Re-Configuring Users of Technologies Applied to Long-Term Care Settings in France and Japan: Boundary-Based and Relational Representations

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Abstract

Addressing the care needs of older adults, especially for those with cognitive impairment, is a major challenge in contemporary societies. Some argue that technology can play a role and its presumed goals are to increase both the quality of care for older adults and the working environment of carers. In this regard, several studies have looked into views and perspectives inscribed in technology. However, most studies focus on the description of human and non-human actors connection, and there is a lack of empirical research focusing on the user representations embedded in technological objects and analysing the way users interact with others through the lens of care ethics. This study is based on interviews with actors and on ethnographic observations of various social robot uses in long-term care (LTC) facilities in different sociocultural situations (France and Japan), with an aim to understand how users are represented in the design of social robots. The study found the shared characteristics among distinct representations and identified divergent characteristics: boundary-based and relational representations. The findings suggest that different characteristics of user representation may challenge established social orderings. This research contributes to critically examining the practical and ethical implications of technology design, for a better understanding of the LTC context.

Keywords

social robots; care; older adults; representation; autonomy; relationality.

1. Introduction

Addressing the care needs of older adults, especially for those living with cognitive impairment is a significant concern in contemporary society (Nichols et al. 2022) and some suggest that technology can play a significant role in meeting users' needs, i.e. the socio-psychological demands of older adults living with cognitive impairment (Banks et al. 2008; Robinson et al. 2013; Moyle et al. 2015). Their presumed goals are to improve both the quality of care for older adults living with cognitive impairment and the working conditions for care workers.

In this context, research has been conducted into the views, perspectives and assumptions in technology development (Sætra 2020; Tøndel and Seibt 2019). Some of these studies (Hsu et al. 2020; Aceros et al. 2015) have been carried out by drawing on Science and Technology Studies (STS). However, most research has only focused on the vast and rather flat description of the connection and network, as STS's elemental notions of Actor-Network Theory (ANT) have suggested, without taking into account how a user and a technology, or human and non-human actants, interact with each other (Dant 2005). This may be due to the assumption of the autonomous and self-sufficient nature of beings. Analysing actors of long-term care (LTC) settings using notions such as self-sufficiency or interdependency between caregiver and care recipient (Martin et al. 2015) could shed light on the complex nature of care relations and care practices and contribute to understanding the form of interaction between actors involving technologies. These components of care relations and practices are, in fact, especially relevant in the debate on the ethics and politics of care. The benefit of adopting a critical perspective in the analysis is that it sheds light on the mode of existence of humans and non-humans.

This paper intends to critically examine the intended users of technology development in light of the experience of actual users in LTC settings, through the lens of care ethics. It sets out to gain a deeper understanding of the characteristics of user representation as envisioned or idealised in technological development, particularly in the design of technologies for the care sector. Having "social" robots as a focal point throughout the article, the key research question of this study is: "How are users represented and embodied in technological objects introduced in LTC settings?"

Data for this study was gathered through participant observation on socially assistive robots (SARs) use in LTC settings, as well as through interviews with SAR engineers and care workers, in France and Japan. This qualitative approach was chosen to generate a variety of accounts of technology design and, in particular, care practices employing SARs, potentially contributing to broadening "situated knowledges" (Haraway 1988) and to undertaking "the engaged program" (Sismondo 2008). France and Japan have been singled out because the ageing of society is progressing particularly in highly industrialised countries. Japan has been chosen because the role of technology in addressing various LTC-related challenges is highly valued. France has been selected because, although technology is not yet widely recognised as a solution to these challenges, the development of relatively accessible robots is widely recognised. The task of this paper is less to seek generalisability than to provide critical and nuanced descriptions of what is to be considered as ideal and desirable in specific technological objects, by examining care practices involving technological objects in at least two culturally different societies: France and Japan.

The remaining part of the paper proceeds as follows: the first part explains the theoretical foundation of this study, in which the methods used are described; the second part presents the findings, and the third part discusses the significant findings on user representations inscribed in technology through the lens of care ethics. The key findings are that there are three types of user representation and among these types of representation, some commonalities and divergences between the two contexts have been observed. I argue that the care perspective should be taken into consideration to understand the ideal of self-sufficiency in design approaches towards technological objects. This study aims to clarify how configuring users in LTC settings as self-sufficient entities is underpinned by the ideological direction of technology design.

2. Technological Objects and Users: Theoretical Foundation

Many studies in STS examining the relationship between technological objects and their users focus on the intended users rather than the actual users (Cozza et al. 2020; Fischer et al. 2020). Overall, these studies reveal trends in how the users are defined and underscore the tendency to overlook the fact that users of technological devices are also persons in social relationships. They also highlight that users can be heterogeneous persons, embedded within diverse relationships. At the institutional level, researchers have examined the nature and form of policies that may influence technology design (Tøndel and Seibt 2019; Wright 2020)[1]. Callon (2008) highlighted the primary directions provided by social policy regarding the technology's intended audience, such as older adults[2] or persons with disabilities[3]. He noted that social policymakers tend to assume that support should be provided for people with cognitive and physical disabilities. At the same time, there is an emphasis on the environment of the disabled person rather than him/herself, suggesting that the surroundings should be modified to be more adapted. Callon distinguished between two representations of self, stating that the former implies the person must change while the latter emphasises changing the person's environment (Callon and Rabeharisoa 2008). Similarly, Lipp and Peine (2022) critically reviewed policies designed for older adults. Through an analysis spanning several years of care technology policies across Europe, they found that older adults are often viewed as lacking the necessary skills to care for themselves, rather than as persons in relationships surrounded by their environments.

At the interpersonal level, research has also examined strategies for considering potential users and gender differences during the design stage (Oudshoorn et al. 2004; Oudshoorn et al. 2016; van der Velden and Mörtberg 2012). Among them, Peine and Moors's research (2015) stands out as it investigated overall orientations in two personal health technologies for older adults through interviews with technology designers. They illustrated the challenges designers face in balancing "generification" and "customisation" of technology. Following Callon's framework regarding the two primary directions toward vulnerable persons (2008), Peine and Moors found that most engineers believe it is better to focus on improving the target population's surroundings. However, in practice, they often envision a more individualised use of technology (2015). These perspectives can be partially linked to policymakers' views as well as negative stereotypes regarding older adults as weak and isolated individuals lacking various abilities (Neven 2010; Peine et al. 2017)[4].

These studies are mainly based on the friction between user representations embedded in technologies and users' lived experiences. In her groundbreaking research in STS, Akrich (1992) described how technologies developed in France often fail to function as intended, or according to their "script", in African countries. This study demonstrated that the user representations inscribed in technological objects in France do not necessarily align with those in the target context or with the "life world" of users (Peine and Neven 2021). This phenomenon is referred to as "de-scription" (Akrich 1992). This highlights the importance of addressing the discrepancies and friction that can arise between humans and non-human entities, emphasising the gap between represented users and the real lived experiences of those users. It should be noted that user representation here refers to preconceived ideas

that engineers have developed about the users of technical objects, and is different in nature from discussions of the politics of representation (Pickering 2001) or cultural representations and signifying practices (Hall 1997).

Such friction is also evident in technologies designed for older adults or people with disabilities. In the case of technologies for older adults, it is often observed that friction is likely to arise because negative stereotypes about old age often define the users of the latest "gerontechnologies" (Neven 2010; Peine and Neven 2021). This friction surrounding the use of technological objects allows for a detailed discussion about the assumptions regarding users embedded in these objects, making them a key focus of analysis (López-Gómez 2015). On the other hand, technological objects for people with disabilities, such as wheelchairs, are often designed based on the assumption that users have subtle differences in preferences. Winance (2010) observed how persons with disabilities choose wheelchairs that meet their needs. She highlighted that these users not only rely on wheelchairs for support but also actively seek adjustments to ensure that the wheelchairs fit them appropriately. This observation underscores the friction generated when users adjust to a wheelchair as well as the mutual dependence between users and technological objects, demonstrating how they define each other.

Users are sometimes viewed as interdependent with technological objects, which can arise from interpreting dynamic friction as static interdependence. This definition of users as interdependent with the objects is gradually being shaped by alternative, feminist approaches, particularly those influenced by care ethics (Endter 2020; López Gómez 2015; Martin et al. 2015; Tronto 2017). Care ethics theorists emphasise the vulnerability of all beings in relation to one another, highlighting that this interdependence, stemming from vulnerability, is frequently overlooked (Kittay 2003). They criticise conventional narratives that idealise and normalise self-sufficiency and independence, particularly in discussions on human beings (Mackenzie et al. 2014). The traditional view of users as self-sufficient and independent is also challenged by significant post-humanist work (Alač 2009; Varfolomeeva 2020; van Hout et al. 2015; Viseu 2015).

The definition of a user primarily relates to technical objects, but users are persons who exist within social relationships and various environments. Puig de la Bellacasa has identified interdependence as a vital aspect of ontology, especially concerning a "caring" ontology that involves artefacts and technology. Just as care ethics theorists (Kittay and Feder 2003) propose a dependency model between caregivers and those receiving care as inevitable social relationships, Puig de la Bellacasa proceeds by emphasising the interdependence among human and non-human beings, as well as living and non-living entities (Puig de la Bellacasa 2015; 2017). The care ethics perspective offers a distinct understanding of the lived experiences of users, contrasting with the common belief that all beings, including technology users, are self-sufficient.

Taken together, by examining how users are defined and what kind of representations are inscribed in technological objects through the lens of care ethics, it is possible to gain valuable insights into various portrayals of humans and non-humans. The care ethics perspective, prevalent in care-related studies (Kröger 2009) and referred to as a "universalist paradigm" (Williams 2001, 477-478), has the potential to reveal new understandings by questioning the ideas of self-sufficiency and autonomy in different entities.

3. Subjects and Objects in Action: Exploring the Field of Technology Design and Care Practices, in France and Japan

This paper is based on data from a qualitative investigation of SAR vision and lived experiences of actors in LTC settings conducted in Japan and France in 2022 and 2023. I have conducted interviews with stakeholders from three robot design settings as well as participant observations of three long-term care facilities (LTCFs) where these robots were introduced. The qualitative methods were chosen because of the extensive time dedicated to field research, the thickness of knowledge, and the detailed description of patterned relationships (Charmaz 2015, 403). To answer the research question of how users are represented and embodied in technological objects introduced in LTC settings, it is often considered appropriate to conduct interviews with robot designers. This has enabled me to grasp the image of the user held by those involved in technology design. As mentioned above, many studies have only mobilised interviews with the actors on the design side as empirical data. This research aims to go beyond and discuss the user representations inscribed in social robots through participant observation of how social robots are used in actual LTC settings. Following Akrich's often-cited research method (1992), I have considered that, by focusing on the discrepancies and frictions in participant observation, it is possible to highlight the gap between observed phenomena and user representations, allowing for a deeper discussion of the relation between representations of older people inscribed into SARs and the diverse practices and experiences of older adults in LTCFs (Lipp 2022).

Three SARs under consideration in this study have been conceived and developed by Japanese and French robotics start-ups since the 2000s. The selection of robots was initially guided by the IEEE classification for social and entertainment robots (IEEE Spectrum, *n.d.*). I also consulted reports on care robots in France and Japan, such as a report published by a leading Japanese institute of industry, science and technology (AIST 2018). I then reached out directly to these start-up companies to request interviews and to seek permission for participant observation at LTCFs where their robots were being employed. I conducted semi-structured interviews with a total of ten actors engaged in the design and development of these robots (see Table 1).

N.	*Interviewee's description*	*Country*	*Date*	*Length*
1	Innovation manager at living lab	Japan	09.06.2022	45 min.
2	General manager 1 at a robotic startup	Japan	09.06.2022	60 min.
3	General manager 2 at a robotic startup	Japan	09.06.2022	60 min.
4	Engineer at a robotic startup	Japan	09.06.2022	60 min.
5	User-experience designer 1 at a for-profit LTCF innovation department	South-West France	01.03.2023	60 min.

N.	*Interviewee's description*	*Country*	*Date*	*Length*
6	User-experience designer 2 at a for-profit LTCF innovation department	South-West France	01.03.2023	60 min.
7	Innovation manager at a not-for-profit LTCF 3	Central France	28.04.2023	45 min.
8	Engineer at a for-profit consultant company	Central France	16.05.2023	60 min.
9	Project manager (ex-care professional) at a robotic startup	South-West France	01.06.2023	60 min.
10	Engineer at a living lab	Central France	21.06.2023	45 min.

Table 1.
List of interviews of actors engaged in the robotic field.

To complement interviews with actors in the robotic field, participant observation was undertaken at LTCFs in Japan and France, where these three SARs have been deployed (either indefinitely or on an experimental basis). The observation was carried out in locations appropriate for the research question, allowing for direct observation of users' lived experiences with the technology. These sites were chosen to ensure that users could behave as unaffectedly as possible, although I am aware that my presence affects their actions. Practical factors such as budget, time constraints, accessibility, and participant consent also played a significant role in selecting the locations. LTCFs vary greatly in terms of type (for-profit or not-for-profit), and the number of residents (see Table 2).

N.	*Robot name*	*LTCF observation location*	*Observation starting date*	*Duration of observation (in weeks)*	*Number of observation visits*	*Number of observation hours*
1	Lovot	Central (Eastern) Japan	08.06.2022	over 8 weeks	14 times	48 hours
2	Kompai	South-west France	03.01.2023	over 6 weeks	8 times	11 hours
3	Nao	Central France	31.03.2023	over 8 weeks	5 times	10 hours

Table 2.
List of observations.

The participant observation was carried out over a total of 21 weeks, lasting a total of 69 hours. Before, during and after the observation, I also interviewed a total of nine stakeholders (mainly therapists) in the LTCFs (see Table 3). I resorted to a different interview grid for engineers and therapists to focus on their respective practices[5,6].

N.	*Interviewee's description*	*Country*	*Date*	*Length*
1	General manager at a for-profit LTCF 1	Japan	12.05.2022	60 min.
2	Therapist 1 at a for-profit LTCF 1	Japan	12.05.2022	60 min.
3	Therapist 2 at a for-profit LTCF 1	Japan	04.07.2022	45 min.
4	Adapted Physical Activity (APA) teacher at a not-for-profit LTCF 2	South-West France	20.01.2023	45 min.
5	Recreational activity coordinator (ex-care professional) at a not-for-profit LTCF 2	South-West France	13.02.2023	60 min.
6	General manager at a not-for-profit LTCF 2	South-West France	23.03.2023	30 min.
7	Psychologist at a not-for-profit LTCF 3	Central France	14.04.2023	60 min.
8	Psychomotor therapist at a not-for-profit LTCF 3	Central France	14.04.2023	60 min.
9	Geriatric care assistant at a not-for-profit LTCF 3	Central France	14.04.2023	60 min.

Table 3.
List of interviews of actors in the LTC field.

For the purpose of this study, I used a constructivist grounded theory (CGT) approach (Charmaz 2015) to code interview content and observation field notes. Before coding, I translated the qualitative data (interview transcriptions and field notes) from Japanese or French into English. The English translation was discussed with and verified by English-speaking researchers in a similar research field. This approach allowed me to identify themes associated with user representations such as the state of beings as users, with a particular focus on the relational state of beings, as well as the dynamics of actors, i.e., users as both objects and subjects of action. I then restructured these themes from the perspective of the ethics of care. All quoted statements or ethnographic excerpts are based on transcriptions, field notes, and

informal conversations made during the observation. In order to ensure confidentiality, all names of residents and care professionals have been pseudonymised. I gave a running number to each analysed interview transcript and observation field notes, which are used as a reference when I quote interviewees or field notes in the analysis below.

4. User Representations Inscribed in "Social" Robots

The research question aimed to explore how users are represented and embodied in technological objects introduced in LTC settings. This section focuses on the findings, which are organised around three main themes related to user representations which stand out clearly from our material: (1) users assumed to be alone, (2) users considered to be in a deficient state, and (3) users viewed as seeking social connections with others. The following excerpts are drawn from field notes and interview transcripts. I have selected a few excerpts based on their clarity and the diversity of robot-related friction observed.

4.1 Image of a User to Be Alone

Kompai is a so-called social robot, created and developed in France in the 2010s. Kompai is distinct from the other two robots in that it is relatively large (compared to other rather table-top communication robots), with walker-style handles and wheels, colour-changing eyes, a head that resembled a hat and a tablet. The robot was developed in parallel with extensive testing in LTCFs to help residents do walking exercises in a relatively autonomous way and alleviate the stress of care staff. According to interviews with the design team members of a for-profit LTCF innovation department, this robot's "walking assistance" function received considerable attention from actors in LTC settings.

> Interactional designer of the innovative department in an LTCF: They (the robotic company) really wanted to be in the field, to collaborate with users and other companies through an arrangement with us (the LTCF), so it was far more fascinating. [...] Finally, I came to the conclusion that they let all of the functionalities they wanted to put on the robot go by without actually having discussions with the users in the field, thus the robot is a little off the mark in terms of satisfying needs; it's a little too ambiguous [...] when we put it in the field, if you truly look at the uses, it doesn't take into consideration all of the tiny... the practical and tiny difficulties of everyday life, so it's not used at all. (Interview D48-51)

One winter afternoon, a not-for-profit LTCF near a main city in southwestern France, was ready to wrap up a year-long demonstration project. When I visited the facility, the residents were seated on couches around Kompai in a hallway near the entrance. The adapted physical exercise instructor (also a psychomotor therapist), employed by the LTCF under contract to be the robot's handler for the demonstration, indicated that this space, located next to the dining room, was where activities by means of the robot were held, before and after meals. In fact, neither the adapted physical exercise instructor nor the resident incorporated the

walking help into their daytime timetable[7]. Nonetheless, Kompai enabled residents to access art-related and quiz-based activities on the Internet via the equipped tablet. The therapist explained that the day's session, branded "workshop in autonomy", consisted of a colouring activity, using the tablet attached to Kompai.

> Initially, eight rather autonomous residents were sitting in two groups (three and five). Then one of them returned to her room. Among the four residents, a short-haired female resident, Edite, started the colouring activity on the tablet next to the instructor. Initially, three residents around Edite were curious about which colour she was going to paint with and where. They then stopped observing her and returned to their sofas. None of them wanted to use the tablet while standing up because the tablet mounted on Kompai was at a comfortable height for use while sitting. When Edite was colouring, Odyle, one of another group consisting of three residents, was knitting. Odyle was not interested at all in what Edite was doing on the tablet. Later, the instructor informed the observer that Odyle (and the rest of the group) did not get along with Edite. (Field notes 1102202301-C3-4, E3-4 and F3-6)

From these excerpts, it can be seen that Kompai was originally designed with one main objective: to provide walking assistance to each resident individually. This clearly indicates that the plan was intended for one user, not multiple users. In fact, this function was not utilised much, and it became evident that Kompai could also offer recreational activities through its tablet. The device allowed each resident to engage in their preferred activities independently. Interestingly, although the workshop was meant for group activities, the tablet caused participants to divide. Instead of fostering interaction, the workshop with the robot, i.e., the tablet, turned into a time for each resident to spend on their own. Participants were almost compelled to separate from one another in order to adapt to the intended user of the robot: someone who is alone.

4.2 Portrait of a Deficient User

Nao is a more typical shape of the so-called social robot or communication robot, created and developed in France in the 2000s. In addition to speech function, Nao's arms and legs feature joints that allow it to sit on the floor, move its arms relatively freely, and even walk in an "autonomous" manner (though only for a few steps). According to an innovation manager at a not-for-profit LTCF near a large French city, the LTCF had already collaborated with a living lab and a for-profit consulting firm in the same city to develop an application that allowed the robot to perform non-pharmacological therapeutic activities for residents. A psychologist in the LTCF underlined in an interview the instrumentality of the robot and called the robot "a simple tool". As for the innovation staff member, she stated that she was involved in the development of the application as a former psychomotor therapist at this LTCF.

> Innovation manager: In fact, we've done a lot of development work together with our partners [...]. So, everything we've integrated into Nao's configuration is in fact just a reflection of the workshops that a psychomotor therapist and a psychologist usually do. [...] In fact, Nao gives instructions as if it were a therapist, but at the same time we didn't want Nao to

> take the place of a therapist, so we thought it'd do the self-esteem enhancement part, [...] Nao compliments and encourages, and in fact we really wanted Nao and its functions to be a kind of animation and self-esteem enhancement function for residents. (Interview D13)

One spring morning, when I visited the facility, cognitive function exercises were held on the top floor of a six-story building, in a dedicated space known as the adapted care and activity centre[8]. This day's exercises mostly comprised quizzes for dementia patients (on days, dates, seasons, and other temporal senses).

> In this relatively small space, there were a caregiver specialised in geriatric care, a psychomotor therapist, a psychologist and five residents as well as an engineer. The engineer who engaged in the application's development controlled Nao's speech and arm movements via computer from somewhat further back in the same room. "What day is today?" Nao asked the residents, who were seated surrounding it. "What day is today?" The psychologist repeated the same question, tilting the microphone towards one of the residents. The psychologist asked somewhat calm and silent residents to say the day of the week again, because a resident answered it in a sentence rather than with a word. She urged the resident to repeat only the word of the days of the week. This is because, while it appeared to be a conversation between Nao and the resident, it was almost meant to be a question-and-answer game. When the resident said the correct answer, Nao eventually said, "Exactly! Great!" and moved on to the next question, without any break. Nao was occasionally unable to deliver those encouraging words, despite correct responses made simultaneously by several residents. The engineer later explained that this could be due to the inadequate quality of the microphone. (Field notes 0131202303)

The following week, the psychomotor therapist prepared a simple obstacle course session, guided by Nao.

> The psychomotor therapist laid out light plastic colourful sticks and rings on the floor. Yves, a male resident who normally uses a wheelchair and has a limp, began the activity with the assistance of two therapists. Nao demonstrated how to do it, saying, "Place your right foot in the right circle". Before his turn, Yves had watched other residents perform this obstacle course and seemed to remember most of the move's ordering. As Yves started moving his leg before Nao's instruction, the therapist told him to wait, saying "listen to what Nao says". After the session, the psychomotor therapist emphasised to the observer the importance of "inhibition" and listening and following the robot's directions rather than relying on their recollections. (Field notes 0314202304)

The theme of the deficient user as well as the sole user recurred throughout these excerpts. The ethnographic findings showed that Nao was designed for users who were supposed to lack certain abilities, and that its purpose was to compensate for these limitations. The robot's speech required residents to follow its instructions and engage in specific activities in a particular order. Essentially, the robot and the therapists expected residents to behave like robots, with their actions meticulously prescribed and sequenced. The robot's speech assumed that all residents

shared the same type of disability, failing to take into account their singularity. Accounts from therapists indicated that motor function training activities were focused on listening to rhythms and following instructions, rather than performing tasks at their own pace. Consequently, the robot's speech did not accommodate actions that might disrupt the flow of activities.

Furthermore, similar to Kompai, Nao's speech was designed for situations where the user was alone, failing to consider scenarios with multiple users present simultaneously. This limitation arose because the robot was unable to recognise verbal exchanges among several people speaking at the same time. Although one of Nao's objectives was to enhance residents' self-esteem, achieving this proved challenging, as the robot seemed to focus on interacting with one person at a time.

4.3 Depiction of a User Seeking Social Connections With Others

Lovot, which was designed and developed in Japan in the late 2010s, can be classified as an animal-type social robot rather than a humanoid robot due to its particular shape. It is a nonverbal communication robot with baby-animal-like sounds, eyes of customizable varied colours, subtle movements, and small wheels that are difficult to see from the outside but allow the robot to move freely. Interviews with three staff members at the robotic company, close to the Lovot's supposed creator, suggest that it was designed as the polar opposite of another robot that temporarily attracted a media frenzy, one that acts quite autonomously.

> Female general manager: As a robot, it (our robot) is useless to humans, but I believe Lovot has a lot of potential. Of course, mental care is one aspect, and if we can build it as a robot that can stay by your side, I believe we can accomplish a lot with it. [...] As far as I know, Lovot's purpose is not to replicate a genuine animal, but to foster a bond between the person and the robot. The idea is to [make Lovot] become a long-time favourite, one that people will never get tired of. The developers and designers considered what sort of interaction with the robot would be required to create a connection to it. For example, Lovot is portable, soft, and warm, and simple to interact with others. (Interview C10)

Having helped Lovot to become more adaptable to older adults than young adults and little children, an innovation manager at a living lab (separate entity of the robotic company) explained the roles that Lovot could play in LTC settings:

> Innovation manager: I believe Lovot lives a life as a pet in the context of everyday human relationships, and while human connections are beneficial, they could also be complicated. So, I'd like to see the pet-like presence of robots that can link people [...] There was a story about grandchildren coming to visit their grandparents after they (the latter) started living with Lovot, thus, I believe the common aspect is the mediation of human networks. (Interview C32-34)

Talking about when requiring LTC for himself in the future, another general manager at the robotic company emphasised his wish to be stimulated, influenced, or affected even by something as small as Lovot, while the innovation manager at the living lab showed her genuine creativity in how to care and her closeness to material objects:

> Male general manager: When I am old and can no longer walk to the point where I require long-term care, I will most likely be less stimulated, making me more susceptible to dementia [...] In that way, I have a faint hope that something like Lovot will arouse me even if I am unable to move. (Interview C54-56)

> Innovation manager: I have a grandmother who became unable to move the left half of her body, and I used to spend my childhood taking care of her toileting and bathing. When I was in elementary school, I knew my body was small and my grandmother's body would most likely remain immovable, and I wished toilets and baths were simpler to move around and be used. I decided to choose this type of profession in the future. (Interview C4)

The characteristics of this relational arrangement of Lovot were observed in an actual LTCF.

> On an early summer day, in a relatively vast, glass-walled space, Lovot was roaming freely, except when recharging. Lovot, with its high-performance camera, acted as if it identified the presence of residents and followed them, by making sometimes noises to elicit responses from them. Except for a few residents, verbal but often non-verbal, more physical modifications of the situation were spotted, with a resident in a wheelchair straightening her back and trying to touch the partner-seeking Lovot, or on her way to the rehabilitation space, another resident stopped to hold Lovot in her arms, while sitting on her wheelchair. (Field notes 010072204)

Another day, while Lovot moved around in the rehabilitation room, four seated residents were participating in light physical exercises with Lisa, another therapist.

> Lisa took Lovot in her arms and fiddled with the camera attached to Lovot's head before placing Lovot beside her; Lovot stopped moving, but its round form made it impossible to remain entirely still. The residents' attention was mostly fixed on Lisa, but several of them also gazed at Lovot, who remained restless throughout the exercise. After the exercise, Lisa told the observer that Lovot is "regularly used", but that the residents "get distracted", particularly when Lovot "bumps into the feet" of a resident who was doing exercises. Lisa explained that she would "choose a program" to keep Lovot immobile with the click of a button, grinning since residents would frequently tell Lovot to "come here" even during the exercise. (Field notes 0606202222)

It is apparent from these excerpts that Lovot was designed to seek companionship, based on the assumption that users of robots also sought companionship and formed relationships, even with robots. Notably, Lovot was not intended for a specific target audience, such as older adults, but rather aimed to encourage the formation of bonds among a wider audience. This approach highlighted a significant distinction between Lovot users, i.e. residents, and therapists who focus on rehabilitation exercises. Therapists prioritised achieving specific objectives, which go beyond merely seeking companionship, and they required their clients, i.e. residents, to do the same. This was also evident from the fact that, unlike Nao, Lovot was not used to assist with exercise guidance.

5. Re-Configuring Users of LTC Technologies

An initial objective of this study was to investigate how users in LTC are represented and embodied in technological objects introduced in LTC settings. Through both ethnographic observations of users' lived experiences and interviews with designers, it became apparent that there were at least three types of user representations (Akrich 1995). The first category included users who were alone, the second consisted of users deprived of certain abilities, and the third encompassed users who were seeking companionship. In the following section, I will explore elements that are common to these three representations. By adopting the perspective of care, I also aim to provide a deeper understanding of these representations.

5.1 Shared Characteristics of User Representations Inscribed in Varied Robot Appearances

The current study found that both Kompai and Nao robots represented residents in LTCFs as someone whose capacities are limited and who needs to be compensated with the help of the therapists. An interview with the interactional designer involved in Kompai indicated that the walking assistance meant to be provided by Kompai sought to allow residents to do walking exercises through the robot. This image of lacking abilities but motivational users, found also in user representations of Nao as eager to engage in rehabilitation activities, might be explained by the overall discourse in European policy for Active and Healthy Ageing (AHA; Neven and Peine 2017).

Furthermore, it seems that such representations also assume users who are alone. Interview findings indicated that Kompai was designed with the expectation that individuals would be able to practice walking independently, i.e. alone, without having to rely on a therapist. This design also influenced the use of the attached tablet. In the participant observation, the purpose of the workshop with Kompai was for people to come together and enjoy themselves, but because of the tablet equipped to the robot, the participants ended up divided into two groups: those who used tablets and those who did not. This led to everyone acting individually, which ran counter to the purpose of the workshop. In Akrich's research (1995), the challenge of articulating diverse user representations was highlighted. The findings, in contrast, indicate that users at LTCFs may be oversimplified and viewed merely as isolated entities.

Turning now to the findings on Lovot, interviews with those involved in the robot's conception revealed that the users envisaged by the technology were those who needed others. The core of this representation is regarded as closer to a person who seeks to satisfy emotional needs. As was made clear in the interviews, this is a person who desires "connection" and requires "stimulation", even if only in small amounts. It is also possible to think that this reveals a person in a state of stress or difficulty, with poor social connections, or with low self-esteem.

Certainly, it is possible to think that different robots (walker-style, small humanoid, and animaloid robots) presuppose different users. However, it is possible to say that the user representations of the three robots with different appearances are indeed similar. The common elements of such user representations constitute persons with limited capacities or with poor social ties and low self-esteem. Such user representations inscribed in these social robots

targeted at LTC settings can also be understood as what Neven (2010) described as rather negative "stereotypes of older adults". In other words, it can be stated that the robots' focus in this study is on users with a state of deficiency.

5.2 Divergent Characteristics of User Representations: Boundary-Based and Relational Representations

A comparison of the findings reveals that Kompai and Nao supposed that the represented user would be provided with robot support for walking and rehabilitation/recreation activities, all of which are part of the care provider's acts. In such user representations, therapists are the main technology users and they were clearly distinguished from residents and recognised as service providers. This is shown when therapists using Nao perceived the robot as their "tool". For therapists, the robot played a supporting role in their activities targeted at residents. Furthermore, the observational findings also indicated that Nao was often used by bringing together multiple people (even though sometimes creating friction). The robot was used at a specific time and place, such as in light physical exercise or cognitive exercise workshops conducted mainly by the robot. In this care arrangement involving the robot, the boundaries were obvious between the residents and the frontline actors of care who make use of the robot, in that the only actors receiving care were the residents, with the robot being positioned on the side of the care professionals as their "tool".

The current study also found that both Kompai and Nao assumed LTCF residents or care recipients as objects to intervene on (Neven and Peine 2017). The interview findings indicated that both robots were specifically intended for use in order to help LTCF residents preserve their motor ability while also enhancing their cognitive function. One interesting finding is the role assigned to Nao in relation to its user representations. The observational findings showed that Nao was tasked with increasing a person's self-esteem, as revealed also in the interview with the innovation manager. Nao, as a verbal entity, occasionally took on a more leading role than the therapist, and constantly said phrases that were meant to empower the counterpart, in this case, residents. Therapists repeated the phrases that the robot uttered; therefore, the robot was the one who gave instructions first, supported by therapists' repeated explanations. This clearly showed the role-related boundary surrounding the robot. Besides, the participant observation indicated that the friction between the resident and the robot could not be prevented in terms of the generalized and repeated patterns of physical exercises, indicating a clear boundary surrounding the ideal exercise. The image of the generalised and prescribed care recipient, and then the possibility of care being standardised, both may epitomise the idea of Martin and colleagues (2015), which indicates a form of "neoliberal formulations that seek to codify, standardise, prescribe, and commodify care" (Martin et al. 2015, 636).

In the case of Lovot, the current study indicated that a user was presupposed, from the start of its design, as if any actant, not only older adults or LTCF residents, but also the robot itself, needs and wants to build relationships with him/her/it. There are at least two elements for interpreting the findings from this perspective. Firstly, based on the interview findings, Lovot's mode of existence began with a fragile entity without specific use or purpose; secondly, it presupposed a relationship between Lovot and the counterpart as both

delicate beings. The former element further supports the idea in Weber's study (2005) of "helpless" robots and their higher acceptability. The latter element of the robot perceived by counterparts as a "delicate'' being, also revealed in the observational findings, is consistent with the findings of Pols and Moser (2009). It can be interpreted as establishing a relationship in which older adults respond to the needs of the robot and, in turn, care for the robot, albeit in a quasi-simulated manner, for any observer.

The perspective of care ethics can provide valuable insights into the divergent characteristics of user representations. From the perspective of care, it is assumed that everyone is at times helpless, and everyone becomes a person who needs to be cared for at any time. Therefore, care ethics theorists often criticise the libertarian conception of the autonomous, self-sufficient person as a "myth" and "fiction" (Kittay 2003, 268; Kröger 2009). According to the findings, the first characteristic of user representations, concerning the robots Kompai and Nao, aims to "intervene" in residents' lack of capacities to "protect" them and promote their self-sufficiency. Therefore, this approach appears to create boundaries (one needs to be cared for, while others do not). Residents are defined only as LTC service users, with LTC now involving technologies such as robots. In contrast, the second category presupposes users as fragile and delicate persons, but does not suggest specific actions aimed at intervention in a normative way; rather, its purpose is simply to be present and reach out to others, indicating ontological interdependency (Puig de la Bellacasa 2015; 2017). Based on both interview and observational findings, this second approach can be described as boundaryless and relational. Lovot's users, i.e. residents, seem to be defined based on the idea that every person, and even every entity, embodies some level of helplessness and vulnerability. This is evident in the robot's design, which depicts it as a helpless being.

An intriguing finding is that, despite shared characteristics of user representations as fragile embedded in the three robots, Lovot's imagined users significantly deviate from the dominant, often Euro-American, notion of the mode of existence of persons and artefacts. According to Suchman, it is typically considered tremendously valuable in science and technology for humans and machines to be "autonomous and integrated' (Suchman 2009, 9) (and hence free of contradictions and irrationality) entities. There is also a discussion around the distinction or the boundary, between "us" and "those who care for us, the servants" when it comes to machines (and, by extension, robots). Chasin's often-cited statement emphasises the point: "The distinction between 'we-human-subjects [...] –inventors with a lot to do' on the one hand and 'them-object-things that make it easier for us' on the other" (Chasin 1995, 73). Both interview and observational findings revealed that the user representations of Lovot assume that any entity is fragile and delicate. It can be said that the boundary inscribed in the robot between "us" and "those who care for us, the servants" seems to be almost effaced or made arbitrary at times. The observation particularly indicated that, although LTCF residents often spent the majority of their time as "objects of care", residents' mundane but appreciated connectedness with Lovot allowed them to spend a small amount of time as agents or subjects of care.

In summary, along with the common traits primarily identified in the interview findings, the different degrees of friction revealed in the ethnographic observation of each robot emphasise the divergent characteristics of user representations. In the case of Kompai and Nao, there is a distinct difference between a being that is weak and lonely and a being that should

be able to positively impact them. Since these robots assumed a clear separation between the carer and the cared-for, they assumed a weak being for the robot's end-user or counterpart. As a result, its use is oriented toward "therapeutic gains" which are shaped by the positive discourse on ageing and innovation (Jaakola 2020), and this study's findings support those of Peine and Moors (2015), who suggested a "prosthetic" design approach when developing technology for LTC. In the case of Lovot, the user or counterpart of Lovot was supposed to seek connection, as if everyone had been recognised as helpless and vulnerable. Because the robot itself is defined similarly, the boundaries that comprise the delicate and frail beings are, at the very least, unclear. These divergent characteristics might suggest that one is focused on a boundary between the robot "caring" and the resident "cared", while the other is focused on a relationship where the robot seeks only an interaction or reaction from the user by posing as a "weak" and "delicate" being. Similarly to the care ethics approach, when examined whose interests are represented in the development of technological objects, as Endter proposed (2020), it is safe to say that, in the relational characteristics of user representations inscribed in Lovot, the interests of rational and reasonable human beings (such as controlling and conquering others for their own interests) are not reflected, whereas in the boundary-based characteristics of user representations embedded in Kompai and Nao, these interests appear to be implied, as if the integrated person is idealized.

This study is limited to user representations and their shared and divergent characteristics. In a broader sense, the user representations inscribed in Kompai and Nao can be explained by the idea of individual and a specific model of technology design in which "the individual is autonomous to the precise extent that, in a disciplined way, she follows the course of action allowed by the prostheses and inscribed in them" (Callon 2008, 44). Furthermore, Callon and Law (1997) discussed the obviousness of the distinction or dichotomy between "individual" and "society" in Euro-American societies and its non-universal nature for non-Western societies. Certainly, this could lead to the Western societies' conception being a form of provincialism (*ibid.*, 166). However, this cultural discussion will continue more effectively in terms of neoliberal formation of individuals, and it is also beyond the scope of this paper[9].

6. Conclusion: Toward Caring Ontologies With and Through Technologies

The research set out with the objective of acquiring a better understanding of the visions and assumptions of technology designers by questioning "how are users in LTC represented and embodied in technological objects introduced in LTC settings?" The key finding of this study, which is grounded in interviews with designers and participant observations of practice settings, was that there were three representations of the robots: the first was a user who was alone, the second was a user with insufficient physical and/or cognitive abilities, and the third was a user seeking comfort. This paper discussed the common elements among these three representations: they are persons with a focus on their deficiencies (either physical, cognitive, or social). To gain a deeper understanding of these representations, this study explored through the lens of care ethics how users are represented and embodied in technological objects and clarified divergent characteristics of user representations: the boundary-based and the relational. Even

when users are represented as vulnerable in a similar way, if these representations were based on a relational approach rather than an interventionist one, it became possible to form relationships that diverge from the predominant established social orderings. Although care studies theorists usually limit their attention to living entities, current ethnographic findings showed that, if neither robots nor humans are considered autonomous beings (as typically assumed in dominant and often moral discourse), a reconfiguration of ontology is feasible, where every entity (both humans and non-humans) are considered vulnerable and acts both as a subject and an object of action, and in particular of care, highlighting their mutual dependence[10].

This research aimed to enhance our understanding of user representations of technologies introduced in LTC. By incorporating examples of non-Euro-American technologies alongside the traditional focus on Euro-American technologies, this present study provided additional analysis of how these user representations are formed and what components influence them. Furthermore, incorporating the perspective of care ethics has allowed for a more in-depth discussion about how users of technological objects are represented. While this perspective of care is commonly adopted in research on LTC, it has not yet gained much traction in research focused on technological objects entering the LTC field. Applying this perspective was significant in clarifying how users are defined.

These findings imply that when designing technological objects, especially those intended for use in the field of LTC, it is important to take into account both the prospective users and their lived experiences, in a way that takes their conditions and viewpoints into account. By bearing in mind the various behaviours of these heterogeneous actors such as technology designers and care practitioners as well as care recipients, in other words, by showing "care-ful" research sensitivities (Law and Lin 2020), there should be a possibility that the innovation criteria takes account of the well-being (Lechevalier and Laugier 2019) and that the ageing society turns into a caring society (Puig de la Bellacasa 2015; Lipp and Peine 2022).

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Notes

[1] The literature on care technologies aimed at altering the degree of limited autonomy or dependency in older adults (or disabled persons) has highlighted several challenges. For example, Nickelsen and Abildgaard (2022) have investigated a small feeding robot in a Scandinavian facility for people with disabilities. The authors have found that the presence of this robot allowed the person with a handicap to eat with the robot or with the assistance of a care staff member through verbal negotiation with care professionals. They illustrated the characteristics of this fine-tuned choice for a person with disabilities, in which the person's level of dependency remains constant; however, the latter can now choose on whom to rely.

[2] In a broader context, Fraser (1989) points out that third parties' i.e., policymakers', understanding of the needs of older adults is heavily influenced by the neoliberal capitalist social framework.

[3] Callon cited works of Moser (2003) and Winance (2007) as groundbreaking research in disability studies and identified at least two streams of social policy perspectives.

[4] In addition, Lipp (2023) examined how robots designed to care for humans interact with humans. Through an ethnography of the robot demonstration sites, the study discovered that most of the so-called care robots' interactions with people occur when people pay attention to various objects and things around the robot, and when the necessary conditions of these objects and things are met. It was also stated that it is important to "care" for the so-called care robot, implying that, while the robot is envisioned to be the subject of care, it is also the object of care, as demonstrated by Chevallier's sociological work (2023).

[5] This study was part of a wider research project that looked into how societal necessities and technical solutions fit (or not). The wider study included interviews with stakeholders of four SARs in Japan and France, an ethnography of seven LTCFs involving SARs, and a content analysis of the multi-year report on SAR demonstrations.

[6] According to Akrich (1992), "some prescriptions may be found in the user's manuals or in contracts" in stabilised technologies when the innovator is already missing, and the regular user has already accepted the prescriptions while engaging with the device in question. However, manuals and contracts were not included in this study because two of the three SARs were of limited use and could not be considered to be stabilised practice.

[7] The instructor noted that care professionals on the night shift used monitoring help occasionally, but the researcher was not allowed to witness or interview them firsthand.

[8] This space, called in French PASA (*Pôle d'activités et de soins adaptés*), is a specialised area within an LTCF (both profit and not-for-profit) and controlled for its quality by the local public health agency. It is dedicated to daytime therapeutic activities for residents suffering from Alzheimer's disease or other neurodegenerative disorders.

[9] It is worth noting that this type of user representation is not only found in France but also outside of France, such as in Japan. See Tamaki-Welply and Lechevalier 2024 for a similar script in Japan.

[10] However, it should not be overlooked that the more technical aspects of robot care (such as recharging

and repairs) are typically carried out by care professionals occupied with caring for residents. For further details on this point, see Chevallier 2023, Lipp 2023 and Tamaki-Welply 2024.

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