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Beyond Speculative Robot Ethics: A Vision Assessment Study on the Future of the Robotic Caretaker

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In this article we develop a dialogue model for robot technology experts and designated users to discuss visions on the future of robotics in long-term care. Our vision assessment study aims for more distinguished and more informed visions on future robots. Surprisingly, our experiment also led to some promising co-designed robot concepts in which jointly articulated moral guidelines are embedded. With our model, we think to have designed an interesting response on a recent call for a less speculative ethics of technology by encouraging discussions about the quality of positive and negative visions on the future of robotics.

Keywords: healthcare, long-term care, methodology, robots, visions, vision assessment

INTRODUCTION

In the past, the cost of manufacturing robots and their limited capabilities have made them suitable mainly for factory work. Today, a new generation of robots is in development, in the United States and Japan in particular, facilitated by falling costs and by technological developments that enlarge their capabilities. These new "social" robots (as opposed to "industrial" robots) will occupy social domains outside of the factory: they will be used for cleaning, caring, entertainment, education, and surveillance; in the home, in hospitals, in restaurants, and in war zones. Expectations are mountain-high, with visions such as the "Ubiquitous Robot Society" and the "Neo Mechatronic Society" looming large. Bill Gates recently heralded the idea of homes with smart mobile devices by

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2025. The South Korean Ministry of Information and Communication expects every South Korean home to have a robot before 2020 (Ohnishi, 2006), and Japanese officials are looking to robots to solve the problems of an ageing society with fewer workers (Lau et al., 2009).

In the field of technology ethics and technology assessment, little attention has yet been paid to the rise of this second generation of "social" robots and the new social and ethical issues they raise (Butter et al., 2008). This omission is echoed by the limited public scepticism thus far concerning robot development, a few exceptions aside. Most recent newspaper articles on the latest robot types strike a tone of reverence and fascination. The study of social and ethical issues seems still in its infancy, though attention for the theme is increasing rapidly, as the publication of this special about robot ethics proves as well. The normative issues should be studied, because a lot of ethical and political questions are at stake, and robots might influence our lives in more ways than the positive expectations foretell.

In current contributions to robot ethics, we often observe a focus on ethical questions connected to the future of humanoid, super-intelligent robots, the ones that are like humans in their communicative and cognitive capabilities. Questions whether humans are replaceable by robots and whether robots should have rights seem to have priority over questions about current and more actual, un-humanlike applications when reflecting the ethical impact of future robotics. In a recent article, the ethicist Peter Singer for example concludes that "For the moment, a [more] realistic concern is not that robots will harm us, but that we will harm them" (Singer and Sagan, 2009). Singer, therefore, pleads for developing robot rights. In other attempts, we find this kind of focus as well (Decker, 1997; Decker, 2008; Levy, 2009; Bostrom, 2006; Van den Berg, 2010).

We think these examples can be classified as "speculative ethics," which rather addresses hypothetical visions than actual pressing issues that deserve attention as well, or even more. This term was lately coined with reference to the field of nanotechnology ethics by technology thinkers Alfred Nordmann and Arie Rip (Nordmann and Rip, 2009). We think the tendencies in robot ethics are surprisingly similar. Ethicists run the risk of being swayed by the speculative expectations and visions of promoters of technology, instead of enforcing reality checks on the fantastic horizons predicted. This poses the danger of neglecting present technology developments and their often less spectacular but more pressing "here and now" normative issues that deserve thorough attention by ethicists and social scientists. As a result, ethicists and social scientists risk overlooking actual social needs and specific ethical concerns of the intended users, instead of trying to help these articulate. Another danger of overlooking present developments is that "worries about the most futuristic visions cast a shadow on the ongoing work" in science and technology (Nordmann and Rip, 2009).

STRATEGIES FOR A NONSPECULATIVE ROBOT ETHICS

Nordmann and Rip recommend two strategies in particular to avoid the pitfalls of speculative ethics. First, they propose to meet the sky-high promises and concerns about new technologies with more scrutiny and with *reality checks*. Ethicists should consider "responsible representations" of the questioned technology and "distinctions need to be made that cut down to size the supposedly unlimited potential." Amongst other things, the technically feasible and the physically possible should be distinguished in the future visions on technology, as well as what would benefit the individual and what might benefit the whole of society. These reality checks should be done by encouraging discussions about the quality of positive and negative visions on the future of technology.

The second proposal is to give more attention to specific areas of research in technology ethics, in order to make better choices in the specific directions of research and development and prepare for a more "meaningful public debate" on social and ethical issues.

In this article we aim to contribute to a less speculative robot ethics in the spirit of these two recommended strategies. We build on the Rip/Nordmann proposal by developing a specific method to encourage a discussion on the quality of visions on the future of robotics: Vision Assessment (VA). VA is an upcoming method that is suitable to articulate visions on new technologies, to distinguish between visions, and to "steer them in a direction that is more desirable for society"[1] (Roelofsen et al., 2008). In line with the second proposal by Nordmann and Rip, we chose for a specific area within robotics in which we expect that near-by social needs and normative issues are abundant and better reflected choices can be made, i.e., robotics for healthcare in the Netherlands, in particular for long-term care, including elderly care. By carrying out this VA, we study normative visions of experts and stakeholders on the future of robotics and future needs in long-term and elderly care in the Netherlands and bring them into dialogue, in order to articulate better informed, less speculative visions.

A SPECIFIC AREA: ROBOTICS IN LONG-TERM CARE IN THE NETHERLANDS

In the Netherlands, strong impact is imputed to new technologies for long-term care and for the expected shortages of healthcare employees (SER, 2007). Especially, new robotics are expected to offer important contributions to this broadly assumed social need (Butter et al., 2008). The Dutch population is aging rapidly (CBS, 2009). Policy makers, health managers, and economists expect an increasing need for long-term care while the availability of employees decreases. Acute shortages are expected in the area of long-term care (Van

der Windt, Smeets, and Arnold, 2008). In the last few years, these developments have inspired a number of researchers to explore the applicability of robots in assisted-living environments, at home or in care institutions (Heerink et al., 2006). However, so far technology push has been a driving force behind the development of many social robots in health care (Hegel, 2007), while insufficient attention is paid to the actual needs and desires in long-term care (Butter et al., 2008). A robot can only find its place in human life if it meets the actual needs of the user (Hegel, 2007). Thus, one of the social and technical challenges seems to bridge the gap between the expert promises and the everyday context of its designated users. Promises on robots delivering a substantial contribution to the imminent shortage of caretakers seem only realizable when these promises are tuned with (future) user contexts and stakeholders.

VA: A DIALOGUE TO DEVELOP VISIONS ON FUTURE ROBOT APPLICATIONS

Being a method in its infancy, there are no golden rules on how to conduct VA yet. Therefore, we deliberatively build on current experience on VA in order to design the conditions for a discussion leading to better informed, more distinguished visions on the future of robotics in long-term and elderly care. We think these better informed visions can be achieved by way of a dialogue meeting several procedural requirements and not just by "encouraging a discussion" (Nordmann and Rip, 2009). In building on current experience, we investigate how VA can serve as an *optimal dialogue* for developing shared visions on the future of robots supporting caretakers.

Thus our main research question is the following one: *Does VA, if designed to serve as a dialogue on visions on the desired future for robots in long-term care, lead to more distinguished, new, and better informed visions on future robots amongst robot experts and future users?*

In the following sections, we study the hypothesis that with VA, existing visions will be exchanged and new ones will be constructed in such a way, that they will be less speculative and more useful to articulate specific and technically feasible robot applications for long term care. We assume that for this dialogue to be optimal, several procedural requirements should be met: The participants of the dialogue should be facilitated in interacting with each other, they need to be mutually open and understanding, they need to feel equal to each other, and trust and respect one another (Smaling, 2008). Mutual learning should not only take place on a first-order level (concerning solution assessments and problem definitions) but also on a second-order level (concerning world views, value systems, and preferred social order) (Grin and Grunwald, 2000).

These visions concern the desired future of robots supporting caretakers. We expect that there will be significant differences between the visions of robot experts and designated users at the start of the VA process. Designated users might be hesitant about robots in long-term care and at the same time they might show profound insights into the needs in long-term care. Robot experts might be more enthusiastic about the future of robots for long-term care but express more superficial ideas about the needs of designated users. During the VA process, the combination of the insights and visions of both groups is expected to lead to a mutual learning process and the explication of new visions on the desired future of robots supporting caretakers.

In case VA proves a useful method for the case of robots in long-term care, generating better informed, less speculative visions, we might broaden our findings and develop a broader design model for VAs for new technologies that need to be tuned to the needs of society.

VA

The need for an interactive approach to VA is repeatedly expressed (e.g., by Grunwald, 2007; Grin et al., 2000). So far only Roelofsen et al. (2008) accepted the challenge of bringing this theoretical idea into practice. In this section, we build on Roelofsen's approach to adapt it to the requirements of an "optimal dialogue." To what extent does Roelofsen's approach meet the requirements for such a dialogue?

Roelofsen proposes the following three-phased approach, preceded by an exploratory study (Personal Communication, July 17, 2009):

Phase 1 Expert meetings (preceded by interviews), during which technologists discuss desirable technological developments for the coming decades;

Phase 2 Focus groups, during which stakeholders that are considered relevant for the technological development reflect on the technologists' visions and discuss what they think is desirable in their context;

Phase 3 A dialogue between technologists and stakeholders, during which they search for (mis)matches between supply and demand. The (mis)matches are then prioritized, and the participants develop strategies to realize the desired future.

The objective of Roelofsen is to involve potential future users in agenda setting early in the technological development and to provide an orientation for future actions (Roelofsen et al., 2008). By doing so, long-term expectations and visions are confronted with knowledge, needs of, and wishes about the context of potential users. For our approach, we take Roelofsen as a starting point.

However, we think her approach needs some important changes. We propose four deviations.

Our first deviation from the approach of Roelofsen is cutting down the time-span of the VA from five years to seven months. Speeding up the VA process is necessary in the light of the innovation dynamics. When an innovation is emerging from technology push, it is crucial to map out societal needs and issues in an early stage, in order to guide the technology towards a future that is desirable for society. The sooner the societal needs are incorporated in the technological development, the better the innovation is expected to fit in its future context.

Secondly, Roelofsen assesses visions on the practical level of what is feasible and handy in the context, e.g., on the influence of the cost of ecogenomics, on the image of the agricultural sector and on the issue of sustainability (Roelofsen et al., 2008). As a consequence, her approach does not sufficiently take into account the fundamental nature of visions and their underlying assumptions. In our view, the articulation of normative aspects and of what is seen as desirable should be a central step in VA. Without pointed attention for these normative aspects, the VA does not meet the requirements of an open and equal dialogue as we stated before. In a dialogue, mutual learning should take place about first-order notions (solution assessments and problem definitions), like addressed in the approach of Roelofsen) as well as second-order notions (world views, value systems, and preferred social order) (Smaling, 2008; Grin and Grunwald, 2000). The second-order notions (and the second-order learning) seems underexposed in the approach of Roelofsen. In order to meet the requirements of a dialogue, we propose to adjust the aim of the dialogue phase (3). Whereas Roelofsen aims for finding practical strategies to lead to the desirable future, we propose the aim should be to jointly construct new visions based on these normative aspects. This has the additional advantage of significantly cutting down the time span needed for the dialogue, as defining strategies is a rather time-consuming activity (at a rough estimate more than a year).

Thirdly, in the approach of Roelofsen, the knowledge of the technologists seems to be more decisive than the knowledge of stakeholders. Even though Roelofsen states that the technologists and stakeholders are equal, which is a requirement for an optimal dialogue, Roelofsen describes the visions of the technologists as guiding visions and uses them as input for the focus groups with stakeholders. Instead of presenting guiding visions to the stakeholders, we think that they should just be provided with information on what the technology is about, so that they can more freely shape their visions. Subsequently, if the topic is complex, it can be decided to provide the stakeholders with the technologists' visions to deepen their understanding of the technological developments. However, the dialogue in Phase 3 seems to be more optimal

when stakeholders can construct their own visions in the focus group, without being guided by the technologists' visions.

The last deviation we propose concerns the themes for reflection in Phases 1 and 2. In the approach of Roelofsen, the technologists mainly have to reflect on their visions about the future of the technology, whereas the stakeholders have to reflect on both the technology and the context. In order to have an equal dialogue, we think both groups should reflect on both aspects. By doing so, they become aware of their knowledge gaps and come to value the knowledge and visions of the other group.

In order to meet the requirements of an optimal dialogue, we propose the following, adjusted approach to the three phases of a VA study:

Phase 1 Expert meetings (or interviews), during which technologists explicate their visions on the contextual needs and the desirable role of technology;

Phase 2 Focus groups, during which stakeholders explicate their visions on the contextual needs and the desirable role of technology;

Phase 3 Dialogues between the technologists and the stakeholders reflect on the (mis)matches between their visions and construct new visions.

We expect that conducting this adjusted VA will lead to new, better informed visions on the desired future of those robots that can guide the actions of the actors in the development of robots for long-time care in a direction that is more ethically desirable. The visions will be "new" as compared to the visions explicated in Phases 1 and 2. In phase 3, the technological knowledge of the robot experts will meet the contextual knowledge of the designated users. In an open and equal dialogue, their caricatured images of respectively the designated users' needs and robots are expected to be enriched and new space will be shaped for shared visions on what robots should bring long-term care. These visions are expected to be new as compared to the visions that are currently guiding the technological developments, as they are informed by both the technology and its designated context.

Visions on Robots in Long-Term Care

What visions do robot experts and designated users bring to the fore on the role of robots in long-term care in the first instance? What assumptions underlie those visions? Will the robot experts and designated users construct new and better informed visions on the desired future of robots in long-term care when engaging in an open and equal dialogue in accordance with our VA approach? These questions were to be answered in the VA study we carried out.

The VA Process for the Carebot Case

The adapted three-phased VA model was applied to the case of robots for long-term care. Table 1 provides an overview of the process.

In phase 1 we interviewed eight robot experts, six of them working for universities and two of them working on robots in an industrial context (one working for a mid-sized company and one for a multinational). They were asked to explicate their visions on the needs in long-term care and the role robots should play in it. Subsequently, we conducted four homogenous focus groups with 30 stakeholders in total, with the same topic as in Phase 1. We chose to focus on caretakers and patients, as they are the designated users who will experience the most crucial ethical consequences of the introduction of robots. Half of the focus groups (one patient group, one caretaker group) focused on homecare, the two other groups focused on institutional care, as in both settings robots are expected to play an important, but very different, role (Van der Plas, 2010).

In the third phase, two dialogue workshops took place. Again, one of those was focused on institutional care and one on homecare. For the dialogues in Phase 3, the robot experts and eight of the designated users were invited to exchange their existing visions and jointly construct new visions on the desired future of robots in long-term care. In order to secure an open and equal dialogue, and in accordance with the requirements to that we formulated in Section 1, all participants were addressed as experts of, respectively, the robot technology and the context of long-term care. Additionally, the moderator of the dialogue played an important role in creating an open and comfortable atmosphere in which all participants could express themselves. Lastly, the tasks

Table 1: Vision assessment (VA) process as conducted in this research project.

Vision assessment process		
Phase 1: Interviews with robot experts	Interviews with eight robot experts about their visions on the needs in long-term care and the role robots should play in it	
Phase 2: Focus groups with designated users (caretakers and patients)	Focus groups with designated users (four homogenous groups of 30 stakeholders in total) about their visions on the needs in long-term care and the role robots should play in it	
	Group 1: Caretakers homecare	Group 2: Caretakers in institutional care
	Group 3: Patients homecare	Group 3: Patients institutional care
Phase 3: Dialogue workshops with robot experts and designated users	Dialogue workshops with eight robot experts and eight designated users during which they exchanged their existing visions and jointly constructed new visions on the desired future of robots in long-term care	

that the participants had to carry out throughout the dialogue were variable in nature, so that all participants were in their comfort zones with at least some of the assignments. Van der Plas (2010) provides a more in-depth description of the empirical findings within this VA process.

PHASE 1: VISIONS EXPLICATED BY ROBOT EXPERTS

During the interviews in Phase 1, the robot experts were asked about their visions on the problems and needs in long-term care and the desired future of robots supporting caretakers.

Visions on the Context of Long-Term Care

On a general level, the robot experts showed to have visions on the needs in long-term care, such as the imminent shortage of caretakers, the stress of the caretakers, the ageing of the population, and the desire of the patients to be independent. However, they lacked a detailed view of the daily routines of the patients and caretakers. Two of the robot experts showed to be very aware of their knowledge deficiency and did not want to be seduced into speculating about what is needed in care:

> *"I can make up things, but that is what the technologist thinks of what is needed in care and that is not the best answer."*

> *"I am not a nurse, so I do not know what a nurse needs or desires."*

Visions on the Role Robots Should Play in Long-Term Care

Despite of the absence of profound images on the day-to-day life of caretakers and patients, the robot experts had clear visions of what robots should do in the context of long-term care and to a lesser extent of how the robots should look and behave. The robot experts often mentioned that robots could take over practical tasks of the caretakers, such as the monitoring of patients and tedious and repetitive tasks like cleaning and lifting patients. From a patient's perspective, the robot experts thought of robots that could increase the patients' mobility. Additionally, they envisioned a social role for robots: serving as companions or as mobile communication means between the patients and their family or caretakers.

Normative Assumptions Underlying the Visions

These visions originate from underlying assumptions that can be divided in *first-order notions* (solution assessments and problem definitions) and *second-order notions* (world views, value systems, and preferred social order)

(Roelofsen et al., 2008). A way to understand what assumptions are underlying to these visions is the use of metaphors (Mambrey and Tepper, 2000) that belong to second-order notions. These metaphors combine what is known and what is new, and they explain new aspects by comparing them to existing ones (Tepper, 1993). A selection of the metaphors that showed to underlie the visions of the robot experts is presented here:

1. *The Robot as a Slave.* Some robot experts referred to Asimov's robot laws (Asimov, 1950) that state that a robot must obey any orders given to it by human beings, except where such orders cause harm to human beings. Humans should always master a robot, as can be made up from the following statements in the interviews such as:

   "It has to do with autonomy; we want to be in charge."

   Another expert stated: *"Robots should not be too dominant (. . .), but should be subordinate to humans. What humans want should happen."*

2. *The Robot as a Fellow Human Being.* It is easiest for humans to interact with other human beings. Therefore, a robot should look, think, and act *human, or at least human-like. Or not? The interviewed e*xperts disagreed about this metaphor, which finds its roots in a long tradition of science fiction telling:

   "People are built to interact with other people. (. . .) We project human characteristics to everything, because we are used to recognize them. That is useful to use. You should put human aspects in a machine."

   "It should not look too humanoid. (. . .) When a robot is fully humanoid, you cannot distinguish between a robot and the real deal."

   Not only robots, but also caretakers and patients are subject to metaphors.

3. *The Caretaker as a Friend.* Caretaking is not just seen as a job by the interviewed experts, but it is considered to be a calling. Caretakers are seen as loving, caring, and emphatic personalities. Although the task list of a nurse seems to consist of all kinds of tedious jobs, the real essence of their job should always be the social aspect, according to caretakers. On expert expressed this by saying: *"Caretaking is mechanical as well as social. A nurse is not just her hands; she also has conversations with the patients."* Another expert emphasized that: *"An alpha [domestic help] cleans your house. But in practice, they are interacting with the patients. And in fact, the patients find that more important than the cleaning."*

4. *The Patient as King of His Castle.* The experts appeared to agree on the principle that a decrease in the patients' dependence on professional support is desirable. Patients should be empowered to make their own choices and live in their own house the way they want to as long as possible. Robots should help them to live independent of caretakers. Some quotes underlining this assumption are "*to be washed by someone else. You would prefer to do it yourself (. . .). Robotics can help to provide independence.*"

   "The longer people can live independent, the better."

PHASE 2: VISIONS EXPLICATED BY CARETAKERS AND PATIENTS

During homogenous focus groups with, respectively, caretakers and patients, participants expressed their visions on long-term care and the role robots should play in it.

Visions on the Context of Long-Term Care

Unsurprisingly, the designated users showed to have rich visions on long-term care and came with very detailed examples of what the caretakers and patients need. For example, a home caretaker stated that: "*Dehydration is a serious issue. We cannot spend enough time with the patients to ensure they drink enough. When I visit a patient in the evening, her cup of morning tea is still untouched.*" Currently there are no technical solutions for this problem.

Visions on the Role Robots Should Play in Long-Term Care

When confronted with the ideas of robots supporting caretakers, especially the caretakers responded somewhat reluctantly, as this quote illustrates:

"A robot for observing signals is ok, but that's all I want it to do."

The designated users expressed their fear for robots taking over jobs and replacing human–human interaction. Some of them, mainly in the patient groups, were rather open towards the idea of robots. Especially robots for physically demanding jobs such as lifting patients and cleaning were warmly welcomed by some of the participants.

The focus groups originally served as a zero measurement of the visions of the designated users. However, different from what was expected, their visions showed to shift already during the focus groups. In the course of the focus group, the idea of robots in long-term care seemed to become more desirable for almost all participants. Towards the end of the focus group, the caretaker that first only wanted the robot to observe signals was fully alive to the idea of

robots supporting caretakers. She was even in favor of a multifunctional robot nurse that most of the designated users found repulsive:

> *"In order for people to remain independent, I think you should warmly welcome robots in any form (. . .). A robot nurse, I would like one."*

Normative Assumptions Underlying the Visions

The assumptions underlying their visions on robots, however, remained the same. Some of them were similar to that of the robot experts, e.g., the "robot as a slave," the "caretaker as a friend," and the "patient as king of his castle" metaphors. A new metaphor brought forward by the caretakers was the robot as a rival colleague.

5. *The Robot as a Rival Colleague.* Rather than other devices (e.g., an alternating mattress that prevents bedsore or a patient lift) that are perceived as tools, the caretakers seem to think of the robot as a colleague. On one hand, this means that it is treated as a living creature that should behave nicely and friendly, but also that it is seen as a competitor by the caretakers because they think that a robot can take over their job. Quotes:

   > *"My greatest fear is a robot that only has ratio and no empathy."*
   > *"Robots might take over the work of caretakers."*

The "caretaker as a friend" and "the robot as a rival colleague" metaphors seem to apply most strongly for caretakers. For the patients, the "king of the castle" metaphor seems to guide their visions. Therefore, the patients seem more open towards robots, as these might make them independent of the caretakers. Consequently, most patients are in favor of robots that help them with intimate tasks such as washing, whereas caretakers think of washing as a moment of true interpersonal contact. These differences in underlying assumptions show that there is not only a gap between robot experts and designated users, but also within the group of designated users. The robot experts thus face the challenge of developing robots that make the patients as independent as possible, while at the same time avoiding to devaluate the social aspects of care.

PHASE 3: DIALOGUING ABOUT THE DESIRED FUTURE OF ROBOTS

In the dialogue workshop, robot experts and designated users were invited to exchange their technological and contextual knowledge and their visions on robots in long-term care and jointly construct new visions. In the first half of the dialogue workshop, the participants exchanged their visions and underlying assumptions and responded to each other's visions. As we have seen in Phases 1 and 2, the robot experts and designated users used largely

similar metaphors, i.e., the caretaker as a friend, the patient as king of his castle, and the robot as a slave. These metaphors again were mentioned in the dialogue confronting the participants with the overlap in their visions and assumptions. Mismatches appeared on a more practical level, when concrete applications were discussed. Similar to their notions in Phase 1, some robot experts stated that robots should serve as companions and communication means that will decrease the patients' loneliness. In contrast, patients and caretakers expressed their fear that the opposite will happen. Some of the caretakers even explicitly stated that robots should never do social tasks.

In the second half of the workshop, the groups split up in four teams of robot experts, patients and caretakers. The teams were invited to design new robot applications. Whereas two groups only slightly adjusted robots that are already under development (robots for lifting patients) or that already exist in other contexts (cleaning robots) to the context of, respectively, institutional care and homecare, the two other groups actually designed new robot applications.

One group, consisting of two robot experts and a homecare receiver, designed a *shoe robot*. They developed the robot from the patient's perspective, while trying to find technological solutions for the most urgent needs in her daily life. Putting on shoes seems a simple task, but because the patient's hands were not strong enough, she had to call for a home caretaker to help her a couple of times a day. A shoe robot would make her, and other patients in her situation, more independent of caretakers and would thus suit "the patient as king of his castle" metaphor.

Another group, consisting of two robot experts and two caretakers, found that pushing beds with patients through the halls is stressful and tough for hospital nurses, because steering the beds is difficult. Therefore, they designed a *robotic bed* that can be steered by the caretaker. He does not have to push or pull, only to steer. This again is a very practical solution, as now only one nurse is needed for moving the beds instead of two. Additionally, the caretaker can focus on interacting with the patient rather than on the task of pushing the bed, which makes this solution fit with the "caretaker as a friend" metaphor. As the nurse remains in charge of the movements of the bed robot, the "robot as a slave" metaphor applies as well.

DISCUSSION AND CONCLUSION

When new technologies enter the stage, their coming is often heralded with fantastic future predictions about transgressing unthought-of limits of human existence, e.g., overcoming scarcity, hard labor, and diseases. Ethicists of technology show a strong inclination of focusing on these futuristic scenarios and tend to reason the ethical downsides of these optimist scenarios. This has

been called the utopia–dystopia syndrome, which often leaves public discussion stuck in two worn-out grooves (Smits, 2006). The problematic pattern seems to return in current moral evaluations of the newest generations of robotics. In response to the phenomenon in nanotechnology ethics, Nordmann and Rip (2009) proposed to encourage discussions about the quality of positive and negative visions on the future of technology and to exercise reality checks. We took up this task for robot ethics, developing a VA method to generate better informed, more down-to-earth visions on robots for long term healthcare.

Can we now conclude from the results of Phase 3 that new visions were constructed in such a way that they will be less speculative and more useful for articulating specific and technically feasible robot applications, as we expected in the introduction? Firstly, we observe that similar to what we expected, the visions that the robot experts expressed in Phase 1 showed differences with the visions of the designated users explicated in Phase 2. Unsurprisingly, the designated users articulated well-informed visions on what is needed in long-term care. For the robot experts, long-term care seemed to be mostly unexplored territory. Their visions on long-term care were far less detailed and well-informed than those of the designated users.

When asked what roles robots should play in long-term care, the robot experts came up with a wide range of robot applications that could solve problems in long-term care. Initially, caretakers and patients responded more double-minded. However, to our surprise, the designated users' notion of what a robot is appeared to shift away from the classical image of the multifunctional super-intelligent humanoid slave in the course of the focus groups. It seemed that a process of reflection took place after we provided the designated users with the definition of a robot as a "sense-think-act" chain as described by Singer (2009, p. 67) in order to open up their interpretation of what a robot is. The longer the designated users discussed robots based on this notion, the more they seemed to break away from the classical robot image and open up to the idea of robots supporting caretakers and patients. However, especially the caretakers remain more reserved towards robots than the robot experts, still expressing the fear that robots would take over their jobs or take away the personal interaction between caretakers and patients.

Additionally, when comparing the assumptions underlying the visions of the robot experts and the designated users on a more abstract level, we observed more similarities than we expected beforehand. Among other things, both groups strongly expressed the vision that patients should be able to live as independent as possible. Both groups agreed that the essence of a caretaker's job is in the social aspect that should not be taken away from them by robots. Concerning the role of the robot, both experts and users emphasized that humans should always be in control of robots. This overlap turned out to provide fertile ground for the dialogue.

In Phase 3, when the knowledge and visions of both groups were confronted in an open and equal dialogue, we observed the same overlapping assumptions as expressed in Phases 1 and 2. Mismatches between the visions of the robot experts and designated users appeared on a more practical level, in terms of the tasks robots should or should not do. No explicitly new visions were expressed in this part yet. Although the expressed (mis)matches in their visions were similar to those expressed in Phases 1 and 2, we think it was necessary to exchange them, as they provided a solid basis for the second half of Phase 3. Armed with contextual as well as technological knowledge and with awareness of their own and each others' visions, the robot experts and designated users jointly designed robot applications in the second half of Phase 3.

In this assignment, a remarkable shift took place. The differences between the visions of the robot experts and designated users moved into the background. With their matching visions and underlying assumptions as leading principles, they co-designed practical concepts of applications in which the articulated visions seem to be inscribed. Thus the visions yielded so far proved to be useful to articulate some specific and technically feasible robot applications for long term care. This affirms our main hypothesis (that following the adapted VA approach would lead to visions enabling specific and technically feasible robot applications). The technological knowledge of the robot experts and the contextual knowledge of the designated users is married in a design, which is able to solve actual needs and seems technically feasible as well, while the design at the same time fits with the visions of the robot as a slave, the caretaker as a friend, and the patient as king of his castle.

ETHICS BEYOND SPECULATIVE ROBOT ETHICS

At first glance, the result of Phase 3 mostly resembles "just" very practical robot solutions for patients and caretakers. How can this "practical result" be qualified as a result of new and better informed moral visions? And how could we even qualify the result as a form of nonspeculative "ethics"? Did we indeed go "beyond speculative ethics"?

We did not, as ethicists might tend to do, end up with specific moral concerns on the new robot applications. Instead we think in the designed robots an interesting translation appeared, a translation from co-constructed moral visions to visions that are embodied in a robot design. Thus we consider the robots designed as the outcome of a process of shared ethical reflection resulting in co-constructed, morally informed guidelines. Moral guidelines and technology seem to be co-designed in the same motion.

Can this still be called doing ethics? We think it does. It comes close to recent pleads of philosophers of technology for an ethics of technology in

which morality and technology are not counterpointed, but co-constructed, and that we should prolong this path. (Dorrestein, 2010; Verbeek, 2009) Without doing injustice to other forms of ethics, we think our proposal for VA shapes fertile ground for elaborating this track for an ethics that shuns too much speculation.

NOTE

1. Until now, vision assessment has mainly been conducted through discourse analysis, with a central role for the analyst in constructing the visions out of discourses (Grin and Grunwald, 2000). Roelofsen deviates from this tradition by proposing an interactive form of vision assessment, in which the visions are co-created by relevant actors.

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