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Design of Robotic Care: Ethical Implications of a Multi-Actor Perspective

Martina Čaić, Stefan Holmlid, Dominik Mahr, and Gaby Odekerken-Schröder

Abstract

The topic of ethically-sound robotic design is timely and societally relevant as service robots have roles with increasingly social demands in diverse service contexts. Robots fill caregiving roles for vulnerable consumers, including older adults and children. This chapter presents an empirical study investigating social and ethical ramifications of robotic elderly care from the perspective of those receiving and those providing care. Consequently, 36 actors (i.e., older adults, informal and formal caregivers) were interviewed through generative phenomenographic interviews. This approach leveraged data-rich narratives and informant-made visualizations of future networks of care to uncover their expectations and concerns. A multi-actor perspective on the ethical implications of robotic care is captured with three thematic maps built around: 1) assistance, 2) monitoring, and 3) companionship. The results indicate that social robots could improve the well-being of older adults and wider care-providing networks through service, constant presence, and increased reliability. However, the visualizations of future robotic care uncovered informants' additional latent fears, in addition to ethical concerns found (e.g., decline in agency, loss of privacy, delusion). For example, formal caregivers who emphasized that they do not fear robots replacing their jobs would not place the robot close to the older person in the visualization of future care constellations. This suggests that although formal caregivers tend to give "desirable" responses in interviews, they are still reluctant to accept robots as care co-providers.

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1. Robots in service contexts

Robots and other artificially intelligent (AI) agents are becoming ubiquitous in diverse service contexts. While decades ago, robots and automation were mainly employed in industrial settings (e.g., factories), nowadays, robots are introduced in various public (e.g. classrooms, museums, hotels, hospitals) and private (e.g. homes) service settings (e.g. Engwall et al. 2021; Tung and Au 2018). It is becoming increasingly common for humans to cross paths with service robots in a restaurant, in an office building on their way to work or at an elderly care facility (KPMG 2016). Robots are not only reserved for automating repetitive, dangerous, and tedious tasks performed in structured industrial environments, but are also interacting with humans in chaotic and highly unstructured customer-facing settings, in which they are expected to perform socially sensitive roles. This brings many challenges for the technology developers since state-of-art AI still lack the ability to handle chaos and context-ambiguity (Charisi et al. 2017). As robots become integrated in the service frontline, they disrupt institutionalized social structures and cause many economic, social, and ethical ramifications. Thus, robot engineers, designers and developers need to leverage socially- and ethically-sound design principles (Fjeld et al. 2020) to minimize negative unintended consequences of their created robotic artefacts.

Robots are embodied technologies capable of moving, sensing, information processing, and responding (Singer 2009). To serve the networks of actors, robots need to be endowed with social value propositions, comprising capability to engage in conversations, gesticulate, perceive, and respond to emotional cues, and other human-like traits (Breazeal 2002; Čaić et al. 2019b). The care robots need to adopt ethical norms of conduct (The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems 2017) and grow into rule-abiding agents to become well-integrated into the human society which thrives on social interactions.

The need to integrate ethical dimensions into the robotics developments was first introduced by the novelist Isaac Asimov, in his three laws of robotics emphasizing that robots 1) should not injure or harm humans in any way, 2) should obey orders by humans (except when they violate the 1st law), while 3) protecting their own existence (when not conflicting with the previous two laws) (Asimov 1942). Today, with the proliferation of AI technologies with a desirable value co-creation potential, the requirement of ethical conduct in robotics seems more relevant than ever before and serves as one of the key drivers of battling robotic hesitancy in actor networks.

However, many technology developers innovate relying solely on their vision of what the technology should look like, feel like, and be capable of doing. In that way, they impose their idea of the solution to users who might have different needs, fears and hopes, and ethical concerns regarding the future technology-enhanced services. In this chapter, we advocate for human-centered, generative research approaches which tap into both explicit and tacit knowledge of users in development and design of robotic care. By doing so, we fill in the gap in extant literature by offering a future user's perspective which helps in balancing technical, social, and ethical aspects of the design of robotic care.

2. Machine Morality and Ethics

The debate about robot's ability to make ethical decisions remains inconclusive. While humans act on moral prescriptions (right vs. wrong) which they learn through social and cultural immersion, robots demand algorithms to analyze various contextual situations and then apply matching ethical principles to guide their actions (Charisi et al. 2017). Utilitarianism (or consequentialism) and deontology (or duty-based ethics) are the most commonly discussed ethical theories (e.g., Charisi et al. 2017; Kuipers 2016; Veruggio and Operto 2008). While utilitarianism stresses that individual rights can be violated for the benefit of the overall societal welfare, deontology prioritises the individual rights relative to overall welfare concerns (Kuipers 2016). To implement these moral capacities, Wallach and Allen (2008) offer two different ways: A top-down approach uses a set of ethical norms, rules, and principles of a chosen ethical theory and defining a decision-making algorithm around it, while the bottom-up

draws on an AI based learning about the norms and morally acceptable behavior without a predefined ethical theory.

2.1 Robot Ethics

Rather than following developments in machine ethics, the field of "robot ethics" attempts to address potential ethical implications of current and prospective robotic developments (e.g., Lin et al. 2011; Veruggio and Operto 2008). When discussing the economic and social consequences, debated topics are consumer privacy concerns, consequences for user wellbeing, threats to employment, data security concerns or deepening the digital divide (e.g. Calo 2011, Wisskirchen et al. 2017). We argue that human-centricity is an essential principle to design robots aiming at coexistence and interaction with humans. Crucially, robots should respect basic human values and rights, not do harm to humans due to malfunction and be accountable for their activities (The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems 2017).

2.2. Robot Ethics in Elderly Care

Designing ethical sound robots is especially important in a service setting which involves vulnerable customers with a potential dependence on technology which can further erode their personal agency. The elderly care setting falls within this category and provokes brisk academic and public policy discussions (Sorell and Draper 2014; Sparrow 2016; Vandemeulebroucke et al. 2020). Especially the wellbeing of the elderly segment and their care-providing networks heavily relies on advancements in robotics and AI. However, there is disagreement about robots being a panacea for the challenges facing the elderly care. In anticipation of robots taking increasingly complex social roles, we cannot say with certainty whether their introduction leads to utopian or dystopian future service scenarios. Nevertheless, by employing human-centered and value-sensitive design (Friedman et al. 2013), engineers and service designers can signal their endeavors toward future robotic services that enhance the wellbeing of carers and the cared-fors.

Within the context of elderly care, robots differ depending on their social and assistive capabilities capabilities (e.g. Čaić et al. 2018; Fong, 2003). Socially assistive robots, which combine these two value co-creation capabilities embody companion and collaborator roles to build close relationships with users raise the most critical social and ethical challenges (Malle et al. 2017). Extant literature (e.g. Sharkey and Sharkey 2012) suggests several areas needing special ethical consideration i) assistance, ii) monitoring, and iii) companionship. First, the assistance domain is concerned with the variety of tasks that robots should take over. In other words, allowing for older adults' prolonged independence without jeopardizing their personal autonomy. Second, the robot's ability to monitor plays an invaluable role for safety and quick reaction in case of an emergency yet raises discussions about potential privacy violation and prevalence of virtual over real visits. Third, while the role of social companion offers a novel value proposition for elderly people and can positively affect their propensity to adopt robotic services, it also puts robots in a unique position to manipulate and deceive users through their "enhanced" human-like traits (e.g. perfect memory, negotiation and persuasion skills, no embarrassment or guilty conscious; Calo 2011; Sparrow 2016).

All the outlined ethical considerations demand a strategic approach to avoid a long-term decline in older adults' wellbeing through loss of human dignity and autonomy, detachment from the real world, increased dependency, and misplaced trust (Veruggio and Operto 2008). While academics and public strongly discuss on whether robots lead to human flourishing or deterioration and whether is ethical or unethical to introduce robots in elderly care networks, little is known on how older adults and their care-providers perceive disruptive effects and ethical ramifications of robotic care and roles of the care robots in their care networks (Sorell and Draper 2014).

3. Method

As a part of a larger study investigating future robot-enhanced elderly care service, we collected prospective users' expectations of both positive (value enhancing) and negative (value hindering) consequences of introducing robotic caregiving. We interviewed twenty older adults, seven formal caregivers, and nine informal caregivers using in-depth interviewing technique (Context Disruption Interviews; Čaić et al. 2019a) leveraging visualizations of future service scenarios generated by informants themselves (see Table 1). This approach allowed us to collect both "what they say" (narratives containing informants' expectations of the future robotized care) and "what they make" (visualizations utilizing specifically designed network actor cards) (Sanders 2000). Informants were prompted to imagine and elaborate on the future in which robots will assist the elderly in their daily activities (e.g. sending medication reminders, safeguarding, engaging in social interactions) and coordinate the entire caregiving network (e.g. updating caregivers on elderly person's medical status, alerting in case of an accident, mediating virtual visits). The objective was to learn about the hopes and fears concerning future robotic care from a multi-actor perspective.

Table 1. Context disruption interview protocol

Step	Name	Description
1	Contextual value network mapping: Current service	Mapping the care-based value network before the introduction of the service robot
2	Active immersion	Sensitizing to new technology usage
3	Introducing disruption	Introducing, assessing, and prioritizing social robot's functions
4	Contextual value network mapping: Future service	Mapping the care-based value network after the introduction of the service robot

Source: adapted from Čaić et al. 2019a

4. Analysis

To analyze the data, we engaged in a rigorous process of thematic analysis (Braun and Clarke 2006). First, we transcribed and reviewed the interviews and got familiarized with the data. We drew upon collected visualizations to get a richer understanding of the meaning of the collected narratives. Second, in a joint analysis session, we generated the initial coding scheme by identifying recurring patterns in the raw data. Third, we inspected for repeating ideas and similarities in coded insights in search of overarching themes. Finally, we reviewed the themes and established relationships between codes and themes by reviewing the existing literature. In this step, we matched the codes and themes with the three ethical considerations identified in the literature (i.e., assistance, monitoring, and companionship). Throughout the process, we identified 17 initial codes for the elderly segment of informants, 14 codes for the formal caregivers, and nine codes for the informal caregivers (see Figure 1). These initial codes were then clustered within seven themes (the elderly informants), five themes (formal caregivers) and four themes (informal caregivers). Finally, we comprised three thematic maps.

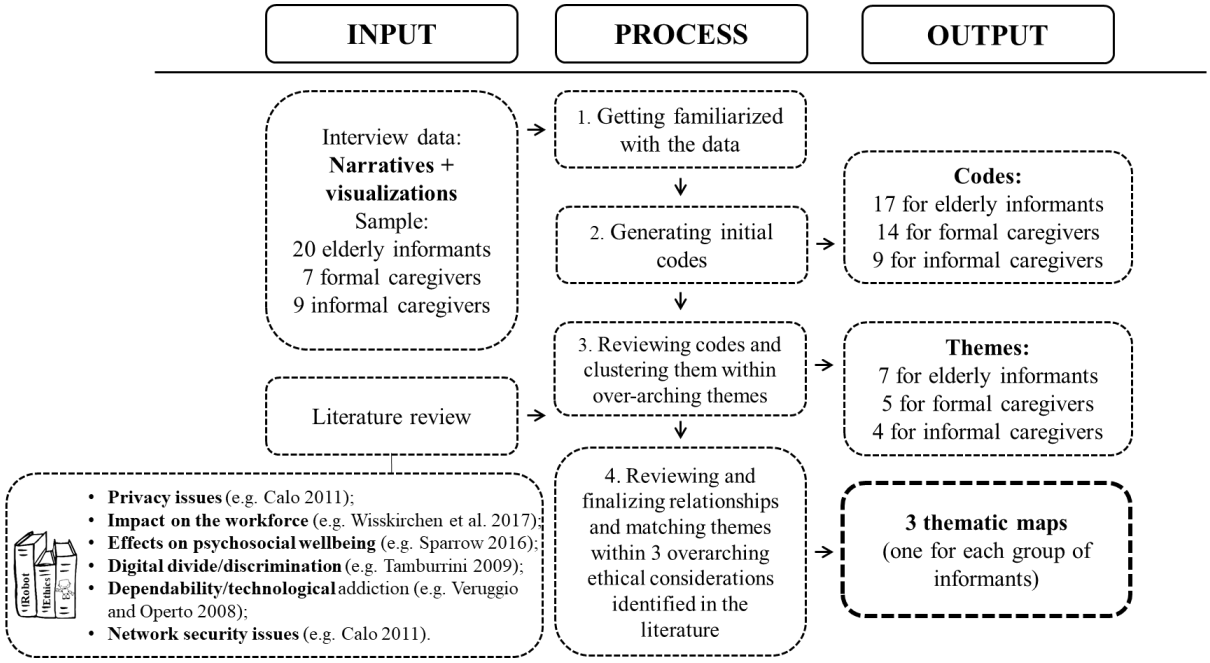

Figure 1. Thematic analysis approach

5. Results

A multi-actor perspective on the ethical ramifications of robotic elderly care is captured by the three thematic maps (see Figure 2, 3, and 4). Each of the three maps is organized according to three ethical considerations identified in the literature 1) assistance, 2) monitoring, and 3) companionship (e.g., Calo 2011; Sharkey and Sharkey 2012).

5.1 Narratives – elderly informants

Assistance The elderly informants recognize the robot's value-creating potential and welcome its assistance through offered reminders, advice, and a more general (cognitive) support. As explained by one of the informants: *"With time, maybe I will not be able to remember every time [to take his medication]. And that is why this function [medication reminder] is really important."* (E4) At the same time, older adults have some concerns that have certain ethical implications:

Decline in agency The informants from this critical stakeholder group fear that the robot might take too much control out of their hands and hence negatively affect their feeling of independence. The following quote emphasizes their desire to stay in charge: *"I am just telling you that for now I do not need it [the robot]. I want to do it myself [track her medication intake]...I know exactly when to take each pill. And how do I know it? I have that box that says «morning», «noon», etc... I want to keep practicing my brain."* (E5)

Uncertain safety The elderly people also fear that the robot might fail to provide proper assistance and jeopardize their safety, either because of the robot's technical problems or seniors' lack of technical skills: *"I have some fears! Whatever I touch, I break it somehow. (laughs) … Yes! The only thing I would like to avoid is that I need to set up the robot myself or anything like that … in order not to break it."* (E3)

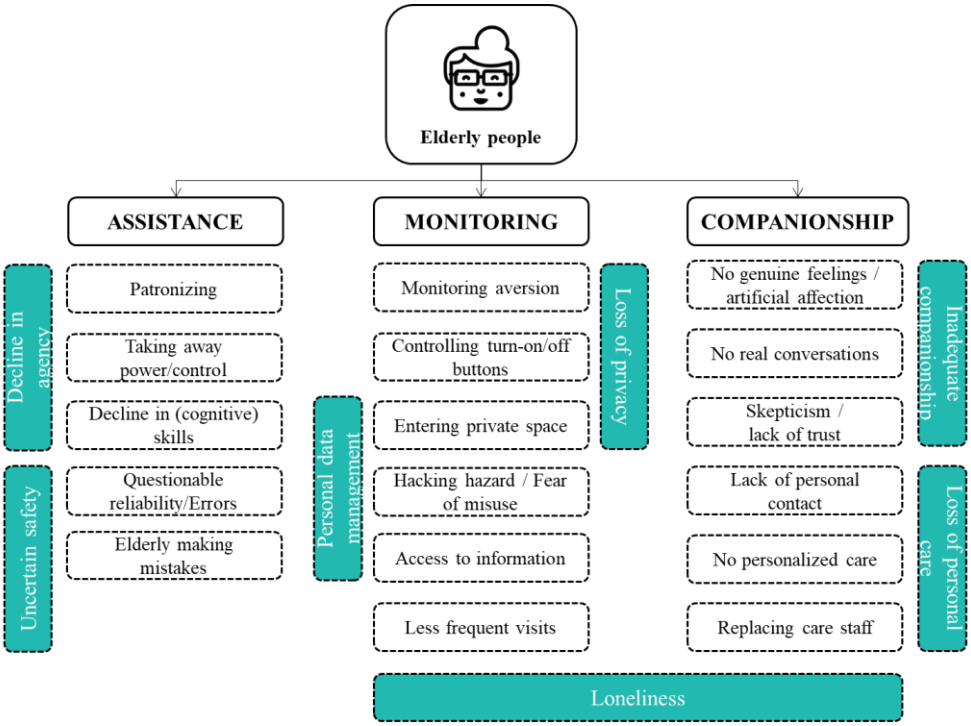

Figure 2. Thematic map 1 - elderly people's perspective
Note: ▭ represent ethical concern themes

Monitoring This segment of informants repeatedly emphasizes a trade-off between certain privacy violations in return for lifesaving alertness: *"If I fall down, I'm in a need of help. And privacy in the bathroom… Naked or not, I'm in need of help… Privacy could be life threatening in my case."* [E9] Despite their general openness toward monitoring due to its value creating potential, the elderly informants indicate three main areas of ethical concern:

Loss of privacy Interviewed elderly informants fear that by granting the robot access to their private spaces, it would record what they permit and what they wish to keep for themselves. For example, one informant explained: *"Well, I wouldn't feel comfortable [being monitored]. Maybe I would get accustomed with time, but it would be rather unusual at the beginning. No one likes to be monitored at all times. With TV and other devices it is easy, you turn them off when you don't want them… but for a robot to monitor you when it should and shouldn't. When you want and don't want…"* (E8) Another informant added: *"I don't want the robot around me all the time. I would turn its power off!"* (E10)

Personal data management Another ethical concern the elderly informants vocalize is a lack of control over and potential misuse of their personal data*: "As much as the robot would be helpful, in case of hacking it could become an enemy."* (E2) Collected narratives include information about different layers of access to the information stored in the robot. As explained by one of the informants: *"I wouldn't want everyone [in her care-based network] to access the information from the robot. I would need to choose carefully to whom to grant access."* (E6)

Loneliness The elderly welcome the possibility to connect with their family and friends via the robot's communication and information-sharing platform. However, they share a concern that virtual visits might exceed real visits and leave them deprived of social contact: *"They [her children] would still visit, but they would not be around for daily help."* (E3) *"I'm afraid it will take a lot of my contacts from me..."* (E10)

Companionship When assessing the robot as a companion, the elderly informants foresee how it could (in the future) alleviate their solitude. *"It [the robot] would be ideal for keeping me company. And it would listen to me. It wouldn't judge me. And it wouldn't have any agenda in it. And I wouldn't be alone."* (E6) However, the role of a social companion also raises the following ethical concerns:

Inadequate companionship The elderly informants do not believe that the robot's current skills can fulfil their need for socialization. They are sceptical about the robot's capability to develop genuine feelings and real conversations. As explained by one of the informants: *"It [the robot] does not interest me. It's not a living creature. It's like a dead person. No, not for me. I don't believe in that thing. For the short time I have left, give me real people who are alive."* (E15)

Loss of personal care Another concern with ethical implications is that the introduction of social robots might lead to less personal interactions with the professional caregivers and consequently decrease the personalized care they are currently receiving. *"People really know me; the robot doesn't know me. Understand me. Yes... the care staff over here knows me and knows what I want and need. They have emotions."* (E9)

Loneliness Finally, the elderly segment fears that as the robot takes the tasks from formal and informal caregivers, they will slowly be replaced, and the old people will be left alone with a metal box. *"Yes, I think it will affect my contact with all of them [other network members]…Because they are less needed."* (E16)

5.2 Narratives – Formal Caregiver

Assistance While the formal caregivers welcome different ways of cognitive assistance offered by the robot (e.g. medication and agenda reminders, nutritional advice), they worry about the robot's intrusiveness and the consequences of overconsuming robotic services. As explained by one of the informants: *"He [the elderly] likes to be notified about his activities. He would appreciate being notified to take his medication… But I can imagine he might feel a bit like a robot interfering too much…"* (FC2) The formal caregivers emphasize the following two ethical considerations needing special attention within the assistance category:

Decline in agency The formal caregivers fear not only that the robot would be annoying and intruding, but also that it would increase the technology dependence and in the long-term decrease elderly persons' wellbeing. As the following quote indicates: *"It's a shame the robot would take these things [autonomy, agency, control] out of their hands. There are things they [elderly people] can do themselves that stimulate them. I don't think the robot should take everything out of their hands."* (FC4)

Isolation / Deprivation of real social interactions While receiving AI assistance may decrease the need for support from other network actors and hence unburden carers of some of their responsibilities, it may lead to an isolated life for the elderly, which has shown to be a risk factor for developing dementia (Fratiglioni et al. 2000) or Alzheimer's disease (Wilson et al. 2007): *"As the robot is more reliable, he [the elderly] would not be in contact with his neighbour [currently the first contact person] so often."* (FC6)

Monitoring This segment of informants insists that the elderly need to preserve their right to control their personal data and, if desired, keep it private: *"I think this [monitoring] does not bother him [elderly patient], for as long as he has control over the information. If he knows that the information will only be shared when he wants and with whom he wants."* (FC6) While formal caregivers acknowledge that monitoring can enhance the wellbeing of multiple network actors (i.e. providing feeling of security, unburdening, reassuring), they suggest two areas rising ethical concerns:

Loss of privacy The formal caregivers emphasize that the robot needs to respect human dignity and not record and share what it is not authorized to. They accentuate privacy regulations as a top priority: *"How privacy would be handled, needs to be discussed thoroughly."* (FC4) They fear that some older

adults will need longer adjustment periods in which they might obstruct the robot's functioning by requesting frequent moments of privacy: *"There will be moments that she [the elderly] will put the power off. She's very keen on her privacy and she already told me before that she does not want the Robot in her bedroom or bathroom. She will use the robot, but only if she wants to."* (FC3)

Isolation / Deprivation of real social interactions Similarly, as for assistance (and companionship), the formal caregivers fear that too much reliance on technology (e.g. video communication via the robot) might lead to social deprivation and isolation: *"If she communicates through Skype, it could be that she does not leave her room anymore to visit her friends."* (FC3)

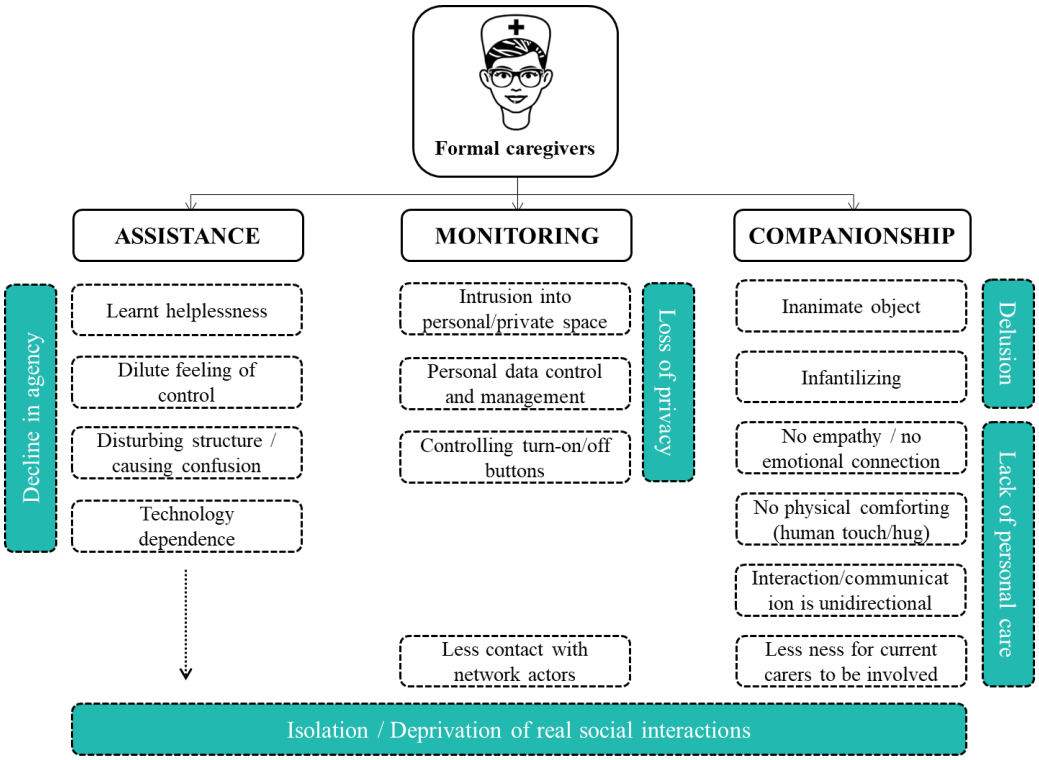

Figure 3. Thematic map 2 - formal caregiver's perspective
Note: ▭ represent ethical concern themes

Companionship In the media, there is a lot of discussion about robots replacing the professional caregivers. Our informants do not seem to share the same dystopian forecasts about the future robotized care: *"Well, there are also people that are afraid that it [the robot] would substitute what we do. But I don't think so. I see it as a complementary!"* (FC4) However, the formal caregivers do emphasize that there needs to be a balance between human and robotic care: *"If there is a high level of robotization, it becomes dehumanizing and there must be a limit."* (FC6) According to this stakeholder group, there are three alarming ethical ramifications:

Delusion While the majority believes that the elderly will not develop attachment with the robot, some indicate that the elderly might start confusing robots for something they are not*: "I know some elderly people forget that [that the robot is a machine] and they think the robot is their friend, their buddy."* (FC2)

Lack of personal care Most commonly emphasized is the belief that robots will not be able to replace human care and love because they cannot experience affection and empathy which are integral to care provision: "*The technology does not replace anything. As much as it helps, the robot will never hug or*

caress him [the elderly]. They [old people] give a lot of importance to the touch or hug, and I don't know how the robot will satisfy them in these emotional terms!" (FC7)

Isolation / Deprivation of real social interactions Another thing the formal caregivers fear is that this simulacrum of social companionship might have detrimental consequences for the elderly person's psychosocial health: *"I think she [the elderly] would prefer the robot to people in the future. And I think that's very dangerous for her... because she will isolate herself. So, for her, a robot is a very interesting thing, but also, in my opinion, a very dangerous thing for her."* (FC1)

5.3 Narratives– Informal Caregivers

Assistance The informal caregivers believe that we are still far from the 'robotic care' in a true sense. *"This is still not a complete, holistic solution for the elderly care. It is only additional help, like an advanced mobile phone with some additional useful functions."* (IC2) They suggest that the introduction of the robot-assisted services might lead to:

Decline in agency The informal caregivers share a worry that the robot will be met with some resistance, which can be explained as elderly people's way of fighting for their independence: "*Keeping in mind my father situation, I don't know if he will happily accept having a machine there to tell him things... he only does what he wants. I think it's going to bother him, because he's going to feel a bit controlled. I don't know if having a machine next to him would seem like a loss of independence to him."* (IC6)

Inadequate care A commonly emphasized ethical theme is 'personalization of care': *"...because they [elderly people] also differ...the ones that are 65 and 75 and 85."* (IC1) The informal caregivers foresee a decline in the quality of care due to the robot's inability to genuinely understand human needs. As explained by one of the informants: *"I think, for my mom, it's actually those moments of contact with people that are important. And especially with medication it's not possible [for robots to replace caregivers] since she is in a wheelchair. The robot can say 'you have to take your medication', but if she can't reach it…"* (IC5)

Monitoring This segment of informants mainly believes that their loved ones (e.g. their parents, family members or friends) will not be bothered by the robot's monitoring capabilities. As exemplified in these quotes: *"I think mom wouldn't have a problem with the robot being here [and monitoring]."* (IC5) and *"I think my dad would be glad that the robot can watch him."* (IC8) However, they do indicate how the introduction of monitoring can lead to certain ethical considerations:

Loss of privacy The informal caregivers acknowledge that it would take some time for the elderly to adapt to the feeling of being constantly watched: "*Maybe she [her mom] will have a feeling that we are controlling her even more. Will she get a feeling that now we can check her all the time, and that we will control her, I don't know… But after a short adaptation period, she would be fine."* (IC3) *"I don't know whether the access is pushed by the robot or fetched by the people? If the robot pushes the info, then it needs to decide what info is for whom. And I think it's a completely different thing if can access the robot in order to find out what she is doing, because then she [his mother-in-law] will become observed…but then I guess everybody has different authorities, because she would not want everyone to know everything."* (IC4)

Companionship There is a prevalent disbelief that the robot could replace the companionship of human caretakers. As suggested in the following quotes: *"It [the robot] could take a bit from each one of us. But not in a sense that she [his mom] would rather talk to Robi [a name he gave to the robot] than with her neighbour or friends. That not, for sure!"* (IC9) *"I still think that the robot cannot take over human interaction."* (IC3) Since the informants within this stakeholder group share the view that robots are incapable of developing genuine emotions and personalized care, they fear that this might lead to negative outcomes for the elderly, foremost:

Lack of personal care As emphasized in the following quote: *"You know, they already have so little face-to-face contact with the caretakers and I think that we need to preserve that little that they have now. And not all of those, robots, just walking around here. Nobody wants no people around…no because that's something… the warmth of people, the voice of people, the emotions of people, I think that's important especially for that generation."* (IC5) These concerns raise the commonly emphasized question of whether it is ethical or not to let the elderly engage in artificial socialization.

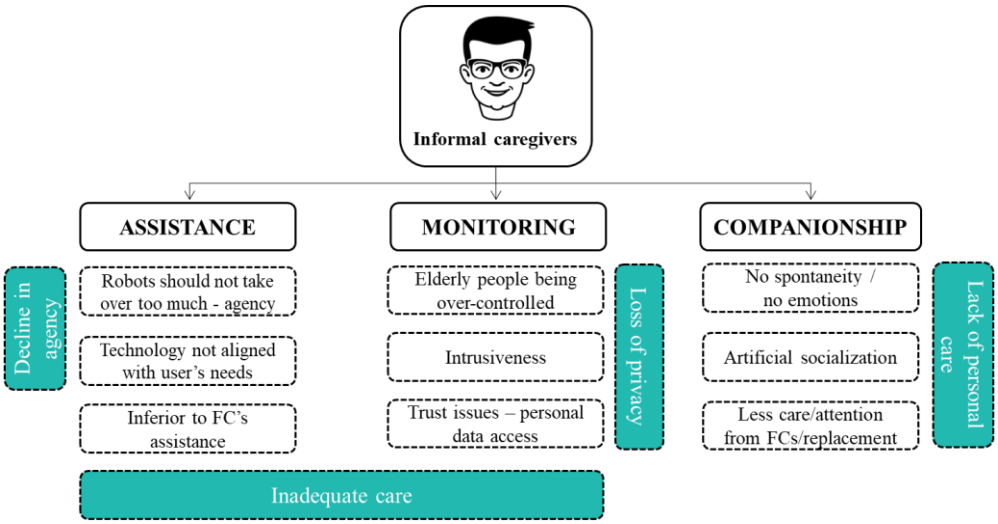

Figure 4. Thematic map 3 - informal caregiver's perspective
Note: [redacted] represent ethical concern themes

5.4 Visualizations

As a last step in a four-step "Context Disruption" interview protocol (Čaić et al. 2018, 2019a), informants were asked to map out the elderly care-based actor networks, as they anticipate them to take form after the introduction of the care robot. The mapping was done using a set of network actor cards specifically designed to depict the focal actor (i.e. elderly person) and various care-providing actors (i.e. formal and informal caregivers). Cards were chosen as a method because of their ability to spark discussions and their tangibility (Brandt 2006; Clatworthy 2011). In this section, we investigate the visual data in addition to the narratives already analyzed and focus on the position of the robot card relative to the elderly person card (i.e. the focal actor card).

The majority of the informants chose to place the robot card close to the elderly person, indicating the importance of assistance, monitoring, and companionship as capabilities of the robot and the necessary quick alerts pushed towards the caregivers in case of an emergency. However, our analysis shows that there were differences between the type of actors, with respect to the position of the robot card relative to the elderly person card (i.e. "prioritized position" right next to the elderly person card vs. "further away" from the elderly person, with formal or informal caregivers having a closeness priority). We found a relatively high number of formal caregivers placing the robot card further away from the elderly person (three out of seven formal caregivers of the interviewed sample; 43%). At the same time, only one out of nine informal caregivers decided to place the robot card further away the elderly person (11%). Finally, four out of 20 elderly people (20%) placed their formal and/or informal caregivers closer than the robot (see Figure 5).

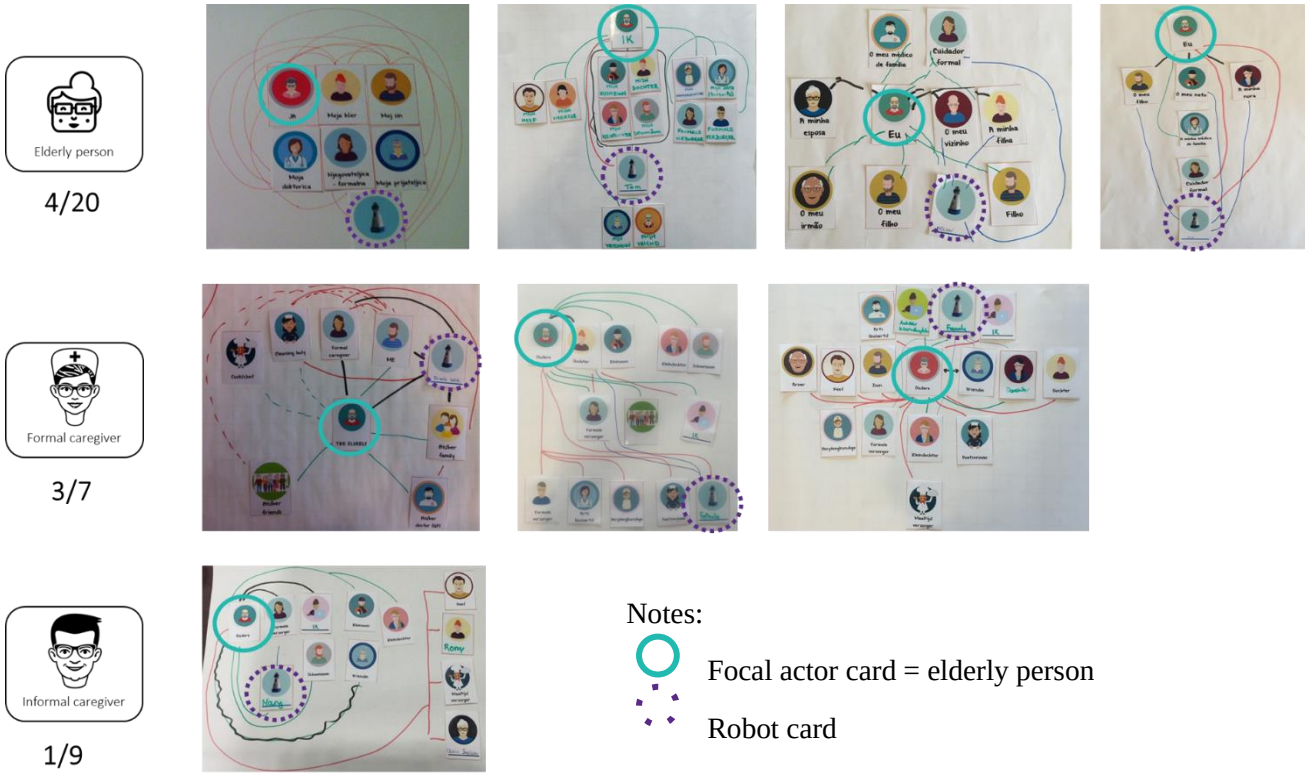

Figure 5. Visualizations of future care networks, showing how the robot is placed further away from the elderly person

In (service) design, mapping techniques, as the one used in this study, help designers collect and summarize (tacit) knowledge, together with users (Blomkvist and Segelström 2014). Visualizations of current and future care-providing networks help designers to develop value-sensitive insights, communicate insights with others, and maintain empathy with informants (Segelström 2013). By analysing the act of placing the robot card further away from or closer to the focal care-receiving actor together with accompanying narratives, we find that:

- The elderly who voice the greatest number of ethical concerns and are reluctant to accept robotic care are the ones who place the robot card further away from the card representing themselves.
- The formal caregivers who repeatedly emphasize that they do not fear the robots replacing their jobs are the ones who place the formal caregiver card closer to the elderly than the robot card.
- The informal caregivers recognize the unburdening potential of the care robot the most, hence also place the robot card very close to the elderly person card.

6. Discussion & Conclusion

Robotic technologies can be seen as a potential solution for ensuring the well-being of elderly people and their care-providing networks through improved service, constant presence, and reliability. Still, the introduction of robots within the elderly care setting provokes brisk academic and public policy discussions (e.g. Sorell and Draper 2014; Sparrow 2016; Vandemeulebroucke et al. 2020) moving from dystopian (e.g. fear of losing human touch, human obsolescence, privacy concerns) to utopian (e.g. panacea for social problems, unburdening of the overworked care staff, prolonged independent living) projections.

In this chapter, we show how by acknowledging multiple network actors as experts of their own experiences (Visser et al. 2005) and by leveraging their narratives and visually-created insights, yields an important input for the design of future robotic care. By combining the two types of collected data

and visualizing the findings in a matrix format (see Figure 6) – with the y-axis representing the amount of vocalized ethical concerns (few/many) and the x-axis indicating the position of the care robot in the user's network visualization (closer to/away from the focal actor) – we show the importance of collecting both "what informants say" and "what informants do":

- For informal caregivers, the findings are straight-forward. We can map them in the lower left quadrant of the matrix, indicating a low number of ethical concerns voiced by this group of informants and their inclination to place the care robot in the close vicinity of the elderly people (i.e., the focal network actor).
- The elderly (upper left quadrant) shared the greatest number of ethical concerns with regards to robotic care, however, by placing the care robot close to themselves in their network visualizations, they are indicating that the benefits of having the care robot might outweigh these, if handled in a good way.
- Finally, the most interesting is the group of formal caregivers (lower right quadrant) who did not share a lot of ethical concerns, and also, when asked if they fear being replaced by care robots they unanimously said "No". However, their act of placing the robot card further away from the elderly person does communicate either their reluctance to accept robots as co-care-providers or their superiority over the inanimate caregivers.

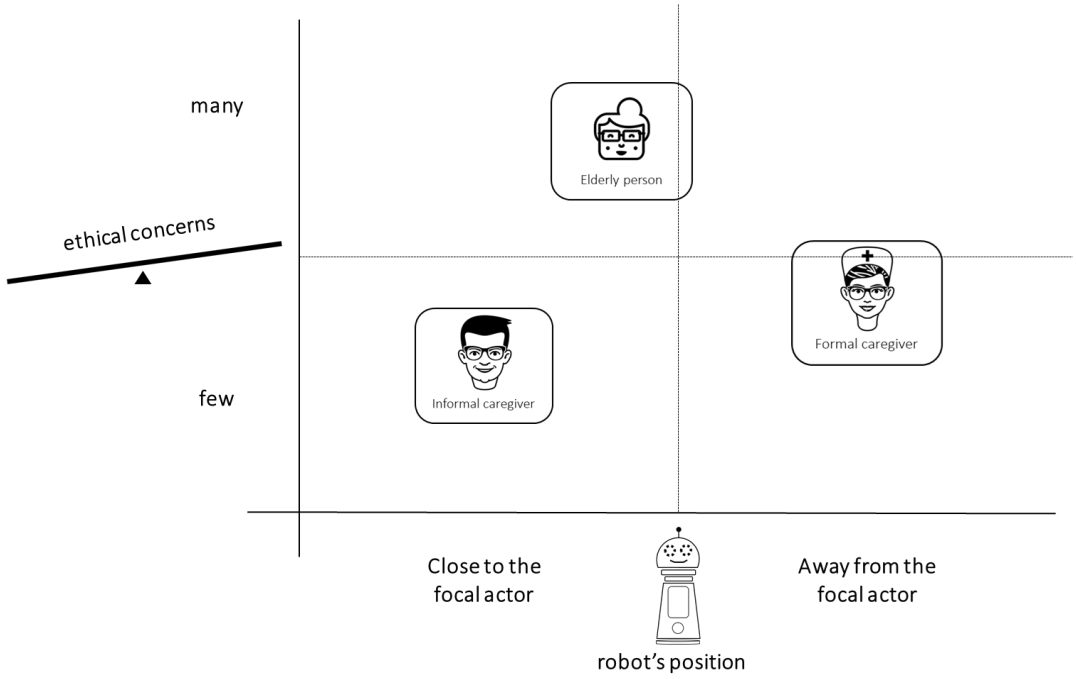

Figure 6. Mapping of vocalized ethical concerns against the "act of placing the robot card close to/away from the focal actor"

References

Asimov, I. (1950). *Runaround. I, Robot.* New York City: Doubleday.

Blomkvist, J., & Segelström, F. (2014). Benefits of external representations in service design: a distributed cognition perspective. *The Design Journal, 17*(3), 331-346.

Brandt, E. (2006). Designing exploratory design games: a framework for participation in participatory design? In *Proceedings of the Ninth Conference on Participatory Design: Expanding Boundaries in Design*, Vol. 1 (pp. 57-66). New York, ACM.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Breazeal, C. L. (2002). *Designing sociable robots*. Cambridge, MA: MIT press.

Čaić, M., Holmlid, S., Mahr, D., & Odekerken-Schröder, G. (2019a). Beneficiaries' view of actor networks: Service resonance for pluralistic actor networks. *International Journal of Design, 13*(3), 69-88.

Čaić, M., Mahr, D., & Oderkerken-Schröder, G. (2019b). Value of social robots in services: social cognition perspective. *Journal of Services Marketing, 33*(4), 463-478.

Čaić, M., Odekerken-Schröder, G., & Mahr, D. (2018). Service robots: value co-creation and co-destruction in elderly care networks. *Journal of Service Management, 29*(2), 178-205.

Calo, M. R. (2011). 12 Robots and Privacy. *Robot ethics: The ethical and social implications of robotics*, 187-201.

Charisi, V., Dennis, L., Lieck, M. F. R., Matthias, A., Sombetzki, M. S. J., Winfield, A. F., & Yampolskiy, R. (2017). Towards moral autonomous systems. arXiv preprint arXiv:1703.04741.

Clatworthy, S. (2011). Service innovation through touch-points: development of an innovation toolkit for the first stages of new service development. *International Journal of Design, 5*(2), 15-28.

Engwall, O., Lopes, J., & Åhlund, A. (2021). Robot interaction styles for conversation practice in second language learning. *International Journal of Social Robotics, 13*(2), 251-276.

Fjeld, J., Achten, N., Hilligoss, H., Nagy, A., & Srikumar, M. (2020). Principled artificial intelligence: Mapping consensus in ethical and rights-based approaches to principles for AI. Berkman Klein Center Research Publication, (2020-1).

Fong, T., Nourbakhsh, I., & Dautenhahn, K. (2003). A survey of socially interactive robots. *Robotics and autonomous systems, 42*(3-4), 143-166.

Fratiglioni, L., Wang, H. X., Ericsson, K., Maytan, M., & Winblad, B. (2000). Influence of social network on occurrence of dementia: a community-based longitudinal study. *The Lancet, 355*(9212), 1315-1319.

Friedman, B., Kahn, P. H., Borning, A., & Huldtgren, A. (2013). Value sensitive design and information systems. In *Early engagement and new technologies: Opening up the laboratory* (pp. 55-95). Springer, Dordrecht.

IEEE Standards Association. (2017). The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems. IEEE. org. [Online]. Accessed March 12, 2021, from: http://standards.ieee.org/develop/indconn/ec/autonomous_systems.html.

KPMG (2016). *Social robots: 2016's new breed of social robots is ready to enter your world*, KPMG Advisory N.V, Arnhem.

Kuipers, B. (2016, March). Toward morality and ethics for robots. In *Ethical and Moral Considerations in Non-Human Agents, AAAI Spring Symposium Series.*

Lin, P., Abney, K., & Bekey, G. (2011). Robot ethics: Mapping the issues for a mechanized world. *Artificial Intelligence, 175*(5-6), 942-949.

Malle, B. F., Scheutz, M., & Austerweil, J. L. (2017). Networks of social and moral norms in human and robot agents. In *A world with robots* (pp. 3-17). Springer, Cham.

Sanders, E. N. (2000). Generative tools for co-designing. In *Collaborative Design* (pp. 3-12). Springer, London.

Segelström, F. (2013). *Stakeholder engagement for service design: How service designers identify and communicate insights*. Doctoral dissertation, Linköping University Electronic Press

Sharkey, A., & Sharkey, N. (2012). Granny and the robots: ethical issues in robot care for the elderly. *Ethics and information technology, 14*(1), 27-40.

Singer, P. W. (2009). *Wired for war: The robotics revolution and conflict in the 21st century*. Penguin.

Sorell, T., & Draper, H. (2014). Robot carers, ethics, and older people. *Ethics and Information Technology, 16*(3), 183-195.

Sparrow, R. (2016). Robots in aged care: a dystopian future?. *AI & society, 31*(4), 445-454.

Sparrow, R., & Sparrow, L. (2006). In the hands of machines? The future of aged care. *Minds and Machines, 16*(2), 141-161.

Tamburrini, G. (2009). *Robot ethics: A view from the philosophy of science*. Ethics and Robotics, pp. 11-22.

Tung, V. W. S., & Au, N. (2018). Exploring customer experiences with robotics in hospitality. *International Journal of Contemporary Hospitality Management, 30*(7), 2680-2697.

Vandemeulebroucke, T., Dierckx de Casterlé, B., Welbergen, L., Massart, M., & Gastmans, C. (2020). The ethics of socially assistive robots in aged care. A focus group study with older adults in Flanders, Belgium. *The Journals of Gerontology: Series B, 75*(9), 1996-2007.

Veruggio, G., & Operto, F. (2008). Roboethics: Social and ethical implications of robotics. In *Springer handbook of robotics* (pp. 1499-1524). Springer, Berlin, Heidelberg.

Visser, F. S., Stappers, P. J., Van der Lugt, R., & Sanders, E. B. (2005). Contextmapping: experiences from practice. *CoDesign, 1*(2), 119-149.

Wallach, W., & Allen, C. (2008). *Moral machines: Teaching robots right from wrong*. New York, NY: Oxford University Press.

Wilson, R. S., Krueger, K. R., Arnold, S. E., Schneider, J. A., Kelly, J. F., Barnes, L. L., Tang, Y., & Bennett, D. A. (2007). Loneliness and risk of Alzheimer disease. *Archives of General Psychiatry, 64*(2), 234-240.

Wisskirchen, G., Biacabe, B. T., Bormann, U., Muntz, A., Niehaus, G., Soler, G. J., & von Brauchitsch, B. (2017). Artificial intelligence and robotics and their impact on the workplace. *IBA Global Employment Institute.*

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