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Review

The use of care robots in aged care: A systematic review of argument-based ethics literature

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ABSTRACT

Background: As care robots become more commonplace in aged-care settings, the ethical debate on their use becomes increasingly important. Our objective was to examine the ethical arguments and underlying concepts used in the ethical debate on care robot use in aged care.

Methods: We conducted a systematic literature search for argument-based ethics publications focusing on care robot use in aged-care practices. We used an innovative methodology that consisted of three steps: (a) identifying conceptual-ethical questions, (b) conducting a literature search, and (c) identifying, describing and analyzing the ethical arguments in connection with the conceptual-ethical questions.

Results: Twenty-eight appropriate publications were identified. All were published between 2002 and 2016. Four primary ethical approaches were distinguished: (a) a deontological, (b) a principlist, (c) an objective-list, and (d) a care-ethical. All approaches were equally represented across the articles, and all used similar concepts that grounded their diverse ethical arguments. A small group of publications could not be linked to an ethical approach.

Conclusions: All included publications presented a strong ethical rationale based on fully elaborated normative arguments. Although the reviewed studies used similar grounding concepts, the studies' arguments were very diverse and sometimes diametrically opposed. Our analysis shows how one envisions care robot use in aged-care settings is influenced by how one views the traditional boundaries of the ethical landscape in aged care. We suggest that an ethical analysis of care robot use employs "democratic spaces," in which all stakeholders in aged care, especially care recipients, have a voice in the ethical debate.

1. Introduction

With expanding care technology, the issue of whether better technology can contribute positively to the current state of aged care is gaining more attention. Moreover, there is a rapidly increasing imbalance between the number of older adults needing care and a decreasing number of caregivers (World Health Organization, 2015). Care robots are viewed by some as a promising technological development that has the potential to mitigate this growing care recipient-caregiver disparity. These robots can be considered as embodied forms of semi-independent or independent technology. They support caregivers and/or older adults in physically assistive tasks. For example, the "My Spoon Robot" can aid someone with eating problems, and the "Sanyo Bath Robot" provides hygienic care to older adults (Bedaf, Gelderblom, & de Witte, 2015). Other care robots serve as social supports (e.g. the seal-like robot Paro or the dog-like robot AIBO) (Bemelmans, Gelderblom, Jonker, & de Witte, 2012). There are also care robots that combine both functions, being socially assistive. They give assistance through social interaction (Feil-Seifer & Matarić, 2005) (e.g. the human-like robot Robovie, and the robot, Pearl) (Kachouie, Sighadeli, Khosla, & Chu, 2014).

Many studies have examined how care robots can be used in aged-care settings (Bedaf et al., 2015; Kachouie et al., 2014; Robinson, MacDonald, & Broadbent, 2014); their effectiveness (Bemelmans et al., 2012; Mordoch, Osterreicher, Guse, Roger, & Thompson, 2013); what factors influence older adults' acceptance or rejection of care robots (De Graaf & Allouch, 2013; Flandorfer, 2012); and older adults' attitudes toward socially assistive robots (Vandemeulebroucke, Dierckx de Casterlé, & Gastmans, 2017). Nonetheless, as robot technology advances, care robots become increasingly independent. As the conviction of their use in aged-care practices builds, there is a growing need to ethically reflect on this use. Indeed, the field of roboethics addresses

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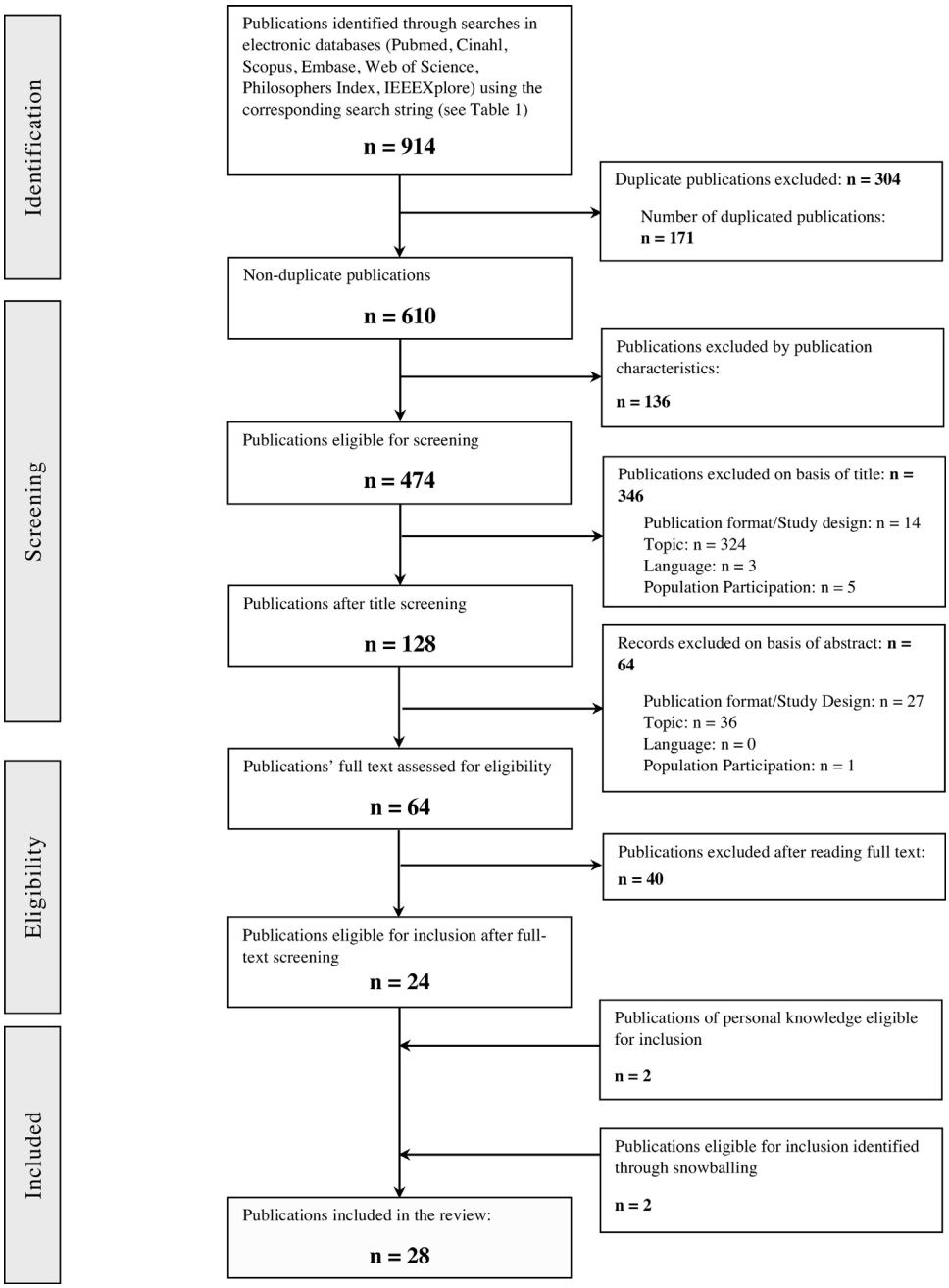

Fig. 1. Electronic search for literature identification and the selection process (after Liberati et al., 2009).

care robot use in aged-care practices (Lin, Abney, & Bekey, 2014; Tzafestas, 2016). Although these studies are valuable, we believe they do not address all arguments in the ethical debate about using care robots in aged care. Furthermore, the arguments presented in these studies have received limited analysis. To address this, we conducted a systematic review of the normative literature motivating the ethical debate on care robot use in aged-care practices.

2. Methods

Systematic reviews of normative literature are published frequently (Mertz, Kahrass, & Strech, 2016). Their goal is to promote informed decisions and judgments in all segments of healthcare, to improve research that aids these decisions and to continuously improve the standards of bioethics (McCullough, Coverdale, & Chervenak, 2007; Sofaer & Strech, 2012). The methodology developed for the present review shares these goals. Three steps were undertaken in our analyses. First, we identified the conceptual-ethical questions; second, we conducted a literature search that addressed the questions; and third, we identified and described the ethical arguments in connection with the conceptual-ethical questions.

2.1. Conceptual-ethical question(s)

Our research questions sought to gain a deeper understanding of the ethical debate and its arguments through discovery of the grounding concepts of those arguments. As such these questions were essentially conceptual-ethical questions, resulting in two aims. One aim was to present an overview of the arguments used in each study. The second aim was to present an overview of the concepts that grounded an argument. We did this, because the same concepts can be used to develop different, even opposite, arguments. Consequently, this information leads to a better understanding of authors' ethical stance and why a certain concept was chosen to ground a specific argument. The

following conceptual-ethical questions were formulated to determine the focus for this review:

- What are the ethical arguments grounding the debate on the use of robotics in aged care?
- What are the ethical concepts on which these arguments are based?

2.2. Literature search

The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram (Liberati et al., 2009) guided our reporting of the literature search, starting from the electronic database search to the final selection of the publications for review (see Fig. 1).

The first reviewer (T.V.) searched the electronic databases Pubmed, Web of Science, Philosophers Index, Embase, Scopus, Cinahl and the IEEE Explore Digital Library using a search string covering three word groups. First, a group related to older adults was used on which the normative argumentation focused. Second, we used a word group related to robotics. Finally, we used a group related to the publications' normative nature. The first reviewer (T.V.) created the search string for Pubmed in consultation with the second reviewer (C.G.). The search string was later modified for use in the other six databases (see Table 1). The publications citations, abstract and full article texts resulting from the searches were consolidated in a reference manager (Endnote™ version 7.4., Clarivate Analytics, Philadelphia, PA, USA) and duplicates were removed before screening candidate article titles, abstracts and full text.

Using predefined inclusion and exclusion criteria, one reviewer (T.V.) screened titles, abstracts and full texts of candidate publications (Liberati et al., 2009). Publications had to meet two main criteria to be included. Marginal candidate articles were discussed by all reviewers (T.V., C.G., B.D.d.C.) until consensus about (non-)inclusion was reached.

The first criterion was that publications had to focus explicitly on robot use in aged-care practices. Those that focused exclusively on robot design or on research ethics involving robots in aged care were excluded. The idea of "interpretative" or "interpretive flexibility" (Feenberg, 1999; Pinch & Bijker, 1984; Van Wynsberghe, 2013) makes us aware that the definition of robots is not preordained or inherent to robots, but instead depends on the context in which they are used, on their users, and on the task(s) they are assigned. As this review focuses on robots that are used in (institutionalized and community-based) aged-care settings and by older adults and/or their caregivers, we characterize these as care robots.

The second criterion was that publications had to consist of fully elaborated normative arguments. They had to make an appeal to certain concepts which can be derived from traditional and/or current practices, existing ethical theories and/or what is considered to be virtuous (McCullough et al., 2007). Because of this appeal, these concepts are considered to be ethical concepts. By this attributed ethical nature, arguments gain their normativity.

To be considered for inclusion, publications had to be written in Dutch, French, German or English. Editorials, overviews of already identified arguments, book chapters, position papers, ethics policies and ethics codes were not considered. We did not restrict our search to a particular time period, because ethical analyses of robots is fairly novel. To ensure our search was exhaustive, we applied the "snowball method" to the reference lists of elligible publications. Finally, any relevant publications we were aware of from our personal experience but were not identified by any of our search methods, were also included if they met the criteria.

2.3. Data extraction and synthesis

Motivated by the five preparatory stages of the coding process of the Qualitative Analysis Guide of Leuven (QUAGOL) (Dierckx de Casterlé, Gastmans, Bryon, & Denier, 2012), this review's data extraction and synthesis process also consisted of five stages. In the first stage, the included publications were read and re-read as a group, with the aim of gaining a holistic understanding of the corpus of publications. In the second stage, extensive narrative summaries of each publication were written. In the third stage, conceptual schemes were created, that characterized the narrative summaries. We were vigilant in checking that these schemes were a fair and accurate characterization of what was stated or implied in the publications. The focus of these schemes was directed at answering our conceptual-ethical questions. Thus, our focus sometimes differed from the publications' authors. Our emphasis shifted from the overall data presentations in the article toward an emphasis on their normative arguments and their grounding concepts. In the fourth stage, the individual conceptual schemes of the overlapping articles—be it because they shared the same ethical approach or focused on similar ethical issues—were transformed into a global conceptual scheme based on the interrelatedness of the arguments and concepts. In the last stage, all the conceptual schemes were synthesized and reported in the results of this review. The text was iteratively compared with our schemes to ensure consistency. Summaries and individual and overall conceptual schemes were drafted by the first author and repeatedly discussed with the other authors.

3. Results

We identified twenty-eight eligible publications for inclusion. Publications dates were from 2002 to 2016, with three appearing before 2010. While doing the data extraction and synthesis, it became evident that most authors of the included publications argued from a specific ethical stance. Four ethical approaches were apparent in the included publications (Table 2): (a) a deontological approach, (b) a principlist approach, (c) an objective-list approach and, (d) a care-ethical approach. Some authors were motivated by several approaches (Coeckelbergh, 2010; Parks, 2010; Vallor, 2011), and thus their articles could be categorized into more than one approach. We also identified several "outliers", publications which could not be readily categorized into one of the four ethical approaches. However, they clearly still dealt with care robot use in aged care.

3.1. Arguments related to deontological approaches

In six publications, authors applied a deontological ethical approach (Decker, 2008; Sharkey & Sharkey, 2012a, 2012b; Sparrow & Sparrow, 2006; Sparrow, 2002). The word 'deontology' is derived from the Greek words 'deon', which means duty, and 'logos', which can mean science or study and refers to humans' rational capacity. This approach argues that what is good or ought to be done can be elucidated through human reasoning. Each rational individual has the responsibility/duty to uphold goodness on the condition that one can autonomously reason. This emphasis on individual rationality and responsibility also finds vocation in a common reading of human rights which holds that because one is autonomous she[1] receives rights that guarantee her autonomy. Moreover, because of her autonomy she can take up the responsibility/duty to secure her own rights and those of others in a rational way.

3.1.1. Autonomy and dignity

A deontological approach argues that humans are ends in themselves and cannot be regarded as merely means to an end. This means that humans need to be respected in their autonomy (Decker, 2008; Sparrow & Sparrow, 2006) and dignity (Decker, 2008; Sharkey & Sharkey, 2011; Sharkey & Sharkey, 2012b; Sparrow & Sparrow, 2006; Sparrow, 2002). Authors adopting this approach warn that the

[1] For alliterative purposes, we use the female pronoun. The concepts apply to both genders, however.

Table 1
Overview of literature database search strategies, search strings used, and number of publication "hits" (Results).

Database	Date	Search					Results
		Group 1: Population	AND	Group 2: Robotics	AND	Group 3: Ethics	
Pubmed	01/23/2017	"aged"[MeSH] OR elder*[Title/Abstract] OR older people [Title/Abstract] OR dementia[Title/Abstract] OR Activities of Daily Living*[MeSH] OR senior*[Title/Abstract] OR care*[Title/Abstract] OR geriatrics		Robot*[Title/Abstract] OR "robotics*"[MeSH] OR care robot*[Title/Abstract] OR service robot*[Title/Abstract]		"ethics"[Mesh] OR ethic*[tiab] OR Caregivers/ethics*[MeSH] OR Machine ethics[Title/Abstract] OR philosophy[MeSH] OR deception[MeSH] OR deception[Title/Abstract] OR ethical issues [MeSH] OR sentimentality [Title/Abstract]	259
Web of Science (Advanced Search)	01/23/2017	TS = (aged OR elder* OR "older people" OR dementia OR "activities of daily living" OR senior* OR care OR "geriatrics")		TS = (robot* OR "care robot*" OR "service robot*")		TS = (ethics OR ethic* OR (Caregivers AND ethics*) OR "Machine ethic*" OR philosoph* OR deception OR "ethical issues" OR sentimentality)	140
Philosophers Index (Advanced Search)	01/23/2017	(aged or elder* or older people or dementia or activities of daily living* or senior* or care* or geriatrics).mp.		(robot* or care robot* or service robot*).mp.		(ethic* or (Caregivers and ethics*) or (machine and ethic*) or philosophy or deception or ethical issues or sentimentality).mp.	21
Embase (All groups Broad Search)	01/23/2017	aged:de OR elder*:ab,ti OR 'older people':ab,ti OR dementia:ab,ti OR 'activities of daily living':de OR senior*:ab,ti OR care*:ab,ti OR geriatrics		robot*:ab,ti OR robotics:de OR 'care robot*':ab,ti OR 'service robot*':ab,ti		ethics:de OR ethic*:ab,ti OR (caregivers:de AND ethics*:de) OR (machine:ab,ti AND ethics:ab,ti) OR philosophy:de OR deception:de,ab,ti OR 'ethical issues':de,ab,ti OR sentimentality:ab,ti	118
Scopus	01/23/2017	TITLE-ABS-KEY (aged OR elder* OR "older people" OR dementia OR "activities of daily living" OR senior OR care OR geriatrics)		TITLE-ABS-KEY (robot* OR robotics OR "care robot*" OR "service robot*")		TITLE-ABS-KEY (ethic* OR "Caregiver* ethic*" OR 'Machin* ethics*" OR philosophy OR deception OR "ethical issues' OR sentimentality)	363
Cinahl	01/23/2017	(MM aged OR AB elder* OR TI elder* OR AB "older people" OR TI "older people" OR AB dementia OR TI dementia OR MM "activities of daily living" OR AB senior* OR TI senior* OR AB care OR TI care OR MM Geriatrics)		(AB robot OR TI robot OR MM robotics OR TI "care robot*" OR AB "care robot*" OR AB "service robot*" OR TI "service robot*")		(MW ethic* OR AB ethic* OR TI ethic* OR (MW Caregiver* AND MW ethic*) OR ((AB Machin* OR TI Machin* OR MW Machin*) AND (AB ethic* OR TI ethic* OR MW ethic*)) OR MH philosophy OR MH deception OR AB deception OR TI deception OR MM "Ethical issues" OR TI sentimentality OR AB sentimentality)	5
IEEE (advanced Search)	01/23/2017	"IEEE Terms": Senior citizens		Robots		Ethics	8
							TOTAL: 914

Table 2
List of 28 included publications and their categorization into the four main ethical approaches.[a]

Ethical approaches				Outliers
Deontology	Principlism	Objective-list	Care-ethics	
Decker (2008) Sharkey and Sharkey (2011) Sharkey and Sharkey (2012a) Sharkey and Sharkey (2012b) Sparrow (2002) Sparrow and Sparrow (2006)	Feil-Seifer and Matarić (2011) Ienca et al. (2016) Körtner (2016) Preuβ and Legal (2016) Sorell and Draper (2014)	Borenstein and Pearson (2010) Coeckelbergh (2010) Coeckelbergh (2015b) Misselhorn et al. (2013) Parks (2010) Sharkey (2014) Sparrow (2015) Vallor (2011)	Coeckelbergh (2010) Coeckelbergh (2015a) Parks (2010) Vallor (2011) Vanlaere and Van Ooteghem (2012)	Blackford (2012) Coeckelbergh (2012) Matthias (2015) Metzler and Barnes (2014) Metzler et al. (2015) Rodogno (2015) Shatzer (2013)

[a] Some articles could be categorized into multiple approaches.

introduction of care robots into aged-care settings leads to inappropriately viewing older adults as means to ends (e.g. economic benefit, etc.). For example, Sharkey and Sharkey (2012a, 2012b) refer to the *Charter of the United Nations* (UN General Assembly, 1945) and the *Universal Declaration of Human Rights* (UDHR) (UN General Assembly, 1948) to express this warning: An "[…] emphasis on human rights provides support for the assumption that the physical and the psychological welfare of the elderly is as important as the welfare of others" and that "[…] it is important to ensure that robots introduced into elder care do actually benefit the elderly themselves and are not just designed to reduce the care burden on the rest of society" (Sharkey & Sharkey, 2012a, p. 27–28).

Misrecognizing older adults as simply means to ends besides themselves leads to thinking of them as plain objects (Decker, 2008; Sharkey & Sharkey, 2012a; Sharkey & Sharkey, 2012b; Sparrow & Sparrow, 2006), or instruments (Decker, 2008; Sparrow & Sparrow, 2006), as "things" lacking autonomy and dignity. Sharkey and Sharkey (2012a, 2012b) give one example: the routine use of care robots in feeding, lifting, or washing practices. Here, older adults may feel that they have lost control about their lives, that they are being objectified. Moreover, Sparrow and Sparrow (2006) argue that the question about care robot use arises from the contemporary misunderstanding of older adults' dignity. Older adults are viewed merely as problems of study objects. On the other hand, some may feel empowered by care robot use, relative to having these tasks carried out by human caregivers (Sharkey & Sharkey, 2012a).

Feeling the loss of autonomy and dignity is also exemplified in feeling a loss of freedom (Decker, 2008; Sharkey & Sharkey, 2012a, 2012b) and privacy (Sharkey & Sharkey, 2012a, 2012b; Sparrow & Sparrow, 2006). However, Decker (2008) argues it is sometimes necessary to restrict older adults' freedom to protect their health (e.g. if they refuse to take their medication). Thus, Sharkey and Sharkey (2012a, 2012b) highlight the possibility that care robots might function as "autonomous supervisors", helping older adults, (e.g. preventing dangerous situations). Wholesale adoption of this function could lead to a "slippery slope"; imprisoning older adults.

While care-robots' monitoring capabilities can increase older adults' safety, or their feeling of being safe, it also risks infringing on their privacy rights (Sharkey & Sharkey, 2012a; Sparrow & Sparrow, 2006). Referring to Article 12 of the UDHR (UN General Assembly, 1948), Sharkey and Sharkey (2012a, 2012b) identify a conflict in older adults being monitored in intimate situations. This article states that "No one shall be subjected to arbitrary interference with his privacy, family home or correspondence, nor to attacks upon his honour and reputation." (UN General Assembly, 1948). Sharkey and Sharkey (2012a, 2012b) propose that in such conflict situations care robots should always announce their presence. Older adults' mental capacities also relate to this issue. For example, older adults may forget that they are being monitored, leading them to act in a way they would not normally if they were aware of the monitoring (Sharkey & Sharkey, 2012a, 2012b). The problems arising from loss of freedom and privacy led Sharkey and Sharkey (2011) to remark users of care robots should always have ultimate control over them. A balance should be struck between improving older adults' lives and protecting their rights (Sharkey & Sharkey, 2012a). Decker (2008) argues that clear information about care robots' range of actions can increase older adults' autonomy because it enables them to make informed choices whether to use care robots in their care (Decker, 2008).

3.1.2. Deception and truth

According to Sparrow and Sparrow (2006), older adults' objectification or instrumentalization is also manifest in the intention to deceive older adults through care robot use. For them, care robots are simulacra pretending to be something they are not. In this view, if older adults feel cared for by care robots, this feeling has to be attributed to conscious or unconscious delusions (Sparrow & Sparrow, 2006; Sparrow, 2002). While admitting these can lead to certain benefits, such as health benefits, (Sparrow & Sparrow, 2006; Sparrow, 2002), these authors argue that delusions do not improve older adults' overall well-being because they disengage them from reality (Sparrow & Sparrow, 2006; Sparrow, 2002). Moreover, delusions create moral failures. They state that we "… have a duty to see the world as it is. […] Thinking that an expensive and sophisticated electronic toy is really our friend is sentimentality of a sort we should avoid." (Sparrow & Sparrow, 2006, p. 155).

Sharkey and Sharkey (2011, 2012a, 2012b) also warn of the negative consequences of deception. These authors state that all humans anthropomorphise objects, and older adults should not be seen as abnormal when they do the same. This behavior does not necessarily lead to deception about the nature of care robots but can lead to a conscious "willing suspension of disbelief" (Sharkey & Sharkey, 2012a, 2012b). They have identified causes or tendencies that strengthen care robots' anthropomorphization, the one more innocent, e.g. lack of technical knowledge, than the other, e.g. need for social contact (Sharkey & Sharkey, 2011). Thus, they conclude that one should be concerned about situations in which anthropomorphization leads to negative consequences instead of about deception *per se* (Sharkey & Sharkey, 2011).

3.1.3. Social isolation and connectedness

As Decker (2008, p. 320) states: "… if as a result of technical processes an individual is no longer capable of acting as a person in the social sphere […] technical constraints exceed the limits of what is acceptable." This means that ignoring the social context in which older adults are embedded risks objectifying or instrumentalizing them. Including social context, then, dismisses the possibility that care robots replace human caregivers (Decker, 2008; Sharkey & Sharkey, 2012a, 2012b; Sparrow & Sparrow, 2006). Moreover, Decker (2008) reminds us that care robots lack the ability to recognize older adults as ends in themselves or as Sparrow (2002) and Sparrow and Sparrow (2006) put

it, they do not share human frailties. This makes care robots incapable of responding empathically.

Some authors argue that care robots could be used as tools to relieve human caregivers' workloads, providing them more time to focus on improving older adults' quality of life (Decker, 2008; Sharkey & Sharkey, 2012b). Nevertheless, some warn that external pressures (e.g. economic pressures) on aged care will lead to the possibility of considering care robots as replacements (Sharkey & Sharkey, 2012a, 2012b; Sparrow & Sparrow, 2006). Apart from this, older adults may choose to spend most of their time with care robots, risking social isolation (Sharkey & Sharkey, 2011; Sparrow, 2002). Although it is possible that care robots might be able to satisfy certain desires or needs of older adults (e.g. help them with to dress) they cannot engage socially (Decker, 2008; Sparrow & Sparrow, 2006; Sparrow, 2002).

On the positive side, Sharkey and Sharkey (2011, 2012a, 2012b) recognize that care robots can serve as social facilitators (e.g. being objects of conversation), stimulating interaction between older adults and others. Furthermore, they see opportunities for care robots to promote older adults' independence by increasing their mobility, possibly improving their social connectedness (e.g. as objects of conversation) (Sharkey & Sharkey, 2012a, 2012b). They also recognize care robots' capabilities to establish virtual visits of family and friends. This could mitigate a degree of loneliness experienced by older adults in care settings (Sharkey & Sharkey, 2012a, 2012b). Nonetheless, they warn that this could lead to a decrease in real visits. Indeed, family members and friends may no longer feel obligated to visit, because they have virtually visited them (Sharkey & Sharkey, 2011, 2012a); and as a result the guilt for not visiting fades (Sharkey & Sharkey, 2012a). Similarly, some argue that care robots' monitoring capabilities lead to isolation because the obligation to check on older adults decreases (Sharkey & Sharkey, 2012a; Sparrow & Sparrow, 2006). This makes "[…] it possible for relationships of trust and concern to be neglected or abandoned in favour of the technical efficacy of remote monitoring." (Sparrow & Sparrow, 2006, p. 153).

3.2. Arguments related to principlist approaches

Five publications embodied principlist approaches to ethics (Feil-Seifer & Matarić, 2011; Ienca, Jotterand, Vica, & Elger 2016; Körtner, 2016; Preuß & Legal, 2016; Sorell & Draper, 2014). We view these as practical translations of the deontological approach, mainly appearing in biomedical ethics discussions. A principlist approach commonly discerns four principles, namely "respect for autonomy," "beneficence," "non-maleficence," and "justice." Respect for autonomy is clearly linked to humans' rational capacities as it is usually defined as allowing one to make informed decisions about one's own care and permitting one to act accordingly (Feil-Seifer & Matarić, 2011; Ienca et al., 2016; Körtner, 2016; Sorell & Draper, 2014).

3.2.1. Autonomy

With the principlist approach, care robots can have positive effects on older adults' autonomy when they clearly understand care robots' capabilities and place in their lives (Feil-Seifer, 2011; Ienca, 2016; Körtner, 2016) and when they are able to control them (Feil-Seifer, 2011; Körtner, 2016; Sorell & Draper, 2014).

Sorell and Draper (2014, p. 189) differentiate autonomy from independence, the latter being described as "… being able to act on one's choices without depending on the consent or co-operation or resources of others." While autonomy can coexist with depending on others, independence cannot, because it emphasizes individuality. Apart from autonomy, care robots can also strengthen older adults' independence (e.g. supporting them physically demanding activities) (Sorell & Draper, 2014).

Using care robots can bring principles into conflict. All authors highlight the tension between older adults' autonomy and privacy (Feil-Seifer & Matarić, 2011; Ienca et al., 2016; Körtner, 2016; Preuß & Legal, 2016; Sorell & Draper, 2014). For example, older adults and caregivers may not realize that robots are recording them and that these recordings may be shared with others (Feil-Seifer & Matarić, 2011). Some authors emphasize that care robots should be able to differentiate between confidential and non-confidential information and respect the former (Feil-Seifer & Matarić, 2011; Körtner, 2016; Sorell & Draper, 2014). Safe and anonymous data storage must be guaranteed (Körtner, 2016). In the case of people with dementia, Ienca et al. (2016) propose that data collection must meet relevant EU regulations: the monitoring process must be transparent, must have a legitimate purpose and must be proportionate to this purpose.

Older adults' autonomy and care robots' independence may also conflict (Feil-Seifer & Matarić, 2011; Sorell & Draper, 2014). For example, the Care-O-Bot discussed by Sorell and Draper (2014), is capable of independently acting and reacting, vocally and physically. This independence suggests that care robots can influence or even exert authority over their user(s), or may even act against them (Feil-Seifer & Matarić, 2011; Sorell & Draper, 2014). Sorell and Draper (2014, p. 193) question whether it is "[…] compatible with [older adults'] autonomy for a carebot to coerce someone to adhere to regimes that will return them to greater independence."

To reduce the possibility of conflicting principles and to respect the autonomy of care-robots' users, some authors stress that care robots' capabilities must be explained thoroughly, arguing that this information will give older adults the possibility to give informed consent to care robot use. However, they acknowledge that educating users about all care robots' capabilities is impossible (Feil-Seifer & Matarić, 2011; Ienca et al., 2016; Körtner, 2016; Sorell & Draper, 2014). This unavoidable lack of knowledge poses risks to older adults' autonomy. Under- or overestimation of care-robots' capabilities can lead to a form of deception that impedes informed decisions (Feil-Seifer & Matarić, 2011; Körtner, 2016; Preuß & Legal, 2016). Nevertheless, Feil-Seifer and Matarić (2011) argue that deception will be tempered as people get to know and understand robots.

Ienca et al. (2016) argue that care robot use can continue when older adults have lost cognitive capacity as long as there are clear physical/psychological therapeutic benefits and signs of distress are absent. In this context having advanced directives are encouraged (Ienca et al., 2016) in combination with consent by proxies (Ienca et al., 2016; Körtner, 2016). This strengthens older adults' autonomy and makes clear their wishes for the use or non-use of care robots in their care.

3.2.2. Beneficence, non-maleficence and safety

The primary risk of interacting with care robots is being physically hurt (Feil-Seifer & Matarić, 2011). Authors stress the need to assess care robots' potential for causing harm (Feil-Seifer & Matarić, 2011; Ienca et al., 2016; Körtner, 2016). For authors adopting a principlist approach, the goal of using care robots is promoting physical, cognitive and social wellbeing, strengthening older adults' autonomy, and to prevent harm (Feil-Seifer & Matarić, 2011; Ienca et al., 2016; Körtner, 2016; Sorell & Draper, 2014). Feil-Seifer and Matarić (2011) also argue that having overly strong attachments to care robots can cause distress and loss of therapeutic benefits when the robots are taken away. In addition, the already mentioned issue of instrumentalization is not only a risk to older adults' autonomy but also can lead to dehumanized care (Feil-Seifer & Matarić, 2011; Ienca et al., 2016; Preuß & Legal, 2016; Sorell & Draper, 2014) with consequences as social isolation affecting older adults' psychological wellbeing (Feil-Seifer & Matarić, 2011; Körtner, 2016; Preuß & Legal, 2016; Sorell & Draper, 2014). To avoid these problems, some authors propose that care robot use should be continually evaluated, vis-à-vis users' personal experiences (Ienca et al., 2016; Körtner, 2016; Sorell & Draper, 2014). Moreover, the evaluation should consider personal and social/cultural backgrounds (Preuß & Legal, 2016).

3.2.3. Justice

For some authors, the justice principle refers to fair distribution of scarce resources (Feil-Seifer & Matarić, 2011; Ienca et al., 2016), prompting the question of who has the right to use care robots for their care. Ienca et al. (2016, p. 571) suggest that care robots cannot be considered as a "one-size-fits-all policy," because of their different functions (Ienca et al., 2016), their costs fluctuate (Feil-Seifer & Matarić, 2011; Ienca et al., 2016), and countries have different healthcare systems that support different needs and are based on different interpretations of justice (Ienca et al., 2016).

The justice principle also begs the question of who takes responsibility when something goes wrong (Feil-Seifer & Matarić, 2011; Ienca et al., 2016). For Feil-Seifer and Matarić (2011), only real-life interactions with care robots will demonstrate what is needed to regulate their use in a responsible way.

3.3. Arguments related to objective list approaches

Seven publications were categorized as having an objective-list approach to ethics (Borenstein & Pearson, 2010; Coeckelbergh, 2010, 2015b; Misselhorn, Pompe, & Stapleton 2013; Parks, 2010; Sharkey, 2014; Sparrow, 2015; Vallor, 2011). In this approach an objective account of care is developed by putting forward several capabilities or "goods" that can be reached or supported by care practices. The objective account of care enables researchers to determine the impact of care robot use in aged-care settings, while considering individual persons, persons' particular contexts, the organizations that implement them, and overall society.

3.3.1. Capabilities approach and dynamic contexts

Martha Nussbaum's capabilities approach occupies a central place in six publications. Sparrow's (2015) paper does not refer to it; however, Parks (2010) refers to it more generally. Most authors specifically refer to Nussbaum's book *Frontiers of Justice* (2006, p. 76–77), in which she compiles a list of 10 central human capabilities representing thresholds of achievement that when breached, lead to a dignified and flourishing life. These are named: "life"; "bodily health"; "bodily integrity"; "senses, imagination, and thought"; "emotions"; "practical reason"; "affiliation"; "other species"; "play"; "control over one's environment." Care based on the capabilities approach focuses on organizing care that creates opportunities for achieving these capabilities.

Two views on the capabilities list can be delineated from the included publications. Some hold that, whereas the capabilities still need to be specified through the lenses of particular contexts or practices, their fundamental structure are unchangeable (Borenstein & Pearson, 2010; Coeckelbergh, 2010; Parks, 2010; Sharkey, 2014; Vallor, 2011). Coeckelbergh (2010) and Sharkey (2014) recognize that this view can manifest as paternalism and lead to neglect of older adults' inner experiences.

Taking this into account, some authors developed a more dynamic account of the capabilities approach (Coeckelbergh, 2015b; Misselhorn et al., 2013). Capabilities need not only be differently perceived through the lenses of particular cultures, but also through people's own different life stages. Moreover, because of certain societal developments—the introduction of care robots in aged care—certain capabilities, might be re-characterised, they might disappear or new ones might emerge. This dynamic prompted Misselhorn et al. (2013) to speak of a dynamic web of capabilities that are reached or dropped by new technological contexts. Hence, it is necessary to go beyond what they call "now-chauvinism" and to employ techno-moral imagination to foresee how capabilities might be perceived in the future.

3.3.2. Care robots and capabilities

Several authors argue that the capabilities approach's focus on the particularity of social contexts, denies an *a priori* refusal of care robots use in aged-care practices. They call for case-by-case evaluations of care robot use (Coeckelbergh, 2010, 2015b; Misselhorn et al., 2013; Sharkey, 2014; Vallor, 2011), starting from the premise that there use must create opportunities for older adults and their caregivers to fulfil their capabilities. However, all authors adopting Nussbaum's capabilities approach argue that care robots cannot be viewed as replacements for caregivers. Instead, they should be viewed as a component of aged-care practices. They suggest that care robots can help ones reach, sustain, and enhance certain capabilities when used appropriately. Nevertheless, some authors are cautious, arguing that external pressures to care (e.g. economic) will force inappropriate use of care robots (Borenstein & Pearson, 2010; Parks, 2010; Vallor, 2011). Nonetheless, if care robots are perceived as a component of aged-care practices, they will influence how these practices are perceived due to the dynamic nature of the capabilities involved in these practices. The dilemma of social isolation is related to capabilities as "affiliation," "emotions," and "control over one's environment." Borenstein and Pearson (2010) and Misselhorn et al. (2013) argue that robots could mitigate feelings of isolation. They also write that people of all ages form morally acceptable bonds with objects or fictional characters. For example, many can relate personally to the proverbial damsel in distress, hoping that she will be rescued by the knight in shining armor. And many cherish a lucky charm. Such everyday examples suggest bonding with robots should not be viewed differently. Capabilities such as "affiliation" and "emotions" need not refer only to relations between humans.

Although the dilemma of deception has already received much attention, authors arguing out of the capabilities approach provide new relevant views on it. Deception, also viewed as the tension between real and virtual experiences is linked with capabilities as "bodily health"; "bodily integrity"; "senses, imagination and thought"; and "affiliation". All authors in the capabilities discourse write that care robot users are being deceived about their true nature. Sharkey (2014, p. 72) also hints at deception that arises from older adults' misconception of care robots' technical abilities: "…vulnerable humans […] may not be clear about their [care robots] abilities." Although deception can be viewed as an attack on older adults' dignity (Parks, 2010), most authors adopt a more nuanced view (Borenstein & Pearson, 2010; Coeckelbergh, 2010, 2015b; Misselhorn et al., 2013). They warn that one should not idealize current aged-care practices when discussing care robot use. Deception is not a new phenomenon in social environments as aged care (Borenstein & Pearson, 2010; Coeckelbergh, 2010, 2015b). Next, authors recognize that deceptive or virtual experiences can have both negative and positive impacts on health (Borenstein & Pearson, 2010; Coeckelbergh, 2010, 2015b; Misselhorn et al., 2013; Sharkey, 2014). This resonates with Coeckelbergh's (2015b) and Parks' (2010) suggestion that the focus should not be on deception *per se*, but rather on how deceptive/virtual experiences disengage or alienate older adults from real life. Coeckelbergh (2015b) even suggests that interactions with care robots could create new ways of engaging with reality, providing opportunities for older adults to fulfil capabilities as "control over one's environment" (Borenstein & Pearson, 2010; Misselhorn et al., 2013) and "play" (Sharkey, 2014). This clarifies the claim that interacting with care robots could increase older adults' feeling of autonomy and self-respect (Borenstein & Pearson, 2010; Misselhorn Pompe & Stapleton, 2013; Sharkey, 2014).

3.3.3. Objective-list approach of well-being

Referring to the philosophy of welfare, Sparrow (2015) develops another objective-list theory that focus on older adults' well-being or welfare instead of care. Similar to the capabilities approach, in this theory, Sparrow argues that evaluating peoples' well-being translates to an evaluation of their chances to realize certain "goods" and the actual realization of them. The first objective good is "recognition," characterised as "[…] the enjoyment of social relations that acknowledge us in our particularity and as valued members of a community" (Sparrow, 2015, p. 4). The second is "respect" which "[…] consists in social and political relationships wherein our ends are granted equal weight to

those of others in the community" (Sparrow, 2015, p. 4).

Sparrow views care robots as depriving aged care of these two fundamental goods, jeopardizing older adults' well-being. His main argument is that machines lack the capacity to initiate affective relationships, which are needed to develop recognition and respect. Care robots only deceptively *appear* to have these affective abilities, so deceiving their user(s). Sparrow also argues that it is naïve to think that care robots will assist human caregivers. Economic pressures on aged care will induce and strengthen the tendency to replace human caregivers with care robots. In the end, Sparrow implicitly asks why we are not more focused on providing human care to older adults instead of shifting to a mechanized care?

3.4. Arguments related to care-ethical approaches

Five publications took a care-ethical approach presenting their arguments (Coeckelbergh, 2010, 2015a; Parks, 2010; Vallor, 2011; Vanlaere & Van Ooteghem, 2012). Care-ethical approaches start from the particular care relationship between caregivers and care receivers, and progressively widen their scope to include a contextual level and then a political level. They stress that meaningful care relationships consist of "caring about" and "caring for" someone. These two characteristics refer to two fundamental interrelated dimensions of care, a reciprocal one and a technical-instrumental one.

3.4.1. Particular care relationship

From the reciprocal dimension of care, all authors argue against the idea of care robots being replacements for caregivers (Coeckelbergh, 2010, 2015a; Parks, 2010; Vallor, 2011; Vanlaere & Van Ooteghem, 2012). Since care robots lack the ability to care about someone, they cannot reciprocate by engaging in a meaningful relationship with care receivers. If care robots replace caregivers, the care relationship is disrupted and loses its meaningfulness. Care becomes unidirectional, exclusively focused on the technical-instrumental aspects of caregiving (Coeckelbergh, 2015a; Parks, 2010; Vallor, 2010; Vanlaere & Van Ooteghem, 2012). This pure technical-instrumental view of care leads to three negative consequences. First, care would merely focus on the material/physical bodily dimension of older adults, objectifying them (Parks, 2010; Vanlaere & Van Ooteghem, 2012). The second negative consequence has already been considered throughout this review, namely deception. If one still views care as two-dimensional while replacing human caregivers with care robots, these robots must appear as like they possess relational reciprocity but in reality they do not, and care receivers are then deceived (Coeckelbergh, 2010; Coeckelbergh, 2015a; Parks, 2010). Lastly, the introduction of care robots as human replacements risks social isolating older adults (Coeckelbergh, 2010; Coeckelbergh, 2015a; Parks, 2010; Vanlaere & Van Ooteghem, 2012).

In discussions about care robots replacing human caregivers, some authors from a care-ethical discourse also focus on goods that are internal to care practices. The moral quality of the care process involving human caregivers and care-receivers brings forth these goods which are valuable for both parties (Coeckelbergh, 2015a; Parks, 2010; Vallor, 2011). One can think of values and attitudes as caring, empathy, vulnerability, engrossment, dignity, and attentiveness (Coeckelbergh, 2010; Coeckelbergh, 2015a; Parks, 2010; Vallor, 2011; Vanlaere & Van Ooteghem, 2012), all of which are reciprocal in nature. As these authors reject the notion that care robots have a reciprocal dimension, except falsely through deception, the question arises about what will become of these internal goods (Parks, 2010; Vallor, 2011; Vanlaere & Van Ooteghem, 2012).

3.4.2. Care as a context-sensitive process

Instead of an a-contextualized act, care is considered to be a context-sensitive process. From the perspective of the care-ethical premise, care-robots can be considered to be a part of the context in which the particular relation between caregiver and care receiver is embedded. This means they are tools to complement or assist in the care practice (Coeckelbergh, 2010, 2015a; Parks, 2010; Vallor, 2011; Vanlaere & Van Ooteghem, 2012). Instead of conceiving of robots as liberators from care, they become liberators *to* care (Vallor, 2011; Vanlaere & Van Ooteghem, 2012). Viewing care robots as tools means that the agency, the initiative to act, still completely lies with human caregivers and not with robots. However used as tools, robots co-constitute the care context and as such influence the care process without severing the link between the reciprocal and technical-instrumental dimensions of care (Coeckelbergh, 2015a; Vanlaere & Van Ooteghem, 2012).

Using care robots as tools can potentially change the face of aged-care practices, plausibly in a more "controlled" way. Again, knowing beforehand what the introduction of robots entails is impossible, even if they are used as tools. Thus, the importance of case-by-case evaluations of care robot use is relevant (Coeckelbergh, 2010; Parks, 2010; Vanlaere & Van Ooteghem, 2012). Once care robots are used, these evaluations prevent them from dominating care practices (Vanlaere & Van Ooteghem, 2012), avoiding risks of objectification, deception and social isolation.

3.4.3. Political context of care

The final topic in the care-oriented studies deals with the political context in which the particular care relations are situated. This refers to societies as a whole or to aged-care organizations. Within these political contexts ethical standards should be established—motivated by the goods internal to care—and should be met by the actual care practices. Indeed, some authors recognize a possible technical-instrumental contribution of care-robots in aged care. For example, the increase of efficiency and productivity is a way to liberate caregivers to care and to liberate care receivers to be cared for (Vallor, 2011; Vanlaere & Van Ooteghem, 2012). Moreover, using care robots may contribute to a fairer distribution of care (Coeckelbergh, 2015a; Parks, 2010; Vanlaere & Van Ooteghem, 2012). Nevertheless, one has to be wary, as robots are mostly viewed in economic terms. If the motivation for care-robot use is to solve the present and future shortage of caregivers, one has to ask if productivity and efficiency are appropriately paramount, reducing the care process to "Machinery of Care" (Coeckelbergh, 2015a; Parks, 2010; Vanlaere & Van Ooteghem, 2012). This domination could lead to a shift from care robots as being assisting tools to care robots as replacers of human caregivers, harboring all the ethical risks this shift holds. In the end, this economic reasoning becomes a vicious circle. If robots are introduced into care settings to meet a shortage of caregivers, one is inclined to think that the number of human caregivers will continue to drop (Parks, 2010). In the end, this makes it appear as if care robots are ethically necessary (Vallor, 2011).

3.5. Deception and the post-human future

Seven publications could not be readily categorized into any of the four identified ethical approaches, these were grouped as "outliers" (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Metzler & Barnes, 2014; Metzler, Lewis, & Pope, 2015; Rodogno, 2015; Shatzer, 2013). They are characterized by their exclusive focus on two themes: deception and care robots' impact on humanity's self-conception.

Six publications analysed the problem of deception (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Metzler & Barnes, 2014; Metzler et al., 2015; Rodogno, 2015). All authors wrote similarly that, because care robots lack consciousness and are not aware of a conscious reality but only can appear to have these properties, they are deceptive (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Metzler & Barnes, 2014; Metzler et al., 2015; Rodogno, 2015).

Some authors point out that, as it stands now, care robots do not intend to deceive, since they lack consciousness (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015). Thus, if there is any intentional deception, it rests with developers, implementators (e.g. caregivers,

care organizations), or the users themselves. Coeckelbergh (2012) and Matthias (2015) argue that there must be basic trust in others, both sentient and non-sentient, that they will not deceive if the overarching desire is to have a flourishing social life. This basic trust does not prevent deception from happening, as it can occur as a side effect through interactions with sentient and/or non-sentient others (Blackford, 2012; Coeckelbergh ,2012; Matthias, 2015; Rodogno, 2015). For example, by over- or underestimation of care robots' capabilities (Coeckelbergh, 2012; Matthias, 2015), or by a willing suspension of disbelief (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Rodogno, 2015).

Four authors highlight the relationship between truth and deception (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Rodogno, 2015). There is a basic human desire to comprehend the world correctly. Nevertheless, this attitude does not exclude the usual kinds of misapprehension (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Rodogno, 2015). Coeckelbergh (2012) argues that since humans are beings living in the world, what the world is and means can only be established through its appearance. As a consequence, one can misapprehend the world without knowing it, and thus be deluded about the world. This also holds for everything that is in the world, including care robots. Furthermore, Coeckelbergh (2012) states that care robots have different "Gestalts", appearances, depending on users and the context in which they are used. For example, older adults who understand the technological mechanisms of care robots will plausibly have a more accurate understanding of them than others who do not have this knowledge. This reasoning leads to the conclusion that robotic deception does not necessarily have to be viewed differently than other kinds of day-to-day harmless deceptions which are consistent with a commitment to truth (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Rodogno, 2015).

Blackford (2012), and especially Rodogno (2015) analyze another aspect of deception, namely its relationship to sentimentality. Both understand sentimentality as over-emotionalizing certain objects, in this case care robots; this leads to their misrepresentation. Rodogno refers to the paradox of emotional fiction, which states that one empathize with fictional characters while at the same time knowing they are fictional, to show: sentimentalizing care robots does not necessarily lead to misrepresenting them. Older adults can be conscious of the fact that robots are not sentient and still express emotions towards them. Further, Rodogno suggests that the proper focus should be on the motives of sentimentalization instead of sentimentalization *per se*. Rodogno argues that the desire to sentimentalize objects is an expression of a need to evoke certain emotions. He states that sentimentality "… involves the attempt to use something to secure a desired feeling or emotional comfort" (2015, p. 8). It is not necessarily the case that negative motives (e.g. social isolation) evoke this desire for emotional comfort. Consequently, sentimentalizing care robots does not necessarily have to be a problem as it can just be another "[…] self-interested pursuit that occasionally involves wrongdoing" (2015, p.9). Nonetheless, it poses a problem "[…] insofar it disrespects other persons, values, or duties that the individuals have" (2015, p. 9).

In the end, the problem of deception is fundamentally linked with the notion of autonomy. Matthias (2015) argues that autonomy in a technological context has to be understood proportionally to users' choices, technological capabilities, and technological knowledge. The way care robots are used should be consistent with users' preferences and personal goals, meaning that depending on the user, deception can increase older adults' autonomy (Blackford, 2012; Coeckelbergh, 2012; Matthias, 2015; Rodogno, 2015). As Matthias (2015) argues a too detailed disclosure about care robots' functions can become unintelligible, leading to a reduced autonomy. In summary, fine-tuning expectations about care robots could probably prevent deception in many situations (Coeckelbergh, 2012; Matthias, 2015).

Care robot practices provide opportunity to reflect on ourselves as human beings (Coeckelbergh, 2012; Metzler & Barnes, 2014; Metzler et al., 2015; Shatzer, 2013) and our societal institutions and their practices (Metzler & Barnes, 2014; Metzler et al., 2015). Shatzer (2013) calls these, secular liturgies. Arguing from a theological-anthropological perspective, he writes that social institutions and their secular liturgies provide society with a view of the human condition and the meaning of human flourishing. He states that older adults' flourishing through care robots means that they are cared for and that they can maintain an independent life. He considers these to be "noble goals" although ignoble goals may also come to the fore. Widespread adoption of care robot use implies that fellow humans and society itself, no longer need to make certain sacrifices to sustain older adults' flourishing. For Shatzer, using care robots also implies that the highest form of human existence is to live independently.

Metzler and Barnes (2014) analyze care robots' possible influence on humans' self-comprehension and the configuration of social institutions and practices. For them, interacting with care robots is not a one-directional activity but a bi-directional one; humans and robots "shape" each other. For them, care-robot practices can redefine the meaning of notions such as "companionship" and "care," leading to a deeper misunderstanding of the very nature of humans and to a loss of control of who they can become.

Metzler et al. (2015) argue that armed with both a growing knowledge of quantum physics and the development of machine-learning processes, the problem of robots' lack of consciousness (and so the problem of deception) would disappear because consciousness would be created by robots themselves. This creation of consciousness would end up completely blurring the differences between robots and humans. For them, this path of robot development leads to pressing questions about human caregivers' role in society. Since technological advances may someday endow care robots with conscious-like reality, what does this mean for the future of caregivers? For Shatzer (2013), this path does not necessarily have to lead to a negative view of a post-human future. He argues that the debate should be about what it means to use care robots in a reflective way, ensuring a human future instead of a post-human future.

4. Discussion

The overall aim of this review of the normative literature was to gain a better understanding of the range of views and ethical arguments on the use of care robots in aged-care practices and their grounding concepts. The diversity and wide-ranging views compiled in our analysis shows that the ethical debate is far from reaching a consensus and potentially is unreachable.

In this robotic age, we find ourselves in well-tilled ethical soil. Debates on the ethics of using robots in human activities are confronted with long-standing philosophical concepts such as "autonomy," "goodness," "a just society," "well-being," "moral agency" and others. What is new about the ethical considerations of this age, however, is that the application of these concepts does not focus solely on the human perspective and interactions of humans with society. Rather, it also includes the relationships humans have with technology, in this case care robots. Hence, the robotic revolution directly abuts up against traditional boundaries of the ethical landscape and perhaps even punches through.

Gunkel (2012) shows that the ethical landscape can be broadened, depending on exclusion and inclusion mechanisms deciding who or what belongs in this landscape. These mechanisms are mostly defined by who has the predication "moral agency." In the history of ethics, moral agency was exclusively associated with being human. Nevertheless, at certain moments in history a broadening of the ethical landscape took place. For example, with environmental ethics, the environment was and still is mostly seen as "pure matter" ready to be used according to human desires. Recently, the environment itself became part of the ethical landscape, because rather than being just an object of reflection, the environment *per se* came to influence reflection about it.

It was predicated a form of moral agency. Gunkel argues that a similar broadening of the ethical landscape can happen in relation to robot technology. Robot technology should not be seen as a pure neutral instrument, but rather as having a form of moral agency capable of influencing the moral reasoning of humans (Gunkel, 2012). Hence, care robots can become moral agents not in the sense that they have the capacity for ethical reasoning but because they are non-neutral phenomena that influence ethical reasoning.

Although the different ethical approaches described in this review addressed similar concepts and topics related to good care-robot practices in aged care (e.g. deception, social justice, instrumentalization, objectification), they differ when it comes to how care robots influence the boundaries of the ethical landscape. Authors using a deontological (Decker, 2008; Sharkey & Sharkey, 2011, 2012a, 2012b; Sparrow & Sparrow, 2006; Sparrow, 2002) or principlist approach (Feil-Seifer & Matarić, 2011; Sorell & Draper, 2014; Ienca et al., 2016; Körtner, 2016; Preuß & Legal, 2016) seem to be most reluctant to broaden the ethical landscape. In these discourses, the ethical landscape pertains to human moral agents seeing robot technology merely as a collection of neutral instruments that can or cannot be used to promote the well-being of older adults. Consequently, these approaches seem to lead to an ethical assessment of care robots instead of an open ethical reflection about their use. The following question is not being posed: "What does care-robots' use in aged care mean for our concept of care and for society?" Nevertheless, such a question potentially leads to an innovative perspective on good care. Instead, criteria are being developed that secure care robot use or non-use in aged-care practices. In both the deontological and principlist discourse the main criterion is the rational basis for introducing care robots in aged care. The ethical assessments resulting from these discourses keep the current care situation as is, with or without the help of care robots. Coeckelbergh (2015a, p. 268) puts a sharp point on this reasoning in his second of 10 working criteria of good care:

> Good care remains within the ethical boundaries widely recognized in standard bioethical ethics, such as autonomy, respect for (patient) autonomy, non-maleficence, beneficence, and justice, and within the boundaries of relevant professional codes of conduct. However such principles and codes mainly set negative moral limits to a practice. They are not very helpful in articulating a positive ideal of good care […]

In the writings of Coeckelbergh (2015a, 2015b), Misselhorn et al. (2013) and Shatzer (2013), the tendency to broaden the ethical landscape lights up. These authors' concern about care robots does not solely focus on what the current situation is in aged-care practices but also, and more importantly on what good care is. This expands the ethical landscape, since they do not restrict their views of robot technology to a neutral instrument that has to comply with fixed criteria. On the contrary, they aim to explore the influence of robot technology on aged-care practices predicating a form of moral agency to care robots. For them, robot technology influences ethical reflection. These authors still are critical about the introduction of care robots, but their approaches broaden ideas about what good care means in aged-care practices, now and in the future. This expansion also provides tools to go beyond a simple yes-or-no answer to the care robot issue. They produce a nuanced normative view about care robot use and the consequences for aged-care practices and society.

The tendency to broaden the ethical landscape or not goes back to the fundamental debate between ethical universalism and particularism (Hooker & Little, 2000). One could argue that deontological and principlist approaches to ethics are characterized by a universalistic tendency. By advancing certain values and principles they prescribe what the goodness or non-goodness of a certain care practice is. Here, the moral boundaries are fixed and reflected in duties and rights that should be respected and which can be reformulated in assessment criteria. There are two interrelated problems with this stance. First, because of its universal character, it risks reasoning too strongly from an external, top-down perspective. Second, a universal stance tends to evolve into a mere assessment tool that evaluates practices as they are, without considering the origin of these situations and to where they are potentially leading. This top-down assessment view tends to stick to what it knows about the ethical landscape without taking into account that the ethical reflection is shaped by the objects it reflects on.

Contrary to ethical universalism, ethical particularism is characterized by a bottom-up approach (Hooker & Little, 2000). Indeed, objective-list approaches and care-ethics approaches are fundamentally focused on the particular care context and relationships in which caregivers and care receivers find themselves. With this particular focus, they aim to explore in an inductive way which moral values are inherent in a specific care practice and try to strengthen these. Although not necessary, their inductive nature makes these approaches susceptible to broadening the ethical landscape as they cannot *a priori* define the boundaries of it. Inspired by the particular care context/relation they need to be open to contextual elements that influence ethical reasoning. This means that care robots can be given a place in the ethical landscape that is being constructed by the reflection on a particular context/relation.

In summary, this review has shown that the ethical debate on care robots use in aged care can take two forms, an ethical assessment of or an ethical reflection about care robots. We value both forms and propose a combined form that can be used in practice. For this proposal, we refer to what has been called "democratic spaces" (Vandemeulebroucke et al., 2017). In these spaces all stakeholders related to aged care should have a voice. Ethical assessments as well as ethical reflection have their role in a democratic space. Assessments result in a decision about using or not using care robots. Ethical reflection constantly open up this decision by refocusing the debate from the use of care robots to what that use does with the care situation and the involved values. Continued case-by-case evaluations of care-robot use are manifestations of this interplay between assessment and reflection. They make tangible the fact that a decision on use—which is always based on certain criteria—has to be made. They also make clear the need for ongoing reflection about this use. In the end, the interplay between assessment and reflection will illuminate the potential ways care robots can be used for good care.

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