is it acceptable to perform this extensive monitoring on people who no longer have the cognitive capacity to know they are being monitored? How often do people need to be reminded? To start answering these questions, we can draw important lessons from research practice [16]. In research studies, institutional review boards guide researchers on appropriate methods to gain informed assent from persons with cognitive impairment and their surrogates. Owing to these guidelines, researchers regularly remind study participants with cognitive impairment that they are participating in specific studies. Researchers also involve surrogates or stop the study when the person with cognitive impairment is too impaired to understand that they are participating in a study (for example, see [34]). For research or clinical care, surrogate decision-makers are often asked to assess what they think their loved ones would have wanted in terms of research or clinical care, a practice called "substituted judgment" [35].

However, no ethical or regulatory guidelines exist for the introduction of artificial companions. A compelling research topic would be to examine to what degree the protocols used in research studies could be adapted for the ongoing voluntary assent of users of applications such as the pet-avatar.

Because of limited protocols as to who is responsible for obtaining informed consent, developers, unlike researchers, can draw on limited references. As a result, developers can shift the burden of obtaining informed consent to customers, whether healthcare providers or caregivers. It is then up to the providers or to the caregivers, both usually with limited expertise on gaining informed consent, to decide whether and how to inform cognitively impaired users about the implications of using artificial companions. As a result, providers and caregivers may make decisions related more to their own priorities (e.g., peace of mind from knowing that someone is watching over their family member, as the journalistic report of Pony suggests) rather than the values of persons with cognitive impairment. In particular, these limited regulations allow the introduction of artificial companions to persons who would never have accepted this intervention if they were cognitively healthy, which is a clear violation of respect for persons. Even though it may be impossible to know if a person with cognitive impairment would have accepted the intervention if he or she were cognitively healthy, it is critical to contemplate this question. It is also important to contemplate this question when considering that the preferences of a person may change because of the presence of the cognitive impairment, which is a question explored in depth for advance directives [36, 37]. Once again, where do we draw the line?

Social isolation

The last key ethical issue arising from the introduction of pet avatars to users with cognitive impairment is that interacting with the tablet might increase their social isolation, which is traditionally defined as having limited meaningful *human* interactions [38]. We initially define “human interactions” as those between two or more human beings not filtered by the pet-avatar. The ethical issue of social isolation is of concern because older adults with cognitive impairment living alone or in residential facilities, who are the target users of the pet-avatar, are at high risk of social isolation. The concern about avatars replacing human contact relies on the assumption that interacting with human beings is more meaningful, stimulating, and comforting than interacting with artificial companions. A counterargument is that artificial companions lack the negative features of human beings (e.g., arguing), therefore they might become better companions [39]. As “companions,” their job is to be agreeable. Such “comforts of virtual reality” [40] can be attractive to users who may already be distressed by their waning abilities, thus further increasing their isolation. However, Sherry Turkle, the author of “Alone Together” argues that these interactions with electronic devices “cheapen the notion of companionship to a baseline of ‘interacting with something.’ We reduce relationships and come to see this reduction as the norm” [41]. A counterargument to Turkle’s observation is that some users, once again as moral agents, may prefer the company of a pet-avatar rather than that of human beings. However, one serious ethical problem that persists, independently from users’ preferences, is that these avatar services make money by keeping people using them, and companies are incentivized to keep people emotionally hooked. This means that older adults and their families may be pressured

to spend more funds for longer than they can afford. On a related note, dropping the avatar for financial (or related) reasons can be devastating to the emotionally-hooked older adult.

Taking this discussion a step further, we can now expand the definition of “human interaction” as interaction between two or more human beings, including the technician guiding the pet-avatar. In this case, the ethical issue of social isolation is complicated by the fact that users interact with a pet through the tablet, which is guided by a human being. The technician is trained to send messages fostering a sense of intimacy. As a result, users might get attached to the tablet because of the positive meanings associated with it. However, these meanings have originated from interactions with strangers trained to induce simulated emotional connections. Taking a broader stance, we might also ask: What if some users, as autonomous moral agents, are uplifted by knowing that a paid stranger typed the messages uttered by the pet-avatar? Thinking about the potential benefits of this technology, what if users had the option to decide whether to display either the pet-avatar or the technician onscreen? Also, what if technicians were genuinely emotionally attuned to users? Taking this even further, what if technicians alternate between supporting the users in person *and* virtually? For some users who are particularly socially isolated, perhaps the interaction through the tablet could be a strategy to foster enough trust to be able to interact with the technician in person at a later point in time. Once again, further research into these core ethical, human concerns may enable innovations to make these technologies much more beneficial and respectful.

CONCLUSION

The pet-avatar case demonstrates the ethical concerns raised by the introduction into unregulated markets of ever more sophisticated technologies to users with cognitive impairment. Limited regulations are detrimental to consumers (e.g., health plans or caregivers), developers, and users. Developers invest considerable resources in products that may require major modifications once regulations are enforced, adding risk to their businesses. Consumers are typically left to decide for themselves how to introduce these technologies, with little directions from developers or regulatory bodies. Users with cognitive impairment likely do not fully understand the implications of interacting with artificial companions programmed to induce a sense of simulated connection.

Limited regulations thus constrain the potential of the sophisticated technologies behind artificial companions. This is a concern considering the ability of technologies to support older adults through reminders, directions, and connections to service providers or family members [4, 42, 43]. For example, participants in the Personal Reminder Information and Social Management study, all older adults living alone, became more socially engaged after using a computer equipped with software designed to increase their social interactions [44]. On a related note, wearable technologies and unobtrusive sensors have the potential to improve clinical trials in dementia research [45]. Voice-activated personal assistants such as Alexa might call for help when an older adult living alone falls [43]. The opportunities are endless.

To facilitate progress, any regulations concerning the pet-avatar and other similar technologies need to be steeped in rigorous ethical analysis. This is critical because right now, limited regulations are allowing the development of applications like the pet-avatar that deceive people with cognitive impairment and invade their privacy, notwithstanding their benefits. As Julie Robillard recently pointed out in this journal, it is important to properly compare and contrast the appealing and numerous benefits of technologies with their potential harms, but also to consider their potential ethical violations of basic rights to be treated with respect as a person [33].

To address the ethical concerns raised in this article, we call for redesigning technologies like the pet-avatar. In particular, we suggest that technologies aimed at supporting users with cognitive impairment comply with two frameworks among the many existing frameworks guiding the development of technologies for older adults: one is the “human-driven technology” platform [46] and the second is the emancipatory gerontology framework [47]. The use of these frameworks could empower users as well as serve caregivers and healthcare plans.

The human-driven technology platform was developed over the last decade as a reaction to improper uses of technology [46]. The priority of technologies informed by this platform is to enhance users’ abilities while carefully respecting their values [48]. In the case of users with cognitive impairment, drawing also from a rich ethical framework, these technologies should be informed by principles like respect for persons, beneficence, and non-maleficence. The emancipatory gerontology framework can help developers to better understand what are the best ways to enhance users’ abilities. In particular, this framework has been recently developed by Carroll Estes, a well-known sociologist of aging, to protect the rights of older adults and to “overcome social exclusion, discrimination, oppression, and inequalities” [47]. For Estes, “emancipatory delineates the potential and capacity to liberate from restraint. It is a form of extrication from the uncomfortable, the unacceptable, and the unjust” [47]. In the case of the pet-avatar, this emancipatory framework calls for the use of this extremely versatile technology to empower its users, rather than support caregivers or healthcare plans.

We argue that the combined use of a “human-driven technology” platform strongly informed by ethical principles and the emancipatory gerontology framework would address the four ethical issues emerging from this case. In particular, the first ethical issue of deception would be addressed by regulations enforcing clear explanations of technologies, with ingrained practices to ensure that users are reminded of the nature of the technology over time. For example, we suggest that innovative technologies to support older adults with cognitive impairment should look like robots rather than pets, to reduce users’ potential misinterpretations due to their impairment. Furthermore, we suggest that innovative technologies targeting older adults with cognitive impairment should not simulate feelings of affection, in order to avoid misinterpretations due to their impairment. Even though emotional alignment is a powerful tool to enhance the adoption, and the use of innovative technologies, the limited capacity of people with cognitive impairment to discriminate between genuine and simulated affection should be acknowledged in the design of those technologies [16]. And the potential to emotionally manipulate older adults into ongoing expensive services is a serious risk. The second ethical issue of monitoring and tracking

would be addressed by clearly explaining to users how, when, and by whom they are surveilled and how they can truly stop this function, by paying attention to the interactions between users and technologies [19]. To protect users from financial and other abuse, strict regulations should screen and monitor technicians over time. The third ethical issue of informed consent should be addressed by setting clear guidelines regarding how to elicit informed consent and who should be responsible to seek informed consent from users or proxies. These clear guidelines would also ensure that users receive reminders that they consented to use a technology and that they can stop using it at any time for any reason. In addition, proxies should give consent based only on a user's values. Finally, and perhaps most importantly, to address the fourth ethical issue and to avoid exacerbating users' social isolation, artificial companions should be designed to foster interactions with other human beings. For example, rather than promoting interactions between users and artificial companions, technologies should allow users to remotely interact with other human beings, to participate in birthday parties, or to watch football games or concerts. Furthermore, a human-driven technology truly driven by users' priorities is likely to support users in key tasks such as arranging transportation, dispensing medications, assisting with phone calls (including screening fraudulent calls), helping during emergencies, ordering in-home deliveries, and reminding them of appointments.

In closing, to further address the ethical concerns raised in this article, as researchers of aging [49–51], as well as developers and regulatory bodies [12, 20, 21, 52], have recently suggested, we call for, and look forward to engaging in new long-term collaborations among developers, researchers, users, providers, policymakers, and ethicists. These collaborations would help make sure that the technologies are developed to serve and protect the values of their users before they are introduced in the market. These collaborations would also narrow the cultural gap between the fast pace of the developers of technologies and the slower pace of regulations.

To conclude, as we enter into a new industrial revolution marked by technologies blending the physical and artificial domains [53], it is critical to better understand what steps we need to take to harness the power of these technologies to truly ease our lives without reducing our humanity.

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Table 1

Examples of artificial companions targeting people with cognitive Impairment

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- A pioneer of artificial companions is “**Paro**,” an artificial baby harp seal-like robot developed in the early 1990s with financial support from the Japanese government (<http://www.parorobots.com>). An artificially-intelligent solution, Paro comforts and entertain people with advanced cognitive impairment through cooing, moving its warm body while being caressed, and opening and closing its wide black eyes while detecting motion. In the United States Paro, which costs about \$5,000, was approved in 2009 as a Class II medical device, joining the rank of power wheelchairs.
 - A more dynamic artificial companion is the dog-like “**Aibo**” robot that fetches artificial bones (“aibones”), cuddles, waves its tail, plays, and recognizes familiar faces. An artificially-intelligent solution developed by Sony and introduced in the United States in 2019, Aibo can be purchased online at a price of \$3,000 (<https://us.aibo.com>).
 - Introduced in 2014, “**Zora**” is a 22-inch tall humanoid robot remotely guided by healthcare providers. A human-in-the-loop solution developed in Belgium, Zora can entertain residents of residential care environments by playing games, chatting, dancing, and leading exercise classes. Zora can be purchased online for \$5,000 (<https://www.robotlab.com/store/zora-robot-solution-for-healthcare>).
 - “**Tombot**” is a dog-like robot developed in the United States. An artificially-intelligent solution, Tombot can be purchased online for \$450, with shipment starting in 2020. Its “hyper-realistic” features, “life-like movements,” and ability to respond to touch are designed to foster emotional attachment with older adults with cognitive impairment. <https://www.tombot.com>
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Table 2

Key ethical issues related to the introduction of artificial companions in users with cognitive impairment (list created by the authors)

Deception	Users may be deceived into believing they have a personal relationship with the artificial companion.
Monitoring and tracking	Users may not understand or may forget that the artificial companion might monitor them.
Informed consent	Uniform guidelines are missing on how to gain informed consent and when and how a proxy should provide consent on behalf of someone with cognitive impairment.
Social isolation	Using artificial companions might reduce the opportunities for people with cognitive impairment to interact with human beings.

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Table 3

Key findings and sources of the “Clinical research&publications” section of the website of care.coach

Findings	Source (<i>access date January 4, 2020</i>)
<ul style="list-style-type: none"> A research team at Pace University in New York, NY, reported a decrease in loneliness and depression in hospitalized tablet users [54] 	<ul style="list-style-type: none"> Abstract, <i>Connected Health Conference</i>, 2018 Oral presentation, <i>American Delirium Society</i>, 2018 Presentation, <i>International Association of Gerontology and Geriatrics</i>, 2017 Case Study, <i>Leading Age</i>, 2019
<ul style="list-style-type: none"> Financial savings in avoidable emergency department visits and nurse home-visit were noted following the use of the pet-avatar [55] 	<ul style="list-style-type: none"> Poster Presentation, <i>National Pace Association Annual Conference</i>, 2017
<ul style="list-style-type: none"> A research team at Washington University in Seattle, WA, interviewed 8 users with mild cognitive impairment who appreciated reminders and had reservations about privacy [56] 	<ul style="list-style-type: none"> Conference Proceedings, <i>Symposium of the American Medical Informatics Association</i>, 2016 Poster Presentation, <i>Annual Meeting of the Gerontological Society of America</i>, 2016

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